Contribution ID: **81** Type: **Short oral in replacement of poster**

Short_Oral_81: Present status of the conceptual study of the DEMO gamma-ray diagnostic

Monday, 6 September 2021 18:05 (10 minutes)

The future DEMO tokamak will be equipped with a multi-line of sight diagnostics which will operate as sensors to monitor and control the position and operation parameters of the DT plasma. Among the suite of sensors, an integrated neutron and gamma-ray diagnostic system is also studied to verify its capability and performance in detecting possible DEMO plasma position variations and contribute to the feedback system in maintaining DEMO DT plasma in stable conditions.
Specifically, this work describes the present status of the conceptual study of the gamma-ray diagnostic (Gamma-Ray Spectroscopic Instrument, GRSI) for DEMO reactor at the end of the first Work-Package contract 2015-2020.
The gamma-ray reaction of interest for DEMO DT plasma consists of D+T ⍰ 5He + ⍰ (16.63 MeV). Being the gamma-ray emission so energetic, it can be clearly detected above the neutron induced background. Depending on the geometry of the integrated neutron and gamma-ray diagnostic system, the GRSI can contribute to the neutron information on DEMO DT plasma position and assess independently and alternatively the DT fusion power with respect to the neutron emission. The characteristics of the GRSI to measure the16.63 MeV gamma-ray emission are reported in this presentation, along with the results of optimization studies conducted with GENESIS and MCNP simulation codes. In particular, the following arguments will be addressed: i) the cross section of the named reaction and how it compares with other gamma-ray reactions in DEMO plasma; ii) the assessment of dimensions and characteristics of the detector of choice for the present application, i.e., Cerium-doped Lanthanum Bromide scintillating crystals; iii) the assessment of the neutron-induced gamma-ray background and use of suitable (neutron) attenuators like lithium hydride and instrument shielding; iv) the assessment of the integration of the gamma-rays and neutron detectors along multiple lines-of-sight both vertical and horizontal according to different geometry to match the DEMO position monitoring and control requirements.
The further phases of the neutron and GRSI design and integration are also discussed.

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