INSTALLATION AND OPERATION OF NEW LONG PULSE DNB ON ALCATOR C-MOD

D. F. Beals, R. Granetz, W. Cochran, W. Byford
MIT Plasma Science and Fusion Center, 190 Albany Street, Cambridge MA 02139
W. L. Rowan
The University of Texas at Austin Fusion Research Center
1 University Station, C1510 Austin, TX 78712-0263
A.A.Ivanov, P.P.Deichuli, V.V.Kolmogorov, G.Shulzhenko
The Budker Institute of Nuclear Physics
Acad. Lavrentiev prospect 11, 630090 Novosibirsk Russia
beals@psfc.mit.edu

A 50 kV, 7 amp, long-pulse (1.5-3.0 s) diagnostic neutral beam (DNB) built by the Budker Institute of Nuclear Physics in Novosibirsk has been installed on the Alcator C-Mod tokamak. The DNB is used for multiple diagnostics, including motional Stark effect (MSE), charge-exchange recombination spectroscopy (CXRS), and beam emission spectroscopy (BES). Facility required power is ~1 MVA and is provided by a 5 kV electrical service. The 1.25 m^3 DNB vacuum chamber is pumped using a 500 l/s turbo molecular pump, and two 50,000 l/s liquid helium cryo pumps. Mass flow controllers regulate the hydrogen gas flow to the source anode and cathode. A heated lanthanum hexaboride emitter is used for the arc cathode in order to provide an enhanced lifespan. The beam is extracted from a plasma arc source and accelerated by a set of perimeter-cooled molybdenum grids. Accelerated ions are partially neutralized in a gas cell, and the un-neutralized fraction is diverted by a bending magnet into a water cooled dump. The neutralized beam is injected through a port duct into the C-Mod tokamak, and has a diameter of approximately 6 cm at the full-width half-maximum (FWHM) at the plasma. Spectroscopic measurements during initial commissioning have shown a full extracted energy fraction of about 70 %. Due to the high energy delivery capability of this diagnostic beam there is a risk of overheating the tokamak inner wall. A beam interlock system will incorporate the tokamak pulse state, plasma density, toroidal field, tokamak gas pressure, and an optical pyrometer aimed at the tokamak inner wall.