

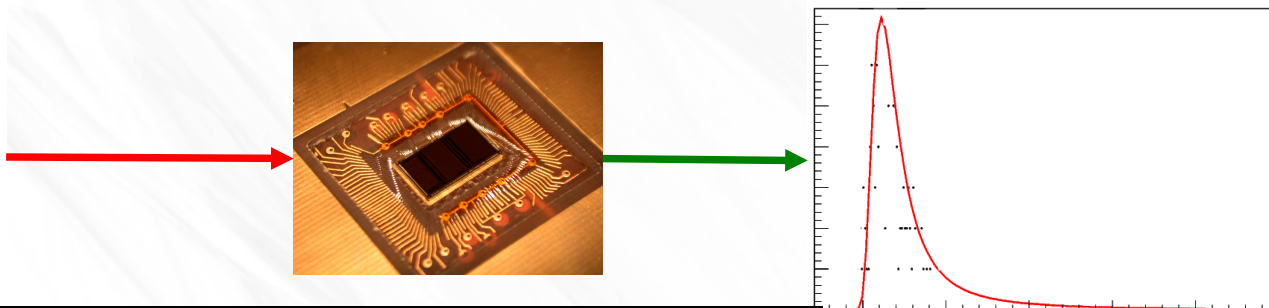
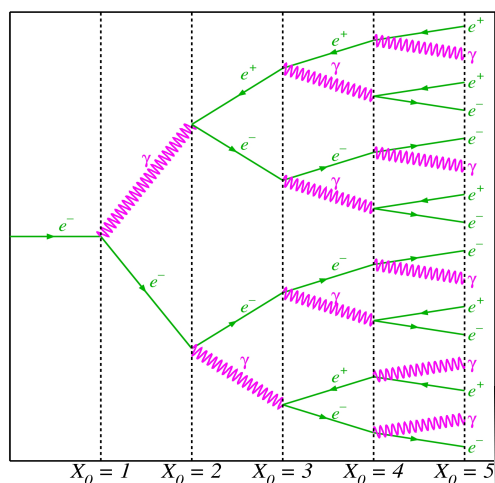


# Shower study for 1-5 GeV energy electron beam with ASIC<sub>SKIROC</sub> readout

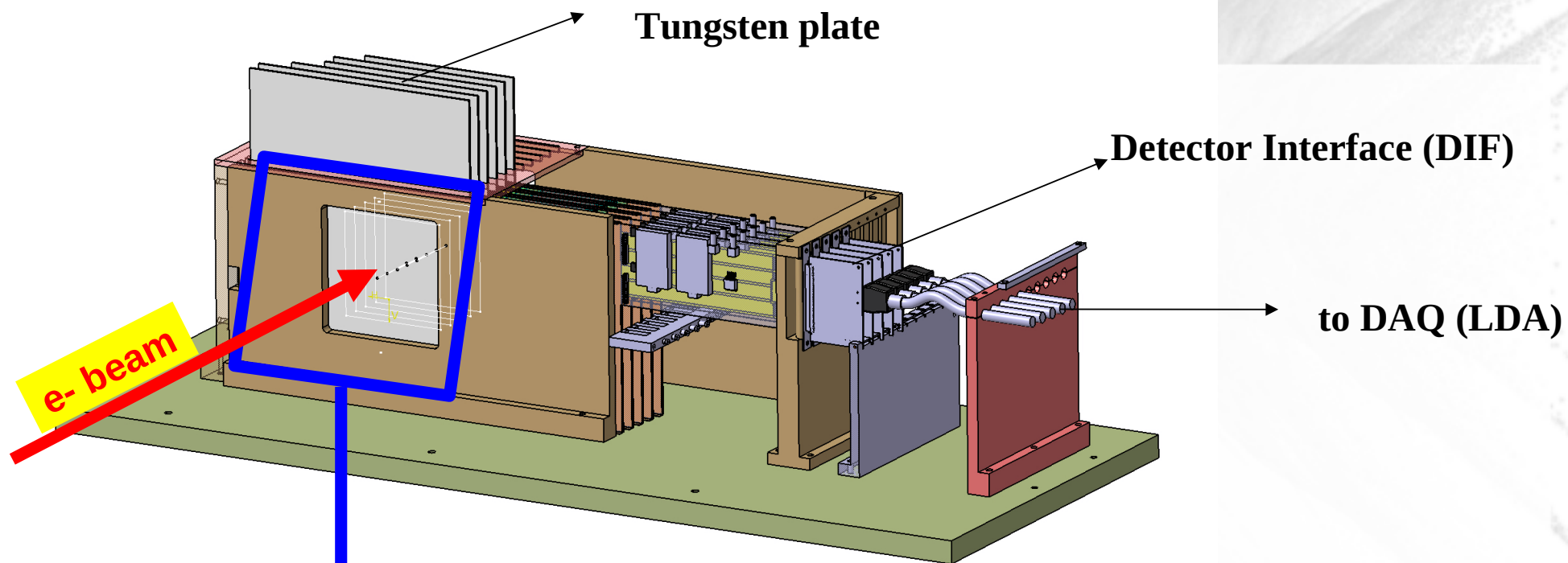
*Elmaddin Guliyev*

LLR – Ecole Polytechnique, CNRS/IN2P3

Palaiseau, France



*26.09.2012- Analysis meeting*

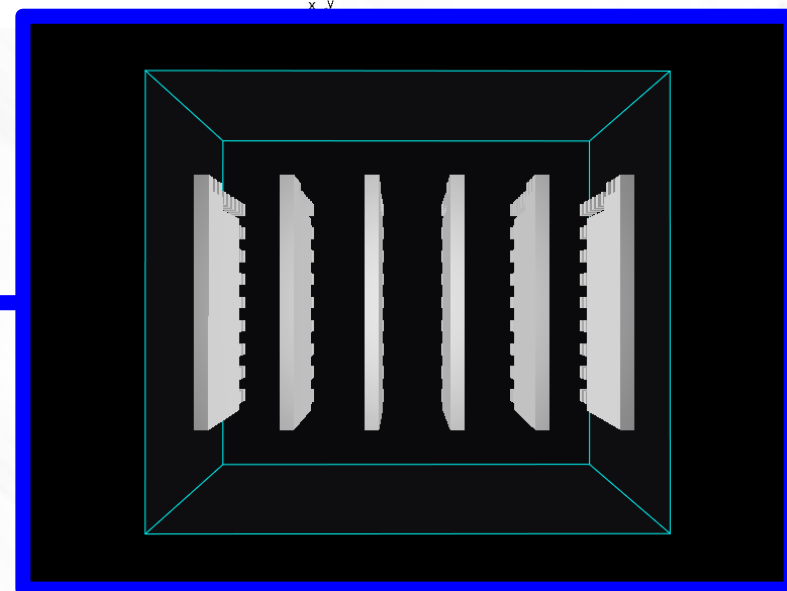


Very front-electronics (FVE8)  
ASIC+Si wafer

**$e^-$  beam energy: 1-5 GeV**  
**Rate: 1 kHz – 5 Hz**

**6 layer of detector=6\*(Si wafer+4ASIC+DIF)**

**Noisy channels are masked!**



# Plan for Test Beam



```
graph TD; A[Plan for Test Beam] --> B[Physics study]; A --> C[Calibration, ASIC performance study]; B --> D[MIP reconstruction]; B --> E[Shower study]; B --> F[Detection efficiency]; C --> G[Trigger calibration]; C --> H[Noise study]; C --> I[Hold optimisation]; C --> J[Energy calibration];
```

The diagram is a hierarchical flowchart titled 'Plan for Test Beam'. It branches into two main categories: 'Physics study' and 'Calibration, ASIC performance study'. 'Physics study' further branches into 'MIP reconstruction', 'Shower study', and 'Detection efficiency'. 'Calibration, ASIC performance study' branches into 'Trigger calibration', 'Noise study', 'Hold optimisation', and 'Energy calibration'. At the bottom, a legend box contains three colored squares with labels: a purple square for 'LAL', a blue square for 'LLR', and an orange square for 'LAL+LLR'.

## Physics study

**MIP  
reconstruction**

**Shower  
study**

**Detection  
efficiency**

## Calibration, ASIC performance study

**Trigger  
calibration**

**Hold  
optimisation**

**Energy  
calibration**

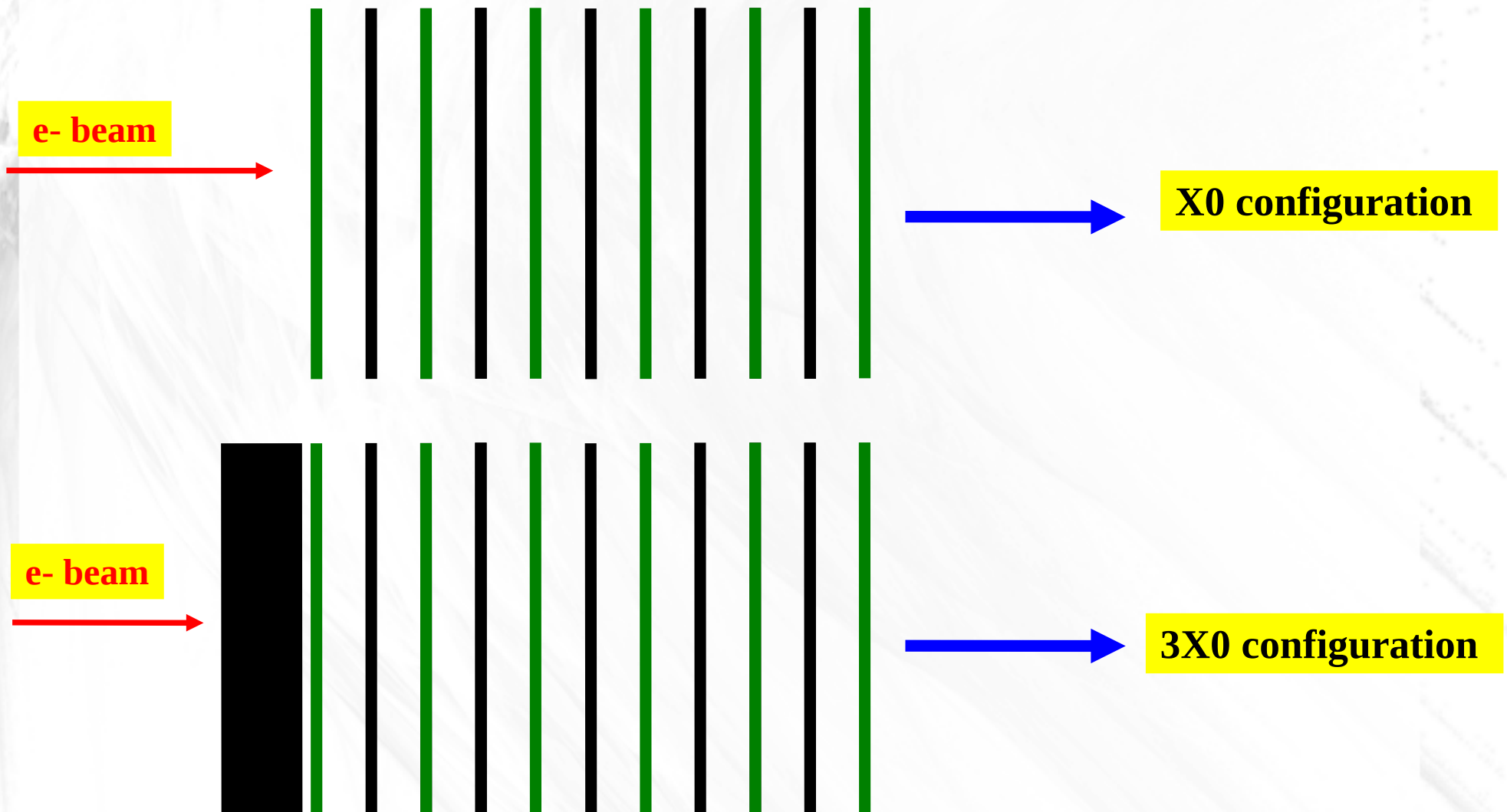
**Noise study**

**LAL**

**LLR**

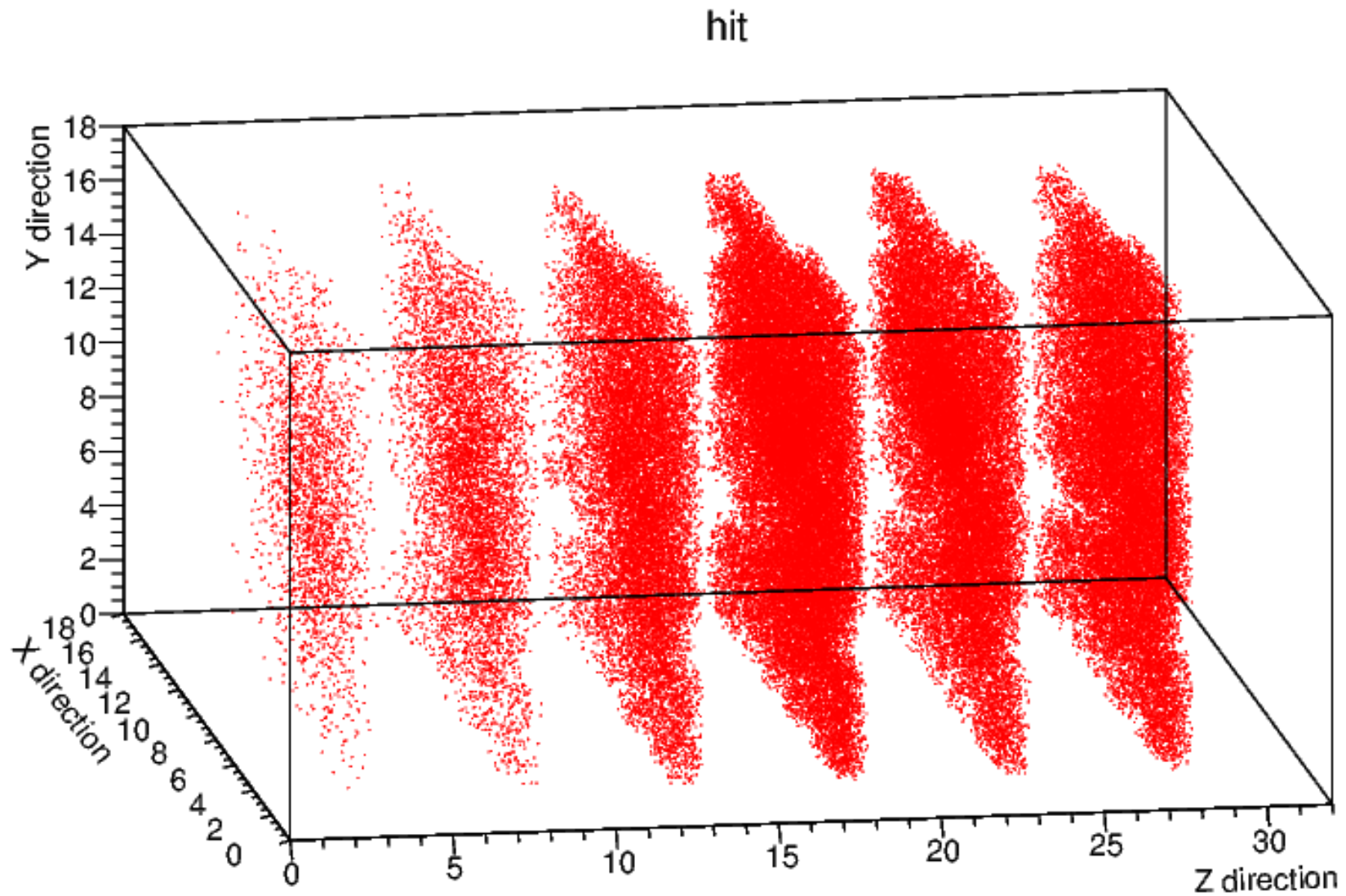
**LAL+LLR**

# Configuration



6 x [ silicon wafer + FEV8 + 4xSKIROC+DIF]    W plate

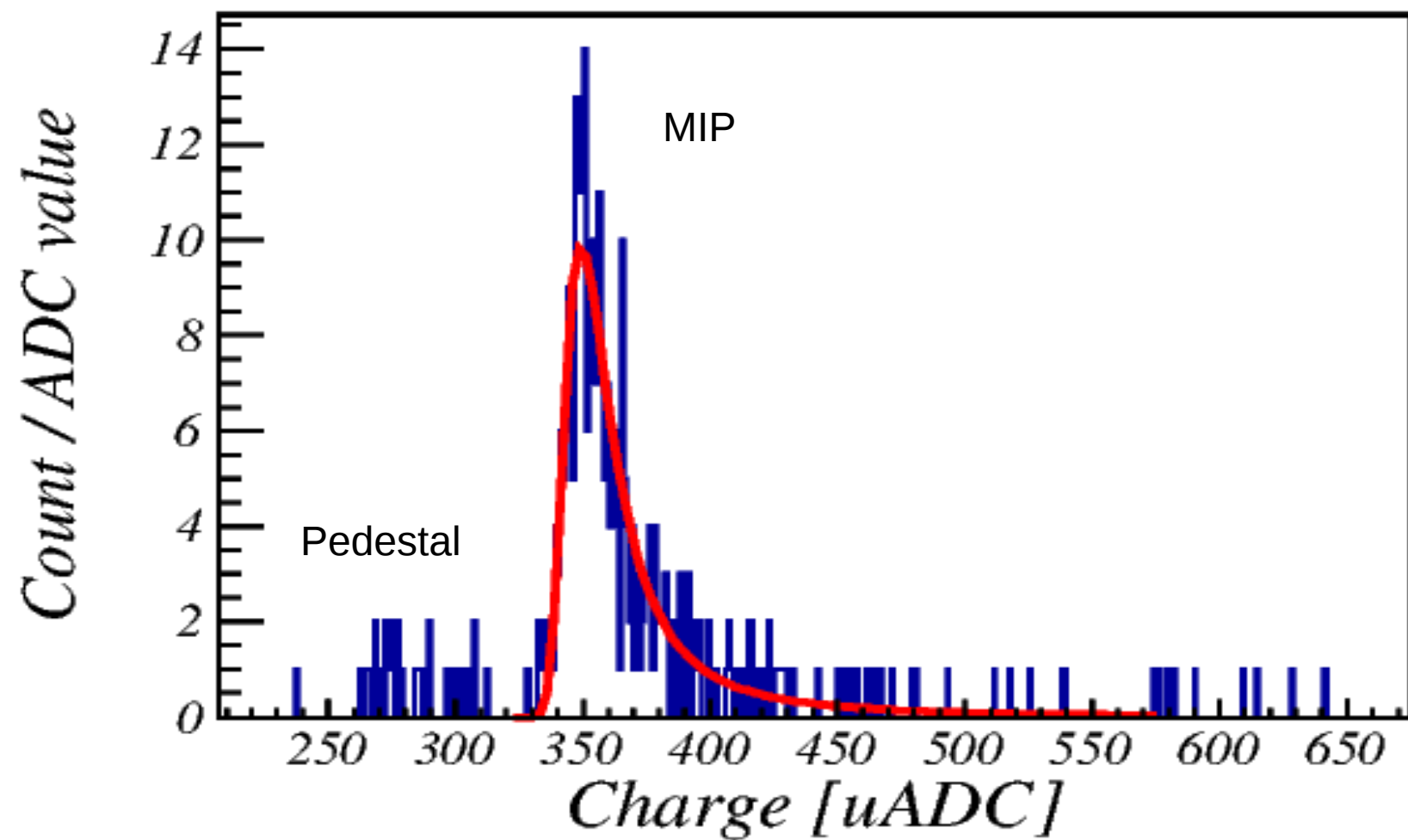
# 1 GeV $e^-$ hit with 6 layer of detector: between the layers W plate placed/X0



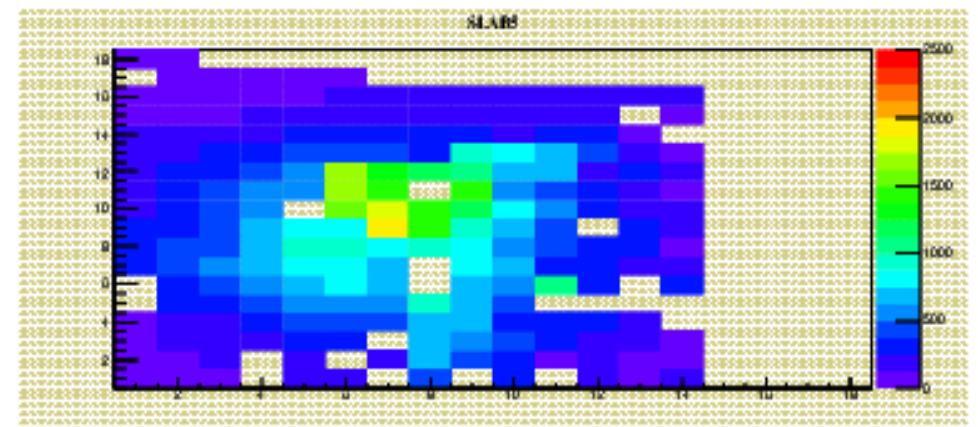
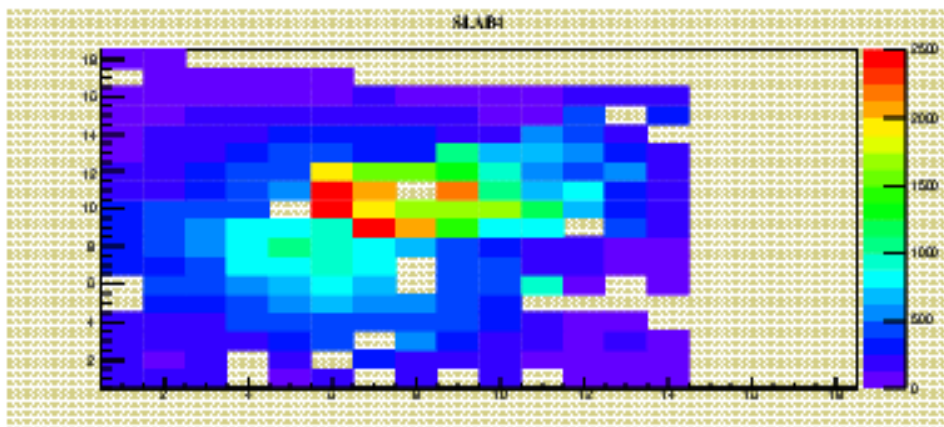
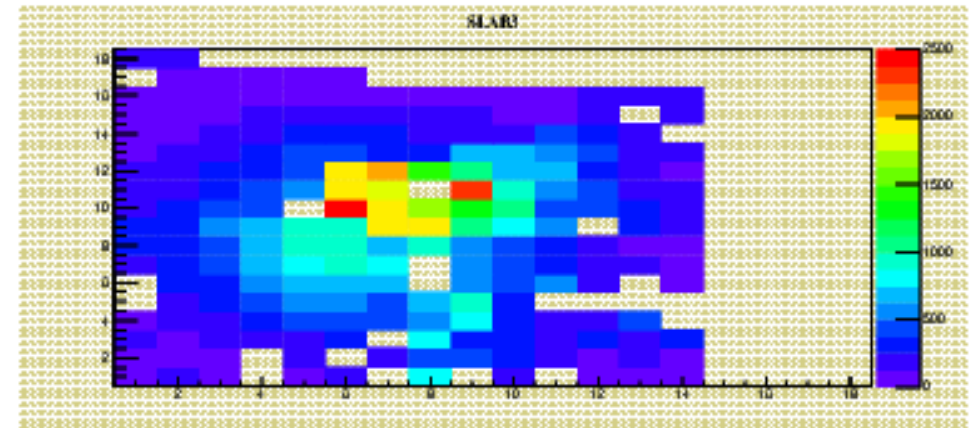
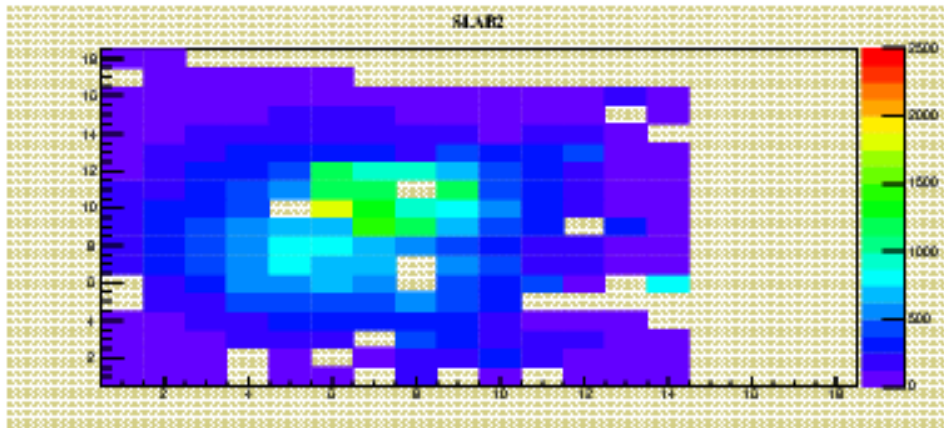
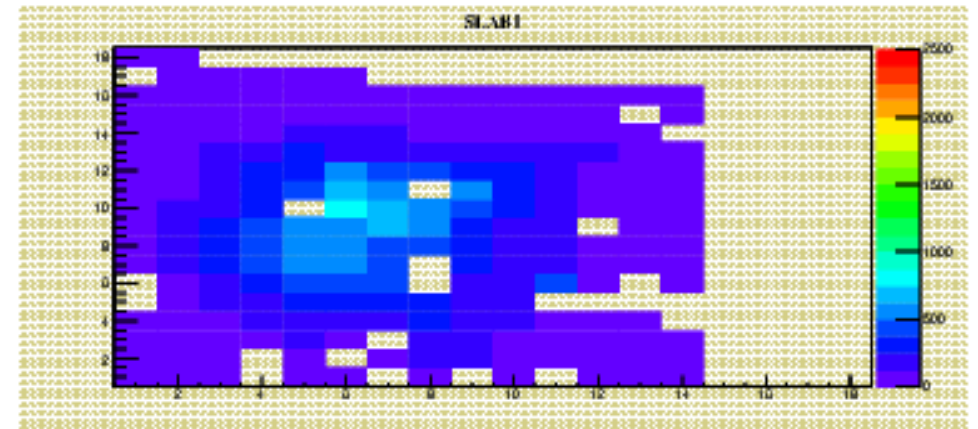
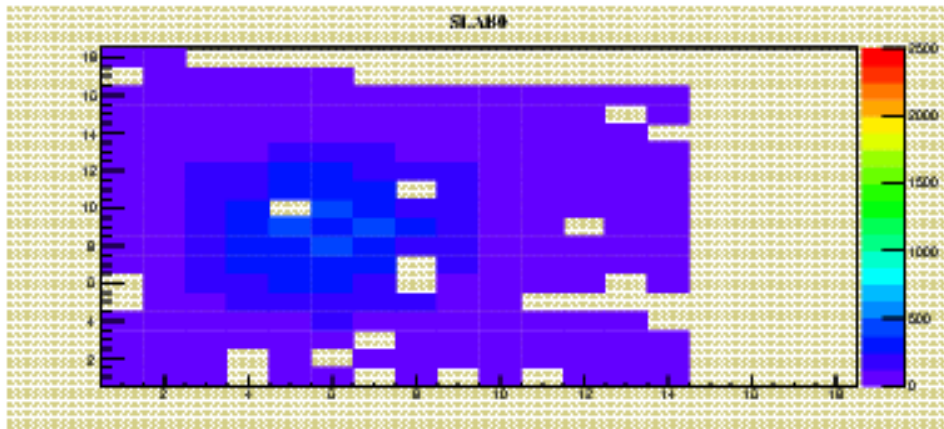
All the run was same: 3600 sec.



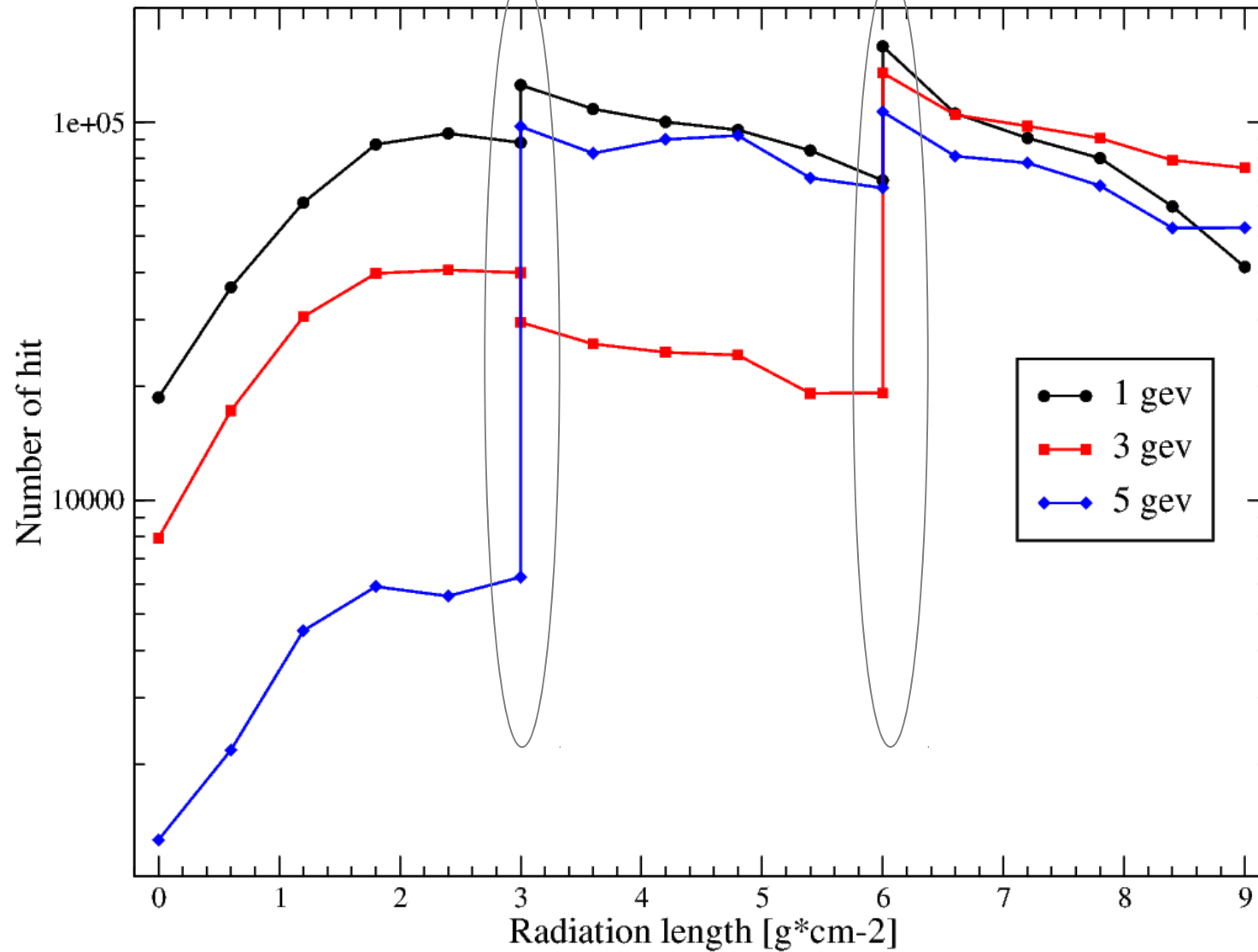
## Example of MIP for one chip, channel, column



# Shower profile for 6 layer/detector for 1 GeV electron / X0

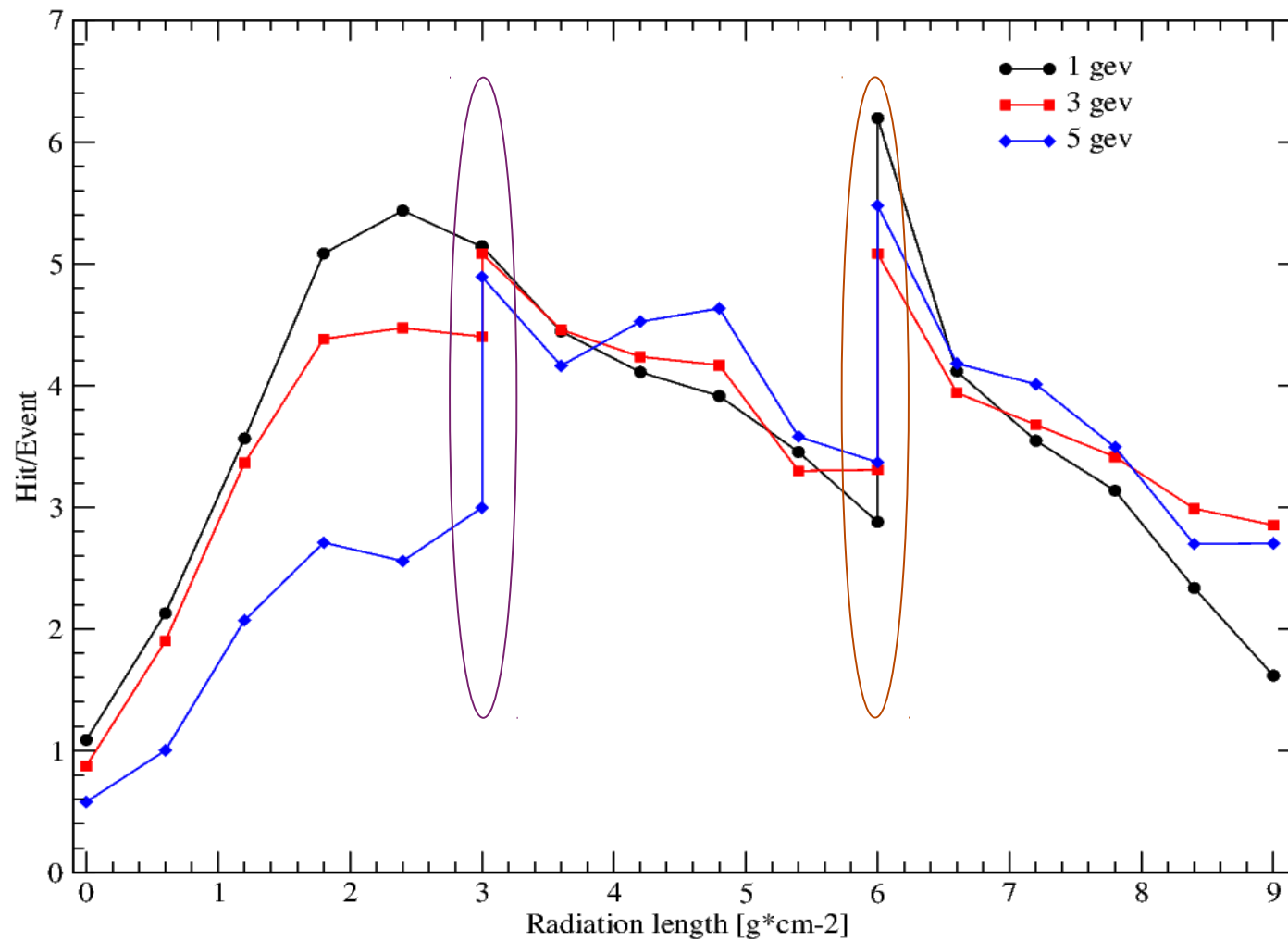


# Beam alignment or leakage in configuration????



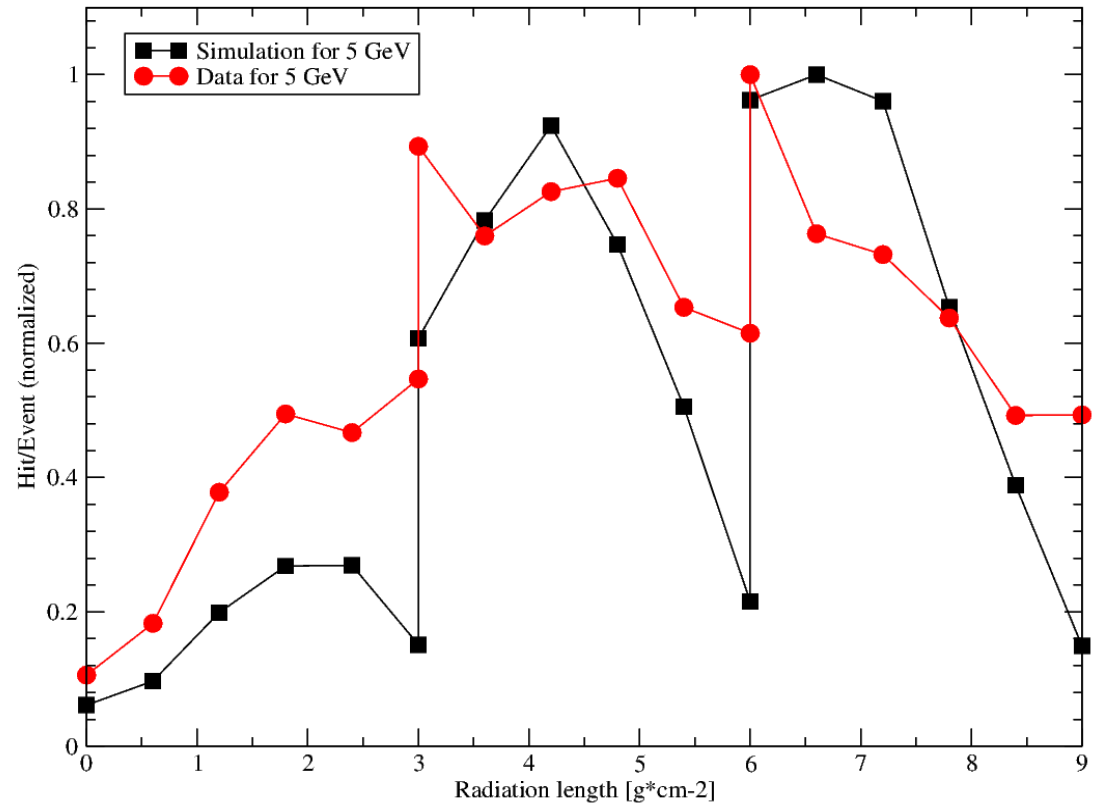
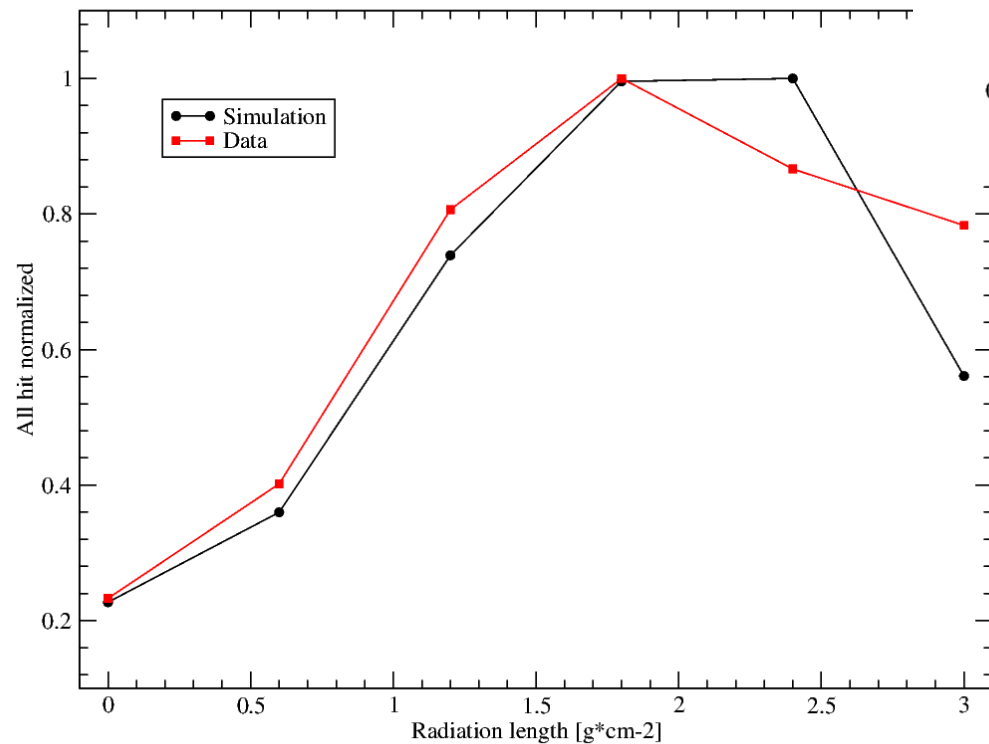


## Hit per event for different radiation length



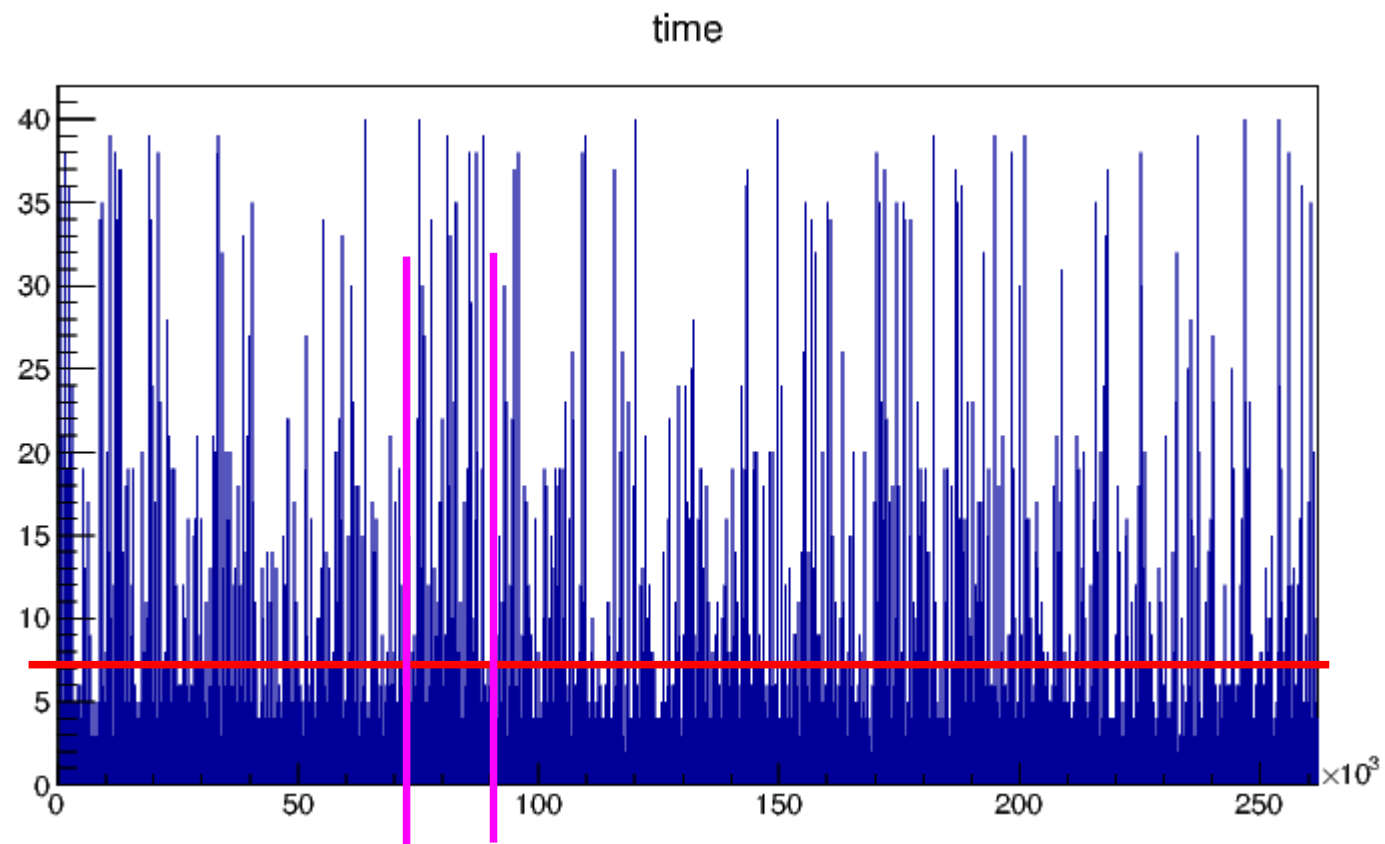
# Simulation vs Data for 5 GeV

X0 for 5 GeV



{simulation done by Tibo}

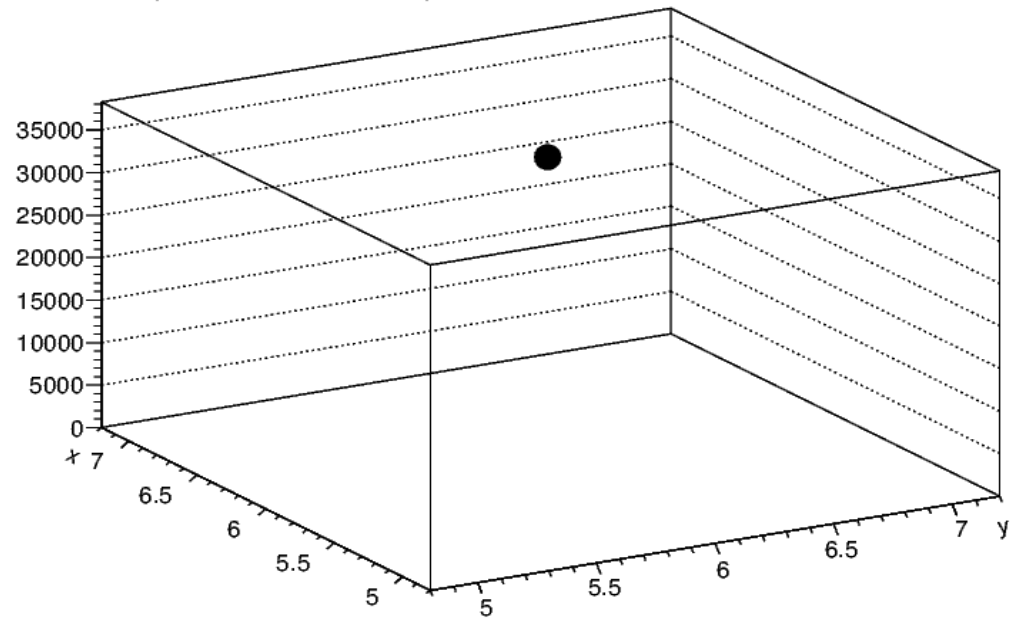
Time cut:



# Time cut

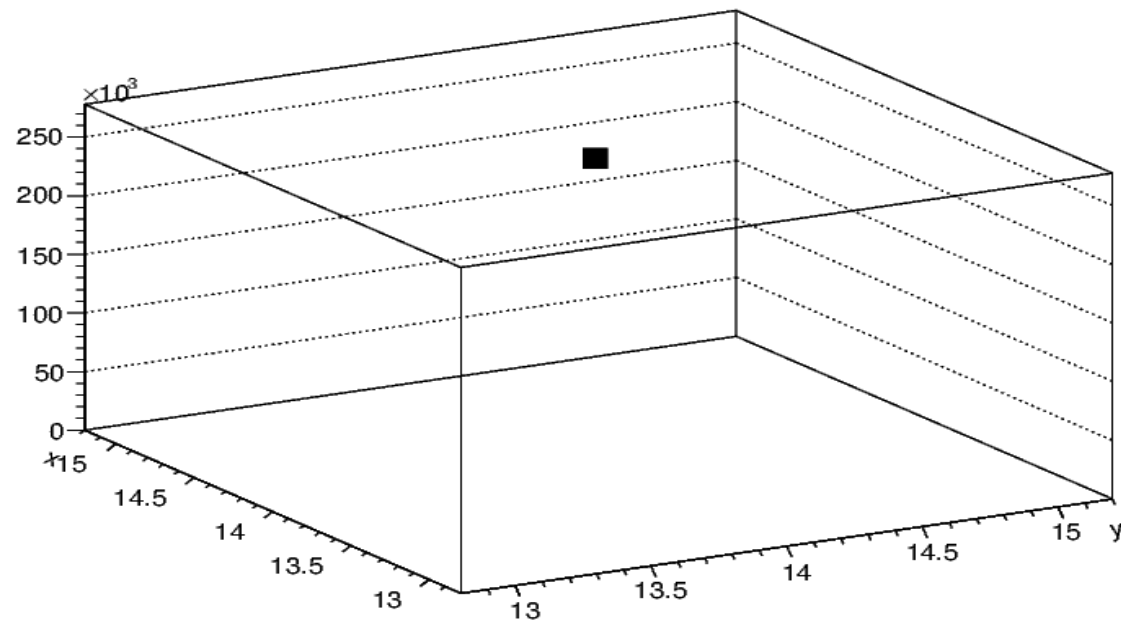
1) Hit = 36257

**$z=30$ , time = 10000, slab = 3**



2) Hit = 263994

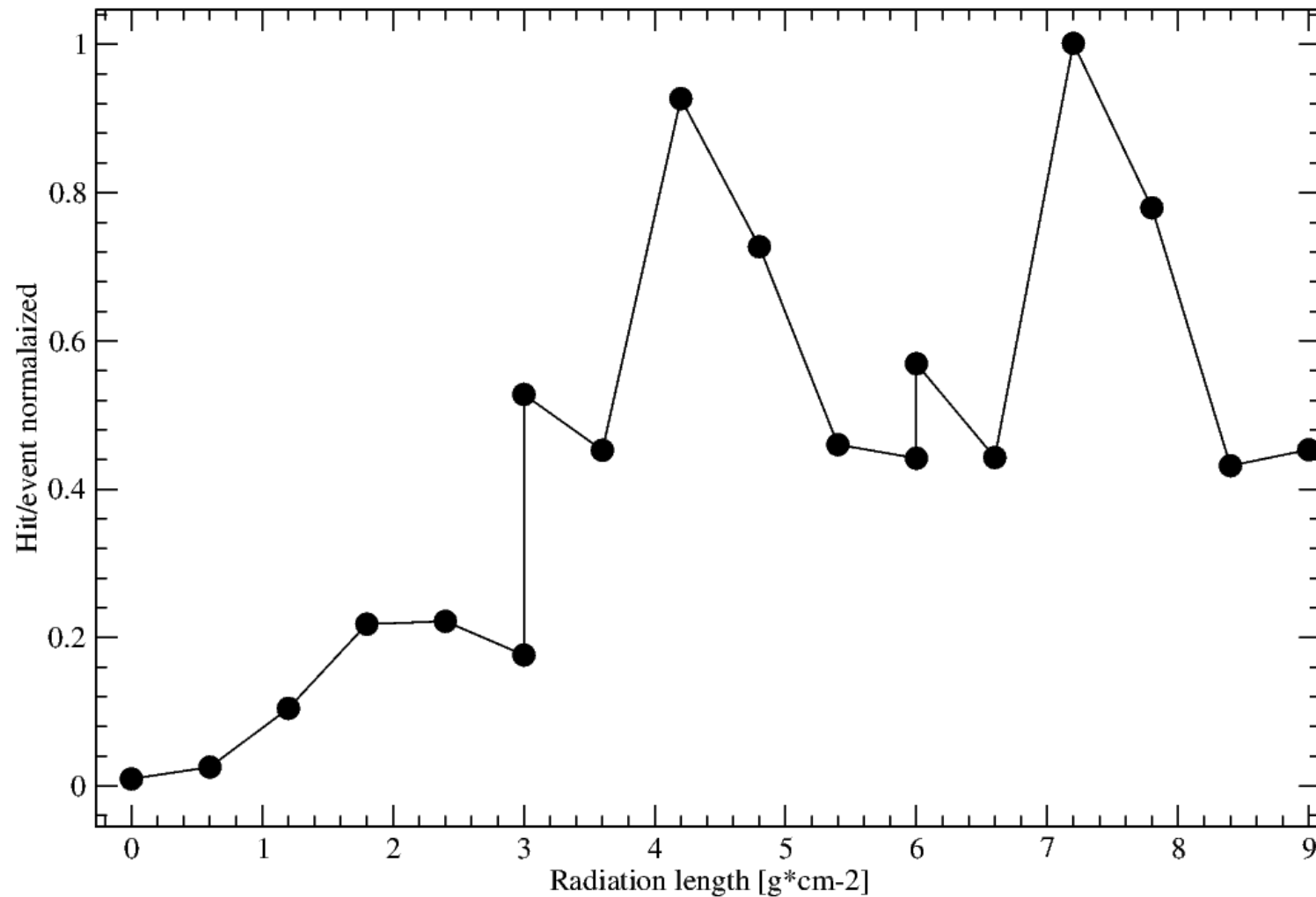
**$z=20$ , time = 1200, slab = 2**

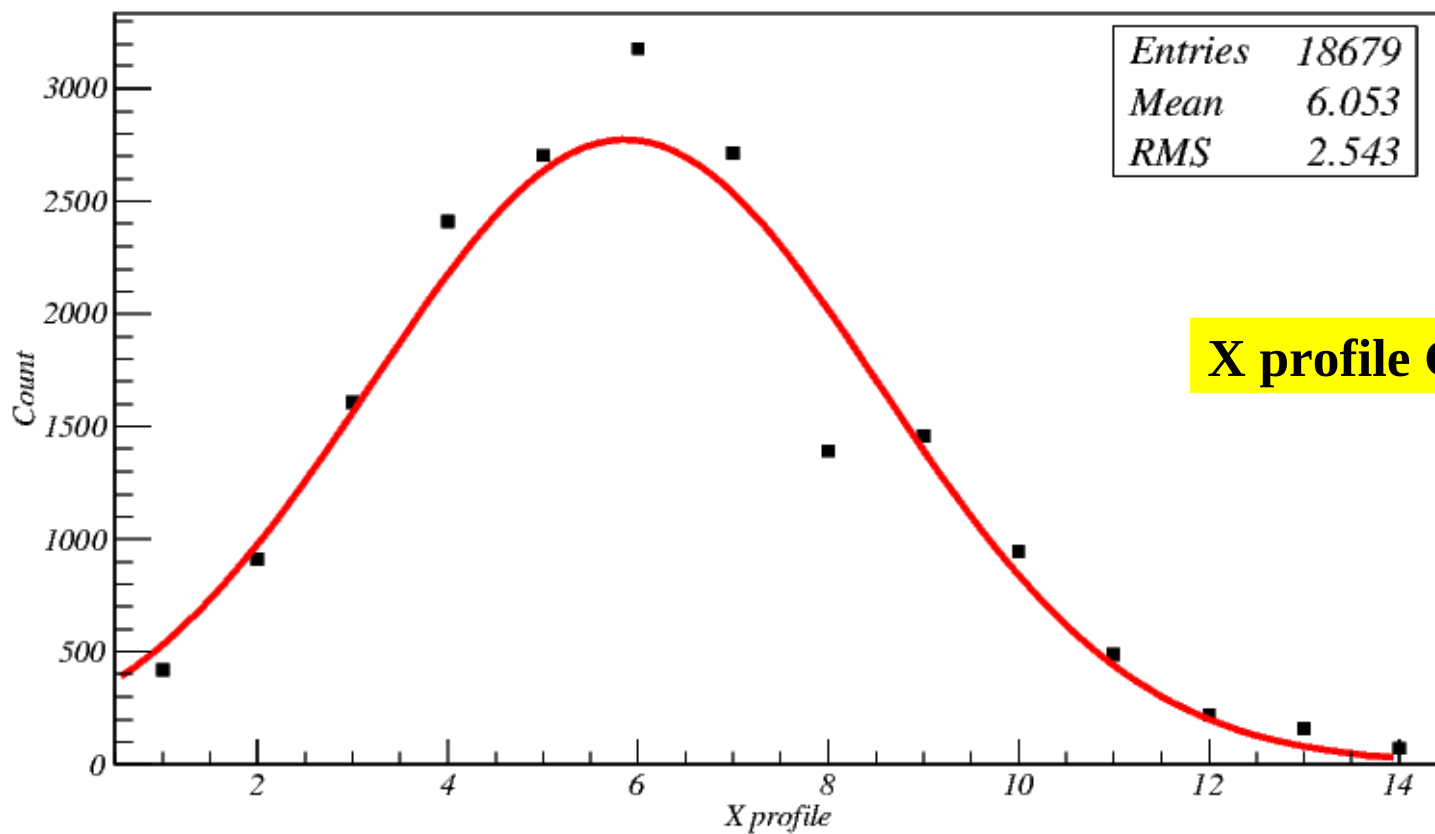




## Shower profile for 5 GeV: the received hits in same BCID

the hit received at same bcid occur in the chips

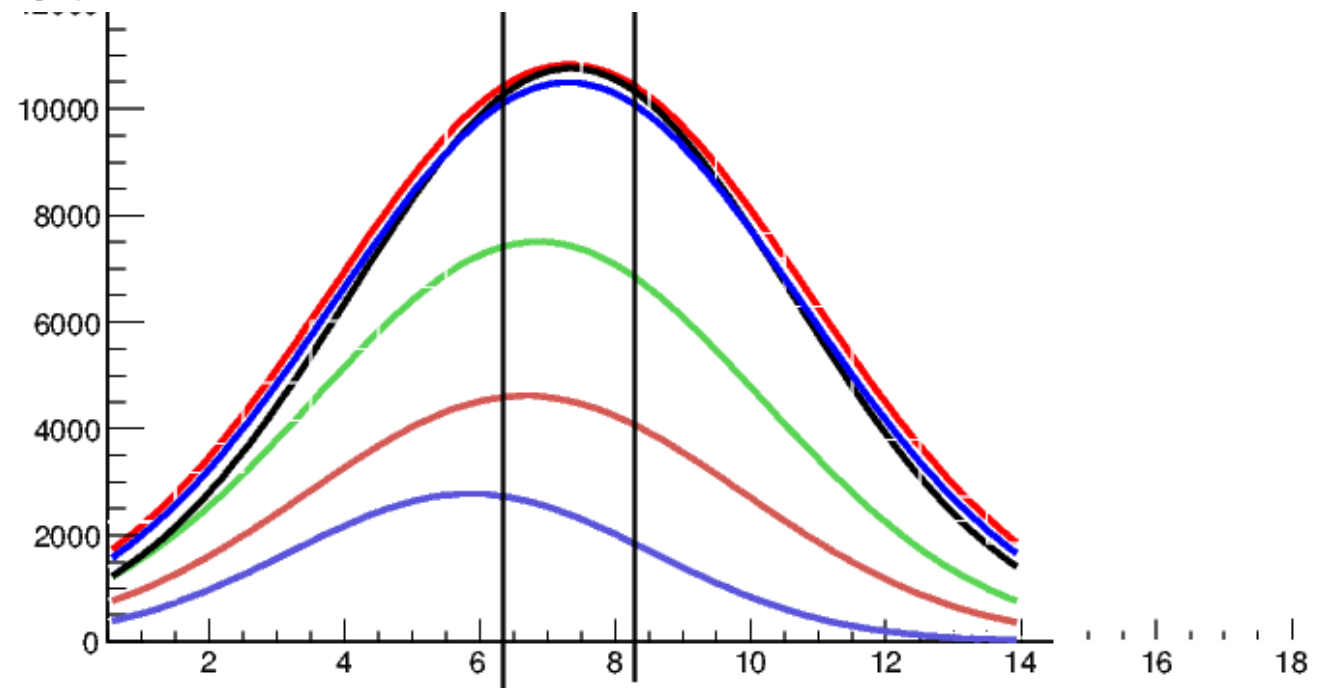


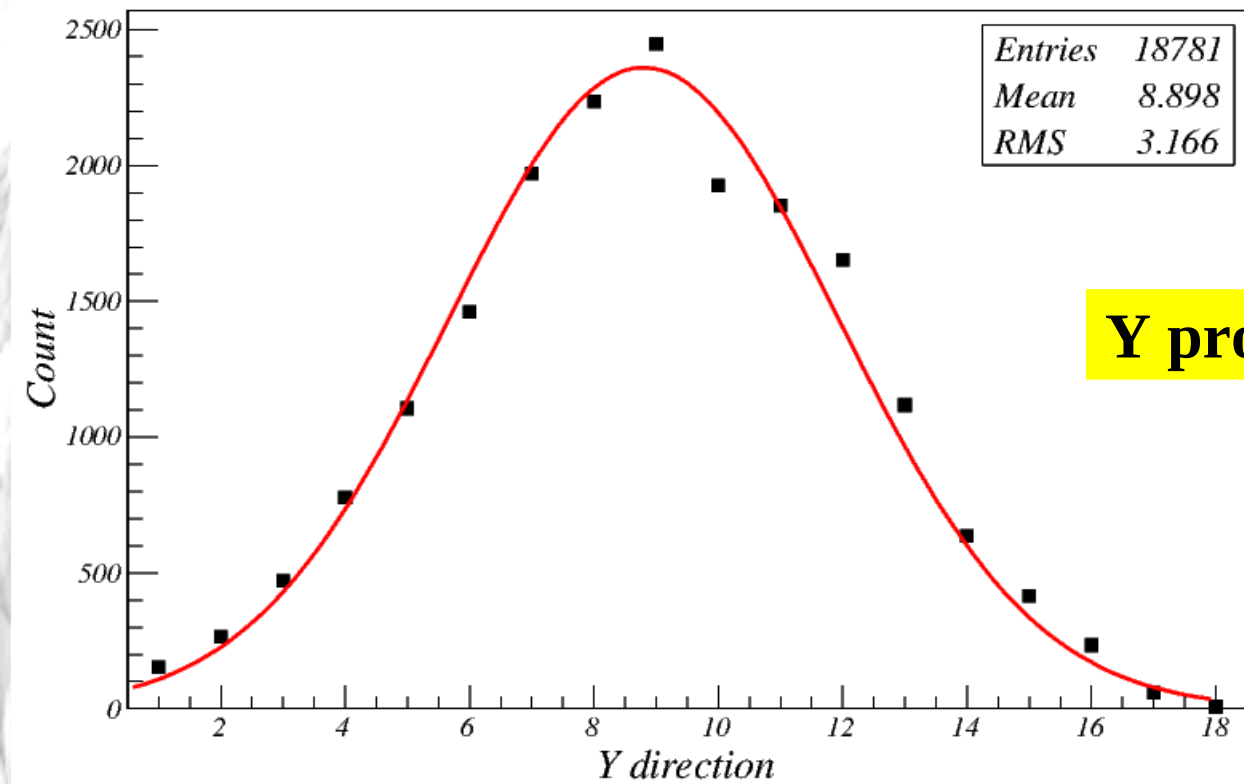


**X profile GAUS fit**

Use to estimate:

Shower size-sigma from gaus  
Beam alignment-mean from gaus

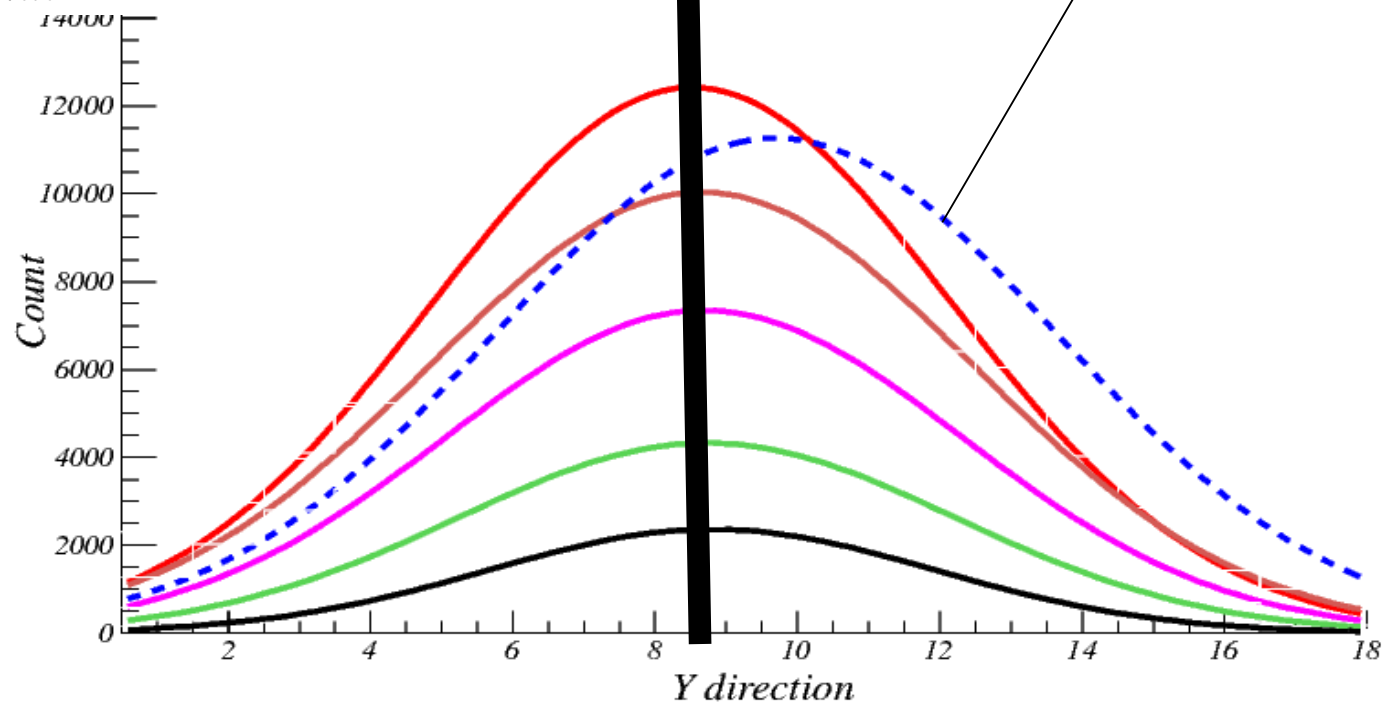




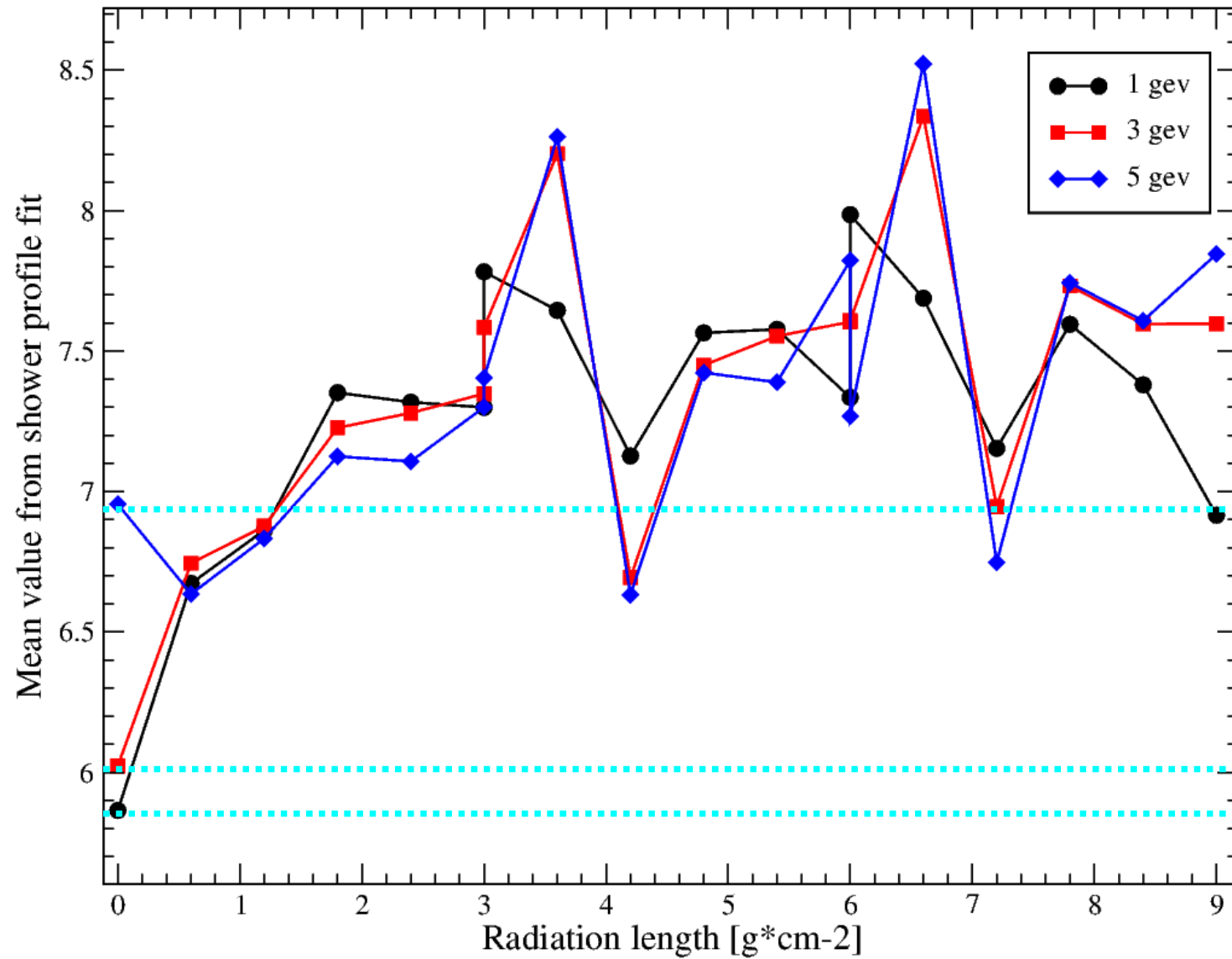
**Y profile Gaus fit**

*DIF behaviour???*

*Noise ???*



## Mean value of Gaus fit of shower on X profile



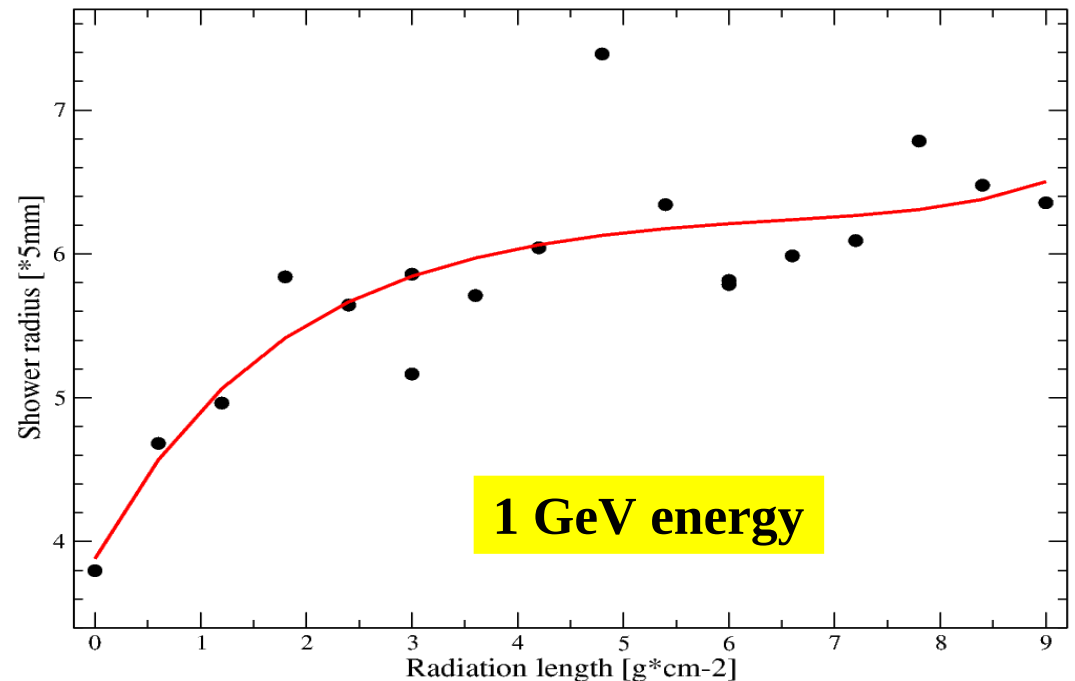
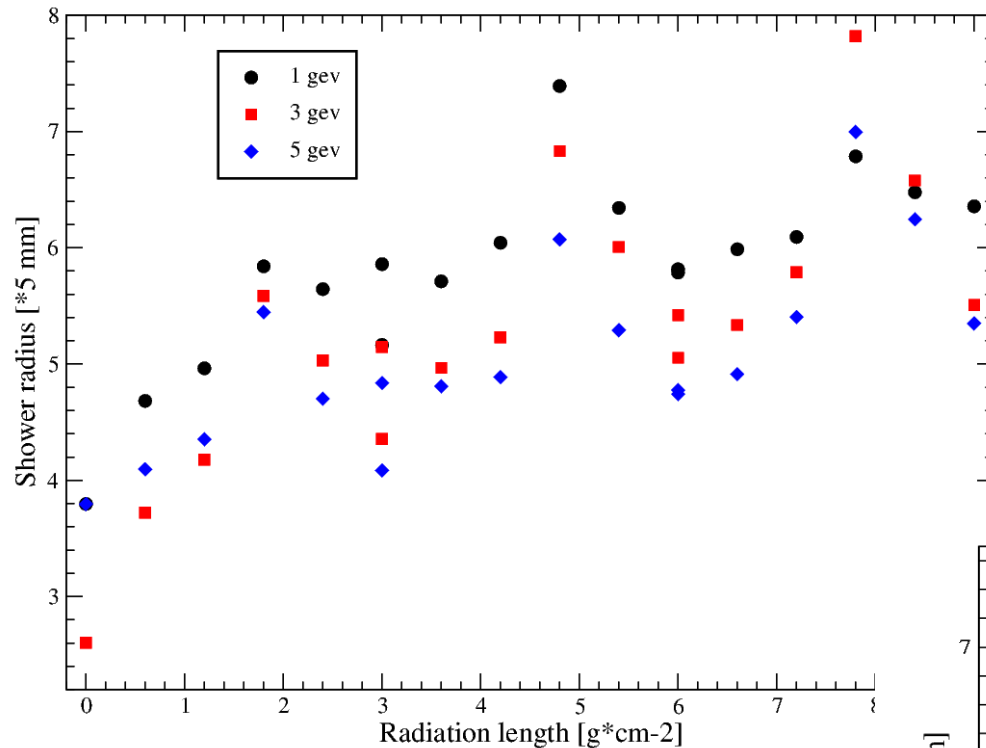
**Deviation ==> beam alignment ==> on X axis**



# Shower size for different radiation length:

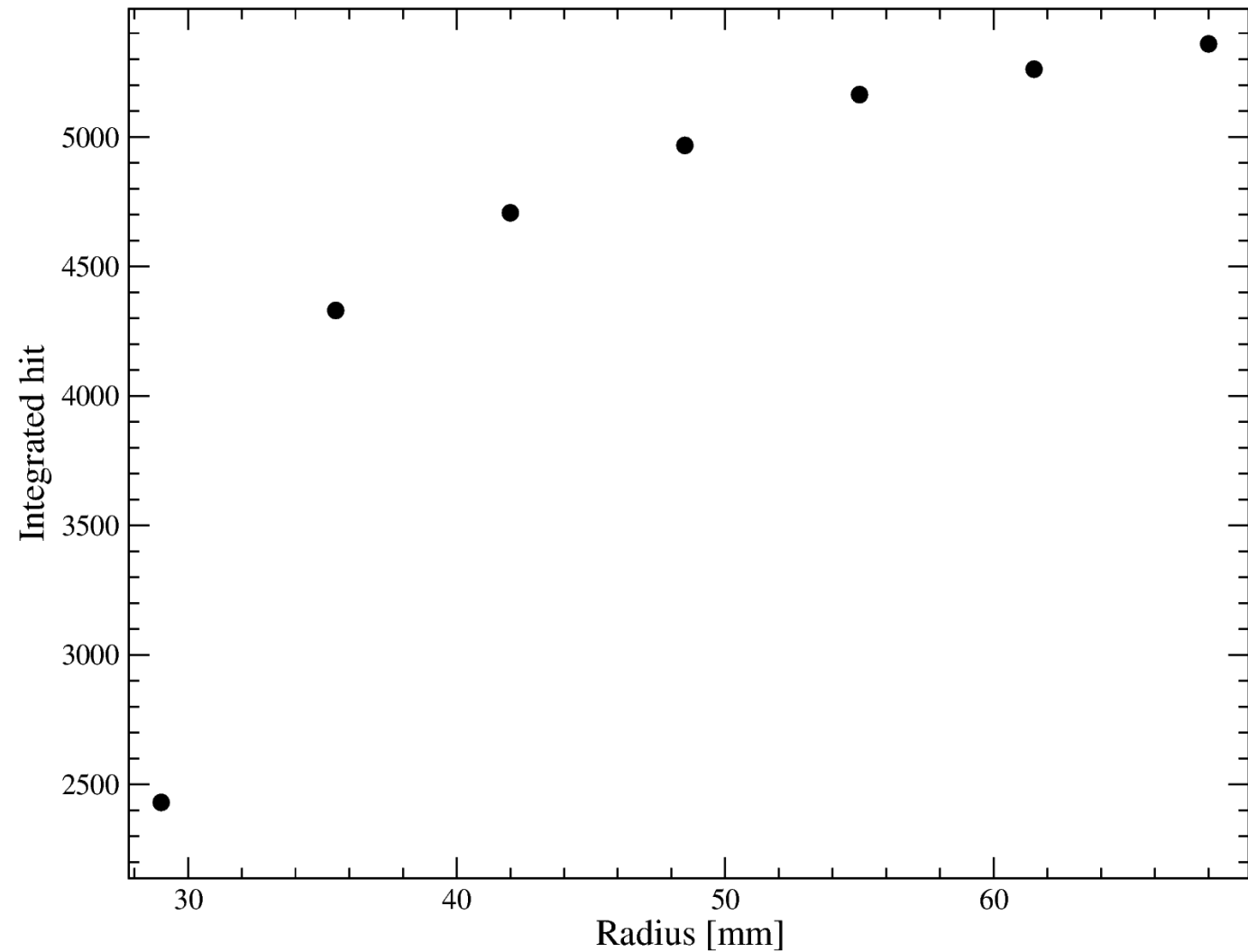
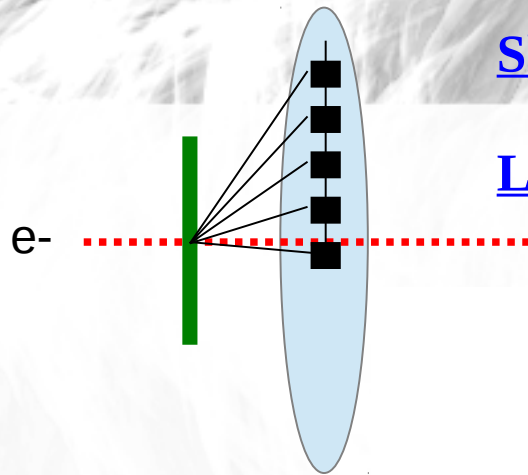
*Size of shower determined from sigma of Gaus fit of shower profile.*

$$\text{Shower radius} = \sqrt{(\sigma_x^2 + \sigma_y^2)}$$

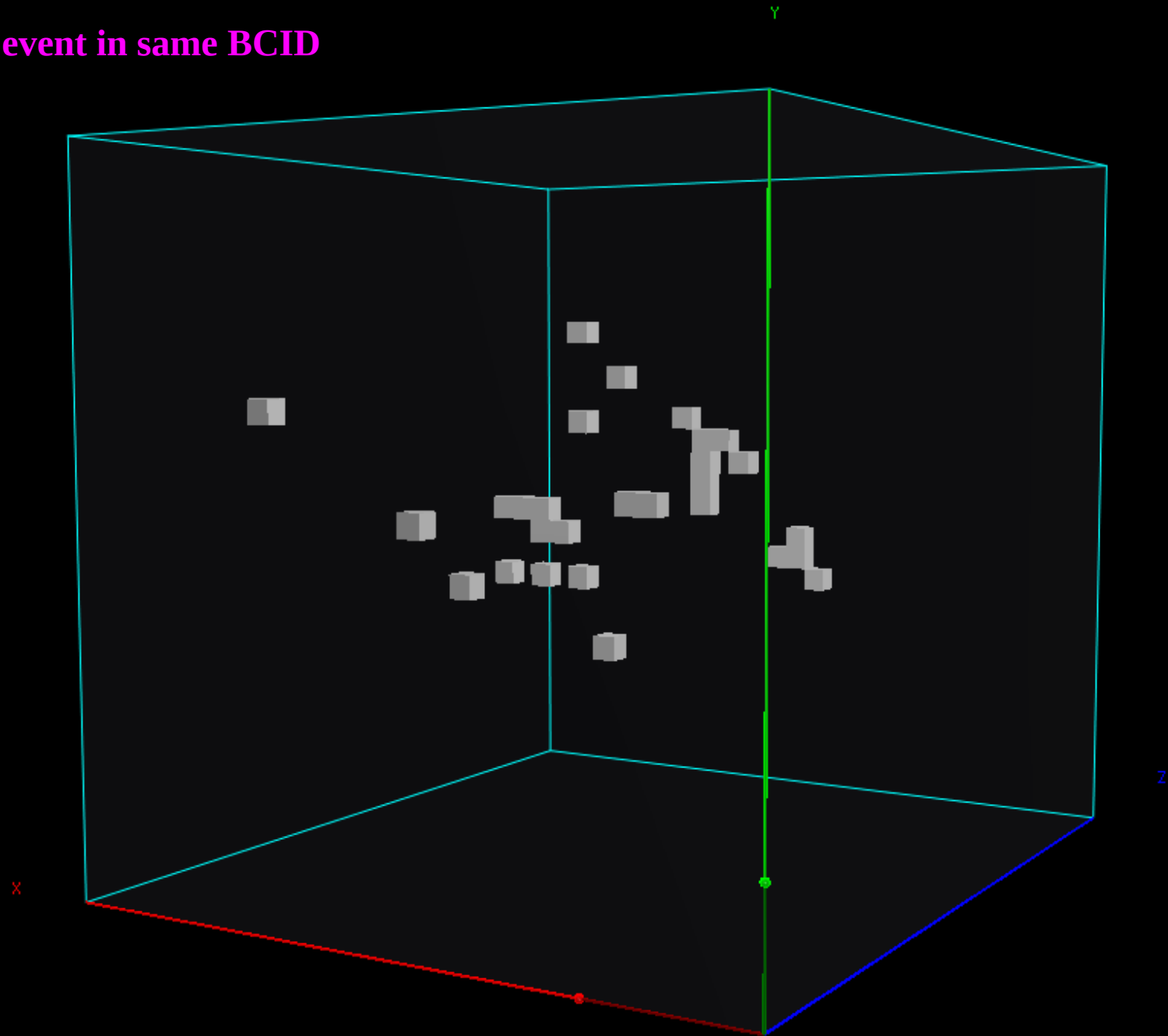


# Shower study in radial direction for different radiation length.

## Lateral shower distribution



**Hit for one event in same BCID**



## **Summary:**

**Hit distribution for different radiation length analysed.  
The size of shower estimated for different radiation length.**

**It seems beam not aligned proper or we had a shower leakage due to particle loose, which gives the discrepancy in end of X0 and beginning of 3X0 configuration (same for 3X0 and 6X0).**

**Need to verify it with same geometry with simulation!**



**Plan for future**

**Analysis**

**Data vs  
Simulation  
Very important**

**Complete as soon  
as possible**

**Discussion  
(meeting) with  
LAL group**

**ASIC performance study**

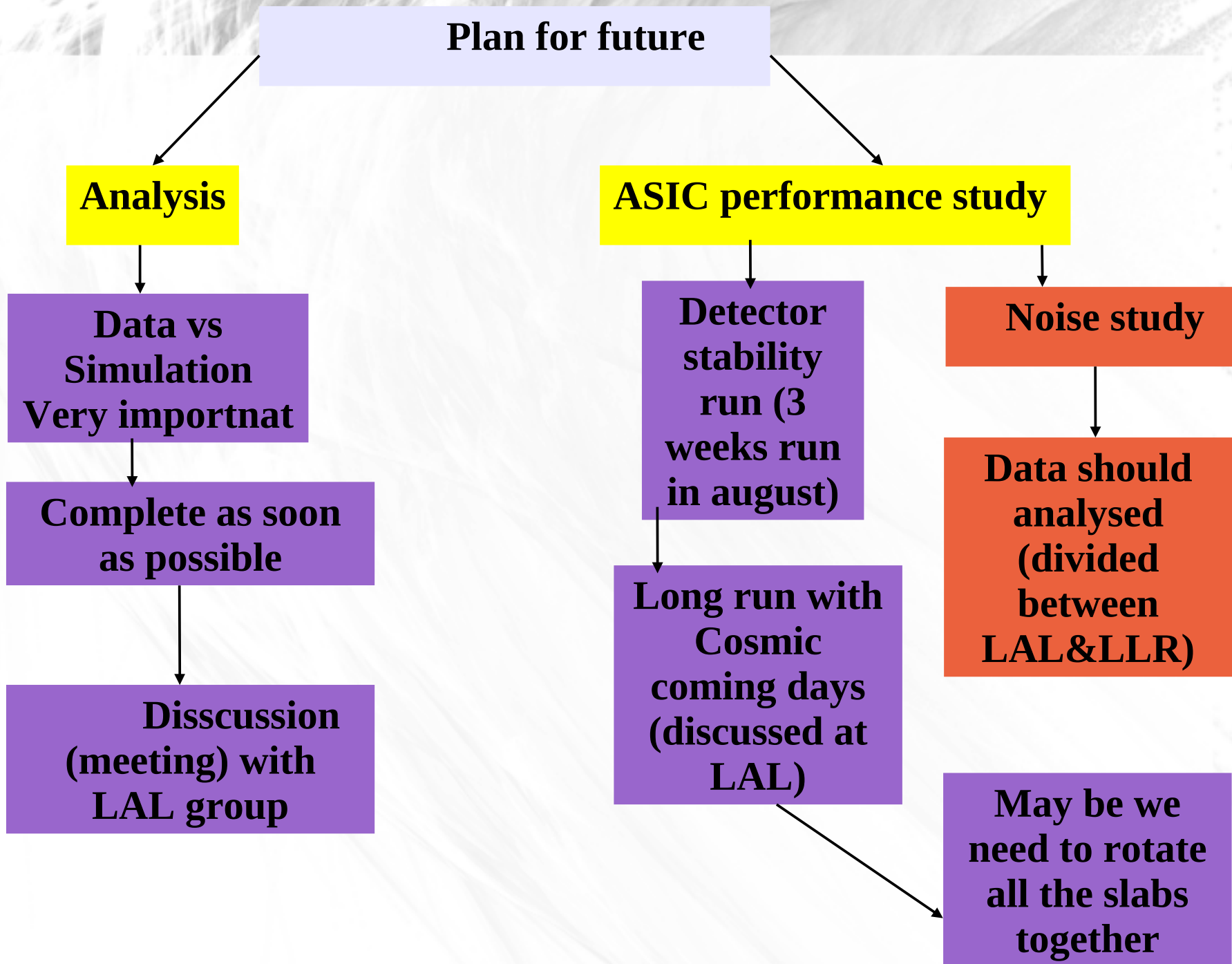
**Detector  
stability  
run (3  
weeks run  
in august)**

**Long run with  
Cosmic  
coming days  
(discussed at  
LAL)**

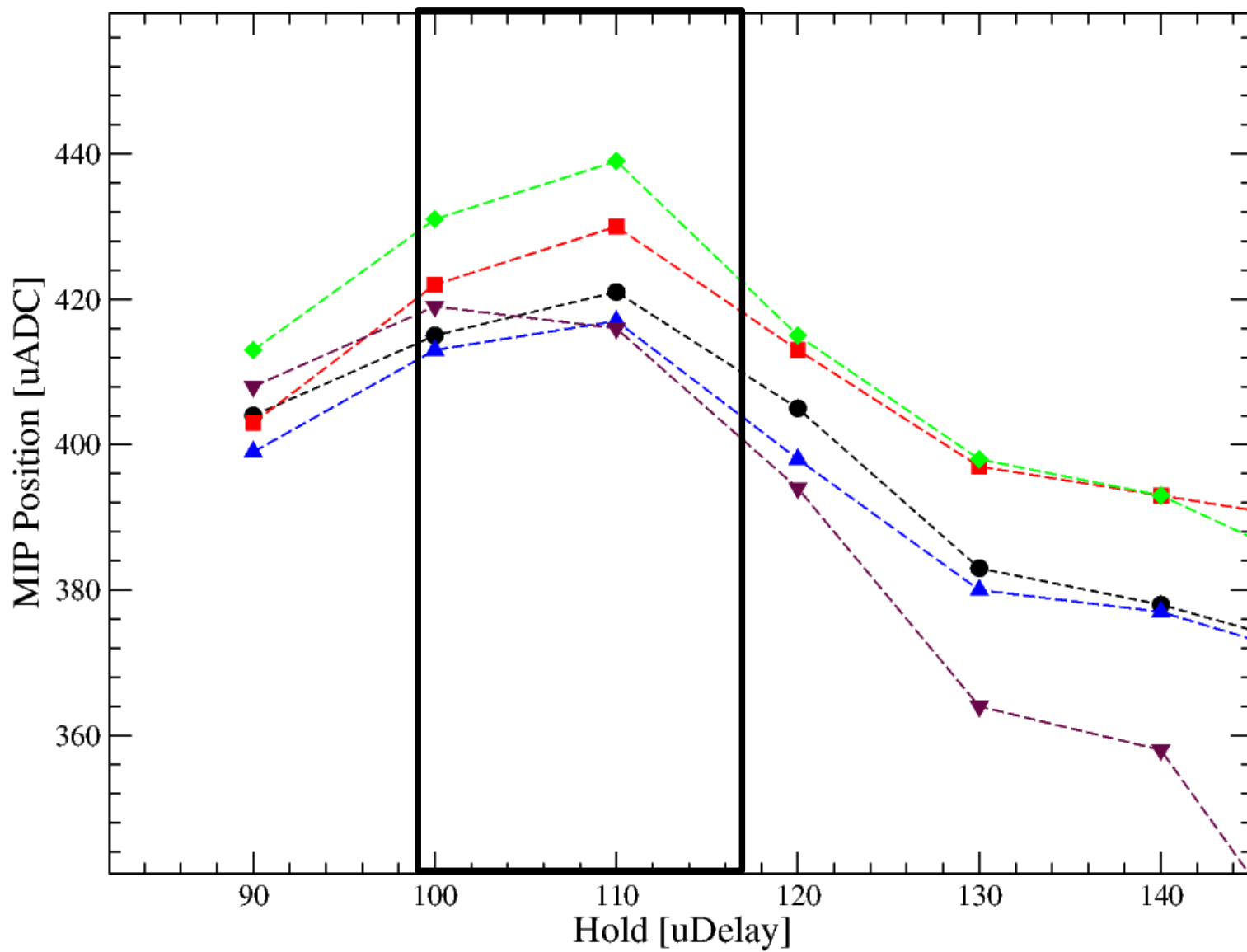
**Noise study**

**Data should  
analysed  
(divided  
between  
LAL&LLR)**

**May be we  
need to rotate  
all the slabs  
together**



## Hold calibration



**Optimized value: 100-110 uDelay**

# Shower study with using 2D fit parameters

