

MonPE07

Analysis of diagnostic calorimeter data by the transfer function technique

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The ITER project requires additional heating provided by two injectors of neutral beams resulting from the neutralization of accelerated negative ions. To study and optimise negative ion production, the SPIDER test facility (particle energy 100keV; beam current 50A) is under construction in Padova, with the aim of testing beam characteristics and to verify the source proper operation. The SPIDER beam will be characterized by the instrumented calorimeter STRIKE, whose main components are unidirectional carbon composite tiles. Some prototype tiles have been employed as a small-scale version of STRIKE (mini-STRIKE) to test the effectiveness of the beam diagnostic.

This contribution describes the analysis procedure applied to the thermal measurements on the rear side of the tiles with the purpose of reconstructing the energy flux due to the negative ion beam colliding on the front side. The method is based on the transfer function technique and allows a fast analysis by means of the FFT algorithm.

The efficacy of the method has been tested both on simulated and measured mini-STRIKE temperature profiles: in all cases the energy flux features are well reproduced and beamlets are well resolved; limits and restrictions of the method are also discussed, providing strategies to handle issues related to signal noise and digital processing.

This work was set up in collaboration and financial support of F4E.