IFR Background Status

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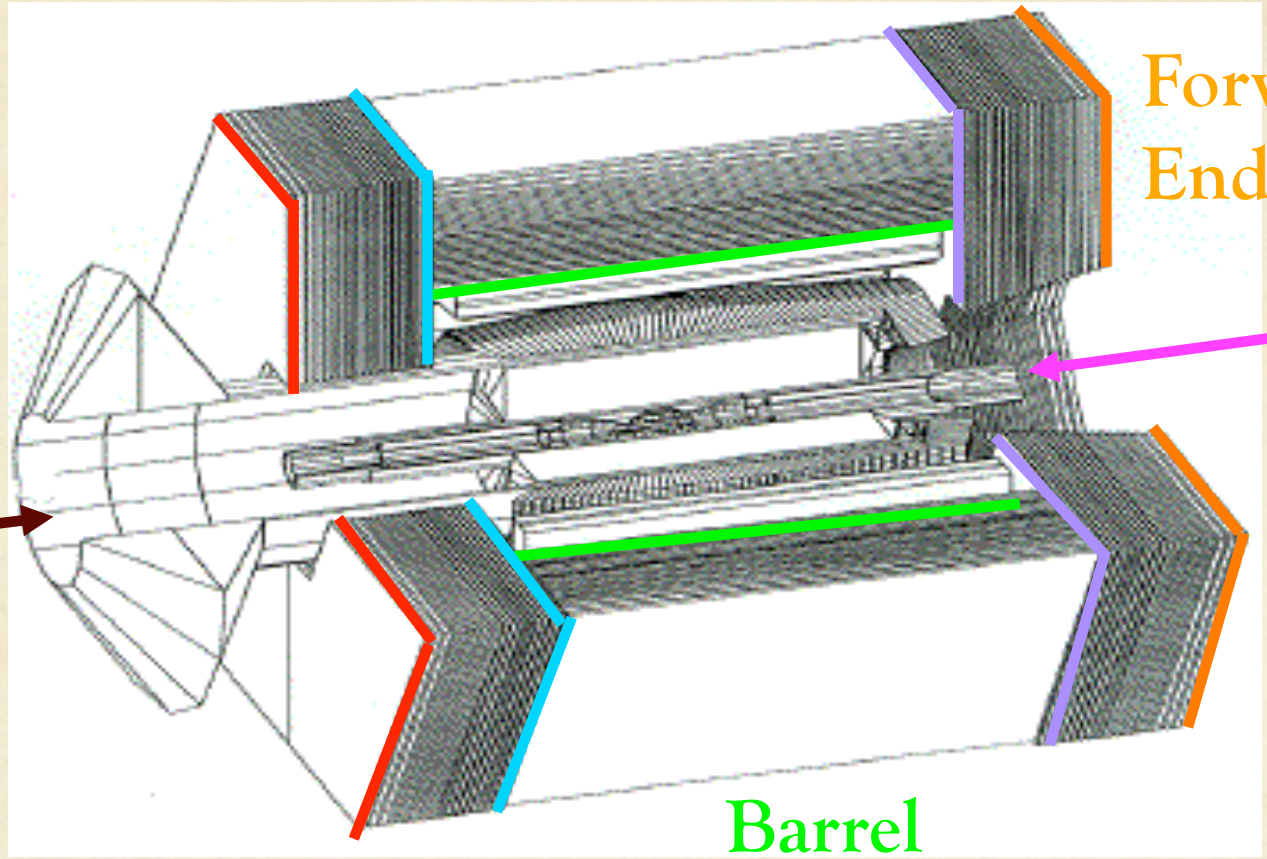
1st SuperB Collaboration Meeting

Hot regions



Barrel: innermost layers, mostly neutrons and photons

FWD encaps (hottest region) : inner layer and outer layers (BEAM halo), neutrons, electron and photons

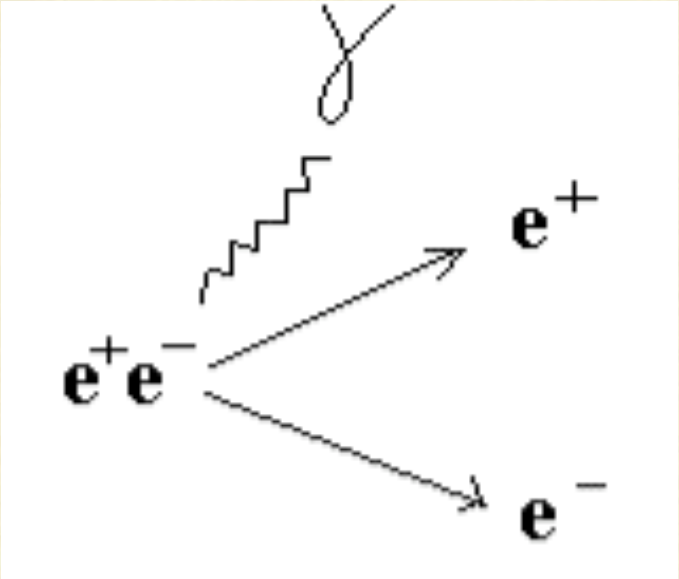
BWD encaps: inner layer and small radii

Outline

- Radiative BhaBha events (Elba 2011 production):
  - Study of the neutrons, photons and electron background crossing the IFR
  - Study of the the neutrons and electron background crossing the IFR FEEs boards

- Touschek scattering events:
  - Study of the neutrons, photons and electron background crossing the IFR

Radiative BhaBha background crossing the IFR detector



Why we don't like Radiative BhaBha:

This background scales with the luminosity

The high energy γ coming from radiative Bhabha strikes a beamline elements and showers secondaries with energies ranging from sub-MeV to several tens of MeV , including MeV-energy neutron producted via the giant dipole resonance

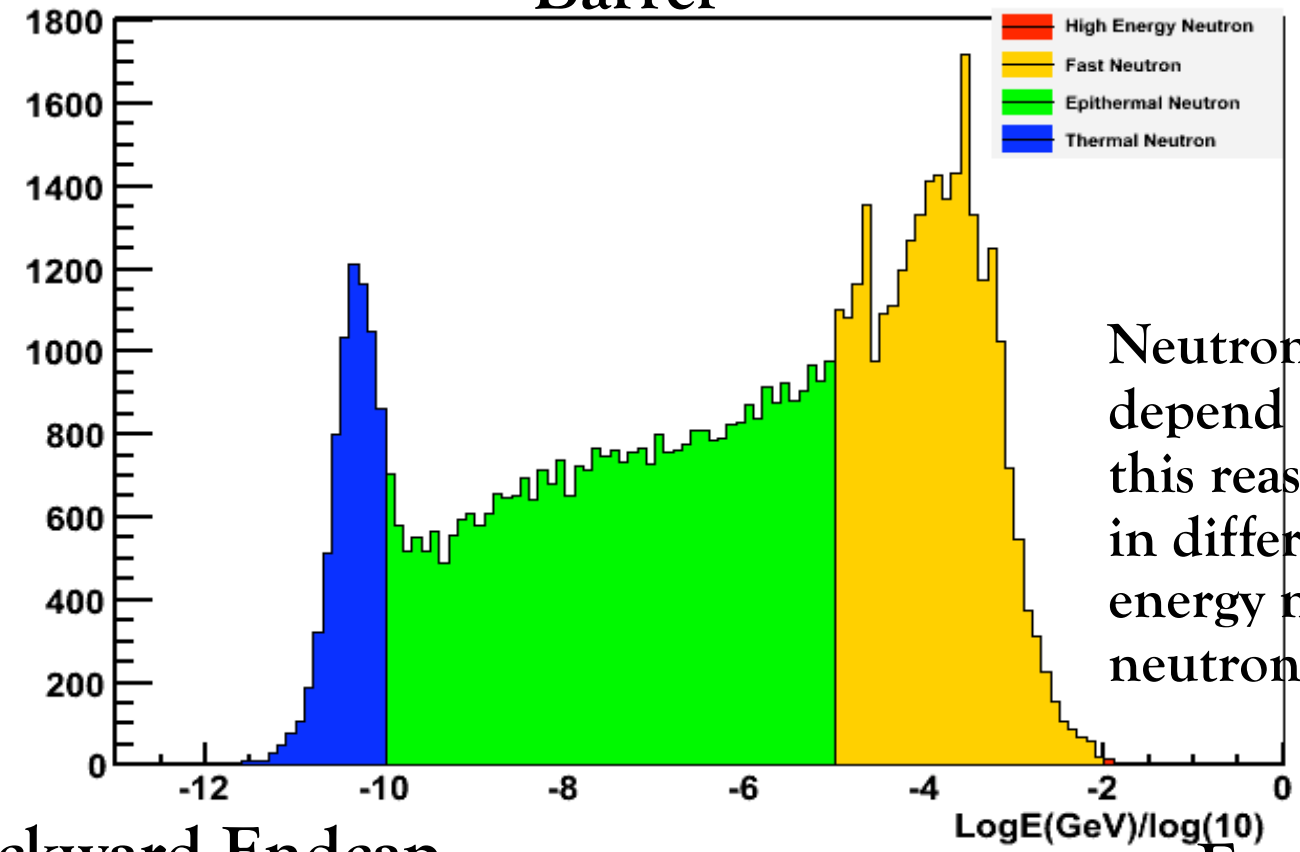
Neutrons

Why do we have to worry about neutrons

- Neutrons damage silicon devices →Neutrons damage SiPM
- The silicon damage function has a strong dependance on the energy spectrum therefore we scaled all the doses in this presentation to 1MeV equivalent accordingly to ASTM E 722 - 93.

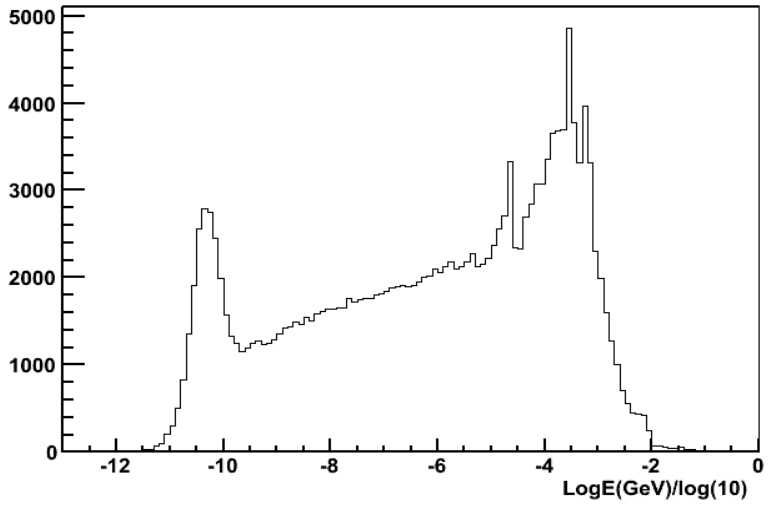
Neutron Energy Distributions

Barrel

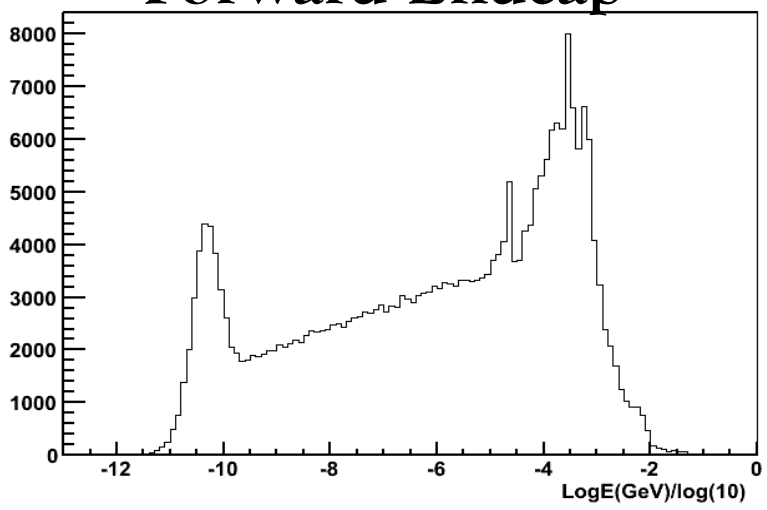


Neutron interactions strongly depend on their energy for this reason they are classified in different categories: high energy neutrons , fast neutrons et ...

Backward Endcap



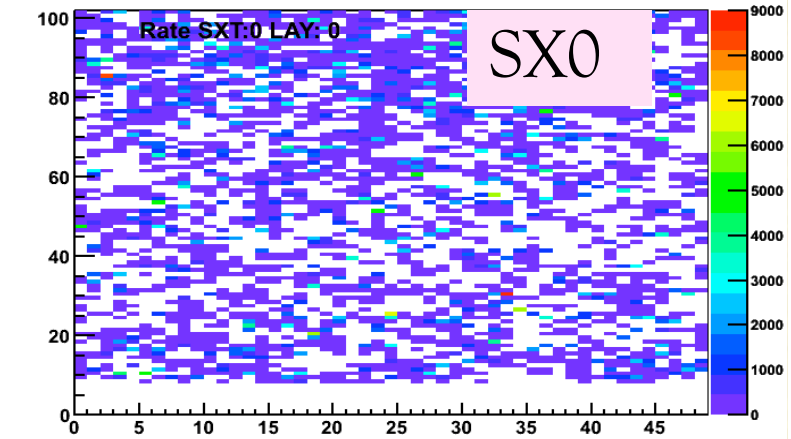
Forward Endcap



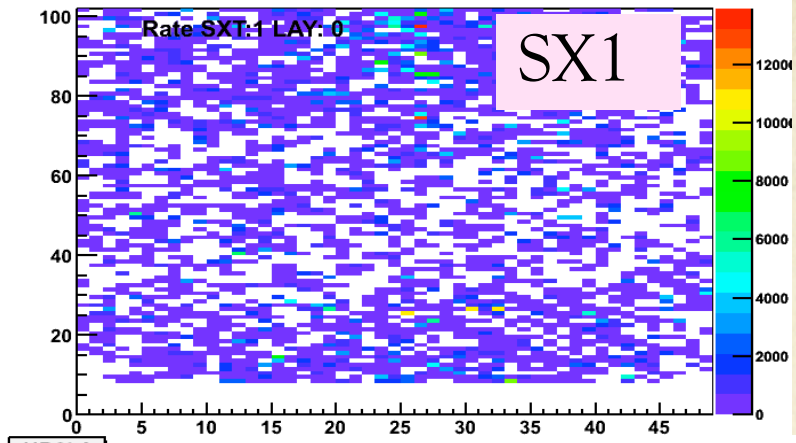
Rate Layer0: Barrel

Hz/cm^2

NB0L0



NB1L0



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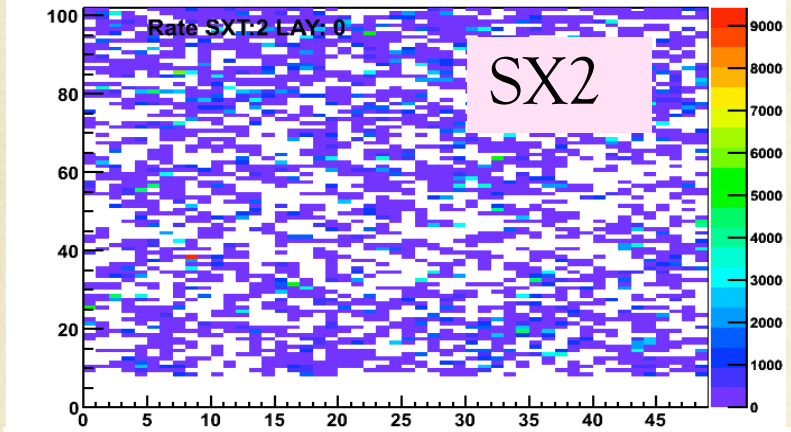

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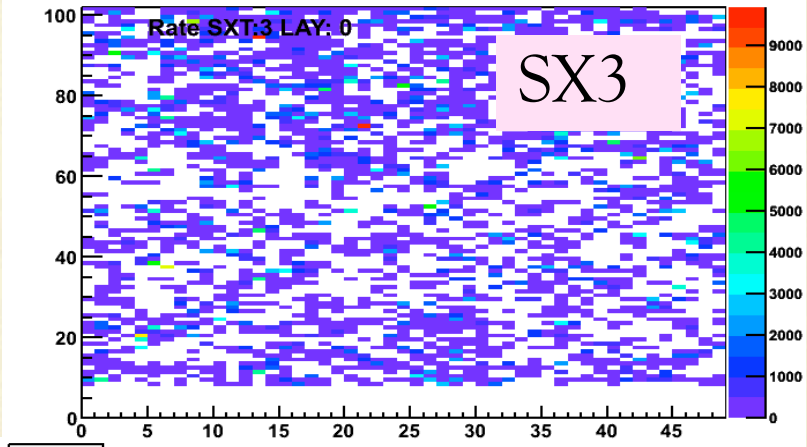
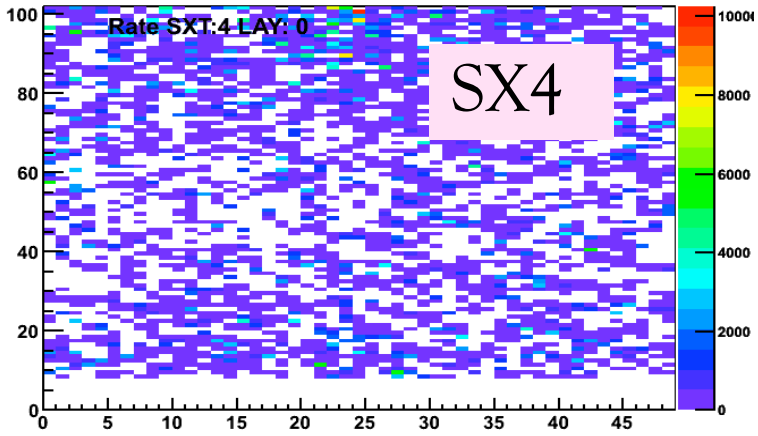
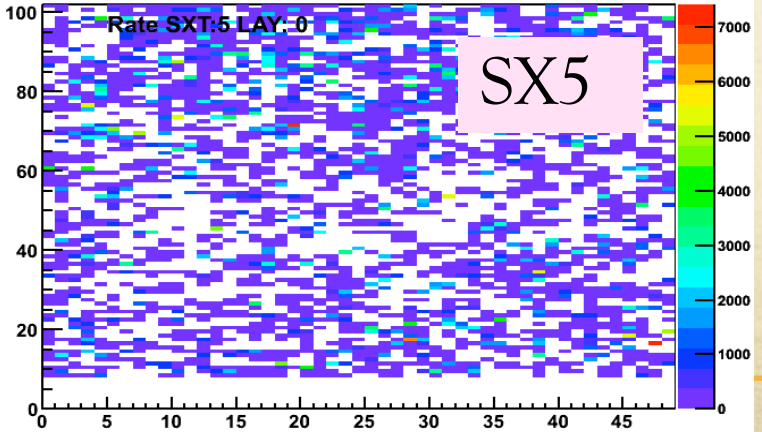
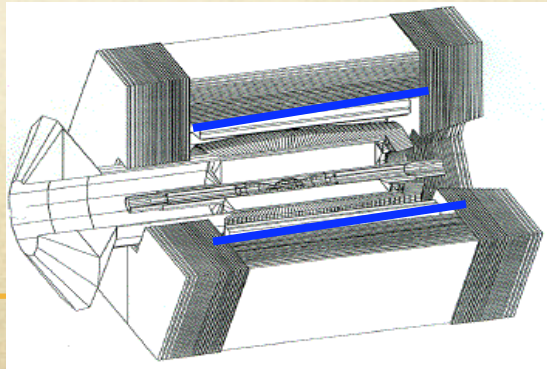


NB5L0



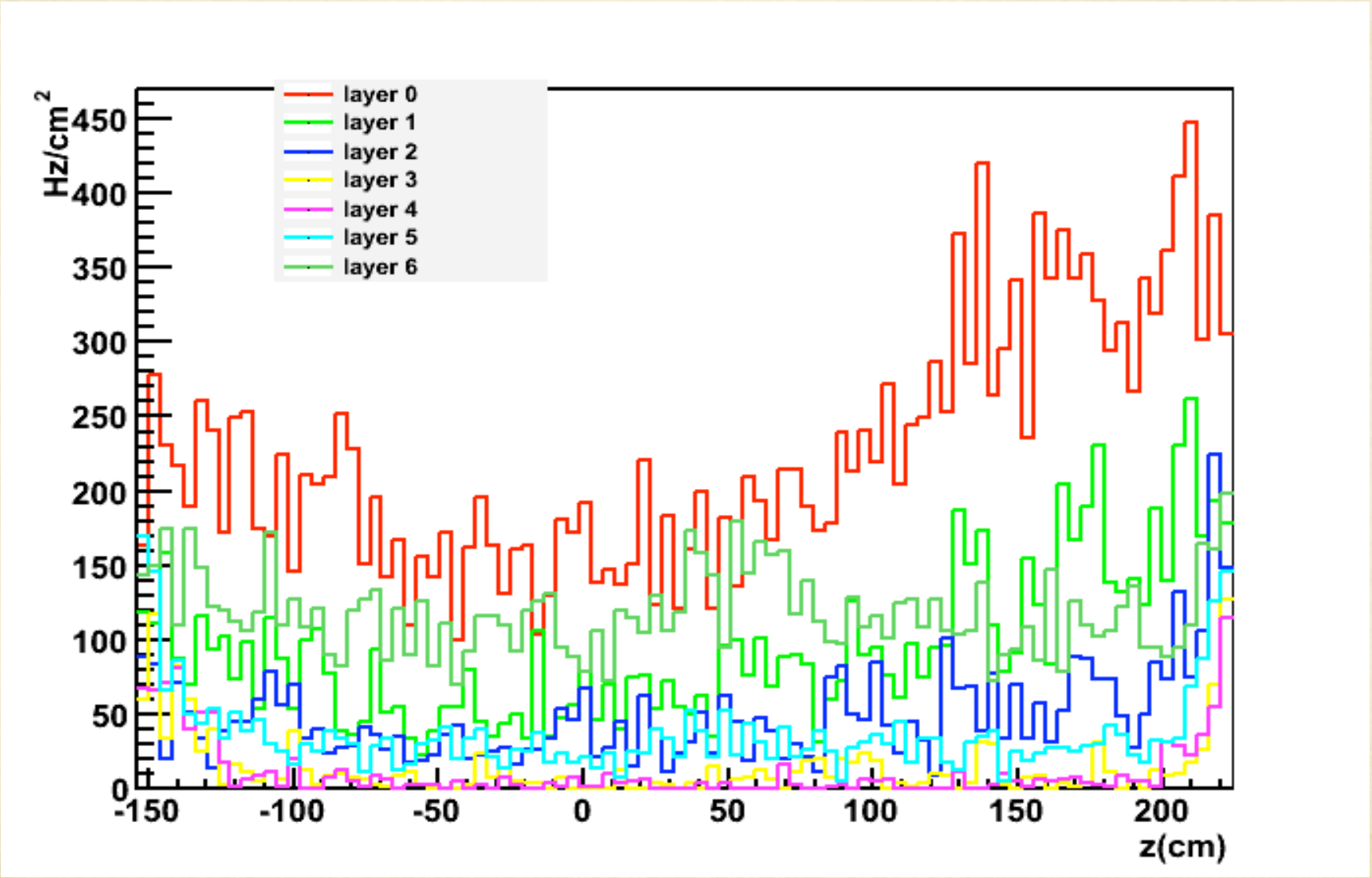


Normalized to 1MeV energy



Rate for Barrel Different layers

Rate vs Z-coordinate

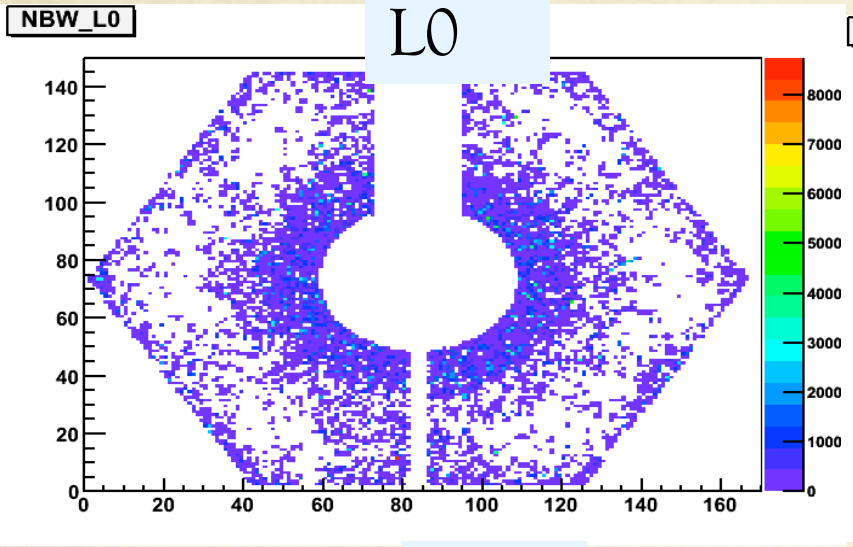


Rate of 450Hz/cm^2 -> about 3x10^9 neutrons/cm^2 for a year

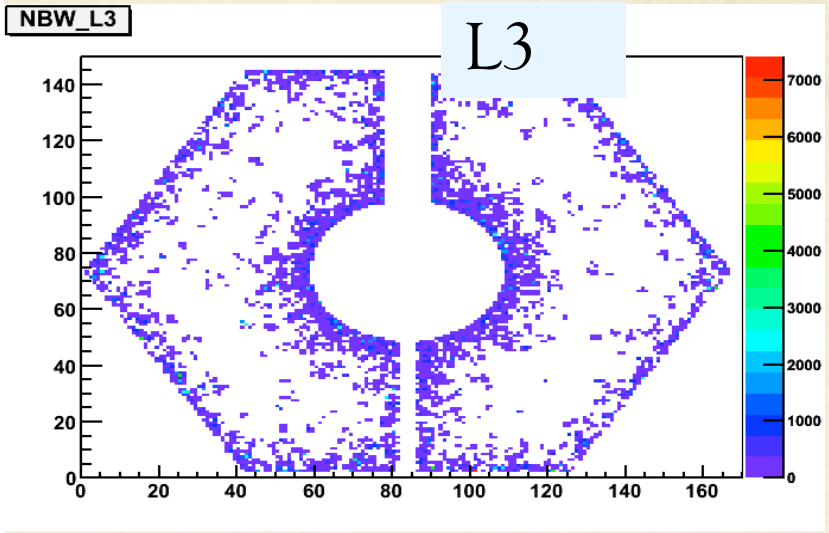
Endcap

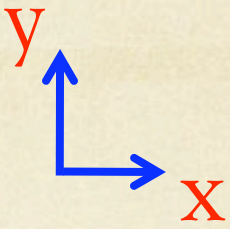
BWD ENDCAP

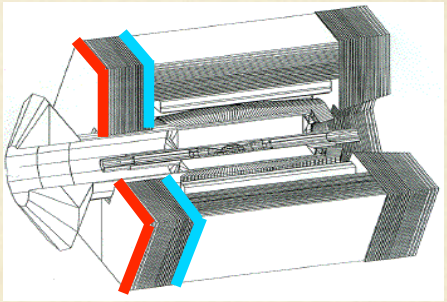
L0



L3

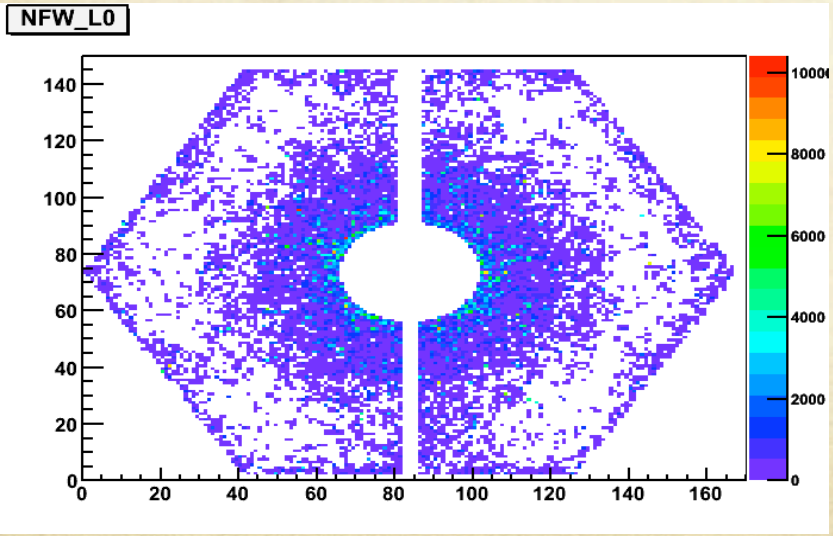




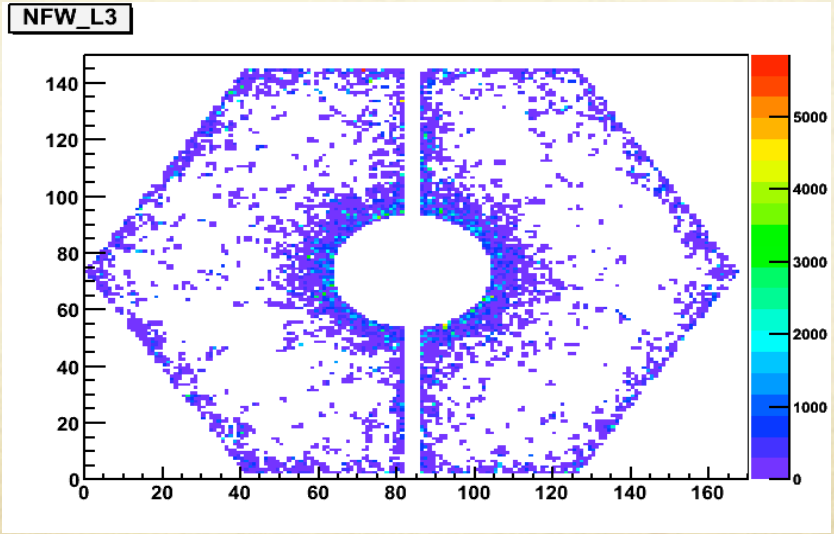


FWD ENDCAP

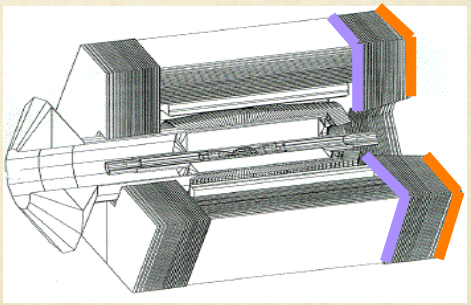
L0



L3

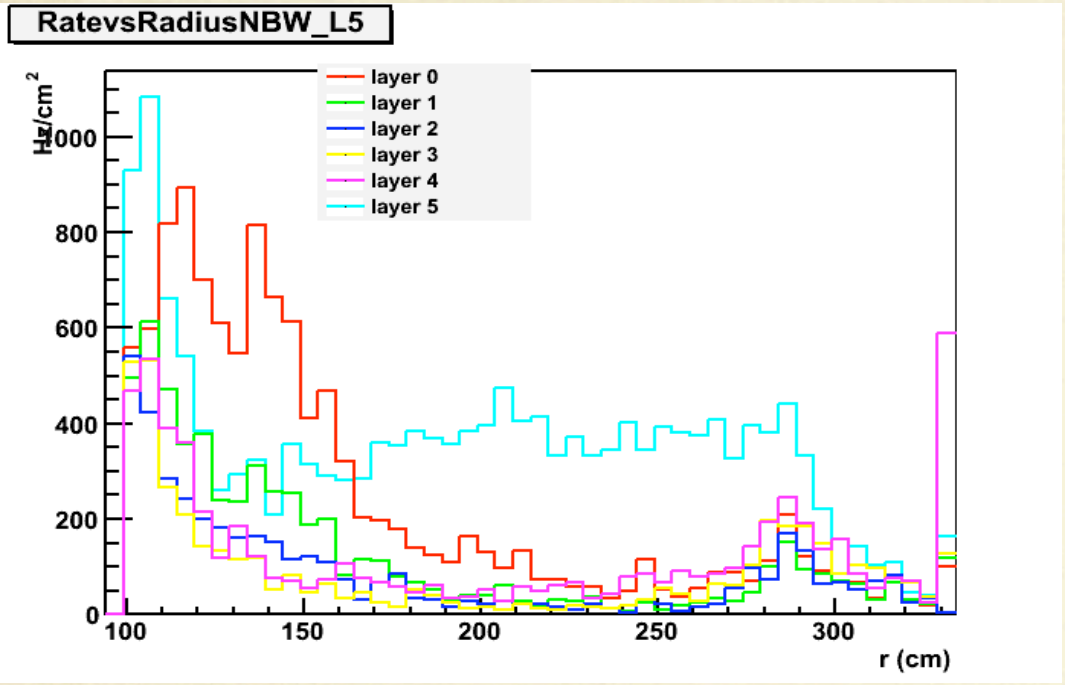


Normalized to 1MeV energy



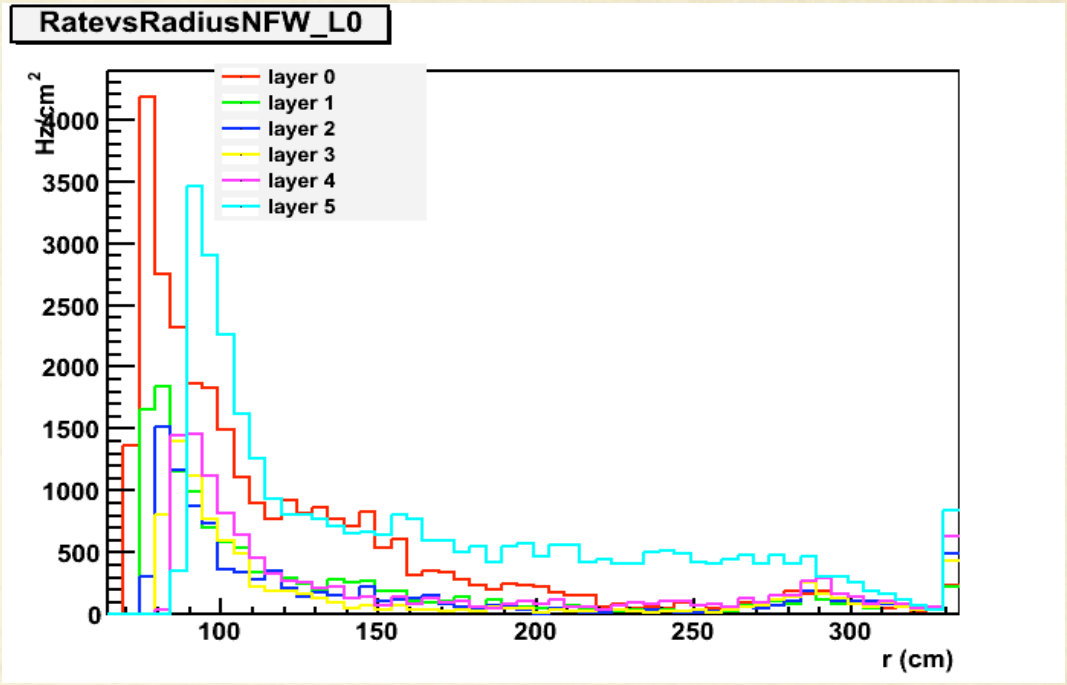
Rate vs Radius for Endcap for Different layers

BWD ENDCAP



Rate of 600Hz/cm^2 -> 4×10^9 neutrons for a year

FWD ENDCAP



Rate of 3000Hz/cm^2 -> 2×10^{10} neutrons for a year

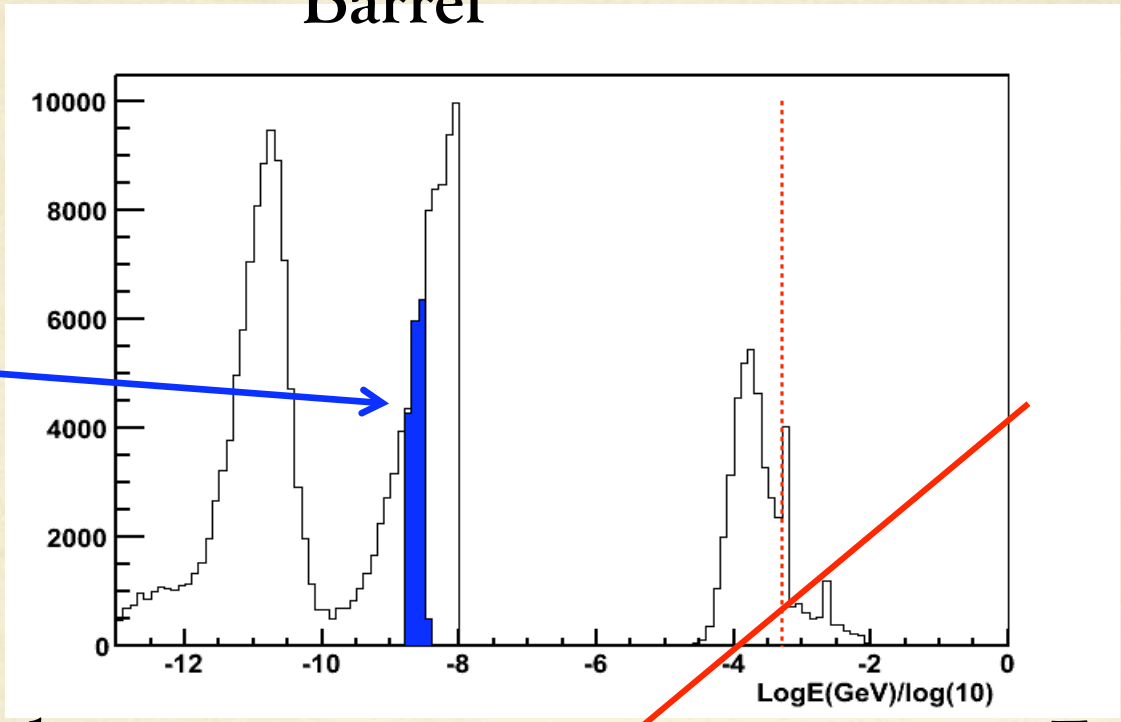
Photons

Why do we have to worry about photons

- High Energy Photons convert in e^+e^- that produce signal in the detector
- Visible photons can produce fake signal

Photon Energy Distributions

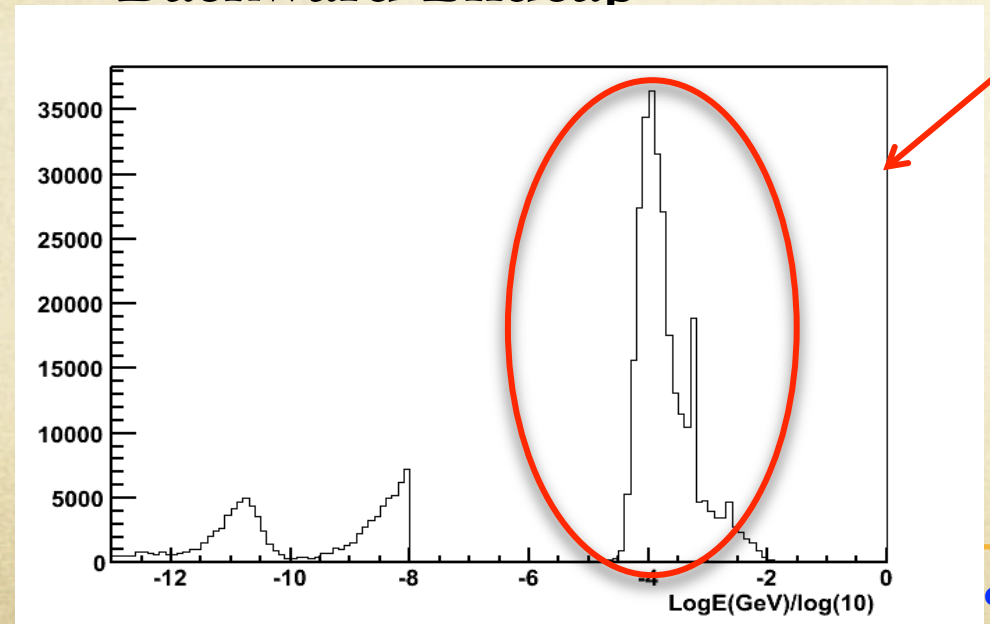
Barrel



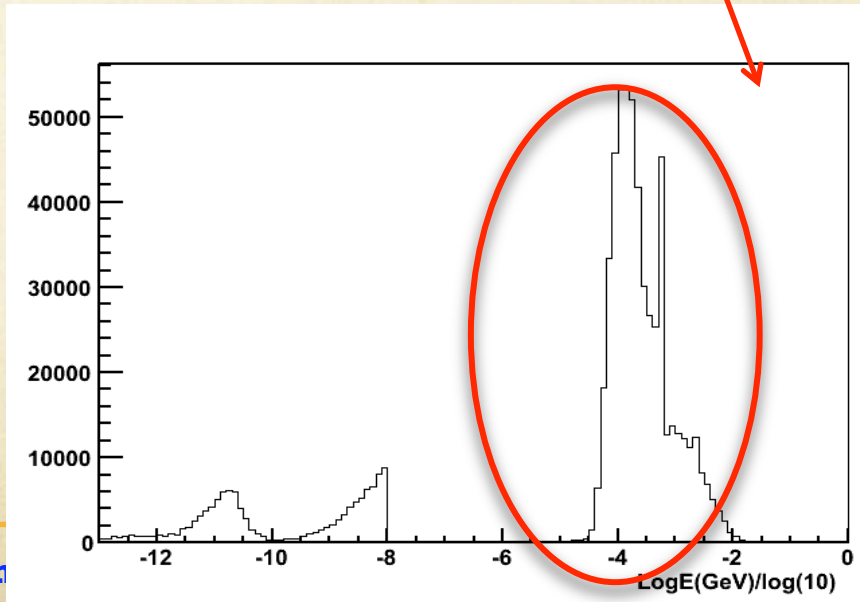
Visible Energy Range

High Energy photons more present in the Endcaps compared to the Barrel

Backward Endcap

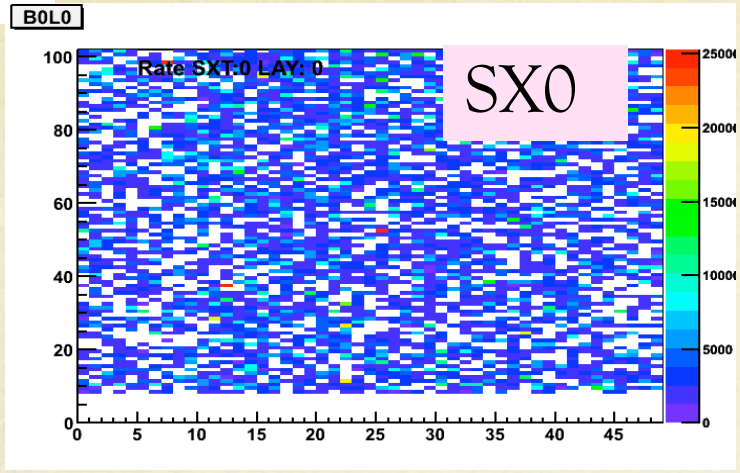


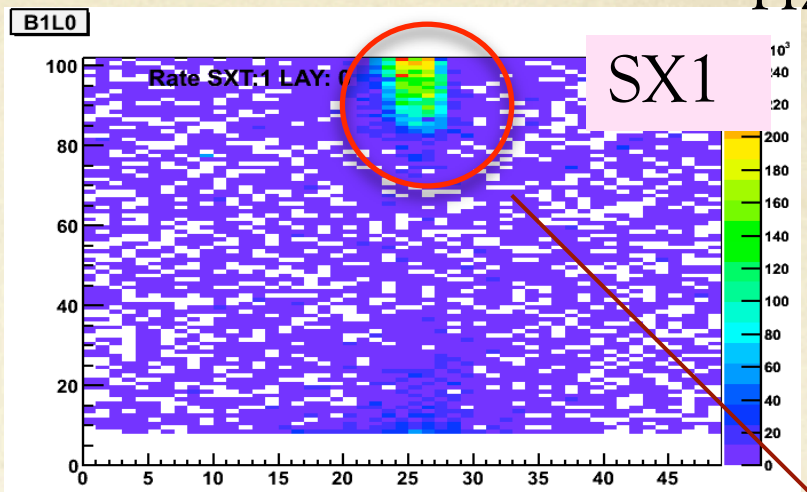
Forward Endcap

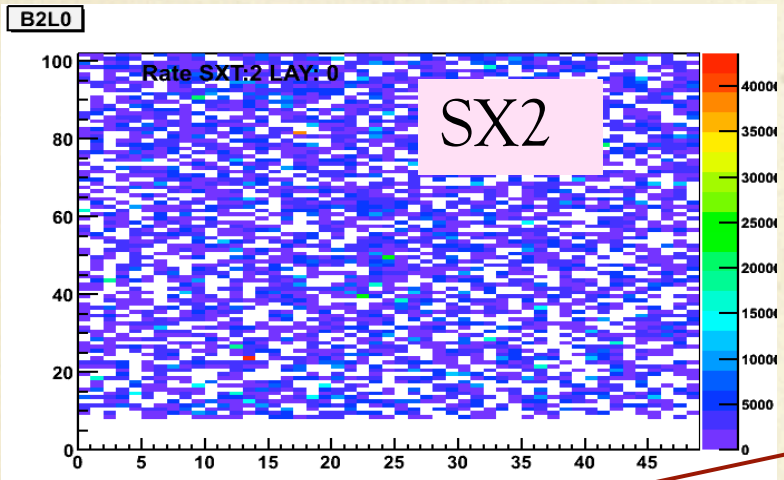


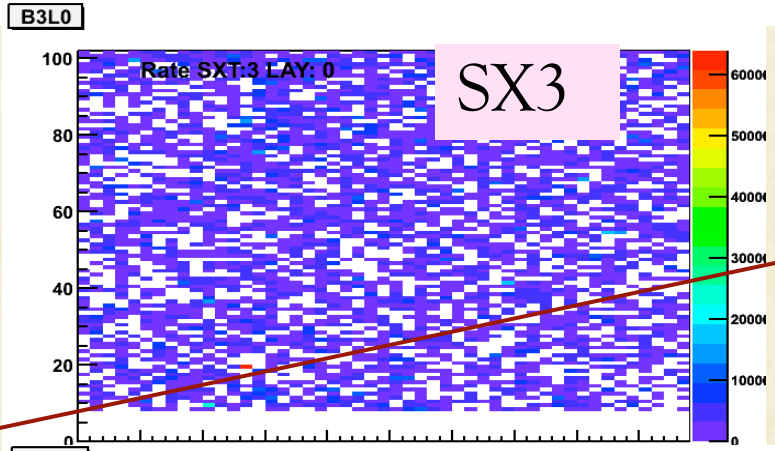
Rate for photons, Layer0: Barrel

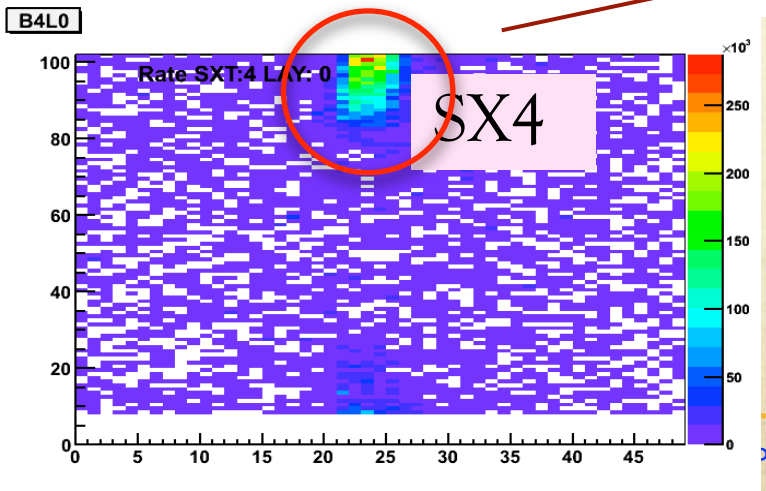
Hz/cm^2

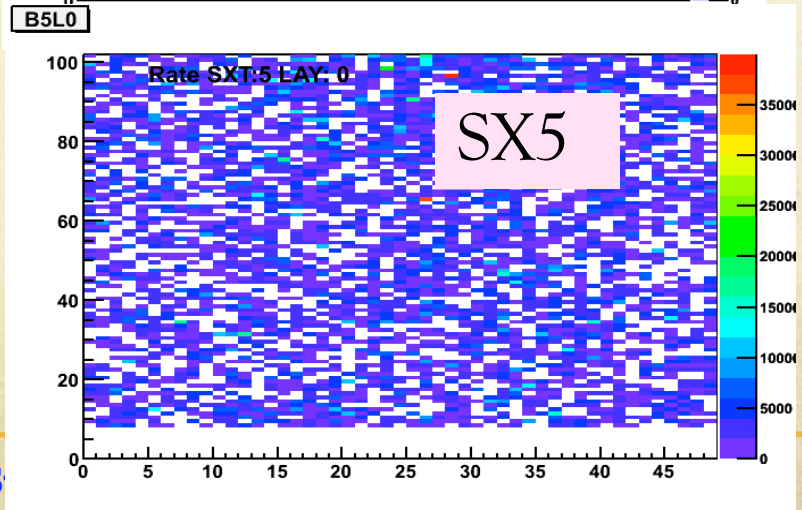








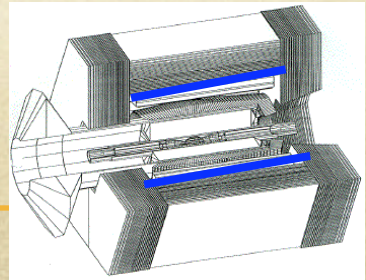




z

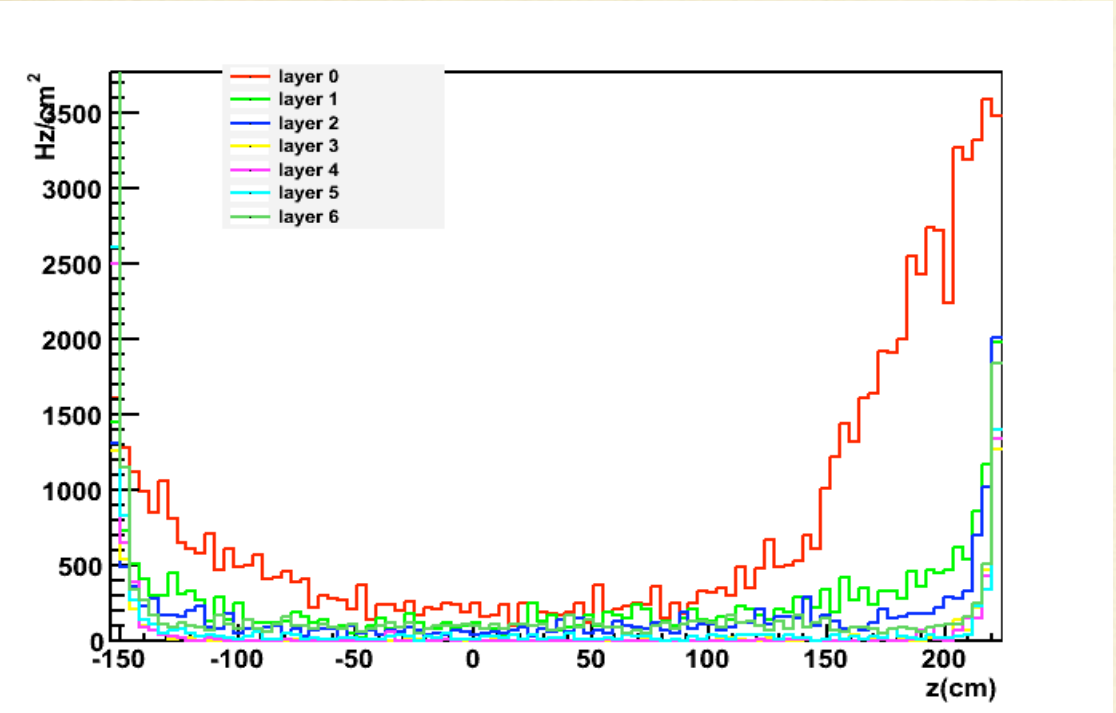
x

HOT SPOTS

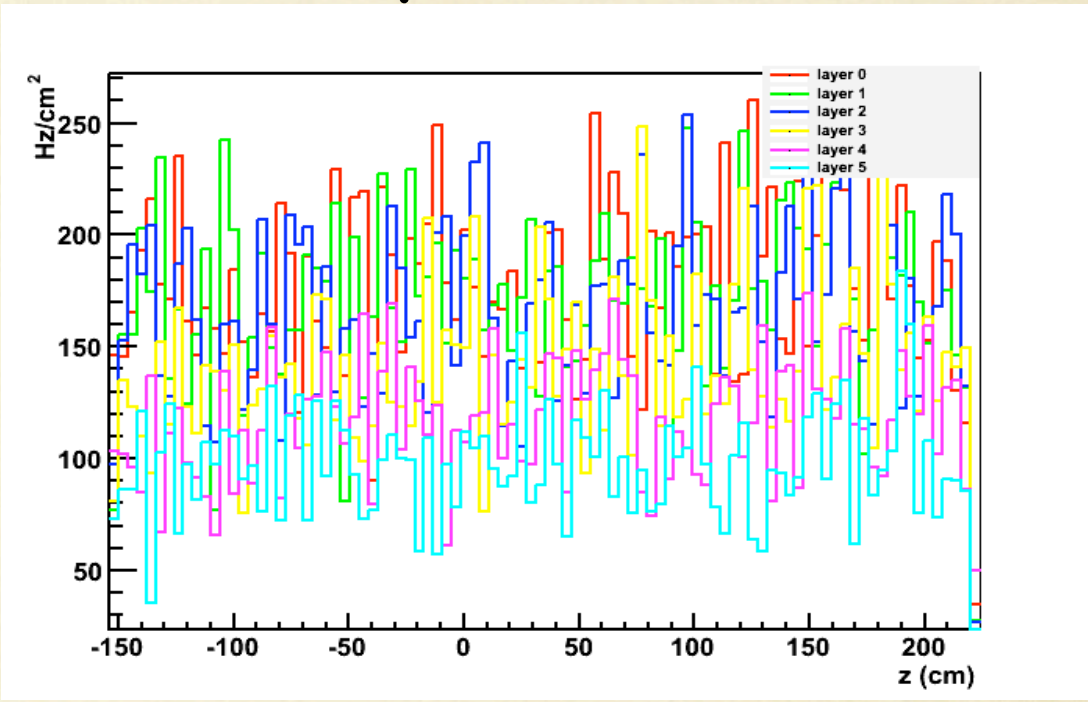


Rate for Barrel Different layers

Rate vs Z-coordinate for all the γ

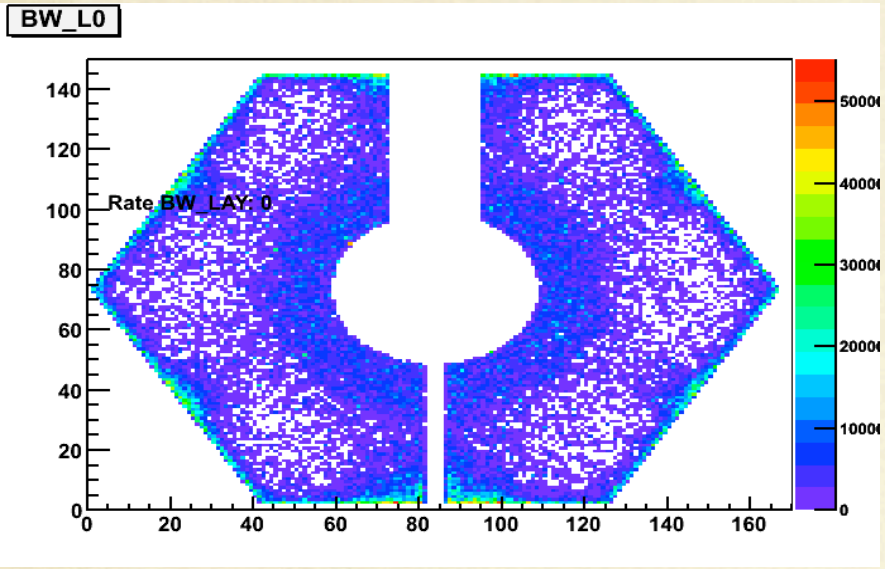


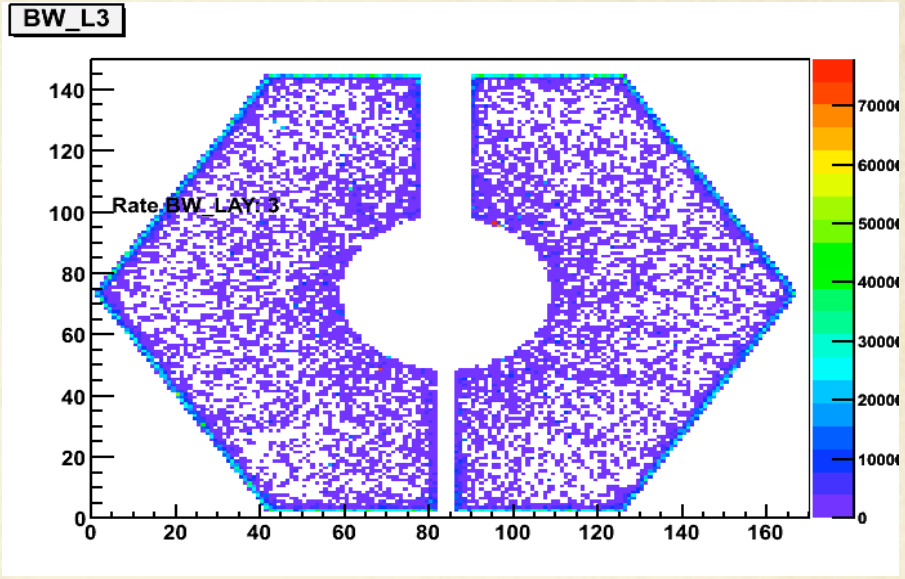
Rate vs Z-coordinate for visible γ

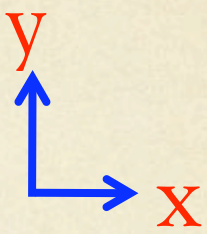


Endcap

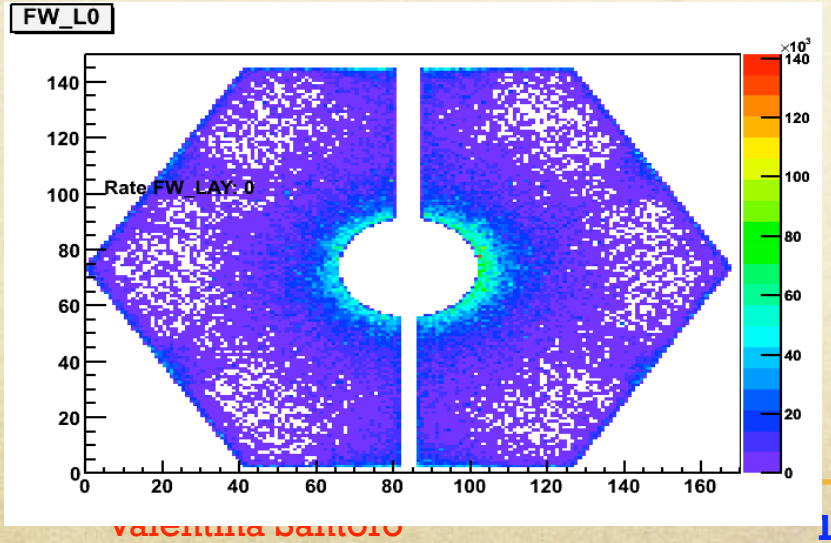
L0 **BWD ENDCAP** L3

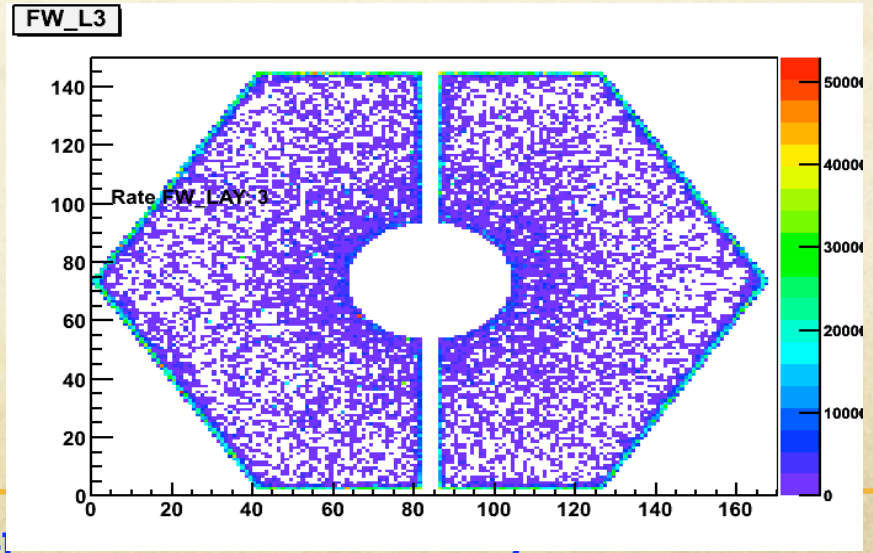






L0 **FWD ENDCAP** L3

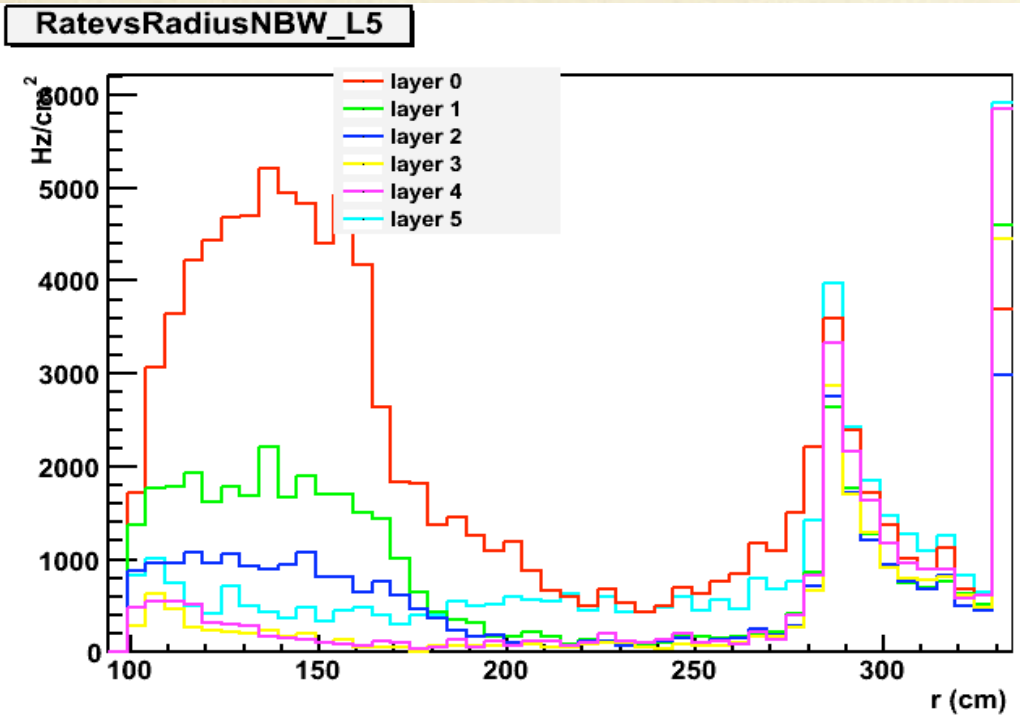




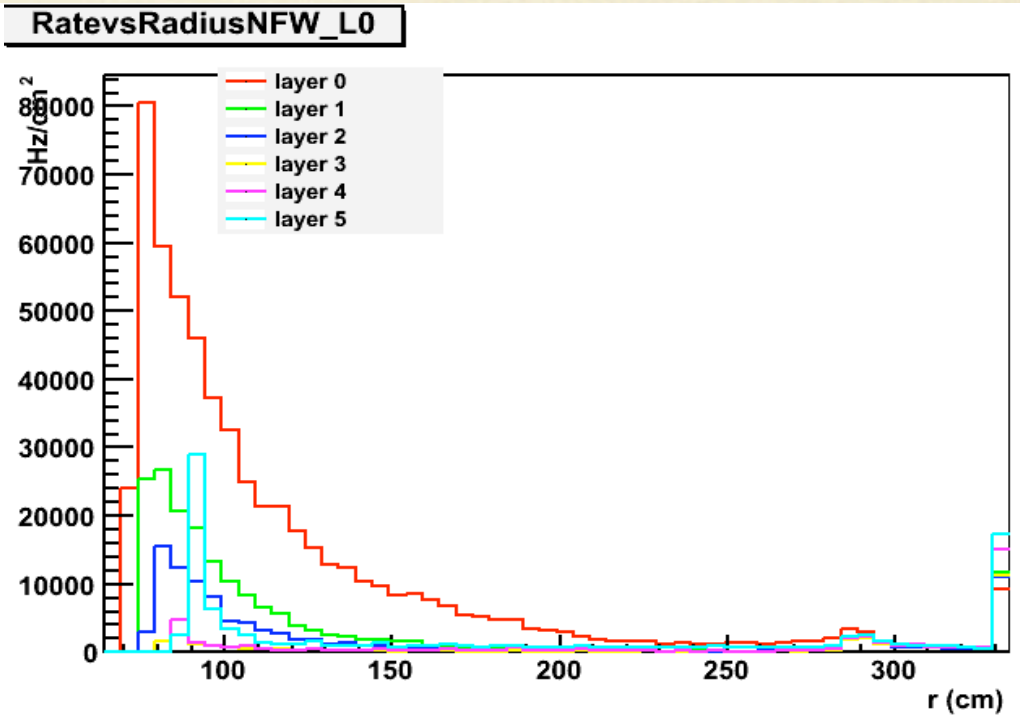
Rate for Endcap for Different layers

Rate vs radius

BWD ENDCAP



FWD ENDCAP



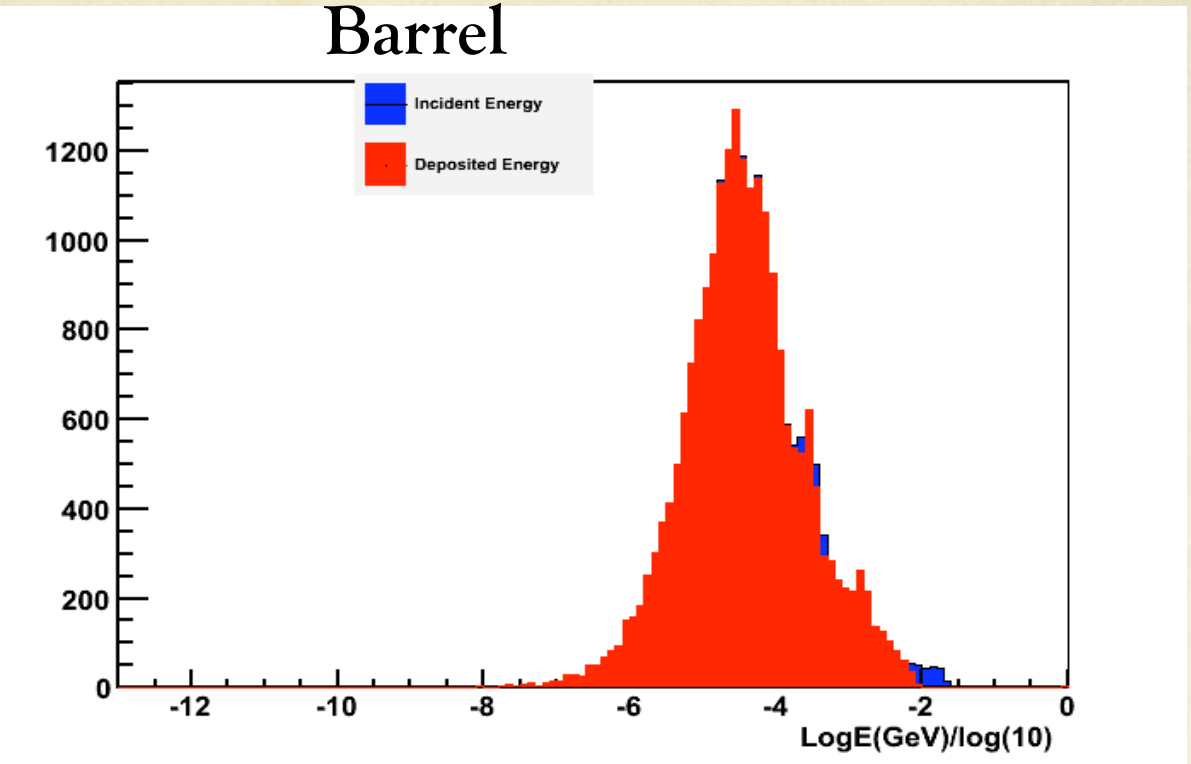
Electrons

Why do we have to worry about electrons

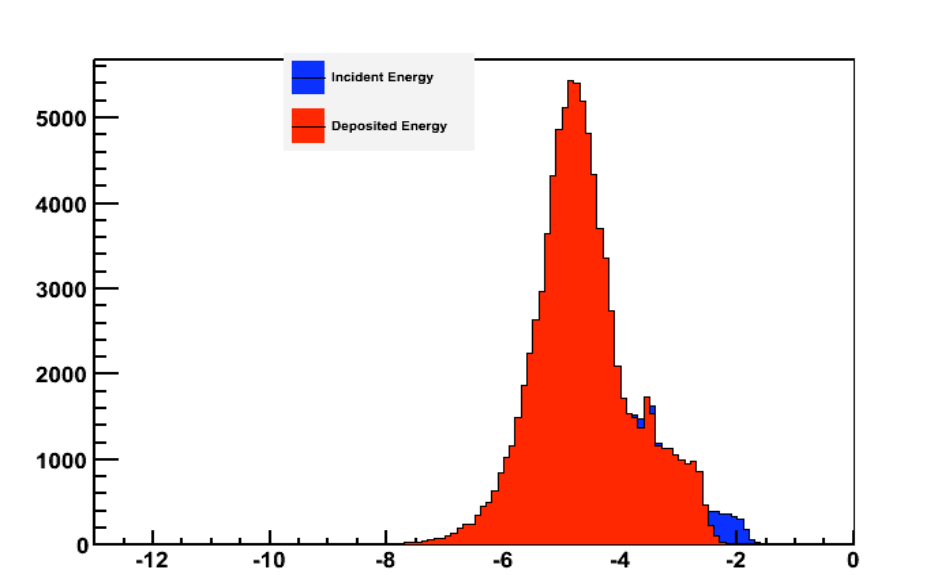
- Electrons are charged particle and can produce signals

Electron Energy Distributions

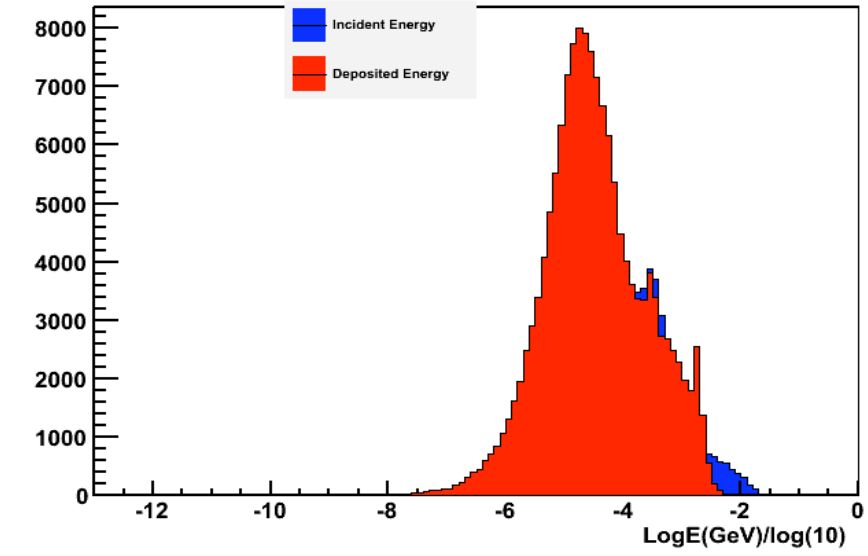
Barrel



Backward Endcap



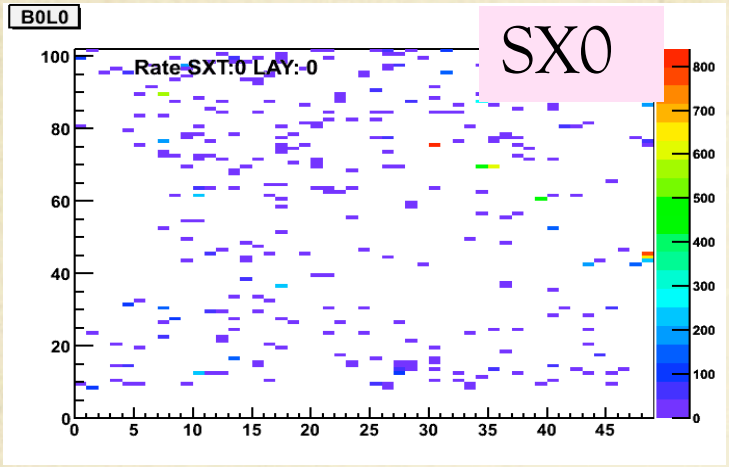
Forward Endcap

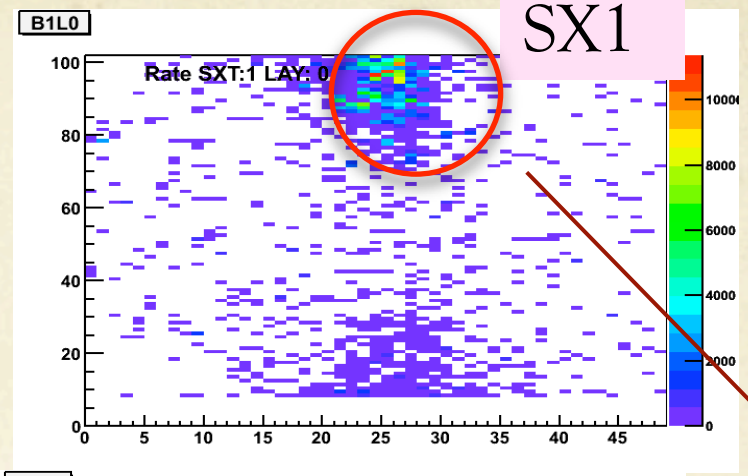


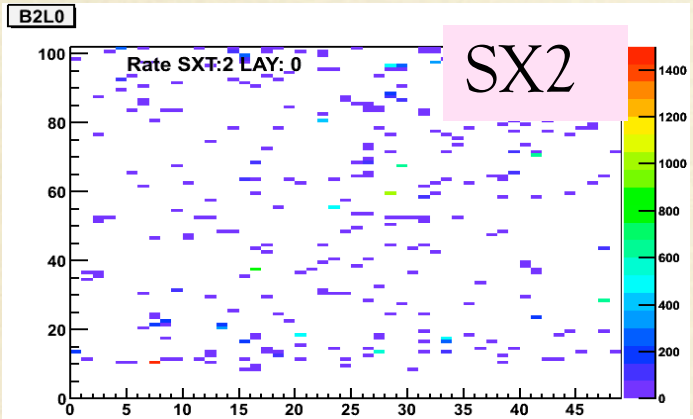
Collaboratio

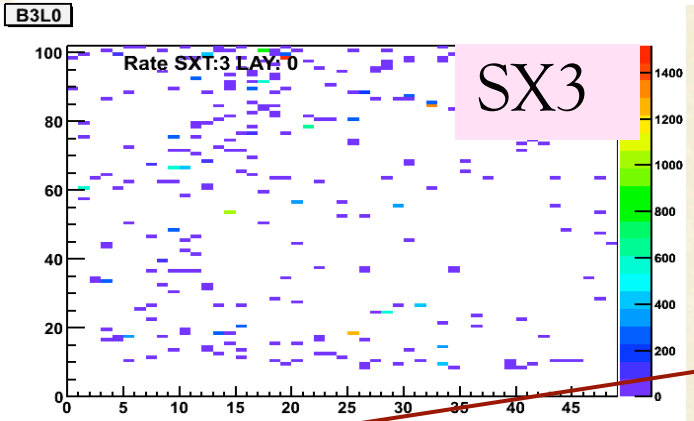
Rate for electrons, Layer0: Barrel

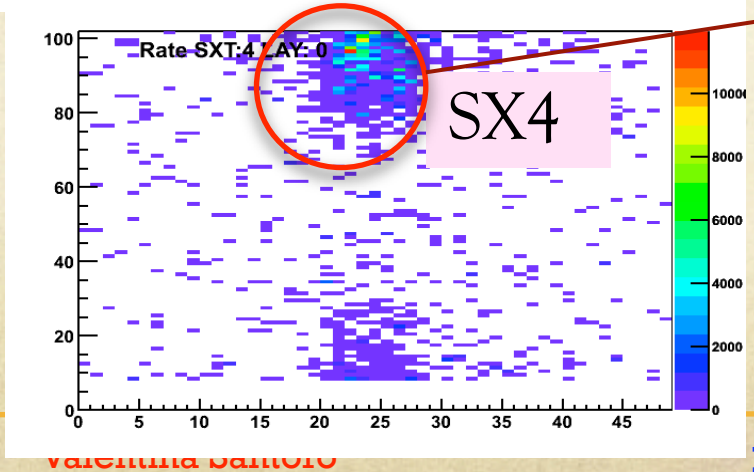
Hz/cm^2

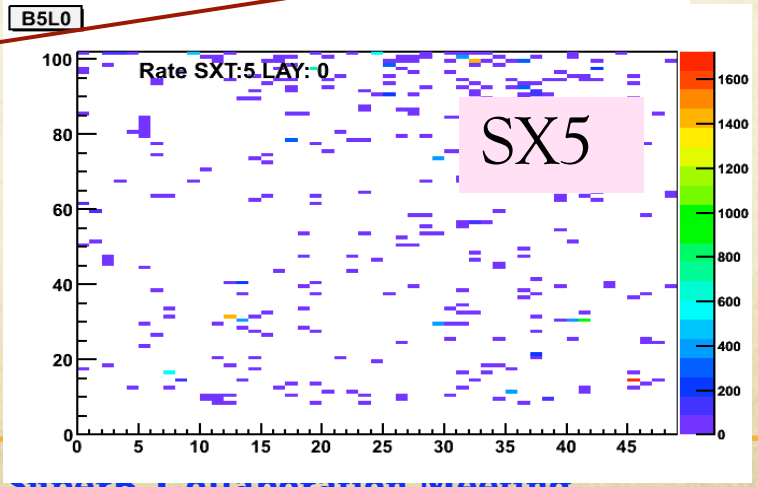


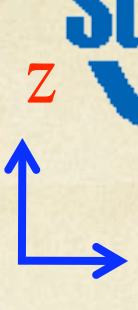




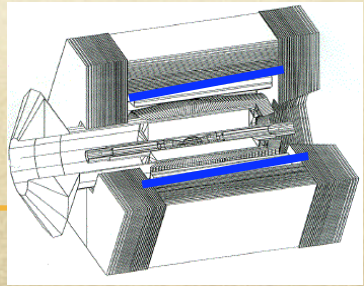






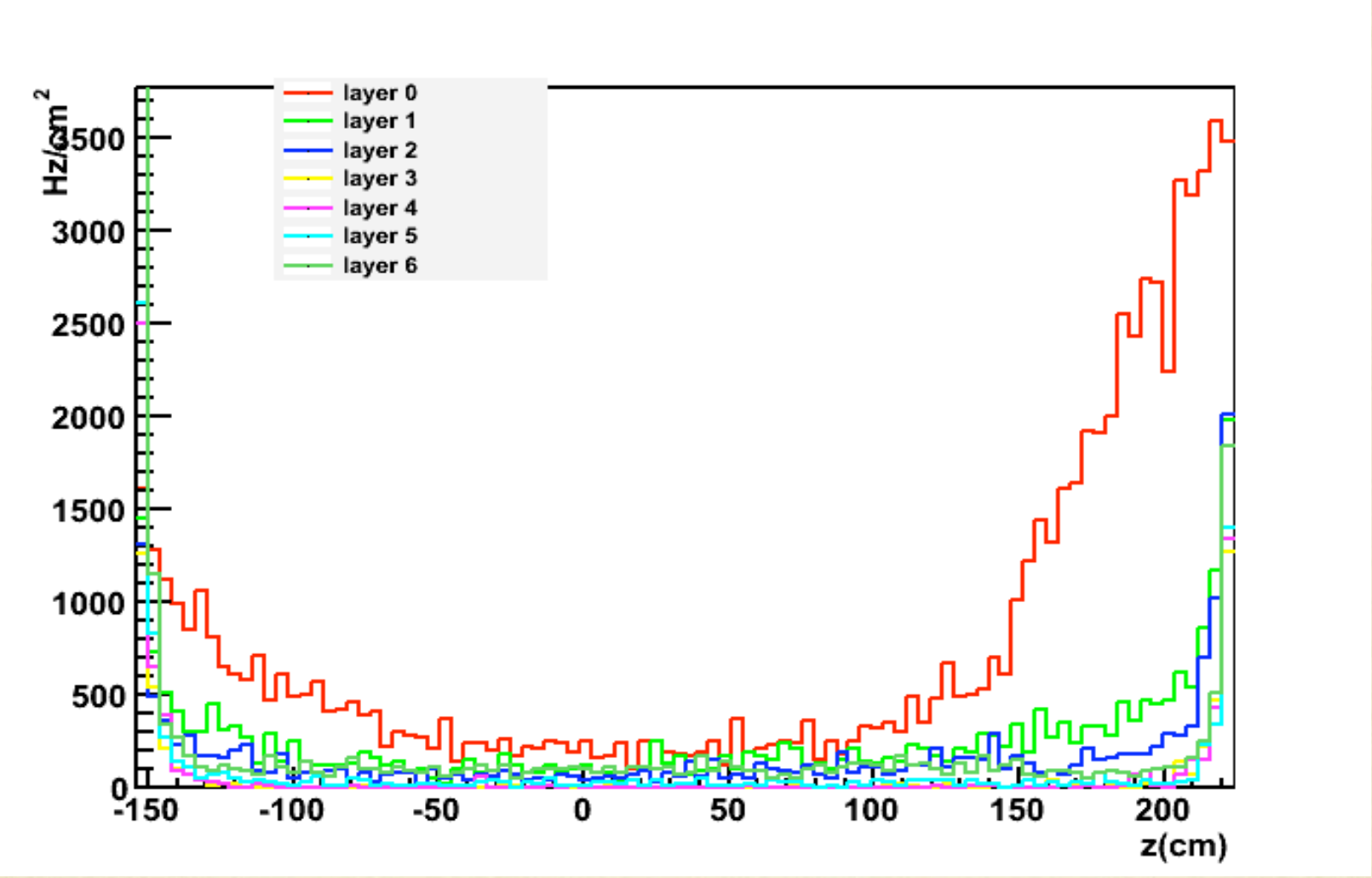


HOT SPOTS LIKE IN THE GAMMA CASE

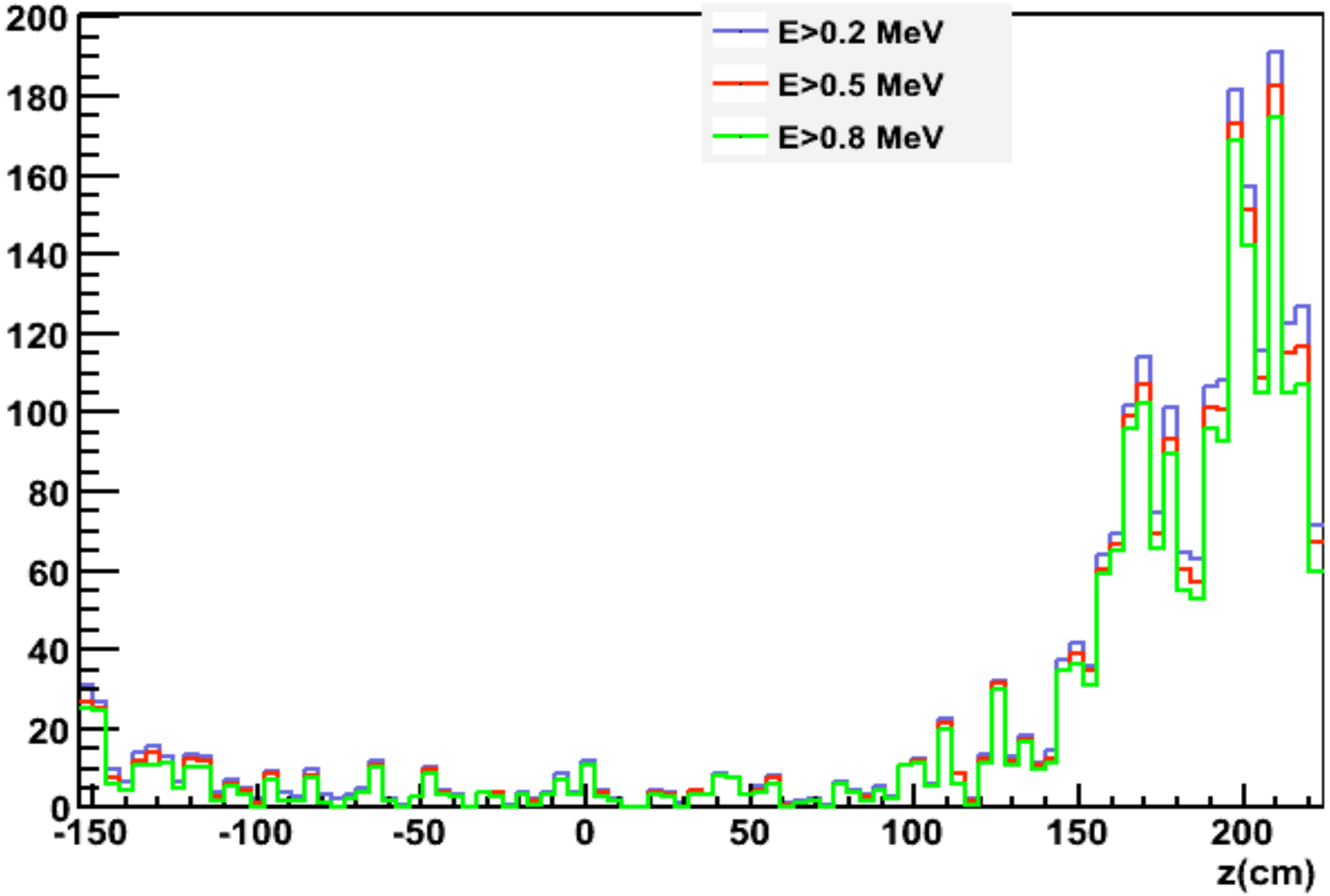


Rate for Barrel Different layers

Rate vs Z-coordinate



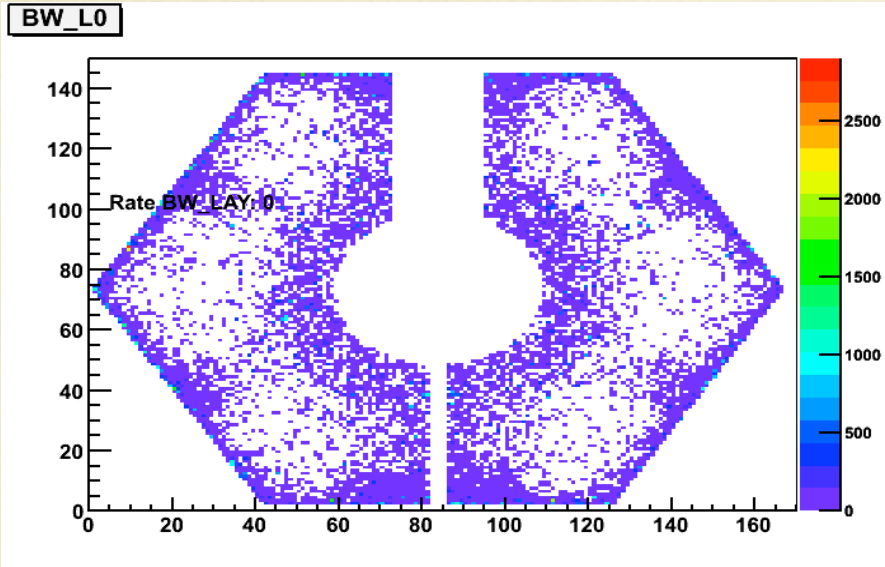
Rate for Layer0 Barrel
for different cut on the deposited Energy



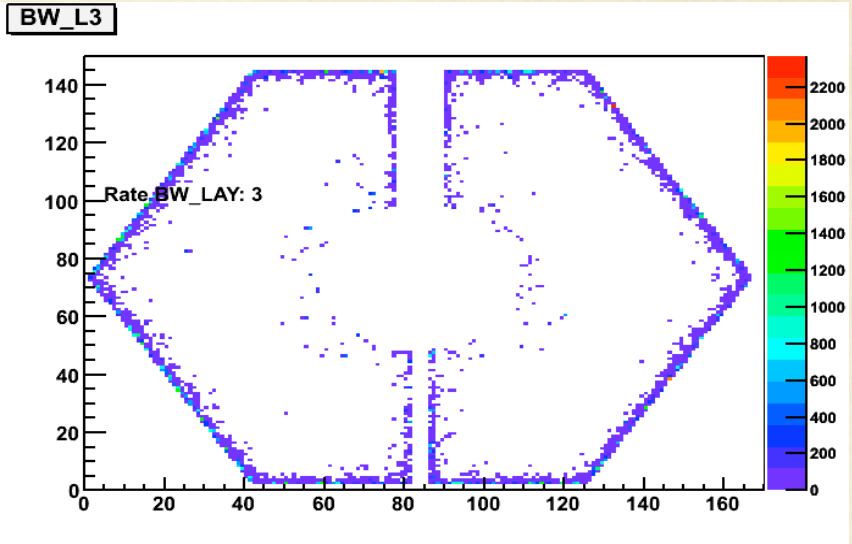
Endcap

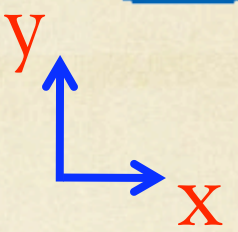
BWD ENDCAP

L0



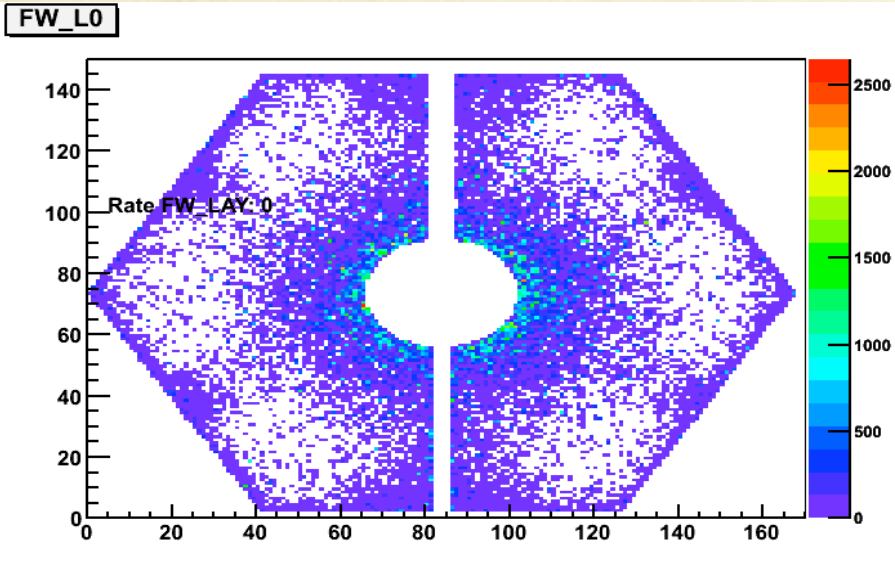
L3



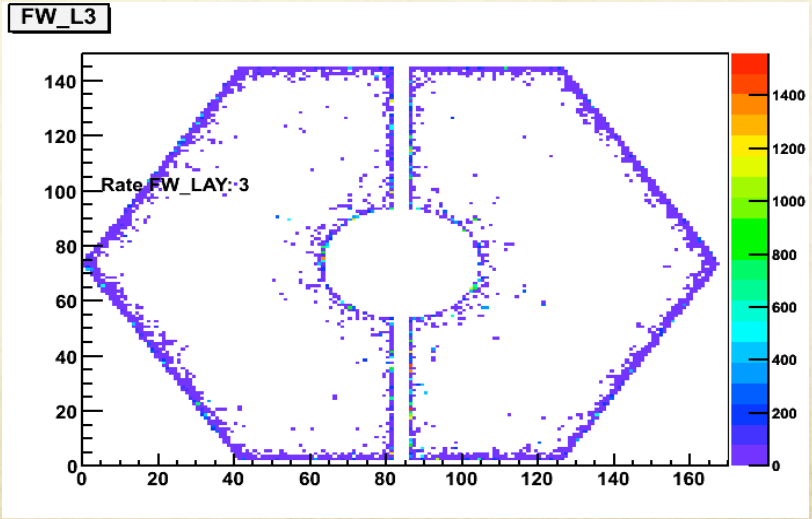


FWD ENDCAP

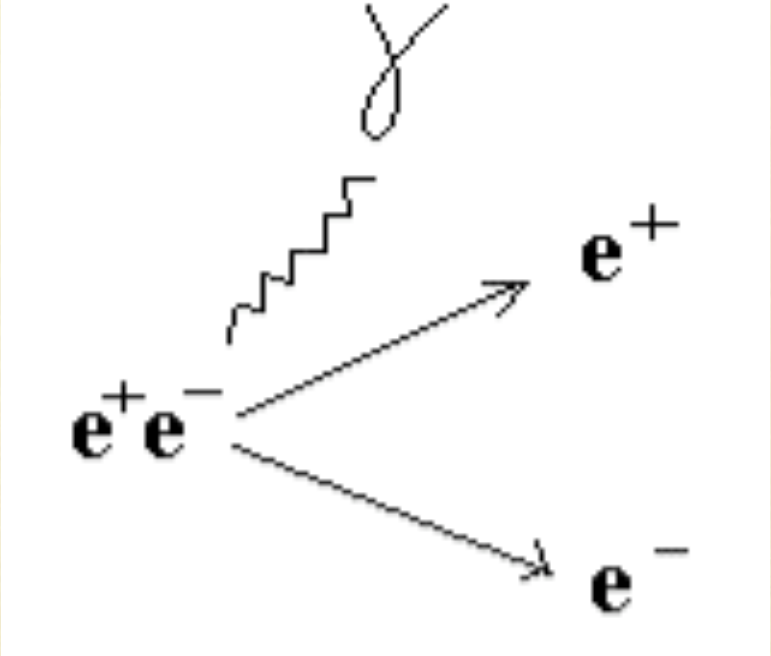
L0



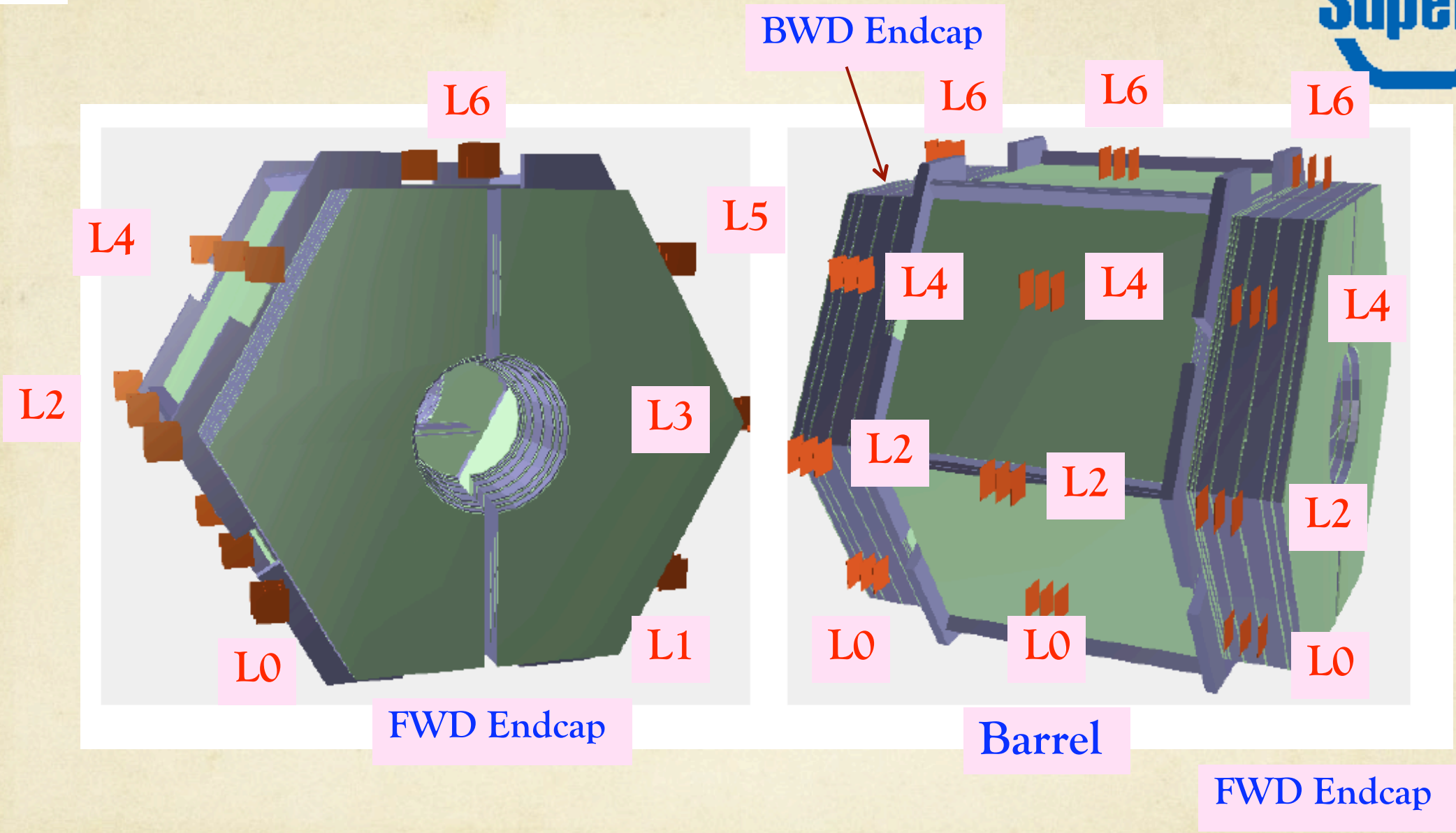
L3



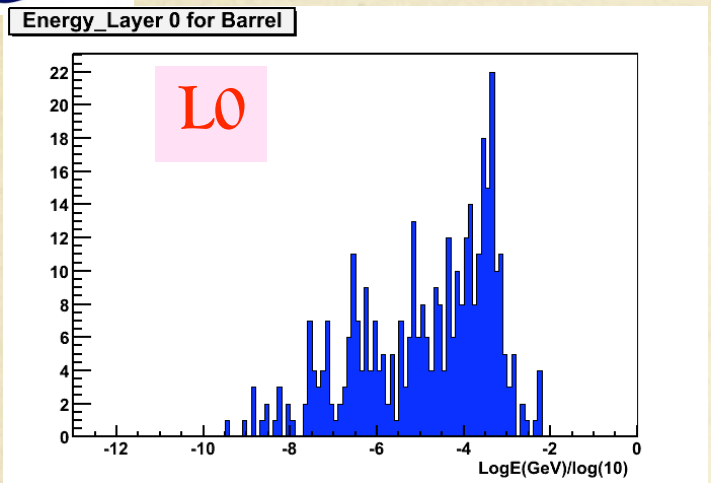
Radiative BhaBha background crossing the IFR FEE boards

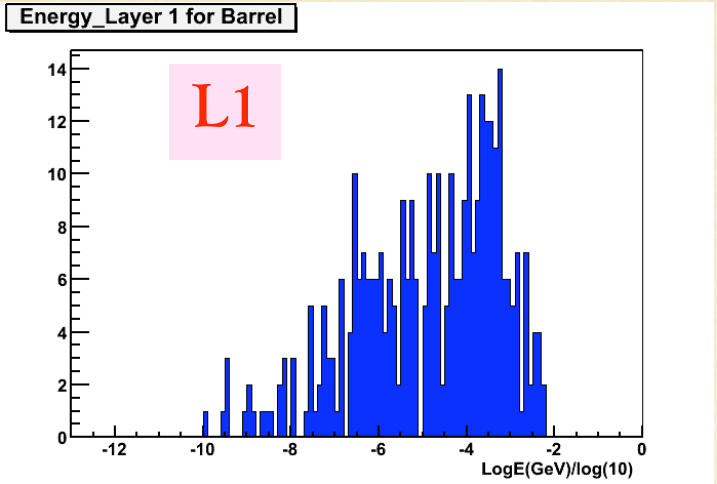


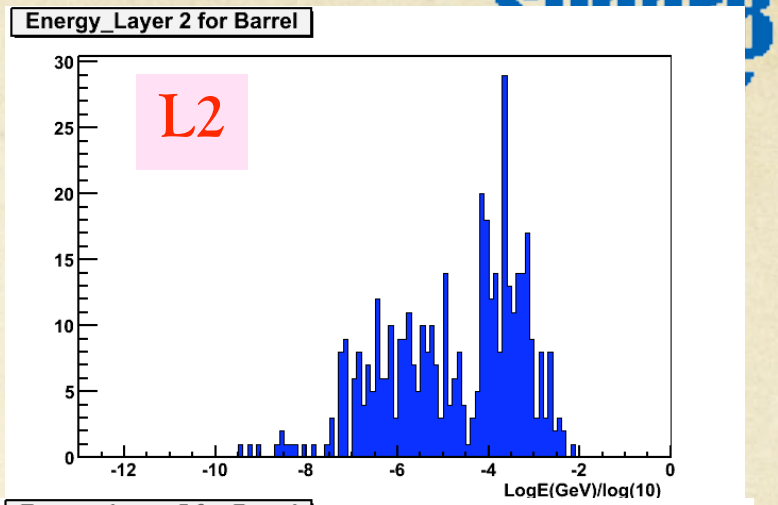
Present layout of the IFR crates

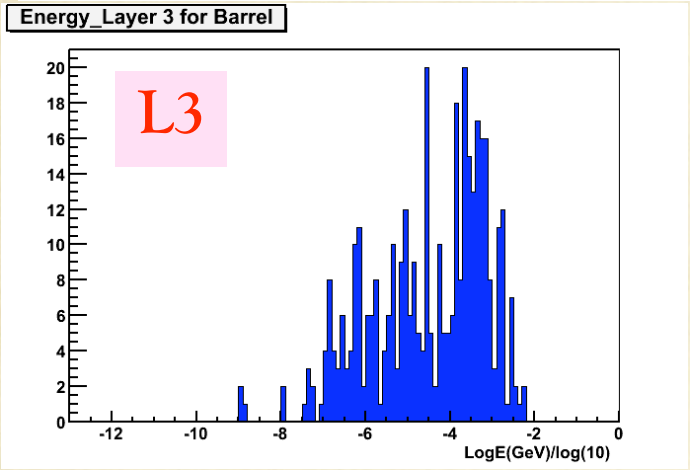


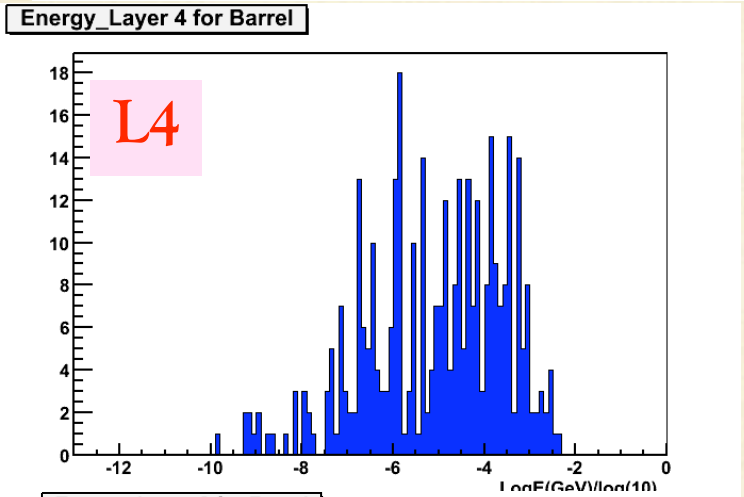
Neutron Energy Distribution for Barrel Electronics

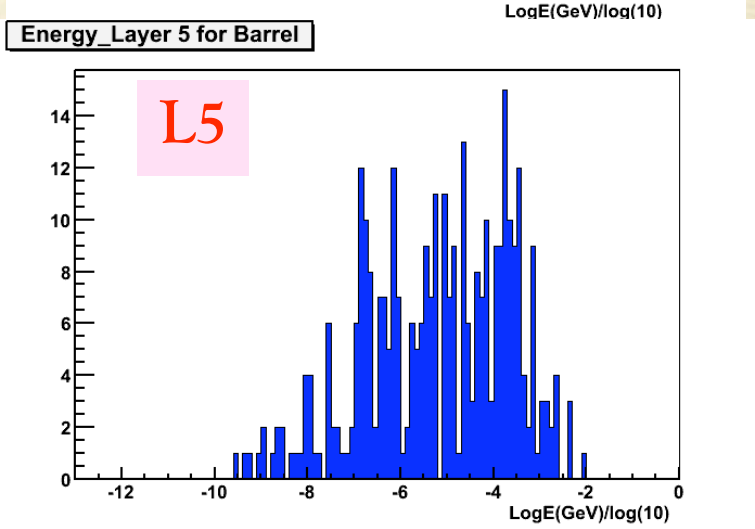


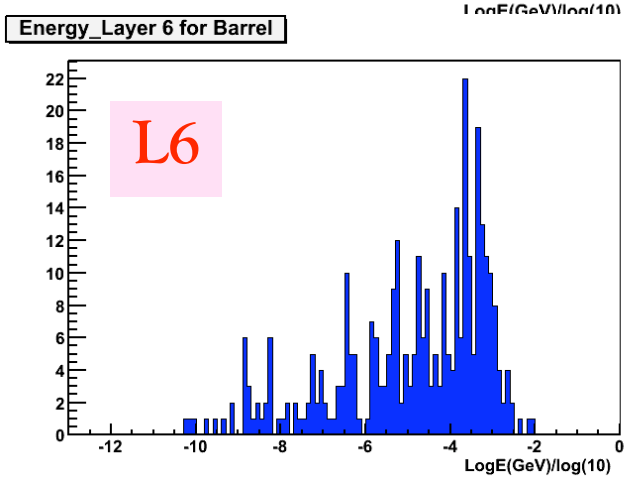




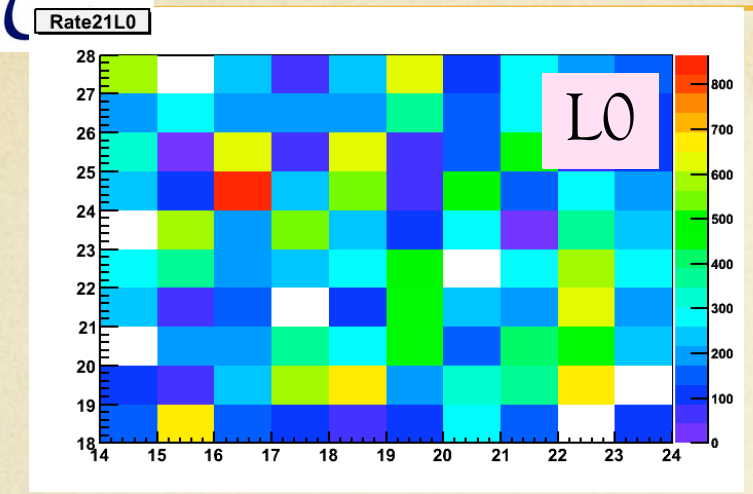


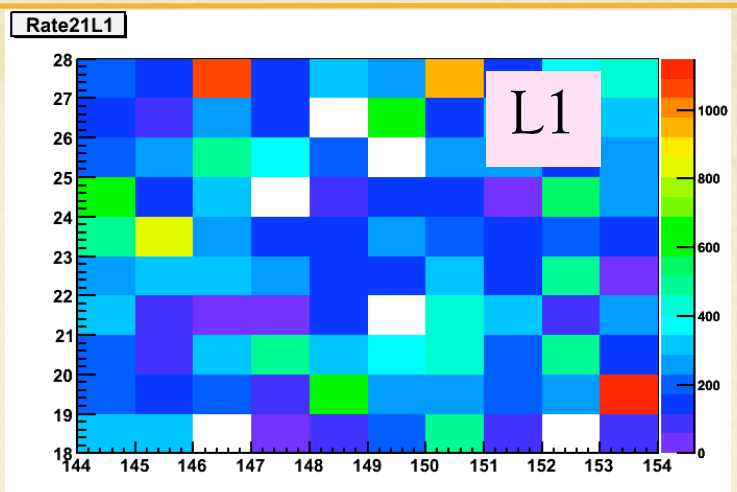




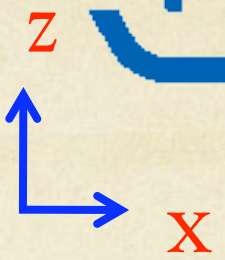


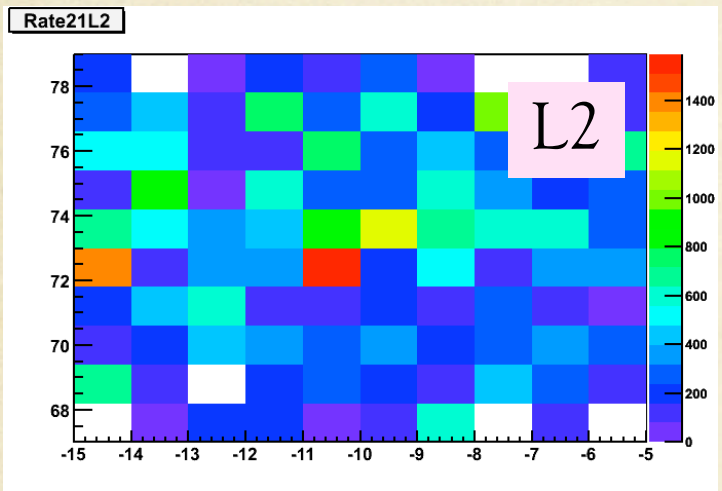
Neutron Rate for FEEs Electronics Barrel

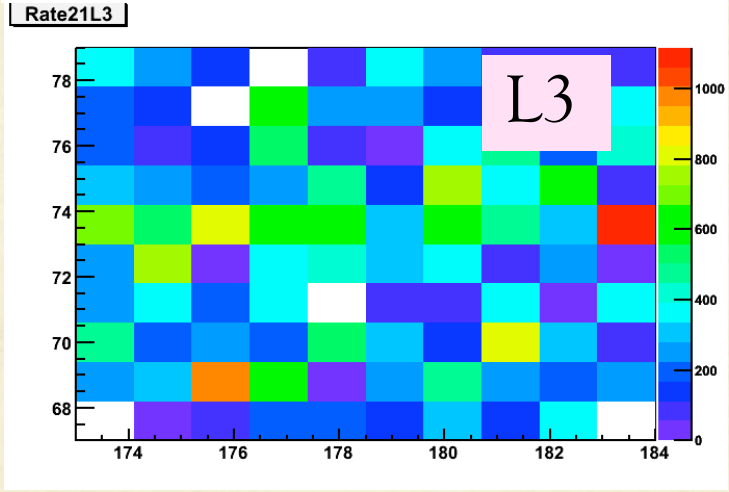


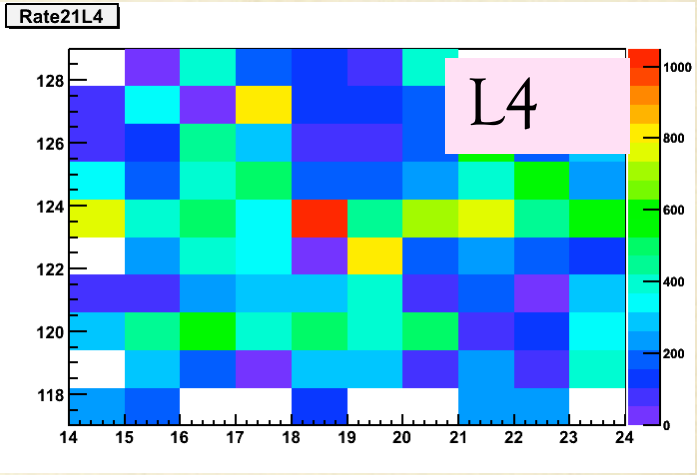


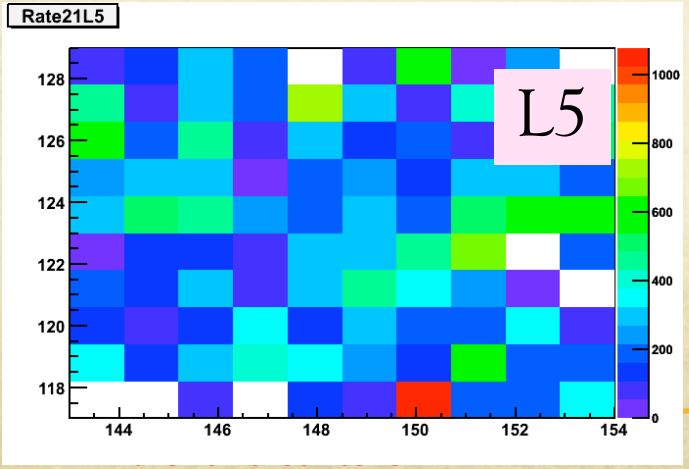
Hz/cm^2

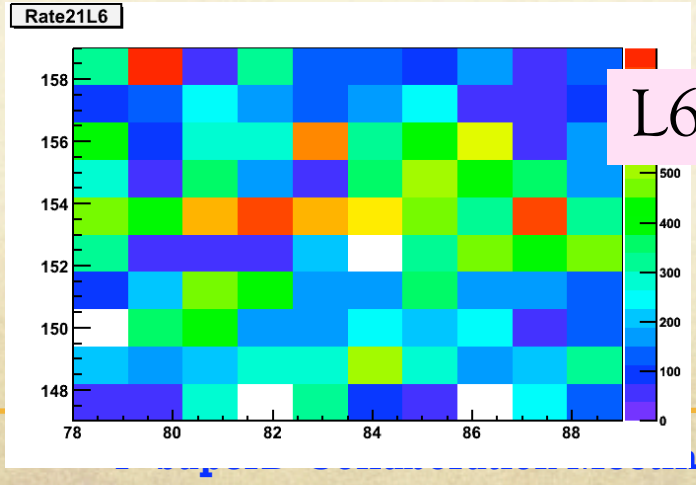








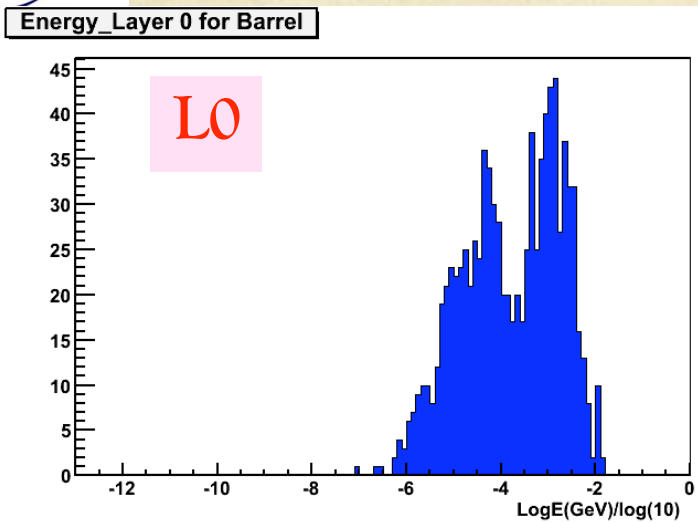


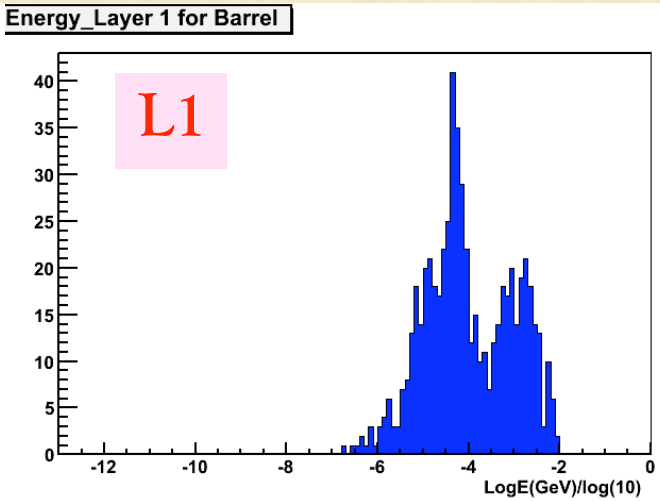


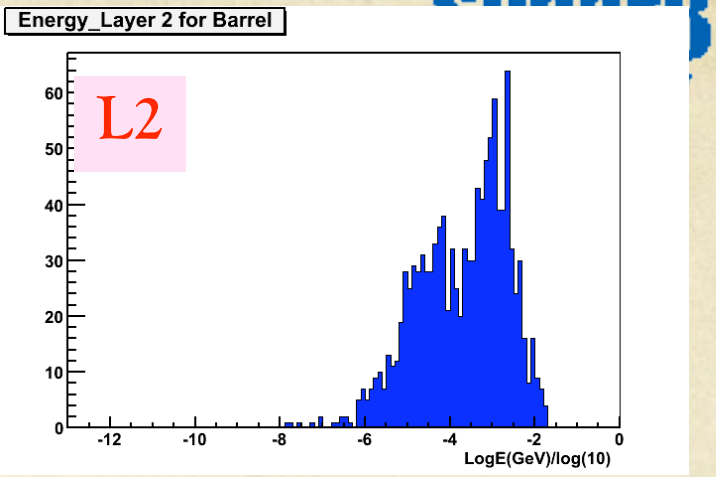
To see the plots with better resolution

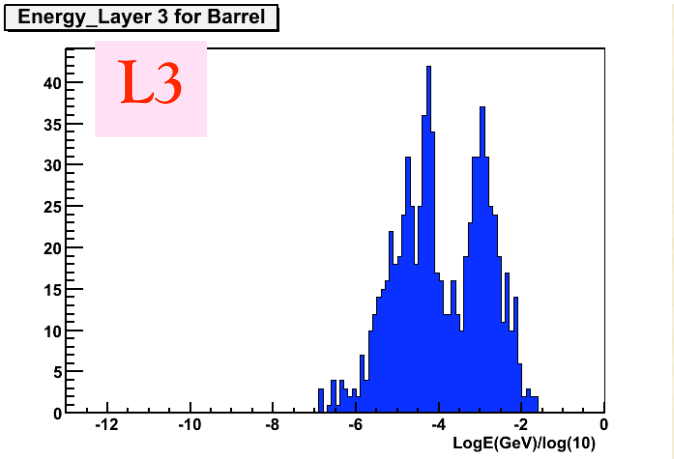
http://www.fe.infn.it./~santoro/SuperB/Background/Neutrons/Touschek.html

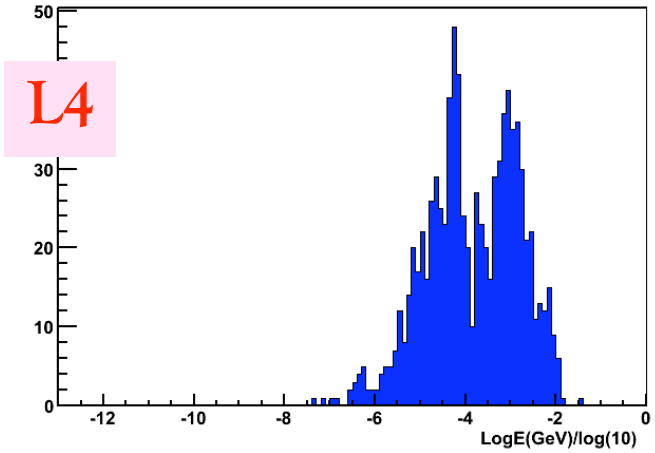
Electrons Energy Distribution for Barrel FEE

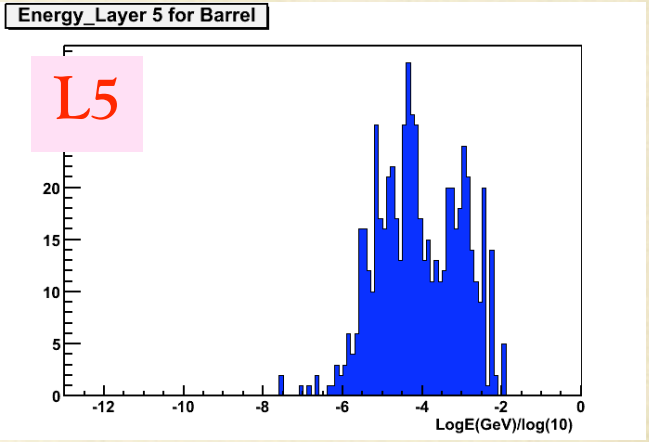


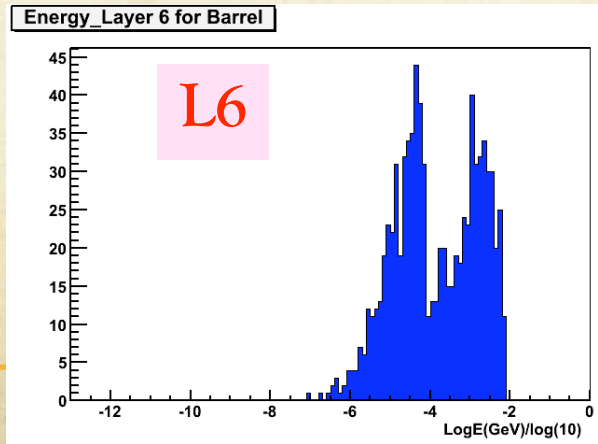






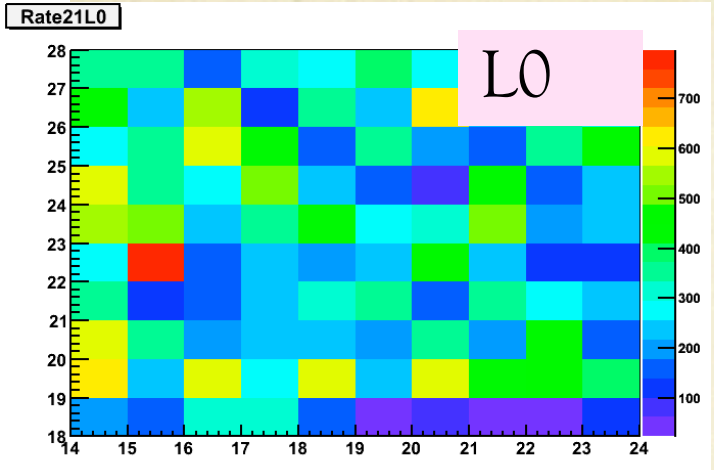


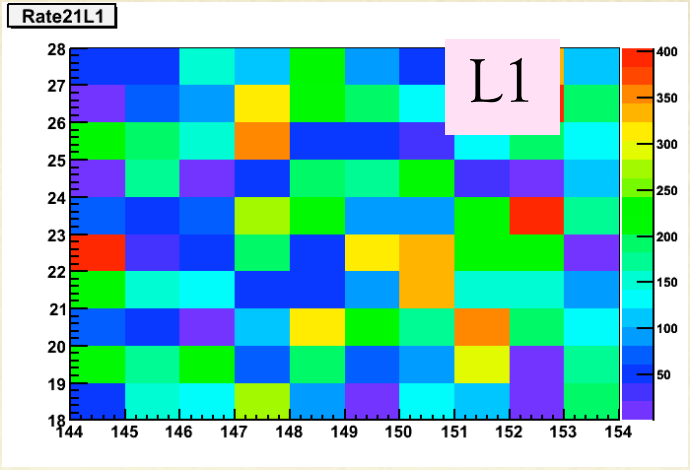




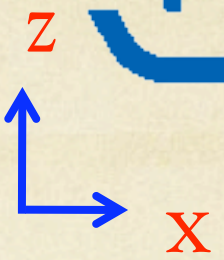
To see the plots with better resolution
http://www.fe.infn.it./~santoro/SuperB/Background/Electrons/Touschek.html

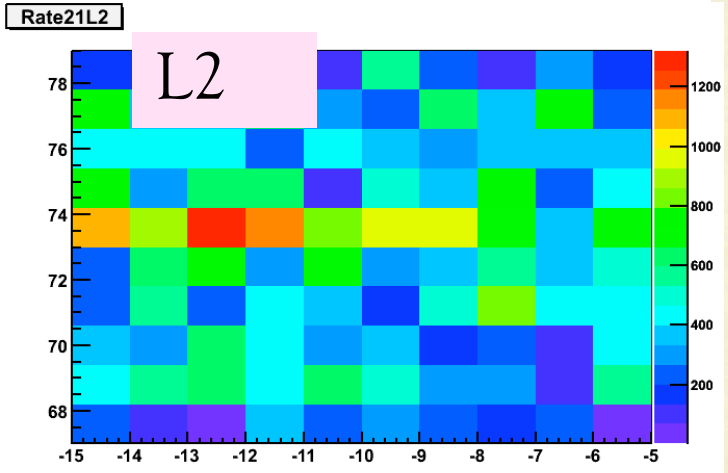
Electrons Rate for FEE Electronics Barrel

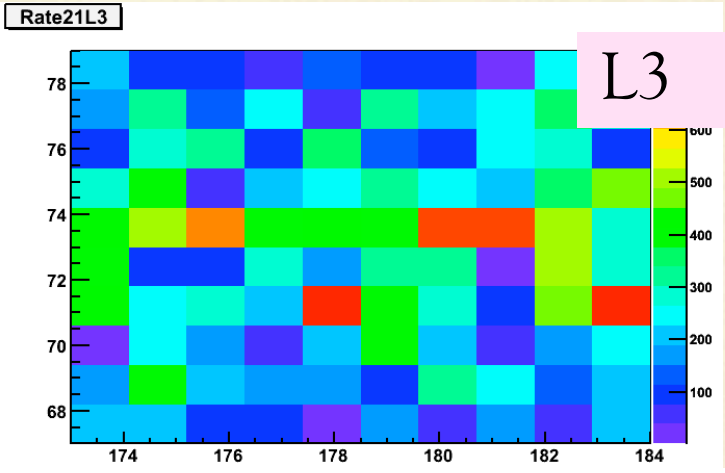


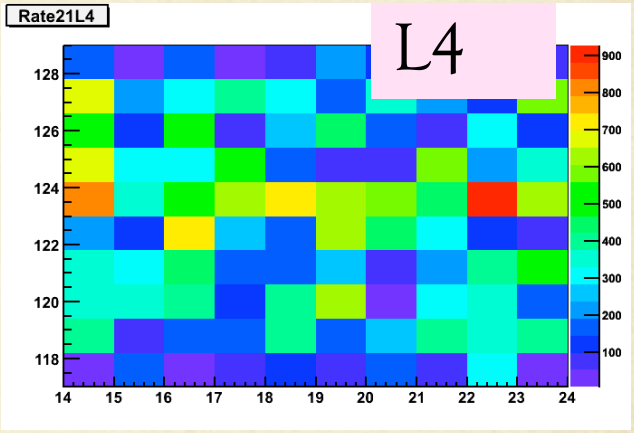


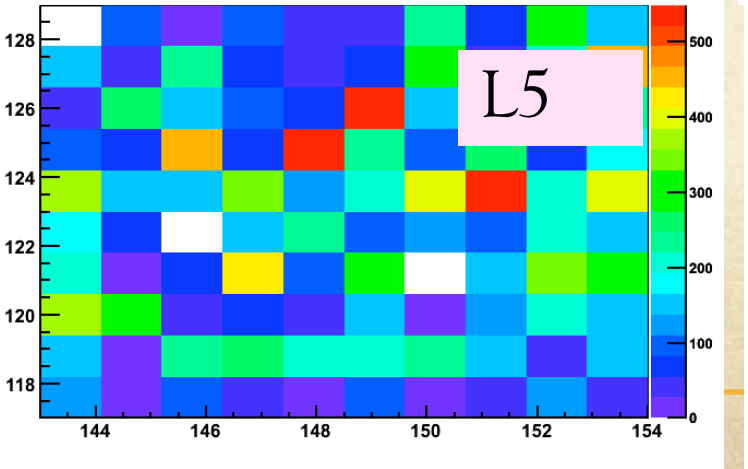
Hz/cm^2

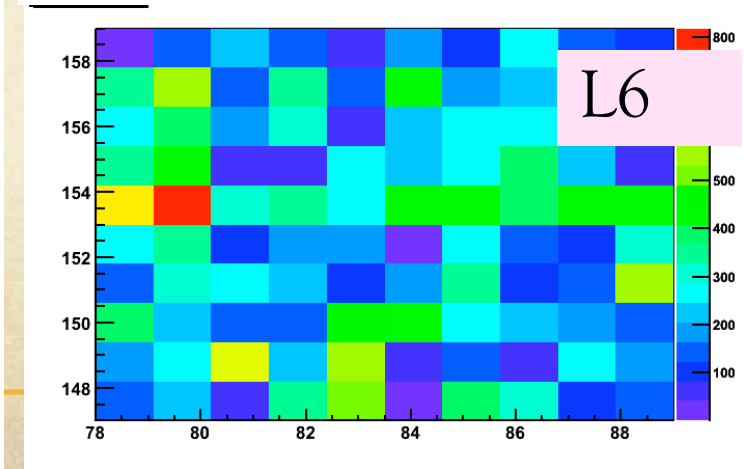












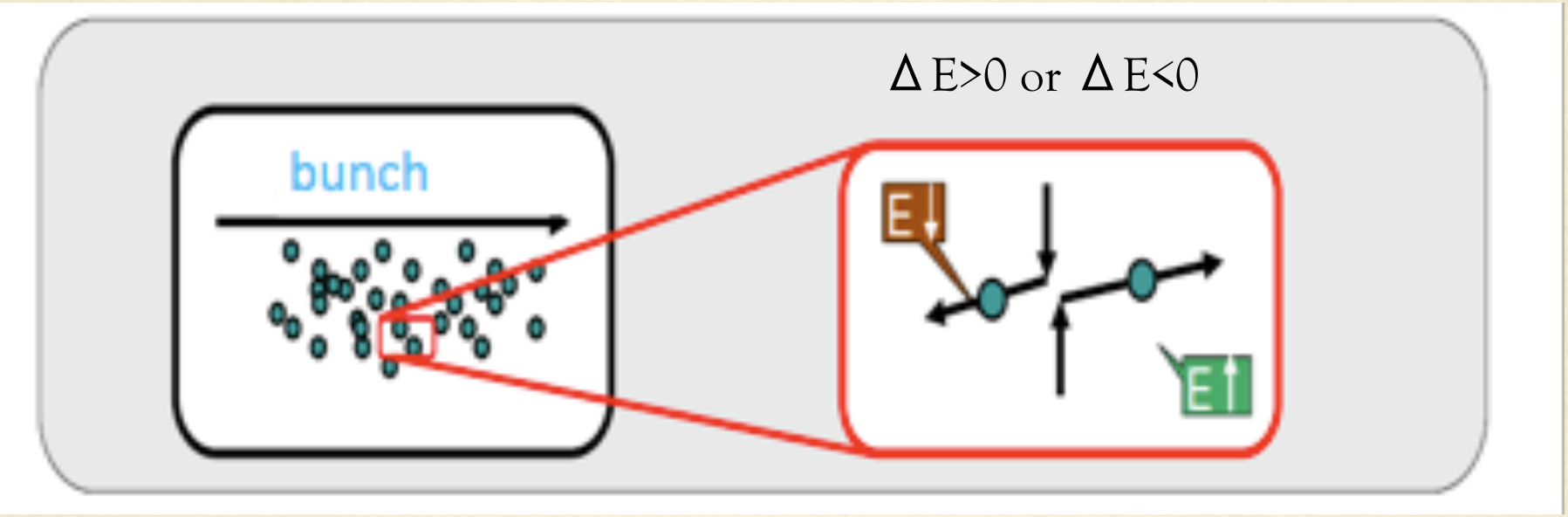
To see the plots with better resolution

http://www.fe.infn.it./~santoro/SuperB/Background/Electrons/Touschek.html

- We have the same information for the FEEs in the Forward and Backward Endcaps
- The code for analyzing the background on the FEEs is now in place if you need a detailed information (absorbed dose, particle flux) please let me know

Touschek events studies

Touschek scattering results from a Coulomb collision of two relativistic electrons in a particle beam, producing an instantaneous change in particle energy



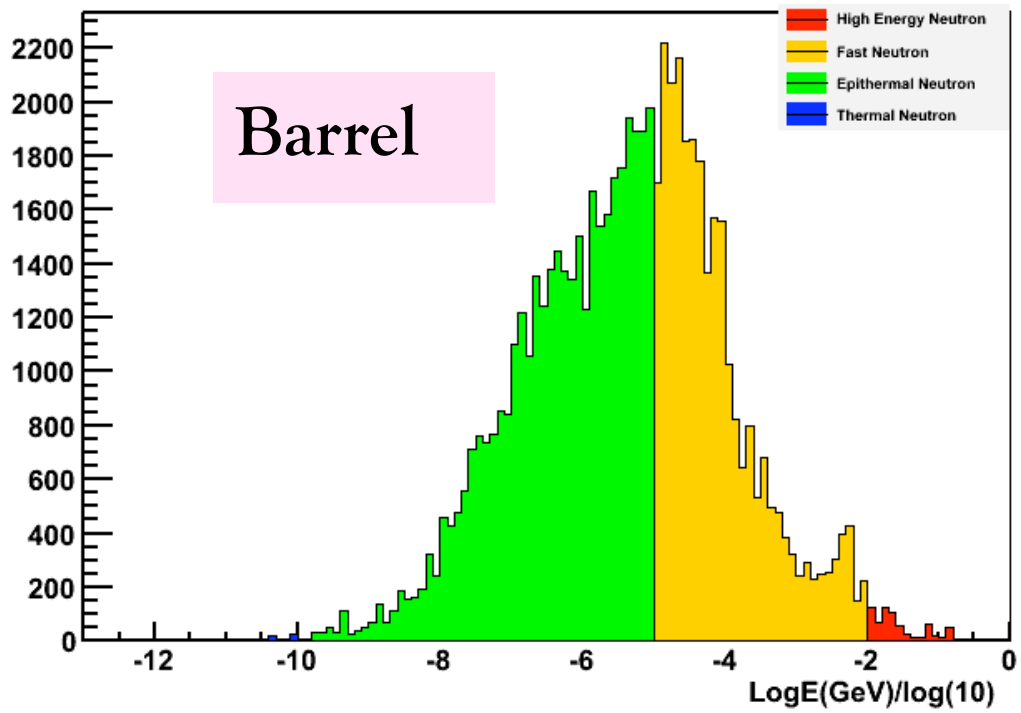
Why we don't like Touschek events:

Scattered e^+/e^- goes off trajectory -> lost at beam pipe wall near IP ->creates shower ->reach detector

The Touschek events in this presentation come from the HER

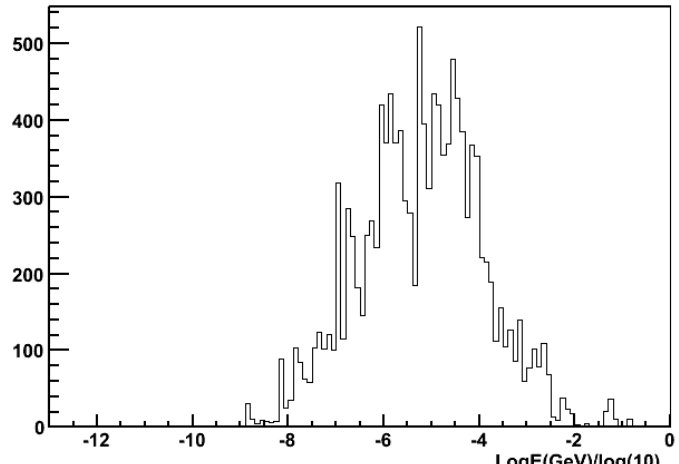
Neutron Energy Distributions for Touschek events

Barrel

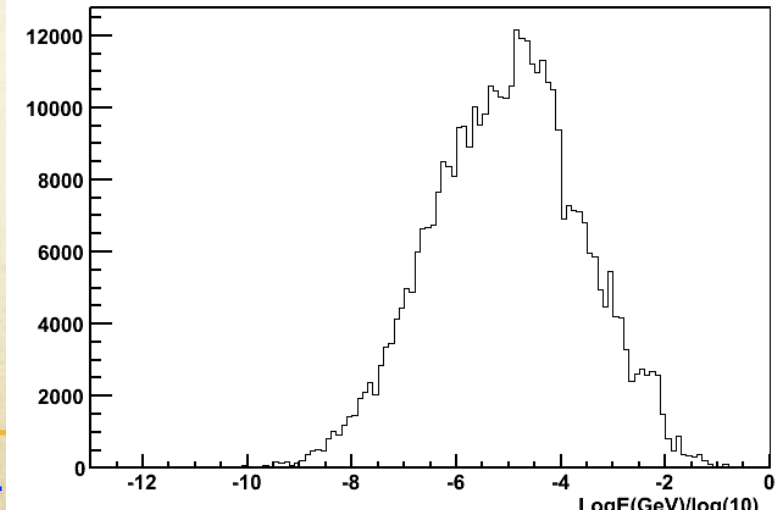


Neutron interactions strongly depend on their energy for this reason they are classified in different categories: high energy neutrons , fast neutrons et ...

Backward Endcap

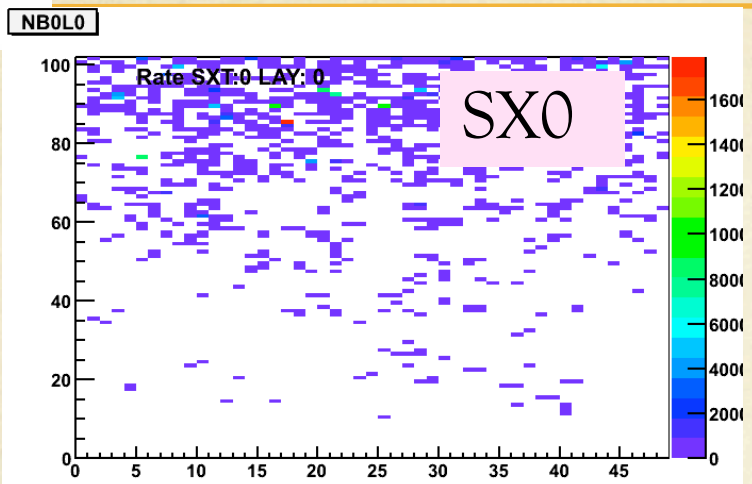


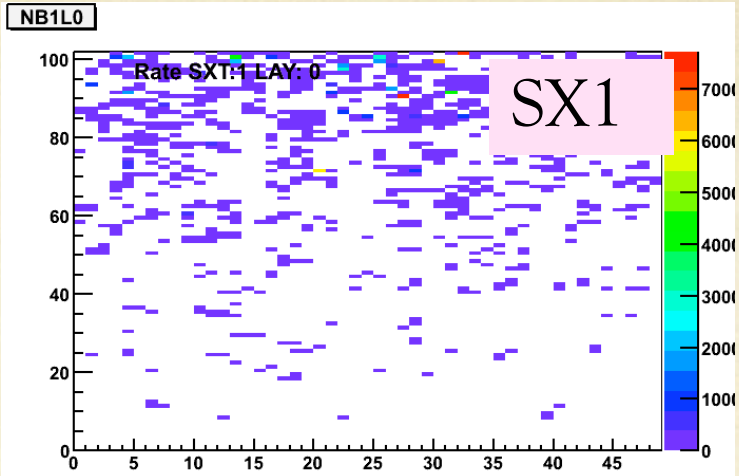
Forward Endcap

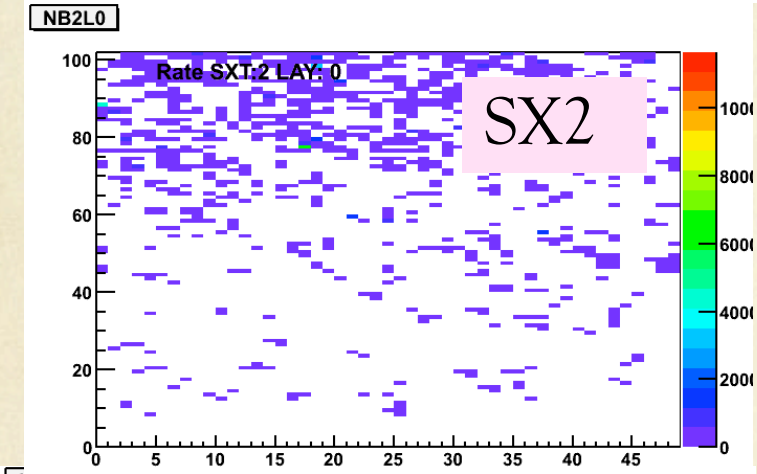


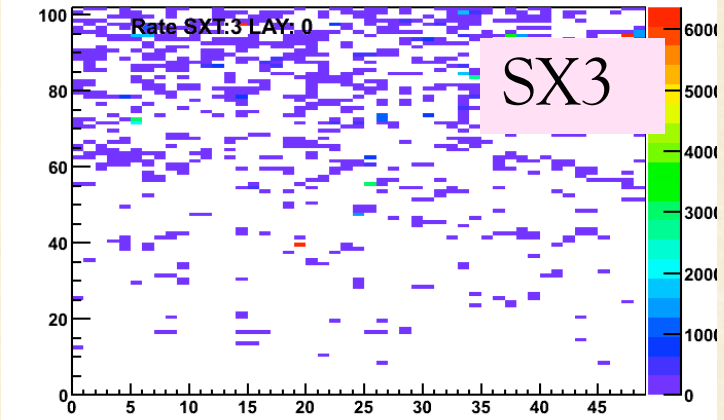
Rate for Touschek events Layer0: Barrel

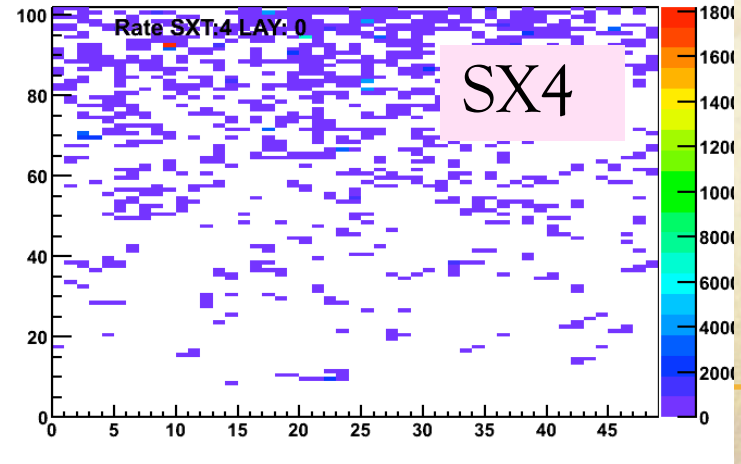
Hz/cm^2

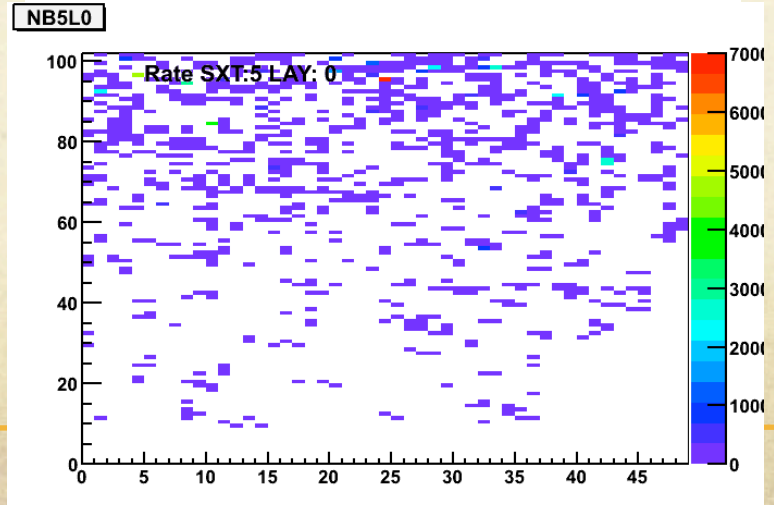








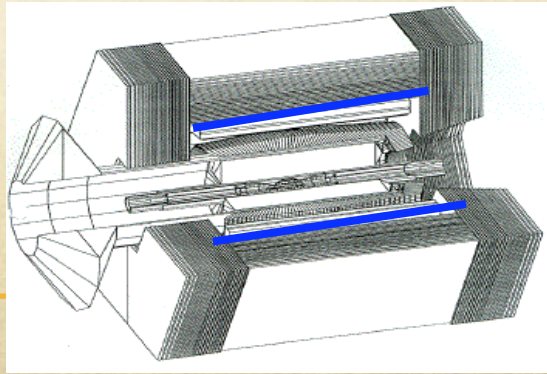




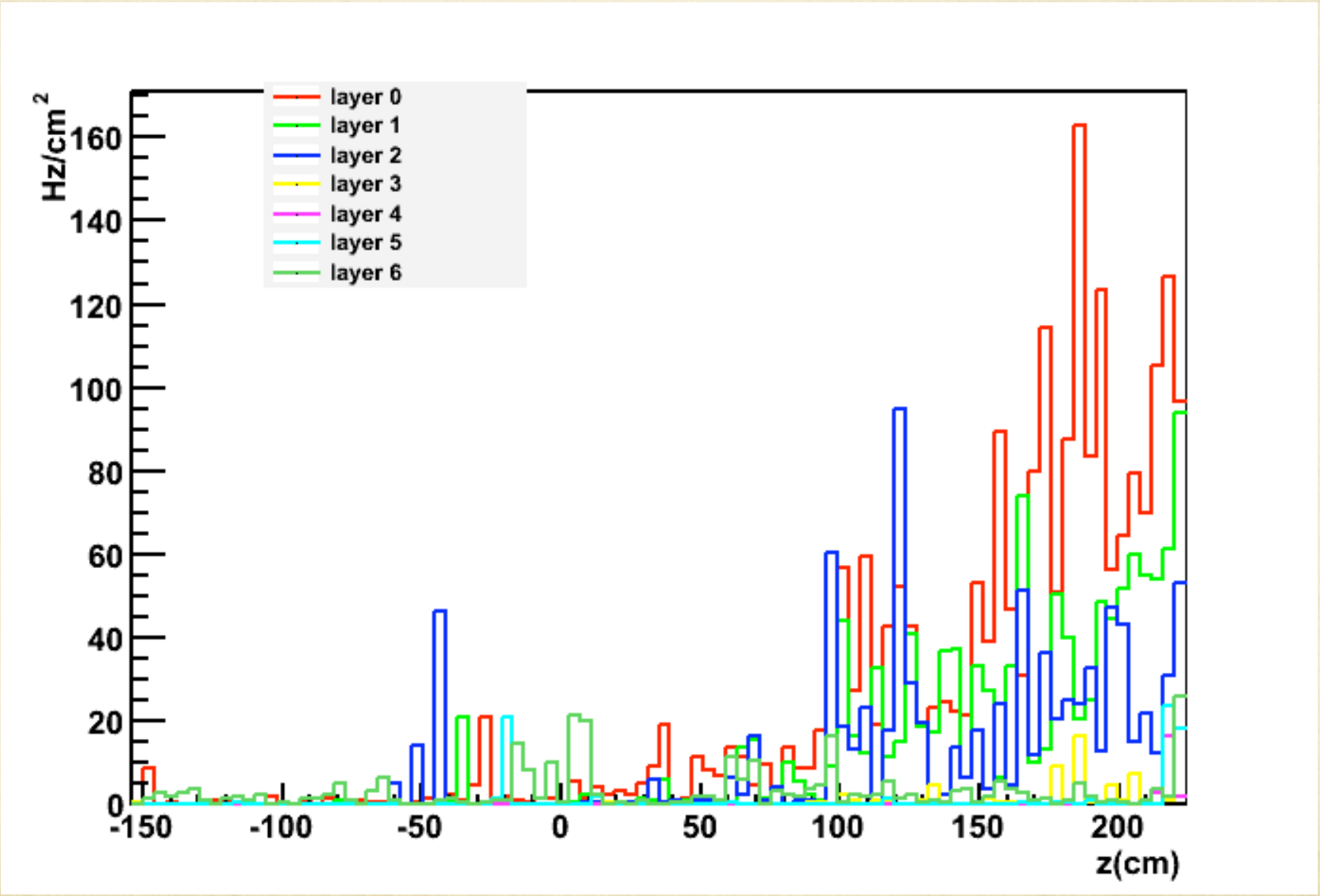
z

x

Normalized to 1MeV energy



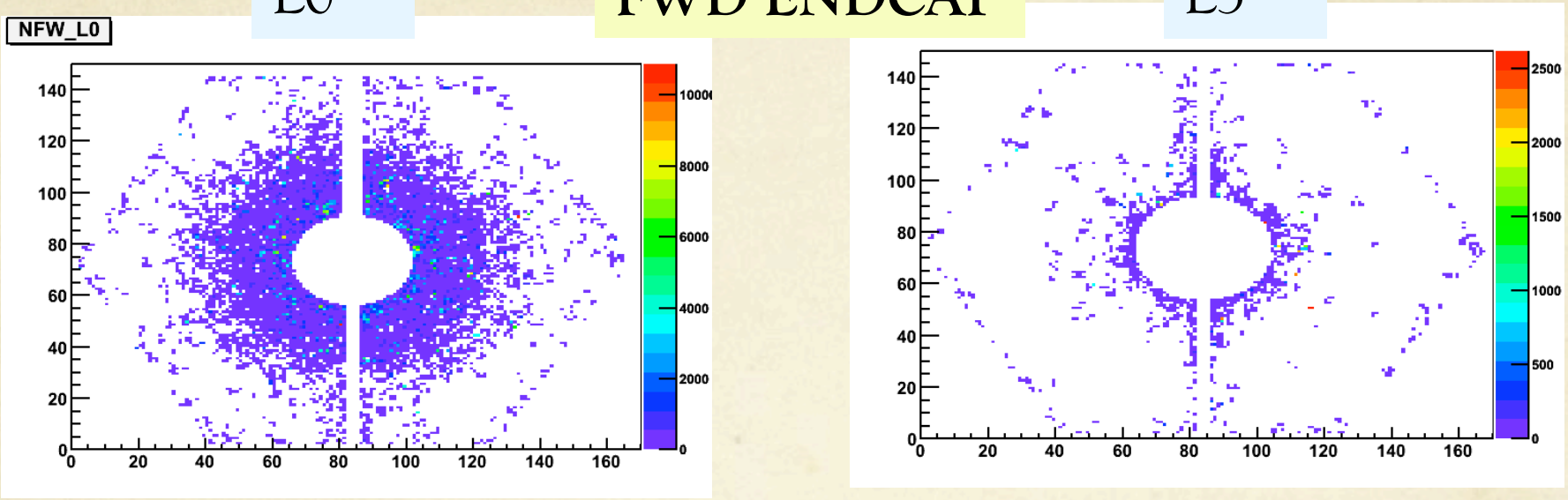
Rate vs Z-coordinate



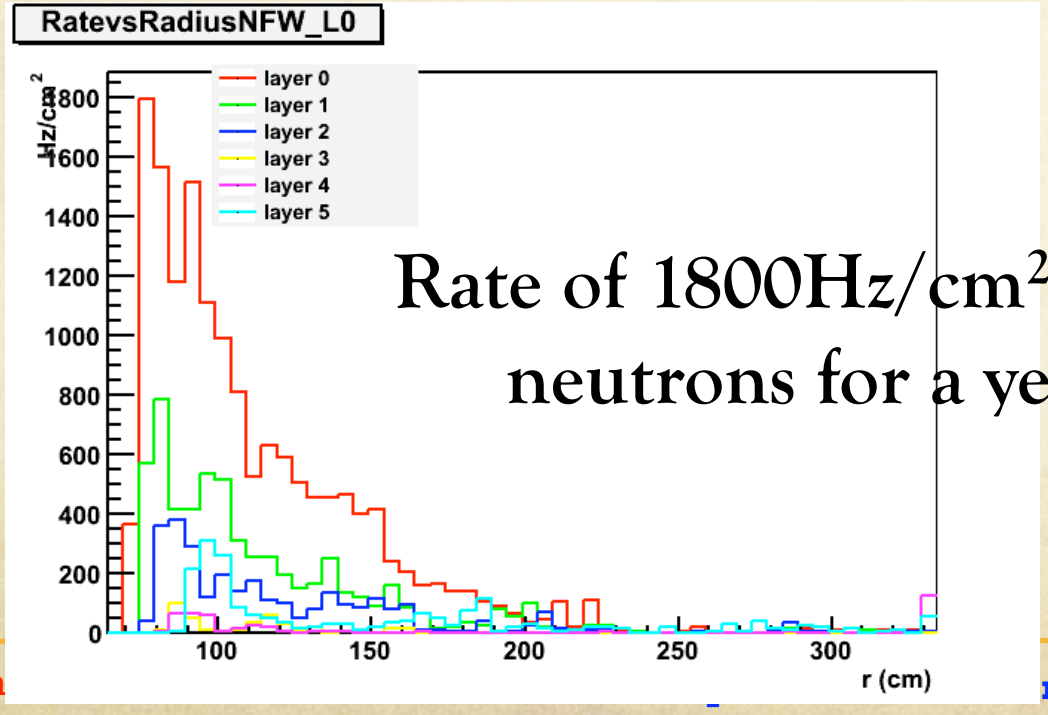
Rate of 160 Hz/cm^2 -> about 1x10^9 neutrons/cm^2 for a year

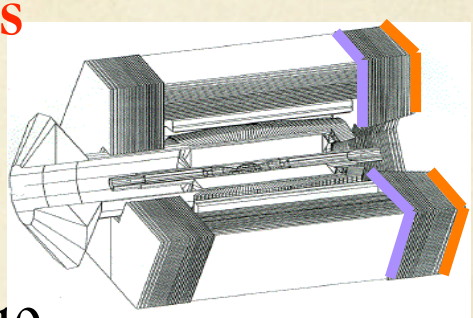
FWD Endcap Touschek events

L0 FWD ENDCAP L3



Rate vs Radius for FWD Endcap for Different layers





Rate of 1800Hz/cm^2 -> 1.2x10^{10} neutrons for a year

Normalized to 1MeV energy

Summary

What we have done:

- ✓ Neutrons background crossing the IFR studied using the Elba 2011 Production
- ✓ Photons and Electron backgrounds has been studied in details for the first time
- ✓ Background from Electrons and Neutrons on FEEs boards studied
- ✓ Touschek background studied for the HER

What we will have to do

- Touschek background studies for the LER (one week)
- Add shielding for the Endcap outer layers (one week)
- Estimate the FEEs doses (few days)

For additional plots and information

http://www.fe.infn.it./~santoro/SuperB/Background/