



Contribution ID: 224 Contribution code: TUP224-WEA

Type: **Poster Presentation**

FAST Injector Modeling for the TESSA experiment

Tuesday 20 August 2024 20:40 (20 minutes)

The FAST facility at Fermilab provides particle accelerator R&D with > 150 MeV electrons from an RF linac out of a PITZ style photoinjector. The TESSA tapered undulator FEL experiment [1] will make use of the FAST accelerator and requires careful control of beam properties with small emittances. We present modeling studies of the photoinjector electron beam dynamics using the Opal code, comparing to recent multi-slit diagnostic emittance measurements. We include computed initial electron beam distributions as well as modeling of the emittance diagnostic. Misalignments of the solenoid and accelerating cavity are taken into account using data from a recent survey. Phase and solenoid current are scanned in simulation to compare with the measurements. Improved modeling for better agreement between measured and computed emittance is expected to help ensure success of the TESSA experiment.

[1] Musumeci, P et. al. (2022). FAST-GREENS: A High Efficiency Free Electron Laser Driven by Superconducting RF Accelerator. JACoW, IPAC2022.

Footnotes

Funding Agency

This work is supported by the DOE Office of Science Office of Basic Energy Science award number DE-SC0018571

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Session Classification: Poster session

Track Classification: Electron sources