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#04-126 CEA-JSI Experimental Benchmark for validation of the modelling of neutron and gamma-ray detection instrumentation used in the JSI TRIGA reactor

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Constant improvements of the computational power and methods as well as demands of precise and reliable measurements for reactor operation and safety require a continuous upgrade of the instrumentation. In particular, nuclear sensors used in nuclear fission reactors (research or power reactors) or in fusion facilities are operated under intense mixed neutron and gamma-ray fields, and need to be calibrated and modelled in order to provide selective and precise neutron and gamma-ray measurements.

With this aim in mind, the French Alternative Energies and Atomic Energy Commission (CEA) and "Jožef Stefan" Institute (JSI) have started an experimental program dedicated to the set up of a detailed experimental benchmark with analysis using Monte Carlo particle transport calculations and uncertainty evaluation for the main neutron and gamma-ray sensor types used in the JSI TRIGA (Training, Research, Isotopes, General Atomics) reactor. This benchmark should also provide recommendations for instrumentation modelling and analysis for mixed gamma-neutron fields.

CEA has setup a simplified TRIPOLI-4 (three-dimensional polykinetic code) modelling scheme of the JSI TRIGA reactor based on the information available in the International Reactor Physics Experiment Evaluation Project (IRPhEP) and International Criticality Safety Benchmark Evaluation Project (ICSBEP) benchmarks in order to simulate the sensor responses for neutrons and gamma-rays. These allow the CEA to perform a TRIPOLI-4 instrumentation calculation scheme taking into account the geometry of the sensor and of the irradiation device as well as the surrounding irradiation conditions.

This paper presents main results of this CEA calculation scheme application and the analysis of their comparison to the JSI results obtained with the Monte-Carlo N-Particle transport code (MCNP) –Evaluated Nuclear Data File B-VII.0 (ENDF/B-VII.0) - International Reactor Dosimetry and Fusion File (IRDFF) calculation scheme. This paper will conclude by giving some information on the second step of the experimental program consisting of a dedicated experimental campaign to be carried out in the following months in the TRIGA reactor core.

Primary authors: FAUSSER, Clément (CEA); Mr THIOLLAY, Nicolas (CEA)

Co-authors: Mr DESTOUCHES, Christophe (CEA); Dr BARBOT, Loic (CEA/DES/IRENE/DER/SPESI/LDCI); FOUR-MENTEL, Damien (CEA, DES, IRESNE, DER, SPESI, Cadarache F-13108 Saint-Paul-Lez-Durance, France); Dr GESLOT, Benoit (DES/IRENE/DER/SPESI/LP2E, CEA Cadarache, F-13108 Saint-Paul-Lez-Durance, France); DE IZARRA, Grégoire (Instrumentation Sensors and Dosimetry Laboratory); GRUEL, Adrien (CEA/DES/IRENE/DER/SPESI/LP2E); GREGOIRE, Gilles (CEA); DOMERGUE, Christophe (CEA); RADULOVIĆ, Vladimir (Jožef Stefan Institute); GORIČANEC, Tanja; AMBROŽIČ, Klemen (JSI); ŽEROVNIK, Gasper (JSI); LENGAR, Igor (JSI); TRKOV, Andrei (JSI); ŠTANČAR, Žiga (JSI); PUNGERČIČ, Anže (JSI); Dr SNOJ, Luka (Reactor Physics Division, Jožef Stefan Institute, Ljubljana, Slovenia)

Presenters: FAUSSER, Clément (CEA); Mr THIOLLAY, Nicolas (CEA); Mr DESTOUCHES, Christophe (CEA)

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