Constraining the subthreshold resonance of $^{13}C(\alpha,n)^{16}O$ using $^{16}O(p,\alpha)^{13}N$ reaction

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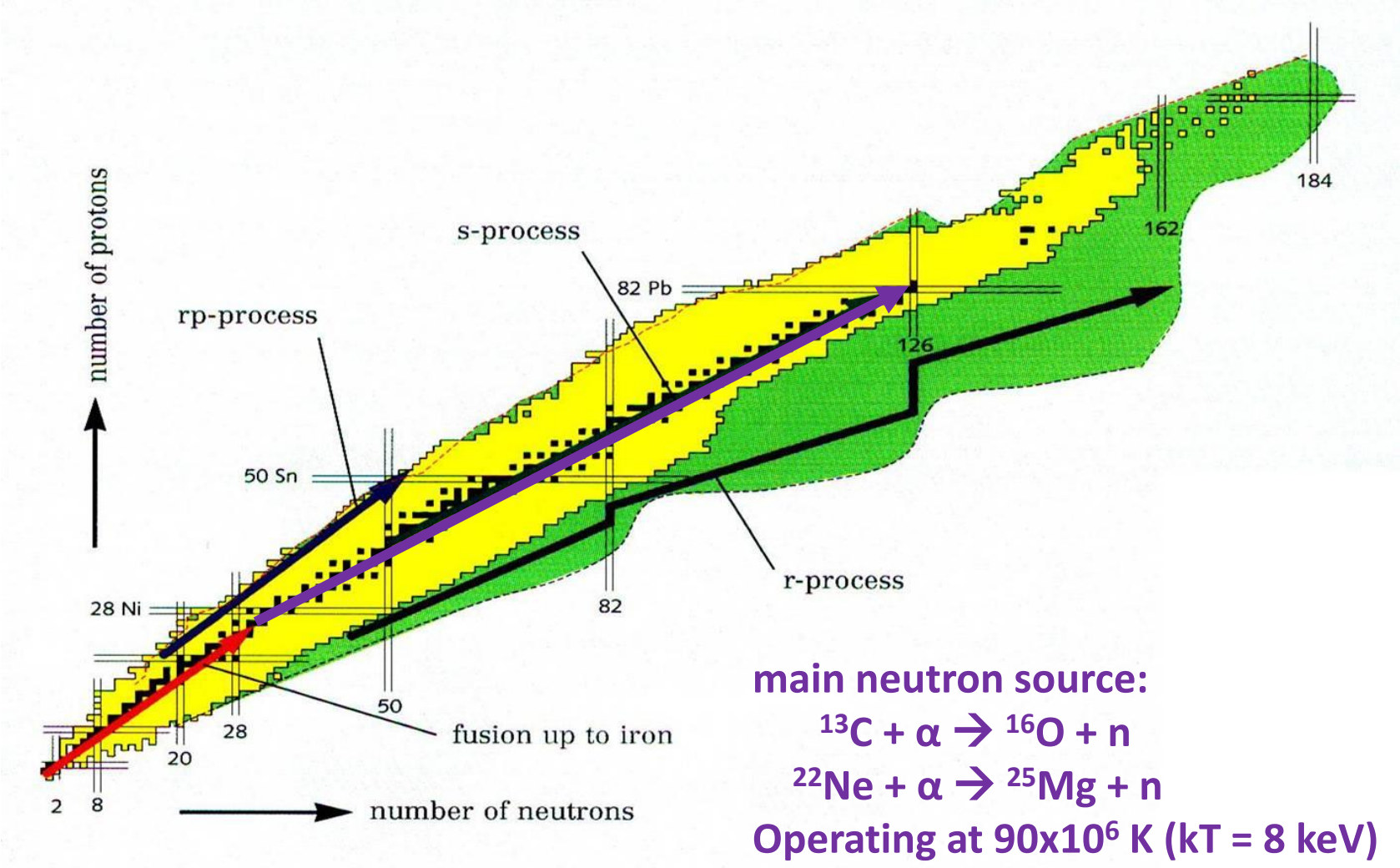
Outline

- **Introduction**
- **Experimental setup**
- **Results and future plan**
- **Summary**

Introduction



main neutron source:

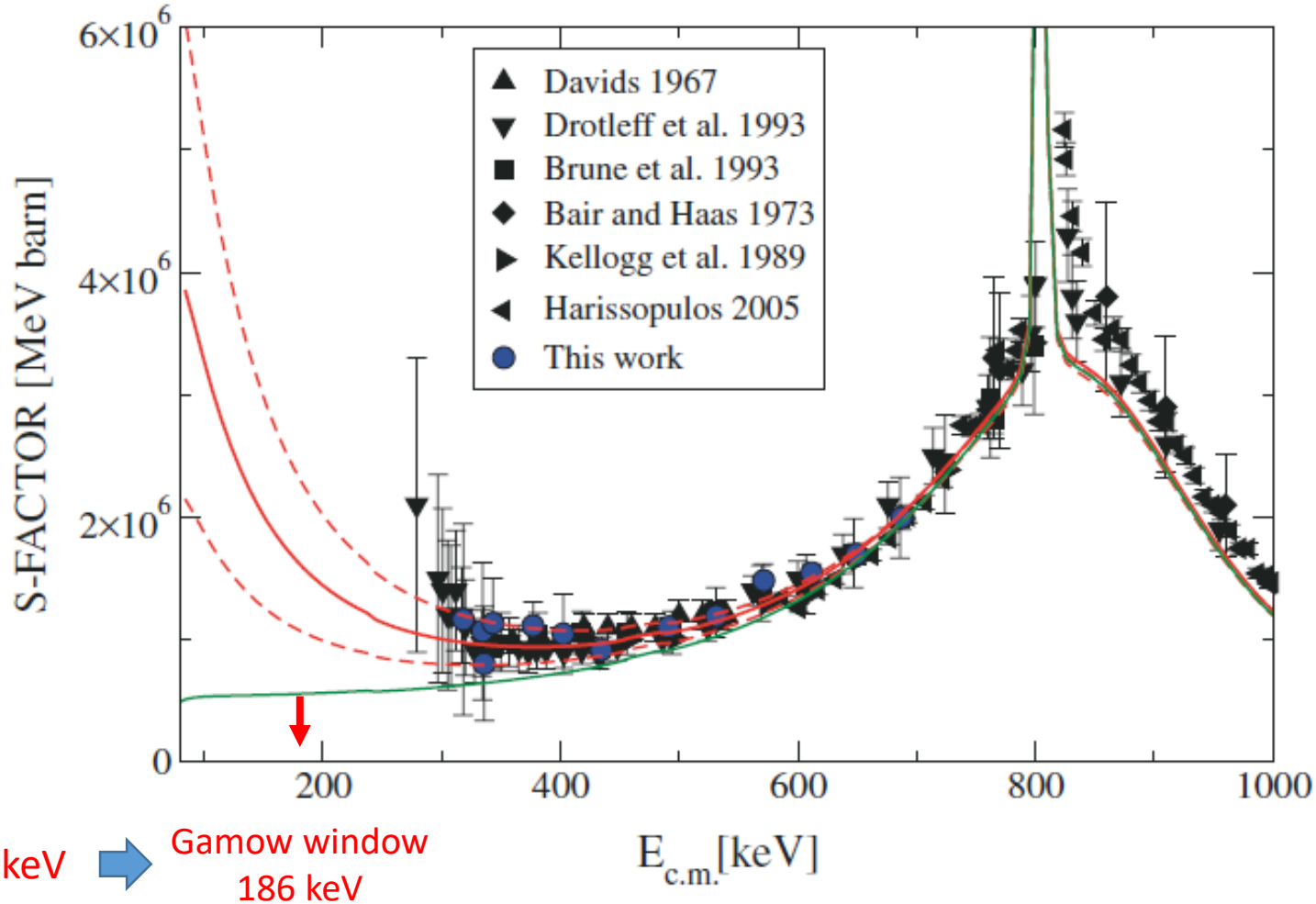
$^{13}C + \alpha \rightarrow {}^{16}O + n$

$^{22}Ne + \alpha \rightarrow {}^{25}Mg + n$

Operating at 90×10^6 K (kT = 8 keV)

Introduction

S factor for $^{13}C(\alpha, n)^{16}O$

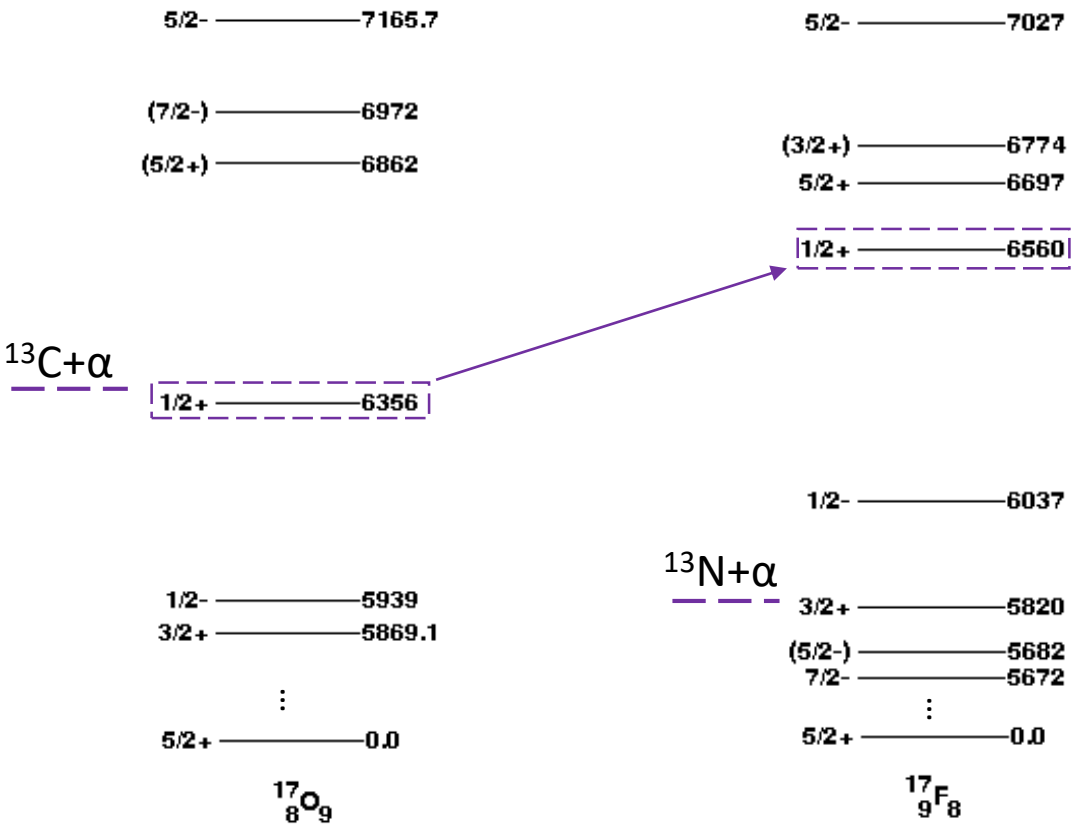


T = 8 keV → Gamow window 186 keV

M. HEIL *et al.* PHYSICAL REVIEW C **78**, 025803 (2008)

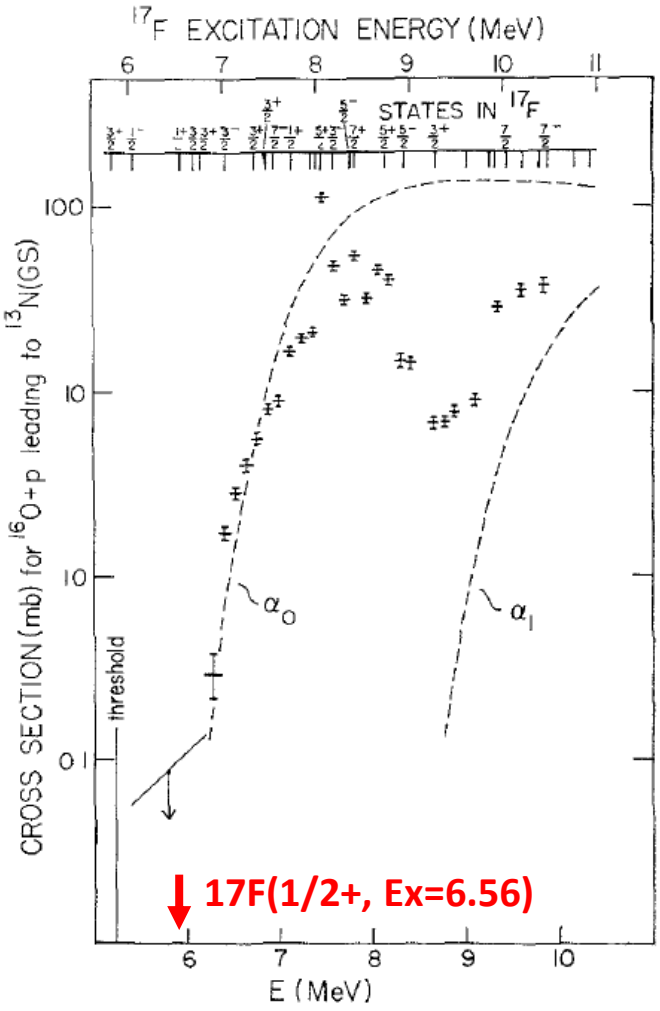
Introduction

Isospin analog state



Introduction

$^{16}O(p,\alpha)^{13}N$ cross section data



A. V. NERO and A. J. HOWARD, *Nuclear Physics* A210 (1973) 60 – 66.

$^{16}O(p,\alpha)^{13}N$ differential cross section data

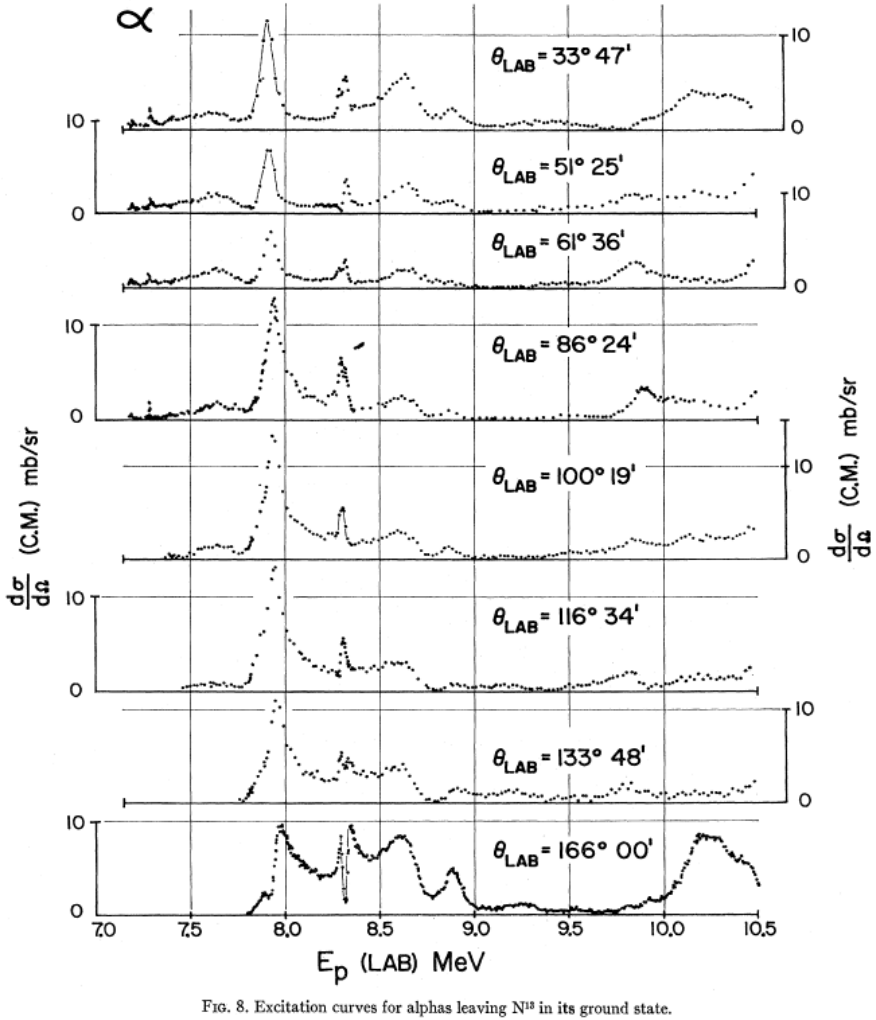
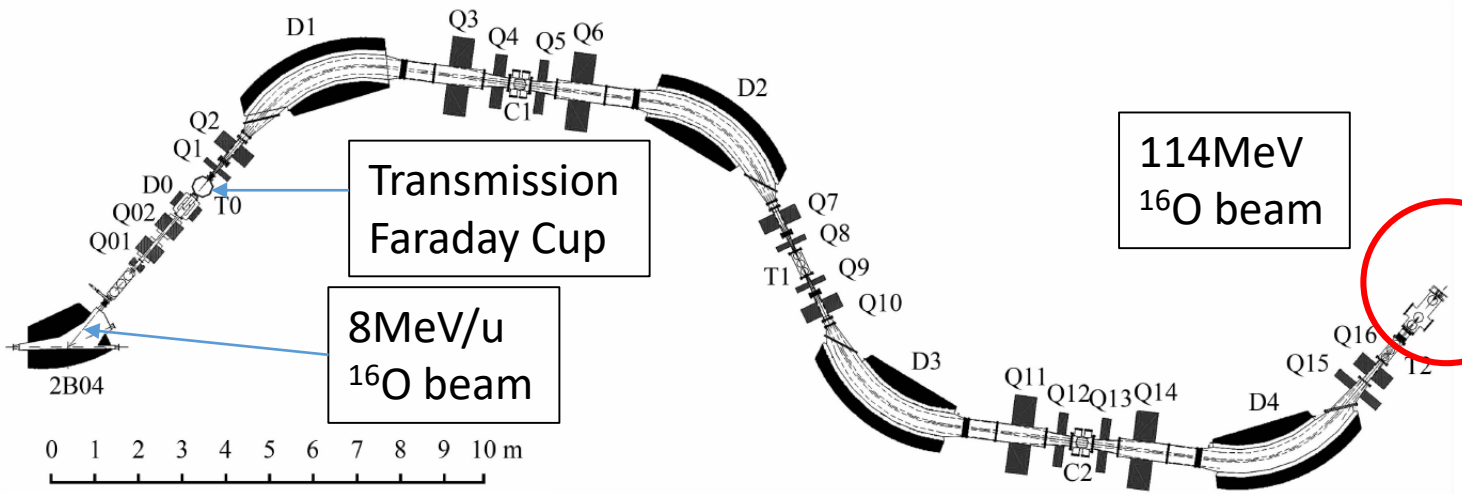
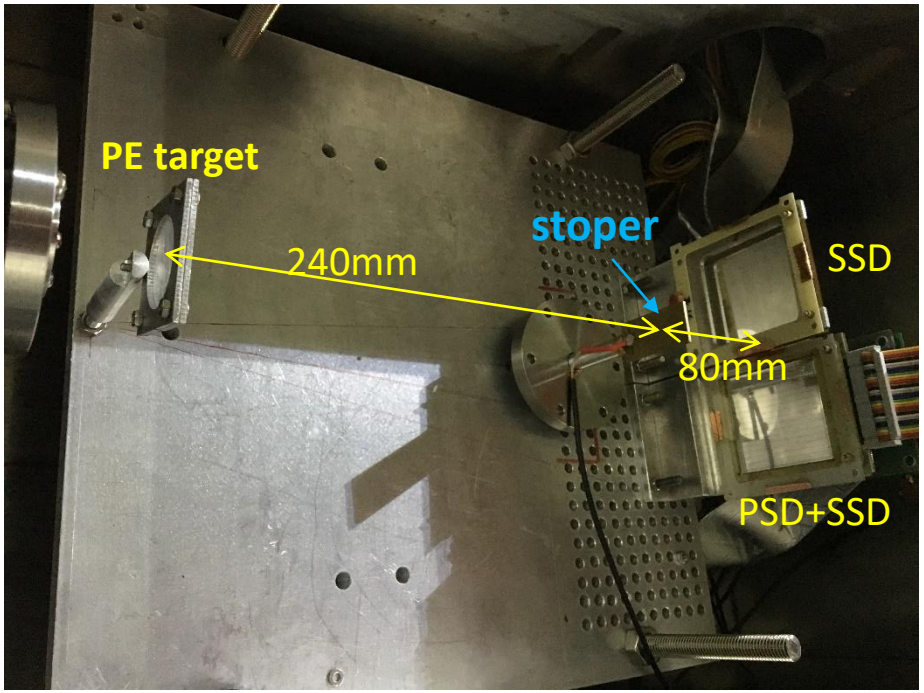


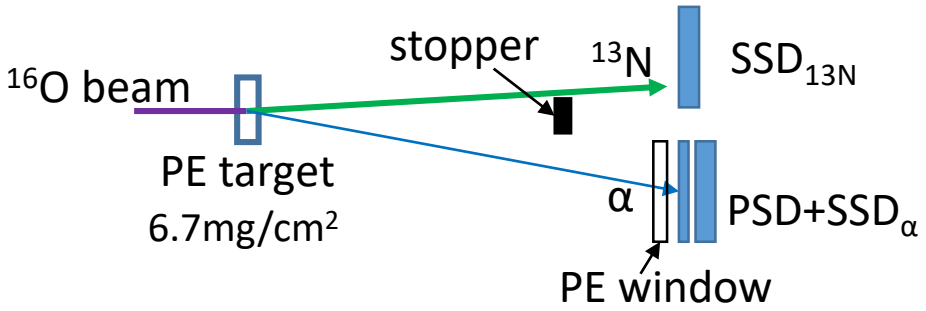
FIG. 8. Excitation curves for alphas leaving N^{13} in its ground state.

R. L. DANGLE, L. D. OPPLIGER AND G. HARDIE, *PHYSICAL REVIEW* 133, B647-659, 1964

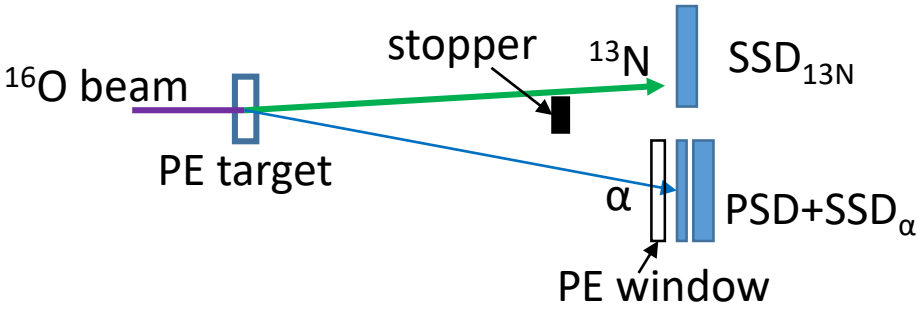
Experimental setup



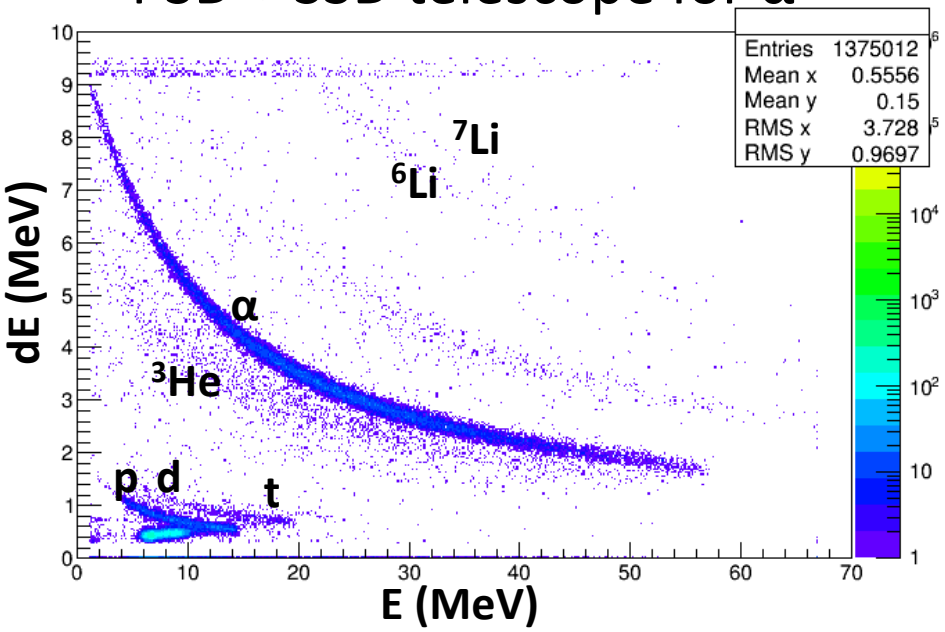




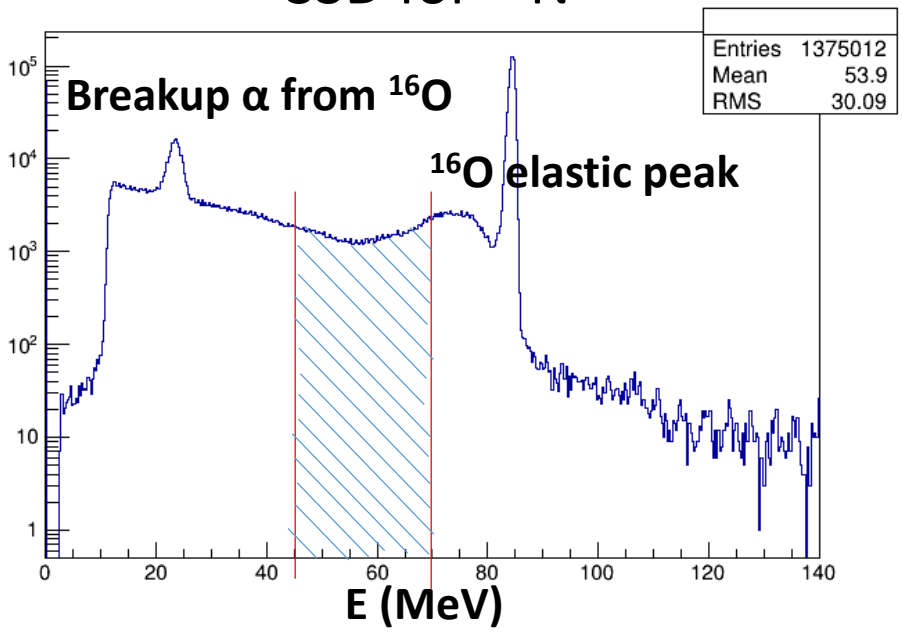
Results



PSD + SSD telescope for α

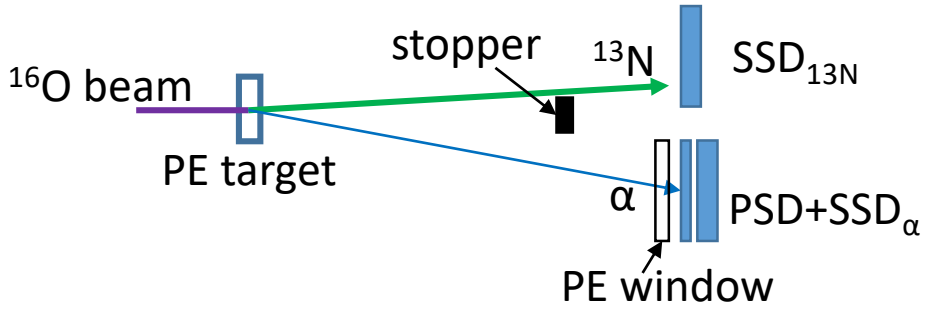


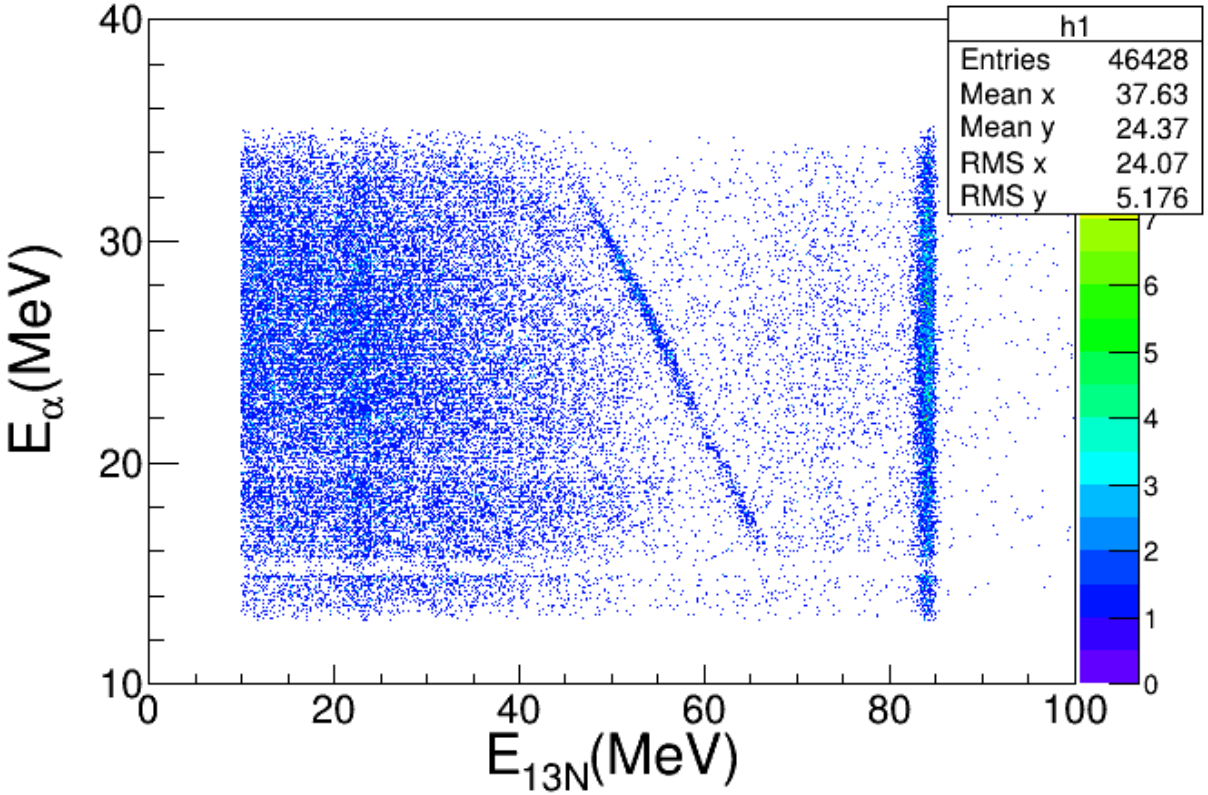
SSD for ^{13}N



Results

α and ^{13}N correlation





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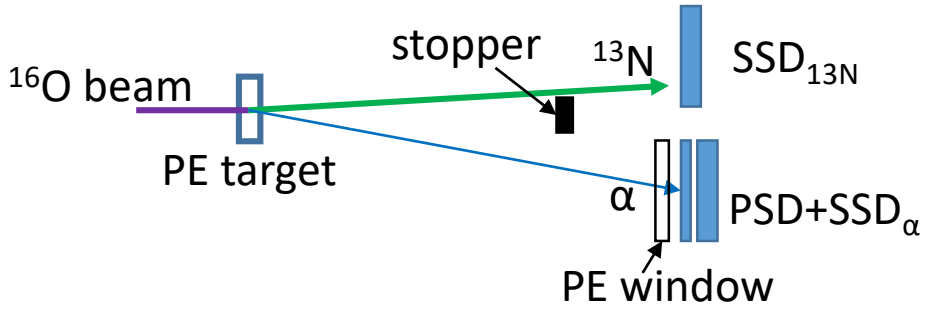
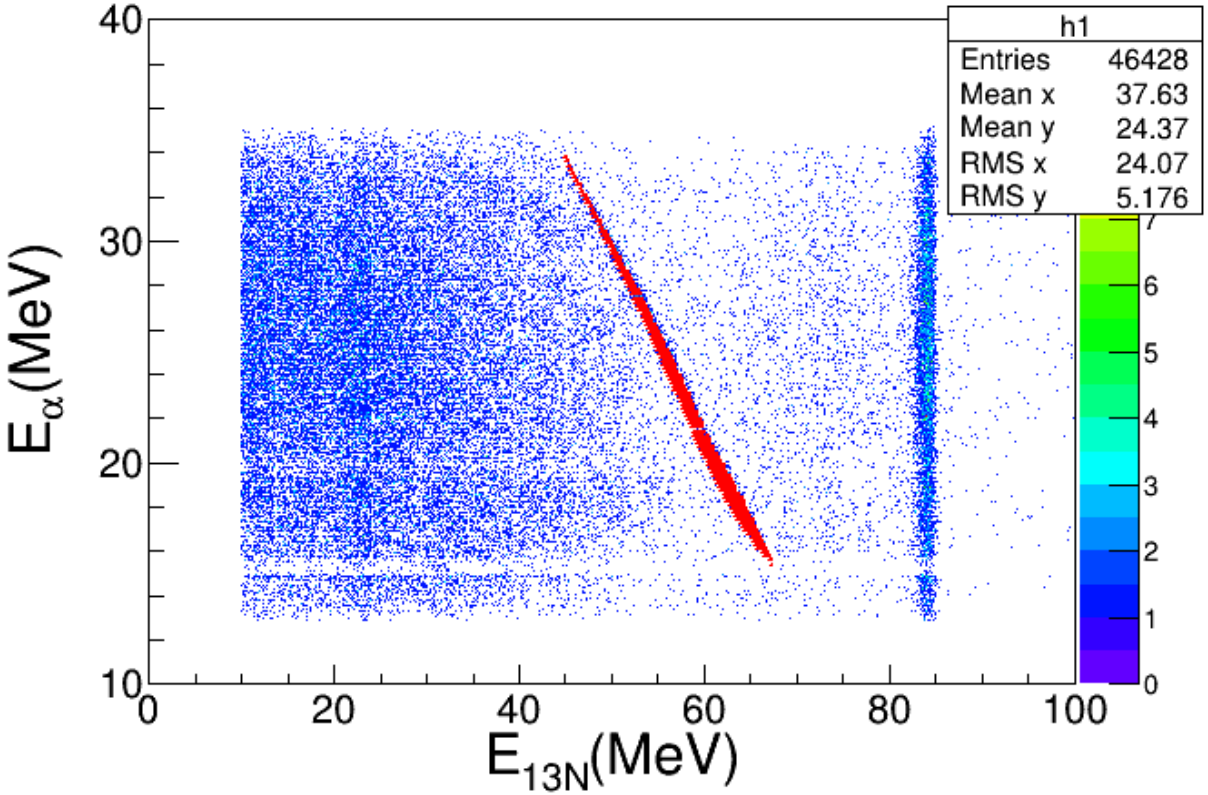
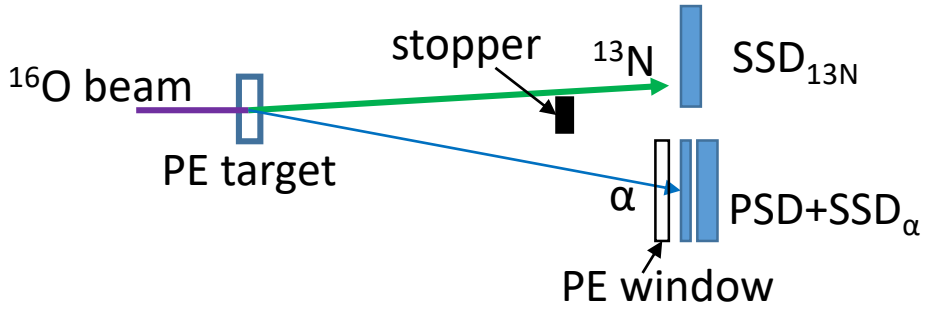
α and ^{13}N correlation

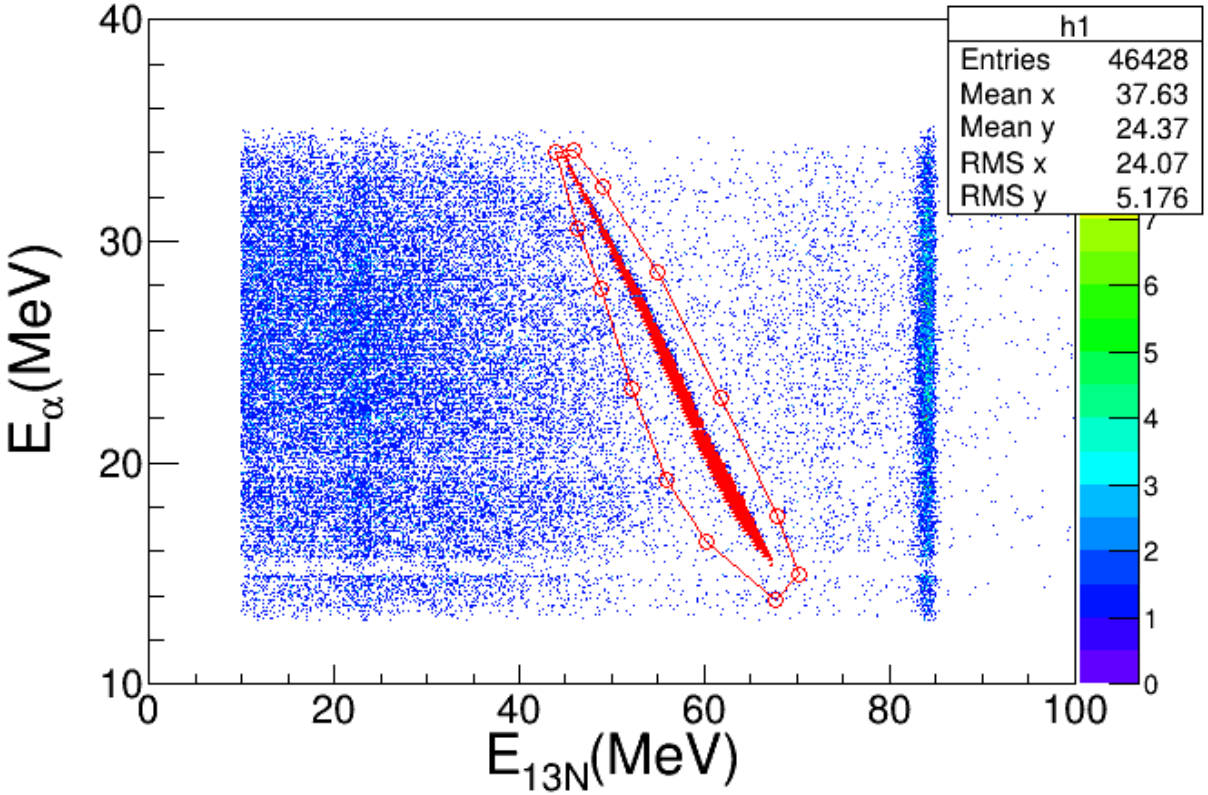




Results

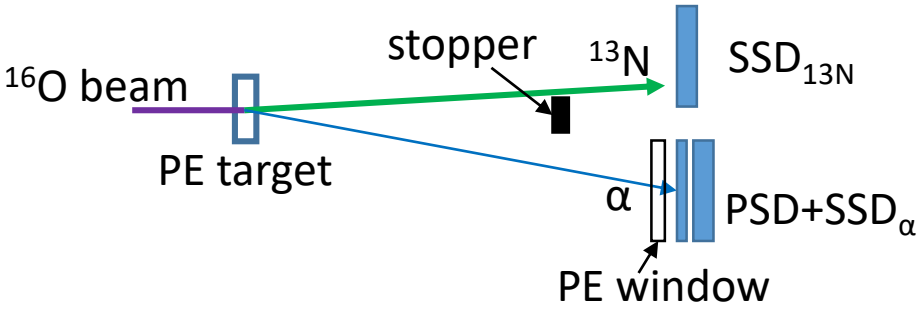
α and ^{13}N correlation

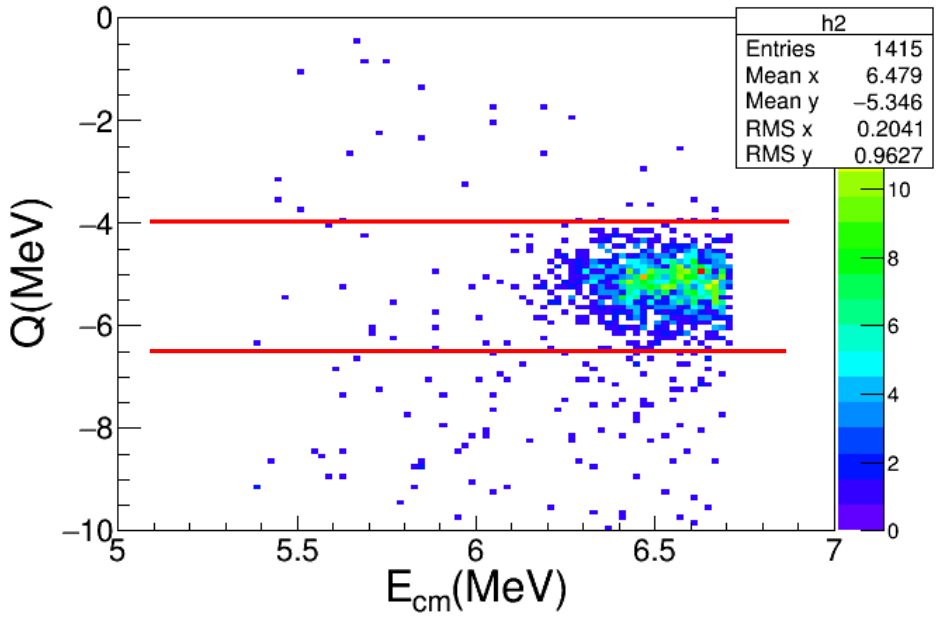


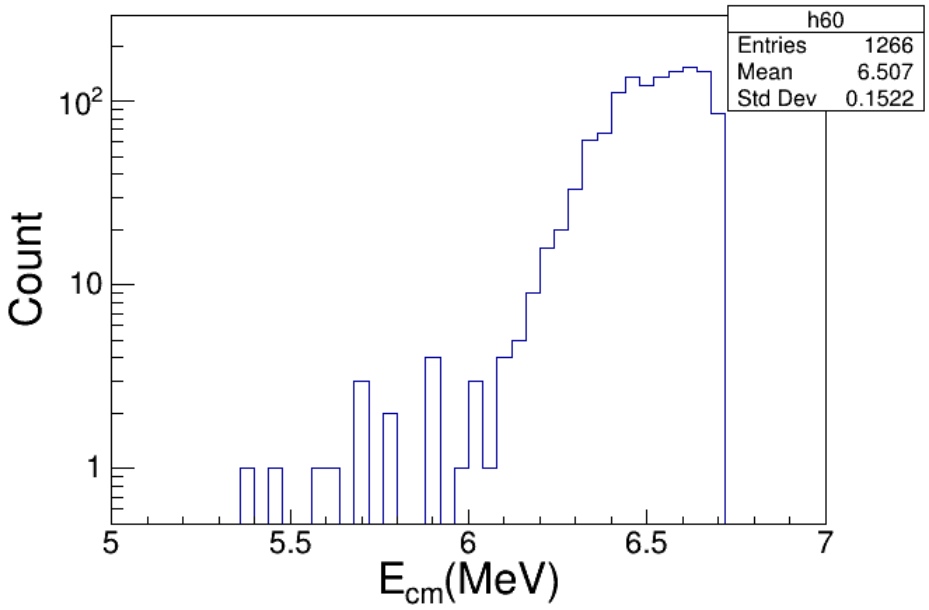


Results

Q value cut

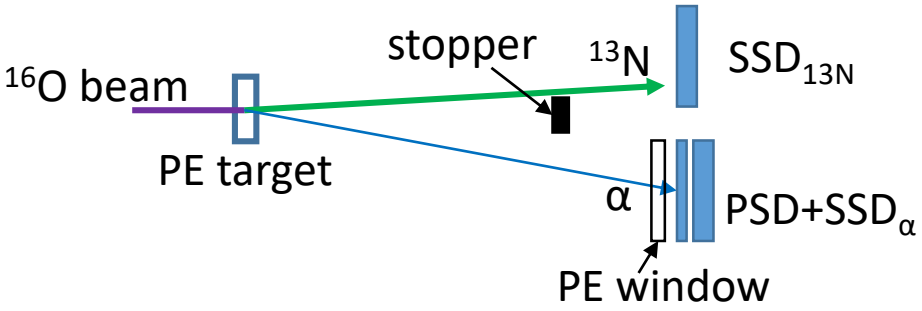




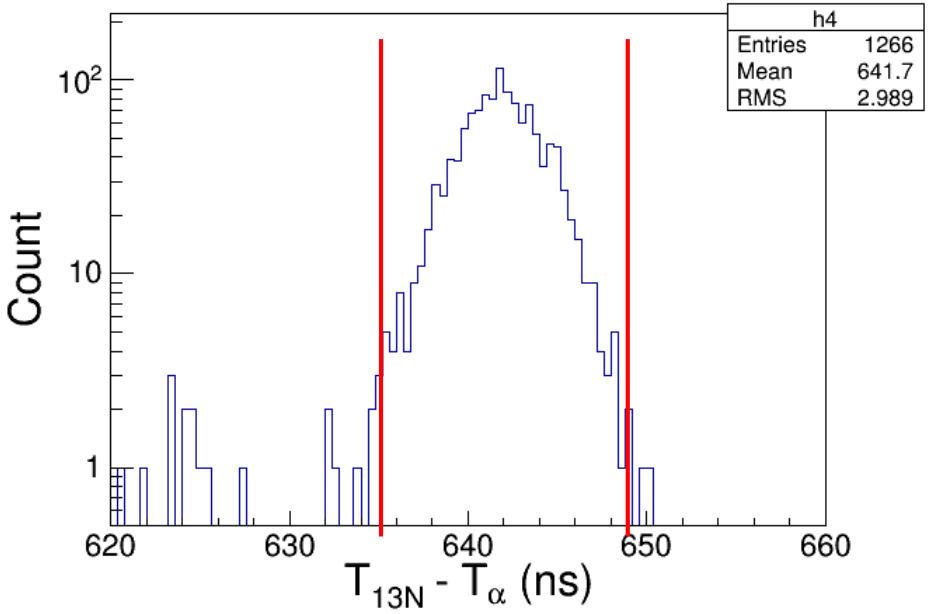


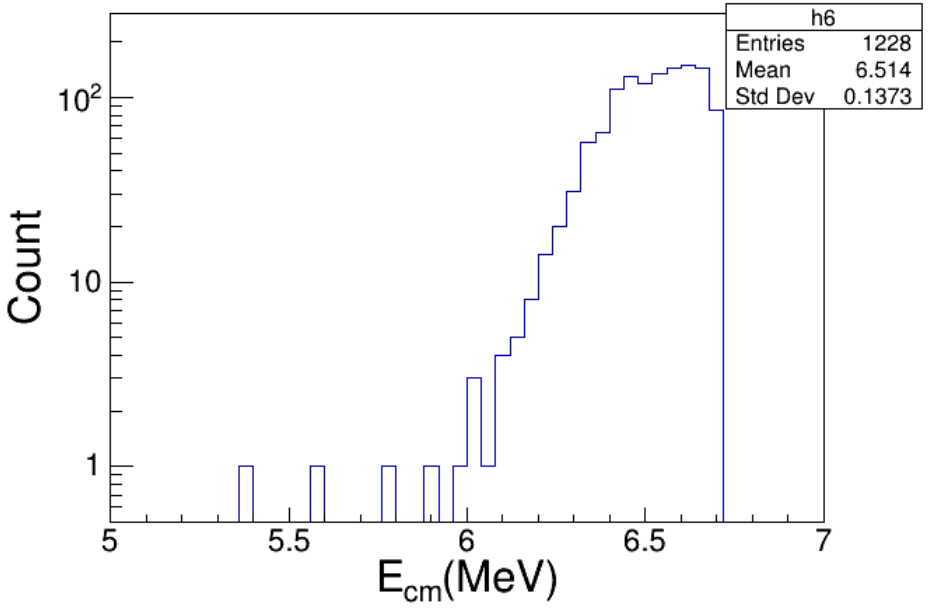
Results

Time cut for TOF



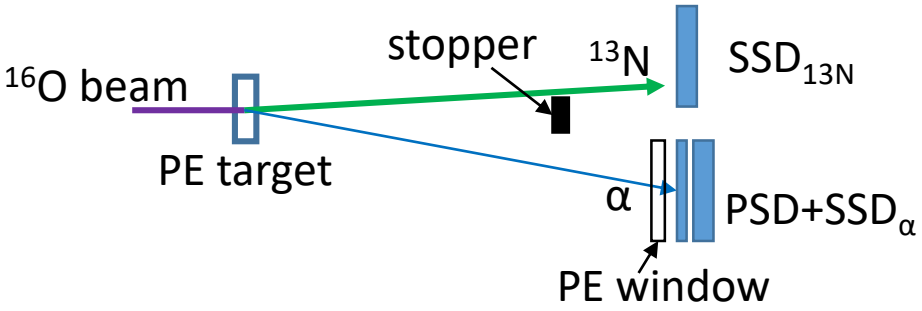
635.04 < T < 648.76 ns

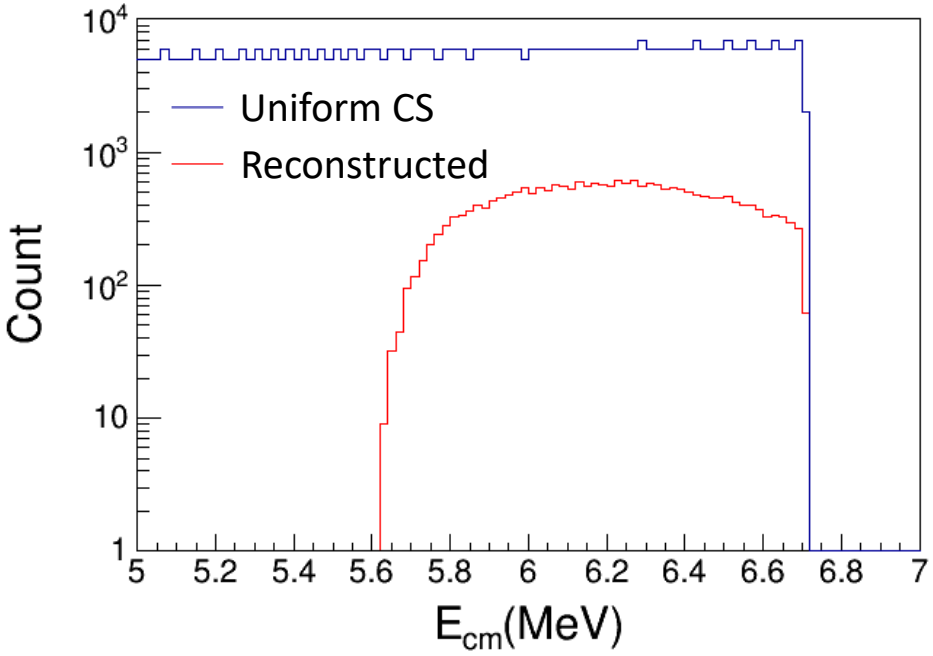


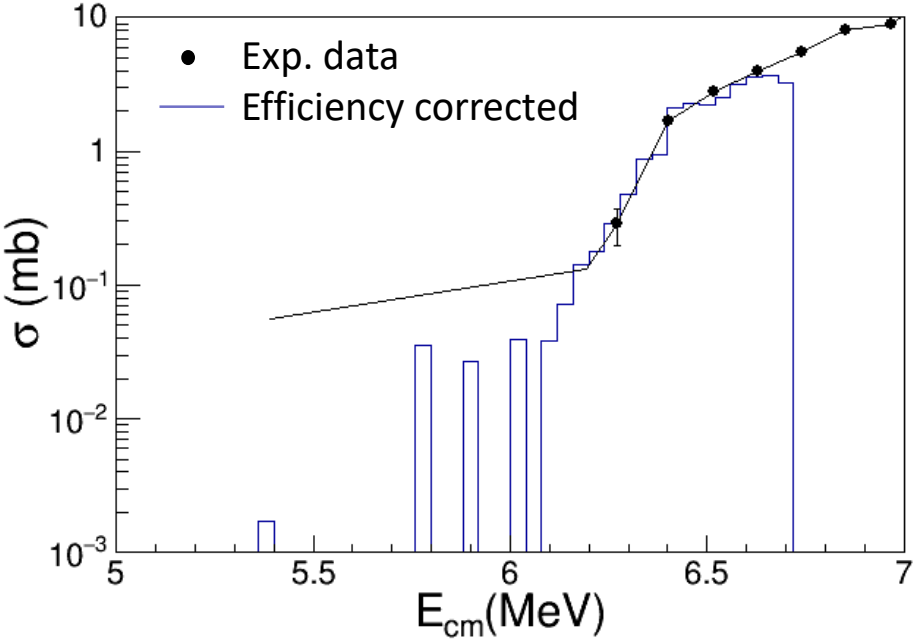


Results

Efficiency correction







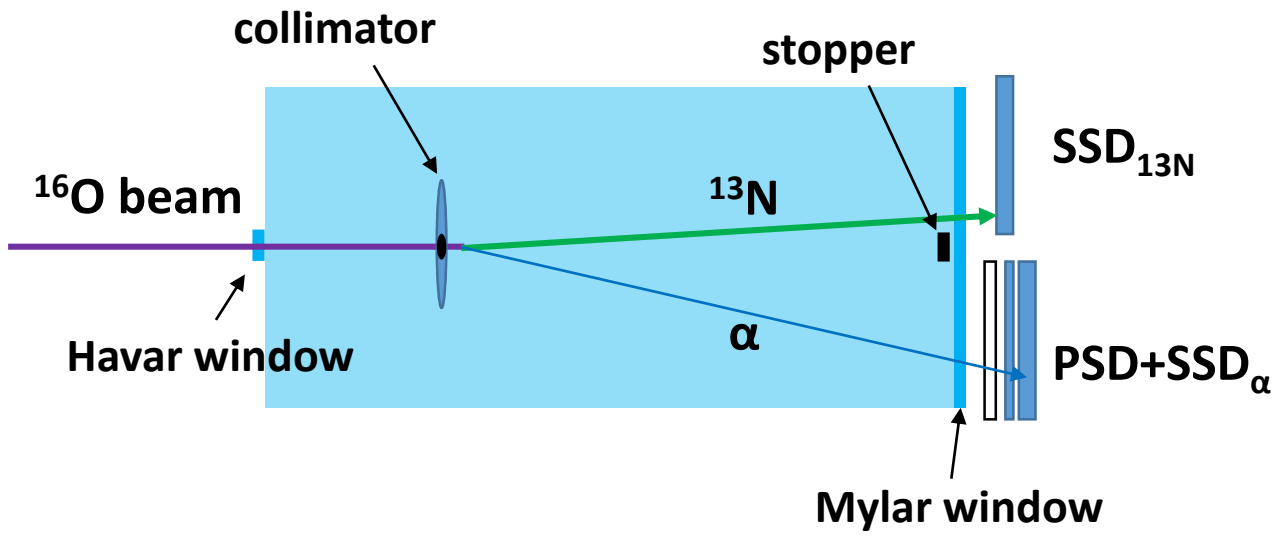
A. V. NERO and A. J. HOWARD, *Nuclear Physics* A210 (1973) 60 – 66.

Future plan

Improvement:

1. Using pure H_2 gas target to reduce the reaction of $^{16}O+^{12}C$;
2. Cover the highest resonance at E_{cm} ~ 7.5MeV.

1 atm H_2 gas target



Summary

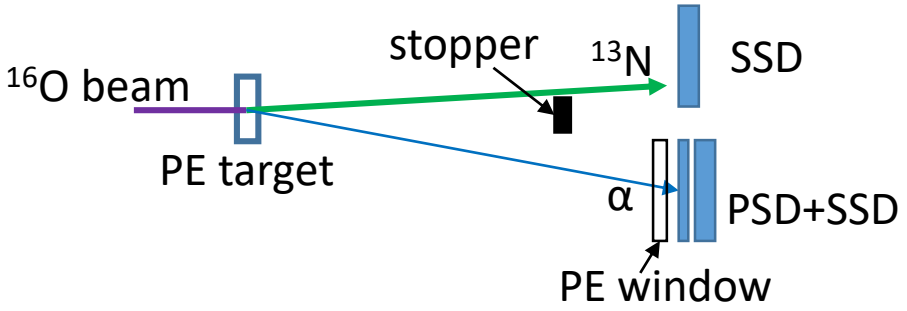
1. For the first time we proposed to measure the isospin analog state $^{17}F(E_x=6.56\ MeV, 1/2^+)$ to constraint $^{17}O(E_x=6.356\ MeV, 1/2^+)$.

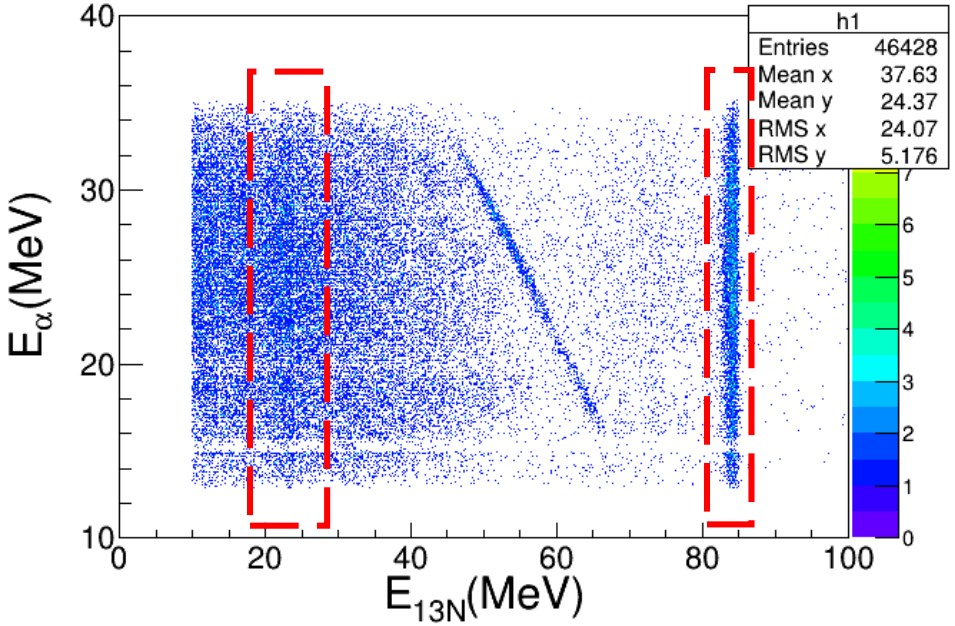
2. Due to the poor statistics, we are not sure about the resonance of $^{17}F(E_x=6.56\ MeV, 1/2^+)$. We need to accumulate more statistics to measure this resonance state.

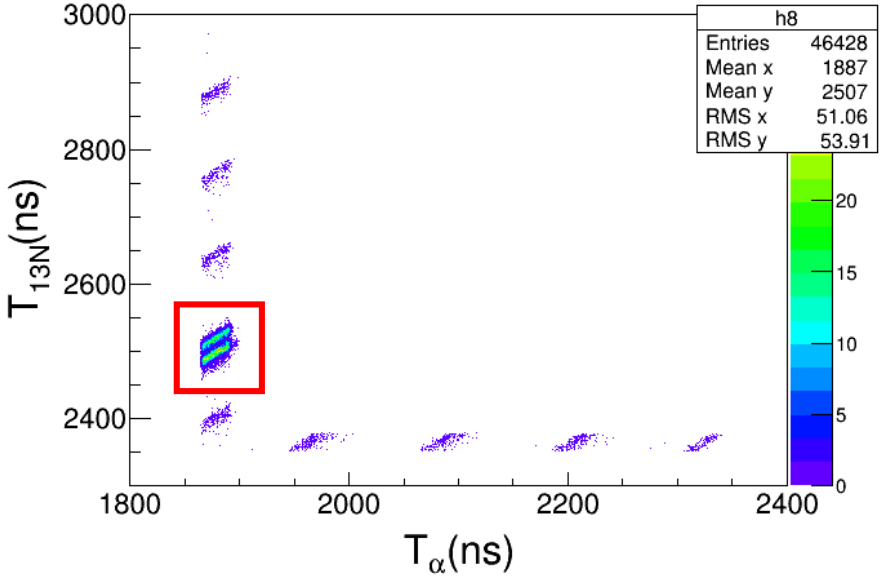
3. To improve the statistics, we plan to use pure H_2 target to reduce the reaction of $^{16}O+^{12}C$.

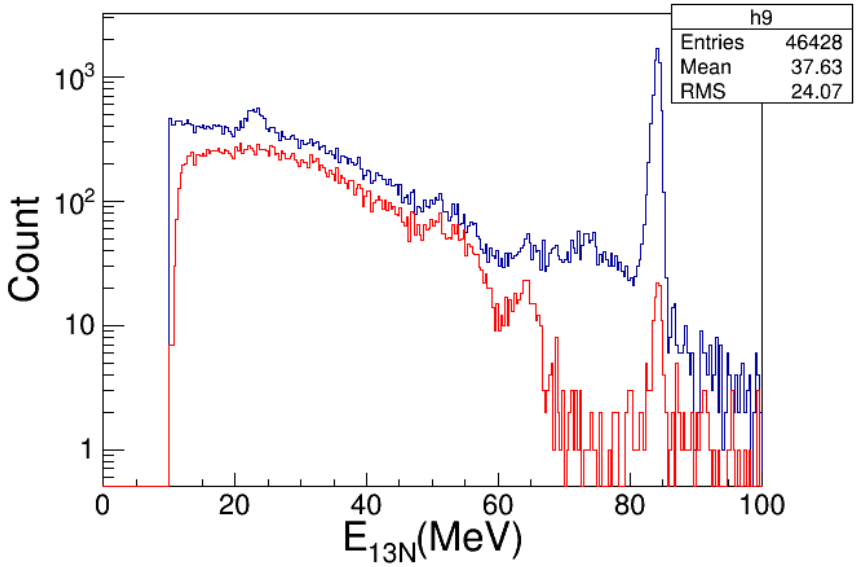
Backup

α and ^{13}N correlation









Backup

Time cut for TOF