PPPS 2019



Contribution ID: 1205

Type: Oral

An Electron Gun for a Sheet Beam with a 3 to 1 Aspect Ratio: Design and Optimization

Thursday 27 June 2019 11:30 (15 minutes)

An electron gun is being designed for an amplifier at Ka-Band that requires a sheet beam with a 3 to 1 (widthto-height) aspect ratio. The design process includes running MICHELLE simulations manually for "one at a time"iterations of the gun geometry, and also "many at a time"MICHELLE simulations using automated optimization tools. We run MICHELLE, a charged particle beam optics code [1,2], in two different user environments: 1) Analyst–MP (Multi Physics) within the National Instruments AWR Design Environment (NI AWRDE) [3] which includes CAD, parametric optimization support, multiple RF solvers and a magnetostatic solver. 2) The AFRL Galaxy Simulation Builder (GSB) [3] framework for large-scale optimization using the DAKOTA [4] optimization library. The gun design approach and optimization results will be presented.

- 1. John Petillo, et al., IEEE Trans. Plasma Sci., vol. 30, no. 3, June 2002, pp. 1238-1264.
- 2. John Petillo, et al., IEEE Trans. Electron Devices Sci., vol. 52, no. 5, May 2005, pp. 742-748.
- 3. Analyst-MP is a commercial electromagnetic analysis software package developed by the AWR Group of National Instruments (http://www.awrcorp.com/ products/additional-products/analyst-mp)
- 4. Stellar Science Ltd Co. Galaxy Simulation Builder (GSB) User Guide, Version 6.6. High Power Electromagnetic Division, Air Force Research Lab, Kirtland, NM, 2017.
- B. Adams et al., "DAKOTA, A Multilevel Parallel Object-Oriented Framework for Design Optimization, Parameter Estimation, Uncertainty Quantification, and Sensitivity Analysis: Version 6.0 User's Manual," Sandia Technical Report SAND2010-2183, 2015

• Work supported by NRL

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Session Classification: 2.3 Slow-Wave Devices

Track Classification: 2.3 Slow-Wave Devices