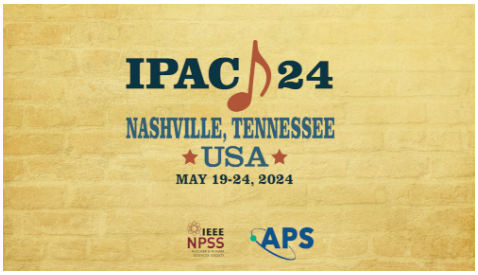

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X-ray optics and diagnostics for the cavity-based X-ray free-electron laser project

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The cavity-based x-ray free-electron laser (CBXFEL) R&D project utilizes a low-loss x-ray cavity (65.5 m long) to provide circulating monochromatized x-ray seeding for electrons from the Cu-linac at SLAC. The project aims to demonstrate the two-pass gain in x-ray regenerative amplifier and XFELO modes by 2024. Here, we report on the design, manufacture, and characterization of x-ray optical and diagnostic components for this project. The low-loss wavefront-preserving x-ray optical components include high-reflectivity C(400) diamond crystal mirrors, drumhead diamond crystal with thin membranes, beryllium refractive lenses, channel-cut Si monochromators, and exact-Backscattering C(440) diamond crystal. The x-ray diagnostics are designed to ensure the accuracy of beam alignment and to characterize and optimize CBXFEL performance. These include different types of x-ray beam position and profile monitors and x-ray beam intensity monitors, and a meV-resolution x-ray spectrograph. All x-ray optical and diagnostic components have been fully characterized with x-rays, and the mechanical installation of these components is expected to be finished soon.

Footnotes

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