Contribution ID: **646** Type: **not specified**

P2.074 Performance estimations for the ITER bolometer diagnostic

Tuesday, 18 September 2018 11:00 (2 hours)

The ITER bolometer diagnostic shall provide the measurement of the total radiation emitted from the plasma, a part of the overall energy balance. Up to 550 lines-of-sight (LOS) will be installed in ITER observing the whole plasma from many different angles to enable reliable measurements and tomographic reconstructions of the spatially resolved radiation profile. The performance of the diagnostic is intimately linked to the constraints imposed by the design requirements, the sensor and data acquisition design, as well as expected noise levels.

The results presented contain the estimated signal intensities for the current design and integration of bolometer cameras in ITER, based on the simulated radiation profile for the ITER standard scenario (DT-plasma at 15 MA, 500 MW with low impurity content). The corresponding power deposited onto the absorber ranges between 0.1 μW and 0.1 W. The expected noise levels are derived mainly from requirements imposed on the signal cables, varying absorber thickness and comparisons to operating bolometer systems. Results lead to estimated values for ITER in the order of 1 μW giving a signal-to-noise ratio (SNR) which clearly indicates a need for optimizing the diagnostic.

The optimization potential is discussed. Considering the current design and installation tolerances, cameras for which collimator and pinhole parameters can be adapted to increase the light yield are identified. Most LOS with SNR<1 view the plasma edge where lower photon energies dominate. Thus, another option to increase the SNR is to investigate the potential for different absorber thicknesses as experiments demonstrated that thicker absorbers have typically higher noise levels than thinner ones. The conclusions will give recommendations for revised camera parameters to improve the light yield as well as identifying those for which an optimized absorber thickness is desirable.

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Session Classification: P2