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Decay-heat validation of simulations with 14 MeV neutrons for fusion

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Nuclear inventory simulations have a vital role to play in the planning and execution of future fusion experiments and power plants. They are able to predict the transmutation (burn-up) of materials and also quantify their radiological response, including decay heat, by tracing the production (and decay) rates of radioactive nuclides. This information can be used to plan maintenance schedules at nuclear facilities, satisfy nuclear regulators during reactor planning, and quantify the waste disposal needs during reactor decommissioning.

The validity of inventory simulations must be verified to give confidence in the predictions. Here we describe an important experimental benchmark of decay heat measurements that test the quality of nuclear code predictions with the FISPACT-II inventory code and nuclear data libraries. The fusion (14 MeV) decay-heat measurements performed at the Japanese FNS facility, combined with detailed assessment techniques, focussed on the complex breakdown of decay-heat contributions from individual radionuclides, have been employed to compare and test results from different international nuclear data libraries.

On-load nuclear heating is also important during fusion reactor operations and is an indirect measure of the damage energy experienced by materials. We highlight the difference between fusion and fission conditions in this respect, we raises questions about the usefulness of fission irradiations to test fusion materials responses.

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