



PRODUCT CONFIGURATIONS OVERVIEW

LICENSING OVERVIEW

RAYSTATION PHOTON 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 can not 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

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

RayStation Planning 3 Users Purchased

Included products

rayPlatform

rayEvaluation

rayAnatomy

rayPlan

raySetup

Level 2

rayConformal (3DCRT)

Scenario 1
Scenario 2
Scenario 3

Included products

rayOptimizer

rayConformal

rayPhotonPhysics

rayIntensity (IMRT)

Scenario 1
Scenario 2
Scenario 3

Included products

rayOptimizer

rayIntensity

rayPhotonPhysics

rayArc (VMAT)

Scenario 1
Scenario 2
Scenario 3

Included products

rayOptimizer

rayArc

rayPhotonPhysics

rayTomo (TomoTherapy)

Scenario 1
Scenario 2
Scenario 3

Included products

rayOptimizer

rayTomo*

rayPhotonPhysics

rayElectronPlanning

Scenario 1
Scenario 2
Scenario 3

Included products

rayElectronPhysics

rayElectronPlanning

*Subject to regulatory clearance in some markets.

Level 3

rayFallback

Scenario 1
Scenario 2
Scenario 3

rayBiology

Scenario 1
Scenario 2
Scenario 3

raySimulation

Scenario 1
Scenario 2
Scenario 3

rayDeformable

Scenario 1
Scenario 2
Scenario 3

rayAutoBreast

Scenario 1
Scenario 2
Scenario 3

rayNavigator

Scenario 1
Scenario 2
Scenario 3

rayExplorer

Scenario 1
Scenario 2
Scenario 3

rayFallback

Scenario 1
Scenario 2
Scenario 3

rayBiology

Scenario 1
Scenario 2
Scenario 3

rayDeformable

Scenario 1
Scenario 2
Scenario 3

rayWave

Scenario 1
Scenario 2
Scenario 3

rayDeformable

Scenario 1
Scenario 2
Scenario 3

rayAutoBreast requires both rayConformal & rayIntensity

rayWave requires rayArc

Level 4

rayTracker

Scenario 1
Scenario 2
Scenario 3

rayTracker

Scenario 1
Scenario 2
Scenario 3

rayTracker

Scenario 1
Scenario 2
Scenario 3

Level 5

rayAdaptive

Scenario 1
Scenario 2
Scenario 3

rayAdaptive

Scenario 1
Scenario 2
Scenario 3

rayAdaptive

Scenario 1
Scenario 2
Scenario 3

2

3

RAYSTATION PROTON PLANNING

Level 1

RayStation Planning

Included products

rayPlatform

rayEvaluation

rayAnatomy

rayPlan

raySetup

Level 2

rayPassiveScattering

Included products

rayProtonPhysics

rayPassiveScattering

rayUniformScanning

Included products

rayProtonPhysics

rayUniformScanning

rayWobbling

Included products

rayProtonPhysics

rayUniformScattering

rayPencilScanning

Included products

rayProtonPhysics

rayProtonPhysics

rayUniformScattering

rayLineScanning

Included products

rayOptimizer

rayProtonPhysics

rayLineScanning

Level 3

rayNavigator

rayBiology

rayDeformable

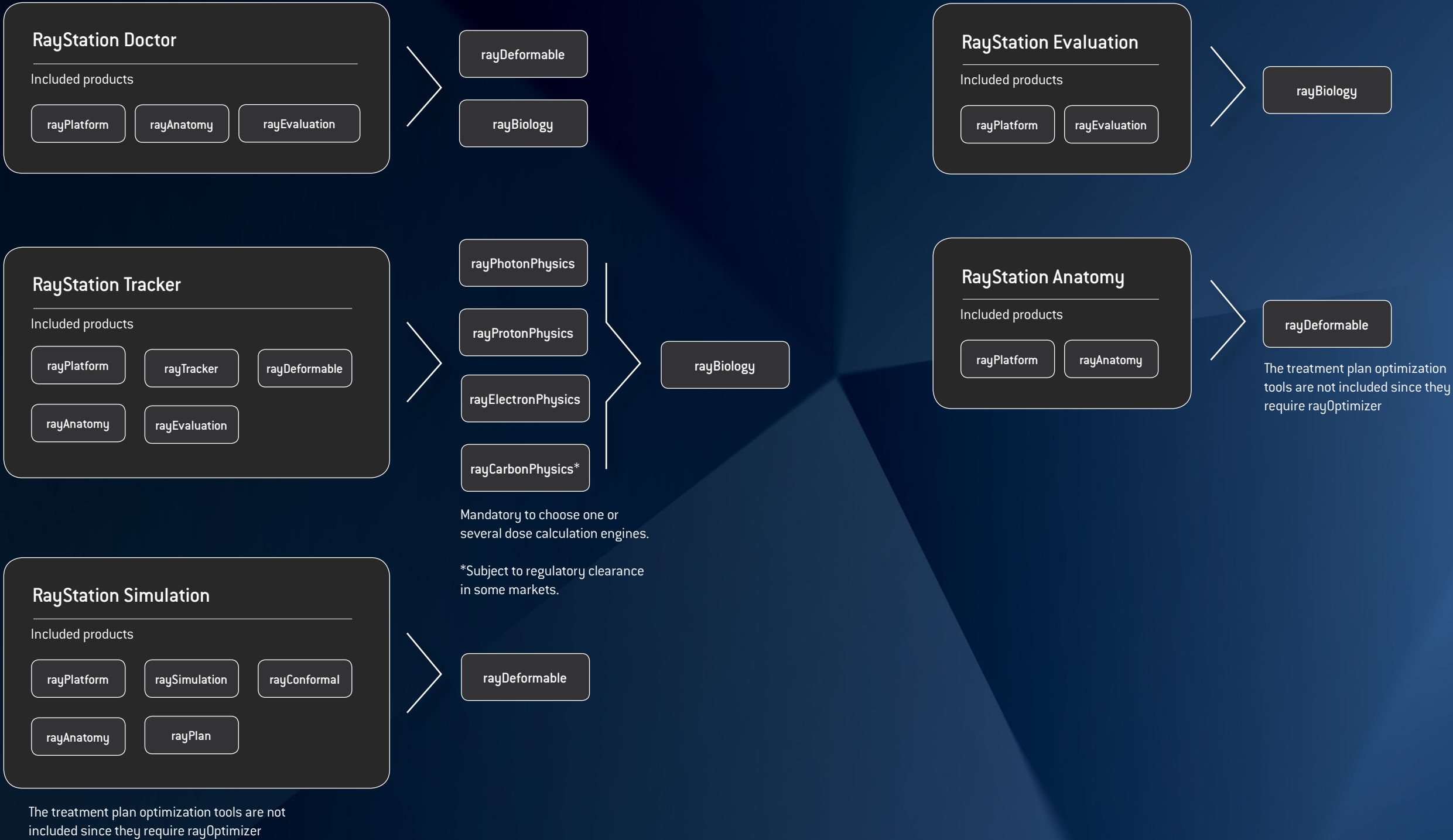
Level 4

rayTracker

Level 5

rayAdaptive

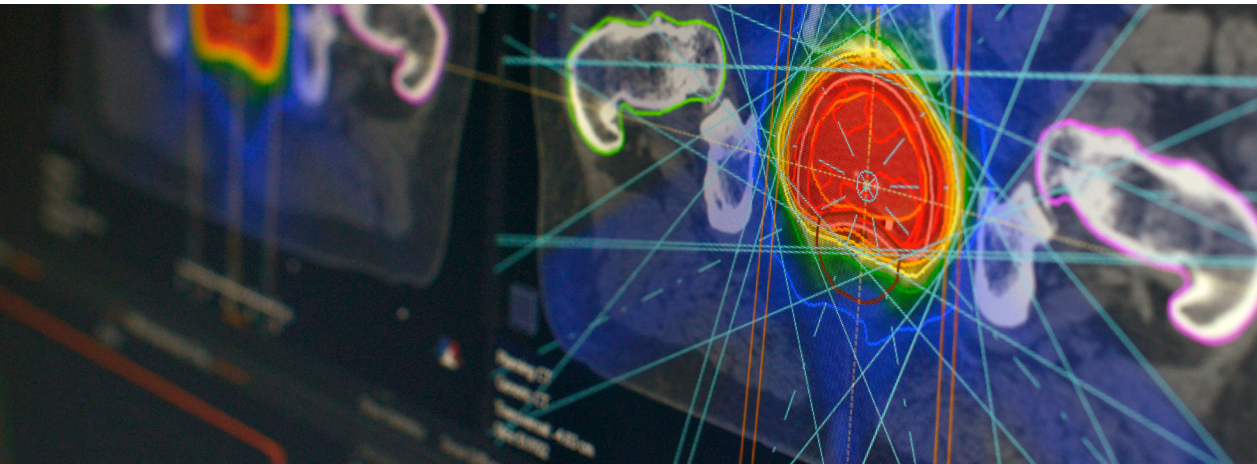
RAYSTATION STANDALONE APPLICATIONS



RAYSTATION 6 PRODUCT DESCRIPTIONS

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:

Core modules	Mandatory (one or several) expansion products	Optional expansion products
rayPlatform	rayConformal	rayNavigator
rayAnatomy	rayIntensity	rayFallback
rayEvaluation	rayArc	rayAutoBreast
raySetup	rayTomo (to be released in a RayStation 6 Service Pack)	rayBiology
	rayWave	rayDeformable
	rayElectronPlanning	rayTracker
	rayPassiveScattering	rayAdaptive
	rayUniformScanning	raySimulation
	rayPencilScanning	rayExplorer
	rayWobbling	
	rayLineScanning	
	rayCarbonPlanning	

RayStation Tracker

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

Core modules	Mandatory (one or several) expansion products	Optional expansion products
rayPlatform	rayPhotonPhysics	rayBiology
rayEvaluation	rayElectronPhysics	
rayAnatomy	rayProtonPhysics	
rayDeformable		
rayTracker		

RayStation Anatomy

RayStation Anatomy is limited to anatomical modeling such as structure definition, image registration, deformable registration and propagation of structures. It includes atlas-based segmentation, model-based segmentation and a comprehensive set of manual and semi-automatic tools. The following products are included:

Core modules	Optional expansion products
rayPlatform	rayDeformable
rayAnatomy	

RayStation Evaluation

RayStation Evaluation is for plan evaluation and approval only. It supports all conventional plan comparison metrics and can also support radiobiological evaluation of rivaling plans as well as different fractionation schedules. The following products are included:

Core modules	Optional expansion products
rayPlatform	rayBiology
rayEvaluation	

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:

Core modules	Optional expansion products
rayPlatform	rayDeformable
rayAnatomy	rayBiology
rayEvaluation	raySimulation (including raySetup and rayConformal, but not rayPhotonPhysics and rayOptimizer)

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:

Core modules	Optional expansion products
rayPlatform	rayDeformable
rayAnatomy	
raySimulation (including raySetup and rayConformal, but not rayPhotonPhysics and rayOptimizer)	

rayPlatform

rayPlatform constitutes the foundation upon which all other products run. It handles the import and export of data and manages the domain model, which includes the scripting interface, undo/redo, etc. In addition to clinical treatment applications, the rayPlatform also provides a base for research purposes. With Python scripting, the user can not only simplify and customize the planning workflow, but also directly interact with core algorithms.

- DICOM import of images (CT, PET/CT, MR, 4D-CT, and CBCT), ROI, photon plans, electron plans, RT ION plans and doses
- DICOM import of images, ROI, plans and doses from iDMS (for TomoTherapy planning)
- DICOM export (requires clinical licenses) to OIS, R&V systems and DICOM archives
- RayStorage, setup of systems and databases
- HIPAA compliance
- Undo/redo for every function, including ROI actions, dose computations, optimizations, etc.
- Auto recovery in case of system crash
- Macro recording
- Python-based scripting

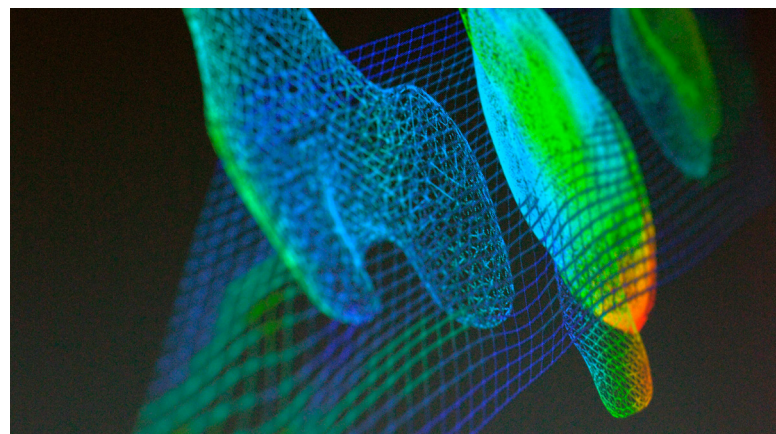
rayPlatform is only available as part of the following applications:

- RayStation Planning
- RayStation Tracker
- RayStation Anatomy
- RayStation Evaluation
- RayStation Doctor
- RayStation Simulation

rayAnatomy – patient modeling

rayAnatomy contains tools for creating a rich representation of the patient anatomy, which is used in the treatment planning process. This includes rigid image registration and fusion for CT, CBCT, MR and PET, advanced manual and semi-manual contouring tools and model-based segmentation.

- Manual and semi-automatic organ and target delineation tools
- Model-based organ delineation
- Atlas-based organ delineation using the clinic's patient database
- Intelligent ROI expansion, algebra and administration
- Streamlined handling of multiple image datasets
- Visualization of ROI in 2D and 3D
- 4D-CT movie function
- Rigid image registration and fusion tools for multiple image series
- Support for CT-PET/CT, MR, CBCT and 4D-CT
- Creation of 4D-CT projections (maximum, minimum, average)



rayAnatomy is only available as part of the following applications:

- RayStation Planning
- RayStation Tracker
- RayStation Anatomy
- RayStation Doctor
- RayStation Simulation

rayEvaluation – plan evaluation

rayEvaluation is a comprehensive toolbox for evaluation and comparison of treatment plans and plan approval. From a number of predefined layouts, dose distribution, dose statistics, clinical goals and dose volume histograms for up to three different plans can be simultaneously compared. Doses can be weighted and added.

- Dose statistics and clinical goal lists
- Plan evaluation tools
- Dose comparison and weighted summation of imported doses from any other system

In RayStation Planning, rayEvaluation provides the following additional features:

- Dose computation for alternative image sets
- Perturbed dose computations for robustness evaluation, e.g., isocenter shifts and density errors
- Dose deformation (requires rayDeformable)

rayEvaluation is only available as part of the following applications:

- RayStation Planning
- RayStation Tracker
- RayStation Evaluation
- RayStation Doctor

raySetup

raySetup provides the planning capabilities that are common for all external beam treatments irrespective of beam modality (photons, protons, electrons or carbon ions).

- Geometrical beam configuration setup tools
- Patient setup tool using keV-beams with DRR
- Support for multiple DRRs per beam
- Room view

In RayStation Planning, raySetup provides the following additional features:

- Multiple beam sets for creation of mixed-modality boost plans, including pretreated dose of any modality imported from any other system (e.g., IMRT, brachytherapy, etc.)
- Auto-scaling of dose to prescription
- Bolus handling
- Template support for beams, clinical goals, etc.
- Plan-generation protocols that can automatically create structures, plans, beams and optimization setup by loading a protocol
- Commissioning tools for modeling of CT and cone-beam CT (CBCT) machines (for HU to density calibration)
- Tools for data preparation for quality assurance
- Report templates

raySetup is only available as part of the following application:

- RayStation Planning
- RayStation Doctor, if raySimulation has been chosen as an expansion product
- RayStation Simulation

rayOptimizer – optimization algorithm

rayOptimizer contains the generic optimization engine used for all plan optimization, irrespective of beam modality and treatment technique. The optimization method used is called sequential quadratic programming and allows for efficient optimization of a non-linear objective, non-linear constraints and rigorous handling of linear constraints and bounds. For convex functions, it guarantees convergence to the globally optimal solution.

- Multi-purpose optimization engine
- Robust optimization based on density, patient setup uncertainties and multiple images.
- Simultaneous optimization of beams for different treatment techniques (SMLC, DMLC, VMAT)
- Physical objective and constraint functions, such as min/max dose, min/max DVH, min/max EUD, uniform dose and target conformance
- Templates for objectives and constraints
- Automatic dose improvements



rayOptimizer is only available as part of the following products:

- rayConformal
- rayIntensity
- rayArc
- rayPencilScanning
- rayLineScanning
- rayCarbonPlanning

rayConformal – 3D-CRT planning

rayConformal provides conventional 3D-CRT forward treatment planning with manual and automatic tools to create conformal treatment using treat-and-protect, beam weighting, wedges, etc.

It also makes modern inverse-planning techniques available for creating conventional 3D-CRT plans. 3D-CRT plans can be automatically optimized with respect to any combination of segment shapes, segment monitor units, collimator, gantry and couch angles. This makes the creation of high quality 3D-CRT plans faster and more consistent.

- Beam aperture with MLC and blocks
- Shielding blocks
- Circular cones
- 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 3D-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

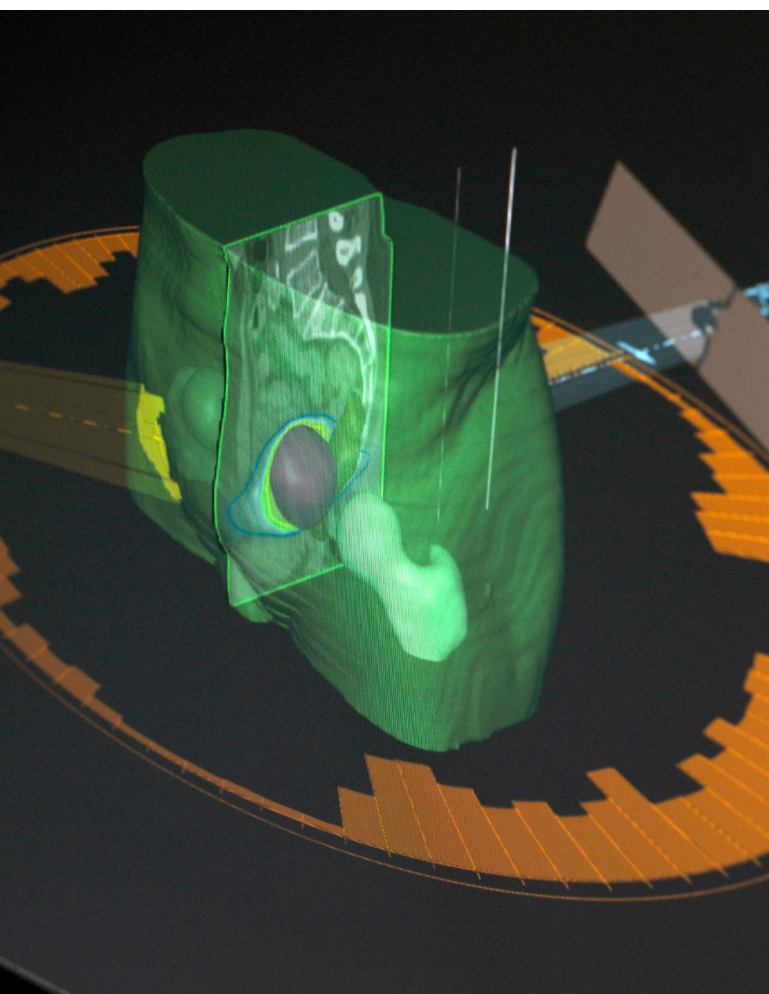
raySimulation provides a dedicated workspace for performing virtual simulation tasks related to isocenter placement, export to patient marking systems and beam design. The tools available are to a large extent available through the automatically included rayConformal product. Specific features unique 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.

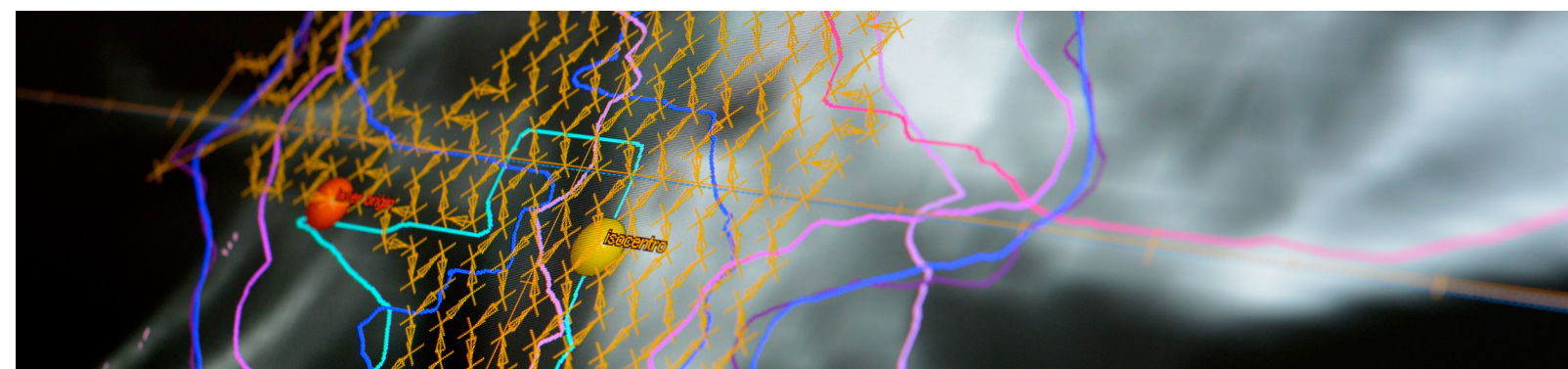
- Direct optimization of leaf positions and arc segment weights considering all machine limitations, such as leaf speed, gantry speed and available dose rates
- Creation of single or multiple arcs
- VMAT with constant gantry angle speed and dose rate for non-upgraded linacs
- Support for all rotational 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 – Helical TomoTherapy optimization

rayTomo provides design and optimization of helical treatments for 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.



- Direct optimization of leaf open times, considering all machine limitations
- Support for dynamic and fixed jaws
- Avoidance region tools – specify ROI not to be exposed.
- Possibility for user to restrict delivery time
- Display of leaf positions and leaf open times in BEV
- Leaf open time histogram

rayTomo includes the following additional products:

- rayPhotonPhysics
- rayOptimizer

rayWave – wave arc optimization

rayWave provides design and optimization of single- or multiple-wave arc plans for the Brainlab Vero linac. A wave arc is an arc where the couch (ring) angle is entitled to vary as the gantry is rotated while the beam is on. When setting up the plan, the user can choose between a number of predefined wave arc templates. The optimization is of the same type as for a standard VMAT plan, i.e., the optimized plan is directly deliverable.

- 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 wave arcs
- Support for the wave arc capable Brainlab Vero linac

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

rayElectronPlanning includes the following additional product:

- rayElectronPhysics

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 SOB modulation width
- Automatic and/or manual selection of SOB field range and width
- Block 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 ROIs
- 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, and compensator shapes
- Beam weighting using sliders
- Very fast approximate dose engine for immediate feedback

By choosing the option rayPassiveScattering and rayUniformScanning the following additional products are included:

- rayProtonPhysics

rayPencilScanning – IMPT optimization

rayPencilScanning provides the tools for designing and optimizing actively scanned pencil beam proton treatment plans. It includes 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 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
- Spot weight filtering
- Range shifter support
- Editable snout position
- Quasi-discrete PBS
- Layer repainting

rayPencilScanning includes the following additional products:

- rayProtonPhysics
- rayOptimizer

rayWobbling – 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
- Block 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:

- rayProtonPhysics

rayLineScanning – 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:

- rayProtonPhysics
- rayOptimizer
- 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:

- rayCarbonPhysics
- rayOptimizer

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 tradeoffs.

- 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 DMLC treatments

rayNavigator requires one or more of the following products:

- rayIntensity
- rayArc
- rayPencilScanning

rayFallback – fallback planning

rayFallback is a tool for creating additional plans to be used in a contingency situation, enabling a patient to be treated on another machine, possibly with a different modality and/or treatment technique, in case the original machine is unavailable.

- Fallback planning using dose mimicking
- After plan approval, the system can generate fallback plans using alternative machines and treatment techniques
- Plans for any modality can be replicated using photon plans with 3D-CRT (rayConformal), IMRT (rayIntensity) and/or VMAT (rayArc)
- User-defined protocols specify the setup of the fallback plans
- Fallback plans are automatically generated from the protocols
- Fallback plans can be compared and evaluated using a number of visual tools (DVH curves, dose differences, etc.)
- A fallback plan can be approved and used for delivery in future fractions

rayFallback requires one or more of the following products:

- rayConformal
- rayIntensity
- rayArc

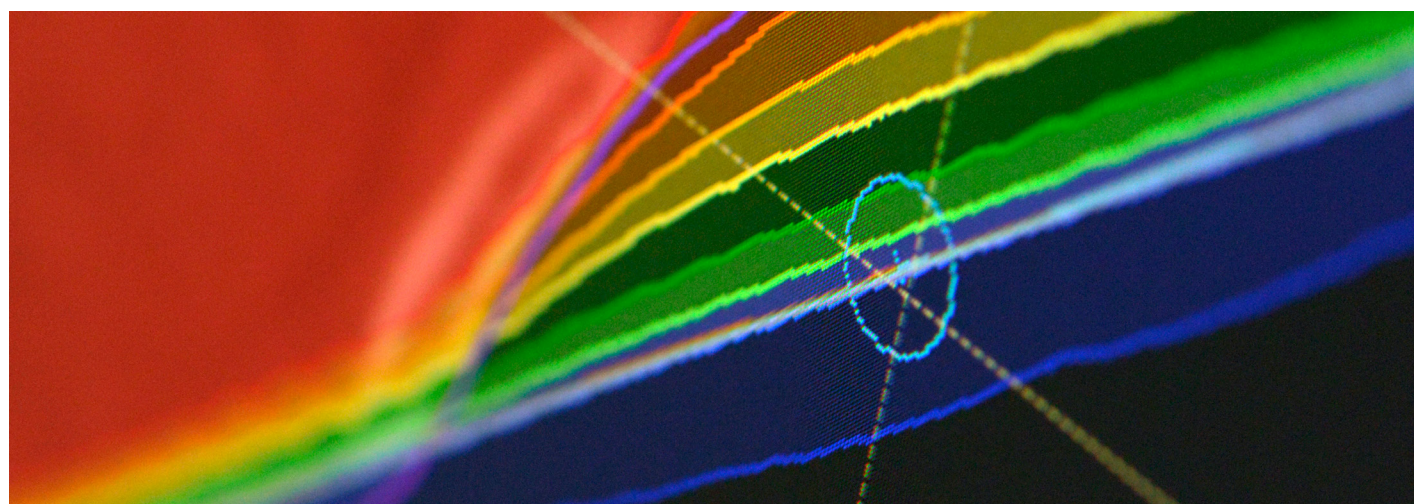
rayAutoBreast – automated breast planning

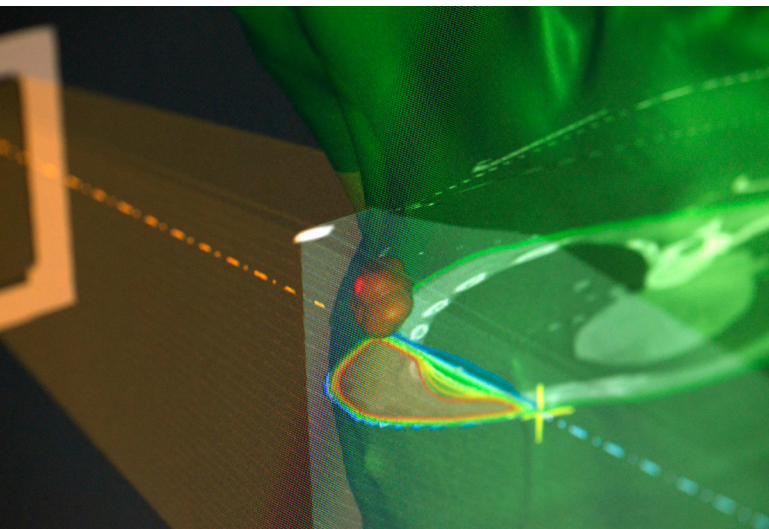
rayAutoBreast provides tools for automated generation of tangential breast IMRT plans using heuristic optimization.

- 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





rayBiology – radiobiological optimization and evaluation

rayBiology provides tools both for evaluation and optimization. Evaluation 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.

- Evaluation of treatment plans using radiobiological models
- Response plots, both as a function of dose and as a function of time
- Radiobiological indices:
 - Single and composite NTCP (Normal Tissue Complication Probability)
 - Single and composite TCP (Tumor Control Probability)
 - Combinations of NTCP and TCP, such as complication-free tumor cure probability (P+)
- Radiobiological models:
 - Poisson–LQ (sublethal repair model, repopulation model for targets, relative seriality model for OAR)
 - LKB (Volume dependence: EUD for OAR)
- Consideration of fractionation schedule using repopulation and repair models
- Biological evaluation workspace
- Editable parameter database for all implemented biological models
- Optimization based on indices and models above
- Optimization based on gEUD

The treatment plan optimization tools require RayStation Planning and one of the following products: rayConformal, rayIntensity, rayArc, rayElectronPlanning, rayPassiveScattering, rayUniformScanning or rayPencilScanning.

rayDeformable – deformable registration

rayDeformable provides functionality for deformable image registration of CT, CBCT and MR images. The deformable registrations can be used to map structures already defined on one image set to other image sets for fast contouring, or for contouring on one image set deformably registered and fused with another. Two algorithms are provided: one based on hybrid intensity and structure, and one based on biomechanical model, which allow accurate modeling of anatomical motion and deformation. Evaluating the deformation field it reveals to what extent, and in which direction, structures and organs move.

- Deformable registration tools to establish mappings between CT, CBCT or MR
- 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 (MORFEUS 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

rayAdaptive 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 derailed treatment back 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)
- Toolbar including relevant parts of plan creation, plan optimization and plan approval

- Create adapted plan from Plan Setup module (based on planned fractions)

rayAdaptive requires:

- rayTracker
- rayPhotonPhysics – Photon Dose Calculation
 - rayPhotonPhysics contains the dose calculation engines for megavoltage photon beams, i.e., conventional linacs, and TomoTherapy machines. It includes the separate application RayPhysics, 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
- rayTomo

– or as an expansion to RayStation Tracker

rayElectronPhysics – electron dose calculation

rayElectronPhysics 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

– rayElectronPhysics is only available as part of rayElectronPlanning or as an expansion to RayStation Tracker

rayProtonPhysics – proton dose calculation

rayProtonPhysics contains the dose engines used for all proton treatment planning and is the entry point to the different treatment techniques for protons. There are two algorithms available: an analytical pencil-beam algorithm and a Monte Carlo algorithm. Both can be used within the optimization loop and for final dose calculation.

- Pencil beam – a highly optimized algorithm with 19-fold multi tracing per spot and separate handling of the nuclear halo effect.

- Monte Carlo – an in-house algorithm developed to maximize computational efficiency without sacrificing accuracy requirements for treatment planning.

rayProtonPhysics is only available as part of the following products:

- rayPassiveScattering
- rayUniformScanning
- rayPencilScanning
- rayWobbling
- rayLineScanning

– 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 RayBiology.

rayCarbonPhysics is only available as part of rayCarbonPlanning or as an expansion to RayStation Tracker

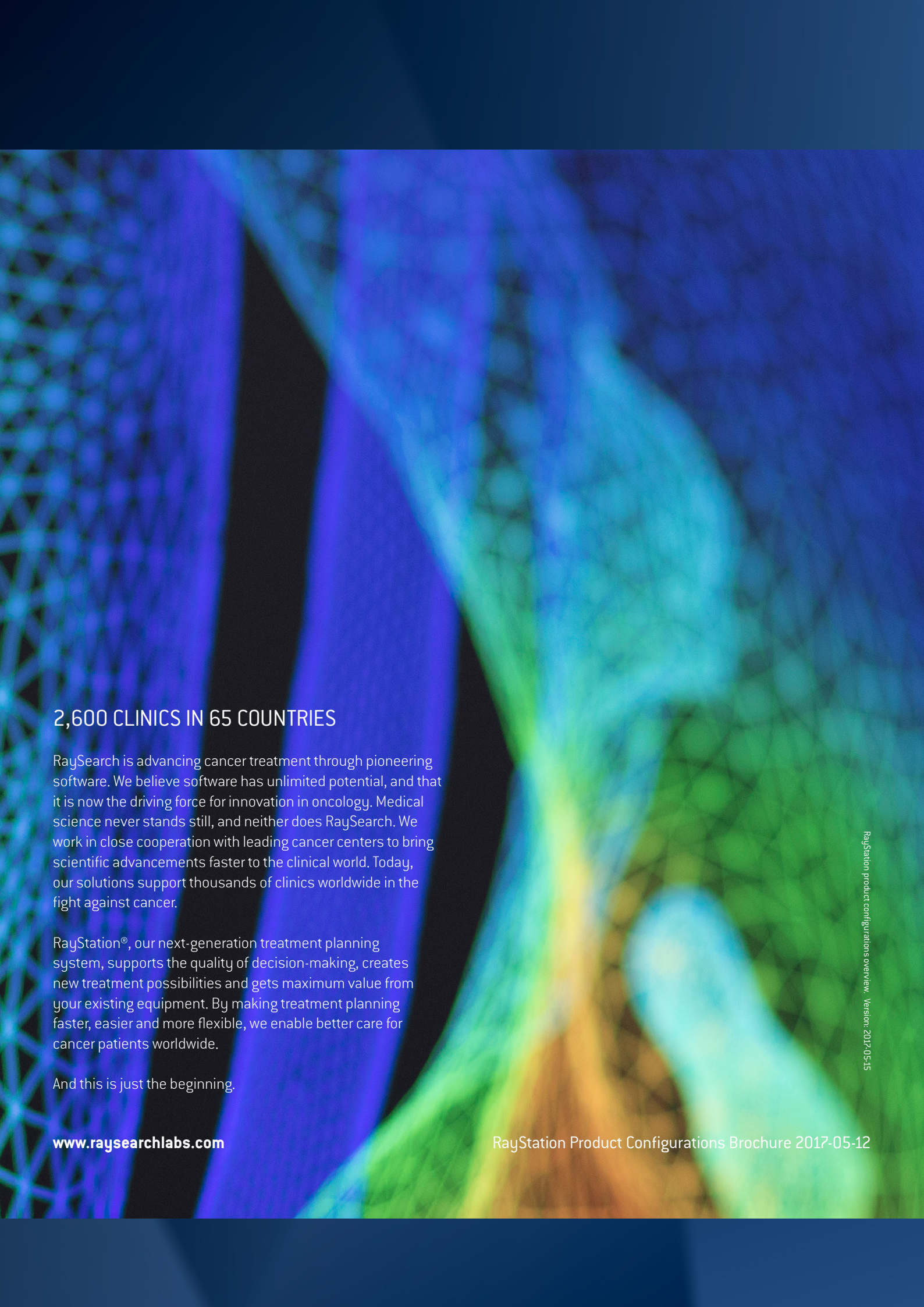
rayExplorer – plan exploration

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



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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RayStation Product Configurations Brochure 2017-05-12