IFR Background Report

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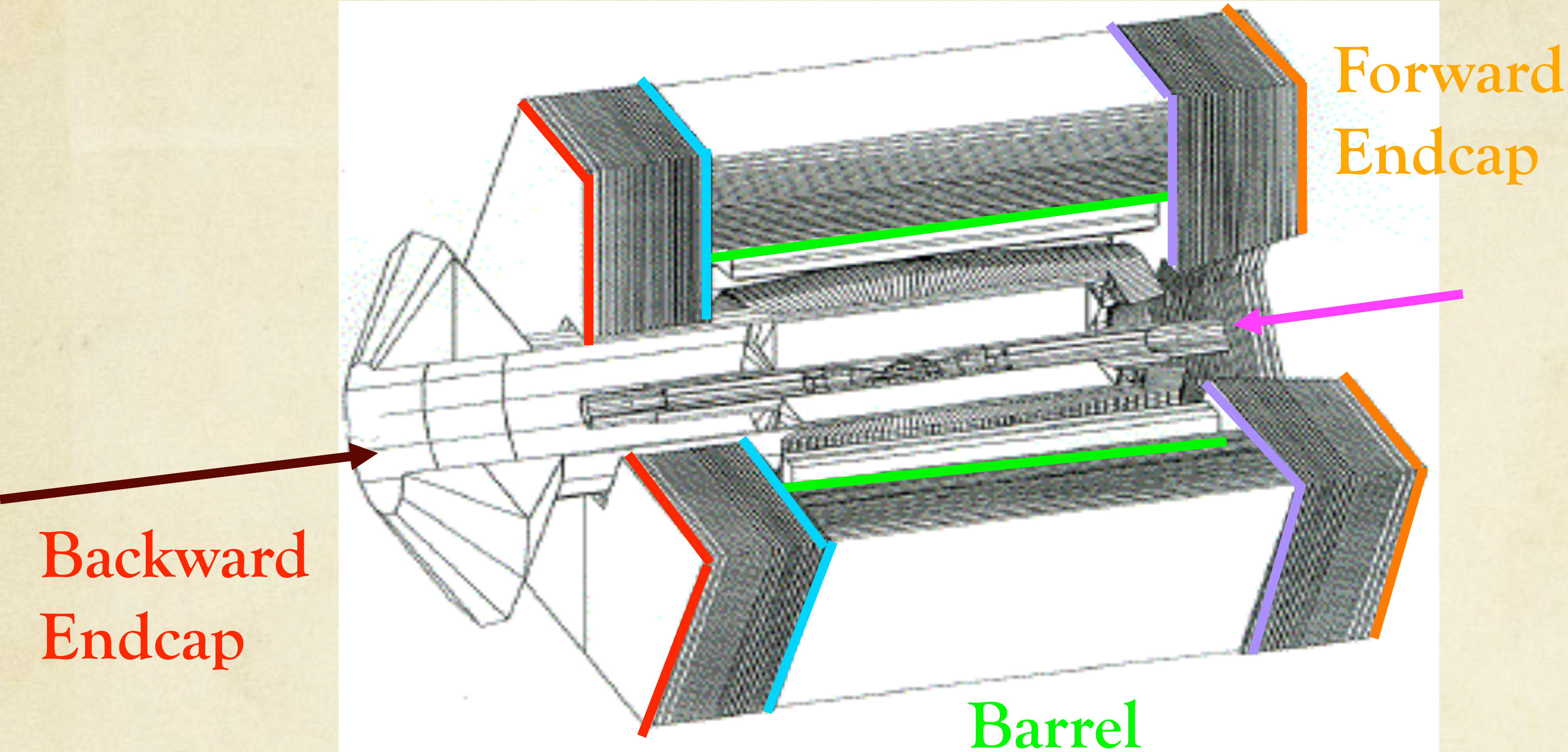
1st SuperB Collaboration Meeting

Hot regions



Barrel: innermost layers, mostly neutrons

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

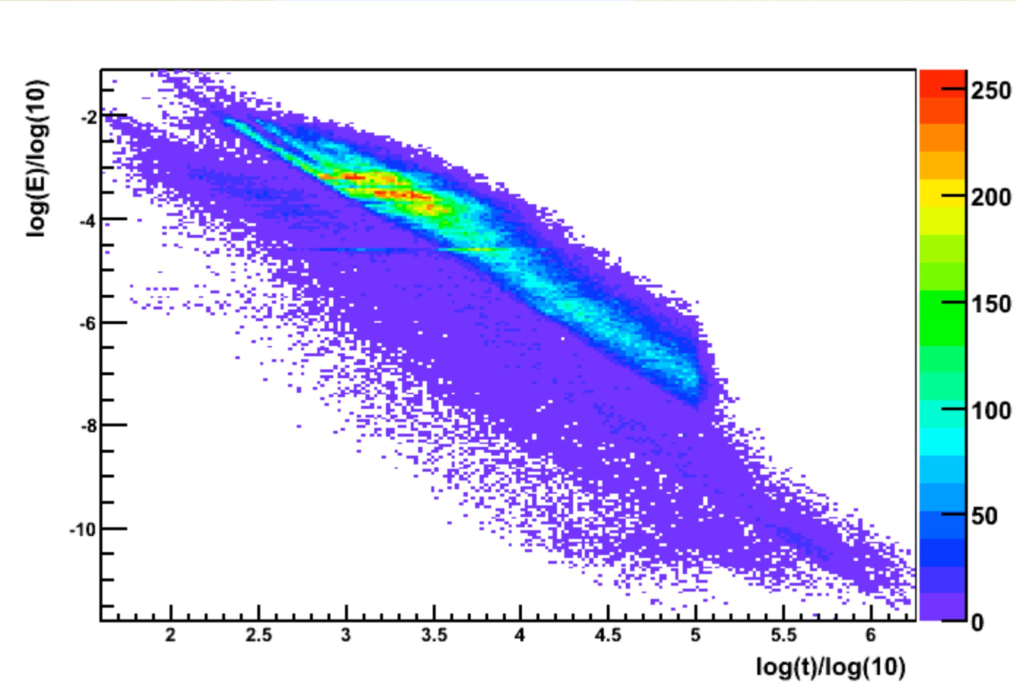
BWD encaps: inner layer and small radii

Outline

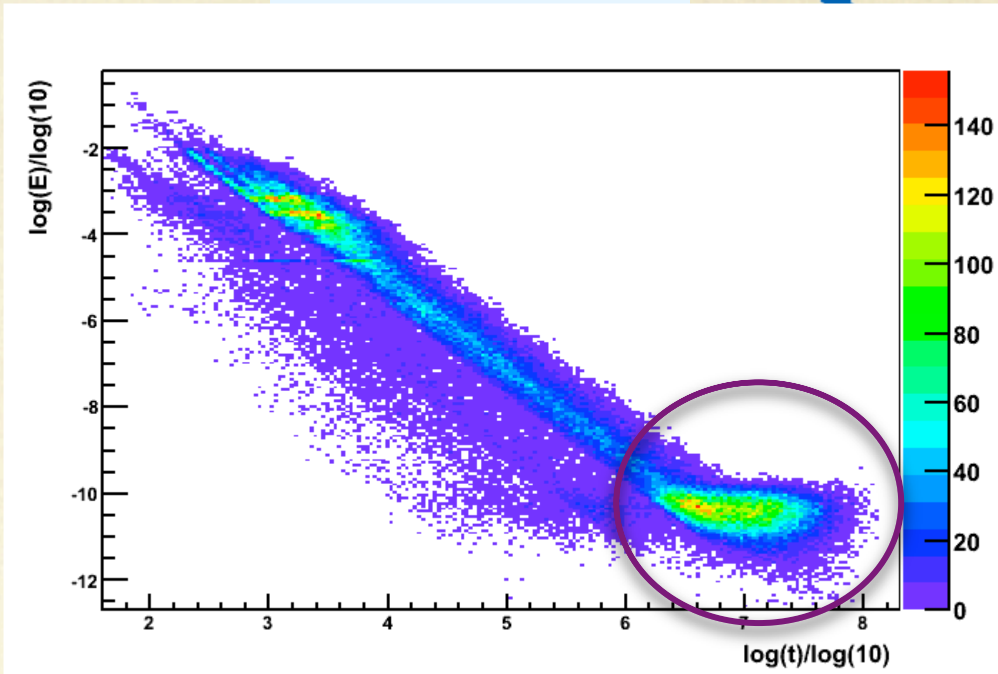
- Validation studies
- Radiative BhaBha events (Elba 2011 production)
- Tousheck background
  - Detailed neutron background analysis
  - Electrons, photons, background studies

Validation of the new production: Neutrons Energy distribution vs time

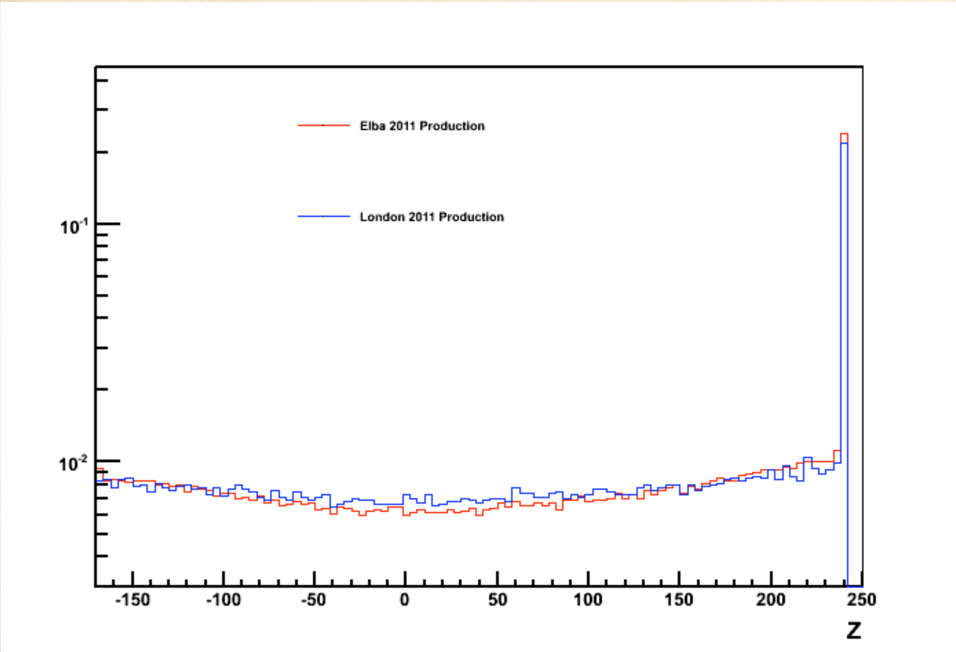
Elba 2011



London 2011



The peak at low energy is due to the fact that the neutrons evolve for a longer time in the London production

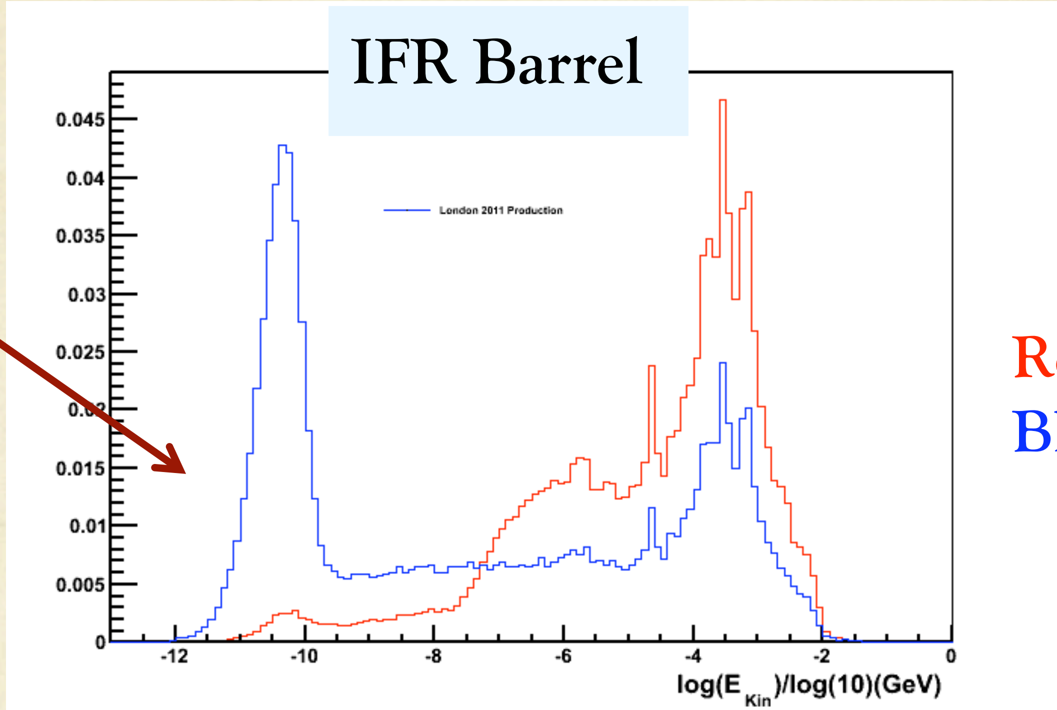


Red: Elba 2011 Production
Blue: London 2011 Production

The rates in Z are consistent between the two productions

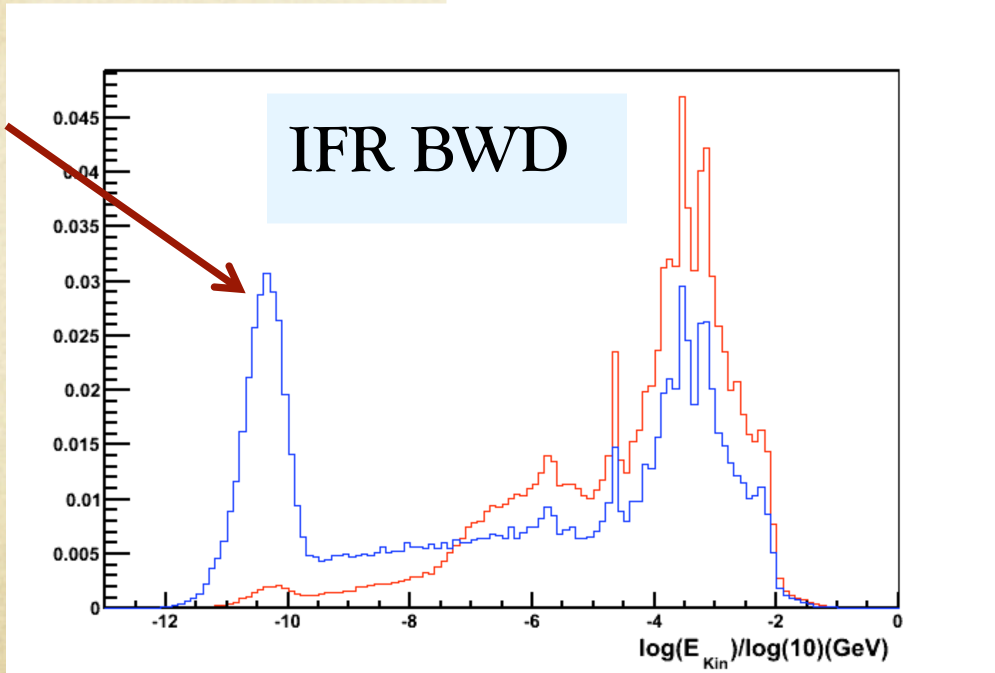
Validation of the new production: Neutrons Energy distribution

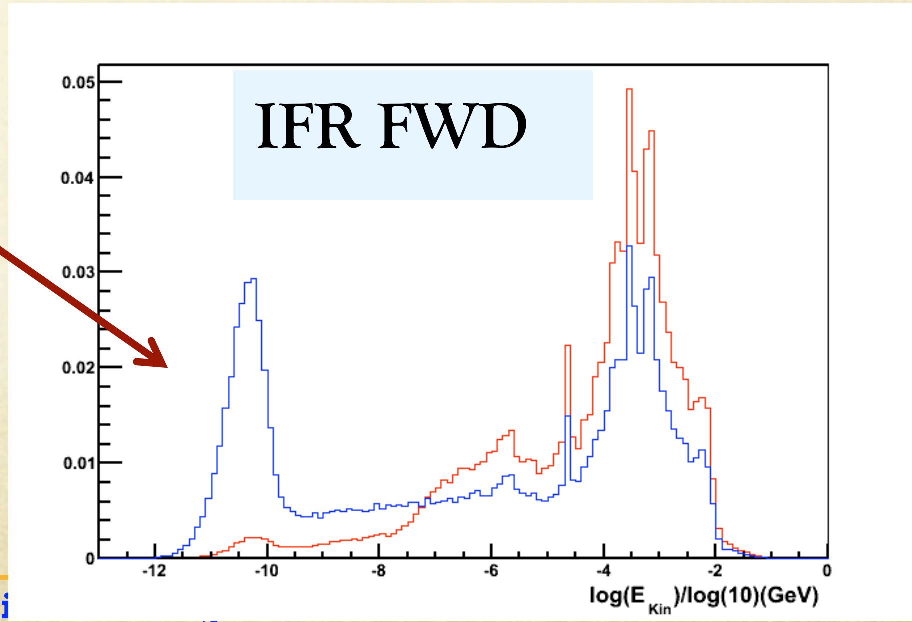
Big peak at low energy that was not present in the previous production



Red: Elba 2011 Production

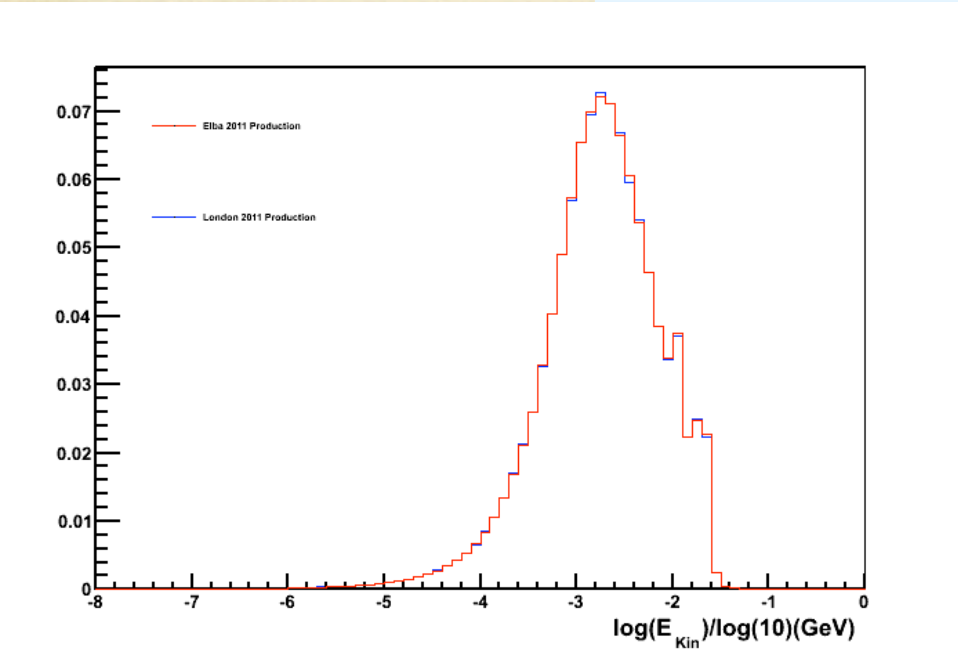
Blue: London 2011 Production



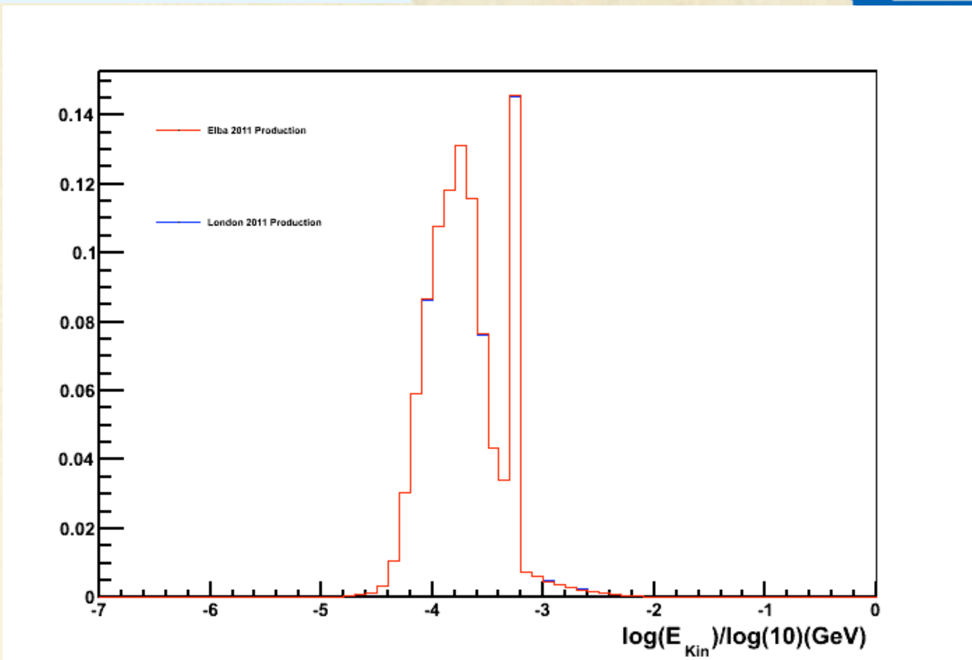


Validation of the new production: Photons and Electrons

IFR Barrel Energy distributions



Electrons



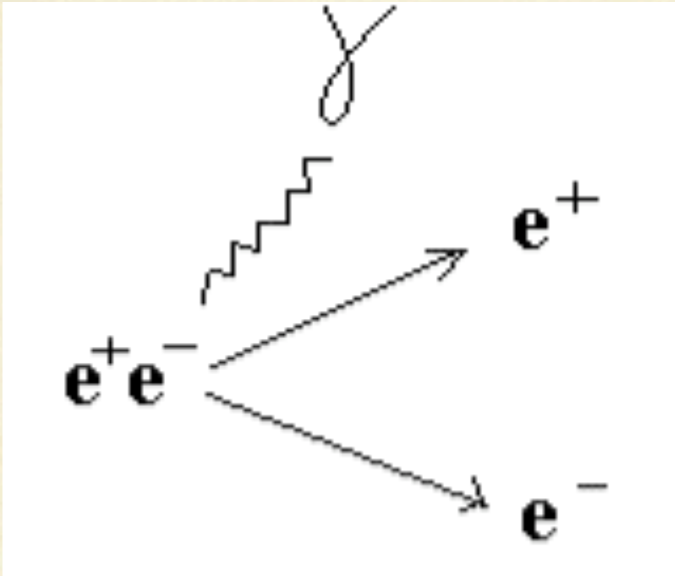
Photons

Red: Elba 2011 Production

Blue: London 2011 Production

Energy distributions and rate for electrons and photons are consistent between the two productions

Radiative BhaBha background crossing the IFR detector



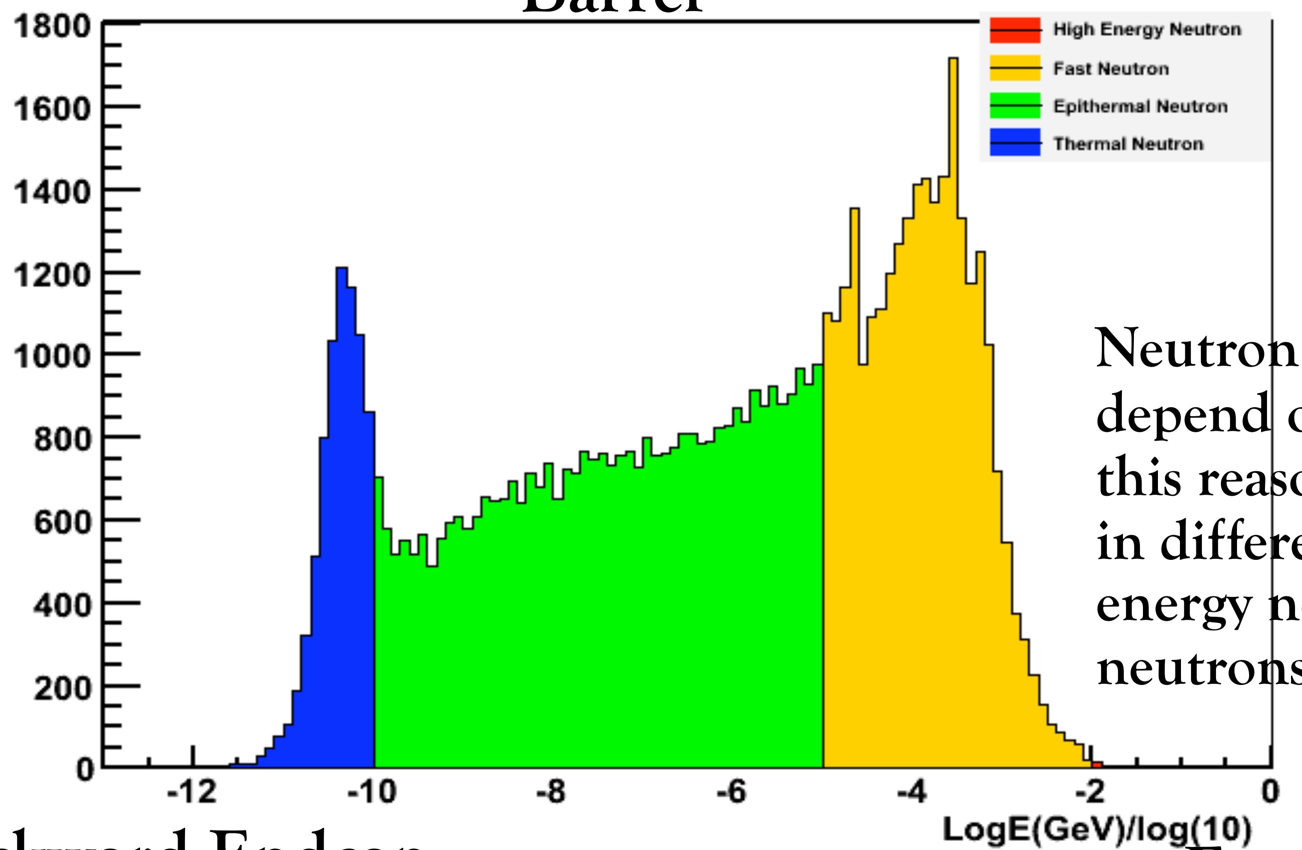
Neutrons

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.

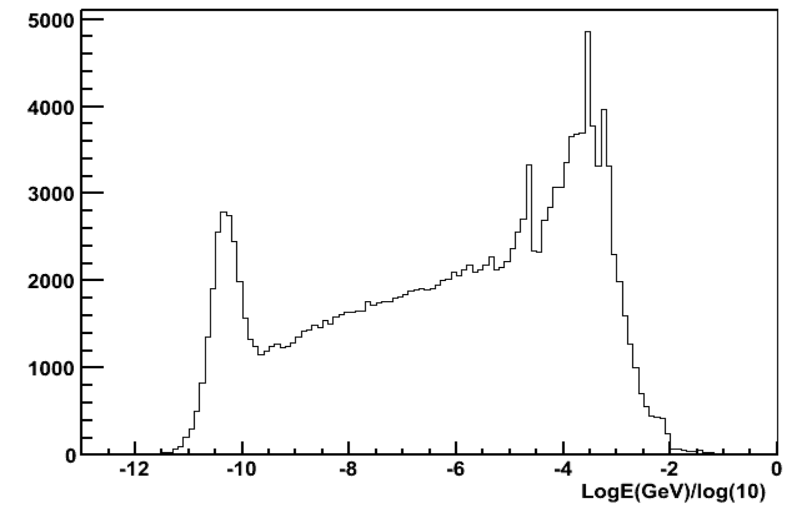
Neutron Energy Distributions

Barrel

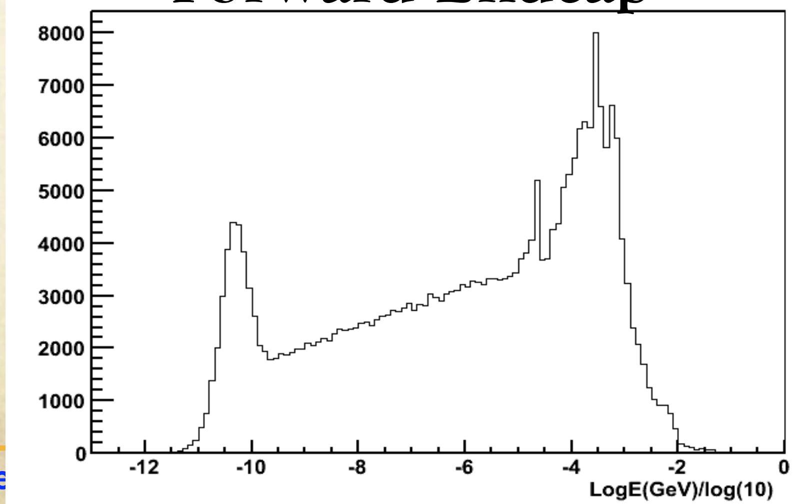


Neutron interactions strongly depend on their energy for this reason they are classified in different categories: high energy neutrons , fast neutrons et cetera

Backward Endcap

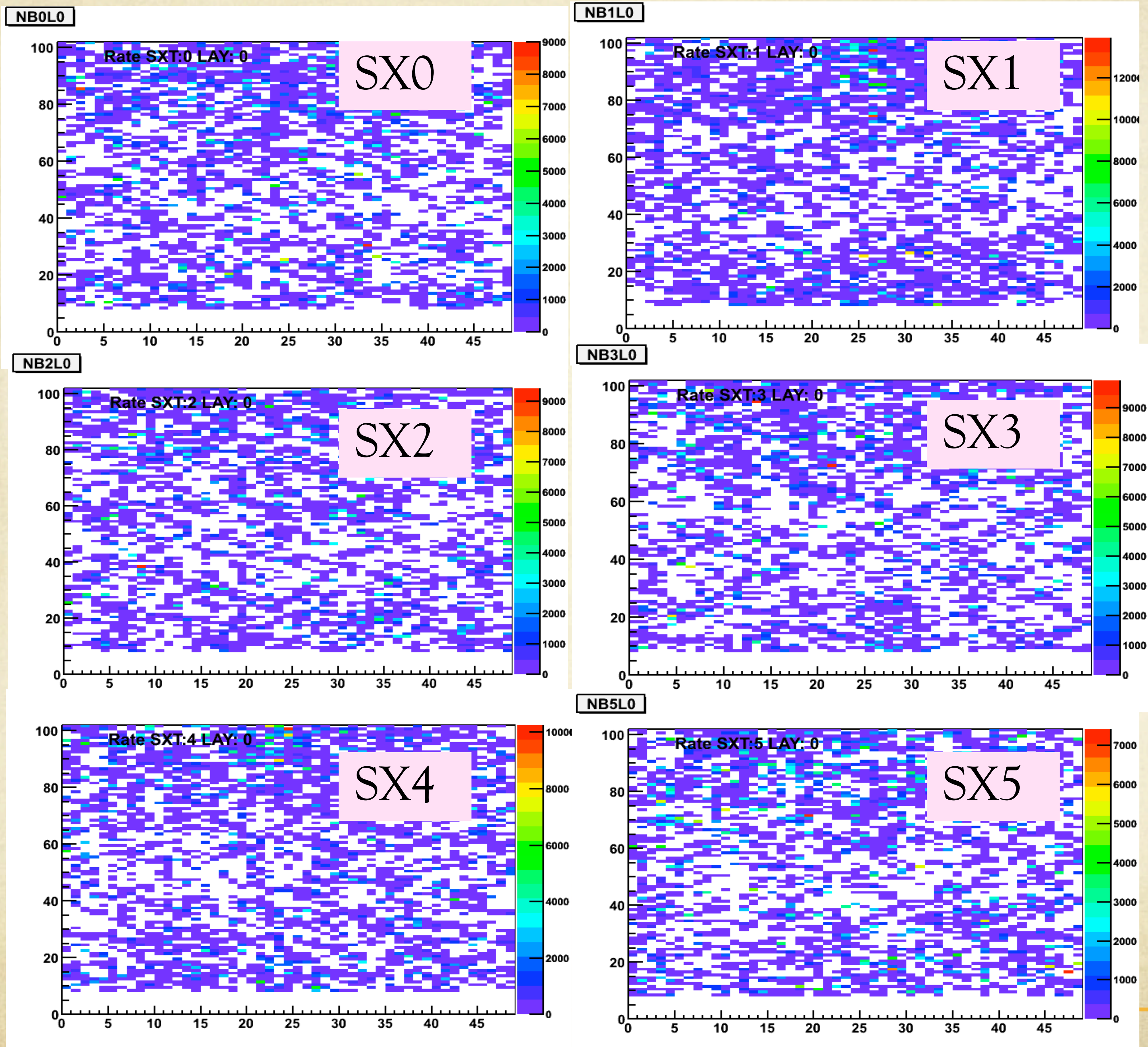


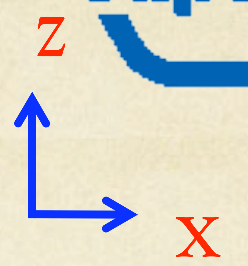
Forward Endcap



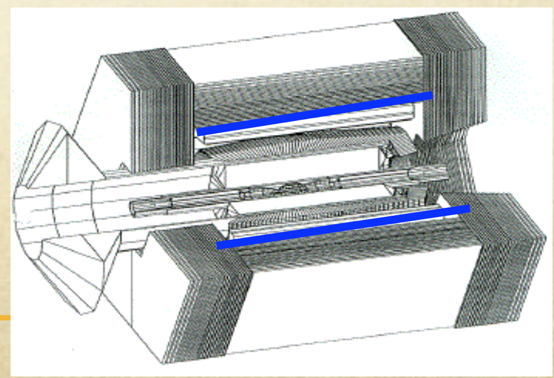
Rate Layer0: Barrel

Hz/cm^2



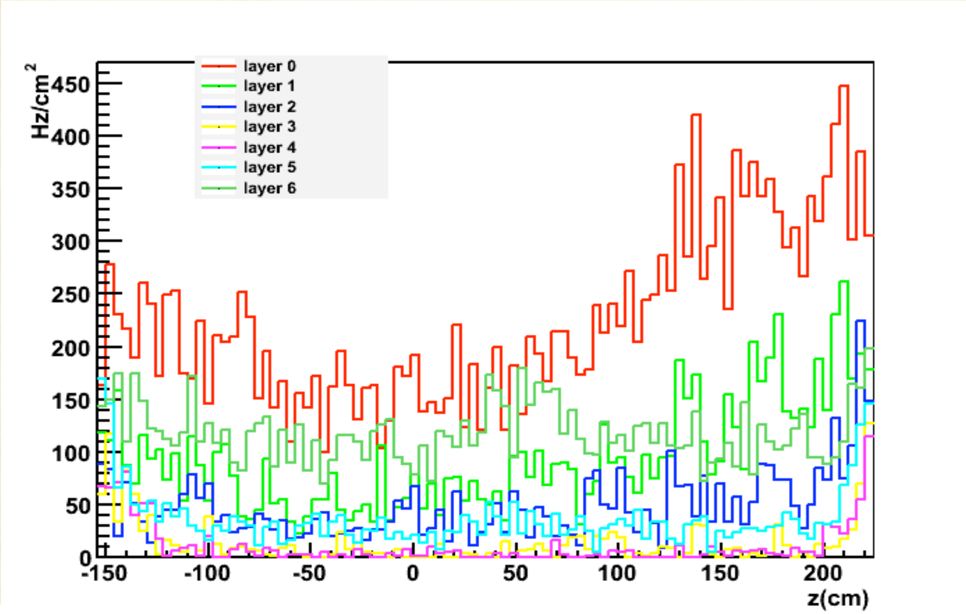


Normalized to 1MeV energy



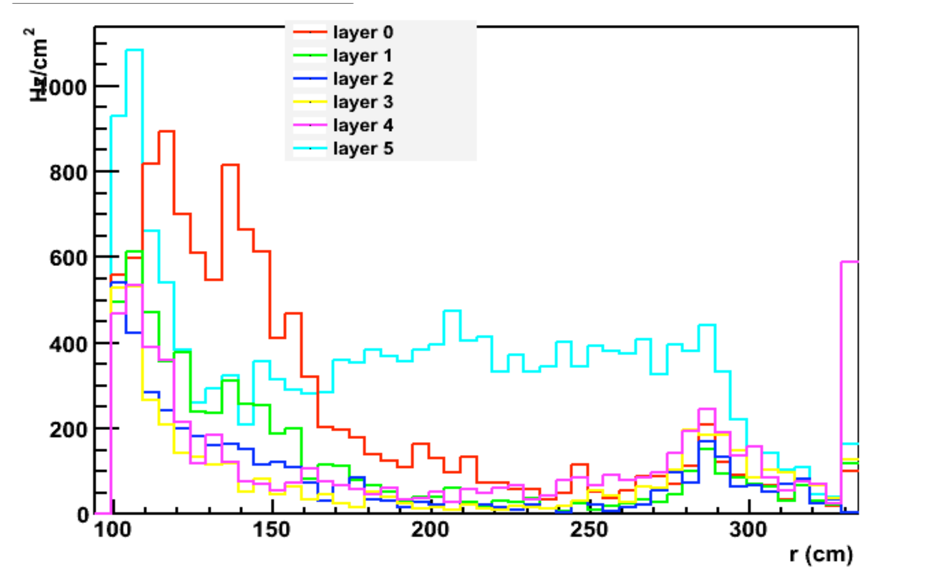
Neutrons rate for different layers

Rate vs Z-coordinate for Barrel

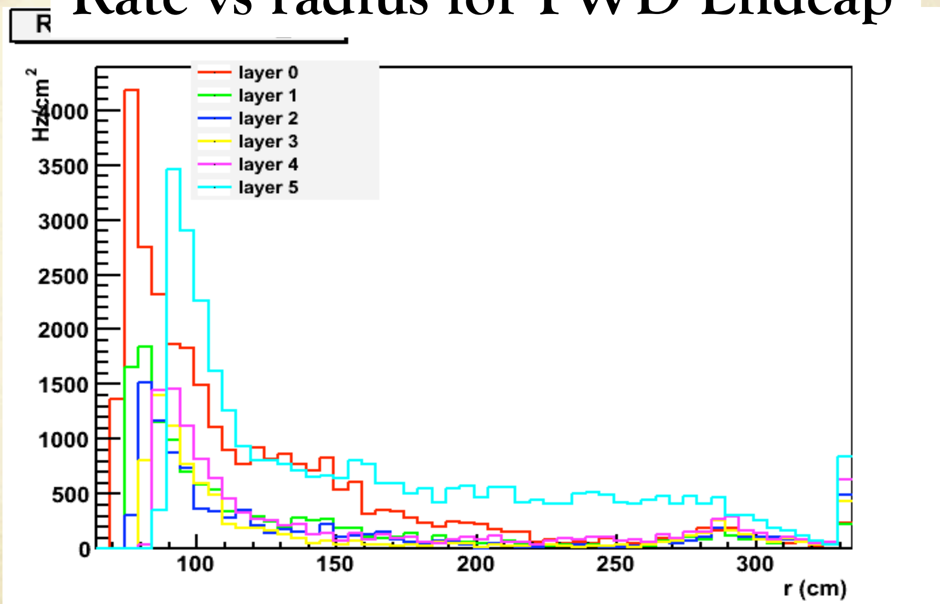


Rate of 450Hz/cm^2 -> about 3x10^9 neutrons/cm^2 for a year

Rate vs radius for BWD Endcap



Rate vs radius for FWD Endcap



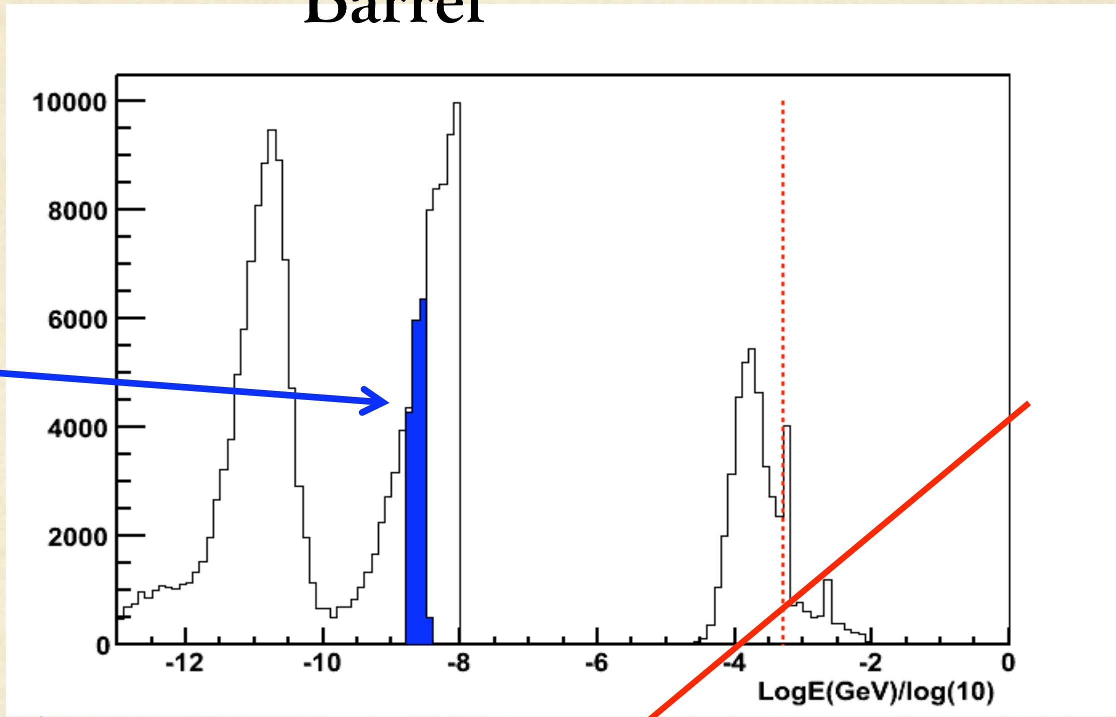
Photons

Why do we have to worry about photons

- High Energy Photons convert in e^+e^- that produce signal in the detector

Photon Energy Distributions

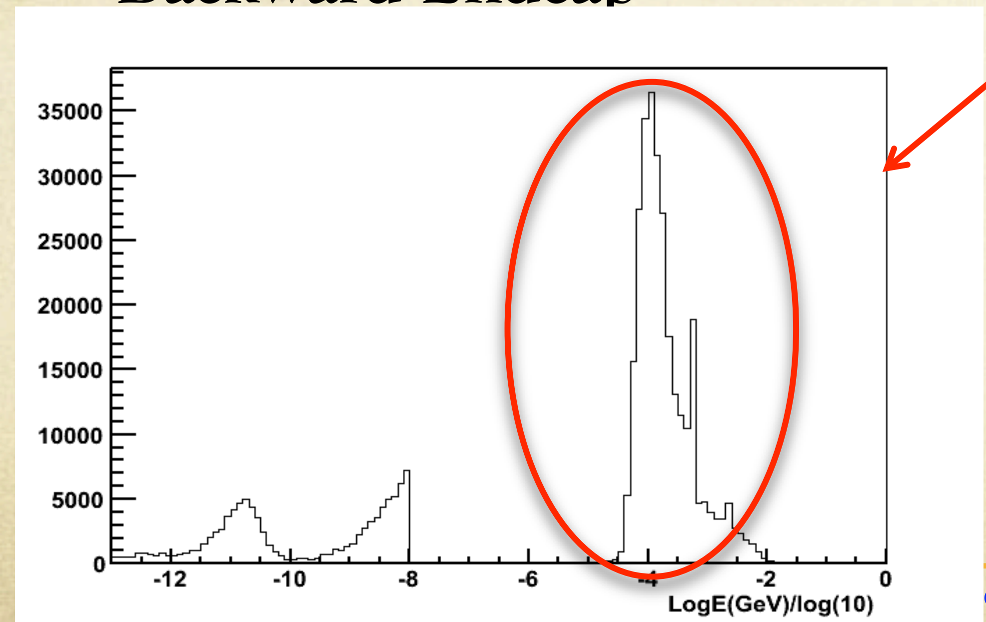
Barrel



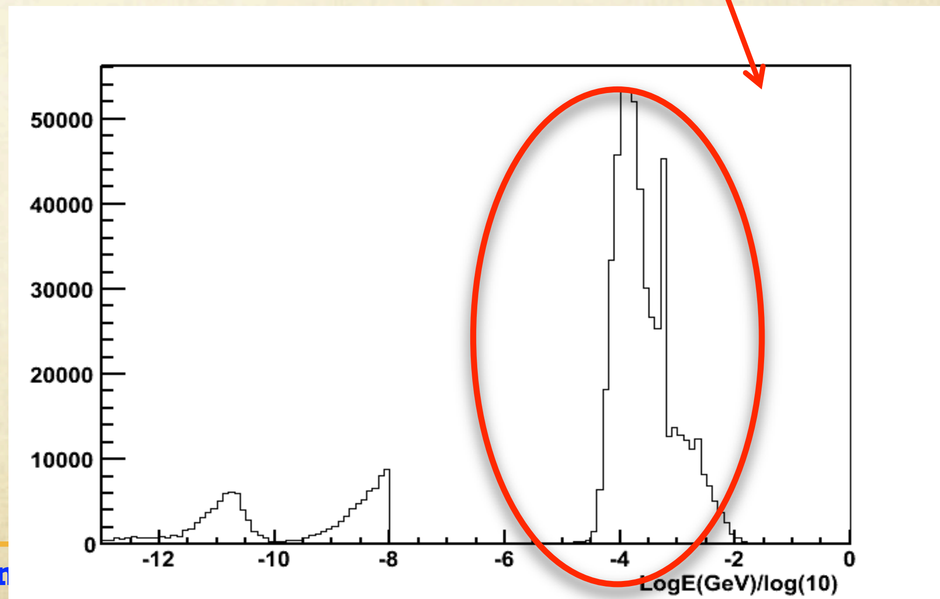
Visible Energy Range

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

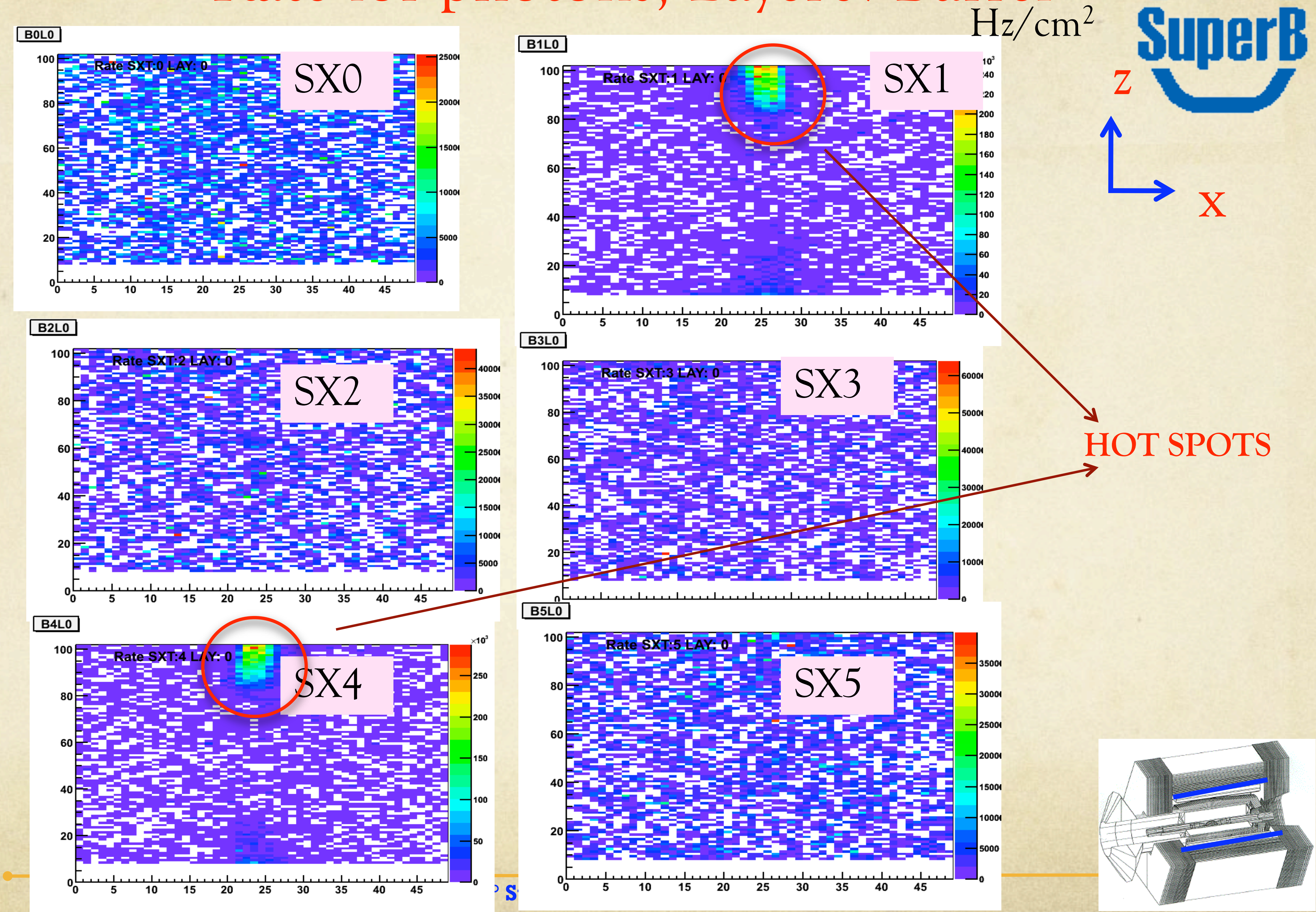
Backward Endcap



Forward Endcap

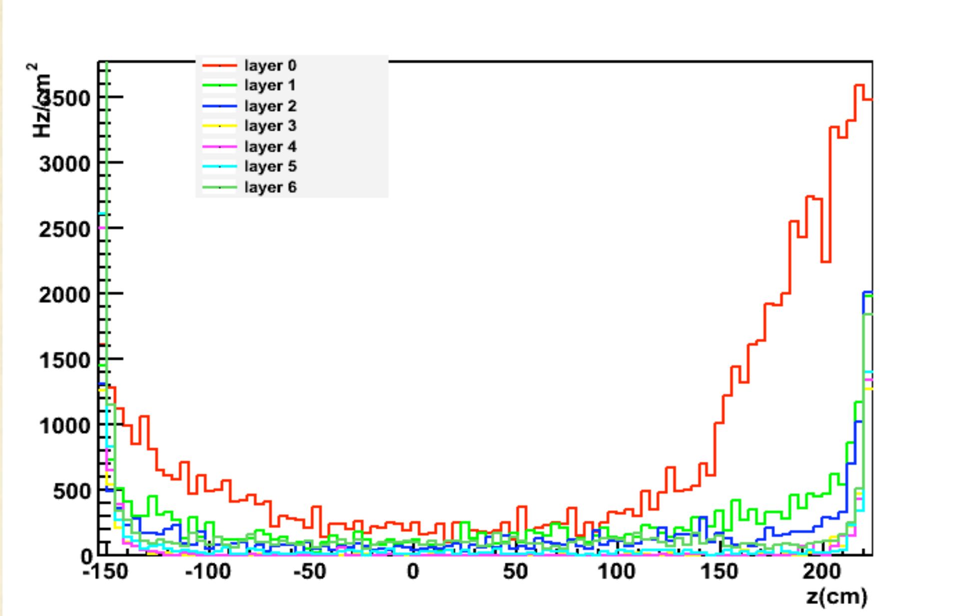


Rate for photons, Layer0: Barrel

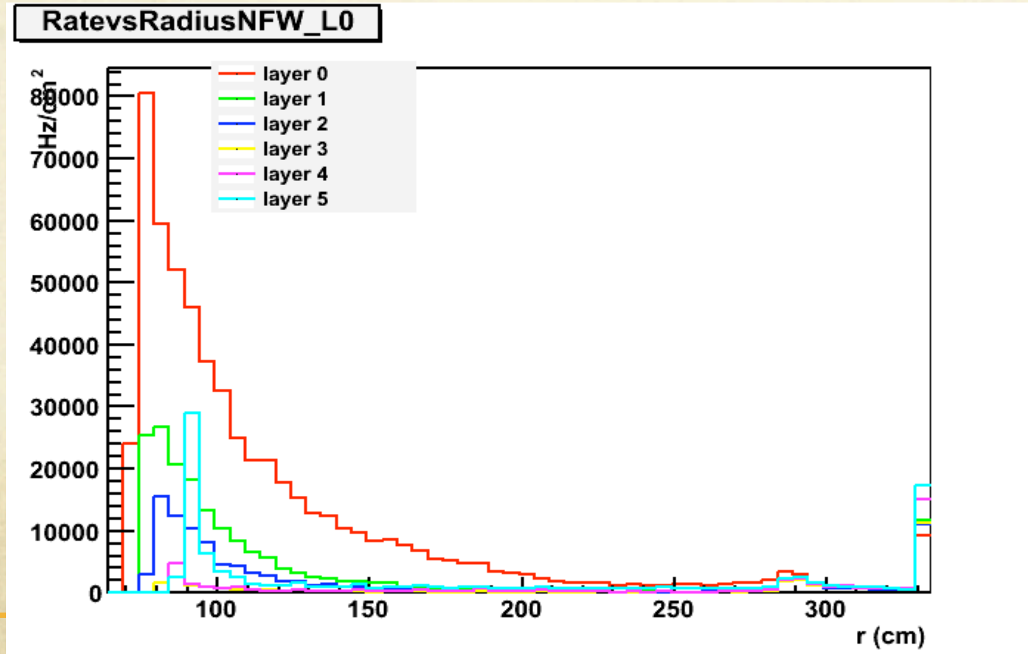


γ rates for Different layers

Rate vs Z-coordinate for Barrel



Rate vs radius for FWD Endcap



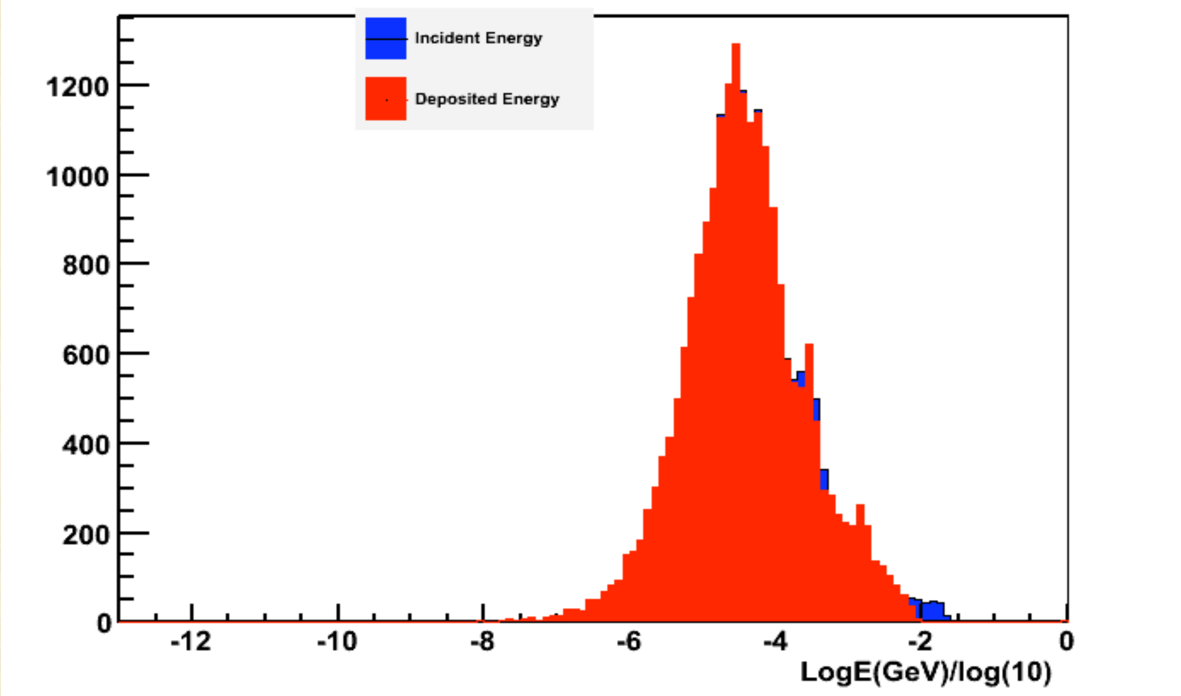
Electrons

Why do we have to worry about electrons

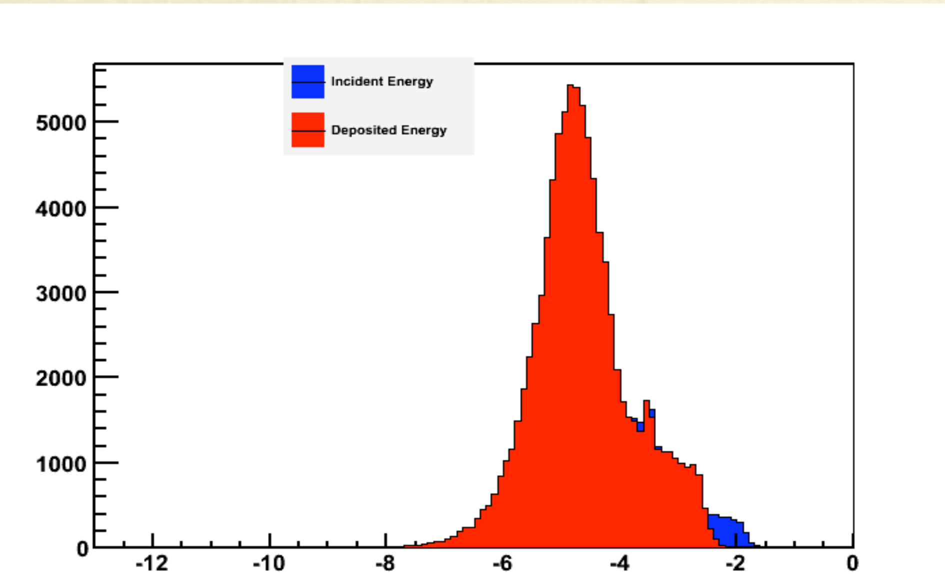
- Electrons are charged particle that produce signals

Electron Energy Distributions

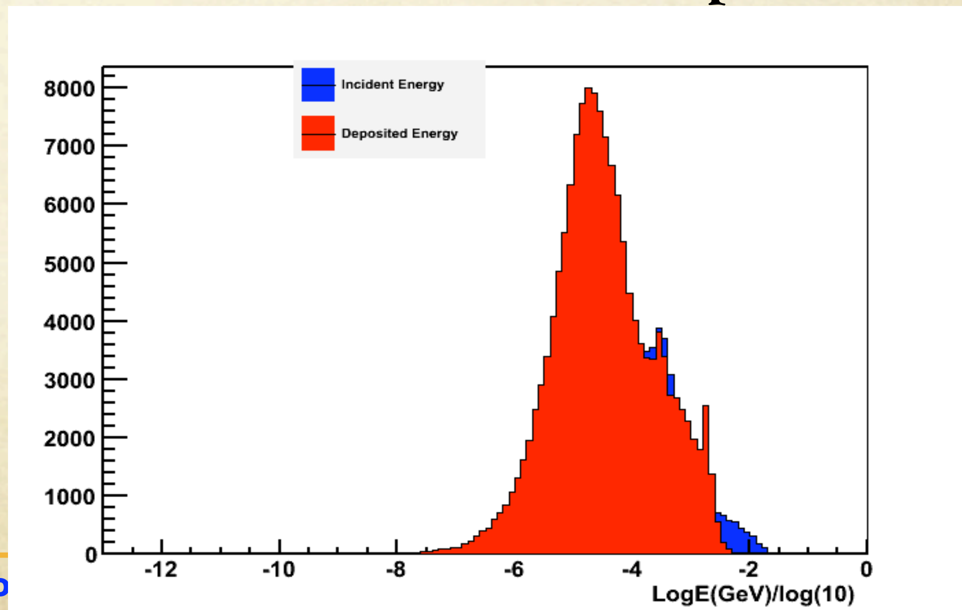
Barrel



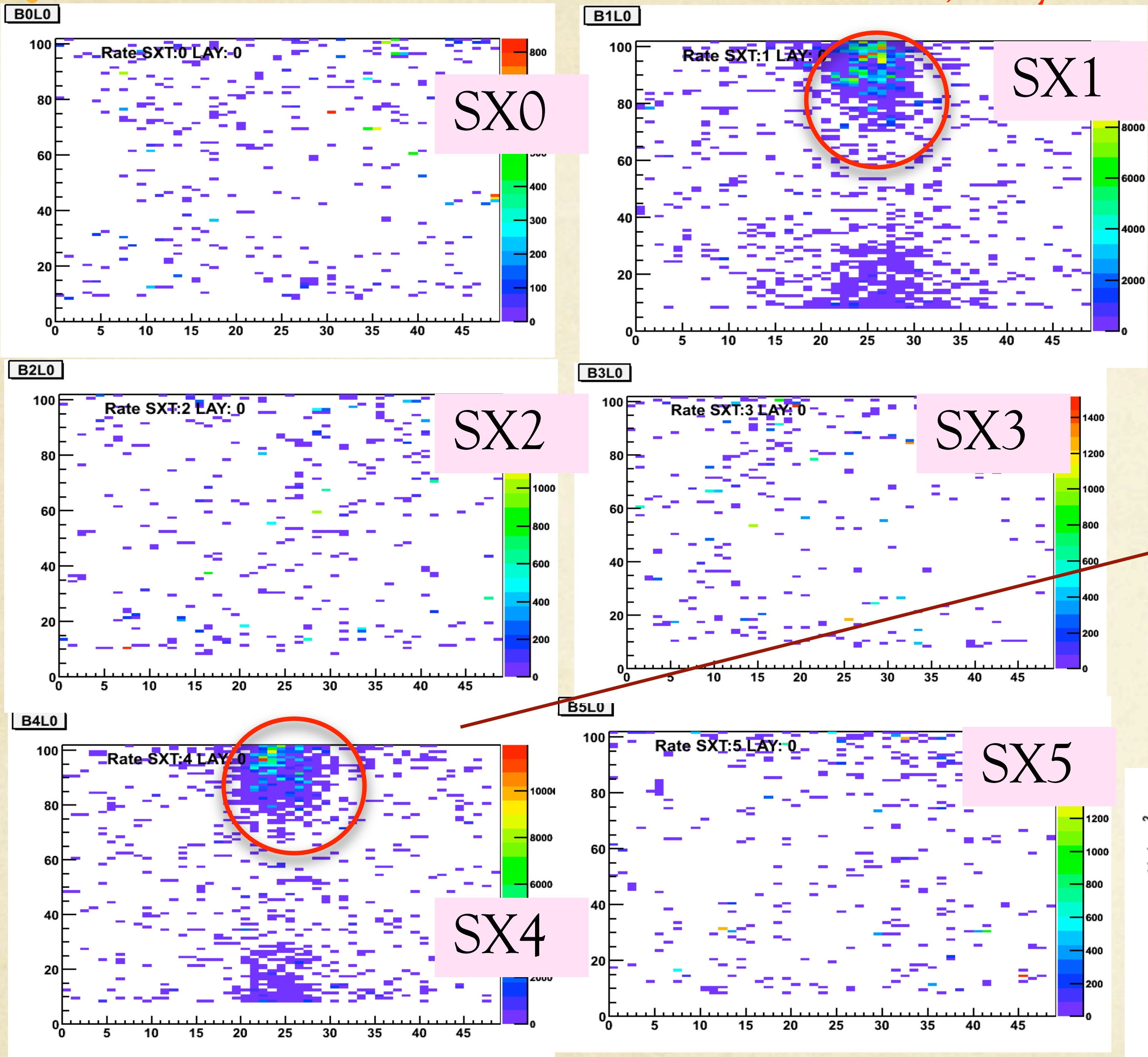
Backward Endcap



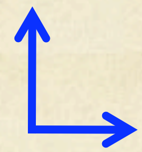
Forward Endcap



Rate for electrons, Layer0: Barrel

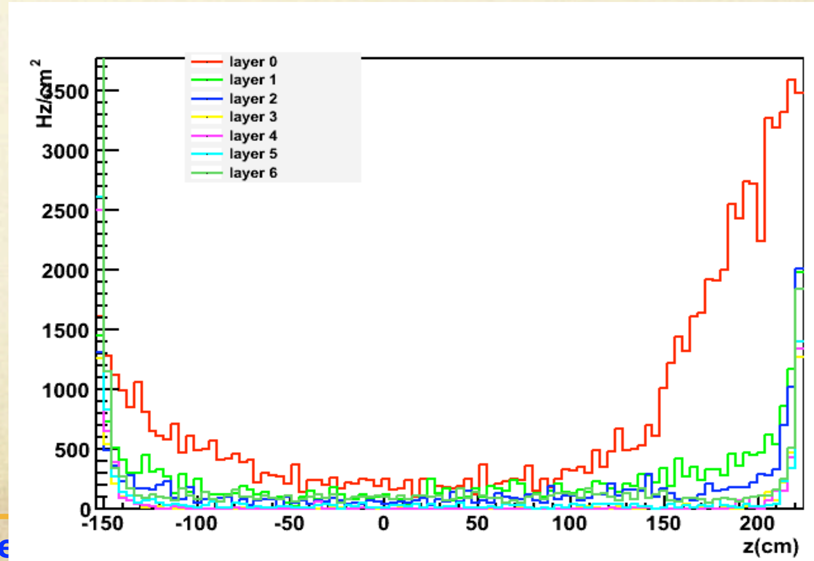


Hz/cm^2

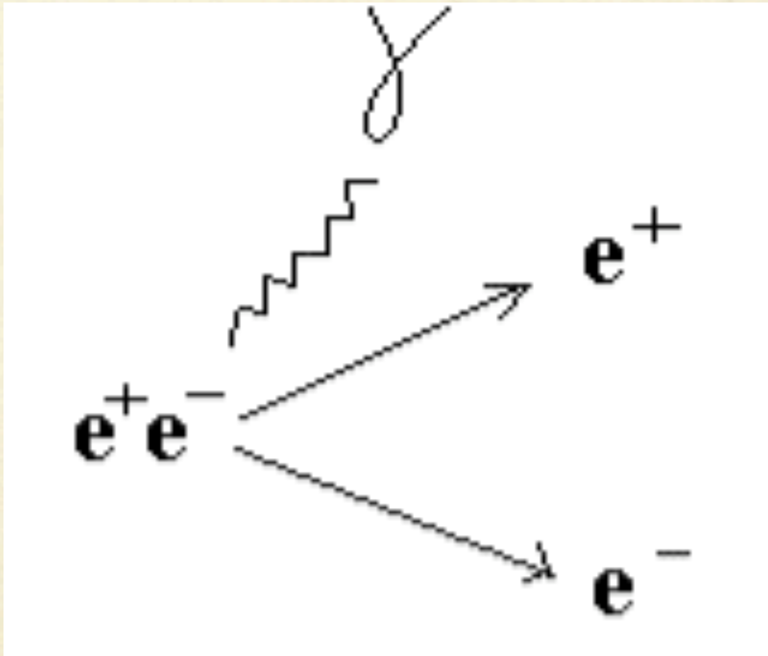


HOT SPOTS
LIKE IN
THE GAMMA
CASE

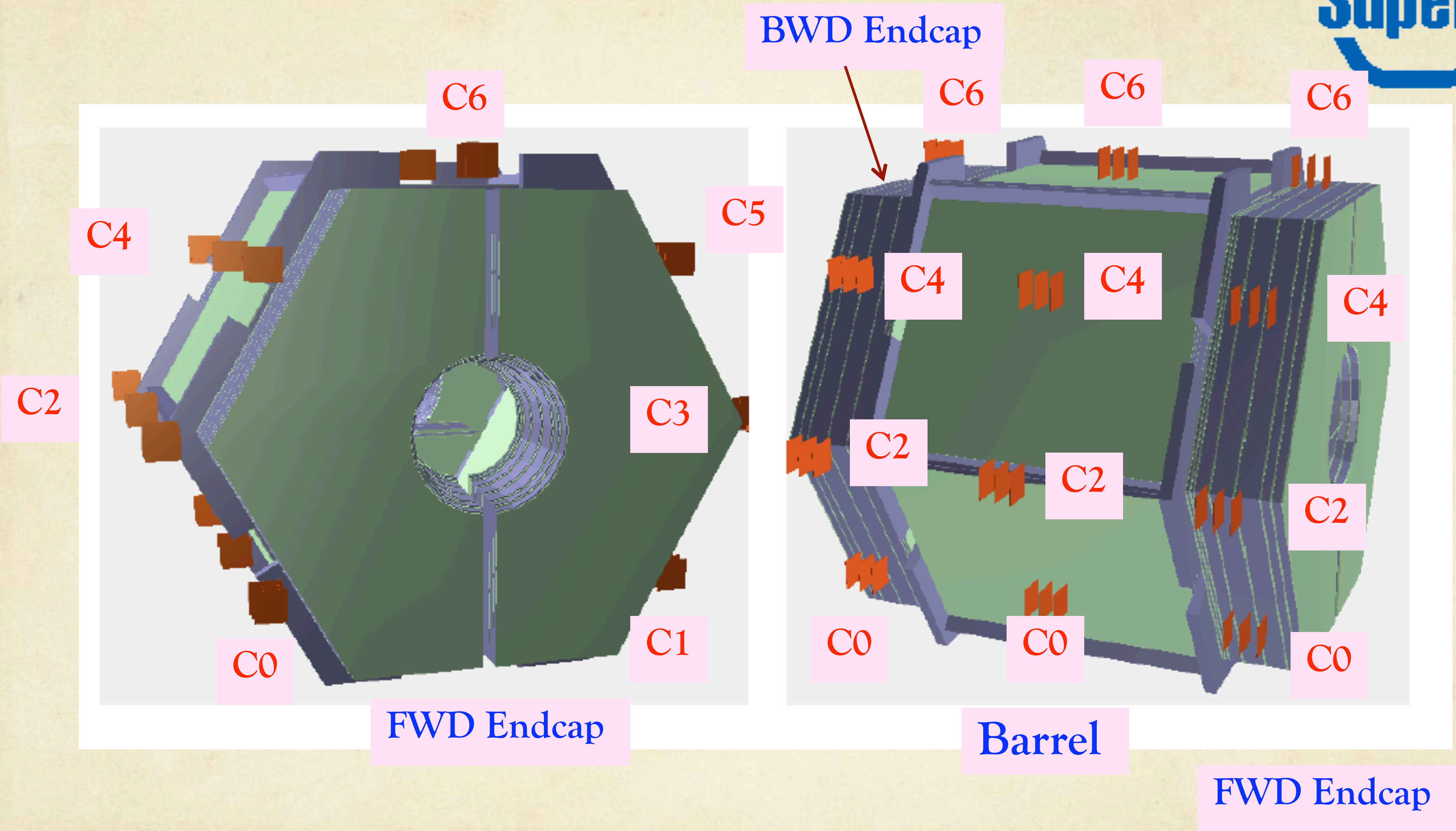
Rate vs Z-coordinate



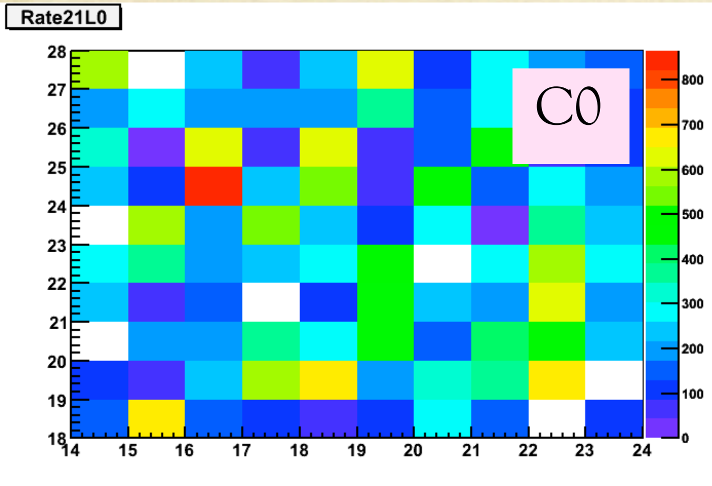
Radiative BhaBha background crossing the IFR FEE boards

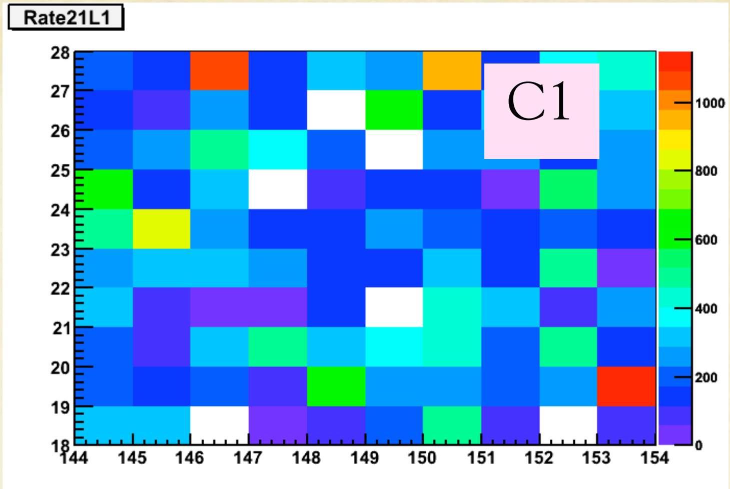


Present layout of the IFR crates

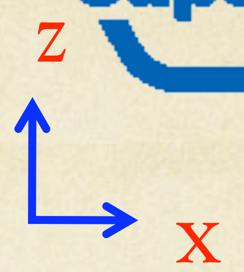


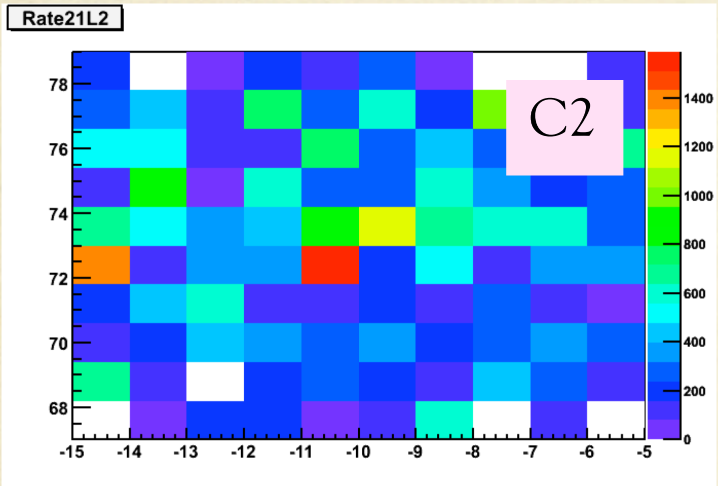
Neutron Rate for FEEs Electronics (Barrel)

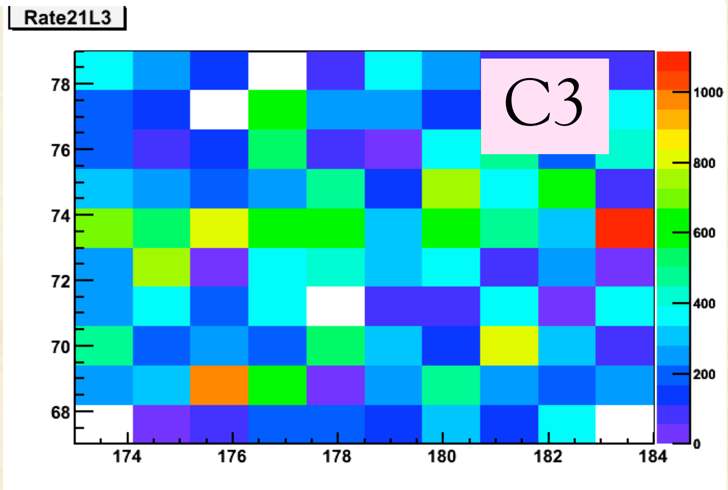


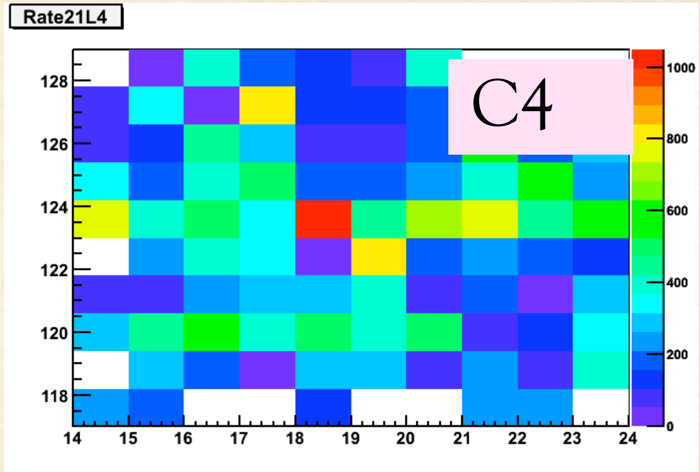


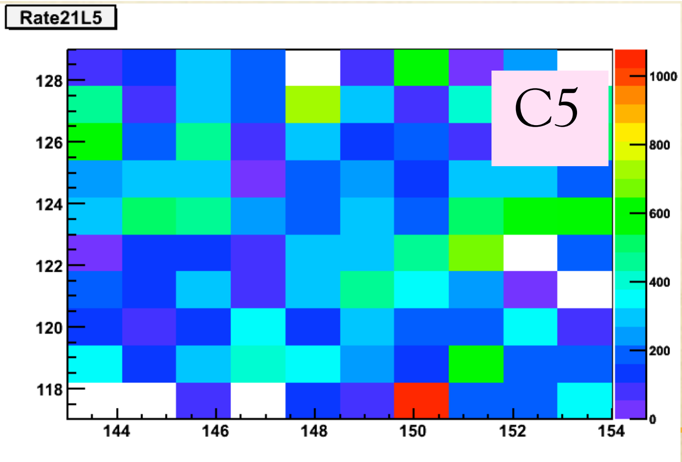
Hz/cm^2

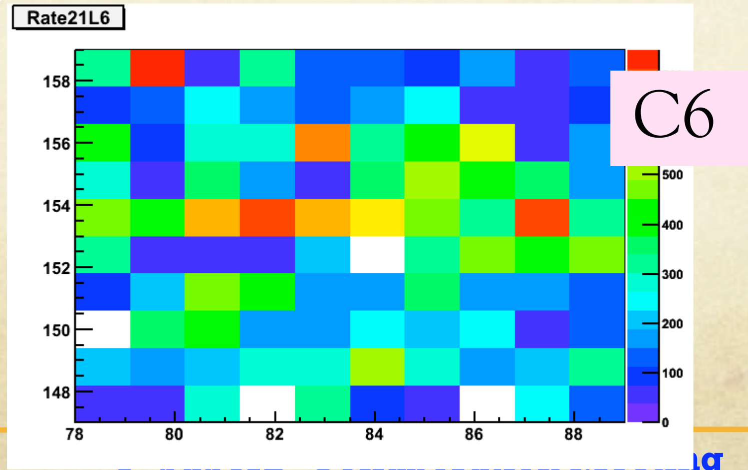






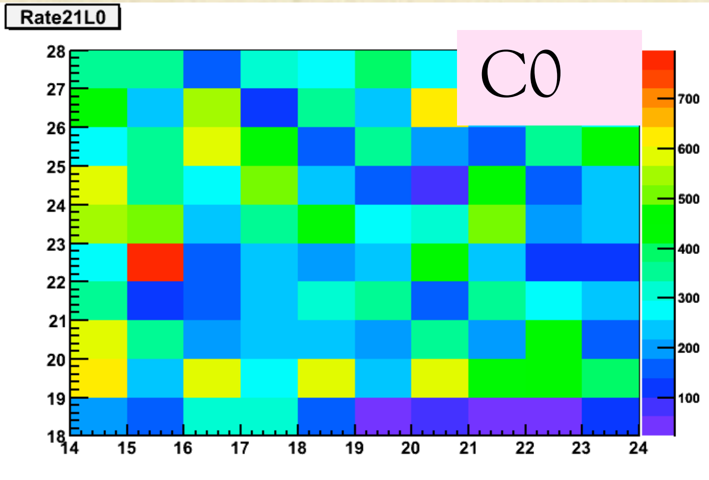


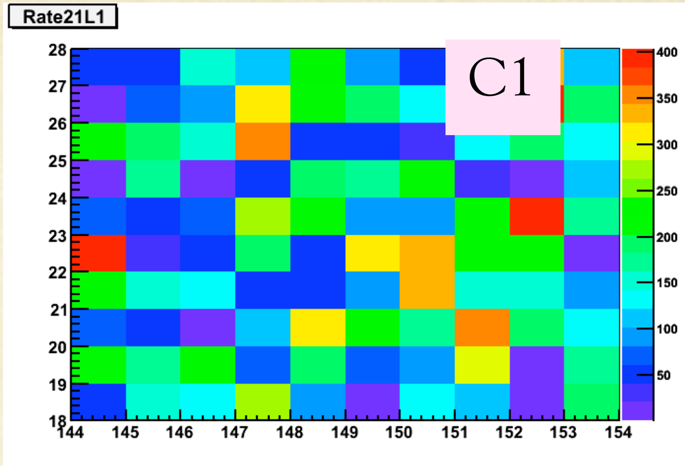




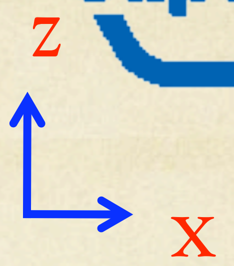
To see the plots with better resolution
http://www.fe.infn.it./~santoro/SuperB/Background/Neutrons/Touschek.html

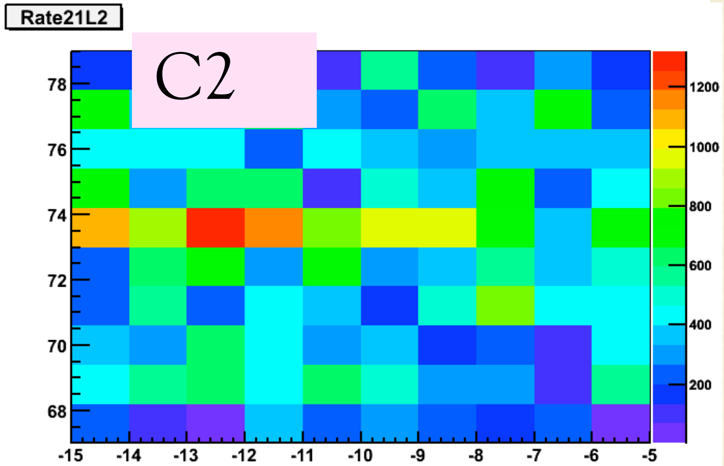
Electrons Rate for FEE Electronics Barrel

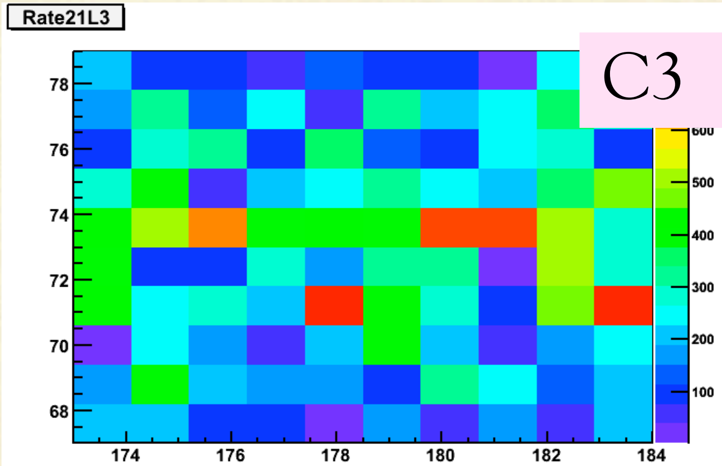


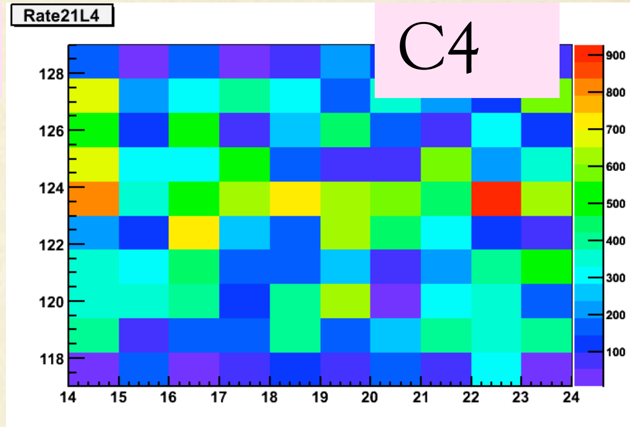


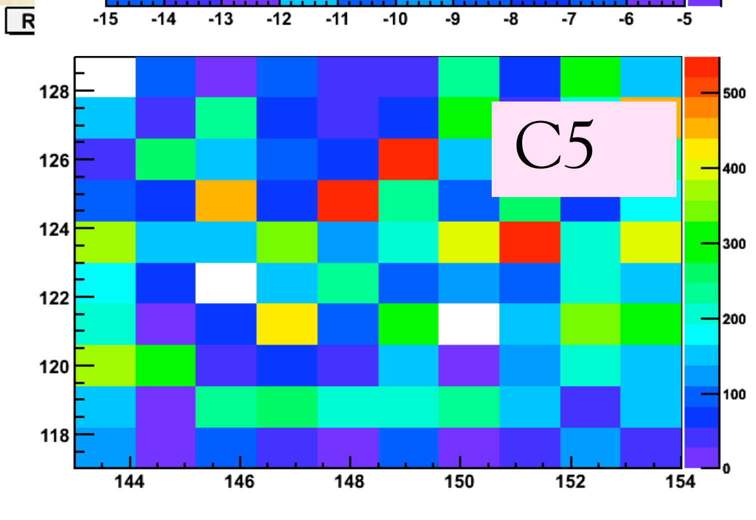
Hz/cm^2

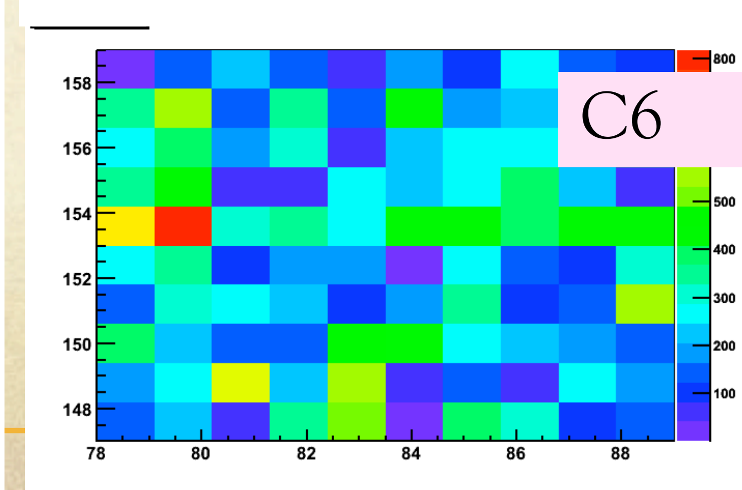












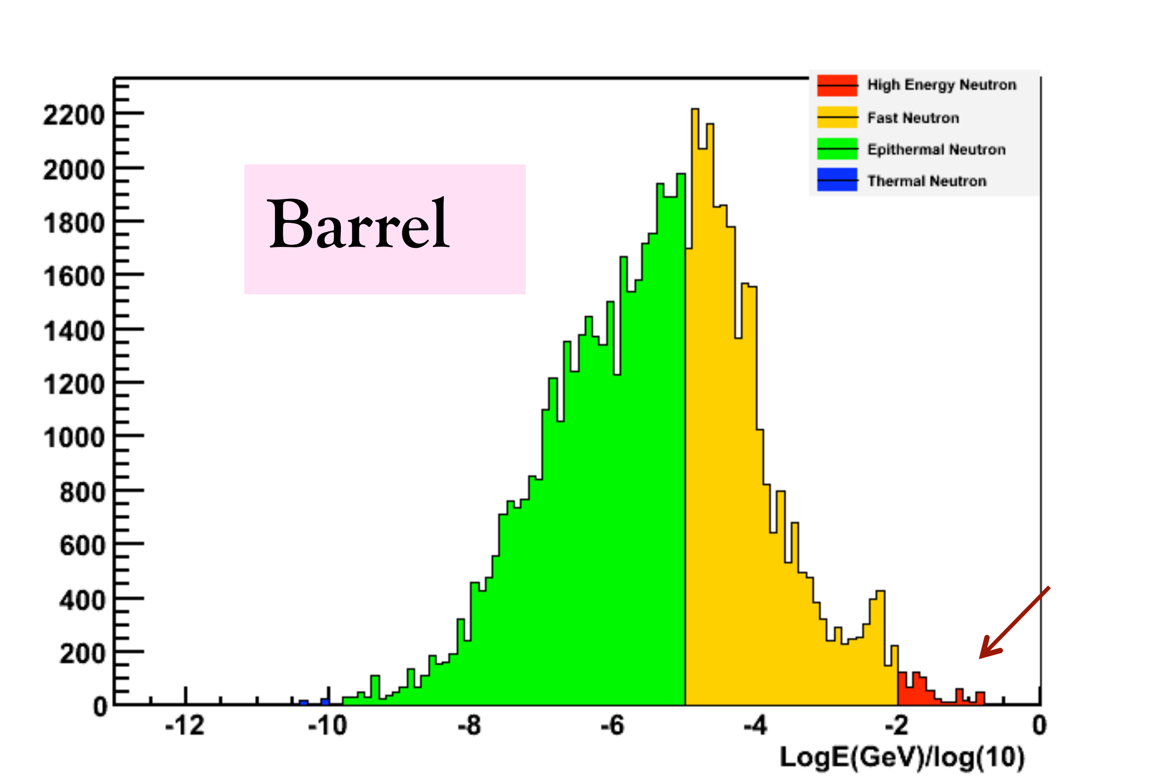
To see the plots with better resolution http://www.fe.infn.it./~santoro/SuperB/Background/Electrons/Touschek.html

- 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 we are working with our electronic expert to have a complete knowledge of the impact of the background to our FEEs

Touschek events studies

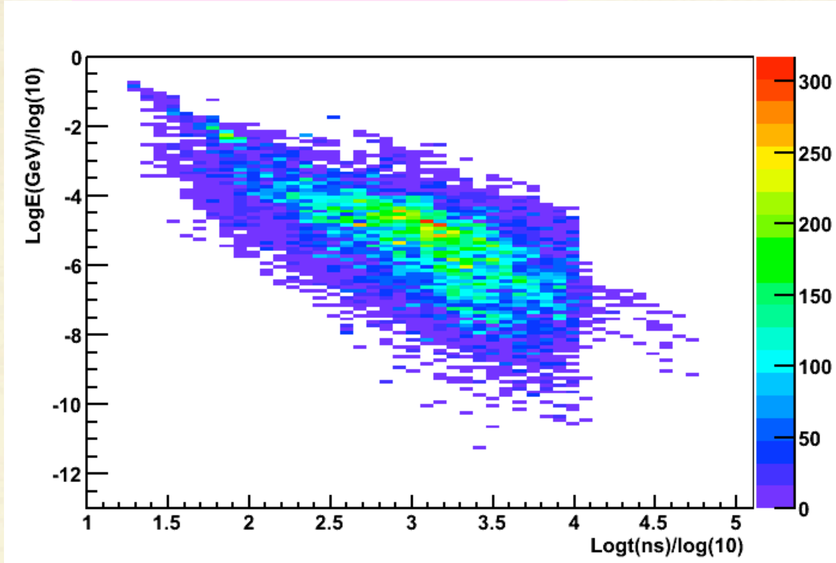
The Touschek events in this presentation come from the HER

Neutron Energy Distributions for Touschek HER events

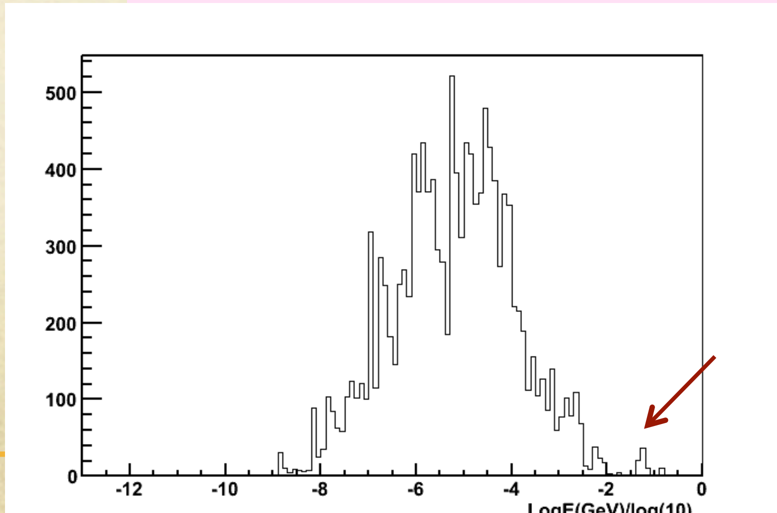


Barrel

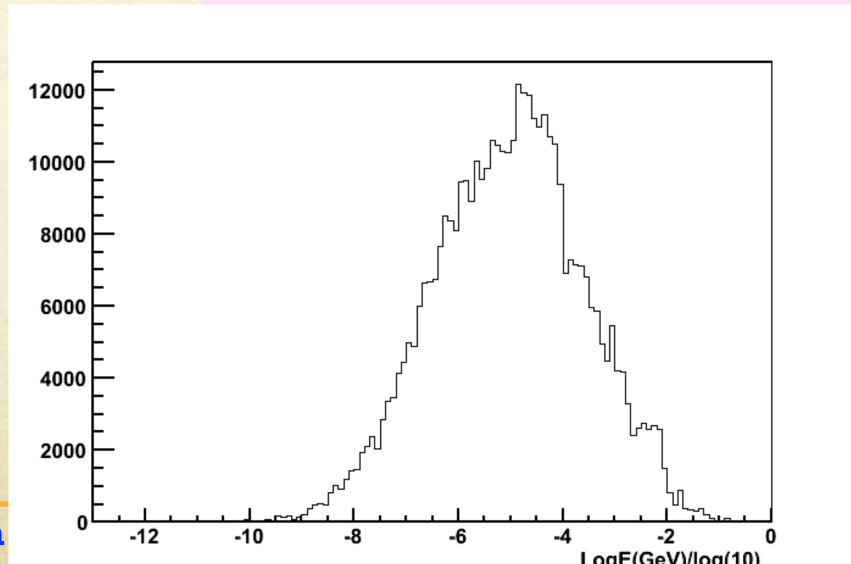
Energy vs time distributions



Backward Endcap

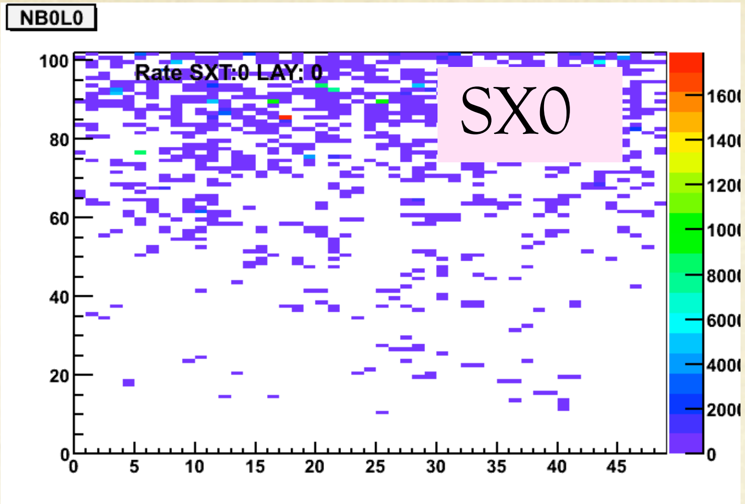


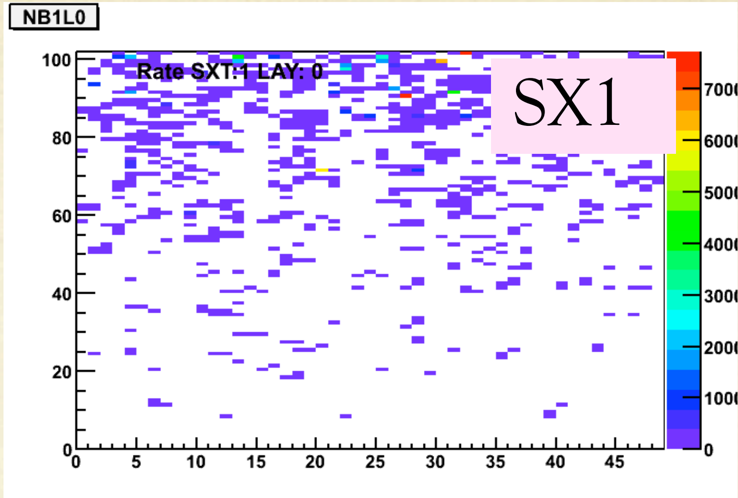
Forward Endcap

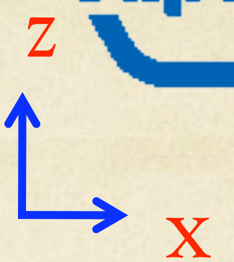


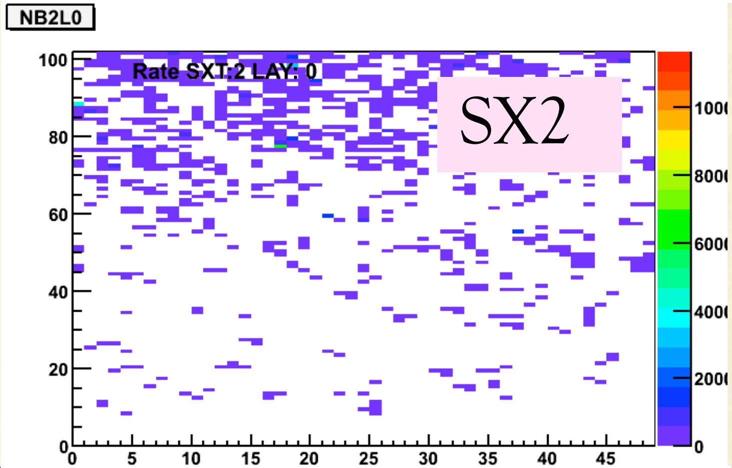
Rate for Neutrons for Touschek events Layer0: Barrel

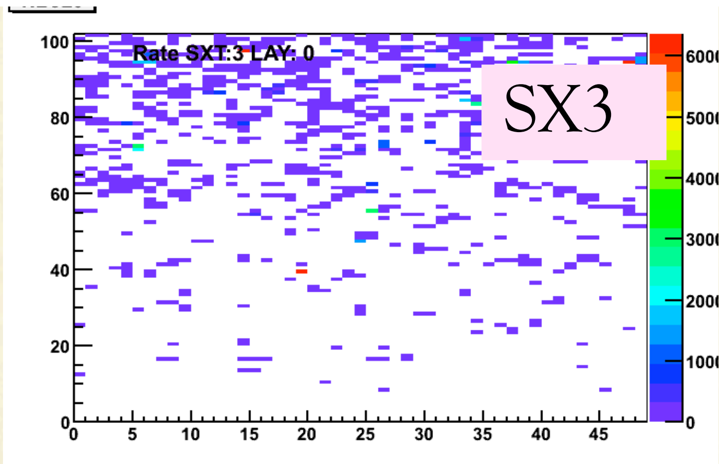
Hz/cm^2



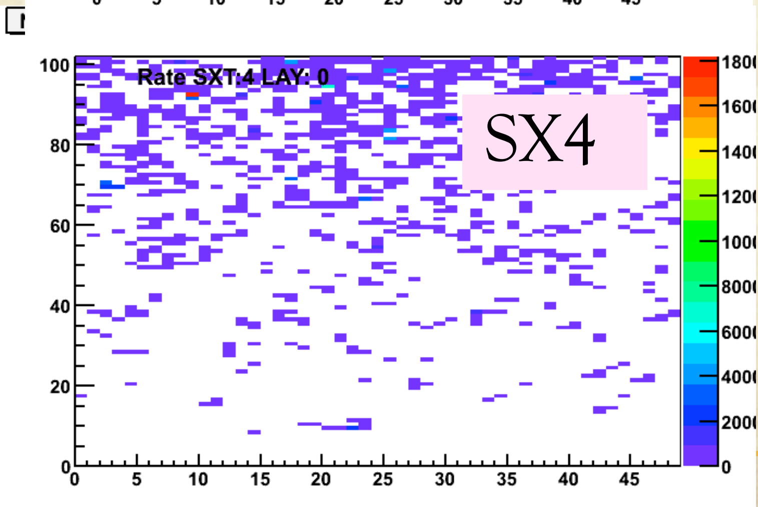


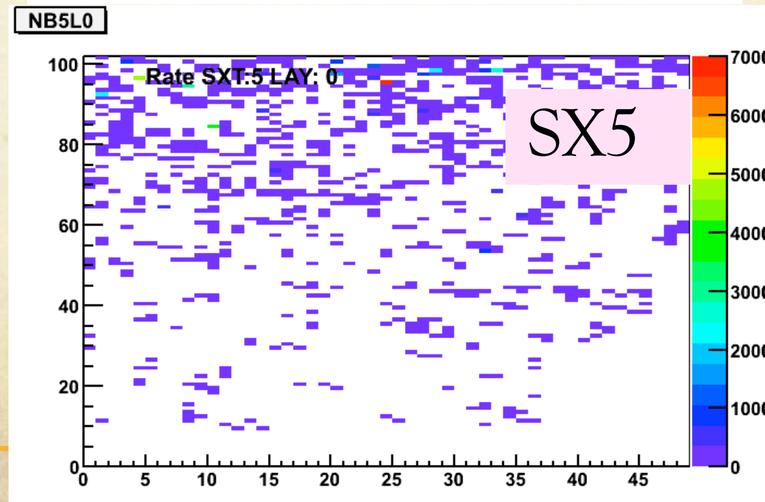


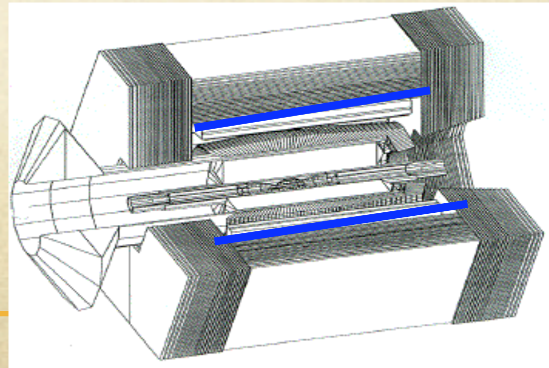




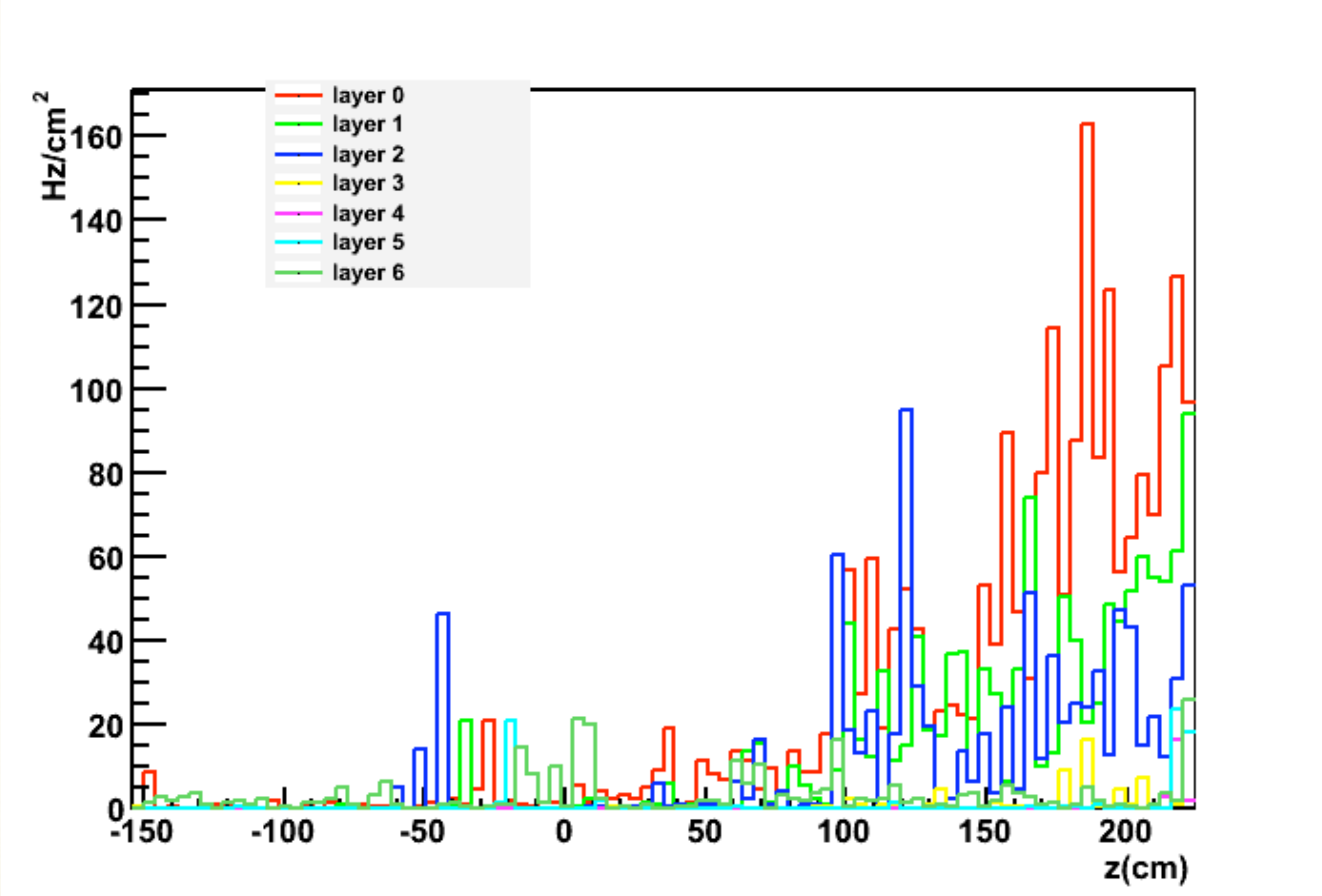
Normalized to 1MeV energy







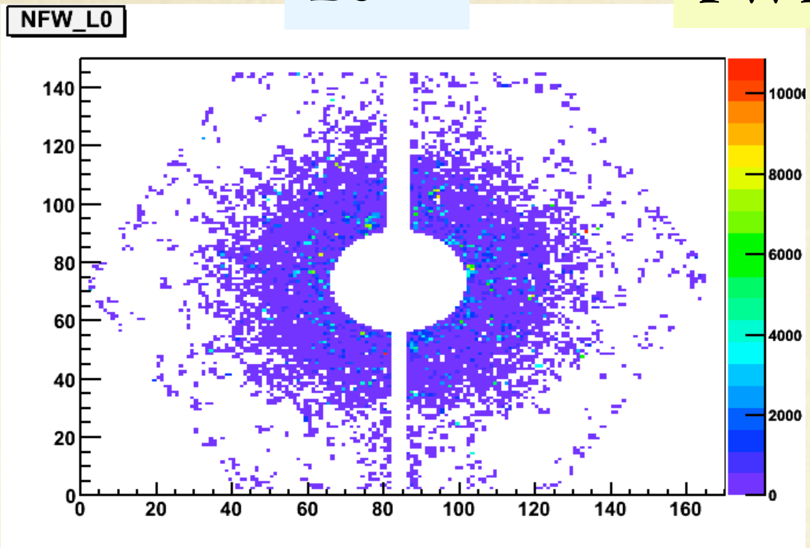
Rate vs Z-coordinate

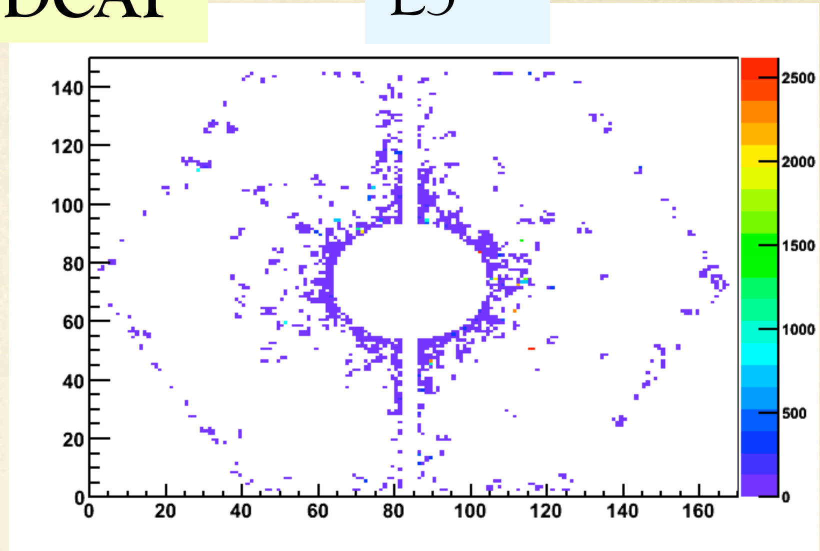


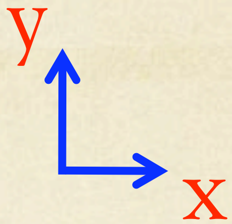
Rate of 160 Hz/cm^2 -> about $1x10^9$ $neutrons/cm^2$ for a year

FWD Endcap Touschek events

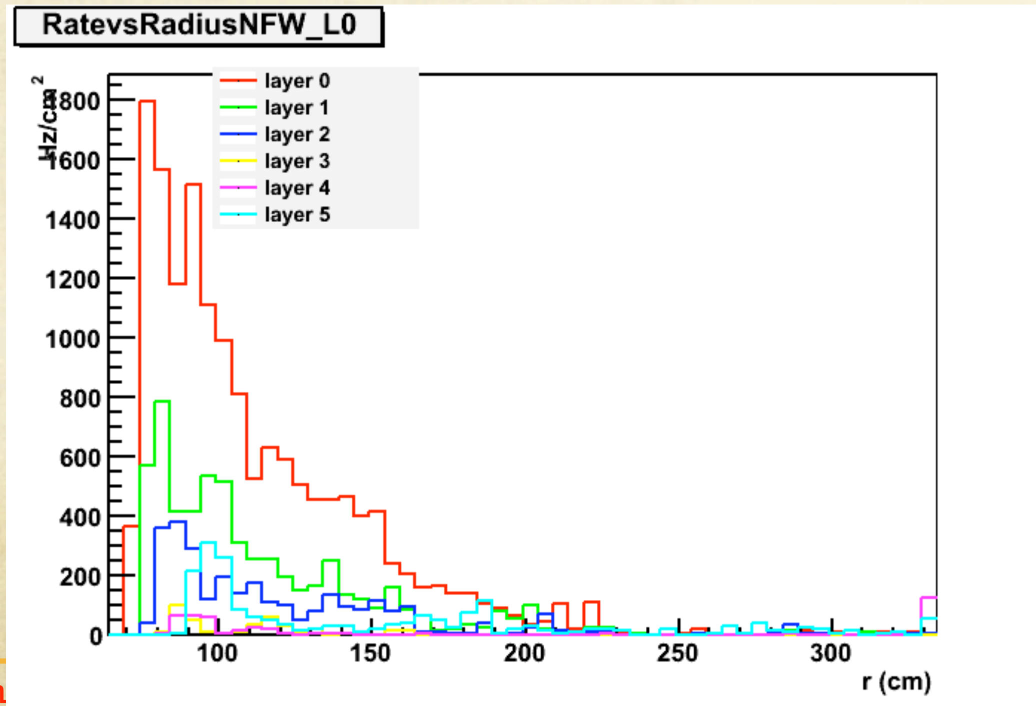
L0 FWD ENDCAP L3

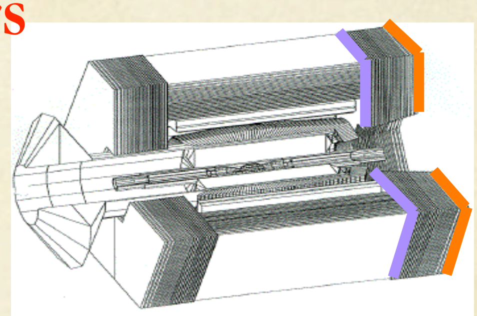






Rate vs Radius for FWD Endcap for Different layers





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/