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EX/P2-03: Overview of ASDEX Upgrade 'Improved H-mode' Scenario Developments

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'Improved H-mode' discharges in ASDEX Upgrade (AUG) are characterized by enhanced confinement factors, high beta and a q-profile with almost zero shear in the core of the plasma at q(0) around 1.
First attempts to reach high performance in the all-tungsten AUG relied on the observation that energy confinement was most improved when nitrogen (N) was puffed. In such plasmas the achieved confinement factors H_98 turned out to be as good as, or even better than, the values obtained in the carbon dominated AUG when discharges at the same values of F_GW are compared. The improved confinement of N seeded discharges is an effect of higher pedestal temperatures which extend to the plasma core via profile stiffness. Further developments of the N seeded scenario aim to extend the duration of the high performance phase to a few seconds and also to increase the triangulatity. The latter step helps to extend the operational window towards higher F_GW values.
By introducing the so called current over-shoot technique significantly improved confinement with H_98 around 1.3 was reached in the carbon walled era at JET. This technique has now been applied to the all-W AUG where 'improved H-modes' with beta_N of 4 and H-factors of 2.5 have been produced transiently. The scenario at AUG uses a fast plasma current ramp up to 1.2 MA with NBI heating starting with the X-point formation and ending at the time of maximum I_p. Then an ohmic phase with a current ramp down to 1 MA modifies the edge part of the q-profile. In the consecutive heating power ramp to about 10 MW many parameters, e.g. stored energy and electron density, but also the radiation, increase strongly. The most stable pulses so far utilise also on-axis ECRH for impurity control and off-axis ECCD to stabilise an occurring (2,1) mode in the periphery of the plasma. With small modifications (gas puff rate, timing of pre-heat in I_p ramp-up) and in particular with less aggressive heating the stability and duration of the high performance phase has been extended.
This paper will deal with the present status of AUG plasma operation of 'improved H-Mode' scenarios at optimized performance reporting on improvements of the nitrogen seeded as well as the current overshoot scenario. For the latter experimental results will be accompanied by TGLF calculations.

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