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Photon diagnostics based on electron beam longitudinal phase space measurements

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The electron beam is the lasing medium of a Free-Electron Laser (FEL). When driven to saturation, the high-gain FEL process leaves a measurable imprint in the electron beam longitudinal phase space (LPS, time-energy). In many FEL operation modes, there is an excellent time correlation between the FEL pulse and its imprint. After mapping time and energy coordinates to transverse coordinates by employing both electron streaking and an energy spectrometer, the LPS is measured with a scintillating screen. By comparing the LPS at FEL-enabled and FEL-disabled configurations, the FEL power profile is retrieved. This contribution provides an overview of electron streaking methods, in particular streaking from passive wakefield structures and and from time-synchronous rf fields. Furthermore, current and possible future applications of this concept and their limitations are discussed.

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