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3D Hot Test Simulations of a 220 GHz Folded Waveguide Traveling Wave Tube Using a CFDTD PIC Method MING-CHIEH LIN, YHK-ISTI, HEATHER SONG, University of Colorado at Colorado Springs — Millimeter or sub-THz wave sources centered at 220 GHz is of interest due to the potential for its commercial and military applications including high resolution radar, remote sensing, and high-data-rate communications. It has been demonstrated via 3D cold test finite element method (FEM) simulations that a folded waveguide traveling wave tube (FWTWT) can be designed and optimized at this frequency range with a small signal gain of 18 dB over a comparatively broad (-3 dB) bandwidth of $\sim$ 10% [1]. On the other hand, 3D hot test simulations of a V-band ladder TWT have been successfully demonstrated using a conformal finite-difference time-domain (CFDTD) particle-in-cell (PIC) method [2] for center frequency of 50 GHz. In the present work, the 220 GHz FWTWT designs have been reviewed and studied. 3D Cold test simulations using both the CFDTD and FEM methods have been carried out and compared with each other as basis for 3D hot test CFDTD PIC simulations. The preliminary simulation result shows that the gain-bandwidth features at 220 GHz are achievable while carefully avoiding beam interceptions. Our study shows that the interaction characteristics are very sensitive to the operating beam parameters. Detail simulation results and discussions will be presented.

[1] R. Zheng and X. Chen, J. Infrared Milli. Terahz Waves 30, 945–958 (2009).
[2] C. R. Douglas, M. C. Lin, P. H. Stoltz, D. Smithe, J. S. Lee, H. Song, and S. H. Lee, IEEE Trans. Electron Dev. 57, 3500-3507 (2010).

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