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ITR/P5-39: ITER High Resolution Gamma Spectrometry

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Gamma- ray spectrometric systems on tokamaks provide means for fast ions and runaway electrons diagnostics. High resolution of HPGe detectors allows registering shapes of gamma lines. Analysis of Doppler broadened lineshapes (LS) can be used for obtaining parameters of fast ions distribution functions (DF) as it was proved in JET experiments [1, 2]. Recent progress in ITER diagnostics development includes adding to the NPA (neutral particles analyzer) project the high resolution gamma- detector (HRGD). Common viewable volume of plasma makes joint analysis of diagnostics data notably more convenient. Indeed, information on lines intensities can be used for deducing the relative plasma components densities, particularly D/T ratio – which is one of the main tasks for NPA. High resolution of the HRGD allows obtaining anisotropy parameters of DF, which are complimentary to NPA data on distribution of perpendicular to magnetic field component of particles speeds. Even more complete data can be obtained using gamma- and neutron- tomography under development for ITER.
At the moment conceptual design of the new NPA diagnostic complex is under development. Using MCNP calculations 1) feasibility of the concept demonstrated, 2) parameters of the shield and _6LiH attenuator to be placed in front of detector formulated and 3) estimated expected detector loads and neutron and gamma fields in diagnostic room and behind it. Monte-Carlo codes are developed and under further improvement for establishing connection between DFs and LSs. Additional semi- analytical models suggested for corresponding data cross- checking. Finally, application of different signal processing techniques including deconvolution and trapezoidal codes have been analyzed. Mentioned techniques were found being able to ensure higher detection efficiency (up to 10ˆ6 counts/sec) than available stock solutions.

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