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LATEST RESULTS FROM THE ITER H-MODE CONFINEMENT AND THRESHOLD DATA BASES

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The ITER H-mode Confinement Database and the ITER H-mode Power Threshold Database have both changed significantly since the last IAEA meeting in Montreal 1996 [2]. In this paper the progress with the analysis of the 2 databases will be reported starting with the H-mode Power Threshold analysis.

The ITER H-mode Threshold Database presently includes 10 divertor tokamaks: Alcator C-Mod, ASDEX, ASDEX Upgrade, COMPASS-D, DIII-D, JET, JFT-2M, JT-60U, PBX-M and TCV. The best log-linear regression models for the threshold power obtained from this database include either major and minor radius or the plasma surface area. The 95% interval for the predicted power threshold in ITER is 50 - 170 MW [1]. This extrapolation to ITER is based on threshold data obtained under operating conditions which are known to give the lowest threshold on each tokamak such as a Single Null configuration with favourable ion gradB drift, high divertor retention and low recycling wall conditions providing low neutral density. The Root Mean Square Error (RMSE) is typical 28% for the log-linear fits. The relatively large value of RMSE is caused by data scattering that differs in character from device to device and this will be discussed in the paper. The recent experiments with tritium in JET indicate that the power threshold is inversely proportional to the effective plasma mass. This reduces the above predicted power threshold in ITER by about 20% in D-T operation. It also opens up the possibility for ITER to first reach the H-mode in pure tritium to take advantage of the lower threshold and then add the necessary deuterium. The latest results of standard regression techniques [1,3] as well as those using more advanced techniques [4] such as discriminant analysis will be presented. The progress with the analysis of local edge parameters will also be reported.

The ITER H-mode Confinement Database presently includes 11 divertor tokamaks: Alcator C-Mod, ASDEX, ASDEX Upgrade, COMPASS-D, DIII-D, JET, JFT-2M, JT-60U, PDX, PBX-M and TCV as well as 2 limiter tokamaks: TEXTOR and TFTR. The new ELMy H-mode standard dataset [1] is significantly better conditioned than the previous version [2]. Not only is the database mean of each of the engineering parameters closer to the ITER parameters, but the ranges in R, n, I, P and B are larger.

The distance between the centre of gravity of the new standard dataset to ITER in units of a standard ellipse to the data has improved by a factor of 1.8. This implies that the uncertainty in the ITER prediction using log-linear scalings is reduced. The new ELMy H-mode standard dataset provides the basis for a robust confinement prediction for ITER. Even substantial perturbations to the dataset, such as removing each tokamak in turn, systematically increasing or decreasing the confinement of each tokamak in turn by 10%, the application of equal tokamak weighting as contrasted with equal weighting of observations, and the use of various forms of open/closed divertor corrections to the ASDEX and/or PDX data, do not change the prediction considerably. In only a few cases do the ITER predictions differ by as much as 20%. Moreover, in contrast to previously, the new ELMy H-mode standard dataset admits a log-linear scaling that satisfies the high-β constraint. Based on this database the 95% log-linear interval estimate for the confinement time of ITER is 4.4 - 6.8 s. However, it is found that the 95% log-nonlinear interval is 3.5 - 8 s [1]. Details of how the interval estimates have been established will be given.

The latest results on the uncertainties in the exponents of the physics variables in the ELMy confinement scaling [5] will also be presented and the influence of the recent isotope data from JET on the ITER prediction will be discussed.

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