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Assessment of the Baseline Scenario at q95˜3 for ITER

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In the last two years the Integrated Operation Scenarios Topical Group (IOS-TG) of the ITPA IOS-TG has combined results of joint experiments with other data available at q95˜3 in a database of global parameters with ˜3300 entries of stationary discharges from AUG, C-Mod, DIII-D, JET and JT-60U for both carbon wall and metal wall experiments. The analyses focus on discharges that are stationary for ≥5 energy confinement times.
Compared to carbon wall data, experiments with metal walls (AUG, JET-ILW, and C-Mod) have (so-far) not found a way to access the low collision frequencies (as defined in [1]). No difference in performance is observed between carbon wall and metal wall discharges at high collisionality. Stationary discharges at q95˜3 and H98(y,2)˜1.0 are typically obtained at βN˜2.0, using pre-dominantly co-current NBI heating (AUG, DIII-D and JET). In experiments using a metal walls in AUG, C-Mod H-mode and JET, the confinement is significantly reduced (H98(y,2)˜0.8-0.9) at βN≤1.8. The figure of merit G ≡ H89x⊠N/q952 should be 0.42 for Q=10 in ITER (note H89 is used here). For carbon wall data, G spans a range of 0.25 to 0.51 at the ITER reference beta of ⊠N=1.8, while for data obtained with metal walls G varies from 0.23 to 0.36. More specifically, G>0.4 has only been obtained at ⊠N>2.5 for metal devices operating at q95˜3, using dominant co-current NBI heating (AUG and JET). The ITER requirement for operation at fGW=0.85 can be obtained for triangularities (separatrix) in the range 0.2 to 0.45; an issue for ITER is that at the design value ⊠x=0.49 or higher, DIII-D and C-mod (metal wall) have no data for fGW > 0.8 and H98(y,2) > 0.95.

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[1] T.C. Luce, et al, Nucl. Fusion 54 (2014) 013015.

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