

# **In-vessel calibration of JET neutron diagnostics - results and experience gained during calibration of the neutron activation system**

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To determine the power produced in a fusion device, an accurate estimation of the neutron yield is necessary. It is a fundamental operational quantity and, being linked to plasma performance parameters, it is an important measure of fusion success. The neutron yield is also needed to support the operational safety case and is the prime input to operational and maintenance doses. In the JET tokamak, the neutron yield is measured by two systems. The first consists of three pairs of  $^{235}\text{U}/^{238}\text{U}$  fission chambers (KN1), located outside the tokamak in octants 2, 6, 8. The second is the activation system (KN2), which enables the irradiation of dosimetric foils at various irradiation ends located at the edge of the vacuum vessel. Due to the second Deuterium-Tritium Experimental Campaign (DTE2), which was performed in 2021 at the JET tokamak, these systems were absolutely calibrated in 2017. One of the most significant and novel challenges during the calibration process of various neutron diagnostics in the JET tokamak was the characterization and deployment of a 14 MeV neutron generator inside the JET vessel, to be used as the neutron calibration source. In order to use the neutron generator as the neutron calibration source detailed characterization work was required. This consisted of precise estimation of its neutron emissivity including angular, spectral, and temporal distributions. One of the methods used was a dosimetry foil activation method. The activation method enables the measurement of integrated neutron fluence, which can be used together with calculated correction factors to determine a time-integrated neutron emission value or flux rate. These integrated results may then be used as a normalizing factor for a real-time neutron detector to determine real-time emission rates.

During the talk, the experimental results related to the monitoring of NG emission with the activation method during the in-vessel calibration of the JET neutron diagnostics will be presented. The cross-calibration of 2 irradiation ends: KN2 3U and 6U will be discussed as well.