A Study of $^{12}C(^{12}C,n)^{23}Mg$

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Outline

- Motivation
- History
- Experiment
- Results w/ Comparison
- Limitations
- Future Work

Weak s-process

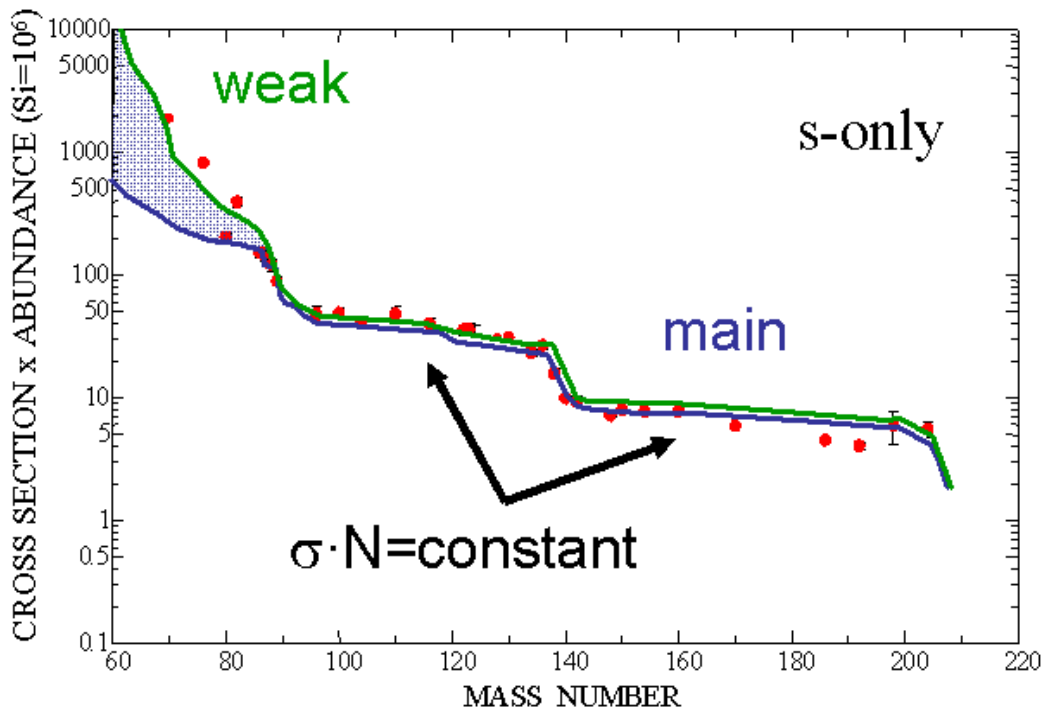
- Largely responsible for elements 60<A<90

- Possible sites:
  - Core He burning
  - Shell C burning

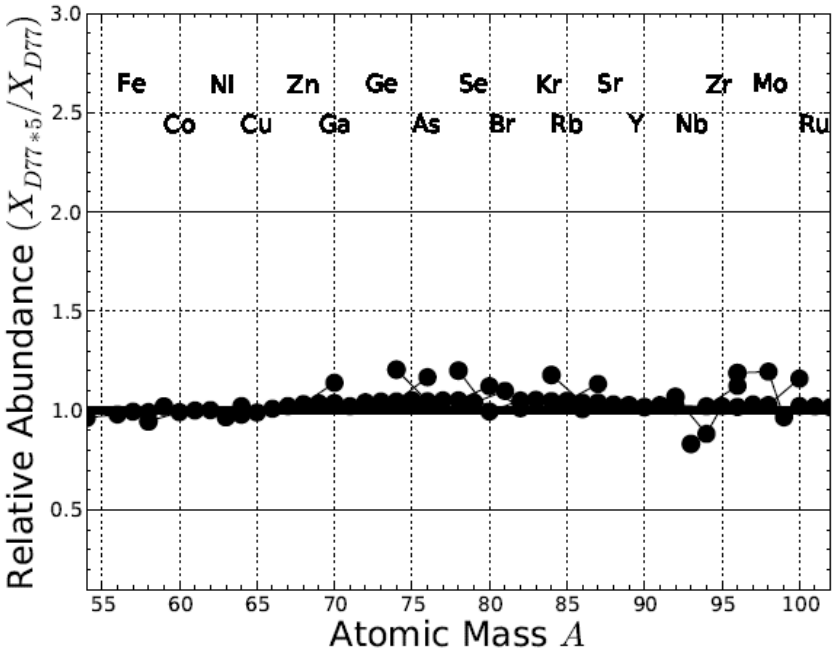
- Neutron sources:

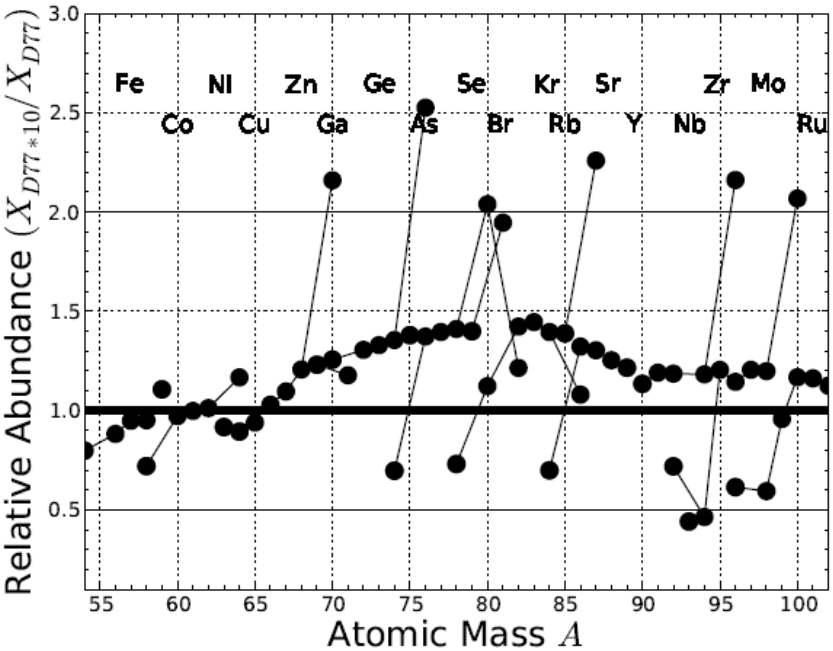
  $^{22}Ne(\alpha,n)^{25}Mg$

  $^{12}C(^{12}C,n)^{23}Mg$ (?)



Study by Pignatari et al. 2009

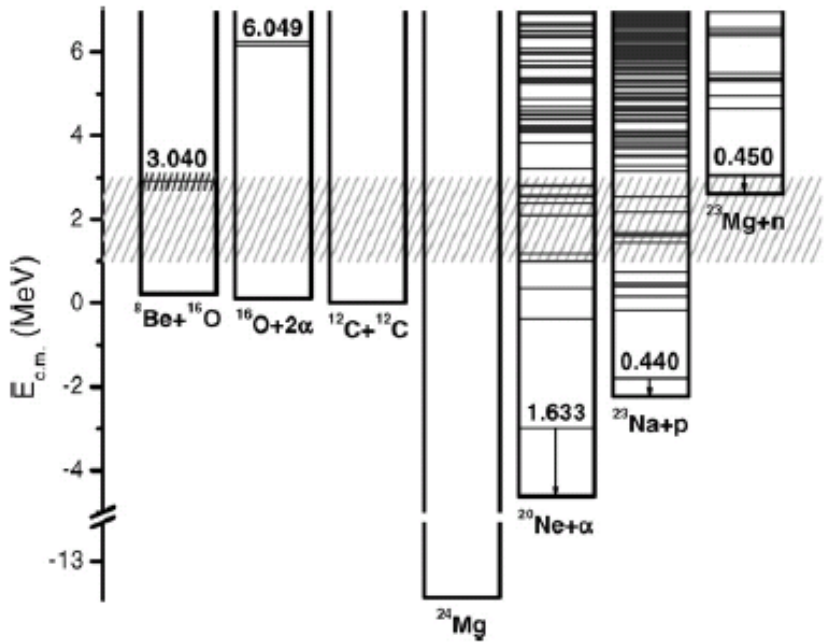


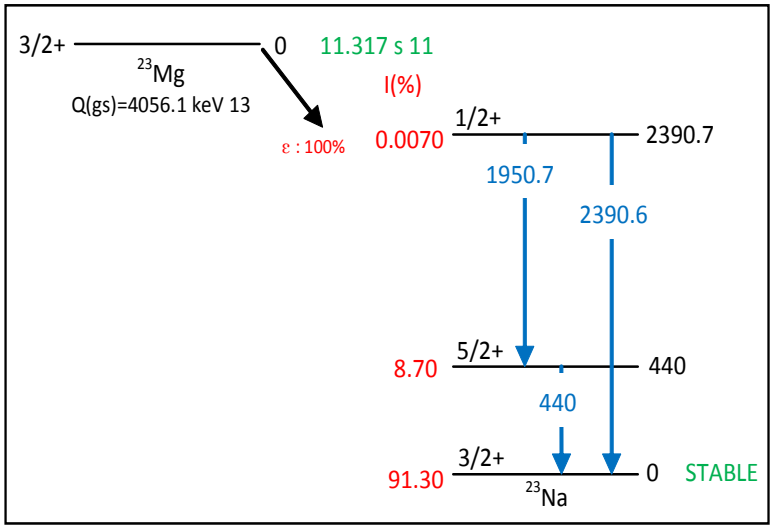


Measure $^{12}C(^{12}C,n)^{23}Mg$ at lower energies with better uncertainties!

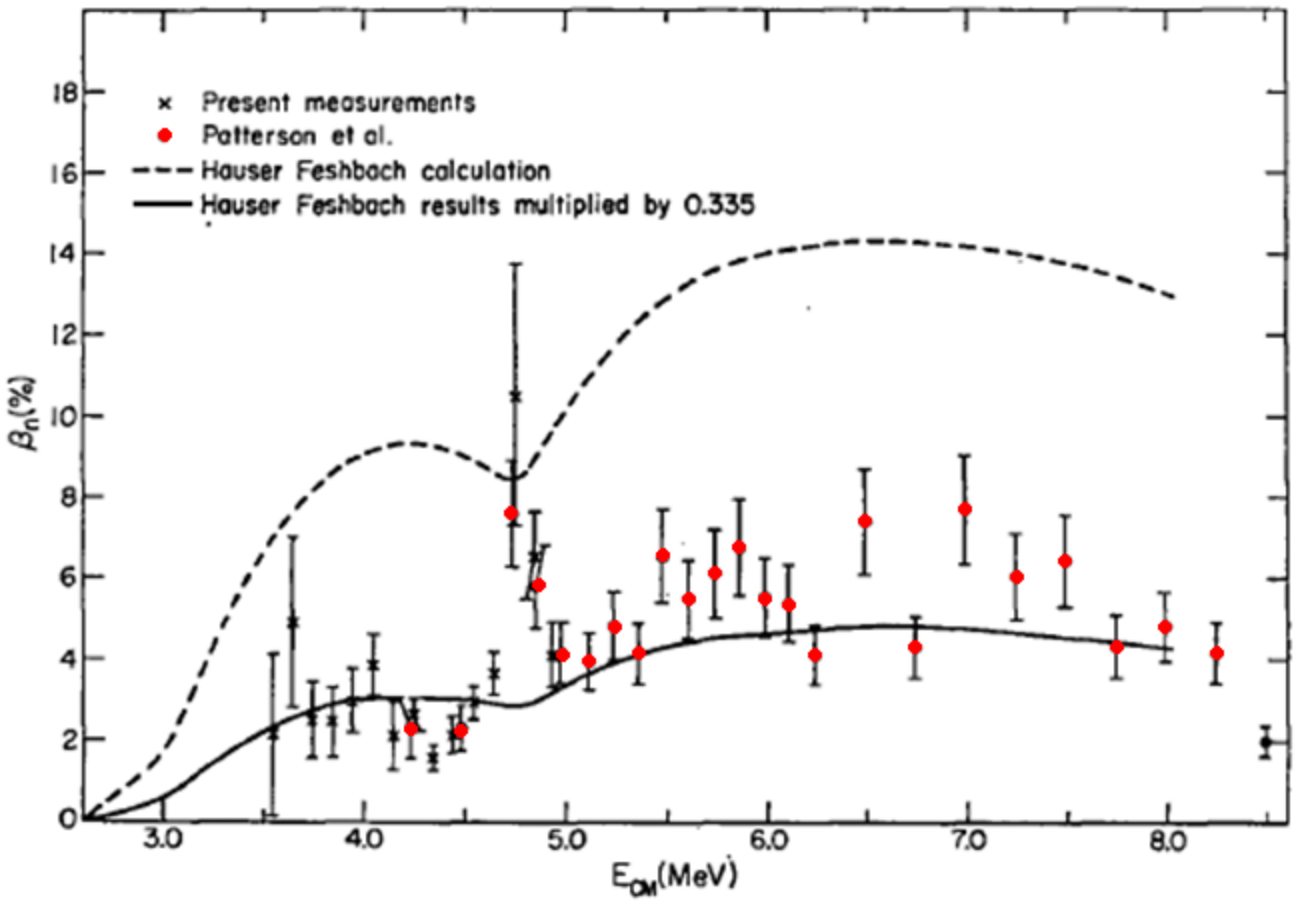
History

- 1969 Patterson et al. detected positrons from ^{23}Mg beta decay (8.7-4.2 MeV C.M.)
- 1977 Dayras et al. detected γ-rays (440 keV & 511 keV) after beta decay (4.9-3.5 MeV C.M.)





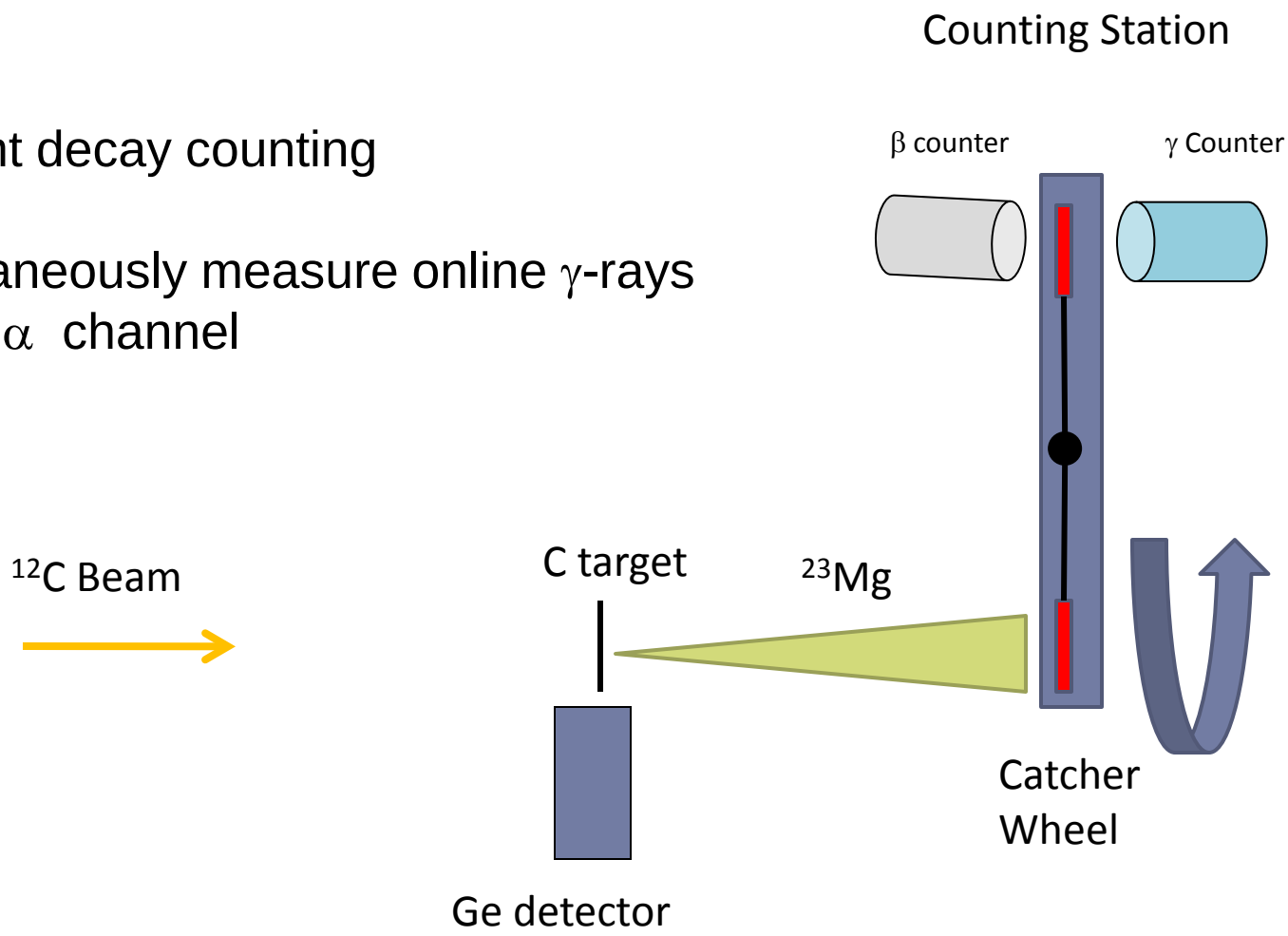
Dayras et al. Results



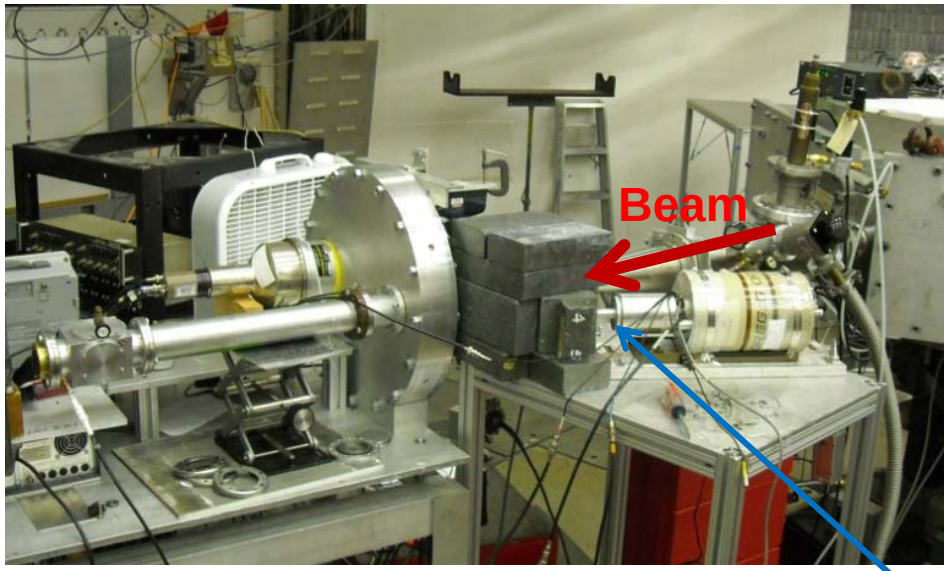
-Sharp peak in β_n?
-Model calculation requires renormalization!

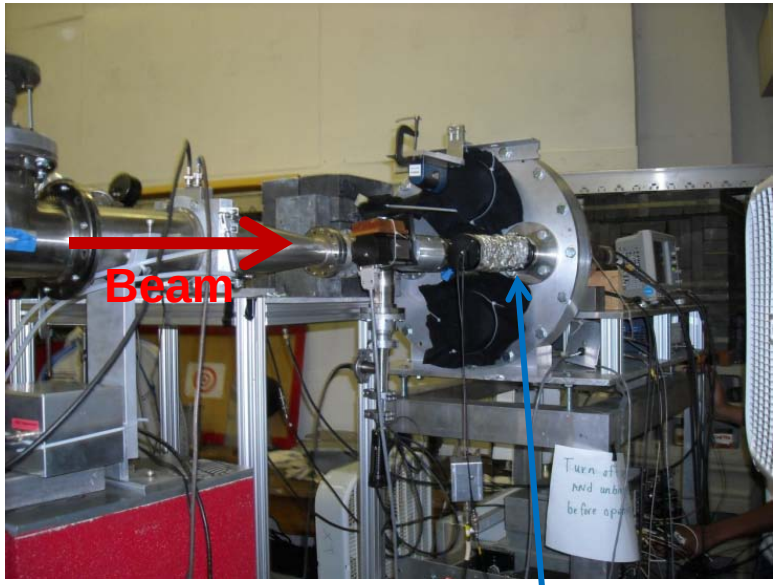
Recent Experiment at ND

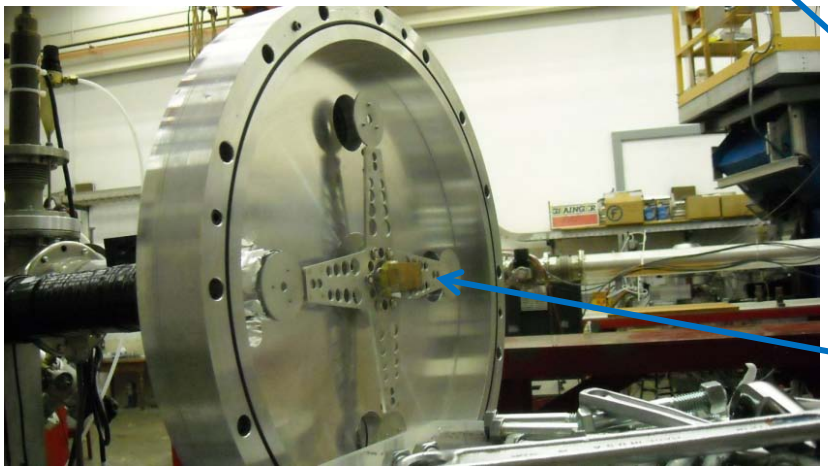
- Efficient decay counting
- Simultaneously measure online γ-rays for p & α channel



Experiment







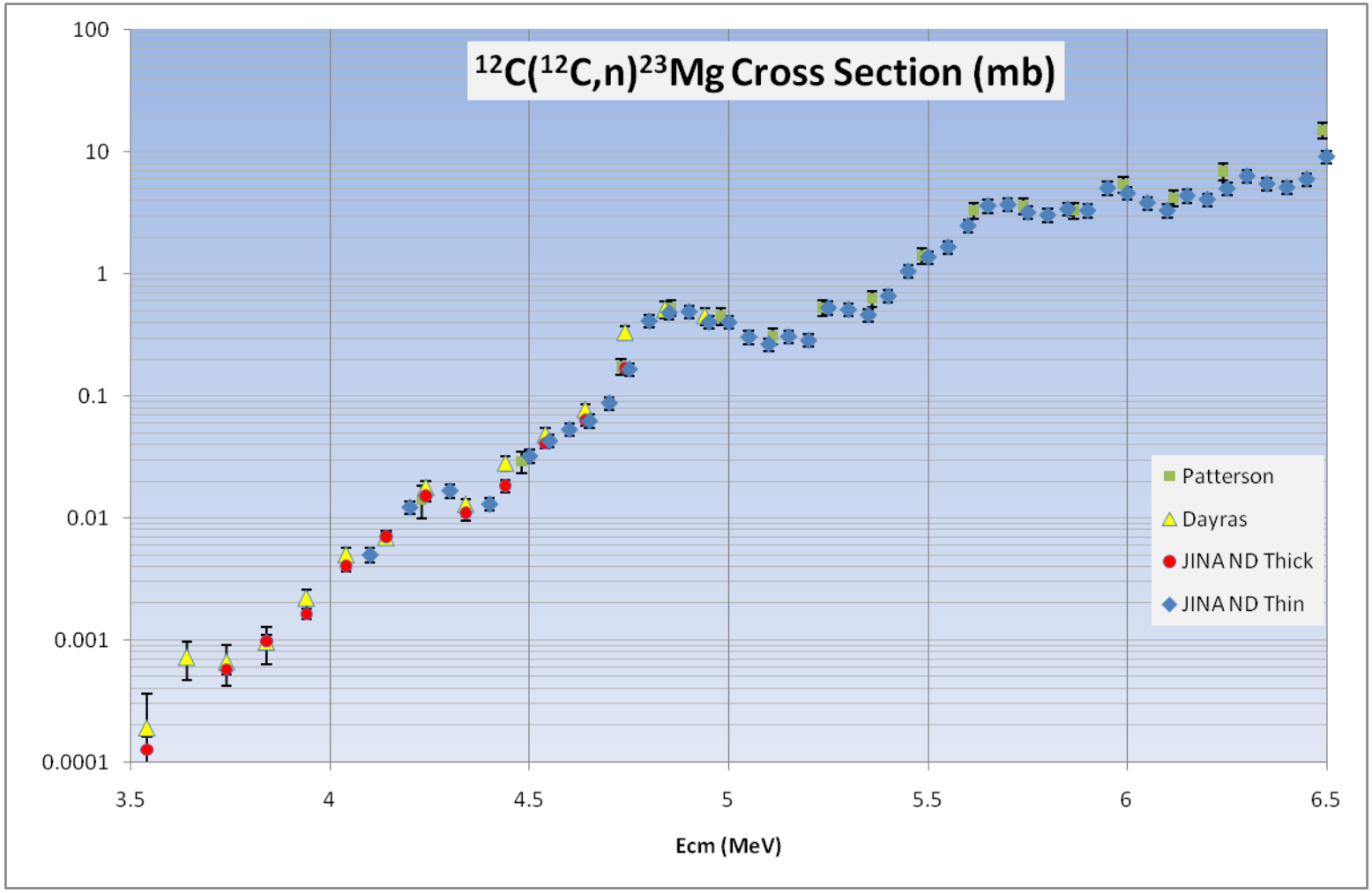
Ge Detector

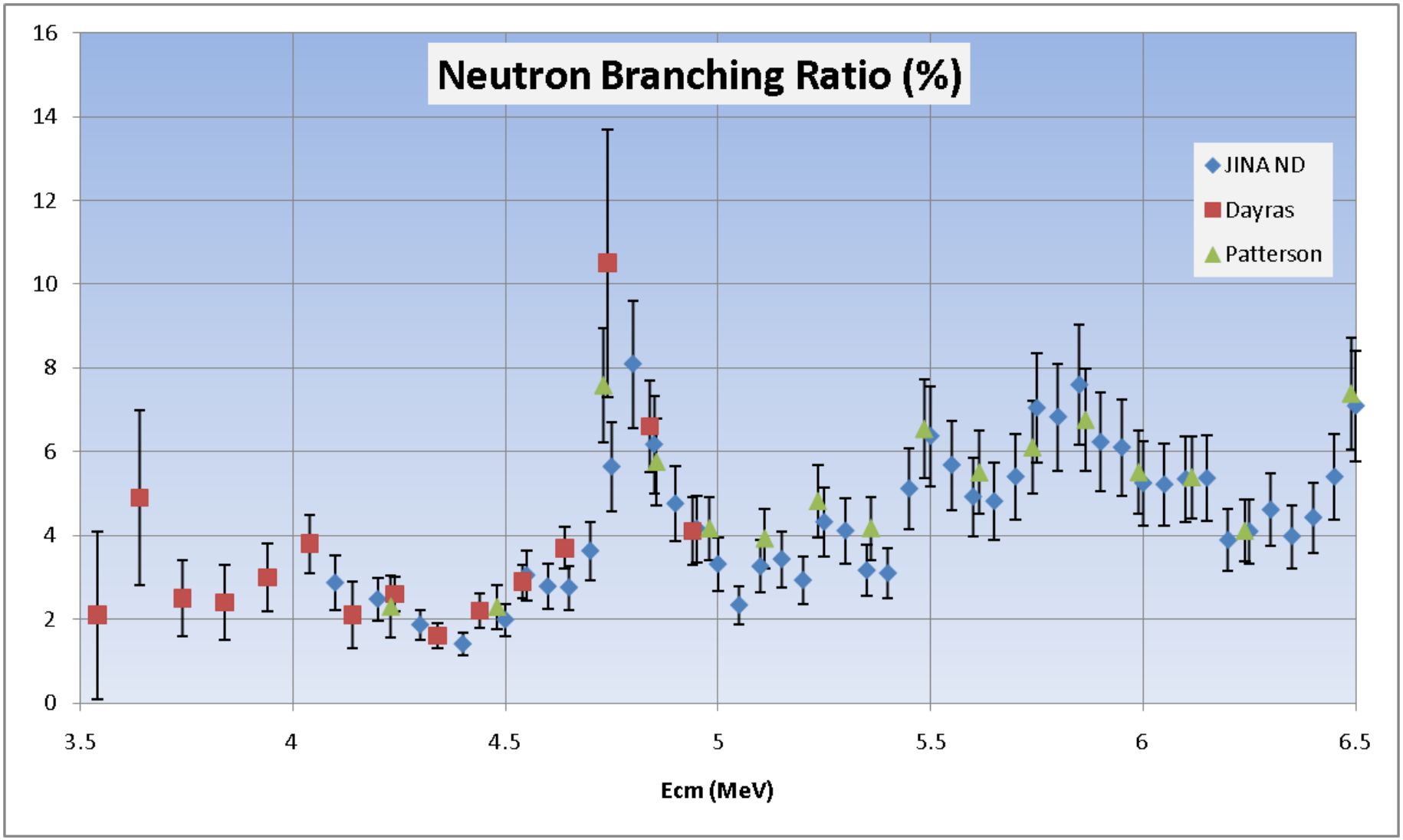
β Counter

Catcher Wheel

Results

-Consistent with others
-Can go to low energies

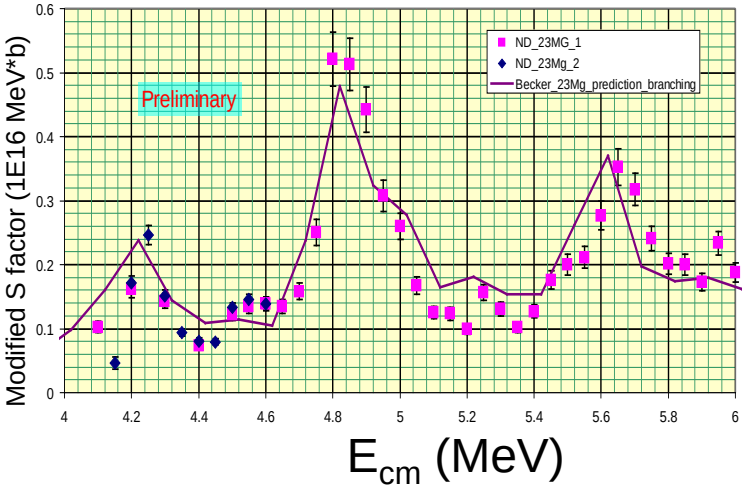




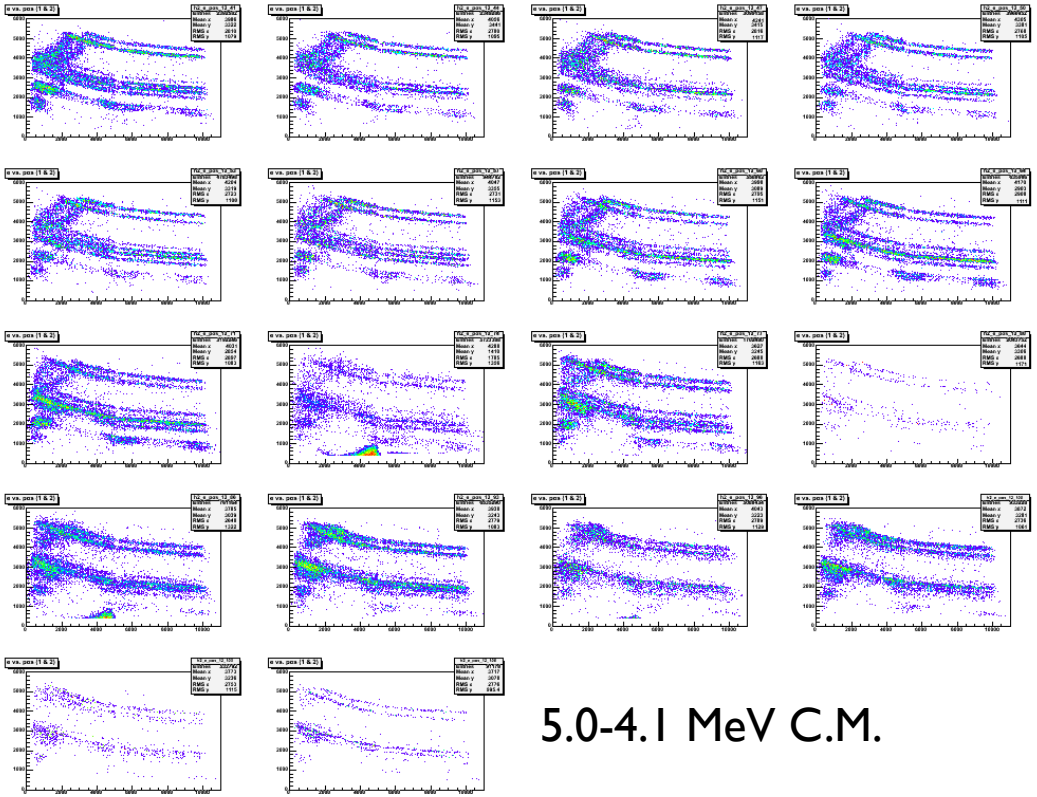
-Confirm peak in β_n !

-Statistical model calculation not reliable!

Extrapolation



Prediction based on proton measurements by Becker et al. 1981



5.0-4.1 MeV C.M.

Recent proton measurements (to be analyzed)

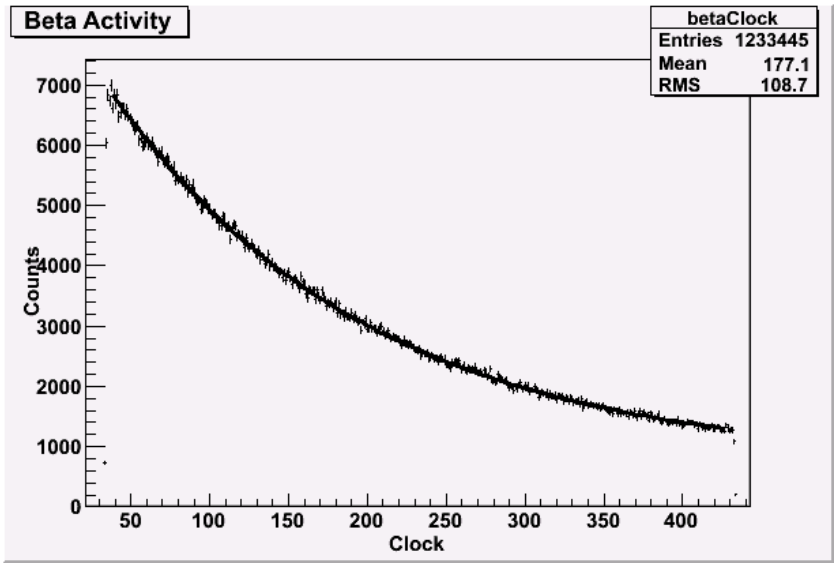
Limitations

Hydrogen contamination!

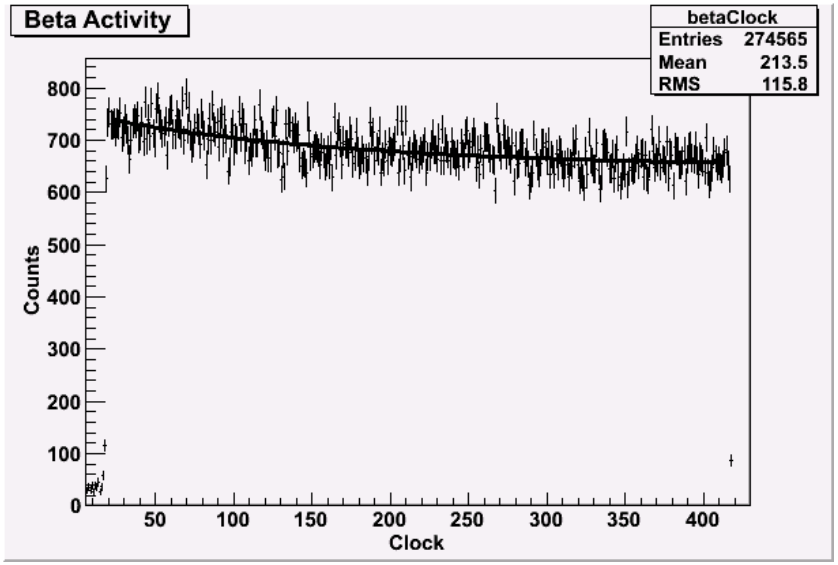
$^{1}H(^{12}C,\gamma)^{13}N$

$^{2}H(^{12}C,n)^{13}N$

^{13}N β^{+} emitter: $t_{1/2}$ = 10 min



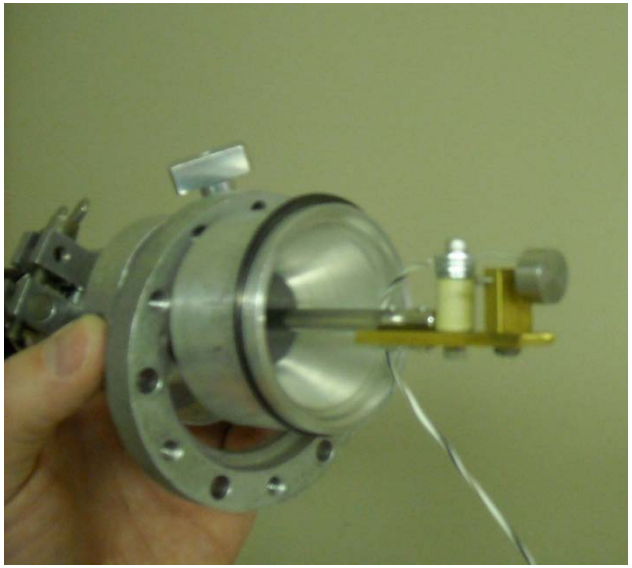
Ecm = 4.74 MeV



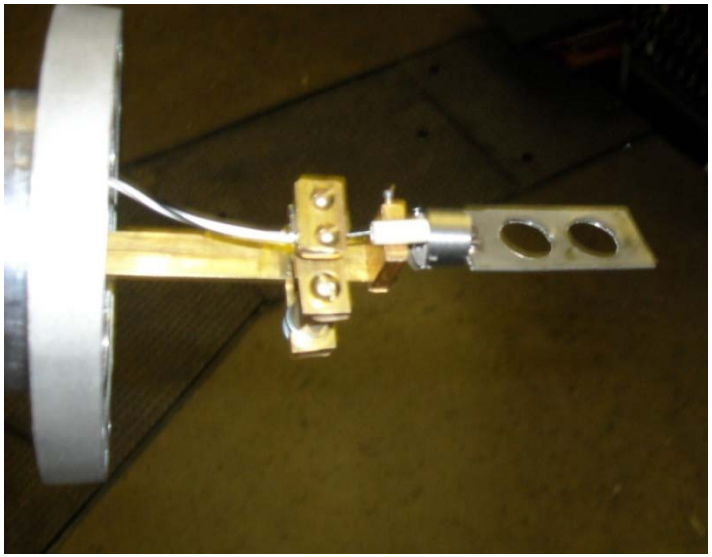
Ecm = 3.74 MeV

Future Work

- Push measurements to lower energies
- Reduce H contamination in targets
- Examine mirror system $^{12}C(^{12}C,p)^{23}Na$ for low energy prediction



Small heater for vacuum



Coupling heater to thin targets

Special Thanks

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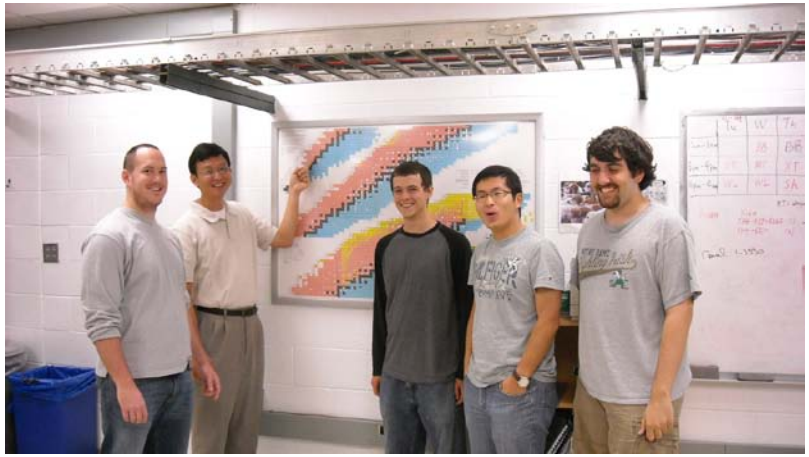
ND NSL: S. Almaraz-Calderon, A. Ayangeakaa, A. Best, M. Couder, J. DeBoer, W. Lu, M. Notani, D. Patel, N. Paul, A. Roberts, R. Talwar, W. Tan, M. Wiescher



Thank You Audience!