EX/C2-1 · Tolerable ELMs in Conventional and Advanced Scenarios at ASDEX Upgrade

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Abstract: Recent ASDEX Upgrade experiments integrated benign type II ELMs (tolerable peak heat loads on target plates) with high performance. In both conventional and advanced H-modes, the operation window with type II ELMs was extended towards $q_{95} > 3.5$ in close to double null configurations at sufficient high edge pedestal density above 50% of the Greenwald density. Type I ELMs are suppressed at almost constant pedestal parameters presumably due to a change in edge stability provided by higher edge magnetic shear, and at the same confinement level. Since conventional reactor designs are optimised at q_{95} around 3 operation with type II ELMs has to compensate the required higher q-value by advanced performance. This was achieved in advanced H-mode scenarios integrating high $\beta_N > 3.5$, improved confinement via density peaking ($H_{98-P} = 1.3$), and densities of 90% of Greenwald density with type II ELMs. Another way to mitigate ELMs is active type I ELM control by means of hydrogen or impurity injection. Using small hydrogen pellets we demonstrated an enhancement of the ELM frequency to almost the pellet rate of 20 Hz and a considerable reduction of the energy loss/ELM by more than a factor of 3.

EX/C2-2 · Achievement of a High Fusion Triple Product and Steady State Sustainment in High-β_p ELMy H-mode Discharges in JT-60U

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Abstract: This paper reports results on the progress in steady-state high-β_p ELMy H-mode discharges in JT-60U. We have obtained the following results: (i) A fusion triple product $n\tau T$ of $3.0 \times 10^{20} m^{-3} \cdot s \cdot keV$ under full non-inductive current drive has been achieved. This result renews the record value of a fusion triple product under full non-inductive current drive by 50%; (ii) A high-beta plasma with $\beta_N \sim 2.7$ has been sustained for 7.4s ($\sim$60 times energy confinement time (τ_E)), where the duration is determined only by the facility limit such as capacity of power supply and upper limit of injection duration of neutral beams; (iii) A higher-beta plasma with $\beta_N \sim 3.05$ has been sustained for $\sim 5\tau_E$; (iv) Destabilization of neoclassical tearing modes has been avoided with good reproducibility through the optimization of current and pressure profiles.

EX/C2-3 · Correlation of H-mode Density Barrier Width and Neutral Penetration Length

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Abstract: Pedestal studies in DIII-D find a good correlation between the width of the H-mode particle barrier width(ne) and the neutral penetration length. These results are obtained by comparing experimental n_e profiles to the predictions of an analytic model for the density profile, obtained from a solution of the particle continuity equations for electrons and deuterium atoms. Initial bench-marking shows that the model is consistent with the fluid neutrals model of the UEDGE code. In its range of validity (edge temperature between 0.02 – 0.3 keV), the model quantitatively predicts the observed values of width(ne), the observed decrease of width(ne) as the pedestal density $n_{e,ped}$ increases, the observed increase of the gradient of n_e with the square of $n_{e,ped}$, and the observation that L-mode and H-mode profiles with the same $n_{e,ped}$ have very similar widths. In the model, width(ne) depends on the fuelling source and on the plasma transport. Thus, these results provide evidence that the width of the particle barrier depends on both plasma physics and atomic physics. *Work supported by U.S. DOE under Contracts DE-AC03-99ER55463, W-7405-ENG-48, and DE-AC05-00OR22725.