Simulations of seeding by modulated laser pulse for THz

Introduction

Train of pulses simulation

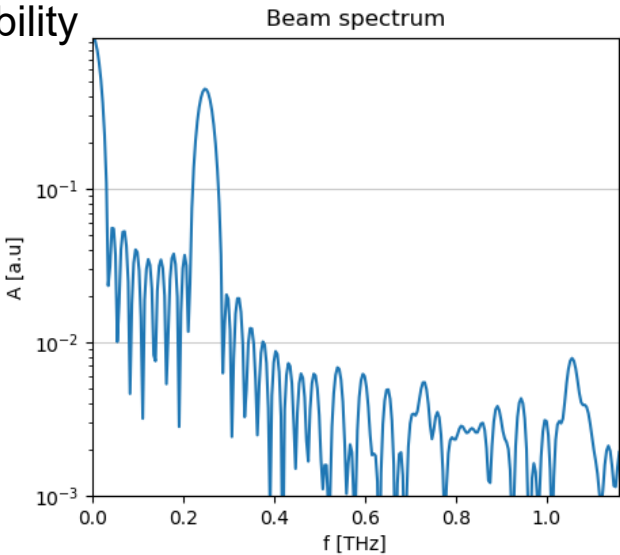**Simulation for Lyot filter**

Summary

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PPS
12.02.2020

Introduction

- Seeding for THz program at PITZ
  - Introducing frequency in the beam (current/energy/energy spread)
  - Ultimate goal: amplify a THz seeding signal in FEL
  - Improvements on stability and energy of SASE
- CTR/CDR experiments
  - Available at the moment
  - Beam current modulation to TR
  - MBI laser
    - Lyot filter modulation of Gaussian pulse
    - Pulse train of short Gaussians
  - PHAROS
    - Longitudinal pulse shaping
    - *No simulations yet*

Initial beam – laser pulse

Simulation

- Pulse train
  - 100 pC and 500 pC
  - 3 or 5 pulses
  - 2 ps FWHM & 4 ps spacing
- Lyot filter
  - 100 pC and 500 pC
  - Truncated Gaussian
 - 4 ps modulation period

90% visibility
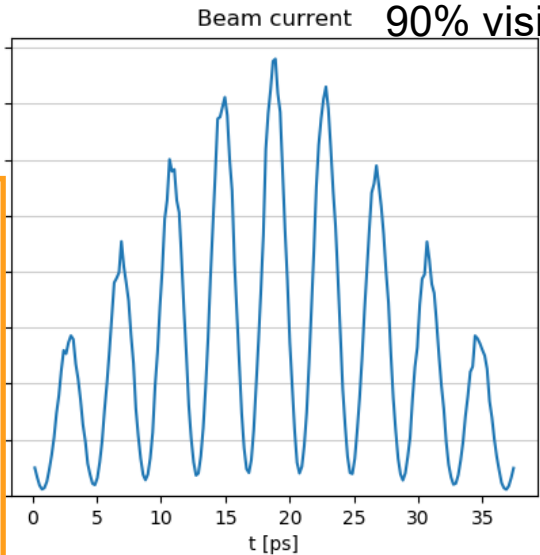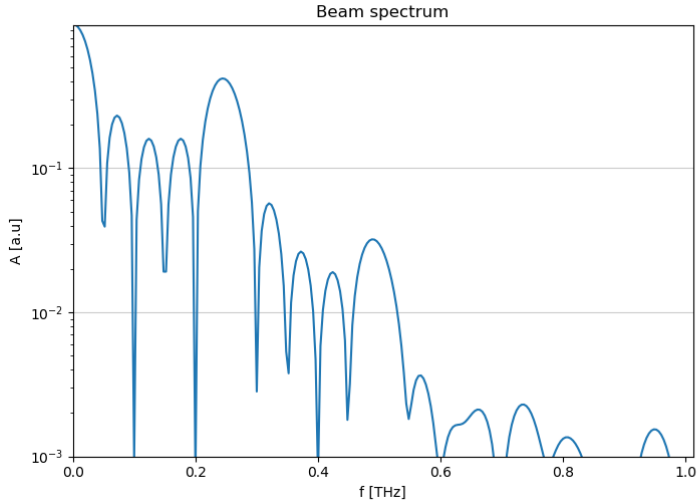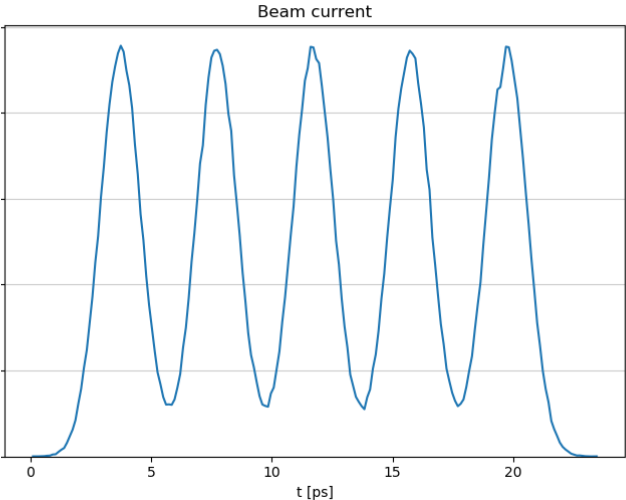
Experiment with Lyot filter
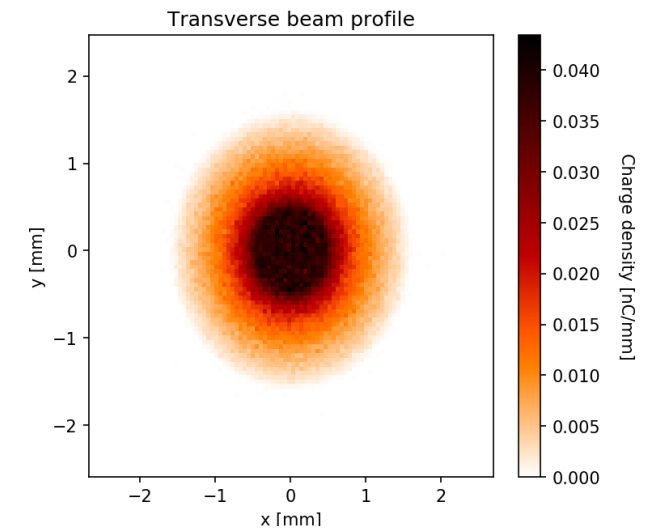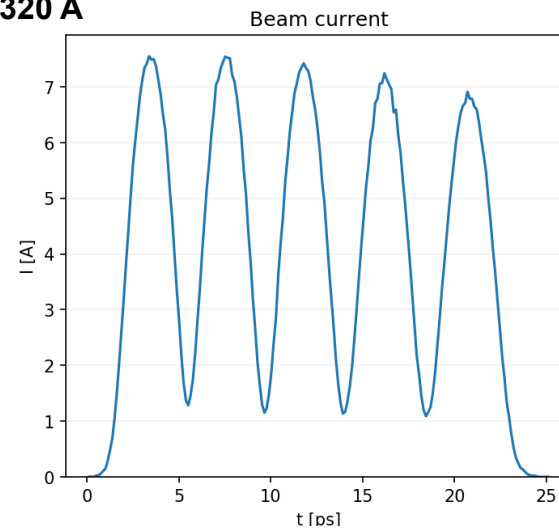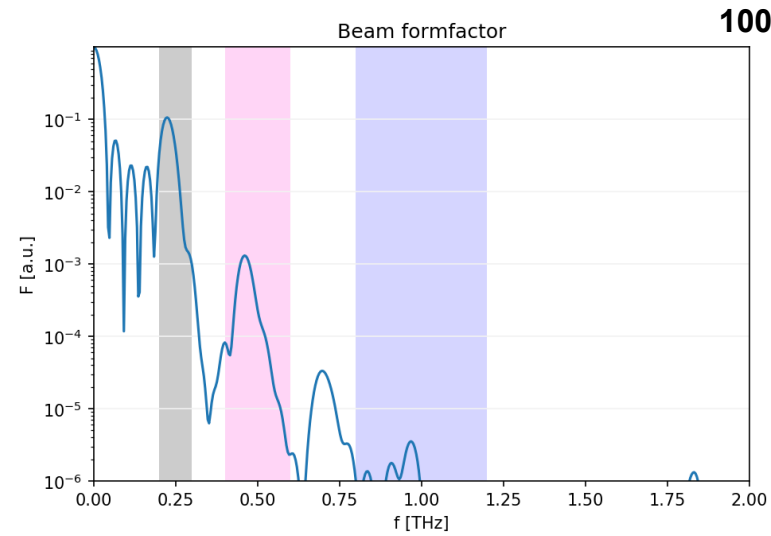
Simulation of pulse train

Setup

- Particle tracking in ASTRA
  - **Final momentum 17,2 MeV/c**
  - *New simulations ongoing*
  - 500k particles
  - BSA 2,5 mm
  - Symmetric space-charge fields
  - Main solenoid current
  - Booster phase (incomplete)
- Initial characteristics
  - Base frequency 0,25 THz
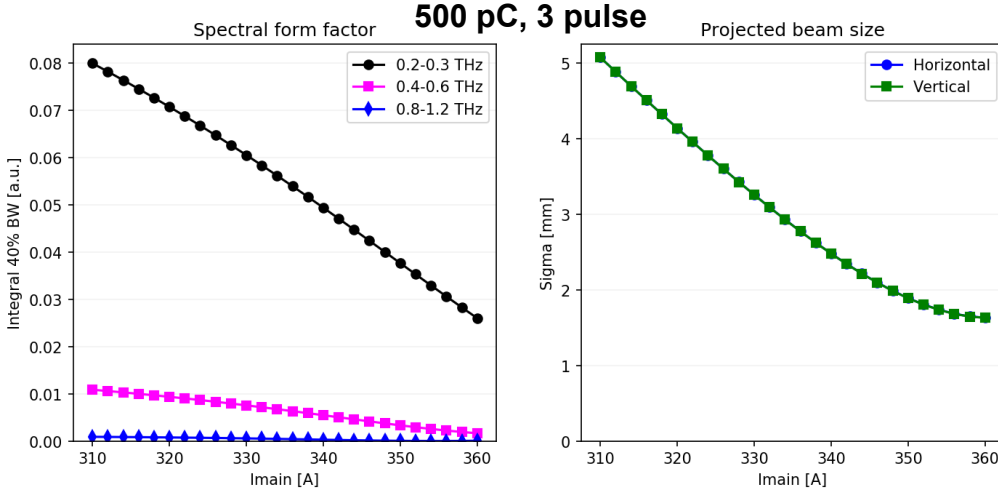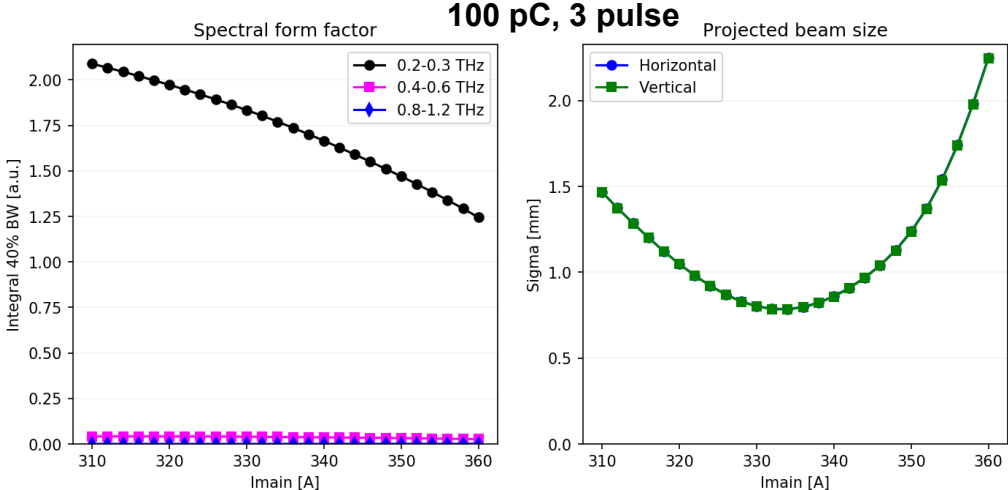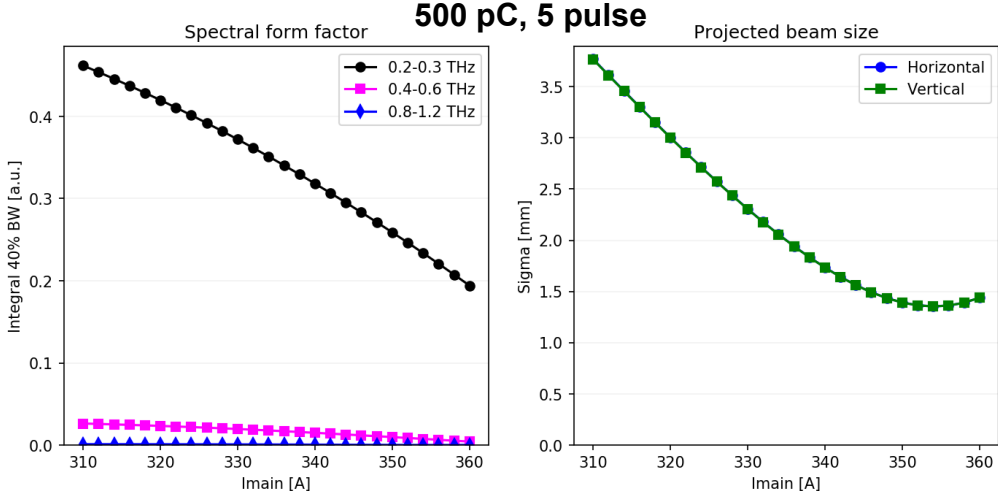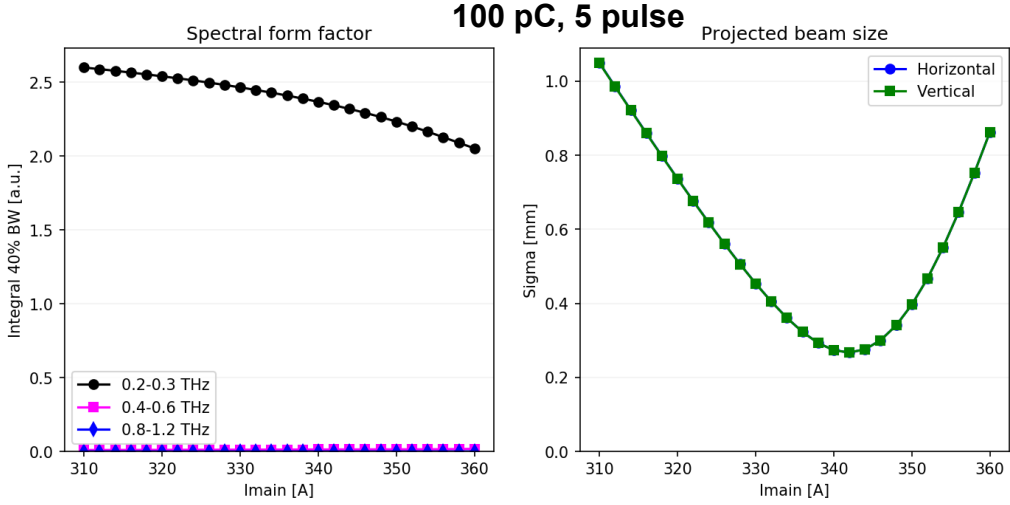 - Strong starting modulation
- Transport to PST.Scr2
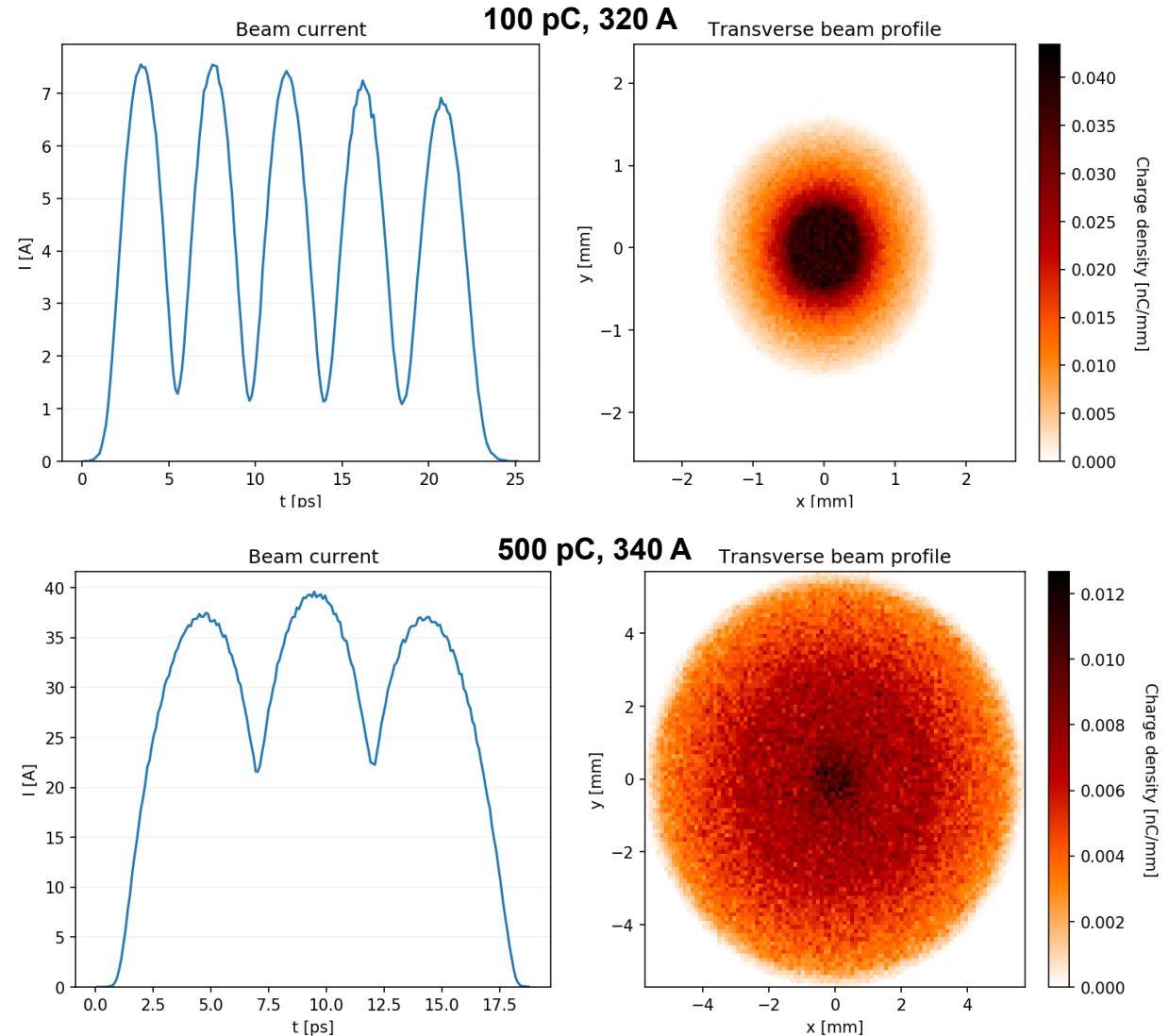
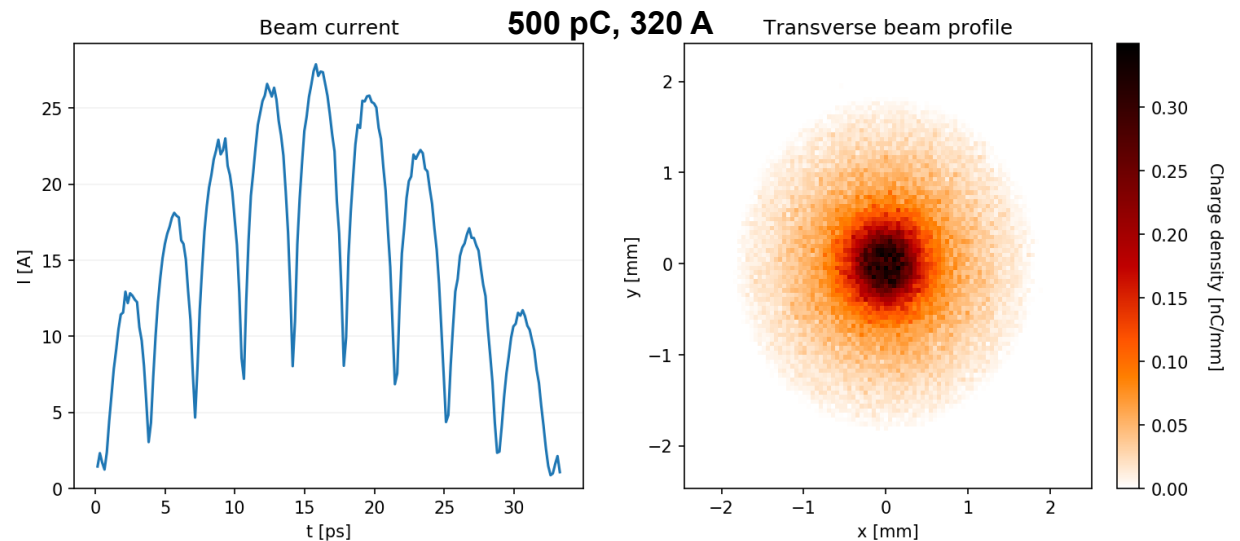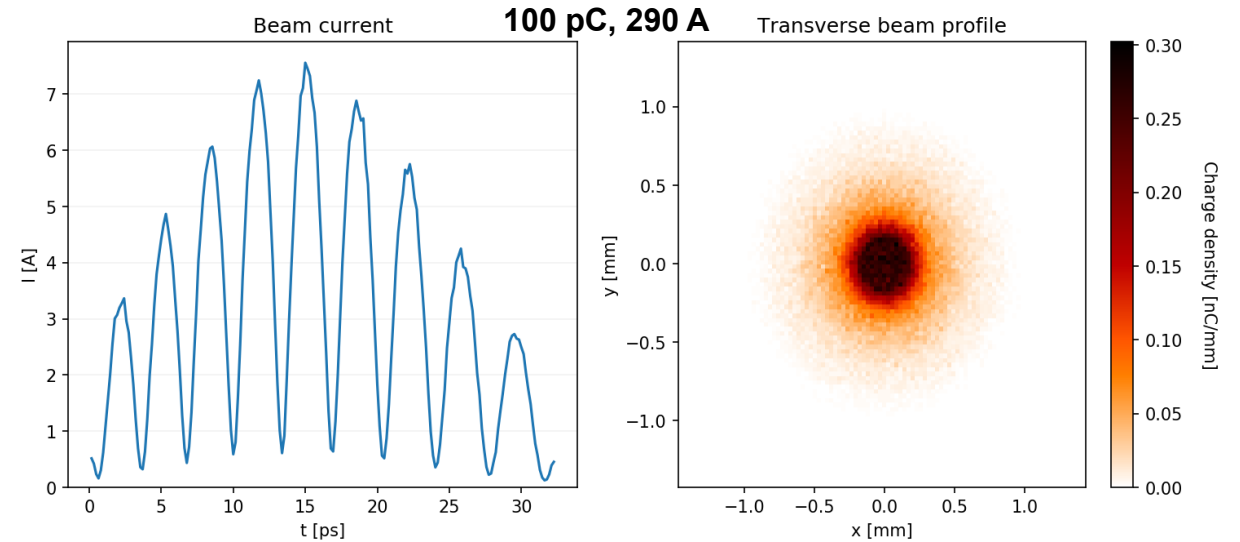# Spectra of pulse train

Form factor
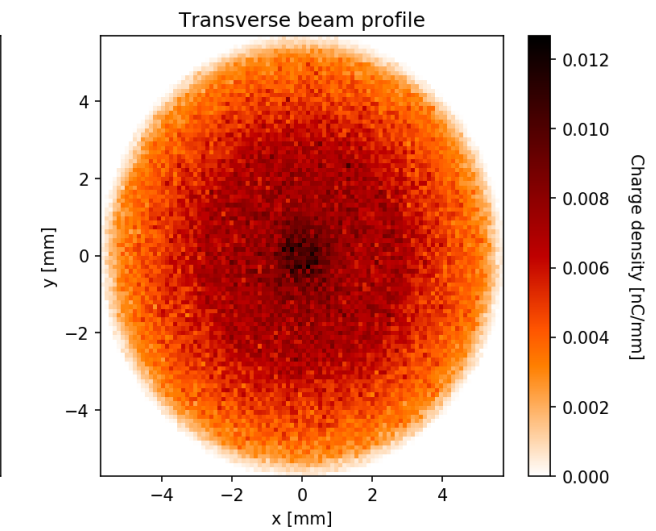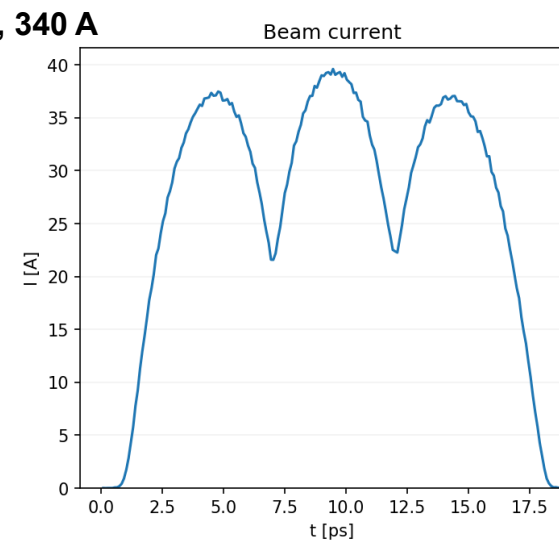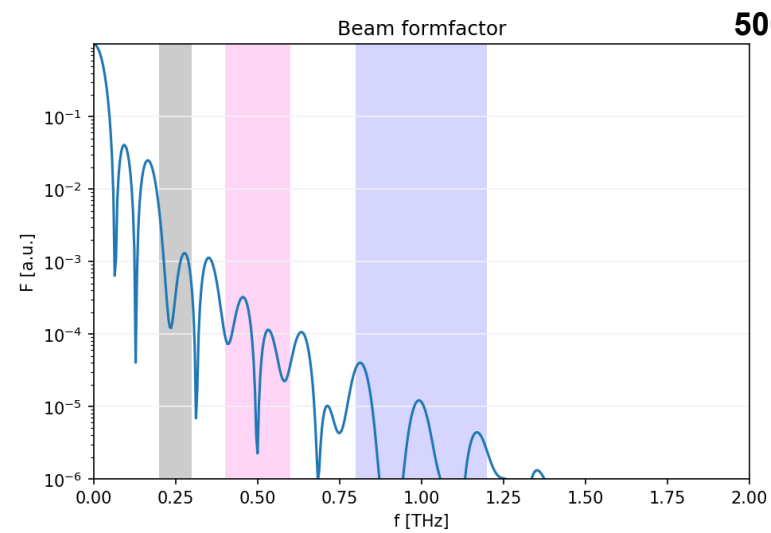
Overview of pulse train

Solenoid dependency

Simulation for Lyot filter

Setup

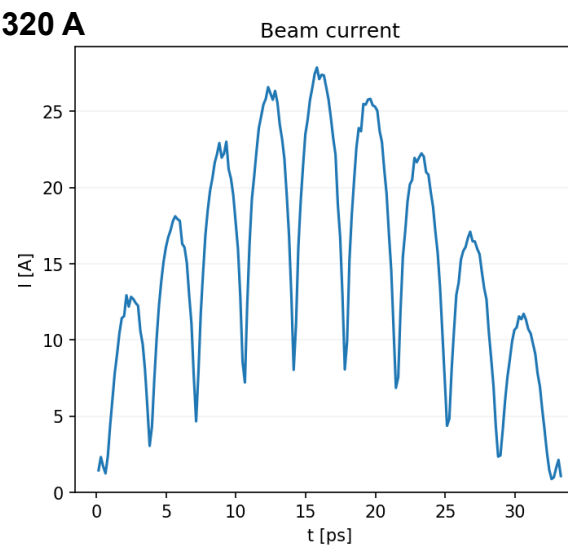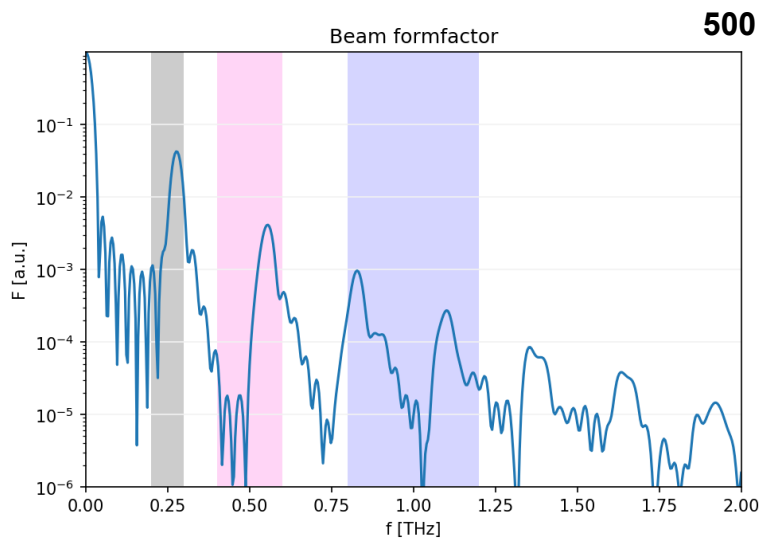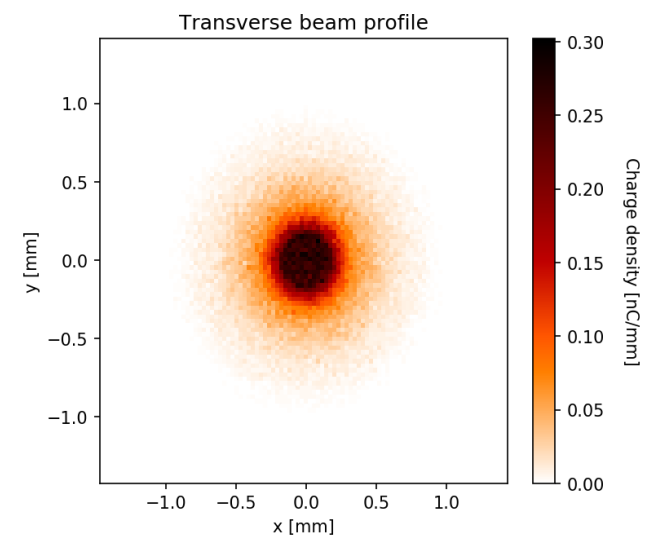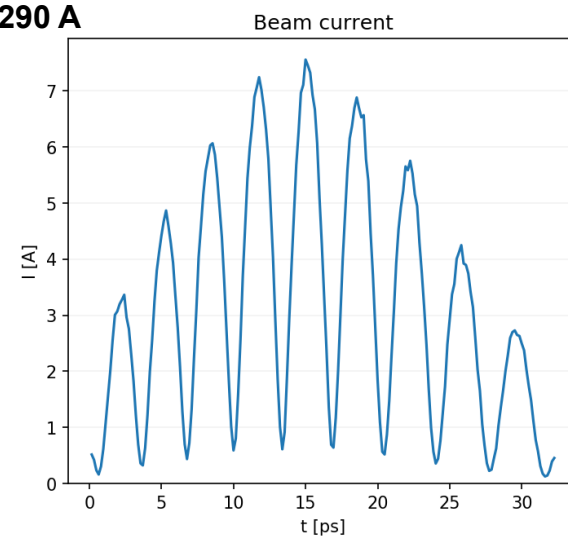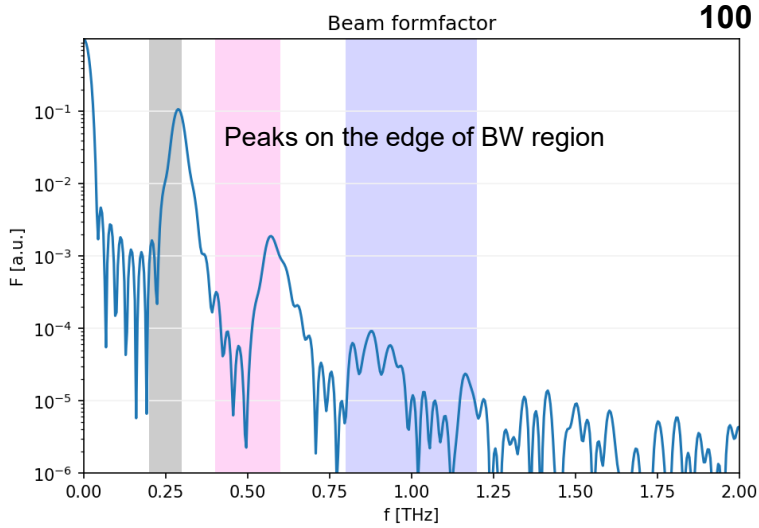- Particle tracking in ASTRA
  - **200k particles**
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- Characteristics
  - Base frequency 0,25 THz
  - Strong starting modulation (experiment)
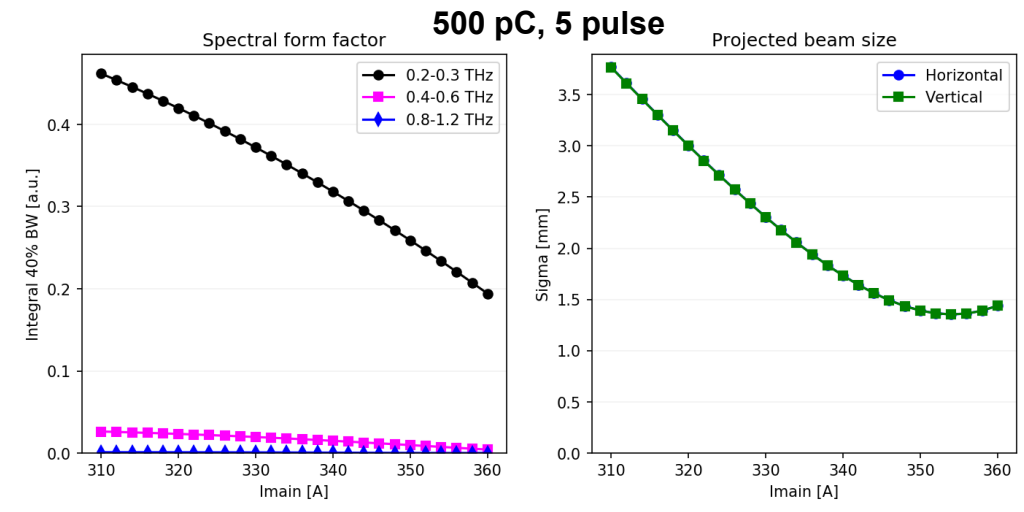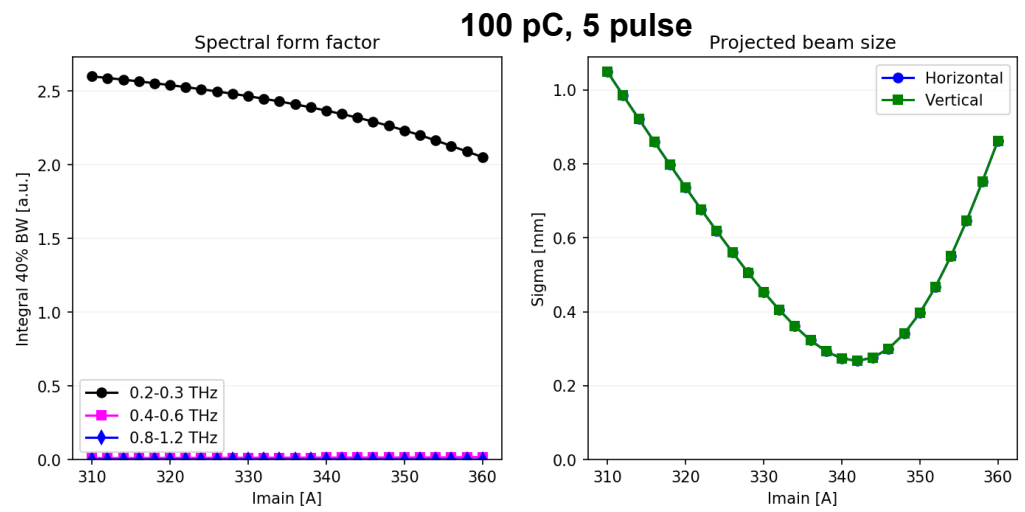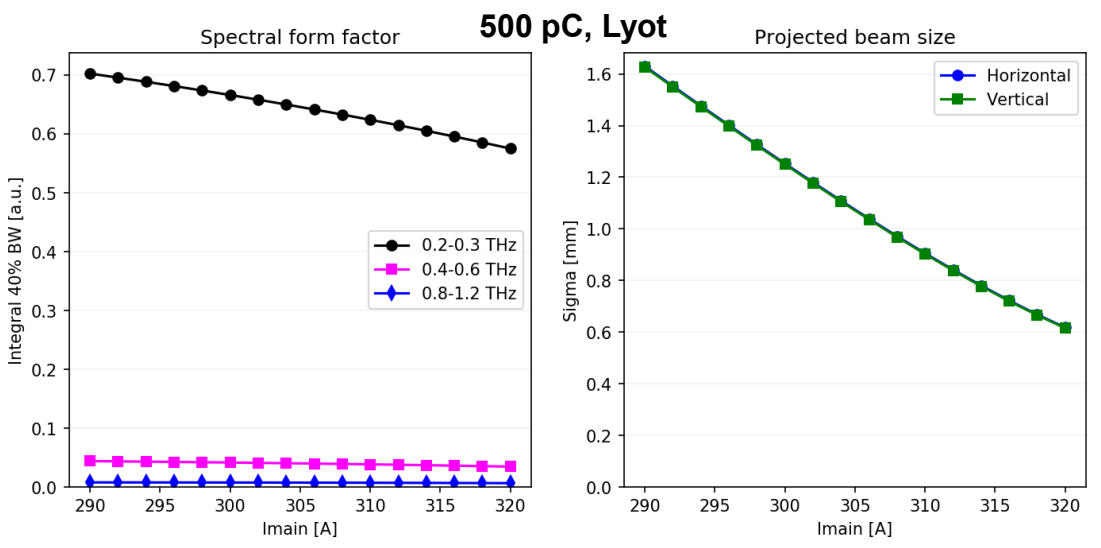- Transport to PST.Scr2

Spectra with Lyot filter
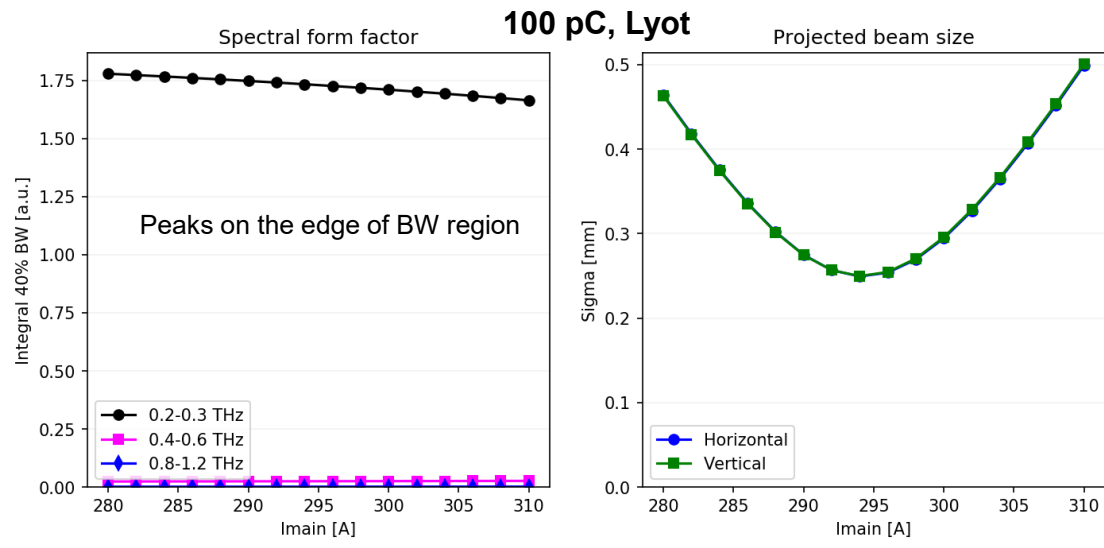
Form factor
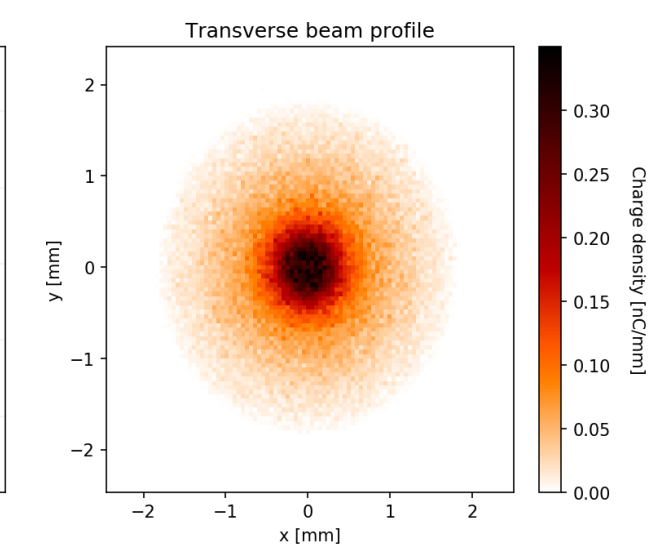
Overview with Lyot filter

Solenoid dependency

Summary

- Pulse train
  - More pulses are better
  - Solenoid currents below min. size on PTS.Scr2 preferred
  - Space charge degrades modulation (~17 MeV/c)
  - Sub THz
- Lyot filter
  - More peaks & longer beam
  - Space charge less problematic
  - Sub THz
- Outlook
  - Ballistic compression
  - Observing in experiment

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THANK YOU!