Collimation Summary

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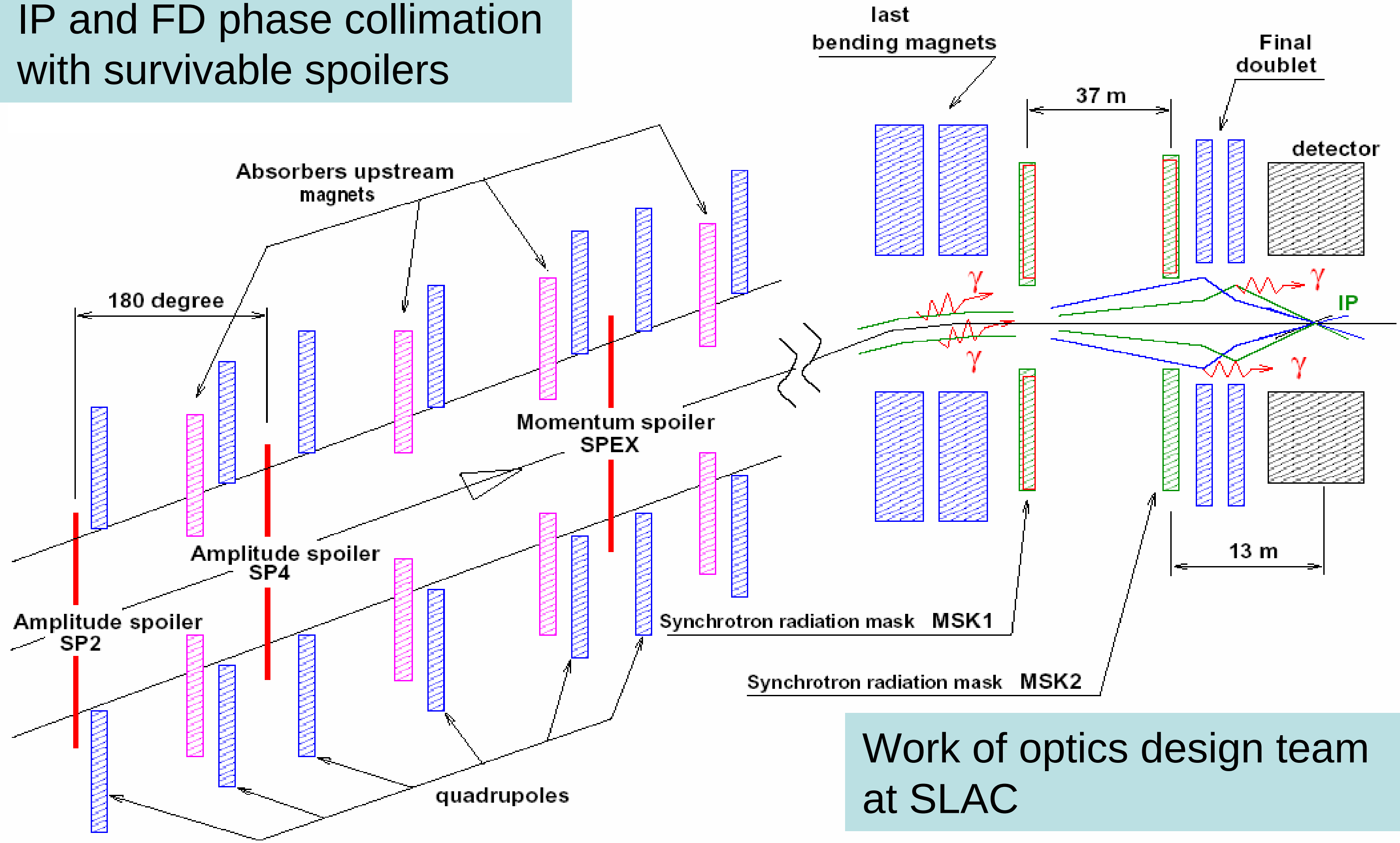
With thanks to John Carter (RHUL), Alexander Drozhdin (FERMILAB), Adam Mercer (Manchester), Nigel Watson (Birmingham)

Collimation Summary

- Current Design
- Collimation depths for current crossing angles
- Collimation performance/efficiency
- Wakefield Effects/Experiments

Collimation Design

IP and FD phase collimation with survivable spoilers



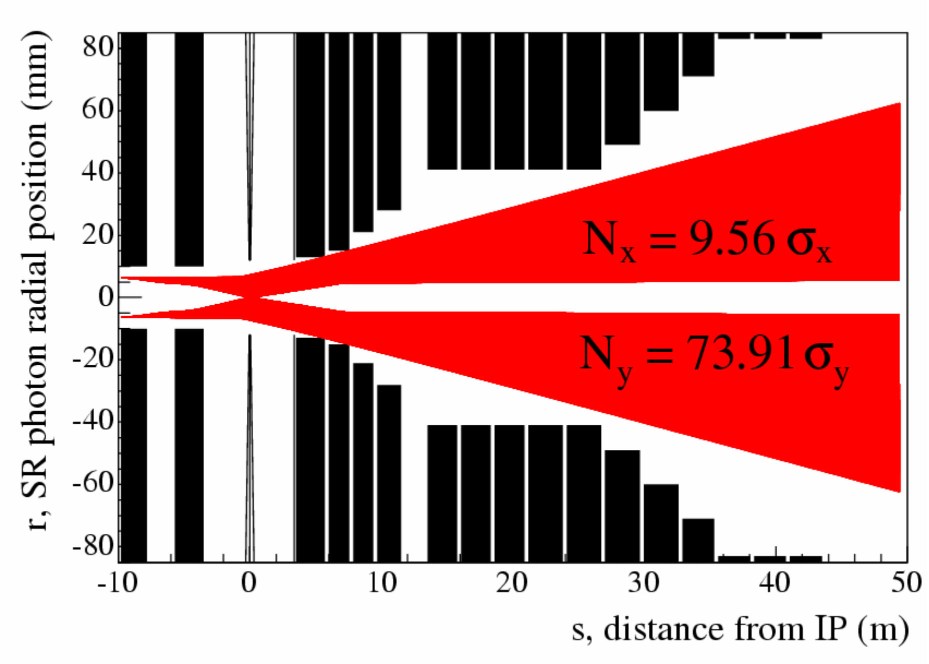
Work of optics design team at SLAC

Collimation Depths

- 20 and 2 mrad evaluation
- Achieve final-doublet-synchrotron-radiation clearance through IR apertures
- Important apertures
  - First extraction quad (20 mrad)
  - Exit hole (beamcal) before QD (2 mrad)
- Additional IR masking may add more constraints
- Use optics SR code DBLT (O Napoly, Saclay) to estimate collimation depths

Collimation Depth Results (20 mrad)

- 20 mrad FD, L*= 3.51 m

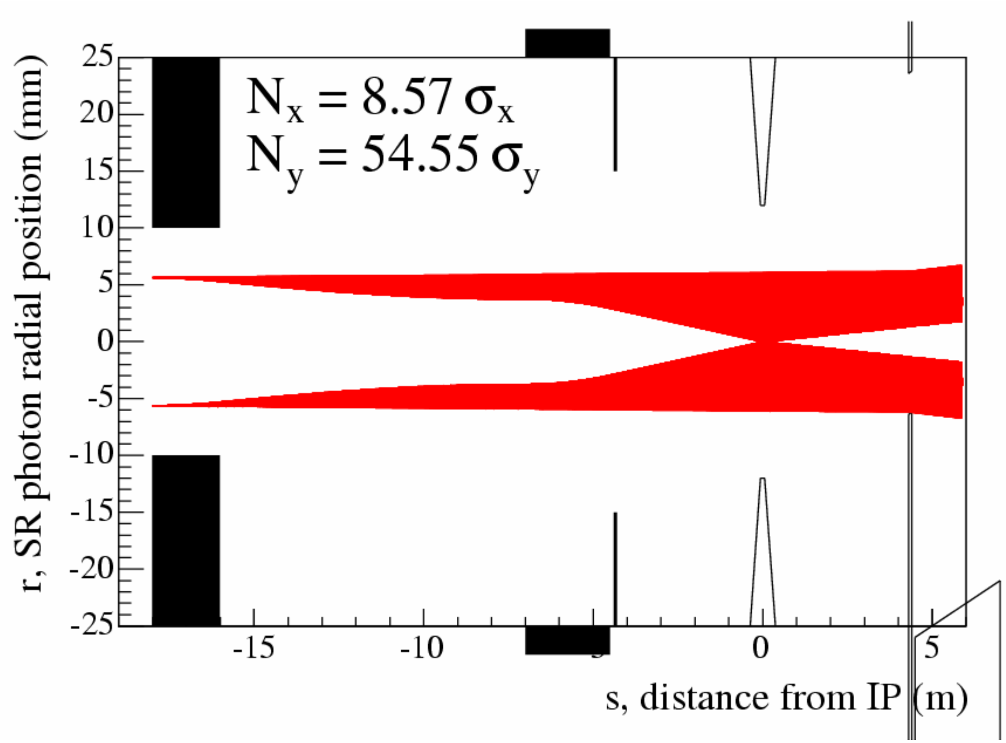


Updated since RHUL BDIR, June 05

- Change to L*=4.5 m will affect this solution

American Linear Collider Physics Group

Collimation Depth Results (2 mrad)

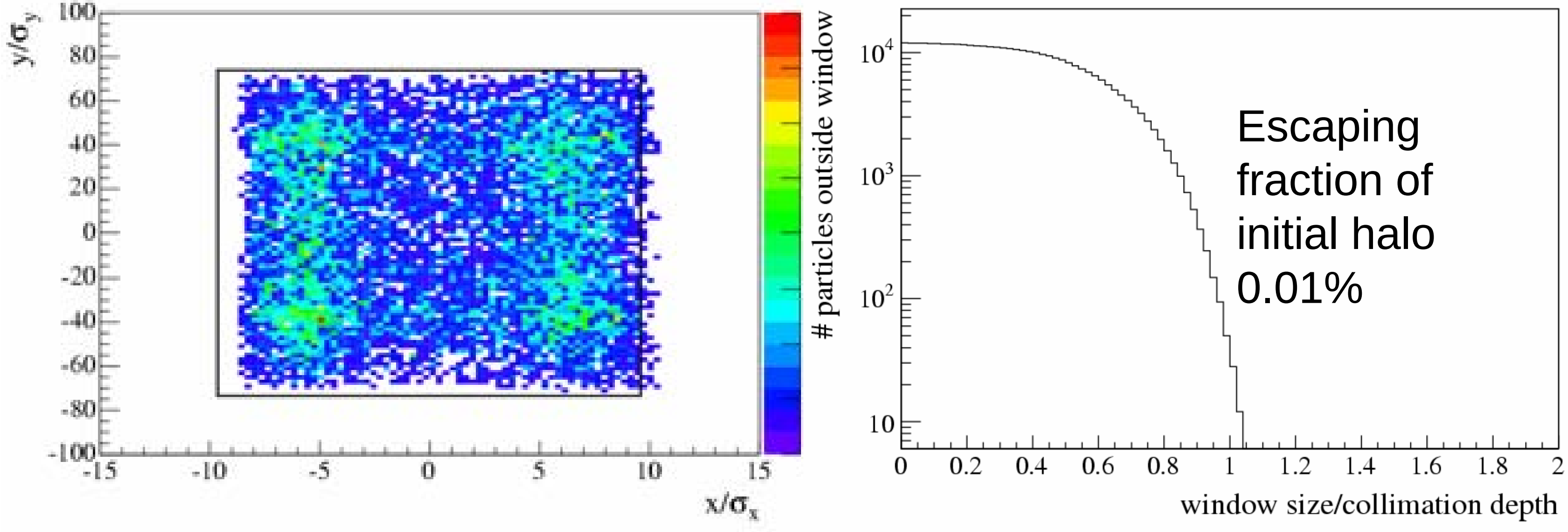


- New 2.0 mrad L*=4.5m final doublet
- Beamcal clearance puts constraint on collimation depth
- r = 15mm case at 1TeV
- r = 12 mm very tight

Collimation Performance

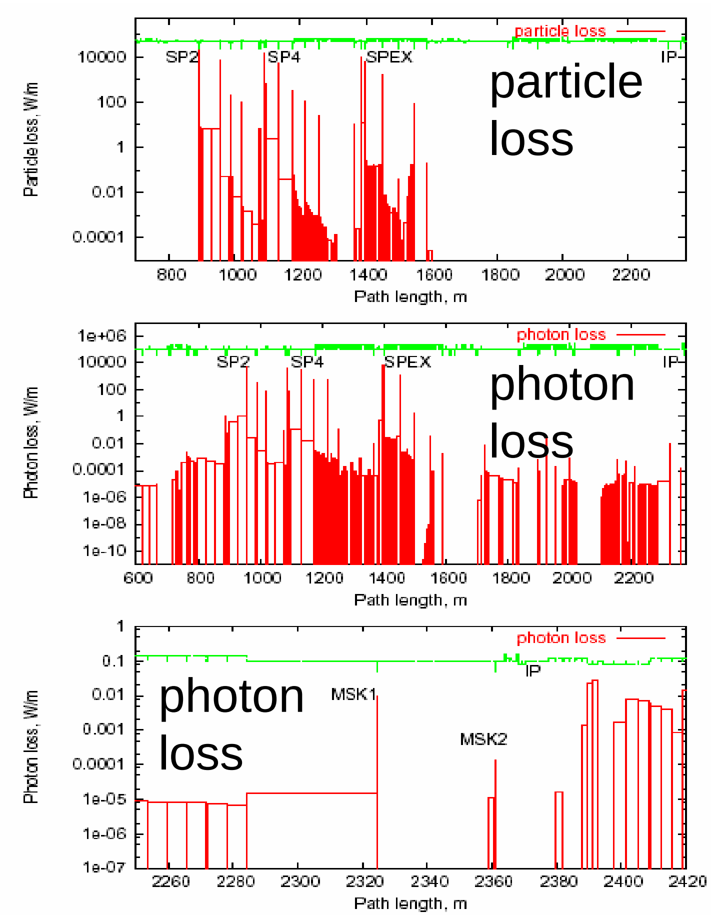
- STRUCT halo tracking simulation (Sasha Drozhdin, FERMILAB)
- 20 mrad deck (mid-June design, optimised bandwidth)
- 1/r halo for increased scattering at collimator edges (1% energy spread)

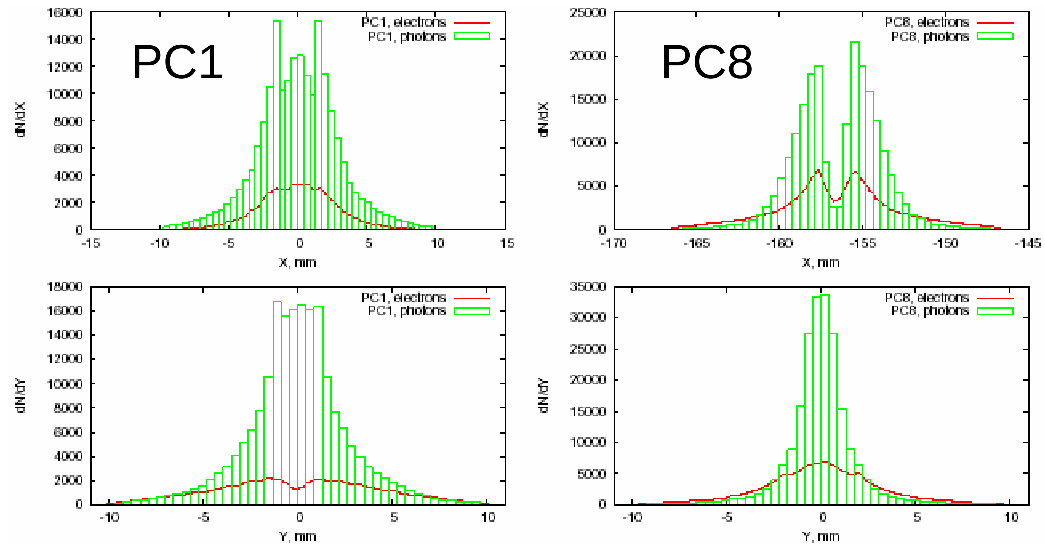
Halo at FD



- Spoilers ($8\sigma_x$) have to be set tighter than collimation depth ($9.6\sigma_x$) in x-plane to achieve target
- Energy spoiler used as secondary betatron spoiler, tight energy gap, $\delta E = 0.33\%$

Collimation Losses





- Particle losses end 800m before IP
- Highest deposition on PC1 and PC8, at 2.7kW and 2.4kW

Wakefields

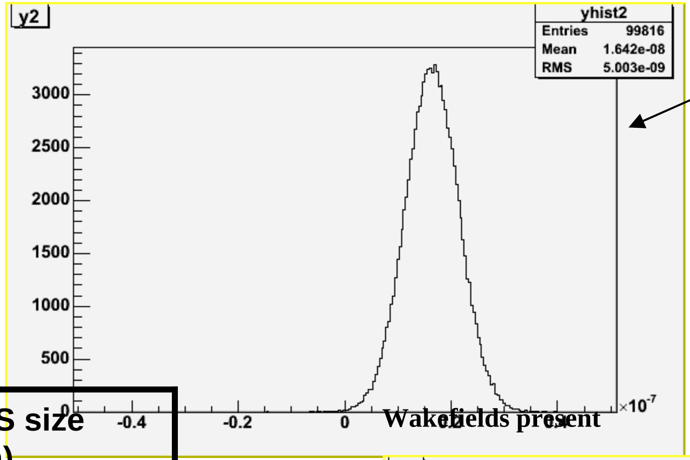
- Emittance growth and jitter amplification yet to be studied in depth
- Beam tracking tool MERLIN includes wakefield effects
  - Studies underway at Univ. Manchester (R. Barlow, G. Kourevlev, A. Mercer)
- Wakefield simulation program beginning
  - C. Beard (Daresbury), J. Smith & A. Sopczak (Univ. Lancaster)
- Wakefield measurements to be performed at ESA
  - P. Tenenbaum (SLAC), N. Watson (Birmingham)

New results A. Mercer

Simulation Parameters
20mrad optics
SR on
Collimation on
Vertical plane considered
Offset at linac exit

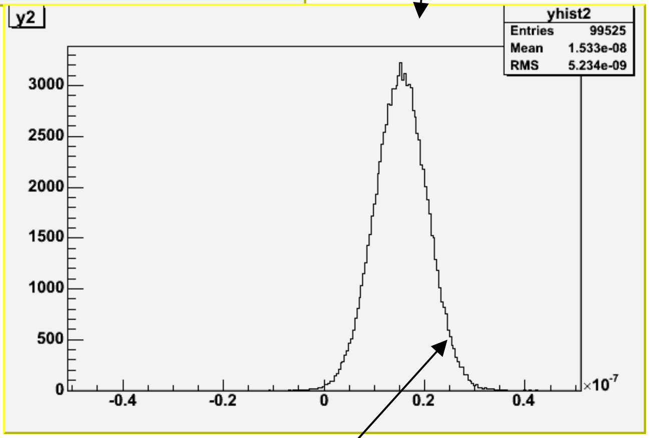
Wakefield modes	Offset (σ_y)	RMS size (nm)
0	1	4.988
1	1	5.016
5	1	5.017
0	3	5.003
1	3	5.231
5	3	5.234

No wakefields



Vertical profile histograms with count vs displacement.

Wakefields present



Difficult to see but, as expected, the profile broadens

Corresponds to :

- 1.1% ε_y growth for a one $1\sigma_y$ offset.
- 9.4% ε_y growth for a $3\sigma_y$ offset.

Higher modes have a converging negligible (fraction of a %) effect.

Collimator Wakefield ESA beam test

- SLAC Proposal T-480 (Tenenbaum, Watson et al)
  http://www-project.slac.stanford.edu/ilc/testfac/ESA/files/ColWake_TestBeamRequest.pdf
  Many people involved directly, see proposal
- Purpose
  - Commision/validate CollWake Expt. at ESA
  - Additional study of resistive wakes in Cu
  - First study of 2-step tapers
  - Development of ECHO-3D code (TEMF) for shallow tapers/short bunches
- Schedule
  - Short run, early Nov. 2005, 4 collimators
  - Longer run, mid-late Jan. 2006, 8 collimators
- Status
  - Beamline prep., DAQ, BPM set up ongoing
  - Test collimators (RAL) sent for fabrication
- Related activity
  - Collimator damage studies also envisaged at ESA

Further Work

- 2mrad collimation efficiency
- Simulation benchmarking
- Halo formation simulations
  - EUROTEV study beginning see D. Schulte talk at RHUL BDIR
- Spoiler survivability and machine protection

Further Information

- Photon loss carries on much further down than secondary particle loss in collimation system
  - Low energy charged particles swept into walls by magnets, photons are not bent
- Differential power losses on SP2,4,SPEX, integrated power on PC1,PC8. PC1 after SP2, PC8 after SPEX.
- IP is at 2374m, photon loss at 2380m is bremsstrahlung, from scattering from upstream elements.