Status of OBLA

500 keV Simulations

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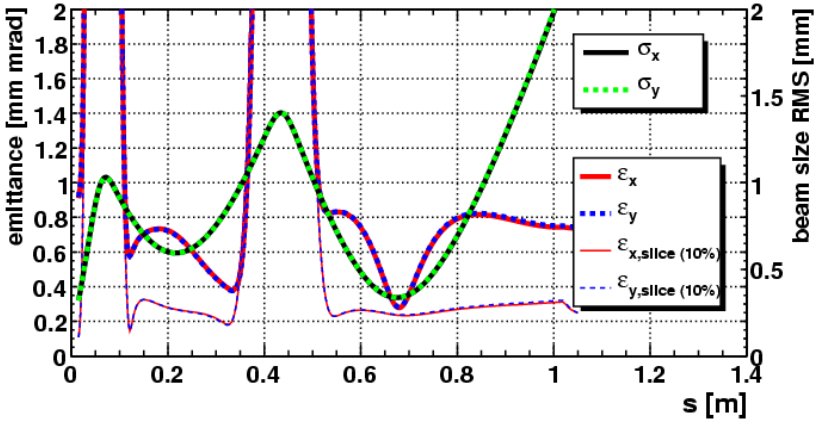
Was bisher geschah (1)

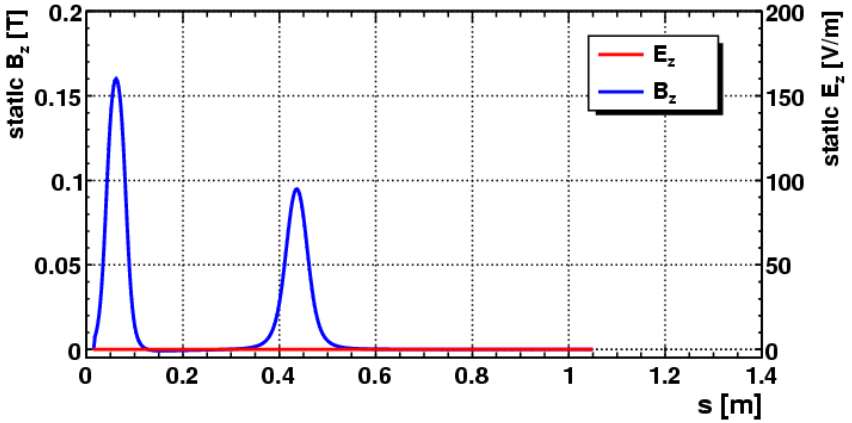
Spring/Summer: simulation of **standard setup** as described in FEL-PM84-005-01 (Marco Pedrozzi)

- i.e. uniform distribution 5.5 A × 40 ps = 220 pC + low-current case with 0.1 A (4 pC)
- Slice studies, B field scans, misalignment studies
- Systematic collection of plots (and movies) available at http://amas.web.psi.ch/projects/fel/obla
- Main conclusions:
  - Fairly good agreement with Homdyn and GPT
  - Solenoid position tolerance is ~10–20 μm
  - For low current, easy to shift emittance minimum between 60 and 120 cm

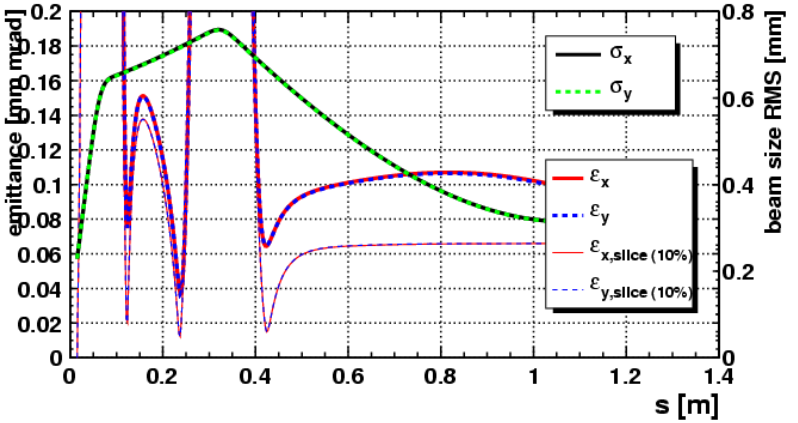
Simulation of standard setup (uniform distribution)

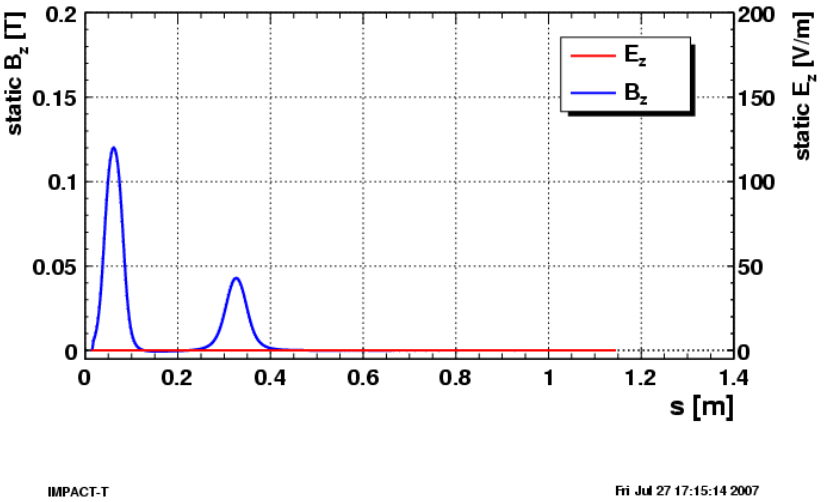
OBLA, phase-I, case1





OBLA, phase-I, case3a



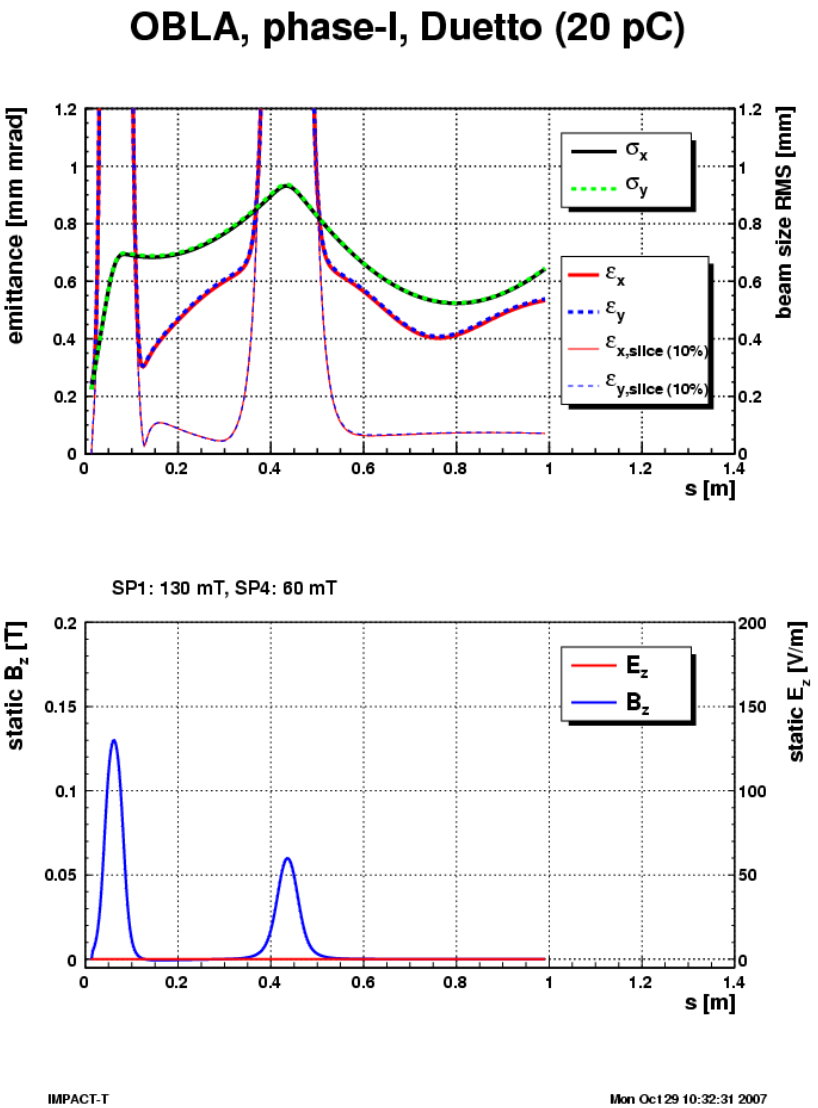


Was bisher geschah (2)

Autumn: simulation of **Gaussian gun**

- Needed modification in ImpactT (Ji Qiang visit in September)
- Simulations for 370 and 20 pC bunch charge
- Found solenoid settings suitable for emittance measurement, not dramatically different from previous low-current case
- Results also documented at http://amas.web.psi.ch/projects/fel/obla

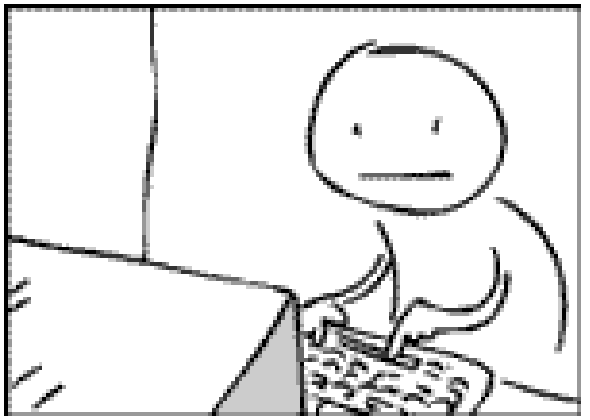
Gaussian Gun, low current



SP1: 130 mT, SP4: 60 mT, given by the requirements:

- ϵ_{min} between 0.6 and 1.0 m
- rms(x) > 0.3 mm at ϵ_{min}
- Only two solenoids are powered

ImpactT

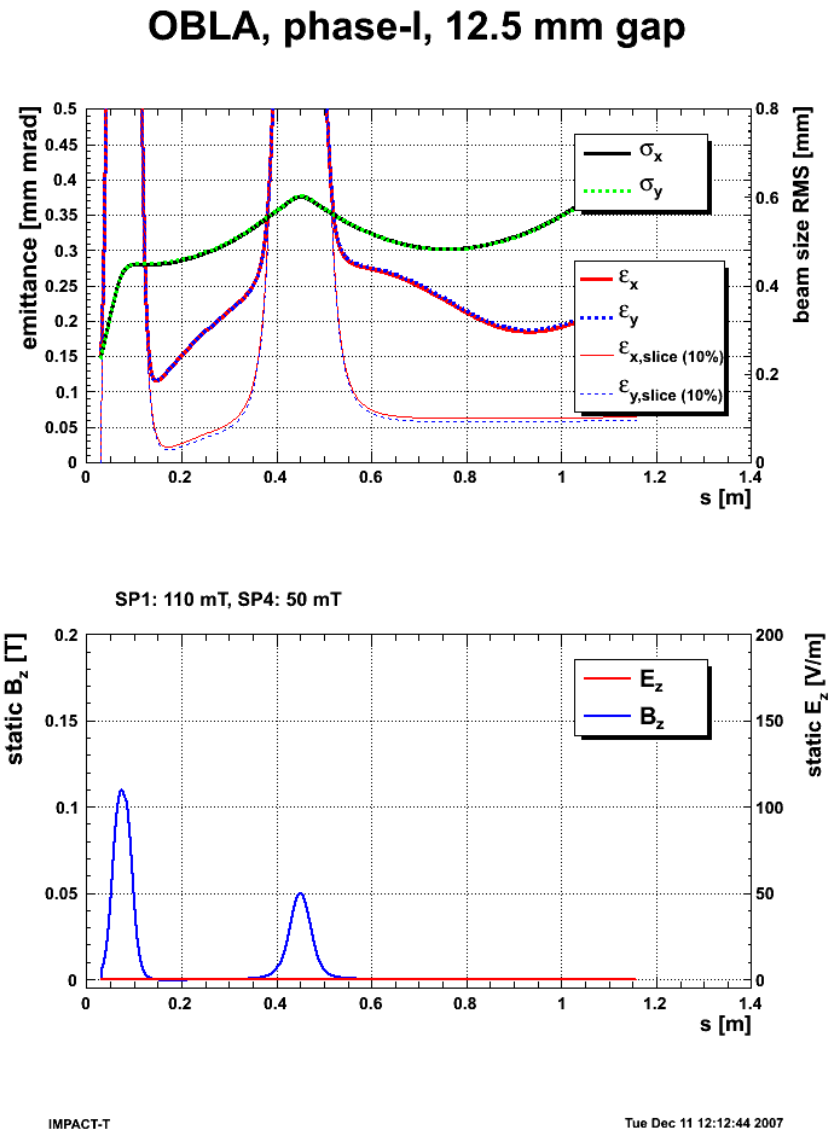


- All these simulations done in ImpactT
  - Error-prone input files
  - Hard to locate bugs/implement new features
- In the future, use OPAL (see Andreas' presentation)
  - Almost ready for show-time
- But for the measurements **starting next week**, we still have to fall back on ImpactT
- A well-understood and maintained ImpactT simulation is needed anyway for comparison to and validation of the OPAL simulation!

Current effort

- Simulate **realistic situation** as a function of OBLA status
- Realistic (as of today):
  - Laser: 6 pC bunch charge from 4.5 µJ at 266 nm (assume Q.E. of 10^{-5}) [RG 7.12.07]
  - In principle need transverse Gauss shape (σ = 110 µm), but not yet implemented in ImpactT
    - Will be much easier in OPAL...
  - Pulser: 12.5 mm gap, given by gradient of 40 MV/m and voltage of 500 kV [MP]
- Diode field map for non-standard gaps generated from René's Matlab file with Poisson/Superfish (thanks Kevin!)
- Still to be done: conversion of magnet measurements to T7 fieldmaps (for now use design fields)
  - Plan is to use Delaunay triangular interpolation of measurements (ROOT), unless someone has a ready-made conversion tool
  - Not urgent (only a second order correction)
- Single-solenoid setup? (SP1 only – for very first measurements)
  - Beam blows up after 30 cm no matter how much focussing at SP1...
  - ⇒ at least two solenoids must be turned on to get the beam to the EM

12.5 mm gap



SP1: 110 mT, SP4: 50 mT, for 6 pC bunch charge

- just a first look from this morning...