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Abstract Submitted
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**Plasma-optical spatiotemporal diagnostics and alignment for electron and laser beams** THOMAS HEINEMANN, University of Strathclyde, DESY, University of Hamburg, The Cockcroft Institute, ALEXANDER KNETSCH, DESY, ANDREW BEATON, PANAGIOTIS DELINIKOLAS, FAHIM HABIB, GRACE MANAHAN, PAUL SCHERKL, DANIEL ULLMANN, University of Strathclyde, The Cockcroft Institute, ANDREW SUTHERLAND, University of Strathclyde, SLAC, OLIVER KARGER, University of Hamburg, JAMES ROSENZWEIG, UCLA, BERNHARD HIDDING, University of Strathclyde, The Cockcroft Institute — The steadily increasing demand for compact accelerator-driven light sources imposes new challenges for generating compact, high-quality electron beams and concomitant $\mu$m-scale, fs-scale diagnostics. During the E210 experimental campaign at FACET (SLAC), we have amended state-of-the-art electro-optical sampling timing diagnostics and optical transition radiation spatial diagnostics with novel plasma-based techniques. By harnessing the ultrasensitive plasma response to intersecting laser and electron beams, we have developed novel diagnostic techniques which potentially enable spatiotemporal alignment with sub-fs and sub-$\mu$m accuracy. Furthermore, the diagnostics can be realized in a simple and robust layout; they are based on measuring the time-integrated plasma recombination light from tunnel ionization as well as electron impact ionization. They thus map ultrashort and small dynamics onto much longer and larger scales, such that the main diagnostic element is a simple imaging device. These techniques, the underlying physics and their potentially far-reaching impact will be presented and discussed.

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