CLIC Main Beam RTML

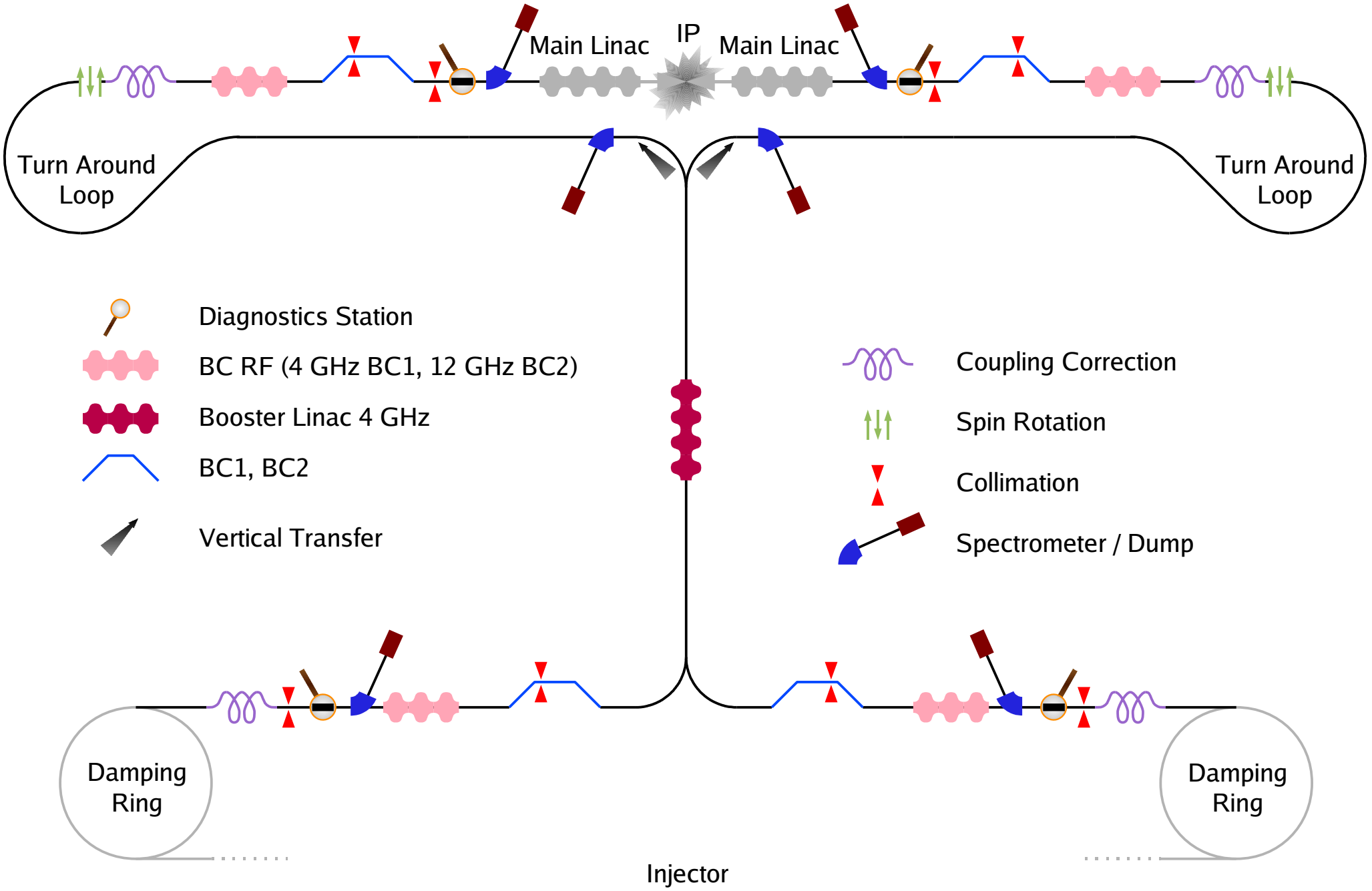
- Overview
- Comparison to ILC RTML
- Status / Outlook

Functions

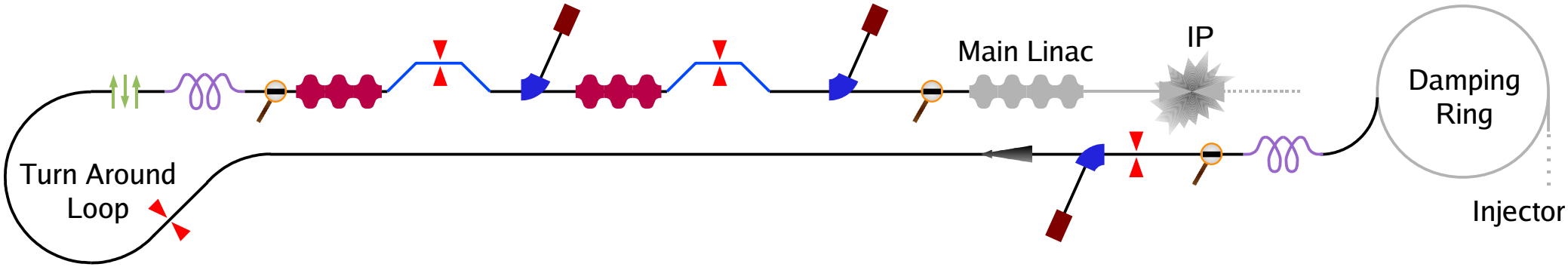
- Transport
  - => Transport Lines, Turn Around Loops, Arcs
- 6D Phase Space Shaping / Matching
  - longitudinal => Bunch Compressors incl. RF for Energy Chirp, Collimators
  - transverse => Optics, Collimators
- Acceleration
  - => Booster Linac
- Re-Orientation of Polarizationvector
  - => Spin Rotator
- Characterization
  - => Diagnostics (Position, RMS Length, longitudinal and transverse Profiles, Energy, Energy Spread, Emittance, Charge, Phase, Polarization,...)
- Correction / Tuning
  - => Dispersion Correction (at ILC: normal and skew quads integrated in BCs, Loop, Arcs), Coupling Correction, Phase Correction / Synchronization, Feedback, Feedforward
- Others
  - => Intermediate Beam Dumps, Spectrometer Beam Lines...

= ILC RTML, but beam dynamics challenges are different!

Functional Layout CLIC RTML (Draft)



Functional Layout ILC RTML



BC RF

BC1, BC2

Emittance Measurement

Spectrometer / Dump

Vertical Transfer

Coupling Correction

Spin Rotation

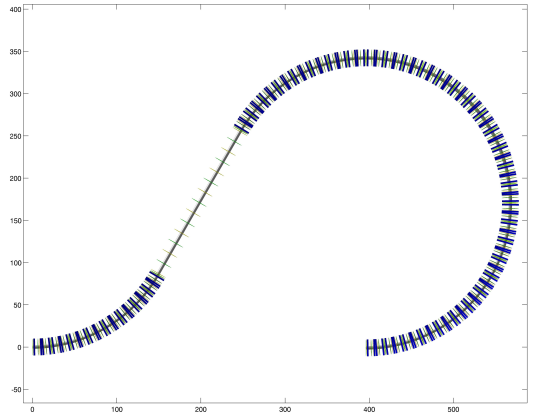
Collimation

Comparison CLIC and ILC RTML

- In both projects the RTML integrates the same functions
- But since the beam parameters are different
  also the beam dynamics challenges are different
- Consequently, the beam lines are different
  (example: Turn around loops,
  at CLIC major issue, since beam energy and energy spread large,
  but bunch length and emittance small)

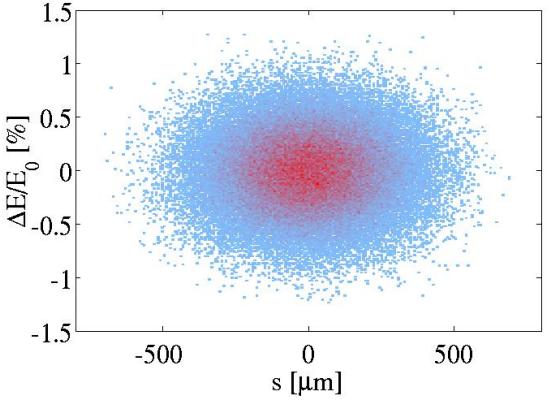
Turn Around Loop (old lattice)

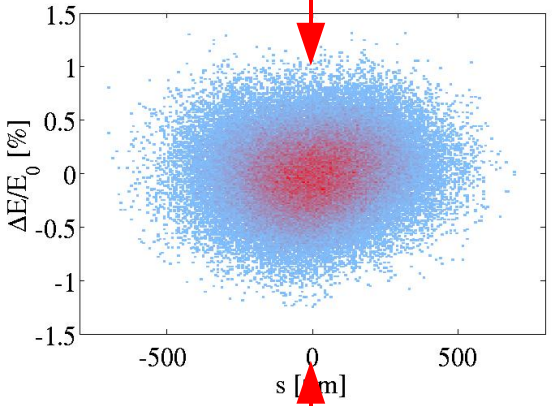
E_0	=	9 GeV
Q_0	=	0.65 nC
σ_s	=	175 µm
I_{peak}	=	460 A
$\epsilon_{n,x}$	=	520 nm rad
$\epsilon_{n,y}$	=	5 nm rad
$\frac{\sigma_{E,unc}}{E_0}$	=	0.32 %
$\frac{1}{E_0}\frac{dE}{ds}$	=	0.0 m^{-1}



CSR

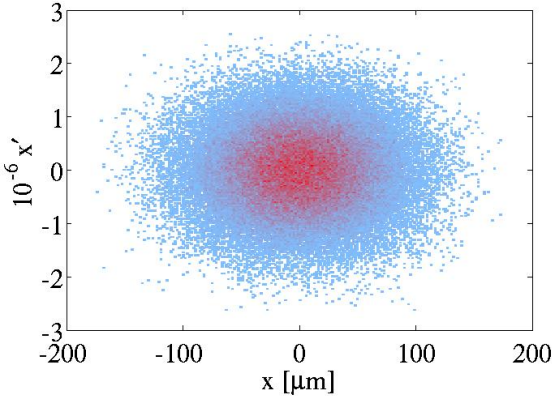
longitudinal phase space

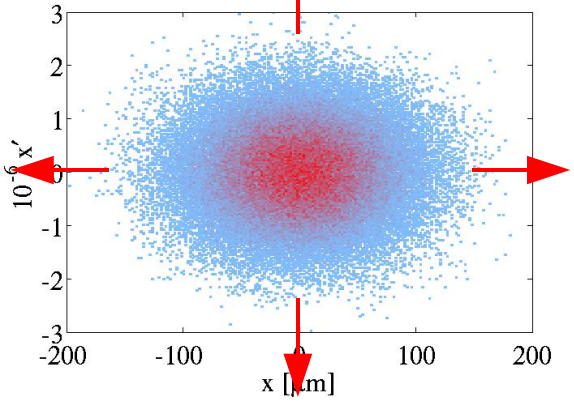




σ_s	=	175 µm
I_{peak}	=	460 A
$\epsilon_{n,x}$	=	580 nm rad
$\epsilon_{n,y}$	=	5 nm rad
$\frac{\sigma_{E,tot}}{E_0}$	=	0.32 %

transverse phase space



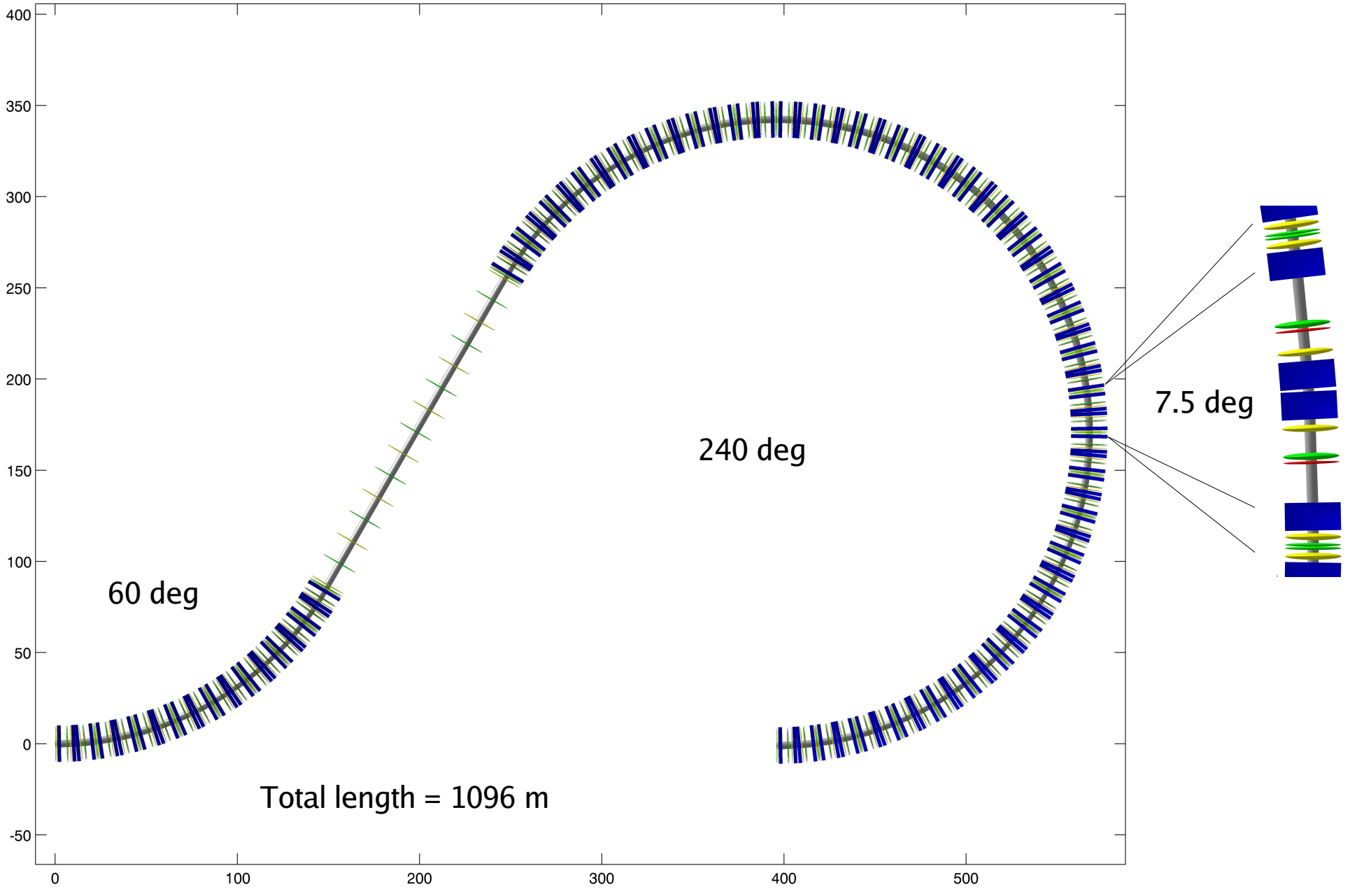


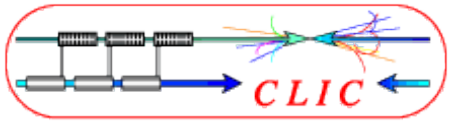
ISR

initial

final

Turn Around Loop (old lattice)





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  (example: Turn around loops,
  at CLIC major issue, since beam energy and energy spread large,
  but bunch length and emittance small)
- Nevertheless, there are some issues where the projects can profit from each other:
  e.g., simulation of wake fields in cavities, CSR in chicanes, (other collective effects),
  magnetic stray fields along transfer line, ground vibrations,...
  (basically any effect we would like to see in the simulations)
- Lattices of spin rotators could be similar,
  but beam parameters at CLIC might be too different
  (in any case, ILC spin rotator will be basis for CLIC spin rotator)
- Correction / Tuning Algorithms, ideas on lattice,... (anything else?)

Status / Outlook

- Initial and final parameters (almost) fixed,
  (to ease design of turn around loop we try to lower energy,
  but this has an impact on main linac and BC2 RF)
- Beam line design is advancing,
  we have first lattices for BC1 RF and Chicane, Booster Linac,
  Transfer Line, BC2 RF and Chicane
- Turn Around Loop lattice recently improved in terms of
  quadrupole and sextupole strengths and better general layout,
  but it became longer by several 100 m and emittance growth did not improve
- Soon, we need to discuss requirements for diagnostics, feedback and feedforward
- Critical item: not yet started to design Spin Rotator