

**The 110 GHz Microwave Heating System on the DIII-D Tokamak\*** John Lohr, R.W. Callis, J.L. Doane, Y.A. Gorelov, K. Kajiwara, D. Ponce, and R. Prater, *General Atomics*

Six 110 GHz gyrotrons in the 1 MW class are operational on DIII-D. Injected power is  $>4.0$  MW for pulse lengths  $\leq 2.1$  s and  $\sim 2.8$  MW for 5.0 s. The rf beams can be steered poloidally across the tokamak upper half plane at off-perpendicular injection angles in the toroidal direction up to  $\pm 20^\circ$ . Measured transmission line loss is about -1 dB for the longest line, which is 92 m long with 11 miter bends. Coupling efficiency into the waveguide is  $>93\%$ . The transmission lines are evacuated and windowless except for the gyrotron output window and include flexible control of the elliptical polarization of the injected rf beam with remote controlled grooved mirrors in two of the miter bends on each line. The injected power can be modulated according to a predetermined program or controlled by the DIII-D plasma control system using real time feedback based on diagnostic signals obtained during the plasma pulse. Two gyrotrons have operated at 1.0 MW output power for 5.0 s. Peak central temperatures of the artificially grown diamond gyrotron output windows are  $<180^\circ\text{C}$  at equilibrium.

\*Work supported by US DOE Contract DE-AC03-99ER54463.