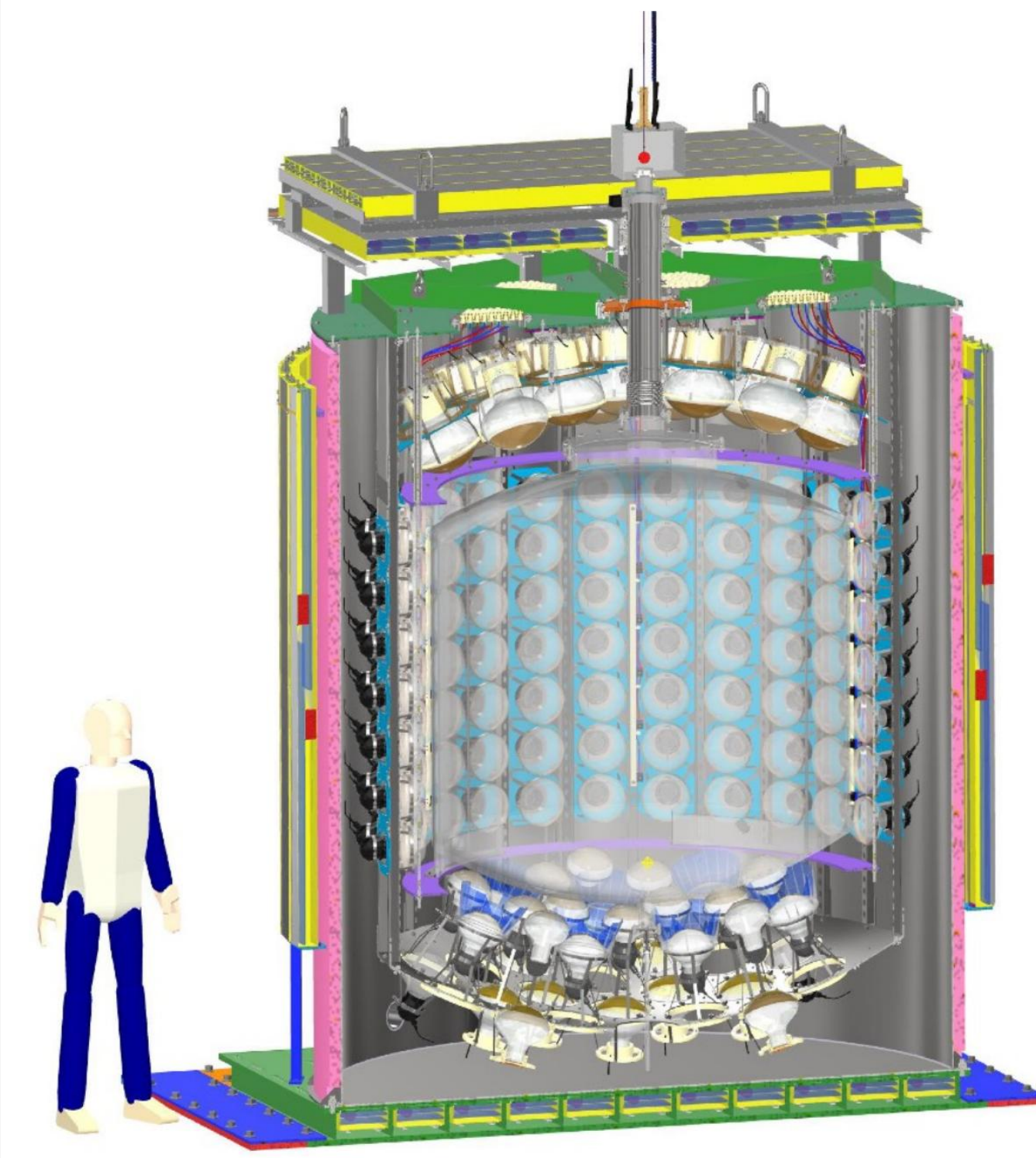


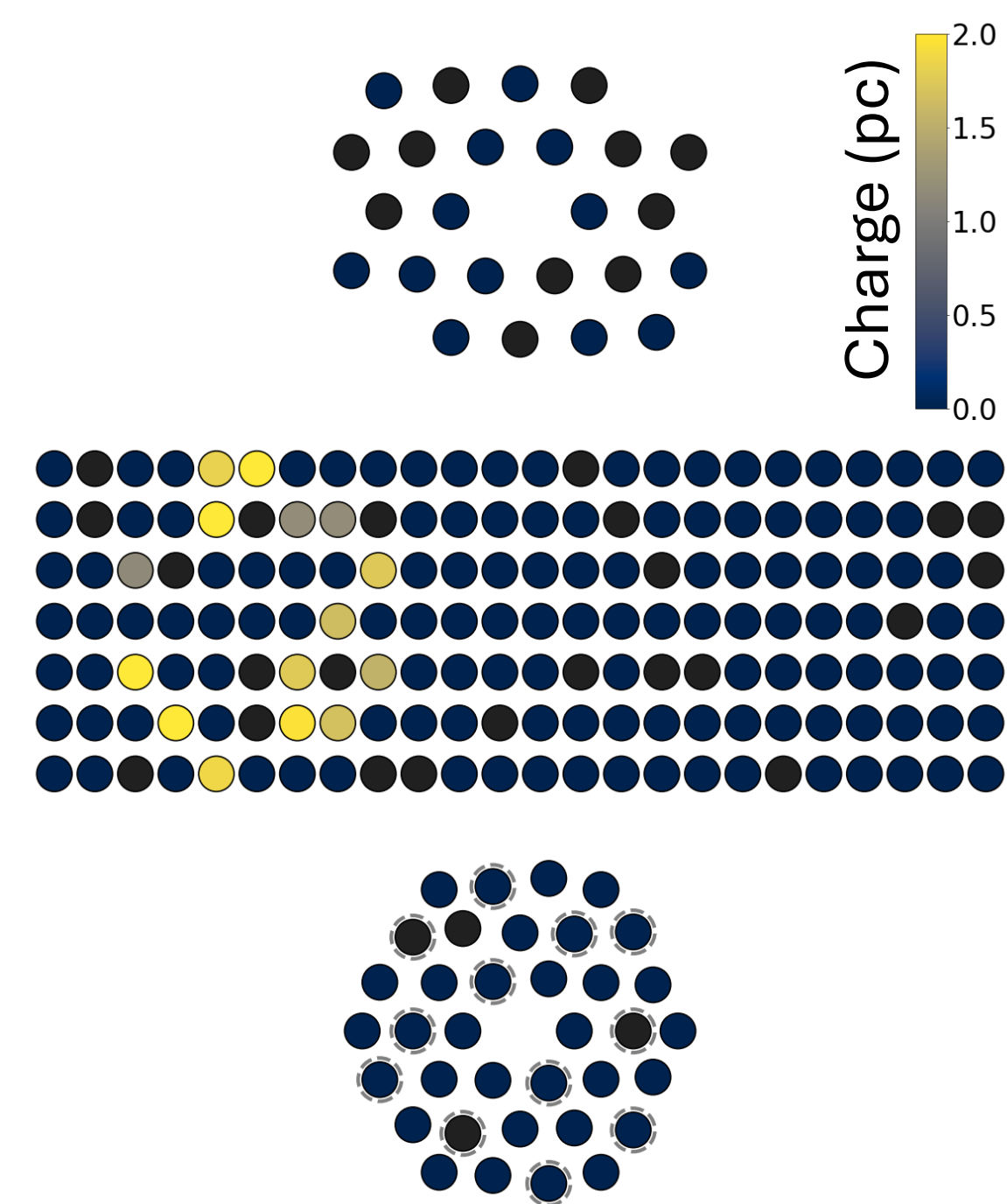
Eos Experiment

- Hybrid neutrino detector with a 4-ton fiducial volume located at UC Berkeley
- Water, WbLS, and LS phases
- Utilizes both Cherenkov light and scintillation light
- R&D for larger kiloton-scale detectors such as THEIA



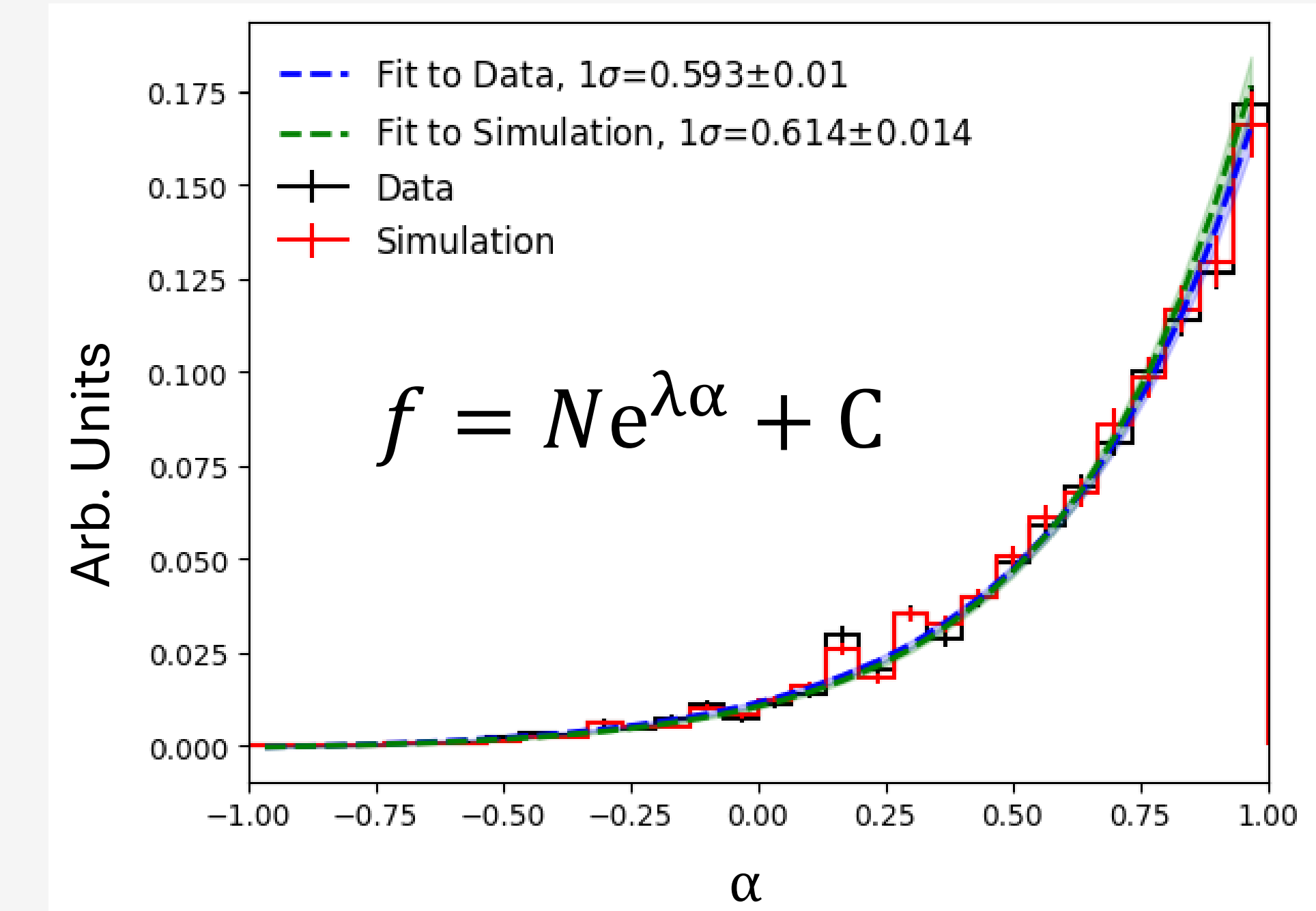
Data

- Single event displayed from ^{106}Ru 20 mm source
- Cherenkov ring structure visible
- Data collected from water phase
- Reconstruction uses hits in prompt time window to isolate Cherenkov light

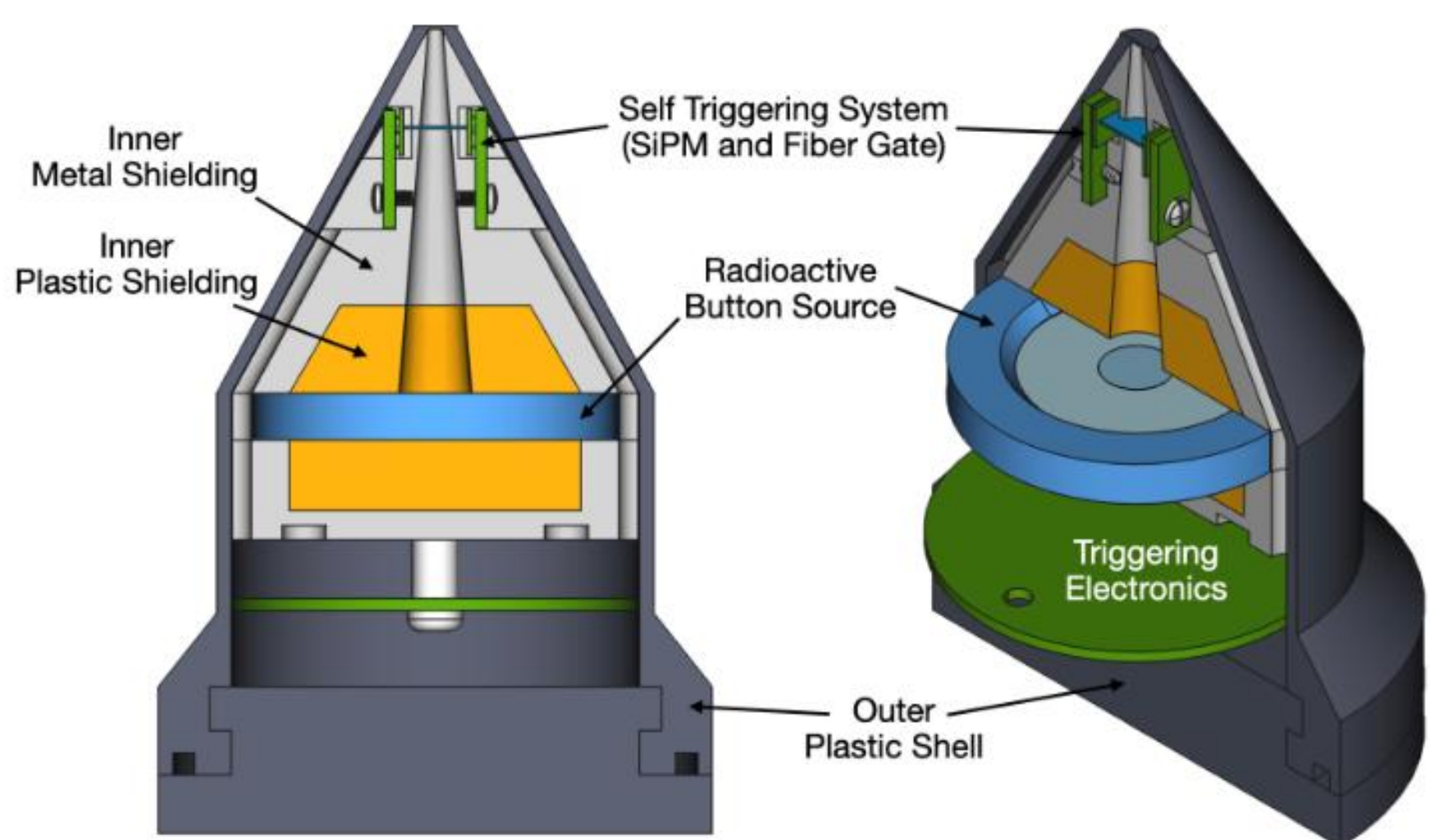


Exponential Fit and Resolution Metric

- A 1σ equivalent containment point, $\alpha_{1\sigma}$ is extracted from an exponential fit and used as the directional-resolution metric
- AERO fitter used as a representative example



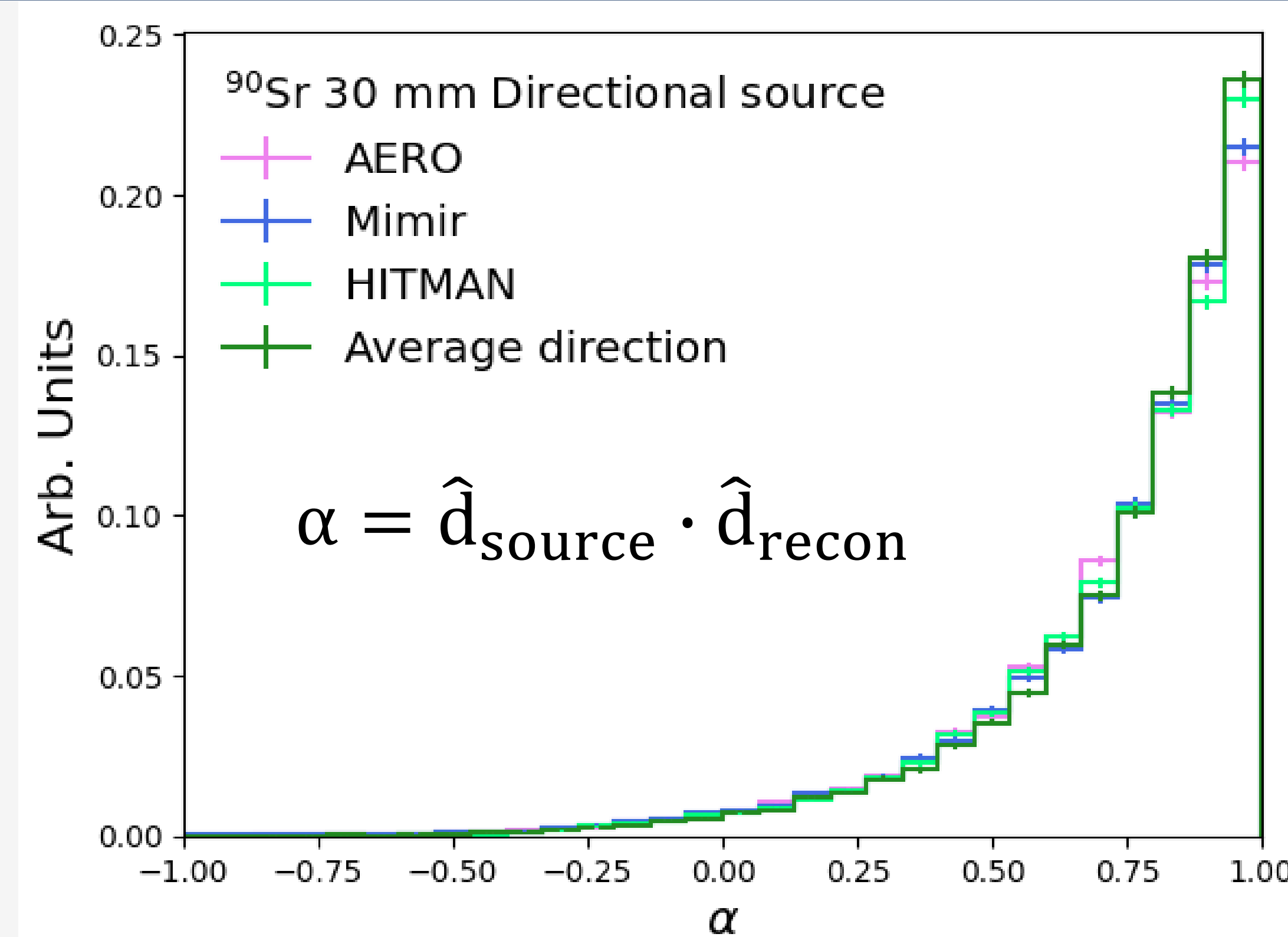
Directional Beta Source



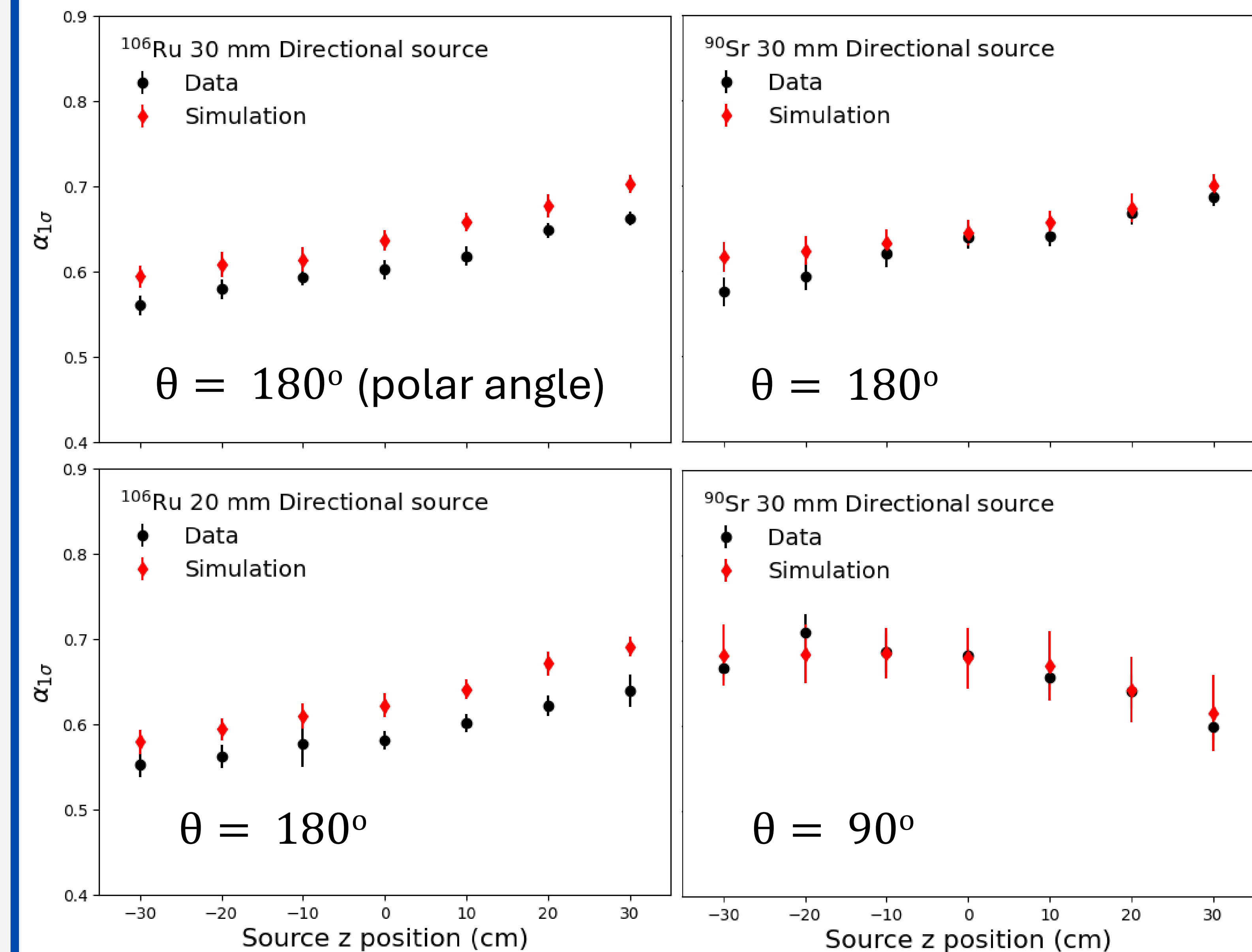
- ^{106}Ru and ^{90}Sr beta sources
- 3 source sizes (12 mm, 20 mm, 30 mm) aids in understanding shadowing effect
- Self-triggering system

- Collimated beta emission provides a known source direction for reconstruction validation

Directional Fitters



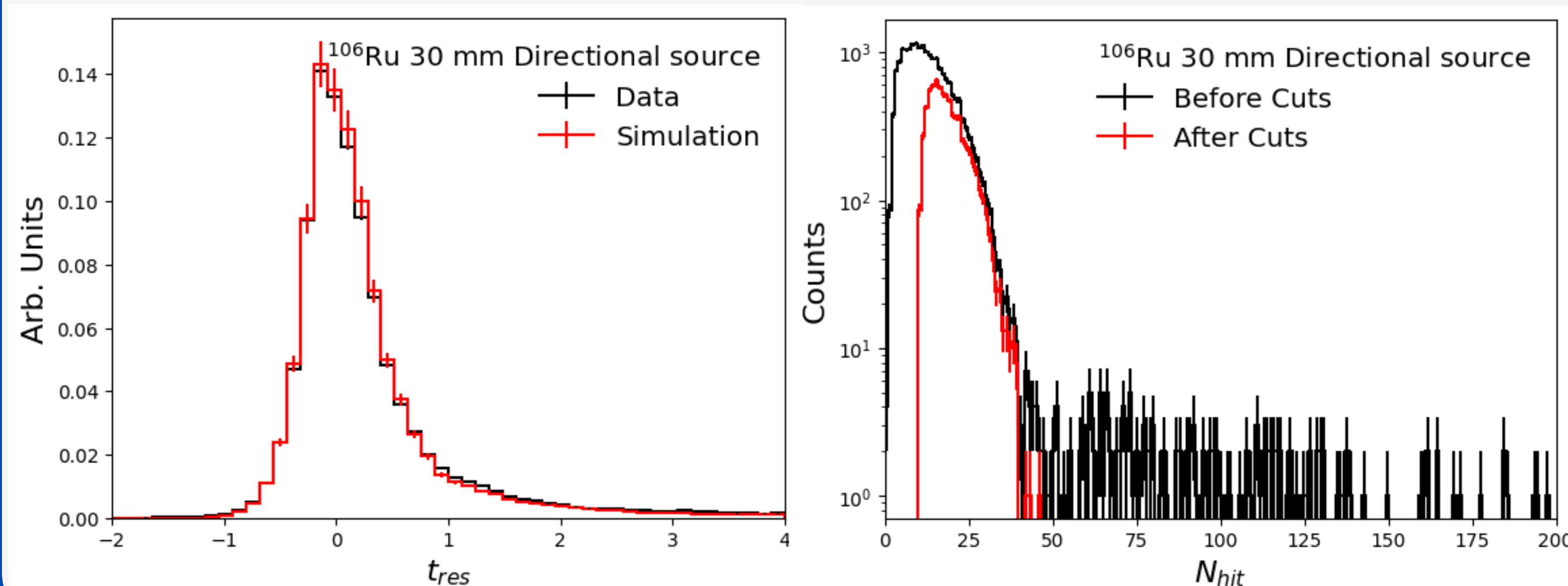
- AERO**: Likelihood-based fitter that uses HEALPix to pixelate the sphere; each pixel contains a 2D PDF of PMT hit time vs PMT ID
- Mimir**: Likelihood-based fitter utilizing PMT-type PDFs in time residual
- HITMAN**: Deep-learning-based reconstruction
- Average direction**: Average of direction vectors from event position to hit PMT positions
- All fitters show similar levels of data/MC agreement



- Directional reconstruction in water shows broadly consistent data/MC behavior across source positions and orientations
- The directional beta source provides a controlled benchmark for comparing reconstruction algorithms in Eos

Event Selection Criteria

- Source trigger timing cut to remove accidental coincidences
- Prompt $N_{hit} > 10$ (for trigger efficiency)
- Fiducial volume cut: $|z| < 70$ cm, $\rho < 70$ cm



Acknowledgements

The project was funded by the U.S. Department of Energy, National Nuclear Security Administration, Office of Defense Nuclear Nonproliferation Research and Development (DNN R&D).