Status and Plan for Versatile Experiment Spherical Torus (VEST)

Y. S. Hwang and VEST team

Seoul National University, Seoul Korea

Lead-author e-mail: yhwang@snu.ac.kr

Ohmic operation of VEST (Versatile Experiment Spherical Torus) has been successfully carried out, generating plasma currents of up to 70 kA with pulse duration of ~15 ms at the toroidal magnetic field of 0.1T on axis. The elongation and edge safety factor of the low aspect ratio plasmas (R=0.4m and a=0.3m) are estimated to be 1.6 and 3.7 respectively from equilibrium reconstruction based on magnetic diagnostics.

Various plasma start-up experiments have been conducted in VEST. Efficient ECH (Electron Cyclotron Heating) assisted plasma start-up scheme utilizing the trapped particle configuration (TPC), a mirror like magnetic field configuration, is developed. TPC significantly enhances the pre-ionization with the enhanced particle confinement due to its mirror effect, and stable decay index in this configuration also enables the prompt plasma current initiation. Consequently, TPC demonstrates robust tokamak start-up with lower loop voltage with lower volt-second consumption as well as wider operation range in terms of the ECH pre-ionization power and the H2 filling pressure. Electron gun has been installed to study electrostatic helicity injection as another startup scheme. By using single power configuration that can provide voltages for both injector operation and helicity injection, gradual rising plasma current of ~ 10kA has been achieved with injection current and voltage of 1.5kA and 500V respectively. With additional power supply for higher injection voltage, plasma currents of up to ~30kA have been achieved with the peak injection current and voltage of 1.0 kA and 1.5 kV respectively.

Various wave heating and current drive experiments are under preparation such as EBW (Electron Bernstein Wave) and low hybrid fast wave heating experiments. Direct mode conversion of X-mode to EBW from low field side is clearly observed in the pre-ionization stage and will be extended to heating and current drive. To study advance tokamak regime with high beta and high bootstrap operation in VEST, high power neutral beam and profile diagnostics are under preparation. Meanwhile ohmic plasmas will be improved to provide proper target plasmas for the high power neutral beam by increasing plasma density with higher plasma current at longer pulse length.