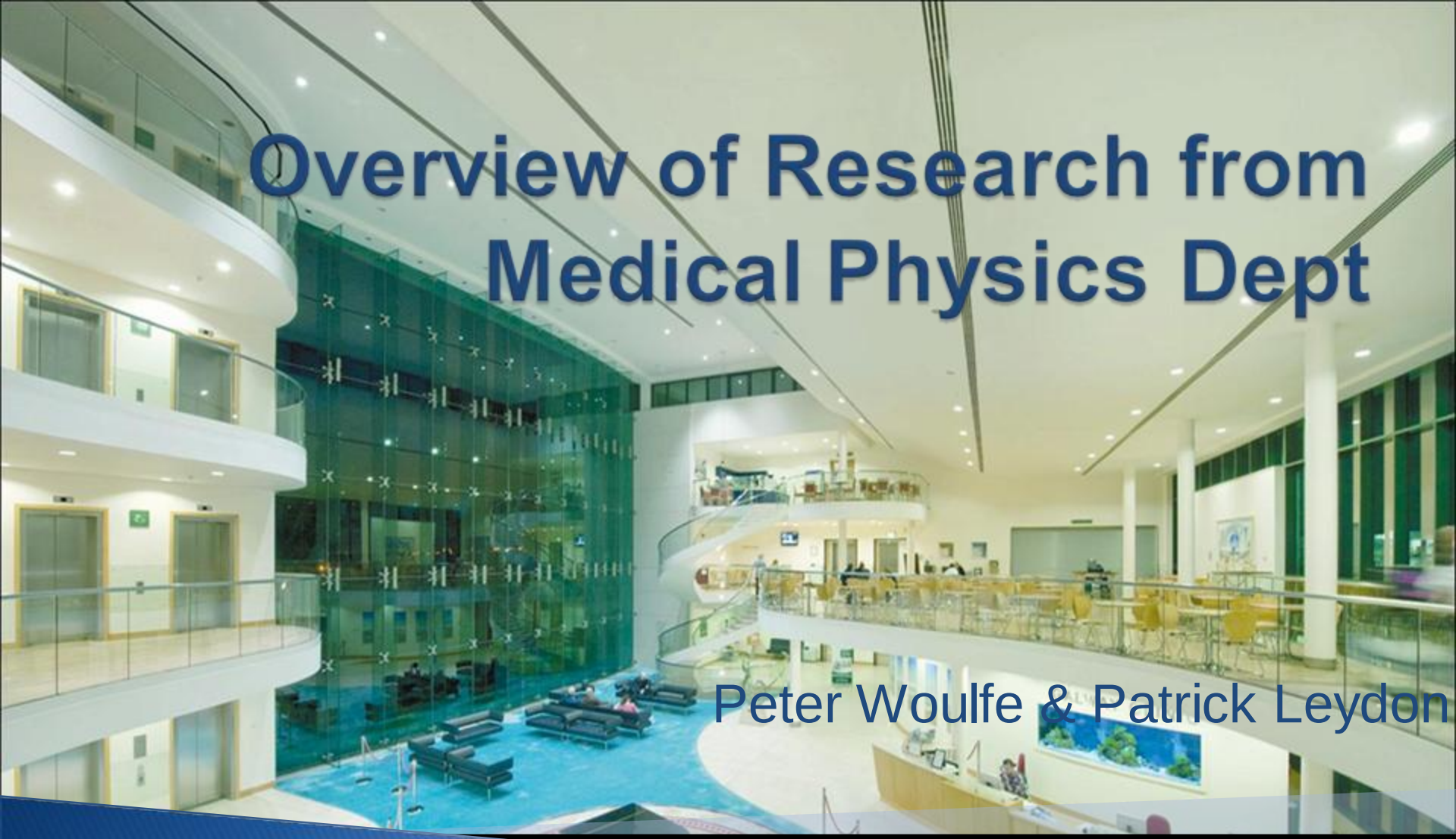


Overview of Research from Medical Physics Dept

Peter Woulfe & Patrick Leydon

GALWAY CLINIC

Optical Fibre Based Scintillation Probe for Radiotherapy Dosimetry

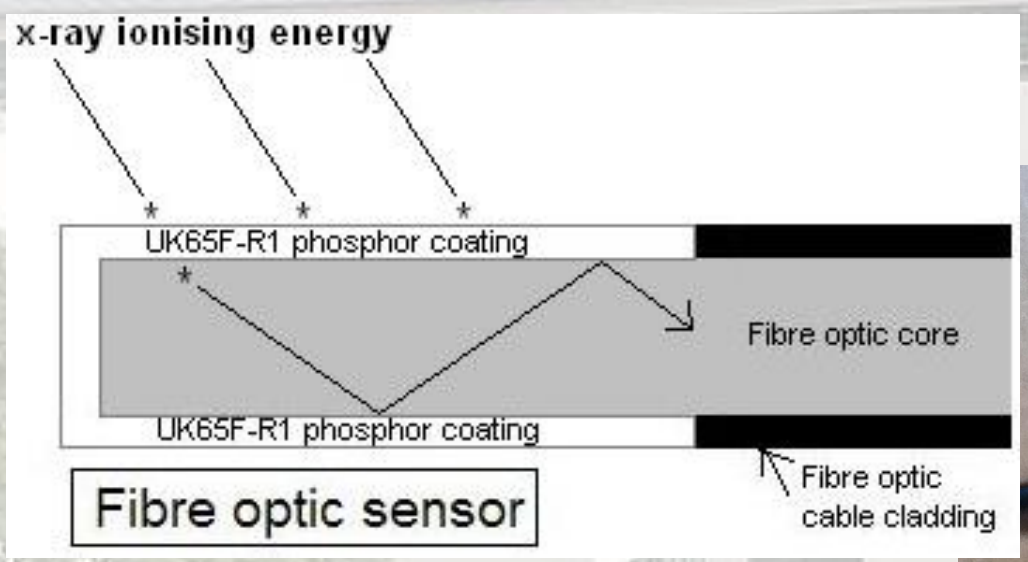
Introduction

- Need for Radiotherapy Dosimetry
- PMMA Optical Fibre Dosimetry
- Experimental Set-up
- Results
- Conclusions

Requirements for Dosimeter

- Monitor up to 15Gy with cGy resolution at dose rates 5 – 600 cGy/min (small field dosimetry)
- Real-time monitoring
- Small size
- Easy to handle
- Remote sensing region
- Distributed sensor with good spatial resolution

Sensor Design



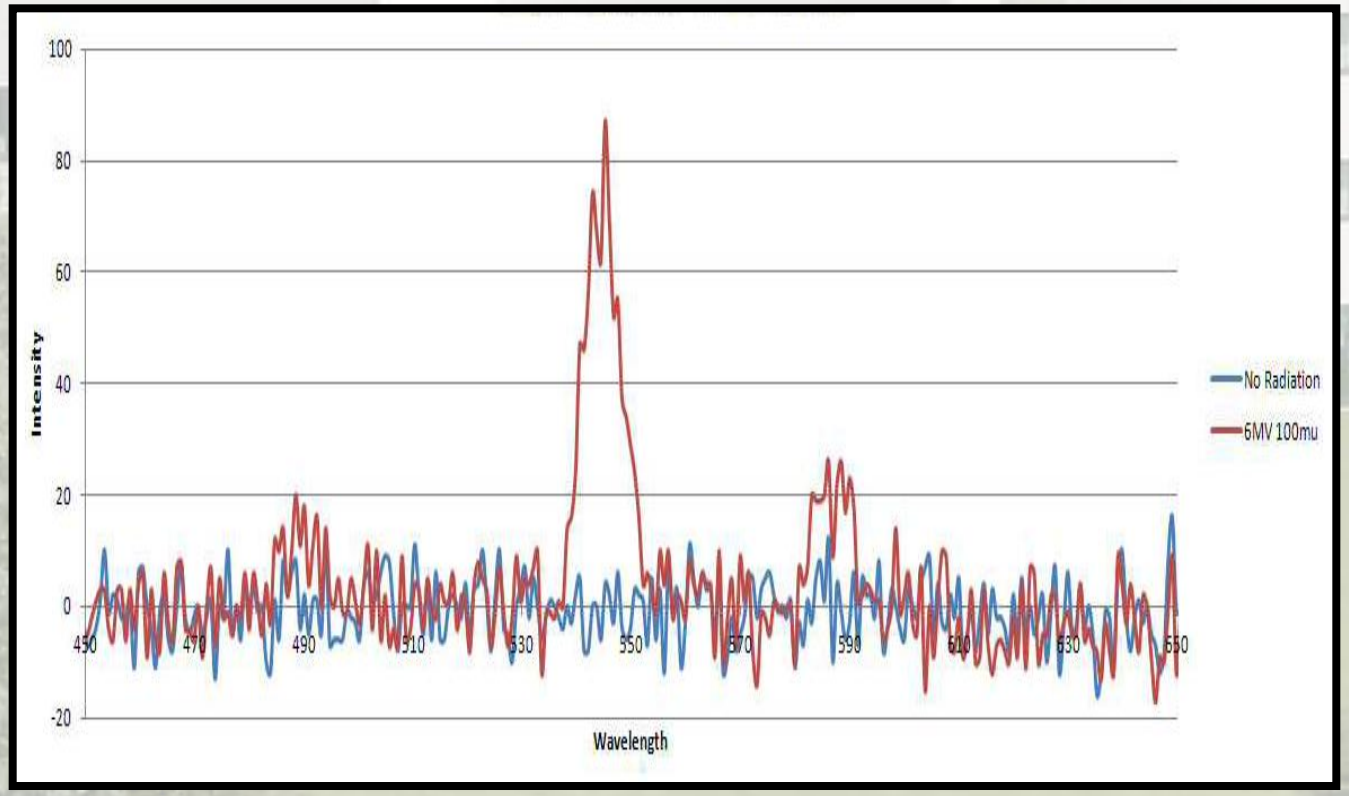
- PMMA based polymer optical fibres
- Coated with scintillating phosphor material: terbium-doped gadolinium oxysulfide ($Gd_2O_2S:Tb$)

Latest Tests
Galway Clinic, Ireland, May 2012

- Siemens Oncor Avant Garde, with 160 MLC and IGRT (Image Guided Radiotherapy) capabilities
- 6MV and 15MV photon energy
- Customised Wte Farmer Insert fabricated for fibre.

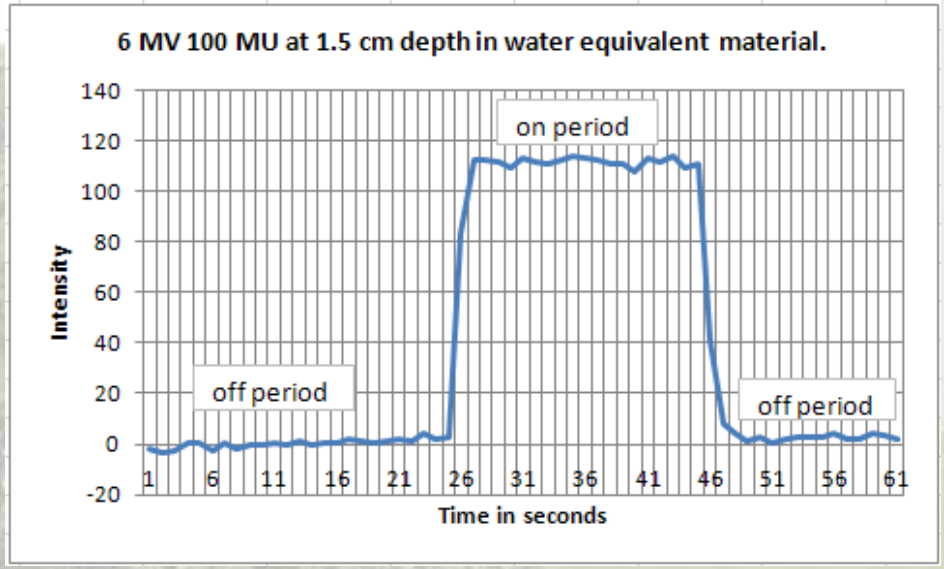
Emission Spectra

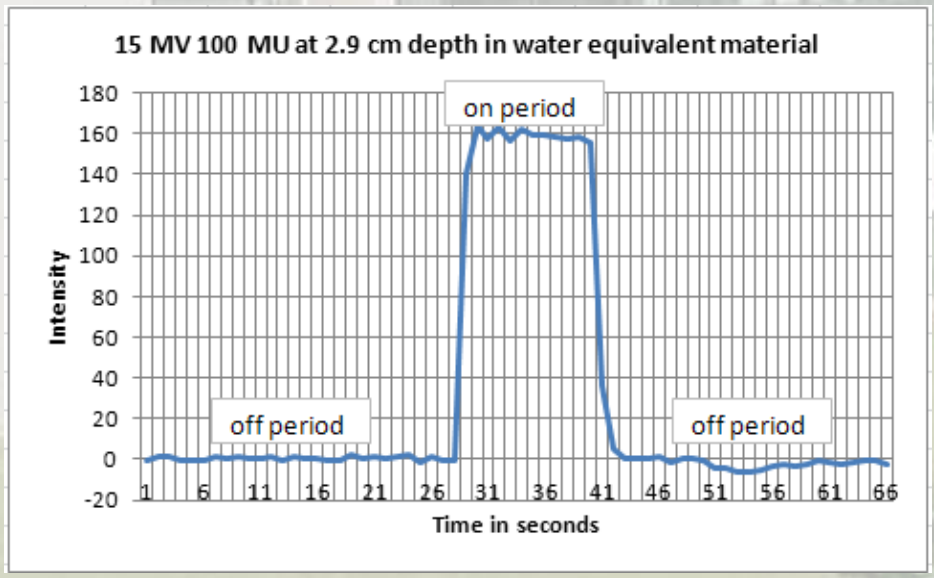
- Peak emission @ 544nm.
- Smaller peaks are also emitted at 490nm and 590nm



Clinical Dosimetry Results (1)

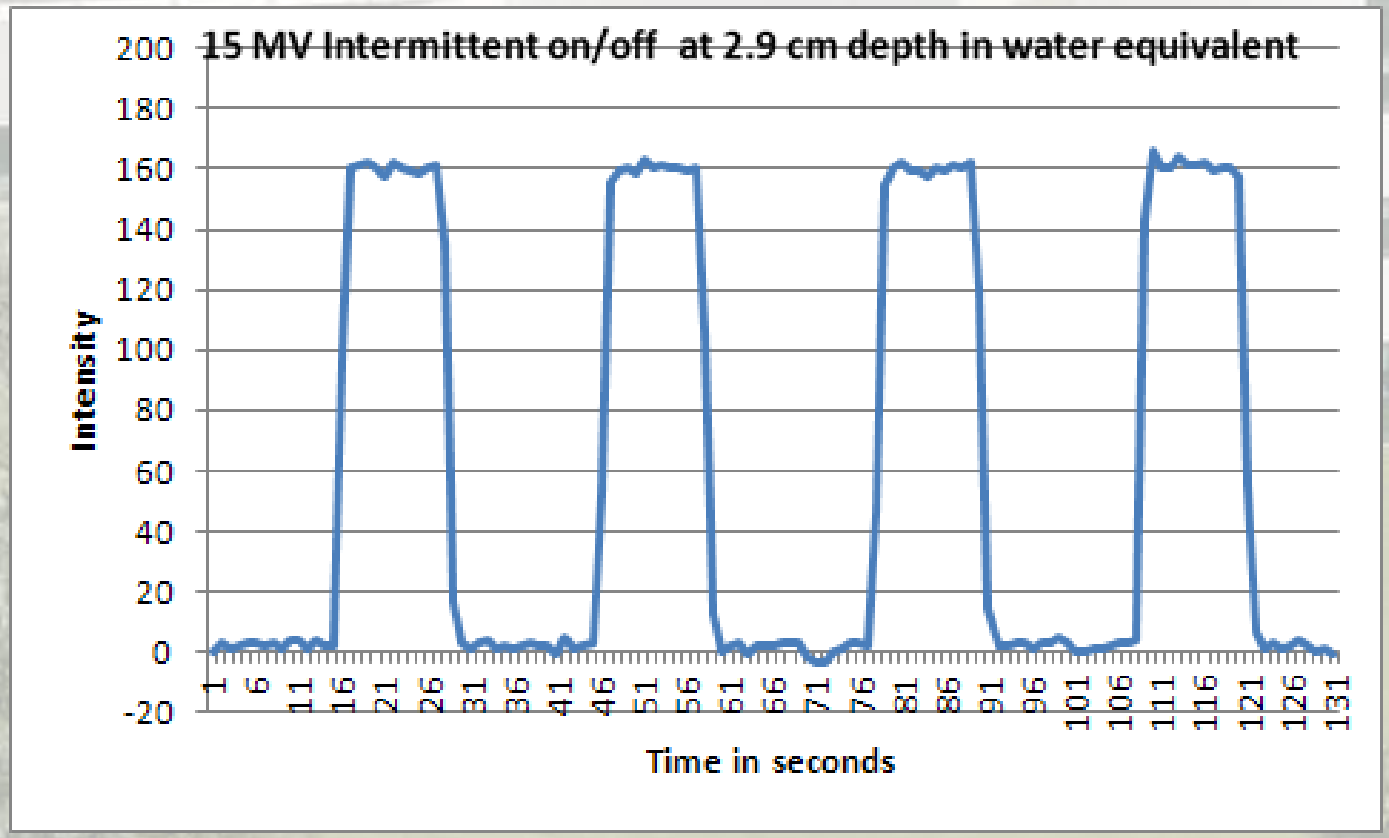
- Sensor time response to 6MV and 15MV at Dmax





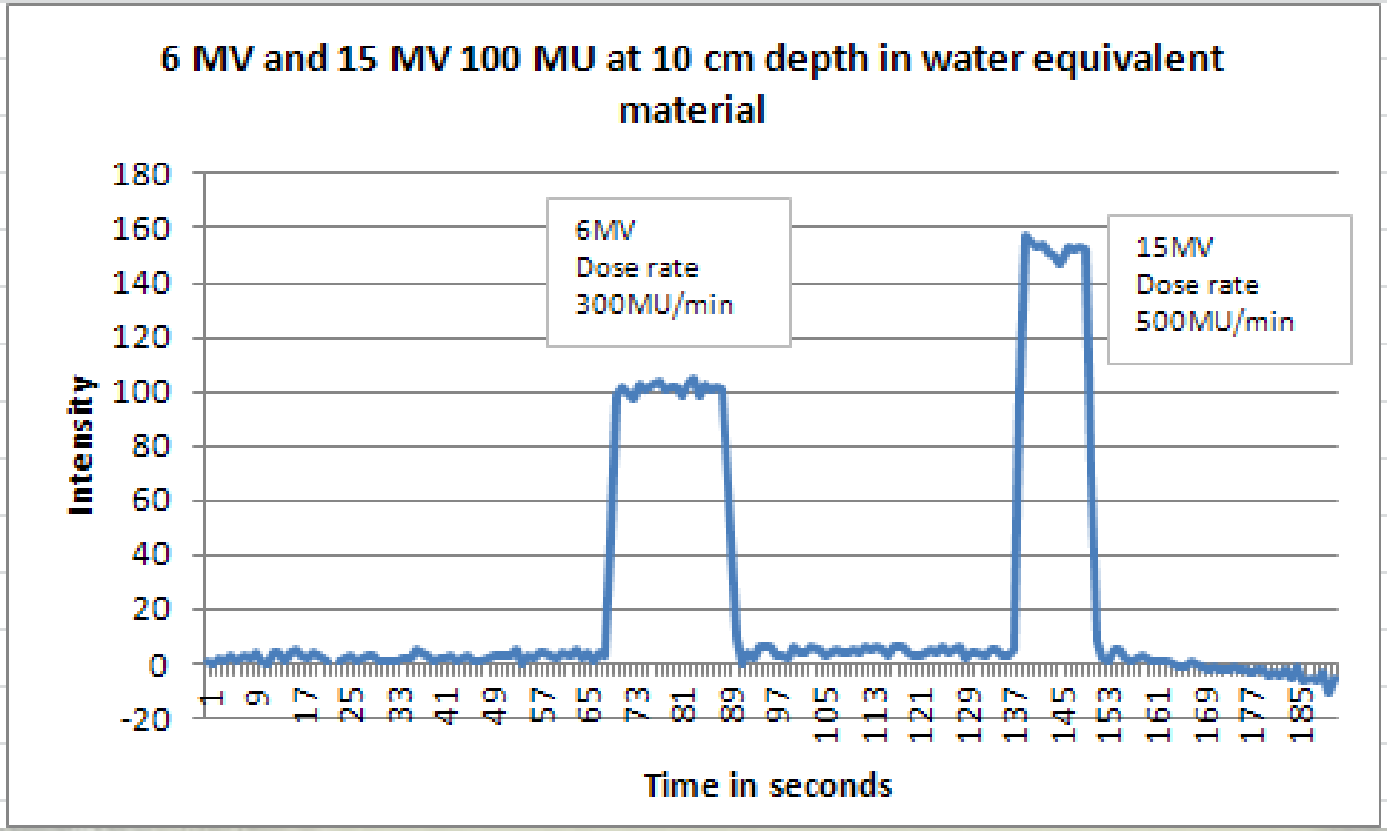
Clinical Dosimetry Results (2)

- Repeatability of sensor



Results (3)

- Response of the sensor to dose rate (calibrated 1 Gy dose)



Conclusions

- Demonstrated use of optical fibre sensor for measurement of low doses of ionising radiation from clinical Linacs
- Sensitivity is good for typical clinical dose rate levels although it could be improved for enhanced signal to noise performance and thus greater accuracy
- To improve sensitivity:
  - improve coating method of scintillation material on to the optical fibre
  - optimise the coating geometry

Acknowledgements

This research was funded by European Commission under the 7th Framework Programme through the 'Marie Curie Re-integration' action of the 'Peoples' Programme, (PERG04-2008-239207)

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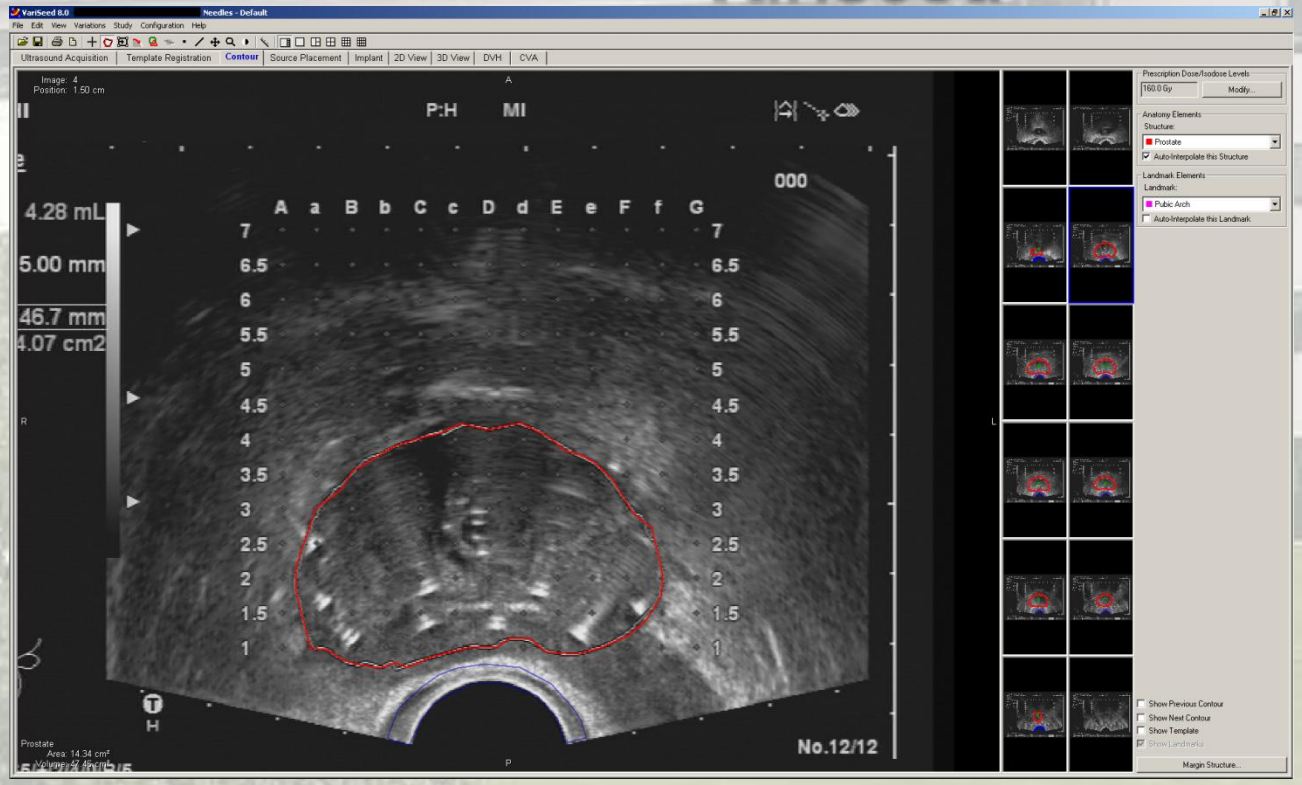
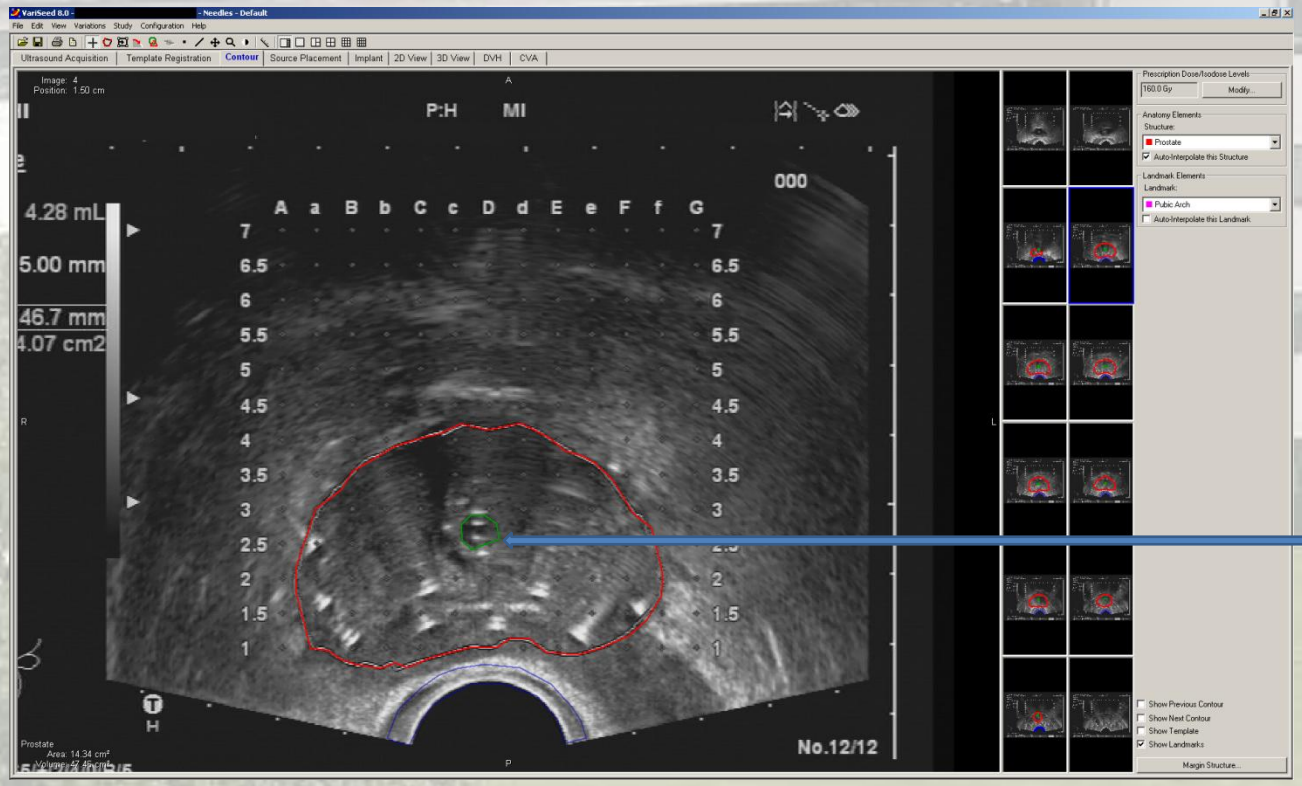
Cone Beam CT for Transperineal Interstitial Permanent Prostate Brachytherapy

Variseed



OARs contoured by the physicist and doctor

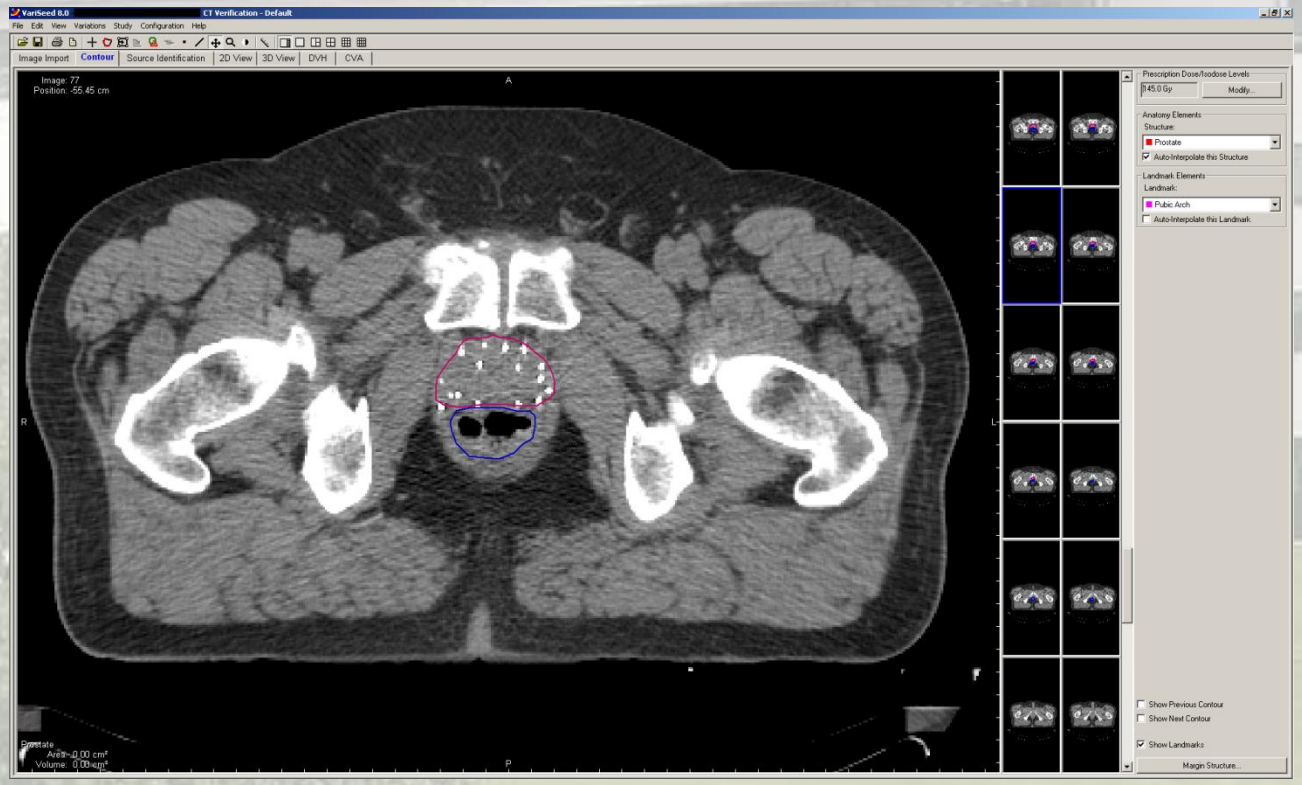
Variseed



OARs contoured by the physicist and doctor

Urethra contour while patient is catheterized

Post Implant CT



Normally a 4 weeks after seed implantation.

The urethra is almost impossible to see, so no contouring is carried out.

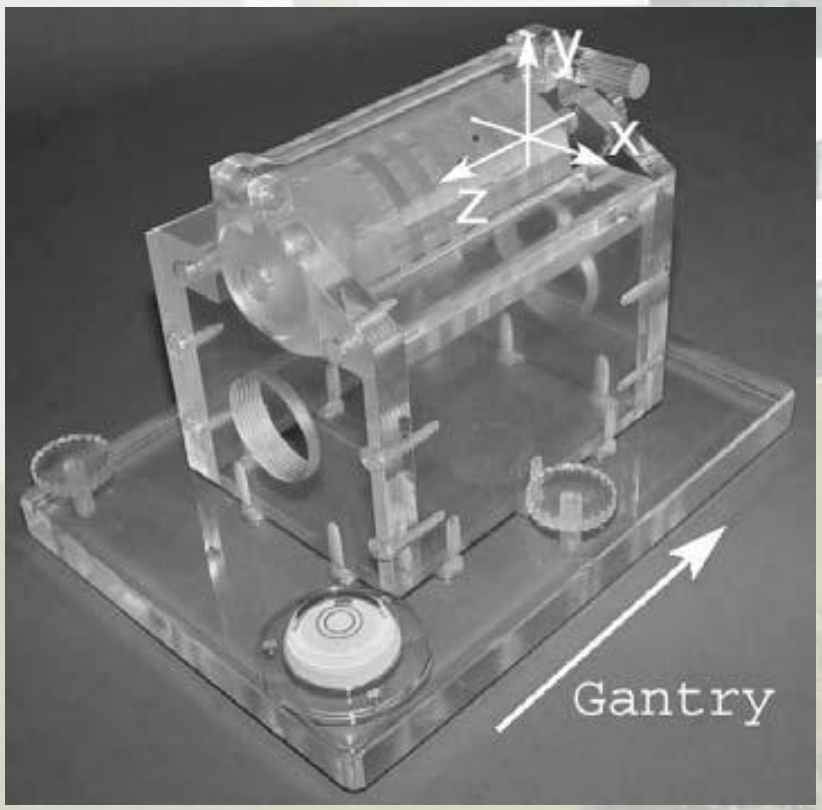
What is our dose to the urethra??

Cone Beam CT

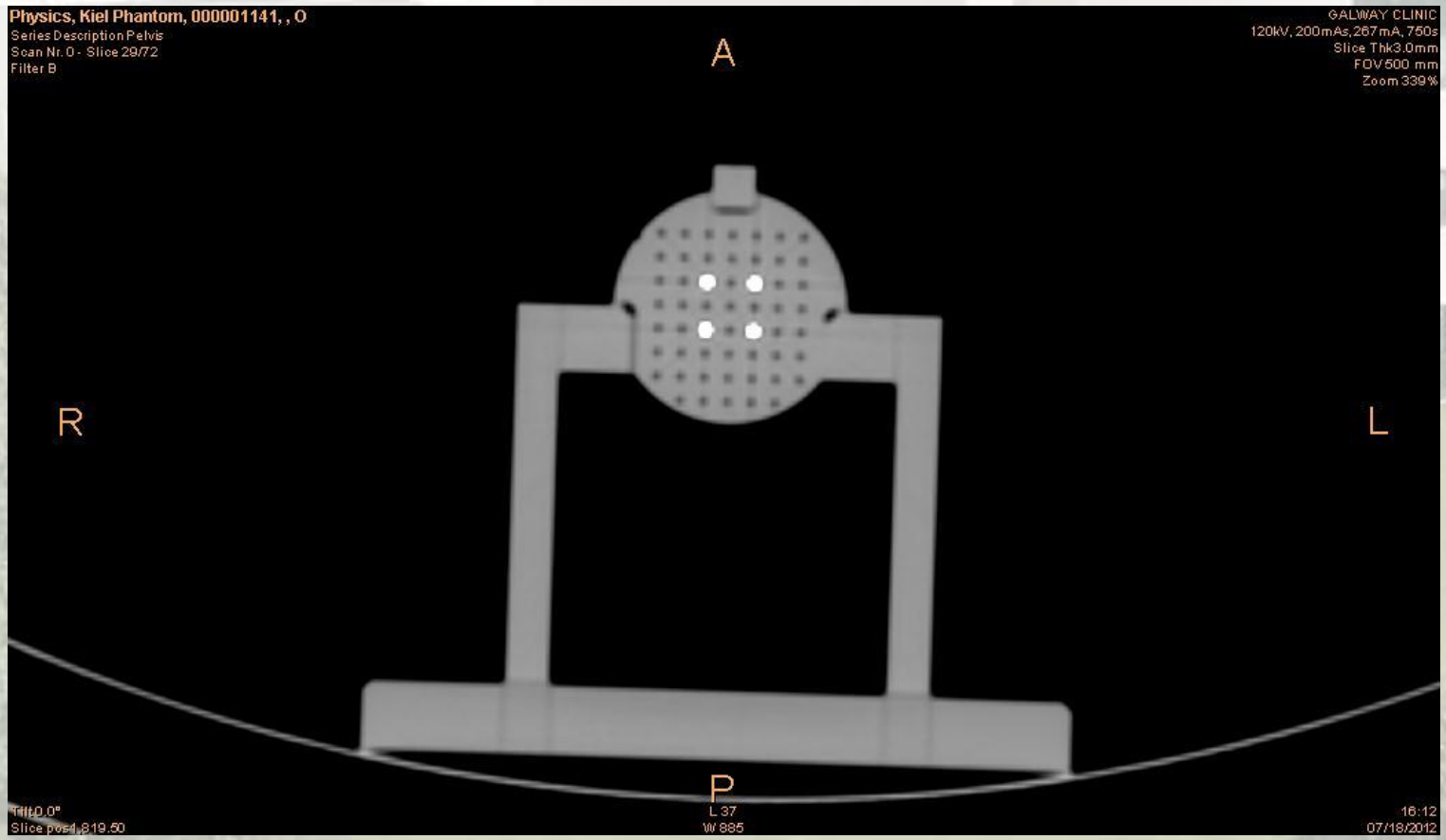
- Philips Allura Xper
- Main Applications in Cardiovascular procedures.
- Possible use in brachytherapy?

Kiel Phantom

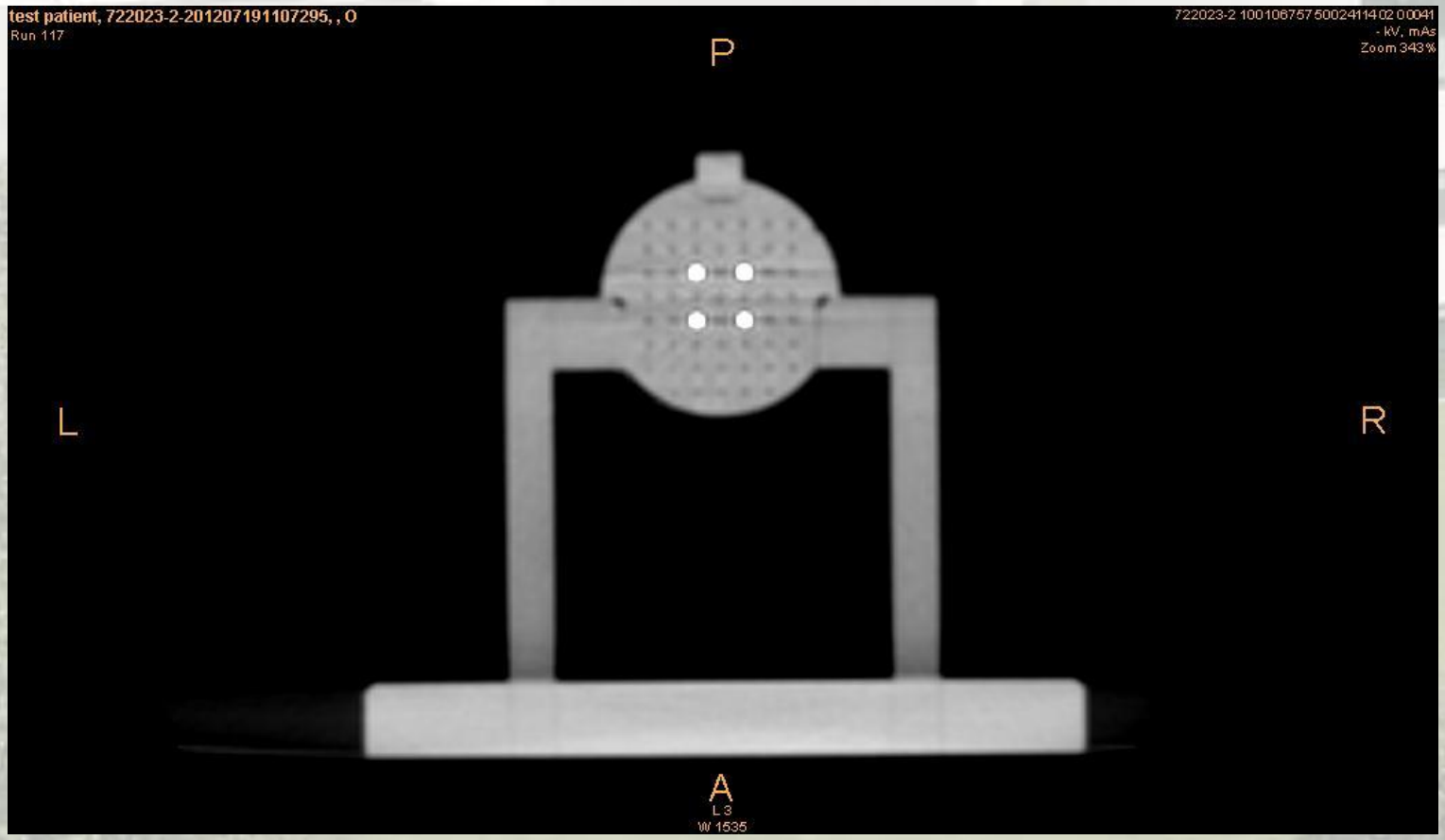
- Inserts allow for various “dummy” seed positions and orientations.
- Initial comparisons with CT are promising.



CT


Physics, Kiel Phantom, 000001141, , O
Series Description Pelvis
Scan Nr. 0 - Slice 29/72
Filter B
GALWAY CLINIC
120kV, 200mAs, 267 mA, 750s
Slice Thk 3.0mm
FOV 500 mm
Zoom 339%
A
R
L
P
Tilt 0.0°
Slice pos! 819.50
L 37
W 885
16:12
07/18/2012

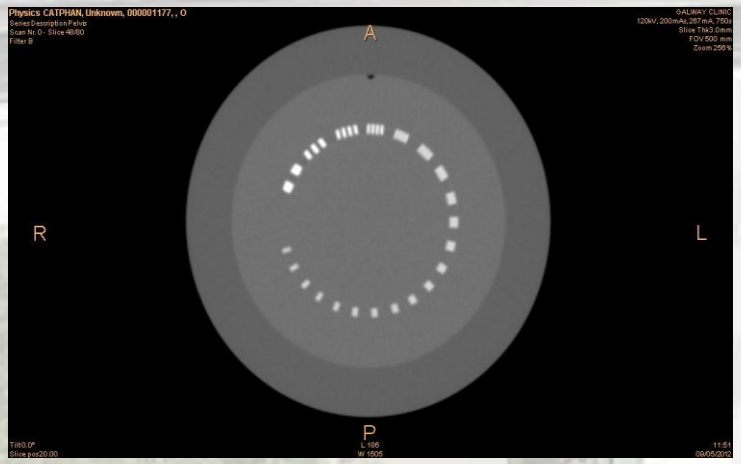
CBCT

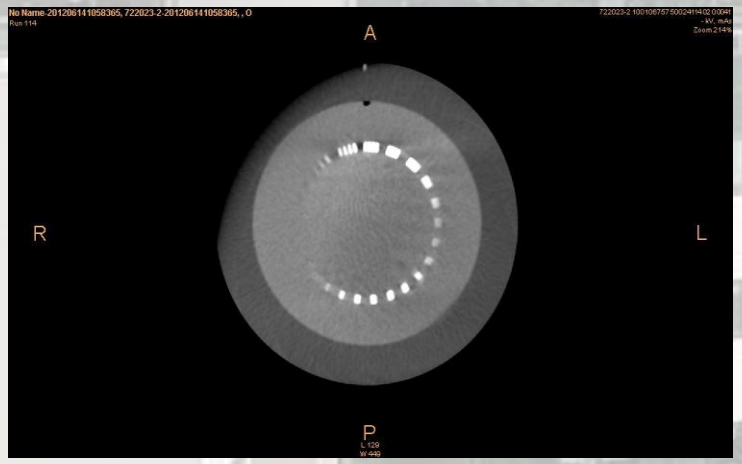

test patient, 722023-2-201207191107295, , O
Run 117
722023-2 100108757 500241140 2 0 0041
- kV, mAs
Zoom 343%
P
L
R
A
L 3
W 1535

CT

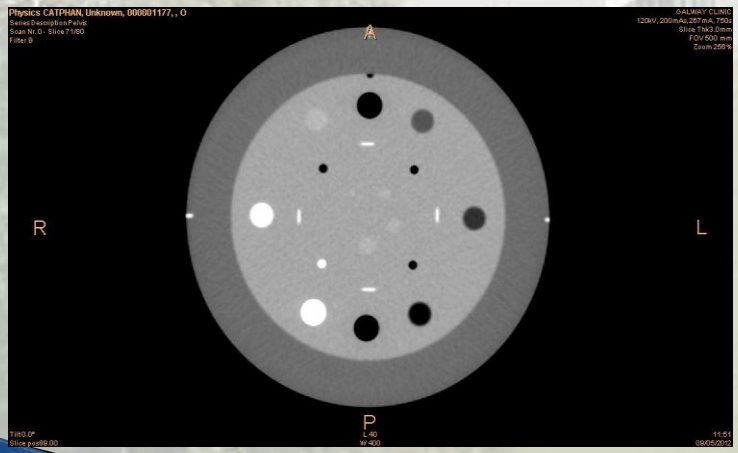
CBCT

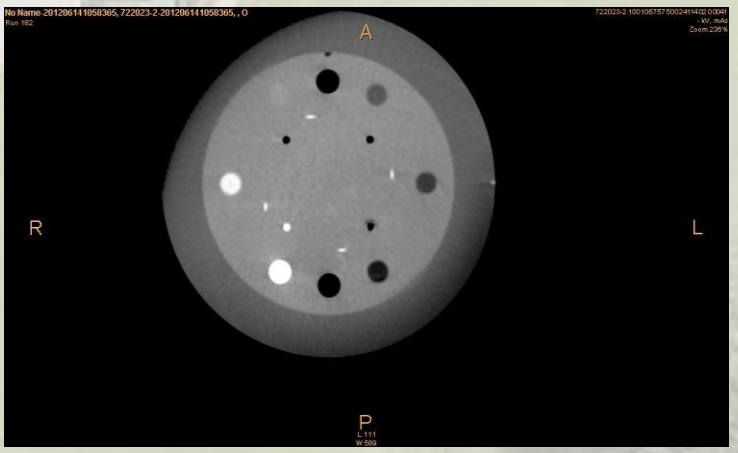
Resolution





High Contrast





For the Future:

- Much more Quantitative Image comparison.
- Rando Phantom comparison.
- Comparison of CT and CBCT contoured volumes in Variseed.
- Full Dosimetry Analysis.