AGA 13: Warhead Dismantlement and Verification Technologies

Time: Thursday 17:00–18:00 Location: EMH 225

AGA 13.1 Thu 17:00 EMH 225

Plutonium characterisation with prompt high energy gamma-rays from (n,gamma) reactions for nuclear warhead dismantlement verification — •Frederik Postelt and Kirchner Gerald — Carl Friedrich von Weizsäcker-Centre for Science and Peace Research, Beim Schlump 83, 20144 Hamburg, Germany, Tel +49 40 42838 7286 Fax +49 40 42838 3052, http://www.znf.uni-hamburg.de

Measurements of neutron induced gammas allow the characterisation of fissile material (i.e. plutonium and uranium), despite self- and additional shielding. Most prompt gamma-rays from radiative neutron capture reactions in fissile material have energies between 3 and 6.5 MeV. Such high energy photons have a high penetrability and therefore minimise shielding and self-absorption effects. They are also isotope specific and therefore well suited to determine the isotopic composition of fissile material. As they are non-destructive, their application in dismantlement verification is desirable.

Disadvantages are low detector efficiencies at high gamma energies, as well as a high background of gammas which result from induced fission reactions in the fissile material, as well as delayed gammas from both, (n,f) and(n,gamma) reactions.

In this talk, simulations of (n,gamma) measurements and their implications are presented. Their potential for characterising fissile material is assessed and open questions are addressed.

AGA 13.2 Thu 17:30 EMH 225

Geant4 for Neutron Multiplicity Measurements Simulations — •Moritz Kütt — IANUS, Technische Universität Darmstadt

Neutron multiplicity measurements allow to estimate the mass of plutonium in a detector cavity for different applications. One future application is the verification of nuclear disarmament. Computer simulations are used to improve and test detector designs, to study a large range of use cases and, especially relevant for disarmament verification, possible ways to hamper or cheat specific systems.

Based on the Monte Carlo particle transport framework Geant4, an application to simulate multiplicity measurements of plutonium samples as an Open Source alternative to established codes has been developed. Although the main purpose of Geant4 has been detector simulations for high energy physics, it includes cross-sections and simulation capabilities for low-energy neutron reactions. A special source definition, a routine to estimate the rate of neutrons produced by (α, n) reactions and a special library to derive the plutonium mass from the pulse train of neutron detection events have been added. The code has been validated using data from a neutron multiplicity benchmark exercise.