Comparing diamagnetic flux measurements and TRANSP simulations
on ASDEX Upgrade

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The diamagnetic flux is the small difference in total toroidal flux with plasma and without plasma. The diamagnetic flux measurement on ASDEX Upgrade [1] is compared to that predicted by TRANSP simulations in different heating scenarios in the ASDEX Upgrade tokamak. In discharges with predominant ICRH heating, the diamagnetic plasma energy is 10% greater than the plasma energy calculated from the magnetic equilibrium. Predictions of the diamagnetic flux from TRANSP simulations with varying anomalous fast ion diffusion coefficient were calculated. The best agreement of the predicted and measured diamagnetic flux is found when no anomalous diffusion of fast ions is assumed.

The demonstration of steady-state plasmas, where the plasma current will be sustained by electron cyclotron and neutral beam current drive, is the goal of a number of supporting experiments for ITER. Deuterium 93 keV neutral beam and electron cyclotron current drive are two means of sustaining a steady state current in ASDEX Upgrade [2]. In these non-inductive discharges, the diamagnetic flux predicted by TRANSP is 3 mWb more negative than the diamagnetic flux measurement in the phase with maximum neutral beam current drive. The reduction in plasma energy due to fast ion losses caused by neoclassical tearing modes or Alfvén modes or an overestimate of deposited neutral beam power are possible explanations for this discrepancy.

References
