

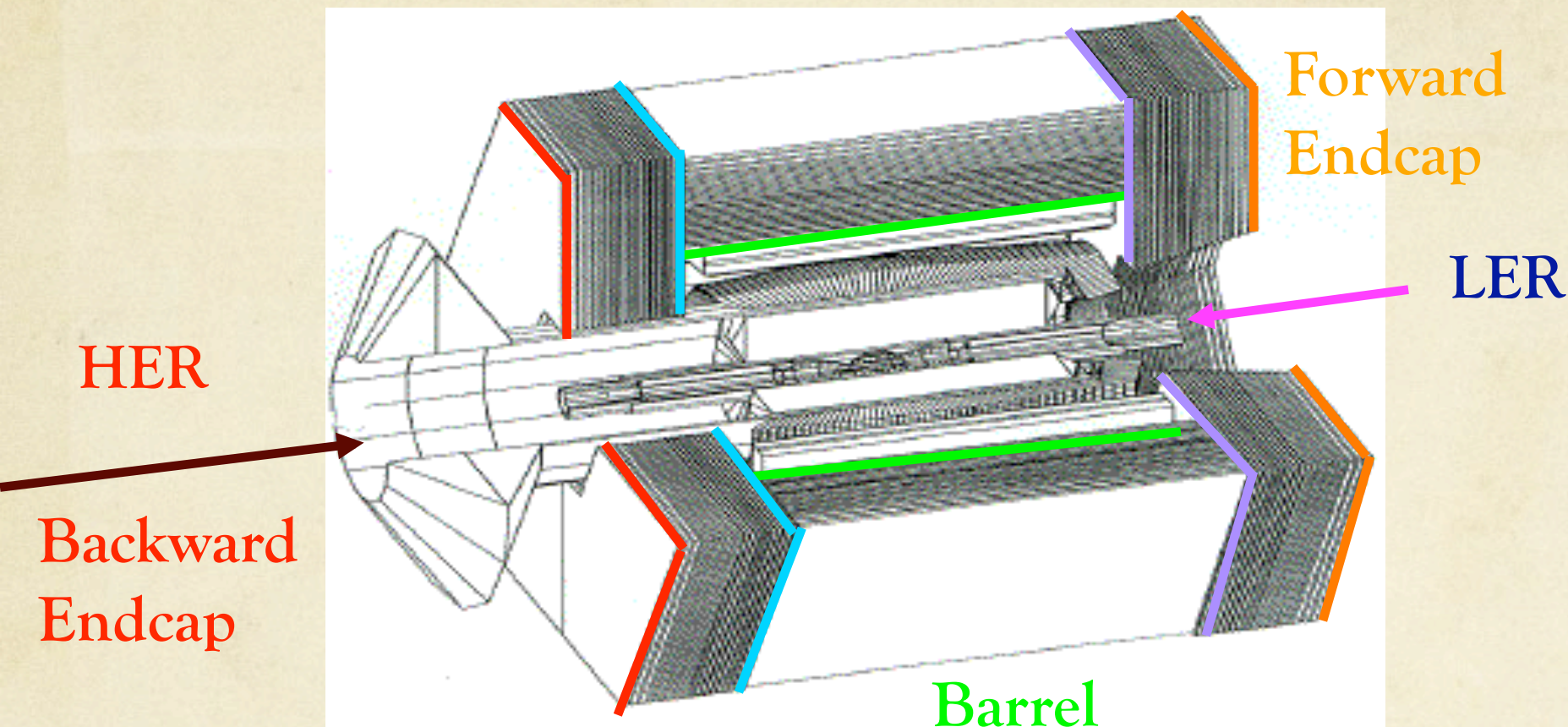


IFR Background Report

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INFN Ferrara

12/15/2011

II-SuperB Collaboration Meeting 15 Dec 2011



Barrel: innermost layers, mostly neutrons

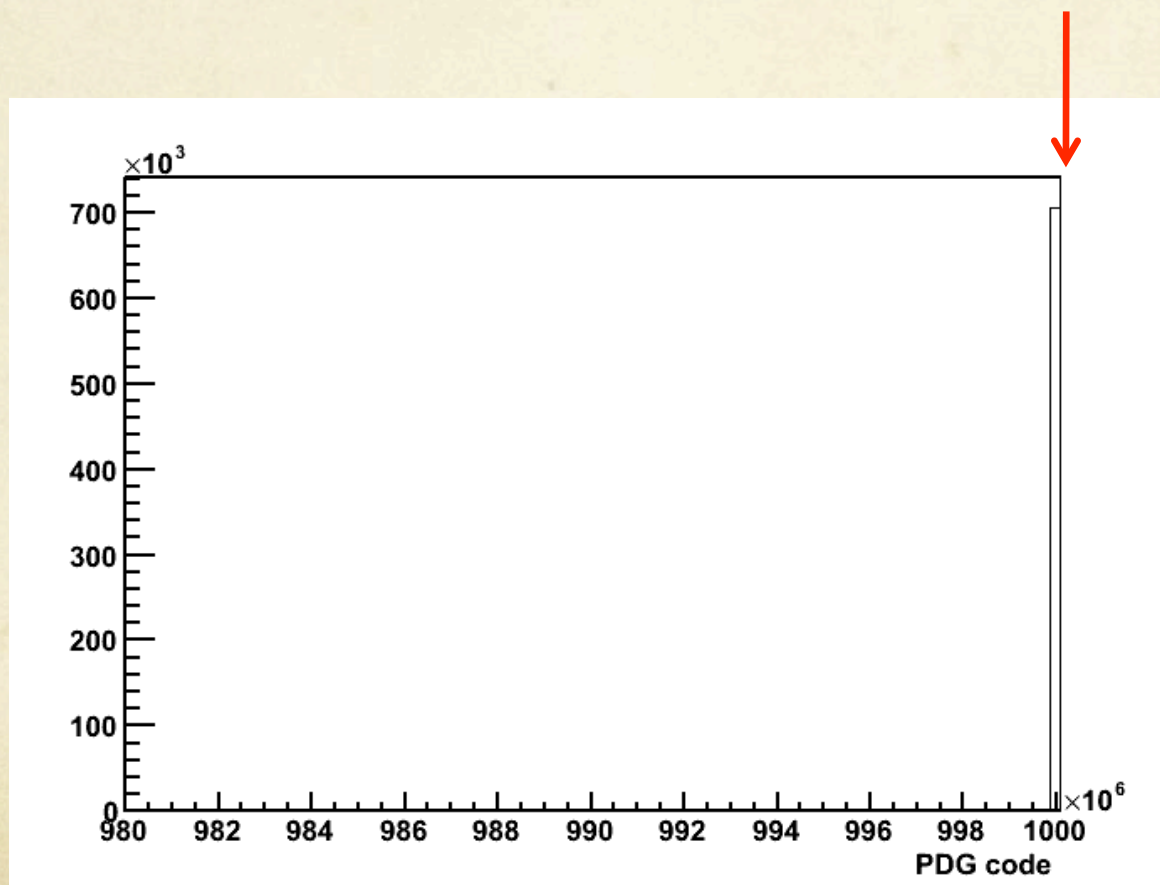
FWD encaps (hottest region) : inner layer and outer layers (BEAM halo), neutrons, electron and photons

BWD encaps: inner layer and small radii

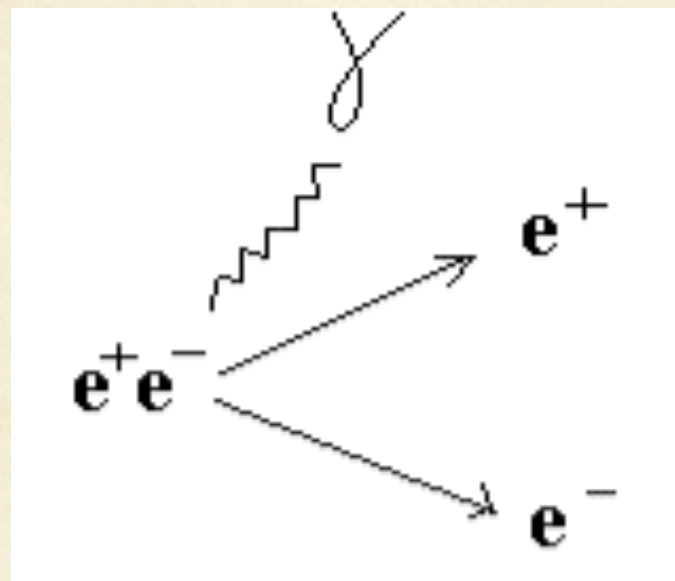
- ✓ Radiative Bhabha Background Studies (neutrons, photons and electron)
- ✓ Touschek background (neutrons, photons and electron)
- ✓ Pair background (neutrons, photons and electron)
- ✓ Background Studies and Absorbed dose on our FEEs

- For Bhabha, Touschek and Pair events the particle crossing the IFR are photons, electron, protons, neutrons and heavy nuclei

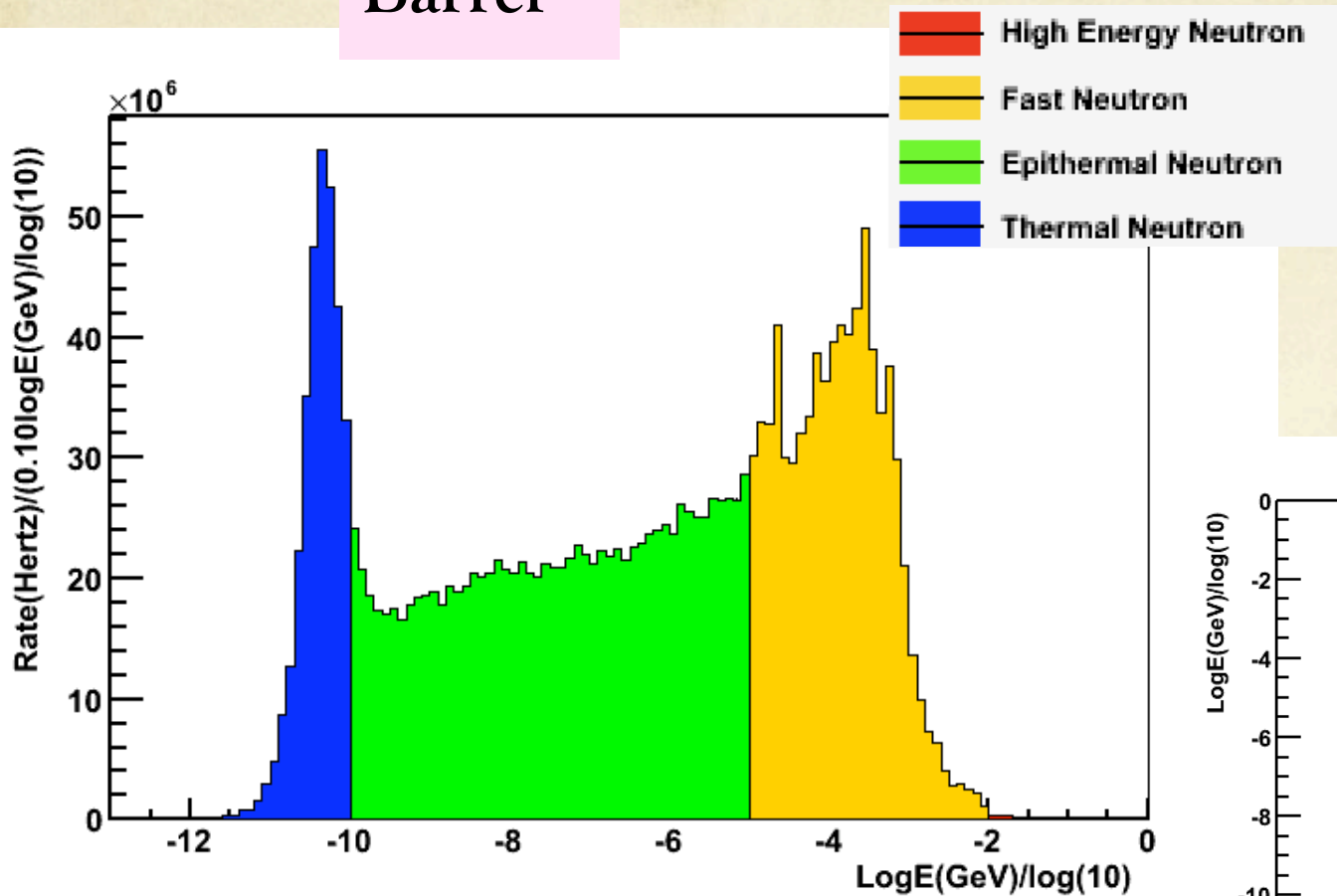
Carbon ion



Radiative Bhabha background crossing the IFR detector

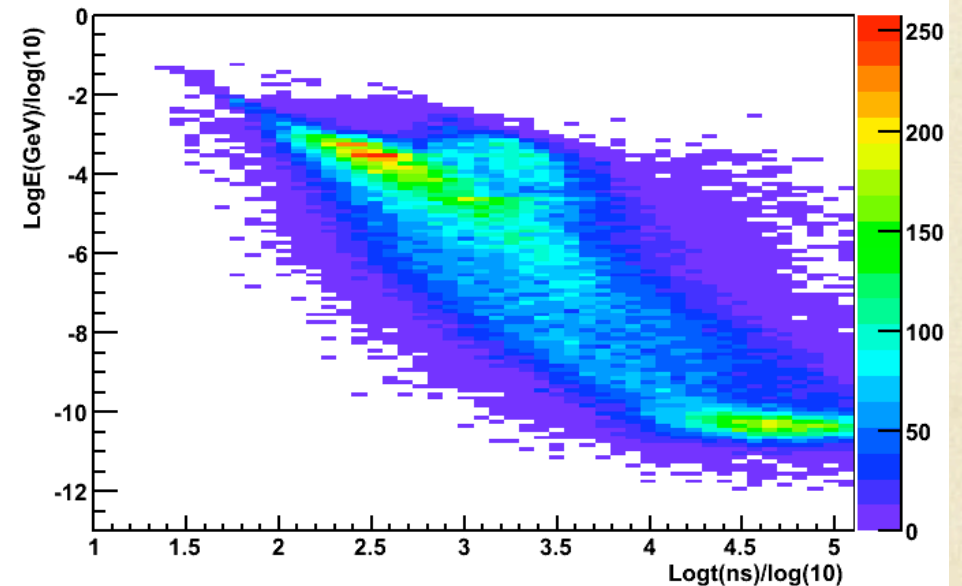


Barrel



Barrel

Energy vs time distributions

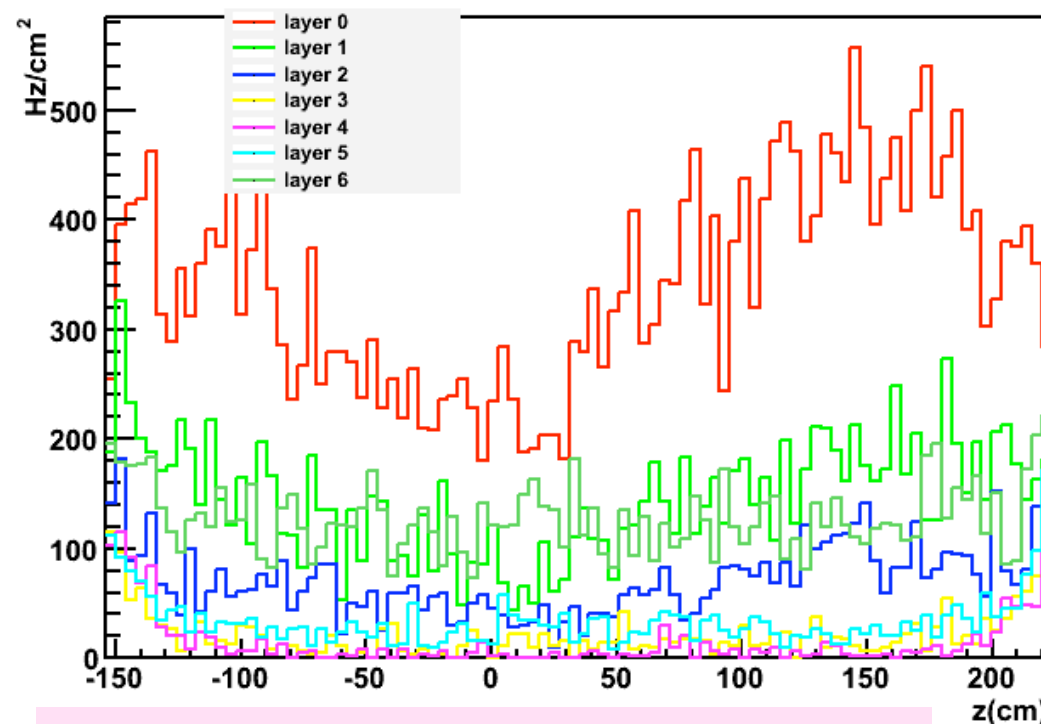


The Energy distribution for FWD and BWD Endcap are similar

Rate vs Z-coordinate for Barrel

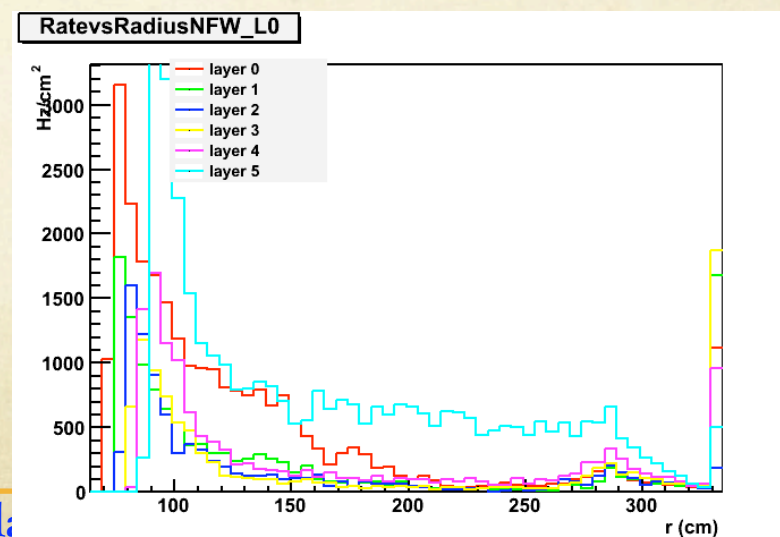
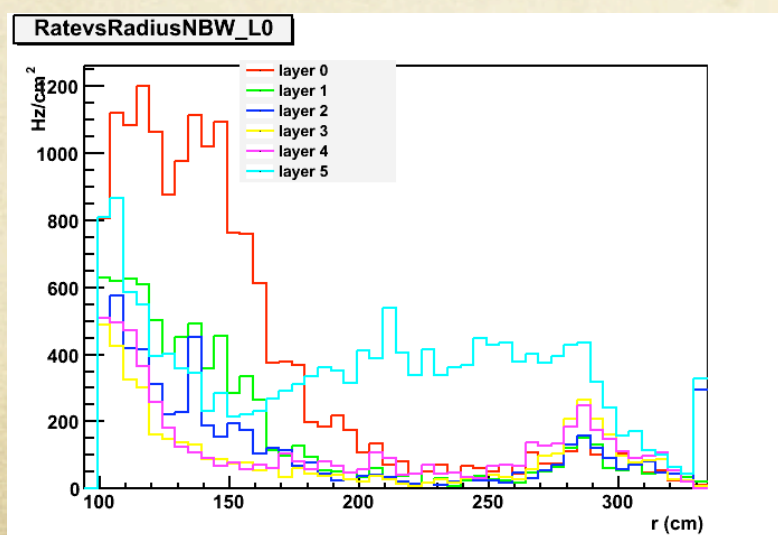
Rate of 450 Hz/cm^2 - \rightarrow about 3×10^9 neutrons/cm² for a year

All the rate are normalized to 1MeV energy



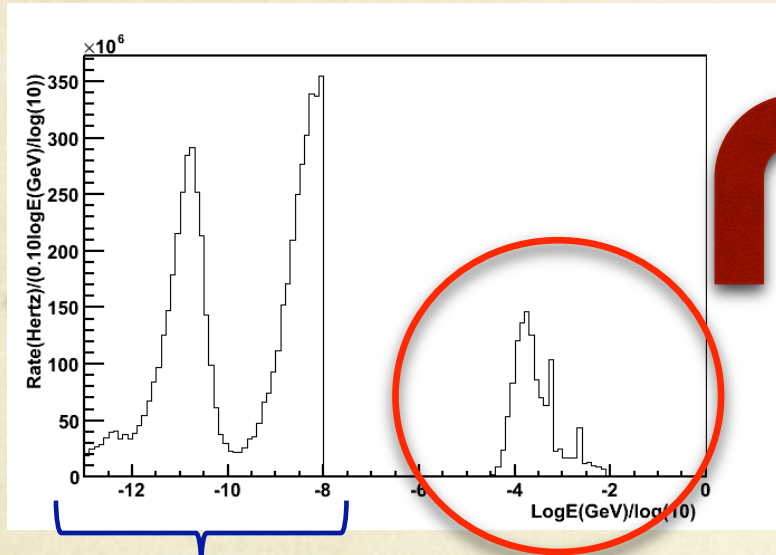
Rate vs radius for BWD Endcap

Rate vs radius for FWD Endcap



Photon Energy Distributions for Radiative Bhabha events

Barrel

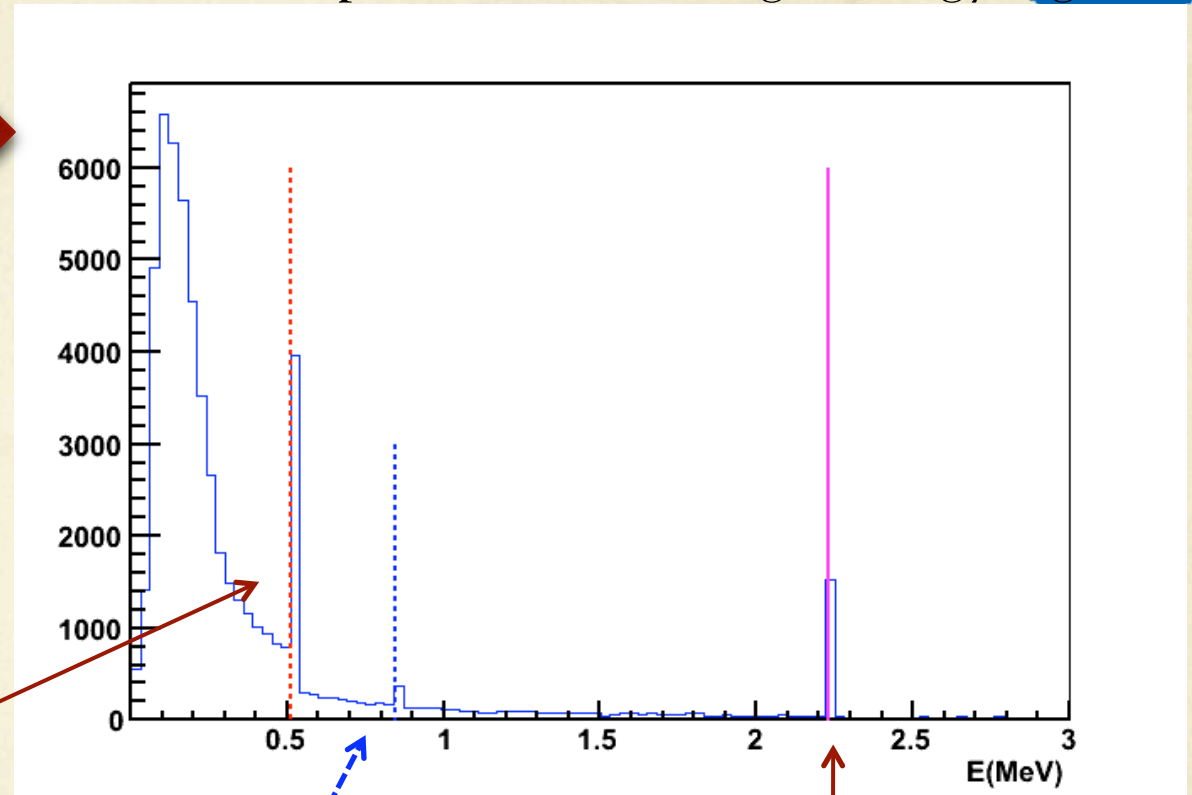


Low energy photons

Photons of energy ~ 0.512 MeV are from annihilation radiation

Barrel

Photon spectrum in the high energy region



Photons of energy ~ 0.847 MeV are due from neutron inelastic scattering on Fe^{56}

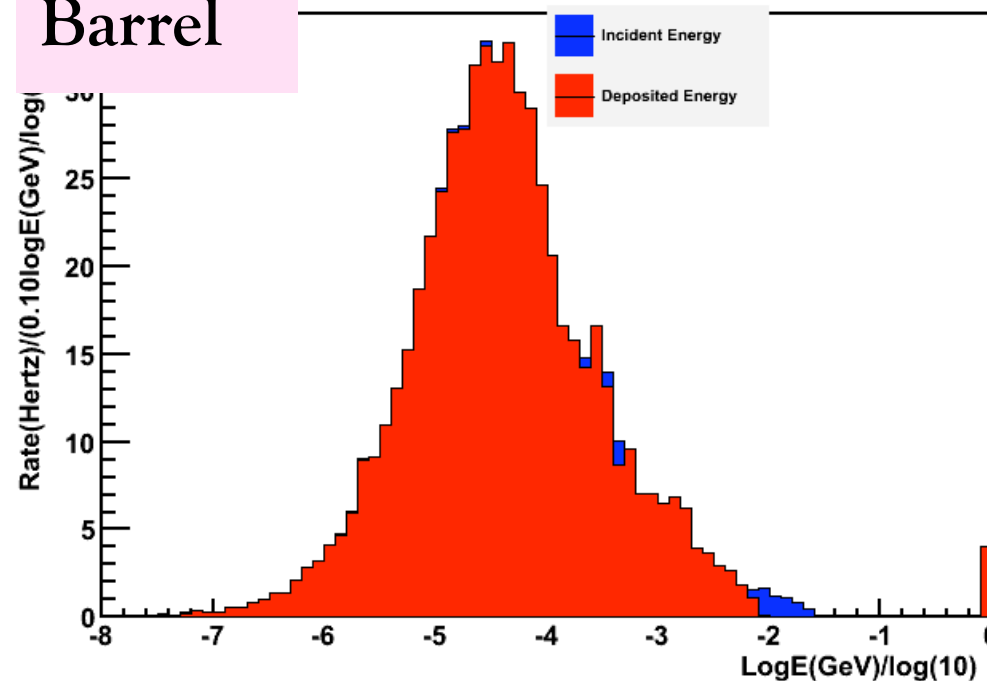
Photons of energy ~ 2.223 MeV are from neutron capture on Hydrogen

The Energy distribution for FWD and BWD Endcap are similar

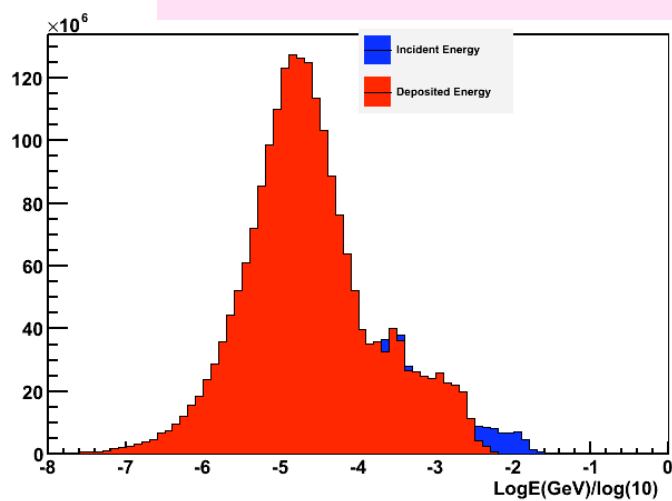
Electron Energy Distributions for Radiative Bhabha events



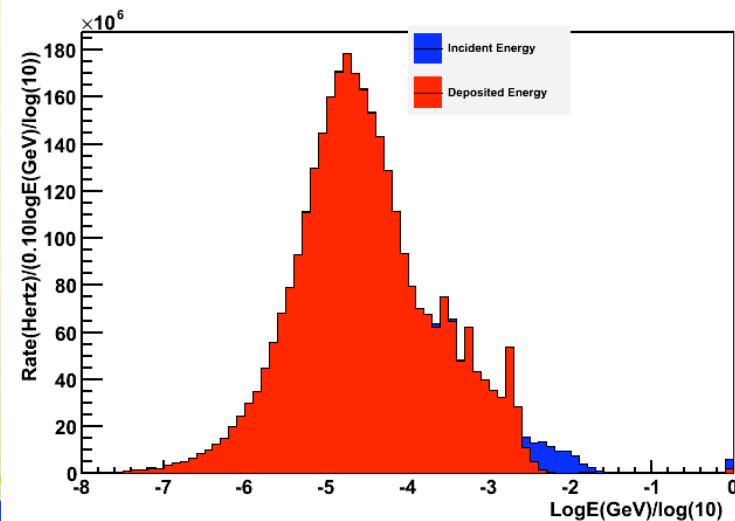
Barrel



Backward Endcap



Forward Endcap

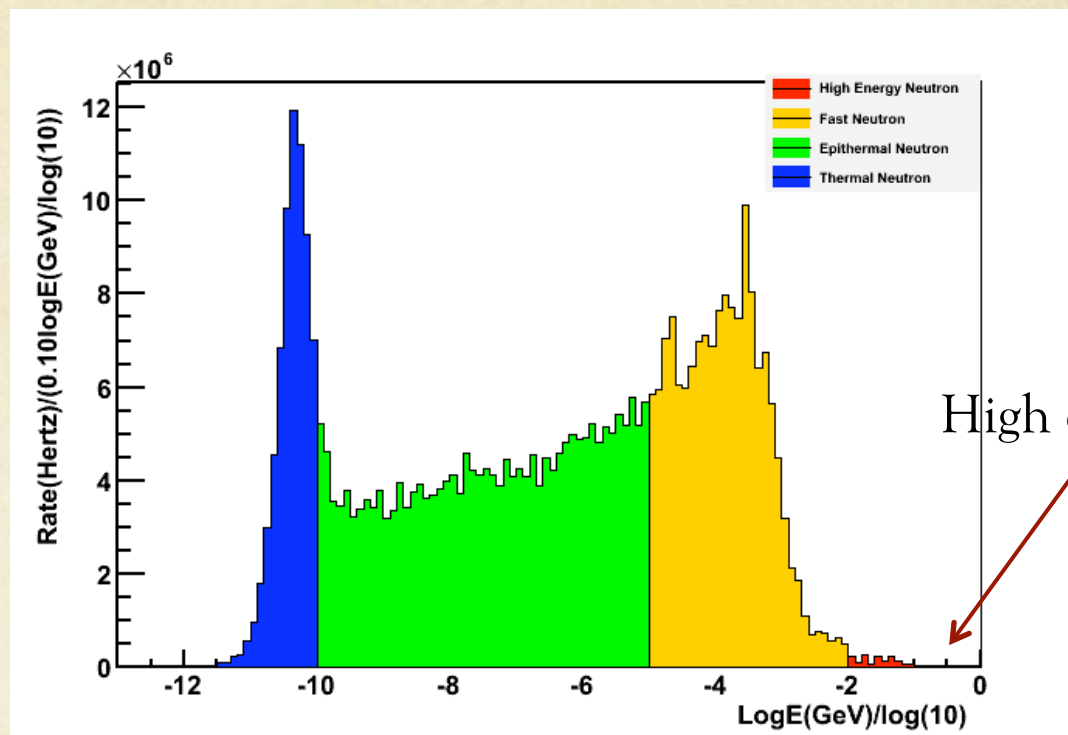




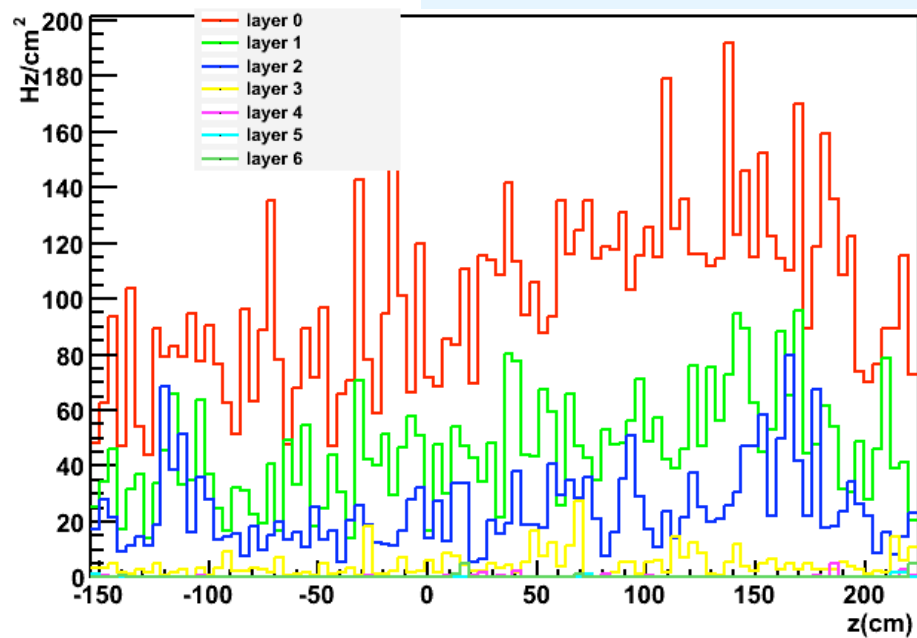
- ✓ The neutrons rates are very high and dangerous for our Sipm
- ✓ The photons and electrons rates are high but they should not be a problem

Touschek events Studies

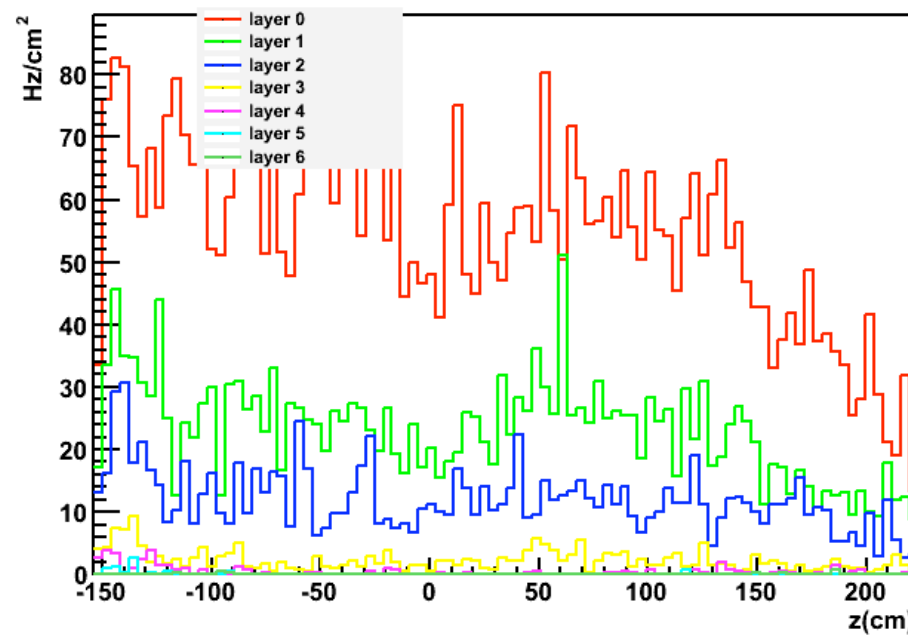
Neutrons Background for Touschek events



Neutron Rate for the HER





Neutron Rate for the LER



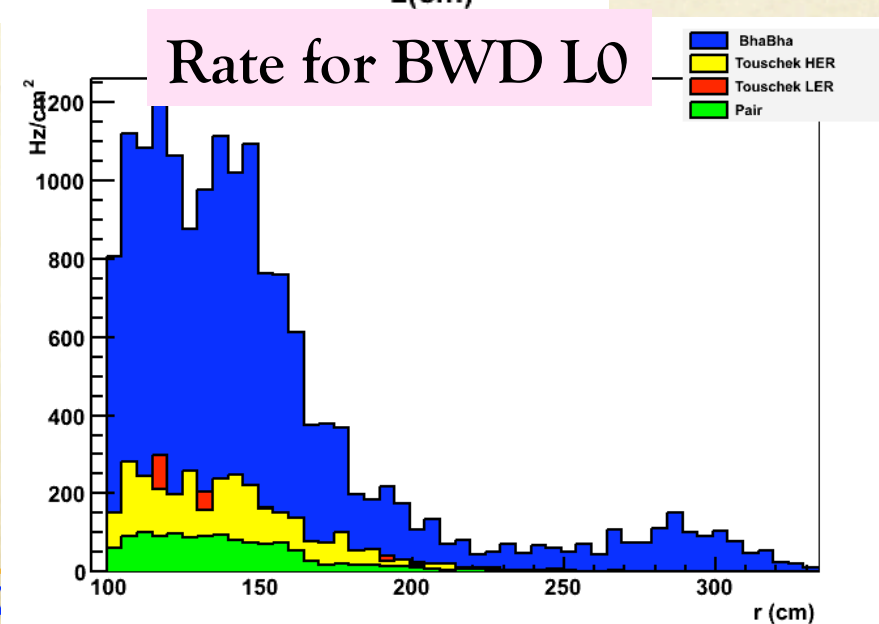
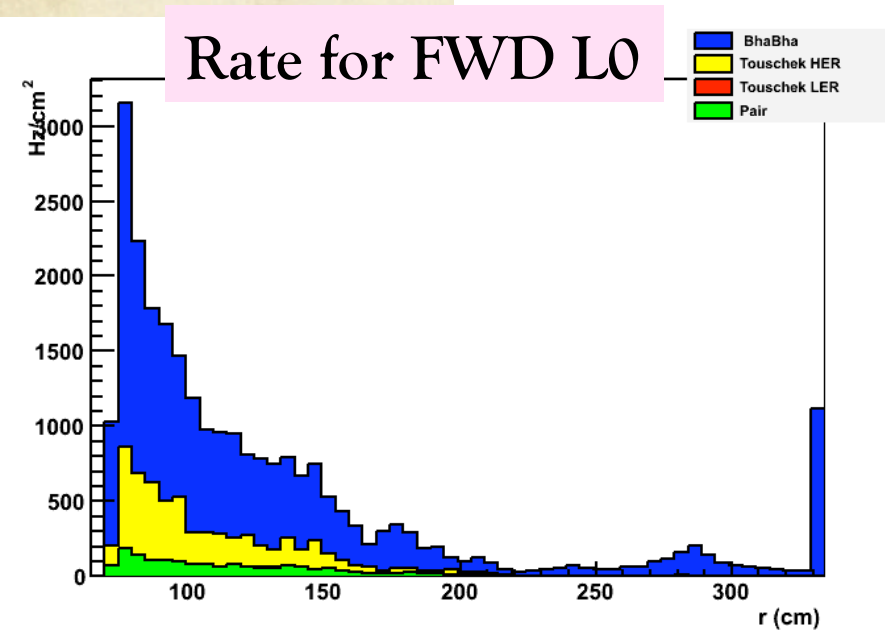
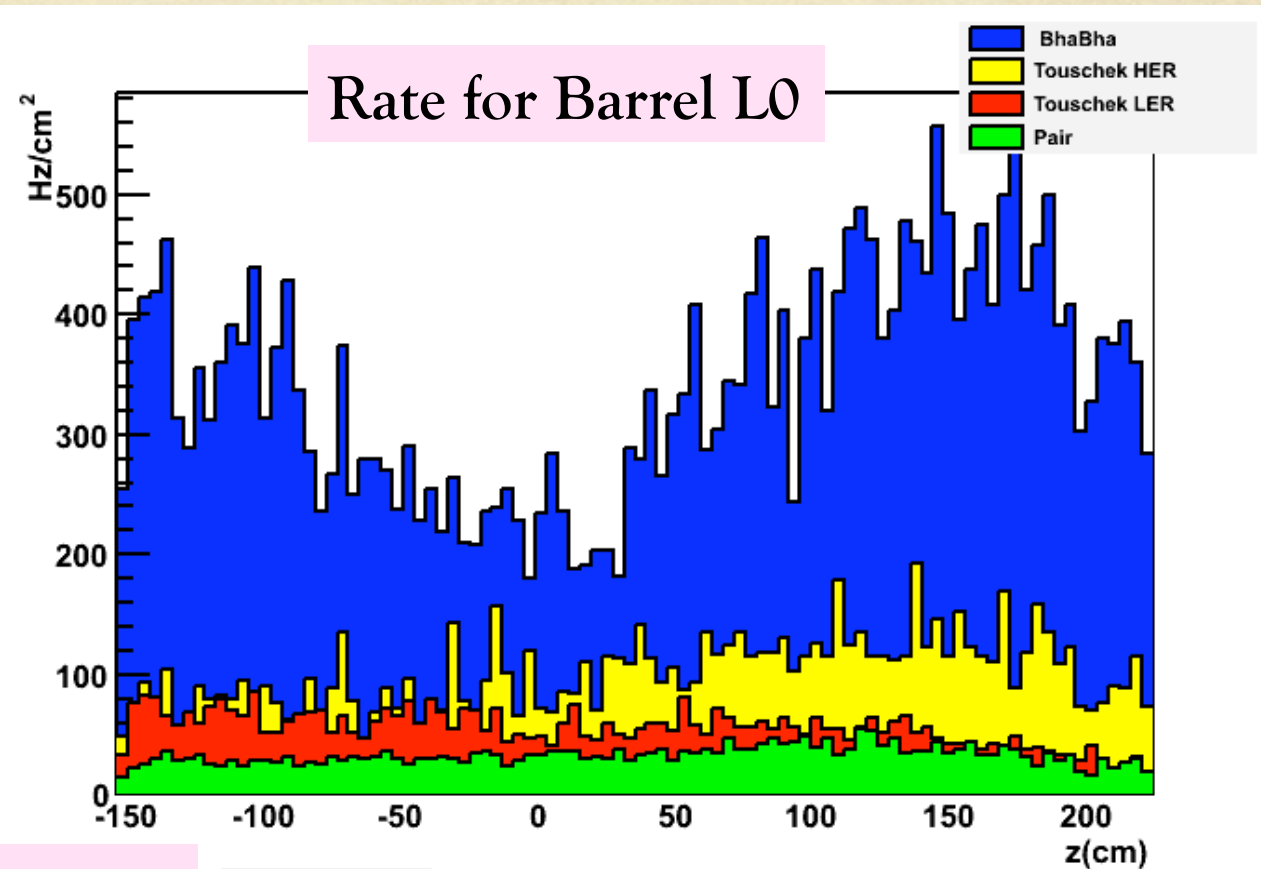


- ✓ Touschek background studied for the HER and LER
- ✓ Results for the HER and LER show that the rate are small compared to the BhaBha one.

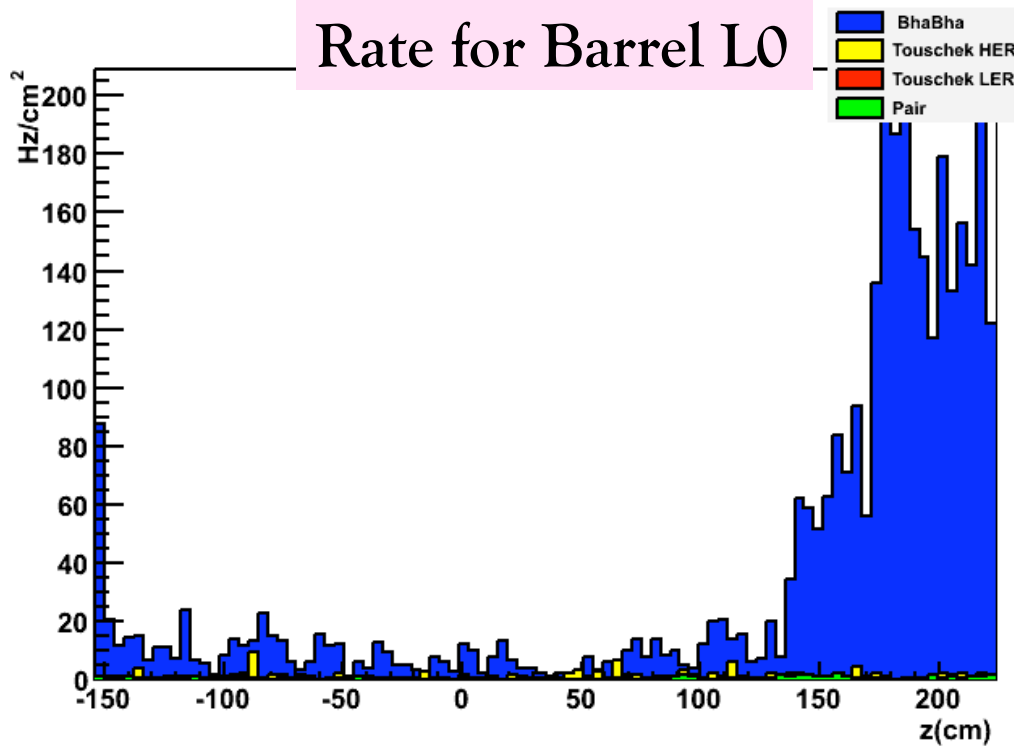
Comparison for background due to different sources

| | |
|---|--------------|
|  | BhaBha |
|  | Touschek HER |
|  | Touschek LER |
|  | Pair |

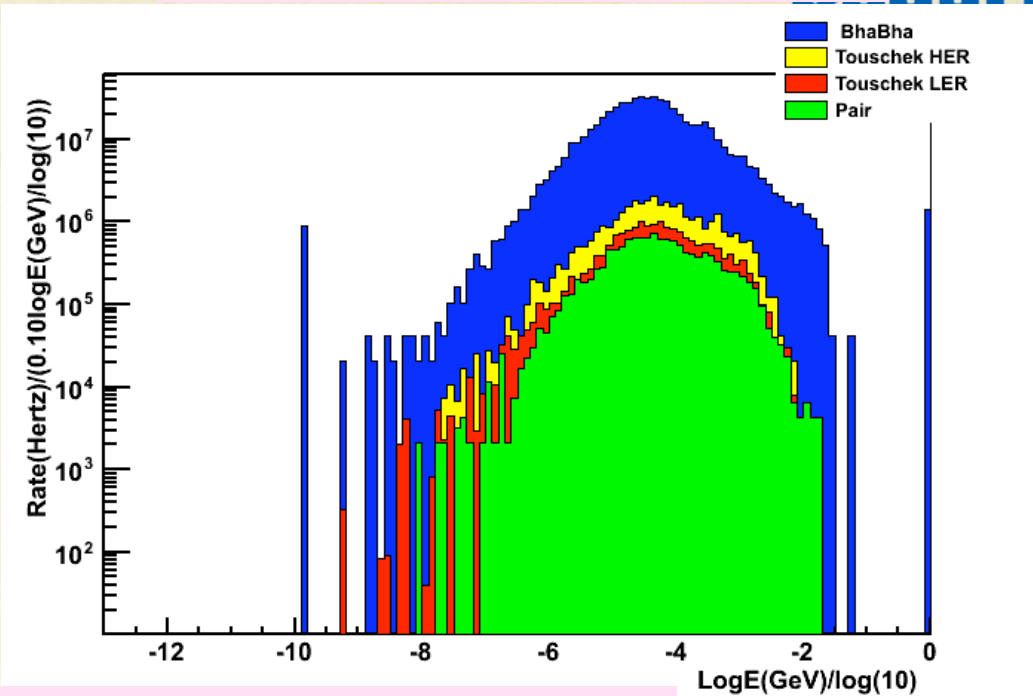
Neutron Rates for layer 0 from different background Sources



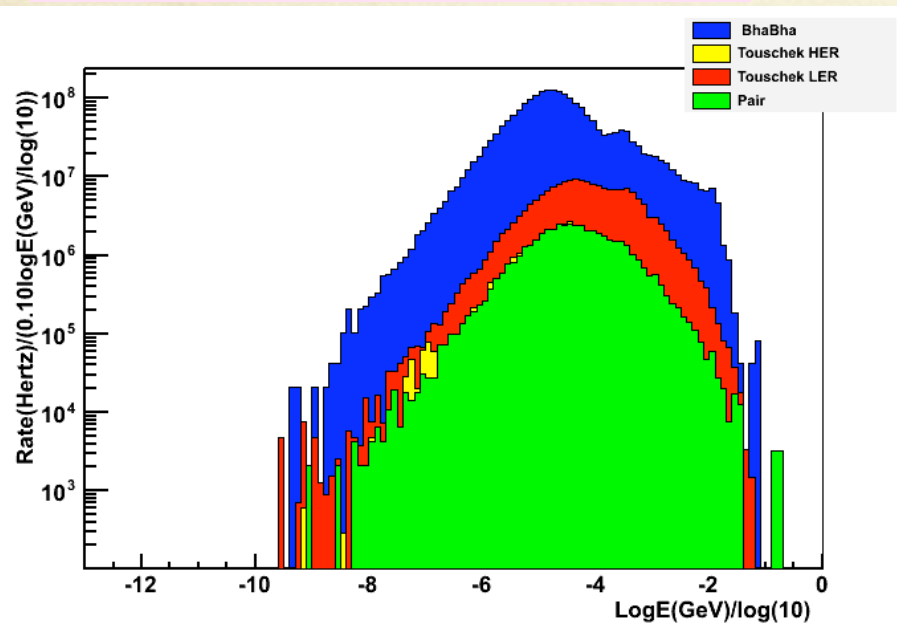
Rate for Barrel L0



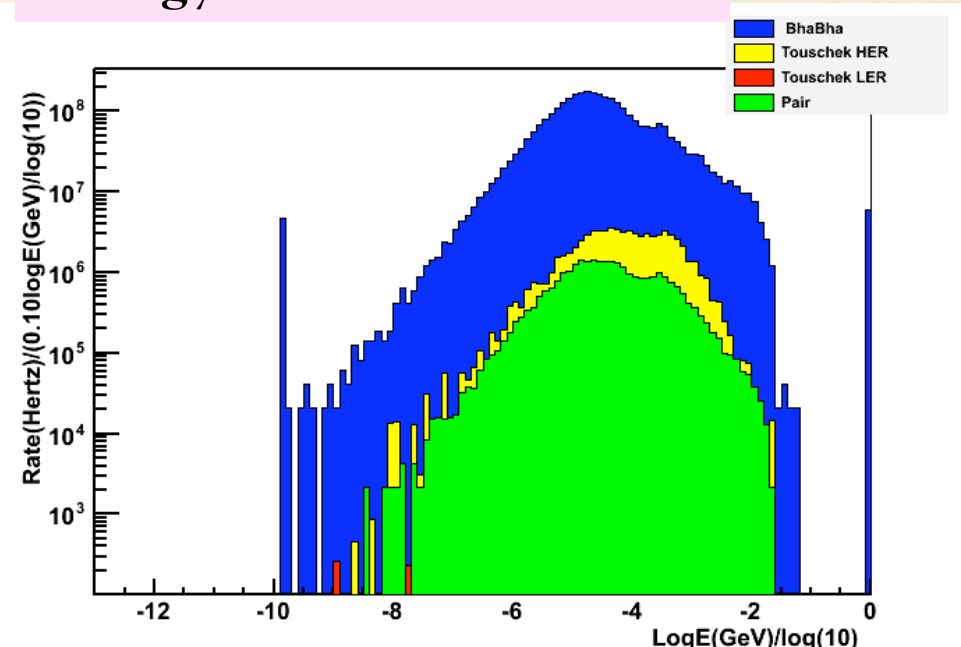
Energy distribution:Barrel



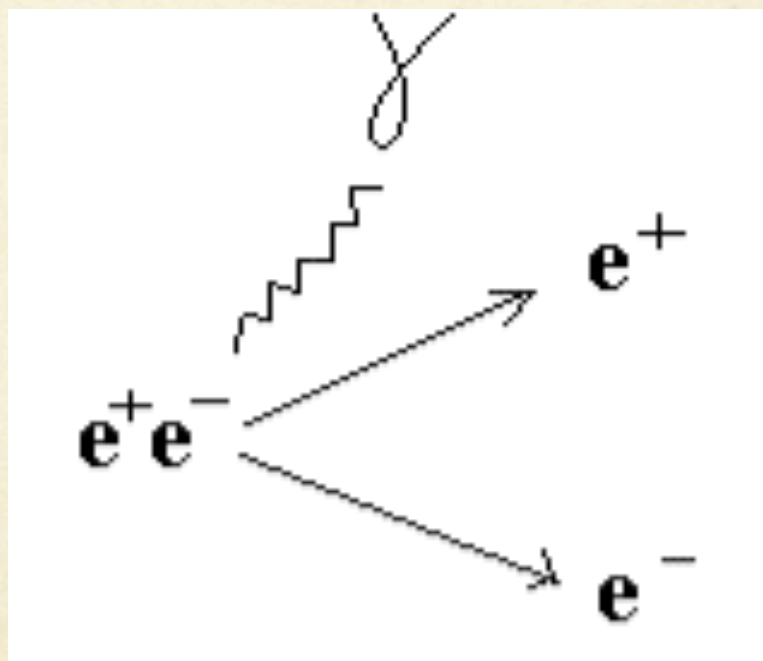
Energy distribution:BWD



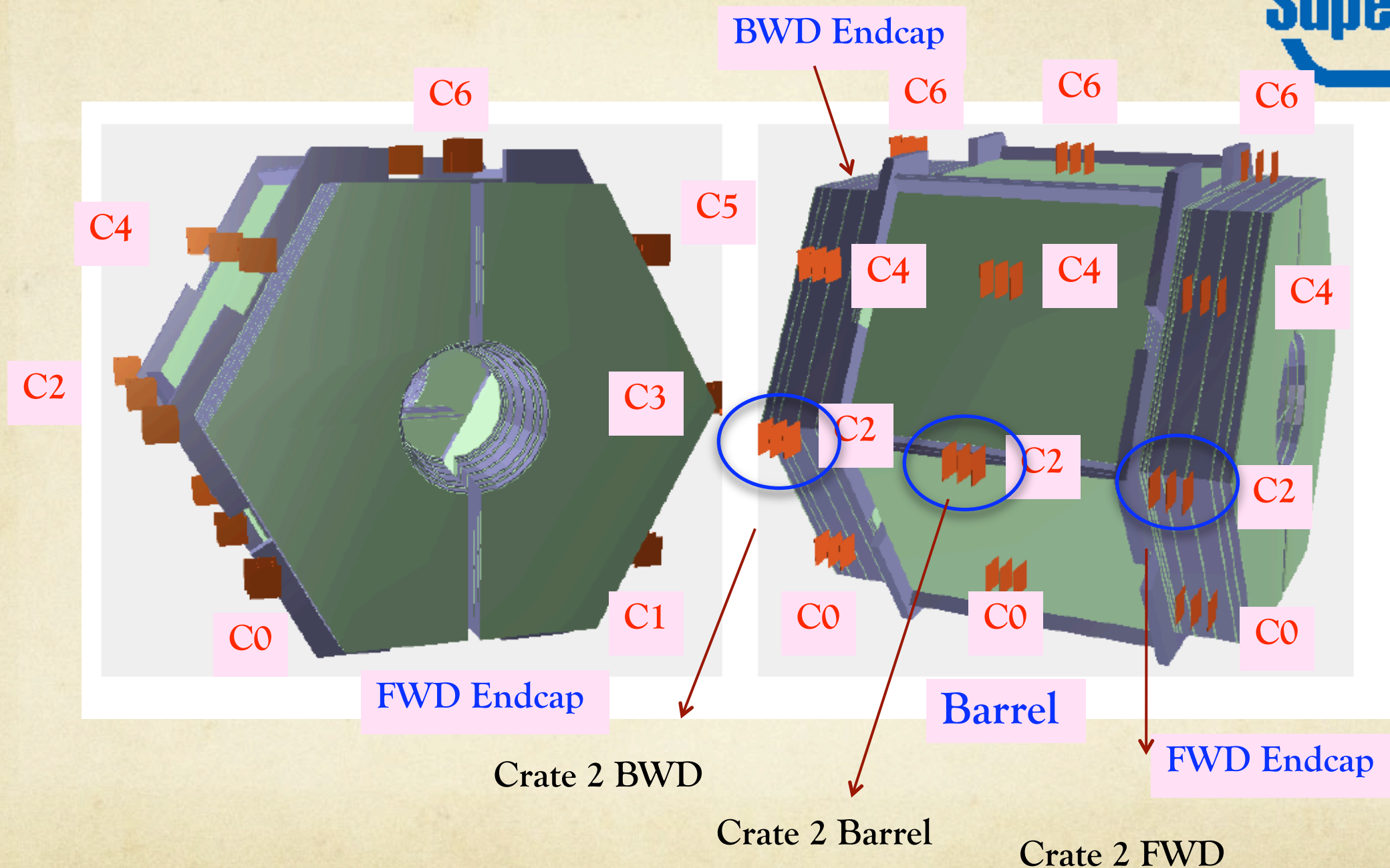
Energy distribution:FWD



Radiative Bhabha background crossing the IFR FEE boards



Present layout of the IFR crates



Neutron Rates for FEEs Electronics

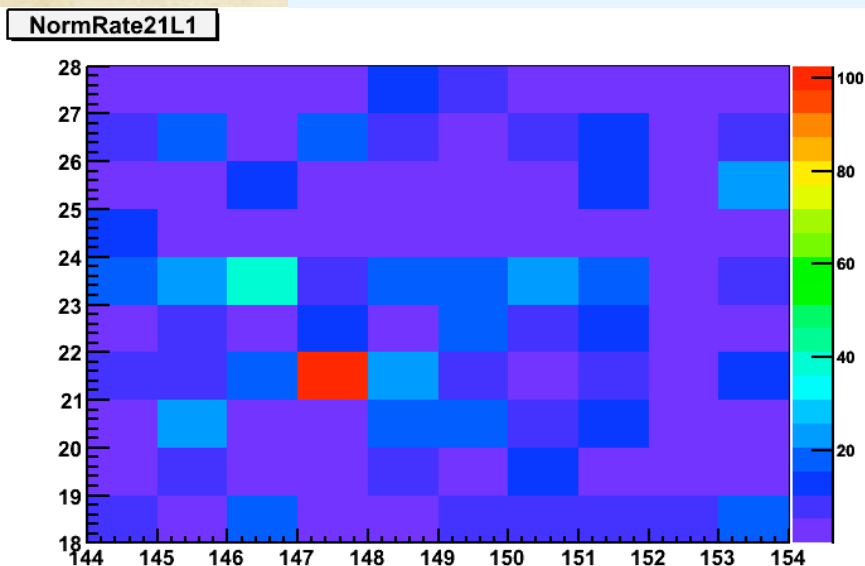


2D view of one FEE

Hz/cm^2

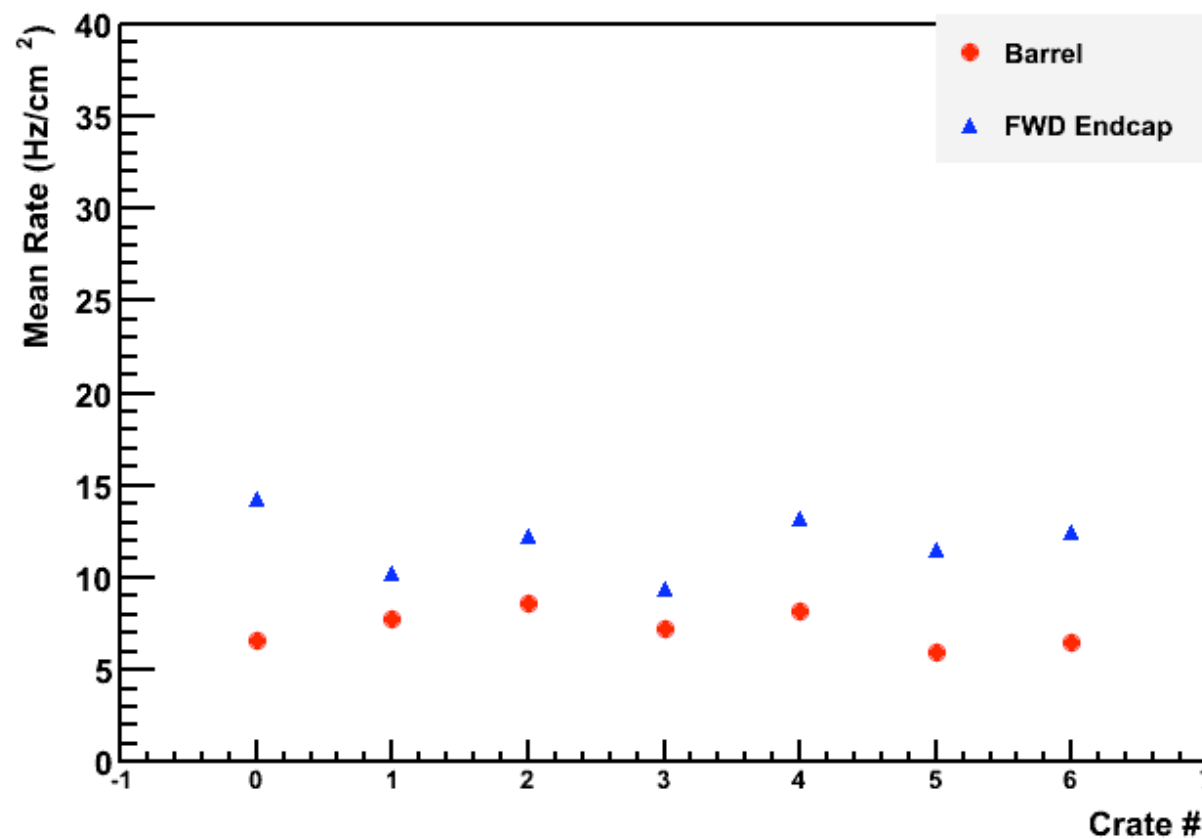
Y

X

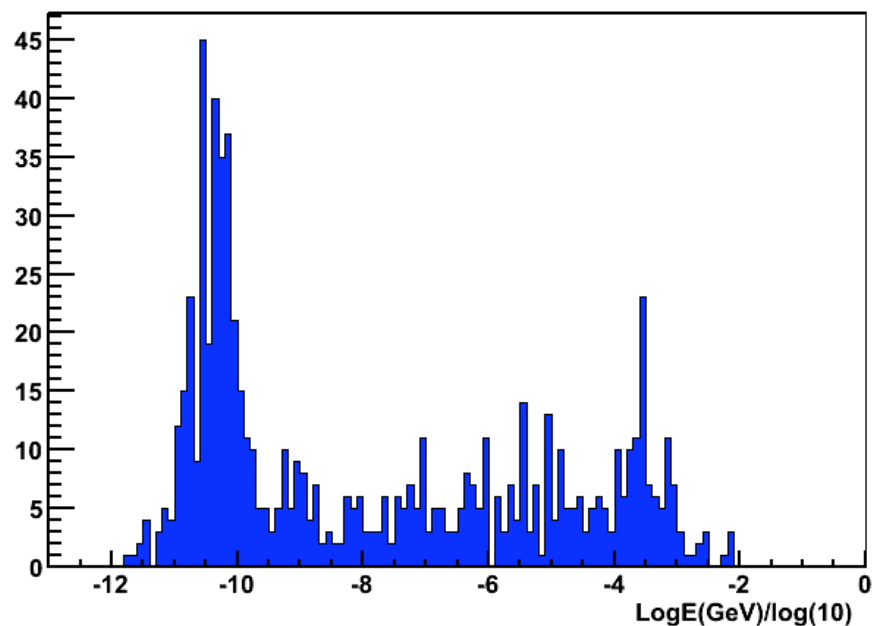


Crates located in the FWD have systematically higher rates compared to that one in the Barrel

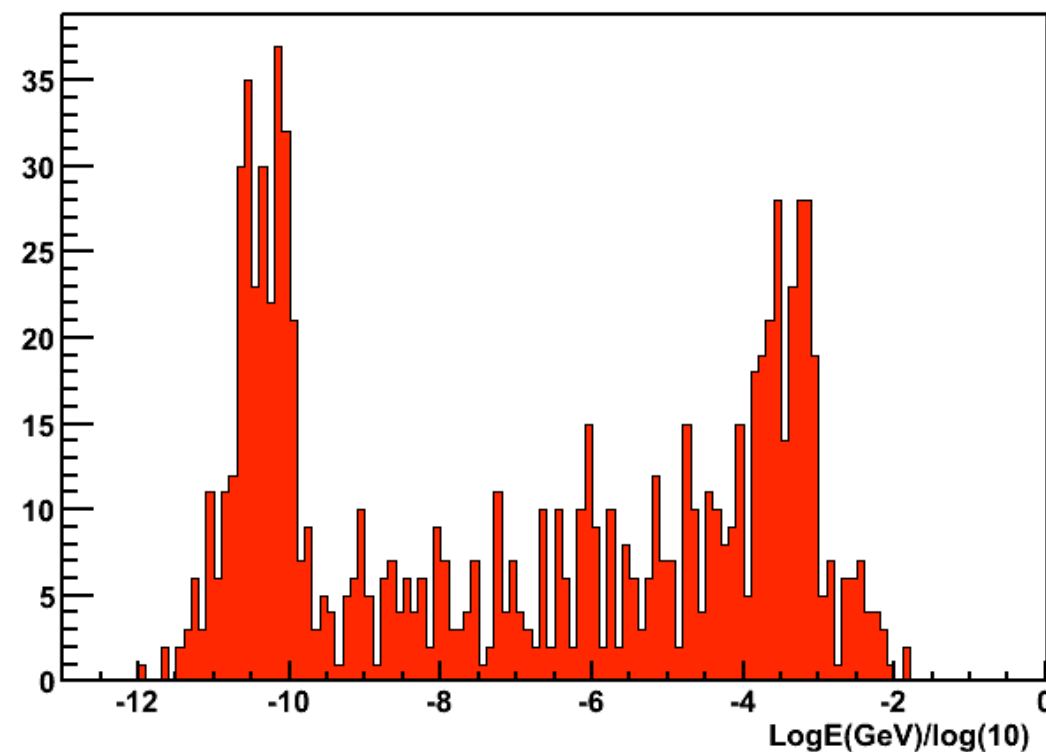
Mean Rate for each FEE in different Crates



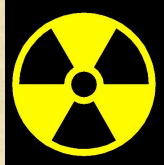
Energy_Crate 2 for Barrel



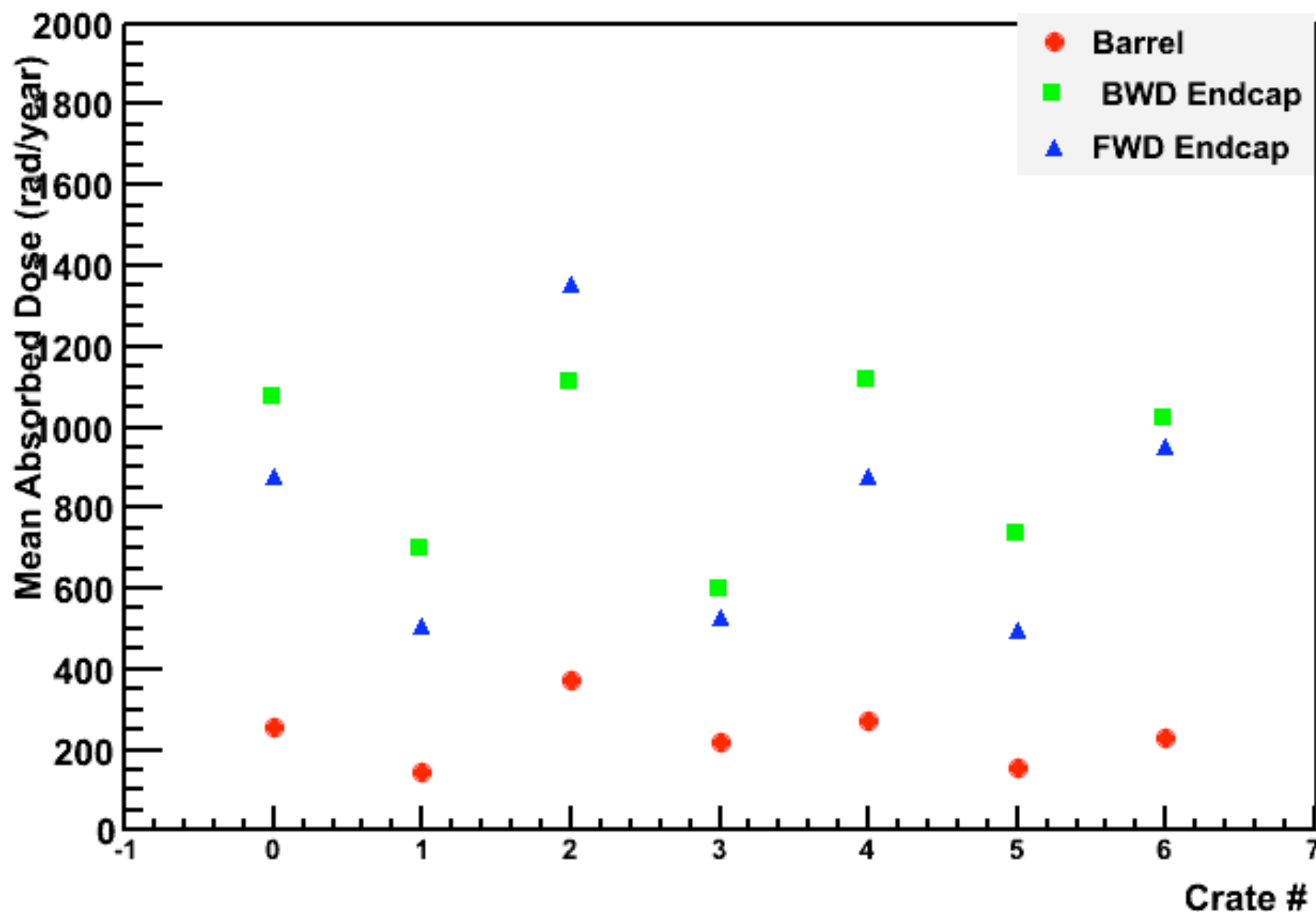
Energy_Crate 2 for FWD



The Energy distribution change for Electronics crate in the Barrel respect to the one in the FWD and BWD endcap

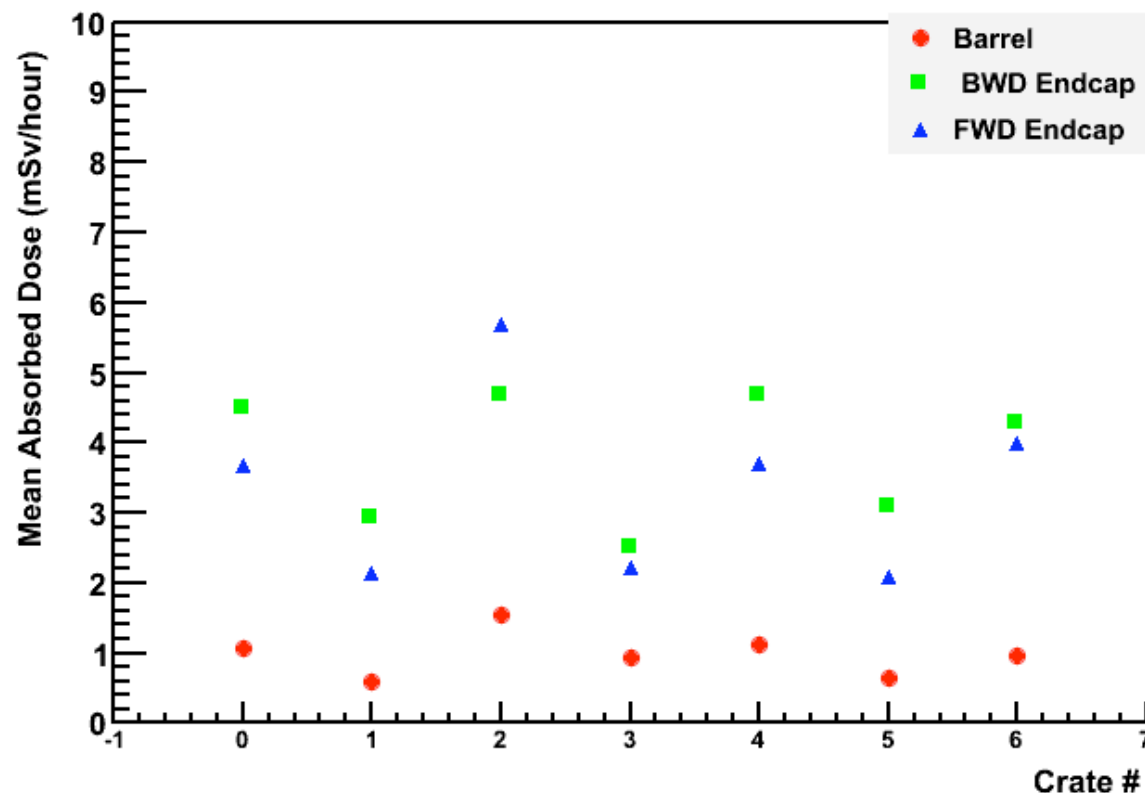
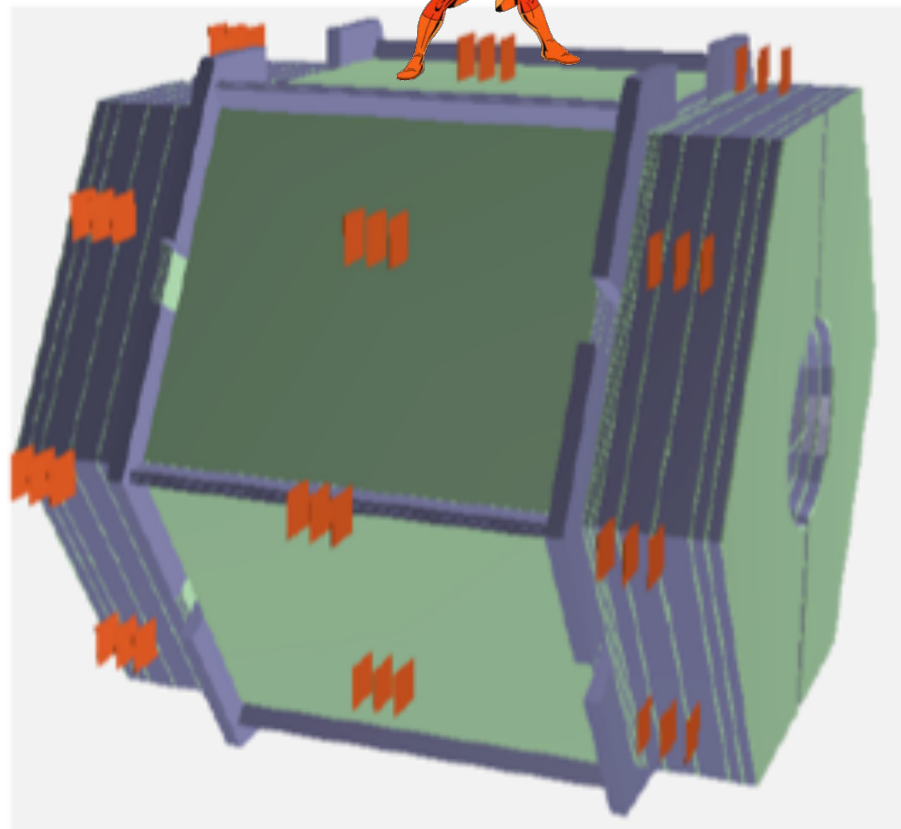


Absorbed Dose for each FEE Crates





Absorbed Dose for a man close to the FEE Crates



Average dose for a man close to the IFR FEE crate is about 3 mSv/hour (26 S/year)

Average natural background dose for a human being is about 2.4 mSv/year

Maximum allowable exposure for U.S. radiation workers: 50 mSv /year

Average effective dose to operation workers during the **Chernobyl disaster: 120 mSv**

- ✓ Radiative BhaBha, Touschek and Pair backgrounds have been studied in details.
- ✓ The effect of these backgrounds have been also studied on our FEEs
- ✓ IFR TDR background on writing

BACK-UP SLIDES

Why do we have to worry about electrons

- Electrons are charged particle that produce signals