SuperBELLE IR Background Study

Synchrotron Backscattering Modelling

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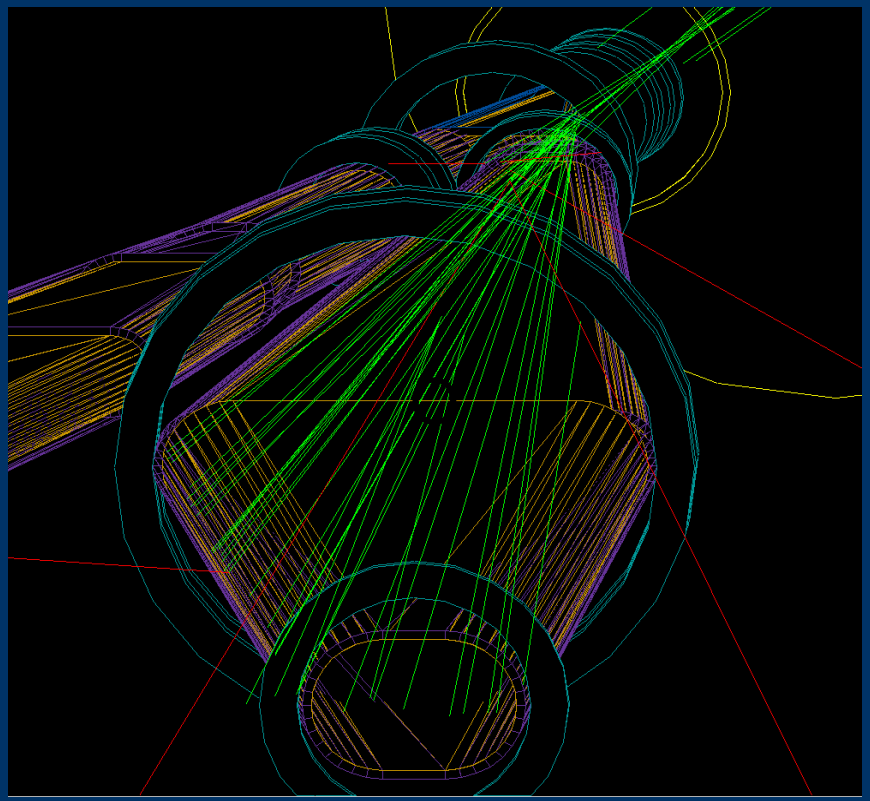
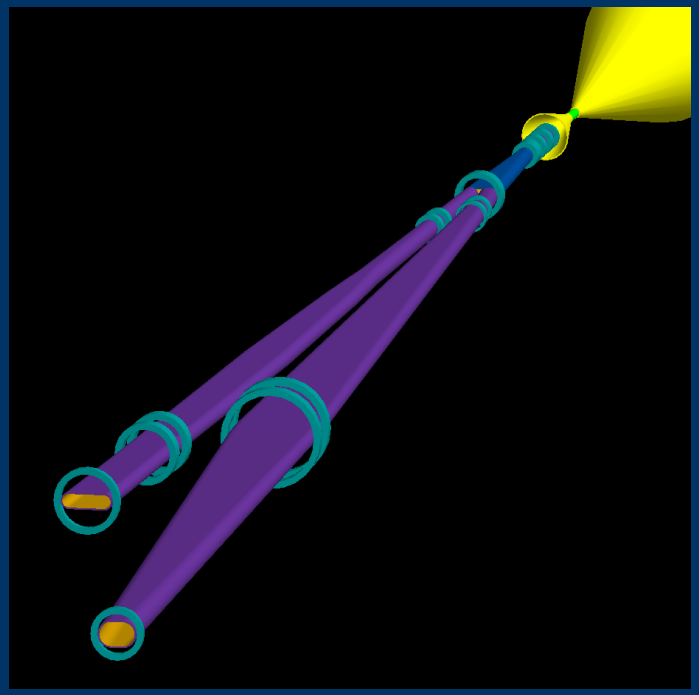
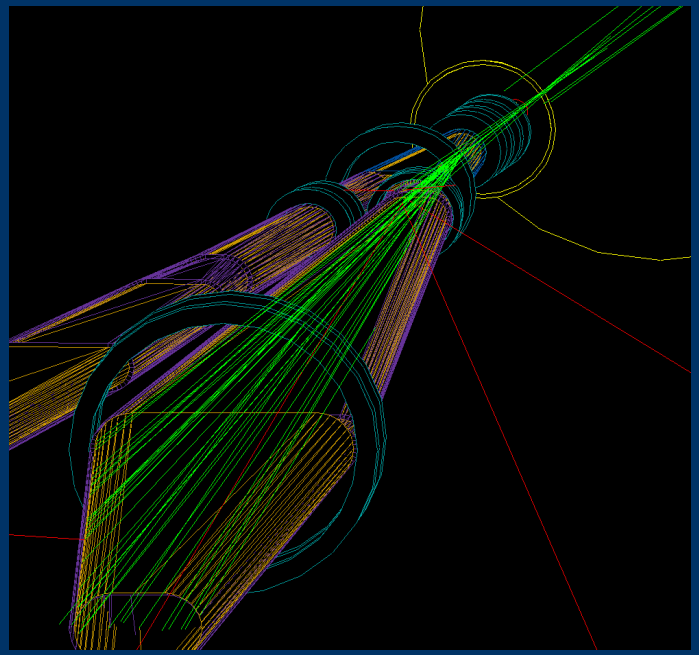


Previous study

- Data from old optics was simulated with Geant4
- Beampipe LER and HER Downstream IR beampipe geometry created and run with SR events simulated by Iwasaki-san
- Most backscatter particles are electrons, which don't hit the IP pipe due to the IP chamber B field
- No backscatter photon hits to the IP beampipe for LER, only a couple for HER
- In this study with new optics we will focus on backscattering effects from HER side only

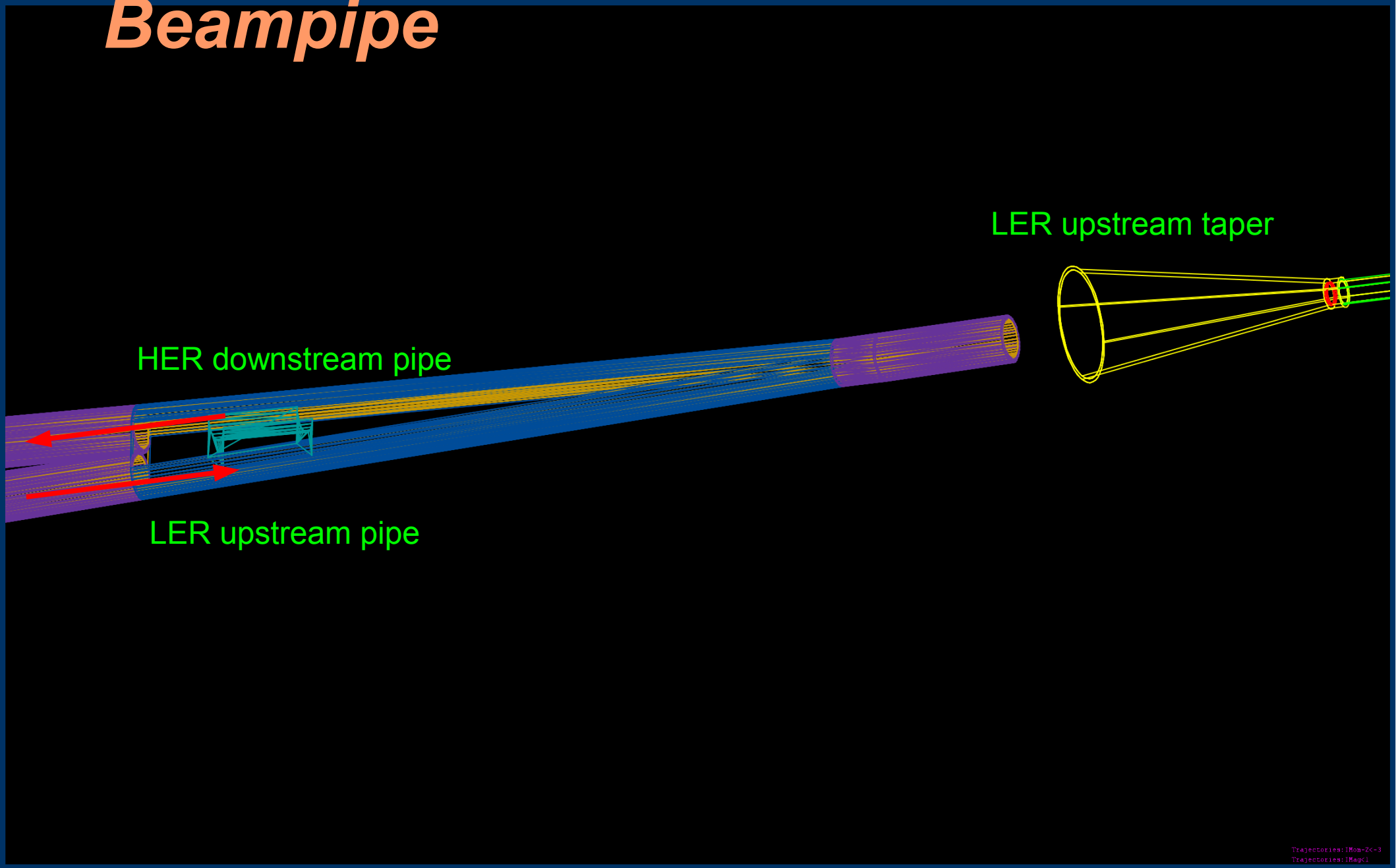




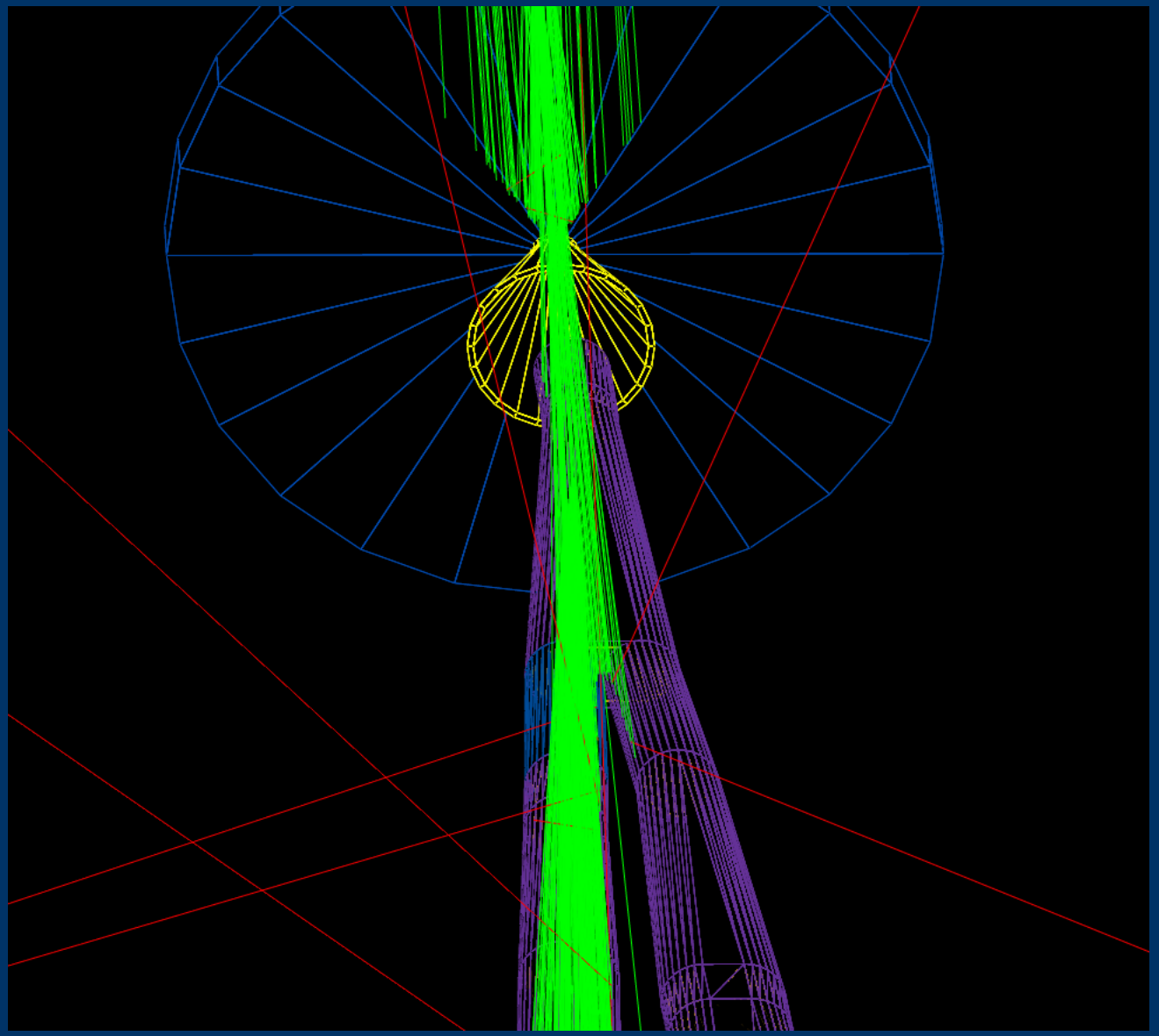
Problem: SVD Occupancy

- Assuming that we go with the DEPFET Pixel Detector design, it is estimated that the maximum occupancy allowable in the SVD is at ~5 hits/beam bunch
- For 50~100keV photons incident at a 30mrad angle on the IP beampipe made out of 10μm gold + 2mm copper, Geant4 simulations show leakage of 5~10%
- The rough maximum amount of background photons acceptable to hit the IP beampipe is ~50/beam bunch

Simulation: HER Downstream IR Beampipe

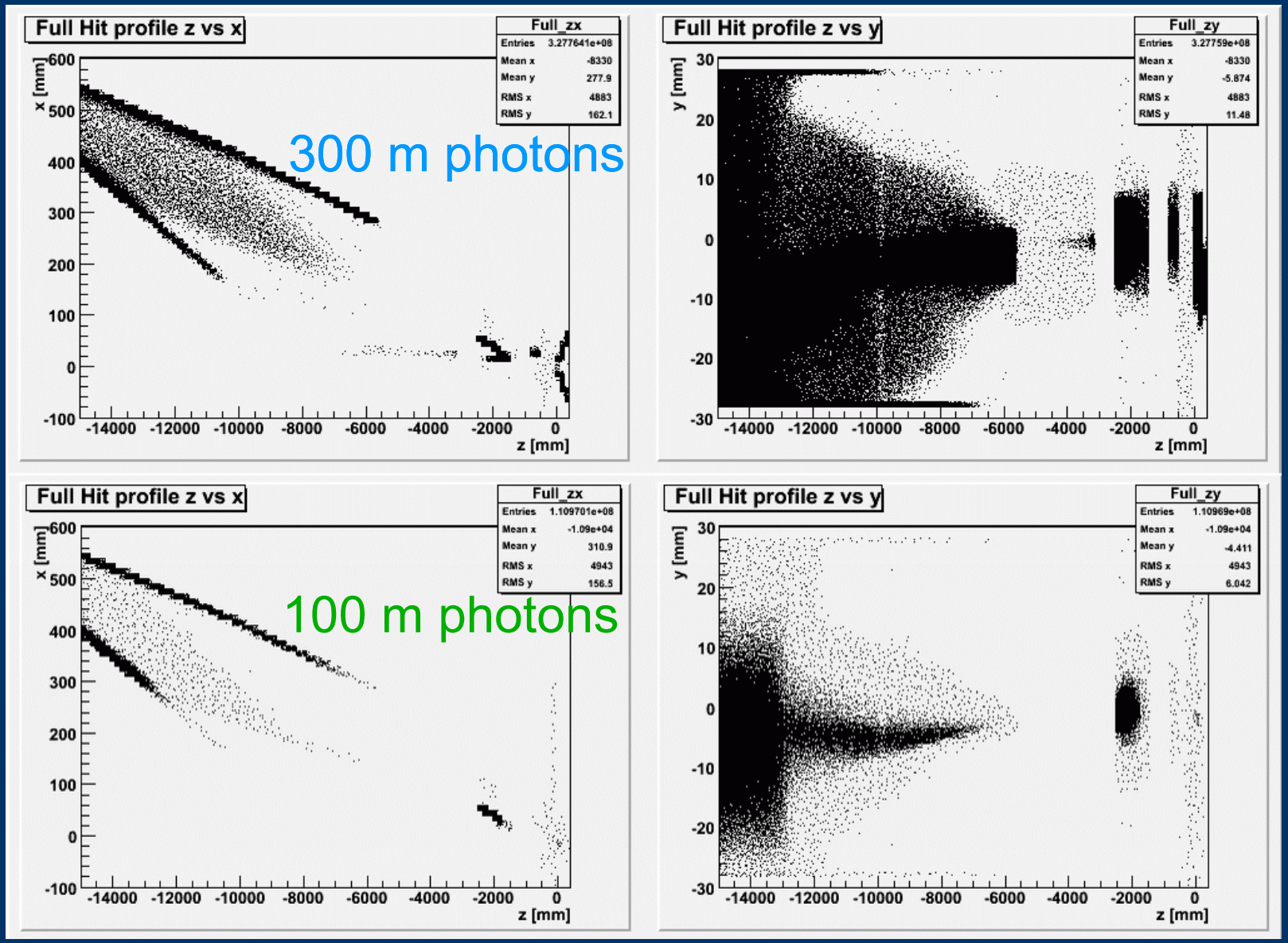


Simulation: HER Downstream IR Beampipe

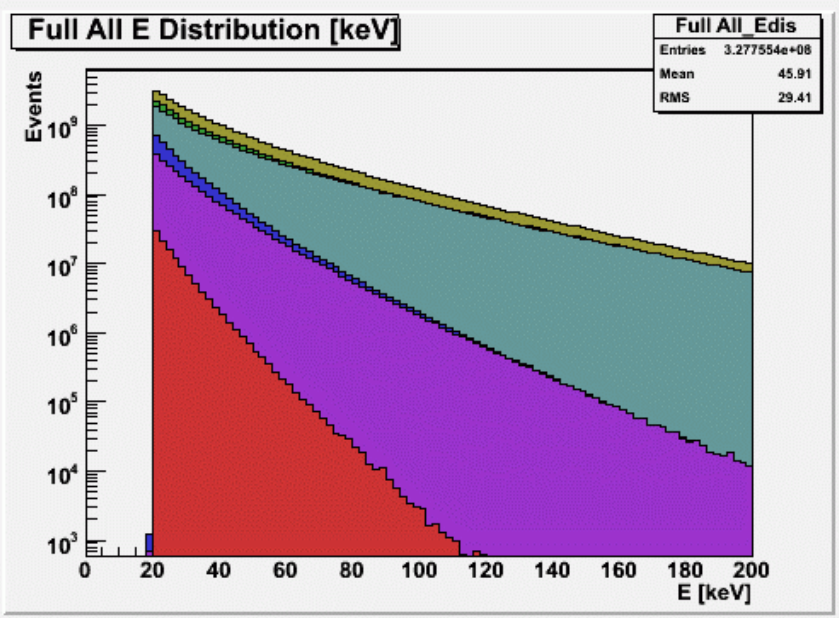


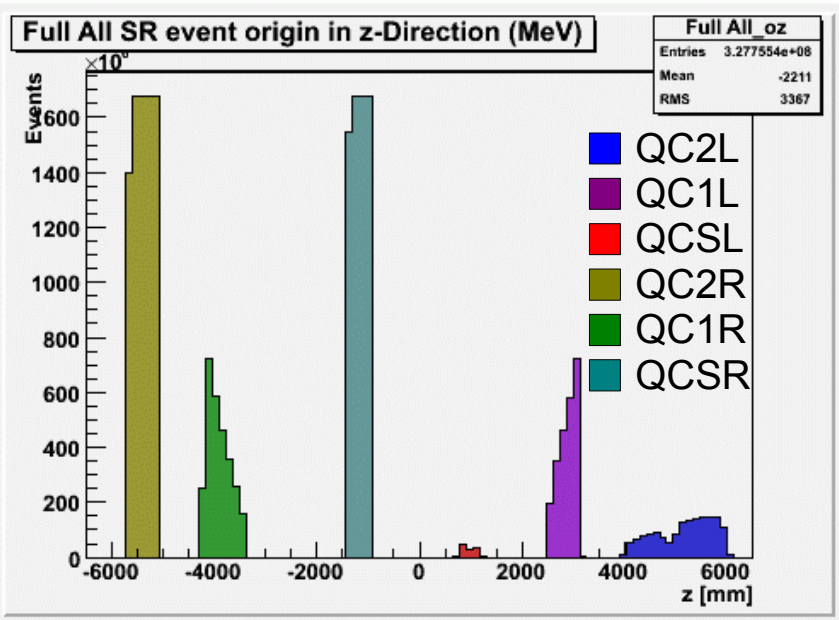
Overview of SR from New Optics

- SR generated from 5×10^{10} beam electrons events, >20 keV cut

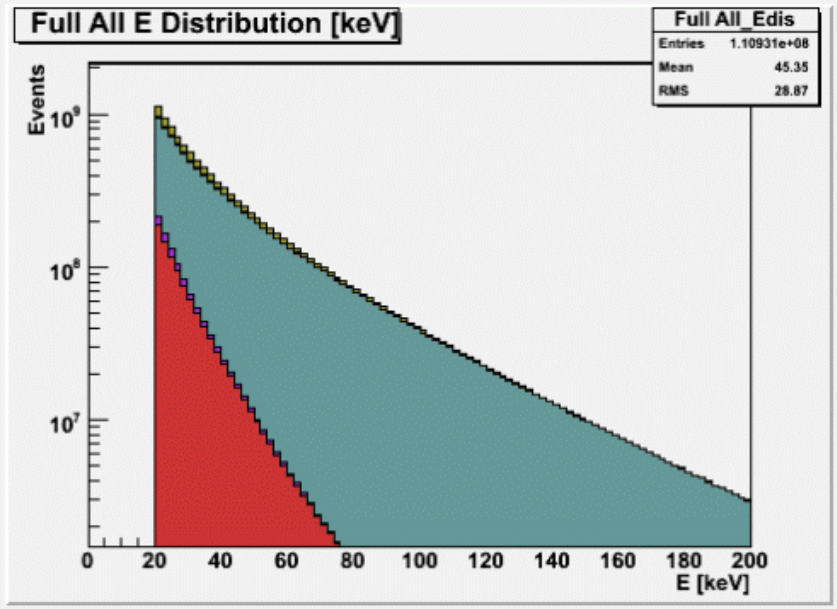


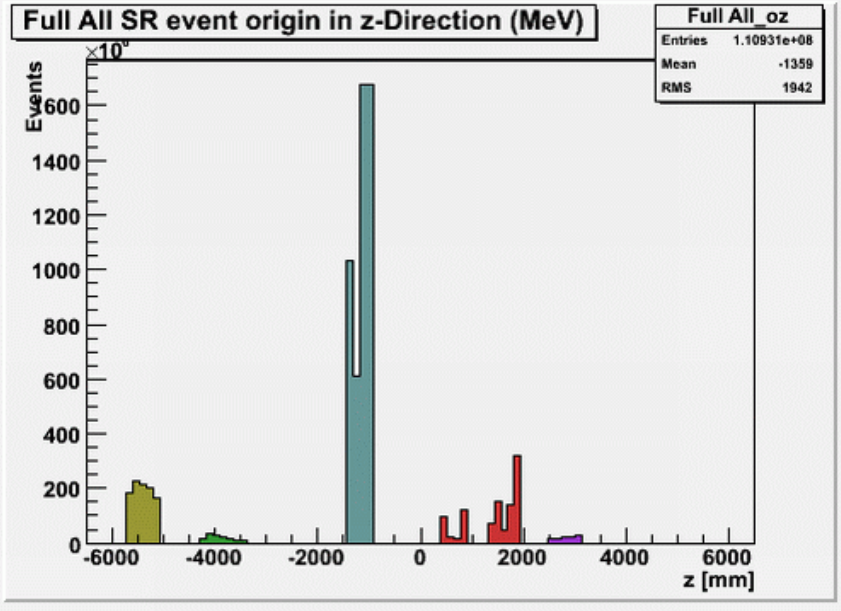
All SR (direct+BS) hits – Full beampipe





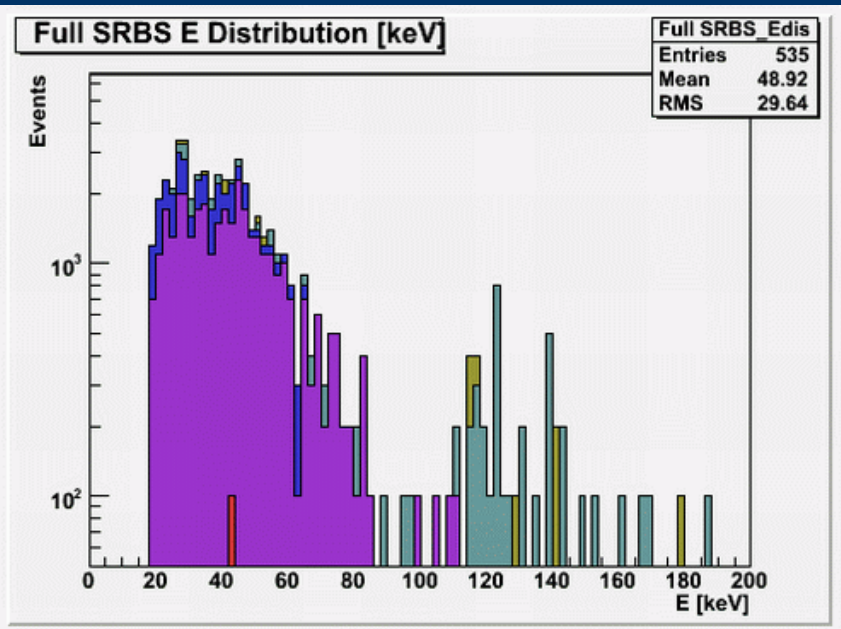
Old

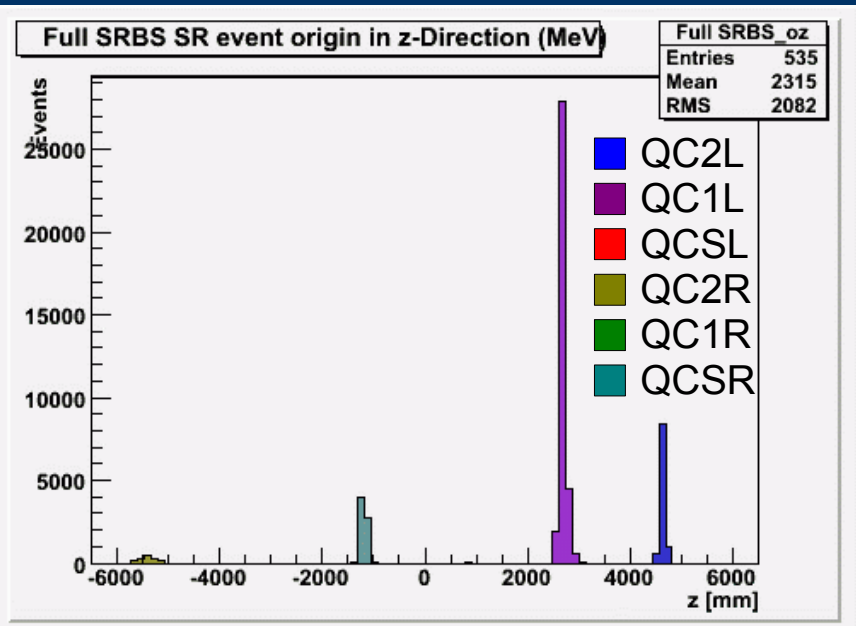




New

Backscatter hits – Full beampipe





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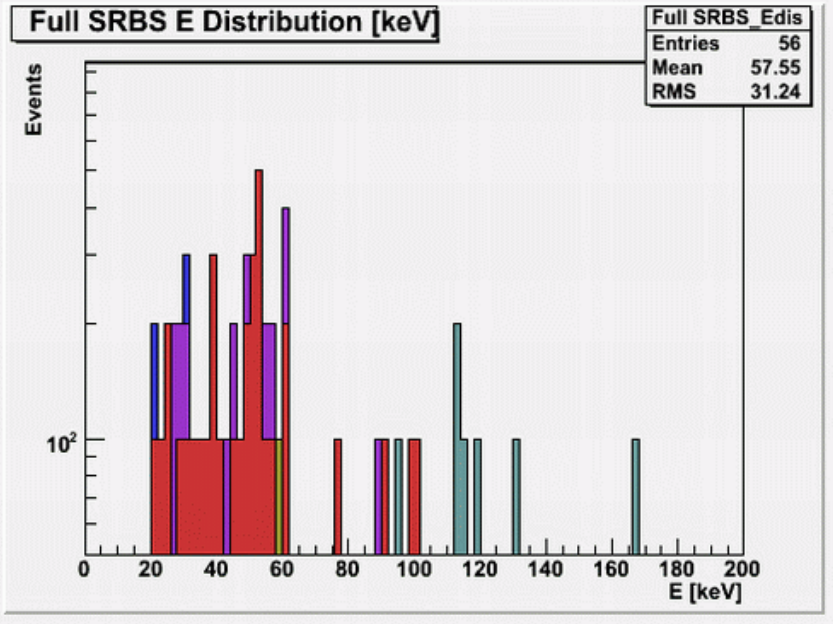
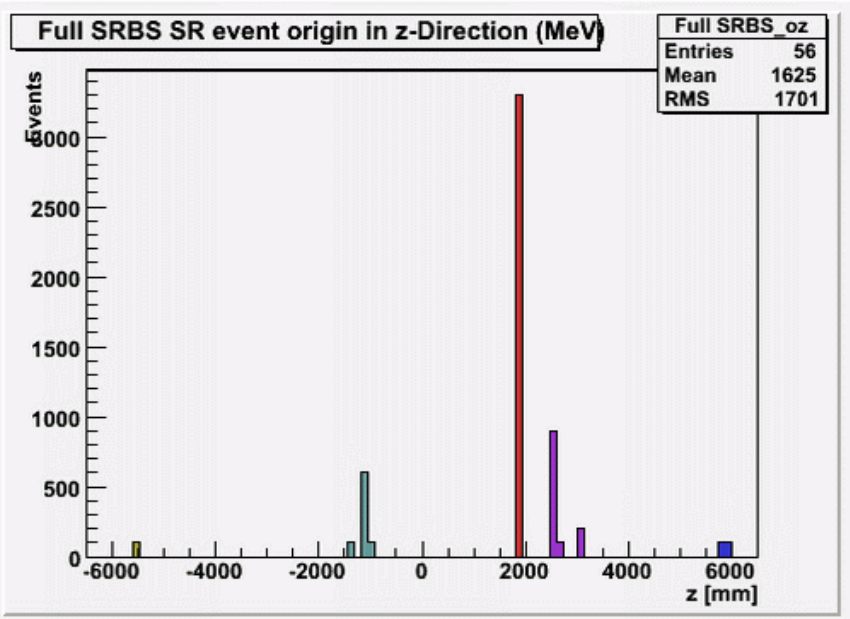
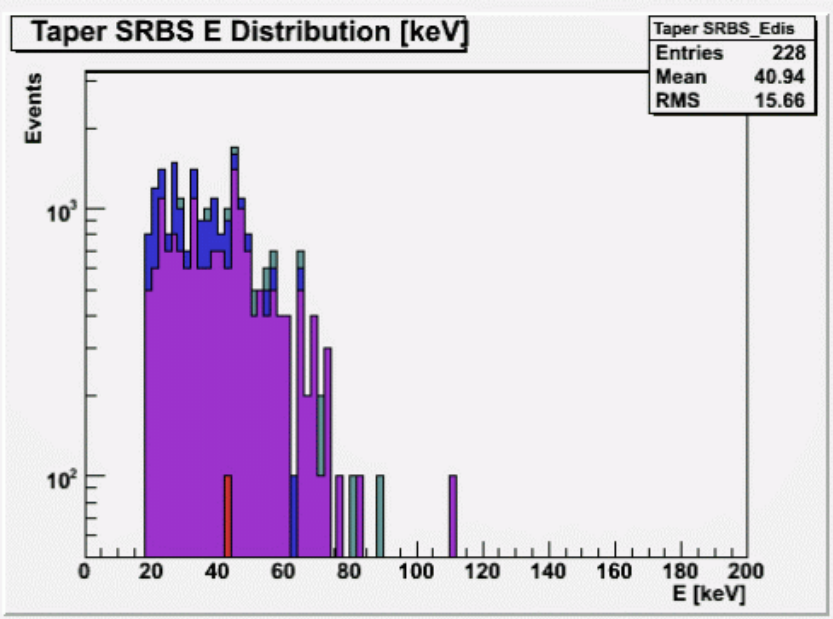
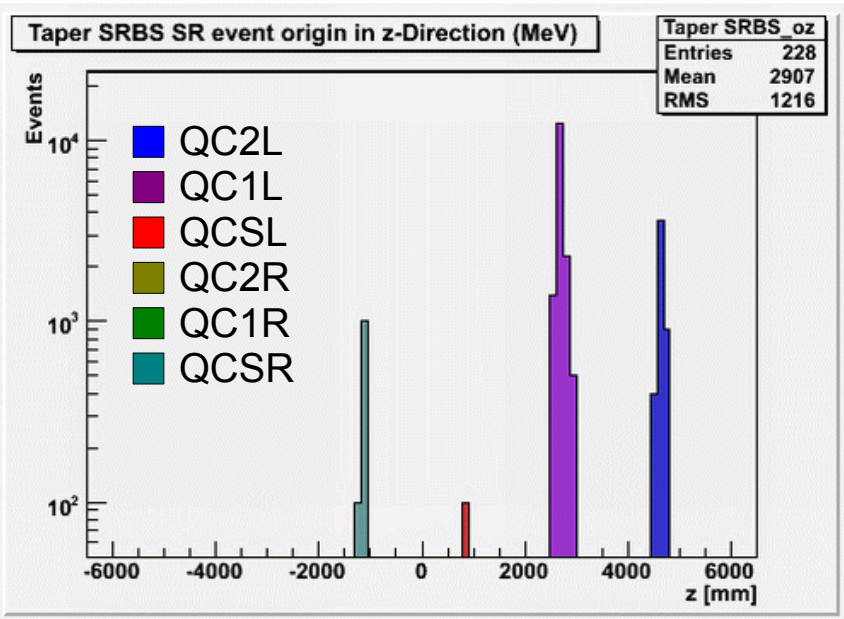




New

Backscatter hits – IP beampipe





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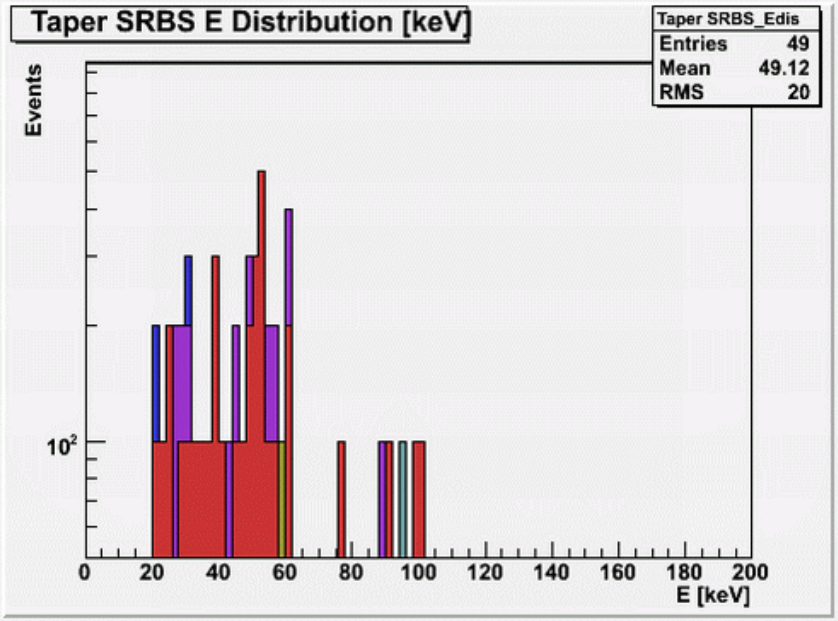
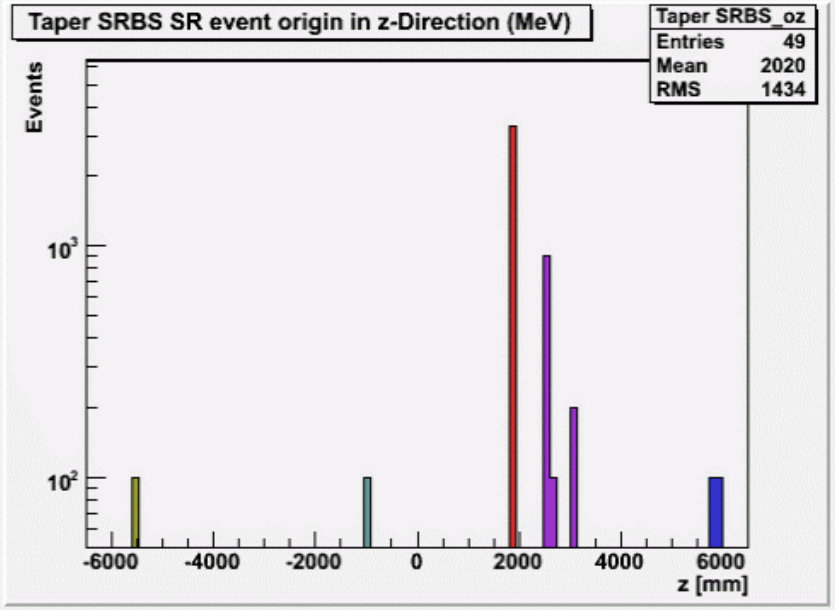
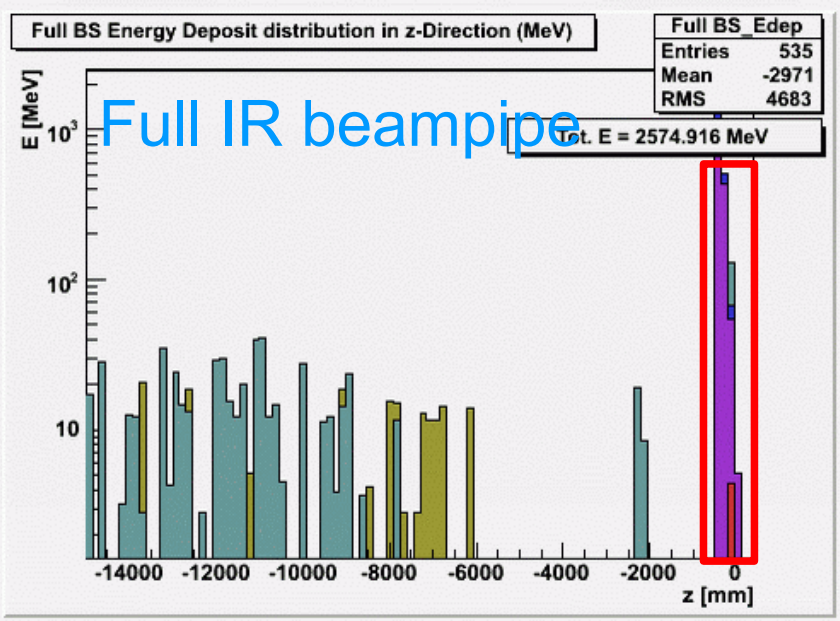
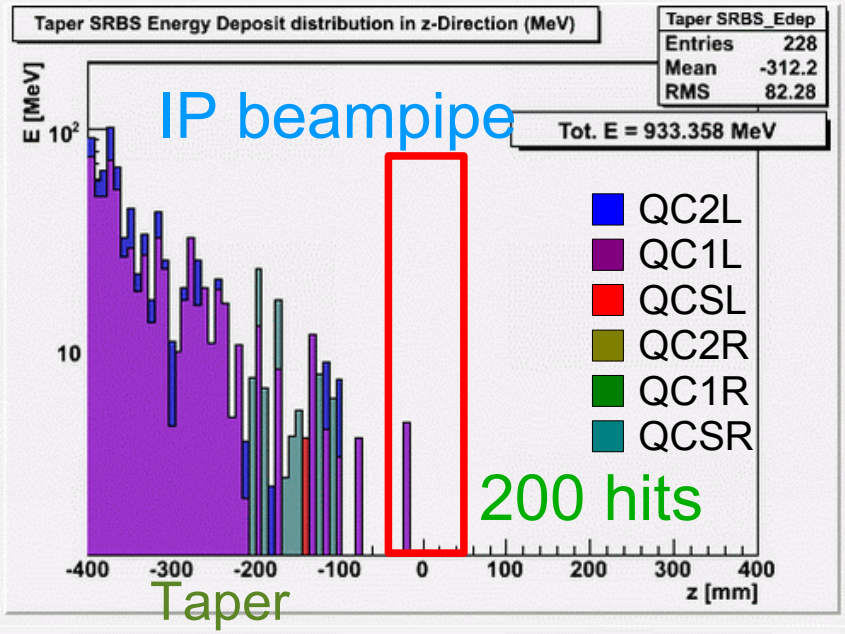




New

Backscatter Hit Position – Full + IP





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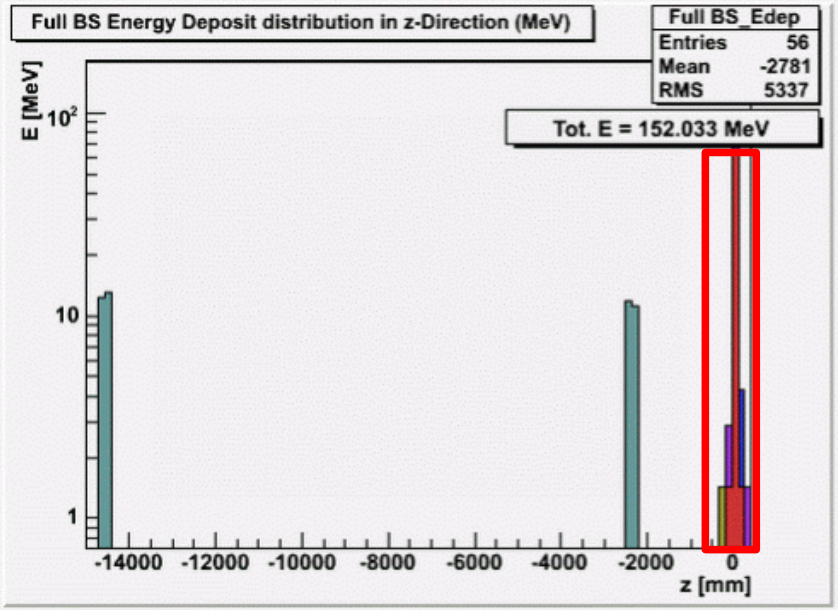
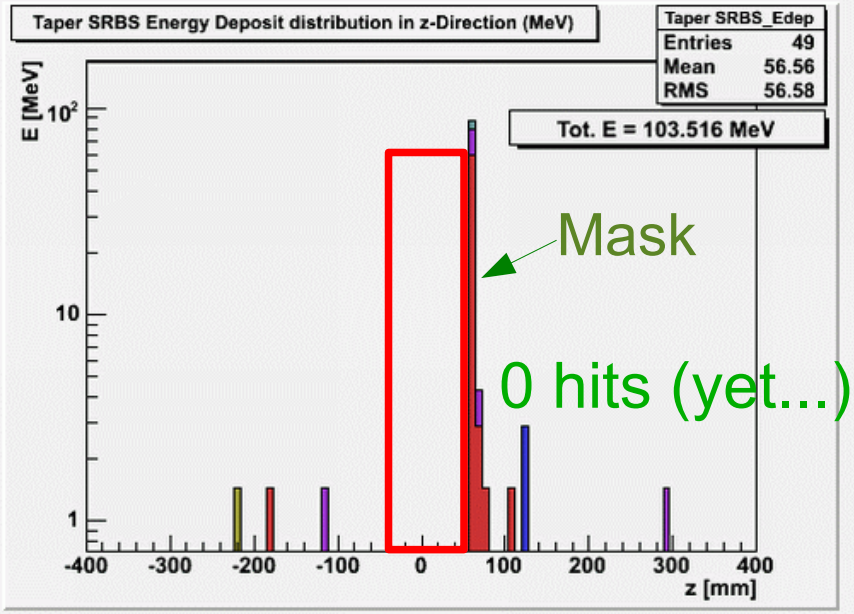
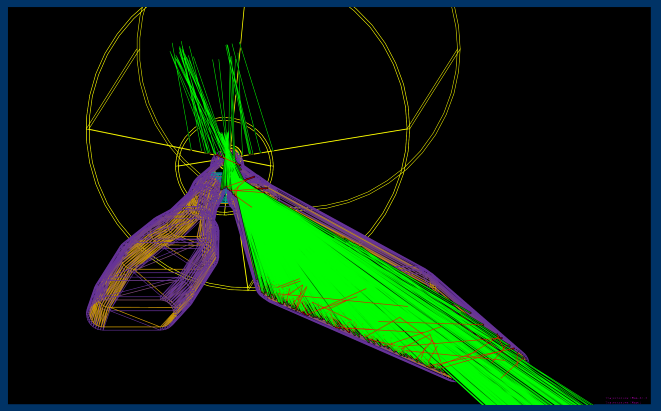




New

Summary and To do...



- A study of SR backscattering from the New KEKB Optics in Geant4 has been performed (statistics of ~100 million photons, 1/100 of a bunch)
- The drop in energy deposit to the IP taper region was 1/10
- The maximum acceptable hits to the IP beampipe according to SVD Occupancy rates is ~50 hits/bunch
- With the simulated statistics no backscatter hits have so far been found in the IP beampipe
- We need to increase the number of statistics by at least 10 fold in order to determine if there will be a occupancy problem; Geometry of IR beampipe also likely to change