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Experimental and Computational Investigations of a High-Power, Long-Pulse Relativistic Klystron Oscillator KYLE HENDRICKS, Air Force Research Laboratory, JACK WATROUS, JOHN LUGINSLAND, NumerEX — A high-power, long-pulse source of high-power microwaves has been investigated experimentally and through a variety of modeling and simulation efforts at the Air Force Research Laboratory. The relativistic klystron oscillator (RKO) is an injection-locked oscillator capable of producing 200ns duration pulses exceeding 1 GW output power at 1270-1275 MHz. Extensive experiments have been closely coupled with computational modeling and simulation to explore a wide range of issues encountered in the operation and diagnostics of the device. The experiment uses coupled three-quarter lambda cavities to modulate the electron beam. Calculations using both HFSS and ICEPIC have been used to reproduce cold test frequency characteristics of the isolated and of the coupled cavities, including the finite conductivity of the RKO walls. Calculations using reduced physics models and ICEPIC have been used to explore the coupling between the beam and the cavities. A highlight of the modeling efforts is a series of calculations, which for the first time predict cavity saturation voltages at sub-virtual-cathode levels. Previous calculations were either restricted to quarter lambda cavities, or showed saturation voltages at the virtual cathode levels. Comparisons between experiment and computation will be presented.

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