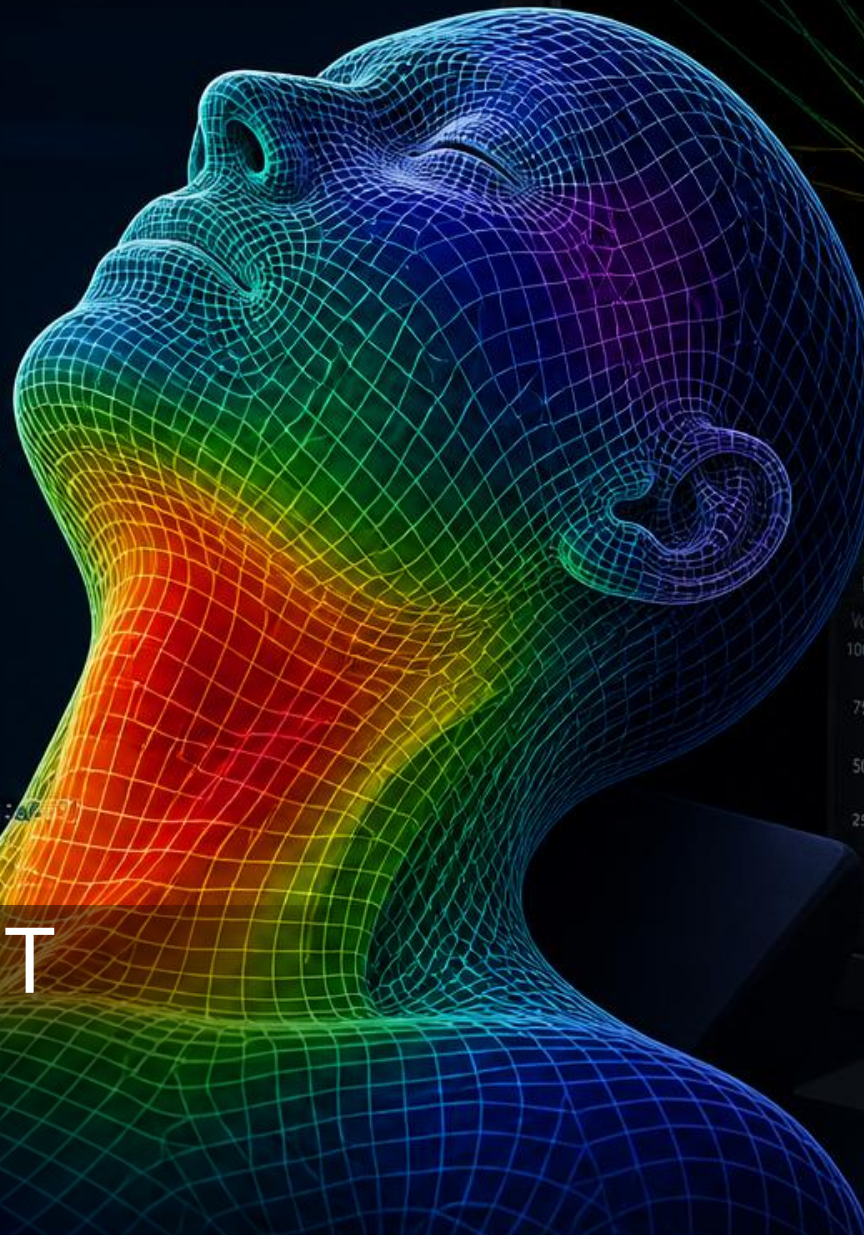


```

3 from connect import *
4
5 # Connect to the treatment planning system
6 case = get_current("Case")
7 exam = case.PatientModel.StructureSets[0]
8 beamset = case.BeamSets[0]
9
10 # Create a surface from external and
11 # selected internal structures
12 body = exam.ExternalGeometry["External"]
13 targets = ["PTV_7000", "CTV_5600", "GTV"]
14 pts = body.GetSurfacePointCloud()
15 for s in targets:
16     pts = np.vstack((pts, exam.StructureSets[0]
17                     .RoiGeometries[s].GetSurfacePointCloud()))
18
19 # Analyze surface
20 z = pts[:, 2]
21 z_norm = (z - z.min()) / (z.max() - z.min())
22
23 # Create analytics-driven parameter
24 metric = np.mean(z_norm)
25 beamset.Description = f"Mean Elevation: {metric:.2f}"
26 print(f"Mean Elevation: {metric:.2f}")

```



Plan Evaluation | Plan Optimization | Plan Sum

Dose

Color wash (%)

- 105.0
- 100.0
- 95.0
- 90.0
- 80.0
- 70.0
- 50.0
- 40.0
- 20.0
- 10.0

Structures

- PTV\_7000
- CTV\_5600
- GTV
- Brainstem
- SpinalCord
- Parotid\_L
- Parotid\_R
- Mandible

Properties

Plan	HN_SG
Technique	VMAT
Machine	TrueBeam
Energy	6X
MU	682.4

DVH

Volume (%)

Statistics

Structure	D95% (cGy)
PTV_7000	6650.2
CTV_5600	5363.4
GTV	7121.7
Brainstem	2458.6
SpinalCord	4078.3
Parotid_L	2608.7
Parotid_R	2594.1

# Scripting with MapRT

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AdventHealth Rocky Mountain Region

[Michael.Tallhamer@AdventHealth.com](mailto:Michael.Tallhamer@AdventHealth.com)

# Disclosures

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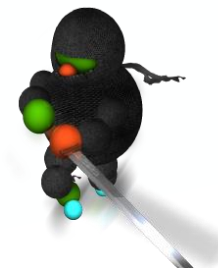
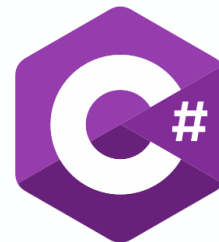
- AdventHealth – Parker has a PSA agreement with Vision RT.
- AdventHealth – Celebration has a COE agreement with Vision RT.

# AdventHealth's SGRT Radiation Oncology Therapy Workflow

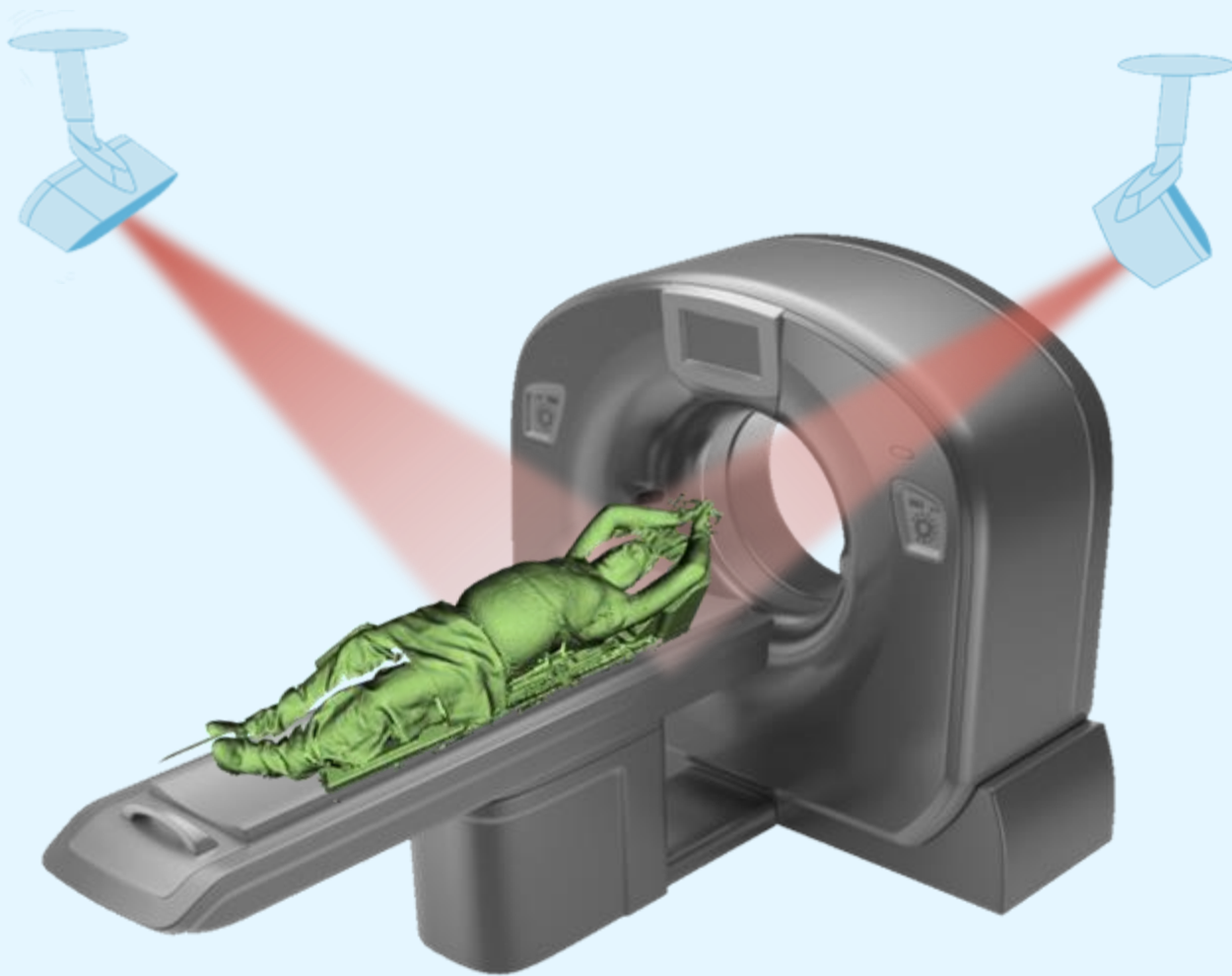


# Goals

- 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.
- Highlight how scripting can bring 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.

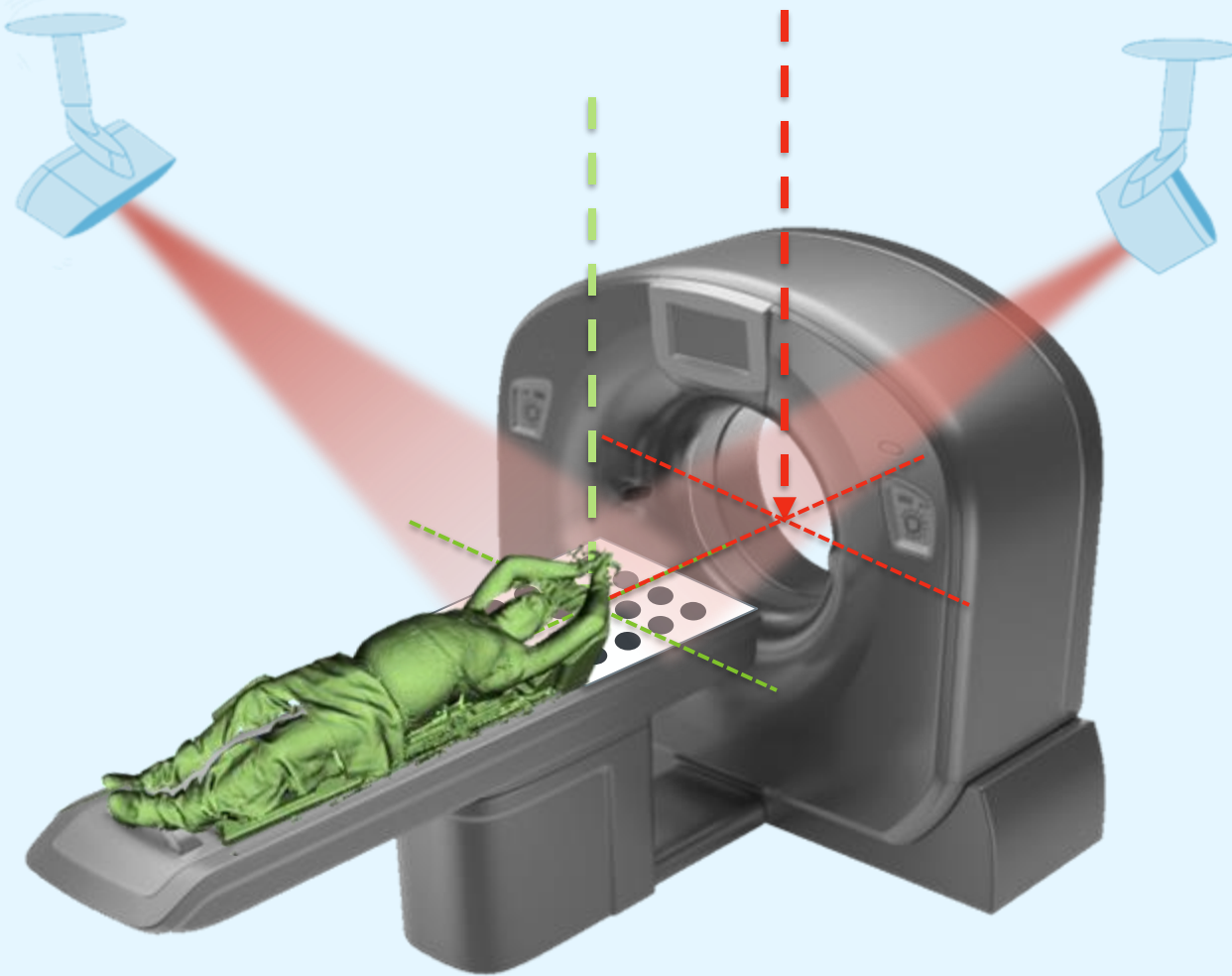


# MapRT Basic System Description for Surface Base Planning



- Installation of 2 lateral cameras with unique large field of view
- Allows for surface capture over a large area encompassing both the patient and the immobilization devices on the CT couch at the time of simulation

# MapRT Registration of Camera and DICOM Coordinates



- The **reference position** can be registered 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 positions.
- This process allows for longer surface captures.

# Powerful Planning Insights

The screenshot shows a software interface with a dark blue background. At the top, there is a navigation bar with tabs: "Patient Info" (highlighted), "Select Patient", "Review Setup", and "Clearance Map". On the right side of the navigation bar, there is a "physics" dropdown menu and a "Continue to Review Setup" button.

The main content area is divided into two sections: "Select Patient" on the left and "Select Plan" on the right. The "Select Patient" section contains a table with the following columns: "Patient Name ↑", "Patient ID", "Modified Date", and "New Plan". A single row is visible in the table with the following data: "Patient Name" (in a dropdown menu), "Patient ID" (in a dropdown menu), "04/06/2025 12:14:34", and a "New Plan" dropdown menu. A blue box highlights the "Select Patient" section.

The "Select Plan" section is currently empty, displaying the text "No patient selected".

At the bottom of the interface, there is a "+ Load DICOM file" button. A red box highlights the bottom portion of the interface, including the "Load DICOM file" button.

# MapRT API in Development of More Familiar Workflows in CT Sim

## MapRT Web Interface

Plan Name: preview, ISO (mm) [0.0, 0.0, 0.0] (11/12/2024 13:29:36) Continue to Clearance Map

Select Patient Surface

Surface Name	Captured
20241211_204223	11/12/2024 13:42:23 [UTC-07:00]
20241211_202936	11/12/2024 13:29:36 [UTC-07:00]

Select Treatment Room

Truebeam	[Truebeam] TrueBeam v2	IGRT Exact v1
Truebeam e10	[Truebeam] TrueBeam (e=10)	IGRT Exact v1
Truebeam e15	[Truebeam] TrueBeam (e=15)	IGRT Exact v1
Truebeam e20	[Truebeam ] TrueBeam (e=20)	IGRT Exact v1
Truebeam e25	[Truebeam] TrueBeam (e=25)	IGRT Exact v1
Truebeam e6	[Truebeam] TrueBeam (e=6)	IGRT Exact v1

## MapRT API

MapRT API

File Options

3D View Settings

Map View 3D View

Render Window

MapRT

API Status: Fetch Data

Treatment Room: ▼

Surface: ▼

Correction: X 0.0 cm Y 0.0 cm Z 0.0 cm

Couch Buffer: 2.0 cm

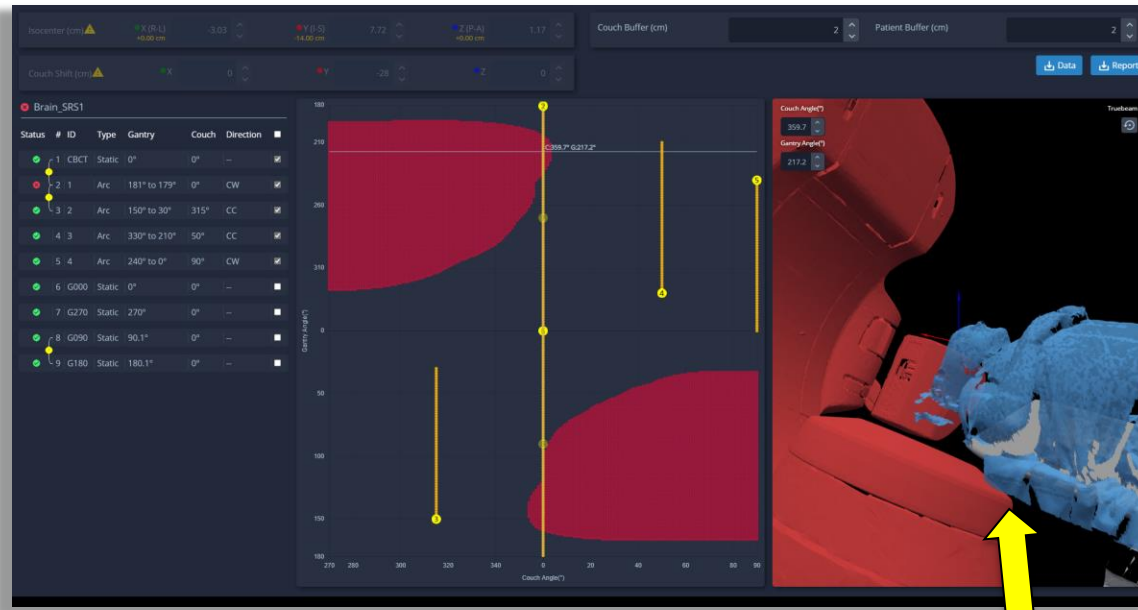
Patient Buffer: 2.0 cm Get Map

Ready

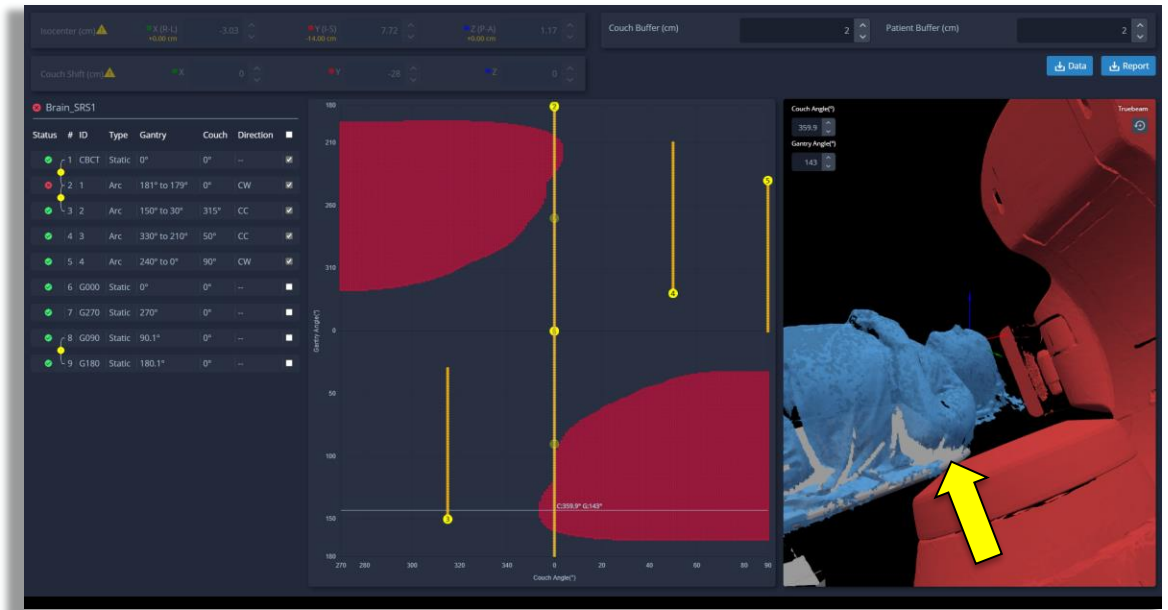
## We can work with the therapy teams to

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

# Evaluation of a Very Simple “Standard” Case



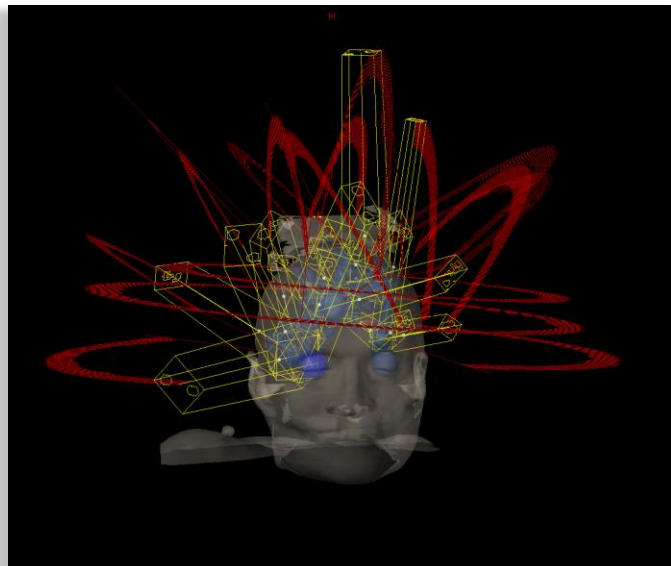
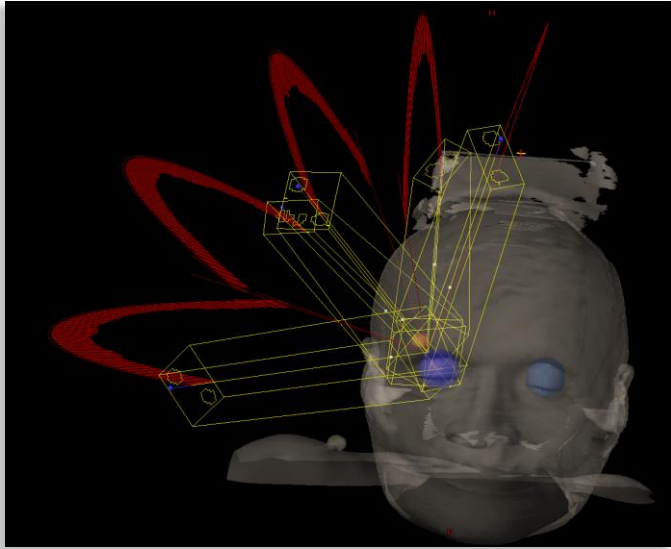
**False Positive on Sheet**



**True Positive on Couch**

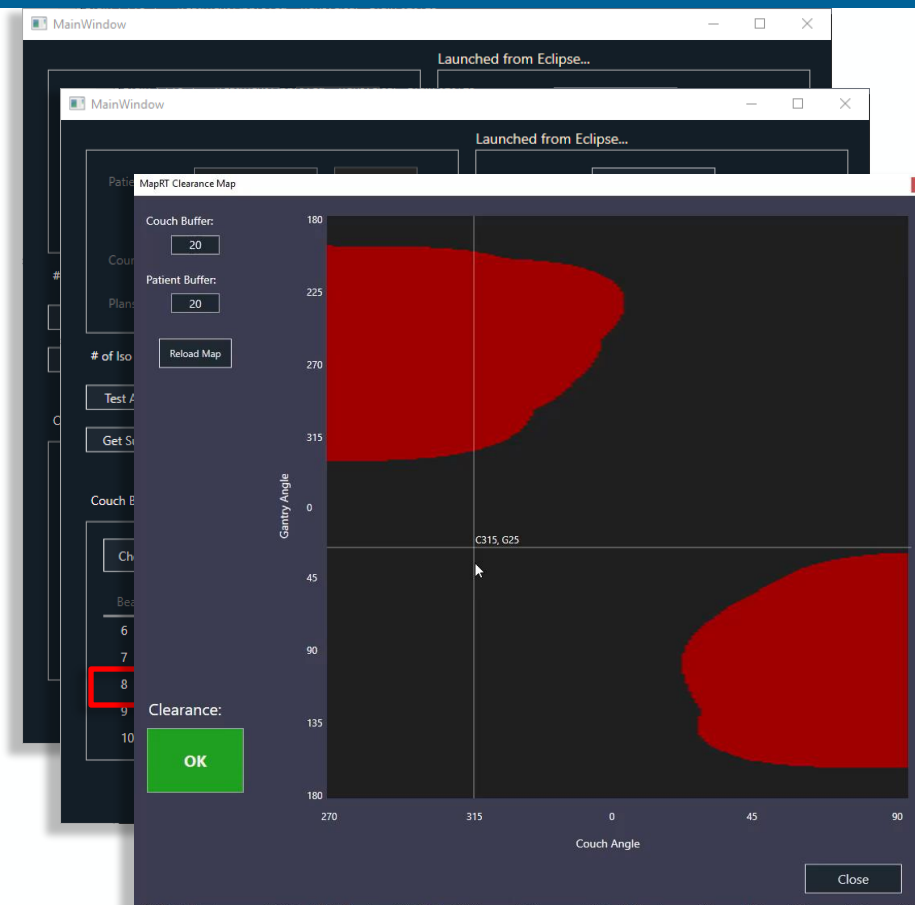
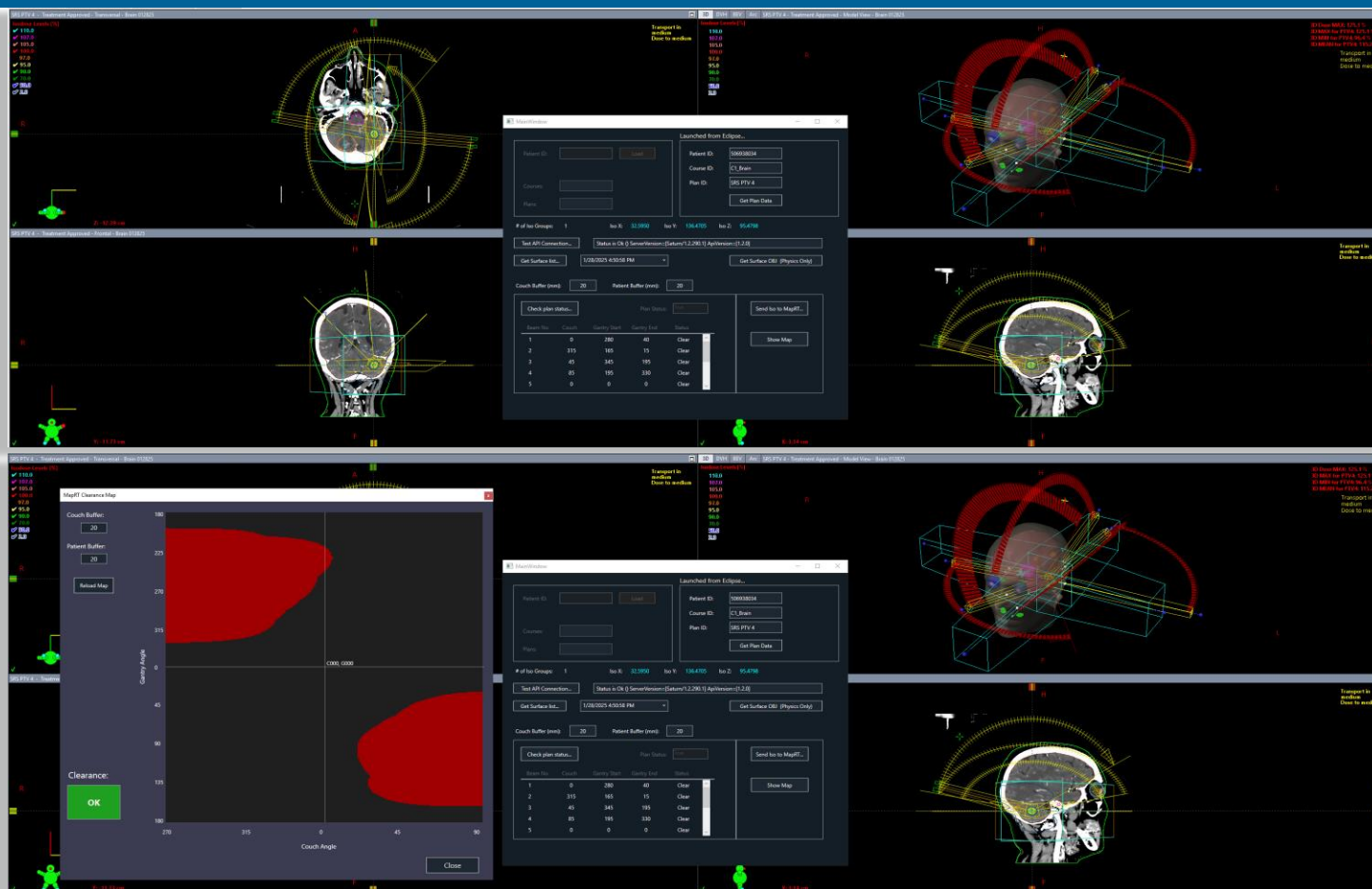
- Review of very basic SRS plan by physics showing a false positive on ipsilateral side of the couch 0 arc due to sheet inclusion in the processed capture surface.
- True collision with table found on contralateral pass of the same arc confirming prior calculation due to a combination of factors that included patient physical size, head position, and target location.

# Efficient Exploration of Noncoplanar Solutions



- Intracranial SRS is a high-precision, high-dose ablative treatment.
- At AdventHealth they are typically delivered in 4-6 non-coplanar arcs.
- While collision risk can be significant, technologies such as Varian's HyperArc help reduce that risk by artificially limiting the planning solution space to a given set of arc geometries and requiring a very specific and approved immobilization system.
- Surface-based planning allows planners to explore the full solution space with confidence, without restrictions on immobilization or beam geometries, facilitating highly complex multi-target SRS cases that must avoid previously irradiated areas.

# Using the API for Efficient Exploration of Noncoplanar Solutions



- Leveraging the API allows the user to rapidly evaluate the plan context being worked during planning.
- The API also allow the user to generate a clearance maps that can be dynamically explored for alternate solutions reducing planning time by more than 30 minutes.

# Workflow Dependent Errors: Clearance Map Validation

Plan Name: Brain\_SRS1, ISO (mm) [-30.3, -11.7, 217.2] (17/02/2025 11:08:26) Continue to Clearance Map

Select Patient Surface

Surface Name	Captured
20241211 204223	11/12/2024 13:42:23 [UTC-07:00]
20241211 202936	11/12/2024 13:29:36 [UTC-07:00]

Select Treatment Room

Truebeam	[Truebeam] TrueBeam v2	IGRT Exact v1
Truebeam e10	[Truebeam] TrueBeam (e=10)	IGRT Exact v1
Truebeam e15	[Truebeam] TrueBeam (e=15)	IGRT Exact v1
Truebeam e20	[Truebeam] TrueBeam (e=20)	IGRT Exact v1
Truebeam e25	[Truebeam] TrueBeam (e=25)	IGRT Exact v1
Truebeam e6	[Truebeam] TrueBeam (e=6)	IGRT Exact v1

Plan Name: preview, ISO (mm) [0.0, 0.0, 0.0] (11/12/2024 13:29:36) Continue to Clearance Map

Select Patient Surface

Surface Name	Captured
20241211 204223	11/12/2024 13:42:23 [UTC-07:00]
20241211 202936	11/12/2024 13:29:36 [UTC-07:00]

Select Treatment Room

Truebeam	[Truebeam] TrueBeam v2	IGRT Exact v1
Truebeam e10	[Truebeam] TrueBeam (e=10)	IGRT Exact v1
Truebeam e15	[Truebeam] TrueBeam (e=15)	IGRT Exact v1
Truebeam e20	[Truebeam] TrueBeam (e=20)	IGRT Exact v1
Truebeam e25	[Truebeam] TrueBeam (e=25)	IGRT Exact v1
Truebeam e6	[Truebeam] TrueBeam (e=6)	IGRT Exact v1

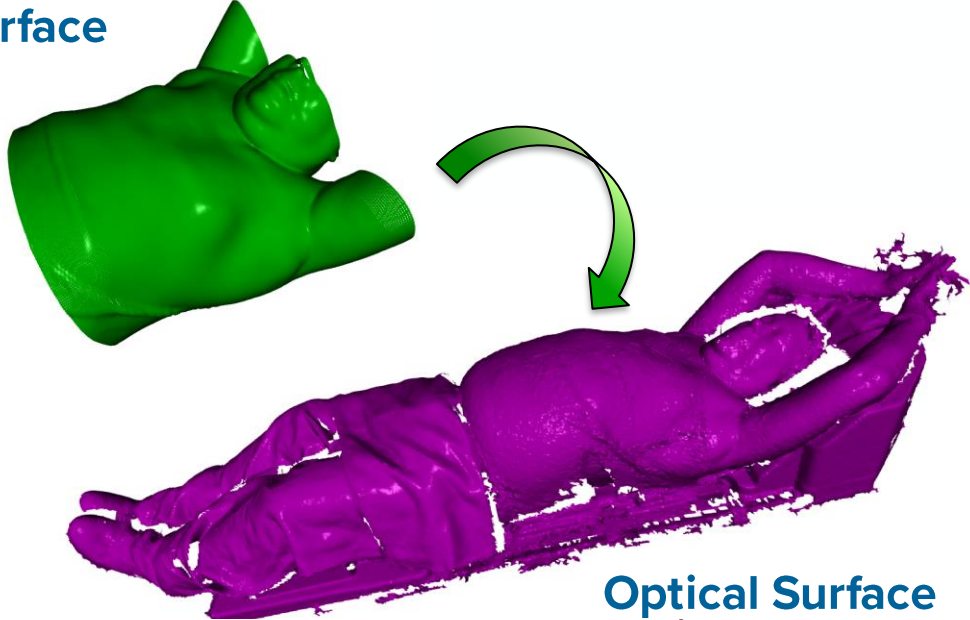
## Promoting replacement of safety checks with new methods requires new safety checks

- 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**

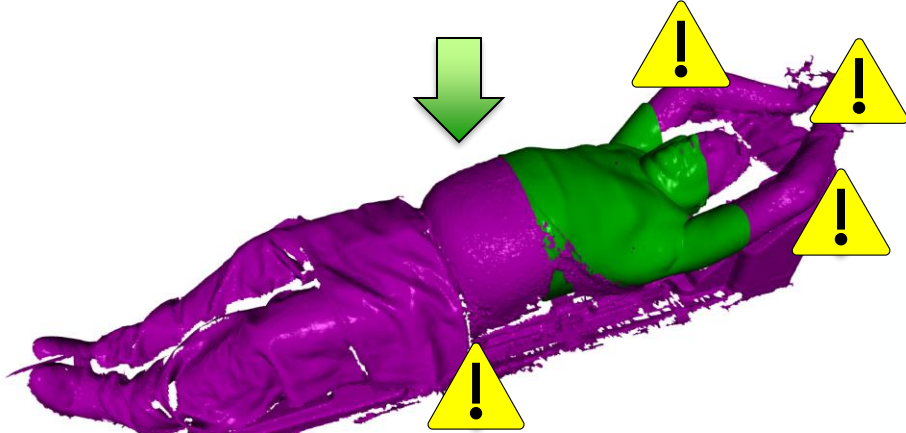


# Combining 3D Volumetric and 3D Surface Information for Planning

CT Surface

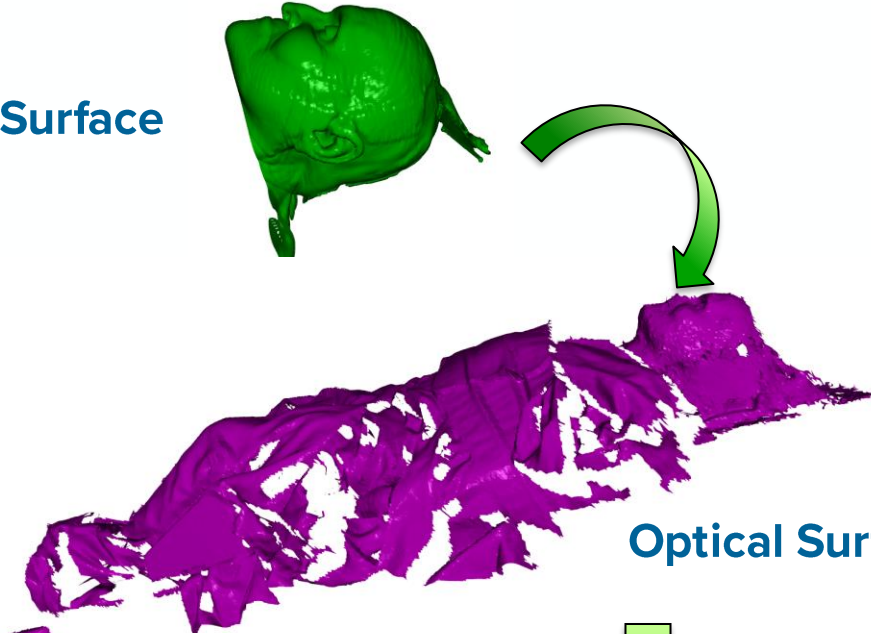


Optical Surface



Merged Result

CT Surface

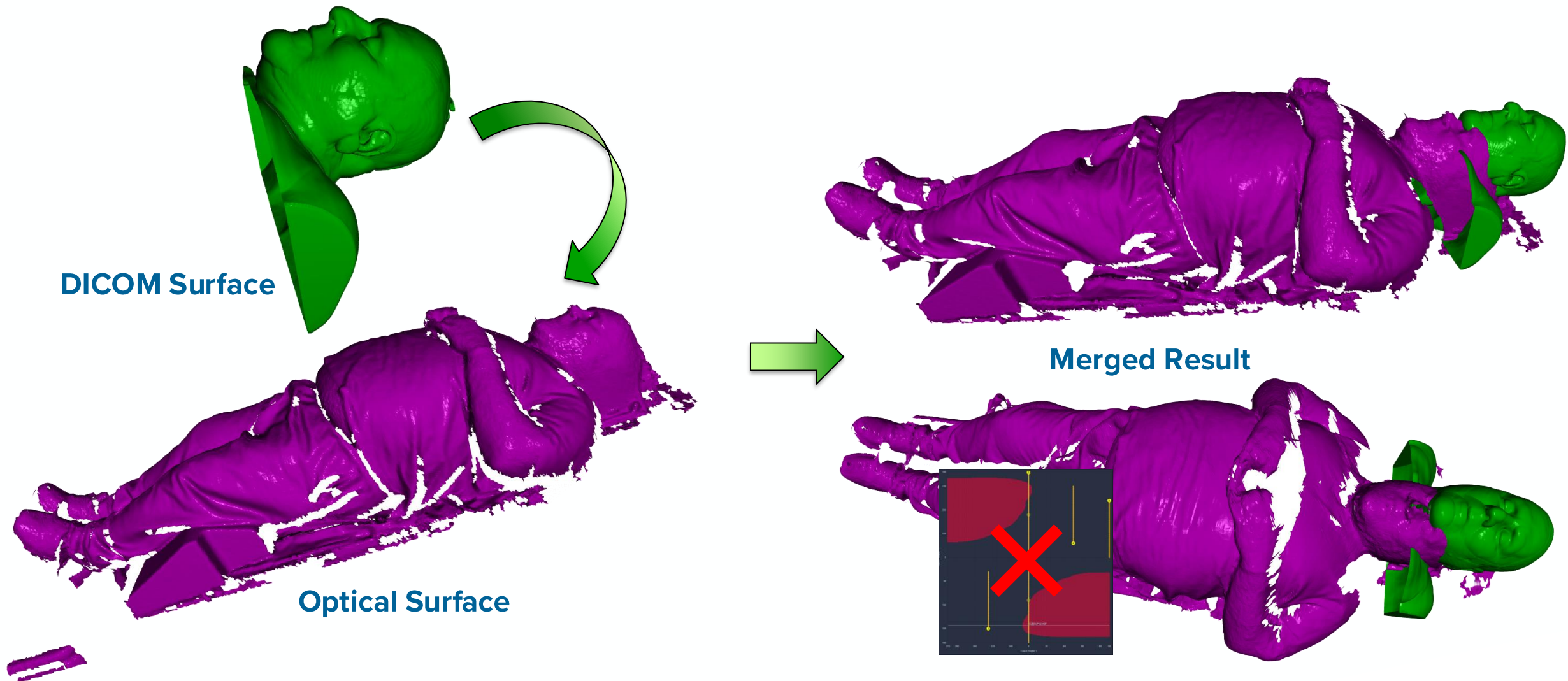


Optical Surface



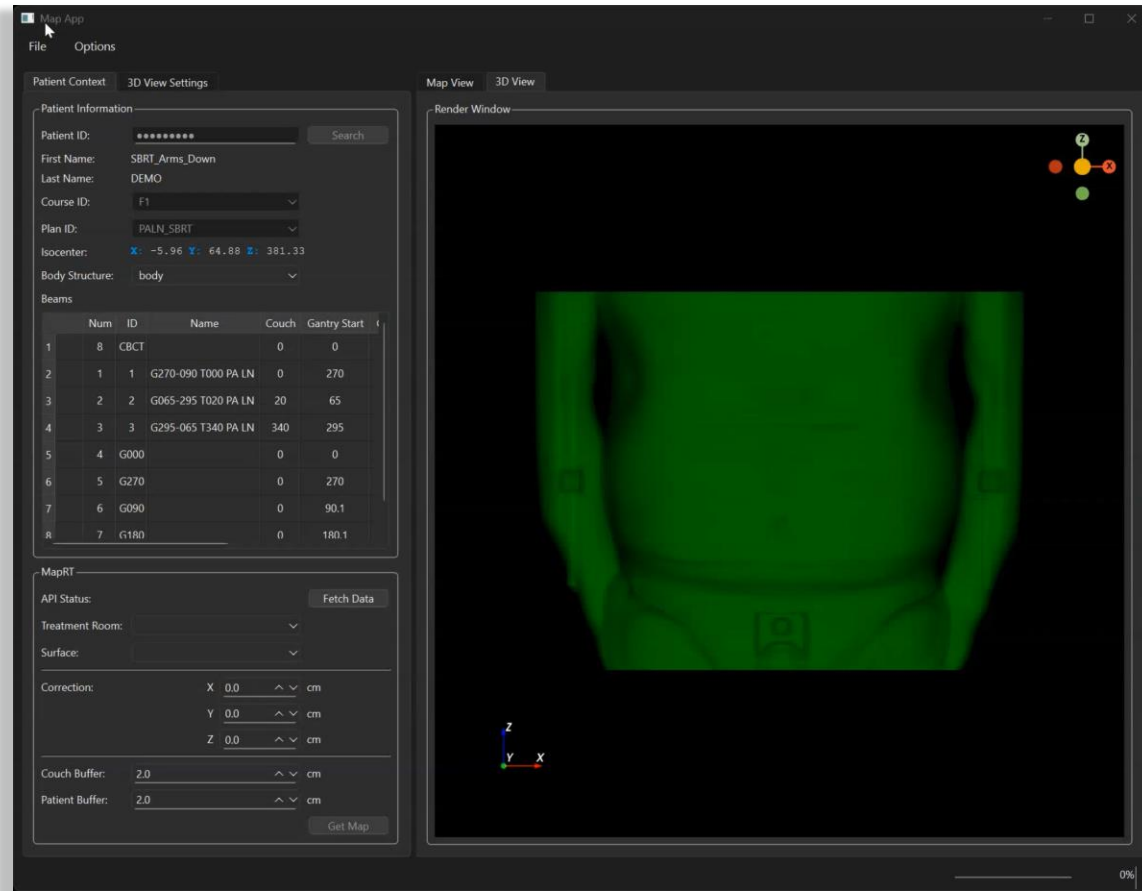
Merged Result

# API Integration for Additional Isocenter Verification

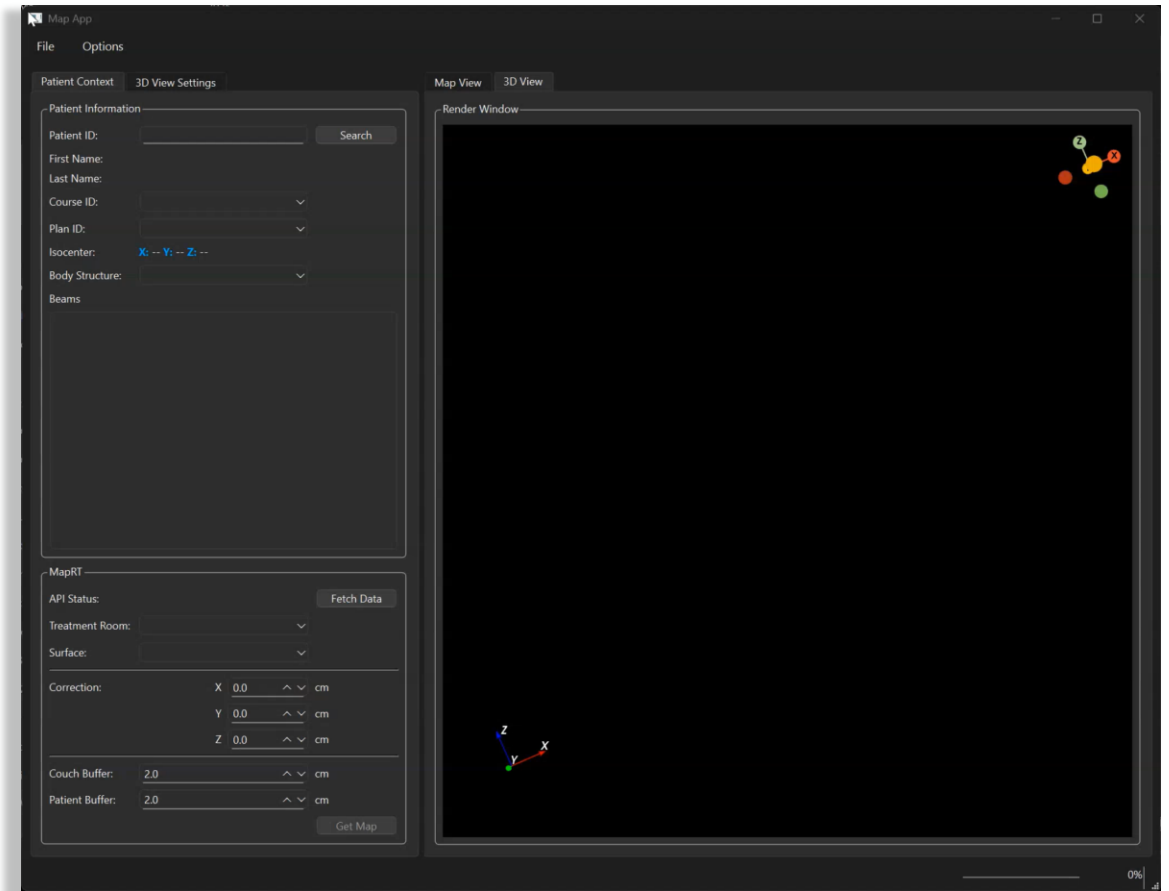


Incorrect captures can result in artificial clearance due to an offset in DICOM isocenter

# Two Improper Surface Capture Correction Workflows

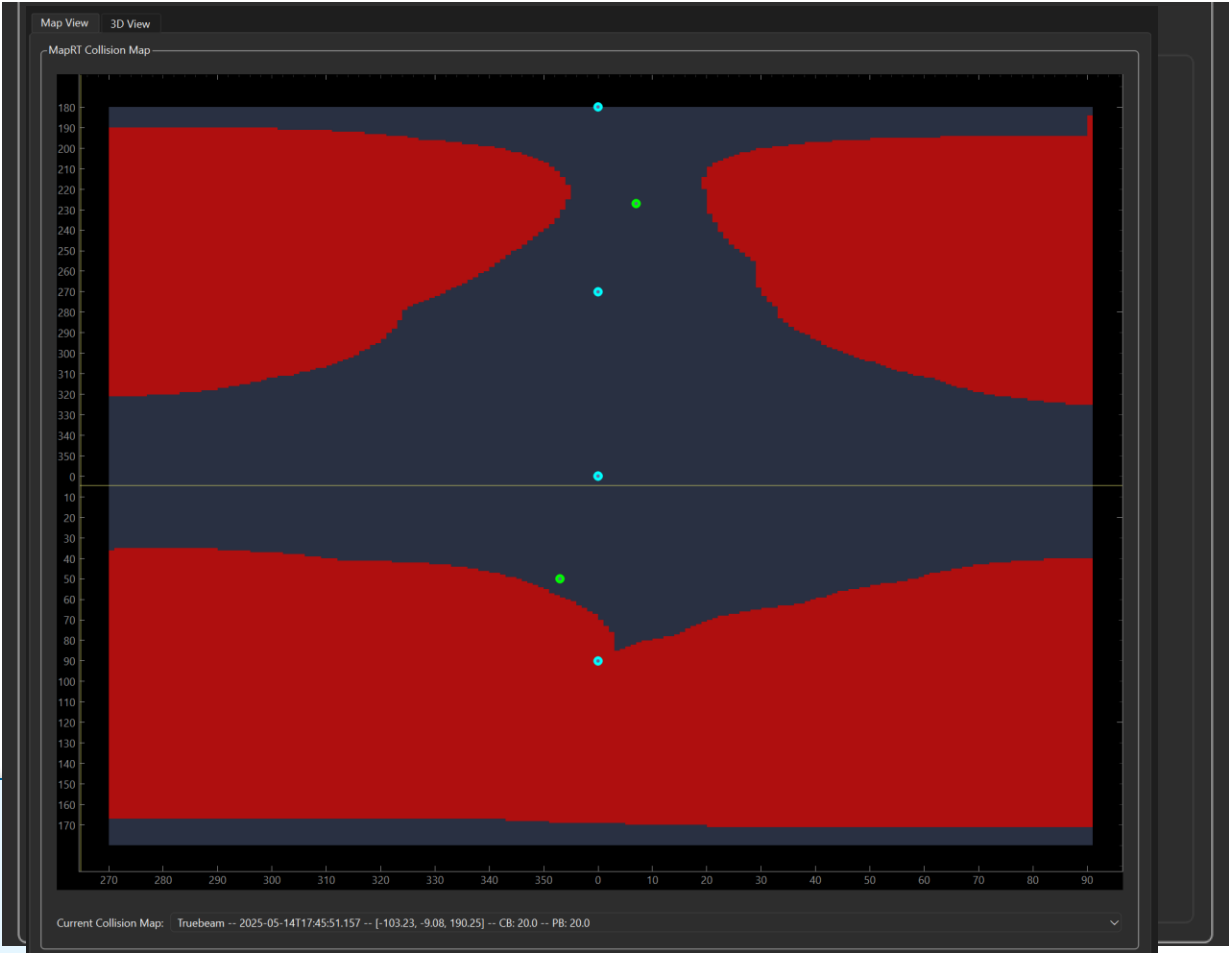
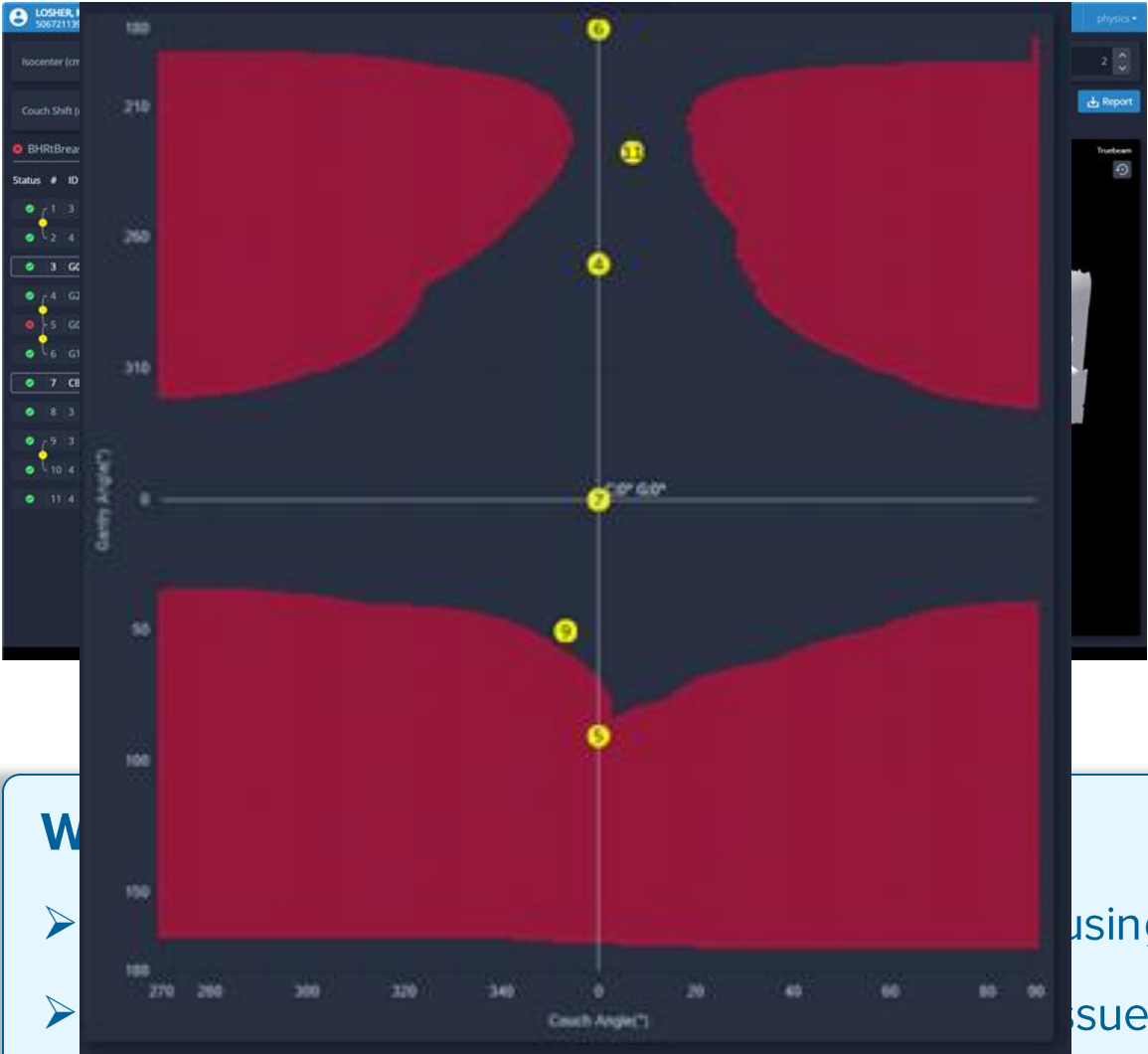


Validation of Correction During Simulation



Correction During Treatment Planning

# MapRT API to Clean Up Information Display During Plan Evaluation



W

➤

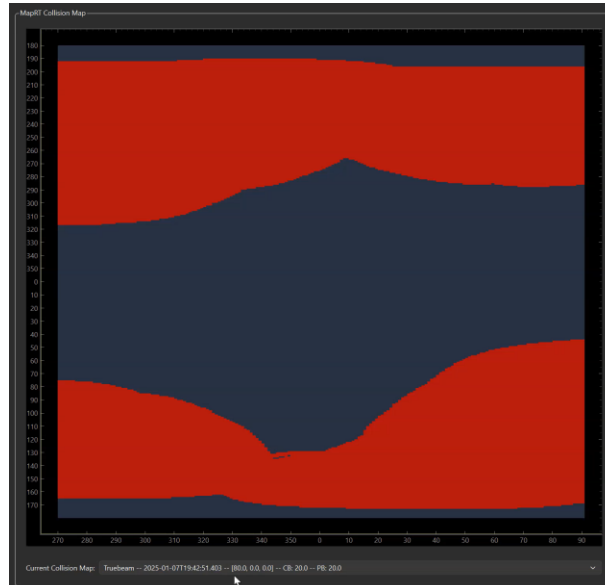
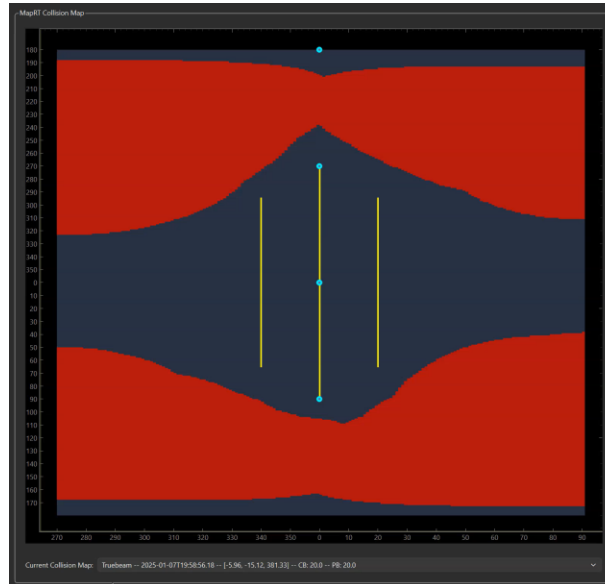
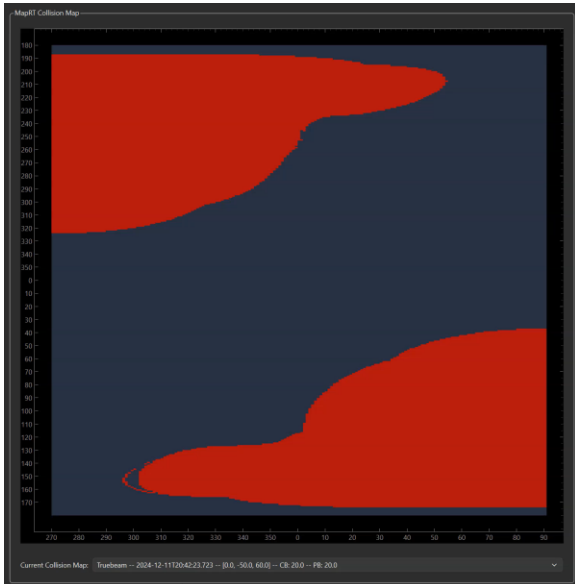
➤

➤

Simply make folks happy

using  
issues from non-issues

# Async Protocols and Map Caching for Isocenter Placement

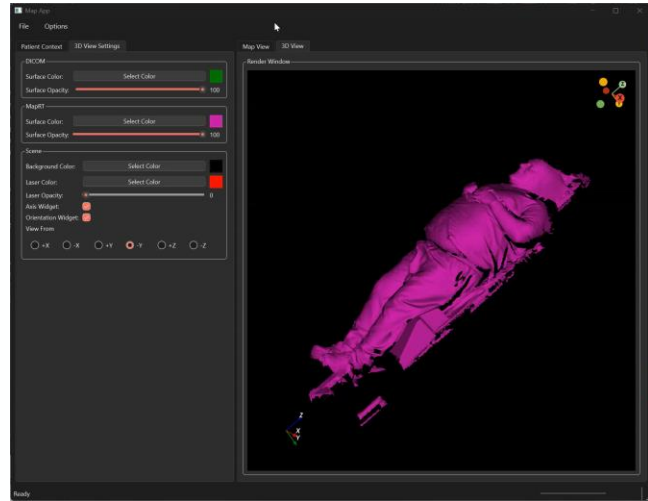


## Leveraging Automation and Asynchronous API calls for Dynamic “5D” Exploration

- The web API allows for asynchronous calls
- Sorting clearance map calls by isocenter coordinates allows you to order the resulting clearance maps for dynamic exploration
- Combining the above with caching and call hooks allows the user to automate the construction of a search protocol around a plan isocenter.
- The resulting dataset can be explored dynamically to identify more advantageous isocenter positioning

# Advanced Surface Based Applications for Planning

## API



## Extraction



## Reconstruction



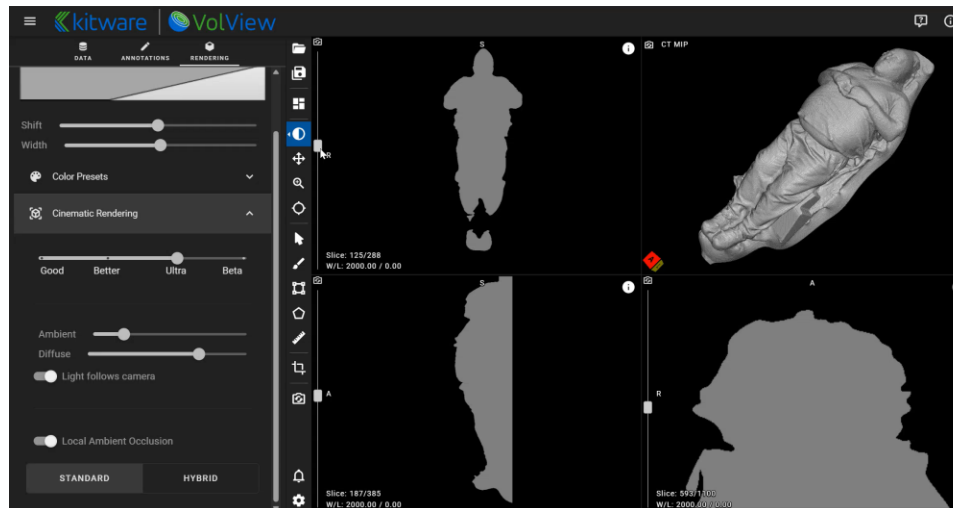
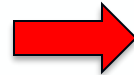
## Isolation



## Normalization



## Voxelization



# Advanced Surface Based Applications for Planning

The screenshot displays a software interface for medical planning, divided into two main sections: Preparation and Treatment. A progress bar at the top indicates the current stage is 'Preparation', with 'Import DICOM' as the first step and 'Set Treatment' as the second. The main workspace features a 3D model of a patient lying on a table, rendered in a purple color. On the left side, there is a 'Treatment Course' panel with the following details:

- Plan Name: Active
- SurfaceScan [Chest] (unchecked)
- Original1 [SBRT] (checked)
- ISO 1 [-3.12, -0.49, 7.25] (checked)
- CT SIM pBODY 1/5/2026 10:55:12 AM (checked)
- Treat Without Beam Control (dropdown menu)
- ROI1 [Isocentric] (selected)
- + Add ROI (button)

At the bottom left, a status bar shows 'alignrt\*' and 'Varian ADI status is Error'. At the bottom right, it displays 'System Status' with a red error icon and the timestamp '2/17/2026 3:49 PM'. A notification at the bottom center states 'Changes are saved automatically'.

# 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..
- Highlighted 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.



# Thank You!

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➤ Special Thanks to the AdventHealth Physics team.