



Contribution ID: 36

Type: **Talk**

# Direct Cavity Combiner

*Tuesday 10 September 2024 15:15 (25 minutes)*

Ion Cyclotron Range of Frequencies (ICRF) have been demonstrated in reactor-grade plasmas to be effective at plasma heating and central current drive, which are necessary to initiate and maintain controlled fusion reactions. For high magnetic field fusion devices 60-240 MHz systems are envisioned, which are ideal for solid state devices.

Diversified Technologies, Inc. (DTI) is building a novel, patented, Direct Cavity Combiner (DCC) VHF Transmitter in a single high power (megawatt-class), compact (2 meter diameter), and efficient (>65%) amplifier under a Department of Energy Small Business Innovative Research (DOE SBIR) grant . The DCC directly combines the RF output of each solid state transistor into a resonant cavity. The low impedance of each transistor output is directly connected to a magnetic coupling loop inside the large cavity. There are no impedance transformers, circulators, cables or connectors in the RF combining stage. DTI has demonstrated this modular DCC solid state transmitter technology previously at L-band and UHF and will develop and produce a low-cost, steady state, solid state megawatt VHF transmitter for RF applications. This technology is an alternative to conventional megawatt-class Vacuum Electron Devices (VED) RF sources and overcomes the limited frequency range, reliability, and supply chain issues associated with tetrodes and similar VEDs. The DCC transmitter can reduce the cost of high-power RF for fusion and similar applications. The basic transmitter technology can be readily tailored over a wide range of frequencies which makes it applicable in a wide range of applications, including high power microwaves, high energy physics, radar, and broadcasting. Of course, other VHF transmitter applications are also possible.

The RF cavity and transistor modules have been fabricated and are presently undergoing testing and evaluation to compare the amplifier performance to that predicted by the design simulations and calculations at 120 MHz operation. In this paper, DTI will report on the design and test results of the RF cavity and modules (>1.3 kW per module) at 120 MHz (approximately the center of the ICRF band).

**Authors:** POTHIER, Brad (Diversified Technologies, Inc.); Dr COPE, David (Diversified Technologies, Inc.); QUINLAN, Kathleen (Diversified Technologies, Inc.); Dr GAUDREAU, Marcel (Diversified Technologies, Inc.); KEMPES, Michael (Diversified Technologies, Inc.); LEWIS, Slade (Diversified Technologies, Inc.)

**Presenter:** QUINLAN, Kathleen (Diversified Technologies, Inc.)

**Session Classification:** Session 4a

**Track Classification:** Power transmission and distribution