

First single-shot and non-intercepting longitudinal bunch diagnostics for comb-like beam by means of Electro-Optic Sampling

Tuesday, June 4, 2013 4:20 PM (15 minutes)

Precise measurements of the temporal profile of ultrashort electron bunches are of great interest for the optimization and operation of plasma wakefield accelerators (PWFAs). Electro Optical Sampling (EOS) based technique have been already demonstrated the possibility to successfully measure the longitudinal properties of electron beams. The electric field of a travelling electron bunch induces birefringence in an electro-optic crystal placed at few millimeters with respect to the beam trajectory. The amount of birefringence depends on the electric field and it is probed by monitoring the change of polarization of a laser pulse, a 800 nm wavelength directly derived from the Ti:sapphire photocathode laser of SPARC_LAB. Such a scheme does not require a dedicated laser oscillator neither a fast gated camera, resulting in a really affordable diagnostic. In our experiment the Spatial Decoding of EOS has been applied for a single-shot direct visualization of the time profile of a comb-like electron beam, consisting of two bunches, about 100 fs long, sub-picosecond spaced with 160 pC total charge. A cross-checking of the absolute time calibration has been performed with both a Transverse-Deflecting RF Structure (TDS) and a Michelson Interferometer, resulting in an excellent agreement.

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Session Classification: WG5 - instrum - Plasma sources and instrumentation

Track Classification: WG5 instrum - Plasma sources and instrumentation