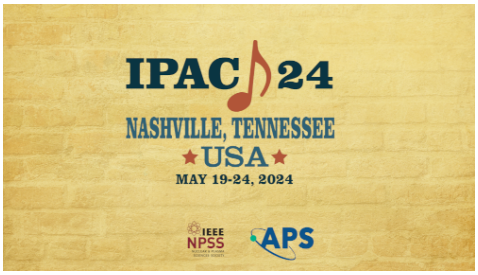

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Solid-state driven X-band linac for electron microscopy

Thursday, 23 May 2024 16:00 (2 hours)

Current transmission electron microscopes (TEM) accelerate electrons to 200-300 keV using DC electron guns with a nanoamp of current and very low emittance. However at higher voltages these DC sources rapidly grow in size, oftentimes several meters tall for 1 MeV microscopes. Replacing these electron guns with a compact linac powered by solid-state sources could dramatically lower cost while maintaining beam quality, thereby increasing accessibility. Utilizing compact high shunt impedance X-band structures ensures that each RF cycle contains at most a few electrons, preserving beam coherence. CW operation of the RF linac is possible with distributed solid-state architectures* which power each cavity directly with solid-state amplifiers which can now provide up to 100W of power at X-band frequencies. We present a demonstrator design for a prototype low-cost CW RF linac for high-throughput electron diffraction producing 200 keV electrons with a standing-wave architecture where each cell is individually powered by a solid-state transistor. This design also provides an upgrade path for future compact MeV-scale sources on the order of 1 meter in size.

Footnotes

- O. Heid and T. Hughes. Proc. 25th International Linear Accelerator Conference, page THP068, 2011. D. Nguyen et al. Proc. 9th International Particle Accelerator Conference (IPAC18), pp. 520-523 M. A. K. Othman, E. A. Nanni, V. A. Dolgashev, S. Tantawi, and J. Neilson. Solid-state powered x-band accelerator. Technical report, SLAC National Accelerator Laboratory, 2016.

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