



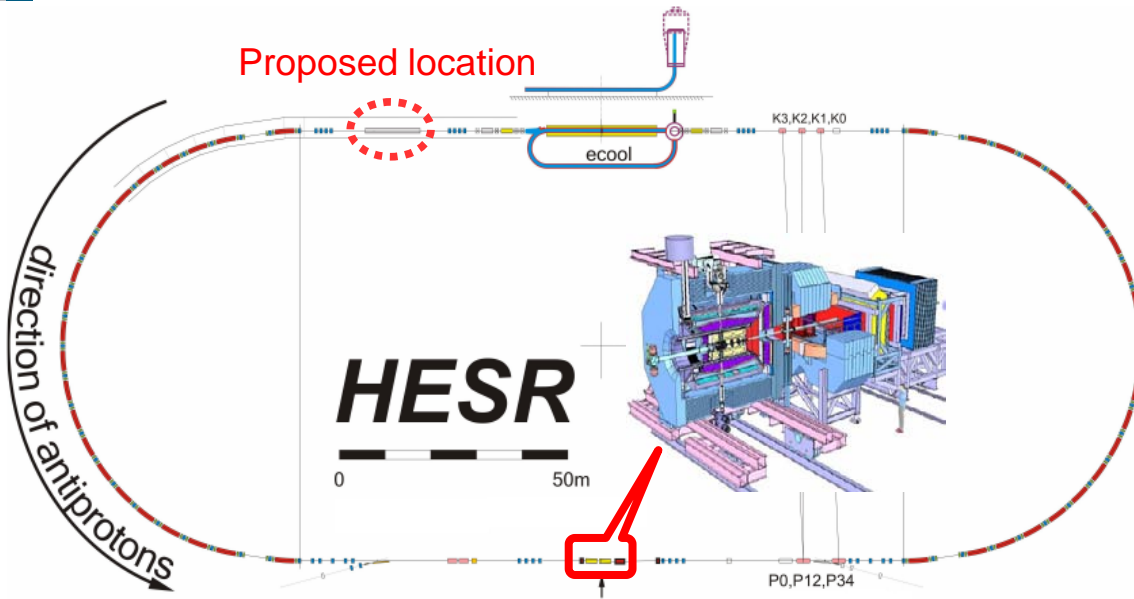
GSI, Dec. 10-14 2012



Status of day-one experiment commissioning at COSY

Huagen Xu

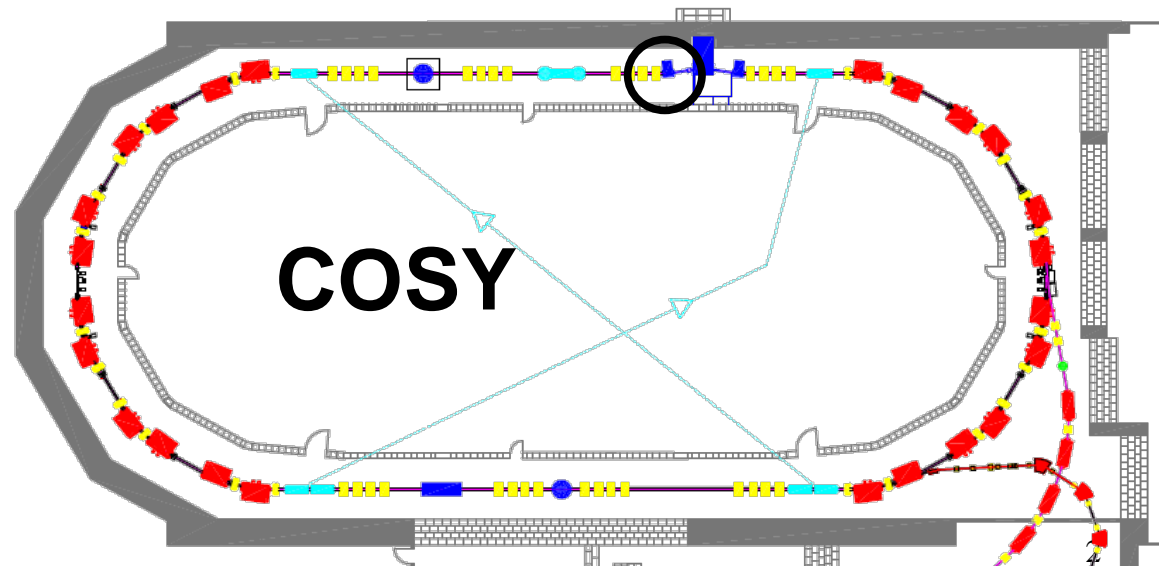
Goals of day-one experiment at HESR



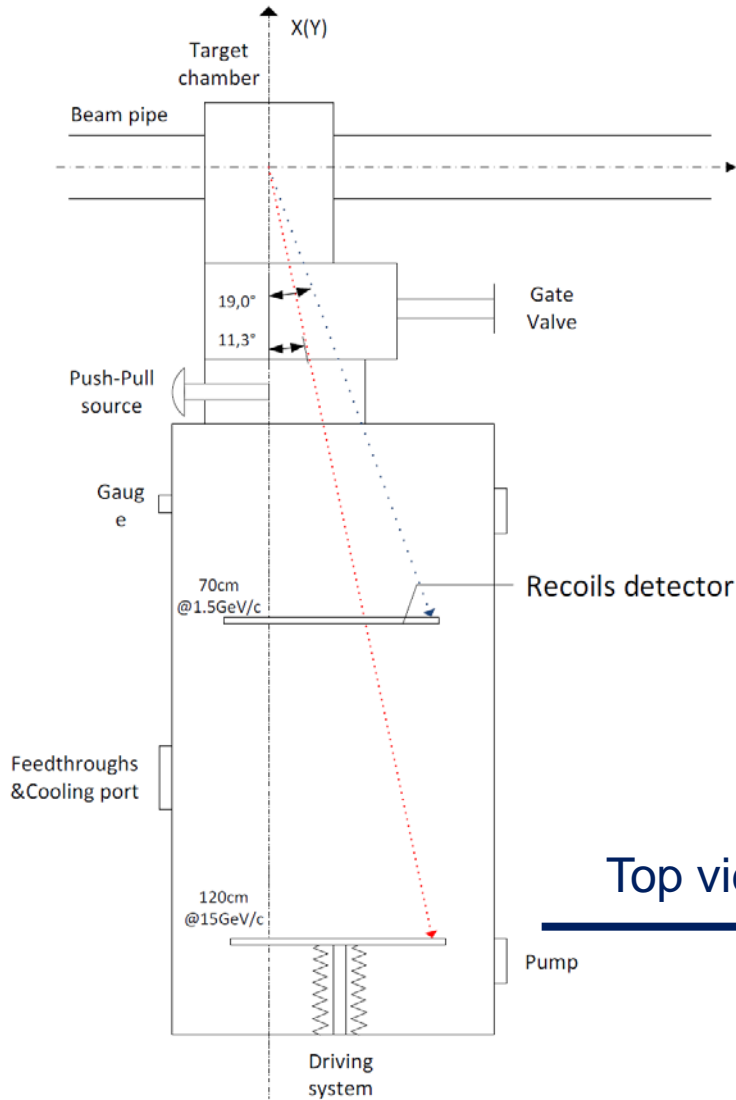
- Pbarp elastic scattering
- Coincidence (forward&recoil)
- Large range of t : $0.0008-0.1 \text{ GeV}^2$

- Test method
- Recoil arm construction
- Commissioning at COSY

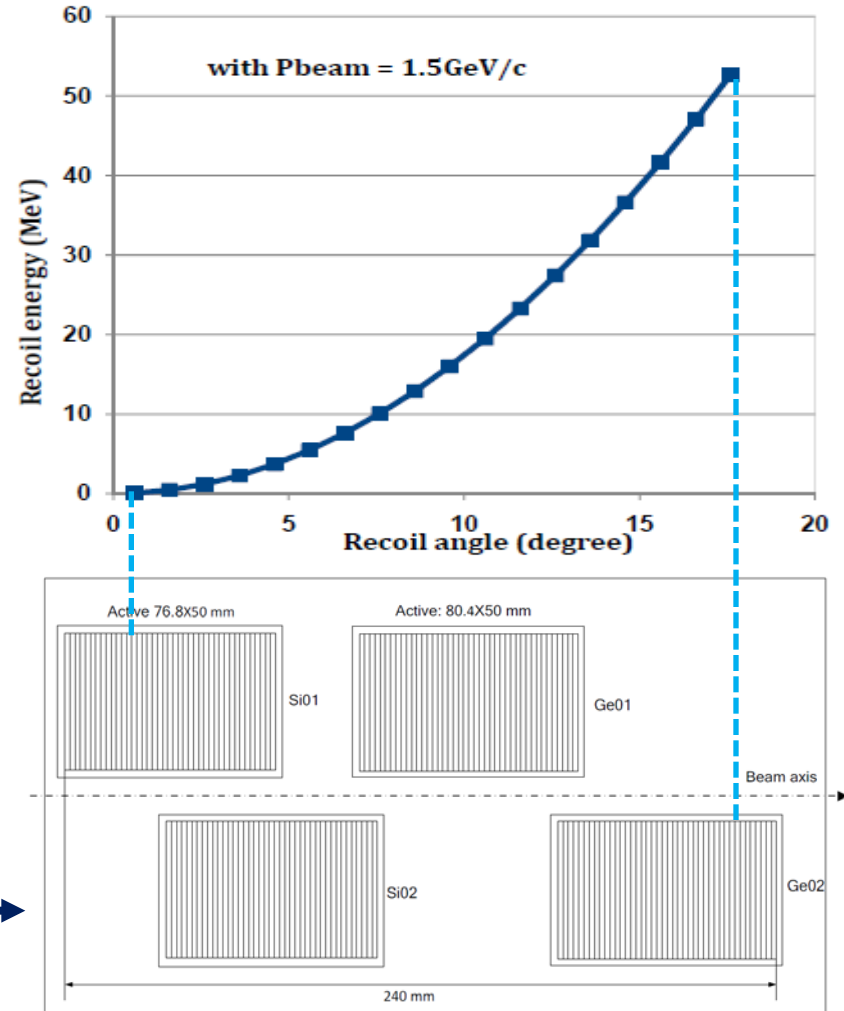
Cluster target at ANKE



Recoil Arm

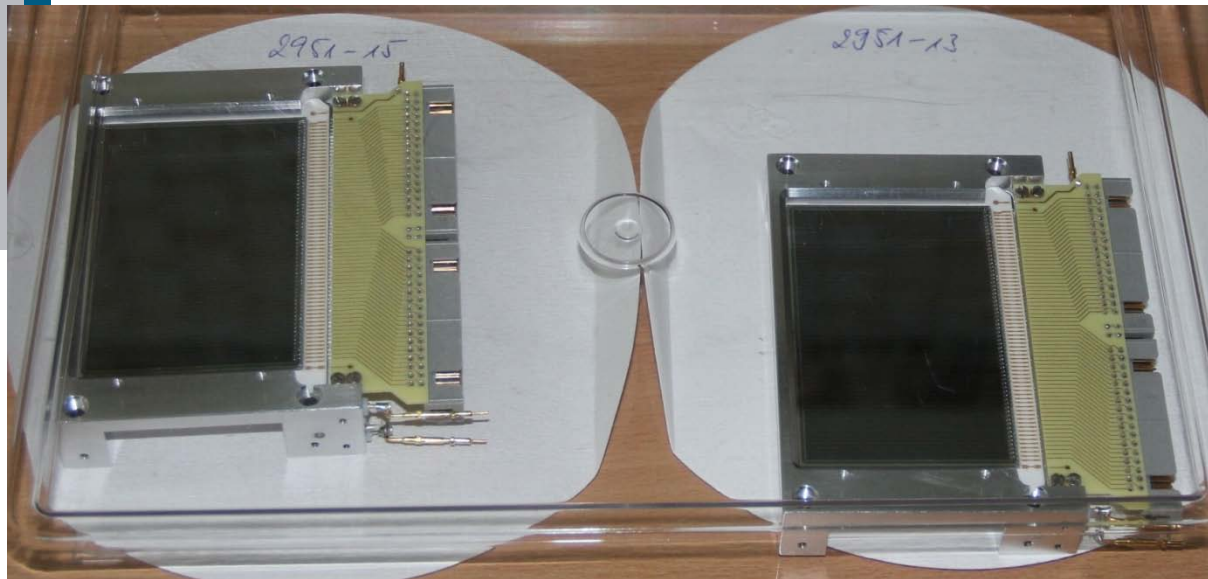


Top view



- 2 Si : 76.8 x 50 x 1 (mm) (1.2 mm pitch)
- 2 Ge: 80.4 x 50 x 5/11 (mm) (1.2mm pitch)

Part 1: Detectors

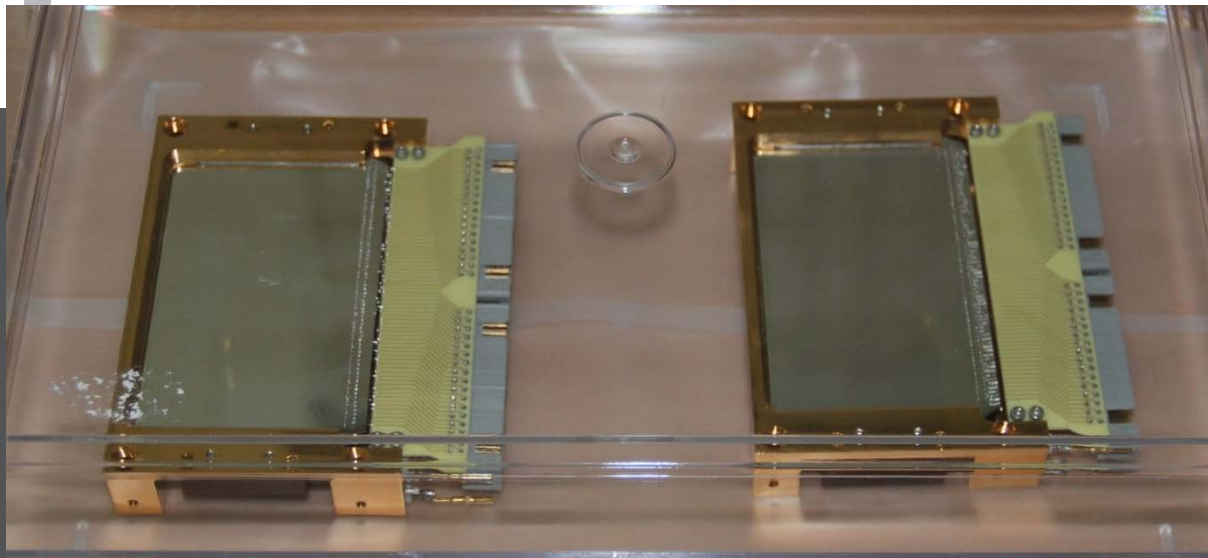


Achievements:

- Get rid of pump oil accident

To do:

- Test after rework
- Final assembly



Achievements:

- High leakage current problem has been fixed

To do:

- Test with new chamber
- Final assembly

Part 2: FEE

Mesytec:

MPR16: 16ch with variable gain

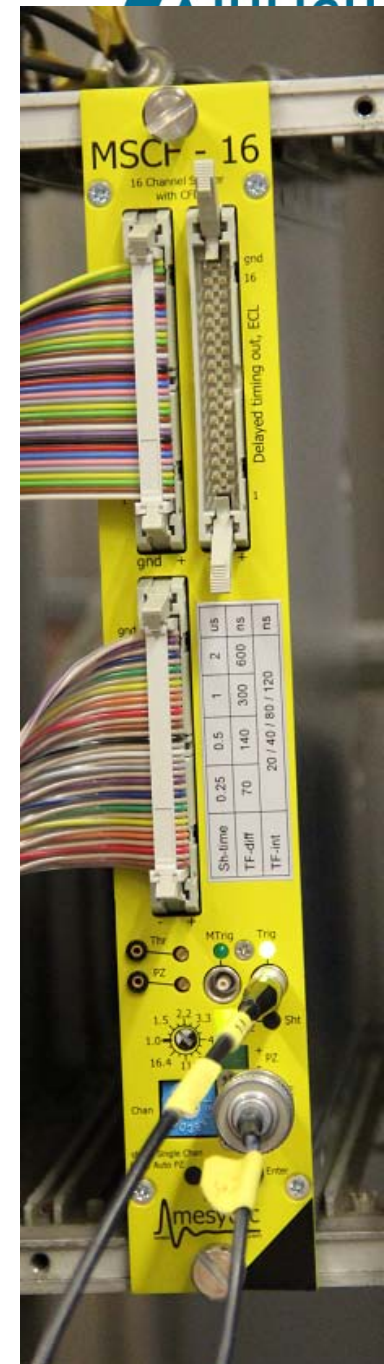
MPR1: for rear side

MSCF16: 16ch with LED output

MADC32: peak sensing ADC, input range and bit resolution selectable

Received:

- | | |
|------------|----------|
| | quantity |
| 1. MPR-16 | 12 / 12 |
| 2. MPR-1 | 5 / 5 |
| 3. MSCF-16 | 12 / 12 |
| 4. MADC-32 | 6 / 6 |



Achievements:

- All new required modules received

To do:

- Test with final setup

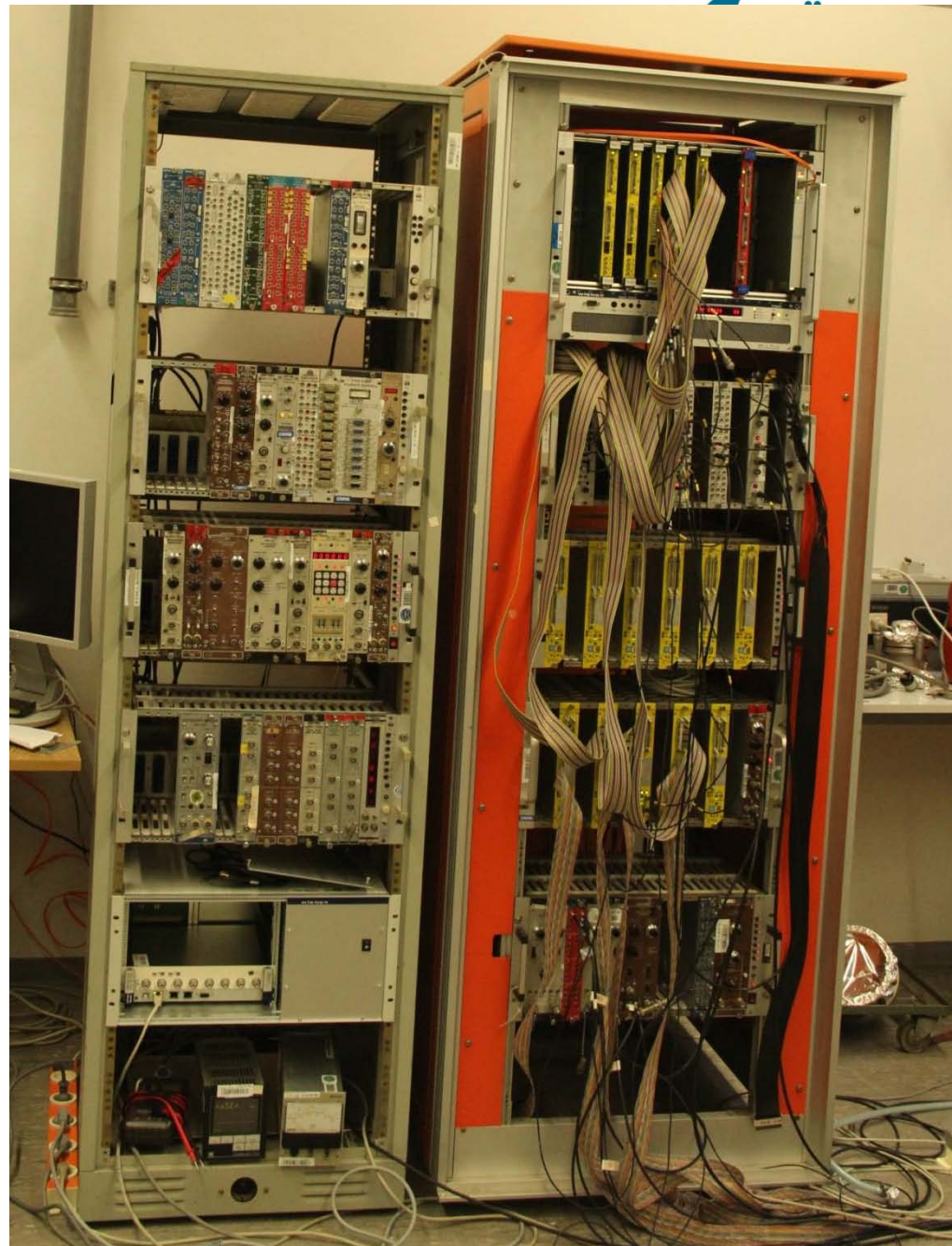
To be Received:	quantity
1. New NIM crates	2
2. Long cable set	14

Achievements:

- Crates, cables clarified and ordered
- Logic modules, NIM crates, rack

To do:

- Final assembly



Cables

Cabling in vacuum (between feedthrough and detector)

Signal (262 strips): 262 strips => 178 FEE channels (Kapton insulated)

HV: 4 stranded core single cable (Kapton insulated)

TempMon: 5 pairs twisted Kapton insulated cable

Heater: 1 pair twisted Kapton insulated cable



Cabling in air (between feedthrough and preamp)

Signal (178 channels): 178 channels

HV: 4 channels (SVH-MHV)

TempMon: 5 pairs twisted

Heater: 1 pair twisted



Achievements:

- Part of the cables have been made.

To do:

- Making the left cables

DAQ hardware:

- VME crate and 6 MAD32 + 1 CAEN V785

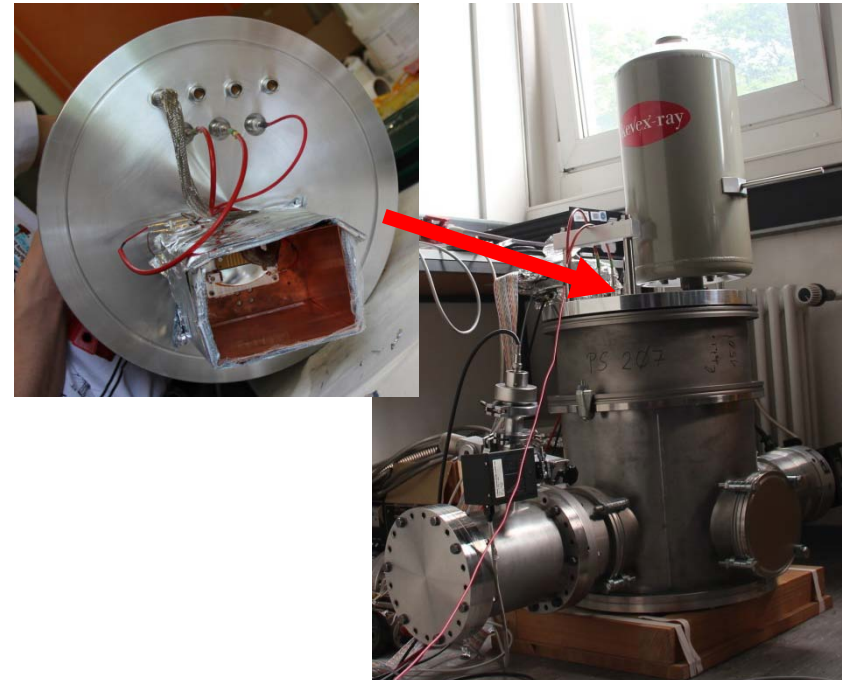
DAQ software:

- IRQ mode (under work)
- Time stamping (under work)
- Online display (step progress)



Test chamber with cooling:

- Old chamber has been contaminated
- New chamber is being built with coldhead



Achievements:

- Hardware are completed

To do:

- Code work for DAQ
- Better chamber for Ge test

Part 4: Cluster target

- The expected specification of existing cluster target at ANKE location has been verified by target operating group.
- The relevant change of the cluster target will be done together with the installation of recoil arm.

**Proposal to use the ANKE cluster target
has been accepted by ANKE collaboration!**

Achievements:

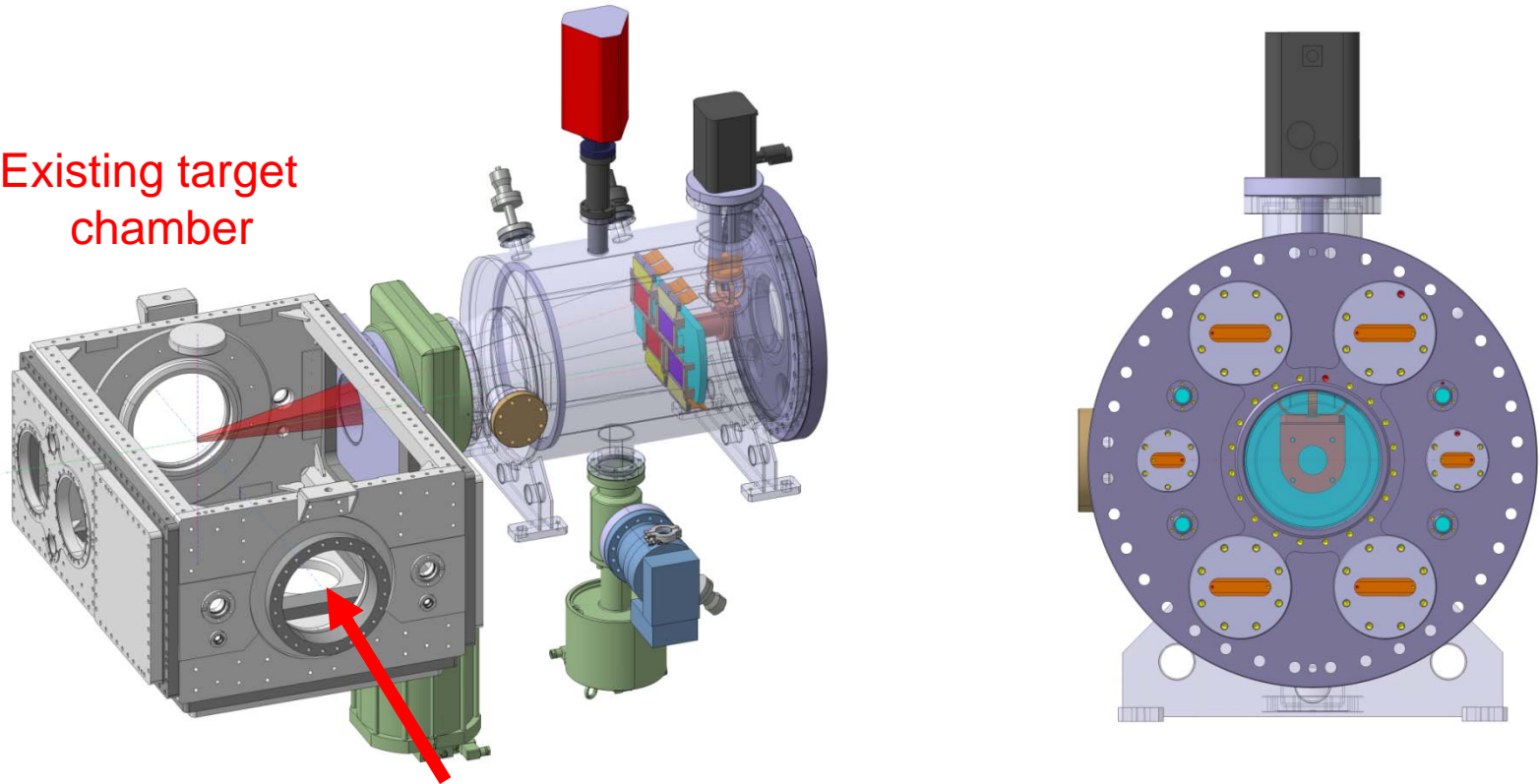
- **New collimator has been prepared**

To do:

- **Changing the collimator and test its spec**

Part 5: Detector chamber

Existing target chamber



- Construction will be finished by the end of January of 2013

Achievements:

- Construction of the chamber is ongoing at ZAT

To do:

- Fix the details for temperature sensor and heater on the cooling plate

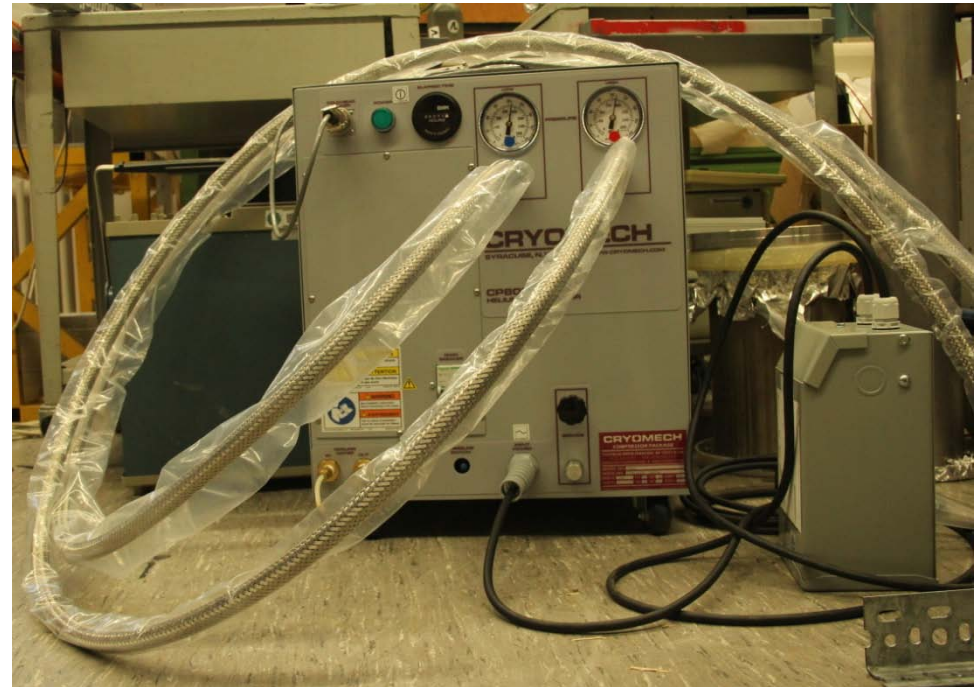
Part 6: Cooling and Temperature controller

Cooling for test chamber

- LN2 solution & coldhead

Cooling for experiment

- Coldhead has been received and tested (CRYOMECH)
- e.g. ~50K with 20 minutes running



Temperature controller

- Lakeshore 336 module is being tested and tuned.
- Heating function is working properly with PID control

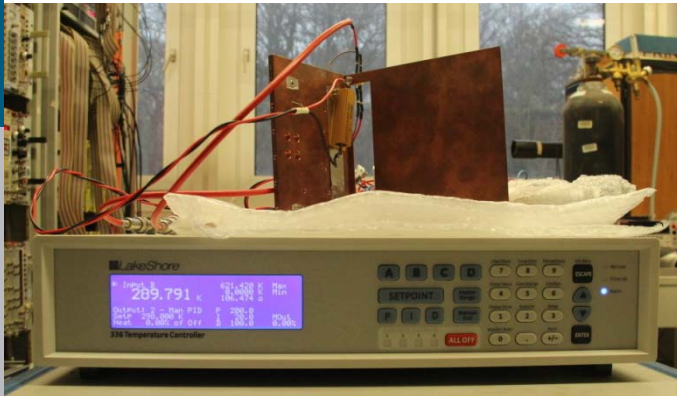
Achievements:

- The coldhead has been received and tested
- Heating resistor has been ordered and tested for outgas

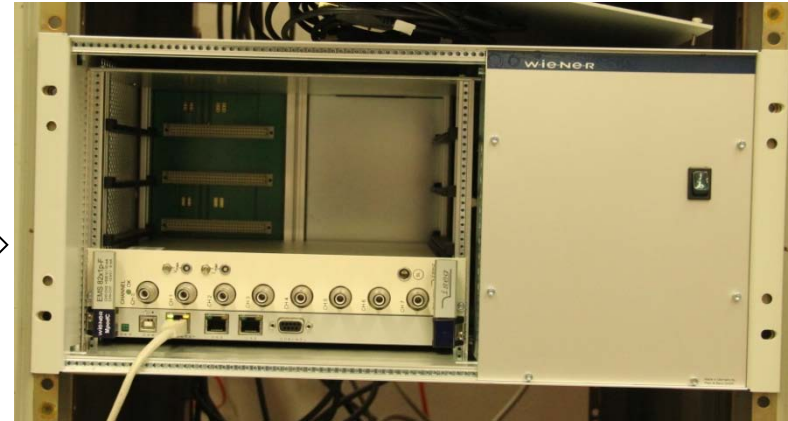
To do:

- Operate coldhead with detector and temperature controller

Part 7: HV and Accessories



Relay changes the active status of HV



Temperature controller

- Temperature monitor, 4 channels
- Safety loop of over-temp

Achievements:

- Hardware is complete
- Remote control of HV module

To do:

- Implement over-temp safety loop
- Test the remote control

HV module:

- 8ch with 4ch 500V & 4ch 2000V
- High precision, e.g. 100pA
- Safety loop protection, i.e. 5-20mA

Crate:

- Mini Mpod (4 slots)
- Versatile accessing interfaces

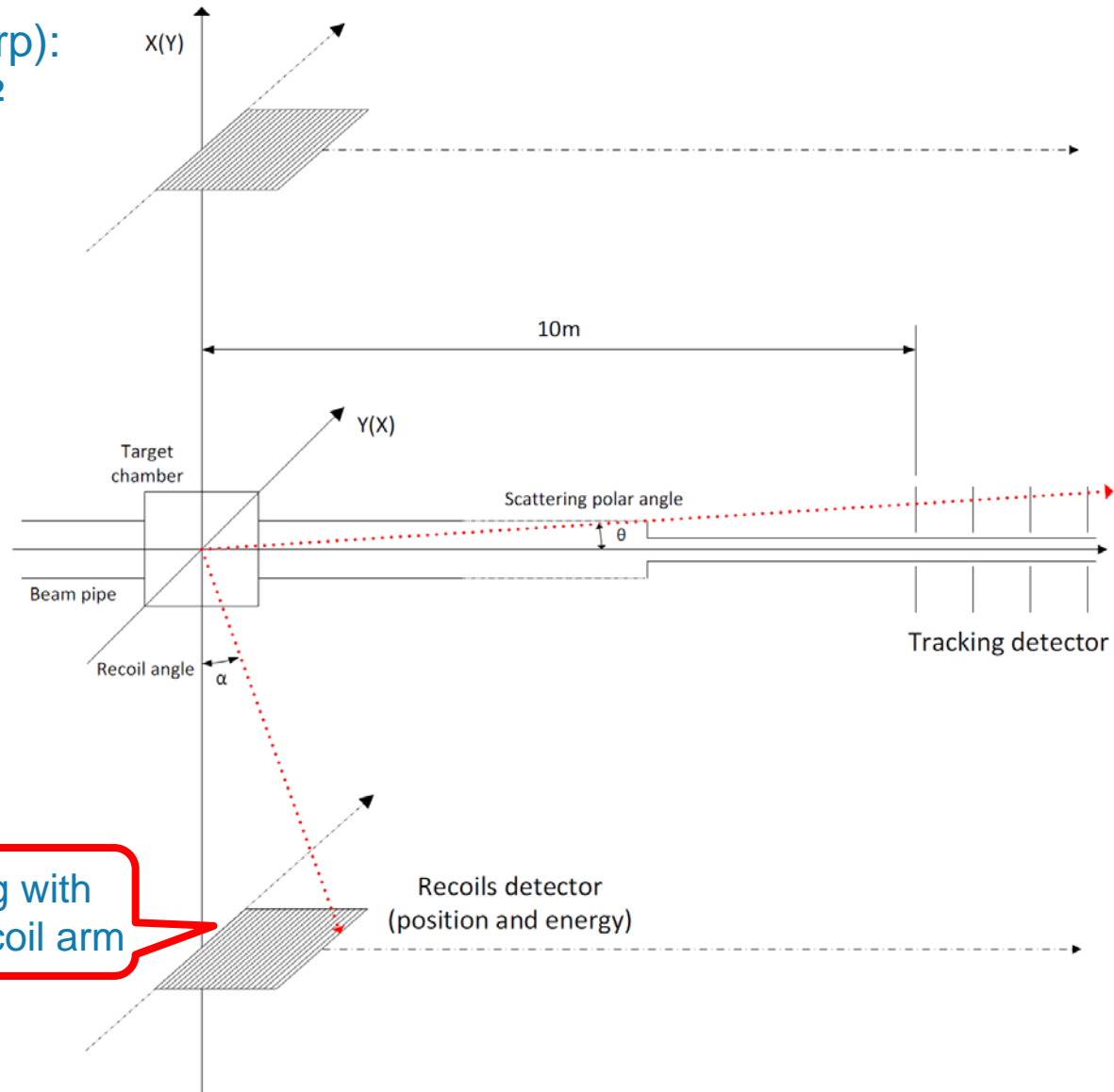
General Topics

- **Infrastructure at site (to be fixed in Oct.)**
 - Power supply (**available**)
 - Space to put FEE rack (**fixed**)
 - Space to put coldhead compressor (**to be found in tunnel**)
 - Cooling water for coldhead compressor (**existing**)
 - Ventilation status at site (**Rack will be outside of tunnel**)
- **Installation schedule**
 - Target modification (after ANKE experiemnt)
 - Day-1 chamber installation (during COSY pause)
 - Pumping time requested
- **Slow control system for day-1 setup**
 - Pumps (integrated into COSY slow control system)
- **Beam time window**
 - May. 13 – Jul. 13 (still pursuing this time window)

Thanks for your attention!

Sketch of day-one experiment

Large t-range (pbarp):
0.0008-0.1 GeV²



Performance evaluation with pure elastic events

Setting for event generator(DPM):

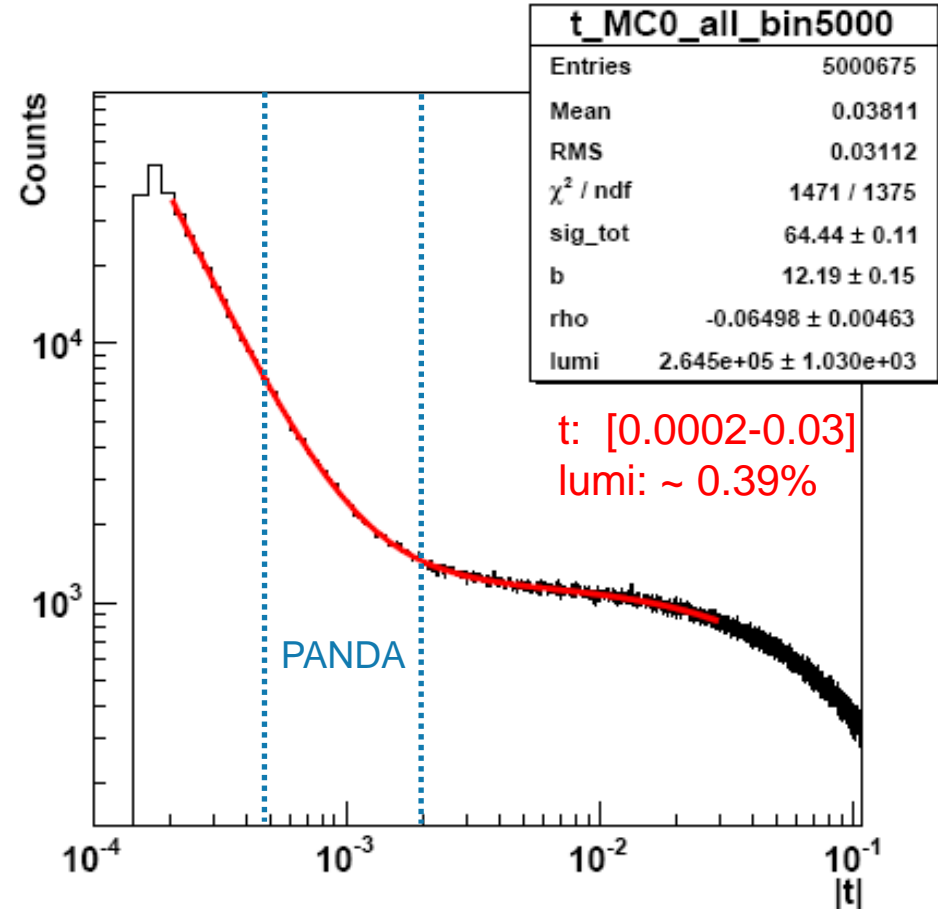
P_{lab} : 6.2 GeV/c, pure elastic events
 Θ_{min} : 0.113° (~1.98mrad)
 Events : 5M
 Parameters : $\sigma_{\text{el}} = 18.97\text{mb}$, $\sigma_{\text{tot}} = 64.50\text{mb}$,
 $b = 11.89(\text{GeV}/c)^{-2}$, $\rho = -0.063$

$$\frac{dN}{dt} = L \left(\frac{d\sigma_c}{dt} + \frac{d\sigma_{\text{int}}}{dt} + \frac{d\sigma_n}{dt} \right)$$

$$\frac{d\sigma_c}{dt} = \frac{4\pi\alpha^2 G^4(t)(\hbar c)^2}{\beta^2 t^2}$$

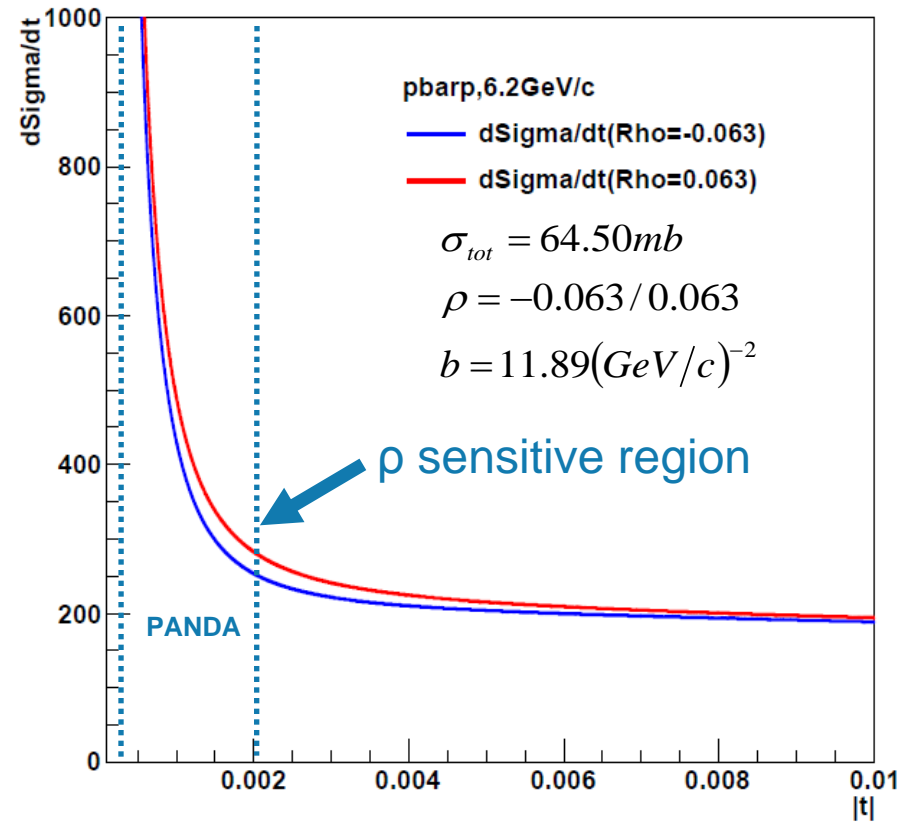
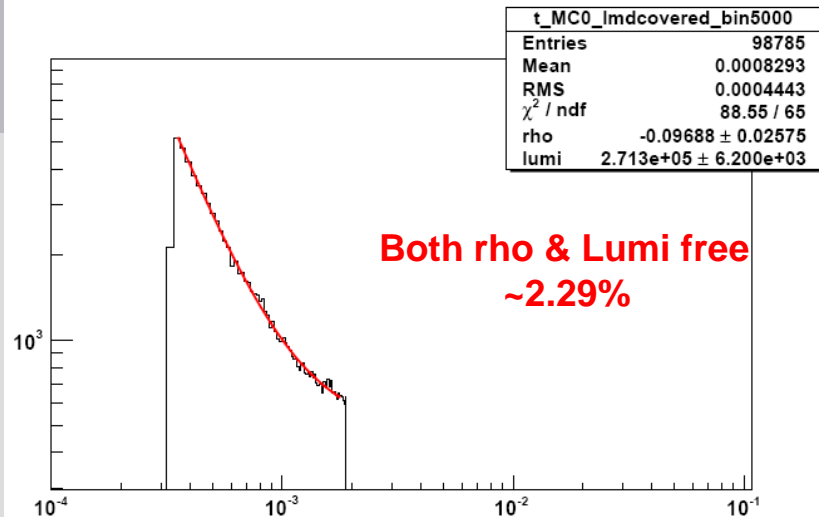
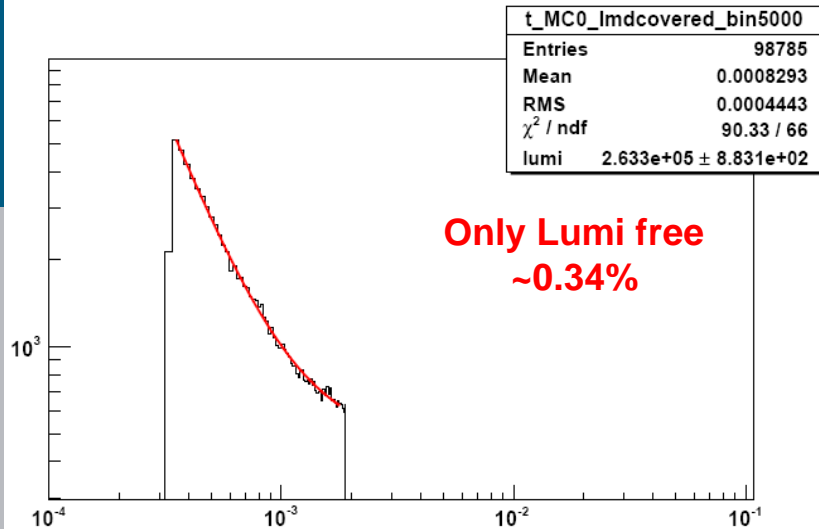
$$\frac{d\sigma_n}{dt} = \frac{\sigma_T^2 (1 + \rho^2) e^{-b|t|}}{16\pi(\hbar c)^2}$$

$$\frac{d\sigma_{\text{int}}}{dt} = \frac{\alpha\sigma_T G^2(t)(\hbar c)^2}{\beta|t|} e^{-\frac{1}{2}b|t|} (\rho \cos\delta + \sin\delta)$$



The measurable t is limited to a small range!

Parameters correlation



Fixing the parameters is needed to determine the absolute luminosity!

Parameters determination

Typical parameterization

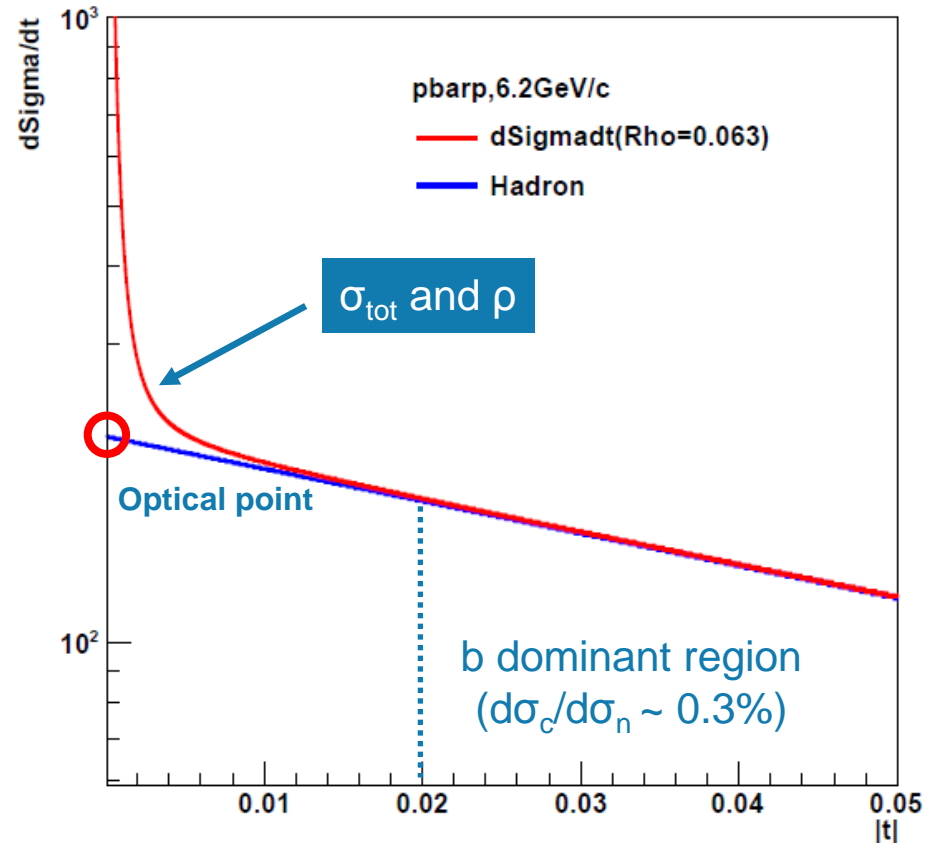
$$\frac{1}{L} \frac{dN_{el}}{dt} = \frac{d\sigma}{dt} = \frac{d\sigma_c}{dt} + \frac{d\sigma_{int}}{dt} + \frac{d\sigma_n}{dt}$$

Optical theorem

$$\sigma_{tot}^2 = \frac{1}{L} \frac{16\pi}{1+\rho^2} \left. \frac{dN_{el}}{dt} \right|_{t=0} \quad \Rightarrow \quad \frac{1}{L} = \frac{\sigma_{tot}^2 (1+\rho^2)}{16\pi \left. \frac{dN_{el}}{dt} \right|_{t=0}}$$

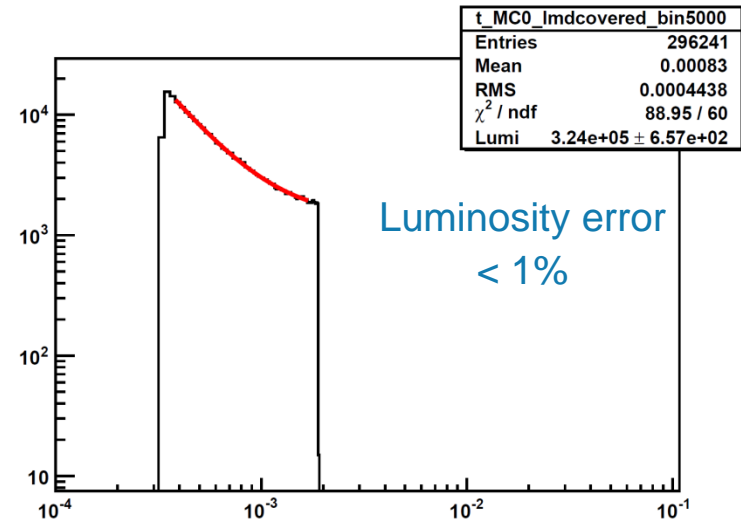
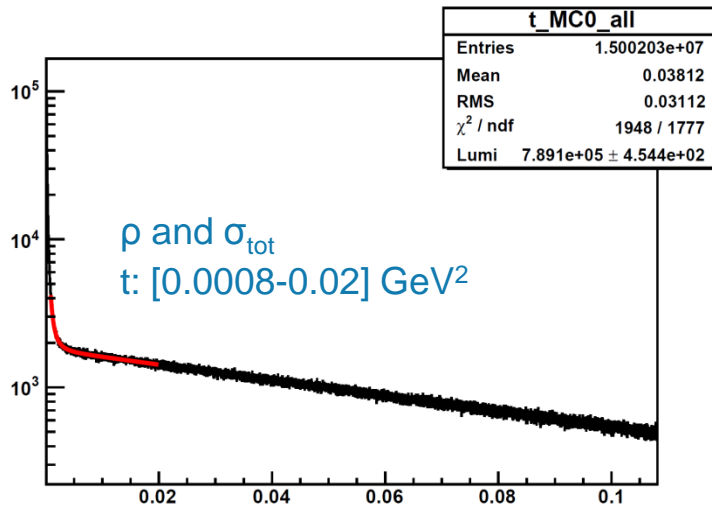
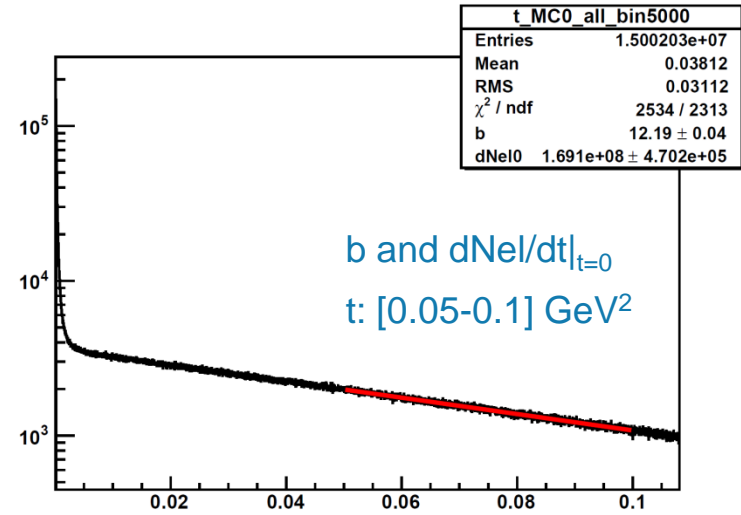
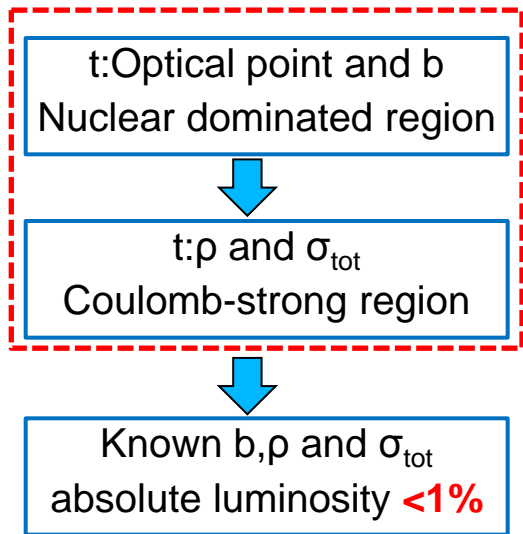
Parameterization for slope b

$$\frac{d\sigma_n}{dt} = A e^{bt} \quad \text{for } |t| < 0.8 \text{ GeV}^2, \text{ moderate energies (5-30 GeV)}$$



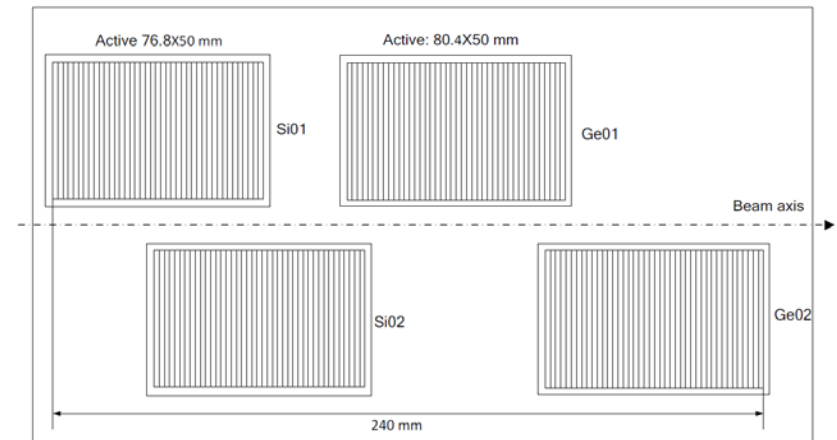
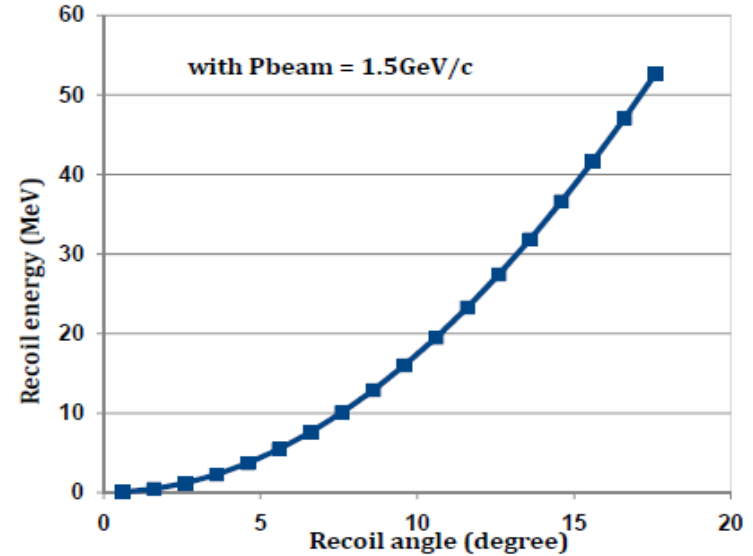
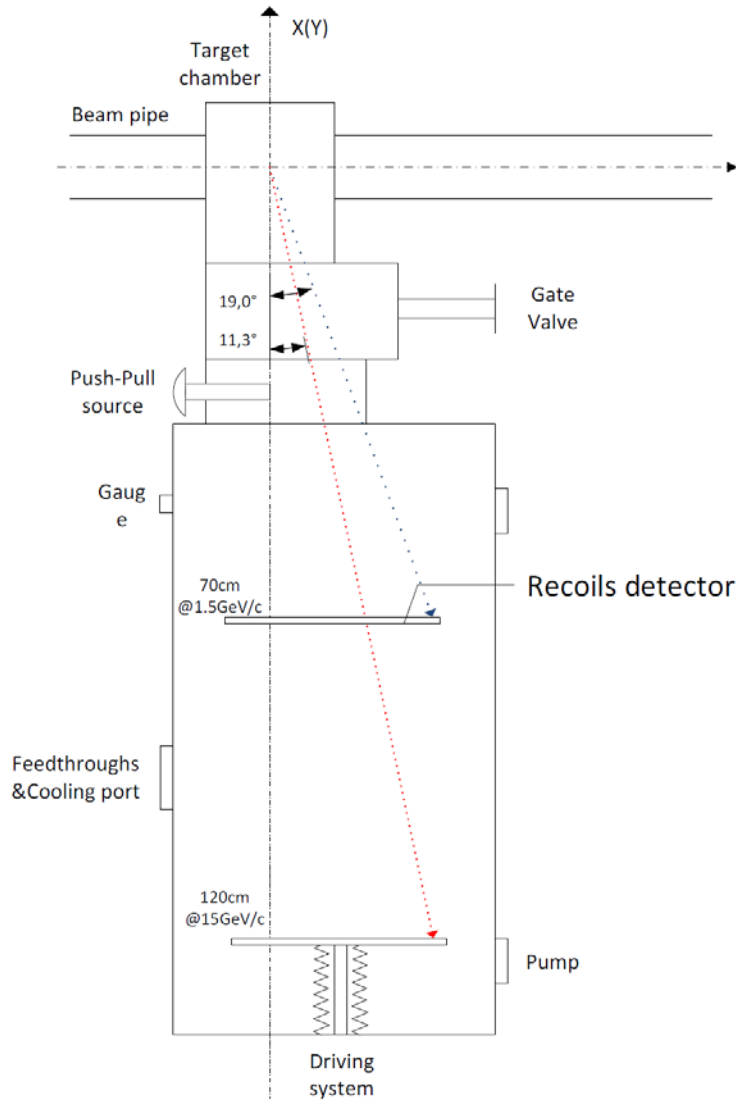
Luminosity independent analysis is feasible!

How large t-range?



Expected t range : 0.0008 – 0.1 GeV²

Sketch of recoil arm



Fixed plane for commissioning

- 2 Si : 7.68cm x 5cm x 1mm (64ch, 1.2 mm pitch)
- 2 Ge: 8.04cm x 5cm x 4 & 10mm (67ch, 1.2mm pitch)