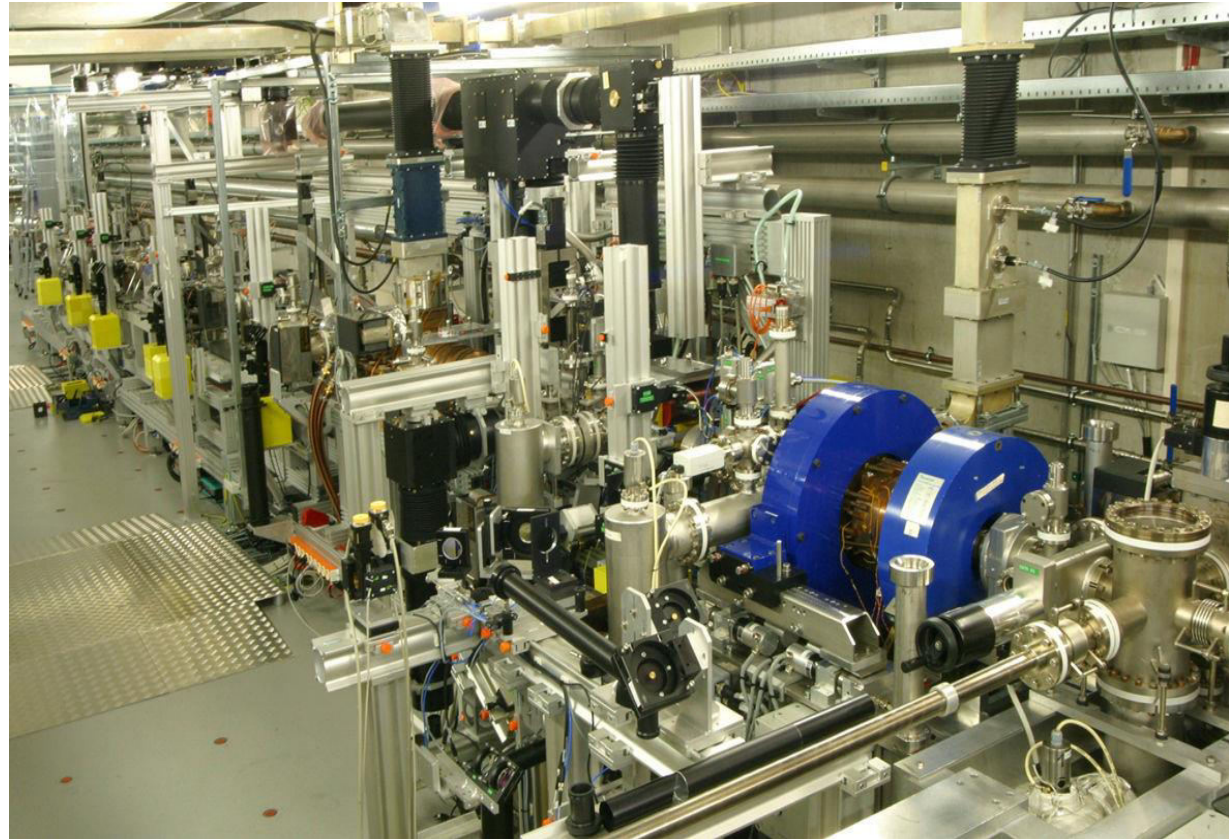


Solenoid focusing at PITZ

Gulnur Kantay
PITZ group
DESY, Zeuthen
06/09/2016

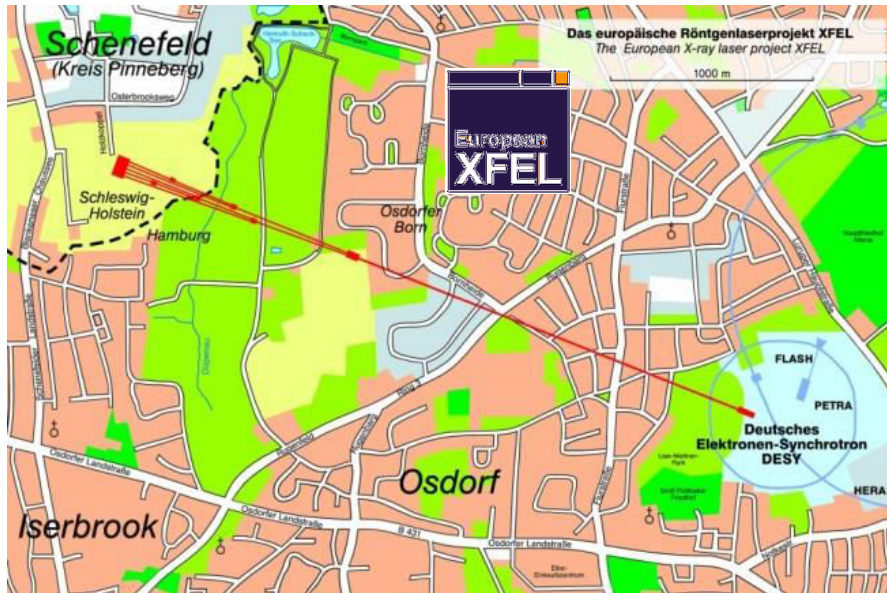


Introduction

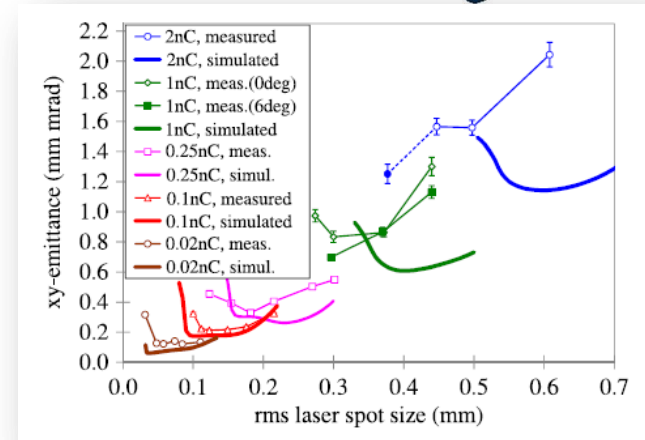
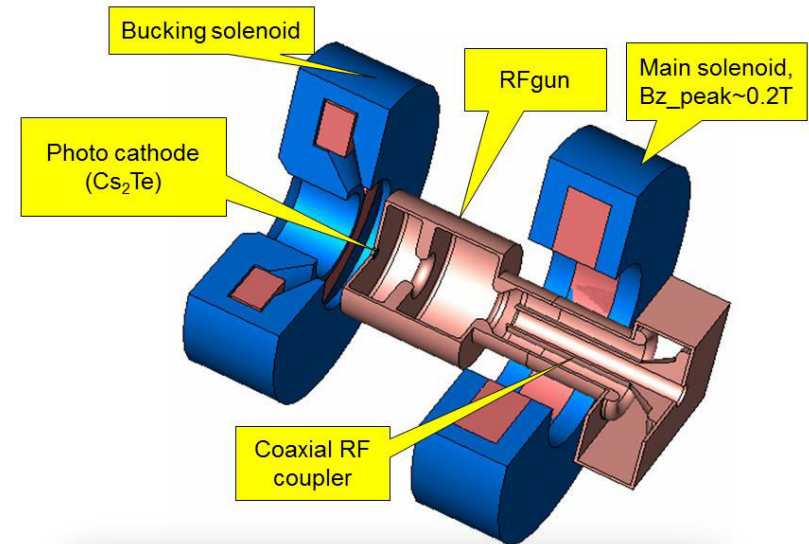
> Photo Injector Test Facility at DESY, Zeuthen (PITZ)

Main focus of PITZ group:

production of electron bunches with extremely small transverse emittance...



... for the European XFEL

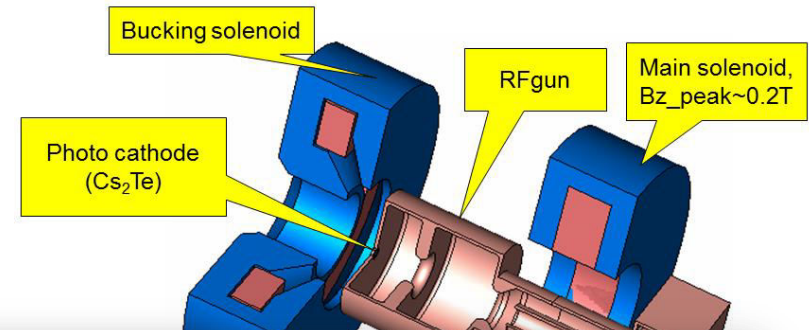


Motivation

> Photo Injector Test Facility at DESY, Zeuthen (PITZ)

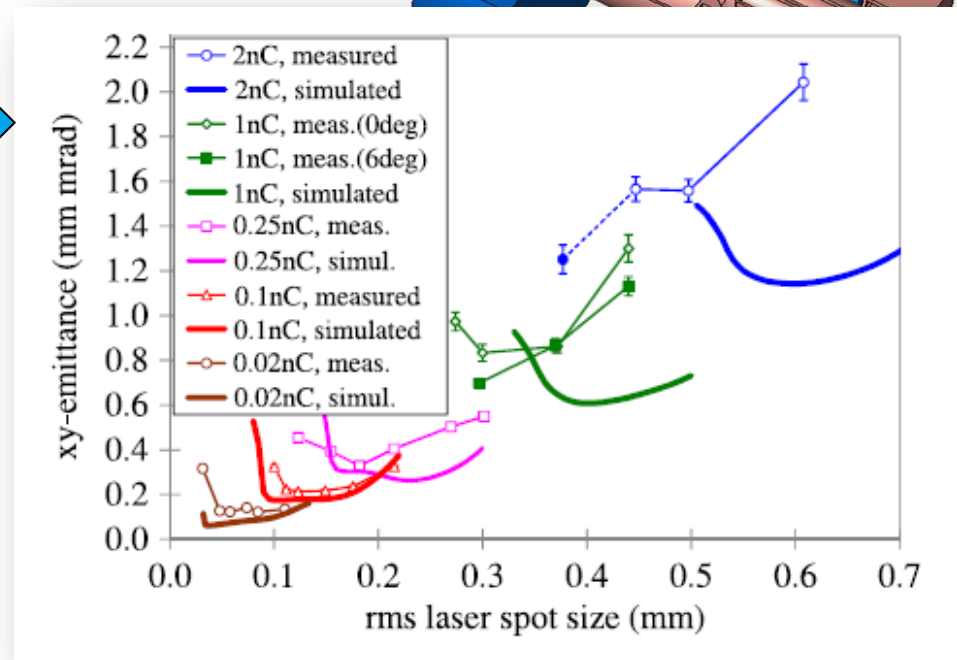
Main focus of PITZ group:

production of electron bunches with extremely small transverse emittance.

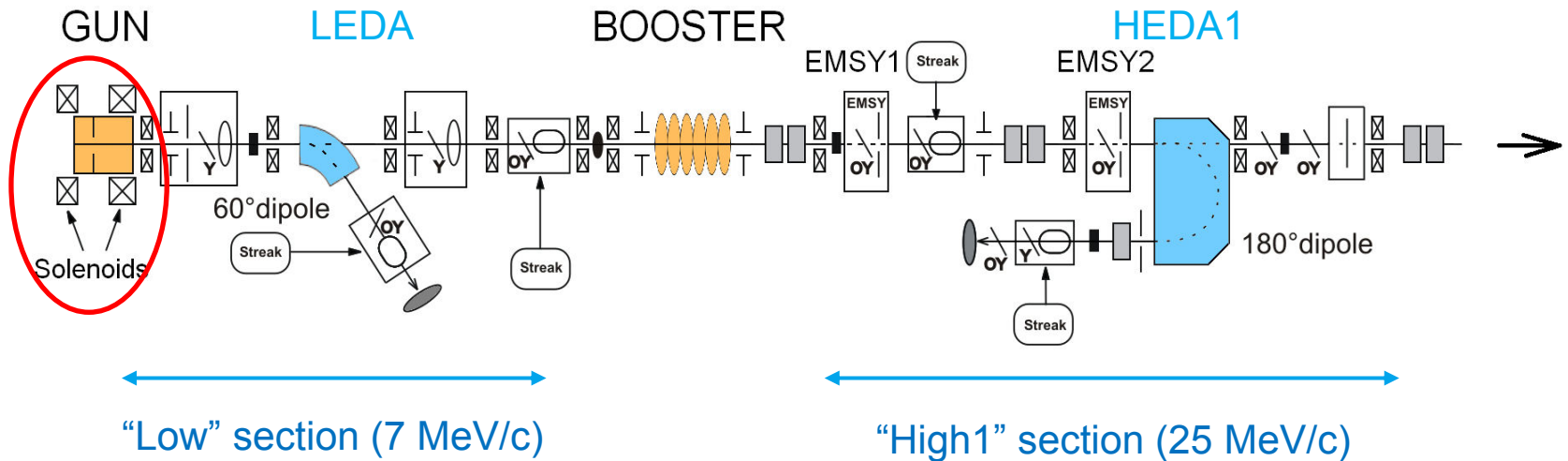


Discrepancies between emittance measurements and simulations

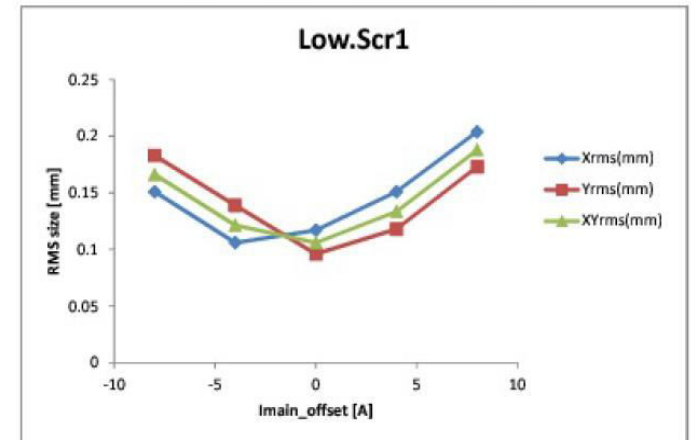
- In terms of optimum laser spot size at given charge (i.e. intensity)
- In terms of optimum solenoid current



PITZ setup and summer student program



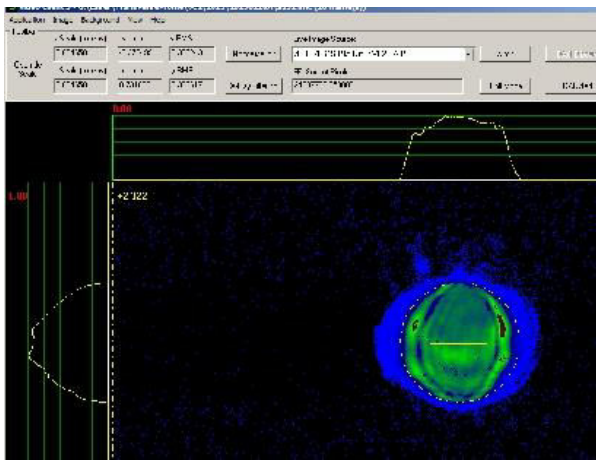
- Investigation of focus size on 6 different screens (1st Experiment) and 4 different screens (2nd Experiment) in Low and High1 sections
- Compare experimental focus size and position with simulations (ASTRA code)
- Vary some parameters (BSA, C+H model, gun and booster gradients) in simulation to find the source of discrepancies



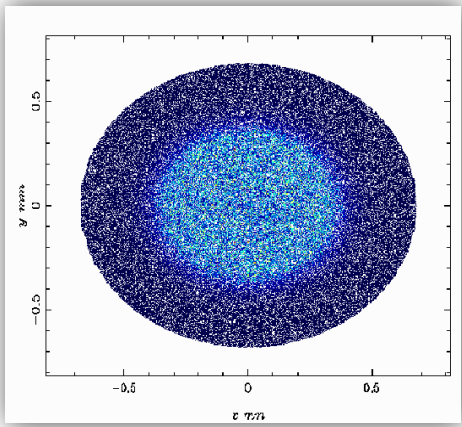
File: http://pitzlib.ifh.de:8080/PITZelog/data/2016/29/22.07_a/2016-07-22T18:04:54-00.ps

Core+Halo model: initial e-distribution for ASTRA code

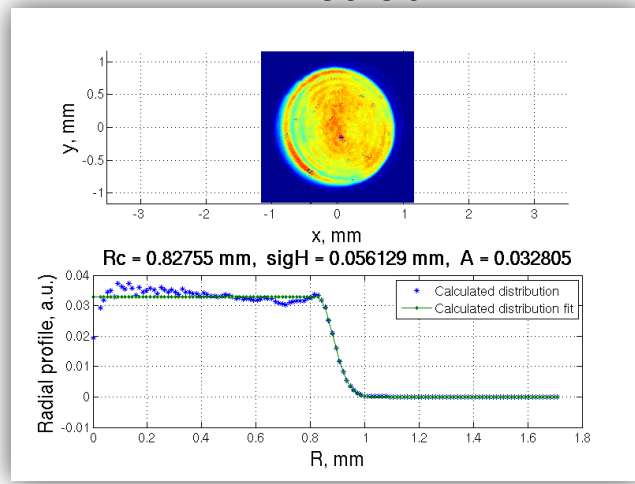
Laser distribution on virtual cathode
imaging camera data capture



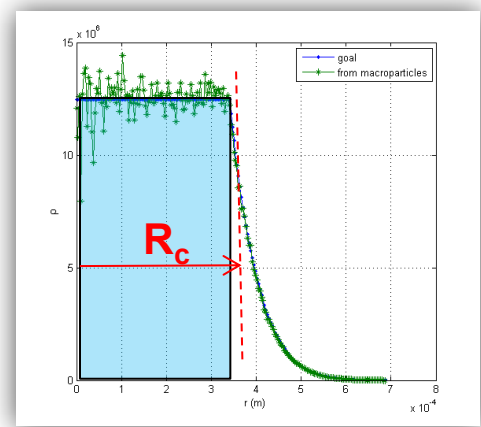
Input distribution shown by postpro
with core + halo



Virtual cathode data fitted
in MatLab



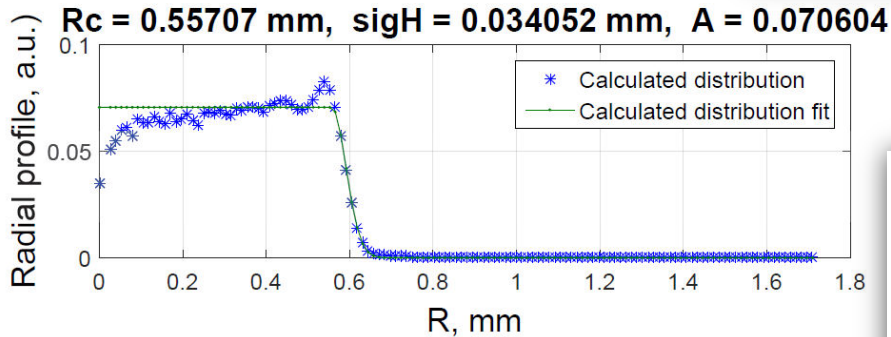
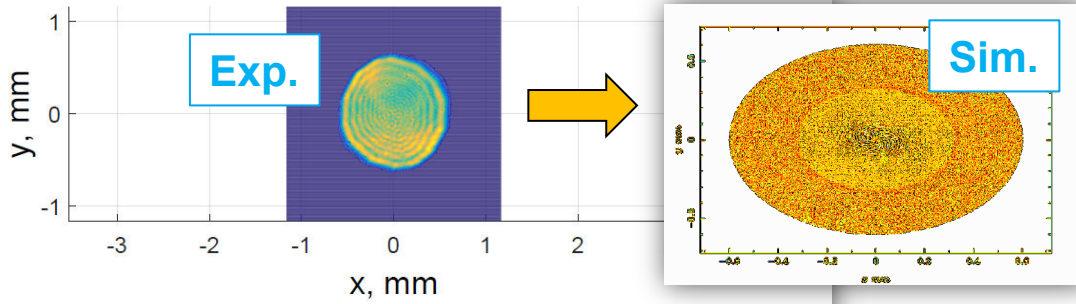
MatLab-generated input distribution
for ASTRA with core + halo



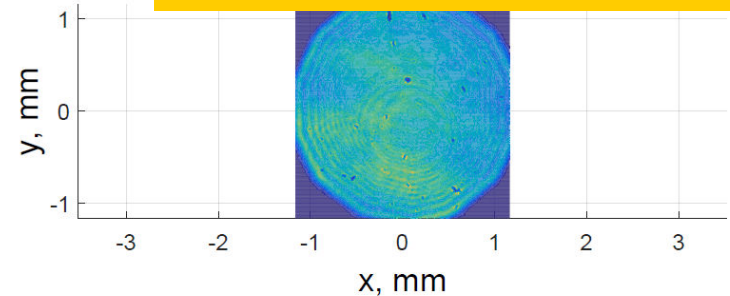
Actual, used distributions

Other parameters:

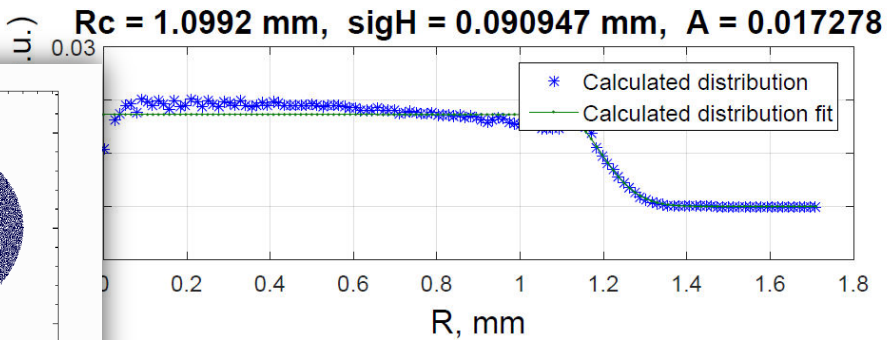
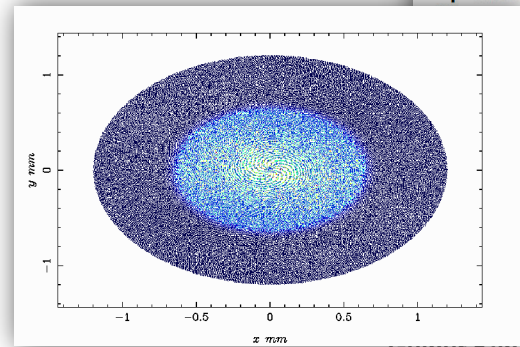
- 500 pC
- 6.5 MeV/c after gun
- ~23 MeV/c after booster



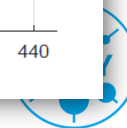
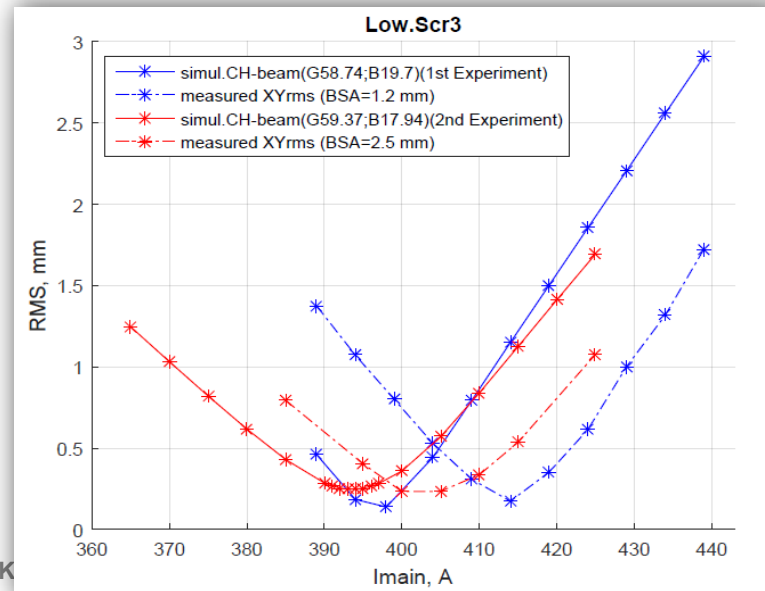
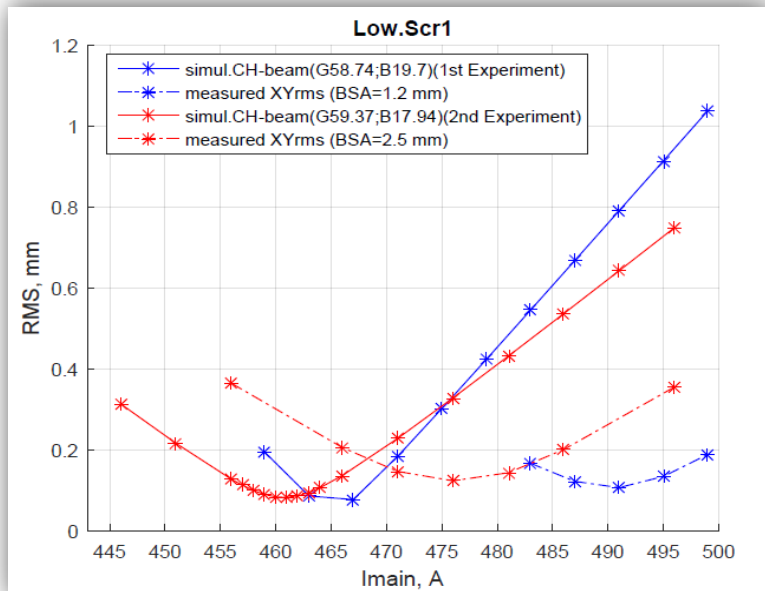
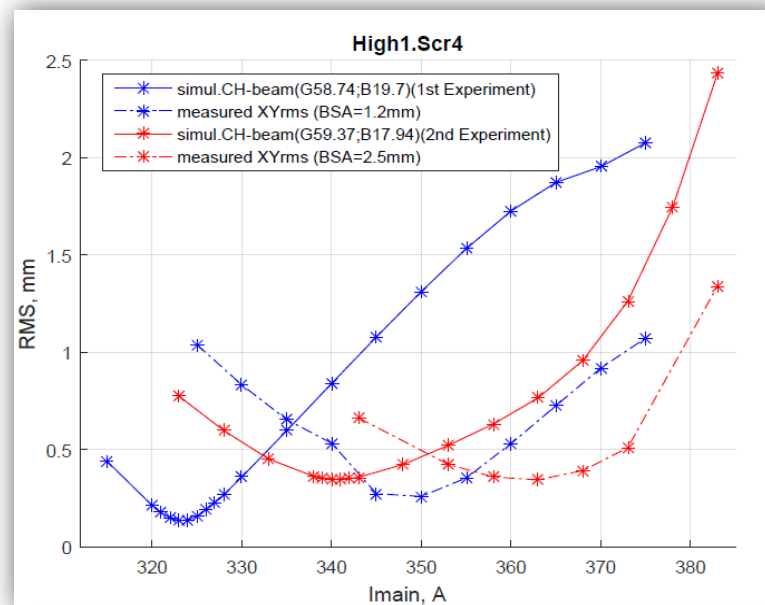
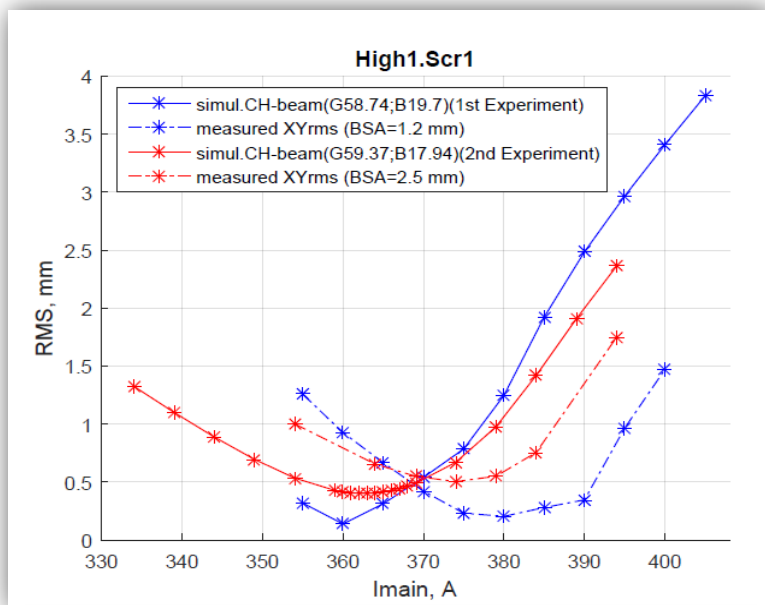
CH_beam_25.ini(BSA=2.5mm)
 („Exp.2“, laser rms size = 0.6 mm)



CH_beam_12.ini(BSA=1.2mm)
 („Exp.1“, laser rms size = 0.3 mm)

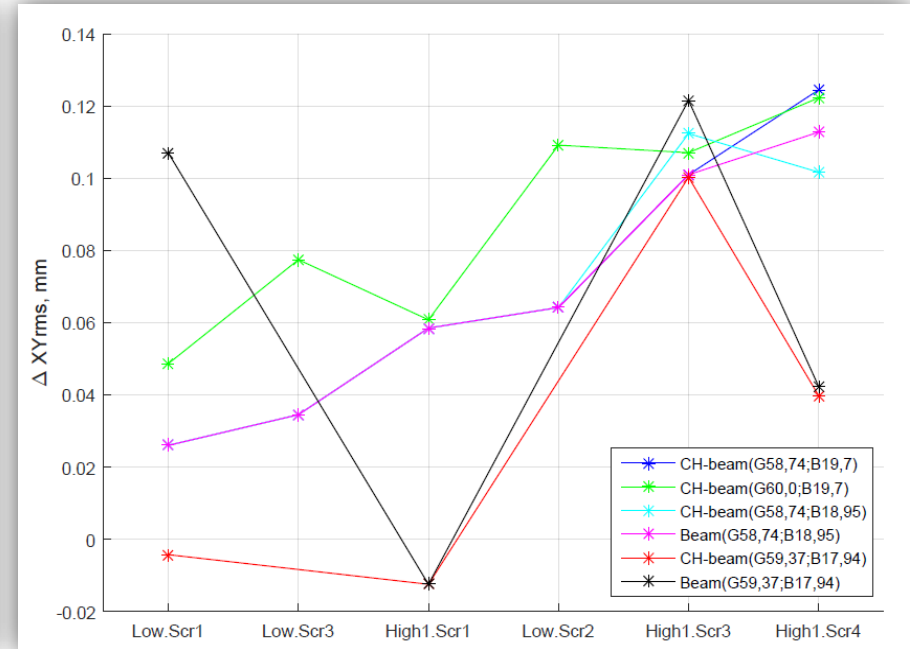
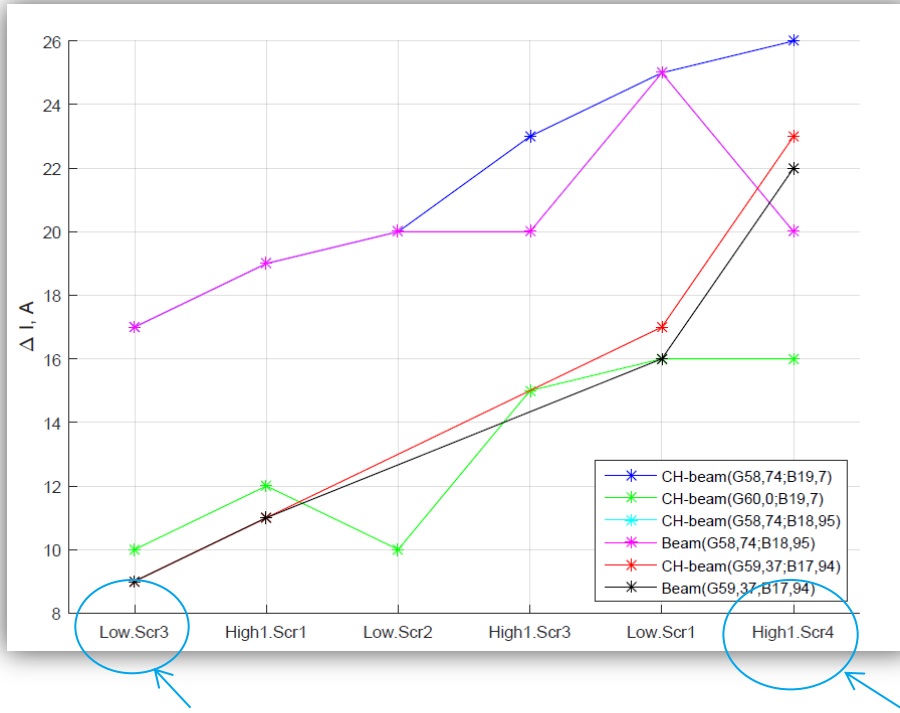


Results (with momentum-matched C+H simulations)



Conclusion

Discrepancies in minimum beam size and solenoid current to obtain focus on screen



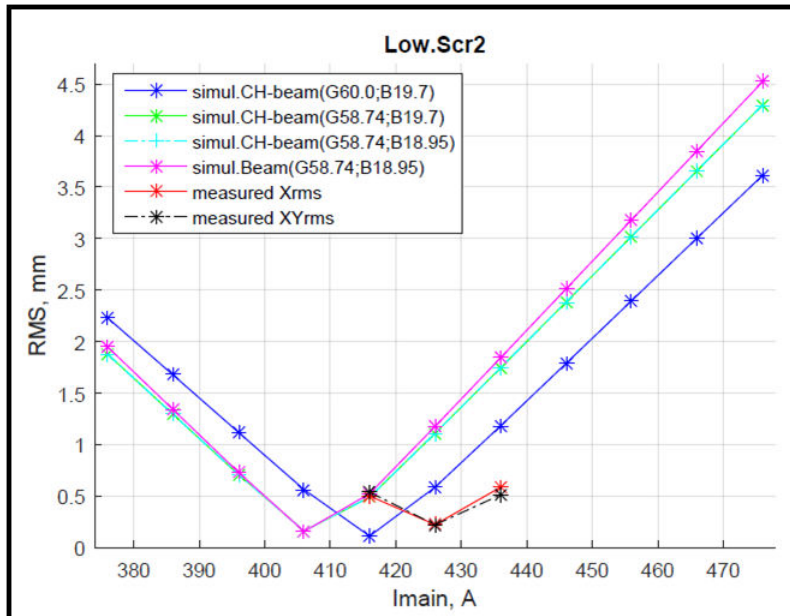
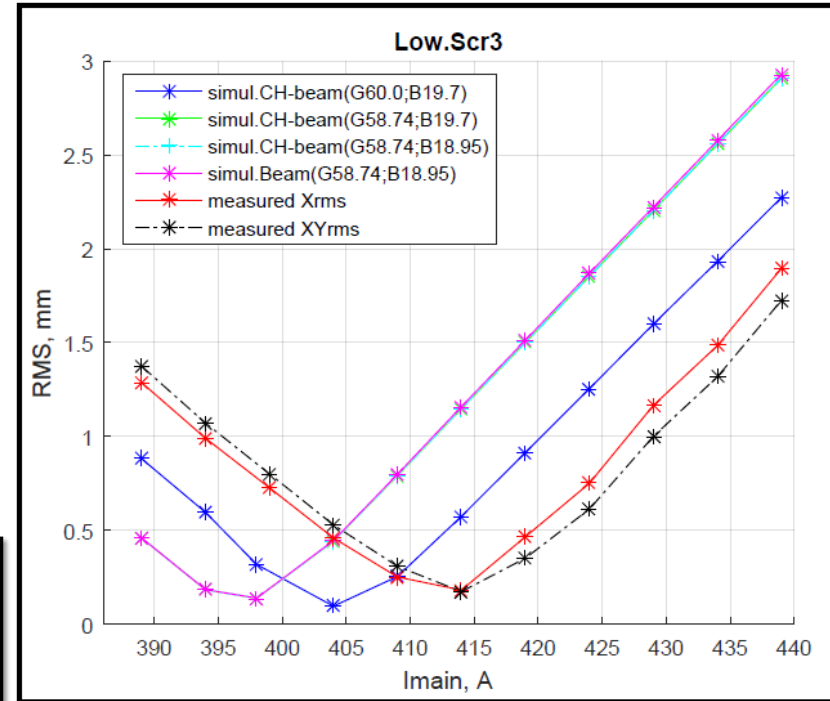
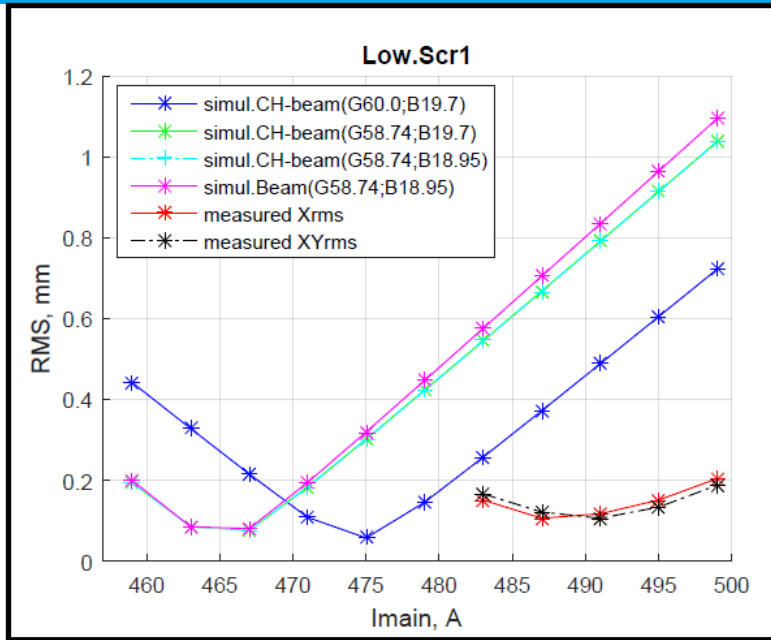
- Smallest discrepancies near booster, largest at start and end (L1, H4)
- Simulations fit better for relaxed space charge density, but still 10-20 A discrepancy
- Problem might be worse than previously assumed (~20 A vs. 5-10 A for slit-scans)
- C+H model has only minor effect
- Momentum-matched gun gradient gives larger discrepancy than the „default“ 60 MV/m (green curve)



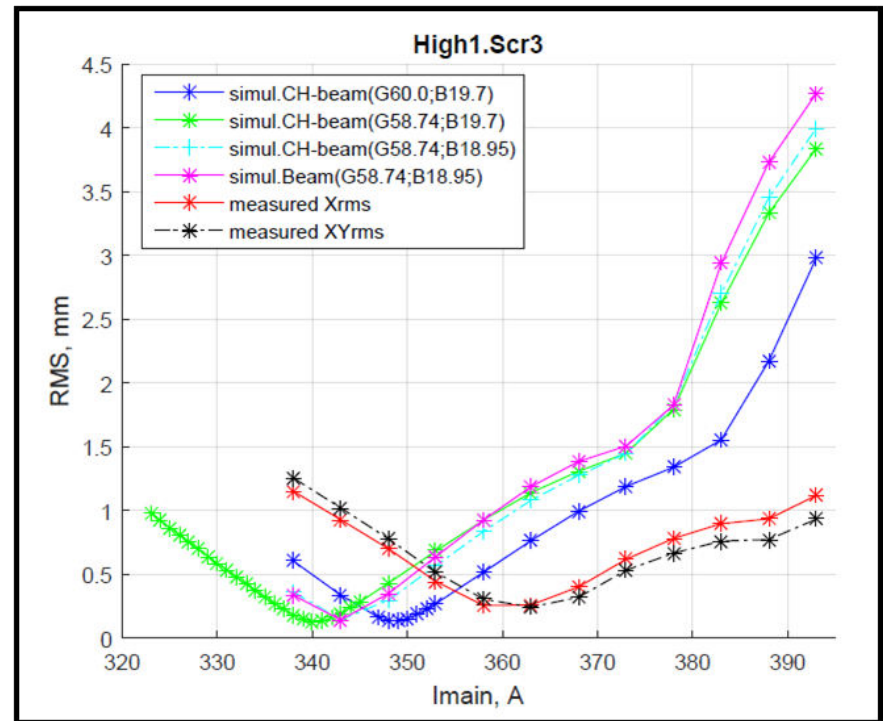
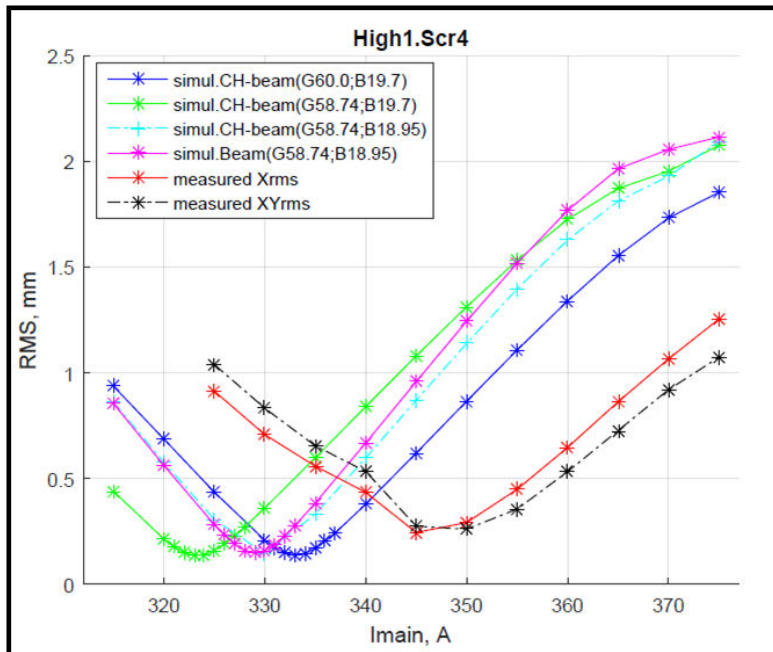
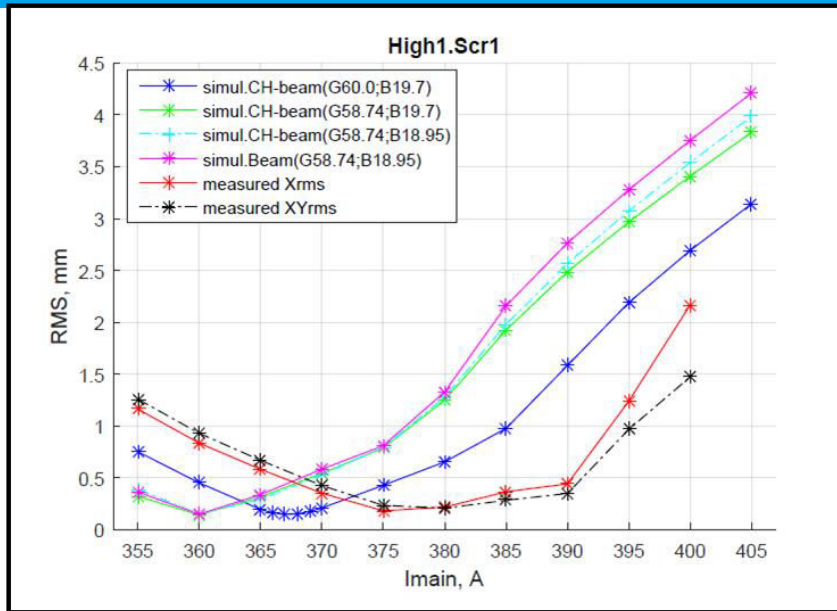
Thank you for your attention! =)



Detailed results (BSA1.2, Low section)



Detailed results (BSA1.2, High section)



Detailed results (BSA2.5)

