

Introduction and Motivation

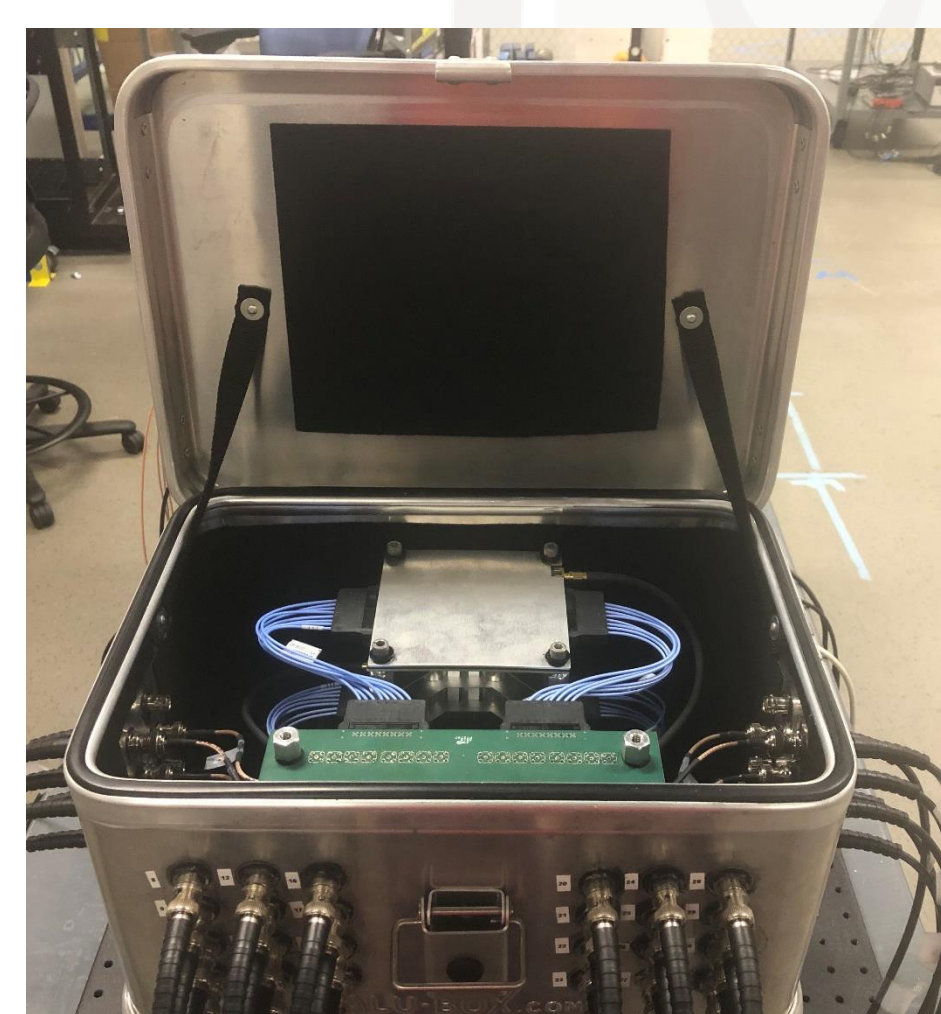
- Comparing a simulated (MCNP) model of the H2DPI system against experimental results
- Verify and validate the simulation

Mission Relevance

- Supports the NNSA in the mission of nonproliferation
- Accurate, validated simulations are used to
 - Generate training data for AI programs
 - Better the understanding of scatter-based imaging systems

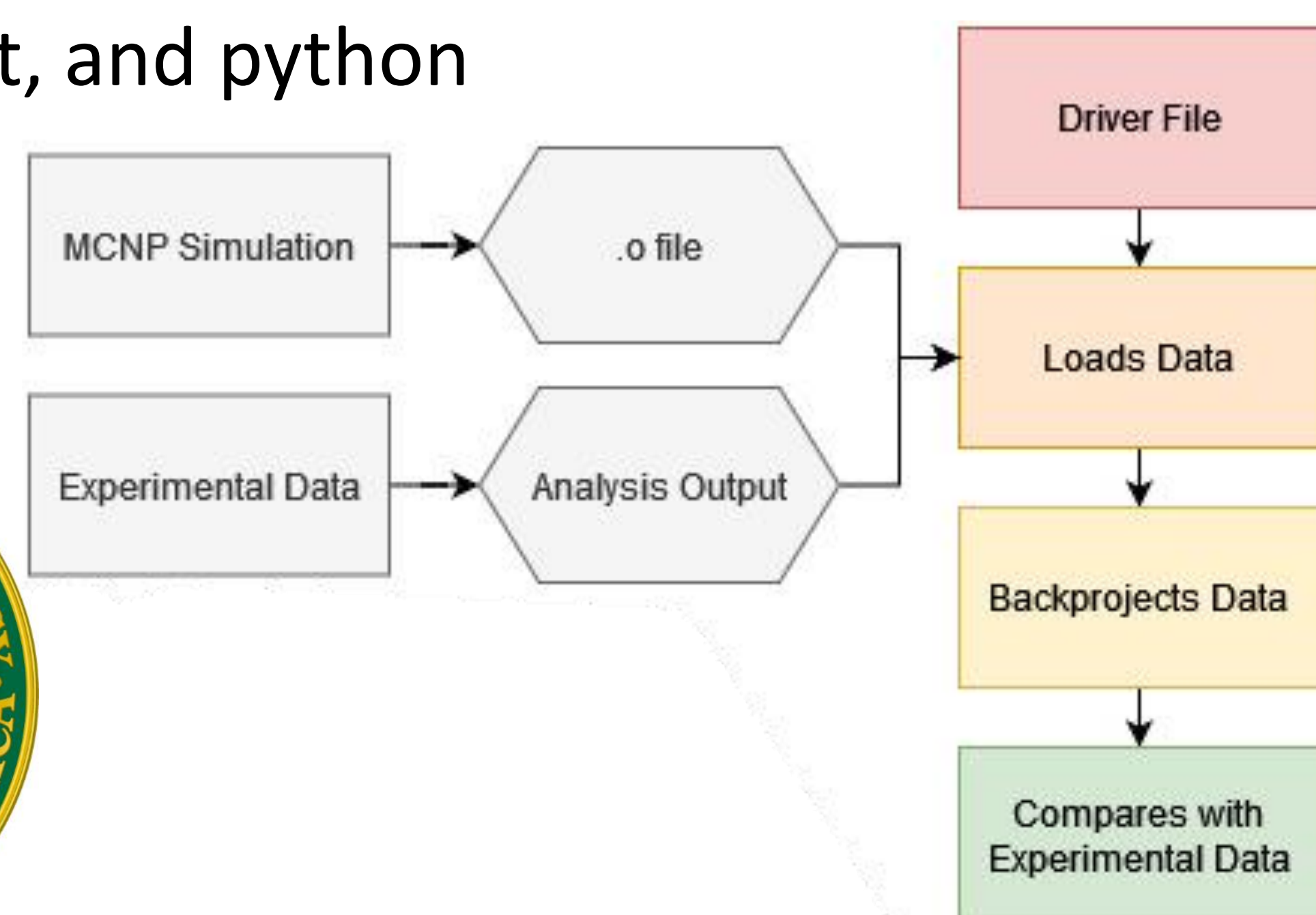
H2DPI (Dual Particle Imager)

- 12 6 x 6 x 50 mm³ organic glass scintillators
- 8 6mm (diameter) x 6 mm (length) CeBr₃ inorganic scintillators
- Compactly measures the spectrum and image of incoming neutrons and gamma rays



Technical Approach

- Simulation workflow uses MCNPX PoliMi, MPPost, and python



Results

- ²⁵²Cf was measured 58.42 cm away from the center of the image, with an activity of 1021.45 μCi
- Simulated neutron interactions of a ²⁵²Cf experiment show little discrepancies to experiments for neutron spectrum (**Fig 1**) and image (**Fig 2**)

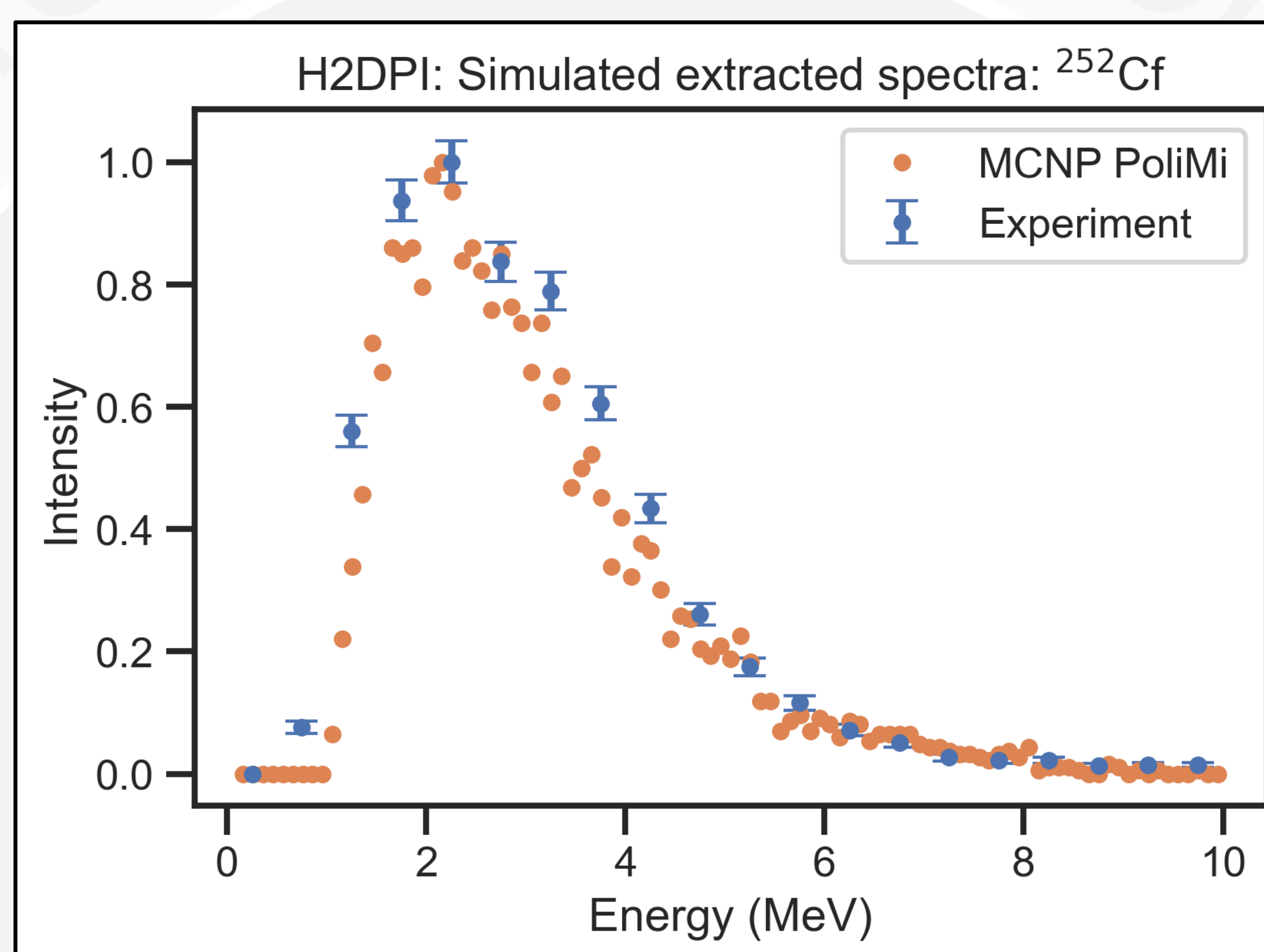


Fig 1: Normalized plot of the simulated spectra vs the experimental spectra for Cf-252.

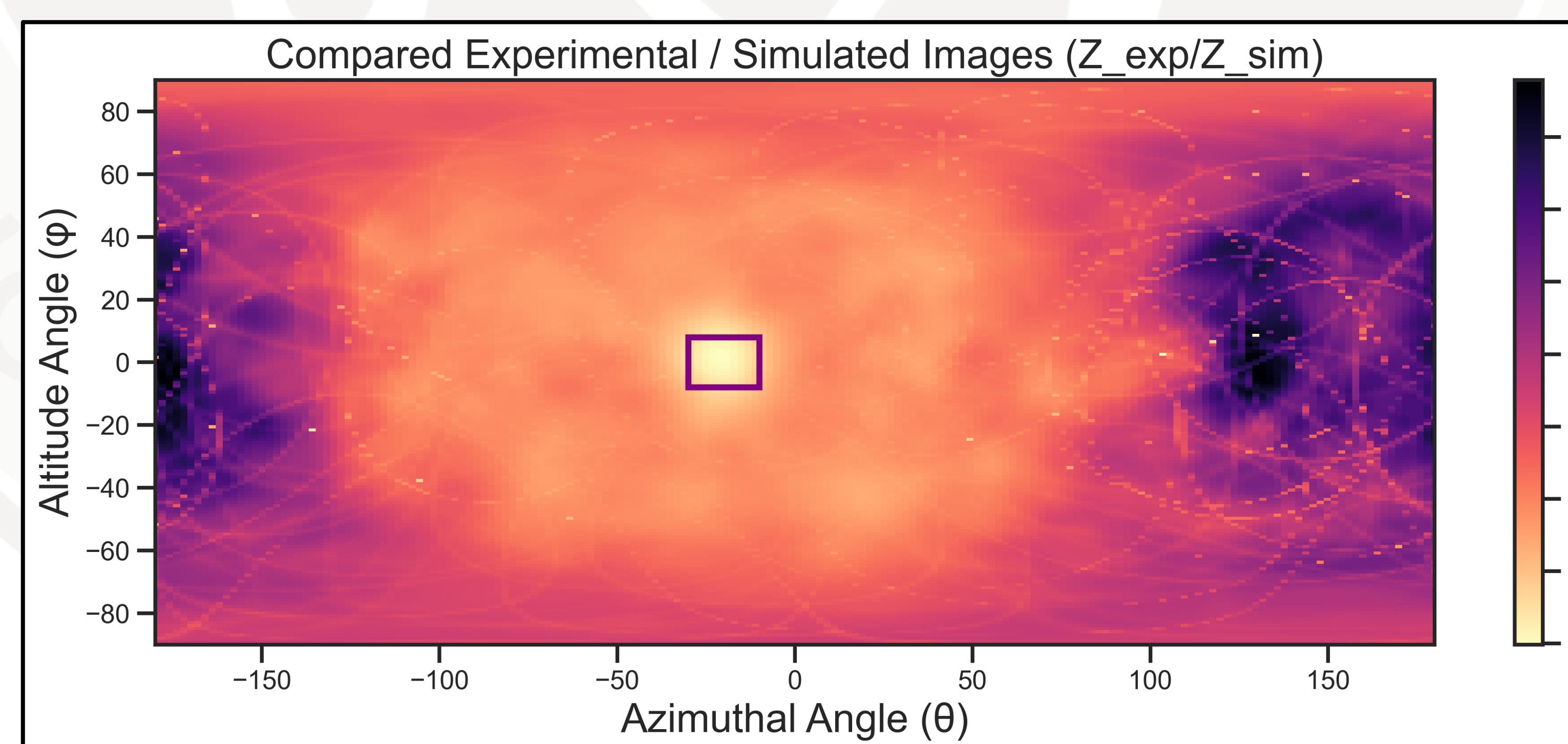
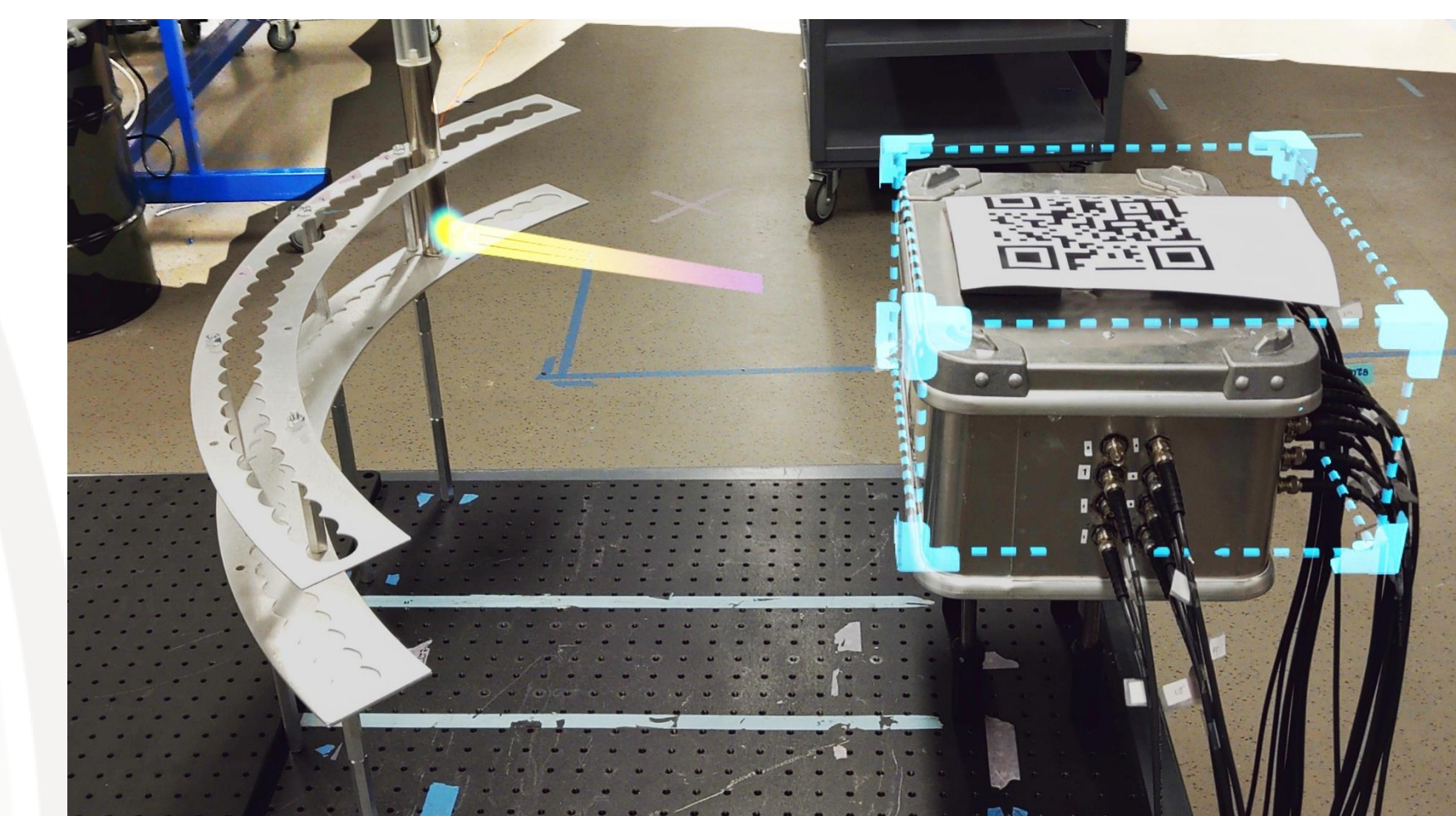


Fig 2: Ratio comparison of the back projected images for the experimental and simulated data. With 0 (white) showing an exact match and 7 (black) showing a relative deviation between the two.

Expected Impact

- Efficient data generation for future radiation imager design improvements
- Validated experiment allows for confident generation of training data for AI models (Please visit Poster 14 for details)
- Ability to further evaluation of performance of the system for a range of applications



MTV Impact

- The MTV fellowship enabled me to do this research

Conclusion

- A new MCNPX PoliMi based simulation workflow was created for the H2DPI system, focusing on neutron spectroscopy and imaging
- Good agreement was found, thereby verifying and validating the workflow

Next Steps

- Verification and validation of gamma ray imaging and spectroscopy
- Attempt to validate more complex scenarios: SNM measurements and multiple sources