

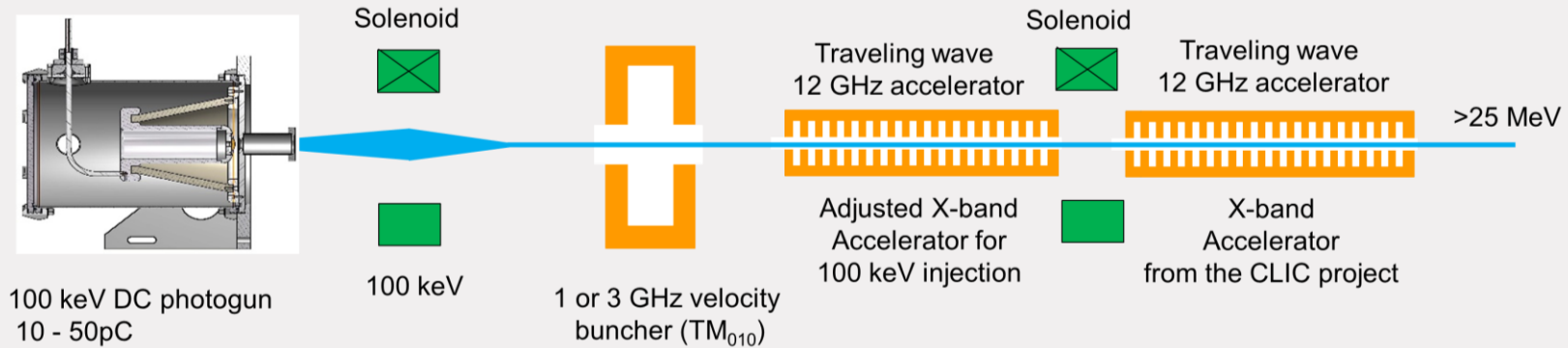
CompactLight @ Eindhoven University of Technology

First XLS – CompactLight Annual Meeting

Peter Mutsaers, Xavier Stragier, Jom Luiten

CompactLight @ Eindhoven University of technology

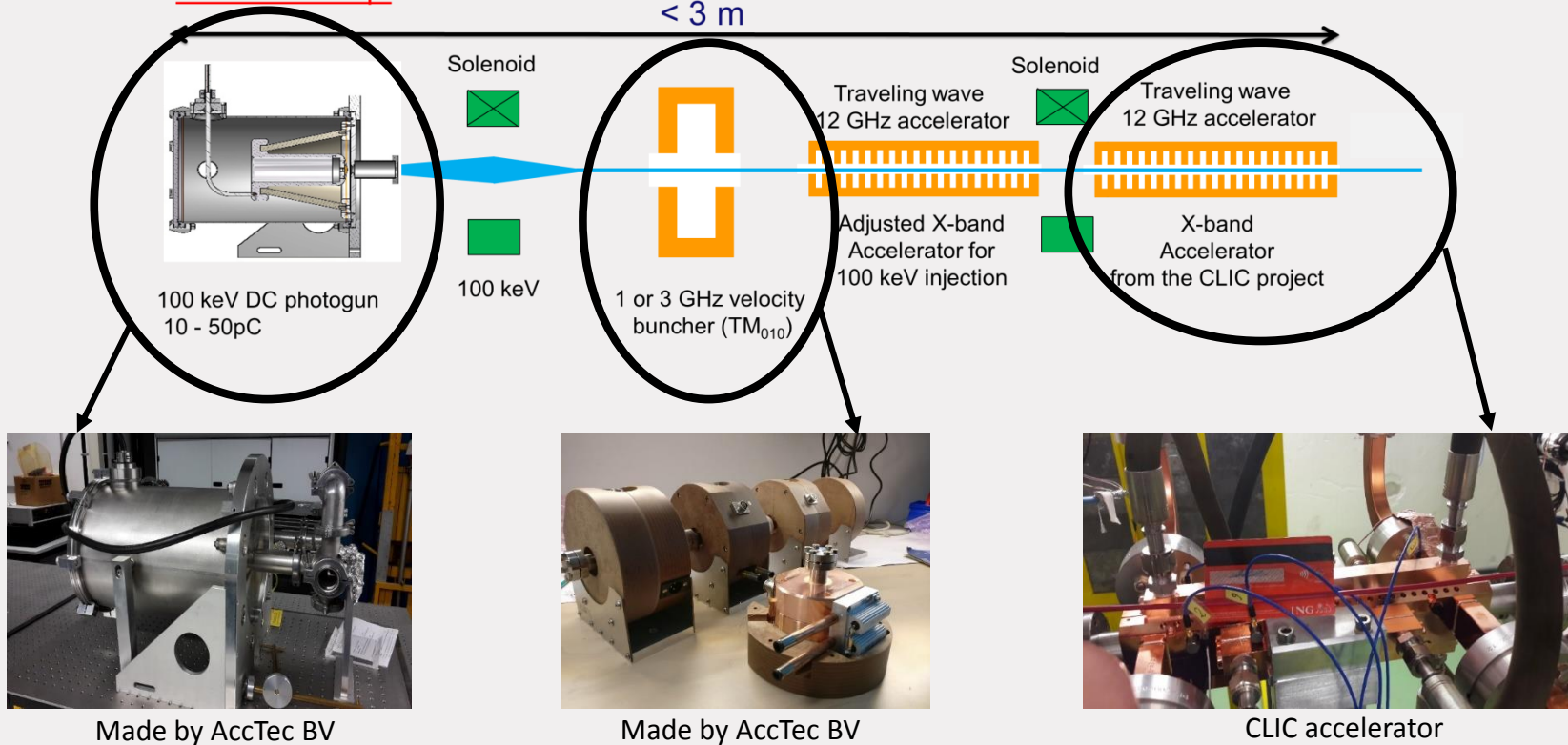
1. DC photogun, buncher, X-band Accelerator
2. Thermionic gun, chopper, buncher, X-band Accelerator



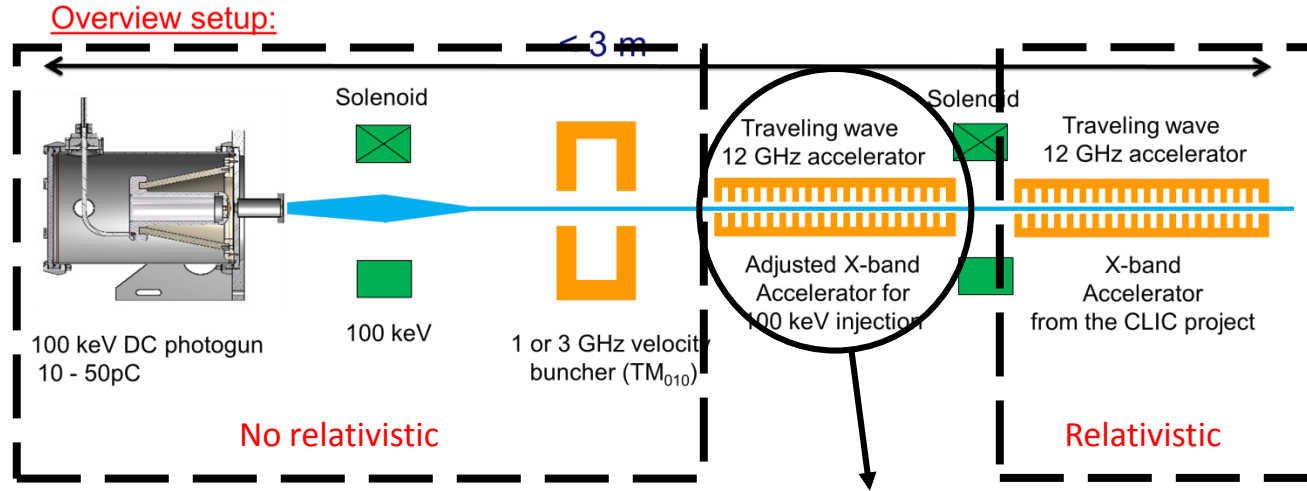
➔ Injector = 100 kV gun/ buncher / X-band accelerator combination

Already developed and available material

Overview setup:



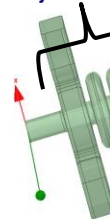
TW Accelerator needs to be designed with a non relativistic front end



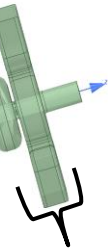
An accelerator section designed for the CLIC project needs to be adjusted for 100 keV electron injection:



First 3 cells shortened and input coupler adjusted for 100 keV electron injection.

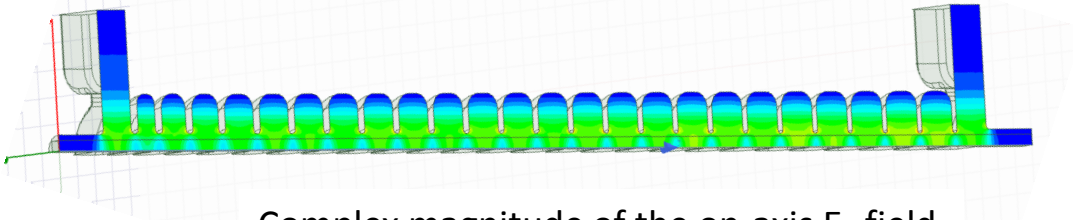


Adjusted output coupler

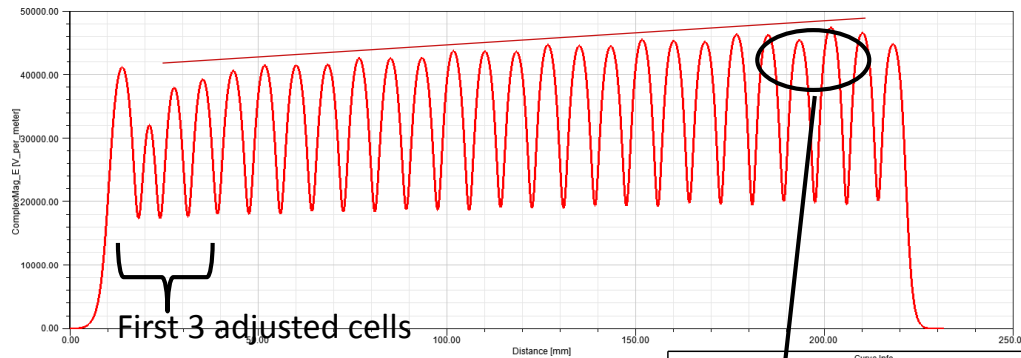


0 40 80 (mm)

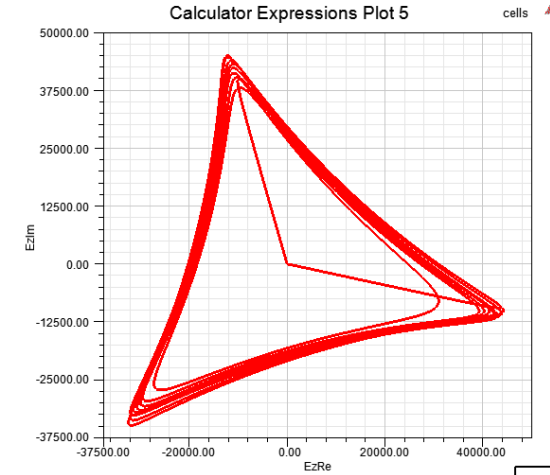
RF design of the adjusted TW accelerator based on the CERN T24 design



Complex magnitude of the on-axis E_z -field



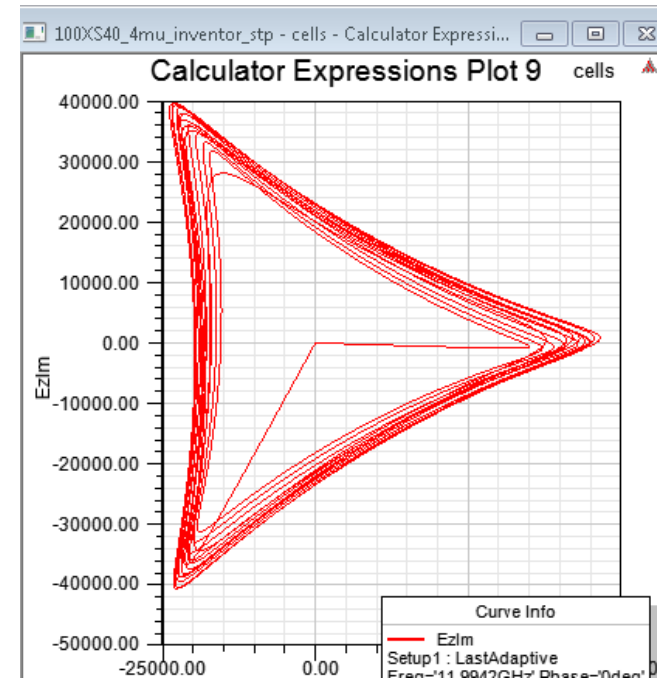
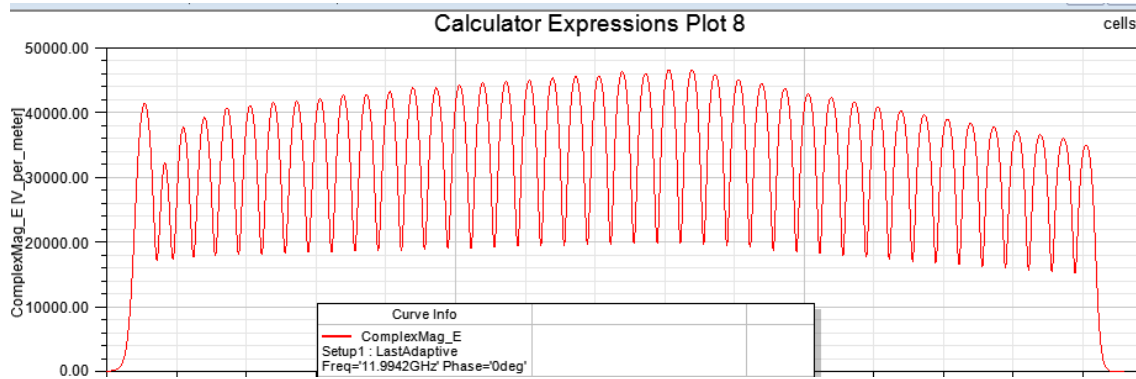
Status July 2018:
Small standing wave component:
< 2% reflected back in the
structure at output coupler



Status October 2018:
Further optimization by
Xavier Stragier in collaboration
with the CLIC team →

RF design of the adjusted accelerator (40 cells: 100XS40)

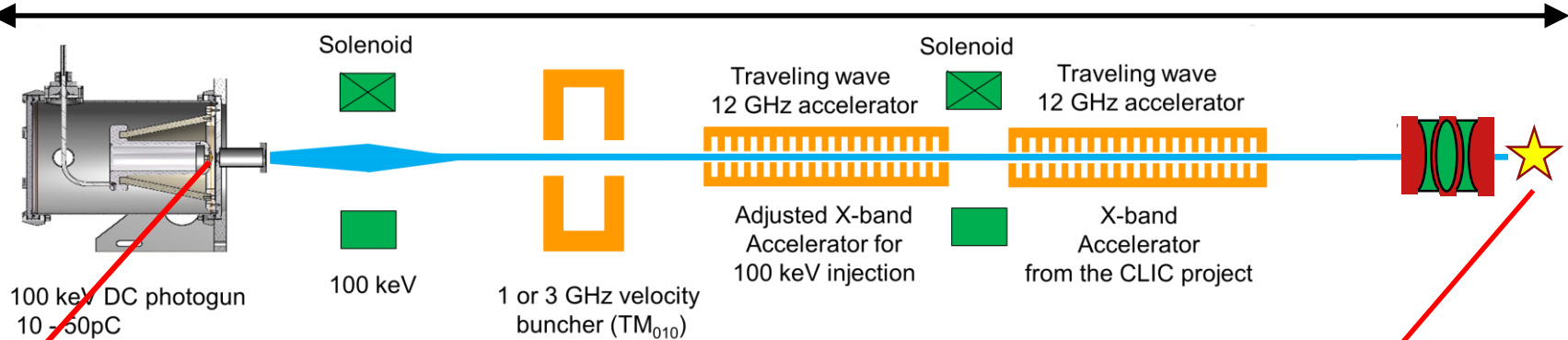
Complex magnitude of the on-axis E_z -field



GPT simulations including adjusted accelerator RF design

Overview setup:

< 3 m



Bunch properties at cathode:

- 10 pC
- 100 keV
- 500 fs laser pulse
- Bunch radius 200 μm RMS
- 0.1 μm thermal emittance

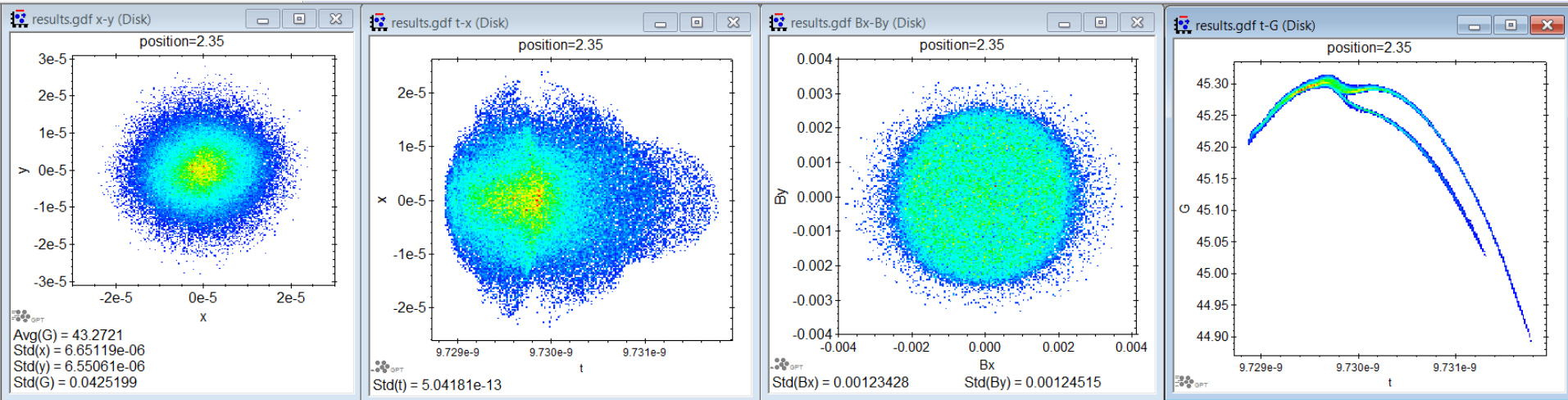
Including 3D field maps:

- DC-gun
- 1 GHz buncher
- Adjusted X-band accelerator
- Field expansions of the on axis E_z field of adjusted accelerator

Bunch properties at with 2 X 10 MW power:

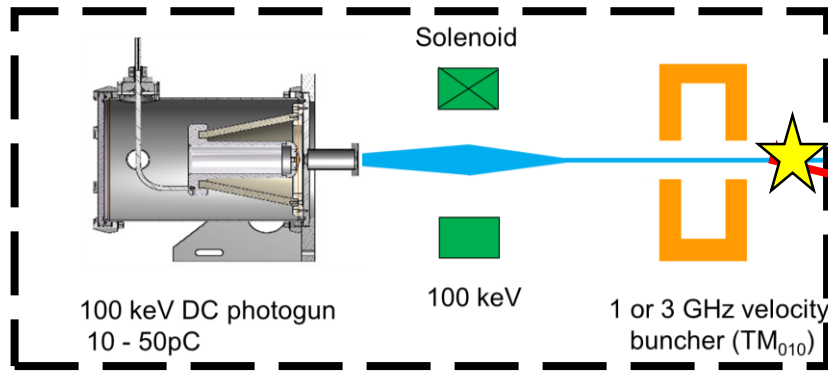
- 10 pC
- > 20 MeV
- 0.5% energy spread
- ~ 150 fs bunch length
- 0.3 μm thermal emittance
- 5 μm spot RMS in x and y direction

GPT simulations: electron bunch properties at focus for a 10 pC bunch

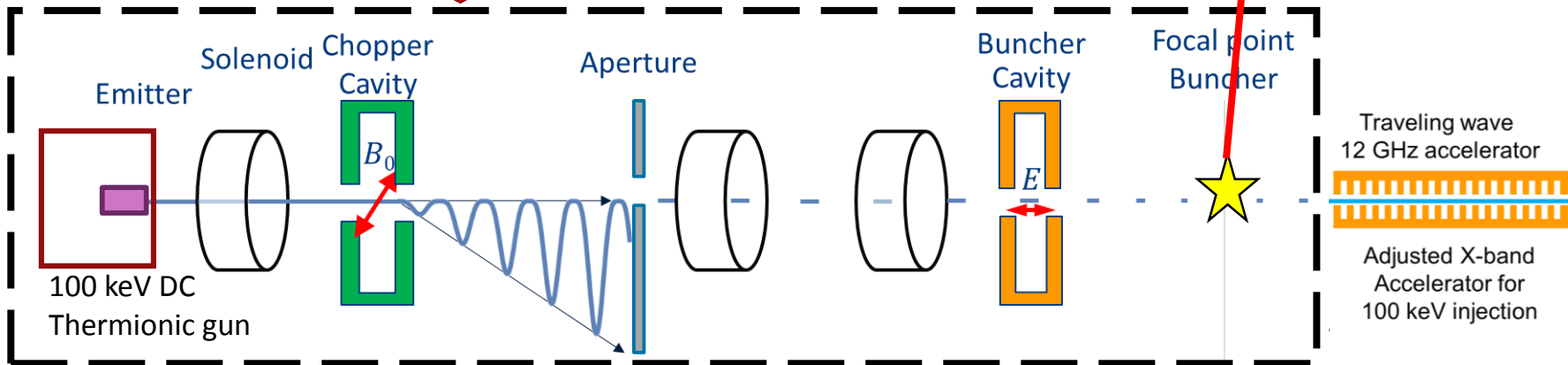


Design finished → ready for construction, ordered klystron
Ready to test mid 2019

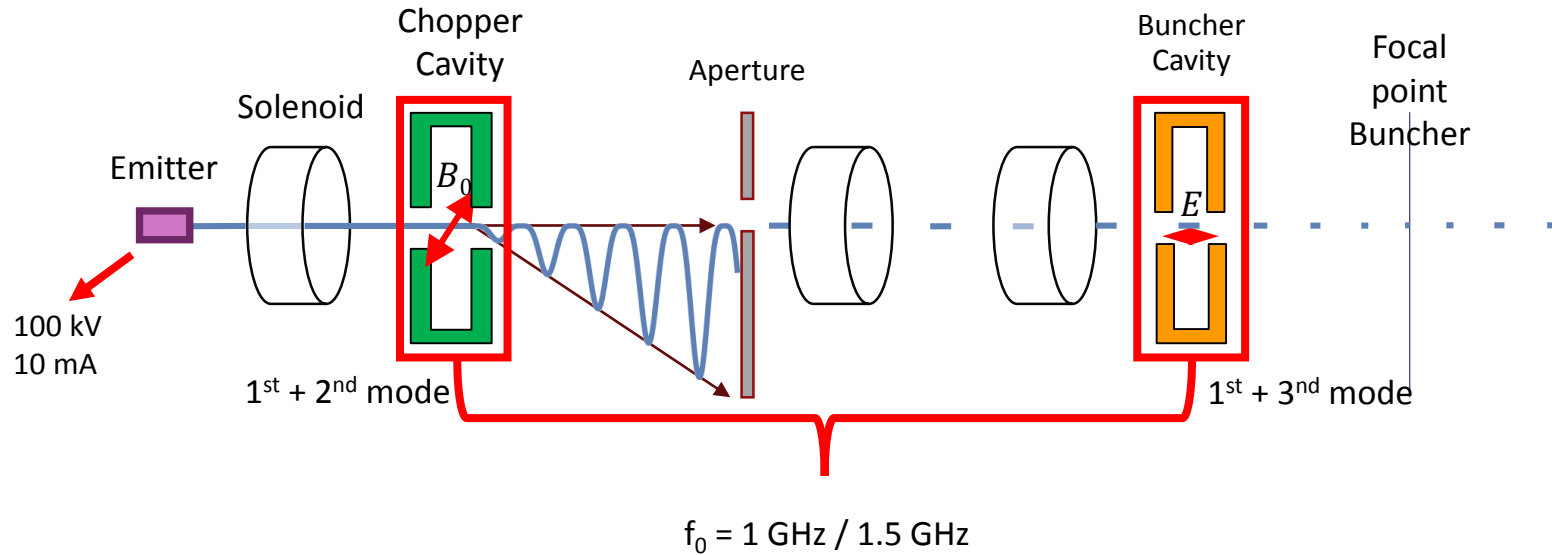
Thermionic gun project : **extreme high** electron bunch repetition rate



Goal:
Comparable bunch properties
as DC photogun but
- no laser and
- 1 GHz + rep rate

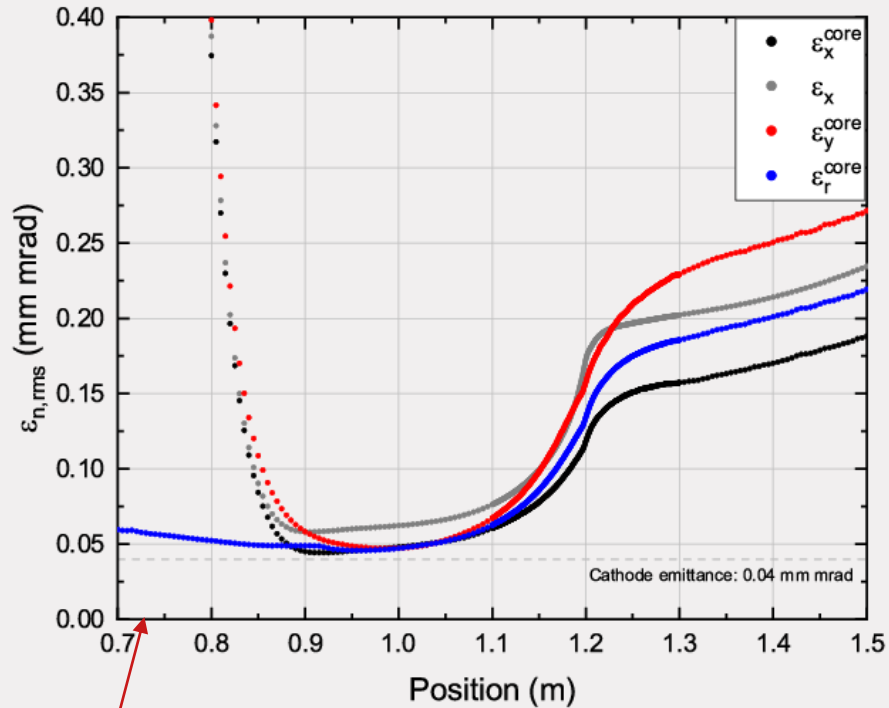


Thermionic gun project : **extreme high** electron bunch repetition rate

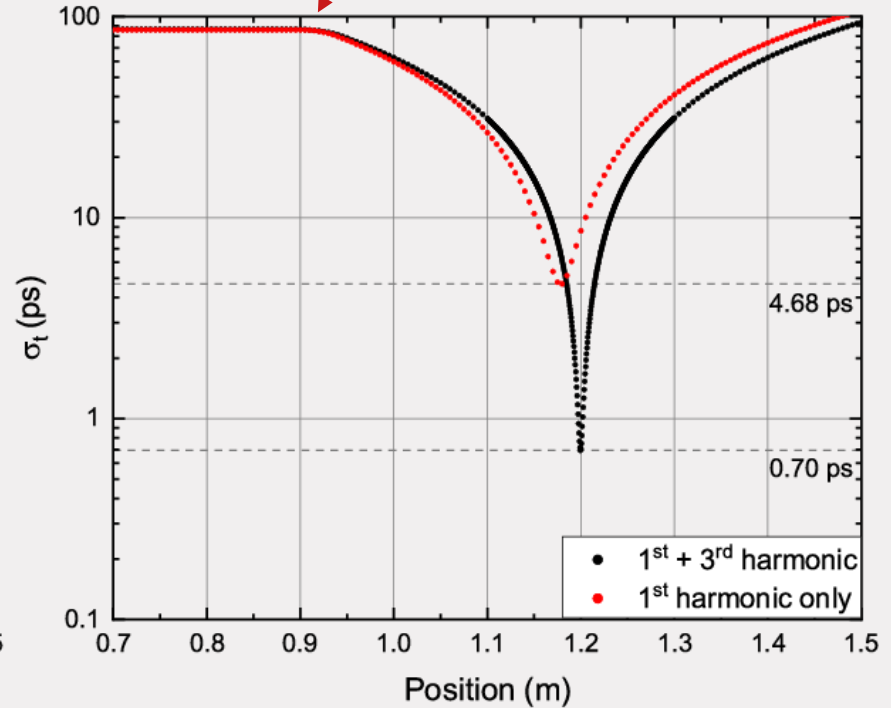


Preliminary results	1 GHz	1.5 GHz
Charge per bunch	~ 2.9 pC	~ 1.9 pC
Dimensions chopper cavity (mm)	379 x 245	253 x 163
Frequencies used	1, 2 & 3 GHz	1.5, 3 & 4.5 GHz

Results @ 1 GHz



Solenoid



Conclusion/Outlook:

DC photogun, buncher, X-band Accelerator

- RF simulations & GPT simulations ready
- Manufacture and test
- Continue with design bunching cavity
- Investigate the possibility to upgrade from 10 pC bunch charge to 100 pC

Thermionic gun, chopper, buncher, X-band Accelerator

- Emitter design ready
- Continue GPT simulations
- Continue design chopping & bunching cavity (1, 1.5 GHz) incl. higher harmonic (PostDoc started)

Thank you!

5 October 2018 Preliminary GPT simulations: bunch properties along the beamline

Overview setup:

