RAYSTATION 11A

RayCommand 2A Instructions For Use

RayCommand

2A

Declaration of conformity

CE 0413

Complies with 93/42/EEC Medical Device Directive as amended by M1 to M5. A copy of the corresponding Declaration of Conformity is available on request.

Safety notices

This user documentation contains WARNINGS concerning the safe use of the product. These must be followed.

<div style="border:1px solid black">

⚠️ **WARNING!**

The general warning sign informs you of a risk for bodily harm. In most cases the risk is related to mistreatment of the patient.

</div>

Note: *The note gives additional information concerning a specific topic, for example, things to consider when performing a certain step in an instruction.*

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RaySearch Laboratories

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1 INTRODUCTION

About RayCommand

The RayCommand application integrates with RayCare to allow the clinic to deliver plans created in RayStation as treatment sessions on treatment systems with a patient positioning system.

This manual describes the parts of the workflow that are directly related to the delivery of treatment plans and controlling the patient positioning system:

- Handling treatment appointments created in RayCare

- Preparation of the patient positioning system for imaging and delivery in RayCommand

- Performing treatment delivery in RayCommand

- Monitoring the treatment machine and patient positioning system using the RayCommand Machine monitor

About this manual

This document is an addition to *RSL-D-RS-11A-USM, RayStation 11A User Manual* and summarizes some of the most important features of the RayCommand application.

Study this manual and the *RSL-D-RS-11A-IFU, RayStation 11A Instructions for Use* carefully before using the RayCommand application. Proper functioning of the device can only be guaranteed if the instructions in these documents are adhered to.

Study the Release Notes in this manual as well as the *RSL-D-RS-11A-RN, RayStation 11A Release Notes* carefully. These notes provide final instructions on how to use the RayCommand application.

The RayStation 11A system is further described in the RayStation 11A product documentation.

Refer to the RayCare 5A product documentation for information about the RayCare 5A system.

2   PRODUCT INFORMATION

This chapter describes the RayCommand product label. For product information regarding the RayStation 11A system, refer to the *RSL-D-RS-11A-IFU, RayStation 11A Instructions for Use*.

The version number of an installed RayStation 11A system can be found by choosing **Help: About RayStation** in the RayCommand menu.

The following information can be identified:

- Product name = RayStation

- 产品型号: RayStation (for the Chinese market only)

- Release version = **11.0**

- Marketing name = RayStation RayCommand 2A

- Software build number = **11.0.0.951**

- Clinical build = Indicates that the software is designed for clinical use.

  Note: A clinical installation requires both a clinical build and a clinical license. Otherwise, 'Not for clinical use' will be displayed in the title bar.

- Product Lifetime = The lifetime per market is one year after the next major release, but no less than three years

- Radiation Treatment Planning System Software = The generic name of the product

- 产品名称: 放射治疗计划系统软件 (for the Chinese market only)

- MD = Indicates that the product is a medical device

- UDI = Unique Device Identification number

- CE 0413 = The CE mark and the notified body number

- = Production date

- = Consult instructions for use

- = The name and address of the manufacturer

- @ = The support e-mail address
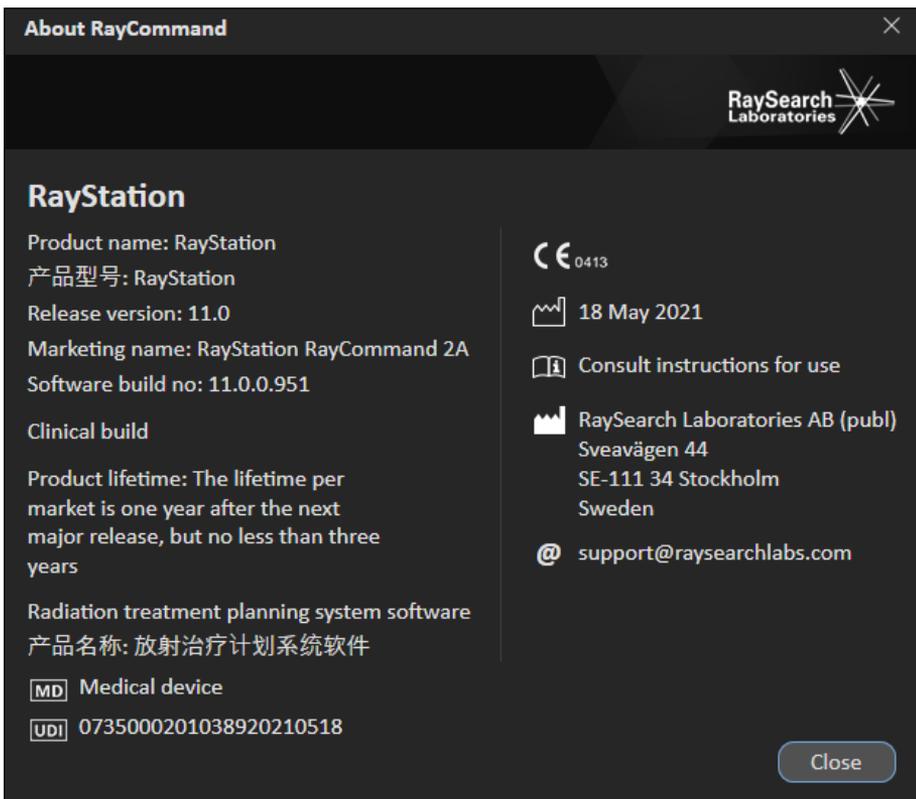
Figure 1.   The **About RayCommand** dialog.

3   INFORMATION NEEDED FOR SAFE OPERATION

Adhere to the following warnings as well as the warnings described in *RSL-D-RS-11A-IFU, RayStation 11A Instructions for Use* for safe operation of the RayCommand application.

3.1   SAFETY PRECAUTIONS

3.1.1   General warnings

> **WARNING!**
>
> **Ensure sufficient training.** The user organization shall ensure that individuals authorized to perform treatment functions are appropriately trained for the functions they perform. Only individuals authorized to enter and accept machine setup or other patient treatment data should use this software. Carefully read all instructions prior to use. The user is responsible for proper clinical use and the prescribed radiation dose.
>
> (334374)

3

> **WARNING!**
>
> **Installation and reconfiguration testing.** The correct functioning of RayCommand depends on configuration and external systems. Configuration changes in RayCommand, RayCare or RayStation require testing according to *RSL-D-RS-11A-RCMDITS, RayStation 11A RayCommand 2A Installation Test Specification*.
>
> (334371)

> **WARNING!**
>
> **Ensure unobstructed view of patient.** Always ensure unobstructed view of the patient before and during irradiation or any other activity related to risk of patient safety.
>
> (334373)

> **WARNING!**
>
> **Only results from completed treatment sessions are displayed in RayCare.** The results of the treatment sessions will not be displayed in RayCare until the session is completed. If it is not possible to complete the session, the result will not be displayed in RayCare.
>
> (334370)

> **WARNING!**
>
> **Safety when moving gantry and snout.** When the patient is finally positioned for treatment, the gantry and snout positions must be verified before the last medical personnel leaves the treatment room.
>
> (334391)

> **WARNING!**
>
> **Safety when moving table top.** When using the motion service in RayCommand to move the patient positioning device, the user operating the Operator Deadman's Switch (ODS) must be attentive during the complete range of movement. The ODS must be released immediately when there is a risk of collision or patient injury.
>
> (334372)

> **WARNING!**
>
> **Patient movement between imaging and completed treatment.** Patient movement between imaging and completed treatment is not automatically detected. Patient movement after imaging may cause incorrect patient setup.
>
> (334434)

> **WARNING!**
>
> **Some state may not be persisted in services or drivers.** If the RayCommand room driver is restarted, the driver's cache of the state of external systems is lost. After a restart, the state will be unknown until the external system is reset.
>
> (334439)

> **WARNING!**
>
> **Configuration of treatment room machine models.** Only compatible machine models must be listed in the machine models list when configuring the treatment room. Incorrect configuration can cause failure of service or incorrect treatment delivery.
>
> (342666)

> **WARNING!**
>
> **Review automatic registration.** Always ensure that the automatic registration between the setup images and the planning CT is properly done by manually reviewing the result.
>
> (344618)

3

> **WARNING!**
>
> **Imaging ring position.** RayCommand does not detect if the imaging ring is blocking the beam. Always ensure that the imaging ring is in a safe position (i.e., not blocking the beam) before delivering the beam.
>
> (344503)

4   RELEASE NOTES

This chapter contains important notes about the use of the RayCommand application. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of the RayCommand application must be familiar with these known issues as well as the known issues described in *RSL-D-RS-11A-RN, RayStation 11A Release Notes***.** Contact the manufacturer for any questions about the content.

Note: *Beware that additional safety-related release notes may be distributed separately within a month of software installation.*

In this chapter

This chapter contains the following sections:

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4.1   KNOWN ISSUES RELATED TO PATIENT SAFETY

Possible to start session when setup instruction versions differ

The setup instructions in RayCommand may not be updated with the latest setup instruction version from RayCare. It is, however, possible to start a session when the setup instruction versions differ. Verify that the setup instructions are up-to-date by comparing the instructions between RayCommand and RayCare.

(332782)

Treatment beam TTP is taken from setup beam instead of treatment beam

If setup beams are created to the localization point, the absolute table top positions (TTP) are incorrectly calculated. Do not use localization point as the setup beam isocenter. If a localization point is still used as the setup beam isocenter, by accident or otherwise, it will be detectable when doing alignment to room lasers.

(345204)

4.2   OTHER KNOWN ISSUES

No warning shown when signing session with uncompleted tasks

When completing a session, the session will be signed without providing warnings about uncompleted tasks. Tracking of task status must be done manually, and tasks must be completed in RayCare.

(344250)

No warning shown if there are rejected offline reviews

There is no warning when starting a treatment session and there are rejected offline image reviews for the treatment course. The user must check in RayCare to see the status of previous offline image reviews.

(333534)

Current table top position is not displayed in the Beam Preparation section

The current table top position is not displayed in the beam information panel. To see the current table top position, either open the position navigation dialog (if applicable) or read the value from the Machine monitor.

(333544)

Snout, nozzle elements, and gantry statuses do not reset when changing beam

For systems with the Exacure patient positioning system, the user must click *Leave treatment mode* between the deliveries of different beams. Otherwise, the options to reposition the gantry, snout and nozzle elements are not available.

(333545)

MADAM version is not checked

MADAM version compatibility must be verified manually before clinical use. Valid versions are provided upon request.

(333547)

Not possible to add treatment records manually within a session

If the delivered meterset is incorrectly recorded in RayCommand, it cannot be updated within the treatment session in RayCommand. Instead, the user must open the session in RayStation and correct the record from there.

(345041)

Possible to take image without confirmed patient ID

It is possible to acquire a daily setup image before the patient ID has been confirmed. If an image of the wrong patient is acquired, the erroneous image must be removed from the PACS. The linking to the erroneous image will remain in RayCommand, but it will not be possible to view or use the image.

(345066)

Non-HFS patient positions give incorrect starting correction vector

The initial correction vector, used when registering setup images to planning images, is incorrect for other patient orientations than 'Head First Supine'.

(345284)

Editing IDT when RayCommand is running gives inconsistent results

If the Imaging Device Transformation (IDT) is changed in Clinic Settings for a treatment room, all RayCommand services and monitors for that room must be restarted.

(345286)

User actions are not disallowed during movement or delivery of beam

It is possible to attempt to move the gantry, snout, and table top during other movements and beam delivery. Such attempts will fail, and may result in system crashes.

(345227)

Not possible to change fraction input once a session has been opened but not started

If a session is opened and then closed without imaging or deliveries being performed (i.e., an 'unstarted session'), the input for that fraction will remain unable to be changed. Input for the fraction cannot be subsequently changed (for example, changing the beamset). RayStation may crash if attempting to do this.

(345229)

All RayCommand services must be run on the same host

MPV OWIN host does not have *IntegratedWindowsAuthenticationEnabled* set to 'true'. To prevent unauthenticated requests to the Machine Parameter Verfication services, all RayCommand services

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must be run on the same host. The firewall needs to be configured to block all external requests to port 1341.

(345124)

Gantry angle is verified by MPV using a positional rule (not an angle rule)

Override of gantry angle difference is incorrectly calculated as a simple difference instead of a difference on the circle. For example, if the target gantry angle is 0 degrees and the actual gantry angle is 359.9 degrees, this should have been considered as a 0.1 degree mismatch but is incorrectly regarded as a 359.9 degree mismatch. This only affects gantry angle tolerance from table tolerance and not the hard limit of 2 degrees.

(345096)

No warning shown when completing session and leaving RayCare tasks uncompleted

It is possible to complete a session in RayCommand without having completed all the configured tasks from the RayCare workflow. The user must verify in RayCare that all tasks for a session have been completed.

(345098)

Not possible to create continuation session from partial delivery

It is not possible to create continuation sessions if completely undelivered beams exist. Instead, if a missing part of the fraction needs to be delivered, create a new beam set containing the missing part and assign that to be delivered in an additional fraction.

(344978)

Main monitor crashes when opening PPS navigator twice

The Main monitor may crash the second time the PPS navigator is opened. If RayCommand crashes, the user can re-open the Main monitor.

(344952)

Session cannot be rescheduled in alternate treatment room

In Clinic Settings, a treatment machine must only be configured with a single room name that exactly matches the name of the machine model in RayPhysics.

(342694)

Patrol interlock status is retrieved from MADAM, not from Exacure

The Patrol interlock status is retrieved from MADAM and not Exacure. Manually make sure that both MADAM and Exacure are showing the correct status.

(344448)

Transmission of treatment records from MAPTA to RayCommand may fail

In rare occasions, the transmission of treatment records from MAPTA to RayCommand may fail. If no treatment record has been received after completion of a beam that has started irradiation, the

session must have the state failed. The user must verify that the delivered meterset as shown in RayCommand is correct. If not, contact RaySearch support.

(344594)

Avatar and fixation devices not shown in room view or used in collision detection

The patient avatar and fixation devices are not included in the collision avoidance for path planning, and are not shown in the room view used for visualizing the planned path. The table top motion must be closely monitored by the user (see *chapter 3 Information needed for safe operation*).

(344662)

Only one setup beam supported for acquiring setup images

Only one single setup beam is supported for acquiring setup images. In the *Treatment room settings* section in Clinic Settings, the treatment room must be configured with *Requires one single setup beam* enabled.

(344828)

Site prescriptions cannot be delivered

Site prescriptions cannot be delivered with RayCommand. Instead, use ROI prescriptions.

(344850)

Appointment comments not shown in RayCommand

Appointment comments are not visible in RayCommand. Appointment comments may contain important or critical information relevant for patient care. Use RayCare to review appointment comments before starting a session.

(344269)

Drivers always use 1% tolerance level to decide if beam is delivered or partially delivered

The meterset tolerance used for deciding if a beam has been completely or partially delivered is not used. Instead, a tolerance level of 1% is always used.

(343025)

Spot map is not shown in Results module

The spot map for the delivered beam is not shown in the Results module, but the table of energy layers is shown correctly. The information is shown correctly in the Delivery module.

(343303)

When completing delivery, treatment mode is still active

When completing the delivery, RayCommand is still in treatment mode. Click the *Leave treatment mode* button in the toolbar to release the patient positioner, snout or gantry, and leave the treatment mode.

(340302)

Latest patient flags may not be shown

Flags are only updated when selecting a session in RayCommand. If flags are updated in RayCare after the session is selected in RayCommand, the latest versions of the flags are not shown. Re-selecting the session in the calendar will refresh the flags.

(338599)

Beamline is not shown (MedAustron)

The name of the beamline is not shown in the *Beam preparation* dialog. Make sure that the correct beamline is selected when working in a room with several beamlines.

(335201)

5   RAYCOMMAND

In this chapter

This chapter contains the following sections:

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5.1   SYSTEM OVERVIEW

The RayCommand 2A system consists of two different applications: *RayCommand Main monitor* and *RayCommand Machine monitor*. The applications are intended to be run on one monitor each. Together they constitute a dual screen control system for the treatment control room.

Information displayed on the two monitors is meant to supplement each other. To get the best experience, the Machine monitor should be placed adjacent to the right of the Main monitor in the control room.

An additional RayCommand Main monitor application can also be run separately, for example inside the treatment room.

5.1.1   Main monitor

The Main monitor provides workflow support and provides the user with tools and information for managing and delivering a selected session.

The list of tasks guides the user through the predefined activities to perform during the session. However, the user is always free to navigate to other parts of the interface.

The user interface in the Main monitor is divided into several areas:
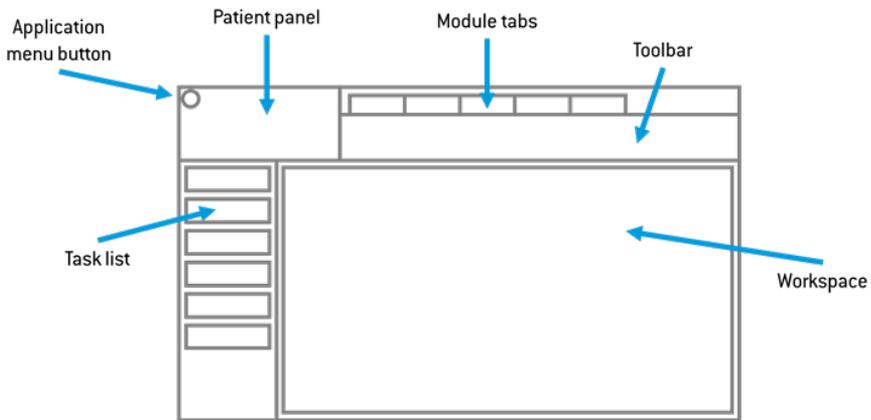
Application menu
The application menu button opens a menu with general application functionality. The application menu is opened by clicking the RayCommand icon in the upper left corner.

Patient panel
The **Patient** panel shows information about the patient for the current session.

Module tabs

The RayCommand application is divided into different parts called *modules*, which represent well-defined treatment activities. A module is accessed by clicking its module tab. The module tabs are placed sequentially from left to right, according to a typical treatment delivery workflow.

The treatment activities are:

• **Schedule**

• **Preparation**

• **Imaging**

• **Delivery**

• **Results**

Toolbar

The toolbar contains tools and information related to the session and the selected module. Some content in the toolbar is available in several modules.

Patient positioning tools

The patient positioning tools are located to the right of the toolbar. They are available in all modules. Use these controls to move the patient positioner to different positions. The user can also launch the **Position navigator** dialog which contains more extensive controls for moving the patient positioner.

Task list

The task list guides the user through the tasks that have been assigned to the patient for the current session. Tasks are defined in RayCare as a part of the patient's care plan.

The task list panel is available in all modules apart from the Schedule module as soon as a session has been started.

Click on a task in the task list to open the **Task properties** dialog. Here the task can be set to completed.

Complete delivery button

Click the **Complete delivery** button to complete the main activity in the current module. Click on the button to complete the activity without moving to the next module. Click on the arrow to complete the activity and navigate to the next module.

Workspace area

The workspace area displays information and functionality that is specific for the selected module.

5

5.1.2   Machine monitor

The Machine monitor application complements the Main monitor with real time information from inside the treatment room and from the different devices included.

The main purpose of the Machine monitor application is to monitor the treatment devices. The interface is fixed, and all content is in the same place all the time. This provides users with current information and situational awareness.

5.2   MAIN MONITOR MODULES AND WORKFLOW

5.2.1   Schedule module
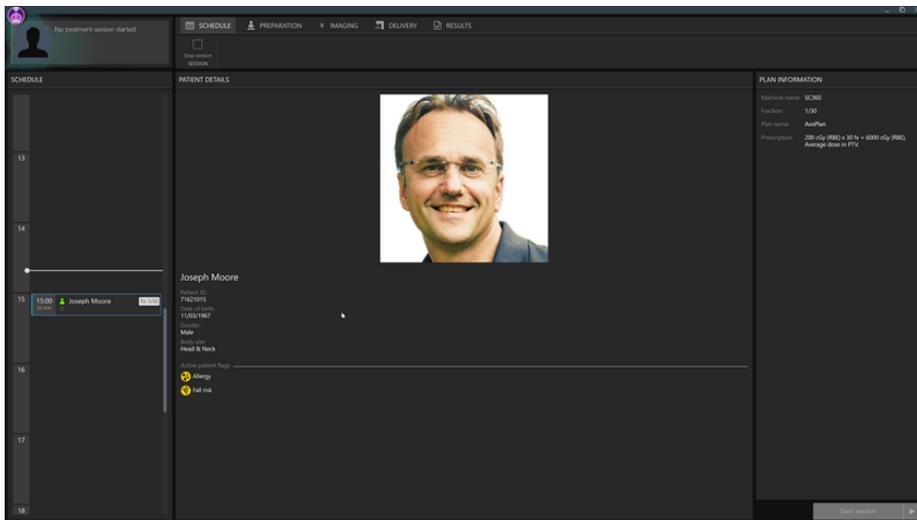
Schedule panel

The **Schedule** panel lists the appointments made for a treatment room. Appointments are scheduled in RayCare. An appointment is associated with a patient and a treatment session.

Select an appointment in the **Schedule** panel to get an overview of the patient and the associated treatment session in the **Patient details** panel.

Note: *The patient information shown in the Patient details panel is not necessarily the patient information for the patient in the currently active treatment session. The current patient is always displayed in the Patient panel (to the upper left in the user interface).*

Appointments

Treatment appointments are listed to the left in the **Schedule** workspace. Each appointment is summarized in a treatment appointment tile.
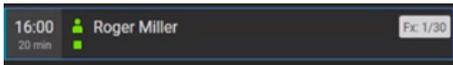
The treatment appointment tile contains the following information:

• Scheduled start time for the treatment appointment

• Estimated duration of the appointment

• Patient check-in status

• Session validation status

• Patient name

• Fraction number out of the total number of fractions. Fraction one is explicitly indicated by a grey background.

The patient check-in status can have the following states:

Patient status	Description
	Patient has not been checked in from RayCare
	Patient has been checked in from RayCare

The following session validation statuses exist:

Session status	Description
	Session has not been validated
	Session is being validated
	Session successfully validated and is ready for delivery
	Session has been canceled
	Session has been delivered and closed
	Session validated with a warning but can still be started
	Session validated with an error and cannot be started

The selected appointment is indicated with a blue frame in the schedule. Information about the patient in the selected appointment is displayed in the **Patient details** panel.

5

An appointment where a session has been started is indicated by a blue arrow in the left part of the treatment appointment tile:

The patient in the started session is displayed in the **Patient** panel.

Patient details panel
The **Patient details** panel displays information about the patient in the selected appointment.

Start session button
Click the **Start session** button to start the treatment session selected in the appointment schedule without navigating to the next module. Click on the arrow start the selected treatment session and navigate to the next module (**Preparation**).

Workflow – MedAustron
For a treatment session to start, the patient must be checked in from RayCare and the treatment session must be successfully validated.

To start a session, select the appointment tile in the schedule and click the **Start session** button.

5.2.2   Preparation module
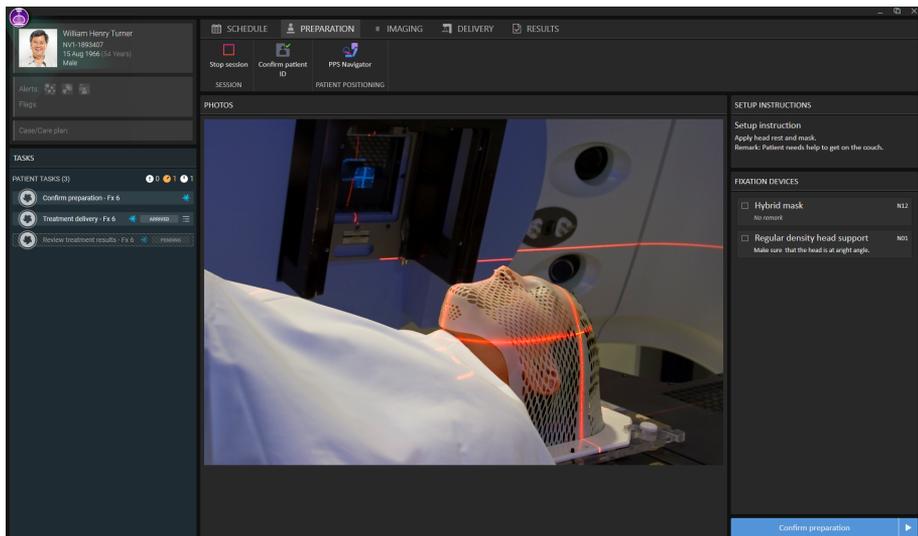
Setup note panel
The **Setup note** panel displays the setup notes created during setup in RayCare.

Fixation devices panel

The **Fixation devices** panel displays a checklist of all devices to be used for patient positioning, defined during setup in RayCare. When a fixation device has been applied, the corresponding checkbox must be selected.

Photos panel

The **Photos** panel displays the photos taken in RayCare during setup of the patient. If several photos are available, they are listed as thumbnails horizontally at the bottom. Select a thumbnail to display the photo in the panel.

Confirm preparation button

Click the **Confirm preparation** button to confirm that the patient setup has been performed as instructed. If all listed fixation devices have not been checked, a reason for this must be provided and signed before preparation can be confirmed.

Clicking the button will confirm the setup without navigating to the next module. Clicking on the arrow will confirm the patient setup and navigate to the next module (**Imaging**).

Workflow – (MedAustron)

1. Apply the listed fixation devices. Verify the application of each device by selecting the corresponding checkbox.

2. Click the **Position navigator** button to open the **Position navigator** dialog.

3. Select the pre-defined target position for patient setup.

4. Click the buttons on the control console to execute the move of the patient positioner to the selected target position.

5. Position the patient according to the photos and the setup instructions in the setup note.

6. Click the **Confirm preparation** button to confirm that the patient setup is correct.

5

5.2.3   Imaging module
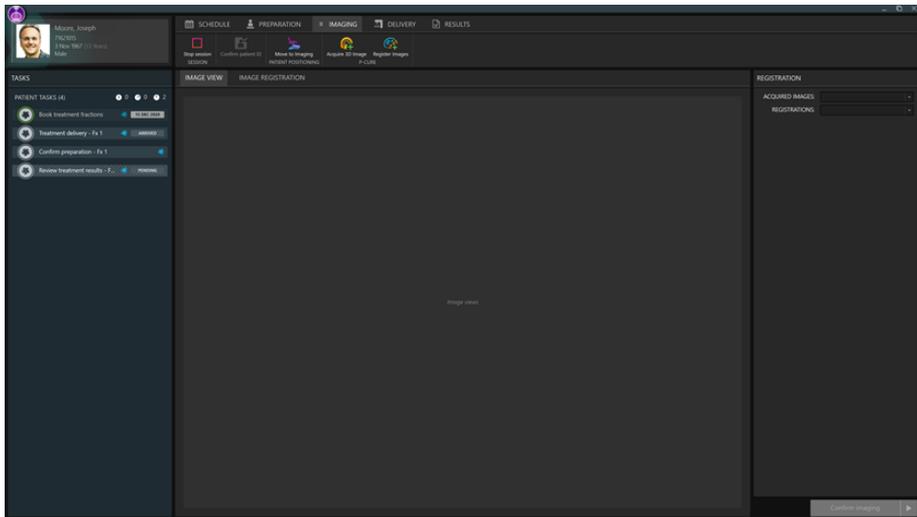
Image area

By default, the image area displays the planning CT image from the plan. When setup images have been acquired, and a registration between the planning images and the setup images has been performed, the fusion between the planning images and the setup images using the selected registration is displayed in the views.

Registration panel

The **Registration** panel manages images and registrations for the current session.

To approve a registration, select an image and a registration object in the **Registration** panel. Then click the **Approve treatment registration** button.

Approve treatment registration button

Click the **Approve treatment registration** button to approve the selected registration without navigating to the next module. Click on the arrow to approve the registration and navigate to the next module (**Delivery**).

WARNING!

⚠️ **Review automatic registration.** Always ensure that the automatic registration between the setup images and the planning CT is properly done by manually reviewing the result.

(344618)

Workflow (MedAustron)

1. Click the **Position navigator** button to open the **Position navigator** dialog.

2. Select a pre-defined target position for imaging.

3. Use the control console to execute the move of the patient positioner to the selected target position.

4. Click the **Acquire setup image** button to request an image acquisition from the MedPhoton Controls system. If setup beams are available with an imaging device selected and an imaged volume defined, a protocol for the image acquisition can be selected from the list of setup beams. The gantry angle of the setup beam corresponds to the view angle, the imaging device corresponds to the protocol name, and the imaging volume corresponds to the volume of interest in the MedPhoton Controls system.

5. Perform imaging acquisition in the MedPhoton application.

6. Click the **Register Images** button.

7. If needed, manually adjust the registration by using the registration tools available in the image area.

8. Save the modified registration by clicking the **Save as new registration** button.

9. Add a description for the registration and confirm saving.

10. (Optional) Click the **Auto register images** button to get an automatic 2D-3D registration with the current registration as input.

> **WARNING!**
>
> ⚠️ **Review automatic registration.** Always ensure that the automatic registration between the setup images and the planning CT is properly done by manually reviewing the result.
>
> (344618)

11. Click the **Approve treatment registration** button to approve the registration for treatment.

5

5.2.4   Delivery module
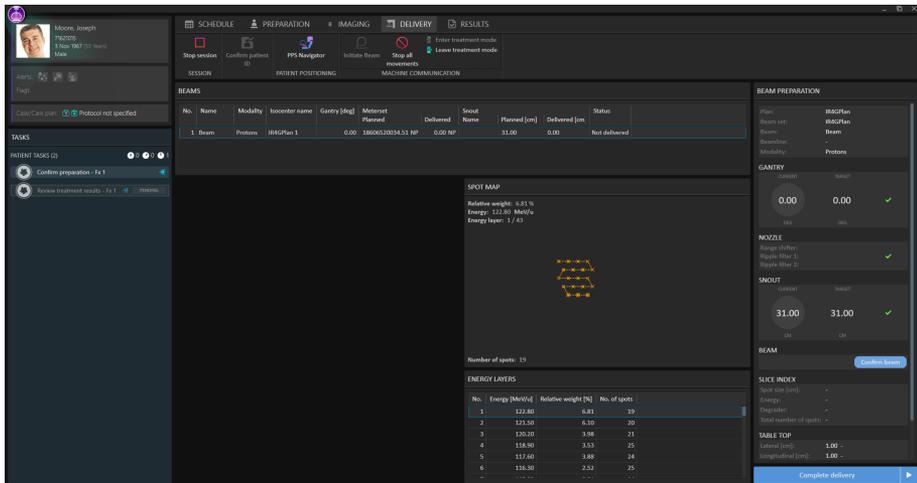
Beams panel

The **Beams** panel displays a list of beams for the plan. When a beam has been successfully delivered it is marked with a green checkmark in the beam list.

The spot map shows the positions of the specified spots in the energy layer selected in the **Energy layers** table.

Beam preparation panel

The **Beam preparation** panel displays the beam and the devices that have been prepared for delivery of the beam.

Complete delivery button

Click the **Complete delivery** button to complete the delivery and set the status for the treatment session to *delivered* without navigating to the next module. Click on the arrow to complete delivery and navigate to the next module (**Results**).

Workflow (MedAustron)

1.   Click the **Position navigator** button to open the **Position navigator** dialog.

2.   Select the target position for the beam.

     The motion planning bar shows the progress status.

3.   Use the control console to move of the patient positioner to the selected target position.

4.   Click the **Move gantry** button to rotate the gantry to the target position (if applicable).

5.   Click the **Set nozzle elements** button to set the position of the nozzle elements to the planned position.

6. Click the **Move snout** button to prepare the snout and move it to the target position (if applicable).

7. Click the **Enter treatment mode** button in the toolbar to lock all devices and set them in treatment mode.

8. Click the **Confirm beam** button to prepare the beam for delivery. Use the treatment control console to deliver the beam. If machine parameter verification fails, a dialog will be shown with the status of all invalid parameters or required overrides.

9. When a beam is delivered, click the **Leave treatment mode** button in the toolbar to release the patient positioner, snout or gantry.

10. When all beams are delivered, click the **Complete delivery** button to set the status for the treatment session to delivered.

Note: *Resumption from interrupted delivery can be done after re-initiating gantry angle and snout position.*

5.2.5   Results module
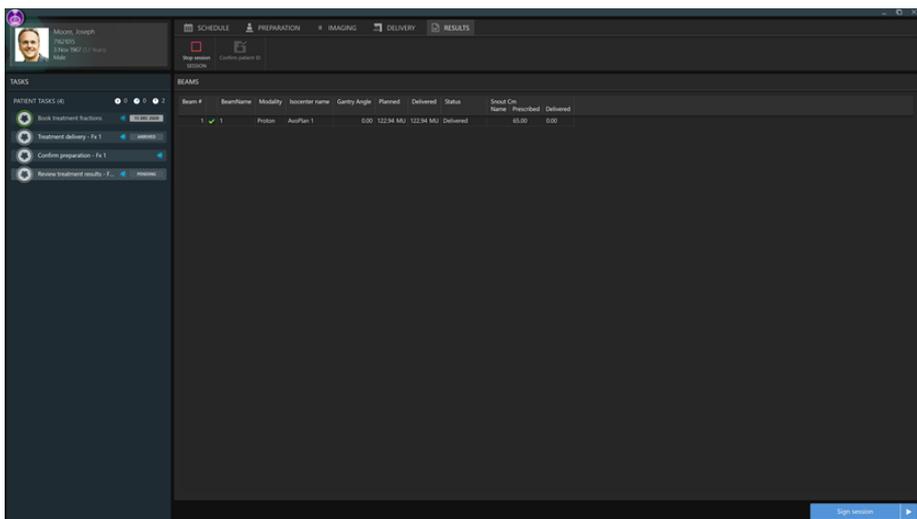
Beams panel

The **Beams** panel displays the list of beams that are to be delivered. Beams that have already been delivered are indicated by a green checkmark.

Sign session button

Click the **Sign session** button to complete the treatment session without navigating to the next module. Click on the arrow to complete the treatment session and navigate back to the first module (**Schedule**).

5.3 MACHINE MONITOR

The content on the Machine monitor complements the information on the Main monitor with real time information from inside the treatment room.
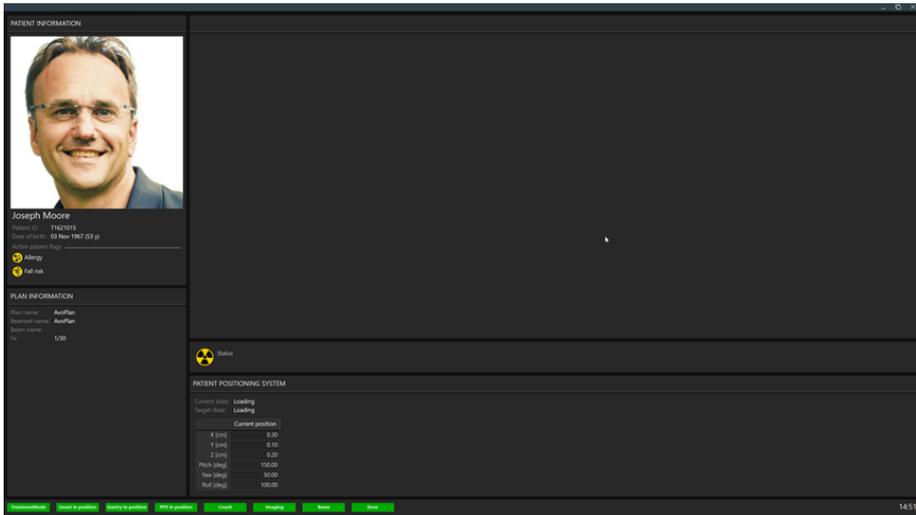
5.3.1 Patient information panel

The **Patient information** panel displays information about the patient associated with the current session.

5.3.2 Patient positioning system

The coordinates for the patient positioner show the current position of the patient positioner, the target position and the estimated distance between them.

Note: *The actual distance may differ from the estimated distance if the calculated trajectory is not straight due to collision detection.*

5.4 SYSTEM HEALTH

If some part of RayCommand has experienced a severe error, RayCommand will enter Error mode. A banner will be displayed at the top of the monitors:
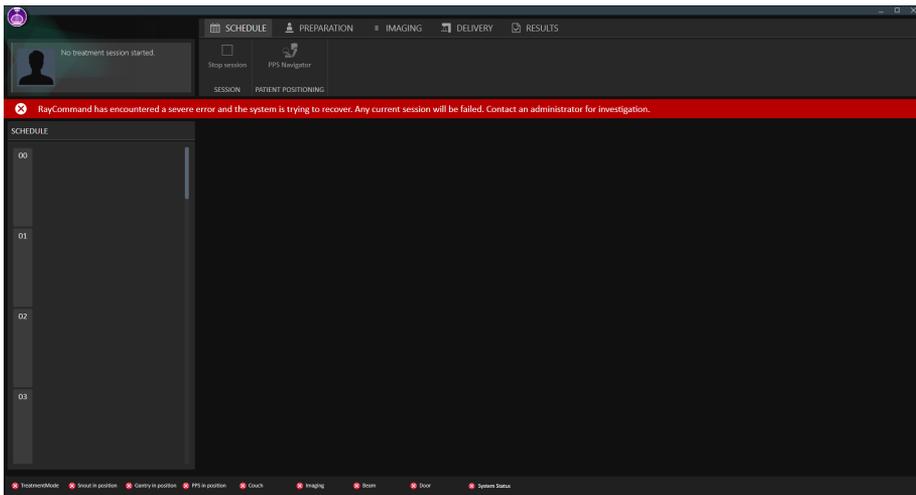
Interaction with a currently open session in the Main monitor will be limited, and the session state will be set to faulted. An additional banner will be shown until the session has been stopped or completed.

Once the error has been resolved, the Main monitor will again allow full interaction and the banner with the error message can be closed:
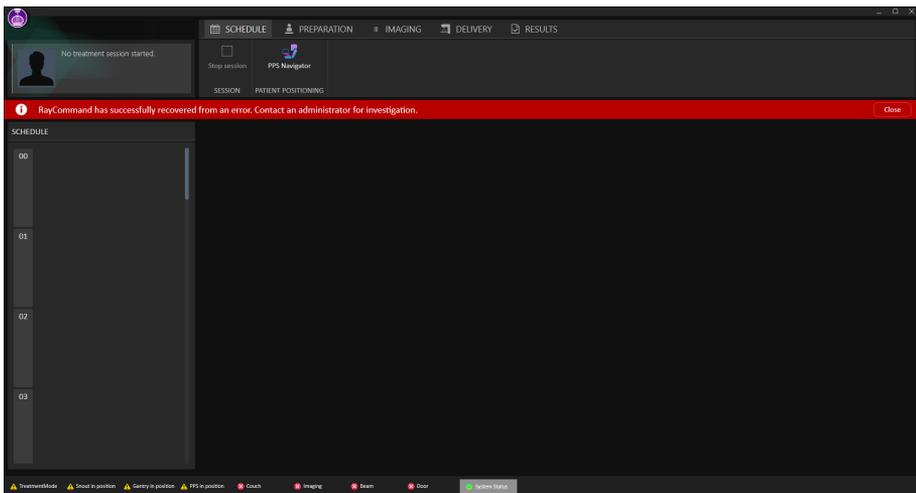
In case of less serious error, RayCommand will enter Degraded mode. A banner with a different message is displayed:
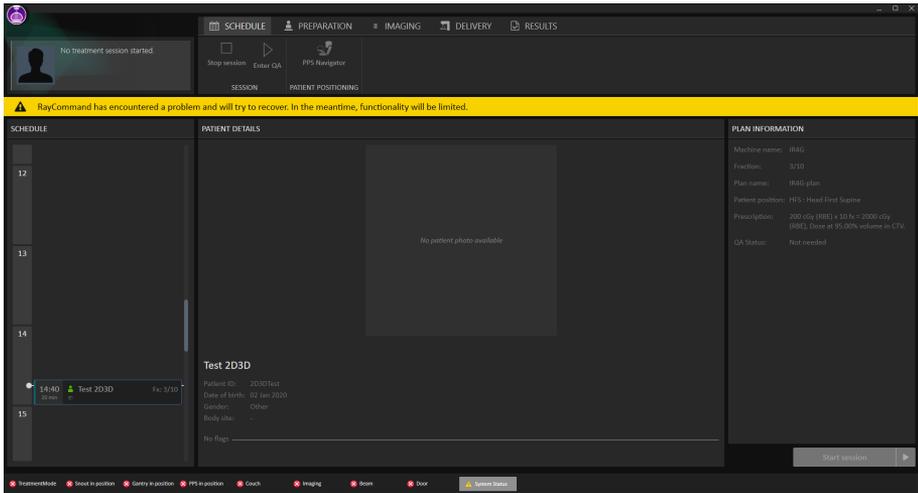
Interaction is the same as for Error mode, but the current session will not be set to faulted.

To see the status of each subsystem, the user can access the **Subsystems** dialog from the status bar. A list of any current errors per subsystem can also be viewed here.
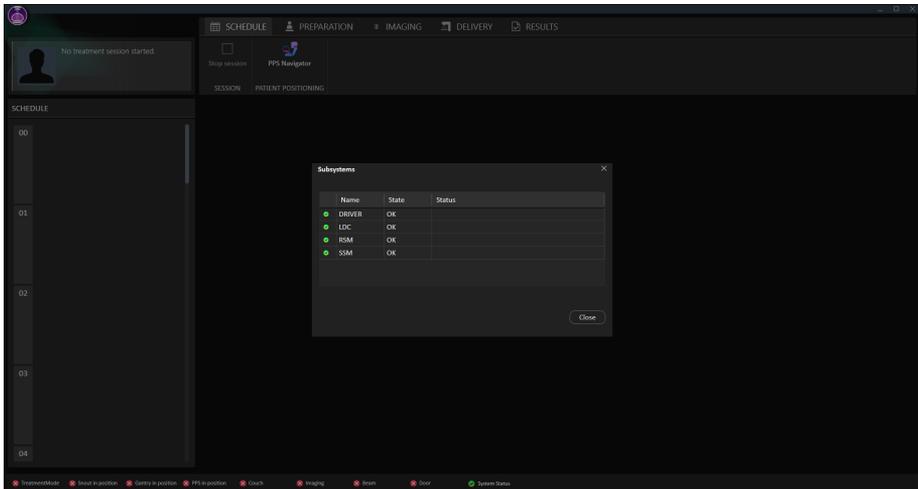
5.5   PATIENT POSITIONING

The patient positioning tools are located to the right of the toolbar and are available from all modules. Use these tools to control the position of the patient positioner.

5.5.1   Couch setup (MedAustron)

Click the **Position navigator** button in the toolbar to open the **Position navigator** dialog.
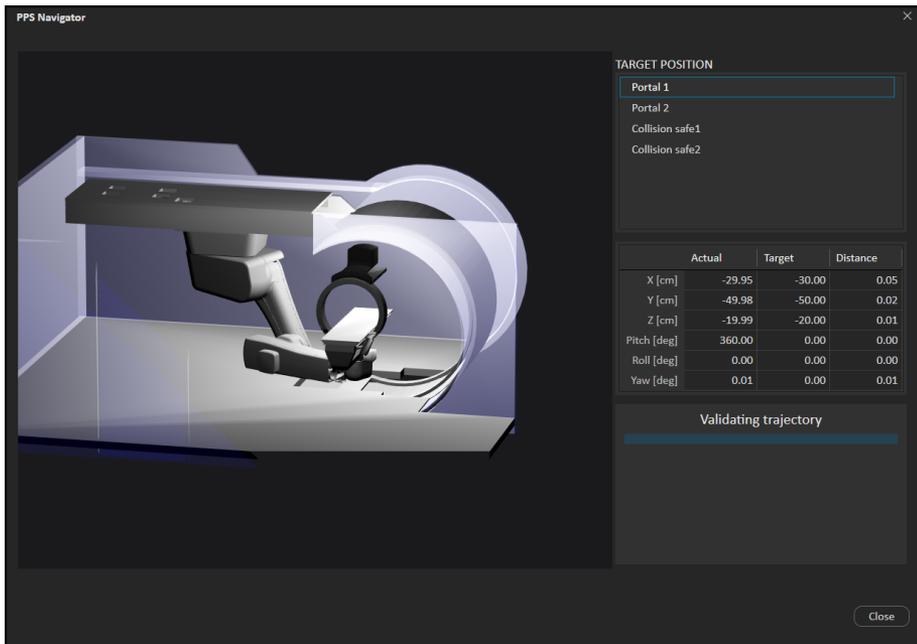
To move the Patient Positioning System (PPS) to a new position:

1. Select a position in the list of target positions.

    The motion planning bar shows the progress status.

2. Use the control console to execute the move.

Available positions are either predefined at system setup or are created based on the beams in the current plan.

Coordinates for the patient positioner are shown in a table: current position, target position and the estimated distance between them. The same table is also displayed on the Machine monitor.

Note: *The displayed distance from the start to target may increase and decrease several times before finally converging to the target since the calculated trajectory may not be a straight line in the room.*

5.5.2   Automatic motion planning

MedAustron installations of RayCommand provide support for *automatic motion planning*.

Without automatic motion planning, the PPS would take a direct path from start to target positions. When executed without supervision, the direct movement can result in physical contact between components such as in the following examples:

• Patient and nozzle

• Table Top with the nozzle

- Imager with the nozzle

- Imager C-arm with the robot arm

With the automatic motion planning feature enabled, when a target position is selected in the **Position navigator**, RayCommand automatically computes a collision-free PPS movement from the start position to the target position.

In both cases, the user must maintain visual contact of the PPS and anticipate collisions while executing the movement with the control console. See *chapter 3 Information needed for safe operation* for relevant safety precautions.

Considerations for automatic motion planning

There are some important considerations for automatic motion planning.

Determinism

The motion planner does not produce a deterministic solution. This means that if RayCommand plans a motion from position A to position B and later plans another motion from A to B, the second motion can be different than the first.

Since it is important for rehearsed movements to be repeatable after the patient mounts the table, RayCommand caches the motion within a treatment session so that all executions of the motion from A to B are the same. However, in a different treatment session, the motion from A to B from the previous session is not recalled and is instead recalculated.

Timeouts

The planner is not guaranteed to produce a solution. RayCommand imposes a configurable timeout on the planning time, typically 10 seconds. The more constrained the physical space, the more likely this timeout will be reached. If this occurs, it is recommended to try again. If multiple timeouts occur, try changing the start or target position or opening up the physical space, such as by retracting the nozzle or parking the imager.

Contact margins

Motion planning performance is sensitive to the preconfigured contact margins, which specify how close objects can get and in what context. For example, when the PPS is moving, in a suggested configuration, the table top may only approach to 10 cm from the nozzle, but when the nozzle is moving, the nozzle could approach to 0.5 cm from the table top. The contact margins may differ by mode (Service, Physics, Clinical). For Clinical mode, they are locked after customer acceptance. Contact RaySearch if you wish to customize the contact margins for Clinical mode.

Handedness

In some positions, the PPS robot arm can take a 'left' or 'right' handed configuration. Due to technical limitations, RayCommand cannot control which handedness the robot takes. As a rule of thumb, the system attempts to preserve the current handedness unless it is not physically feasible.

5.6   QA MODE

To perform quality assurance on scheduled plans:

1.   Select **Enter QA-Mode** from the application menu. RayCommand will now enter QA mode. A colored frame is displayed as an indication of the QA mode.

     The schedule will be replaced with a list of scheduled plans for which quality assurance has not yet been performed.
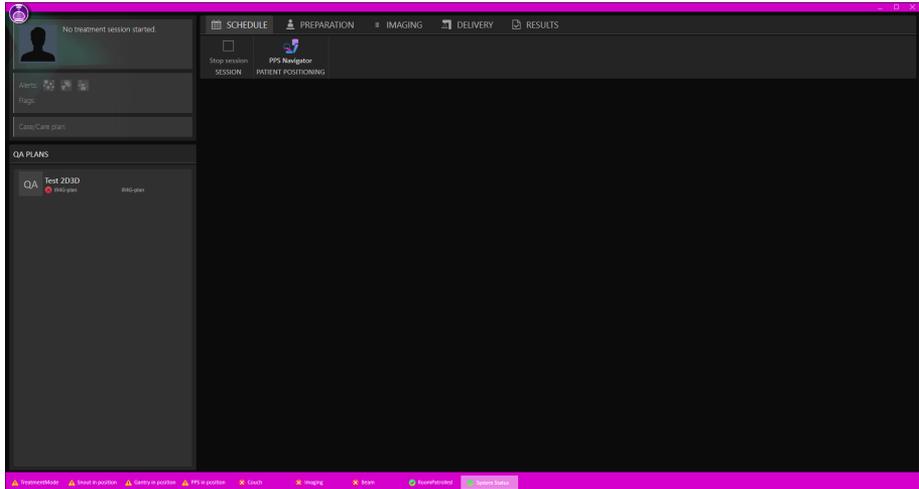
2.   Select a plan and click **Start session**. A QA session is created and started.

Treatment **Preparation**, **Imaging** and **Delivery** can now proceed as normal, with the exception that the user needs to confirm that no patient is present on the table before delivering a beam.

In QA mode, the beams delivered will not contribute to nominal dose, and unapproved treatment courses can be delivered.

To be able to exit QA mode, the session must first be stopped or completed.

5.7   MACHINE PARAMETER VERIFICATION

The machine parameter verification compares planned and current values, and checks interlock status.

Interlocks are only considered valid if locked or overridable. Values such as positions and angles have a hard tolerance that cannot be overridden. If tolerance tables or meterset tolerances (a configuration for the treatment room in Clinic Settings) have been assigned the treatment course, those values will be used. Hard tolerances always have precedence over user-defined tolerances.

The table below shows a complete list of verified machine parameters.

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Machine parameter	Hard tolerance	Soft tolerance	Description
Interlocks	—	—	All relevant interlocks.
Machine name	—	—	Verifies room driver configuration.
Range shifters	—	—	Verifies inserted accessories.
Range modulators	—	—	
Planned Meterset	—	User-defined	Verifies planned meterset. It is possible to configure absolute and relative tolerance.
Gantry angle	2 degrees	User-defined	Verifies current gantry angle.
Snout position	5 mm	User-defined	Verifies current snout position.
Table top vertical position	5 mm	User-defined	Verifies current table top position.
Table top longitudinal position	5 mm	User-defined	
Table top lateral position	5 mm	User-defined	
Table top pitch position	2 degrees	User-defined	
Table top roll position	2 degrees	User-defined	
Table top yaw position	2 degrees	User-defined	

A   DEFINITIONS

Term	Meaning
GPU	Graphics Processing Unit
BEV	Beam's Eye View
Control point	Position of the PPS in the treatment room according to IEC 61217: Yaw (IEC theta, Rz), X (table top lateral), Y (table top longitude), Z (vertical), Pitch (IEC psi, Rx), Roll (IEC phi, Ry)
DVH	Dose Volume Histogram
deg	When the term deg is seen in RayStation this refers to degrees.
DRR	Digitally Reconstructed Radiograph
External ROI	The ROI used to define the outline of the patient in the dose computation. The ROI used to define the outline of the patient in the dose computation.
GUI	Graphical User Interface
MU	Monitor Units
ROI	Region of Interest
Path	A sequence of control points.
Patient positioner	Collective name for the device used to place the patient on. This can typically be a treatment couch, or a chair mounted on a positioning device.

Term	Meaning
Trajectory	PPS speeds and accelerations through a path, calculated for the comfort of the patient, stability of the ROI, and protection of the PPS, with respect to mechanical limits and IEC standards.
Control console	The physical control panel provided by the manufacturer of the patient positioning system or the treatment machine.
PPS	Patient Positioning System

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