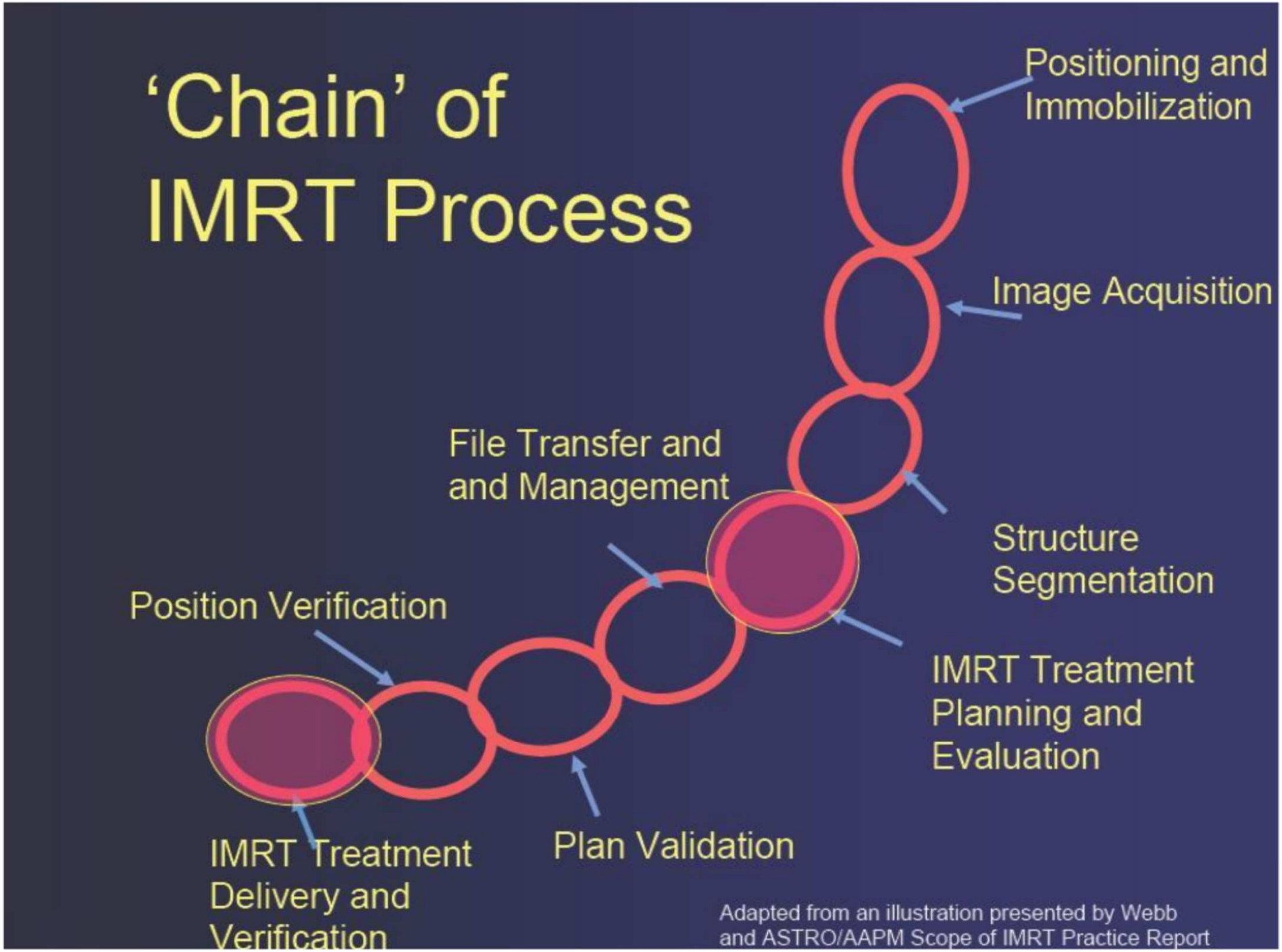
QUALITY ASSURANCE OF IMRT

A.PICHANDI
CURIE CENTRE OF ONCOLOGY


'Chain' of
IMRT Process
Positioning and
Immobilization
Image Acquisition
File Transfer and
and Management
Structure
Segmentation
Position Verification
IMRT Treatment
Planning and
Evaluation
IMRT Treatment
Delivery and
Verification
Plan Validation
Adapted from an illustration presented by Webb
and ASTRO/AAPM Scope of IMRT Practice Report

IMRT QA

Two types of QA

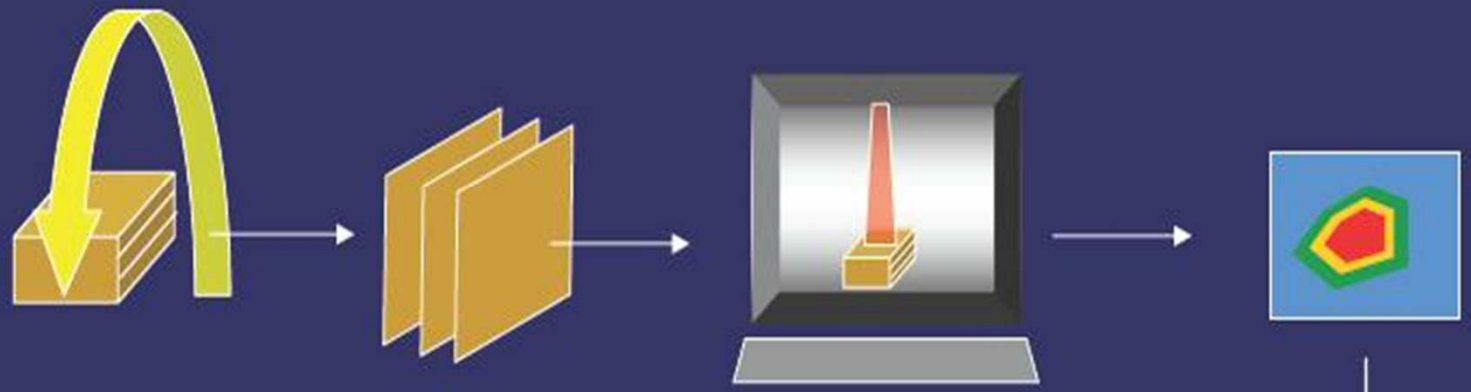
System related

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

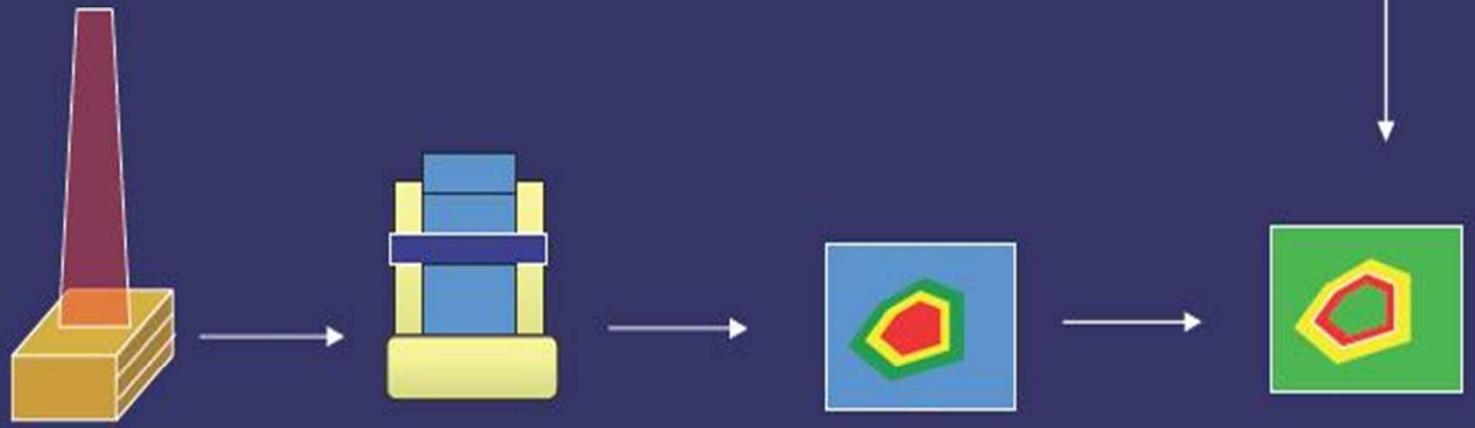
Patient Specific

- 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

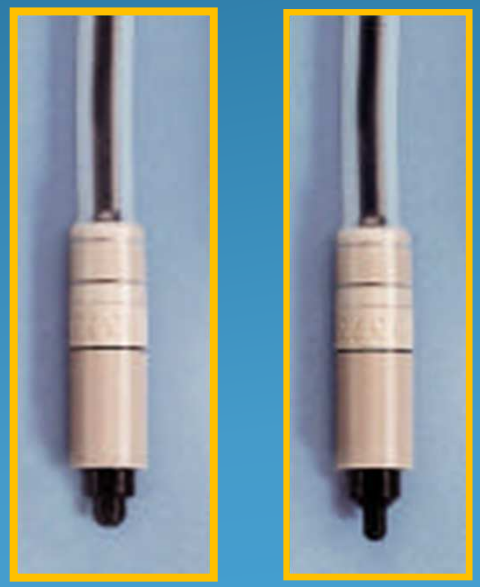
For head & Neck - 5 cm
For Pelvis & abdomen - 10 cm

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

Patient Name :
Patient IMRT No. : 0186_2007
Tem. : 22.2° C
Pressure : 914 mbar
Ionization Chamber : 0.13cc chamber
Model : Compact chamber CC13
Make : Scanditronix wellhofer
Absorbed-dose-to-water calibration factor $N_{D,w}$: 26.36 x 10^{7} Gy/C

Beam No.	M.U	Meter Reading				Dose (cGy)		Variation in Dose cGy
		R1	R2	R3	Avg.	Mes.	TPS	
1(15%)	118	117.1	117.1	117.1	117.1	116.5	116	+0.5
2(15%)	12							
3(16%)	108	115.0	115.0	115.0	115.0	114.4	113	+1.4
4(16%)	11							
5(16%)	115	117	117	117	117	116.41	116	+0.41
6(16%)	11							
7(16%)	113	113	113	113	113	112.4	112.5	-0.1
8(16%)	12							
9(16%)	112	119	119	119	119	118.4	116.9	+1.5
10(16%)	11							
11(16%)	115	124	124	124	124	123.4	123	+0.4
12(16%)	12							
13(14%)	117	114.4	114.4	114.4	114.4	113.8	113.6	+0.2
14(14%)	12							

Measurement at a depth of 10 cm of perspex
Average difference in dose is 0.616 cGy

Measured By

Medical Physicist

TOLERENCE ≤ 2cGy OR ≤ 3%

RADIATIONFLUENCY QA

Goal :- To compare of Fluence maps generated by the Treatment planning system and measured

RADIATION FLUENCY QA

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
dingli@shands.ufl.edu

RADIATIONFLUENCY QA -PROCEDURE

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

MESUREMENT

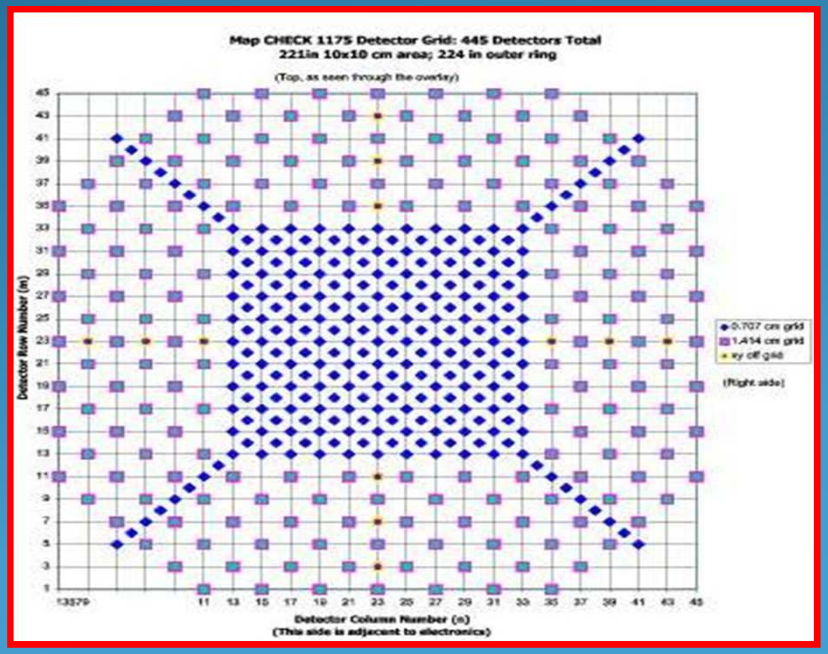
PLEVIC - 10 CM

HEAD AND NECK - 5 CM

MAP CHECK or Film dosimetry

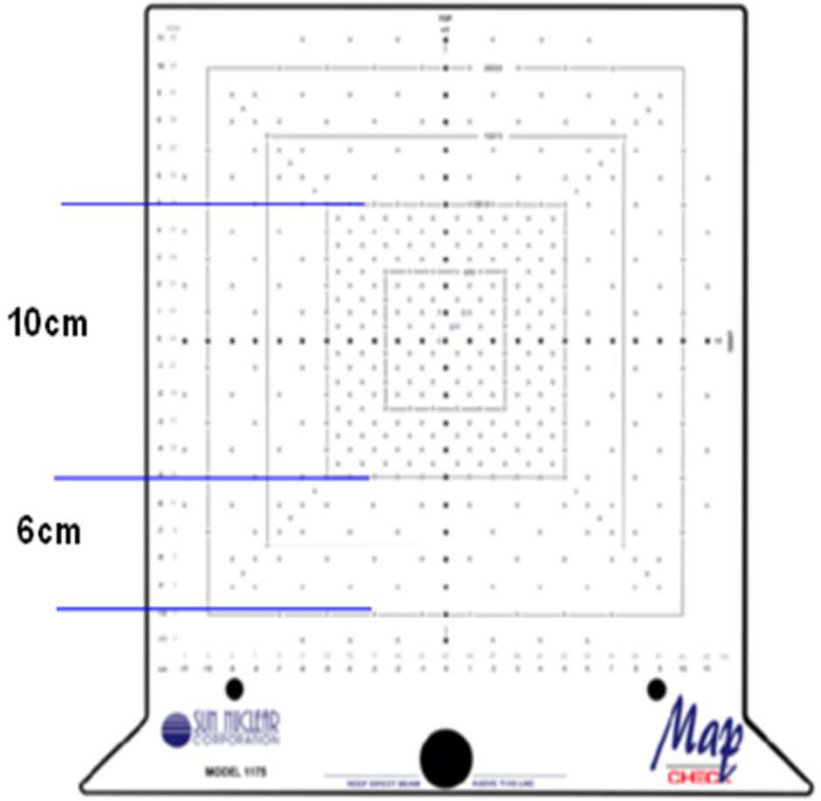
MAP CHECK

- 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

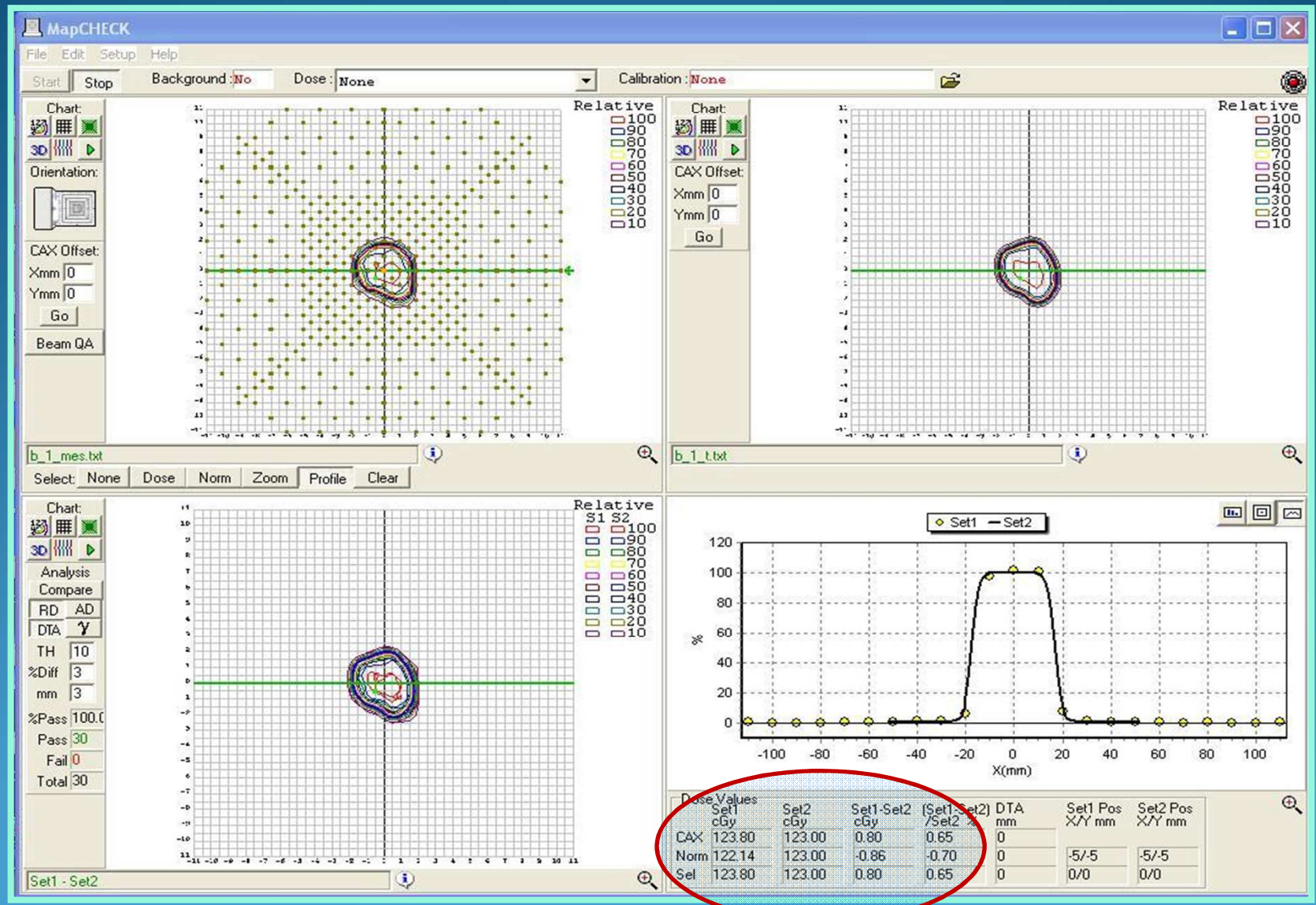


Detectors

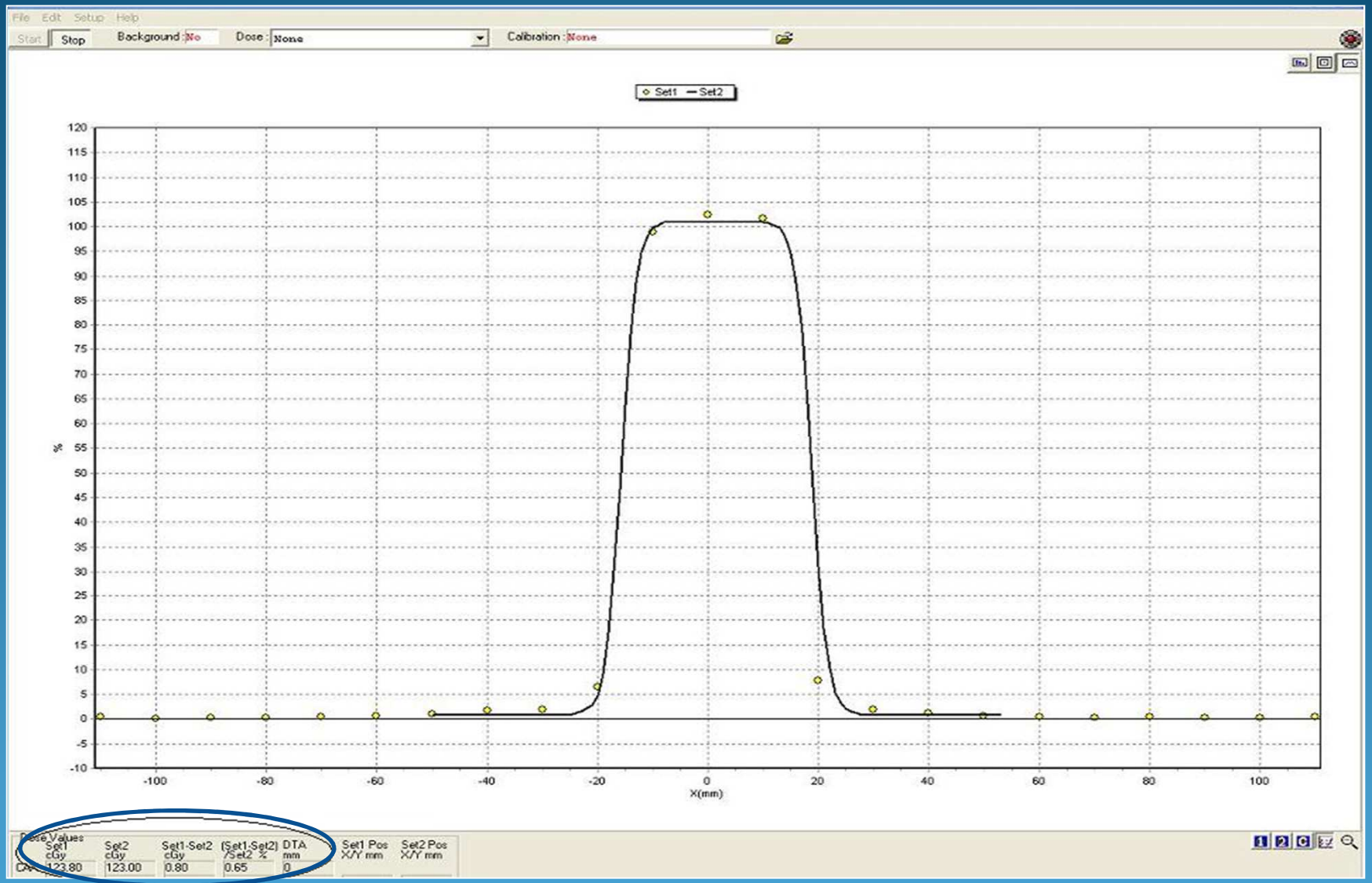
- Beneath the acrylic top, there are 445 detectors arranged in a precise grid
  - 221 detectors in the inner 10 x 10cm array with a resolution of 0.707cm
  - 224 detectors in the outer array (6cm wide) with a resolution of 1.41cm
- The detectors are housed beneath inherent buildup of 2.0 g/cm^3
  - Physical distance from the surface to the detector plane is 1.35cm
- The MapCHECK field size is 22cm x 22cm
  - Fields of up to 40cm x 40cm are supported using the NEW Combine feature (shown later in the presentation)



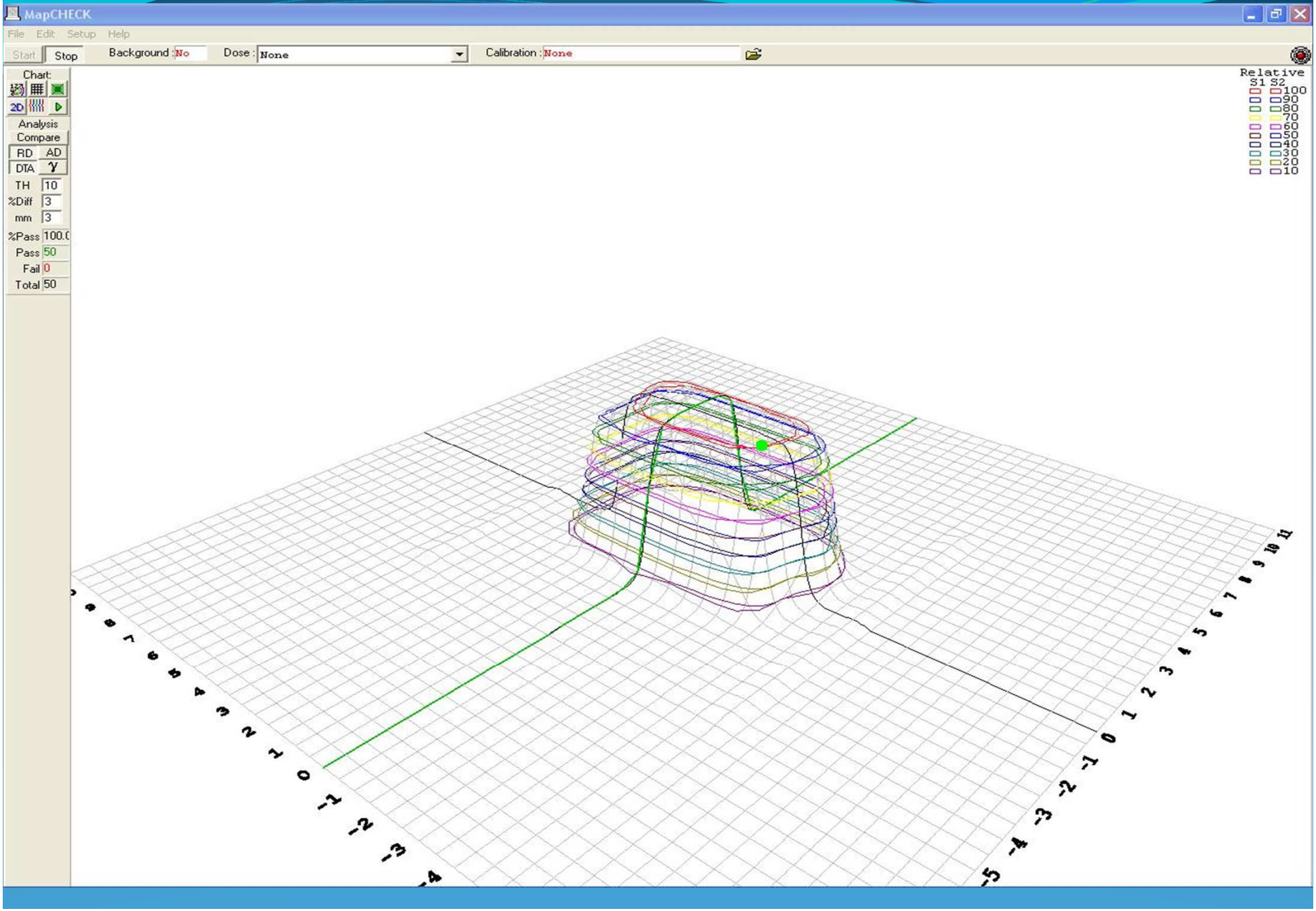
ISODOSE DISTRIBUTION: MEASURED vs PLANNED



BEAM PROFILE: MEASURED vs PLANNED



3D ISODOSE DISTRIBUTION - COMPARISION



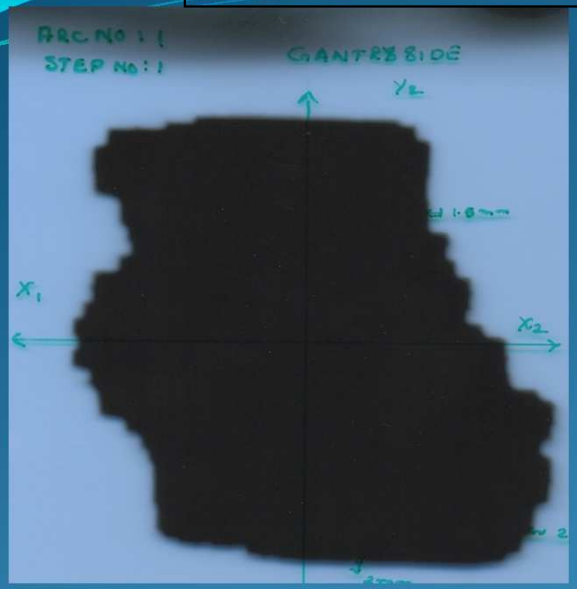
DTA : Planned Vs Measured

- If DTA passes at 3%/3mm level proceed with the treatment .

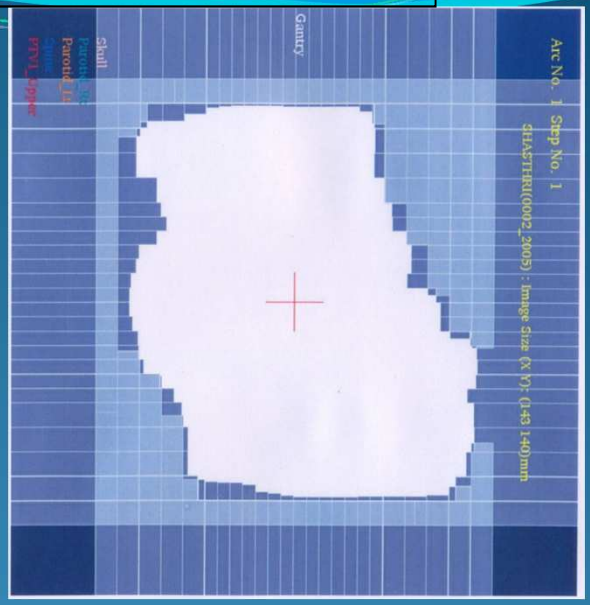
- At the 5%/5mm level examine sources of discrepancies. Proceed with treatment only if
  - Discrepancies can be resolved or
  - Region of error are clinically insignificant

- Beyond 5%/5 mm, Perform the measurement

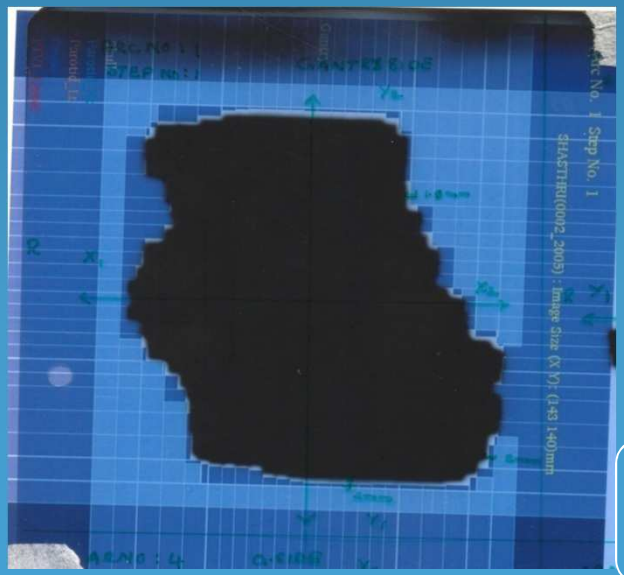
BEAM EYE VIEW VERIFICATION



RADIATION FIELD



TPS FIELD

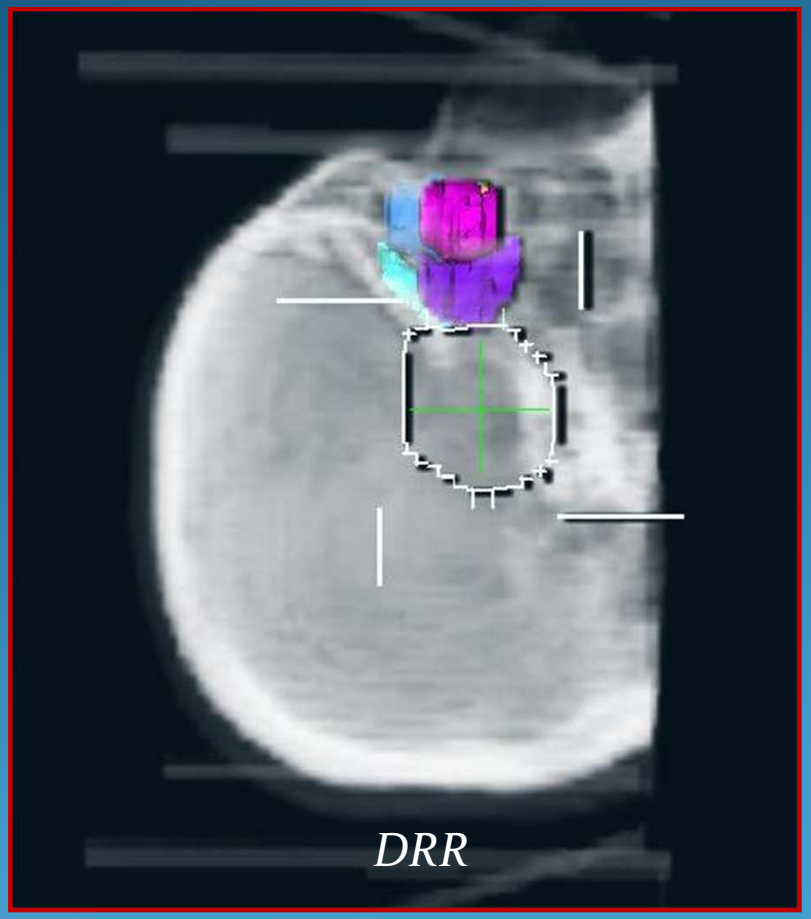


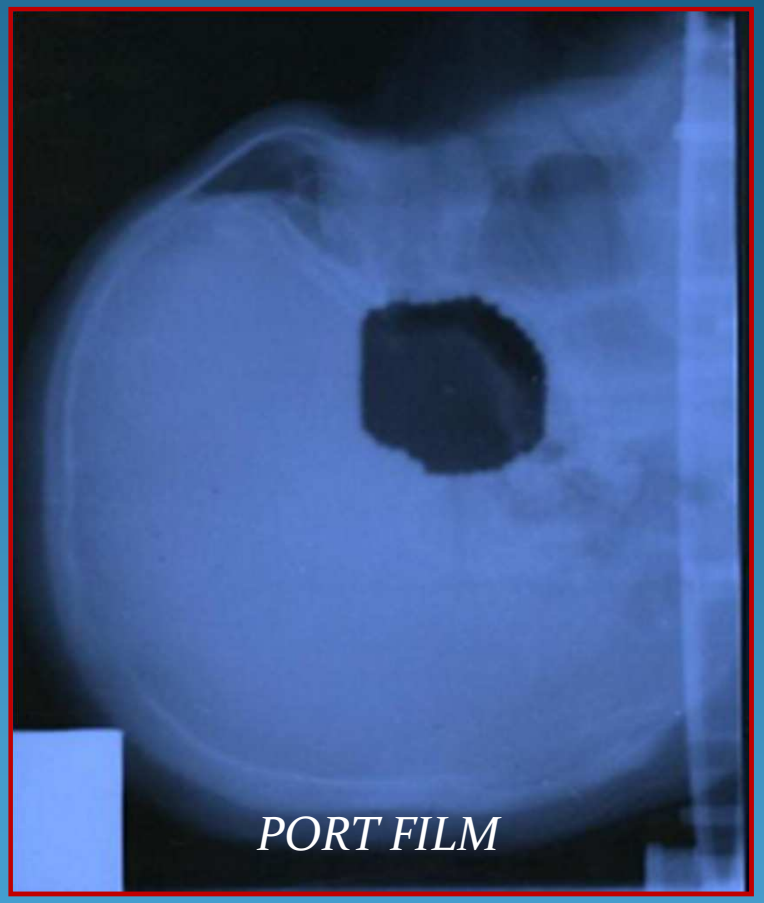
FUSION

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

REFFERENCES

"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.,
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THANK YOU.....