FEL2022



Contribution ID: 201 Contribution code: WEP17

Type: Contributed Poster

Feasibility of Single-Shot Microbunching Diagnostics for a Pre-bunched Beam for TESSA at 515 nm

Wednesday, 24 August 2022 17:10 (20 minutes)

Co-propagating a relativistic electron beam and a high-power laser pulse through a short undulator (modulator) provides an energy modulation which can be converted to a periodic longitudinal density modulation (or microbunching) via the R56 term of a chicane. Such pre-bunching of a beam at the resonant wavelength and the harmonics of a subsequent free-electron laser (FEL) amplifier seeds the process and results in improved gain in a TESSA** experiment. We describe potential characterizations of the resulting microbunched electron beams after the modulator using coherent optical transition radiation (COTR) imaging techniques for transverse size (50 micron), divergence (sub-mrad), trajectory angle (0.1 mrad), coherence factor, spectrum (few nm), and pulse length (ps). The transverse spatial alignment is provided with near-field imaging and the angular alignment is done with far-field imaging and two-foil COTR interferometry (COTRI). Analytical model results for a 515-nm wavelength COTRI case with a 10% microbunching fraction will be presented. COTR gains of 22 million were calculated for an initial charge of 1000 pC which enables splitting the optical signal for single-shot measurements of all the cited parameters.

**Tapering Enhanced Super-radiant Stimulated Amplification (TESSA)*Work supported by U.S. Department of Energy, Office of Science, under Contract No. DE-AC02-06CH11357.

I have read and accept the Privacy Policy Statement

Yes

Primary author: LUMPKIN, Alex (Argonne National Laboratory)

Co-authors: RULE, Donald (Naval Surface Warfare Center); MUSUMECI, Pietro (University of California, Los Angeles); MUROKH, Alex (RadiaBeam Technologies)

Presenters: LUMPKIN, Alex (Argonne National Laboratory); RULE, Donald (Naval Surface Warfare Center); MUSUMECI, Pietro (University of California, Los Angeles)

Session Classification: Wednesday posters

Track Classification: Electron diagnostics, timing, synchronization & controls