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Experience with a bunch lengthening cavity at the APS

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The Advanced Photon Source Upgrade at Argonne National Laboratory (ANL) provides hard x-ray photon beams with a brightness 500 times greater than the original machine. A bunch lengthening cavity is used to decrease the effects of Touschek scattering (on beam lifetime) and intrabeam scattering (on beam emittance). The superconducting RF (SRF) cavity operates at 2 K in a passive, i.e. beam-driven mode at the 4th harmonic (1408 MHz) of the main RF system. A helium cryoplant provides 2 K refrigeration for the SRF cavity. The cavity and cryostat were built and tested by the ANL Physics Division and installed into the electron storage ring starting in August 2023. Cryoplant commissioning began in December 2023 followed by 2 K operation in January 2024. Since then, the cavity and associated RF, cryogenic, and vacuum systems have been brought on-line in stages as part of the overall storage ring and x-ray beamline commissioning. In February 2025 the cavity demonstrated a stable 1.1 MV accelerating gradient with 200 mA beam for user operation. The bunch lengthening subsystems, commissioning, and operating experiences are described.

Footnotes

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