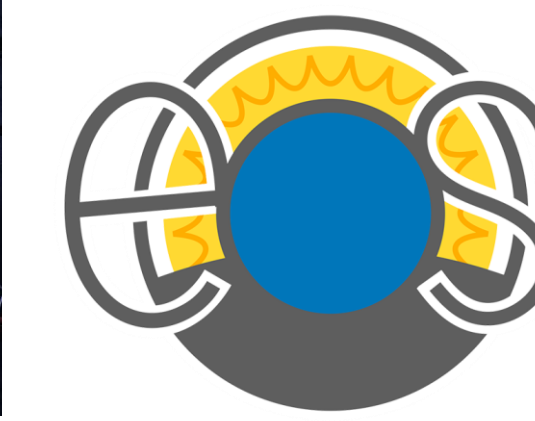
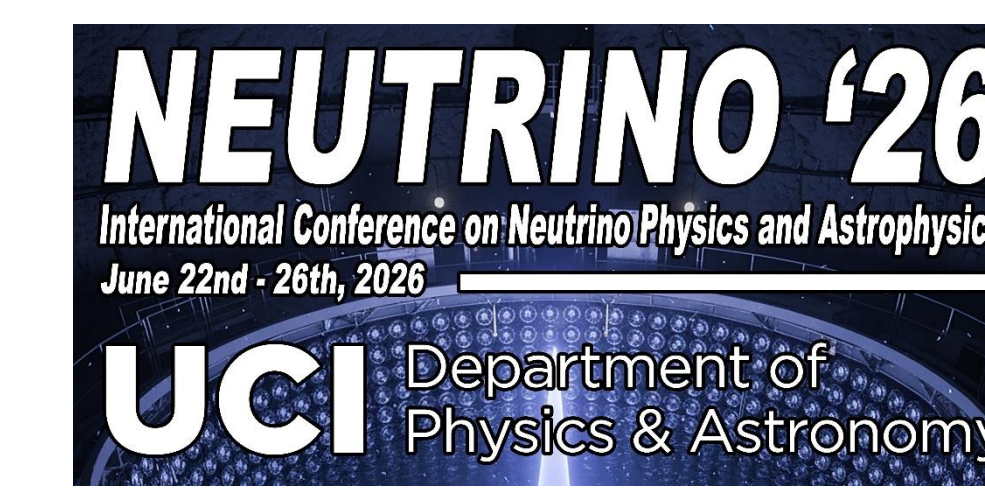


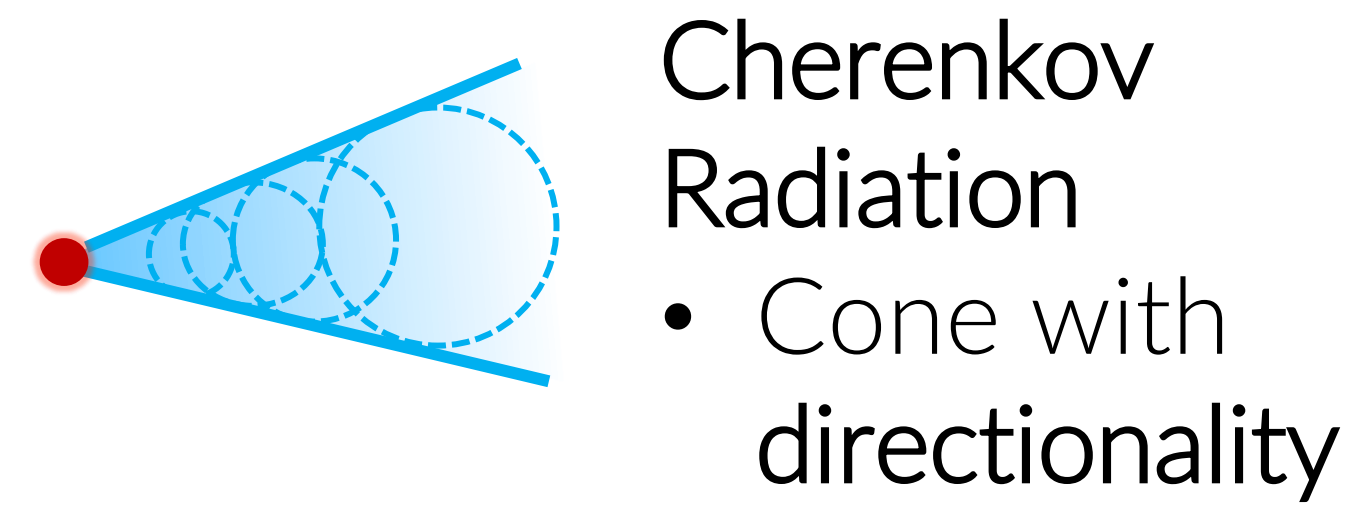
A Directional Beta Calibration Source for Cherenkov-Scintillation Studies in the Eos Detector

Julia Ryshkewitch for the Eos Collaboration
Department of Physics, Boston University, Boston MA



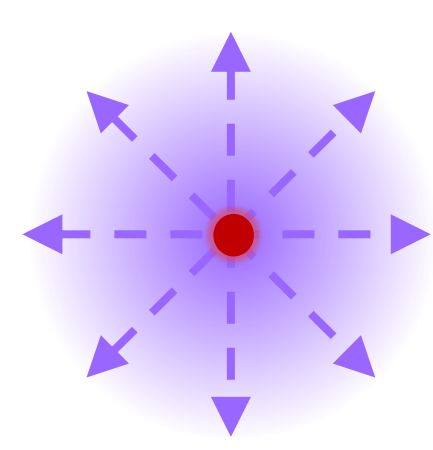
Hybrid Detection and the Directional Beta Source

The Eos Detector is a testbed for hybrid detection of both scintillation and Cherenkov photons



Cherenkov Radiation

- Cone with directionality



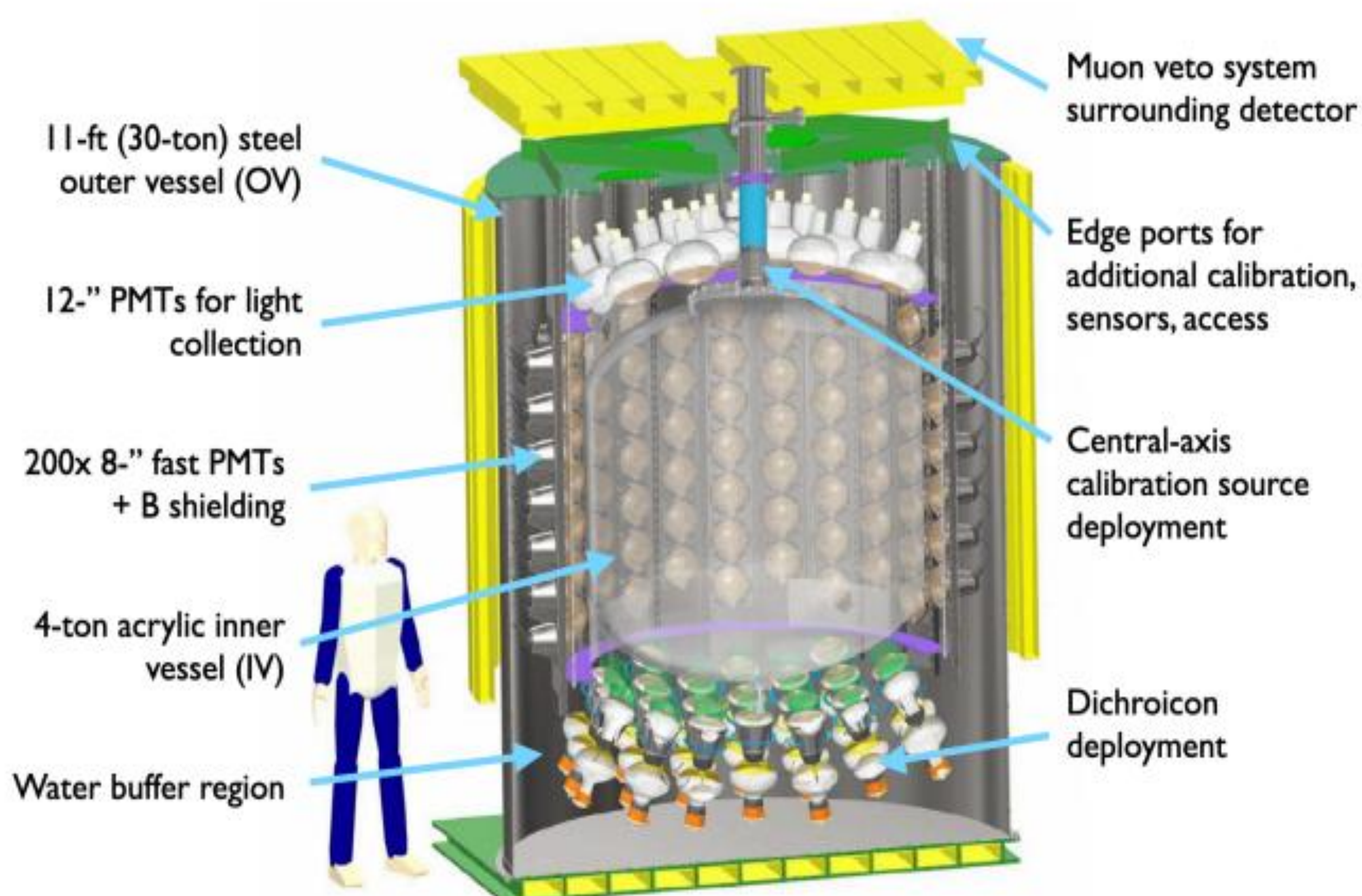
Scintillation

- Isotropic
- Excellent energy and position reconstruction

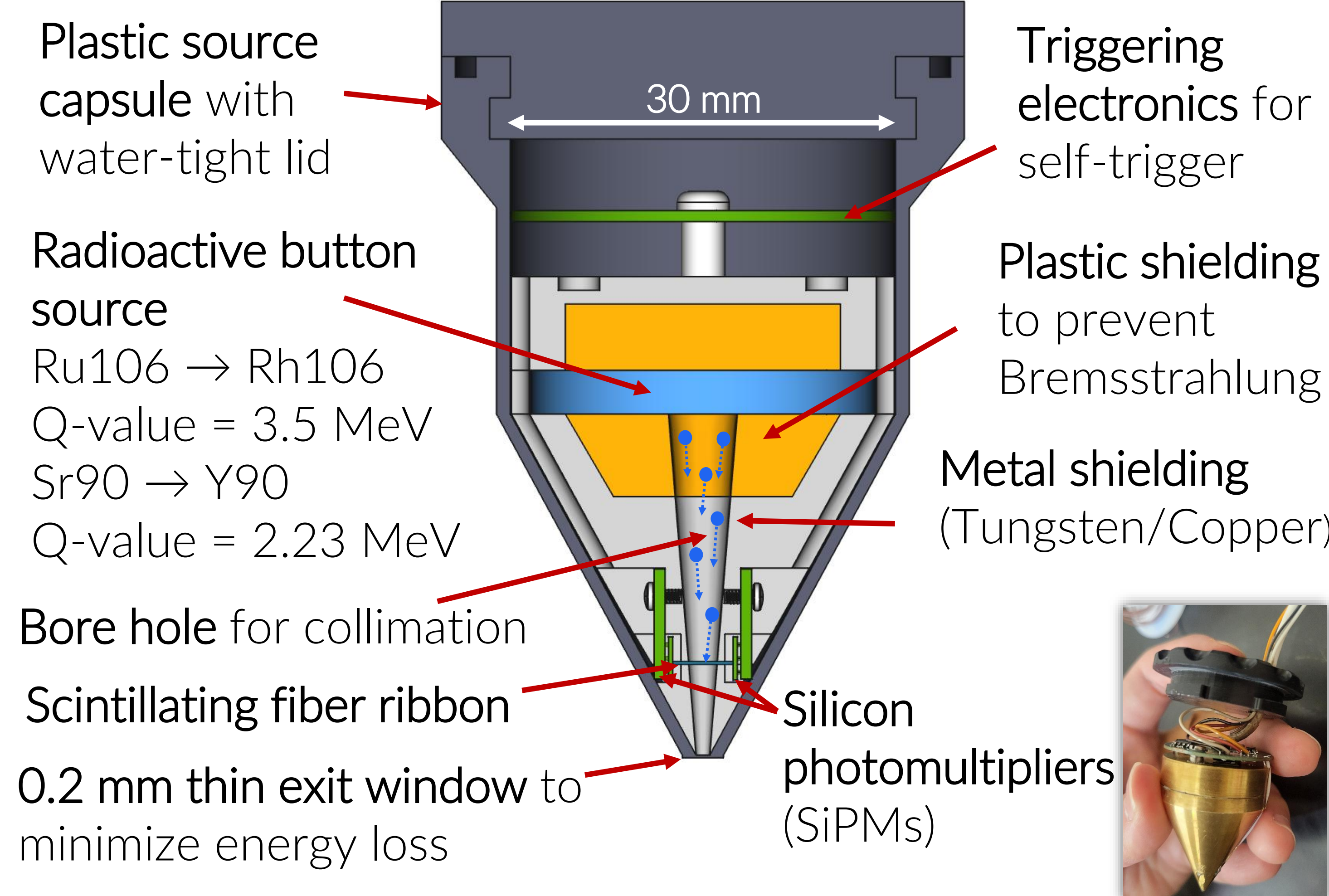
The directional beta source provides a controlled, known-direction calibration sample for testing Cherenkov/scintillation separation and validating directional reconstruction in Eos

The Eos Hybrid Detector

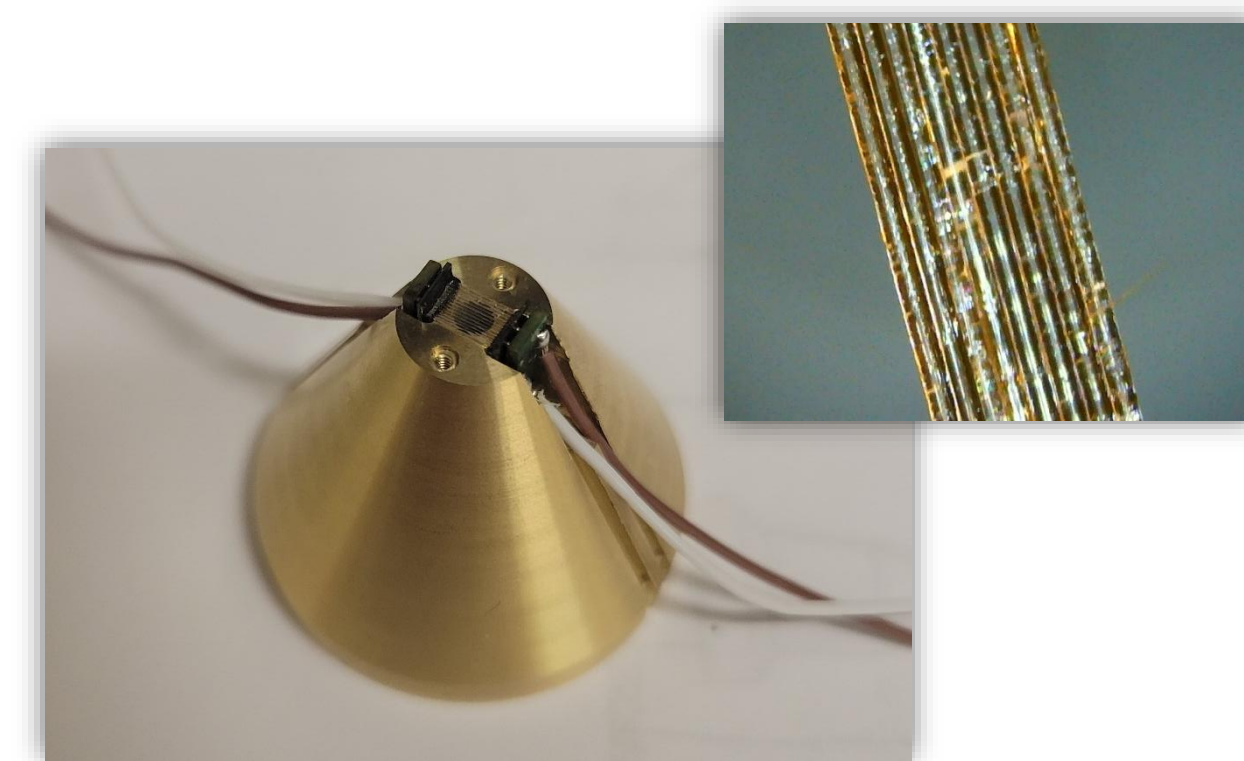
- Eos is a fiducial 4-tonne R&D detector located at UC Berkeley
- Tests novel scintillators such as water-based liquid scintillator (WbLS)
- Informs the design of future kilotonne-scale hybrid neutrino detectors such as THEIA



Source Design

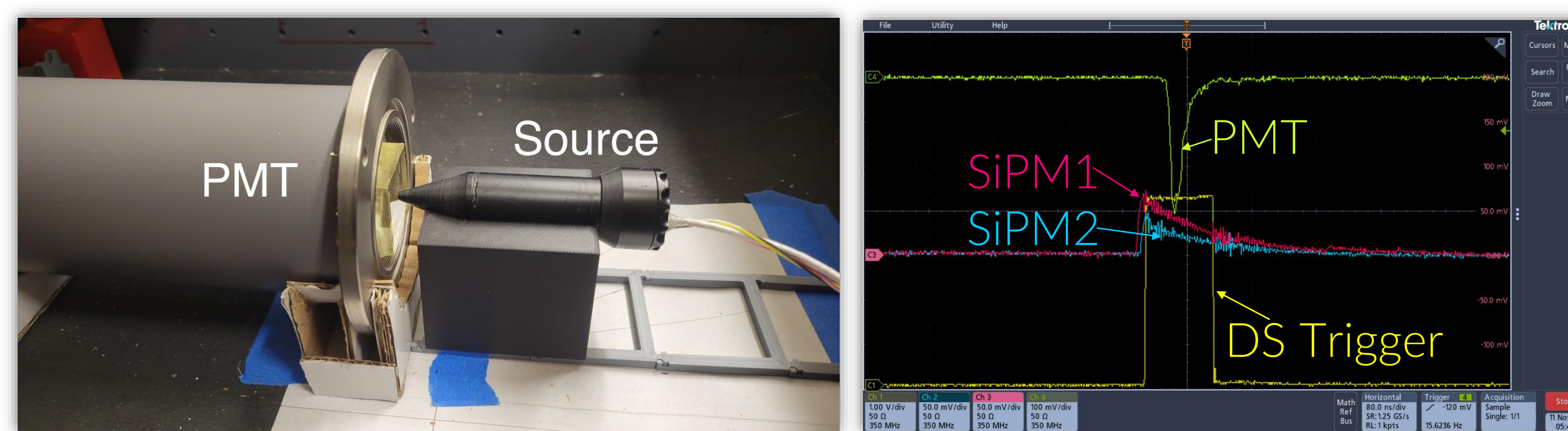


Self Triggering System

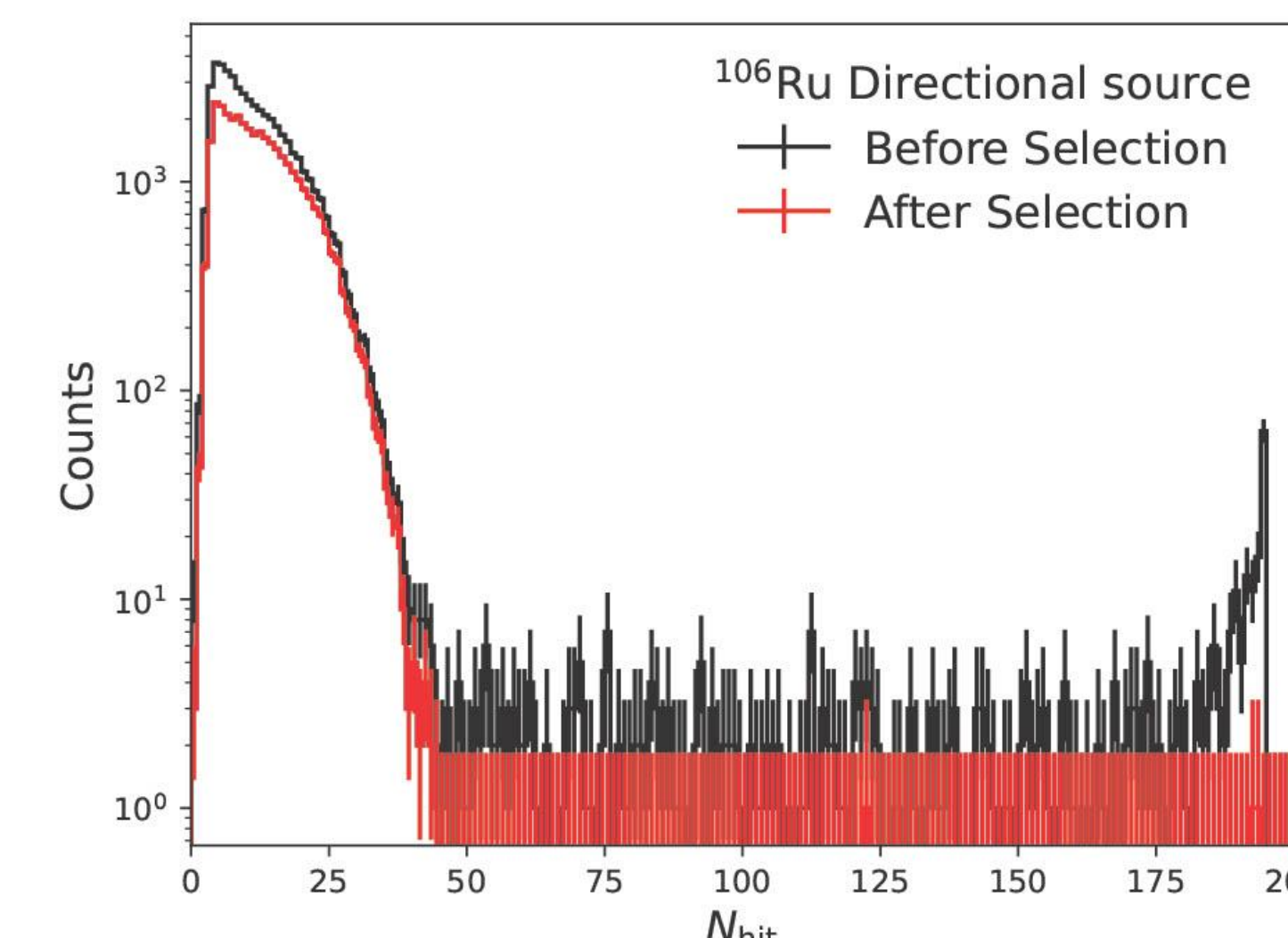


β s pass through scintillating fiber ribbon which is optically coupled to two SiPMs. The SiPM signals are read out as the directional source self-trigger

Triggering efficiency tested on benchtop at Boston University

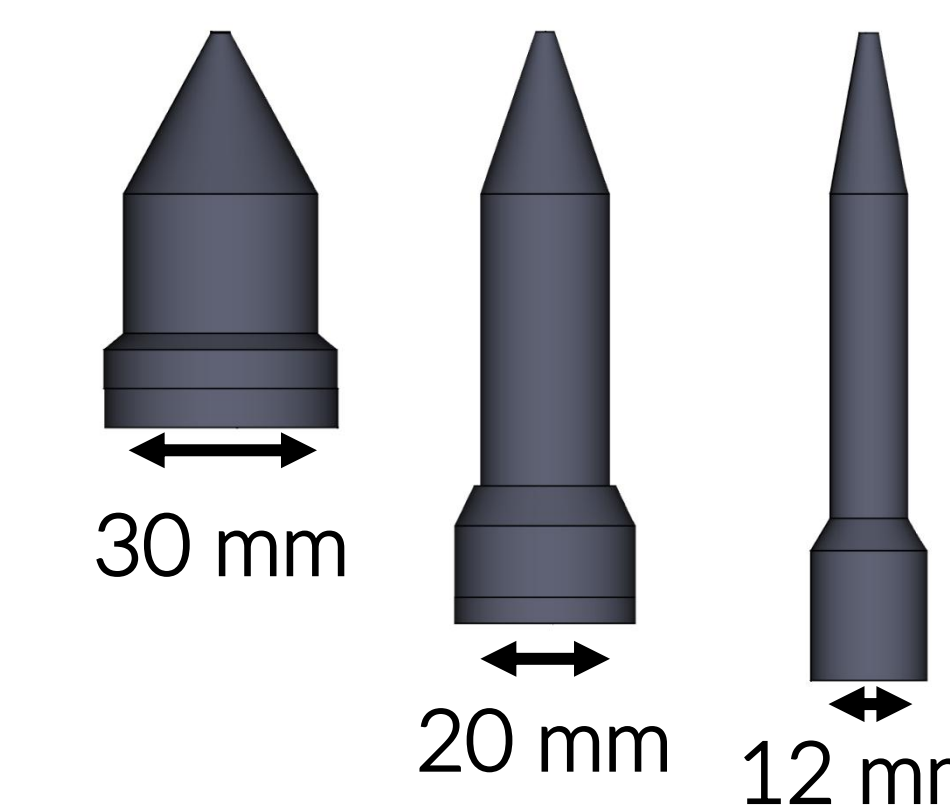
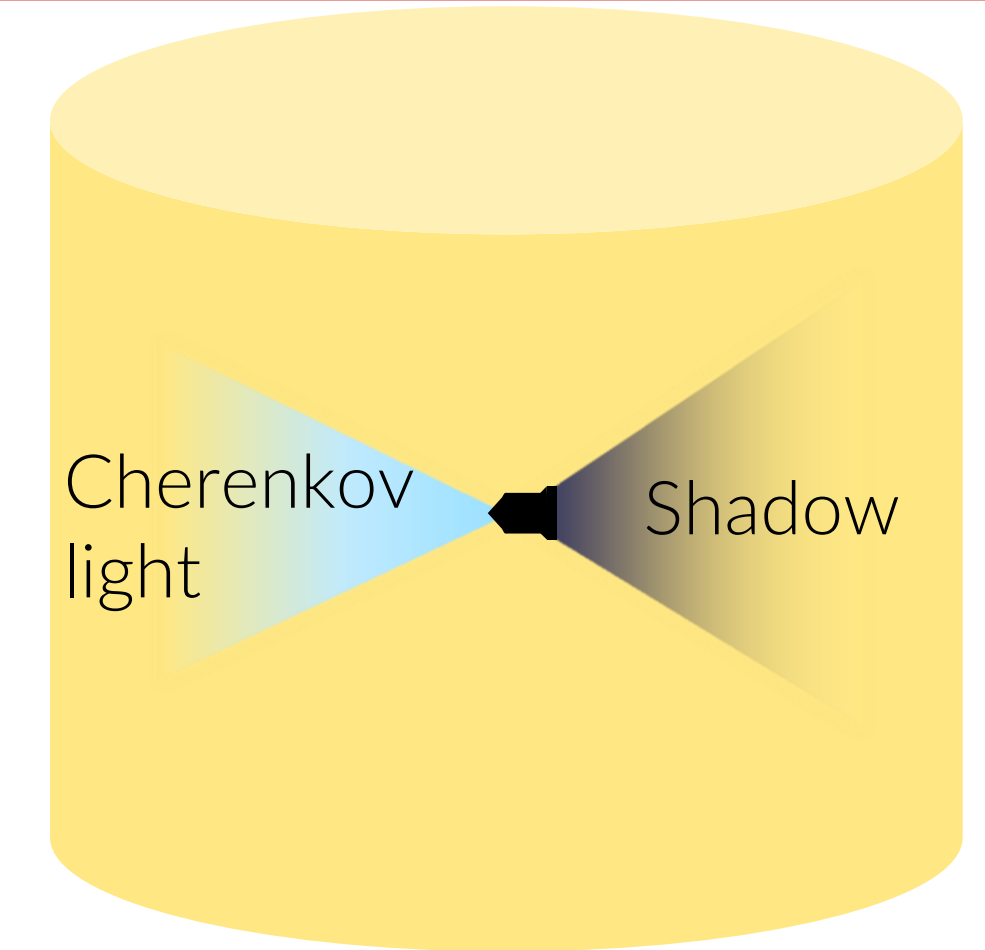


Excellent event cleaning capabilities using directional source trigger



Shadowing Effects

In WbLS, betas travel less than ~ 1 cm, so scintillation light is produced close to the source body. The source can shadow part of this light, introducing a geometry-dependent bias in direction reconstruction.



Three source sizes: 30 mm, 20 mm, 12 mm

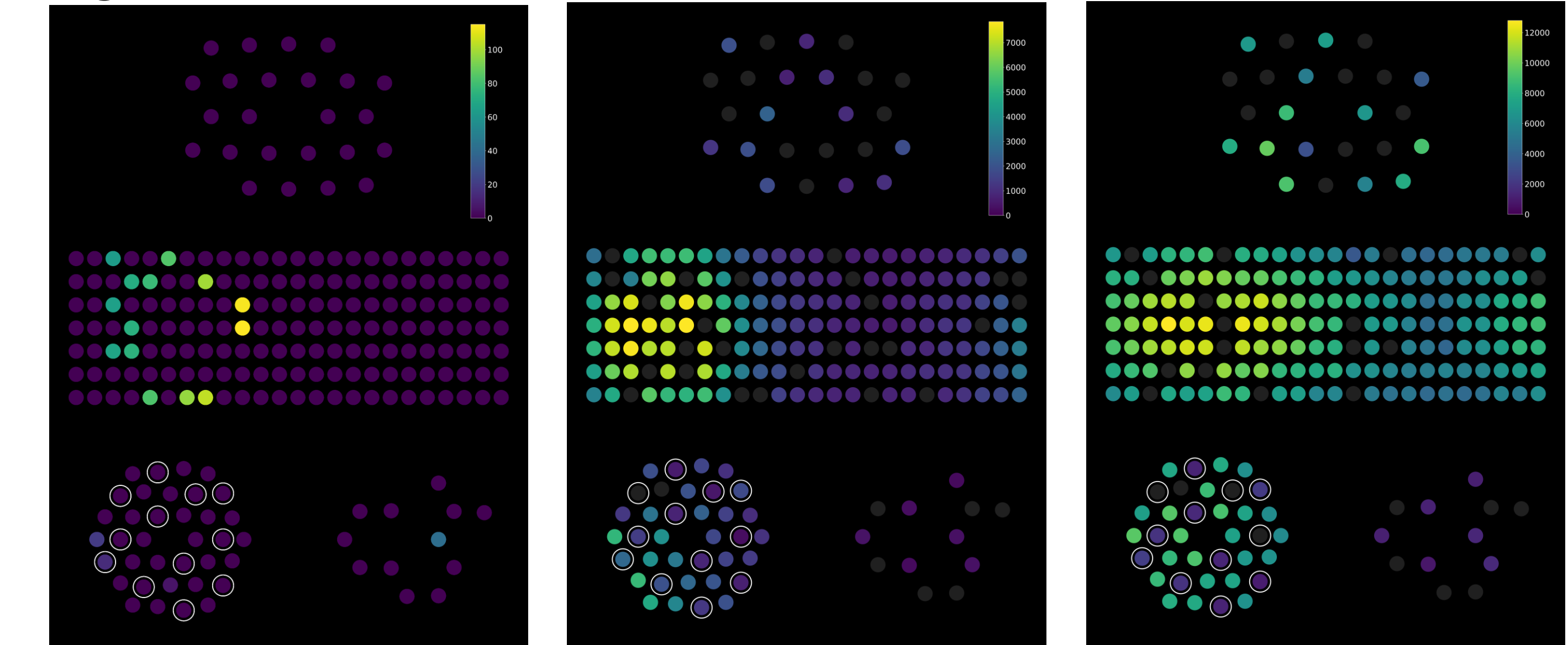
Thinner sources reduce shadowing, enabling controlled studies of source-induced reconstruction bias.

Deployment

Status: Directional beta sources have been successfully deployed in water and 1% WbLS. The self-trigger provides strong event-cleaning capability, and the three source diameters enable controlled studies of source-shadowing effects



Single event in water Full run in water Full run in WbLS



Acknowledgements

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