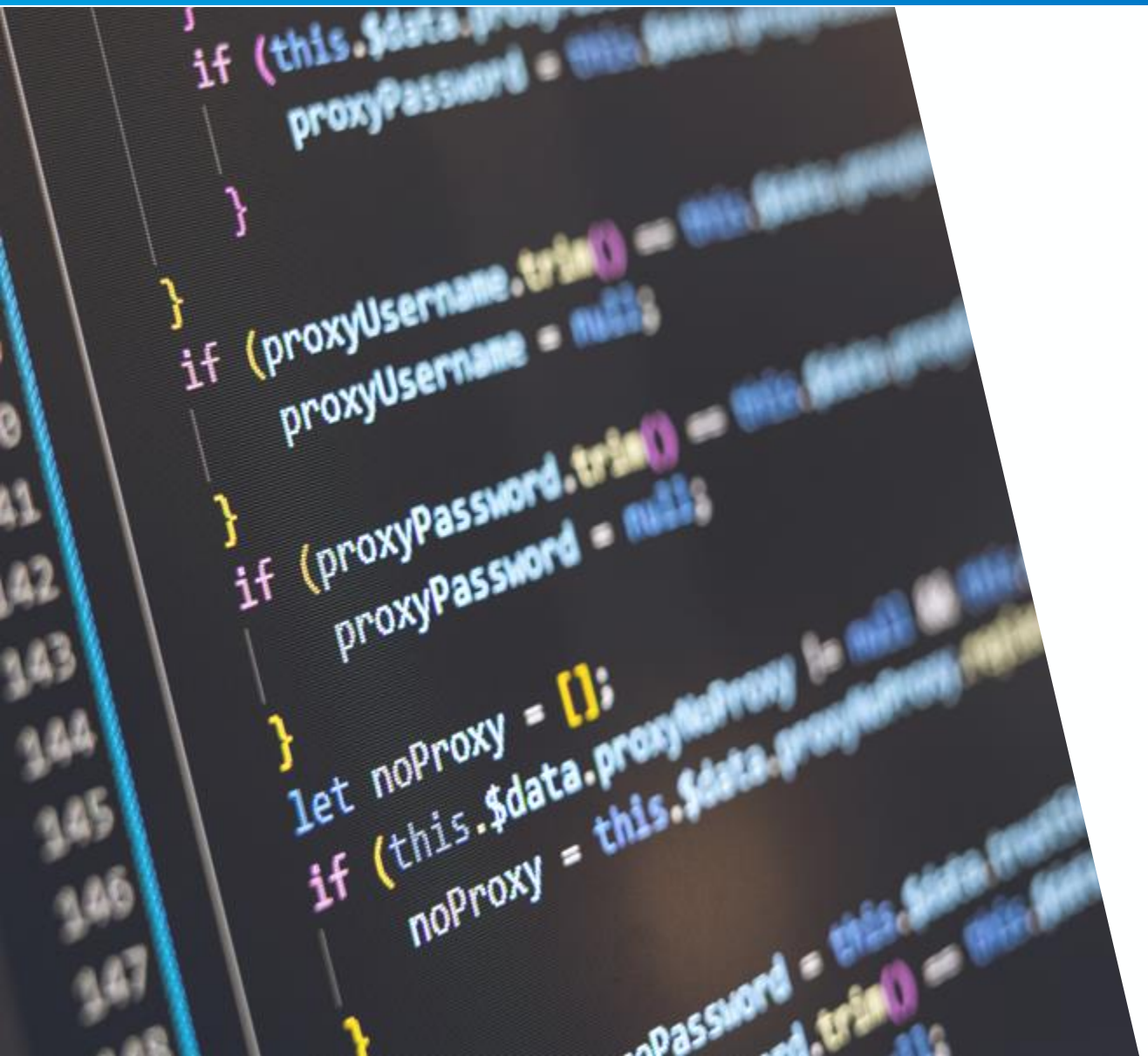
Scripting Applications Using MapRT's new API

How scripting can be used to increase the quality, safety, and efficiency of your workflow



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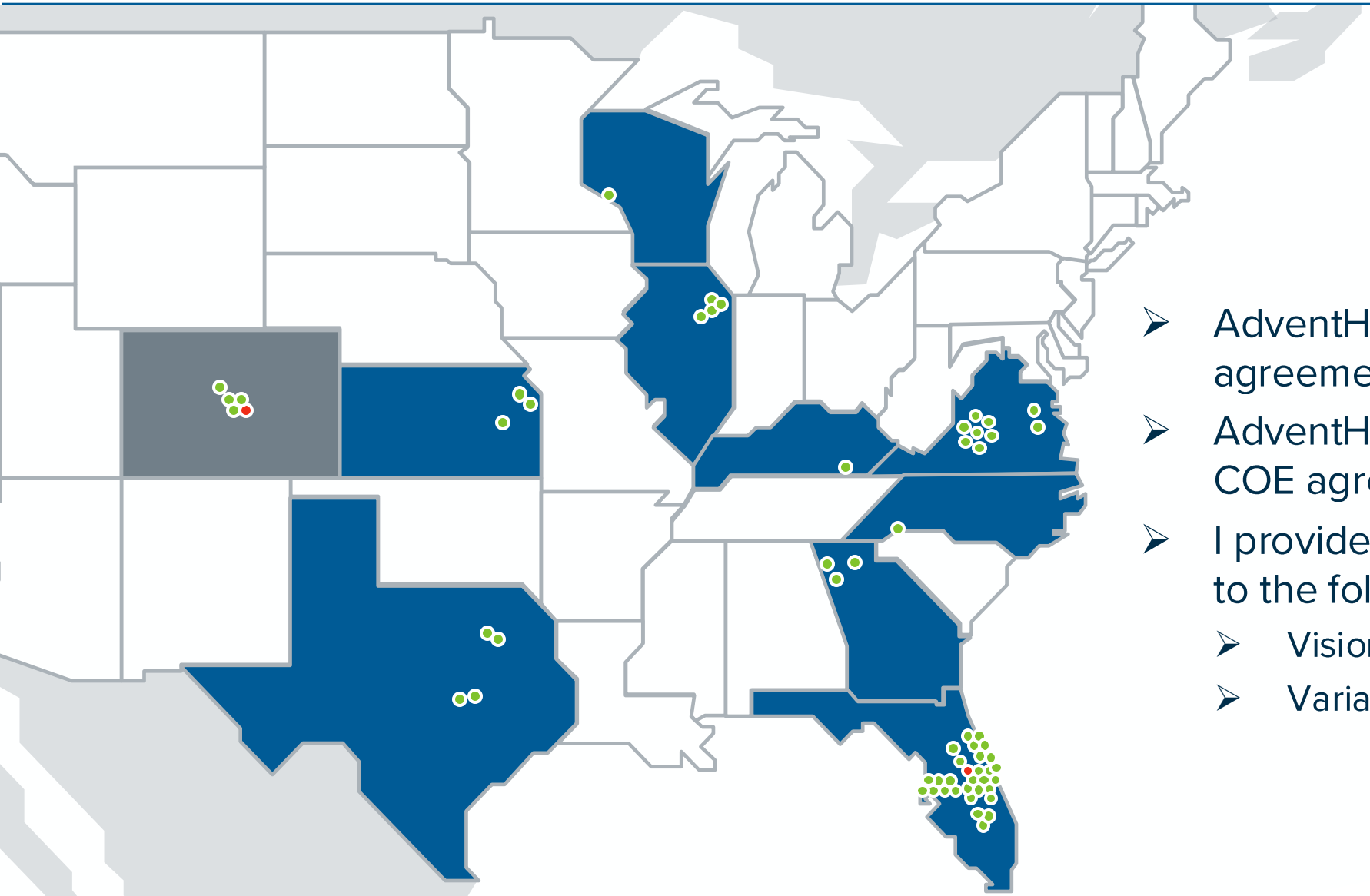
Disclosures



- AdventHealth – Parker has a PSA agreement with Vision RT.
- AdventHealth – Celebration has a COE agreement with Vision RT.
- I provide physics consultation services to the following vendors
  - Vision RT
  - Varian Medical Systems

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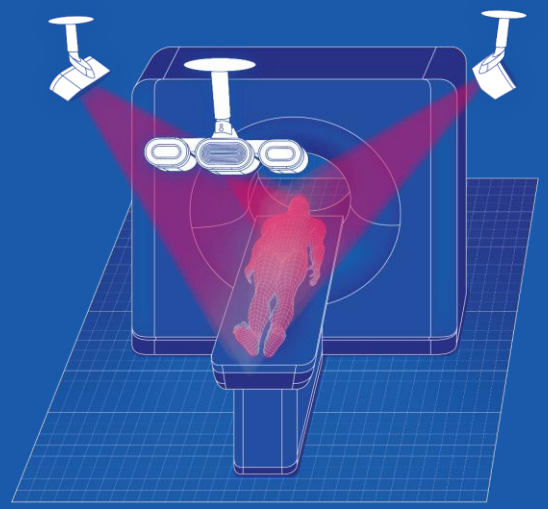
AdventHealth's SGRT Portfolio

SGRT Use of surface guidance to help improve the safety, effectiveness and efficiency of the *entire* radiation therapy workflow

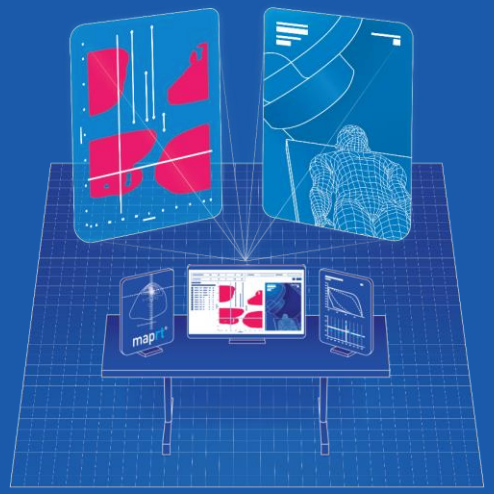
SIM



4D AND BREATH HOLD CT

simrt™

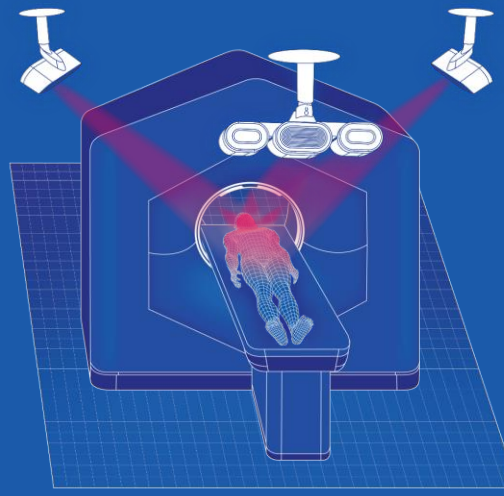
PLAN



CLEARANCE MAPPING

maprt®

TREAT



MOTION MANAGEMENT

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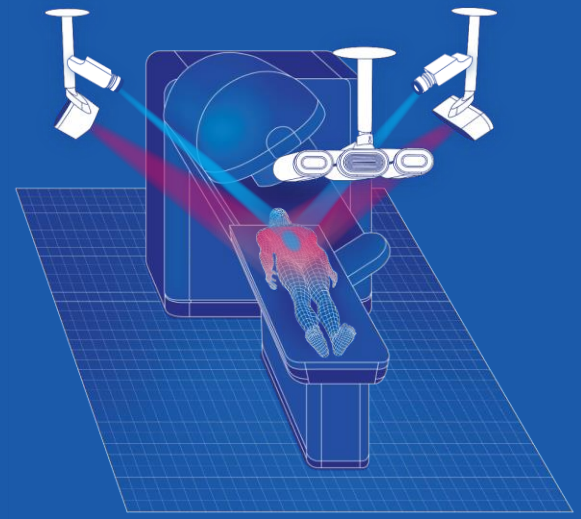
DOSE



DOSE VISUALIZATION

alignrt® dosert™ Powered by BeamSite®

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Goals

- Give a simple and basic introduction to MapRT
- Discuss the use of SGRT for surface guided planning and some of the benefits it brings to our patients
- Discuss case studies where scripting can address concerns within our workflows and/or validate changes to your process.
- Highligh how scripting can tie together currently isolated steps in the SGRT End-To-End workflow.
- Hopefully give a good overall perspective on what is possible with scripting and help others start exploring new possibilities and workflows.

GitHub

python™ VTK PySide Python for Qt C#

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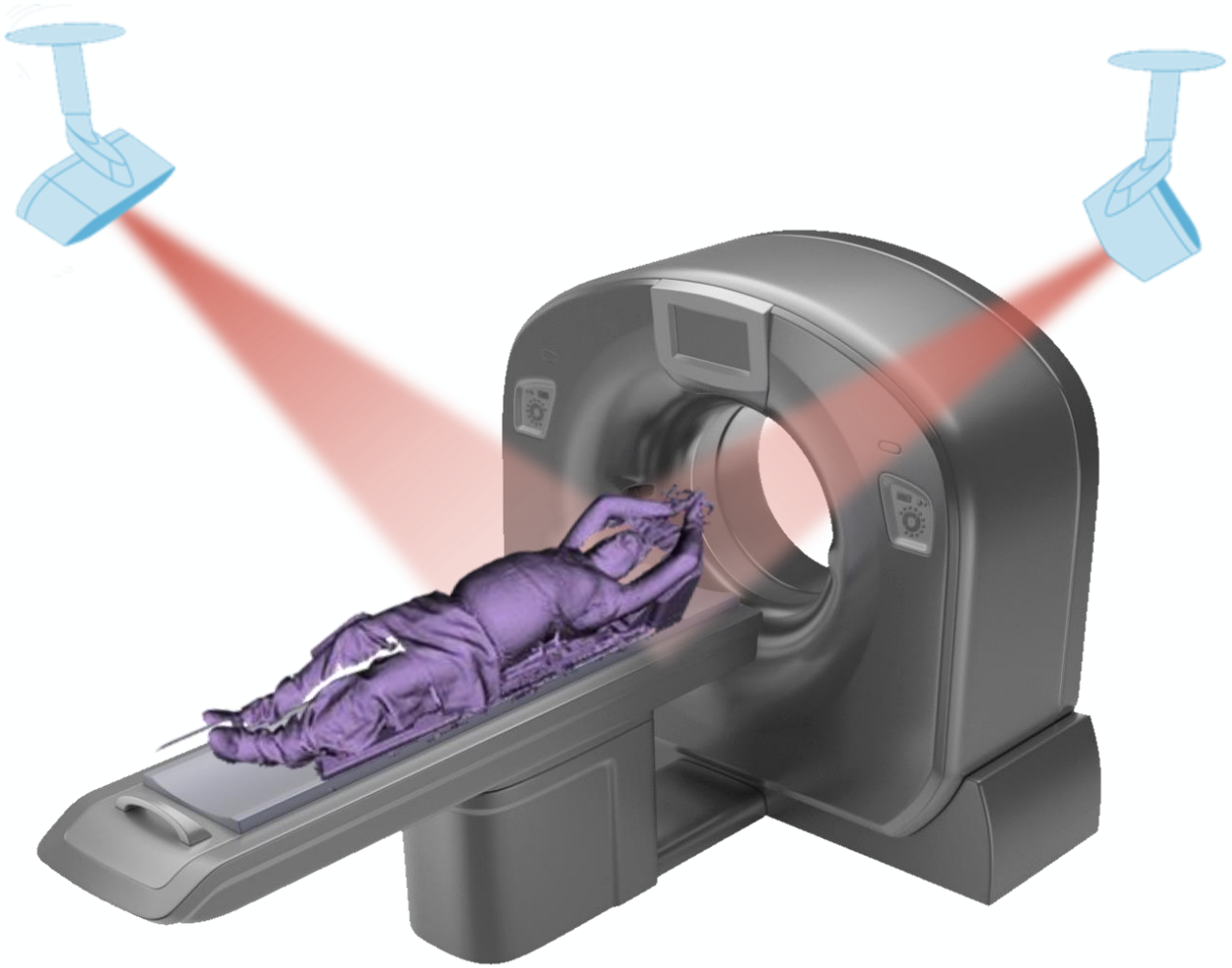
MapRT Basic System Description for Surface Base Planning



- Installation of 2 lateral cameras with unique large field of view
- Allows for surface capture over a large area encompasing both the patient and the immobilization devices on the CT couch at the time of simulation
- If properly acquired the MapRT surface can be used during the planning process to determine if collision zones exist even if they are far from the region captured during the CT for treatmetn planning

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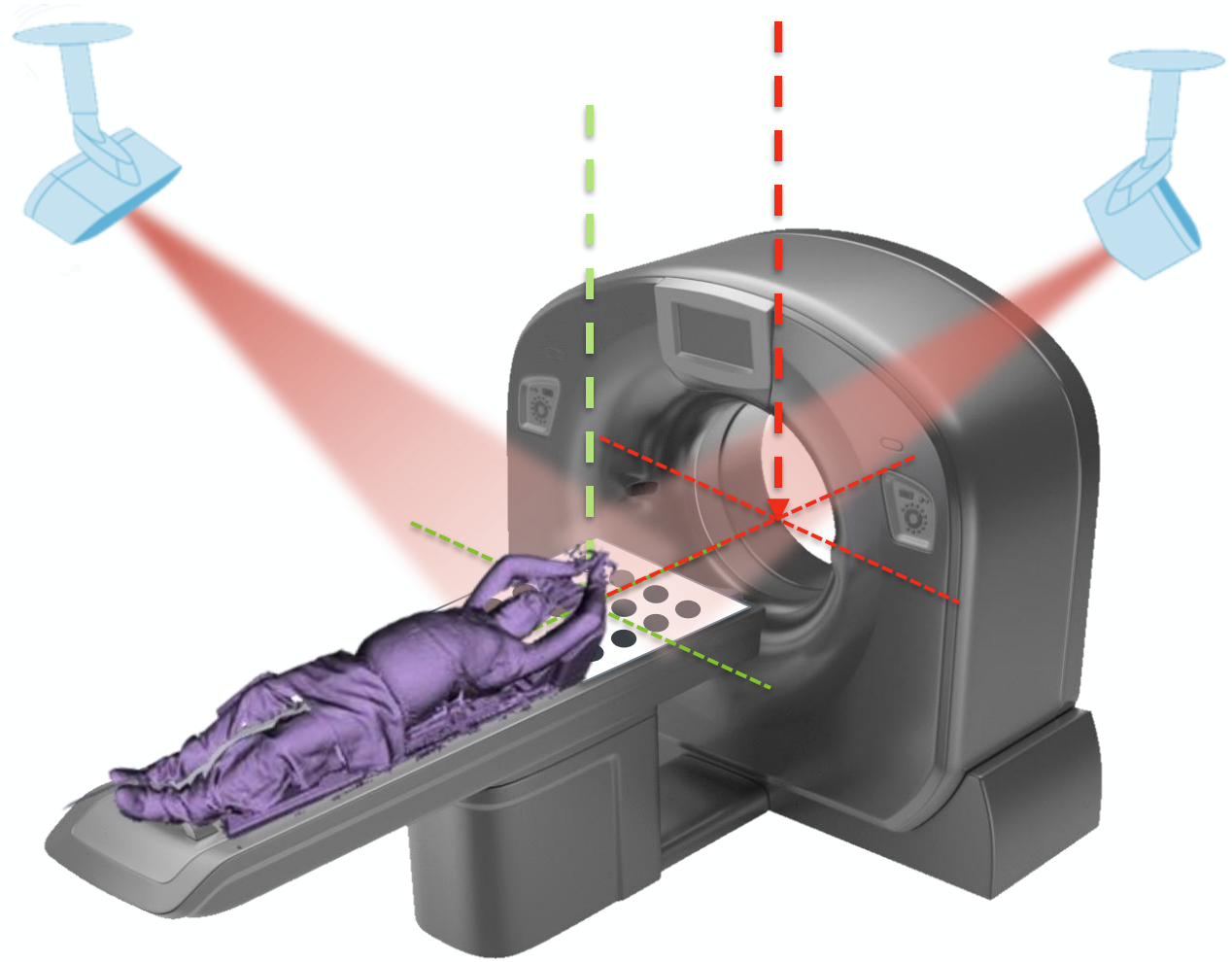
MapRT Registration of Camera and DICOM Coordinates



- Once the system is calibrated surface captures are now aligned to the reference position established during the calibration process.
- The **reference position** can be coregistered with the DICOM frame of reference through the **DICOM origin** which is defined in a vendor specific transform.
- A least one couch marker must be visible in both sensors on the same camera pod to allow for merging of surface captures at different couch poisitions.
- This process allows for longer surface captures.

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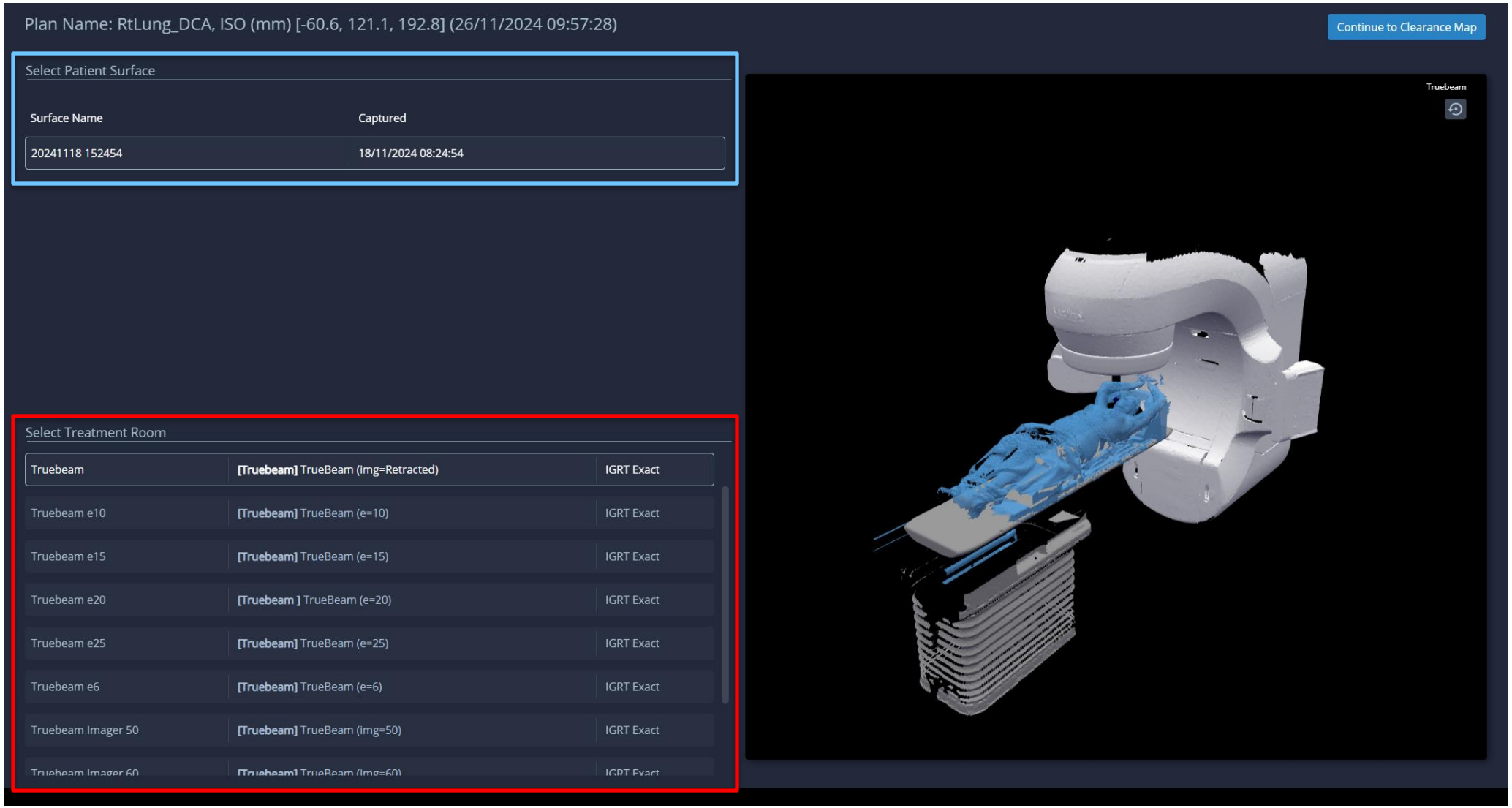
MapRT Verification After Installation: Machine Model Acceptance



- Machine models (i.e. Treatment Room Selection) should ideally match the intended treatment geometry

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MapRT Verification After Installation: Machine Model Acceptance

- Machine models (i.e. Treatment Room Selection) should ideally match the intended treatment geometry

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MapRT Verification After Installation: Machine Model Acceptance

- Machine models (i.e. Treatment Room Selection) should ideally match the intended treatment geometry

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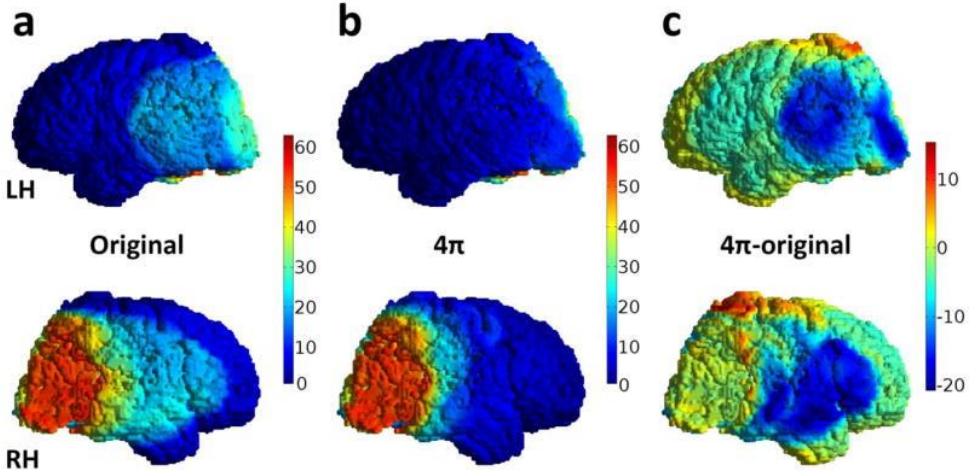
MapRT: Plan and Isocenter Validation and Treatment Coordination

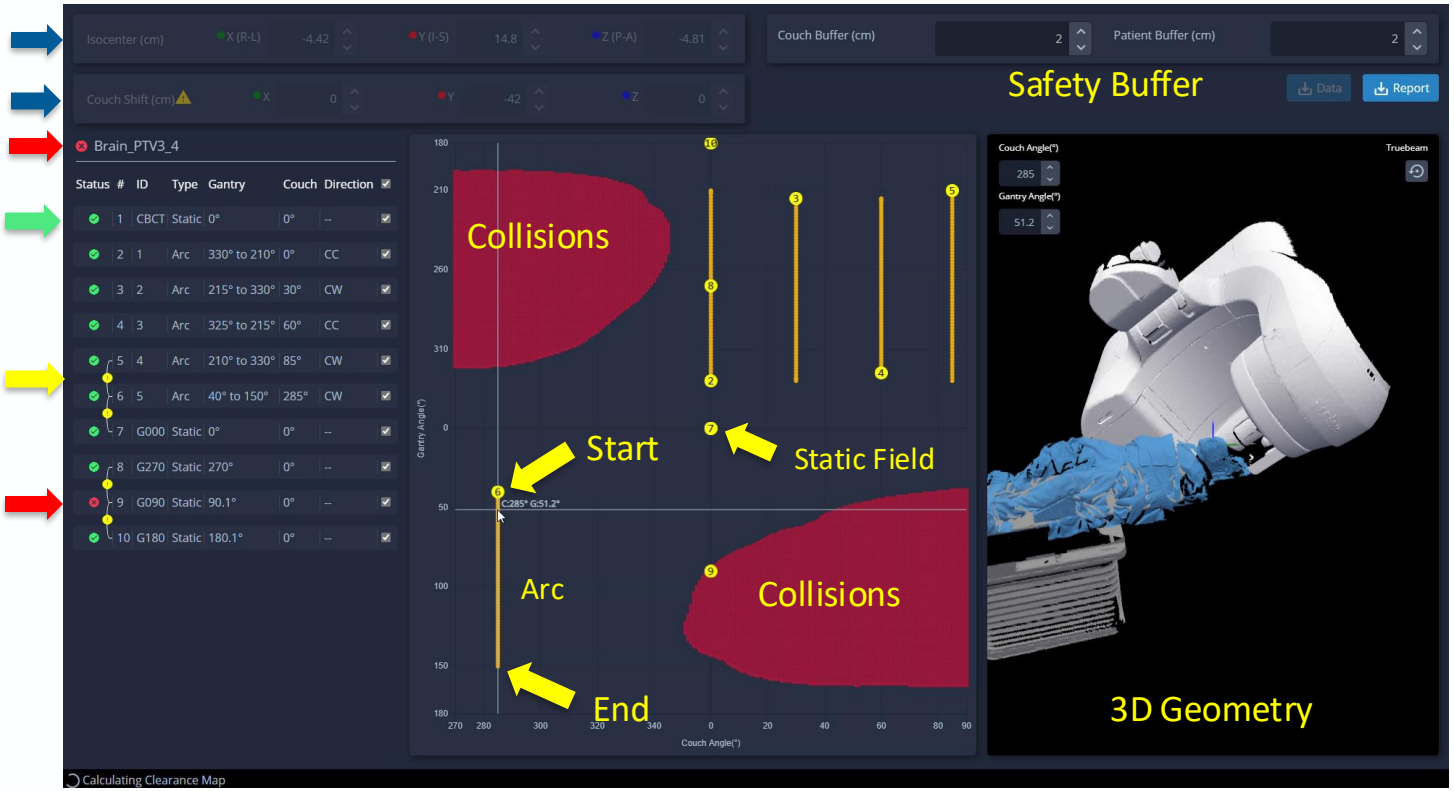
SGRT for Treatment Planning

Non-Coplanar Treatment to Spare Cortex

- Non-coplanar beam delivery enhances conformality
- 13 patients evaluated, non-coplanar versus delivered plans
- Example: Hippocampus mean dose improved 40%



Murzin et al., Radiother Oncol, 2019



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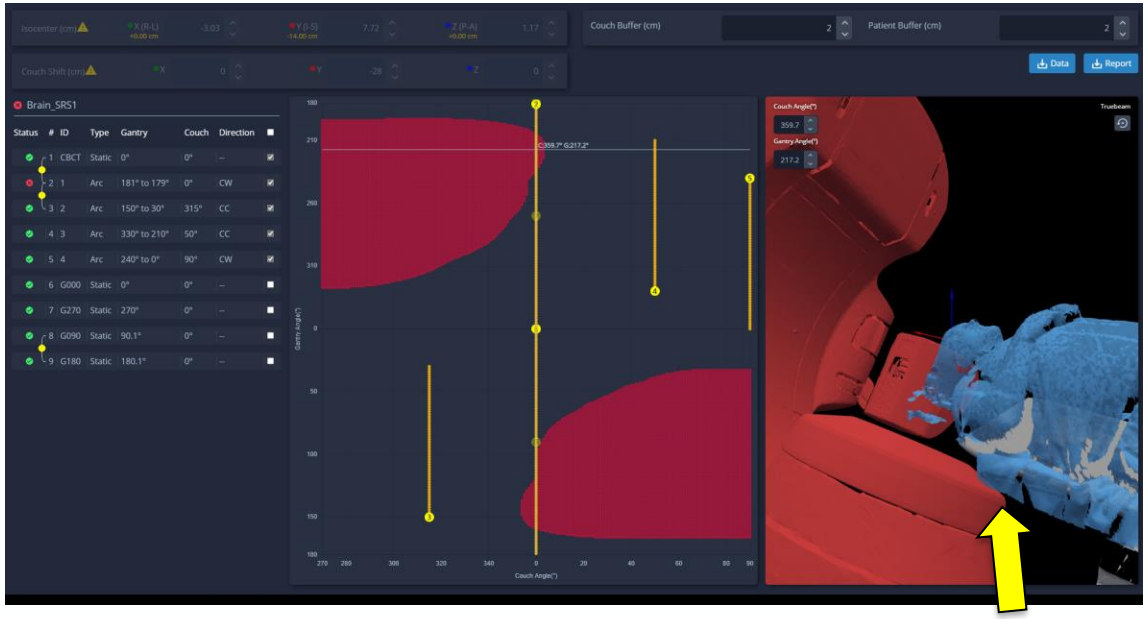
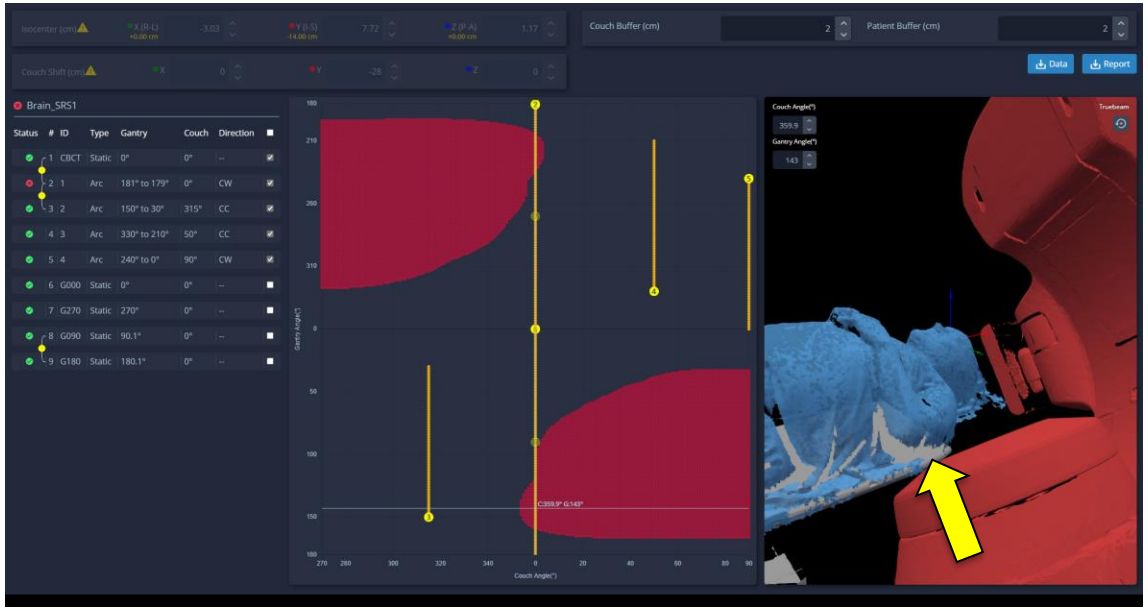
MapRT: Evaluation of a Very Simple Standard Case



False Positive on Sheet



True Positive on Couch

- Intracranial SRS is considered a high precision high dose abalitive procedure.
- It is often delivered in non-coplanar beam arangements utilizing 4 - 6 couch positions
- While risk of collision can be high developments like Varian's HyperArc artifically reduce the risk by limiting the available solution space explored during the planning process
- MapRT allows planers to explore the full possibility of the solution space with confidence even for highly complex single isocenter multiple target (SIMT) SRS cases with previous irradiation that need to be avoided

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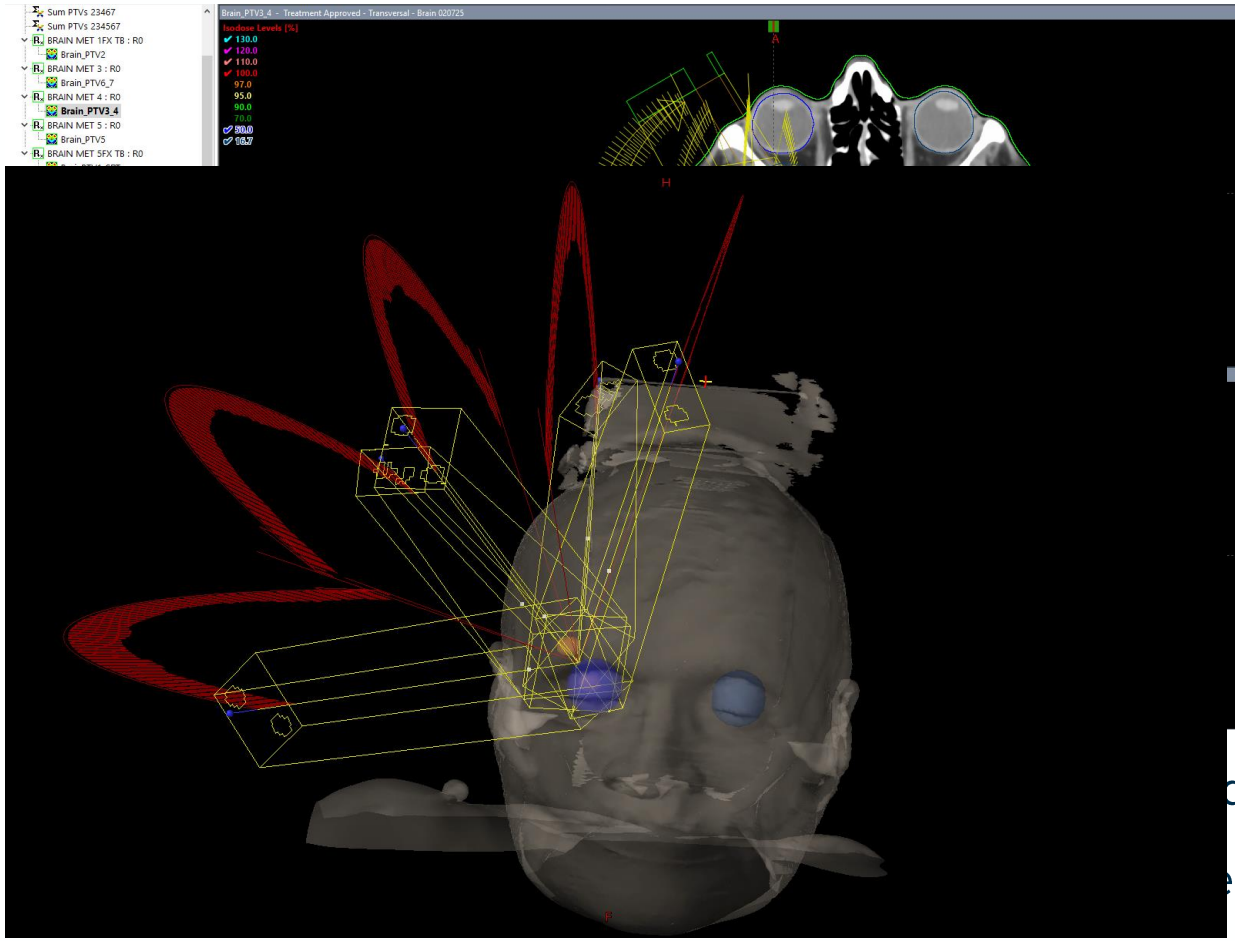
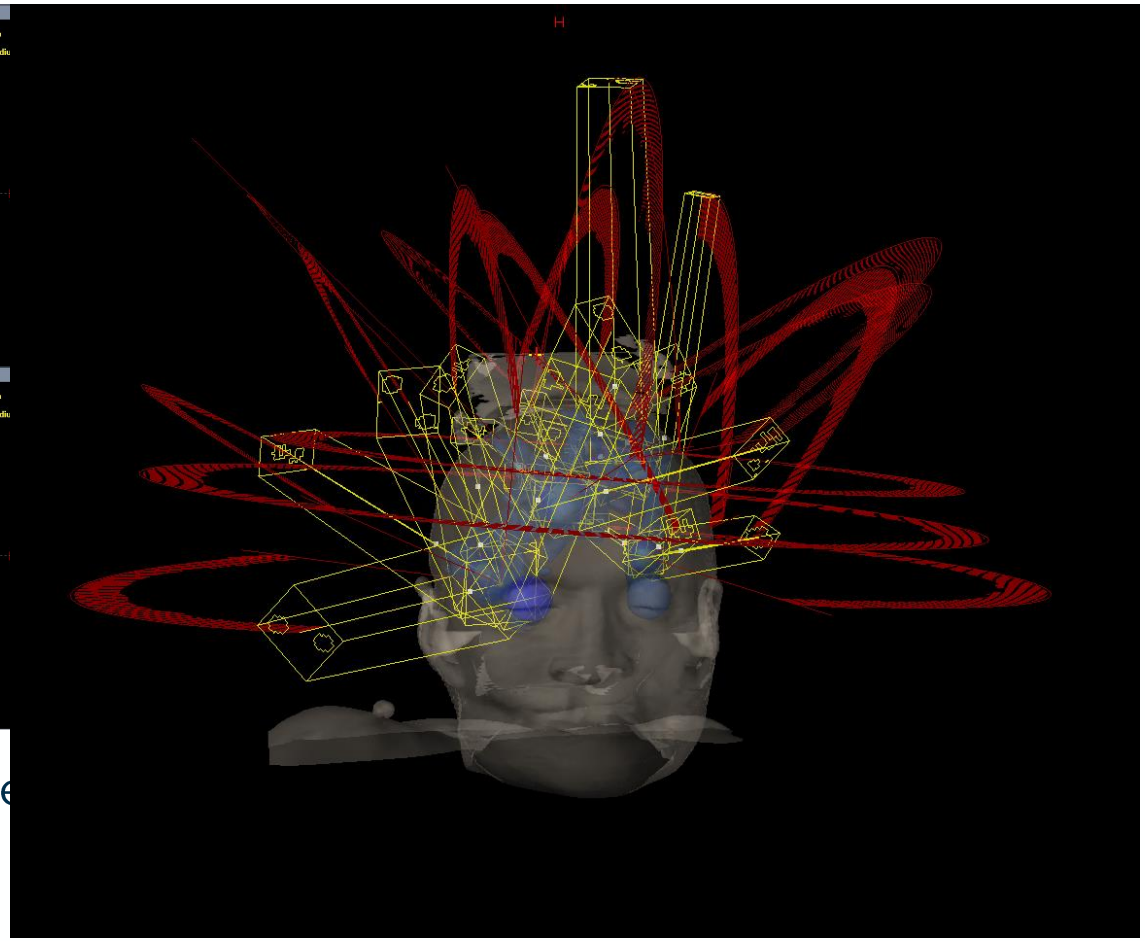
MapRT for Intracranial SRS Planning



Single SIMT SRS Plan



4 grouped SIMT SRS Plans to avoid previous treated areas

- While risk of collision can be high developments like Varian's HyperArc artifically reduce the risk by limiting the available solution space explored during the planning process
- MapRT allows planers to explore the full possibility of the solution space with confidence even for highly complex single isocenter multiple target (SIMT) SRS cases with previous irradiation that need to be avoided

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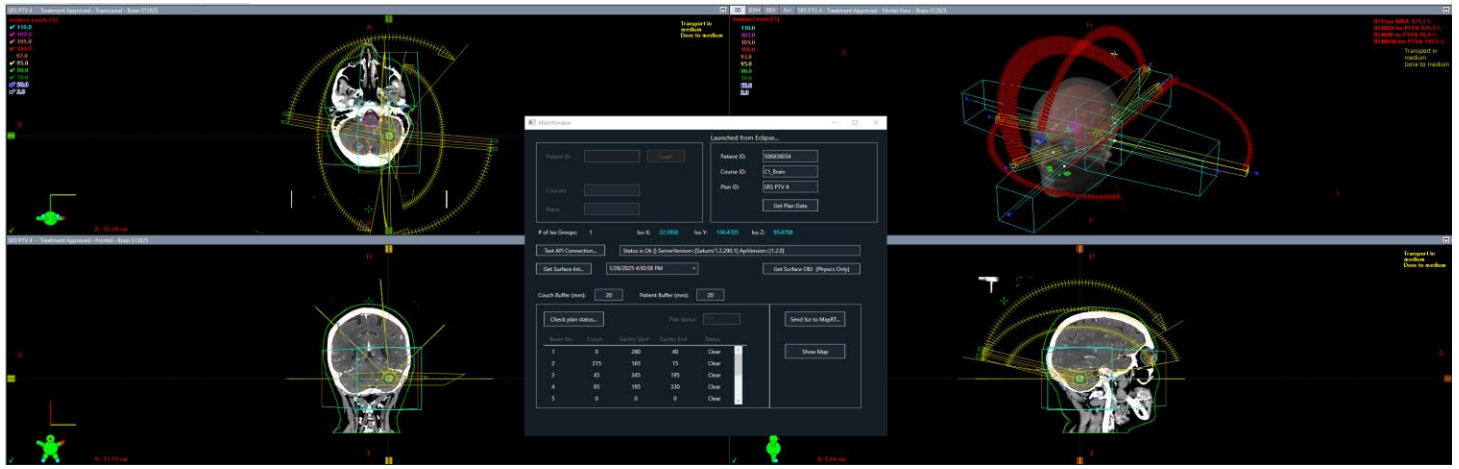
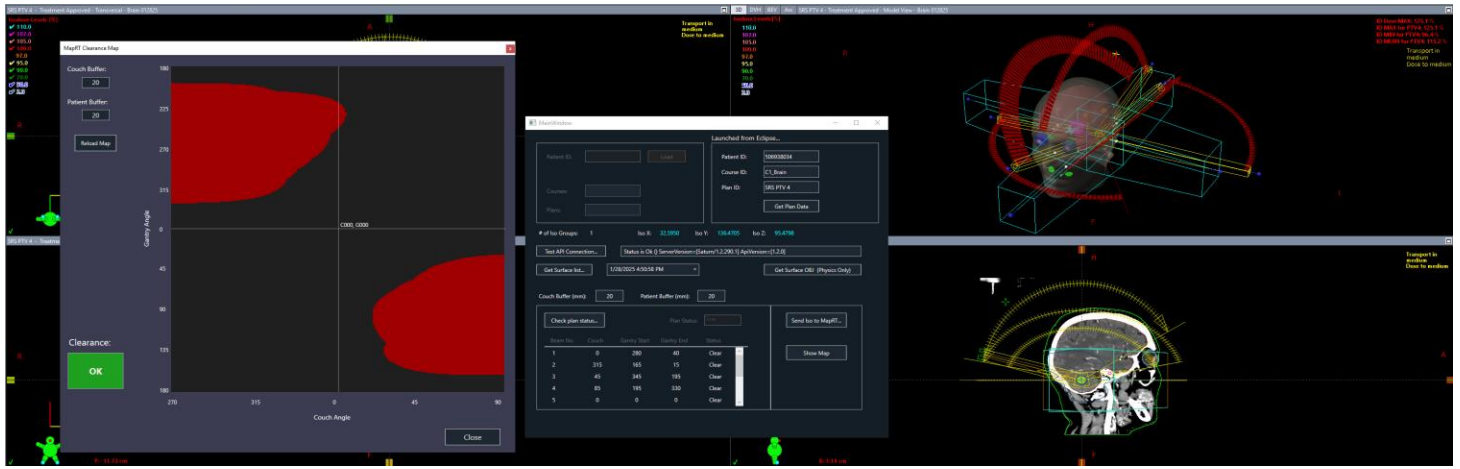
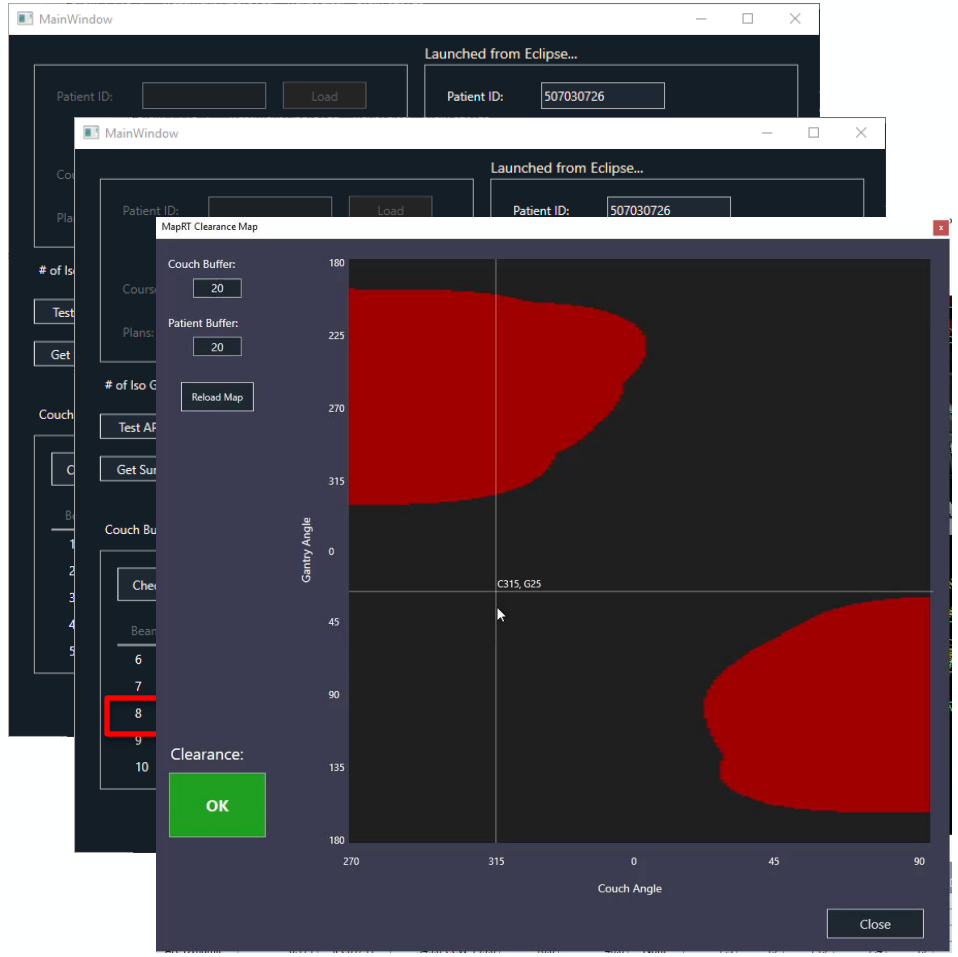
MapRT API for Rapid Plan Validation Through ESAPI Integration (C#)







- Leveraging the API allows the user to rapidly evaluate the plan context being worked on while planning.
- The API also allow the user to generate a collision map that can be dynamically explored for alternate solutions for failing fields reducing planning time by more than 30 minutes.

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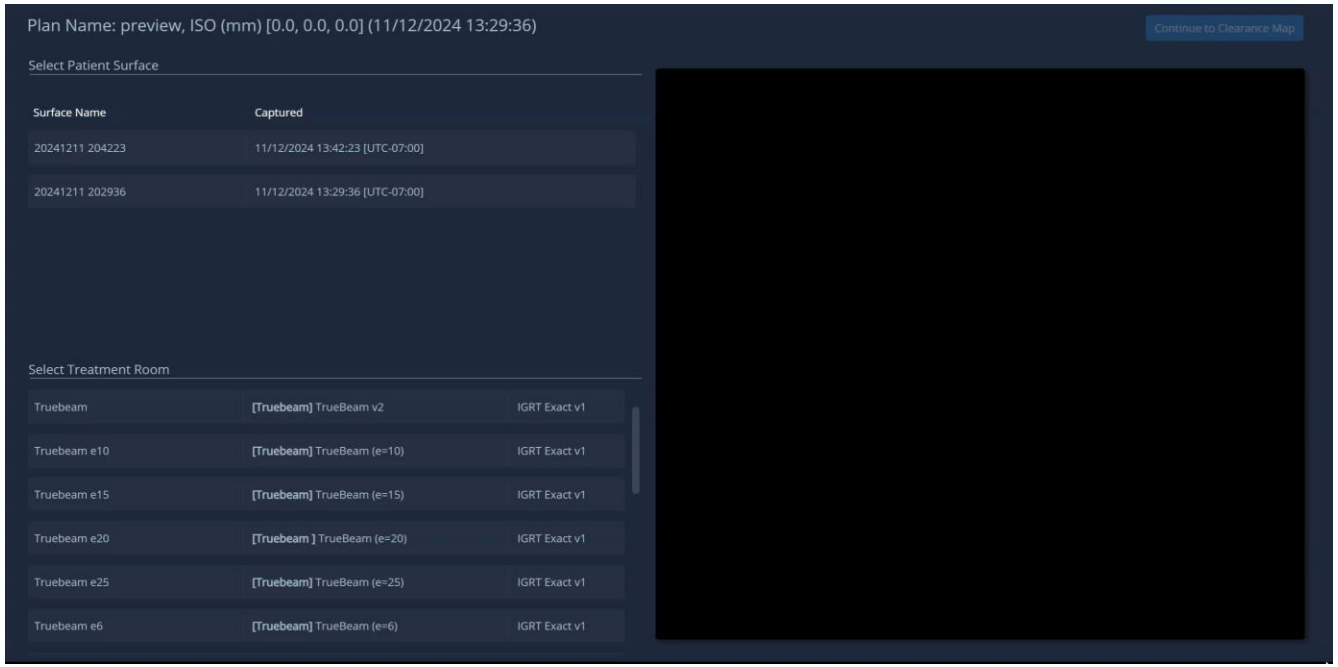
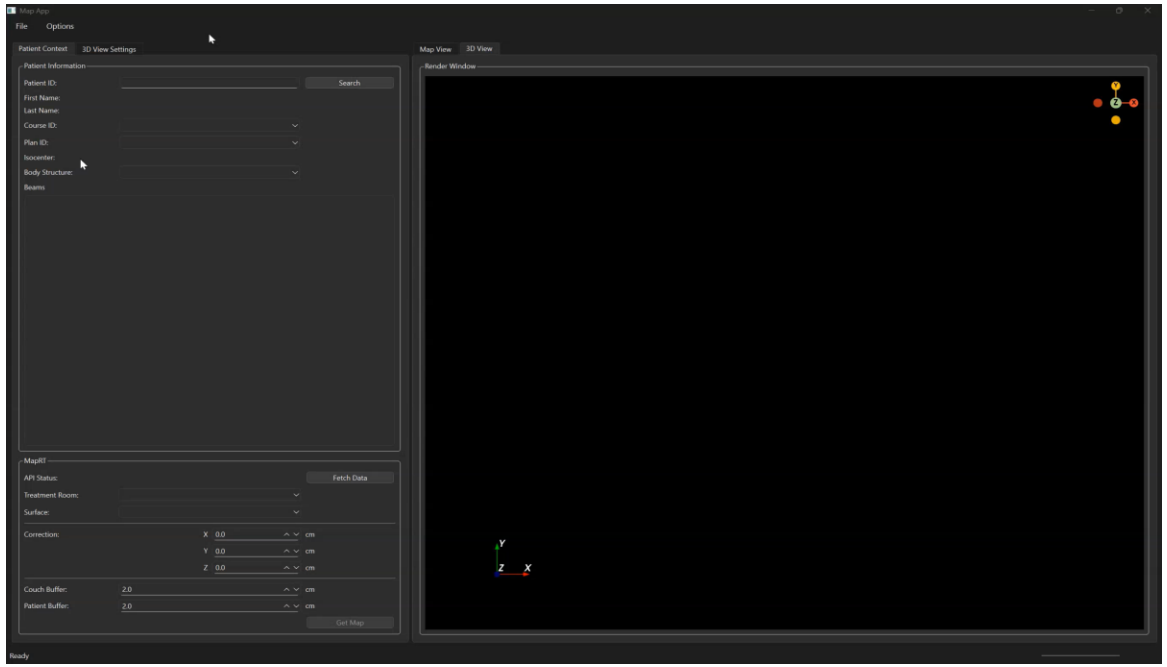
MapRT API in Development of More Familiar Workflows in CT Sim



MapRT Web Interface



MapRT API

We can work with the therapy teams to

- Design workflow to take advantage of the familiarity of the sim room (e.g. lasers vs axis marker)
- Set isocenter once and compare multiple collision maps
- Cache maps to avoid recalculation with repeated changes

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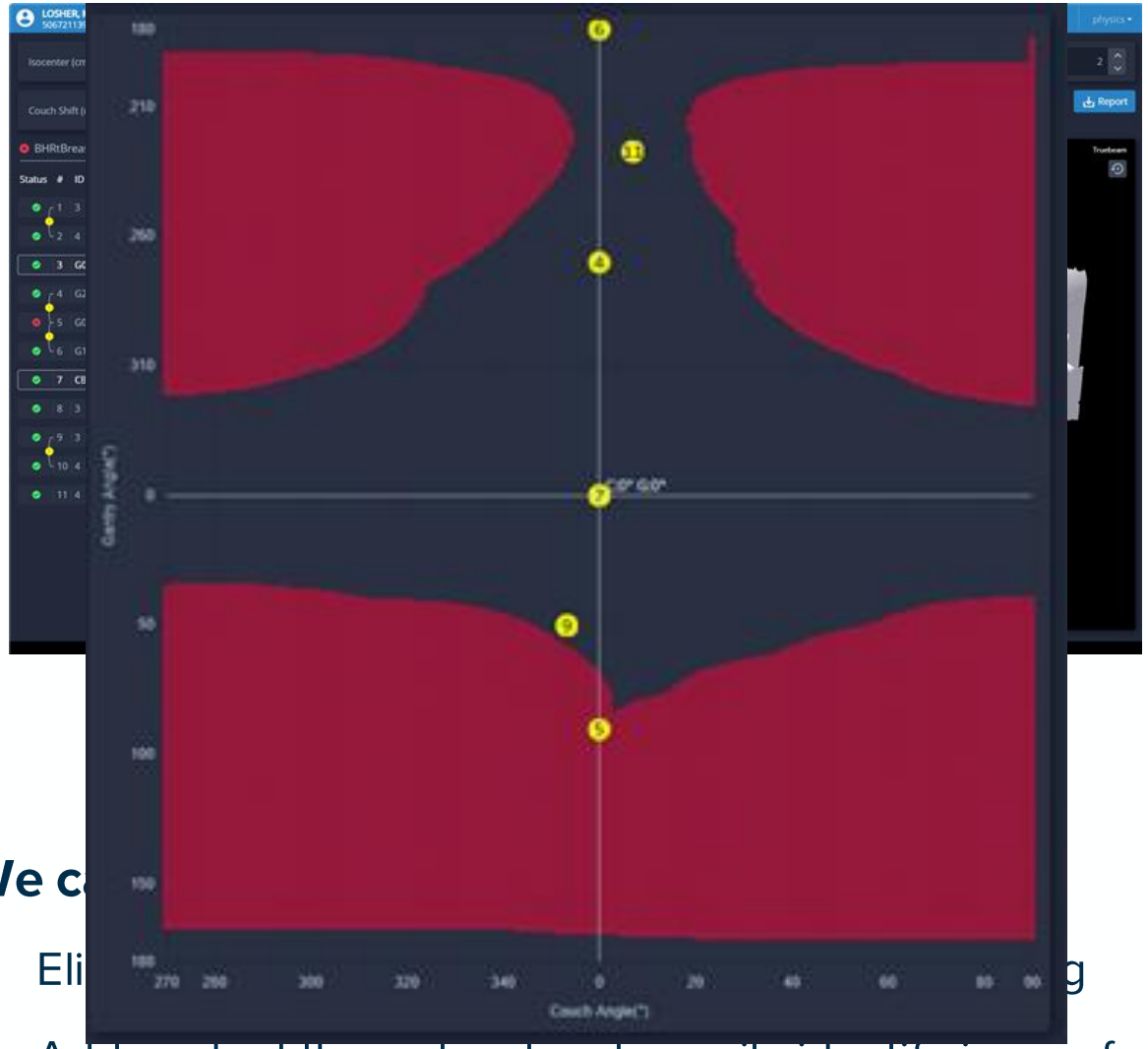
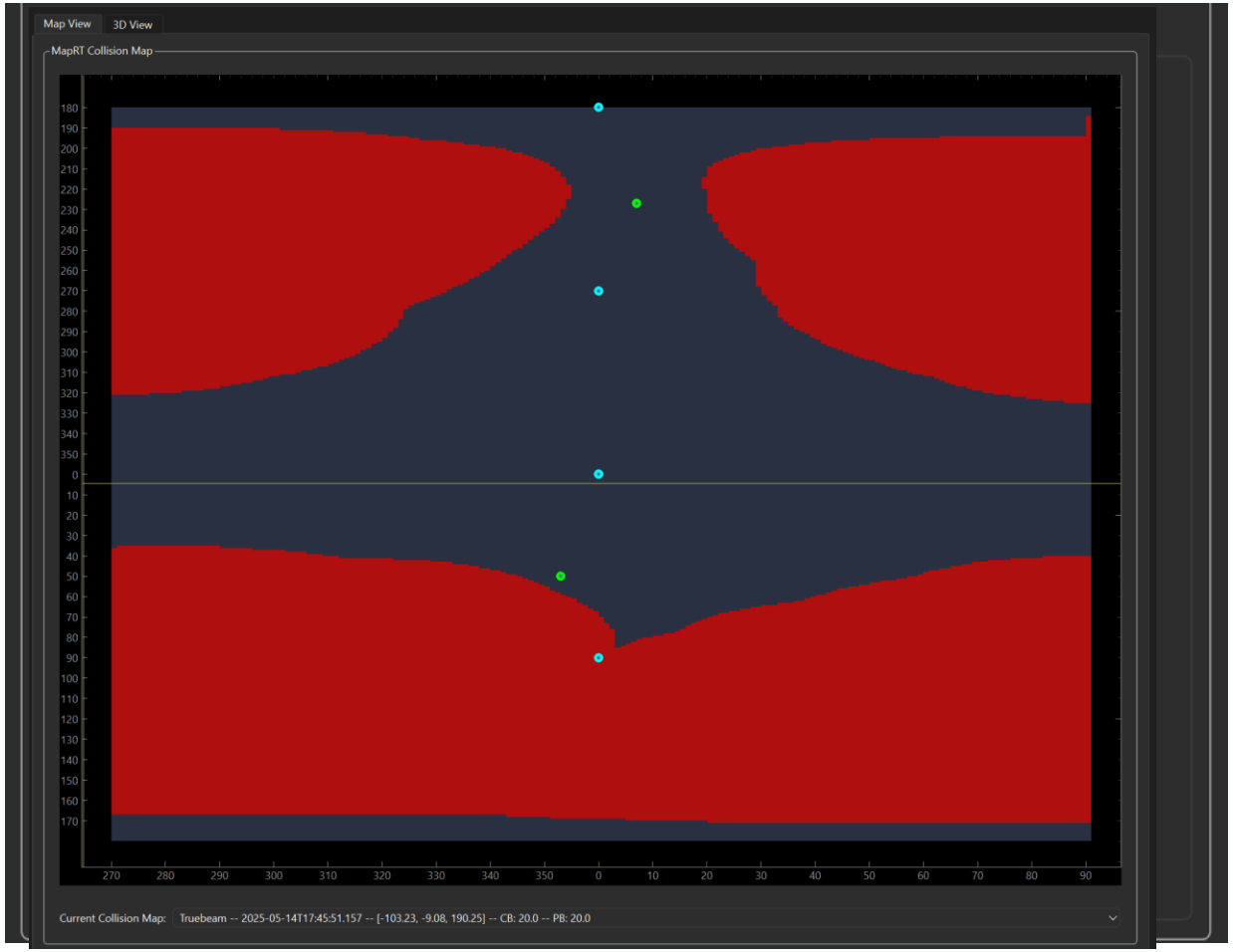
MapRT API to Clean Up Information Display During Plan Evaluation





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- Eli g
- Add context through colors to easily identify issues from non-issues
- Simply make folks happy

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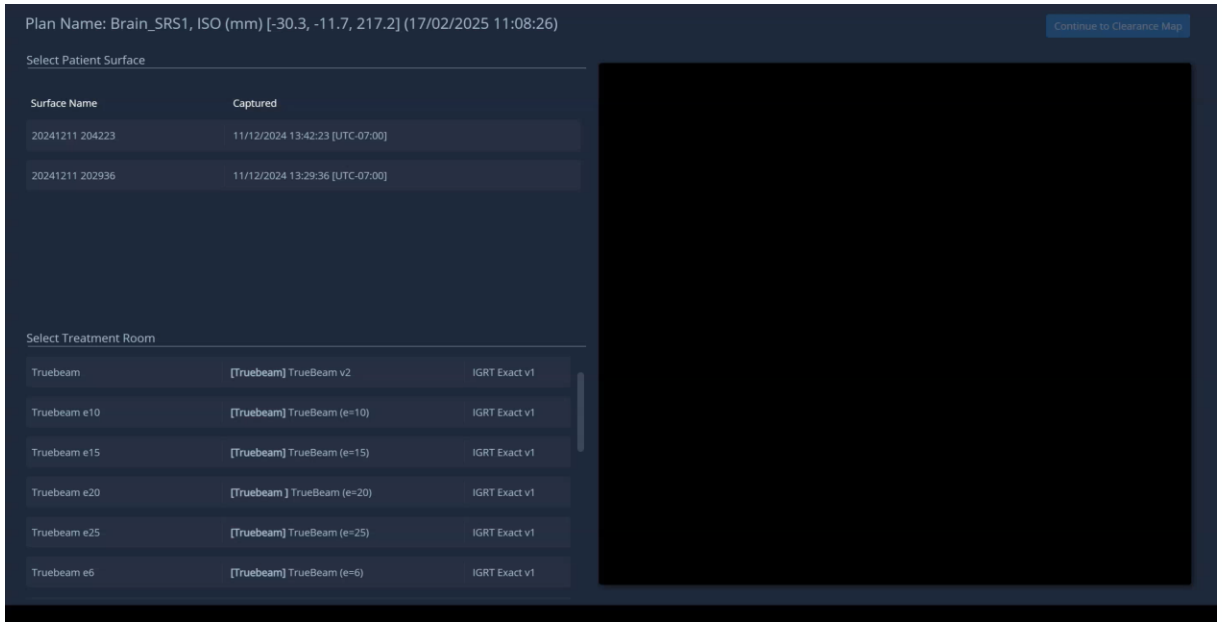
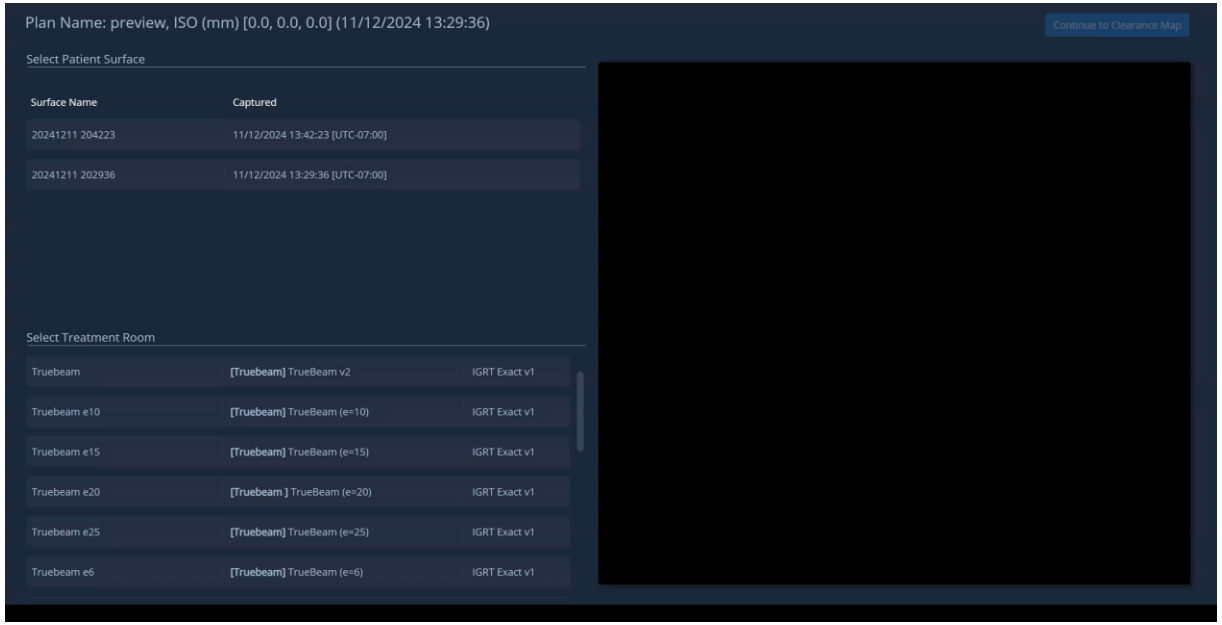
Workflow Dependent Errors: Collision Map Validation





Promoting replacement of safety checks with new methods requires new safety checks

- We need to verification that the proper data is used for collision map calculation if collision maps are going to be used to help guide our planning
- Safety dictates that errors should be readily identifiable if the new check is to replace the old
- **Policies and Procedures** are the lowest level of the **Hierarchy of Effectiveness**

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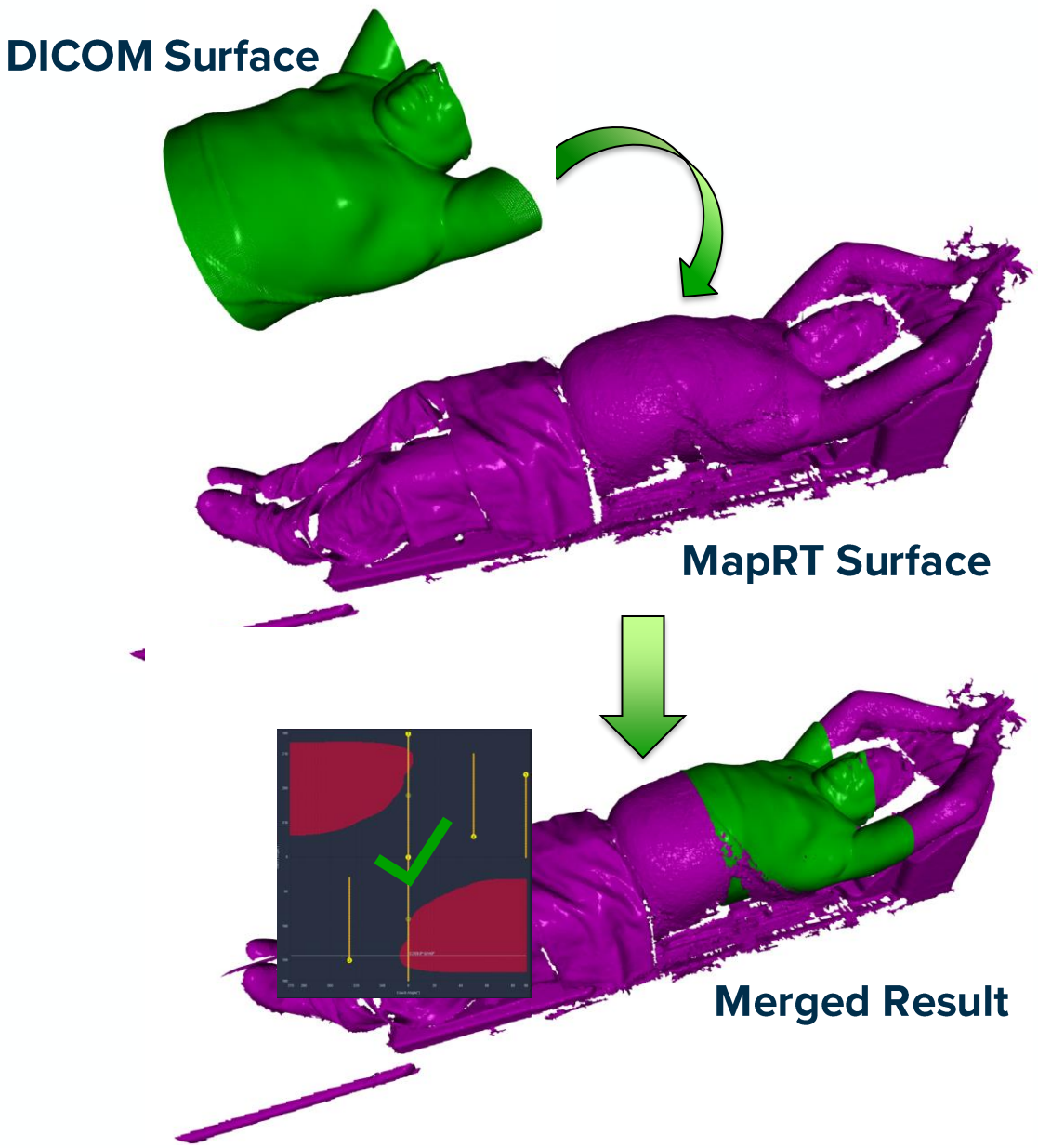
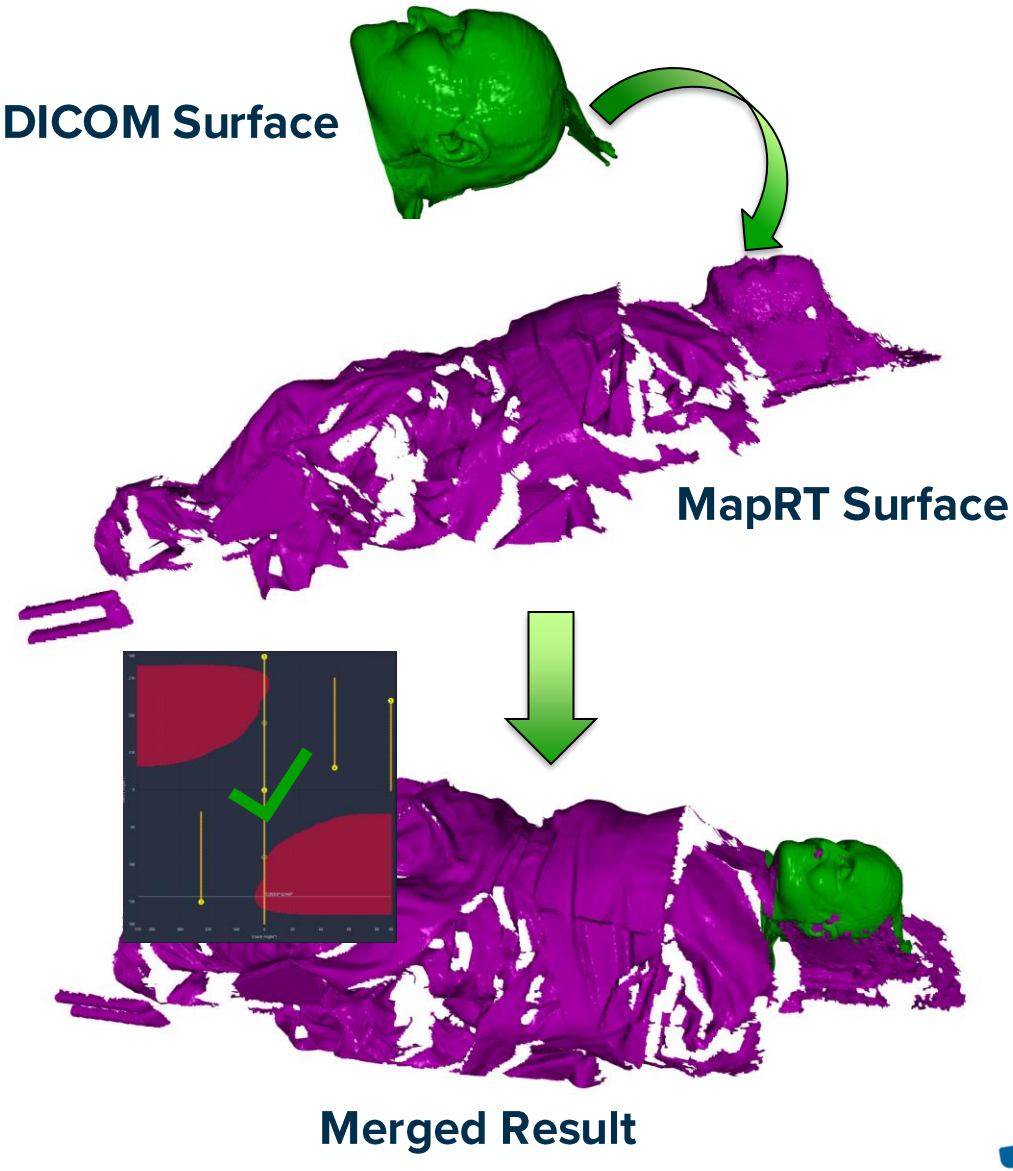
MapRT: API Integration for Additional Isocenter Verification





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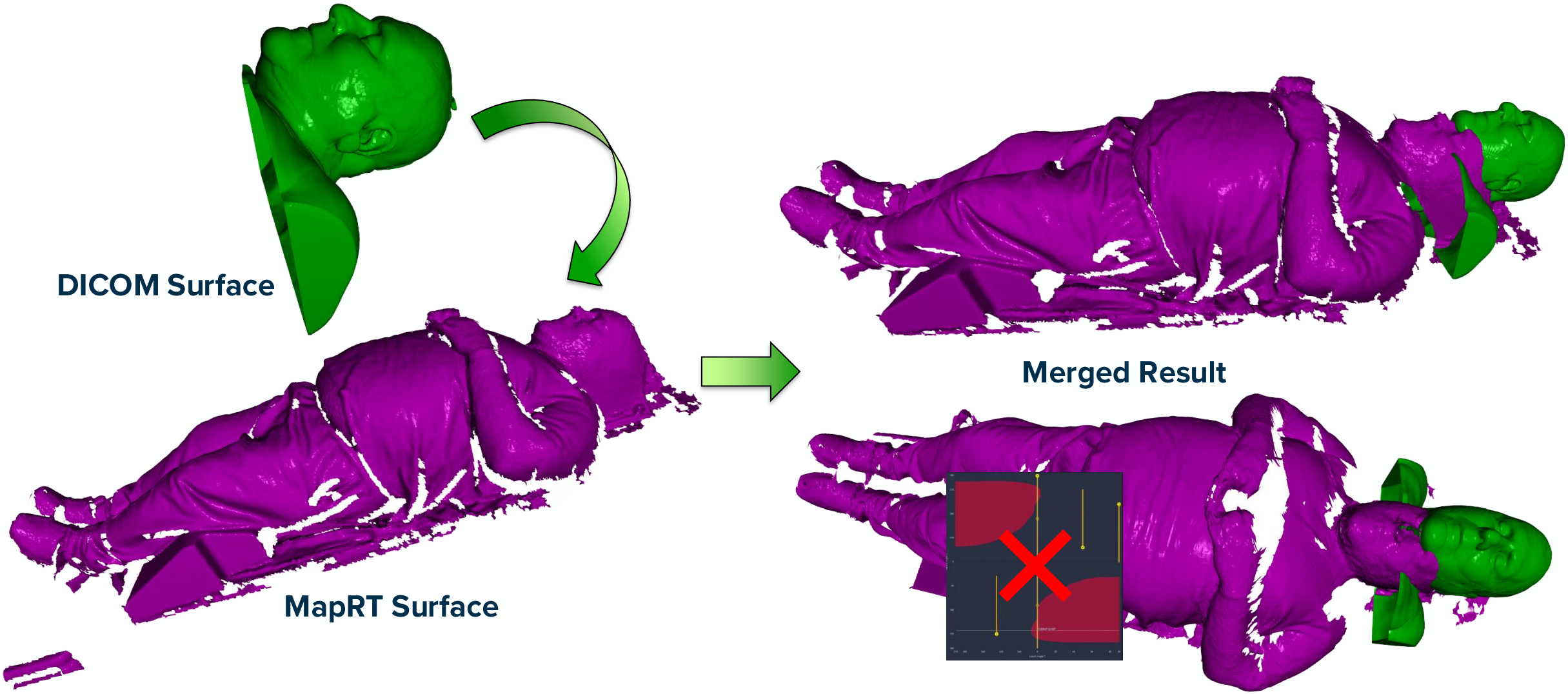
Preventing False Collision Maps From Incorrectly Captured Surfaces



- Incorrect captures can result in artifical clearance due to an offset in DICOM isocenter

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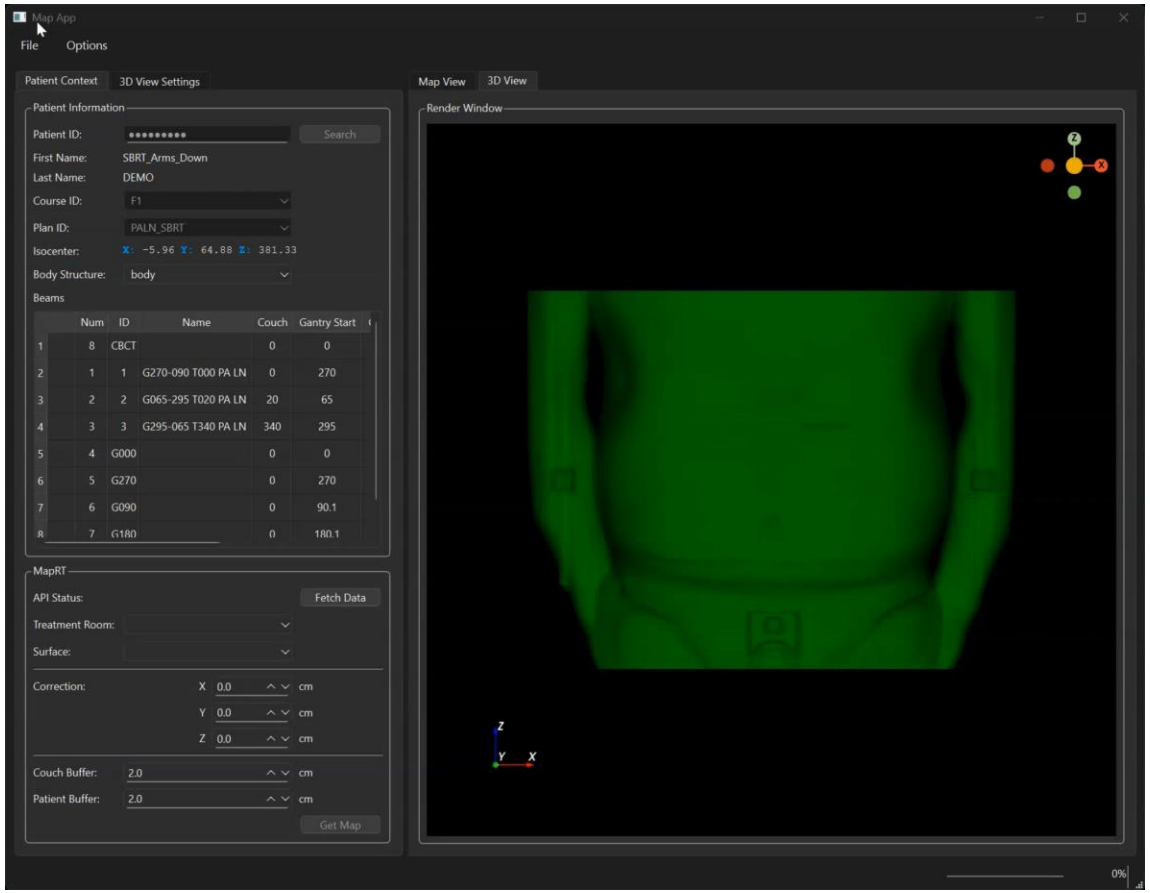
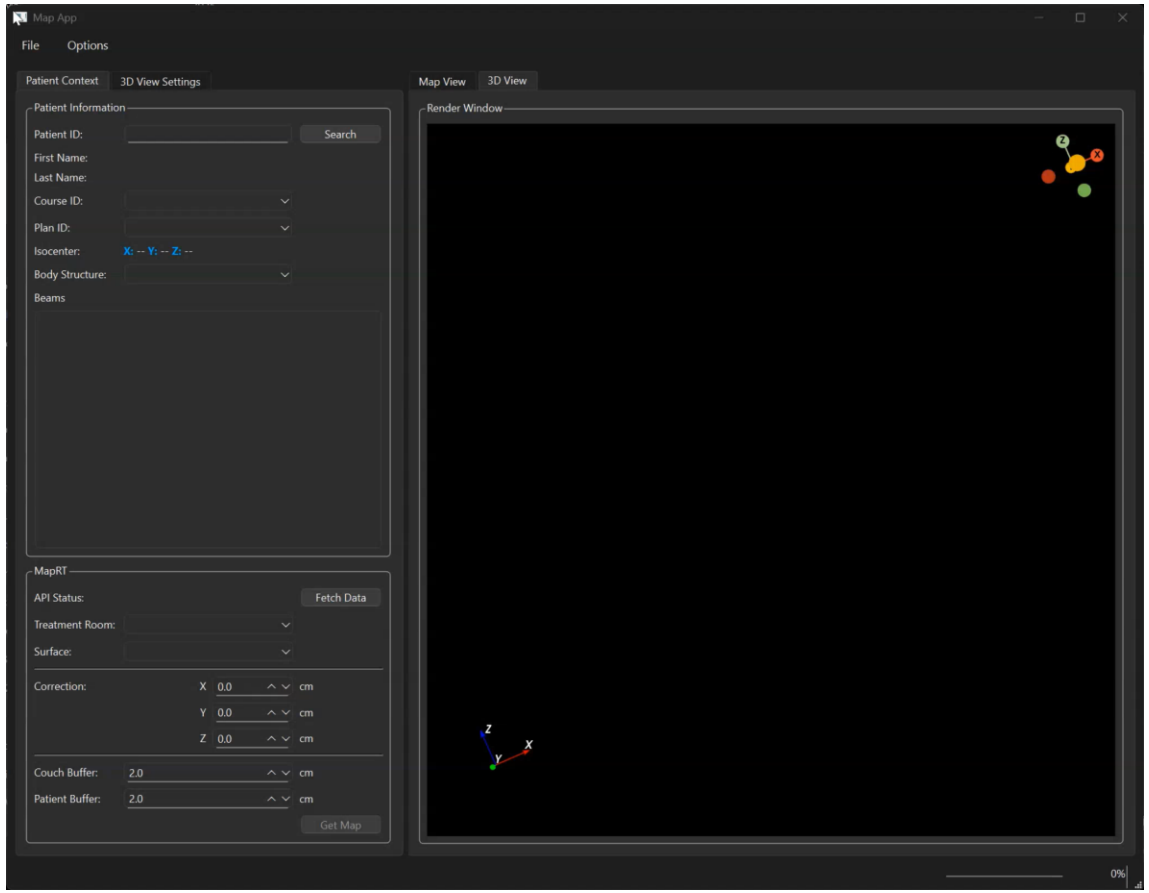
Two Improper Surface Capture Correction Workflows



Validation of Correction During Simulation



Correction During Treatmetn Planning

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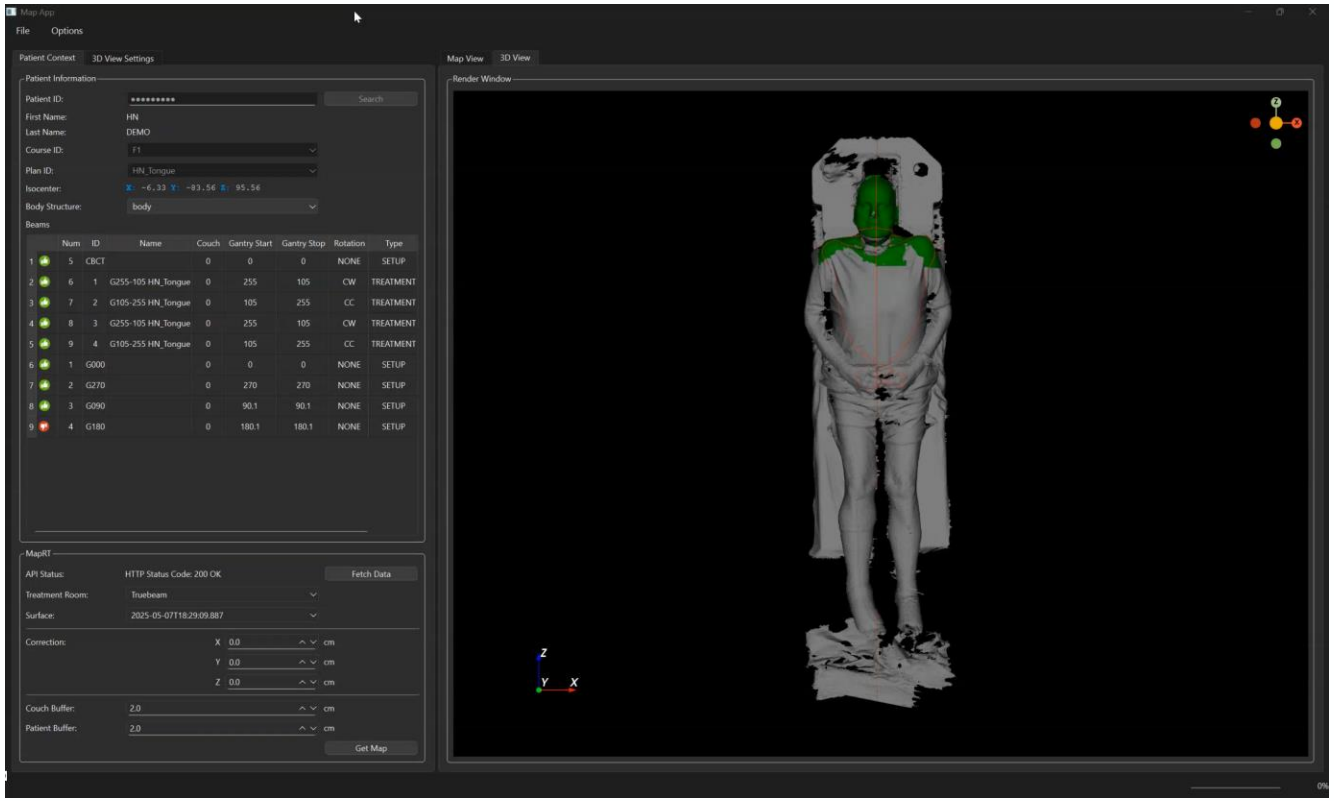
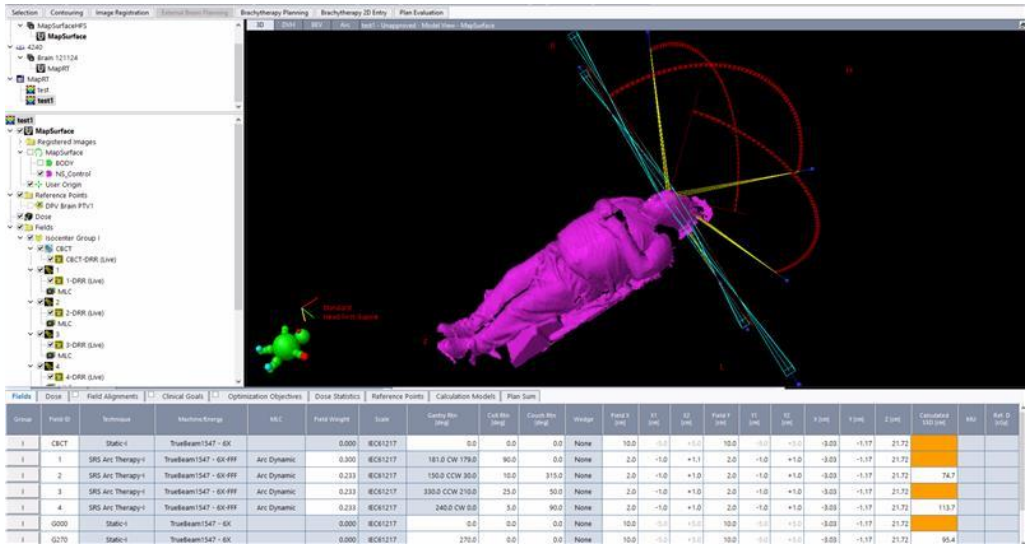
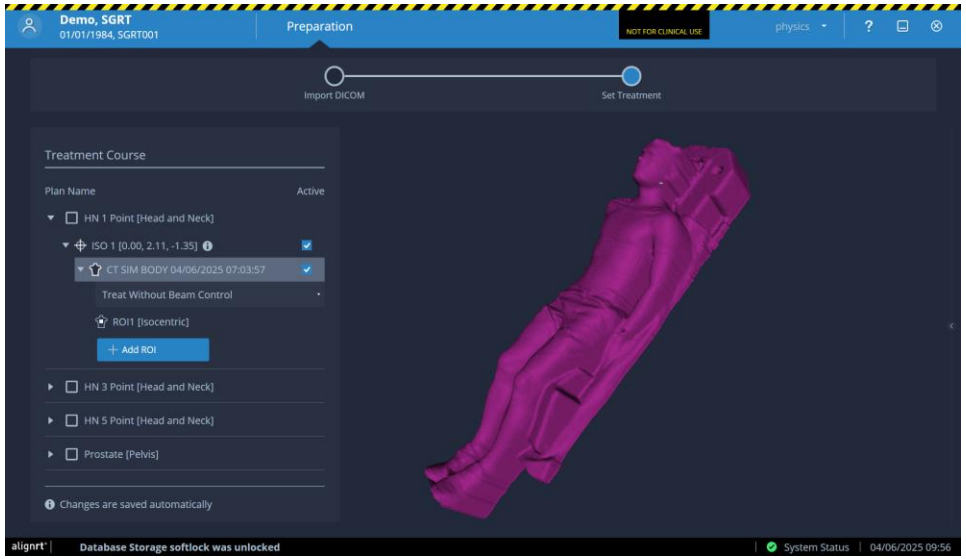
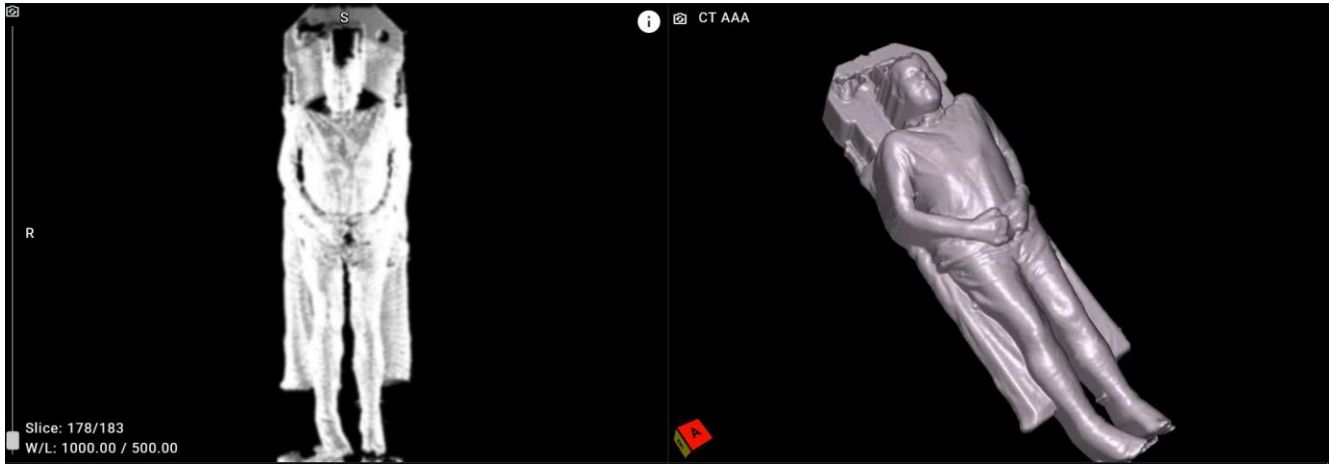
Conversion of Surface Mesh to DICOM and Generation of Synthetic CT









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Summary

- We have had a basic introduction to MapRT and what it offers
- Discussed some of the benefits of surface guided planning and the benefits it can bring to your patients
- Seen some case studies where scripting can be used to increase safety and reliability of surface guided planning process..
- Highlighed how scripting can be used to leverage surface guided planning information to enhance other areas of the End-To-End SGRT workflow (**Sim**-**Plan**-**Treat**-Dose) .
- Hopefully gave you a good overall perspective on what is possible with scripting so that you can start exploring new possibilities and workflows.

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Thank You!

- Special Thanks to the AdventHealth Physics team.

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Extending the Healing Ministry of Christ