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Statistical analysis of Plasma Shape Influence on the Power Threshold to access the H-mode

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Various empirical models are available to determine the power threshold between the L and H mode of confinement. They are typically the results of regression analysis of the data collected in different machines and they are presented in terms of equations in power law monomial form. Even if the positive effects of the plasma shape on the confinement time have been clearly documented, the dependence of the L-H power threshold on elongation and triangularity is still an aspect no completely clarified. In this paper, linear and nonlinear regression are applied to the ITPA database to determine the empirical scaling laws to access the H mode. The dependence on elongation and triangularity is first formulated as a hypothesis testing problem for each individual device. Once determined on which machines there is evidence for this dependence to be statistically significant, various model selection techniques have been applied, to determine the most likely values of the exponents for elongation and triangularity. The main results of this analysis is that the dependence on elongation and triangularity is different for individual machines, which questions the statistical relevance of building multi-machine databases to extract a general scaling laws for these two variables.

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