

# High Efficiency High Power Resonant Cavity Amplifier For PIP-II

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Diversified Technologies, Inc. (DTI) is developing an integrated resonant-cavity combined solid-state amplifier for the Proton Improvement Plan-II (PIP-II) at Fermilab. The prototype has demonstrated multiple-transistor combining at 70% efficiency, at 675 watts per transistor at 650 MHz. The patent pending design simplifies solid-state transmitters to create straightforward scaling to 100 kW and higher high power levels. A crucial innovation is the reliable “soft-failure” mode of operation; a failure in one or more of these myriad combined transistors has negligible performance impact. This design couples the transistor drains directly to the cavity without first transforming to 50 Ohms, avoiding the circulators, cables, and connectors that would normally be required. Under an ongoing SBIR grant from the Department of Energy, DTI designed the system to accommodate over 100 transistors in each 50 kW cavity, with minimal RF, DC, and cooling connections. By the end of the SBIR, DTI will build and demonstrate a complete 100 kW-class transmitter by combining 2 cavity modules to show the expandability of the design to very high power levels, comparable to large VEDs.

\* Work funded under US DOE Grant No. DE-SC0015780