RECENT ADVANCES IN THE MURI EASTERN CONSORTIUM FOR RESEARCH ON HIGH ENERGY MICROWAVE GENERATORS

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Harmonic-Multiplying Gryo-Amplifiers. The Phigtron has been studied both theoretically and experimentally to demonstrate the performance capability of harmonic gyro-amplifiers and investigate the nonlinear electronic processes which are the basis for these devices. The key issues are to what extent frequency multiplication and cyclotron harmonic operation may degrade or possibly improve amplifier performance. The experiments were conducted with Ku-band input and Ka-band, TE_3 mode output over a wide range of operating parameters. Output power as high as 720 kW, bandwidths up to 0.7%, efficiency of 36% and saturated gain of 30 dB were measured. Furthermore, phase noise and stability were studied. The results show that the Phigtron performs as well or better than the current state-of-the-art gyrotron amplifiers indicating that harmonic, frequency-multiplying operation may improve device performance.

Plasma-Loaded BWO. Operation was achieved over a wide plasma density range (up to 10^{14} cm^3 = overdense regime) and high beam current (up to vacuum limiting value). Frequency tunability of up to 200% was achieved by controlling the plasma density.

Ceramics for High Power Microwave Tubes. Successful pressureless, microwave sintering of aluminum nitride with very high thermal conductivity (>200 W/m C) – much better than conventionally sintered aluminum nitride/silicon carbide are strong candidates for replacing toxic beryllium oxide and beryllium oxide/silicon carbide in high power tubes.

Relativistic TWT Amplifiers (Cornell). At beam parameters of 700 kV and 160-200 A, two X-band TWT amplifiers have been operated with full pulse width and output power up to 75 MW, corresponding to 55% efficiency. Bandwidth is at least 0.4 GHz.