



# *Cosmic Ray Trigger Status*

Rachid Ayad  
University of Tabuk

14<sup>th</sup> January 2016

- 1) basf2 cosmic Rays simulation to set scintillators size
- 2) Mechanical Frame design
- 3) Overall schedule/plan until cosmic tests on Fall 2017
- 4) Bench Cosmic setup at Tabuk
- 5) Conclusion

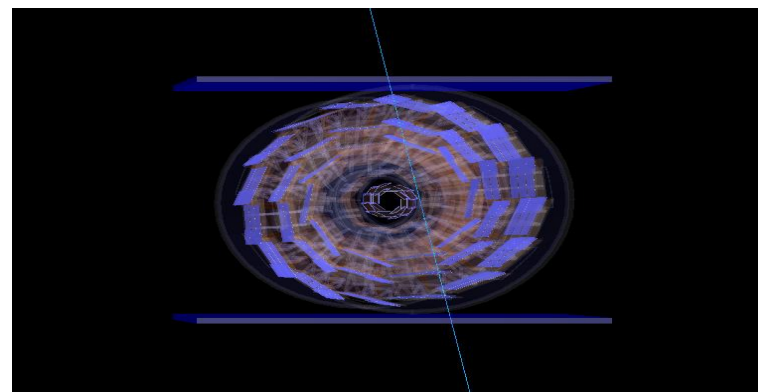
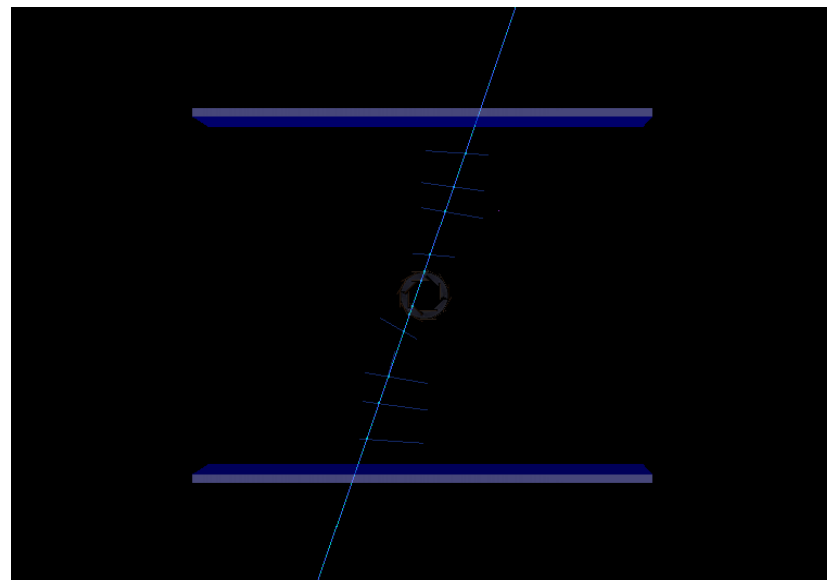
# Setup (simple)

Scintillator 1

VXD

Scintillator 2

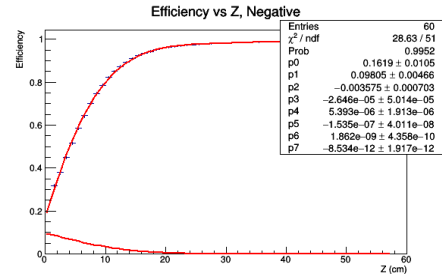
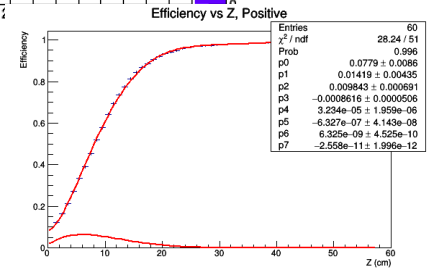
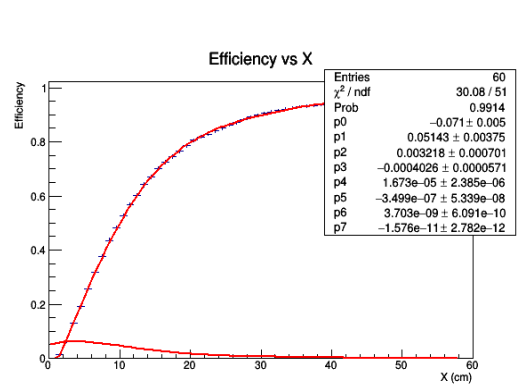
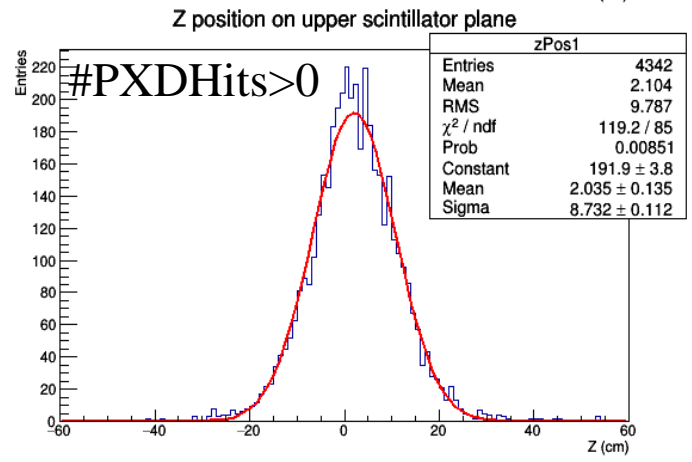
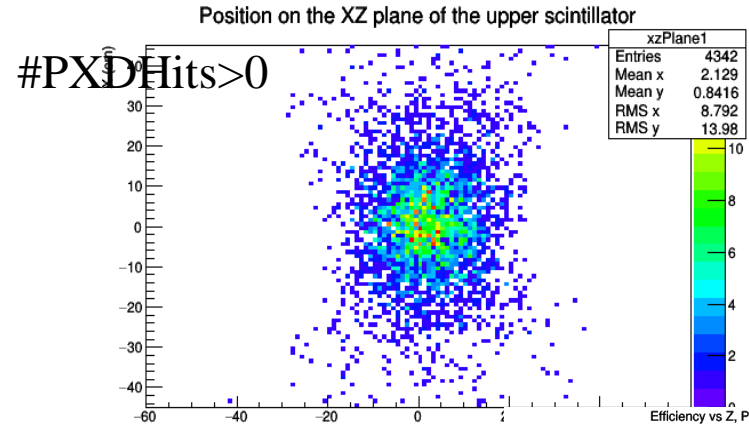
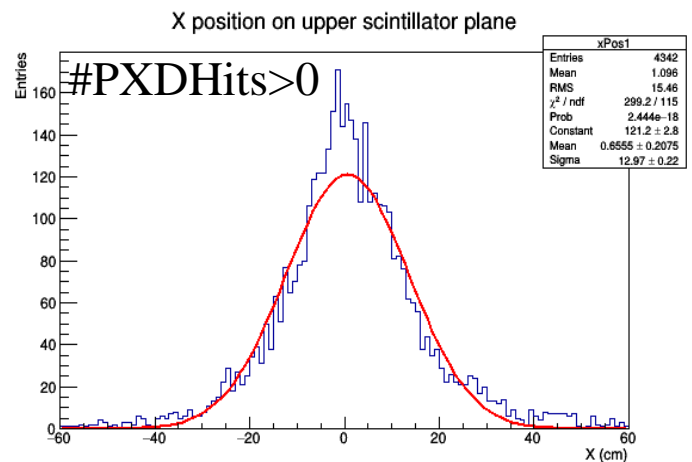
Basf2 simulation with just VXD





# Reminder

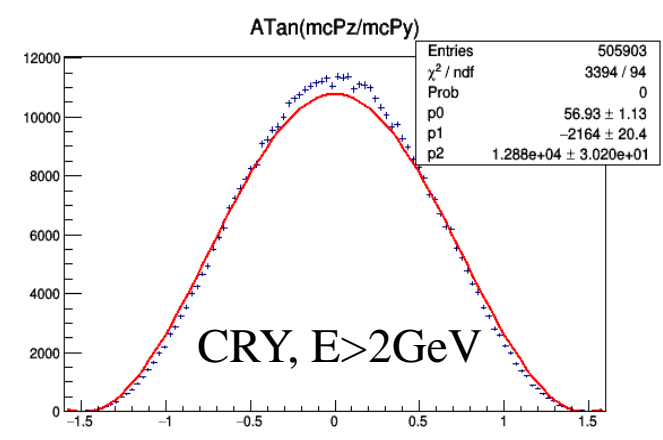
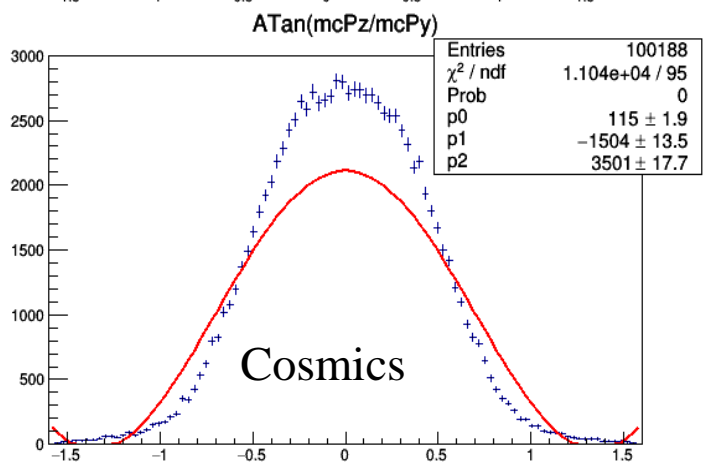
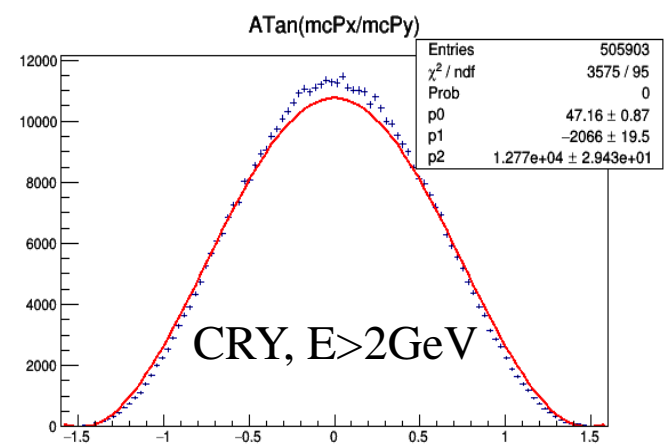
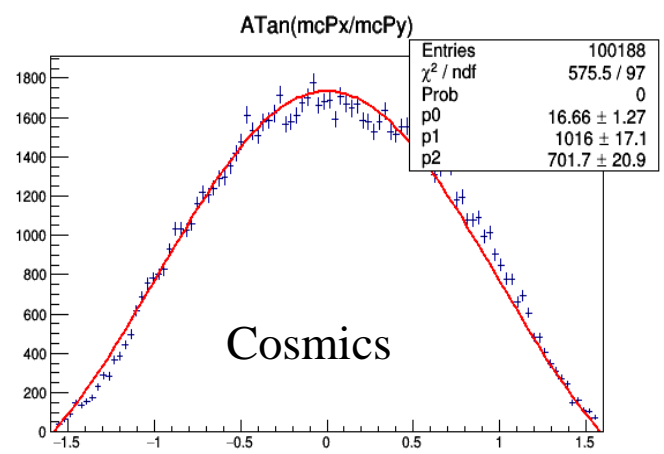
- With *Cosmics* (i.e. Belle default) generator transverse (x) hit distribution on scintillator plane to be much broader w.r.t. longitudinal (z)





# Generator validation

- We switched to CRY generator, recently included in basf2
- After some testing we found reasonable settings
- $\text{Atan}(\text{mcPx}/\text{mcPy})$ ,  $\text{Atan}(\text{mcPz}/\text{mcPy}) \rightarrow$  we fit by  $a+b*\cos(x)+c*\cos^2(x)$



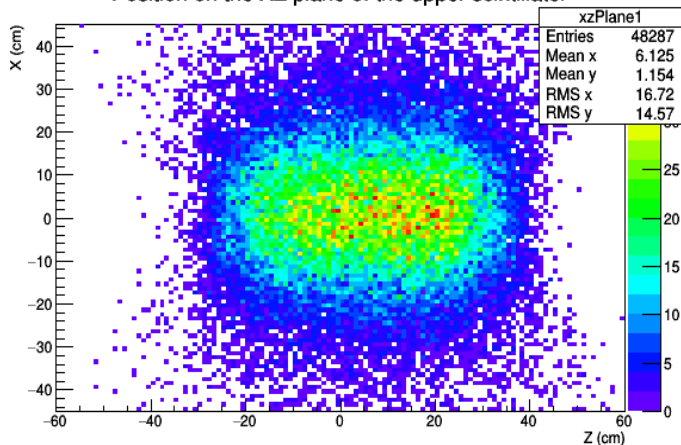


# Generator validation

- Effect of change in generator can clearly be seen on the hit distribution on scintillator plane

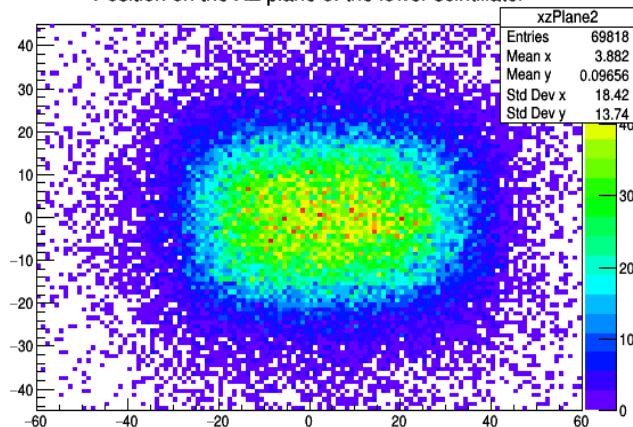
### Cosmics, all tracks

Position on the XZ plane of the upper scintillator



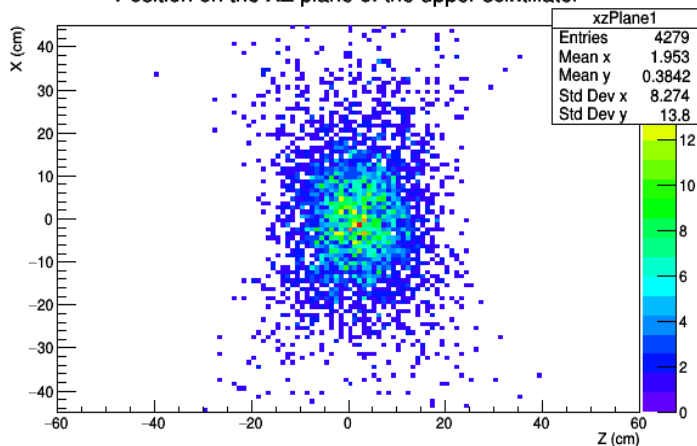
### CRY, E>2GeV, all tracks

Position on the XZ plane of the lower scintillator



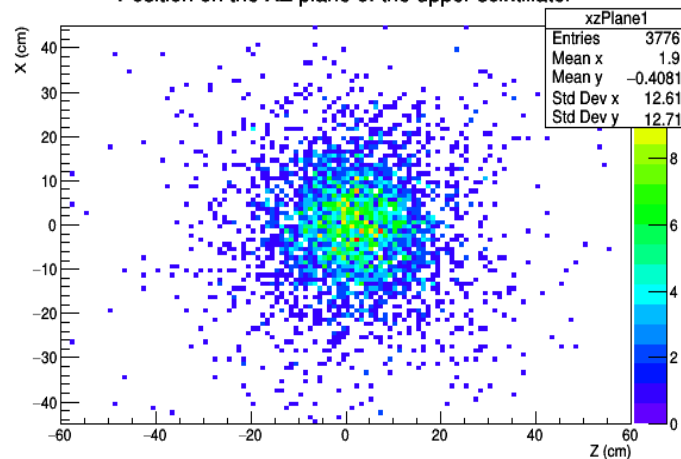
### Cosmics, nPXD\_hits>1

Position on the XZ plane of the upper scintillator



### CRY, E>2GeV, nPXD\_hits>1

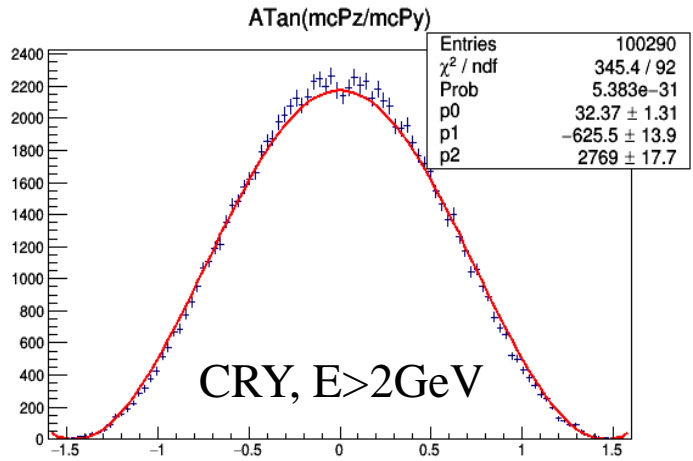
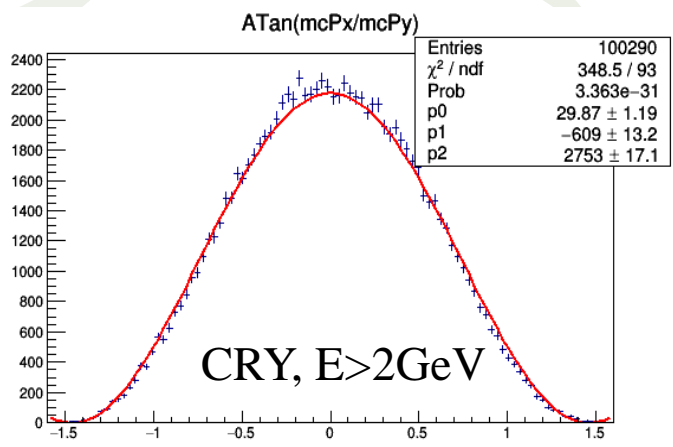
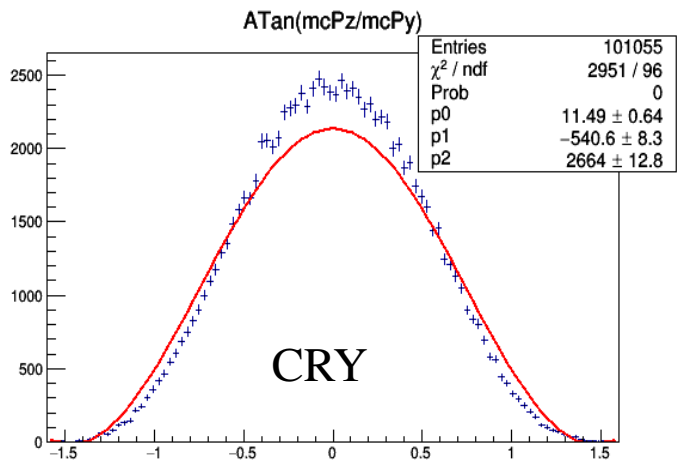
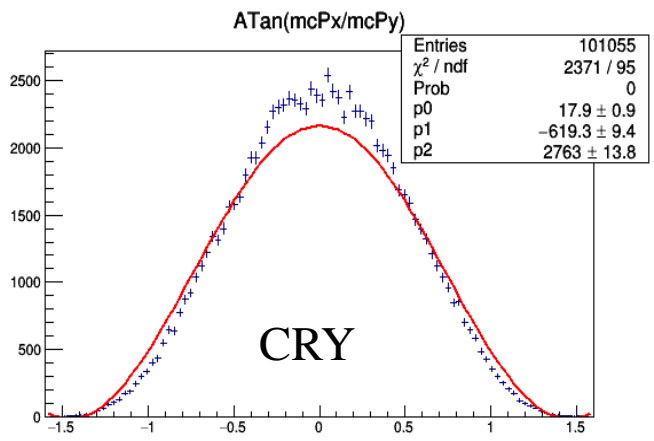
Position on the XZ plane of the upper scintillator





# CRY: the 2 GeV cut-off

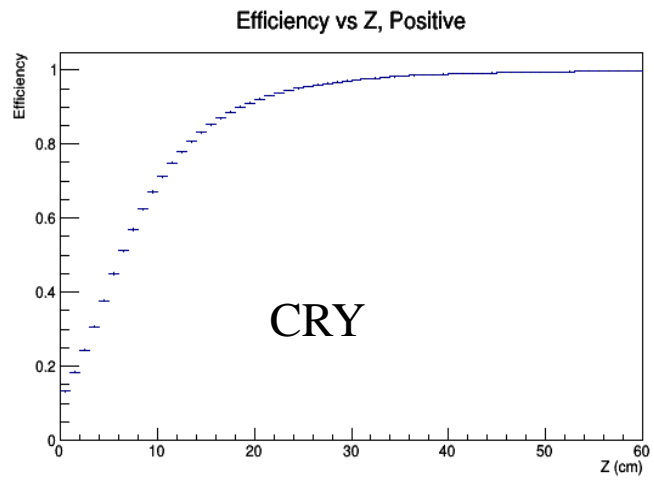
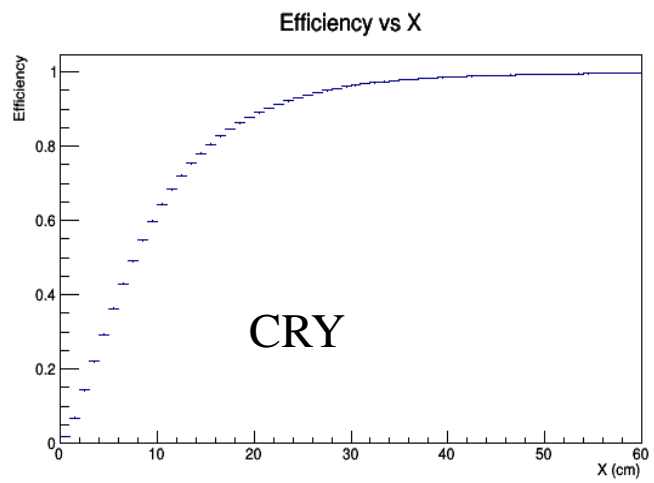
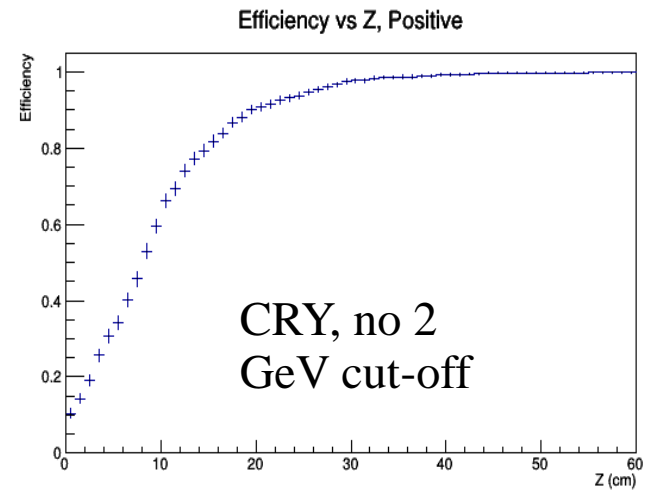
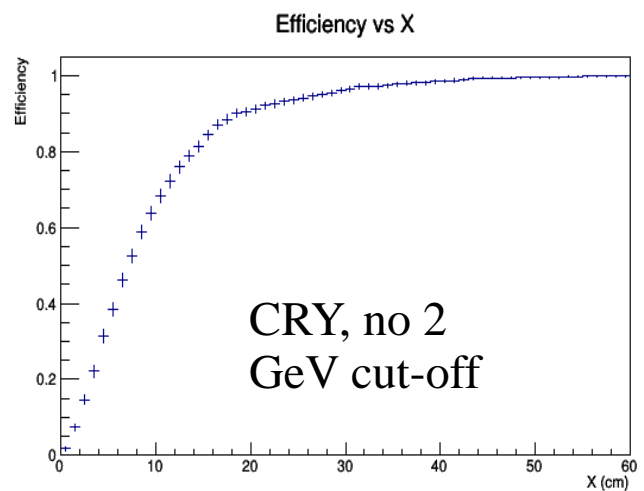
- $E > 2$  GeV cut-off is used to remove “soft” component of cosmic rays which results in steeper distribution
- 2 GeV cut is assumed in the following if not otherwise specified





# Generator comparison

- 2 GeV Cut has no big effect on efficiency

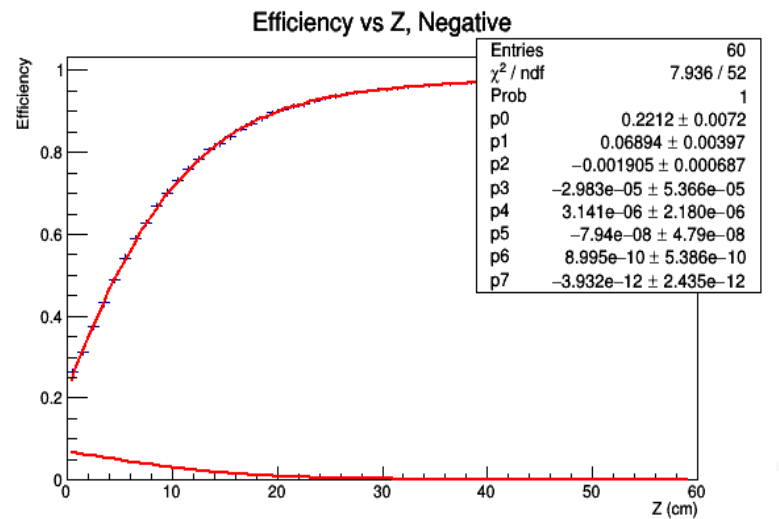
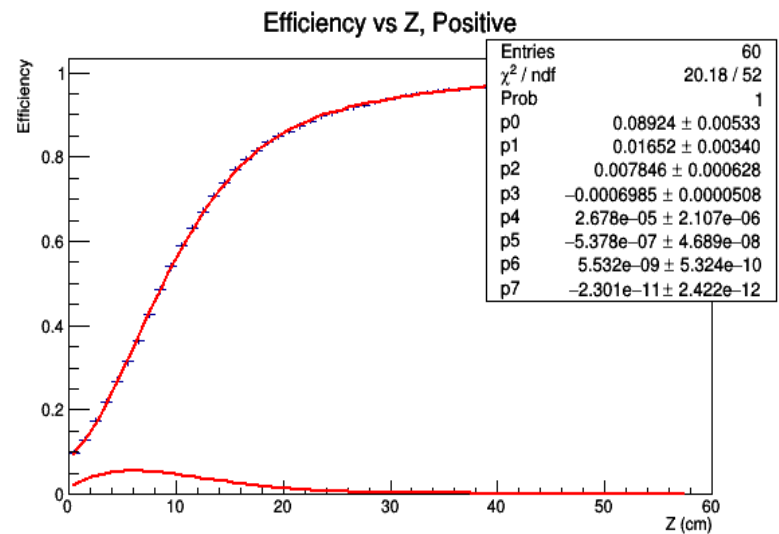
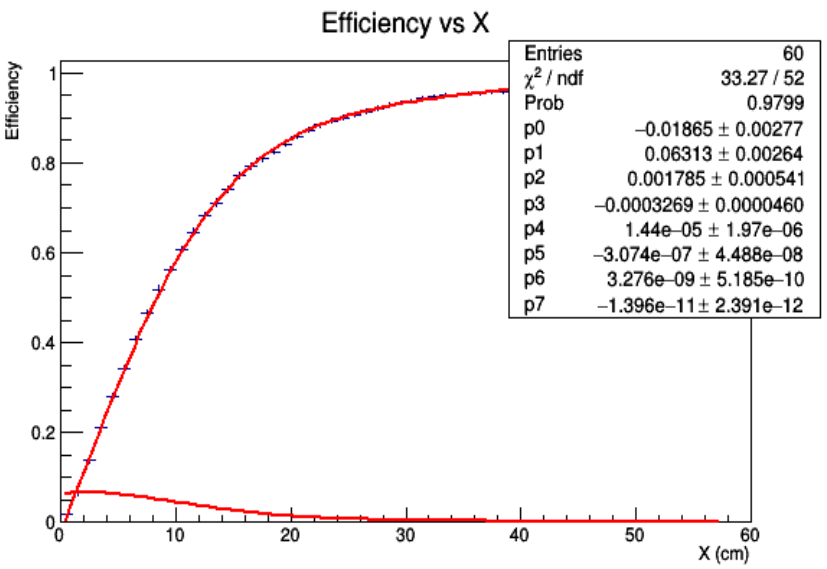






# Fits

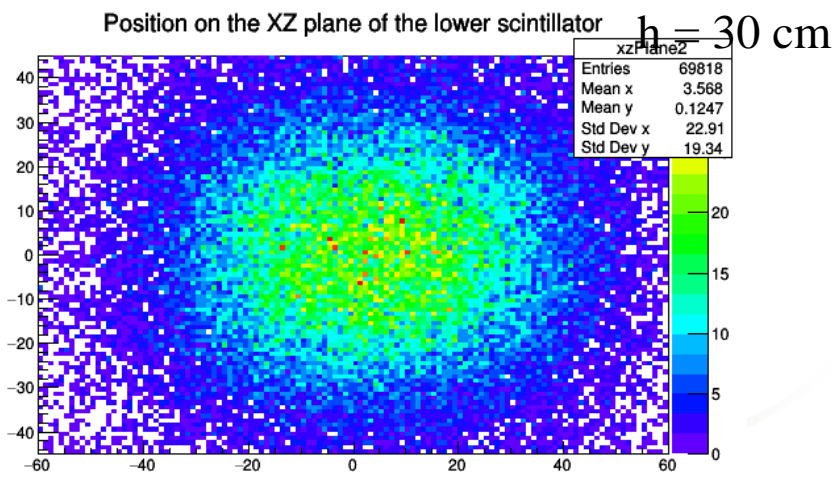
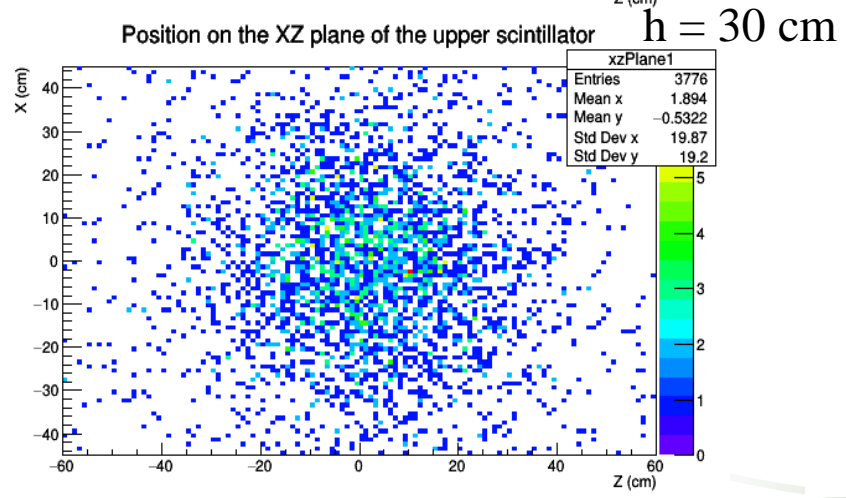
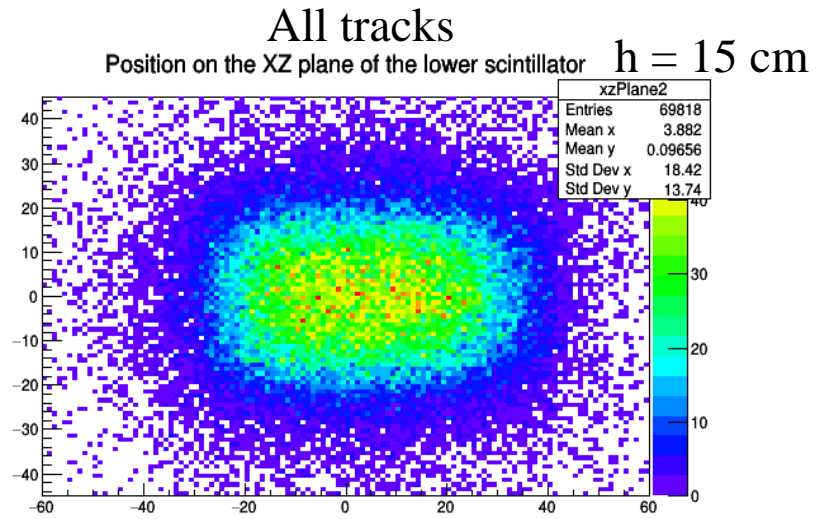
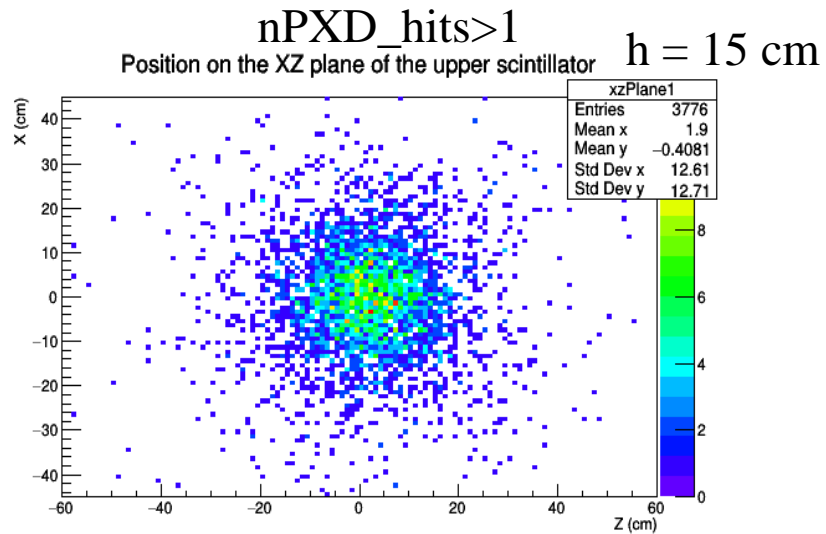
- Fit with 7<sup>th</sup> order poly





# Effect of Installation height

- Until now we have always assumed  $h=15$  cm
- Switching to  $h \rightarrow 30$ cm



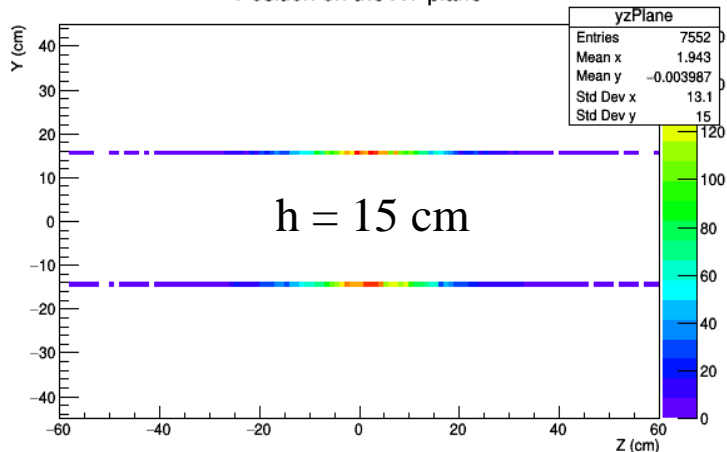


# Installation height

- Distribution on y-z plane

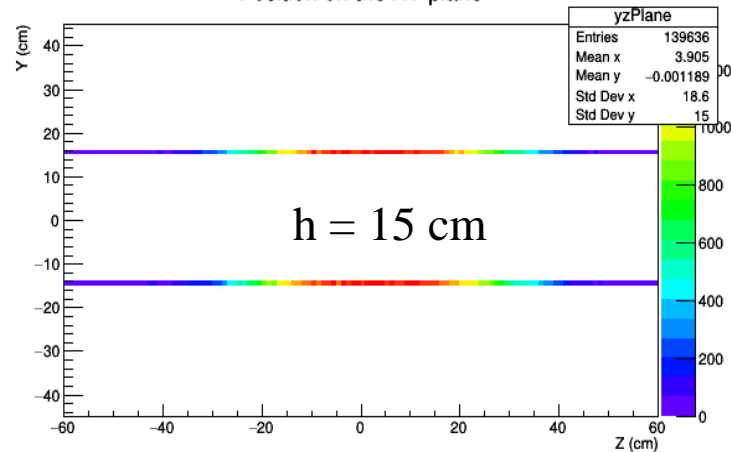
nPXD\_hits>1

Position on the XY plane

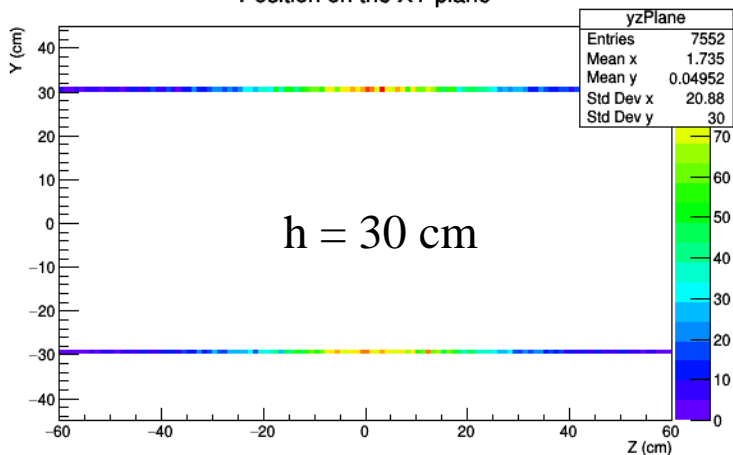


All tracks

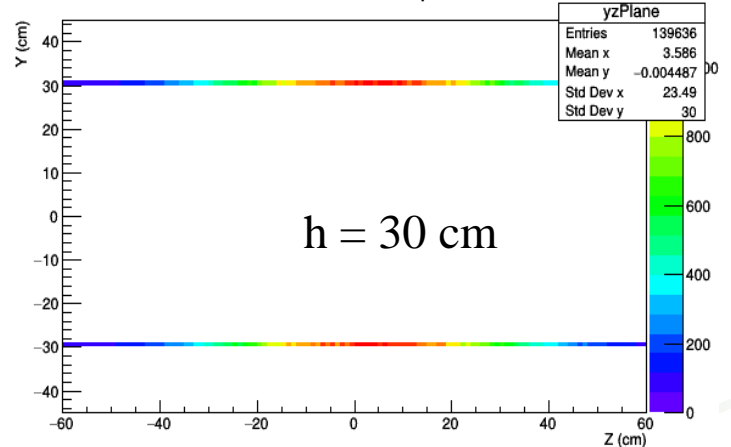
Position on the XY plane



Position on the XY plane



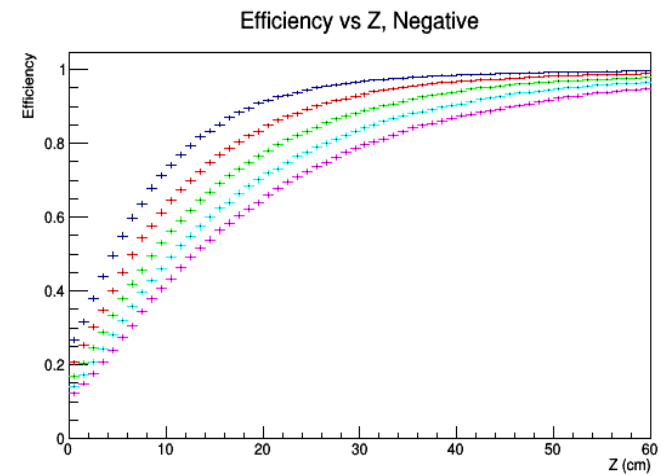
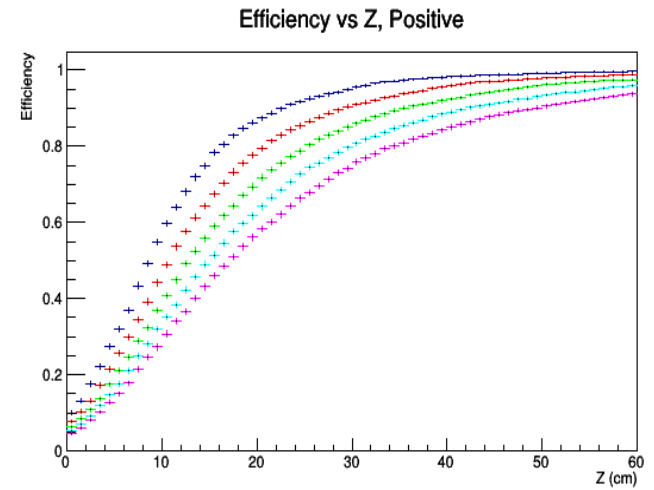
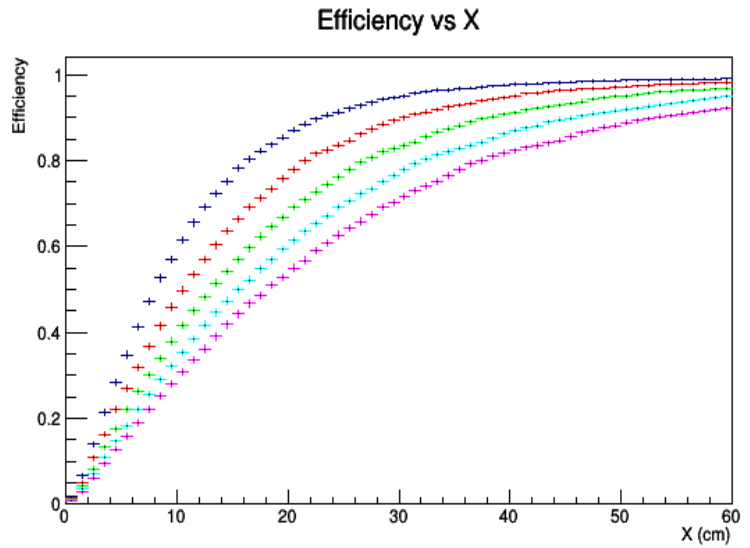
Position on the XY plane





# Installation height

- $h = 15, 20, 25, 30, 35$
- $n\text{PXDHits} > 1$

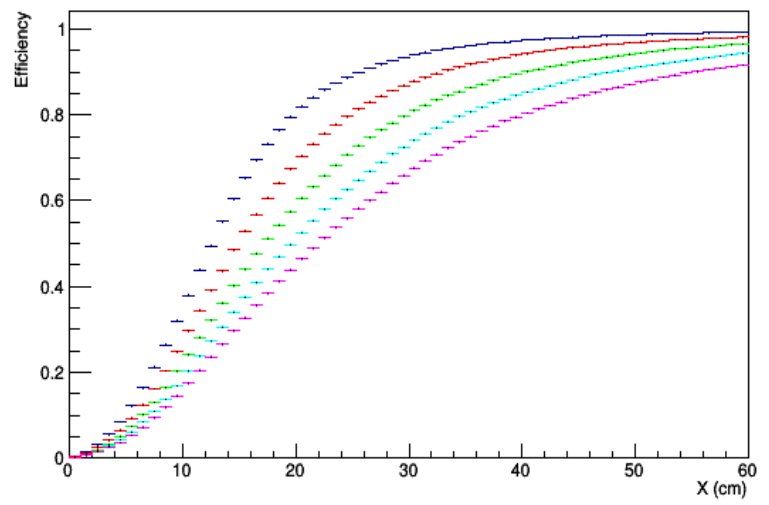




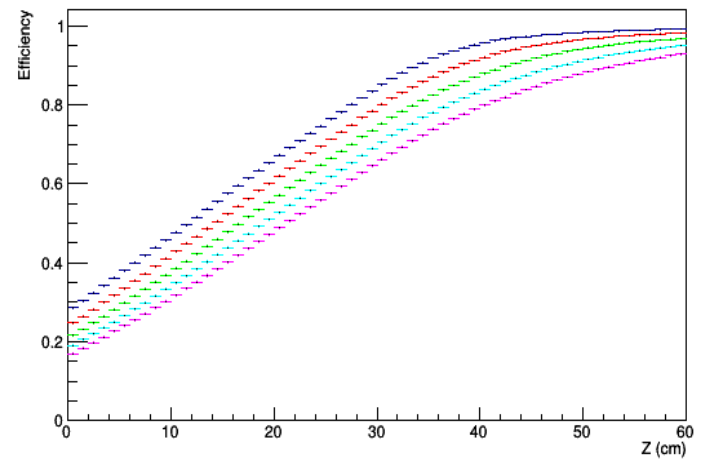
# VXD

- Similar to what we have done for PXD we can optimize for SVD
- $h = 15, 20, 25, 30, 35$

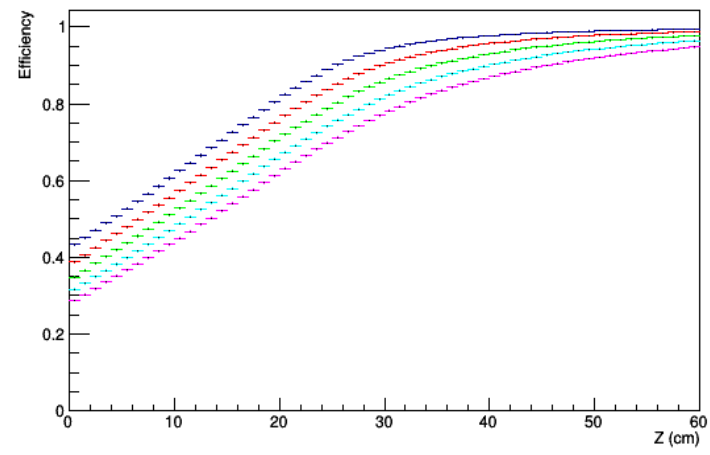
Efficiency vs X



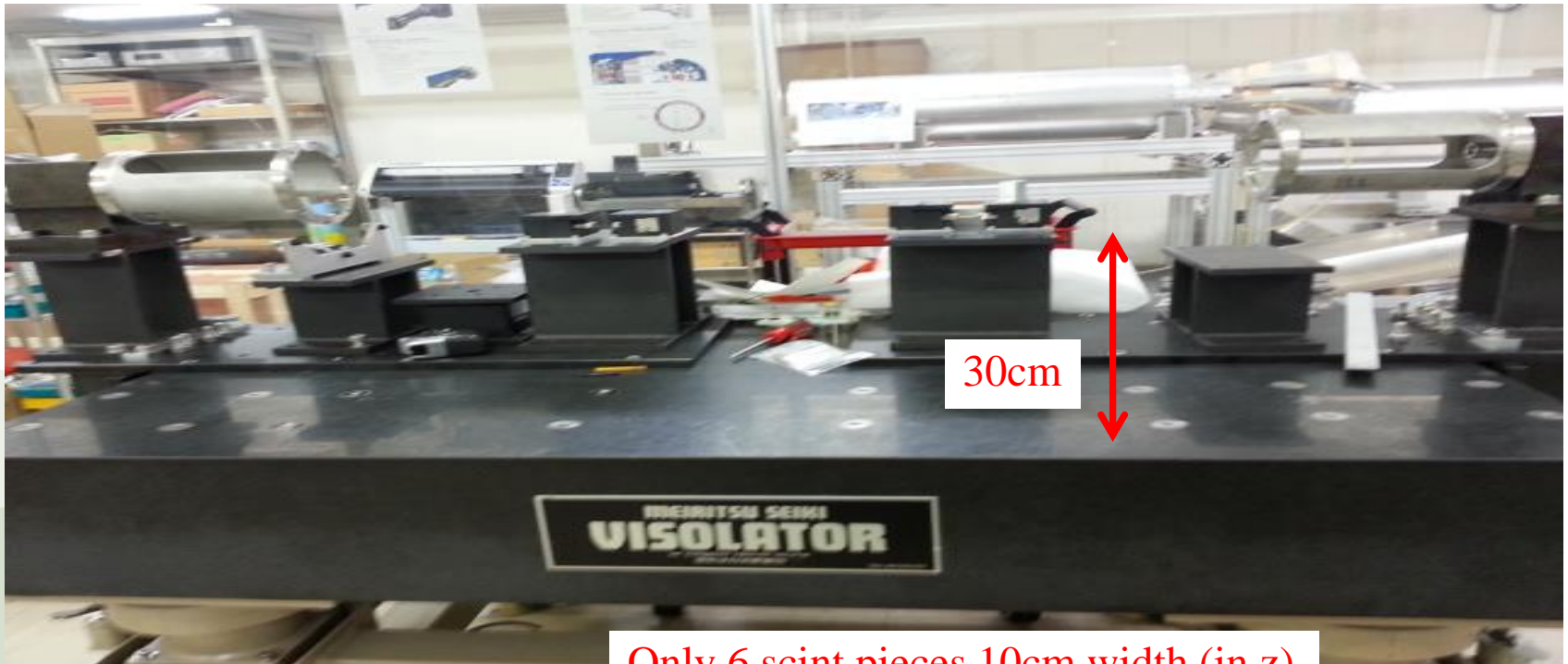
Efficiency vs Z, Positive



Efficiency vs Z, Negative

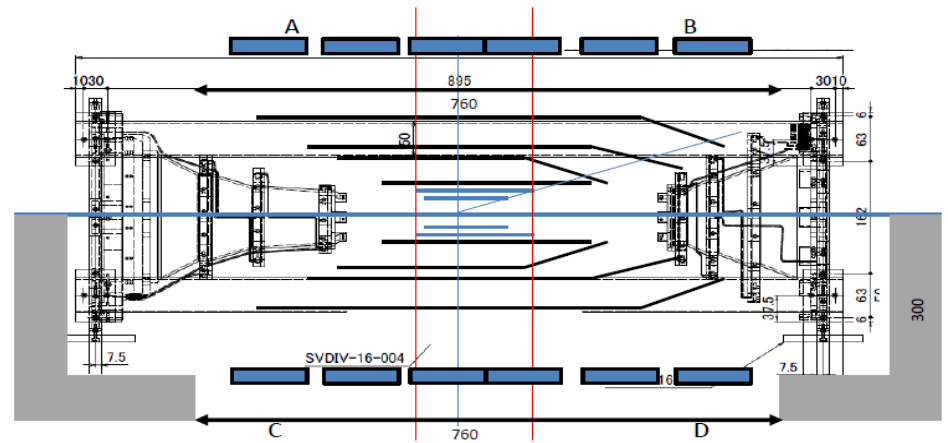
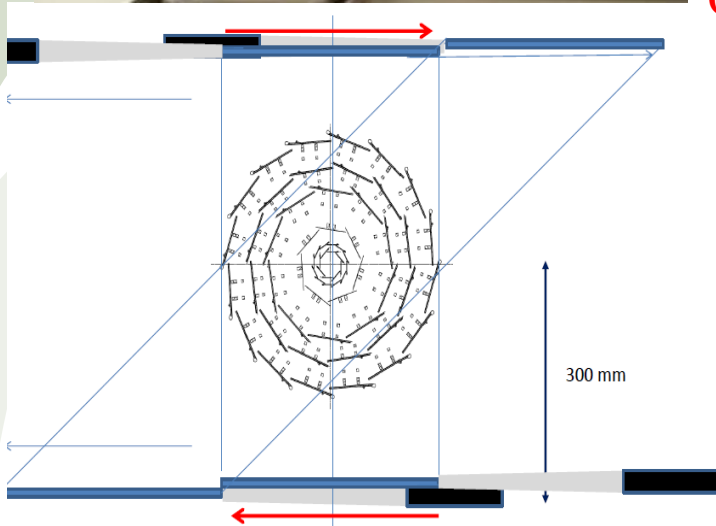


# Frame Design(for B1 room)



30cm

Only 6 scint pieces 10cm width (in z)

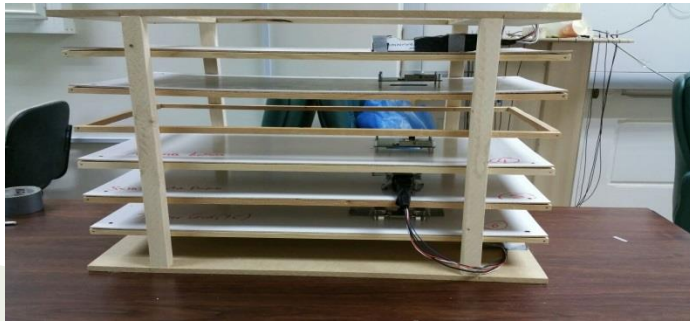


# Overall Plan

Task	2016												2017												2018					
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
Simulation	█	█	█																											
Design				█	█	█	█																							
Mechanics								█	█	█	█	█																		
PMs	█	█	█																											
Scintillators											█	█	█	█																
Electronics	█	█	█	█	█	█	█	█	█	█	█	█	█	█																
Assembly Tabuk																	█													
Tests Tabuk																	█	█												
Shipped to KEK																			█	█										
Tests at KEK																					█	█	█	█	█					
Analysis Code	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█										
Data Analysis																					█	█	█	█	█	█	█	█	█	█
Publish	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█



# Cosmic Setup at Tabuk (Final Setup)



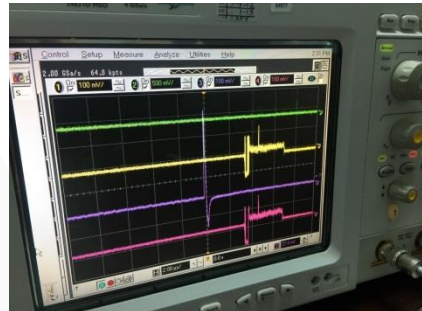
- Shelf to mount Scintillator 1
- Shelf to mount Alibava Tracker Plane 1
- Shelf to mount the PXD module
- Shelf to mount Alibava Tracker Plane 2
- Shelf to mount Scintillator 2
- Shelf to mount Alibava Trigger Card (TC)

A more developed frame with Micro-step moving table will be built by ALIBAVA

A shelf with Alibava Plane detector installed



Coincidence on two Alibava Planes with Beta source

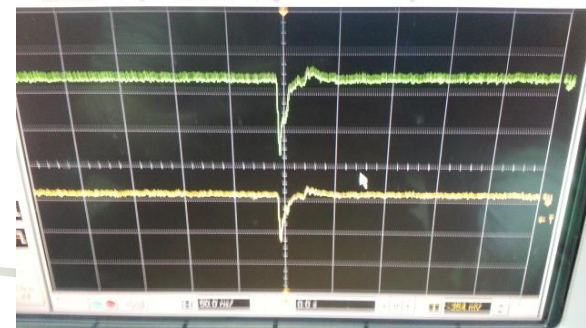


## Trigger: Two scintillators

A 10cmx1cmx0.5cm scintillator two crossed scints so a 1x1cm<sup>2</sup> cross section to match the Alibava Tracker sensible area



## Scintillators coincidence: Muon





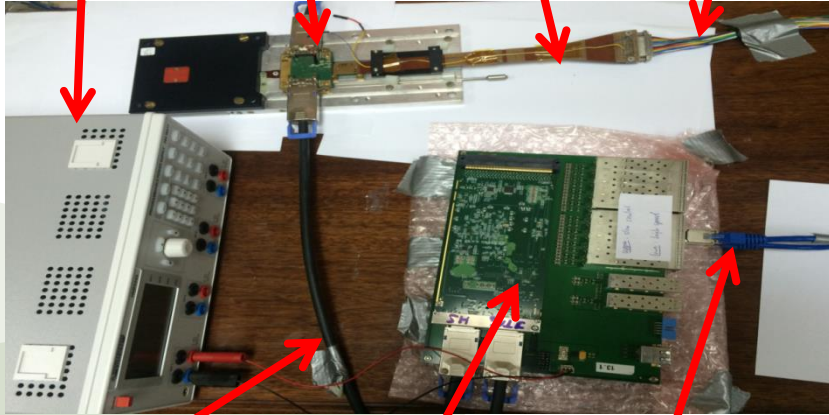
# PXD setup and Software

Power Cable from Breakout Board

Patch Panel Cable

PS to power DHH

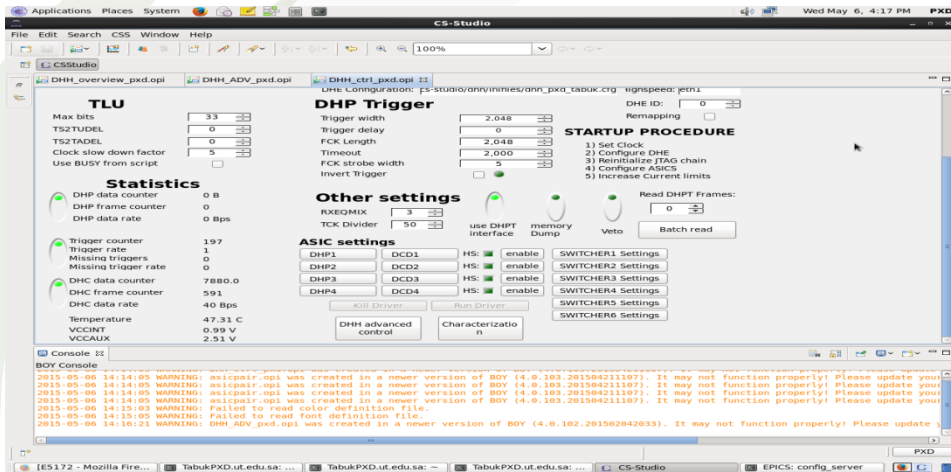
EMCM piece



Infiniband cable

DHH and it carrier board

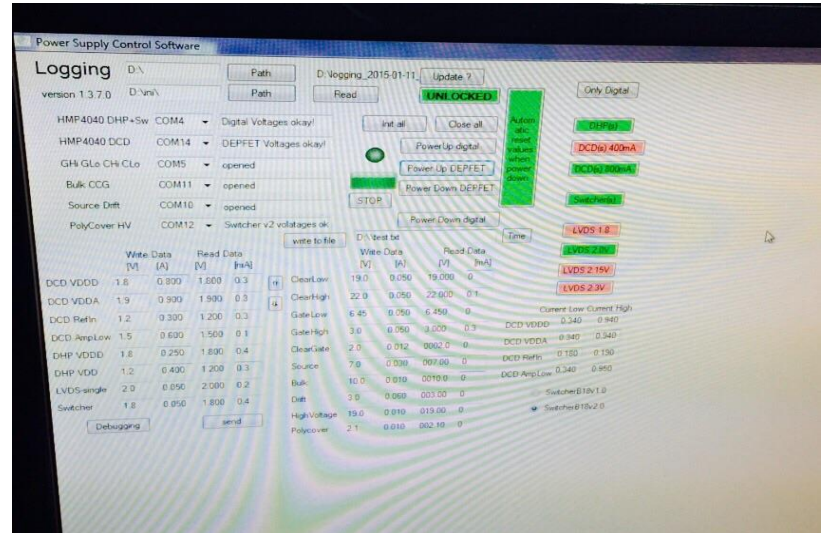
SC and HS Ethernet Cables to computer



**PXD testing setup available at Tabuk (PXD module cured at MPI from cooling leak)**

**Slow Control powering ASICs and DEPFET**

**SC (PSs) program works fine and stable**



**All items in the Rack including the PC**





# Outlook

- New generator shows good performance, strange x-z asymmetry has disappeared.
- Huge effect from installation height → nearing scintillator planes, even few cm, would significantly increase efficiency
- Segmenting scintillators? As we need them collected at the central the central region ...
- We are now at work to implement the segmented geometry → it is important to agree about installation height to test the effect of spacing. This will be showed in next B2GM to close this issue and design the frame at MPP.

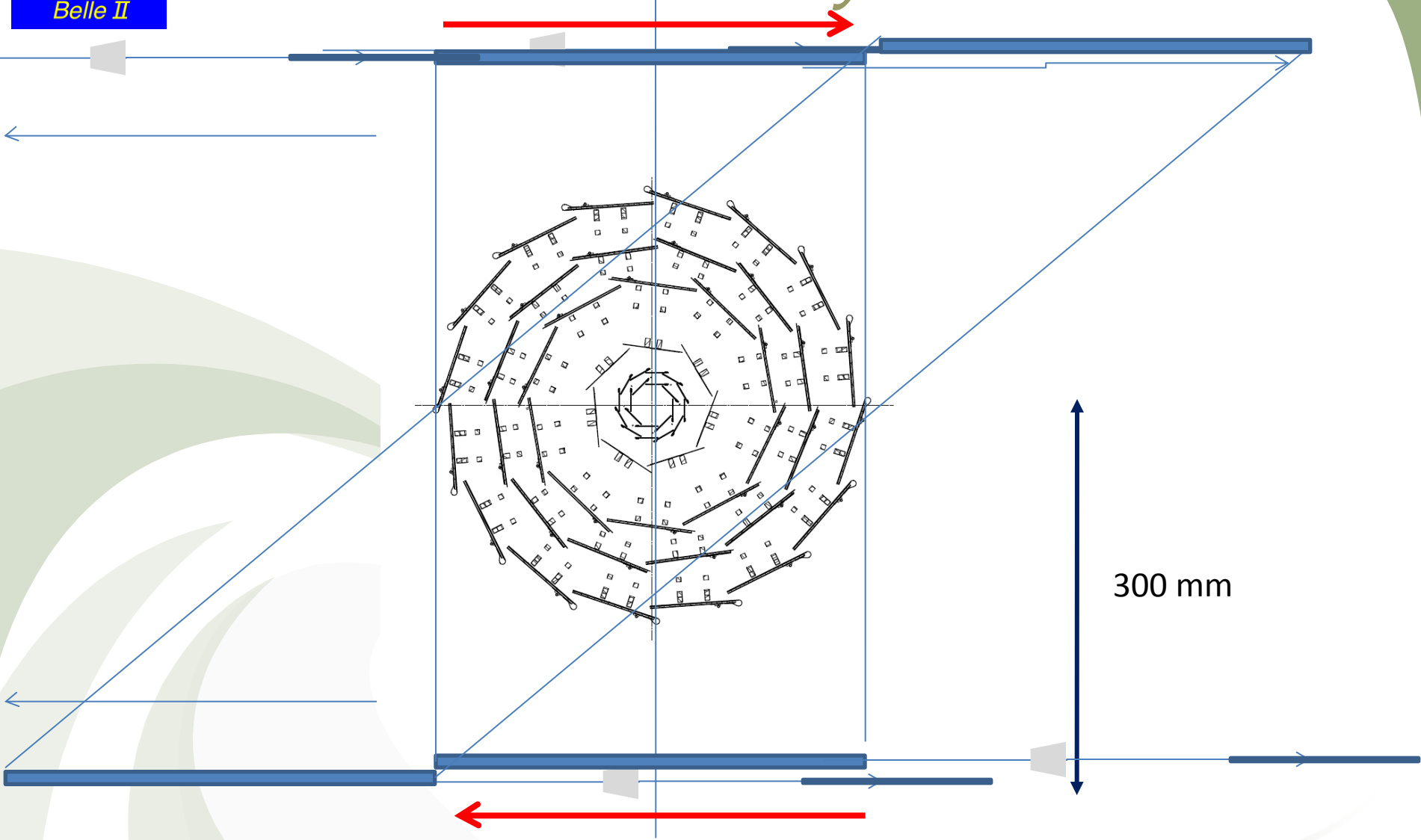


# *Backups*





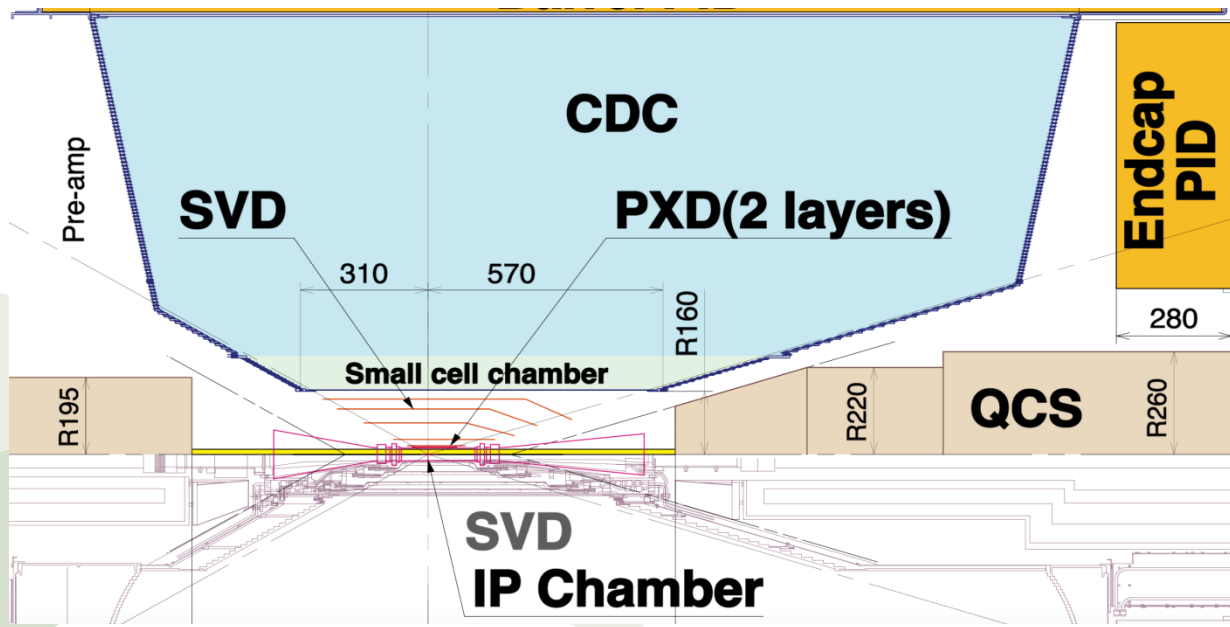
# Geometry



300 mm



# Geometry





# Generator comparison

- Generator change has no big effect on efficiency as  $f(x)$
- Slower rise on z

