

Validation of modelling of JT-60SA tokamak scenarios with METIS code

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The integrated modeling code METIS [1] is a faster than real-time scenario simulation suite which can be applied to a significant variety of plasma modelling activities due to its comprehensive list of physical models. It allows analyses of current diffusion and heat and particle transport and sources including W.

Recently, in the framework of the construction of JT-60SA, it has been adapted for JT-60SA scenario preparation and development. We have used METIS to optimize the scenario development of JT-60SA [2] especially during the ramp-up phase, with the aim of saving flux consumption, which is a key point to achieve longer duration discharges (the available poloidal flux is limited due to the maximum current allowed in central solenoid coils) [3,4]. We present here the activity of validation and some studies of scenario optimization developed for JT-60SA.

The activity of validation has consisted, firstly, in a benchmark of METIS results against CRONOS simulations of JT-60SA scenario based on models tuned on JET and JT-60U experiments [5]. For this benchmark, METIS parametrisation has been kept as close as possible to that used for JT-60SA scenario development. Results display a good agreement between METIS and CRONOS (the much more sophisticated modelling suite), although some discrepancies appear for high beta scenarios. The second part of the validation has consisted of studies of the capability of METIS to simulate ramp-up of selected JET experiments. This study allowed highlighting the capacity of METIS to simulate the ramp-up of a device with similar size to JT-60SA. Comparisons between METIS predictions and experiments show good agreement, even if some limitations appear. Differences appear, in particular, in kinetic profile predictions.

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[1] METIS: A FAST INTEGRATED TOKAMAK MODELLING TOOL FOR SCENARIO DESIGN, J-F Artaud et al, submitted to Nuclear Fusion

[2] JT-60SA Research Plan, Research Objectives and Strategy, Version 3.3, 2016, March: JT-60SA Research Unit (http://www.jt60sa.org/pdfs/JT-60SA_Res_Plan.pdf)

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