CLIC Collimation Depths

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Introduction

- First order estimate of collimator gaps using SR ray tracing through IR
- Calculated for CLIC some years ago
  - Similar result to other LC designs, nothing significantly worse (or better) in CLIC case
- Revisit for up-to-date CLIC parameters and design
- Compare to ILC

General Features of LC collimation

- The driving concern always the same – halo SR must clear the IR
- IR apertures are circular, but $\varepsilon_x >> \varepsilon_y$
- Horizontal collimators always closer to the beam (gaps $\approx$ 10-20 σ_x , 60-80 σ_y)
- But vertical collimators usually more damaging (wakefields) to the beam

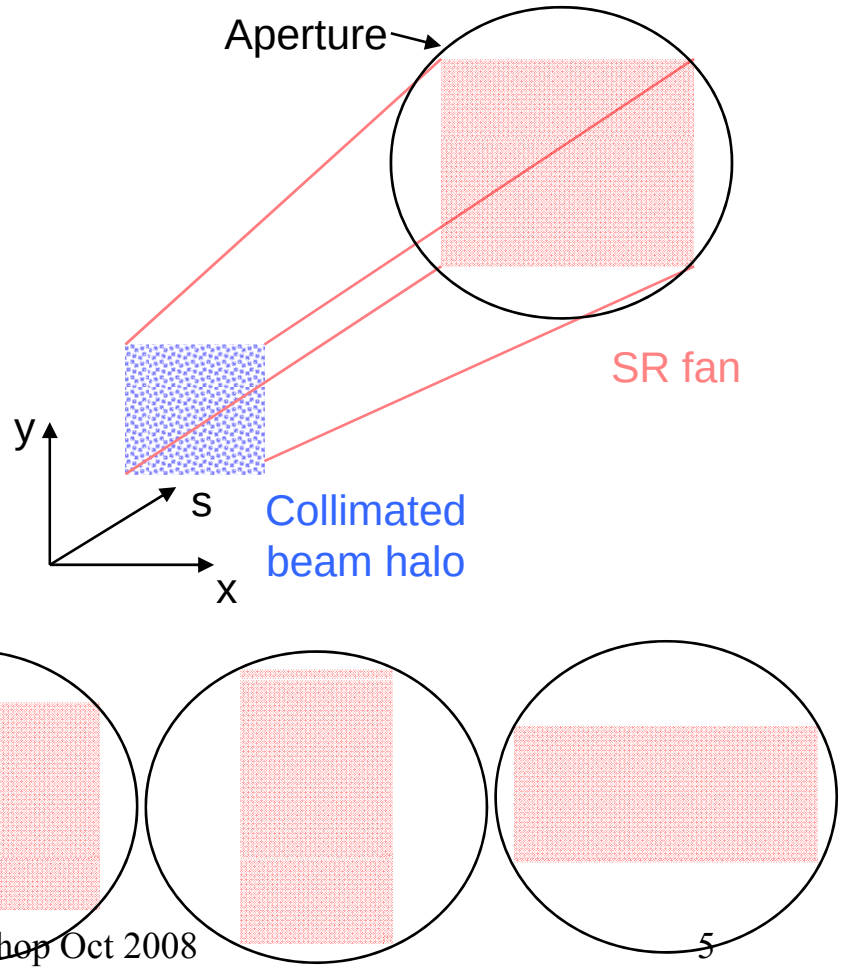
Latest Estimations for CLIC

- Collimation depth estimated* at $10\sigma_x$, $44\sigma_y$
- Evolved/scaled from previous calculation of $14\sigma_x$, $83\sigma_y$
- Includes correction for dispersion in FD
  - $14\ \sigma_x$ in FD includes dispersive contribution (same size as beta function)
  - Betatron spoilers have no dispersion so need to be tighter by sqrt2

*EUROTeV-2008-050

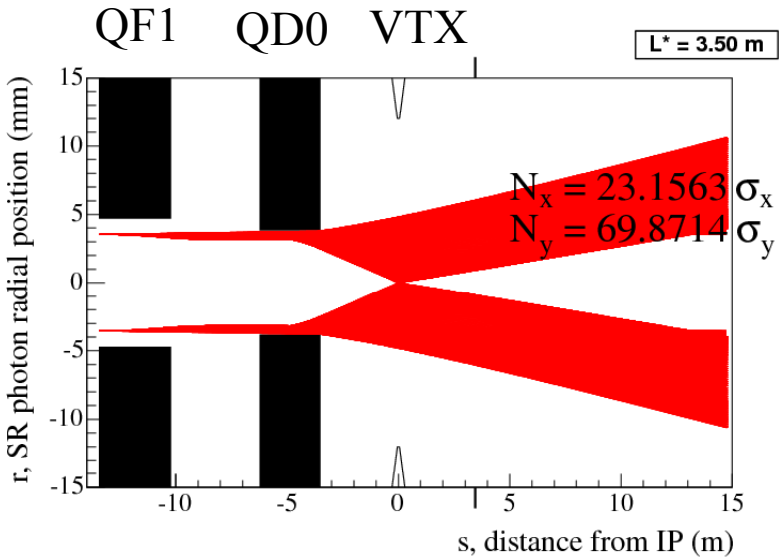
Calculating Collimation Depths

- Project the SR fan for every emission point in the FD
- Apply constraints of the IR apertures and solve for collimation depth
- **O. Napoly (Saclay)** has provided code to perform this.
- The solution is non unique!



CLIC Collimation Depths Compact FD L* = 3.5m

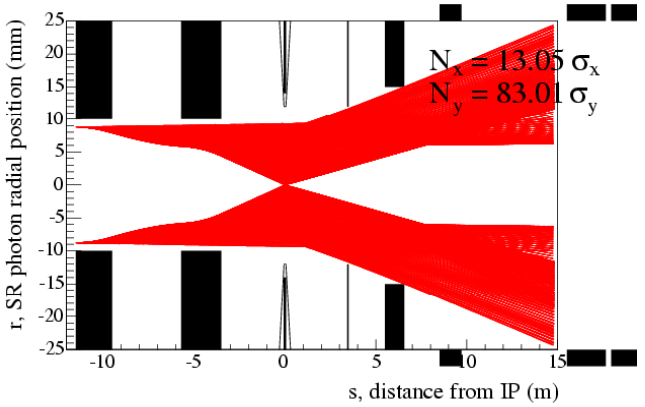
- Latest parameter set
- $\beta^*_{x,y} = 6.9,\ 0.07$ mm
- $\varepsilon_{x,y} = 660,\ 20\times10^{-9}$ m.rad
- Constraining aperture is QD0 (3.8 mm)
- Fan remains < 10 mm at 15 m from IP
- Correction for dispersion $\rightarrow 16\ \sigma_x,\ 70\ \sigma_y$
- Indicates somewhat looser collimation than current estimation



Comparison to ILC

- Quite similar but for different reasons
- ILC beam divergences much bigger than CLIC
- But IR apertures looser (QD0 superconducting 10 mm aperture)
- Low dispersion in FD, ignore this effect

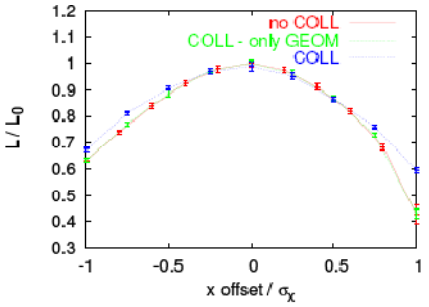
Extraction quads



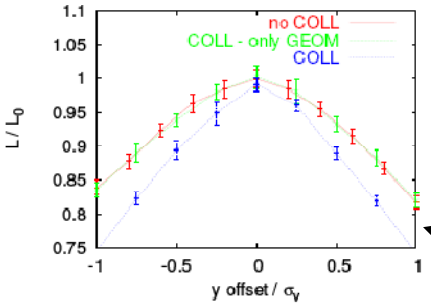
L*=3.51 design

Conclusion

- Updated CLIC collimation depths not very surprising
- Longer doublet (L* = 4.3) not necessarily worse
- Can argue over exact size of apertures needed
- Main concern is wakefields (vertical)



$(\sigma_x \sim 4\mu\text{m})$



$(\sigma_y \sim 0.25\mu\text{m})$

A. Latina, EUROTeV meeting Jan 2007

~10% lumi loss at 1σ jitter

- Need alternative wakefield mitigation strategy?
  - Tight tolerance on transverse beam jitter
  - Octupole tail folding