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Beam position monitor for high intensity environments

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A novel diagnostic based on the well-established electro-optic sampling (EOS) technique is adaptable for non-interceptive, ultrafast position monitoring for high-intensity femtosecond beams. By using two pairs of crystals, the EOS system can also reveal the e-beam's transverse position with ultrafast temporal resolution. This configuration is informally called the electro-optic sampling beam position monitor (EOS-BPM). In comprehensive application, the EOS-BPM can yield the full 3D centroid positioning of two bunches in a wakefield accelerator, or the tilt of a beam used to power a light source. Under ideal conditions, simulation-based estimates show that this device may be able to achieve temporal and transverse resolution for the beam centroid positions of a two-bunch wakefield accelerator beam of order 50 fs and 1 μm , respectively. An initial prototype of the EOS-BPM using only 1 pair of crystals, called 2D EOS-BPM has already been conceptually developed and is currently installed at the SLAC FACET-II facility. We improved its design and showed efficiency and reliability of our optimization by running benchtop tests. We also designed a prototype EOS-BPM using 2 pairs of crystals and extended our work to build a first version of it, proving its mechanical and optical functionality.

Working group

WG5 : Beam sources, monitoring and control

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