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Bunch duration measurements in the APS-U booster

Monday 11 August 2025 16:00 (2 hours)

We present the results of time-based, bunch length measurements in the Advanced Photon Source Upgrade booster synchrotron using the bunch duration monitor (BDM) optical diagnostic. The BDM diagnostic is based on the detection of visible-wavelength synchrotron radiation. The detector is a metal-semiconductor-metal device followed by 42 dB of wide-band amplifier gain. Bunch duration is determined by de-convolving the raw output signal with the circuit's impulse response function. The BDM allows measurement of bunch duration over virtually the entire booster ramp. De-focusing in the optical path was necessary to overcome thermal steering from the in-tunnel mirror. Also, the effects of detector saturation must be considered to ensure a linear response. Presently, the booster increases bunch energy from 425 MeV to 6 GeV. Booster charge varies from 5 nC to 13 nC depending on storage ring operating modes. BDM data reveal that the bunch undergoes large longitudinal oscillations shortly after injection into the booster. The longitudinal oscillations are compared with elegant simulations. These oscillations are a source of injection loss especially at higher charge.

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No

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

Funding Agency

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Yes

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