EAST NEWSLETTER

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EAST has successfully achieved the first plasma discharge

After the first very successful engineering commissioning in March 2006, EAST (Experimental Advanced Superconducting Tokamak) has achieved, in day one of operation, the first plasma with plasma current up to 220 kA, in collaboration with General Atomic (GA) and Princeton Plasma Physics Laboratory (PPPL), USA. This has demonstrated that EAST construction is completely successful. EAST is the first full superconducting tokamak at mega-ampere scale presently in operation. It will be a unique facility to explore some critical issues relating to steady-state operation with shaped plasma cross-section in the next few years.

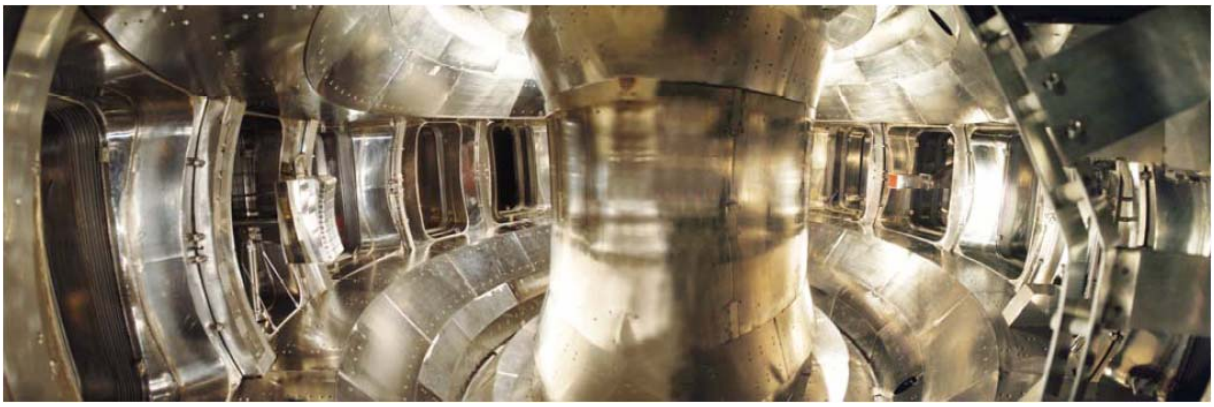

Fig. 1 Picture of the in-vessel structures

After the first commissioning, the port extensions were welded to the vacuum vessel, completing the machine construction. The full stainless steel in-vessel components including liners, diverter plates, internal coils, RF antenna, etc. were also installed (Fig.1). For the initial operation, the machine is equipped with 5 newly built diagnostics and other 10 diagnostics moved from HT-7. Plasma discharges are controlled by a plasma control system (PCS) built in collaboration with GA, which is similar to the PCS of DIII-D, but with new EAST features. The RF systems at ICRF (30 kW) and at LHF (180 kW) are available for wall conditioning and discharge pre-ionization. Two movable molybdenum limiters have been installed at R= 2.38 m.

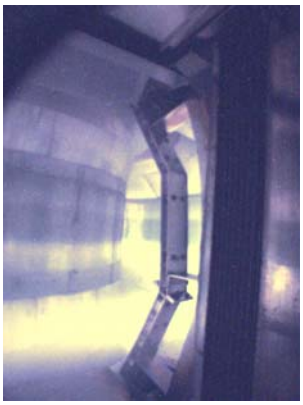

Fig.2 1st RF plasma

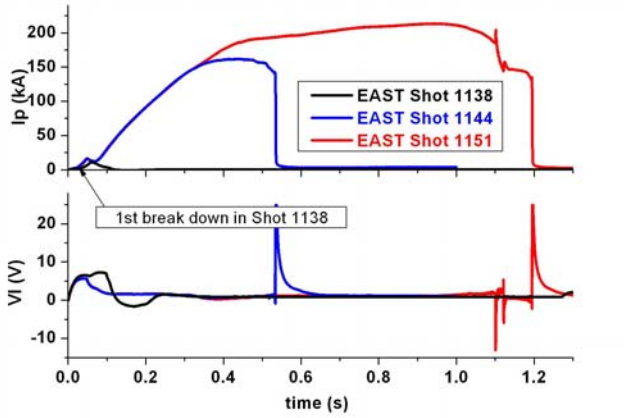

Fig.3 1st break down and following shots with Ip > 150 kA and 220 kA

The superconducting magnets started to cool down at the end of July, 2006 for the first experimental campaign, but only down to 60-80 K due to a turbine damage, and were maintained at these temperatures for one month. All the magnets were cooled to 4.5 K on August 20 after 3 days of starting the new turbine. All superconducting coils have successfully passed full field testing. The toroidal magnet was safely excited to 14.55 kA (designed at 14.3 kA), corresponding to 3.55 T at R = 1.7 m.

The first DC glow discharge and RF plasma (Fig.2) were obtained in August, 2006 for wall cleaning. The first ohmic plasma was achieved in September 26, in the day-one of operation. To achieve reliable break down and plasma-current ramping up, the machine has been boronized by RF discharge, which was used routinely for wall conditioning in HT-7. Considering the limitation of the PF current ramping rate, plasma initiation was carefully simulated, taking into account eddy currents in the vacuum vessel. The break down was successfully achieved at B_T = 2 T @ 1.7 m (Fig.3 EAST shot 1138).

After several breakdown shots, plasma current was very smoothly ramped up to 150 kA at a rate of about 0.5MA/s by pre-programmed control (Fig.3 EAST shot 1144) and up to 220 kA after only a few more shots. The plasma current of 220 kA and duration of 2.7s have presently been achieved. Now the operation is still going on with the feedback control of the plasma density and current, as well as the position. We will try the plasma shaping experiments in few days.

The first successful operation of EAST demonstrates that EAST has been successfully constructed and is ready for operation, which will provide the world fusion community a very good international research facility for steady-state diverter plasma research.