

Silicon Detector with a Dipole Magnet

Effective charge state of ions in Gas in 2 - 9 MeV

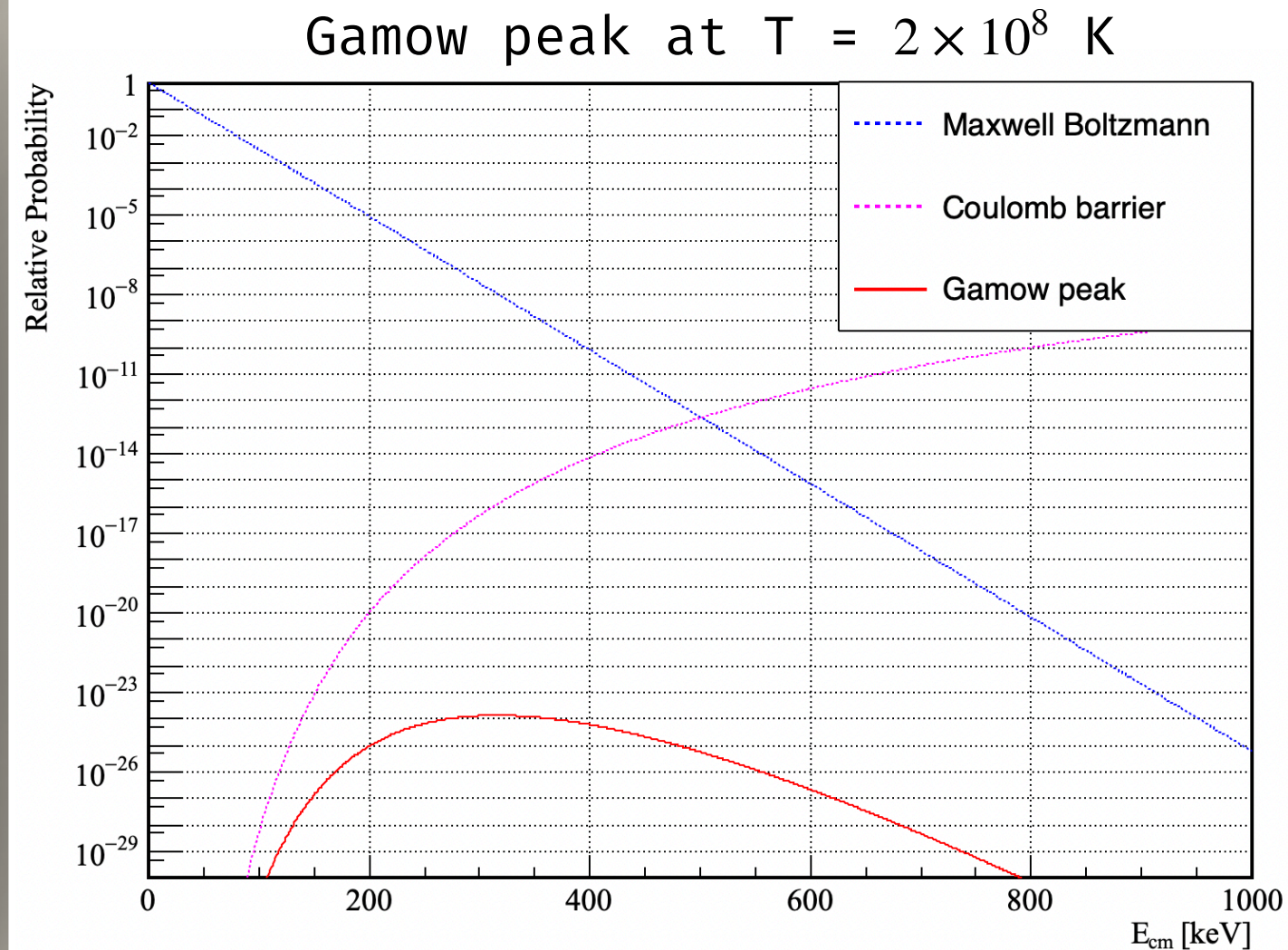
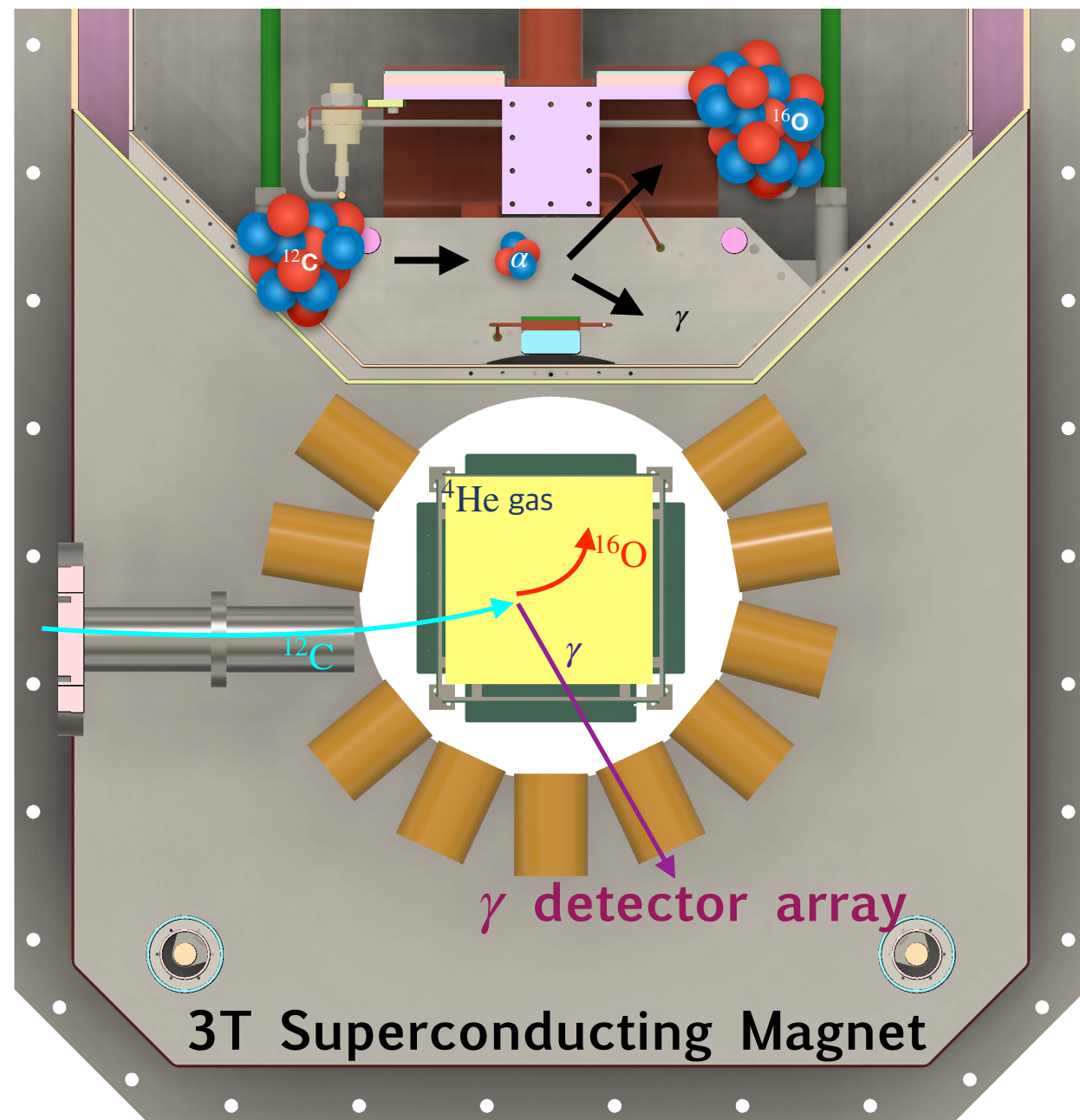
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COREA Experiment

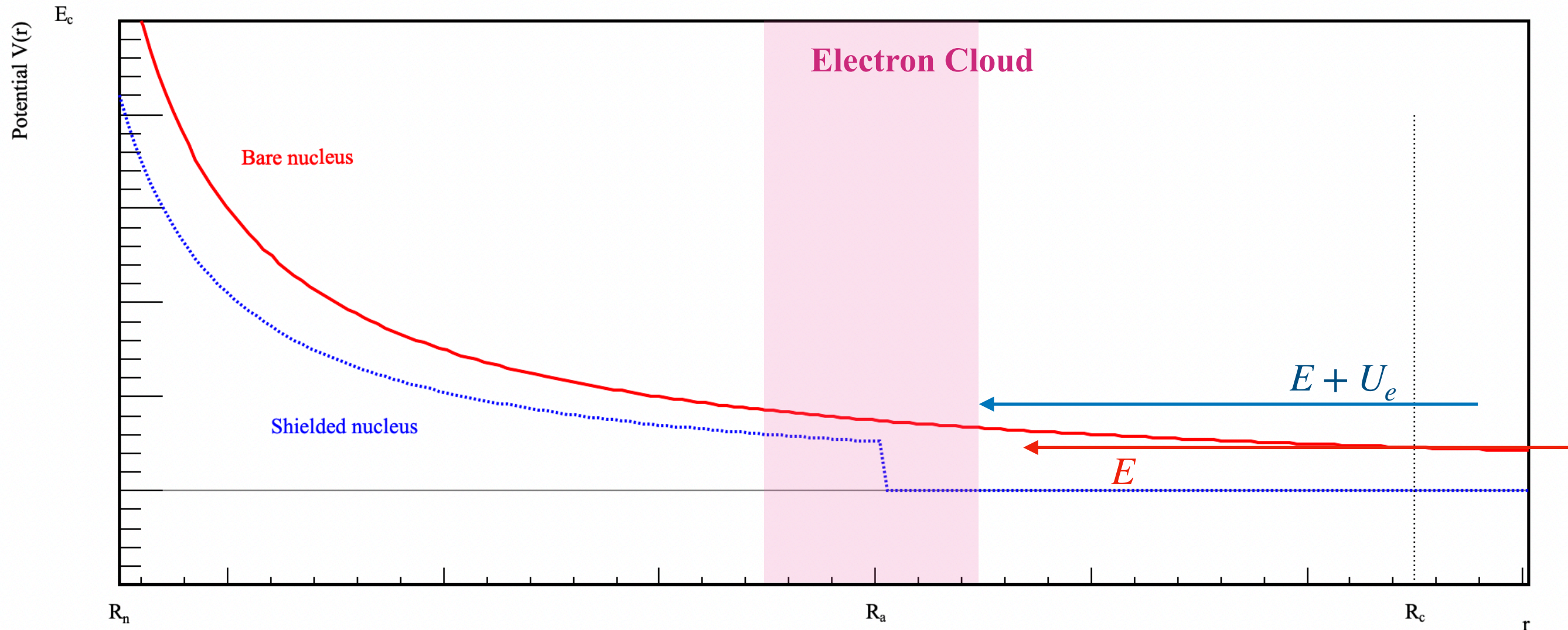
Carbon **O**xygen **R**eaction **E**xperiment with **A**ctive target TPC

^{12}C Beam ($E_k < 10\text{ MeV}$) with ^4He active gas target



Precise experimental determination of $^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ cross section at low energies are necessary

Effects of Electron Screening



Understanding of effective charge
is necessary to yield exact cross section

$$f(E) = \frac{\sigma_s(E)}{\sigma_B(E)} = \exp\left(\pi\eta\frac{U_e}{E}\right)$$

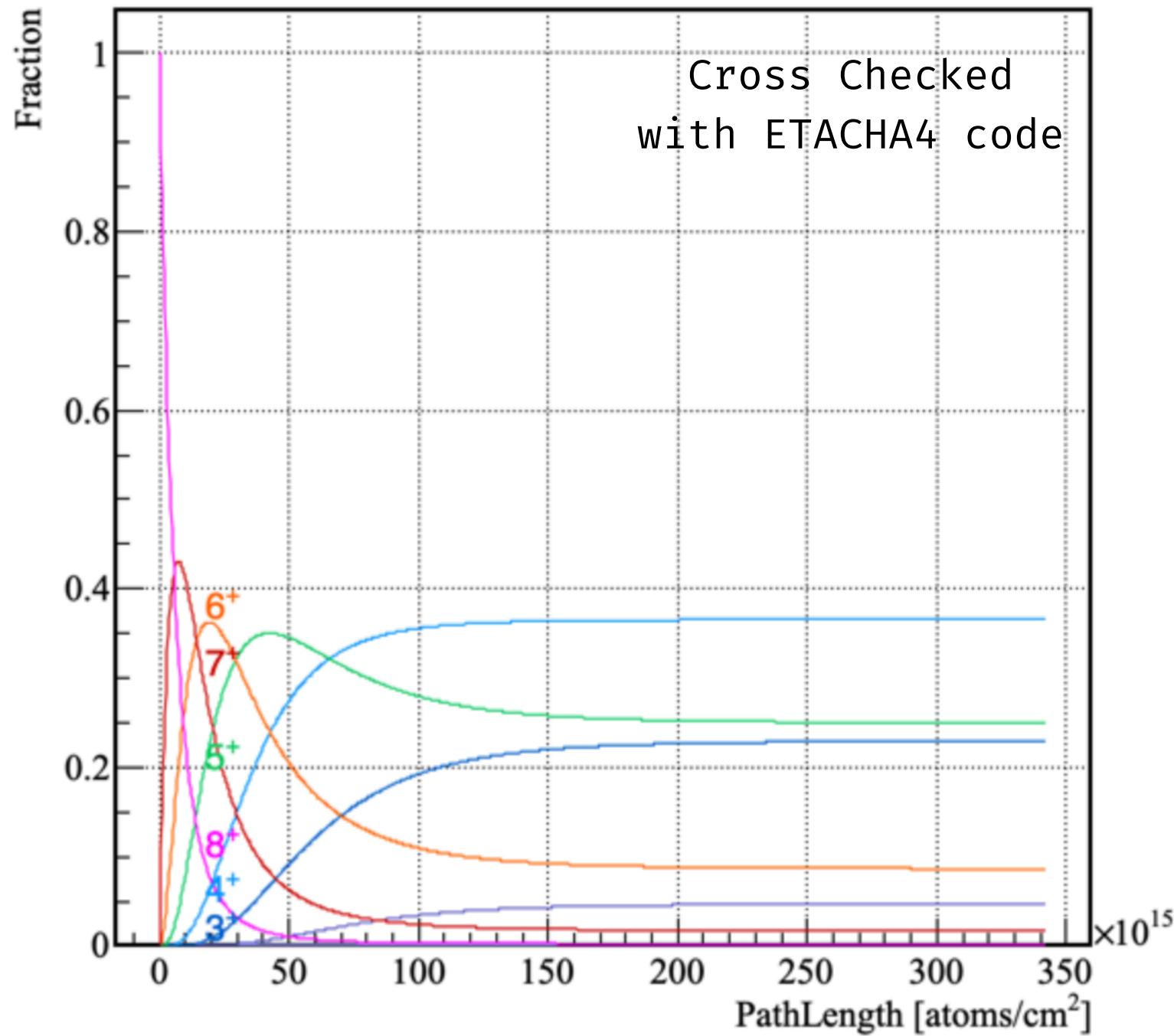
$$E/U_e \simeq 1000 : f_{12}\text{C}_{+\alpha} = 1.007$$

$$E/U_e \simeq 100 : f_{12}\text{C}_{+\alpha} = 1.25$$

H.J. Assenbaum and K. Langanke Z. Phys. A - Atomic Nuclei 327, 461 468 (1987)

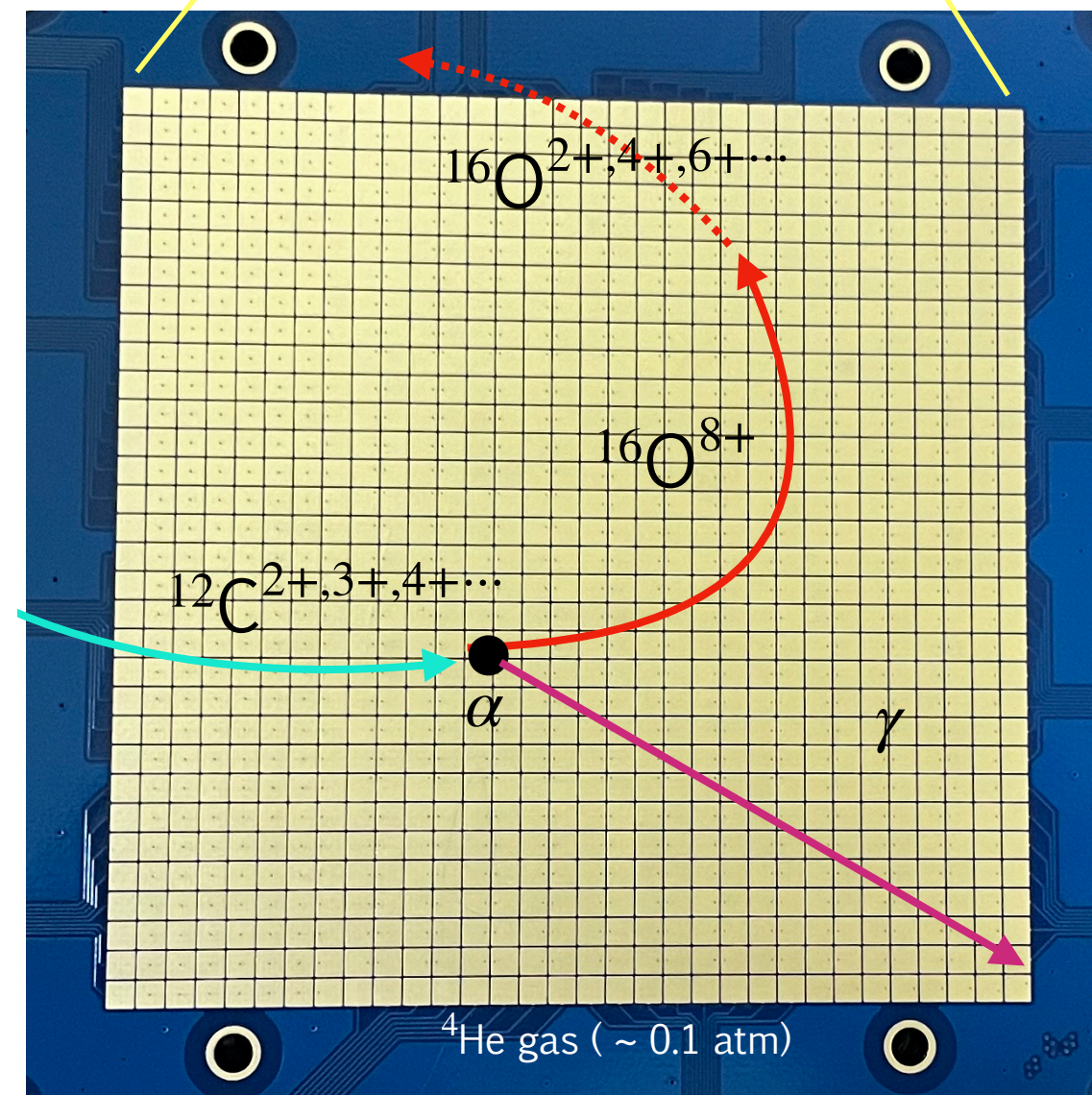
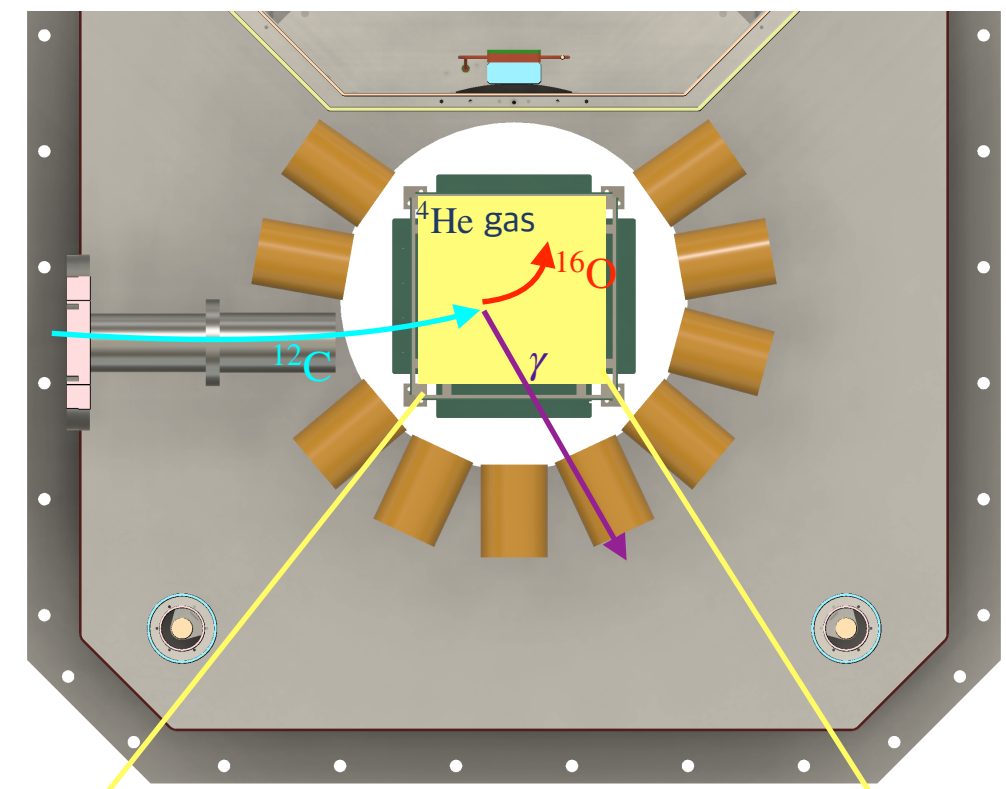
Charge Evolution in ATTPC

^{16}O charge evolution in 0.1 atm P10 gas



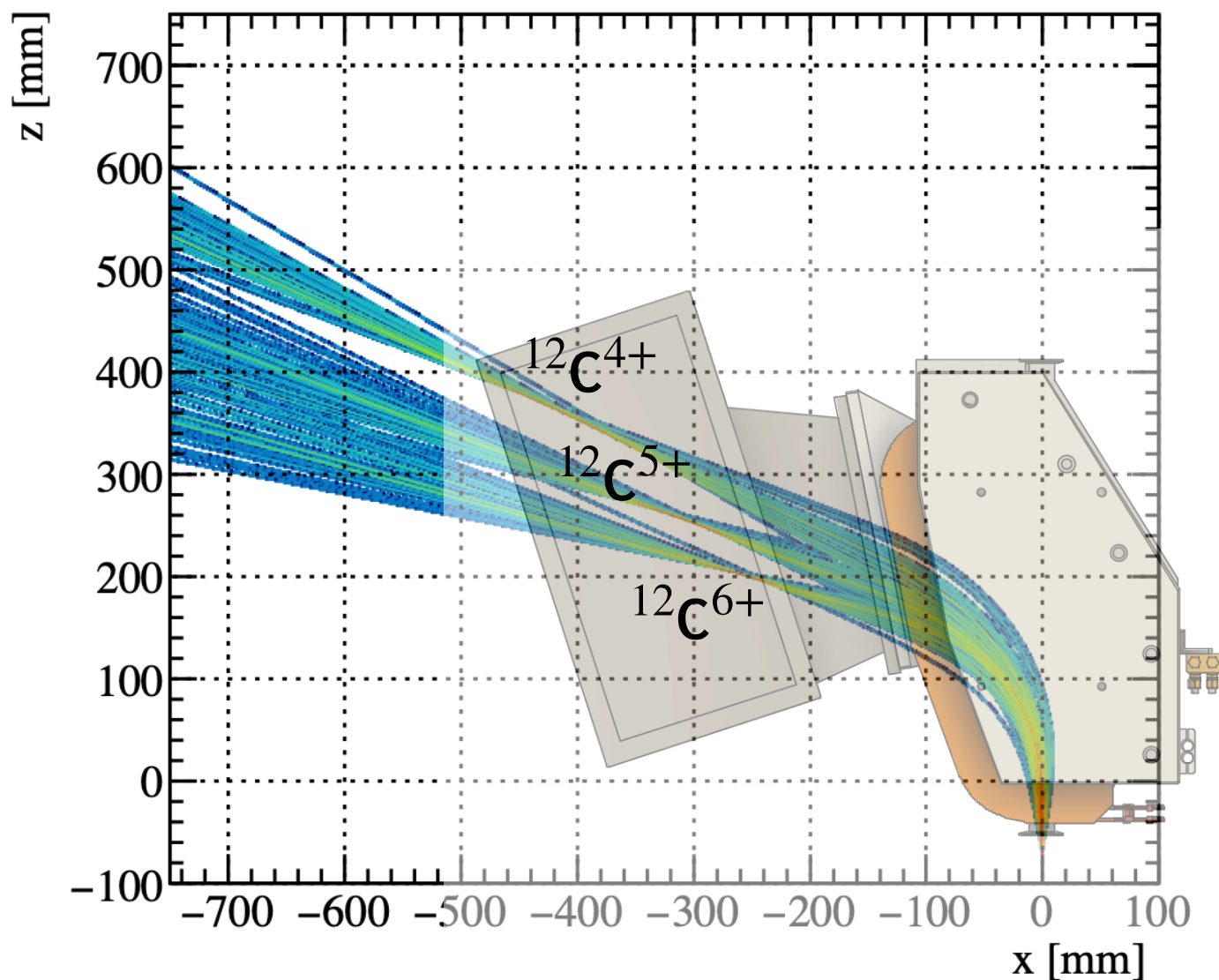
$$\sigma_q^{\text{cap}}(E_k) = 2\pi a_0^2 Z_T^{2/3} q^{2.5} \left(\frac{v_0}{v_k} \right)^5$$

$$\sigma_q^{\text{loss}}(E_k) = \pi a_0^2 Z_T^{2/3} \frac{1}{q} \frac{v_0}{v_k},$$

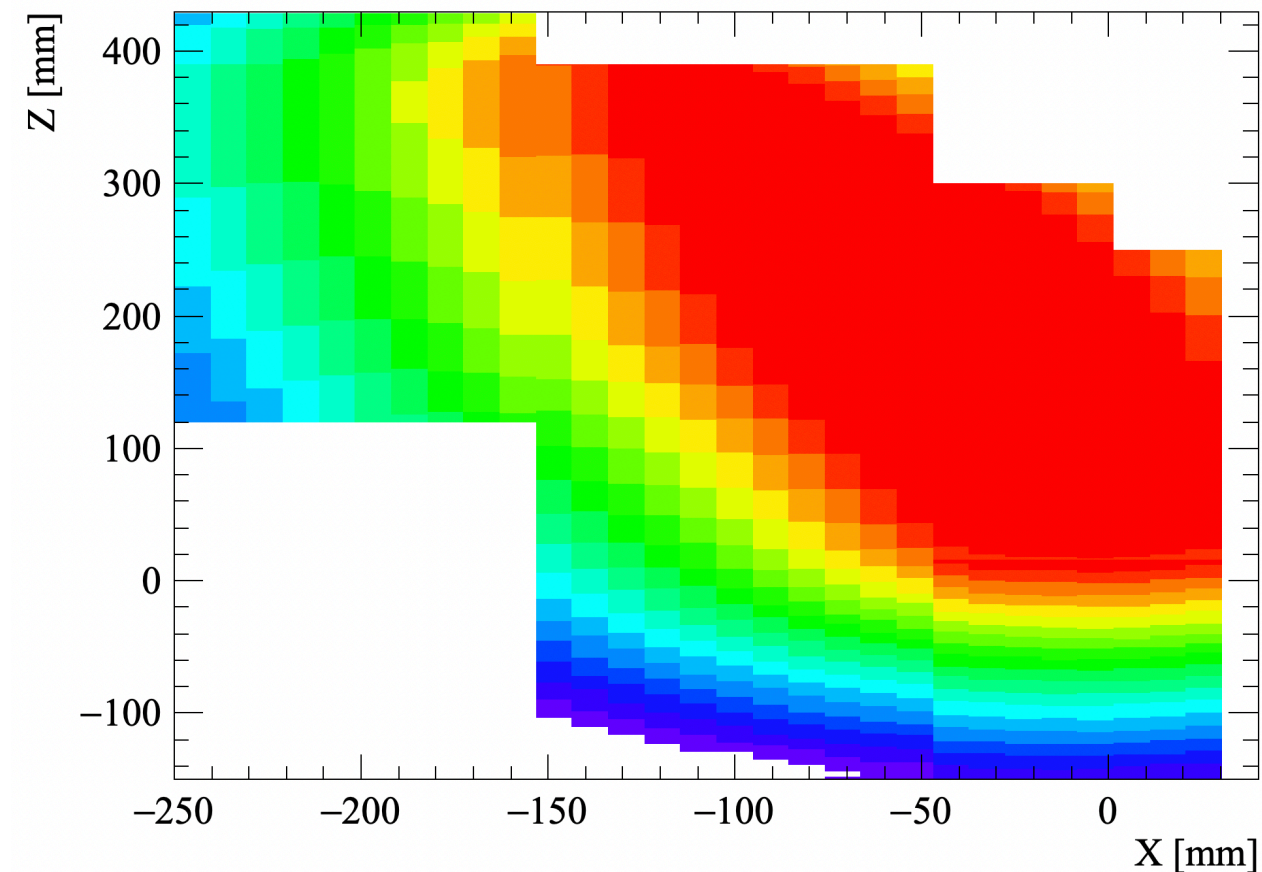


1.2 T Spectrometer System

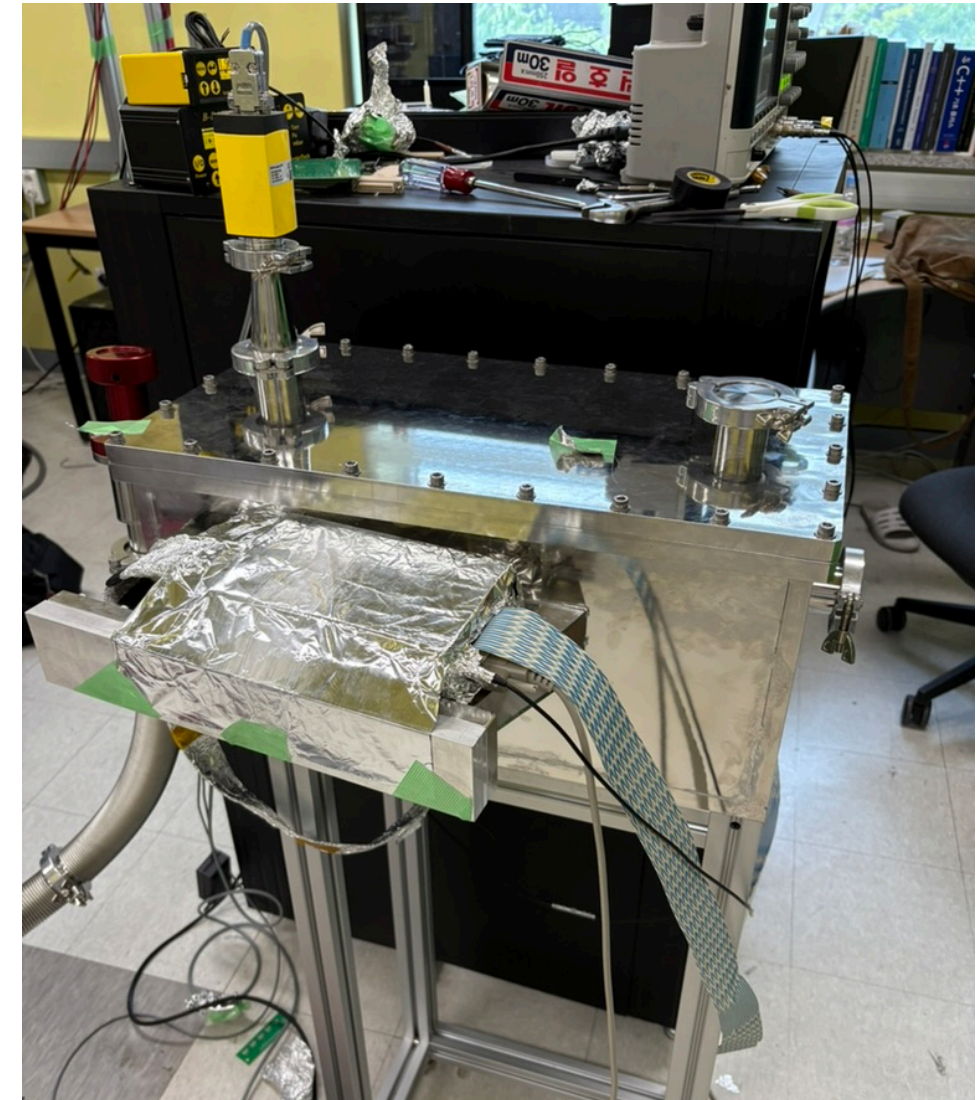
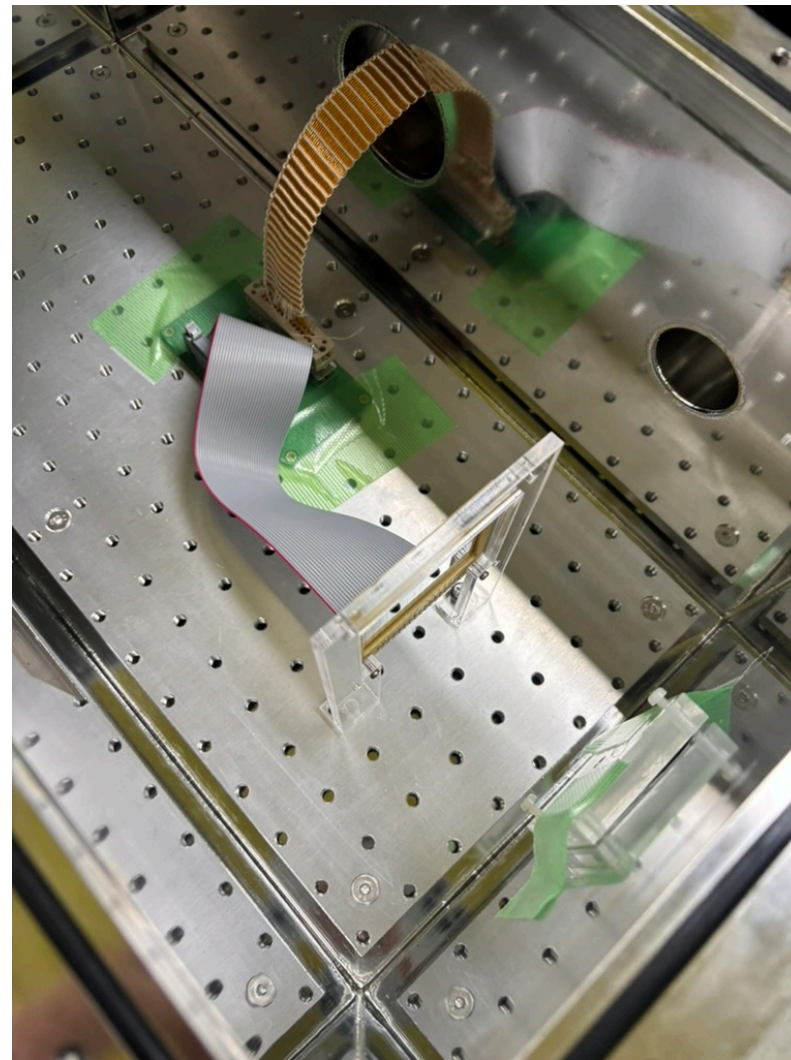
Dipole magnet up to 1.2 T is prepared



For CSD measurement,
spatial and energy informations are
necessary : **Silicon Detectors**



Bench Test Setup



Two W1(SS) SSD detectors will be installed

Thickness : Single Sided, 400 μm , 3.1mm pitch 16 strips

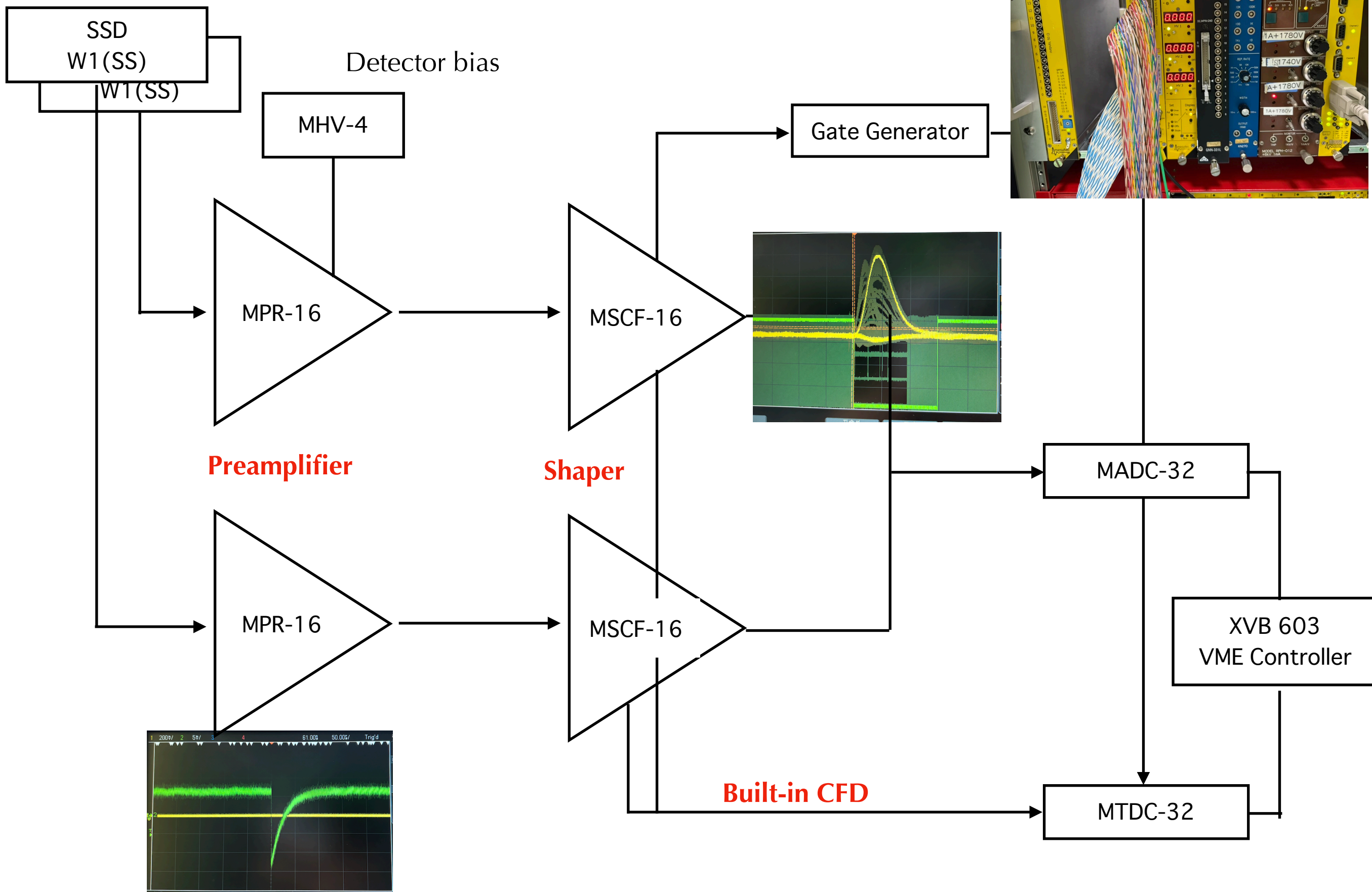
Chamber was also manufactured to accommodate SSSD

Stand-alone, or with 1.2 T dipole magnet

^{241}Am Alpha source tests and corresponding Geant4 simulations are ongoing

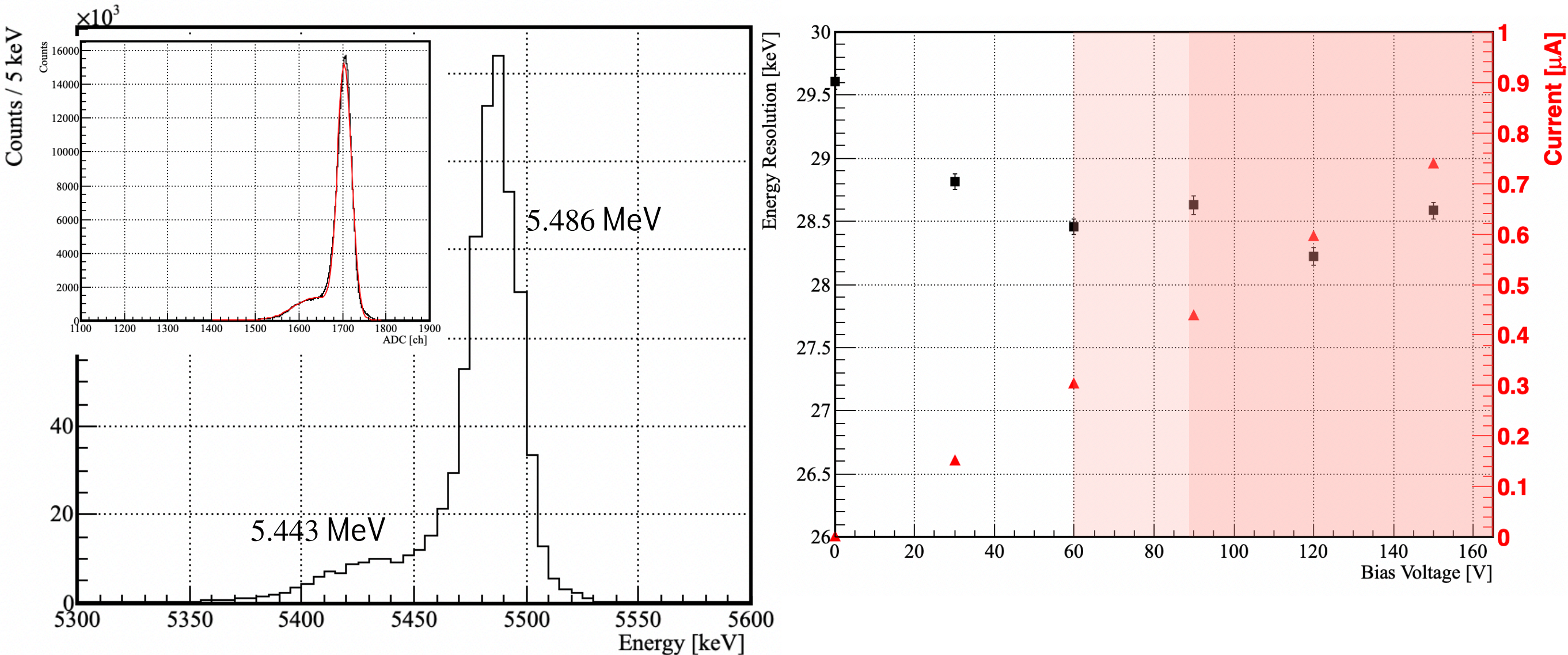
Average vacuum pressure : $\sim 10^{-5}$ Torr

Electronics



Performance Test Result with ^{241}Am

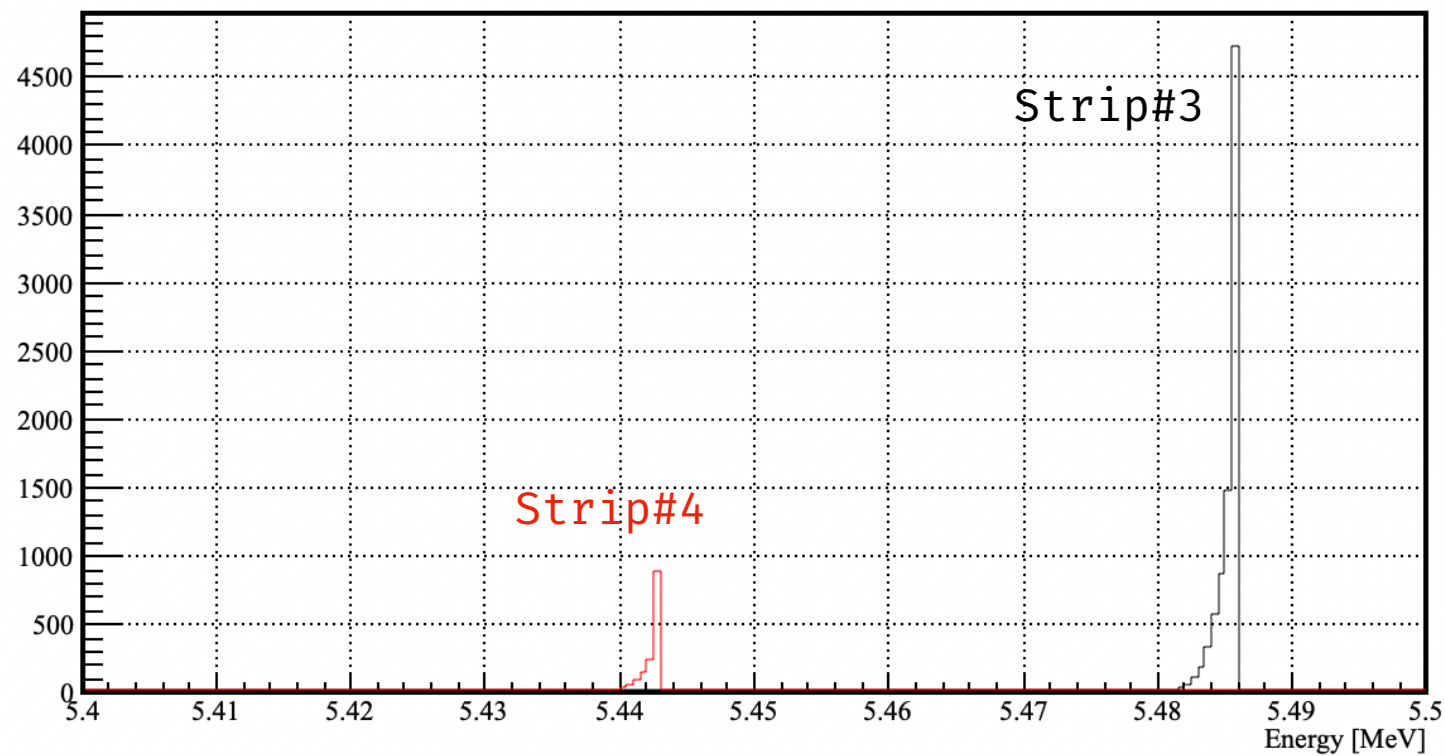
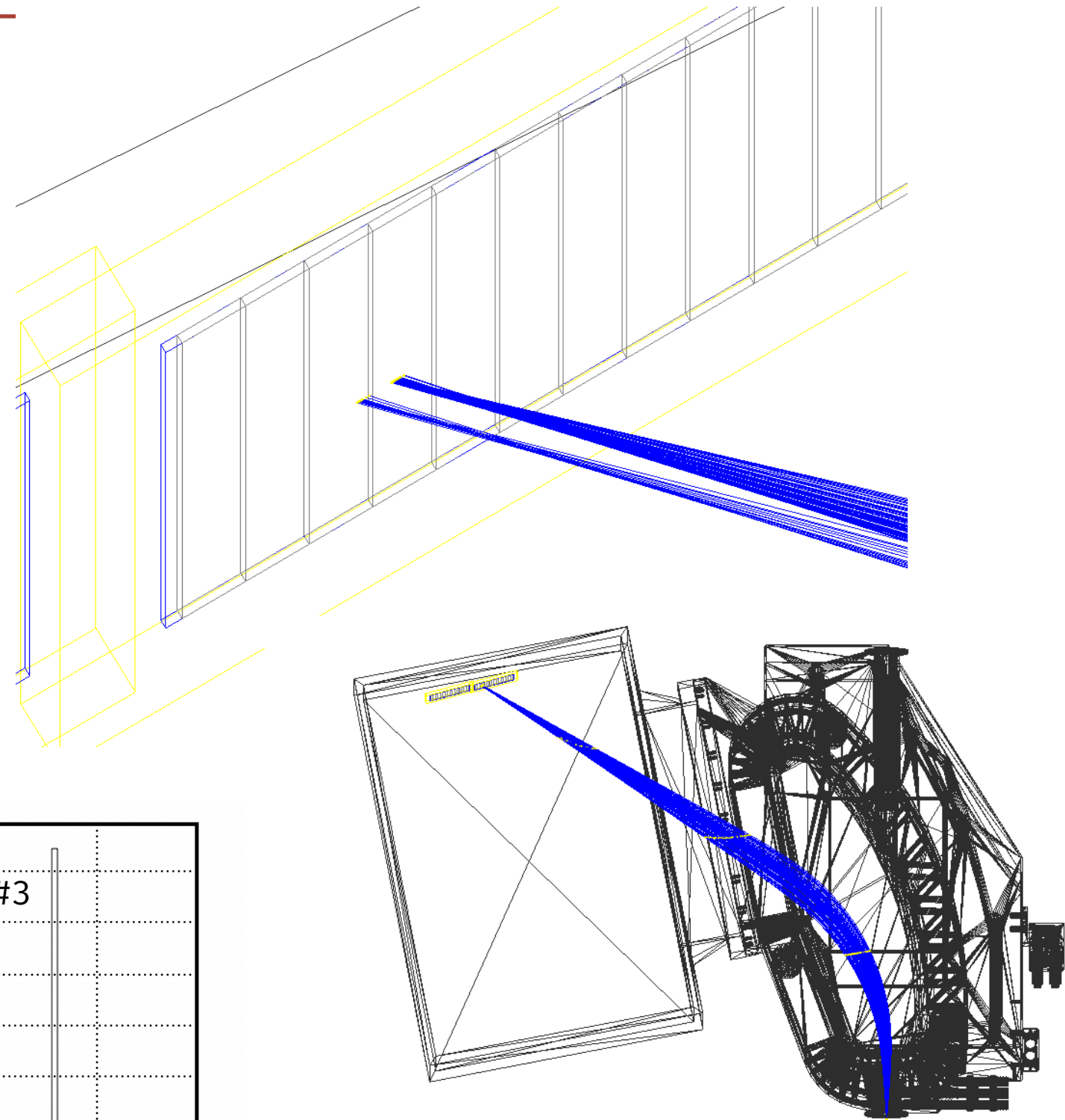
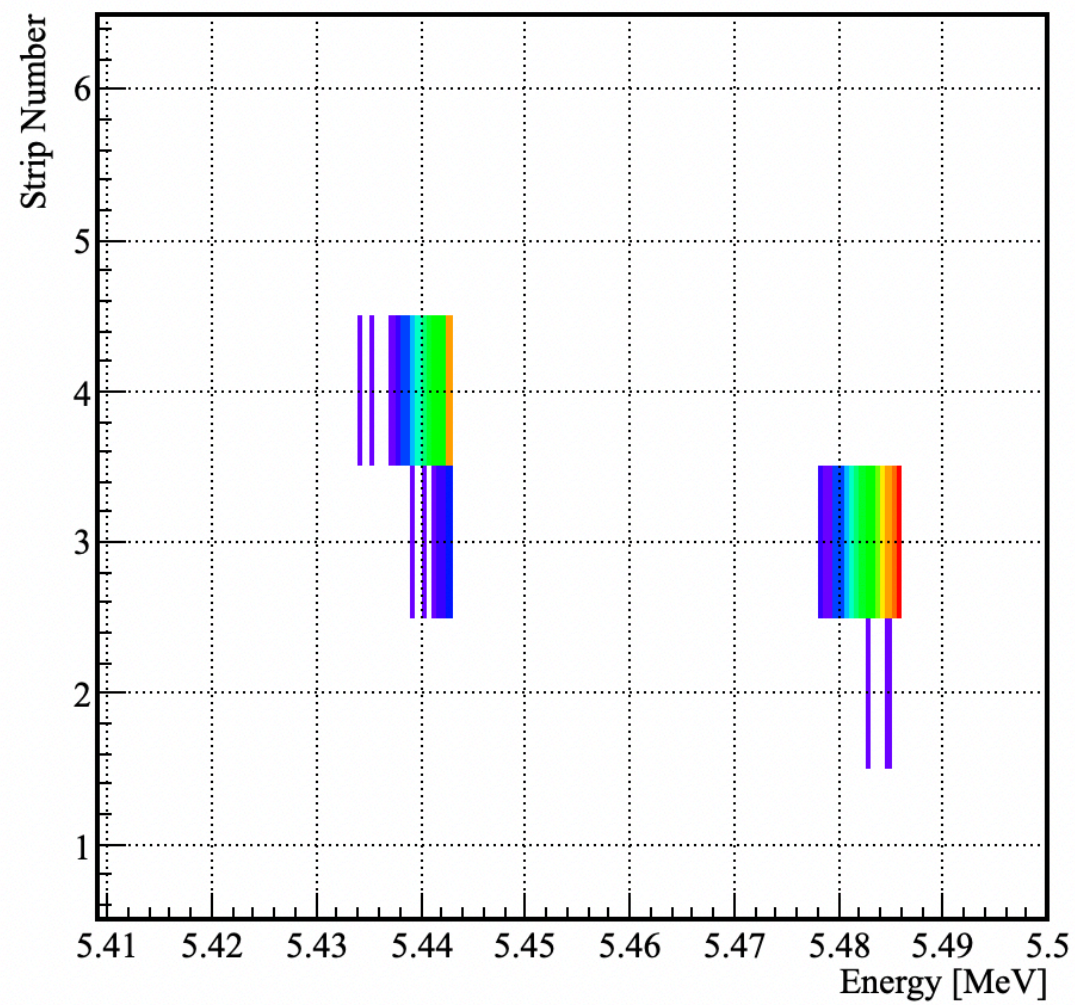
Basic performance test was done for each SSDD



Energy Resolution (FWHM) :
~ 24 keV for 5.486 MeV α particle from ^{241}Am

Full depletion : ~ 60 V (~ 90 V from manufacturer)

^{241}Am Dipole Magnet Simulation



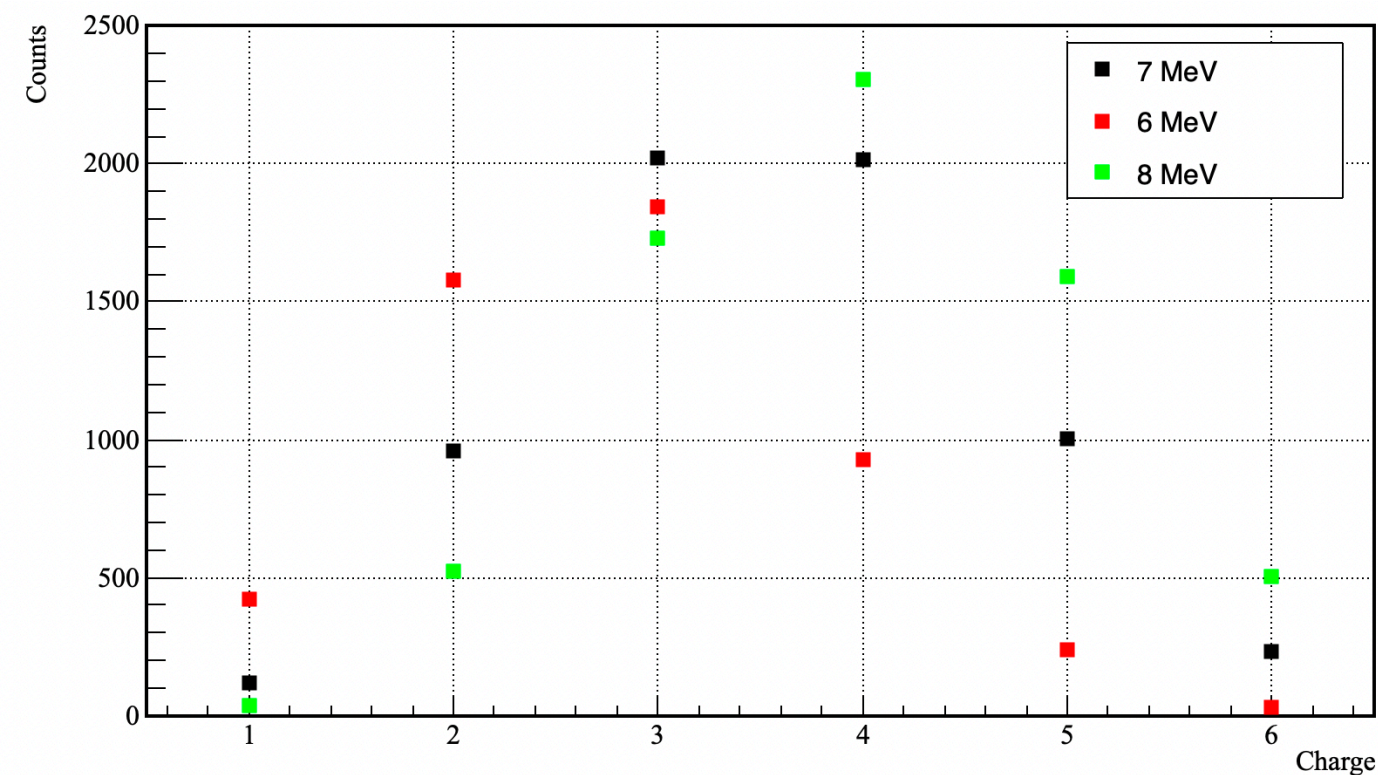
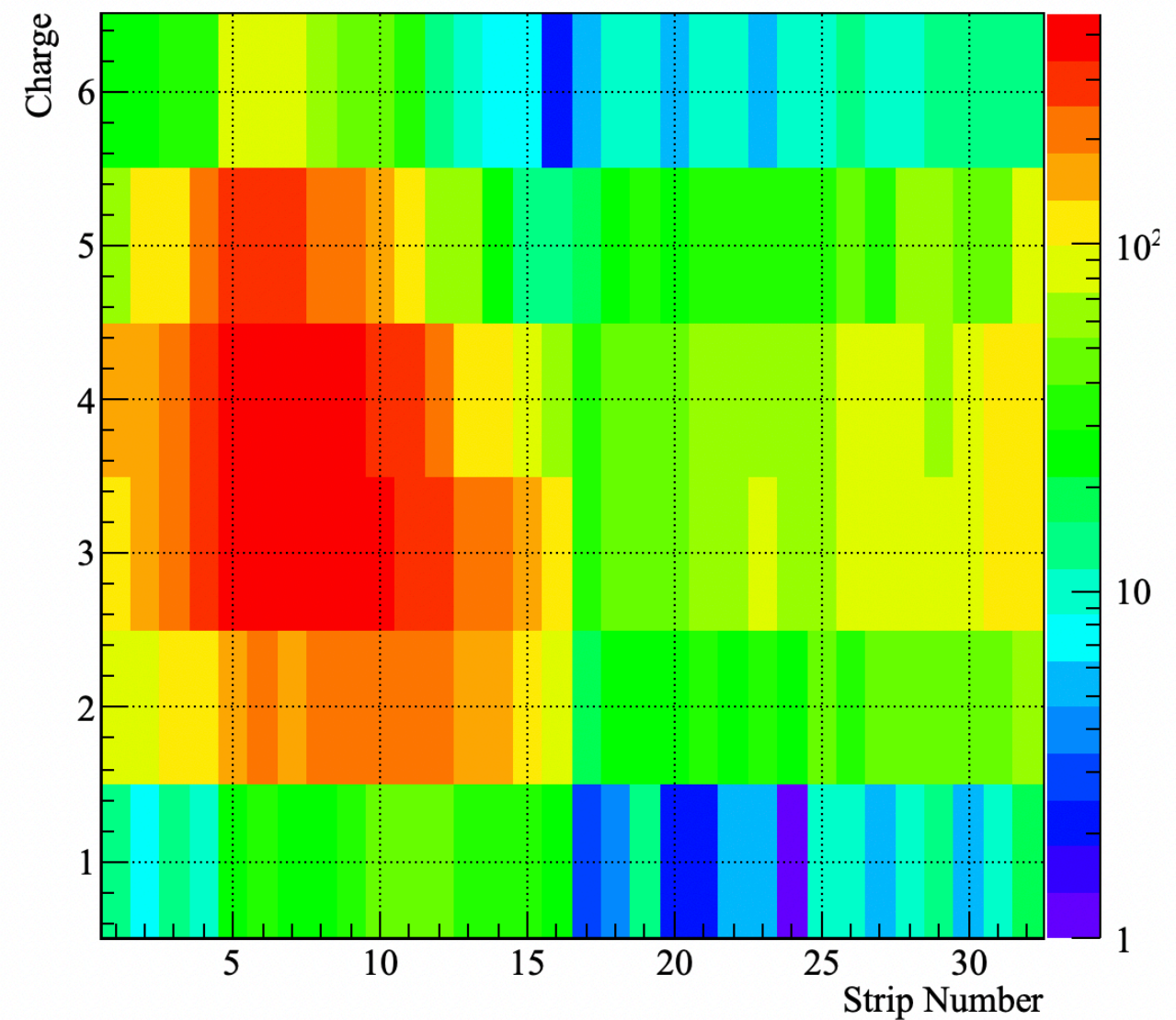
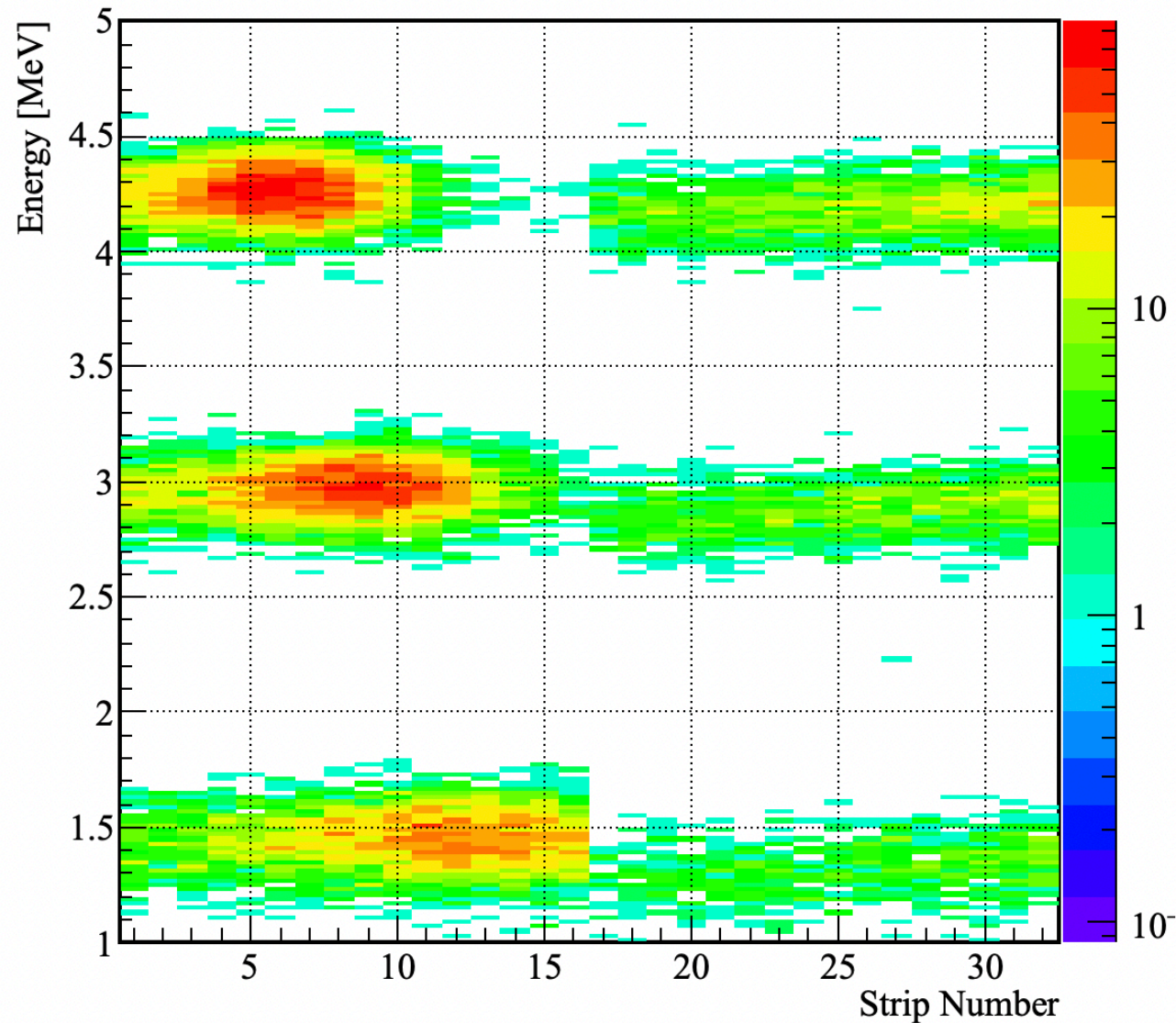
Average vacuum pressure :
 $\sim 10^{-5}$ Torr

GEANT4 Simulation

0.1 atm P10 gas

Focal Plane : Set to 3+ (Adjustable)

Incident Ion : $^{12}\text{C}^{6+}$, 6 MeV, 7 MeV, 8 MeV



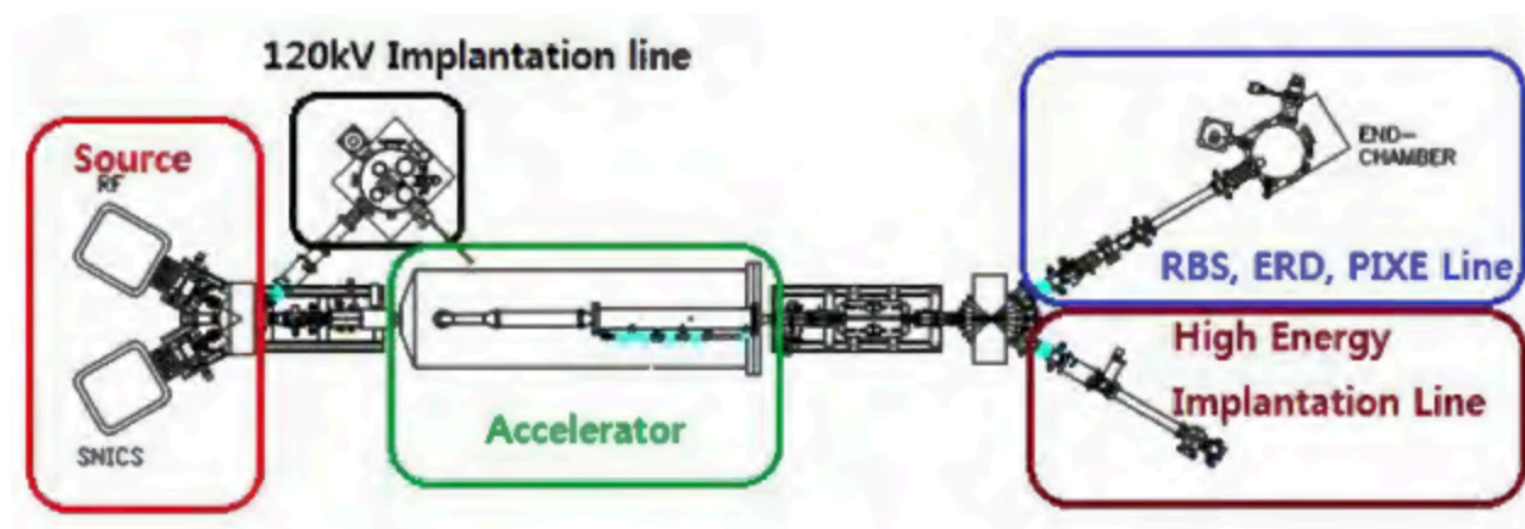
More studies are ongoing

Differing energy, focal plane..

Future Plans

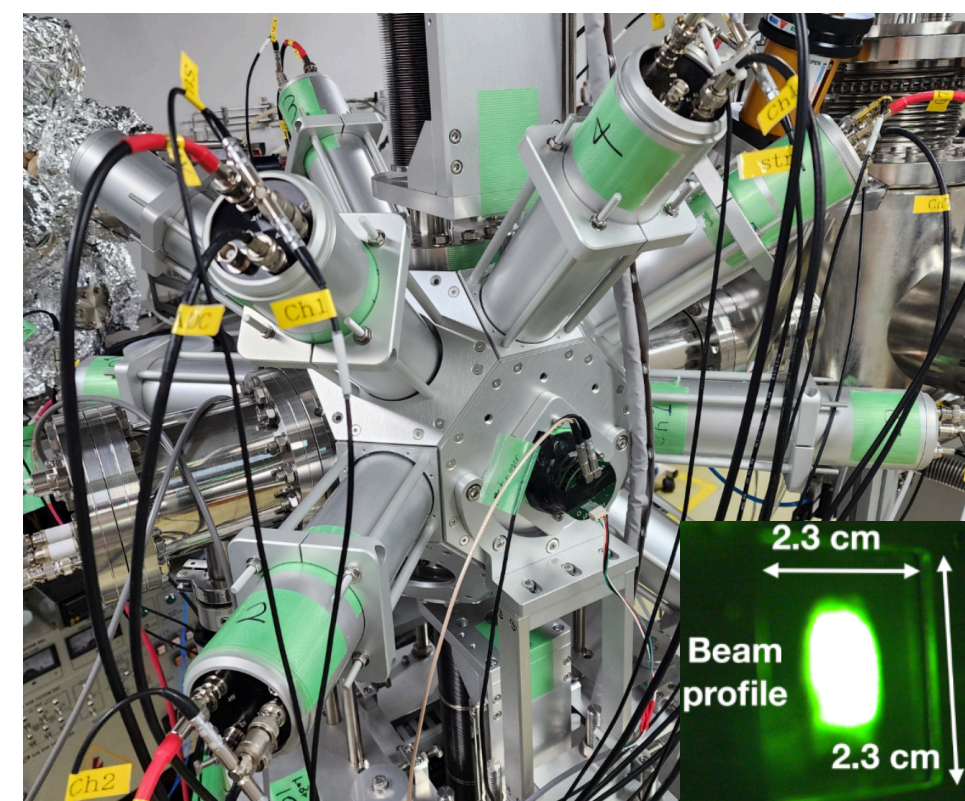
^{241}Am source test	Stand alone	
	With 1.2 T spectrometer	
RI Beam test @ KIST, Seoul		

Several COREA experiments are performed/planned @ KIST

 $^{27}\text{Al}(p,\gamma)^{28}\text{Si}$ reaction using LaBr3 detector array $^{11}\text{B}(p,\gamma)^{12}\text{C}$ reaction using SSD and LaBr3 detector array

2 MV Pelletron facility @ KIST

Max. Kinetic Energy : $(1+q) \times 2 \text{ MV} / 1 \sim 2 \text{ } \mu\text{A}$



Summary

A experimental setup for effective charge measurement is prepared

Vacuum chamber for operating SSSD at focal plane & electronics system

Basic performance test using ^{241}Am

Hardware preparation is almost finished

Geant4 Simulation study is ongoing

Effective charge model is incorporated to GEANT4 Simulation Toolkit

Simulation for ^{16}O , ^{12}C under various gas system

We are planning actual beam test @ KIST

Effective charge study of ^{16}O , ^{12}C , ^4He under 0.01 ~ 0.1 atm P10, isobutane

Several experiments concerned with COREA is planned using Silicon detector