AGA 2: Nuclear Safeguards

Time: Wednesday 17:00–18:00 Location: PTB HS HvHB

AGA 2.1 Wed 17:00 PTB HS HvHB

Antineutrino-based Safeguards for the Monitoring of Spent Nuclear Fuel — •Yan-Jie Schnellbach[1], Thomas Radermacher[1], Irmgard Niemeyer[2], Stefan Roth[1], and Malte Göttsche[1] — [1]Physics Institute III B, RWTH Aachen University, Aachen, Germany — [2]Forschungszentrum Jülich, Jülich, Germany

Spent nuclear fuel (SNF) is an inevitable by-product of nuclear power generation and must be safeguarded. These safeguards are also required during the operation of storage facilities, which is expected to continue for decades to centuries. Antineutrino emissions from the ongoing beta decay of fission fragments can provide a monitoring channel complementary to current safeguards techniques as antineutrinos pass unhindered through any surrounding shielding. This study investigates antineutrino detector concepts for monitoring SNF storage facilities, using Geant4-based detector simulations combined with the modelling of different storage sites configurations. The expected signal rate, sensitivity and directional capabilities of the concept detectors are investigated for different deployment scenarios and use cases, including general monitoring, reducing the burden on operators and inspectors or re-verification of specific casks. Several technological approaches, including liquid organic (LOr) time projection chambers (TPCs), will be compared to establish requirements for background levels, directionality, scalability and positioning. This ongoing work will determine the feasibility of antineutrino detectors as complementary safeguards for SNF facilities and highlight the strengths of the different technologies compared.

AGA 2.2 Wed 17:30 PTB HS HvHB

Digital Tools in Support of Safeguards and Verification Inspections — •Manuel Kreutle[1], Irmgard Niemeyer[1], and Alexander Glaser[2] — [1]Forschungszentrum Jülich, Germany — [2]Princeton University, USA

Safeguards inspections and potential nuclear disarmament verification inspections need thorough planning, long preparation periods and, given that possible errors might cause an interruption of the continuity of knowledge, happen under the risk of vast political consequences. Digital tools in the form of virtual reality (VR) applications or digital twins can support decision making and risk assessment before and during inspections through live data analysis and thus can help to mitigate the source of errors. They might further allow for remote access to inspected sites which otherwise would not be physically accessible due to conditions like danger, timeliness or political tension. In the context of nuclear disarmament, they could contribute to trust building between parties by disclosing (just the) agreed information to the inspecting party while protecting interests of the inspected party.

In this talk we will present a proof-of-concept VR tool for remote nuclear disarmament verification inspection developed at the Program on Science and Global Security at Princeton University as well as the ongoing work on a digital twin of an interim or final nuclear waste disposal sites for safeguard inspections executed at Forschungszentrum Jülich. Both projects will serve as a basis to discuss the benefits and limits of digital inspection tools.