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Simulating neutron tracks in the new TS1-TRAM at ISIS with FLUKA code: some insights towards an optimised and more efficient target-moderator-reflector assembly for high power spallation sources

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In 2020 the ISIS Target Reflector and Moderator assembly (TRAM) at target station 1 (TS1) will be replaced with a new design incorporating lessons learnt from the design of the ISIS 2nd target station with a particular focus on maintainability. The new TRAM will be made up of a 10 plate Tantalum clad Tungsten target, 2 water moderators in the upper part,2 cryogenic moderators (liquid Methane and liquid Hydrogen respectively) in the lower part and a solid Beryllium reflector.

A detailed FLUKA model of the new TS1 TRAM at ISIS has been built and used to get both scientific and engineering relevant information, such as: neutron and other secondary particle production, energy deposition profile, particle fluence energy spectrum, decay heat, overall radionuclide inventory etc.
The comparison between the FLUKA predictions and the corresponding MCNPX simulations has been performed for several physical quantities (i.e. spatial profile of energy deposition in each TRAM region, decay heat, moderators brightness), showing a generally good agreement (within the statistical accuracy) with only few exceptions.
Exploiting an advanced use of the FLUKA code, it has been possible to track the TRAM escaping neutrons in such a way to assess quantitatively the contribution of the different target plates to the overall neutron leakage as well as the effective contribution of the water moderators to a couple of ISIS-TS1 instrument beam lines. The results of these calculations provide some useful hints that could help to address a more efficient design of the whole target-moderator-reflector assembly for high power spallation source.
A general overview of the work done will be given and the most relevant results will be discussed.

Poster back-up

Primary author: Dr QUINTIERI, Lina (Rutherford Appleton Laboratory-STFC-UKRI)

Co-author: STEVEN, Lilley (Rutherford Appleton Laboratory-STFC-UKRI)

Presenter: Dr QUINTIERI, Lina (Rutherford Appleton Laboratory-STFC-UKRI)

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