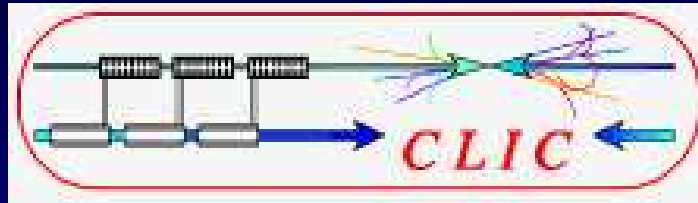


CLIC Beam Delivery System Instrumentation



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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

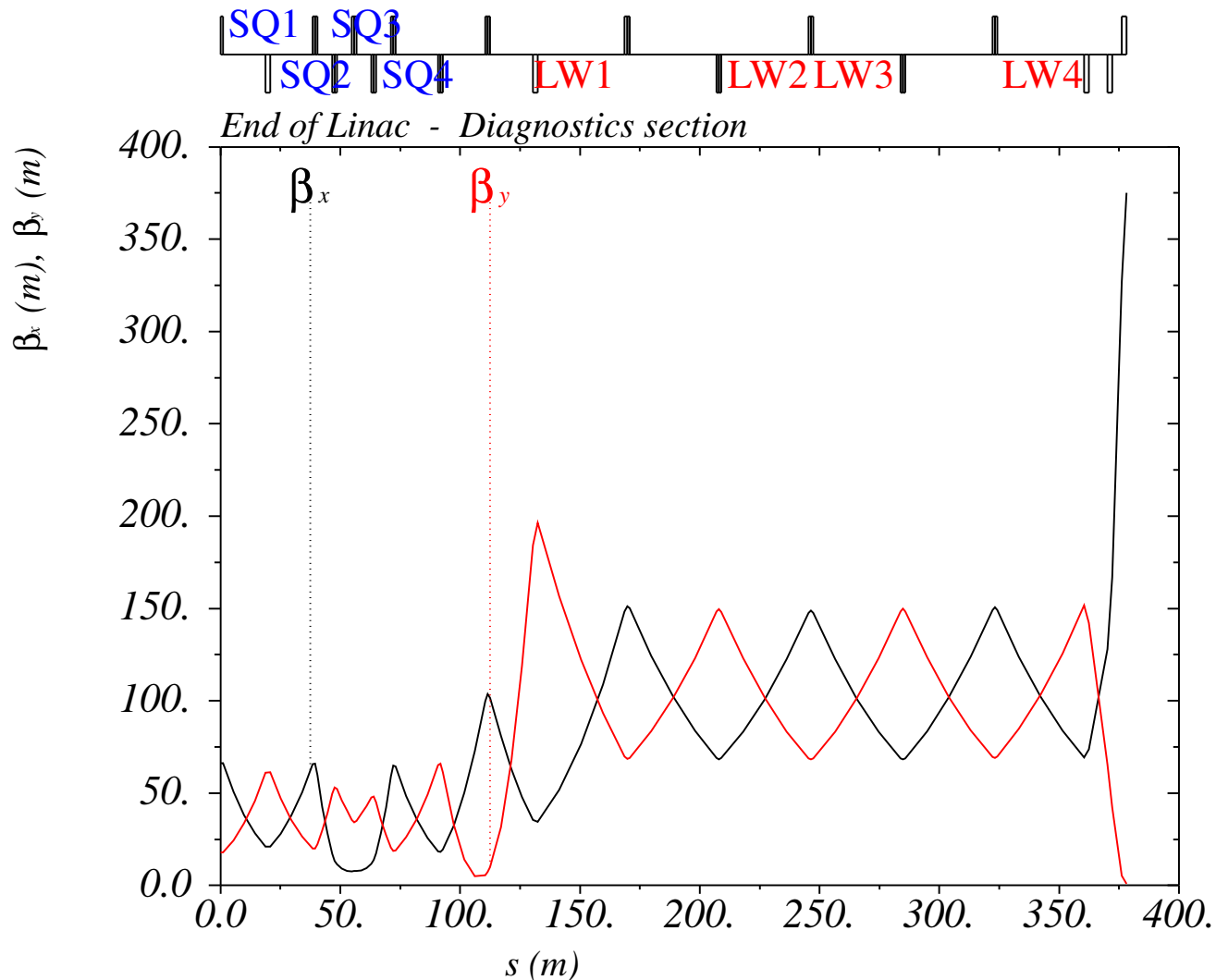
Goals:

- 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

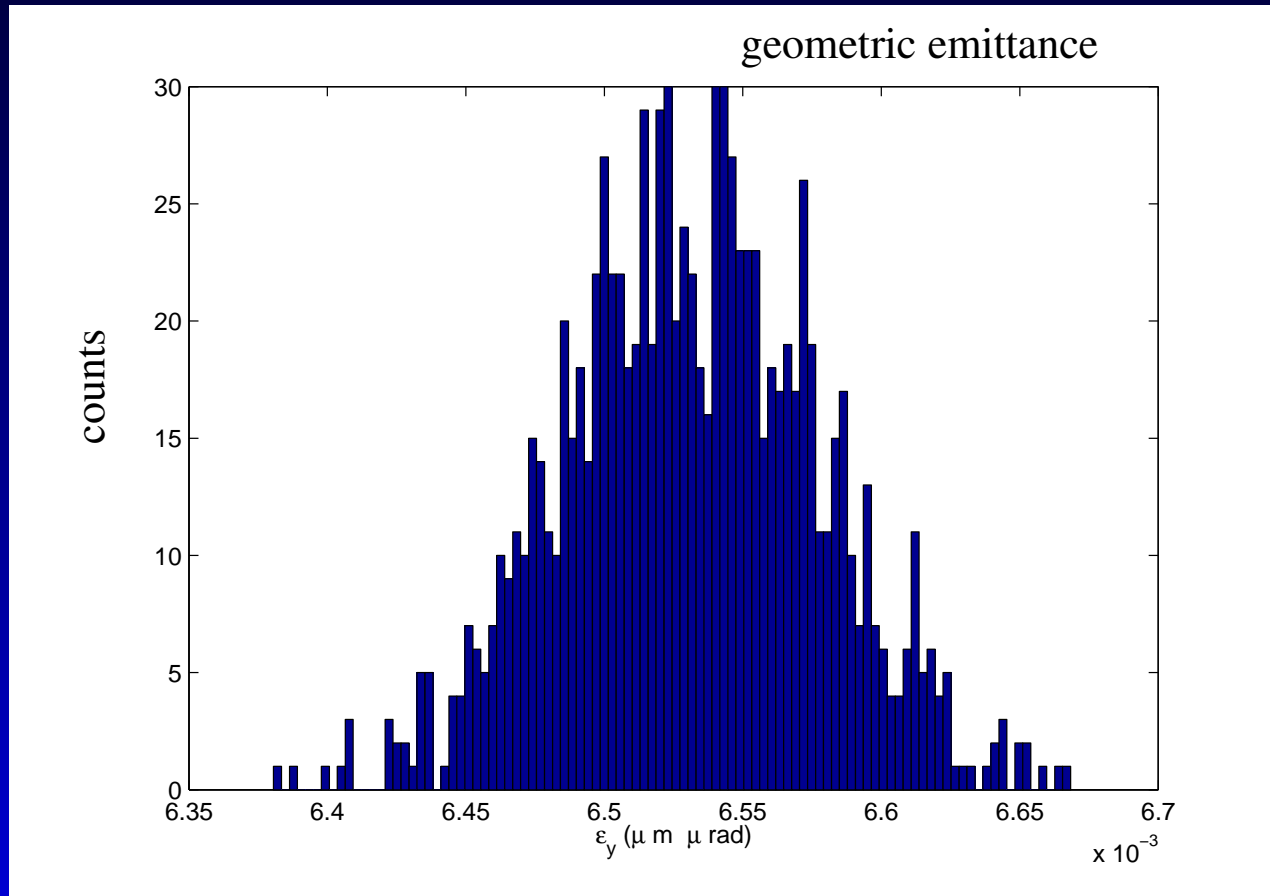
Diagnostics: emittance measurement



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

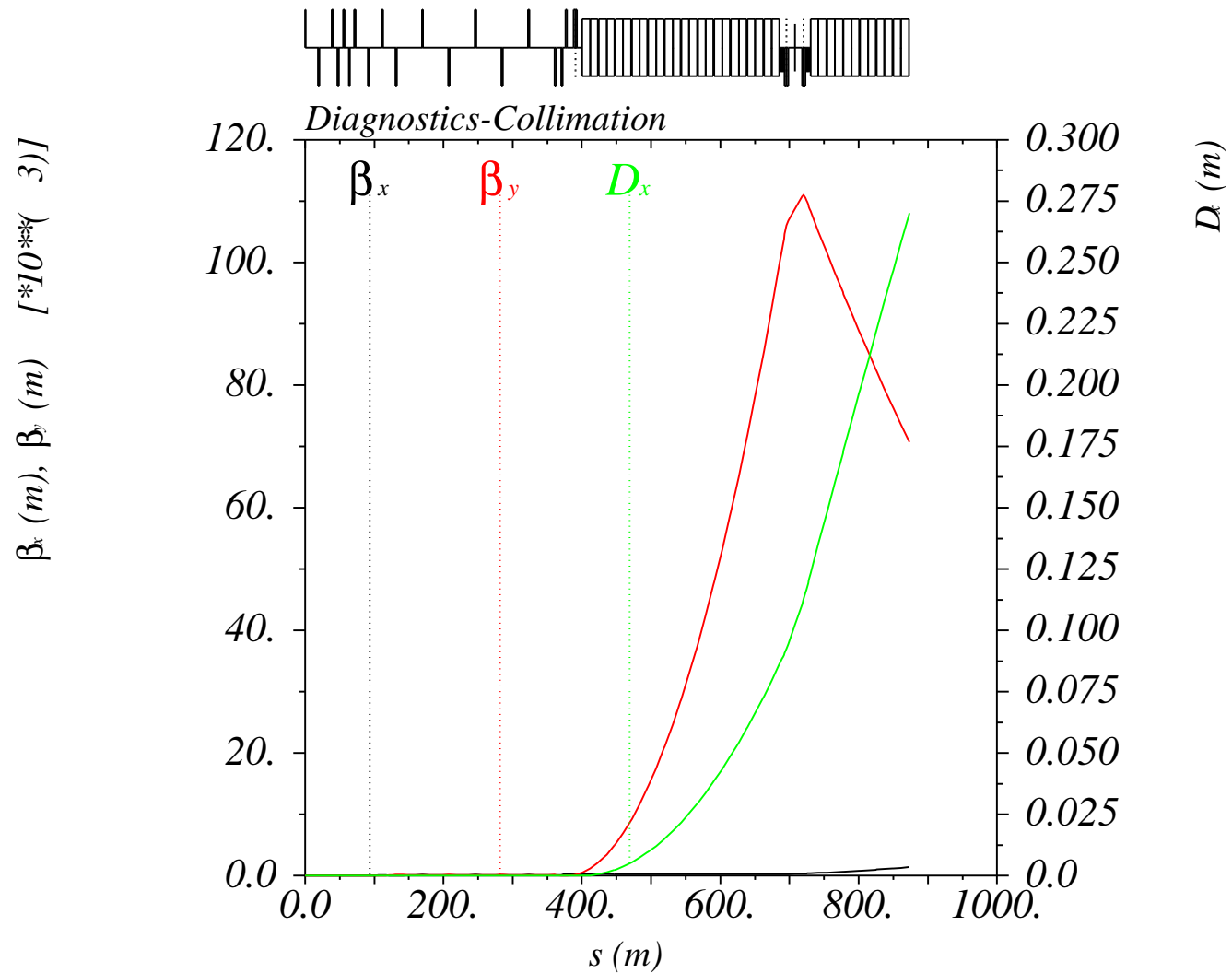
Emittance measurement

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

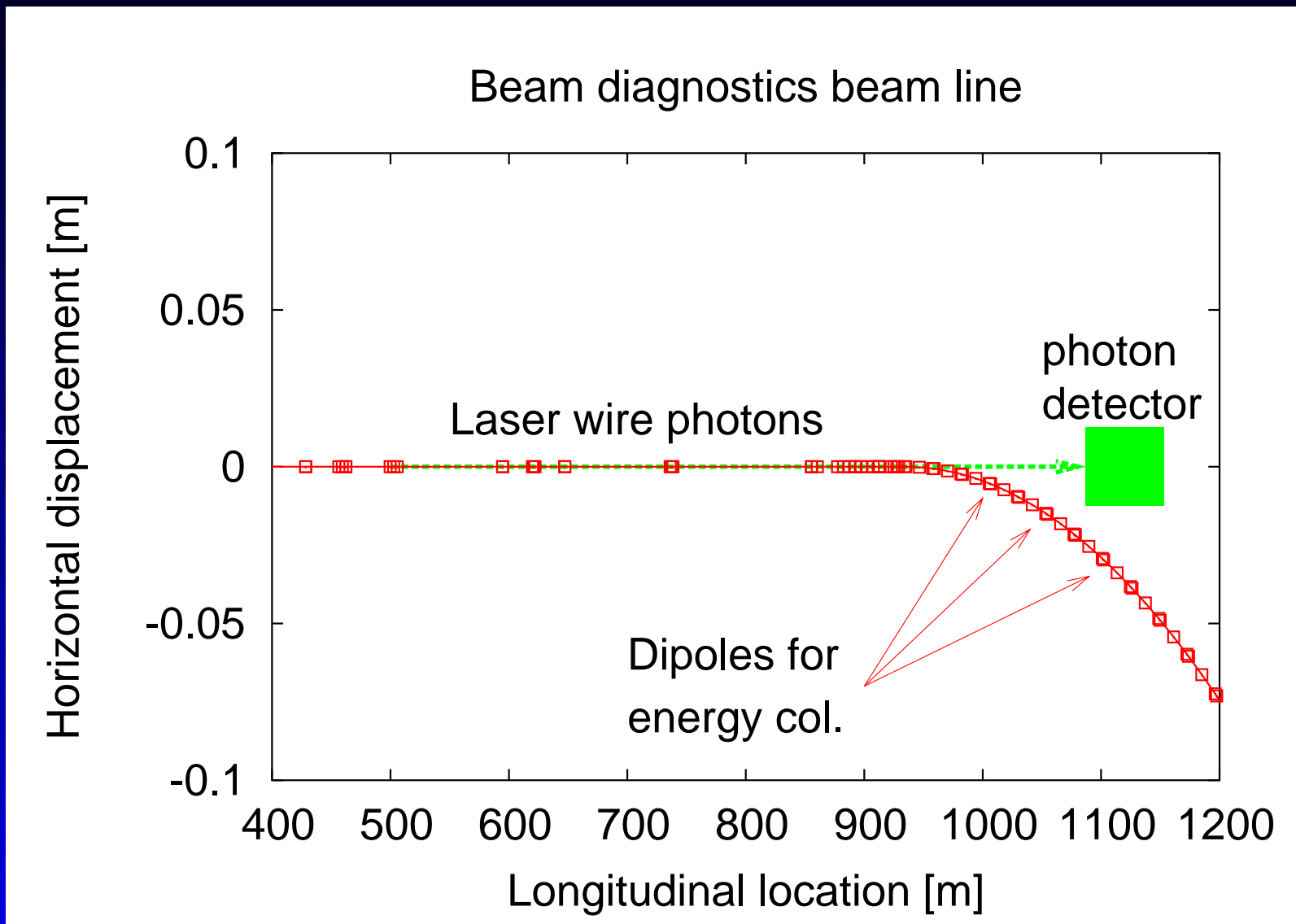


$$\Delta\epsilon_{x,y}/\epsilon_{x,y} \approx 7\%$$

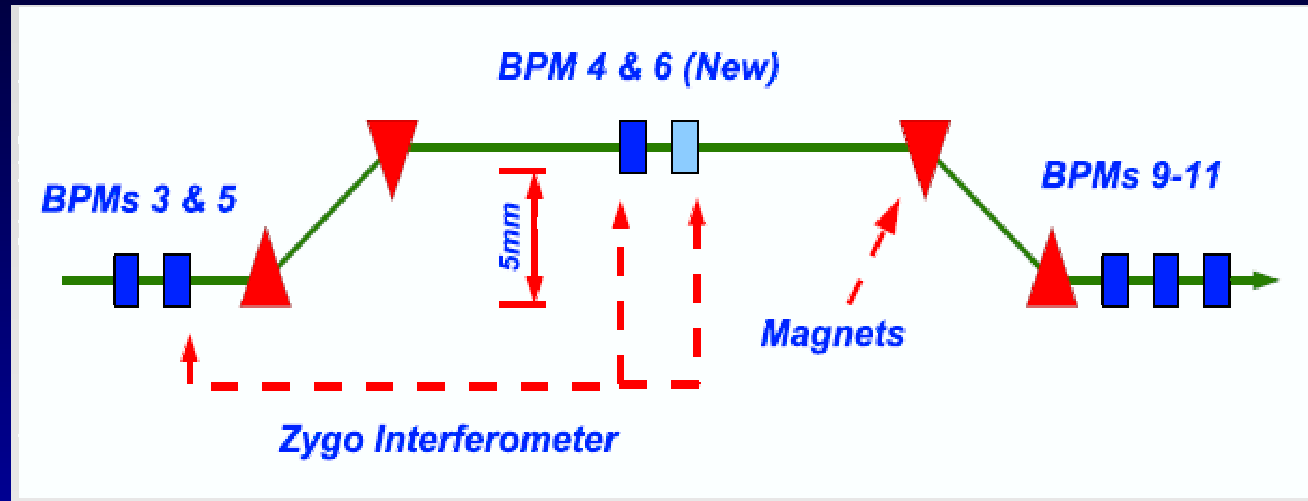
Diagnosics inside collimation



Layout & photon collection



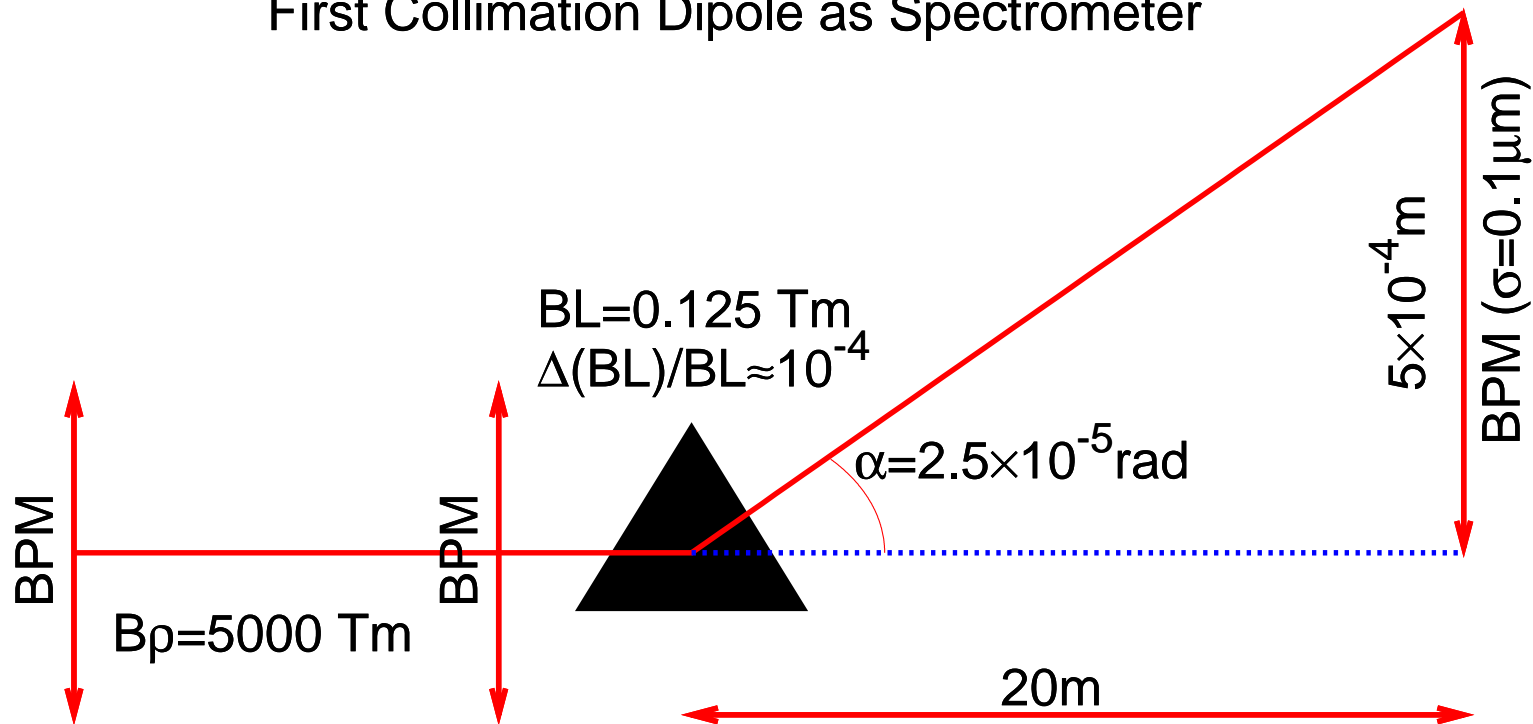
Traditional energy measurement (SLAC)



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

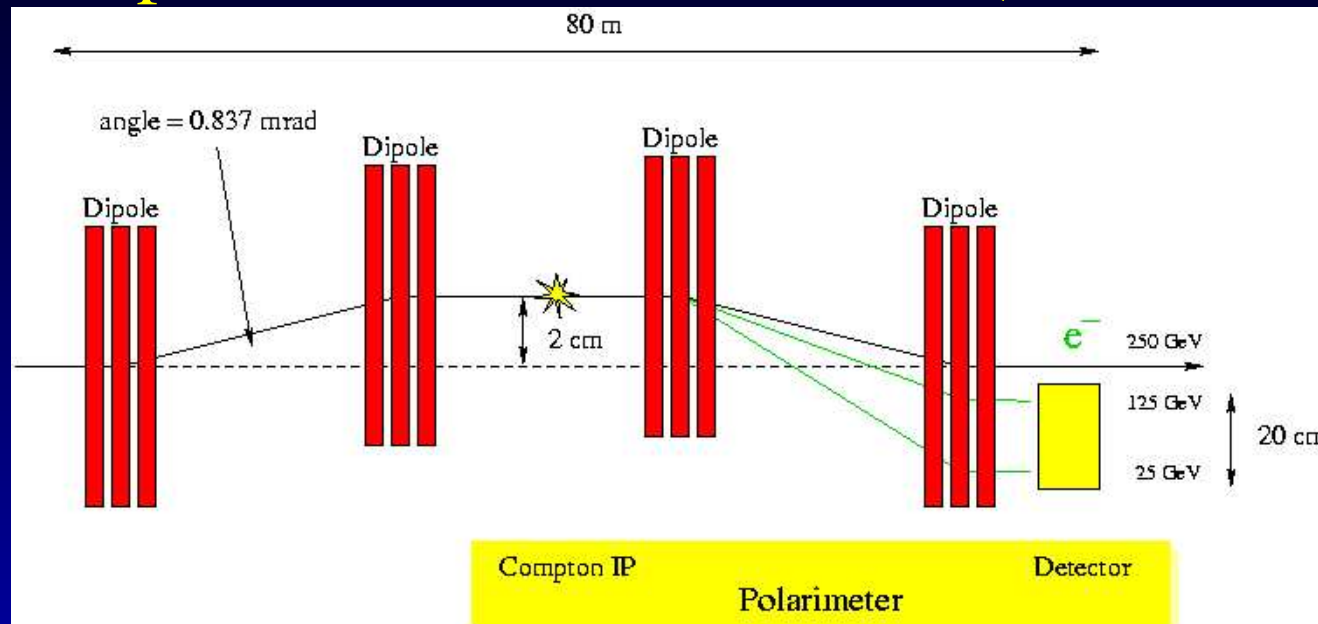
First Collimation Dipole as Spectrometer



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

Polarization measurement (!)

ILC polarization measurement:(M. Beckmann)



Extraction of electrons via Compton scattering
CLIC has no energy chicane!

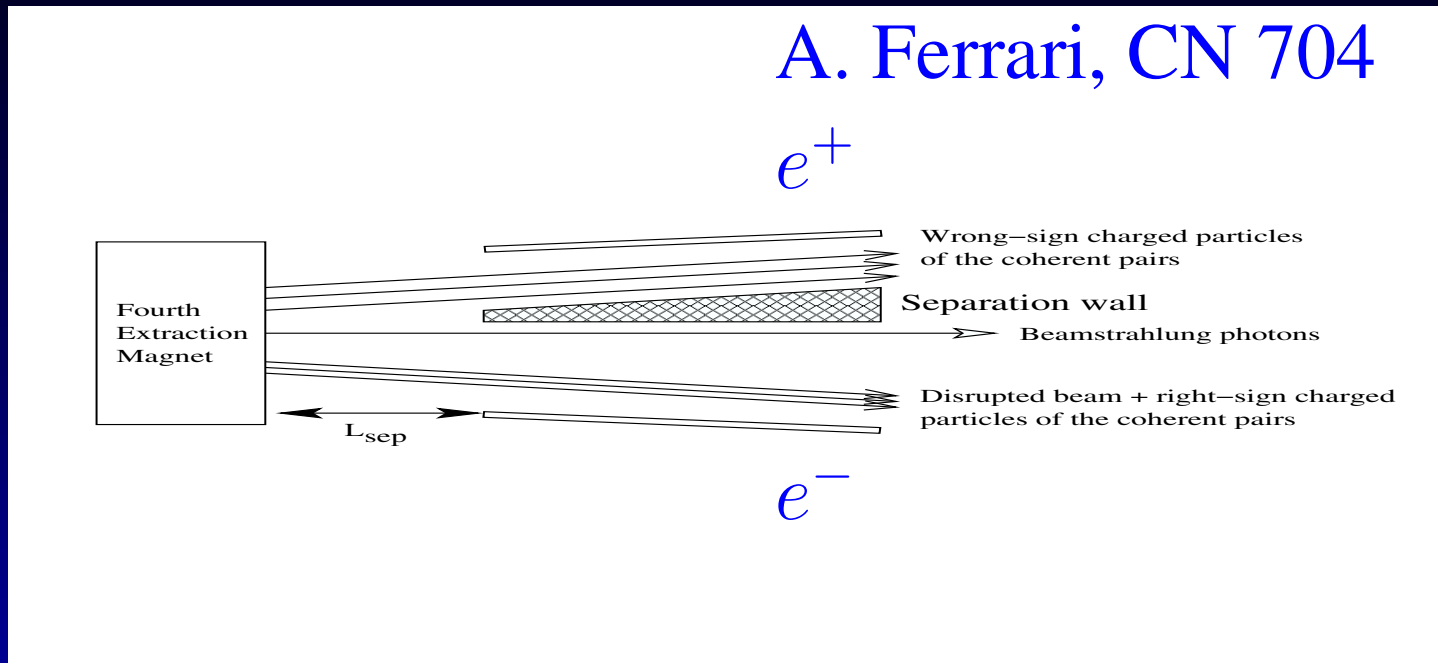
Where can we put it?

In the instrumentation section it interferes with laser wire photons

End of collimation section?

Post-collision line instrumentation

● IP



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