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Correlated background within the SoLid anti-neutrino detector

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The SoLid experiment aims to measure the anti-neutrino energy spectrum 6–9 m from the core of the BR2 nuclear reactor at SCK•CEN in Mol, Belgium. The main goals are to provide a very sensitive search for short-baseline neutrino oscillations and to resolve the reactor neutrino anomaly. The proposed detector technology will be very useful for anti-neutrino detection in other settings as well, such as nuclear safeguard and non-proliferation monitoring of nuclear reactors.
The experiment uses a novel, highly segmented composite scintillator detector. The detector unit is based on 5 cm polyvinyl toluene scintillator cubes, thin neutron sensitive ^{6}LiF:ZnS(Ag) sheets and a reflective Tyvek layer wrapping them for light tight. A first large scale detector prototype based on this technology was deployed at the BR2 reactor by the end of 2014. The main purpose was to study the capability of the detector design to discriminate background. Due to the low overburden and proximity to a nuclear reactor, efficient background reduction is crucial for a successful experiment.
This contribution will be presenting and discussing the advantages of the SoLid detector design for background reduction. The background components studied include atmospheric and spallation neutrons induced by cosmic rays and possible natural radioactivity contamination from the decay chains of ^{238}U and ^{232}Th. The results are based on the data taken with the prototype detector and its full chain GEANT4 based Monte Carlo simulations.

Primary authors: PIÑERA-HERNÁNDEZ, Ibrahin (University of Antwerp, Belgium.); ABREU-ALFONSO, Yamiel (University of Antwerp, Belgium.); SIMARD, Laurent (Université Paris-Sud/LAL, Paris, France); VAN MULDERS, Petra (Vrije Universiteit Brussel, Brussel, Belgium)

Co-author: SOLID COLLABORATION

Presenter: PIÑERA-HERNÁNDEZ, Ibrahin (University of Antwerp, Belgium.)

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