RAYSTATION v2026

Release Notes

RayStation

v2026

Traceback information:
Workspace Main version a1134
Checked in 2026-06-30
Skribenta version 5.6.020.1

Disclaimer

For information on functionality not available for regulatory reasons, see the Regulatory Information in the RayStation Instructions for Use.

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.

Safety notices

Warning and caution notices in the user documentation inform about the safe use of the product and must be followed.

WARNING!

A warning notice informs about a risk for bodily harm or death. In most cases, the risk is related to mistreatment of the patient.

CAUTION!

A caution notice informs about a risk for damage to equipment, software or data.

Note: *A note provides additional helpful information, tips or reminders.*

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1 INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document contains important notes about the RayStation v2026 system. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of RayStation v2026 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 v2026

This chapter describes the news and improvements in RayStation v2026 as compared to RayStation v2025.

2.1 HIGHLIGHTS

- Support for online treatment adaptations in integration with RayCare (introduced in RayStation v2025 SP2)
- Enhanced reirradiation support with cumulative dose evaluation
- New module for patient-specific EPID QA
- Advancements in adaptive replanning
- Enhanced automated planning with improved configuration support
- Increased coverage of deep learning segmentation models and quality metrics
- Faster deep learning planning with new and updated models
- Approval of individual ROI and POI geometries, and improved multi-image views
- New photon helical arc planning capabilities
- Plan generation protocols for PBS
- Faster proton PBS optimization utilizing the GPU
- Support for encrypted DICOM communication

2.2 REIRRADIATION SUPPORT

- It is now possible to add a prior treatment to a treatment plan.
  - The prior dose is automatically mapped to the planning image, and cumulative doses are computed.
  - Optimization functions and clinical goals can be associated with the cumulative dose.
  - All modalities and treatment techniques are supported except for boron neutron capture therapy (BNCT).
- Equieffective dose in 2 Gy fractions (EQD2).

  - EQD2 parameters (α/β ratios and tissue recovery factors (TRFs)) can be defined per ROI and stored per treatment plan.
  - EQD2 distributions and statistics can be viewed in the Plan evaluation module.
  - Optimization functions and clinical goals can be evaluated with respect to EQD2, either with or without corrections for TRFs.
  - Parameter-specific EQD2 distributions are computed for α/β ratio and TRF combination used by the ROIs. These distributions are used for evaluation of DVH curves, dose statistics, optimization functions and clinical goals. This means that the correct EQD2 parameters are always applied across the entire ROI volume, including voxels shared with other ROIs, for example at ROI boundaries or within overlapping regions.
- Required license: raySequel.

2.3 EPID QA

- New module for performing patient specific EPID QA.
- Creation of verification plans for delivery with the EPID.
- Import of measured EPID images from Varian machines.
- Computation of EPID images using EPID model defined on the LINAC machine model.
- Comparison of measured and computed EPID images using response differences, line profiles and gamma metrices.
- Required license: rayEpid

2.4 PLAN GENERATION PROTOCOL SUPPORT FOR PBS

- Plan generation protocols now support automated creation of Pencil Beam Scanning (PBS) plans. Protocol steps have been extended to enable RBE model selection, configuration of robustness settings, PBS optimization settings, and beam computation settings for PBS beams.

2.5 GENERAL SYSTEM IMPROVEMENTS

- The default color tables can be modified in the *Adjust color tables* dialog.
- It is now possible to switch between planning activities and modules using the keyboard, as an alternative to clicking the activity or module tab. Press the Alt key and then the underlined letter in the activity or module name (e.g., Alt+M to switch to Patient modeling, or Alt+O to Plan optimization).
- Support for Microsoft SQL Server version 2025.
- The *Measure* tool can be toggled on and off using keyboard shortcut M.
- RayStation is validated on NVIDIA Blackwell GPUs (since RayStation v2025 SP2).

2.6 PATIENT MODELING

- It is now possible to approve individual ROI and POI geometries.
  - An approved geometry will be locked from editing on the selected image set.
  - It is still possible to edit ROI and POI properties (for example name, color and material) when the geometry is approved.
  - The approval information is stored in the audit log.
  - The option is enabled for users belonging to the RayStation-PlanApproval group.
  - Single sign-on (SSO) can be enabled for approval of geometries in Clinic settings.
- Multiple image layout: Three images can now be displayed side-by-side. The left-most view will always show the primary image set, on which contours are modified when using contouring tools, and the other two views can present any image next to it. If an image has a registration to the primary image set, synchronized scrolling is enabled, and contouring is possible.

2.7 DEEP LEARNING SEGMENTATION

- For ROI geometries initially generated by deep learning segmentation (DLS), a Dice similarity coefficient is now calculated upon approval to quantify discrepancies between the original DLS output and any manual modifications made by the user. Additionally, geometric metrics such as volume, center of mass, and bounding box are calculated and stored for both the original DLS and the edited geometries. The results are accessible in RayIntelligence and through scripting.
- The RSL DLS CT model includes 11 improved ROIs, as outlined below.
  - Anorectum
    - Extended support for female pelvis and prostatectomy cases.
    - Improved anatomical continuity with Colon_Sigmoid.
  - Bladder
    - Extended support for female pelvis and prostatectomy cases.
    - Improved robustness for varying levels of bladder filling.
  - Colon_Sigmoid
    - Extended support for female pelvis and prostatectomy cases.
    - Improved anatomical continuity with Anorectum.
  - Spc_Bowel
    - Updated definition: Now extends further cranially to include all bowel structures.
    - Extended support for female pelvis and prostatectomy cases.

  - PenileBulb
    - Extended support for prostatectomy cases.
    - Improved cranial and caudal ends.
  - Heart, Kidney_L/R, Lung_L/R, SpinalCanal
    - Extended support for pediatric cases.
- One ROI has been removed from the RSL DLS CT model: L6 vertebra.
- The RSL DLS CT model also includes 32 new ROIs, listed below.

Group	Modality	Regions of Interest
Bowels	CT	Colon Duodenum Jejunum_Ileum Jejunum_Ileum_Colon
Pelvis	CT	Canal_Anal Rectum
Female Pelvis	CT	Female_Genital_Tract LN_Gyne_Iliac LN_Gyne_Inguinofem_L LN_Gyne_Inguinofem_R LN_Gyne_Paraaortic LN_Gyne_Presacral LN_Gyne_Pelvic_Sidewall Parametrium_L Parametrium_R
Prostate Bed	CT	ProstateBed_ESTRO ProstateBed_PERYTON
Bronchial Tree	CT	Bronchus_Lingular Bronchus_Lobar_Inferior_L Bronchus_Lobar_Inferior_R Bronchus_Lobar_Middle Bronchus_Lobar_Superior_L Bronchus_Lobar_Superior_R ProximalBronchialTree
Artificial Hip & Femur	CT	Artificial_Hip_L Artificial_Hip_R Femur_L Femur_R

Group	Modality	Regions of Interest
Vessels	CT	A_Femoral_L A_Femoral_R V_Femoral_L V_Femoral_R

- For the RSL DLS CT model, several neural networks have been retrained as part of technical updates. This affects the generation of the following ROIs:
  - Bone_Pelvic_L/R, Bronchus_InterM, Bronchus_Main_L/R, C1–C7, Carina, Coccyx, Femur_Head_L/R, L1–L5, Prostate, Prostate_minus_VenousPlexus, Sacrum, SeminalVesicles, and T1–T12.
  - Updated network weights may result in minor variations in the generated ROIs compared to previous versions.

2.8 PLAN EXPLORER

- Plan generation protocols now support automated creation of PBS plans. This means that:
  - PBS exploration plans can be created directly in the Plan explorer module.
  - Exploration templates can include PBS plans.
- Improved responsiveness when working with large sets of exploration plans. This applies specifically when selecting plans, removing plans, using exploration filters and adding existing plans to a plan exploration.
- A selection of multiple exploration plans can now be marked as candidates with a single click.
- Exploration plans created using plan generation protocols or exploration templates will no longer be visible in the *Plan* drop-down list by default. This is to avoid a long list of plans when many plans are generated automatically. To make the plans available in the *Plan* drop-down list, a new option *Show in other modules* is added to the plan thumbnail context menu.
- The clinical goal list in the *Compare* workspace now has the same design as the list in other modules.

2.9 BRACHYTHERAPY PLANNING

- During channel reconstruction, the views are now automatically aligned with channel direction.
- Added support for basal point creation.
- Improved display of dwell point data by showing the source strength corrected treatment time per dwell point, and the dwell point positions relative to a pre-configured reference point.
- TG43 and brachytherapy Monte Carlo doses are capped at 100 Gy during dose computation.

- *Zoom to max D90* checkbox is added to DVH graphs to be able to quickly zoom in a graph.
- An applicator model can now be created from structures (ROIs, LOIs and POIs) via scripting.
- TG43 dose can now be computed on CBCT images.

2.10 PLAN SETUP

- If the patient and case exist in RayCare, the prescription can now be copied from RayCare, as an alternative to defining the prescription in RayStation. The number of fractions in RayCare will replace the RayStation value.

2.11 3D-CRT BEAM DESIGN

- Conformal arc segments can be generated for wave-arc trajectories on LINACs with this capability, such as Hitachi OXRAY.

2.12 PLAN OPTIMIZATION

- The treat function can be applied during optimization of VMAT plans featuring wave-arc trajectories on LINACs with this capability, such as Hitachi OXRAY.
- Changed behavior for VMAT and Conformal arc: If the collimator angle or the couch angle is changed, the segments of the beam are removed.
- ECHO and ML planning automation strategies can now be configured through the user interface. The configuration dialog is accessed from the *Automation* tab.

2.13 MACHINE LEARNING PLANNING

- The machine learning planning backend has been refactored, resulting in significantly faster dose prediction and removing the need for a scripting environment. Minor differences are expected in optimization results due to this update. The quality of the deliverable dose created using an ML strategy should be verified after upgrading.
- New models:
  - RSL Breast Locoregional: Single level locoregional breast model for treatment of the breast or chest wall including regional lymph nodes.
  - RSL Lung Proton: Proton model for treatment of primary and/or nodal tumors in either lung.
  - RSL Prostate SVs Nodes 2LVS: New updated version for the RSL Prostate SVs Nodes 2LVS model, for the treatment of prostate, seminal vesicles including lymph nodes.

2.14 PHOTON HELICAL ARC PLANNING

- Photon beams can now use a helical arc trajectory, allowing longitudinal table-top motion while the gantry rotates during delivery. This enables planning of advanced helical arc treatments on compatible LINACs.
- Required license: rayHelicalArc

2.15 PROTON PENCIL BEAM SCANNING PLANNING

- Part of the proton PBS optimization algorithm has been moved to the GPU, making the optimization faster. The speed-up will depend on the case and available hardware.
- Support is added for dose driven continuous scanning (DDCS) for Hitachi proton machines.
  - If the Hitachi machine is equipped with the DDCS option, RayStation will create plans that fulfill requirements of deliverability. This includes minimum and maximum spot weights, if the beam is on or off when scanning to the next spot, and an optimal meterset rate per energy layer, providing the fastest delivery time while maintaining plan quality.
  - Required license: rayContinuousScanning

2.16 PROTON ARC PLANNING

- Support is added for upright static PBS arcs, where the chair rotates between energy layers.
  - Static PBS arcs with rotating chair are analogous to static arcs where the gantry rotates (supported in previous versions of RayStation).
  - Any proton PBS machine using a chair as patient support can be configured to support planning for PBS arcs where the chair rotates.
  - A PBS arc plan with rotating chair must be converted to a regular PBS plan before delivery.
- PBS arc planning is now available on oblique image sets.

2.17 LIGHT ION PENCIL BEAM SCANNING PLANNING

- Dose computation for light ions is now restricted when a Bragg peak is located within the range shifter. The optimizer will no longer create plans containing such spots. However, they may still be present in plans that were manually edited by the user or created with earlier versions of RayStation. In such cases, a message is displayed identifying the affected beam and energy layer, and the plan must be reset and re-optimized, or the problematic energy layers removed manually.
- Support is added for Hitachi carbon ion systems.
  - Fine tuning range shifters.
  - Dose driven continuous scanning (DDCS):
    + RayStation will create plans that fulfill requirements of deliverability. This includes minimum and maximum spot weights, if the beam is on or off when scanning to the next spot, and an optimal meterset rate per energy layer, providing the fastest delivery time while maintaining plan quality.
    + Required license: rayContinuousScanning

- A range shifter air gap model can now be added to a light ion machine model. The model introduces a correction factor to the dose as a function of range shifter thickness and air gap, making it possible to model scattered particles that do not hit the patient due to large air gaps.

2.18 ADAPTIVE REPLANNING (UPDATES INTRODUCED IN RAYSTATION V2025 SP2)

- The Automated replanning module now offers enhanced integration with RayCare for delivery on the Varian TrueBeam treatment machines. For active online adaptive sessions, it provides tools to support data transfer and communication with RayCare, including a streamlined workflow for image set and image registration import. After review and decision to proceed with the adapted beam set, selecting *Assign adapted* will make the adapted beam set available in RayCare and automatically assign it to the correct fraction. If the decision is to continue with the originally scheduled beam set, the *Proceed with scheduled* option can be used. Delivery of the already scheduled beam set may then continue in RayCare.
- When creating an adapted beam set, the treatment beams are now given new default names to indicate that they belong to an adapted beam set. The adapted beam name consists of the original beam name with a suffix appended. The suffix has the format 'A[n]', where 'n' is the fraction number.
- During the approval of an adapted plan, the plan will now be compared to the reference plan, and a warning dialog will appear if significant differences are detected. These differences are evaluated in terms of beam configuration, prescription, total meterset per fraction, treatment technique, and assigned treatment machine. The meterset difference threshold can be configured.

2.19 AUTOMATED ADAPTIVE REPLANNING

- When recomputing a synthetic CT, the deformable registration is now automatically recomputed as well.
- More options for mapping ROIs and POIs using rigid registrations from structure templates are now available. The existing Frame of Reference registration can be used, and options *Discard rotations*, *Focus on bone structures* and *Focus on ROI* when a registration is created.
- Image conversion now supports selecting the output resolution for corrected CBCT image sets, including the option to use the reference CT resolution. When a field-of-view (FOV) ROI is used, it is now possible to select the covered superior-inferior range from the reference image set. If no range is specified, the full superior-inferior range of the reference image set is used by default.
- Support for stopping and continuing the automated replanning workflow has been improved. The automated replanning can now be quickly stopped by canceling the currently running step. After stopping, the workflow can be resumed from the first incomplete step.

2.20 DICOM

- RayStation supports DICOM Transport Layer Security (TLS) for secure, encrypted data transfer with compliant DICOM systems.
- It is now possible to DICOM import from a PACS source in the *PACS* tab.
- Increased precision and configurable rounding of exported decimal values are added.
- "RECON TOMO" multi-frame NM (SPECT) data is now supported (including DICOM import and export, visualization, registration and contouring). No real-world conversion is included (data will be displayed unitless).
- Exported QA plan doses now populate the Image Orientation (Patient) (0020,0037) based on what is selected in the dialog. In previous versions, the image orientation for coronal and sagittal views would be exported incorrectly, leading to incorrect orientation. This was corrected in RayStation v2025 SP2.

2.21 SCRIPTING

- Two new actions for setup beams, CopySetupBeamAction and DeleteSetupBeamActions, are now scriptable and available via scripting API.
- 'Gender' has been replaced by 'Sex' in the user interface. However, 'Gender' is still used in scripting.
- The properties Beam.ArcRotationDirection and Beam.ArcStopGantryAngle have been removed. For an arc beam, the following methods and properties are used to read and write settings related to beam angles:

Read	Write	Comment
GetArcRotationDirection	SetArcRotationDirection	
GantryAngle	SetGantryAngle	Represents the start gantry angle for an arc beam where the gantry rotates.
GetGantryArcStopAngle	SetGantryArcStopAngle	Applicable only for arcs with a rotating gantry.
CouchRotationAngle	SetCouchRotationAngle	Represents the start couch/chair angle for an arc beam where the couch/chair rotates.
GetCouchArcStopAngle	SetCouchArcStopAngle	Applicable only for arcs with a rotating couch or chair.
InitialCollimatorAngle	SetCollimatorAngle	

Note that the properties GantryAngle, CouchRotationAngle and InitialCollimatorAngle cannot be set directly for an arc beam. The corresponding set methods must be used.

- The method Beam.DeleteArcTrajectory has been removed.
- The method Beam.SetArcTrajectory has been renamed to SetWaveArcTrajectory.
- TomoSegment.CouchYOffset has been replaced by TomoSegment.TableTopLongitudinalOffset (applies to Tomo Helical).
- New scriptable action is added for PhotonBeam: SetHelicalArcTrajectory
- SetWaveArcTrajectory has a new argument: TableTopLongitudinalOffsets
- CreateQAPlan has a new argument: CenterHelicalArcBeams

2.22 ION BEAM COMMISSIONING

- Dose driven continuous scanning (DDCS) parameters are now visible in the *Scanning data* tab for Hitachi proton and carbon ion machines.
- Intensity (meterset rate) computation settings are now visible in the *Scanning data* tab for Toshiba carbon ion machines.

2.23 RAYSTATION DOSE ENGINE UPDATES

The changes to the dose engines for RayStation v2026 are listed below.

Dose engine	v2025	v2026	Requires recommissioning	Dose effect[i]	Comment
All	-	-	-	Negligible	Small change in the conversion to voxel ROI. ROI volumes might be slightly different when compared with an identical ROI in previous versions of RayStation.
Photon Collapsed Cone	5.11	5.12	No	Negligible	Routine version increment
Photon Monte Carlo	3.3	3.4	No	Negligible	Routine version increment
Electron Monte Carlo	5.3	5.4	No	Negligible	Routine version increment
Proton PBS Monte Carlo	5.8	5.9	No	Negligible	Minor changes to the computation of LET_d.

Dose engine	v2025	v2026	Requires recommis-sioning	Dose effect [i]	Comment
Proton PBS Pencil Beam	6.8	6.9	No	Negligible	Routine version increment
Proton US/DS/ Wobbling Pencil Beam	4.13	4.14	No	Negligible	Routine version increment
Carbon PBS Pencil Beam	7.2	7.5	No	Negligible	Routine version increment
Brachy TG43	1.7	1.8	No	Negligible	Fraction dose values are capped at 100Gy. This is a postprocessing step in the dose computation. It does not affect the dose computation itself, or evaluation of the doses.
Brachy Monte Carlo	1.1	1.2	No	Negligible	Fraction dose values are capped at 100Gy. This is a postprocessing step in the dose computation. It does not affect the dose computation itself, or evaluation of the doses.

i The dose effect (Negligible/Minor/Major) refers to the effect when recommissioning of the machine model is not performed. After successful recommissioning the dose changes should be minor.

2.24 CHANGED BEHAVIOR OF PREVIOUSLY RELEASED FUNCTIONALITY

- Note that RayStation v2026 introduces changes to the proton PBS optimization. Part of the algorithm has been moved to the GPU, and the low-dose volumes of the spot doses used in the optimization are now sampled at a courser grid than that given by the dose grid. The optimization results may therefore differ slightly compared to earlier versions for the same optimization problem. If an optimization problem from an earlier version is used in v2026, objectives, constraints, and associated weights may have to be adjusted to achieve the best possible plan.
- 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 RayStation 11B introduced changes in the dose statistics calculations. 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.

- Note that RayStation 2024A introduced the possibility to associate a clinical goal to either the beam set dose or the plan dose. This information regarding existing plans and templates with clinical goals is important if upgrading from a RayStation version earlier than 2024A:

  - Physical clinical goals in single beam set plans will now be automatically associated with that beam set.
  - For plans with multiple beam sets, physical clinical goals will be duplicated to ensure all possible associations within the plan. For example, a plan with two beam sets will yield three corresponding copies of each clinical goal: one for the plan and one for each of the two beam sets.

  - Clinical goals defined in templates will be assigned to beam set with name 'BeamSet1'. Users who plan with multiple beam sets are advised to update their templates with the correct association and beam set name. Pay special attention to templates used in protocols. Beam set names stored in templates should match a beam set created in the protocol.

- Note that RayStation v2025 introduced changes related to Sumitomo HI Line Scanning beam commissioning and treatment planning:

  - Line segment MU rounding is no longer performed as part of the final dose computation. Dose is now computed based on the plan parameters that are exported in the RT Ion Plan. New checks have been added to final dose computation, approval and DICOM export to ensure that the plan is deliverable with respect to Line Scanning machine constraints. Existing plans can be made deliverable by re-optimization or using the new *Make beams deliverable* functionality.

  - In previous versions of RayStation, there is a constraint on the line segment lengths used in *Absolute dosimetry* and when manually creating an energy layer using the *Add energy layer* function. This constraint has been removed in RayStation v2025.

  - The unit used for the Line Scanning Beam scanning speed limits table has been changed from m/s to cm/s. Machine models that are upgraded from previous versions of RayStation will be automatically updated.

  See also *section 2.25 Upgrading a Line Scanning beam model from a RayStation version earlier than v2025 on page 22*.

- Note that RayStation v2025 introduced changes related to materials that are available. This information is important for users if upgrading from a RayStation version earlier than v2025:

  - The materials installed with RayStation will no longer be available when setting a material override for an ROI until actively selected to be available. The selection is made by clicking *ROI material management* (available in the *ROI* list and the *ROI/POI details* dialog), then *Add new common material* and then selecting materials to add from the list under *Add predefined*.

- Note that RayStation v2025 introduced changes related to collimator rotation for beams with a block or cutout. This information is important for photon and electron users if upgrading from a RayStation version earlier than v2025:

  - The block or cutout contour will by default be kept constant when rotating the collimator for photon and electron beams. In previous versions, the default behavior was to change the contour to maintain the same exposed area after the collimator rotation. This has now changed so that the contour is kept constant.

2.25 UPGRADING A LINE SCANNING BEAM MODEL FROM A RAYSTATION VERSION EARLIER THAN V2025

Since RayStation v2025, the discrete delivery times of the Sumitomo HI delivery system must be considered by the line segment meterset weights in a plan prior to a dose computation. In earlier versions, this rounding of the weights was performed in the dose calculation itself. This change has the following implications for the *Absolute dosimetry* input data of a Sumitomo Line Scanning machine model:

- The *Meterset* value per nominal energy is no longer included.
- The metersets used for the *Dose per meterset* values are stipulated to be the delivered metersets. (In RayStation versions prior to v2025, planned and delivered metersets could differ due to the line segment weight rounding done in the RayStation dose engine and by the Sumitomo delivery system, and therefore it was the planned, not the delivered, meterset that was used when computing *Dose per meterset*.)

It should be noted that the *Ions per MU* in existing Line Scanning models are still valid in RayStation v2025 or later, and commissioned Line Scanning beam models thus remain valid in RayStation v2025 and later. However, due to the changed definition of *Dose per meterset*, all imported and computed absolute dosimetry data will be automatically deleted from Line Scanning machine models when upgrading from a RayStation version earlier than v2025. To recompute *Dose per meterset*, or to perform auto modeling of an existing model from a RayStation version earlier than v2025, the absolute dosimetry data needs to be imported again to RayPhysics, ensuring that the new requirements on *Dose per meterset* values are fulfilled.

2.26 RESOLVED FIELD SAFETY NOTICES (FSNS)

The issues described in Field Safety Notices (FSNs) 159027, 161525, 167168 and 176257 have been resolved.

Resolved: [FSN 159027] ROI contours flipped upside down

There was an issue where certain operations made on an ROI that was defined on an image set with slice normal (0, 0, -1) could flip the ROI upside down and place it in an incorrect location. This issue has now been resolved.

(1310961)

Resolved: [FSN 161525] Generation of non-unique UIDs in RayGateway

DICOM UIDs generated during export from RayStation to iDMS via RayGateway were not guaranteed to be unique. This issue has now been resolved.

(1313444)

Resolved: [FSN 167168] Missing dose invalidation for ROI with material override

In rare cases related to ROIs with a material override applied or ROIs of type *Bolus*, *Fixation* or *Support*, the dose was not invalidated when a geometry was added or modified, or when the material was removed. This issue has now been resolved.

(1477976)

Resolved: [FSN 176257] Incorrect RBE-weighted dose above 50 cm WED in LEM Classic

There was an issue with the carbon and helium dose calculation. When using LEM Classic, the final dose calculation contained an error in the RBE (and consequently in the RBE-weighted dose) in voxels with water-equivalent depth greater than 50 cm in the beam direction. This issue has now been resolved.

[1538893]

2.27 NEW AND SIGNIFICANTLY UPDATED WARNINGS

For the complete list of warnings, see *RSL-D-RS-v2026-IFU, RayStation v2026 Instructions for Use*.

2.27.1 New warnings

WARNING!

The ROI collision check methods shall not be used as final protection against collisions in the treatment room. The ROI collision check methods *DetectRoiSurfaceCollisionsForOneRotationCenter*, *DetectRoiSurfaceCollisionsForTransformationMatrices* and *DetectRoiSurfaceCollisionsForTwoRotationCenters* available through scripting shall not be used as final protection against collisions in the treatment room. The collision check is only performed with the given ROIs, which may not represent the actual treatment room. It is up to the user to include relevant ROIs with suitable geometry and position in the collision check. The ROI collision check may provide an early indication of a potential collision but shall not replace standard collision avoidance procedures prior to patient treatment.

[1479620]

WARNING!

Brachytherapy Monte Carlo dose engine: Validation method and commissioning. The RayStation brachytherapy Monte Carlo dose engine has been validated against consensus reference data in water: the AAPM HEBD consensus along-away dataset for the supported sources in a water phantom. Additionally, the brachytherapy Monte Carlo has been validated versus the RayStation TG-43 using clinical plans in patient anatomies overridden to water.

For heterogeneous geometries, validation was performed in clinical patient anatomies and slab phantoms with bone, lung, air and high-Z material interfaces, by comparison to the independent Monte Carlo code *egs_brachy* and not by direct phantom dose measurements.

For details on the commissioning of a brachytherapy Monte Carlo dose engine, refer to AAPM TG-186 and WGDCAB Report 372 (or equivalent regional guidelines).

[1593258]

WARNING!

Capping of brachytherapy doses. Brachytherapy doses computed with the TG43 and Monte Carlo dose computation engines are capped at 100 Gy per fraction. Any dose value exceeding this threshold will be limited to 100 Gy in the resulting dose distribution. This affects all dose-related outputs, e.g., dose views, DVHs, dose statistics and clinical goal evaluations.

Note that when dose distributions including capped dose values are rescaled, the capped values will be rescaled by the same factor, i.e. if a dose distribution including dose values capped at 100 Gy is scaled by a factor z, the capped dose values will have the new value z x 100 Gy. Consider recomputing dose after performing significant downward rescaling of the dose distribution to avoid capping clinically relevant dose values.

(1312866)

WARNING!

Evaluation criteria for EQD2 distributions. Evaluation criteria for physical dose cannot be used directly for assessment of EQD2 distributions. The physical dose criteria must always first be converted to the EQD2 domain. This is essential also for treatments prescribed at 2 Gy/fraction to the tumor: even if the prescribed dose in the tumor will be 2 Gy per fraction both in physical dose and in EQD2, cold and hot spots inside the tumor will be further aggravated in the EQD2 domain. More importantly, normal tissue tolerances can differ significantly between the physical dose and the EQD2 distribution also for 2 Gy-fractionated treatments.

(1538161)

WARNING!

Use of parameter-specific EQD2 distributions in plan reports. Plan reports for plans with EQD2 parameters will present data (clinical goals; and, if such snapshots are included, DVHs, dose statistics, and 2D dose views) evaluated using parameter-specific EQD2 distributions, where the EQD2 parameters of the ROI are used for all dose grid voxels. The parameter-specific EQD2 distribution of the External ROI is used for ROIs without designated parameters.

(1482590)

WARNING!

Limitations of the pencil beam algorithm. The pencil beam algorithm employed for light ion dose computation entails certain approximations and limitations. These may affect the accuracy of the computed dose in voxels at the surface of the patient, especially in the presence of a range shifter and/or tangential beams. This includes doses computed for spots that do not intersect the patient at all, such as may occur in certain robust optimization scenarios, as well as for spots with a Bragg Peak in the range shifter.

(1311597)

WARNING!

Absolute dose accuracy for light ion PBS with range shifters. There are limitations to the modeling of the beam spread in the region between a range shifter and the patient, also called the air gap, in the analytical dose engine used for light ion dose calculation in RayStation. While the impact of the air gap in the presence of a range shifter is already explicitly included in the modeling of the nuclear halo, some effects may not be fully captured by this modeling, especially for particularly large air gaps. For this reason, an optional range-shifter air gap correction factor can be included in the beam model to correct for potential discrepancies between measured and computed dose for large air gaps. The inclusion of the correction factor has been successfully validated for air gaps up to 72 cm. The user should take extra care in validating the dose computation when using large air gaps.

(1592905)

WARNING!

Dose and dose-averaged LET accuracy for beams traversing porous tissue with submillimeter heterogeneities. The proton and light ion dose computation is not able to account for submillimeter heterogeneities that are not fully resolved in CT images, such as porous lung structures. Such heterogeneities can lead to Bragg peak degradation and longitudinal widening of both dose and dose-averaged LET distributions. The user should be aware that the computation may not be fully accurate when a beam traverses a significant distance through such structures.

(1479623)

WARNING!

Helical arcs - patient setup. During commissioning of helical arc treatments, verify that setup instructions are in accordance with the treatment machine delivery workflow. When planning VMAT/Conformal helical arc beams, patient setup instructions such as DRRs and tabletop displacements will relate to the isocenter of the first control point, as the initial treatment position.

Before clinical use, verify that the patient positioning workflow is suitable for your treatment unit.

(1537945)

WARNING!

No synchronization is maintained after copying a series prescription from RayCare. After a RayStation beam set prescription is added by copying a series prescription from RayCare, no synchronization is maintained. Any later changes to prescriptions in RayStation or RayCare will not be transferred to the other system. No subsequent validation is performed to verify that the prescriptions are consistent with each other.

(1538003)

WARNING!

Reirradiation planning. It is strongly advised to evaluate the cumulative dose for a plan with prior treatment(s) before approval, and to do the evaluation based on the equieffective (EQD2) cumulative dose even when the prescribed target fraction dose is 2 Gy.

(1483026)

WARNING!

Limitations of the tissue recovery factor (TRF). The tissue recovery factor (TRF) is a simplified representation of long-term normal tissue recovery between courses of radiotherapy. Its use in cumulative EQD2 calculations is subject to important limitations:

- **Recovery is subject to considerable uncertainty and lack of consensus.** Evidence supporting the use of tissue recovery is limited and there is no established consensus on the magnitude and time-dependence of the recovery that can be assumed. Assigned TRF values should therefore be treated as an uncertain parameter and clinical decisions should preferably be robust across a plausible range of TRF values.

- **TRF simplifies complex biology into a single scaling factor.** The model assumes that tissue recovery can be represented by scaling the EQD2 contribution from a prior treatment. A single scaling factor cannot capture the full complexity of the factors that affect recovery, such as sublethal damage repair, accelerated repopulation, vascular changes, and inflammatory response.
- **Recovery varies widely across individuals.** The potential for recovery differs substantially between patients due to numerous factors, such as comorbidities, prior toxicity, treatment interval, presence of concurrent therapies, and patient-specific radiosensitivity. A standardized TRF value may therefore not appropriately reflect recovery in all clinical scenarios and should be applied with caution.

Given these limitations, recovery-corrected EQD2 (EQD2 TRF) should be interpreted only as an approximate indicator of tissue recovery, not as a reliable predictor of increased normal tissue tolerance due to recovery. Users are advised to evaluate a range of plausible TRF values and to always include the cumulative EQD2 computed without TRF in their assessment.

(1538126)

2.27.2 Significantly updated warnings

WARNING!

Brachytherapy models must be validated before clinical use. Brachytherapy afterloaders, source models and application setups must be validated before clinical use.

It is the responsibility of the user to validate all brachytherapy afterloaders, source models and application setups before clinical use. For more details on application setups, see warning 283879.

For the TG43 source models, refer to warning 283358, and for the Monte Carlo source models, refer to warning 1593258.

(285635)

WARNING!

Assignment of CBCT density table. For direct usage of the raw CBCT information in dose computation, RayStation uses an image-specific CBCT density table. Since there is a limited set of density levels specified for a CBCT compared to what is normally specified for a CT, dose computation on CBCT images may be less accurate than using CT images or converted CBCT images. The accuracy of the dose computation using CBCT with an assigned density table relates to the tuning of this table, and how well the real density in the patient maps to the selected densities in the table.

Always review the density table before it is used in dose computation. The review can be performed through spot check of selected slices in the Create Density Table for CBCT dialog where the effect of the density table is visualized.

Dose calculation on raw CBCT image data sets is only supported for photons, and for brachytherapy with the TG43 dose engine.

(9355)

WARNING!

Machine constraints. RayStation relies on delivery of RayStation generated treatment plans being performed with a treatment delivery verification/control system that ensures safe performance preventing treatments not achievable due to non-feasible machine parameters such as, e.g., gantry angle, collimator angle, MLC leaf positions and MU, snout position and minimum spot weight (for ion treatments), as well as gantry and leaf speed for dynamic treatments.

If the machine constraints defined in RayPhysics do not accurately reflect the behavior of the treatment machine and R&V system, the plans may either be stopped at delivery or adjusted outside RayStation, resulting in a delivered dose that differs from the approved dose. When creating a machine model from a template, ensure that all machine constraint parameters are adapted to the specific treatment machine. Even when RayStation adheres to all machine constraints specified in RayPhysics, there is no guarantee that all plans will be deliverable. Ensure that plans are not modified outside RayStation in any way that significantly affects dose without proper evaluation.

(3185)

WARNING!

Ensure that doses computed with different dose engines are compatible. Combining or comparing doses computed with different dose engines (e.g., in fall-back, co-optimization, background doses, summation of doses) must be handled with care if the dose convention differs between algorithms and the plan is sensitive to dose in high Z materials.

The electron and the proton Monte Carlo dose engines report dose to water with radiation transport in medium. The proton and light ion pencil beam dose engines report dose to water. The photon collapsed cone dose engine computes dose to water with radiation transport in different density water, a property which is in between dose to water and dose to medium when computed in medium. The photon and brachy Monte Carlo dose engines for RayStation v2026 report dose to medium with radiation transport in medium. When transported in medium, differences between dose to water and dose to medium for photons have been found to be small for tissues other than bone (1-2%), but the difference can become relatively large for bone (10%) or other high Z materials.

The dose convention for imported doses is unknown to RayStation, and should be handled with care if the plan is sensitive to dose in high Z materials and if the dose is used as background dose or for dose-mimicking.

(409909)

WARNING!

Interpretation of evaluation EQD2 distributions. Evaluation EQD2 distributions computed in the Plan evaluation module use a priority-based approximation for assignment of α/β-values to voxels that belong to multiple ROIs. Special care must be taken when interpreting such distributions:

- For an evaluation EQD2 distribution, adjacent or overlapping ROIs can be assigned with different α/β-values, causing the EQD2 distribution to be discontinuous across boundaries between ROIs with different α/β-values. For voxels that only partially belong to an ROI, or that lie within a region of ROI overlap, a priority rule is used to assign a single α/β-value for the EQD2 computation. As a result, the α/β-value specified for an ROI may be applied only in part of that ROI.
- To ensure that a specific α/β-value is used for the entire ROI when a clinical goal is evaluated for an evaluation EQD2 distribution, it is recommended to first extract the physical dose clinical goal and then convert it to EQD2 with the α/β-value of choice, rather than extracting the clinical goal directly from the EQD2 distribution. Reporting of EQD2 metrics is common in brachytherapy, and RayStation supports EQD2 clinical goals in the Brachy planning module, which automatically performs the recommended conversion.
- The priority-based assignment is only used for evaluation EQD2 distributions, and not for the planning EQD2 distributions obtained when EQD2 parameters are assigned to a treatment plan. ROI-specific quantities such as clinical goals, dose statistics, and DVH curves can be assessed directly for planning EQD2 distributions, as all such assessments are performed with respect to underlying parameter-specific distributions where the correct α/β-value is applied to the full ROI volume.

(408774)

WARNING!

Contouring on Virtual CT. The Virtual CT is created by deforming a reference CT to match the original image set, then replacing mismatching low-density regions. Outside these regions the Virtual CT will be the same as the deformed CT. Consequently, the geometry in the Virtual CT may not precisely match the geometry of the original image. Even if the contours generated on the Virtual CT appear accurate, they may not represent true anatomical locations. In many cases, these contours are equivalent to a deformable mapping of planning CT structures onto the Virtual CT. For optimal accuracy, perform any automatic or manual contouring on the original image set, or on an image converted using the Corrected CBCT algorithm.

(405815)

WARNING!

The predicted machine learning dose and the reference machine learning dose shall not be used for making clinical decisions. These doses are only visualized to provide the user with transparency into the output of the machine learning model and what reference dose will be used during optimization.

(936842)

WARNING!

Always review the deformable registration before using it for dose deformation. Before a deformable registration is used for dose deformation, the user shall review and verify the registration quality. This review can be performed by:

- evaluating the registration in the *Fusion* view.
- evaluating the deformed grid in the *Deformed grid* view.
- evaluating mapped structures between reference and target image sets.

This review is especially important for dose tracking and when deformed dose is used as background dose during optimization of an adapted plan or a plan with prior treatment(s). Because biomechanical deformable registrations are not guaranteed to be invertible, they shall be reviewed with extra care.

It is also important to note that steeper dose gradients can result in larger errors in the deformed dose. Therefore, cases involving steep dose gradients should be reviewed with extra care.

(9656)

WARNING!

Quasi-discrete spill dose is not computed in RayStation. For proton and light ion scanned beam delivery systems that employ a *quasi-discrete* delivery technique, a small amount of dose may be delivered between the plan spots since the beam is not always switched off while the beam moves. This so-called *spill dose* is not explicitly calculated in RayStation, but is added at the position of the plan spot to which the beam moves. The total amount of spill dose depends mainly on the beam meterset rate, the scanning speed, and on the fraction of spots for which the beam is turned on during movement. The relative amount of spill dose also depends on the average meterset of the plan spots. These properties are in turn influenced by planning parameters such as spot spacing, number of overlapping beams, prescription dose per fraction, minimum and maximum planning spot weight, and energy layer rescanning.

The effect of excluding the spill dose in the dose calculation has been investigated for a wide selection of treatment cases, planning strategies, and delivery systems, and no significant dosimetric effect has been found. However, the user shall be aware of this and verify that the approximation holds when commissioning RayStation as well as for each treatment field in the patient specific quality assurance procedure.

(2417)

3 KNOWN ISSUES RELATED TO PATIENT SAFETY

There are no known issues related to patient safety in RayStation v2026.

Note: *Additional release notes may potentially be distributed after installation.*

4 OTHER KNOWN ISSUES

4.1 GENERAL

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)

4.2 IMPORT, EXPORT AND PLAN REPORTS

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 v2026

The upgrade to RayStation v2026 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)

4.3 BRACHYTHERAPY PLANNING

Mismatch of planned number of fractions and prescription between RayStation and SagiNova version 2.4.1.0 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 compared to the brachytherapy afterloading system SagiNova. This applies specifically to SagiNova versions 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 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.

(1483614)

DICOM connectivity issue with Oncentra Brachy related to measured source paths

An issue has been identified affecting the DICOM import of measured applicator model source paths into Oncentra Brachy.

When importing an applicator model from an XML file into RayStation, it is possible to import measured source paths. These measured source paths are characterized by absolute 3D positions of the source points that are not equidistant. The measured source paths are imported from the XML files as described in *RSL-D-RS-v2026-BAMDS, RayStation v2026 Brachy Applicator Model Data Specification*, and the resulting 3D source positions in RayStation correctly represent the source paths provided in the XML files. The 3D source positions are also correct in DICOM exports from RayStation. However, when importing the file into Oncentra Brachy the measured source paths undergo a shift, causing a discrepancy between the absolute source positions in Oncentra Brachy and RayStation. This could mean that a dose distribution recomputed in Oncentra does not match the corresponding dose distribution calculated in RayStation.

The dose distribution computed by RayStation is correct, provided that the applicator is correctly modeled in RayStation. As noted in the *RSL-D-RS-v2026-IFU, RayStation v2026 Instructions for Use* (see warning 726082, Review applicator models), users are strongly advised to adhere to industry standards on applicator model quality assurance to ensure that the applicator is accurately represented in RayStation.

This issue is specific to measured source paths within applicator models and does not affect source paths reconstructed by other methods.

(1043992)

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)

Add MCO function not working correctly in conjunction with background dose

The reference dose function created when clicking the *Add MCO function* button will for a dependent beam set not include the background dose. RayStation will attempt to recreate the navigated beam set dose instead of the navigated beam set + background dose, if such a reference dose function is included in the optimization. This will typically result in a lower optimized dose than intended. Using the *Add MCO function* button is therefore not recommended for dependent beam sets. Creation of a deliverable plan in the MCO module is unaffected by this issue.

(932475)

4.6 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]

The spine tracking grid smaller in Accuray TDC than the grid displayed in RayStation

The spine tracking grid used and displayed in Accuray TDC (Treatment Delivery Console) for treatment delivery setup will be around 80% smaller than the grid visualized in RayStation. In RayStation, make sure to assign the grid a margin around the intended setup area. Note that the grid size is editable in Accuray TDC at delivery.

[933437]

4.7 TREATMENT ADAPTATION

Not possible to import individual registrations in the import dialog during online adaptive procedure

The *Import images and registration* dialog in the Automated replanning module will not allow import of individual registrations. During an online adaptive session, a registration is imported along with its related CBCT. If an imported registration is not good enough for planning and needs to be replaced, it shall first be deleted and then a new registration can be imported using the normal *DICOM import* dialog. Alternatively, the CBCT can be deleted and re-imported along with the new registration using the *Import images and registration* dialog.

[1479560]

4.8 RAYPHYSICS

Updated recommendations for detector height usage

Between RayStation 11A and RayStation 11B, recommendations on the usage of detector height and depth offset for depth dose curves have been updated. 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. When upgrading to a RayStation version newer than 11A, 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-v2026-REF, RayStation v2026 Reference Manual*, section *Depth offset and detector height* in *RSL-D-RS-v2026-RPHY, RayStation v2026 RayPhysics Manual* and *RSL-D-RS-v2026-BCDS,* *RayStation v2026 Beam Commissioning Data Specification* for information about the new recommendations.

(410561)

4.9 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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