

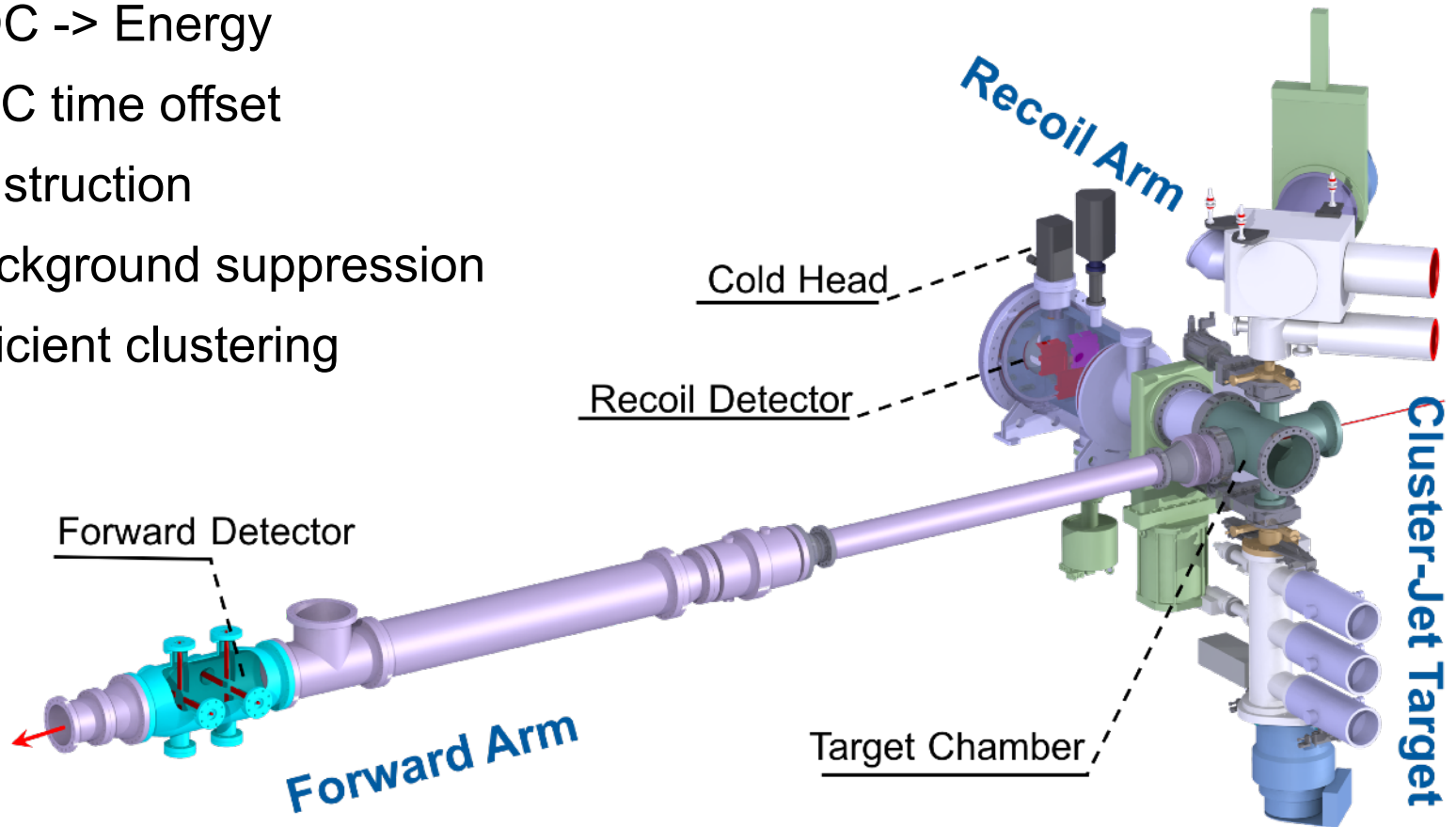


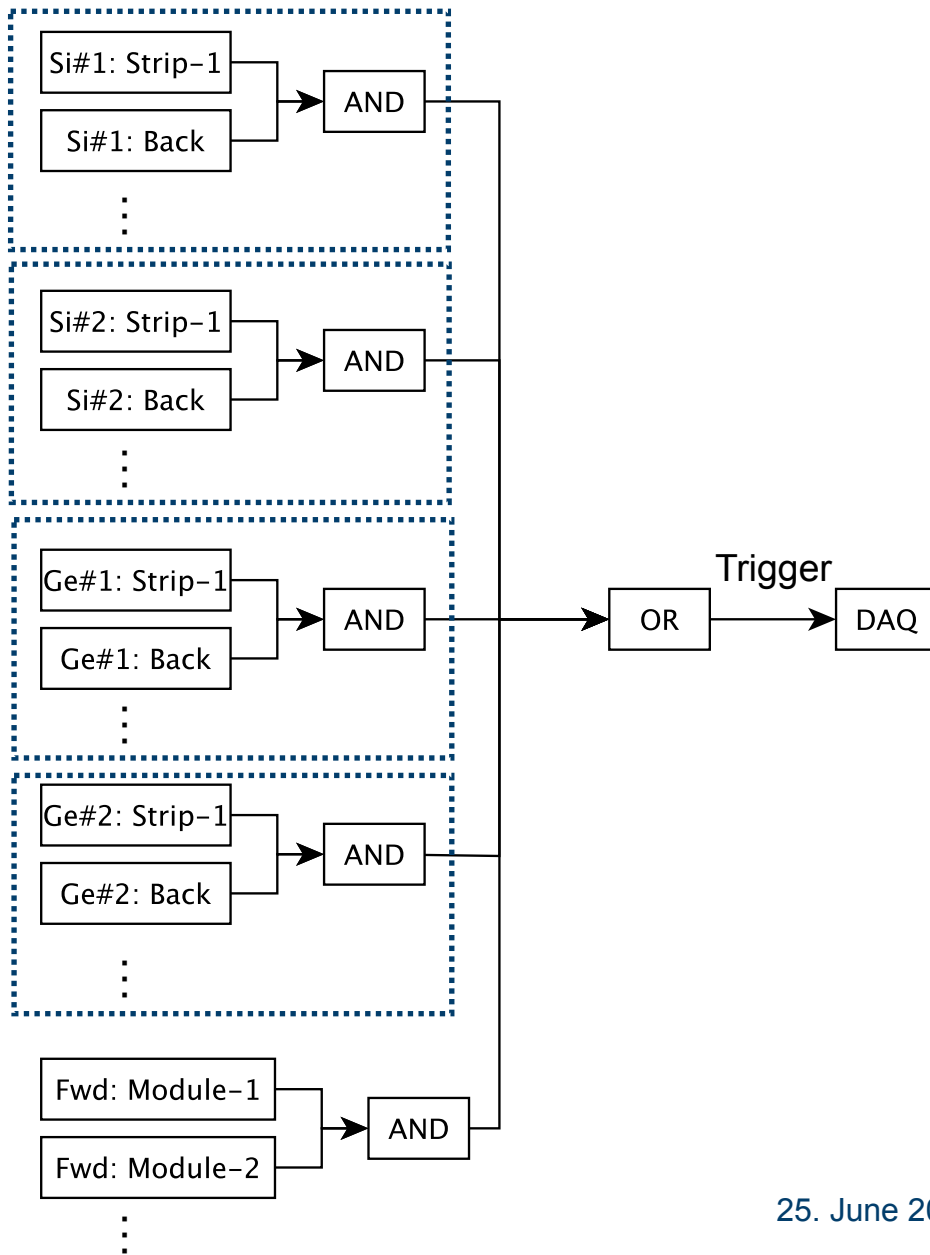
# Calibration in KOALA

05.11.2019 | YONG ZHOU | IKP-FZJ

## Elastic scattering event selection based on recoil energy and position

- Calibration
  - ADC -> Energy
  - TDC time offset
- Reconstruction
  - Background suppression
  - Efficient clustering





## VME based DAQ

- ADC : recoil energy
- QDC : fwd energy
- TDC : recoil and forward time
- Synchronization clock:  
*VME internal clock (16 MHz)*

## Self-Triggering

- Each strip on recoil detector
- Each side on fwd detector

## Trigger Logic

- Common OR of all channels

# Calibration : ADC to Energy

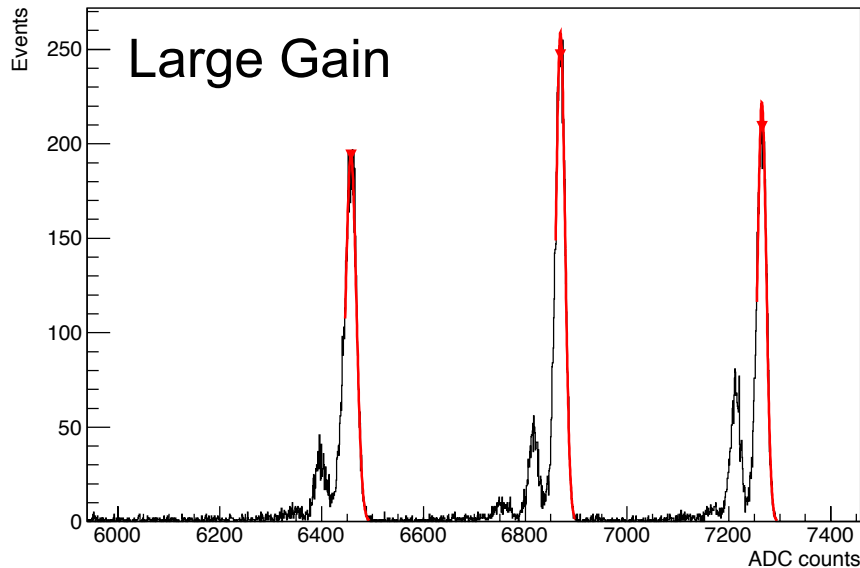
## Challenge:

- Large dynamic range
  - Min : ~100 keV
  - Max: ~60 MeV
- Different gain settings

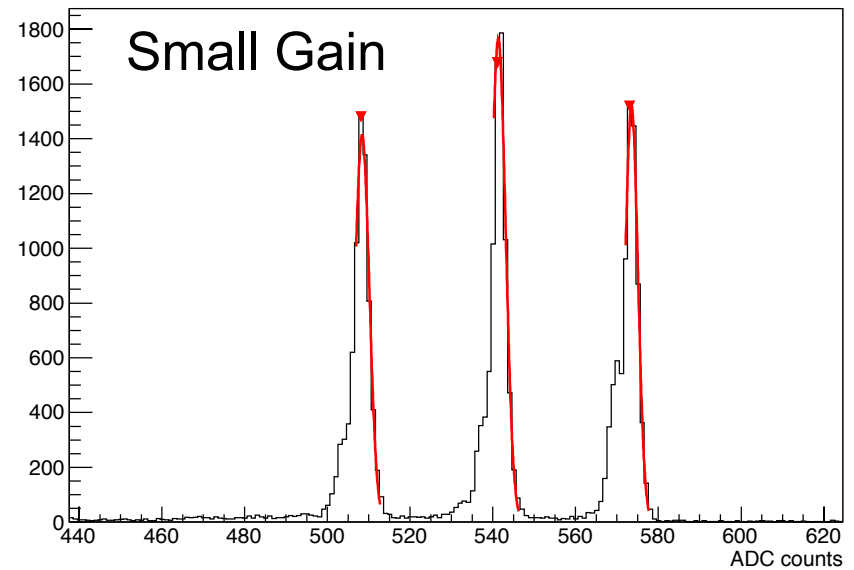
## $\alpha$ -source ( keV)

Pu-239	5156.59	5144.38
Cm-244	5804.83	5762.70
Am-241	5485.56	5442.80

ADC : Si#1/strip#11



ADC : Ge#2/strip#28

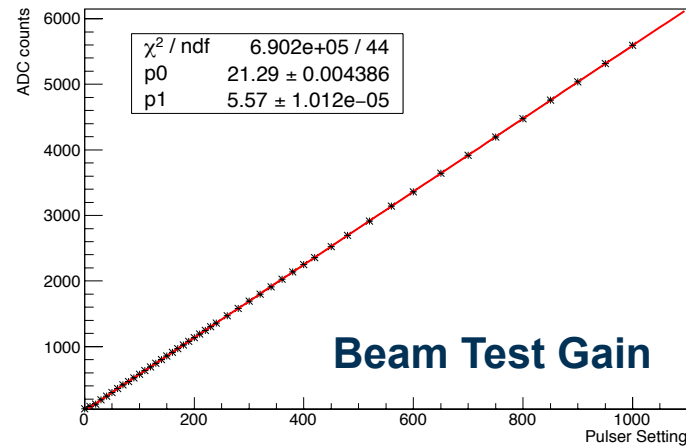
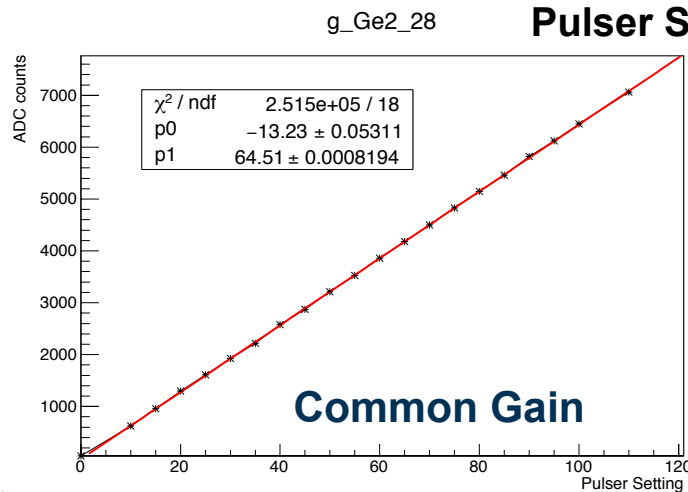
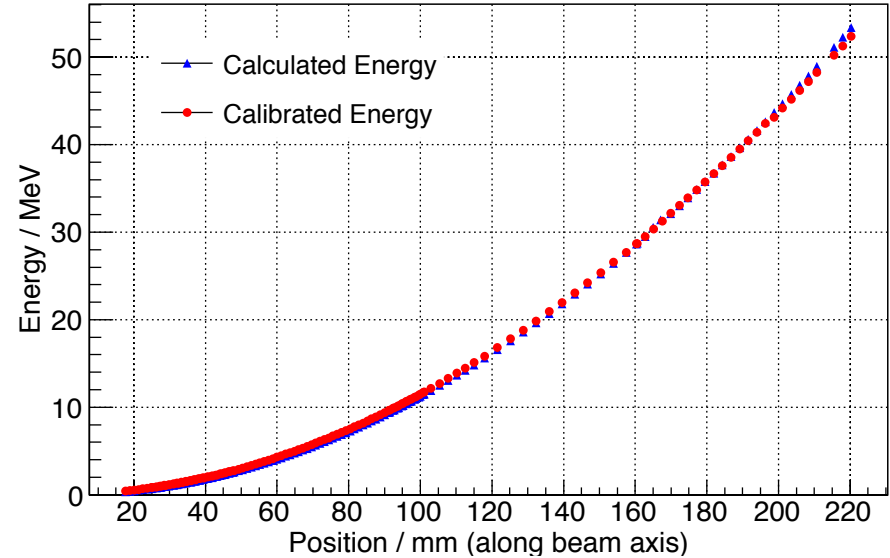


# Calibration : ADC To Energy

## Solution:

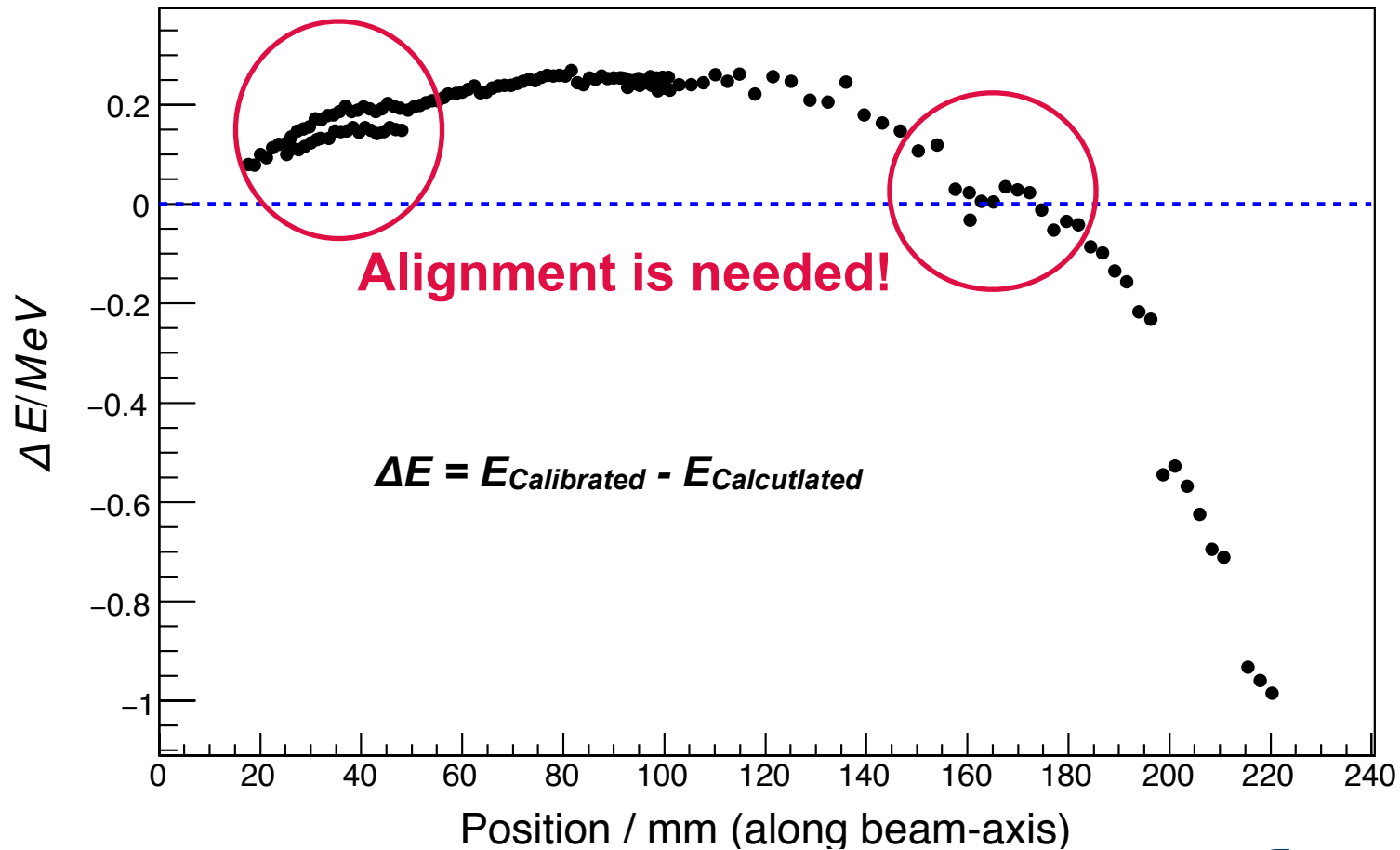
- Two gain configurations:
  - Beam test (small)
  - Common (large)
- $\alpha$  source response at common setting
- Pulser to calibrate the gain difference between the two setting
- Deduce parameters for beam test gain setting

## Energy vs Position



# Calibration: ADC to Energy

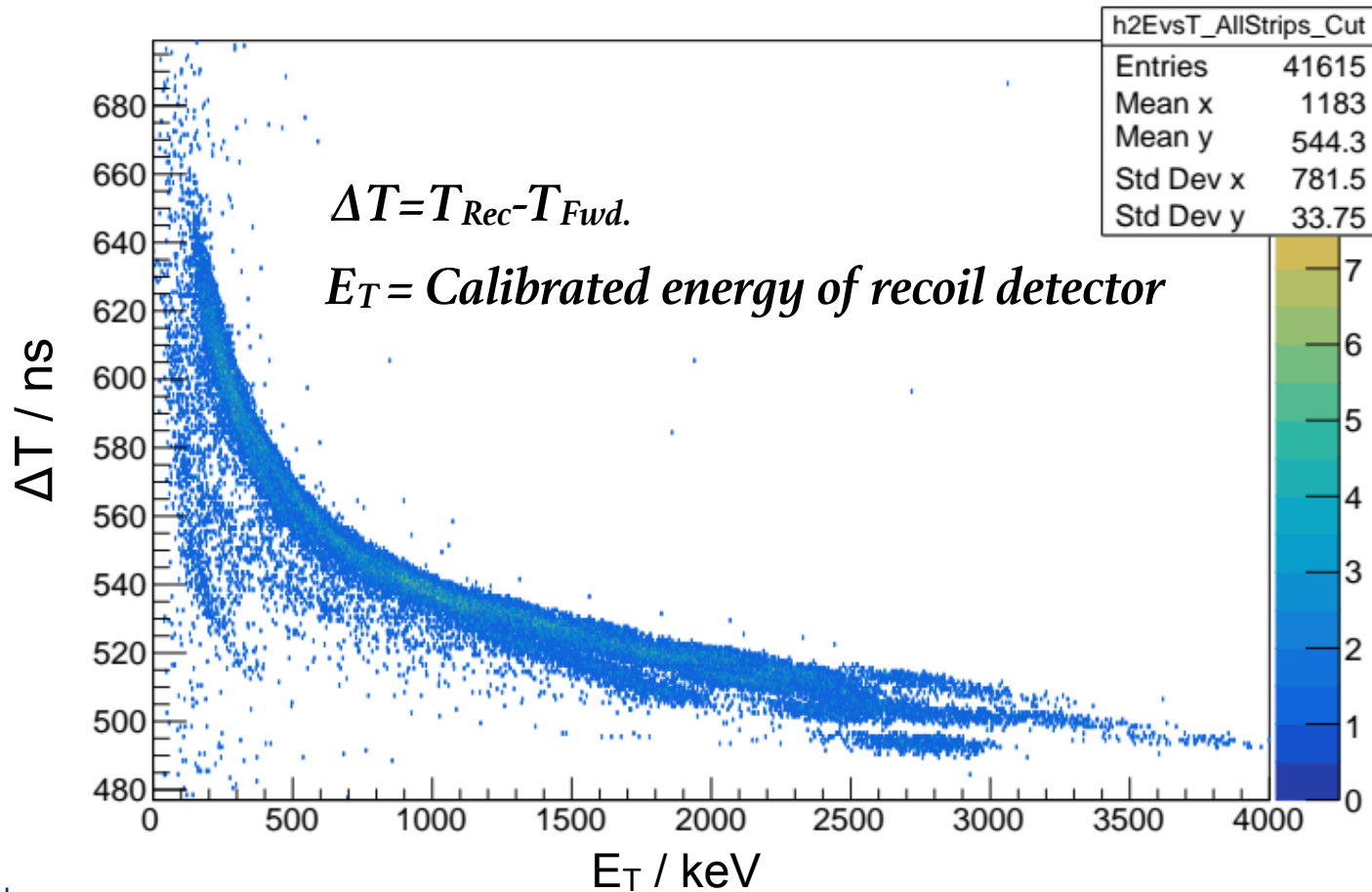
Difference between calibrated energy and calculated energy



# Calibration : TDC Time Difference

## Challenge:

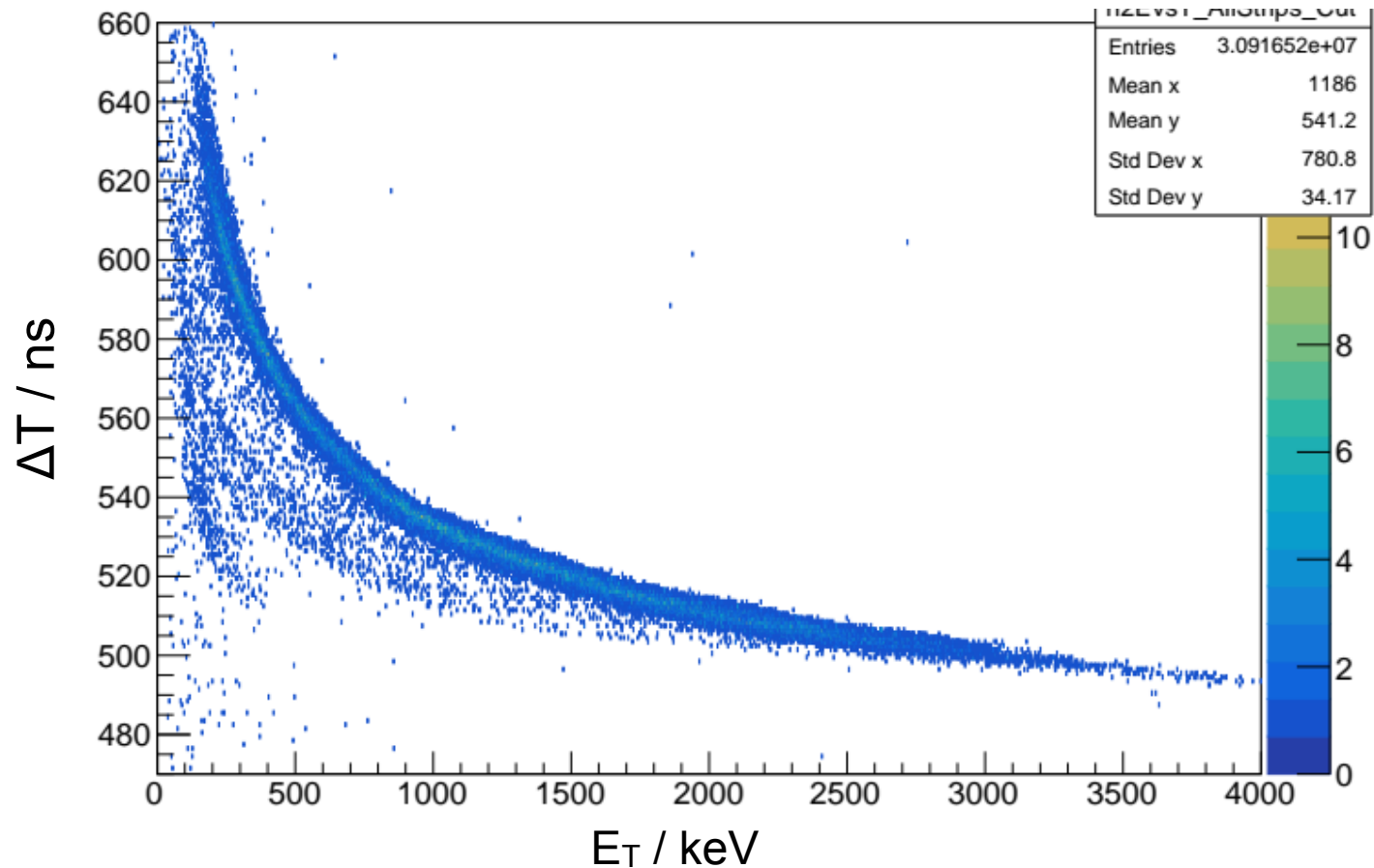
- Time difference exists between channels (cable delay ...)
- Smearing the TOF-E spectrum



# Time Difference With Correction

## Solution:

- Get the time difference using pulser signal
- Normalize to one specific channel (e.g. Si1#1)





# Summary & Outlook

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## Summary:

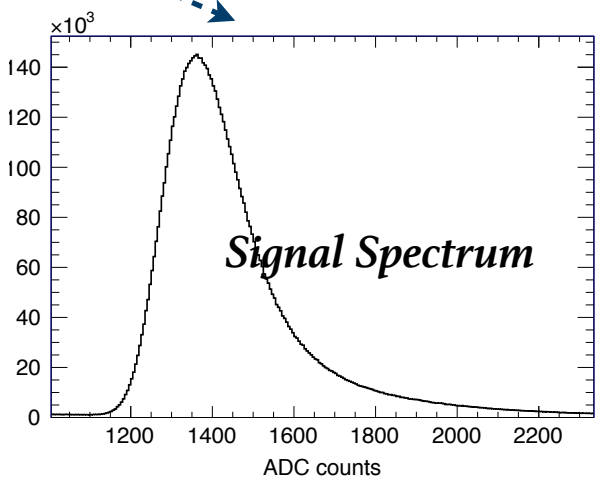
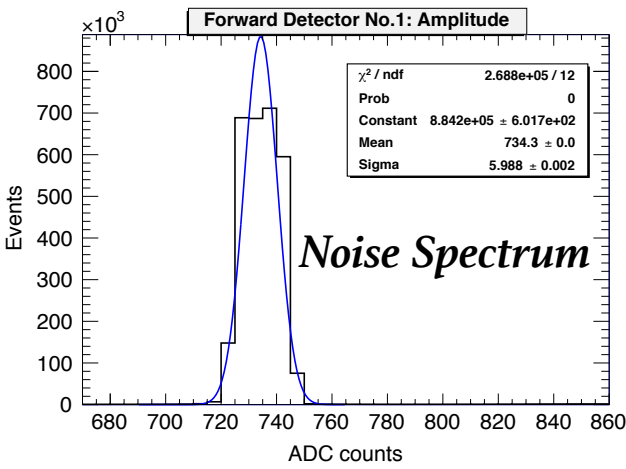
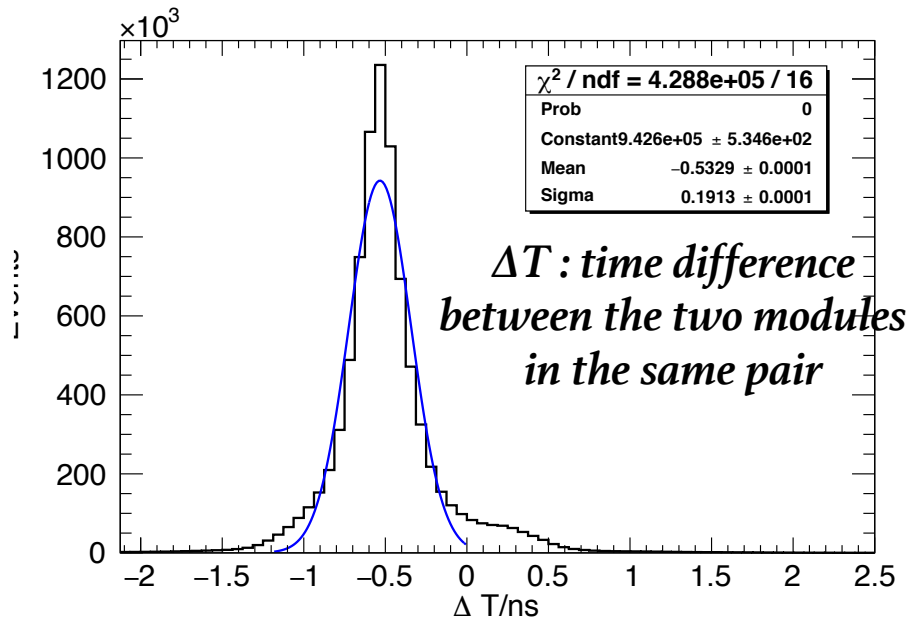
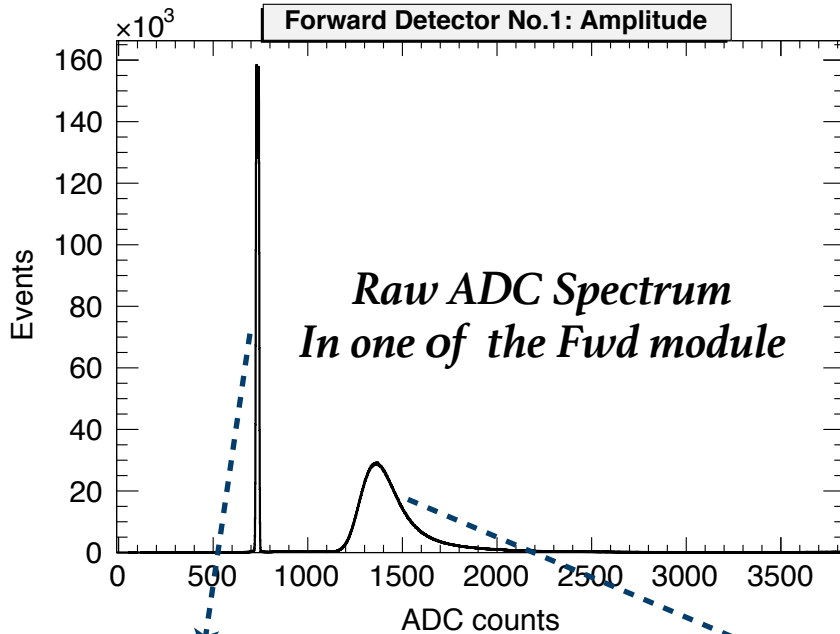
- Calibration of recoil detector energy is completed
- Correction of time offset of recoil detector is completed
- Alignment is needed to get more accurate result

## Outlook:

- Develop an algorithm for recoil sensor alignment
- Energy reconstruction using clustering
- Cross-checking with simulation

# THANK YOU !!

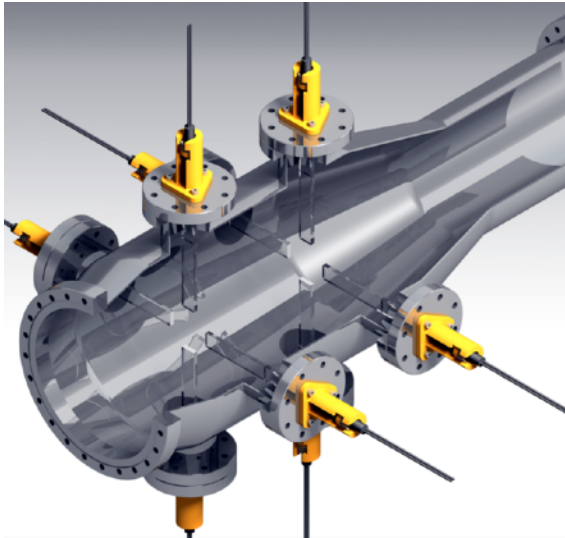
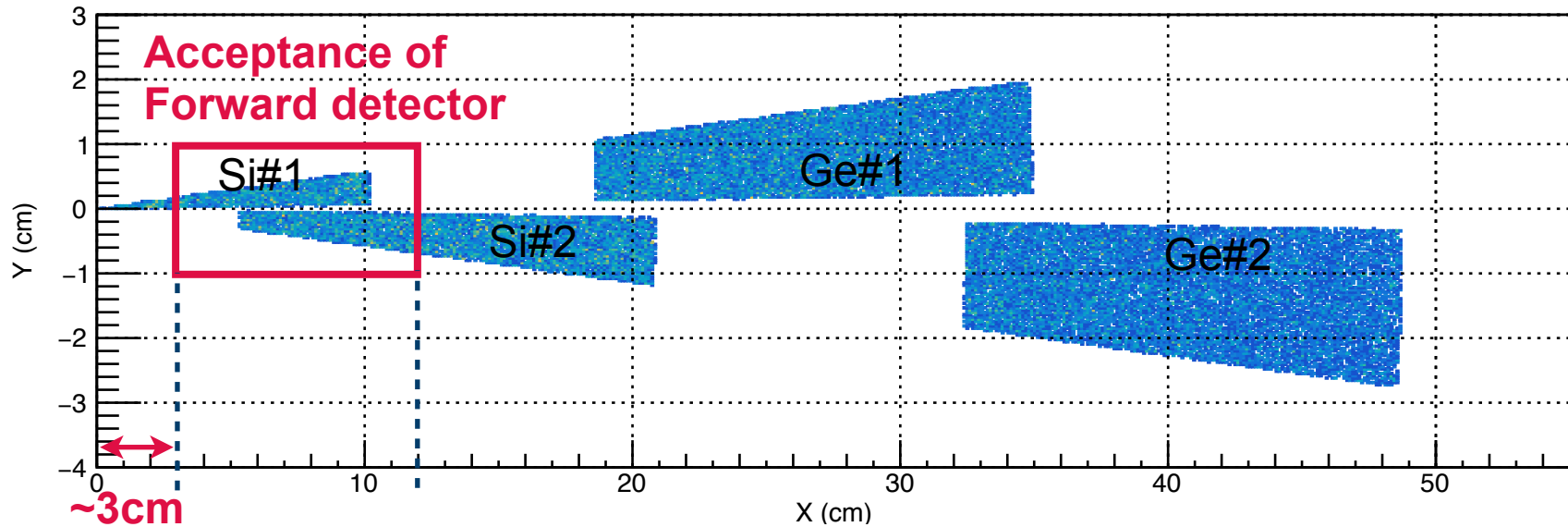
# Forward Detector Performance



- **Signal/Noise:**  
 $\sim 10^2$
- **Time resolution:**  
 $\sim 140 \text{ ps}$

# Forward Detector: Design

Distribution of the Correlated Scattering Proton in Fwd Detector Position @ 4.6m



- Scintillator: 90 x 20 x 6 mm<sup>3</sup>
- Position: z= +4.6 m and +4.8 m
- Polar angle (@4.6 m) :  $0.4^\circ < \theta < 1.5^\circ$
- 8 modules in 4 symmetric pairs:
  - Beam position monitoring
  - Reduce random coincidence

# Time Resolution of Recoil Detector

Strip#22 @ Si1

h1cut22

