RAYSTATION 11B

Release Notes

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Declaration of conformity

CE 2862

Complies with Medical Device Regulation (MDR) 2017/745. A copy of the corresponding Declaration of Conformity is available on request.

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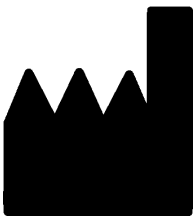
1 INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document contains important notes about the RayStation 11B system. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of RayStation 11B 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 11B

This chapter describes the news and improvements in RayStation 11B compared to RayStation 11A SP2.

2.1 HIGHLIGHTS

- CBCT conversion for dose calculation.
- EQD2 dose computation for brachy and photon dose.
- LET evaluation for ions.
- Improved workflow for image registration.
- Persistent ROI visualization settings.

2.2 CBCT CONVERSION

It is now possible to convert CBCT images to CT-like HU calibrated images that can be used for more accurate photon dose calculations.

2.3 MACHINE LEARNING PLANNING

- Machine learning planning models are now set on a beam set level instead of a plan level. Beam set name restrictions have been removed and dependencies are handled via the regular RayStation functionality.
- The machine learning planning mimic framework has been enhanced and supports individual weights per run and standard optimization functions.
- The machine learning planning strategy framework has been improved and now supports more DVH modification functions as well as background dose.
- ROI expressions can now be handled inside the model strategy.
- Licensing for machine learning planning has been updated. The treatment technique-specific licenses are replaced by RayDeepPlanningPhotons and RayDeepPlanningProtons.

2.4 DEEP LEARNING SEGMENTATION

- A *Select/Deselect all* button has been added. This makes it easier to select just a few ROIs from the full list before running the model.
- Configurable ROI visibility. The list of ROIs that is shown in the user interface for a specific deep learning segmentation model can be restricted. This means that ROIs that are never used by a clinic can be excluded from the user interface.
- RSL Head and Neck CT is a new deep learning model for segmentation of:

brainstem	nasolacrimal duct L/R	posterior fossa
cochlea L/R	nasopharynx	spinal cord
eye L/R	optic nerve L/R	submandibular gland L/R
glottic larynx	oral cavity	superior esophagus
lacrimal gland L/R	oropharynx	supraglottic larynx
lens L/R	parotid gland L/R	temporomandibular joint L/R
mandible	pituitary	tongue base

- RSL Thorax CT is a new deep learning model for segmentation of:

heart	spinal cord
esophagus	spinal canal
lung L/R	stomach

2.5 NON-FUNCTIONAL IMPROVEMENTS

- The GPU (Graphics Processing Unit) environment is now validated for a GPU model instead of a particular physical GPU unit. This simplifies running RayStation in cloud environments by removing the need to re-approve the physical GPU which can change when restarting RayStation.
- The usage of MD5 checksums are replaced in order to make the application FIPS compatible.

2.6 GENERAL SYSTEM IMPROVEMENTS

- Directories with rsbak files now can be used as secondary databases. This will improve the workflow for restoring single patients and simplify backups. Multiple patients can be moved from the primary database to rsbak using the RayStation Storage tool.
- The ROI list and POI list can now return to a previous combination of visible and hidden ROIs/POIs when using the visibility indicators in the headers. Clicking the checkbox once will hide all ROIs in the group, a second click will show all ROIs, and a third click will revert to the previous visibility.

- The GPU settings dialog is now accessible also from RayStation, not only from RayPhysics.
- The product version is now displayed in the launcher as well as in Clinic Settings.
- It is now possible for administrators to add new common materials to be used for all patients and to define the full elemental composition for the materials.
- Material view selection has moved to the 2D view tabs. The tab also indicates if the image set view or the material view is selected.
- Material for support and fixation ROIs is now shown in the material visualization view.
- The couch pitch and roll angles can be edited interactively in the BEV.
- It is now possible to use CT density instead of material override for Support, Fixation and used Bolus ROIs.
- Dose statistics calculations are updated in RayStation 11B. This means that small differences in evaluated dose statistics are expected when comparing to a prior version.

  The dose statistics accuracy improvement is more noticeable with increasing dose range (difference between minimum and maximum dose within an ROI), and only minor differences are expected for ROIs with dose ranges smaller than 100 Gy. The updated dose statistics no longer interpolates values for Dose at volume, $D(v)$, and Volume at dose, $V(d)$. For $D(v)$, the minimum dose received by the accumulated volume v is instead returned. For $V(d)$, the accumulated volume that receives at least the dose d is returned. When the number of voxels within an ROI is small, the discretization of the volume will become apparent in the resulting dose statistics. Multiple dose statistics measures (e.g., D5 and D2) may get the same value when there are steep dose gradients within the ROI, and similarly, the dose ranges lacking volume will appear as horizontal steps in the DVH.
- Shortcuts in the shortcut dialog are now categorized and a search function is implemented.
- Plan explorer now supports HPC Pack 2019.

2.7 PATIENT DATA MANAGEMENT

If a plan, or part of a plan (e.g., a beam set) is approved, deleting the plan now requires authentication by a user with the proper authority.

2.8 PATIENT MODELING

- Multiple rigid image registrations are now supported.
  - One frame-of-reference registration
    - # Only one per frame-of-reference pair allowed
    - # Used when computing dose on other data set
    - # Used when creating deformable registrations

  - Multiple image registrations
    # Possible to create multiple registrations between two images
    # Can be created for images in the same frame-of-reference
    # Can be selected when contouring in fusion mode

- It is now possible to approve registrations. This applies to frame-of-reference registrations, image registrations and deformable registrations.
- It is now possible to rename registrations. This applies to frame-of-reference registrations, image registrations and deformable registrations. Renaming a registration will not affect approval of plans or dose calculations.
  - Renaming a registration group will update the name of all registrations in the group where the registration name starts with the group name.
- It is now possible to add a description for a registration, which is shown as tooltip in the registration tree.
- POI based rigid registrations no longer require four POIs. A registration can now be done with one (or more) POIs.
- When an ROI or POI (or the geometry of an ROI/POI) is deleted, and the ROI/POI is neither approved nor referenced by a dose calculation/derived ROI/clinical goal etc., there will no longer be a confirmation dialog. If the deletion was unintentional, Undo will restore the ROI/POI (geometry). If deleting multiple ROIs/POIs, a confirmation dialog will still appear if at least one of the selected ROI/POI would have required confirmation.
- When switching patient direction in the Structure Definition module, the camera pan and zoom level will not reset.
- The triangulation algorithm has been updated and is now faster. There may be minor differences compared to previous versions.

2.9 BRACHYTHERAPY PLANNING

- Image fusion is now also available in the Brachy planning module, to make it easier to work with multiple image sets during planning of brachytherapy treatments.
- Brachy equipment is now listed in a separate section in the ROI list for ROIs of brachy type.
- The support for rotating and translating applicator models has been extended to also include POIs and to enable moving of only selected parts. This can be used to move the ring but not the tandem, and to include Point A in the applicator model.
- It is now possible to switch visualization of channels and channel candidates on and off.
- The channel tip visualization now reflects the source applicator tip length specified in RayPhysics for each channel.

- Smart draw is now significantly faster.
- It is now possible to lock specific dwell points so that they do not change during an optimization.
- It is now possible to define clinical goals in two Gray equivalent dose (EQD2) based on the linear-quadratic model.

2.10 PLAN SETUP

- The handles for editing the dose grid interactively have been enlarged.
- All prescriptions are now displayed in the default beam set report.
- Nominal dose contributions to prescription are now included in the default beam set report.
- The maximum number of fractions is now 100 (reduced from 1000).
- Nominal dose contributions to prescription are rounded to always add up to the prescribed fraction dose in full cGy. This should avoid potential rounding issues in the OIS. Note that the prescribed beam set dose in cGy must be divisible by the number of fractions for the nominal contribution to match exactly.

2.11 3D-CRT BEAM DESIGN

Support is added to automatically set the jaws a distance from the MLC opening for segments created with Treat and Protect. The distance to the MLC opening is a parameter defined by the user in RayPhysics for the LINAC.

2.12 PLAN OPTIMIZATION

- Fine-tune optimization is a new tool to improve an optimized treatment plan. The user selects a number of clinical goals that the algorithm tries to fulfill while preserving DVHs and overall spatial dose distribution. Fine-tune optimization can be used for any modality.
- It is now possible to map template ROIs/POIs to ROIs/POIs in the patient when loading clinical goal list templates and optimization function list templates. This is useful in cases where the ROI/POI does not have the same name in the patient as in the template.
- Support is added to automatically set the jaws a distance from the MLC opening for optimized segments (3DCRT, SMLC, DMLC, VMAT, Conformal Arc). The distance to the MLC opening is a parameter defined by the user in RayPhysics for the LINAC.
- It is now possible to delete multiple energy layers at once by selecting several rows in the table before pressing the *Delete* button.

2.13 ROBUST OPTIMIZATION

It is now possible to perform 4D optimization with background dose, as long as all robust optimization functions are on the beam set dose (i.e., not beam set + background).

2.14 MULTI CRITERIA OPTIMIZATION (MCO)

The generation of Pareto plans in the segment-based mode for VMAT has been changed. The periodic sweeps of the MLC leaves back and forth across the target as the gantry rotates are no longer enforced to be strictly unidirectional. This gives the Pareto plans greater flexibility to shape dose distributions and makes generation of Pareto plans less likely to terminate due to violated constraints.

2.15 GENERAL PHOTON PLANNING

- Segment doses used during segment MU (Monitor Units) optimization are stored with a lower accuracy than previously. This leads to a reduced risk of using up all available memory while the changes in optimization results are small.
- New tools are added for reversing an arc beam and creating a reversed copy of an arc beam.

2.16 PROTON PENCIL BEAM SCANNING PLANNING

- It is possible to compute dose-averaged LET (Linear Energy Transfer) as part of the final dose computation when using the Monte Carlo dose engine.
- Water equivalent thickness (WET) is computed/displayed/exported for BDSP.

2.17 PROTON BROAD BEAM PLANNING

- Water equivalent thickness (WET) is computed/displayed/exported for BDSP.
- Compensator physical thickness is computed/displayed/exported for BDSP.
- The range modulator name is displayed for Ocular Gaze plans.
- Support for the Single Scattering delivery technique.
- Support for beam models with a non-uniform fluence.

2.18 LIGHT ION PENCIL BEAM SCANNING PLANNING

- It is possible to compute dose-averaged LET (Linear Energy Transfer) as part of the final dose computation for carbon ions.
- Water equivalent thickness (WET) is computed/displayed/exported for BDSP.

2.19 BORON NEUTRON CAPTURE THERAPY (BNCT) PLANNING

Support is added for setup beams for BNCT, including DICOM export.

2.20 PLAN EVALUATION

- It is now possible to compute, deform and accumulate the 2 Gy equivalent dose (EQD2) from photon and brachy fraction doses.
- It is possible to rename summed evaluation doses and EQD2 evaluation doses.

- Support for plan evaluation of LET (Linear Energy Transfer) distributions:
  - The LET distributions for protons and light ions are listed in the dose tree, if present.
  - The LET distribution can be displayed in the 2D views.
  - A separate LET color table is available. It is possible to define a dose threshold value (default 0), under which no LET value is shown in the 2D view. The dose refers to the beam set dose.
  - It is possible to compute LET as part of Compute perturbed dose and Compute on additional data sets.
  - The LET distribution along a line can be shown in Line dose view. If viewed together with a dose distribution, two y-axes are displayed (one for each quantity).
  - The LET volume histograms are shown in the LVH view.
  - The LET statistics are shown in the Dose statistics view.
- It is possible to manually enter maximum value for Y axis in Line graphs. Y maximum value no longer updates to maximum of all doses when changing displayed dosed.
- It is now possible to compute perturbed dose with patient rotation perturbation.

2.21 TREATMENT DELIVERY

- The Treatment course list can now be configured to show either planning image or acquired image(s), or both.
- Fractions and sessions in the Treatment course list now have a tooltip that shows more information about the fraction/session.

2.22 ADAPTIVE REPLANNING

It is now possible to select/change the tolerance table in an adapted plan. It is also possible to view the tolerance table values.

2.23 DICOM

For machines configured to export the Beam Dose as the nominal contribution/part of the prescribed dose value, it is now possible to toggle whether Beam Dose (300A,0084) is to be exported as beam nominal contribution or with beam dose specification point dose at the time of the export. Previously, it has not been possible to override the setting on the machine.

2.24 VISUALIZATION

- The ROI visualization settings for 2D, 3D, BEV and DRR views are now persistent and saved together with the ROI.
- The slice indicator widget has been improved with clearer colors.

- 3D visualization of POIs, CyberKnife beams and Brachy channels has been enhanced.
- If the visualization setting for an ROI is turned off in any view, this will be indicated via the eye symbol in the ROI list.
- It is now possible to visualize setup imager DRRs on the receptor plane. The measure tool and crosshair scale are adapted to give distances on the receptor plane.
- Beam angles are written on exported DRRs, together with other annotations.

2.25 SCRIPTING

Script creation/management now includes links to the installed scripting API.

2.26 SETUP IMAGING SYSTEMS

- The source-axis distance (SAD) property for setup imaging systems has been moved to the individual setup imagers of the setup imaging system.
- A setup imager can be assigned a receptor model represented by its width, height and isocenter to receptor plane distance. Setup imager DRRs will be vizualized on the receptor plane. The measure tool and crosshair scale are adapted to give distances on the receptor plane. To keep DRRs presented on isocenter plane, select an isocenter to receptor plane distance of zero, and specify the receptor size on isocenter plane.
- A setup imager can be assigned DRR export data that will tell how the DRRs will be exported.

2.27 PHOTON BEAM COMMISSIONING

- It is now possible to move uncommissioned CyberKnife and TomoTherapy treatment machines into groups in the machine tree.
- Updated template machines:
  - Beam qualities with and without flattening filter are merged into same machine.
  - Various minor corrections to machine model parameters for several template machines.
- It is now possible to compute all photon Monte Carlo dose curves for a machine.
- It is now possible to compute all dose curves for a machine at once (Collapsed Cone, photon Monte Carlo and electron Monte Carlo).
- When computing selected dose curves for photon Monte Carlo, all dose curves with the same field size and modulation (open/wedge/cone) as a selected curve will also be computed. The time required to compute all curves for the same field size and modulation is the same as the time for only computing one.
- Recommendations have been updated on the usage of detector height and depth offset for depth dose curves. If the previous recommendations were followed, the modeling of the build-up region for photon beam models could lead to surface dose overestimation in computed 3D

dose. It is recommended to review and, if needed, update photon beam models with respect to the new recommendations. Refer to section *Detector height and depth offset* in *RSL-D-RS-11B-REF, RayStation 11B Reference Manual*, section *Depth offset and detector height* in *RSL-D-RS-11B-RPHY, RayStation 11B RayPhysics Manual* and *Beam Commissioning Data Specification* for information about the new recommendations.

2.28 ELECTRON BEAM COMMISSIONING

It is now possible to compute all dose curves for a machine (Collapsed Cone, photon Monte Carlo and electron Monte Carlo).

2.29 DOSE ENGINE UPDATES

2.29.1 RayStation 11B dose engine updates

The changes to the dose engines for RayStation 11B are listed below.

Dose engine	RS 11A SP2	RS 11B	Dose effect	Comment
All	-	-	-	The issue described in FSN 84236 has been resolved, in some cases leading to noticeable changes in dose for beams passing through the interface between the External ROI and ROIs of type Support, Fixation and Bolus for beam. Updated computation for surface triangulations of ROIs, which can have minor effect on ROI voxel volumes.
Photon Collapsed Cone	5.5	5.6	Negligible	Existing machine models do not need to be re-commissioned.
Photon Monte Carlo	1.5	1.6	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version. This has a minor effect on the computed Photon Monte Carlo dose, which due to the statistical nature is very sensitive to even small disturbances. For dose calculation with low statistical uncertainty, the difference in dose compared to previous version is negligible. Existing machine models do not need to be re-commissioned.

Dose engine	RS 11A SP2	RS 11B	Dose effect	Comment
Electron Monte Carlo	3.9	3.10	Negligible in most cases. Electron dose can be changed noticeably for cases affected by the issue described in FSN 84236.	Existing machine models do not need to be re-commissioned.
Proton PBS Monte Carlo	5.2	5.3	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version. This has negligible effect on the computed proton PBS Monte Carlo dose. Existing machine models do not need to be re-commissioned.
Proton PBS Pencil Beam	6.2	6.3	Negligible	Existing machine models do not need to be re-commissioned.
Proton US/DS/Wobbling Pencil Beam	4.7	4.8	Negligible	Existing machine models do not need to be re-commissioned.
Carbon PBS Pencil Beam	4.3	4.4	Negligible	The platform used for GPU computations in RayStation (CUDA) has been upgraded to a new version. This has negligible effect on the computed light ion dose. Existing machine models do not need to be re-commissioned.
Brachy TG43	1.1	1.2	Negligible	Existing machine models do not need to be re-commissioned.

2.30 CHANGED BEHAVIOR OF PREVIOUSLY RELEASED FUNCTIONALITY

- Note that RayStation 11A introduced some changes regarding prescriptions. This information is important if upgrading from a RayStation version earlier than 11A:
  - Prescriptions will always prescribe dose for each beam set separately. Prescriptions defined in RayStation versions prior to 11A relating to beam set + background dose are obsolete. Beam sets with such prescriptions cannot be approved and the prescription will not be included when the beam set is DICOM exported.

- Prescriptions that are set using a plan generation protocol will now always relate to the beam set dose only. Make sure to review existing plan generation protocols when upgrading.
- Prescription percentage is no longer included in exported prescription dose levels. In RayStation versions prior to 11A, the Prescription percentage defined in RayStation was included in the exported Target Prescription Dose. This has been changed so that only the Prescribed dose defined in RayStation is exported as Target Prescription Dose. This change also affects exported nominal dose contributions.
- In RayStation versions prior to 11A, the Dose Reference UID exported in RayStation plans was based on the SOP Instance UID of the RT Plan/RT Ion Plan. This has been changed so that different prescriptions can have the same Dose Reference UID. Because of this change, the Dose Reference UID of plans exported prior to 11A has been updated so that if the plan is re-exported a different value will be used.

- Note that RayStation 11A introduced some changes regarding Setup imaging systems. This information is important if upgrading from a RayStation version earlier than 11A:
  - A Setup imaging system (in earlier versions called Setup imaging device) can now have one or several Setup imagers. This enables multiple setup DRRs for treatment beams as well as a separate identifier name per setup imager.
    - # Setup imagers can be gantry-mounted or fixed.
    - # Each setup imager has a unique name which is shown in its corresponding DRR view and is exported as a DICOM-RT Image.
    - # A beam using a setup imaging system with multiple imagers will get multiple DRRs, one for each imager. This is available for both setup beams and treatment beams.

- Note that RayStation 8B introduced handling of effective dose (RBE dose) for protons. This information is important for proton users if upgrading 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 that was exported 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*.

- Note that dose statistics calculations are updated in RayStation 11B. This means that small differences in evaluated dose statistics are expected when comparing to a prior version.

  This affects:

  - DVHs
  - Dose statistics
  - Clinical goals
  - Prescription evaluation
  - Optimization objective values
  - Fetching dose statistics measures via scripting

  This change also applies to approved beam sets and plans, meaning that, for example, prescription and clinical goals fulfillment may change when opening a previously approved beam set or plan from a RayStation version prior to 11B.

  The dose statistics accuracy improvement is more noticeable with increasing dose range (difference between minimum and maximum dose within an ROI), and only minor differences are expected for ROIs with dose ranges smaller than 100 Gy. The updated dose statistics no longer interpolates values for Dose at volume, $D(v)$, and Volume at dose, $V(d)$. For $D(v)$, the minimum dose received by the accumulated volume v is instead returned. For $V(d)$, the accumulated volume that receives at least the dose d is returned. When the number of voxels within an ROI is small, the discretization of the volume will become apparent in the resulting dose statistics. Multiple dose statistics measures (e.g., D5 and D2) may get the same value when there are steep dose gradients within the ROI, and similarly, the dose ranges lacking volume will appear as horizontal steps in the DVH.

- Automatic range shifter selection takes range shifter size into account to ensure that the chosen range shifter is not too large for the current snout.
- The maximum value for the Y axis in Line graphs in Plan Evaluation no longer updates to the maximum of all displayed doses when changing doses to display.
- *Default for dose deformation* is the new name for the feature to select which deformable registration to use for dose deformation (previously named *Approve for dose accumulation*).
- Recommendations have been updated on the usage of detector height and depth offset for depth dose curves. If the previous recommendations were followed, the modeling of the build-up region for photon beam models could lead to surface dose overestimation in computed 3D dose. It is recommended to review and, if needed, update photon beam models with respect to the new recommendations. Refer to section *Detector height and depth offset* in

RSL-D-RS-11B-REF, RayStation 11B Reference Manual, section *Depth offset and detector height* in *RSL-D-RS-11B-RPHY, RayStation 11B RayPhysics Manual* and *Beam Commissioning Data Specification* for information about the new recommendations.

3 KNOWN ISSUES RELATED TO PATIENT SAFETY

There are no issues related to patient safety in RayStation 11B.

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

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)

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

(341059)

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 and the rendered dose color being fetched from different voxels. 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)

Incorrect information in the Edit plan dialog when adding a new beam set, if current beam set has deprecated prescription

When adding a new beam set and the currently selected beam set has a prescription relating to beam set + background dose (deprecated functionality), the *Edit plan* dialog will incorrectly display that the prescription for the new beam set also will be set for beam set + background dose. This is incorrect since prescriptions for a new beam set relate to the beam set dose. The information in the *Edit plan* dialog will be corrected when switching beam sets in the dialog.

(344372)

4.2 IMPORT, EXPORT AND PLAN REPORTS

Import of approved plan causes all existing ROIs to be approved

When importing an approved plan to a patient with existing unapproved ROIs, the existing ROIs may become automatically approved.

336266

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)

RayStation sometimes reports a successful TomoTherapy plan export as failed

When sending a RayStation TomoTherapy plan to iDMS via RayGateway, there is a timeout in the connection between RayStation and RayGateway after 10 minutes. If the transfer is still ongoing when the timeout starts, RayStation will report a failed plan export even though the transfer is still in progress.

If this happens, review the RayGateway log to determine if the transfer was successful or not.

338918

Report Templates must be upgraded after upgrade to RayStation 11B

The upgrade to RayStation 11B 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)

Warnings listed in the beam set Warnings report table might be incorrect for approved plans

If a report is generated for a plan approved in an earlier RayStation version than 11A, the warnings displayed in the beam set *Warnings* table might not reflect the warnings displayed at the time of approval. The beam set *Warnings* table is generated by RayStation at the time when the report is created, by performing all checks that will cause warnings in RayStation 11A. Therefore, there might be additional warnings in the report that were not present at the time of plan approval.

(344929)

4.3 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)

Floating view in Image registration module

The floating view in the Image registration module is now a fusion view that only displays the secondary image set and contours. The change of the view type has changed how the view works/displays information. The following have changed:

- If Level/window is activated from the floating view it will affect the Primary image set instead of the Secondary. The level/window in the Secondary image set can be changed via Fusion tab instead.

- It is not possible to edit the PET color table from the floating view. The PET color table in the Secondary image set can be changed via Fusion tab instead.
- Scrolling in the floating view is limited to the Primary image set, e.g., if the Secondary image set is larger or does not overlap the Primary in the fusion views it will not be possible to scroll through all slices.
- The image orientation indicator, "Ray", does not update based on the registration rotations in the floating view.
- Position, Direction (transversal/sagittal/coronal), Patient direction letters, Imaging system name and Slice number are no longer displayed in the floating view.
- Image value in the floating view is not displayed if there is no registration between the Primary and Secondary image sets.

(409518)

4.4 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)

4.5 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)

4.6 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)

4.7 PLAN EVALUATION

Material view in Approval window

There are no tabs to select to display the material view in the Approval window. The material view can be selected instead by clicking on the image set name in a view and then selecting material in the drop-down that appears.

(409734)

4.8 CYBERKNIFE PLANNING

Verifying deliverability of CyberKnife plans

CyberKnife plans created in RayStation may, for about 1% of the cases, fail the deliverability validation. Such plans will not be deliverable. The affected beam angles will be identified by the deliverability checks that are run at plan approval and plan export.

To check if a plan is affected by this issue before approval, the script method `beam_set.CheckCyberKnifeDeliverability()` can be run. The affected segments can be manually removed before running a continued optimization for the last adjustments.

(344672)

4.9 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)

4.10 TREATMENT DELIVERY

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)

Treatment course list is not correctly updated when a new deformable registration is selected as Default for dose deformation

When a new deformable registration is is selected as Default for dose deformation and a deformed dose already exists, the information about the dose deformations in the treatment course list is not displayed correctly. However, the updated deformed dose is displayed correctly. The list is updated by recalculating the deformed dose.

(341739)

4.11 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)

Negative values in Automated breast planning settings

Negative values between -0.01 and -0.99 cannot be written directly in the Settings dialog in Automated breast planning. A workaround is to first write the positive version, e.g., 0.50, and then add the '-' or copy and paste the value from another place.

(408334)

4.12 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)

4.13 MEDICAL ONCOLOGY PLANNING

No regimen information shown in Open Case dialog

When selecting a patient plan with a regimen in the Open Case dialog, which is used for opening a patient case that is already in the database, there is no information shown indicating that the plan has a regimen. There is a list of beam sets of the patient plan, which is empty for plans with regimens.

(146680)

Backup and restore does not work correctly for medical oncology patients

When performing a backup of a medical oncology patient, not all referenced data is included in the backup. Vitals, medication statements, active substances and regimen templates are not included in backups. However, these can be backed up using the RayStation Storage tool, see section D.3.12 Export data in *RSL-D-RS-11B-USM, RayStation 11B User Manual*.

To back up a patient, start by backing up all referenced active substances, regimen templates, vitals and medication statements in the RayStation Storage tool. Vitals and medication statements are

combined and backed up as observations. When this is done, back up the patient in RayStation. To restore the patient, start by restoring active substances, regimen templates and observations in RayStation Storage Tool, see section D.3.11 Import data in *RSL-D-RS-11B-USM, RayStation 11B User Manual*, and then restore the patient in RayStation.

(143750)

4.14 MACHINE LEARNING PLANNING

Machine learning optimization with background dose

When using Machine learning optimization with a background dose, the background dose must be calculated with updated voxel volumes.

(410647)

4.15 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)

4.16 COLLISION CHECK

Rotation point for patient displacement when geometry is missing in prescription ROI (MedAustron only)

The rotation point used for patient displacement in RayCommand is set to the geometrical center of the primary prescription ROI. If the primary prescription ROI does not have a geometry, the rotation point is set to 0,0,0 (Right-Left, Inf-Sup, Post-Ant).

(410343)

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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