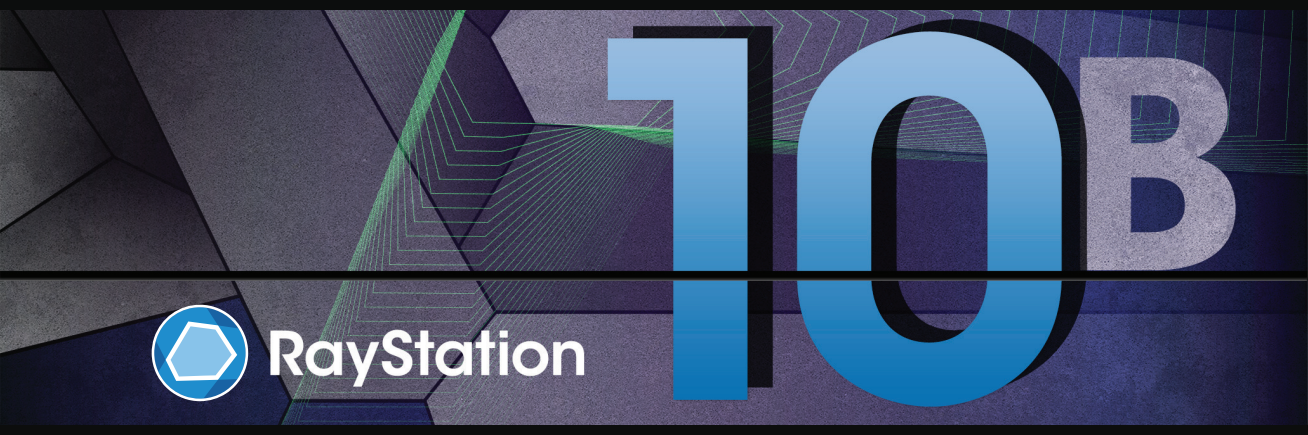
RAYSTATION 10B

Release Notes



Traceback information:
Workspace Main version a625
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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.

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RaySearch Laboratories

TABLE OF CONTENTS

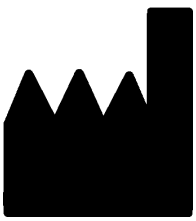
1 INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document contains important notes about the RayStation 10B system. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of RayStation 10B must be familiar with these known issues. Contact the manufacturer for any questions about the content.

1.2 MANUFACTURER CONTACT INFORMATION



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1.3 REPORTING OF INCIDENTS AND ERRORS IN SYSTEM OPERATION

Report incidents and errors to the RaySearch support email: support@raysearchlabs.com or to your local support organization via telephone.

Any serious incident that has occurred in relation to the device must be reported to the manufacturer.

Depending on applicable regulations, incidents may also need to be reported to national authorities. For the European Union, serious incidents must be reported to the competent authority of the European Union Member State in which the user and/or patient is established.

2 NEWS AND IMPROVEMENTS IN RAYSTATION 10B

This chapter describes the news and improvements in RayStation 10B compared to RayStation 10A SP1.

2.1 HIGHLIGHTS

- HDR brachytherapy planning.
- Machine learning optimization for protons.
- Robust machine learning planning for photons and protons.
- Proton Monte Carlo with multi-GPU support.
- Robust optimization with respect to inter- and intra-fractional uncertainties.
- Selection of planning image set per beam set.
- Dose calculation and planning on oblique image sets.
- Improvements regarding jaw and MLC positioning for LINACs.
- Improved support for large datasets and many simultaneous users.
- Integrated planning task list when using RayStation together with RayCare.

2.2 HDR BRACHYTHERAPY PLANNING

- Creation of plans for brachytherapy High Dose Rate (HDR) treatments.
- Automatic channel reconstruction on CT image sets.
- Channel reconstruction based on predefined channel geometry.
- Dwell time optimization.
- Tools for selecting specific dwell points and editing corresponding dwell times.
- Channel reconstruction and plan evaluation using arbitrary image view rotation.
- Dwell time and dose scaling.
- Dose computation based on the TG43 formalism.

2.3 MACHINE LEARNING

- Machine learning planning for proton PBS and Line Scanning.
- Robust machine learning optimization.
  - Dose mimicking is performed using robust objectives.
- Deep Learning planning for photons and protons.
  - Models may be trained using Deep Learning.
- The parent object of the scriptable action RunOarSegmentation is changed to Examination (from PatientDB), and it is now possible to select ROIs to be included through scripting.
- Licensing has changed to new treatment technique specific licenses for machine learning optimization.

2.4 NON-FUNCTIONAL IMPROVEMENTS

- More robust and faster when saving to rsbak file format.

2.5 GENERAL SYSTEM IMPROVEMENTS

- The ROI algebra dialog can now be launched from the ROI list context menu (Shortcut Ctrl + L). No resulting ROI is preselected. For a derived ROI, the Edit derived ROI dialog is also available in the context menu and will open the relevant dialog to modify the derived ROI.
- The function *Move POI to slice intersection* is now available from the context menu of the POI list in all modules where *Localize POI* is available.
- Tooltips in the toolbar will now show both the tool description and the reason for it being disabled instead of just one of them. Keyboard shortcut, if any, will also be displayed.
- Auto recovery data can be stored on disk to offload the database server. Storage location (database or file system) is selected in the Clinic Settings application. Default value for RayStation 10B is file system and storage on the local disk.
- The database size for a patient can now be calculated in both primary and secondary databases.
- For clinics that use RayStation together with RayCare, the treatment planning task list now is available in RayStation.

2.6 PATIENT DATA MANAGEMENT

- The *Edit patient data* dialog is updated to show ideographic and phonetic representations of the patient name (also supported from scripting methods). Which representations to show is selected in the Clinic Settings application.

2.7 PATIENT MODELING

- Faster loading of deformable registrations.
- New keyboard shortcut for faster navigation. The shortcut Ctrl + G moves focus to the *Current ROI* or *Current POI* drop-down list (depending on visibility). Type part or the full name of the desired ROI/POI and press Ctrl + Enter to select and localize the highlighted ROI.
- Improved reconstruction from contours to voxel ROIs.
- Possible to use a limiting ROI for 3D region growing.
- It is now possible to store which image sets are selected as primary and secondary.
- Possible to use a limiting ROI in the Expand/Contract dialog.
- New method to generate controlling ROIs for biomechanical deformable registration which can be accessed from scripting. Refer to the *RSL-D-RS-10B-SG, RayStation 10B Scripting Guidelines* for an example.
- For storage purposes it is now possible to force invalidation of a deformable registration using scripting. The deformation vector field can be recomputed when needed. Refer to the *RSL-D-RS-10B-SG, RayStation 10B Scripting Guidelines* for an example.

2.8 AUTOMATED BREAST PLANNING

- Improved *Settings* dialog.
- Possible to edit plan properties in the Automated breast planning module.
  - Allows changing most of the values defined in the *New plan* dialog.
  - The treatment plan must be regenerated after making changes.
- Beam qualities with non-standard fluence mode FFF (Flattening Filter Free) and SRS (Stereotactic Radio Surgery) are now supported.

2.9 PLAN SETUP

- Oblique image sets can now be used for planning. This feature requires a separate license which will only be distributed to a selected group of clinics to start with.
- Planning image set can now be selected per beam set. This feature requires a separate license which will only be distributed to a selected group of clinics to start with.
- Shifts to imaging/setup beam isocenters are presented in the *Patient setup* dialog and plan reports.
- Default table top pitch and roll couch angles are set from the selected planning image set if present in the DICOM data.

2.10 PLAN OPTIMIZATION

The VMAT algorithm has been improved. The directions from which fluence optimization is performed have been increased, which makes the representation of the target projections more exact.

2.11 ROBUST OPTIMIZATION

- Possible to perform robust optimization using inter-fractional (random) uncertainties for patient position and geometry, simulating an entire treatment course with different errors in each fraction. This feature requires a separate license which will only be distributed to a selected group of clinics to start with.
- Possible to perform robust optimization using intra-fractional (e.g., breathing) uncertainties for patient geometry. This feature requires a separate license which will only be distributed to a selected group of clinics to start with.
- Improved *Robustness settings* dialog.

2.12 MULTI-CRITERIA OPTIMIZATION

- For proton Pencil Beam Scanning (PBS) the spot dose cache for pareto plan generation is now saved also for a failed initial feasibility check when generating pareto plans. Thus, it is possible to relax the constraints and continue generating pareto plans without recomputing the spot doses. The existence of the spot dose cache is indicated with a lightning bolt in the relevant buttons in the toolbar.
- For proton Pencil Beam Scanning, beam computation settings are possible to edit even with existing pareto plans, but editing will invalidate the pareto plans.

2.13 GENERAL PHOTON PLANNING

- Jaw positions can now be defined to be rounded to 1, 2 or 3 decimals (defined per treatment machine in RayPhysics).
- Possible to define the behavior of guard leaves per treatment machine in RayPhysics.

2.14 PROTON PENCIL BEAM SCANNING PLANNING

- Improved performance of proton GPU Monte Carlo.
- Support for multi-GPU computation.
- The Mevion Hyperscan Spot Map Converter is now also used in the dose computation for optimization. This significantly reduces the dose difference between the optimized and final doses that previously could occur for Mevion Hyperscan plans employing the Mevion Hyperscan Adaptive Aperture.
- Significantly improved spot cache memory handling, which previously could cause a non-responsive behavior in RayStation, for example, when changing plans. The spot cache

memory is now managed dynamically and the greatest impact is seen for plans with many spots, where the new handling also may reduce the total optimization time.

2.15 PROTON BROAD BEAM PLANNING

- Patient-specific accessory codes can be used for block and compensator.

2.16 LIGHT ION PENCIL BEAM SCANNING PLANNING

- Possible to use different RBE cell types per ROI:
  - Overlap only allowed on the External ROI.
  - RBE cell type assigned to an ROI is indicated with a text annotation in the 2D patient views.

2.17 PLAN EVALUATION

- Possible to calculate dose on additional oblique data sets.
- Multiple warnings at approval will now be displayed as a bullet list, with the warning icon as bullet.

2.18 TREATMENT DELIVERY

- Possible to use oblique image sets for individual fractions in the Dose tracking module.

2.19 PLAN REPORTS

- It is now possible to include evaluation doses in treatment plan reports. Which evaluation doses to include are selected when the report is created. DVH, clinical goals, dose statistics, dose views (T/S/C) and dose difference (one direction only) can be included. The selected report template determines which of these will be displayed in the report. The image slice to show in the dose and dose difference views can be selected before generating the report.
- The percentage outside dose grid for ROIs reported for clinical goals is now always correct. [FSN 68727, fixed in RayStation 10A SP1]
- The values for couch pitch and couch roll for setup beams are now always reported correctly. [FSN 69129, fixed in RayStation 10A SP1]

2.20 DICOM

- Import of oblique CT and MR image sets is now supported. (This feature requires a separate license which will only be distributed to a selected group of clinics to start with.)

- Possible to define some export properties per beam set. The new *Export properties* dialog is opened from the RayStation menu, under DICOM export. The introduction of this dialog replaces the following DICOM export filters:
  - RSL-D-61-386 Rename Treatment Machine
  - RSL-D-61-359 Stereotactic with Cone to MOSAIQ
  - RSL-D-61-358 Add RayCare Custom Label
- Added support for import of open MR images with Patient Positions HLS, HLP, FLS and FLP. The Patient Positions are interpreted as follows:
  - HLS -> HFS
  - HLS -> HFS
  - HLP -> HFP
  - FLS -> FFS
  - FLP -> FFP
- Possible to override transfer syntax in scriptable export to file.
- Possible to export RBE doses and physical doses separately.
- Added warnings in *DICOM import* dialog for Storage SCP if missing files are detected. [Added in RayStation 10A SP1]
- In previous versions of RayStation, import of corrupt DICOM data could lead to incorrectly linked prescription ROI/POI and bolus ROI. These issues have now been fixed. [FSN 66704, fixed in RayStation 10A SP1]

2.21 VISUALIZATION

- Changed behavior when maximizing patient views:
  - When maximizing a patient view with a double click or by clicking the maximize window button, the patient view now only expands so that the beam list is not hidden behind the patient view. Shortcuts for various ways of expanding the patient views can be found in the shortcuts list.
- Several improvements to DVH views:
  - It is no longer possible to zoom out further than the range of visible curves in the DVH diagram. Zooming out with the mouse wheel stops when all curves are fully visible.
  - Mouse wheel zoom is centered on the position of the mouse pointer instead of in the middle of the DVH graph.

  - The visualization option *Show enhanced DVH* has been split into two options: *Light background* and *Thick lines*. This means that it is now possible to have thick lines on a dark background.
  - The light background color has been changed to white. ROI colors are adjusted, if necessary, to enhance visibility.
  - The additional option Text size has been added to change the font size of axis labels, axis values and header text.
  - When a curve is clicked, the thickness of the line increases to make the curve stand out.
  - It is possible to change curve style for curve sets, for example, when comparing doses in the Plan evaluation module. The preset curve style is the same as before.

- Possible to edit visualization of an ROI from the *ROI properties* dialog. In addition to the *ROI details/POI details* dialog, the user can now change the visualization of a single ROI by accessing the *ROI properties* dialog.
- Possible to change rotation axes when rotating in the 3D view. It is now possible to rotate along the frontal axis and the longitudinal axis or the sagittal axis and the longitudinal axis in the 3D view.
- Support for 6D couch in the Room view.
- Possible to scroll/view the Beam's Eye View (BEV) for each degree along the arc of a newly created arc beam before optimizing.
- Spots, for which the Bragg peaks are located outside the External ROI or the dose grid, are now visualized in a different color in the BEV.

2.22 CLINIC SETTINGS

- Possible to specify the default spot pattern setting to be used during ion PBS optimization.
- Possible to specify the default reference intensity setting for Toshiba Carbon PBS machines.
- The setting *Allow localization point as isocenter for setup beams* is removed, as the selection of isocenter for setup beams is now always visible if the user selects to create setup beams for the treatment plan.

2.23 RAYPHYSICS

2.23.1 Photon beam commissioning

- Random number handling has been changed for photon Monte Carlo dose curves to make the dose curve computation deterministic regardless of which set of curves are computed.
- Rounded jaw positions:

  - Possible to define if jaw positions shall be rounded to 1, 2 or 3 decimals for plans created in RayStation.
  - Two rounding modes are supported.

- Guard leaves:
  - Possible to define if guard leaves shall be opened for plans created in RayStation.
  - Possible to define the distance from the y-jaw within which guard leaves shall open.
  - The updated handling of guard leaves changes the rectangular field setup used when computing dose curves for some field sizes for affected machines. This leads to slight changes in computed dose curves for these field sizes compared to the previous version.

2.23.2 Ion beam commissioning

- Support for non-centered outer snout dimensions of rectangular snouts:
  - Enables more accurate patient collision detection for e.g., Mevion Hyperscan machines.
- Support for auto-modelling and commissioning of Mevion Hyperscan machines.
- Beam line objects:
  - *Description* and *Lateral Spreading Device Setting* fields added for scatterers.
  - Possible to specify Tray Id for the block.

2.24 DOSE ENGINE UPDATES

2.24.1 RayStation 10B dose engine updates

The changes to the dose engines for RayStation 10B are listed below.

Dose engine	10A SP1	10B	Dose effect	Comment
All	-	-	Negligible	Changed reconstruction from contours to voxel ROIs.

Dose engine	10A SP1	10B	Dose effect	Comment
Photon Collapsed Cone	5.3	5.4	None	Handling of guard leaves has been introduced. Guard leaves usage is defined by MLC parameters in the machine model. When upgrading to RayStation 10B, guard leaf parameters are automatically set for existing LINACs that have non-fixed jaws which are placed downstream of the MLC. The guard leaf distance parameter is set to the same value as the leaf width of the MLC. This affects the rectangular field setup in beam commissioning for some field sizes for affected machines which may lead to slight changes to computed dose curves for these field sizes. To review the differences in computed dose curves, create a copy of the machine and recompute the curves. Existing machine models do not need to be re-commissioned.
Photon Monte Carlo	1.3	1.4	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version: CUDA 11.0. This has a minor effect on the computed photon Monte Carlo dose. For dose calculation with low statistical uncertainty, the difference in dose compared to previous version is negligible. The new handling of guard leaves described for photon Collapsed Cone applies to photon Monte Carlo as well. Existing machine models do not need to be re-commissioned.
Electron Monte Carlo	3.7	3.8	None	Existing machine models do not need to be re-commissioned.

Dose engine	10A SP1	10B	Dose effect	Comment
Proton PBS Monte Carlo	5.0	5.1	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version, CUDA 11.0. Support for multi-GPU computations have been added. For Mevion Hyperscan machines the nozzle exit window will assume the shape and dimensions corresponding to the snout outer dimension (including its center point offset). Updated Mevion SMC. Affects Mevion Hyperscan only. Existing machine models do not need to be re-commissioned.
Proton PBS Pencil Beam	6.0	6.1	Negligible	Existing machine models do not need to be re-commissioned.
Proton US/DS/Wobbling Pencil Beam	4.5	4.6	Negligible	Existing machine models do not need to be re-commissioned.
Carbon PBS Pencil Beam	4.1	4.2	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version, CUDA11.0. Existing machine models do not need to be re-commissioned. Note that new beam models are required if using clinic-specific fragment spectra.

2.25 CHANGED BEHAVIOR OF PREVIOUSLY RELEASED FUNCTIONALITY

- Clinic setting to allow different setup beam isocenter (localization point) is removed. Now the option is always available when adding/editing beam sets. Default behavior is unaffected, setup beams will be created to treatment beam isocenters if no other option is selected.
- Multiple dose grids exist in plans with multiple planning image sets. The dose grid selected for dose grid modifications is now based on the currently selected beam set. Methods accessible via scripting (UpdateDoseGrid and SetDefaultDoseGrid) have moved from plan to beam set level.
- Behavior of importing ROIs has changed. In previous versions, only the name of the ROI was compared and import of an ROI with a name that conflicted with an existing name would be disregarded. The name conflict is now resolved by adding a sequence number (e.g., 'External', 'External 1', 'External 2' etc.) as names must be unique within the patient model. The check if

an ROI name already exists is now done by looking at the combination of ROI Number and SOP Instance UID.

- Support for DICOM Person Name in alphabetic, ideographic and phonetic representations now allows patient name to be parsed correctly according to the DICOM Person Name encoding. This will affect presentation in all places where the patient name is shown. Previous versions would include the character = which is special in DICOM and should not be displayed. This character and anything that follows up to the character ^, also special in DICOM, would be included in one of the patient name components (Last name, middle name, first name, title or suffix).
  - Example: Doe^John=Unknown

    In RayStation 10A this would present as: John=Unknown (first name) Doe (last name)

    In RayStation 10B this would present as: John (alphabetic first name) Doe (alphabetic last name), Unknown (ideographic first name)
- Editing of polygons and splines in the BEV can no longer be canceled with the ESC key. Instead, the Ctrl key shall be used as for other editing tools.
- It is no longer possible to select a GPU that supports ECC RAM if this is not enabled.
- The computation of the automatic spot spacing for proton PBS has changed. In RayStation 10A the spot spacing was determined from the lateral size of spots that traced through the target. In RayStation 10B the spot spacing is determined from the spots that trace through the target and where the Bragg peak is found inside the dose grid.
- The Spot Map Converter is now used during optimization of Mevion Hyperscan plans when using the Monte Carlo dose engine. This significantly reduces the dose difference between the optimized and final doses.
- Shape and lateral dimensions can no longer be specified for nozzle exit window (Mevion Hyperscan only). Existing machines are affected (shape/lateral dimensions removed).
  - In the MC dose computation, the nozzle exit window will assume the shape and dimensions corresponding to the snout outer dimension (including its center point offset).
  - Proton fluence ending up outside the snout outer dimension at the most downstream plane of the nozzle exit window will be lost.
  - The sanity check for a 5 cm lateral margin between spot center points and the outline of the nozzle exit window that existed in previous versions has been removed.
  - It is the responsibility of the user to enter and verify suitable parameter values for the snout inner dimensions and snout outer dimensions.

- Note that RayStation 8B introduced handling of effective dose (RBE dose) for protons. This information is important for proton users if upgrading to 10B from a RayStation version earlier than 8B:
  - Existing proton machines in the system will be converted to RBE type, that is, it is assumed that a constant factor of 1.1 has been used. Contact RaySearch if this is not valid for any machine in the database.
  - Import of RayStation RT Ion Plan and RT Dose of modality proton and with dose type PHYSICAL from RayStation versions earlier than 8B will be treated as RBE level if the machine name in the RT Ion Plan refers to an existing RBE machine.
  - RT Dose of dose type PHYSICAL from other systems or from RayStation versions earlier than 8B with a machine that does not have the RBE included in the beam model will be imported as in earlier versions and will not be displayed as RBE dose in RayStation. The same applies if the referenced machine does not exist in the database. It is the responsibility of the user to know if the dose should be treated as physical or as RBE/photon equivalent. However, if such a dose is used as background dose in subsequent planning, it will be treated as an effective dose.

  For more details, refer to *Appendix A Effective dose for protons*.
- Approved phantoms are no longer possible to delete from the Beam 3D modeling module in RayPhysics.
- Light ion beam models that reference clinic-specific fragment spectra no longer require a locally stored data file. The spectra are now stored in the machine database. This is expected to facilitate installation and version control. Beam models using clinic-specific fragment spectra need to be updated before use in RayStation 10B.

3 KNOWN ISSUES RELATED TO PATIENT SAFETY

There are no issues related to patient safety in RayStation 10B.

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

4 OTHER KNOWN ISSUES

4.1 GENERAL

Report Templates must be upgraded after upgrade to RayStation 10B

The upgrade to RayStation 10B requires upgrade of all Report Templates. Also note that if a Report Template from an older version is added using Clinic Settings, this template must be upgraded to be used for report generation.

Report Templates are upgraded using the Report Designer. Export the Report Template from Clinic Settings and open it in the Report Designer. Save the upgraded Report Template and add it in Clinic Settings. Do not forget to delete the old version of the Report Template.

(138338)

Slow GPU computation on Windows Server 2016 if the GPU is in VDDM mode

Some GPU computations running on Windows Server 2016 with the GPUs in WDDM mode may be significantly slower than running the computation with the GPU in TCC mode.

(283869)

Relative DVH x-axis not properly updated when changing number of fractions

When changing the number of fractions in a plan, the DVH x-axis is not updated correspondingly when relative dose is displayed. A workaround is to switch the Dose axis to 'Absolute' and then back to 'Relative'.

(138539)

The auto recovery feature does not handle all types of crashes

The auto recovery feature does not handle all types of crashes and sometimes when trying to recover from a crash RayStation will show an error message with the text "Unfortunately auto recovery does not work for this case yet". If RayStation crashes during auto recovery, the auto recovery screen will pop up next time RayStation is started. If this is the case, discard the changes or try to apply a limited number of actions to prevent RayStation from crashing.

(144699)

Limitations when using RayStation with large image set

RayStation now supports import of large image sets (>2GB), but some functionality will be slow or cause crashes when using such large image sets:

- Smart brush/Smart contour/2D region growing are slow when a new slice is loaded
- Hybrid deformable registration might run out of memory for large image sets

- Biomechanical deformable registration might crash for large image sets
- Automated Breast Planning does not work with large image sets
- Creating large ROIs with gray-level thresholding might cause a crash

(144212)

Limitations when using multiple image sets in a treatment plan

Plan total dose is not available for plans with multiple beam sets that have different planning image sets. Without plan dose it is not possible to:

- Approve the plan
- Generate plan report
- Enable the plan for dose tracking
- Use the plan in adaptive replanning

When the total dose view is selected, the *Move isocenter to intersection* and *DSP creation* tools will use coordinates from the total dose image set even if the selected beam set uses another planning image set.

(283717)

Slight inconsistency in dose display

The following applies to all patient views where dose can be viewed on a patient image slice. If a slice is positioned exactly on the border between two voxels, and dose interpolation is disabled, the dose value presented in the view by the "Dose: XX Gy" annotation can differ from the actual presented color, with regards to the dose color table.

This is caused by the text value being fetched from the nearby voxel A, while the rendered dose color gets its value from the neighboring voxel B. Both values are essentially correct, but they are not consistent.

The same can occur in the dose difference view, where the difference might seem larger than it actually is, because of neighboring voxels being compared.

(284619)

Cut plane indicators are not displayed in 2D patient views

The cut planes, used to limit the CT data used for computing a DRR, are not visualized in regular 2D patient views. To be able to view and use cut planes, use the DRR settings window.

(146375)

Laser export not possible for decubitus patients

Using the laser export functionality in the Virtual simulation module with a decubitus patient causes RayStation to crash.

(331880)

Limitation in the auto recovery functionality

The auto recovery functionality has a limitation when it comes to the amount of data that can be handled. Actions that produce more than 2 GB of modified data cannot be handled and RayStation will crash to prevent memory corruption. The workaround is to turn off auto recovery in the Clinic Settings application.

(332576)

The slice position indicator might be incorrect for coronal images in the plan report

If the first patient view included in a plan report is a coronal view, the slice position will have the incorrect sign (+/-). This is due to an issue using the DICOM coordinate system for the first image, instead of the IEC coordinate system.

To avoid the issue, do not create plan report templates with a coronal view as the first patient view. Also, when including evaluation doses in a plan report, make sure the first patient view included is not coronal.

(332531)

4.2 PATIENT MODELING

Memory crashes can occur when running large hybrid deformable registration computations on GPU

GPU computation of deformable registration on large cases can result in memory related crashes when using the highest grid resolution. The occurrence depends on the GPU specification and the grid size.

(69150)

Limited FOV tools disabled for oblique image sets

It is not possible to use the tools *Create field-of-view ROI* and *Create external ROI on limited FOV data* on oblique image sets.

(331916)

4.3 BRACHYTHERAPY PLANNING

Mismatch of planned number of fractions and prescription between RayStation and SagiNova version 2.1.4.0 or earlier

There is a mismatch in the interpretation of the DICOM RT Plan attributes *Planned number of fractions* (300A, 0078) and *Target prescription dose* (300A,0026) in RayStation 10B compared to the brachytherapy afterloading system SagiNova version 2.1.4.0 or earlier.

When exporting plans from RayStation:

- The target prescription dose is exported as the prescription dose per fraction multiplied by the number of fractions of the beam set.
- The planned number of fractions is exported as the number of fractions for the beam set.

When importing plans into SagiNova version 2.1.4.0 or earlier for treatment delivery:

- The prescription is interpreted as the prescription dose per fraction.
- The number of fractions is interpreted as the total number of fractions, including fractions for any previously delivered plans.

Possible consequences are:

- At treatment delivery, what is displayed as prescription per fraction on the SagiNova console is actually the total prescription dose for all fractions.
- It might not be possible to deliver more than one plan for each patient.

Consult with SagiNova application specialists for appropriate solutions.

(285641)

4.4 PLAN DESIGN AND 3D-CRT BEAM DESIGN

Center beam in field and collimator rotation may not keep the desired beam openings for certain MLCs

Center beam in field and collimator rotation in combination with "Keep edited opening" might expand the opening. Review apertures after use and if possible use a collimator rotation state with "Auto conform".

(144701)

4.5 PLAN OPTIMIZATION

No feasibility check of max leaf speed performed for DMLC beams after dose scaling

DMLC plans that result from an optimization are feasible with respect to all machine constraints. However, manual rescaling of dose (MU) after optimization may result in violation of the maximum leaf speed depending on the dose rate used during treatment delivery.

(138830)

Plan approval and DICOM export of robust optimized plans might crash

After using robust optimization over additional image sets, some actions performed on the plan will cause subsequent plan approval and DICOM export to crash. Performing an optimization (zero iterations is enough) or unchecking the secondary image sets in the Robustness Settings dialog will correct this. Examples of actions that can trigger a crash are dose grid edits and version upgrade of RayStation.

(138537)

Density uncertainty includes range shifter thickness in robust optimization

If a range shifter is used when performing robust optimization with respect to density uncertainty, the water equivalent thickness of the range shifter will erroneously be taken into account for the density uncertainty. If the actual water equivalent thickness of the range shifter is known, this will

lead to an overestimation of the uncertainty in range, and the optimized plan will be more robust than intended.

The error will result in unnecessary spots in the initial spot selection before the robust optimization, and is also present in the approximate scenario dose computation during optimization. Note that the accurate scenario dose computation is correct (i.e., it does not include the range shifter water equivalent thickness), and should be used when using a range shifter. In this case, it is possible to counteract the effect of unnecessary spots from the initial spot selection by setting up the optimization functions on the External ROI or OARs with sufficiently high weights.

Make sure to review plans according to warning 10775, *Evaluate the dose after robust optimization*, in the *RSL-D-RS-10B-IFU, RayStation 10B Instructions for Use*.

(332647)

Robust evaluation doses with different computation settings

Scenario doses using the same position and density uncertainty settings in more than one scenario group will not be recomputed between scenario groups, in order to avoid unnecessary computations. A change of computation (dose engine choice and statistical uncertainty for Monte Carlo) between scenarios should trigger a new computation but does not. This might lead to a mix of doses in the case where two or more scenario groups with overlapping scenarios and different computation settings are created. To avoid this problem the user is advised always to use the same computation settings in Robust evaluation as in Final dose. The information about the dose computation settings for each scenario is correctly displayed in the dose views.

(333048)

4.6 PROTON AND LIGHT ION PLANNING

Beam line objects and beam parameters not updated when changing machine for an adapted plan

If the machine is changed when either creating a new adapted plan or when editing an existing adapted plan, then the beam line objects and spot tune ID of the beams in the adapted plan will not be updated automatically. The snout of the previous machine will remain in the beam list, which might be incompatible with the new machine. The range shifter might be listed as [Unknown]. In the case that the machine was changed when creating a new adapted plan, the range modulator might also be listed as [Unknown].

For any affected beam, open the Edit beam dialog and update the necessary beam line objects and spot tune ID and then click OK. Note that if only the range modulator is missing, it is enough to open the Edit beam dialog and close it again by clicking OK. This workaround will update the beam line objects and allow continued use of the beam.

(224066)

4.7 TREATMENT DELIVERY

Removing prescription when creating adapted plan does not work

When an adapted plan is created, the original plan's prescription will be kept even if dose prescription is de-selected during plan creation. The dose prescription can be removed afterwards using the Set Prescription dialog or the Edit Patient dialog.

(69235)

CT-reference in treatment course

In the Plan Evaluation module, the "Image set" column shows the image set for the computed dose. However, the "Images" column of a Treatment Course shows the acquired images on that fraction, not the image sets that were used for dose computation. The image set used for dose computation and the image set for deformed doses are displayed by clicking the arrow in the Dose column.

(62376)

Mixed beam sets in plan fraction schedule

For plans with multiple beam sets where the plan fraction schedule has been manually edited for a subsequent beam set, a change to the number of fractions for a preceding beam set will result in a faulty fraction schedule where beam sets are no longer planned in sequence. This can lead to issues in dose tracking and adaptive replanning. To prevent this, always reset the plan fraction schedule to default before changing number of fractions for beam sets in a multi beam set plan after the fractionation pattern has been manually edited.

(331775)

4.8 AUTOMATED PLANNING

Protect setting always set to None in beam list after TomoTherapy optimization running HPC in Plan Explorer

After optimization of a TomoTherapy treatment plan using HPC in Plan Explorer, the Protect setting is always set to 'None'. However, protect settings selected prior to optimization are correctly used during the optimization.

(136436)

Incorrect Beam on interval might be set back without notification

In the Plan Explorer Edit Exploration Plan dialog, when editing the Beam on interval value in the Beam Optimization Settings tab, the value will change back to the previous value without notice if the entered value is out of range. This could easily be missed, for example if the dialog is closed directly after entering an incorrect value. The Beam on interval value is only applicable for VMAT treatment machines commissioned for burst mode (mArc).

(144086)

4.9 BIOLOGICAL EVALUATION AND OPTIMIZATION

Biological evaluation of fractionation schedule can lead to crash when creating new adapted plan

If the fractionation schedule is edited from the Biological Evaluation module, the system will crash when creating an adapted plan. To perform biological evaluation, copy the plan and do the fractionation schedule changes on the copy.

(138535)

Undo/redo invalidates response curves in the Biological Evaluation module

In the Biological Evaluation module, the response curves are removed on undo/redo. Recompute the function values to restore the response curves.

(138536)

4.10 SCRIPTING

Limitations regarding scripted reference functions

It is not possible to approve a beam set that includes a scripted reference dose function referencing an unlocked dose. This will lead to a crash. Also, approving a beam set that includes a scripted reference dose function referencing a locked dose, and consecutively unlocking the referenced dose will lead to a crash.

If a scripted reference dose function refers to an unlocked dose, there will be no notifications if the referenced dose is changed or removed. Finally, there is no guarantee when upgrading to new versions of RayStation that upgrades of optimization problems including scripted reference dose functions will retain the dose references.

(285544)

A EFFECTIVE DOSE FOR PROTONS

A.1 BACKGROUND

Starting with RayStation 8B the effective dose of proton treatments is treated explicitly, either by including a constant factor in the absolute dosimetry in the machine model or by combining a machine model based on physical dose in the absolute dosimetry with a constant factor RBE model. When upgrading from a RayStation version prior to RayStation 8B to RayStation 8B or later, all existing machine models in the database will be assumed to have been modeled with a constant factor of 1.1 in the absolute dosimetry to take the relative biological effects of protons into account. Contact RaySearch support if this is not valid for any machine in the database.

A.2 DESCRIPTION

- The RBE factor can either be included in the machine model (as was the standard workflow in RayStation versions prior to 8B) or be set in an RBE model.
  - If the RBE factor is included in the machine model, it is assumed to be 1.1. These machines are referred to as 'RBE'.
  - A clinical RBE model with factor 1.1 is included in every proton RayStation package. This is to be combined with machine models based on physical dose. These machines are referred to as 'PHY'.
  - For other constant factors than 1.1, the user needs to specify and commission a new RBE model in RayBiology. This option can only be used for PHY machines.
- **All existing proton machines in the system will be converted to dose type RBE, where it is assumed that a constant factor of 1.1 has been used to scale absolute dosimetry measurements. Correspondingly, the dose in all existing plans will be converted to RBE dose.**
- Display of RBE/PHY for PHY machine in the RayStation modules Plan design, Plan optimization and Plan evaluation.
  - Possible to toggle between physical and RBE dose in these modules.
  - Possible to view the RBE factor in the Difference view in Plan evaluation.
- For RBE machines, the only existing dose object is RBE dose. For PHY machines, RBE dose is the primary dose in all modules with the following exceptions:

  - Display of Beam Dose Specification Points (BDSP) will be in physical dose.
  - All doses in the QA preparation module will be in physical dose.

- DICOM import:
  - Import of RayStation RtIonPlan and RtDose of modality proton and with dose type PHYSICAL from earlier versions of RayStation than RayStation 8B will be treated as RBE dose if the machine name in the RtIonPlan refers to an existing machine with RBE included in the model.
  - RtDose of dose type PHYSICAL from other systems or from RayStation versions prior to 8B with a machine that does not have the RBE included in the beam model will be imported as in earlier versions and will not be displayed as RBE dose in RayStation. The same applies if the referenced machine does not exist in the database. It is the responsibility of the user to know if the dose should be treated as physical or RBE/photon equivalent. However, if such a dose is used as background dose in subsequent planning, it will be treated as an effective dose.

  Note: *Plans for machines from Mitsubishi Electric Co follow different rules and the behavior has not been changed from versions prior to RayStation 8B.*

- DICOM export:
  - Treatment plans and QA plans for proton machines with dose type RBE (changed behavior compared to RayStation versions prior to 8B where all proton doses were exported as PHYSICAL):
    - # Only EFFECTIVE RT Dose elements will be exported.
    - # BDSP in RT Plan elements will be exported as EFFECTIVE.
  - Treatment plans for machines with dose type PHY:
    - # Both EFFECTIVE and PHYSICAL RT Dose elements will be exported.
    - # BDSP in RT Plan elements will be exported as PHYSICAL.
  - QA plans for machines with dose type PHY:
    - # Only PHYSICAL RT Dose elements will be exported.
    - # BDSP in RT Plan elements will be exported as PHYSICAL.

  Note: *Plans for machines from Mitsubishi Electric Co follow different rules and the behavior has not been changed from versions prior to RayStation 8B.*

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