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Gamma-Ray Spectrometer in the ITER NPA System

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Gamma-ray Spectrometer (GRS) is as a part of the diagnostic system built around neutral particle analyzer (NPA). Viewing the same plasma area in the equatorial plane as the rest components of the system, GRS can significantly improve its diagnostic abilities.
Line integrated diagnostic of gamma-ray emission over this area can support NPA data on the following key ITER measurements (parameters) [1]:
• 11: Fuel ratio in plasma core (020: n_d/n_t core);
• 28: Ion temperature profile (064: Core T_i);
• 30: Confined alphas and fast ions (069: Alpha Energy Spectrum)
with time resolution of up to 100 ms each. Also detailed data on fast ions velocity distribution functions and some other parameters not mentioned in [1] can be obtained. Finally, application of GRS in NPA system could support tomographic measurements provided by Vertical and Radial Gamma ray Spectrometers.
GRS consists of high resolution germanium (HPGe) and scintillation LaBr_3 detectors installed inside a neutron dump of NPA system. Direct neutron fluxes suppressed with LiH attenuator. This report is dedicated to the latest developments of the gamma ray diagnostic techniques. Monte Carlo calculations of neutron and gamma-ray fluxes in EQ11 Port Cell and in the places of allocation of gamma-detectors have been carried out. Gamma and neutrons emissions in the tokamak for different scenario were modelled and spectra calculated. Latest diagnostic justification and development results also includes new processing codes implementations which are capable of real-time processing of LaBr_3 signal with count-rates up to 10^7 1/s, tritium production in LiH attenuator studies and others –to be discussed in details in the report.

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[1] Costley, A.E., et al. SRD-55, 2012.

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