



Fermilab

Accelerator Physics Center

Update on MARS15 Background Rates in a Muon Collider Detector

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Muon Collider Physics and Detector Meeting

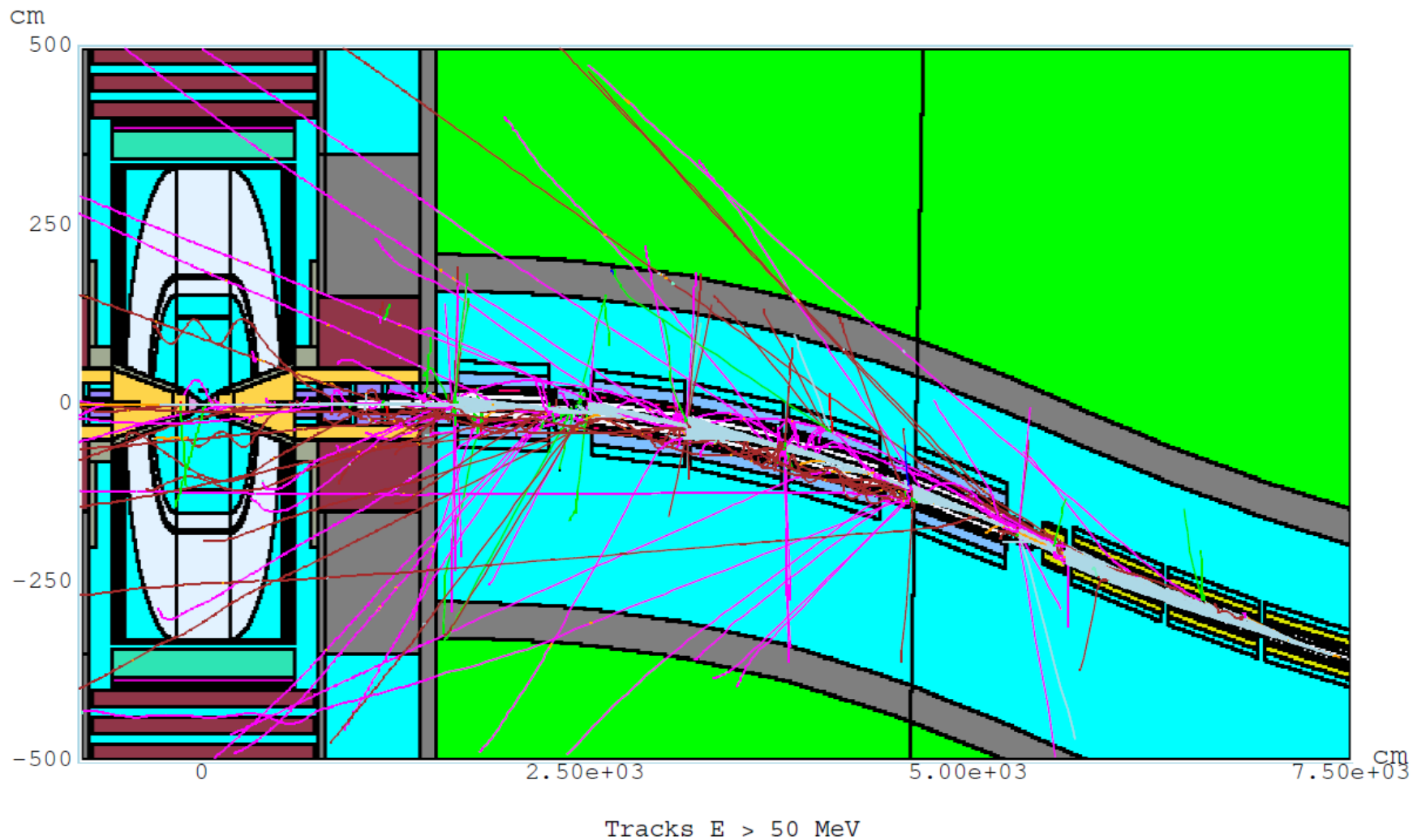
Fermilab

July 14, 2010

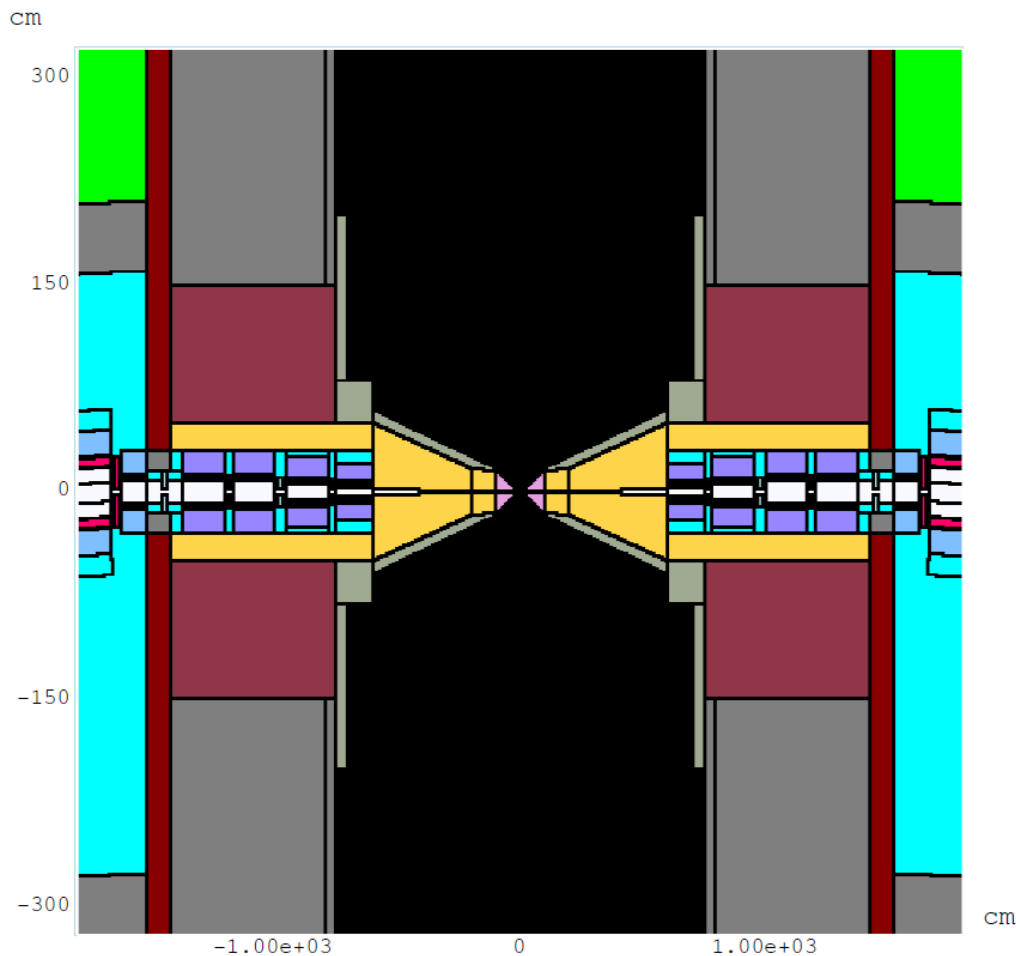
OUTLINE

- Source Term Studies
- Further Cone Optimization
- Reduction of Statistical Weight Spread

Particle Tracks in IR



Scoring Particles Entering Black Hole



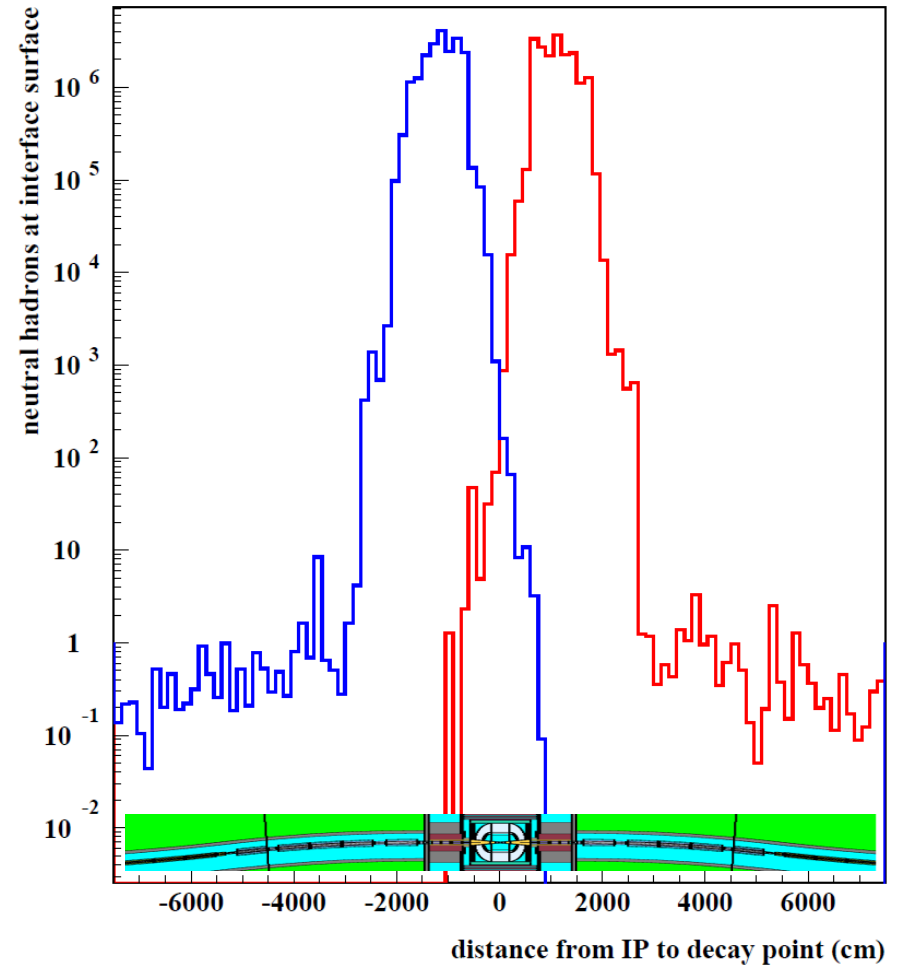
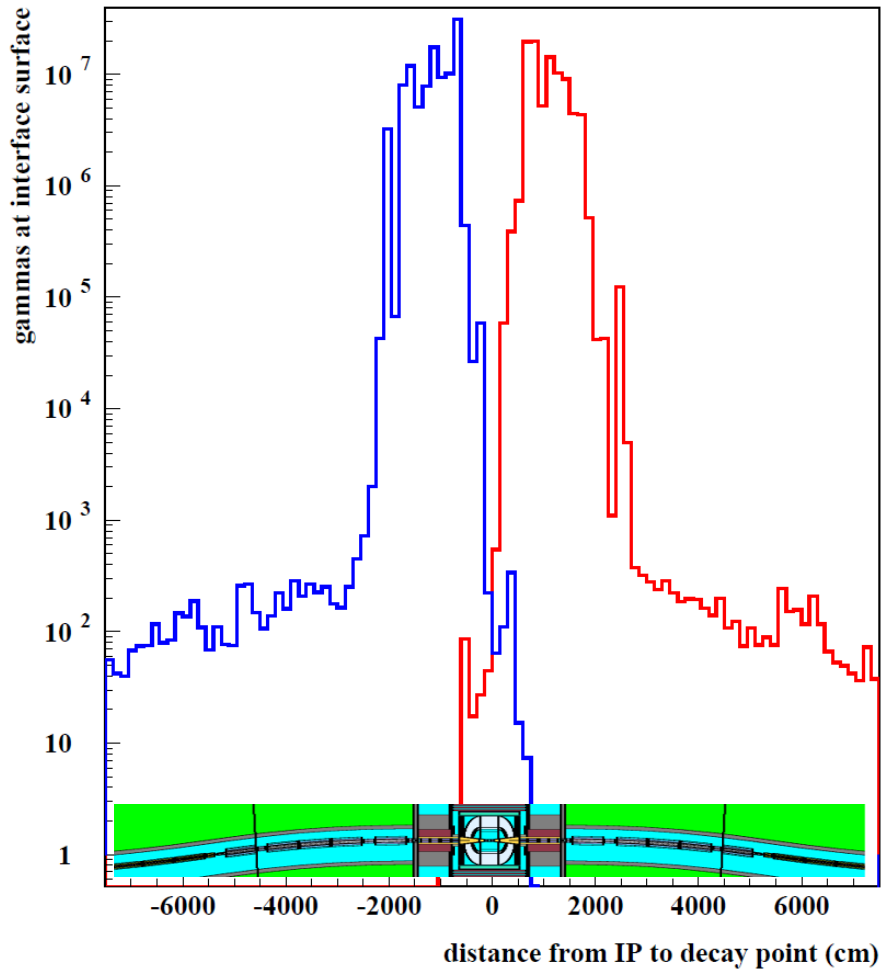
Scoring particles
with tagging info
for μ^- (L) and μ^+ (R)
beams ± 75 m

$X:Z = 1:5.6$

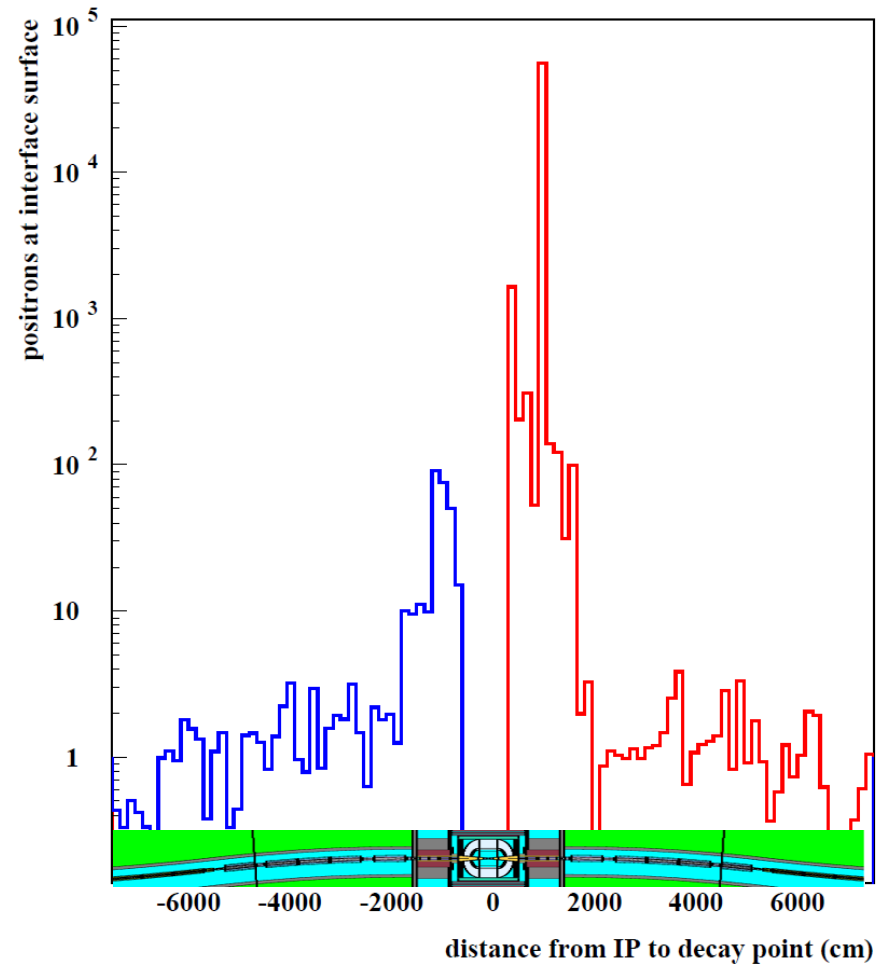
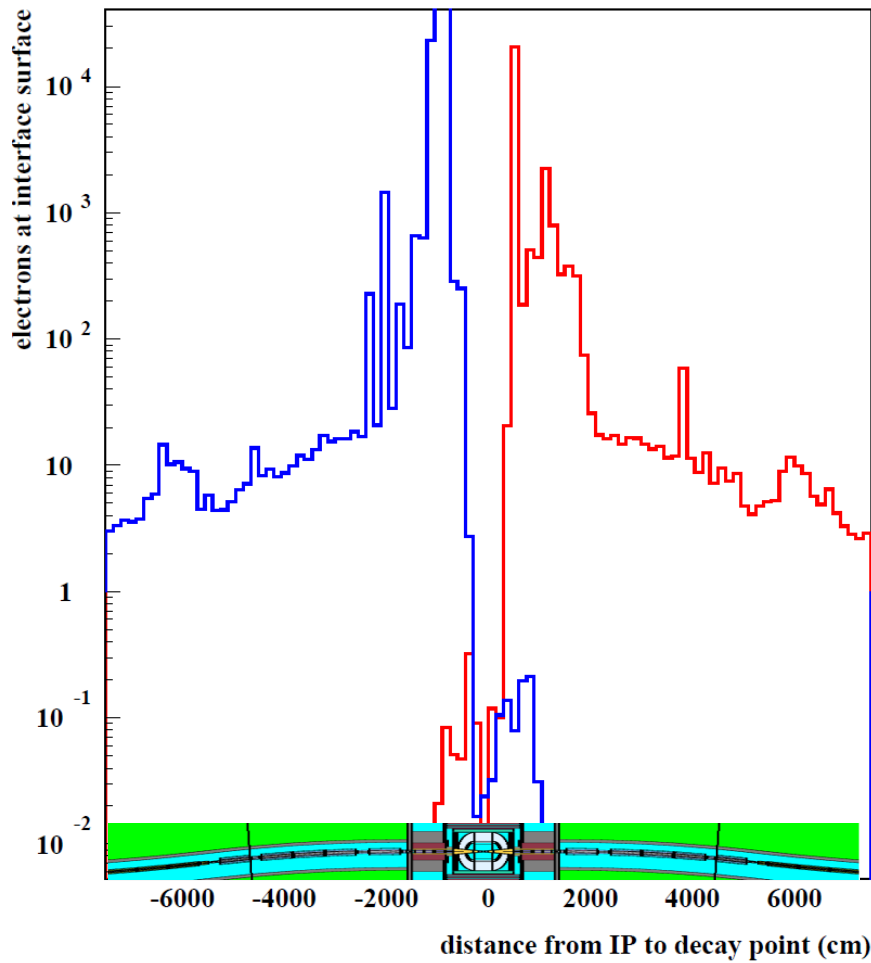


Aspect Ratio: X:Z = 1:5.625

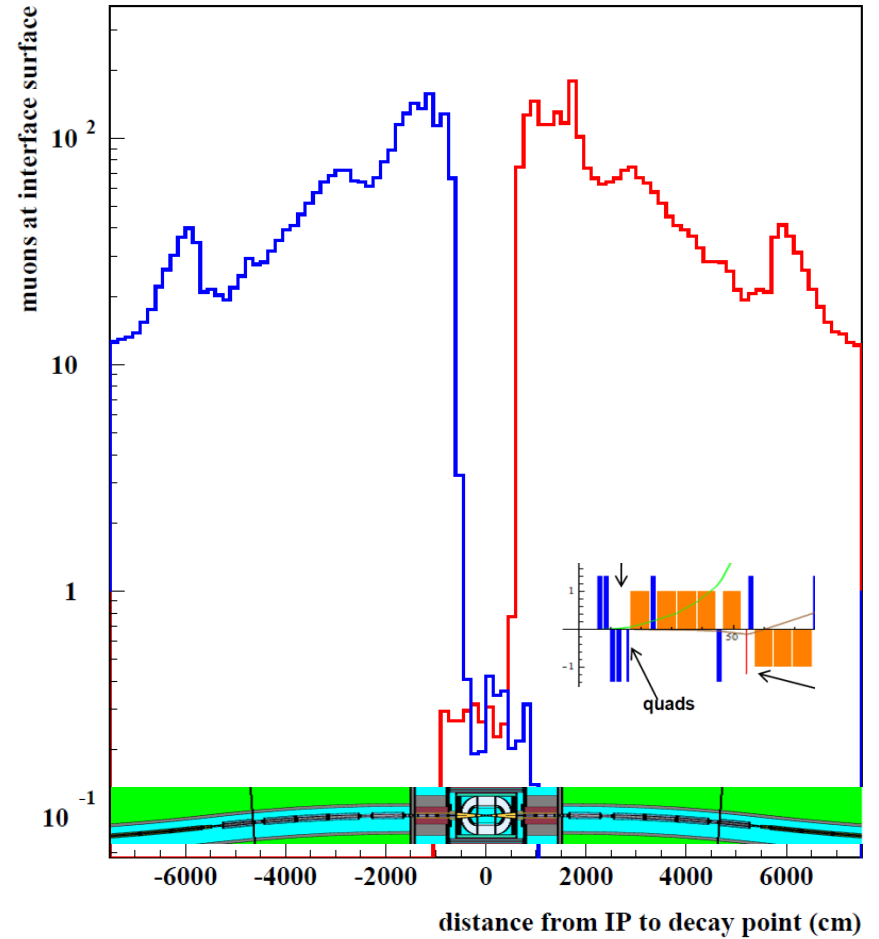
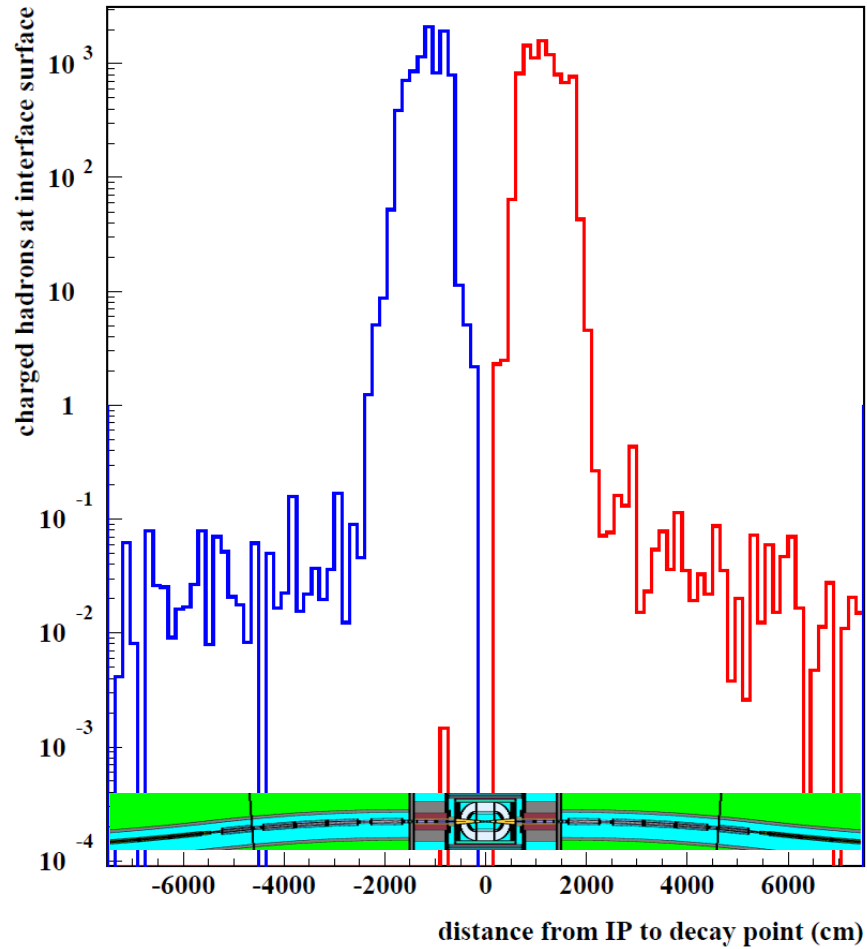
Photons and Neutral Hadrons



Electrons and Positrons



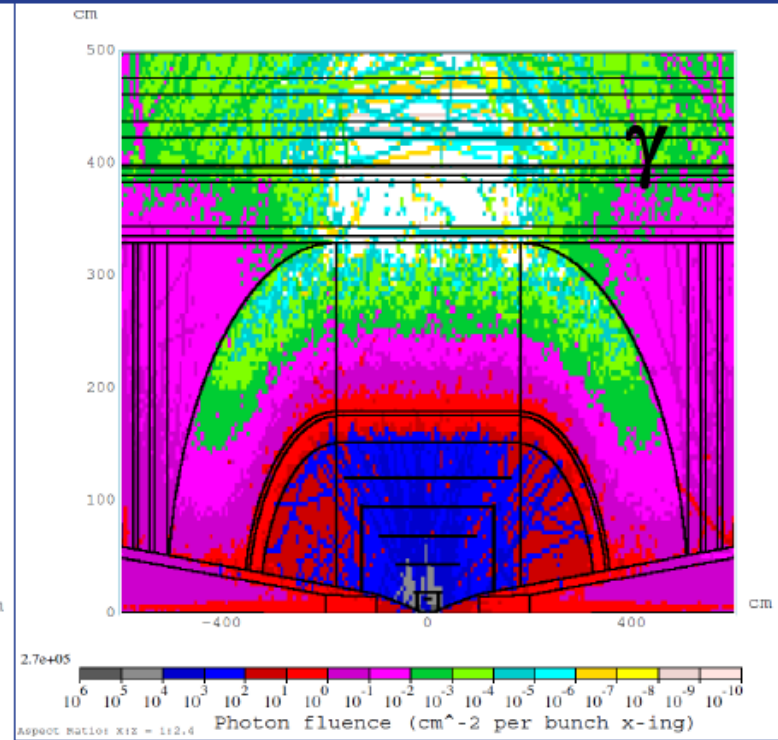
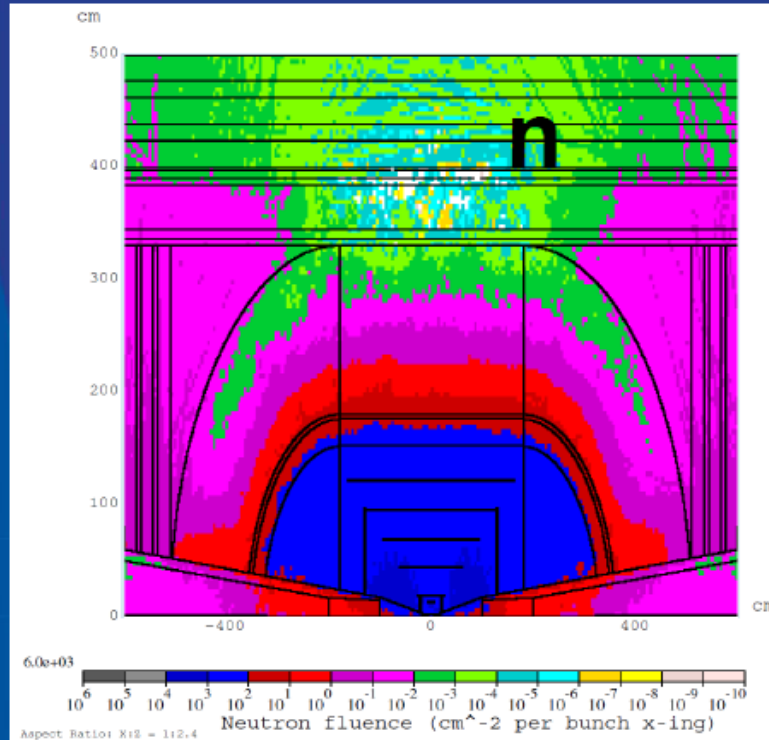
Charged Hadrons and Muons



Neutron and Photon Fluence: MC vs LHC

Fluence per bunch crossing, starting from MARS source term for $S_{\max} = 75$ m. Compared to best 20-deg '96 configuration, peak values are down 5-10 times for all particles but photons.

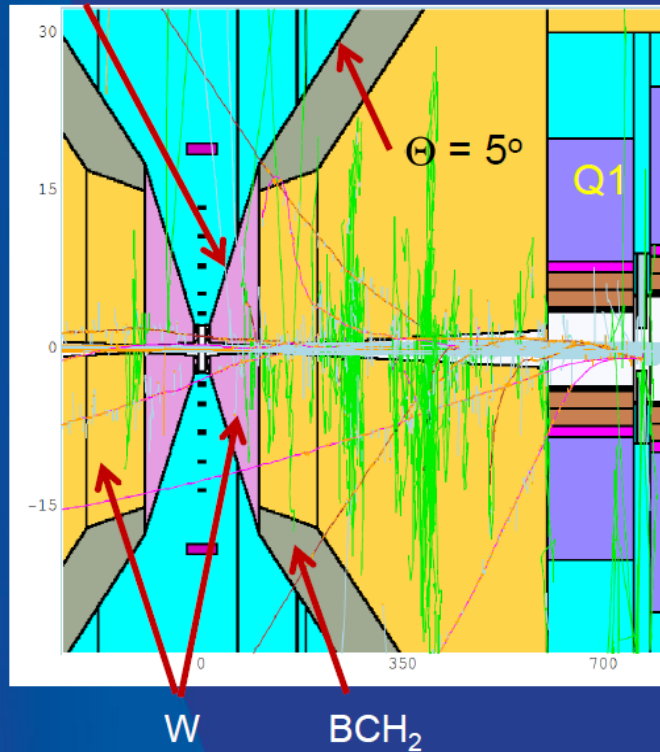
Neutron peak/yr = $0.1 \times \text{LHC} @ 10^{34}$



Nozzle Optimization

Tungsten Nozzle in BCH₂ Shell

$\Theta = 10^\circ$ $6 < z < 600$ cm $x:z = 1:17$



1. Minimize it ($20^\circ \rightarrow 10^\circ$)

- Top production in forward regions as CoM energy goes up
- Asymmetries are more pronounced in forward regions
- $Z' \rightarrow t\bar{t}$
- Final states with many fermions (e.g. SM $t\bar{t}$ events) are hardly ever contained in the central detector

2. Instrument it

- Forward calorimeter
- Lumi-cal a'la ILC (40-140 mrad) for precise measurement of the int. luminosity ($\Delta L/L \sim 10^{-3}$)
- Beam-cal at smaller angles for beam diagnostics

Reducing Weight Fluctuations

Last weeks are working on minimization of statistical weight spread. Fluctuations come predominantly from electromagnetic showers (bremsstrahlung and pair production). Looking for an optimal combination of exclusive and inclusive modes. Some progress.

Hope, within two weeks, to generate new files to feed detector modeling.