



CLIC Beam Delivery System Instrumentation

R. Tomas, I. Agapov, A. Latina and D. Schulte

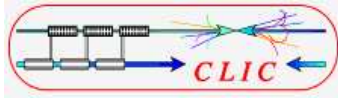
Abstract

One of the major recent changes of the CLIC Beam Delivery System is the addition of a diagnostics section right at the start. The goals of the diagnostics section are: coupling correction, emittance measurement, energy measurement and polarization measurement. The latter still requires design and simulation studies. The post-IP dump line should also be equipped with various instrumentation devices that should comply with the challenging requisites of the spent beam.

Acknowledgements

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CLIC workshop 2007

Contents

- The new diagnostics section for $\epsilon_y=20\text{nm}$:
 - Emittance measurement
 - Energy measurement
- Polarization measurement (!)
- The post-collision line instrumentation (!)

Goals & Requisites of Diagnostics

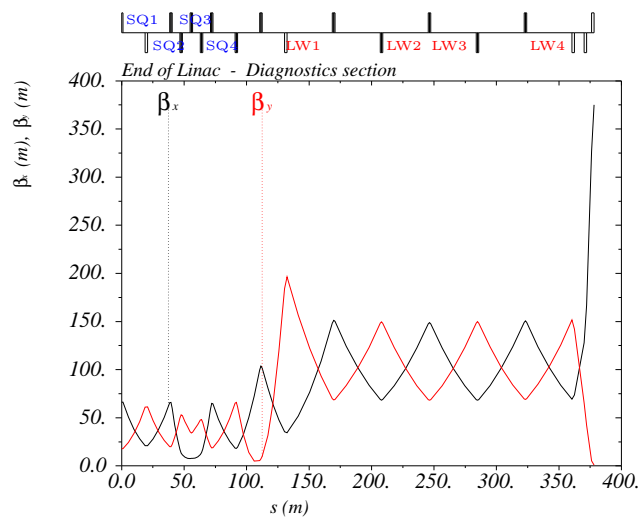
Goals:

- Coupling correction
- Emittance measurement
- Energy measurement (placed in collimation section to save space)

Requisites:

- 4 skew quadrupoles
- 4 laser wires
- Photon detector
- Precise dipole and BPMs

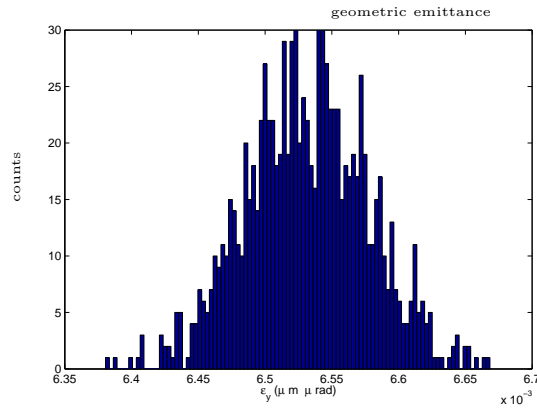
Diagnostics: emittance measurement



$\sigma_y=1\mu\text{m}$ @ Laser wires (for $\epsilon_y=20\text{nm}$)

Emittance measurement

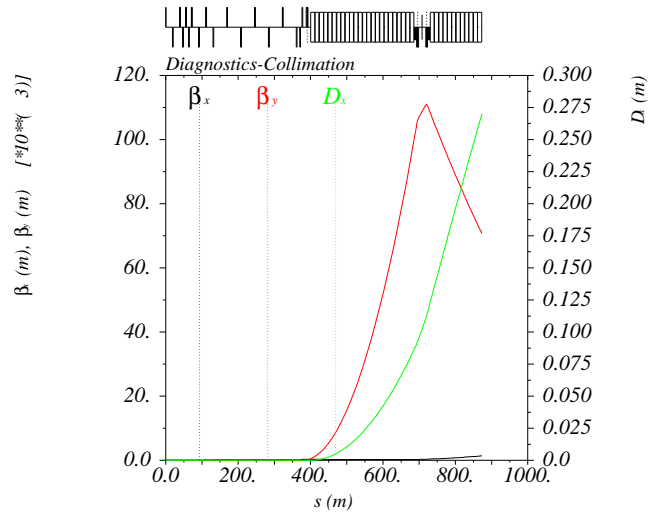
Simulations by I. Agapov: 3 trains, 3 wires and 10% error on beam size



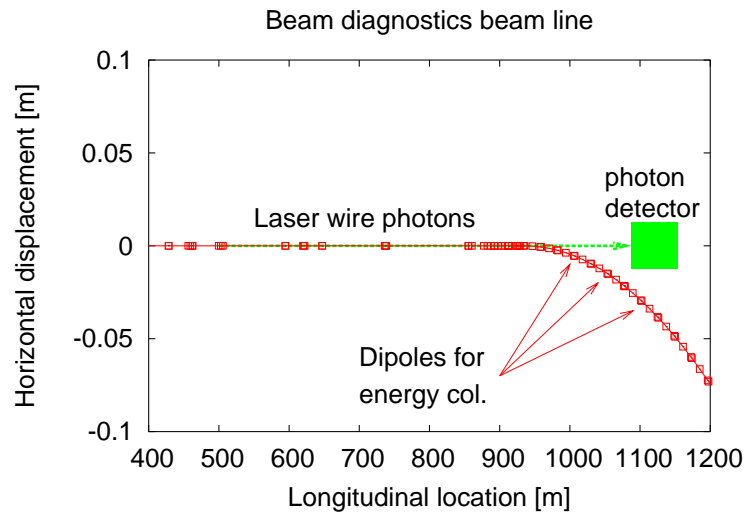
assumed.

$$\Delta\epsilon_{x,y}/\epsilon_{x,y} \approx 7\%$$

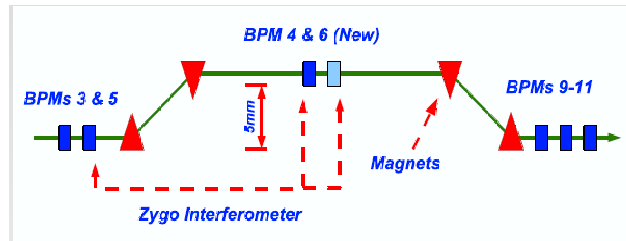
Diagnostics inside collimation



Layout & photon collection



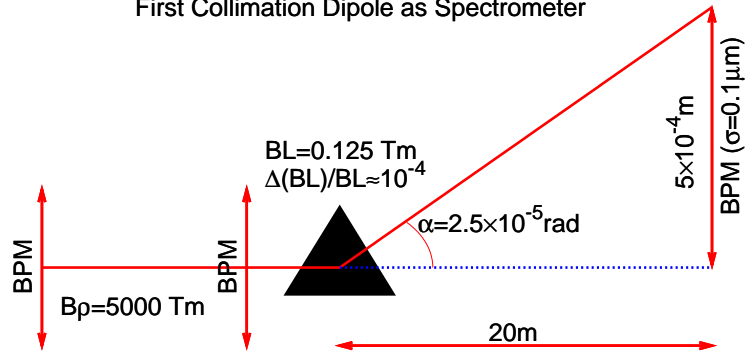
Traditional energy measurement (SLAC)



- 4 Bends chicane: The energy is inferred from BPMs.
 Drawback for CLIC: too long!, alternatives:
 → Compton backscattering (under study @ ILC)
 → using a single bend?

CLIC compact energy measurement

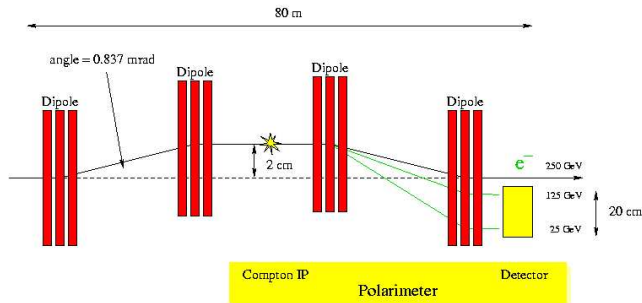
First Collimation Dipole as Spectrometer



$$\Delta E/E = \Delta\alpha/\alpha \oplus \Delta(BL)/BL \approx 3.6 \times 10^{-4}$$

Polarization measurement (!)

ILC polarization measurement: (M. Beckmann)



Extraction of electrons via Compton scattering

CLIC has no energy chicane!

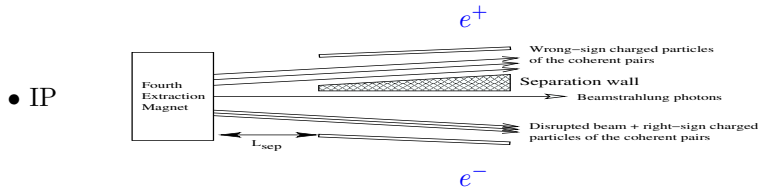
Where can we put it?

In the instrumentation section it interferes with laser wire photons

End of collimation section?

Post-collision line instrumentation

A. Ferrari, CN 704



Lots of observables: e^- , e^+ , γ energies, sizes, polarization, etc.
Challenges: design, losses, beam sizes $\approx 40\text{cm}$, $\Delta E/E_0 \approx 50\%$, etc.
→ A lot to do!

Summary

- Diagnostics section ready for $\epsilon_y = 20\text{nm}$:
 - Emittance measurement $\leq 7\%$ accuracy assuming:
 - * 10% size resolution for $1\mu\text{m}$ beam size
 - Energy measurement $\approx 0.04\%$ accuracy assuming:
 - * $\sigma_{BPM} = 0.1\mu\text{m}$
 - * $\sigma_{BL}/BL = 10^{-4}$
- Polarization measurement design pending
- Post-collision line instrumentation requires studies