PRODUCT CONFIGURATIONS
OVERVIEW
RAYSTATION PLANNING

The product rayPlatform is required to access RayStation and decides the number of simultaneous users.

All licenses are floating but not between applications; for instance, rayDeformable will float between rayConformal, rayIntensity, rayArc and rayElectronPlanning, but cannot be accessed from the standalone application RayStation Anatomy.

When accessing RayStation through RayStation Planning, Tracker, Doctor, Evaluation or Anatomy, the products included are consumed when the same user is using additional products such as rayConformal, rayIntensity, rayArc, rayNavigator, rayFallback, rayBiology and rayDeformable.

This is an illustrative example of how the floating license mechanism works, the number of users, and how they can simultaneously access the acquired licenses for different scenarios. In this example, the clinic has purchased the following configuration:

- Raystation Planning 3
- rayConformal 2
- rayIntensity 2
- rayArc 1
- rayFallback 1
- rayNavigator 1
- rayDeformable 1
- rayTracker 1
- rayAdaptive 1

Example below: Clinic has purchased licenses for 3 simultaneous users.

LICENSING OVERVIEW

RAYSTATION
PHOTON PLANNING

Level 1
Example below: Clinic has purchased licenses for 3 simultaneous users.

Level 2

Level 3

Level 4

Level 5

rayAutoBreast requires both rayConformal & rayIntensity

rayWave requires rayArc
RAYSTATION
PROTON PLANNING

Included products
- rayPlatform
- rayEvaluation
- rayAnatomy
- rayPlan
- raySetup

Included products
- rayPassiveScattering
- rayUniformScanning
- rayWobbling
- rayPencilScanning
- rayLineScanning

Included products
- rayProtonPhysics
- rayUniformScattering

Included products
- rayProtonPhysics

Included products
- rayProtonPhysics

Included products
- rayProtonPhysics
- rayLineScanning

Included products
- rayPencilScanning
- rayUniformScattering

Included products
- rayNavigator
- rayBiology
- rayDeformable

Included products
- rayTracker

Included products
- rayAdaptive
RAYSTATION STANDALONE APPLICATIONS

RayStation Doctor
Included products
rayPlatform rayAnatomy rayEvaluation

RayStation Tracker
Included products
rayPlatform rayTracker rayDeformable rayAnatomy rayEvaluation

RayStation Simulation
Included products
rayPlatform raySimulation rayConformal rayAnatomy rayPlan

RayStation Evaluation
Included products
rayPlatform rayEvaluation rayDeformable rayBiology

RayStation Anatomy
Included products
rayPlatform rayAnatomy rayEvaluation rayDeformable rayBiology

The treatment plan optimization tools are not included since they require rayOptimizer.

Mandatory to choose one or several dose calculation engines.

*Subject to regulatory clearance in some markets.
RayStation can be deployed as different applications representing groups of tasks in the clinical workflow. The applications are RayStation Planning, RayStation Anatomy, RayStation Doctor, RayStation Evaluation, RayStation Simulation and RayStation Tracker. The capabilities of an application are provided by the products it includes. All applications come with a set of products that are always included, and can also be expanded by selecting additional products.
RayStation Planning
The Planning application is the complete treatment planning system, where all steps of the planning process can be performed. The following products are included:

- **RayStation Tracker**
  - RayStation Tracker provides the capability for computing dose and accumulating dose over changing anatomy. The following products are included:

<table>
<thead>
<tr>
<th>Core modules</th>
<th>Mandatory (one or several) expansion products</th>
<th>Optional expansion products</th>
</tr>
</thead>
<tbody>
<tr>
<td>rayPlatform</td>
<td>rayConformal</td>
<td>rayNavigator</td>
</tr>
<tr>
<td>rayAnatomy</td>
<td>rayIntensity</td>
<td>rayFullback</td>
</tr>
<tr>
<td>rayEvaluation</td>
<td>rayAutoBreast</td>
<td></td>
</tr>
<tr>
<td>raySetup</td>
<td>rayDose (to be released in a RayStation 6 Service Pack)</td>
<td>rayBiology</td>
</tr>
<tr>
<td>rayWave</td>
<td>rayDeformable</td>
<td></td>
</tr>
<tr>
<td>rayElectronPlanning</td>
<td></td>
<td>rayTracker</td>
</tr>
<tr>
<td>rayPassiveScattering</td>
<td></td>
<td>rayAdaptive</td>
</tr>
<tr>
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<td></td>
<td>raySimulation</td>
</tr>
<tr>
<td>rayPencilScanning</td>
<td></td>
<td>rayExplorer</td>
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<tr>
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<td></td>
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<tr>
<td>rayLineScanning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rayCarbonPlanning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **RayStation Doctor**
  - RayStation Doctor provides functionality for anatomical modeling and plan evaluation. It can optionally be expanded with deformable registration, radiobiological evaluation, and virtual simulation. Deformable registration makes it possible to deform dose. The following products are included:

<table>
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<tr>
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<td>rayBiology</td>
</tr>
<tr>
<td>rayEvaluation</td>
<td>raySimulation (excluding raySetup and rayConformal, but not rayPhotonPhysics and rayOptimizer)</td>
</tr>
</tbody>
</table>

- **RayStation Simulation**
  - RayStation Simulation provides functionality for virtual simulation, including patient modeling, isocenter placement, export to patient marking systems, and beam design. It can optionally be expanded with deformable registration. RayStation Simulation does not enable exporting of plans. It therefore needs to be deployed in conjunction with RayStation Planning, where dose computation and DICOM export can be performed. Both these applications connect to the same database. The following products are included:

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<td>raySimulation (including raySetup and rayConformal, but not rayPhotonPhysics and rayOptimizer)</td>
<td></td>
</tr>
</tbody>
</table>
• Support for CT-PET/CT, MR, CBCT and 4D-CT
• Rigid image registration and fusion tools for multiple image series
• 4D-CT movie function
• Visualization of ROI in 2D and 3D
• Streamlined handling of multiple image datasets
• Intelligent ROI expansion, algebra and administration
• Atlas-based organ delineation using the clinic’s patient database
• Model-based organ delineation
• Manual and semi-automatic organ and target delineation tools
• Geometrical beam configuration setup tools
• Circular cones
• Shielding blocks
• Tools for drawing and manipulating apertures in BEV
• Automatic computation of apertures based on target ROIs and OARs
• Merging of beams for field-in-field planning
• Direct optimization of 3-D CRT treatment parameters, such as leaf positions, beam weights, wedge angles, wedge fractions, collimator angle, gantry angle and couch angle
• Support for all MLC equipped Elekta, Varian and Siemens linacs
By choosing rayConformal as part of a RayStation Planning application, the following additional products are included:
  • rayPhotonPhysics
  • rayOptimizer

When rayConformal is included as part of a RayStation Simulation or a RayStation Doctor application, no additional products are included.
raySimulation – virtual simulation
raySimulation provides a dedicated workspace for performing virtual simulation tasks related to isocenter placement, export to patient marking systems and beam design. The tools available are to a large extent available through the automatically included rayConformal product. Specific features unique to the raySimulation product are:
- Dedicated workspace for virtual simulation
- One-click creation of a plan with an orthogonal beam pair
- Isocenter placement using DRR pair
- Export to patient marking systems

raySimulation does not enable export of plans. Therefore it needs to be deployed in conjunction with RayStation Planning, in which dose can be computed and DICOM export be performed.

raySimulation includes the following additional products are included:
- raySetup
- rayConformal

rayIntensity – IMRT optimization
RayIntensity provides state-of-the-art tools to design and optimize IMRT treatment plans. Through direct optimization of step-and-shoot segments, i.e., the aperture shape and weights of each segment, IMRT plans of high-quality and with a minimum number of segments are created, increasing the overall treatment quality by speeding up both the planning and delivery processes.
- Direct optimization of step-and-shoot segment shapes, and segment weights
- Direct optimization of sliding window segments
- Support for all MLC-equipped Elekta, Varian and Siemens linacs
- Possible to select target ROI and target margin per beam (SMLC)

rayIntensity includes the following additional products:
- rayPhotonPhysics
- rayOptimizer

rayArc – VMAT optimization
rayArc provides design and optimization of single or multiple-arc plans for Elekta, Varian and Siemens linacs. Direct and simultaneous optimization of all available VMAT treatment parameters, while at the same time ensuring the fulfillment of accelerator constraints, makes it possible to produce treatment plans with outstanding quality. Because of the direct machine parameter optimization, the optimized plan is directly deliverable, with no quality-degrading post-processing required.
- Direct optimization of leaf positions and arc segment weights considering all machine limitations, such as leaf speed, gantry speed and available dose rates
- Creation of single or multiple arcs
- VMAT with constant gantry angle speed and dose rate for non-upgraded linacs
- Support for all rotational arc capable linacs from Elekta and Varian
- Support for rotational arc capable linacs from Siemens
- Possible to select target ROI and target margin per beam

rayArc includes the following additional products:
- rayPhotonPhysics
- rayOptimizer

rayTomo includes the following additional products:
- rayPhotonPhysics
- rayOptimizer

rayTomo – Virtual TomoTherapy optimization
rayTomo provides design and optimization of helical tomotherapy machines. Direct and simultaneous optimization of all relevant machine parameters makes it possible to create treatment plans with outstanding quality. Because of the direct machine parameter optimization, the optimized plan is directly deliverable with no quality-degrading post-processing required.
- Leaf open time histogram
- Display of leaf positions and leaf open times in BEV
- Possibility for user to restrict delivery time
- Avoidance region tools – specify ROI not to be exposed
- Support for dynamic and fixed jaws
- Avoidance region tools – specify ROI not to be exposed
- Beam weighting using sliders
- Versatile tools for manual editing of exit aperture, as well as fixed SOBP modulation width
- Block aperture computation
- Beam specific target and risk organ specification
- Compensator shape exported via DICOM
- Milling/drilling tool size taken into account
- Smearing and maximum gradient filters
- Compensator shape exported via DICOM
- Beam weighting using sliders
- Very fast approximate dose engine for immediate feedback

By choosing the option rayPassiveScattering and rayUniformScanning the following additional product is included:
- rayPhotonPhysics

rayPassiveScattering and rayUniformScanning – conformal proton planning
RayPassiveScattering and rayUniformScanning provide the tools for designing treatment plans for passively scattered and uniformly scanned protons respectively.
- Support for beam delivery techniques using continuous as well as fixed SOBP modulation width
- Automatic and/or manual selection of SOBP field range and width
- Block aperture computation
- Beam specific target and risk organ specification
- Compensator shape exported via DICOM
- Versatile tools for manual editing of exit aperture, as well as fixed SOBP modulation width
- Compensator shape exported via DICOM
- Beam weighting using sliders
- Very fast approximate dose engine for immediate feedback

By choosing the option rayPassiveScattering and rayUniformScanning the following additional product is included:
- rayPhotonPhysics

rayElectronPlanning includes the following additional product:
- rayPhotonPhysics

rayWave requires:
- rayArc

rayElectronPlanning – electron planning
RayElectronPlanning contains the tools for creation and design of electron treatment plans.
- Forward electron treatment planning tools for electron applicators and inserts
- Support for Elekta, Varian and Siemens linacs
RayStation offers a comprehensive suite of tools for designing and optimizing proton therapy treatment plans. Here are some key features:

- **rayPencilScanning** – IMPT optimization
  - rayPencilScanning provides the tools for designing and optimizing actively scanned pencil beam proton treatment plans. It includes robust optimization, which makes it possible to create treatment plans that are robust to geometrical and dosimetric uncertainties, as well as support for block apertures.
  - Optimization of pencil beam scanning using multi-field optimization and single-field uniform dose techniques
  - Step-and-shoot spot scanning
  - Can be combined with patient-specific block apertures during optimization
  - Optimization including lower and upper spot weight limits of delivery system
  - Robust optimization, scenario-based optimization regarding uncertainties in range (density) and position (isocenter shifts, target shifts, etc.)
  - 4D optimization
  - Control of initial energy layer/spot selection with respect to target, OAR, and entrance surface. Different margins in lateral, proximal and distal directions
  - Manual editing of spot pattern
  - Spot visualization
  - Bragg peak visualization
  - Range shifter support
  - Editable snout position
  - System-wide handling of physical and RBE-corrected dose
  - Equivalent functionality as for proton IMPT (i.e., spot selection, filtering and sorting, manual editing, etc.). Robust optimization is not supported for carbon ions.
  - RayPencilScanning includes the following additional products:
    - rayConformal
    - rayIntensity
    - rayAutoBreast
  - rayPencilScanning – planning for Sumitomo Wobbling
  - rayWobbling provides the tools for designing treatment plans for Sumitomo machines using the Wobbling technique.
    - Support for SOBP modulation using discrete ridge filters
    - Automatic and/or manual selection of nominal beam energy and ridge filter setting
    - Beam-aperture computation
    - Beam specific target and risk organ specification
    - Border smoothing taking the milling tool size into account
    - Aperture shape exported via DICOM
    - Compensator computation
    - Conforms to beam-specific targets and distal blocking ROI
    - Smearing and maximum gradient filters
    - Milling/drilling tool size taken into account
    - Compensator shape exported via DICOM
    - Versatile tools for manual editing of exit aperture, compensator and MLC shape
    - Beam-weighting using sliders
    - Very fast approximate dose engine for immediate feedback
  - rayWobbling includes the following additional products:
    - rayCarbonPlanning
    - rayAutoBreast – automated breast planning
    - rayNavigator – multi-criteria optimization
    - rayNavigator introduces the concept of multi-criteria optimization (MCO), which provides an alternative optimization workflow: Instead of the planner performing iterative optimization with adjustments to optimization functions and weights, RayStation generates a set of Pareto plans. Based on these plans, which cover a range of treatment plan options, the planner or physician can manipulate sliders in real time to balance between trade-offs.
      - An interactive navigation tool for selecting the best clinical trade-off based on fluence-based anchor plans
      - Automatic tool for generating a deliverable treatment plan from this selection
      - Directly deliverable MCO for EMLC treatments
  - rayWobbling – planning for Sumitomo Line Scanning
  - rayLineScanning provides the tools for designing and optimizing proton treatment plans using Sumitomo line scanning. It includes, tools for robust optimization, which make it possible to create treatment plans that are robust to geometrical and dosimetric uncertainties, as well as support for block apertures.
    - Optimization of pencil beam line scanning using multi-field optimization and single field uniform dose techniques
    - Can be combined with patient-specific block apertures during optimization
    - Optimization including scan speed and beam intensity limitations of delivery system
    - Robust optimization, scenario-based-optimization regarding uncertainties in range (density) and position (isocenter shifts, target shifts, etc.)
    - 4D optimization
    - Control of initial energy layer/spot selection with respect to target, OAR, and entrance surface. Different margins in lateral, proximal and distal directions
    - Manual editing of spot pattern
    - Line segment visualization
    - Bragg peak visualization
    - Spot weight filtering
    - Range shifter support
    - Editable snout position
    - Layer repainting
  - rayLineScanning includes the following additional products:
    - rayCarbonPlanning
    - rayCarbonPlanning is the functionality for optimizing pencil beam scanned carbon ion treatments.
    - Carbon dose computation using pencil beam dose engine (Support for GPU and CPU)
    - RBE dose computation using Local Effect Model (LEM)
    - Optimization of carbon ion Pencil Beam Scanning (PBS) plans
    - Equivalent functionality as for proton IMPT (i.e., spot selection, filtering and sorting, manual editing, etc.). Robust optimization is not supported for carbon ions.
    - System-wide handling of physical and RBE-corrected dose
  - rayCarbonPlanning includes the following additional products:
    - rayCarbonPlanning
    - rayAutoBreast – automated breast planning
    - rayAutoBreast provides tools for automated generation of tangential breast IMRT plans using heuristic optimization.
      - Automatic detection of radio-opaque markers defining the breast
      - Automatic contouring of all the relevant target and risk organs
      - Automatic setup of beams, including heuristic optimization of gantry and collimator angles
      - Automatic creation of objective functions, optimization and segmentation settings and clinical goals
  - rayAutoBreast requires all of the following products:
    - rayConformal
    - rayIntensity
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    - Automatic detection of radio-opaque markers defining the breast
    - Automatic contouring of all the relevant target and risk organs
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      - An interactive navigation tool for selecting the best clinical trade-off based on fluence-based anchor plans
      - Automatic tool for generating a deliverable treatment plan from this selection
      - Directly deliverable MCO for EMLC treatments
  - rayNavigator requires one or more of the following products:
    - rayConformal
    - rayIntensity
RayStation Planning and one of the following products: rayConformal, rayIntensity, rayArc, rayPhotonPhysics, rayElectronPhysics, rayProtonPhysics, rayCarbonPhysics.

Planning and optimization tools provide tools for evaluation and optimization. Treatment planning tools include the possibility to evaluate treatment plans based on radiobiological indices such as NTCP and TCP according to different radiobiological models. The effects of different fractionation schedules, including the scenario where fractions have been missed, can also be estimated. Treatment plan optimization tools make it possible to optimize directly on the biological indices used in radiobiological evaluation, in combination with physical dose indices.

- Deformable registration tools to establish mappings between CT, CBCT or MR images.
- Mapping and accumulation of dose between the CT datasets.
- Propagation of ROI contours or meshes between images, including 4D-CT.
- Hybrid intensity and structure based deformation algorithm (GPU supported). Biomechanical model based deformation algorithm (MORFUS’s based).
- Tools for analysis and evaluation of deformable registration.
- RayTracker – dose tracking:
  - By combining dose calculation capabilities for CBCT images and deformable registration, it is possible to accumulate dose over changing anatomy within a single system, i.e., without imports or exports to other systems. CBCT isocenter registration and density estimation is provided.
  - Dose calculation based on CBCT.
  - Easy dose accumulation over fractions.
  - Dedicated workspace for evaluating deformable dose accumulation.
  - Fraction schedule, shows delivered fractions, acquired images and available doses.
  - Synchronized side-by-side views of planned and delivered dose.
- RayTracker requires:
  - RayDeformable
- RayAdaptive – adaptive replanning:
  - Provides tools for adaptive replanning and opens up for the most recent technology in the history of external radiation treatment. Based on the results from RayTracker, clinicians can steer a detailed treatment plan on track by reoptimizing and adapting the plan to the patient’s current anatomical structures, taking accumulated dose into account. Plans can be reoptimized and adjusted to compensate for dose coverage problems or to adapt to adjusted clinical goals.
  - Adaptive replanning workspace.
  - Fraction schedule, [shows delivered and replanned fractions].
  - Tools for including relevant parts of plan creation, plan optimization and plan approval.
- RayAdaptive requires:
  - RayTracker
  - RayPhotonPhysics contains the dose calculation engines for megavoltage photon beams, i.e., conventional linacs, and Tomotherapy machines. It includes the separate application RayPhotonPhysics, with advanced tools for beam modeling, such as partly automated beam modeling tools and the Beam 3D Modeling module, wherein machine models can be evaluated for a real patient and treatment plan before being commissioned for clinical treatment.
  - Collapsed cone photon dose calculation engine with clinical accuracy (GPU supported).
  - Singular value decomposition photon dose calculation engine for real-time purposes.
  - Beam commissioning workspace with auto-modeling.
- RayPhotonPhysics is only available as part of the following products:
  - RayConformal.
  - RayIntensity.
  - RayArc.
  - RayAdaptive.
- RayProtonPhysics – proton dose calculation:
  - RayProtonPhysics contains the dose engine and beam modeling and commissioning workspace for therapeutic electron beams.
  - Electron dose calculation engine using a Monte Carlo technique for energy transport in the patient and an in-house beam model to determine the phase space from the treatment unit head, including applicators.
  - Beam commissioning workspace.
- RayProtonPhysics is only available as part of rayElectronPhysics or as an expansion to RayStation Tracker.
- RayCarbonPhysics – carbon ion physics:
  - RayCarbonPhysics comprises the dose engines used for carbon treatment planning. These are a pencil-beam dose engine for computation of physical dose and a RBE-weighted dose computation using the Local Effect Model (LEM). RayCarbonPhysics also includes the management of RBE models (LEM) in RayBiological.
- RayCarbonPhysics is only available as part of rayCarbonPlanning or as an expansion to RayStation Tracker.
- RayExplorer – plan exploration:
  - RayExplorer provides functionality to automatically generate a large set of plans for different treatment techniques, treatment parameters and machines. From this large set of plans, a few candidates can be selected by filtering based on different plan characteristics. These candidates are evaluated against each other in a separate GUI.
  - Automatically generate plans [e.g., 20-100] for different treatment techniques and beam arrangements.
  - Automatic plan generation using prioritized clinical goals.
  - Select from plan exploration using filters based on clinical goals, treatment techniques and machines.
  - Side-by-side comparison of plan selection.
  - Plan generation can be deployed on HPC cluster.
- RayExplorer requires one or more of the products:
  - RayIntensity.
  - RayArc.
  - RayProtonPhysics.
  - RayCarbonPhysics.
  - RayElectronPhysics.
  - RayPhotonPhysics.
  - RayLineScanning.
  - RayConformal.
  - RayIntensity.
  - RayArc.
  - RayAdaptive.

Monte Carlo – an in-house algorithm developed to maximize computational efficiency without sacrificing accuracy requirements for treatment planning.
2,600 CLINICS IN 65 COUNTRIES

RaySearch is advancing cancer treatment through pioneering software. We believe software has unlimited potential, and that it is now the driving force for innovation in oncology. Medical science never stands still, and neither does RaySearch. We work in close cooperation with leading cancer centers to bring scientific advancements faster to the clinical world. Today, our solutions support thousands of clinics worldwide in the fight against cancer.

RayStation®, our next-generation treatment planning system, supports the quality of decision-making, creates new treatment possibilities and gets maximum value from your existing equipment. By making treatment planning faster, easier and more flexible, we enable better care for cancer patients worldwide.

And this is just the beginning.

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