RAYSTATION V2025 SP1

Release Notes

Traceback information:
Workspace Main version a1000
Checked in 2025-06-18
Skribenta version 5.6.019

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.

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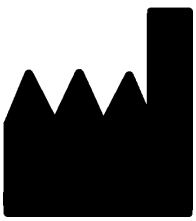
1 INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document contains important notes about the RayStation v2025 system. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of RayStation v2025 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 V2025

This chapter describes the news and improvements in RayStation v2025 as compared to RayStation 2024B.

2.1 HIGHLIGHTS

- Enhanced automated planning
- Enhanced plan explorer
- Improved automated adaptive replanning
- Support for upright treatments
- General performance improvements

2.2 AUTOMATIC PLANNING ALGORITHM ECHO

- Optimization of treatment plans using the ECHO algorithm.
- ECHO (*Expedited Constrained Hierarchical Optimization*) is a two-phase algorithm.
    - In the first phase, machine parameters are optimized to obtain a uniform target dose while considering dose constraints on OARs.
    - In the second phase, the dose to the OARs is minimized while keeping the uniformity of the target dose obtained in the first phase.
- Running ECHO provides a treatment plan ready for review. The plan can be further improved by using the standard tools in RayStation.
- Requires product license rayEcho.

2.3 ENHANCED PLAN EXPLORER

- Automatic generation of multiple plans, e.g., with different trade-offs, different beam arrangements and different treatment machines.
    - Pre-configuration is performed by plan generation protocols.

- Plan generation supports machine learning planning and the auto-planning algorithm ECHO. The generated treatment plans are ready for review and can be further improved by using the standard tools in RayStation.
- Efficient tools to filter and browse among plan candidates to find the most suitable plan.
  - New exploration tools such as a plan score based on clinical goal fulfillment, and a DVH graph including multiple candidate plans.
- Seamless connection with all RayStation functionality.
  - Plans created in *Plan explorer* are immediately available in the other RayStation modules.
  - Existing plans are easily included in a plan exploration.

2.4 ENHANCED SUPPORT FOR UPRIGHT TREATMENTS

- The general support for upright treatment planning in RayStation has now been extended for plans using the Leo Cancer Care upright patient positioning system with variable backrest tilt angle.
- New 3D room models for upright treatments, including a generic fixed beam nozzle and two chair designs.
- Requires product license rayUpright.

2.5 COLLISION CHECK

- Integration with VisionRT software MapRT.
- The feature *Clearance check* provides information on collision status per beam for standard LINACs.
  - A clearance map for all gantry and couch combinations is computed by MapRT and is presented in the RayStation user interface to help the planner choose appropriate beam directions and arc trajectories.
- Surface scans of the patient can be imported from MapRT and are visualized as regular ROIs.
- Requires product license rayClearanceCheck.

2.6 INFRASTRUCTURE AND SPEED IMPROVEMENTS

- It is now faster to open modules and to switch between modules.
- The memory consumption during optimization of a treatment plan is reduced.
- The method for producing search directions in the optimization algorithm has been updated. As a result, most optimizations are expected to be faster. The result of an optimization will differ but in most cases these differences are small.

- The creation of a new database system based on an existing system has been improved. The creation no longer depends on the SQL server backup and restore functionality. This change removes known problems and reduces the time needed to create a system.

2.7 SECURITY

- RayStation Storage tool now supports a Data administration role, to allow non-SQL Server admin users to for example import/export data and transfer patients.
- SQL Server user permissions can be defined for *RayStationResourceDB*, *RayStationServiceDB*, *RayStationIndexDB* and *RayStationLicenseDB*.
- SQL Server data encryption (TDE) can be enabled for all RayStation databases.
- SQL Server audit logging definition is now supported by RayStation.
- It is now mandatory to define one or more AD groups with access rights (read and write) to the RayStation databases. The recommendation is to use a specific *RayStation-Users* group.
- It is now mandatory to specify groups with access to the RayStation services.
- Active directory validation has been improved. Use either local users and groups, or the domain users and groups (default). Mixed setups are not supported.

2.8 GENERAL SYSTEM IMPROVEMENTS

- The graphic design of RayStation has been modernized.
- Toggling ROI visibility and deleting multiple ROIs are much faster than in previous releases.
- Some tables now have a context menu entry that copies the entire table content to the clipboard for subsequent paste into other applications.
- In the *Beam dose specification points* tab, the *Copy to all* function is now available in the *Points* column.
- Rotations applied to an image set in patient 2D views through either the *Image view transformation* panel in the Visualization tab or the *Rotate* 2D click tool can now be saved and loaded from the Visualization tab. Saving and loading a rotation is only available in modules with *Image view transformation* enabled (Structure definition and Brachy planning modules).
- The button for setting pivot point has been removed from the *Image view transformation* panel. The rotations applied through the panel now use the current slice intersection as the pivot point.
- It is now possible to decide which of the materials installed with RayStation will be available when setting a material override for an ROI. The list of available materials will be empty in RayStation v2025 until actively selected. The selection is made by clicking *ROI material management* and then *Add new common material* (available in the *ROI* list and the *ROI/POI details* dialog).

  - The following predefined materials have been removed: Brass, Cerrobend, CoCrMo and Steel. Existing patients using these materials will not be affected by this change.
  - The following predefined materials have had minor updates with respect to mass density, material composition and/or mean excitation energy: Adipose, Air, Aluminum [Al], Brain, Cartilage, Cranial bone, Eye lens, Heart, Iron [Fe], Kidney, Lead [Pb], Liver, Lung, Muscle skeletal (called Muscle in previous version), PVC, RW3, Silver [Ag], Skin, Spleen and Wax. Existing patients using these materials will not be affected by this change.

- For computations using multiple CPU cores it is now possible to set a suggested limit for the number of CPU threads used. This can be used to improve system responsiveness when running multiple instances of RayStation on the same computer.
- The auto recovery support has been improved for ion plans.
- Auto recovery now works for cases with data structures larger than 2GB. Compression has been added, and memory stream has been replaced with file stream.
- The patient size command in RayStation Storage has been optimized.
- There is now a separate Physics mode application, see *section 2.29 Physics mode on page 21*.
- It is now possible to access image sets from other cases.
  - It is now possible to add and remove ROI and POI associations between different cases, using either the *Associate ROIs/POIs between cases* dialog or scripting.
  - It is now possible to create frame-of-reference registrations and hybrid deformable registrations with image sets accessed from another case.
  - It is now possible to deform a dose from another case.
- Support for photon Monte Carlo dose computation in a magnetic field is added, for the purpose of using RayStation as a second-opinion dose calculator for MR LINACs. (Requires product license rayMagnetPhysics.)

2.9 PLAN GENERATION PROTOCOLS

- *Apply optimization settings* is now available as a protocol step. The step is available for both plan generation protocols and automated replanning protocols.
- It is now possible to add new plan generation protocols by copying existing ones.
- *Apply auto-optimization settings* is a new protocol step that sets the automation strategy to be used during auto-optimization. Both machine learning and ECHO strategies are supported.

2.10 PATIENT DATA MANAGEMENT

- The *Open case* dialog has been redesigned.
  - Loading is now faster for database systems with many patients.

- The 100 latest modified patients are now listed when opening the dialog, making it easier to find the recently used patients.
- More plan information is displayed: approval information, planning image set and number of fractions.

2.11 PATIENT MODELING

- It is now possible to define a volume box as focus region for gray-level based rigid registration. The focus volume/volume of interest is defined in the patient views on the primary image set.
- It is now possible to select image sets and to create multiple rigid registrations without needing to close the dialog. It is also possible to select how a rigid registration shall be created directly in the creation dialog, possible options are:
  - Gray-level based (default)
  - Use existing registration
  - Set to zero
- POI geometries can now be copied between image sets using the *Copy geometries* dialog.
- POI geometries can now be copied and mapped between image sets by right-clicking on the *POI* list.
- It is now possible to rotate patient 2D views in the Structure definition module using a click tool similar to zoom and pan.
- Mapped POIs can now be added to structure templates.
- It is now possible to create POIs defined in a rotated image view coordinate system.
- ROI and POI associations can now be added and removed between different cases, using either the *Associate ROIs/POIs between cases* dialog or scripting.
- It is now possible to create frame-of-reference registrations and hybrid deformable registrations with image sets accessed from another case.
- It is now possible to smooth ROIs using the new *Smooth ROI* tool.

2.12 DEEP LEARNING SEGMENTATION

- The *RSL DLS CT* model better detects whether an ROI is in the field-of-view and only segments ROIs that are inside, which is useful for variable field-of-view protocols like palliative treatment. It also shows greater stability on full-body images.
- The breast lymph nodes models have been improved, with cleaner cranial and caudal ends.
- The inferior vena cava now segments the full extent of the vein. Previously, only the most cranial part was segmented.

- The stability for the humeral heads has been improved on images with Siemens DirectDensity reconstruction algorithm.
- The release features a total of 76 new ROIs, listed in the table below.

Group	Modality	Regions of Interest
Heart substructures	CT	A_Aorta_Root, A_Aorta_Asc_Prox, Atrium_L, Ventricle_L, A_Pulmonary, V_Pulmonary, Atrium_R, Ventricle_R, V_Venacava_S_Prox
Pelvic	CT	Coccyx, Colon_Sigmoid, Bone_Pelvic_L, Bone_Pelvic_R, Musc_Iliopsoas_L, Musc_Iliopsoas_R, LN_Pelvics, PenileBulb, Sacrum
Thorax	CT	Cartlg_Costal_L, Cartlg_Costal_R, Clavicle_L, Clavicle_R, CW_Anatomical_L, CW_Anatomical_R, CW_2cm_L, CW_2cm_R, Humerus_L, Humerus_R, Ribs_L, Ribs_R, Scapula_L, Scapula_R
Vertebrae	CT	C1, C2, C3, C4, C5, C6, C7, L1, L2, L3, L4, L5, L6, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12
Vessels	CT	A_Iliac_L, A_Iliac_R, A_Iliac_Ext_L, A_Iliac_Ext_R, A_Iliac_Int_L, A_Iliac_Int_R, V_Iliac_L, V_Iliac_R, V_Iliac_Ext_L, V_Iliac_Ext_R, V_Iliac_Int_L, V_Iliac_Int_R
Pelvic	MR	Anorectum, Canal_Anal, Bladder, PenileBulb, Prostate, Rectum, SeminalVes

2.13 BRACHYTHERAPY PLANNING

- The 2D views can now be automatically rotated to align with a dwell point or a channel tip.
- It is now possible to view delivery times corrected for the current source activity.
- It is now possible to create a row of POIs from a channel, all positioned at a certain lateral distance from the dwell points.
- It is now possible to create POIs with a slice intersection offset in rotated image views.
- It is now possible to save and load dwell time distribution as a template.
- The dose can now be scaled to reach an average dose value in a set of points.
- Applicator models with flexible channels can now be imported. The flexible channels can be modified after import.
- The orientations and absolute 3D positions of the dwell points can now be retrieved through scripting.

- Rotations applied to an image set in patient 2D views through either the *Image view transformation* panel in the *Visualization* tab or the *Rotate* 2D click tool can now be saved and loaded from the *Visualization* tab.
- The dose brush in brachytherapy plans has been improved to update the dose in real time by scaling the dwell times of the selected dwell points.
- Monte Carlo dose computation support has been added for the BEBIG Co0.A86 source.
- It is possible to commission afterloaders for brachy Monte Carlo dose computation. Commissioning will entail that afterloaders can compute dose using the brachy Monte Carlo dose algorithm for a specific source selected during commissioning.
- DICOM export mode '*Varian*' has been introduced, enabling the export of treatment plans in a format suitable for direct import into Varian's ARIA/BrachyVision systems. The mode is set in RayPhysics. Note that further plan transfer to Varian afterloaders has not been validated by RaySearch.
- Improvements have been made to the dwell time graph. It is now easier to select dwell points and to adjust dwell times.

2.14 PLAN SETUP

- DRR settings have been re-designed to be specified per beam and imager, and the support for multiple DRR types has been removed. The settings are automatically applied in all views, in images in reports and at DICOM export of RTImage.
  - DRR settings values (such as Level/Window) can be copied to all beams.
- Templates for DRR settings now include Level/Window, allowing the user to automatically apply predefined Level/Window values to all beams/imagers.
- The default DRR settings template is automatically applied to all newly created beams.

2.15 PLAN OPTIMIZATION

- There is now support for optimizing a treatment plan using an automation strategy. The planner first selects a planning intention and a strategy. A planning intention refers to the body site and may include information regarding the number of dose levels and prescription dose. A strategy can be of type ECHO or Machine Learning. After running an optimization, a treatment plan is ready for review. The plan can be further improved by using the standard tools in RayStation.
- VMAT optimization with the protect feature applied has been improved. In certain cases where the target is completely hidden by a protected structure, the conversion to segments previously failed. This has now been resolved.

- The algorithm for positioning closed leaf pairs in between multiple targets has been improved to minimize dose to normal tissue. This may affect the treatment techniques VMAT, Conformal Arc and DMLC.
- The arrows representing objectives/constraints in the DVH are now visible when viewing absolute ROI volumes in the DVH. Dragging the arrows and the context menu now behaves similarly to the relative volume display.
- For 3D-CRT plans, wedge is no longer selected as a beam optimization variable by default.
- For 3D-CRT plans, it is now possible to set the 'Minimum segment area' constraint in the *Settings* dialog for optimization and segmentation settings.
- Auto-scale to primary prescription is now automatically deactivated when fine-tune optimization is started.
- It is now possible to select jaw assignment *Lock to limits* also for LINACs where jaw movement rule is *Per segment*.

2.16 MACHINE LEARNING PLANNING

- The *RSL Brain Proton* model is designed to predict dose distributions for brain tumor patients receiving proton radiotherapy. The model has been designed to adapt to any beam arrangement.
- The *RSL Breast Locoregional 2LVS* model is designed to predict photon dose distributions for breast patients that require cancer treatment on the breast itself and the nearby lymph nodes. The locoregional treatment focuses on controlling cancer in these specific areas.
- The *RSL Oropharynx 3LVS* model is designed to predict photon dose distributions for head and neck patients that require cancer treatment to the primary and secondary target volumes, respectively, as well as the elective nodes.
- A new mimic optimization algorithm has been implemented. It optimizes through two distinct phases. The first phase optimizes to achieve overall similarity to the reference dose while prioritizing organ at risk dose constraints. The second phase further refines the optimization to mimic target coverage while meeting the predefined dose goals, thus balancing adherence to the reference dose with clinical necessities.
- All models have been configured for the improved mimic algorithm.
- All patient treatment positions are now supported in machine learning optimization.

2.17 ELECTRON PLANNING

- The applicator name is included in the cutout report.

2.18 PROTON PENCIL BEAM SCANNING PLANNING

- The following changes have been made to the Line Scanning functionality: (1091594)

  - It is now possible to set a *Dynamic range* optimization setting, which allows users to control the trade-off between delivery time and plan quality.
  - *Meterset rate* per energy layer is displayed in the *Energy layers* table in RayStation and in treatment plan reports. Meterset rate is DICOM-exported in attribute *Meterset rate (300A,035A)*.
  - New checks have been added for final dose computation, approval and DICOM export, to ensure that the plan is deliverable with respect to the Line Scanning machine constraints. Existing plans can be made deliverable by re-optimization or by using the *Make beams deliverable* functionality.
  - See also *section 2.36 Changed behavior of previously released functionality on page 24*.

- The option to perform optimization using distal edge tracking has been removed from the *Beam computation settings*. The energy layers of treatment plans created in previous versions of RayStation are not affected by this change.
- The *OAR range margin* setting in *Beam computation settings* has been renamed to *Avoidance structures*. The functionality is the same as in previous versions of RayStation.

2.19 PROTON ARC PLANNING

- Discrete PBS arc has been renamed to static PBS arc. The treatment technique itself is unchanged.
- It is now possible to approve, DICOM export and import, and generate treatment plan reports for PBS arc plans (requires technical license rayIonStaticArcExport). This functionality is not available when using a Mevion Hyperscan machine. The *Convert to PBS* functionality remains as an alternative workflow.

2.20 LIGHT ION PENCIL BEAM SCANNING PLANNING

- The option to perform optimization using distal edge tracking has been removed from the beam computation settings. The energy layers of treatment plans created in previous versions of RayStation are not affected by this change.
- The *OAR range margin* setting in *Beam computation settings* has been renamed to *Avoidance structures*. The functionality is the same as in previous versions of RayStation.

2.21 FINE-TUNE OPTIMIZATION

- It is now possible to run fine-tune optimization considering the clinical goals robustly.

2.22 BORON NEUTRON CAPTURE THERAPY (BNCT) PLANNING

- RBE-weighted dose is now computed in RayStation.

- RayStation v2025 introduces cell-type doses. After BNCT dose computation, cell-type doses are automatically computed for every combination of material override and RBE cell type in the patient. They are used to compute dose statistics, DVHs, clinical goals and prescriptions for the ROIs assigned the corresponding material override and RBE cell-type. This avoids artificial hot or cold spots in dose statistics and DVHs due to voxels in the border between ROIs with very different RBE cell type properties. Cell-type doses can also be inspected in the Plan evaluation module.

2.23 QA PREPARATION

- Approval of phantoms to be used in the QA preparation module is now done in the separate Physics mode application instead of in the former Beam 3D modeling module in RayPhysics. Phantoms that were approved in Beam 3D modeling in a previous version must be unapproved and then approved again in Physics mode to be available for QA plan creation.

2.24 DOSE TRACKING

- It is now possible to view the fractionation schedule of the dose tracking treatment course in the Dose tracking module.

2.25 AUTOMATED ADAPTIVE REPLANNING

- During planning and after plan approval, it is now possible to select a replanning protocol to be used when running automated replanning for a specific beam set.
- Dose tracking is now automatically initiated when running automated replanning.
- The *Start automated replanning* dialog has been improved:
  - The fraction to replan can be selected without dependency on the number of fractions in the dose tracking treatment course.
  - If a beam set is assigned to the selected fraction in the dose tracking treatment course, it will automatically be selected as the base beam set in the dialog.
  - If the selected fraction number is set for an image set, that image set will be automatically selected as the fraction image set in the dialog.
- If the optimization step fails, the adapted plan will now always be preserved. This allows for manual correction of the problem, followed by a restart of the optimization.
- The automated replanning protocols have been improved:
  - Mapped POIs can now be included in structure templates, and such templates can be used in automated replanning protocols.
  - It is now possible to have multiple structure template steps in an automated replanning protocol.

  - Multiple rounds of optimization can now be used for all treatment techniques. This is configurable in replanning protocols.

- It is now possible to run the automated replanning workflow via scripting.
- The estimated dose without adaptation, presented in the *Scheduled* review workspace, is now preserved also when another beam set is assigned for the selected fraction in the dose tracking treatment course.

2.26 DICOM

- When automatic DICOM import into RayStation is configured, a list of the automatically imported patients is displayed in the RayStation menu and in the Patient data management module. There is also a button to manually refresh the list.
- The population of the attribute *Source to Surface Distance (300A,0130)* has been updated. Previously, the value included *Bolus* and *Patient Positioning Devices*, but now it strictly represents the source to skin distance. The previous value is now exported in attribute *Source to External Contour Distance (300A,0132)*.
- A new machine setting is added: Default patient setup technique. It will be exported as *Setup technique (300A,01B0)* in the RT Patient setup module.
- For Line Scanning RT Ion Plans, energy layer meterset rate is exported in attribute *Meterset rate (300A,035A)* and imported from the same attribute.

2.27 VISUALIZATION

- Several more visualization settings can now be saved in the *Save visualization settings* dialog. Settings not possible to save are hidden instead of disabled.
- Dose visibility in material views can be toggled on or off using a separate visualization setting. The default value is off, to have a clear view of the full material distribution throughout the patient. This setting can also be saved as part of the visualization settings.
- Positions reflecting SSD intersection points (*Source to skin* and *Source to surface*) are now visualized in views. If the points coincide, only one point is visualized.
- Both *Source to surface* and *Source to skin* distances are visible in the DRR views (if applicable).
- Machine models for Room view are added, for use with upright treatments.

2.28 SCRIPTING

- The Python package *connect* containing the RayStation scripting interface has been renamed to *raystation*. To specify which version the script is written for, the version can be added (e.g., *raystation.v2025*).

- The script editor in RayStation has been improved by embedding components from Visual Studio code.
- Code completion is now available for the types in the RayStation scripting API, both in the internal script editor and in external editors. In external editors, code completion is achieved through the Python package *raystation.v2025*.
- A new argument, *EvaluateUsingSecondaryAcceptanceLevelIfExists*, is introduced to scripting methods used for the evaluation of clinical goal fulfillment. Its value determines whether the primary or the secondary acceptance level of a clinical goal is used when determining fulfillment. The argument must be provided when evaluating the fulfillment of clinical goals with secondary acceptance levels. For clinical goals that only have a primary acceptance level, the argument is ignored. The following methods are affected:
  - *EvaluateClinicalGoal*
  - *EvaluateClinicalGoalForAccumulatedDose*
  - *EvaluateClinicalGoalForEvaluationDose*
  - *EvaluateClinicalGoalForVoxelwiseWorstTotalDose*
- Two new methods are available in UI scripting. These methods only apply to the top-level window UI element.
  - *TakeWindowSnapshot*: Captures the RayStation window screen area.
  - *TakeAreaSnapshot*: The RayStation window enters a state that allows the user to drag the rectangle to be captured.
  - The return value of the above script methods can be passed as the *ImageData* argument to a new script method on the *TreatmentCase* object: *AddSnapshot*.
- *SpotTuneId* is removed from *CreatePBSIonBeam*. It will instead be populated automatically from beam model when energy layers are created.
- It is now possible to run automated replanning from scripting. A new method, *RunAutomatedReplanning*, is found on the case level.
- *SetOarRangeMarginRois* has been renamed to *SetAvoidanceStructures*.
- The keep connected component, *KeepConnectedComponent3D*, is now scriptable.
- Extracting connected components into separate ROIs is now possible through scripting, with filters on max and min volume as well as number of components. The method is called *GetConnectedComponents*.
- *CopyRoiGeometriesToExistingRoi* is now scriptable.
- *Discrete ion arc* has been renamed to *static ion arc*. This results in a name change of the following properties:
  - *IonArcDiscreteProperties* > *IonArcStaticProperties*

  - *IonArcProperties.DiscreteProperties* > *IonArcProperties.StaticProperties*
  - *SetIonArcType* now takes argument value *Dynamic* and *Static*.

- The scripting method *RunAutomaticPlanning* is removed. Machine learning optimization can be accessed via scripting by first specifying a machine learning strategy with the *SetAutoOptimizationSettings* method, and then calling *RunOptimization*.

2.29 PHYSICS MODE

- Physics mode is a separate application, which is a version of RayStation that uses phantoms as patients and allows the user to work with uncommissioned LINAC treatment machines.
- Physics mode replaces the Beam 3D modeling module in RayPhysics.
- Physics mode offers similar tools for patient modeling and plan creation as in RayStation. Different kinds of automated plan creation and deep learning segmentation tools are not included in Physics mode.

2.30 RAYPHYSICS

- The Beam 3D modeling module is removed and replaced by the Physics mode application.

2.31 PHOTON BEAM COMMISSIONING

- Monte Carlo dose curve post processing during beam modelling is now faster.
- It is now possible to commission a Monte Carlo beam model for computation in a magnetic field. (Requires product license rayMagnetPhysics.)

2.32 ELECTRON BEAM COMMISSIONING

- The Elekta template electron applicators are updated to work with thicker electron cutouts.

2.33 ION BEAM COMMISSIONING

- It is now possible to compute all spot profiles, Bragg peaks and absolute dosimetry in a single click, using the *Compute all curves* button.
- For Line Scanning machines:
  - It is now possible to specify *Beam scanning speed limits* that are *Anisotropic*, as an alternative to the isotropic limits previously supported.
  - It is now possible to specify a machine default value for the *Dynamic range* optimization setting.
  - The handling of *Absolute dosimetry* has been modified, see *section 2.36 Changed behavior of previously released functionality on page 24*.

- For Pencil Beam Scanning machines, the checkbox *Supports discrete arcs* under *Scanning data* has been renamed to *Supports static arcs*.

2.34 RAYSTATION DOSE ENGINE UPDATES

The changes to the dose engines for RayStation v2025 are listed below.

Dose engine	2024B	v2025	Requires recommissioning	Dose effect[i]	Comment
All	-	-	-	Negligible	ROI volumes might be slightly different when comparing with an identical ROI in previous versions of RayStation.
Photon Collapsed Cone	5.10	5.11	No	Negligible	Added support for dose calculation using patient position SITTING for non-arc delivery techniques. Updates to coordinate system transformations needed to support SITTING may have minor effect on dose computed for beams with gimbal angles.
Photon Monte Carlo	3.2	3.3	No	Negligible	Added support for dose calculation using patient position SITTING for non-arc delivery techniques. Updates to coordinate system transformations needed to support SITTING may have minor effect on dose computed for beams with gimbal angles. Added support for dose computation in a magnetic field.

Dose engine	2024B	v2025	Requires recommis-sioning	Dose effect[i]	Comment
Electron Monte Carlo	5.2	5.3	No	Negligible	Beam line material handling has been refactored, causing a slight change in the results of the electron phase space calculation on the floating-point precision level. This has a minor effect on the comput-ed electron Monte Carlo dose, which due to the statistical nature can be very sensitive to even small disturbances. For dose calculation with low statistical uncertainty, the difference in dose compared to the previous version is negligible.
Proton PBS Monte Carlo	5.7	5.8	No	Negligible	Dose computed for static PBS arc beams using a Mevion Hyperscan machine has been updated and is now marked as clinical.
Proton PBS Pencil Beam	6.7	6.8	No	Negligible	Routine version increment
Proton US/DS/ Wobbling Pencil Beam	4.12	4.13	No	Negligible	Routine version increment
Carbon PBS Pencil Beam	7.1	7.2	No	Negligible	Routine version increment
Brachy TG43	1.6	1.7	No	Negligible	Routine version increment
Brachy Monte Carlo	1.0	1.1	No	Negligible	Routine version increment

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.

2.35 IMAGE CONVERSION ALGORITHM UPDATES

The changes to the image conversion algorithms for RayStation v2025 are listed below.

Conversion algorithm	2024B	v2025	Dose effect	Comment
Corrected CBCT	1.4	1.5	Negligible	No changes to Corrected CBCT algorithm but minor changes in created image sets can occur due to that voxel volumes of ROIs used in the algorithm might differ slightly compared to previous versions of RayStation.
Virtual CT	1.4	1.5	Negligible	No changes to Virtual CT algorithm but minor changes in created image sets can occur due to the fact that voxel volumes of ROIs used in the algorithm might differ slightly compared to previous versions of RayStation.

2.36 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 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 introduces 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 2.37 Upgrading a Line Scanning beam model to RayStation v2025 on page 28*.

- The Treatment delivery planning activity is renamed to Treatment adaptation.
- In RayStation 2024B, scripting methods used to evaluate clinical goals with secondary acceptance levels would report fulfillment based on the secondary acceptance level. They would, in other words, return true if a clinical goal was fulfilled (green), or acceptable (yellow) and false otherwise. In RayStation v2025 this has been changed, allowing the user to specify which acceptance level shall be used to determine fulfillment, introducing the new boolean argument *EvaluateUsingSecondaryAcceptanceLevelIfExists*.
- The option to deselect *Display all scenarios* in the Robust evaluation module has been removed. The same effect can still be achieved by setting full transparency.
- In the ROI list, an ROI with material override will be indicated with the mass density of the selected material instead of '*'.
- It is no longer necessary to provide a *Spot tune ID* when creating PBS/LS beam. This is also no longer visible as a beam computation setting but is automatically set when energy layers are created to the value in the beam model.
- The block/cutout contour will by default be kept constant when rotating the collimator for photon and electron beams. Previously, 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.
- 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*.
- The visibility of the material view in the 2D Patient views has been improved. Both *Image* and *Material* are now displayed as options in the view header, and view selection is done directly in the header. The current selection is highlighted.
- Beam 3D modeling has been removed from RayPhysics. The separate Physics mode application is now used for approval of phantoms to be used in the QA preparation module and for working with uncommissioned LINAC treatment machines. Phantoms that were approved in Beam 3D modeling in a previous version must be unapproved and then approved again in Physics mode to be available for QA plan creation.
- The term 'Base' is replaced in the adaptive workflow:
  - The plan used as the origin of an adapted plan is now referred to as the 'Reference' plan.
  - In the *Automated replanning* module, the workstep to assess the daily dose without adaptation is renamed to 'Scheduled'.

  - In the *Automated replanning* module, the daily dose without adaptation is referred to as the 'Scheduled' dose.

- There is a new default naming convention for adapted plans and their beam sets: The suffix 'FxN' is changed to 'AN'. Example if the adapted plan is created for fraction 3: *Reference plan name A3* and *Reference beam set name A3*.
- Automated replanning for Radixact/Tomo will no longer automatically run two runs of optimizations. To reach the same behavior as in RayStation 2024B, add two optimization setting steps in the replanning protocol: one with N iterations+final dose, followed by an additional N/2 iterations before the last final dose.
- Changes in the Plan explorer module that should be considered when upgrading:
  - When upgrading from an earlier version of Plan explorer, all previous exploration plans in all plan explorations will be removed. To keep an exploration plan, it must be copied to the plan list before the upgrade. In the new version, it can be re-added to its exploration.
  - The HPC (High Performance Computing) solution, previously used for parallel plan optimization in Plan explorer, has been removed.
  - The plan generation algorithm in Plan explorer, based on clinical goals and their priorities, has been removed. This includes removal of clinical goals of type *reduce average dose* and *dose fall-off* which were only used by the previous algorithm. It is no longer possible to add these types of clinical goals, and they will be cleared from existing clinical goal templates. Optimization in Plan explorer can now be configured more freely. In addition to ML optimization, the ECHO algorithm and standard optimization functions are supported.
  - Exploration templates in Plan explorer are no longer created based on existing explorations, but instead by setting up a list of references to existing plan generation protocols. Previous exploration templates are obsolete and will be cleared from the database when upgrading to v2025.

2.37 UPGRADING A LINE SCANNING BEAM MODEL TO RAYSTATION V2025

In 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, and commissioned Line Scanning beam models thus remain valid in RayStation v2025. 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 to RayStation v2025. To recompute *Dose per meterset*, or to perform auto modeling of an existing model in RayStation v2025, the absolute dosimetry data needs to be imported again to RayPhysics, ensuring that the new requirements on *Dose per meterset* values are fulfilled.

2.38 RESOLVED FIELD SAFETY NOTICES (FSNS)

The issues described in Field Safety Notices (FSNs) 148655 and 157634 have been resolved.

Resolved: FSN 148655 - Density perturbation in Compute perturbed dose and Robust evaluation gives a lower range perturbation

The inconsistency in the use of *Density uncertainty* in the RayStation functions *Robust optimization*, *Robust evaluation* and *Compute perturbed dose* for protons and light ions has been resolved.

The impact of the mass density shift now works in the same way for all use cases (*Robust optimization*, *Robust evaluation* and *Compute perturbed dose* and independent of CT calibration method): the relative change in stopping power and water-equivalent range will follow the user-defined shift in mass density. The description of the functions in the UI has been updated to better describe the meaning and effect of the mass density uncertainty.

Resolved: FSN 157634 - Incorrect Hounsfield units in DICOM exported CT image sets created from 4D CT

The issue with sometimes incorrect DICOM Rescale Slope and Rescale Intercept values, and therefore incorrect Hounsfield units in exported DICOM CT image sets created as minimum, maximum or average of a 4D CT set, has been resolved.

Minimum, maximum or average CT image sets previously created with RayStation 2024B may still be incorrect. If this functionality has been used in RayStation 2024B, contact RaySearch support for assistance.

2.39 NEW AND SIGNIFICANTLY UPDATED WARNINGS

For the complete list of warnings, see *RSL-D-RS-v2025-IFU, RayStation v2025 SP1 Instructions for Use*.

2.39.1 New warnings

WARNING!

MR LINAC dose computation.

Dose computation region: No dose is scored outside the dose computation region (see warning 9361). Electrons and positrons created in the dose computation region are traced in air, accounting for energy loss and magnetic field curvature, until they exit the dose grid or re-enter the patient. As it is possible that an electron/positron may be deflected outside of the dose grid but would otherwise re-enter the patient later in its path, the user must ensure that the dose grid is large enough to capture the full path of deflected electrons/positrons; otherwise, their dose contribution on re-entry to the patient will be missed. This relates to the conventional electron return effect, the lateral electron return effect and electron streaming.

Surface dose: Photon scatter in air and spiraling electrons before the patient are disregarded in the dose computation. For the Elekta Unity, this may result in a missed surface dose component in protruding surfaces in the craniocaudal direction. For the MagnetTx Aurora, the electrons are confined inside the field and a conventional electron component can be added to retain surface dose to some degree. For details, refer to *RSL-D-RS-v2025-REF, RayStation v2025 Reference Manual*.

Detector selection and output factor measuring: The user must ensure to follow machine vendor measurement protocols and consult the latest scientific literature for recommended detectors, effective point of measurement shifts and magnetic field size corrections. For details, refer to *RSL-D-RS-v2025-RPHY, RayStation v2025 RayPhysics Manual*.

(1153758)

WARNING!

Aurora MLC shadowing can lead to underdosage at off-axis y-positions.

For MagnetTx Aurora, the shadowing from the tongue extension in the tongue-and-groove region varies with y-axis position such that it may lead to a substantial decrease in dose in highly modulated plans where the tongue-and-groove region is exposed at off-axis y-positions. This variation cannot be modelled by RayStation. It is advised to fully measure and evaluate this behaviour for your specific LINAC as part of the commissioning process and ensure to keep treatment plans within the range of clinical validity. Checking plan complexity metrics, such as the relative area of exposed tongue-and-groove region off-axis, e.g. using RayStation scripting, and replanning if needed, is recommended to increase the likelihood that the plan passes plan-specific QA.

(1202498)

WARNING!

Images in upright scanning position typically labeled as HFS. Due to the limitations of the DICOM standard, images acquired in the upright scanning position are typically labeled as head-first supine (HFS). The 'SITTING' scanning position does not exist in DICOM. For images acquired by CT scanners that provide the backrest pitch angle, this angle will be shown in the RayStation GUI as a suffix appended to the patient scanning position.

(1201906)

WARNING!

The clearance check shall not be used as a final protection against collisions in the treatment room. The accuracy of the clearance check is approximate. Its purpose is to reduce the probability of a collision during standard patient collision avoidance verification before treatment. The clearance check shall not replace standard collision avoidance procedures prior to patient treatment.

(1095407)

WARNING!

External machine accessories may not be considered in the clearance check. External machine accessories such as blocks, cones, wedges and electron applicators are not considered in the clearance check unless they are explicitly present in the MapRT room model. Clearance maps shown in RayStation are not reliable for such beams and may, in reality, include larger or additional regions with collisions.

(1096363)

WARNING!

The clearance check only uses the surface scan as input. The presence or absence of a bolus for a specific beam is not considered in the clearance check.

(1095417)

WARNING!

Verification of image set and treatment position. The user must verify that the imported surface scan geometry matches the corresponding image set by inspecting the 2D and 3D patient views. The user must also verify that the surface scan matches the intended patient treatment position.

(1095410)

WARNING!

Verification of sufficient accuracy. Some fixation and support devices as well as parts of the patient may be absent from the CT image and the surface scan. In some situations, the patient surface may also exhibit artefacts or gaps. Such a surface scan may not have sufficient accuracy for a reliable clearance check. The user must therefore inspect the imported surface scan and verify that it represents the patient and other relevant structures with sufficient accuracy.

(1153638)

WARNING!

Use of cell type doses in BNCT plan reports. Plan reports for BNCT plans will present data (DVHs; clinical goals; prescription dose references and dose statistics) evaluated on the corresponding cell type doses for any ROI with cell type and material assigned, except for the External.

Only the default (non cell type) dose will be shown in the 2D views.

1201289

WARNING!

Material rescaling approximation for cell type dose computation. The rescaling of the physical dose components employed in the standard BNCT RBE cell type dose computation to account for different materials is an approximation of a full dose computation. Large differences between the material for which the cell type dose computation is performed and the original material assigned to the voxel may therefore affect this approximation. The user must be aware of this approximation and its limitations when evaluating cell type doses or quantities computed from them (such as DVHs, clinical goals, dose statistics and prescriptions). See section *Cell type dose computation* in the *RSL-D-RS-v2025-REF, RayStation v2025 Reference Manual* for further details.

1201180

2.39.2 Significantly updated warnings

WARNING!

Ensure that the .decimal GRID block contour in RayStation matches the physical block. The CreateDotDecimalBlockContour method creates a block contour matching the .decimal GRID block. After creation, the .decimal GRID block is handled as a regular photon block in RayStation and can be edited. Since the .decimal GRID block is not manufactured based on a block contour exported from RayStation, it is crucial to ensure that the block contour in RayStation matches the physical block and that it is not unintentionally altered by manual editing. To ensure that the block contour remains unchanged, the CreateDotDecimalBlockContour method can be called again as a last step before final dose computation and plan approval.

(936115)

WARNING!

Evaluation of PBS arc plans. If a PBS arc plan is converted to an equivalent PBS plan for treatment delivery using the Convert to PBS function, then the quality and robustness must be evaluated on the converted PBS plan.

(711947)

WARNING!

HDR brachytherapy delivery in magnetic fields. If the HDR brachytherapy treatment is performed in a magnetic field (e.g. delivery during MRI), there might be large discrepancies between delivered dose and dose computed using RayStation. The derivation of published TG43 parameters does not include magnetic fields and RayStation's brachytherapy Monte Carlo dose engine does not account for magnetic fields during particle transport. Any effect of magnetic fields on the dose distribution will thus be disregarded in the dose computation. The user must be aware of this limitation if the treatment is to be delivered in a magnetic field. Special care should be taken for ^{60}Co sources and for magnetic field strengths larger than 1.5 T as well for regions containing (or in close proximity to) air.

(332358)

WARNING!

Dwell time limits. The dwell time limits in RayPhysics are based on the reference air kerma rate at the specified reference date and time for the current source; no decay correction is applied at the time of planning. Ensure that the specified limits account for the full expected range of decay correction factors over the lifetime of the source - in particular, to avoid violating any afterloader constraints on the maximum permitted dwell time.

(283881)

WARNING!

Brachytherapy applicator models must be validated before clinical use. It is the responsibility of the user to validate all brachytherapy applicator models before they are used in clinical brachytherapy treatment plans.

RayStation is developed to be used by trained Radiation Oncology professionals. Users are strongly advised to adhere to industry standards for quality assurance of brachytherapy applicators and treatment planning. This includes performing dosimetric verification using methods such as gafchromic film measurements, as recommended by the American Association of Physicists in Medicine (AAPM) in *Task Group 56 (TG-56) on the quality assurance of brachytherapy equipment and Medical Physics Practice Guideline 13.a*.

It is also strongly advised to create a structure template and, after completing relevant quality assurance checks, to approve the template to ensure that the applicator structures are not unintentionally changed. During the treatment planning process, users should only use structures from these approved templates to maintain consistency and accuracy in treatment delivery.

(726082)

WARNING!

Verify database consistency before upgrade. Before creating a new system based on an existing system in the RayStation Storage Tool, the user must verify the data consistency in the existing system. This can be done by using the *Validate* command in the Storage Tool for systems based on RayStation 7 or later; for systems based on earlier versions, use the ConsistencyAnalyzer tool.

(10241)

3 KNOWN ISSUES RELATED TO PATIENT SAFETY

There are no known issues related to patient safety in RayStation v2025.

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

4 OTHER KNOWN ISSUES

4.1 GENERAL

Dose computation is not prevented on oblique image sets containing ROIs outside the image stack without material override

RayStation normally cancels a dose computation with a warning if an ROI without a material override assigned extends beyond the image stack. However, for oblique image sets where an ROI without a material override assigned extends beyond the image stack but is within the bounding box, i.e. if the ROI does not extend beyond the outermost corners of the image stack parallelepiped, dose computation is possible.

Ensure that all ROIs relevant for the dose computation and potentially extending outside of the image stack have a material override assigned.

(1203823)

RayStation beam numbering

RayStation may generate beam sets with nonconsecutive beam numbering. It is also possible to give a beam number 0. Such plans for Tomo/Radixact and CyberKnife have caused issues in the integration with RayCare and with Accuray delivery systems. Always make sure to verify that the beam numbering is valid for the delivery system.

(1312395)

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)

Auto recovery includes steps from the redo list

The action list in the *Recover unsaved changes* dialog will include steps that were undone before an uncontrolled termination of RayStation. Before recovery, make sure to review the list of actions and deselect steps that should not be recovered.

(1201661)

4.2 IMPORT, EXPORT AND PLAN REPORTS

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 v2025

The upgrade to RayStation v2025 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 PATIENT MODELING

Deep learning segmentation CT models should not be used on CBCT images

The deep learning segmentation CT models have not been validated for use with cone beam CT (CBCT) images, and this is not their intended purpose, even though the models are tagged with CBCT in RayMachine. The models should not be used on CBCT images.

(1203216)

4.4 BRACHYTHERAPY PLANNING

Mismatch of planned number of fractions and prescription between RayStation and SagiNova

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. If the clinic is using a version later that 2.1.4.0, contact customer support to verify whether the issue persists.

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.

(285641)

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-v2025-BAMDS, RayStation v2025 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-v2025-IFU, RayStation v2025 SP1 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)

Delivery of Brachytherapy plans on Elekta afterloaders

When exporting Brachytherapy treatment plans from RayStation for delivery on Elekta afterloaders, the plans must be re-approved in Oncentra Brachy before they can be transferred to the afterloader. This is a requirement of the Elekta delivery system.

As a result:

- The plan becomes temporarily unapproved in Oncentra Brachy, which may increase the risk of unintended modifications.
- The plan identifier (UID) changes upon re-approval, making it more time-consuming to confirm that the delivered plan is identical to the original plan approved in RayStation.

To support safe and efficient clinical workflows, RaySearch will provide a Python script upon request that allows users to verify whether two DICOM RT plans (e.g., the one exported from RayStation and the one exported from Oncentra Brachy) are equivalent for delivery. This tool is intended to help clinics ensure plan integrity when using Elekta afterloaders.

For more information or to request the verification script, contact RaySearch support.

(1202989)

Brachy Monte Carlo number of histories

The number of histories used to compute a brachy Monte Carlo dose distribution is not displayed in the patient views. This information can be retrieved through scripting. It is the responsibility of the user to ensure that a Monte Carlo dose is computed with a sufficient number of histories to reach an acceptable statistical uncertainty.

(1043893)

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)

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)

4.7 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)

4.8 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)

4.9 AUTOMATED PLANNING

Not possible to approve an auto-planning definition

Auto-planning definitions used to define parameters for automated optimization using machine learning or ECHO cannot be approved. Therefore, there is a risk that parameters of an existing auto-planning definition are edited. A clinic using automated optimization techniques needs to have processes in place where they make sure that auto-planning definitions in clinical use are not edited unintentionally. It is recommended to back up auto-planning definitions through RayStorage when starting to use them clinically to avoid workflow interruptions if unintentional edits are discovered.

(1201476)

4.10 BIOLOGICAL EVALUATION AND OPTIMIZATION

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)

4.11 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-v2025-REF, RayStation v2025 Reference Manual*, section *Depth offset and detector height* in *RSL-D-RS-v2025-RPHY, RayStation v2025 RayPhysics Manual* and *RSL-D-RS-v2025-BCDS, RayStation v2025 Beam Commissioning Data Specification* for information about the new recommendations.

(410561)

4.12 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)

5 UPDATES IN RAYSTATION V2025 SP1

This chapter describes the updates in RayStation v2025 SP1 as compared to RayStation v2025.

5.1 NEWS AND IMPROVEMENTS

5.1.1 Resolved safety notices (FSNs)

The issue described in Field Safety Notice (FSN) 159027 has been resolved.

For details, see *section 5.3 Resolved issues on page 48*.

5.1.2 Corrected nomenclature in the Dose tracking module

In the Dose tracking module the term *evaluated* is now consistently used instead of *delivered*. This is not yet updated in *RSL-D-RS-v2025-USM, RayStation v2025 User Manual*.

5.1.3 Beam names in adapted beam sets

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.

5.1.4 RayStation dose engine updates

Dose engine	v2025	v2025 SP1	Requires recommis-sioning	Dose effect [i]	Comment
Carbon PBS Pencil Beam	7.2	7.3	No	Minor	Improved dose prediction in surface voxels in low-density regions. Note that the dose is affected only for specific combinations of range shifters and machine models.

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.

5.1.5 Machine learning models

No new machine learning models/ROIs are introduced.

5.2 FOUND ISSUES

Two new issues have been found: 1203823 and 1312395. These issues are described in detail in *Chapter 4 Other known issues*.

5.3 RESOLVED ISSUES

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: Too high surface dose for some carbon ion plans with large air gap

There was an issue with the light ion Pencil Beam dose engine. For some combinations of range shifter water equivalent thickness (WET) and large air gap, certain surface voxels could get a very high dose. This issue has now been resolved and the version number of the Carbon PBS Pencil Beam dose engine has been increased from 7.2 to 7.3.

(1203657)

5.4 NEW AND SIGNIFICANTLY UPDATED WARNINGS

For the complete list of warnings, see *RSL-D-RS-v2025-IFU, RayStation v2025 SP1 Instructions for Use*.

5.4.1 New warnings

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)

5.4.2 Significantly updated warnings

There are no significantly updated warnings in RayStation v2025 SP1.

5.5 UPDATED MANUALS

The following manuals have been updated in RayStation v2025 SP1:

- RSL-D-RS-v2025-IFU-2.0 RayStation v2025 SP1 Instructions for Use
- RSL-D-RS-v2025-RN-2.0 RayStation v2025 SP1 Release Notes
- RSL-D-RS-v2025-SEG-2.0 RayStation v2025 System Environment Guidelines

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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