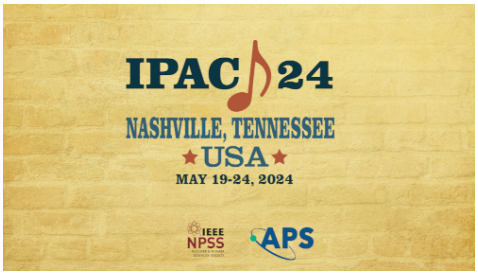

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Multi-mode cavity design and characterization

Monday, 20 May 2024 15:20 (20 minutes)

We present the design and initial characterization of a multi-mode cavity, a novel electromagnetic structure with potential benefits such as compactness, efficiency, and cost reduction. The 2nd Harmonic mode was chosen to linearize the fundamental mode for use as an accelerating and bunching cavity. The reduction in the number of cavities required to bunch and accelerate promises cost and space savings over conventional approaches. Superfish and COMSOL simulations were used to optimize the cavity's geometry with the goal of balancing various design parameters, such as quality factor (Q-factor), harmonic modes, and mode coupling. A 3D-printed copper-plated cavity was used to validate code predictions.
The cavity's multi-mode nature positions it for use with other harmonic modes with small deviations in design. For example, a 3rd Harmonic can be used to decrease energy spread by widening the peak of the fundamental. This research lays the foundation for further exploration of the cavity's applications and optimization for specific use cases, with potential implications for a wide range of accelerator fields.

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