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DESIGN OF ONE-OCTAVE BANDWIDTH GYRO-BWO WITH ZIGZAG QUASI-OPTICAL TRANSMISSION LINE *

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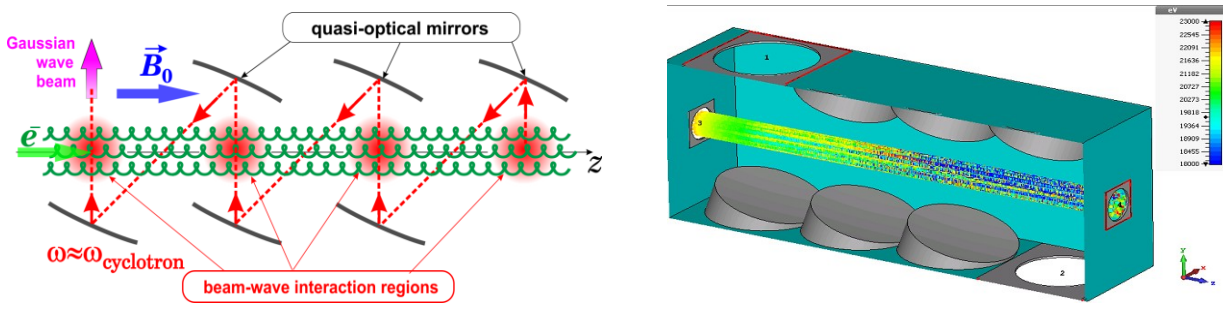
A gyrotron backward-wave oscillator (gyro-BWO) is a type of cyclotron resonance maser (CRM), which differs from a gyrotron (the most developed version of CRM) by the potential for a much wider-band smooth oscillation frequency tuning (see e.g. [1], [2]). In conventional gyro-BWOs using a section of a smooth waveguide, the frequency tuning is, as a rule, piecewise with strong variations in the power and spatial structure of the output radiation [3]. In [4] we proposed a concept of a CRM, based on the use of an open quasi-optical (QO) mirror transmission line as a microwave circuit, in which a Gaussian wave beam is directed by mirrors along a zigzag trajectory, so that its periodic intersections with the electron beam occur at right angles (Fig.1). 3D Particle-In-Cell (PIC) simulations show that such a configuration is prospective for implementation of relatively high-power short-millimeter-wave amplifiers and oscillators with extremely wide frequency tunability.



a) b)

Fig.1. Schematic layout (a) and CST model (b) of a gyro-BWO with 3-period zigzag QO transmission line.

In this paper, we present design of a proof-of-principle experiment on implementation of such a broadband frequency-tunable gyro-BWO. A general layout and results of computer modeling of major experimental components (interaction circuit, electron gun, output microwave system etc.) are discussed for a CW device using a cryomagnet with the B-field of 4-8 T. According to CST simulations, the designed gyro-BWO ensures output of nearly Gaussian wave beam of kilowatt power level at any predefined frequency within 107-215 GHz range.

REFERENCES

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