^{25}Al + p Elastic Scattering at RIKEN

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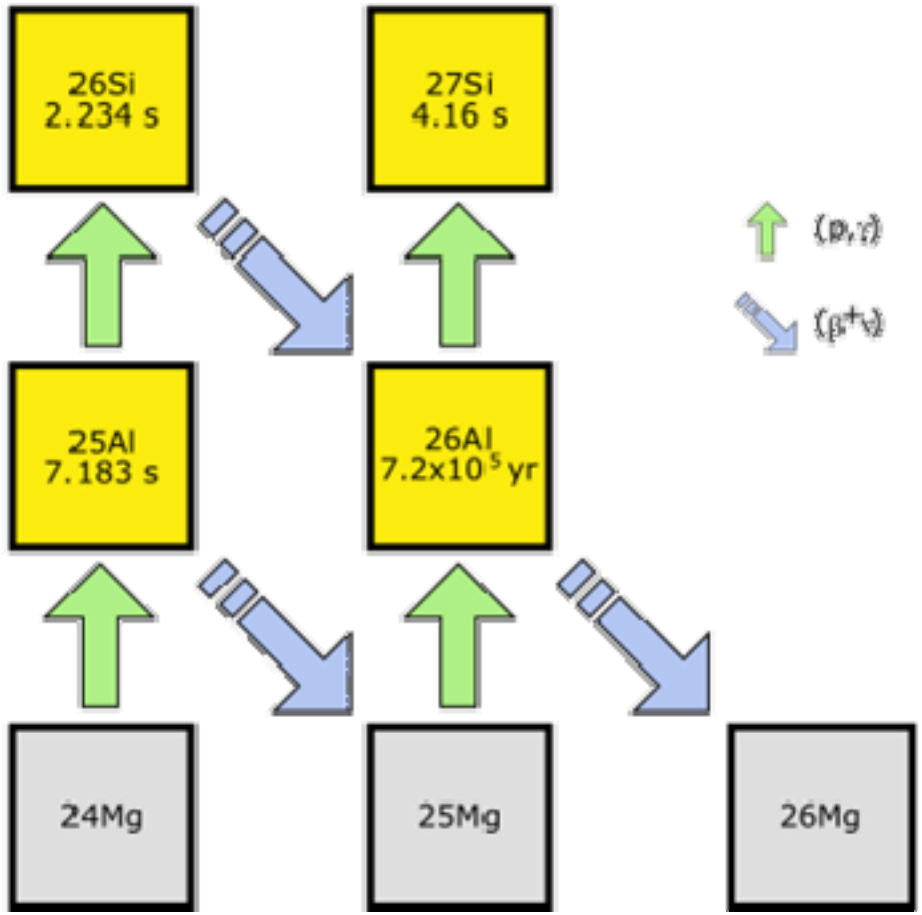
Aim

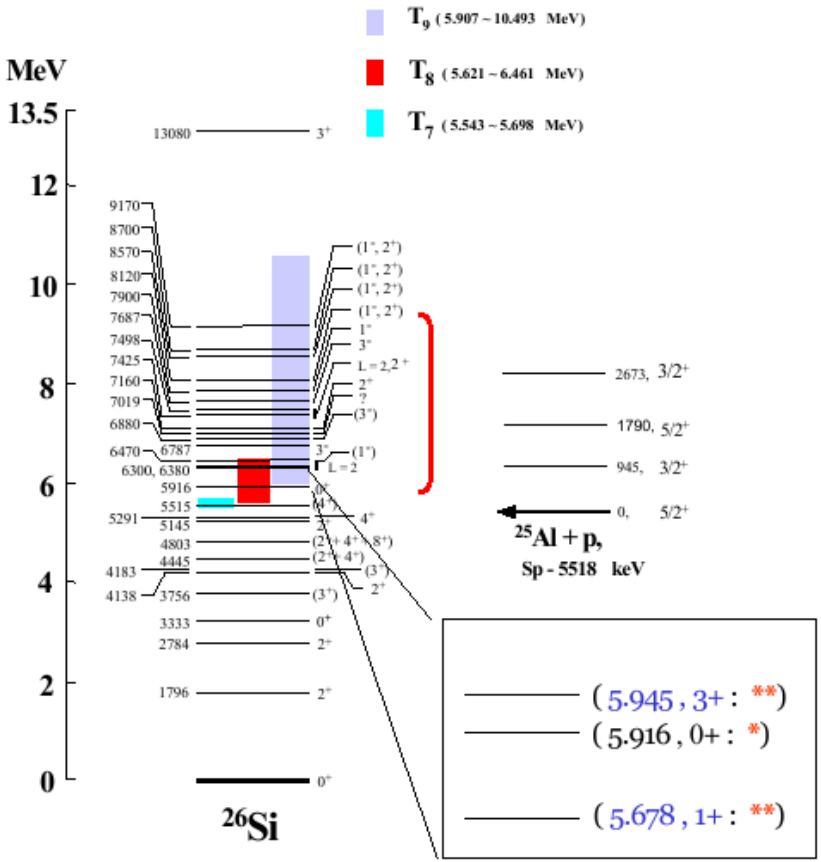
- To measure ^{25}Al + p elastic scattering and use R-matrix theory to fit excitation function to obtain nuclear parameters such as E_x, Γ and J^π of ^{26}Si levels

Motivation

- ^{26}Al in explosive hydrogen burning
  - For ONe novae, ^{23}Na(p,γ)^{24}Mg, ^{25}Al(p,γ)^{26}Si and ^{26g}Al(p,γ)^{27}Si affect ^{26}Al yield
- 26Al production
  - Faster ^{25}Al(p,γ) → less ^{26g}Al, as ^{26}Si decays through ^{26m}Al 100% to ^{26}Mg



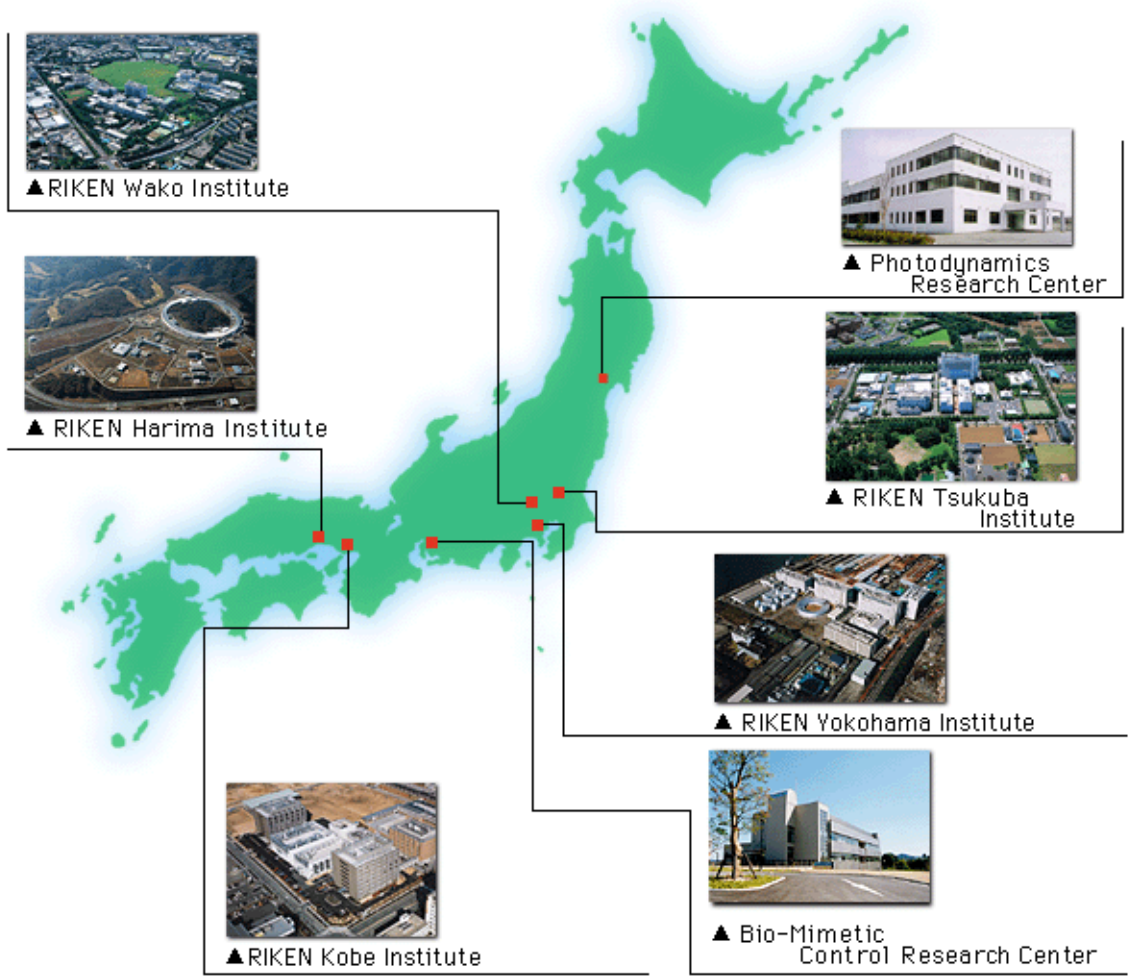
- ^{26}Si spectroscopy – more level-parameter information is needed
- Constrain mirror assignments between low-lying levels in ^{26}Si and ^{26}Mg



* : D.W.Bardayan et al. PRC. Vol.65, 2002
**: J. A. Caggiano et al. PRC. Vol.65,2002

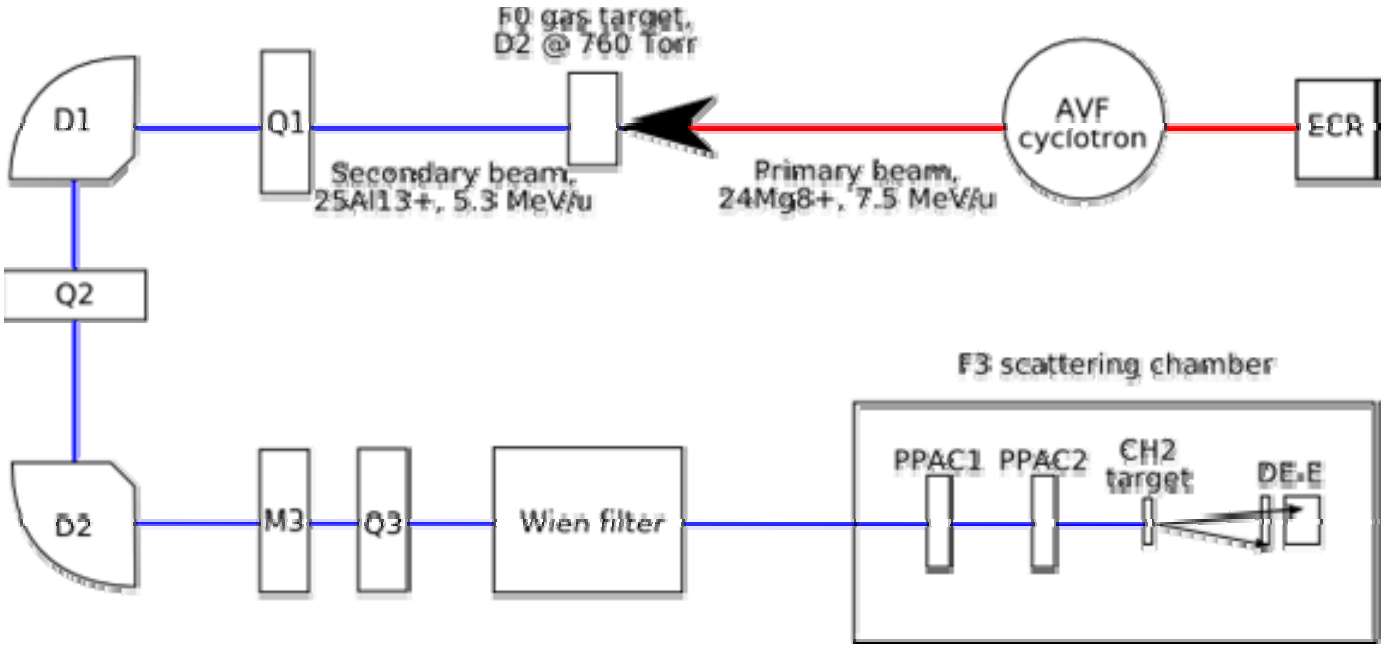
RIKEN

- RIKEN Wako campus located just outside Tokyo
- Experiment performed at the Centre for Nuclear Study (CNS) using the CNS Radioactive Ion Beam (CRIB) facility from June 30th to July 4th 2005



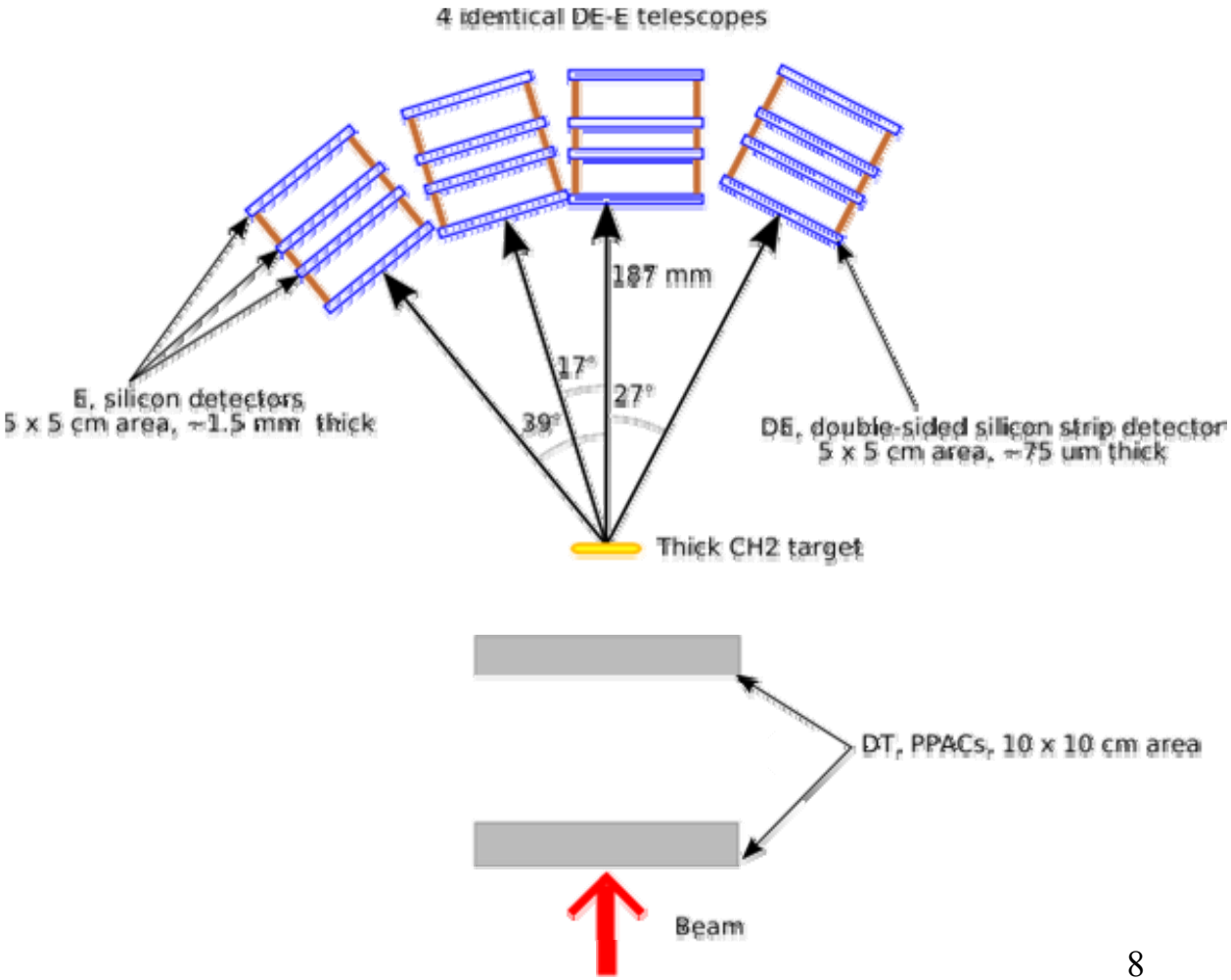
CRIB

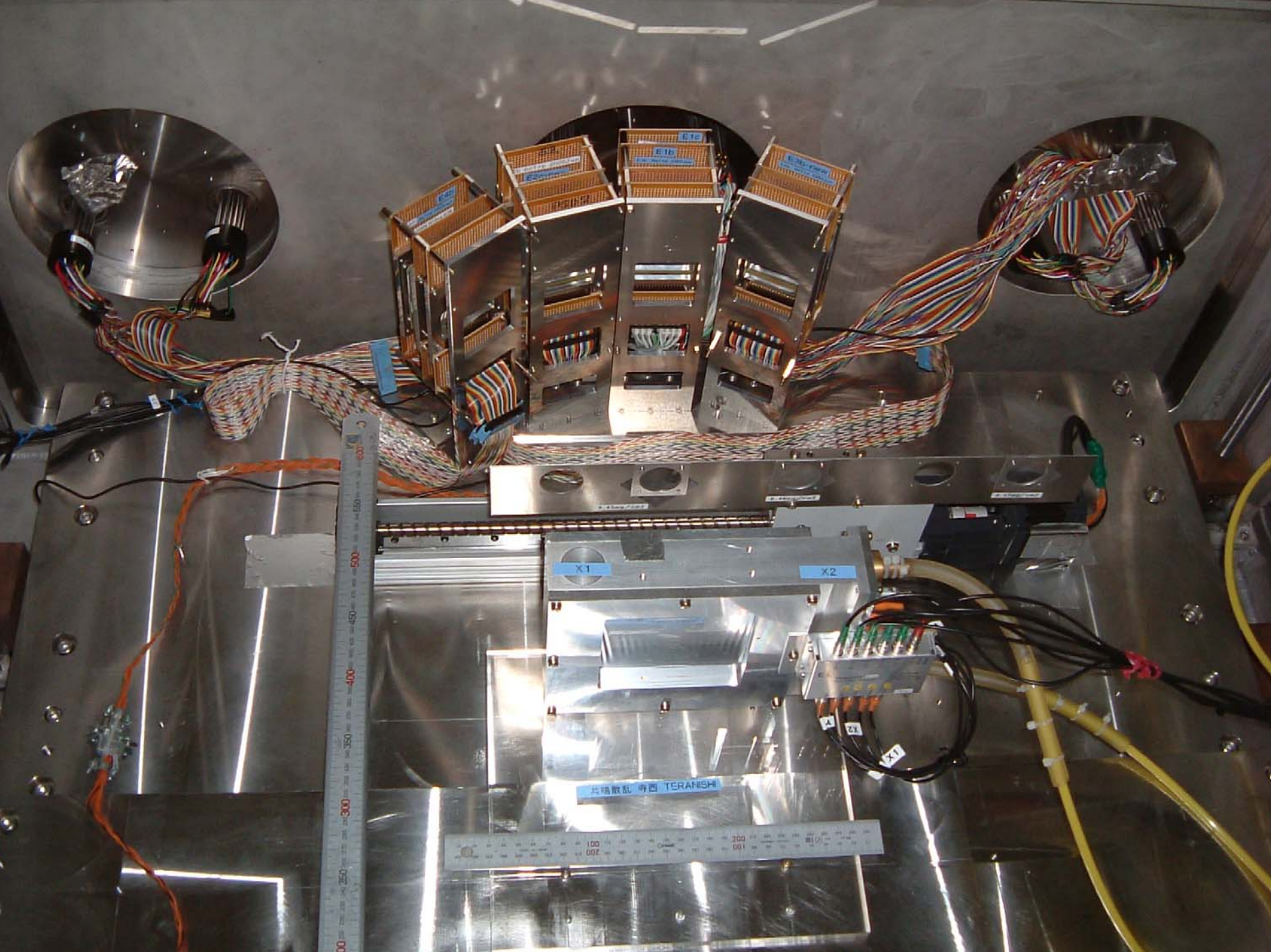
- $^{24}Mg^{8+}$ primary beam produced in ECR ion source, 1.6×10^{11} pps
- ^{25}Al secondary beam produced at F0 target using $^{2}H(^{24}Mg,n)^{25}Al$ reaction, 5×10^{5} pps



Chamber Setup

- Used 3 out of 4 installed *ΔE-E* telescopes
- Used a NaI gamma-array with 10 detectors
- Thick targets




E1c
E1b
X1
X2
A
41
X1
TERANISHI

Experimental Running

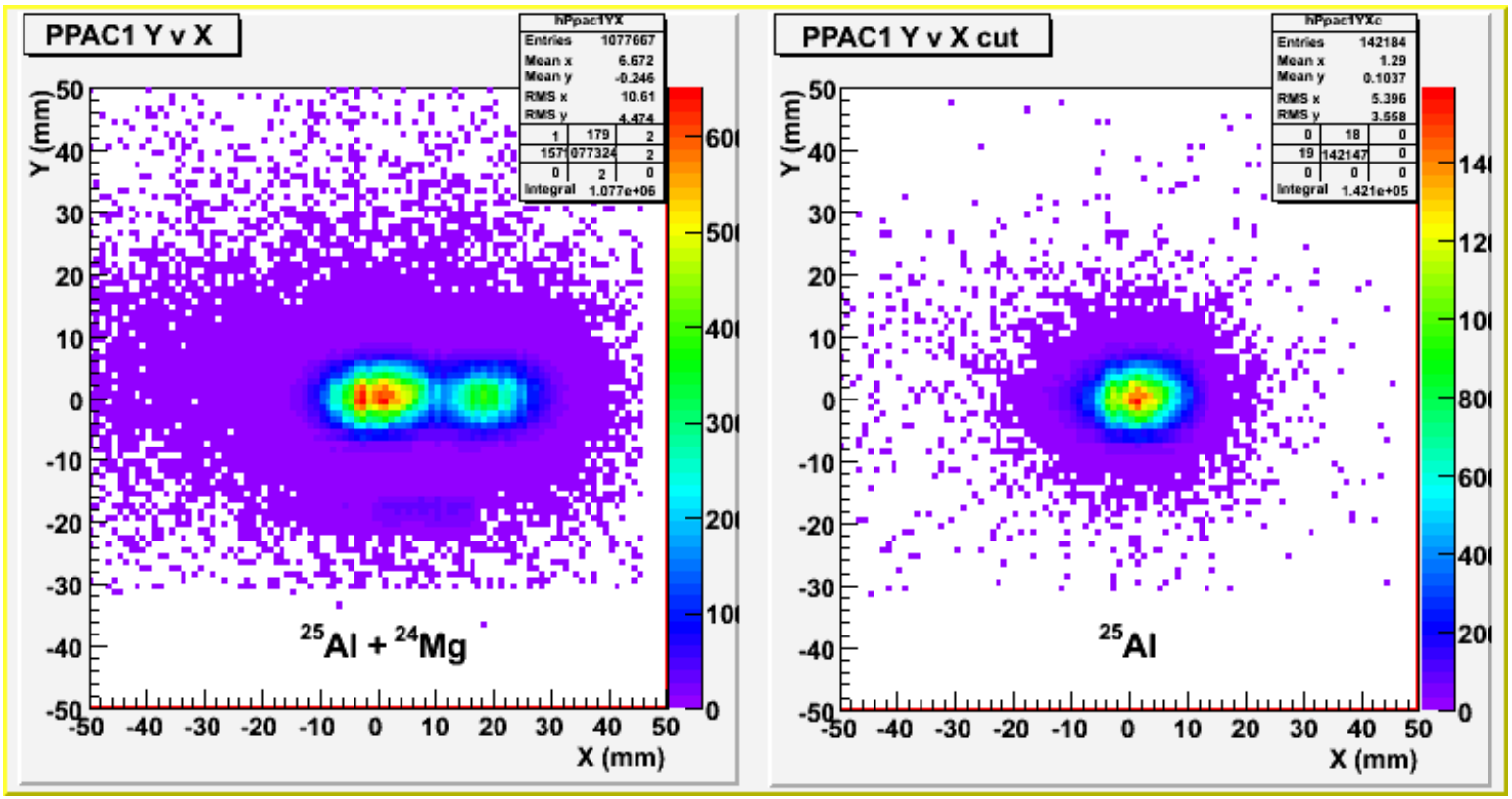
- ~2-5×10^5 pps ^{25}Al @ 3.426 MeV/u on target
- Thick CH_2 targets, 6.5 mg/cm^2 were used for reaction runs
- Scanned ~3.3 MeV in centre-of-mass, maximum proton energy ~12.5 MeV, minimum detectable proton energy ~3 MeV
- 9.45 mg/cm^2 C target was used for background run

Experimental Running

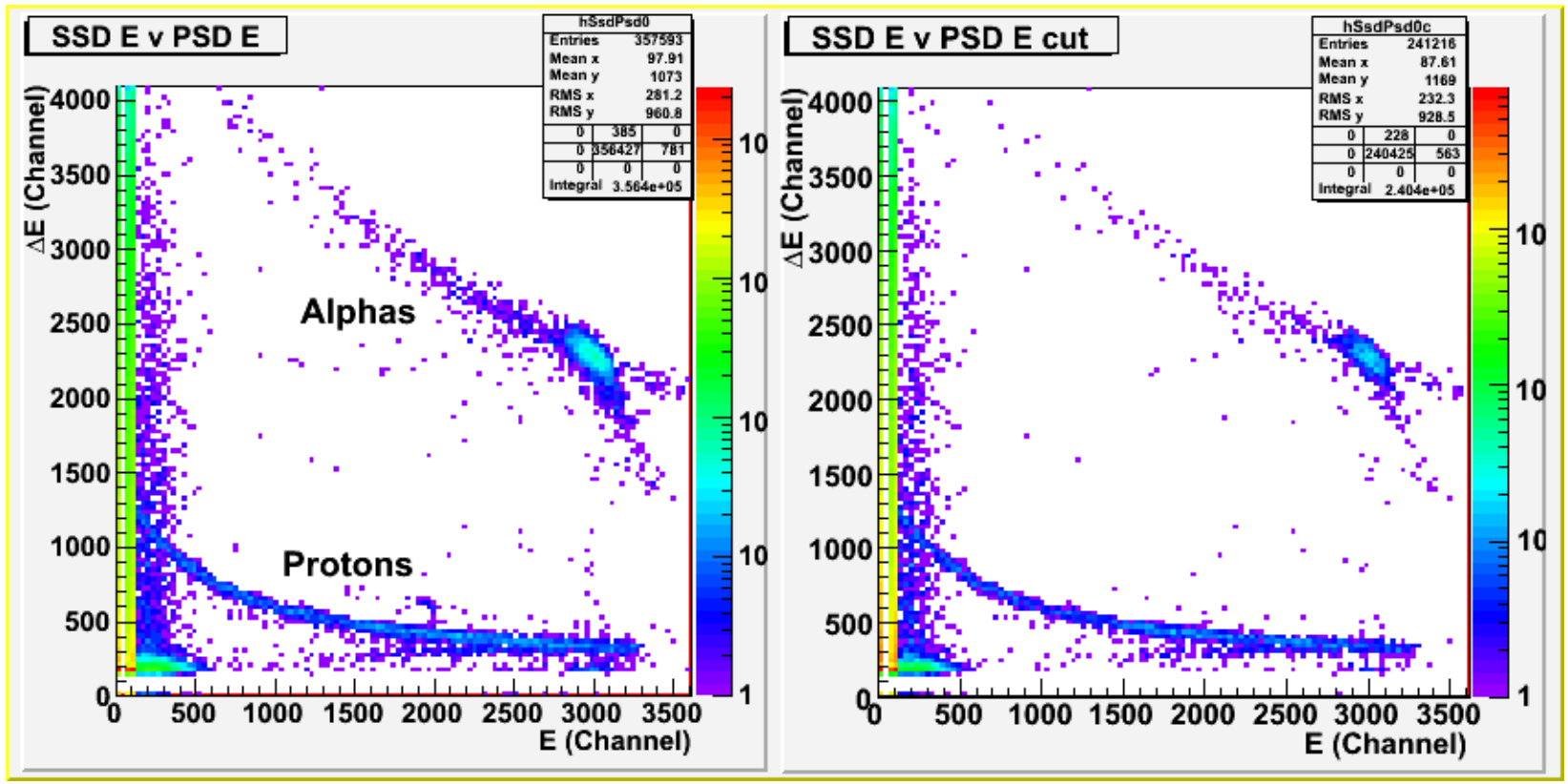
- 40 hours spent tuning primary and secondary beams to scattering chamber
- 55 hours running ^{25}Al beam + CH_2 target
- 4 hours running ^{25}Al beam + C target
- 12 hours with ^{1}H beam for calibrating silicon detectors at 2, 5, 9, 14 MeV, and calibrating target thickness at 6, 9, 14 MeV
- Silicon detector calibration also with 3α-source
- NaI detector calibration with ^{22}Na source

Beam Identification

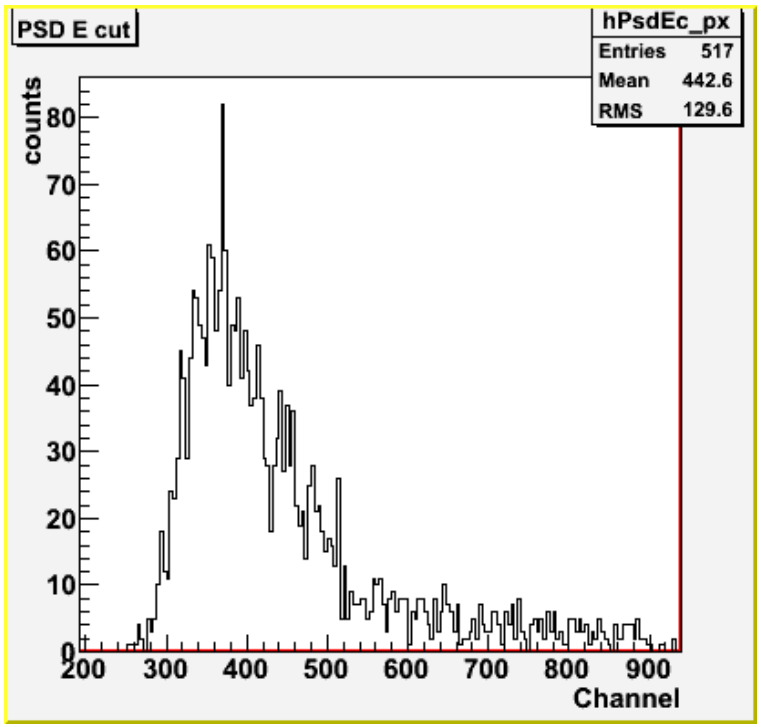
- Beam species ID with PPAC, ^{25}Al cut made on RF

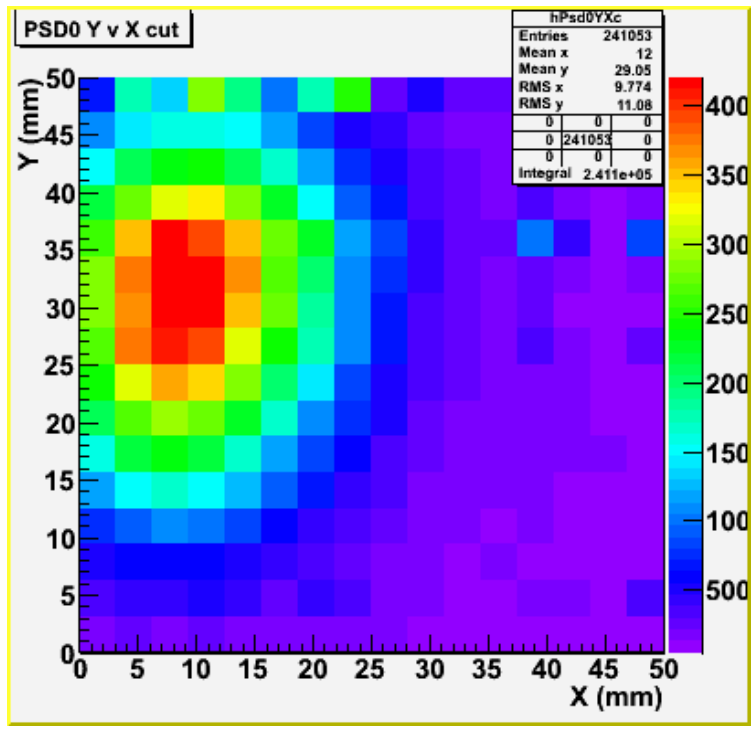


SSD-PSD E-ΔE Spectrum



ΔE Detector





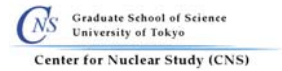
- Proton energy spectrum and hit pattern

Next steps

- Lots of calibration, background subtraction
- Change to use centre-of-mass energies
- Bin excitation function for angular ranges
- Use *R*-matrix theory to fit excitation curves

Acknowledgements

A. Chen, J. Pearson



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Done.