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P2.054 Calibration and test of the 6LiF-diamond detector for the HCPB mock-up experiment at JET

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Within EUROfusion WPJET3 programme, the unique 14 MeV neutron yields produced in the scheduled JET DT campaign will be exploited to validate codes, models, procedures and data currently used in ITER design in order to reduce the related uncertainties and the associated risks in the machine operation.
One relevant experiment selected for DT is the irradiation of the HCPB-TBM mock-up of ITER which will be located in front of the JET horizontal port of Octant-8. The objective is to take advantage of the significant 14 MeV neutron emission to produce a measurable quantity of tritium to validate tritium breeding predictions in a reactor-like environment. The neutronics performances of the HCPB-TBM will be measured through independent measurement techniques and the experimental quantities compared to the results of MCNP simulation. Of the main importance is thus the measurement of the tritium production rate in the HCPB-TBM. This will be attained by using a single crystal diamond detector (SCD) covered with a thin layer of 6LiF (LiDia detector). The tritium production is obtained by measuring the 6Li(n,α)T reaction rate. This technique was already proved to be effective, however it requires the accurate knowledge of the mass of 6Li.
In the present work the 6Li mass calibration of the selected LiDia detector was performed in a well characterized thermal neutron flux spectrum. Furthermore, a performance test of the LiDia detector was carried out by locating it inside a small polyethylene phantom which was irradiated under 14 MeV neutrons at the Frascati Neutron generator (FNG). The tritium produced by the 6Li(n,α)T reaction was measured. The experimental set-up was accurately simulated by using the MCNP6 code and the calculated tritium production compared to the experimental one. The paper reports the thermal calibration procedure as well as the results of the test experiment.

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