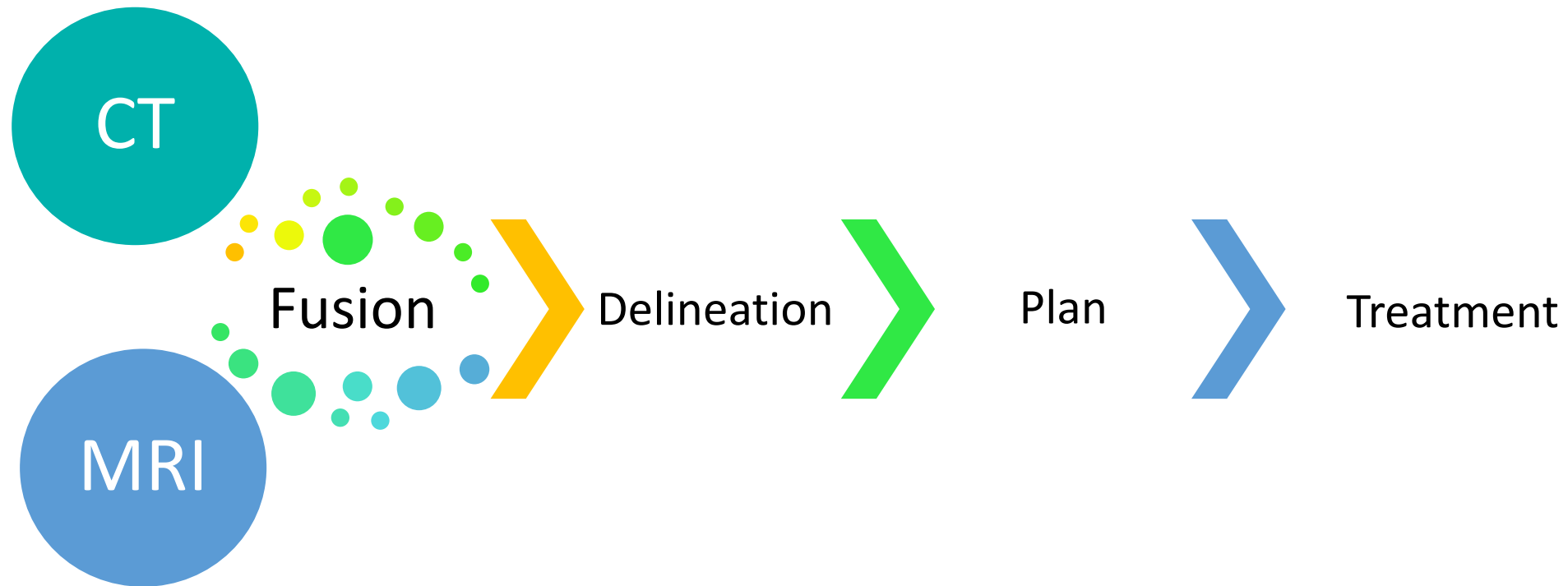


# Prostate MR-only radiotherapy: are fiducial markers necessary?

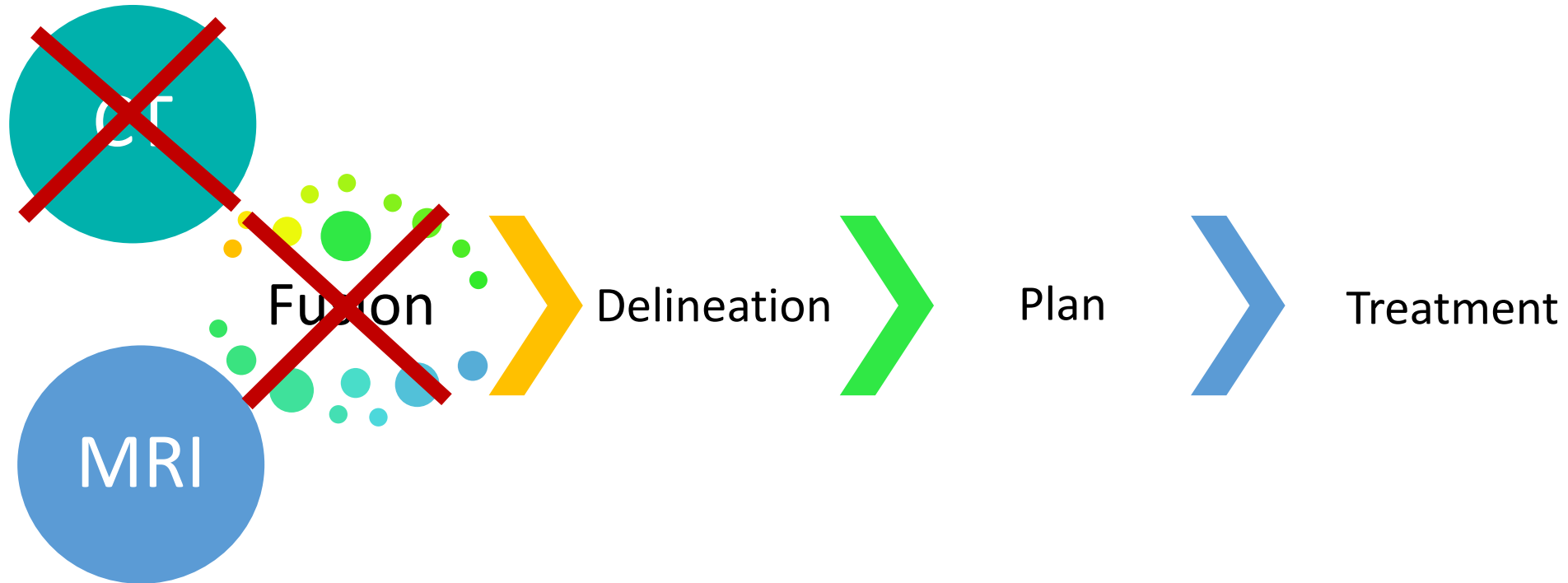
Rachel Brooks-Pearson

Research and Development Clinical Specialist Radiographer

# Current Radiotherapy Pathway

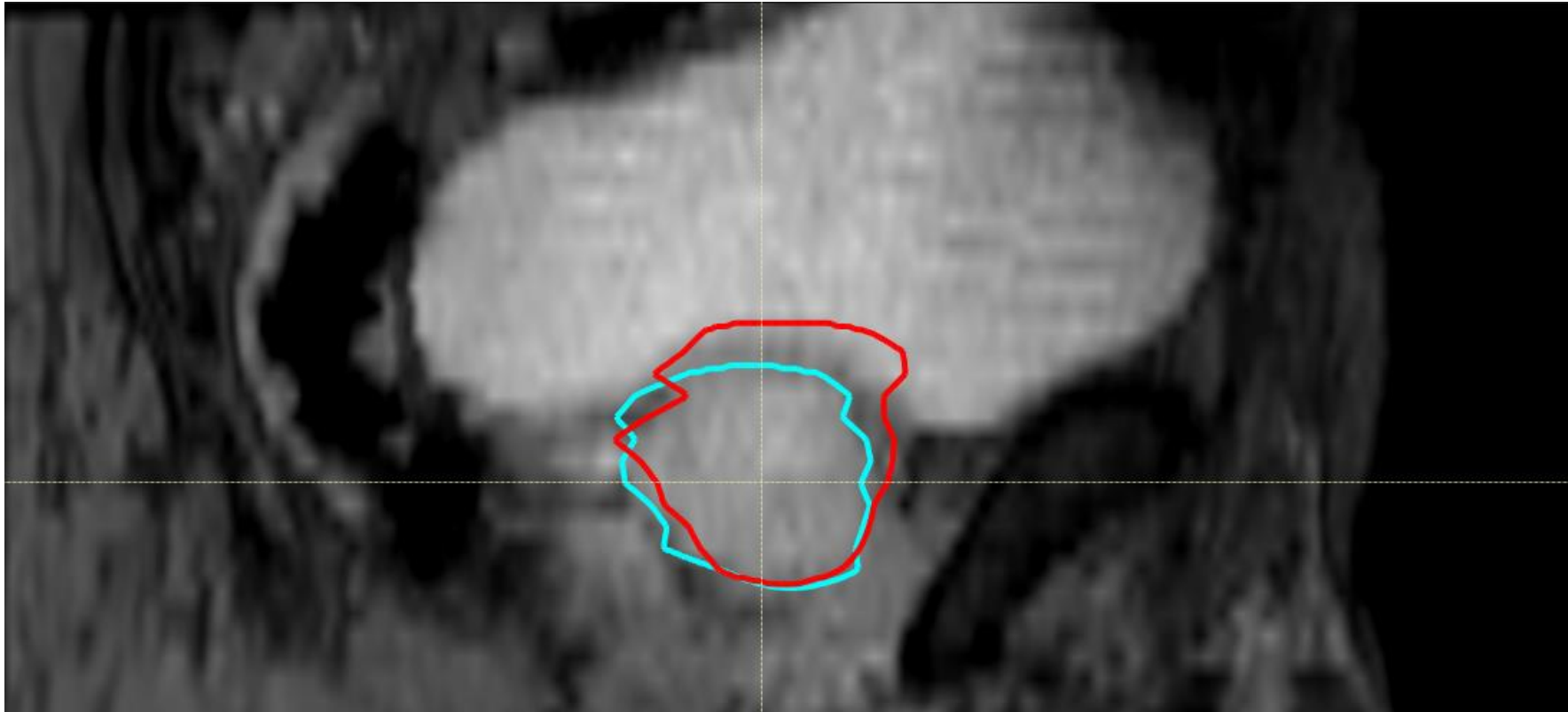


# Current Radiotherapy Pathway



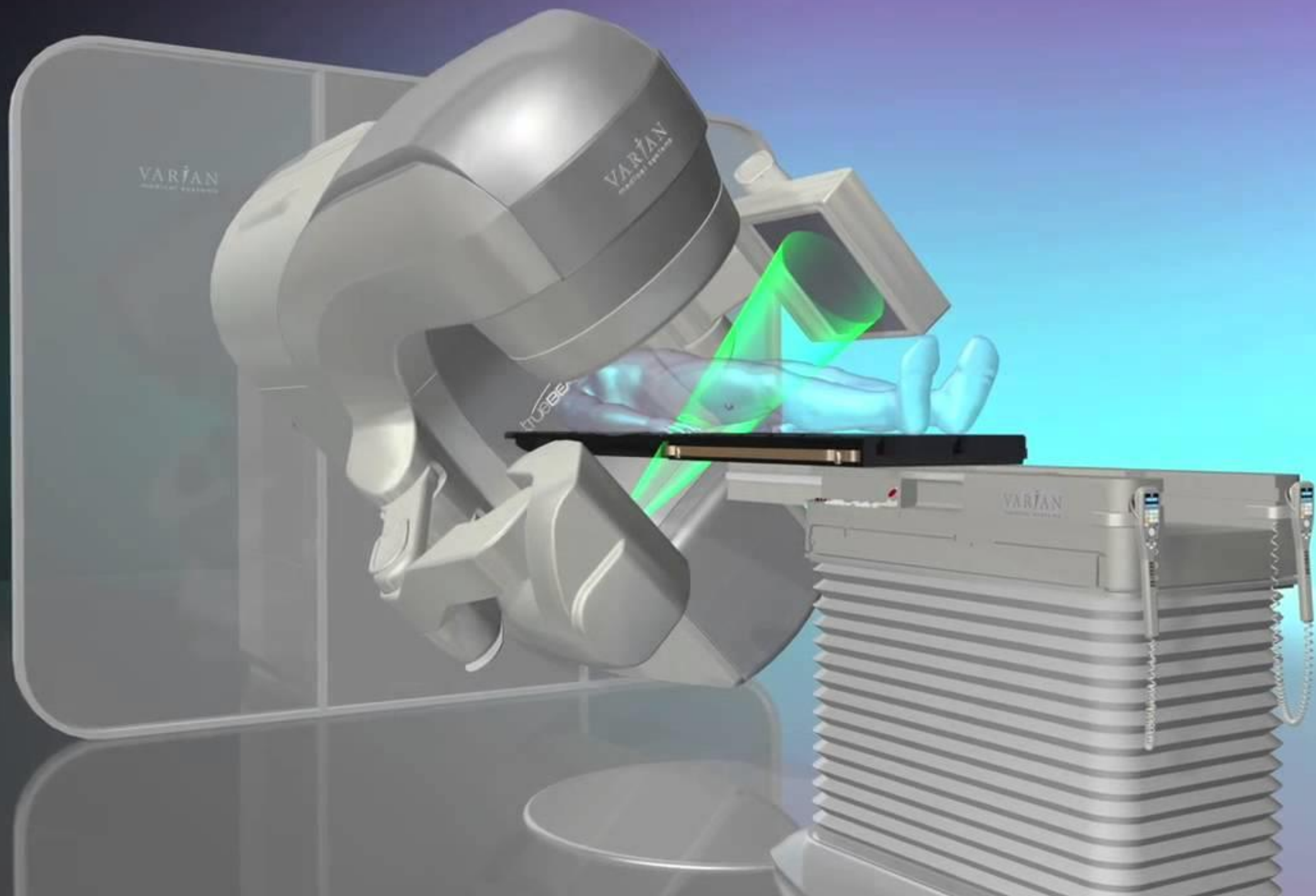
# MR-only radiotherapy pathway



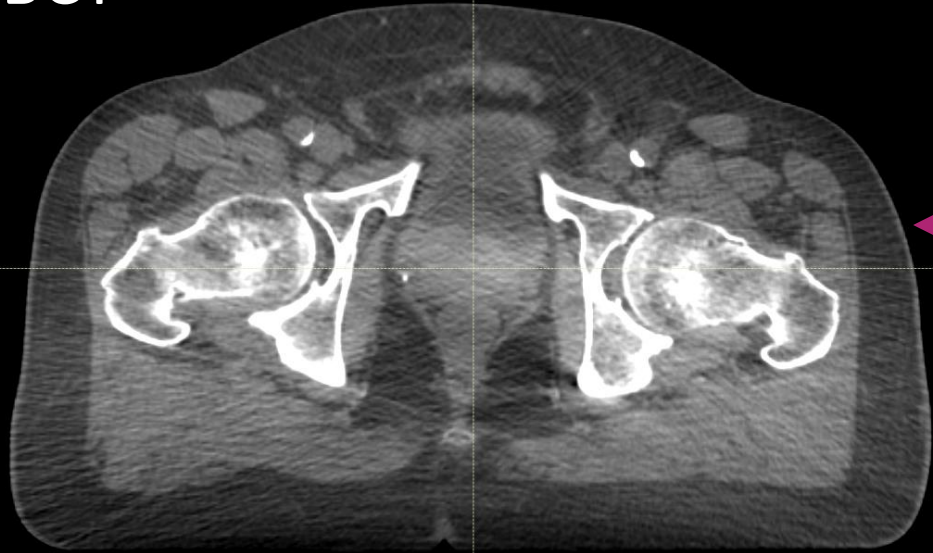


MR-CT GTV delineation in Red, MRI only in blue  
showing a smaller volume

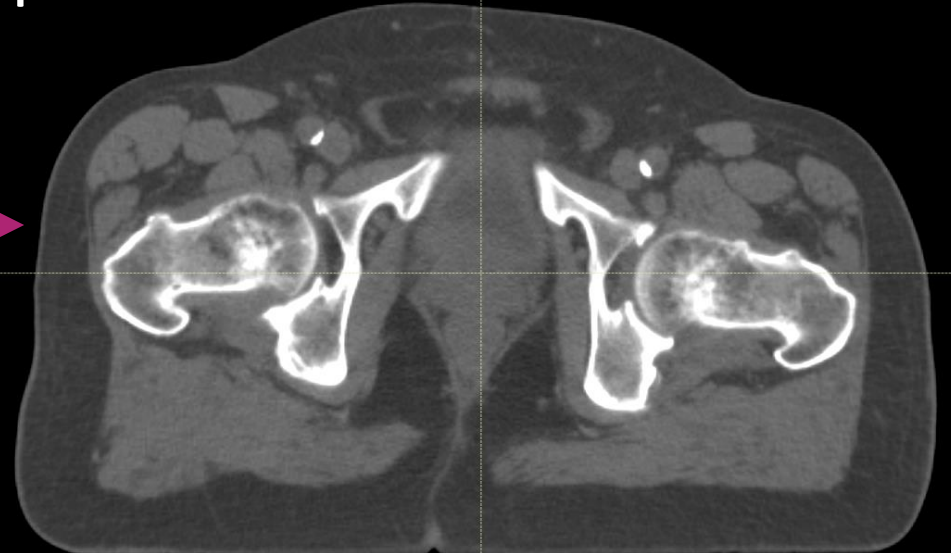




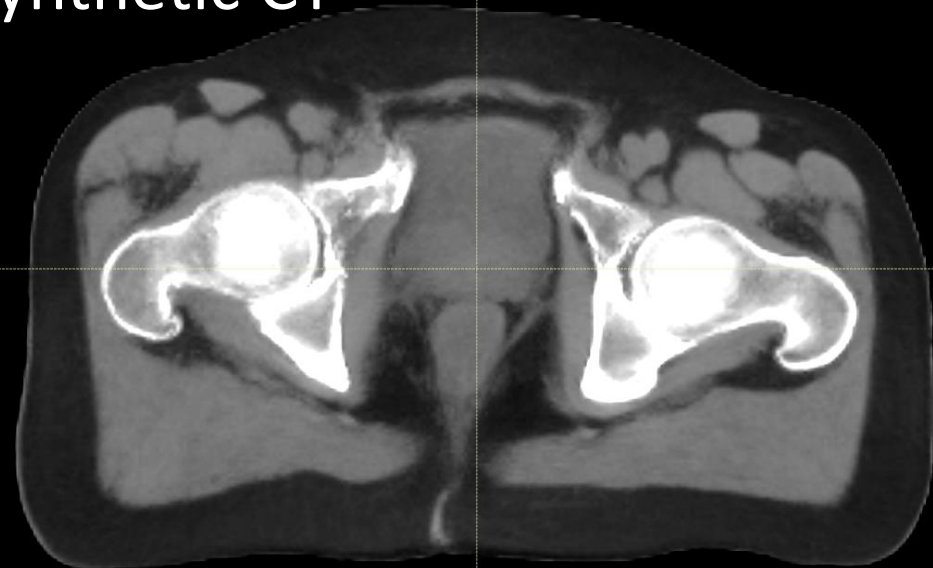
CBCT



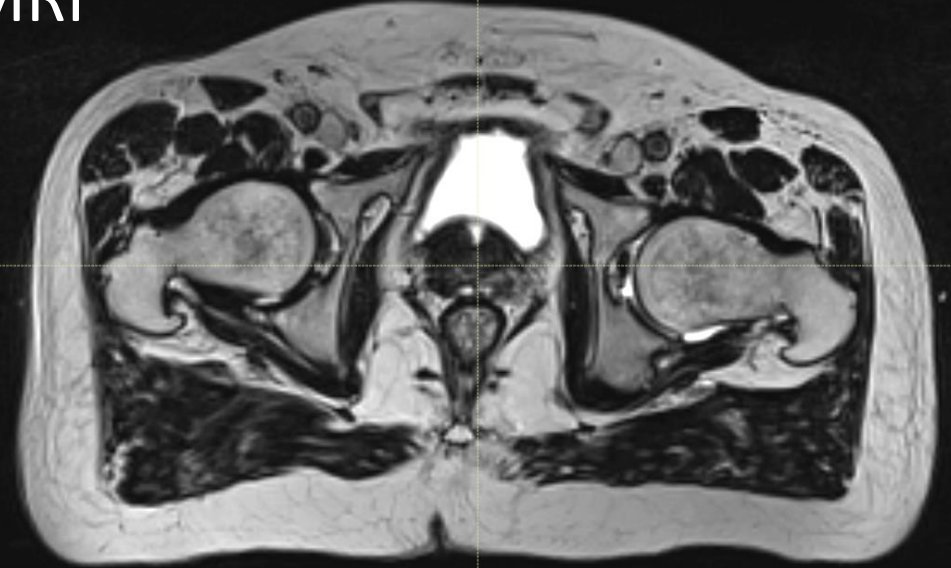
CT



Synthetic CT

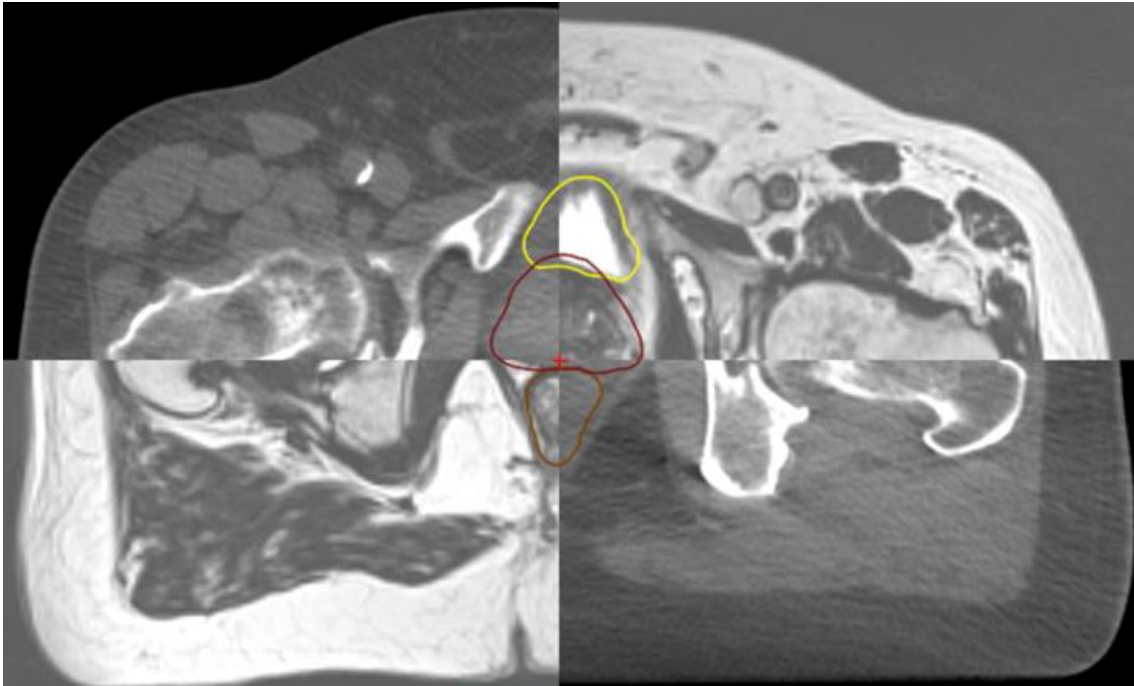


MRI





# MR-CBCT Matching Accuracy



## Mean Differences in MR-CBCT and CT-CBCT match

Vertical:  $-0.1 \pm 0.3$  mm

Longitudinal:  $-0.2 \pm 0.3$  mm

Lateral:  $-0.1 \pm 0.2$  mm

*Wyatt et al. (2019) The accuracy of Magnetic Resonance – Cone Beam Computed Tomography soft-tissue matching for prostate radiotherapy. Physics and Imaging in Radiation Oncology.*





# Are CT IGRT skills transferrable to MRI?



23 Radiographers

Minimal training burden (Self-directed, offline)

Yes-IGRT skills are transferrable!

*Brooks, R.L., et al 2021. Are cone beam CT image matching skills transferrable from planning CT to planning MRI for MR-only prostate radiotherapy?. The British Journal of Radiology, 94*



# World first to implement MR-only prostate soft tissue matching into clinical practice



... but also, global outlier!

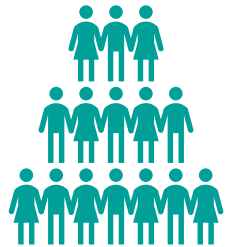




## 2 “Newcastle” Hospitals:

Northern Centre for Cancer Care, Newcastle upon Tyne Hospitals NHS Foundation Trust, UK

Calvary Mater Newcastle, Australia



25 patients



25 CBCTs (First fraction)



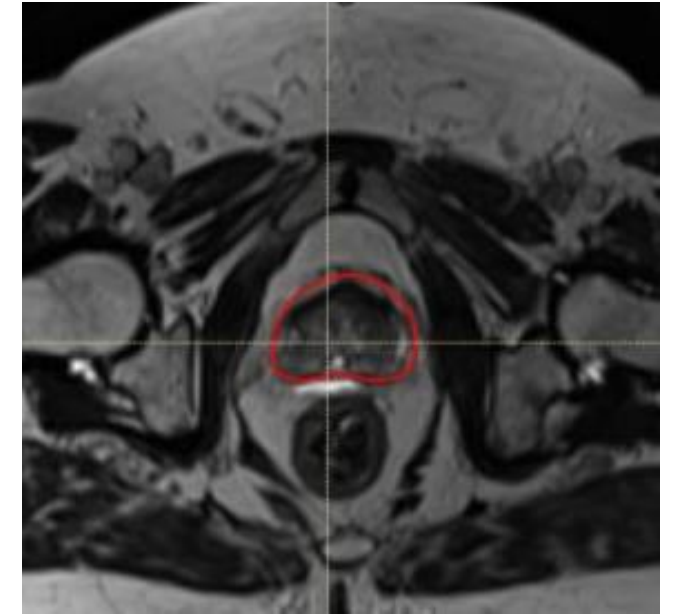
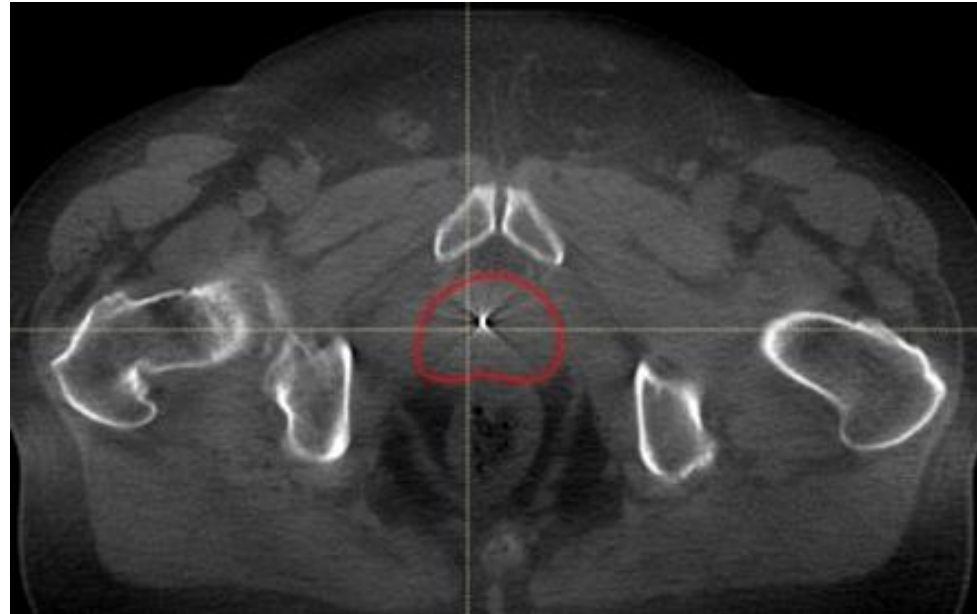
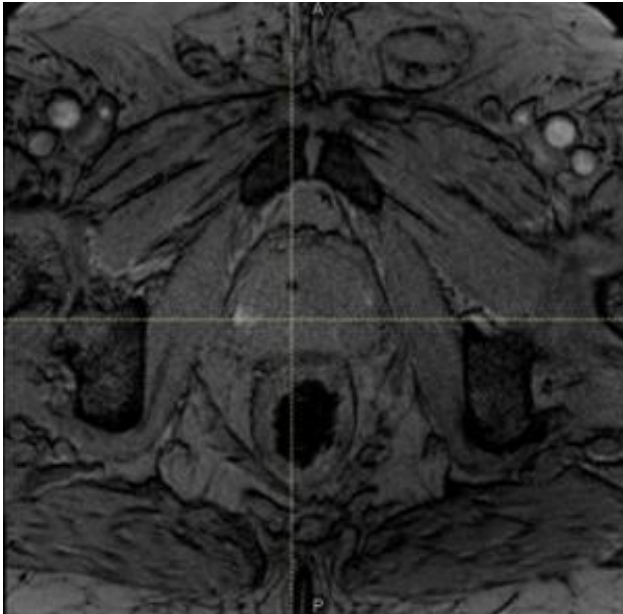
4 Therapeutic Radiographers (RTT)



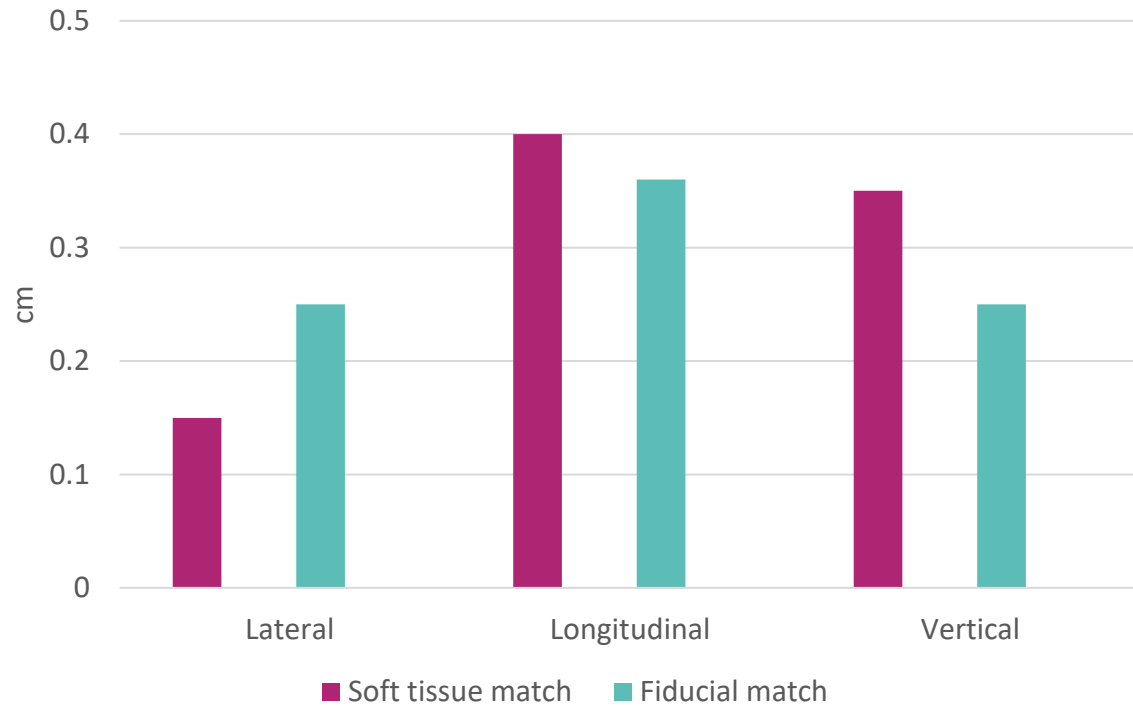
**Fiducial match:**  
T1 weighted MRI

**CBCT**

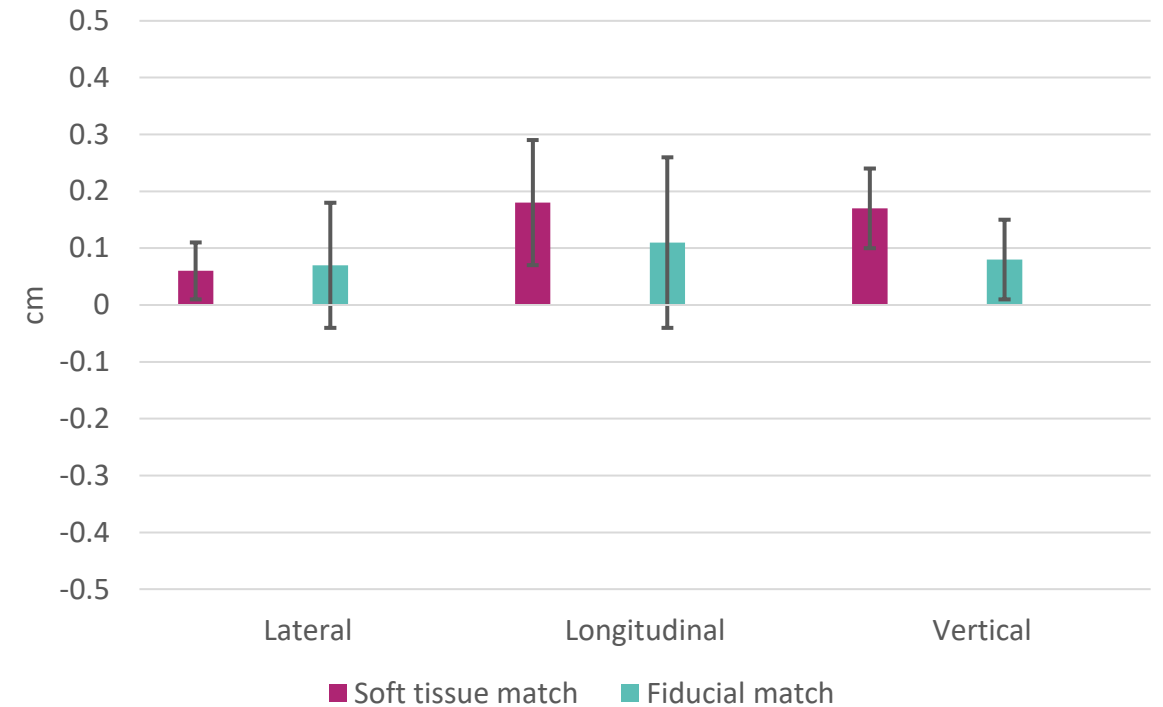
**Soft tissue match:**  
T2 weighted MRI



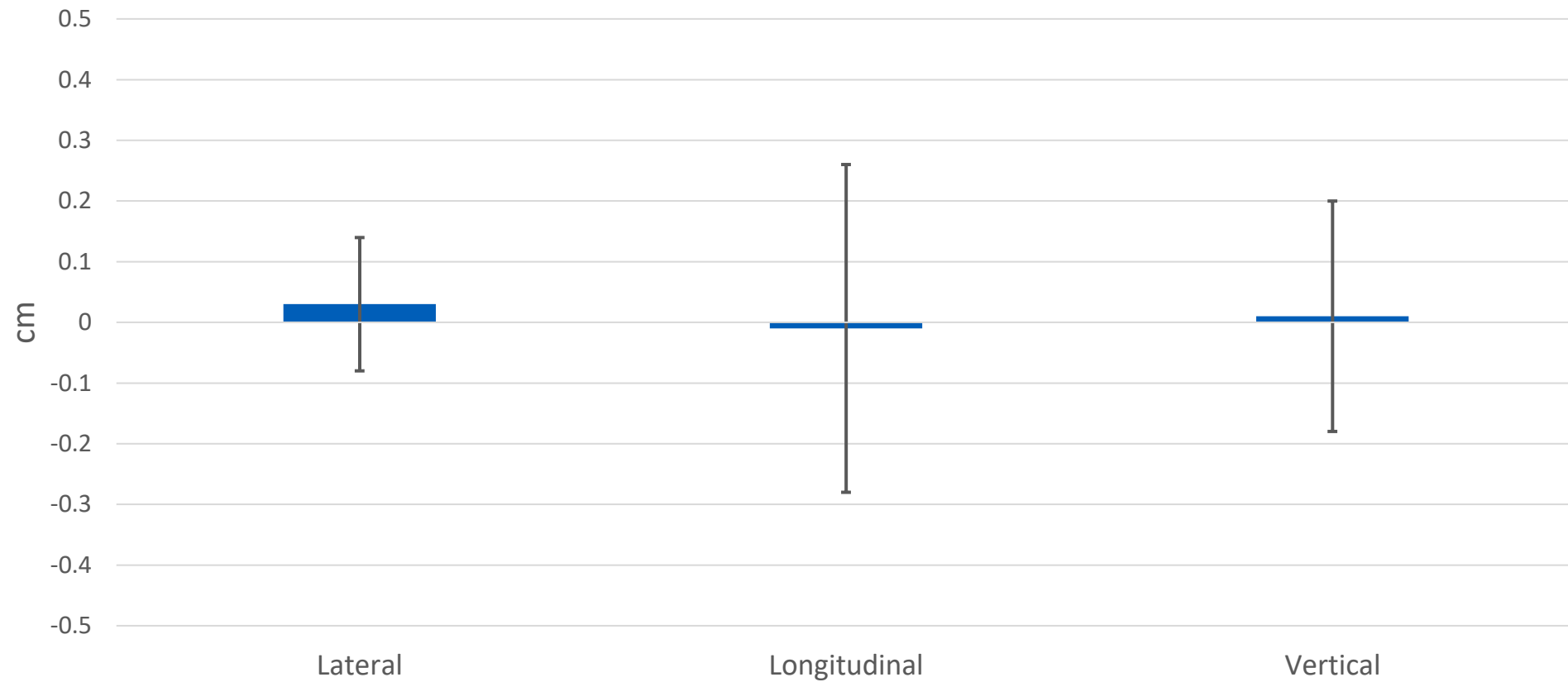
Limits of agreement



Inter-observer error ( $\pm$ standard deviation)



# Absolute difference between Soft Tissue Match and Fiducial Match ( $\pm$ standard deviation)



# To summarise...

- Confidence in MR-only soft tissue matching for prostate patients
- Repeatedly demonstrated that radiographers can match to MRI planning dataset
- Minimal training is required for radiographers, IGRT skills are transferrable
- Since we do not need to rely on fiducial markers, we can extend MR-only planning to other tumour sites!



# Acknowledgments

## MR-only Team at NCCC:

JJ Wyatt (Lead Clinical Scientist)

Hazel McCallum (Consultant Clinical Scientist and Honorary Clinical Senior Lecturer)

Rachel Pearson (Consultant Clinical Oncologist)

Stephen Hedley (Lead Clinical Scientist)

Karen Pilling (Clinical Lead Superintendent Radiographer)

Serena West (Pre-treatment Clinical Specialist Radiographer)

## Radiographer image matching at NCCC:

Debra Redding (Clinical Specialist Radiographer)

Emily Wilkins (Senior Radiographer)

Sophie Taylor (Senior Radiographer)

## Data - Calvary Mater Newcastle, Australia:

Laura O'Connor (Senior Radiographer)

Kate Skehan (Senior Radiographer)

# Questions?