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## Directionally Accelerated Detection of an Unknown Second Reactor with Antineutrinos for Mid-Field Nonproliferation Monitoring

When monitoring reactor antineutrinos for nuclear nonproliferation purposes, a hidden nuclear reactor can be obscured by activities of a known reactor of much greater power nearby. Thus any monitor must discriminate known background reactor fluxes from possible unknown reactor signals. We find the confidence to reject the (null) hypothesis of a single proximal reactor, by exploiting directional antineutrino signals in the presence of a second, unknown reactor. In particular, we simulate the IBD response of a 1 kT fiducial GdLS detector. We predict  $3\sigma$  confidence to detect the unknown reactor within five weeks, at 3 km or nearer. At longer baselines, this time increases significantly. However, the relative improvement from directional sensitivity also increases, providing an eight-week speedup at 5 km. Therefore, directionally sensitive antineutrino monitoring can accelerate the mid-field detection of unknown reactors whose operation might otherwise be masked by more powerful reactors in the vicinity.

### Mini-abstract

In nuclear nonproliferation, mid-field reactor antineutrino monitoring benefits from directionality.

### Experiment/Collaboration

WATCHMAN Collaboration

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