

CLIC Collimation Update

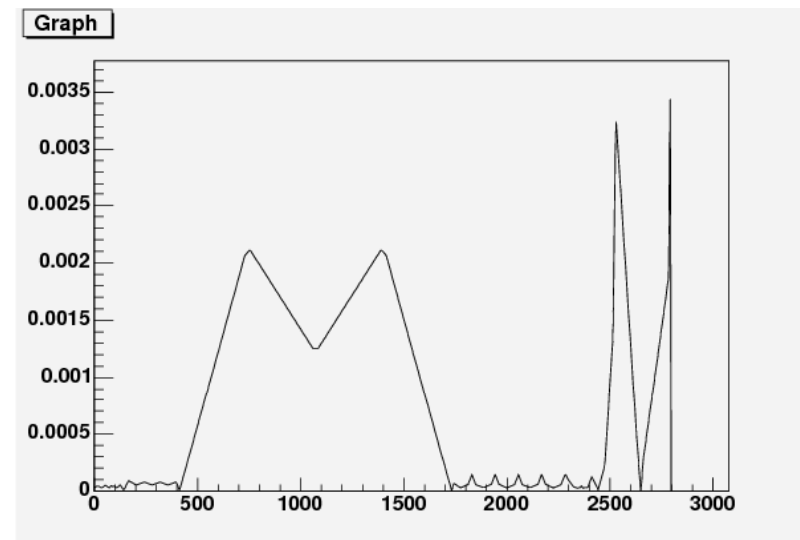
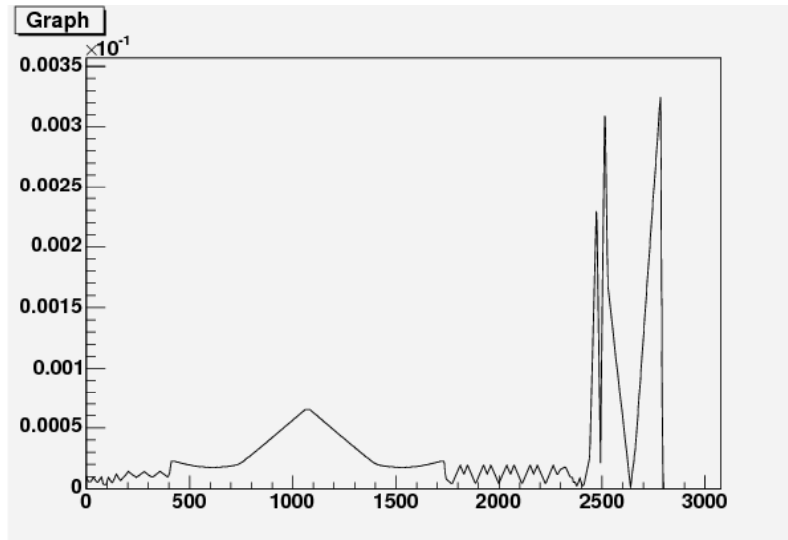
MERLIN x-check

Frank Jackson

Intro

- Use MERLIN to track beam+halo
- Deck http://clicr.web.cern.ch/CLICr/MainBeam/BDS/v_07_09_25/
- Collimation Depth $10\sigma_x, 44\sigma_y$
- Uniform halo in x, x', y, y' extending to 50% larger than collimation depth in all dimensions.
- Black spoilers

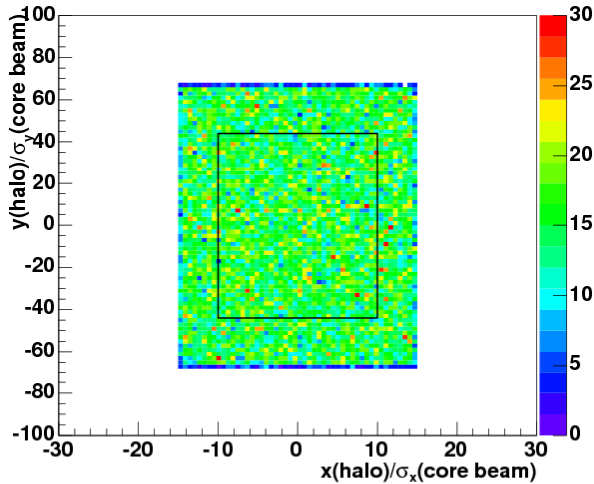
Sanity Checks



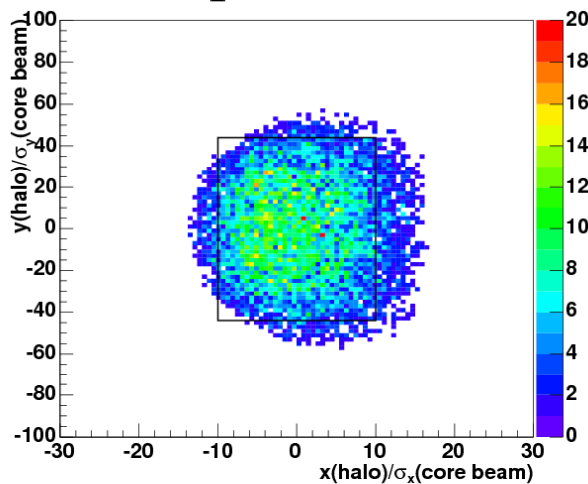
- Turn off sextupoles and energy spread to recover linear optics and compare with clic MAD design desk
- MAD deck IP params (and CLIC parameter table) $\beta^*x= 6.96$ mm
 $\beta^*y=67.7$ um
- MERLIN IP beamsize $\text{sig}_y = 0.68$ nm $\text{sig}_x = 39.7$ nm, tallies with beta fns above and emittances of 660 nm and 20 nm
- With $\text{dp}= 0.1\%$ and sextupoles on, $\text{sig}_y = 0.88$ nm $\text{sig}_x = 39.9$ nm
- MERLIN can't handle zero length octupoles

Results - Collimated halo at FD

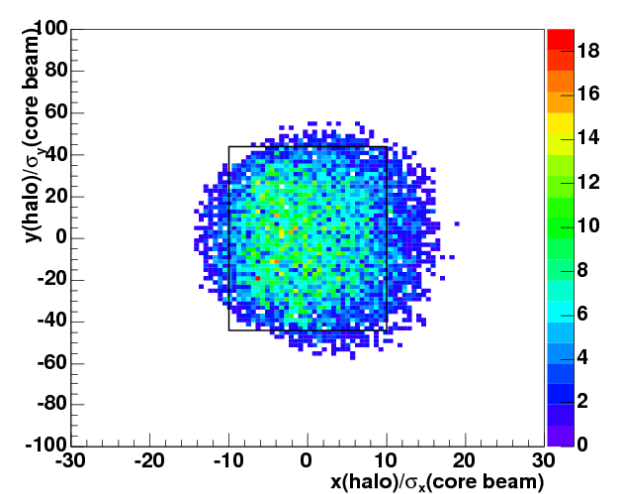
BDS Entrance



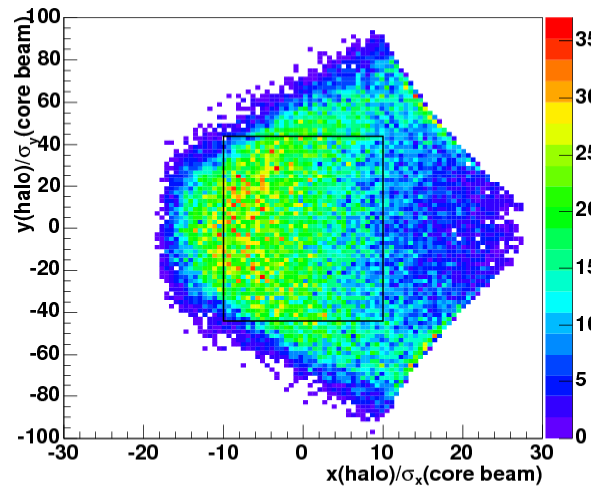
FD, dp = 0%



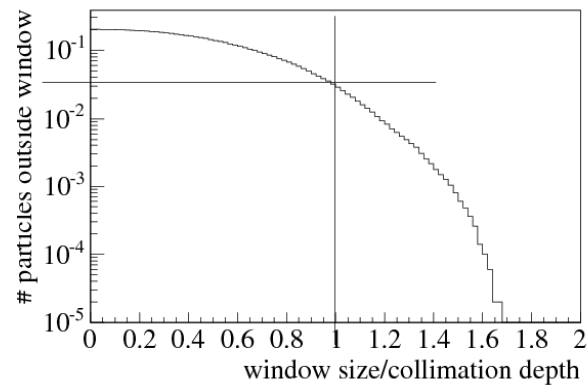
FD, dp = 1.0%



no coll, FD, dp = 0.29%¹



FD, dp = 0.29%

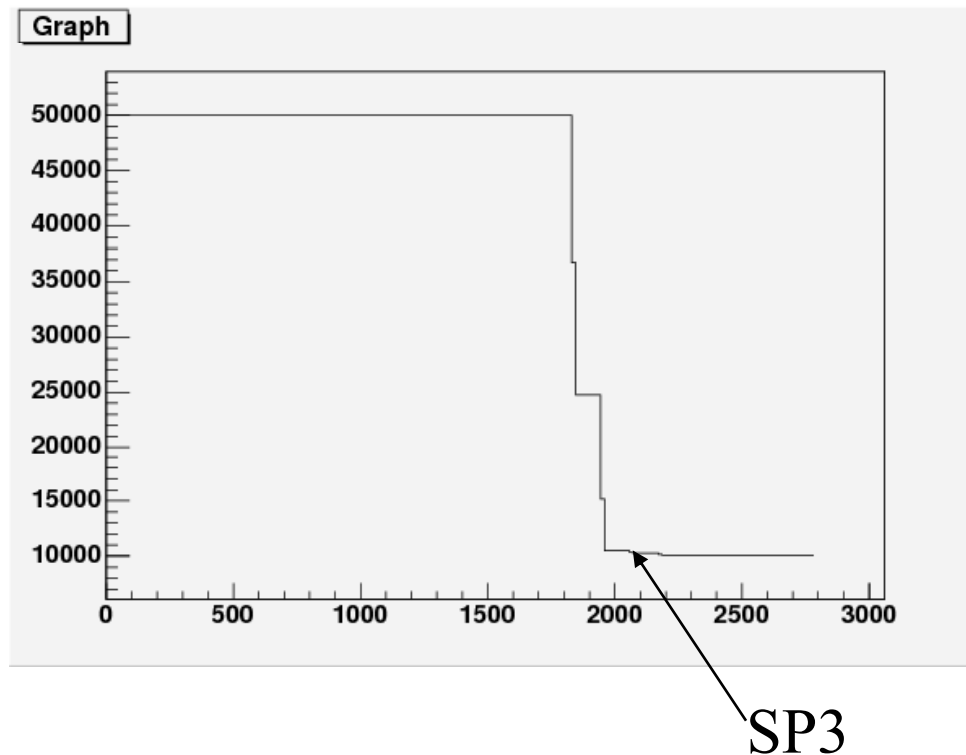


- No energy collimation
- Around 3% of total initial halo population lies outside collimation depth at entry to FD²
- Some particles at 1.6× collimation depth survive
- Inefficiency is NOT due to off energy particles

² c.f. 1% for non-optimised ILC lattice Jackson PAC 07

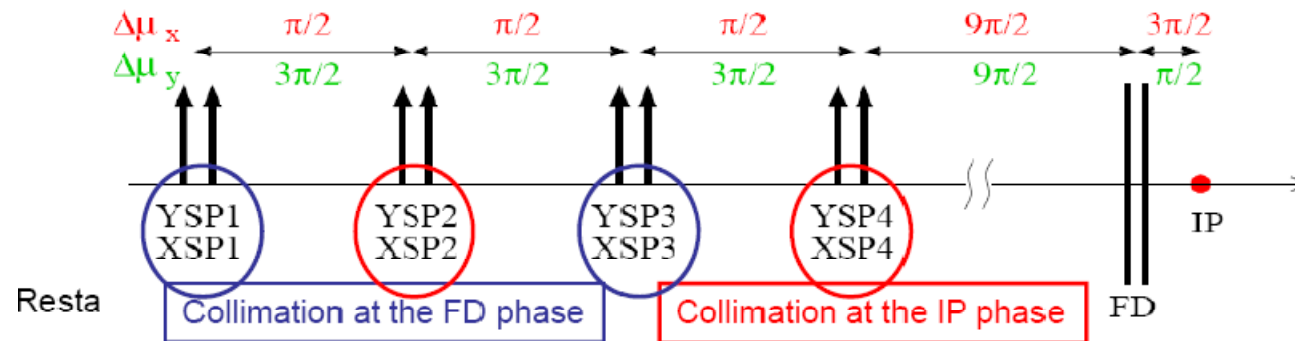
¹ <http://cllc-meeting.web.cern.ch/cllc-meeting/clitable2007.html>

Losses



- 99% primary losses on first two spoiler sets.
- ILC used only one $\pi/2$ pair

Phase Advances



- I find the phase advances X/YSP4→IP are not perfect
- $\Delta\mu_x = 9.7 \pi/2$ and $\Delta\mu_y = 10.6 \pi/2$
- Phase advances are not integer multiples of $\pi/2$

Conclusion

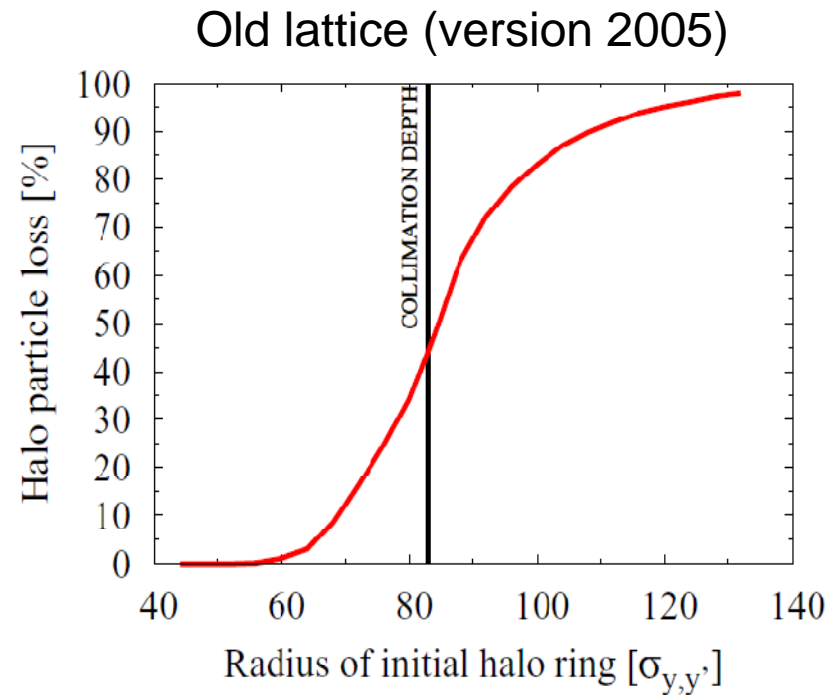
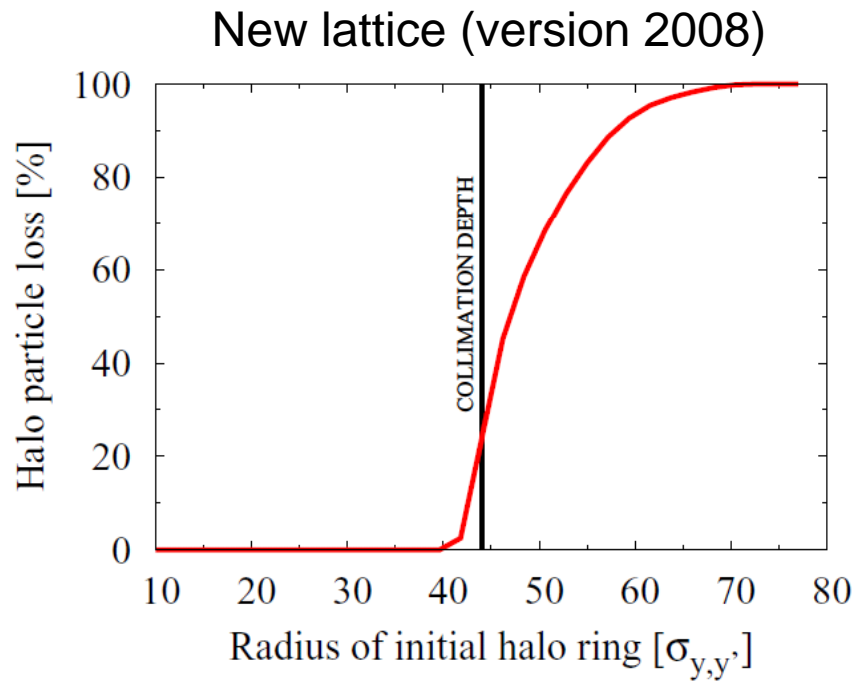
- Proper consistency check with Javier to be performed
 - Octupole inclusion
- Try to rematch lattice for collimation phase advances whilst maintaining lumi

Background

Collimation efficiency

Betatron collimation y - y'

Halo particle losses versus the radius of the halo ring:



Notes on JRL results

- Plots show y-collimation. x collimation included?
- Suggests that, at best, 50% of halo particles outside the collimation depth are removed (exact number will depend on the actual halo distribution)
- Even substantial amount ($\sim 1\%$) of large-amplitude halo ($\sim 2 \times$ collimation depth) survives collimation.

MERLIN Parameters

params.txt file

```
Ebeam 1500 0.00  
Ehalo 1500 0.00  
Emitt 660E-09 20E-09  
Beta 66.145 17.924  
Colldepth 10 44
```

collimator params

CLIC Spoiler tables: $x_{\text{gaps}} = 80 \text{ um}$, $y_{\text{gaps}} = 80 \text{ um}$ for 10 sigx and 44 sigy
In MERLIN this is X0.16Y10 for xspoiler
X10Y0.16 for yspoiler
 $0.16 = 0.16 \text{ mm} = 2 \times \text{half gap of } 80 \text{ um}$

FD Protection

- Compact FD QF1 4.63 mm QD0 3.83 mm
- At QF1 beam size is $s_x = 133 \text{ um}$ $s_y = 24 \text{ um}$
 - Gives an acceptance of $35s_x$, $190s_y$