Verification of the TGLF implementation in the JETTO integrated transport modelling tool

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This paper reports on the verification effort of the new version of the JETTO [1,2] integrated transport equation solver including the Trapped-Gyro-Landau-Fluid (TGLF) [3] first-principle based anomalous transport model. The major development steps required for incorporating TGLF in the transport solver are briefly outlined. These are the extension of the Transport Code Interface (TCI) with a TGLF specific add-on, and the parallelization of JETTO with Message Passing Interface (MPI) in order to reduce simulation times to a practically acceptable level. It is shown that over 90% efficiency is achieved with a simple parallelization scheme when running JETTO-TGLF on 20 processors on the JET Analysis Cluster (JAC). Simulations with JETTO-TGLF appear to be sensitive to input gradients and prone to numerical instabilities. The methods applied to stabilise simulations are outlined and compared, showing that an upper limit in the diffusivities is typically necessary to prevent significant time-step degradation.
The code is compared against simulations with TGYRO [4], the Predictive Transp (PT) solver [5] and CRONOS [6], all using TGLF for computing the anomalous transport coefficients. The comparisons include a JET carbon-wall L-mode discharge (68733) and a high density hybrid shot (77922) already analysed with PT-solver and/or CRONOS. Two additional JET L-mode discharges (73221, 73224) are analysed with TGYRO and JETTO, and an investigation of why both codes consistently overpredict the main plasma profiles is presented.
Transport analysis of the ITER-like-wall (ILW) JET hybrid pulses and the assessment of the electromagnetic and fast-ion effects on turbulent transport quenching are the main objectives of this project. Initial simulations of short MHD quiescent periods in JET shots 84542 and 84545 exploring these effects are presented.

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