Integrating clearance mapping with MapRT into clinical practice

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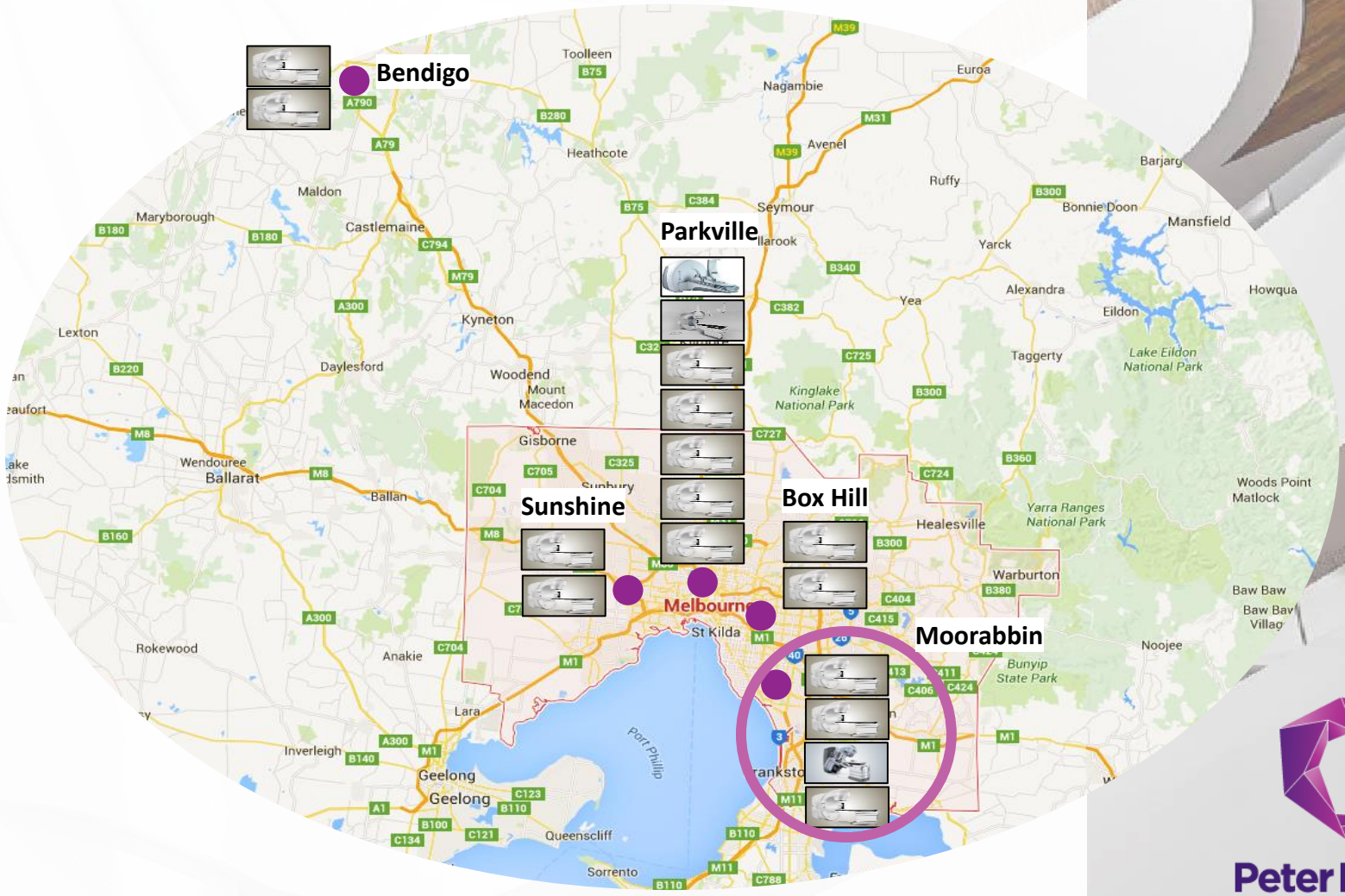
5 Petermac Sites:

- 16 Varian linacs
- 11 Vision RT AlignRT Advance
- 3 Gen 5 HD cameras
- 8 Horizon cameras
- 1 Elekta Gammaknife
- Elekta brachytherapy
- Varian Eclipse
- Brainlab Elements
- Elekta Leksell Gammaplan
- Elekta MOSAIQ ROIS
- 6 Phillips CT
- 1 Siemens CT
- 1 Vision RT MapRT



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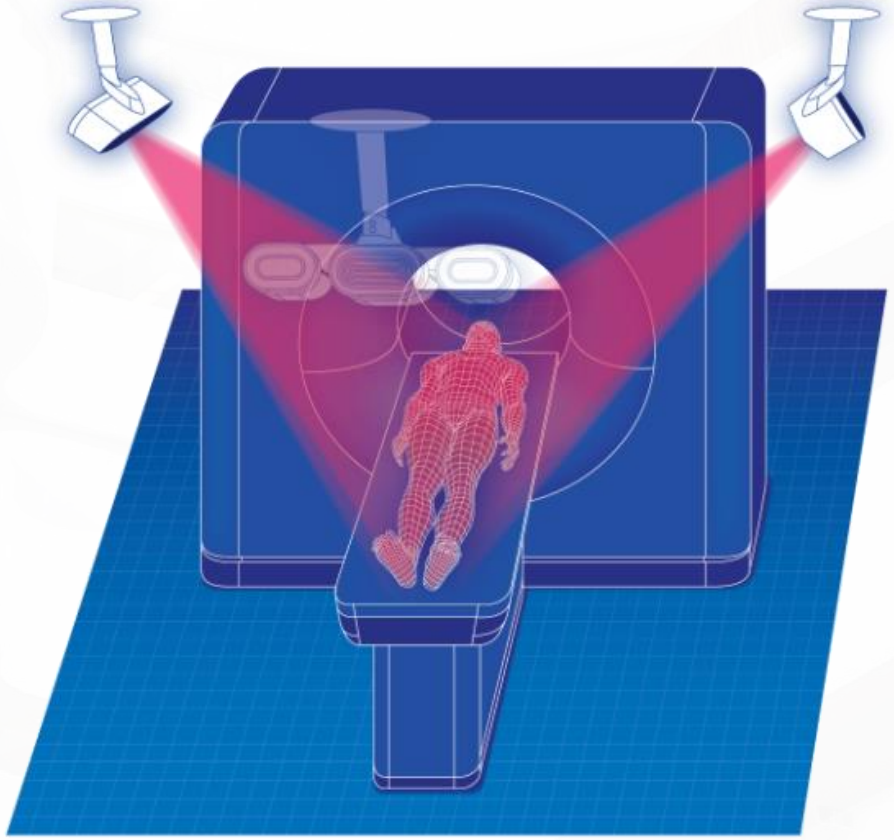
What is MapRT?

- 2 x Horizon Full field of view cameras
- 2 x dedicated MapRT computers
- Capture 3D surface of entire patient + accessories



MapRT image courtesy of VisionRT

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What is MapRT?

- View clearance map in online browser
  - ➢ Interactive interface

- Patient position, plan isocentre, linac, imaging arms, couch

MapRT Clearance browser with an exported plan

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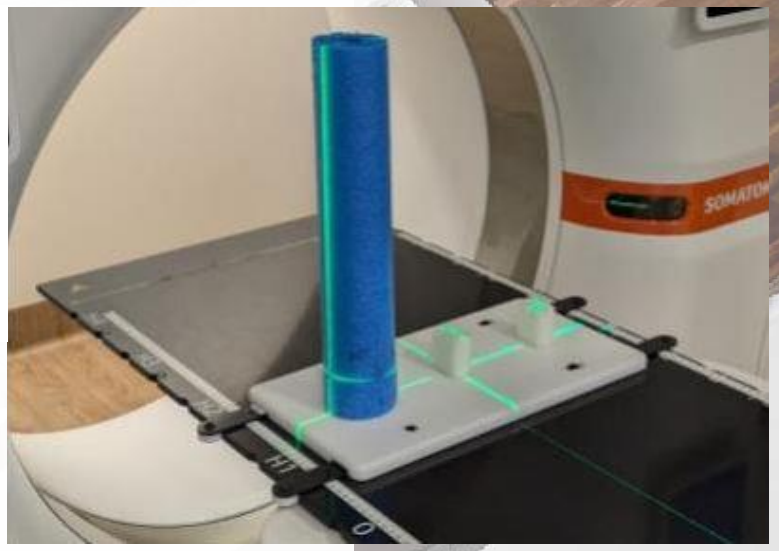
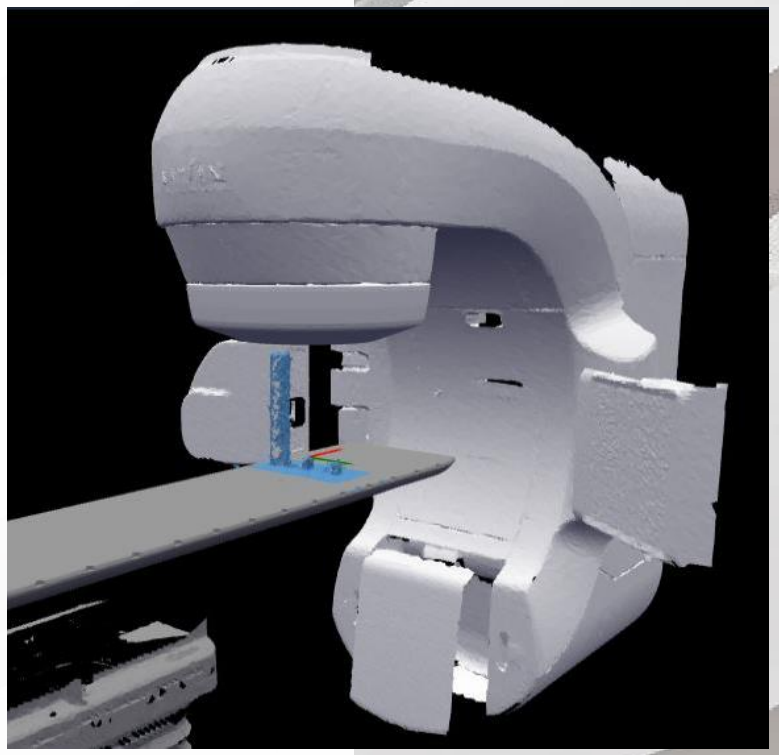
Commissioning

- **Installed** on 20th May 2024
- Phantom tested **trigger points** of both machine and patient interlocks
- Most measured collisions agreed with MapRT within **1 degree**
- MapRT software **not officially released** for clinical use by VisionRT yet
  - Still need to perform a mockup



Physics QA Phantom for MapRT



Staff Training

Vendor training

- 1 day training
- CT & Education staff

Initial staff training

- Rollout of training to all planning staff
- Competency checklist

Ongoing staff training

- Upskilling of new staff rotating into planning as needed

MapRT utilization

- Assessed how MapRT was being used by the staff

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Workflow

- Capture before or after CT scan
  - Suggested to capture prior to scanning

Patient data input
- Name
- UR number

First capture
- Taken at TRP/zero slice

Assess
- Assess quality of the capture
- Potential gaps/missing equipment

Additional Capture
- If needed, move the bed for second capture
- Merge captures together

Couch height
- Input DICOM couch height
- Must not change between capture & scan

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- Re-open the surface capture in MapRT to assess iso placement and clearance at CT
  - Can adjust the patients position prior to scanning if needed

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- Capture before or after CT scan
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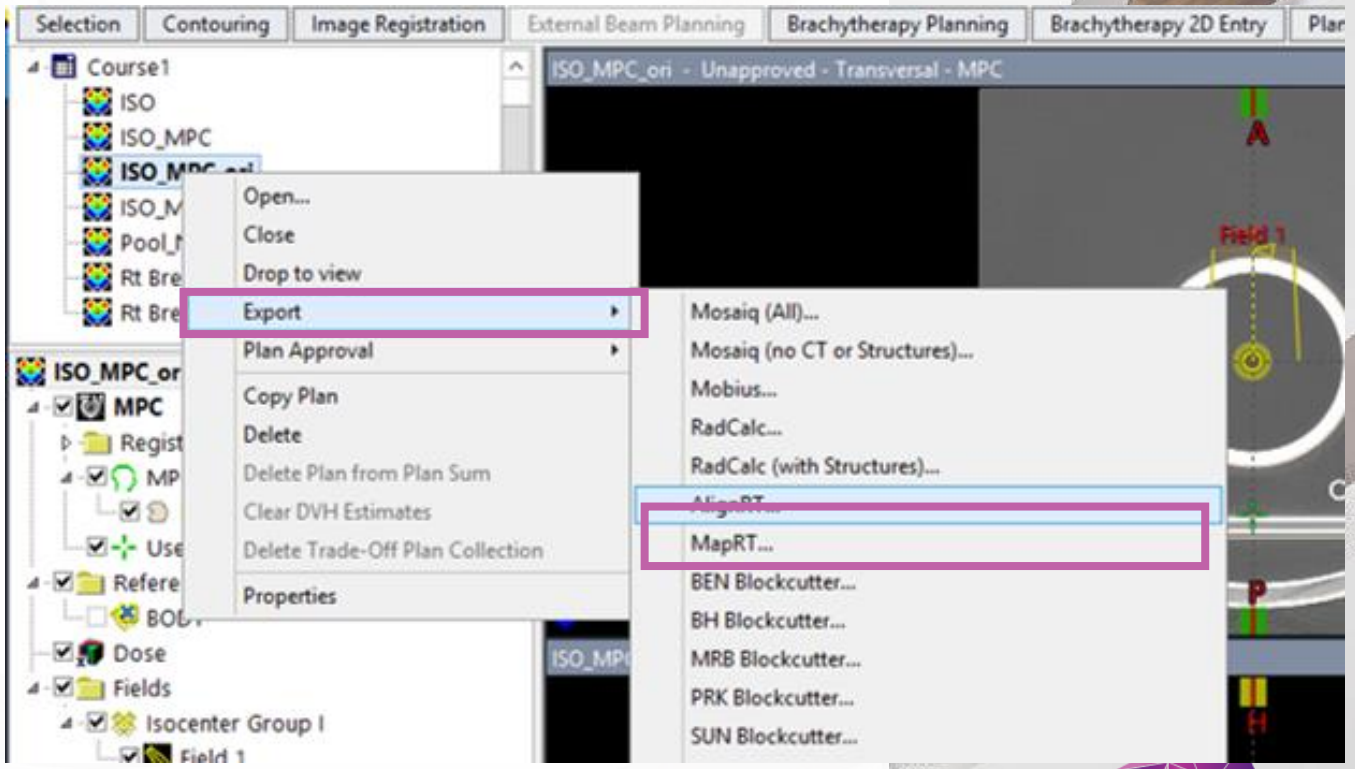
- Re-open the surface capture in MapRT to assess iso placement and clearance at CT
  - Can adjust the patients position prior to scanning if needed
- During the planning phase – plans can be sent directly to MapRT for clearance assessment
  - MapRT web browser
  - No restrictions on use



Exporting plans directly from TPS to MapRT

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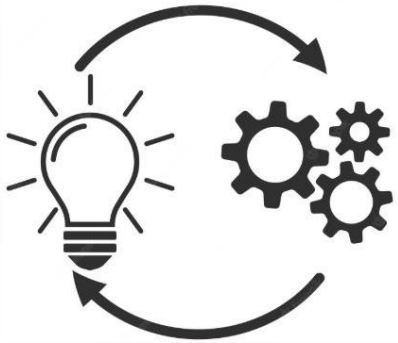
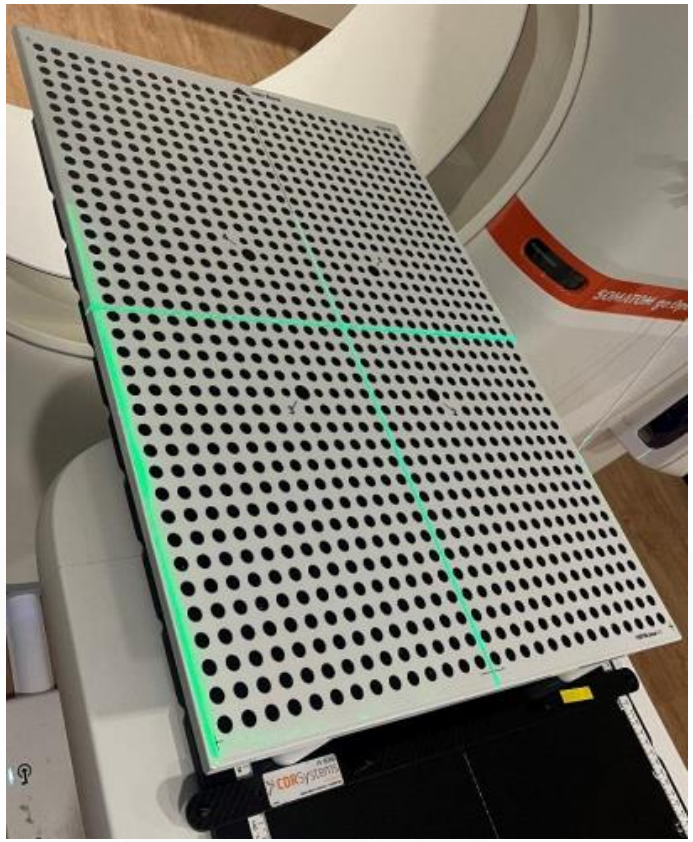
Integration



- Ideally **all** scanned patients will have a MapRT capture
  - Build up a bank of data/patients to assess utilization & future projects
- MapRT capture **after** the CT procedure
  - Staff found this workflow easier rather than before the CT scan
- **Extra step** in the CT process
  - Additional 2-3mins – some patients may not tolerate
- Extra step in the **morning QA** process
  - Daily QA required - additional 5mins



MapRT QA equipment

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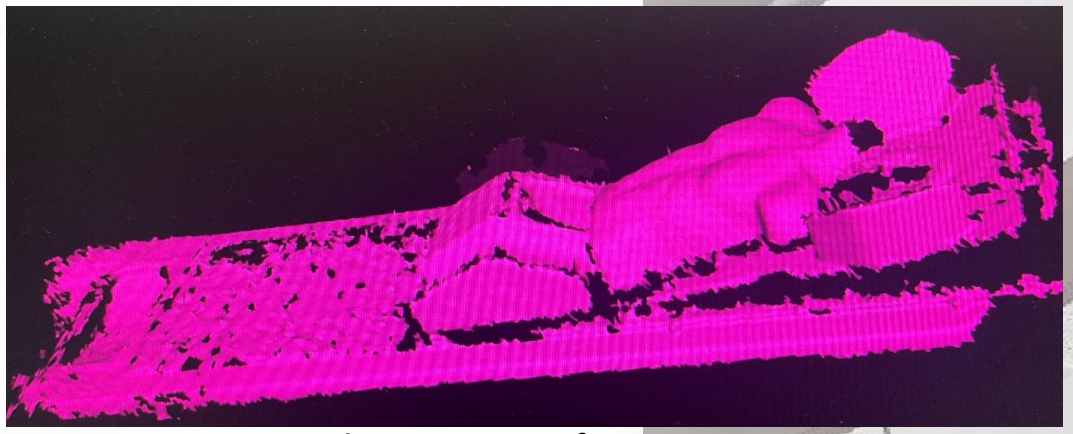
Clinical Learning

- **Dark/shiny materials** were not captured by Horizon cameras
  - Known issue – same cameras as AlignRT
  - Cover all equipment with a sheet



Example MapRT Surface capture

- **Remembering** the new process
  - Updated our CT document as a prompt to take the capture before finishing
  - For H&N patients - can take a retrospective capture with the equipment & DICOM co-ords

- Ensure the patient is **exposed** for the capture
  - i.e. don't cover the patient with a sheet – interfere with body contour/capture

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Utilisation

- ✓ BEAM ANGLE SELECTION
- ✓ NON-COPLANAR ANGLE CLEARANCE
- ✓ IMAGING CLEARANCE

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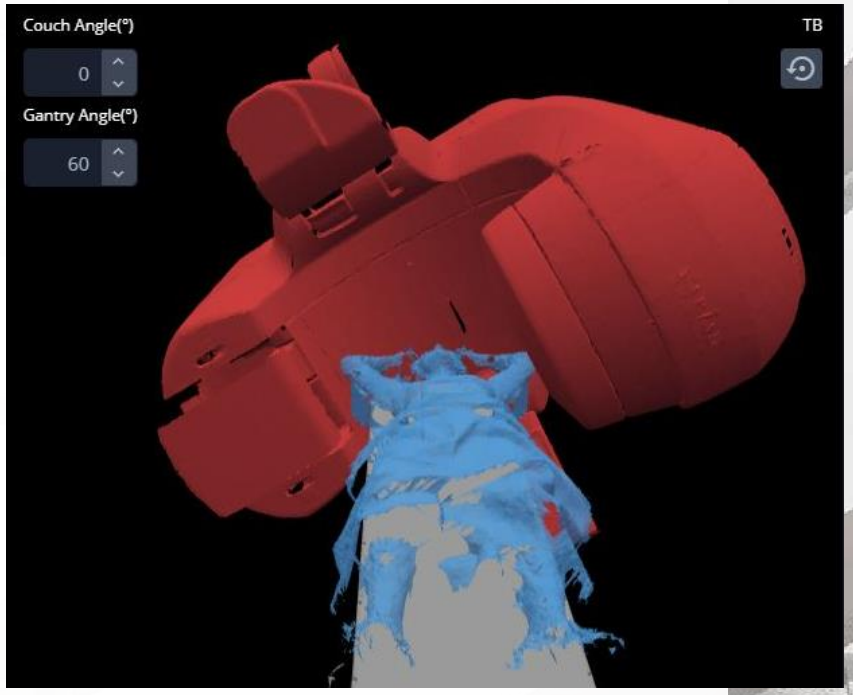
Beam Angles

- Assessing **achievable** beam angles

- Increased uptake in MapRT use with **Breast planning**
  - Contralateral elbow clearance
  - Breast planners now routinely send their plans to MapRT



MapRT demonstrating a collision with the patient's contralateral arm

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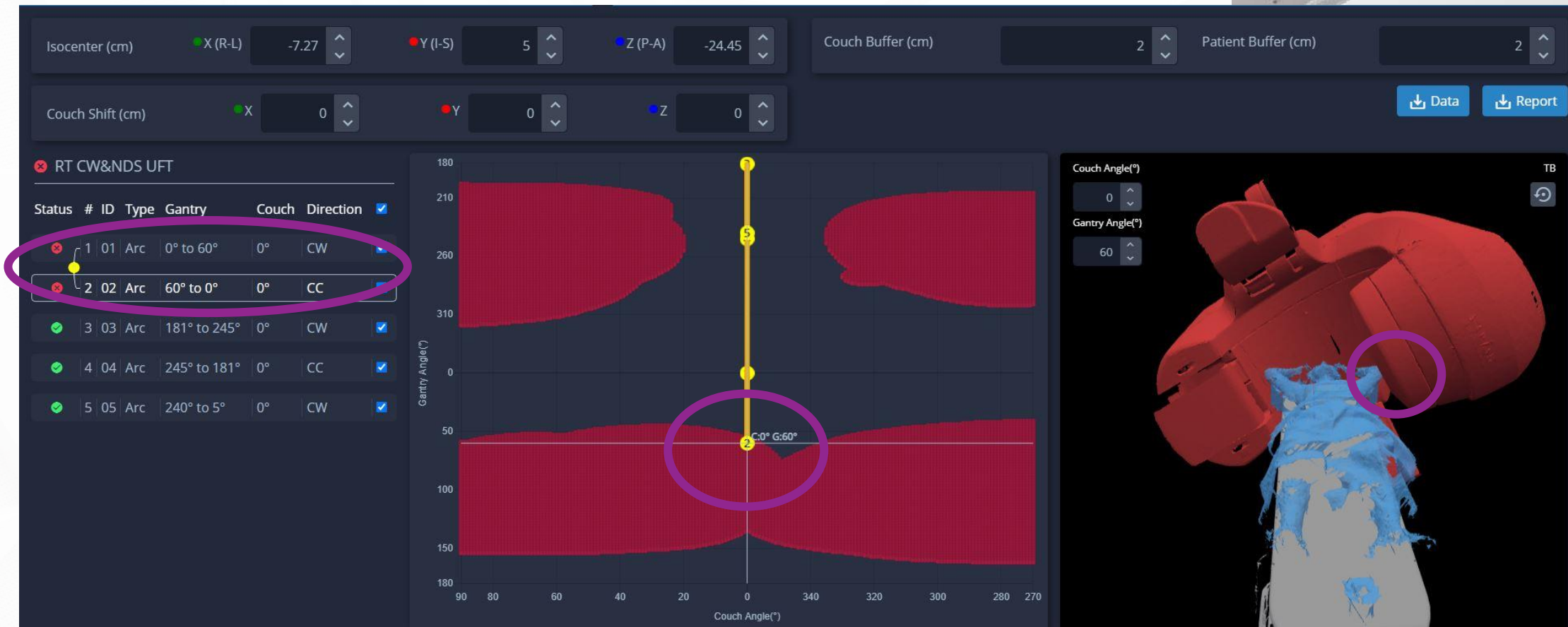
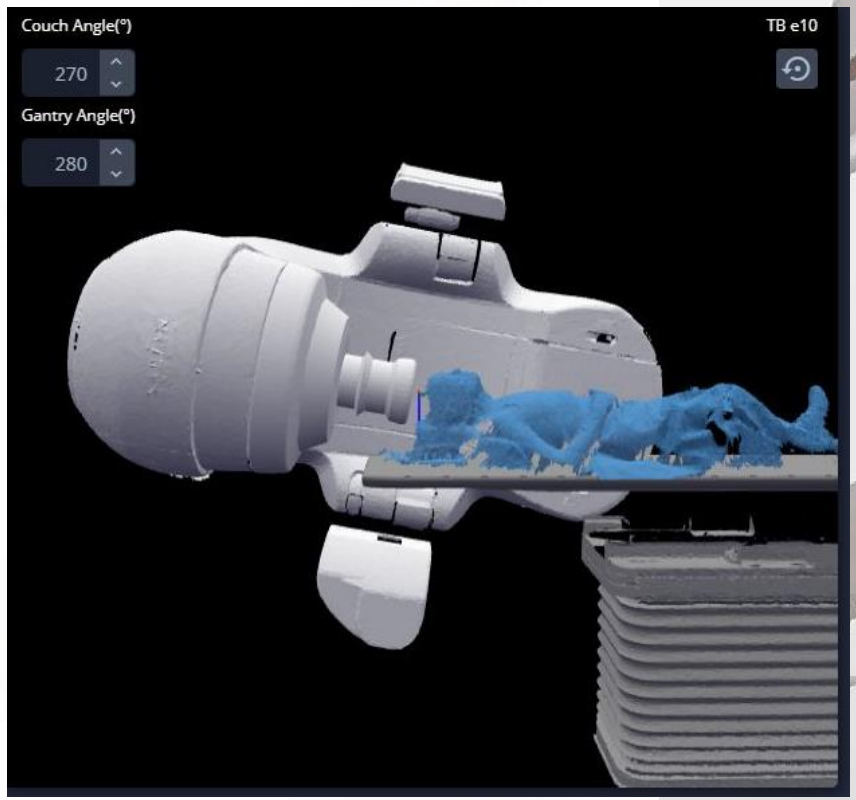
Beam Angles – Clinical Example

- Right sided Chestwall & Nodes patient - VMAT plan
- Plan already approved and QA'd -> sent to MapRT after
- MapRT modelled a collision with contralateral elbow



Non-Coplanar Angles

- MapRT provides great **visualization** of plan geometry
- Given our planners more **confidence** with planning non-coplanar
  - Previously we were often very conservative with floor angles
- Particularly useful for **metastatic skin** patients
  - Electron treatments – applicator clearance
  - Lesions in tricky places – extremities



MapRT demonstrating electron applicator clearance

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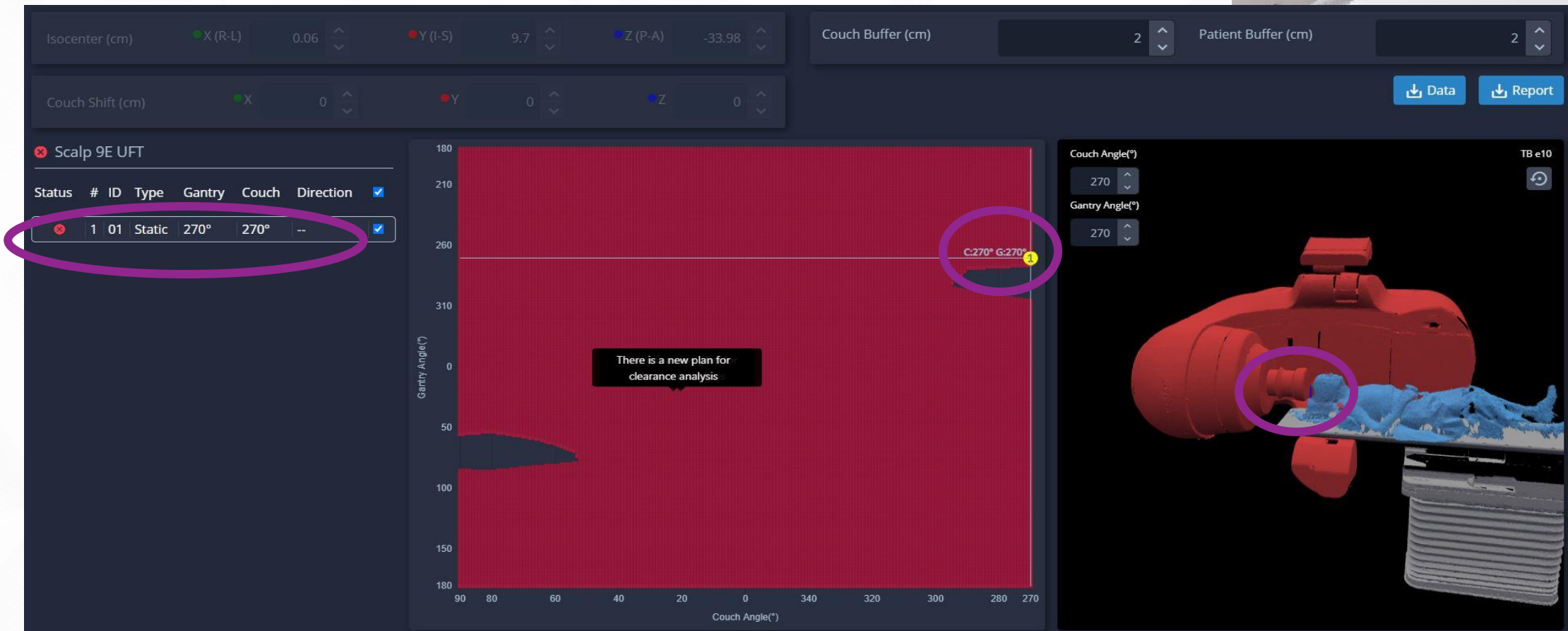
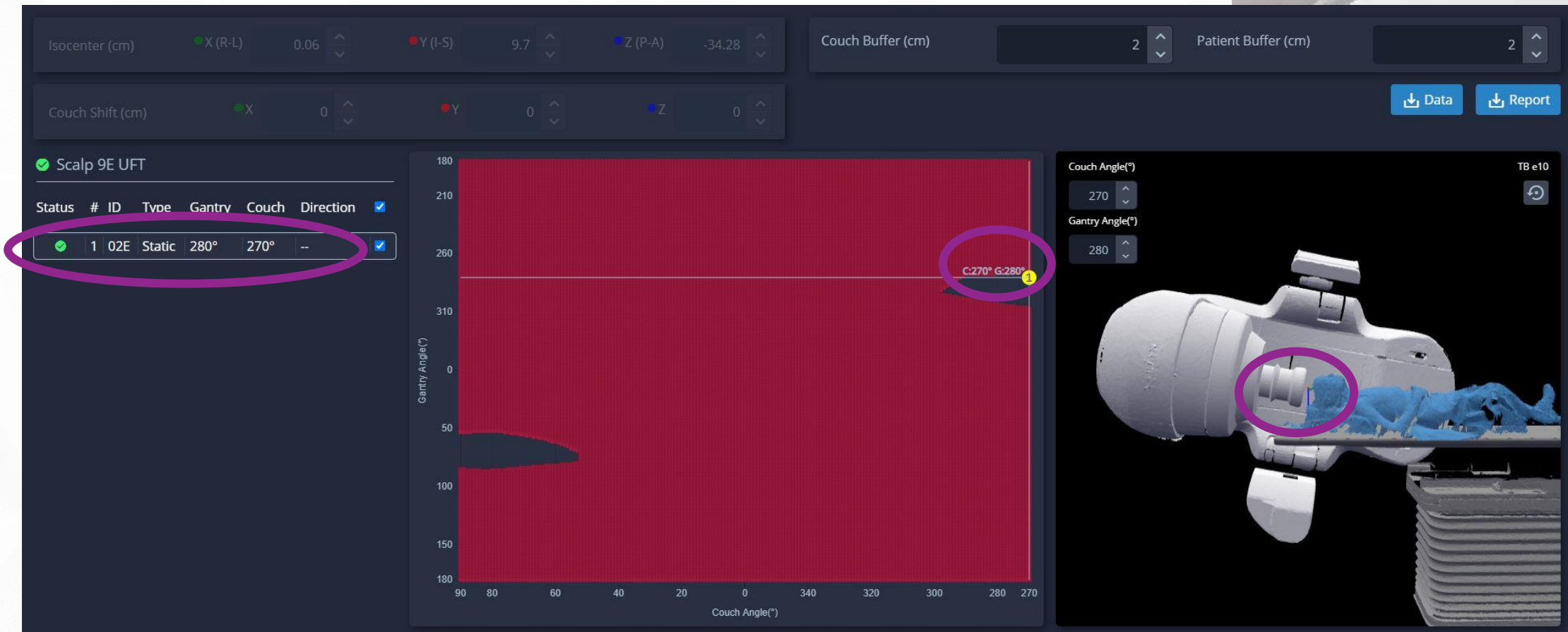
Non-Coplanar Angles – Clinical Example

- Metastatic skin patient, superior scalp volume -> electrons
- Initially planned 100cm to skin, G270 C270 field
- MapRT modelled collision with the neckshape



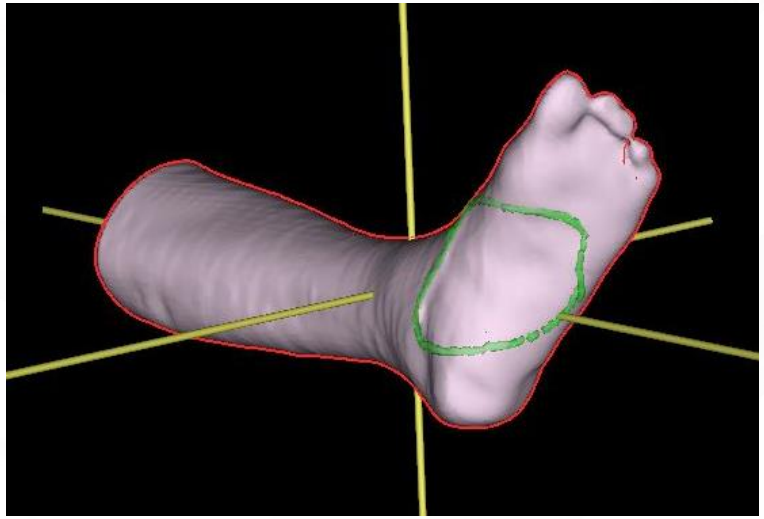
Non-Coplanar Angles – Clinical Example

- MapRT was used ***during*** the planning process
- Planner accounted for the clearance issue with a 10-degree gantry adjustment
- MapRT modelled this was safer for clearance

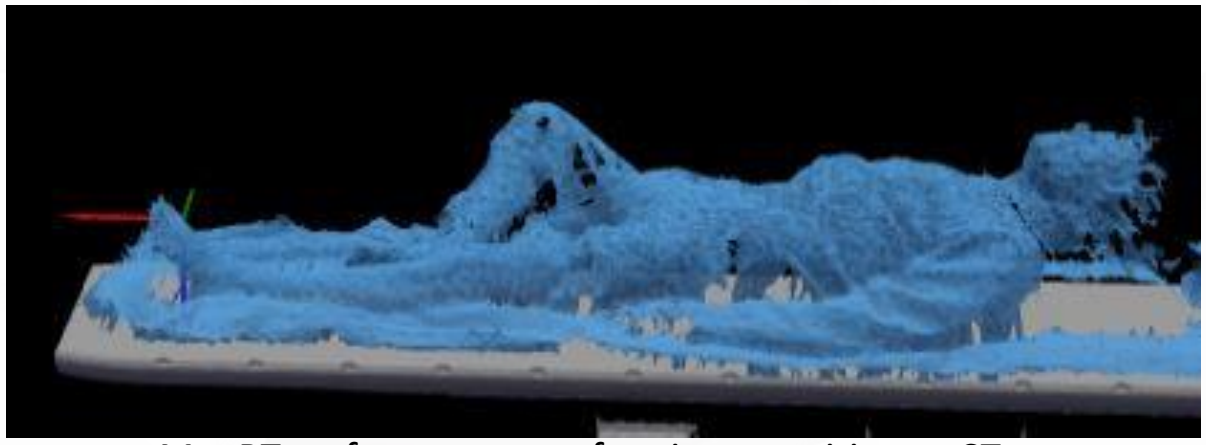


Non-Coplanar Angles – Clinical Example

- Metastatic skin patient – foot lesion
- Dr requested to treat tangentially to spare a lymphatic strip
- Geographically complex considering lesion position and contralateral leg position



Foot lesion clinical mark



MapRT surface capture of patients position at CT

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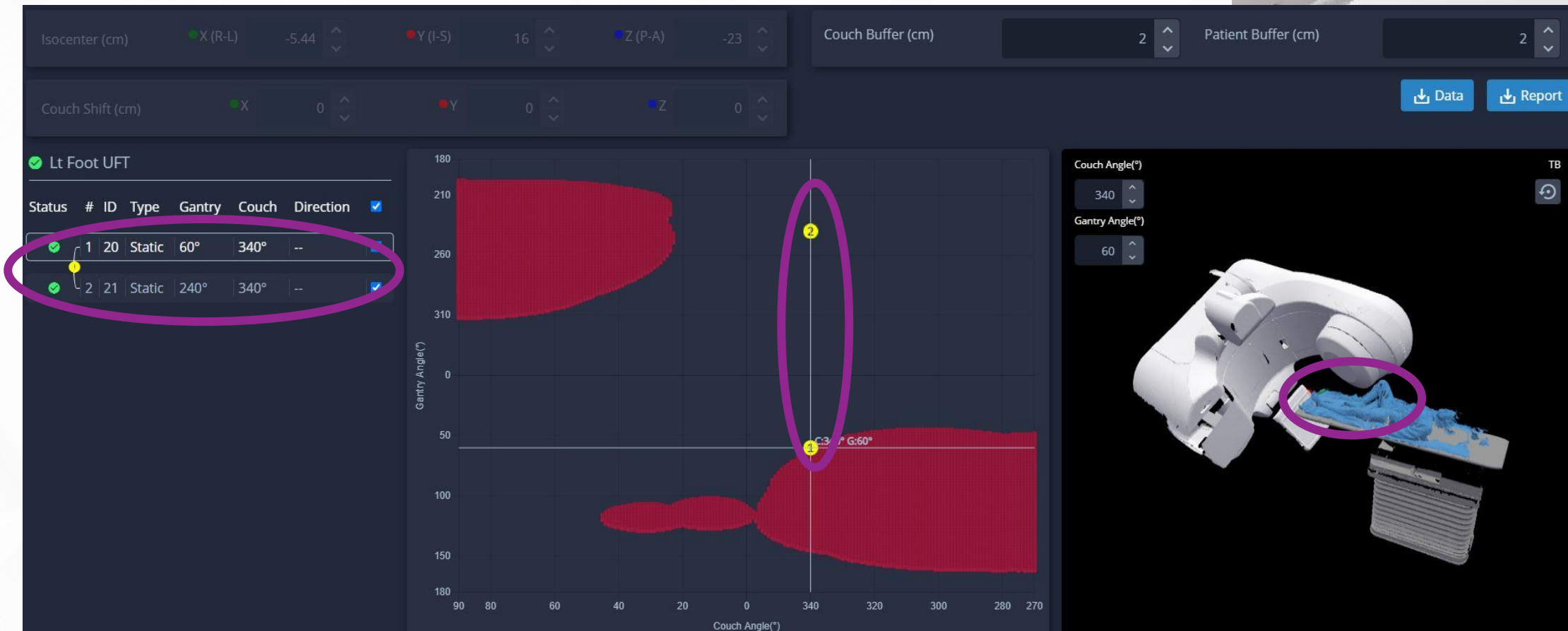
Non-Coplanar Angles – Clinical Example

- Visually demonstrate to the Dr what angles are achievable
- MapRT gave the planners confidence with this tricky volume

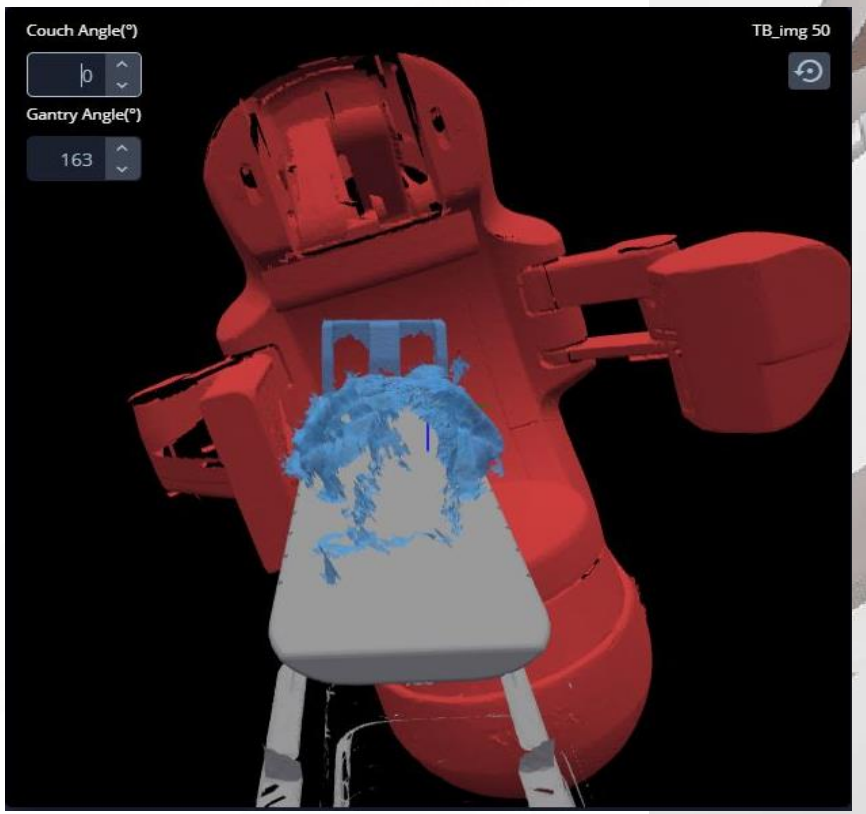


Imaging Clearance

- Imaging fields are **not** specifically modelled by MapRT
  - Create dummy fields to export
  - Manually move the interactive gantry graphic to assess clearance with the imaging arms
  - Models kV & MV imaging arms together

- CBCT clearance
  - Reduce the need for dry runs
  - Preempt if couch centering is needed

- kV imaging
  - Offset/lateral isocentre patients
  - Selecting better kV angles, e.g. obliques



MapRT demonstrating kV imaging panel collision

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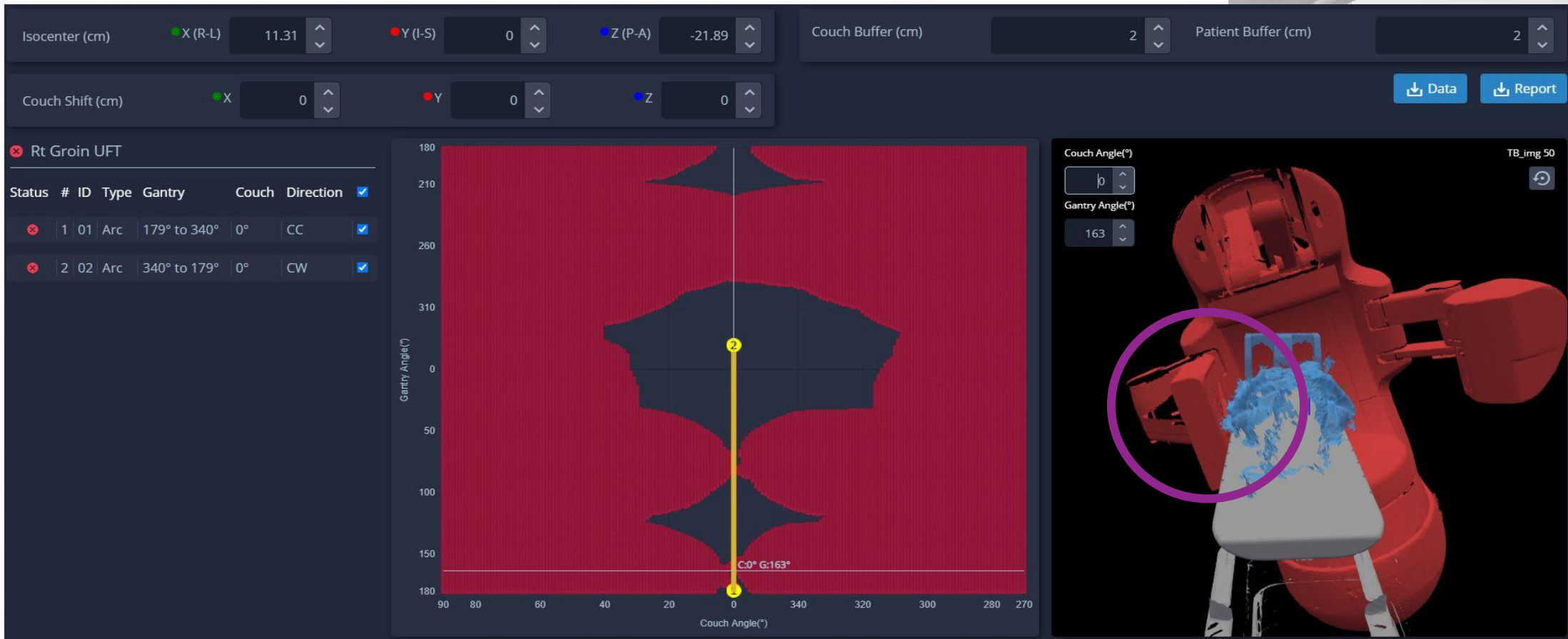
Imaging Clearance – Clinical Example

- Pelvis patient planned feet to gantry -> very lateral isocentre
- Standard kV imaging angles of kV0 & kV90 did not clear Fx1
- MapRT accurately modelled the most appropriate oblique imaging angles



Future Projects

- Non-coplanar Bilateral Head & Neck planning
  - Address shoulder positioning issues
- Non-coplanar SABR planning
  - Assess dosimetric benefits
- Mono-isocentric bilateral breast VMAT isocenter placement
  - Couch height clearance
- Breast CBCT
  - Spotlight CBCT clearance on treatment

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Summary

- **Fast** and **easy** interface to use
  - Sending plans to MapRT is almost instant & provides a great visual of plan geometry
- **Accurately** models plan geometry
  - Reduced the need for replans
  - Reduced repeat QA work and wasted resources
- Gives our planners more **confidence** with non-coplanar planning
  - Able to preempt potential collisions before the patient is on the treatment couch
- Capture process does add an **additional step** to the CT procedure
  - Benefits of using MapRT outweigh this

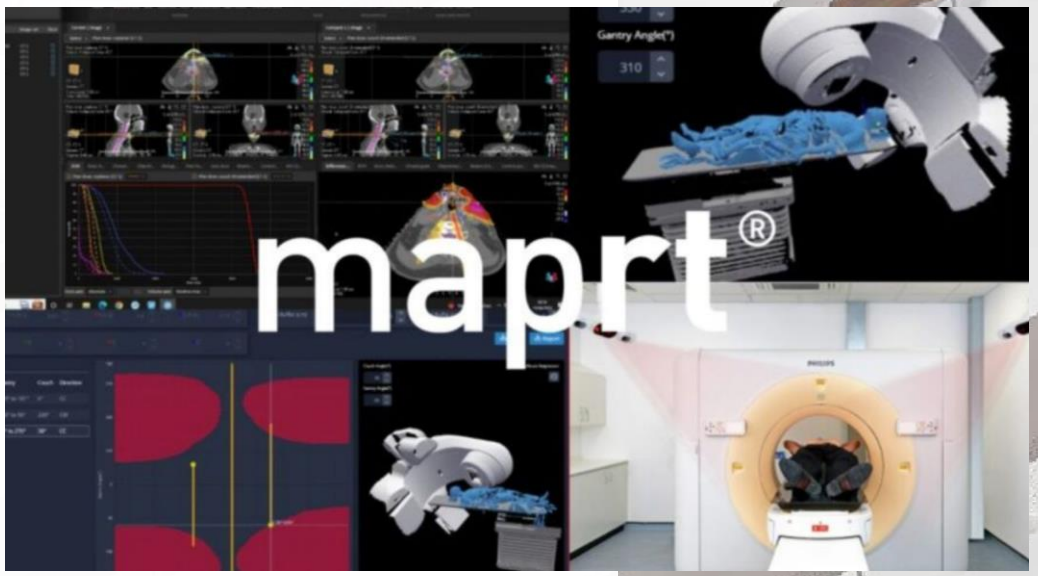

Image courtesy of VisionRT

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Acknowledgments

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Questions?

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