Design and Performance of the 110 GHz Electron Cyclotron Heating Installation on the DIII-D Tokamak*

D. Ponce, R.W. Callis, W.P. Cary, M. Condon, H.J. Grunloh, Y. Gorelov, R.A. Legg, J. Lohr, R.C. O'Neill

General Atomics, P.O. Box 85608, San Diego, California 92186-5608

R. Cool, Y. Demers

Centre Canadien de Fusion Magnetique, Quebec, Canada

S. Raftopoulos

Princeton Plasma Physics Laboratory, Princeton, New Jersey

The 110 GHz Electron Cyclotron Heating System on the DIII-D tokamak is undergoing an extensive expansion. When the expansion is complete, five one-megawatt class gyrotrons will have been added to the existing three. Four of the eight tubes will be able to pulse for ten seconds. The versatility of the system for tokamak experiments is also being improved by the incorporation of launchers capable of steering the rf beam inside the tokamak poloidally and torodially. One of these has already been installed.

Three of the tubes are new diode gun tubes. These gyrotrons use CVD diamond windows to obtain the high power with long pulse capability. The beam from these tubes is nearly Guassian and requires less correction optics to couple to the HE1,1 mode in the circular waveguide.

Two systems, based upon Gycom gyrotrons, were obtained from the Tokamak de Varennes program in Quebec. A Canadian and Russian team installed them and brought them into operation. The equipment was located in the DIII–D building extension for EC equipment, and the interface to the master ECH control system was done using equipment designed for the new diode gun.

The EC system expansion presented the opportunity to redesign aspects of the ECH system. Pulse control and data acquisition were moved to the compact PCI format, which increased speed and versatility while reducing cost. The gyrotron tanks were redesigned to minimize the oil volume and for easier access. Conduits and waveguides were routed under a raised floor.

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Four gyrotrons will be used in this year's tokamak campaign. Conditioning of the systems is underway. System architecture and data from the gyrotron checkout and from DIII-D experiments will be presented.