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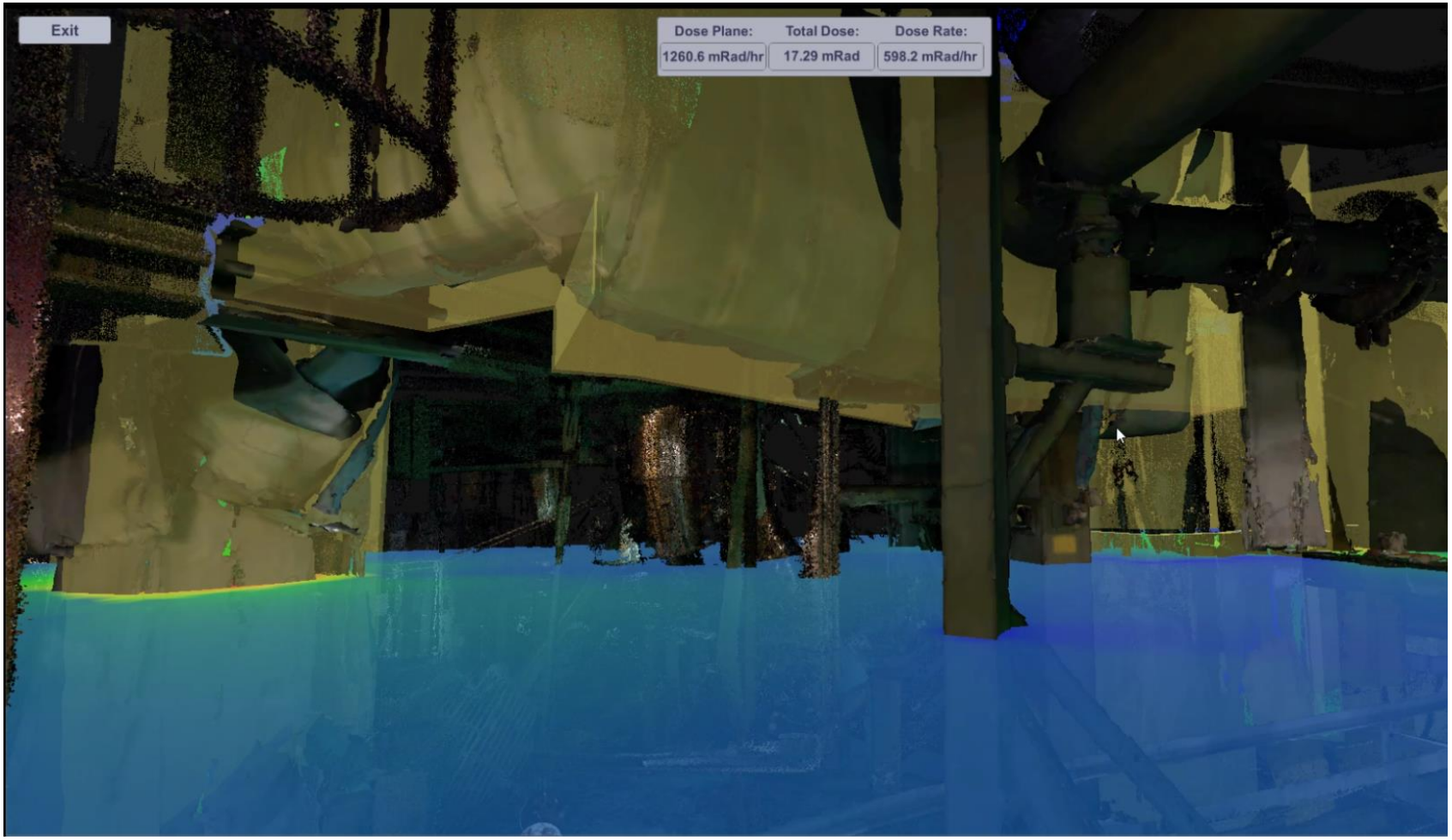
RadVision$^{3D®}$



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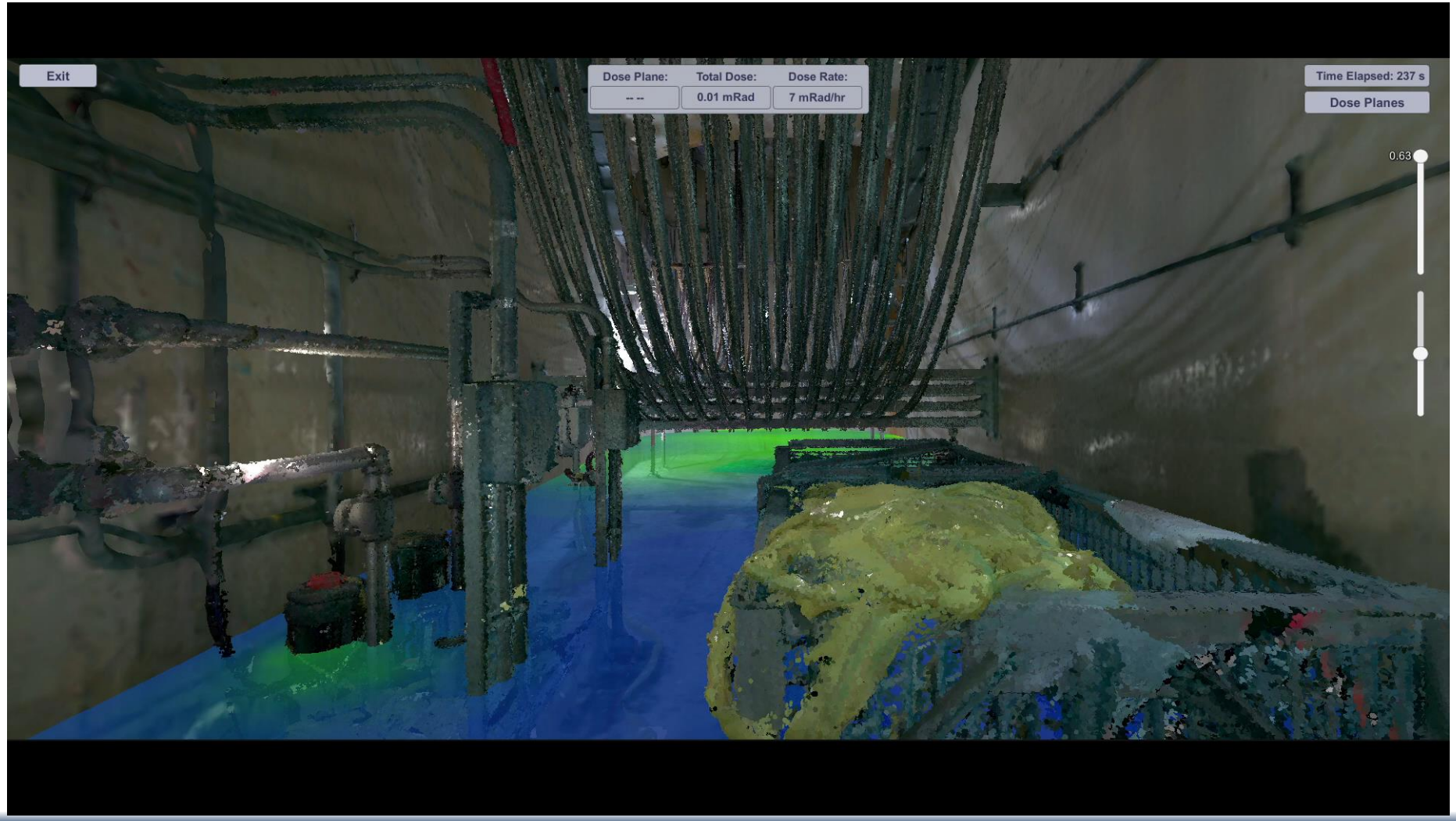
RadVision^{3D}® Viewer Demo



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RadVision$^{3D®}$ Overview

- **RadVision$^{3D®}$ is the only complete radiation detection and planning service that lets you take control of your work planning and empowers safer plant and decommissioning conditions.**
- **Can be robotically deployed in hazardous environments**
- **Technology has been used for challenging legacy waste issues (UK) and radiological accident conditions (Japan and US)**

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RadVision^{3D}® Overview

Detect

- Reality capture for geometric and radiological conditions using lidar scanners and specialized gamma detectors

Analyze

- Examination of radiation conditions through a full 3D model of the scanned area that merges geospatial point clouds and gamma radiation data

Mitigate

- Simulate a variety of source removal or shielding solutions and determine their effects on plant conditions

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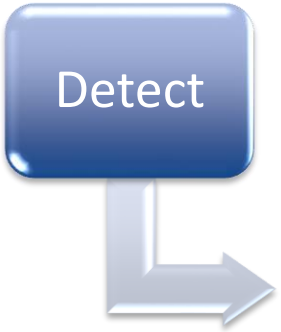
The RadVision^{3D}® Process



- Radiation and Lidar scans are conducted by trained technicians
- Immediate results include hot spot localization and isotope identification

- Analysis shows radiation exposure anywhere within the environment
- Visualizes the distribution of the sources

- Simulate the effect of shielding or source removal options

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N-Visage™ Mark III Scanner

Gamma Ray Spectrometer

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

Packaging

- High dose tolerant: up to 100 Rem/hr
- Fits through small apertures: 85mm OD
- Low mass: 10kg
- Umbilical length of over 100m
- IP67 Enclosure Rating

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 20m
- Resolution: +/- 40mm @ 20m

Camera

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

*Createc's N-Visage™ technology is protected by global patents including:
U.S. Patent 9,190,182 B2
U.S. Patent 8,405,786 A2

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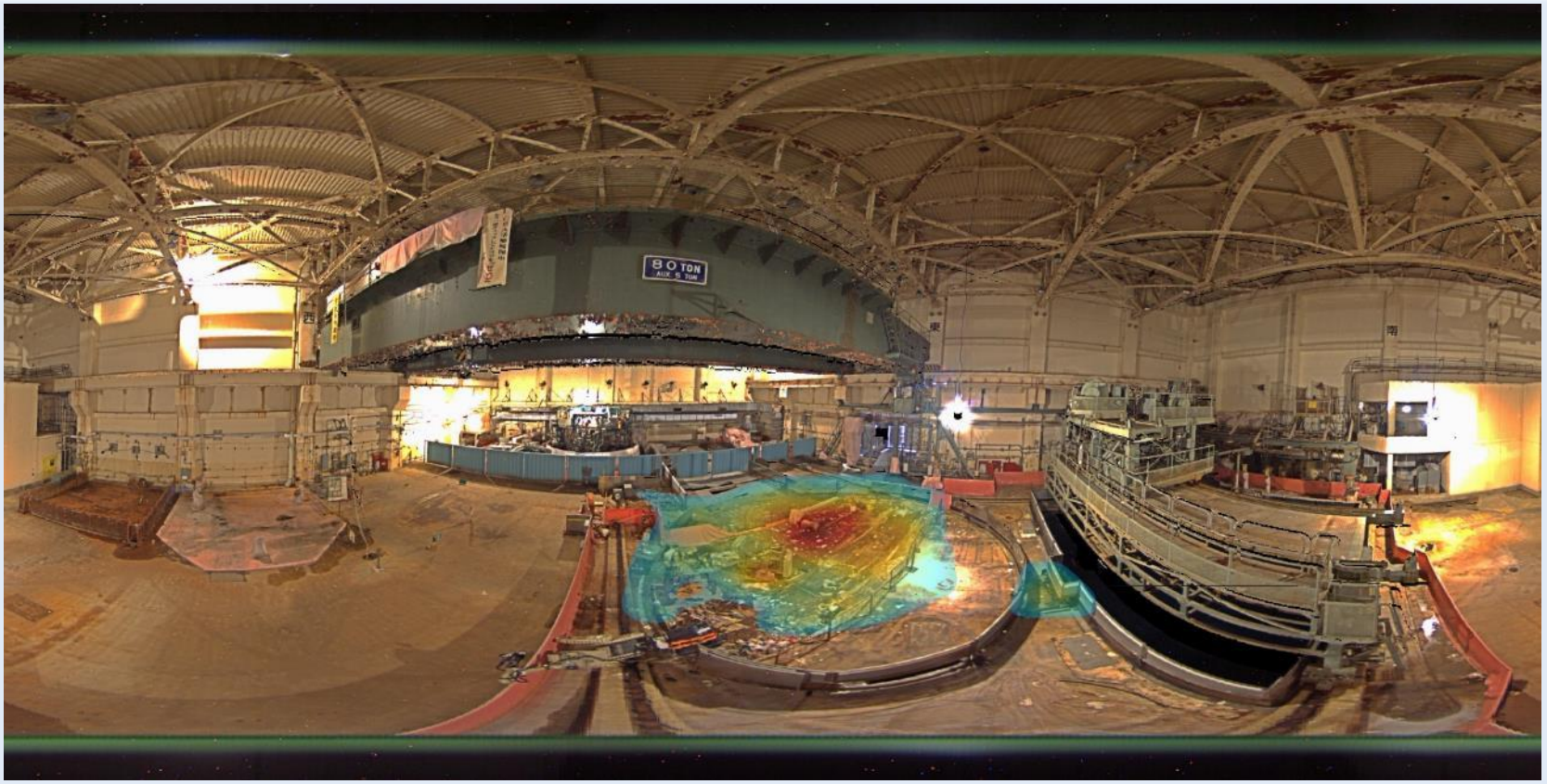
N-Visage™ Mark III Real-Time Output



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Dynamic Compton Camera Surveys

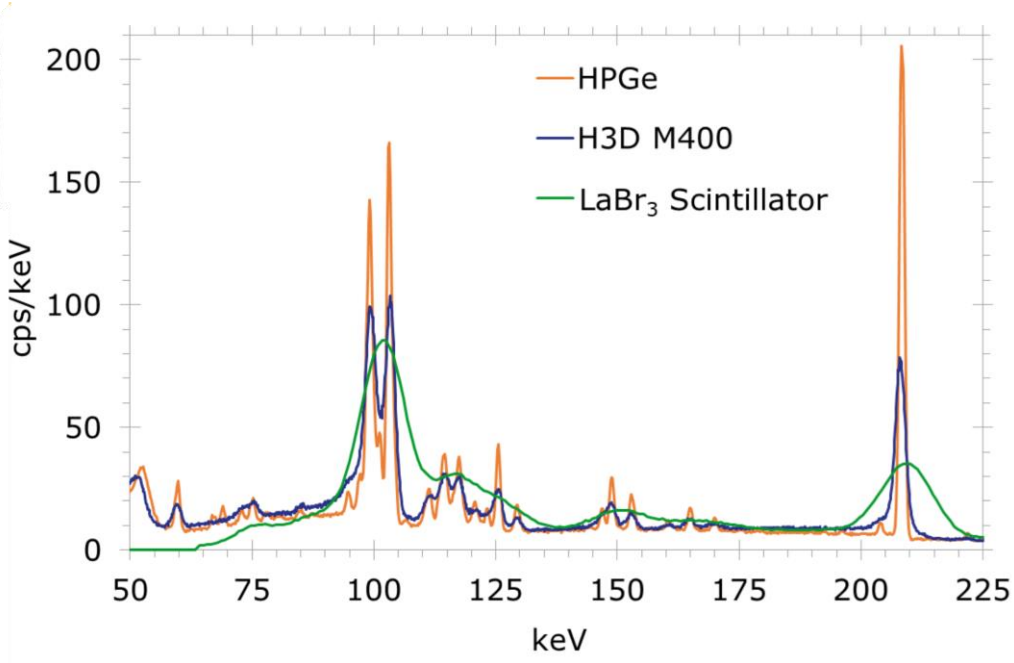
Transco is working with multiple companies to add SLAM enabled scanning devices into our arsenal of scanners

- **Scan as You Go**
  - **SLAM enabled devices allow user to collect data as they move throughout environment**
  - **Exponentially faster data collection (<30 min to scan a room compared to a full day of work)**
- **Faster Data Analysis (Days to Hours)**

Dynamic Compton Camera Surveys

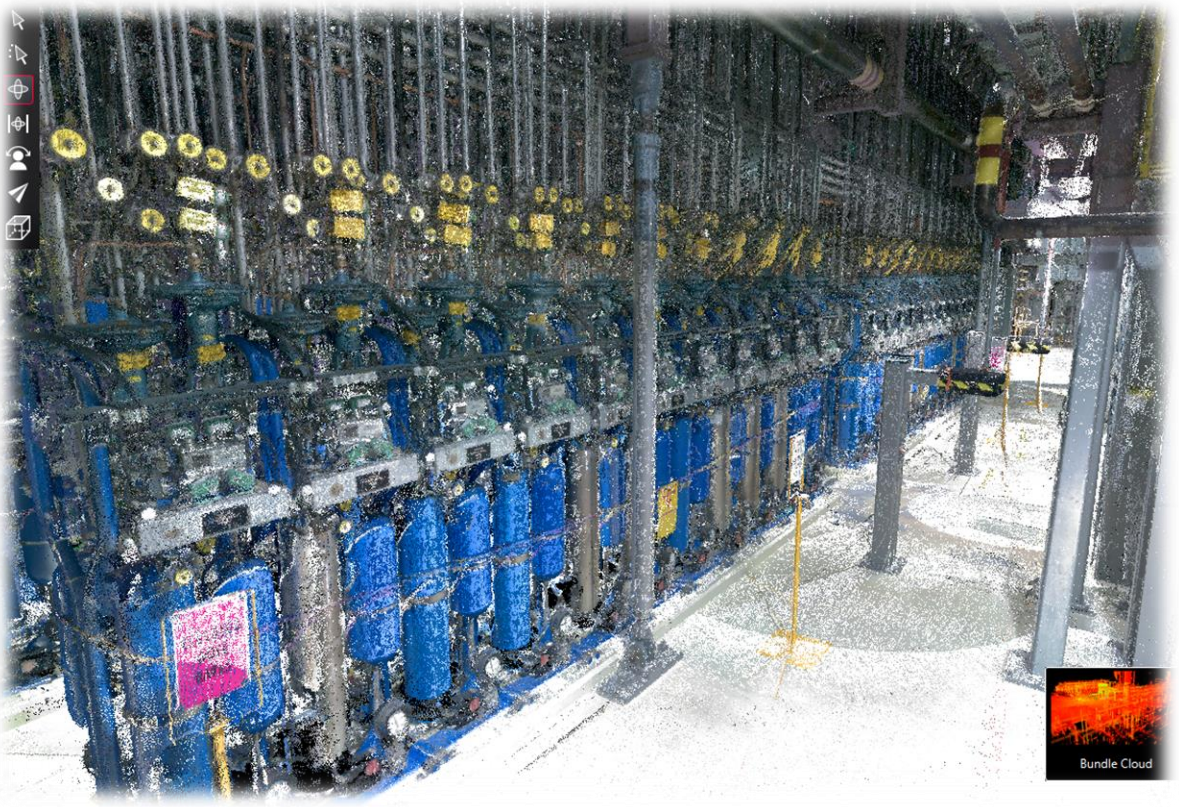
Many of these SLAM enabled scanners are powered by H3D's CZT spectrometers such as their M400

- **Near-HPGe energy resolution at room temperature**
- **Real time results**
  - **Imaging**
  - **Isotope ID**
  - **Spectroscopy**



Lidar Scanning

- **Supplemental Geospatial data is collected with lidar technology**
- **Optional but highly recommended**
- **Full Facility Lidar Scans**
- **Digital Twin Rad Monitoring System**
- **Updated To-Scale Survey Map Schematics**



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Robotic Deployments

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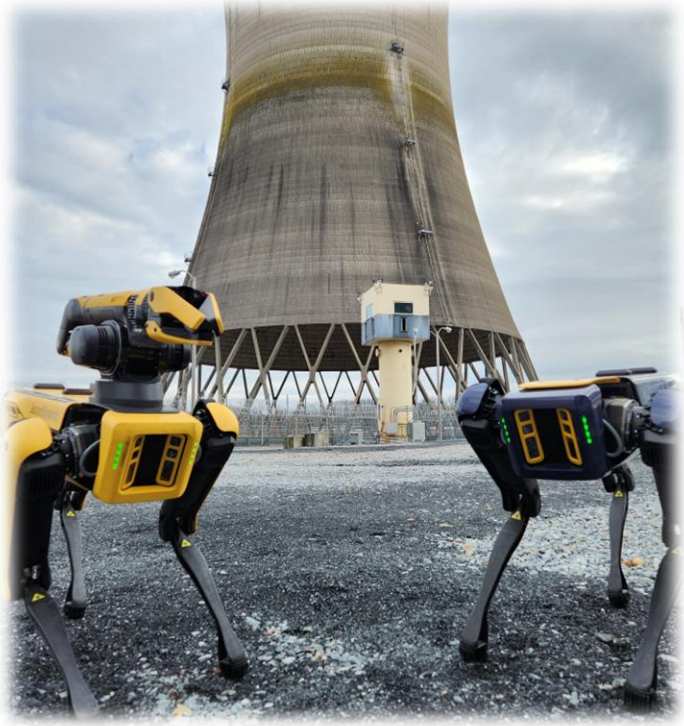
Robotic Surveys

- **Routine automatic surveys**
- **Vastly increase quality and quantity of survey data**
- **Eliminate unnecessary dose exposure**
- **Remote inspections of hazardous scenarios**



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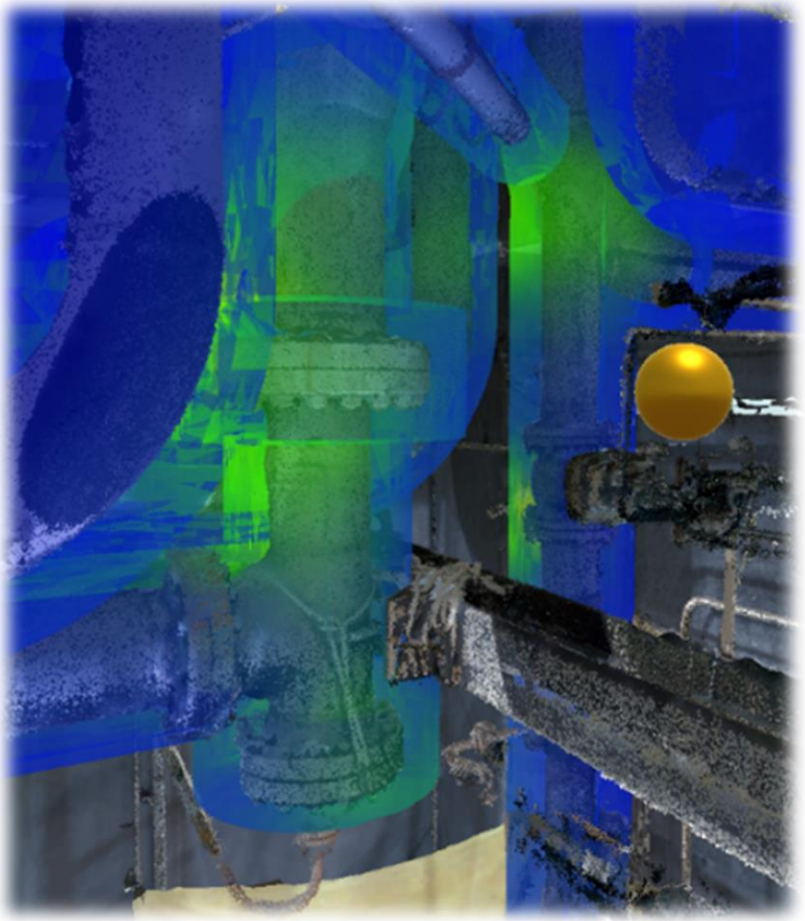
RadVision^{3D}® Analysis

Two analysis types

- **Full RadVision^{3D} Analysis**
  - **Data collection performed with stationery scanners**
  - **Analysis performed by trained technicians**
  - **Higher level of accuracy**
  - **Higher level of visual fidelity**

- **RadVision Shield Analysis**
  - **Data can be collected with SLAM enabled devices**
  - **User-based analysis**
  - **Fast**



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RadVision^{3D}® Analysis

Users receive a written report and an interactive viewer which includes:

- **Full three-dimensional model of scanned area including merged optical, point cloud and gamma radiation data**
- **Customizable dose planes to interrogate dose rates at various elevations in the model**
- **Customizable virtual shielding or source removal solutions that can be overlaid in the model**
- **Work planning tools such as a dose estimator**

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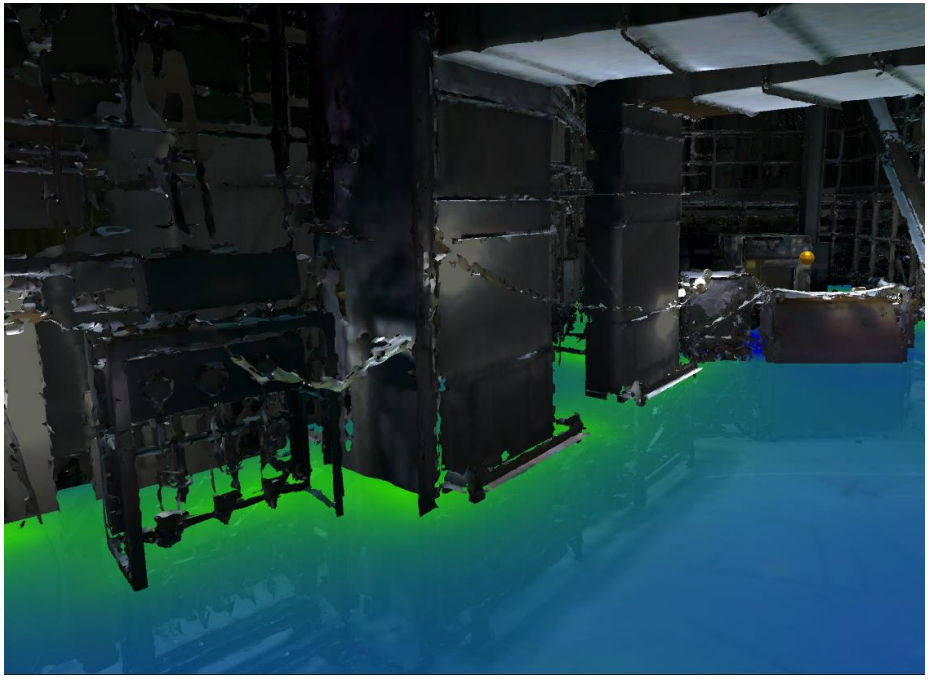
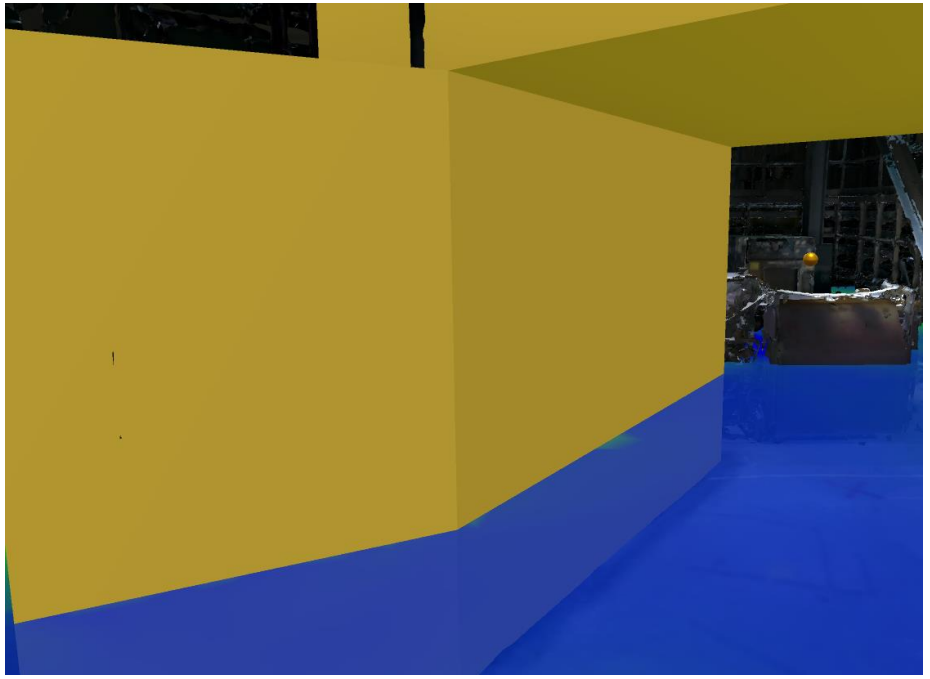
RadVision^{3D}® Mitigation





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RadVision^{3D}® Current Capabilities

- **Work Planning Tools**
  - **Dose uptake estimation**
  - **Long term work simulation**
  - **Precise rescaling of heat maps**
- **Additional views and perspectives (e.g. plan view)**
- **Variable levels of fidelity for 3D models (CAD, BIM, Pointcloud, High-Fidelity Mesh)**
- **Source Overlay**
- **Exportable screen captures**
- **Quality of life improvements**

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RadVision^{3D}® Current Capabilities

- **Further Base Development and Improvements from Original Design**
- **Additional Features Based on Field Experience and Client Feedback**
- **New Viewer Types to Fit Every Customer's Needs**
- **New User Analysis Capabilities**

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Viewer Types

- **Standard High-Fidelity Desktop Viewer**
- **Virtual Reality (VR) Viewer**
- **Web Hosted Viewer**
- **Simplified Desktop Viewer**

- **Simplified Plan View Tablet/Phone App**

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Extended Reality Software

- **Virtual and Augmented Reality (VR and AR) training simulations for generic or project specific scenarios**
- **AR field headset for real time visualization of radiation heatmaps and automatic repeatable surveys**

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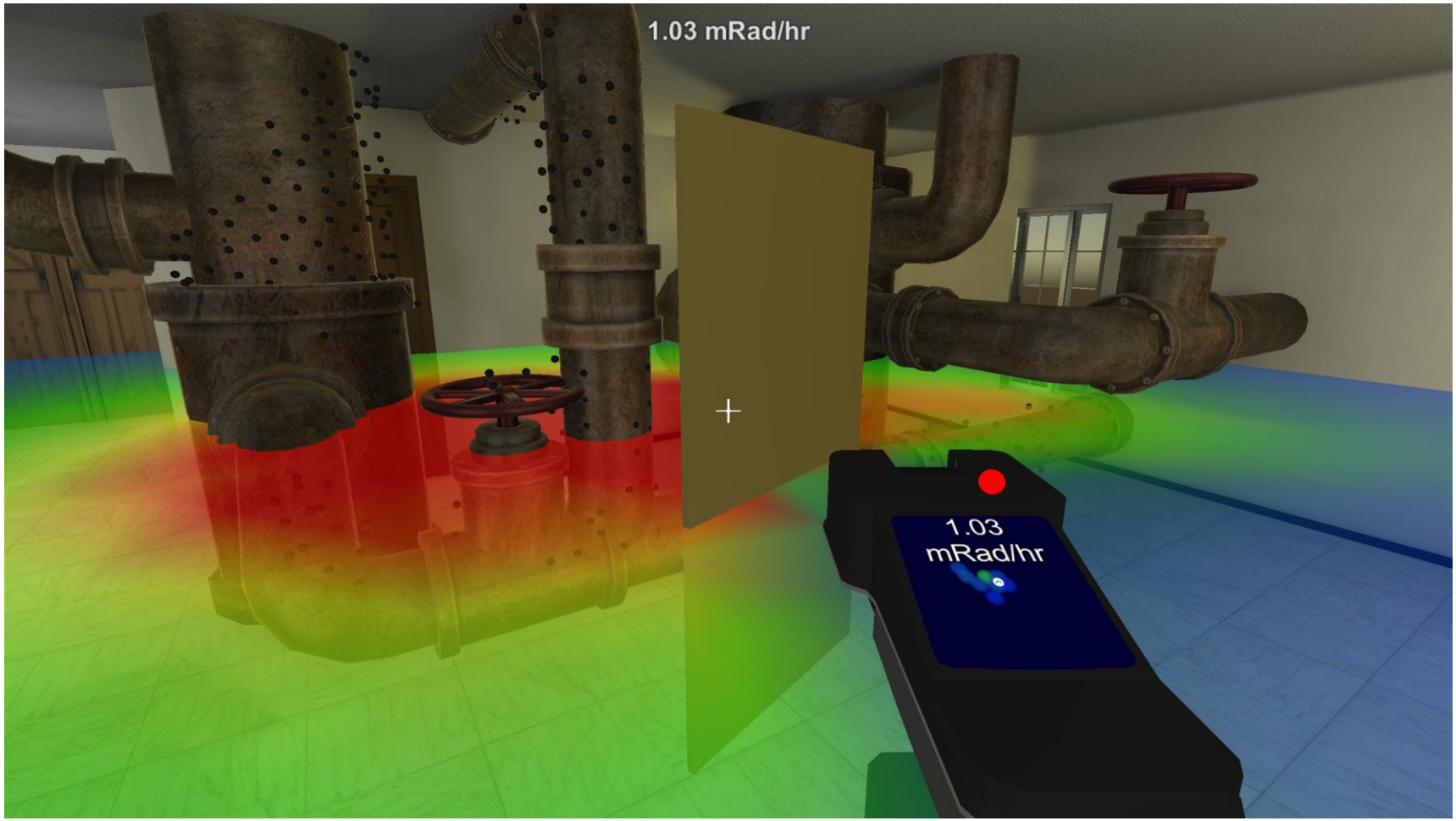
RadVision Shield Analysis Software



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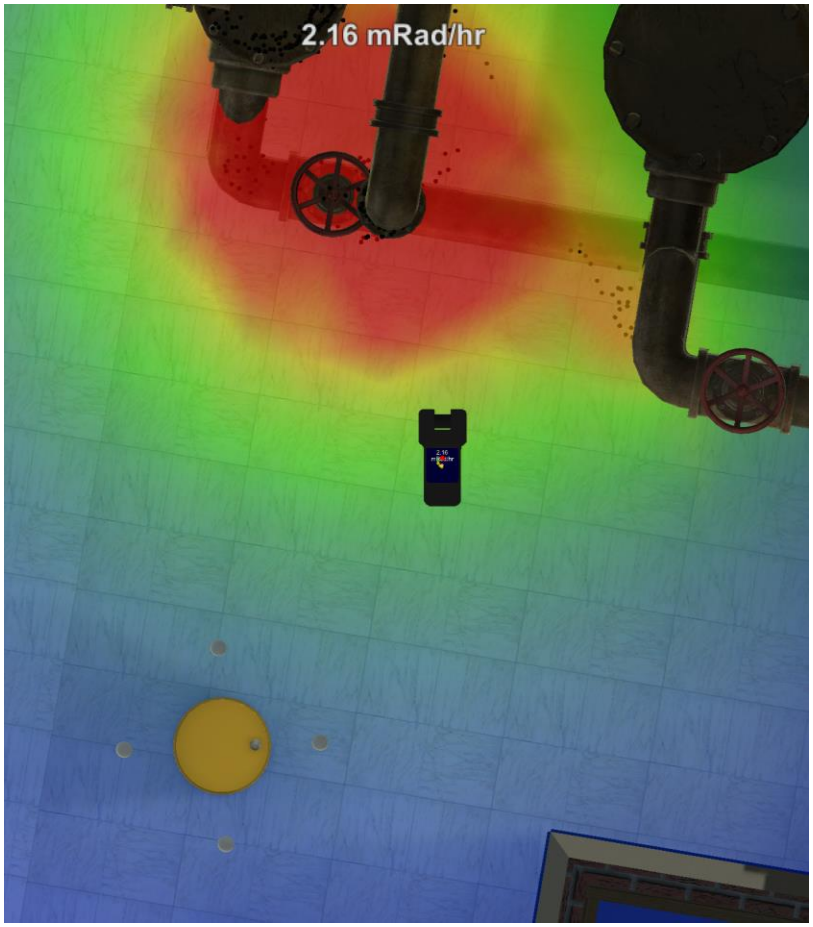
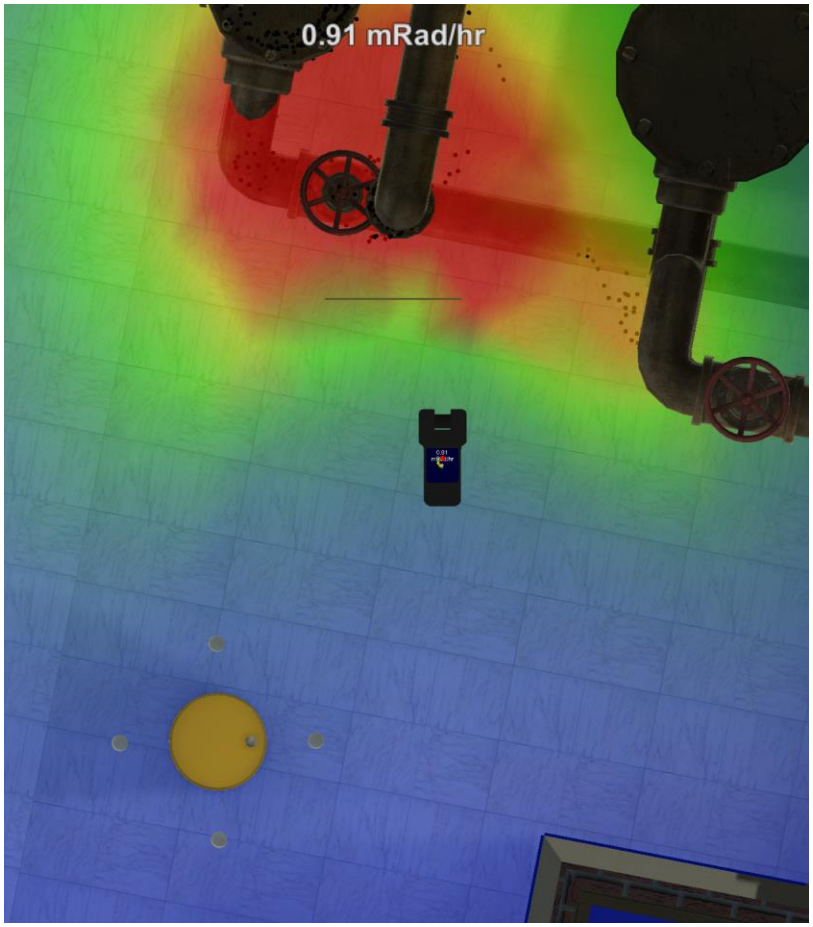
Shield Simulation



Original Conditions



Added Half Inch of Lead

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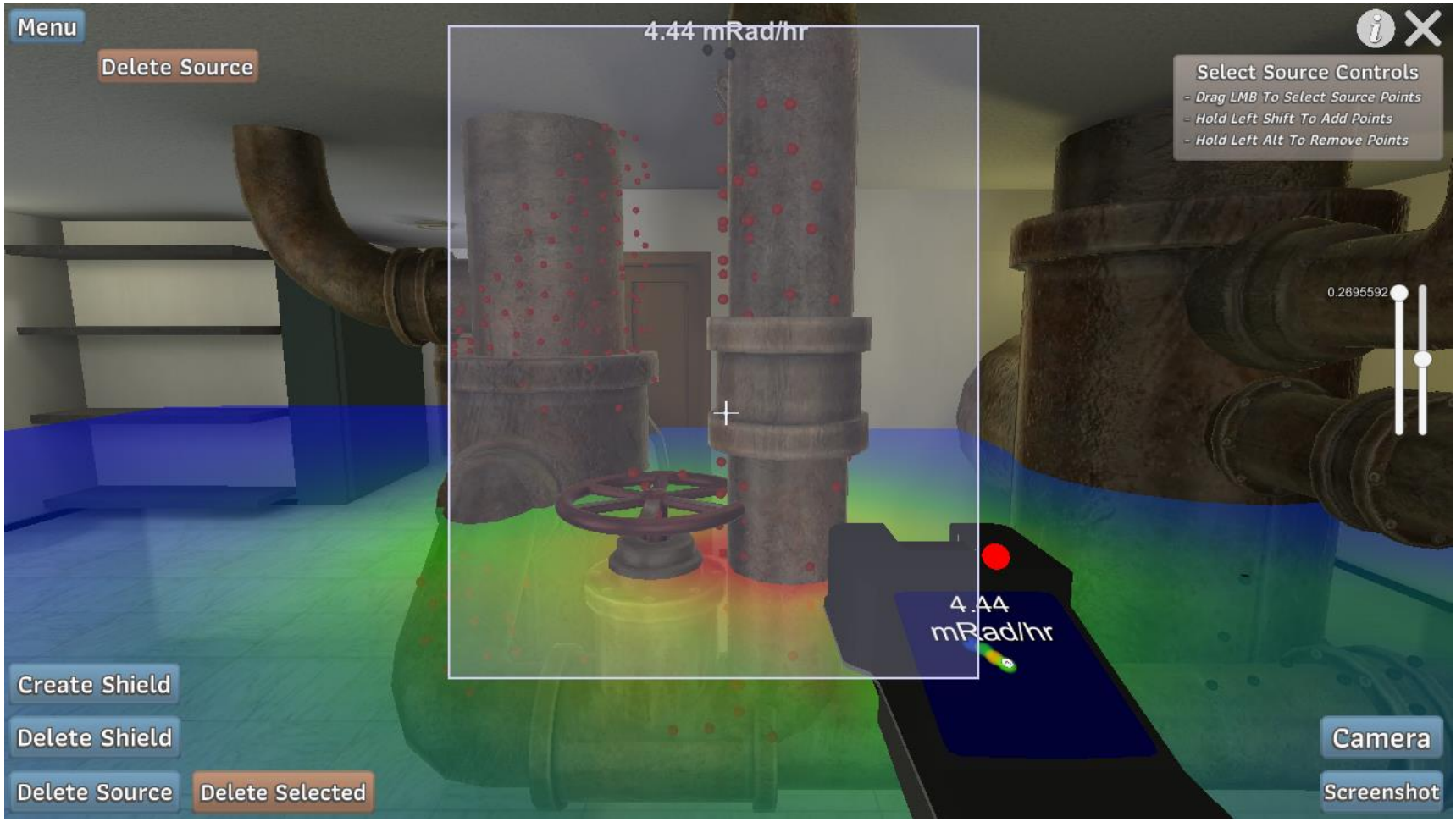
Source Removal Simulation



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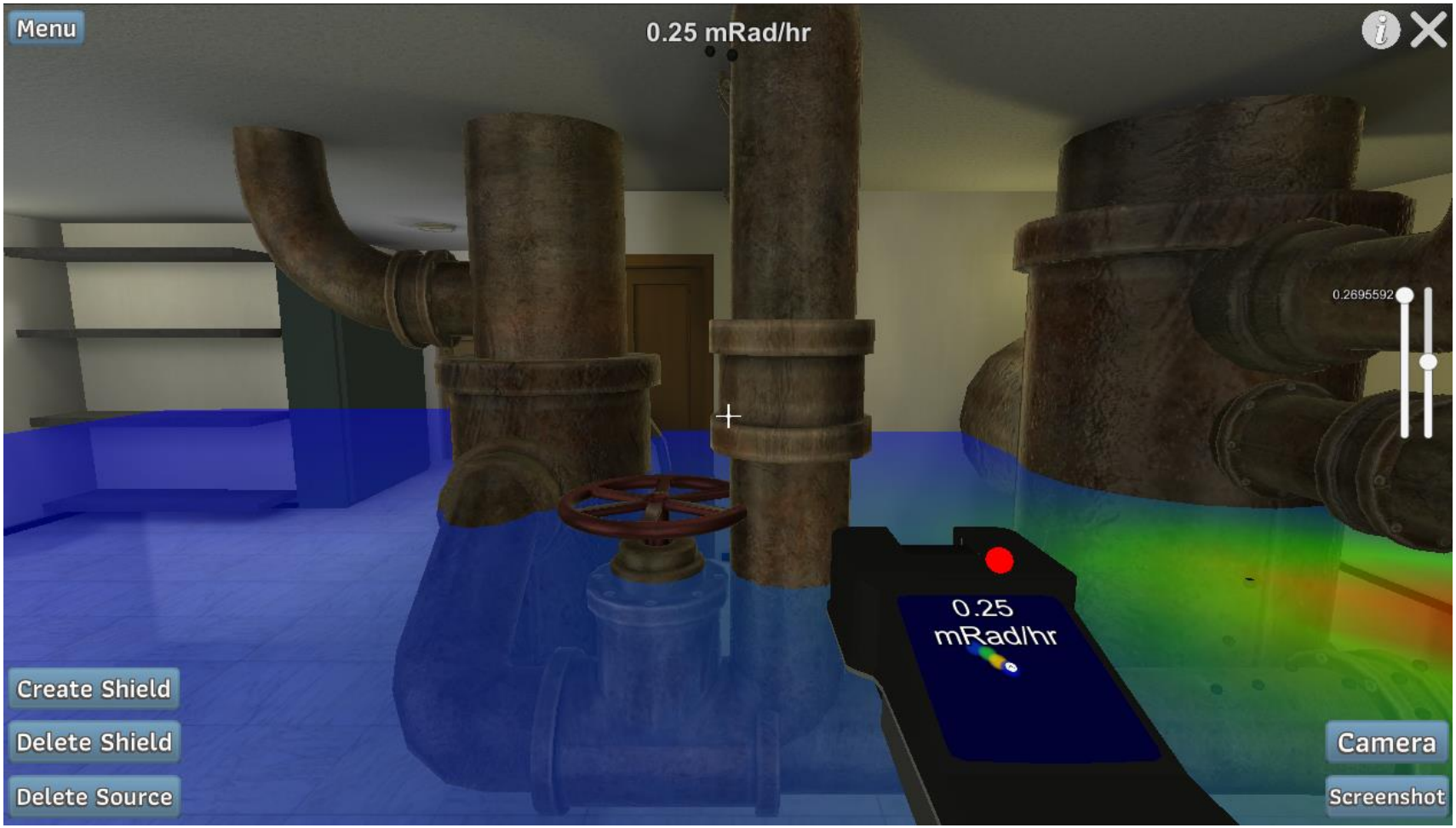
Source Removal Simulation



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RadVision Shield Analysis Software

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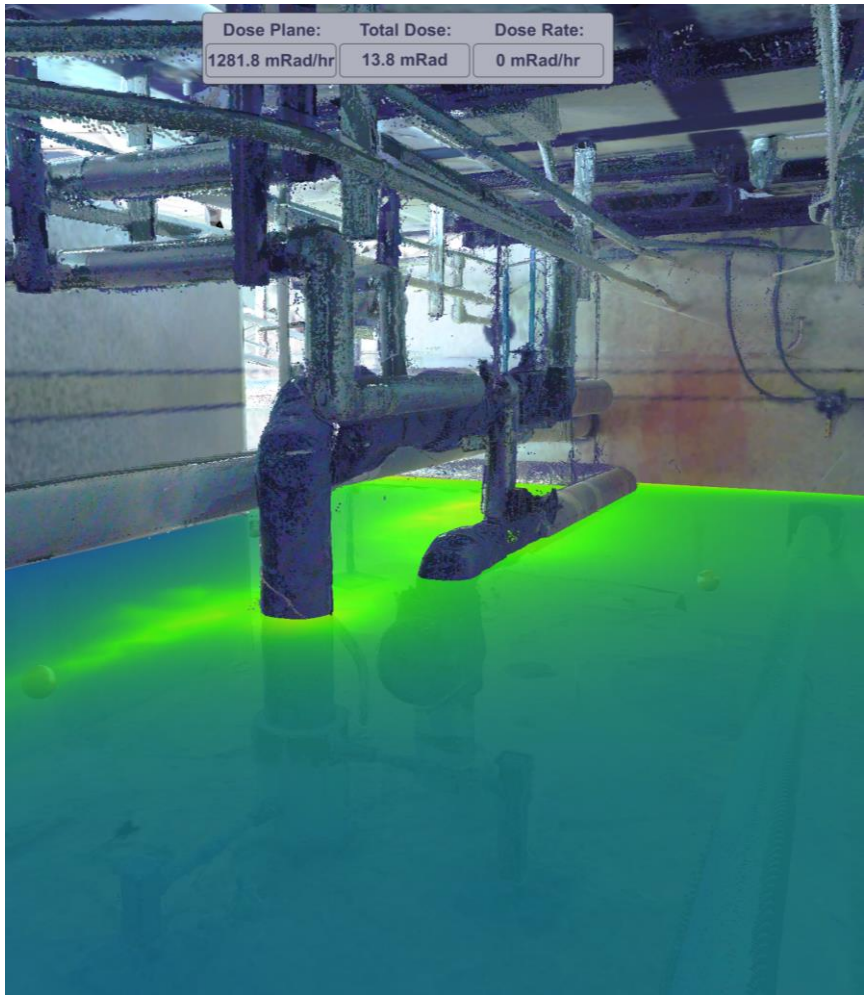
Examples of RadVision^{3D}® Projects

- **Shielding Optimization**
- **Source Localization and Source Removal**
- **Decommissioning Full Facility Scan**
- **Hot Spot Identification**

Shielding Optimization

LaSalle's Reactor Water Cleanup Valve needed to be breached and have internals replaced.

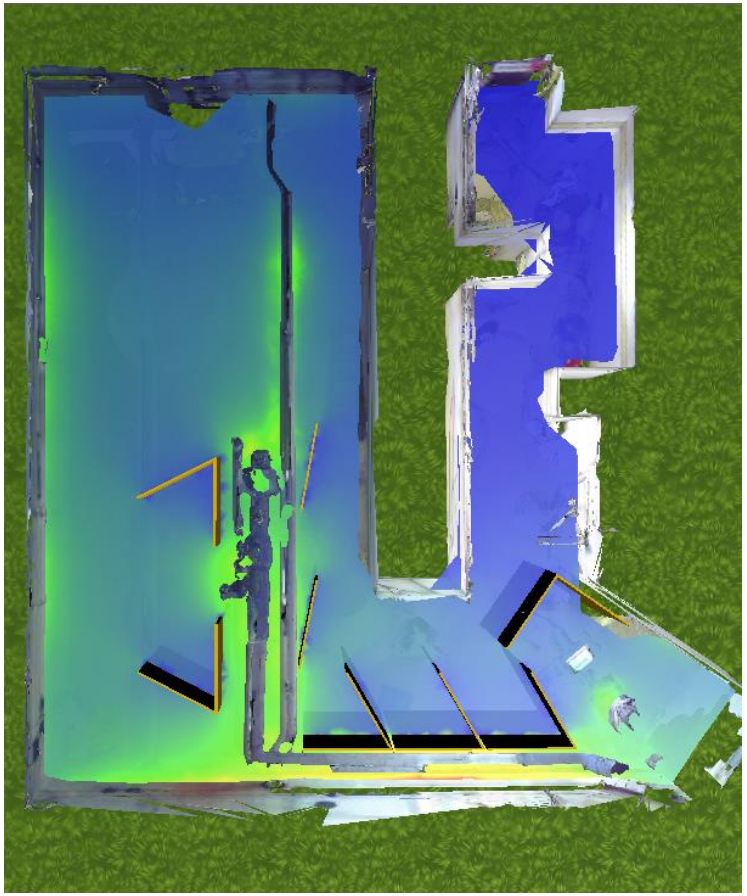
- **LaSalle's goal was to obtain an optimized shielding package which reduced dose rates by 50% while minimizing cost and complexity.**
- **The general area dose rates were 600-1300 mRem/h with hotspots up to 5000 mRem/hr.**
- **It took less than 2 days of scanning and 2 weeks of analysis to produce accurate radiation distribution maps as well as locate multiple hot spots within the area of interest.**



Shielding Optimization

Transco was able to work closely with the customer to design multiple shielding scenarios.

- **Simulated these shielding iterations to determine the most optimal option.**
- **This was found to be 40%-70% more effective than the “traditional” shielding configuration**
- **Dose measurements were found to be within 8% error.**
- **It was determined by the customer that Transco’s analysis saved LaSalle 12 Rem of dose for the project.**



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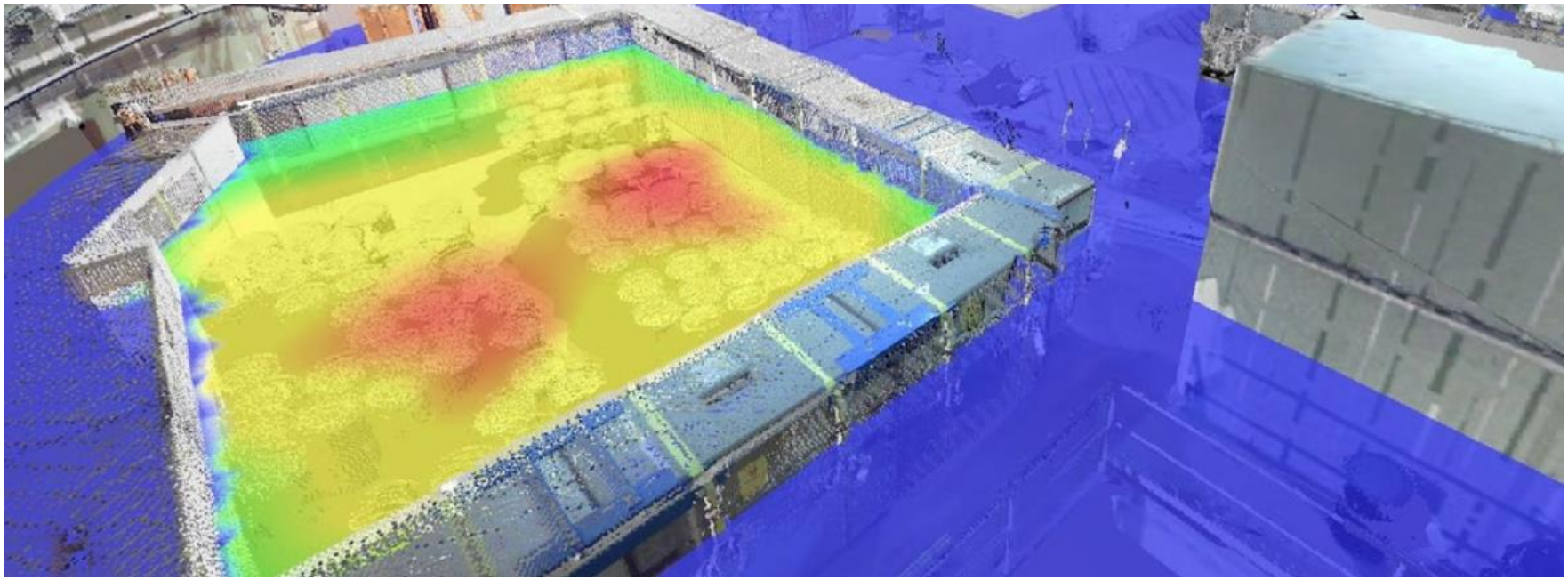
Source Localization and Removal

The customer was storing drums of radioactive waste and the polar crane used to move the barrels was in need of inspection.

- **The National Lab's goal was to better understand the dose rates where workers would be performing inspection activities and to reduce those rates as much as possible.**



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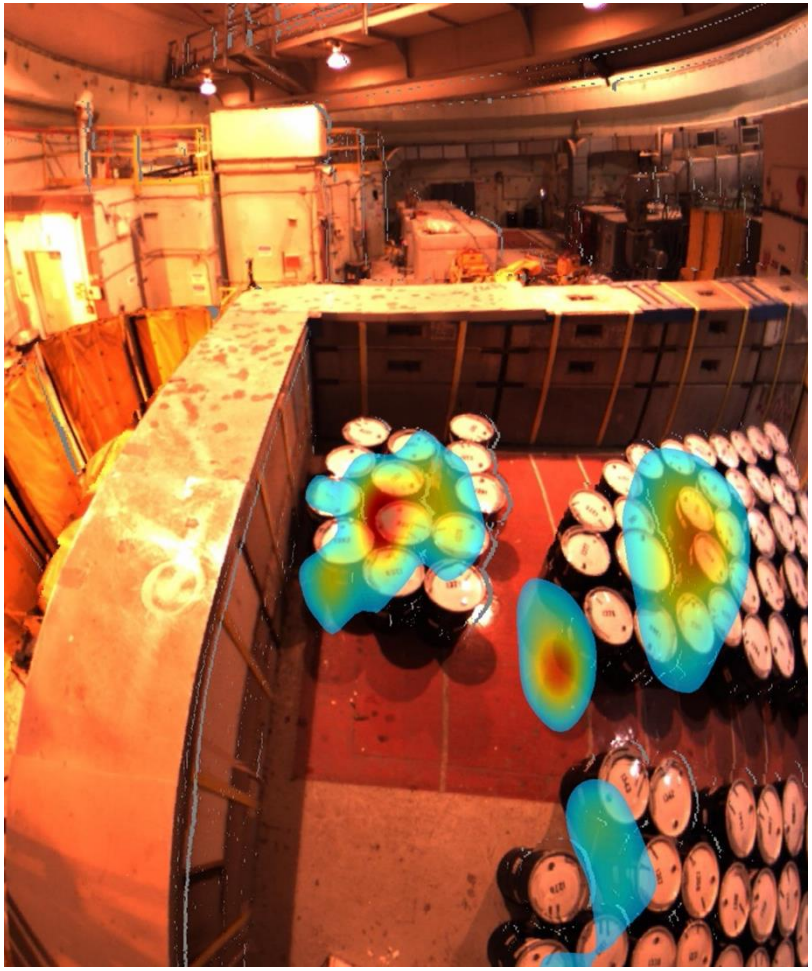
Source Localization and Removal

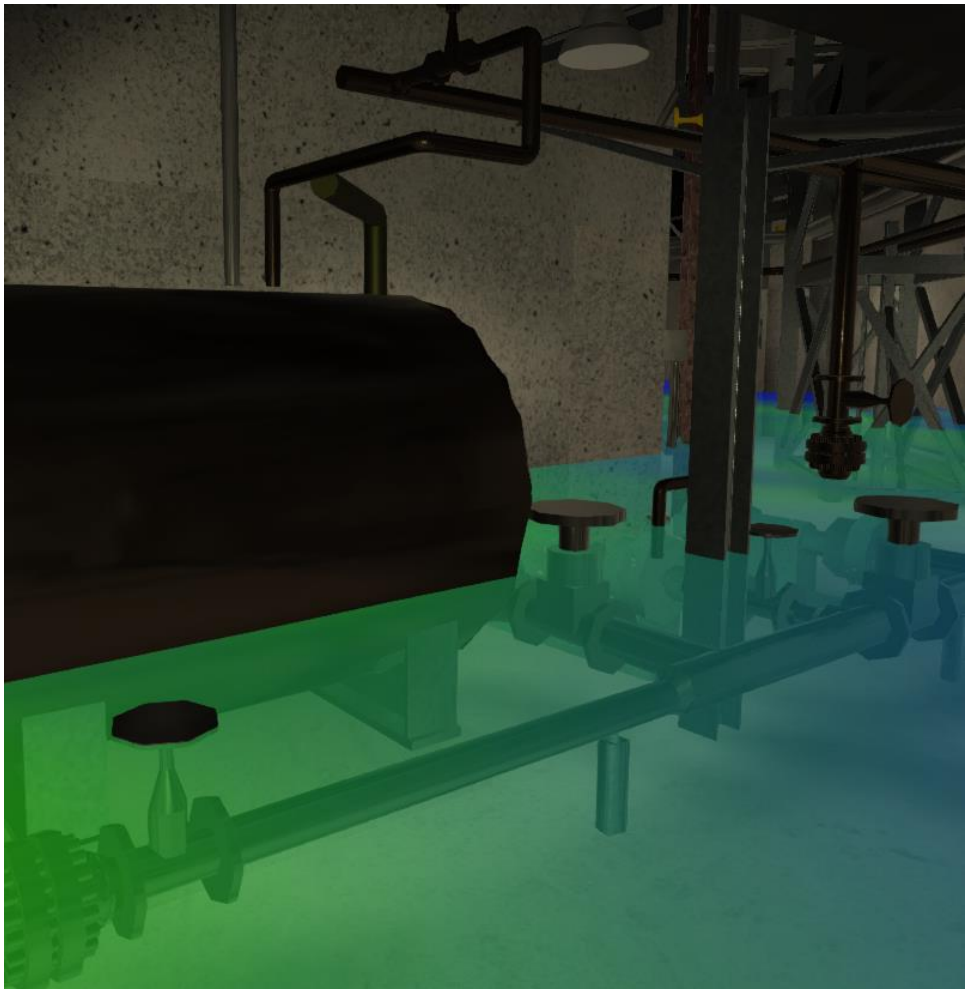
- Only 6 gamma scans needed
- Radiation heat maps were produced at 4ft above the floor, at the crane elevation, and 10ft above the crane.
- 8 drums were identified as the largest sources.
- Simulating their removal showed a reduction in dose rates on the crane by 24%.
- Simulated dose rates were found to be within 6% error.



Decommissioning Facility Scan

Entire Facility Scan

- **The customer's goal was to characterize the entire containment building and test mitigation techniques**
- **Zones of extreme dose rate needed to be remotely scanned using a variety of robotic platforms.**
- **The Lidar scans collected as part of the RadVision process were found to be invaluable for other projects the customer was pursuing.**



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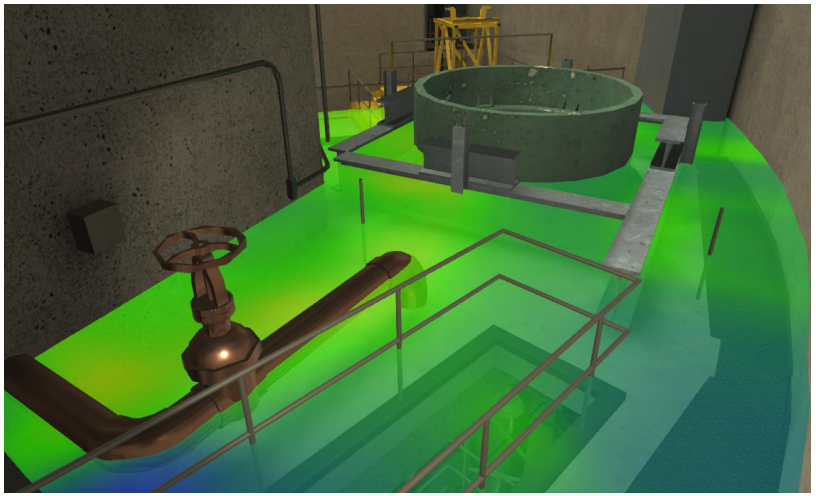
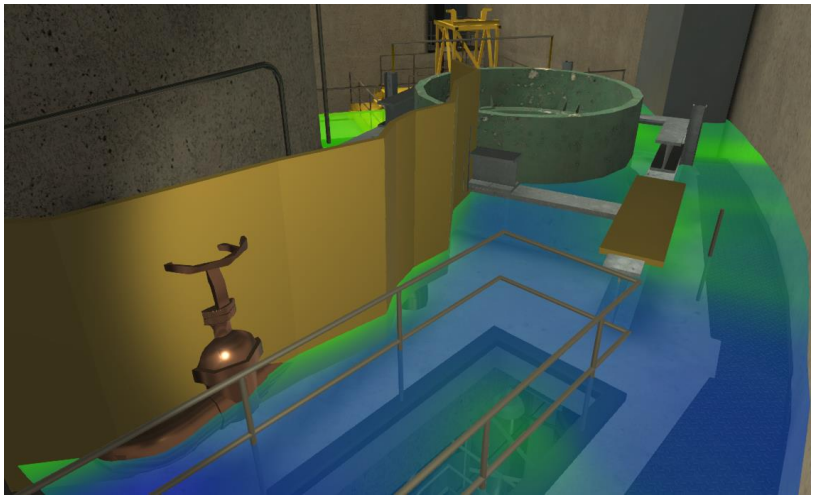
Decommissioning Facility Scan

- Over 30 mitigation strategies were developed and virtually tested
- Unknown Hot Spots were identified and often addressed in real time.
- Full surveys of inaccessible areas were performed remotely using robotic platforms





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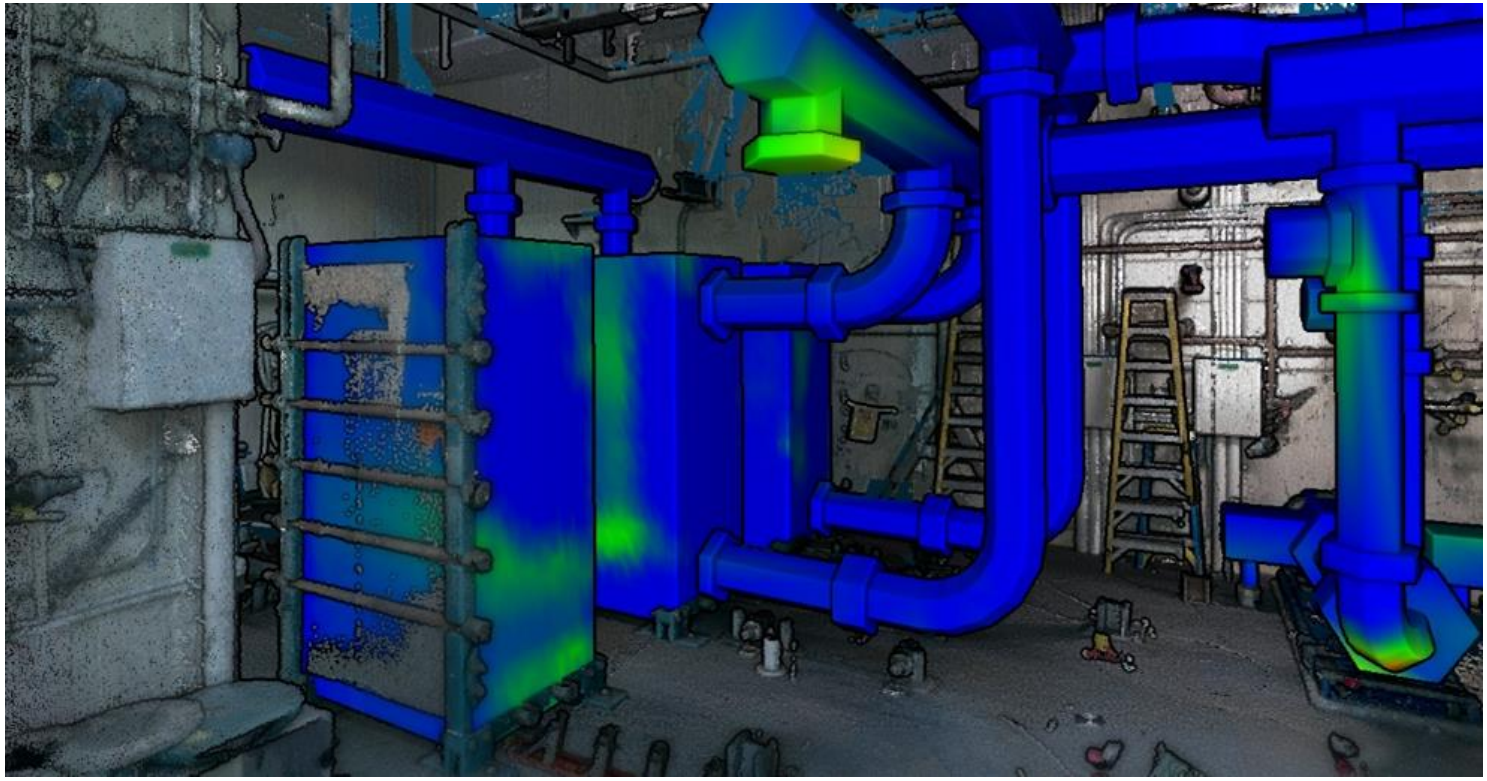
Hot Spot Identification

Customer experienced a reactor event which resulted in highly radioactive material circulating throughout their coolant system.

- **The customer's goal was to localize and identify the radioactive material**



Hot Spot Identification

Transco scanned the entire coolant system within a week.

- **Preliminary results in the form of gamma images throughout the scanning process to aid in cleanup preparation.**
- **After the full analysis, 18 major hot spots were identified as well as a multitude of distributed sources.**
- **Energy spectra collected were also utilized to identify the larger source producing isotopes contaminating the system.**

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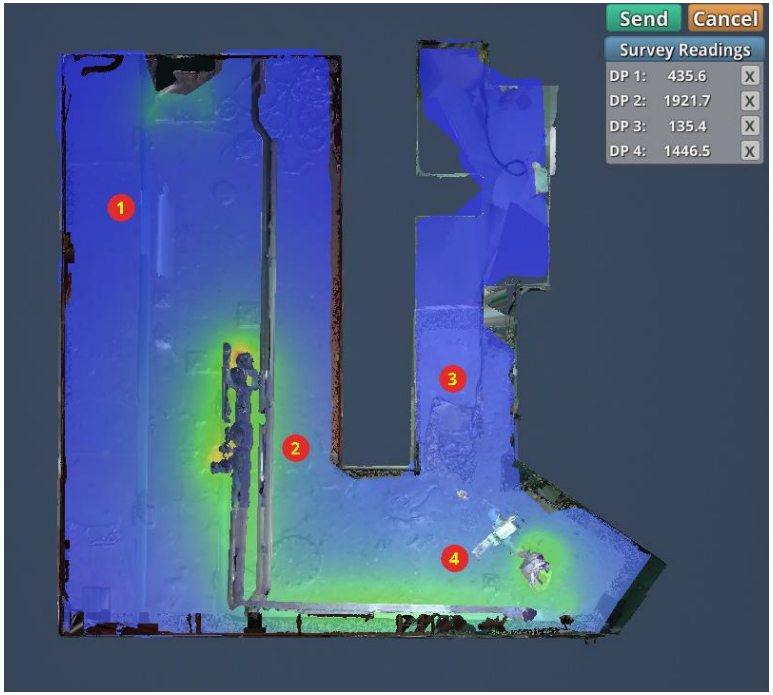
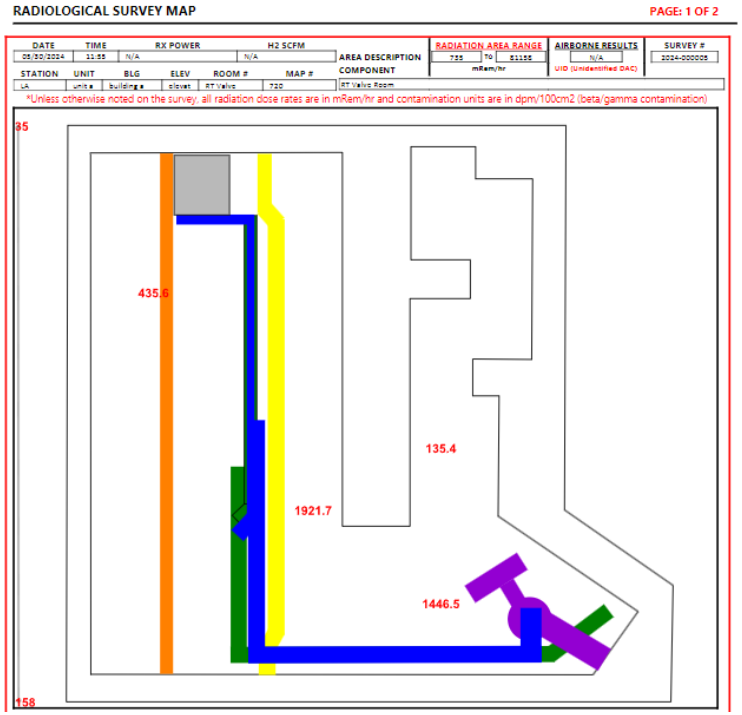
Survey Map Integration

- **Integration with Electronic Radiological Survey Softwares (ERSS) such as RadSurv**
- **Access RadVision via ERSS server**

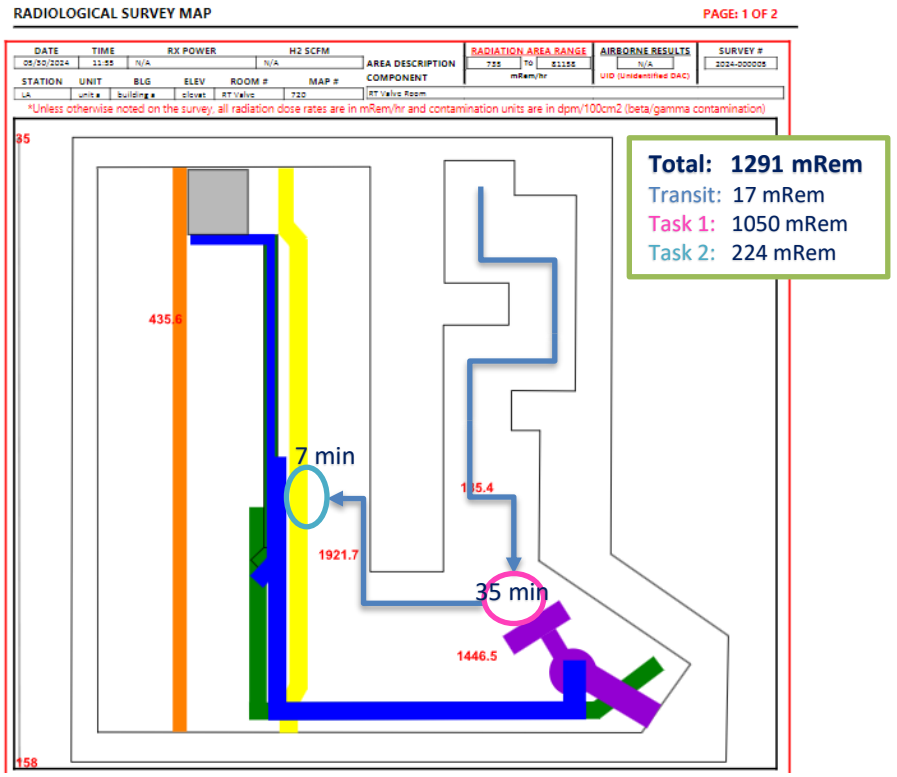


- **Update surveys using RadVision**
- **Automatic survey collection and creation**



Work Planning Software

- **Compatible with RadVision scans or traditional survey maps**
- **Point and Click Controls**
- **Quickly calculate estimated dose exposure for projects**
- **Optimize walking paths and body placements**
- **Better visualization of radiological conditions**



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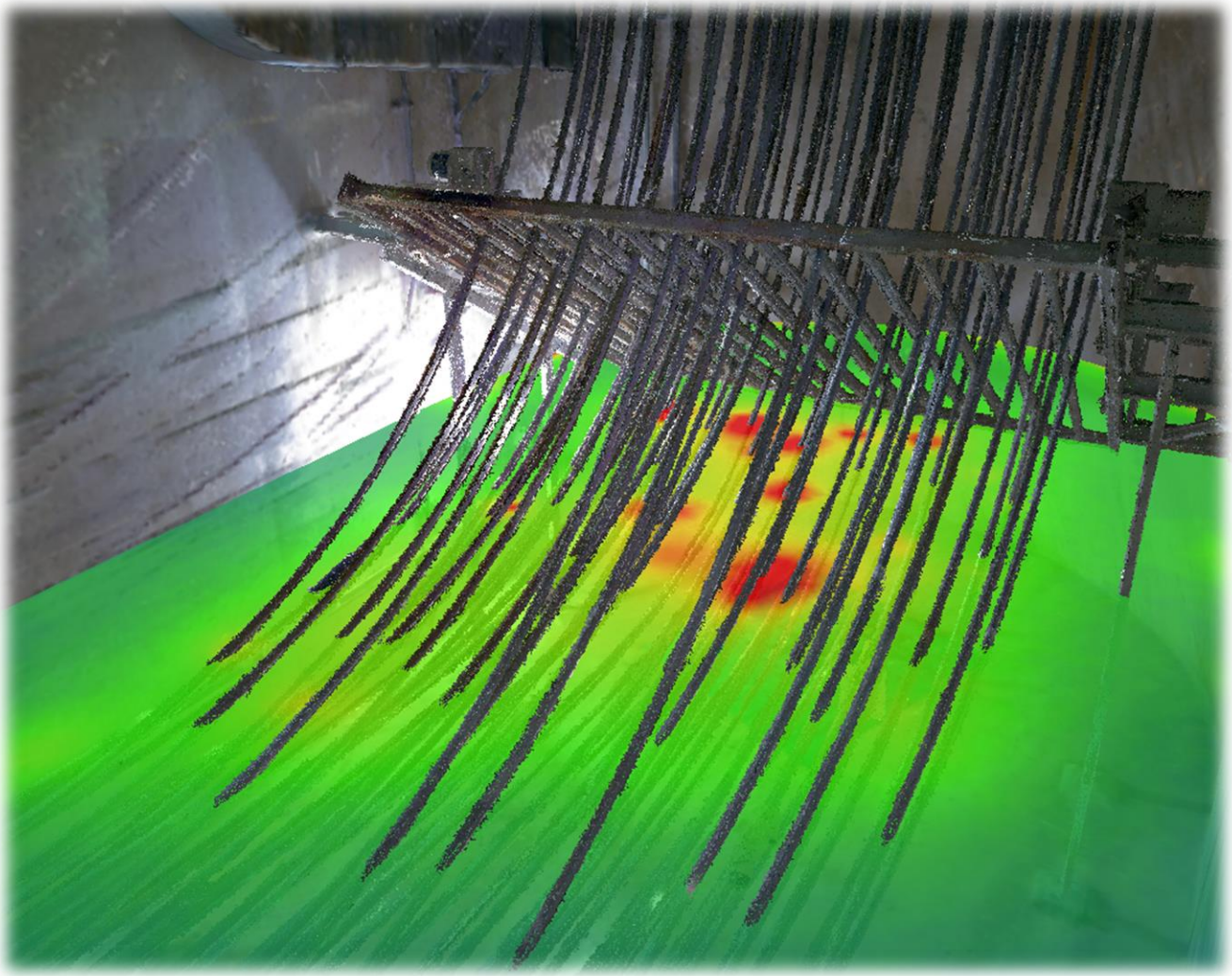
Q & A



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Thank You!

For Any Additional Questions Please reach out to:

Christian Zircher
czircher@transcoproducts.com
(312) 324-6690

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RadVision Roadmap

- **SLAM enabled Compton Camera Based Surveys**
- **Robotic Surveys**
- **Robotic Training and Support**
- **XR Training Software**
- **AR Survey System**
- **Survey Map Software Integration (e.g. RadSurv)**
- **Facility Lidar Scans and Survey Map Schematic Updates**
- **Digital Twin Rad Monitoring System**
- **Suite of Work Planning Software**