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Neutron dosimetry in Nuclear reactors

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summary of 'Neutron dosimetry in Nuclear Reactors'

One of the main objectives of reactor dosimetry is the determination of the physical parameters characterizing the neutron field in which test samples are irradiated.
These characteristics, from neutron spectrum to reaction rates characterization are used in experimental reactors to carry out the follow-up of the irradiation and to qualify the neutron calculation scheme used to model the experiment. In power reactors these characteristics are used for the follow-up of the predicted damages to vessel and interns.
Neutron parameters are derived from the dosimeter's activities which have suitable reactions (cross sections and radioactive emissions) using nuclear data, neutron computation results and data characterizing the conditions of irradiation (temporal and technological data, changes of location, etc.). Neutron spectra are derived using unfolding codes (CALMAR, STAY-SL,..).
The current CEA interpretation process is based on the use of the neutron calculation tools, for example, a full 3D Monte Carlo reactor modeling providing reaction in a point wise format and recent releases of the updated international nuclear data libraries, JEFF4, ENDF/B-VIII, JENDL4 for transport calculation and IRDFF-II for dosimetry libraries. In addition, uncertainties associated to the derived metrics are quantified in a rigorous way using simulation methods designed to cope with the high non-linearity of the process.

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Christophe DESTOUCHES (53 year old) is head of two R&D Projects dedicated to Instrumentation for Nuclear Reactors at the IRESNE Institute of the CEA, French Atomic Energy and alternative Energies Commissariat located at the CEA Cadarache center (France).
He started at the SILOE reactor facility (CEA-Grenoble center –France), at the associated Reactor Dosimetry Laboratory in charge of experimental irradiation device fluence evaluation, then in 1999 and until 2004, at the MASURCA reactor (CEA-Cadarache center / Experimental Physic Service –France), in charge of the realisation of the European experimental programme on ADS, MUSE 4. In parallel, he has continued his work on reactor dosimetry for the interpretation of the OSIRIS experiments and for the neutron induced embrittlement Survey Programme of the French PWR reactor vessels.
Since the beginning of 2011, he is head of a CEA nuclear instrumentation development project aiming at developing sensors and measurement techniques for the MTR experimental irradiation devices and critical mock-up reactor facilities (EOLE, MINERVE, MASURCA, OSIRIS and the future JHR). He also took the lead of a project dedicated to the innovative instrumentation for PWRs in 2020.
He is Senior Expert in Reactor Dosimetry and Instrumentation for nuclear reactors since 2014 and INSTN associated professor in Radiation-Matter Interactions since 2021.

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