Validation of a real-time model-based approach for ITER first wall heat flux control on the TCV tokamak

H. Anand[1], R. A. Pitts[1], J. A. Snipes[1], P. C. De Vries[1], L. Kos[3], L. Zabeo[1] ,Y. Gribov[1], S. Coda[2], C. Galperti[2], M. Brank[3], and G. Simic[3]

[1] *ITER Organization, Route de Vinon-sur-Verdon, CS 90 046, 13067 St.-Paul-lez-Durance Cedex, France*

[2] *Ecole Polytechnique Fédérale de Lausanne (EPFL), SPC, CH-1015 Lausanne, Switzerland*

[3] *University of Ljubljana, Aškerčeva 6, 1000 Ljubljana, Slovenia*

A real-time (RT) first wall (FW) heat load control system will be required at a very early stage of ITER plasma operations. The long pulse nature of the device imposes active cooling of all plasma-facing components (PFCs) and thus strict control of surface power flux density at all times. A 2-D physics-based and control oriented heat flux estimation model, based on real time (RT) equilibrium reconstruction has already been successfully implemented into the ITER Plasma Control System Simulation platform (PCSSP). However, an additional module accounting for 3-D geometrical structure of the FW panels is essential to estimate a more realistic value of true heat flux on the plasma facing components. The evaluation of an improved RT approach to first wall heat flux control accounting for shaping of the FW panels on the TCV tokamak will be reported. For a given magnetic equilibrium, the integration of the 3-D effect into the algorithm is performed by offline determination of the heat load distribution on the inner FW panels of the TCV tokamak using a new utility, SMITER GUI, developed at the ITER Organization. A comparison of surface power flux density with the infra-red measurements of the TCV central column tiles is also presented. The associated weights with respect to the position in the poloidal plane and magnitudes of the peak heat flux are extracted for implementation into the 2-D approach. The implementation and experimental performance of the new improved RT model based approach on the TCV digital control system will be reported.