AGA 4: Nuclear Archeology

Time: Thursday 11:45–12:45 Location: PTB HS HvHB

AGA 4.1 Thu 11:45 PTB HS HvHB

Applying Nuclear Archaeology to Reprocessing Waste in DPRK — •Johannes Bosse and Malte Göttsche — RWTH, Aachen, Deutschland

At some point, endeavors aimed at denuclearizing the Democratic People's Republic of Korea (DPRK) must confront the challenge posed by its stockpiles of fissile material. The available information on the historical and current operation of North Korea's fuel cycle is incomplete, making it challenging to establish a reliable and quantitative assessment without additional information. This knowledge gap could prove to be a significant hurdle in future verification efforts during disarmament initiatives.

To address this issue, inspectors could employ techniques derived from nuclear archaeology to gain valuable insights into DPRK*s historical fissile material production. My work demonstrates how the Bayesian approach to nuclear archaeology we develop in Aachen can leverage measurements of isotopic ratios of high-level reprocessing waste to extract meaningful information.

In this work, I simulate potential measurements and utilize them as evidence in a Bayesian nuclear archaeology model. A notable challenge arises from the fact that reprocessing waste from different batches of spent fuel is combined, making it non-trivial to deduce the operational history of the reactor. This study showcases how such an approach could enhance disarmament verification efforts in the DPRK and potentially in other regions.

AGA 4.2 Thu 12:15 PTB HS HvHB

Nuclear Archaeology with Reprocessing Waste: Discriminating Reactor Types — •Benjamin Jung and Malte Göttsche — Nukleare Verifikation und Abrüstung, RWTH Aachen

Sustainable nuclear disarmament requires a concept for accounting for the fissile material that would emerge from the dismantled warheads and the existing stockpiles of fissile material that are not currently under safeguards. Nuclear archaeology provides a toolkit with the potential to answer some of the questions that arise during related verification activities.

Previously, we have shown that a Bayesian inference framework can reconstruct reactor parameters such as fuel burnup and time since irradiation. Here, we present an extension of this framework to infer the source reactor type as well as several parameters of interest. This inference model discriminates between three reactor types (Magnox, PHWR, and PWR) and simultaneously reconstructs the fuel burnup, time since irradiation, initial enrichment, and average power density. We apply this model to a set of simulated test data and evaluate the performance by comparing the highest posterior density region with the ground truth. The model performs well on the test data, demonstrating that Bayesian inference can potentially extract information from samples of reprocessing waste even when the reactor of origin is unknown.