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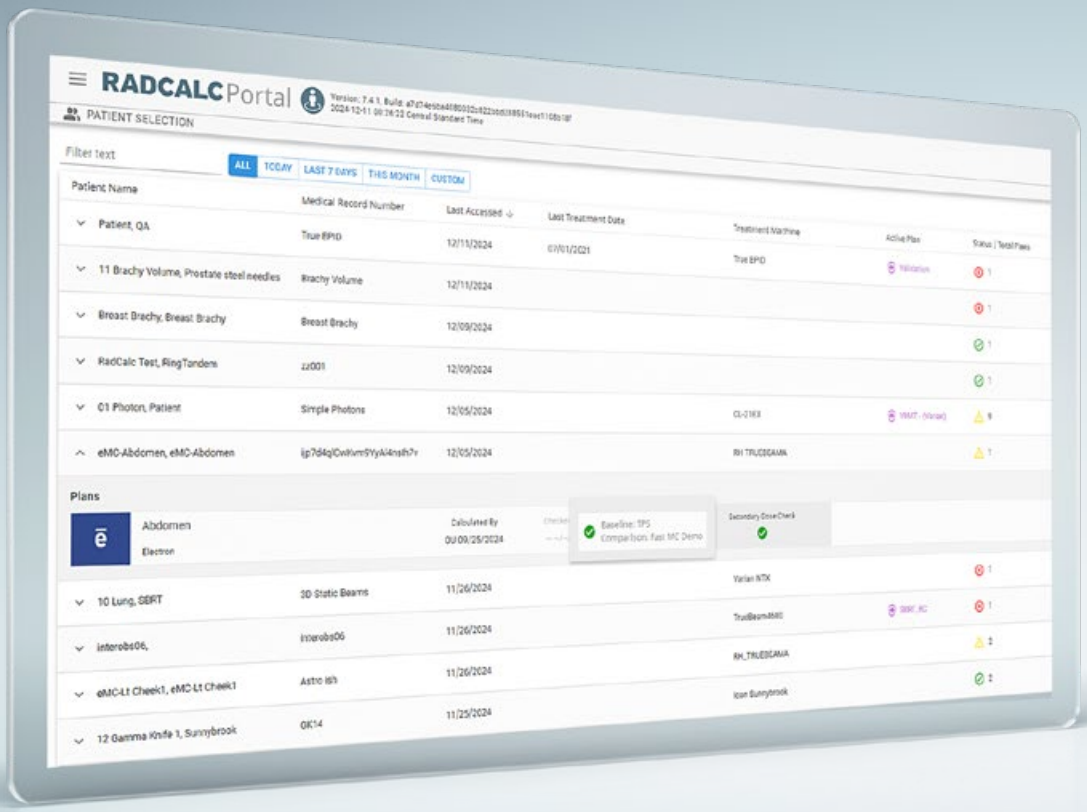


RadCalc QA Software

Advanced platform for independent and unbiased patient quality assurance

RADCALC

Simply Precise


St. George Hospital

Why patient QA?

Patient Quality Assurance (QA) is crucial in radiation therapy to ensure the safety, accuracy, and effectiveness of medical treatments and services.

- QA helps identify and correct potential errors before they can impact patients, preventing adverse events.
- QA ensures that treatments are delivered precisely as planned, minimizing risks and maximizing effectiveness.
- QA contributes to better patient outcomes, faster recoveries, and fewer complications, leading to a higher quality of life for patients.
- QA helps ensure that healthcare providers remain compliant with best practices, protecting patients.
- QA encourages ongoing monitoring, evaluation, and improvements in healthcare processes, which leads to innovations and enhanced standards of care over time.

This is exactly what RadCalc does by independently verifying dosimetric calculations from the treatment planning system (TPS) and reconstructing the dose delivered for pre-treatment QA and in vivo dosimetry. All in an easy-to-use software platform.

How do you check calculations of the treatment planning system?

RadCalc software was developed to simplify the QA process which has become increasingly complex and expansive.

Fast and fully automated patient-specific RT plan QA is a big step towards a QA process conforming to global standards. RadCalc's QA platform validates treatment plans quickly and easily, allowing for more time with your patients.

The automation available with RadCalcAIR will automatically import and push your patient plans through the secondary calculation in the background.

The automatically generated report is created ready to be imported into your record and verify system. Additionally, RadCalc provides another level of automated plan delivery verification with the addition of the Delivery QA package.

This package offers EPID dosimetry and Fractional Log QA (FLQA) for Log File analysis and dose reconstruction.

As a result, reports can be generated for not only the secondary dose check, but also for pre-treatment and fraction-by-fraction desired.

RadCalcAIR saves you valuable time by fully automating the robust Patient Specific QA at the planning, pre-treatment, and treatment delivery phases. Enhance your clinic's safety with an independent check, which perfectly suits your existing QA process.

Treatment planning (31 %) and treatment delivery (30 %) are the most common step in the patient's workflow where errors are caught!

Aggregate Historical Sum from RO-ILS
2021 Report Card

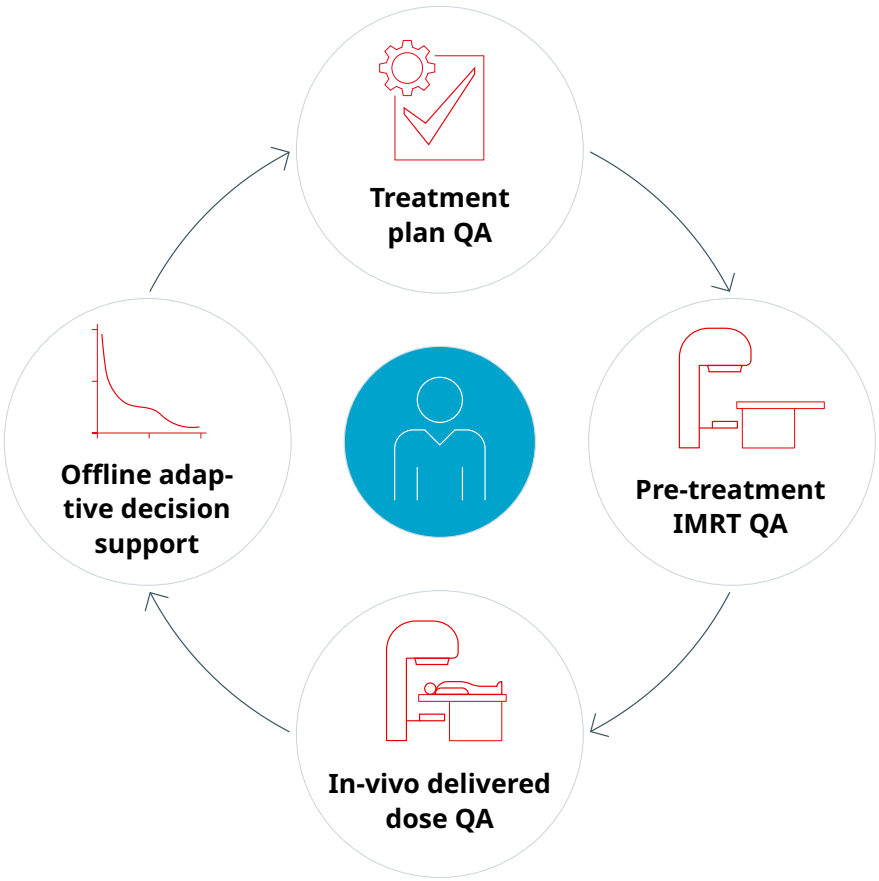
Seamless and easy

Patient-centric workflow

Included with every install, RadCalcAIR (Automated Import & Reporting) provides an automated process with tools for percent difference, DVH, Gamma and Distance to Agreement analysis and more.

RadCalcAIR imports the treatment plans and performs the calculations and evaluations, based on the defined settings. The results can be exported, without user interaction, alerts are sent if parameters exceed set values.

RadCalcAIR also automates delivery QA tasks, providing true composite 3D pre-treatment QA and in-vivo dosimetry phantom-less workflows. RadCalc's EPID dosimetry and Fractional Log QA (FLQA) can eliminate phantom-based plan verifications.



Treatment plan QA

- Increasing complexity of radiotherapy plans requires critical accuracy for safe deliveries
- RadCalc's globally utilized 3D Monte Carlo, incorporating BEAMnrc and Collapsed Cone algorithms, instils confidence and sanity among clinicians

Pre-treatment IMRT QA

- RadCalc offers 3D true composite EPID absolute dosimetry and treatment log file 3D dose volume reconstruction
- Truly independent solution for direct comparison to the intended plan
- Designed for an automated and seamless workflow

In-vivo delivered dose QA

- RadCalc's absolute true composite 3D calculation stands alone, with an independent workflow
- Continuous monitoring of treatment delivery data allows for Fractional Log QA
- Enables single platform comparison with Pre-treatment QA and integration into in-vivo EPID dosimetry workflow

Offline adaptive decision support

- Enhances independent dosimetric validation calculations for speed, ease, and accuracy
- Dosimetric calculations provide a truly patient-focused QA routine that is seamlessly integrated into adaptive radiation therapy workflows

Precision meets simplicity

RadCalc is an advanced platform for independent and unbiased patient QA. The seamless integration into existing workflows increases efficiency and safety. Comprehensive documentation and plan analysis tools offer the features medical physicists need.

- → *Identify clinically relevant deviations within the entire patient volume using the 3D Monte Carlo or 3D Collapsed Cone algorithms.*
- → *Increased accuracy for point dose with ray tracing of the densities found in the CT dataset.*
- → *Automate your calculations and evaluations while also having additional tools available to identify where deviations occur.*
- → *Save time while also having the opportunity to work remotely.*

Fast

A fully automated import and export is much faster when compared to manual data entry and eliminates transcription errors.

Accurate

Studies have shown the verification dose to be within ±3 % of the treatment plan dose providing excellent accuracy.

Powerful

Most common treatment plans can be verified with RadCalc QA software. Comprehensive analytical features provide powerful tools for physicists for plan analysis.

Independent

RadCalc provides the opportunity to check all results independently from the manufacturer's TPS. This ensures unbiased third-party validation.

Easy

Due to its user-friendly interface, the software is easy to use. Clear structure, guided menus and a sophisticated layout make the recurring tasks simple and time-saving.

Automated

RadCalc can seamlessly be integrated into the clinical workflow. Automate our QA workflow for all calculation types using RadCalcAIR.

Accuracy is key

Secondary check of treatment planning

Electron & photon calculations

3D calculations are now available with RadCalc's electron Monte Carlo (eMC) algorithm and fast Monte Carlo! Calculations can also be performed by using the EZ photon and electron tools. For electron calculations, a library of custom cutouts can be maintained. Cutout factors can be computed using a sector integration or square root method.

3D off-axis assistance

RadCalc's use of 3D coordinates simplifies the process of off-axis calculations by automatically computing the off-axis distances in the Beams Eye View (BEV). The tool can also be used to manually position additional off-axis point, without needing to go back into the TPS.

Refined Clarkson implementation for modulated treatment plans

RadCalc utilizes a Modified Clarkson Integration (MCI) and when including the planning CT, RadCalc's ray tracing capabilities provide improved accuracy of point dose calculations. Additionally, view MLC and calculate fluence and dose map patterns.

Fluence and dose map

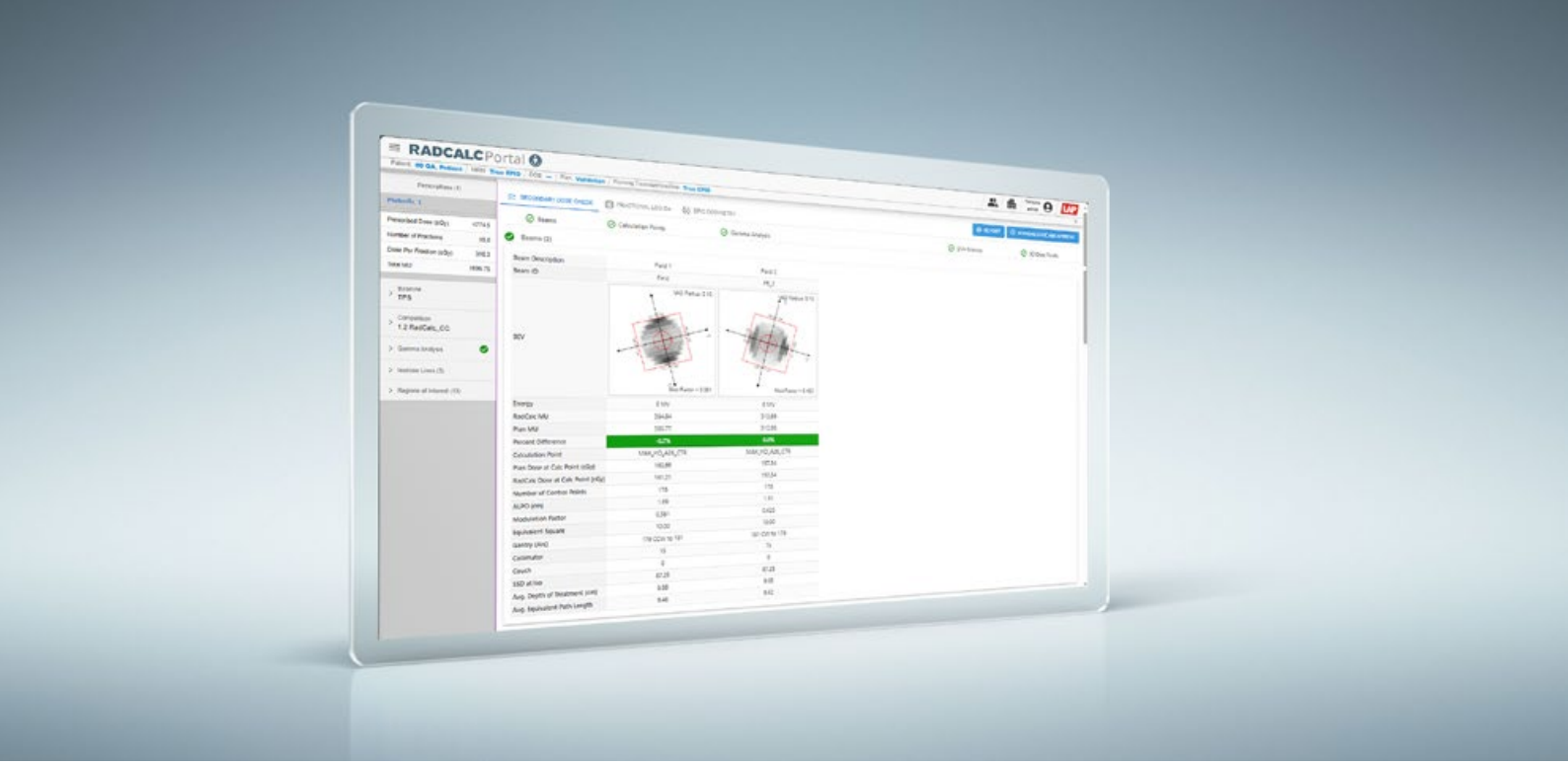
Users can extend the pre-treatment MU verification with comparing RadCalc calculated dose map with a measured, or TPS calculated dose map and with comparing the RadCalc calculated fluence with TPS fluence.

Plan comparison

This unique RadCalc feature allows users to compare the plan from the R&V system with the plan data directly exported from the TPS, thus discovering errors during the plan export process. They can also easily analyze two arbitrary plans and quickly highlight the difference in plan parameters side by side.

RadCalc LINAC Logger

The RadCalc LINAC Logger produces delivery log files through an external utility to allow users to gather machine operating information from all Elekta LINACs for use within the RadCalc software.



3D Functionalities

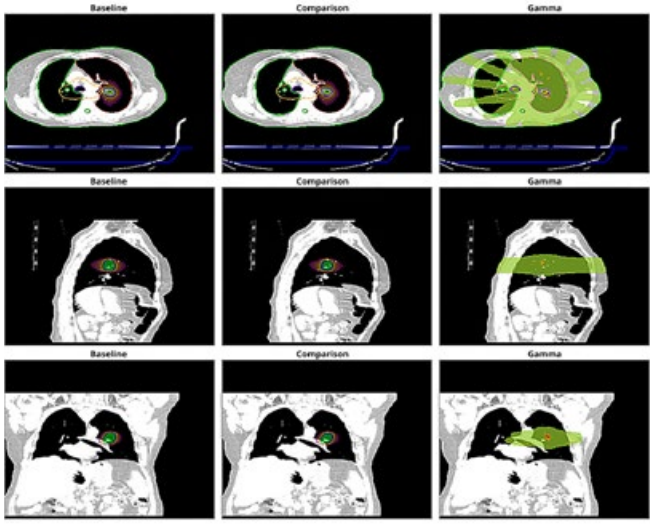
Smart QA instead of basic verification

Basic 2nd check procedures

- Verifies dose at single points
- Considers the patient as a box
- Relies on complex processes with manual work & corrections
- Uses general standards
- Time-consuming & costly with hardware phantom

Independent & patient-centric QA with RadCalc

- Conducts a volumetric measurement
- Considers patient as a whole
- Evaluating dose directly on planning CT
- Uses automated workflows
- Bases on the gold standard of algorithmic dose measurement
- Saves up to 30 % of QA time

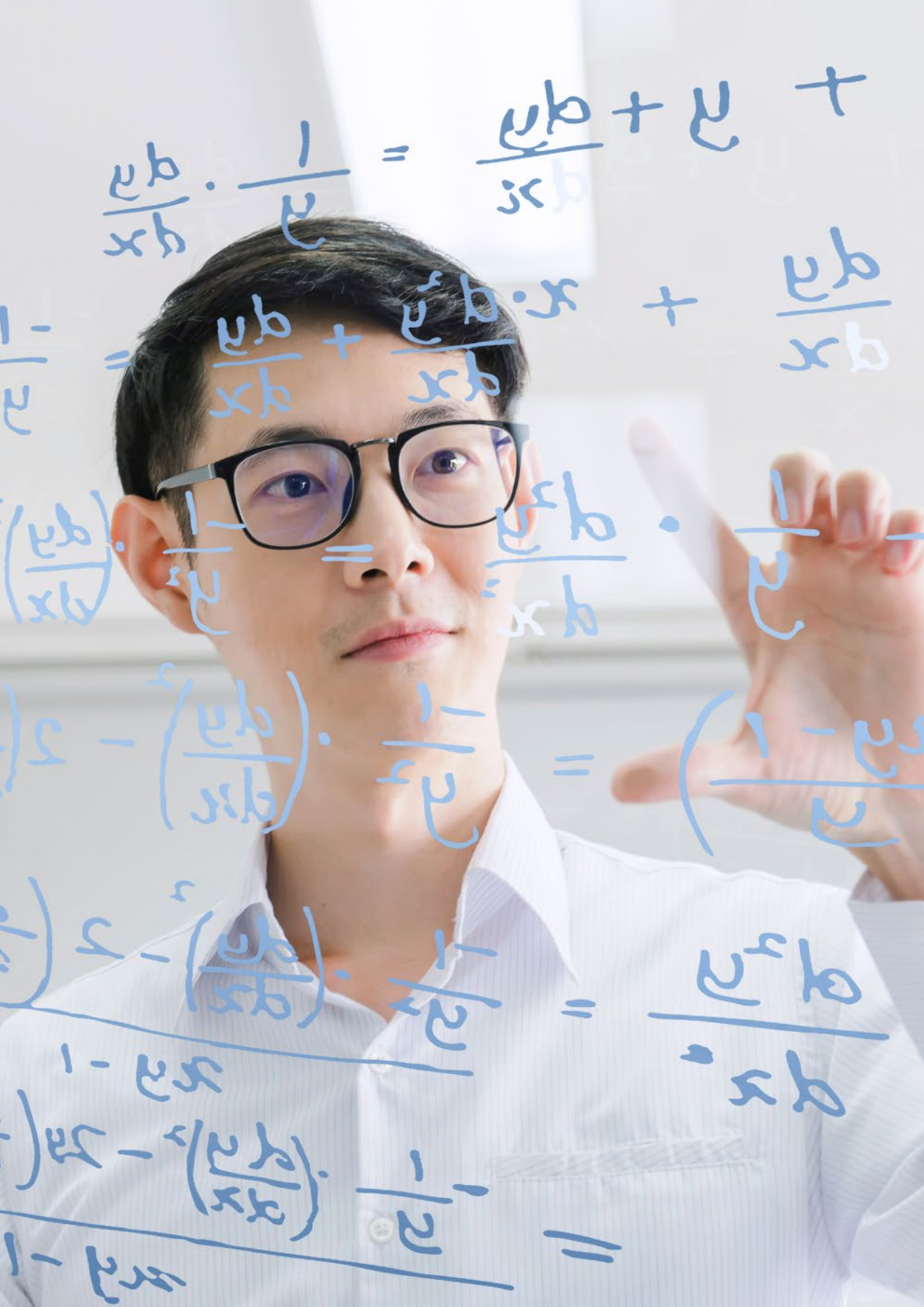


3D Dose analysis

RadCalc provides Percent difference, DVH, Distance to Agreement, Gamma analysis tools to evaluate 3D computations. The functionality includes RadCalcAIR (Automated Import & Report) providing a fully automated process for plan import, computation, 3D dose analysis and report generation. RadCalc's fully automated process immediately alerts you to plans that fail your pre-set Gamma analysis acceptance criteria. RadCalc utilizes user-defined rules to automatically apply different Gamma Calculation values and acceptance criteria.

DVH Protocols

Any number of DVH protocols can be defined from the analysis screen within RadCalc. Using rules in RadCalc, different DVH protocols can be automatically selected and applied to the specific plan. RadCalc automatically checks whether the DVH objectives are met for critical structures using both the TPS and RadCalc's 3D dose. Analysis reports are automatically attached to the verified plan and sent to your workstation via email or to a directory of your choice on your server.



Calculation Algorithms

In addition to the Clarkson algorithm for point dose calculations, RadCalc provides Collapsed Cone Convolution Superposition and Monte Carlo algorithms that deliver fast, easy, and accurate 3D Dose Volume verification for the most commonly used treatment planning systems.

Treatments have become more complex with higher dose per fraction. Monte Carlo is widely recognized as the gold standard dose calculation method. RadCalc's 3D Monte Carlo algorithm employs the most established Monte Carlo dose engine available (BEAMnrc), and also utilizes proprietary machine modeling acquired from McGill University.

Additionally, new in version 7.4, RadCalc introduces fast Monte Carlo (fMC) for both photons and electrons! Doses in inhomogeneous structures such as lung tissue are calculated with very high accuracy.

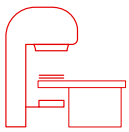
"Nearly 60 % of the reported errors involved a lack of an appropriate independent secondary check of the treatment plan or dose calculation."

According to IAEA Technical Report 430

RadCalc EPID for pre-treatment dosimetry

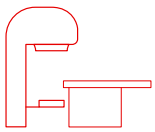
Tackling risks of high error sensitivity

RadCalc's EPID module delivers TG 307/218 compliant pre-treatment and in-vivo calculations. Acquired in-vivo images are transmitted back through the patient to determine the incident fluence, differentiating it from all other available solutions.



Potential error detection with phantom-based measurements

- Data transfer corruption
- Deliverability of dose
- Checks TPS dose on phantom
- Spends additional time on aligning and calibrating phantoms
- Costly and time-consuming



Potential error detection with on-board imager and RadCalc software

- Data transfer corruption
- Deliverability of dose
- Checks TPS dose on volumetric patient image
- Saves up to 20 % of QA time
- Uses reconstructed 3D measurements

Simple to use

RadCalc's EPID module utilizes the collected integrated measurements for all static and dynamic beam segments to reconstruct 3D dose on the patient's real anatomy using RadCalc's Collapsed Cone algorithm.

Supported modalities

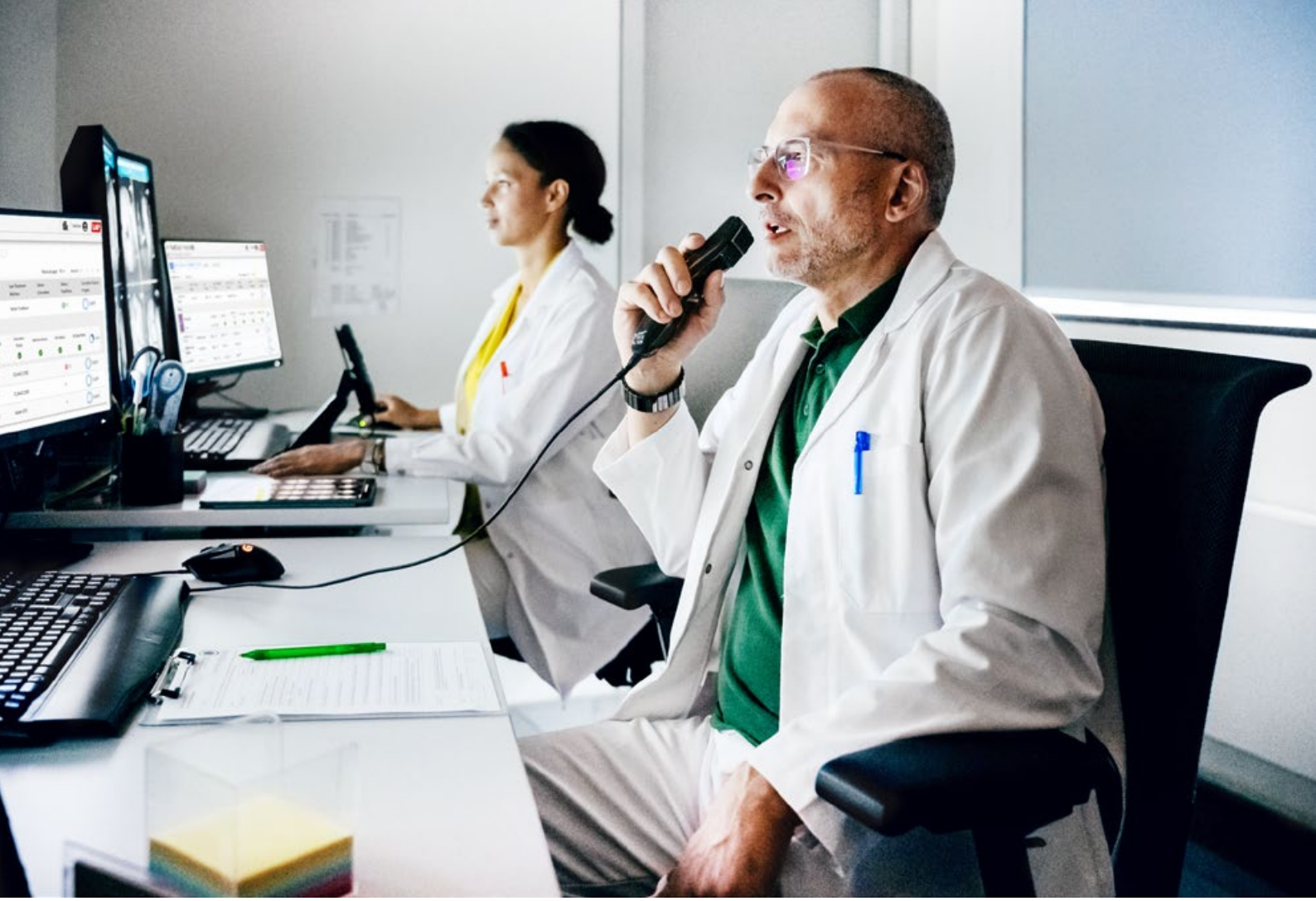
Supporting commercially available linear accelerators with integrated EPID panels for all treatment techniques.

True composite

Actual dose delivered is compared with both the intended dose from the TPS and RadCalc's 3D dose reconstruction for a thorough pre-treatment QA.

Inherent sensitivity

RadCalc's implementation utilizes the inherent sensitivity of the EPID to detect small changes in the patient making it a valuable tool for analyzing deviations from the intended dose.



Versatile

Which treatment techniques are supported?

Hypofractionation

During hypofractionation higher doses are delivered to the target within a treatment, than during normal radiation therapy. Accuracy of these treatments is therefore essential. RadCalc's 3D Monte Carlo employs the most established EGS-system-based BEAMnrc Monte Carlo algorithm which utilizes proprietary machine modelling acquired from McGill University. Doses volumes verified with RadCalc thus increase patient safety and plan quality by enhancing your ability to more accurately verify complicated treatment plans. RadCalc's 3D Monte Carlo and 3D Collapse Cone algorithms white-paper shows the verification dose to be within ±3 % of the treatment plan dose providing very high accuracy.

Adaptive radiation therapy

Radiation therapy continues to grow in complexity, consequently the task of quality assurance and will continue to become more time-consuming. RadCalc was developed by an ABR board-certified physicist to make the task of performing independent dosimetric validation calculations much faster, easier and more accurate.

RadCalc's dosimetric calculations provide a fully automated process for your QA routine, which can be seamlessly integrated into adaptive radiation therapy workflows.

SRS/SRBT

RadCalc provides Monte Carlo and Collapsed Cone Convolution Superposition algorithm modules that deliver fast, easy, and accurate 3D dose volume verification. Utilizing a patient's planning CT for calculations, RadCalc's 3D functionality offers verification for Conventional, IMRT, VMAT, and SRS/SBRT plans.

Dose throughout the treatment volume is verified with RadCalc, thus increasing patient safety and plan quality by enhancing your ability to verify complicated SRT/SBRT treatment plans more accurately.

Modulated radiation therapy IMRT and VMAT

RadCalc's 3D Collapsed Cone, 3D Monte Carlo and point dose calculation algorithm support step-and-shoot, sliding window and compensator-based IMRT treatment plans. A regions of interest module is part of RadCalc's photon calculations for performing second check verifications for VMAT. ROI structures are exported with the plan file from the VMAT calculation to the RadCalc software. RadCalc computes an independent depth and effective depth value for each individual control point as well as the dose comparison for all imported calculation points. Users can also utilize the Volume Average Dose Tool to analyze the variation in dose (at a given distance) around the primary calculation point.

With regard to point dose-based second check for IMRT, the computation is performed utilizing a modified Clarkson scatter integration along with a head scatter algorithm to improve accuracy.

Electron treatments

RadCalc provides secondary, independent dose calculations to verify electron treatments. The system checks the planned dose with calculation points at specified depths with parameters like field size, beam energy, and source-to-surface distance (SSD) set by manual entry or RT plan import.

Starting with version 7.4, RadCalc includes electron Monte Carlo (eMC) capabilities, allowing for the creation of 3D dose volumes. These volumes can be directly compared to your TPS Monte Carlo calculations, enhancing verification accuracy.

Brachytherapy techniques

RadCalc follows the TG-43 protocol to perform 3D dose volume and point dose verification for HDR (incl. Xoft), LDR and for Permanent Implant treatments. The TPS and RadCalc dose can be compared side by side in either 2D or 3D views. Isodose levels can be displayed, dose volume analysis can be performed using Percent Difference DTA or Gamma analysis and DVH protocols can be used.

RadCalc can compute the dose and DVH based on translated and/or rotated source for an individual treatment. Comparing the isodoses, DVH with the optimal source position the clinical impact of a source misplacement can be evaluated.

Modular and multitasking

Supported modalities

RadCalc includes comprehensive institution and physics data setup, import of radiation therapy plans, automated dosimetric calculations, and export to record and verify systems. RadCalc also provides powerful reporting tools and flexible site licensing.

→ *Calculations and evaluations can be done automatically in the background, without user interaction.*

MR-LINACs

MR LINACs set new standards in radiotherapy. RadCalc supports secondary MU and point dose verification for MR LINACs. These calculations take the presence of the magnetic field into account through the imported measurement profiles. All calculations can be automated together with RadCalc's import, export and reporting features. Additionally, for Elekta Unity, RadCalc provides a plan integrity check with the plan comparison tool.

TomoTherapy

RadCalc supports TomoHelical, TomoDirect and TomoEDGE and verifies the treatment time and dose to multiple calculation points. Each control point can be visualized together with the illustrated leaf open times. If more accuracy is required, perform full 3D volumetric Monte Carlo calculations. Additionally, the sinogram can be displayed.

Cobalt 60

The Co60 treatment plans can be imported from treatment planning system or from any supported record and verify system. They can contain wedges, blocks and cutouts which can be imported with the plan or defined manually in RadCalc.

LINACs

Besides the 3D Dose calculations with Collapsed Cone or Monte Carlo (photon and electron) algorithms, RadCalc performs independent MU or point dose verification calculations for conventional 2D and 3D treatment plans, including electron, photon, MLC, 3D off-axis, diode and wedge support. Additional functionality is available with RTP import, R&V export and IMRT utilities.

CyberKnife

RadCalc supports CyberKnife machines equipped with fixed Cone, Iris or MLC. The treatment plan can be imported from MultiPlan or from Precision TPS. RadCalc provides point dose calculation options and other features for CyberKnife machines, such as fully automated calculation and reporting.

Superficial

RadCalc superficial calculations are based on real measured values. The software allows the definition of multiple energies with individual HVL values and energy-specific parameters. Every energy can have a list of allowed SSDs, cones and measured backscatter factors.

Halcyon/Ethos

RadCalc provides 3D Collapsed Cone, 3D Monte Carlo and point dose verification for Halcyon and Ethos machines, supporting Varian's dual-layer MLC. For 3D calculations features such as dose volume analysis and Gamma calculation, DVH protocols and analysis lines can be utilized. The Delivery QA package provides true composite 3D pre-treatment QA and in-vivo dosimetry phantom-less workflows.

Gamma Knife

RadCalc performs point dose verification calculations for various Gamma Knife versions and the Leksell GammaPlan (LGP) planning system. It stores and maintains a copy of the Elekta proprietary data providing independent table lookup and interpolation processes.

Brachytherapy

RadCalc supports intracavitary radiotherapy calculations for permanent seed implant, LDR, HDR and Xoft Brachytherapy machines. The calculations are 3D calculations based on the TG-43 protocol. Users may define rotations and/or translations of the source positions even for one single fraction. DVH can be calculated with original or translated/rotated source positions and can be compared to imported DVH, and against DVH protocols.

Modality overview and corresponding features

Features of RadCalc modules

	MR-LINAC	LINAC (Photon)	LINAC (Electron)	Halcyon	Tomo-Therapy	Cyber-Knife	Gamma-Knife	Cobalt 60	Super-ficial	Brachy-therapy
Point dose verification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MU or treatment time verification	✓	✓	✓	✓	✓	✓		✓	✓	
3D ROI visualization	✓	✓	✓	✓	✓	✓	✓	✓		✓
3D dose calculation and analysis		✓ MC/CC	✓ MC	✓ MC/CC	✓ MC					✓ TG-43
DICOM RT or other proprietary import	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R and V import/export	✓	✓	✓	✓		✓		✓	✓	✓ (Import)

Advanced features

	MR-LINAC	LINAC (Photon)	LINAC (Electron)	Halcyon/ Ethos	Tomo-Therapy	Cyber-Knife	Gamma-Knife	Cobalt 60	Super-ficial	Brachy-therapy
Support of wedge, attenuator, block/cutout, bolus, compensator	✓	✓	✓ (Bolus and cutout)	✓				✓	✓ (Cutout)	
In-vivo diode calculations supported	✓	✓	✓	✓	✓	✓		✓		
DVH calculation and analysis, isodose levels supported		✓	✓	✓	✓					✓
Plan data comparison supported	✓	✓	✓	✓		✓	✓	✓	✓	
Automated import, calculation and reporting	✓	✓	✓	✓	✓	✓		✓	✓	✓
Ray tracing with CT densities for point dose		✓	✓	✓	✓	✓				


RadCalc Portal
LAP
Plans
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RadCalc's import utilities

RadCalc allows you to import from radiation therapy planning systems, verify and record systems, and/or virtual simulation software through DICOM RT or other proprietary formats. Third-party products supported by RadCalc:

- DICOM RT
- RTP Format: IMPAC/MOSAIC, LANTIS, Varis
- Pinnacle: DICOM RT, Hotscript, Direct FTP connection (Prior to Pinnacle version 9.0)
- Eclipse: DICOM RT, print template in Eclipse to provide missing effective depth information
- MIMiC Plan: hybrid plan import
- CyberKnife: from MultiPlan, Precision, RayStationTPS
- Nucletron Plato Brachytherapy: direct FTP connection
- GammaKnife: direct import from the GammaPlan ODBC database
- Zap-X plan: import from the Zap-X treatment planning system

RadCalc's export utilities

RadCalc provides an export utility that allows users to export treatment plans to a format readable by a record and verify system. Exporting to record and verify systems saves re-entry of data, ensures that patient's medical records contain the verification results and allows users to export customized plans for special QA processes. Transferred data includes:

- Treatment field parameters and MU
- Beam name
- Gantry angle
- Collimator angle
- Couch angle
- Field size
- Treatment depth
- SSD
- Treatment dose
- Wedge information
- Either static or dynamic MLC leaf sequences
- Prescription information

Users may export plans and calculations to any record and verify system that accepts DICOM RT or RTP Connect format files.

RadExporter

- Simplified DICOM export from Eclipse using scripting API
- Generate calculation points automatically, eliminating the need for manual creation in the plan before export
- Export multiple plans for a treatment course simultaneously
- Preview second check results and export report to ARIA without leaving Eclipse External Beam workspace

Which hardware is required?

General hardware requirements for RadCalc (main program)

	Network install	Local install – not recommended
Operating System	Microsoft® Windows® Server 2016, 2019 or 2022	Microsoft® Windows® 10, and 11, 32-bit and 64-bit operating systems
Processor	8 Core or better	8 Core or better
RAM	16 GB or more	
Network	5 Gbps connection, bandwidth to the client should be 10 mbps with a latency not exceeding 50 ms	
Video	Minimum resolution 1024 × 768 px (scaling up to 125 %) and minimum 1 GB video memory (RAM)	
Graphics	OpenGL 1.1 support required	OpenGL 1.1 support required
Hard drive space	1TB SSD available, varies with quantity and type of patient data	512 GB available, varies with quantity and type of patient data

Dedicated RadCalc external calculation engine hardware

	Collapsed Cone Dose Engine	Monte Carlo Dose Engine	Fast Monte Carlo (Photon and Electron) Dose Engine
Operating System	Windows 64-Bit OS (10,11, Server 2012, 2016, 2019 or 2022)	Windows 64-Bit OS (10,11, Server 2016, 2019 or 2022)	Windows 64-Bit OS (10,11, Server 2016, 2019 or 2022)
GPU	NVIDIA GeForce RTX 2080 Ti, or similar (must be NVIDIA)		NVIDIA GeForce RTX 3080 Ti, or similar (must be NVIDIA with 12 GB or more)
CPU	Intel Core i7-9700, 8 Core, 12 MB cache, or better	Dual Intel Xeon Gold 5220, 2.2GHz, 3.9GHz Turbo, 18 Core, or better	Intel Core i7-9700, 8 Core, 12 MB cache, or better
RAM	16 GB or more	64 GB or more	32 GB or more
Disk	512 GB SSD or more	512 GB SSD or more	512 GB SSD or more

About us

LAP is one of the world's leading suppliers of systems that increase quality and efficiency through laser projection, laser measurement, and other processes. Every year, LAP supplies 15,000 units to customers in industries as diverse as radiation therapy, steel production, and composite processing. LAP employs 300 people at locations in Europe, America and Asia.

LifeLine Software, Inc., the developer of RadCalc, is part of the LAP Group. We are driven to improve the lives of those who fight cancer. We help to assure that they are receiving quality treatments. Our goal is to create the highest quality software products. We strive to achieve this goal by our commitment and dedication to continuous improvement of all we do in responding to the needs of our customers for the benefit of the patients and families they serve.

In order to achieve this vision, we look for associates and business partners who share our passion to serve others through their hard work and dedication to excellence in all they do every day. We do our best to create a work environment that encourages our associates to listen to their customers, both inside and outside our company and to deliver results with integrity.

RadCalc is our commitment to responding to the needs of Radiation Oncology health care providers by contributing to the enhancement of the quality of their work, and to the quality of life of their patients. RadCalc was developed by our board-certified physicist to make independent Dosimetric calculation verification accurate, quick, and easy.

Request a demo

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