

Startup studies of MT-1 Spherical Tokamak

Monday 5 July 2021 16:30 (10 minutes)

Abstract:

MT-1 a small spherical Tokamak in Pakistan, is the modified version of GLAST-II (Glass Spherical Tokamak) wherein glass vacuum vessel has been replaced by metallic vessel. Its major and minor radii are 15 and 9 cm respectively. Various coil systems for generation of toroidal, poloidal magnetic fields and toroidal electric field are installed. Diagnostic systems like Rogowski coils, magnetic probes, flux loops, Langmuir probes, and emission spectroscopy are also installed on the device. The generation of the plasma current in Tokamak is mainly dependent on impurity free environment in the chamber and optimized application of magnetic and electric fields. For conditioning of chamber first of all electric tape heating is employed then microwave heating and helium glow discharge are used. In order to monitor vacuum conditions, optical emission spectroscopy and RGA (residual gas analyzer) are used. During initial experimentation for generation of plasma current, it was found that in addition to other error vertical fields, a strong field generated because of eddy current flowing in the chamber is main problem for discharge initiation. One method to compensate this error vertical field is to apply an equal vertical field in reverse direction externally. Experiments were conducted for plasma current generation with vertical field produced by different combinations of vertical field coils installed symmetrically around chamber. This scheme did not work because the applied vertical field is suppressed because of strong coupling of central solenoid and vertical field coils. In order to apply vertical field independently at start of pulse, mutual inductance of two systems was measured and based on it; decoupling coils were designed and installed. All these efforts resulted in successful generation of plasma current. All signals during experiments are recorded using indigenously developed data acquisition system.

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Session Classification: Plasma Control 1

Track Classification: Plasma Control