IFR Background Report

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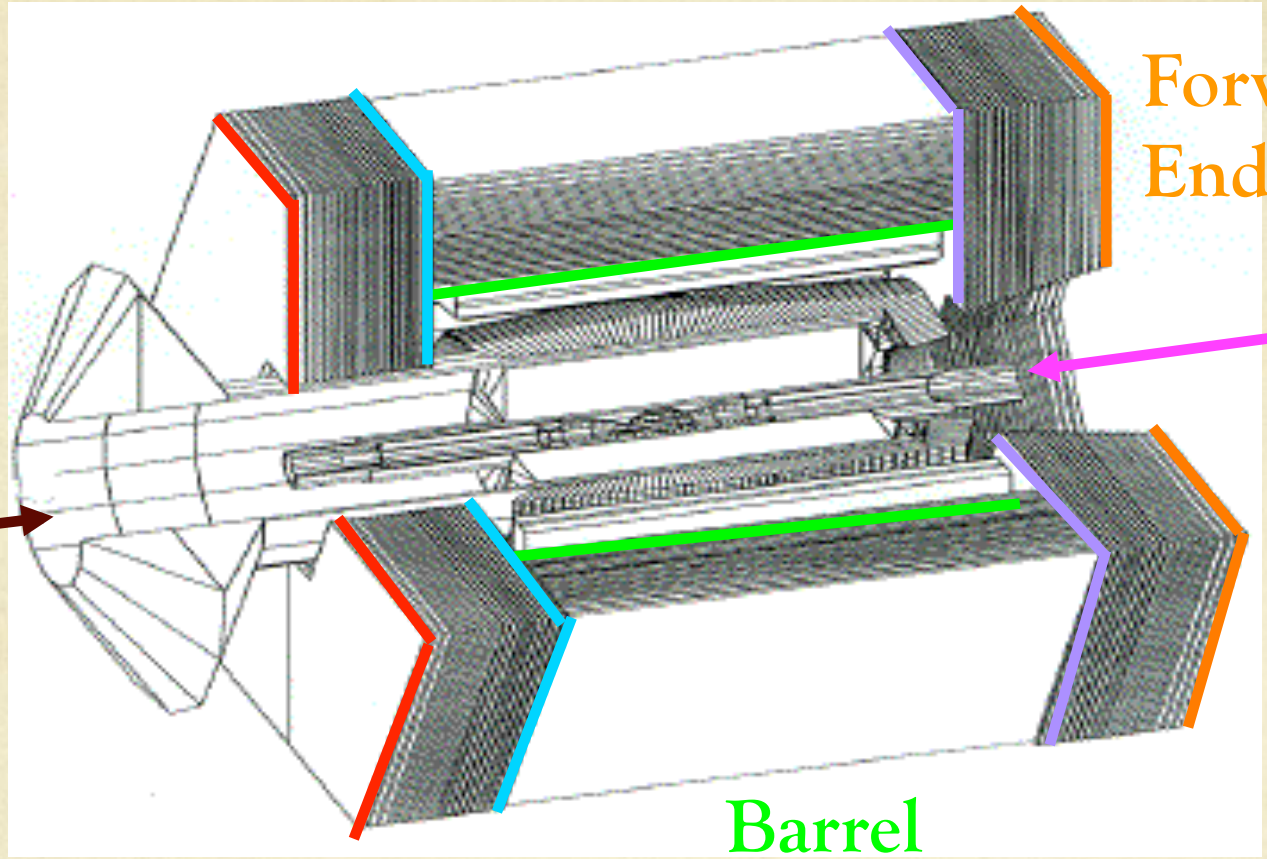
SuperB Collaboration Meeting 1 June 2012

Hot regions



Barrel: innermost layers, mostly neutrons

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

BWD encaps: inner layers and small radii

What's new from the Frascati CM Meeting

Frascati March 2012

- ✓ Beam Composition for the IFR background
- ✓ 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

New

- ✓ Tunghsten shield changed from 3 cm to 4.5 cm
- ✓ Added a Boron Loaded Polyethylene Shield between Magnet and IFR (5 cm)
- ✓ Added a Boron Loaded Polyethylene Shield (10 cm) in FWD and BWD endcap + iron structure (10cm)

Some ``Shielding Physics"

We added a **Polyethylene** $(C_2H_4)_nH_2$.)Boron Loaded (5%) shield for the following reasons

PE has a high hydrogen density which slows neutron particles down so they can be absorbed.

Hydrogen slow down neutron since when a fast neutron collides with a light nucleus, it loses a large fraction of its energy

The Boron we used is ^{10}B since this has a very high cross section for capture of thermal neutron

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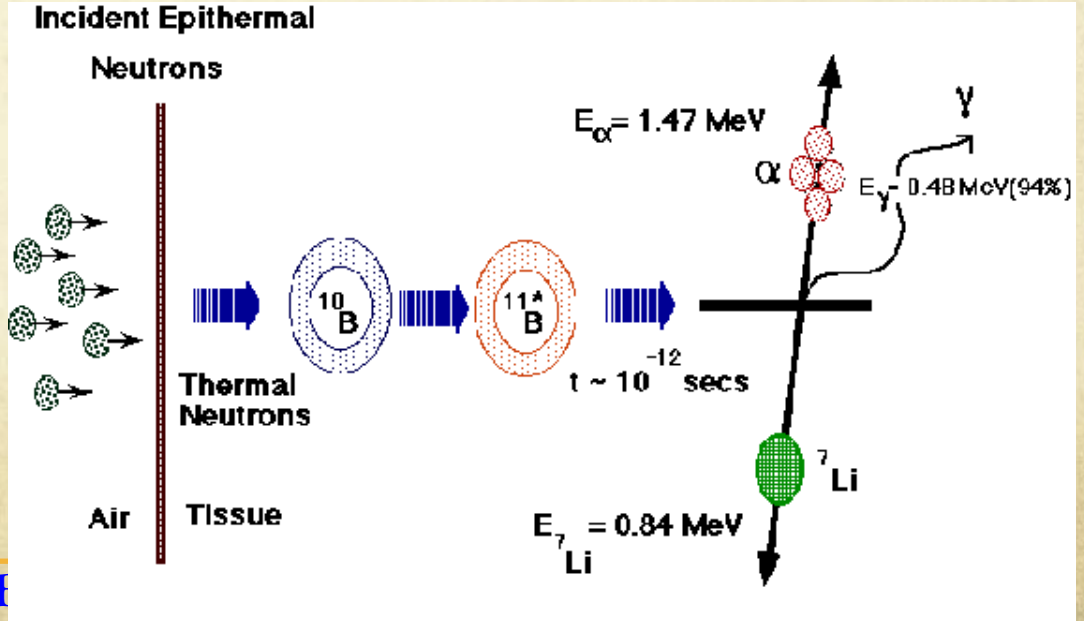
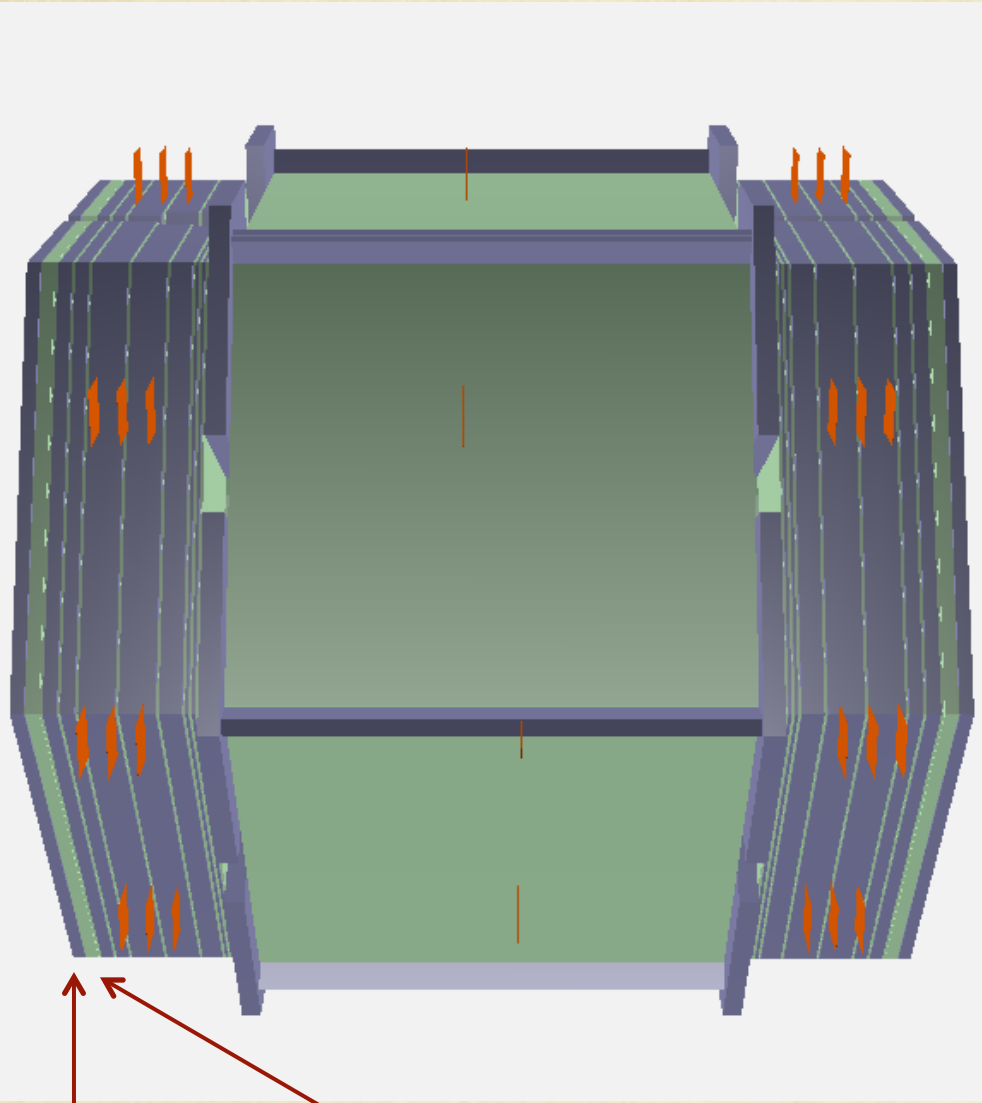
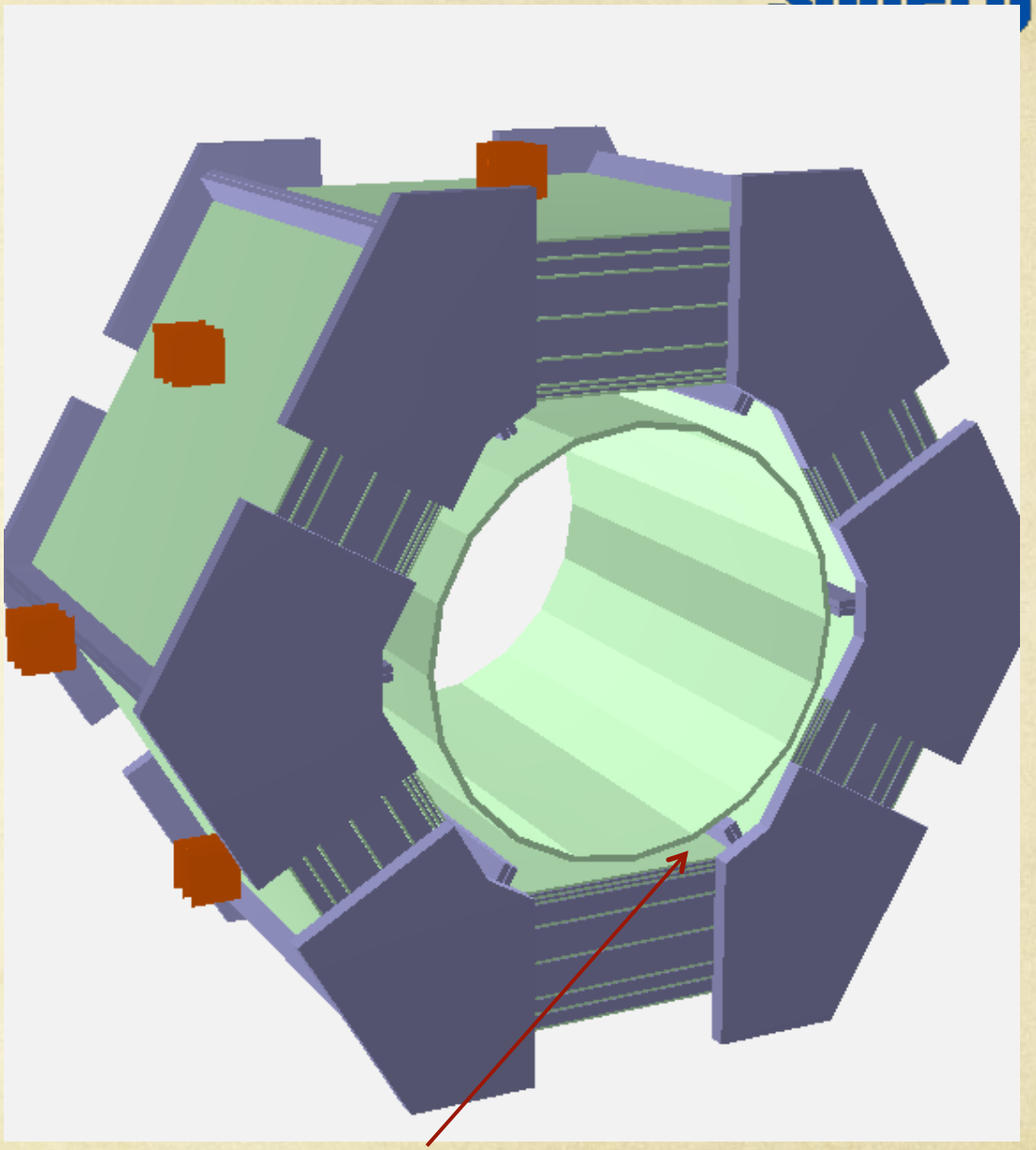


Our Shield Configuration



10 cm of Iron+10 cm PE

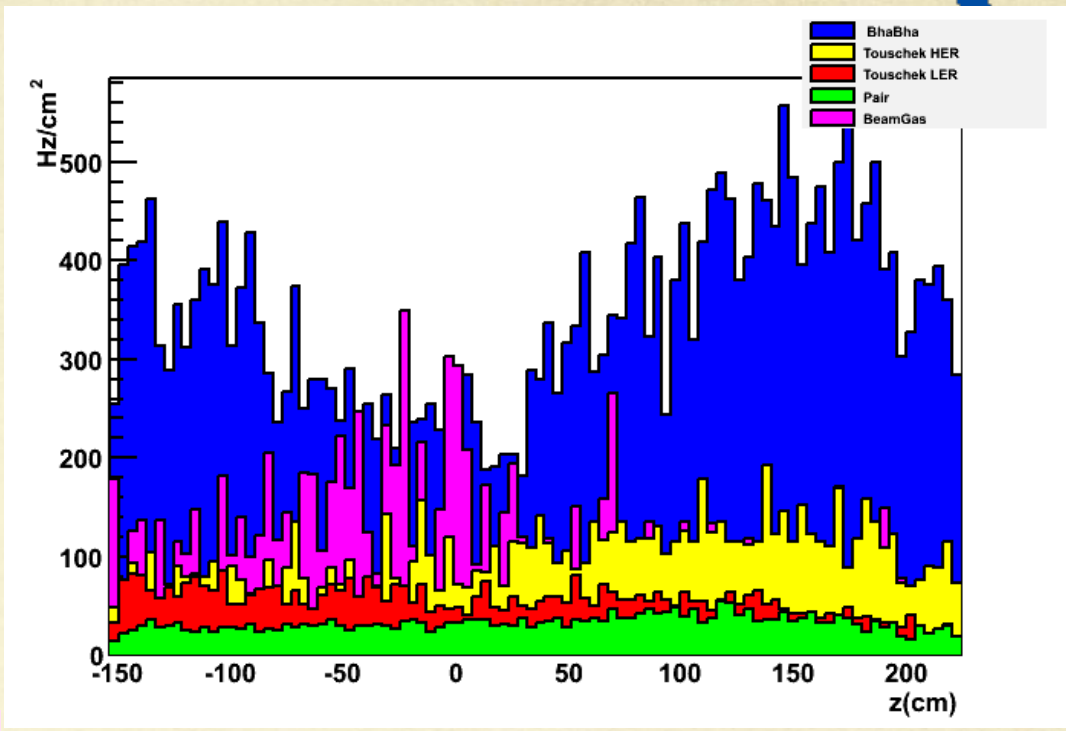


5 cm PE

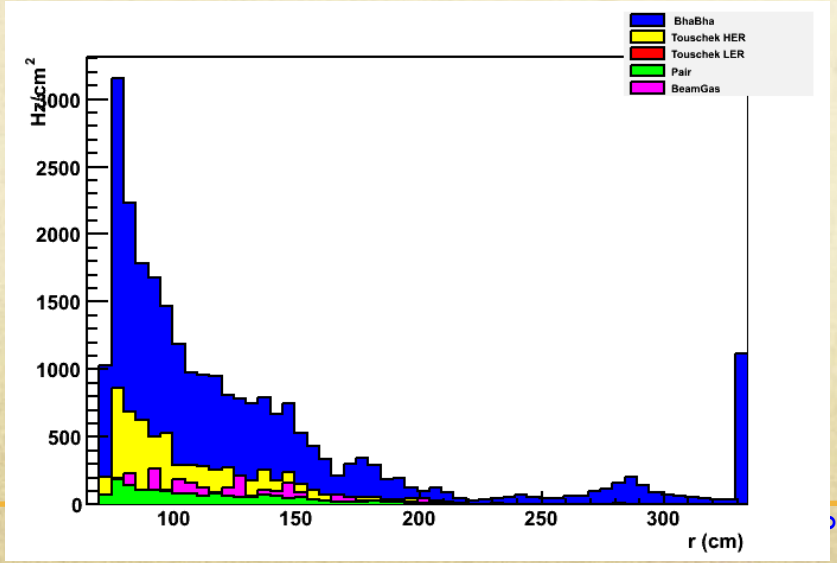
Neutron Rates (for different background sources)

Rate vs Z-coordinate for Barrel

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



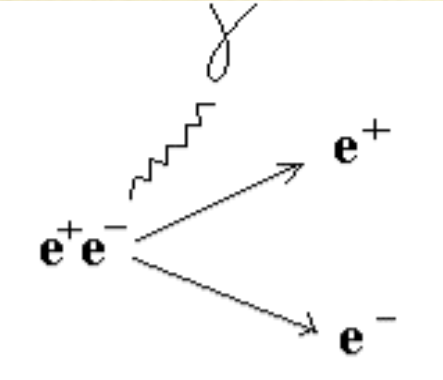
Rate vs radius for FWD Endcap



All the rate are normalized to 1MeV energy

The main contribution to the background are Radiative BhaBha

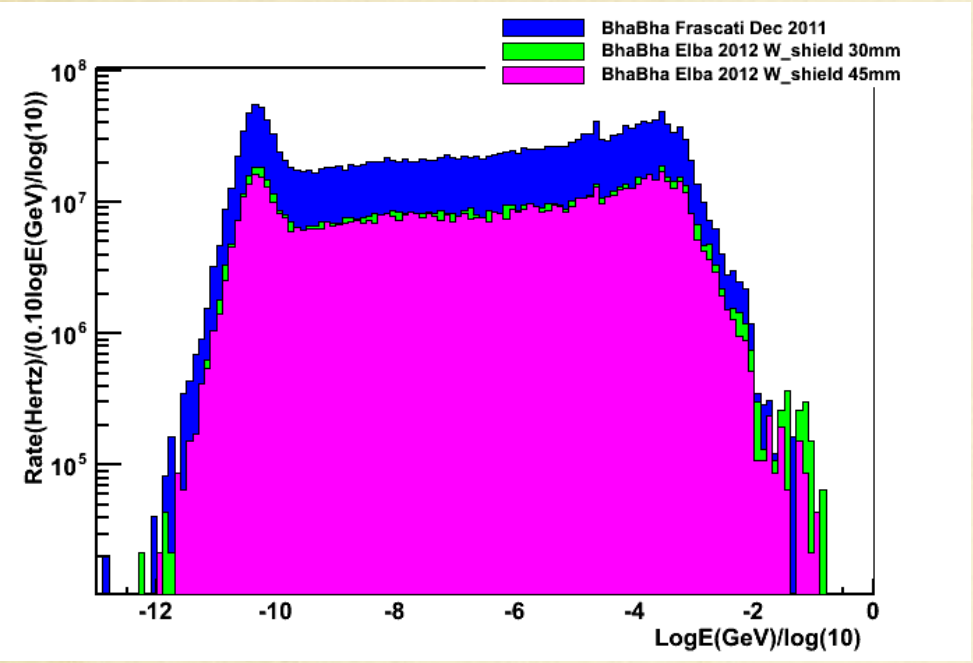
Effect of the Shielding on Radiative BhaBha Background



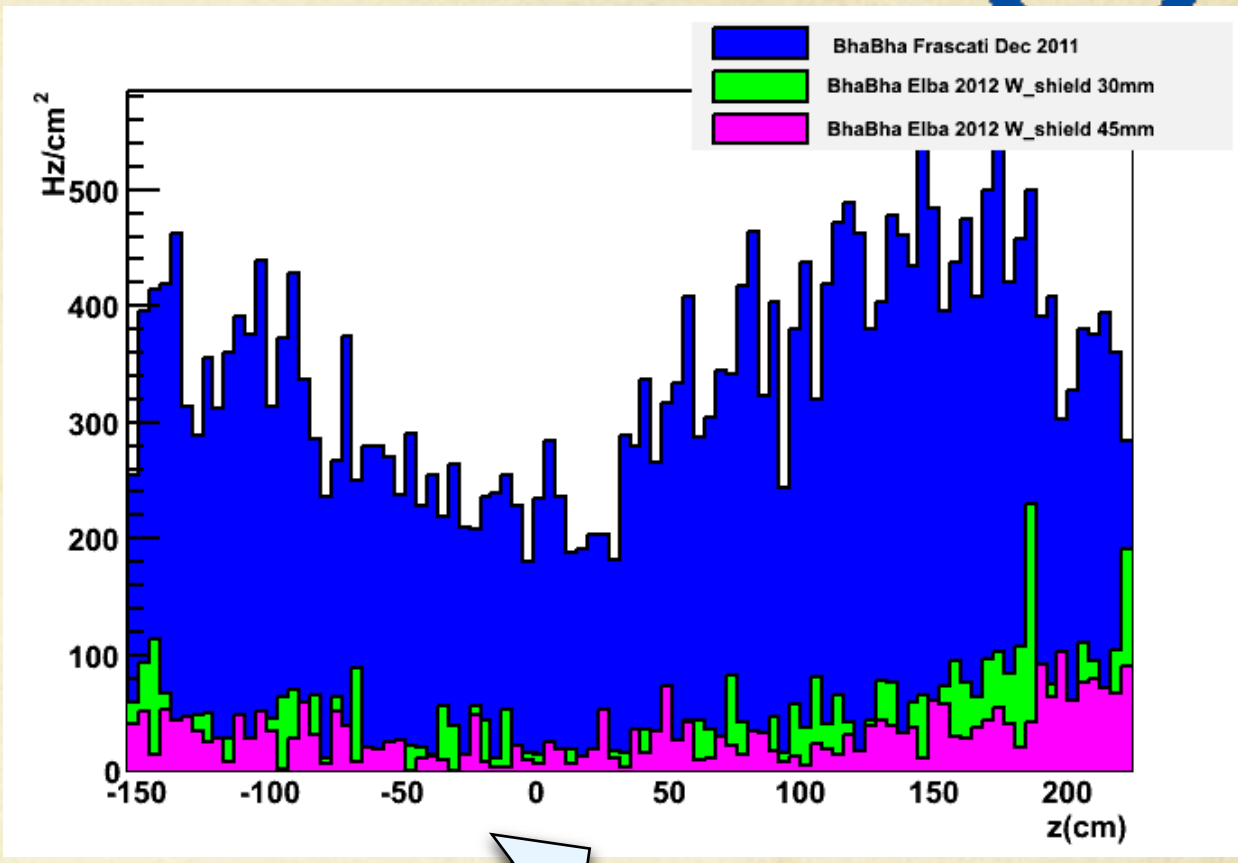
Neutron Distributions for Radiativa BhaBha events

Barrel

Energy Distribution



Rate vs Z-coordinate for Barrel

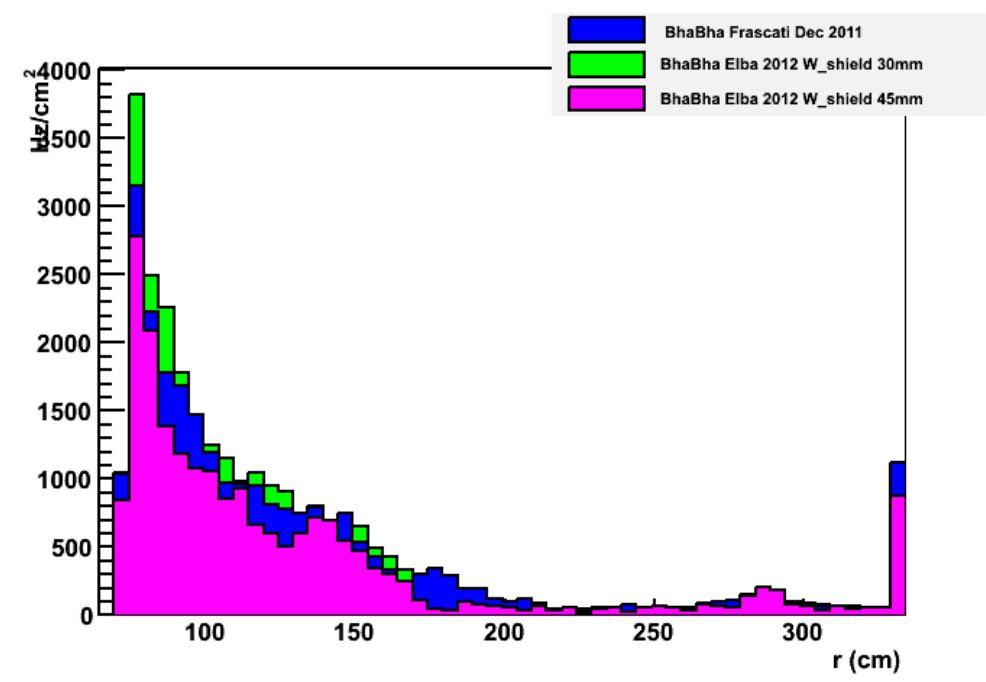


Significant reduction of the neutron rate on Barrel L0 from 450 Hz/cm^2 to ~ 50 Hz/cm^2 : 1 order of magnitude less

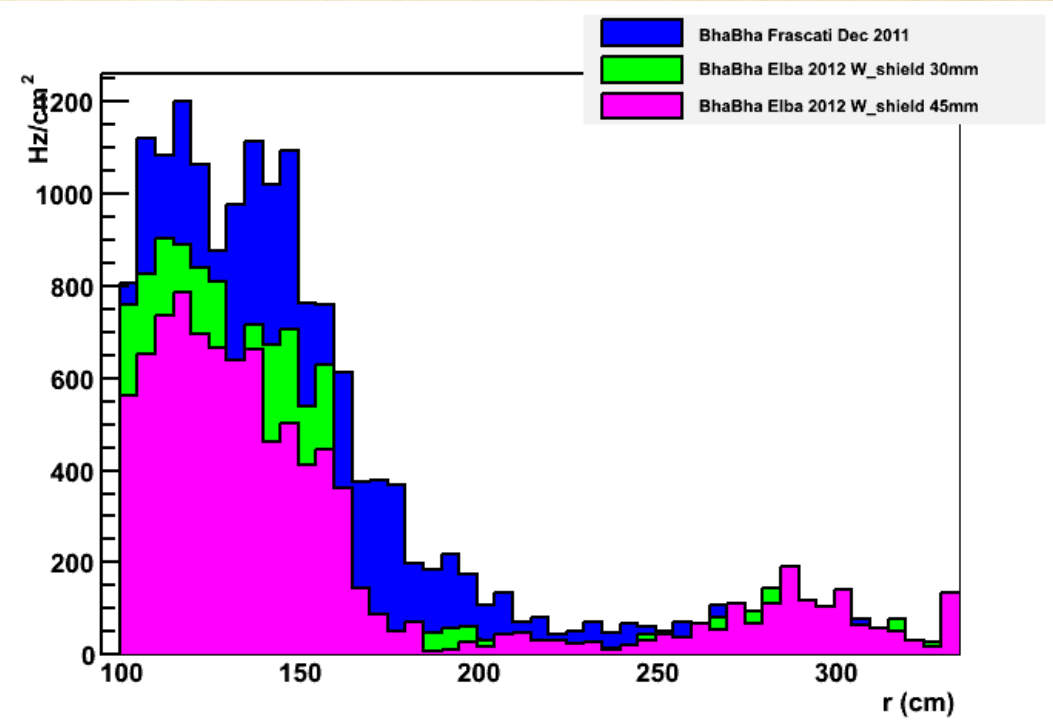
Neutron Distributions for Radiativa BhaBha events

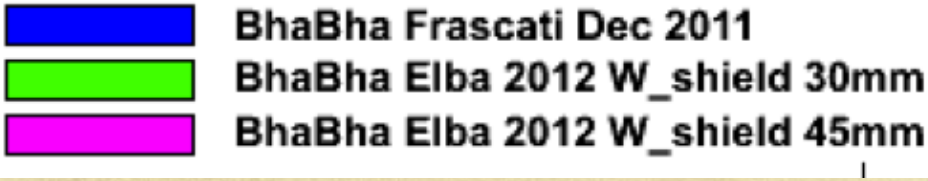
Endcaps

Rate vs Radius FWD



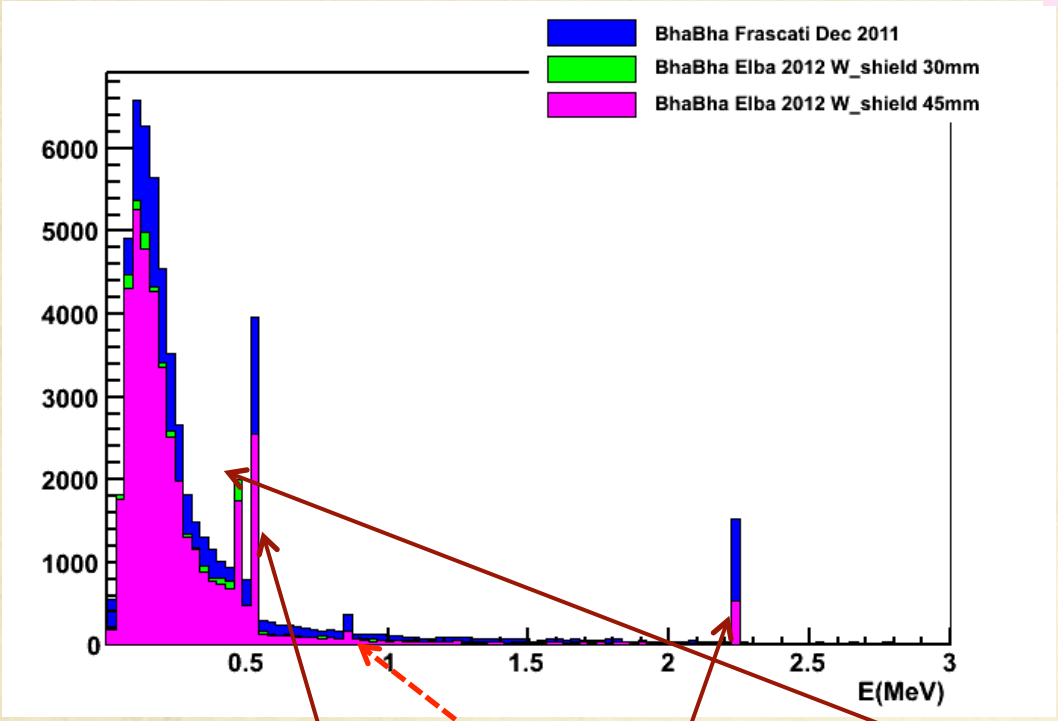
Rate vs Radius BWD



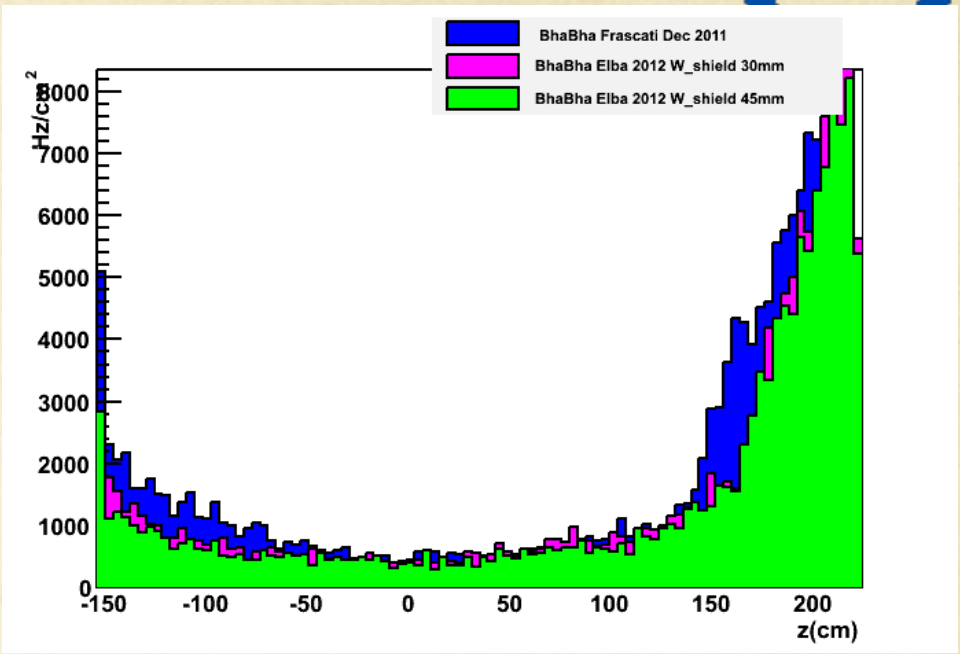


Photons Distributions

Barrel: Photon Energy Distribution



Rate vs Z-coordinate for Barrel



The Energy distribution for FWD and BWD Endcap are similar

Photons of energy ~0.512 MeV are from annihilation radiation

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

NEW: Photons of energy ~0.48 MeV are from neutron capture on B^{10}

Summary and Future Plans

- ✓ Radiative BhaBha background, have been studied after the addition of the shielding. The results seem promising
- ✓ Other background sources after the shielding effects will be studied in the next days
- ✓ IFR TDR background on writing

BACK-UP SLIDES