Heat and particle transport simulation in COMPASS and T-10 with Canonical Profile Transport Model

A.V. Danilov[1], Yu.N. Dnestrovskij[1], A.V. Melnikov[1], S.V. Cherkasov[1], L.G. Eliseev[1], A.Yu. Dnestrovskij[1], S.E. Lysenko[1], G.F. Subbotin[1], V.A. Vershkov[1], J. Havlíček [2], J. Urban[2], J. Stöckel[2], P. Bílková[2], P. Böhm[2], M. Šos[2], M. Hron[2], M. Komm[2], R. Pánek[2]

[1]*NRC 'Kurchatov Institute', 123182 Kurchatov Sq. 1, Moscow, Russia*

[2]*Institute of Plasma Physics of the CAS, 18200 Prague 8, Czech Republic*

The remarkable property of tokamak plasma to maintain the shape of some parameters profiles (e.g. the electron pressure, electron temperature, toroidal rotation velocity) under different external influences has been discussed since early eighties [1, 2]. This effect is considered as manifestation of plasma self-organization and corresponding normalized profiles are called as stiff. The quantitative measure of the profiles stiffness appeared as a factor standing in front of the difference between the normalized gradient of temperature (or pressure) and the critical gradient in expressions for heat or particle fluxes in the Canonical Profile Transport Model (CPTM) [3].

The report presents the CPTM simulation results using the ASTRA code for L-mode plasmas of the circular limiter tokamak T-10 and D-shaped diverted plasmas of COMPASS. On top of that, Ohmic and NBI heated H-mode in COMPASS was modeled. The H-mode simulation was performed by means of "forgetting factors", suppressing heat and particle fluxes, caused by profile stiffness, inside the edge transport barrier [4]. Modeled electron temperature and density profiles are consistent with the measured ones with RMS deviations within the range of experimental accuracy: 10-15%.

Calculations demonstrate quite similar density profiles for Ohmic and NBI heated H-mode plasmas in COMPASS and higher electron temperature pedestal for NBI heated H-mode in agreement with measurements. The results of L-mode simulation in COMPASS were compared with those obtained for T-10. For both tokamaks the simulation results met measurements, but stiffness coefficients in the particle transport equation for T-10 proved to be about two times less than these for COMPASS.

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