

Monte Carlo-Driven Analysis of Key Nuclear Parameters in Target Design for Optimised Neutron Yield: Insights from ISIS-TS1 and Notional Design Evaluation

Tuesday, 29 October 2024 11:00 (25 minutes)

The nuclear and engineering design of the target is critical for optimizing the performance and efficiency of neutron sources. This study presents a Monte Carlo-driven analysis, conducted with the FLUKA code, of the currently operating ISIS-TS1 target and several derived notional designs. The analysis aims to quantify the impact of key nuclear parameters—such as proton range and the neutron absorption cross sections of the coolant and target vessel—on the effective neutron yield. The study also investigates the significance of the coupling between the reflector and target on overall system performance. This analysis provides insights into the relationship between some selected target design parameters and the neutron yield, uncovering important lessons that can help to better address future design efforts. A clear understanding of the role of some nuclear parameters, and how this role is influenced by coupling with the reflector, could be particularly relevant for future programmes focused on developing more efficient neutron source concepts. The findings of this analysis can contribute to a better understanding of the effective impact of some nuclear parameters of the target design to the effective neutron leakage and underscore the importance of integrating advanced MC simulation tools early in the design process.

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Session Classification: Application of new materials data and/or safety codes, computational modelling/analysis

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