

EAST Experimental Campaign 2012

(2/1/2012-5/30/2012)

Campaign Goals

With the advent of significantly augmented auxiliary heating and operational capabilities, the Experimental Advanced Superconducting Tokamak (EAST) is starting an experimental campaign in February, 2012, aiming at exploring the boundary and understanding the physics of the EAST operational space with favorable stability and confinement, and developing suitable means to expand this space toward steady-state operation. To these ends, the campaign is focusing on ICRH and LHCD physics, MHD and ELM control, L-H transition and pedestal physics, divertor physics and emerging PSI issues under long pulse operational conditions, and developing integrated scenarios that integrate high performance with advanced divertor steady-state operation to achieve:

- 30s H-mode with $I_p = 400\sim 600$ kA, $n_e = 2.5\sim 4 \times 10^{19}$ m⁻³, and $P_{in} = 1\sim 4$ MW.
- A few hundreds seconds scale long pulse discharges at lower current and density, *i.e.*, $I_p = 300\sim 400$ kA and $n_e = 2.0 \times 10^{19}$ m⁻³.

EAST Capabilities

EAST has undertaken an extensive upgrade during the last shutdown, from Plasma Facing Components (PFC), poloidal field (PF) power supply, auxiliary heating systems to diagnostics, as highlighted below:

- Replaced all the carbon tiles on the wall and divertor surfaces with molybdenum tiles, except those on the divertor target plates, allowing baking up to 250 °C.
- Upgraded the Li evaporation system to improve coating uniformity. This, along with enhanced wall baking capability, will greatly facilitate recycling control.
- Implemented a new pellet injection system and a new supersonic molecule beam injection (SMBI) system for ELM control and deeper fuelling.
- Augmented auxiliary heat capabilities with upgraded RF antennas to allow 4 MW LHCD @ 2.45 GHz and 6MW ICRF @ 25-75MHz.

Added new and upgraded many diagnostics for key profiles and more specific measurements, *e.g.* edge turbulence and fluctuation. More information is available in the EAST proposal management system web.

Research Thrusts

Based on the global capabilities, the following critical thrust areas have been identified for accomplishing the mission and goals of the campaign:

1. Heating and current drive

- To achieve efficient ICRF coupling (3.5 MW with 4 MW source power), suppress core impurity accumulation by central ICRH, and investigate fast particle behavior under long-pulse operational conditions.
- To achieve efficient LH coupling (3 MW with 4 MW source power) and current drive, explore the feasibility of LHCD for high density, ITER-relevant regimes.

- To obtain a better understanding of ICRH and LH heating and current drive physics, and their synergistic effects. To develop a high performance scenario relevant for steady-state operation.

2. *MHD and ELM control*

- To develop an integrated ELM control scenario for controlling ELMs by means of LHCD power modulation, pellet pacing, impurity seeding and SMBI, explore accessibility to small or no ELM regimes.
- To access stability boundaries with sufficient heating/current drive power and control emerged instabilities by modulating ICRF, LHCD and profile tailoring, develop sawtooth control with fast particles induced by ICRH.

3. *L-H transition and pedestal physics*

- To assess the role of edge turbulence and zonal flows on the L-H transition and the effect of recycling, divertor configuration and X-point height.
- To investigate ELM dynamics, and plasma rotation in ICRH/LHCD plasmas.

4. *Divertor physics and emerging long-pulse PSI issues*

- To control heat load by D₂ puffing or impurity (Ar/N₂) seeding with active divertor pumping, demonstrate steady-state detachment for long pulse operation.
- To control plasma density and recycling by wall conditioning and active Li coating for long pulse operation, assess Li coating effect on Molybdenum wall with respect to previous graphite wall.
- To assess ELM particle and energy loading on divertor targets in ICRH/LHCD plasmas and the effect of disruptions, investigate PSI issues with high power, long pulse operation.

Campaign Organization

The experimental program is organized into three Task Forces (TF): (a) **Core** TF, covering a board range of MHD stability, heating and current drive, confinement and transport; (b) **Pedestal** TF, involving L-H transition, ELM control, edge turbulence and fluctuation studies; (c) **Divertor/SOL** TF, focusing on steady-state heat load and recycling control and emerging PSI issues under long-pulse operating conditions. Each TF will be further organized into Working Groups (WG), which may overlap across TFs based on research topics, *e.g.* ELM control that may touch all three TFs. Overall TF research activities will be coordinated by a Central Experimental Committee (CEC) consisting of Director *Jiangang Li* (j_li@ipp.ac.cn), Deputy Director *Baonian Wan* (bnwan@ipp.ac.cn), TF leaders: Core, *Yufeng Liang* (y.liang@fz-juelich.de), Pedestal, *Guosheng Xu* (gsxu@ipp.ac.cn), and Div/SOL, *Houyang Guo* (hyguo@ipp.ac.cn), also serving as CEC Coordinator.

You are welcome to contribute to our exciting research program for the next EAST experimental campaign. If you would like to propose any specific experiments, please contact appropriate TF leaders, or directly submit your proposals to the following website: <http://202.127.204.30/upload/proposal/proposal/index.php>.