RAYSTATION 12A

Release Notes

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Declaration of conformity

CE 2862

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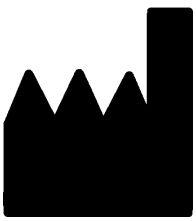
1 INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document contains important notes about the RayStation 12A system. It contains information related to patient safety and lists new features, known issues and possible workarounds.

Every user of RayStation 12A 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 12A

This chapter describes the news and improvements in RayStation 12A compared to RayStation 11B.

2.1 HIGHLIGHTS

- Templates and protocols for deep learning segmentation.
- Brachy planning for Elekta Flexitron afterloaders.
- Robust evaluation on multiple images.
- New, much faster electron Monte Carlo dose engine.
- CyberKnife planning improvements.
- Improved light ion dose computation accuracy for larger range shifter air gaps.

2.2 DEEP LEARNING SEGMENTATION

- It is now possible to include deep learning segmentation model information in structure templates.
    - When running the template on an image set, the geometry for applicable ROIs will be created by deep learning segmentation.
    - ROIs from multiple deep learning segmentation models can be included in the same template.
    - A structure template can include a combination of deep learning segmentation ROIs and other type of ROIs.
    - The templates can be used in protocols.
- Support has been added to make it possible for a deep learning segmentation model to be used for multiple image modalities, for example both CT and CBCT.

2.3 NON-FUNCTIONAL IMPROVEMENTS

- The audit log for a patient is now visible in RayStation. Any major change of the patient is visible. It is possible to search and filter logs on time, user and category, as well as on free text.

- The index service now holds a cache of patients to make restarting RayStation faster.

2.4 GENERAL SYSTEM IMPROVEMENTS

- Beam entry validation is now performed at dose computation, to ensure that warnings are displayed earlier in the planning process.
- ROI/POI mapping is now available when loading clinical goal or function list templates as a part of running a protocol.
- It is now possible to add tags on plans and structure sets. The tags can be used to find or filter out specific patients, either in the *Open* dialog or when moving patient data between different systems using the RayStation Storage Tool.

2.5 PATIENT MODELING

- It is now possible to view inverse image registrations.
    - If there exists an image registration from image set A to image set B, the registration will be viewed in fusion views or side-by-side views and will be used when copying ROI geometries (no matter which of the image sets are primary/secondary).
- It is now possible to set an image registration as *Default for fusion*. The registration selected as *Default for fusion* will be automatically selected when activating fusion or side-by-side views, or when copying ROI geometries.
- Expand/contract margin computations for ROIs have been updated and are now faster. There may be minor differences to the computed margins compared to previous versions.
- It is now possible to set a default initialization method for a structure template.
- It is now possible to create open mesh ROIs from .stl files using scripting. It is possible to rotate, translate, deform and scale these ROIs. Since the surface is not closed, no volume can be defined. Therefore, it is not possible to obtain dose statistics or DVH curves for open mesh ROIs. Open mesh ROIs are not included in the DICOM export.

2.6 BRACHYTHERAPY PLANNING

- It is now possible to create plans for Elekta Flexitron afterloaders. Plans created in RayStation can be imported into Oncentra Brachy, and then be delivered on the afterloader.
- A new dwell time graph makes it possible to see all dwell times more accurately, and to easily modify dwell times manually.
- It is now possible to easily set dwell times for every second, fourth, fifth or tenth selected dwell point.

2.7 PLAN SETUP

- It is now possible to copy a beam set. A beam set can be copied within a plan or from another plan, if both plans use the same planning image set and patient treatment position.
- It is now possible to create a new plan by copying beam sets from other plans.
- The Plan setup module now includes two setup DRR views.
  - For imaging systems with multiple imagers, it is now possible to visualize different imagers in each DRR to support easier imaging isocenter positioning.

2.8 3D-CRT BEAM DESIGN

- The *Smart angles* algorithm for Conformal Arc has been modified to use a more accurate cost function when determining the optimal angle. Now, the cost is defined as the area of the smallest aperture fully containing all selected targets. This makes the algorithm useful for single targets as well.

2.9 PLAN OPTIMIZATION

- It is now possible to exclude DMLC beams (Sliding window) from the optimization and only optimize the other beams.
- The functions *Merge* and *Split* (unmerge) beams are now available for the treatment technique SMLC.
- Min or Max DVH objectives/constraints can now be specified either in relative or in absolute volume.
- When adding a clinical goal, *At most* is selected by default if the selected ROI is an OAR. This applies to *Average dose*, *Volume at dose* and *Dose at volume*.

2.10 ROBUST OPTIMIZATION

- The planning CT is now marked with a "crown" symbol.
- It is now possible to set user defined patient shifts (position uncertainty) through scripting.

2.11 GENERAL PHOTON PLANNING

- Beam templates created for the treatment technique SMLC can now be used for DMLC and vice versa. Beam templates created for VMAT/Conformal Arc can be used for Static Arc and vice versa.
- Monte Carlo dose computation inside and around low-density regions is improved, and statistical noise is reduced in these regions.

- In RayPhysics, it is now possible to configure an Elekta machine with an Agility head so that the minimum tip gap between opposing leaves is defined as a function of the displacement of the leaf pair center from the Y-axis. Thereby, dose leakage can be reduced, and normal tissue can be spared.
- In RayPhysics, the minimum field size (minimum distance between opposing jaws) can now be specified.
- It is now possible to specify accessory codes for photon blocks in the Beams list. The accessory code is required in plan reports for IEC 62083 compliance. If clinic specific report templates are used, add the accessory code to the template to avoid compliance warning in plan reports.

2.12 TOMOTHERAPY PLANNING

- The machine constraint *Max active leaf cycles per second* is now considered in the optimization of Tomo plans.
- When a new TomoHelical or TomoDirect plan is created, the delivery time factor gets the default value 1.50.

2.13 CYBERKNIFE PLANNING

- It is now possible to restrict the MU of a beam set or a segment when a CyberKnife plan is optimized.
- Candidate beam directions have been modified for cone/iris plans, to improve dose conformity. Beams with larger cones are more centrally positioned in the targets.
- It is now possible to view DRRs for both imagers when editing the align center and imaged volume.
- Support is added to create a 1-view margin ROI and base the motion on geometries from multiple phases of a 4DCT, and/or give the magnitude of organ motion as input. A margin in the imager coordinate space can be added.

2.14 ION (PROTON, CARBON, HELIUM) PENCIL BEAM SCANNING PLANNING

- It is now possible to set the "spot spacing" of an energy layer from scripting.
    - This is a workaround that allows the user to "Continue" the optimization for quasi-discrete machines where some energy layers are created manually or are DICOM imported, and where the parameter is not defined. The "spot spacing" parameter affects spot island creation for quasi-discrete machines.
- The range shifter must no longer fit inside at least one snout.

2.15 PROTON BROAD BEAM PLANNING

- Wedges are now supported for ocular planning.

2.16 LIGHT ION PENCIL BEAM SCANNING PLANNING

- The light ion pencil beam dose engine now includes accurate modeling of the beam widening across the air gap, i.e., the distance between the range shifter and the patient.
- Nominal energies are now stored and presented in MeV per nucleon (MeV/A). This applies to energy layers and all properties defined per nominal energy in the machine model.

2.17 BORON NEUTRON CAPTURE THERAPY (BNCT) PLANNING

- The outer shape of BNCT collimators can now be visualized as conical.
  - When adding a collimator to an NCT machine in RayPhysics, the "source side outer diameter" and "patient side outer diameter" values must be specified, and the collimator outer shape is visualized according to that. These outer diameters are not passed to the dose engines and thus not used for dose calculation.

2.18 ELECTRON PLANNING

- The previously used plug-in for in-patient transport for the electron Monte Carlo dose engine, called VMC++, has been exchanged with a version fully developed by RaySearch, which gives several advantages.
  - The new electron Monte Carlo dose engine is implemented to run on the GPU, resulting in much faster dose computations.
  - It is now possible to use user-specified material overrides.
  - It is now possible to compute density perturbed dose for electrons.
  - It is now possible to specify statistical uncertainty directly instead of number of histories for the electron Monte Carlo dose computation.
- It is now possible to specify accessory code for electron cutouts in the Beams list. The accessory code is required in plan reports for IEC 62083 compliance. If clinic specific report templates are used, add the accessory code to the template to avoid compliance warning in plan reports.

2.19 PLAN EVALUATION

- The tool *Create ROI from dose* can now also be used to create an ROI from an evaluation dose.
- It is now possible to create an evaluation dose with user-defined dose values from scripting.

  - For proton and light ions, it is possible to specify if the dose is an RBE dose or not. If specified as an RBE dose and there exists a corresponding physical dose for the same beam set, the difference view in Plan evaluation will show the RBE factor between the two doses.
  - If the dose-averaged LET (LET_d) has been computed for the beam set, it can be used in combination with the physical dose to construct an RBE dose using an arbitrary RBE model.

- Optimization objectives and constraints are now displayed in the Plan evaluation module.
- The grouping layout and the information in the dose list tab are improved. Adapted plans will always be grouped based on base plan and intended start fraction.

2.20 ROBUST EVALUATION

- Support is added for robust evaluation with respect to organ motion uncertainties, i.e., evaluation on multiple image sets (e.g., 4DCT or other CTs/CBCTs).

2.21 TREATMENT DELIVERY

- Presentation units for metersets defined in Number of particles have been updated. Number of particles will always be presented in 10^6 NP.

2.22 ADAPTIVE REPLANNING

- An alternative plan can be created on a different planning image set. This is achieved by copying the currently selected plan and its beam sets onto a new image set using the frame-of-reference (FoR) registration, while preserving the planned fraction schedule (i.e., replanning without background dose).
- In Plan evaluation, adapted plans will always be grouped based on base plan and intended start fraction. The group header will include information about the base plan and start fraction.

2.23 DICOM

- It is now possible to export and import Deformable Spatial Registration objects.
- It is now possible to configure the DICOM export to enable increased precision in exported attributes with Value Representation (VR) Decimal String (DS). This is controlled by a setting and the old behavior is still default.
  - If increased precision is activated, DS attributes exported may be longer than what is allowed in DICOM (16 bytes). Exported DICOM files containing DS attributes (e.g., RT Structure Set and RT Plan) will also have a larger data size.

- The tolerance when importing image stacks that are not located exactly along a straight line, or with slightly varying Image Orientation, is improved. This solves three of five issues previously adjusted by the "MR Import" filter.
- The generation of the Dose Reference Description for the primary prescription is updated. The Dose Reference Description for this item will be set to the same value as the RT Plan Label. This replaces the previously existing filter "Edit Dose Reference Description for Mosaiq".
- (For clinics using RayCare only) DRRs can now be included in the automatic DICOM export when approving a beam set/treatment plan. The automatic export of DRRs is configured in Clinic settings.

2.24 PLAN REPORTS

- The generation of the Warnings table for plan reports has been updated. In previous RayStation versions, the warnings that were produced for approved objects (plans, structure sets, etc.) were generated at the time of report creation. In RayStation 12A, the warnings presented to the user during approval are stored and displayed in the plan report. For objects approved in previous RayStation versions, the previous behavior with warnings generated at the time of report creation remains.
- Series description is now reported for the planning image set in the default plan report.
- The full username from Active Directory will be used for approvals and in reports to make it easier to identify who made the approval.

2.25 VISUALIZATION

- View rotation in 3D and Room view has been improved to allow for more precise control of the view.

2.26 SCRIPTING

- The following scriptable methods for performing beam entry validation have been added: *CheckBeamEntry()*, *CheckBeamEntryAgainstDoseGrid()* and *CheckBeamEntryAgainstImageStack()*.
- It is possible to set the patient position uncertainty scenarios manually by using the scriptable method *opt_parameters.SaveRobustnessParameters()*.

For further updates regarding scripting, see the RayStation Script API HTML Documentation.

2.27 CLINIC SETTINGS

- It is now possible to configure the authentication behavior for the different security operations defined in RayStation. The default is to prompt for username and password but it is possible to allow single sign on and allow the operation without entering the password.

2.28 RAYSTATION STORAGE TOOL

- Secondary data sources can now be configured to move patient records instead of copying the data. This will reduce data duplication and the setting will affect the behavior in the RayStation *Open case* dialog.

2.29 PHOTON BEAM COMMISSIONING

- The commissioning wizard has been removed.
- It is now possible to specify accessory codes for cones and standard wedges.

2.30 ELECTRON BEAM COMMISSIONING

- The previously used plug-in for in-patient transport for the electron Monte Carlo dose engine, called VMC++, has been exchanged with a version fully developed by RaySearch which gives several advantages.
  - The computation is now performed using the GPU and is much faster.
  - It is now possible to specify statistical uncertainty directly instead of number of histories for the dose curve computation.
- A new step has been added to the auto modeling list, which computes all applicator curves with dose contributions. This step can be added after another auto-modeling step if curves computed with contributions are desired.
- The commissioning wizard has been removed.
- It is now possible to specify accessory code and tray ID for applicators.

2.31 ION BEAM COMMISSIONING

- The range shifter must no longer fit inside at least one snout.
- Support is added for PTW 150 Bragg Peak detector (14.7 cm diameter) for proton PBS auto-modeling.

2.32 CT COMMISSIONING

- The UI is improved, allowing a much larger HU to mass-density/SPR conversion plot.

2.33 DOSE ENGINE UPDATES

2.33.1 RayStation 12A dose engine updates

To support an increased HU value range [-2000, 100 000], the list of reference materials for all dose engines except Collapsed Cone has been updated. Iron has been removed. Ti-6Al-4V, titanium,

steel, CoCrMo, silver, tantalum and gold have been added. The consequence is that the dose computation for CTs containing pixels with densities above aluminum may yield significantly different results.

Difference at noise level is also expected for all other CTs when using the proton MC dose engine.

When using an HU-to-SPR CT table, the list of interpolated materials generated from the reference materials has been changed. The interpolated materials are now identical to those generated when using an HU-to-mass-density CT table. A consequence is that the dose computation for all proton and light ion treatment plans using an HU-to-SPR CT table may yield slightly different results than in the previous version of RayStation.

The changes to the dose engines for RayStation 12A are listed below.

Dose engine	RS 11B	RS 12A	Dose effect	Comment
All	-	-	-	New voxel volume algorithm version due to an update of the density computation from CT image data. In cases where the External extends all the way out to the image stack border, voxels at the image stack border will generally get a lower density than before, since the part of such voxels that extends outside of the image border is now assumed to have density 0 g/cm^3, while it previously was assumed to be 1 g/cm^3.
Photon Collapsed Cone	5.6	5.7	Negligible	Existing machine models do not need to be re-commissioned.
Photon Monte Carlo	1.6	2.0	Small	Improvements to dose computation inside and around low-density regions. Adjustments have been made to the photon Monte Carlo engine to better handle low energy physics. For external beam treatment energies, the effect is small, but existing machine models need to be re-commissioned.
Electron Monte Carlo	3.10	4.0	Large	The previously used plug-in for in-patient transport for the electron Monte Carlo dose engine has been exchanged with a version developed by RaySearch. Existing machine models need to be re-commissioned.

Dose engine	RS 11B	RS 12A	Dose effect	Comment
Proton PBS Monte Carlo	5.3	5.4	Small	The lateral block grid resolution in the Proton PBS Monte Carlo dose engine has been reduced from 1 mm and is now a dynamic function of the aperture area. It is proportional to the square root of the area with a minimum and maximum cap such that it is 0.5 mm for apertures larger than 100 cm^2 and 0.2 mm for apertures smaller than 10 cm^2. The multiple scattering threshold has been lowered for primary protons in range shifters. Differences are negligible except for very short residual range (< 1 cm), small fields and large air gaps. Existing machine models do not need to be re-commissioned.
Proton PBS Pencil Beam	6.3	6.4	Negligible	Existing machine models do not need to be re-commissioned.
Proton US/DS/Wobbling Pencil Beam	4.8	4.9	Negligible	Existing machine models do not need to be re-commissioned.
Carbon PBS Pencil Beam	4.4	5.0	Large	Range shifter air gap model is introduced and nuclear halo parameters are updated. Existing machine models need to be re-commissioned.
Brachy TG43	1.2	1.3	Negligible	Existing machine models do not need to be re-commissioned.

2.34 CBCT CONVERSION ALGORITHM UPDATES

The changes to the CBCT conversion algorithms for RayStation 12A are listed below.

Conversion algorithm	RS 11B	RS 12A	Dose effect	Comment
Corrected CBCT	1.0	1.1	Negligible	Performance improvements. No changes to the conversion algorithm. Images may show negligible differences due to general system changes.

Conversion algorithm	RS 11B	RS 12A	Dose effect	Comment
Virtual CBCT	1.0	1.1	Negligible	Performance improvements. No changes to the conversion algorithm. Images may show negligible differences due to general system changes.

2.35 CHANGED BEHAVIOR OF PREVIOUSLY RELEASED FUNCTIONALITY

- The generation of the Warnings table for plan reports has been updated. In previous RayStation versions, the warnings that were produced for approved objects (plans, structure sets, etc.) were generated at the time of report creation. In RayStation 12A, the warnings displayed during approval are stored and displayed in the plan report. For objects approved in previous RayStation versions, the previous behavior with warnings generated at the time of report creation remains.
- All sequentially approved versions of a structure set will now be possible to export. All (sub) structure sets will be available for selection in the DICOM export dialog.

  Exported approved plans will, as previously, always be exported with the (sub) structure set that includes the structures that were available at the time of plan approval.

  The update also involves changes in the interface for the scriptable export, related to specifying which structure sets to be exported. An example of this can be found in the example script *Example_05_DICOM_export.py*.
- In Plan evaluation, adapted plans will always be grouped based on base plan and intended start fraction. This only affects new adapted plans. After an upgrade, existing adapted plans will remain in their original group.
- The CyberKnife functionality used to add an imager specific margin ROI has been removed. It is exchanged for the Add 1-view margin ROI functionality.
- Line doses in the plan evaluation module are no longer cleared when switching 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.

3 KNOWN ISSUES RELATED TO PATIENT SAFETY

There are no issues related to patient safety in RayStation 12A.

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

4 OTHER KNOWN ISSUES

4.1 GENERAL

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

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

(283869)

The auto recovery feature does not handle all types of crashes

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

(144699)

Limitations when using RayStation with large image set

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

- Smart brush/Smart contour/2D region growing are slow when a new slice is loaded
- Hybrid deformable registration might run out of memory for large image sets
- Biomechanical deformable registration might crash for large image sets
- Automated Breast Planning does not work with large image sets
- Creating large ROIs with gray-level thresholding might cause a crash

(144212)

Limitations when using multiple image sets in a treatment plan

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

- Approve the plan
- Generate plan report
- Enable the plan for dose tracking

- Use the plan in adaptive replanning

(341059)

Slight inconsistency in dose display

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

This is caused by the text value and the rendered dose color being fetched from different voxels. Both values are essentially correct, but they are not consistent.

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

(284619)

Cut plane indicators are not displayed in 2D patient views

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

(146375)

4.2 IMPORT, EXPORT AND PLAN REPORTS

Import of approved plan causes all existing ROIs to be approved

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

336266

Laser export not possible for decubitus patients

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

(331880)

RayStation sometimes reports a successful TomoTherapy plan export as failed

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

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

338918

Report Templates must be upgraded after upgrade to RayStation 12A

The upgrade to RayStation 12A 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

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

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

(69150)

Floating view in Image registration module

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

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

(409518)

4.4 BRACHYTHERAPY PLANNING

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

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

When exporting plans from RayStation:

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

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

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

Possible consequences are:

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

Consult with SagiNova application specialists for appropriate solutions.

(285641)

4.5 PLAN DESIGN AND 3D-CRT BEAM DESIGN

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

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

(144701)

4.6 PLAN OPTIMIZATION

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

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

(138830)

Plan approval and DICOM export of robust optimized plans might crash

After using robust optimization over additional image sets, some actions performed on the plan will cause subsequent plan approval and DICOM export to crash. Performing an optimization (zero iterations is enough) or unchecking the secondary image sets in the Robustness Settings dialog

will correct this. Examples of actions that can trigger a crash are dose grid edits and version upgrade of RayStation.

(138537)

4.7 PLAN EVALUATION

Material view in Approval window

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

(409734)

4.8 CYBERKNIFE PLANNING

Verifying deliverability of CyberKnife plans

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

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

(344672)

4.9 PROTON AND LIGHT ION PLANNING

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

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

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

(224066)

4.10 TREATMENT DELIVERY

Mixed beam sets in plan fraction schedule

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

(331775)

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

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

(341739)

4.11 AUTOMATED PLANNING

Incorrect Beam on interval might be set back without notification

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

(144086)

4.12 BIOLOGICAL EVALUATION AND OPTIMIZATION

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

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

(138535)

Undo/redo invalidates response curves in the Biological Evaluation module

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

(138536)

4.13 MEDICAL ONCOLOGY PLANNING

No regimen information shown in Open Case dialog

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

(146680)

Backup and restore does not work correctly for medical oncology patients

When performing a backup of a medical oncology patient, not all referenced data is included in the backup. Vitals, medication statements, active substances and regimen templates are not included in backups. However, these can be backed up using the RayStation Storage tool, see section D.3.12 Export data in *RSL-D-RS-12A-USM, RayStation 12A User Manual*.

To back up a patient, start by backing up all referenced active substances, regimen templates, vitals and medication statements in the RayStation Storage tool. Vitals and medication statements are combined and backed up as observations. When this is done, back up the patient in RayStation. To restore the patient, start by restoring active substances, regimen templates and observations in RayStation Storage Tool, see section D.3.11 Import data in *RSL-D-RS-12A-USM, RayStation 12A User Manual*, and then restore the patient in RayStation.

(143750)

4.14 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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