

# Characterizing Backgrounds for Neutrino Applications Use Cases with the ROADSTR PSD Scintillator Detector Prototype



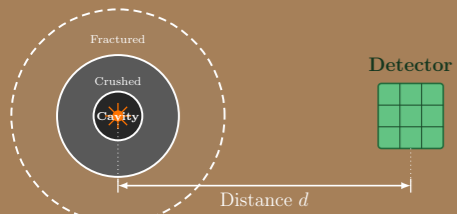
## 1. Motivation

\* See poster 493, by S. Ghosh

Technology demonstration in relevant environments and readiness for optimal outcome on MAD\* use-cases\*\*, particularly important to:

\*\* See poster 492, by N. Bowden

### Test Site Explosion Monitoring

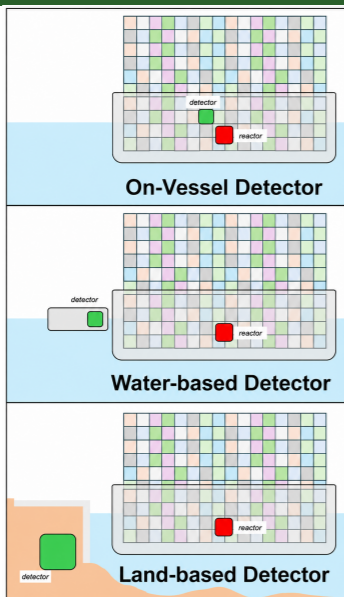


- **Absence** of neutrino signal can set limit on fission content of chemical explosion

- Essential to **characterize** environmental backgrounds in an underground cavity

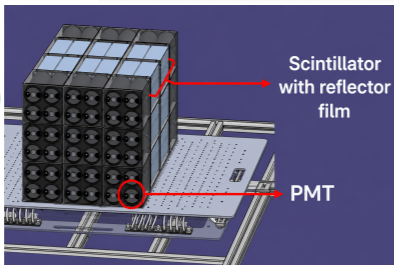
### Maritime Reactor Monitoring

- Renewed interest in civilian nuclear propulsion
- Non-intrusive reactor verification with antineutrinos
- Challenges: low flux, **high backgrounds**, harsh environments
- **Multiple** deployment concepts identified with **different shallow overburden**



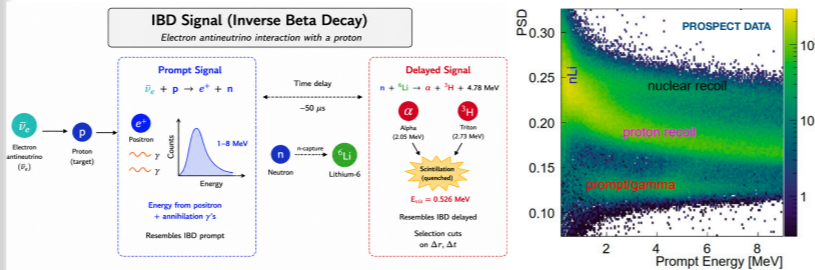
## 2. The ROADSTR Detector

- 60 kg active mass
- 2D-array of  $^6\text{Li}$ -doped PSD Plastic Scintillator bars
- 36 bars x 55 x 55 x 500 mm
- 72 x 2" Photomultiplier tubes
- Compact, rugged, and deployable on a rover/cart

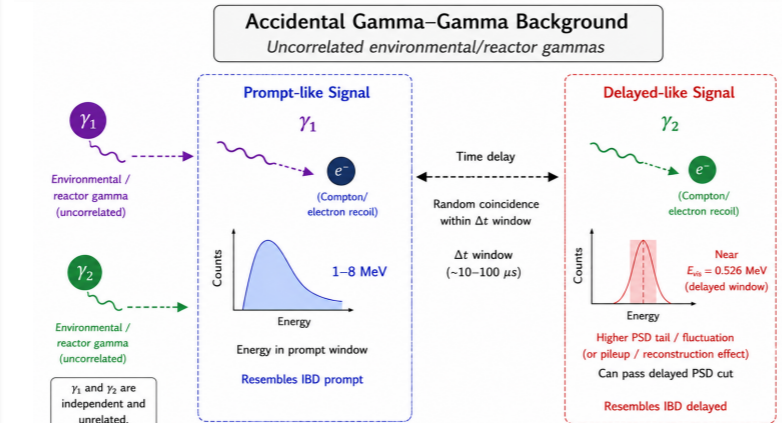
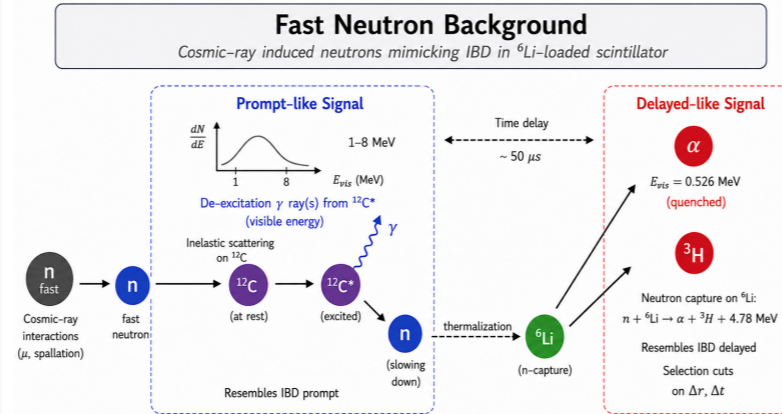
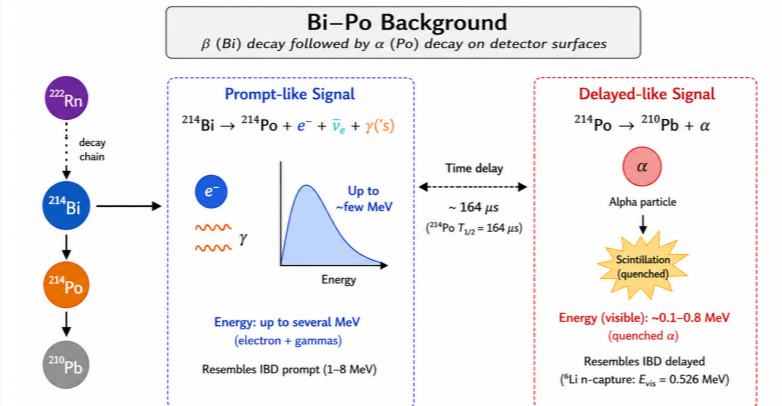


## 3. Signal versus Background

### Signal:



### Backgrounds:



## 4. Deployment Locations

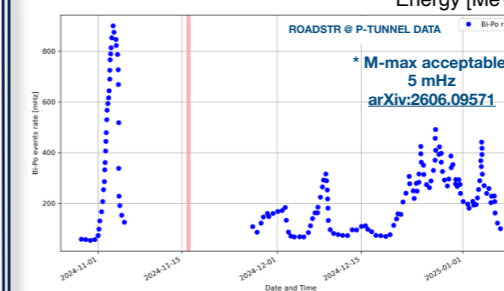
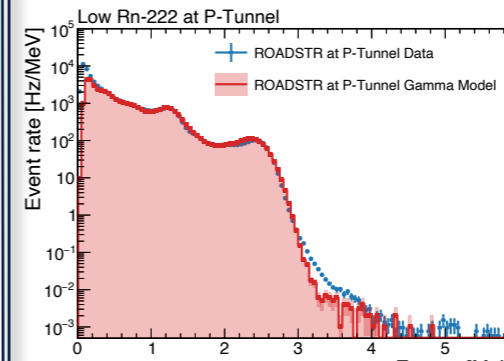
### P-Tunnel, NNSS



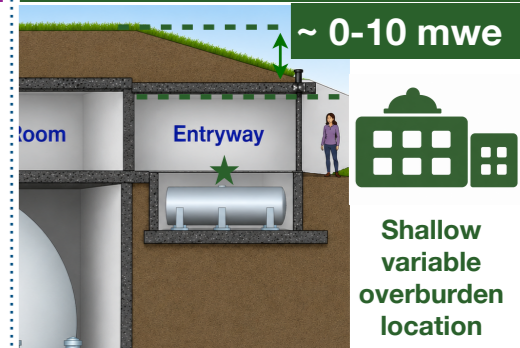
Underground facility at the Nevada National Security Site

~ 300 mwe

- Radiogenic background is dominant
- Collected data from 2024-2025

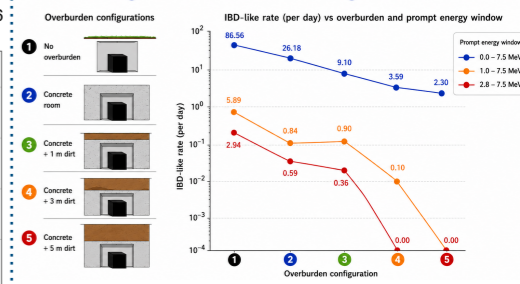


### MiniBooNE Hall, Fermilab



- 4 different deployment locations
- Slow variable overburden allows observation of transition of type of cosmogenic background
- Benchmark cosmic simulations for optimized use-case development
- Detector is currently collecting data (Spring-Summer 2026)

### Cosmogenic fast neutron background estimation



## 5. Takeaways

ROADSTR is providing critical background measurements for neutrino-based safeguards applications, generating data that informs future deployments and use-cases for MAD and similar monitoring technologies.