Performance-based QA for Radiotherapy: TG 135
QA for Robotic Radiosurgery

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Status of TG 135

- Aug 2006: Writing starts for 11 international authors
- Oct 2008: Writing cut-off for final editing
- Nov 2008: Original Draft submitted to QA Subcommittee
  several revisions ...
- Sep 2009: Revised Draft went to TPC & Professional Council
  Several revisions ...
- Mar 2010: TPC votes 8 yes, 8 no, 3 abstain
  Major discussion point: requirement for DQA for every patient
- Jul 2010: TPC meeting decides ...
- When approved: Submission to Medical Physics
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- QA for individual system components:
  - Robot & Room
  - Accelerator
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  - Overall Accuracy (all subsystems)
- Summary & QA tables
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**TG-135 does not contain:**
- Instructions for commissioning
- Recommendations on specific detectors
- Recommendations on technology implemented widely in clinics after October 2008 (IRIS, MC)

**TG-135 is:**
- A “fast-track” TG giving basic recommendations until switching to TG-100 style QA
- Pointing out areas where we need to develop QA
QA for Individual System Components: Accelerator

- Obvious differences to regular linac:
  - No flattening filter
  - Fixed & IRIS collimators
  - X-band
  - No bending magnet
- QA is straightforward, follow TG-40, TG-42, TG-45, TG-142
- Small field dosimetry
  - TG-155 (in progress)
  - Summarized findings of current publications
QA for Individual System Components: 
Software

- TG-53 gives excellent guidelines
- CK software is integral part of system
- Topics not covered by TG-53:
  - Data security: who can change data, and how? (TG201)
  - Custom CT density model
  - Checking accuracy of inhomogeneity calculations
    - With ray-tracing algorithm
    - With MC
- Delivery QA (DQA) for each patient or not?
QA for Individual System Components: Imaging System

- Stability of Geometry
- Generators and Sources
- Amorphous Si detectors
- Patient dose from image guidance (TG-75)
Which image artifacts have what effect on tracking algorithm?

QA is usually done in good alignment – SHIFT your E2E phantom!

Phantoms are easier to track than patients
QA for Integrated Systems: Imaging/Software

• Essential to ensure accuracy of image guidance
• Available Resources:
  • Reports #14 and #74 of TG 12 on diagnostic imaging QA
  • AAPM TG 75
• Obvious challenges:
  • Training in diagnostic imaging QA
  • Availability of diagnostic tools
  • No manufacturer recommendations
• That we do not know how to do it now does NOT mean we can ignore the issue!
QA for Integrated Systems: Accuracy of Radiation Delivery

1. Robot Mastering (by manufacturer)
2. 1st order: uses beam laser on isocrystal
3. 2nd order: fine-tunes 1st order calibration
4. Commissioning document specifies <0.5mm average rms error per path (~40 nodes)
5. Robot pointing has been shown to be stable by repeated use of srch2 for up to 2 years (longer data not available)
6. Problems:
   - laser as a substitute for beam
   - 2nd order calibration check only available through FSE
7. Daily AQA will detect drifts in joint position long before E2E will pick it up (Munich data)
Overall System QA:
Patient delivery QA (DQA) Why?

- It is the **only** non-isocentric QA test
- It tests all aspects of technical delivery
- Develop pass/fail criteria:
  - What is your case mixture: trigeminals, prostates ...
  - RTOG protocols for SRS/SBRT are good guidance
  - Your own expectations
- AND it tests your complete **clinical process**

- **Do we need DQA for every patient?** Very differing **opinions!!!**
Overall System QA: Patient-Specific/Like QA: How?

Take anthropomorphic phantom and run a mock treatment, including all processes:

1. RTT does simulation
2. Plan non-isocentric
3. In “Patient” mode
4. Have MD approve
5. Do documentation
6. Have RTT treat
7. Analyze film (gamma-index)
Example of Overall System QA:
Implementation of TG-135

- Technology changes since editing “lockdown”:
  - IRIS collimator
  - MC for IRIS collimator
  - InTempo (change of prostate imaging)
  - Major database/software change
  - ...

- Report should serve as Guideline, adapt to clinic
- Keep up with the literature on QA
- TG 100: Process map, FMEA analysis