QUALITY ASSURANCE OF IMRT

A. PICHANDI
CURIE CENTRE OF ONCOLOGY
"Chain" of IMRT Process

- Positioning and Immobilization
- Image Acquisition
- Structure Segmentation
- IMRT Treatment Planning and Evaluation
- File Transfer and Management
- Position Verification
- IMRT Treatment Delivery and Verification
- Plan Validation
**IMRT QA**

Two types of QA

System related

- Accuracy of delivery system
- Treatment planning system data integrity
- Various test to be added to periodic QA

Patient Specific

- Check of plan parameters
- Independent check of planned dose calculation
IMRT QA WORK FLOW

CT scan phantom, plan with patient beams, calculate doses

Treat phantom, perform film dosimetry, get doses, compare to calculation
IMRT QA

- Point dose measurement
- Evaluation of Fluence map generated by the TPS
- Leaf positioning Check (BEV)
POINT DOSE MEASUREMENT

Goal: measurement of absolute dose value in a reference point

For head & Neck - 5 cm
For Pelvis & abdomen - 10 cm

Verification of the planned versus delivered dose
POINT DOSE MEASUREMENT

Equipments required: ionization chambers, electrometer, phantom

CC0.13
CC0.01

point ionization chamber

Dose 1 electrometer
### PATIENT SPECIFIC ABSOLUTE DOSE MEASUREMENT

**BEAM DOSE MEASUREMENT**

Date: 28/07/2007

<table>
<thead>
<tr>
<th>Beam No.</th>
<th>M.U.</th>
<th>Meter Reading</th>
<th>Dose (cGy)</th>
<th>Variation in Dose cGy</th>
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<td></td>
<td></td>
<td>R1</td>
<td>R2</td>
<td>R3</td>
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<tr>
<td>1(15%)</td>
<td>118</td>
<td>117.1</td>
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<td>3(16%)</td>
<td>108</td>
<td>115.0</td>
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<td>117</td>
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<td>7(16%)</td>
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<tr>
<td>14(14%)</td>
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Measurement at a depth of **10 cm** of perspex

Average difference in dose is **0.616 cGy**

Measured By

Medical Physicist

**TOLERANCE ≤ 2cGy OR ≤ 3%**
Goal: To compare Fluence maps generated by the Treatment planning system and measured.
All IMRT QA checks are done at 0 gantry position and compared with dose distributions recalculated from the TPS at the same gantry angle. Acceptance criteria of 3% and 3 mm DTA resulted in agreement of > 94% of the points for all IMRT fields.

AAPM, 2003 Abstract ID: 9452 Title: IMRT QA with a 2D Diode Array
- L. Ding*, W. Ahluwalia, C. Liu, J. Li, J. Palta
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RADIATION FLUENCY QA - PROCEDURE

PATIENTS PLAN TRANSFER TO MAP CHECK
(EACH ARC CONVERTED INTO SINGLE ORIENTATION (GANTRY = 0)
& SPECIFIED DEPTH IN PHANTOM)

MEASUREMENT
PLEVIC - 10 CM
HEAD AND NECK - 5 CM

MAP CHECK or Film dosimetry
MAP CHECK

- 2-dimensional therapy beam measurement system
- Contains 445 diode detectors arranged in a grid
- 10x10 cm center portion of the grid contains detectors with 7mm spacing
- Outer area contains detectors with 14mm spacing
Detectors

- Beneath the acrylic top, there are 445 detectors arranged in a precise grid
  - 221 detectors in the inner 10 x 10 cm array with a resolution of 0.707 cm
  - 224 detectors in the outer array (6 cm wide) with a resolution of 1.41 cm
- The detectors are housed beneath inherent buildup of 2.0 g/cm³
  - Physical distance from the surface to the detector plane is 1.35 cm
- The MapCHECK field size is 22 cm x 22 cm
  - Fields of up to 40 cm x 40 cm are supported using the NEW Combine feature (shown later in the presentation)
ISODOSE DISTRIBUTION: MEASURED vs PLANNED
3D ISODOSE DISTRIBUTION - COMPARISON
If DTA passes at 3%/3mm level proceed with the treatment.

At the 5%/5mm level examine sources of discrepancies. Proceed with treatment only if
- Discrepancies can be resolved or
- Region of error are clinically insignificant

Beyond 5%/5 mm, Perform the measurement
Acceptable limited is less than 2 mm

At curie ~ 200 fields checked and found less than 2 mm
LEAF POSITIONING & ISOCENTRE CHECK (DRR vs PORT FILM)

TOLERANCE: 2mm
REFERENCES

“A Practical Guide to Intensity Modulated radiation Therapy”,
Medical physics Publishing and Memorial Sloan
Cancer center, 2003

“Intensity Modulated Radiation therapy, The state of the art”
Palta, J.R., Mackie, T.R., eds.,
AAPM monograph 29, 2003
THANK YOU