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Proposed investigations of electron-beam microbunching in the Advanced Photon Source linac

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We propose further investigations on the longitudinal-space-charge-impedance mechanism for inducing microbunching of relativistic electron beams within the Advanced Photon Source S-band linac. The microbunched content is evaluated by observing the coherent enhancements of optical transition radiation (COTR) generated as the beam transits a metal-vacuum interface. The facility also uniquely includes both thermionic cathode and photocathode rf guns as electron sources for comparisons of effects. Previously, we addressed mitigation of the COTR's deleterious effects in the 2-D visible-light beam images at 325 MeV. *By extending our wavelength coverage into the NIR, we will access the much stronger enhancements predicted (>100)** and elucidate their spectral content. We will use an existing optical transport line for visible to NIR COTR (0.4 to 3.0 microns) from the diagnostics cube in the tunnel to an enclosed, external optics table. The inexpensive addition of a NIR-sensitive photodiode and integrating circuit with an existing digital oscilloscope in the optical setup would provide immediate extension of the detectors'wavelength coverage and would enable the testing of the current model predictions for the microbunching instability into the NIR.

Footnotes

*A.H. Lumpkin et al., Phys. Rev. ST Accel. and Beams, Vol. 12, p. 080702 (2009).
** E.L. Saldin, E.A Schneidmiller, M.V. Yurkov, NIM Phys. Res. A, vol. 490, pp1-8, (2002).

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