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Pulsed Compton Gamma-ray beam generation using pulsed FEL beam

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For certain photonuclear experiments utilizing Compton gamma-ray beams, beam-uncorrelated background poses a significant challenge. At the High Intensity Gamma-ray Source (HIGS), we have developed methods to generate pulsed free-electron laser (FEL) beams by transversely or longitudinally modulating the storage ring FEL. Both methods enable periods of FEL interaction: one by transversely manipulating the electron beam orbit, the other by de-synchronizing the electron and FEL beams. The recently-developed longitudinal method has proven superior: it avoids beam loss and is applicable across a wide range of electron beam energies. In this work, we describe the operational principle of pulsed FEL beam generation using longitudinal modulation, and we present measurements of the macro- and micro-temporal structure of the FEL beam. Furthermore, we present experimental results demonstrating the effectiveness of using a pulsed gamma-ray beam to reduce beam background.

Footnotes

M.W. Ahmed et al. <https://doi.org/10.1016/j.nima.2003.08.166>.

S.F. Mikhailov et al. <https://accelconf.web.cern.ch/IPAC2015/papers/tupma012.pdf>

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Primary author: YATES, Stephen (Triangle Universities Nuclear Laboratory)

Co-authors: AHMED, Mohammad (Triangle Universities Nuclear Laboratory); MIKHAILOV, Stepan (Duke University); POPOV, Victor (Duke University); WU, Ying (Duke University)

Presenter: MIKHAILOV, Stepan (Duke University)

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