Mobius

Innovative software for modern radiation oncology

QA Portfolio
2019

&

varian | MOBIUS

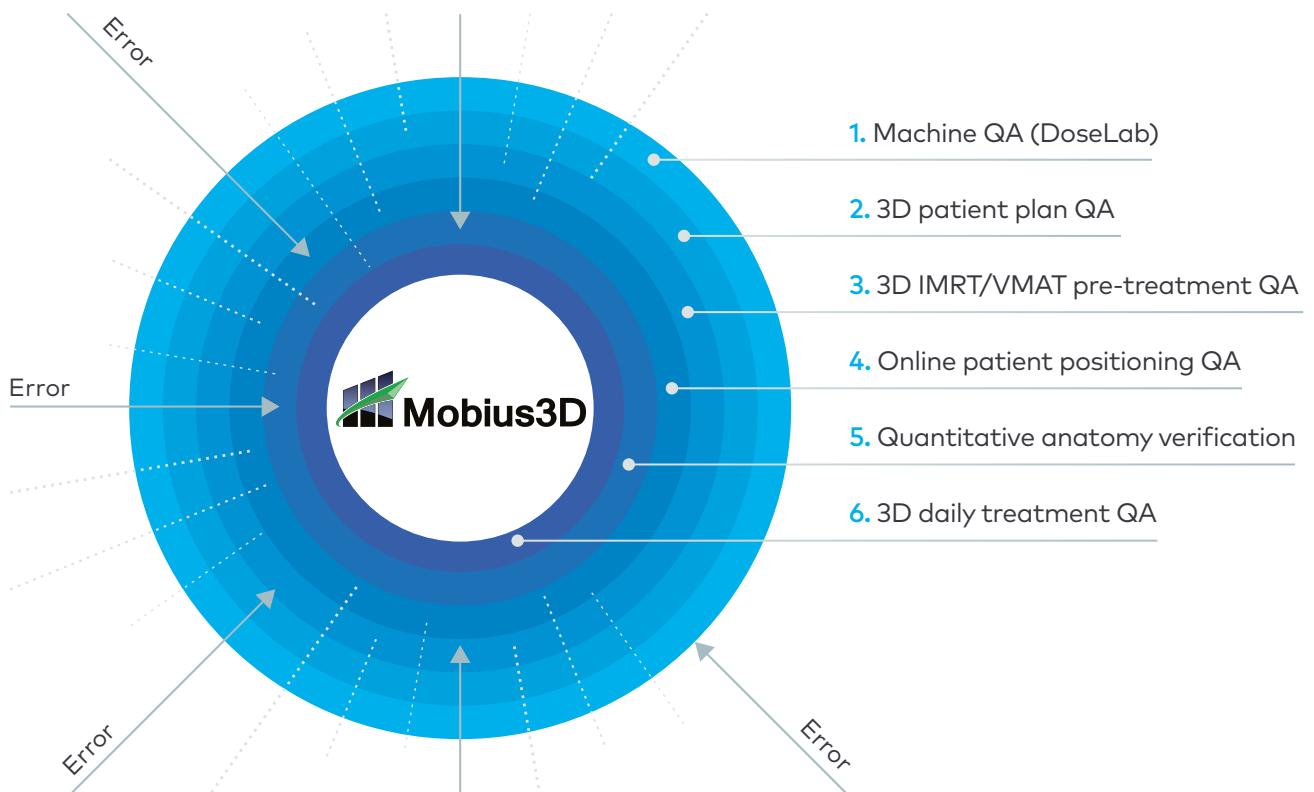# Table of Contents

Mobius3D®: The Complete Patient QA System

Over 500,000 patients clinically verified
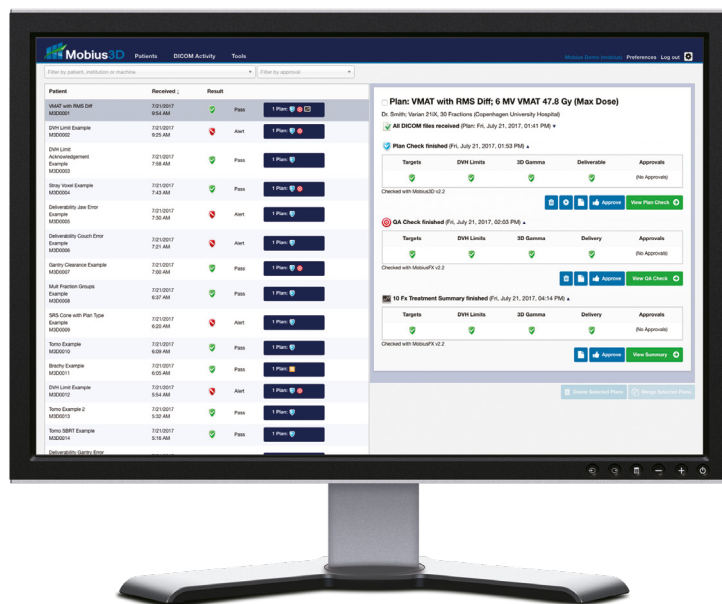
Mobius3D modules

- **MobiusCalc:** 3D Plan QA
- **MobiusFX:** 3D IMRT/VMAT & Daily Treatment QA
- **MobiusCB:** Patient CBCT QA
- **DoseLab®:** Machine QA
- **One system, six layers of error protection**

1. Machine QA (DoseLab)
2. 3D patient plan QA
3. 3D IMRT/VMAT pre-treatment QA
4. Online patient positioning QA
5. Quantitative anatomy verification
6. 3D daily treatment QA

Error

Error

Error

Error

Mobius3D

How does it work?

A single Mobius3D server can operate all Mobius3D modules for up to 10 Linacs and has storage available for more than 20,000 patients.

Mobius3D receives all your patients' treatment plans via DICOM-RT and generates results within an intuitive web interface.

Mobius3D specifications

Treatment machines	Varian, Elekta, Siemens, TomoTherapy®
MLC	Millennium™ Series • HD120™ • BrainLab m3 • Agility™ • Beam Modulator™ • MLCi2 • Siemens 160 MLC • Optifocus™
Cones	Varian and Elekta 4 mm–30 mm SRS Cones
Brachytherapy	HDR, LDR
Treatment modes	Photons • SRS/SBRT (Cones & MLC) • All Energies • Static Beams • IMRT • Arcs & VMAT • Electrons* • Flattening Filter Free (FFF) • Wedges (Physical, Dynamic,Universal)
Treatment Planning Systems (TPS)	Any TPS capable of DICOM-RT export including: Pinnacle[3] • Eclipse™ • XiO® • iPlan® • RayStation® • Monaco®
Treatment machines for MobiusFX (Log File-Based Delivery QA)	Varian C-series and TrueBeam® • Elekta
Product codes	Mobius3D: HMBA • DoseLab: HDLA

*Single-point electron calculations performed using the pencil beam redefinition algorithm (PBRA).

MobiusCalc: 3D Plan QA

Workflow

Just export the Plan, Structures, Dose and CT DICOM files, and MobiusCalc will do the rest. In minutes, an email alerts you if any issues were found in the four verified areas: Target Dose, DVH Limits, 3D Gamma, and Deliverability.

TPS NAME	MEAN DOSE			90% COVERAGE			STRAY VOXELS
	TPS	MD3	%Diff	TPS	MD3	%Diff	
▪ CTV	43.3Gy	45.6Gy	0.7%	44.6Gy	44.7Gy	0.23%	None
▪ GTV	45.3Gy	45.8Gy	0.97%	44.7Gy	44.9Gy	0.54%	None
▪ GTV-T	45.3Gy	45.8Gy	1.19%	44.7Gy	44.7Gy	0.69%	None
▪ PTV	45Gy	45.2Gy	0.35%	43.9Gy	43.7Gy	-0.51%	None

Results

Target coverage

MobiusCalc automatically identifies target structures and verifies that their mean dose and coverage agree with the TPS dose. Users can also identify contouring errors with the stray voxel check.
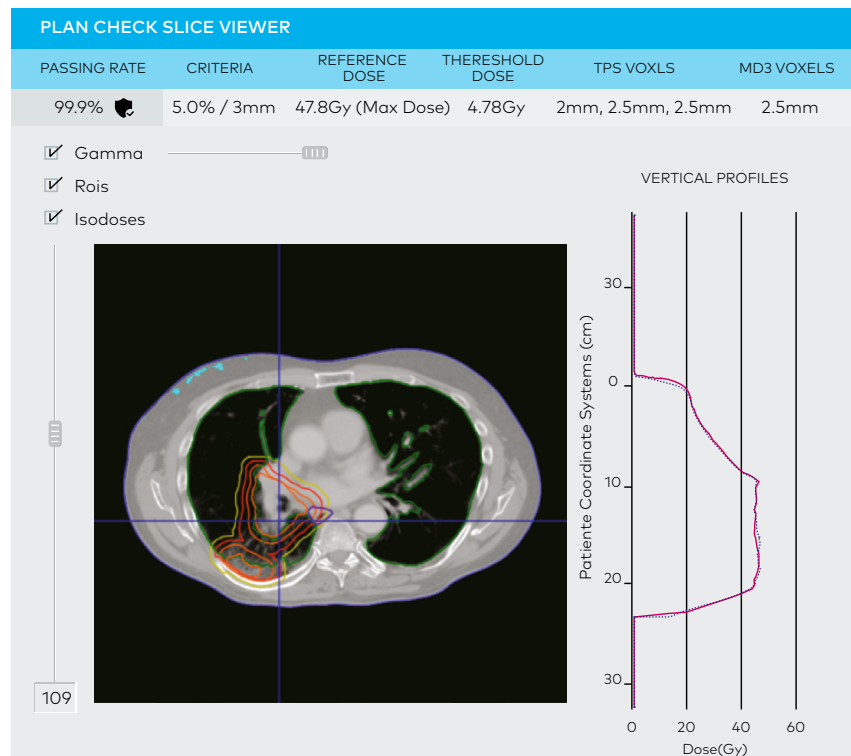
TPS NAME	LIMIT NAME	VOLUME	DOSE	TPS	M3D
▪ ESOPHAGUS	ESOPHAGUS	15%	<54Gy	45.4Gy	46.3Gy
▪ ESOPHAGUS	ESOPHAGUS	33%	<45Gy	39.2Gy	39.5Gy
▪ ESOPHAGUS	ESOPHAGUS	Mean	<35Gy	19.9Gy	19.9Gy
▪ HEART	HEART	33%	<60Gy	7.92Gy	7.62Gy
▪ HEART	HEART	67%	<45Gy	2.87Gy	2.99Gy
▪ HEART	HEART [RTOG 0623]	100%	<40Gy	0.44Gy	0.36Gy
▪ HEART PLANNING	HEART	33%	<60Gy	7.08Gy	6.86Gy
▪ HEART PLANNING	HEART	67%	<45Gy	2.62Gy	2.71Gy
▪ HEART PLANNING	HEART	100%	<40Gy	0.44Gy	0.36Gy
▪ TOTAL LUNG	LUNG (right and left)	Mean	<20Gy	12.6Gy	12.3Gy
▪ TOTAL LUNG	LUNG (right and left)	378%	<20Gy	7.71Gy	7.51Gy

DVH limits

MobiusCalc arrives pre-loaded with RTOG Conventional Fractionation and TG-101 SRS/SBRT protocols and automatically assigns relevant DVH limits to each treatment plan based on structure names. Users can also customize the DVH limits in MobiusCalc according to their own site-specific or physician-specific protocols to verify that both the TPS dose and the MobiusCalc dose meet all relevant constraints.

3D Gamma

MobiusCalc displays a global 3D gamma comparison between the TPS dose and the Mobius dose in the patient CT. Users can view gamma and isodose differences at isocenter in the transverse, coronal, and sagittal planes or use the 3D slice viewer to scroll throughout the complete patient CT to evaluate differences.

PLAN CHECK SLICE VIEWER

PASSING RATE	CRITERIA	REFERENCE DOSE	THERESHOLD DOSE	TPS VOXLS	MD3 VOXELS
99.9%	5.0% / 3mm	47.8Gy (Max Dose)	4.78Gy	2mm, 2.5mm, 2.5mm	2.5mm

☑ Gamma
☑ Rois
☑ Isodoses

VERTICAL PROFILES

109

Deliverability

In addition to verifying dose, MobiusCalc also performs a virtual delivery of each plan to verify that the plan is within machine delivery parameters and provides sufficient gantry clearance.

BEAM	2AP	1RT	4PA	3LT	4A PA	2A PA	2B AP	4B PA
Energy (MV)	15	15	15	15	15	15	15	15
TPS MU	59.2	68.9	70.6	67.2	55.3	50.5	9.15	10
M3D MU	–	–	–	–	–	–	–	–
TPS Beam Dose (cGy)	26.62	28.36	36.46	28.36	29.52	22.57	3.7	4.63
M3D Beam Dose (cGy)	–	–	–	–	–	–	–	–
Dose difference	–	–	–	–	–	–	–	–
Diode Dose	–	–	–	–	–	–	–	–
Segments	1	1	1	1	1	1	1	1
X1/X2 Jaws (cm)	10 / 10	10.2 / 9.5	9.5 / 9.3	10 / 10.2	9.5 / 9.3	10 / 10	7 / 4.6	4.6 / 7
Y1/Y2 Jaws (cm)	20 / 19.5	20 / 0	20 / 19.5	20 / 0	0 / 19.5	0 / 19.5	-10.5 / 19.5	-10.5 / 19.5
Wedge	None	None	None	None	None	None	None	None
MLC	Static	Static	Static	Static	Static	Static	Static	Static
Rotation	Static	Static	Static	Static	Static	Static	Static	Static
Gantry	0°	270°	180°	90°	180°	0°	0°	180°
Collimator	0°	0°	0°	0°	0°	0°	0°	0°
Couch	0°	0°	0°	0°	0°	0°	0°	0°
Gantry Clearence (cm)	–	9.9	–	–	–	–	–	–
Deliverable	Yes	Yes	Yes	Yes	Yes	Yes	2 JawY erros	2 JawY erros

Need a hand Calc?

MobiusCalc's Photon and Electron Quick Calc utilities calculate MU in a water phantom CT—no patient CT required. Both utilities support manual entry and RT-import.

MobiusFX: 3D IMRT/VMAT and Daily Treatment QA

Workflow

Deliver the plan, and...that is it! MobiusFX automatically captures measurements of the delivery via machine log files, determines the delivered fluence distribution from those measurements, and uses its CCCS algorithm to interpret 3D delivered dose in the patient.

Results

3D IMRT/VMAT QA

MobiusFX automatically compares its delivered dose to the original TPS dose in a 3D "apples to apples" comparison. 3D comparison metrics, including Target Coverage, DVH Limits, and 3D Gamma, specifically identify clinically relevant errors.

Machine evaluation

MobiusFX provides a root-mean-square error analysis of every moving linac component, segregating and isolating machine performance errors for the user.

End-to-end data transfer check

MobiusFX checks the linac starting positions against the TPS plan to verify complete and accurate plan data transfer. If the data transfer is incomplete or beam delivery parameters are somehow changed, MobiusFX will immediately alert the user to those discrepancies.

3D daily treatment QA

MobiusFX works in the background to verify every treatment fraction for every patient. Each daily check will automatically associate with the patient treatment summary, and users will receive immediate email alerts if machine performance or data transfer errors are detected.

DELIVERED FRACTIONS

FRACTION	QA	DELIVERED	DURATION	CBCT	MEAN DOSE	DVH LIMITS	3D GAMA	RMS VALUES	DATA TRANSFER
✏ – ⓘ	◉ ◉	Tue, June 23, 2015, 12:20 AM	2 min 52 sec	– ⊖	2.25%		99.9%	1.64 mm	
✏ 1 ⓘ	○	Tue, June 23, 2015, 08:27 PM	5 min 2 sec	– ⊖	-0.96%		98.8%	26.5mm	
✏ 2 ⓘ	○	Wed, June 24, 2015, 8:14 PM	3 min 2 sec	– ⊖	2.15%		99.9%	1.75mm	
✏ 3 ⓘ	○	Thu, June, 2015, 7:59 PM	3 min 12 sec	– ⊖	2.31%		99.9%	1.67mm	
✏ 4 ⓘ	○	Fri, June 26, 2015, 08:02 PM	2 min 50 sec	– ⊖	2.27%		99.9%	1.78mm	
✏ 5 ⓘ	○	Mon, June 29, 2015, 08:40 PM	3 min 2 sec	– ⊖	2.29%		99.9%	1.65 mm	
✏ 6 ⓘ	○	Tue. June 30, 2015, 10:06 PM	2 min 49 sec	– ⊖	2.11%		99.9%	1.91mm	
✏ 7 ⓘ	○	Wed, July 01, 2015, 09:11 PM	2 min 51 sec	– ⊖	2.08%		99.9%	1.68mm	
✏ 8 ⓘ	○	Thu, July 02, 2015, 09:05 PM	2 min 56 sec	– ⊖	2.16%		99.9%	1.73mm	
✏ 9 ⓘ	○	Tue, July 07, 2015, 08:49 PM	2 min 51 sec	– ⊖	2.35%		99.9%	1.45mm	
✏ 10 ⓘ	○	Wed, July 08, 2015, 8:46 PM	2 min 57 sec	– ⊖	2.39%		99.9%	1.72mm	
✏ 11 ⓘ	○	The, July 09, 2015, 08:51 PM	2 min 54 sec	91.5%	2.1%		99.9%	1.92mm	
✏ 12 ⓘ	○	Fri, July 10, 2015, 09:16 PM	3 min 6 sec	90.8%	2.22%		99.9%	1.96mm	

Integrated gold standard verification

The MVP phantom integrates seamlessly with MobiusFX to provide external absolute dose verification at the user's discretion. This water-equivalent phantom features seven chamber positions and a film plane. Its CT is integrated into Mobius3D, so users are not required to CT the phantom or create phantom QA plans if they want to perform additional measurements. The user only has to physically obtain the absolute dose measurement and then verify that the MobiusFX log file dose agrees with the gold standard.

MobiusCB: Patient CBCT QA

Workflow

Follow your regular protocol for patient CBCTs. Once a patient's CBCT and registration is saved by the therapist, MobiusCB automatically retrieves the CBCT/registration via R&V DICOM query/retrieval, and performs a quantitative comparison between the planning CT and CBCT.

Results:

Online positioning error detection

MobiusCB checks the CBCT against the planning CT with a density gamma comparison designed to highlight gross errors in patient positioning and significant changes in patient anatomy. The density gamma result lets users visualize changes in the patient while also providing a quantitative metric for evaluation.

Immediate registration feedback

Passing Rate		Criteria	Planning CT Voxels	CBCT Voxels	Patient Positioning
71.5%	🛡	0.2 g/cc / 3 mm	2 mm, 0.97 mm, 0.97 mm	2 mm, 0.97 mm, 0.97 mm	Better Shift Found

New Gamma Passing Rate	Move Table Right	Move Table Down	Move Table Toward Gantry
95.6%	1.02 cm	1.03 cm	0.92 cm
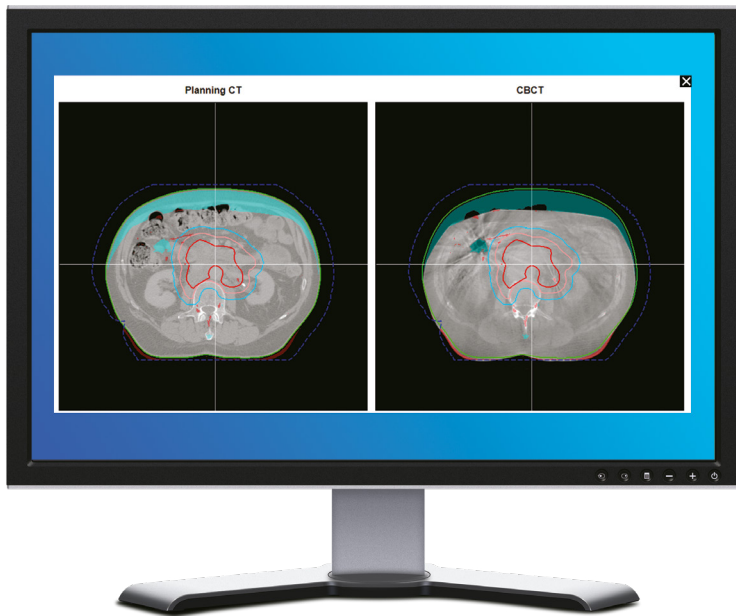
Weight change detection

MobiusCB clearly highlights instances of soft tissue loss or gain in the patient CBCT, automatically flagging patients for offline review.
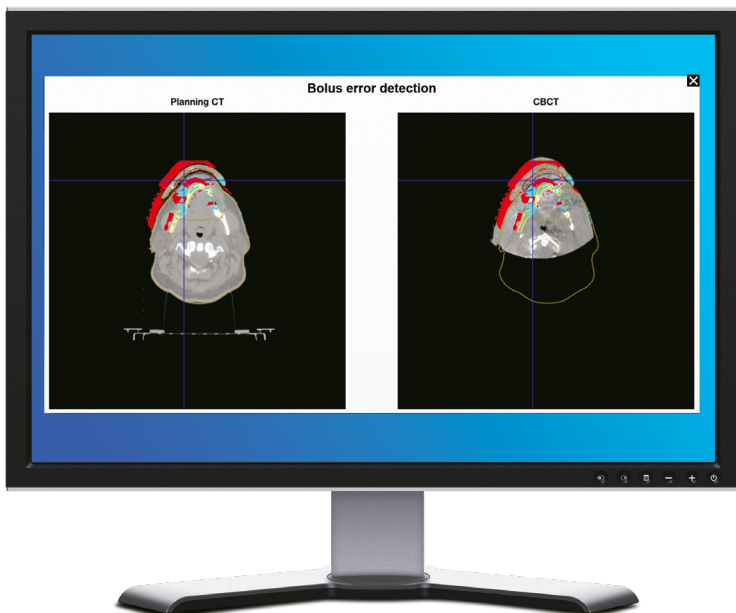
Bolus error detection

MobiusCB includes virtual structures in its density comparison between the patient CT and pre-treatment CBCT, to visualize and verify correct bolus placement.

DoseLab: TG-142 | Machine QA

Workflow

DoseLab features automatic image analysis, both as a standalone Windows tool and as a module within Mobius3D. This AutoQA functionality monitors for machine QA images and processes them according to the user's tolerances and preferences, with zero clicks required.

Results

Single Image Analysis

All analyses in this DoseLab module use a single image for producing quantitative results to verify numerous machine QA parameters. This module also features a full complement of image manipulation tools—simple rotation, flipping/cropping, and filtering/smoothing operations.

MV/kV Imaging
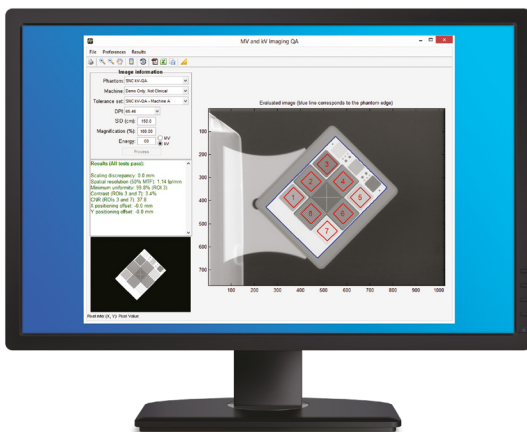
MLC Strip Test
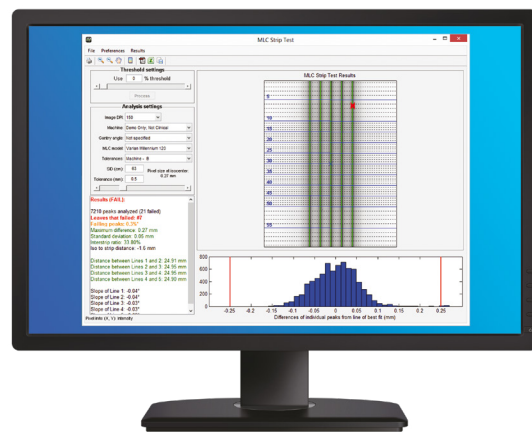
Starshot
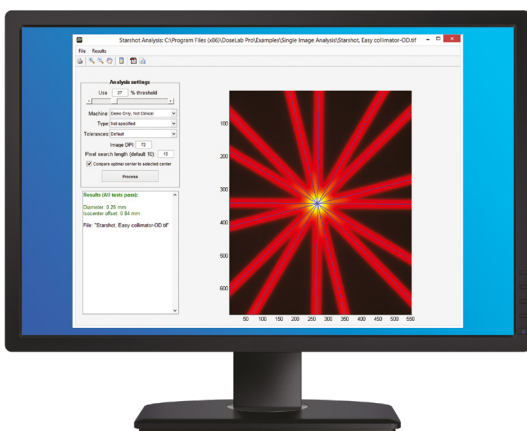
Flatness and Symmetry
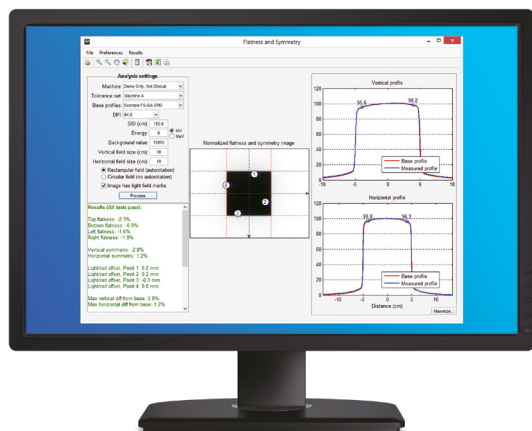
Winston-Lutz

DoseLab simplifies the Winston-Lutz test for both SRS and IGRT positioning/re-positioning. With automatic 2D and 3D analysis, DoseLab quickly determines the center of each field and target marker and reports in-plane and cross-plane offsets for each image, vector delta between the two centers, and cumulative 3D target position, including effects of gantry and couch positions.

VMAT/Dynamic MLC Testing

DoseLab provides fast and easy analysis of tests using different dose rates, gantry speeds and MLC leaf speeds to verify the accuracy of VMAT and dynamic MLC deliveries.
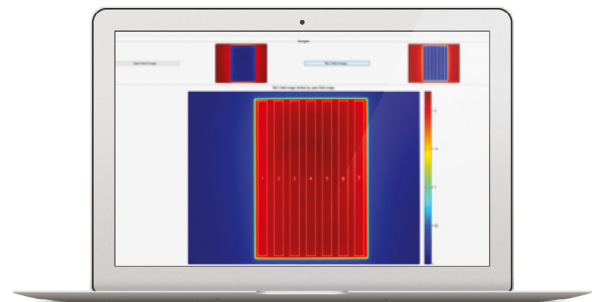
CBCT/CT

Providing a comprehensive analysis of your Cone Beam or CT simulator, DoseLab automatically finds the correct image slices for QA.

MLC Log File Analysis

MLC performance is key to precise delivery of modulated treatments. Machine log files contain minutiae about each MLC leaf with up to 105 readings per second and spatial resolution as small as 0.01 mm. DoseLab analyzes this data to determine the mean and max RMS errors for each individual leaf as well as for leaf speeds.

DoseLab Client Computer Specifications

- Windows® XP or higher
- Microsoft Excel
- 32-bit video card
- 1024 x 68 min display
- 2GB RAM
- 1GB Hard Drive Space

DoseLab: TG-142 | Machine QA

Pre-Built Phantom Support

DoseLab features pre-built support for both standard and aftermarket imaging phantoms. Users can also incorporate the DoseLab TG-142 Phantoms for added time savings.

MC^2

The MC^2 Phantom can be used for both MV and kV planar imaging tests. The phantom requires only one set up to test both imagers, which means fewer trips into the vault and faster, easier QA.
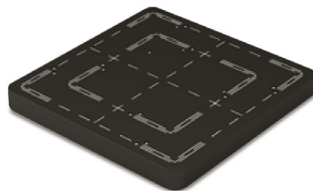
RLf

The RLf Phantom features field size markers for both 10 x 10 and 15 x 15 fields and is ideally suited for DoseLab's analysis routines for flatness/symmetry and radiation field/light field coincidence.

WL^3

The WL^3 Phantom is made from Plastic Water® and easy to align. Designed for DoseLab's Winston-Lutz analysis, the WL^3 phantom contains a hidden 5mm tungsten sphere at the center, which is easily revealed during MV and kV imaging. Off-set alignment markers are also incorporated, making the WL^3 phantom ideal for checking IGRT coincidence accuracy.

Fast and easy wedge film calibrations

DoseLab supports film calibration with a series of film images, or users can also calibrate film using a single wedge image for quicker, easier film QA.
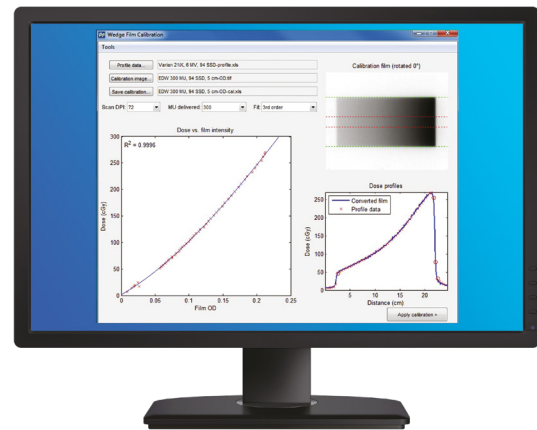
Automatic dose comparisons

DoseLab will automatically validate calculated dose using measurements from film or most diode/ion chamber arrays. In batch mode, DoseLab automatically performs QA for multiple fields in sequence.
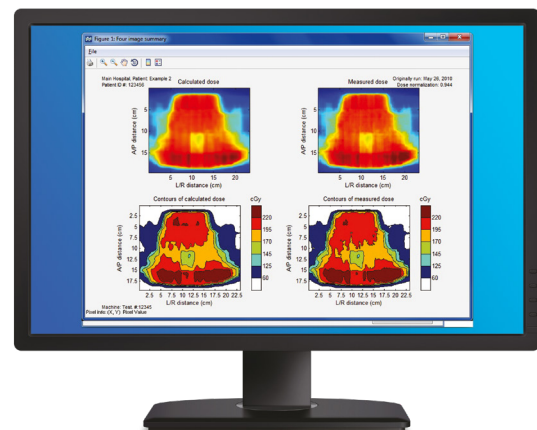
Windows and web-based applications for simplified automation and trend analysis

Customers

Customers

Mobius QA products are sold direct to our customers in the United States and Canada and to our international customers through an extensive distributor network. Mobius QA products are used in over 1,000 centers around the world.

Map may not reflect current product availability.

Over **1,000** sites worldwide relying on Mobius QA products

Over **500,000** patients clinically verified with Mobius3D

Over **11,000** patients per day benefiting from safer treatments

Intended Use Summary

Mobius software is used for quality assurance, treatment plan verification, and patient alignment and anatomy analysis in radiation therapy. Mobius3D® uses read-in treatment plans and planning images (such as CT) to calculate radiation dose three-dimensionally in a representation of a patient or a phantom. DoseLab® Pro imports radiation-exposed images from scanned film, other measurement devices, and treatment planning systems to display differences between measured and calculated dose distributions.

Important Safety Information

Radiation treatments may cause side effects that can vary depending on the part of the body being treated. The most frequent ones are typically temporary and may include, but are not limited to, irritation to the respiratory, digestive, urinary or reproductive systems, fatigue, nausea, skin irritation, and hair loss. In some patients, they can be severe. Treatment sessions may vary in complexity and time. Radiation treatment is not appropriate for all cancers. Mobius3D is not a treatment planning system. It is only to be used by trained radiation oncology personnel as a quality assurance tool.

Medical Advice Disclaimer

Varian as a medical device manufacturer cannot and does not recommend specific treatment approaches. Individual treatment results may vary.

Not all products or features available for sale in all markets.