

# ILC IR SR COLLIMATION

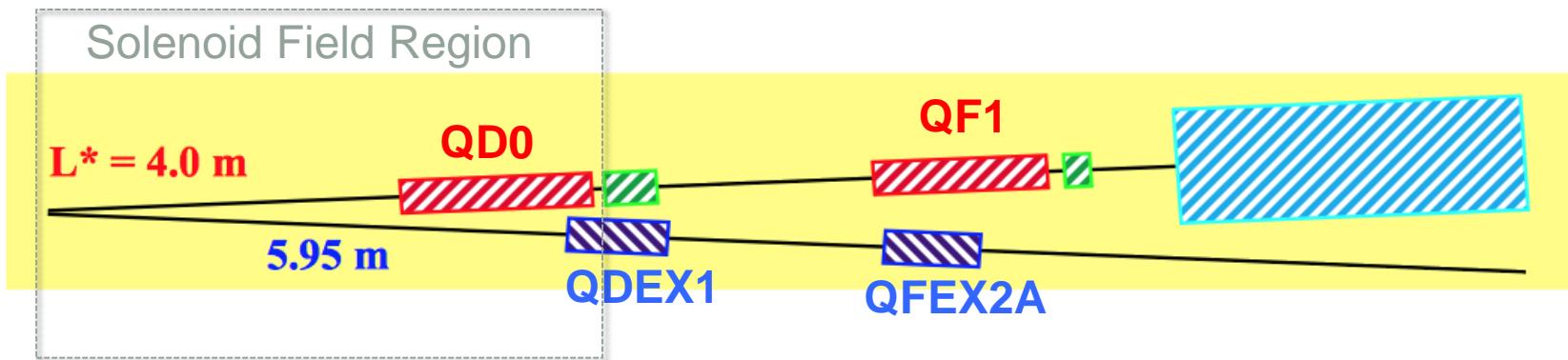
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Glen White, SLAC

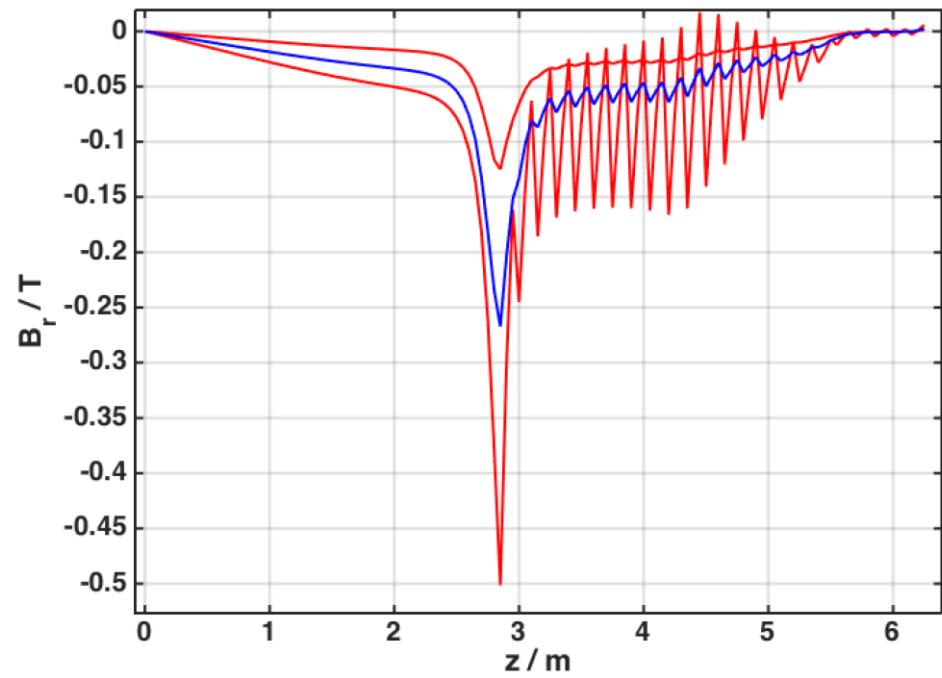
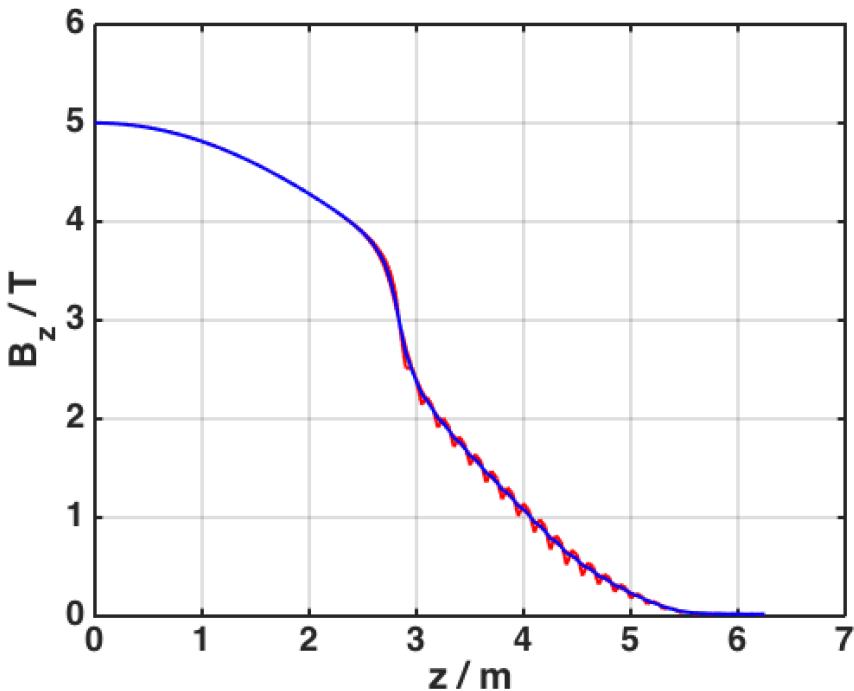
Dec. 3, 2014

# Overview

- Find collimation solution required to eliminate IR SR hits
- FFS  $L^*=4\text{m}$ , EXT  $L^*=5.95\text{m}$
- $E_{\text{CM}} = 500 \text{ GeV}$
- Tail-folding octupoles OFF
- Include IR solenoid field map
- Using Lucretia macro-particle tracking with GEANT4 for solenoid field tracking

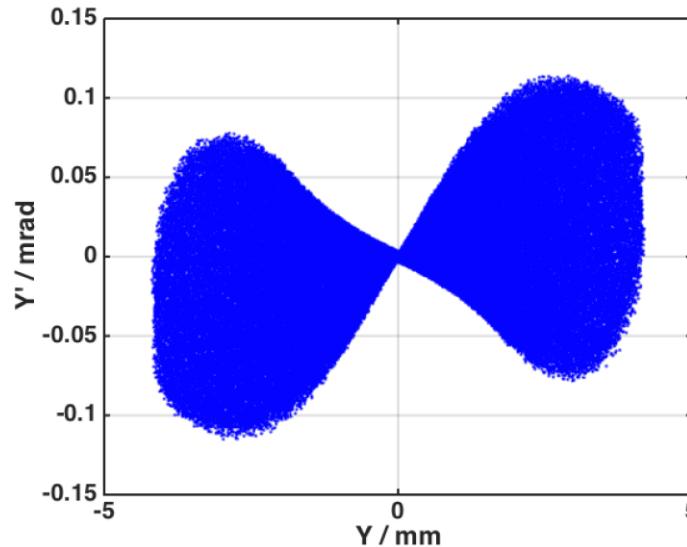
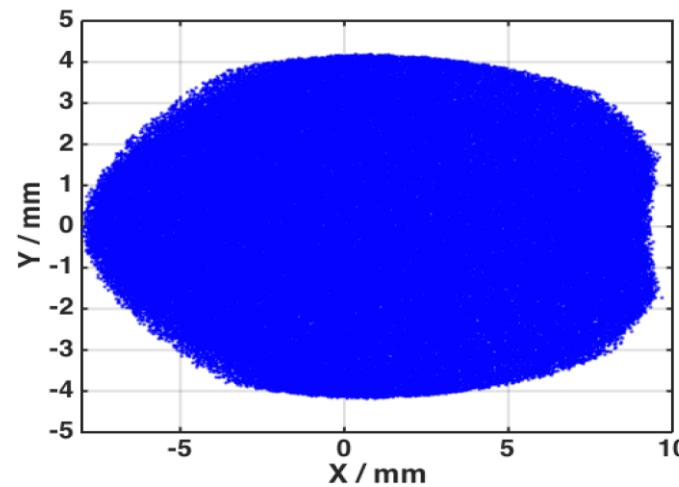
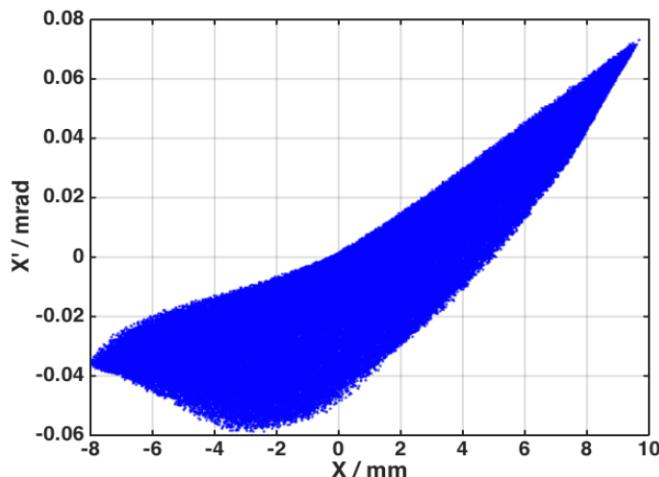


# Add IR Solenoid Field to Tracking Simulation



- 5T Solenoid field implemented (SiD)
- Shown longitudinal and radial B field component as a function of  $z$  (symmetry assumed) on-solenoid-axis (blue) and at  $\pm 5\text{cm}$  radially (red).
- Beam tracked through field according to crossing angle (14mrad / 2)
- Tracking through the solenoid field region done by GEANT4 (including SR) using above field map overlaid on to quad field maps.
- Add dipole fields to quads to steer reference orbit flat through solenoid.

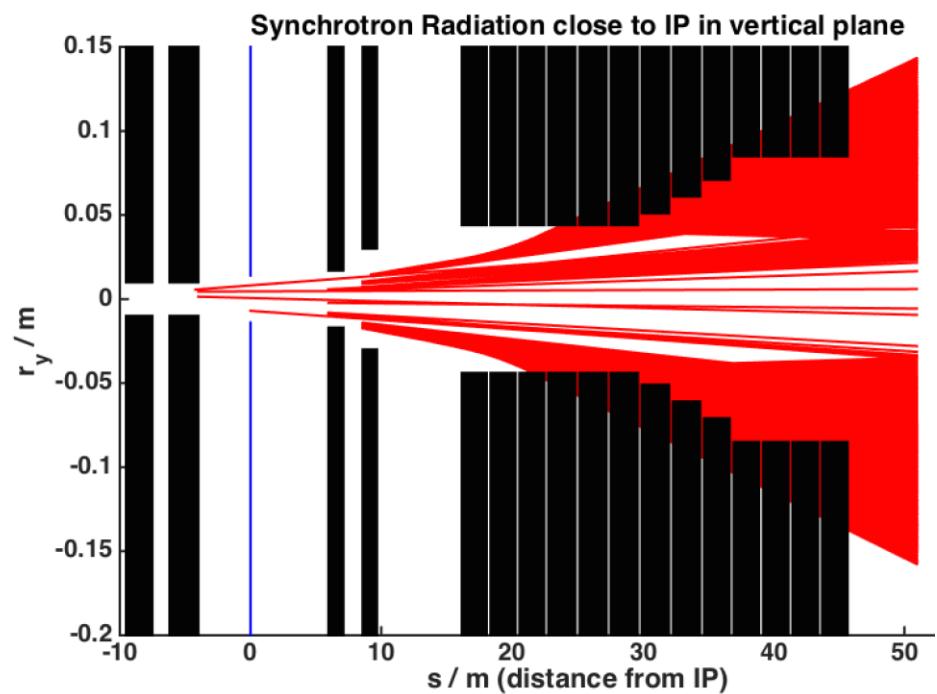
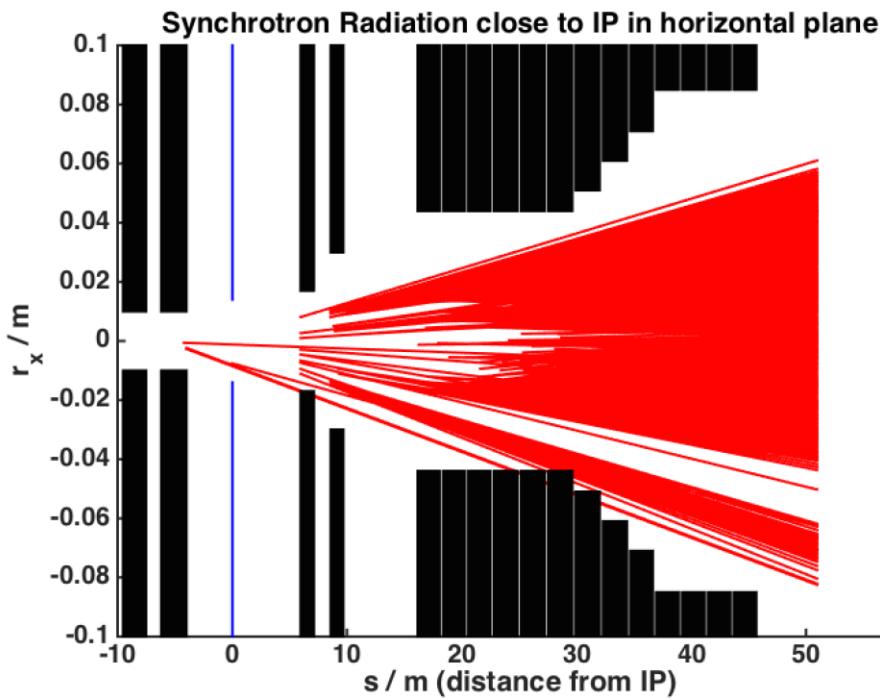
# Initial 5D Phase-Space for tracking given by Dynamic Aperture @ QF1



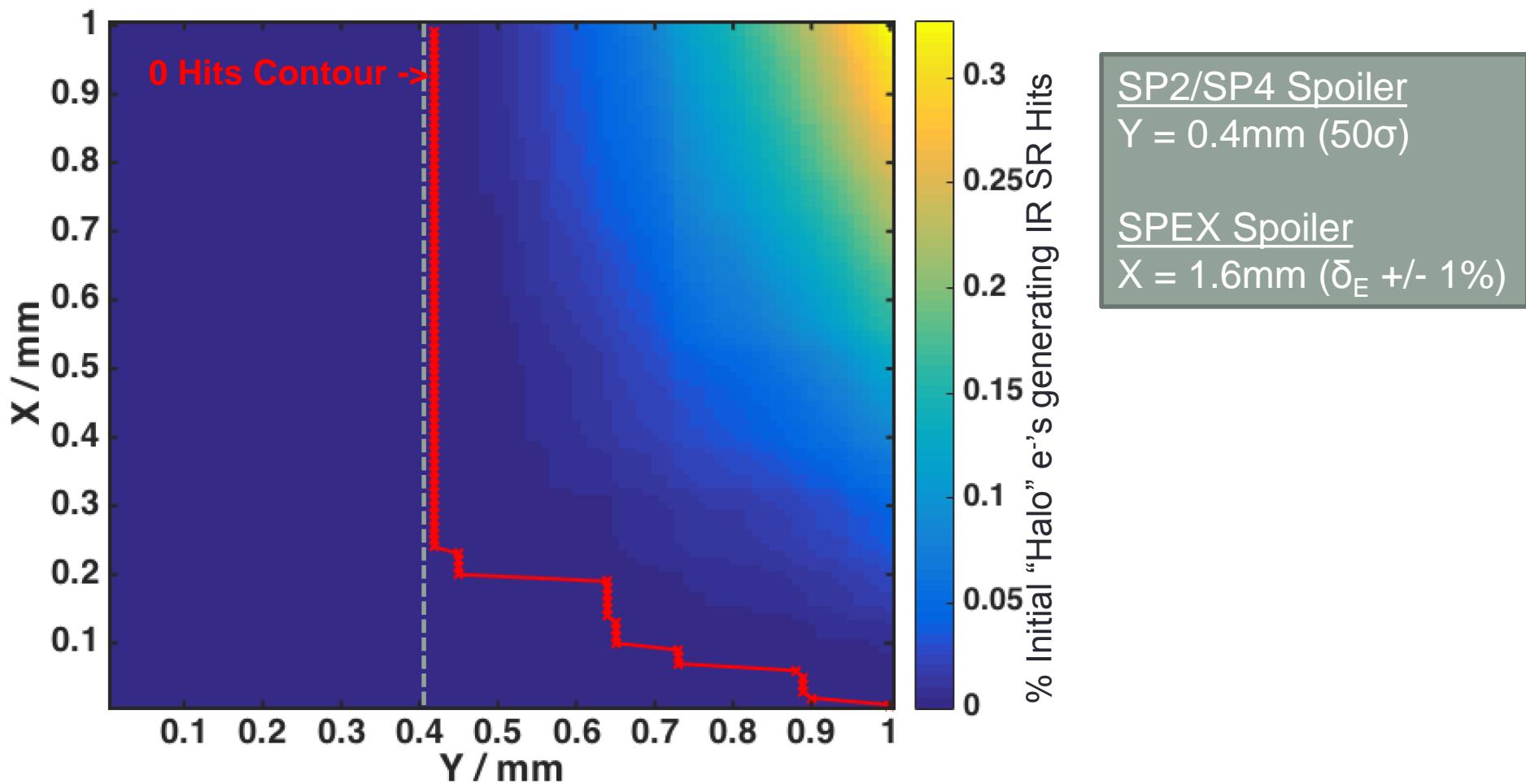
$\delta_E \pm 1\%$

$N_{\text{macro}} \sim 1E6$

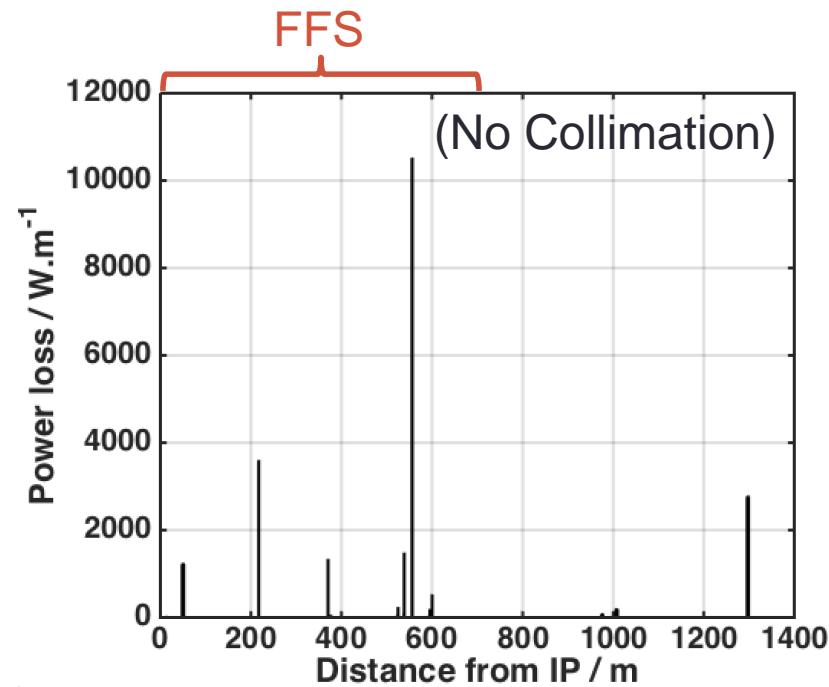
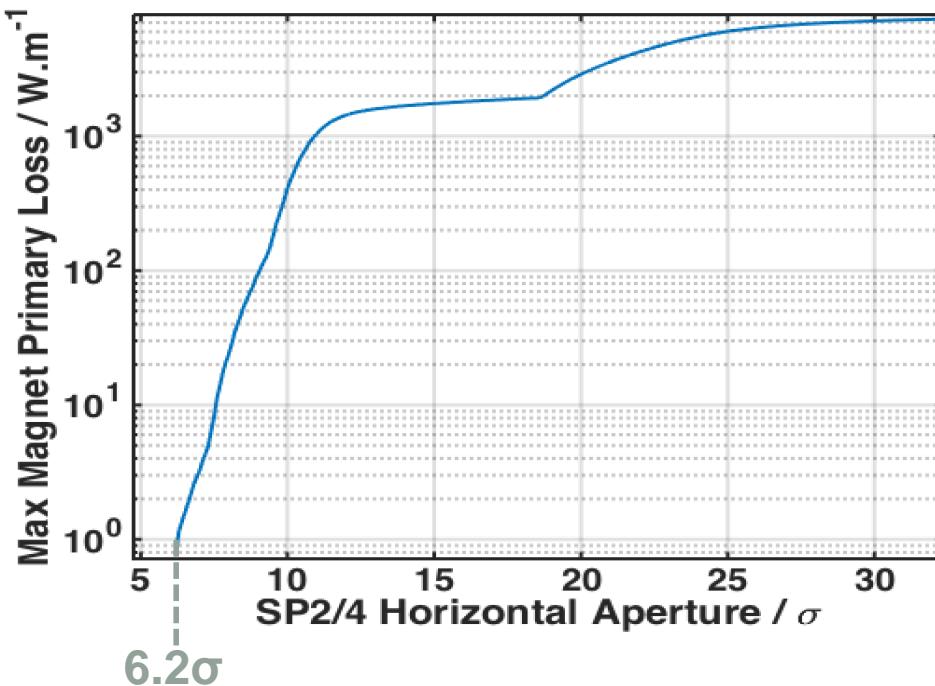
# Sample of Resulting SR Rays in IR



# Collimation Required to Suppress SR Hits to Apertures +/- 50m (z) from IP



# Halo Loss Rate in Magnets



- Represent beam halo as 0.1% main beam charge (intercepting) with  $1/r$  profile in transverse dimensions and 1% dP/P (Gaussian distribution).
  - Calculate max loss rate in magnets from tracking simulation ( $10^7$  MP)
- Loss rate for magnets as a function of horizontal SP2/4 collimator aperture
  - Fix vertical @  $50\sigma$
  - Primary collimation <1W/m pk loss @  $6.2\sigma$

# Summary

- Suggested collimation requirements shown for  $L^*=4\text{m}$  BDS optics.
  - $6.2 \times 50 \sigma$  collimation @  $\beta\text{COLL}$  spoilers required
    - $(0.6 \times 0.2\text{mm} @ \text{SP2/4})$
    - based on requirement of no allowed SR photon hits  $\pm 50\text{m}$  of IR & magnet halo protection
  - cf. TDR specification: “ $6\text{-}9 \times 40\text{-}60 \sigma$ ”
- Still to check:
  - Updated IR fields, ILD field map
  - Collimation performance with secondary particle production
  - Expected muon fluxes
  - Collimator wakes
  - Tail-folding octupoles
  - Realistic optics errors & misalignments
  - Systematic error study of simulation