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SoLid: Innovative Antineutrino Detector for Nuclear Reactor Monitoring

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The detection of antineutrinos emitted in the decay chains of the fission products in nuclear reactors associated with accurate simulations could provide an isotopic tomography of the core. Nevertheless, their extremely low interaction probability makes the shielding of antineutrinos, practically impossible. In conclusion, such kind of technique could detect a change occurring in the reactor core composition, thus it could be used for non-proliferation purposes. For a declared isotopic composition of the reactor core, the information coming from the antineutrino flux is valuable for the electricity companies which run the reactors in order to increase the precision of the power measurement.

In order to be used as a potential safeguard tool, the antineutrino detectors should be a good compromise between detection performances and design constrains related to safety, low cost and size reduction. An example of such detector is SoLid, which will be installed and will take data at SCKCEN/BR2 research reactor, in Belgium. SoLid uses a Lithium-6 based composite scintillator which provides by design a high degree of safety. The design of the detector provides also high detection efficiency as well as maximum robustness against potential background which could fake the antineutrino signal. In consequence, the dimensions of the detector can be reduced without lowering its performances. The combination of Lithium-6 and high segmentation provides ways of imaging the composition of cores, unreachable with a traditional liquid scintillator.

A 20x20x20 cm3 prototype of the SoLid detector has been developed in order to validate the new technology and it takes data at BR2 reactor since August 2013. A larger scale demonstrator able to monitor the reactor in real time will be installed at mid 2015. First results from the prototype system as well as expected performance for the large system will be presented at this symposium.

Country or International Organization

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