Contribution ID: **8** Type: **not specified**

Possibility study of the partial neutron calibration for neutron flux monitors in torus devices

Monday, 17 September 2018 11:00 (2 hours)

The absolute calibration of the detection efficiency for the total neutron yield in the whole plasma is one of the most important issues in the neutron diagnostics such a neutron flux monitor (NFM). In many magnetic confinement devises, those neutron detectors are calibrated by moving or rotating a neutron source such as a Cf-252 radioactive source or a compact neutron generator on the magnetic axis in the vacuum vessel. The in-situ calibration work needs a long time and a big effort. Therefore, we consider the possibility of the partial neutron calibration, where the neutron source is located in the vacuum vessel only near the detector or limited number of the toroidal positions, from the in-situ neutron calibration data of the Large Helical Devise (LHD), JT-60U and the other tokamaks. The partial calibration is very useful to estimate the detection efficiency prior to the full calibration, especially on ITER, and might be a final calibration instead of the full calibration. In the case of the NFM using a U-235 fission chamber located outside of the vacuum vessel on the equatorial plane, larger than 90% of the detector counts are contributed by neutrons in the toroidal angle range of -60°~ +60°. The detection efficiency for the neutron source located one toroidal position on the magnetic axis (called point efficiency) decreased exponentially with the absolute toroidal angle of the neutron source. We found that a partial calibration in the toroidal angle range of -60°~ +60° combined with exponential extrapolations to -180° and +180°can estimate total detection efficiency within 5% uncertainty. In the case of the point efficiency measurement at the limited number of the toroidal locations, typically 10-20 locations, the total detection efficiency for the whole plasma can be estimated within 5% uncertainty by the interpolation using the MCNP simulation result.

Co-authors: Prof. NISHITANI, Takeo (National Institute for Fusion Science); Dr OGAWA, Kunihiro (National Institute for Fusion Science); Dr ISOBE, Mitsutaka (SOKENDAI (The Graduate University for Advanced Studies)); Dr KAWASE, Hiroki (SOKENDAI (The Graduate University for Advanced Studies)); Dr PU, Neng (SOKENDAI (The Graduate University for Advanced Studies)); Dr SHINOHARA, Kouji (National Institute for Quantum and Radiological Science and Technology); Dr ISHIKAWA, Masao (National Institute for Quantum and Radiological Science and Technology); Dr KRASILNIKOV, Vitaly (ITER); Dr OSAKABE, Masaki (SOKENDAI (The Graduate University for Advanced Studies))

Presenter: Prof. NISHITANI, Takeo (National Institute for Fusion Science)

Session Classification: P1

Track Classification: Diagnostics