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Decay Heat and Radionuclei inventory in ISIS TS1 target: measurements in tungsten core and tantalum cladding based on 2 different experimental methods and comparison with FLUKA predictions

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The TS1 spallation target operated at ISIS between 2014 and 2019 for the production of neutrons by high energy protons (700-800 MeV) is made of 12 tungsten plates cladded with tantalum and water-cooled. Residual radioactive nuclei can be produced in the target either as a direct product of the spallation process or as a result of secondary low energy neutron absorption.

This work presents the indirect measurement of the decay heat deposited in the tungsten core and tantalum cladding of each ISIS TS1 target plate, by using two different experimental approaches: the first one, for the tungsten core, is based on the temperature rise measurement by thermocouples located in the centre of each plate and the second one, applied to the tantalum cladding, is based on the gamma spectrometry measurements. The experimental assessed values have been compared with the Monte Carlo FLUKA-CERN predictions at different cooling times, showing a good agreement for both the tungsten core and the tantalum cladding. This benchmarking gives confidence in the FLUKA model we built to predict measurable physical quantities relevant for the engineering thermal design of the target/reflector and moderator (TRAM) assembly. In addition, it also provides indirect evidence of the accuracy of the simulated spallation physics and neutron interaction through all the TRAM assembly.

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