RadVision^{3D}

LaSalle Reactor Water Cleanup Valve Room Case Study

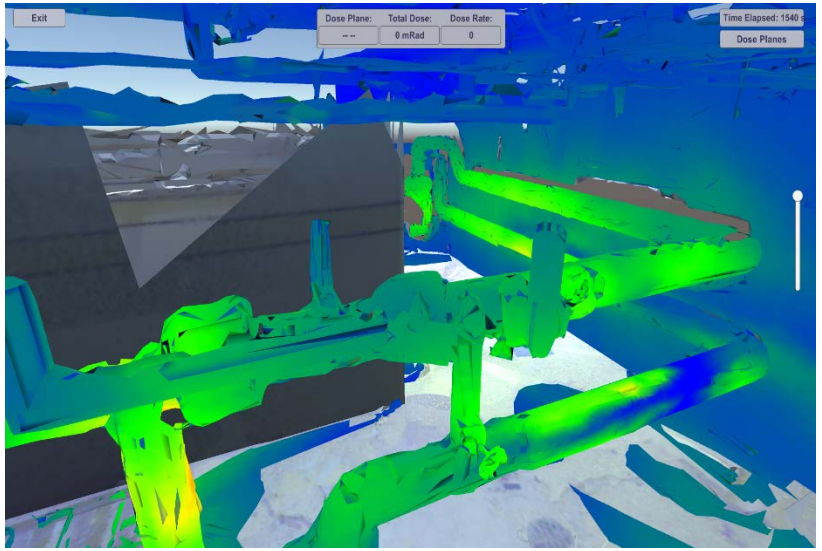
RadVision^{3D} Results

In the scope of one job, LaSalle Generating Station saved

≈12 Rem

Through the use of 3D Gamma Radiation Source Mapping and Intervention Analysis,

RadVision^{3D}



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RadVision^{3D} – Scanner Specifications

Gamma Ray Spectrometer

- Full 360° gamma image
- Completes gamma images in under 2 hours
- Software controllable scan time and resolution
- No software required to review, analyze, share
- Energy resolution: 3% FWHM @ 662 keV
- Energy range: 30 keV to 2 MeV

Packaging

- High dose tolerant: up to 1 Sv/hr
- Fits through small apertures: 110mm OD
- Low mass: 10 – 15 kg (configurable)
- Umbilical length of up to 125m

3D Laser Scanner

- Provides measurements of surrounding surfaces
- Resulting point cloud can help better understand environment
- Point cloud can be converted into 3D model
- Range: 30 m
- Resolution: ± 2mm @ 10 m

Camera

- Produces spherical image for environment inspection
- Spherical image resolution: 12 Megapixel

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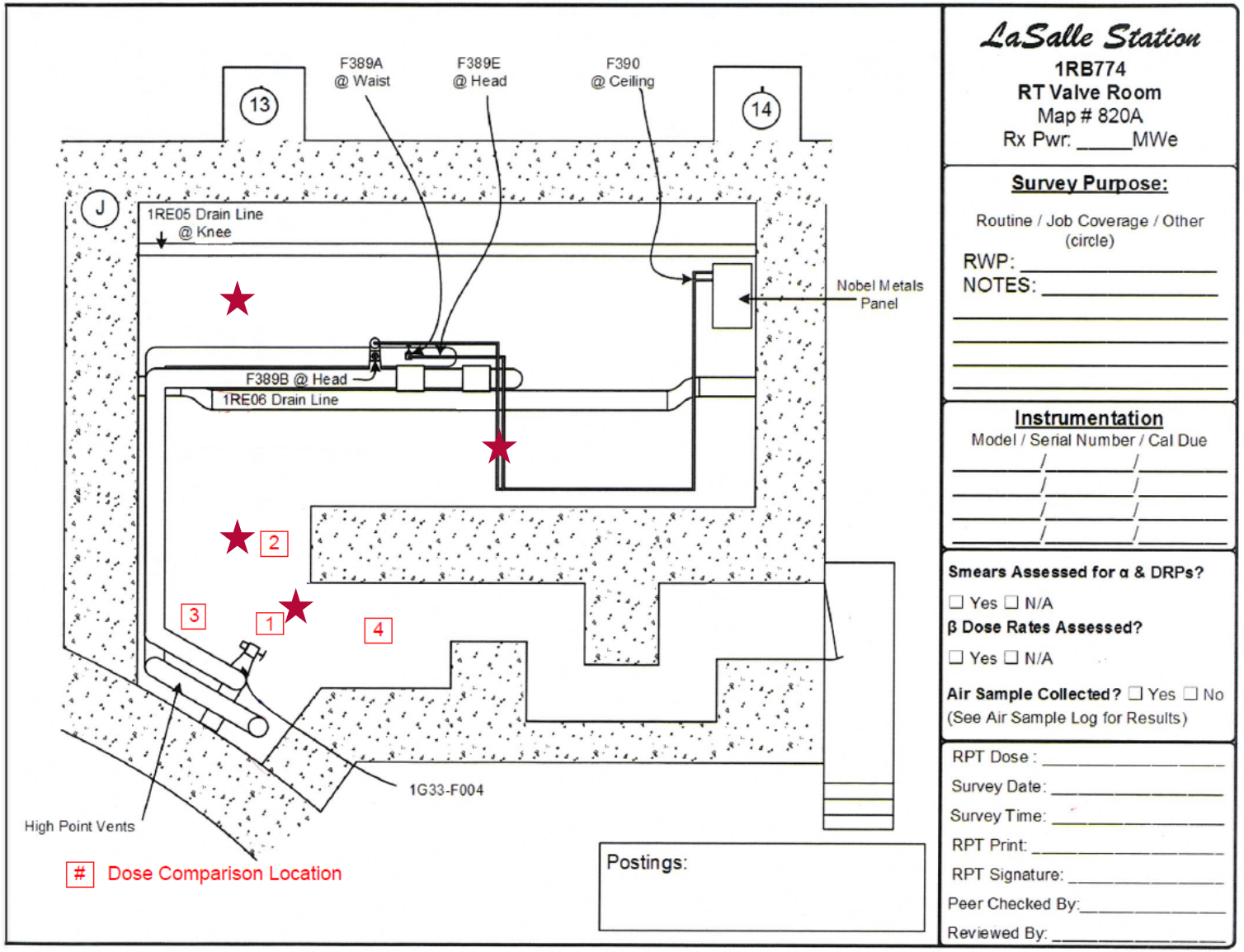
RadVision^{3D} – Step 1: Capture

- 3 or more scans required
- ~3 minutes set up time
- ~120 minutes per scan

- Four scans required for LaSalle case study project
- Scan locations indicated by ★



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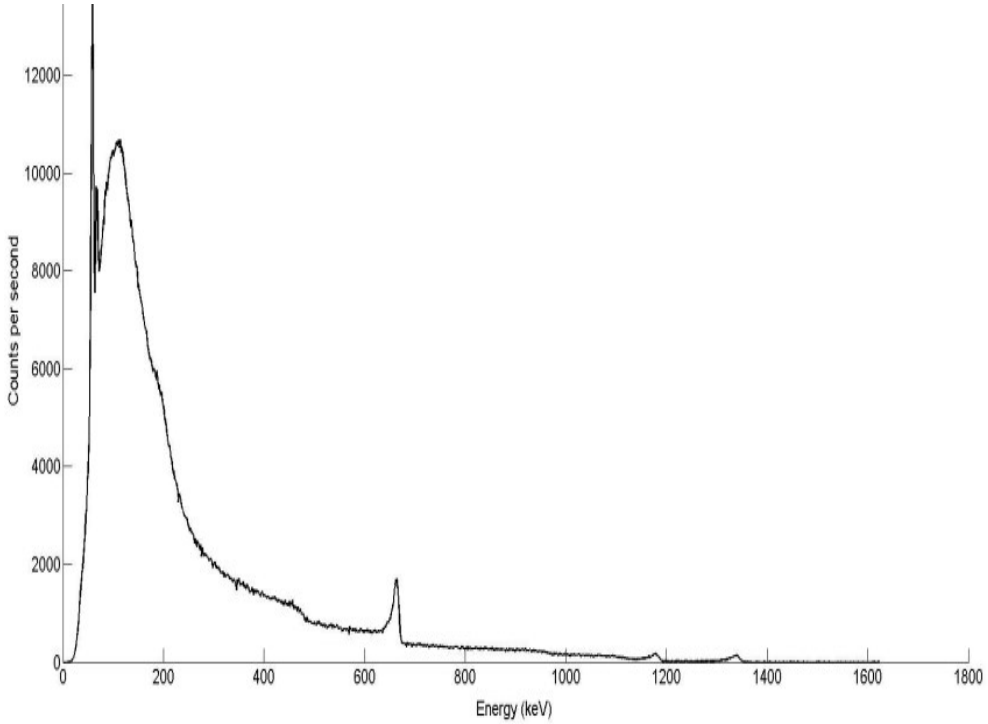
RadVision^{3D} – Step 2: Analyze

Unique Technology combines CZT Spectroscopy with 3D Laser Scanning



Energy Spectrum

1:1 Scale 3D Environment

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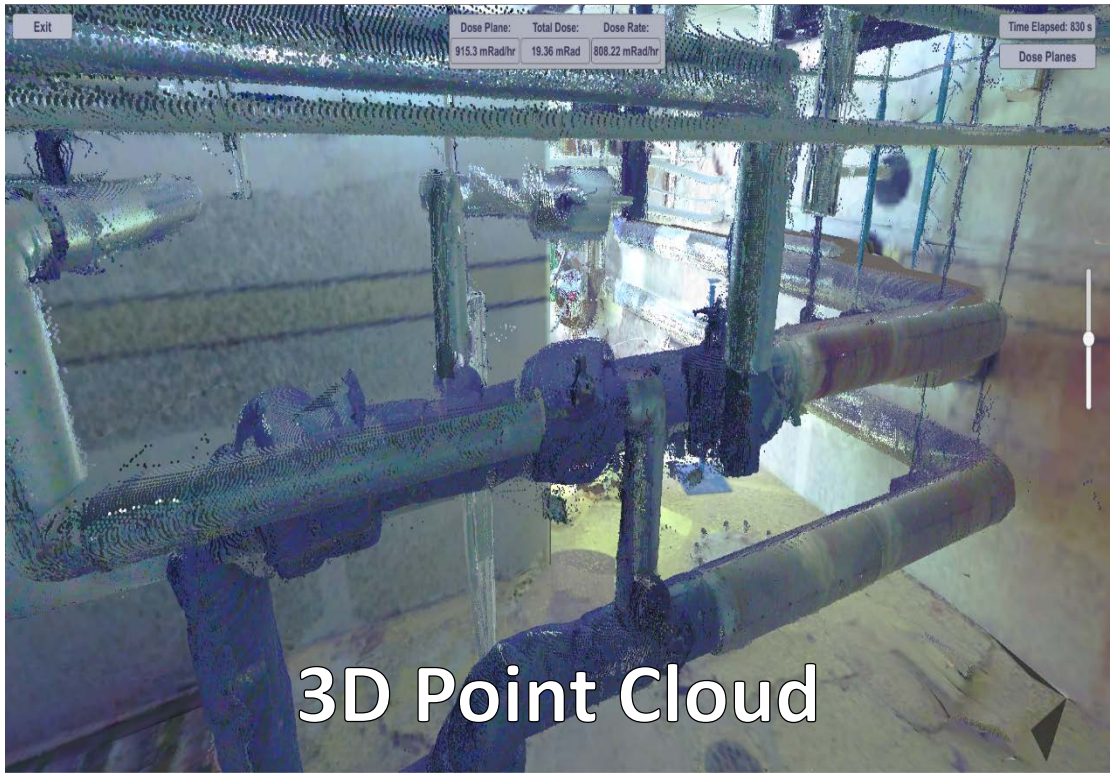
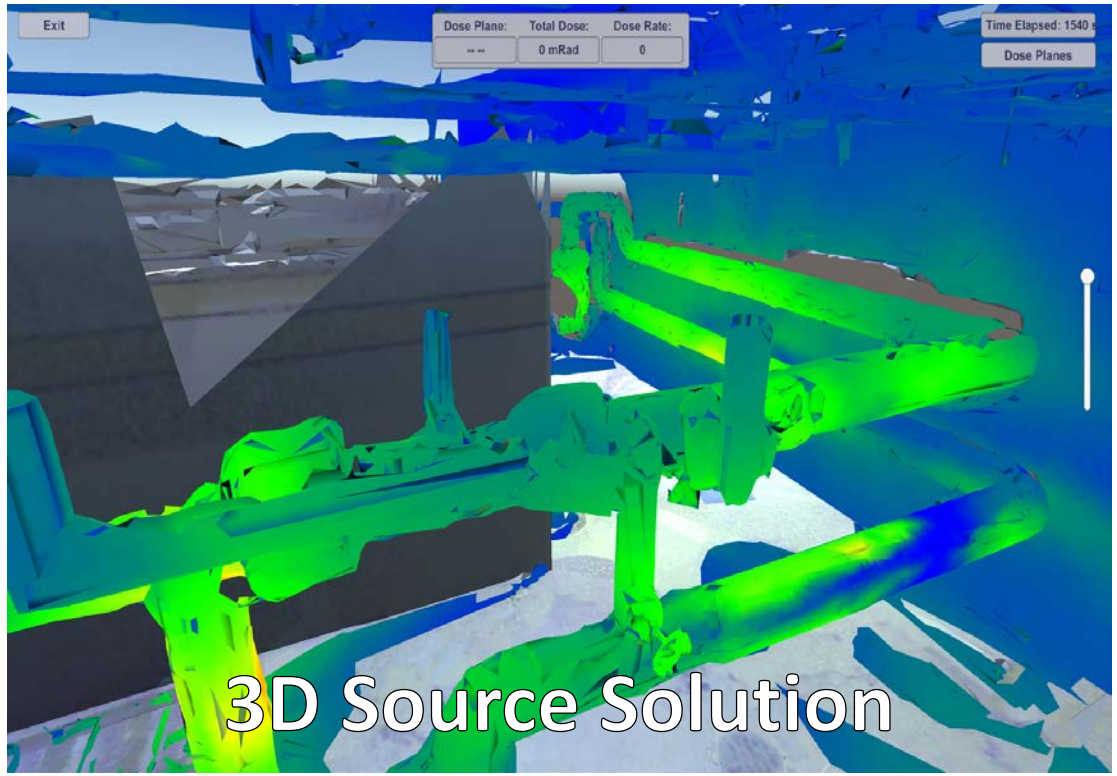
RadVision^{3D} – Step 2: Analyze

3D Source Solution

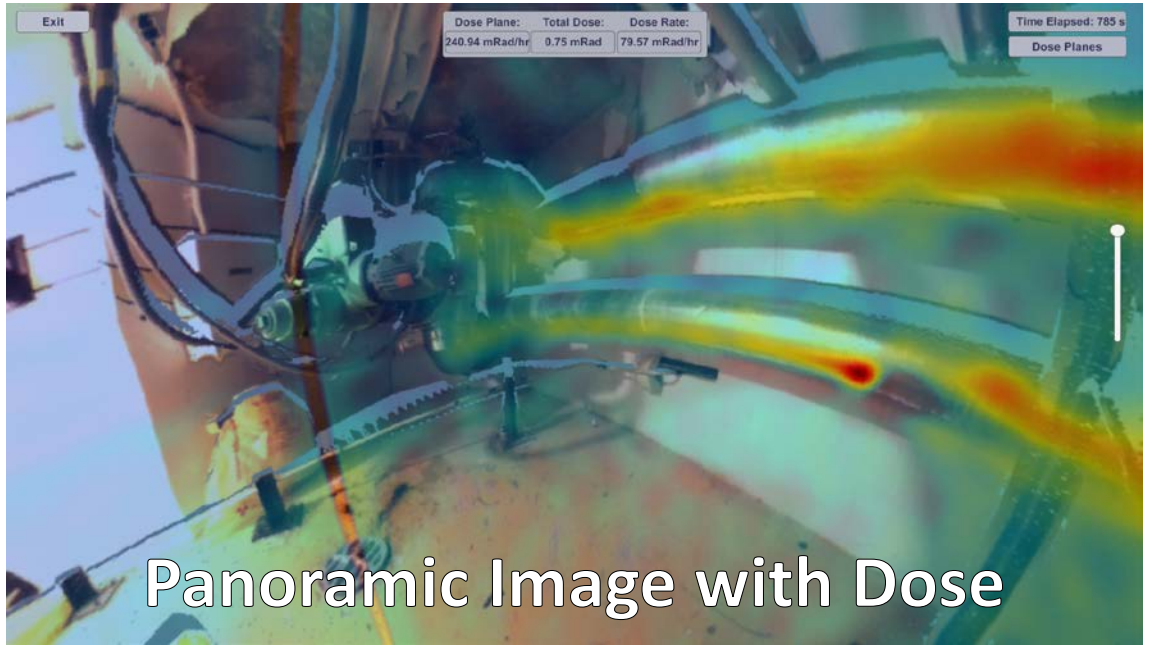
- *Location* of all gamma sources
- *Intensity* of all gamma sources
- Tour the environment virtually using the desktop view





RadVision^{3D} – Step 3: Visualize

- Panoramic images with gamma source overlay
- 360° X 360° view
- Transparency of gamma source visualization is adjustable



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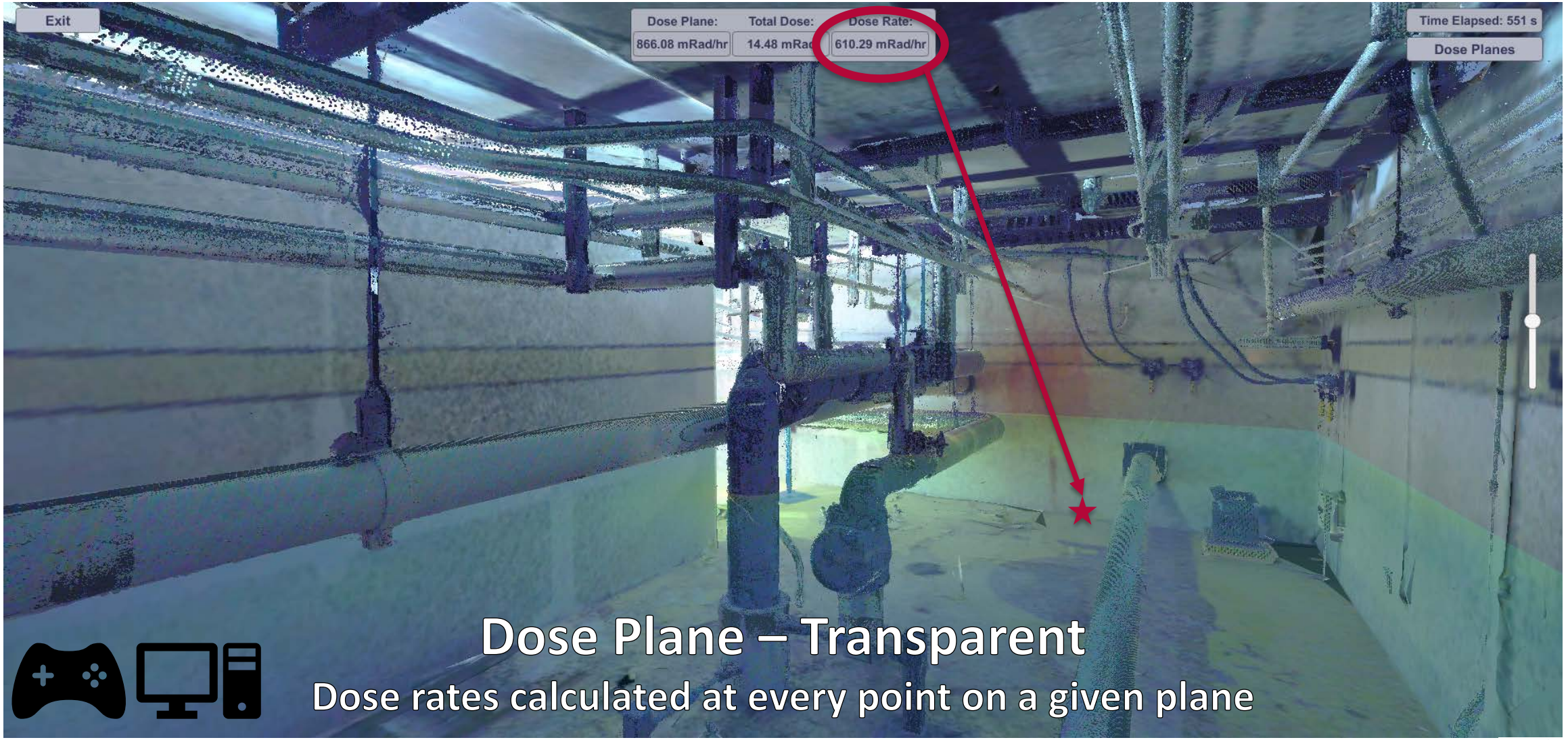
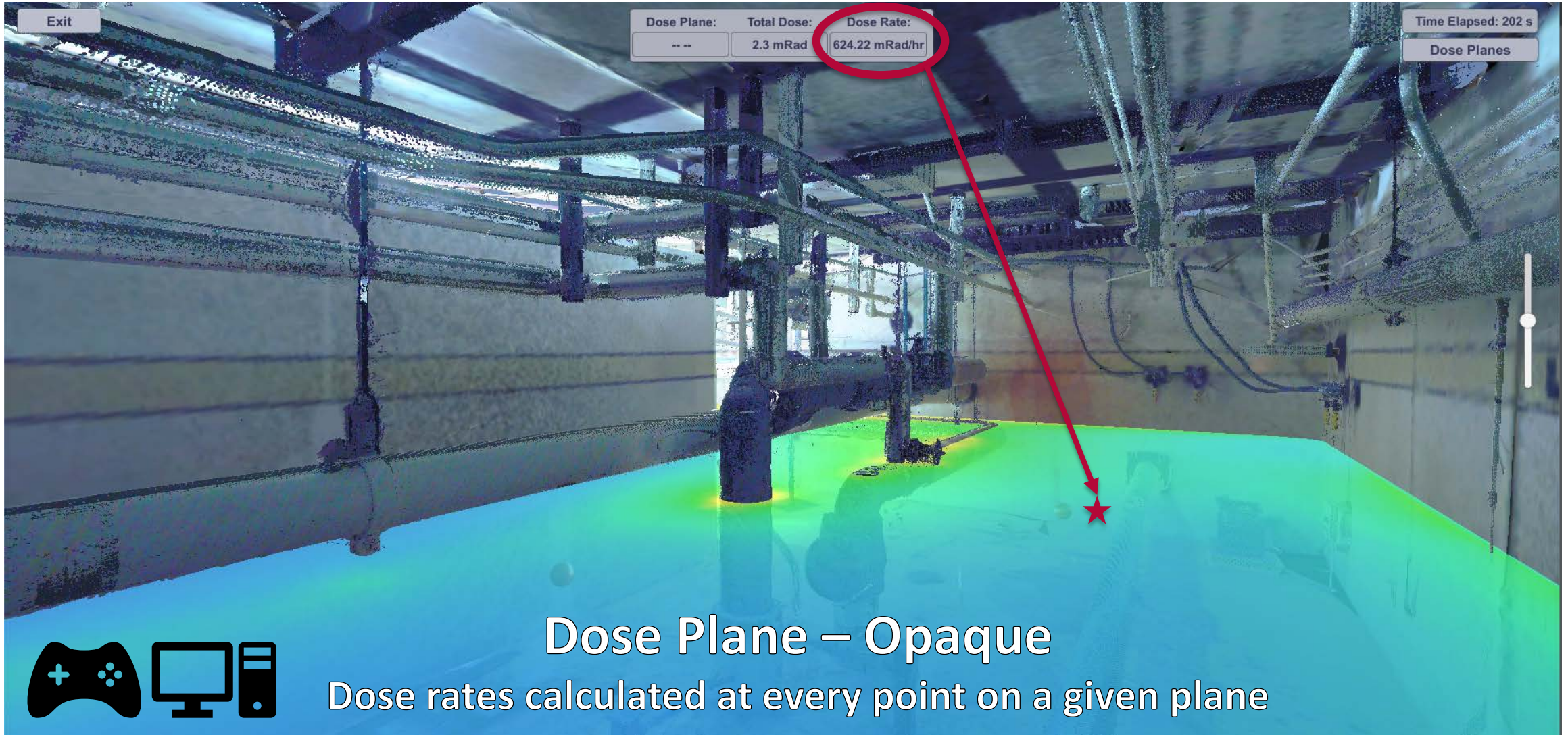
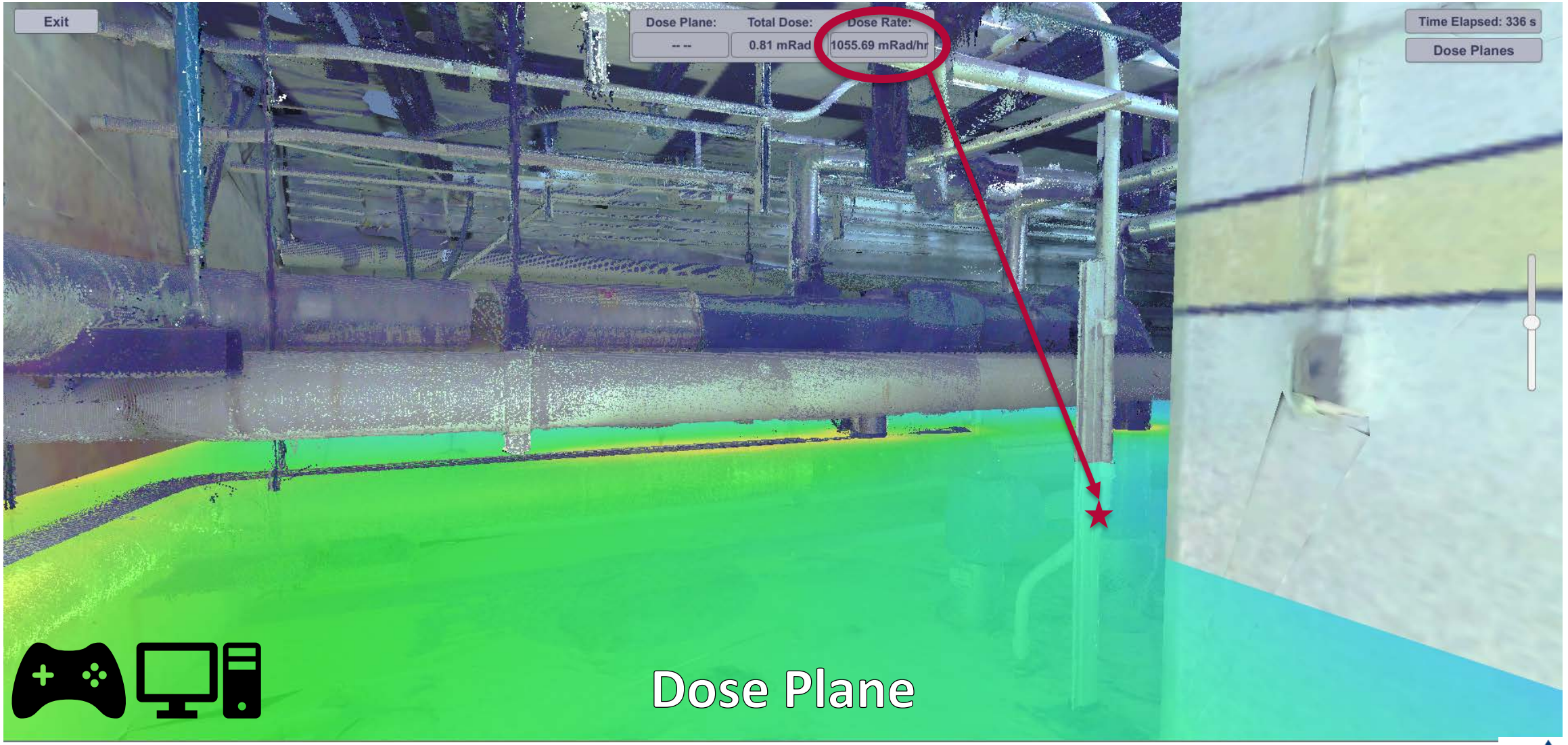
RadVision^{3D} – Step 3: Visualize



RadVision^{3D} – Step 3: Visualize

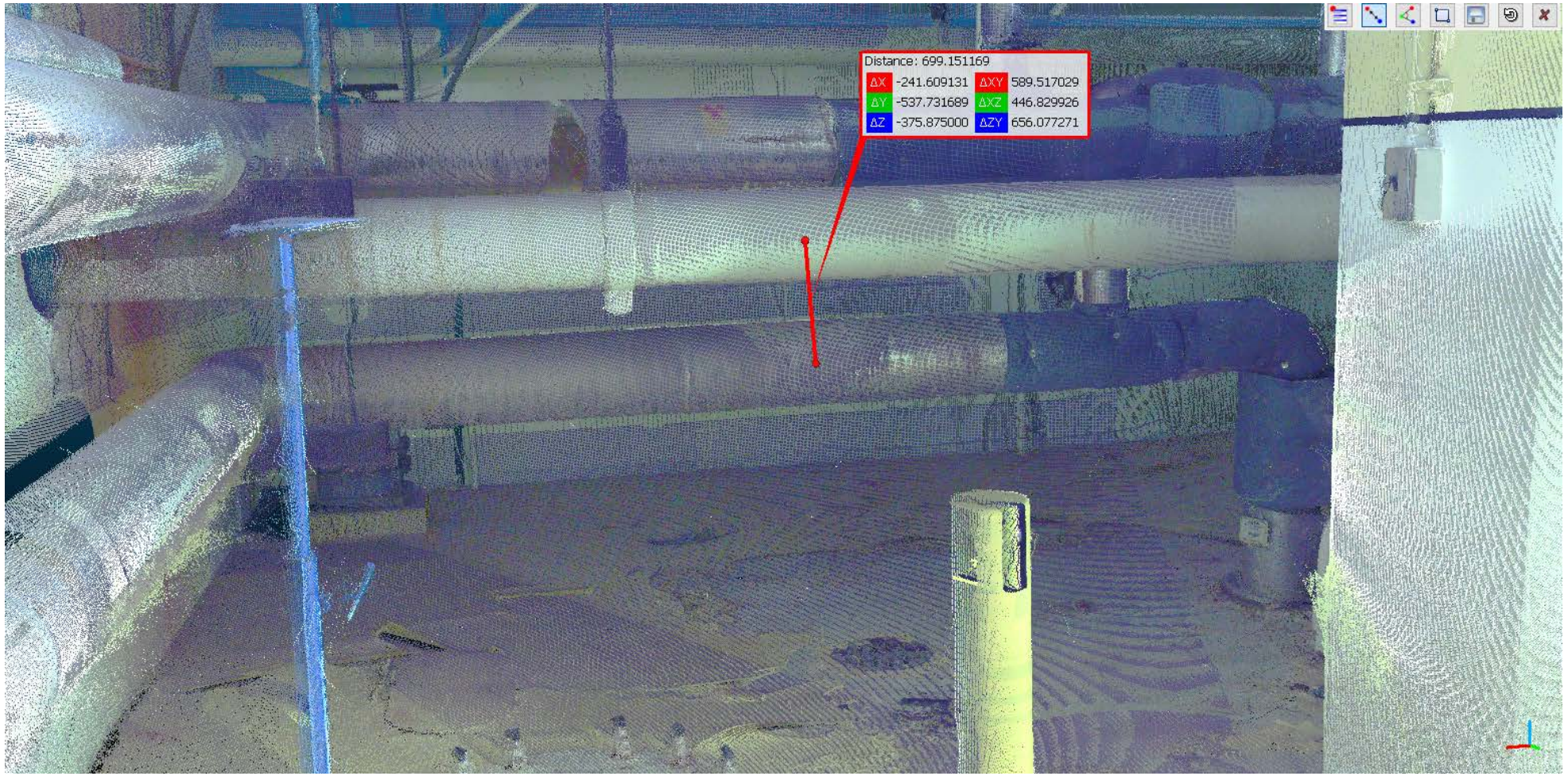


RadVision^{3D} – Step 3: Visualize



RadVision^{3D} – Step 4: Simulate

Laser scan model provides necessary measurements for tailored fit shielding



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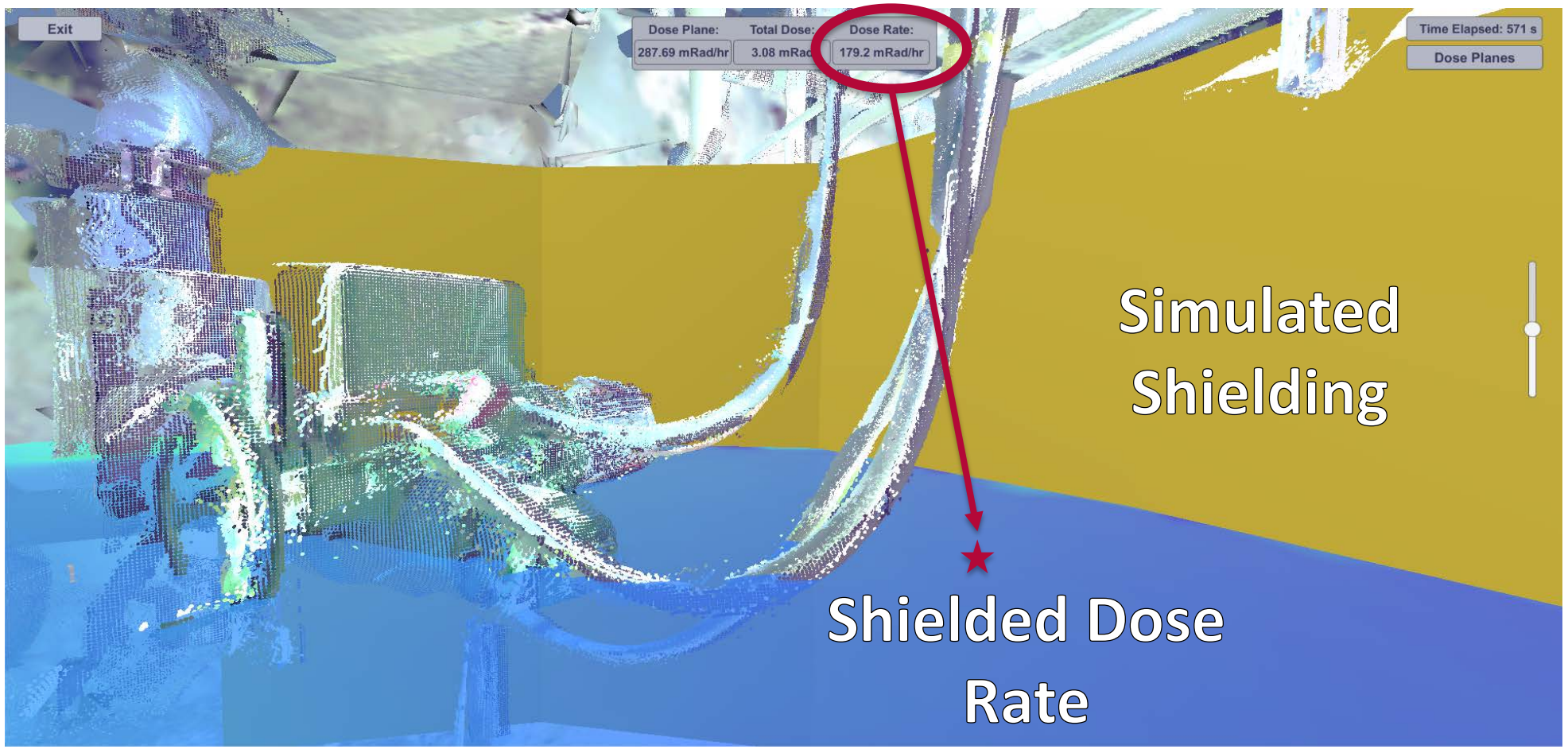
RadVision^{3D} – Step 4: Simulate



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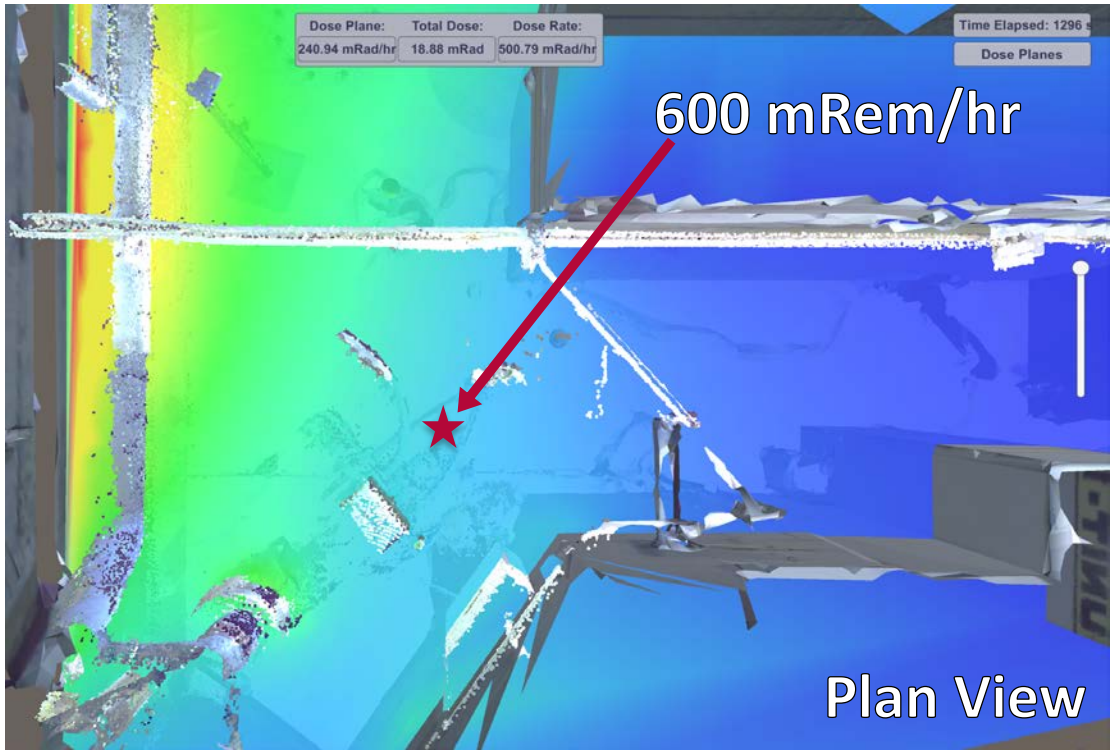
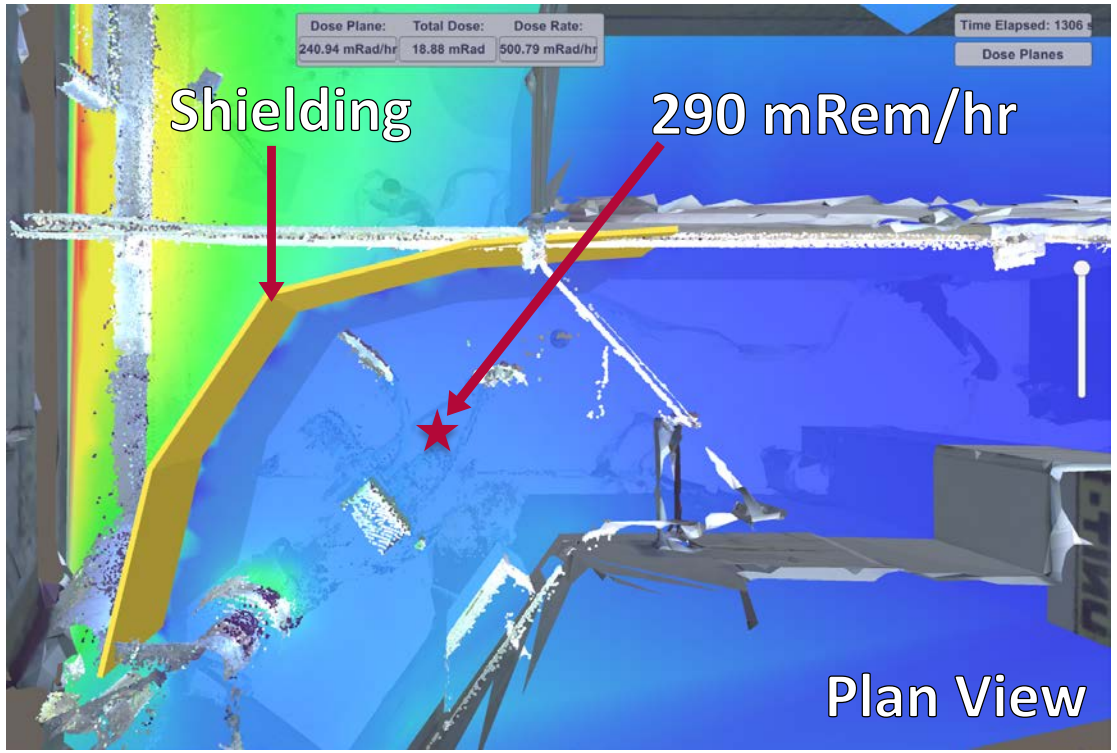
RadVision^{3D} – Step 4: Simulate

- Optimal shielding configuration discovered
- Maximum dose reduction achieved



Unshielded



With Optimal Shielding

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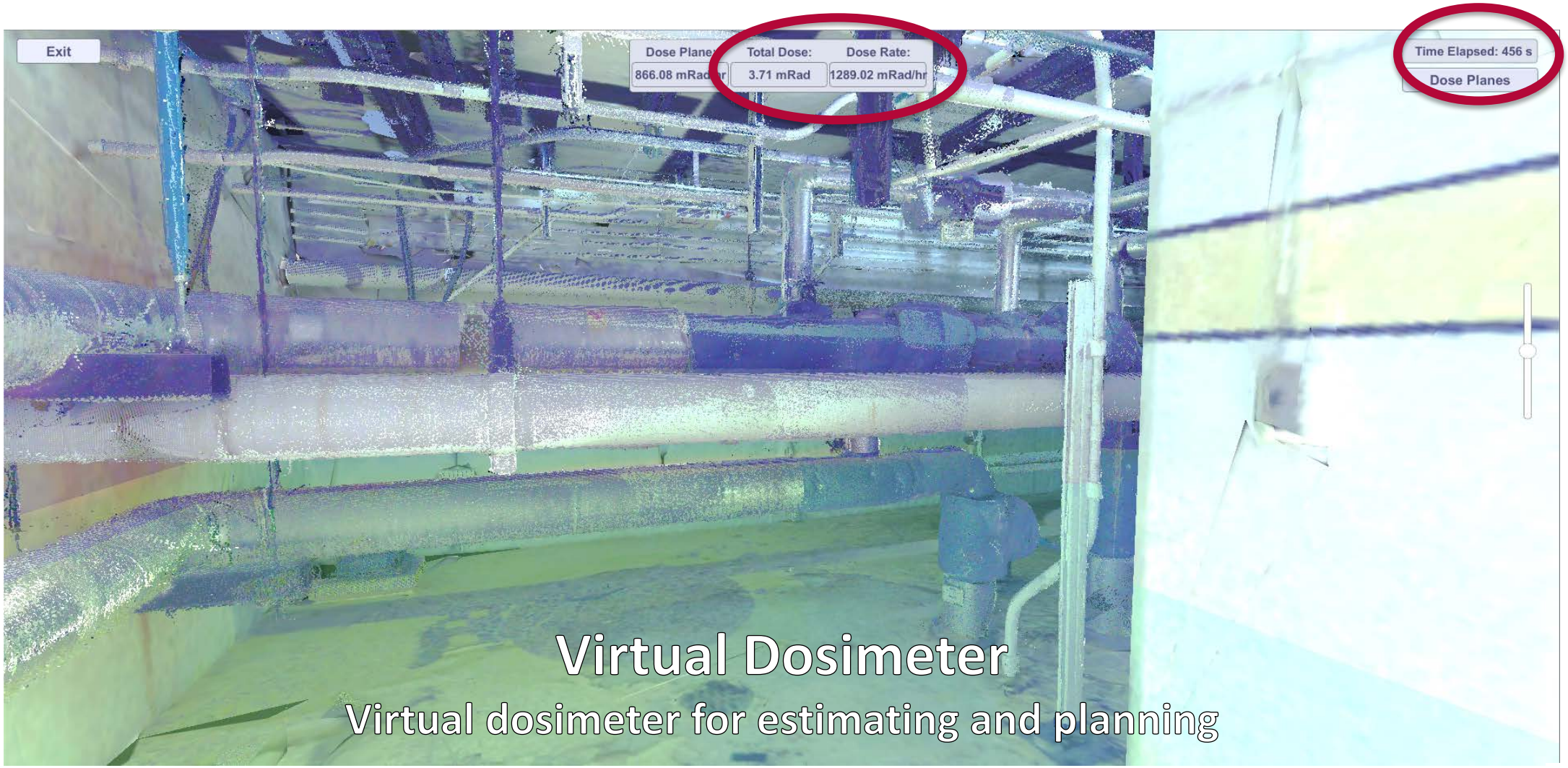
RadVision^{3D} – Step 4: Simulate



RadVision^{3D} – Step 5: Mitigate

Utilize the industry's widest breadth of engineered shielding options available from NPO/Transco

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Benefits of Scanning and Planning

Simulate
- Shielding packages to calculate dose reduction
- Work processes for dose estimation

Train
- Virtual reality simulation for training and briefing
- Full scale color maps of gamma sources and dose rates

Estimate
- Improved pre-job dose estimate accuracy
- 3D point cloud (ASCII .xyz file) measurements

Assess
- How removing source will affect environment?
- Will shielding installation justify dose and dollars spent?

Mitigate
- Improved shielding efficiency
- Improved work processes

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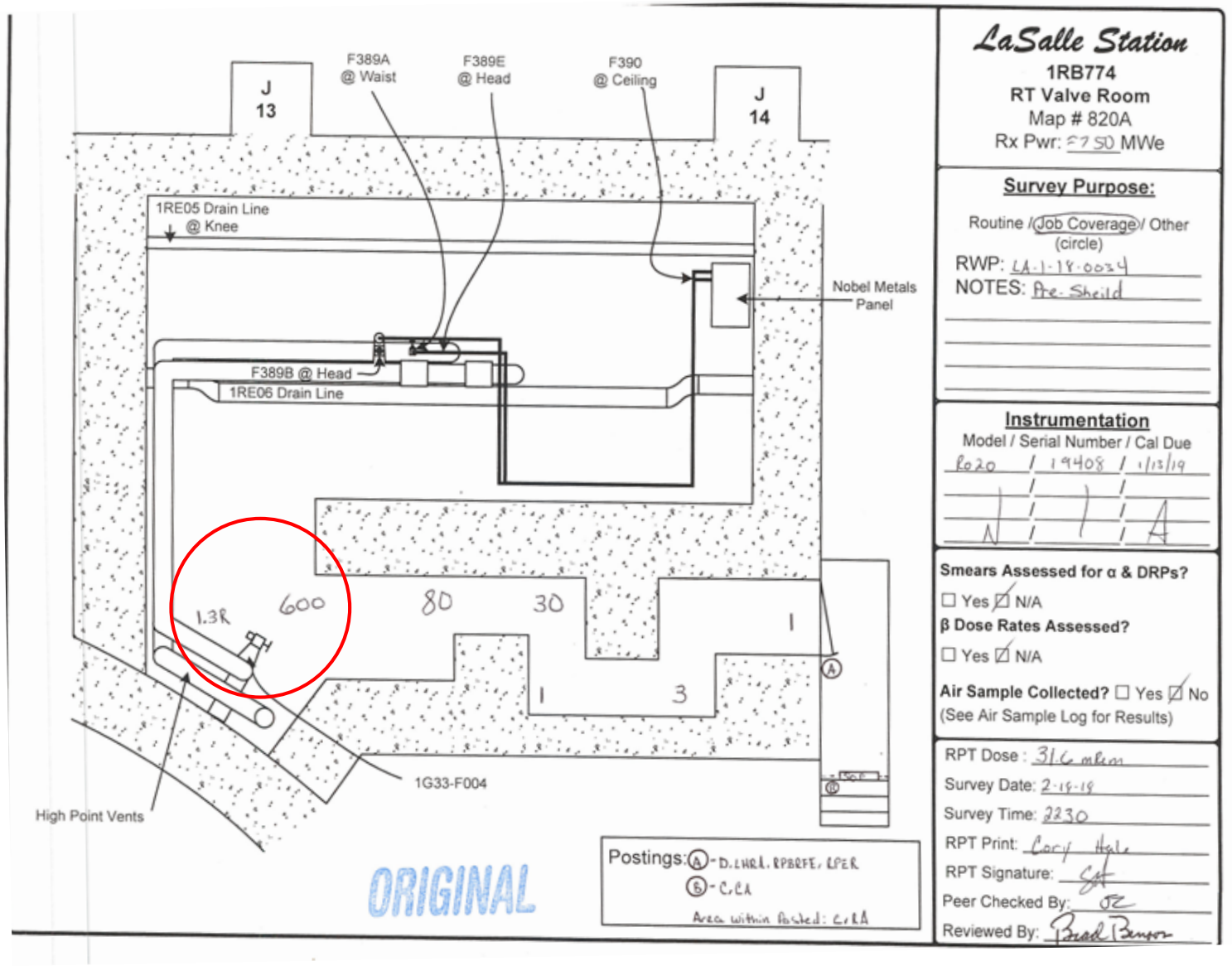
Case Study: LaSalle Station

- The Reactor Water Cleanup valve is an Anchor Darling valve that needed to be breached and have internals replaced during refuel outage
- Most work processes take place in the area circled in red



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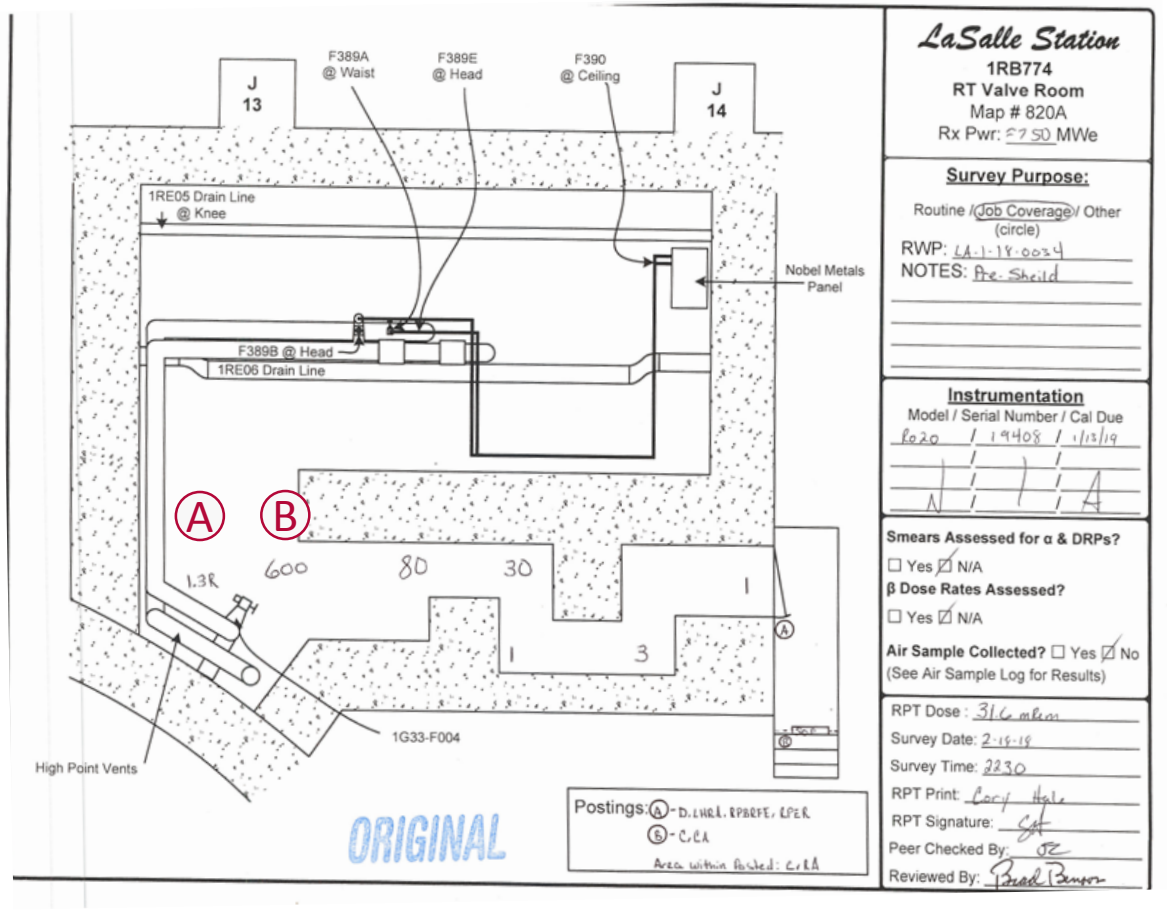
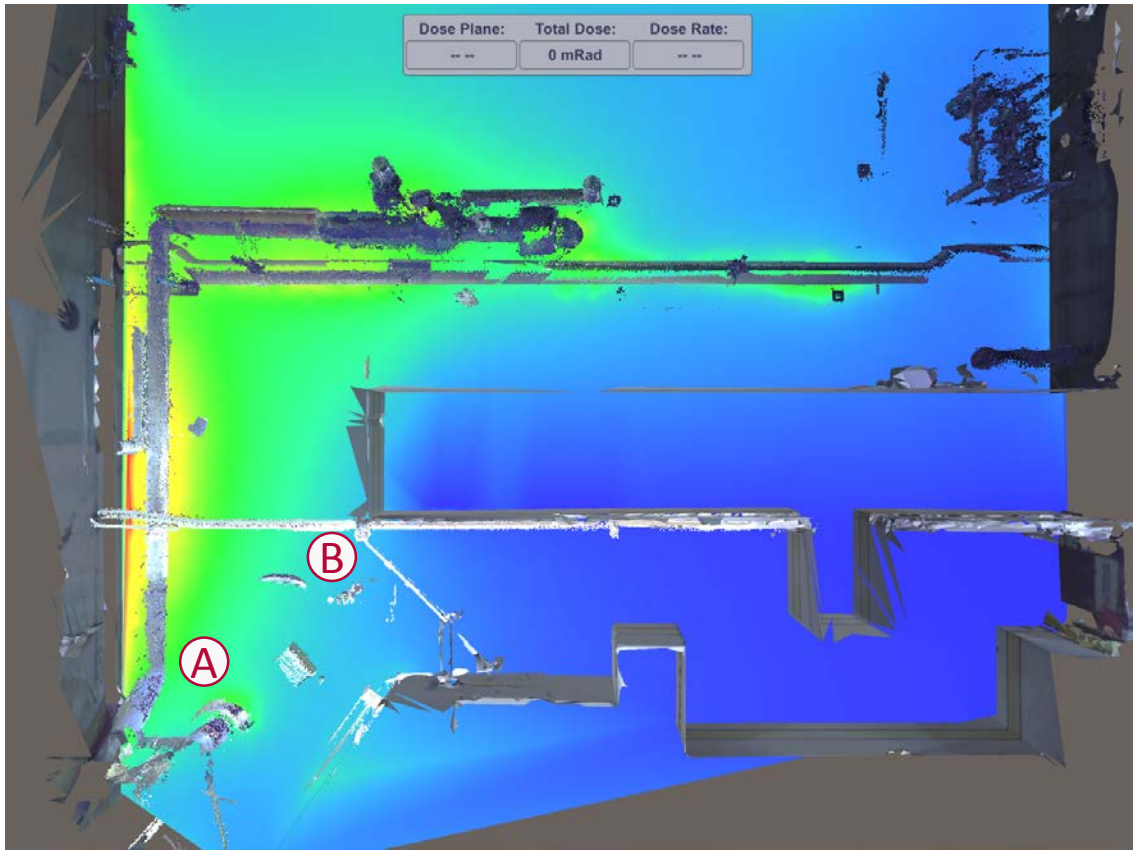
Data Validation – Pre-Job Survey vs RadVision Scan Calculation





Survey Location	Survey Data	RadVision^{3D} Data
A	1300 mRem/hr	1304 mRem/hr
B	600 mRem/hr	635 mRem/hr

RadVision^{3D} Data is the average of 5 pick points in the approximate area of the dose survey

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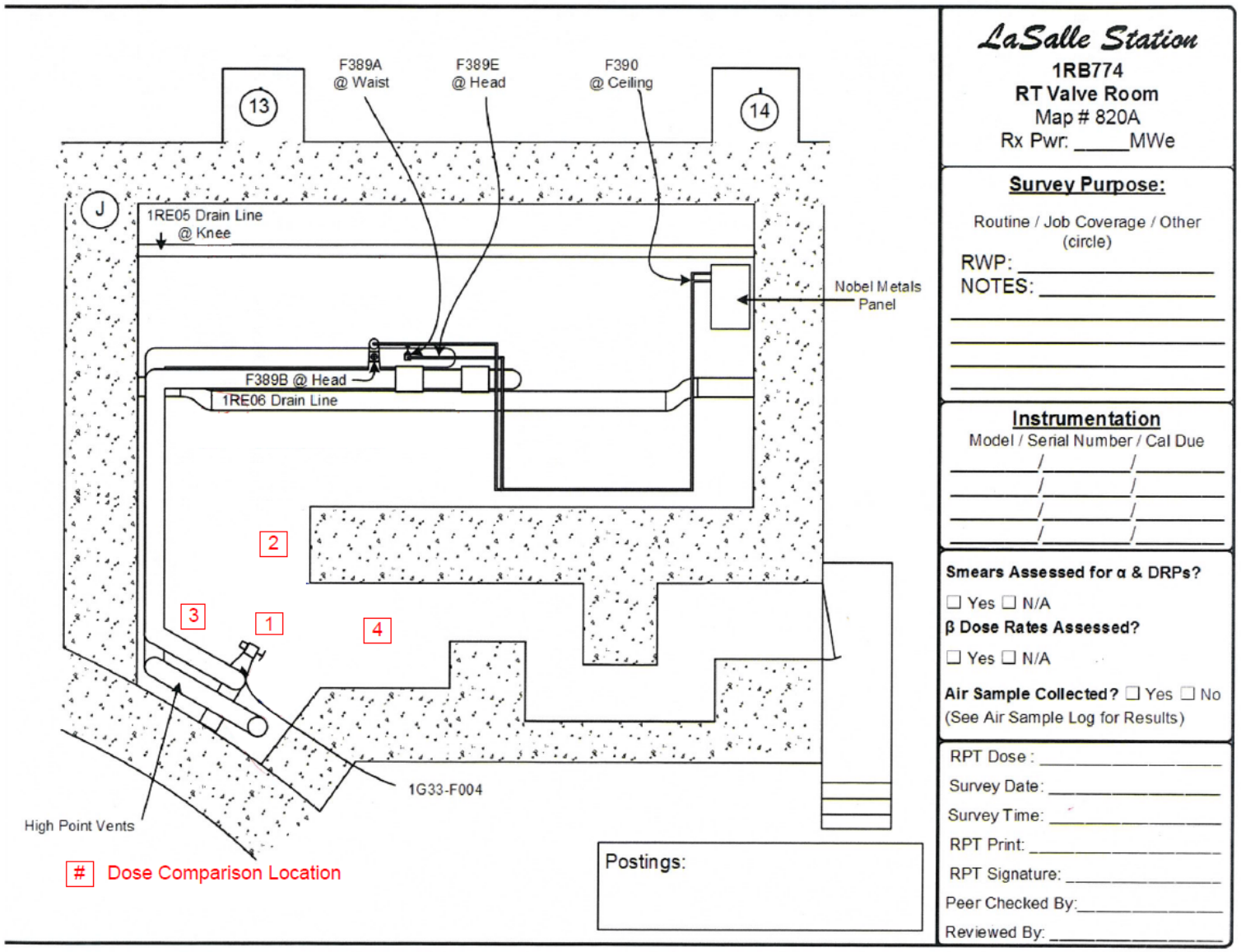
Locations to be Analyzed for Dose Reduction

- Key locations were chosen to minimize dose rate with shielding technology
- Areas most important to the scope of work are 1, 2, 3, and 4



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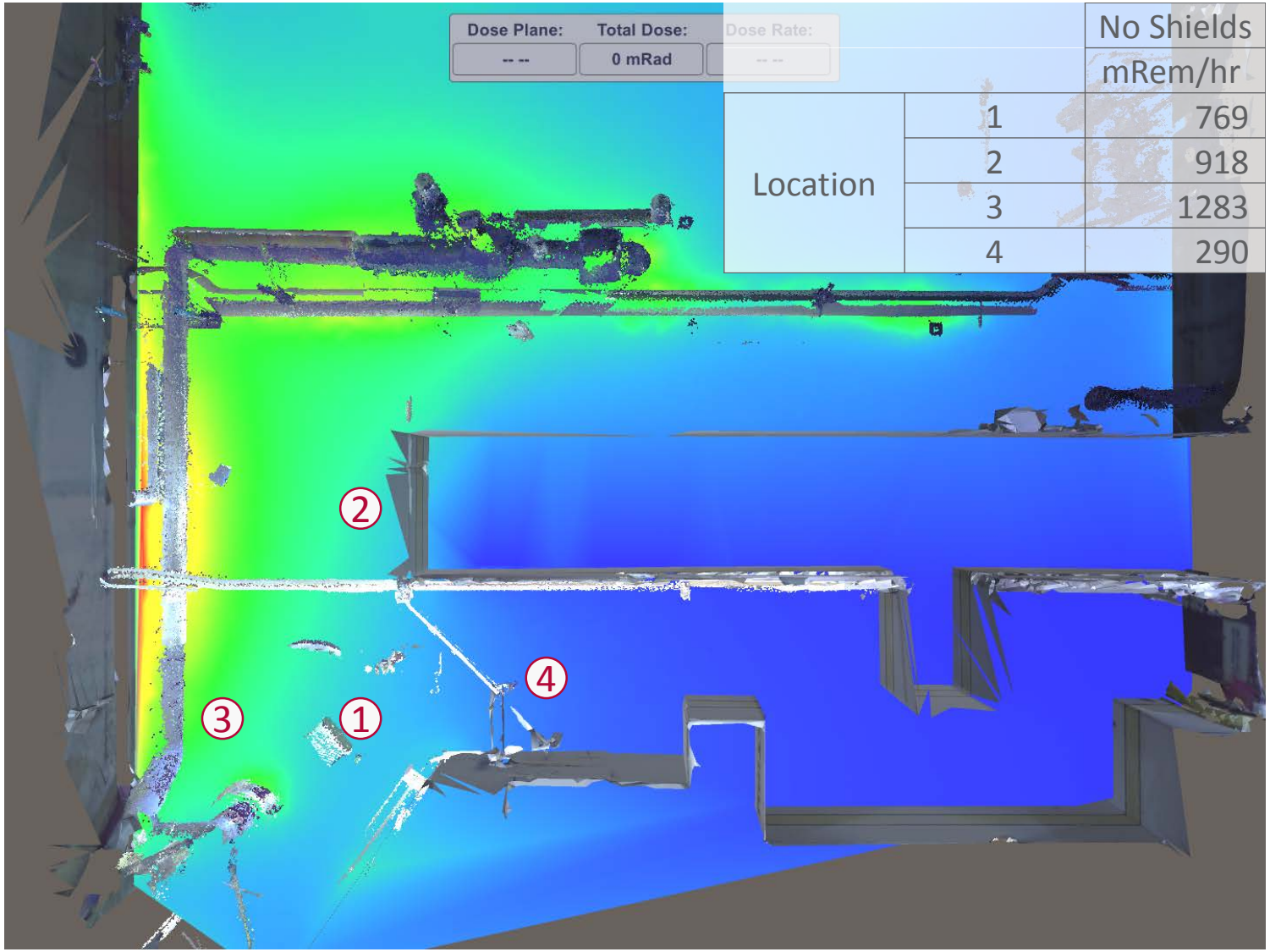
No Shielding – Current State



Location	No Shields mRem/hr
1	769
2	918
3	1283
4	290

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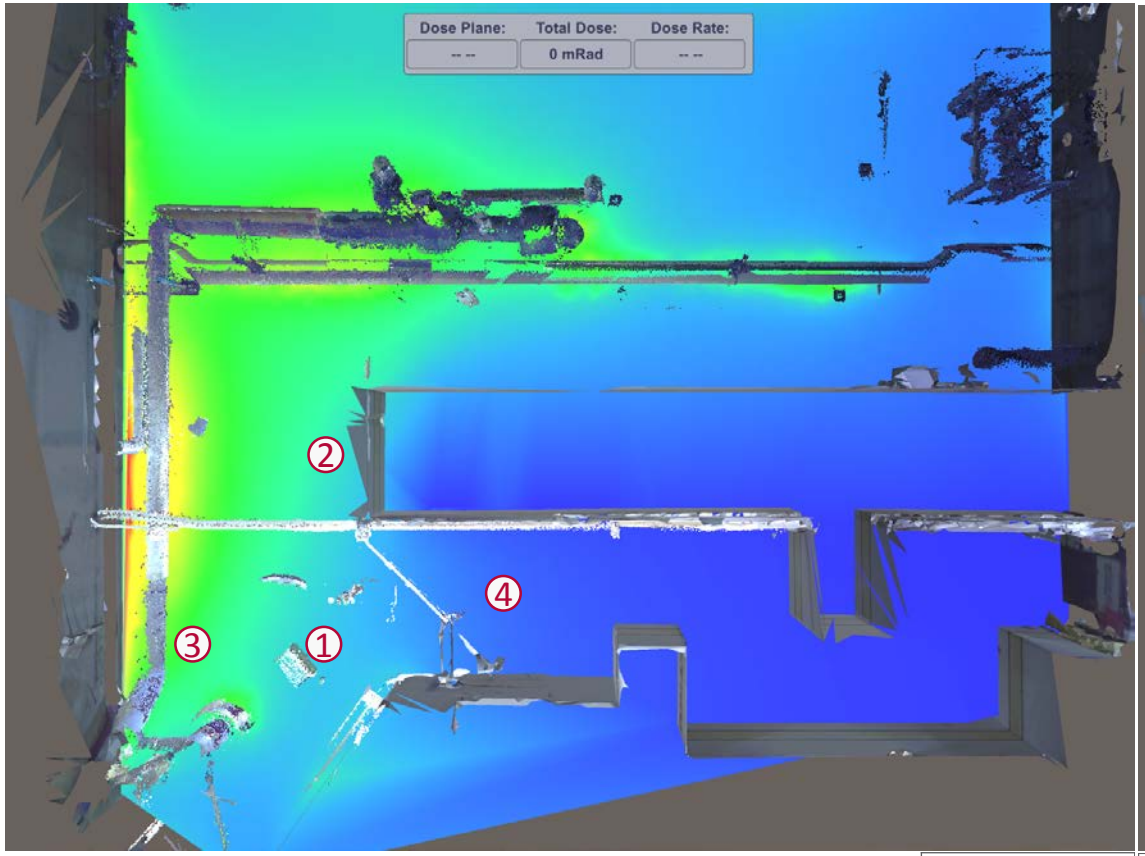
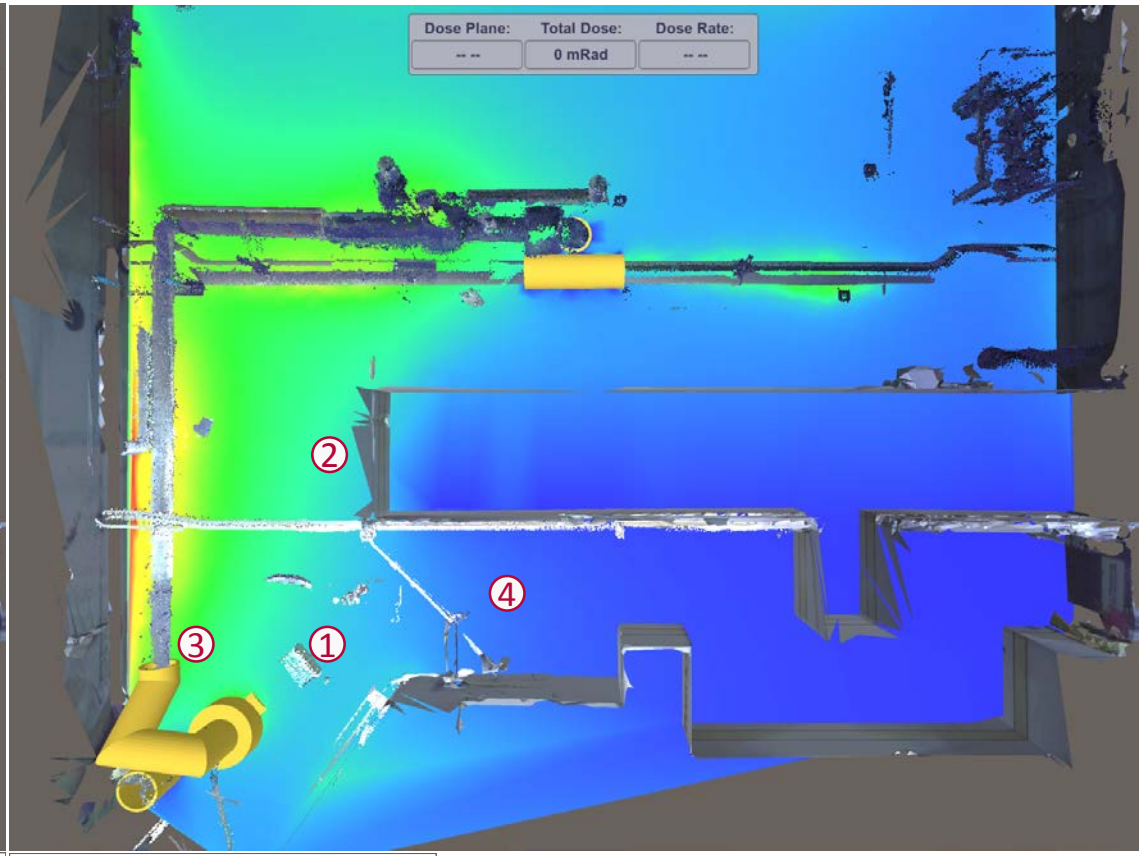
Conventional Shield Package – Shielding the Hot Spots





		No Shields	Hot Spot Shielding	
		mRem/hr	mRem/hr	Reduction
Location	1	769	756	2%
	2	918	901	2%
	3	1283	1242	3%
	4	290	286	1%

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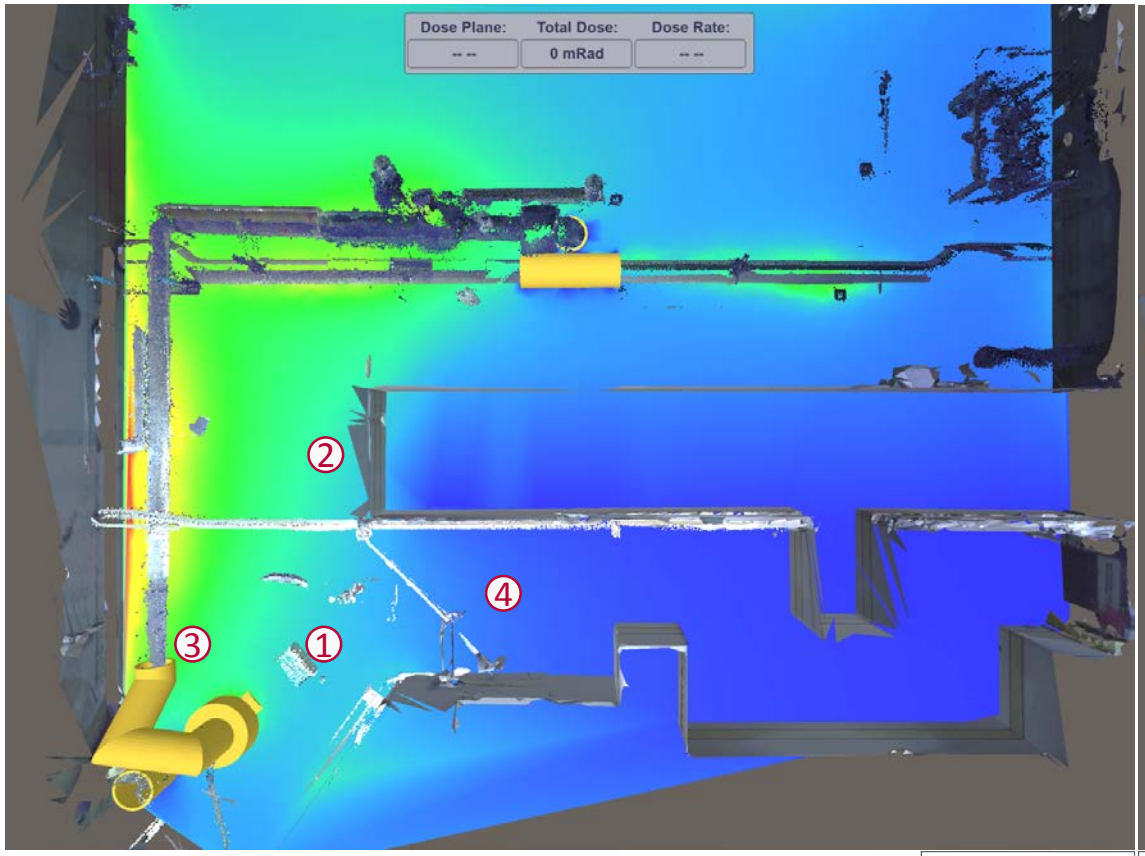
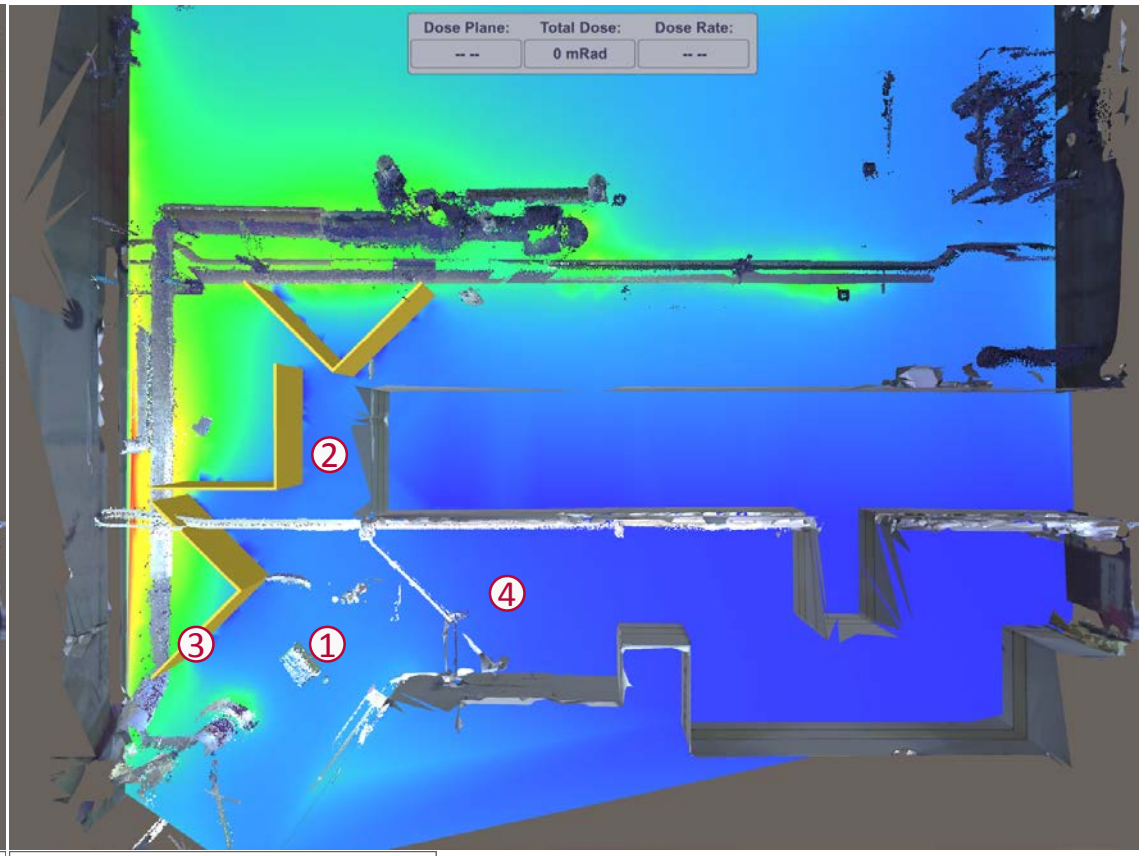
Simulated Shielding Configuration 1





		Hot Spots	Configuration 1	
		mRem/hr	mRem/hr	Reduction
Location	1	756	477	38%
	2	901	378	59%
	3	1242	534	58%
	4	286	192	34%

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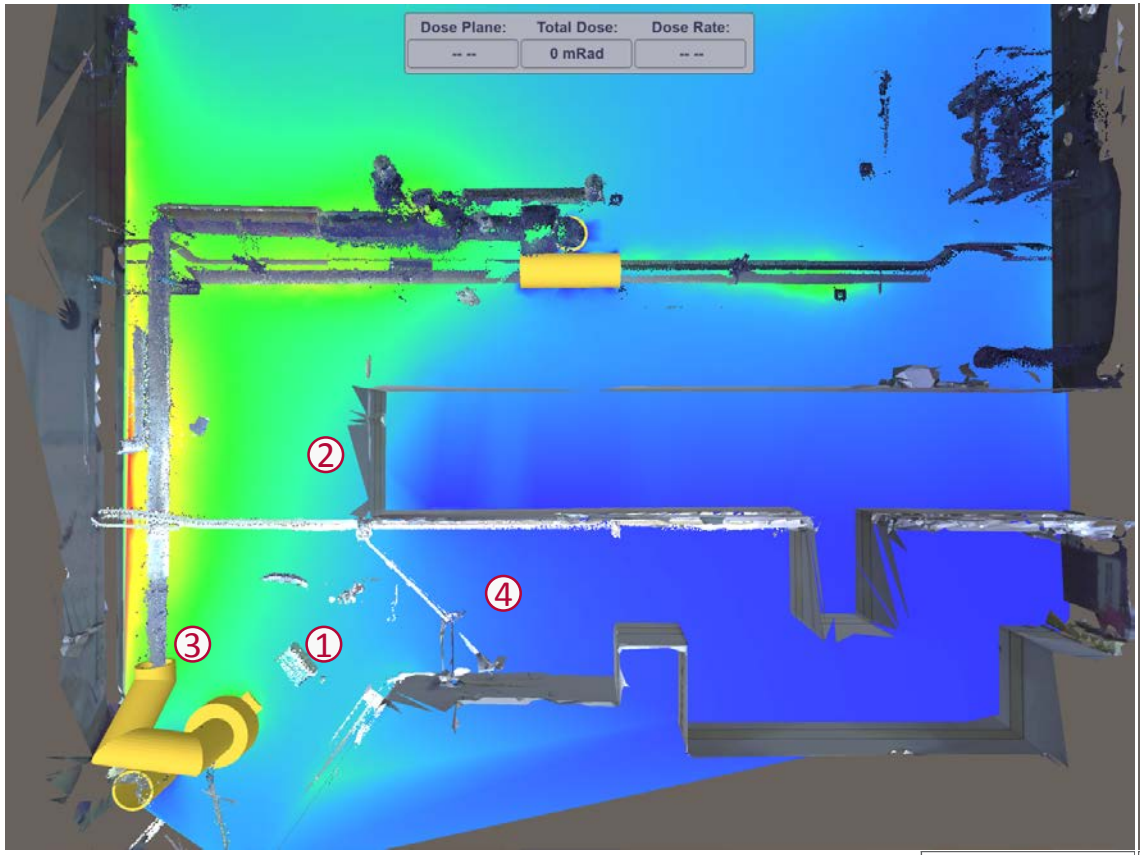
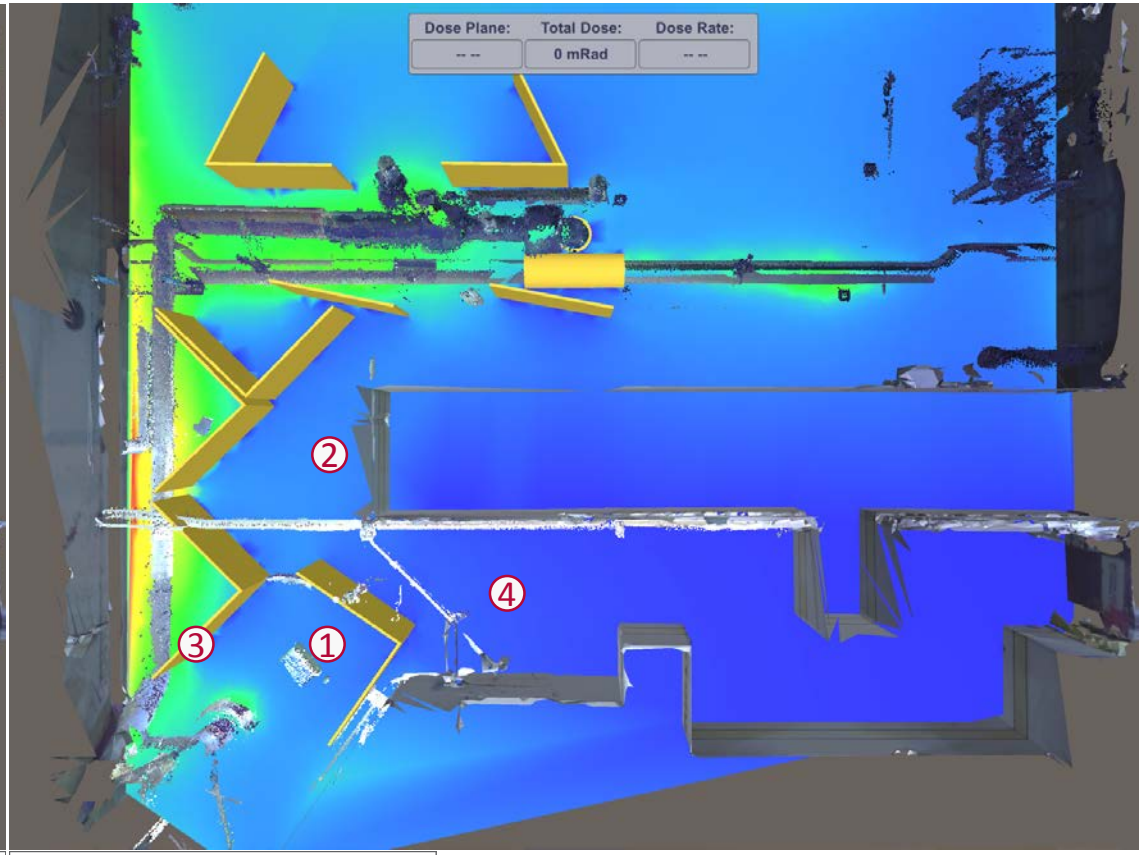
Simulated Shielding Configuration 2





		Hot Spots	Configuration 2	
		mRem/hr	mRem/hr	Reduction
Location	1	756	335	56%
	2	901	427	53%
	3	1242	517	60%
	4	286	151	48%

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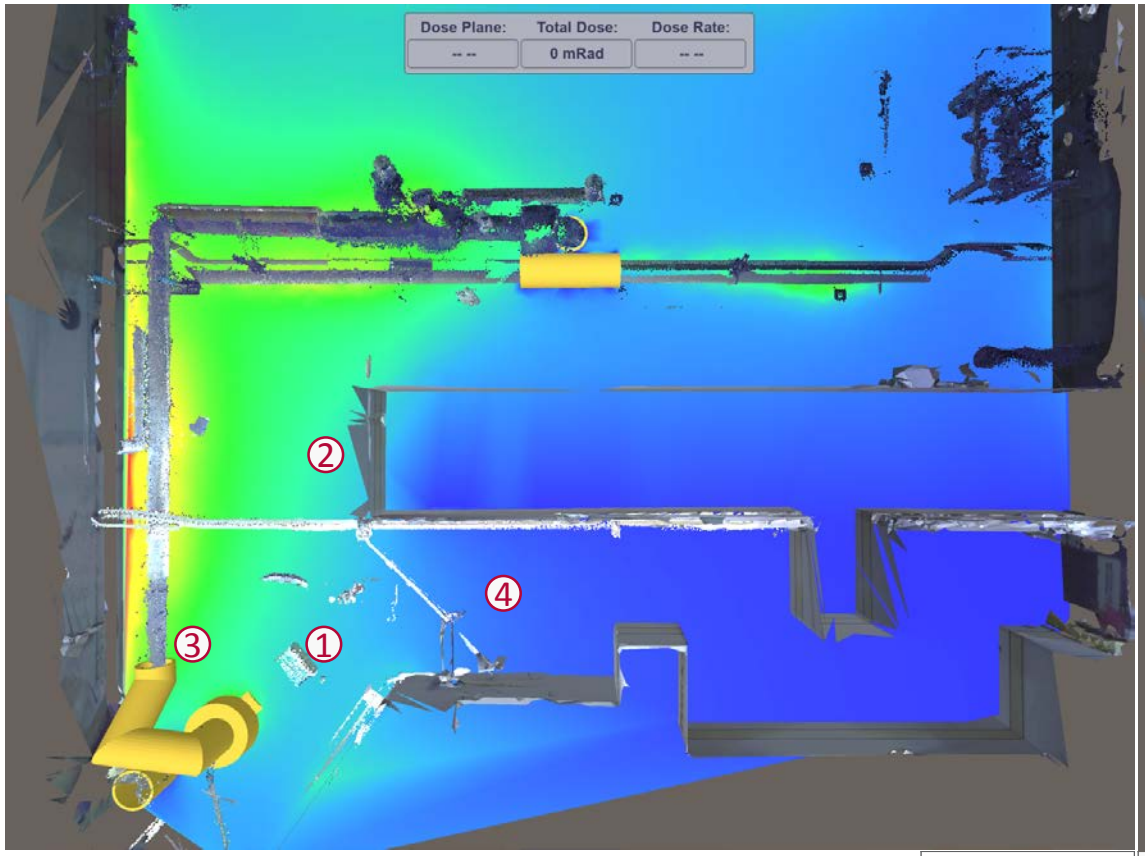
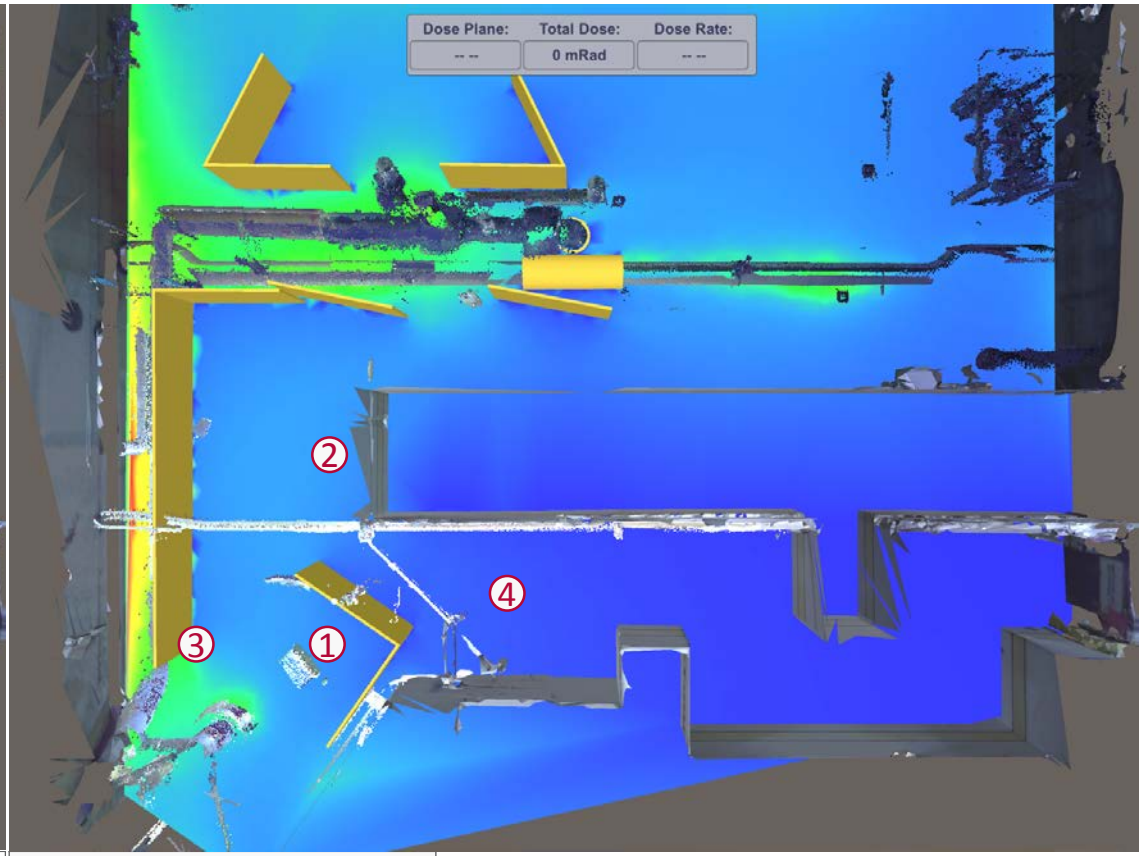
Simulated Shielding Configuration 3





		Hot Spots	Configuration 3	
		mRem/hr	mRem/hr	Reduction
Location	1	756	362	53%
	2	901	502	45%
	3	1242	740	42%
	4	286	155	47%

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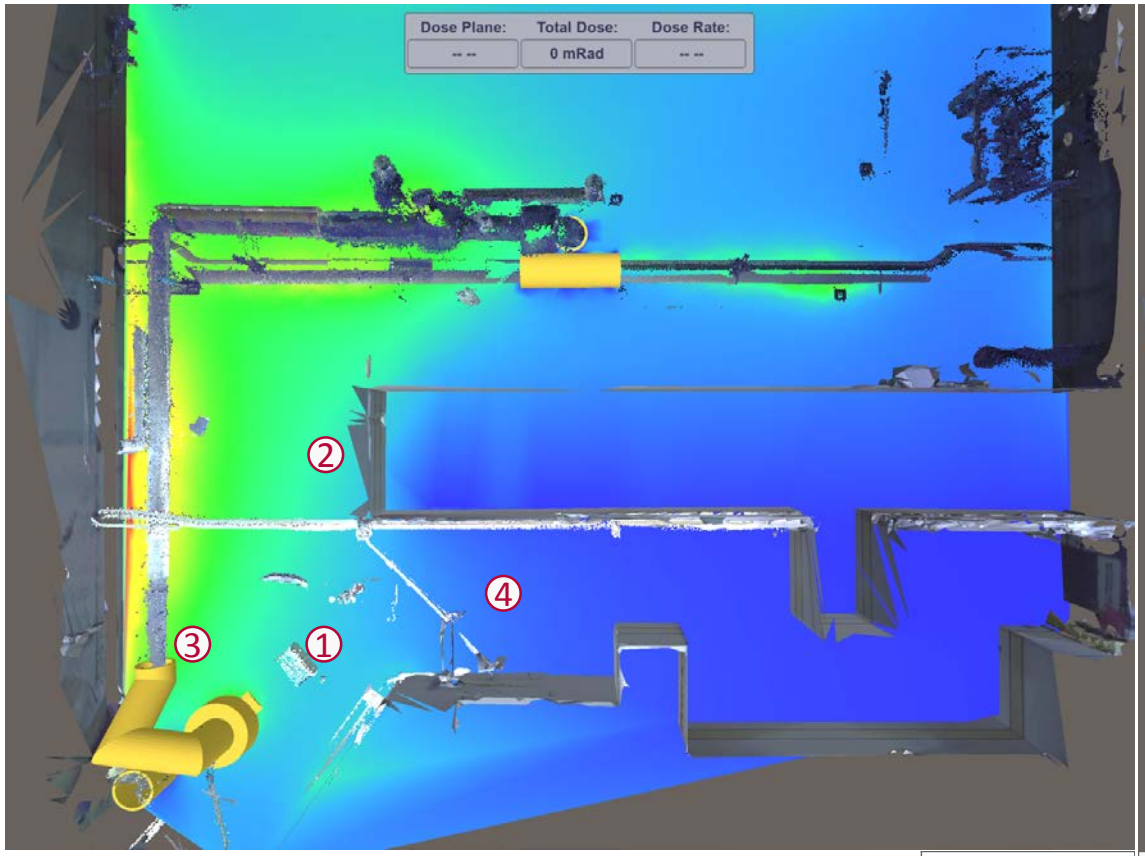
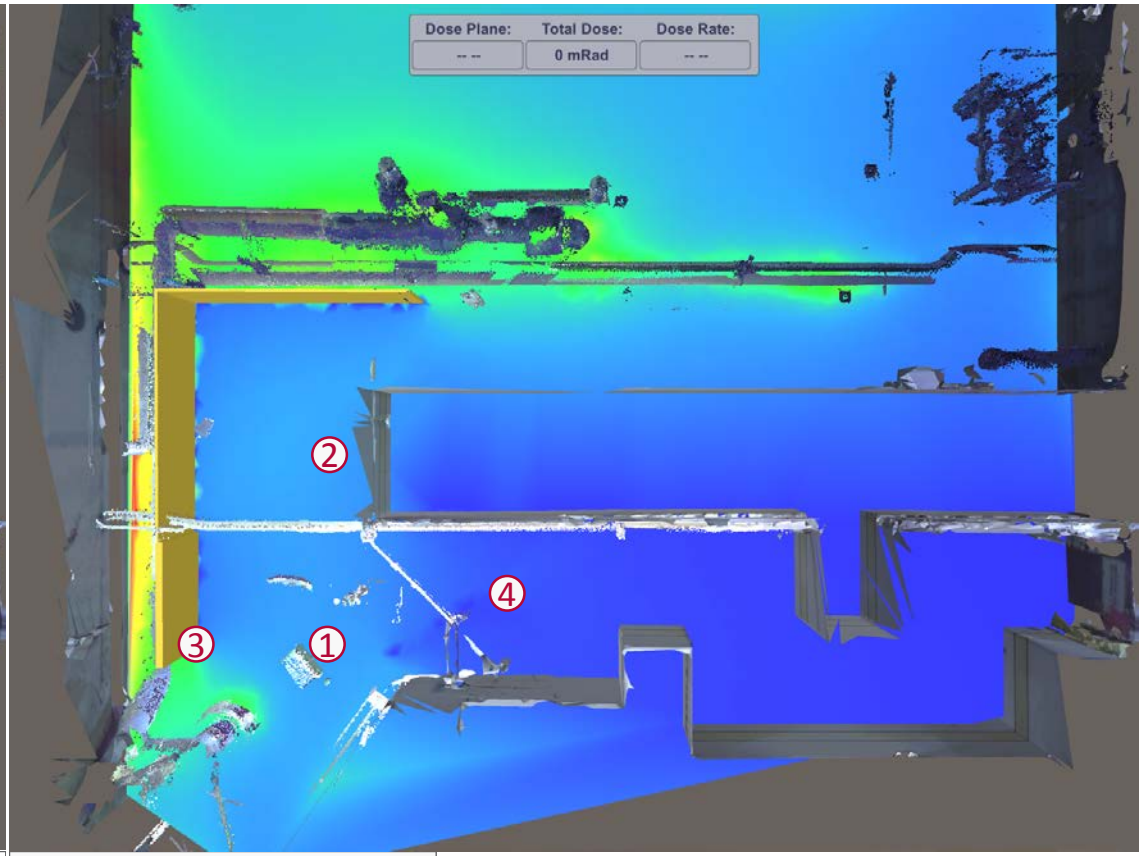
Simulated Shielding Configuration 4





		Hot Spots	Configuration 4	
		mRem/hr	mRem/hr	Reduction
Location	1	756	522	32%
	2	901	531	42%
	3	1242	740	42%
	4	286	89	69%

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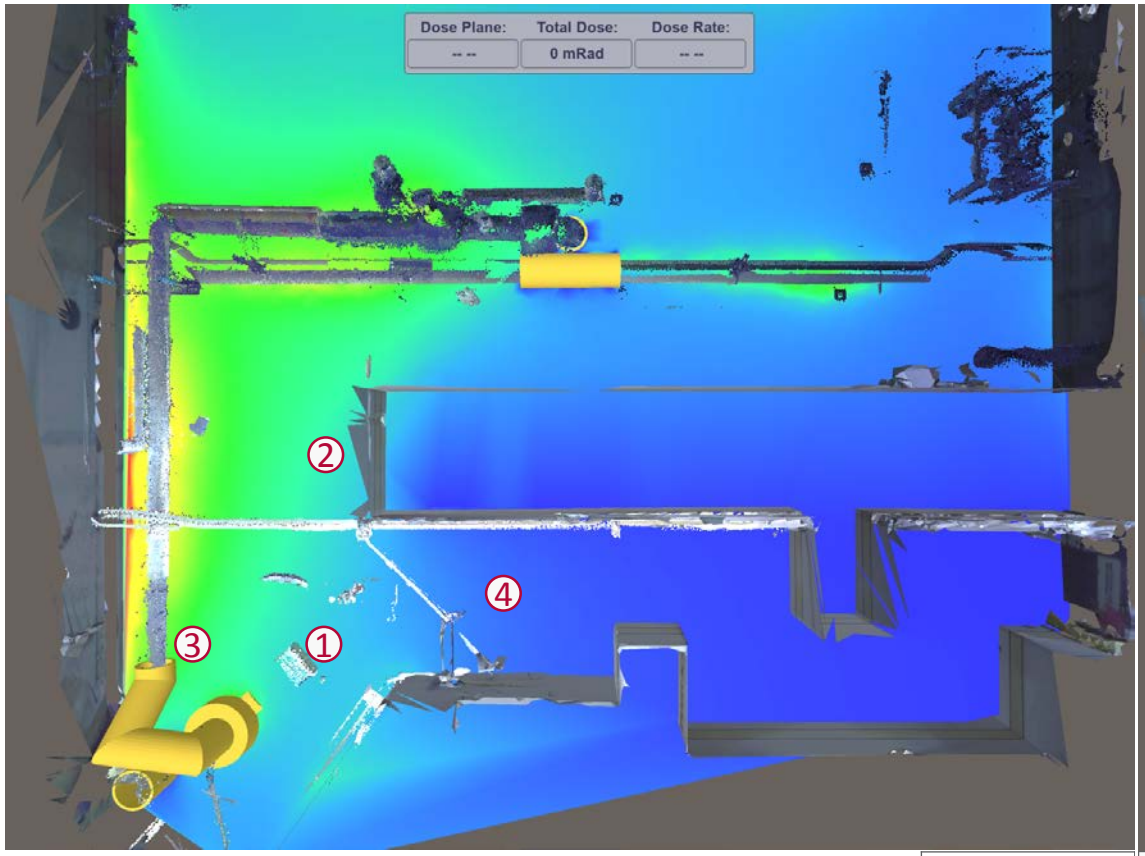
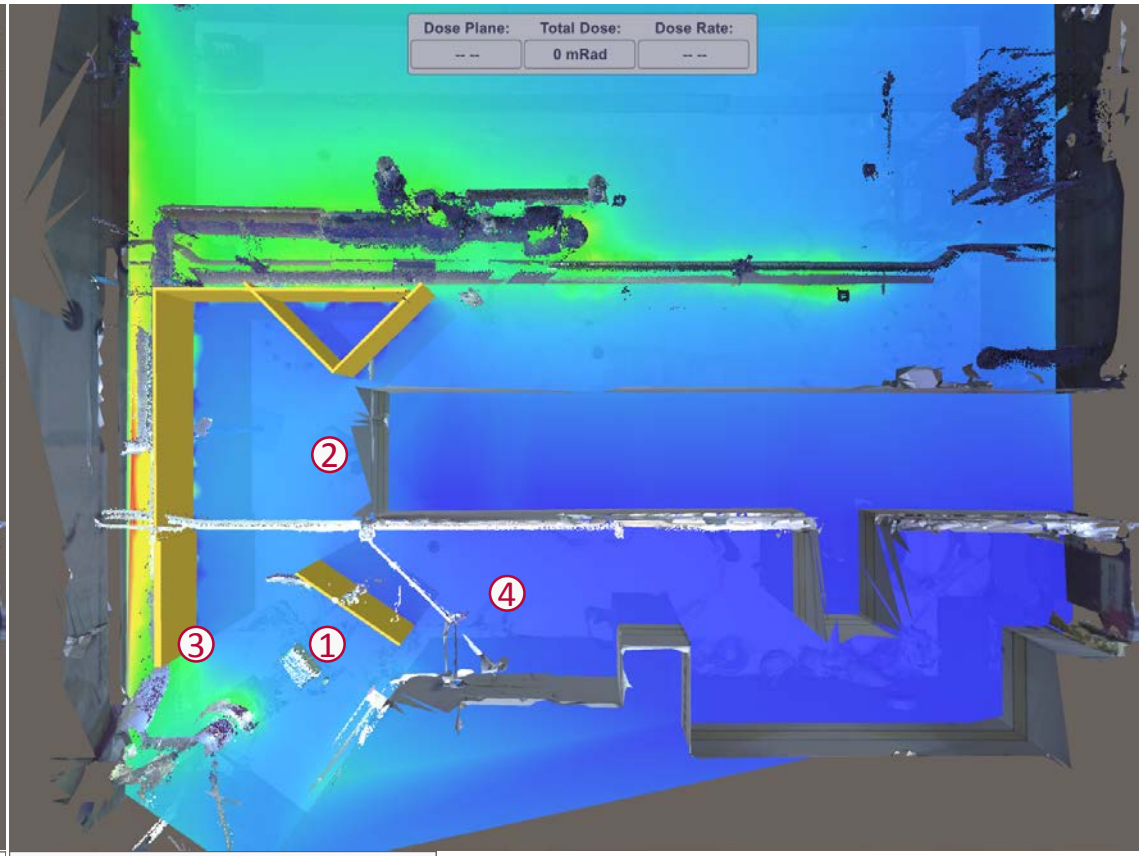
Simulated Shielding Configuration 5





		Hot Spots	Configuration 5	
		mRem/hr	mRem/hr	Reduction
Location	1	756	409	47%
	2	901	455	50%
	3	1242	729	43%
	4	286	179	38%

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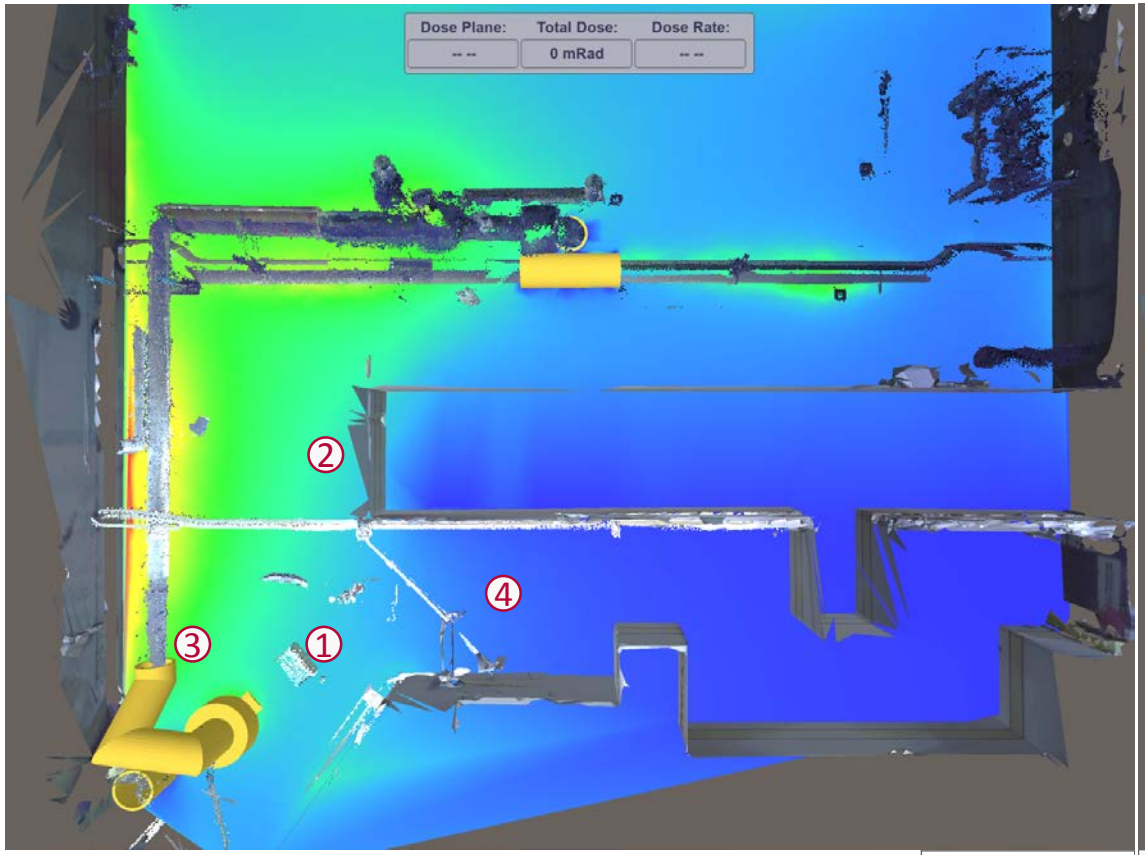
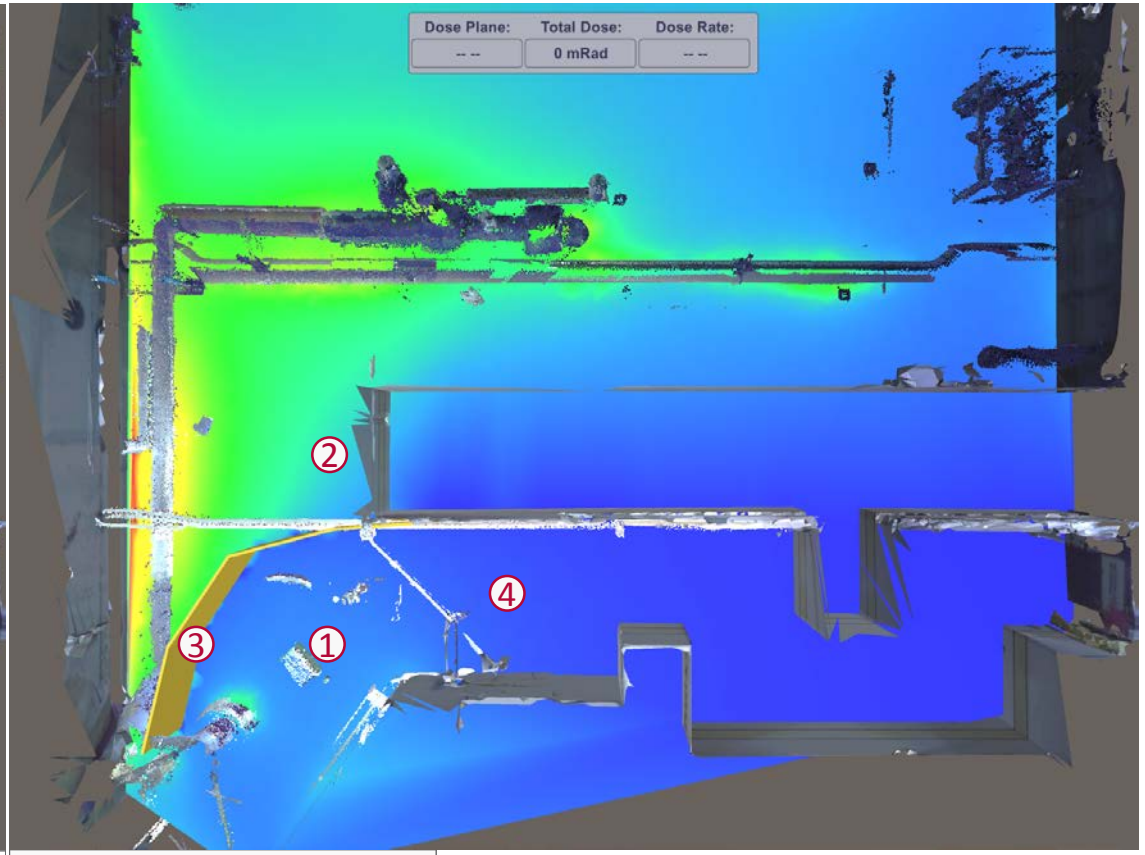
Optimal Shielding Configuration





		Hot Spots	Optimized Shielding	
		mRem/hr	mRem/hr	Reduction
Location	1	756	422	45%
	2	901	824	10%
	3	1242	414	68%
	4	286	169	42%

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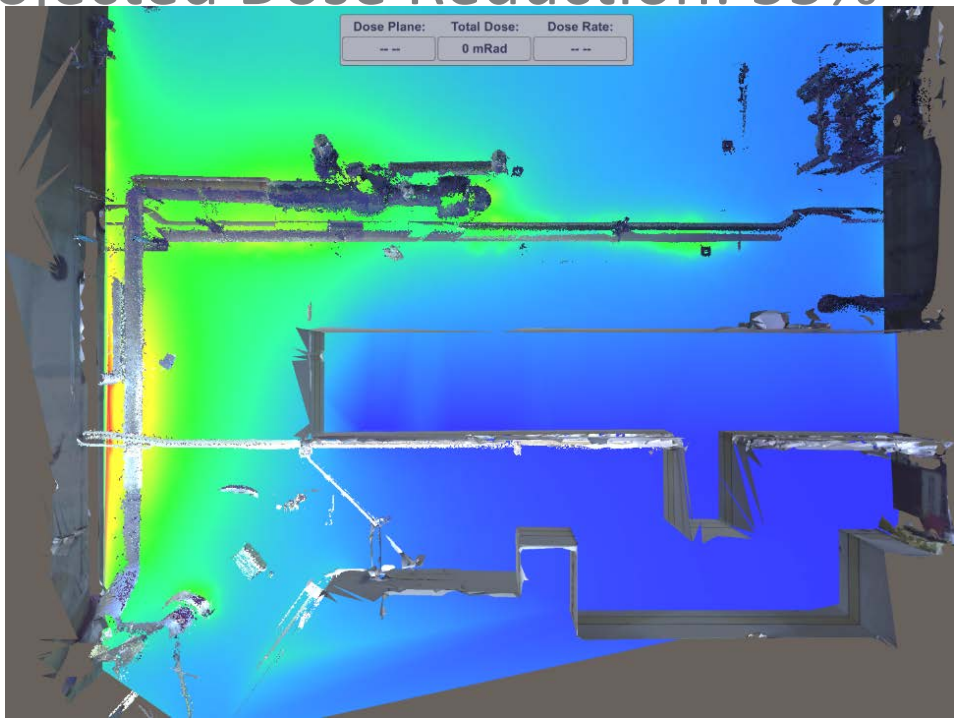
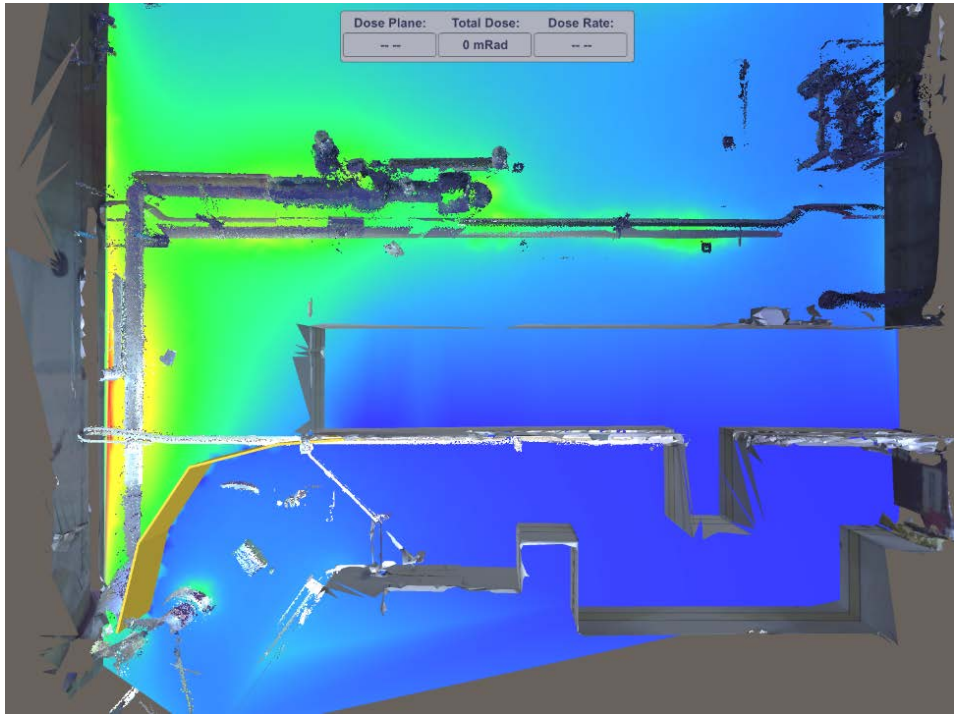
Projected Results Using Optimized Shielding Package

Shield Package: NPO Serpentine Racks with 1 “ solid lead equivalent shielding

Projected Dose Reduction: 55%



Unshielded



With Optimal Shielding

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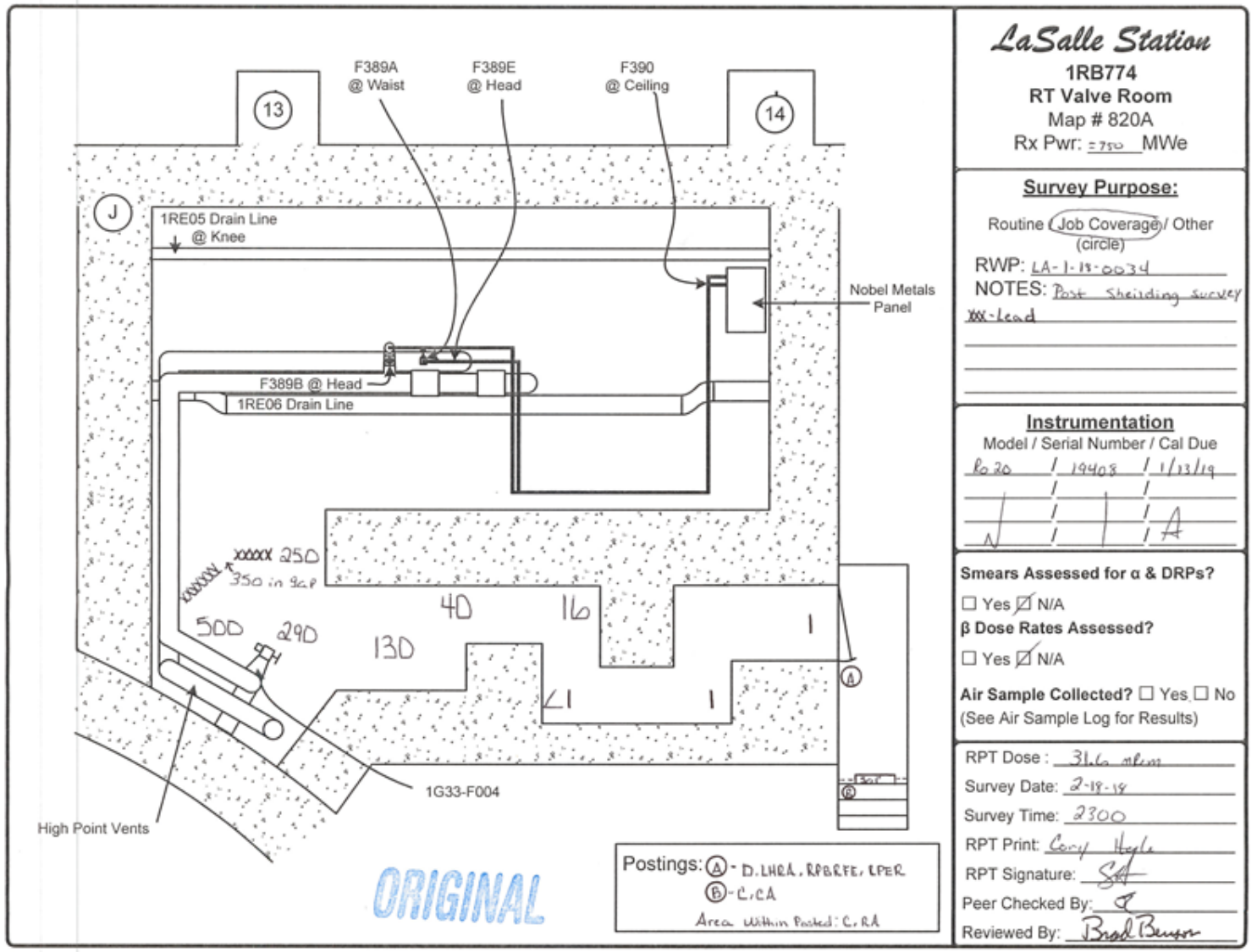
Post Shielding Survey



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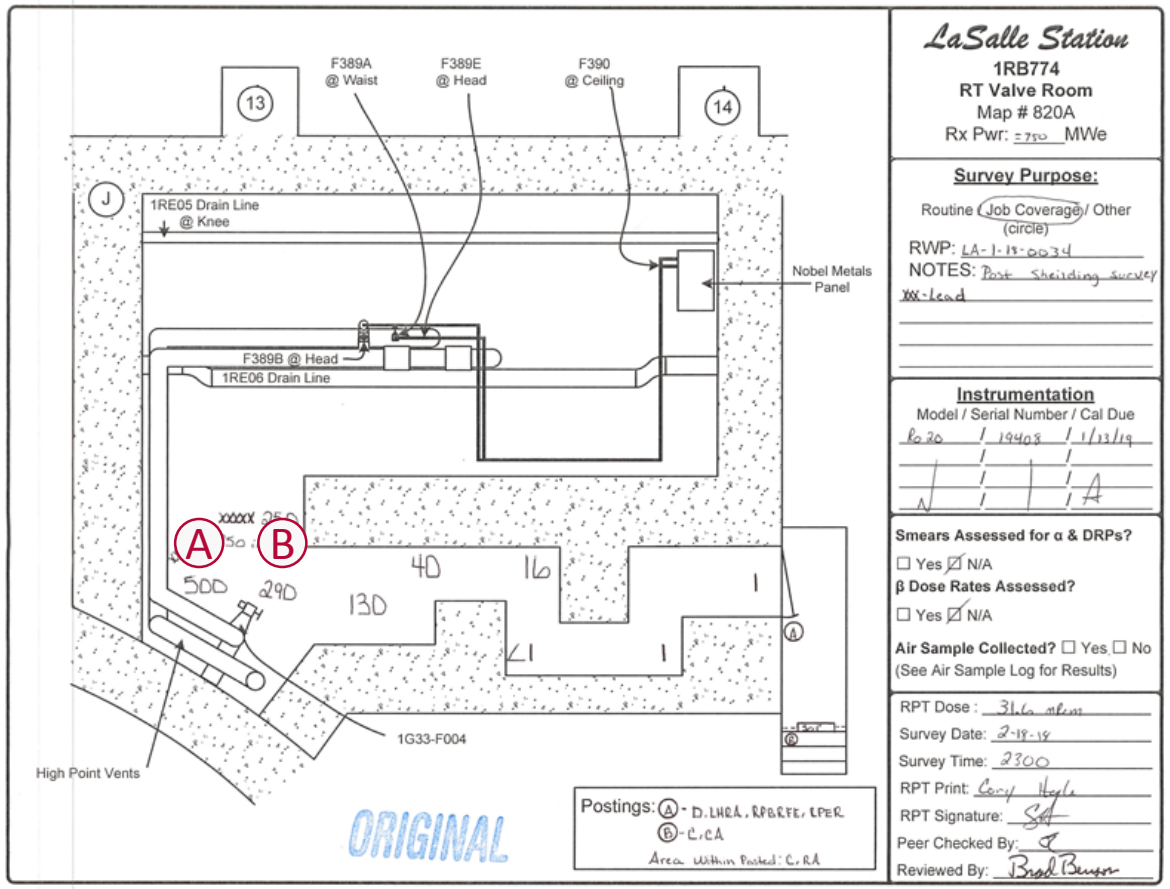
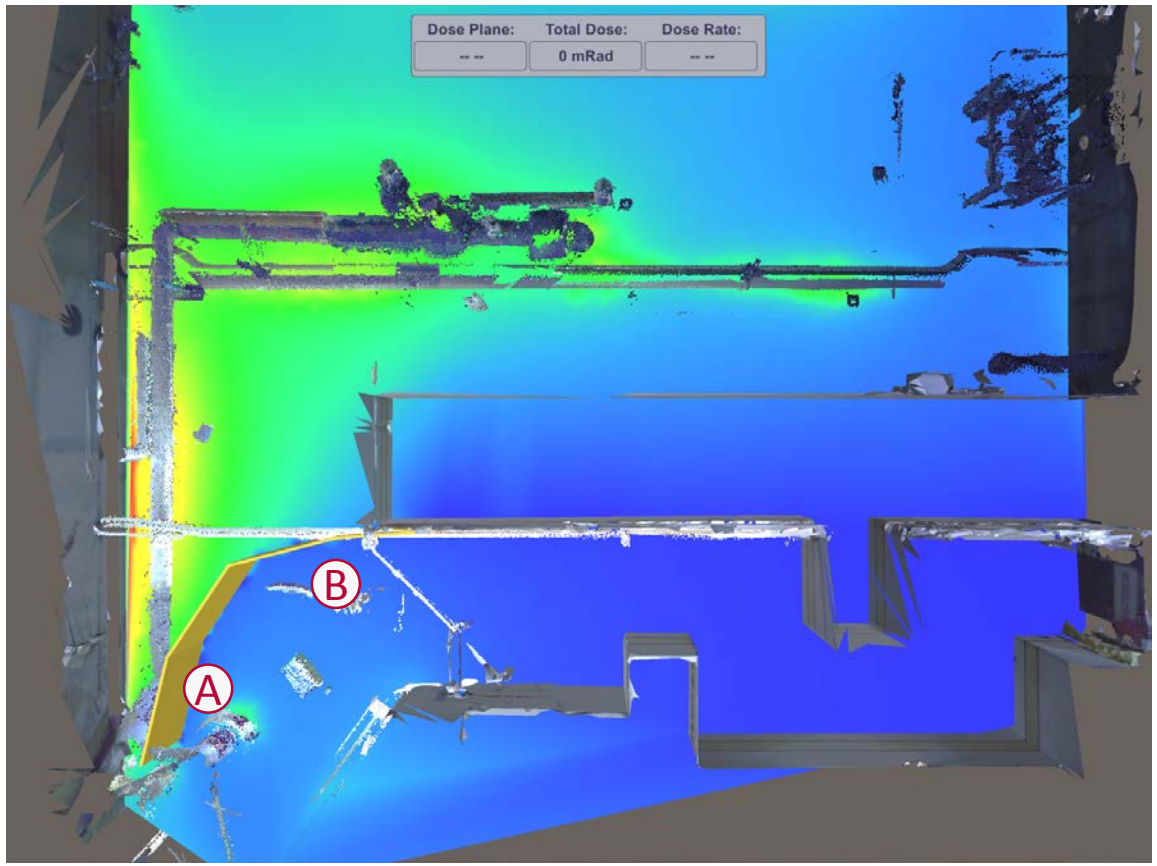
Post Shielding Data Validation





Survey Location	Survey Data	RadVision^{3D} Data
A	500 mRem/hr	483 mRem/hr
B	290 mRem/hr	270 mRem/hr

RadVision^{3D} Data is the average of 5 pick points in the approximate area of the dose survey data

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Summary

- RadVision^{3D} scan dose: 30 mRem
- Shielding Installation Time: 20 minutes
- Shielding Installation Dose: 163 mRem
- Total Job Dose: 11,900 mRem
- Total Dose Savings: 12,000 mRem

≈12 Rem saved
for all work done

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Financials

12 Total Rem Saved

x $80,000 Per Rem Saved (4th quartile plant)

$960,000

- RadVision3D cost comparable to typical laser scan

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