

## Design of a frequency tripling, third harmonic Gyro-TWT

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A two-stage gyro-traveling-wave-tube(gyro-TWT) separated by a radiation-free drift section is being designed. The rf input and output sections of gyro-TWT operate at 11.5 GHz fundamental harmonic and 34.5 GHz third harmonic respectively. By choosing a proper drift section length, the third harmonic of the modulated electron beam current at the entrance to the output waveguide may be comparable to the fundamental harmonic due to the ballistic bunching of the beam in the drift section. The well prebunched beam makes beam-wave interaction in the output waveguide more efficient. The magnetic field  $B_0$  is about  $4.4 kG$  so that permanent magnetic packaging is possible. This type Gyro-TWT features subharmonic injection, compact volume and superior stability.

Mode selective circuits are used in both the input and the output gyro-TWT sections to suppress spurious oscillation and mode competition. The interaction structure of the output gyro-TWT, which realizes the mode conversion of  $TE_{03} \rightarrow TE_{04} \rightarrow TE_{05}$  over a wide frequency range in the simulation, ensures the operation stability and promotes the power capability of gyro-TWT. Matching loads are introduced in all ends of the interaction sections to avoid the reflection of the amplified wave. A large-signal code is currently being used to simulate the beam-wave interaction in the gyro-TWT and the results will be presented.

The design parameters of this gyro-TWT are as follows: a 80kV, 50A beam,  $\alpha = 1.5$ ,  $\eta \geq 25\%$ , output power of 1MW, gain of 40dB, bandwidth of 6%. Testing of a prototype two-stage gyro-TWT, which is also based on the concept of harmonic multiplying, is in preparation in the University of Maryland. Preliminary experiment results will also be presented.

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