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Activation foil measurements at JET in preparation for D-T plasma operation

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In the frame of the JET3 Deuterium-Tritium (D-T) technology project within the EUROfusion Consortium program, several neutronics experiments are in preparation for the future high performance D-T campaign at the Joint European Torus (JET). The experiments will be conducted with the purpose to validate the neutronics codes and tools used in ITER, thus reducing the related uncertainties and the associated risks in the machine operations. One of the requirements for the implementation of successful benchmarks is the accurate measurement of neutron fluence during the irradiation phase. The development of measurement techniques for the accurate monitoring of neutron fluence in the device as well as in the surrounding areas is a crucial aspect with respect to neutronics code validation for shielding design, radiation protection and safety assessment. Among others, the foil activation technique is used at JET to evaluate neutron streaming in regions far from the plasma source and along large shielding penetrations as well as to provide an estimate of the neutron spectra to complement shutdown dose rate measurements.
In the present study, the neutron fluence measurements performed using activation foils during the JET Deuterium-Deuterium (D-D) campaigns are discussed. The activation foil results are compared against other experimental techniques and Monte Carlo simulations and a satisfactory agreement is observed. Moreover, the pre-analysis of the experiments to be performed in the forthcoming JET Tritium-Tritium (T-T) and Deuterium-Tritium (D-T) campaigns is presented. The results of the study provide important data for the implementation of experimental activities at JET and support the preparation in view of the planned D-T operation, allowing the exploitation of the unique 14 MeV neutron yields anticipated. Furthermore, they contribute to the validation of the tools employed in nuclear analyses, which are fundamental for the design and safety of ITER and future fusion power plants.

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