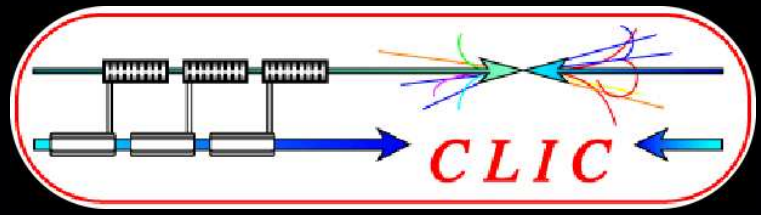
Beam Delivery System instrumentation



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P. Schuler and D. Schulte

CLIC BI workshop 2009

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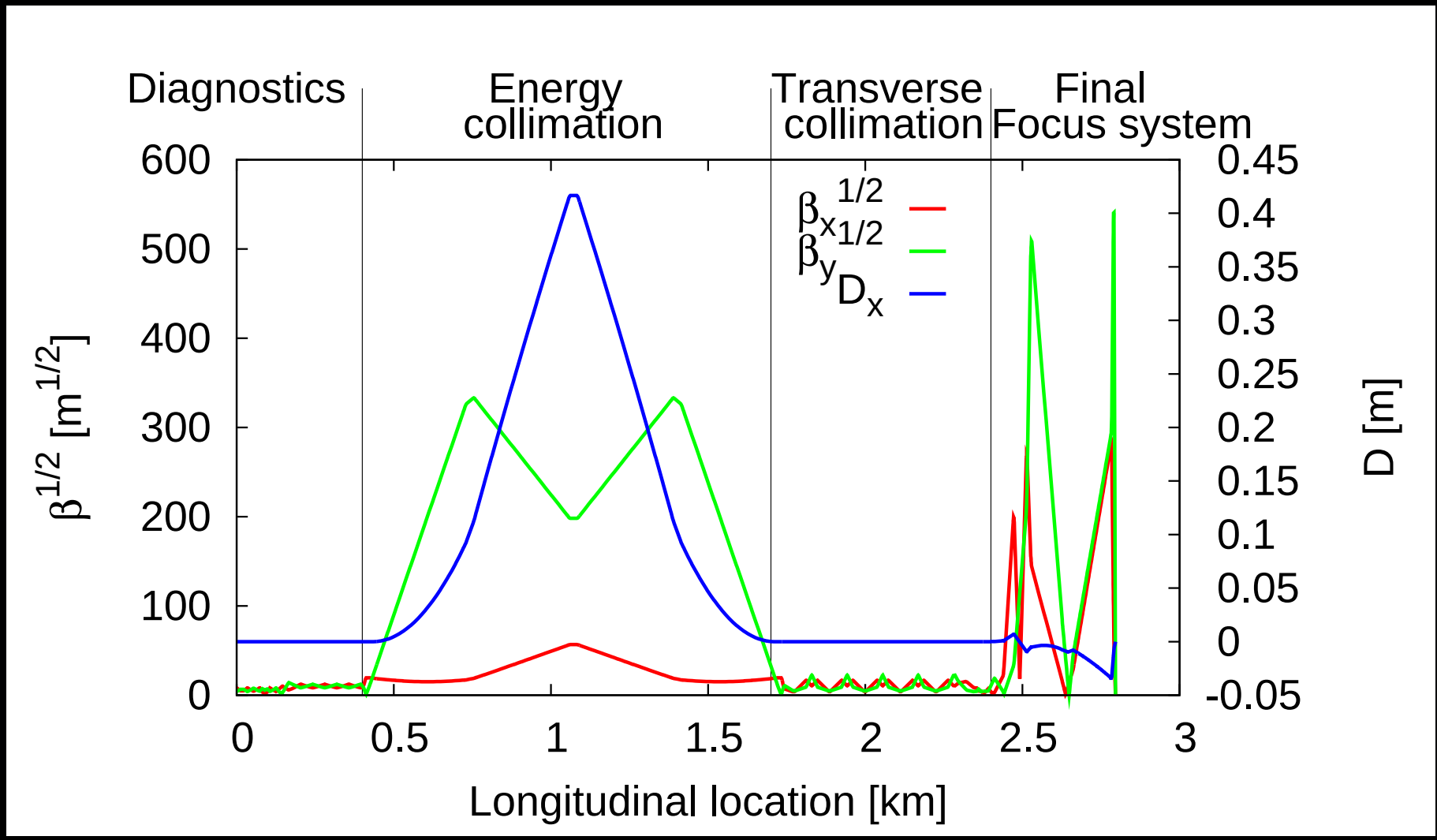
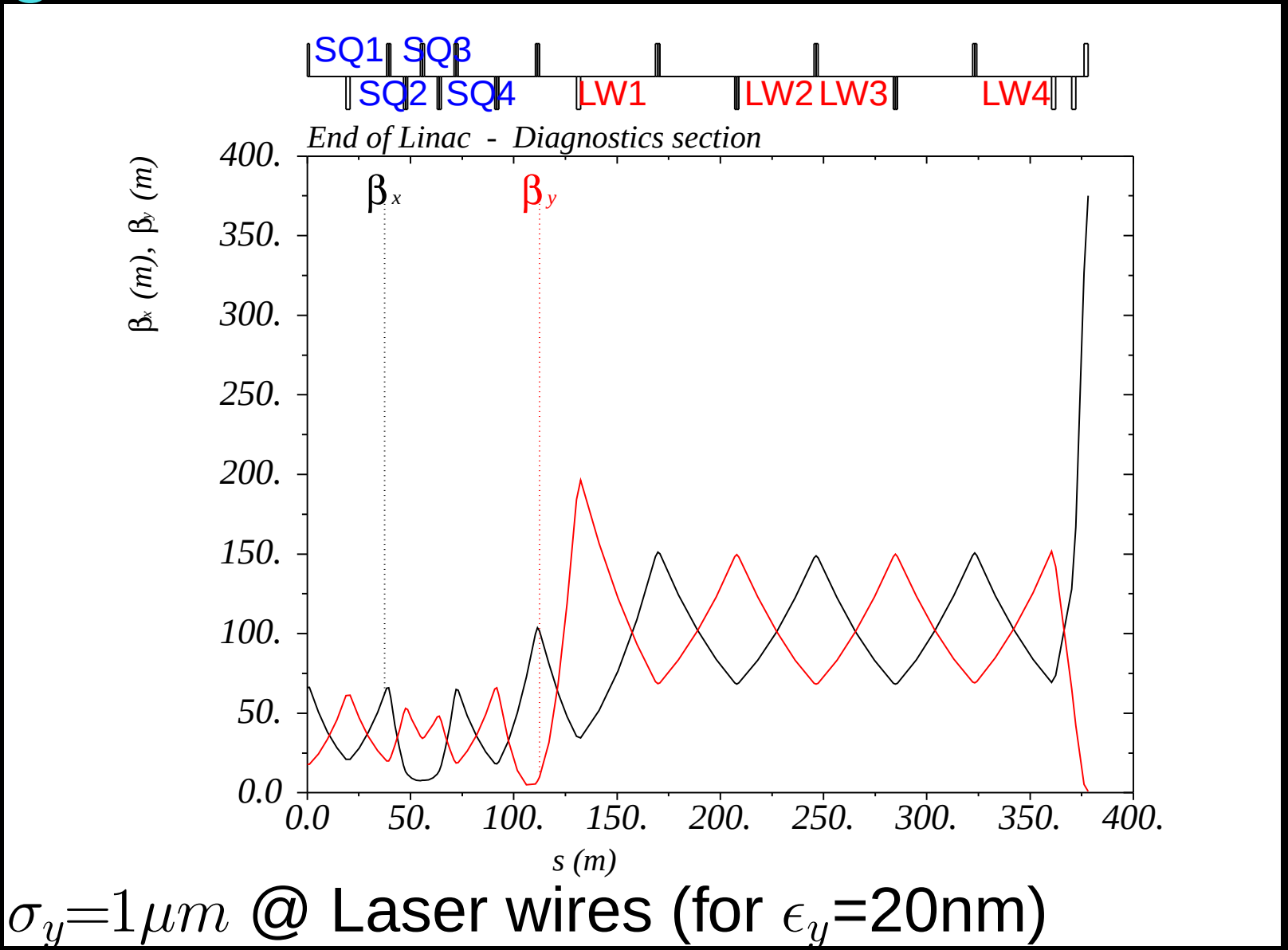
The BDS


Diagnostics
Energy collimation
Transverse collimation
Final Focus system
$\beta_x^{1/2}$
$\beta_y^{1/2}$
D_x
$\beta^{1/2}$ [$m^{1/2}$]
D [m]
Longitudinal location [km]
600
500
400
300
200
100
0
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
0
0.5
1
1.5
2
2.5
3

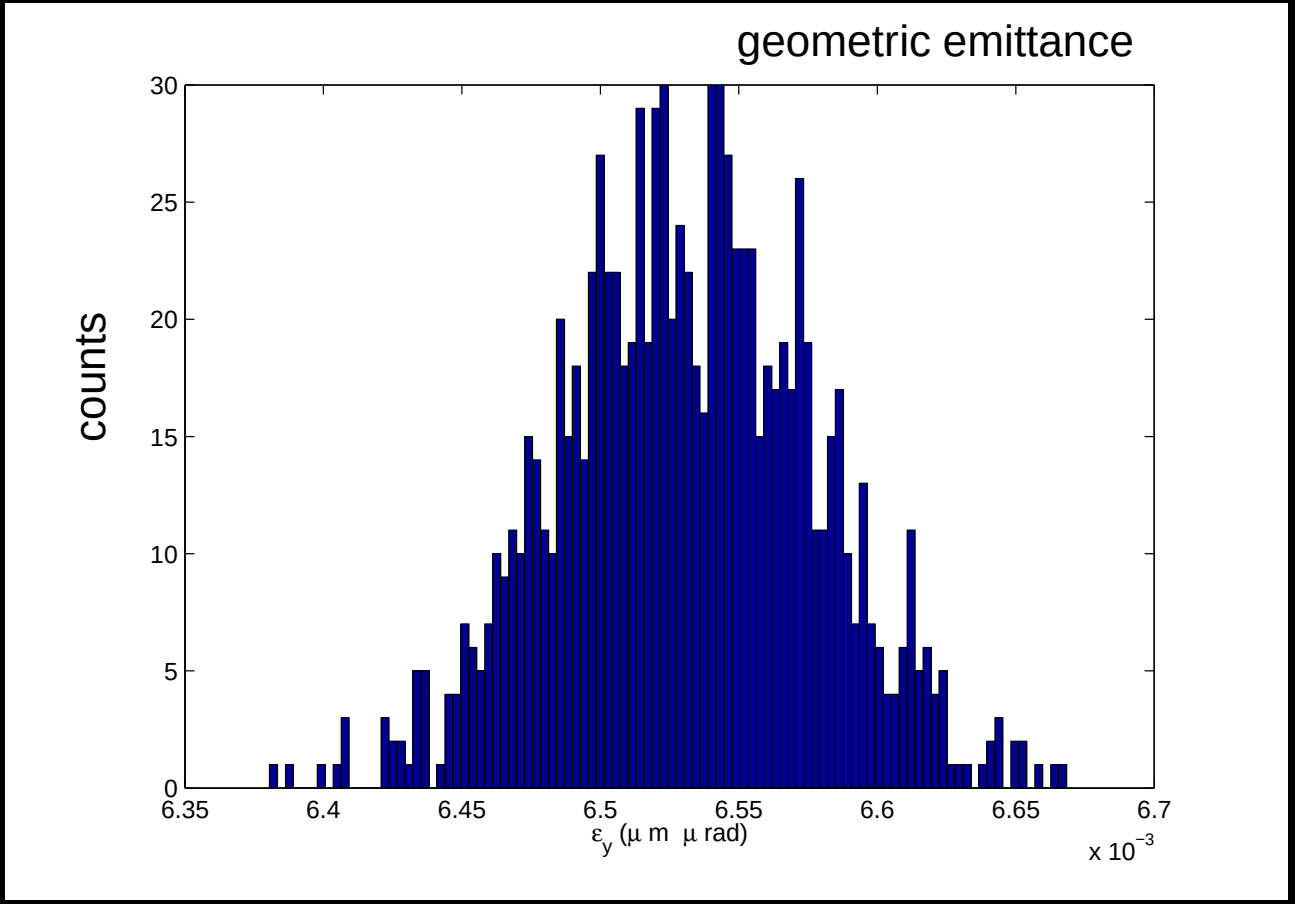
Diagnostics: emittance measurement



σ_y=1μm @ Laser wires (for ϵ_y=20nm)

Emittance measurement

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

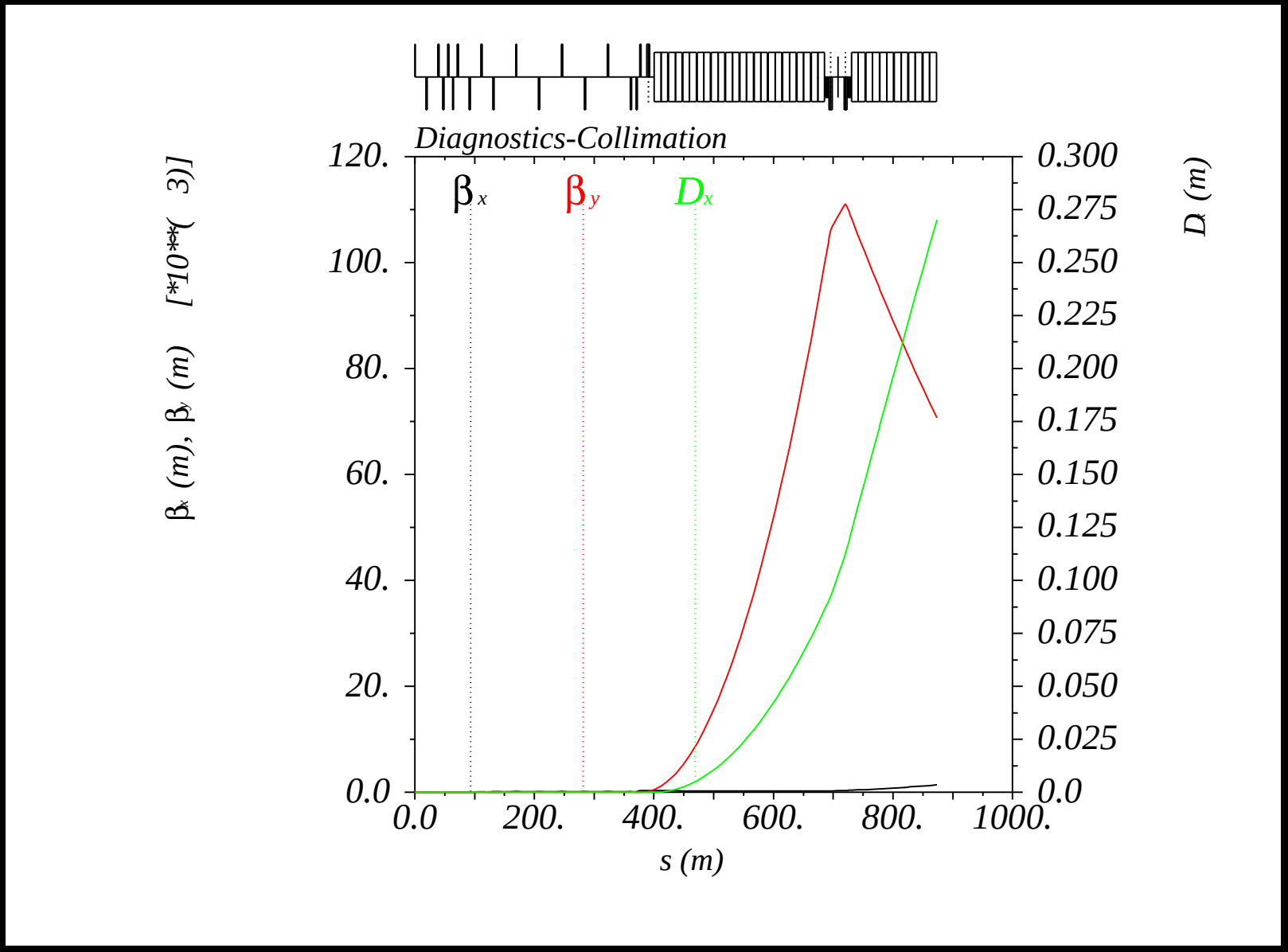


$$\Delta\epsilon_{x,y}/\epsilon_{x,y} \approx 7\%$$

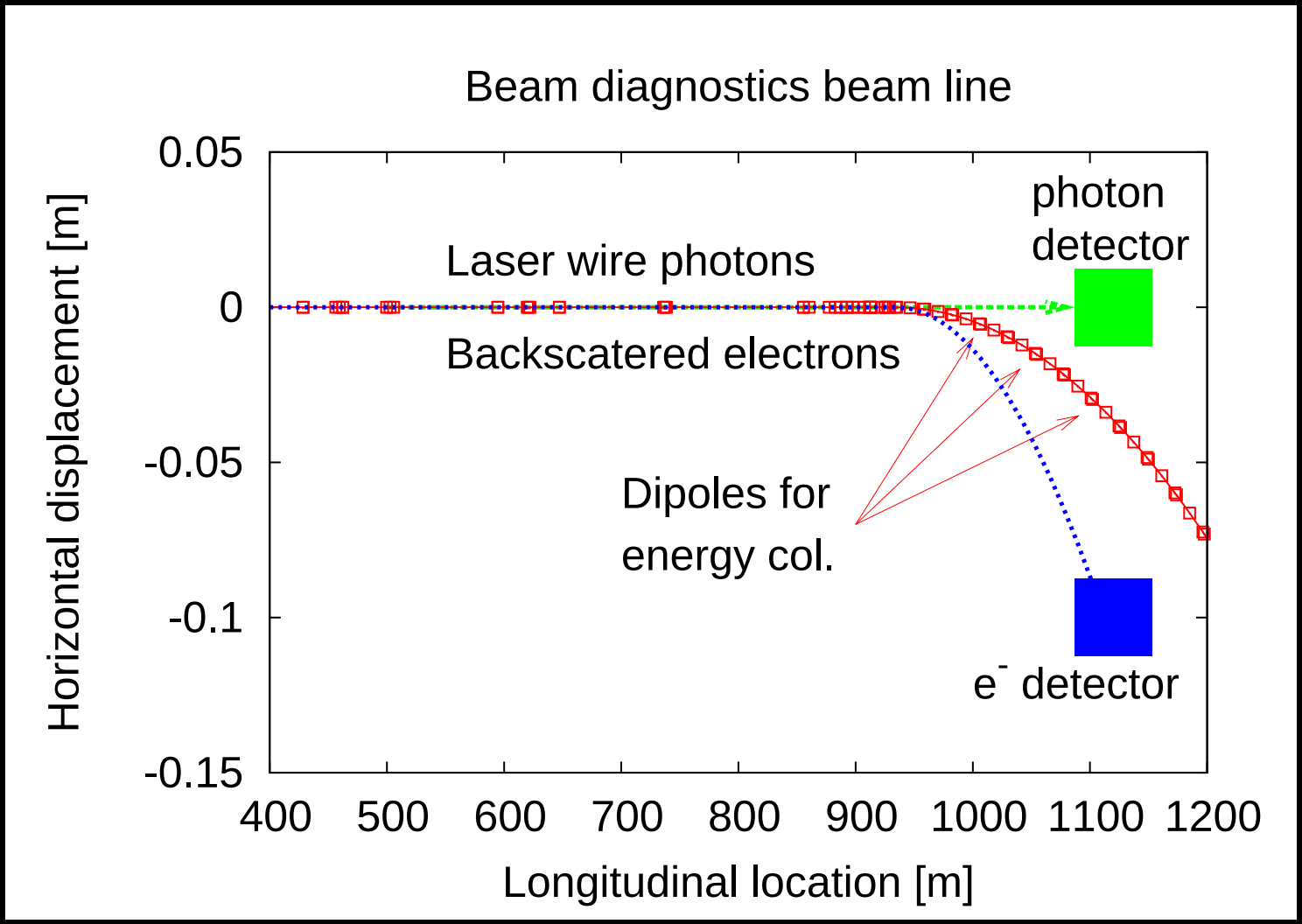
Laser-wire work (G. Blair)

- Implementation of a fast-scanning 2-D system at PETRAIII (A. Bosco et al. Nucl.Instrum.Meth.A592:162-170,2008). The system is under commissioning.
- R&D on a micron-scale laser-wire system at ATF2. PAC paper demonstrating scan at 3μm. The path to improving the resolution has also been identified.

Diagnostics inside collimation

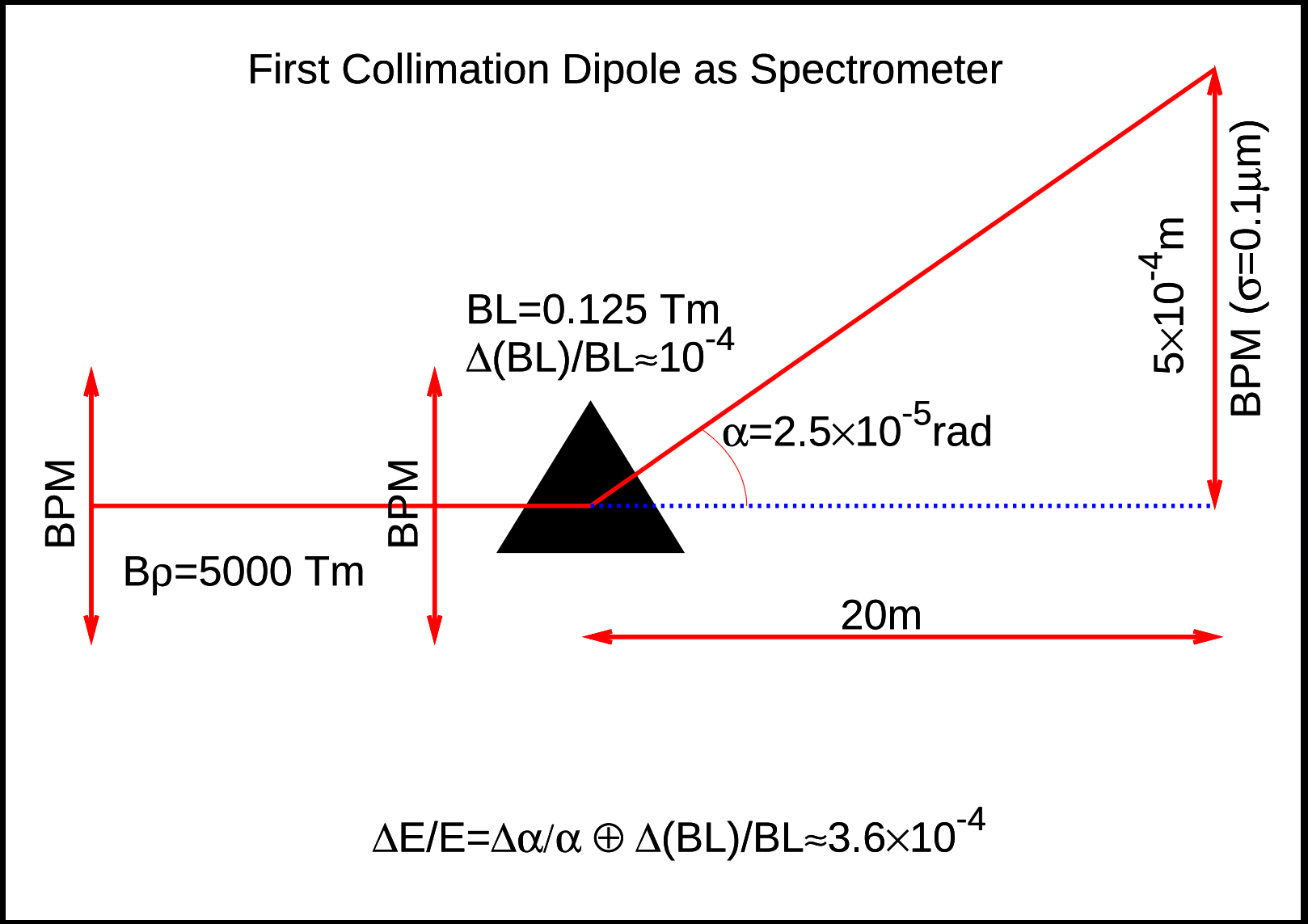


Conceptual layout & e^- collection

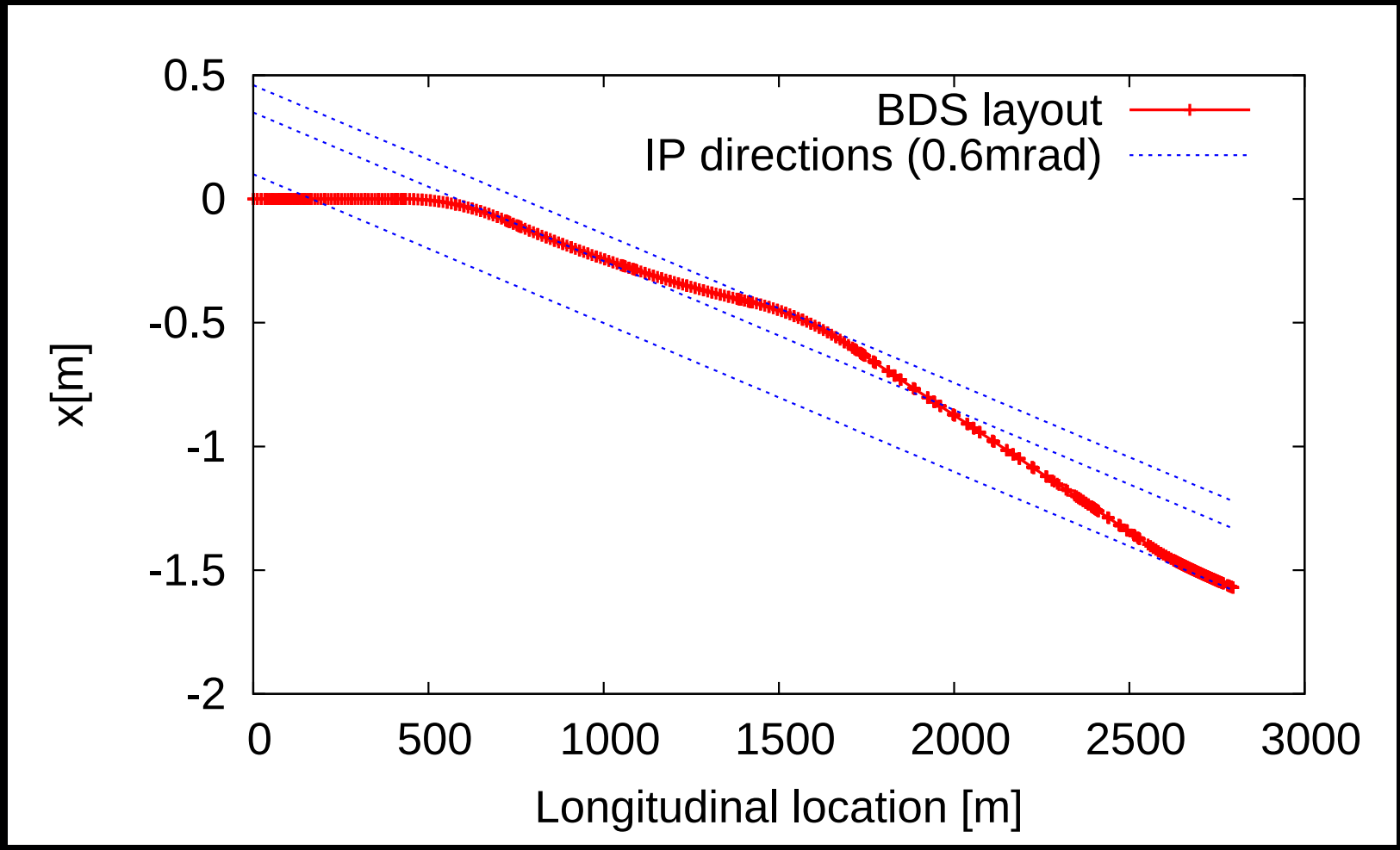


Backscatered e^- is the best signal (ILC-Note-2008-041). Need CLIC detailed studies.

CLIC compact energy measurement



Polarimeter location & performance



Laser IP at 742 m and detector at 907 m. Relative polarization measurement error is 0.61% (for 1s).

The laser of the polarimeter (P. Schuler)

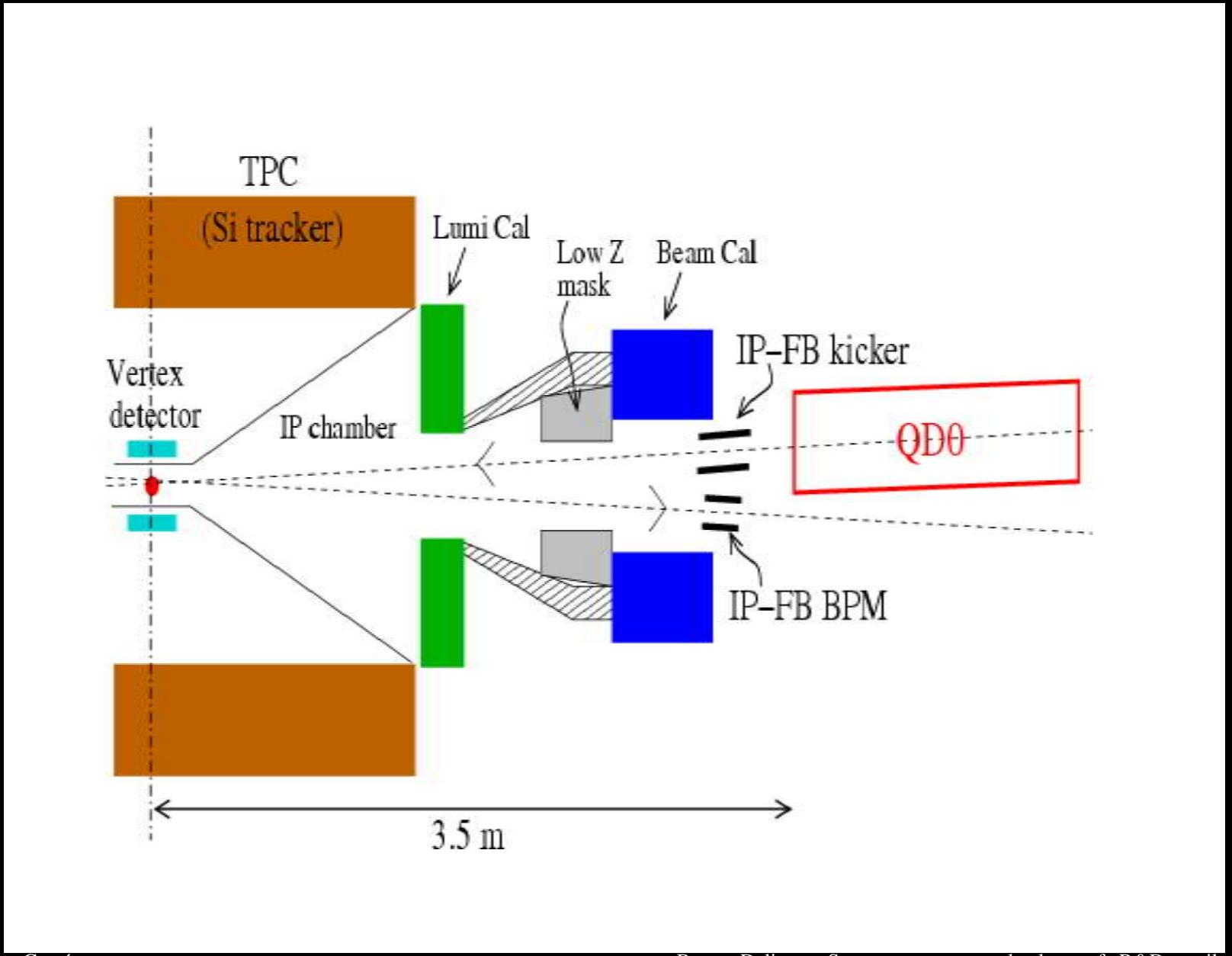
Q-switched YAG lasers:

- 100 mJ pulse energy at 532 nm (2.33 eV)
- 50 Hz operation (one laser pulse per CLIC bunch train)
- 3 ns pulse width covers 5 adjacent CLIC bunches
- crossing angle of 10 mrad

BDS BPMs

- Beam pipe radius 8 mm (vacuum 10 nTorr)
- BPM resolution 50 nm
- One BPM per quadrupole and in some drifts
  $\approx$ 200 BPMs

CLIC IP feedback (J. Resta)



CLIC IP feedback (J. Resta)

- FB BPM should be placed closer to IP (about 1m).
- FB BPM resolution = 1μm
- Latency time of 20ns (a correction every 40 bunches).
- Strength of the kicker ?

QD0 specifications

	L*=3.5m	L*=8.0m
Gradient	575T/m	211T/m
Aperture (radius)	3.5mm	8.5mm
Outer radius	35mm	70mm
QD0 jitter	0.15nm	0.18nm
QD0 support	detector	ground
QD0 technology	PM	PM
QD0 grad tol.	5×10^{-6}	3×10^{-6}

A superconducting QD0 adds the extra challenge of stabilizing coils.

Extra challenges for BI

- Fast and precise luminosity measurement
- Post-IP polarization measurement
- Any instrumentation in the Post-collision line: BPMs, energy meas., BSMs?
- Crab cavity RF phase feedback (0.025° for 12 GHz)