

AAPM TG-135 U1

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DISCLAIMER

The draft of this TG is being submitted to Quality Assurance Subcommittee Review in August 2016. Changes may occur.

New Technology since AAPM TG-135 (2006)

- Iris collimator (2005)
- MC dose calculation algorithm (2008)
- Fiducial-less lung tracking (2010)
- MLC (2015)

IRIS Collimator



All recommendations are subject to change during review

Centerline Laser to CAX Alignment

- 1. Option: align laser to fixed collimator assembly CAX
 - May increase Tx plan penumbra for IRIS/MLC collimator

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- May be clinically acceptable if IRIS/MLC only used for SBRT
- 2. Option: align laser to enter of of all CAX positions
 - Slightly increase Tx plan penumbra for all
 - Longer procedure
- 3. Tolerance of laser to CAX remains at 0.5 mm

IRIS Field Size Measurement and QA

- 30 min wait time for DVRT before IRIS calibration
- Every IRIS calibration should be independently verified for all fields to ensure field sizes match those at commissioning

IRIS Field Size Measurement Methods

- Water tank as Gold standard for commissioning
- GaFchromic Film current standard for routine QA
- Direct image-based method (camera)
- Dose area product using Bragg Peak PP





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IRIS Output Factors



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Summary IRIS QA

Frequency	Parameter	Tolerance	Method
Quarterly / Commissioning / Path Calibration	IRIS beam CAX / Laser coincidence	≤0.5 mm	Film, water tank
Commissioning	Absolute field size /FWHM	N/A (ref.)	Water tank
Monthly	Field size spot check	±0.5 mm, ±0.2 mm suggested	Film, camera, dose area product
Recalibration	All Field sizes	±0.5 mm, ±0.2 mm suggested	Film, camera, dose area product

MLC

Biomed. Phys. Eng. Express 2 (2016) 017003

GAsmerom et al



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Mechanical MLC QA

- Manufacturer recommendations
- AAPM TG-142
- AAPM TG-198 (implementation guide for TG-142, in review)

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• MPPG8a (in review)

Patient Delivery QA (DQA)

- Controversial topic
- Guarantee changes in the review process!
- Until we have more data, err on side of caution
 - Isoconformal = 3D???
 - Conformal avoidance = step & shoot IMRT
- DQA should have **2D** dose distribution
 - Point dose measurements can be part of DQA, but is not a complete DQA

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Lung Optimized Treatment

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LOT Simulation

- Image acquisition:
 - Extraction of inhale/exhale scans for ITV from 4DCT ideal
 - Breath-hold scans need to be checked for positional repeatability
 - Slow free breathing highly recommended to complement Breath-hold scans for ITV consistency
- LOT simulation on CK essential to determine tracking mode

Tracking modes

- Educational paragraphs on 2-View, 1-View and 0-View tracking
- O-View or fiducial tracking: clinical decision
- Code of practice guidelines for number and location of fiducials based on clinical considerations

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LOT QA (mostly code of practice type)

- E2E tests should be performed on anthropomorphic phantom with appropriate tissue densities and motion
- 0.95 mm tolerance level
- Quarterly test, unless patients are treated less than quarterly
 - Less than quarterly, but before patient Tx

LOT treatment QC

- Fiducial tracking accuracy during treatment easy to visually verify (physicists' eye)
- Accuracy of 2-View or 1-View more challenging, esp. for partially obscured tumors (Radiologist's eye)
- Code of Practice for on-Tx quality control

Synchrony

All recommendations are subject to change during review

Synchrony QA and Code of practice

- Clear guidance on Synchrony E2E
- Clinical practice guidelines on:
 - LED marker placement
 - Which tool to use to time imaging
 - Clinical guidelines on correlation model limits (<3 mm)

Monte Carlo TPS

All recommendations are subject to change during review

Commissioning the MC Model

- Summarizes this specific MC implementation
- Explains the MC commissioning process
- TPR should be within 2% beyond Dmax
- OCR within 1% in field, and 1 mm in FWHM field size

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• OF within 0.5%

Verification of MC model

 Single beam PDD and profiles on inhomogeneous slabs
E. E. Wilcox and G. M. Daskalov: Accuracy of dose within and beyond heterogeneties



 Independent DQA at model commissioning (or any change), e.g. using IROC Houston lung phantoms

DQA and MU checks for MC

- At commissioning, use e.g. IROC Houston lung phantom for independent peer review of MC model
- Use heterogeneous phantom for patient DQA for first several cases
- Repeat heterogeneous phantom annually
- MU checks currently check raytracing plan

Clinical Use

- Educational: literature summary of RT/MC comparisons
- Recommend to use MC for lung
- Recommend to use MC to verify RT in thoracic spine (target dose overestimate in RT)

Summary Recommendations

Frequency	Parameter	Tolerance	Method
Commissioning	TPR	2%	MC calculation vs. measured dose
	OCR	1% in field 1mm FWHM width	MC calculation vs. measured dose
	OF	0.5%	MC calculation vs. measured dose
	Single beam PDD and profile	2%	Film in inhomogeneous slab
	DQA	Gamma 3%/3mm	IROC Houston lung phantom or similar phantom
Annual	DQA	Gamma 3%/3mm	IROC Houston lung phantom or similar phantom

Uncertainty in Robotic Radiosurgery



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Educational Section on Uncertainty

- Complement Summer School on Linac-Based Uncertainty
- Focusing on topics which are CK specific
- Pulls data from recent literature
- Points out areas requiring further research

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When will it be published?

All recommendations are subject to change during review

Timeline

- August 31st: Reviewable Draft to QASC/WGEBQA review
 - ~ 2 months for review, revision, 2nd review
- Science Writer to go over document (2-3 weeks?)
- Submit to TPC
 - ~2 months for review, revision, 2nd review
 - Potentially new workflow with concurrent review from Science Council
- Submission to Medical Physics & Review
- AAPM name behind publication, hence the extreme scrutiny!