Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Study on the Before Cavity Interaction in a Second Harmonic Gyrotron Using 3D CFDTD PIC Simulations M. C. LIN, Hanyang University, S. ILLY, M. THUMM, J. JELONNEK, Karlsruhe Institute of Technology — A computational study on before cavity interaction (BCI) in a 28 GHz second harmonic (SH) gryotron for industrial applications has been performed using a 3-D conformal finite-difference time-domain (CFDTD) particle-in-cell (PIC) method. On the contrary to the after cavity interaction (ACI), i.e. beam wave interaction in the non-linear uptaper after the cavity, which has been widely investigated, the BCI, i.e. beam wave interaction in the non-linear downtaper before the cavity connected to the beam tunnel with an entrance, is less noticed and discussed. Usually the BCI might be considered easy to be eliminated. However, this is not always the case. As the SH gyrotron had been designed for SH TE_{12} mode operation, the first harmonic (FH) plays the main competition. In the 3-D CFDTD PIC simulations, a port boundary has been employed for the gyro-beam entrance of the gyrotron cavity instead of a metallic short one which is not reflecting a realistic situation as an FH backward wave oscillation (BWO) is competing with the desired SH generation. A numerical instability has been found and identified as a failure of the entrance port boundary caused by an evanescent wave or mode conversion. This indicates the entrance and downtaper are not fully cut-off for some oscillations. A further study shows that the undesired oscillation is the FH TE_{11} BWO mode concentrated around the beam tunnel entrance and downtaper. A mitigation strategy has been found to suppress this undesired BCI and avoid possible damage to the gun region.

Ming-Chieh Lin
Hanyang Univ

Date submitted: 21 Jul 2016 Electronic form version 1.4