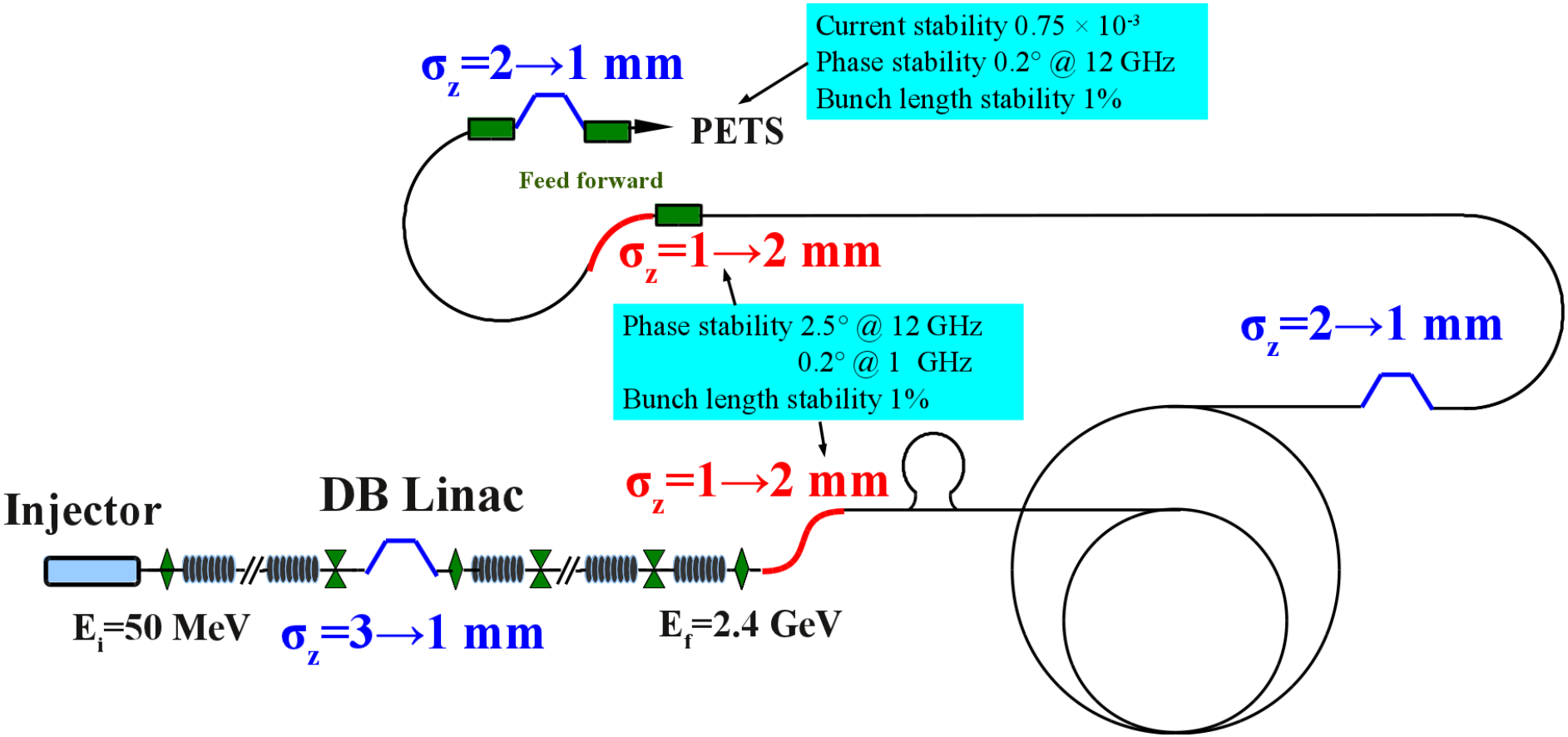
Photo cathode RF gun @ CLIC Drive Beam Linac

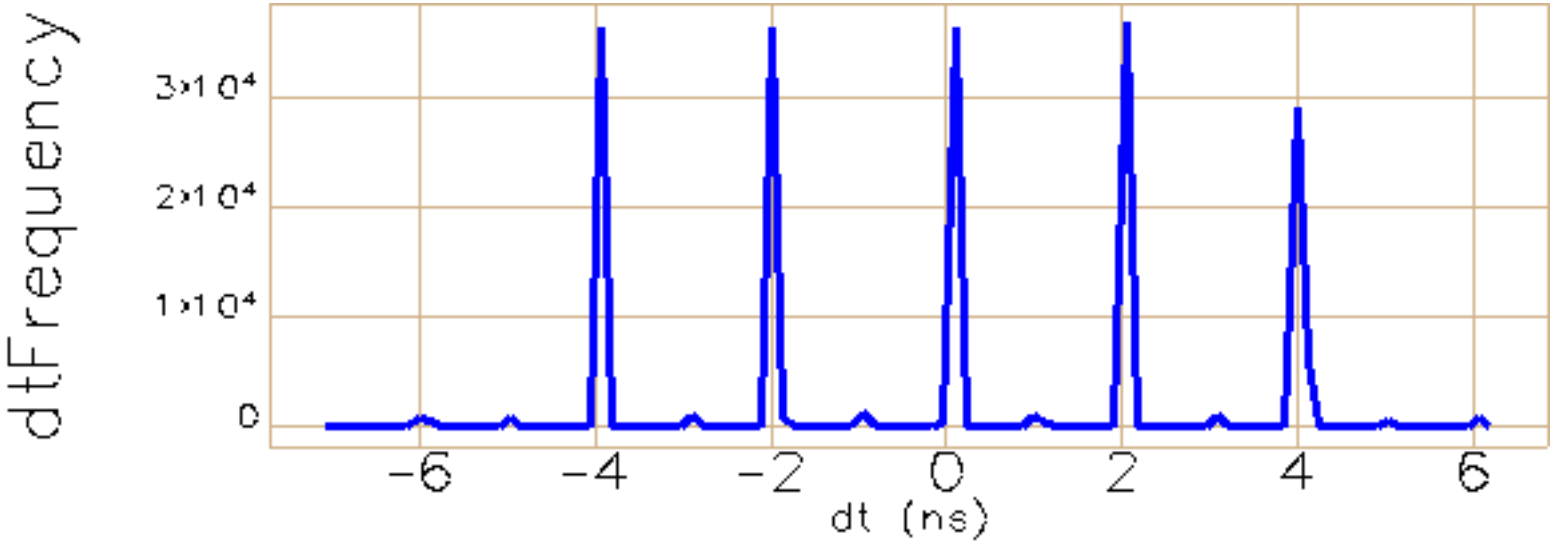
Avni AKSOY

Introduction



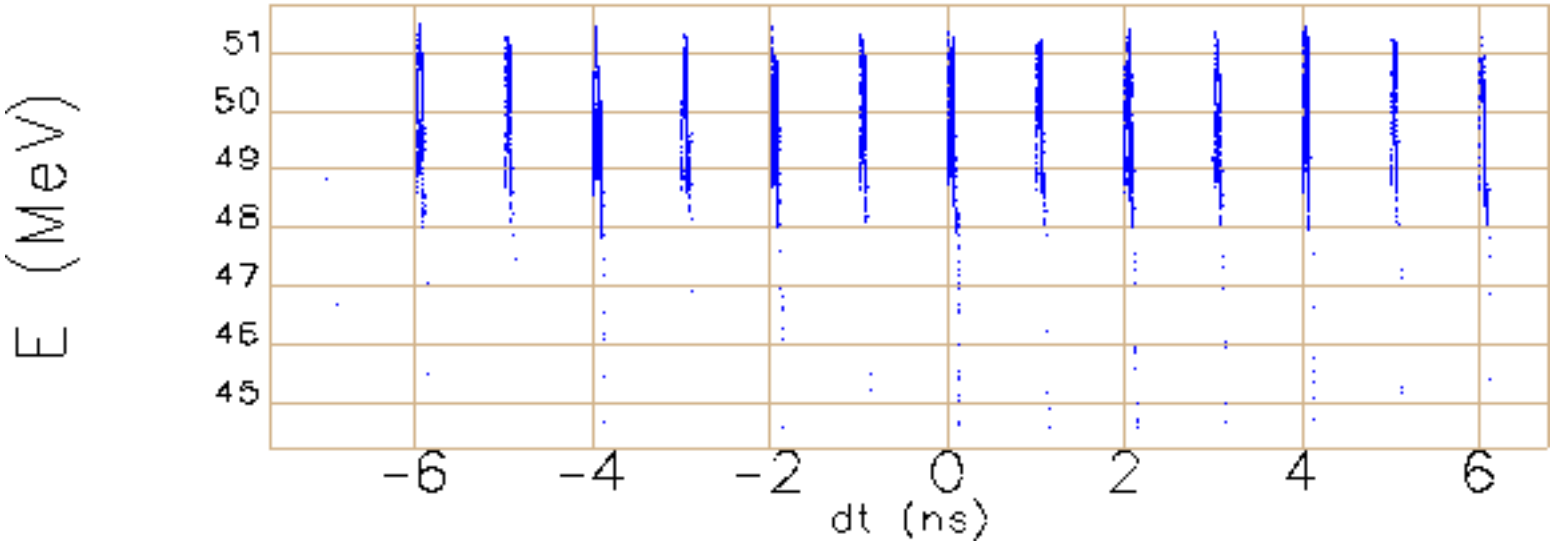
- The beam provided by injector is accelerated up to 2.4 GeV in DBL
- Than the beam is stretched / compressed in further sections of DB complex
- The longitudinal phase space of bunches plays important role in
  - Wakefield effect
  - bunch compression

Bunch coming from thermionic injector



Not only the satellites are problem

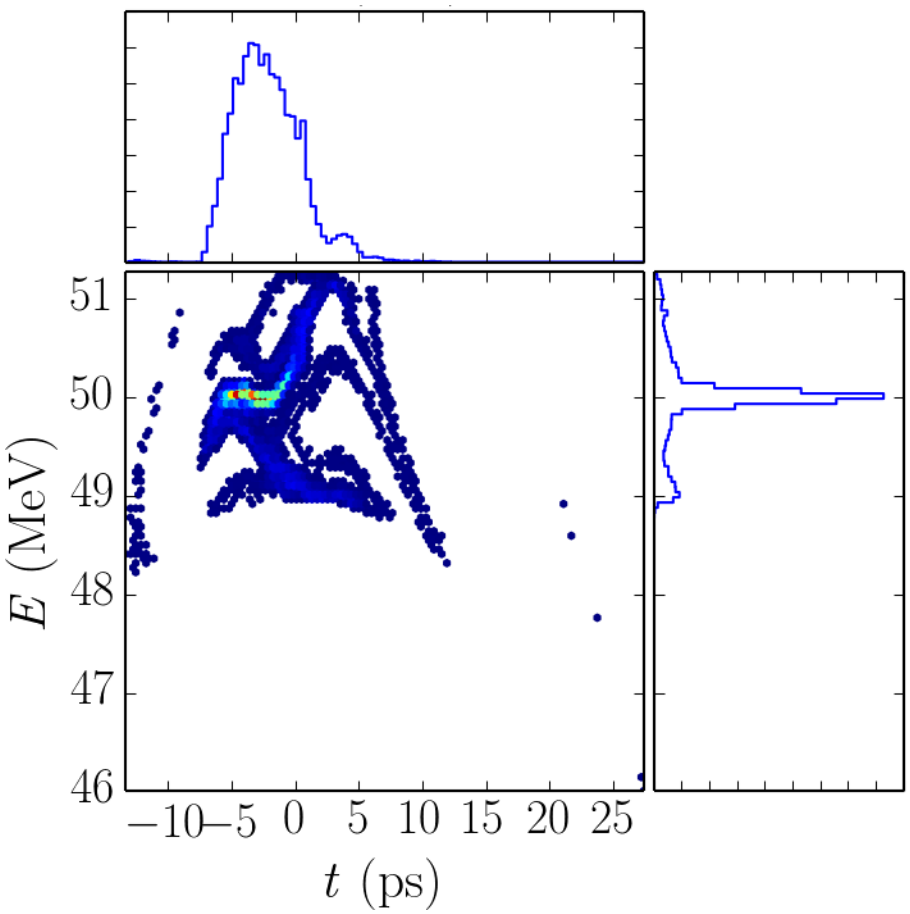
Bunch charge distribution will lead the wakefield effect



Shahin Sanaye

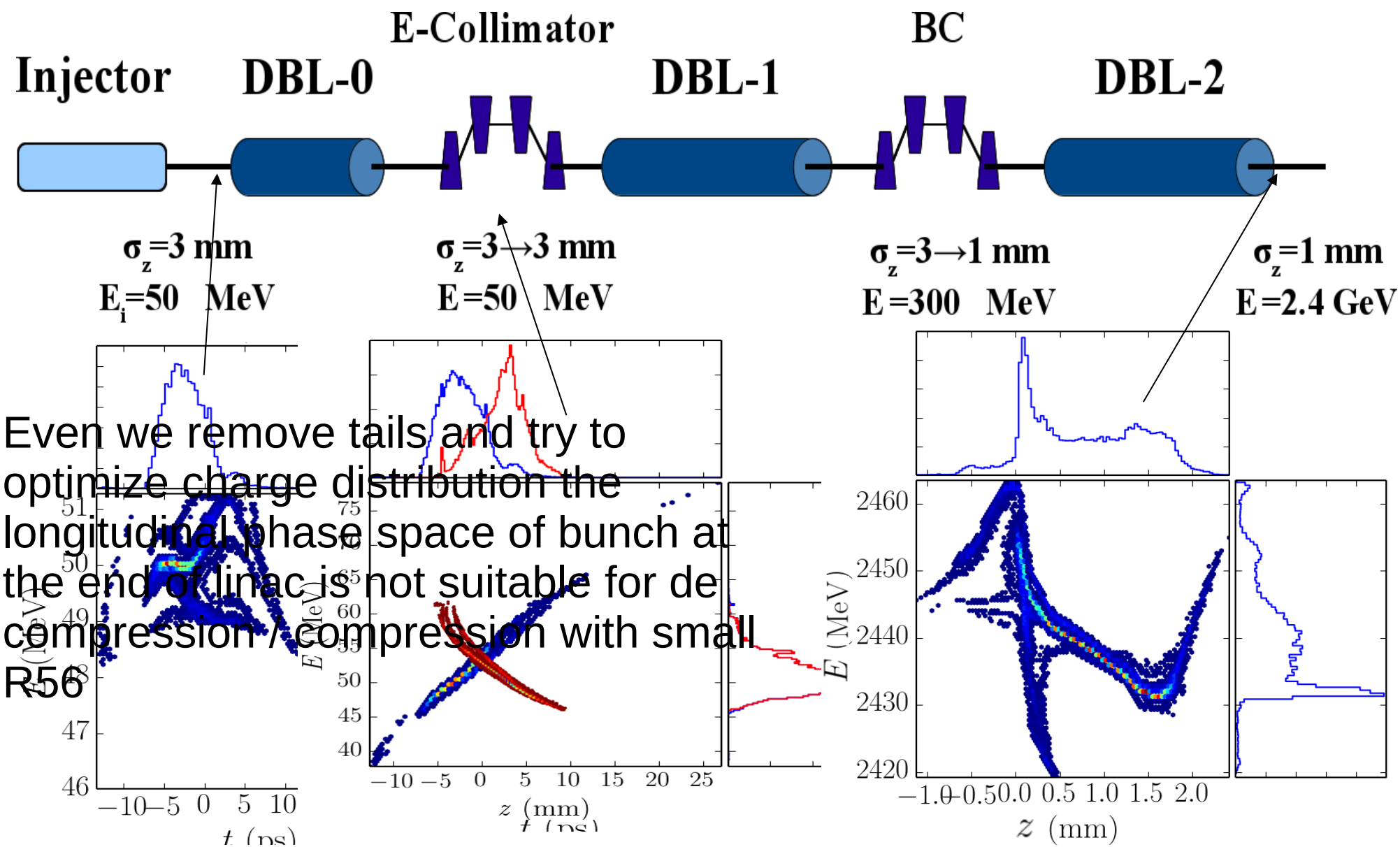
Bunch coming from thermionic injector

- The tail should be removed



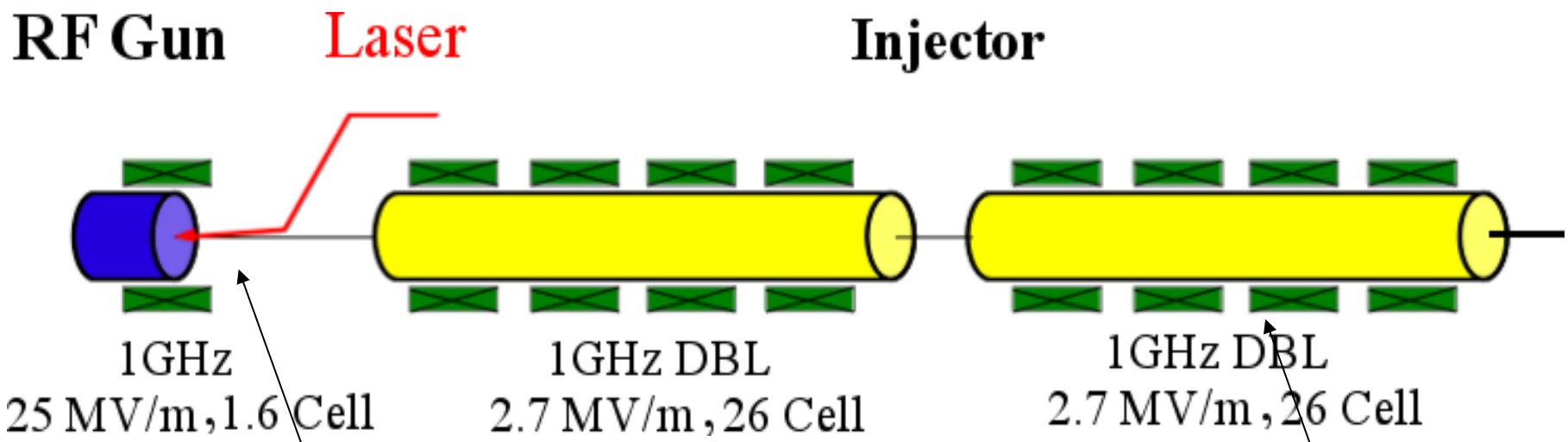
Parameter	Unit	Value
E	MeV	49.981
$\varepsilon_{n,x}$	μm	78.977
$\varepsilon_{n,y}$	μm	78.765
ε_z	keV.ps	1204.96
σ_x	mm	1.524
σ_y	mm	1.523
σ_z	ps	2.655
σ_E	keV	454.95
$\Delta E/E$	%	0.910

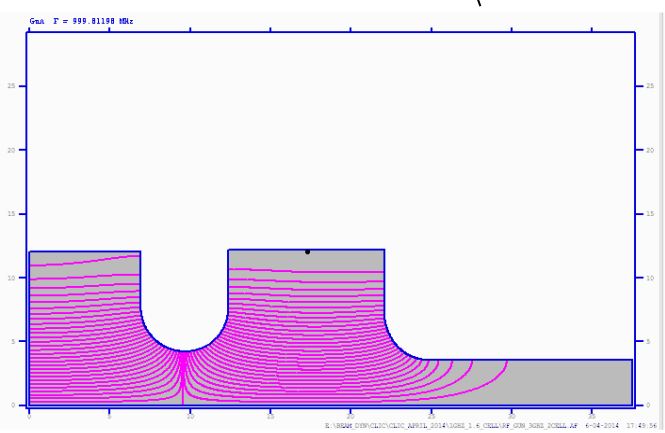
We propose energy collimator just after injector

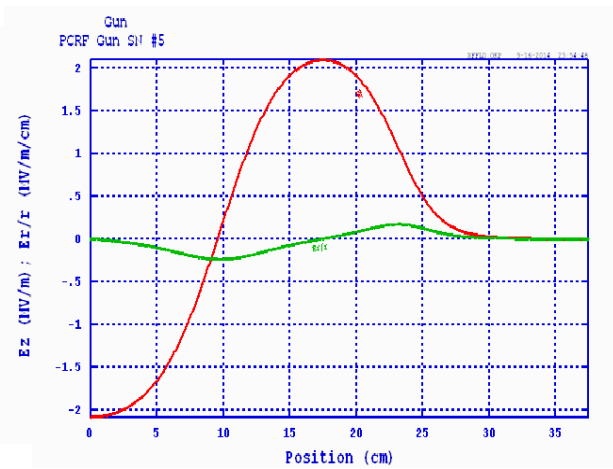


Even we remove tails and try to optimize charge distribution the longitudinal phase space of bunch at the end of linac is not suitable for de compression / compression with small R56

We propose to use photocathode RF gun



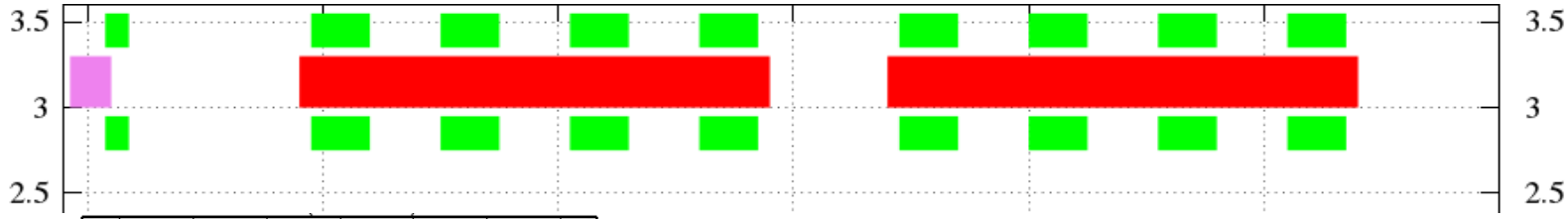


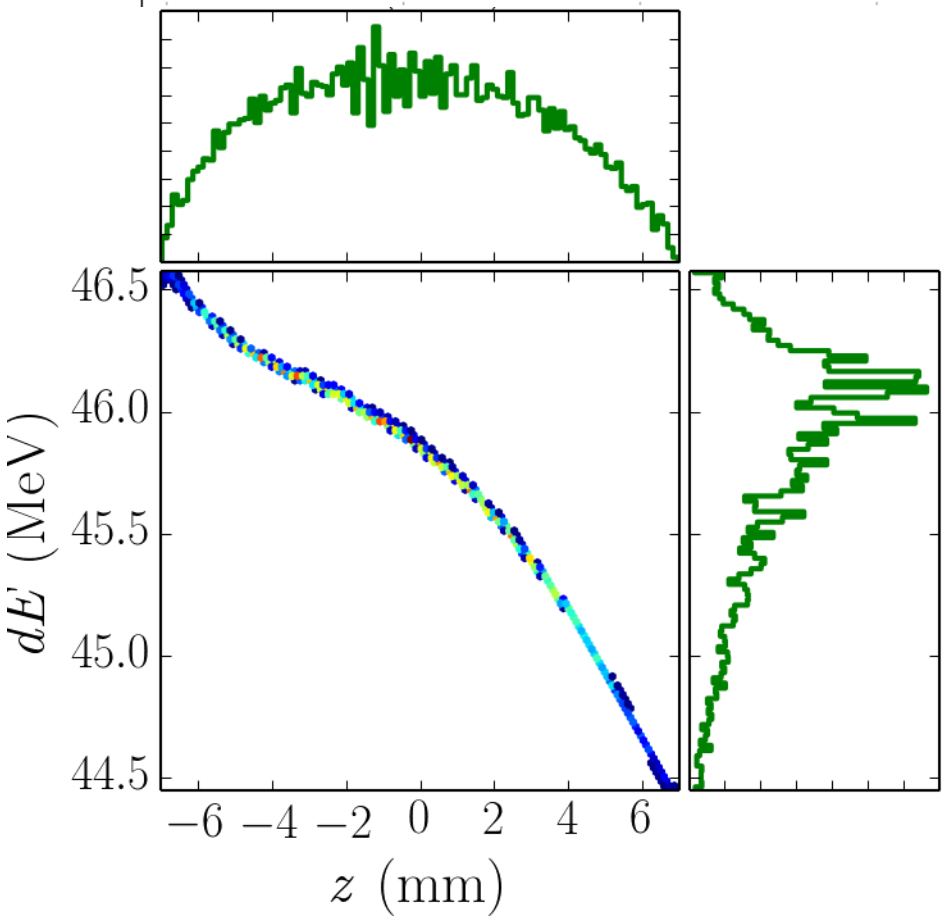


Structures are identical to DBL structure

- Phin gun is scaled to 1 Ghz

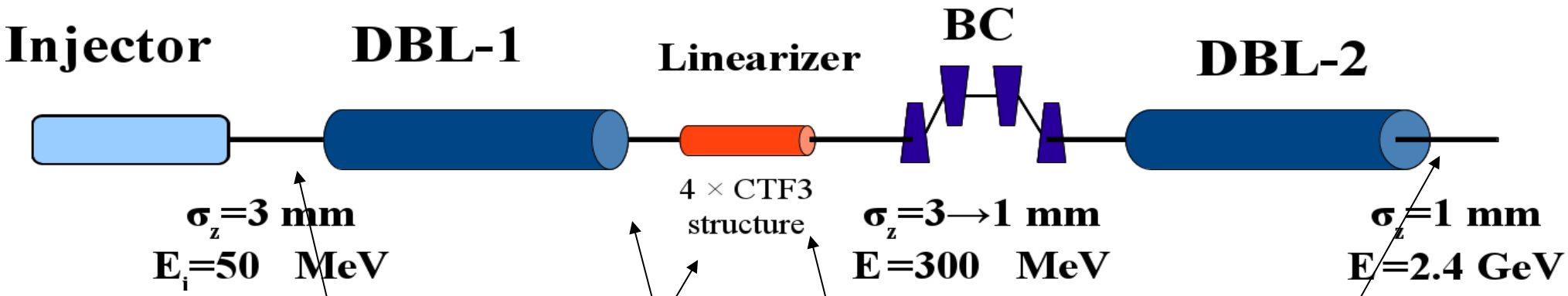
Bunch after Photo injector

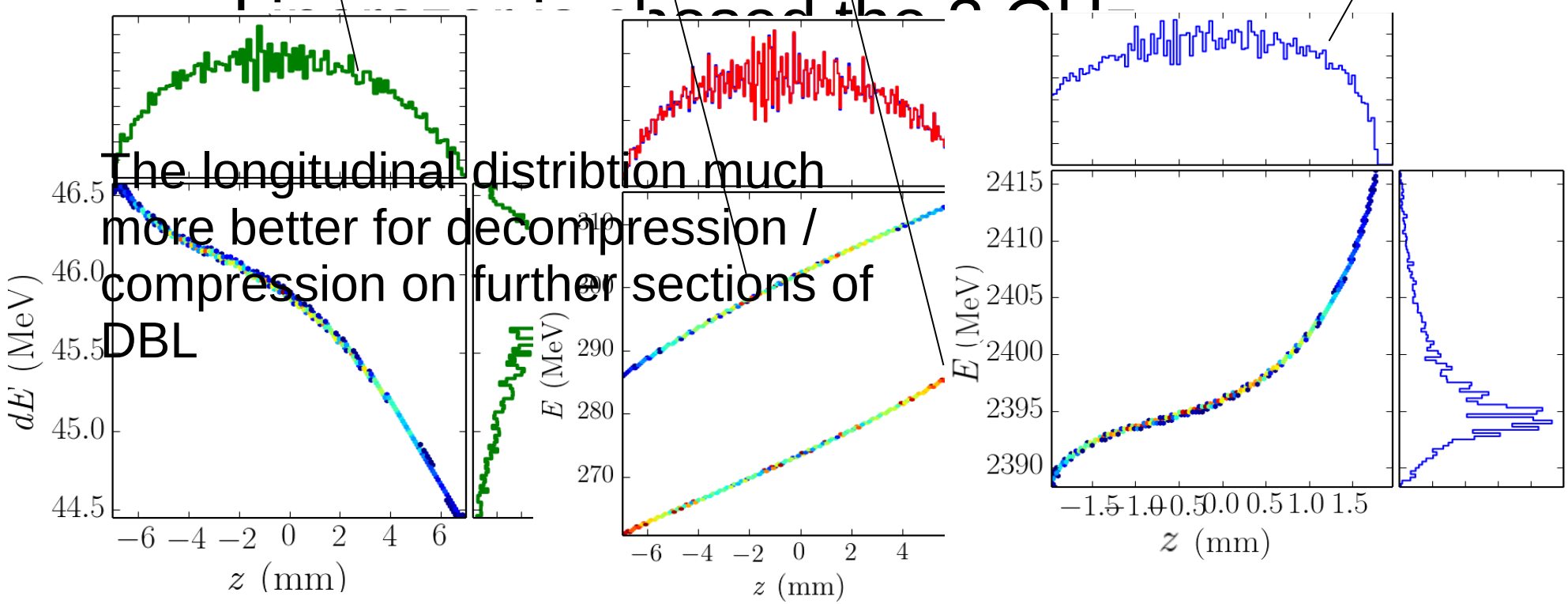




Parameter	Unit	Value
E	MeV	45.790
$\varepsilon_{n,x}$	mm.mrad	8.904
$\varepsilon_{n,y}$	mm.mrad	8.888
ε_z	keV.mm	345.254
σ_x	mm	0.842
σ_y	mm	0.842
σ_z	mm	3.361
σ_E	keV	450.601
$\Delta E/E$	%	0.984

DBL layout with photo injector





The longitudinal distribtion much more better for decompression / compression on further sections of DBL

Conclusion

- The advantages of photo cathode gun
  - Satellite problem can be solved
  - Lower emittance
  - Better charge distribution against the effect of wakefiled
- The disadvantages...
  - Laser technology
  - Laser stabilization → charge stabilization
  - Cathode lifetime
- The RF tolerances for photo injector are more relax than thermionic case since we use single dispersive section