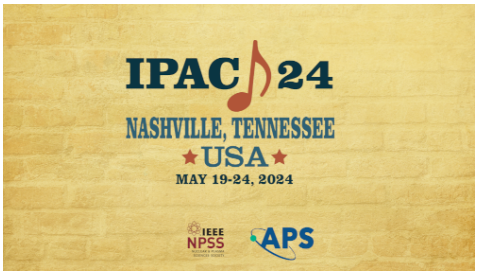

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Magnetic focusing architecture for a compact electron beam buncher

Monday, 20 May 2024 16:00 (2 hours)

We present a beam-focusing architecture using electro- and permanent magnets for a novel compact electron beam buncher under development for space-borne electron accelerators. Developing compact and efficient accelerator components has become desirable with renewed interest in using space-borne electron beams for ionospheric aurora research and very low frequency wave generation for particle removal from the magnetosphere. An electron gun injects a direct current electron beam, and the buncher modulates the DC beam into periodic bunches at a frequency of 5.7 GHz. A 5.7 GHz linear accelerator in the downstream will capture the bunched beam with minimal acceptance mismatch. The beam modulation is done by three radiofrequency pillbox cavities. The buncher uses the electrostatic potential depression (EPD) method to shorten the structure length remarkably. The electron gun and a tunable solenoid provide the initial focusing of the beam. We then use a series of permanent magnets surrounding the buncher cavities clamped together by ferromagnetic steel plates to focus the beam through the buncher. Permanent magnets do not consume any power and weigh less than solenoid magnets, which provide equivalent focusing, making them ideal for use on a satellite or sounding rocket. We use the three-dimensional (3D) particle tracking solver from CST Studio Suite to simulate the beam-focusing.

Footnotes

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