Update on Simulations for Xseed and Laser Heater and Future Requirements

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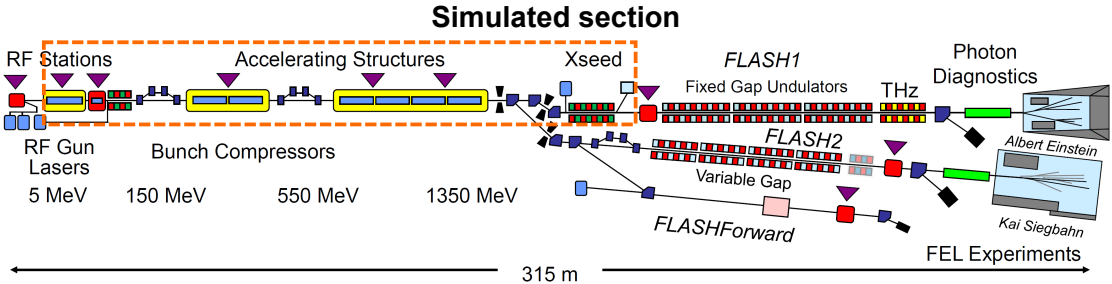
Context

- this workshop is dedicated to FLASH2020+, the future machine
- the talk is on Xseed, the current machine, which is going to be dismantled in about a year
- investing in simulations of Xseed is a good idea

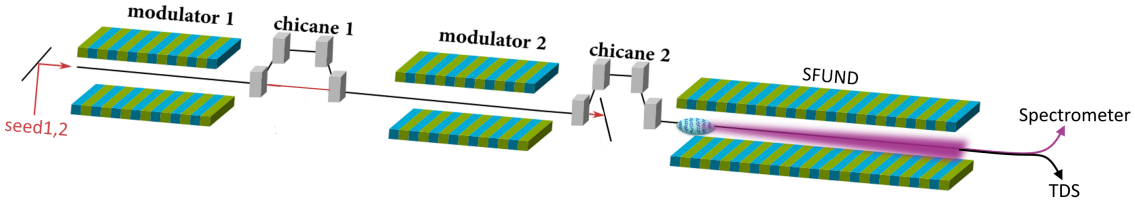
Overview

- Machine layout and relevant components
- Recent developments: Laser heater commissioning
- Recent developments: demonstration of EEHG
- Motivation for xSeed simulations
- Simulation status and next steps

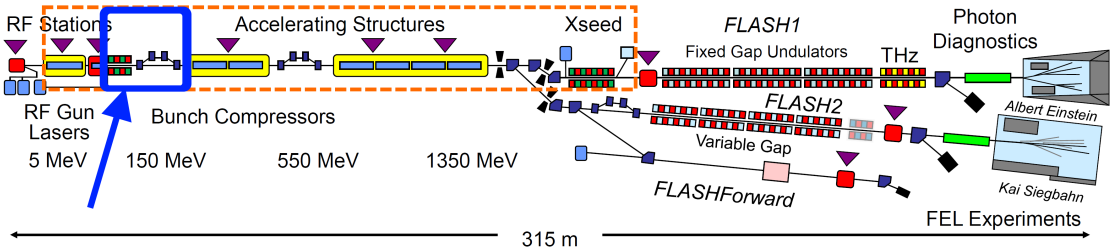
xSeed at FLASH



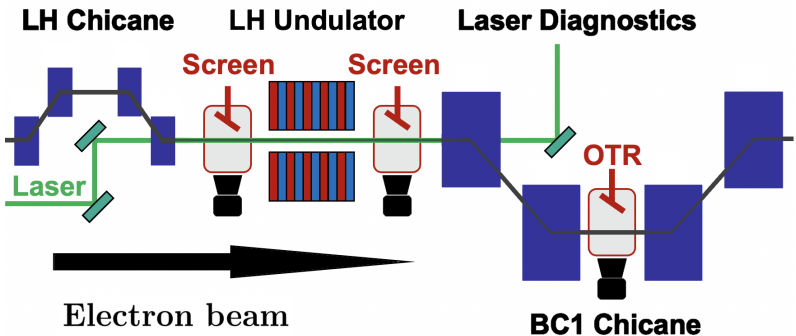
xSeed Layout



Laser Heater at FLASH

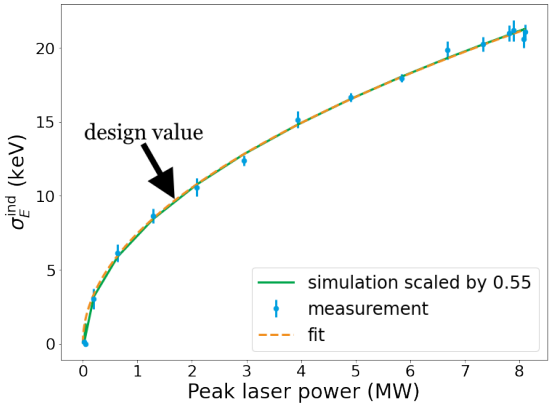


Laser Heater Layout



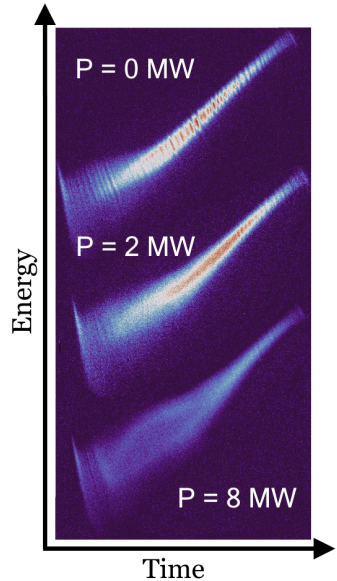
Laser heater commissioning

- LH induces uncorrelated energy spread to suppress microbunching instability and improve FEL performance
- so, step 1 - measure the induced energy spread
- design value is comfortably achieved



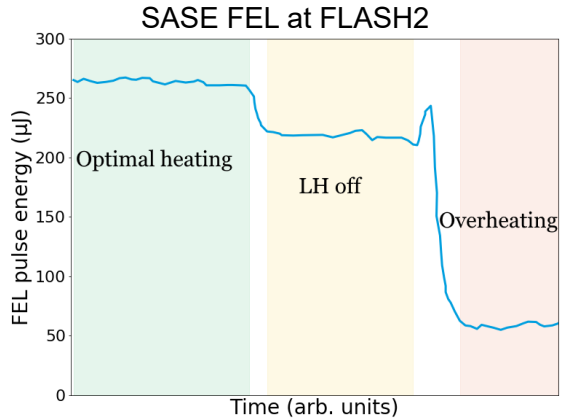
Laser heater commissioning

- energy spread is induced
- step 2 - do we suppress μB?
- at moderate laser power μB is suppressed

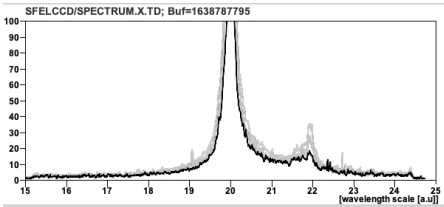


Laser heater commissioning

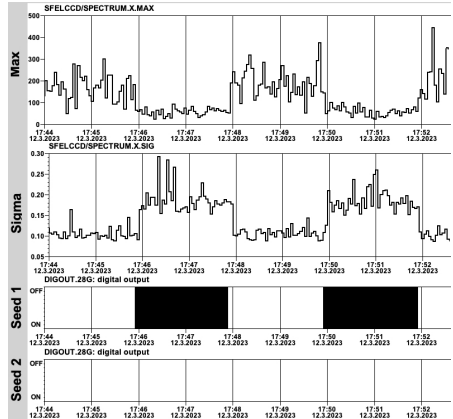
- μB is suppressed
- step 3 - can we improve FEL?
- intensity improved by 10-20%
- LH at FLASH works!



Demonstration of EEHG at FLASH



> seeding at FLASH works!



Motivation

- LH and seeding at Xseed work
- we can acquire data for seeded FEL and effect of the LH before FLASH2020+
- we can benchmark our simulation framework for FLASH2020+ with data from xSeed
- we need to simulate current xSeed experiment

Linac configuration

- layout is the same as for FLASH2020+
- charge and final energy are known
- compression settings are read directly from the machine
- peak current from TDS measurement

Charge	0.4 nC
Compression	4-5
Peak current	350-500 A
Energy	680 MeV

Seeding section configuration

- layout is different
  - lattice files
  - optics
  - bunching optimization for HGHG end EEHG
- topic for the bachelor thesis

Laser wavelength	267 (300) nm
Harmonic	9-17

Conclusion

- the current Xseed experiment can produce useful data for seeded FEL (HGHG and EEHG) and the effect of the laser heater
- simulating Xseed is a reasonable amount of work
- benchmarking the simulation framework against the experimental data
- increase credibility of simulations for FLASH2020+

Thank you!

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