Guy's and St Thomas'
NHS Foundation Trust

Commissioning for HDR Prostate Brachytherapy and Early Clinical Experience

Rissa Cunningham

Overview

Guy's and St Thomas' NHS Foundation Trust

- GSTT has a great deal of experience in LDR Brachytherapy
- HDR prostate service at GSTT for boosts went clinical in November 2022
- Treated 5 patients so far

HDR prostate procedure

Ultrasound guided insertion of 6F flexible, hollow catheters into the prostate using the Martinez template

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CT and MRI scans

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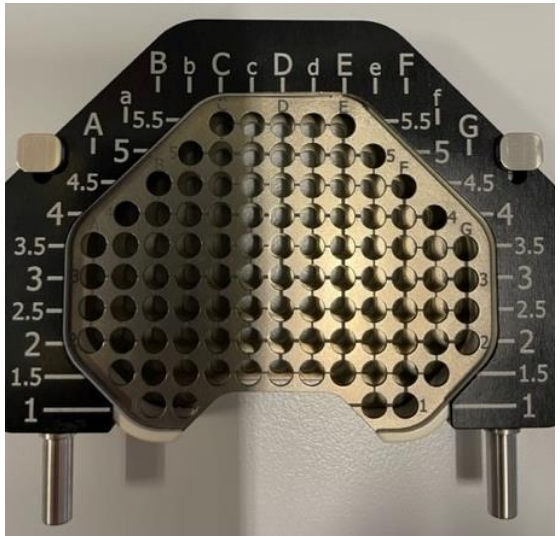
Scans fusion and Clinician voluming of prostate and OARs



Clinician approval and plan delivery

←

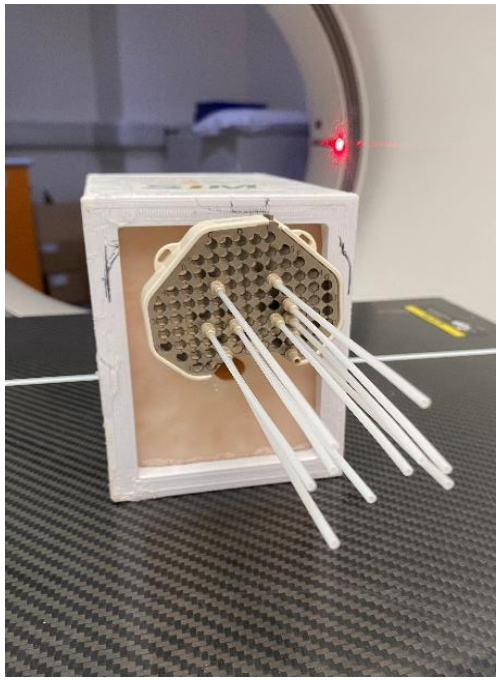
Physics Plan check, verification CT and plan export to Afterloader

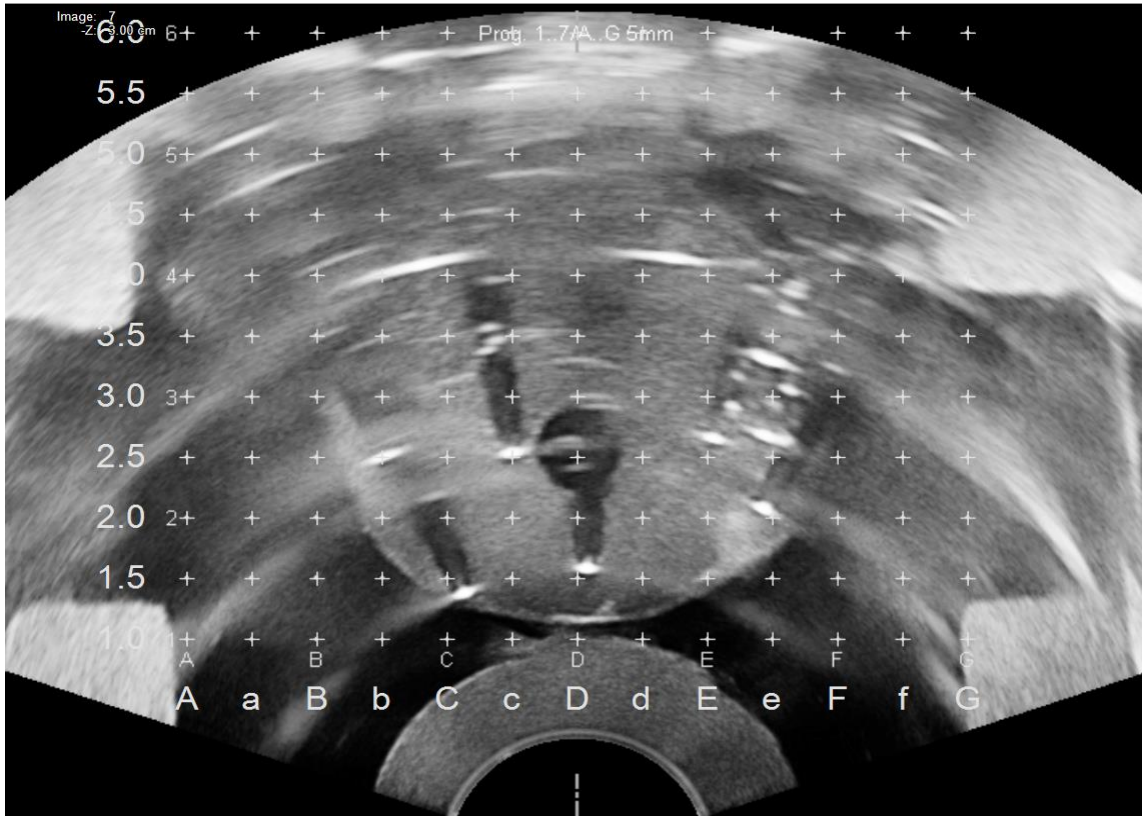
←

Catheters connected to the Afterloader via transfer tubes and the plan delivery using Iridium-192 source

Phantom simulation

- Using a SIM prostate phantom, the catheters were inserted into the ‘prostate’ guided by the ultrasound
- The phantom was CT and MRI scanned

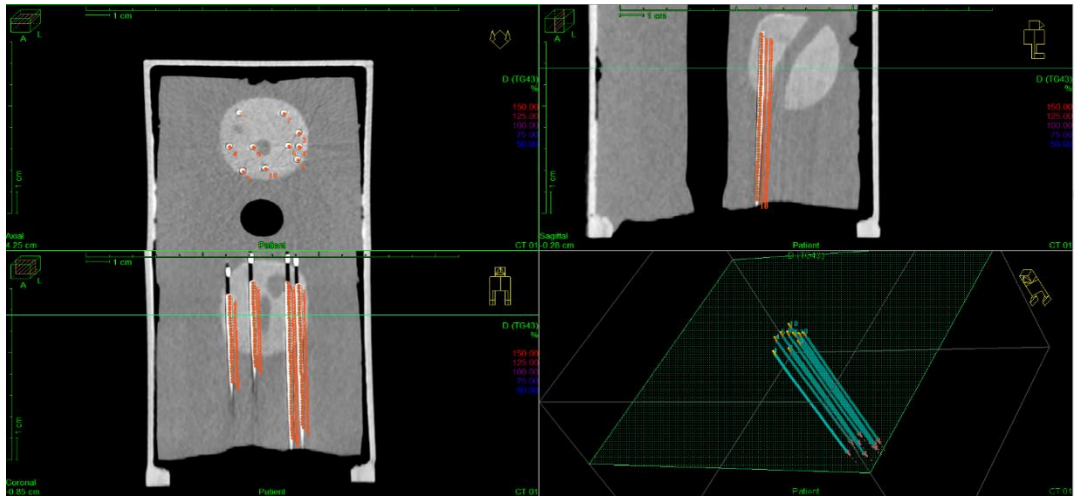


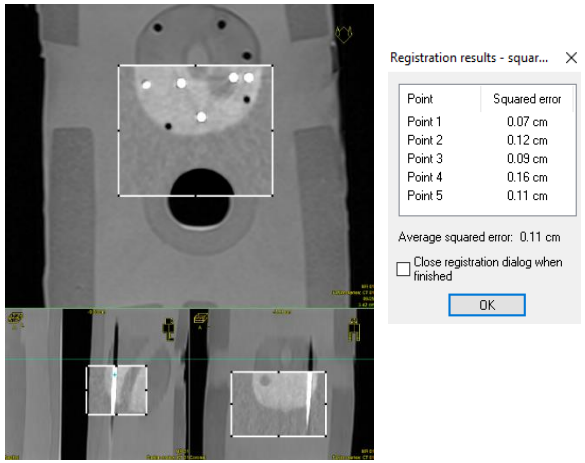


Phantom simulation

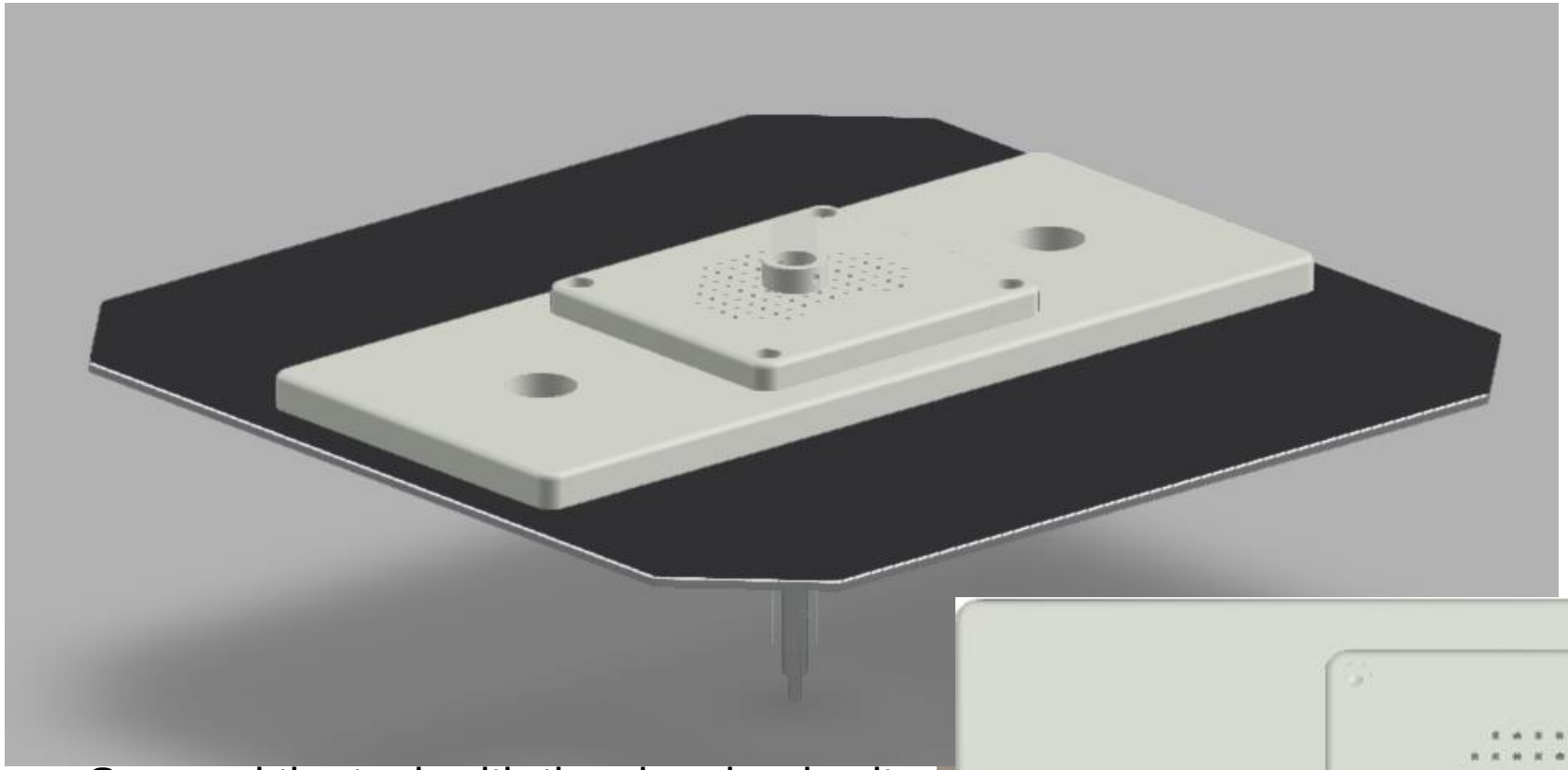
The phantom was used during commissioning to:

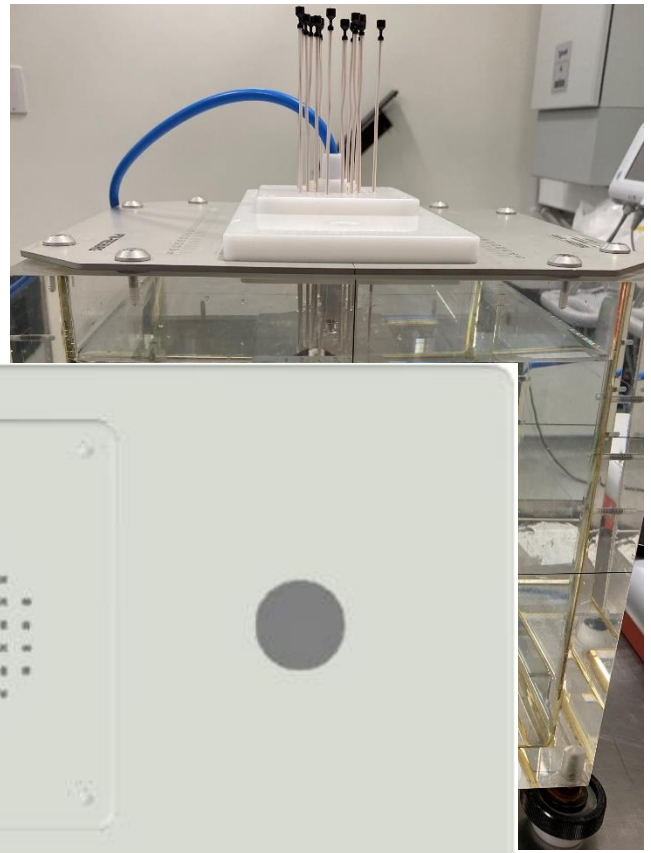
- Test the fusion options in Oncentra
- Needle reconstruction
- Design a template for the inverse planning optimisation function

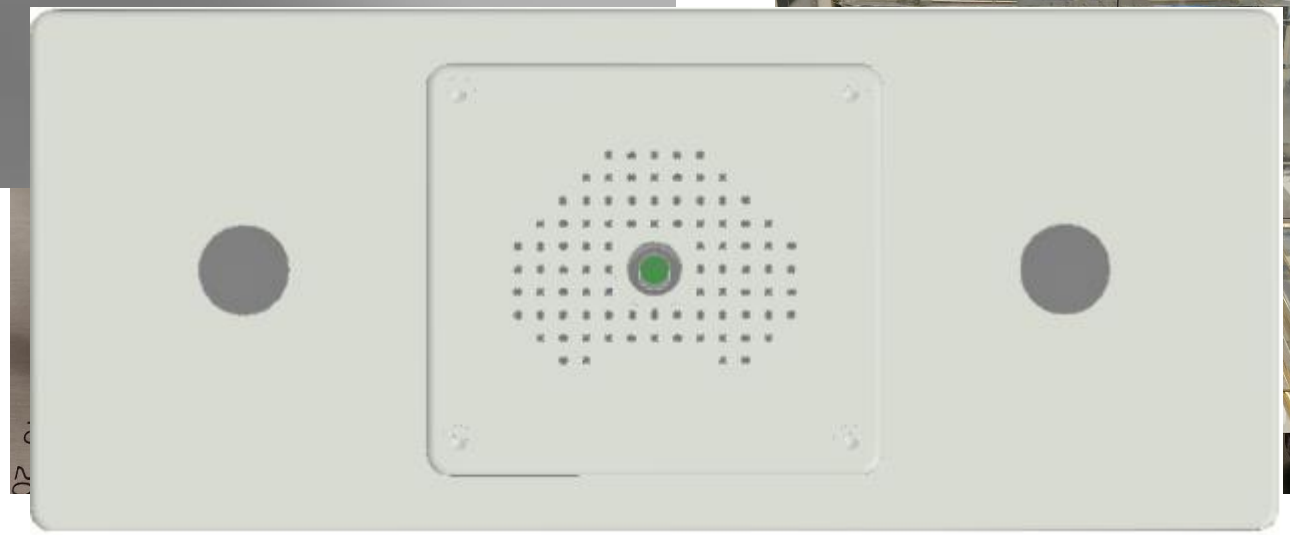




ionisation







- Scanned the tank with the chamber in situ and marker wires in the catheters to define the first dwell position
- Imported the scan into Oncentra TPS and simulated a plan

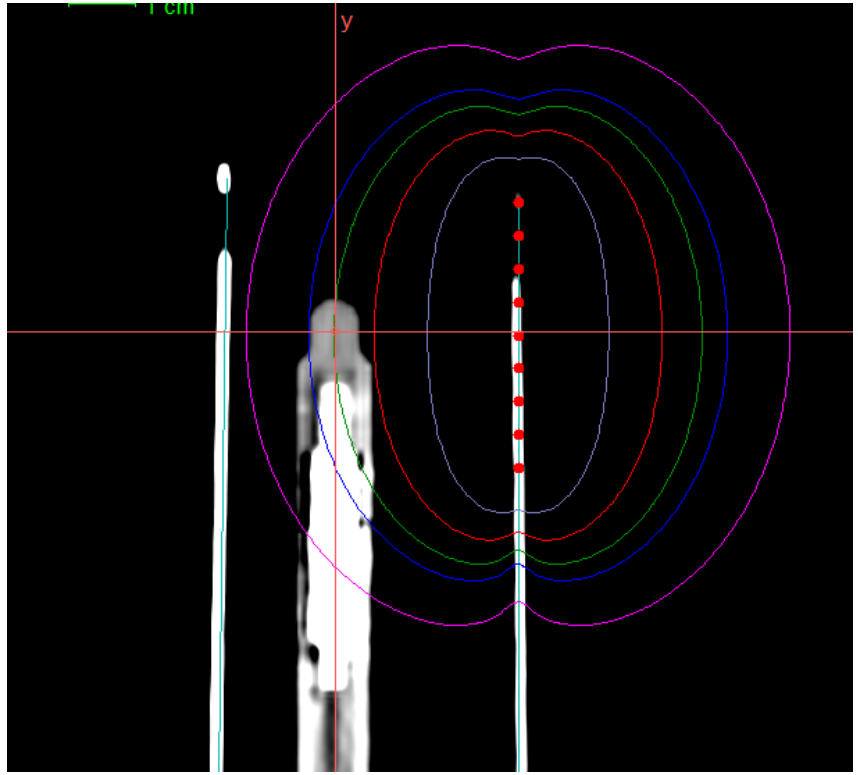
Creating treatment plans in Oncentra TPS

3 plans were created in Oncentra TPS for chamber measurements in the water filled tank:

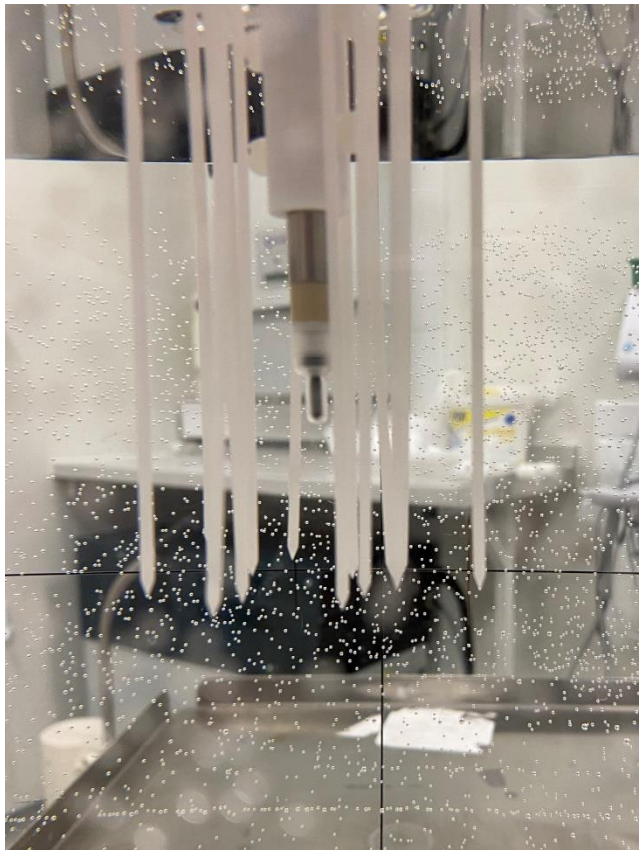
1. Calibration coefficient plan: one catheter activated and normalised to the pinpoint's effective point of measurement to a known dose of 2Gy

2. Rechecked by activating a different catheter with the final calibration factor taken by their average

3. Clinical plan created using the inverse planning optimisation function



Water tank measurements



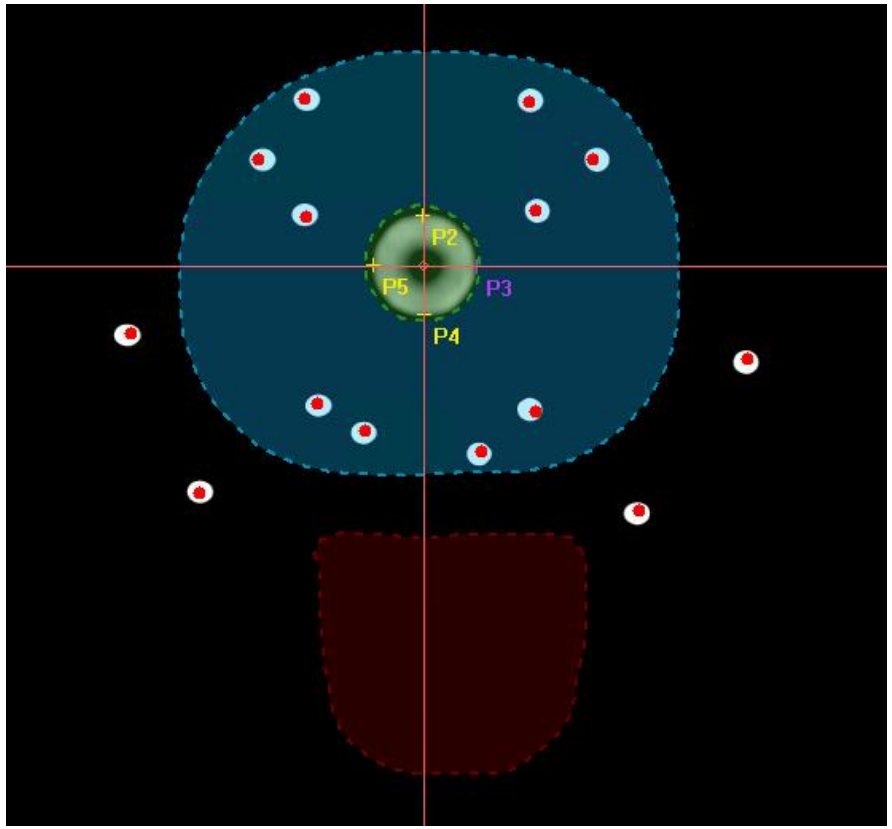
9% dose difference between the chamber reading and the TPS calculated dose for the clinical plan

Possible reason for the deviation:

- Energy dependence with the chamber used

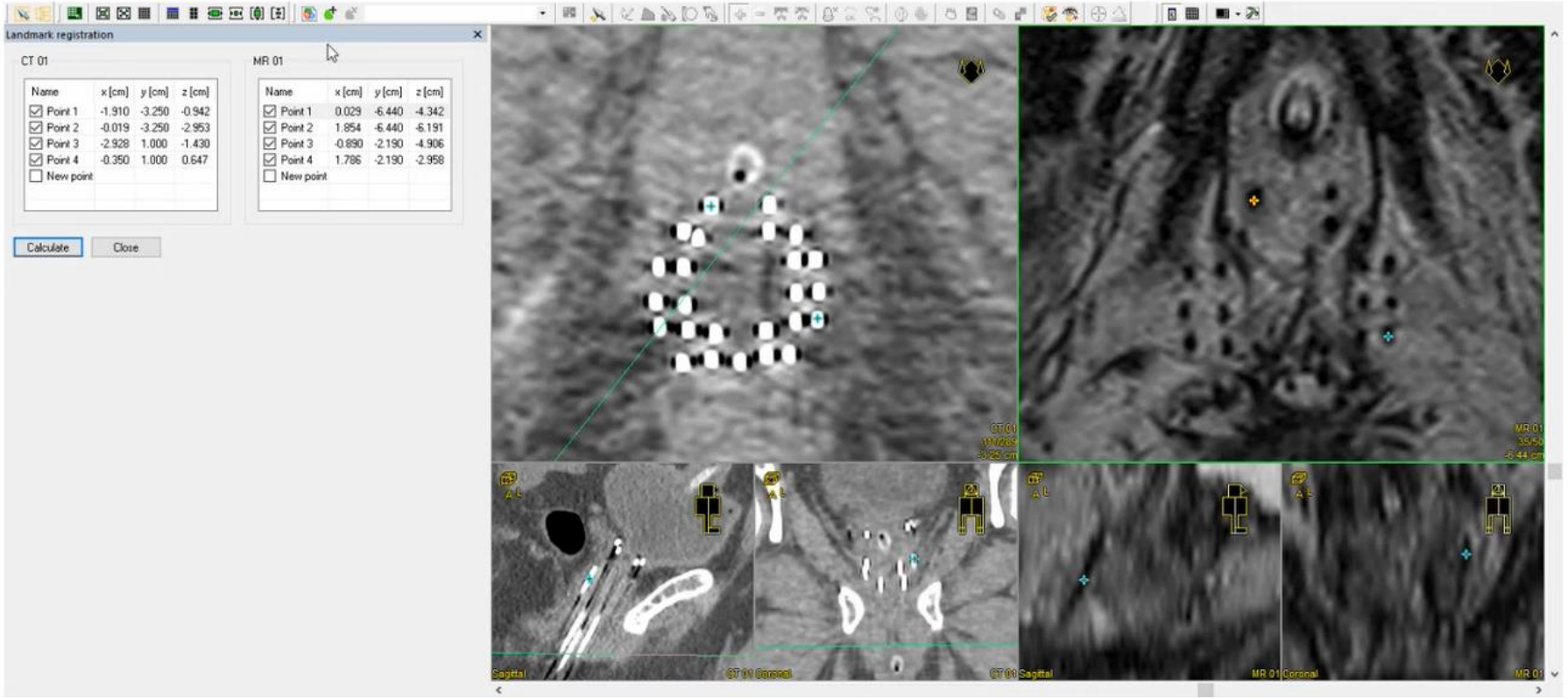
TLD measurements in the tank

- Verified the tank measurements using TLDs as the measuring device
- Delivered the same plans as mentioned before (calibration plan and clinical plan)
- 5% dose difference between the TPS dose and TLD readings
- A previous IAEA audit confirmed an absolute dose difference with other centres of 0.5%

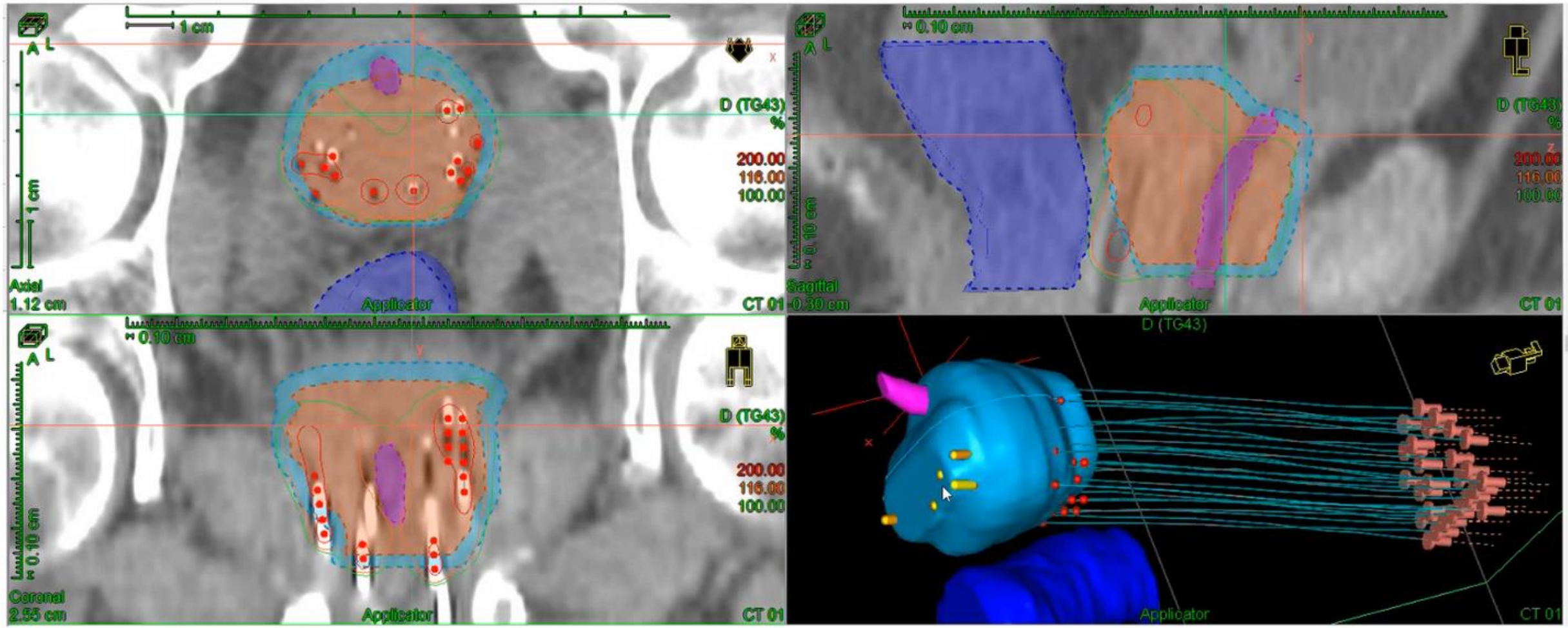


Early Clinical Challenges- fusion challenges

- Standard method on Oncentra at GSTT: Landmark fusion
- Worked well on the first and second patient but ran into problems on the third patient
- Fusing in Eclipse- MRI scan taken a week before treatment to save time on the day



Early Clinical Challenges- Plan optimisation



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DVH metrics

ROI	Dose [%]	Dose [Gy]	Volume [%]	Volume [ccm]
CTV				
CTV	**100.00**	15.0000	93.33	32.51
CTV	72.08	10.8122	**100.00**	34.83
CTV	**150.00**	22.5000	34.84	12.14
CTV	**200.00**	30.0000	12.03	4.19
CTV	106.23	15.9340	**90.00**	31.35
PTV				
PTV	**100.00**	15.0000	83.69	43.14
PTV	58.61	8.7917	**100.00**	51.55
PTV	**150.00**	22.5000	29.63	15.27
PTV	**200.00**	30.0000	10.34	5.33
PTV	90.48	13.5715	**90.00**	46.39
Rectum				
Rectum	95.73	14.3602	0.03	**0.01**
Rectum	**100.00**	15.0000	0.01	0.00
Rectum	100.00	**15.0000**	0.01	0.00
Rectum	51.33	7.6991	6.15	**2.00**
Urethra				
Urethra	114.15	17.1218	7.56	**0.10**
Urethra	113.66	17.0486	**10.00**	0.13
Urethra	**140.00**	21.0000	-	-
Urethra	150.00	**22.5000**	-	-
Urethra	109.98	16.4963	**30.00**	0.40

- PTV coverage low D90 = 90-96% for our 5 patients so far (target is 100%)
- CTV coverage has been good D90 well over 100% for all patients so far
- Limiting OAR has been the urethra in all cases:
  - D10 < 17.5Gy (116%)
  - D30 < 16.5Gy (130%)

Likely caused by needles not being pushed in far enough

Conclusions

- Implemented and commissioned a pathway for HDR Brachytherapy for prostates
- 5 patients successfully treated
- Continue to improve our method to fuse the CT and MRI scans
- Continue to optimise needle placement

Thank you for listening

Any questions?

Rissa.Cunningham@gstt.nhs.uk