PERFORMANCE OF THE 1 MW, 110 GHz, 10 s GYROTRONS RECENTLY INSTALLED IN THE DIII–D ECH SYSTEM*

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ECH power has proven capabilities for both heating and current drive in energetic plasmas. For the second phase of ECH power on DIII–D, there will be three 1 MW sources added to the existing three systems for a total power generating capacity of 5.1 MW. This upgrade is based on the use of the single disc chemical vapor deposition (CVD) diamond window, 1 MW diode gyrotron, recently developed by CPI. All gyrotrons are connected to the tokamak via a low-loss, windowless, evacuated transmission line system, using circular corrugated waveguide for propagation in the HE_{11} mode. Each waveguide system incorporates an in-vessel two-mirror launcher. The newest launcer can steer the rf beam poloidally from the center to the outer edge of the plasma and toroidally for either co- or counter-current drive. An overview of the total system, its integration with the DIII–D tokamak, and recent results will be discussed. The various new aspects of the upgrade ranging from building modifications to the use of the new steerable launcher will also be addressed.

With the addition of two short pulse gyrotron systems, that have been acquired from TdeV and are currently being installed, a total of eight 1 MW class 110 GHz ECH systems installed on the DIII–D tokamak. The initial installation of short pulse 1 MW class gyrotrons was completed in 1998, with physics experiments taking place during the FY99 physics campaign. Shortly after completion of this first step, funding was approved for an additional 3 MW of ECH. The gyrotrons to be used in this phase were to have the capability of operating at full power with pulse lengths of up to 10 s. The long pulse requirement necessitated the development of the CVD diamond output window. Additionally, after evaluating the operation of both triode and diode gun gyrotrons, it was decided to use the diode gun configuration. Initial testing of the CPI 110 GHz diode gun gyrotron has validated this decision. The first of the three gyrotrons has performed to specifications with short pulses of over 1 MW. The pulse limitation was due to the power supply capability at the manufacturer. Full power and pulse operation will be validated at GA this year.

With the introduction of the second phase 1 MW 10 s gyrotrons, a total generating capacity of 3.1 MW will be available to support physics experiments during the 2000 DIII–D campaign. With the demonstration of reliable operation of the CVD/diode-gun gyrotrons, significant experiments in the advanced tokamak plasma regimes will be possible.

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