www.standardimaging.com

Adaptivo™

Version 2.1

User Manual

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General Precautions

Warnings and Cautions alert users to dangerous conditions that can occur if instructions in the manual are not obeyed. Warnings are conditions that can cause injury to the operator, while Cautions can cause damage to the equipment.

WARNING:
Federal law in the U.S.A., and Canadian law, restricts the sale, distribution, or use of this product to, by, or on the order of a licensed medical practitioner. This product should be used under the guidance of a medical physicist in a secure network environment.

WARNING: Adaptivo is not intended to be used as a primary calculation for patient treatment. Should results differ from the treatment planning or other primary calculation results, the planning result discrepancy will require resolution prior to treatment.

WARNING:
Where applicable, Standard Imaging products are designed to be used with the versions of common radiation delivery devices, treatment planning systems and other products or systems used in the delivery of ionizing radiation, available at the time the Standard Imaging product is released. Standard Imaging does not assume responsibility, liability and/or warrant against problems with the use, reliability, safety or effectiveness that arise due to the evolution, updates or changes to these products or systems in the future. It is the responsibility of the customer or user to determine if the Standard Imaging product can be properly used with these products or systems.

WARNING:
Incorrect installation of Adaptivo™ may produce incorrect calculation results. It is the responsibility of the user to follow installation instructions provided.

WARNING:
An NVIDIA Windows Standard driver is strongly recommended. NVIDIA Windows DCH drivers are known to be incompatible and will prevent calculation.

WARNING:
If the EPID panel captures only part of the treatment field, the gamma analysis will be limited to that area and may result in incomplete or misleading results.

WARNING:
Incorrect or poor quality image calibration may reduce calculation accuracy. It is the responsibility of the user to verify image calibration and to ensure image value to density tables are correctly defined in Adaptive configuration. Enter complete and correct data. Ensure that complete and correct data has been entered by viewing the data on the screen before proceeding.

WARNING:
Dose calculations in regions of metal artifact in a CT may be incorrect in Adaptivo™ if a point is not defined in the image value to density table. The user should review dose in those regions carefully.

WARNING:
Image value to density table (IVDT) changes are effective when the next dose calculation is initiated. If image value to density parameters are changed while a dose calculation is in progress, the change does not take effect until the next current plan completes calculation.

WARNING:
Conduct Acceptance and routine QA Testing. It is the responsibility of the user to conduct Acceptance Testing on the machine specified for treatment, and to conduct routine QA Testing at appropriate intervals.

WARNING:
Treatment machines must be commissioned before use. Verify physics data prior to commissioning. Only machines commissioned prior to the initiation of a treatment plan may be used to complete the plan.

WARNING:
Incorrect or poor quality cone beam CTs (CBCT) may reduce calculation accuracy. It is the responsibility of the user to verify imaging practices.

WARNING:
The use of Adaptivo™ does not preclude the need for routine machine QA.

WARNING:
It is recommended that the treatment machine output and calibration be verified prior to commencing the In-Vivo commissioning process to include Electronic Portal Imaging Device (EPID) calibration and In-Vivo commissioning data collection.

WARNING:
There must be an Electronic Portal Imaging Device (EPID) installed and capable of collecting and storing integrated images for In-Vivo to work.

WARNING:
The EPID must be calibrated for all clinical dose rates according to the manufacturer's instructions for the type and model of device.

WARNING:
Routine quality assurance should be carried out on the EPID device particularly following maintenance that could alter the EPID response with respect to the EPID response at the time In-Vivo commissioning data is collected.

WARNING:
The EPID panel image is sampled at 2mm resolution to match the calculation grid of the gamma comparison therefore delivery errors smaller than 2mm may not be detected.

WARNING:
The commissioning data collection is a critical component for accurate results. Care should be taken to read and follow all instructions in the sequential order specified.

WARNING:
The In-Vivo application does not take into account any density values that are overridden in the plan structure set except the values used for the couch structures. If a structure in a plan contains a density override, the In-Vivo results may not be reliable.

WARNING:
The Hounsfield Unit (HU) to relative electron density table values are critical to the calculated Portal Prediction. It is recommended that these values be confirmed with an electron density phantom containing density plugs and compared to the values in the treatment planning system.

WARNING:
The In-Vivo calculator does not take into account any density values that are overridden during treatment planning except for the values used for the couch replacement structures. If a structure in a plan contains a density override, the In-Vivo results may not be reliable.

WARNING:
An integrated image must be scheduled in ARIA or MOSAIQ for all treatment beams to be analyzed with In-Vivo. The program will not calculate a result without an integrated image.

WARNING:
Achieving correct configuration of the In-Vivo software requires reading and following all instructions. If there are doubts as to the instructions, place a call to the support desk.

WARNING:
Failure to review alerts and notifications properly may result in failing to detect a treatment deviation.

WARNING:
Not calibrating the imaging panel properly before performing commissioning data collection can lead to incorrect results.

WARNING:
All dose rates (MU/min) that are used for clinical treatments must be calibrated and verified before collecting the In-Vivo commissioning data. If a dose rate that has not been calibrated is used for In-Vivo commissioning data collection, the commissioning results could be incorrect.

WARNING:
The correct thickness of water equivalent slab or slabs placed on the couch must be used for a given commissioning plan. The plan naming convention details the thickness of solid water to be placed on the treatment couch for each plan. Incorrect slab thickness commonly results from delivering the plans out of sequence resulting in the wrong thickness of solid water; the plans are numbered and should be collected in numerical order to make the collection efficient and aid in preventing errors during the collection. If necessary, use the Reorder Plans and Fields function in ARIA Plan Scheduling to put the plans in numerical order. A checklist to aid collection is also provided in Appendix A.

WARNING:
Commissioning plan names should not be edited/changed. The commissioning tool uses the plan naming schema as well as key DICOM information as part of its process. If the plan names are edited and do not match the template, the commissioning tool will not function.

WARNING:
Solid water slabs have inconsistent density properties between slab manufacturers. The solid water slabs used for commissioning data collection should be consistent. The commissioning tool relies on a single solid water density value input as part of the commissioning process. It is suggested that you scan the solid water to be used for data collection and spot check the consistency of the slabs before performing the data collection.

WARNING:
Solid water slabs must be placed over a radiolucent portion of the treatment couch. The commissioning tool does not account for any attenuation resulting from the treatment couch or any other accessory placed between the radiation source and the megavoltage image panel. The solid water needs to be placed over the most radiolucent portion of the treatment couch.

WARNING:
Couch support rail should be out of the field of measurement during commissioning. The couch support rails, contained on non-IGRT treatment couches, attenuate the exit beam signal and affect the commissioning results. Make sure the couch support rails are in their outer most position and not under the solid water slabs or in the path of the beam for the in-air collections.

WARNING:
According to the DICOM standard, Inner and Outer Contours can be represented by two different techniques:
1) Using the "keyhole" technique, an ROI with an excluded inner part is represented with a single planar Contour.
2) Using the "XOR" technique, an ROI with an excluded inner part is represented by two planar Contours that are combined by a geo-metric exclusive disjunction, thus extracting the inner from the outer Contour. These contours would have a Contour Geometric Type (3006,0042) of CLOSEDPLANAR_XOR.Nested or overlapping contours with a Contour Geometric Type (3006,0042) of CLOSED_PLANAR will be combined in Adaptivo with an "OR" or a union.

CAUTION:
Adaptivo™ does not handle treatment plans calculated without heterogeneity correction. The user is advised to disregard results for treatment plans calculated homogeneously.

CAUTION:
Review deformed contours and dose for accuracy. If contour or dose deformation is deemed clinically unacceptable, the user should disregard results in Adaptivo™.

CAUTION:
The computer monitor used to display In-Vivo must meet the minimum specifications or results may be displayed incorrectly.

CAUTION:
In-Vivo requires DICOM files in order to process and calculate results.

CAUTION:
Network speed should meet minimum specifications for optimum system performance relating to file transfer and web interface interactions.

CAUTION:
For a panel calibrated to 1 Monitor Unit (MU) = 1 Calibrated Unit (CU) with the MV imaging panel at 100 SID with a 10x10 field size, the resulting QA check should result in a CU reading at the central axis of approximately 90.7 with 100 MU's delivered with a 10x10 field at 105 SID.

CAUTION:
Integrated image collection must be scheduled in plan scheduling in ARIA or within MOSAIQ in order for the portal images to be stored. Images must be captured and stored to use as inputs to the In-Vivo commissioning tool.

CAUTION:
Plans must be delivered in clinical mode. The In-Vivo commissioning tool needs an RT record for proper file matching. Plans must be delivered in a mode that produces an RT Record.

CAUTION:
A treatment beam may be interrupted during treatment. If this occurs during commissioning, perform the collection for the interrupted beam again to capture the entire signal for all the planned monitor units for that beam. The commissioning tool performs a check to make sure that 100 monitor units were delivered in order to use the collected portal image in the commissioning process.

CAUTION:
The imaging panel must be at the correct height for commissioning data collection. The plans are set up and numbered so that all the plans to be collected at 105 SID are grouped together followed by all the plans at 150 SID. The commissioning tool includes a check on the panel SID and will not process results that fall outside the specified distance for a collection.

CAUTION:
Cybersecurity is a shared responsibility between Standard Imaging and the customer. Secure use of this product is dependent upon the proper utilization of passwords, firewalls, networks, computer platforms, operating systems and data storage.

CAUTION:
It is recommended that FFF beams be delivered at the nominal high dose rate when using the InVivo module for FFF Relative Mode comparisons. Flattening Filter Free (FFF) beams delivered at dose rates lower than 1000 MU/min may be associated with the non-flattened beam commissioning model of similar energy and result in inaccurate gamma comparison.

CAUTION:
Remaining hard disk detection may not work properly if system is configured with multiple hard disks.

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1 Introduction

Radiotherapy has rapidly evolved to the now common standard of image guided radiotherapy (IGRT). IGRT technology aims to position the patient more accurately for daily treatment by utilizing either 2D images acquired using the Electronic Portal Imaging Device (EPID) or a three-dimensional CT acquired just prior to treatment. The broad integration of EPID imagers into the radiotherapy workflow also opens the possibility for use of the EPID for both pre-treatment delivery verification and for during-treatment delivery monitoring. The Pretreatment QA module of Adaptivo provides this pre-treatment delivery QA in a straightforward and automated fashion, while the In Vivo module of Adaptivo uses the exit image acquired during patient treatments to monitor the machine output and patient position variations simultaneously. Collected images are compared to a predicted image computed using a forward projection technique of the planned beams transferred from the TPS into the clinic's Record and Verify system. Collected EPID images are also compared to a reference measured image from the first few days of treatment. The Adaptive dose recalculation module of Adaptivo provides a means for clinicians to perform a daily offline verification of a patient's treatment utilizing the CT acquired for patient positioning. The Adaptive module computes daily and cumulative doses using the daily CBCT taken just prior to treatment. DVH data are compared against a flagging system such that dosimetric, setup and geometric changes in the patient will produce alerts which indicate that a patient may require review.

1.1 Indications for Use

Adaptivo is a stand-alone software product that provides comparative dose information about the daily and cumulative dose received by a radiotherapy patient relative to their treatment plan. It is to be used by a radiation oncology licensed medical professional for the following purposes:

- As a guide to provide pre-treatment delivery verification
- To monitor daily treatments and indicate potential clinically relevant deviations from the intended delivery
- To provide estimates of daily and cumulative dose delivered to the patient, accounting for patient position and anatomy changes
- To aid in determining whether a patient plan should be altered partway through the course of treatment in order to meet the treatment planning goals

Adaptivo is not a primary treatment planning software, and it cannot be used to generate radiotherapy treatment plans.

1.2 System Requirements

Adaptivo is a versatile EPID Dosimetry patient QA solution offering 2D and 3D modules. The 3D Adaptive module requires a GPU for efficient computation and analysis, while the 2D modules, Pre-treatment and InVivo EPID Dosimetry, function effectively with a CPU-based setup. This setup ensures that users focusing solely on the 2D modules benefit from a cost-effective, CPU-only system while those utilizing the 3D Adaptive module enjoy the accelerated performance enabled by a GPU. Also note the Varian MV portal imaging system must be calibrated for use with Adaptivo so that **1 Calibrated Unit (CU) equals 1 Monitor Unit (MU)**. This calibration requires the Varian Portal Dosimetry software.

	Minimum	Recommended
Operating System	Windows Server 2025	Windows Server 2025
Memory	24GB DDR3 RAM	32GB RAM
Hard Drive	2 TB	4 TB (SSD preferred)
Power Supply	700 W TDP	1100 W TDP
Processor	8 cores with clock speeds of 3 GHz	8-16 cores with clock speeds ≥ 4 GHz
Security	Secure Boot Trusted Platform Module (TPM)	
Screen Resolution	22” monitor = 1920x1080	
Adaptive Module Only: Validated GPU	NVIDIA RTX A2000 12GB, A4000, 2000 Ada Generation, 4000 Ada Generation NVIDIA GeForce GTX 780, 980, 1070, or 1080 NVIDIA Quadro P4000, P5000, or RTX 4000 NVIDIA T1000 8GB	
Adaptive Module Only: NVIDIA Driver	NVIDIA Windows Standard driver is strongly recommended	
Disk Mirroring	RAID 1 or equivalent	
Phantom	CIRS density phantom	
Record and Verify System	ARIA Version 11 or later Mosaiq Version 2.86 or later	

Beam Data	Varian Gold Standard
Compensators	MLC only: wedges and physical compensators will not be handled.
Browser	Firefox v.89 or newer, Google Chrome v.91 or newer

2 Installation

The Adaptivo software has been pre-installed on your dedicated Adaptivo computer. If re-installation is required, please contact Standard Imaging Customer Care at support@stanadardimaging.com, by phone at +1 608-831-0025, or through our website at www.standardimaging.com.

2.1 Adaptive Viewers Installation

The Adaptive Viewers for the Adaptivo application must be installed locally for the viewers to run. Follow the steps below to install the viewers. IT personnel should review the Adaptive Calculator and Viewers installation instructions in the Adaptivo Assembly Procedure to ensure remote viewers can access the adaptive data on the Adaptivo server.

1. Log in to Adaptivo Web. Click on Help from the top menu.
2. From the Downloads section of the Help page, download both the Adaptive Viewer installer and the MATLAB Runtime installer.
3. Extract the files in the MATLAB Runtime installer ZIP file.
4. Open the MATLAB Runtime installer folder. Double-click **setup.exe** to run the installer. Click Yes if prompted for confirmation by the User Account Control.
5. Accept the license agreement and all defaults to complete the installation.
6. Double-click **AdaptiveViewersInstaller.exe** to run the installer.
7. When prompted to enter the shared folder network path, enter "\\hostname\Adaptivo_Adaptive$" and replace "hostname" with the hostname of the Adaptivo Server.
8. Select the "Install" button.
9. Select the "Next" button, select the "Finish" button to complete the install.

The monitor used for viewer display may require adjustments to display settings. Contact Customer Care should you require assistance.

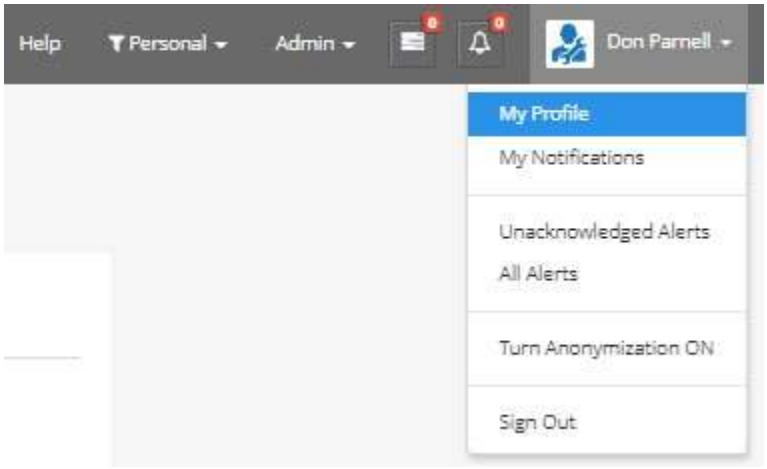
2.2 Adaptivo Print Service Installation and Configuration

The Adaptivo Report Service will listen for "report available" workflow events from the Adaptivo Server. For ONLY Average Fraction Reports, the system will save the PDF reports to a specified folder. Configuration options are available to add basic business logic to determine if a report should be saved depending on its Pass/Warn/Fail status and if alert comments are present. For example, the Report Service can be configured so reports with a Fail status must have an alert comment before they are saved to the output folder.

2.2.1 Installation

1) Create API Key

a) Log in to the Adaptivo Web application.
b) Navigate to your user profile.



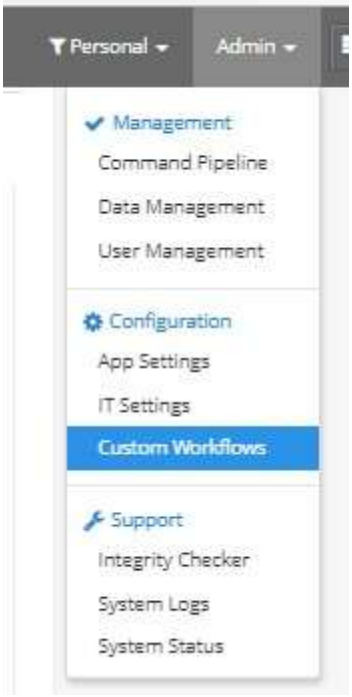
c) Scroll to the bottom of the page and create an API Key. You must copy and save the key in a safe place because it will not be shown again after it is created.

2) Verify Port and Create Firewall Rule

a) Run the “PowerShell 7” application as administrator.
b) Run the following command to verify that port 4444 is not in use.
   i) netstat -aof | findstr :4444
c) If the previous command does not return any results, you can continue to step 3. If it does return any results, port 4444 is in use, and you must select a different port for the Adaptivo Report Service. You can use the previous command to find another port to use that is not in use. For example, try port 4445.
d) If you must use a port other than 4444, review each of the subsequent installation steps carefully to change all occurrences of port 4444 to the new port number. For example, the next step specifies the port number in the PowerShell command and would have to be updated.
e) Run the following command to create a new Inbound Firewall Rule.
   i) New-NetFirewallRule -DisplayName "SI Adaptivo" -Group "SI Adaptivo web application" -Description "Inbound rule for SI Adaptivo application to allow incoming network traffic [TCP]." -Direction Inbound -Action Allow -Protocol TCP -LocalPort 4444 -RemoteAddress 192.168.50.2

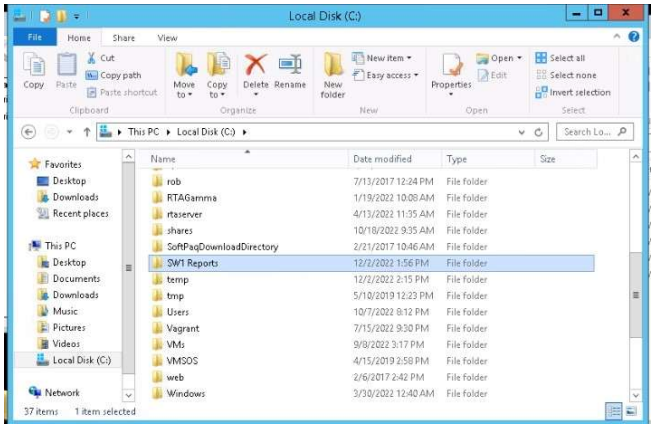
3) Create Workflow

a) In Adaptivo Web, navigate to Admin > Custom Workflows.



b) Enter the following information in the "Create New Notifier" section.
   i) Notifier Type: **Http**
   ii) Name: **Report Service**
   iii) Ignore SSL Errors: **Yes**
   iv) Destination URL: http://192.168.50.1:4444/webhook
c) Select the "Create" button.

4) Create Reports Output Folder and Enable Network Sharing

a) Create the following folder on the C Drive: "C:\SW1 Reports"
   i)


b) Replace “SW1” in the folder name with the current system name (which can be found in the Windows System Information).
c) You may want to enable network sharing for the folder to share the output reports.

5) Deploy Report Service

a) Navigate to the “ReportService” subfolder of the Adaptivo build that was installed on your Adaptivo Server.
b) Double-click on “ReportServiceInstaller.exe” to run the Report Service installer.
c) Review and accept the License Agreement to continue.
d) Review the default installation location of “C:\AdaptivoReportService”. If you install the Report Service in a different location, please note that the location will differ in the subsequent installation/configuration steps.
e) Click “Install” to install the Report Service.
f) Click “Close” to close the installer.

2.2.2 Configuration

1) Report Service Configuration File

a) Open the C:\AdaptivoReportService\appsettings.json file in a text editor (e.g. Notepad++).
b) Note that the Report Service must be restarted if configuration settings are changed.

2) Report Service Configuration Options

a) **Kestrel.Endpoints.Http.Url**: This setting may need to be updated if you are using a port other than 4444.
b) **Adaptivo.BaseUrl**: The default port of 44300 may need to be updated in this URL if your Adaptivo Web setup differs from the default configuration. This URL should begin with the same URL that you use to access Adaptivo Web. For example:

i. https://**localhost:44300**/api/v1/
ii. https://**localhost:443**/api/v1/
iii. https://**localhost**/api/v1/

c) **Adaptivo.ApiKey**: Replace the API Key with the one created in step 1 of the installation.
d) **Adaptivo.Output**: Replace the example path with the path to the Reports Output Folder created in step 4 of the installation. (You should maintain the example format using “C:/” for the path specifier.)
e) **Adaptivo.Statuses**: The report statuses that require an alert comment to be present before reports are saved to the output folder. Available options include Pass, Warn, and Fail. For example, a "Warn|Fail" configuration would require an average report with the status of Warn or Fail to have an alert comment before the report is saved to the output folder.
f) **Adaptivo.ApiVersion**: This allows the Report Service to work with different versions of Adaptivo (which have different versions of the Web API). Available configuration options include 1.5 and 2.0. This should be set to the version of Adaptivo that you are currently using.

g)

```
{
  "Kestrel": {
    "Endpoints": {
      "Http": {
        "Url": "http://192.168.50.1:4444"
      }
    }
  },
  "Logging": {
    "LogLevel": {
      "Default": "Information",
      "Microsoft.AspNetCore": "Warning"
    }
  },
  "AllowedHosts": "*",
  "Adaptivo": {
    "BaseUrl": "https://localhost:44300/api/v1/",
    "ApiKey": "2|isllTxo2f5xcPbE37a7kWeFyUuQ5zV6aIXIADVsg",
    "Output": "C:/Adaptivo Reports",
    "Statuses": "Warn|Fail",
    "ApiVersion": "2.0"
  }
}
```

2.2.3 Scheduled Task Creation

1) Create Scheduled Task

a) Open the Windows Task Scheduler application.

b) Create a new task with the following settings:

i) Name: Adaptivo Report Service

ii) Security options

(1) Verify or change the user that runs the task. In a typical Adaptivo Server setup, you would use the local “Adaptivo” Windows user.

(2) Select “Run whether user is logged on or not.”

iii) From the “Configure for” dropdown list, select Windows Server 2025.

iv) From the “Triggers” tab, create the following new trigger.

(1) Begin the task: At startup

(2) Click OK to save the trigger.

v) From the “Actions” tab, create the following new action.

(1) Action: Start a program

(2) Program/script: cmd

(3) Add arguments: /c C:\AdaptivoReportService\ReportService.exe >> log.txt

(4) Start in: C:\AdaptivoReportService

(5) Click OK to save the action.

vi) Click OK to save the scheduled task. You may be prompted to enter the password for the user from step ii.

2) Start the Report Service

a) In the Windows Task Scheduler, right-click on the “Adaptivo Report Service” task and select Run.

b) View log file for application status: "C:\AdaptivoReportService\log.txt"

3) Stop the Report Service

a) In the Windows Task Scheduler, right-click on the “Adaptivo Report Service” task and select End.

3 Licensing

If the license is not active or you are receiving error messages related to licensing, please follow the instructions below to license your software.

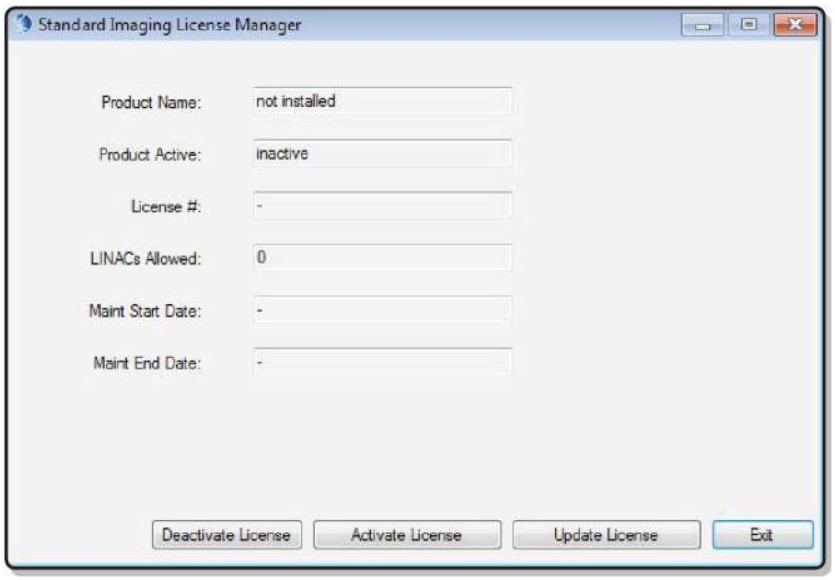
IMPORTANT: By using this software, you are agreeing to abide by the terms of the Software License Agreement, shown on page 224.

3.1 Adaptivo Licensing Setup

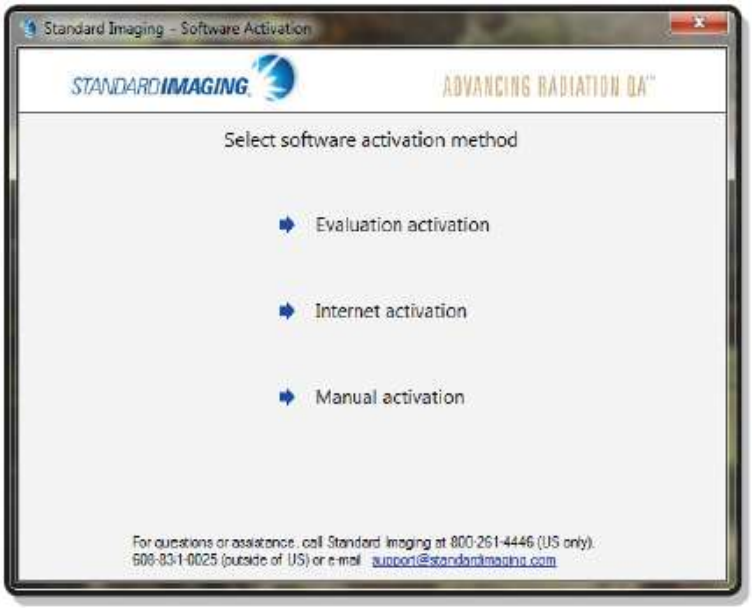
On the Adaptivo workstation, open explorer and navigate to the folder:

c:\rtaserver\bin\si_license

Run the program SI_License_manager by double-clicking. If no license has been created, you should see the following:



Click the Activate License button. A Software Activation window will appear that looks like the following:

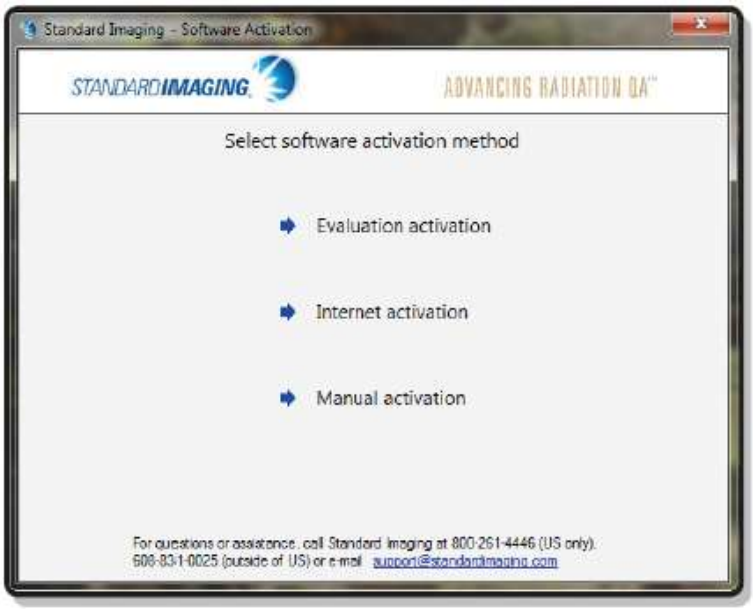


Click on Internet Activation. Fill in the required fields, including License Key, First name, Last name, Email, Facility, State/Province/Region, and Country.

3.2 New License

Licensing of this software is controlled by the number of linacs your organization has registered with Standard Imaging. Attempting to use the software on unregistered linacs is prohibited. If you wish to register additional linacs, please contact your Standard Imaging sales representative.

Launch the SI License Manager application. If no shortcut for the license manager is present on the desktop, the application can be found at C:\rtaserver\bin\si_license\SI_License_Manager.exe. This will display the 'Standard Imaging – Software Activation' dialog.

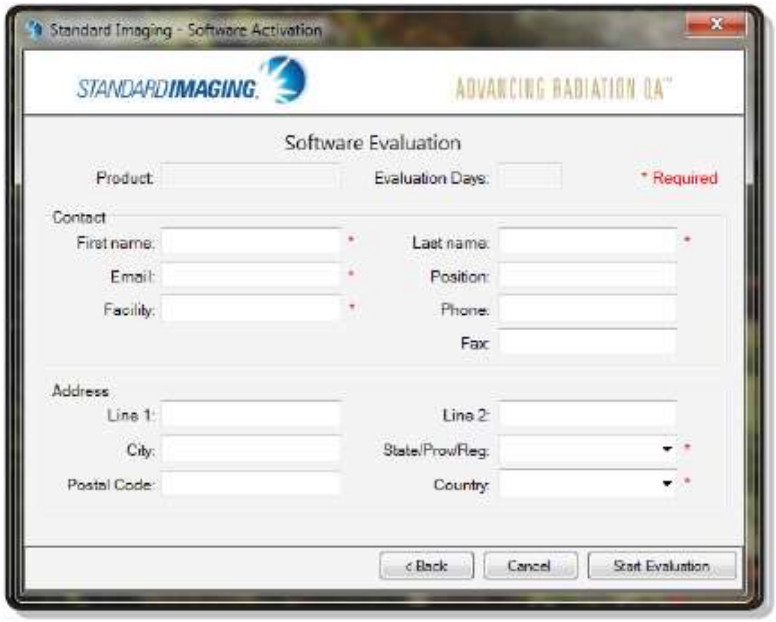


Select one of the licensing options.

3.3 Evaluation Activation

Evaluation mode allows full use of the software for a period of 30 days. After 30 days the evaluation period will expire, and the software will no longer be usable until a regular license is purchased.

Begin by selecting “Evaluation activation”. This will display the Evaluation Activation pane.



Enter contact and address information, then select “Start Evaluation”. The Evaluation mode will be enabled.

Each time the application is launched, a rolling dialog will be displayed above the task bar, indicating how much time is left until the evaluation expires.

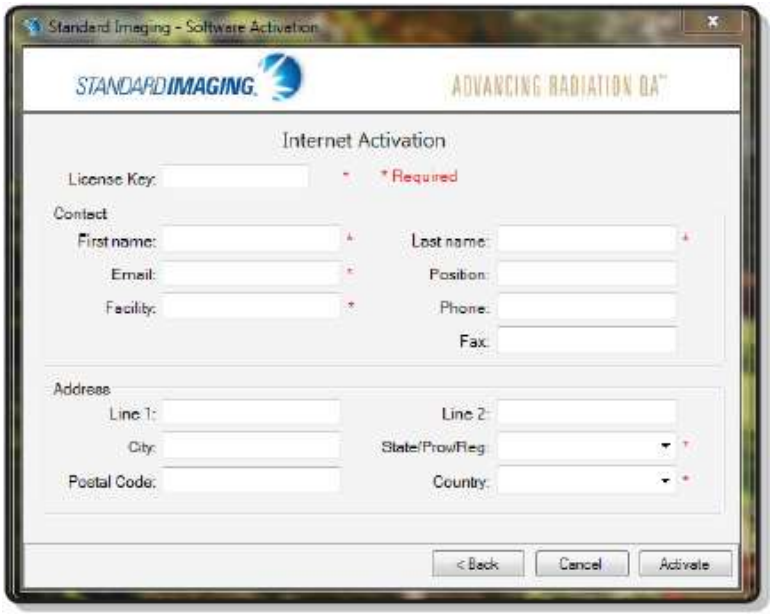
3.4 License Adaptivo Computer

Your Adaptivo computer license was activated at Standard Imaging prior to shipment. If the license is not active or you are receiving error messages related to licensing, please refer to the Licensing section on page 18.

3.5 Internet Activation

Internet activation is the preferred method of license activation. The application will register the license key via the Internet.

Begin by selecting “Internet activation”. This will display the Internet Activation pane.

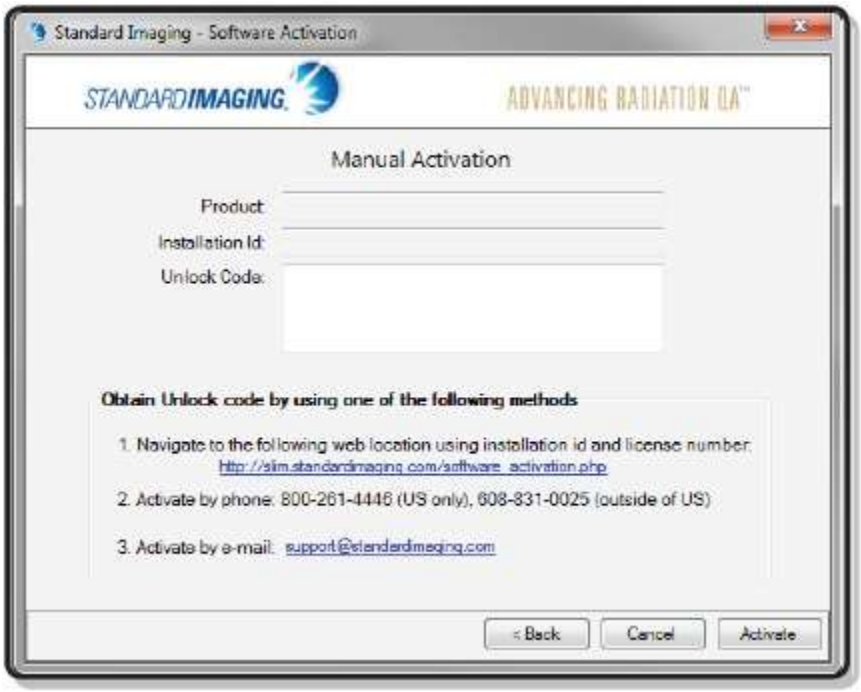


The license key will be received via an email and may also be found in your Customer Care Portal. Enter the license key, contact, and address information. When finished, select “Activate”. This will activate the license and allow the program to be used.

3.6 Manual Activation

Manual activation is an option in instances where an Internet connection is not available.

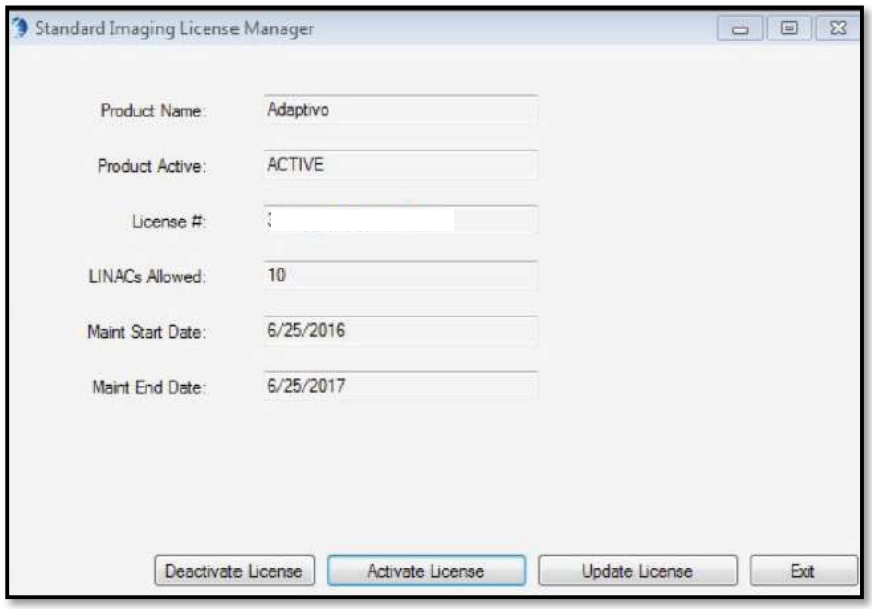
Begin by selecting “Manual activation”. This will display the Manual Activation pane.



An unlock code is needed to complete a manual activation. Following the directions in the dialog, you can visit the website, call, or email to obtain the unlock code. Once received, the unlock code should be entered into the provided field and select “Activate”. This will activate the license and allow the program to be used.

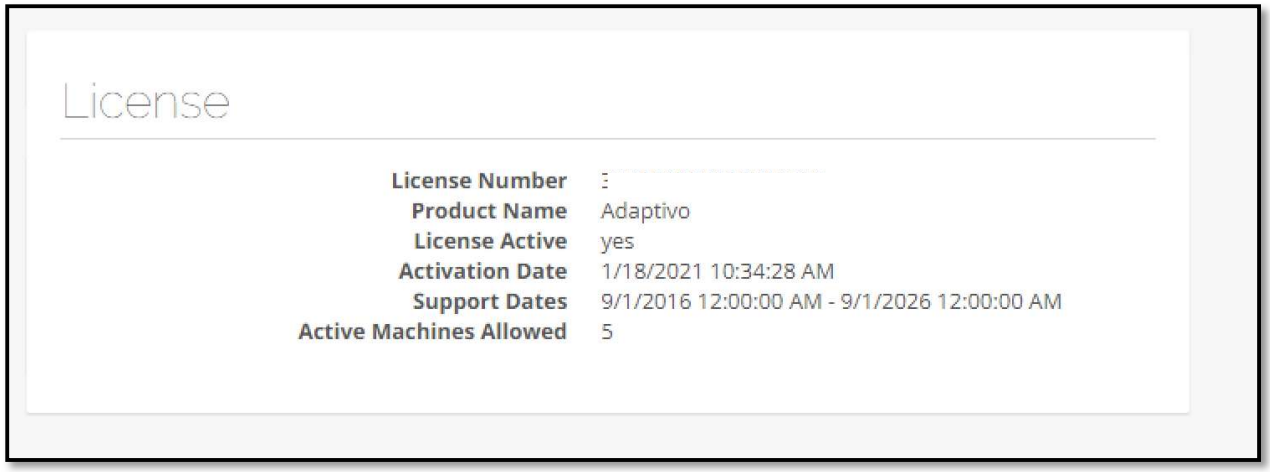
3.7 Completing Adaptivo Licensing

Click OK to close the dialog. Review the license information presented and confirm the Product Active field shows ACTIVE similar to the following:



Click on Exit to exit the license tool.

After completion of licensing, verify the license installation by accessing the Adaptivo Help page to review license information.



3.8 Deactivate License

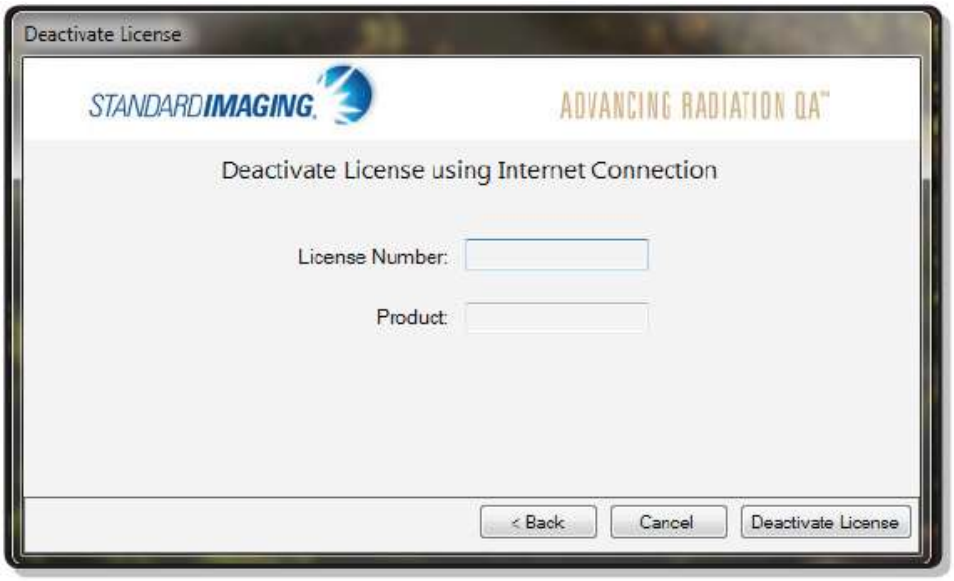
It is occasionally necessary to deactivate a license. For example, when moving the software to a different machine, or if the machine itself is being decommissioned. Deactivating a license will prohibit the program from being used. The software cannot be used again until the license is activated.

Begin by selecting Help>License>Deactivate License in the main menu. This will display the Deactivate License dialog.

The license can be deactivated through the internet or manually.

3.8.1 Deactivate using the Internet

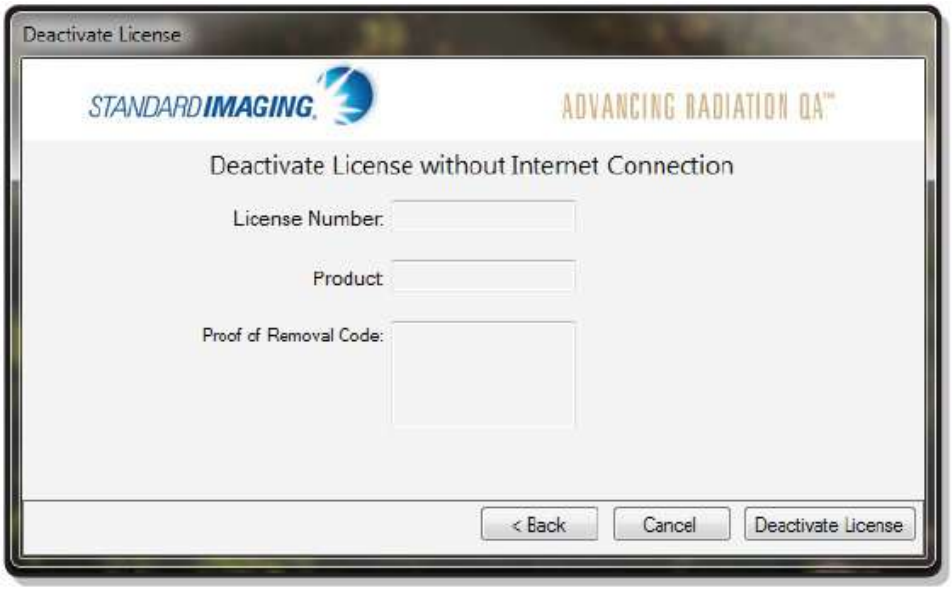
Start by selecting [Use the Internet]. This will display the 'Deactivate License using Internet Connection' pane.



Enter the license number and product name, and select [Deactivate License]. The license will be deactivated automatically. A message dialog will be displayed indicating that the deactivation was successful.

3.8.2 Deactivate without the Internet

Start by selecting [Return without Internet]. This will display the 'Deactivate License without Internet Connection' pane.

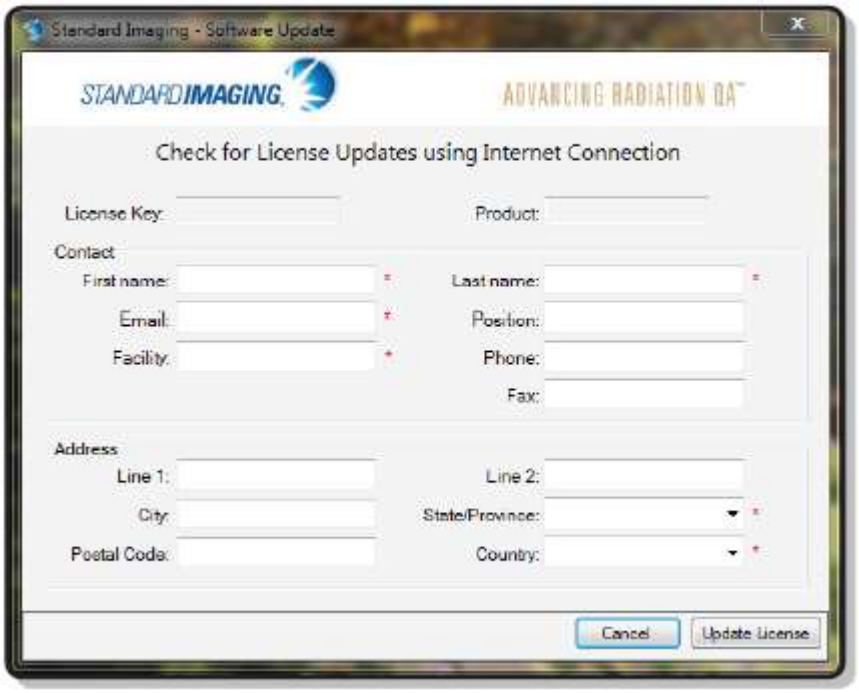


Select [Deactivate License]. This will generate a Proof of Removal code in the specified field. The program will automatically be disabled, but the Proof of Removal code must be communicated to Standard Imaging by email or phone to complete the deactivation process.

3.9 Update License

Updating the license is necessary when additional linacs have been registered with Standard Imaging or if the license end date has been extended.

Begin by opening the SI License Manager application. If no shortcut for the license manager is present on the desktop, the application can be found at c:\rtaserver\bin\si_license\SI_License_Manager.exe. This will open the license management window. Select 'Update License.' This will display the 'Standard Imaging – Software Update' dialog.



Enter the contact and address information if these are not already present and then select [Update License]. If no updates are available, a message dialog will be displayed saying so. If updates are available, the update will occur automatically, and a confirmation message will be displayed.

4 Setup and Configuration

4.1 Power up computer

Login: Adaptivo

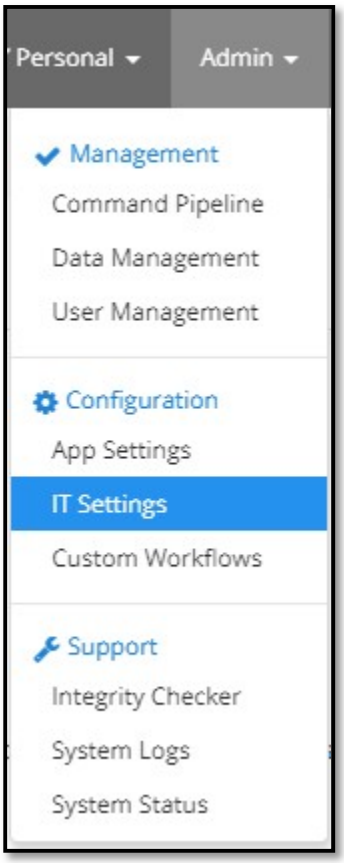
Password: Radiat!On

4.2 Open web browser

Open your web browser and navigate https://localhost:44300 if you are on the Adaptivo computer. For access from other hospital network computers, please contact your IT department for the Adaptivo website address.

4.3 IT Settings

To configure IT Settings, log in as an IT Administrator. Under the Admin menu, select IT Settings. Here, set up is available for email notifications and LDAP Authentication using Active Directory.



4.4 Email Settings

User emails setup during user registration can receive email from Adaptivo if the settings are configured under IT Settings. The hostname and port must be entered. The appropriate encryption method (none, tls or sll) is selected. The Username and Password are optionally required depending on the institutional email setup. The from email and from name are set at the user's discretion and will appear on all emails generated by Adaptivo. Select Save and attempt a test email. The institution can optionally determine

if email outside of the network (example.com) can receive notifications by selecting the external recipient check box.

4.5 LDAP Authentication Using Active Directory

LDAP Authentication must be set up by IT prior to registering Active Directory users in Adaptivo. The following steps must be performed on the Adaptivo Server to configure and deploy a Microsoft Active Directory Lightweight Directory Services (AD LDS) proxy server. Please see the notes at the end of this section on how to use the ADSI Edit (Active Directory Service Interface Editor) tool to access the proxy server.

1. Navigate to the Adaptivo installation folder for the build that is currently installed on the Adaptivo server.

2. Navigate to the web subfolder. Double-click InstallLDAP to run the LDAP installation script.

   The script will run in PowerShell and will print the following message when it has completed successfully: "InstallLDAP.ps1: SUCCESS." Wait for this message before proceeding.

3. Open Notepad with administrator privileges (right click and select “Run as administrator”). In Notepad, open the following file: C:\Windows\ADAM\SISyncConf.xml.

4. Replace all values in SISyncConf.xml that start with "EDIT:" with your organization's information. The items required are:

   a. <source-ad-name>EDIT:Fully.Qualified.Domain.Server</source-ad-name>

      i. Fully Qualified Domain Name of the Active Directory server to authenticate against.

      ii. Only one server should be specified in this field.

   b. <source-ad-partition>EDIT:dc=Domain,dc=DN</source-ad-partition>

      i. Distinguished Name of the Active Directory partition to authenticate against.

   c. <source-ad-account>EDIT:DomainAdminUsername</source-ad-account>

i. User account name to use to bind to the Active Directory server to synchronize the accounts to the proxy server.

d. <account-domain>EDIT:DomainName</account-domain>

i. Domain of the user used to bind to the Active Directory server (in step c above).

e. <target-dn>dc=adaptivo,dc=prx</target-dn>

i. Distinguished Name of the local proxy server. This is a fixed value and should not be modified.

f. <base-dn>EDIT:ou=DistinguishedNameOrganizationalUnitContainingADtree ,dc=domain,dc=TLD</base-dn>

i. Distinguished Name of the Organizational Unit in the Active Directory tree that contains the users that will be allowed to access the Adaptivo Server. This location is the head of the sub-tree that will be searched to populate the list of proxy users in the AD LDS instance.

ii. Due to a limitation of Microsoft's AD LDS, the base-dn tag MUST be a direct child of the source-ad-partition tag (see 4.b above).

iii. Top Level Domain (TLD) (e.g. .com, .net, .org).

5. Save your changes to SISyncConf.xml and close the file.

6. Open PowerShell with administrator privileges.

7. Run the following commands in PowerShell.

a. cd C:\Windows\ADAM

b. .\adamsync.exe /install <localServer>:<ad lds port> SiSyncConf.xml /passprompt /log -

i. Replace <localServer> with the hostname of your Adaptivo server.

ii. Replace <ad lds port> with the AD LDS port number (50000 is the default port assigned by the Adaptivo setup).

iii. You can replace "/log -" with "/log [log file]" to write log messages to a file instead of the screen.

iv. When you are prompted for a password, enter the password for the account used in the <source-ad-account> field in SISyncConf.xml from step 4.

c. .\adamsync.exe /sync <localServer>:<ad lds port> "DC=Adaptivo,DC=prx" /force -1 /log –

i. Replace <localServer> with the hostname of your Adaptivo server.

ii. Replace <ad lds port> with the AD LDS port number (50000 is the default port assigned by the Adaptivo setup).

iii. You can replace "/log -" with "/log [log file]" to write log messages to a file instead of the screen.

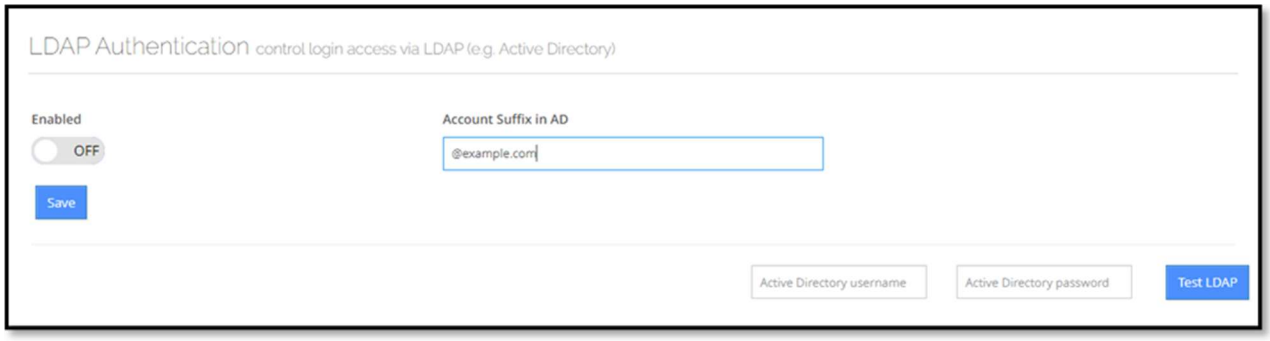
iv. This command should be run regularly to keep the local instance up to date with the source Active Directory system. For example, you may want to set up a Scheduled Task to run this command.

8. Log in to Adaptivo Web (https://localhost:44300) as a user with IT Admin privileges.

9. Go to Admin > IT Settings from the top menu.

10. In the LDAP Authentication section, click and drag the Enabled toggle to enable LDAP authentication.

11. Enter the Account Suffix in Active Directory for your organization following the example shown in the text field. The suffix should match the one used in the userprinciplename field on the Active Directory server.

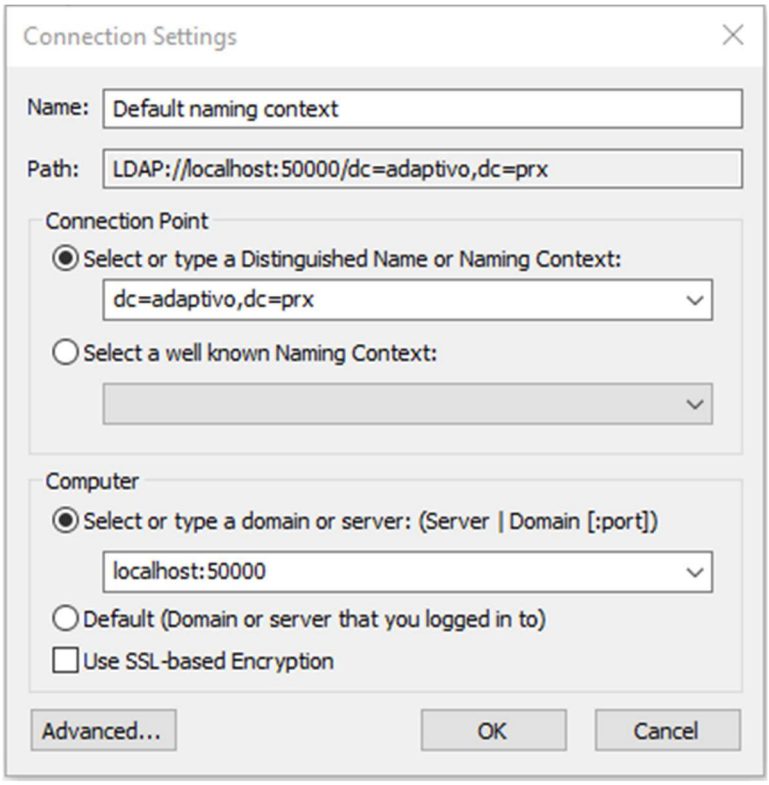


12. Click Save.

13. You can use the Test LDAP fields to test the LDAP authentication.

14. When a user from your Active Directory system attempts to log in to Adaptivo Web, they will receive the following message: "Your account is not active." Their account has now been added to the Adaptivo system, but it has not been activated yet. An existing Adaptivo user with IT Admin privileges must log in to Adaptivo Web and activate the new user from the Admin > User Management page before the user can log in to Adaptivo.

The ADSI Edit (Active Directory Service Interface Editor) tool can be used to access the Adaptivo proxy server. ADSI Edit was installed on the Adaptivo Server when the Windows Server AD LDS feature was enabled during the installation of Adaptivo Web. Use the following connection settings to access the Adaptivo proxy server in ADSI Edit:



4.6 SSL Configuration

Multiple steps are required to install SSL certificates to ensure a secure connection between client and server. Server here is the computer where Adaptivo software is installed. Client here is a web browser, potentially on another computer which will access Adaptivo software via HTTPS protocol. We presume server and client, while potentially being on separate computers, live on the same network and share the same domain name.

4.6.1 Certificates

The end user must provide the certificate files in PEM format containing both the chain of certificates and private key and in CER format containing the domain wildcard certificate and the domain root certificate.

OpenSSL suite commands (either on Windows or on Linux) can be used to convert certificates between different formats if the certificates are in a format other than PEM or CER. Some examples are shown below.

Convert from P7B to PEM using the following command:

> openssl pkcs7 -inform der -print_certs -in INPUT.p7b -out OUTPUT.pem

Convert from .pfx files in the PKCS#12 format, which include both the certificates and the private key, using the following commands:

Export the private key:

> openssl pkcs12 -in certname.pfx -nocerts -out key.pem -nodes

Export the certificate:

> openssl pkcs12 -in certname.pfx -nokeys -out cert.pem

Remove the passphrase from the private key:

> openssl rsa -in key.pem -out server.key

4.6.2 Server-side Certificate Installation

The Adaptivo Server runs on Windows Server 2025, and SSH is installed in the Windows features. Adaptivo Web runs on the NGINX web server on a Ubuntu 18.04 Hyper-V virtual machine (VM) which runs on the Adaptivo Server.

The PEM file with the certificates chain must be named adaptivo_cert.pem. The PEM file with the private key must be named adaptivo_key.pem.

1. Run PowerShell 7 as administrator.
2. In PowerShell, go to the directory containing the PEM certificate files.
3. Run the following commands from this directory.
    a. scp adaptivo_cert.pem adaptivo@adaptivo:/home/adaptivo
    b. scp adaptivo_key.pem adaptivo@adaptivo:/home/adaptivo
    c. ssh adaptivo@adaptivo
    d. sudo mv adaptivo_cert.pem /etc/nginx/ssl
    e. sudo mv adaptivo_key.pem /etc/nginx/ssl
    f. sudo reboot

4.6.3 Client-side Certificate Installation

Client-side certificates in the CER format must be named adaptivo_wild.cer and adaptivo_root.cer for the domain wildcard certificate and the domain root certificate, respectively.

1. Run PowerShell 7 as administrator.
2. In PowerShell, go to the directory containing the CER certificate files.
3. Run the following commands from this directory.

a. Import-Certificate -FilePath adaptivo_wild.cer -CertStoreLocation Cert:\LocalMachine\Root

b. Import-Certificate -FilePath adaptivo_root.cer -CertStoreLocation Cert:\LocalMachine\Root

4. Set your web browser of choice to trust root certificate authorities.

   a. Firefox

      i. In the address bar, type the following:

         about:config

      ii. If a warning appears about changing advanced configuration preferences, click the option to continue. Then, click “Show All.”

      iii. Click the button to toggle the “security.enterprise_roots.enabled” preference to “true.”

   b. Google Chrome

      Chrome is set to trust certificates in the Trusted Root Certificates Store as deployed, so no updates should be necessary.

   c. Microsoft Edge

      After version 79, Edge is set to trust certificates in the Trusted Root Certificates Store as deployed, so no updates should be necessary.

5. You can now access Adaptivo using the fully qualified domain name. In your web browser of choice, type the following address (The following assumes your domain is in .com, but this should be replaced with the appropriate suffix if necessary. The following also assumes that during setup the port was set to 44300, but may for some locations be a different value.).

   https://<servername>.<domainname>.com:44300/

6. The connection should be secure.

4.6.4 SSL References

https://www.feistyduck.com/library/openssl-cookbook/online/ch-testing-with-openssl.html2

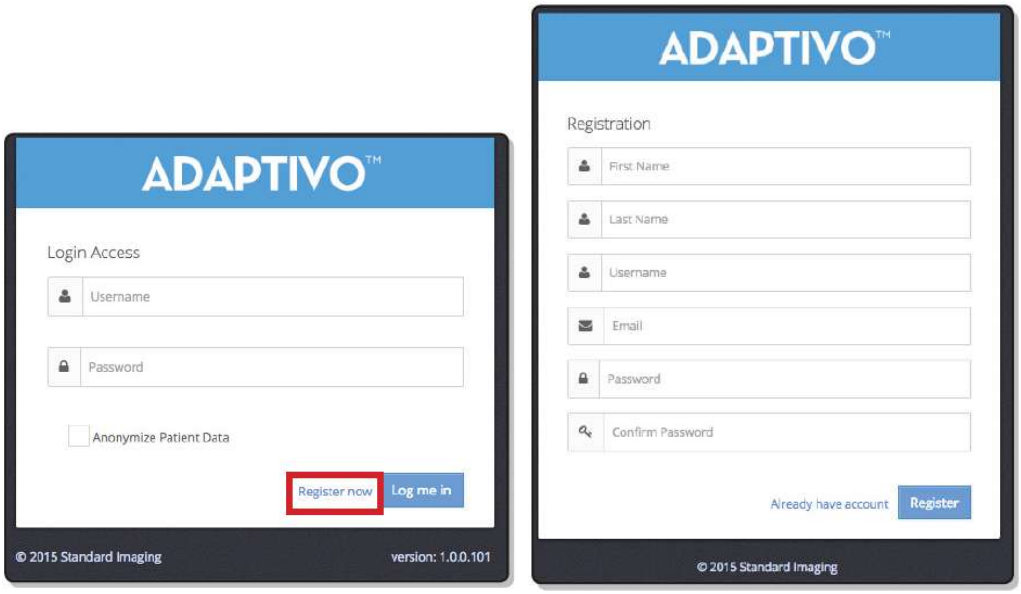
https://support.umbrella.com/hc/en-us/articles/115000669728-Configuring-Firefox-to-use-the-Windows-Certificate-Store

https://www.thewindowsclub.com/manage-trusted-root-certificates-windows

4.7 Add Users to System

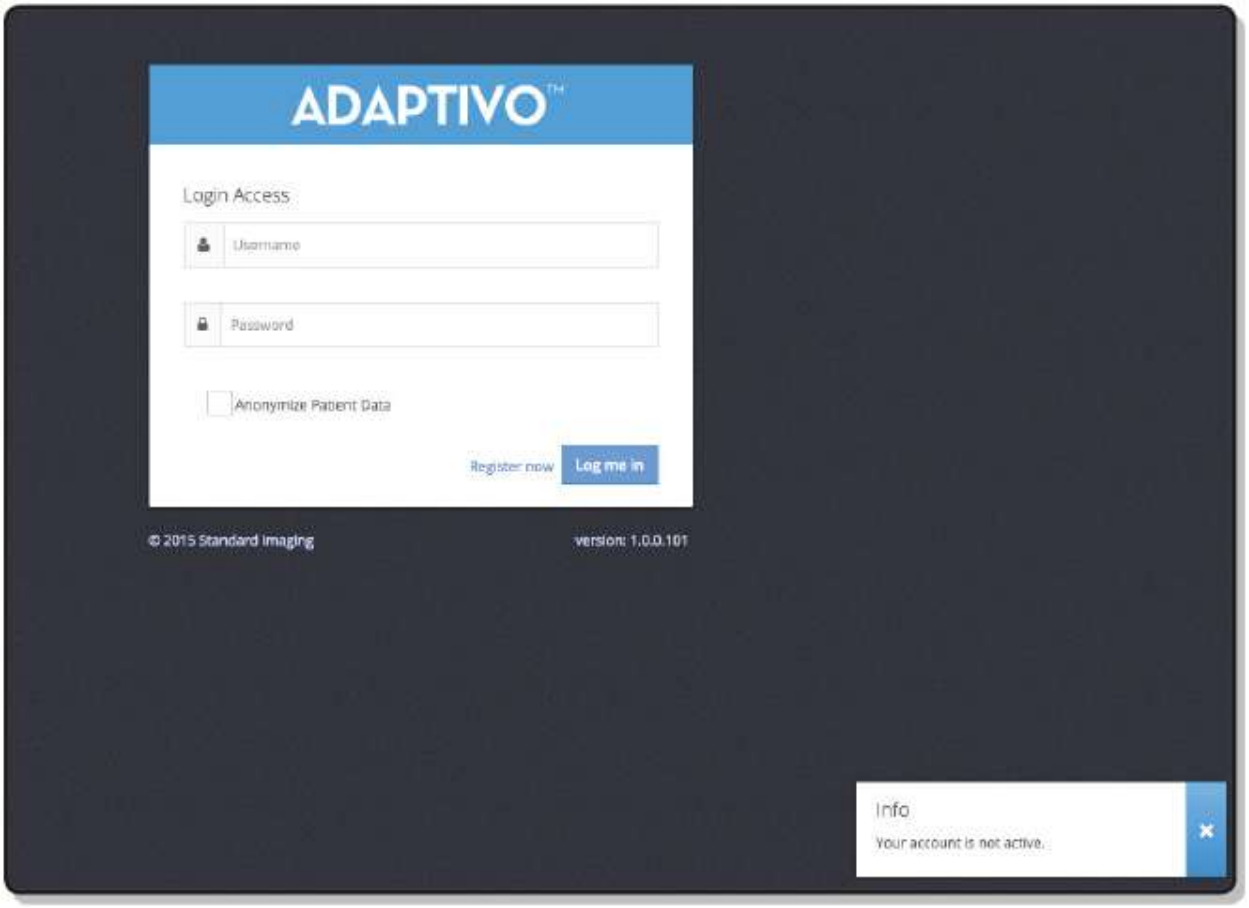
Users can be added to Adaptivo either manually or by Active Directory LDAP authentication.

To manually add a new user, click “Register now” from the login screen. Enter the user information on the Registration screen and click Register. After a user registers an account, a popup message will show that the account is not active.



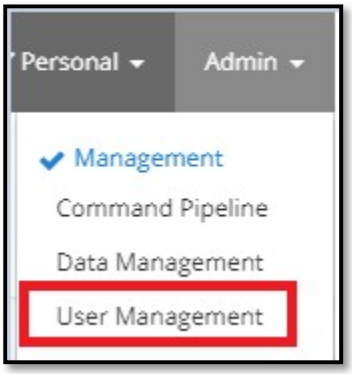
Active Directory LDAP authentication must be set up by IT prior to registering Active Directory users. Then, to add an Active Directory user to Adaptivo, enter the username and password directly on the login screen and click “Log me in.” A popup message will show that the account is not active.

An IT Administrator user must activate both local and Active Directory accounts before the user can access Adaptivo.



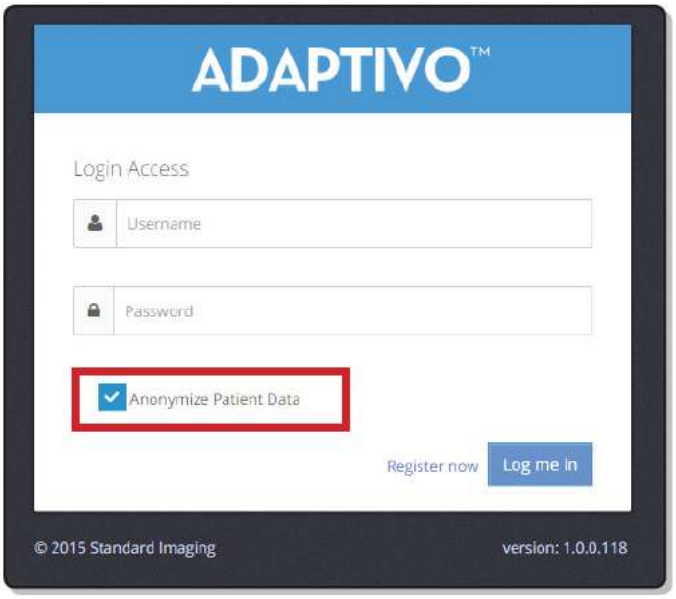
4.7.1 Activate User Account

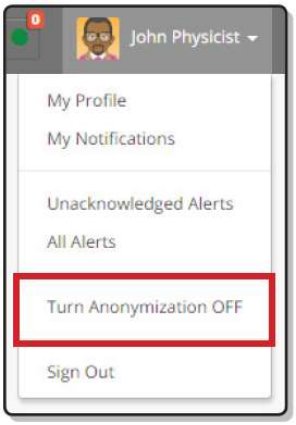
To activate a user account, log in as an IT Administrator. Under the Admin menu, select User Management. Check "Active" to activate a user's account. Check the appropriate "Admin" level to enable privileges. Three categories are available: Physics Admin, Patient Admin, and IT Admin. See the Administrator Options section for additional details on the privileges of these users. A combination of these privileges may be most appropriate for some users.



Anonymization

Anonymization can be turned on at the login screen.





If anonymization is selected at login, in can be turned off within the program by using the User dropdown menu. For more information, refer to Anonymization on page 58.

4.8 Clinic set up for commissioning collection

- In the Clinics menu, select Manage Clinics. Press the New Clinic button to add a clinic. Enter the clinic information and select "Create."
- Click on the cog icon next to the clinic name to enter the Clinic Configuration. Select Add Machine, and enter the required machine information. Select Create.
- Add Commissioning Template
    - Under Clinic Configuration, select Manage Clinics. Select the configuration cog icon to manage the selected clinic's configuration. Select the In Vivo configuration link for the machine of interest, and then select Commissioning from the Configuration menu list on the left side of the screen. Select Create New Templates.
    - Use a unique QA patient ID that would be a new patient in ARIA or MOSAIQ. Use only letters and numbers in the patient ID. Do not use symbols.

- Enter the Machine Serial Number, Name, Energies, Tolerance Table, and if used, the Wedge ID's, and Wedge ARIA Internal Codes to match ARIA exactly.

- Download Template

4.9 Import commissioning template into OIS (ARIA or MOSAIQ) for data collection

- Move the commissioning template to a folder that can be seen/mapped by the Oncology Information System (OIS) IMPORT/EXPORT tool. If Adaptivo has not been connected to the clinic network, use a USB drive to transfer the files.
- Have a clinic user import the commissioning template patient(s) into ARIA.
  - Re-order plans so that they are in numerical order.
  - Schedule plans for delivery to include integrated images for all fields - double check that every field has an integrated image scheduled.
  - Reference points - the daily, session, and total dose reference points should have the maximum allowable value entered in ARIA.
  - Plan Approve and Treat Approve all plans.
  - Add the commissioning patient to the treatment schedule. Schedule the commissioning patient(s) for two to three appointment times. This permits a plan or beam to be delivered two to three times if needed due to a treatment interrupt, provided the Reference Point doses have the maximum allowable values for daily, session, and total dose.
- For users with MOSAIQ rather than ARIA, have a clinic user import the commissioning template patient(s) into MOSAIQ and follow similar steps.

Import/Export of existing In Vivo beam models

Existing In Vivo beam models may be exported from one system and imported into another using the following steps.

On System 1:

1. Export a template. – Go to Clinic/Machine and select In Vivo for the desired machine. Click Actions and select Export Commissioning Model from the list. Repeat for any other energies you wish to export.
2. Verify the exported template is created as a zip file and available in the shares folder.
3. Copy the exported zip file so that it is accessible from System 2.

On System 2:

4. Import the zip file. – Go to Manage Clinics and select Import In Vivo Commissioning Model in the upper right corner.
5. Verify the clinic was imported.
6. Verify the machine was imported.
7. Verify the default couch settings were imported.
8. Gamma criteria and Calculation settings are not maintained. Update as needed to desired settings.
9. Verify the In Vivo commissioning template was imported with the results.

10. Select the “approve the model” action. Repeat for other energies associated with this machine.
11. Verify the charts for the model are present.
12. Approve this model for clinical use.

4.10 Access the Hospital/Clinic Network (if permitted)

The clinic IT personnel need to add the Adaptivo computer to Domain with ACCESS to the Varian Network.

This requires the AE Title/IP Address of Varian DB Daemon and Portal Number for the Varian DB Daemon.

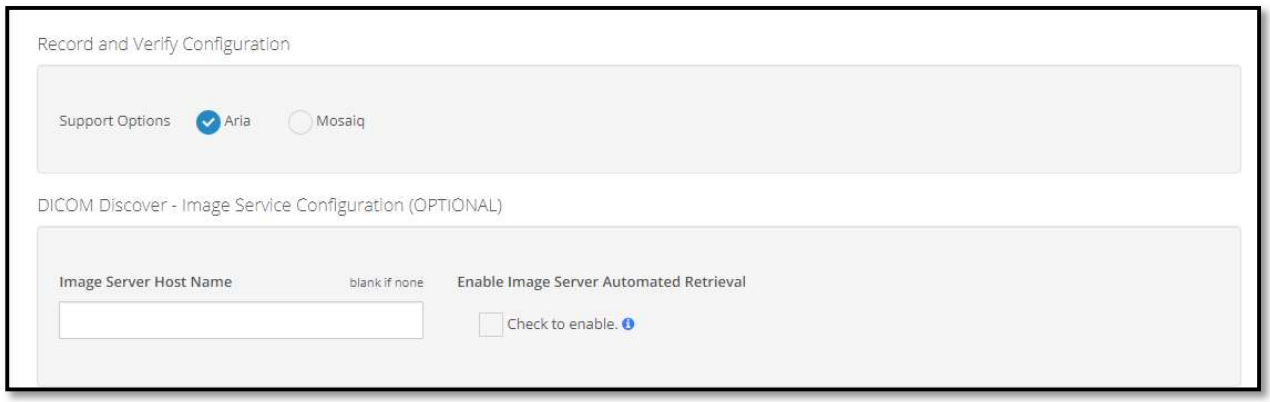
NOTE: The Varian DB Daemon must also be configured when Adaptivo is used with Varian linacs and the MOSAIQ R&V system.

Local IT or department personnel may be able to provide this information or may need to call Varian customer support.

Please be aware that SI personnel **cannot** place calls to Varian customer support for you.

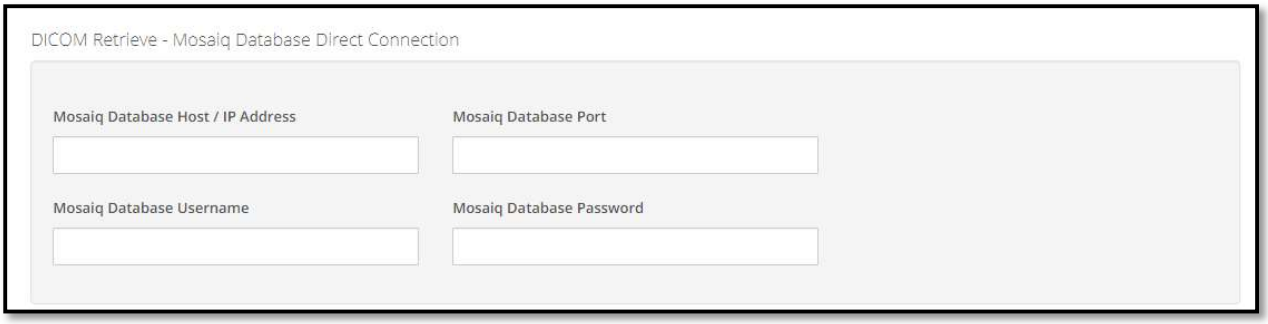
Local IT or department personnel will need to provide the AE title/IP Address of the Adaptivo computer to Varian Customer support.

To configure the DICOM information, first select the appropriate OIS.

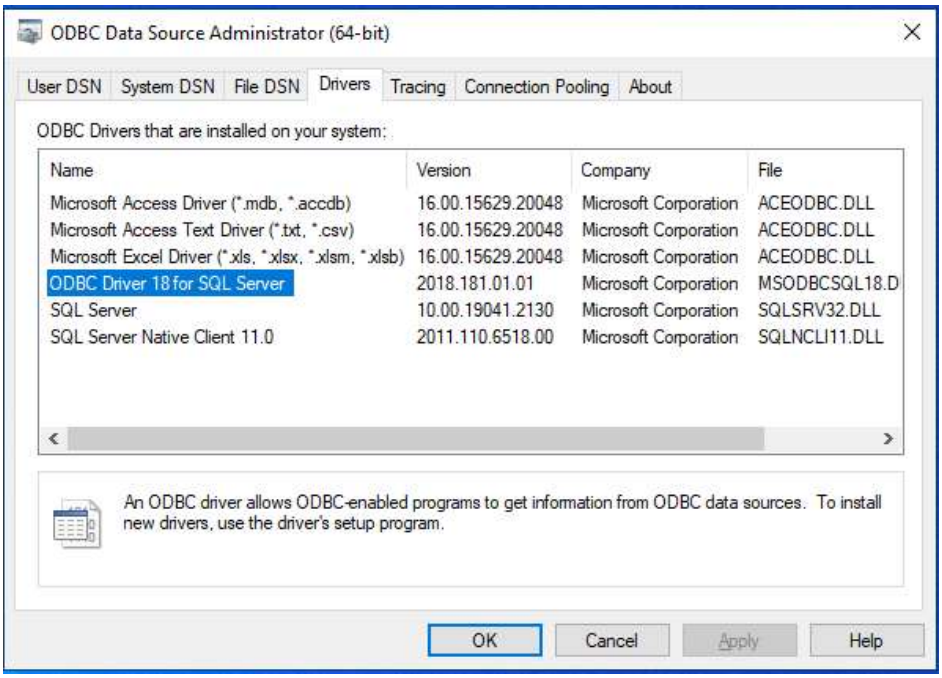


a. MOSAIQ Image Service example: //xxxx/c$/impac/Data
b. ARIA Image service example://xxxx/VA_DATA$/patients

For MOSAIQ, configure the database connection.



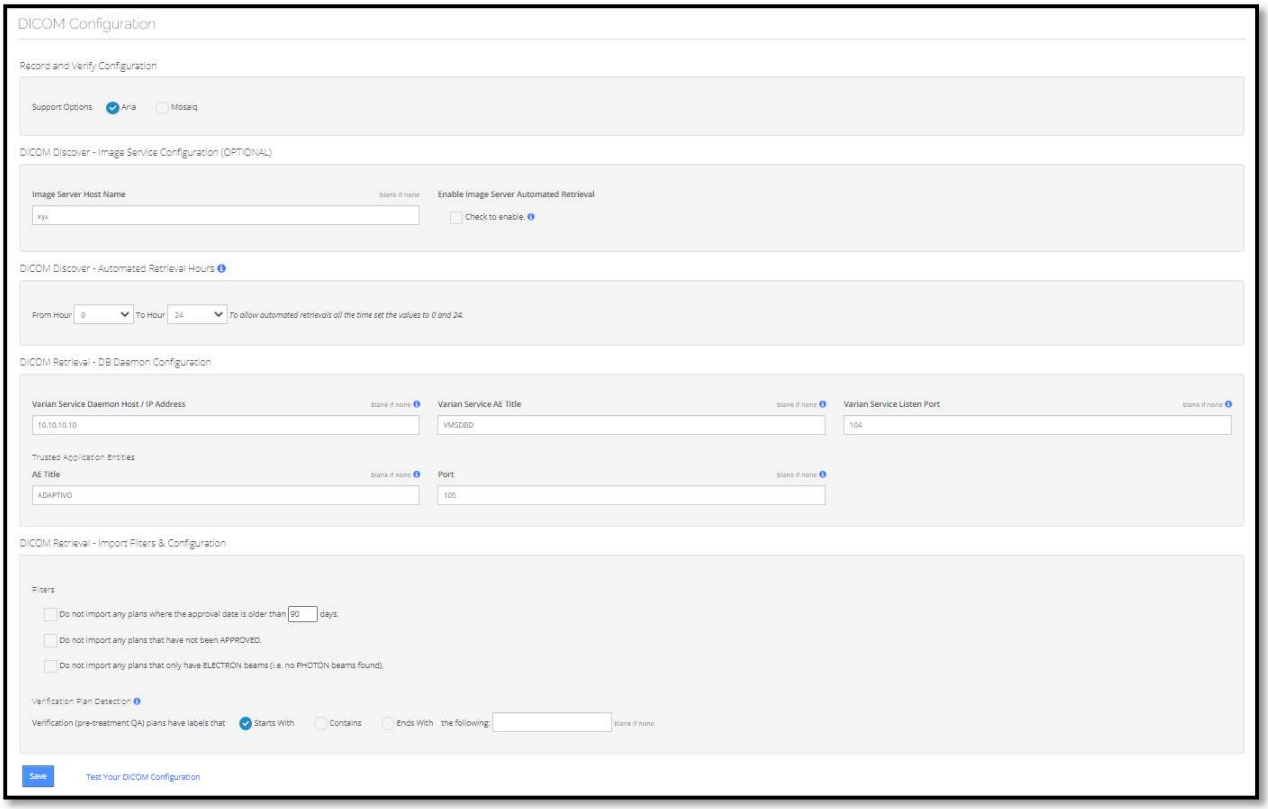
The Microsoft ODBC Driver 18 for SQL Server must be installed on the Adaptivo server for the MOSAIQ database connection to succeed. Verify the installation of this driver by opening the Windows ODBC Data Source Administrator tool and selecting the Drivers tab.



If the driver must be installed, it can be downloaded from Microsoft: https://learn.microsoft.com/en-us/sql/connect/odbc/download-odbc-driver-for-sql-server?view=sql-server-ver16

Verify connectivity to both the DB Daemon and MOSAIQ after configuration using the *Test Your DICOM Configuration* button at the bottom of the page.

See below for DICOM Configuration information needed to retrieve from ARIA:



Configuration to connect to Varian DB Daemon

Fields include:

- Image Server Host Name
- Varian Service Daemon Host Name /IP address
- Varian Service AE Title
- Varian Service DB Daemon Listening Port
- Adaptivo AE Title
- Adaptivo Port

Additional controls include:

- Import Allowed Hours- only relevant if using automatic retrieval from an image server

Import Filters:

- Do not import any plans where the approval date is older than X days
    - If this filter is checked no plans older than the number of days entered into the filed will be imported.
- Do no import any plans that have not been APPROVED.
    - If this filter is checked only plans in the APPROVED state can be imported.
- Do not enter any plans that only have ELECTRON beams.

    - If this filter is checked a plan that includes only ELECTRON beams will not be imported. Plans that use a combination of PHOTON and ELECTRON beams will be imported.
- Filter into sub area Verification (pre-treatment QA) plans based on plan label
    - Specified label such as “QA” can be at the beginning, middle or end of the plan name
    - Consider naming carefully such as including an underscore to avoid inadvertently filtering out patient treatment plans into the Pretreatment QA Plans area

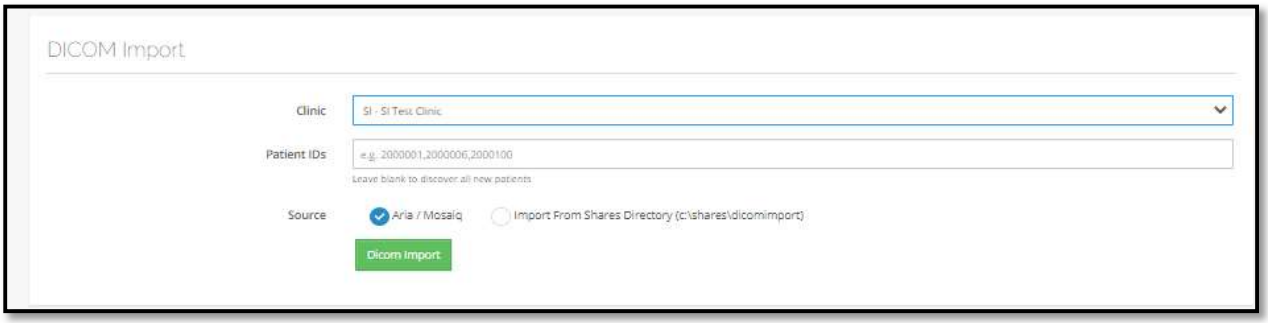
For MOSAIQ, remove the DICOM_MODE variable in the Adaptivo Web environment file.

1. Open the “PowerShell 7” app.
2. Type the following command: ssh adaptivo@adaptivo
3. Type in password “adaptivo” if prompted (with the default Adaptivo Web setup, you will not be prompted for this password).
4. Edit the contents of the following file using the text editor of your choice (e.g. vim): /home/adaptivo/code/web/current/.env
5. Remove the following line from the .env file:
    a. DICOM_MODE=dicom
6. Save your changes to the .env file, exit the text editor, disconnect from the VM (using “exit” command), and close PowerShell.

4.11 Initiating DICOM file retrieval from ARIA/Mosaiq

If connectivity to ARIA/Mosaiq exists but either connectivity with the image server is not available or automatic patient retrieval has not yet been enabled, patient import can be initiated via the DICOM Import page.

From the Clinic menu, select DICOM Import. Select the correct clinic, and enter the patient ID or IDs you wish Adaptivo to import. Leaving the Patient ID field blank will retrieve all new patients. Select the Dicom Import button.

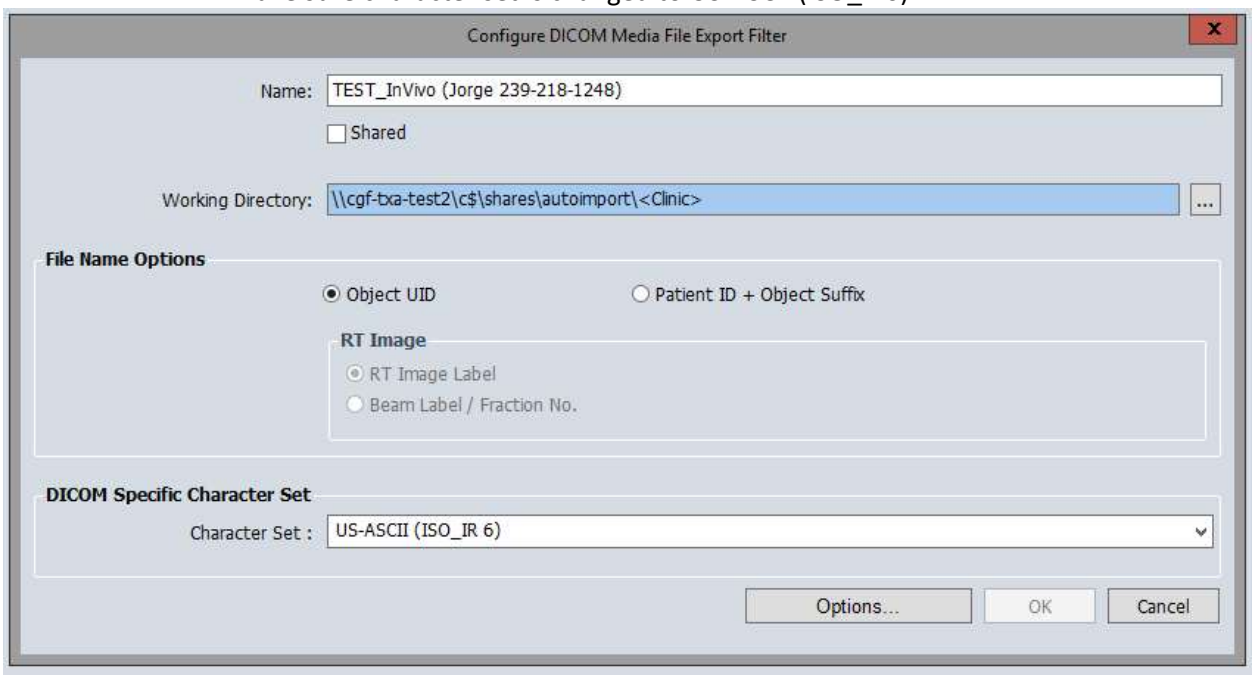


Patient file retrieval needs to be initiated only one time for a given patient. Subsequent treatment deliveries for this patient will be automatically retrieved by Adaptivo.

4.12 ARIA 15 DICOM import method

Aria version 15 requires the following setup for automated import to function.

1. Create a DICOM export filter from ARIA.
    a. Make sure the filter is set up to export data to a folder labeled with Patient ID. Adaptivo requires data to be in a folder.
    b. Point the export to the following directory
        i. \\ [computer name or IP]\c$\shares\autoimport\ [clinic abbreviation]
        ii. Make sure character set is changed to US-ASCII (ISO_IR6)

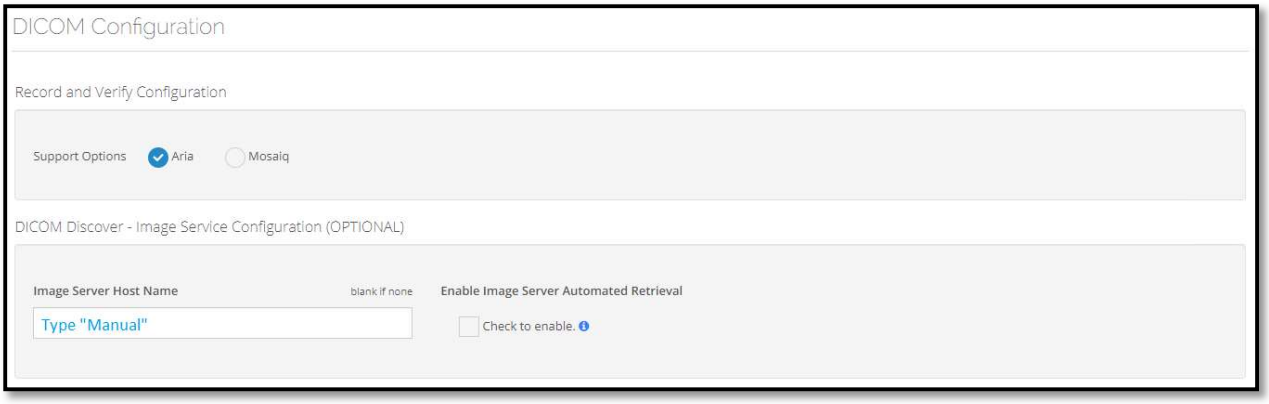


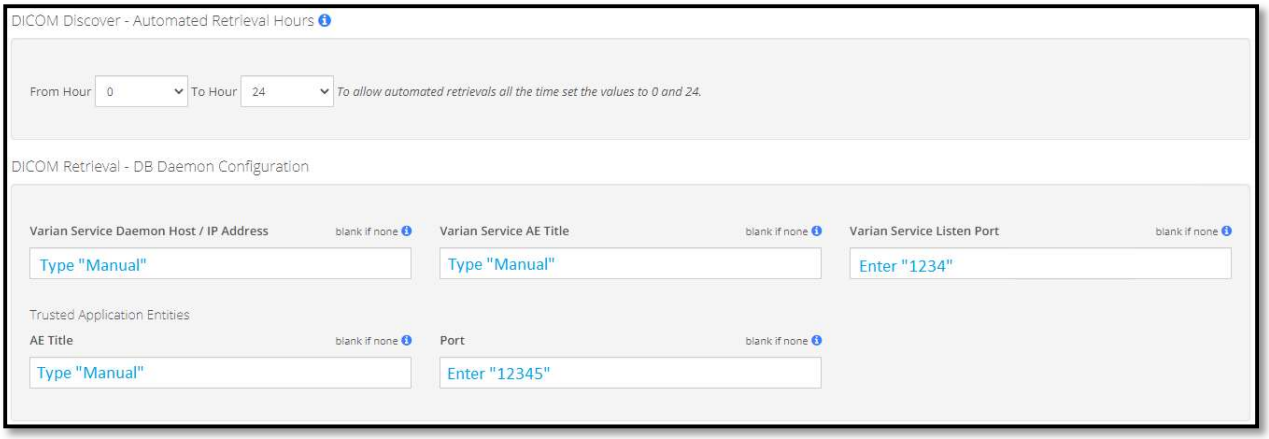
        iii. Export the patient. Refer to data requirements for necessary file types.
2. A clinic folder is generated in this directory once a new clinic is created. Adaptivo will perform a query of this directory every 15 minutes and import data automatically. Once a patient's data are imported via this method, new daily treatment information for that patient will be queried through the standard DICOM settings.
    a. Adaptivo will wait for the last file to have a timestamp older than 10 minutes prior to importing to guard against an incomplete data set.

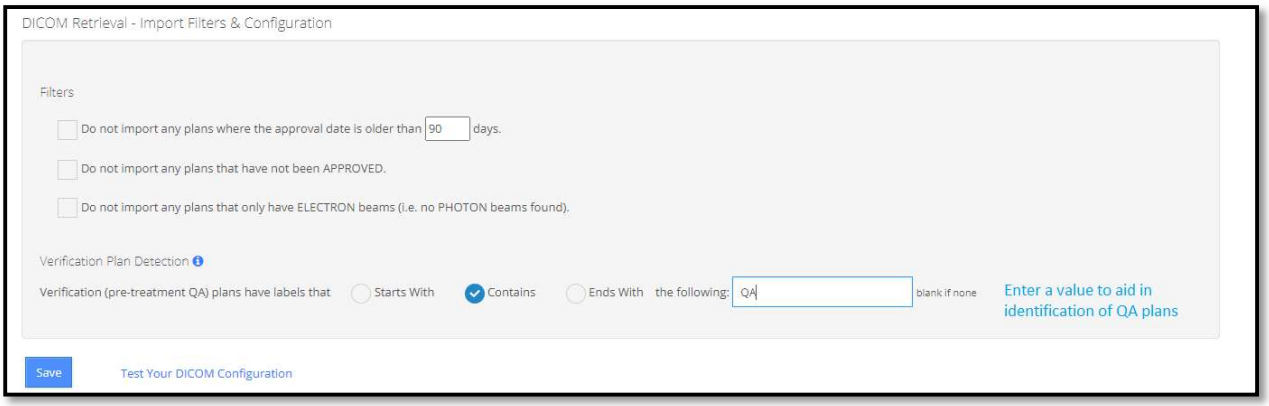
4.13 DICOM Import in standalone/manual mode

Patient DICOM files can be manually moved and imported in the Adaptivo computer. The data from the TPS can be imported either manually or retrieved automatically via Aria or MOSAIQ.

Manual import still requires DICOM Configuration to be filled in at least with some values to permit import. See below for example:







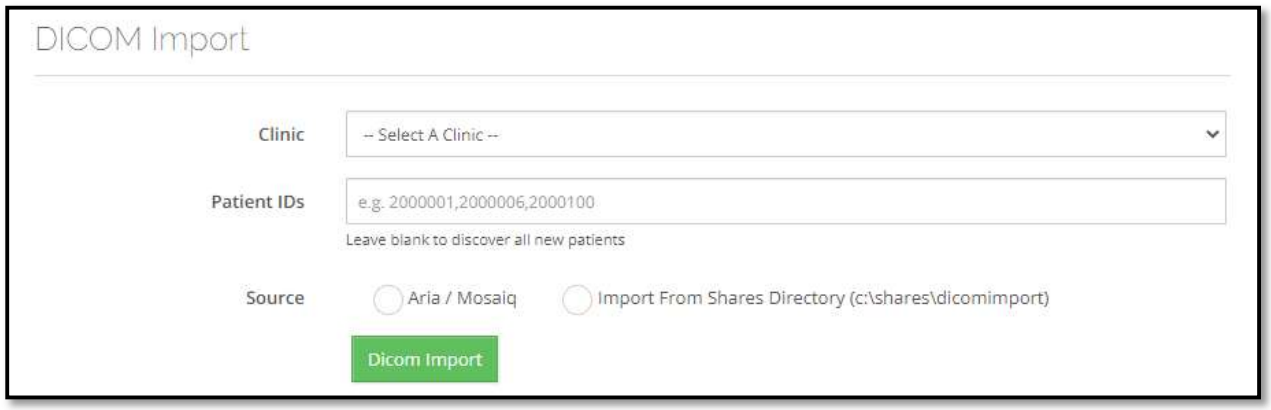
Manual DICOM Import when no ARIA connectivity is present

4.14 DICOM file retrieval from a local Shares directory

Retrieving DICOM files from a local shares directory permits exporting patient data from ARIA to a shared folder if the computer is on the network. The Adaptivo computer shares the folder located at C:\shares\dicomimport, and this folder can be mapped with the Export tool in ARIA.

One can also manually copy exported files from another computer in the same domain by opening File Explorer to "\\[Adaptivo Server]\Adaptivo_Dicom_Import" and copy the files to this location. This copy saves the files in the C:\shares\dicomimport directory on the adaptivo server specified so that users do not need to VNC or Remote Desktop into the adaptivo server.

After a patient is exported from ARIA to C:\shares\dicomimport directory, use the "DICOM Import" function to import all patients in the "shares" folder. Select "Import From Shares Directory", select the clinic into which the patients should be imported, and click on "DICOM Import":



All patients in the Shares Directory will be imported./

4.15 Test DICOM Services

To test the DICOM Import services, the clinic staff can export a patient from ARIA to a location accessible by the Adaptivo computer or transfer the files to the Adaptivo computer using a USB drive. The patient file export must include the planning CT files, plans (RP files), dose (RD files), structure sets (RS files), treatment records (RT files) and portal images (RI files).

Place the files in the desktop share folder and follow the process above. A successful import will result in the patient and plans being listed on the Adaptivo Dashboard.

4.16 Complete default software configurations

Adaptivo settings are customizable to fit the individual clinic's needs and preferences. The figures in this section are intended to show the recommended settings as a guide for users just setting up their system. See the App Settings section description for settings up Gamma region names colors and importing gamma configuration files for the installation.

4.16.1 Clinic Configuration

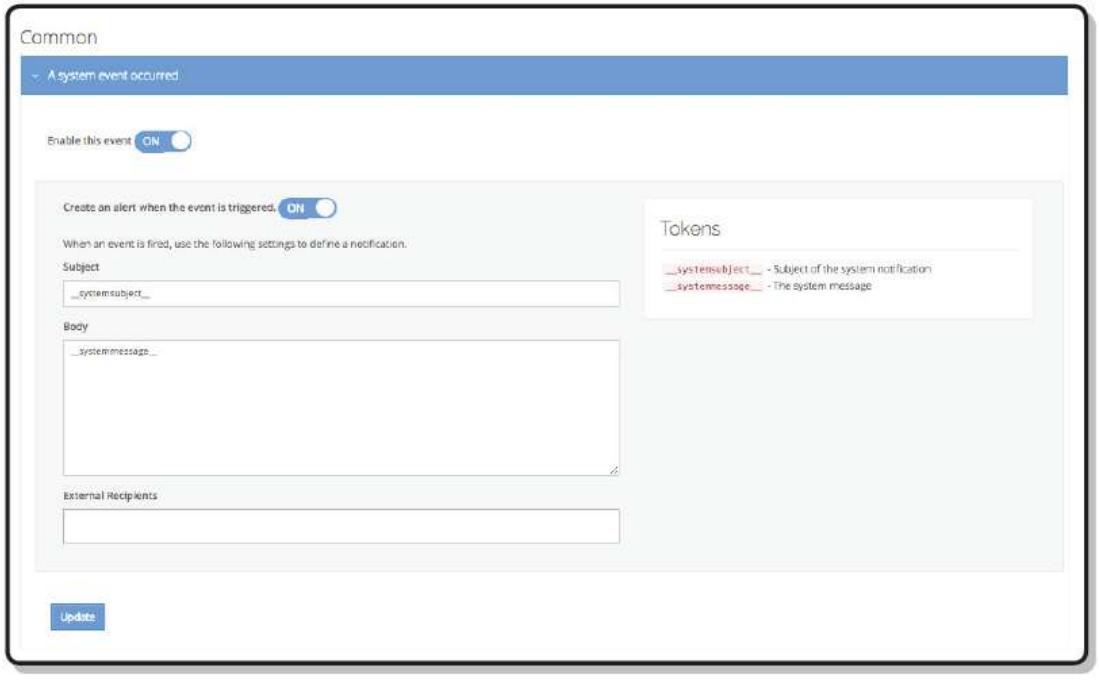
The user can modify and move between functions by selecting the Edit Clinic, Machines, Notifications/Alerts, Automation, Reports, DICOM, and Adaptive Rules setup as shown below:

4.16.2 Notifications/Alerts

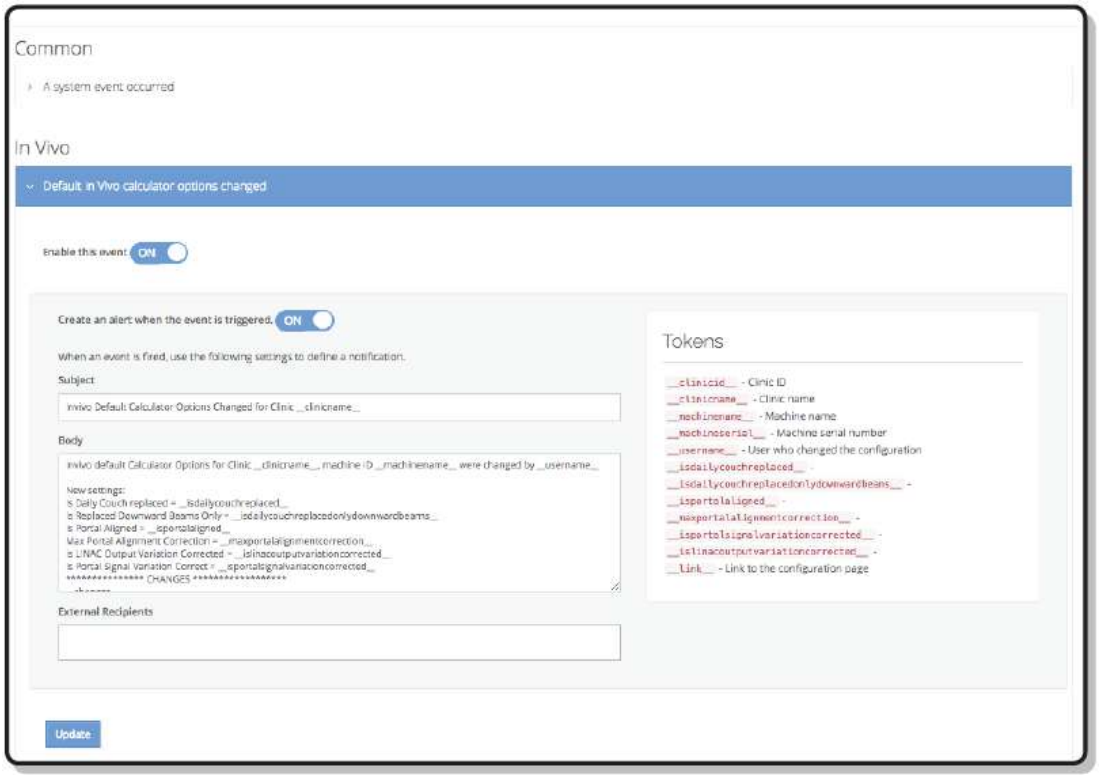
The images below show recommended settings for the notification configuration. To modify notifications, go to the Clinics Menu> Manage Clinics then select the cog associated with the Clinic of interest. Select Notifications / Alerts from the Clinic Configuration menu.

The notifications and alerts that one may begin with are listed below and are enabled to be on by default. The user can select if their plan notifications are sent via email or to the dashboard under the user's My Profile.

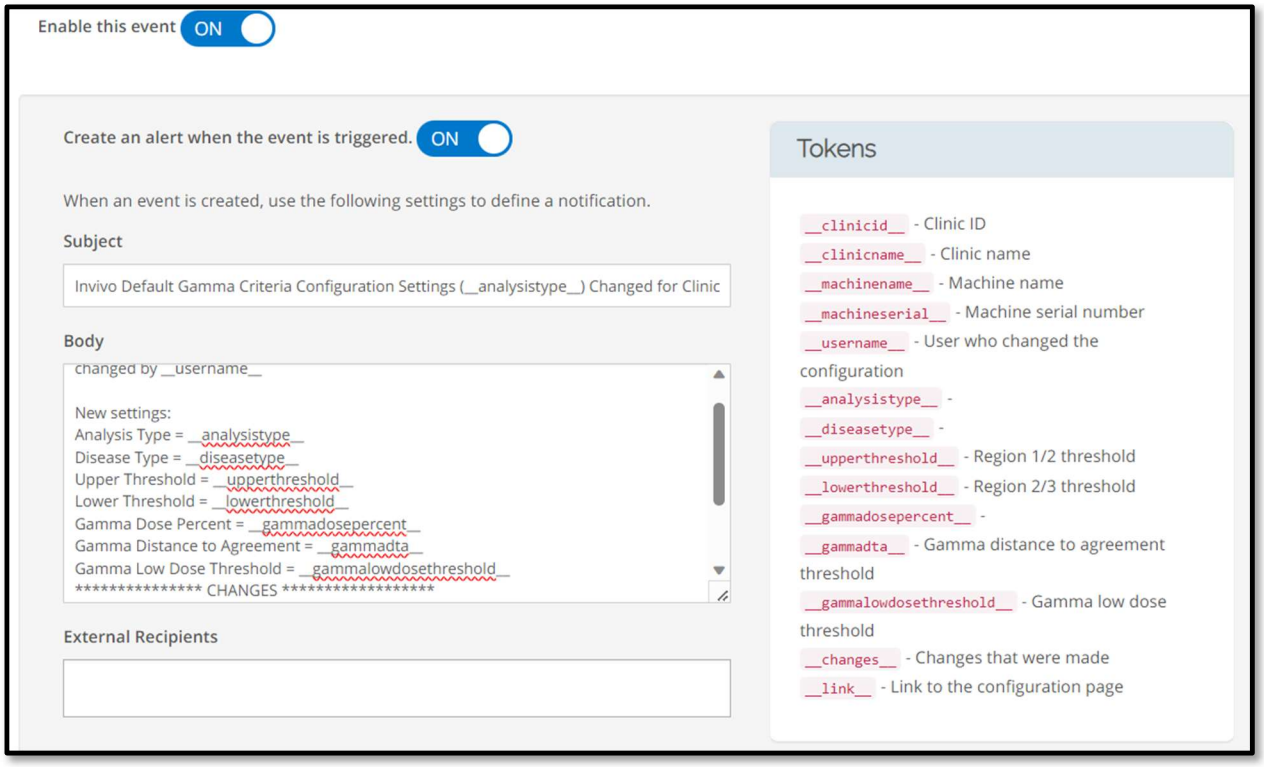
Default System event notification



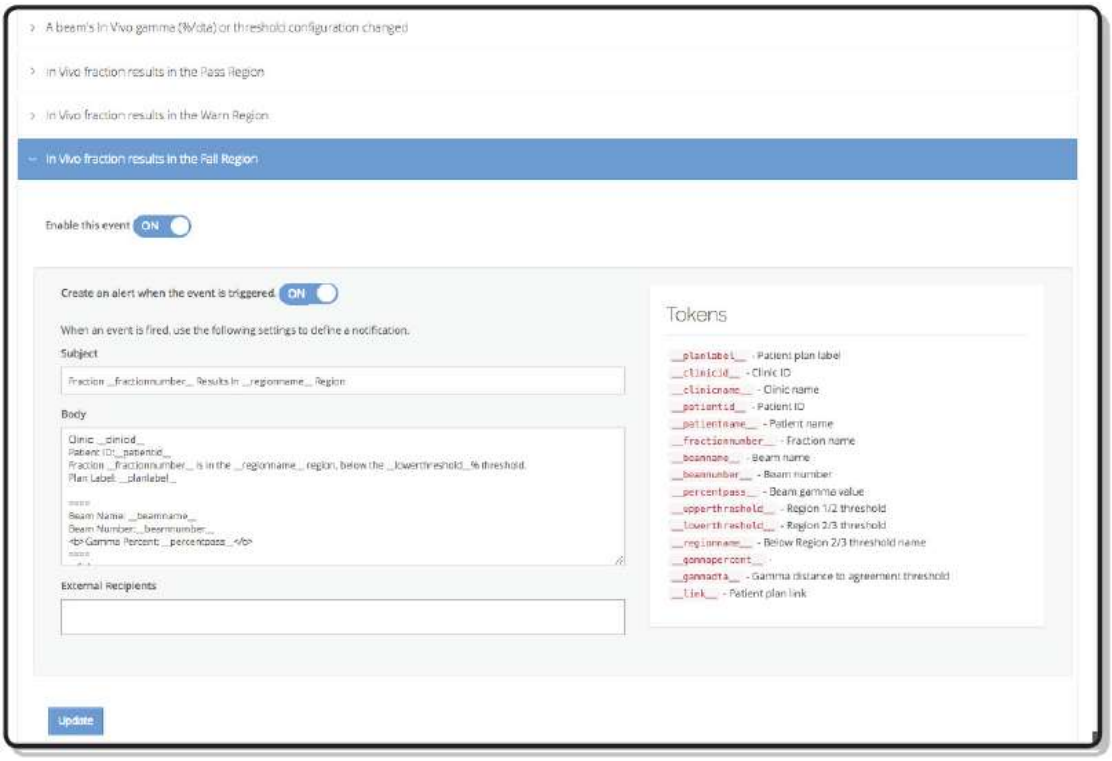
Default In Vivo Calculator Options Changed



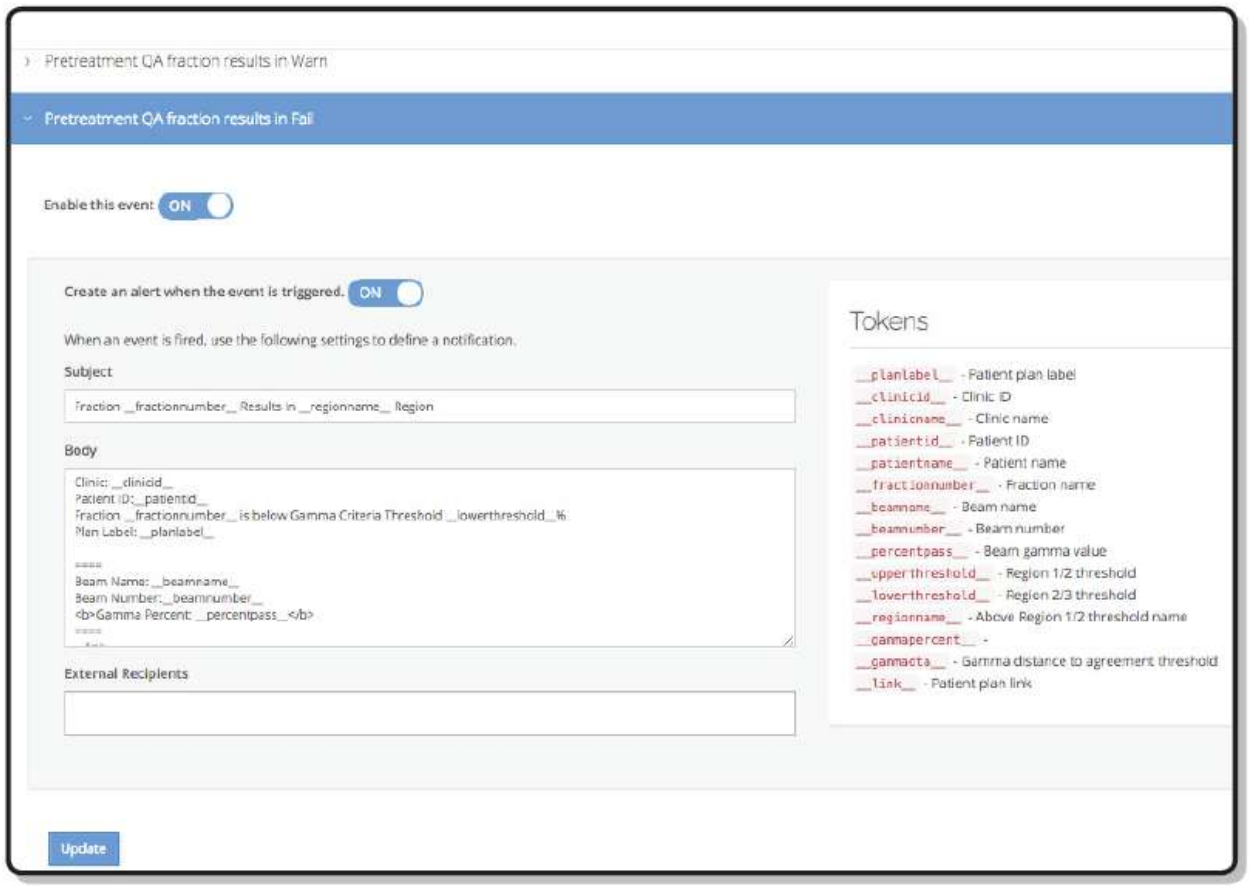
Default In Vivo gamma (% / dta) or Threshold/Region of Tolerance Changed



In Vivo Fraction Results in the lowest Region of Tolerance

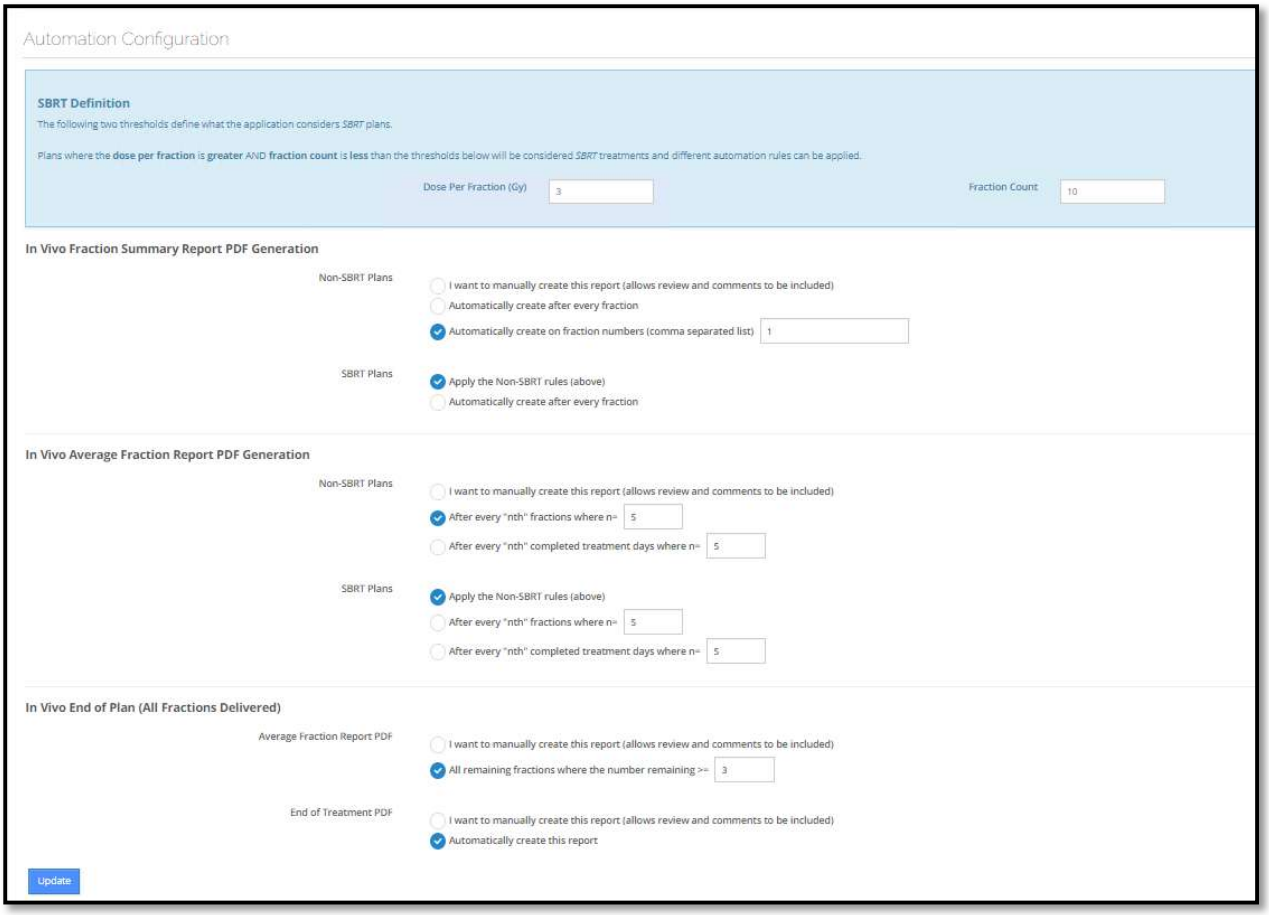


Pretreatment QA Results in the Lowest Region of Tolerance



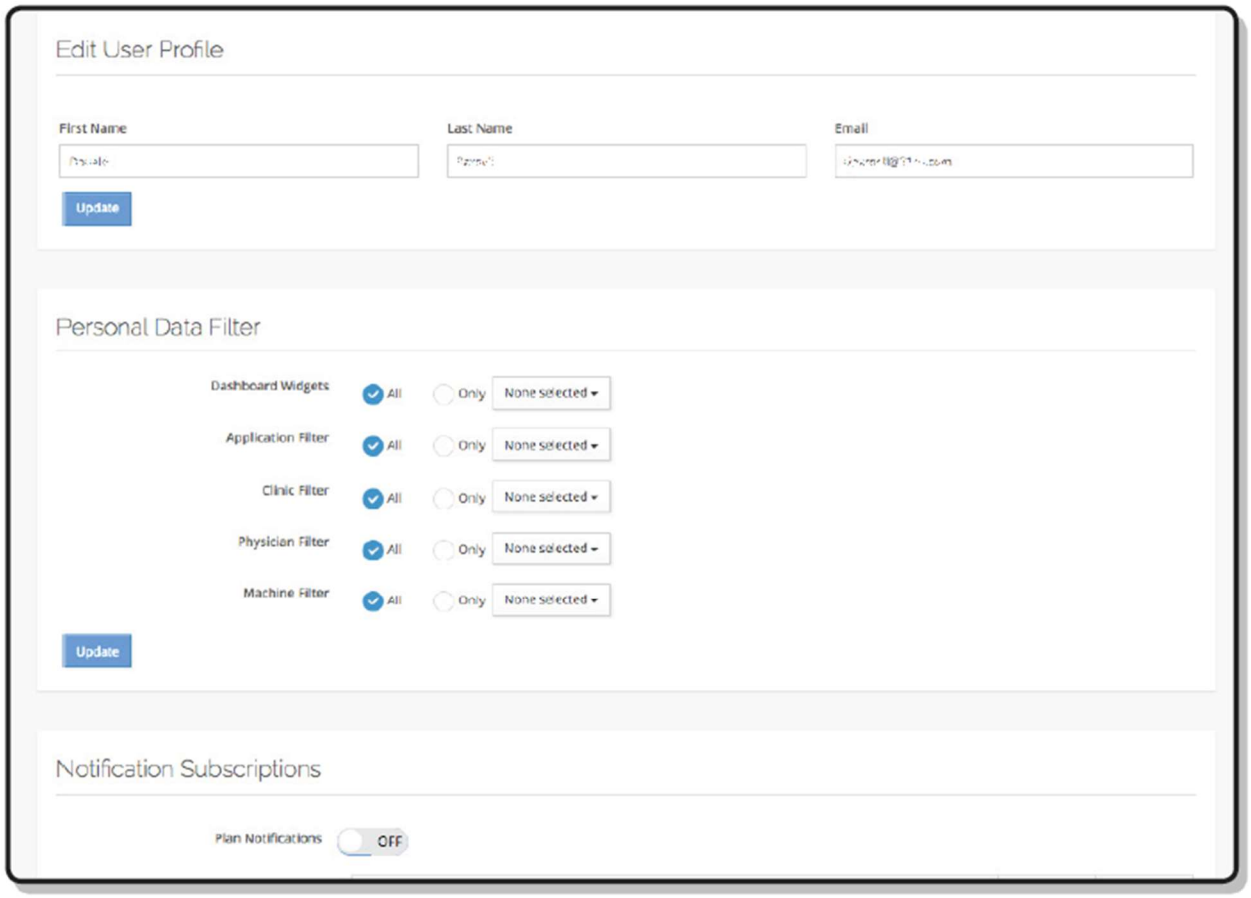
4.16.3 Automation

The automation settings designate the frequency at which In Vivo reports are automatically generated. Automatic calculation of average fractions can also be set. The definition of what plans Adaptivo will designate as an SBRT plan is specified in this section based on dose per fraction and fraction count. The report schedule for SRS/SBRT plans can be set equal to non-stereotactic plans or can have a unique schedule.



4.16.4 Edit User Profile Settings

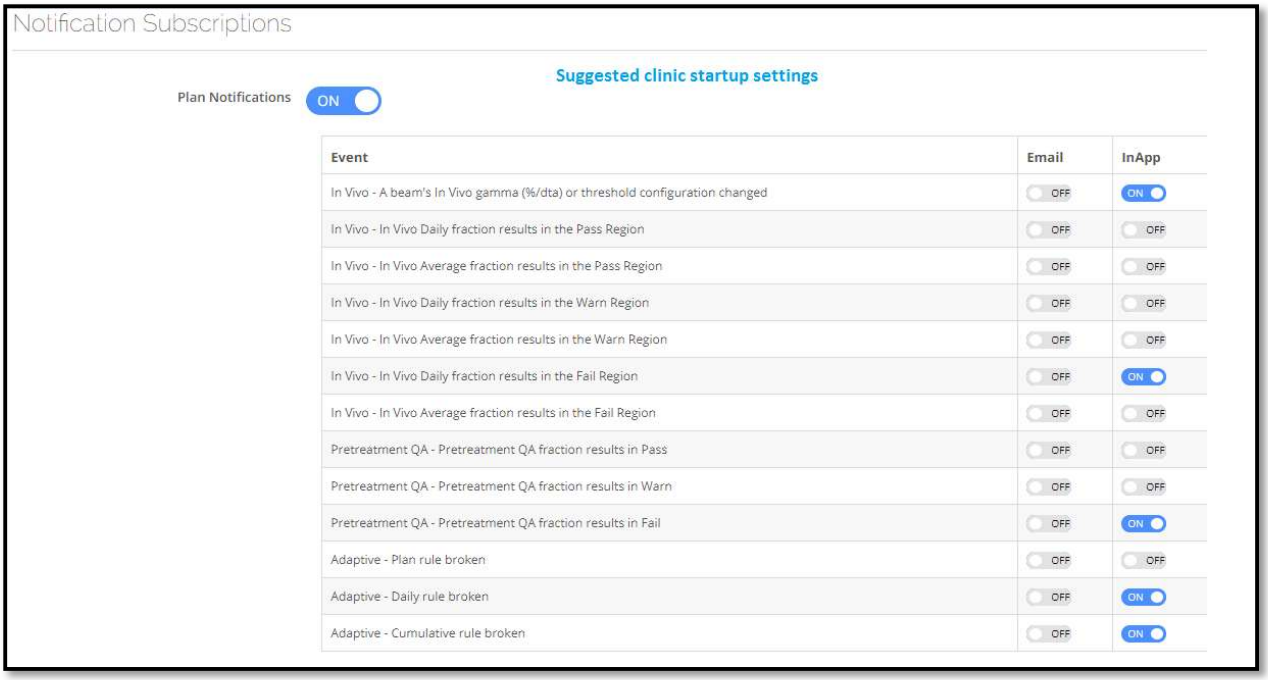
A user may edit their name and email address within their User Profile. A customized data filter for the user's home page can also be set here. After settings are changed, click "Update" to apply those changes.



4.16.5 User Notification Subscriptions

Users may choose whether to activate plan notifications and system notifications, and how they would like to receive notifications of each event.

Please note that event notifications must also be enabled in the clinic configuration settings in order for the user to receive notification of the event.



User Notification Subscriptions recommended for initial use of Adaptivo.

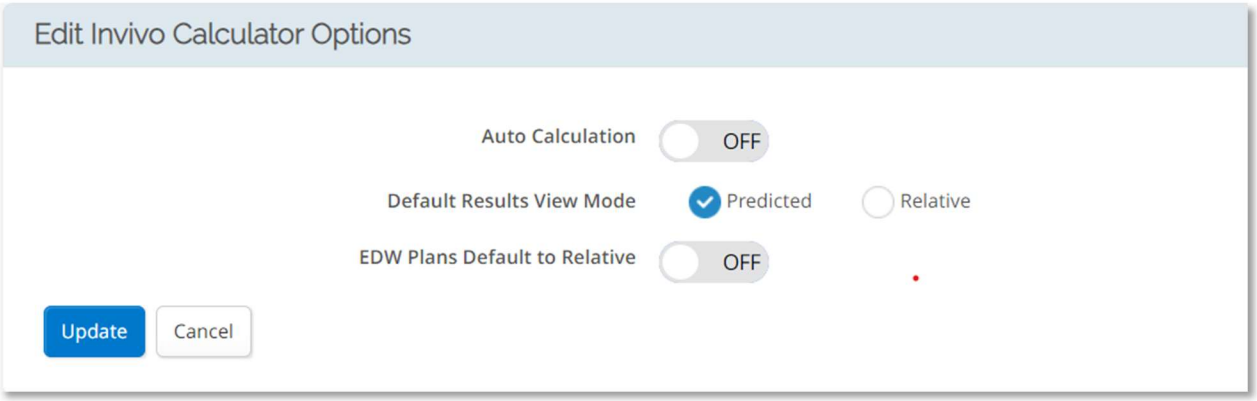
After changing notification settings, click on Update to save the changes.

4.16.6 In Vivo Configuration

Changes to the In Vivo Configuration can be accessed under Clinics > Manage Clinic and selecting the cog for the Clinic of interest and selecting In Vivo under the Configuration column for the machine to be configured.

4.16.7 Calculation Options

Click Edit to the right of In Vivo Calculator Options to make changes. The In Vivo program should be started initially with Auto Calculation OFF until users are comfortable with the software. This prevents undesirable delays while a potentially large backlog of data is calculated.



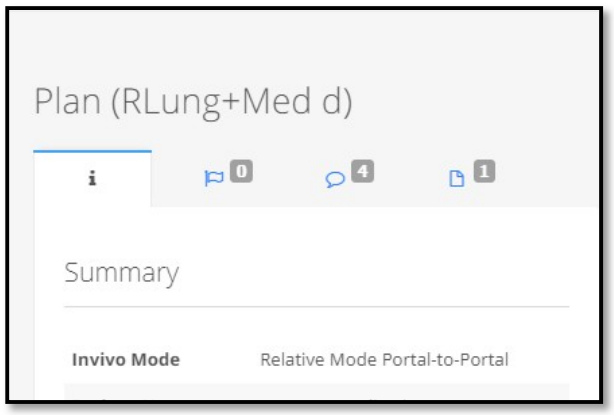
Auto Calculation, when enabled, will automatically begin calculations when new DICOM data is imported.

Note: *If numerous plans/ patients are imported at clinic startup it could take a few days to process all patients.* ***Users should start with Auto Calculation OFF****.*

4.16.8 Default Results View Mode

The In Vivo module can run in Predicted or Relative mode. This option allows the user to select the default mode used for the display of calculation results. To run in Predicted Mode, a commissioning model must be present and approved. During program start up, begin with a default commissioning model approved for each photon energy containing a commissioned model. Note that plan specific changes to Gamma analysis parameters will only be applied to the default results view mode specified, either predicted or relative. The user can check which mode the plan was calculated with from the plan Summary. The top item on the list is the mode which will be one of four options:

1) Relative Mode Portal-to-Portal
2) Predicted Mode as Planned (for In Vivo Calculator Option “None”)
3) Predicted Mode Rules Based Results (for In Vivo Calculator Option “Only Downward Beam Angles”)



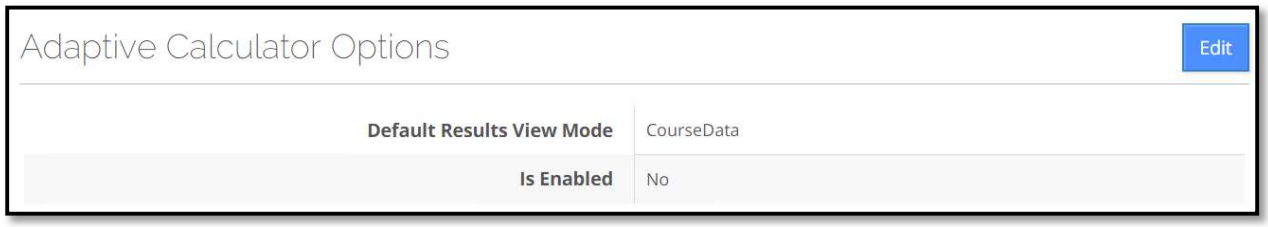
4.17 Adaptive Module Configuration

To enable the Adaptivo system to calculate 3D daily and cumulative dose results in the Adaptive module, the energies must first be enabled.

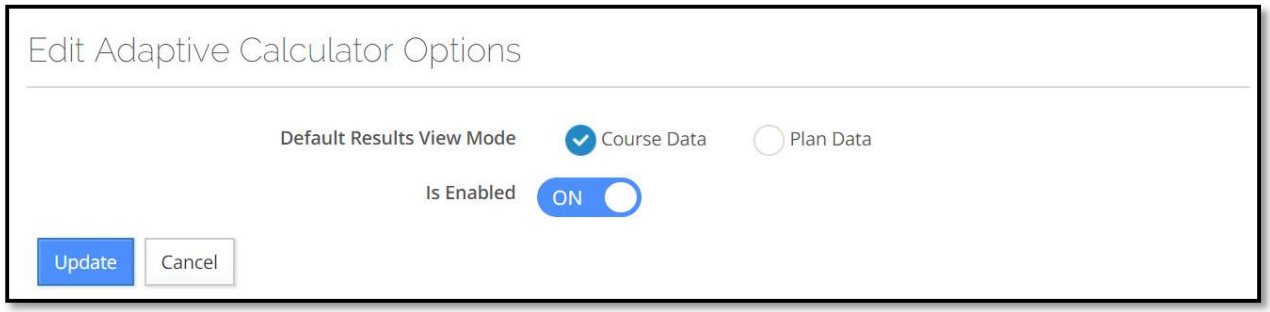
Under the Clinics menu, select Manage Clinics. Select the cog icon for clinic configuration, and then click on the Adaptive link under Machines for the linac you wish to set up.

Select the Commissioning link on the left of the screen. To enable a beam energy, select Update next to that energy, then ensure the correct Varian Representative Data Model is selected for the energy you have chosen. Select Create Model then click Activate. Repeat this process to activate beam models for all desired energies. You may be required to enter your username and password when updating the commissioning.

From the left of the screen, select Calculator Options. This will show whether the default calculation mode is for plan or course data, and whether Adaptive calculations have been enabled for this linac. To enable calculations or to change the default view mode, select the Edit button.



Select the desired default view mode and toggle the Enabled switch to On to enable the Adaptive calculator.



Select Update to save your settings.

Selecting Course data means that when multiple plans are calculated in a course, the plan review will default to display the summation dose of associated plans. Selecting Plan Data will result in the default review mode being the individual plan dose.

Plan data will calculate cumulative values based only on the number of fractions in the individual plan. This is the suggested default. Course data will include multiple plans in a treatment course ONLY IF they

have the same planning CT image set. This usually happens if you have a treatment plan and a boost plan that are planned from the start. This option can be chosen for individual plans when appropriate. If the treatment plan and boost plan are planned on different planning images the dose from both plans cannot be combined for review in the Adaptive module.

Please note that in the current version of Adaptivo, you must still enable each patient plan to calculate in the Adaptive module. Please refer to page 92 for instructions.

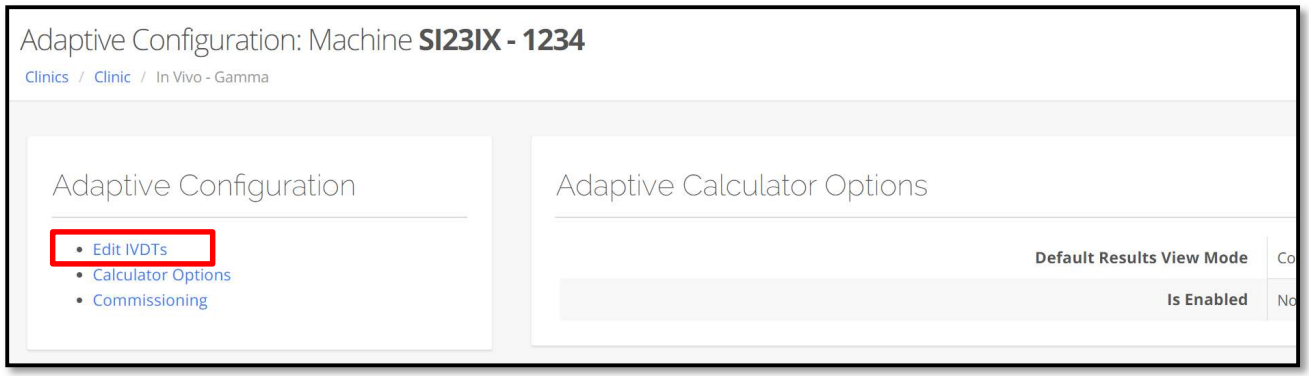
4.17.1 Image Value Density Table (IVDT)

To configure the Image Value Density Tables for a linac, the Adaptive CBCT modes must be configured, and both a head and body size electron density phantom measured for all modes. See Appendix B for more details on the CBCT setup and density measurements.

Once image values have been obtained, they can be entered along with the associated relative electron density values as IVDT data in Adaptivo.

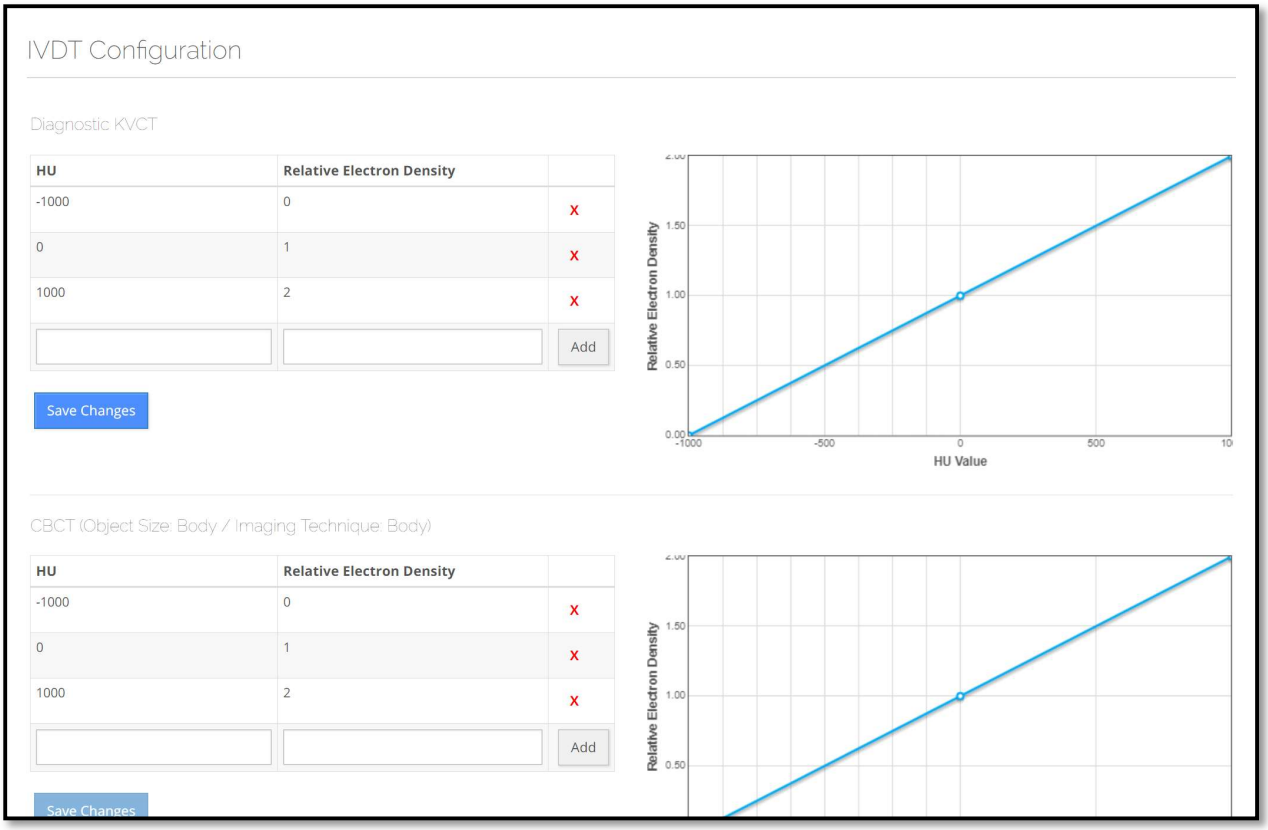
From the Clinics menu, select Manage Clinics. Select the cog icon for clinic configuration, and then select Adaptive under the Configuration column next to the linac that is to be configured.

From the Adaptive Configuration page, select Edit IVDTs .



The IVDT Configuration page allows entry of the HU and relative electron density values for the diagnostic kVCT as well as six configurations of the CBCT: three Adapt CBCT protocols with two phantom sizes each.

Enter values for each HU, RED pair, and select Add. Until Add is selected values will not be recognized.



Use the red X to remove any incorrect entries. Ensure the curve shows a reasonable trend. After you are satisfied with the entry for each configuration select the Save Changes button for each technique. If the HU and relative electron density values are not both monotonically increasing for any of these tables, one or more points may need to be averaged, slightly modified, or omitted in order to satisfy this requirement.

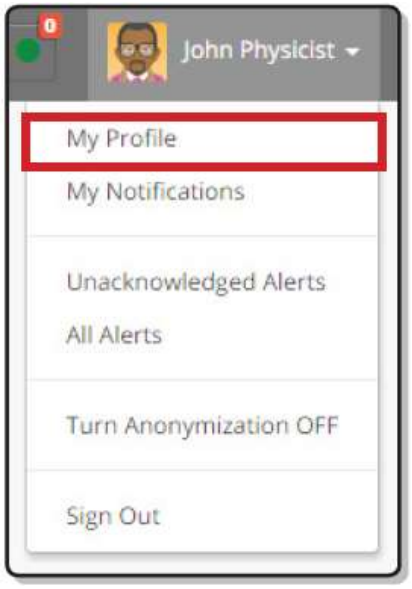
Please note: A point at -1000 HU, 0 density is **required** by Adaptivo for **every** IVDT data set.

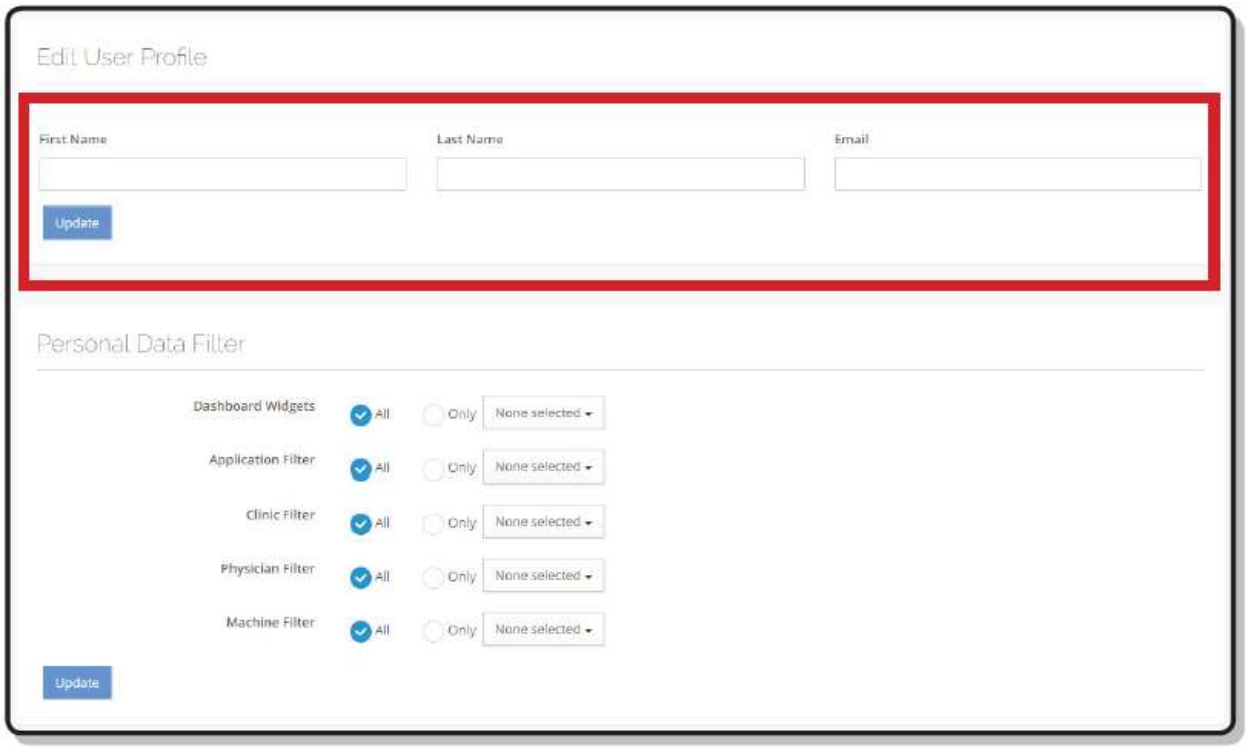
5 User Setup and Configuration

Each user can configure his or her profile and filters to display only the desired information.

5.1 My Profile

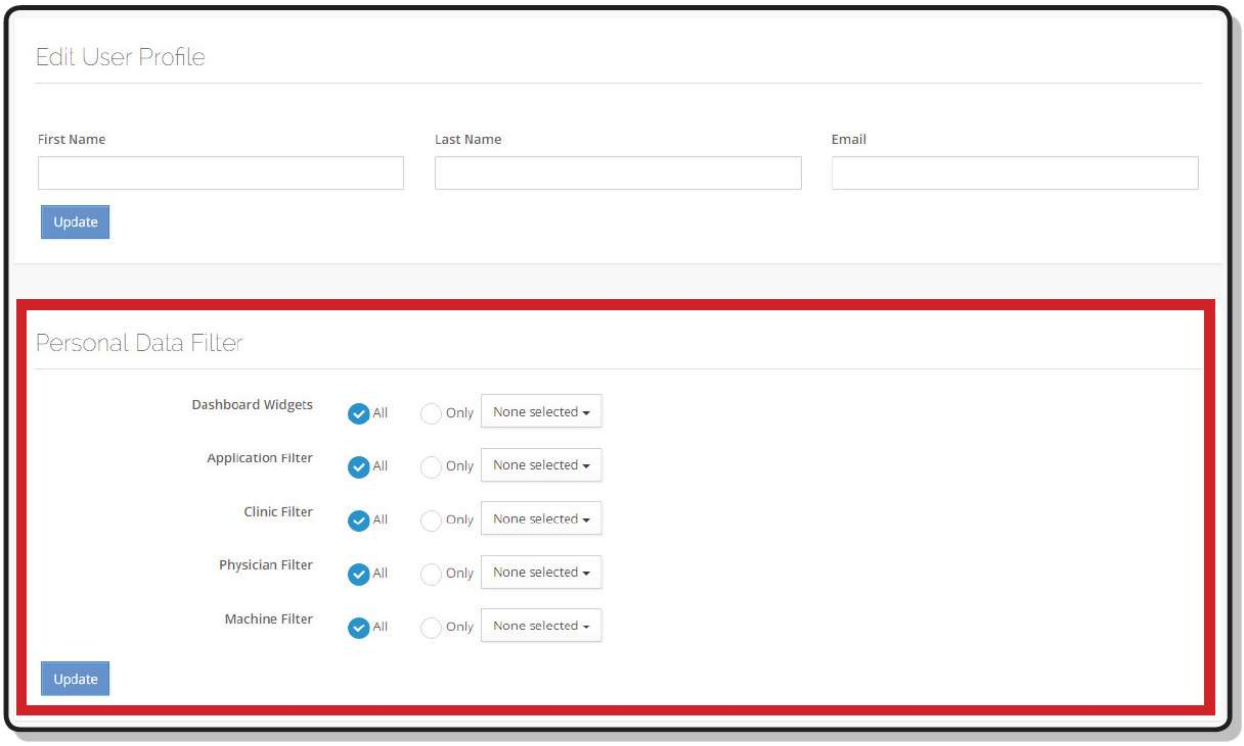
To set up your user profile, select My Profile, and begin by verifying or entering your name and email address.





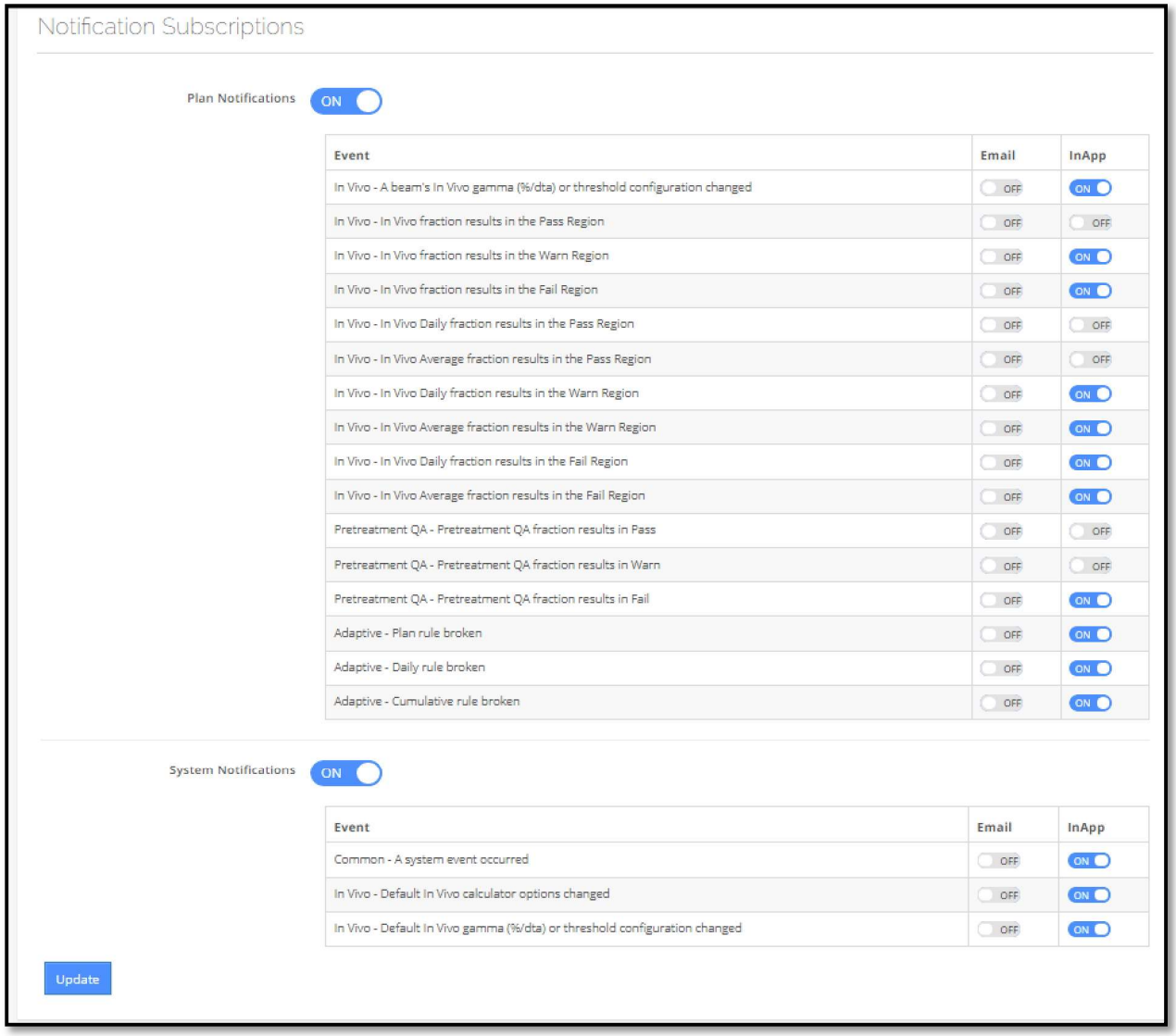
Select Update to save any changes to this section.

Next, adjust the Personal Data Filters as desired. Select the All radio button to view all the data in each category, or select the desired subset from the associated Only menu.



Select Update to save any changes to this section.

Adjust notification subscriptions as desired. Select whether to receive notifications by email and/or within Adaptivo.



Select Update to save any changes to this section.

5.2 My Notifications

The My Notifications page works similarly to an email inbox. Typical Notifications include plan-based alerts as well as system notifications. The Notification Subscription setting in My Profile determines which of these types you see on the My Notifications page. When a new notification is received, it is indicated in the navigation bar, as well as in the Unread Notifications widget on the home screen.

On the left of the My Notifications page is a series of categories. Each category includes a number, indicating the number of notifications it contains.

5.2.1.1 All vs. Unread Notifications

Select 'All' to view all received notifications, or 'Unread' to view only those which have not been opened yet. A notification is considered 'read' once it has been opened.

5.2.1.2 Type

System notifications include system events and changes in the default calculation or gamma settings.

Based on subscription settings, patient notifications are generated when the patient's Pre-treatment QA, In Vivo measurement, or DVH curve generates either a Warn or Fail result. You may choose which of these levels generate notifications for your profile, and you may even choose to receive notification for passing results in the Pre-treatment and In Vivo module.

5.2.1.3 Severity

Select one of the Severity categories to view notifications that correspond to the specified threshold or 'pass/fail' criteria. The threshold criteria are determined by the pass/warn/alert settings.

Once a category has been selected, all associated notifications will be listed in the middle panel.

To view a notification, select it from the list. The application will display the details for the selected notification on the right.

5.3 Alerts

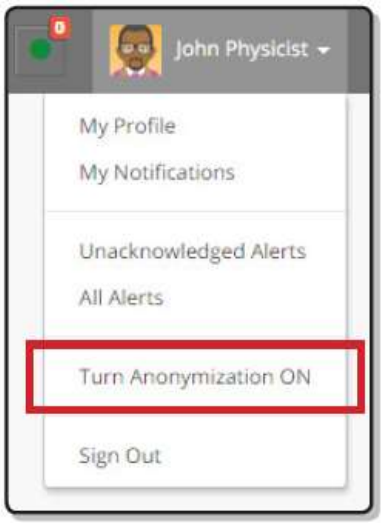
Selecting Unacknowledged Alerts from the user dropdown menu will show a full list of unacknowledged alerts. Selecting All Alerts will show a complete list of unacknowledged and acknowledged alerts, along with the name and date these were acknowledged.

Unacknowledged Alerts will also appear in the Active Alerts area of your home screen and has red flags above the Patient and In Vivo results. You may click on the alert to be taken to the plan or treatment that generated the alert, or to acknowledge the alert.

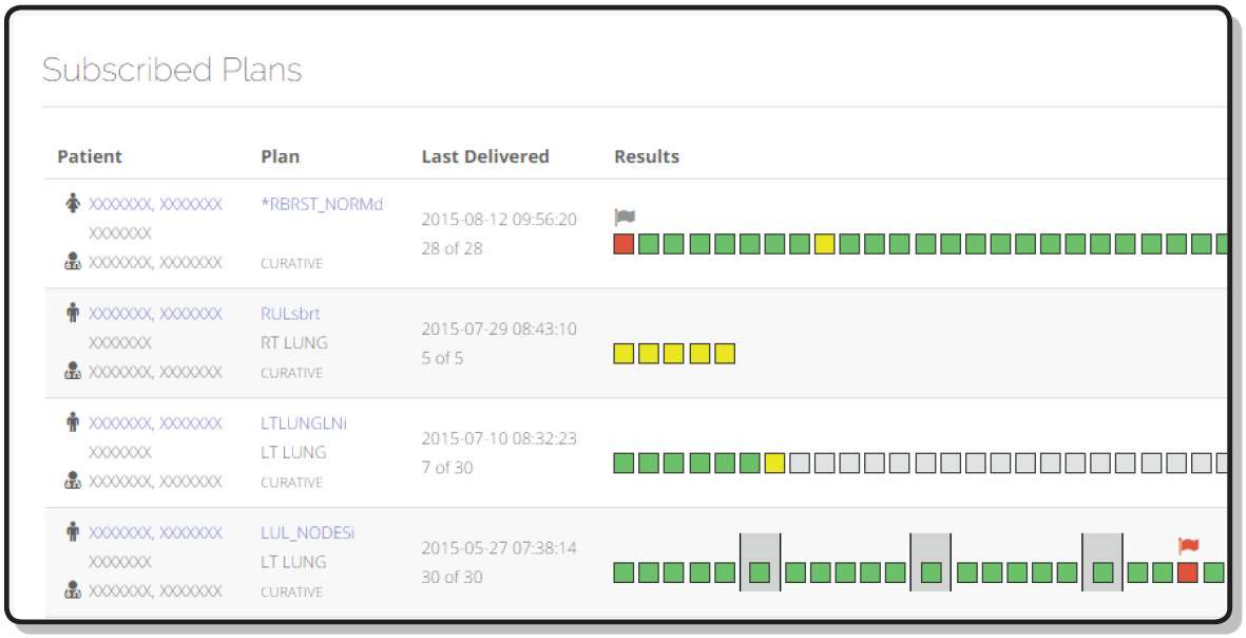
Please note that only alerts that have been enabled in the clinic configuration will be sent. If you have subscribed to an alert that has not been enabled and set to send an alert, you will not receive a notification even if the event occurs. The content of the notification may be customized in the clinical configuration.

5.4 Anonymization

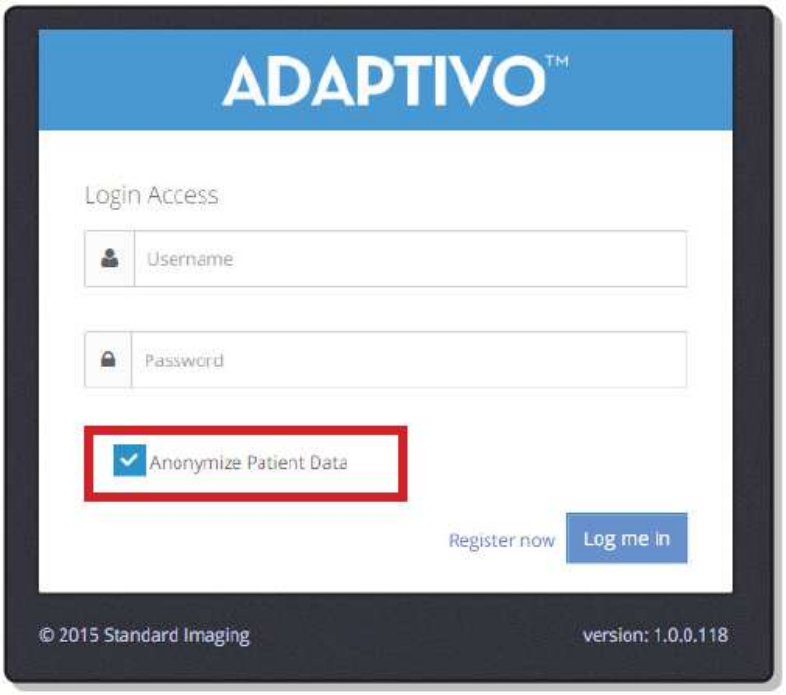
Anonymization can be toggled on and off by selecting the Anonymization option from the User dropdown menu.



When anonymized, the personal information for each patient will be replaced with “XXXXXXXXX”. All other information will still be visible.



Alternatively, anonymization can be turned on at the login screen. If anonymization is turned on here, it can still be turned off within the program by using the User dropdown menu, as described above.



Please note that while anonymization is turned on, the 3D viewers in the Adaptive module will not function.

5.5 Signing Out

To sign out of Adaptivo, select the Sign Out option from the User dropdown menu. You will be signed out (logged out) of the program and returned to the initial login screen.

Please note that the 3D viewers need to be closed individually. They will not be closed automatically after you have signed out of Adaptivo.

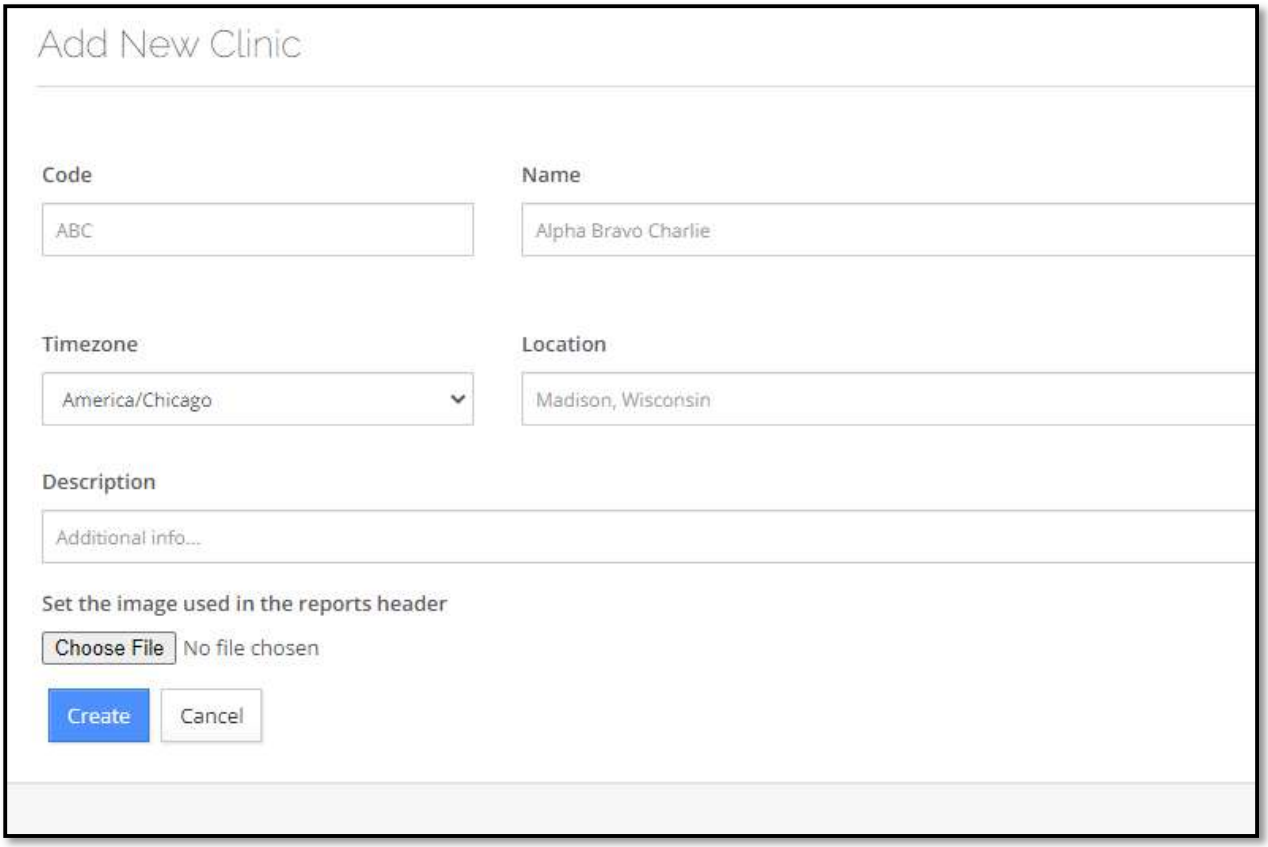
6 Clinic Setup

6.1 Clinics

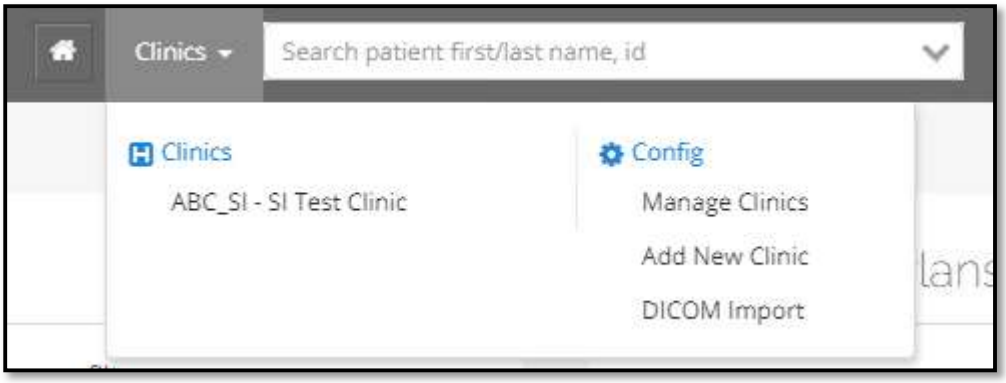
6.1.1 Add New Clinic

To add a new clinic, select the Clinics dropdown menu and choose Add New Clinic. The application will open the Add New Clinic page.

Fill in all fields as necessary. When complete, select [Create]. To cancel and discard changes, select [Cancel].



Once a new clinic has been added, it will be listed in the Clinics dropdown menu. Refer to Manage Clinics for information on how to complete clinic setup.



6.1.2 Manage Clinics

To add or edit the information for an existing clinic, begin by selecting Manage Clinics from the Clinic dropdown menu.

The application will display the list of existing clinics. Each clinic will have a series of buttons on the left side of the screen. They are the clinic dashboard, the clinic patient list, and the clinic configuration.

	Alarms	Code	Name	Location	Timezone	Patients	Plans / Fractions / Beams
	0	ABC_SI	SI Test Clinic	Madison, Wisconsin	America/Chicago	5	10 / 168 / 85

The clinic dashboard and the clinic patient list show all patients treated at this clinic who have data in Adaptivo.

The clinic configuration provides access to the machine list and machine configuration, notifications and alerts, automatic report generation, report configuration, DICOM configuration, and Adaptive Rules configuration.

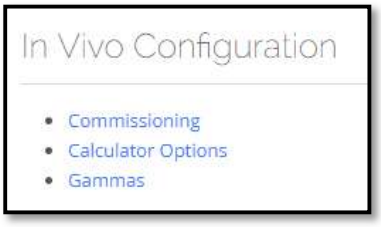
6.2 Clinic Configuration

6.2.1 Machines

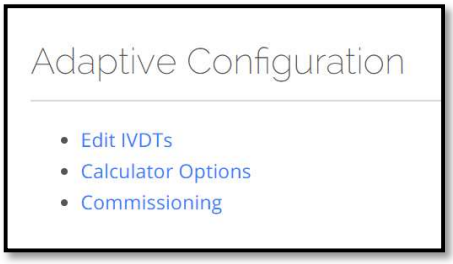
The Machines page will display a list of all the machines associated with the selected clinic.

	Configuration	Serial Number	ID	Model	Manufacturer	Panel Type	Default Couch	
	In Vivo | Adaptive	1234	SI23IX	2300iX	Varian Medical Systems	Varian 40x30 cm aS500/aS1000	IGRTMed	
	In Vivo | Adaptive	1332	TB_3	TrueBeam	Varian Medical Systems	Varian 40x30 cm aS500/aS1000	IGRTMed	

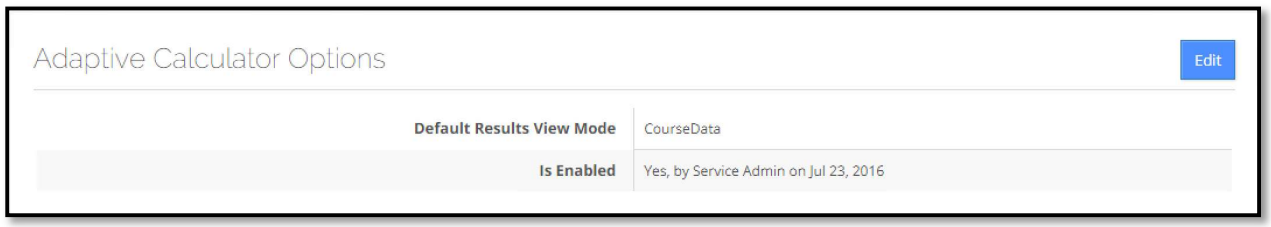
Click the pencil icon at the left of the machine serial number to edit the machine information. Click In Vivo under Configuration to edit the settings for Pretreatment QA and In Vivo daily exit dose monitoring. The default view will show the Gamma analysis settings for that machine, with a navigation list on the left side to allow Commissioning and Calculator Options to be accessed as well.

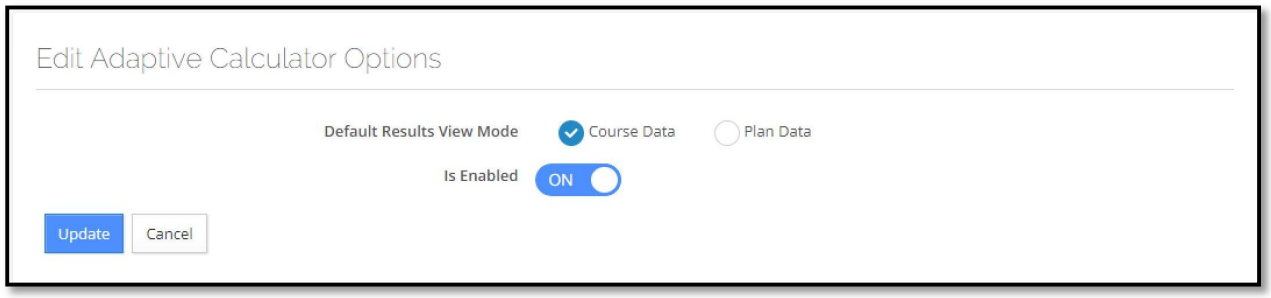


Click Adaptive under Configuration to edit the settings for the Adaptive module. The default view will show Calculator Options, but Commissioning and creation or review of IVDT tables is also available from the menu list at the left of the screen.



Calculator Options will allow the Adaptive calculations to be enabled for a particular patient plan for energies that have been commissioned. The default of Plan or Course view is set in this area by selecting Edit and Update once edits are complete.





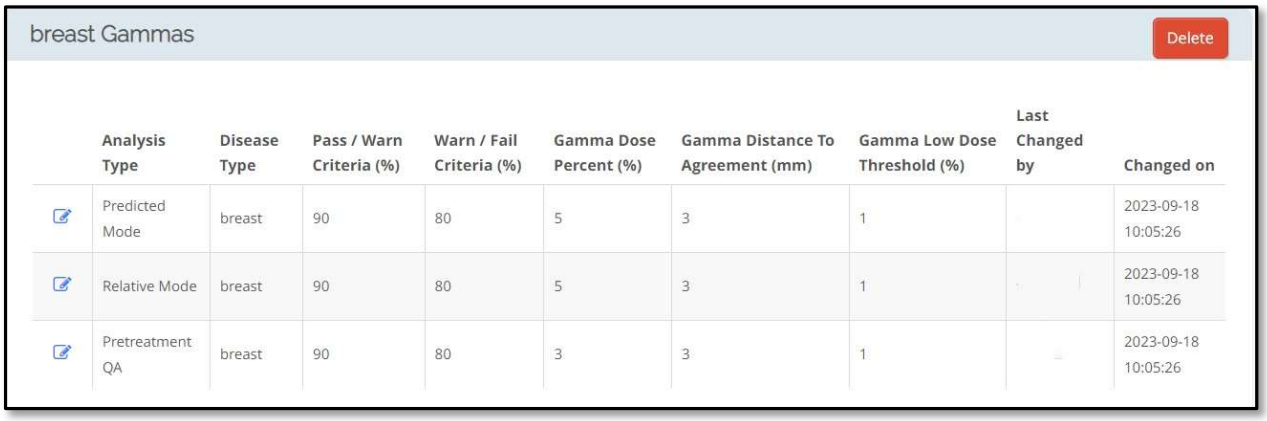
The Commissioning menu allows activation of the Varian Representative Data Models for the Adaptive calculations. No additional beam data are needed, although image density information is required for the Adapt CBCT modes before calculations can be performed. Please see page 119 for more information regarding setup of the required CBCT modes.

6.2.2 Setting up and applying disease specific gamma criteria

Disease specific gamma criteria can be set up under the In Vivo Configuration Gammas menu.

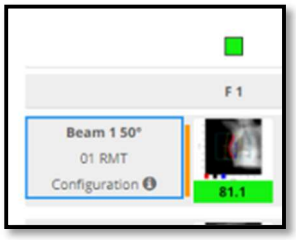
1. Go to Clinics -> Manage Clinics
2. Select the cog icon next to the clinic you wish to review
3. Select the In Vivo link for the machine for which you would like to create disease specific gamma criteria.
4. Type the disease site for which you would like to create criteria

5. A new table will appear labeled with the disease specified.

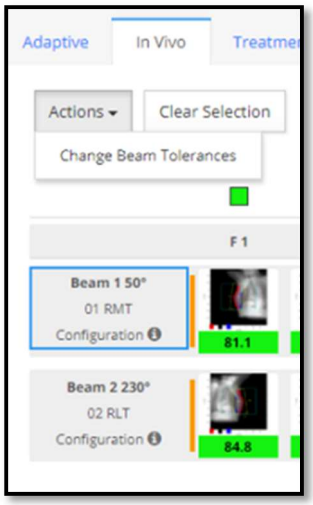


	Analysis Type	Disease Type	Pass / Warn Criteria (%)	Warn / Fail Criteria (%)	Gamma Dose Percent (%)	Gamma Distance To Agreement (mm)	Gamma Low Dose Threshold (%)	Last Changed by	Changed on
	Predicted Mode	breast	90	80	5	3	1		2023-09-18 10:05:26
	Relative Mode	breast	90	80	5	3	1		2023-09-18 10:05:26
	Pretreatment QA	breast	90	80	3	3	1		2023-09-18 10:05:26

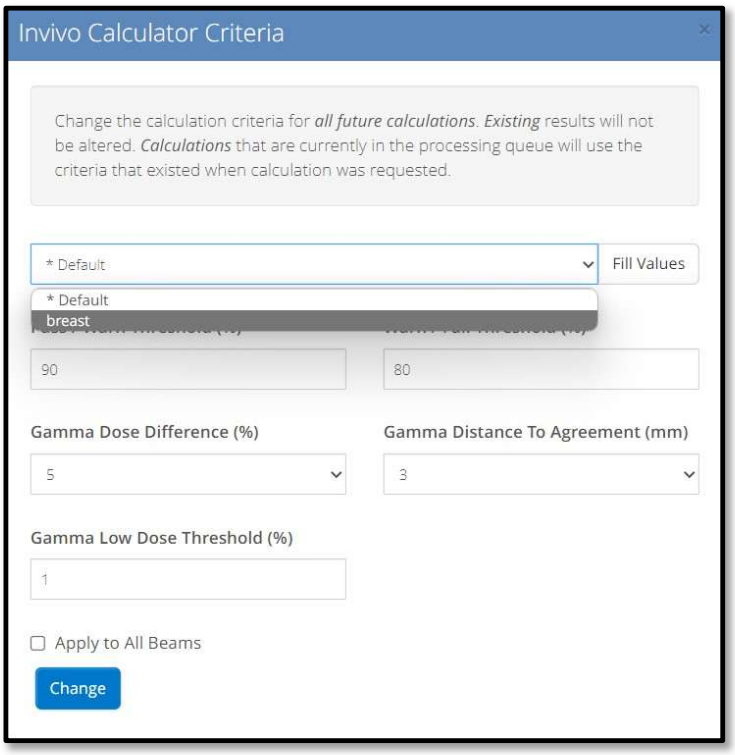
6. Edit gamma criteria using the edit icon next to each analysis type.
7. To apply disease specific gamma criteria to a plan, open the plan to the plan review page.
8. Left click on the Beam label in the Row header.



9. Go to the Actions menu and select Change Beam Tolerances



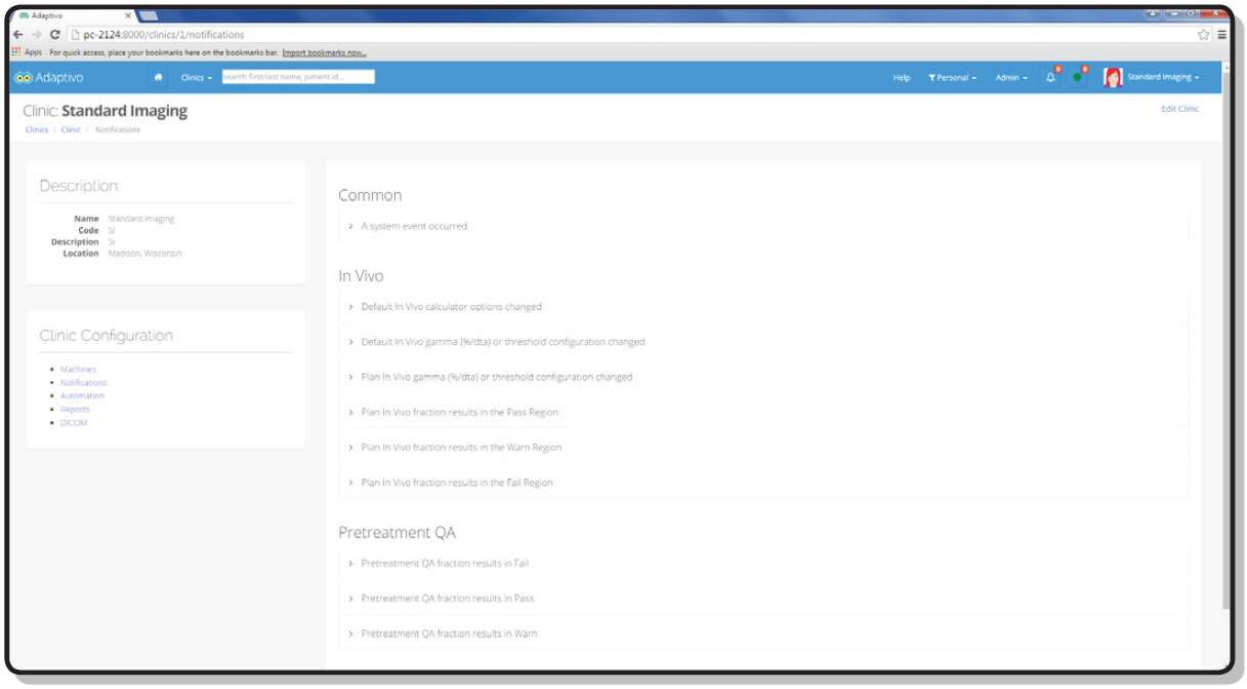
10. Select the dropdown menu and choose the disease site criteria you would like to apply. Click Fill Values and verify the gamma criteria updates.



11. Checking Apply to All Beams will update criteria for all beams in the plan. Leaving it unchecked will apply the gamma criteria to the selected beam only.
12. Select Recalculate All from the Actions menu to update the gamma results.

6.2.3 Notifications/Alerts

The main Notifications page found under Clinic Configuration will display a list of all existing notifications, organized by the module in which they occur.



To see details about a specific notification, select the associated carrot to expand the text under the notification name.

Notifications can be turned on and off using the Enabled and Create an Alert slider buttons.

The Subject and Body fields describe what data will be displayed in the notification email. Both the Subject and Body fields are largely comprised of tokens, or variables, which represent a specific piece of data to be filled in when the report is generated. A description of each token is provided in a panel on the right.

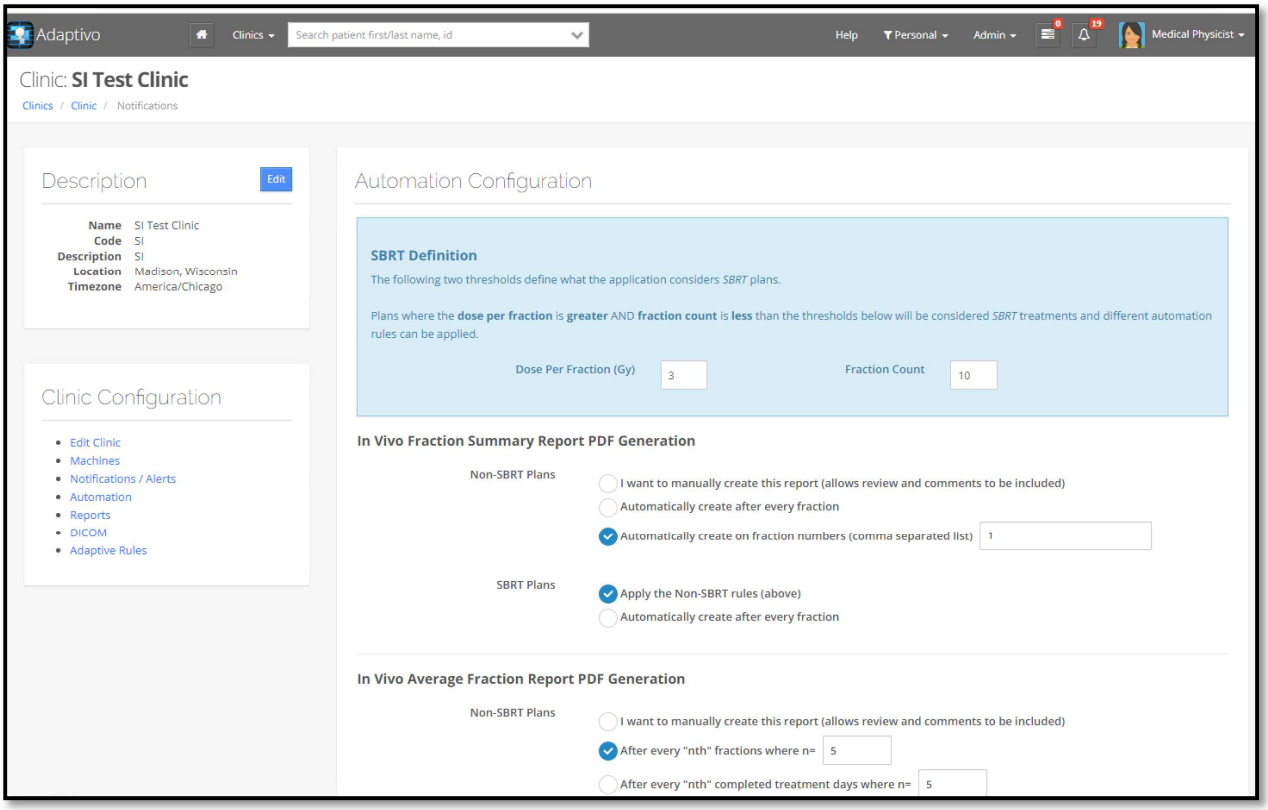
Edit the Subject and Body fields as desired. The Tokens shown at the right are available for use in the subject and body of the notification.

Add email addresses of external recipients (such as IT personnel for systems issues) if desired. Multiple email addresses should be separated by a comma.

When finished, select Update to save changes.

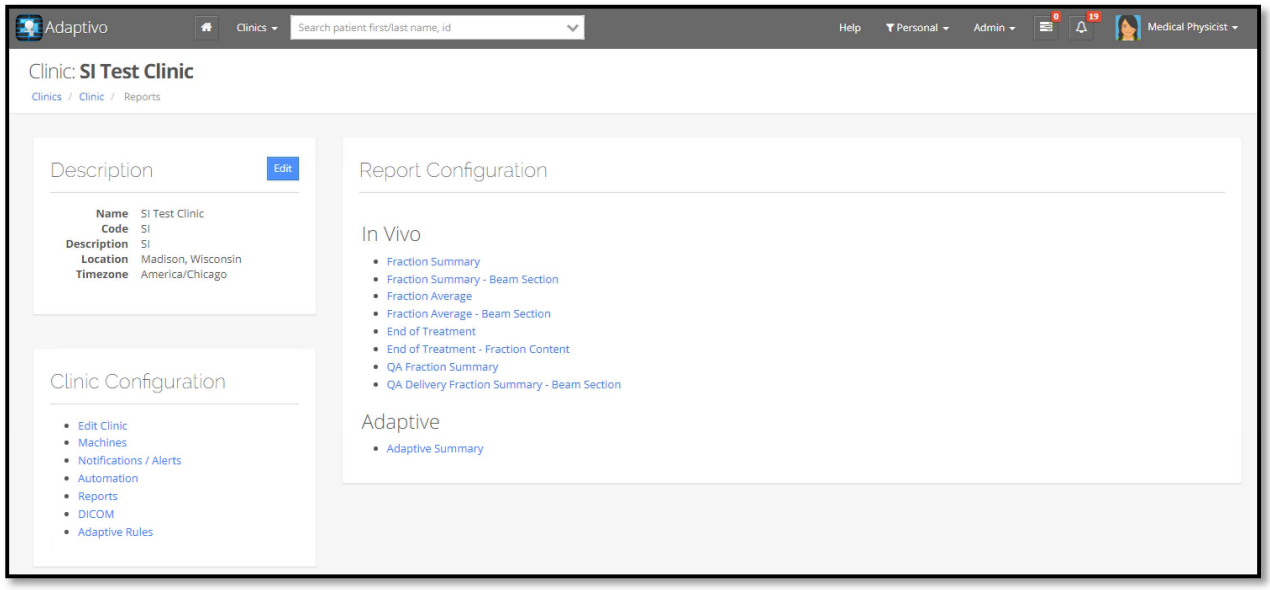
6.2.4 Automation

The Automation page under Clinic Configuration provides a series of controls to specify when reports and average fraction calculations will be generated automatically. Separate configuration options for stereotactic and non-stereotactic plans are available.

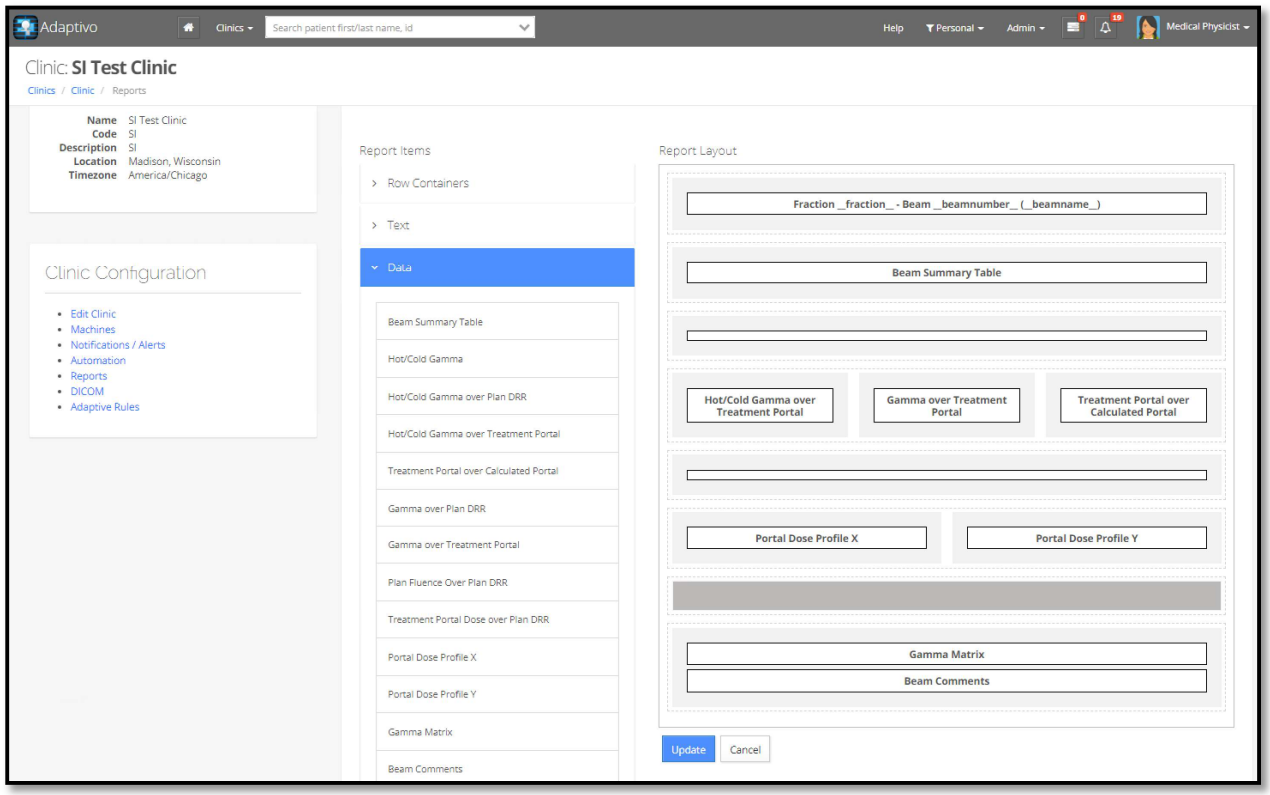

Adaptivo
Clinics
Search patient first/last name, id
Help
Personal
Admin
Medical Physicist
Clinic: SI Test Clinic
Clinics / Clinic / Notifications
Description
Edit
Name SI Test Clinic
Code SI
Description SI
Location Madison, Wisconsin
Timezone America/Chicago
Clinic Configuration
Edit Clinic
Machines
Notifications / Alerts
Automation
Reports
DICOM
Adaptive Rules
Automation Configuration
SBRT Definition
The following two thresholds define what the application considers SBRT plans.
Plans where the dose per fraction is greater AND fraction count is less than the thresholds below will be considered SBRT treatments and different automation rules can be applied.
Dose Per Fraction (Gy) 3
Fraction Count 10
In Vivo Fraction Summary Report PDF Generation
Non-SBRT Plans
I want to manually create this report (allows review and comments to be included)
Automatically create after every fraction
Automatically create on fraction numbers (comma separated list) 1
SBRT Plans
Apply the Non-SBRT rules (above)
Automatically create after every fraction
In Vivo Average Fraction Report PDF Generation
Non-SBRT Plans
I want to manually create this report (allows review and comments to be included)
After every "nth" fractions where n= 5
After every "nth" completed treatment days where n= 5

6.2.5 Reports

The main Reports page will display a list of existing report styles. To view a style, select its name in the list.

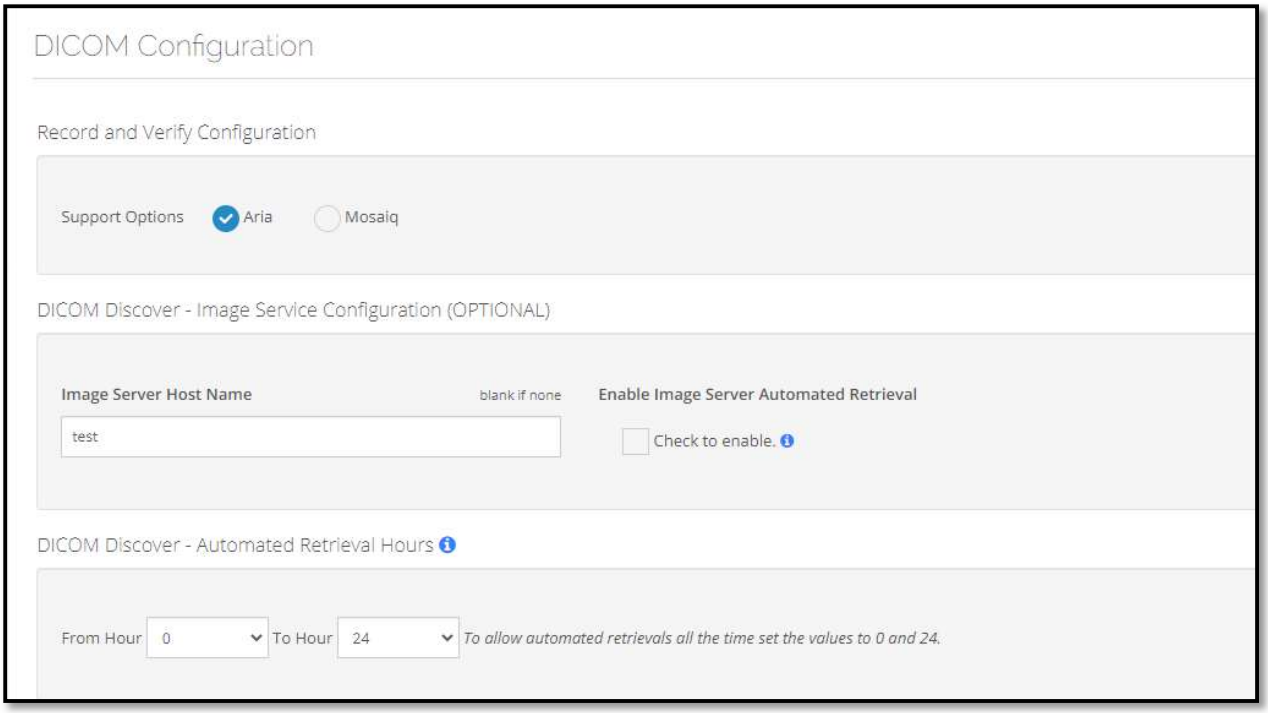


Reports can be customized by selecting items to remove from or add to the report.



6.2.6 DICOM

The DICOM page will display all the parameters related to importing DICOM files into Adaptivo.



The hours during which automated DICOM retrieval is allowed can be set here as well. If there are concerns about network traffic and stability, Adaptivo can be set to retrieve data only after clinic hours.

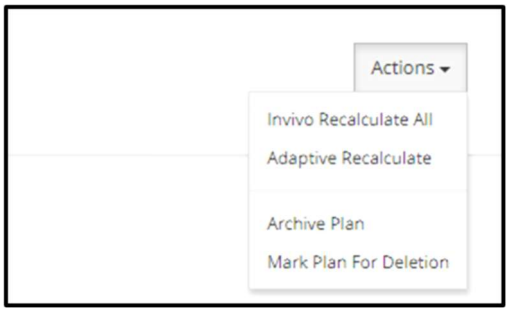
If pre-treatment verification plans are labeled a certain way at your clinic, you can enter the text under Verification Plan Detection to aid Adaptivo in sorting these automatically from In Vivo images. Mis-categorized plans can easily be reclassified by selecting the plan, then selecting Change Plan Intent under the Actions drop-down menu.

6.3 Archive/Restore

Adaptivo has a dedicated archive folder for patient plans. This folder can be set to automatically back up to the hospital network. Plans from the archive can then be returned to the folder for restore. A full system database restore is also available. A database backup is automatically generated periodically that can be manually restored. IT may want to automatically move this backup to a network location on a periodic basis. Contact Customer Care for additional assistance.

6.3.1 Plan Archive Workflow

- Under the Actions menu to the right of the plan results select “Archive Plan”



- Wait until the Archive Plan command is complete, and the plan appears in the archives section of the patient list

- From the Actions menu to the right of the plan select “Mark Plan For Deletion” Do not delete using the “I understand, schedule patient for deletion” red button at the bottom of the Patient page.
- The delete may take up to 24 hours as a background process.
- To delete the plan from Adaptivo immediately go to Admin > Data Management and Click the red ”I understand. Start deletion now.” button
- Clinic IT should setup automatic backup and removal of the C:\shares\archives\”ClinicCode”\ folder to a network location

6.3.2 Plan Restore Workflow

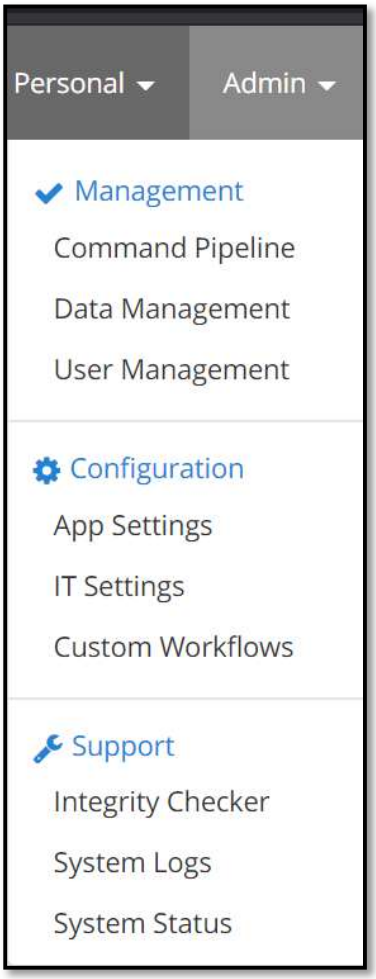
- Ensure the previously archived patient is copied to C:\shares\archives\”ClinicCode”\ folder
- From the Archives section of the Patient List from the Actions menu select “Restore Plan”

Should the Archived plan show in the Plans Not Imported section of the Patient List just below the Archives section. Select "Import”.

Note: The restore process can take some time depending on the amount of data on the system and the restore plan command may not dispatch for some time. These commands are visible in the command pipeline. Do not continue to select “Restore Plan” as you will generate multiple restore commands.

7 Administrator Options

To access the Administrator options, select the Admin dropdown in the upper right of the screen. The available options vary by user role.

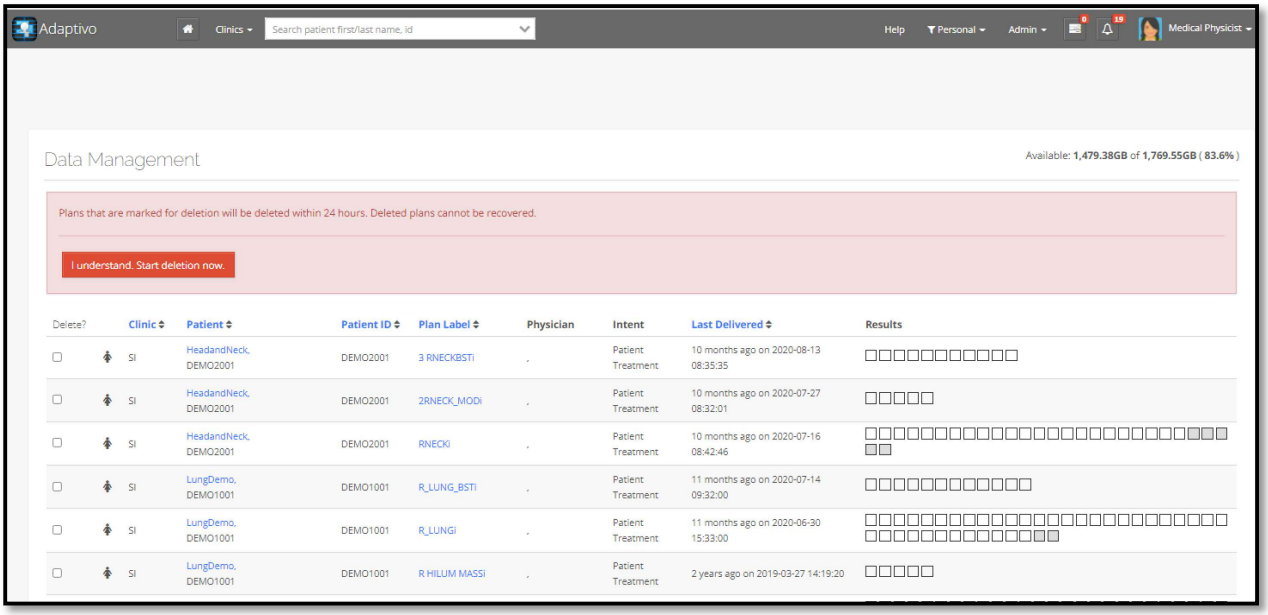


7.1.1 Command Pipeline

The Command Pipeline or processing queue page provides a description of everything the server is currently working on, and any errors that have been encountered. One must have patient admin rights in order to view the processing queue. For those with access the queue is opened by selecting the icon to the right of the Admin pull down or the top item on the Admin pulldown. Plans awaiting or undergoing calculation are listed. In addition, the full history may be viewed and filtered by patient and command type. To delete a job from the processing queue, click the vertical dots at the right side and select delete.

7.1.2 Data Management

The Data Management displays a list of every plan currently in the system. When necessary, a plan can be deleted by selecting the associated Delete checkbox, then clicking on the red button acknowledging that deleted plans cannot be recovered. Note that immediate manual re-import of the same plan will be problematic if the commands for the DB delete have not yet completed.



7.1.3 User Management

The User Management page will display a list of all current users.

Use the checkboxes on the right to indicate whether a user is Active, Physics administrator, Patient administrator and/or an IT administrator. The table below shows functional areas that each type of user can access. The functionality specified in the table is for new installations. For upgrades the current user access is not removed. For example, previous IT Admin role user's could access the Data Management function.

To edit the details of an individual user, select the associated pencil button to the left.

User Types:

	Service	IT admin role	Patient admin role	Physics admin role
Role	Initial system user	Configure IT Resources	View/Manage Patient Data	Configure Clinics
Processing Queue	n/a	n/a	v	n/a
Admin > Management				
Command Pipeline	n/a	n/a	v	n/a
Data Management	n/a	n/a	v	v
User Management	v	v	n/a	v
Admin > Configuration				
App Settings	n/a	n/a	n/a	v
IT Settings	v	v	n/a	n/a
Custom Workflows	v	v	n/a	v
Admin > Support				
Integrity Checker	v	v	n/a	v
System Logs	v	v	v	v
System Status	v	v	v	v
Clinics > Configure				
Manage Clinics	n/a	n/a	n/a	v
Add New Clinic	n/a	n/a	n/a	v

DICOM Import	n/a	n/a	v	v

v – able to access options n/a – unable to view

An Active user can login but not see any information. The Service or users with Physics or IT admin role credentials are the users who can activate registered users and grant permissions.

App Settings

Gamma region names and per fraction (chiclet) color display can be customized. Under the Admin menu in the Configuration area, choose App Settings to view and change both the color and the label for the In Vivo Pass, Warn, and Fail gamma regions. In the In-Vivo Regions section, an administrator can choose the color code for the pass/warn/alert regions. Both the names and colors can be changed. Select [Save] when complete.

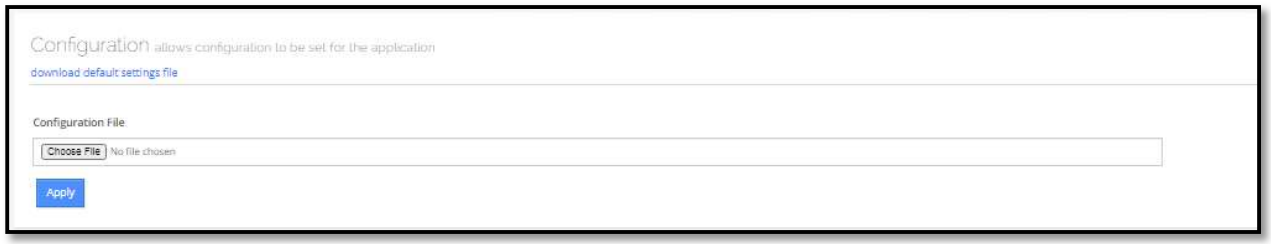
Defaults: Pass – (green)

Warn – (yellow)

Alert – (red)

The gamma threshold numeric values are set in the individual machine configuration menus.

A gamma configuration file can be imported or exported to easily ensure uniformity of setup amongst different Adaptivo installations. Also, under the Admin menu in the Configuration area, choose App Settings to download the default gamma configuration for the application or import a previously saved configuration file. This file contains the threshold regions for all analysis types as well as what active alert and fail flags are sent to the dashboard.



7.1.4 IT Settings

To configure IT Settings, log in as an IT administrator. See the IT Settings section on page 20 for additional details. Dialogs for the email setup, LDAP Authentication, Configuration files, and SSL Configuration are also available on this page for users with IT Administration accounts.

7.1.5 Custom Workflows

The Custom Workflow page allows notifications to be generated so that external applications can be made aware of application events or so that secure access to the application data can be achieved via the Data API. To create a new notification, fill in the necessary information and select [Create].

7.1.6 Integrity Checker

The integrity checker periodically performs a self-analysis to verify that the software code has not been altered. If an alteration is detected, the files that have been modified will be shown, and the associated software features will be disabled.

To initiate a code analysis, press “Queue integrity checker job.”

7.1.6.1 System Logs

Log files for system activity can also be downloaded into a zipped format to aid Standard Imaging in providing customer support. These files are anonymized, so no patient identification data are included in the log files. At the top of the list all logs can be selected or de-selected using the box to the left of System. Alternatively individual or just selected logs may be downloaded as a zip file. Select Download to create the zip file.

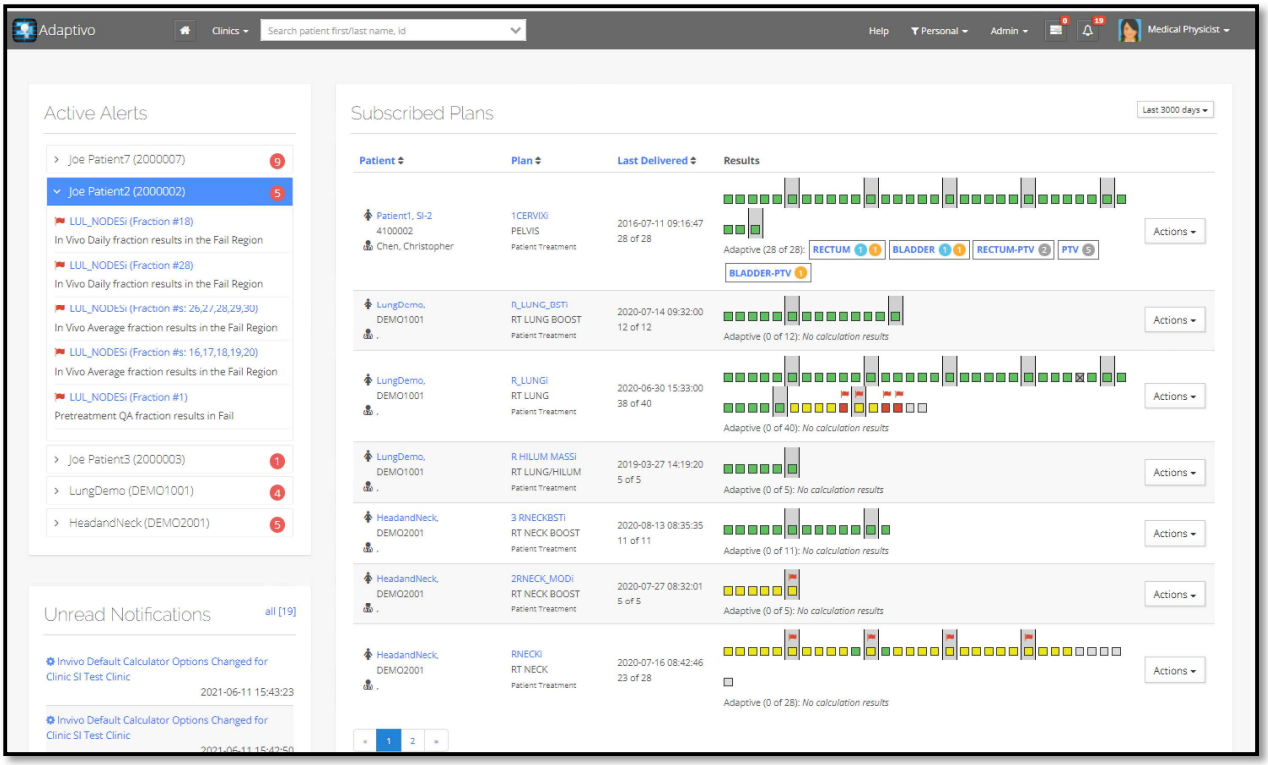
7.1.6.2 System Status

The status of the component applications is provided along with their version number. Failed jobs and workflow notifications are also provided here.

8 The Home Screen

The Home Screen is comprised of a series of widgets displaying information according to the user’s set preferences.

The Home Screen can always be returned to by selecting the ‘Home’ button in the top menu bar.



8.1 Widgets

8.1.1 Active Alerts

The Active Alerts widget displays a list of all alert messages that have not been resolved. Depending on your customized alert settings, alerts may include both “watch” and “alert” level pre-treatment, in vivo and adaptive fraction results. Alerts are grouped by patient. Click on the patient name to expand the alert list.

To view an Alert, select [Review]. The application will display the patient plan page. The relevant tab page will be displayed, and the fraction which generated the alert will be highlighted.

Review the fraction as needed. To dismiss an Alert from your Active Alerts widget, select [acknowledge]. The Alert must be viewed, and a comment entered before it can be acknowledged. An Alert cannot be acknowledged from the home screen.

To close the alert without acknowledging it, click the x at the upper right of the pop-up window.

8.1.2 Unread Notifications

The Unread Notifications widget displays a list of notifications which have not been read yet. Notifications are marked as 'read' once they have been opened. Notifications include both patient alerts and system or configuration change notifications, depending on the user preferences and on what has been enabled for the clinic.

8.1.3 Subscribed Plans

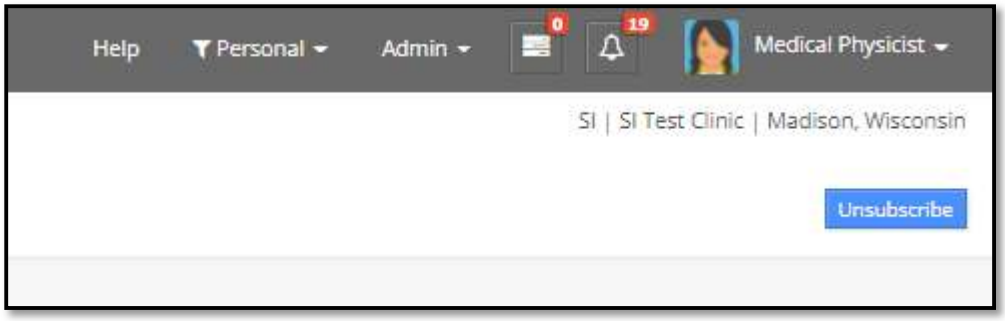
The Subscribed Plans widget displays the list of plans the current user has subscribed to. By default, the most recently delivered plan is shown at the top of the list.

Each user may subscribe to different plans, and subscription status may be changed at any time.

Changing Your Subscription Status

To change your subscription to a specific plan, begin by navigating to the plan page. This can be done by selecting the plan from your Subscribed Plans list, or from the Clinic page. You can also choose "Show All" in the filter drop-down in the gray navigation bar to show all patients regardless of your subscription settings. Please note that all patients will be displayed only for those modules you have selected to include on your home page. For instance, In Vivo patient data will not be displayed if you have opted to show only the Adaptive module.

Once the plan page is displayed, locate the subscription button in the upper right of the screen. If you are already subscribed to the plan, it will read [Unsubscribe]. If you are not currently subscribed to the plan, it will read [Subscribe]. Selecting the button will change your subscription status accordingly.



You may change your subscription status at any time.

The dropdown menu in the upper right on the home page allows you to display subscribed plans according to recent activity. For example, select '7 days' to display only those plans that were active (beams delivered) in the past seven days.

Each of the listed plans will display the following information:

- **Patient:** Patient name, ID, and physician
- **Plan:** Plan name, ROI, Type (Patient Treatment or Quality Assurance)
- **Last Delivered:** Date, Time, and Fraction # of #
- **Results:** For the In Vivo module, a series of color-coded squares representing EPID data gamma analysis results is displayed. Each square represents a treatment fraction. Adaptive module calculation results are shown as boxes indicating the structure that violated one of the DVH rules, along with a colored circle indicating the type and number of unacknowledged alerts generated for that structure.
- The color code of the squares indicates pass/warning/alert, according to clinic- and machine-specified criteria. Light gray squares are fractions scheduled but not yet delivered, and dark gray squares are delivered fractions whose results are not yet calculated.
- Half block squares represent an interrupted delivery/treatment. An interrupted delivery/treatment can be flagged by any of the following criteria:
    - Multiple RT records found
    - RT Record TreatmentTerminationStatus is not NORMAL
    - RT Record TreatmentDeliveryType is CONTINUATION
    - Treatment delivery may be incomplete because the total delivered meterset (RT Records) is less than the planned monitor units (RT Plan) by 2 or more monitor units.
    - Multiple RT 33winds were found
    - Portal dose image may be incomplete. The total Meterset exposure of the image(s) is less than the planned monitor units (RT Plan) by 2 or more meterset exposure.
- Half colored/white squares represent an interrupted image that was completed. The resulting analysis is the result of the combined images. The green/yellow/red colors represents the usual pass/warning/alert results.
- Squares marked with a flag have generated an Alert.

- Squares between brackets indicate a series of fractions that have been averaged. Fractions are averaged automatically according to the automation criteria, or manually if several fractions are selected and “create average fraction” is selected from the Actions menu.
- DVH alerts are shown according to the structure that generated the alert. Plan (blue), Daily (gray), and Cumulative (orange) alerts are indicated by the numbers shown in these colors.

NOTE: Patient Treatment plans are shown under In Vivo, and Verification plans are shown under QA. Switching the plan intent from one to the other shifts the delivery from one module to the other.

8.1.4 Subscribed Pretreatment QA Plans

The Subscribed Pretreatment QA Plans widget displays the list of pretreatment QA plans the current user has subscribed to.

NOTE: The Pretreatment QA module has been validated for 6MV and 10MV only. Other energies are not clinically available in the current version of the software.

Each user may subscribe to different pretreatment QA plans, and subscription status may be changed at any time.

Changing Your Subscription Status

To change your subscription to a particular QA plan, follow the same steps as outlined for above for patient treatment plans.

The dropdown menu in the upper right on the home page allows you to display subscribed plans according to recent activity. For example, by selecting ‘7 days,’ the widget will display only those plans that were active (beams delivered) in the past seven days.

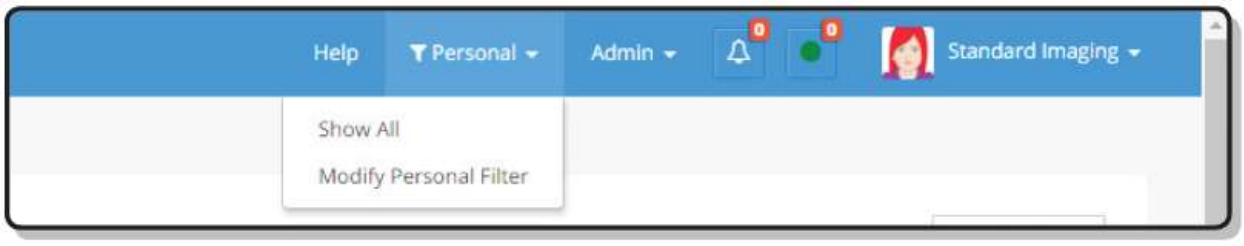
Each of the listed pre-treatment plans will display the following information:

- **Patient:** Patient name, ID, and physician
- **Plan:** Plan name, ROI, Type (Verification)
- **Last Delivered:** Date, Time, and Fraction # of #
- **Results:** A series of color-coded squares. Each square represents one delivery of the plan.
    - The color code indicates pass/warning/error, according to clinic-specified criteria.
    - Squares marked with a flag have generated an Alert.

NOTE: Patient Treatment plans are shown under Subscribed Plans, and Quality Assurance plans are shown under QA Plans. Switching the plan intent from one to the other shifts the delivery from one module to the other.

8.2 Customizing Your Home Screen

Widgets can be added to or subtracted from the Home Screen by modifying your Personal Data Filter. Select the Filter drop-down menu and choose Modify Personal Filter.



Locate the Dashboard Widgets option.

By selecting the 'All' radio button, all widgets will be displayed on your home screen.

If you only want to see a few widgets, select the 'Only' option, plus the desired widgets from the associated dropdown menu. Only the widgets you select will be displayed on your Home Screen. Your selection will not affect other users' Home Screens.

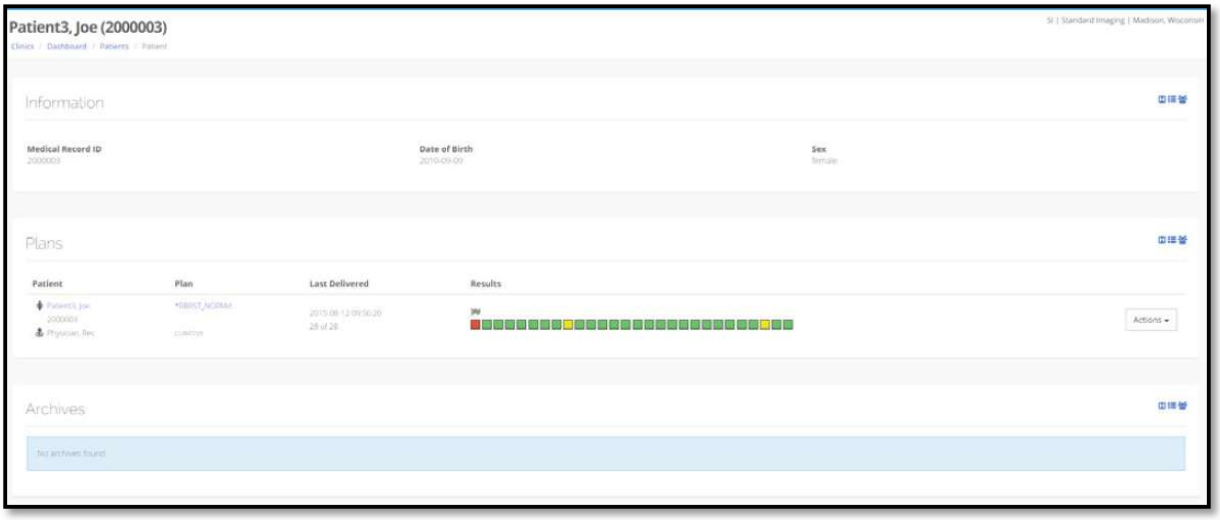
You may also further customize your dashboard by limiting the application (modules) shown, or by selecting specific clinics, physicians, or machines.

From your home screen, you may also show all patients by selecting "Show All" from the Filter drop-down menu. Reapply your personal filter by selecting Apply Personal Filter from the Filter drop-down menu.

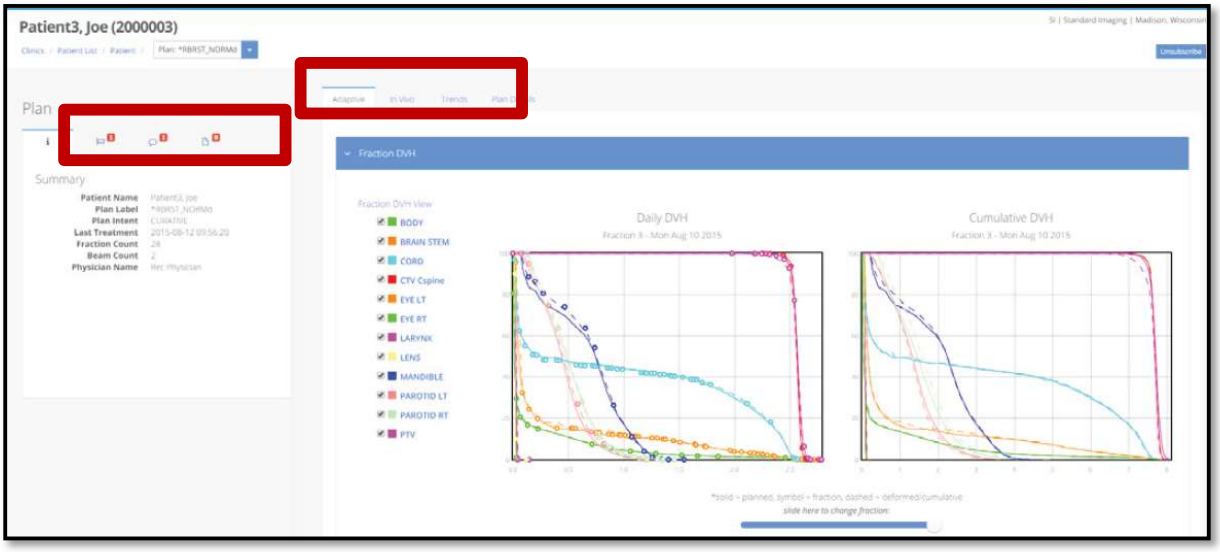
Please note that your Application Filter settings will still be applied, even when "Show All" has been selected from the Filter drop-down menu.

9 Plans

To view a specific plan, select the plan or fraction image in the Plans list.



On the left, the Plan widget displays a summary of the plan currently on display. By using the tabs in the Plan widget, you can also review the associated Alerts, Comments, and Reports.

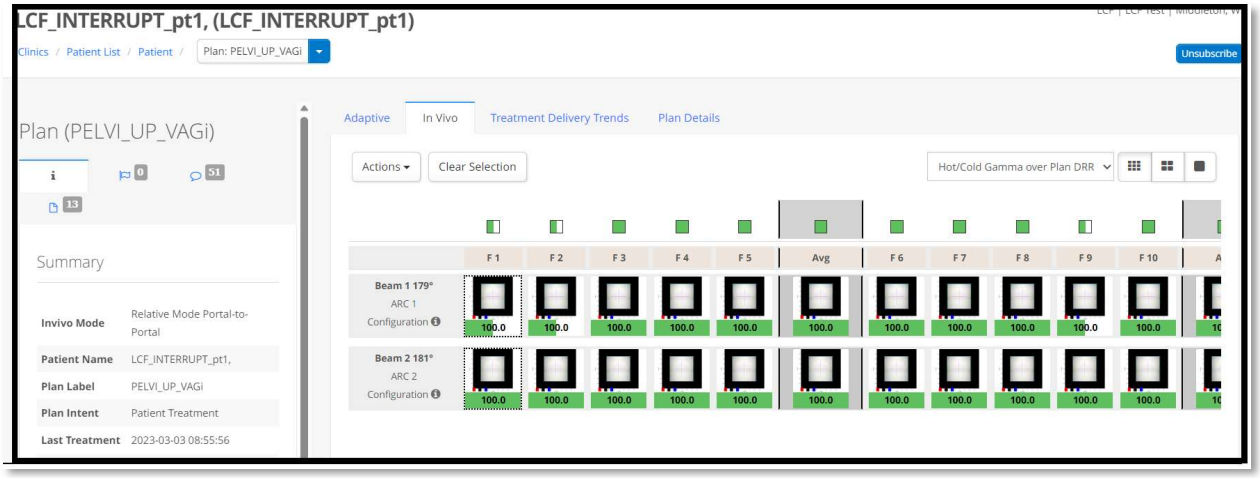


The main area of the screen will display the patient's plan, with information organized into a series of tab pages. Each tab contains a different module. The In-Vivo module is displayed upon opening a plan, by default.

9.1 In Vivo

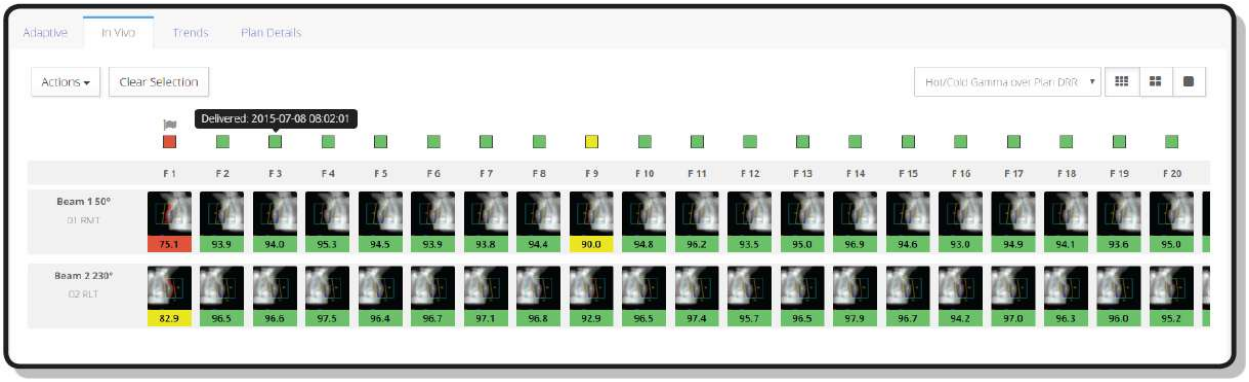
The In Vivo module allows clinicians to verify pre-treatment plan delivery, monitor daily photon treatment deliveries, and indicate potential clinically relevant deviations from the intended plan delivery for head-first supine and head-first prone patient positioning. Comparisons can be made using one or more of the following techniques:

1. Comparing a calculated beam measurement to the measured beam with the EPID to perform pretreatment quality assurance. This is described in more detail in the Pretreatment QA section.
2. Comparing a calculated exit beam image with the couch in the planned position to the measured exit beam data from a delivered patient treatment.
3. Comparing a selected reference baseline exit beam measurement to other treated fraction exit beam measurements for patient treatments.



A thumbnail image showing the signed gamma and DRR for each beam in the selected plan will be displayed in the main area of the screen. Each thumbnail is associated with a color, corresponding to the pass, warn, and alert criteria, with the gamma passing percentage shown in the color bar beneath each image. A color bar that is half colored and half white represents an interrupted delivery/treatment.

Hover the cursor over the image, and the application will display a tooltip detailing the date and time that beam was delivered.



Click on an image to select that beam and fraction or click on the fraction label to select the entire fraction. The information shown in the left panel and in the Actions drop-down will reflect the selection that has been made. Multiple items may be selected simply by clicking on them. Select [Clear Selection] to de-select everything. Information shown in the left panel will now reflect the entire plan.

Once a beam or fraction is selected, beam tolerances can be changed by selecting the option from the Actions menu in the upper left.

The application will display the In Vivo Calculator Criteria dialog. Edit the criteria as needed. Changes will not affect existing results. Any pending calculations will use the criteria that existed when the calculation was requested. When ready, select [Change] to save changes to the criteria and close the dialog. To dismiss the dialog without making changes, select the [x] in the upper right.

Click the gamma value number at the bottom of the image to display a dropdown menu, which includes Animate Beam and View Beam Details.

- Animate Beam – the application will display a dialog with an animation of all the fractions for that beam. Select  to play the animation or use the  and  buttons to scroll through the images manually. When finished, select  in the lower right of the dialog.
- View Beam Details – the application will display the Beam Details page. See 'Beam Details' for more information.

The left panel:

Active Alerts for the plan are displayed at the top of the left panel in the plan display. Select these alerts to acknowledge them.

Plan information is shown beneath the alerts. The information is dynamic, and reflects the fractions selected on the right.

indicates information about the plan or fraction

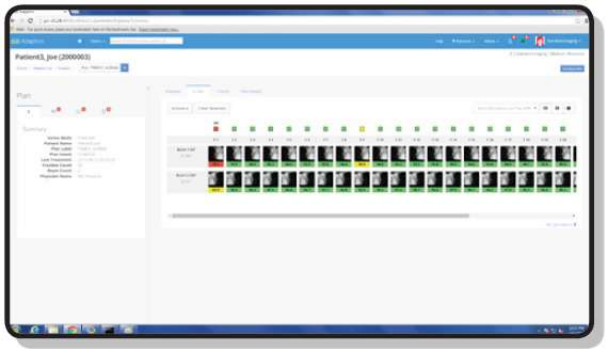
indicates the number of alerts

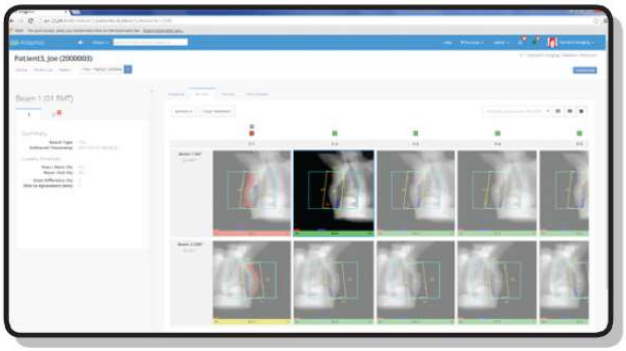
indicates the number of comments linked to the plan or fraction. Select comments at the bottom of the list to enter either a memo or a physics report.

indicates the number of reports linked to the plan or fraction.

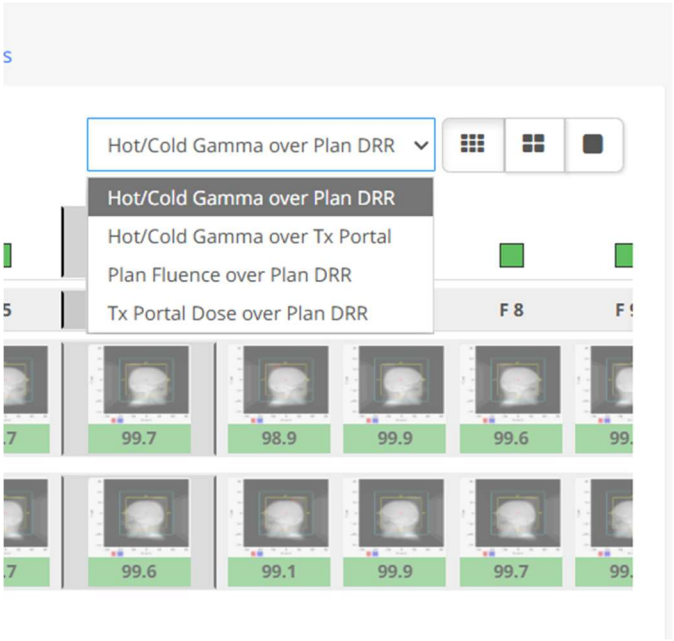
9.1.1 Display Options

The size of the thumbnail can be adjusted by using the  buttons in the upper right of the tab page.





The image displayed in each thumbnail is determined by the option selected in the dropdown menu at the top right of the In Vivo tab page. To change this image, select a different option from the menu.



Display Options include:

- Hot/Cold Gamma over Plan DRR
- Hot/Cold Gamma over Tx Portal
- Plan Fluence over Plan DRR
- Tx Portal Dose over Plan DRR

9.1.2 Actions

The options available in the Actions dropdown menu will depend on the selected beams or fractions. If no selection has been made or the selection has been cleared, the Actions dropdown menu will include the following options:

9.1.2.1 Recalculate All

Select this option to recalculate all fractions of the displayed plan.

9.1.2.2 Change Plan Mode

The application will open a dialog allowing you to change the mode of the selected plan. Mode options include None, Relative, and Predicted.

Select the desired Mode from the dropdown menu.

> Relative mode compares each measured image to a reference measured image. The default reference image is the first day of treatment.
>
> Predicted mode compares the measured exit image with a predicted image. This mode can only be used if the beam model has been commissioned in Adaptivo.

When finished, select [Change] to implement the change and close the dialog. Select [Cancel] to close the dialog without implementing any changes.

WARNING: Changing modes will delete existing alerts, comments and reports for all delivered fractions. **This cannot be undone.**

9.1.2.3 Change Plan Intent

The application will open a dialog allowing you to change the intent for the selected plan. Intent options include: Patient Treatment, Verification, and Unknown. Selecting Verification indicates that the plan is a Pre-treatment QA plan.

Select the desired Intent from the dropdown menu.

When finished, select [Change] to save and close the dialog. To dismiss the dialog without making a change, select [x] in the upper right.

9.1.2.4 Change Calculation Model

Select the fractions to be recalculated and the date and time stamp of the model. This feature is used primarily if adjustments have been made to the model due to machine repair or maintenance. When

finished, select Update & Recalculate. To dismiss the dialog without making changes, select Cancel or select [x] in the upper right.

9.1.2.5 Change Auto Calculation

This menu item allows auto calculation to be turned on or off for the selected plan. Toggle the slider button if desired, and select update. To dismiss the dialog without making changes, select Cancel or select [x] in the upper right.

9.1.2.6 End of Treatment Report

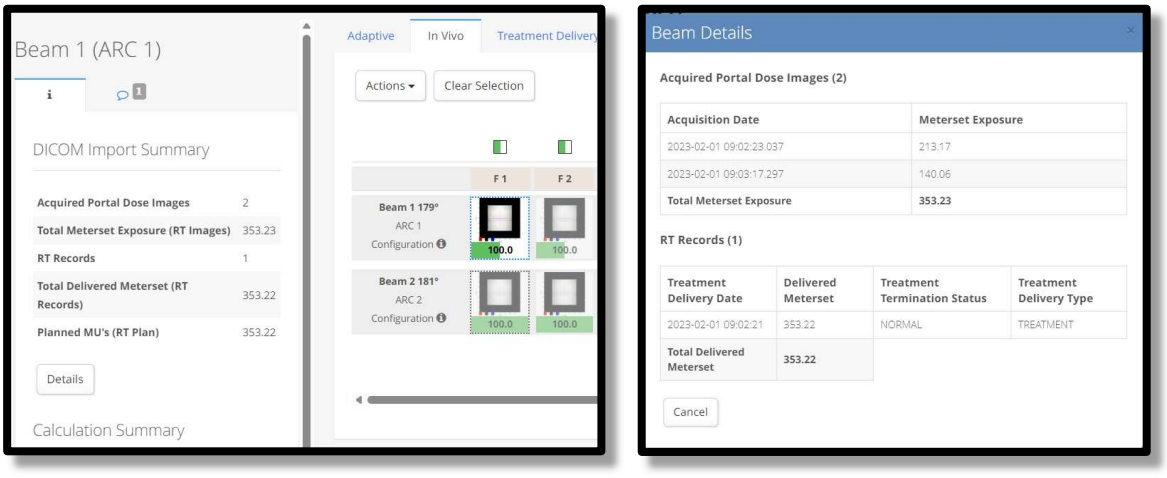
The application will display the report for the selected plan in a new window. Review as needed. When ready, select [Save Report to PDF] in the upper right.

The application will open a dialog stating that the report has been added to the queue. You will receive a notification when the report is ready to review.

For more information about how reports are generated, please refer to Reports.

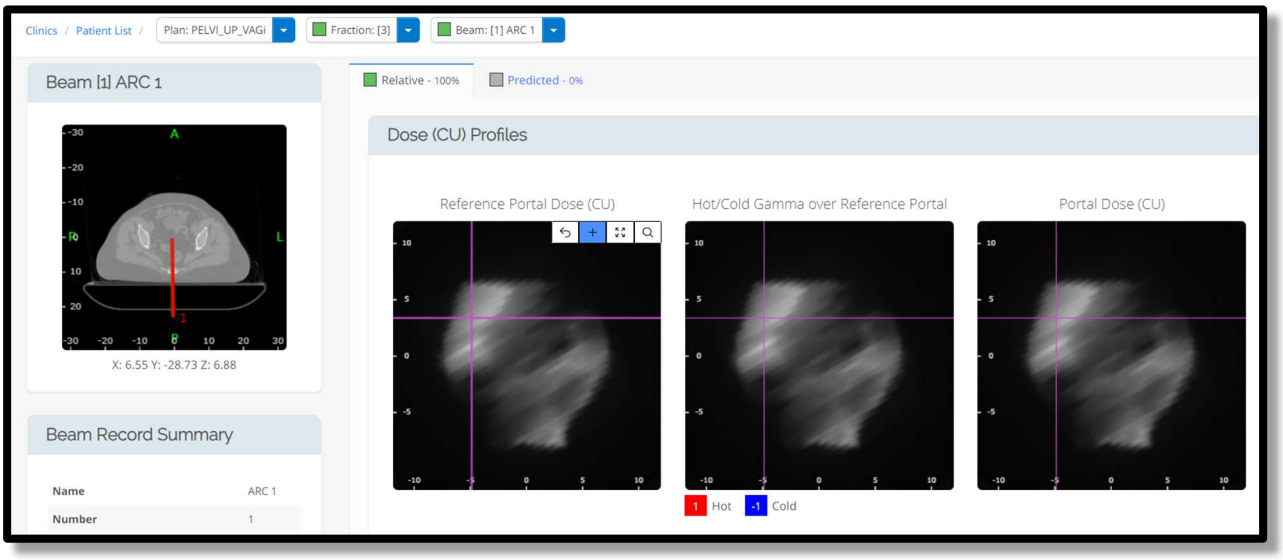
9.1.3 Dicom Import Summary

Click on the fraction image to view the DICOM Import Summary on the left. For an interrupted image, the number of acquired portal dose images will be greater than one. The Total Meterset Exposure is a summation of all partially acquired images. The Total Delivered Meterset value is the summation from of all RT Records. The Total Delivered Meterset should match the Planned Mus from the RT Plan when the fraction has been completed. For further details click the details button at the bottom of the DICOM Import Summary section.



9.1.4 Beam Details

Click on the color bar under a beam image to show the View beam details option. The Beam Details page provides an in-depth look at the selected beam and fraction.

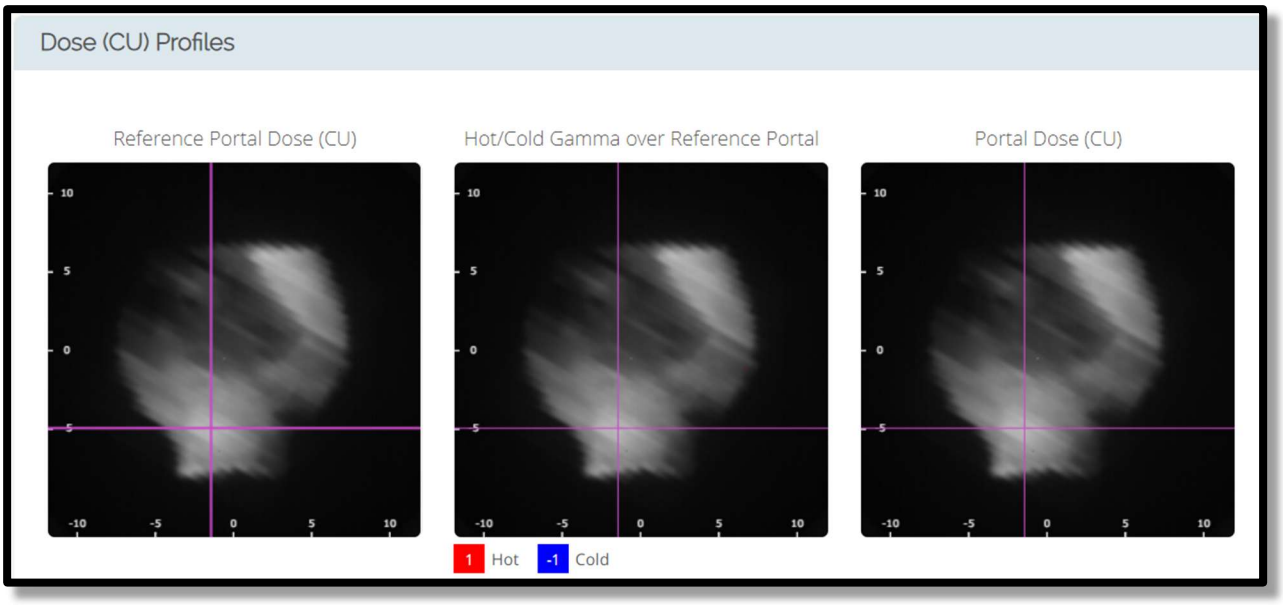


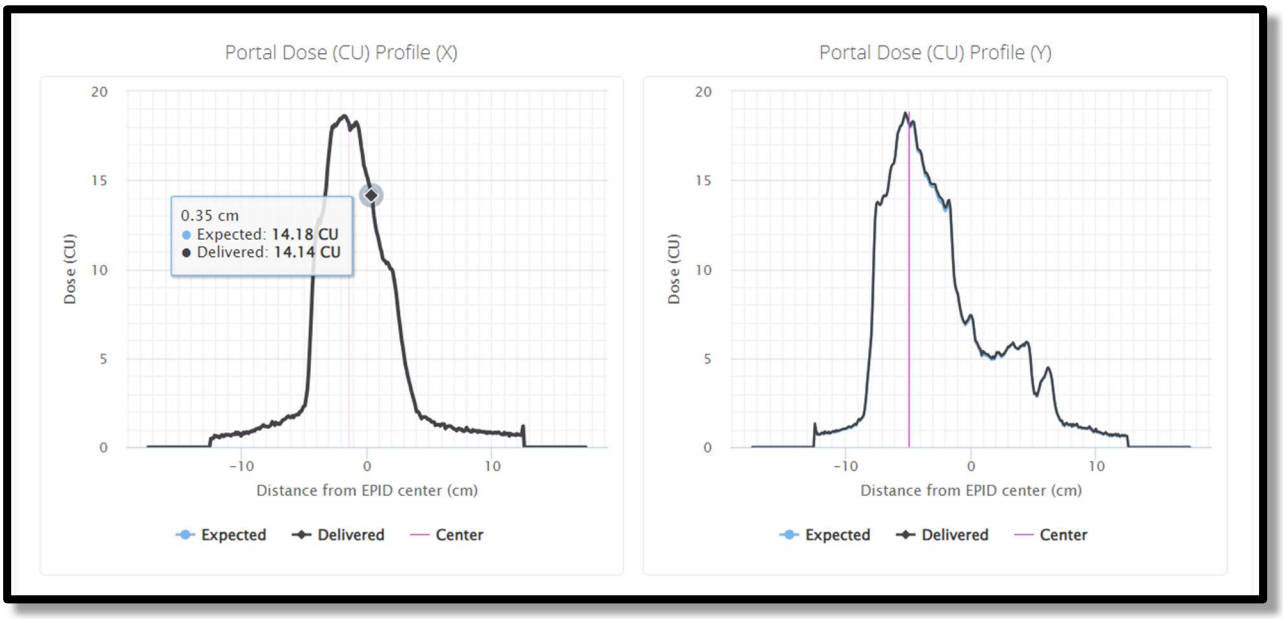
The beam location and orientation are displayed in the upper left.

The Beam Record Summary at the lower left provides a quick look at the parameters for the selected beam. If the beam was delivered in more than one session, the beam details will reflect the summation of the partial fractions.

There are two tab pages which display either Predicted or Relative analysis results for the selected beam. Each analysis method is associated with a color, providing a quick indication of pass/warn/alert status.

Interactive profile comparison allows the user to actively view dose profile comparisons for off-axis X and Y planes by moving the image crosshair to any desired location. X and Y dose profiles will be automatically displayed with the axes centered at the designated crosshair position. Hovering the mouse over any point on the X or Y dose profile will display the corresponding expected and measured data at that point on the dose profile.





Additional image display options are displayed in Gamma, and Plan Fluence and Port Dose sub-tabs under the supplemental images section. Note: The yellow box shown on the supplemental images represents the most open RTPlan jaw positions, with gamma statistic calculations extending 1 cm beyond its boundaries.

Additionally, the beam details include a gamma statistics table, gamma histogram, and a dose difference histogram**.**

9.1.5 Modifying Reference Fraction

To change the reference fraction from the default fraction:

1. Select the desired fraction and select the Actions menu
2. Select Set Fraction Beams as reference. Beams will update with a dotted line outline to indicate they are the reference used for relative mode comparison.
3. To change a reference fraction mid-treatment, select the beams to be included with the new reference fraction. Two fractions will now be indicated as reference with a dotted line outline.

9.1.6 Trends

The Trends tab page displays a series of charts that track parameters of interest throughout the course of treatment.

The charts include:

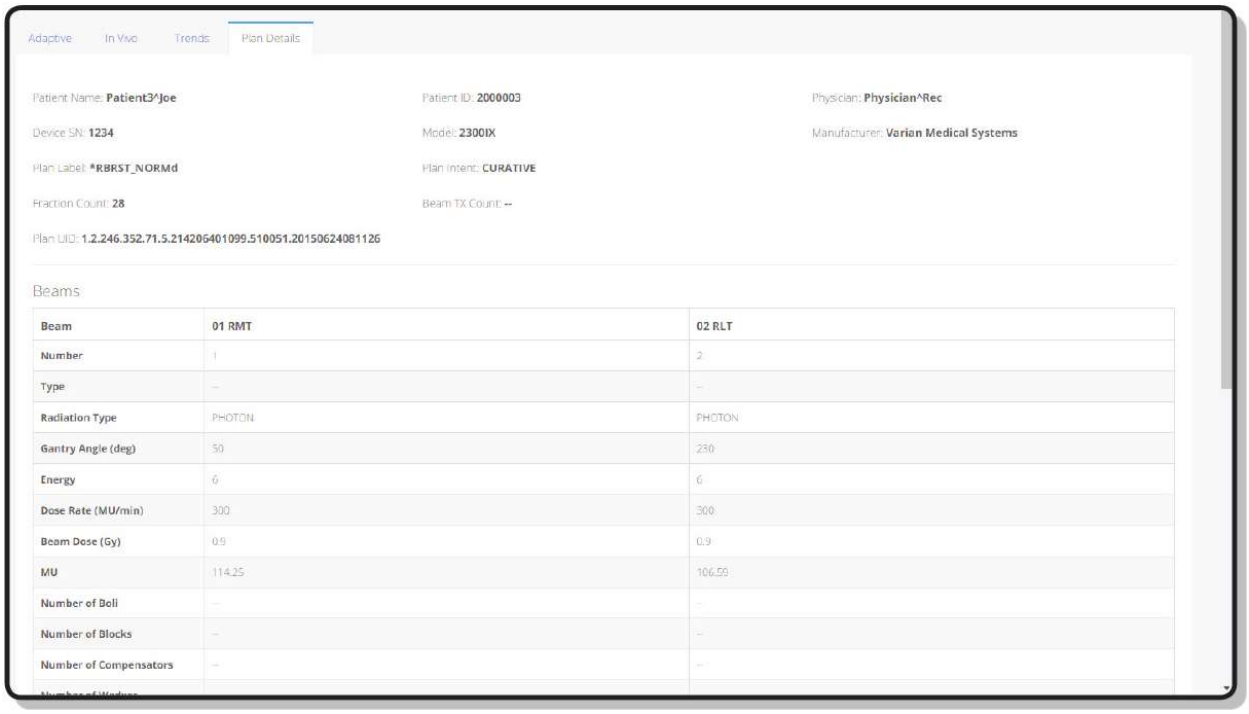
- Number Of Frames
- Meterset Exposure (MU)
- Total Delivered Meterset (MU)
- Daily Lateral Panel Position (X)
- Daily Longitudinal Panel Position (Y)
- Daily Vertical Panel Position (Z)
- Daily Treatment Couch Position
- Portal to Calculation Gamma - Predicted Mode
- Portal to Calculation Gamma - Relative Mode Portal-to-Portal

For details on each point in a chart, hover the cursor over that point. The application will display a tooltip with the name, date, and value of that point.

To print or save a chart, select the menu button in the upper right corner of the chart. To print, select the Print Chart option. To save the chart to another location, select one of the Download options, according to the desired file format.

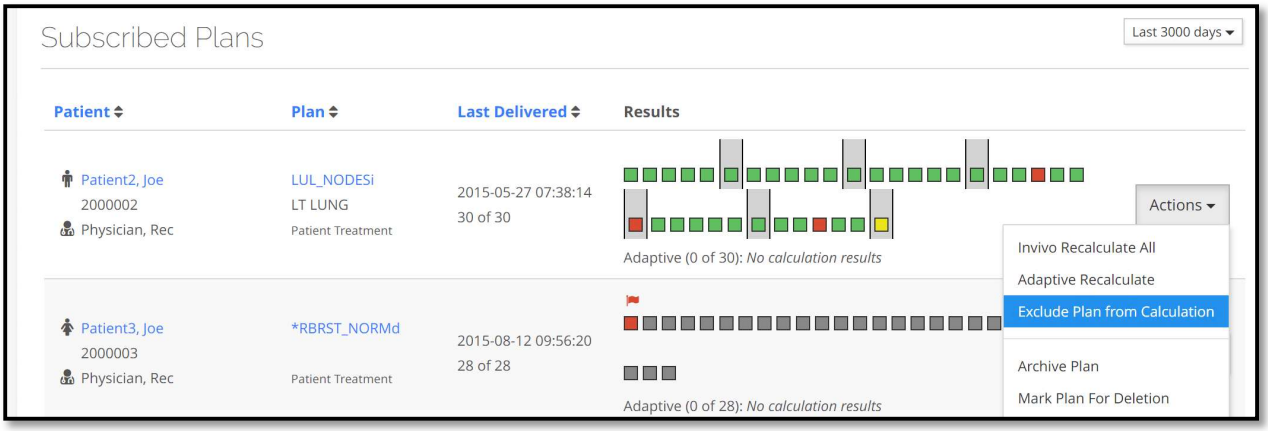
9.1.7 Plan Details

The Plan Details tab page displays the patient and beam information associated with the selected plan. The information on the Plan Details tab page cannot be edited.

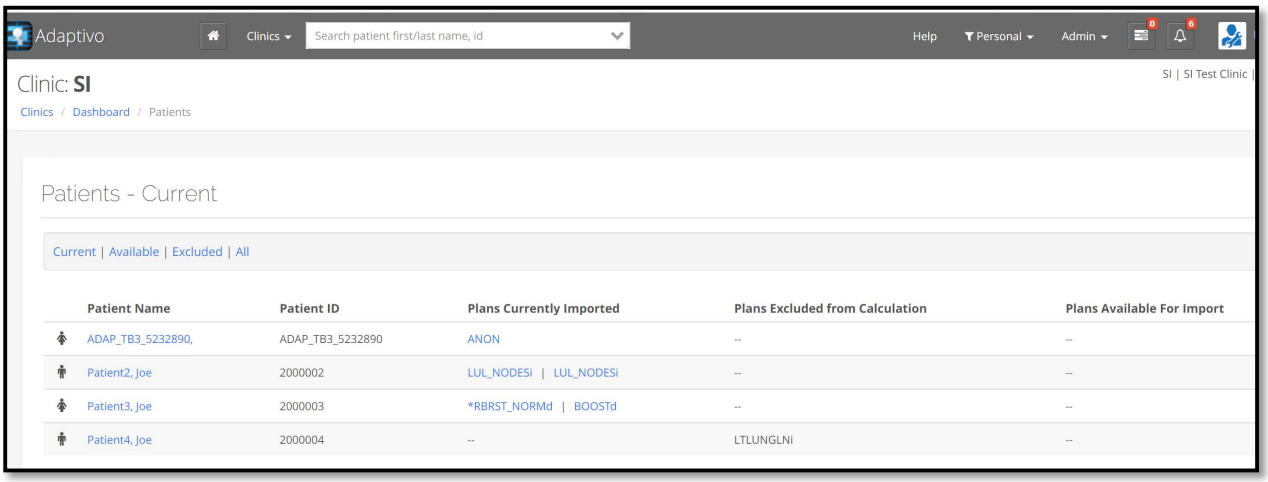


9.1.8 Stop Patient Plan Processing

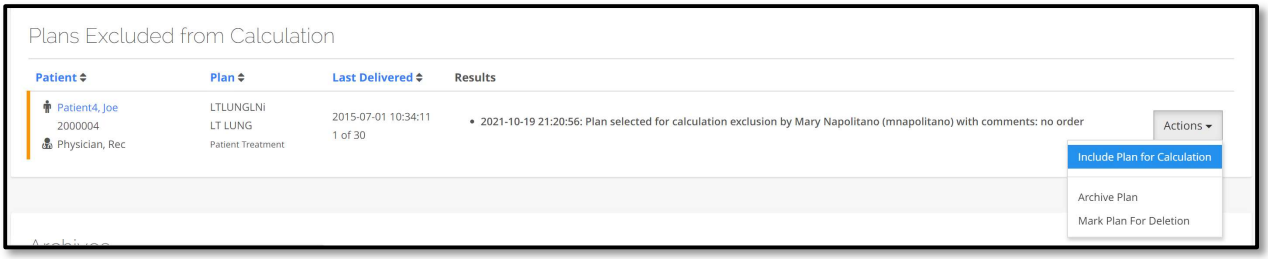
For plans that a clinic wishes not to process because either a particular modality isn't supported or because the physician has not requested gamma analysis for the particular patient, the user can opt out of plan processing. This option is available directly from the Dashboard by selecting from the Actions list "Exclude Plan from Calculation".



This option stops calculations, alerts, notifications, and report generation. These patients will no longer be visible from the Dashboard. These patients will only be visible in the patient list in the column labeled “Plans Excluded from Calculation”. An orange bar will be placed to the left of the excluded plan along with a message telling the date and user who selected to exclude the plan along with any comments.



The user can reverse the exclusion by going to the clinic patient list and selecting the patient. Select the Actions list available next to the excluded plans. The plan can be included for processing again by selecting “Include Plan for Calculation”.



Any fractions delivered while the plan was excluded should begin calculation once the next fraction is delivered. One can optionally calculate immediately through the beam details page. Use of the Actions list to select “Calculate Fraction” if results are desired before additional fractions are delivered.

Active Alerts present before the plan was excluded from calculationing will once again appear in the dashboard as an active alert if the exclusion is later reversed.

9.2 Adaptive

The Adaptive module performs 3D dose calculations using the daily CBCT and a Reference Dose Perturbation algorithm. Deformable registration is performed to map the structures from the planning image to the daily CBCT. Dose is calculated on the CBCT and is mapped back to the plan image to allow summation of all delivered fractions on this common geometry. See Appendix A for additional details.

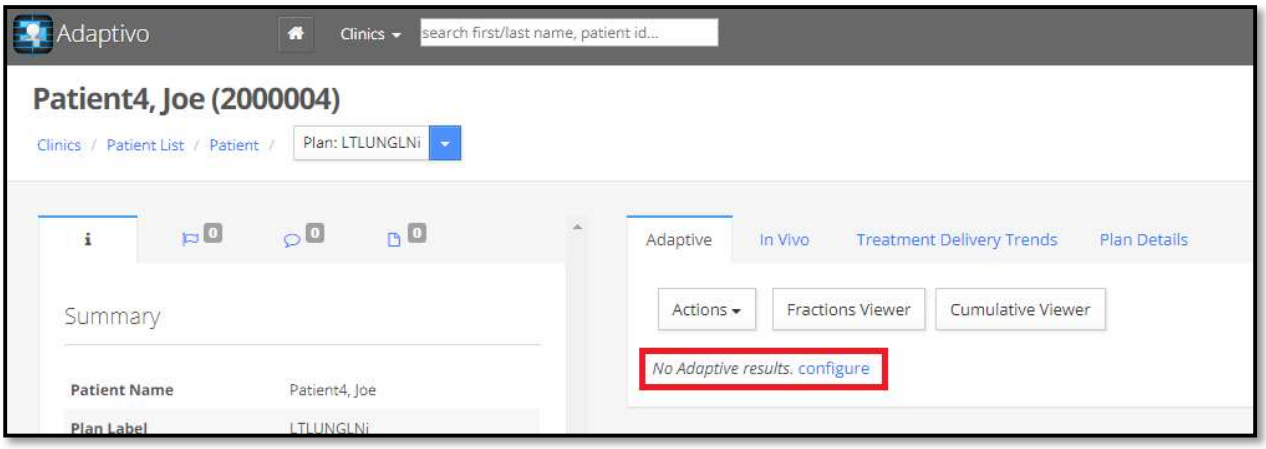
NOTE: Only Varian linacs with Millenium 120 MLCs or HD 120 MLCs are supported in the current version of the Adaptive module of the software.

NOTE: Daily and cumulative dose calculations require a CBCT to be taken on the first day of treatment for each plan in a treatment course.

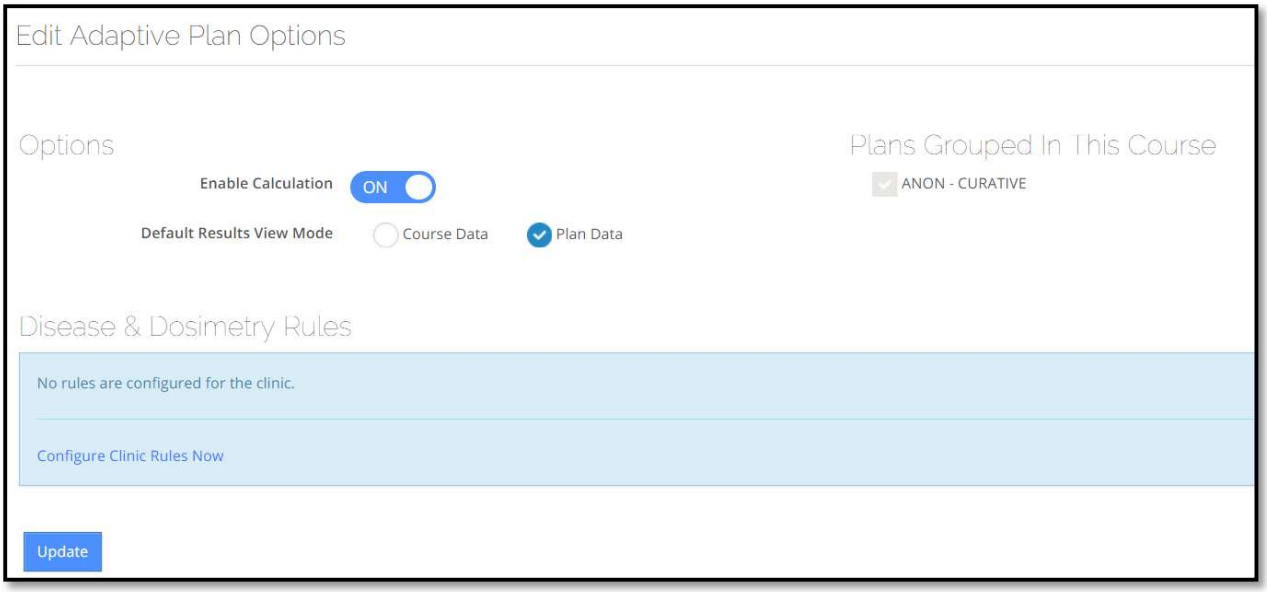
9.2.1 Configure plan to enable calculation

After a plan has been imported, it must be configured to calculate. Navigate to the Adaptive plan tab for the patient by clicking on the plan name and then selecting the Adaptive tab.

Select Actions -> Configuration, or click on the word configure.



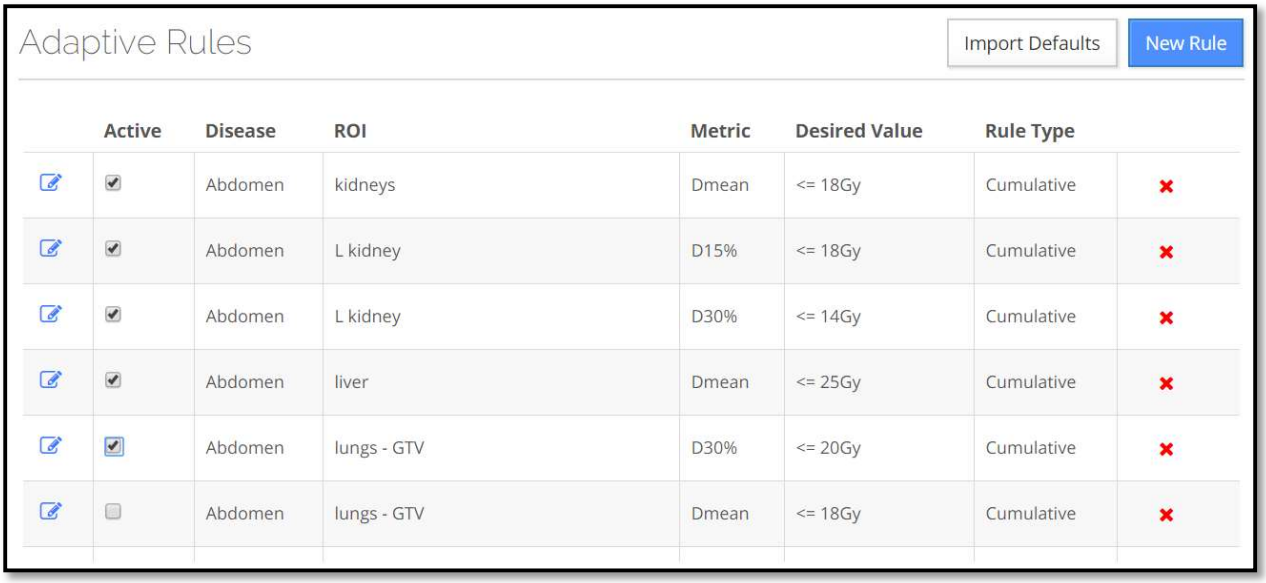
Enable calculation for this patient and select whether results should reflect plan or course dose. Please note that only plans in the same frame of reference can be summed. Select a disease site to link the plan with dosimetric rules for flagging if configured and select Update to save your selections.



9.2.2 Adaptive rules

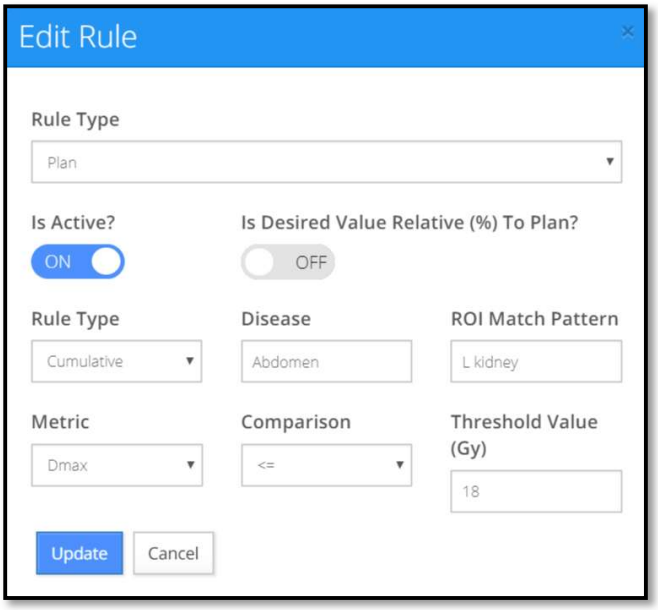
To configure Adaptive rules, select Configure Clinic Rules Now, or navigate to the Clinic Configuration -> Adaptive Rules page.

Rules may be added by either selecting Import Defaults to revert to the default list, or by adding individual rules using the New Rule button.

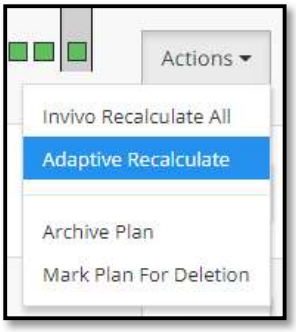


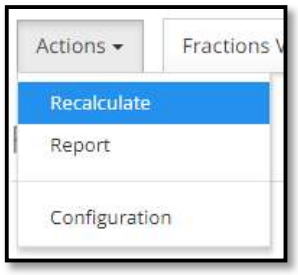
Adaptive flagging rules are active if checked, not active if not checked.

To edit an existing rule, select the pencil icon to the left of the rule. For new or edited rules, enter or change the desired information, then select Update. In order for previously calculated results to be evaluated against new or modified rules select recalculate. Daily dose will not be recalculated.



To initiate a calculation or recalculation for a patient in the Adaptive module, select Adaptive Recalculate from the Actions button shown on the home screen for that plan, or select Recalculate from the Actions menu on the Adaptive tab for that patient's plan.





Note: New fractions imported after the Adaptive calculations have been configured for a patient's plan will automatically calculate.

9.2.3 Viewing Adaptive Results

To open a plan for review, select the plan name and then select the Adaptive tab, or select the badge next to an alert in your plan dashboard.

The structure list on the left describes the color code used in the charts on the right. A structure can be shown or hidden in the Daily and Cumulative DVH plots by checking or unchecking the associated box.

Alerts for a given structure are shown next to the structure name. Blue indicates plan dose alerts, gray indicates daily dose alerts, and orange indicates cumulative dose alerts. The numerical values shown are the number of unacknowledged alerts and the number of total alerts for each type. Cumulative alerts are indicative of the total dose delivered to date.

To acknowledge an alert, select the structure name, then select "Acknowledge" for the desired alert. Select the type of acknowledgement action (No Action, Rule Disabled, or Inconclusive), and enter comments if desired. Select Submit to complete the process, or Cancel to close the dialog without

acknowledging the alert. Selecting “Rule Disabled” will mute this alert for the remainder of the patient’s treatment course.

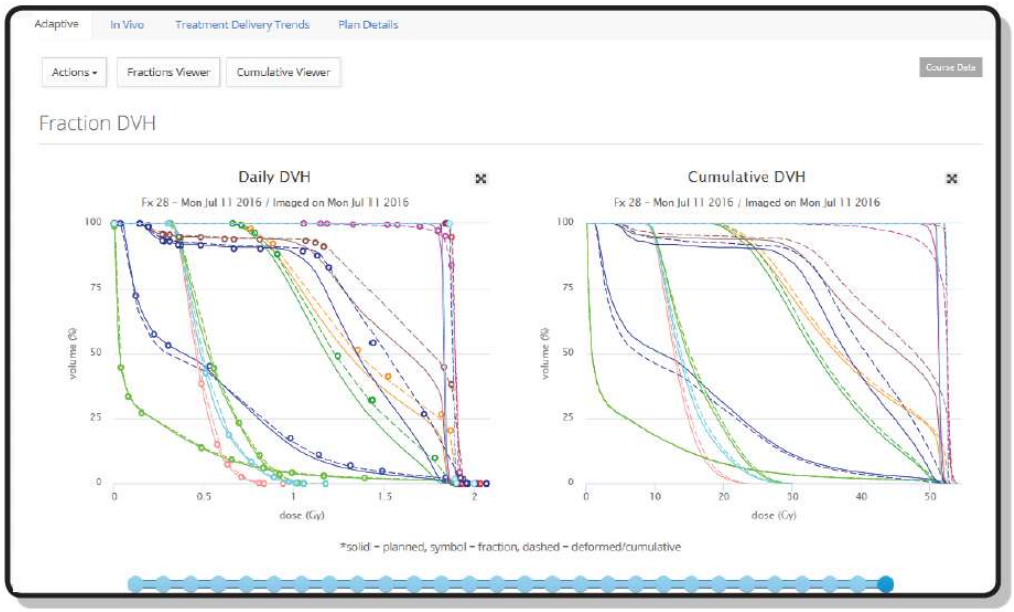
Within the DVH plots, the circles represent the dose calculated on the daily CBCT. For fractions without a daily CBCT the most recent preceding CBCT will be used for image fusion. The date of CBCT can be verified in the daily DVH label. The dashed lines represent the daily dose that has been mapped from the CBCT back to the plan image. In the Cumulative DVH, each day’s delivered dose has been added together to produce the dashed cumulative DVH. The solid line shows the planned DVH for one fraction (left) or for the number of delivered fractions (right).

For the daily dose calculation, the plan image is used outside the field of view of the CBCT. This combined image is referred to as a merged image.

NOTE: If the dots do not overlay the DVH line, this may indicate a potential issue with the deformable registration for this day.

NOTE: The Adaptive module does not currently support Feet First Supine (FFS) or Feet First Prone (FFP) orientations.

9.2.4 DVH Review



DVH of re-computed dose of each fraction (Daily DVH).

> For fractions without a daily CBCT the most recent preceding CBCT will be used for image fusion. The date of CBCT can be verified in the daily DVH label.

DVH of deformed dose accumulated onto planning CT (Cumulative DVH).

Uncheck the box next to a structure name to hide the DVH. Empty structures will not appear in the DVH chart.

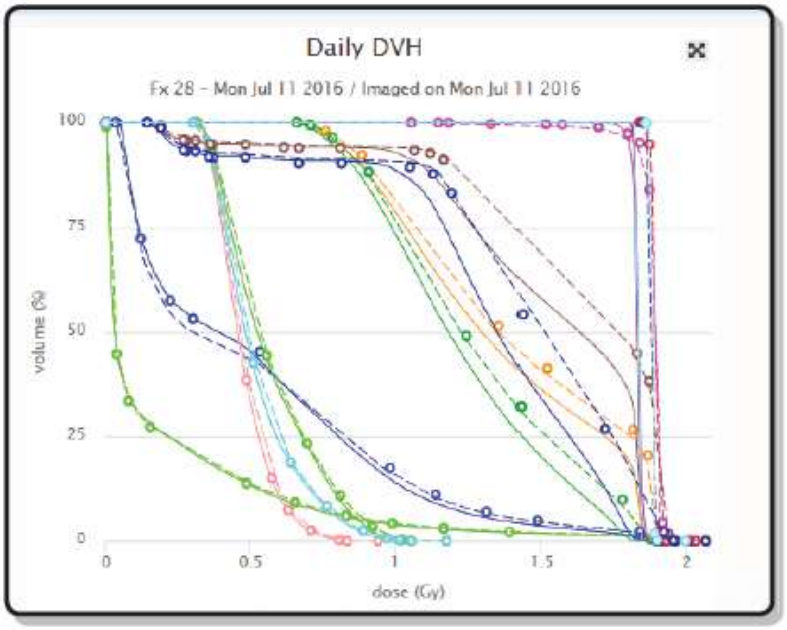
Slide the bar under the Daily DVH and Cumulative DVH to change which fraction is displayed. If a fraction is interrupted or incomplete, the daily DVH chart will label the fraction interrupted to alert the user.

To export DVH data or an image of the DVH plot, select the bar icon on the upper right side of the DVH chart and select an option from the displayed menu. The file type you select will be downloaded.

IMPORTANT: Should plan results displayed in the Adaptive module differ from the treatment planning results, these differences may be due to discrepancies in DVH binning. Further review of treatment plan is needed to determine if Adaptivo results are acceptable.

IMPORTANT: Please carefully review plans with Enhanced Dynamic Wedges (EDW), as these calculations have not been fully validated in the current version of the software.

9.2.4.1 Daily DVH Review



Three DVH curves are shown in the Daily DVH chart:

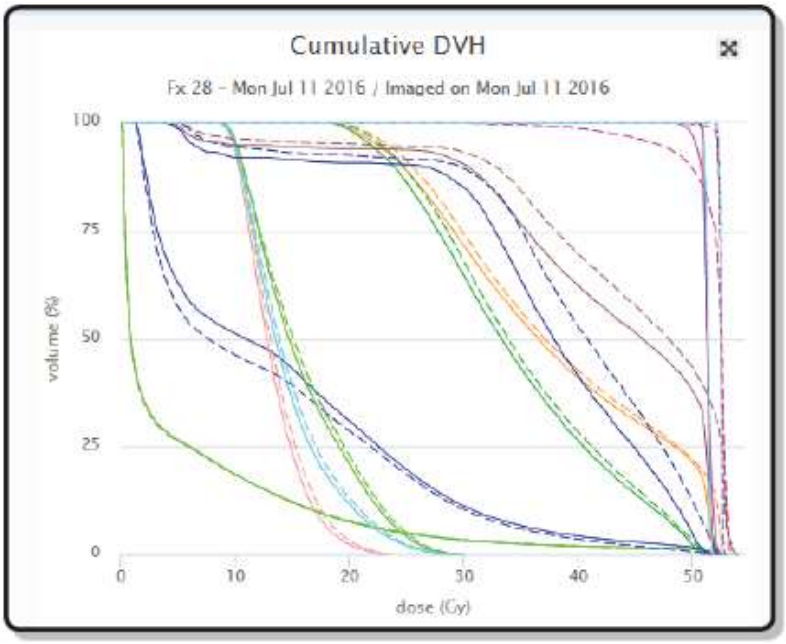
- Solid line = plan dose
- Dashed line = deformed daily dose
- Circles = dose calculated on daily image

Review planned vs. delivered dose for each fraction.

The daily DVH (circles) uses the deformed ROI and is generated from the dose calculated on the daily merged CT. Deformed daily dose DVH (dashes) uses the planning ROI and is generated from ***daily dose*** deformed/mapped to the planning CT for dose accumulation.

NOTE: A large difference between the circles and dashes may indicate questionable deformation.

9.2.4.2 Cumulative DVH Review



Two DVH curves are shown in the Cumulative DVH chart:

- Solid line = plan dose scaled to fraction number
- Dashed line = cumulative dose

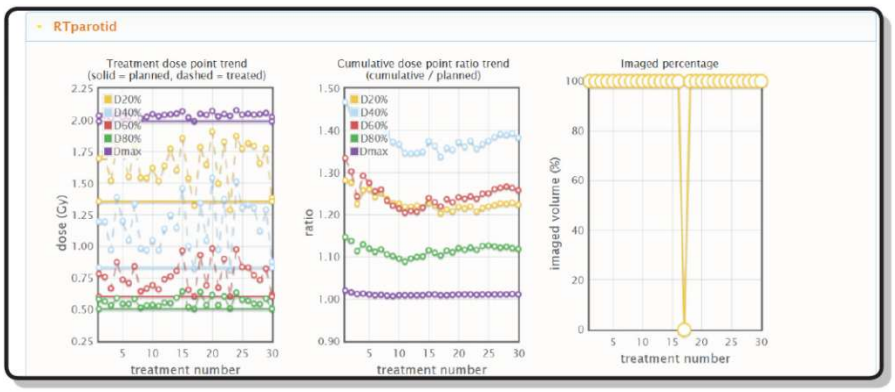
Review planned vs. delivered cumulative dose.

Daily dose is mapped back to the planning CT. Dose is then accumulated to generate the dashed line DVH displayed in this graph.

IMPORTANT: An interrupted fraction may invalidate the cumulative dose calculation. Please use caution when interpreting cumulative dose results if a patient has received an incomplete delivery of one or more fractions.

9.2.5 Trending Plots

Click on a structure name and select View Trending Plots to jump to trending plots, or scroll down and click on the structure name to expand the data.

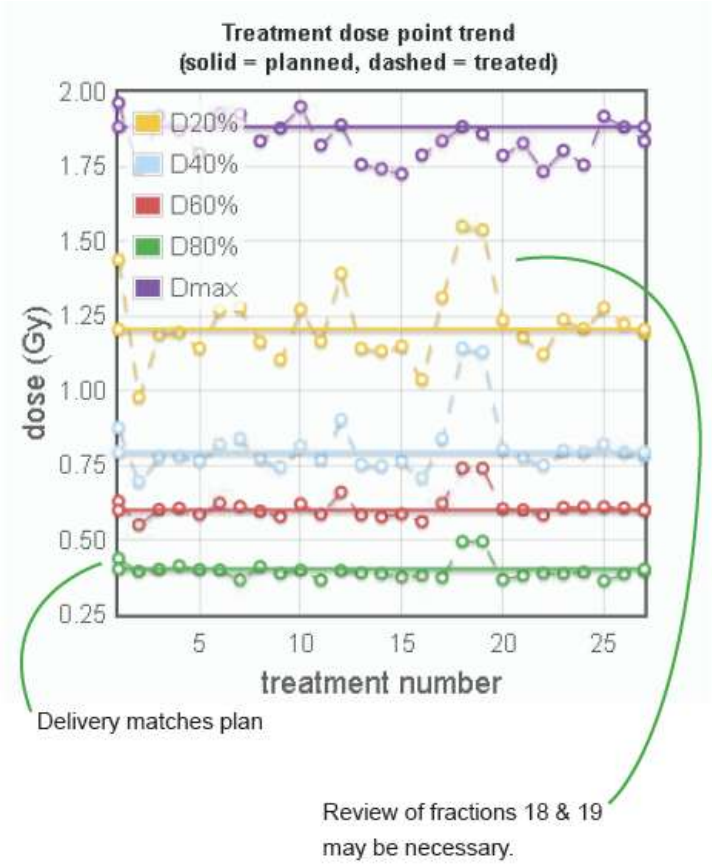


9.2.5.1 *Treatment Dose Point Trend*

This is a snapshot of the daily DVH plot for each fraction. The symbols represent the Adaptive reconstruction dose, and the solid lines represent the planned dose.

If there is a difference in DVH for the structure or region of interest (ROI), this graph will show it on a per fraction basis.

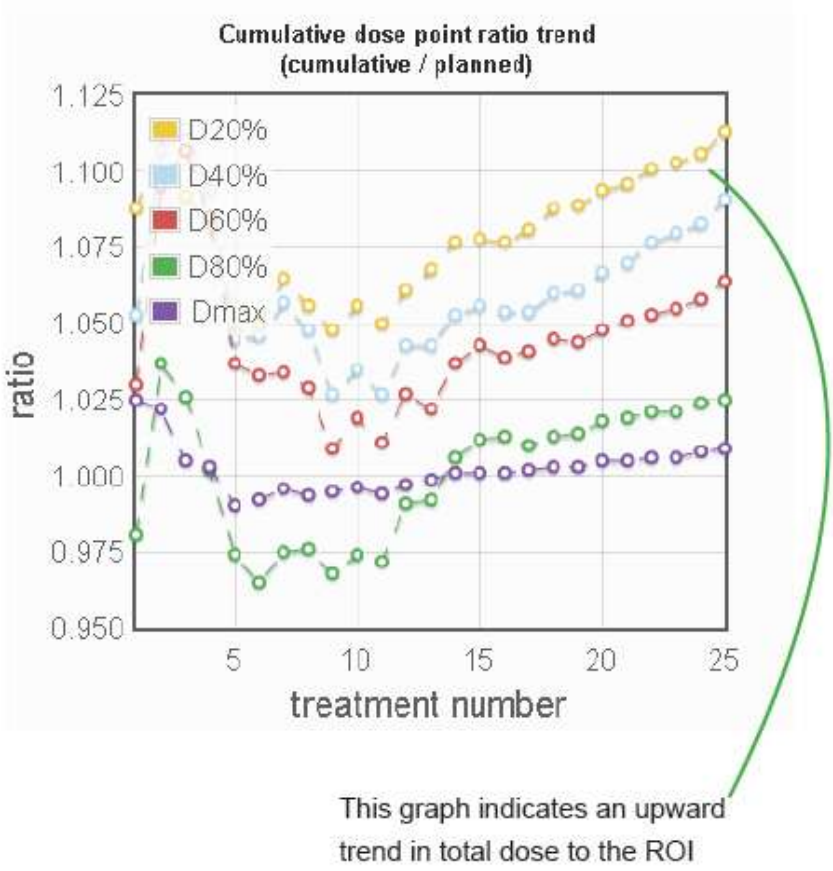
Deformed ROIs and daily recalculated dose are used to create the plot.



9.2.5.2 Cumulative Dose Point Ratio Trend

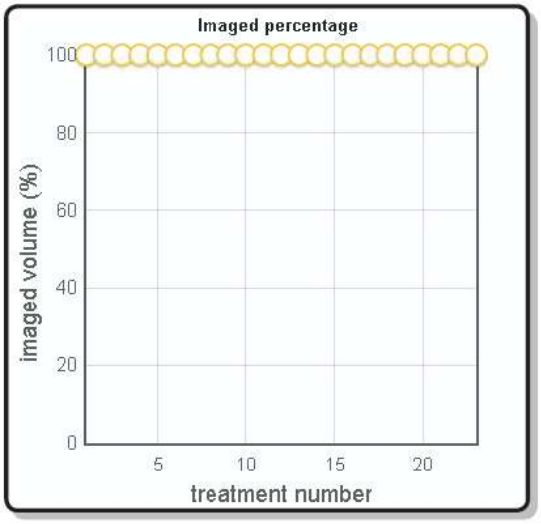
This plot provides a snapshot of the cumulative DVH after each fraction has been delivered. The cumulative dose DVH is divided by the Planned dose DVH to provide a ratio. A value of 1.0 indicates that the daily and planned DVH values match. A value greater than one is hotter than planned, less than one is colder than planned.

This plot is useful in showing whether dose differences from gradual changes in volume of a structure, e.g. tumor regression or weight loss, are affecting the overall treatment.

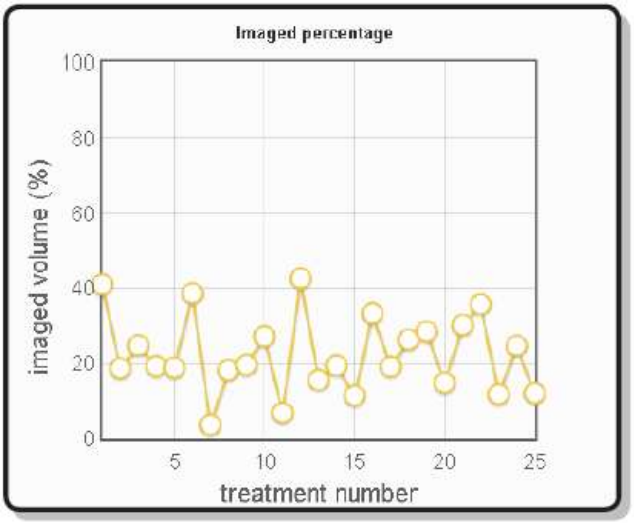


9.2.5.3 Imaged Percentage

Imaged percentage shows the percentage of the structure that was included in the daily image for each fraction.



Reliable for selected ROI

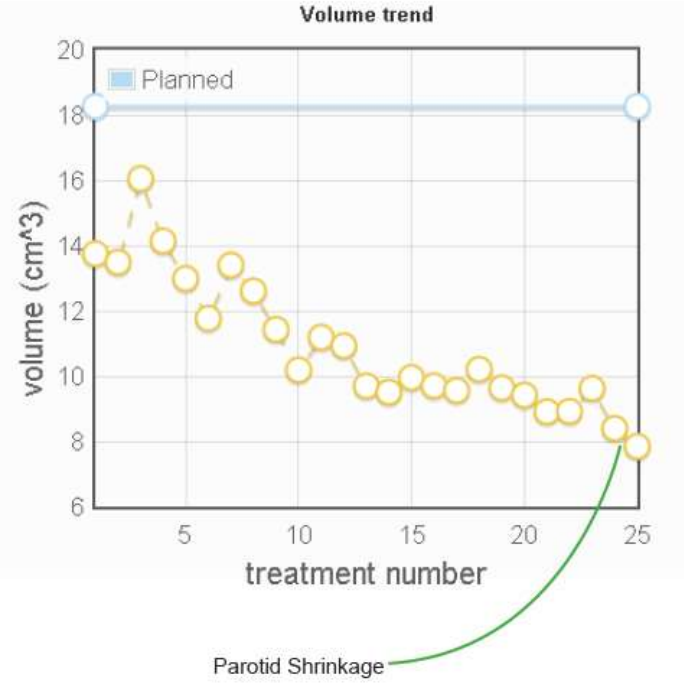


Unreliable dose information for selected ROI

9.2.5.4 Volume Trend

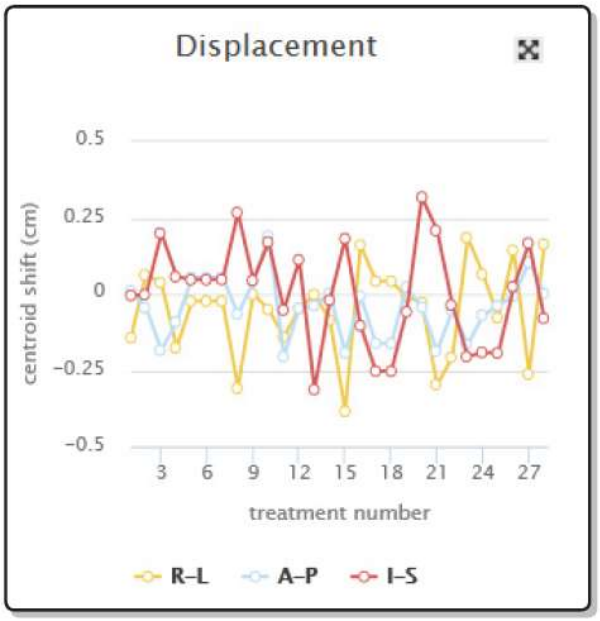
This plot shows the absolute volume of the structure for each fraction based on the deformed ROI.

Volume changes during treatment - e.g. tumor regression or organ volume decrease due to patient weight loss - are cleanly displayed in this plot. Use it to cross check information in the cumulative dose point ratio trend to see if there is a correlation for an increasing dose to a ROI over the course of treatment.



9.2.5.5 Displacement Trend

If a patient loses weight over the course of treatment there is potential for a structure to shift medially. This graph indicates if an ROI is shifting.



Other examples that could be reflected in the displacement trend include poor setup and bladder or rectal fill changes.

- Position distance is based on the geometric center of the ROI. R-L would show if a ROI is shifting medially or laterally, A-P would be anterior or posterior, S-I is superior or inferior
    - +X = R > L
    - +Y = A > P
    - +Z = I > S

This information is useful for determining if dose differences seen in the trending data are related to changes in the location of the ROI.

9.2.6 Image Viewers

The fraction and cumulative viewers are applications to display the CT and dose images. Single click on the button to open the associated viewer.

9.2.6.1 Fraction Viewer

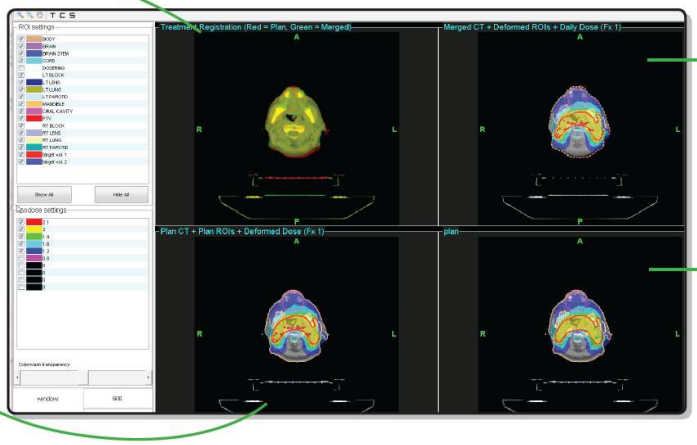
The fraction viewer shows each delivered fraction. The CBCT image registration with the plan is shown along with the daily dose on the merged CT, the daily dose mapped back to the plan image, and the plan for comparison purposes. Patient orientation labels are shown on each image, and the fraction number is shown in the upper right. Use Page Up/Down to change the displayed fraction.

Registration Panel:

Red = plan CT

Green = merged CT

Yellow = matching registration (or not imaged)



Daily Panel:

Merged CT

+ computed daily dose

+ deformed ROIs

Plan Panel:

View original Plan

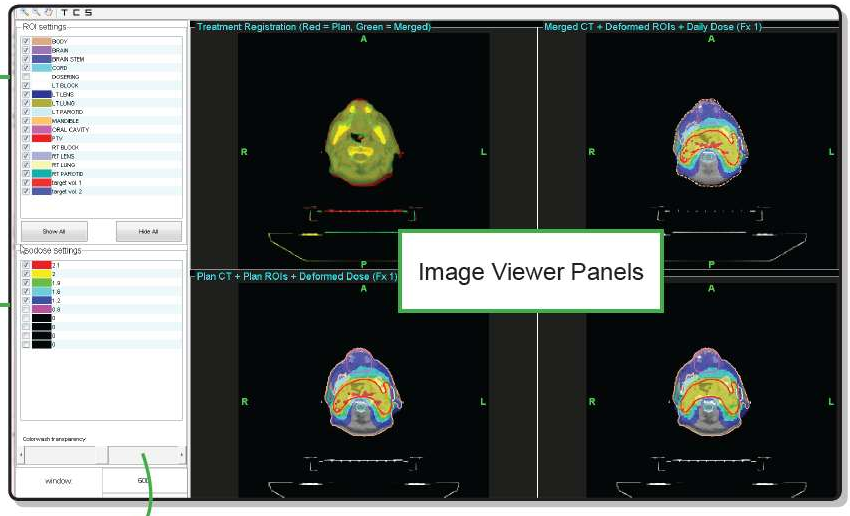
Daily Deformed Panel:

Plan CT

+ deformed dose

+ plan ROIs

ROI display settings



Isodose display settings

- left click to change isodose levels

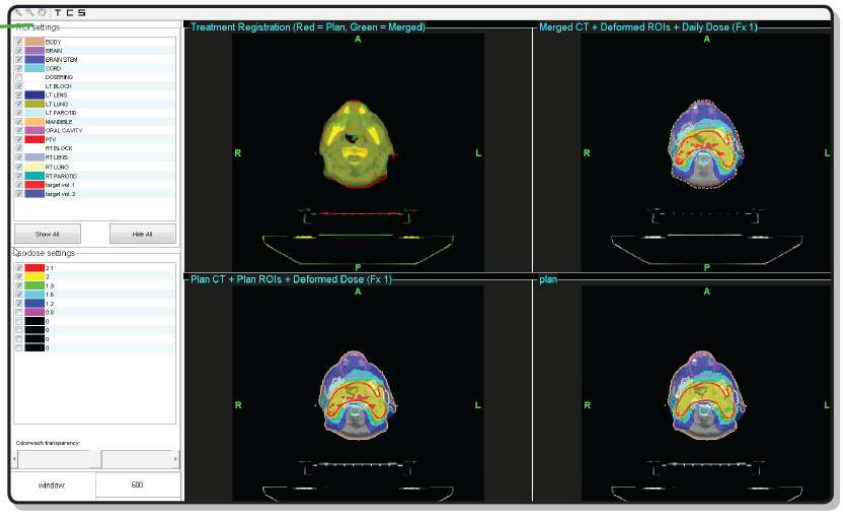
Drag slider to change colorwash transparency

Zoom, pan, TCS view tools

Key Controls:

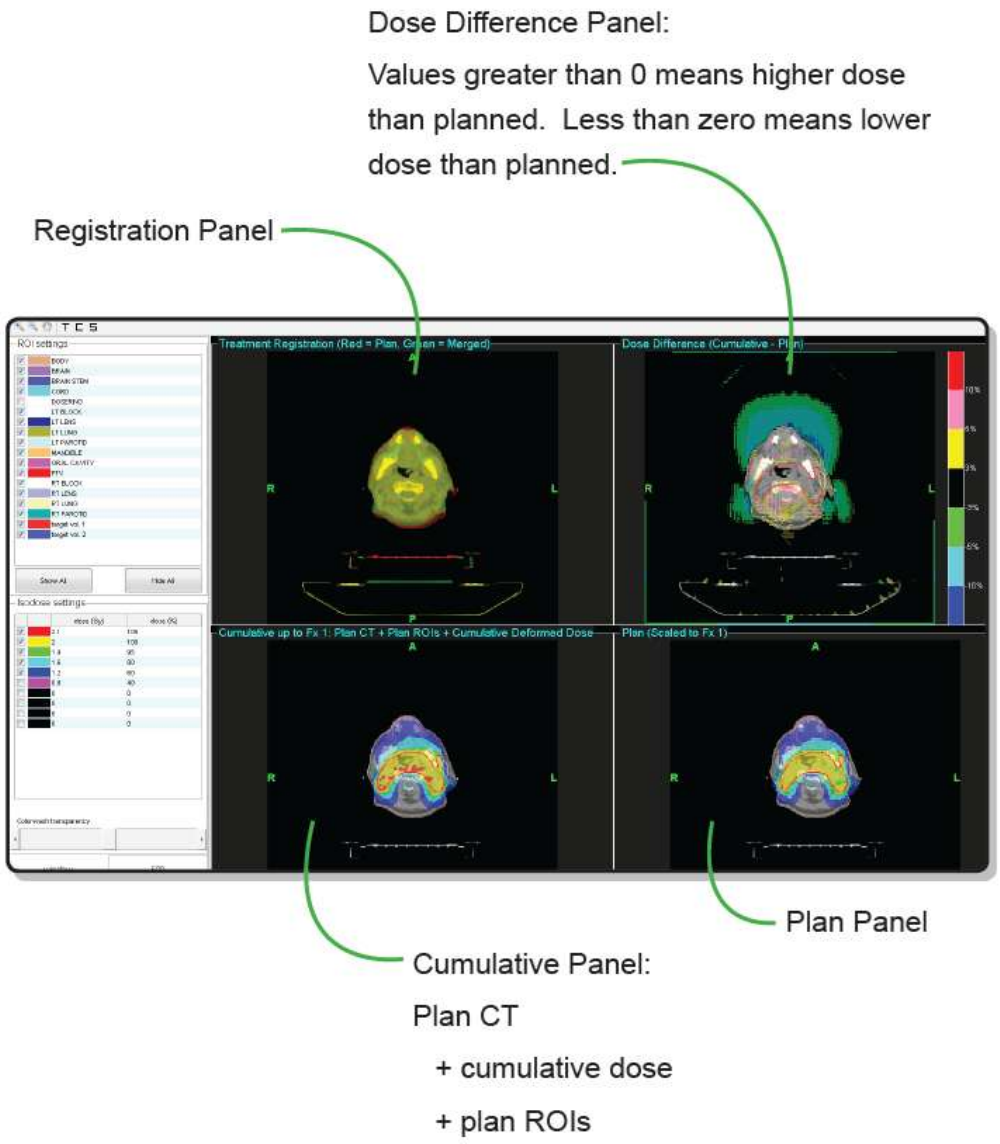
Mouse Wheel = change slice

Page Up/Down = change fraction



9.2.6.2 Cumulative Viewer

The cumulative viewer displays the most recent CBCT image registration, the cumulative dose determined through the most recent fraction, the plan dose scaled to the number of fractions delivered, and the point-by-point difference between reconstructed and planned dose.

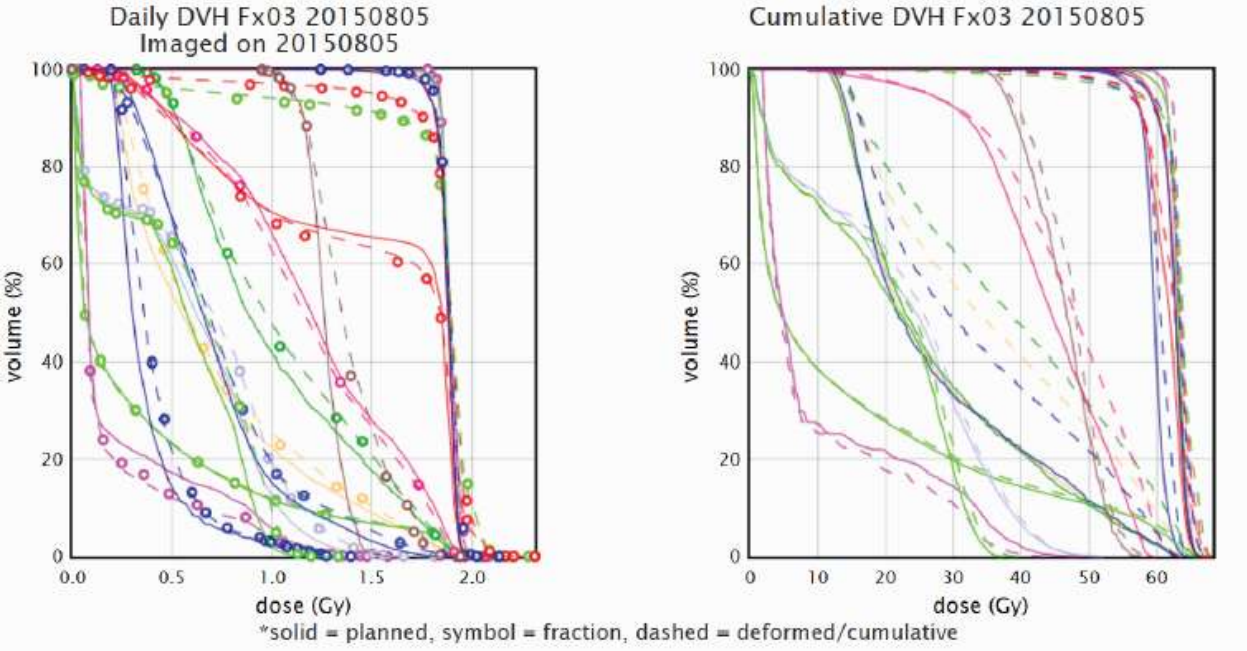


9.2.7 Plan Summation

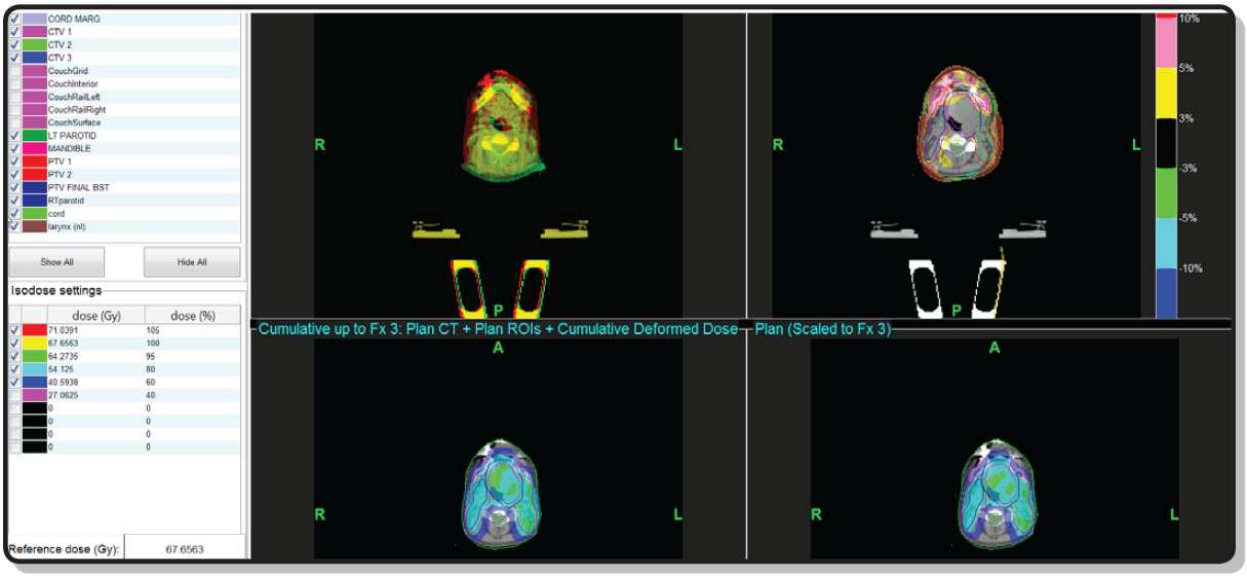
Phase 1 and Boost treatment plans under the same course defined in ARIA will be summed automatically in the Adaptive module.

To view a summed plan in the Adaptive module, open the plan level link labeled with the most recently treated plan in the Course and navigate to the Adaptive tab, or select an Adaptive flag for that plan:

Cumulative DVH data will reflect previously delivered dose:



The cumulative Viewer will reflect previously delivered dose. A reference dose is determined based on the summed doses. Reference dose can be edited if necessary by updating the dose level defined in the reference dose field.



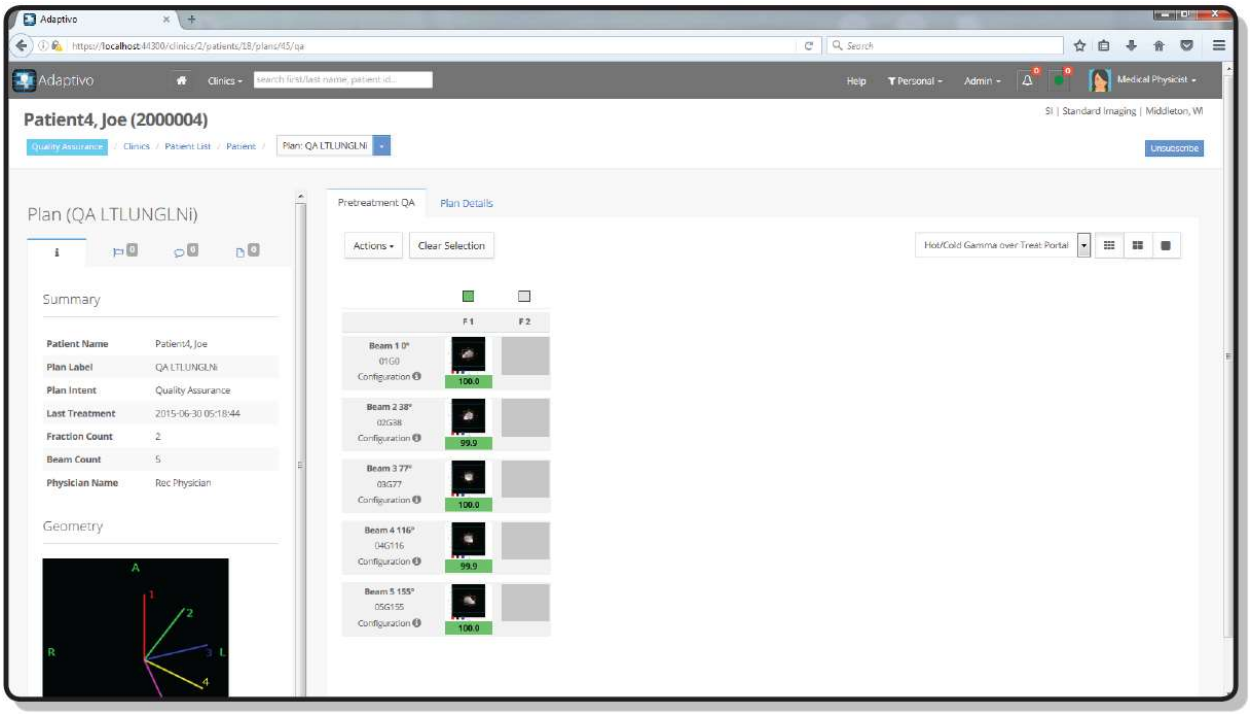
IMPORTANT: Only CTs in the same frame of reference can be summed.

IMPORTANT: An interrupted fraction may invalidate the cumulative dose calculation. Please use caution when interpreting cumulative dose results if a patient has received an incomplete delivery of one or more fractions.

10 Pretreatment QA Plans

The Pretreatment QA Plans are plans delivered through air to the portal imager to verify that the treatments can be delivered accurately. Measured images are compared to a predicted image generated by Adaptivo based on the beam information retrieved from the R&V system along with the imager calibration in Adaptivo.

To view a specific pretreatment QA plan, select the plan name from the list. The application will display the selected pretreatment QA plan page.



NOTE: Pretreatment QA has been validated for 6MV and 10MV only. Other energies are not clinically available in the current version of the software.

NOTE: Pretreatment QA must be delivered in Treatment mode in order to generate an RT Record of the delivery.

10.1 Pretreatment QA

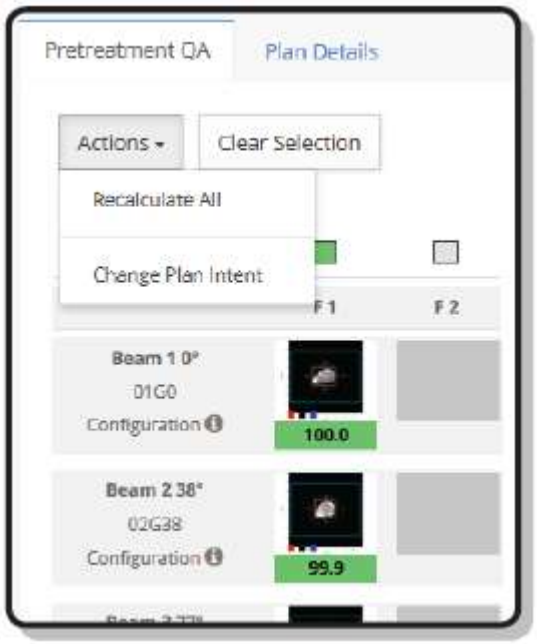
The Pretreatment QA tab page displays how many times the plan was delivered and whether the gamma value falls within the pass, warn or alert criteria.

A thumbnail image showing the signed gamma and predicted image for each beam in the selected plan will be displayed in the main area of the screen. Each thumbnail is associated with a color, corresponding to the pass, warn, and alert criteria, with the gamma passing percentage shown in the color bar beneath each image.

Click the gamma value number at the bottom of the image to display a dropdown menu, which includes Animate Beam and View Beam Details. Details similar to those displayed in the In Vivo module are displayed when you select View Beam Details.

10.2 Actions

Select an option from the Actions dropdown menu to perform one of the following:



10.2.1 Recalculate All

The application will display a confirmation dialog.

WARNING: Existing results will be deleted and new results will be calculated.

To proceed with recalculating, select [Continue]. To dismiss the dialog without recalculating, select [Cancel].

10.2.2 Change Plan Intent

The application will open a dialog allowing you to change the intent for the selected plan. Intent options include: Curative, Verification, and Unknown. Selecting 'Verification' indicates that the plan is a Pretreatment QA plan.

Select the desired Intent from the dropdown.

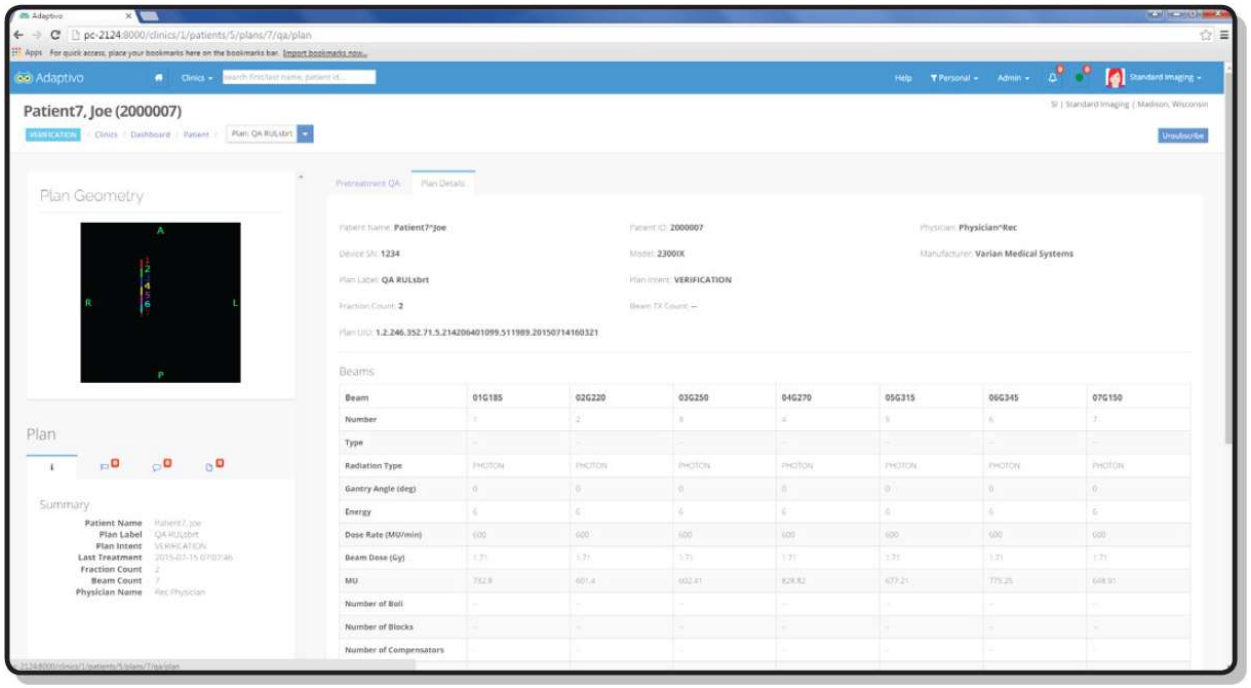
When finished, select [Change] to save and close the dialog. To dismiss the dialog without making a change, select the [x] in the upper right.

10.2.3 Reports

To generate a pre-treatment QA report, select one fraction, then select Actions>QA Summary Report. Review the report then select Save Report to PDF. To exit without generating a report, simply close the browser tab without clicking save report.

10.2.4 Plan Details

The Plan Details tab page displays all the DICOM header information for the selected plan. Data displayed in the Plan Details tab page cannot be edited.



10.3 Reports

Multiple types of reports can easily be generated within Adaptivo. These can be customized, and have been designed to be informative and as clearly presented as possible.

QA Summary Reports

QA Summary Reports provide documentation of the pretreatment delivery QA that is performed using Adaptivo. These can be generated by selecting the plan and the specific QA delivery, then selecting Create QA Summary Report from the Actions drop-down menu. The first page of the report provides summary information, and the subsequent pages provide the beam specific information in order to satisfy the reporting requirements for pretreatment QA billing codes.

Please note that all pretreatment QA reports may need to be reviewed regardless of their pass/warn/alert status in order to satisfy billing requirements.

Fraction Summary Reports

Fraction Summary Reports can be generated by selecting the fraction in the In Vivo module, then selecting Fraction Summary Report from the Actions drop-down menu. This report provides information about the beams that were delivered in the selected fraction, the gamma thresholds and analysis results, comments that have been entered into Adaptivo regarding the selected fraction, and beam images and profiles. Review the report, then save to pdf if desired or close the browser tab to cancel.

Fraction Average Reports

Fraction Average Reports are similar to Fraction Summary Reports but use the calculated average fraction rather than a single delivered fraction. Once the average fraction has been calculated, select the average fraction results, make comments if desired, and then select Fraction Average Report from the Actions drop-down menu. Review the report, then save to pdf. Close the browser tab to cancel.

Adaptive Module Reports

Adaptive Module Reports can be generated after any fraction to show the cumulative DVH plot of the dose delivered to date compared with the planned DVH. From the Adaptive tab of the patient plan display, select Report from the Actions drop-down menu. Review the report, then save to pdf if desired, or close the browser tab to cancel. Please note that the IVDT table used for each of the daily calculations is indicated in the report.

End of Treatment Reports

End of Treatment Reports for the In Vivo module can be generated once a patient has completed treatment. Review the plan, add comments where desired, then select End of Treatment Report from the Actions drop-down menu. Review the report, then select Save Report to PDF. To exit without generating a report, simply close the browser tab without clicking Save Report.

Creating Report Templates

Each clinic may have its own set of report templates. Only users with Physics Admin rights can access and edit templates.

To create a report template, select Reports from the lower left of the Clinic Configuration window.

A list of report types is displayed. Select the type of report you wish to customize.

The main portion of the screen will then display the tool for creating a report template.

On the left under Report Items is a series of variables with which to populate the report. The variables are organized into categories that may be expanded by selecting the associated arrow. Later when a report is generated the variable is replaced by the actual data associated with the selected plan.

To add a variable to the report, simply click and drag the variable from the Report Items list to the desired position in the report.

Hover over a data section to see a Remove option. Click to remove the data block. Hover over a text section to see a Remove and an Edit option. Click Edit to edit the text.

Once all changes are applied, select Update to update the report template.

References

Boriano, A., Lucio, F., Calamia, E., Russi, E., & Marchetto, F. (2013). A new approach for the pixel map sensitivity (PMS) evaluation fo an electronic portal imaging device (EPID). Journal of Applied Clinical Medical Physics , 14 (6).

Chen M, Lu W, Chen Q, Ruchala KJ, Olivera GH. (2008) A simple fixed-point approach to invert a deformation field. Med Phys. 35(1), 81-88.

Ju T, Simpson T, Deasy JO, Low DA. (2008) Geometric interpretation of the gamma dose distribution comparison technique: Interpolation-free calculation. Medical Physics. 35(3), 879–887.

Low, D. A. (2003). Evaluation of the gamma dose distribution comparison method. Medical Physics , 30 (9), 2455-2464.

Lu W, Chen M, Mo X, Parnell D, Olivera G, Galmarini D. (2013) MO-D-108-04: Validation of a Simple Portal Dose Calculation Model for Plan QA and In-Vivo Dosimetry. Medical Physics. 40(6), 396–396.

Lu, W., Chen M., Mo, X., Parnell, D., Olivera, G., and Galmarini, D. (2014). Fast in vivo volume dose reconstruction via Reference Dose Perturbation. J. Physics, Conf. Series 489, 012016.

Varian Medical Systems. (2014, April 7). Section 6.2. Dosimetric Calibration of the Portal Imager on 4DITC workstation. Varian Medical Systems Customer Technical Bulletin - PV-887 Installation and Verification of the Portal Dosimetry Pre-configuration Package 1.0 DWG Number 100058491, DWG Number 100058491 Rev B . Varian Medical Systems.

Appendix A: Definitions

In Vivo Module Definitions

- **In Vivo:** Literally meaning "in the living organism," this technique directly monitors the radiation dose delivered to a patient during radiation therapy.

- **EPID—Electronic Portal Imaging Device:** This is a flat panel imaging device based on Amorphous Silicon technology. It is placed in line with the radiation source and used to acquire 2D images before, during, or after treatment delivery.

  Calibrated Units (CU): CU is defined so that 100 CU corresponds to the CAX value at the isocenter of a 10X10 cm field at a Source-to-Detector Distance (SDD) of 100 cm when 100 Monitor Units (MU) are delivered. CU can be calibrated in MU, Gy, or cGy. For a typical Varian EPID, the water-equivalent depth, consisting of a copper plate and materials above the phosphor layer, is approximately 0.8 cm, where calibration occurs with ion chamber measurements. CU is typically calibrated in centiGray, with 1 CU equal to 1 cGy.

- **Monitor Unit (MU):** A measurement of machine output based on the charge measured by a transmission ionization chamber in the head of the linac. The charge collected for one MU is set based on a calibrated correlation with delivered absorbed dose under specific conditions.

- **Meterset Exposure:** Treatment machine Meterset duration over which an image has been acquired, specified in Monitor units (MU) or minutes as defined by the Primary Dosimeter Unit.

- **Number of Frames:** Is the number scans of the EPID that were performed to generate an integrated image.

- **Fraction:** Designates a single treatment session for a radiation treatment delivery.

- **Portal Prediction:** The dose computed by a dose calculator on the EPID based on a particular plan to be delivered.

- **Relative Mode:** Comparisons using a particular metric between two measured portals.

- **Predicted Mode:** Comparisons using a particular metric between a calculated portal dose and a measured portal dose.

- **QA** - Quality Assurance in the context of Adaptivo refers pretreatment patient-specific 3DCRT, IMRT,SRT, SBRT and VMAT plan quality assurance performed with the Adaptivo Pretreatment QA module.

- **Portal Dose:** The dose image measured by the EPID.

- **Gamma:** Refers to the gamma values obtained with the gamma metric without indicating if the difference is an underdose or overdose (Low, 2003).

- **Gamma metric:** A mathematical comparison of pixels in a given image to determine whether they meet either the dose difference or distance to agreement criteria.

- **Gamma Pass Condition:** The criteria that must be fulfilled to allow a "pass" label to be applied to the image comparison.

- **Dose Difference %:** The percent of dose difference used to compute the Gamma metric.

- **Distance-to-Agreement (DTA) (mm):** The acceptable distance between a dose value in one image and a matching dose value in the correlated comparison image. This value is used for the gamma metric computation.

- **Gamma Low Dose Threshold:** A parameter to exclude dose points below a specified threshold for the calculation of the gamma index.

- **Hot/Cold Gamma:** Gamma values computed and displayed as hot (red) if the measured CU is greater than the TPS predicted value, or cold (blue) if the measured CU is less than the TPS predicted value.

- **Hot/Cold Gamma over DRR at SID:** Figure indicating hot/cold gamma values overlaid on the planning DRR at the plane/distance of the imaging panel.

- **Hot/Cold Gamma over Reference Portal at SID:** Figure indicating hot/cold gamma values overlaid on the measured portal dose at the plane/distance of the imaging panel.

- **Dose Difference at SID:** Predicted versus measured dose difference map in the plane of the imaging panel.

- **Plan Fluence:** Representation of the intensity of the fluence map at the portal level.

- **Plan Fluence over DRR at SAD:** Figure representing the plan fluence values over the planning DRR in the isocenter plane.

- **Plan Computed Dose (CU) over DRR at SID:** Figure representing the plan computed dose over the planning DRR in the plane of the imaging panel.

- **EPID Panel Measured Dose (CU) over DRR at SID:** Figure representing the measured dose over the planning DRR in the plane of the imaging panel.

- **Portal Dose (CU) Profile X:** Profile of the portal dose (CU) in the IEC X direction centered on the position of the interactive crosshair of the DRR.

- **Portal Dose (CU) Profile Y:** Profile of the portal dose (CU) in the IEC Y direction centered on the position of the interactive crosshair of the DRR.

- **Reference (ref):** Reference in the context of Adaptivo In-Vivo refers to the selected beam portal dose image used as a basis of comparison in Relative Mode Gamma comparisons. The reference may be chosen by the user, based either on the Calculated Mode comparisons or on other indicators of good patient setup. Fraction 1 is taken as the default reference until an alternate selection is made by the user.

- **Gamma Trend:** A trend line plot of the gamma calculation results.

- **Couch Trend:** A trend line plot of the treatment couch position contained in the radiation delivery record.

- **Monitor Unit Trend:** A trend line plotting the planned monitor units vs. the delivered monitor units contained in the treatment delivery record.

- **Gamma Statistics:** Matrix representing percentage of pixels in an image that satisfy the Gamma criteria for different combinations of dose difference (rows) and distance to agreement (columns).

- **Gamma Histogram:** Distribution of gamma and signed gamma values as function of gamma.

- **Dose Difference Histogram:** Distribution of absolute and signed dose differences as function of the percentage dose difference.

- **Plan Geometry:** A graphic representation of the planning CT with the couch replacement at the time of planning, if a couch replacement if performed. Otherwise, the planning CT will be displayed.

- **Fraction Geometry:** A graphic representation of the planning CT with the treatment couch positioned according to the information in the treatment delivery record.

- **Registration View:** An overlay of the Fraction Geometry and the Plan Geometry using the planning CT. Used to identify any differences in couch type and/or position at planning versus the treatments.

- **Pixel Gain Filter:** An image filter based on a technique used to characterize the response of each element of a detector matrix by a different gain based on a reference.

- **Source-to-Image Distance (SID):** In In-Vivo, this represents the distance from the source of radiation to the megavoltage imaging panel in mm.

- **Plan Beam Summary:** The treatment beam information contained in the DICOM RT Plan file.

- **Treatment Beam Summary:** Treatment beam information contained in the DICOM RT record file.

- **Flattening Filter Free (FFF):** A mode of radiation delivery in which the flattening filter is removed from the radiation beam enabling higher dose rates (MU/min).

- **Enhanced Dynamic Wedge (EDW):** A mode of radiation delivery in which one of the collimator jaws is used to alter the radiation delivery to simulate a physical wedge.

- **Slab Density:** In In-Vivo this is relative electron density value for the water-equivalent material used during the commissioning process.

Adaptive Module Definitions

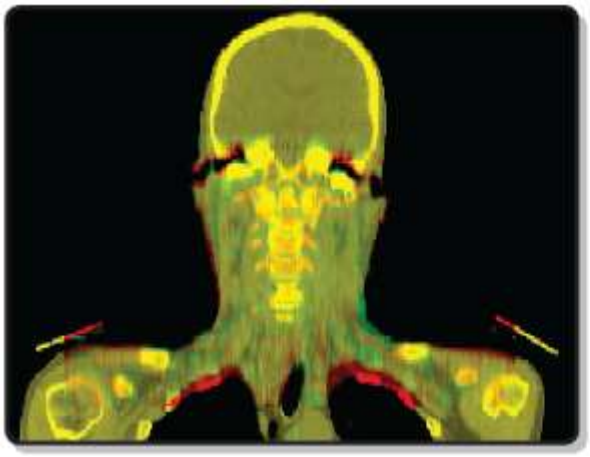
Merged CT

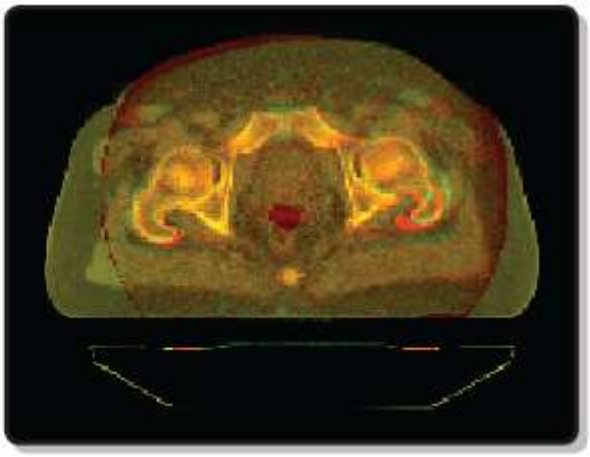
Created by inserting the daily CT in treatment position into the correct location in the planning CT using image fusion.

Used for daily dose calculation.

Any area outside the daily CT that is not within the daily CT FOV is filled with the planning CT.

For more accurate dose, make sure all tumor volumes and OARs you would like to track are included in the daily MVCT. Also make sure your patient is within the FOV of the MVCT to prevent radial fill when possible.

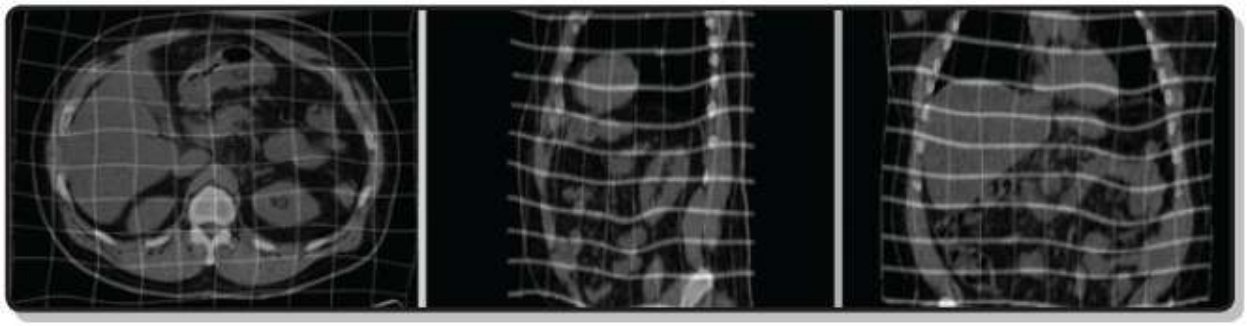




Deformable registration

The process of matching the 2 image sets in 3D space. In this tool the merged CT is deformed to the planning CT. Deformable registration is required:

- To generate the closest match of the daily CT to the planning CT.
- Rigid registration does not account for geometric differences in anatomy.
- To create a new set of ROIs based on the patient's anatomy on a given day.



Adaptivo uses a Morphons algorithms for deformable registration.

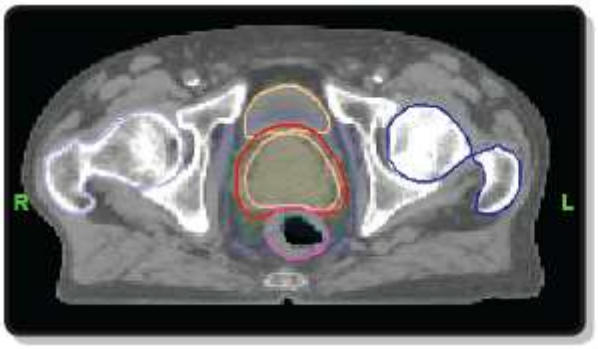
Knutsson, Hans, and Mats Andersson. "Morphons: Segmentation using elastic canvas and paint on priors." IEEE International Conference on Image Processing 2005. Vol. 2. IEEE, 2005.

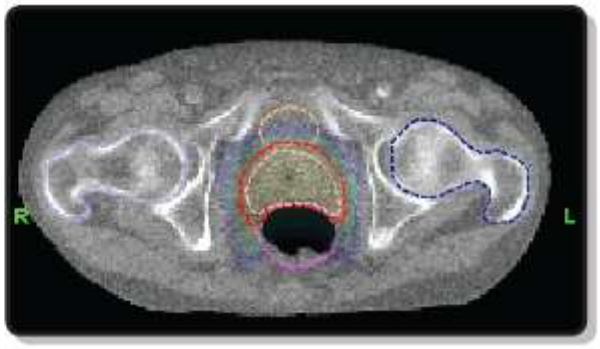
Castadot, Pierre, et al. "Comparison of 12 deformable registration strategies in adaptive radiation therapy for the treatment of head and neck tumors." Radiotherapy and oncology 89.1 (2008): 1-12.

Deformed Regions of Interest (ROIs)

ROIs from planning are deformed onto the merged CT to create a set of structures based on the daily image.

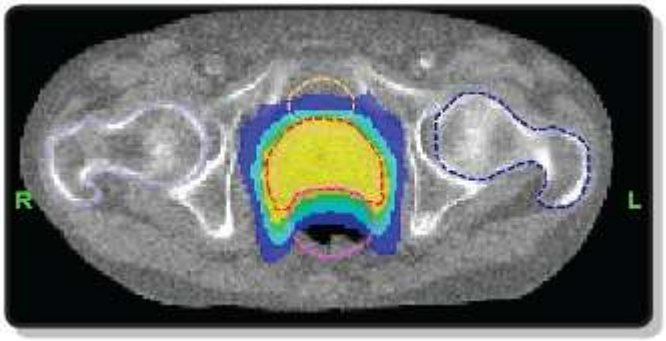
Daily DVHs are then generated from the deformed ROIs.





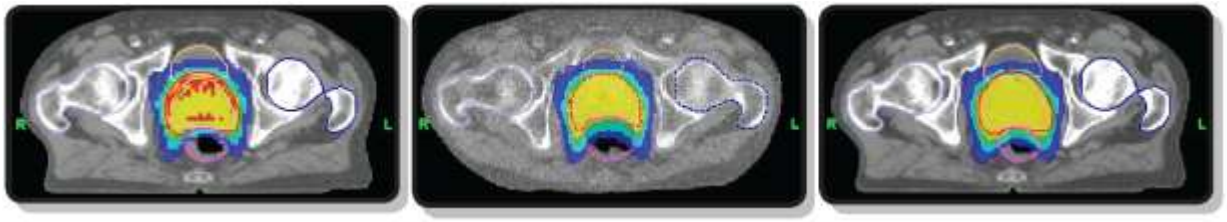
Daily Dose

Dose is calculated using each fraction's daily CT. Any reference to daily dose refers to the dose that is calculated using the merged CT.



Deformed Daily Dose

Each calculated daily dose is mapped back to the plan image for dose accumulation using the deformation map generated by deformable image registration. In order to provide cumulative dose information a defined reference image is required to map dose back to.



Appendix B: Beam Model Data Collection Templates for ARIA Setup

The following templates details the ARIA field entries with plan naming for each plan to be collected for model generation for a two energy data collection (6MV and 23MV) set. The recommended practice is for a single patient ID and template to include only one energy to be collected.

Please note that these plans can be generated easily and automatically using the commissioning screens in Adaptivo for a particular clinic and energy. The template examples are summarized in the Table below with details for each example plan immediately following.

Example	Course	Plan	Energy (MV)	Buildup	Couch(vert,lat,long)	Imager(vert,lat,long)	Field	Summary
1	QA, Air	01_6xAir	6	none	(0,20,0)	(-5,0,0)	10	10 Fields from 1cmx1cm to 20cmx20cm
2		02_23xAir	23	none	(0,20,0)	(-5,0,0)	10	10 Fields from 1cmx1cm to 20cmx20cm
3		08_6x_Slab0	6	none	(0.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
4		09_23x_Slab0	23	none	(0.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
5	QA Slab 150 SID	10_6x_Slab1	6	1cm	(0.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
6		11_23x_Slab1	23	1cm	(0.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
7		13_6x_Slab5	6	5cm	(2.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
8		14_23x_Slab5	23	5cm	(2.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
9		16_6x_Slab10	6	10cm	(5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
10		17_23x_Slab10	23	10cm	(5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
11		19_6x_Slab15	6	15cm	(7.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
12		20_23x_Slab15	23	15cm	(7.5,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
13		22_6x_Slab20	6	20cm	(10,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
14		23_23x_Slab20	23	20cm	(10,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
15		25_6x_Slab30	6	30cm	(15,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
16		26_23x_Slab30	23	30cm	(15,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
17		28_6x_Slab40	6	40cm	(20,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
18		29_23x_Slab40	23	40cm	(20,150,0)	(50,0,0)	5	5 Fields (cmxcm) 2x2, 5x5, 10x10, 15x15, 20x20
19	QA Detector Cor	31_DetectorCorr	6,23	none	(0,20,0)	Various	10	For each energy panel is centered and then shifted 4mm in 4 directions from center

Course	QA_Air									
Plan	02_23xAir									
Field Order/Type	1	2	3	4	5	6	7	8	9	10
Field ID	1x1	2x2	3x3	5x5	8x8	10x10	10x5	15x15	20x10	20x20
Field Name	1x1	2x2	3x3	5x5	8x8	10x10	10x5	15x15	20x10	20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600	600	600	600	600	600
MU	100	100	100	100	100	100	100	100	100	100
Time	1	1	1	1	1	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0	0	0	0	0	0
Field X (cm)	1	2	3	5	8	10	10	15	20	20
Field Y (cm)	1	2	3	5	8	10	5	15	10	20
MLC	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Int Mount										
Couch Vrt [cm]	0	0	0	0	0	0	0	0	0	0
Couch Lng [cm]	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20
Couch Lat [cm]	0	0	0	0	0	0	0	0	0	0
Imager Vrt [cm}	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
Imager Lng [cm}	0	0	0	0	0	0	0	0	0	0
Imager Lat [cm}	0	0	0	0	0	0	0	0	0	0

Course	QA_Air				
Plan	08_6x_Slab0				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+0.5	+0.5	+0.5	+0.5	+0.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Air				
Plan	09_23x_Slab0				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+0.5	+0.5	+0.5	+0.5	+0.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	10_6x_Slab1				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+0.5	+0.5	+0.5	+0.5	+0.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	11_23x_Slab1				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+0.5	+0.5	+0.5	+0.5	+0.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	13_6x_Slab5				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+2.5	+2.5	+2.5	+2.5	+2.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	14_23x_Slab5				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+2.5	+2.5	+2.5	+2.5	+2.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	16_6x_Slab10				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+5	+5	+5	+5	+5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	17_23x_Slab10				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+5	+5	+5	+5	+5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	19_6x_Slab15				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+7.5	+7.5	+7.5	+7.5	+7.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	20_23x_Slab15				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+7.5	+7.5	+7.5	+7.5	+7.5
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	22_6x_Slab20				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+10.0	+10.0	+10.0	+10.0	+10.0
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	23_23x_Slab20				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+10.0	+10.0	+10.0	+10.0	+10.0
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	25_6x_Slab30				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+15.0	+15.0	+15.0	+15.0	+15.0
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	26_23x_Slab30				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+15.0	+15.0	+15.0	+15.0	+15.0
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	28_6x_Slab40				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	6X	6X	6X	6X	6X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+20	+20	+20	+20	+20
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course	QA_Slab150SID				
Plan	29_23x_Slab40				
Field	1	2	3	4	5
Field ID	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Field Name	01_2x2	02_5x5	03_10x10	04_15x15	05_20x20
Technique	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	Varian IEC	Varian IEC	Varian IEC	Varian IEC	Varian IEC
Energy	23X	23X	23X	23X	23X
Dose Rate (MU/min)	600	600	600	600	600
MU	100	100	100	100	100
Time	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0
Field X (cm)	2	5	10	15	20
Field Y (cm)	2	5	10	15	20
MLC	NONE	NONE	NONE	NONE	NONE
Int Mount					
Couch Vrt [cm]	+20	+20	+20	+20	+20
Couch Lng [cm]	+150	+150	+150	+150	+150
Couch Lat [cm]	0	0	0	0	0
Imager Vrt [cm]	+50	+50	+50	+50	+50
Imager Lng [cm]	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0

Course		QA_DetectCorr								
Plan		31_DetectCorr								
Field	1	2	3	4	5	6	7	8	9	10
Field ID	01_Center_150	02_Center_150	03_IN_150	04_IN_150	05_OUT_150	06_OUT_150	07_LEFT_150	08_LEFT_150	09_RIGHT_150	10_RIGHT_150
Field Name	01_Center_150	02_Center_150	03_IN_150	04_IN_150	05_OUT_150	06_OUT_150	07_LEFT_150	08_LEFT_150	09_RIGHT_150	10_RIGHT_150
Technique	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC	STATIC
Scale	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217	IEC61217
Energy	6X	23X	6X	23X	6X	23X	6X	23X	6X	23X
Dose Rate (MU/min)	600	600	600	600	600	600	600	600	600	600
MU	100	100	100	100	100	100	100	100	100	100
Time	1	1	1	1	1	1	1	1	1	1
Gantry Rtn [deg]	0	0	0	0	0	0	0	0	0	0
Collimator Rtn [deg]	0	0	0	0	0	0	0	0	0	0
Field X (cm)	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
Field Y (cm)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
MLC	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Int Mount										
Couch Vrt [cm]	0	0	0	0	0	0	0	0	0	0
Couch Lng [cm]	+20	+20	+20	+20	+20	+20	+20	+20	+20	+20
Couch Lat [cm]	0	0	0	0	0	0	0	0	0	0
Imager Vrt [cm]	-50	-50	-50	-50	-50	-50	-50	-50	-50	-50
Imager Lng [cm]	0	0	0	0	0	0	0	0	0	0
Imager Lat [cm]	0	0	0	0	0	0	0	0	0	0

Appendix C: In-Vivo Beam Model Data Collection Checklist Example

In-Vivo Beam Model Data Collection Checklist for 6MV Full Data Set

Air Collections

Plans 01

01_6xAir ☐ **Panel set to 105 SID** ☐ **Tx couch retracted**

Plans 02

02_6x_Slab0 ☐ **Panel set to 150 SID** ☐ **Tx couch retracted**

Solid Water Collections

☐Image panel at 150 SID for all Solid Water Collections

Plan 03

QA_Slab150SID
03_6x_Slab1 ☐ **Place 1 cm of solid water on the couch** ☐ **Isocenter at mid-depth (0.5 cm)**

Plan 04

04_6x_Slab5 ☐ **Place 5 cm of solid water on the couch** ☐ **Isocenter at mid-depth (2.5 cm)**

Plan 05

05_6x_Slab10 ☐ **Place 10 cm of solid water on the couch** ☐ **Isocenter at mid-depth (5 cm)**

Plan 06

06_6x_Slab15

☐ **Place 15 cm of solid water on the couch**
☐ **Isocenter at mid-depth (7.5 cm)**

Plan 07

07_6x_Slab20

☐ **Place 20 cm of solid water on the couch**
☐ **Isocenter at mid-depth (10 cm)**

Plan 08

08_6x_Slab30

☐ **Place 30 cm of solid water on the couch**
☐ **Isocenter at mid-depth (15 cm)**

Plan 09

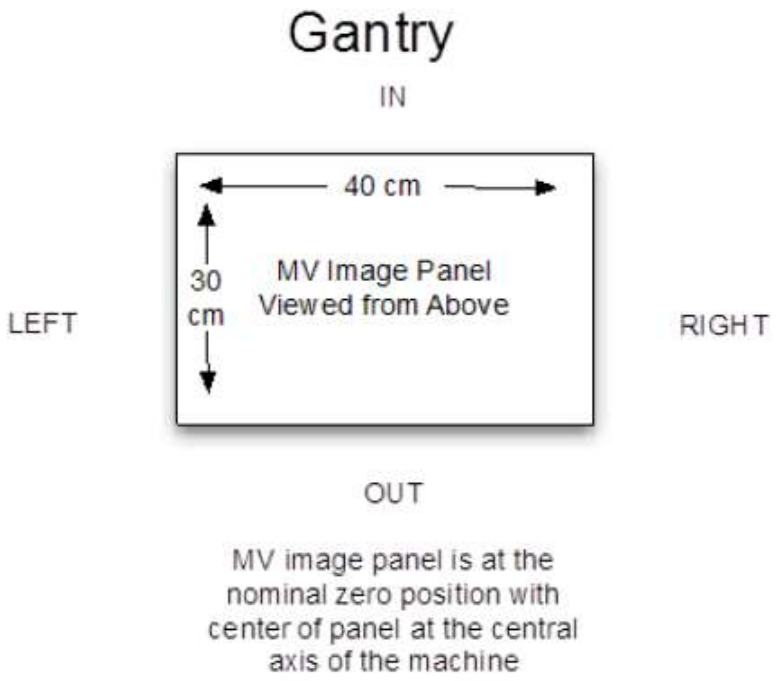
09_6x_Slab40

☐ **Place 40 cm of solid water on the couch**
☐ **Isocenter at mid-depth (20 cm)**

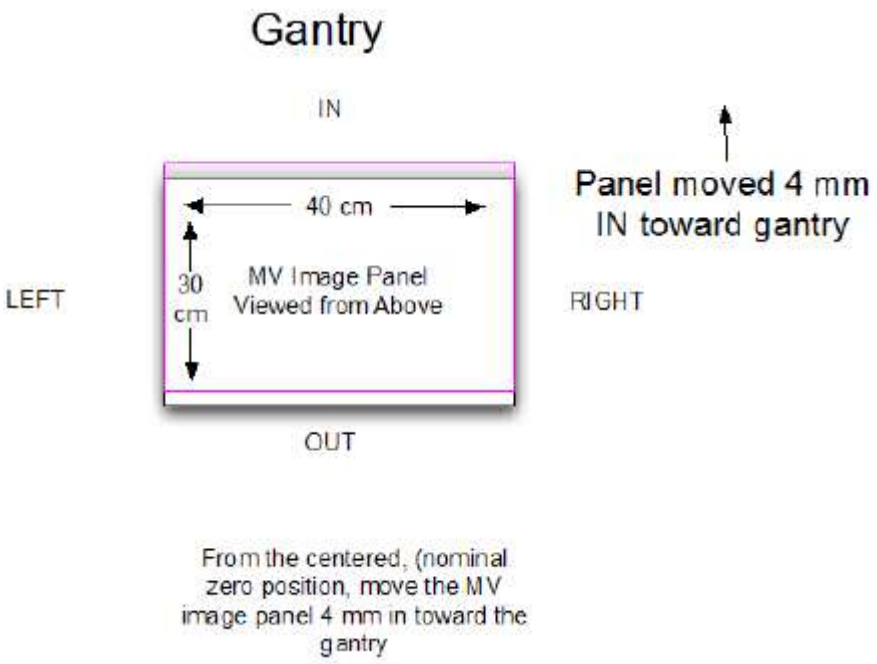
Plan 10

QA_DetectorCorr
10_DetectCorr
01_Center_150 02_IN_150 03_OUT_150 04_LEFT_150 05_RIGHT_150 ☐ **Air Collections** ☐ **Panel set to 150 SID** ☐ **Couch retracted** ☐ **Follow panel move instructions (below) for each position**

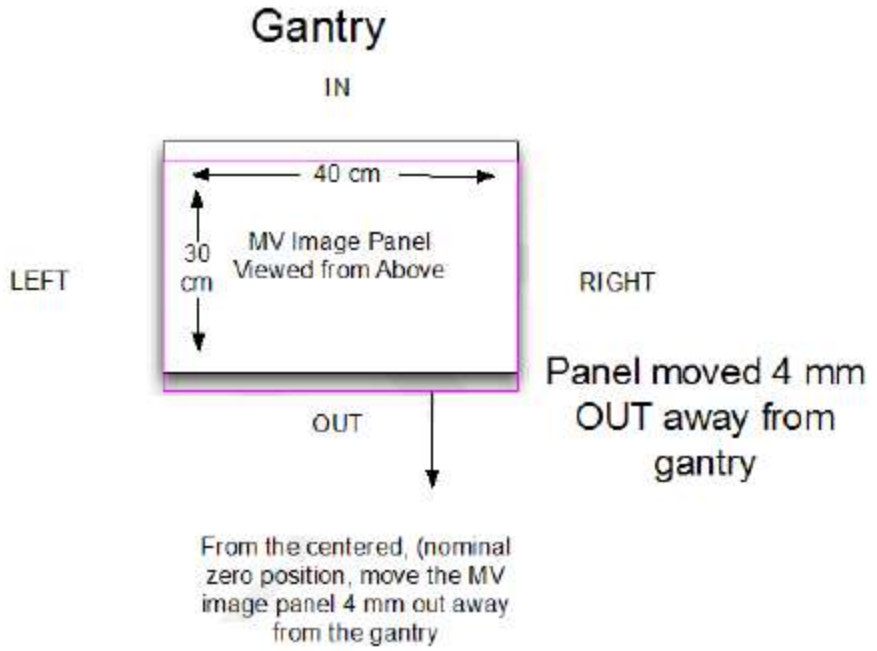
Fields: 01_Center_150



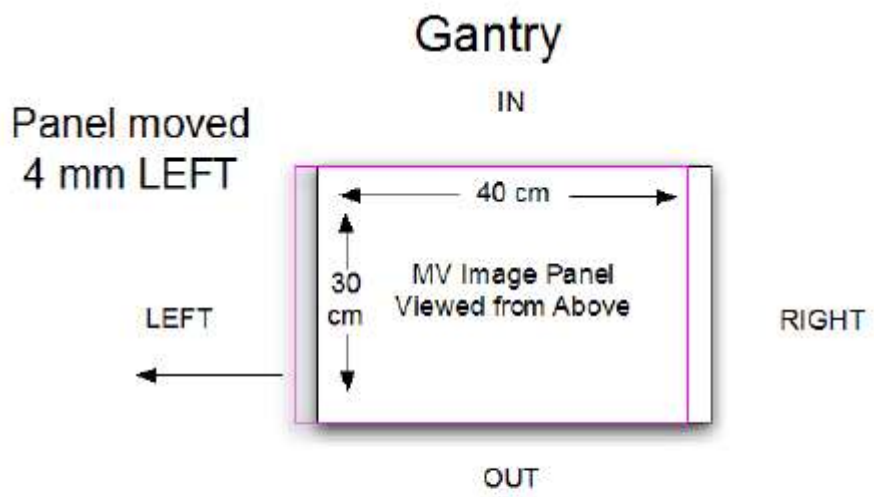
Fields: 02_IN_150



Fields: 03_OUT_150

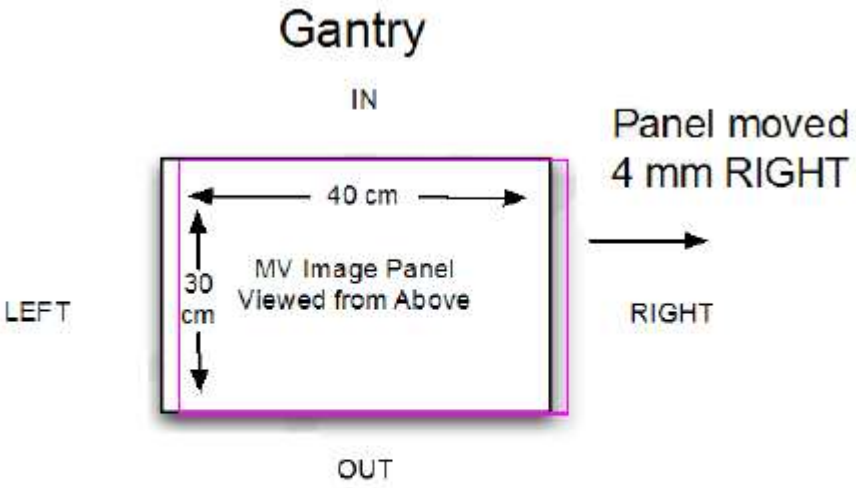


Fields: 04_LEFT_150



From the centered, (nominal zero position), while facing the gantry, move the MV image panel 4 mm to your LEFT

Fields: 05_RIGHT_150



From the centered, (nominal zero position), while facing the gantry, move the MV image panel 4 mm to your RIGHT

In Vivo Beam Model Data Collection Checklist - 6MV Representative Data

Air Collections

Plan 01

QA_Air
01_6xAir ☐ **Panel set to 105 SID** ☐ **Tx couch retracted**

Plan 02

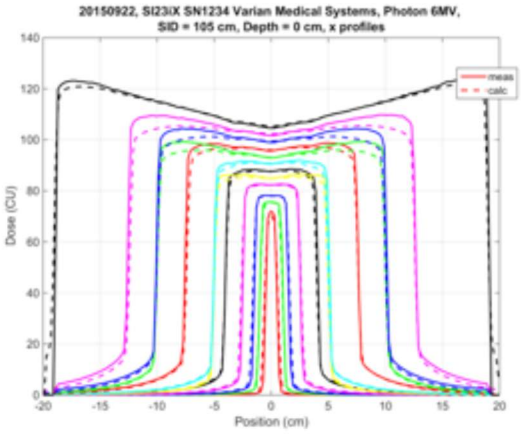
02_6x_Slab0 ☐ **Panel set to 150 SID** ☐ **Tx couch retracted**

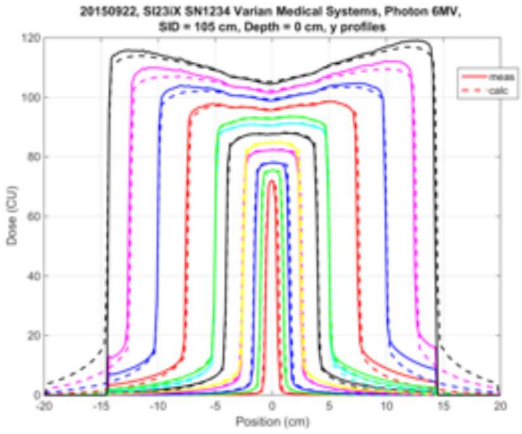
Panel Response Sensitivity Data Collection

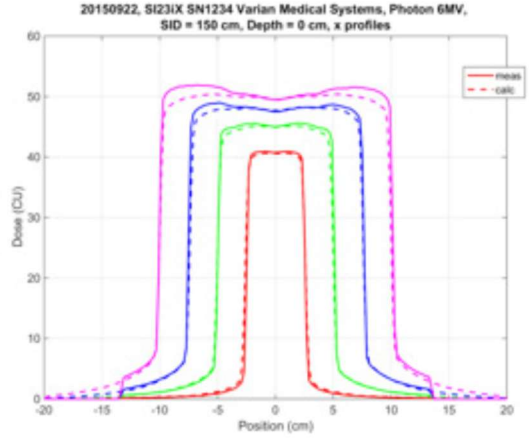
Plan 03 (see previous pages for movement instructions)

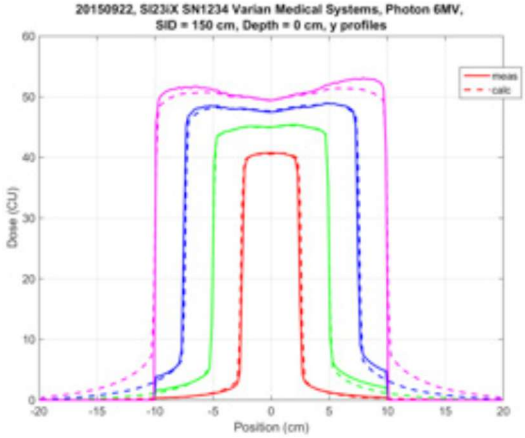
QA_DetectorCorr
03_DetectCorr
01_Center_150 02_IN_150 03_OUT_150 04_LEFT_150 05_RIGHT_150 ☐ **Air Collections** ☐ **Panel set to 150 SID** ☐ **Couch retracted** ☐ **Follow panel move instructions (above) for each position**

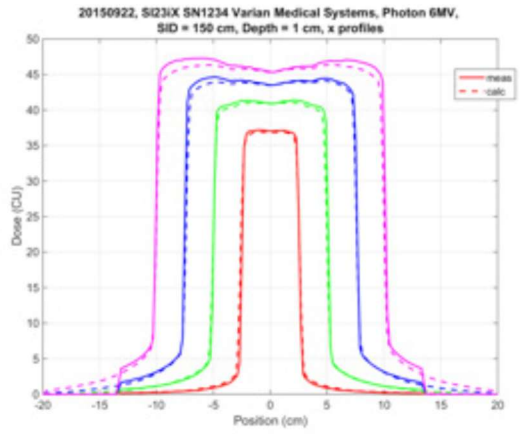
Appendix D: Beam Model Results Examples

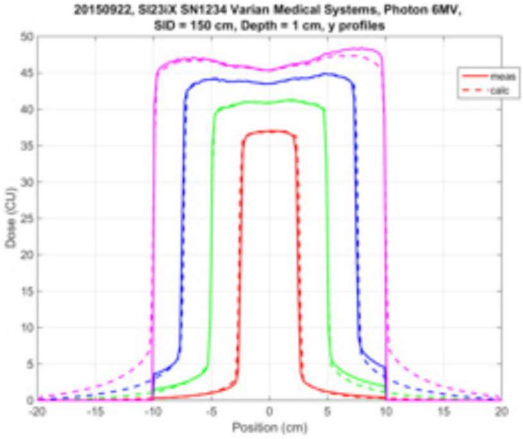


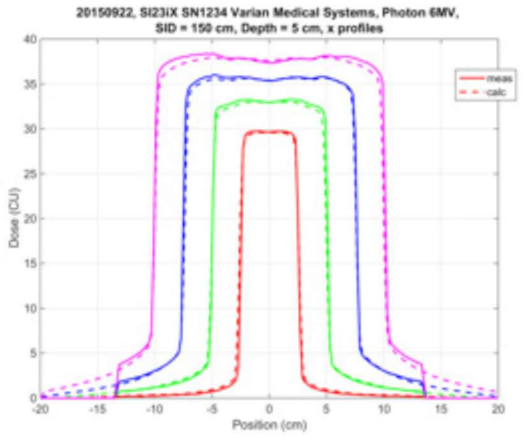








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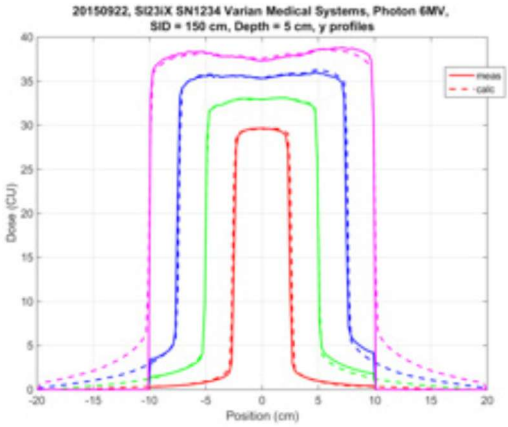
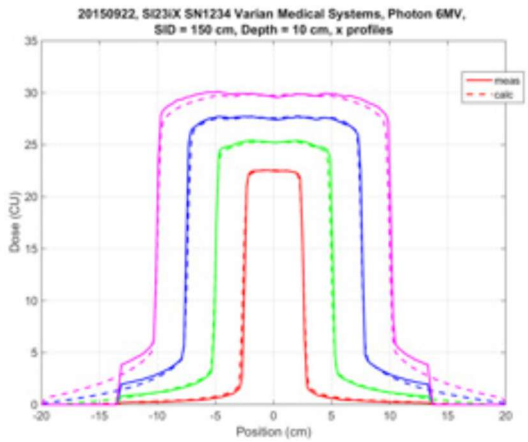
meas
calc
Dose (CU)
Position (cm)


20150922, SI23iX SN1234 Varian Medical Systems, Photon 6MV,
SID = 150 cm, Depth = 5 cm, y profiles
meas
calc
Dose (CU)
Position (cm)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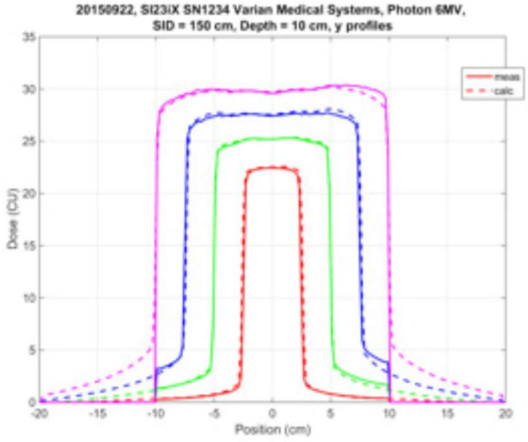
meas
calc
Dose (CU)
Position (cm)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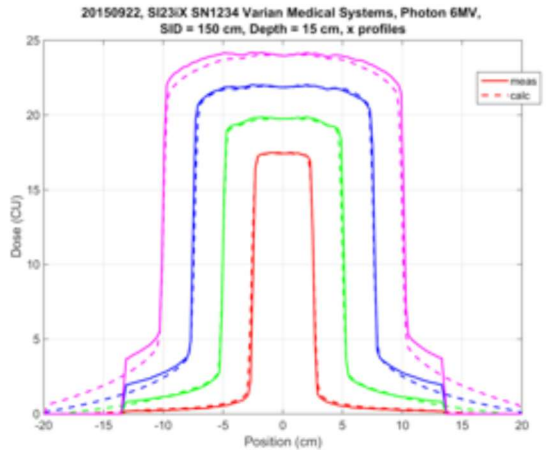
SID = 150 cm, Depth = 10 cm, y profiles
meas
calc
Dose (CU)
Position (cm)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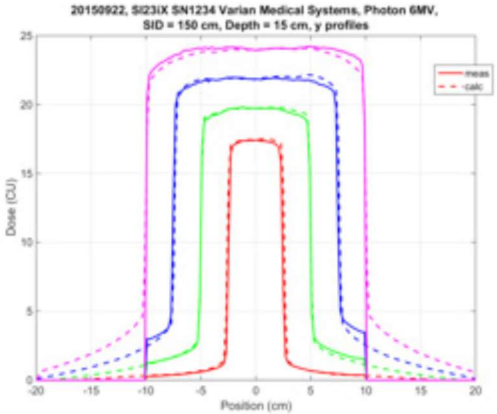
meas
calc
Dose (CU)
Position (cm)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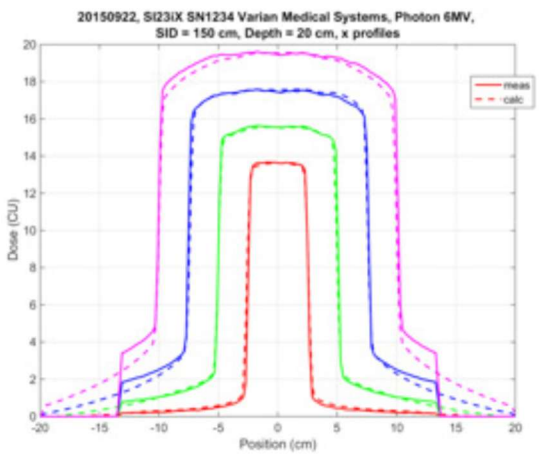
SID = 150 cm, Depth = 15 cm, y profiles
meas
calc
Dose (CU)
Position (cm)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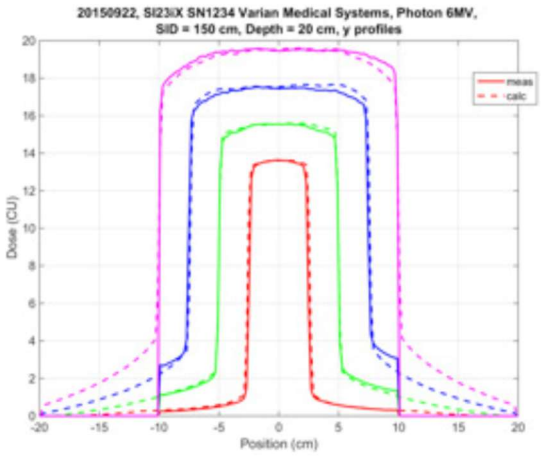
meas
calc
Dose (CU)
Position (cm)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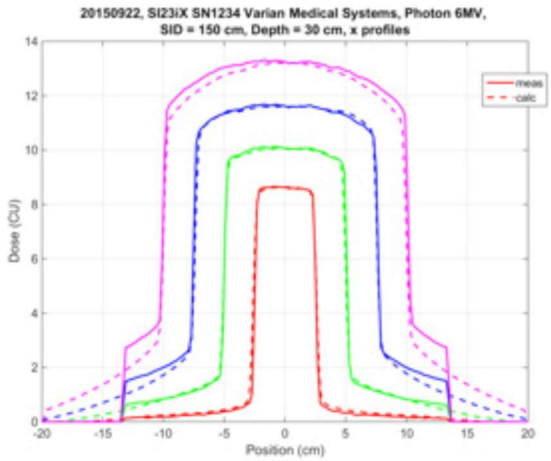
meas
calc
Dose (CU)
Position (cm)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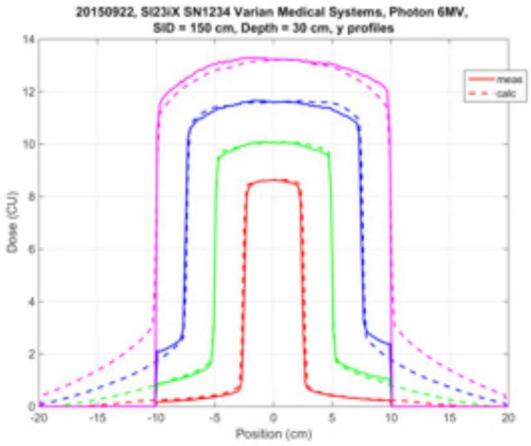
meas
calc
Dose (CU)
Position (cm)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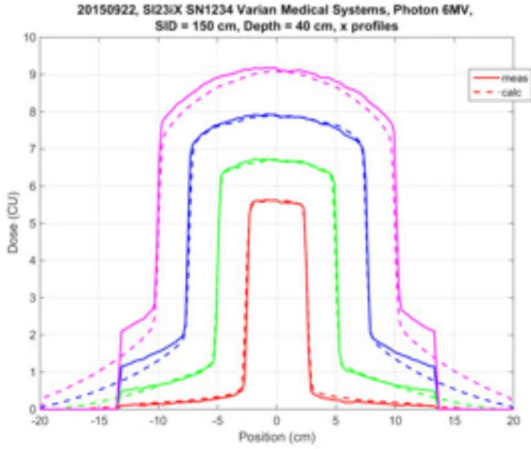
calc
Dose (CU)
Position (cm)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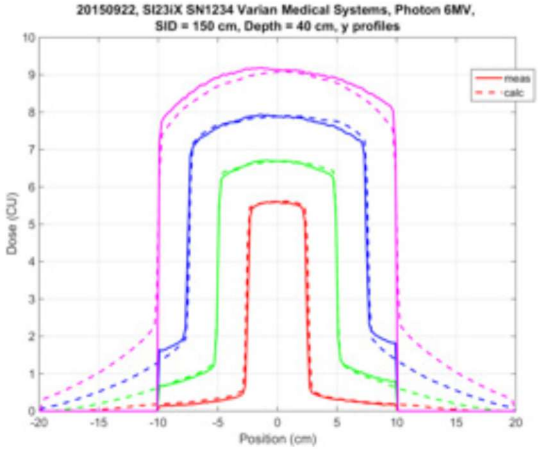
Position (cm)


20150922, SI23iX SN1234 Varian Medical Systems, Photon 6MV,
SID = 150 cm, Depth = 40 cm, y profiles
meas
calc
Dose (CU)
Position (cm)

Appendix E: In Vivo Commissioning Data Collection Guide

Introduction

This document contains guidelines and instructions for collecting commissioning data for Adaptivo In-Vivo for Varian treatment machines with ARIA

Scope

This document is intended to provide guidelines covering a Varian, Eclipse and ARIA machine configuration.

Objective

The objective of this document is to provide sufficient instructions to enable the collection and processing of the data required by the In-Vivo commissioning tool by a user with limited Adaptivo software experience.

Varian MV Image Panel Calibration

The Varian MV portal imaging system must be calibrated for use with Adaptivo so that **1 Calibrated Unit (CU) equals 1 Monitor Unit (MU)**. The imaging panel should be set to 100 SID with a field size of 10x10. Calibration must be performed for each dose rate (MU/min) according to the manufacturer's instructions specific to the treatment machine, including the version of the MV portal imaging software. The resulting QA check should yield CU readings near the central axis of approximately 90.7 after delivering 100 MU with a 10x10 field size, with the imaging panel set at 105 SID.

After calibrating the MV portal imaging system, conduct a post-calibration check by treating the Panel QA patient used for morning panel QA but selecting the Post-Calibration (PCal_QA) plan. If the clinic operates multiple treatment machines, each machine will require its own Panel QA patient setup in the record and verify system. Verify that the readings for the post-calibration check fall within acceptable guidelines.

Prerequisites

1. Treatment machine output and calibration are within acceptable standards of all photon energies that will be collected.
2. Electronic Portal Imaging Device (EPID) is calibrated for all dose rates (MU/min) that are used for clinical treatments.
3. Electronic Portal Imaging Device daily panel quality assurance results are within established specifications. Commissioning data collection should be performed at the same dose rate (MU/min) used for the daily panel quality assurance. This should also be the most common dose rate (MU/min) used for clinical treatment.
4. After verifying the MV image panel calibration, according to the hospital/clinic policy, begin scheduling and collecting integrated images during patient treatments for all eligible photon fields with a sufficient panel SID to avoid collision with the treatment couch or patient.

Machines and Modes Supported

Varian treatment machines with ARIA:

- Photon modes only, electrons are not supported as there is no exit signal.
- Physical wedges **are not supported** at this time.
- Dynamic wedges with MLCs are supported for both relative and predicted modes.
- Flattening Filter Free (m) beams are supported for relative mode only.

Materials needed for In-Vivo Commissioning Data Collection

40 centimeters of water equivalent material to build the following thicknesses:

- 1 cm thickness
- 5 cm thickness
- 10 cm thickness
- 15 cm thickness
- 20 cm thickness
- 30 cm thickness
- 40 cm thickness

NOTE: The water equivalent material must be uniform and have a consistent relative electron density for all slabs. The material dimension must be large enough to provide sufficient lateral scatter for a 25cm x 25cm field.

Common Pitfalls Surrounding In-Vivo Commissioning Data

1. **Imaging panel not properly calibrated before performing commissioning data collection.**
    a. All dose rates (MU/min) that are used for clinical treatments must be calibrated and verified before collecting the In-Vivo commissioning data.
    b. For a panel calibrated to 1 Monitor Unit (MU) = 1 Calibrated Unit (CU) with the MV imaging panel at 100 SID with a 10x10 field size, the resulting QA check should result in a CU reading at the central axis of approximately 90.7 with 100 MU's delivered with a 10x10 field at 105 SID.
2. **Integrated image collection is not scheduled in plan scheduling in ARIA so the portal images are not stored.** Images must be captured and stored to use the In-Vivo commissioning tool.
3. **Plans not delivered in clinical mode.** The In-Vivo commissioning tool needs a proper link between all files associated with a plan for the commissioning tool to operate.
4. **A treatment beam is interrupted during treatment.** If this occurs, perform the collection for the interrupted beam again to capture the entire signal for all the planned monitor units for that beam.

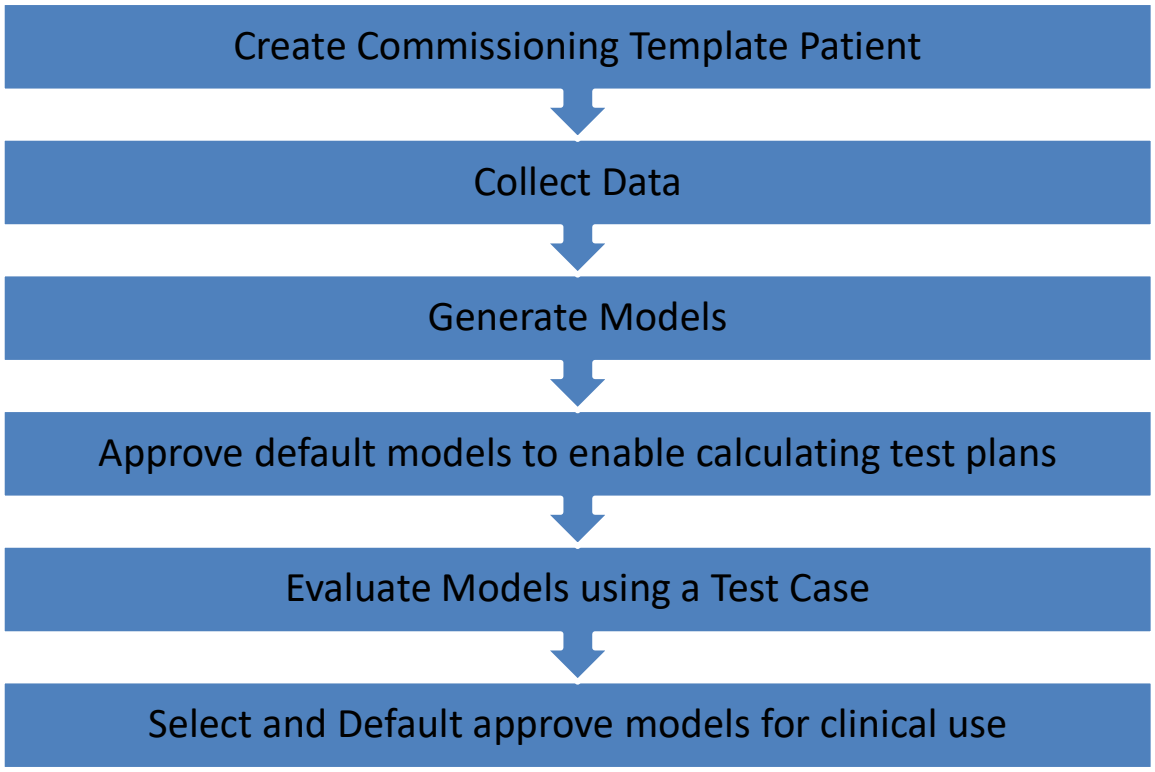
5. **Incorrect thickness of water equivalent slab or slabs placed on the couch for a given plan.** The plan naming convention details the thickness of solid water to be placed on the couch for each plan. Incorrect slab thickness commonly results from delivering the plans out of sequence; the plans are numbered and should be collected in numerical order to make the collection efficient and error free. **If necessary, use the Reorder Plans and fields function in Plan Scheduling to put the plans in numerical order.**
6. **Image panel not at the correct height for data collection.** Again, the plans are set up and numbered so that all plans to be collected at 105 SID are grouped together followed by all the plans at 150 SID.
7. **Plan names are edited/changed.** The commissioning tool uses the plan naming schema as well as key DICOM information as part of its process. If the plan names are edited, the commissioning tool will not function.
8. **Water equivalent slabs have inconsistent density properties between slabs.** The water equivalent slabs used for commissioning data collection should be consistent. The commissioning tool relies on a single solid water density value input as part of the commissioning process. The recommended practice is to scan the solid water to be used for data collection and spot check the consistency of the slabs before performing the data collection.
9. **The water equivalent slabs were placed over a non-radiolucent portion of the treatment couch.** The commissioning tool does not account for any attenuation resulting from the treatment couch. The solid water needs to be placed over the most radiolucent portion of the treatment couch. Check the underside of the treatment couch below the solid water and verify that there is no extra buildup area like couch rails or carbon support beams under the solid water.
10. **Couch support rail in the field of measurement.** The couch support rails on non-IGRT treatment couches attenuate the exit beam signal and affect the commissioning results. Ensure the couch support rails are in their outermost position and not under the water-equivalent slabs or in the path of the beam for the air collections.

[1]Varian Medical Systems Customer Technical Bulletin – PV-887 Installation and Verification of the Portal Dosimetry Pre-Configuration Package 1.0 – DWG Number 100058491. Section 6.2. Dosimetric Calibration of the Portal Imager on 4DITC workstation

[2]Varian Medical Systems - Installation and Verification of the Portal Dosimetry Pre- Configuration Package for TrueBeam™ Family of Products v1.0.pdf

Commissioning Process Overview

The commissioning process involves six primary steps. .



Beam Model Data Collection Template Creation

Prerequisites

Adaptivo In Vivo module software installed and accessible with physics administrative user access

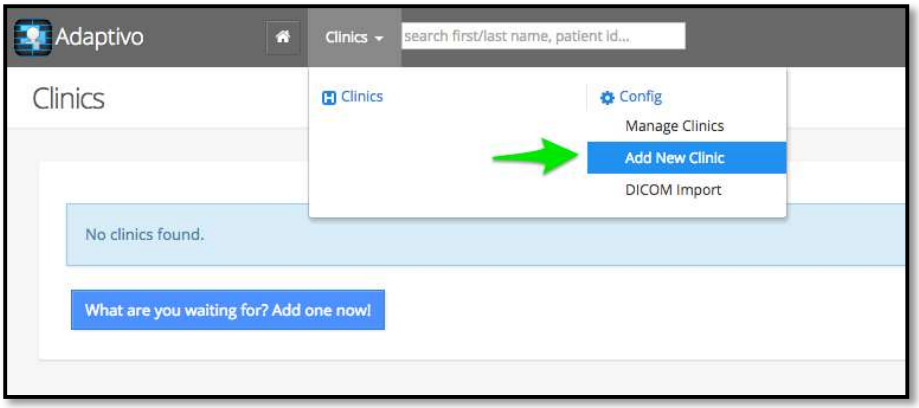
Access to ARIA administration

Access System as Administrative User

Open an internet browser window and press the Adaptivo bookmark button. If no bookmark exists, navigate to localhost:44300 on the Adaptivo server. Log in as a Physics Administrative user. (See page 10 for information about setting up users.)

Add a New Clinic

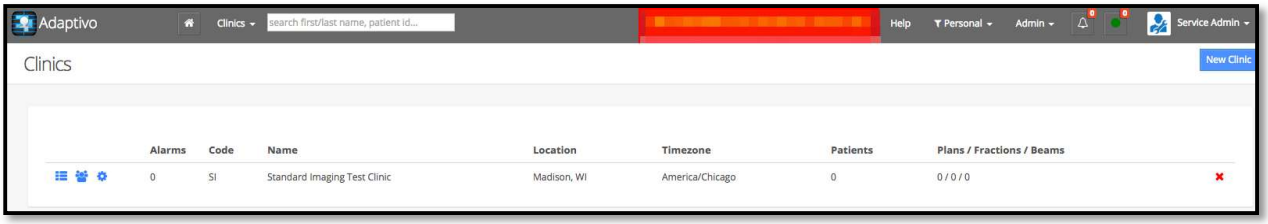
Access the Adaptivo software as an administrator and navigate to the manage clinic screen. Click on "Add New Clinic."



Fill in Clinic information

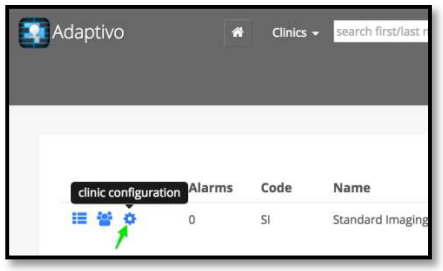
A description must be entered: it can be any free text. Select the correct time zone for the clinic, as this will determine the time stamp of any reports that are created.

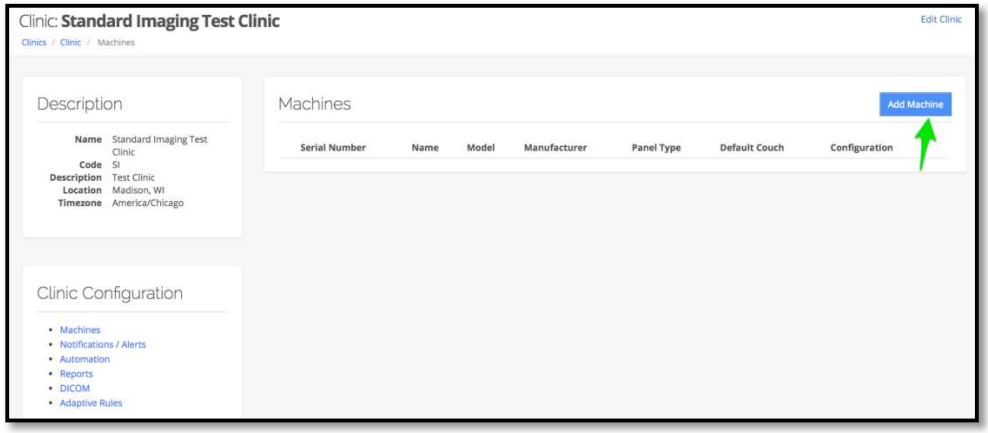
Clinic is Created



Add a Treatment Machine

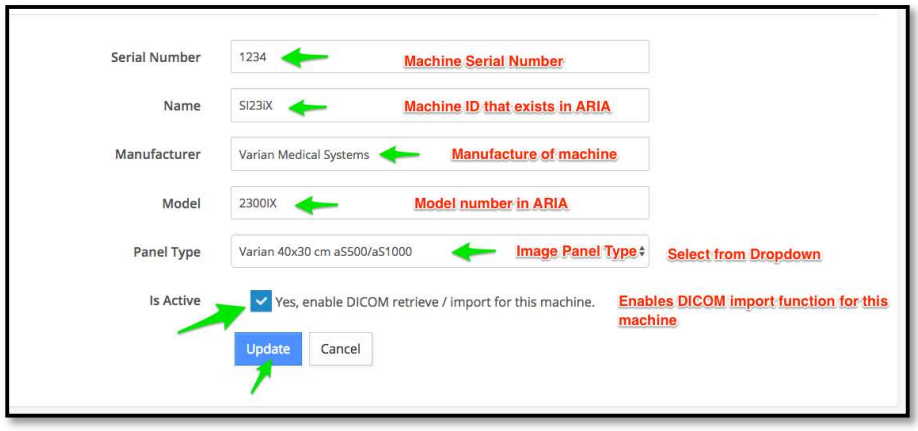
To access the machine creation menu, click on the “Clinic Configuration” icon.





Enter Treatment Machine Details

Fill in the treatment machine details exactly as they exist in ARIA. It is recommended that ARIA administration be accessed to verify the machine serial number and name/ID in ARIA. If the match is not exact when a patient is processed the software will not calculate.



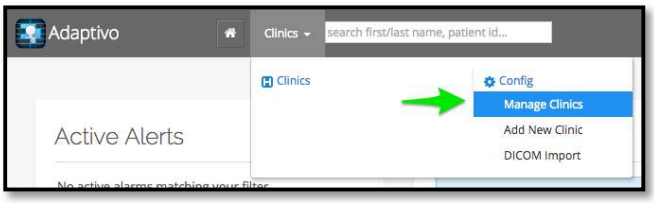
Please note that this is a critical step. The recommended procedure is to access the ARIA RT Administration to verify the treatment machine serial number and machine ID. Fill in the treatment

machine serial number, machine ID/name, manufacturer and model number to match ARIA RT Administration exactly. Check the box to make the machine active and enable DICOM retrieve/Import.

Commissioning - Create New Templates

Templates permit ARIA import of the plans to be used to collect the commissioning data. Recommended practice is to use ARIA Administration to determine the exact spelling and capitalization for all entries. The treatment machine serial number, ID, and tolerance table in ARIA must be matched exactly.

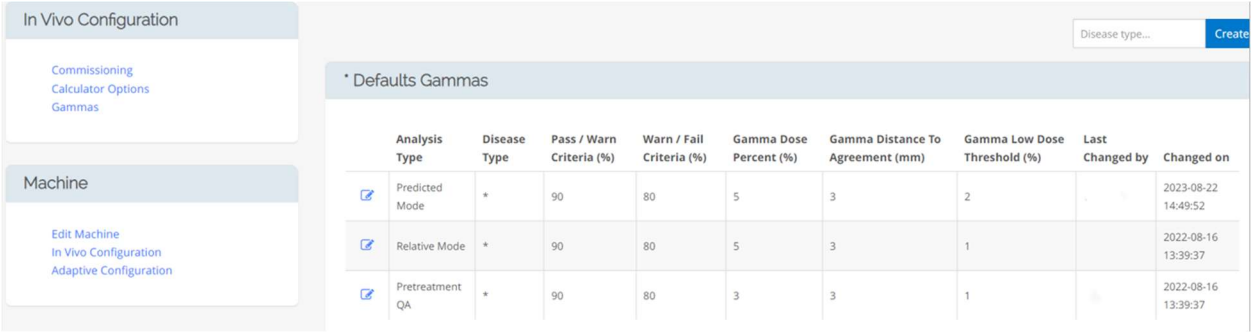
First, select Manage Clinics.



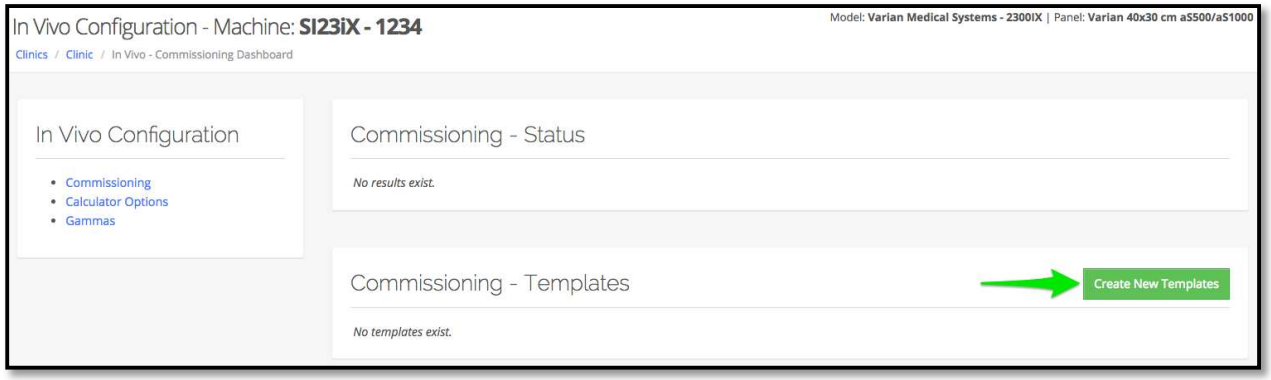
Then select the Clinic Configuration icon.

Select the In Vivo link in the Machine Configuration.

Select the Commissioning page.

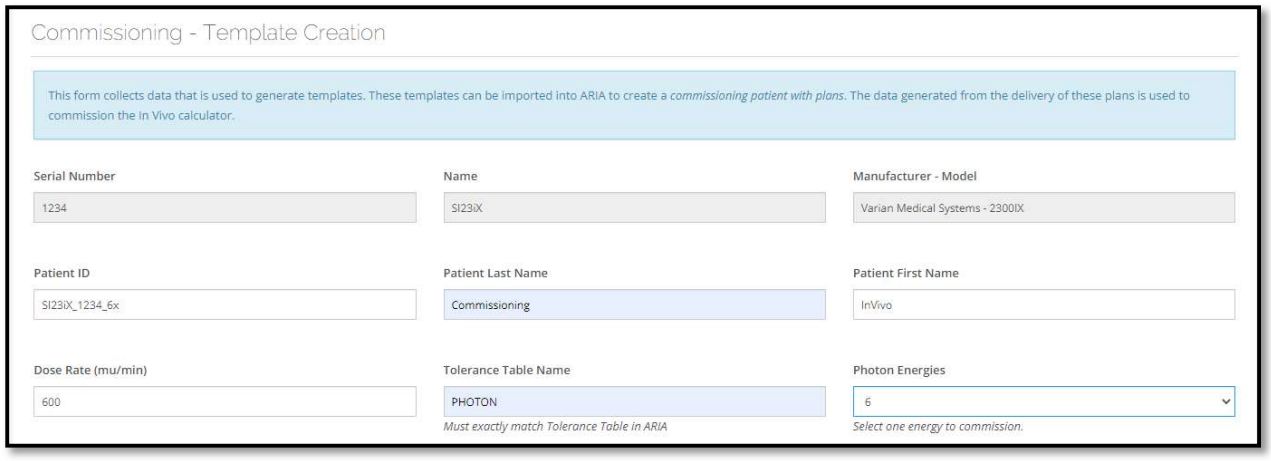


Select Create New Templates



Template Patient Creation

To enter data in the commissioning template, ensure that the patient ID is unique and does not already exist in ARIA. Maintaining commissioning data under a unique ID, separate from other types of quality assurance data, allows for smoother processing and reduces the likelihood of errors. The patient ID should include the machine serial number, machine ID, and the energy of the collection. For example, if you have a 6MV beam data template for a machine with a serial number of 2345 and a machine ID of SI23iX, the recommended patient ID would be SI23iX_2345_6x. Please take note that it is crucial to differentiate between 6x, 6FFF, and 6SRS in the naming convention of the beam data templates and ensure that there are no spaces at the beginning of the patient ID or name.. This naming practice facilitates easier identification of the appropriate collection templates within the commissioning program.



There are several advantages of using a separate template patient. First, it will minimize the chance of difficulty in the ARIA import, scheduling, and saving of the data being collected. It also segregates the data collection, which makes both troubleshooting and re-collection of any required data easier. Separate templates also permit a faster collection, particularly for the TrueBeam® machines, which have a long cycle time to change energy. Re-collection of the entire dataset is required if any one plan is

collected incorrectly. For example, shifting the EPID panel in the incorrect direction or forgetting entirely the plan for the panel response sensitivity.

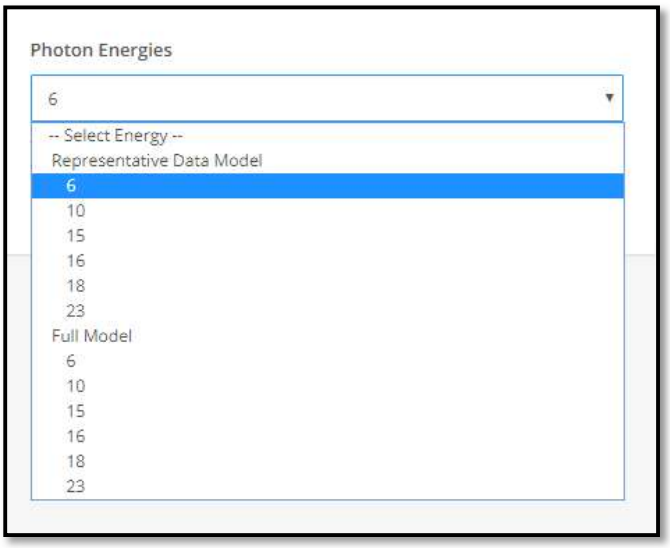
The most common dose rate used clinically should also be used for data collection. Enter a tolerance table name that is contained in ARIA. The Tolerance Table entry must match the name in ARIA exactly. Select the photon energy to be collected.

Representative or Full Data Model

If desired, a simplified commissioning approach can be used that eliminates the need for collecting data in a phantom using a series of water equivalent slabs. When an energy from the Representative Data Model set is selected, a subset of data collection plans is created, and all data is collected in air.

If data collected from the use of a Representative Data Model does not generate passing results when verified using the Commissioning Validation Test Case described in the Beam Model Validation Test Case section of this document, the user should perform a full commissioning data collection.

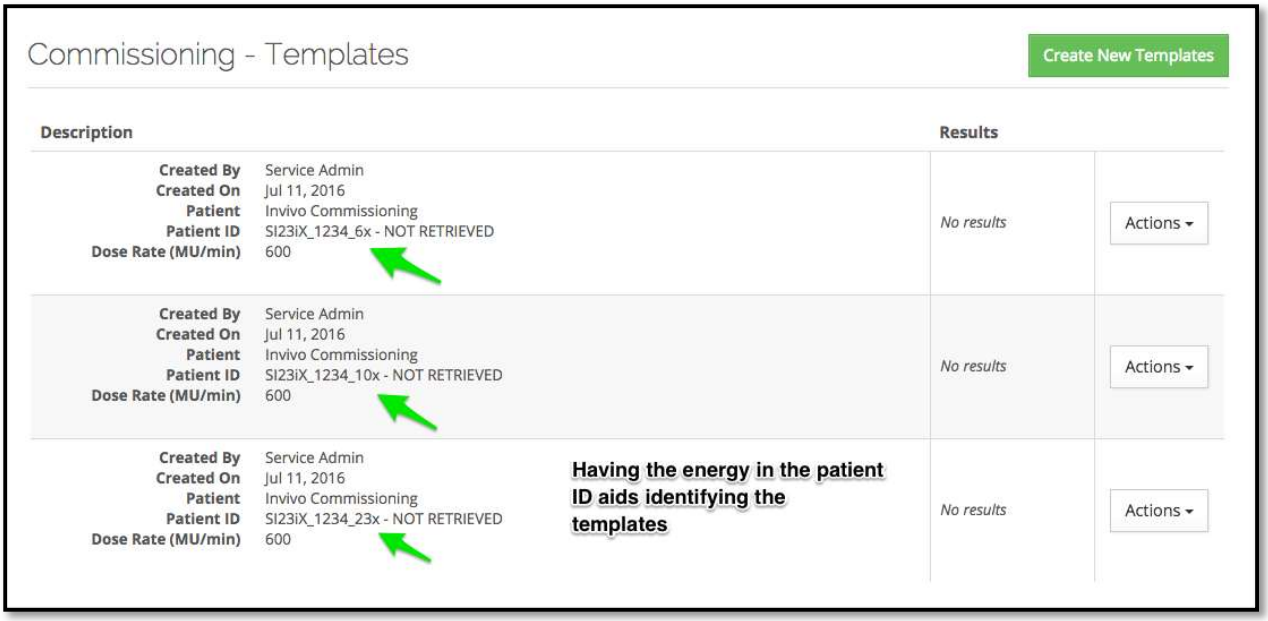
To use the simplified commissioning approach, select an energy from the Photon Energies menu in the Representative Data Model list.



Energies listed under Full Model require data collected using water equivalent material. Energies listed under Representative Data Model provide a simplified commissioning approach utilizing only data collected in air. Full data model collection is recommended when representative data commissioning does not generate passing results in a commissioning validation plan.

Template Created

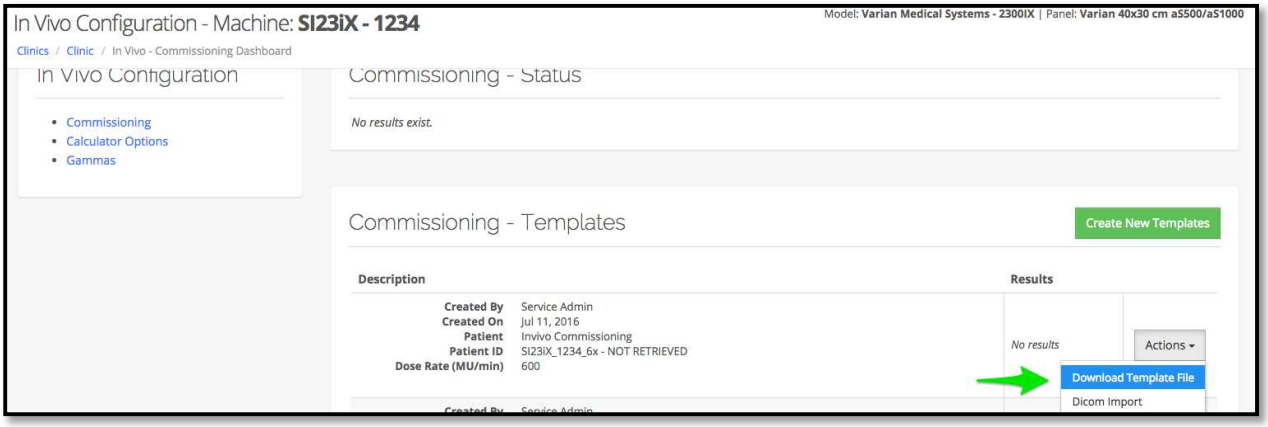
Once a template is created, template files will be available for download. If the energy has been included in the patient ID, this will aid in identifying the templates.



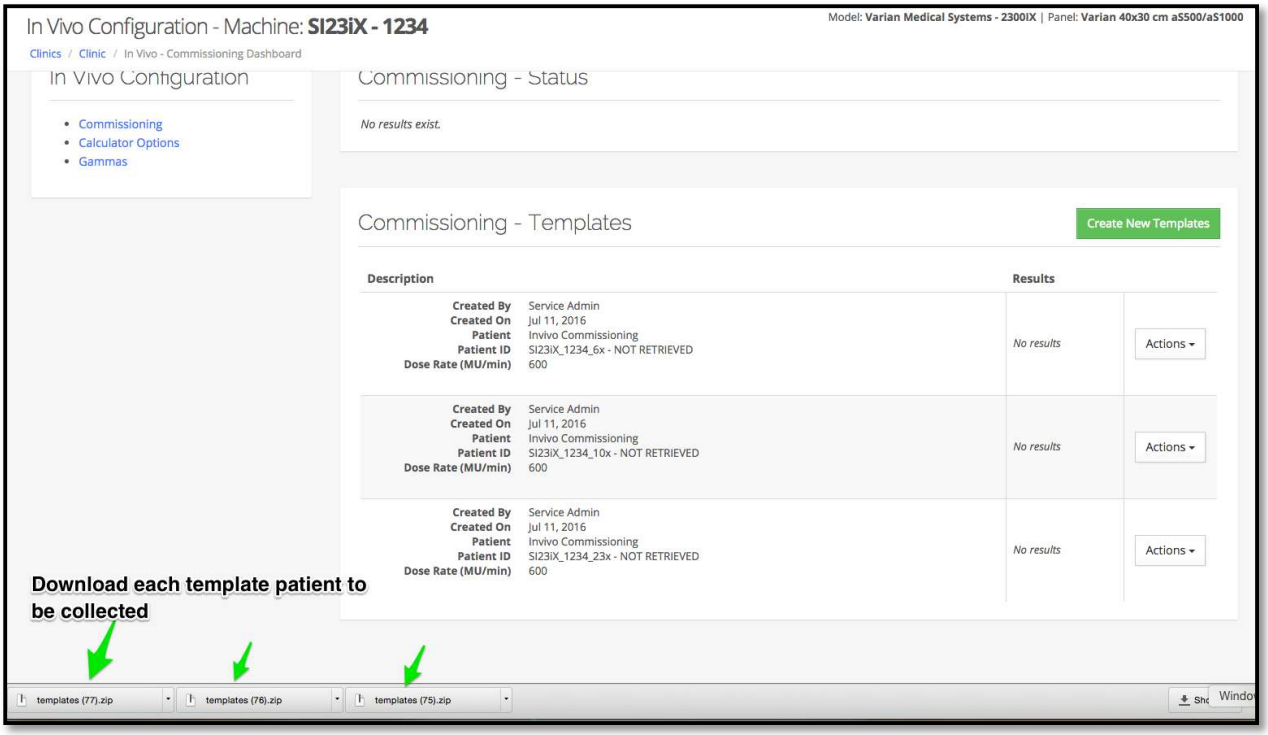
Representative Data Model templates will be indicated with a badge shown within the Template description.

Download Template File

Under Actions, select “Download Template File”

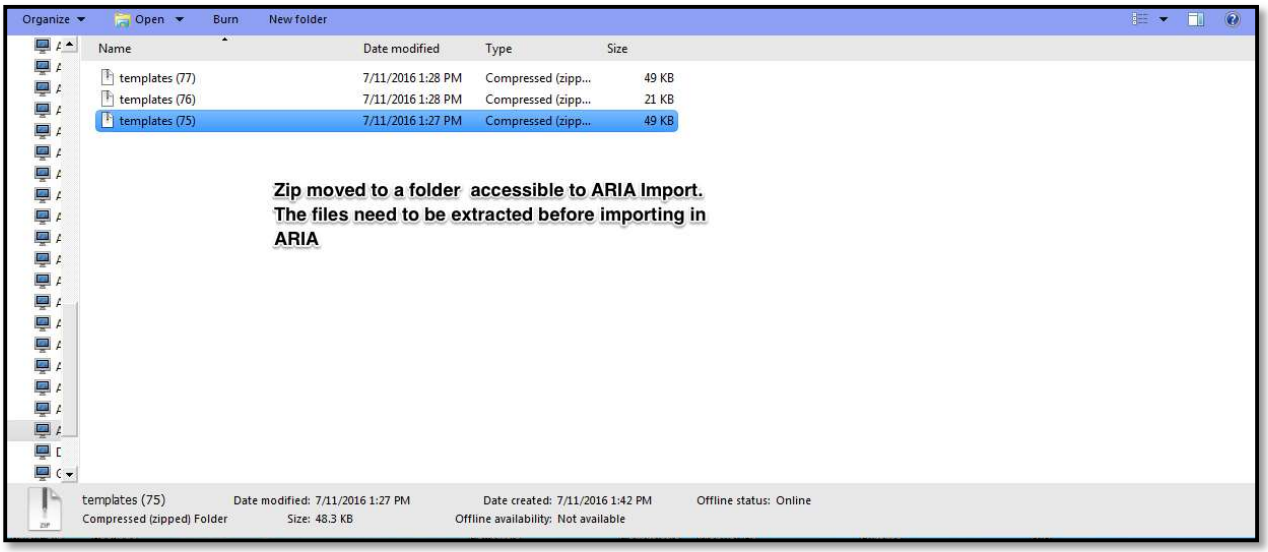


Templates are saved as zipped files, as indicated by the green arrows in the image below.



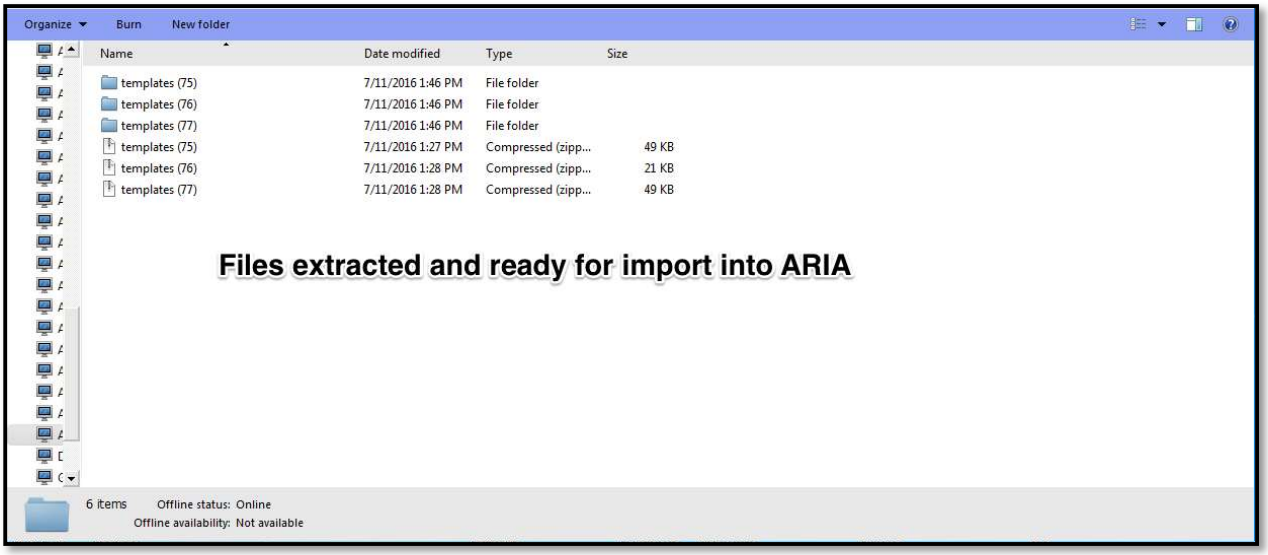
Move Template Files to a folder and Import Templates into ARIA

The template files need to be placed in a location/folder that the ARIA import filter can access to import. The files can be placed in any folder accessible by ARIA Import.

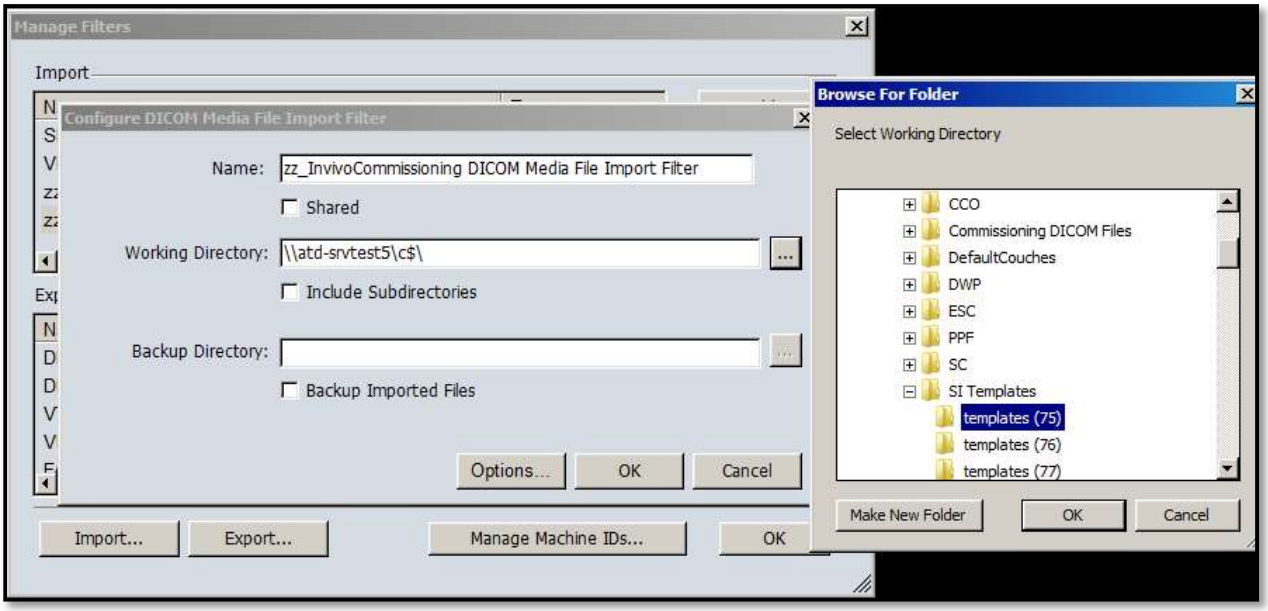


Once files have been moved to this folder, they need to be extracted.

Unzip the files and import them one set at a time.

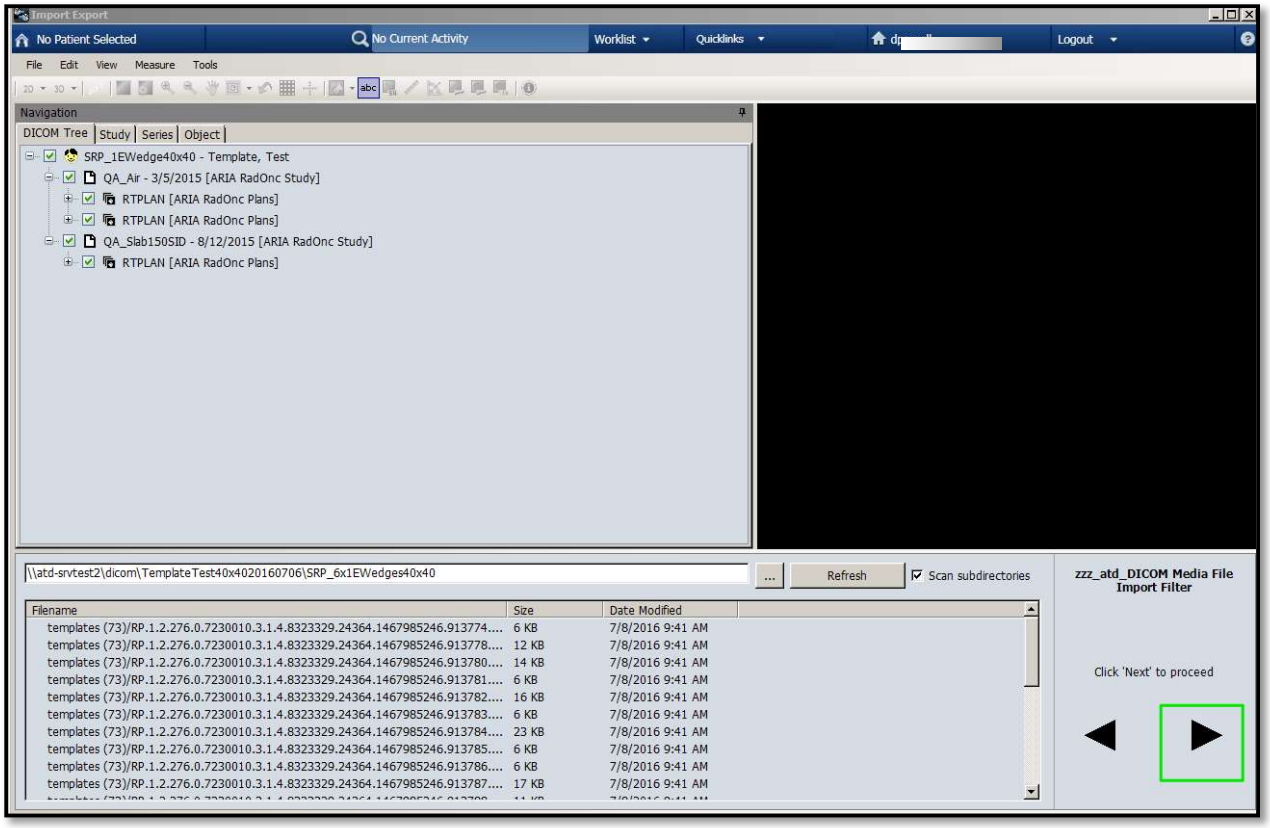


Configure the ARIA import filter to point to the folder with the commissioning template files to import. Import one set of files at a time.

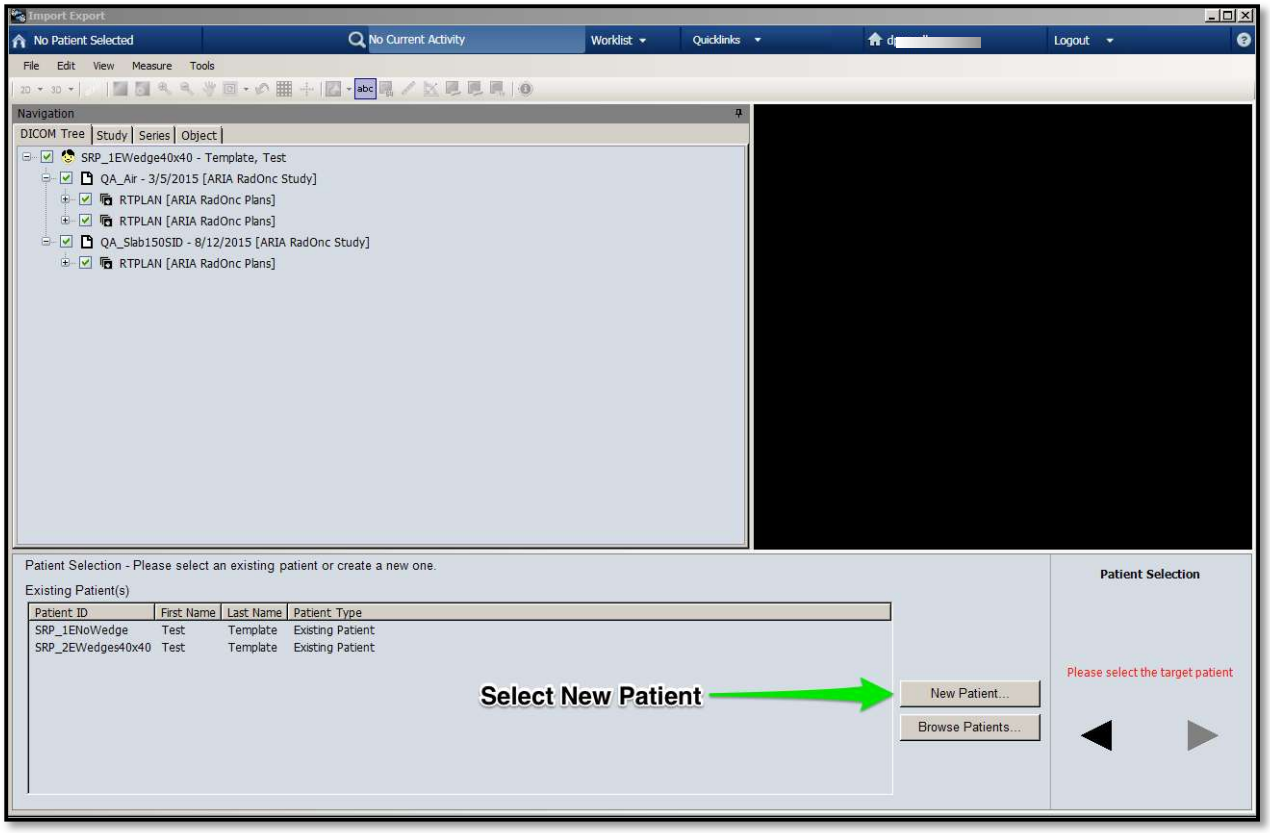


Template Patient ARIA Import

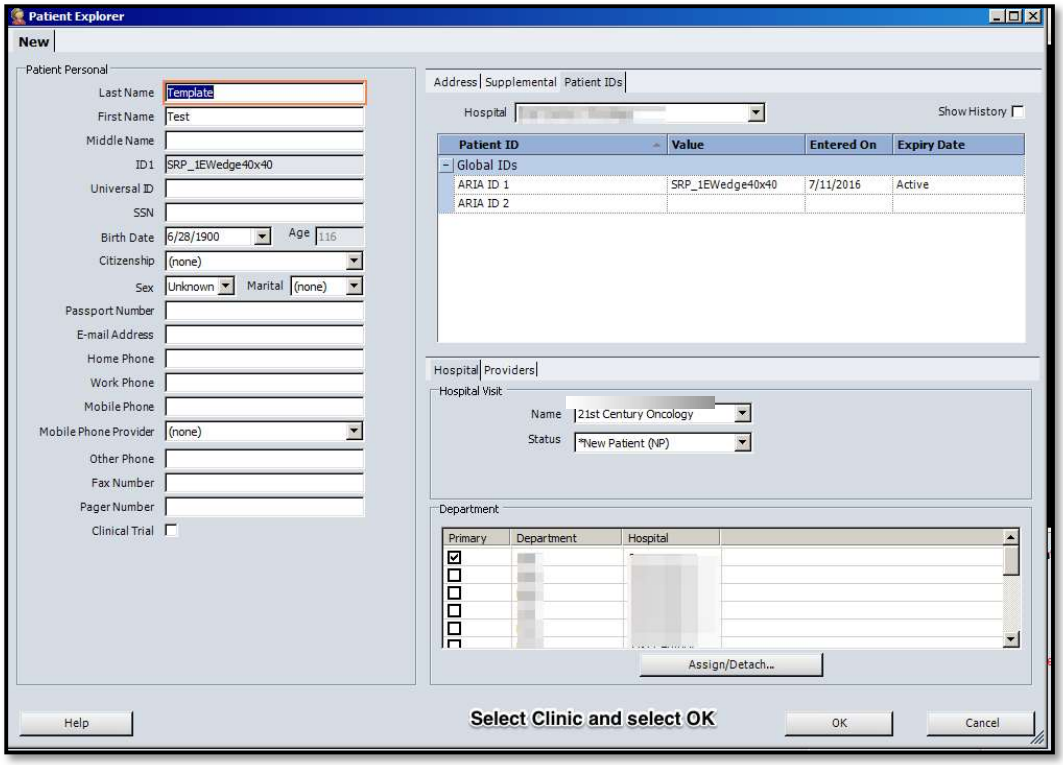
Import each template as a new patient. Select Next:



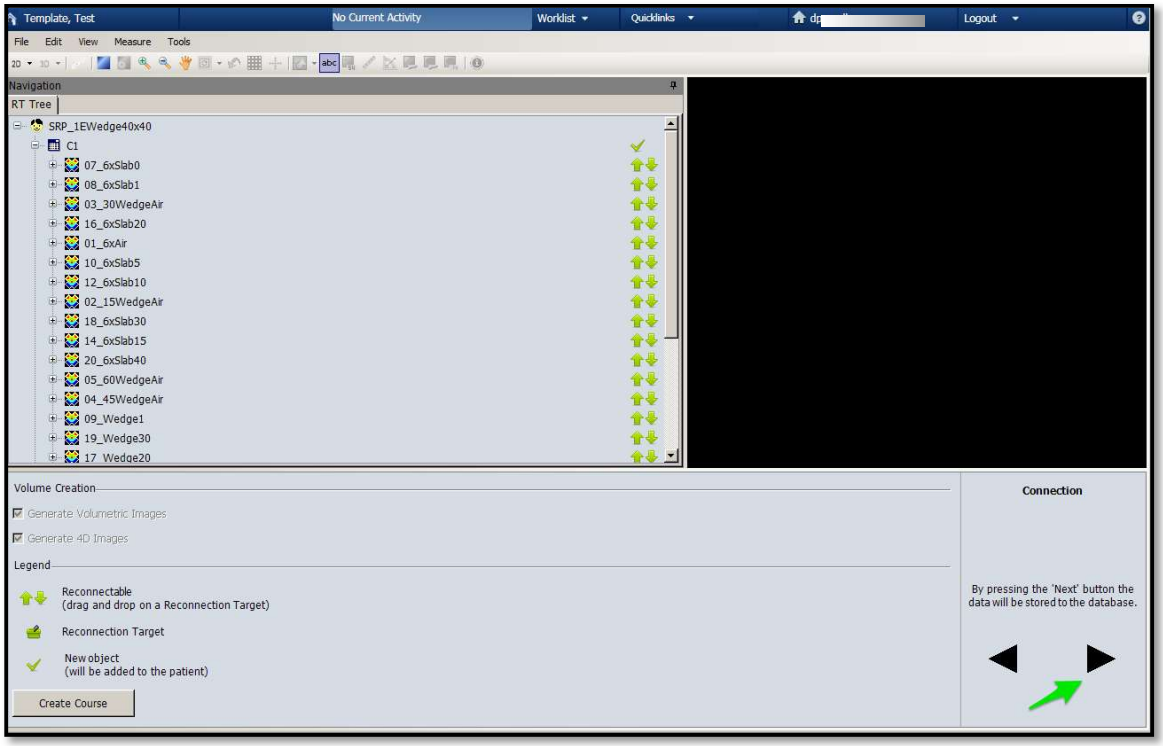
Then select New Patient



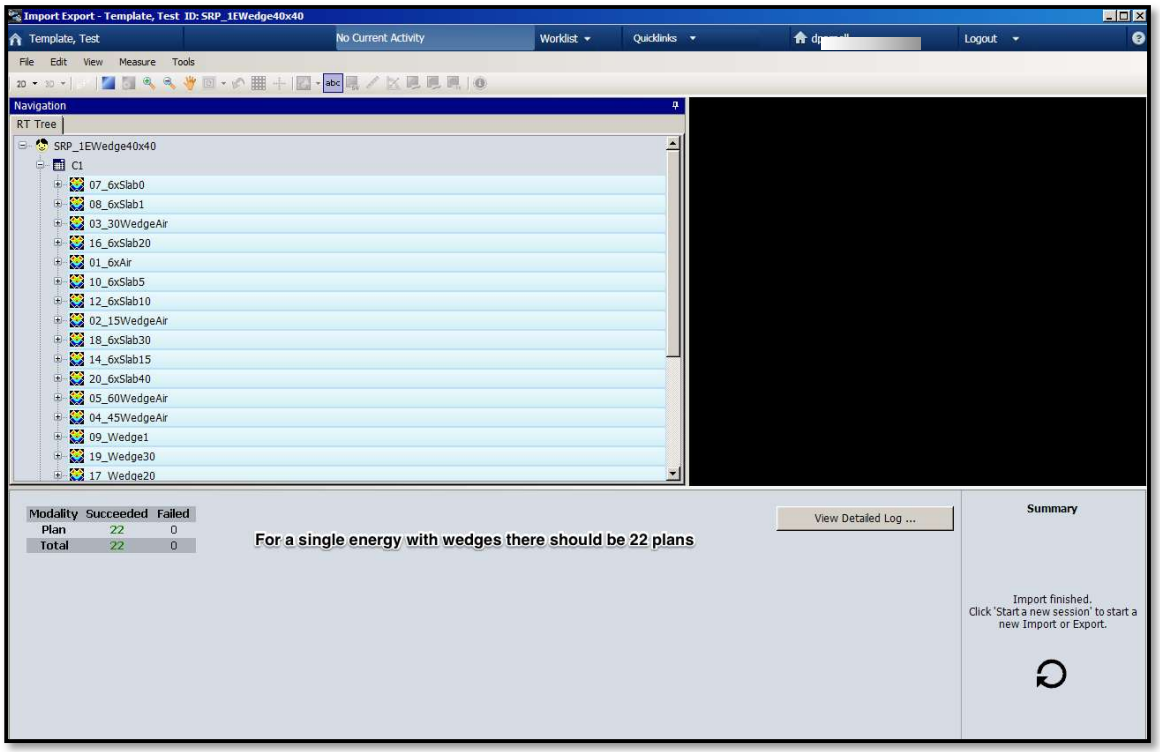
Select the appropriate department and proceed with the import.



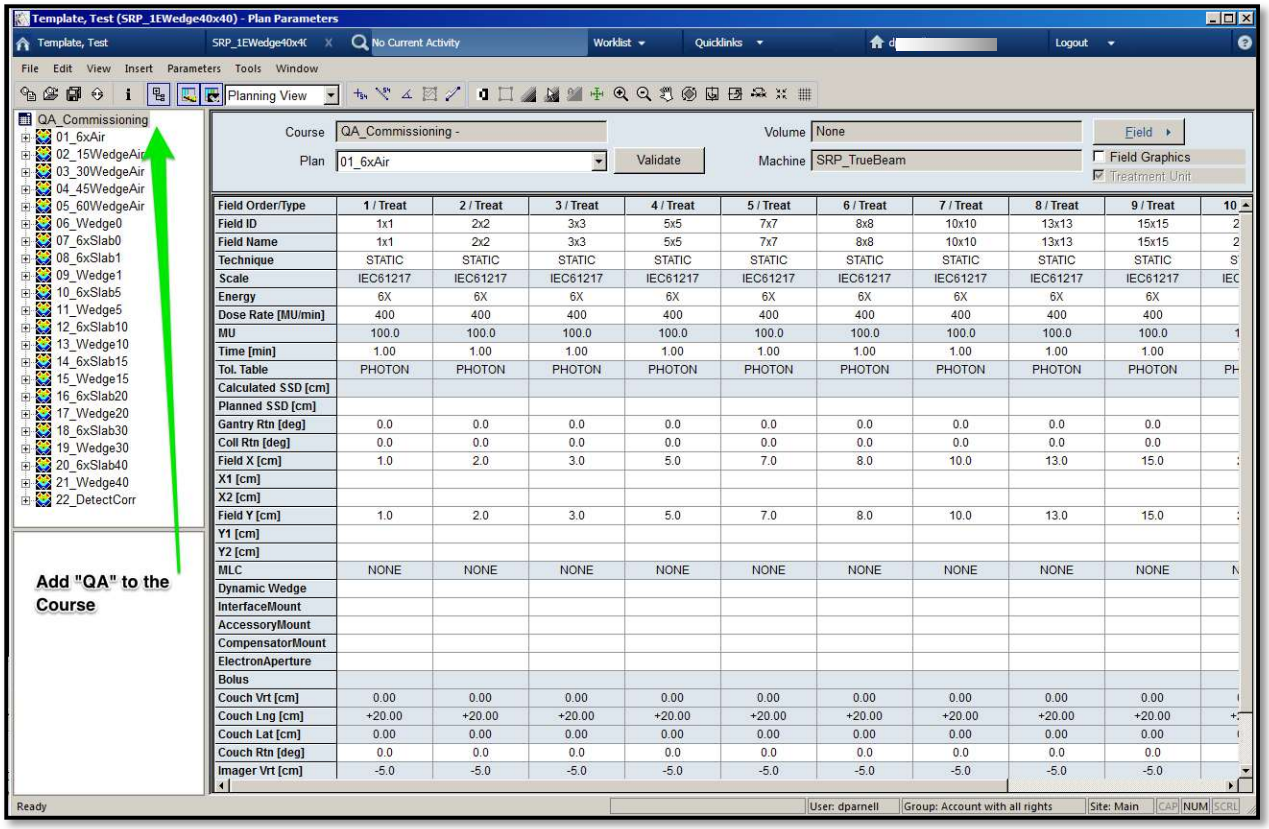
Select the Next arrow.



For a single energy with no wedges, 10 plans should be imported. For a single energy using the Representative Data Model, 3 plans should be imported.

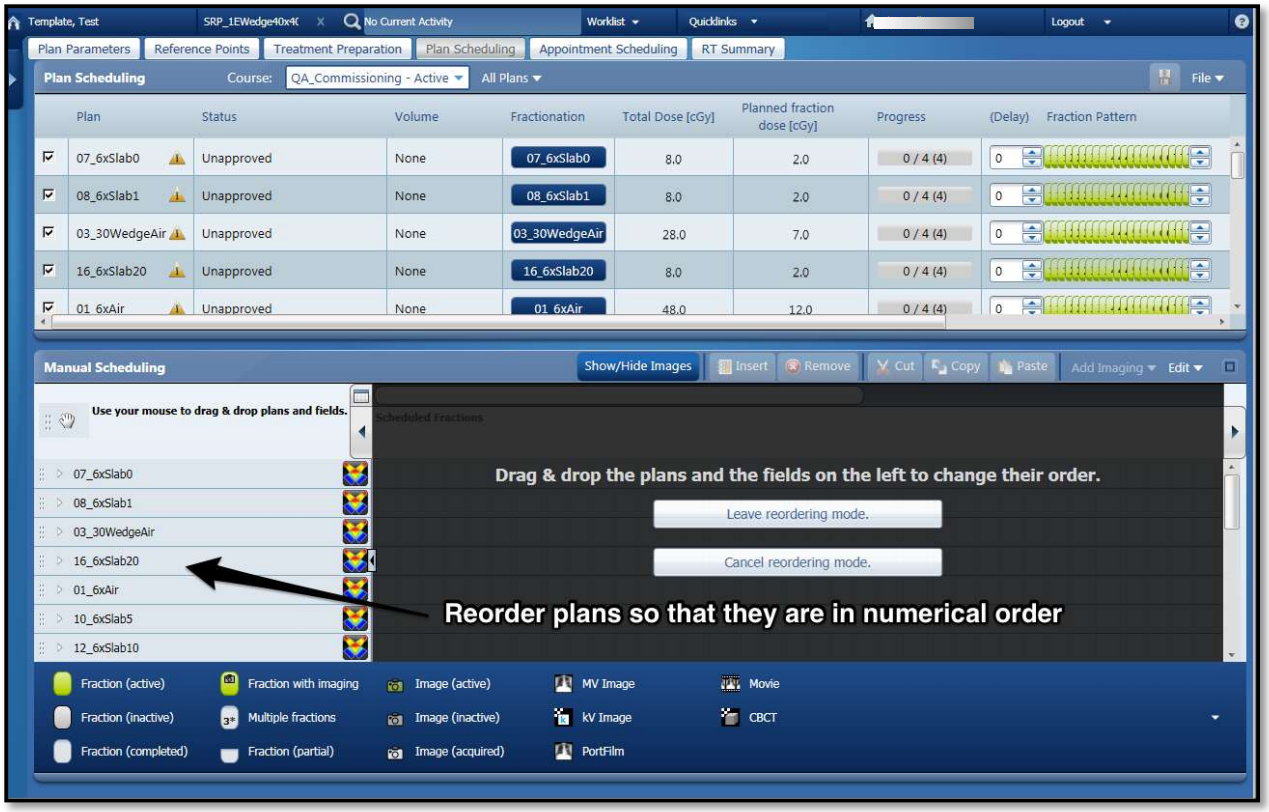


To avoid interfering with the daily treatment count, edit the Course and add QA to the name.

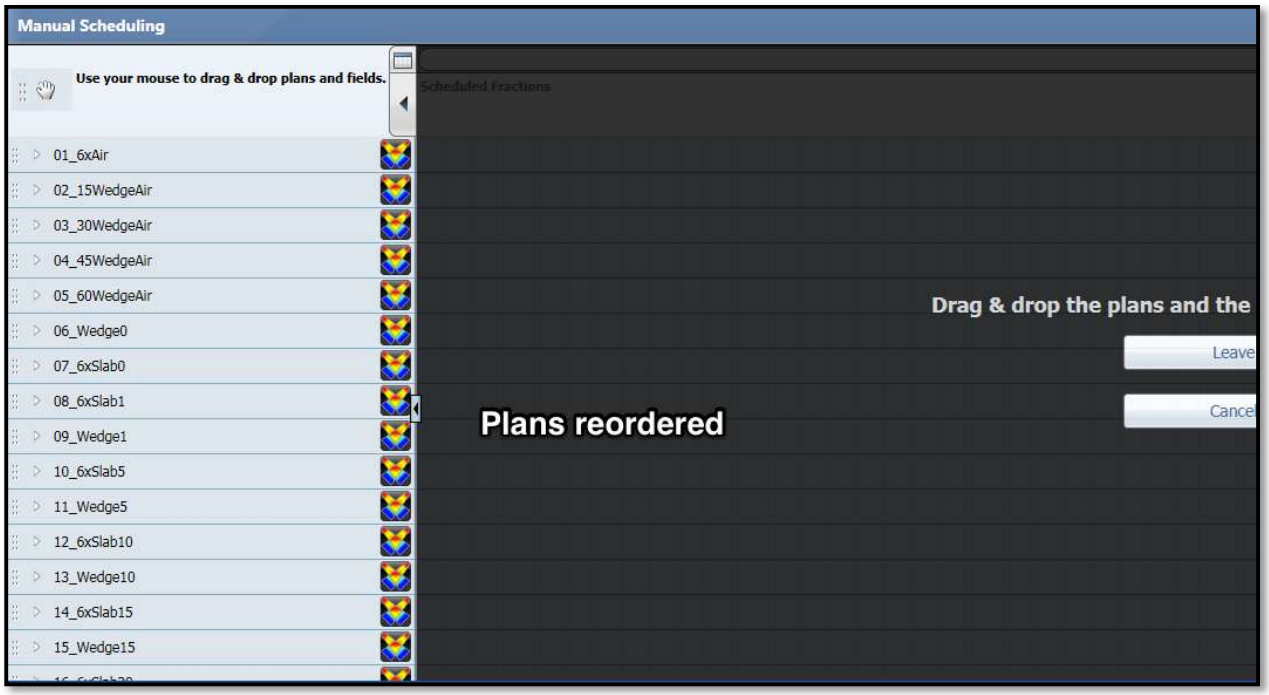


Re-Order Treatment Plans for Delivery

The treatment plans need to be re-ordered according to the number in the plan name. The numbering aids in collection consistency by grouping plans that are air collections and use the same thickness of solid water etc. Re-order the plans according to the first two numbers in each plan name.

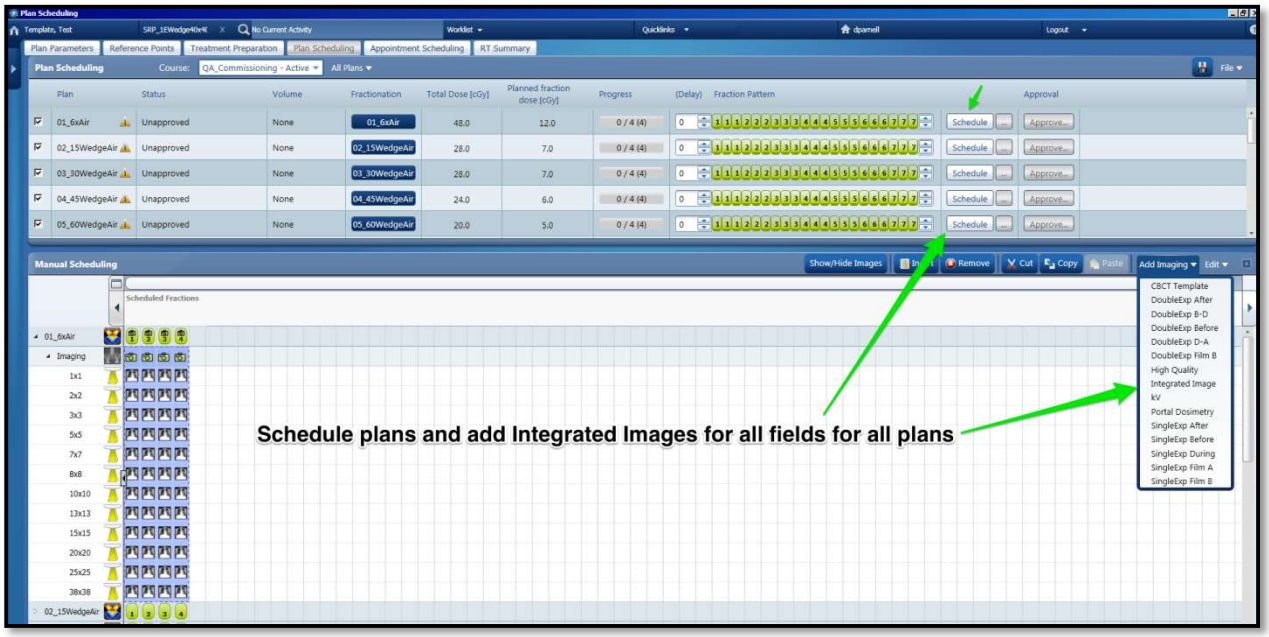


The plan list should look like this after reordering:



Scheduling Integrated Image

An integrated image must be scheduled so that the portal image is saved.



Plan and Treatment Approval

The commissioning collections need to be performed in clinical mode so that an RT Record is generated. All plans will need approval and treatment approval.

Treatment Delivery for Air Collections

1. For the air collections, the treatment couch must be retracted so that no part of it is covering the MV image panel.

2. The MV Image panel must be centered and set to 105 cm for all plan collections with Air at the end of the plan name.

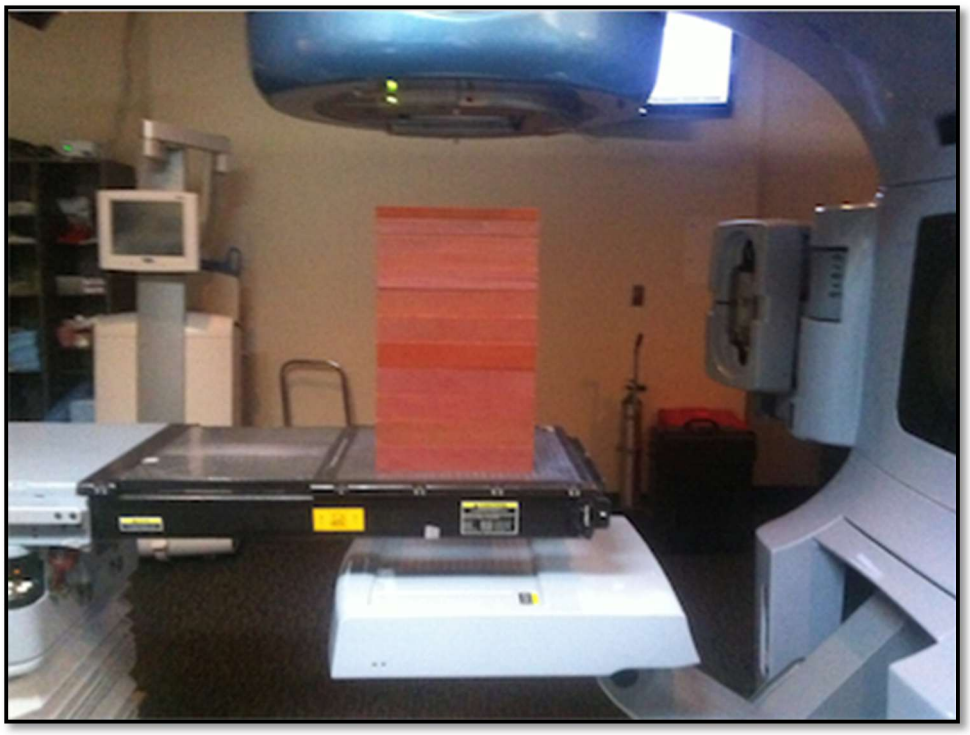
3. The MV image panel must be moved to 150 cm for air collections with Wedge0 or Slab0 at the end of the plan name. These are also air collections but are performed at 150 cm.

Solid Water Placement for Data Collection

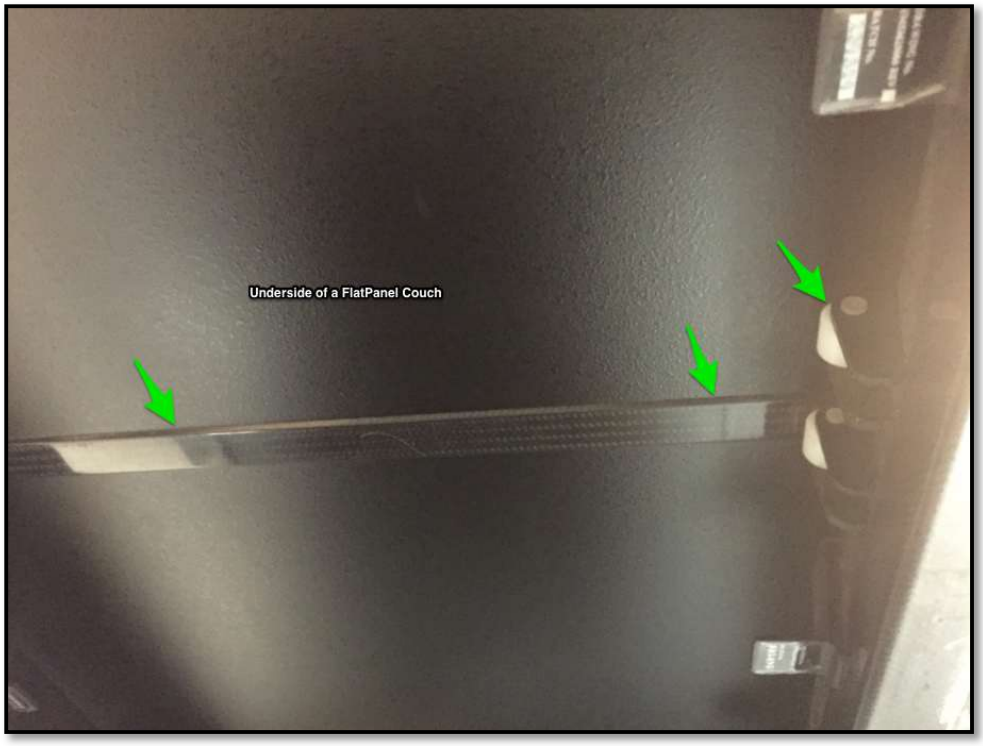
If the Representative Data Model is being used for commissioning, please skip the solid water measurement sections here.

For the measurements that require the water equivalent slabs on the couch, place the slabs over the most radiolucent area of the treatment couch. For non-IGRT couches, make sure the rails are moved to their outer most position.

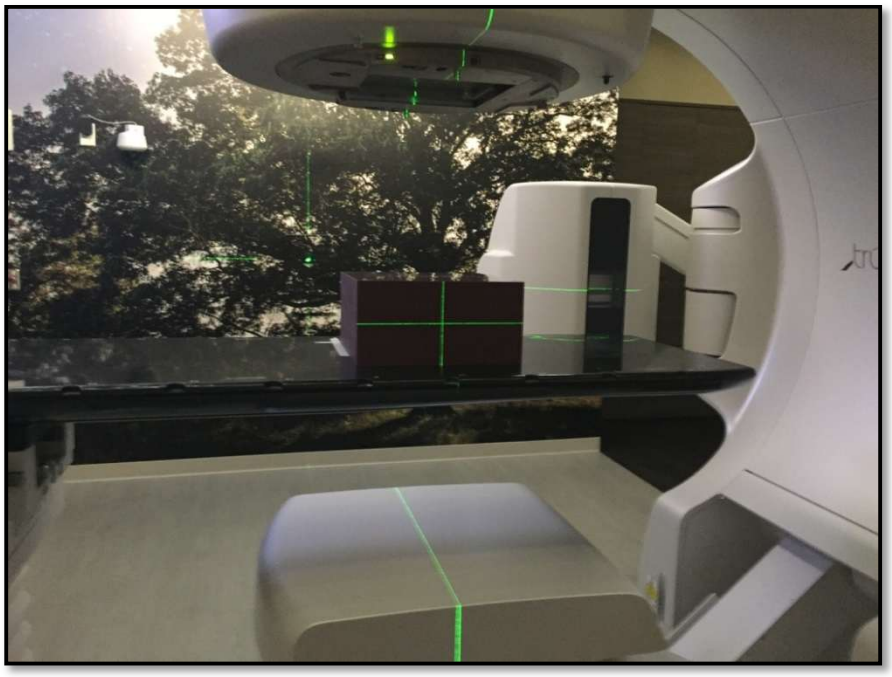
Do not place any leveling boards or other material between the couch and the water equivalent material that attenuates the signal received by the image panel. The image below shows the water equivalent slabs centered over the tennis racket with the support rails in the outer most position:



For an Exact couch top with Flat Panel, the green arrows in the image below show support structures underneath the couch that are to be avoided during the water equivalent material image collections. These support structures will influence the commissioning outcome.

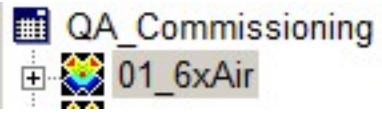


Solid water placement on an IGRT couch:



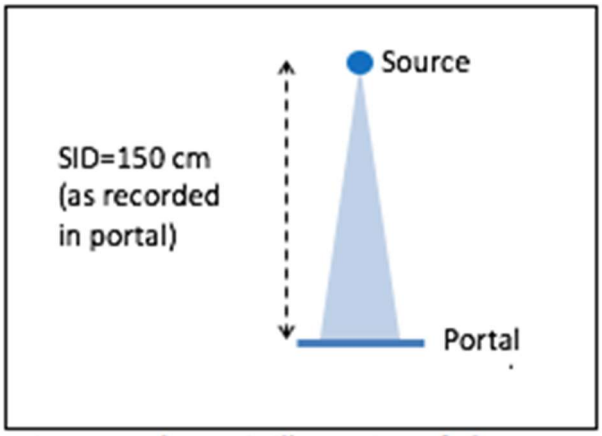
ARIA Commissioning Patient Review for Data Collection

Plan 01 with plan names containing “Air” at the end of the name are air collections with the image panel at 105 Source-to-Image-Distance (SID) for open fields and wedges. See Figure below:



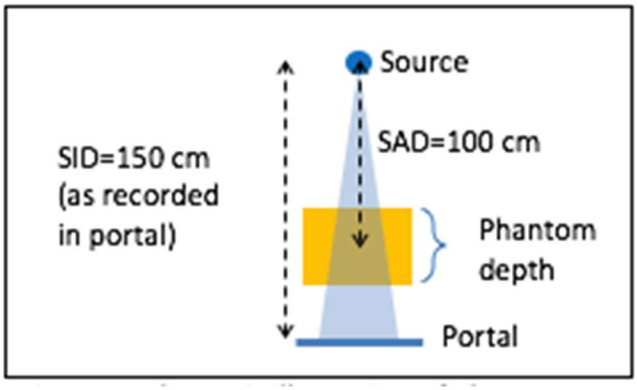
Plans 01 is collected at 105 SID with no portion of the treatment couch over the image panel.

Example Plan 02 is also air collections but the image panel is dropped to 150 SID. The Slab0 in the plan names indicate an air collection but with the image panel at 150 SID. See Figure 4 below:



Plans 02 is collected at 150 SID with no portion of the treatment couch over the image panel.

Plans 03-09 are collected with water equivalent slabs (Solid Water) on the couch with the image panel at 150 SID. The number at the end of each plan name indicates the thickness in centimeters of solid water to be used for the collection. For example, plan 03_6x_Slab1 is collected with 1 cm of solid water on the couch. Example 2, plan 07_6x_Slab20 is collected with 20 cm of solid water on the couch. The isocenter is always set to mid-depth of the slab thickness for all solid water collections. See Figure 5 below for plans 10-30:



Plans 03-09 are collected at 150 SID with various thicknesses of solid water on the couch. Isocenter is set to mid-depth of the slabs for all collections.

Couch height setting in ARIA can aid the data collection process by helping place the isocenter at the appropriate mid-depth in the solid water. See the example below for Plan 03_6x_Slab1. The couch height is set in ARIA to place the isocenter at mid-depth. This process assumes the digital readout on the treatment couch is calibrated to place the couch vertical at the indicated height. See Figure 14 below:

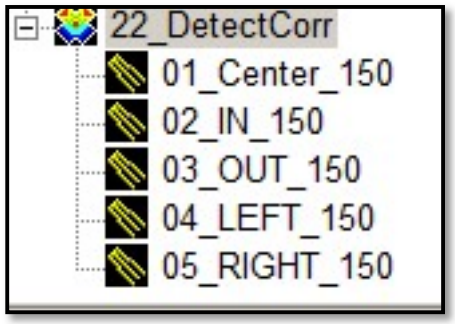
Course: QA_Commissioning -

Plan: 05_6XSlab10

Field Order/Type	1 / Treat	2 / Treat
Field ID	10x10	25x25
Field Name		
Technique	STATIC	STATIC
Scale	IEC61217	IEC61217
Energy	6X	6X
Dose Rate [MU/min]	400	400
MU	100.0	100.0
Time [min]	1.00	1.00
Tol. Table	PHOTON	PHOTON
Calculated SSD [cm]		
Planned SSD [cm]		
Gantry Rtn [deg]	0.0	0.0
Coll Rtn [deg]	0.0	0.0
Field X [cm]	10.0	25.0
X1 [cm]		
X2 [cm]		
Field Y [cm]	10.0	25.0
Y1 [cm]		
Y2 [cm]		
MLC	NONE	NONE
Dynamic Wedge		
InterfaceMount		
AccessoryMount		
CompensatorMount		
ElectronAperture		
Bolus		
Couch Vrt [cm]	-5.00	-5.00
Couch Lng [cm]	+128.00	+128.00
Couch Lat [cm]	0.00	0.00
Couch Rtn [deg]	0.0	0.0
Imager Vrt [cm]	-50.0	-50.0
Imager Lng [cm]	0.0	0.0
Imager Lat [cm]	0.0	0.0
Setup Note	Set image pan...	Set image pan...

*Plan **05_6x_Slab10** Couch Vrt (cm) set to -5.0 to place isocenter at mid-depth for the 10 cm slab collections. ***This already exists in the Template patient.****

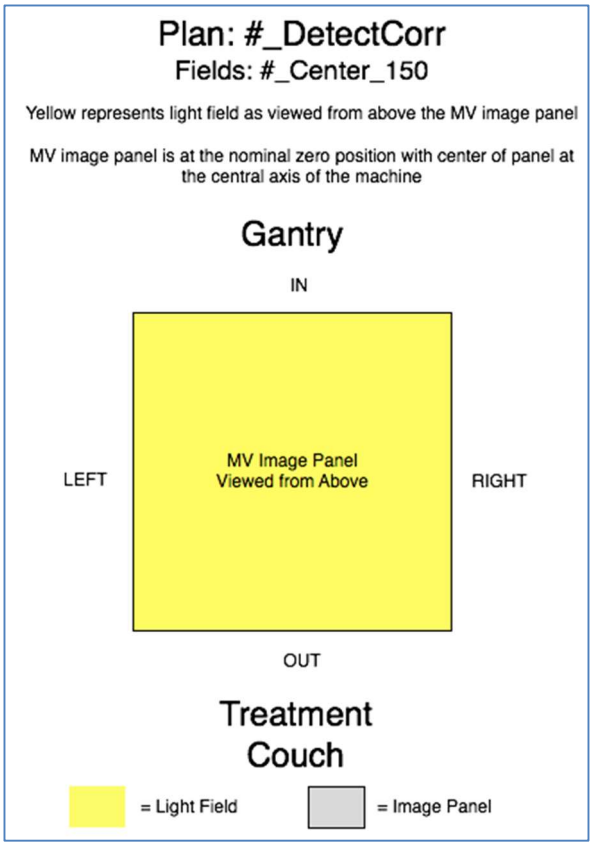
Plans for Detector Correction or #_DetectCorr

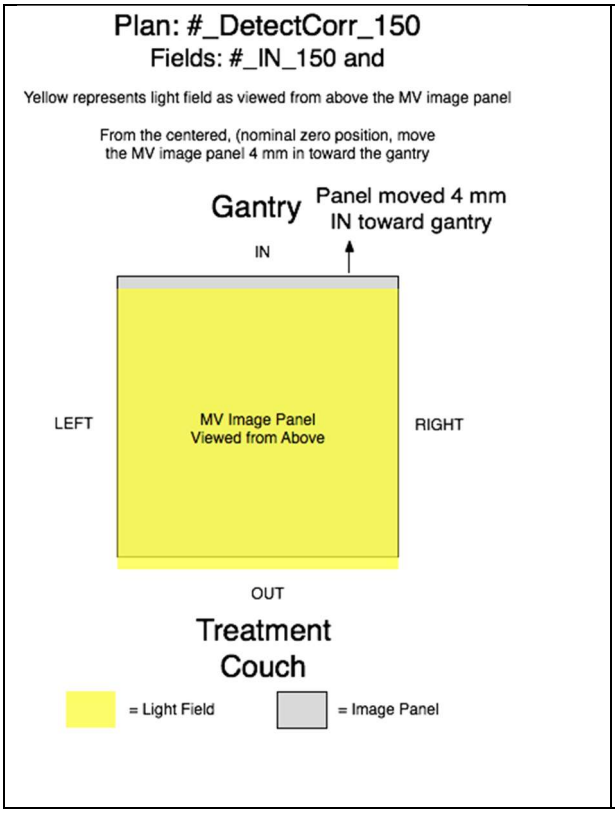


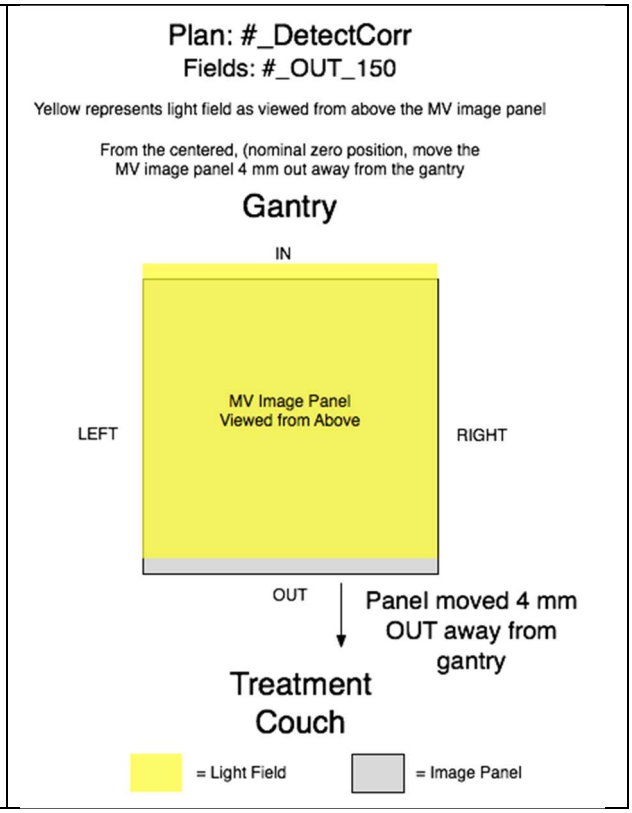
Plan and Fields for Detector response correction data collection.

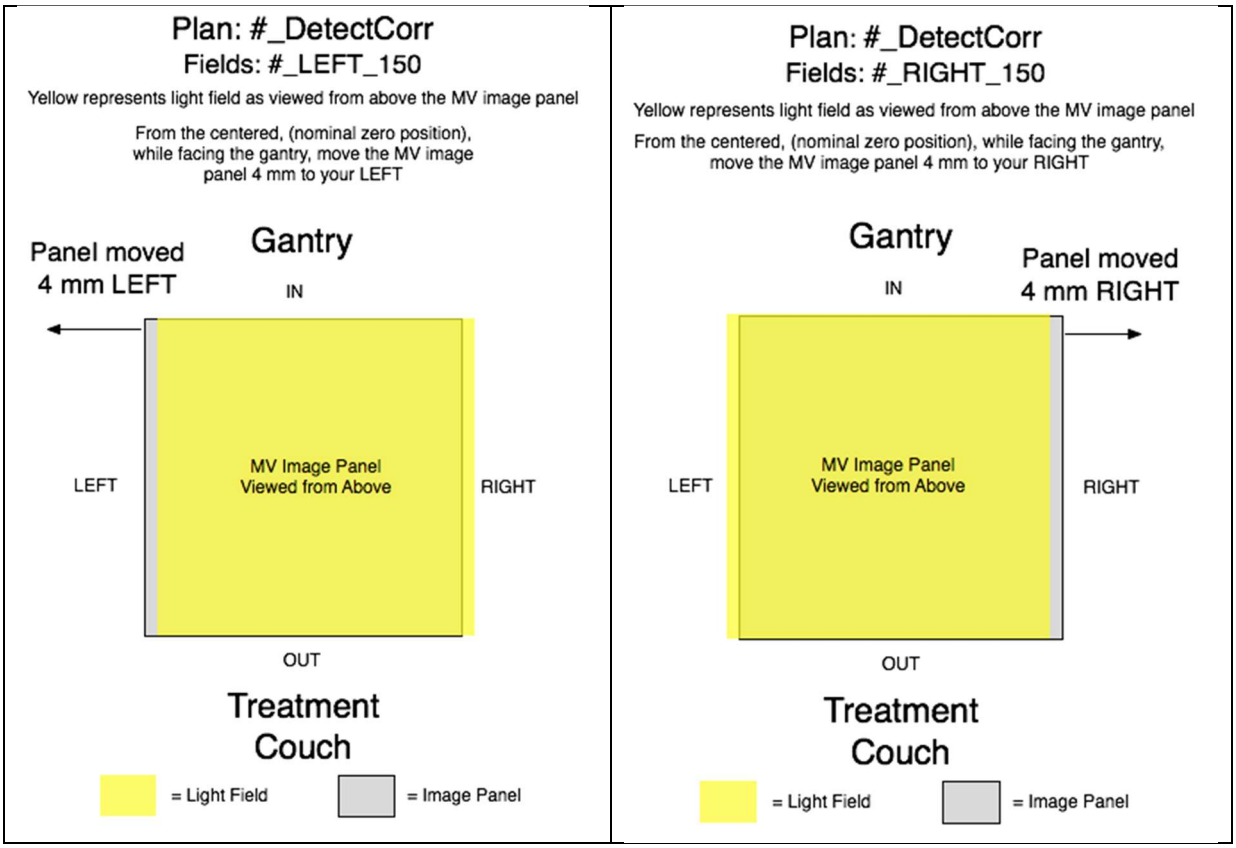
These plans collect data to aid in characterizing panel response. It is extremely important to move the panel as precisely as possible for these collections with particular attention to the SID and the direction of the panel movement

- These are air collections with no additional buildup added to the panel
- Plan #_DetectCorr is collected at 150 SID
- The number at the beginning of the plan name will be generated by the commissioning template generator.
- 100 MU's will be used for all fields.
- The field size is X = 26.7 and Y = 20.0 for all fields.
- There are 5 different panel positions for each photon energy. The diagrams below show examples of the panel moves.
- Be as precise as possible when executing the 4 mm panel moves.
- All MV image panel moves originate with the panel at the "zero" (centered) position.
- The move instructions are included in the on-screen setup instructions in ARIA

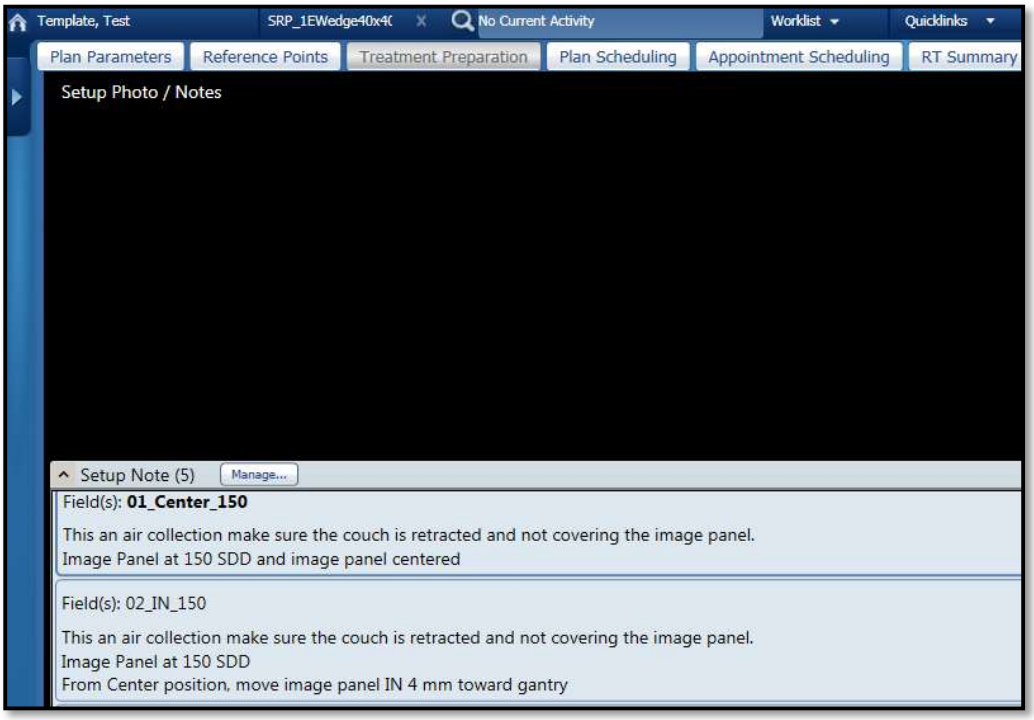

Plan: #_DetectCorr
Fields: #_Center_150
Yellow represents light field as viewed from above the MV image panel
MV image panel is at the nominal zero position with center of panel at the central axis of the machine
Gantry
IN
LEFT
MV Image Panel
Viewed from Above
RIGHT
OUT
Treatment
Couch
= Light Field
= Image Panel


Plan: #_DetectCorr_150
Fields: #_IN_150 and
Yellow represents light field as viewed from above the MV image panel
From the centered, (nominal zero position, move the MV image panel 4 mm in toward the gantry
Gantry
Panel moved 4 mm
IN toward gantry
IN
LEFT
MV Image Panel
Viewed from Above
RIGHT
OUT
Treatment
Couch
= Light Field
= Image Panel


Plan: #_DetectCorr
Fields: #_OUT_150
Yellow represents light field as viewed from above the MV image panel
From the centered, (nominal zero position, move the MV image panel 4 mm out away from the gantry
Gantry
IN
LEFT
MV Image Panel
Viewed from Above
RIGHT
OUT
Panel moved 4 mm
OUT away from
gantry
Treatment
Couch
= Light Field
= Image Panel



Field settings for Panel pixel sensitivity collection



Setup notes for panel moves are on-screen to provide easy access to instructions for each field.

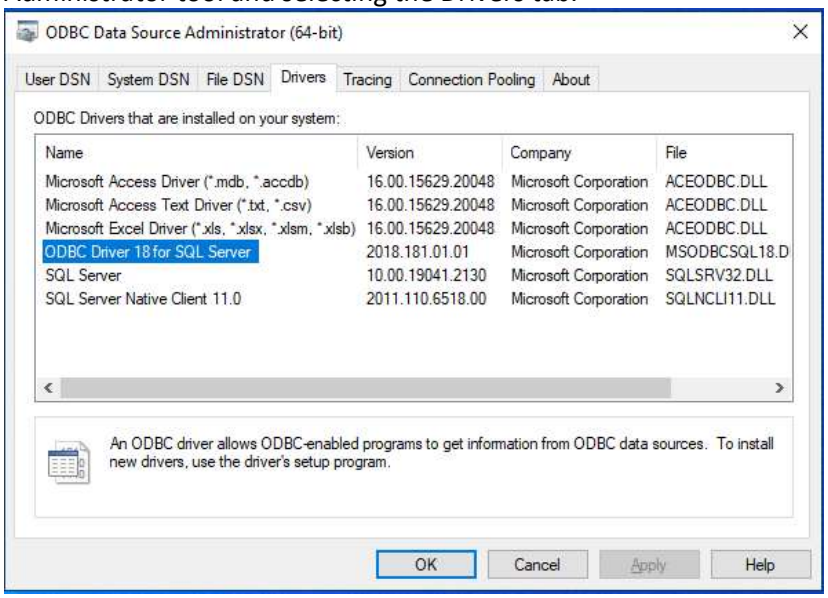
DICOM Configuration

The DICOM configuration must be completed for Adaptivo to be able to process patients, including commissioning files. This applies to query and retrieve or manual data import. If no connectivity to ARIA or MOSAIQ exists, the dcmstore needs to be filled in and the word 'test' or 'manual' can be entered for items that do not require integers. Port numbers require integers.

For automated or manual query and retrieve, the Varian DB Daemon needs to be installed and configured. .com

Prerequisites to pull from ARIA or MOSAIQ:

- Add Varian DB Daemon access for the Adaptivo software. This may be able to be provided by the local IT department depending on the level of support provided by the hospital/clinic IT department. An alternate option is for the clinic staff contact Varian support to have them enable access.
- Varian support will need the Client AE title, IP address and port number for the Adaptivo Computer.
- Varian support should provide the AE title, IP address, and port number for the DB Daemon access.
- For MOSAIQ, the Microsoft ODBC Driver 18 for SQL Server must be installed on the Adaptivo server for the MOSAIQ database connection to succeed.
    - Verify the installation of this driver by opening the Windows ODBC Data Source Administrator tool and selecting the Drivers tab.

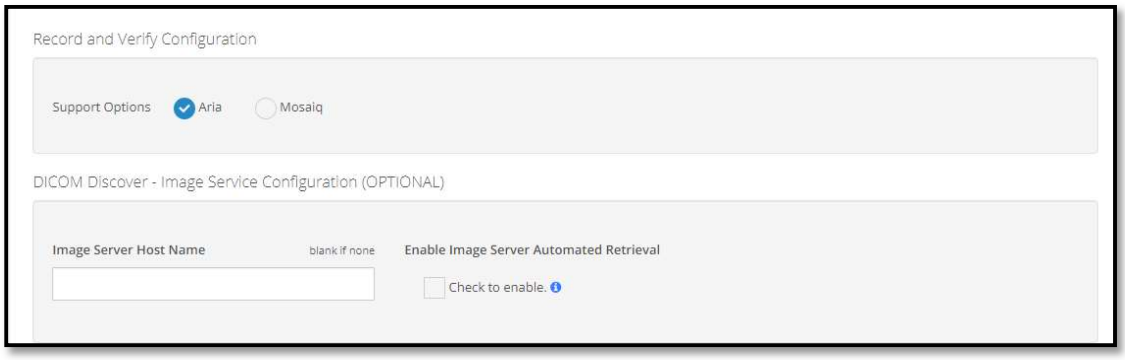


    - If the driver must be installed, it can be downloaded from Microsoft: https://learn.microsoft.com/en-us/sql/connect/odbc/download-odbc-driver-for-sql-server?view=sql-server-ver16
- For MOSAIQ, remove the DICOM_MODE variable in the Adaptivo Web environment file.
    - Open the "PowerShell 7" app.

- Type the following command: ssh adaptivo@adaptivo
- Type in password “adaptivo” if prompted (with the default Adaptivo Web setup, you will not be prompted for this password).
- Edit the contents of the following file using the text editor of your choice (e.g. vim): /home/adaptivo/code/web/current/.env
- Remove the following line from the .env file:
  - DICOM_MODE=dicom
- Save your changes to the .env file, exit the text editor, disconnect from the VM (using “exit” command), and close PowerShell.

Import hours allowed must be configured to import files either automatically or manually. The settings can be set according to a twenty-four-hour clock to allow retrieval any time or restrict it to certain hours.

2. Select the appropriate OIS
   a. MOSAIQ Image Service example: //xxxx/c$/impac/Data
   b. ARIA Image service example://xxxx/VA_DATA$/patients



3. Configure the MOSAIQ Database Connection

a. Note that it is also necessary to configure the DBDaemon when MOSAIQ is used for the OIS.
b. Verify connectivity to both DBDaemon and MOSAIQ after configuration using the *Test Your DICOM Configuration* button at the bottom of the page.

If the Automatic DICOM Retrieval option is selected, the system will perform a query every 15 minutes and retrieve any newly discovered treatments.

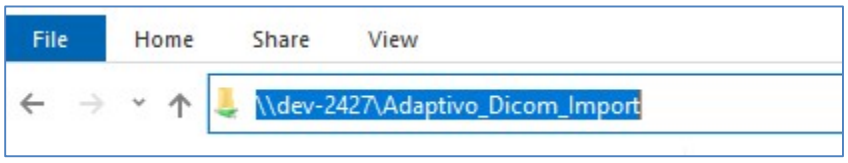
For Verification Plan Detection, three options are provided to aid in automatically detecting quality assurance plans. Configure this section based on the clinic naming conventions for QA plans.

Configuration for retrieving from ARIA if the Varian DB Daemon has been configured to permit retrieval.

Manual Import Procedure

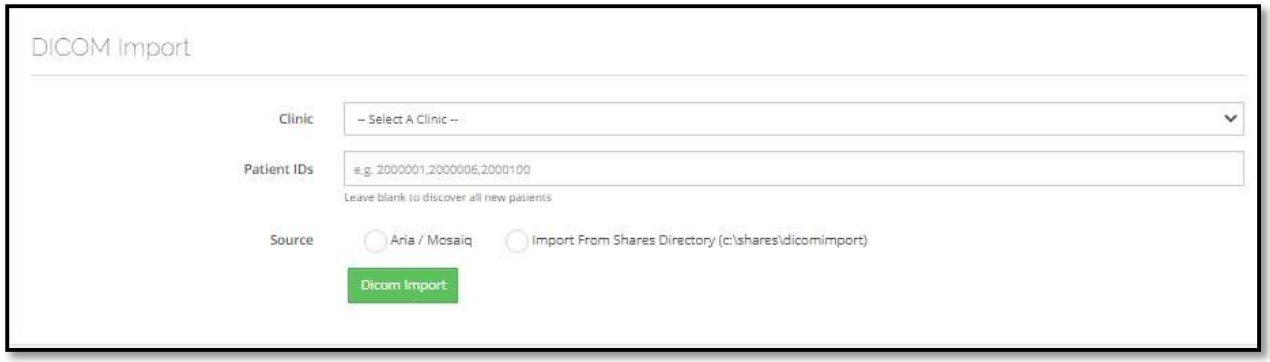
Manual import may be used with data exported from Aria and not MOSAIQ. Using Import/Export feature in ARIA export the entire patient to a location that can be accessed to move the DICOM files manually or via shared folder if connected to the network.

If performing a manual move of the patient, the DICOM data needs to be placed in the "C:\shares\dicomimport" folder on the adaptivo server. This can be accomplished by opening Internet Explorer and typing in \\[Adaptivo Server]\Adaptivo_Dicom_Import. This allows users to copy files to the adaptivo server from other computers in the domain without the need to directly connect to the server.



Manual DICOM import share folder location

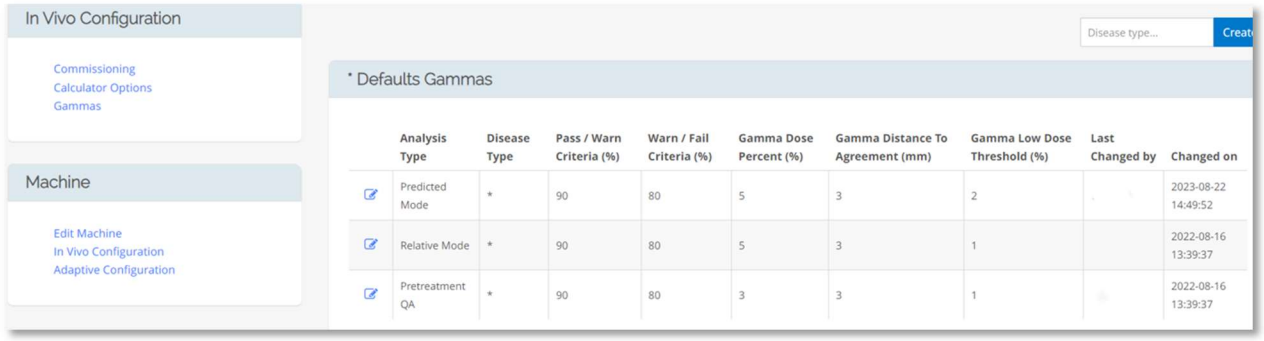
Navigate to the DICOM Import screen. The DICOM Import function from the local shares directory permits placing one or more patient data sets in the Shares Directory and retrieving them into Adaptivo.



Import from shares directory. This imports data from the C:\ shares\dicomimport folder.

In Vivo Configuration

The default gamma parameters can be configured by clicking on the edit symbol and editing the parameters. The software will record and indicate the user who made the change along with the time and date of the change.



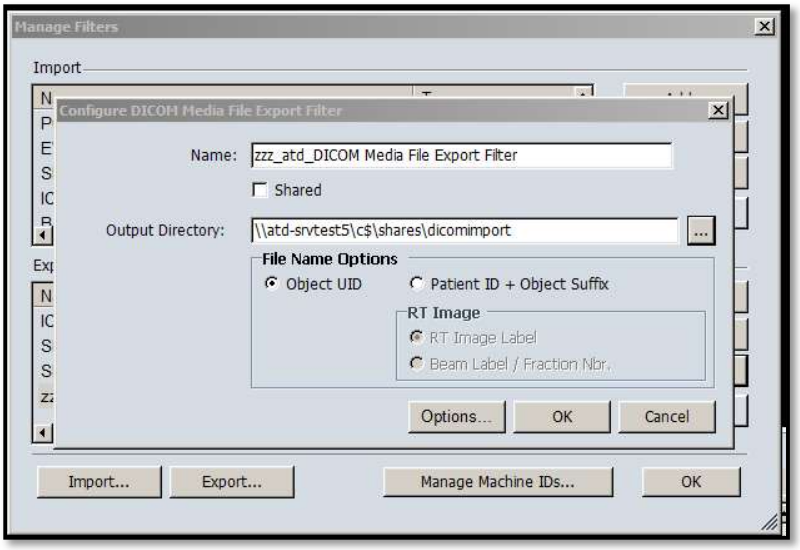
Gamma parameters may be changed by opening and editing the settings. The administrative user who is logged in at the time the change is made will be recorded as the person making the change.

Manual Data Export and Retrieval

Export commissioning patient from ARIA or Eclipse to a location that the patient DICOM files can be transferred to the Adaptivo computer to the “C:\ shares\dicomimport” folder.

Manual Import Procedure

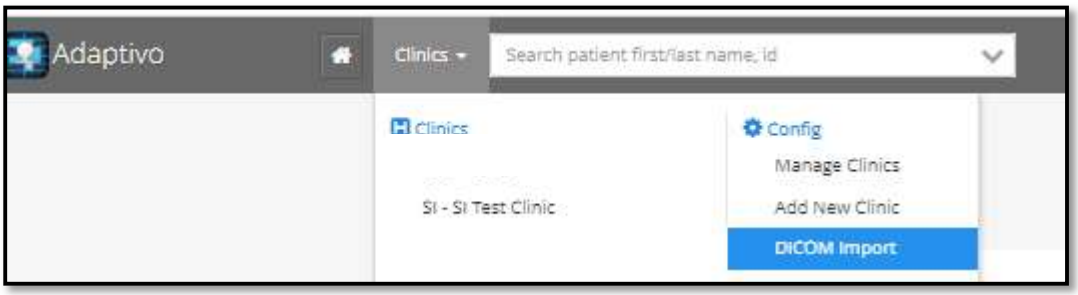
Using Import/Export feature in ARIA export the entire commissioning patient to the Adaptivo computer. See the example below in which files are exported to a computer named ‘atd-srvtest5’.



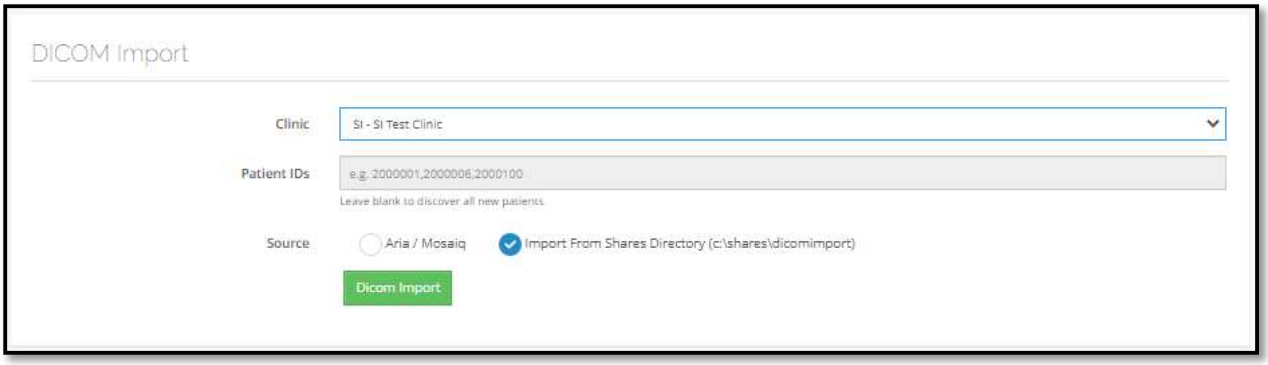
If a manual move of the patient is being performed, the DICOM data need to be placed in the "C:\shares\dicomimport" folder. A shortcut should exist on the desktop of the Adaptivo computer, and this can be used to check to make sure the files were exported.

Manual DICOM import share folder location.

Once the files are exported from ARIA, navigate to the DICOM import function on the Adaptivo web page:



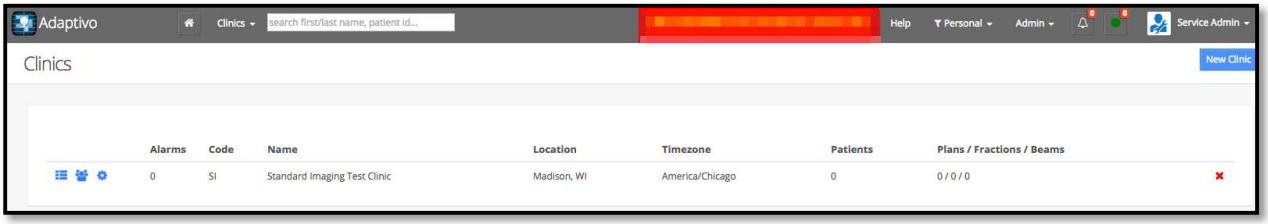
Ensure the correct clinic is selected, then select Import from Shares Directory and select Dicom Import. All DICOM files in the shares directory will be imported.



Create Commissioning Model

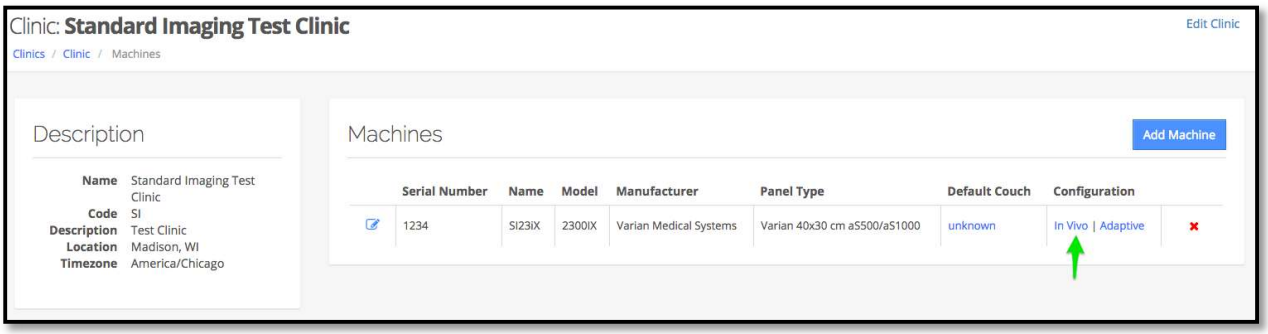
Navigate to the machine configuration screen and select the In Vivo option then select Commissioning. In the Commissioning –Templates screen, select “Actions” and “Create Model.”

Access the machine configuration page

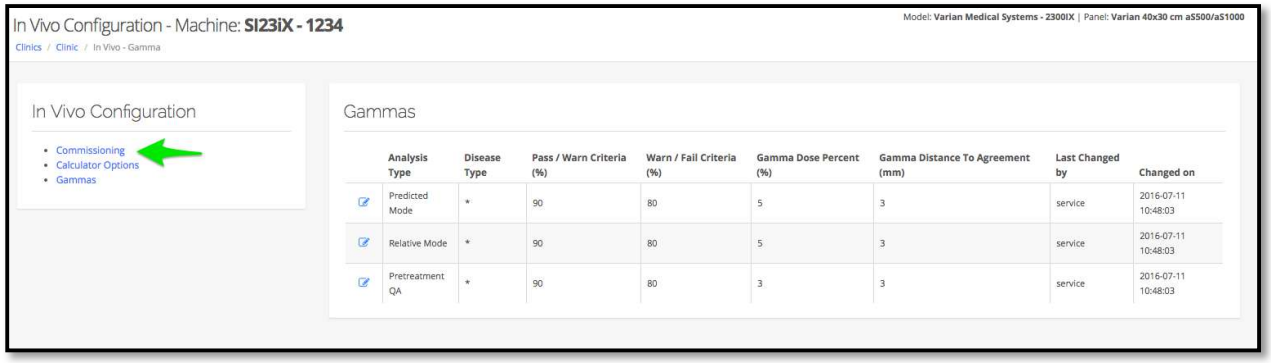


Select the clinic configuration icon

Select In Vivo in the configuration section of the machine



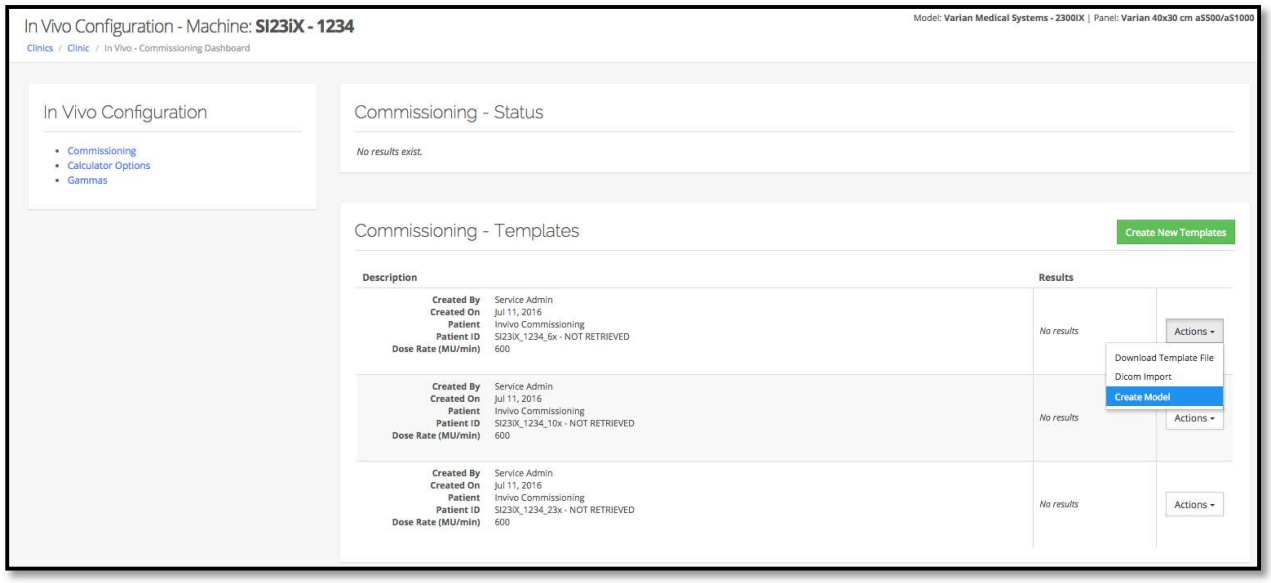
Select Commissioning to access the commissioning templates.



Create Model Options

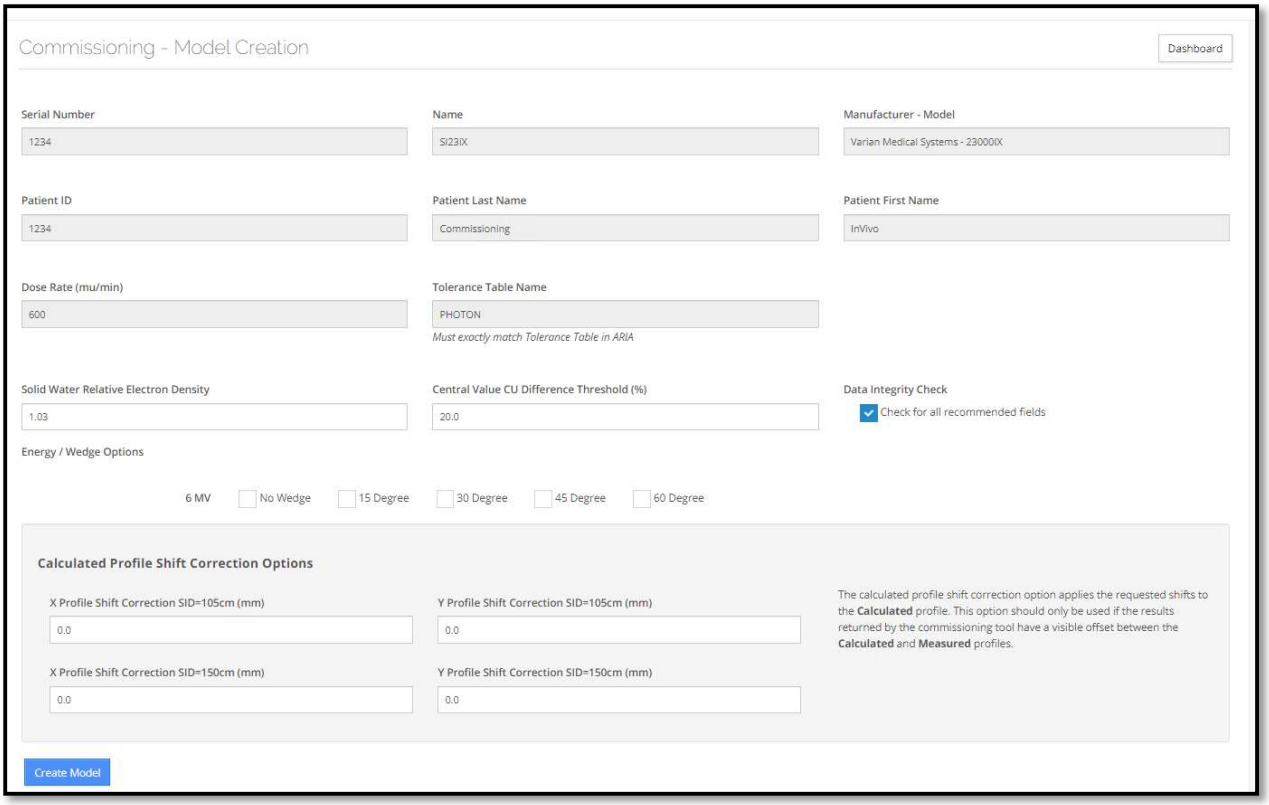
The Commissioning - Model Creation screen permits selecting energies and physical wedges, if used, to generate a commissioning model.

Select “Create Model”



Create Model - Select Energies

The Commissioning – Model Creation screen permits specifying the solid water relative electron density used during data collection.



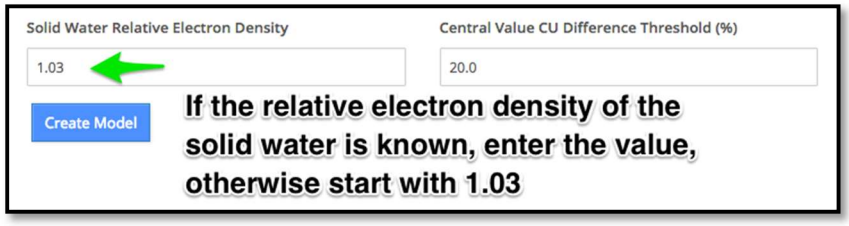
Create Model - Slab Density, Central Value Difference Threshold, and File Integrity Check

For the solid water relative electron density, enter the relative electron density for the water equivalent slabs used during the commissioning collection. Some solid water manufacturers provide a certification of the material that also provides these values. It is recommended that the solid water be scanned and a tool used to identify the relative electron density of 40 cm thickness of solid water. Sample several solid water slabs to identify the relative electron density value to be entered into the commissioning tool. Generally, this value should fall between 1.02 and 1.04. Since there can be variations in uniformity of solid water slabs during manufacturing, the solid water to be used for commissioning data collection should be scanned and evaluated for consistency before commissioning data are collected.

The Central Value Difference Threshold permits a check against the predicted central CU value with the measured central CU value. A default value of 20% is provided but the value is editable.

The File Integrity Check provides a check of the DICOM portal image or RI files to make sure that all recommended files are present in the commissioning data collection. If the collection fails the integrity check, the missing files will be identified. The commissioning files may still be processed by unchecking the File Integrity Check option.

A few models may be generated with a range of slab densities to aid in producing and selecting the best model. For example, create separate commissioning models by entering a slab density and selecting create model for the slab densities of 1.02, 1.03, and 1.04.



It will generally take a few hours for these to process but these will aid in eliminating some uncertainty in selecting a commissioning model. Once the commissioning models are calculated, the results will be available for review. To evaluate the influence of the slab density on the commissioning process, users should create and perform a validation test case plan to compare commissioning results with different slab densities.

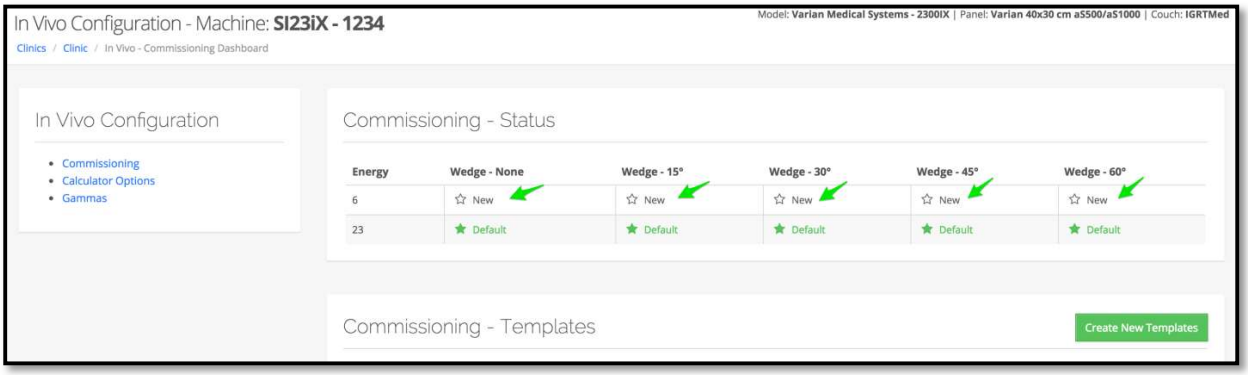
Results Available for Review and Approval

The commissioning model processing generally takes approximately 20-30 minutes for a one energy collection. Once the commissioning model is created, the model is available for review and approval. The review and approval process is a two-step process that involves generating the commissioning model and performing an assessment of the data collection process followed by an assessment of the slab density assignment using a phantom validation test.

Once the commissioning models are computed, the results are available for review. This is an example of a 6 MV beam with multiple models available for review with different Slab Density values entered for the commissioning model.

Select Model for Review

Select a model to review by selecting the "star" in the Commissioning – Status screen or selection the Actions menus in the Commissioning – Templates section.

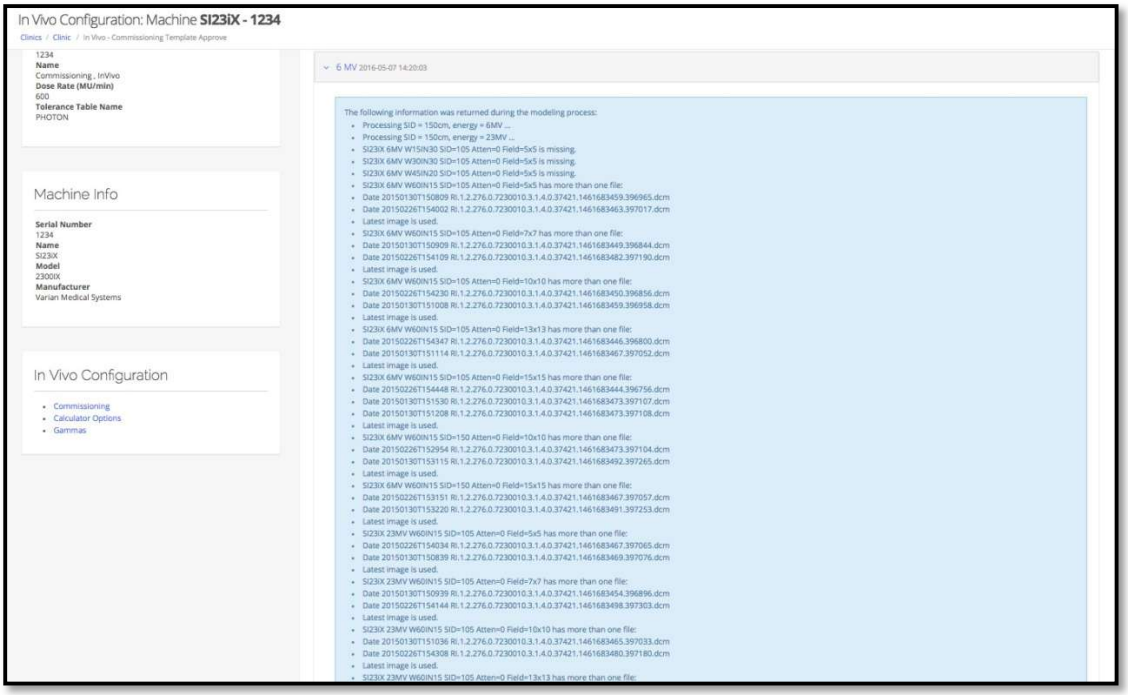


The star "New" indicates a model available for review.

Commissioning Models with two energies available for review. Select a model to review the measured vs. calculated profiles.

Review Model Creation Messages

Any messages related to the commissioning model processing will be available when the model is opened for review.



Any messages associated with the commissioning model generation will be displayed.

Review Results

Review the commissioning results. A table and a plot of the central CU values vs. depth for the 10x10 fields are provided as a reference. The shape of the curve provides an indication that the data collection falls within acceptable parameters and that there are no large differences in the solid water slabs. The profile plots of the predicted portal profile and the measured portal profile are provided for X and Y direction for air and depth measurements.

Portal Dose [CU] vs. Depth/Thickness of solid water for 10x10 cm fields

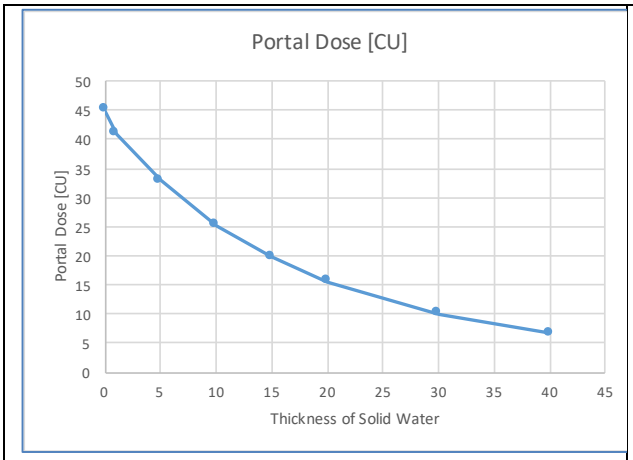


Figure 1: Expected curve shape

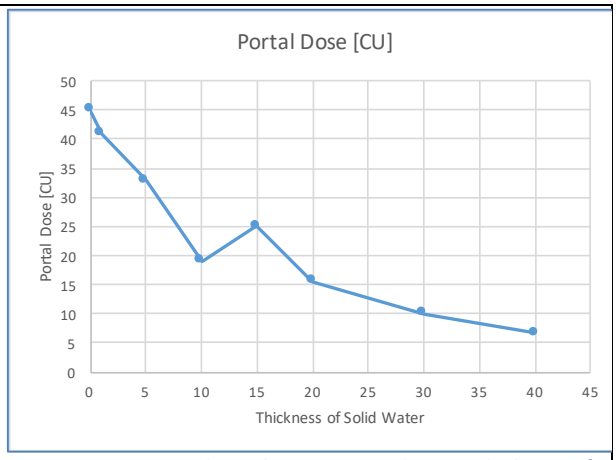
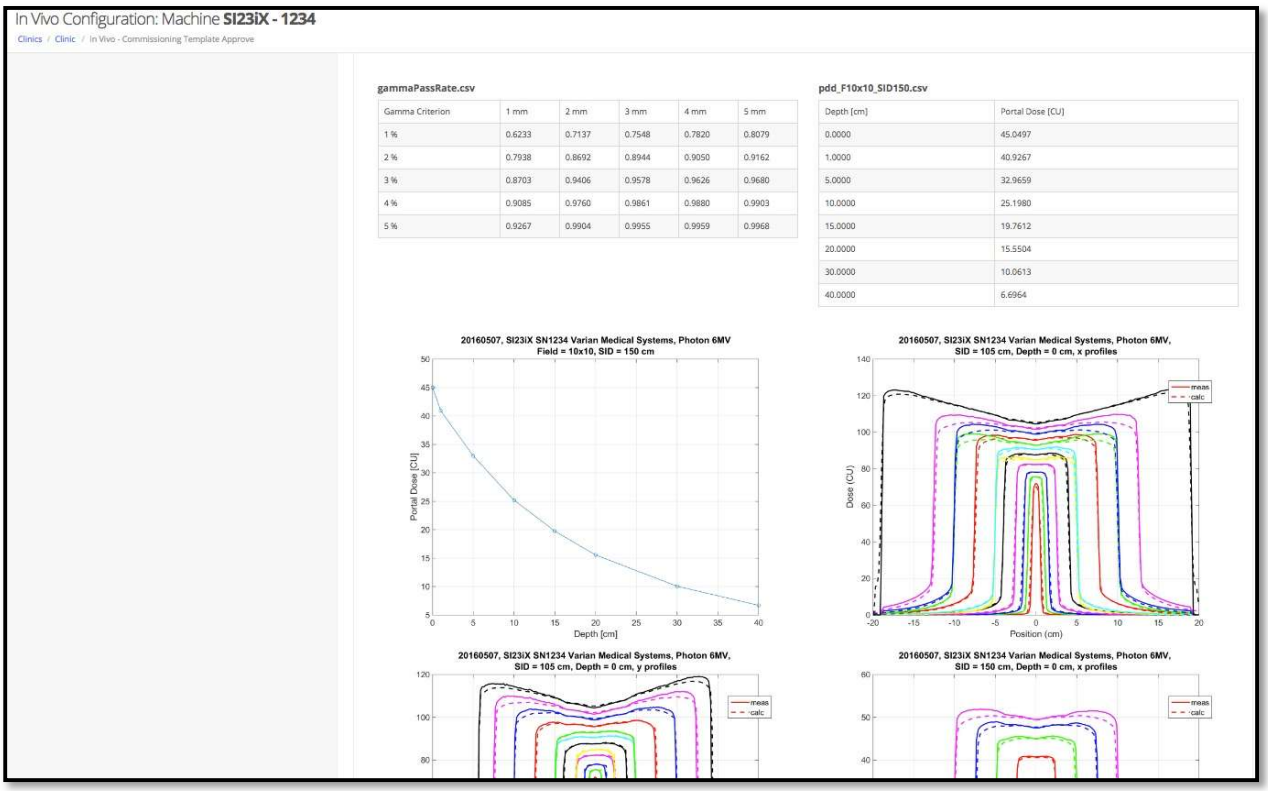


Figure 2: Unexpected Result at 10 cm and 15 cm thickness of solid water. The 10 and 15 cm thickness would need to be collected for this energy again paying particular attention to the thickness of solid water placed on the table

Profile plots of the predicted portal profile with the measured portal profile are provided for X and Y direction for air and depth measurements. The resulting fit or match between the measured vs. calculated/predicted is not adjustable.

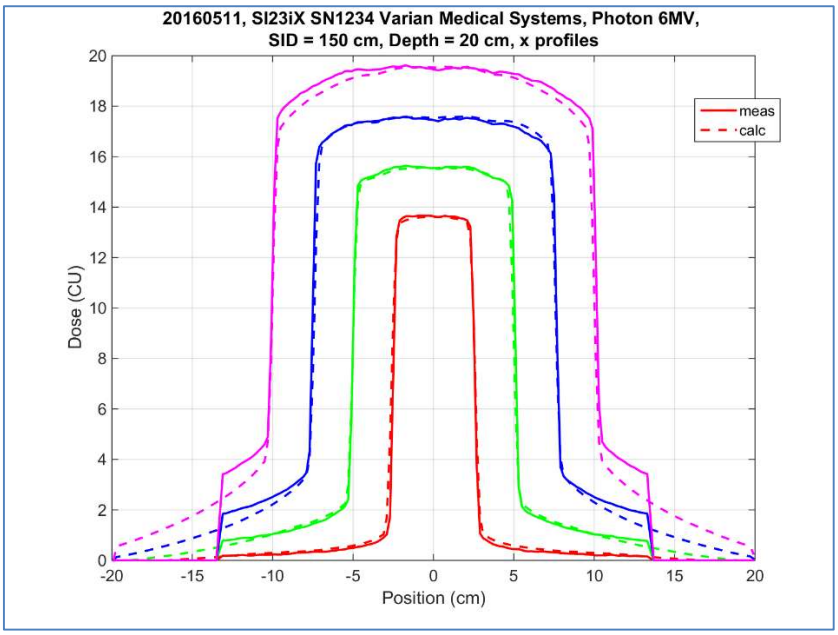
1.5



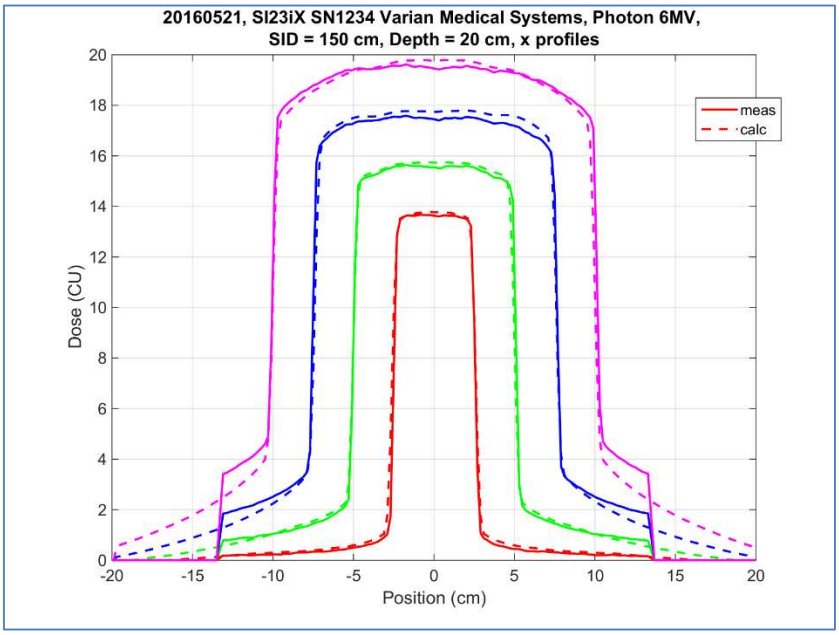
Model review screen

Beam Model Profile Review

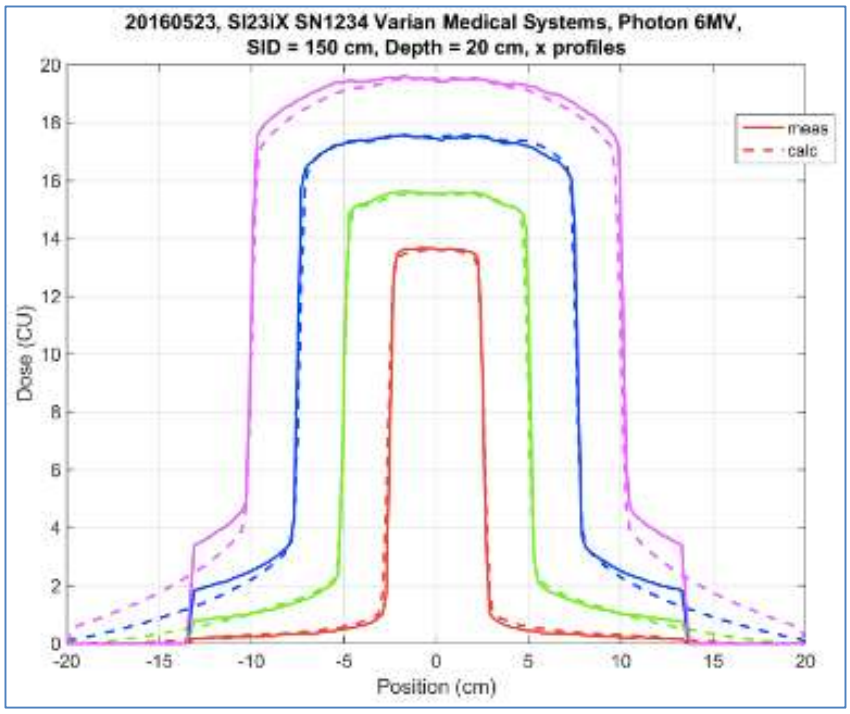
The following profiles demonstrate profile match as it relates to the slab density value entered in the model generation process. The following profiles illustrate the x profile at 20 cm depth for different slab density values. Even though the profile match looks reasonable for slab densities of 1.03, 0.9, 1.0, and 1.1, the results from a phantom test will demonstrate a larger variation in results. The profile match for a slab density of 1.5 clearly demonstrates an unacceptable result.



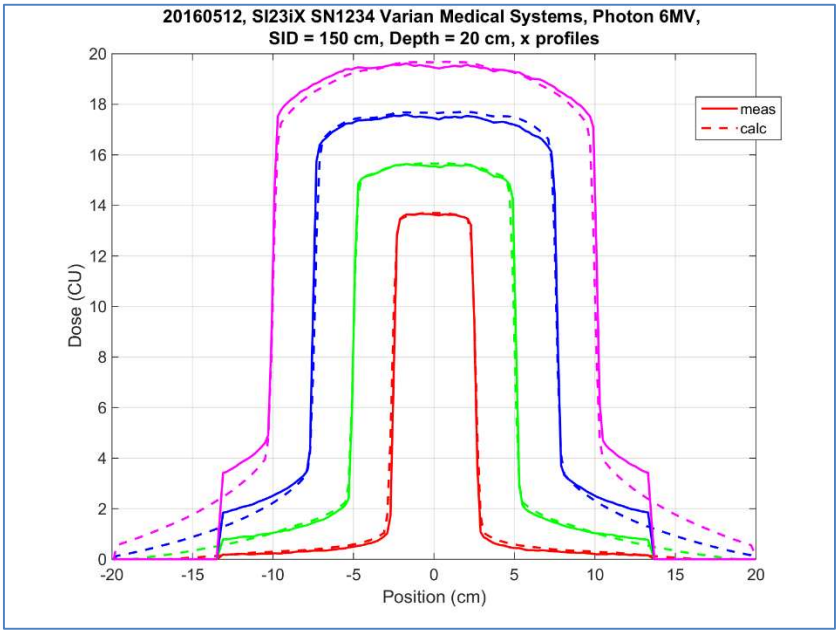
Slab Relative Electron Density of 1.03 for commissioning



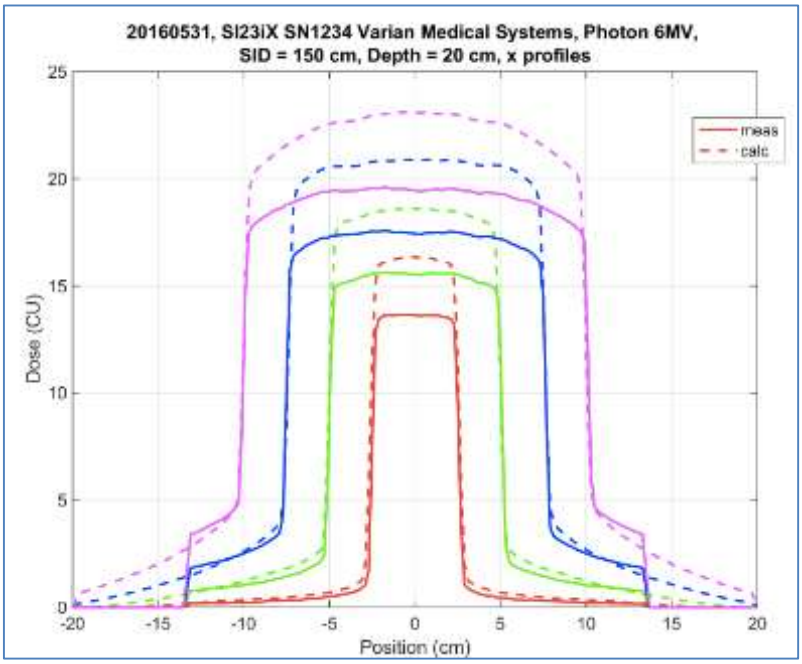
Slab Density entry of 0.9 Relative Electron Density



Slab Density Value of 1.0 for Relative Electron Density



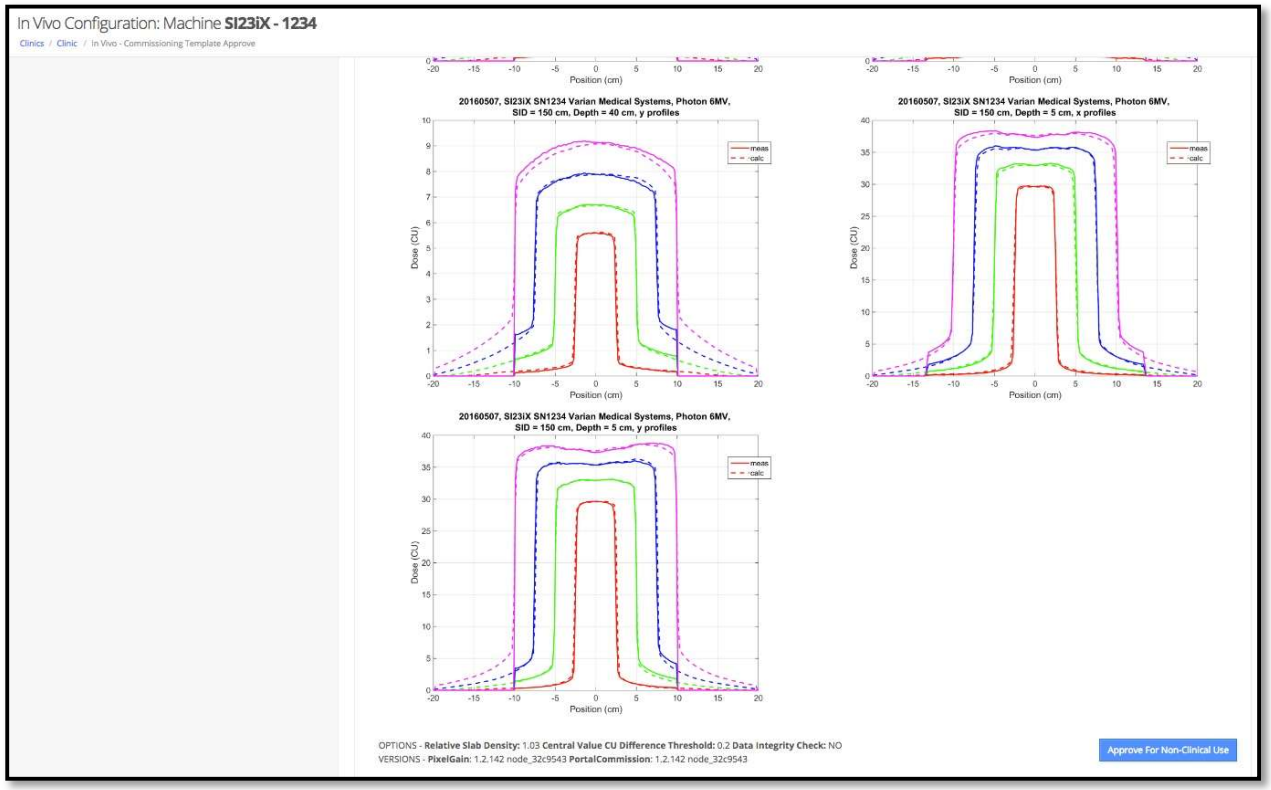
Slab Density entry of 1.1 Relative Electron Density.



Slab Density Value of 1.5 for Relative Electron Density. This demonstrates a large disagreement between the measured portal images vs. the calculated/predicted portal images.

Beam Model - Approve for Non-Clinical Use

The first step in the approval process is to Approve for Non-Clinical Use.

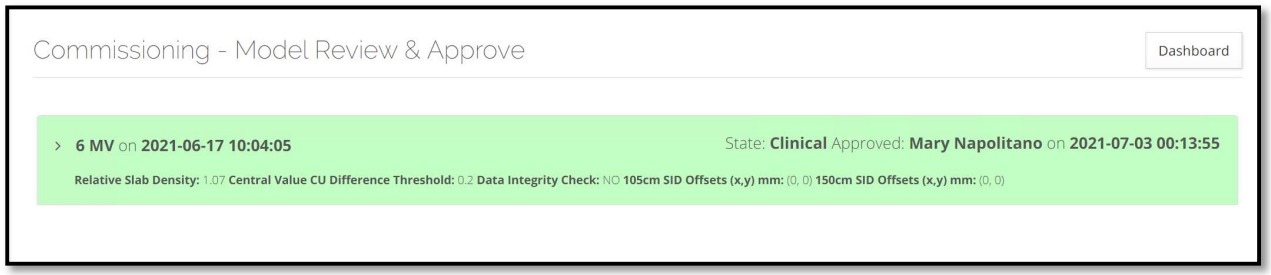


The example below shows that the 6 MV beam was approved for Non-Clinical Use along with the person logged in as an administrative user that performed the approval. The date and time of the approval is provided.

1.5

Beam Model - Approve for Clinical Use

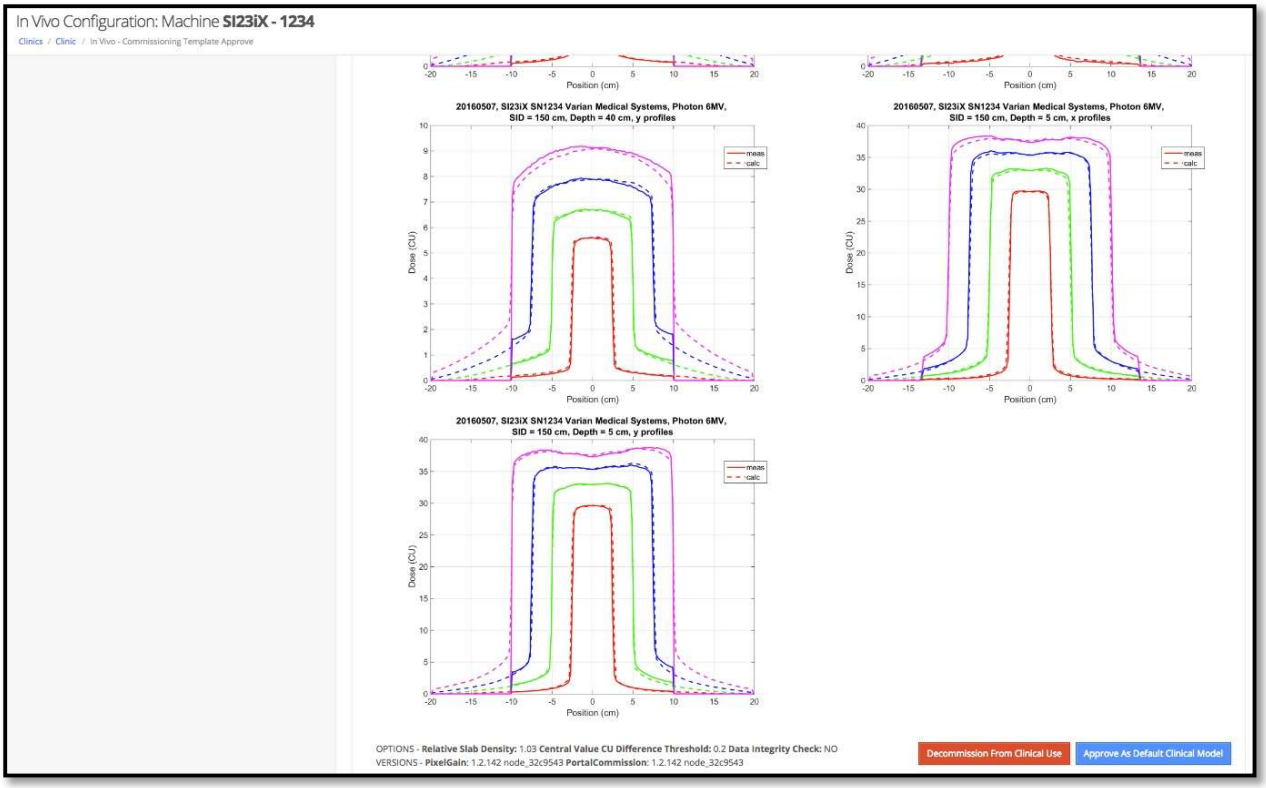
The second step in the approval process is to Approve for Clinical Use. This permits calculations to be performed in a manual fashion removing the Non-Clinical Use tag. The software will not automatically process predicted cases in this mode.



The example below shows the 6 MV beam was Approved for Clinical Use along with the person logged in as an administrative user that performed the approval. The date and time of the approval is provided.

Beam Model - Approve as Default Clinical Model

The final approval is the Approved as Default Clinical Model. This level of approval permits automated processing of plan data.



The example below shows the 6 MV beam was Approved as Default Clinical Model along with the person logged in as an administrative user that performed the approval. The date and time of the approval is provided. For program startup, the Approved as Default Clinical Model approval should be used. This approval state permits automatic processing in Predicted Mode. Without an Approved as Default Model, for any photon energy contained in a plan, the plan will default to Relative Mode. If a commissioning model exists for a photon energy and it is either Approved for Non-Clinical User or Approved for Clinical Use, the model must be manually assigned. To assign a model to a beam, use the Actions menu on the Fraction Review page and select Change Calculation Model and select a model.

Models approved as Default Clinical Model enable automatic processing with Predicted Mode.

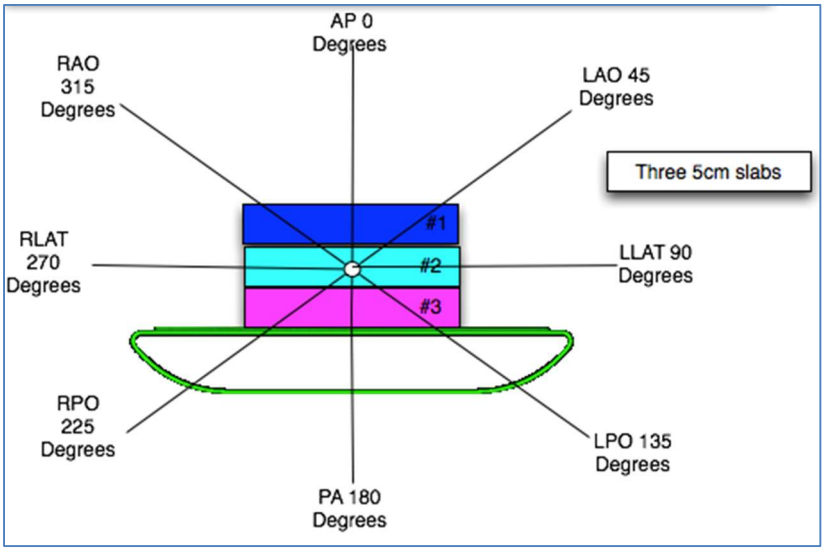
Beam Model Validation Test Case

Phantom Scan and Treatment Plan

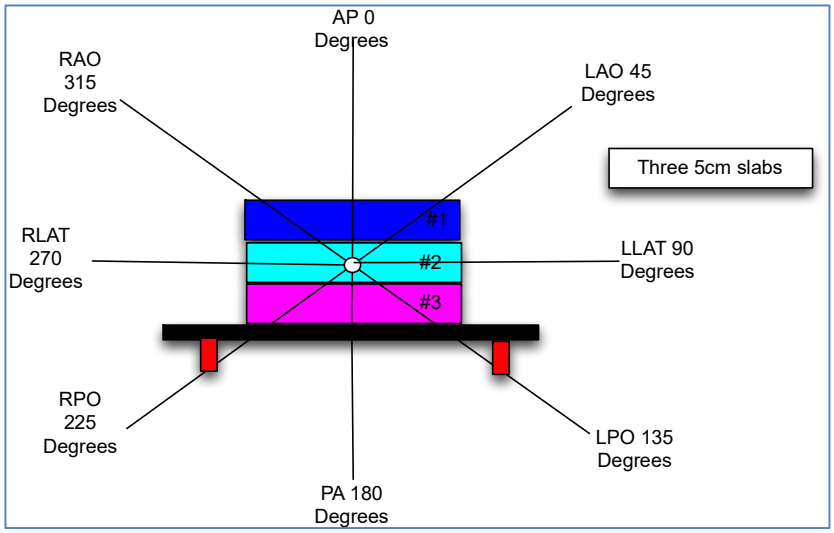
1. Scan 15 cm of solid water, preferably consisting of three 5 cm solid water slabs with a CT slice spacing of 2 to 3 mm and the largest field of view available.
2. When performing the CT scan try to position the phantom as straight as you can since the position will need to be reproduced in the treatment room when the subsequent treatment plan is delivered.
3. Attempt to place the CT scanner isocenter/center of rotation as close to the center of the phantom as feasible. This aids in having a centered couch replacement in Eclipse.
4. Import the phantom CT scan into Eclipse
5. Create a plan with eight equally spaced beams per photon energy. For a single photon energy

there should be 8 fields, two photon energies = 16 fields, and three photon energies = 24 fields.

6. Place the isocenter at the center of the phantom
7. Field size for all fields is 15 x15 cm except for the lateral beams.
8. Field size is 10 x 10 cm for lateral beams.
9. Perform a couch replacement in Eclipse with the Eclipse couch model that best matches the couch installed on the treatment machine. The couch replacement should be centered under the phantom so that when the plan is delivered on the treatment machine the couch lateral can be as close to the nominal zero position as possible.
10. If the treatment couch has moveable support rails, place them in the OUT position.
11. After computing the plan, set 100 MU's for all fields.
12. Add a pre-treatment CBCT with largest field-of-view to aid in positioning the phantom and troubleshooting the In Vivo results.
13. It can be helpful to add a setup field and enter a rectangular field that is same size or slightly smaller than phantom. For example, if the solid water is 30x30 cm, enter a 30x30 cm setup field and the couch can be raised or lowered using the light field to aid in making sure the phantom is setup squarely and centered from left to right on the couch.
14. See below for beam arrangement and example of an IGRT couch and a couch with support rails:



IGRT couch example



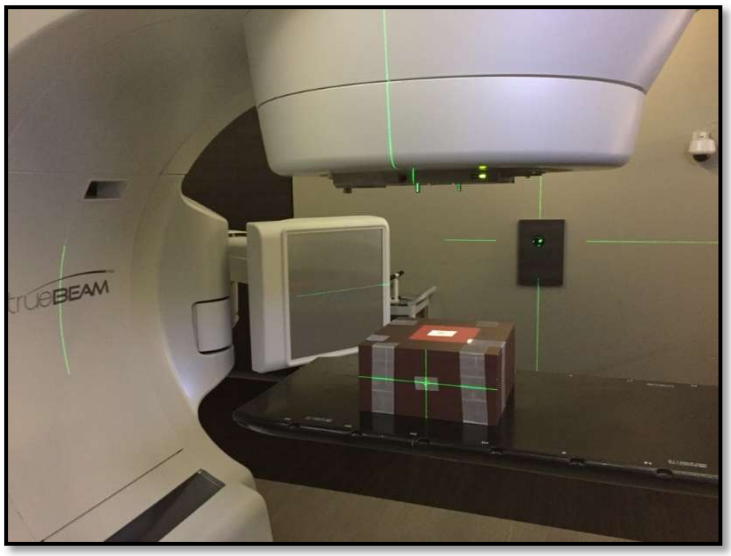
Exact Couch Example with Rails Out

ARIA Setup

1. Set the couch height to achieve 7.5 cm depth in the phantom. This can be adjusted at the time of the delivery.
2. Schedule integrated images for all fields
3. Enter enough fractions and daily/session dose tolerance to run the test multiple times if needed.

Phantom Treatment Delivery

1. Using the setup field and plan printouts reproduce the plan as closely as feasible.
2. Take the pre-treatment CBCT
3. Perform an image registration and reposition the phantom as needed.
4. Deliver the treatment.
5. See below for an example of a 15 cm solid water phantom used as a test case:



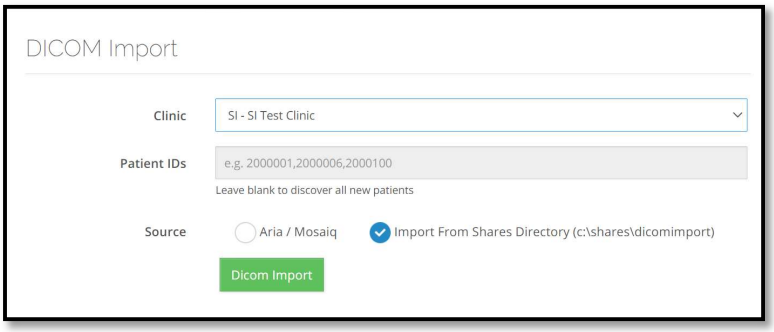
15 cm solid water phantom used as a commissioning test. Notice the tape applied to the phantom to aid in reproducing the setup.

Transfer to Adaptivo Computer

Using Import/Export feature in ARIA, export the entire patient to a location that can be accessed to move the DICOM files manually or via shared folder if connected to the network.

If performing a manual move of the patient, the DICOM data needs to be placed in the "C:\shares\dicomimport" folder. There should be a shortcut on the desktop of the Adaptivo computer.

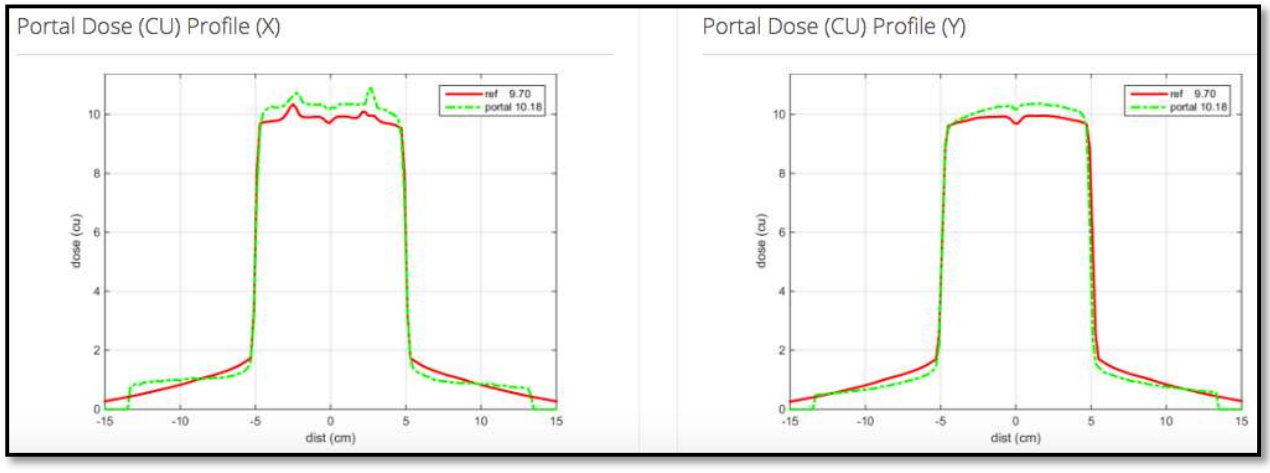
Navigate to the Clinics and DICOM Import screen:



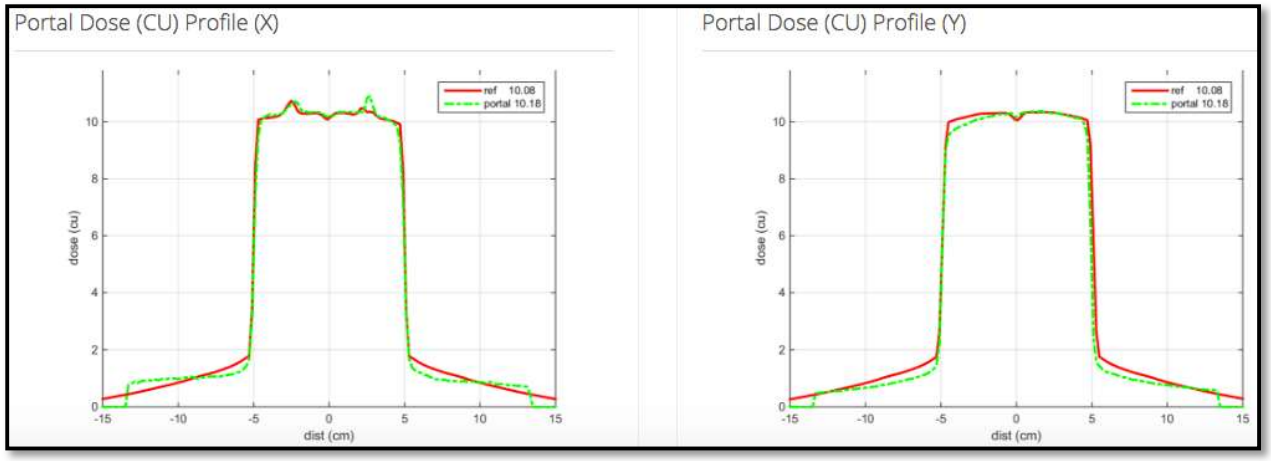
Import from shares directory. This imports data from the C:\shares\dicomimport folder

Selecting a Commissioning Model by using the Validation Test Plan to Evaluate Slab Density Value

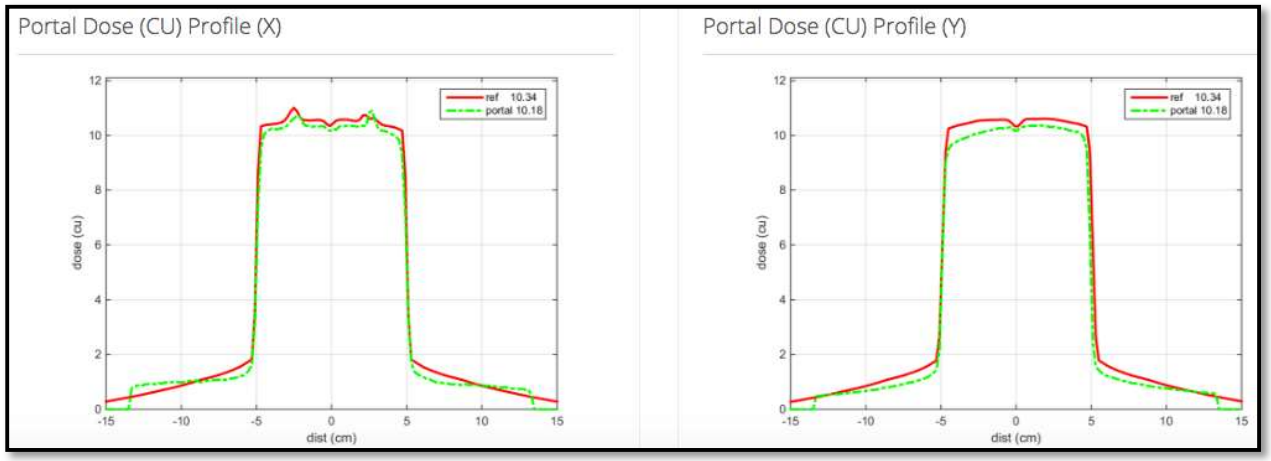
The lateral fields in the validation test plan may be used to select the optimal slab density value for the commissioning model. The lateral fields are used since there is no influence from the treatment couch. The following results demonstrate the difference the slab density value has on the calculation results. The same validation test plan was processed using slab density values of 1.0, 1.03, and 1.05. The X and Y profiles along with the gamma matrix are shown for each result. The LLat90 results are presented first followed by the RLat270 results.



Results for 6 MV LLat 90 with a slab density value of 1.0 entered for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.



Results for 6 MV LLat 90 with slab density of 1.03 entered for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.



Results for 6 MV LLat90 with 1.05 entered for slab density for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.

Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	25.44	35.53	44.47	49.58	58.75	68.06	73.89
dd_cri = 2%	34.64	43.67	51.08	57.86	65.61	72.33	77.61
dd_cri = 3%	61.44	68.08	71.53	73.08	75.69	79.39	83.94
dd_cri = 4%	79.47	85	87.56	88.75	91.17	93.94	96.19
dd_cri = 5%	91.53	97.17	98.33	99.33	100	100	100
dd_cri = 7%	94.08	99	99.56	100	100	100	100
dd_cri = 10%	97.22	100	100	100	100	100	100

Gamma matrix results for 6 MV LLat 90 for 1.0 slab density value entered for the commissioning model.

Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	45.97	56.58	68.31	75	80.86	89.64	94.75
dd_cri = 2%	57.14	67.28	75.97	81.42	86.25	93.94	97.69
dd_cri = 3%	76.53	85.08	91.56	94.61	96.39	98.31	99.69
dd_cri = 4%	87.58	95	97.72	98.53	99.11	99.69	100
dd_cri = 5%	91.64	97.89	99.22	99.64	99.81	99.97	100
dd_cri = 7%	94.58	99.44	99.94	100	100	100	100
dd_cri = 10%	97	99.94	100	100	100	100	100

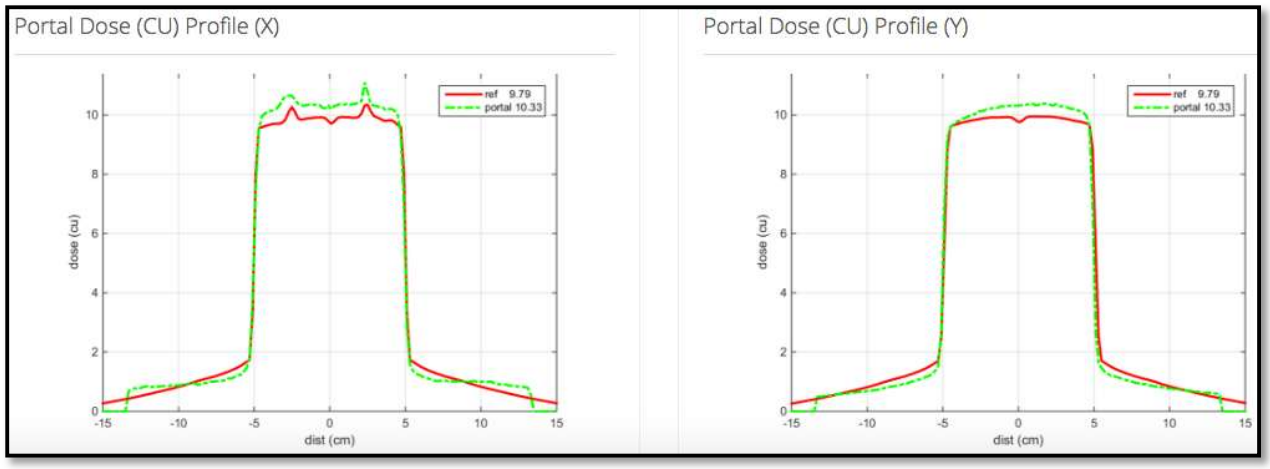
Gamma matrix results for 6 MV LLat90 for slab density value of 1.03 entered for the commissioning model.

Gamma Statistics

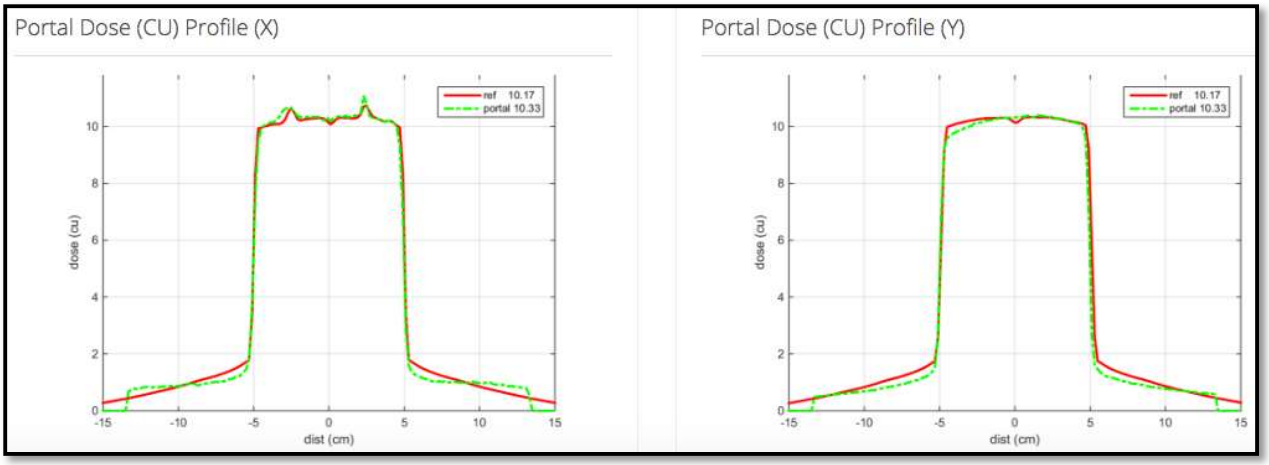
	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	13.89	22.97	31.64	36.42	43.11	55.64	64.89
dd_cri = 2%	22.31	32.47	40.36	47.22	54.11	67.11	78.42
dd_cri = 3%	50.81	60.11	66.14	72.86	78.14	83.58	88.19
dd_cri = 4%	73.36	79.86	83.03	85.83	87.61	90.17	93.08
dd_cri = 5%	81.36	87.42	91.42	92.81	93.78	95.39	97.89
dd_cri = 7%	89.86	96.92	98.67	99.17	99.44	99.83	100
dd_cri = 10%	96.28	99.47	99.94	100	100	100	100

Gamma matrix results for 6 MV LLat 90 for 1.05 entered for slab density value for the commissioning model.

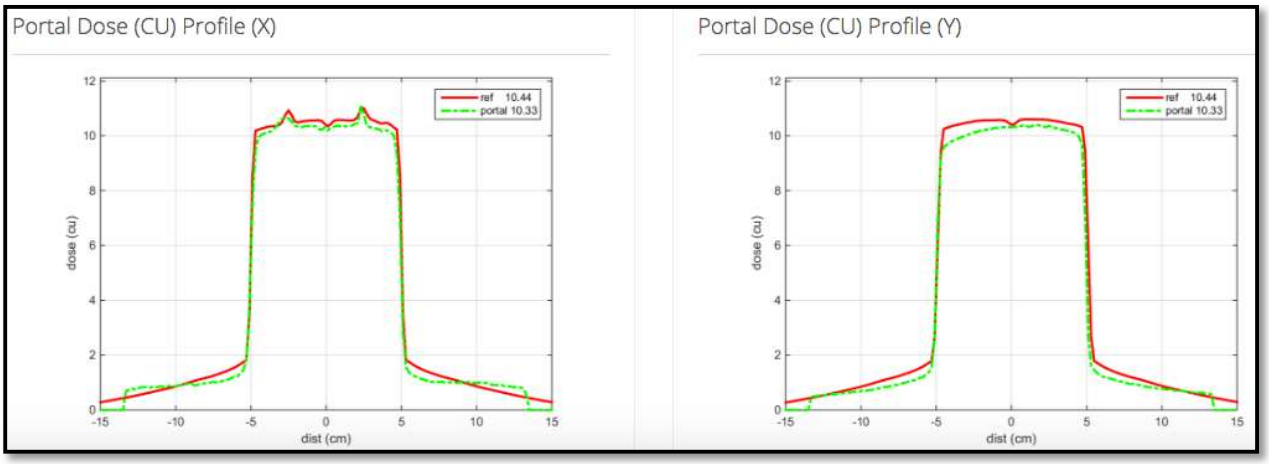
RLat 270 Results:



Results for 6 MV RLat270 for a slab density value of 1.0 entered for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.



Results for 6 MV RLat270 for slab density value of 1.03 entered for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.



Results for 6 MV RLat270 for slab density value of 1.05 entered for the commissioning model. Red line is the predicted portal profile and green line is the measured portal profile.

Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	25.72	35.72	44.83	51.47	57.78	67.03	73.42
dd_cri = 2%	34.25	46.08	51.69	59.06	65.31	71.53	76.89
dd_cri = 3%	59.61	67.08	70.08	71.75	73.78	77.25	81.64
dd_cri = 4%	77.11	83.33	84.39	85.47	86.81	89.53	93.06
dd_cri = 5%	91.17	96.69	97.03	97.28	97.75	99	99.97
dd_cri = 7%	96	99.36	99.44	99.89	100	100	100
dd_cri = 10%	97.28	100	100	100	100	100	100

Gamma matrix result for 6 MV RLat270 for a slab density value of 1.0 entered for the commissioning model.

Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	48.58	60.19	69.67	74.78	83	91.44	96.11
dd_cri = 2%	60.39	70.94	78.25	84.44	89.11	95.53	98.83
dd_cri = 3%	80.56	90.42	94.06	96.19	97.75	98.86	99.67
dd_cri = 4%	89.97	97.5	98.75	99.31	99.56	100	100
dd_cri = 5%	92.19	99.06	99.78	99.94	100	100	100
dd_cri = 7%	94.58	99.72	100	100	100	100	100
dd_cri = 10%	97.11	100	100	100	100	100	100

Gamma matrix result for 6 MV RLat270 for slab density value of 1.03 entered for the commissioning model.

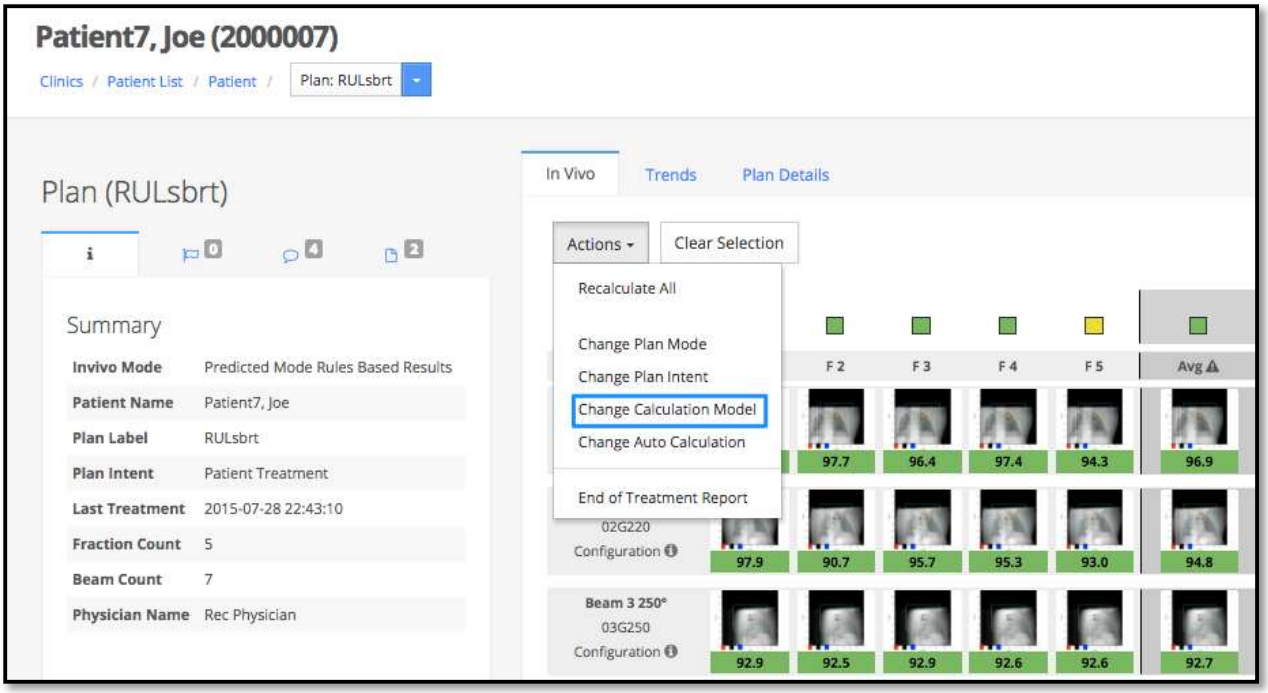
Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	16.14	26.78	34.25	38.72	47.14	58.78	68.86
dd_cri = 2%	28.86	39.22	46.72	52.94	60.92	73.31	82.64
dd_cri = 3%	58.39	68.89	72.64	78	80.97	85.75	90.25
dd_cri = 4%	77.17	84.11	86.61	88.61	89.83	92.14	94.89
dd_cri = 5%	83.86	90.53	93.39	94.58	95.33	96.94	98.78
dd_cri = 7%	91.64	98.44	99.25	99.64	99.92	100	100
dd_cri = 10%	95.94	99.81	100	100	100	100	100

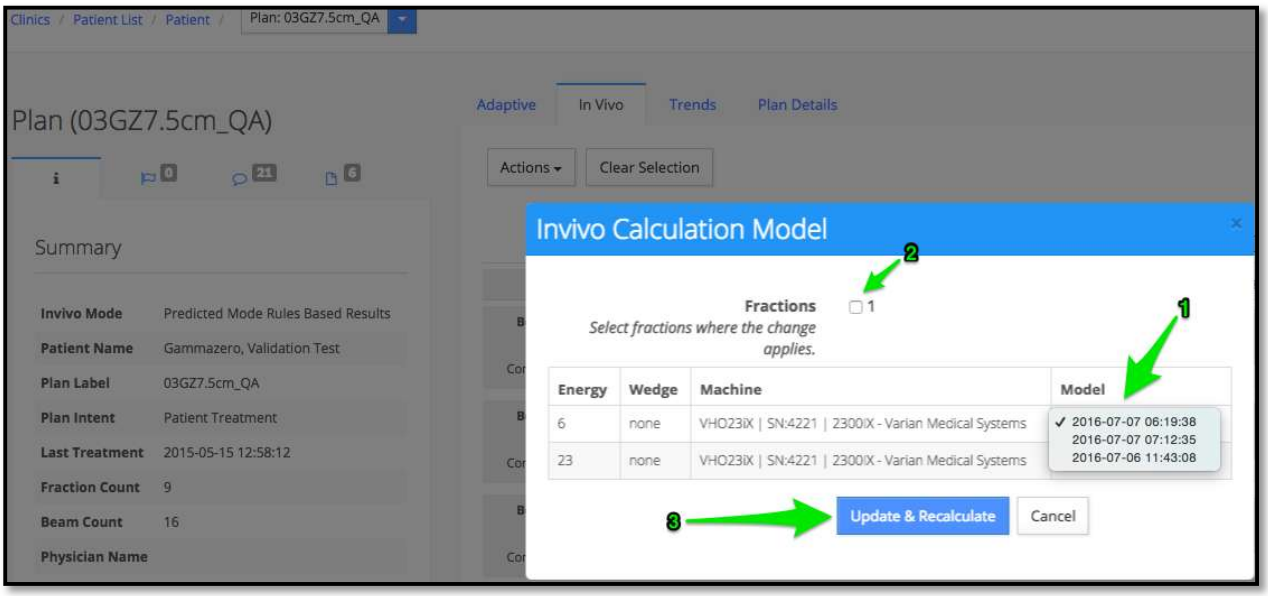
Gamma matrix result for 6 MV RLat270 for slab density value of 1.05 entered for the commissioning model.

Change Calculation Model

If a commissioning model exists for a photon energy and it is either Approved for Non-Clinical Use or Approved for Clinical Use, the model must be manually assigned to be used for calculation. To assign a model to a beam, use the Actions menu on the Fraction Review page and select Change Calculation Model and select a model.



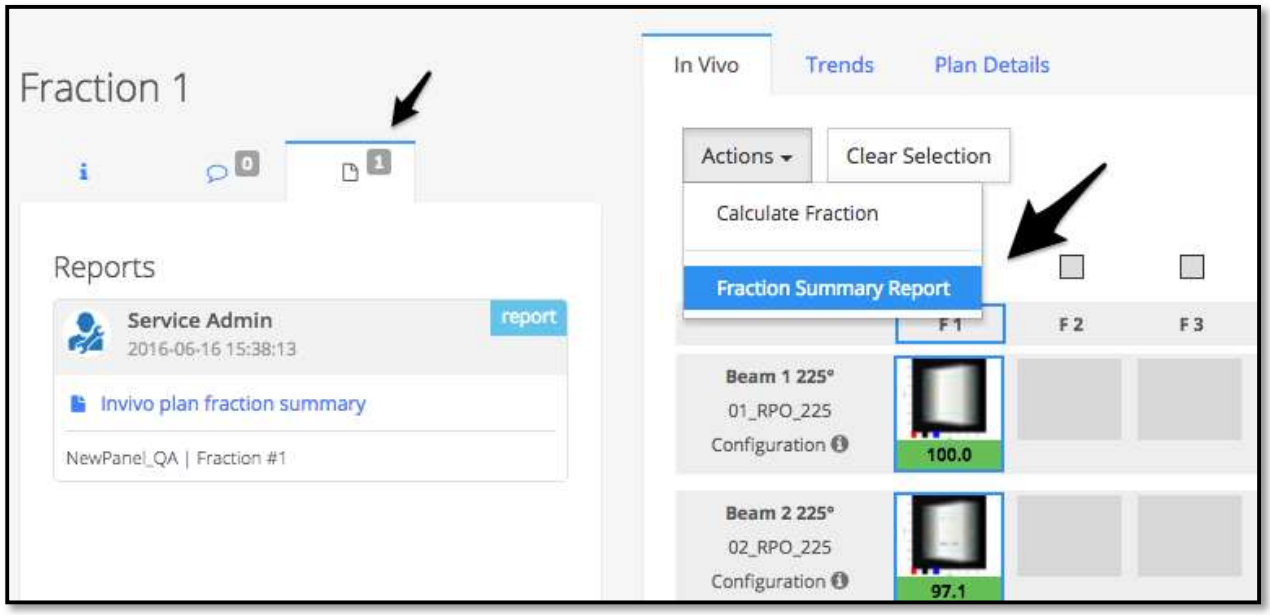
Under Actions menu select Change Calculation Model and select the commissioning model to be used for calculation along with the fractions that should use the commissioning model.



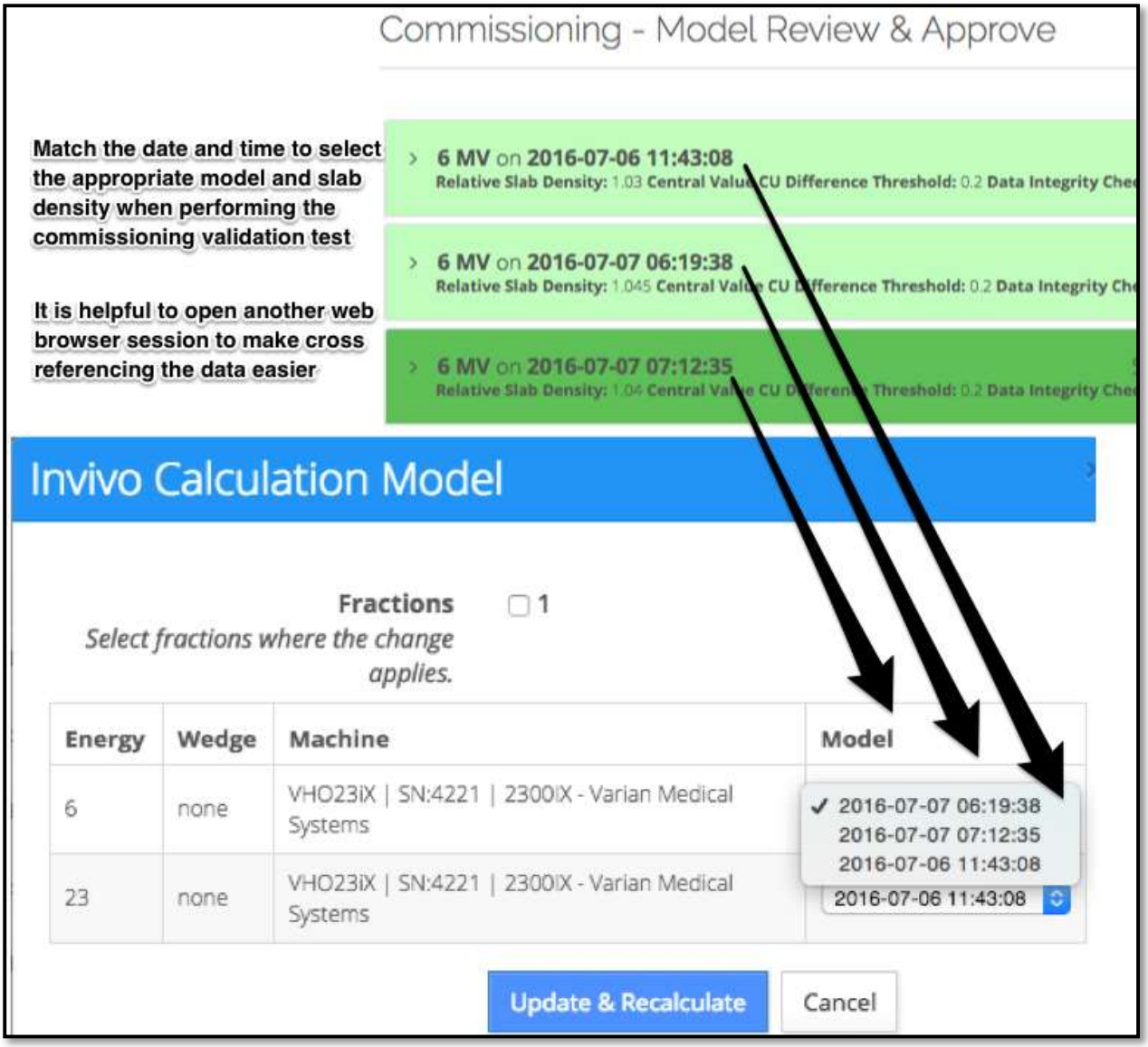
Select the desired model from the choices available. Select the fractions that the model should apply to for this plan. Finally, select Update & Recalculate. Follow the order of operation indicated by the numbers in the figure. If a model is selected but no fractions are selected no recalculation will occur.

Updating Approval Status of a Beam Model

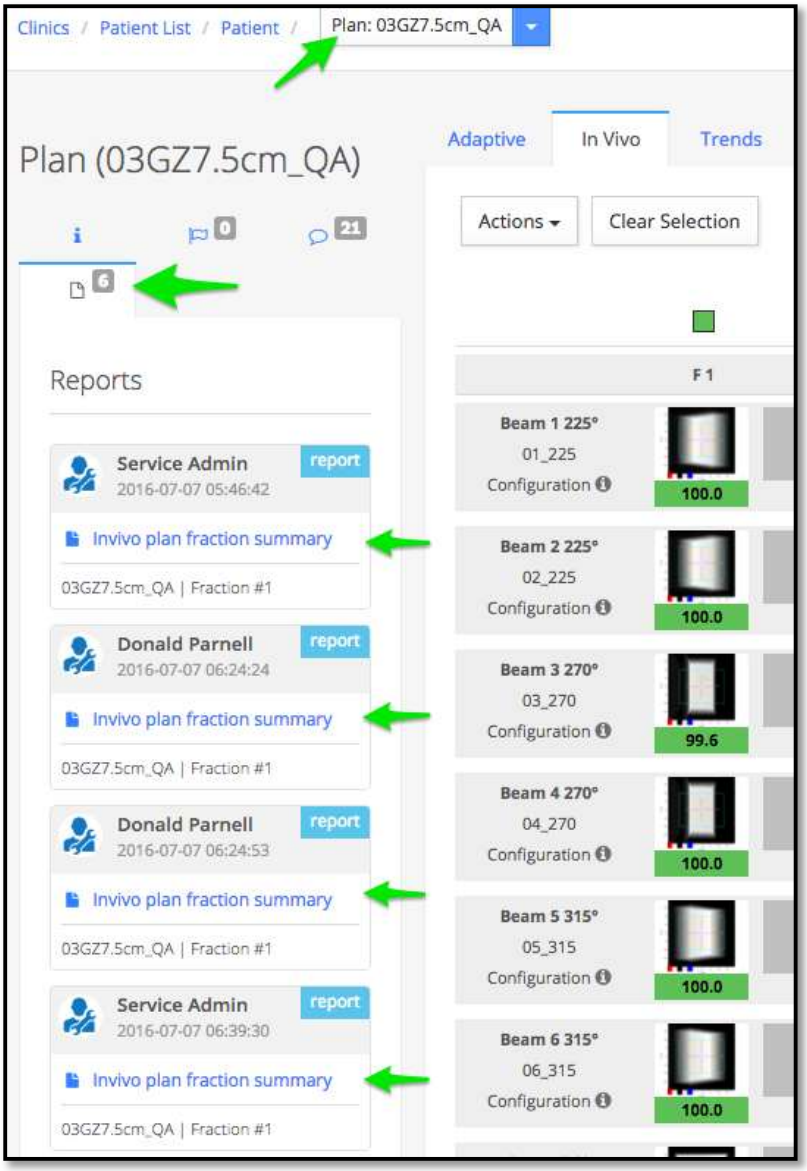
Once the Test Case calculation completes and results are available for review, generate a fraction report and save a pdf version. The Fraction Summary report for each result will be used to compare results with difference slab density values.



To compare commissioning results with different slab densities, calculate the fraction and generate a fraction summary report. Do this for each commissioning model to be compared.

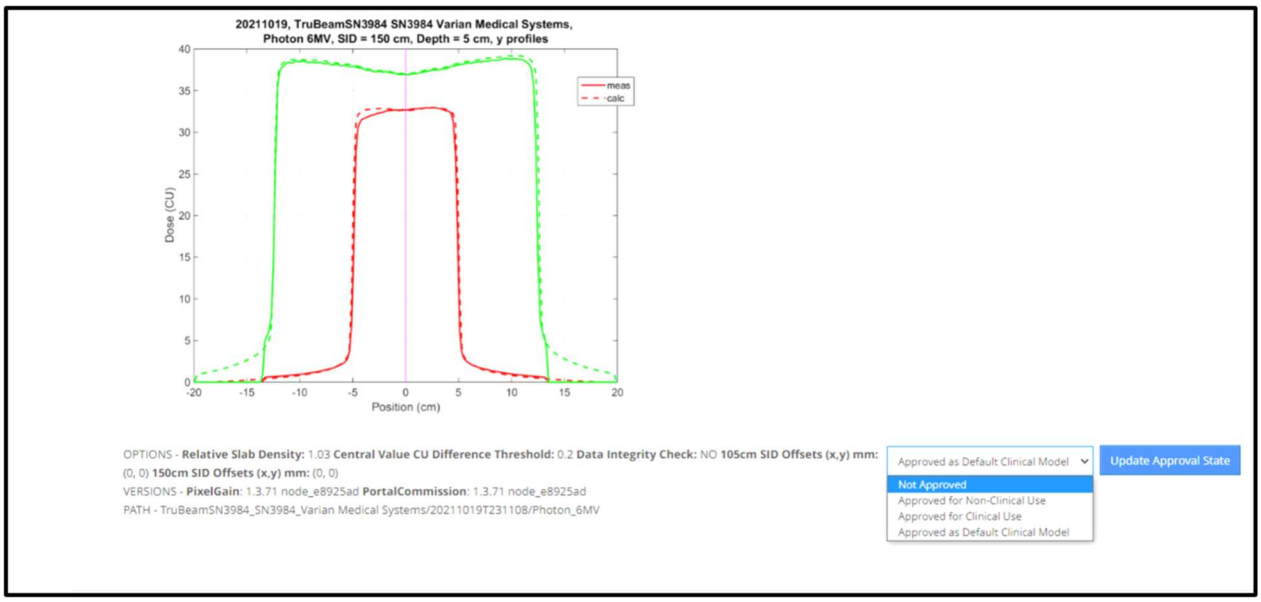


Use two web browser sessions by duplicating the web page to cross reference commissioning models and slab density when changing calculation models while performing the commissioning test case.



Under the plan view, all the fraction summary reports that have been generated are available for review.

Finally, modify approval status of any models used during the commissioning process that should not be used clinically.



Modify approval status of any models used during the commissioning process that should not be used clinically. Set these models to "Not Approved" or "Approved for Non-Clinical Use"

Appendix F: Instruction for Cone Beam CT (CBCT) Calibration

Overview

In order to calculate the volumetric dose on CBCT, the imaging system needs to be calibrated properly. The following is an overview of the procedure as a preliminary step to calibrate the CBCT in various configurations. For step by step instructions, refer to the Procedure Summary page.

Calibration

1. Set up CBCT Modes

Three new CBCT modes should be created, which will be referred to as head, thorax and body techniques below. Each mode should be set up using the maximum (15-17 cm) opening in the longitudinal (superior-inferior) direction and can be generated from existing CBCT modes. Please refer to Varian User Guides for generating CBCT modes if the standard Varian CBCT modes do not already exist and match the tables below, refer to Varian User Guide ***Creating a New Mode***.

NOTE: The CBCT settings are used by Adaptivo to determine which density table to use in the dose calculation. Deviation from the values shown below may prevent dose calculations from occurring for that CBCT mode.

New CBCT Modes for non TrueBeam® linacs,

New CBCT Mode	Adapt Head	Adapt Thorax	Adapt Body
Existing CBCT Mode	Standard Dose Head	Low Dose Thorax	Pelvis
X-Ray Voltage [kVp]	100	100	125
X-Ray Current [mA]	20	20	80
X-Ray Millisecond [ms]	20	20	13
Gantry Rotation Range [degrees]	200	360	360
Number of projections	360	655	655
Exposure (mAs)	145	262	680
CTDIw (mGy/100 mAs)	2.7	1.8	2.6
Dose (cGy)	0.39	0.47	1.77
Fan Type	Full Fan	Half Fan	Half Fan
Bow Tie Filter	FULL	HALF	HALF
Default Pixel Matrix	384 x 384	384 x 384	384 x 384
Slice Thickness [mm]	2.5	2.5	2.5
Reconstruction Filter	Sharp	Standard	Standard
Scan Width	Max (~15-17)	Max (~15-17)	Max (~15-17)
SID	150	150	150

New CBCT Modes for TrueBeam® linacs

New CBCT Mode	Adapt Head	Adapt Thorax	Adapt Body
Existing CBCT Mode	Standard Dose Head	Low Dose Thorax	Pelvis
X-Ray Voltage [kVp]	100	125	125
X-Ray Current [mA]	15	15	60
X-Ray Millisecond [ms]	20	20	20
Gantry Rotation Range [degrees]	200	360	360
Number of projections	500	900	900
Exposure (mAs)	150	270	1080
CTDIw (mGy/100 mAs)	2.11	1.48	1.48
Dose (cGy)	0.32	0.4	0.6-1.6
Fan Type	Full	Half	Half
Bow Tie Filter	Full	Half	Half
Default Pixel Matrix	512 x 512	512 x 512	512 x 512
Slice Thickness [mm]	2	2	2
Reconstruction Filter	Auto	Auto	Auto
Scan Width	Max (~15-19)	Max (~15-19)	Max (~15-19)
SID	150	150	150

2. Calibrate CBCT Modes

Prior to performing any CBCT HU to density calibration, a calibration of the 3 newly added CBCT modes should be performed by a Varian engineer.

The Catphan phantom (The Phantom Laboratory, Salem, NY) may be used to calibrate the HU. Please acquire CBCT for Catphan using all three techniques and assign HU values accordingly.

3. Calibration of HU to electron density

Phantom Configurations

The CIRS® (Computerized Imaging Reference Systems, Inc., Norfolk, VA) CBCT electron density phantom (Model 062MA as shown in the Figure 1) should be used to obtain comprehensive Image Value Density Tables (IVDTs). The phantom comes with 9 types of density plugs (17 in total). Please **ignore** both liver equivalent plugs. Other plugs may be omitted if necessary.

NOTE: Adaptivo requires IVDT values to be monotonically increasing for both HU value and density value. One or more density points may need to be omitted to satisfy this requirement.

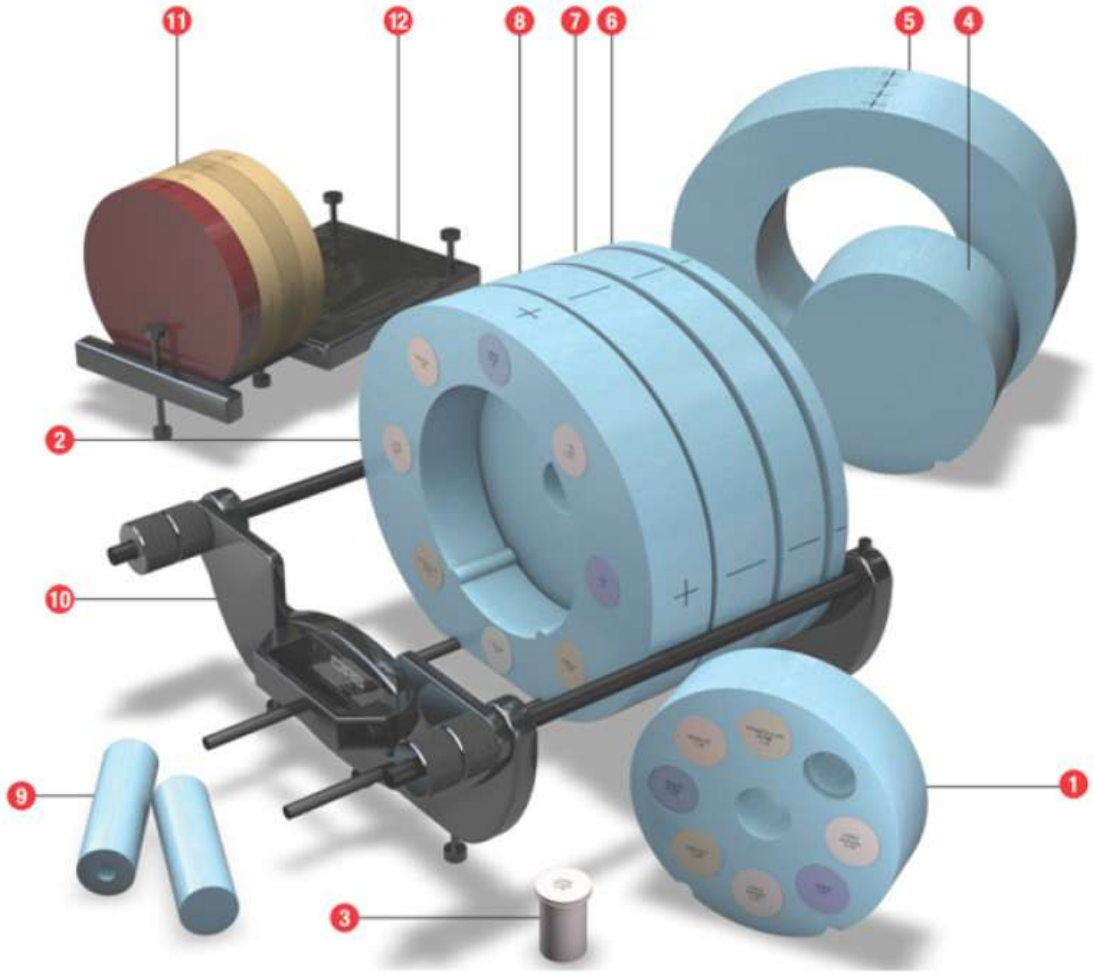


Figure 1. CIRS® CBCT phantom components 1-12

- Part 1 and 4 together is referred as the head phantom. Use 8 different types of plugs and leave one air cavity.
- Part 1 to 10 together is referred as the body phantom. Use all 15 plugs and leave two air cavities.

4. kV (fan-beam) CT acquisitions

Please acquire a kV CT scan of the CIRS head phantom and a kV CT scan of the CIRS® body phantom with density plugs described above. The patient can be named something descriptive, e.g. CRIS head. Export both image sets to your treatment planning system. Take a photo of the density plug arrangement for both the Head and the Body phantom for future reference.

Two Scans Required

1. CIRS® Head Phantom
    a. Density plugs inserted (ignore liver plugs)
    b. Place a cup of water next to the phantom

2. CIRS® Body Phantom
    a. Density plugs inserted (ignore liver plugs)
    b. Place a cup of water next to the phantom

CBCT Acquisitions

Acquire CBCT scans of both CIRS® head and body phantoms using the appropriate image technique (6 scans in total). The phantoms should be placed close to the central axis and if possible a small cup of water should be placed to the right or left of the phantom to provide a real water measurement. These images can be taken under a phantom patient. **Properly align the phantoms to minimize rotational shifts (yaw, pitch, etc.) and do not change the plug positions between kV and CBCT scans.**

Six Scans Required

3. CIRS® Head Phantom
    a. Adapt Head
    b. Adapt Thorax
    c. Adapt Body
4. CIRS® Body Phantom
    d. Adapt Head
    e. Adapt Thorax
    f. Adapt Body

NOTE: For your convenience, a table is provided to record CBCT acquisitions.

Table 1: **Adaptive CBCT IVDT Calibration Image Collection**

Date	Phantom	Plan Name	CBCT Mode	Long. Opening	Bow Tie Filter	Time of CBCT	Notes
Example	Head	CBCT_HN	Adapt Head	17	Full	4:45pm	
	Head		Adapt Head				
	Head		Adapt Thorax				
	Head		Adapt Body				
	Body		Adapt Head				
	Body		Adapt Thorax				
	Body		Adapt Body				

Notes:

2. Complete blank fields, if the field is not blank it is a setup requirement.
3. Adapt CBCT Modes may need to be created. If they are not available use the Varian User Guides to generate them.
4. Bow tie filters should be changed for the appropriate CBCT Mode.
5. Place a cup of water next to the phantom for a real water measurement.

Procedure Summary

1. Acquire kV CT scan of the CIRS® Head Phantom with density plugs. Ignore both liver equivalent plugs.
    a. Place a cup of water to the right or left of the phantom for a real water measurement.
    b. Take a photo of density plug arrangement.
2. Acquire kVCT scan of the CIRS® Body Phantom. Ignore both liver equivalent plugs.
    a. Take a photo of density plug arrangement.
3. DICOM export the image sets to your treatment planning computer.
4. Generate a treatment plan for both the Head phantom and the Body phantom and schedule CBCTs for both in ARIA®.
    a. 1 treatment plan for Head phantom
    b. 1 treatment plan for Body phantom
    c. Treatment plan is only used to schedule CBCTs on the linac. The quality of the plan is not relevant nor is any beam geometry. Use a prescription that will allow for at least 25 fractions so that there are plenty of CBCT procedures available.

5. 6 CBCT Scans required- use maximum longitudinal opening and place a cup of water to the right or left of the phantom for a real water measurement. Do not change the density plug arrangement from what was used for the kV CTs. The cup of water needs to be as close as possible to the phantom so that a portion of it will be included in the FOV.
    a. Register the CBCT to the planning image, apply shifts and save match.
        i. CIRS® Head Phantom/ Head phantom treatment plan
            1. 3 CBCTs required
                a. CBCT Mode: Adapt Head
                b. CBCT Mode: Adapt Thorax
                c. CBCT Mode: Adapt Body
        ii. CIRS® Body Phantom/ Body phantom treatment plan
            1. 3 CBCTs required
                a. CBCT Mode: Adapt Head
                b. CBCT Mode: Adapt Thorax
                c. CBCT Mode: Adapt Body
    b. Use Table 1 to record necessary CBCT procedure information
6. Export all scans to a treatment planning computer and measure HU values for all plugs.
    a. Use Table 2 to record HU values

Table 2: **Adaptive CBCT IVDT Values**

Material	**Relative Electron Density***	**kV Scan of CIRS® Head**	**CBCT of CIRS® Head**			**kV Scan of CIRS® Body**	**CBCT of CIRS® Body**		
		CT simulation	Adapt Head	Adapt Thorax	Adapt Body	CT simulation	Adapt Head	Adapt Thorax	Adapt Body
Air									
Lung Inhale									
Adipose									
Breast									
Muscle									
Bone 200									
Bone 800									
Water									

*Verify current Relative Electron Density (RED) values for the CIRS®plugs.

Appendix G: Dose Tolerance Criteria

The information below is the defined default dose tolerance criteria configured in Adaptivo. If the criteria are not met, a flag will be generated.

[^-] indicates that a prefix can be used; e.g. R Eye, L Eye, L Lung etc.

Head and Neck

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
optic chiasm	Dmax	<=		50.0
[^-]optic nerve	Dmax	<=		50.0
pituitary fossa	D5%	<=		50.0
temporal lobe	Dmax	<=		65.0
[^-]cochlea	D5%	<=		55.0
[^-]lens	Dmax	<=		7.0
[^-]eye	Dmax	<=		50.0
brainstem	Dmax	<=		60.0
cord	Dmax	<=		50.0
brachial plexus	Dmax	<=		66.0
brachial plexus	D5%	<=		60.0
[^-]parotid	Dmean	<=		25.0
larynx	Dmean	<=		45.0
larynx	Dmax	<=		66.0
pharynx	Dmean	<=		45.0
pharynx	D33%	<=		50.0
pharynx	D15%	<=		60.0
lips	Dmean	<=		20.0
lips	Dmax	<=		30.0
oral cavity	Dmean	<=		30.0
esophagus	Dmean	<=		35.0
esophagus	D15%	<=		54.0
esophagus	D33%	<=		45.0
mandible	Dmax	<=		75.0

Breast

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
cord	Dmax	<=		50.0
brachial plexus	Dmax	<=		66.0
brachial plexus	D5%	<=		60.0
[^-]lung	D20%	<=		20.0
heart	D15%	<=		15.0
contralateral breast	Dmax	<=		5.0

Brain

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
[^-]optic nerve	Dmax	<=		55.0
optic chiasm	Dmax	<=		55.0
[^-]cochlea	D5%	<=		55.0
[^-]lens	Dmax	<=		7.0
[^-]eye	Dmax	<=		50.0
brainstem	Dmax	<=		60.0
cord	Dmax	<=		50.0
brain	Dmax	<=		72.0

Lung and Mediastinum

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
lungs-PTV	Dmean	<=		20.0
lungs-PTV	D37%	<=		20.0
lung	Dmean	<=		15.0
esophagus	Dmean	<=		34.0
heart	D33%	<=		60.0
heart	D67%	<=		45.0
heart	D100%	<=		40.0
brachial plexus	Dmax	<=		66.0
brachial plexus	D5%	<=		60.0
spinal cord	Dmax	<=		50.0
liver	Dmean	<=		30.0

Esophagus

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
heart	D50%	<=		40.0
cord	Dmax	<=		45.0
lung	D25%	<=		20.0
lung	Dmean	<=		15.0
liver	Dmean	<=		30.0

Abdomen

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	

[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
lungs	D30%	<=		20.0
lungs	Dmean	<=		18.0
heart	D50%	<=		40.0
liver	Dmean	<=		30.0
stomach	Dmax	<=		54.0
stomach	D10%	<=		50.0
stomach	D15%	<=		45.0
small bowel	Dmax	<=		54.0
kidneys	D70%	<=		20.0
cord	Dmax	<=		45.0

Pelvis

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
small bowel	Dmax	<=		50.0
R kidney	D50%	<=		18.0
L kidney	D50%	<=		18.0
rectum	D5%	<=		50.0
bladder	Dmax	<=		50.0
bladder	D5%	<=		50.0
bladder	D35%	<=		40.0
bladder	D50%	<=		35.0
femoral heads	Dmax	<=		50.0
femoral heads	D5%	<=		44.0
femoral heads	D35%	<=		40.0
femoral heads	D50%	<=		30.0
cauda equine	Dmax	<=		50.0
iliac crests	D5%	<=		50.0
iliac crests	D35%	<=		40.0
iliac crests	D50%	<=		30.0
external genitalia	D50%	<=		20.0
external genitalia	D35%	<=		30.0
external genitalia	D5%	<=		40.0

Prostate

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
rectum	D5%	<=		75.0
rectum	D20%	<=		65.0
rectum	D50%	<=		50.0
bladder	D20%	<=		70.0
bladder	D50%	<=		60.0
penile bulb	Dmean	<=		52.5
femoral heads	Dmax	<=		50.0

Spine

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D100%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	5.0	
[^-]ptv	Dmean	<	-5.0	
spinal cord	Dmax	<=		50.0
brachial plexus	Dmax	<=		66.0

Sarcoma

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	>	5.0	
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
femoral heads	D5%	<=		60.0
anus	D50%	<=		30.0
vulva	D50%	<=		30.0
testis	D50%	<=		3.0
kidneys	D50%	<=		14.0

skin	D50%	<=		20.0
joint	D50%	<=		50.0
bone	D50%	<=		50.0

Other

ROI Label	Metric	Comparison	Relative to plan value (%)	Absolute Dose (Gy)
[^-]ctv	D98%	<	-5.0	
[^-]ptv	D95%	>	10.0	
[^-]ptv	D95%	<	-10.0	
[^-]ptv	Dmean	>	10.0	
[^-]ptv	Dmean	<	-10.0	
brainstem	Dmax	<=		54.0
cord	Dmax	<=		45.0
cauda equina	Dmax	<=		50.0
brain	Dmax	<=		85.0
lens	Dmax	<=		7.0
retina	Dmax	<=		45.0
R optic nerve	Dmax	<=		54.0
L optic nerve	Dmax	<=		54.0
optic chiasm	Dmax	<=		54.0
pituitary	Dmax	<=		70.0
R parotid	Dmean	<=		25.0
L parotid	Dmean	<=		25.0
mandible	Dmax	<=		70.0
super pharyngeal constrictors	Dmean	<=		60.0
larynx	Dmean	<=		50.0
oral cavity	Dmean	<=		50.0
lips	Dmax	<=		50.0
temporomandibular joint	Dmax	<=		60.0
brachial plexus	Dmax	<=		66.0
lungs – GTV	D30%	<=		20.0
lungs – GTV	Dmean	<=		18.0
lung	D25%	<=		20.0
lung	Dmean	<=		15.0
trachea	Dmax	<=		90.0
esophagus	D40%	<=		50.0
esophagus	Dmean	<=		34.0
heart	D50%	<=		40.0
great vessels	Dmax	<=		90.0
liver	Dmean	<=		30.0
stomach	D25%	<=		60.0

small bowel	Dmax	<=		50.0
rectum	D35%	<=		60.0
rectum	D25%	<=		70.0
rectum	D15%	<=		75.0
kidneys	D50%	<=		20.0
kidneys	Dmean	<=		18.0
R kidney	D50%	<=		18.0
L kidney	D50%	<=		18.0
bladder	D50%	<=		65.0
bladder	D25%	<=		75.0
bladder	Dmax	<=		85.0
penile bulb	D90%	<=		50.0
ovaries	Dmax	<=		6.0
testicles	Dmax	<=		3.0
femoral heads	Dmax	<=		55.0
whole joint	Dmax	<=		50.0
epiphyseal plates	Dmax	<=		18.0

IMPORTANT: If an OAR is not labeled in the Dose Tolerance Criteria it is not configured to be flagged. If the ROI needs to be monitored, manually review the patient or manually add additional Dose Tolerance Criteria to enable flagging of the desired ROI.

WARRANTY STATEMENT- 4424-18

Standard Imaging, Inc. sells this product under the warranty herein set forth. The warranty is extended only to the buyer purchasing the product directly from Standard Imaging, Inc. or as a new product from an authorized dealer or distributor of Standard Imaging, Inc.

For a period provided in the table below from the date of original delivery to the purchaser or a distributor, this Standard Imaging, Inc. product, provided in the table, is warranted against functional defects in design, materials and workmanship, provided it is properly operated under conditions of normal use, and that repairs and replacements are made in accordance herewith. The foregoing warranty shall not apply to normal wear and tear, or if the product has been altered, disassembled or repaired other than by Standard Imaging, Inc. or if the product has been subject to abuse, misuse, off label use, negligence or accident.

Product	**Warranty Period**
Standard Imaging Ionization Chambers	5 years
Standard Imaging Detectors	1 year
Standard Imaging Well Chambers	2 years
Standard Imaging Electrometers	5 years
Standard Imaging BeamChecker Products	2 years
TomoScanner and TomoElectrometer	2 years
Standard Imaging Software Products	1 year
All Other Standard Imaging Products	1 year
Standard Imaging Custom Products	1 year
Standard Imaging Remanufactured Products	180 days
Standard Imaging Custom Select Products	90 days
Consumables	90 days
Serviced Product	90 days (for service performed)
Resale Products	As defined by the Original Equipment Manufacturer
ADCL Product Calibration (Standard Imaging uses the UW-ADCL for recalibrations required under warranty, unless otherwise requested)	0 - 90 days = 100% of ADCL Calibration Costs 91 - 182 days = 75% of ADCL Calibration Costs 183 – 365 days = 50% of ADCL Calibration Costs 366 – 639 days = 25% of ADCL Calibration Costs (days from date of shipment to customer)

Standard Imaging's sole and exclusive obligation and the purchaser's sole and exclusive remedy under the above warranties are, at Standard Imaging's option, limited to repairing, replacing free of charge or revising labeling and manual content on, a product: (1) which contains a defect covered by the above warranties; (2) which are reported to Standard Imaging, Inc. not later than seven (7) days after the expiration date of the warranty period in the table; (3) which are returned to Standard Imaging, Inc. promptly after discovery of the defect; and (4) which are found to be defective upon examination by Standard Imaging Inc. All transportation charges (including customs, tariffs, duties and brokerage fees) are the buyer's responsibility. This warranty extends to every part of the product excluding consumables

(fuses, batteries, or glass breakage) or material reactions. Standard Imaging, Inc. shall not be otherwise liable for any damages, including but not limited to, incidental damages, consequential damages, or special damages. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

This warranty is in lieu of all other warranties, express or implied, whether statutory or otherwise, including any implied warranty of fitness for a particular purpose. In no event shall Standard Imaging, Inc. be liable for any incidental or consequential damages resulting from the use, misuse or abuse of the product or caused by any defect, failure, malfunction or material reactions of the product, whether a claim of such damages is based upon the warranty, contract, negligence, or otherwise.

This warranty represents the current standard warranty of Standard Imaging, Inc. Please refer to the labeling or instruction manual of your Standard Imaging, Inc. product or the Standard Imaging, Inc. web page for any warranty conditions unique to the product.

Serialization Information

Standard Imaging products that are serialized contain coded logic in the serial number which indicates the product, day and year of manufacture, and a sequential unit number for identification:

A YY DDD X
A Unique product ID
YY Last two digits of the year
(e.g. 1999 = 99, 2000 = 00)
DDD Day of the year (1≤ DDD ≤ 365)
X Unique unit ID number (0 ≤ X ≤ 9)

Customer Care Policy Statement

Standard Imaging, at its discretion, may extend customer support only to the buyer purchasing the product directly from Standard Imaging, Inc. or as a new product from an authorized dealer or distributor of Standard Imaging, Inc. This customer care statement is in lieu of all other customer support statements, express or implied, whether statutory or otherwise, including any implied statements of fitness for a particular purpose.

Standard Imaging:

- Technical support is preferentially biased to those customers with valid and applicable Standard Imaging Certificate of Maintenance agreements.
- Technical support may range from providing detailed solutions to upgrade recommendations to the latest version of software for discontinued products.
- Will, at a minimum, provide technical support during its normal hours of operation.
- May, at its discretion, limit support of ancillary systems beyond its direct control, such as information technology systems, database management and 3rd party programs.
- Will provide technical support for the product for a minimum of 7 years from the date of delivery or discontinuance.
- Will not provide technical support for obsolete products, those products which are 7 years past the date of discontinuance.
- Will provide technical support for any and all involving issues with significant product risk, regardless of product age.

This customer care statement represents the current standard customer care statement of Standard Imaging, Inc. Please refer to the labeling or instruction manual of your Standard Imaging, Inc. product or the Standard Imaging, Inc. web page for any customer care statement conditions unique to the product. Specifications subject to change without notice.

Customer Responsibility

This product and its components will perform properly and reliably only when operated and maintained in accordance with the instructions contained in this manual and accompanying labels. A defective device should not be used. Parts which may be broken or missing or are clearly worn, distorted or contaminated should be replaced immediately with genuine replacement parts manufactured by or made available from Standard Imaging Inc.

⚠ CAUTION: Federal law in the U.S.A. and Canadian law restrict the sale, distribution, or use of this product to, by, or on the order of a licensed medical practitioner. The use of this product should be restricted to the supervision of a qualified medical physicist.

⚠ CAUTION: As desired by IAEA, English is the default language for labeling and manuals. If translated versions are available, resolve any differences in favor of the English versions.

⚠ WARNING: Standard Imaging products are intended for radiation quality assurance for healthcare uses. They are not designed and/or labeled for the purpose of medical diagnosis and/or treatment. Diagnosis and/or treatment decisions are the direct responsibility of the attending and licensed medical professional.

⚠ WARNING: Measurement of high activity radioactive sources is potentially hazardous and should be performed by qualified personnel.

⚠ WARNING: Proper use of this device depends on careful reading of all instructions and labels.

⚠ WARNING: Where applicable, Standard Imaging products are designed to be used with the versions of common radiation delivery devices, treatment planning systems and other products or systems used in the delivery of ionizing radiation, available at the time the Standard Imaging product is released. Standard Imaging does not assume responsibility, liability and/or warrant against, problems with the use, reliability, safety or effectiveness that arise due to the evolution, updates or changes to these products or systems in the future. It is the responsibility of the customer or user to determine if the Standard Imaging product can be properly used with these products or systems.

⚠ Should repair or replacement of this product become necessary after the warranty period, the customer should seek advice from Standard Imaging Inc. prior to such repair or replacement. If this product is in need of repair, it should not be used until all repairs have been made and the product is functioning properly and ready for use. After repair, the product may need to be calibrated. The owner of this product has sole responsibility for any malfunction resulting from abuse, improper use or maintenance, or repair by anyone other than Standard Imaging Inc.

Standard Imaging will make numerous and reasonable attempts to contact a customer following completed manufacture or service of a product. Should a customer product remain at Standard Imaging for more than 1 year following its completed manufacture or service, Standard Imaging reserves the right to resell, restock, donate, discard or destroy the product.

If, in relation to the use of this product, a death or a serious deterioration of health has occurred, this should be reported to Standard Imaging, Inc. and the National Competent Authority of the country in

which the incident occurred. When in doubt, please consult with an advisor or reach out to Standard Imaging, Inc. for further assistance.

The information in this manual is subject to change without notice. Please see www.standardimaging.com for the latest information. No part of this manual may be copied or reproduced in any form or by any means without prior written consent of Standard Imaging Inc.

Service Policy

If service, including recalibration, is required, please contact Standard Imaging's Customer Service department by phone or email prior to shipping the product. Standard Imaging's Customer Service and Technical Service staff will attempt to address the product issue via phone or email. If unable to address the issue, a return material authorization (RMA) number will be issued. With the RMA number, the product can be returned to Standard Imaging. It is the responsibility of the customer to properly package, insure and ship the product, with the RMA number clearly identified on the outside of the package. The customer must immediately file a claim with their carrier for any shipping damage or lost shipments. Return shipping and insurance is to be pre-paid or billed to the customer, and the customer may request a specific shipper. Items found to be out of warranty are subject to a minimum service fee of 1 hour labor (excluding recalibrations) for diagnostic efforts and require a purchase order (PO) before service is performed. With concurrence from customer, the product may be replaced if it is unserviceable or if the required service is cost prohibitive. Products incurring service charges may be held for payment. Standard Imaging does not provide loaner products. See the Standard Imaging Warranty and Customer Responsibility for additional information.

Return Policy

No merchandise will be accepted for credit without prior approval of return. Please contact Standard Imaging's Customer Service Department to receive a return authorization number before returning any merchandise for exchange or credit. Products manufactured by Standard Imaging must be returned within thirty days of receipt of order in 'like new' condition. No credit will be given for products returned after thirty days from receipt of order. A minimum twenty percent restocking fee will be charged on all returned merchandise. All materials returned must be shipped pre-paid. Credit for returned goods will be issued to customer's account for use against future purchases of merchandise only. Special orders, custom products, re-sale (not manufactured by Standard Imaging) products, and ADCL calibrations will not be accepted for return credit or exchange.

All products may not be registered, cleared, licensed or approved for sale in all countries or territories. Please contact Standard Imaging Customer Care for details.

SOFTWARE LICENSE AGREEMENT

Contains licensed program materials of Standard Imaging, Inc.

This software is protected by U.S. and international copyright laws, international treaties, FDA and international regulations, and other intellectual property laws and treaties. This is a software license agreement to use the software product or products (the product) enclosed in this package and described in the applicable purchase order or other ordering document, unless otherwise specified in the product labeling.

Standard Imaging (SI), Inc., a Wisconsin corporation hereby grants to the purchaser of the product (Licensee) the right to use the product, together with its documentation and other related materials, only in connection with the computers or computer network system located at the site of use (the site) previously designated as such by Licensee and only if in strict compliance with the terms and conditions set forth below. Any purchase and installation or use of the product shall constitute acceptance of and agreement by Licensee to be bound by the terms and conditions hereof. Licensee also agrees that the agreement terms and conditions will prevail in the event of any conflict between the agreement and applicable purchase order or other ordering documents.

All rights not specifically granted to licensee under this software license agreement are reserved by SI. The SI documented Warranty and Customer Responsibility statements shall be considered to be part of this agreement. The term of this agreement and the licenses granted hereunder will continue in perpetuity, unless sooner terminated by SI.

Licensee shall:

a. Use the product only on the authorized number of computers, network systems or number of linear accelerators at the site of use as provided in the related product and/or sales documentation;
b. Make backup copies of the product only for back-up, recovery and archival purposes;
c. Authorize SI to use non-patient related data compiled, free of charge, from the Licensee's use of the product for its own use, shared use with other medical device manufacturers for quality assurance purposes and/or the independent promotion of scientific knowledge, provided that SI does not identify the name of the Licensee to the general public;
d. Authorize SI to communicate to the Licensee via email regarding the product.

Licensee may not and shall not:

a. Make copies of the product, except as otherwise permitted herein;
b. Rent, lease, sub-lease or otherwise permit any third party to use the product;

c. Redistribute any portion of the product, its software programs, documentation, or other related materials;
d. Other than as set forth in section 1.b. above, copy the product, any of its software programs, documentation or other related materials, without the express written permission of SI;
e. Remove or obscure copyright and/or trademark notices appearing on the product;
f. Reverse engineer the product in order to derive or appropriate for any reason or purpose the source code or any other trade secret or other proprietary information;
g. Transfer the software program of the product to another site or to a third party purchaser without the express written permission of SI and agreement to all the terms and conditions of the then current software license agreement utilized by SI by the authorized representative of the new site or such third party.

The licensee shall be solely responsible for the installation of the product and any updates provided by SI. SI shall provide telephone technical support for the product for a period of (1) one year from the date of shipment. Any updates, upgrades and new releases to the product within the period of (1) year from date of shipment will be provided at no additional costs. After the expiration of the period of (1) year from the date of shipment, SI will provide technical support, and updates, upgrades and new releases for an additional fee.

SI shall not be liable for any amount in excess of the product costs actually paid by the licensee giving rise to any claims hereunder. In no event shall SI be liable, whether in contract, tort or otherwise for any indirect, incidental or consequential damages arising out of the subject matter of this agreement.

In the event of breach by Licensee of any of the terms and conditions of this software license agreement, SI shall be entitled to enforce all legal rights and remedies conferred upon it by State of Wisconsin, federal, and/or international law. SI and Licensee acknowledge that because breach by Licensee of any of the terms or conditions of this agreement will likely cause irreparable harm to SI, injunctive relief would be an appropriate remedy for SI resulting from any such breach by Licensee. In the event that action, suit, or legal proceedings are initiated or brought to enforce any or all of the provisions of this agreement, the prevailing party shall be entitled to such attorney's fees, costs, and disbursements as are deemed reasonable and proper by a court of law or an arbitrator. In the event of an appeal of an initial decision of a court or of an arbitrator, the prevailing party shall be entitled to such attorney's fees, costs, and disbursements as are deemed reasonable and proper by such appellate court.

Notwithstanding the foregoing, in the event of any breach by Licensee of the terms and conditions of this agreement, SI may, upon reasonable advance written notice to Licensee (which in no event shall be less than (30) thirty days), terminate this license. Upon such termination by SI, Licensee shall furnish SI with a sworn affidavit stating that all of the product, including, without limitation, its software program(s), documentation and other related material and any copies thereof, have been returned by certified mail, return receipt requested to SI or destroyed by Licensee.

This agreement shall be deemed executed in the State of Wisconsin and shall be interpreted and construed in accordance with the laws of the State of Wisconsin. If any provision of this agreement is judicially declared to be invalid, unenforceable, or void by a court of competent jurisdiction, such decision shall not have the effect of invalidating or voiding the remainder of this agreement and the part or parts of this agreement so held to be invalid, unenforceable, or void shall be deemed to be deleted from this agreement and the remainder of this agreement shall have the same force and effect as if such part or parts had never been included.

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