13th INTERNATIONAL STELLARATOR WORKSHOP

OVERVIEW ON RECENT W7-AS RESULTS

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During the almost one year shutdown in 1999/2000 the Stellarator W7-AS underwent two major modifications: First, the limiters were replaced by ten divertor modules (2 per magnetic field period), and the diagnostic set associated with the plasma boundary and target plate regions was greatly expanded for the divertor experiments. The aim is to perform extensive tests of the island divertor concept foreseen for W7-X. After readjusting the divertor target plates early in 2001 the divertor experiments were continued. Almost complete plasma detachment is observed over a large fraction of the divertor target plates in discharges with high neutral beam heating power at core densities of $3x10^{20}$ m^{-3} and for magnetic field configurations with large edge islands. Stable discharges with a radiation level of 0.8 P_{abs} (mainly edge radiation) can be maintained up to pulse lengths of about 0.5s.

Secondly, the previously counter tangential neutral beam injector box was shifted to a co-position, making for a total of two co-injectors (whereby co means the neutral beam driven current increases the external rotational transform). Thus, the heating efficiency is increased at low magnetic fields and high densities, where high-β experiments are usually performed, but where counter beam injection suffers from substantial fast ion losses. This improvement allows W7-AS to investigate once more the high-β stability. Preliminary results indicate access to higher $<\beta>$- values with higher electron temperatures at only weak MHD-activity.

The replacement of all limiters by divertor modules is also a final step in improving the control of the plasma wall interaction which is very important to obtain good plasma performance. W7-AS started experiments with a “metallic” torus wall 13 years ago. In the meantime, all plasma facing components are covered by graphite tiles, and boronization has improved density control and reduced impurity radiation considerably. In that sense the divertor modules can be considered as improved “limiters” having a larger surface and preventing field lines hitting the metallic torus wall also at high rotational transform where the magnetic field at the plasma boundary is dominated by the 5/m magnetic field perturbations. Besides the high-β stability investigations studies of the plasma performance under these conditions (which are quite similar to the situation on W7-X) are under way, for example with respect to high confinement discharges, H-Mode, long pulses with high heating power and density limit.

Meanwhile 5 gyrotrons (70 and 140 GHz) are available on W7-AS with a total heating power of up to 2.5 MW. They are used for example to study in detail neoclassical transport at very high electron temperatures (up to 6.7 keV) and to explore the OXB heating scheme in neutral beam heated discharges at densities above the ECRH cut-off density where the electron temperatures are usually quite small.

Conference topic 1?
Poster preferred: No
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