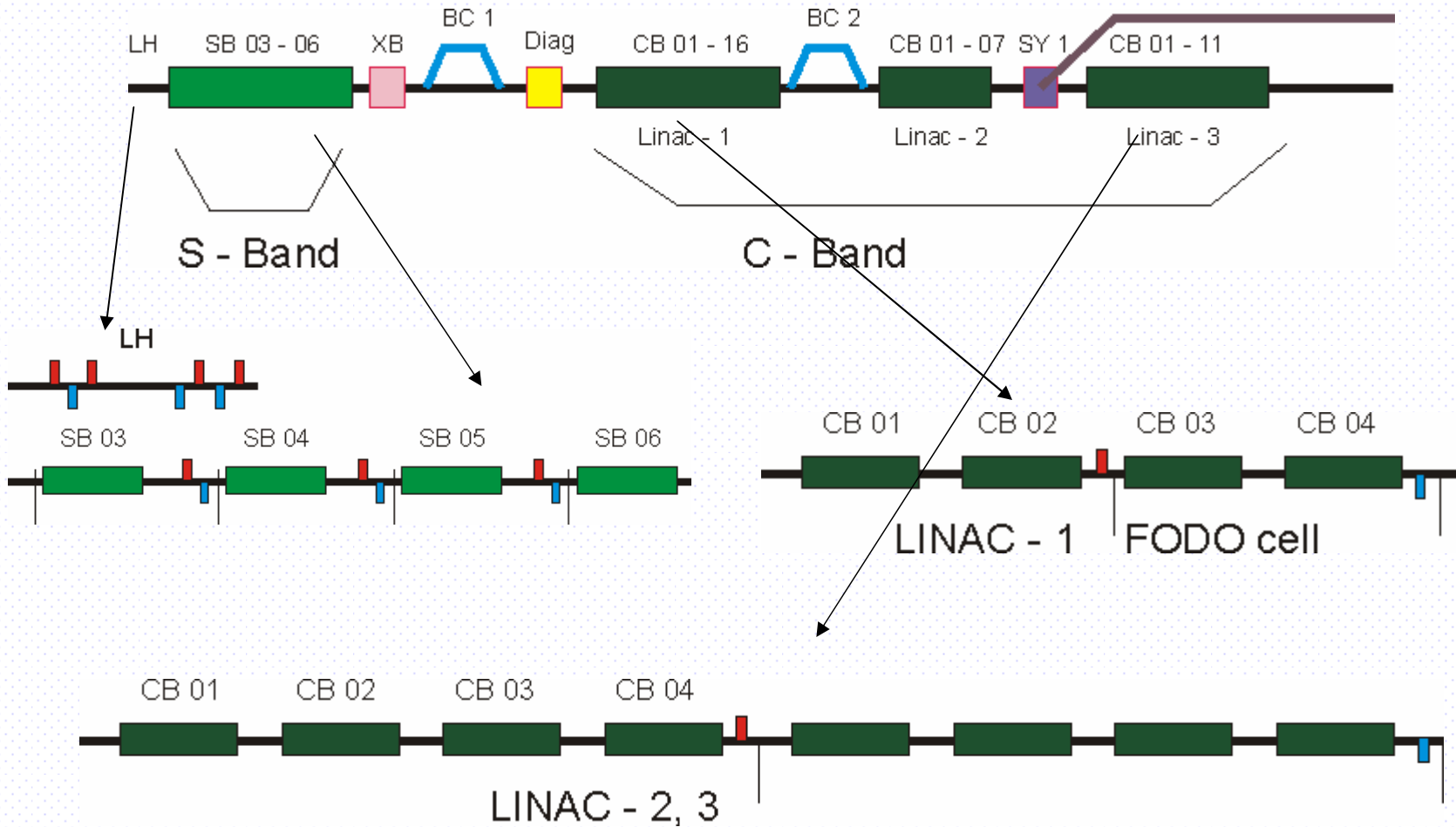


ELEGANT Simulations for SwissFEL.

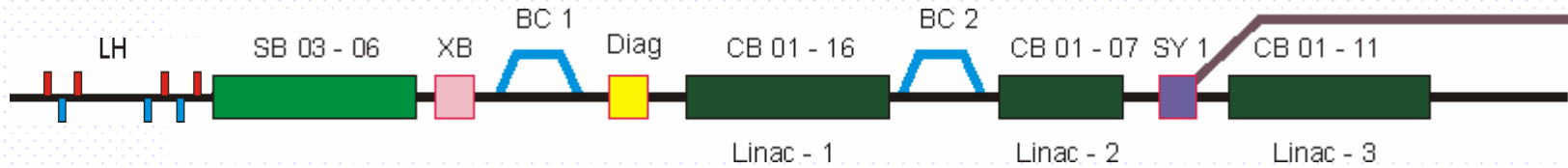
- Machine layout
- Quadrupole misalignments
 - Beam trajectory
 - Transverse and longitudinal bunch profiles
 - Bunch compression
 - One-to-one correction
- Comparison of machine layouts
- Conclusion

SwissFEL Layout Comparison.



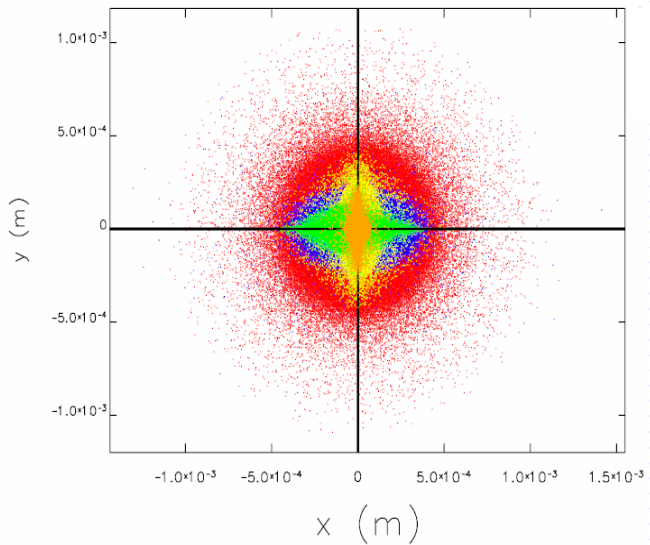
SwissFEL. Quadrupole Misalignment.

Bunch Transverse Profile

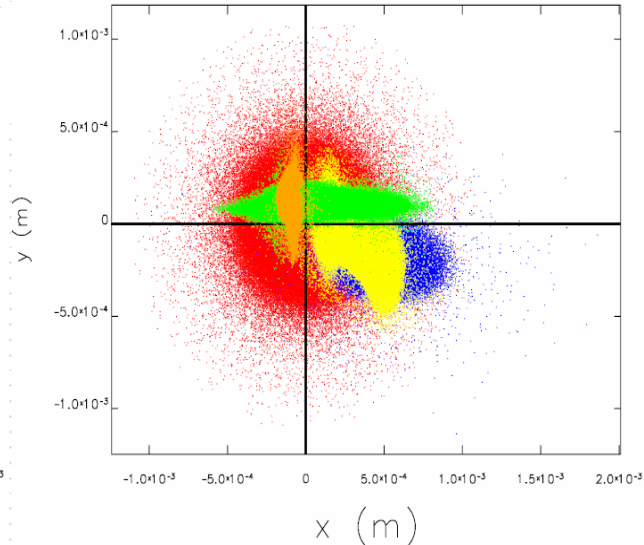


- Linac entrance - red
- Before BC 1 - blue
- After BC 1 - yellow
- Before BC 2 - green
- After BC 2 - brown

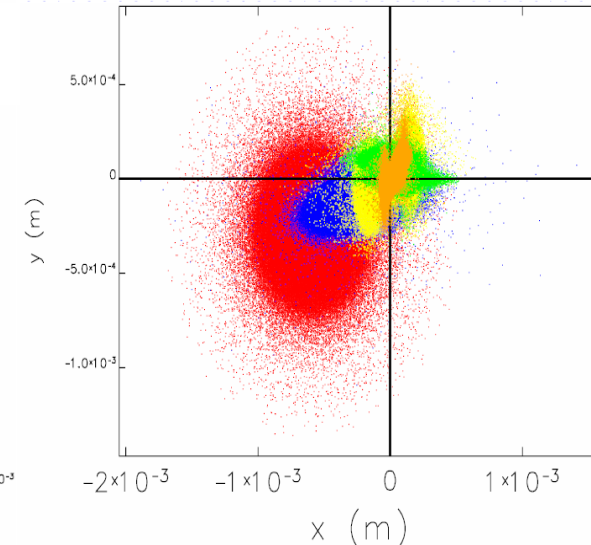
No Misalignment.



LH section misal. 100um.
No Correction



LH section misal. 100um.
One-to-one correction



SwissFEL. Quadrupole Misalignment.

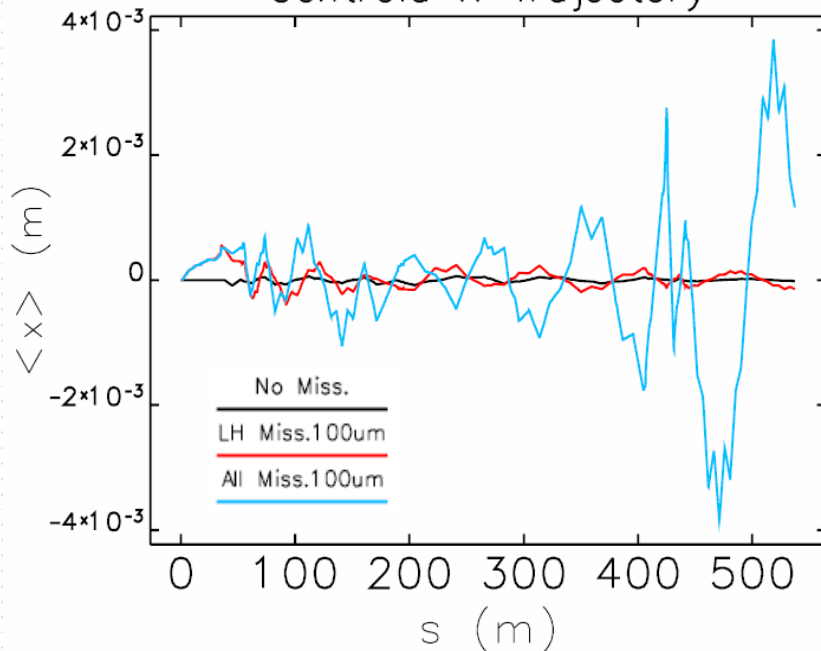
Bunch Centroid Trajectory / Transv. Profile

Random (gaussian) misalignment of all quads in x and y plane.
Worst scenario, no correction

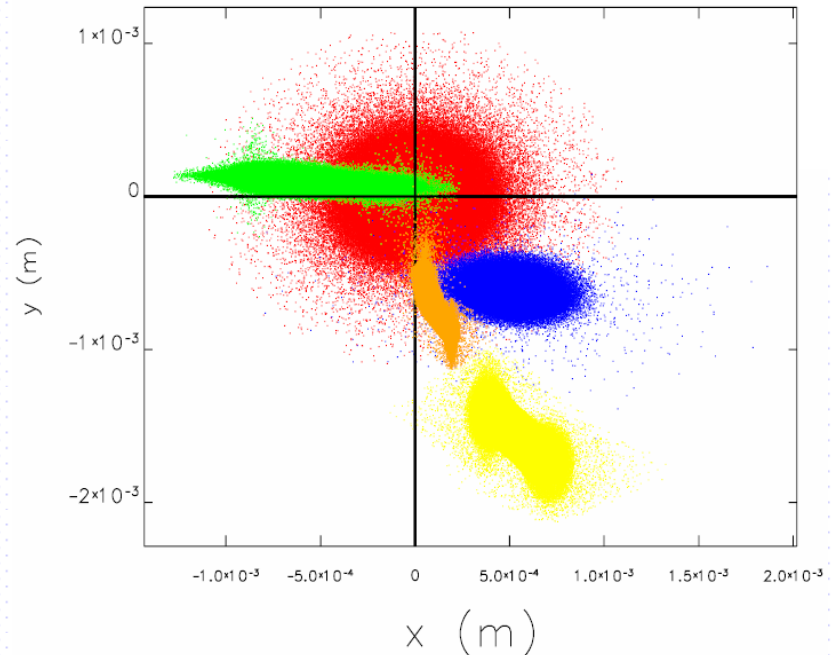
No Misalignment - black
LH quads misal 100um - red
All Quads Misaligned - blue

No Orbit Correction

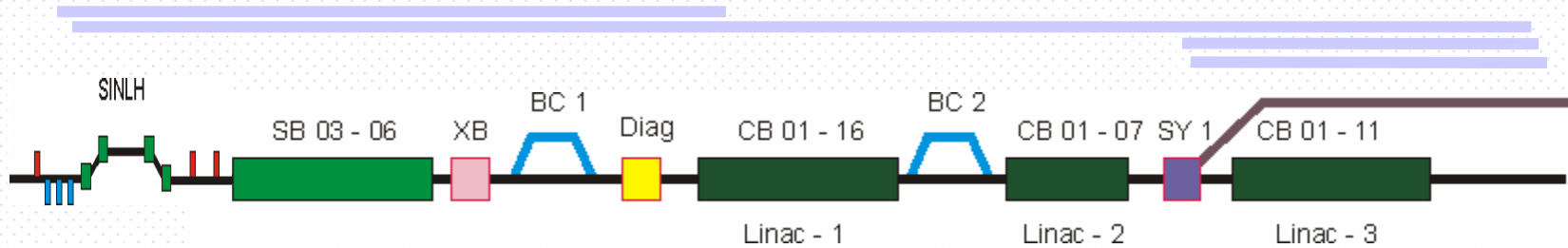
Centroid X Trajectory



Linac entrance - red
Before BC 1 - blue
After BC 1 - yellow
Before BC 2 - green
After BC 2 - brown
No Orbit Correction

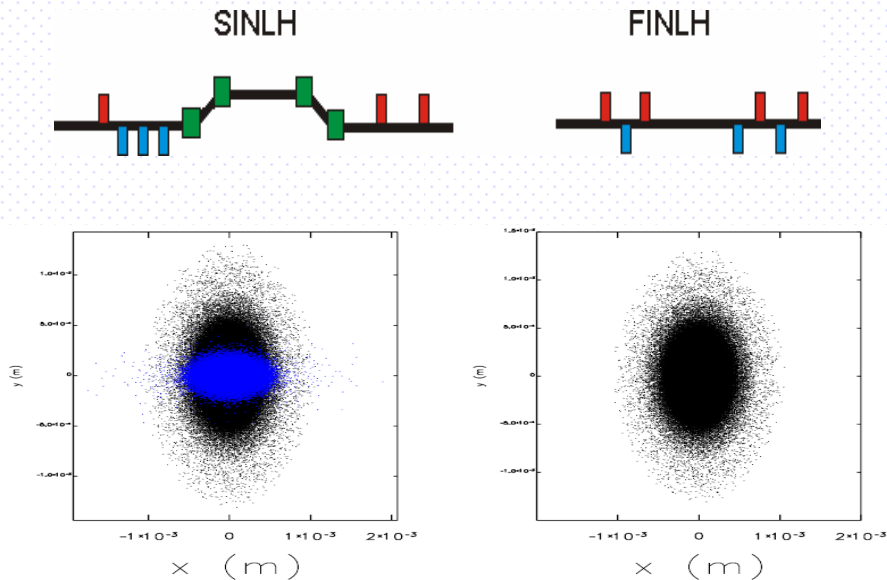


SwissFEL. New Layout

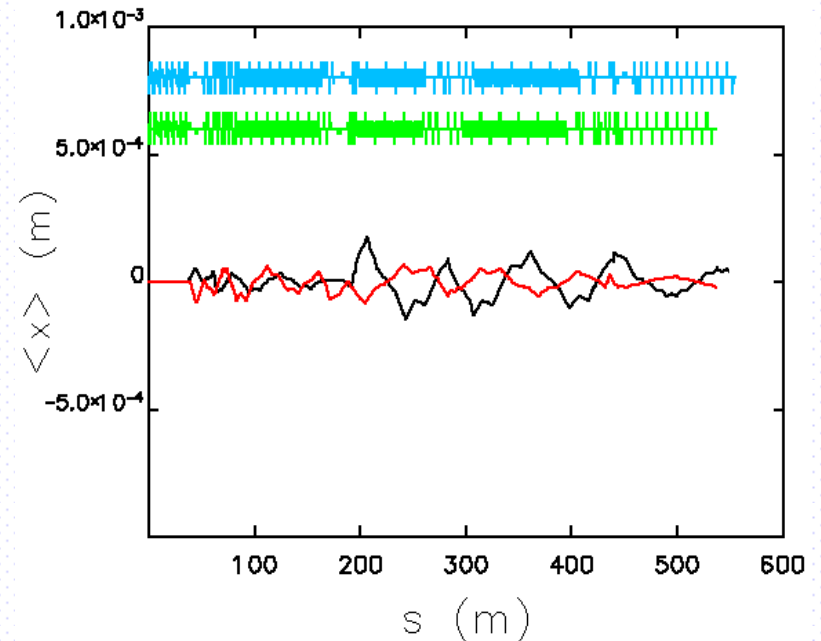


Main differences with new layout :

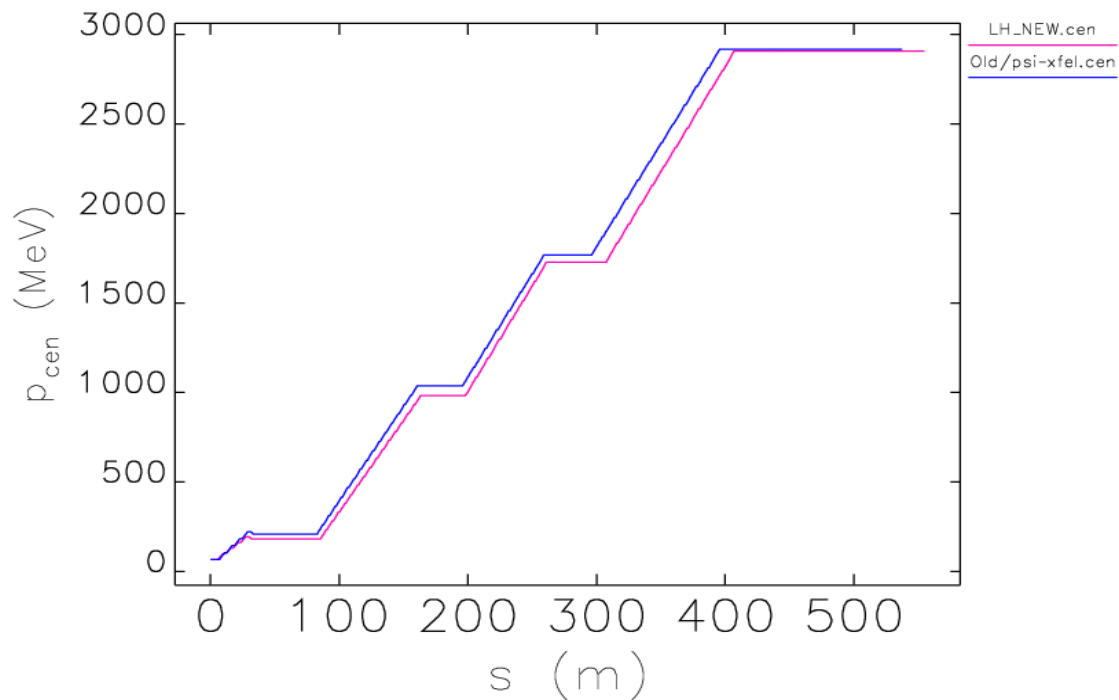
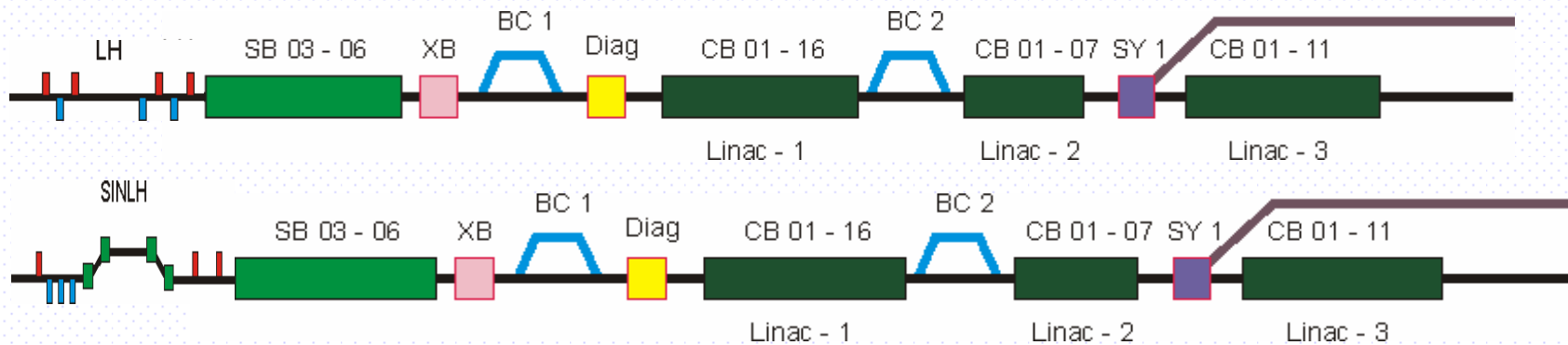
- 3 stage bunch compression, additional compression in LH section.
- Lower energy in S-band, higher in C-band
- Longer Diagnostic section after BC 1
- Higher C-band gradient



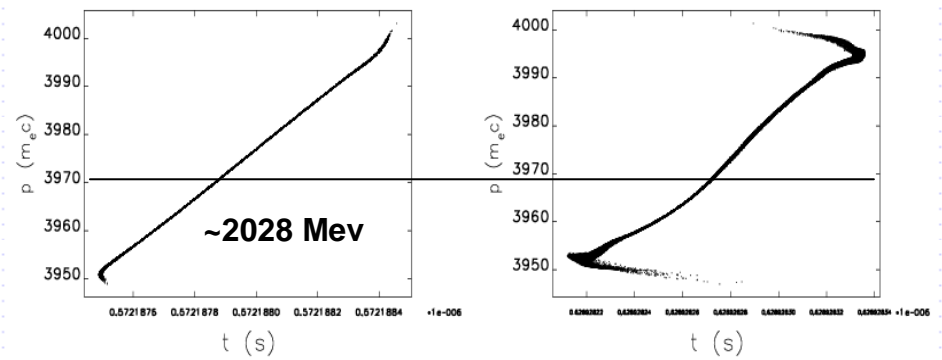
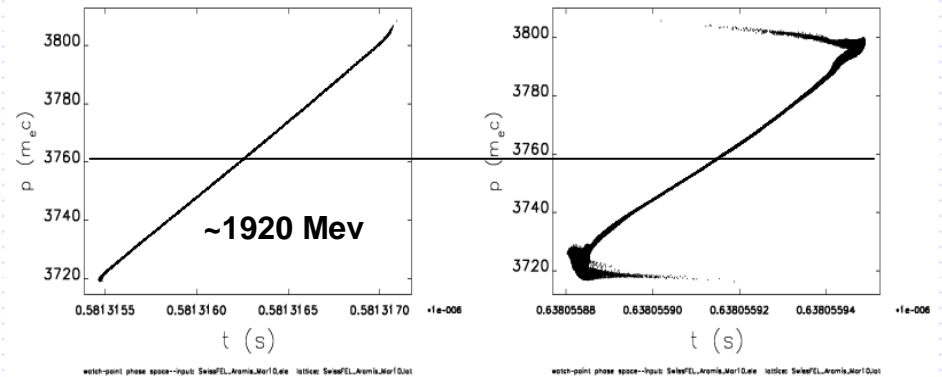
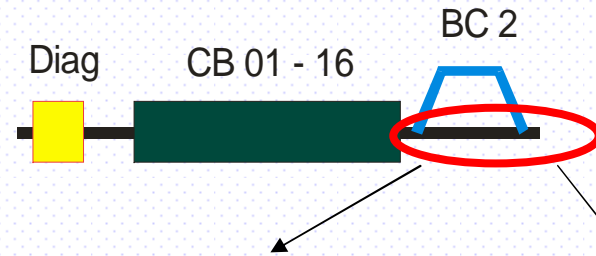
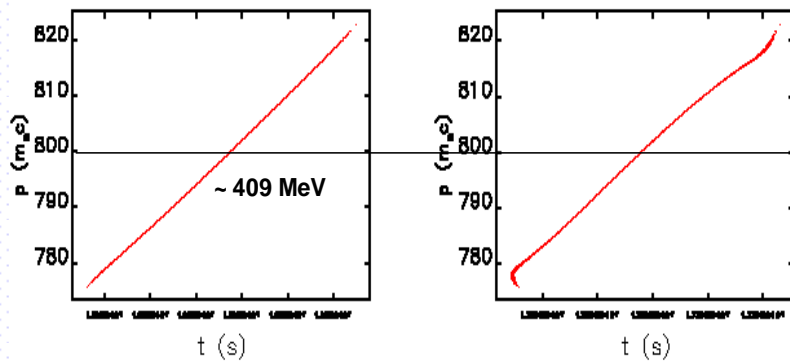
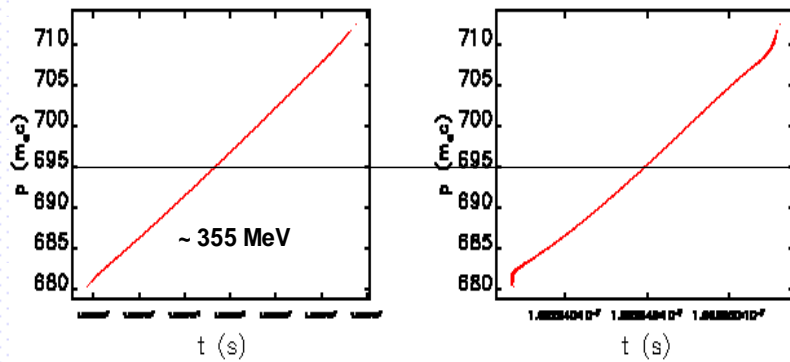
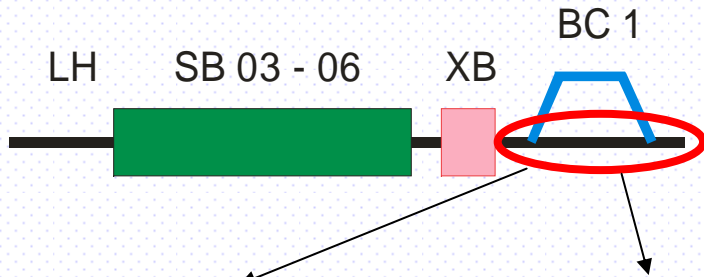
Centroid Trajectory



Layout Comparison. Energy gain

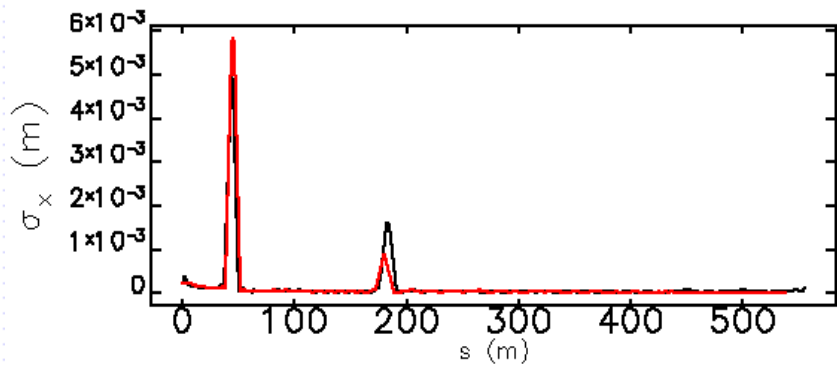


Layout Comparison. Longitudinal Profile

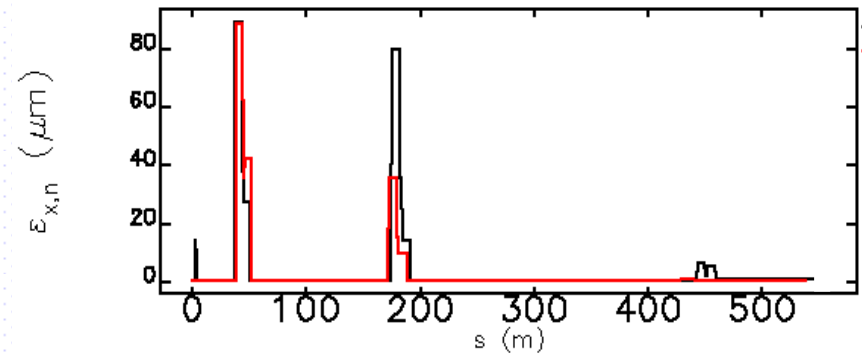


Layout Comparison. Transverse Beamsize, Emittance

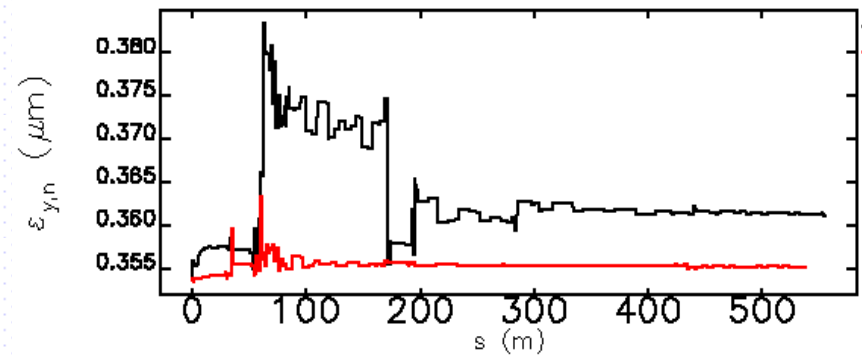
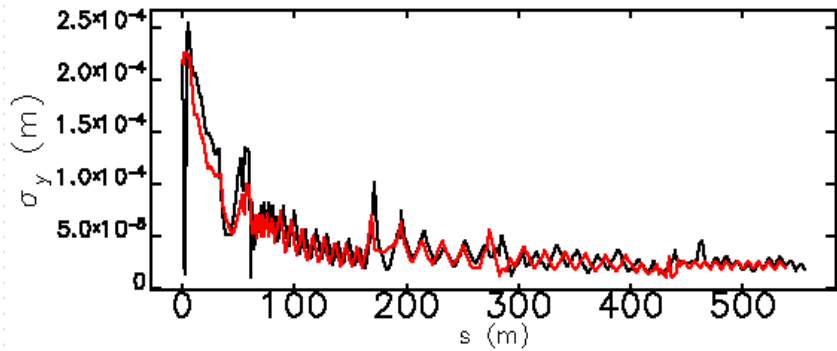
Transverse beamsize / Emittance



sigma matrix—input: SwissFEL_Aramis_Mar10.ele lattice: SwissFEL_Aramis_Mar10.lat



sigma matrix—input: SwissFEL_Aramis_Mar10.ele lattice: SwissFEL_Aramis_Mar10.lat

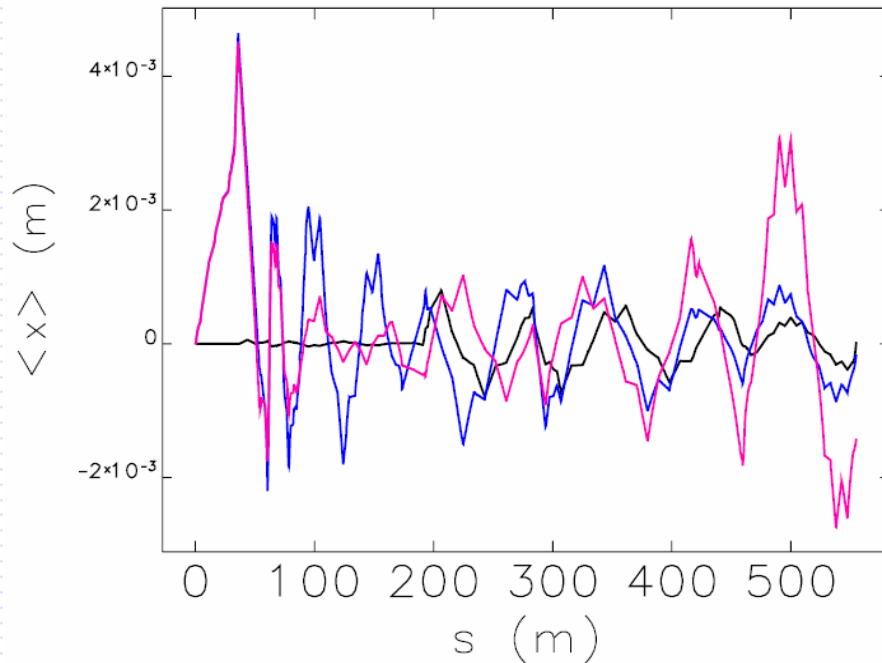


Layout Comparison.

Bunch Centroid Trajectory / Transv. Profile

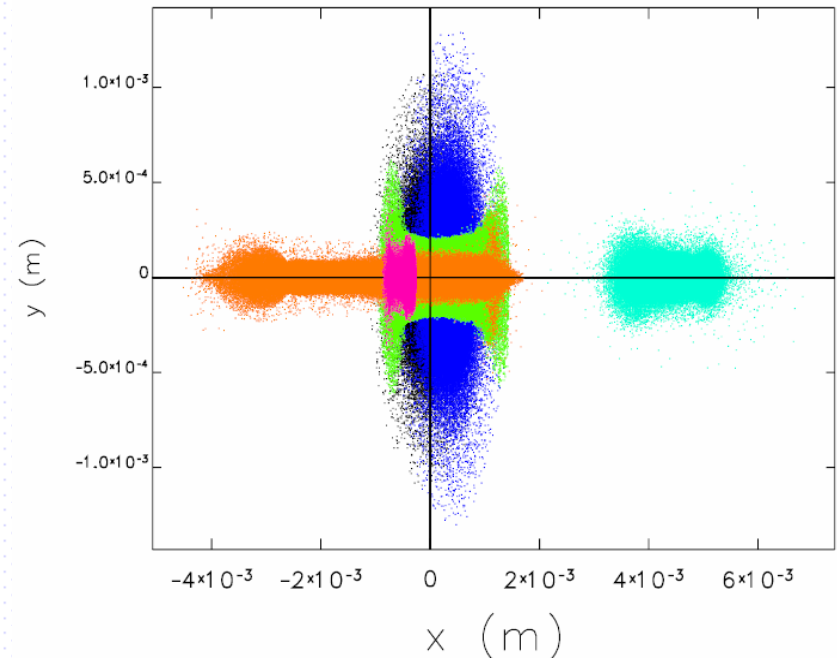
No Misalignment - black
LH quads misal 100um - blue
All Quads Misaligned - magenta

No Orbit Correction



Linac entrance - black
After LH BC - blue
Before BC 1 - cyan
After BC 1 - green
Before BC 2 - brown
After BC 2 - magenta

No Orbit Correction



Summary

- ⊕ Quadrupole misalignment and one-to-one trajectory correction where studied for SwissFEL.
- ⊕ Correction and calculations for new layout are in progress.
- ➔ Quadrupole misalignment destroys beam trajectory and bunch compression
 - More bunch compressors are more sensitive to quad misalignment
 - One-to-one correction scheme recovers dispersive effects, but for bunching process designed orbit should be corrected more accurate
- ➔ Optimization goals
 - Basic parameters to be optimized
 - Should the quadrupoles misalignment tolerances be studied in parallel to optimization ?
- ➔ Final design goals