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EX/1-4: Dominant ECR Heating of H-mode Plasmas on ASDEX Upgrade Using the Upgraded ECRH System and Comparison to Dominat NBI or ICR Heating

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In contrast to ITER and future fusion reactors, plasmas used today for preparational or fundamental studies are often heated dominantly via the ion channel and with strong concurrent momentum input. This is due to the dominance of NBI heating systems, which are widely used because of their reliability and universal applicability. The potential danger of this approach is an over-estimation of the scaled fusion performace, which depends on T_i and not T_e, but the ratio of these temperatures may depend on the heating mix. Even worse, an increasing value of T_e/T_i is expected to increase the ITG dominated turbulent transport in the ion channel reducing T_i further. Additionally, the significantly reduced torque of future NBI-systems may increase transport due to a reduction of rotational shear.

To clarify above mentioned uncertainties it is important to study the effect of dominant electron heating with a minimum of momentum input. At ASDEX Upgrade such studies have been started using the upgraded ECRH system which delivers 4 MW of ECRH to the plasma, exceeding the minimum H-mode power threshold for typical high I_p, B_t conditions by a factor of two. Additionally, 6 MW of ICRH and 20 MW of NBI are installed at AUG. This contribution reports on the upgrade of the ECRH system and its application in studying H-mode plasmas in which the heating mix between the three available systems is varied while keeping the total heating power constant. This was done for several different levels of total heating powers.

Kinetic profiles (n,T,v,E) are measured using the recently upgraded suite of diagnostics in the core and, with high spatial resolution, in the pedestal region. Transport analysis and comparisons to predictions based on stability of drift modes (GS2) are presented. The major findings are: no effect of the heating mix on pedestal pressure although plasma rotation varies significantly, no direct correlation of the rotational shear with the shape of density or temperature profiles, and a significant increase of T_e/T_i as the fraction of electron heating exceeds a certain threshold. The cases analysed so far were all at high collisionality. These studies will be continued towards higher heating powers and lower collisionality.

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