The realization of a 1-THz cascade backward wave amplifier (C-BWA) represents a breakthrough in European technology in the THz vacuum electron device field. The huge design and fabrication obstacles solved by the innovative solutions devised during the three years of the OPTHER project added new knowledge over the state-of-the-art\(^1\).

The backward wave regime was chosen to allow a moderate beam voltage (10 kV) with dimensions compatible with the LIGA fabrication process. The cascade backward wave amplifier consists of the cascade of two backward wave amplifiers\(^1\). The first one is fed by the input RF signal and is devoted to establish a sufficient beam current modulation. The second one provides the amplified signal at the output port by interacting with the modulated electron beam flowing from the previous BWA section. A drift tube RF isolates the two BWA sections. The length of the drift tube is critical for the whole amplifier performance and has to be minimized. The double corrugated waveguide\(^2\) was adopted as slow wave structure to support a cylindrical electron beam, generated by a miniaturized Pierce electron gun.

A period of 40 \(\mu\text{m}\) was chosen to obtain moderate losses and good interaction impedance. Extensive simulations by a 3-D PIC code were performed. Optimization of the input and output couplers and the windows was performed to maximize the performance. A magnetic focusing field of 0.8 T is applied. A gain of 14 dB is obtained at 992 GHz, with a 110 \(\mu\text{W}\) input signal and increased copper losses. The fabrication of the cascade backward wave amplifier is in progress.


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