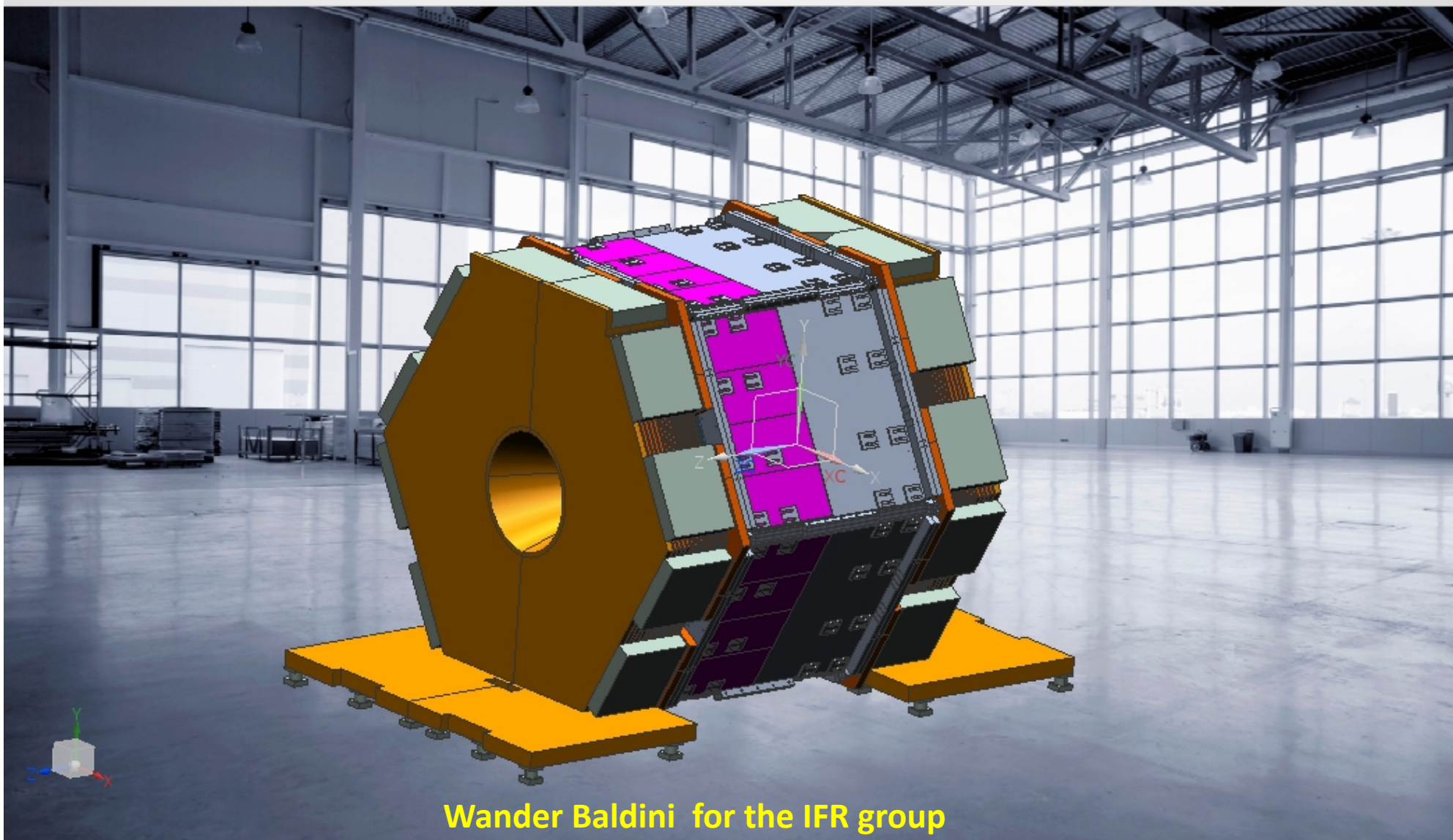
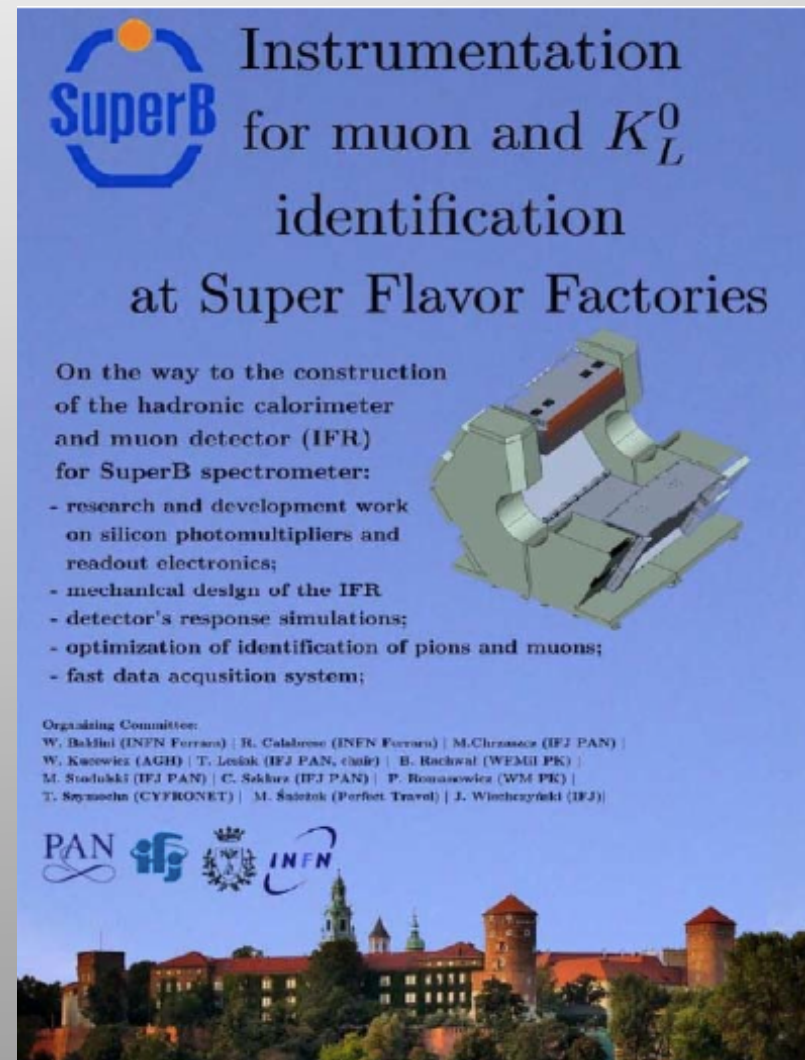


Update of IFR Activities since the Elba Meeting



The IFR Workshop in Krakow

- Held in Krakow 7-9 Sept 2012
- The workshop was organized in such a way that we could dedicate a relevant part of the time to detailed discussions all the ongoing/future activities
- This was very fruitful since in all the persons involved in the various activities were present
- Many thanks to Our IFJ-PAN, AGH, CUT colleagues for the perfect organization



The poster features a blue background with a white and orange 'SuperB' logo at the top left. The main title is 'Instrumentation for muon and K_L^0 identification at Super Flavor Factories'. Below this, it states 'On the way to the construction of the hadronic calorimeter and muon detector (IFR) for SuperB spectrometer:'. A 3D CAD model of a detector component is shown on the right. A list of activities includes: research and development work on silicon photomultipliers and readout electronics; mechanical design of the IFR; detector's response simulations; optimization of identification of pions and muons; and fast data acquisition system. The organizing committee members are listed at the bottom, along with logos for PAN, IFJ, and INFN, and a photograph of the Krakow skyline.

SuperB Instrumentation for muon and K_L^0 identification at Super Flavor Factories

On the way to the construction of the hadronic calorimeter and muon detector (IFR) for SuperB spectrometer:

- research and development work on silicon photomultipliers and readout electronics;
- mechanical design of the IFR
- detector's response simulations;
- optimization of identification of pions and muons;
- fast data acquisition system;

Organizing Committee:
W. Bakkali (INFN Ferrara) | R. Calabrese (INFN Ferrara) | M. Chruszko (IFJ PAN) |
W. Kucowicz (AGH) | T. Lesiak (IFJ PAN, chair) | B. Rachwał (WEMU PK) |
M. Studziński (IFJ PAN) | C. Szklarski (IFJ PAN) | P. Romanowicz (WM PK) |
T. Szymoch (CYFRONET) | M. Szotek (Perfit Travel) | J. Włodarczyk (IFJ)

PAN IFJ INFN



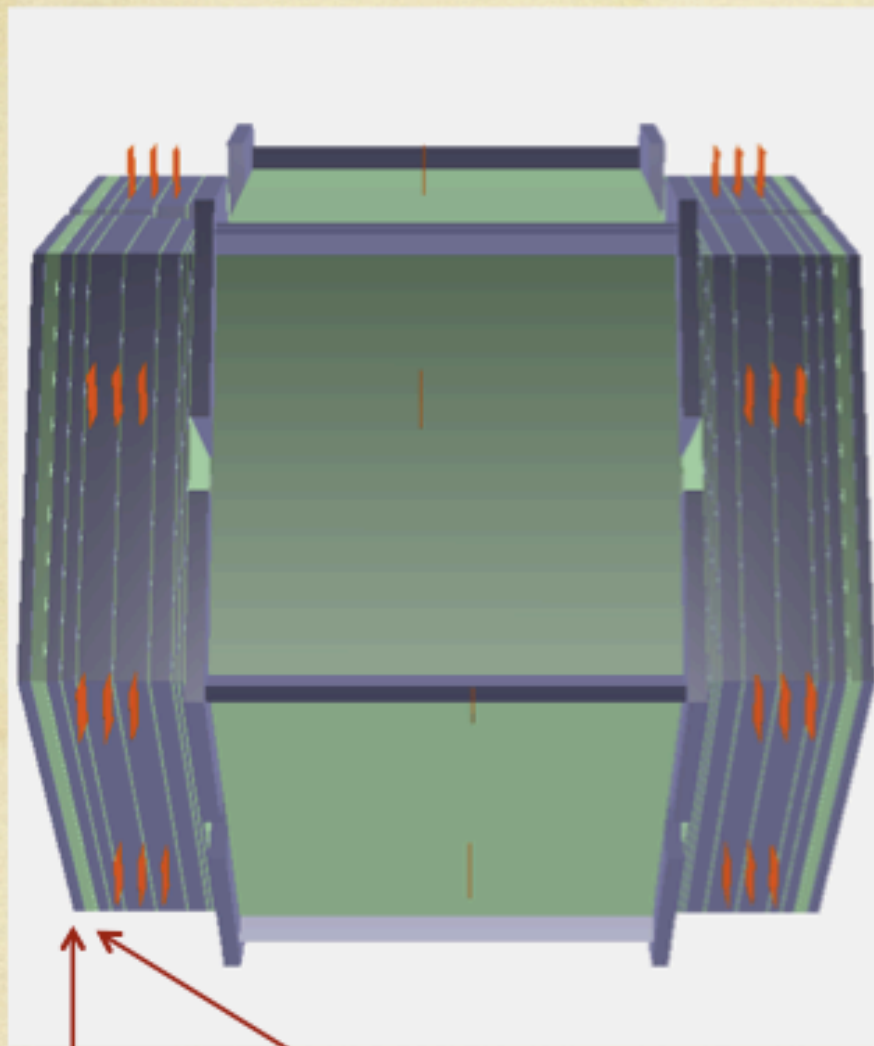
THE IFR GROUP

INSTYTUT FIZYKI JĄDROWEJ
IM. HENRYKA NIEWODNICZAŃSKIEGO
POLSKIEJ AKADEMII NAUK

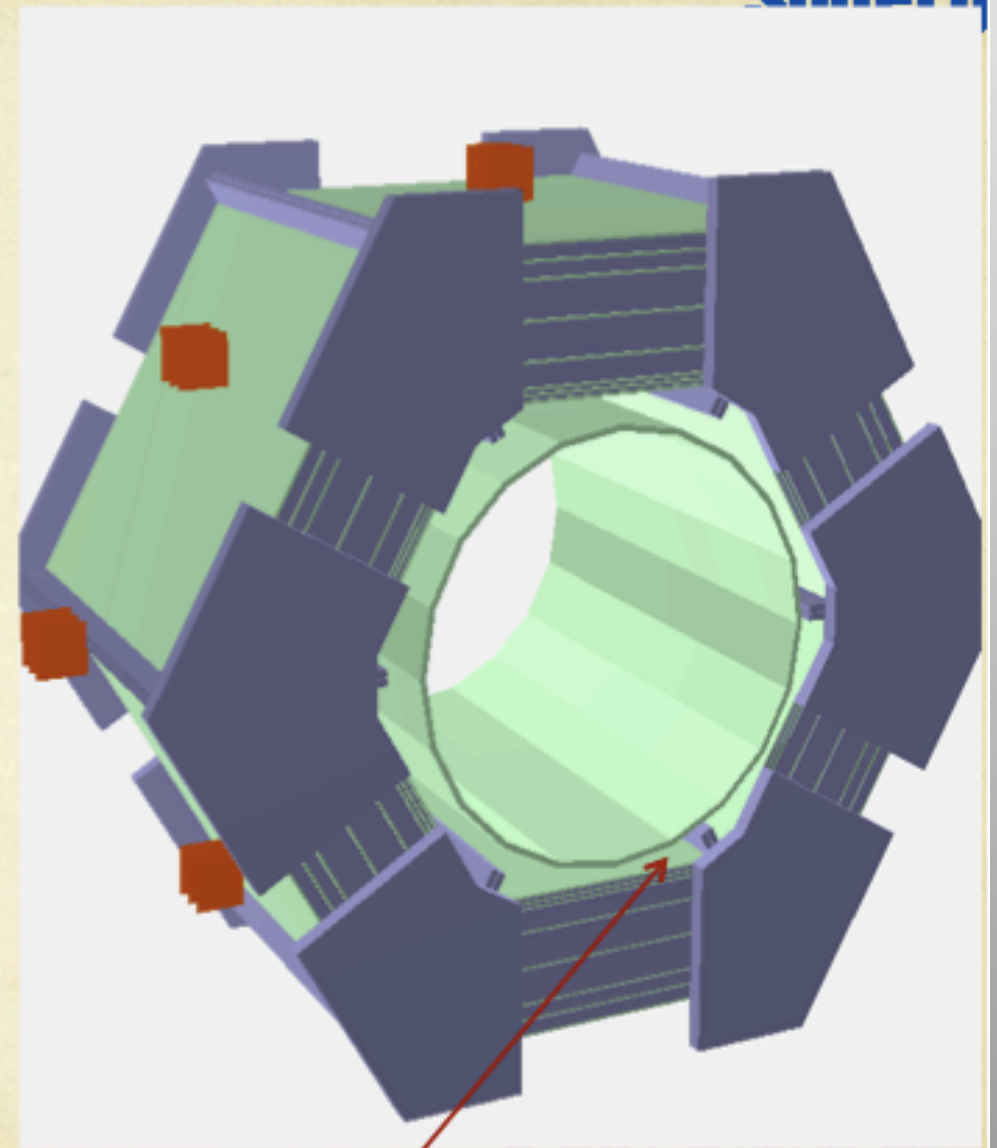


Background Studies: Simulations and Irradiation test (preliminary results)

Our Shield Configuration



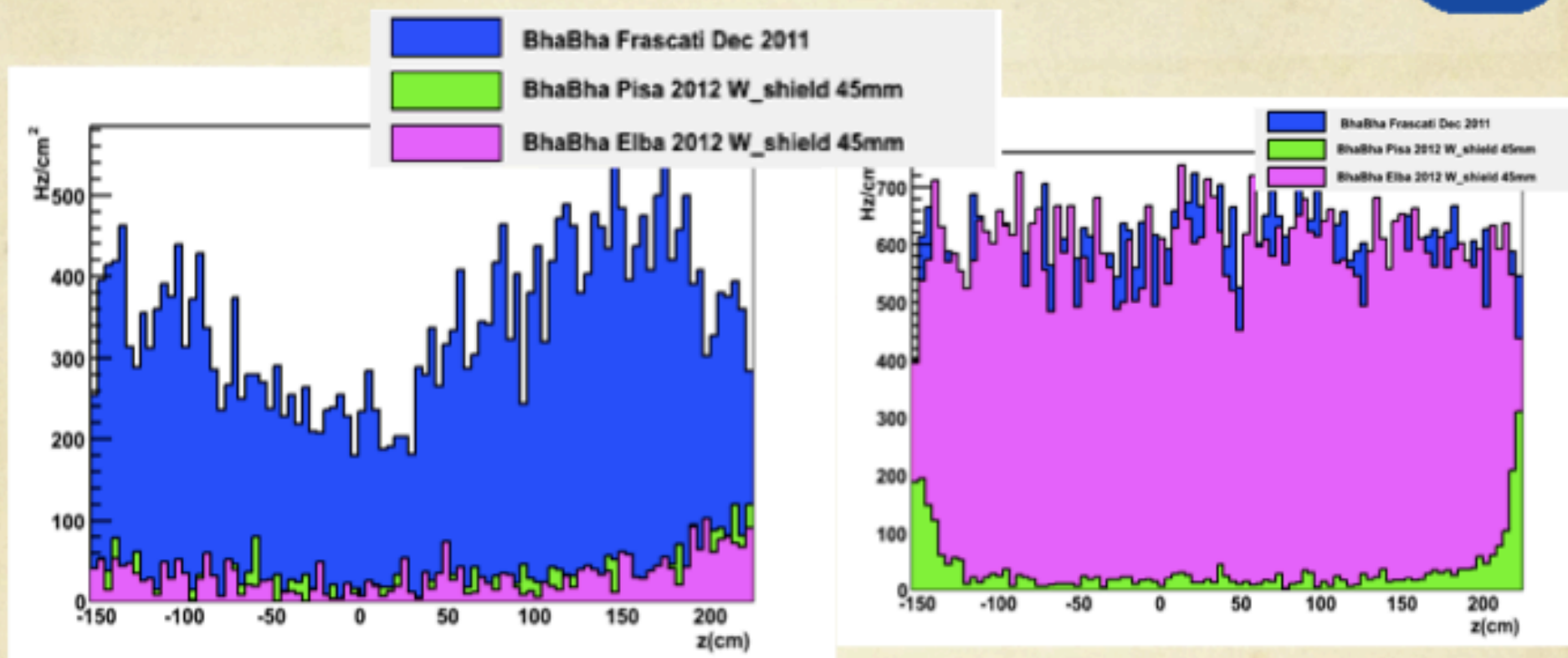
10 cm of PE+10 cm iron



5 cm PE

Rate L0 vs Z-coordinate for Barrel

Rate L7 vs Z-coordinate for Barrel

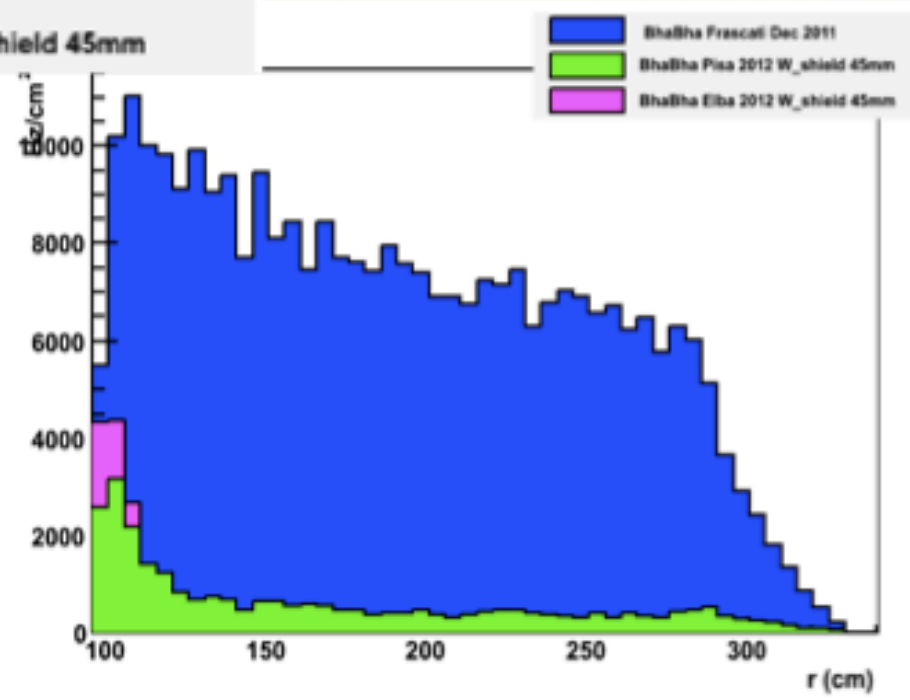
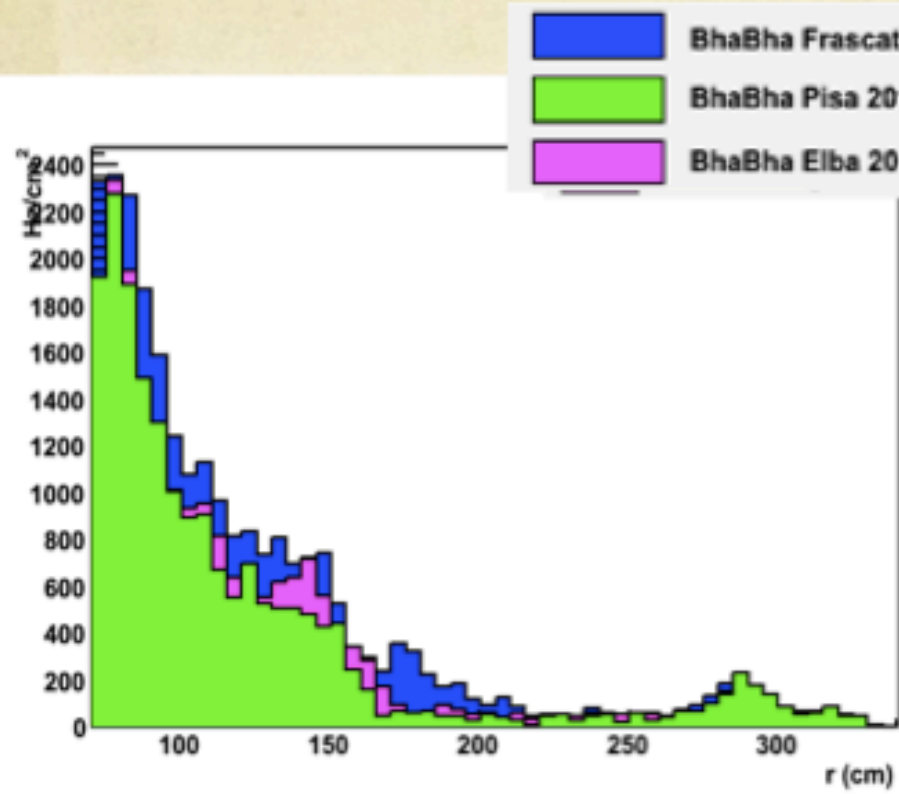


Significant reduction of the neutron rate on Barrel L0 and Barrel Layer 7 ~ 1 order of magnitude

Neutron Distributions for Radiativa BhaBha events

Rate L0 vs Z-coordinate for FWD

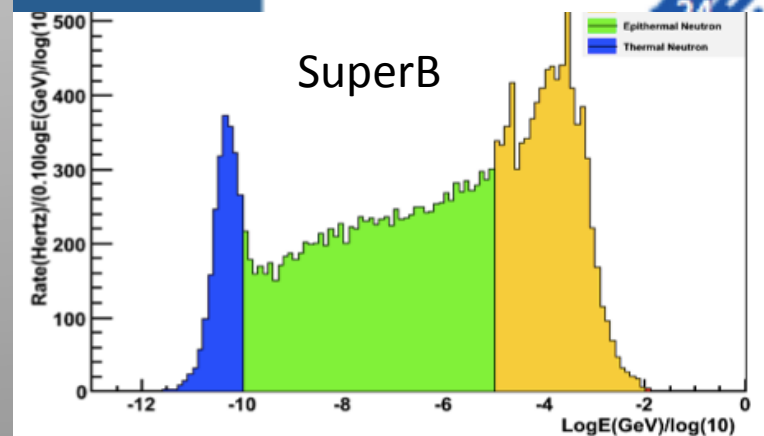
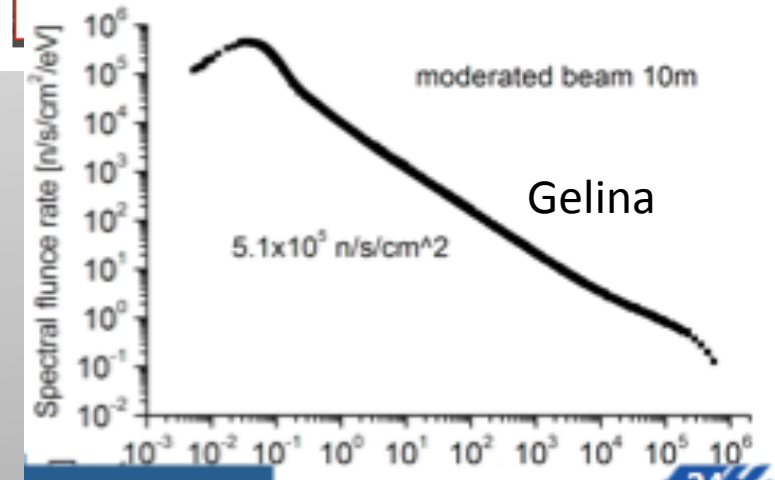
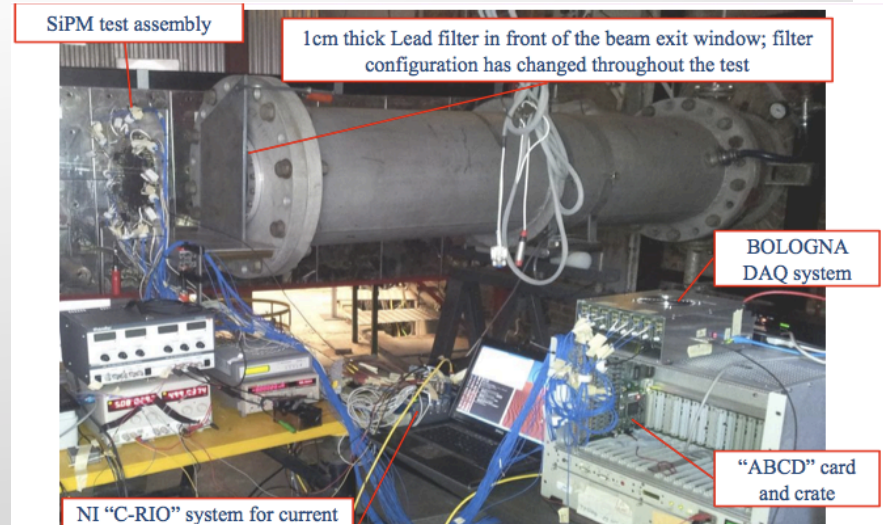
Rate L7 vs Z-coordinate for FWD



Significant reduction of the neutron rate on FWD L7 but this does not happen on L0 since the L0 is not shielded

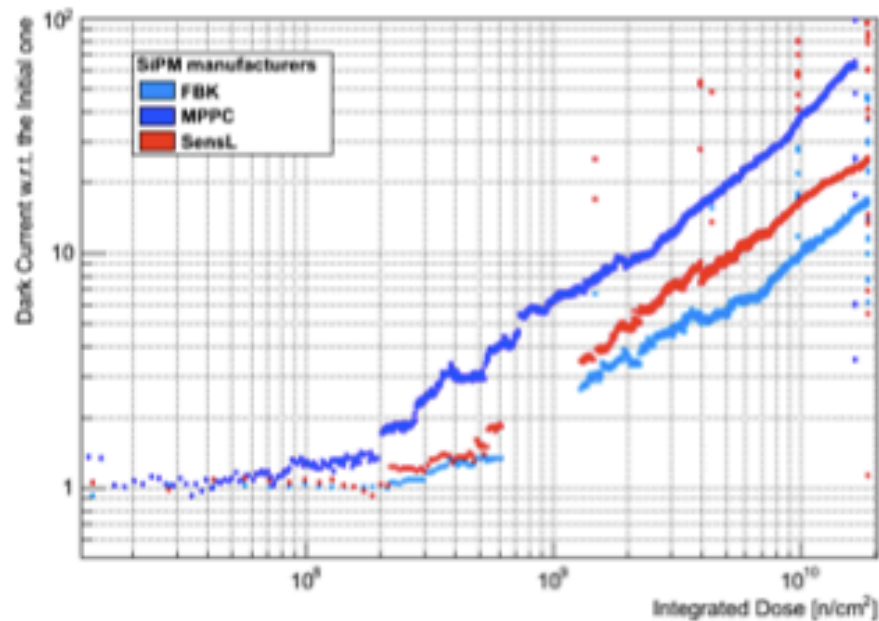
The GELINA irradiation test

- 9-20 July at the GELINA facility (Geel, Belgium)
- The facility: 100 MeV linac, electrons on Uranium target + moderator to obtain a neutron beam similar to superB in the low energy range (\leq keV)
- Several Hamamatsu, FBK and SenSL devices:
 - 25,50,100 μm pixels
 - 1x1, 3x3 mm^2 active area
 - Radiation Hard devices from Hamamatsu (3x3 mm^2)
- Measured:
 - Dark Current/Noise vs dose
 - I-V curves
 - Threshold scan
 - Dark spectra for a subset of SiPMs
- Total integrated dose: $1.86 \times 10^{10} \text{ n/cm}^2$ (about 2 running years x safety factor 5)



Same cell size (50um) different brand

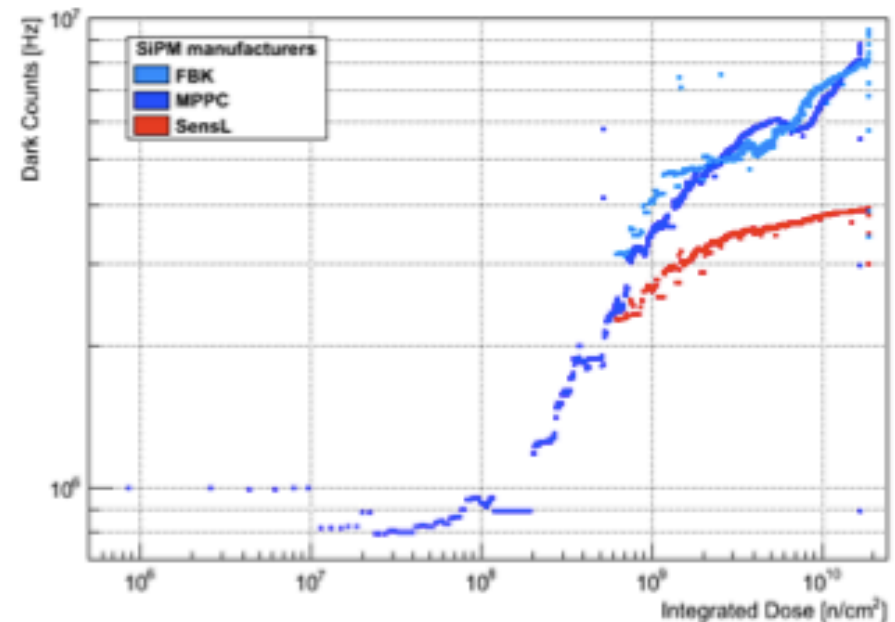
SiPM 50 μm 1x1 mm^2 : Dark Current vs Integrated Dose



Dark counts vs dose

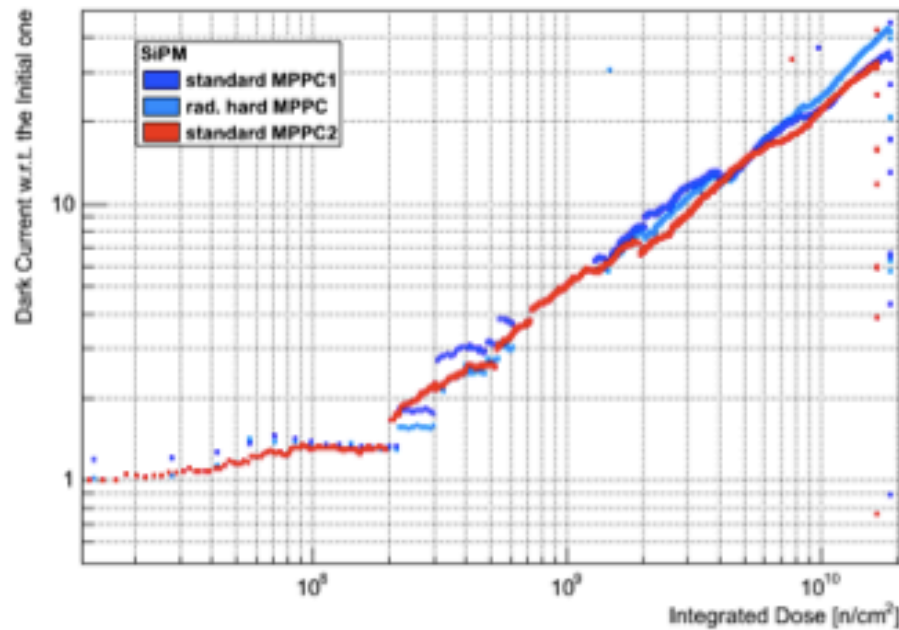
Currents vs dose

SiPM 50 μm 1x1 mm^2 : Dark Counts vs Integrated Dose



MPPC radiation hard

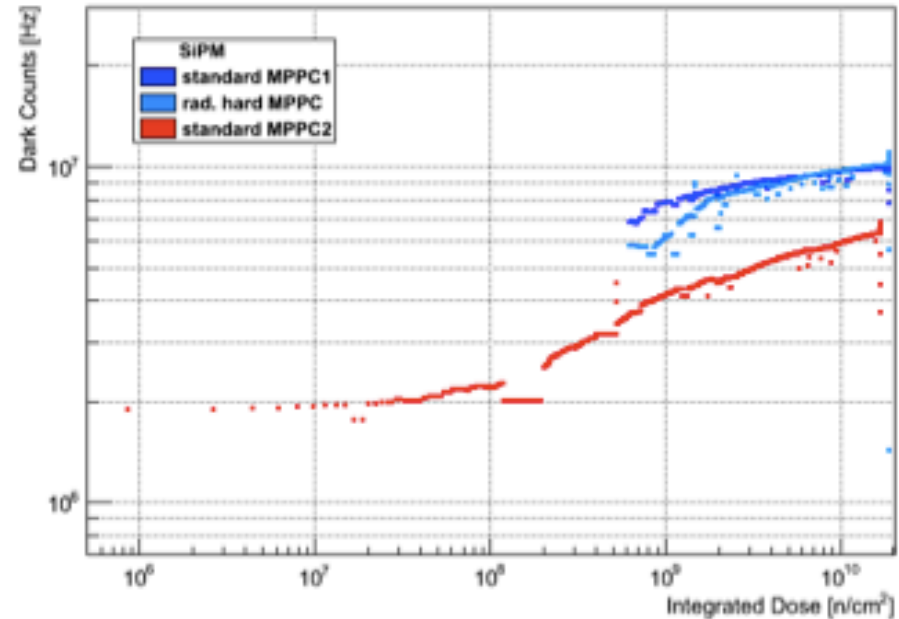
MPPC 50 μm 3x3 mm^2 : Dark Current vs Integrated Dose



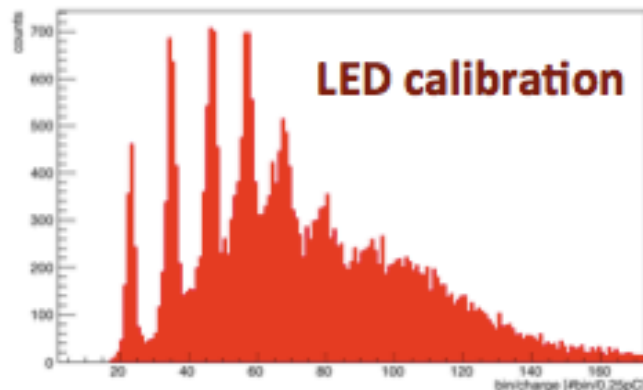
No particular difference with the other ones can be observed from currents and rates analysis.

Special MPPC radiation hard have also been tested.

MPPC 50 μm 3x3 mm^2 : Dark Counts vs Integrated Dose



MPPC rad hard with cosmic test



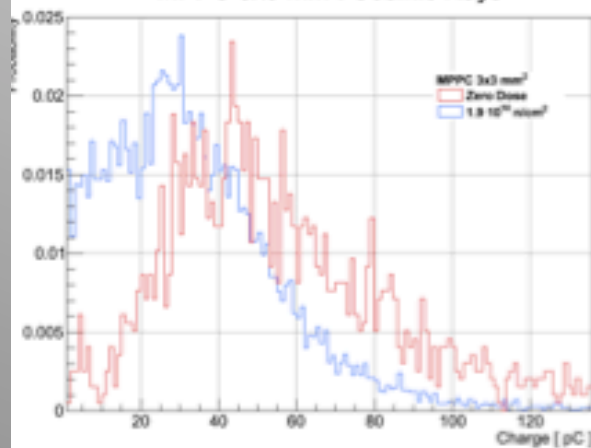
The light yield has been also measured before and after the irradiation with using a scintillator bar:

No final results yet, need more careful studies; but at a first sight

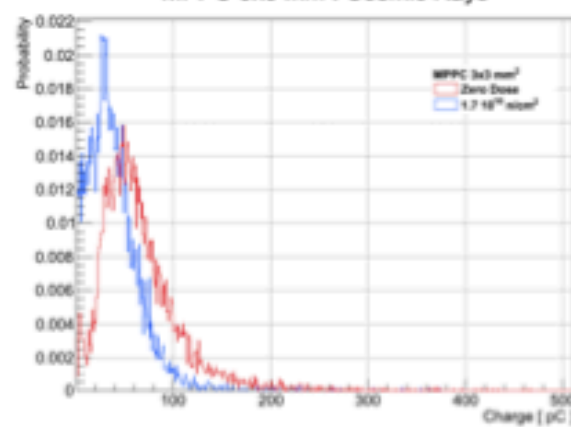
- the efficiency loss is not negligible
- the rad hard devices performs like the others

Cosmic ray spectra

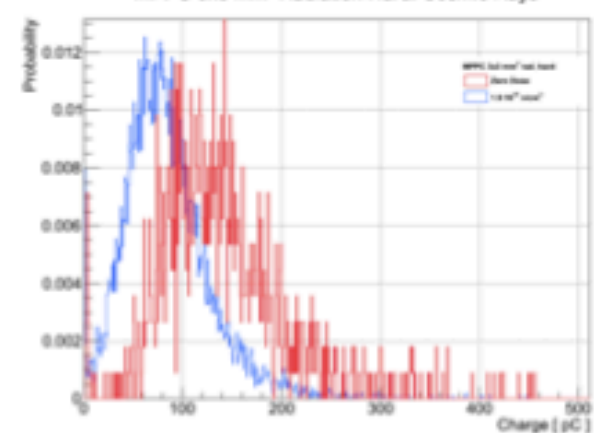
MPPC 3x3 mm²: Cosmic Rays



MPPC 3x3 mm²: Cosmic Rays



MPPC 3x3 mm² Radiation Hard: Cosmic Rays



Update on R&D studies

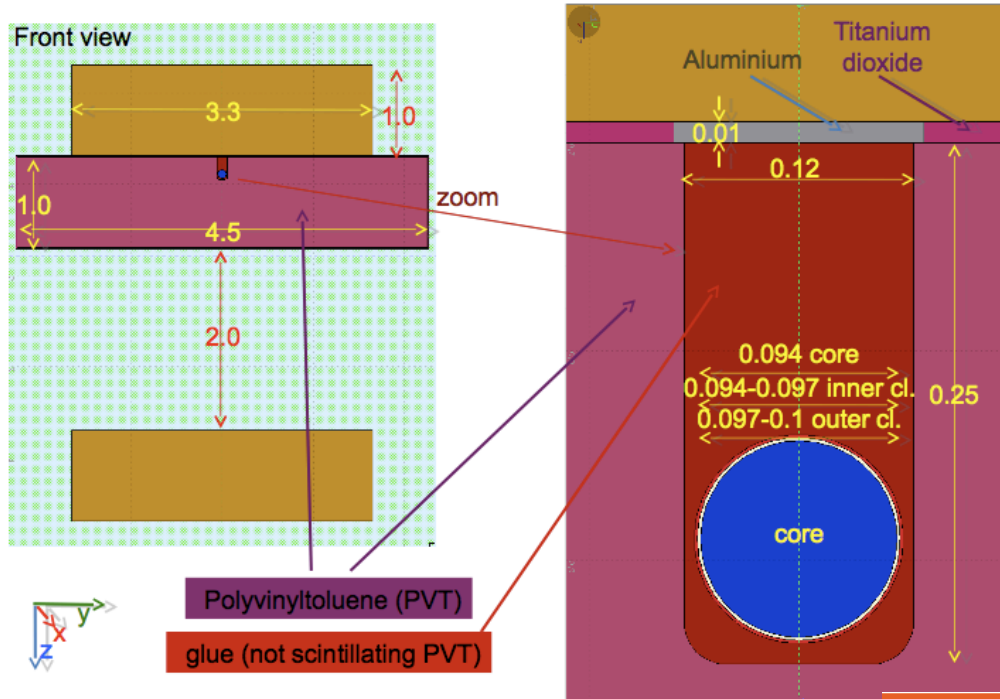
Light collection simulation

Tiziano
Rovelli

- setup a **detailed simulation** of light production, propagation and detection in a **prototype of a scintillator bar** (FLUKA)
- cross check expected results from simulation with **data collected from a real prototype**: tune simulation free/unknown parameters
- use simulation setup to study different geometries and optical couplings
- still preliminary results..

Presented by Nicolo' Tosi

Prototype setup

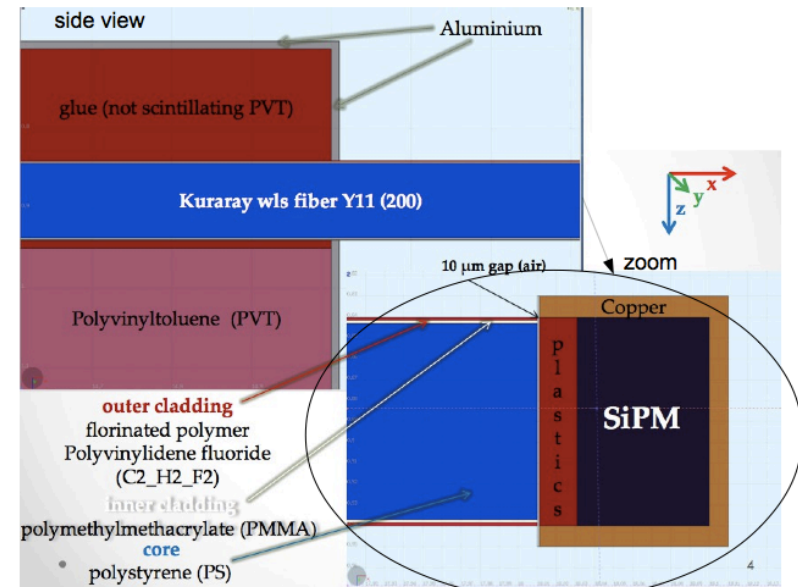


Detailed simulation of all the setup!

Krakow, 07 September 2012

Alessandro Montanari

Prototype setup



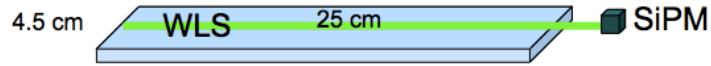
Krakow, 07 September 2012

Alessandro Montanari

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Effect of glue and aluminization

- Simulate same geometry as real prototype:



		+ 22% →	
		Not Glued	Glued
+ 31% ↓	Not Aluminized	32 ± 3	39 ± 3
	Aluminized	42 ± 3	

In DATA was:

37 58

46

Data/ MC comparison

- Good agreement with data (SiPM xtalk not simulated)
- **Effect of glueing is underestimated..**

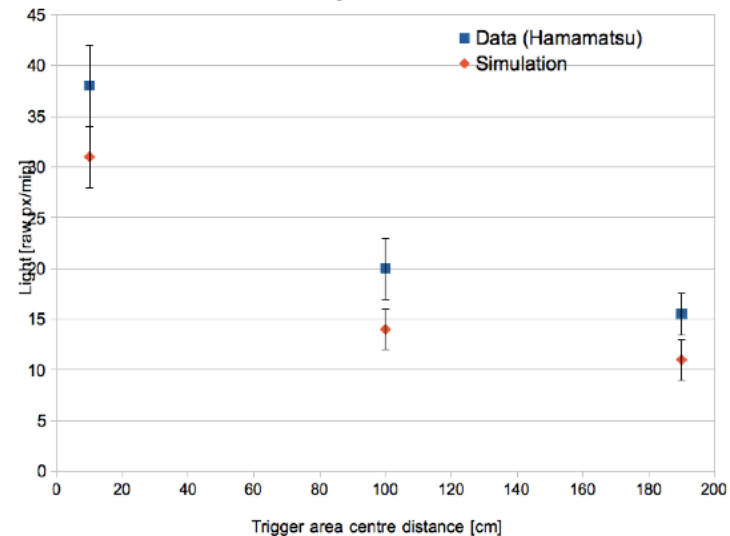
Krakow, 07 September 2012

Alessandro Montanari

Good agreement
(10 – 20% level)

Long scintillator bar

- 2 m bar, WLS Kuraray Y11 **NOT GLUED**



- Behavior is well reproduced

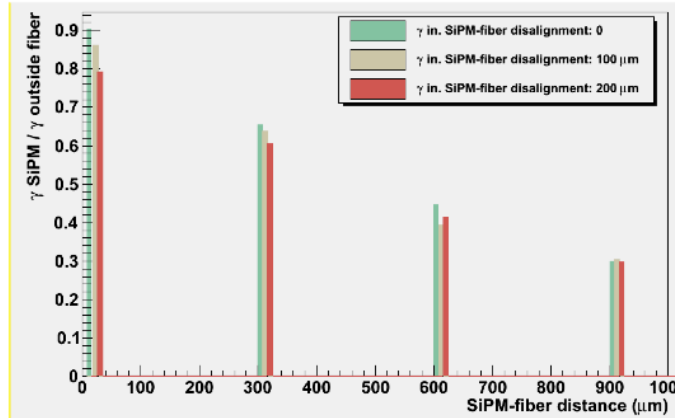
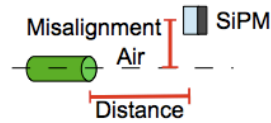
Krakow, 07 September 2012

Alessandro Montanari

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Effect of SiPM distance/misalignment from fiber

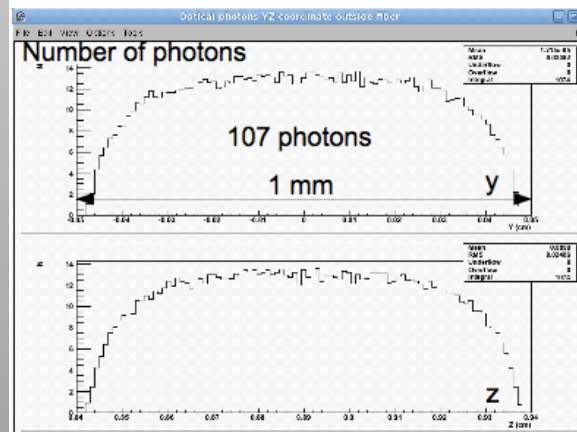
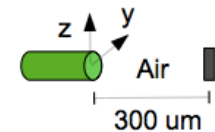
- Ratio = $(\gamma @ \text{SiPM}) / (\gamma @ \text{Fiber})$ (air in between)
- SiPM in plastic package (300 μm)



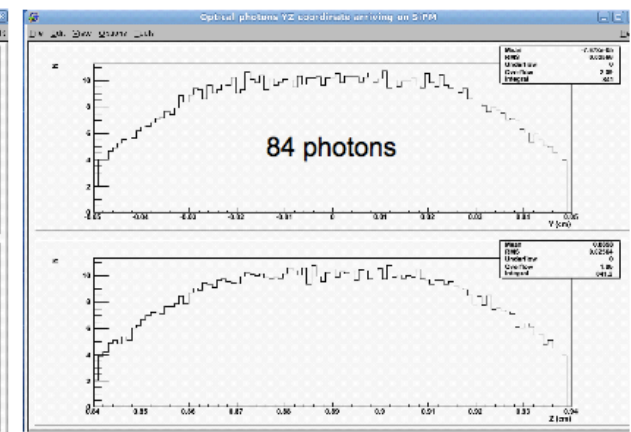
Once the simulation is well tuned many effects can be studied (saving quite some time!)

Photon beam profile

- More photons from the center of the fiber
- Less sensitivity to SiPM misalignment



@ fiber output

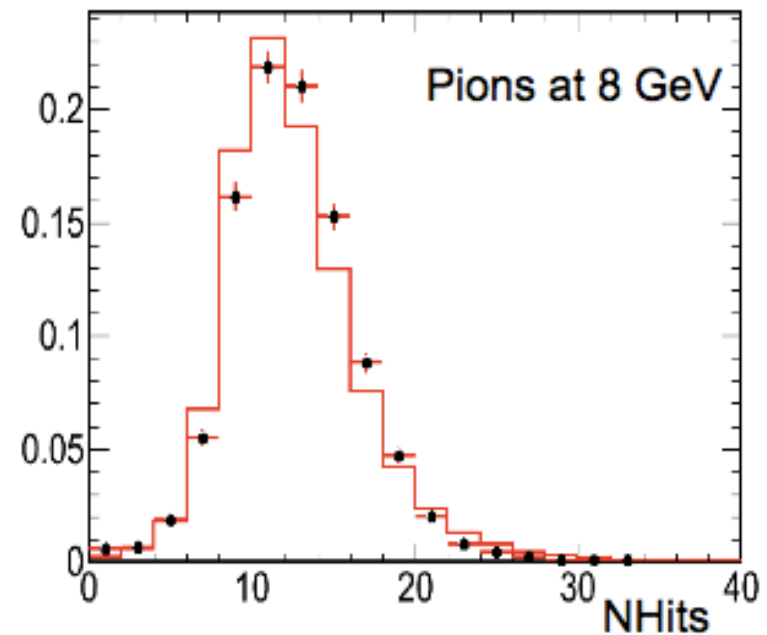


@ 300 μm

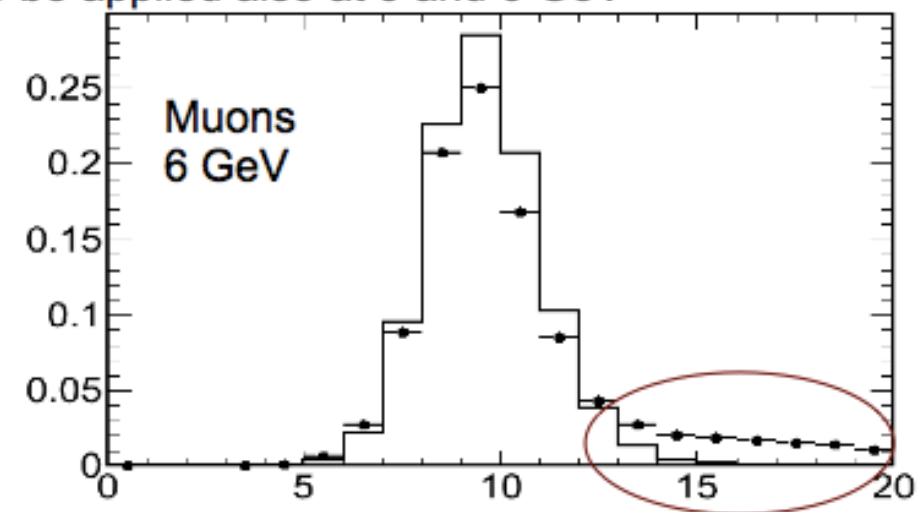
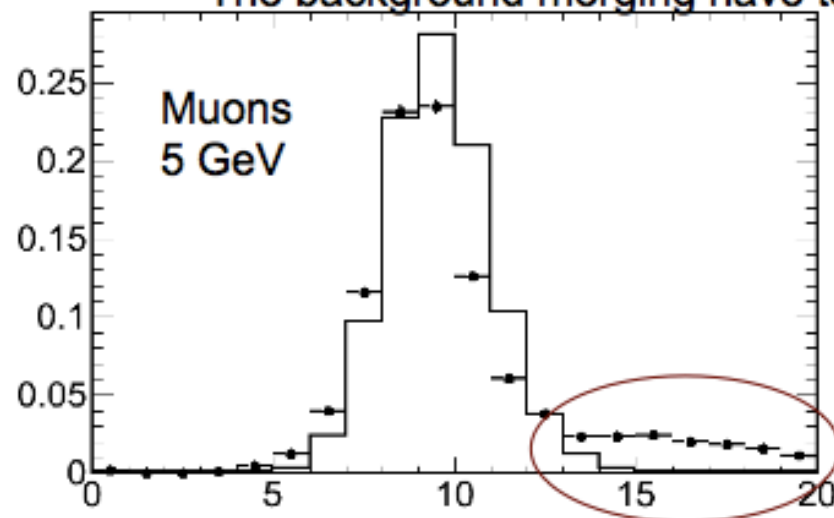
Beamtest Data/MC Analysis

Some other Data/MC comparison

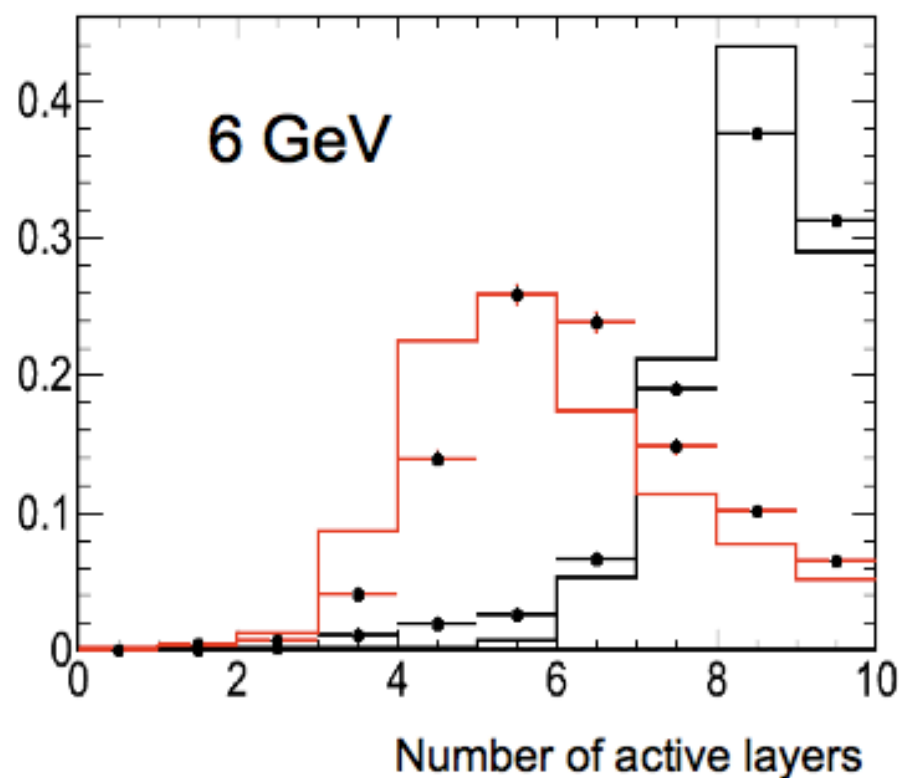
After all corrections applied using the muons at 8 GeV, the 8 GeV-Pions are simulated well!



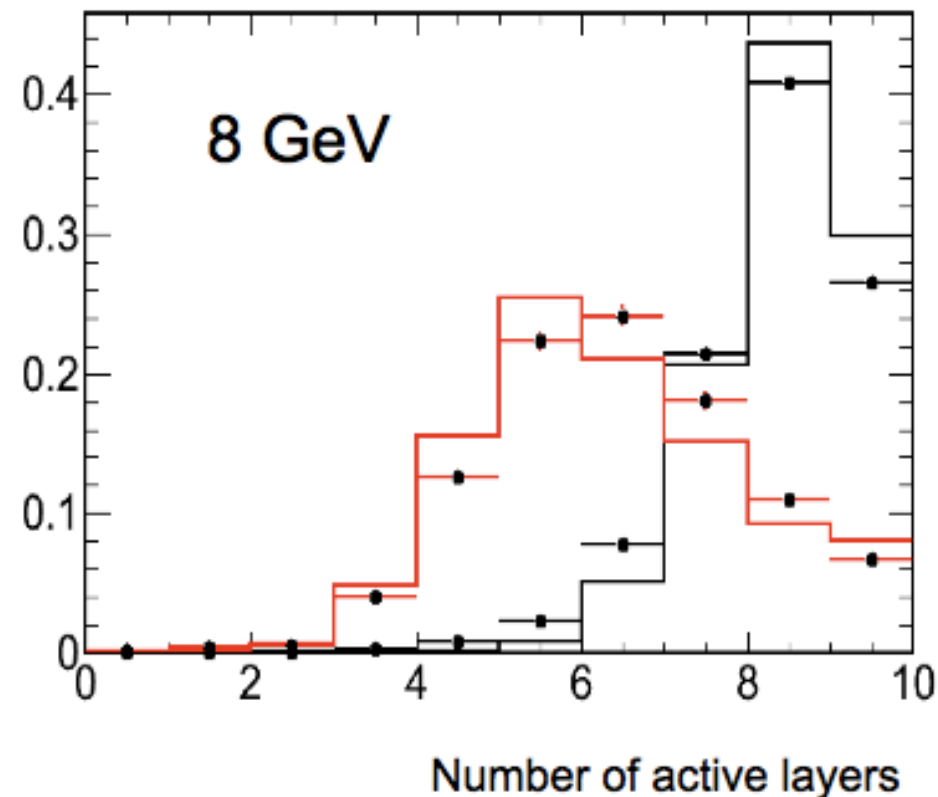
The background merging have to be applied also at 5 and 6 GeV



... an other variable



↑
Without background merging



Despite these small differences at 8 GeV
Try to compare the overall data/MC
Performance ...

TDR Status and next activities

- The writing of the TDR is ~80% complete
- All our efforts, in the next weeks, will be dedicated to the TDR finalization

Other short term future activities:

- Continue the irradiation test data analysis
- Finalization of the Testbeams data analysis
- Background studies and remediation
-

Conclusions

- Many activities ongoing in the last months on the IFR system
- Almost ready to proceed to the construction phase → lot of work
- The IFR group would like to welcome our new collaborators from Mexico, we had already some useful discussions about the possible contribution on the construction and we are sure that it will be a very fruitful collaboration