

THE 8.4 MW MODULATOR/REGULATOR POWER SYSTEMS FOR THE ELECTRON CYCLOTRON HEATING FACILITY UPGRADE AT DIII-D*

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Over the next several years the DIII-D National Fusion Facility at General Atomics will be upgrading its Electron Cyclotron Heating (ECH) capability from the present 3 MW at 110 GHz to 6 MW and then to 10 MW of injected microwave power.¹ There will be ten gyrotron tubes supplied by five 8.4 MW modulator/regulator (M/R) power systems. The project has gained considerable leverage from the acquisition of surplus hardware from the MFTF program that was conducted at LLNL in the early 1980's. One of these systems had been refurbished and converted for use as an ECH power supply at DIII-D ten years ago. The experience gained and the lessons learned on that system have proved valuable in guiding the engineering of the new systems. This paper provides an overview of the power system design and a report on the present status of the project.

Each power system, with a nominal output of -80 kV and 80 A, supplies a pair of gyrotrons with up to 10 s long pulses that may or may not be modulated. The MFTF M/R was designed about the BBC CKQ200-4 tetrode and due to the availability of unused surplus tubes, this aspect of the original design was retained. In order to meet the performance goals of the program, a high performance grid driver was developed that would achieve dc voltage regulation of <0.5% and output modulation of 30% amplitude at 20 kHz. A newly designed crowbar/filter unit features a new high speed triggered gas switch. The system controls are an example of how the DIII-D facility is embracing the industry trend of network based distributed control systems and embedded technology.² The ac/dc power supply is virtually unchanged from the original design with the exception of mechanical improvements to the rectifier transformer to increase its fault current withstanding capability.

The first system is expected to begin full capability testing with a gyrotron load in November of 1999. Completion of the power systems facility is planned for late 2001 (it will have truly been an "Odyssey").

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¹W.P. Cary, *et al.*, "The Upgrade of the DIII-D 110 GHz ECH System to 6 MW," this conference.

²J.D. Baggest, *et al.*, "A New Distributed Control System for the Upgraded DIII-D Electron Cyclotron Heating Power Systems," this conference.

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