INL/MIS-23-72159-Revision-0

3D Virtual Simulation for Radiation Safety and Hazards Identification Training

May 2023

Xingyue Yang

Changing the World's Energy Future

Idaho National Laboratory

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Idaho Falls, Idaho 83415

http://www.inl.gov

Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517, DE-AC07-05ID14517

May 4, 2023

Xingyue Yang

Visualization Researcher

Applied Visualization Laboratory (AVL)

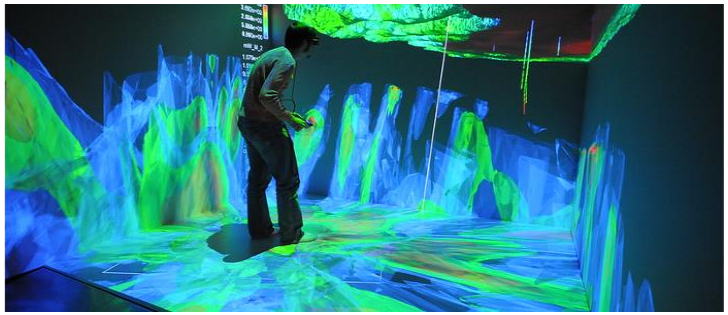
3D Virtual Simulation for Radiation Safety and Hazards Identification Training

CAES Center for Advanced Energy Studies

INL Idaho National Laboratory

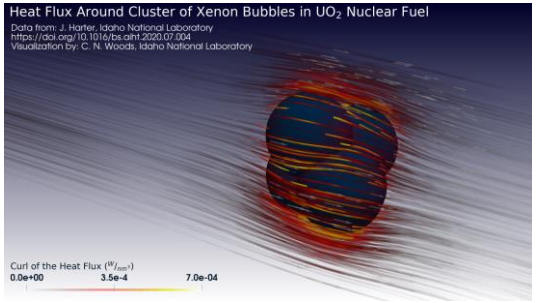
Applied Visualization Laboratory (AVL)

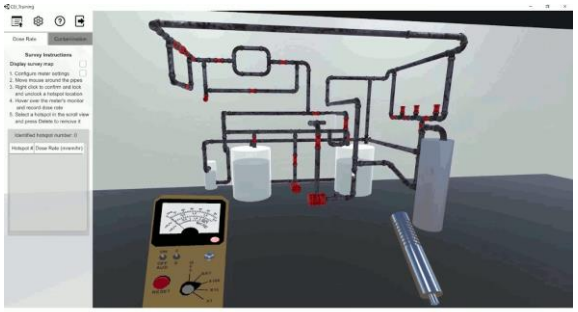
- Center for Advanced Energy Studies (CAES), Idaho Falls, ID
- Contains state-of-the-art visualization technologies and 3D environments

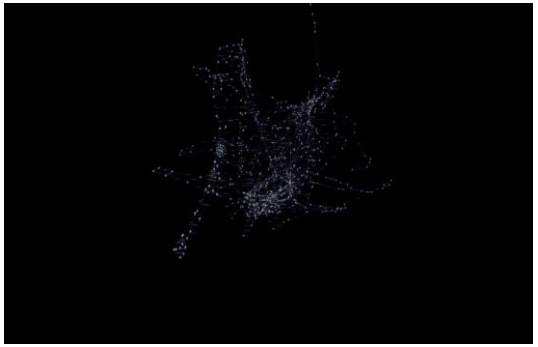


Applied Visualization Laboratory (AVL)

- Scientific visualization
- Immersive analytics
- Digital twin
- Remote collaboration
- Virtual training
- Graph visualization
- WebXR
- LiDAR







Virtual Training

- Simulated digital environment
- Real-life scenarios
- Interactive and engaging
- Flexibility

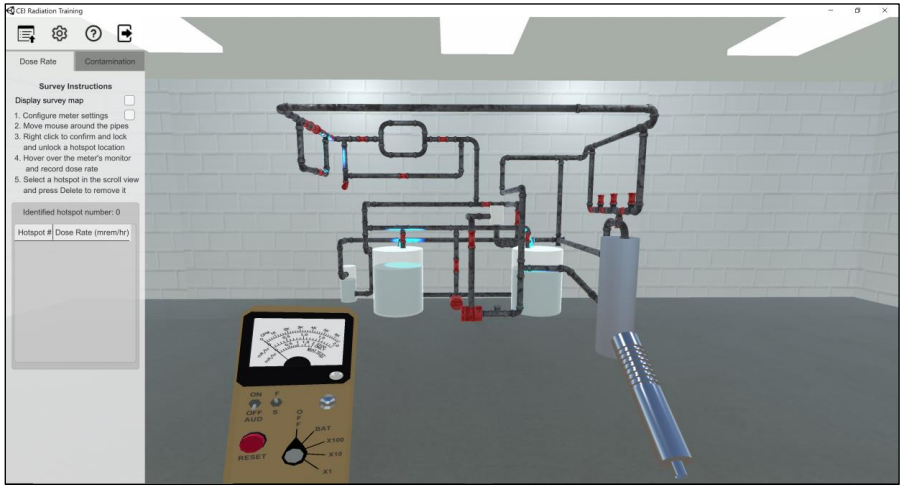
Virtual Training

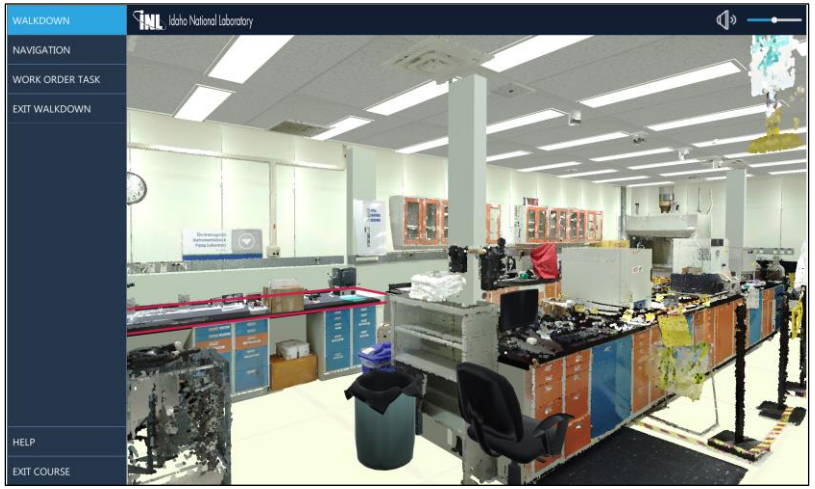
- First responder training
- Medical training
- Radiation training
- Military training
- Workforce training
- Interpersonal skills training

(Xie et al., 2021)

Virtual Training

- Training 1: Radiation safety and survey
- Training 2: Hazards identification



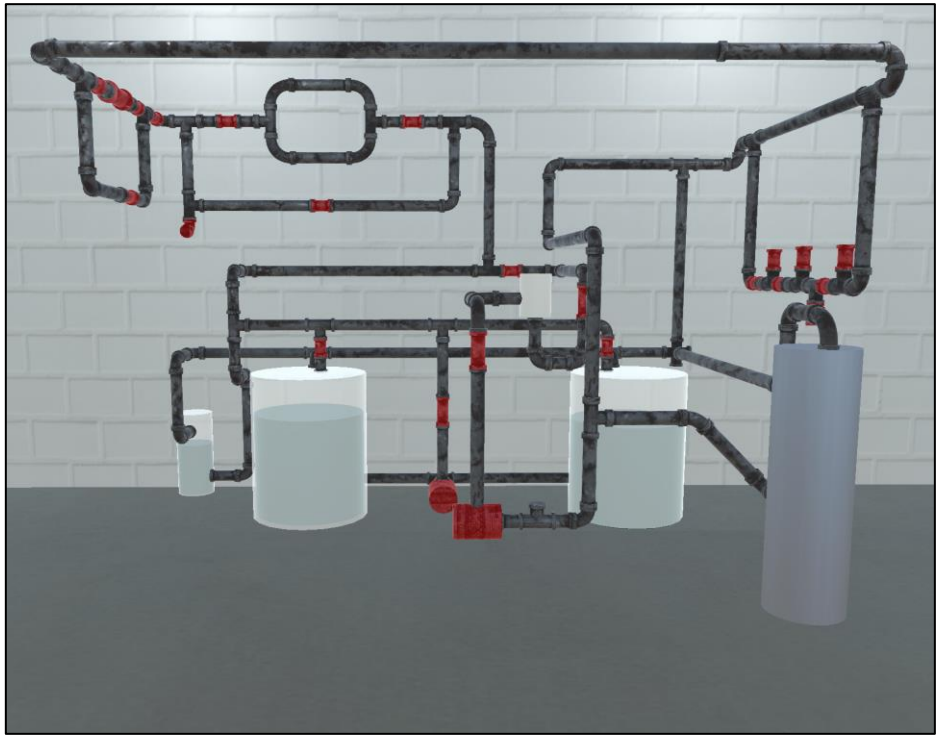


Virtual Training - Radiation Safety and Survey

- Collaboration between AVL and College of Eastern Idaho (CEI)
- Virtual training for conducting radiation and contamination surveys

Virtual Training - Radiation Safety and Survey

- Collaboration between AVL and College of Eastern Idaho (CEI)
- Virtual training for conducting radiation and contamination surveys
  - Pipe scenario



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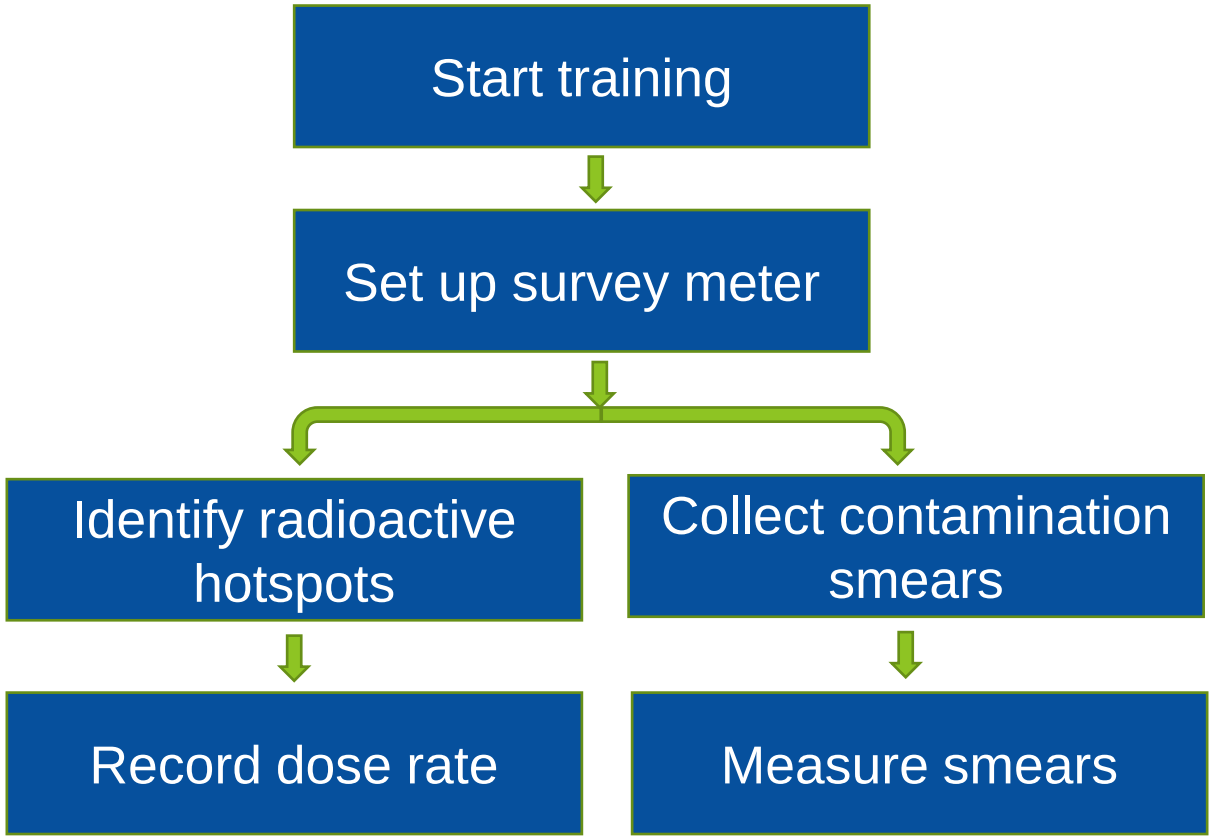

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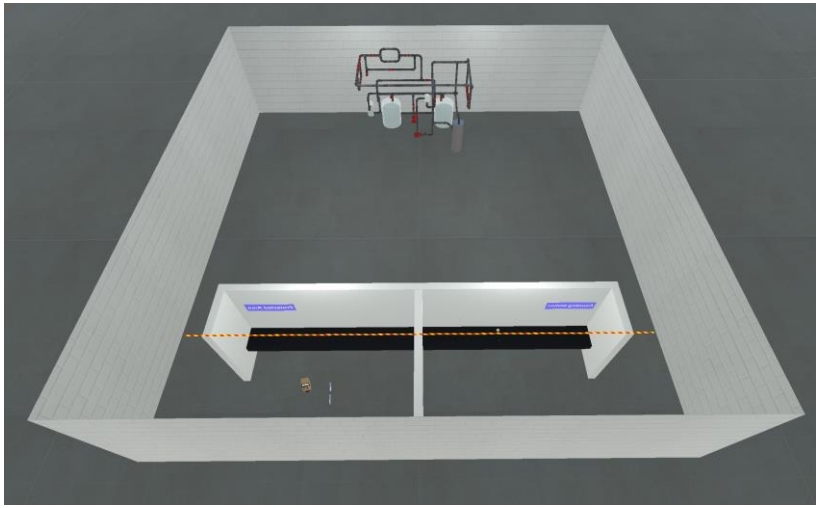
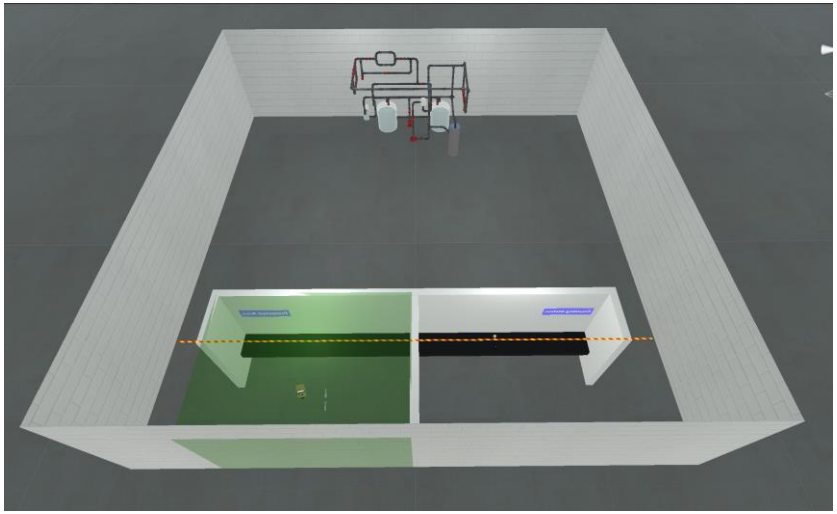
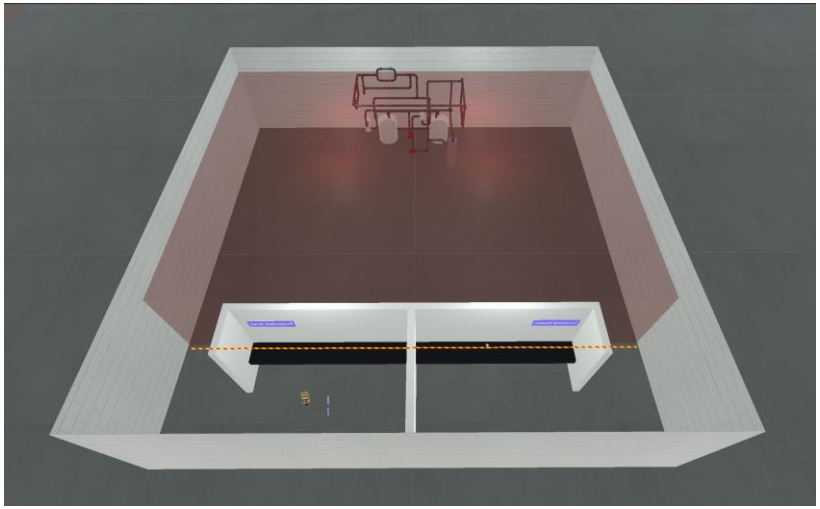
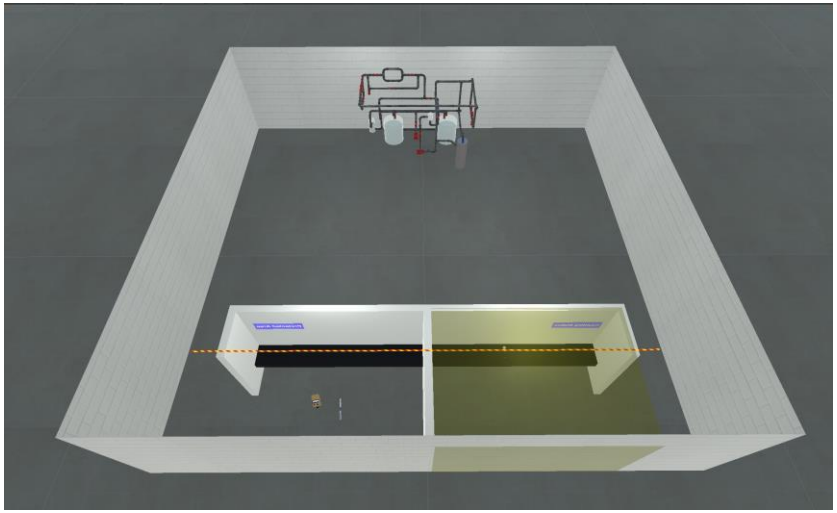


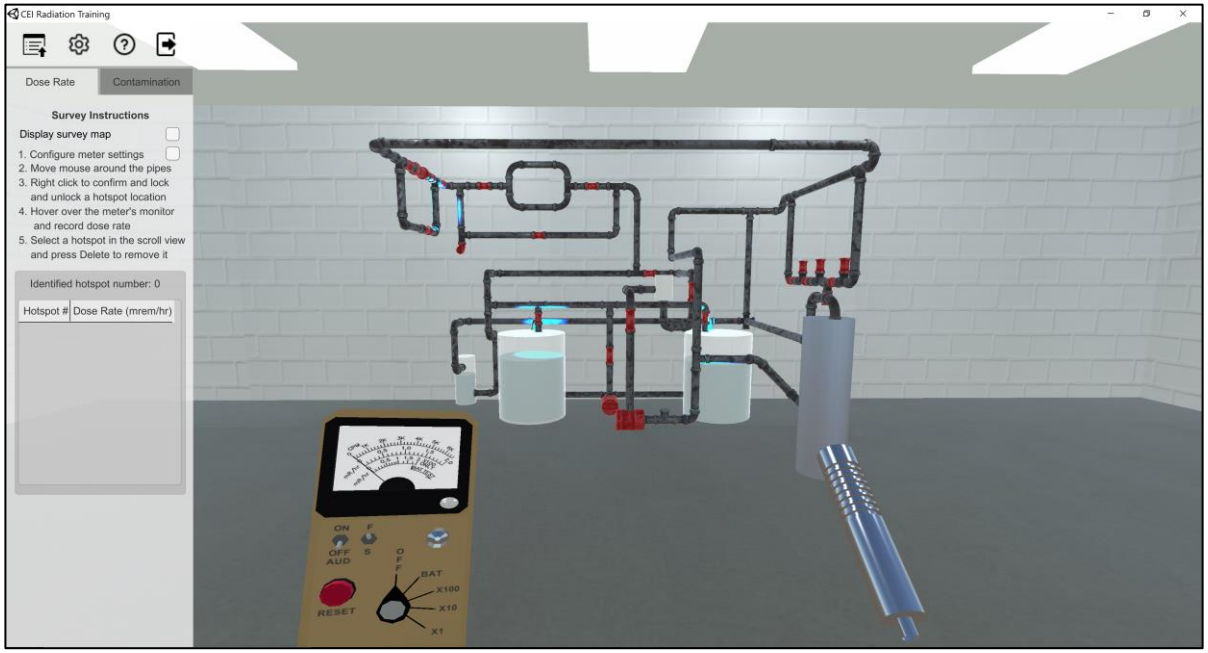






Virtual Training - Radiation Safety and Survey

- Random scenarios
- Guided instructions
- User Interactions
- Sound and visual feedback
- Survey data storage



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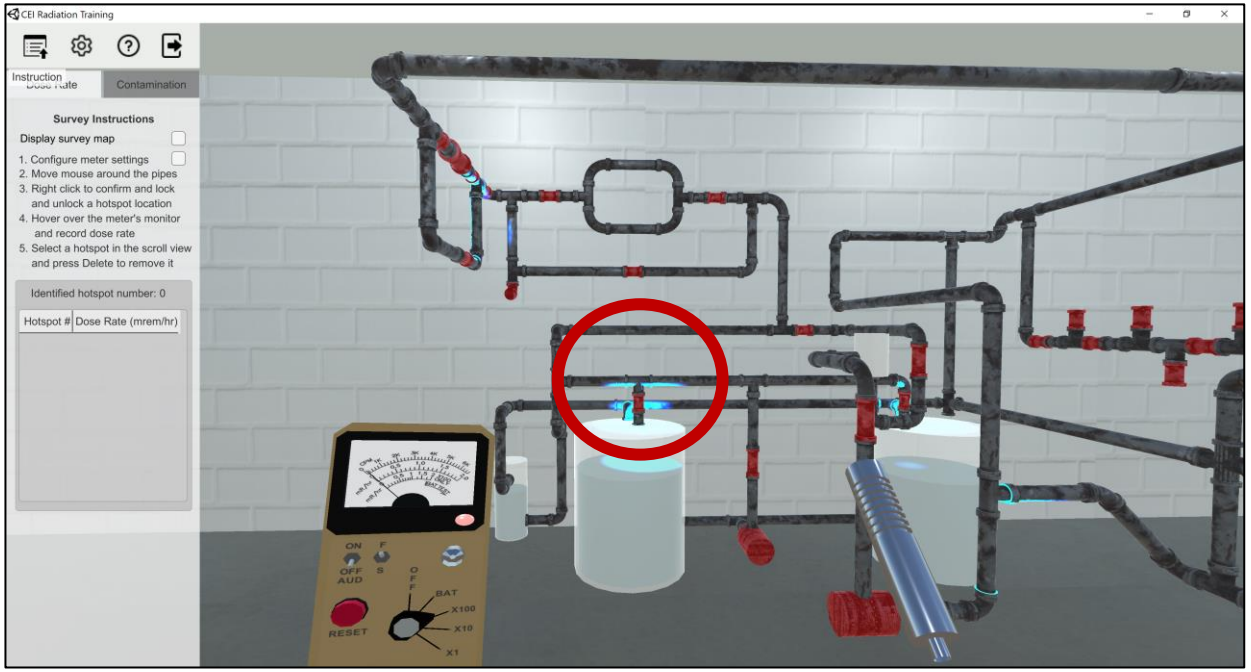

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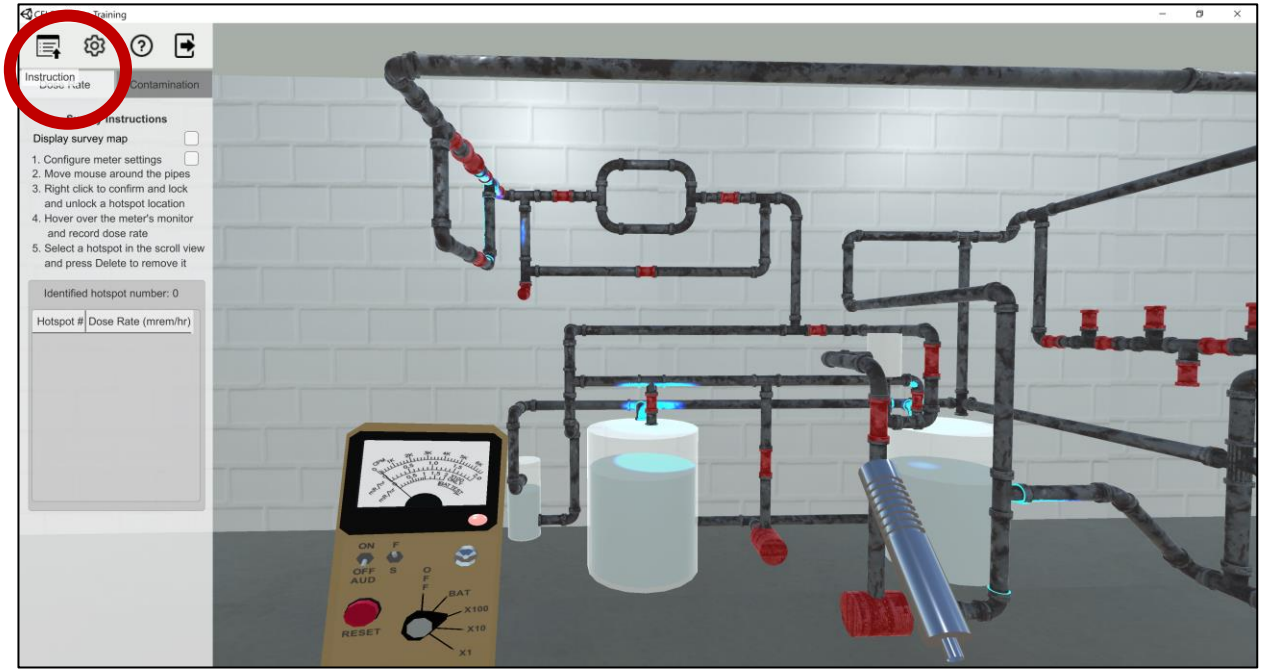

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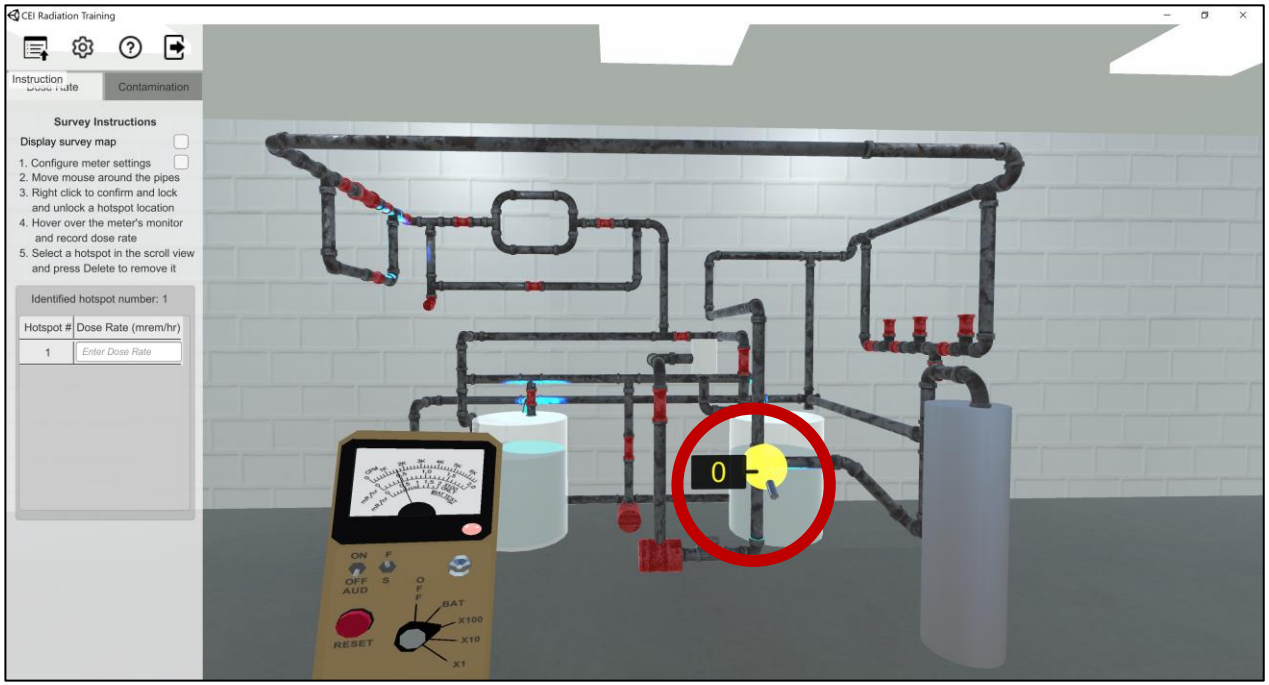

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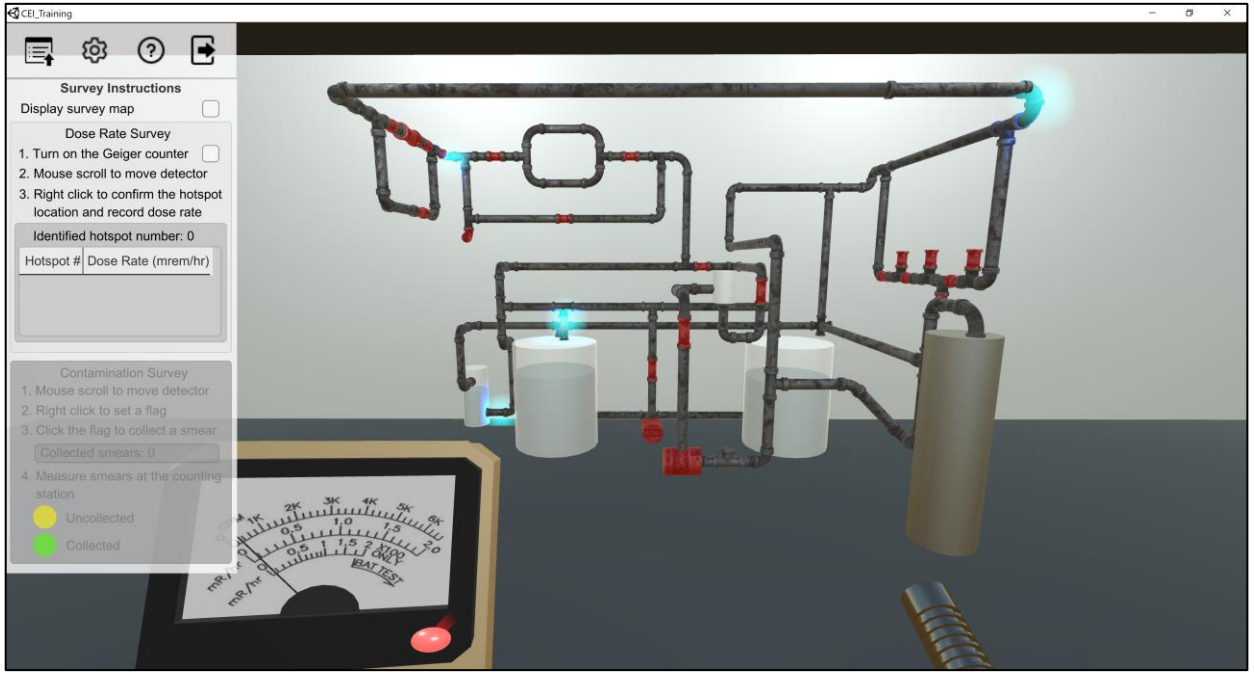

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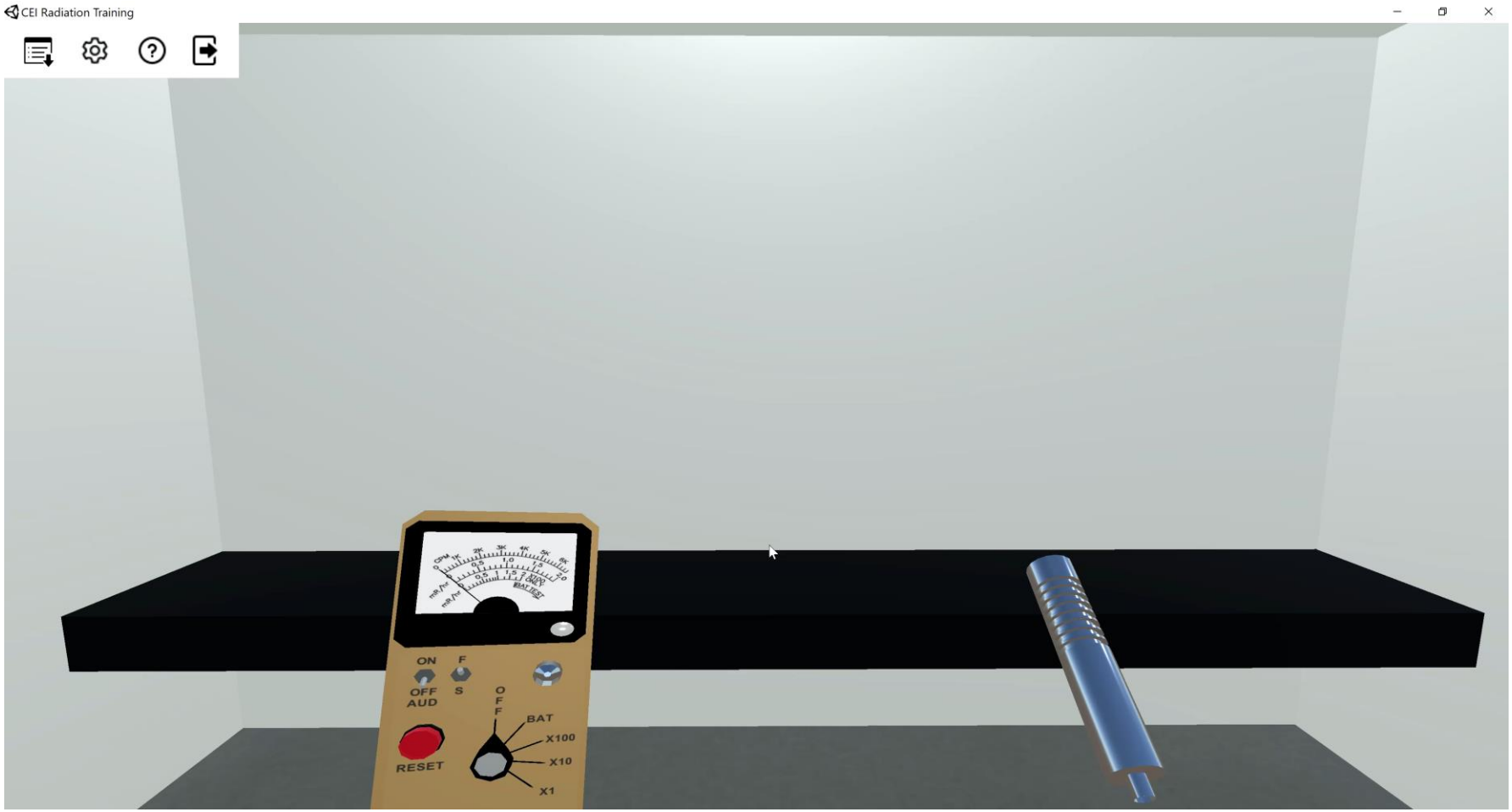
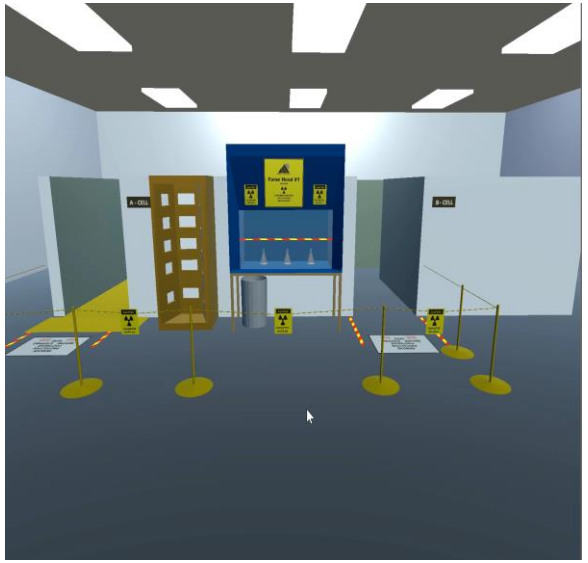


Virtual Training - Radiation Safety and Survey

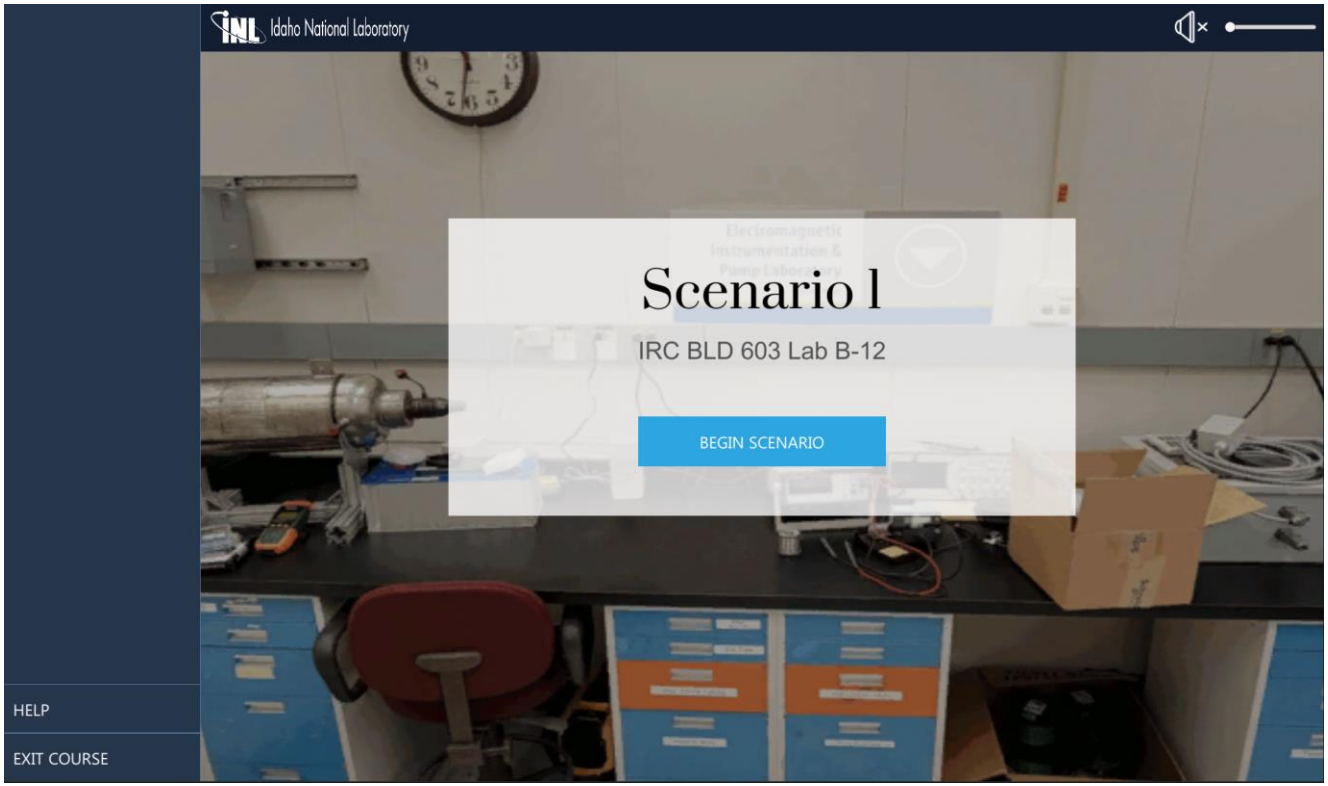
Current and Future Work

- Save training progress
- Tutor/student mode
- Evaluation and feedback
- More scenarios
- VR simulation
- Industrial training



Virtual Training – Hazards Identification

- Safety training for personnel working at IRC, MFC, and ATR facilities
- Virtual training for learning and identifying workplace hazards



Virtual Training – Hazards Identification

Choose character

↓

Schedule walkdown

↓

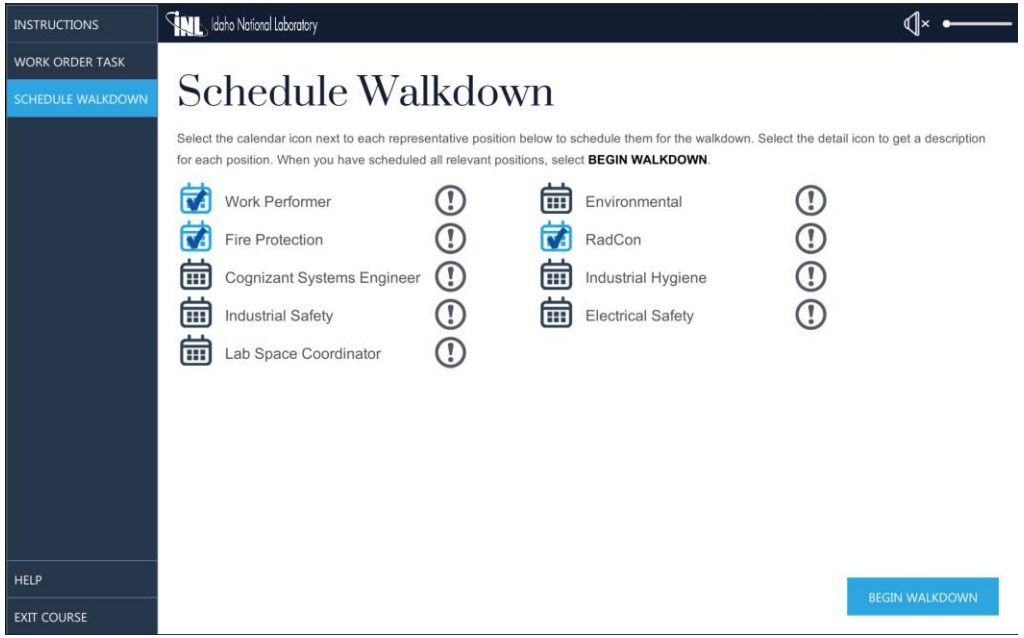
Click hazard hotspots for more information

↓

Training results

↓

Receive credits



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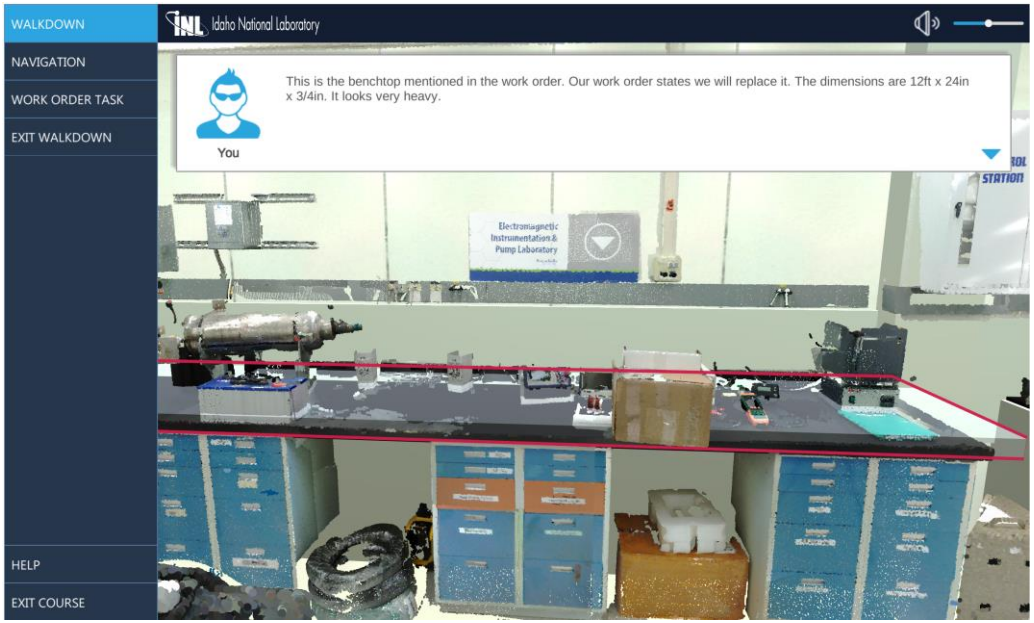

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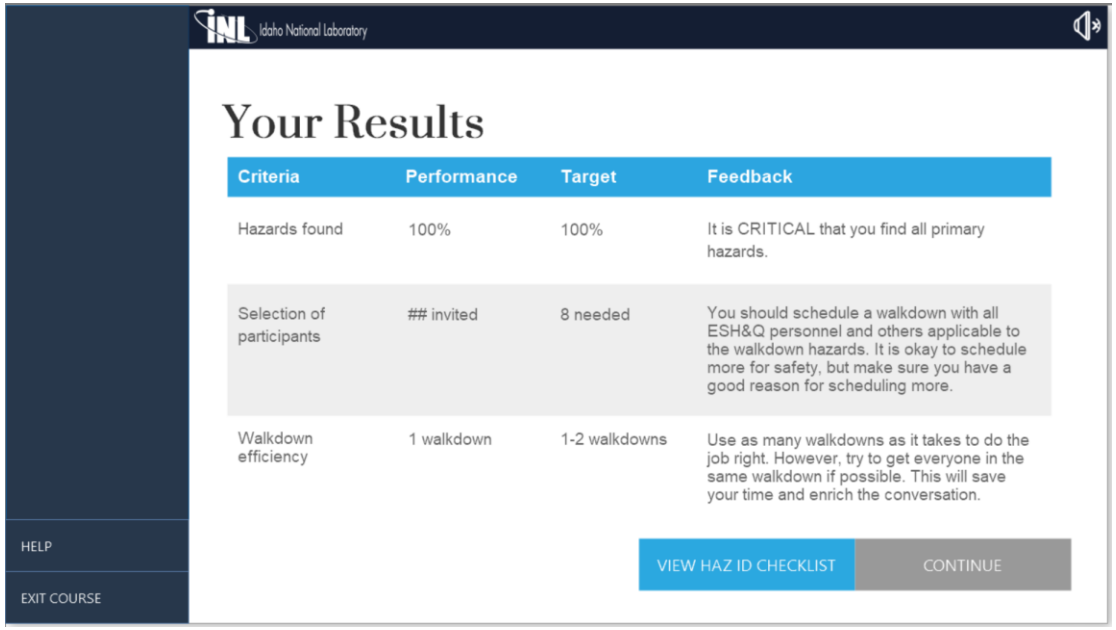

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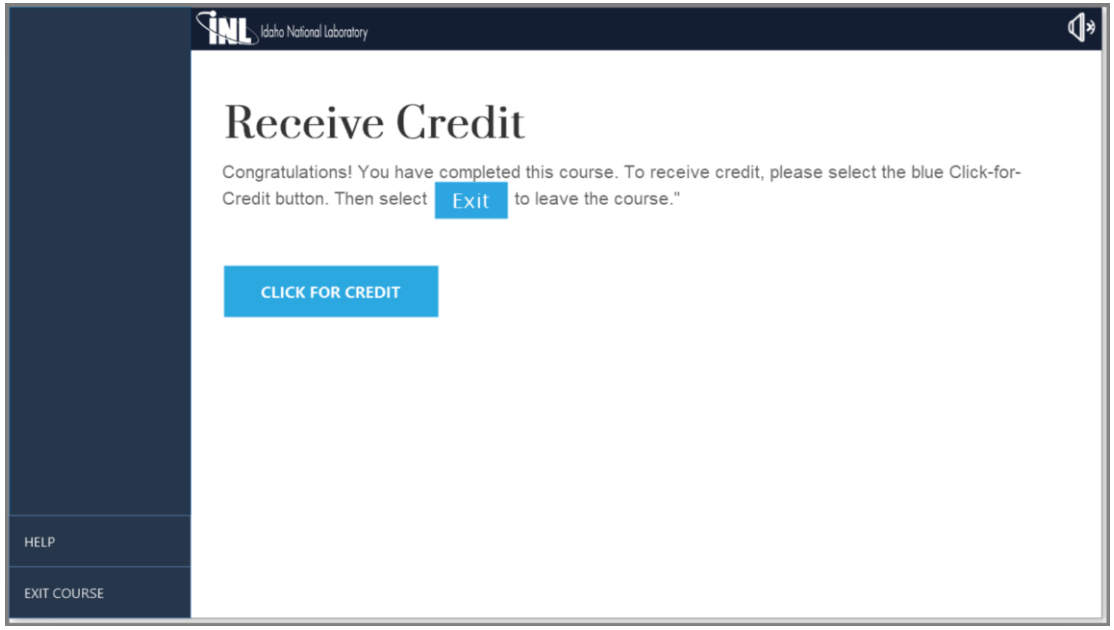
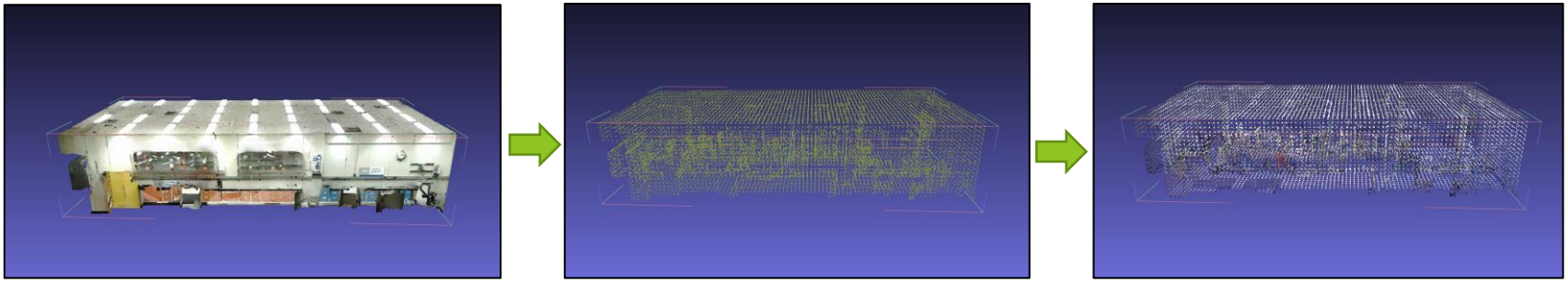


Virtual Training – Hazards Identification

Challenges: LiDAR scan processing and application performance

- Data capture: Faro scanner
  - Point cloud data
  - Vertex render
- Data processing
  - MeshLab
    - Point cloud simplification
    - Cluster vertex sampling

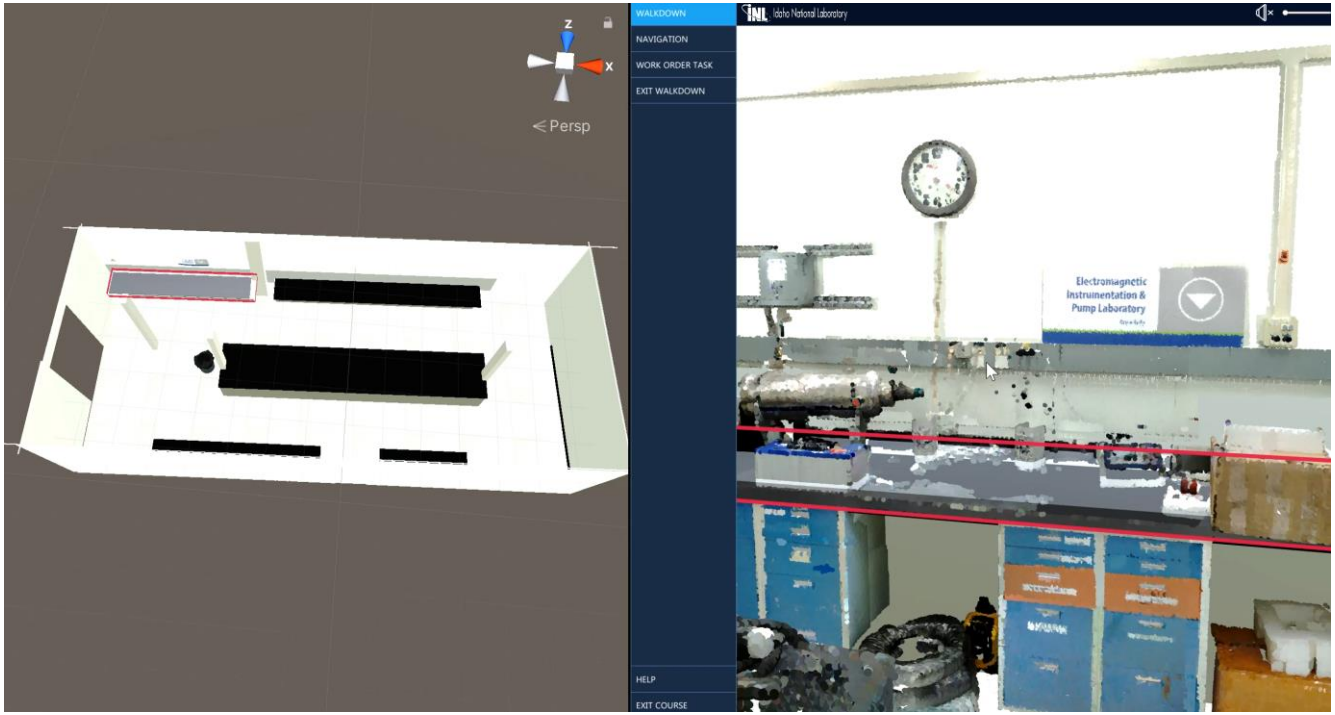


Virtual Training – Hazards Identification

- Improve Application performance
  - Reduce the build size
    - Remove replaced sections: walls, ceiling, floor, etc.
    - Compress point cloud in Unity
    - Compress the build project in Player settings

Virtual Training – Hazards Identification

- Improve Application performance
  - Camera visibility
  - Level of details (LOD) group



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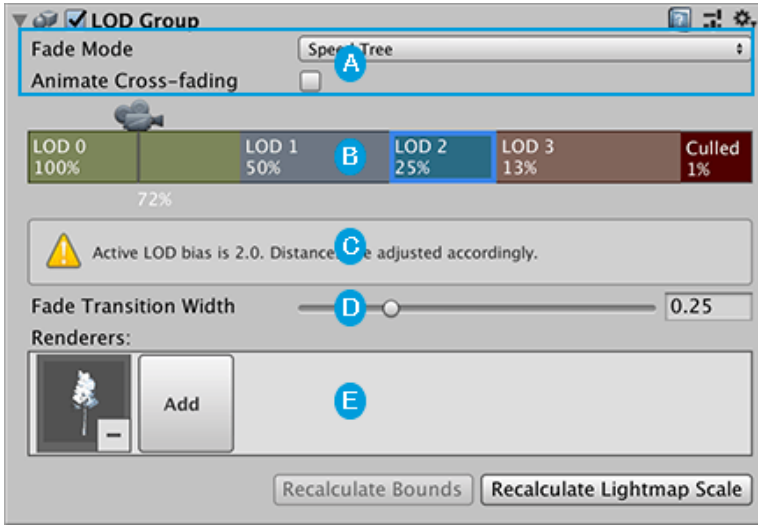

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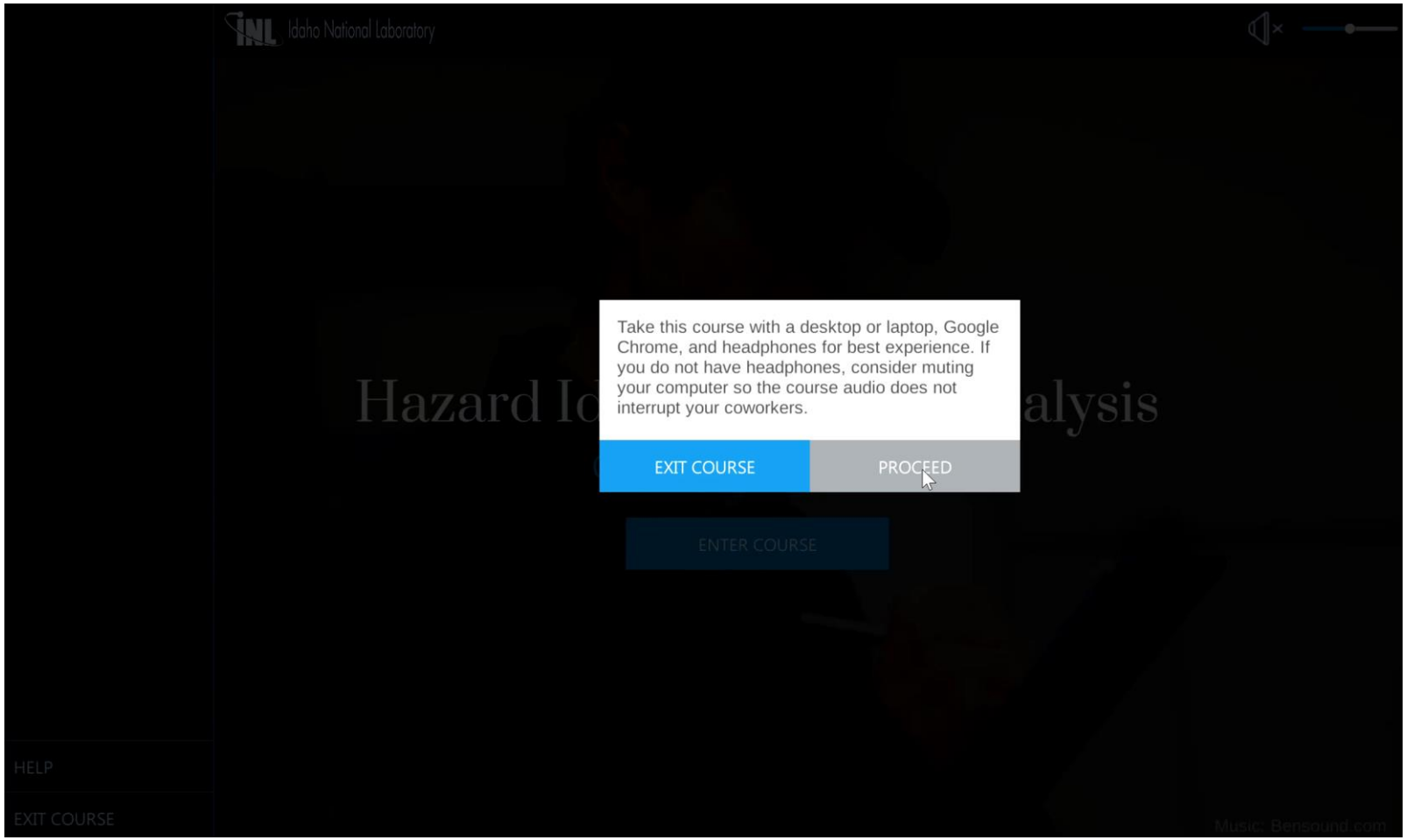


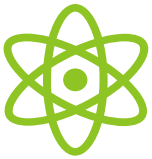
Virtual Training

Simulate conditions that are difficult to create in the lab environment

LiDAR scanner provides a realistic and accurate simulation

Promote virtual and remote training for education outreach and industry training

Minimize hazards exposure during training



Apply the simulation methods to other laboratories

References

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Thank You

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