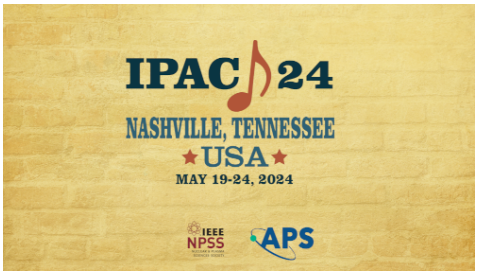

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Models for power combining magnetrons in a magic tee

Tuesday, 21 May 2024 16:00 (2 hours)

Industrial accelerator applications require efficient, scalable, continuous wave (CW) microwave power systems. Magnetrons are inexpensive and efficient devices for converting electrical energy into microwave power; however, their power output is limited to approximately 100 kW. Cost effective power combining magnetron systems would serve the accelerator industry by providing practical and affordable RF power to accelerator applications.
In a magic tee configuration, two oscillators can be power combined and locked to a common frequency. Researchers at General Atomics, in collaboration with Thomas Jefferson National Accelerator Facility, have constructed an experiment to demonstrate the power combining of magnetrons in a such a configuration. An analytic model is presented describing the power combining efficiency of a 4-port magic tee, accounting for two magnetron output signals, an injection signal, and a reactive load. The Adler-Chen model is solved numerically using robust computational geometry techniques*. These complete solutions provide insight to the phenomena of magnetron frequency locking and optimal combining efficiency, which are compared to experiment.

Footnotes

- S. C. Chen, "Growth and frequency pushing effects in relativistic magnetron phase-locking," IEEE Trans. Plasma Sci., vol. 18, no. 3, pp. 570–576, Jun. 1990, doi: 10.1109/27.55928.

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