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Radiation detection for the PAX Experiment at FACET-II

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The ongoing Plasma-driven Attosecond X-ray source experiment (PAX) at FACET-II aims to produce soft x-ray pulses of attosecond duration with TW peak power using a Plasma Wakefield Accelerator [1]. These X-ray pulses can be used to study chemical processes where attosecond-scale electron motion is very important.
For this first stage of the experiment, PAX plans to demonstrate that sub 100 nm FWHM electron beams can be generated by taking the 10 GeV beam produced at the FACET-II photoinjector and using the plasma cell to give it a percent-per-micron chirp. Then, the chirped beam is sent into a chicane and compressed. Since the beam is on the order of 10s of nm long, the CSR radiation produced by the final bend magnet in the chicane contains coherent radiation as low as 50 of nm. After the radiation is produced, it is reflected into two spectrometers for measurement. Future iterations of the experiment plan to use a short undulator to produce significantly more radiation and to demonstrate coherent harmonic generation using an undulator tuned to a resonant wavelength of ~1-10 nm.

[1] C. Emma, X.Xu et al APL Photonics 6, 076107 (2021)

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