Low ΔE/E Rad-bhabha and Synchrotron Radiation backgrounds

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SuperB

Outline

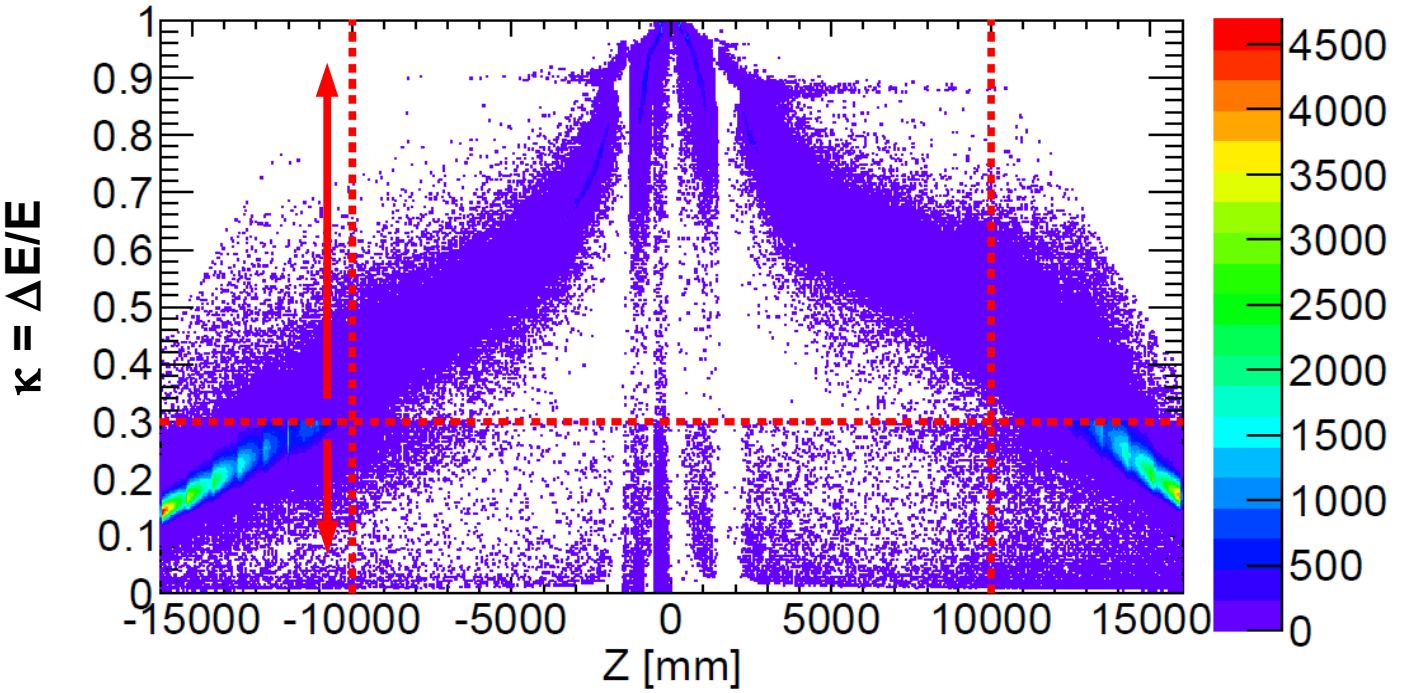
- **Simulating low ΔE/E Rad-bhabha events**
  - Motivation and strategy
  - Losses at the beam pipe

- **Synchrotron Radiation (SR)**
  - Motivation and strategy
  - Delivered SR power at the beam pipe

Low ΔE/E rad-Bhabha backgrounds

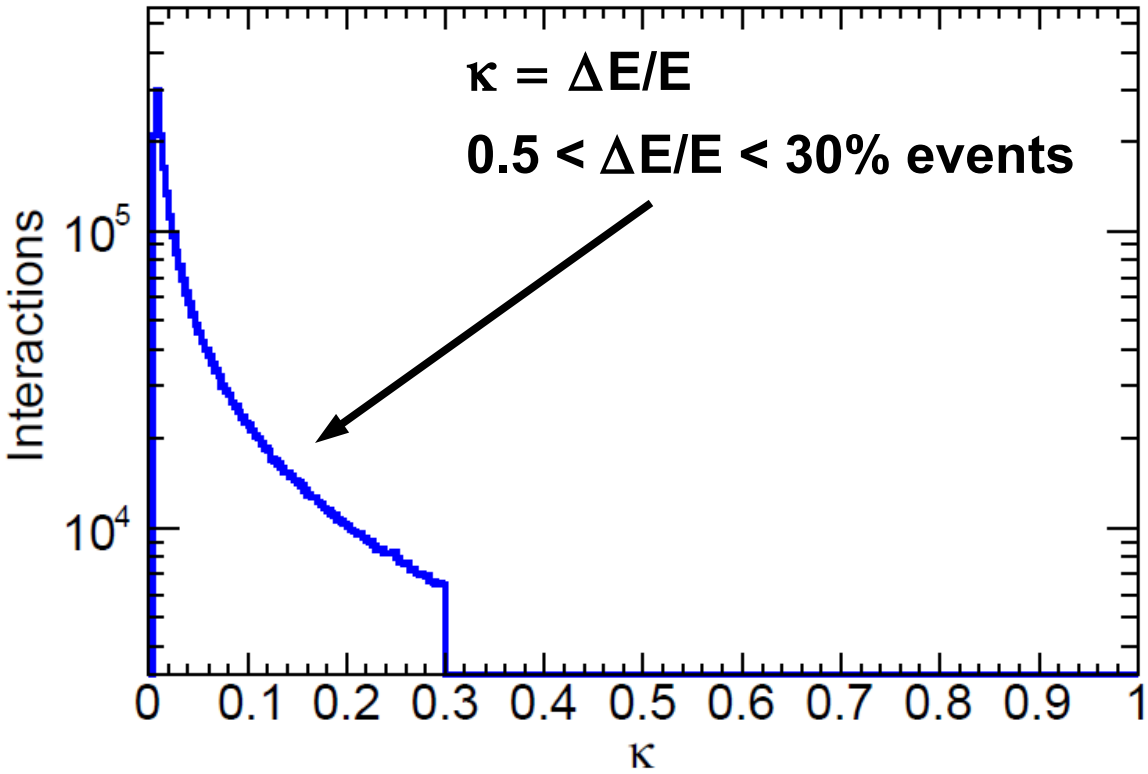
Simulating low ΔE/E Rad-Bhabha: Motivations

- Currently only simulate rad-bhabha events at with ΔE/E > 30%. This is the main contribution to the losses at the beam pipe for |Z| < 10 mts
- Rad-bhabha events with ΔE/E < 30% characterize for:
  - Photons with energies up to 2GeV that hit the beam pipe at the 1st and 2nd dipoles downstream the beam line
  - A significant amount of high energy electrons/positrons hitting the beam pipe at the 1st and 2nd dipole downstream
  - These particles can produce neutrons that can contribute significantly to the neutron cloud



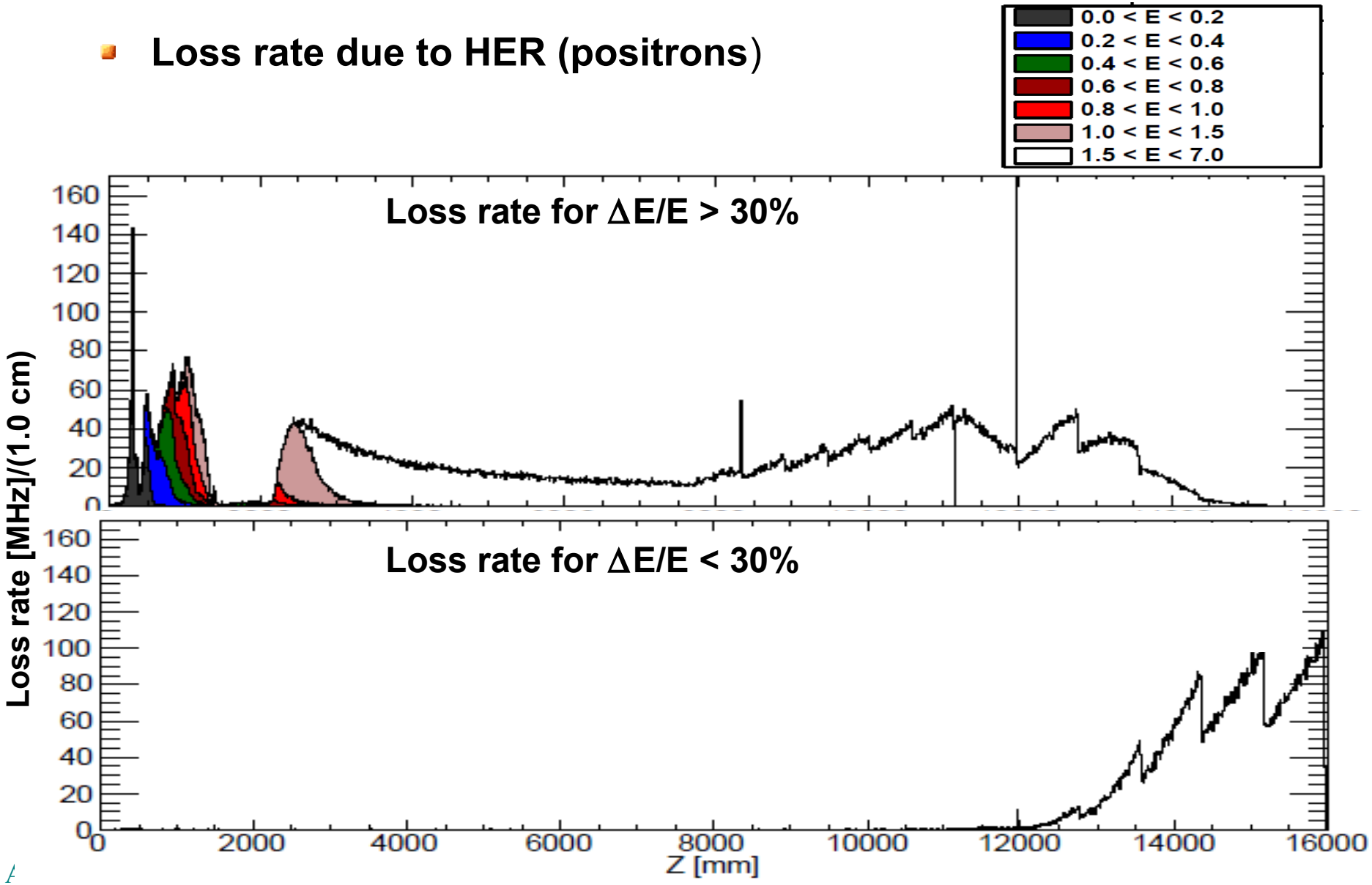
Simulating low ΔE/E Rad-Bhabha: Strategy

- Initially decided to use the ΔE/E > 30% to get a reasonable simulation time
- Lowering the cut will make the execution time per event to explode
- Use only the rad-bhabha primaries with 0.5 < ΔE/E < 30% (obliged to set up a lower limit)
- Track primaries up to they either hit the beam pipe or exit the SuperB world volume
- Save only the primaries that hit the beam pipe: hit location, momentum and time
- Simulate these primaries to get the effect on the SuperB detector



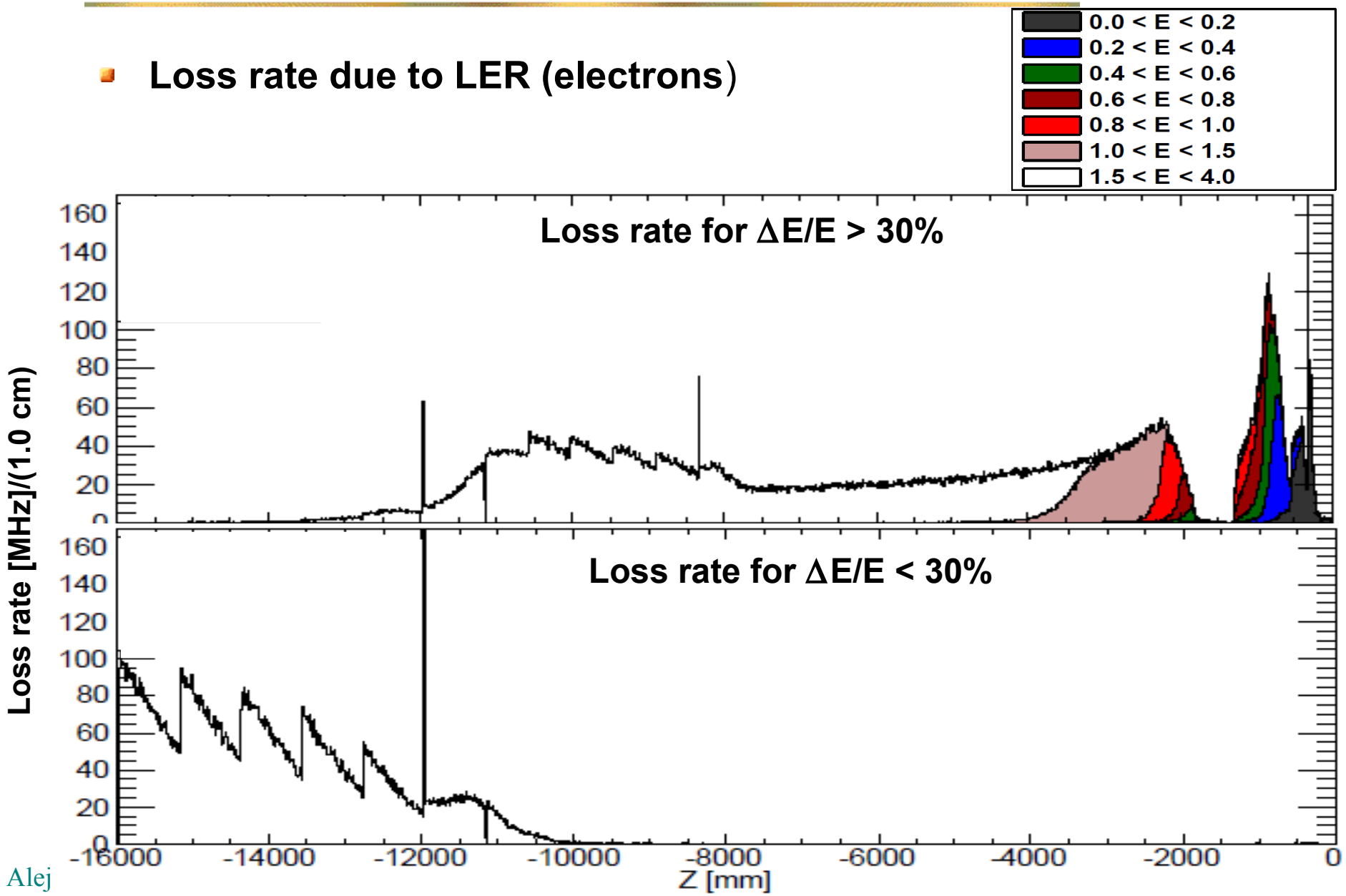
Simulating low ΔE/E Rad-Bhabha: Losses at Beam Pipe

- Loss rate due to HER (positrons)



Simulating low ΔE/E Rad-Bhabha: Losses at Beam Pipe

- Loss rate due to LER (electrons)



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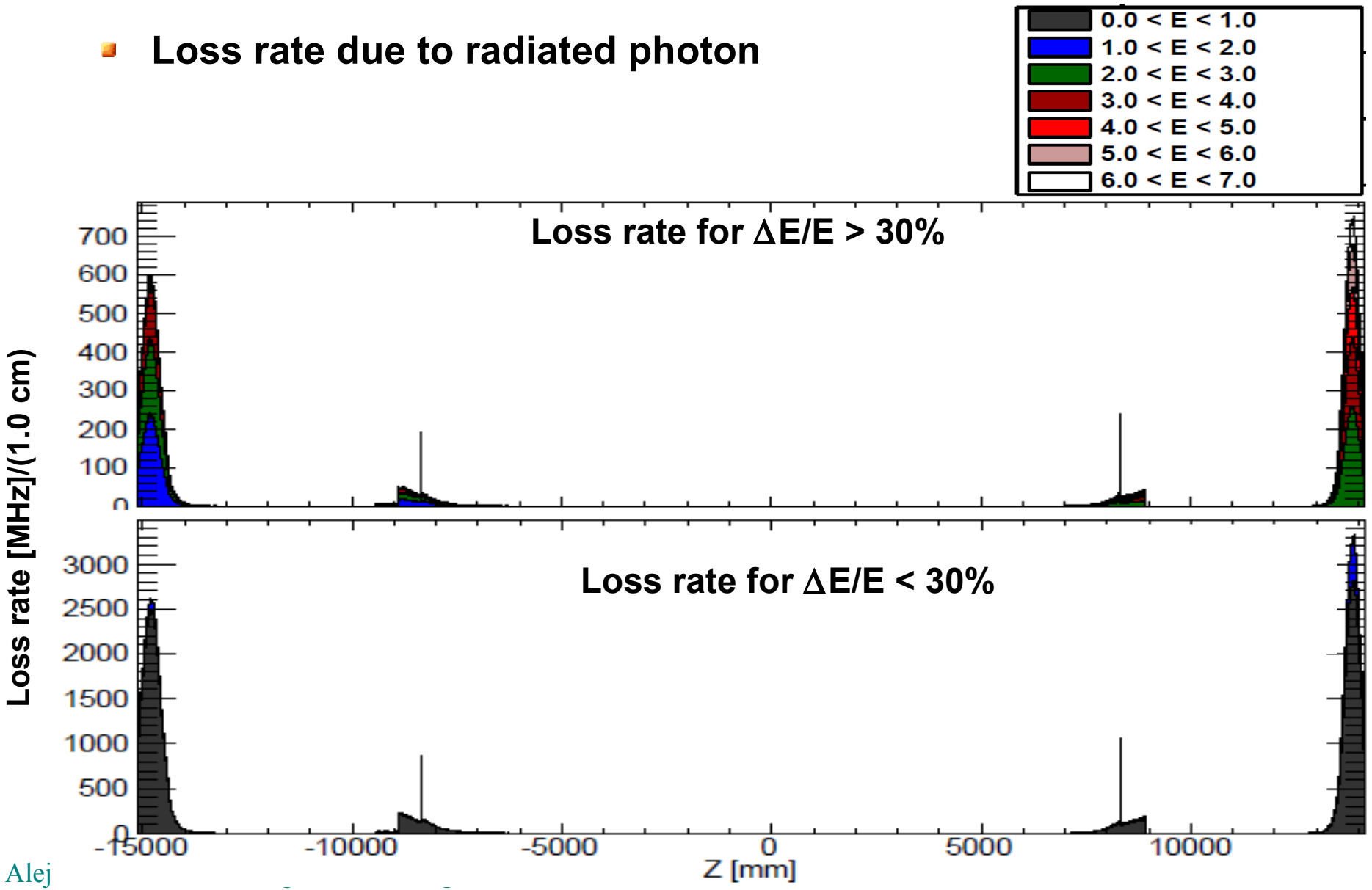
Simulating low ΔE/E Rad-Bhabha: Losses at Beam Pipe

- Loss rate due to radiated photon

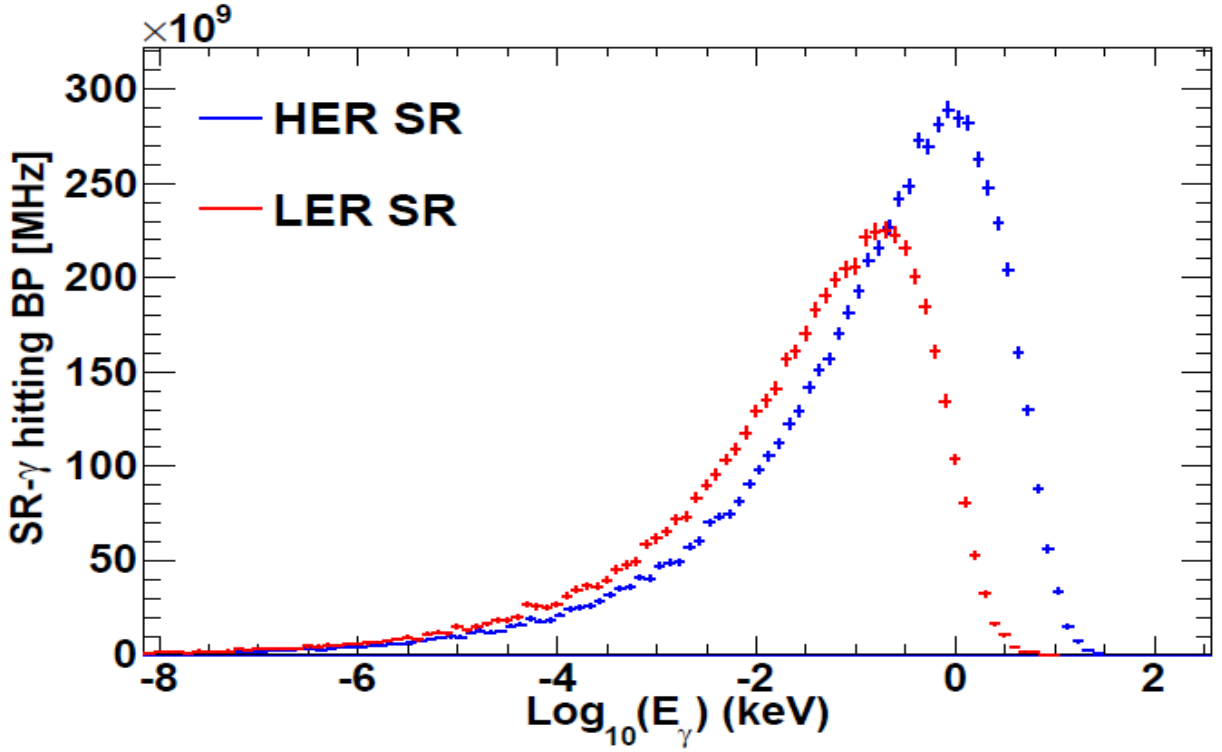


SR backgrounds

SR background: Motivations

- Even though the primaries of this background source are mainly soft X-rays (i.e. γ with energies around ~1-50 keV), the rates are huge
- Simulate then will allow to estimate,
  - The dose inside the cryostat
  - The doses on the innermost layers of the SVT

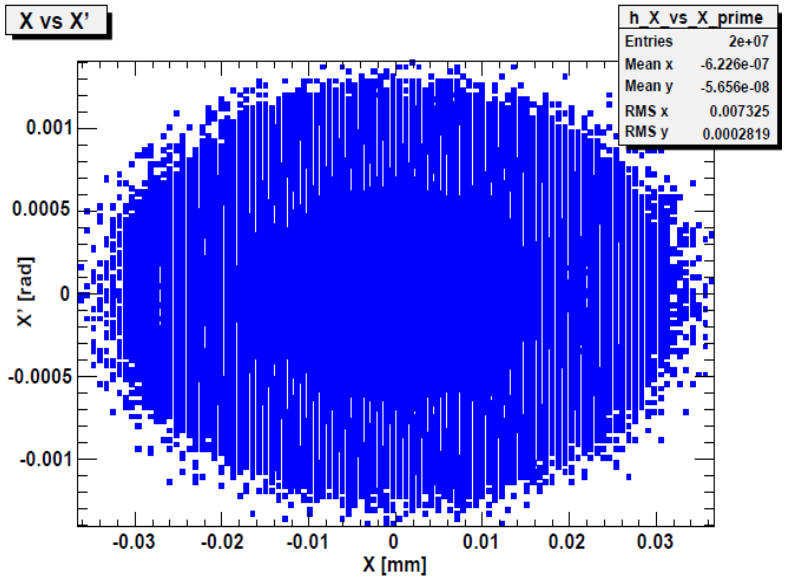
Energy spectrum of SR hitting beam pipe (-3,3) mts



SR background: Strategy

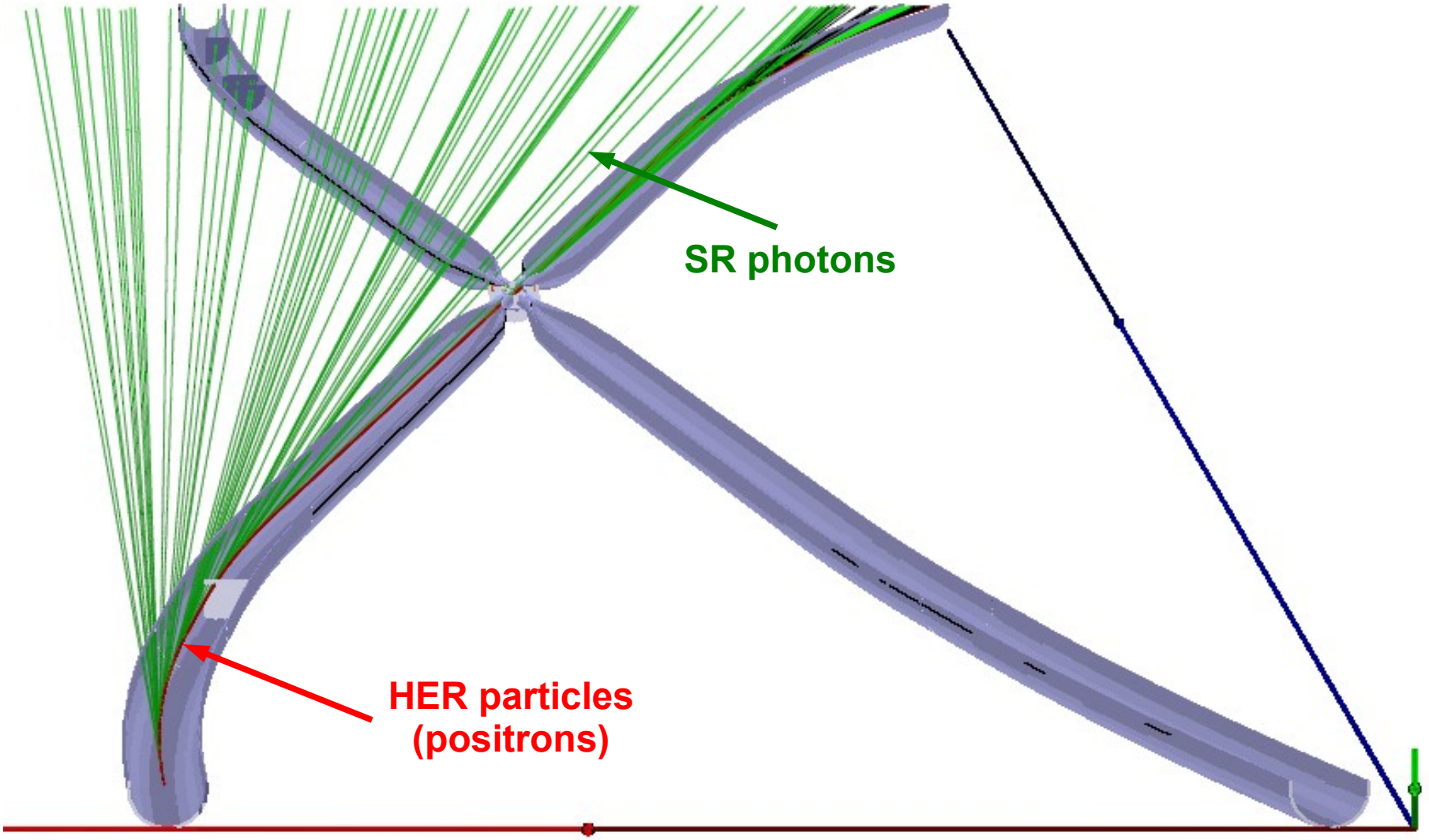
- Generate primaries at the IP with the usual beam parameters

Parameter	HER (e^+)	LER (e^-)
E (GeV)	6.69	4.18
σ_X (mm)	7.33×10^{-3}	8.7×10^{-3}
β_X (mm)	26.0	32.0
σ_Y (mm)	36.0×10^{-6}	35.0×10^{-6}
β_Y (mm)	253.0×10^{-3}	205.0×10^{-3}
α_Z	-30 mrad	π+30mrad



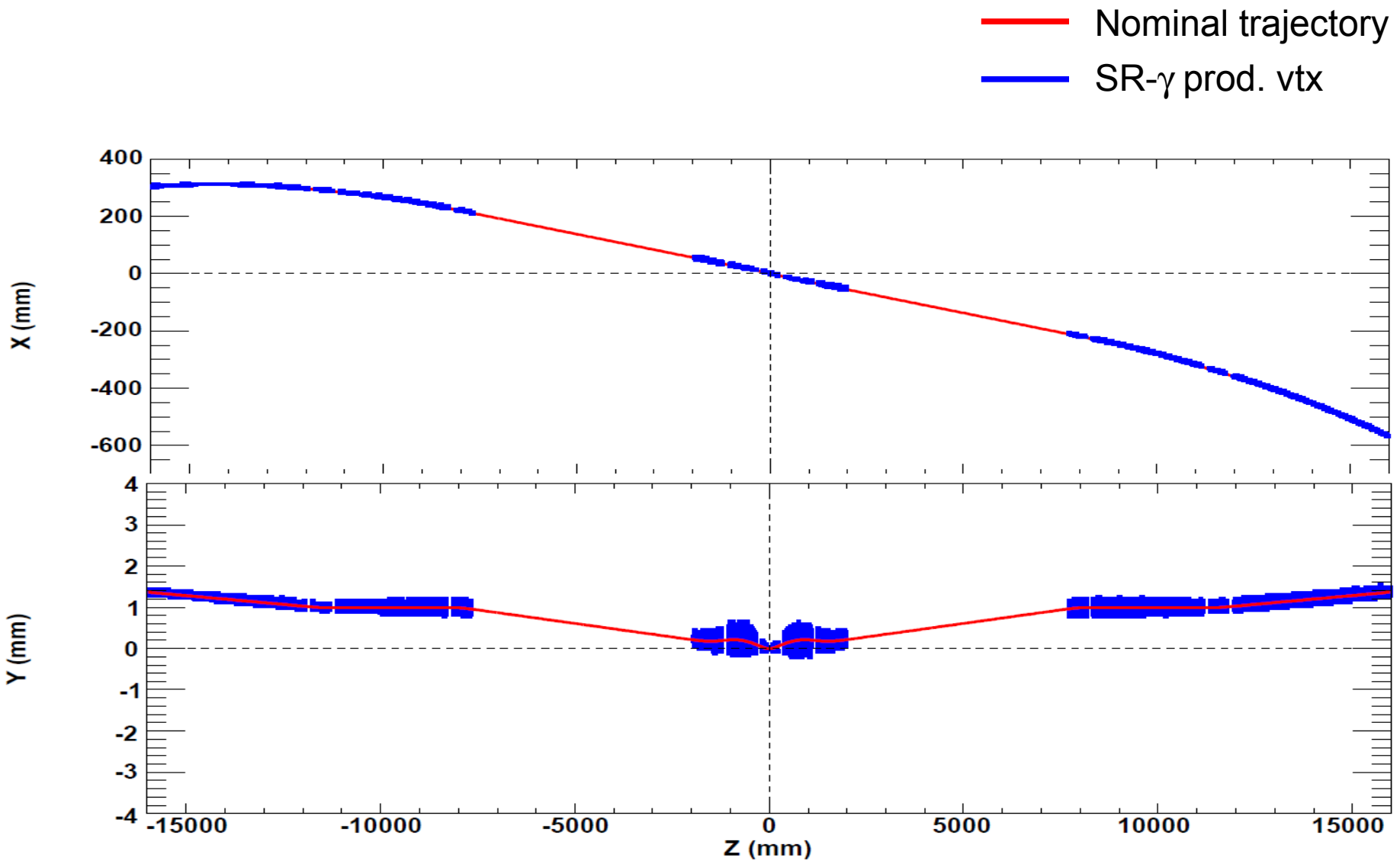
- Invert charge and momentum ($e^+ \leftrightarrow e^-$ & $p \leftrightarrow -p$) of those primaries and track them up to the 2nd dipole upstream the beam-line (back-track)
- Invert back charge and momentum and track the primaries turning on the SR (forward-track)
- Save the SR photons which hit beam pipe in a region around the IP: (-3,3) mts
- Use these primaries to estimate the doses on inside the cryostat and the SVT, DCH, ...

SR background: Fwd-track Visualization



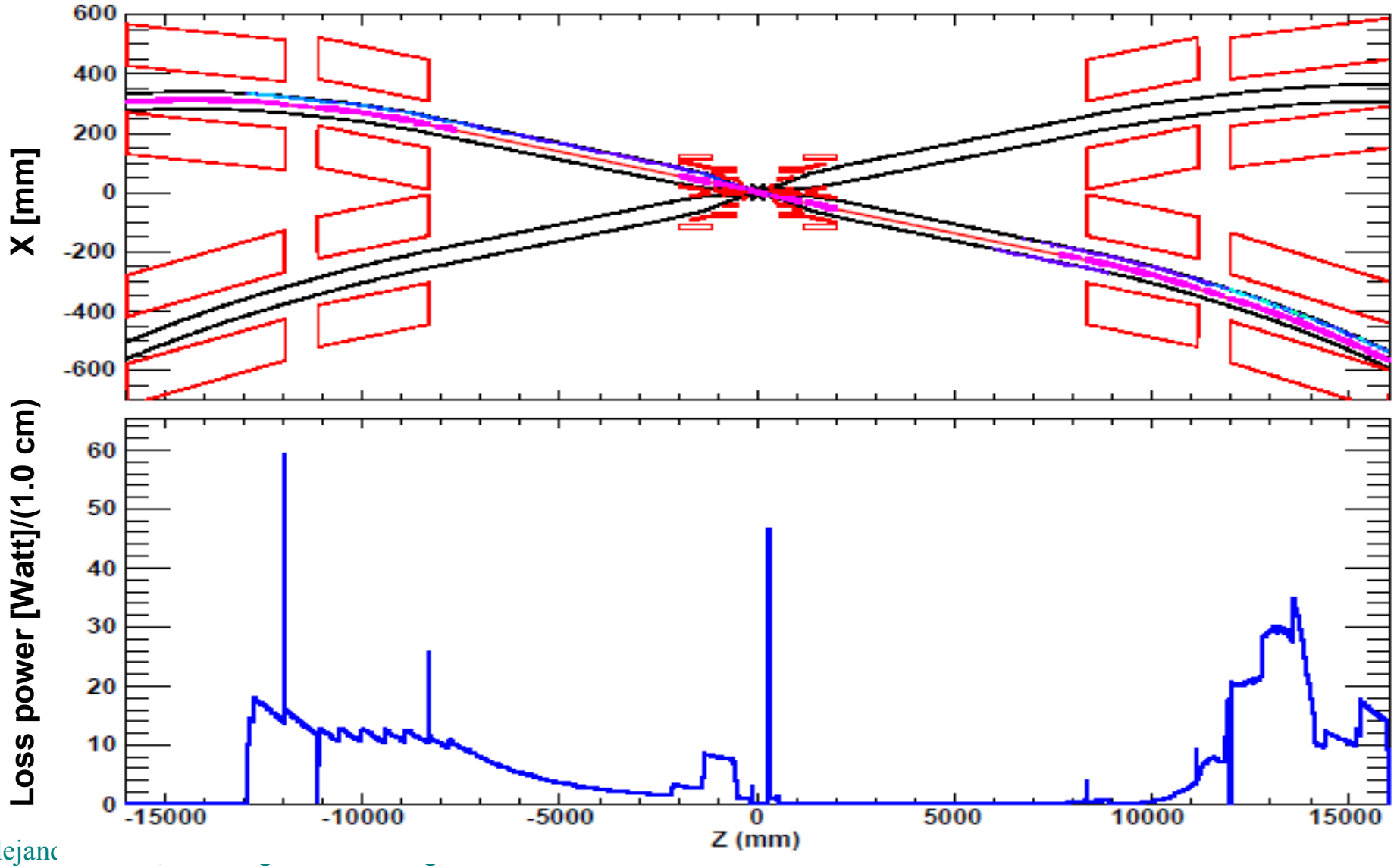
SR background: Fwd-track

- **Production vertex of SR photons from HER**



SR background: Losses at Beam Pipe

- SR-γ loss rate due to HER



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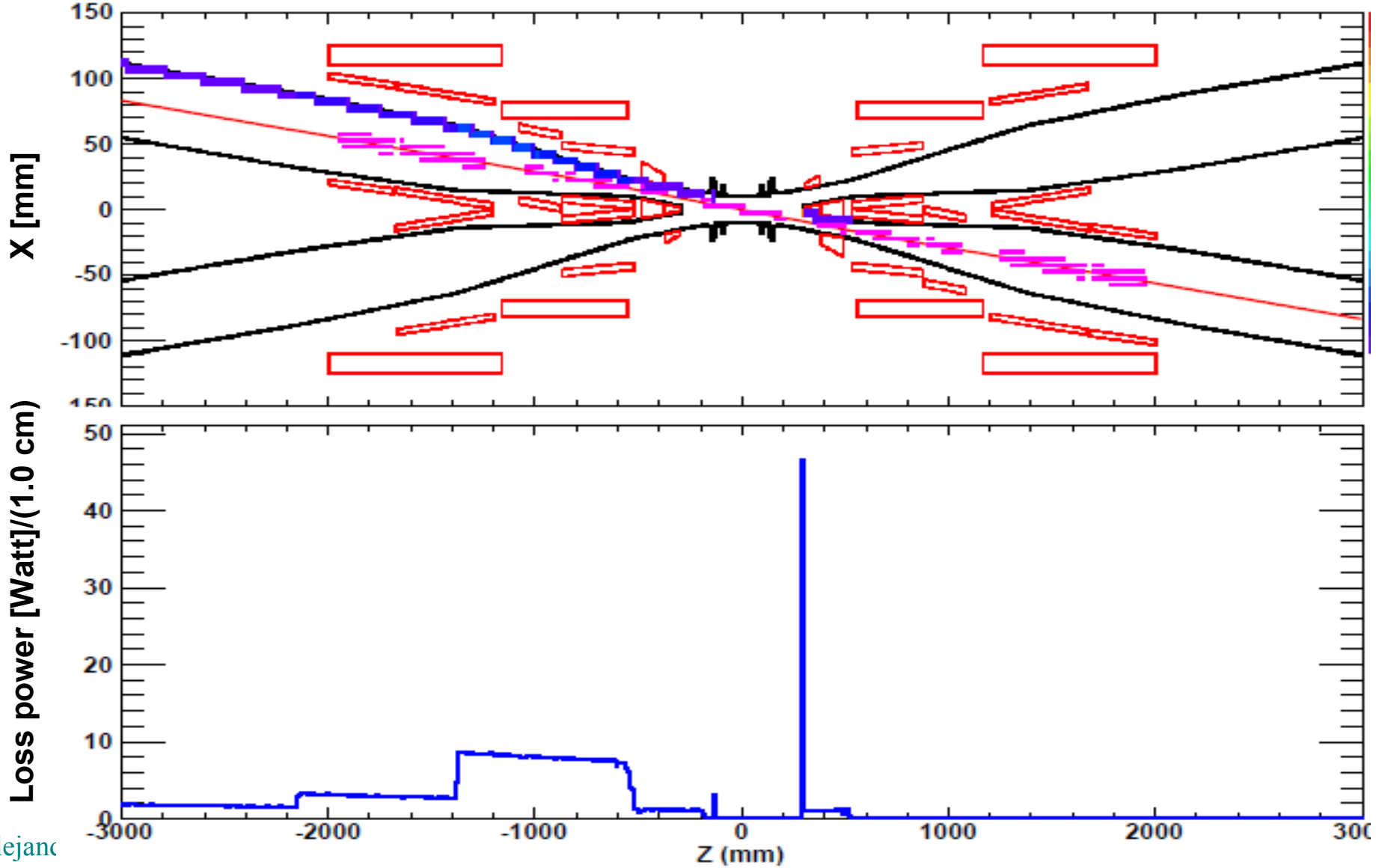
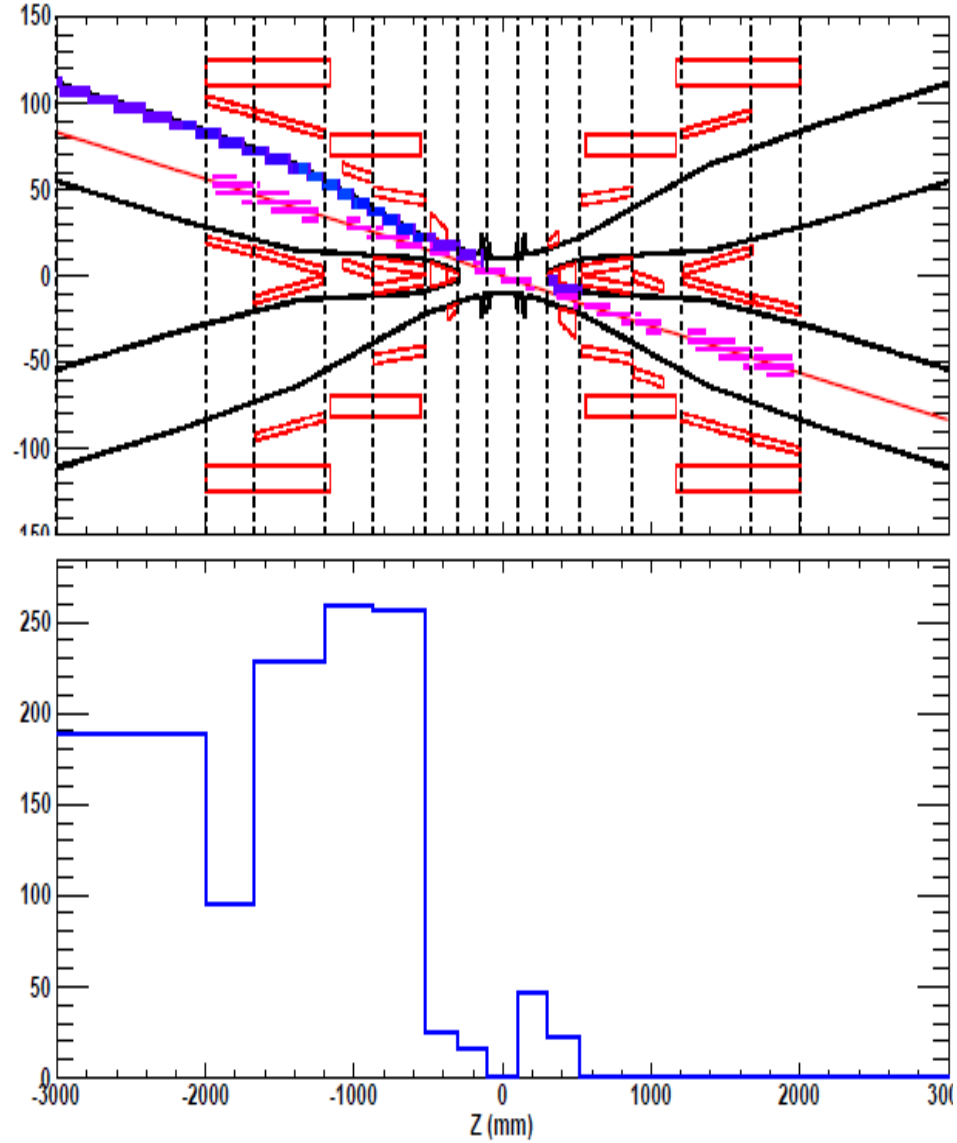
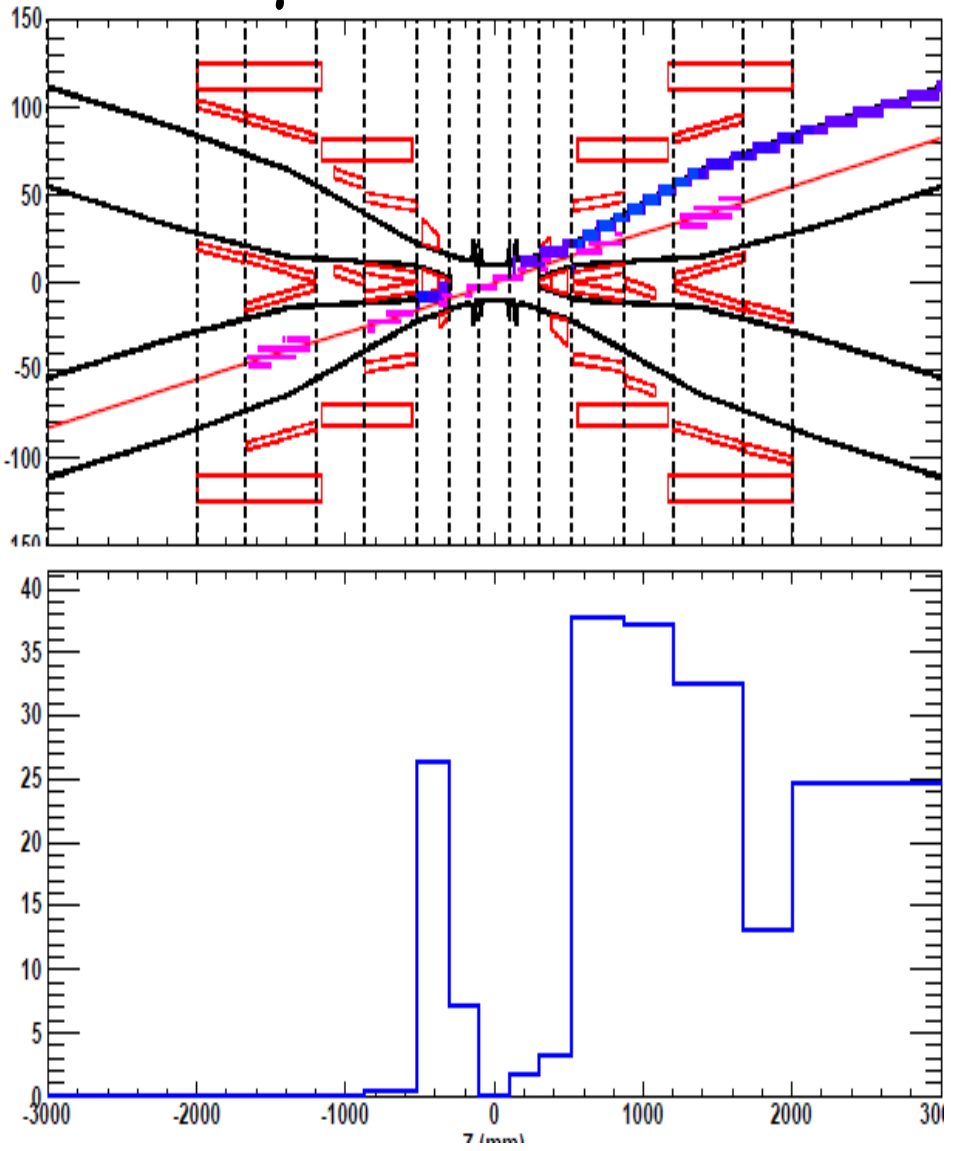


SR background: Losses at Beam Pipe

SR-γ loss rate due to HER



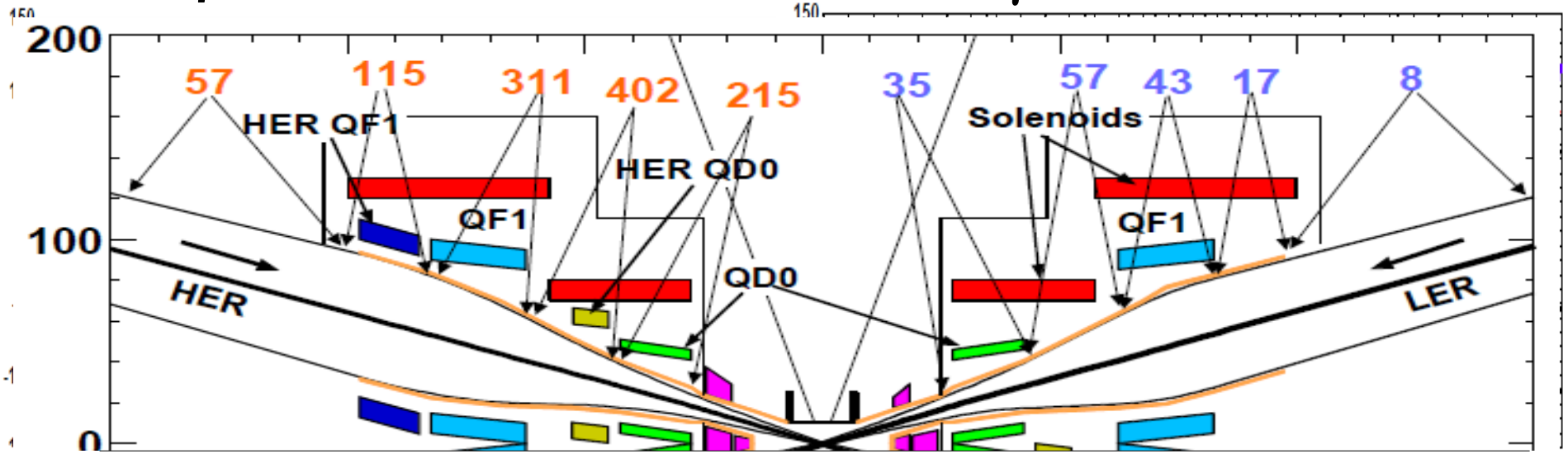
SR-γ loss rate due to LER

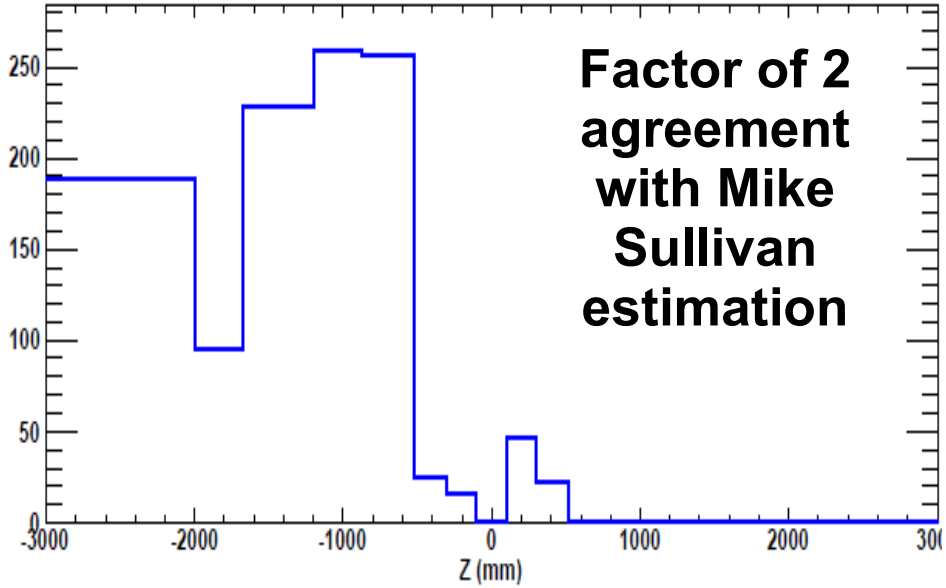


SR background: Losses at Beam Pipe

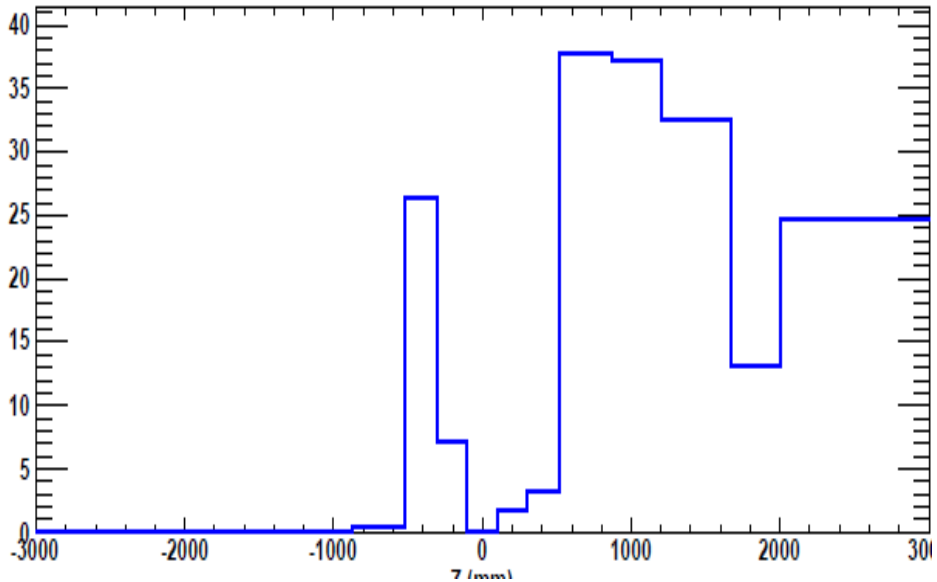
SR-γ loss rate due to HER

SR-γ loss rate due to LER





Factor of 2 agreement with Mike Sullivan estimation



Summary and Outlook

- **Simulating low ΔE/E Rad-bhabha events**
  - Main contribution to the particle losses at the 1st and 2nd dipoles downstream the IP
  - Expect that these high energy electron/positron and photons hitting the bending magnets will contribute to the neutron cloud
  - Samples are ready for production

- **Synchrotron Radiation (SR)**
  - Developed a method to simulate SR backgrounds using beam parameters at the IP: back-track and fwd-track
  - Evaluated power incident at the beam-pipe and got similar numbers to Mike Sullivan
  - Samples of SR background including the gaussian core of the beam are ready for simulation
  - Non-gaussian tails of the bunch due to Touschek/BeamGas will be included shortly ⇒ machinery is already in place


Backup