Assessment of Operational Space for Long-pulse Scenarios in ITER

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- Long-pulse operation Δt_{burn} ~ 1000 s with Q ≥ 5 is foreseen in the ITER baseline to demonstrate high neutron fluence scenarios which can be used for the qualification of nuclear technology and for the TBM. In this study we address the viability of achieving ITER's long-pulse scenario goal for plasmas without the improved core confinement in the current-density (I_p-n) operational space (OS). In contrast to other studies we take into account predictions of the pedestal parameters by EPED1 consistent with predicted by SOLPS boundary conditions.

- The EPED1 with SOLPS boundary conditions predicts no reduction of pedestal pressure for lower pedestal density in contrast to standard EPED1.

- For I_p = 15 MA reduction of density, n/n_{GW}~0.5 increases the burn time Δt_{burn} ~ 1000 s with Q ~ 5, neutron fluence, $F/F_{baseline}$ ~ 1 due to increase of temperature w/o core confinement improvement or special shaping of current profile.

-Transition from standard EPED1 to EPED1+SOLPS has no effect on baseline case at high density, n/n_{GW}~1, has small effect for scaling-based models, but strongly improves plasma performance for stiff core transport at low densities, n~7-5 10^{19} m^{-3}.

- Core fuelling and access to the H-mode are easier with the density reduction

- The screening of W in the pedestal and the limit of the tungsten concentration acceptable for H-mode increase. Sensitivity studies for peaked density profiles and stiff models are in progress

-Thus, these reduced density high current H-mode plasma scenarios look attractive to achieve long pulse Q ≥ 5 operation in ITER and deserve further analysis and experimental demonstration in present tokamaks.