Preparation and Commissioning of Day-One Experiment at COSY

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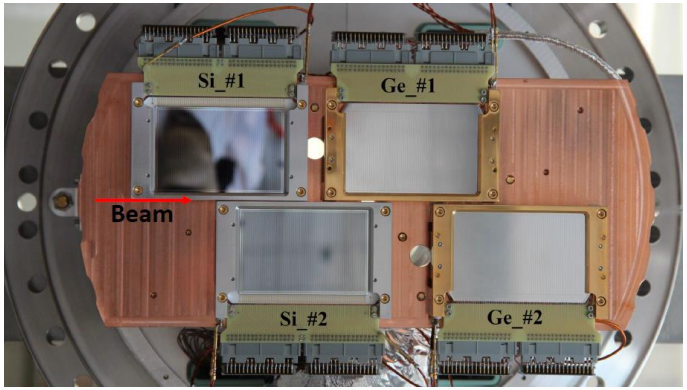
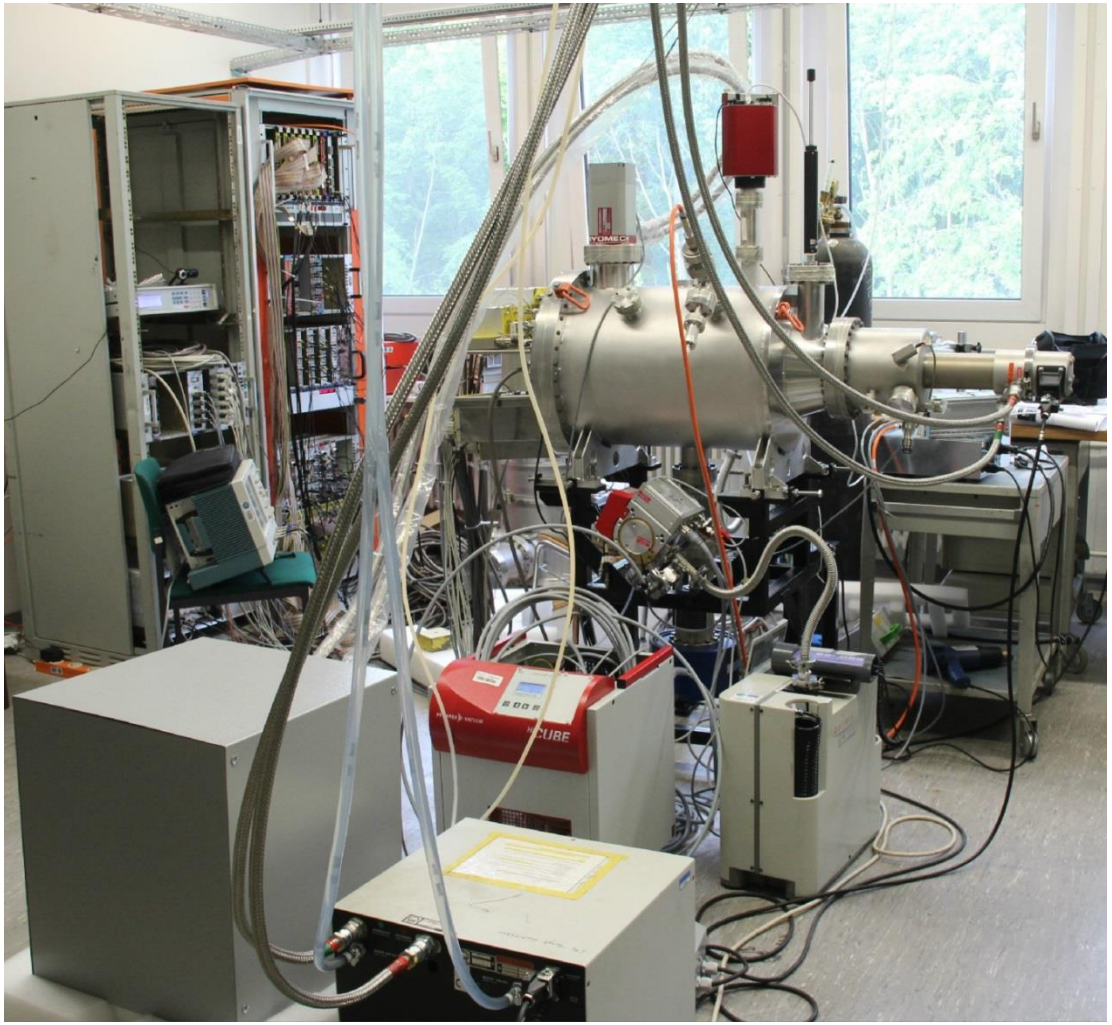
Outline

- Motivation of Day-One experiment
- Recoil detector test
- Commissioning experiment at COSY
- Conclusion

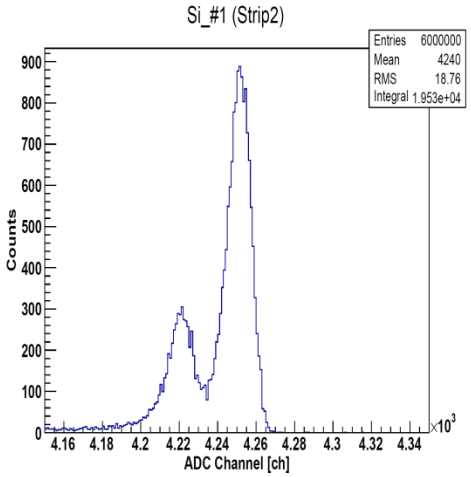
Laboratory test for the recoil detector

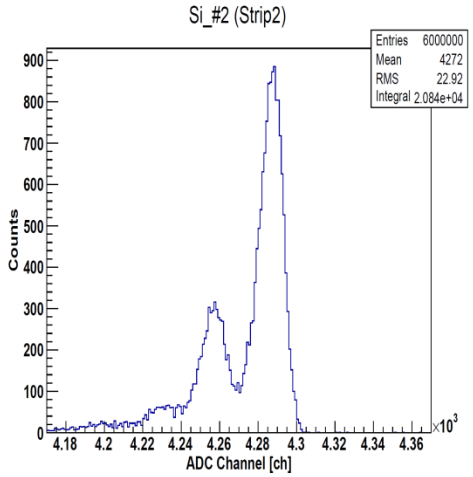
Detector layout

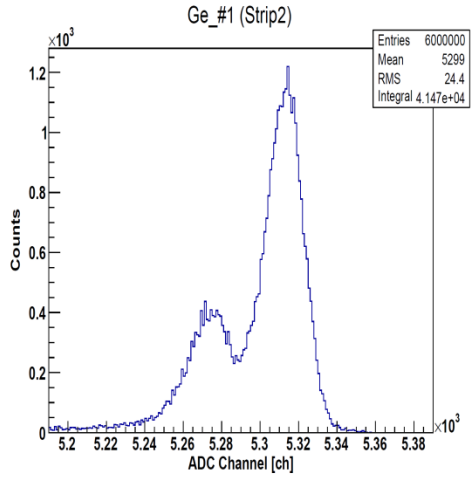


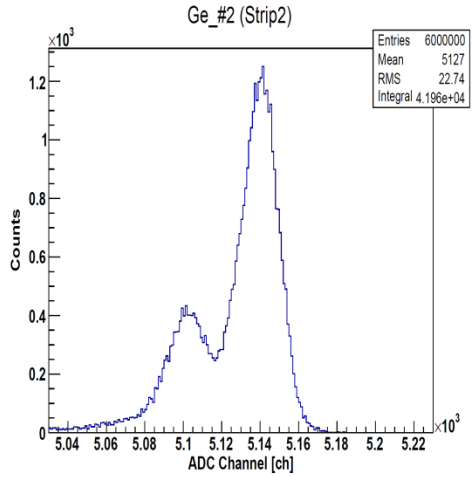


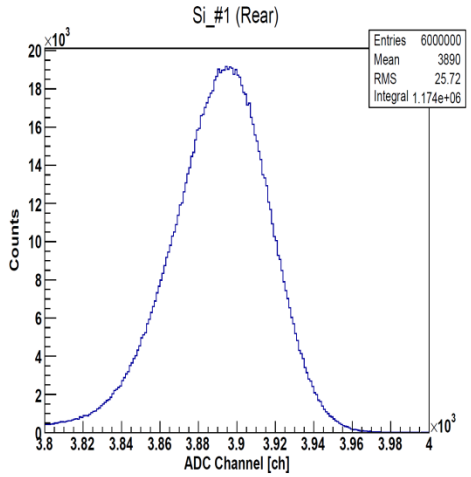
Energy spectra of ^{244}Cm @ 125 K

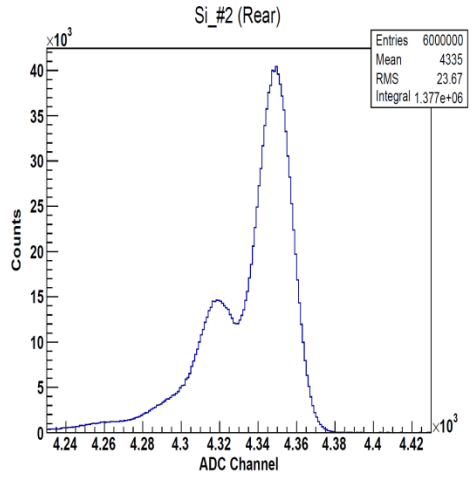


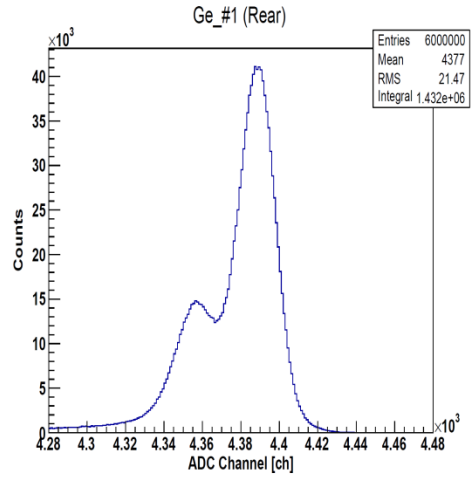


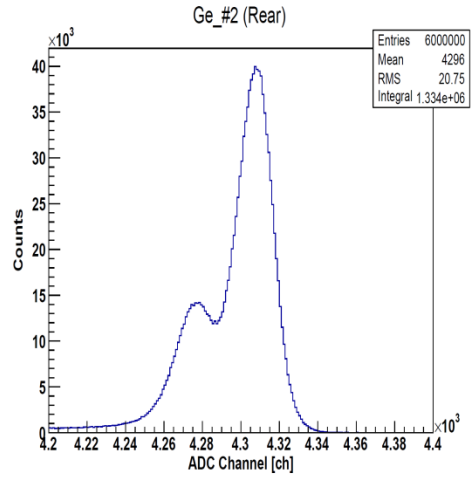




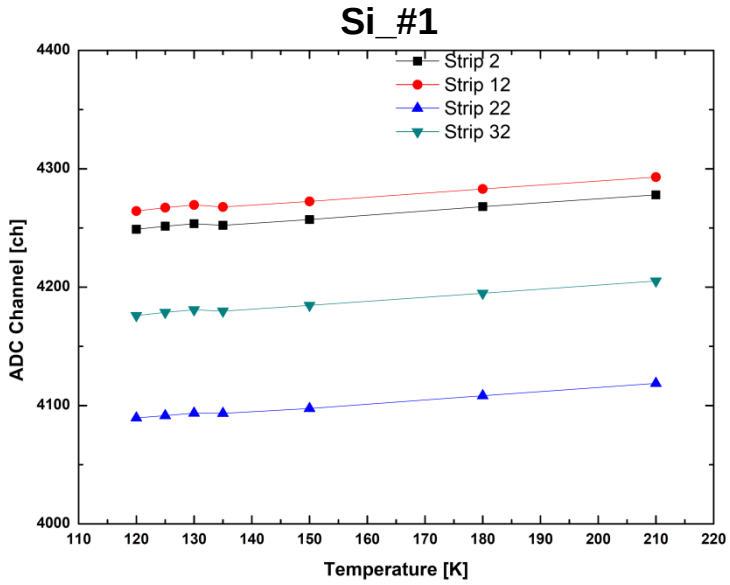


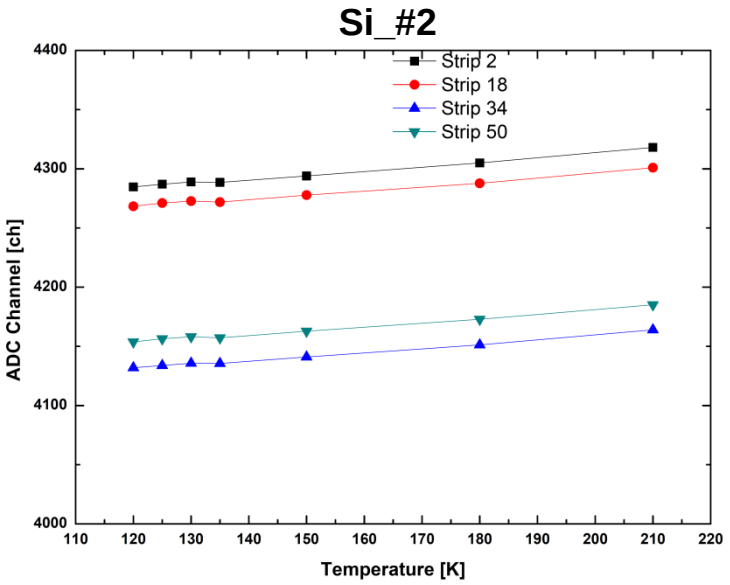


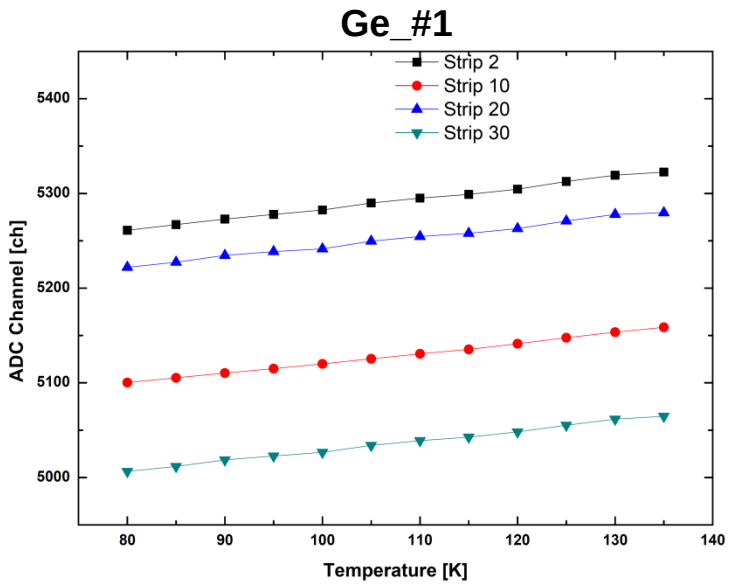


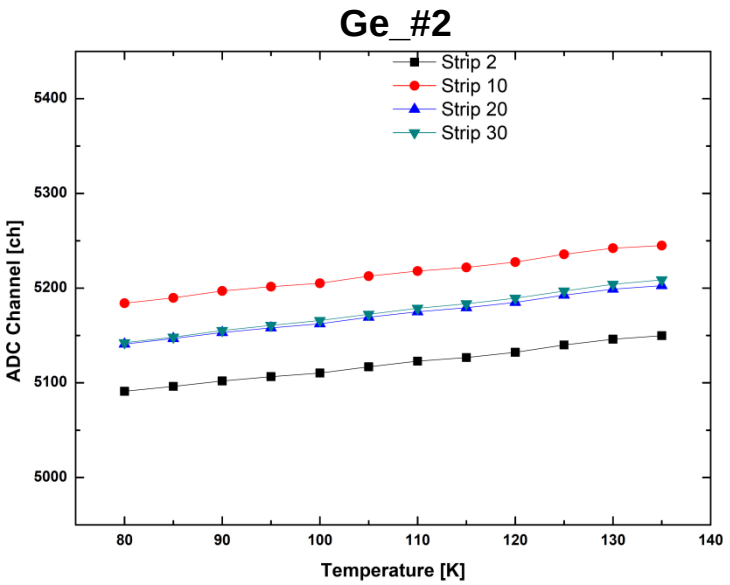


Amplitude vs. Temperature (Strips)

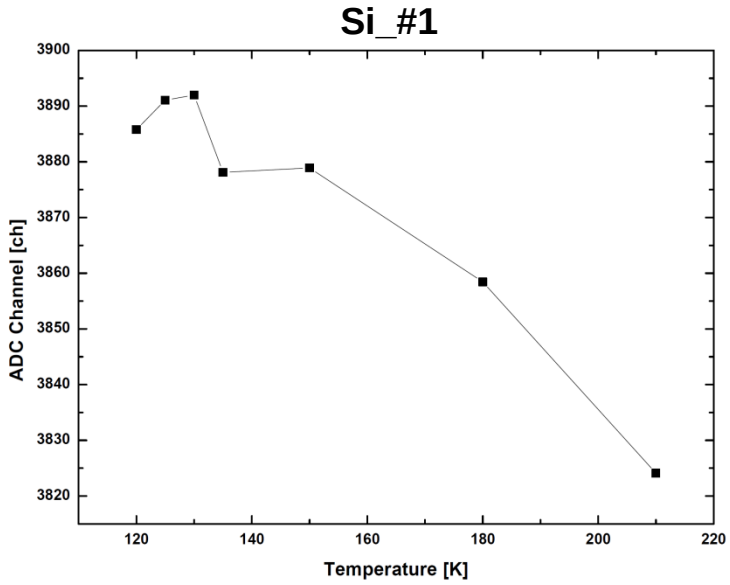


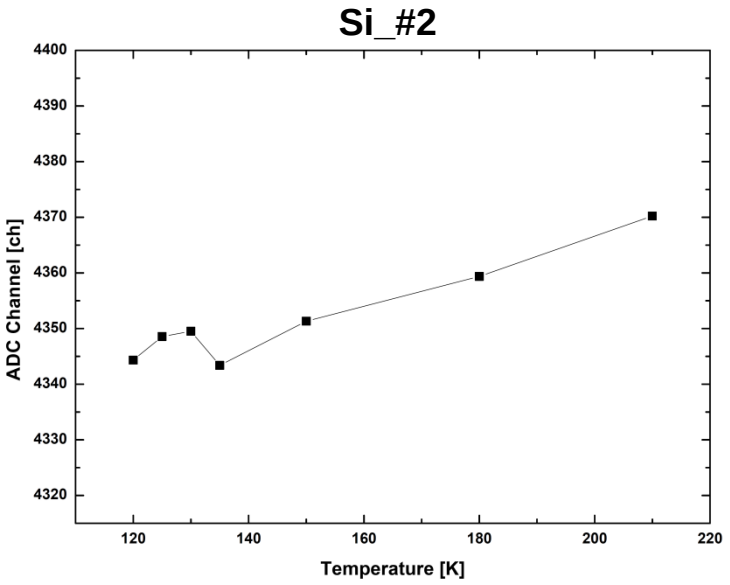


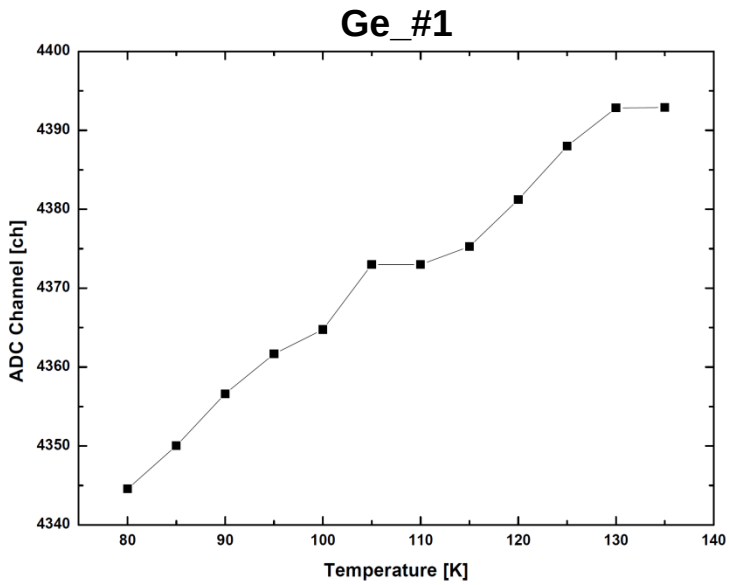


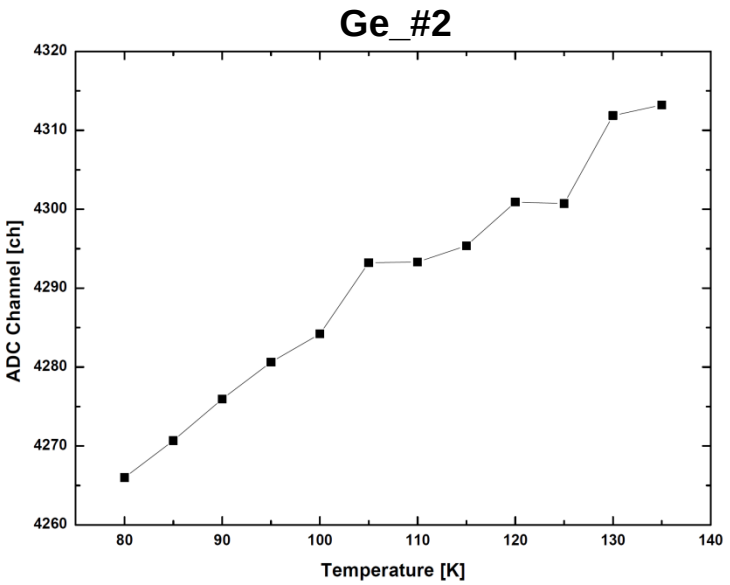


Amplitude vs. Temperature (Rear)

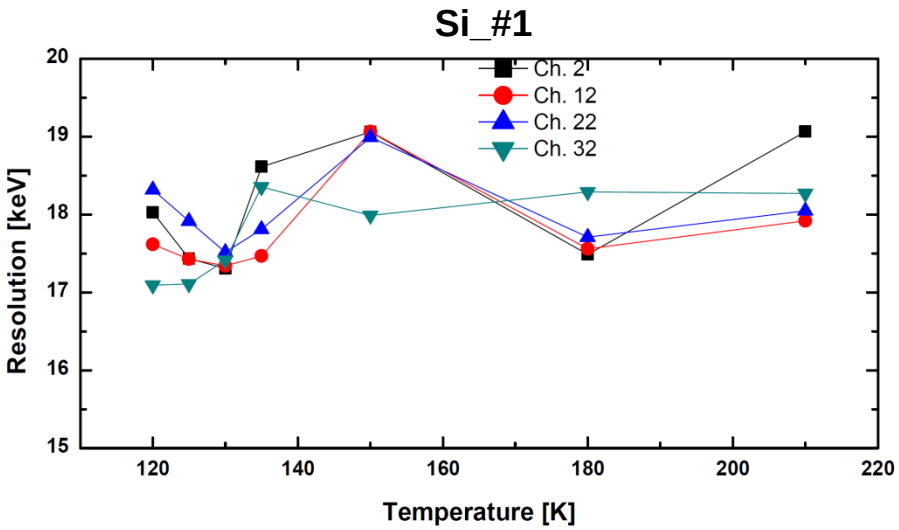


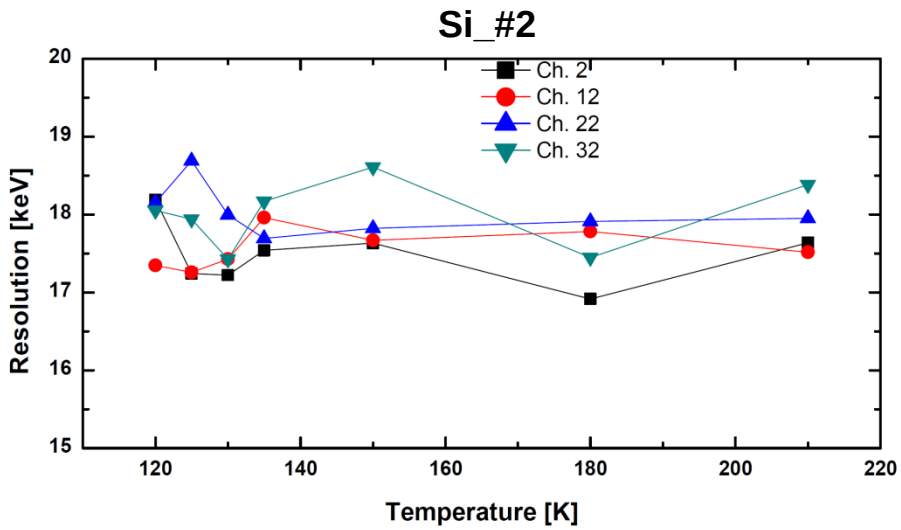


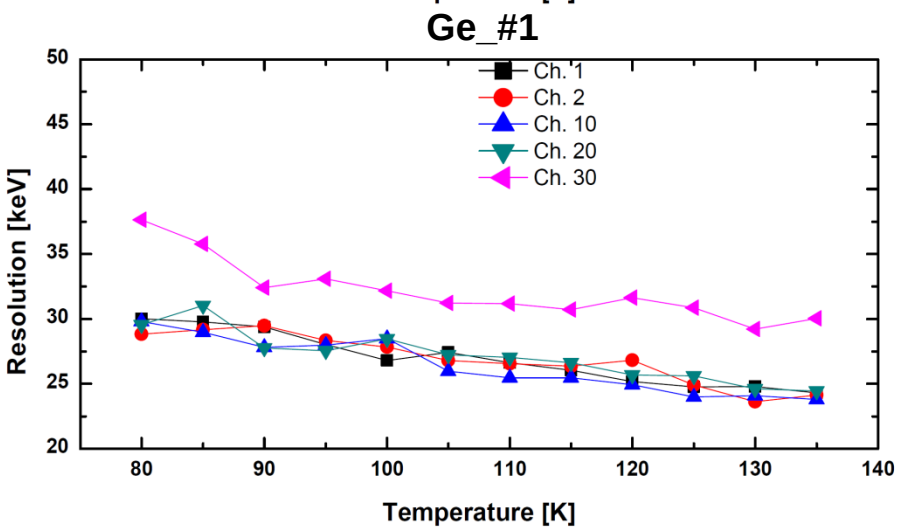


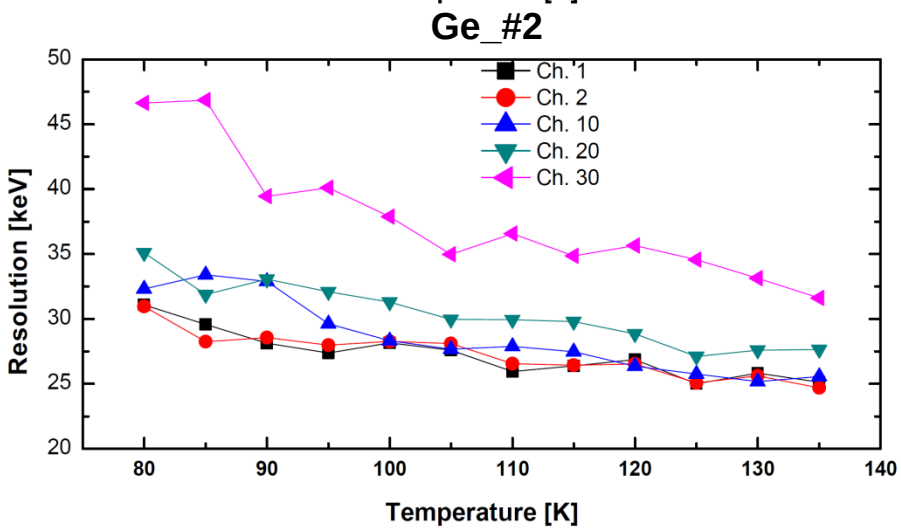


Resolution vs. Temperature (Strips)

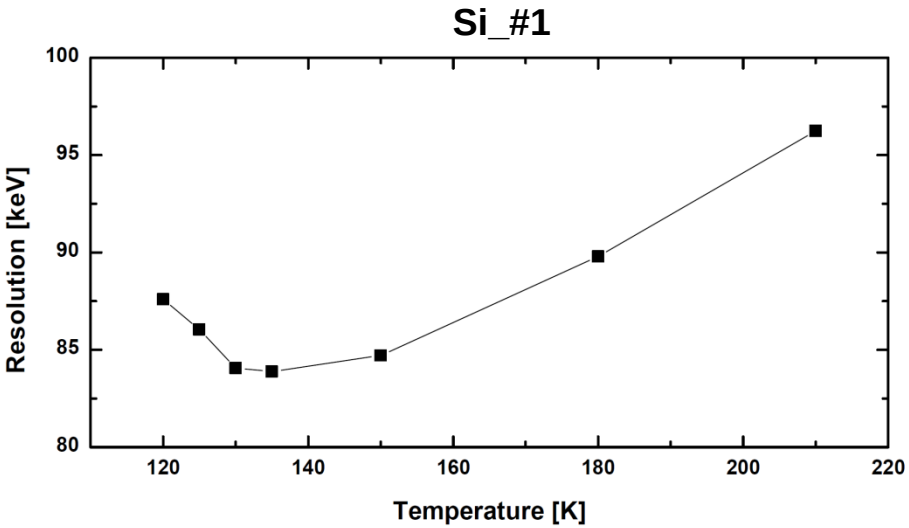


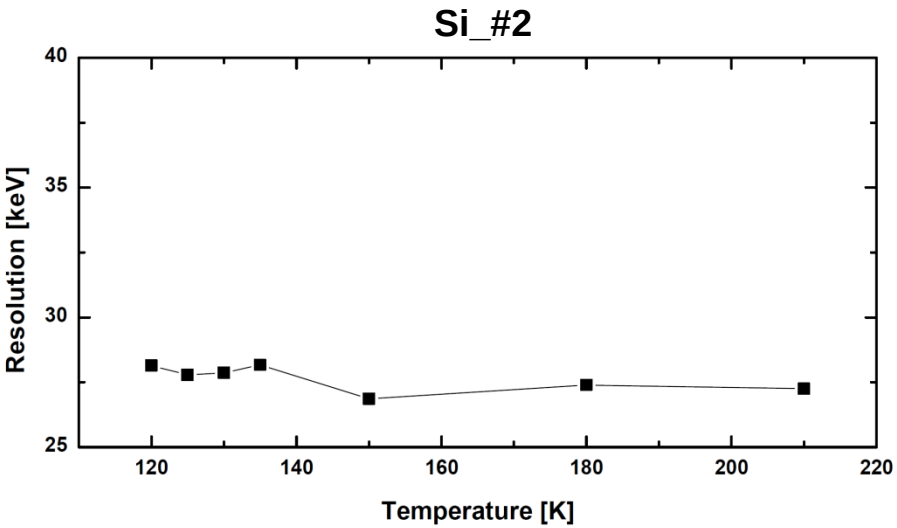


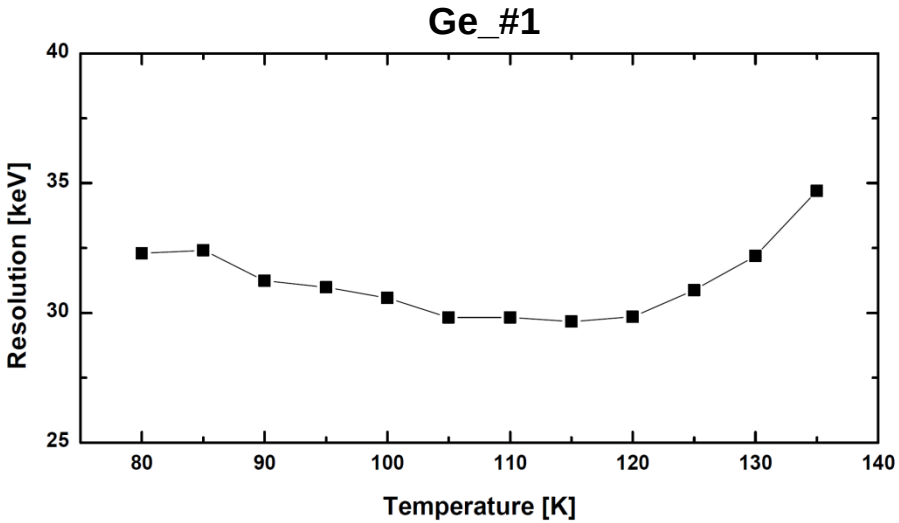


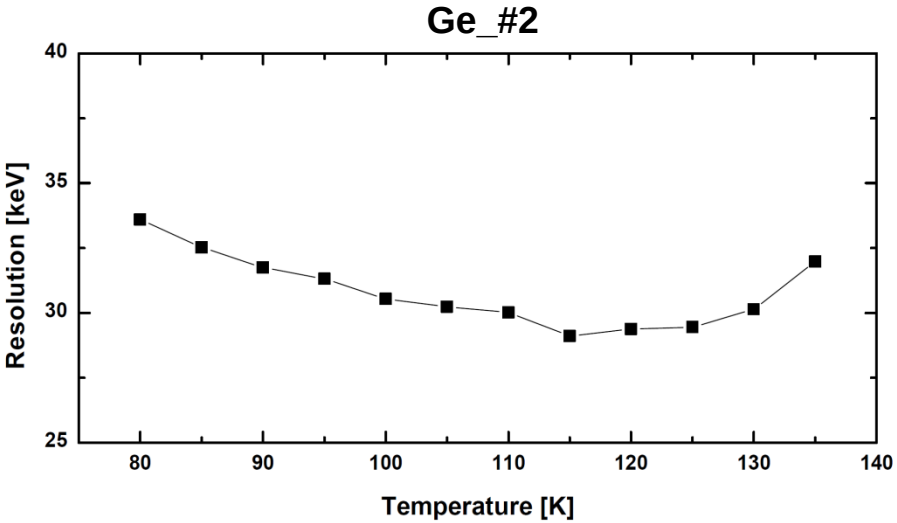


Resolution vs. Temperature (Rear)



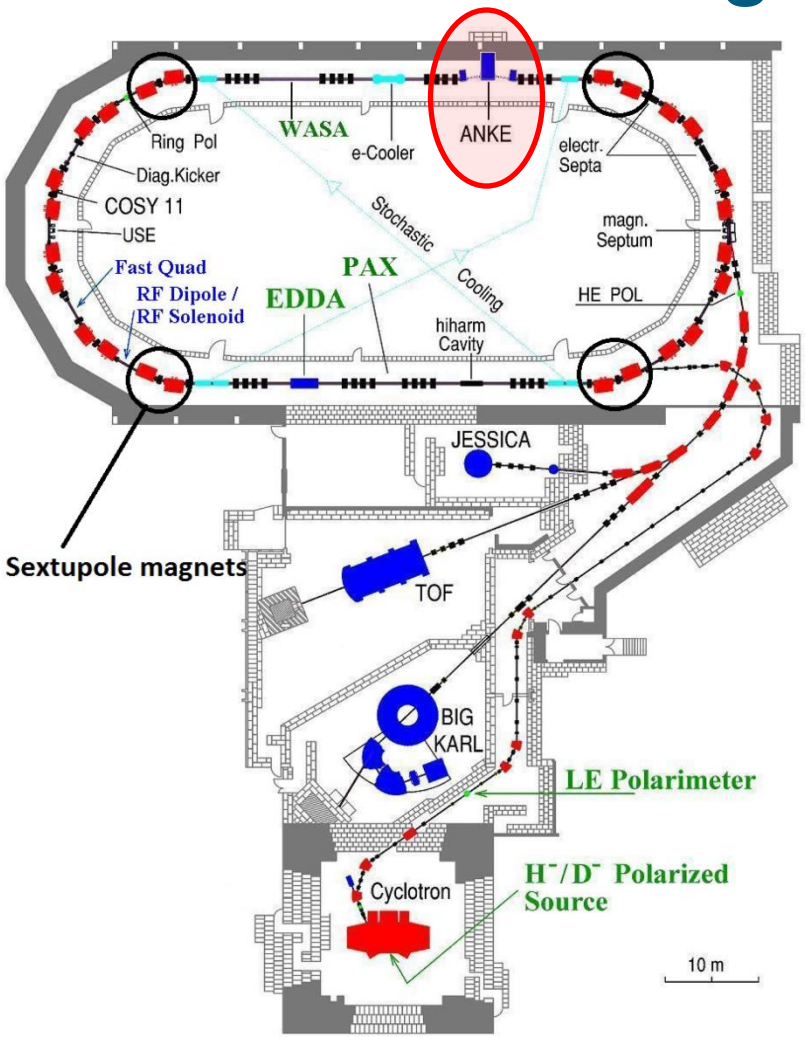






125 K was chosen as working temperature since the leakage current of germanium detectors increased quickly above 125 K

Commissioning experiment at COSY



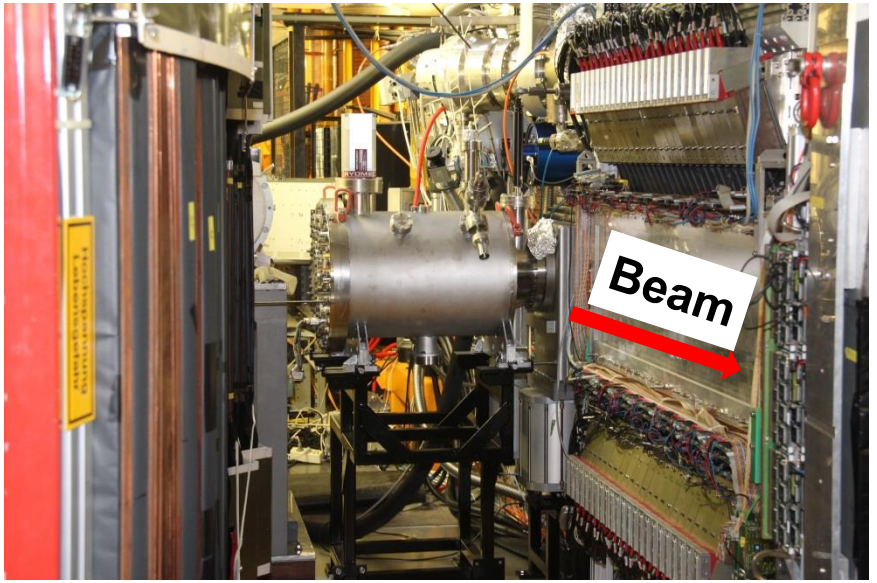


Figure 1.3: Schematic view of the COSY storage ring at Forschungszentrum Juelich.

D. Ecersmann, Analysis of Spin Coherence Time at the Cooler Synchrotron, Feb. 2013

Beam runs

Target：Cluster-jet target (H_2)

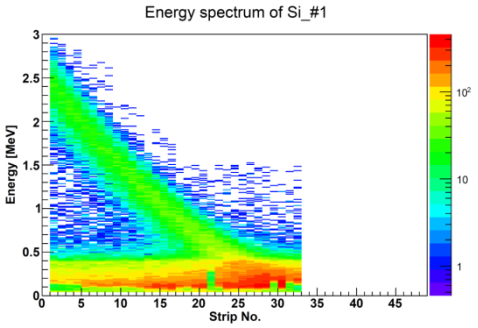
Thickness：< 2 mm

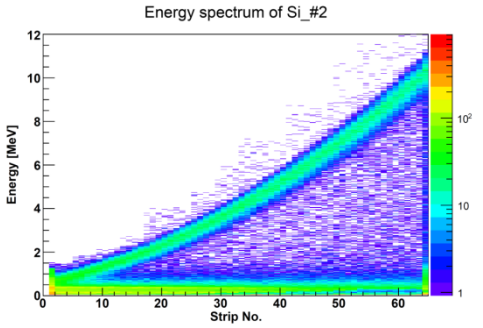
Density: ~ $10^{14}/cm^3$

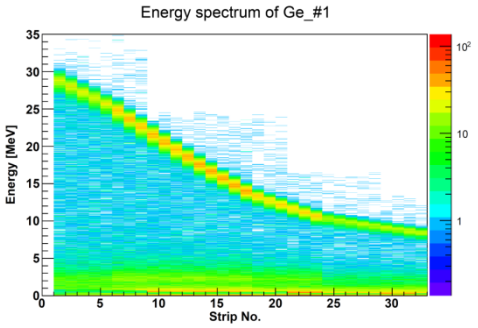
Data size

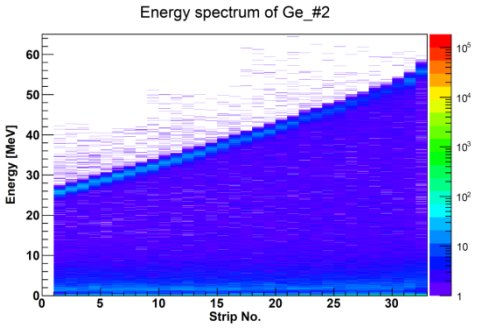
Time	P_b (GeV/c)	File size (GB)
2013.7.15 ~ 2013.7.21	1.7	~ 10
	3.2	~ 22
2013.9.23 ~ 2013.9.29	2.5	~ 23
	2.8	~ 56
	3.2	~ 30

Data of July after preliminary calibration

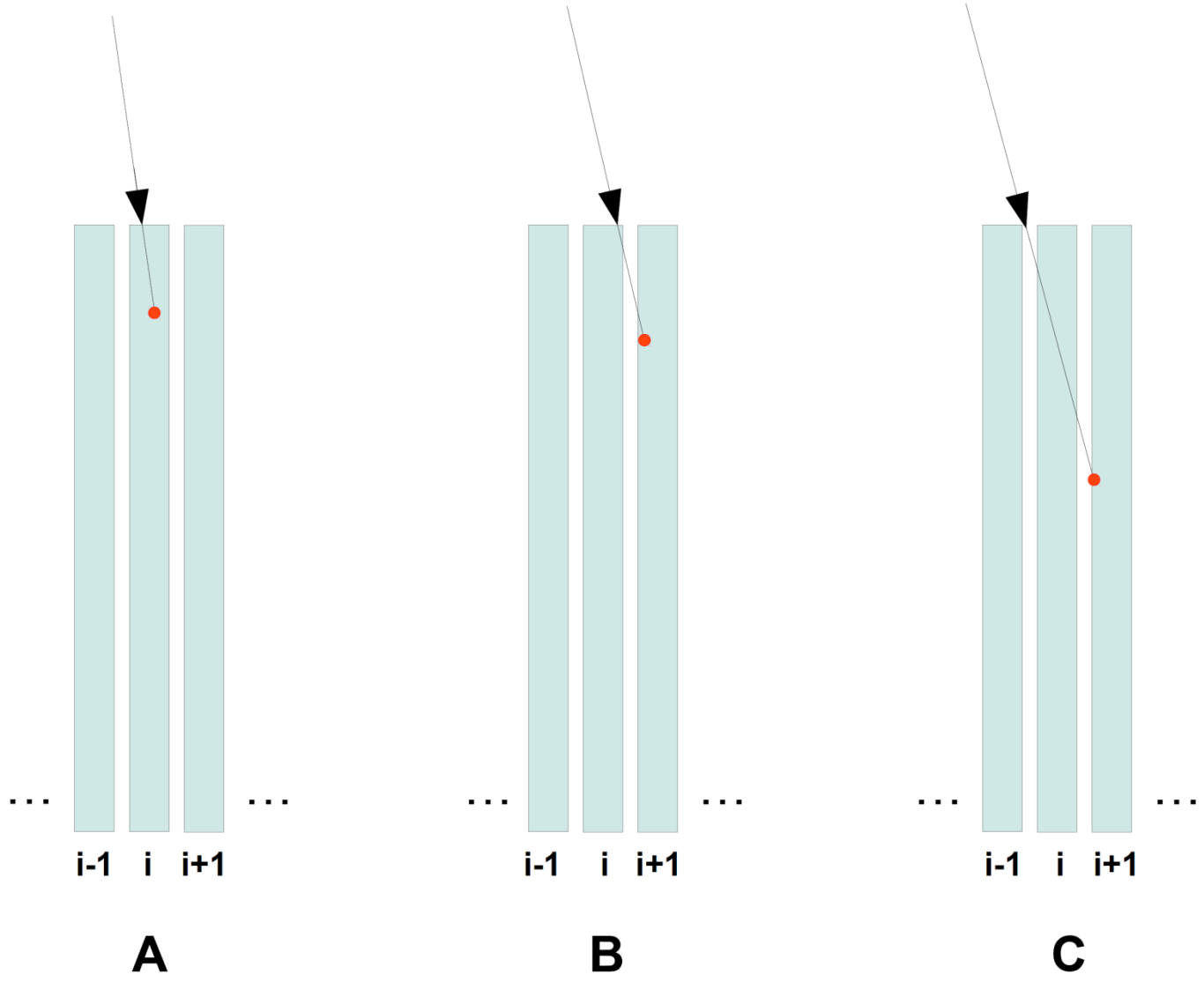






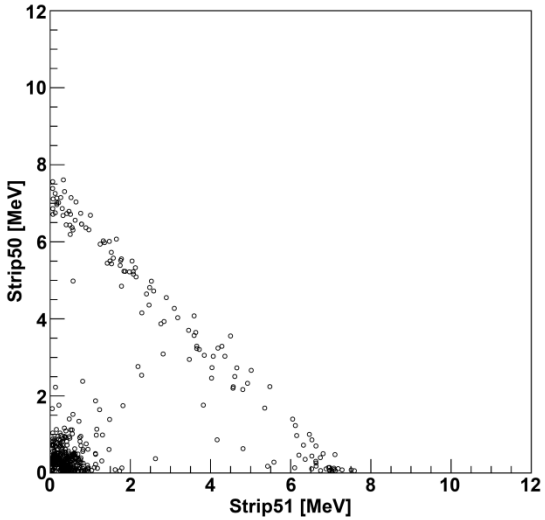


Multiplicity

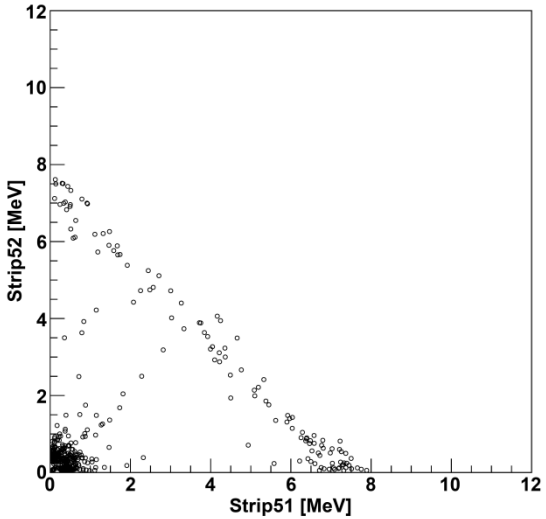


Two dimensional spectra of Si_#2 & Ge_#2 (P_b=3.2 GeV/c, July)

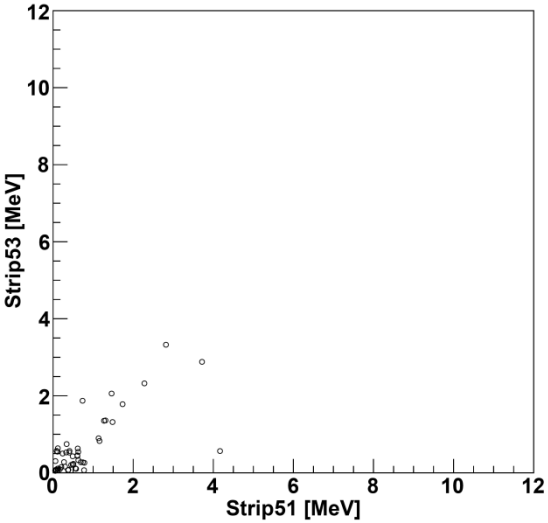
Si_#2
Strip51 vs. Strip50



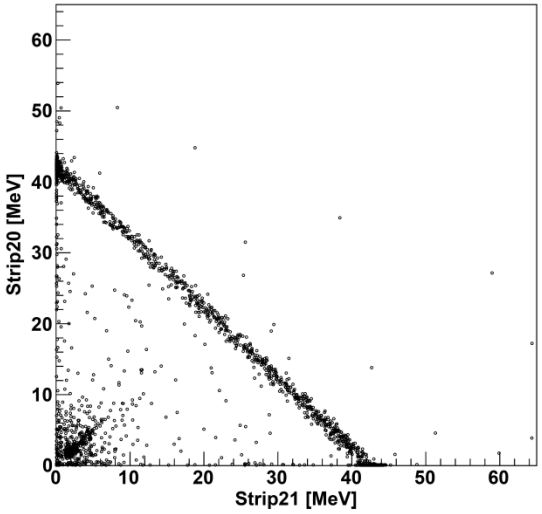
Si_#2
Strip51 vs. Strip52



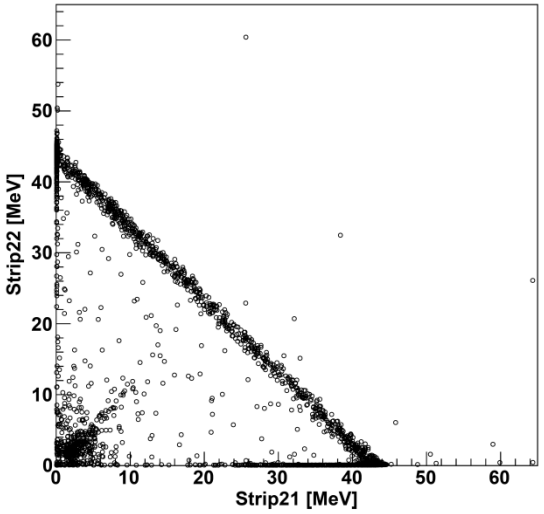
Si_#2
Strip51 vs. Strip53



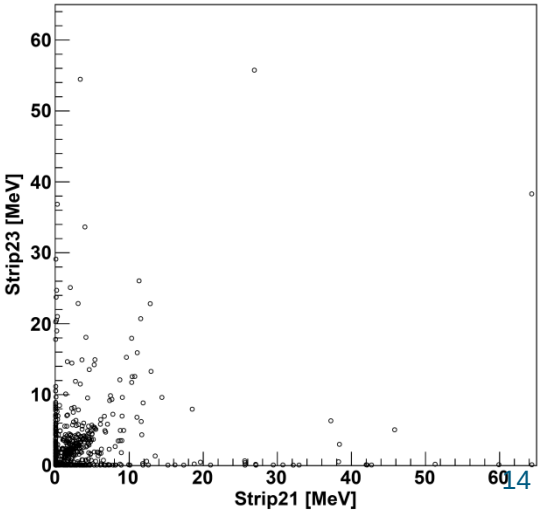
Ge_#2
Strip21 vs. Strip20



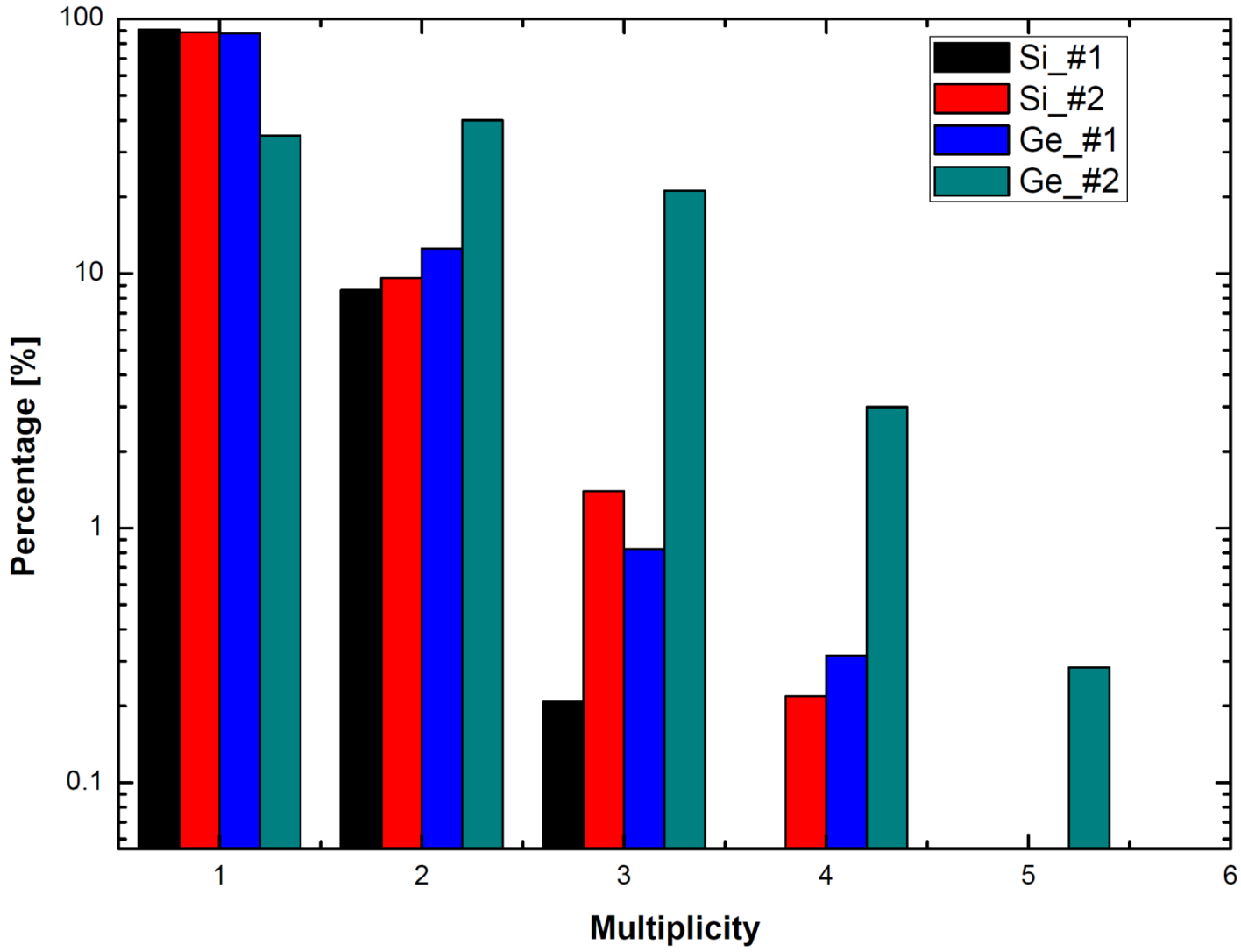
Ge_#2
Strip21 vs. Strip22



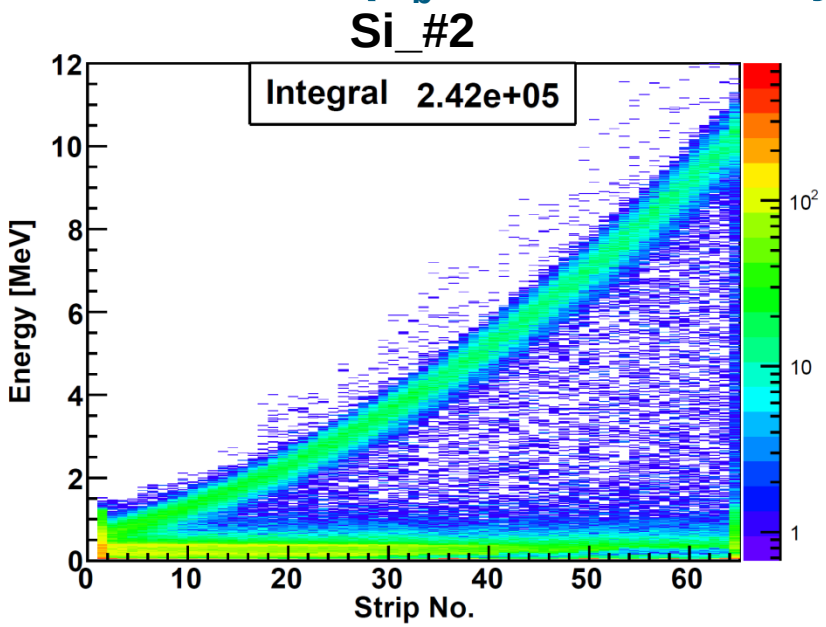
Ge_#2
Strip21 vs. Strip23

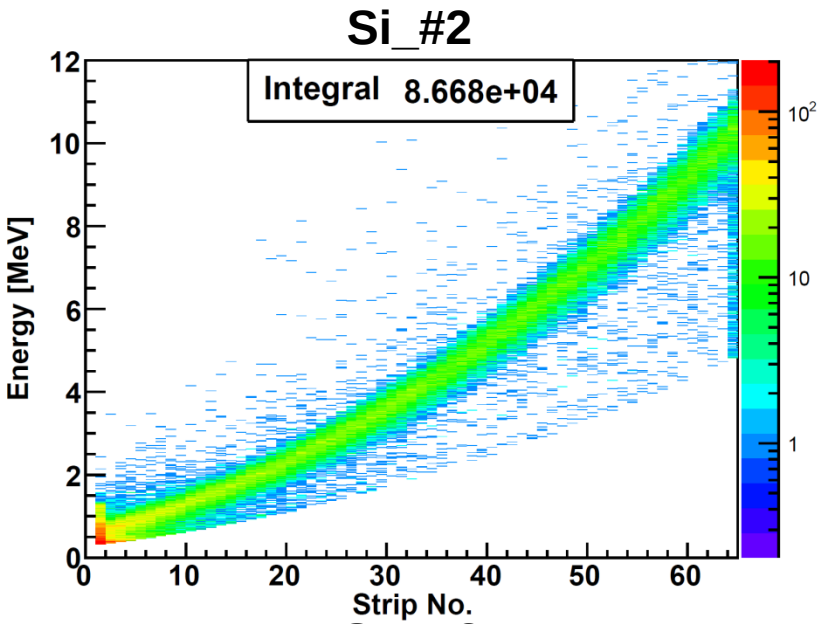


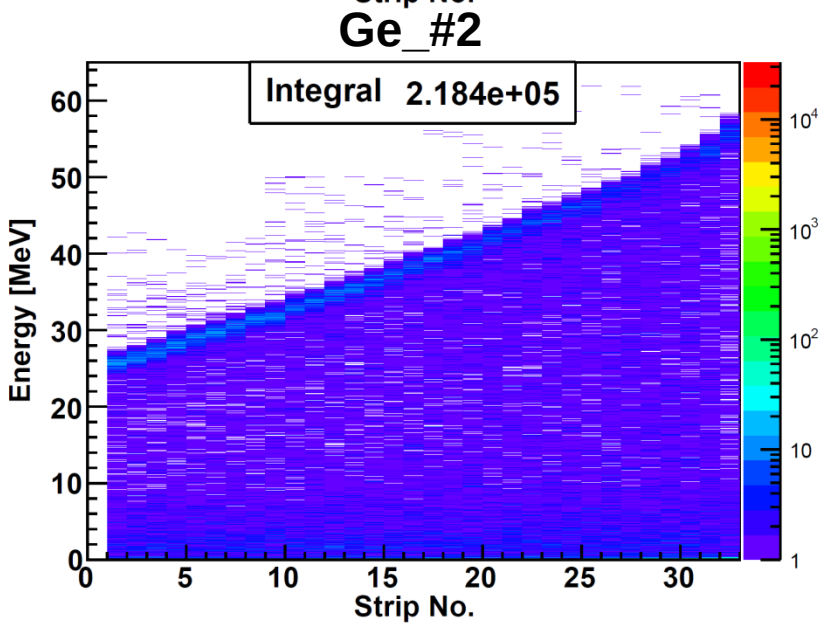
Multiplicity distribution (P_b=3.2 GeV/c, July)

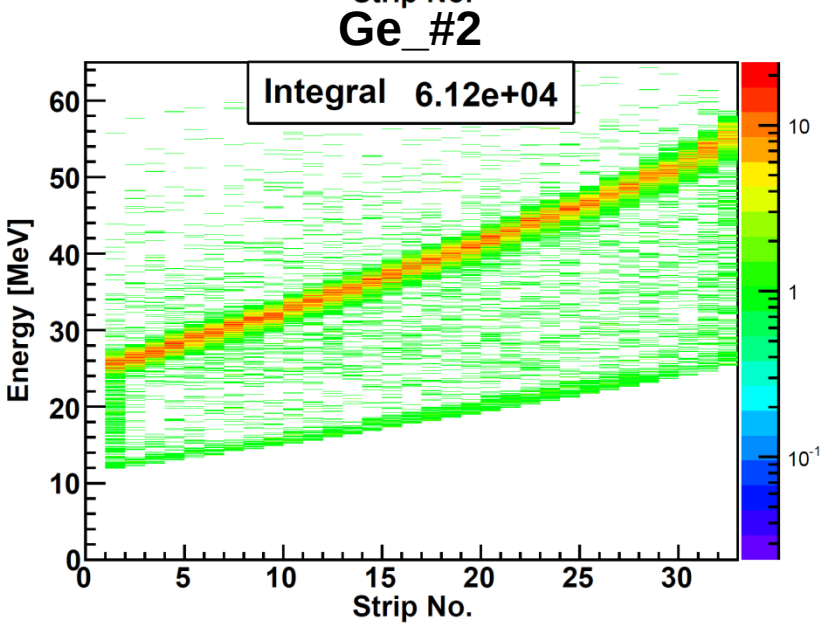


Clusterization (P_b=3.2 GeV/c, July)

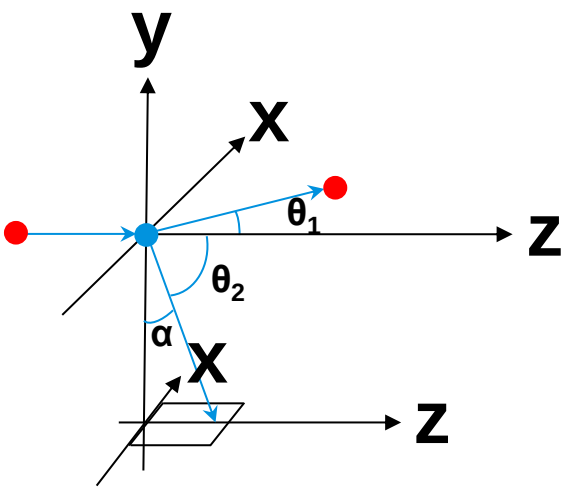


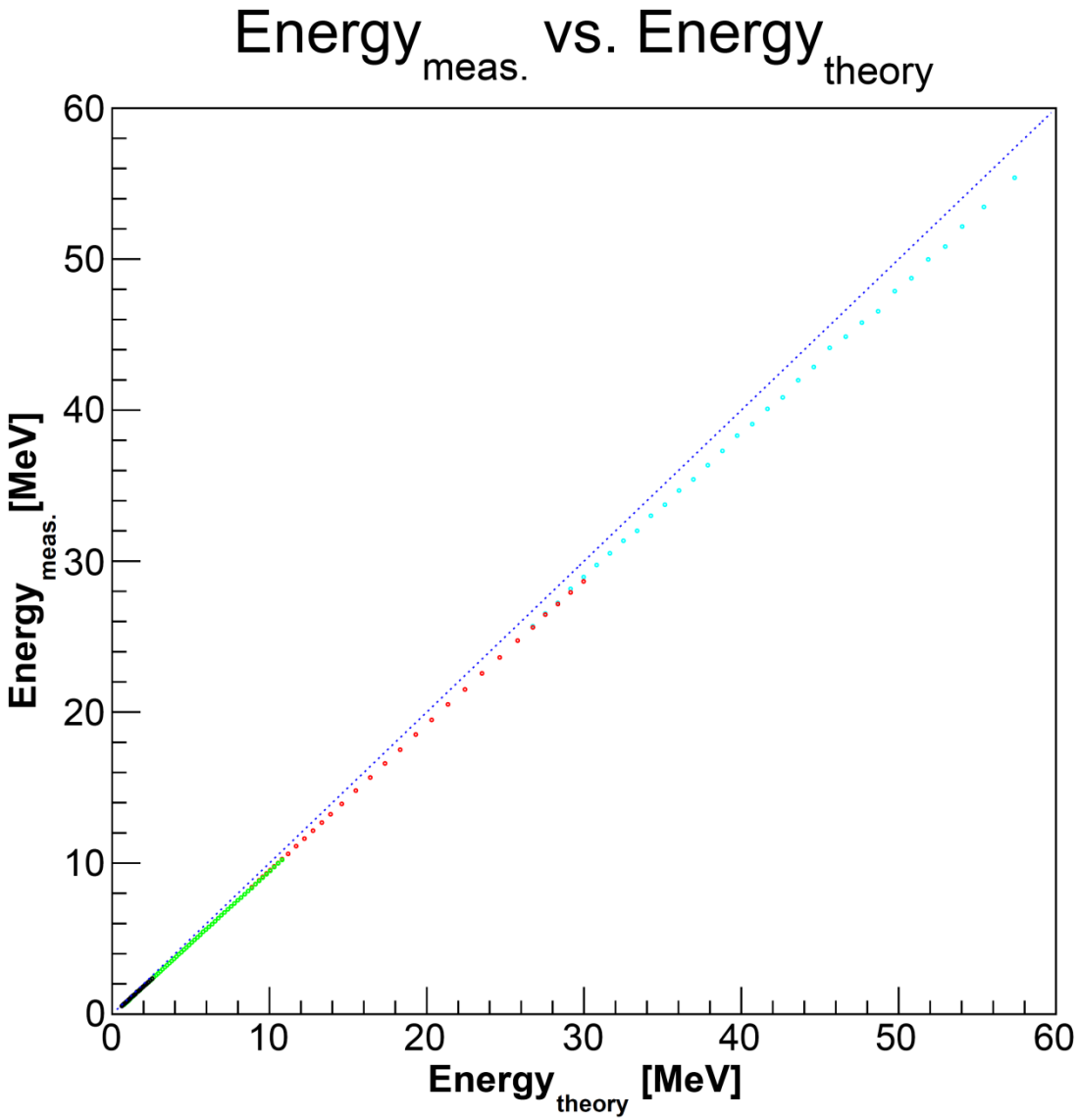




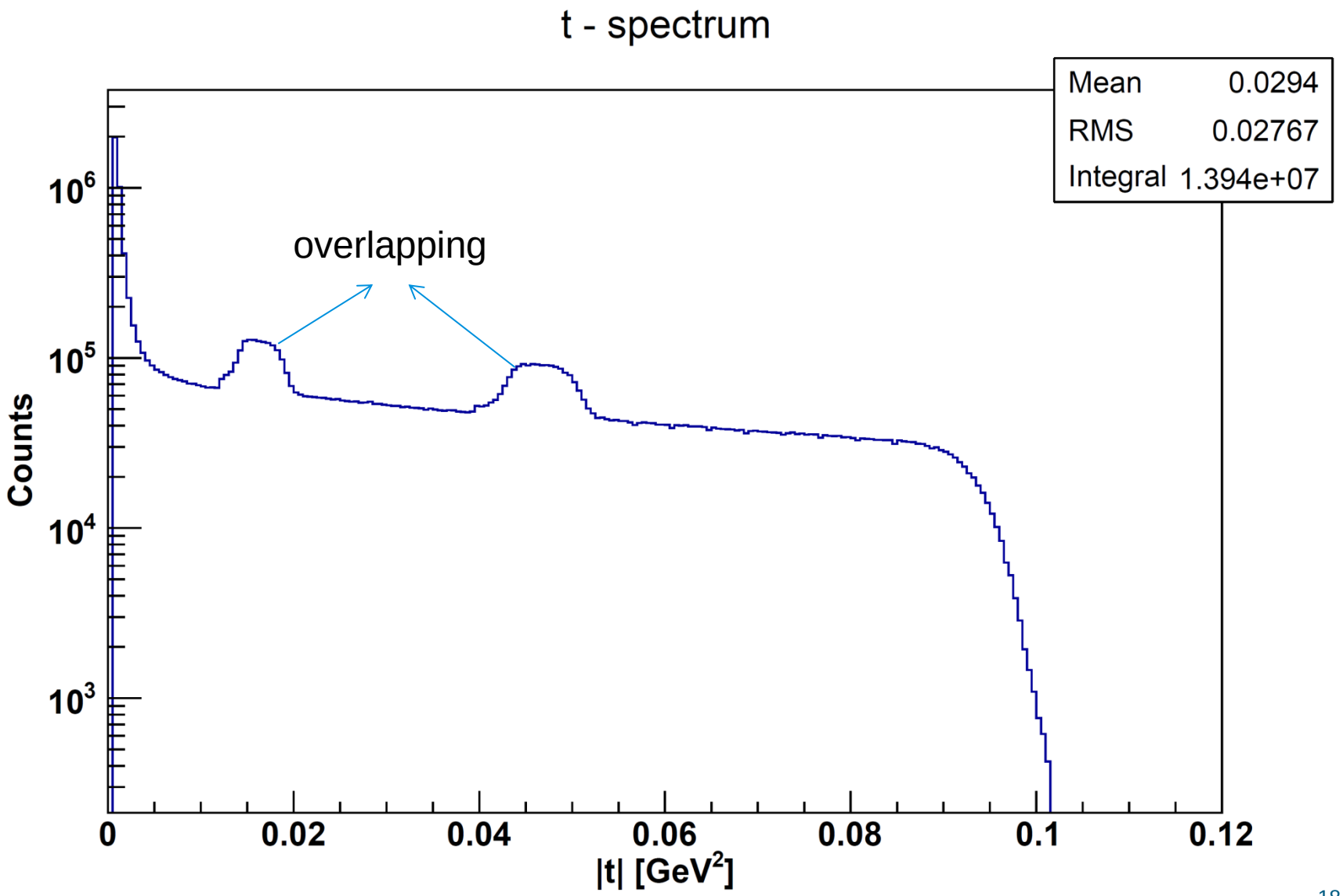


Energy comparison (P_b=3.2 GeV/c, July)





t-spectrum by using energy (P_b=3.2 GeV/c, July)



Conclusion

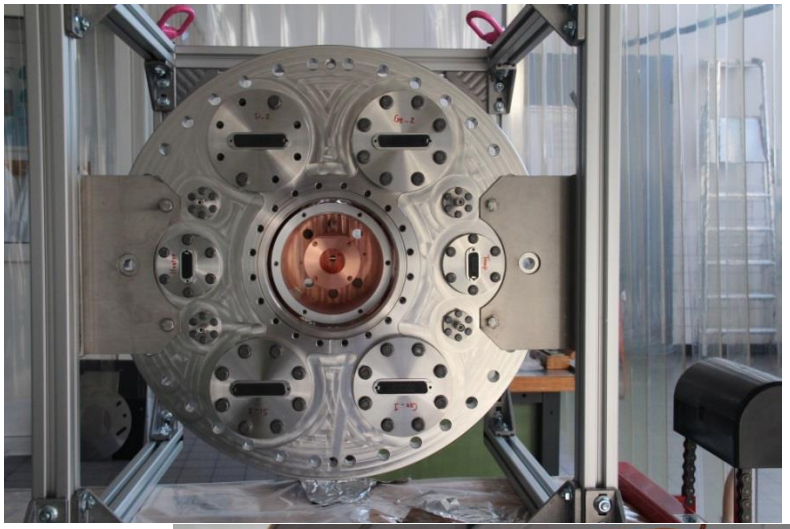
- The strips' resolutions of the silicon (<20 KeV) and germanium (<30 KeV) detectors meet expectation
- The optimal working temperature for germanium detector has been determined
- Clusterization for energy reconstruction has been implemented

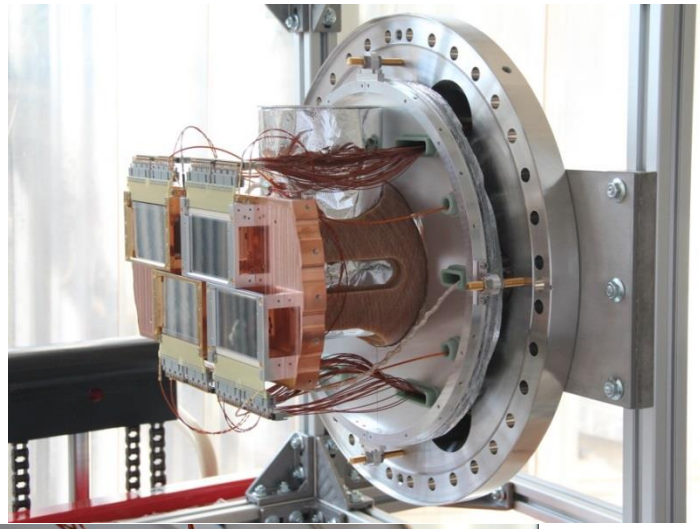
Next steps

- To determine the dead layer's thickness of Si & Ge detectors for energy calibration
- To study the beam-target overlapping position by Monte-Carlo simulation
- To construct the t-spectrum

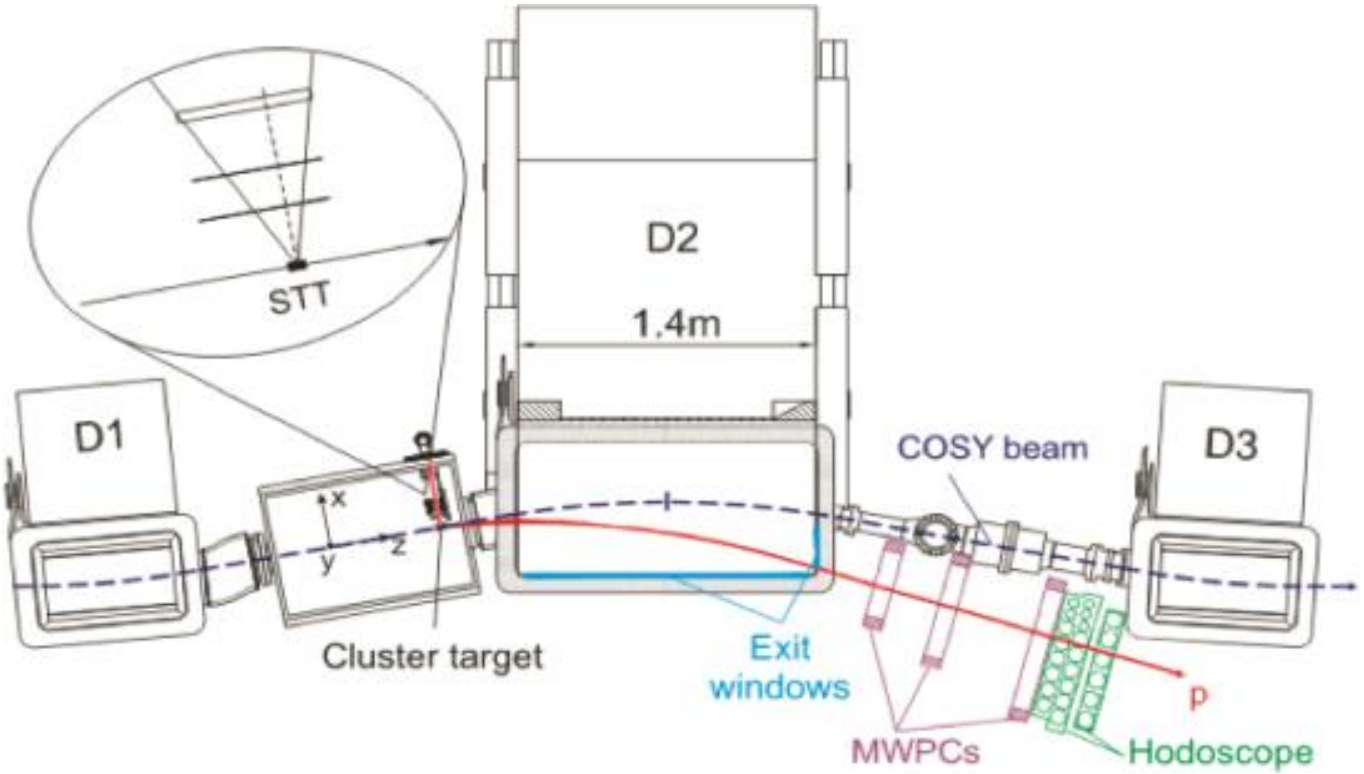
Thank you for your attention !

Assembling





ANKE


STT
D2
1.4m
D1
D3
COSY beam
x
y
z
Cluster target
Exit
windows
MWPCs
p
Hodoscope

ε vs. T

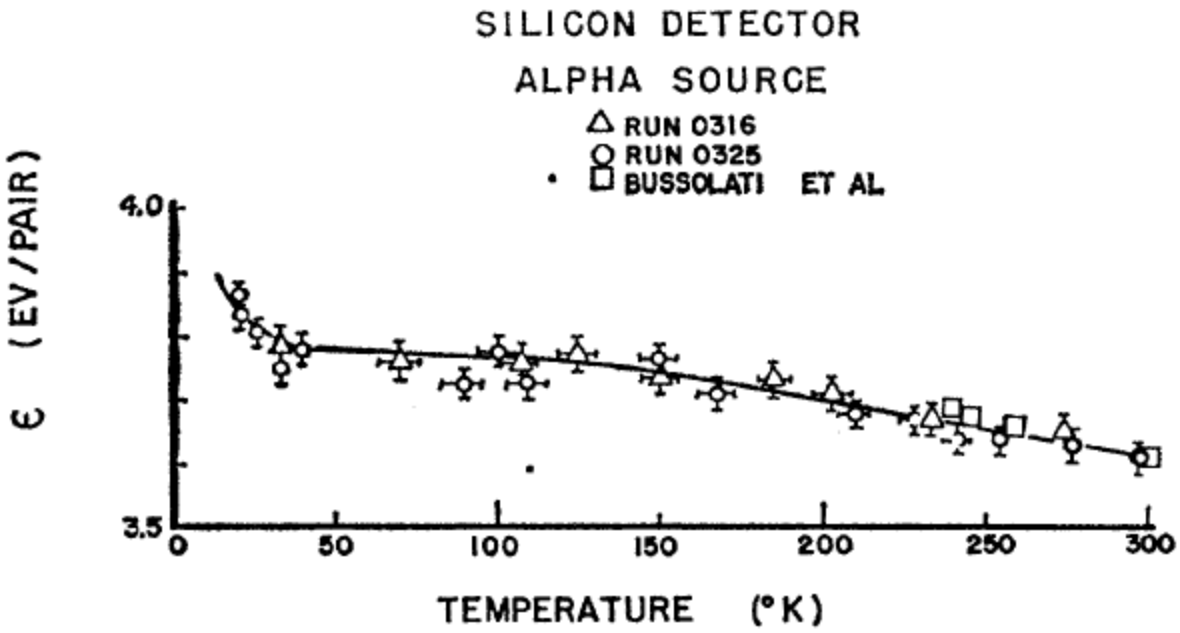


FIG. 5. Plot of ϵ versus temperature for 5.477-MeV α particles. incident upon silicon detector. Solid-line equation given by: $\epsilon = 2.2E_g(T) + 0.96\,E_g^{3/2}(T)\exp(0.75\,E_g(T)/T)$. $E_g(T)$ data are from Smith.

PR140(1965)A2089

Measurement method

luminosity-independent measurement

Optical theorem

$$\frac{(1+\rho^2)}{16\pi(\hbar c)^2}\frac{\sigma_T^2}{\left.\frac{dN_{el}^n}{dt}\right|_{t=0}} = \frac{1}{L}$$

PRL68,1992,2433-2436
PLB537,2002,41-44

Parameterization expression

$$\frac{1}{L}\frac{dN_{el}}{dt} = \frac{d\sigma}{dt}$$

$$= \frac{4\pi\alpha^2(\hbar c)^2 G^4(t)}{|t|^2}$$

$$+ \frac{\alpha(\rho+\alpha\varphi)\sigma_T G^2(t)}{|t|}\exp(-b|t|/2)$$

$$+ \frac{\sigma_T^2(1+\rho^2)}{16\pi(\hbar c)^2}\exp(-b|t|)$$