ENERGY CONFINEMENT SCALING WITH MACHINE SIZE IN THE UPDATED ITPA GLOBAL H-MODE CONFINEMENT DATABASE

J. HALL, G. VERDOOLAEGE
Department of Applied Physics
Ghent University
Ghent, Belgium
Email: Joseph.Hall@ugent.be,

P. ZHANG
Department of Physical Sciences
Nankai University
Tianjin, China

Abstract

The well-known IPB98 scaling law for the energy confinement in tokamak H-mode plasmas has recently been revised[1]. A considerably larger data set was used for estimating the scaling, including data from devices with fully metallic walls (JET and ASDEX Upgrade). In order to facilitate comparison with IPB98, the new scaling was estimated using a simple power law model. Like its predecessor, the new ITPA20-IL scaling can be used as a benchmark for experiments, for setting boundary conditions in modelling codes and for extrapolation to ITER-like devices. Particular attention was paid to establishing practically useful uncertainty estimates on the scaling parameters and predictions, in order to account for model uncertainty. Considering these error estimates, the dependence of the confinement time on several predictor variables turns out to be rather weak. Nevertheless, one key difference with the '98 scaling is the significantly weaker dependence on machine size, from quadratic to slightly stronger than linear. The present work is aimed at clarifying the cause for this weaker size scaling. To do this, the influence on the size scaling is investigated by analysing the data points that were added to the most recent iteration of the database. In particular, we explore the effect specific regions of the operational space have on the scaling.

[1] G. Verdoolaege, et al, Nucl. Fusion 61, 076006, 2021. https://doi.org/10.1088/1741-4326/abdb91