

FUTURE AUDIT APPROACHES



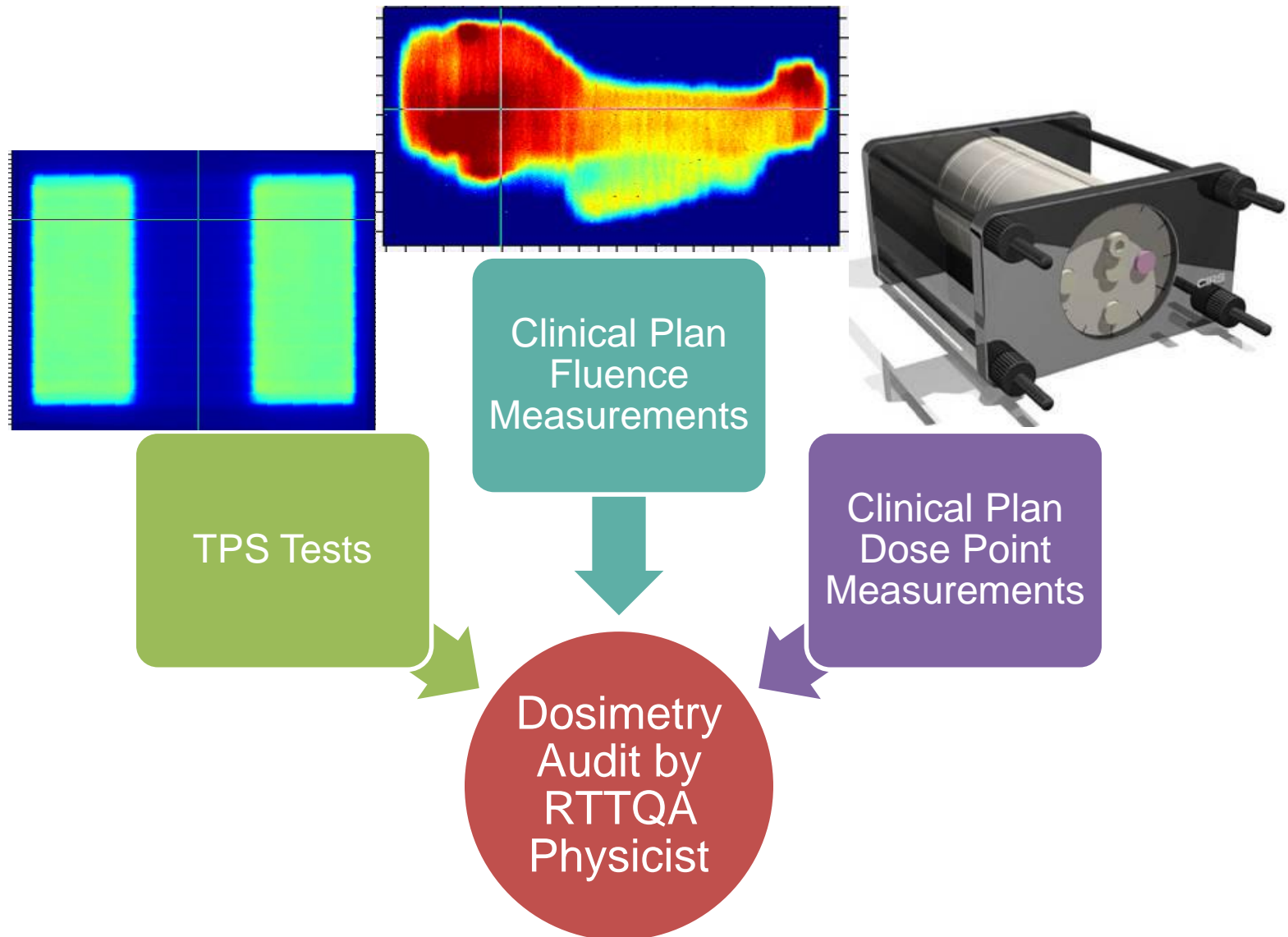
David Bernstein

On Behalf of RTTQA IMRT Subgroup

RTTQA IMRT SubGroup

- “To review and improve Quality Assurance of UK IMRT trials”
- 9 Step IMRT credentialing program
- Steps 6-9 = dosimetry audit

Current Audit Procedure



Current Audit Procedure

Each audit visit: 1 day at host centre, including 4.5-5 hours linac time. Additional preparation and analysis time.

Current Audit Procedure





Hierarchy of IMRT complexity or uncertainty?



IMRT Fluence Complexity

	MU/Gy [1]	PIMV [2]	PIMV/nnz	MI_x [3]	MI_y [3]	MI_xy [4]
Least ↓ Most	CHHIP	CHHIP	ARTDECO	PIVOTAL	COSTAR	COSTAR
	COSTAR	COSTAR	COSTAR	ARTDECO	PIVOTAL	CHHIP
	ARTDECO	PIVOTAL	PIVOTAL	COSTAR	CHHIP	PIVOTAL
	PIVOTAL	ARTDECO	PARSPORT	CHHIP	ARTDECO	ARTDECO
	PARSPORT	PARSPORT	CHHIP	PARSPORT	PARSPORT	PARSPORT

Dong et al, IMRT DP QA results [5]

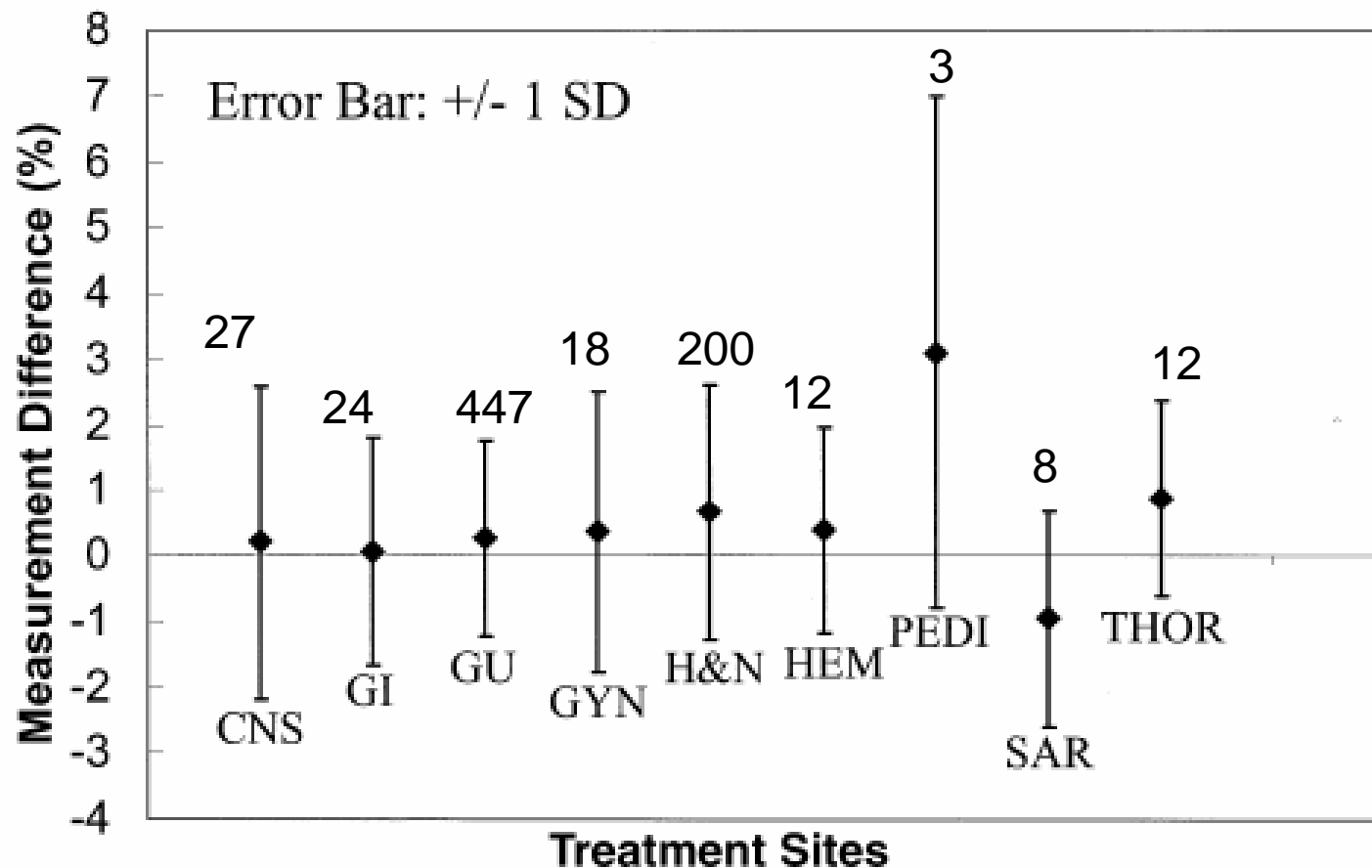


Fig. 6. Comparison of point dose measurement and calculation in 9 different treatment sites for a total of 751 cases. The center diamond symbol indicates the mean difference for the treatment site and the error bar is ± 1 SD.

Abbreviations: QA = quality assurance; GYN = gynecologic; CNS = central nervous system; GU = genitourinary; H&N = head and neck; THOR = thoracic; PEDI = pediatric; sMLC = step-and-shoot multileaf collimator.

Hierarchy of IMRT complexity or uncertainty?



Reducing Audit Workload and Streamlining

- New approach to assess dosimetry for different trials and centres needed due to increasing workload
- Can not use a hierarchical approach confidently as a basis of reducing workload
- However can streamline the process and identify new approach to audits

New Approach Requirements

- Flexibility for centres
- Reduced linac time
- Independent absolute dose check

- Reflect centre participation in multiple trials with multiple treatment methods

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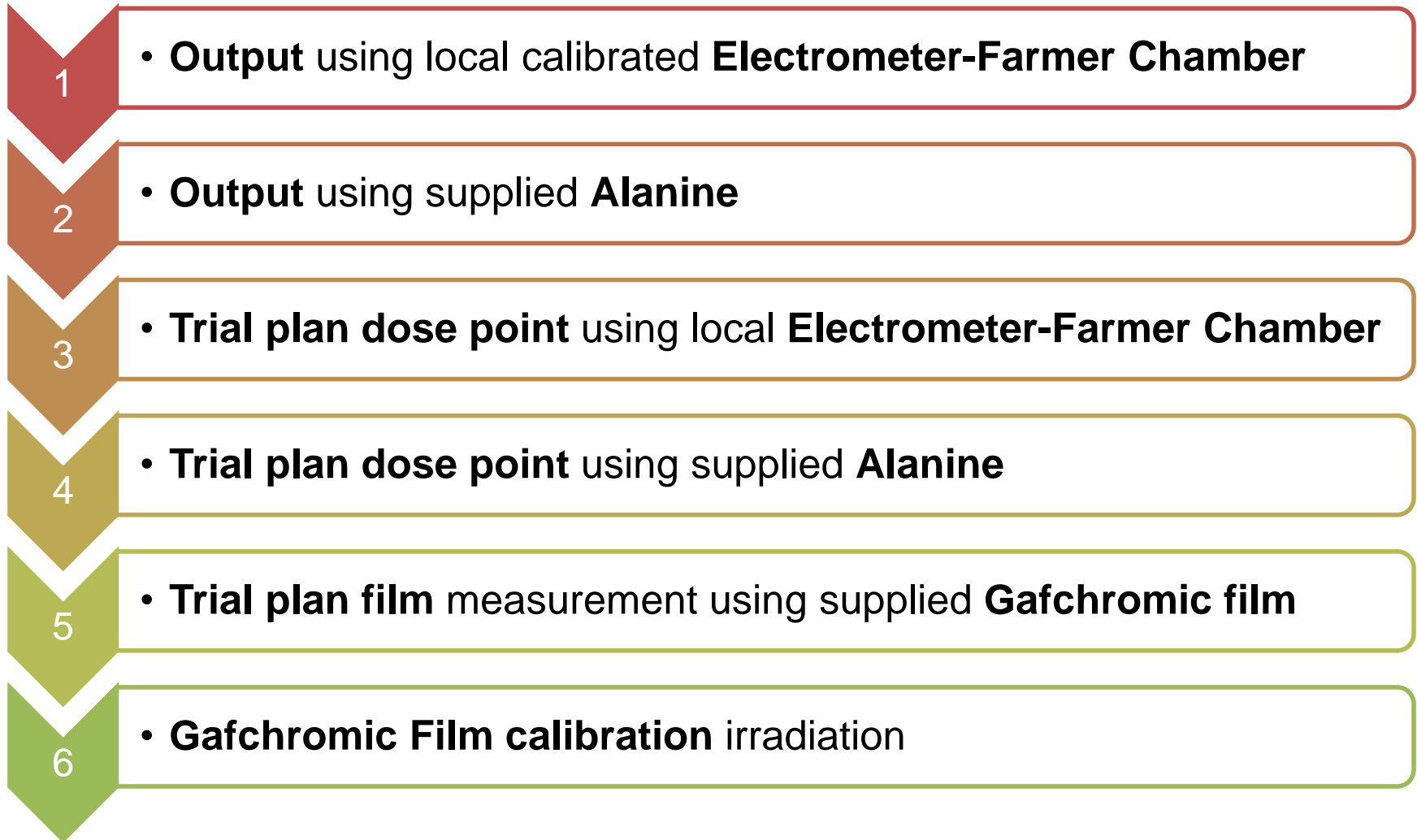
Postal Audit



Postal Audit

- Solid Water phantom developed by RTTQA IMRT Subgroup
- Equipment supplied by RTTQA/NPL
- Results analysed by RTTQA/NPL
- Phantom setup and delivery performed by host centre
- Cornerstone is the NPL Alanine service
- Modular design to allow future modifications, e.g. to include inhomogeneities
- Fiducial markers inserted to facilitate IGRT setup

Postal Audit Process



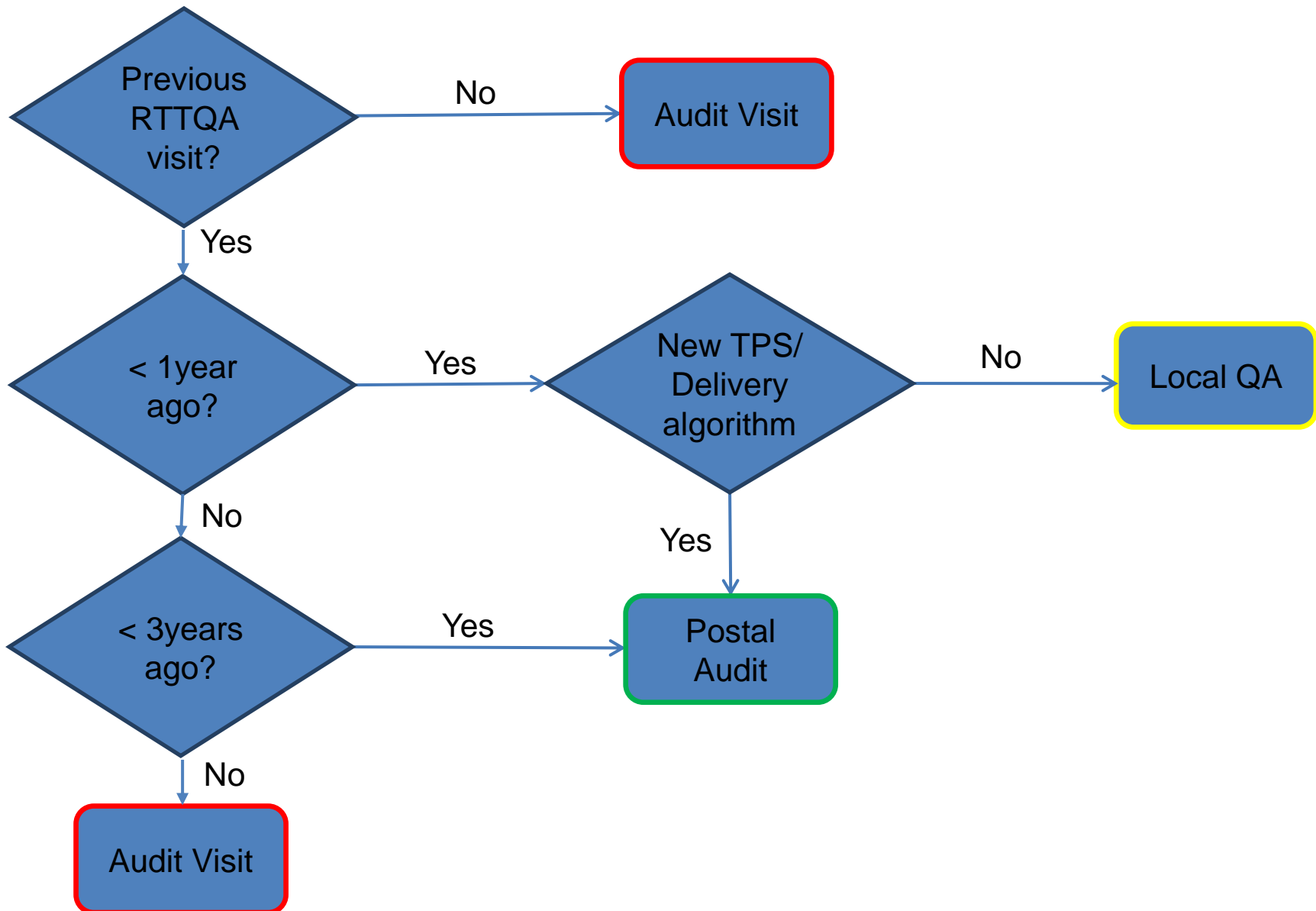
Audit Streamlining



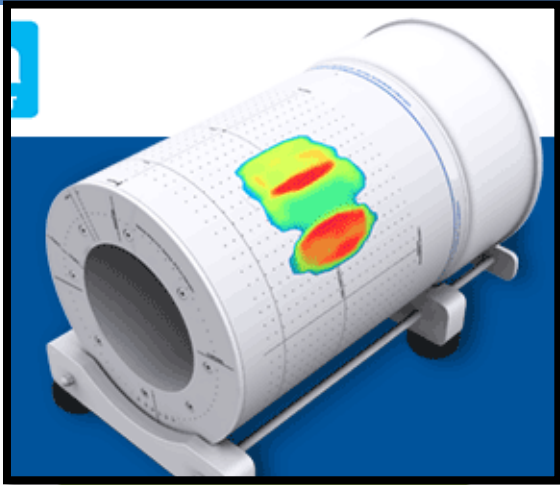
Established RTTQA guidelines to determine

- When a centre is to receive an audit
- What form the audit will take

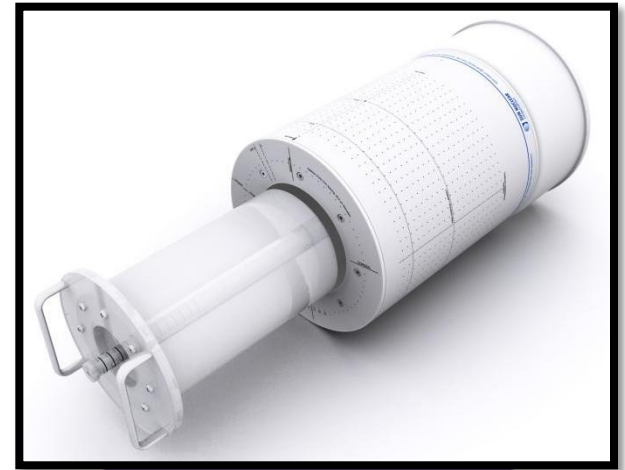
Audit Streamlining



New Audit Visit Process



Clinical Plan
Fluence
Measurements



Clinical Plan
Dose Point
Measurements

Dosimetry
Audit by
RTTQA
Physicist

Work in Progress

- Pilot Alanine Audits currently taking place (Varian & Elekta)
- Establish which subset of alanine to read out
- Resolve apparent systematic ArcCheck SemiFlex results
- To roll out both audit methods early 2014

References

- [1] Conor K. McGarry, Assessing software upgrades, plan properties and patient geometry using intensity modulated radiation therapy (IMRT) complexity metrics, Med. Phys. 38(4), April 2011
- [2] Martha M. Coselmon, Jean M. Moran, Jeffrey D. Radawski, and Benedick A. Fraass, Improved IMRT delivery efficiency using intensity limits during inverse planning, Med. Phys. 32(5), May 2005
- [3] S. Webb, Use of a quantitative index of beam modulation to characterize dose conformality: illustration by a comparison of full beamlet IMRT, few-segment IMRT (fsIMRT) and conformal unmodulated radiotherapy, Phys. Med. Biol. (2003) 48 2051
- [4] N. Giorgia, F. Antonella, V. Eugenio, C. Alessandro, A. Filippo, and C. Luca, 'What is an acceptably smoothed fluence? Dosimetric and delivery considerations for dynamic sliding window IMRT, Radiation Oncology 2, 42 (2007)
- [5] L. Dong, et al. Patient-specific point dose measurement for IMRT monitor unit verification. Radiation Oncology, 56, 3, p867-877, July 2003.

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