

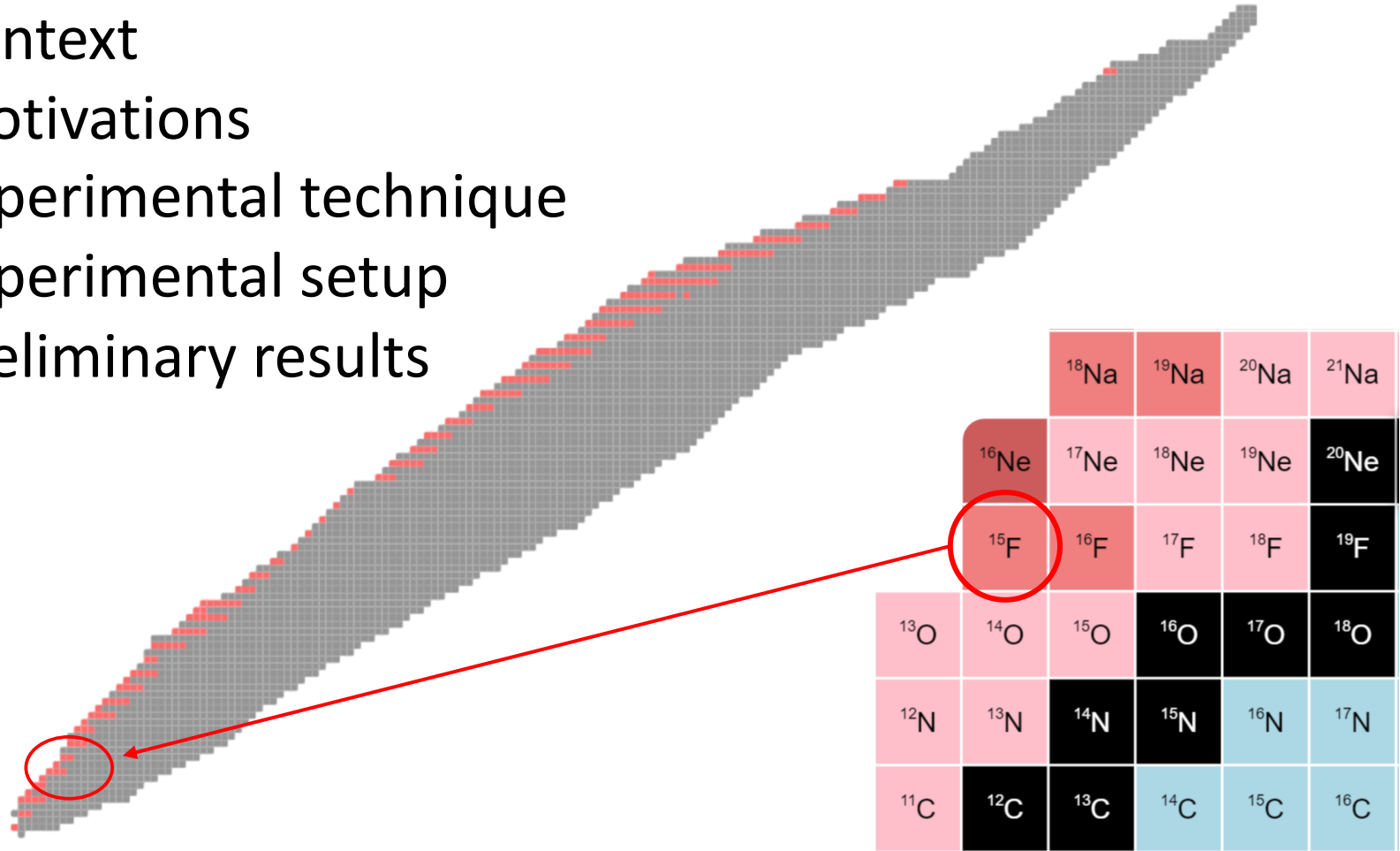
Above barrier narrow  
resonances in the  
unbound nucleus of  $^{15}\text{F}$

Valérian Alcindor (GANIL / IPNO)

GANIL colloque 09/09/19 – 12/09/19

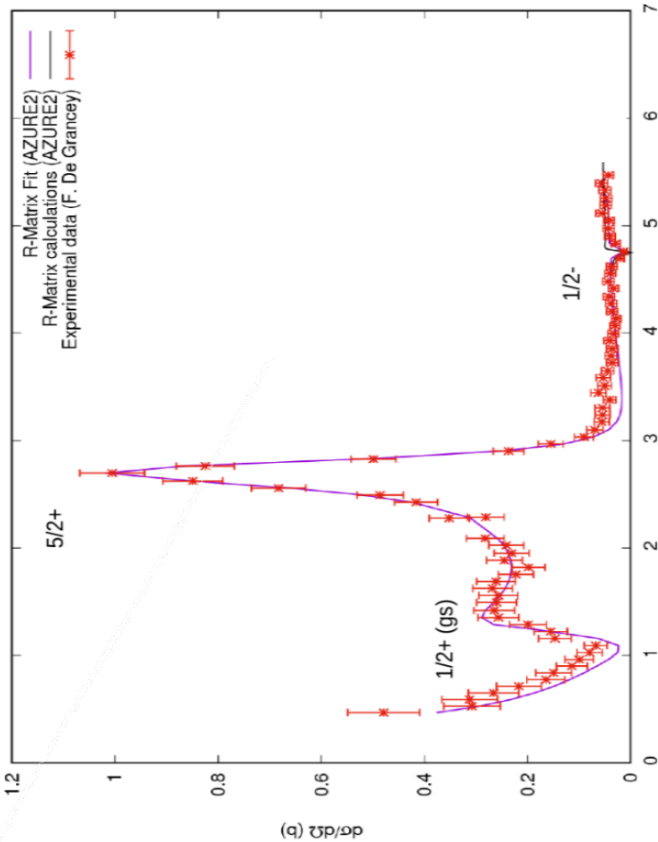
# Outline

- Context
- Motivations
- Experimental technique
- Experimental setup
- Preliminary results



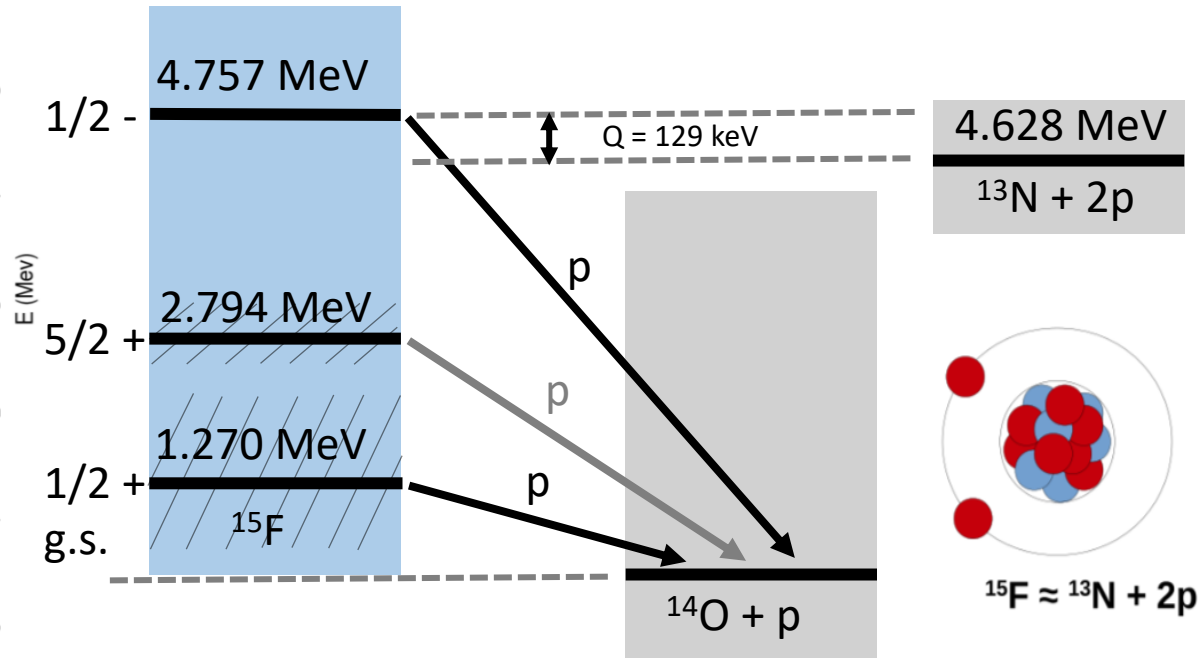
# Context

F. de Grancey : Phys. Lett. B 758 (2016) 26–31



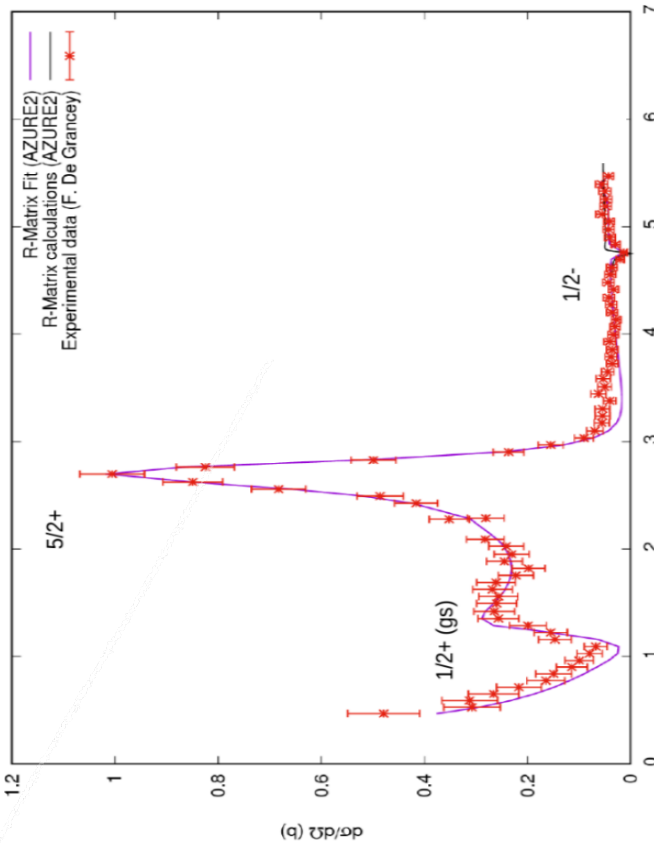
$$T \propto \frac{1}{\Gamma}$$

E (keV)	$\Gamma$ (keV)	$J^\pi$	T (s)
1270	660	1/2+	$\sim 10^{-21}$
2794	300	5/2+	$\sim 10^{-21}$
4757	36	1/2-	$\sim 10^{-20}$



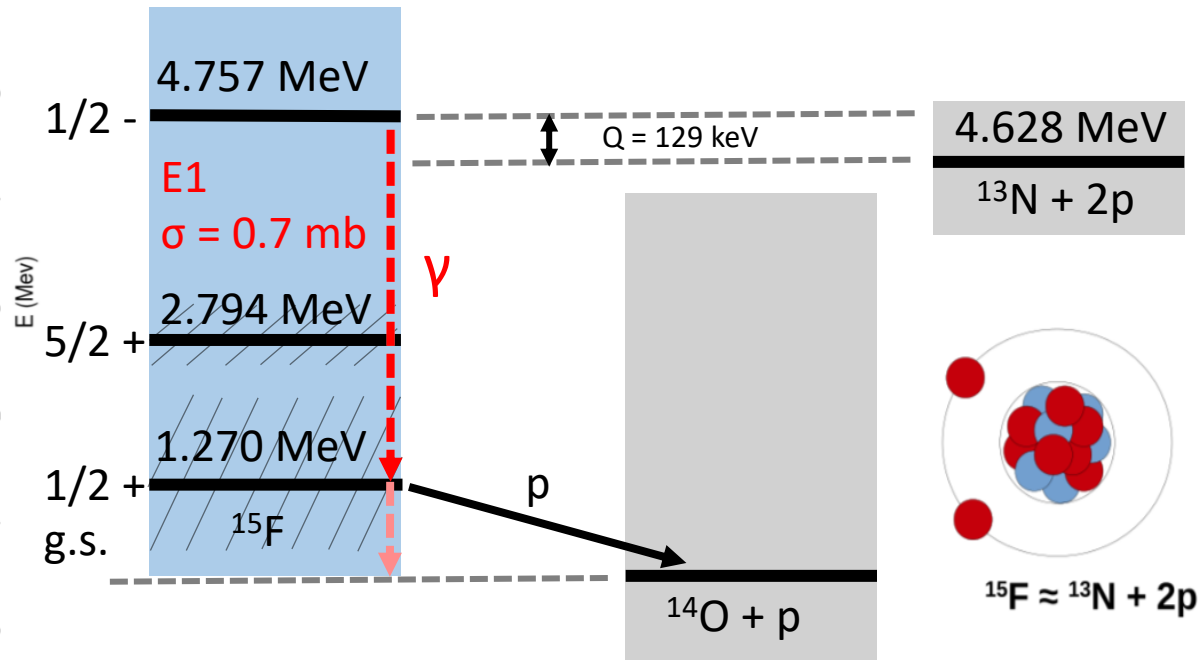
# Motivation 1 : Gamma transition in $^{15}\text{F}$ ?

F. de Grancey : Phys. Lett. B 758 (2016) 26–31



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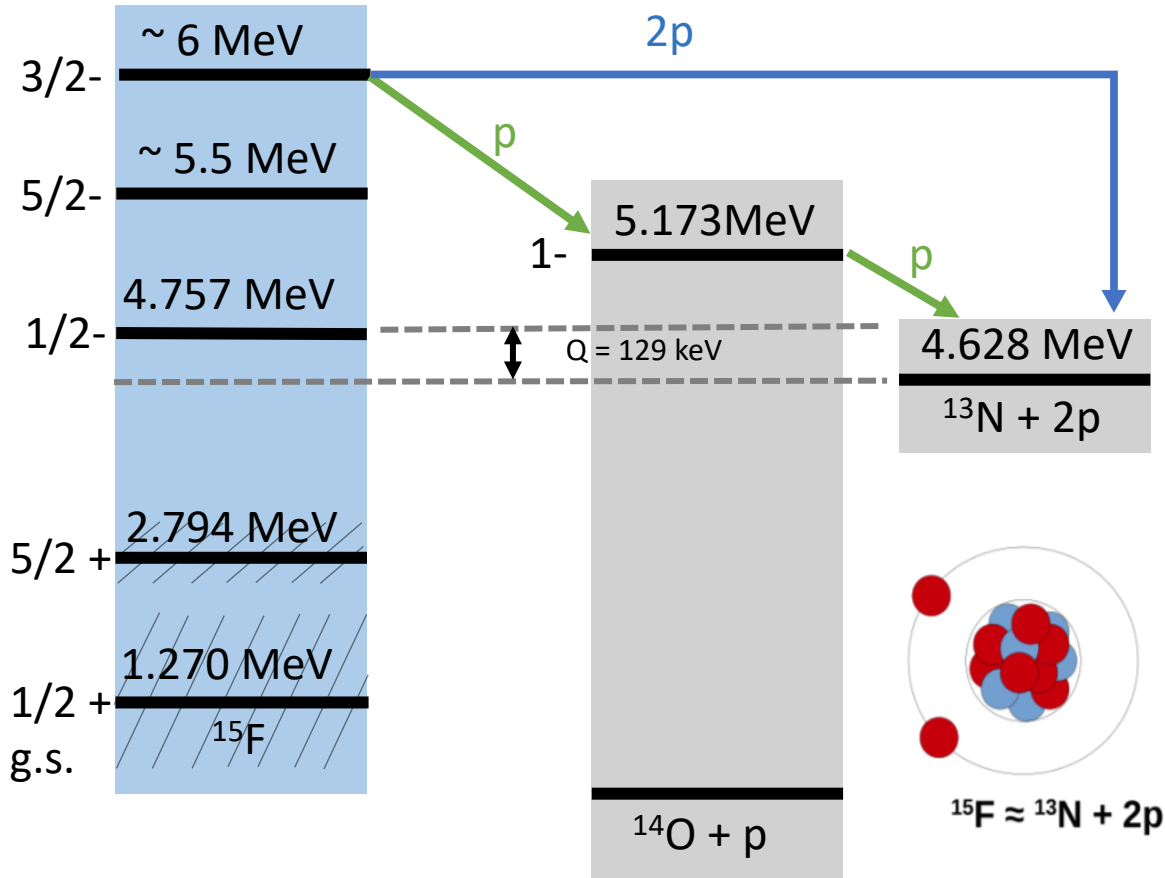
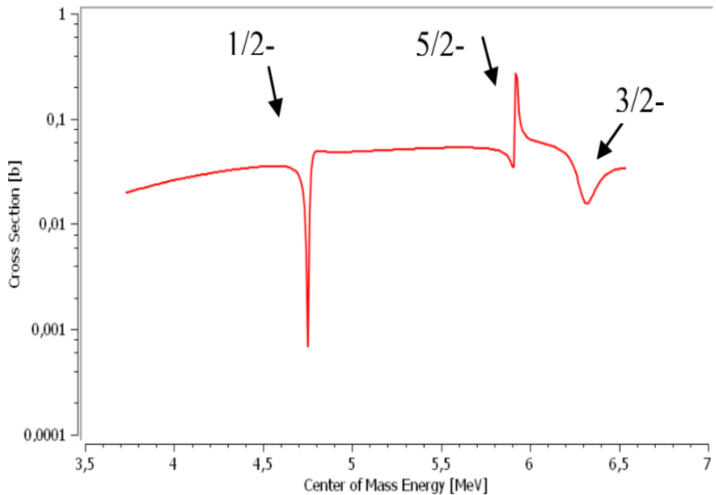


# Motivation 2-3 : New two-proton emitting states ?

TABLE II. Energies (MeV) and widths (keV) in  $^{15}\text{C}$  and  $^{15}\text{F}$ .

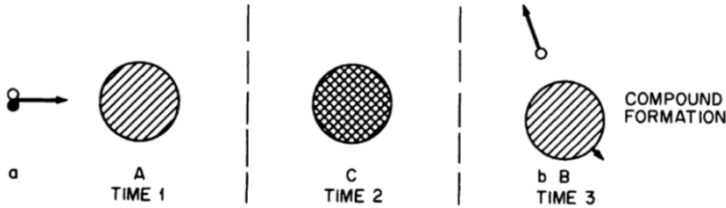
$^{15}\text{C}$				$^{15}\text{F}$		
$J^\pi$	$E_x$	Source	$\Gamma$	Source	$E_p$	$\Gamma$
$1/2^-$	3.10	Ref. [1]	2	Ref. [1]	5.49	5
		Present	29(3)	Present	4.63	38
$5/2^-$	4.22	Ref. [1]	2	Expt (Refs. [4,5])	4.9(2)	200(200)
		Present	Narrow	Present	5.92	6
$3/2^-$	4.66	Ref. [1]	90	Ref. [1]	7.25	40
		Present	176(15)	Present	6.30	350
				Expt (Refs. [4,5])	6.4(2)	200(200)

H. T. Fortune : Phys. Rev. C 83, 024311 (2011)

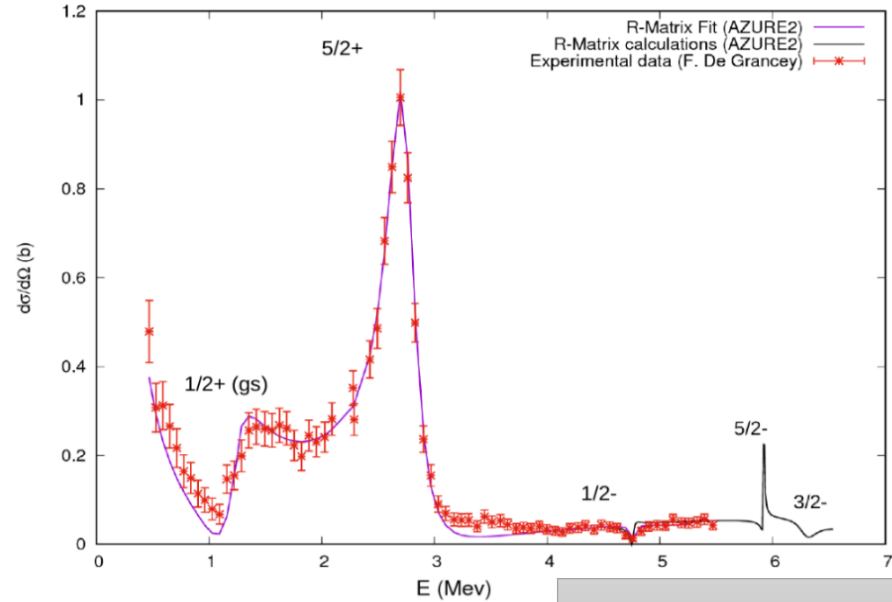
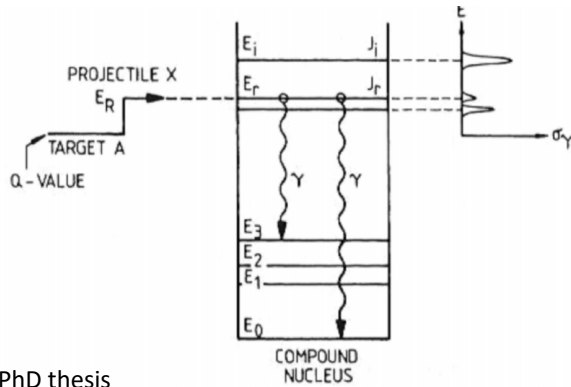


# Experimental technique

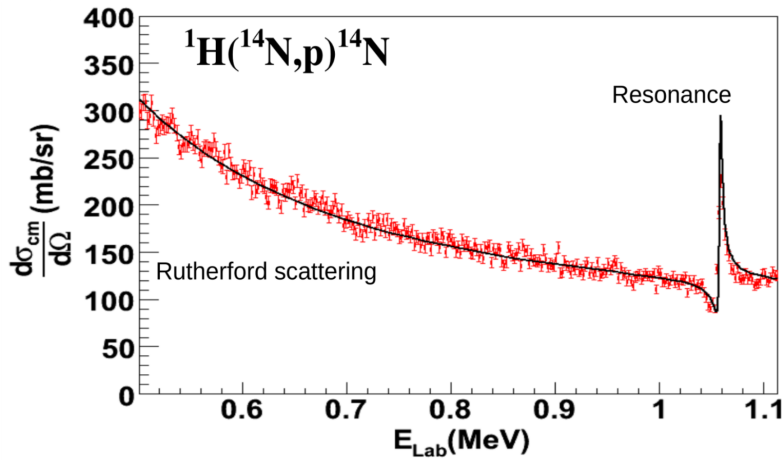
Satchler : Intro to nuclear reactions



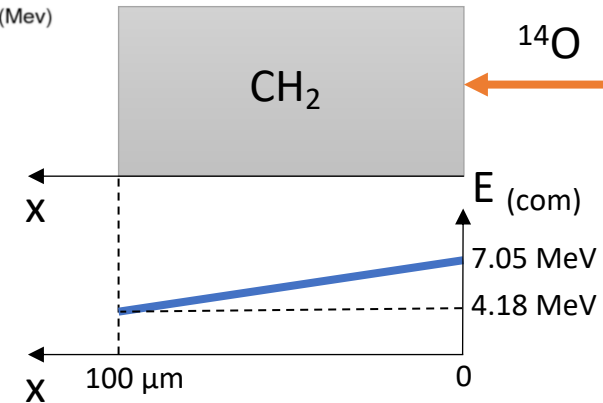
C. E. Rolfs : Caudrons in the cosmos



I. Stefan PhD thesis



Radioactive Ion Beam (RIB) in a thick target



# Experimental setup

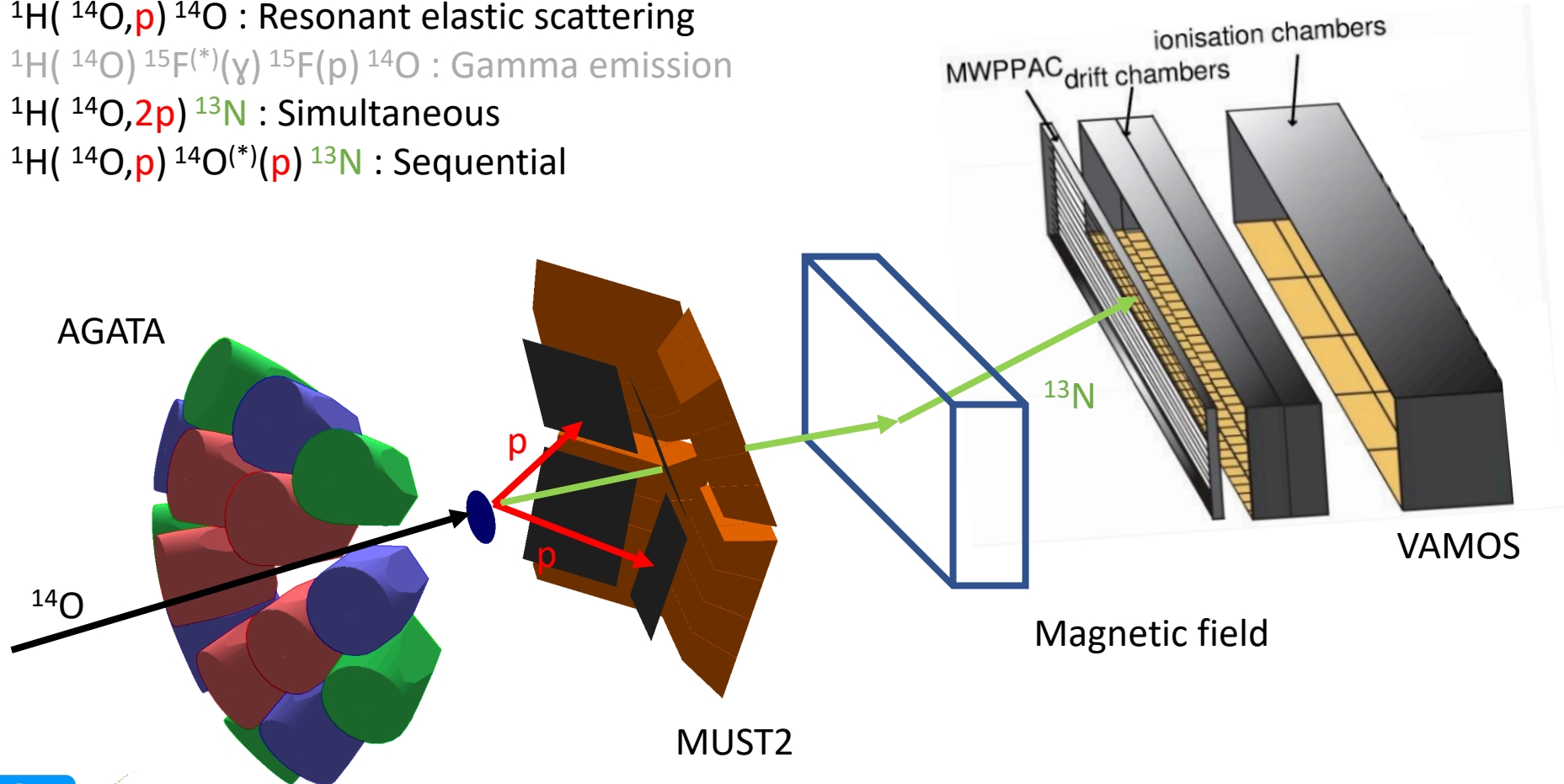
Nuclear reactions studied :

$^1\text{H}(^{14}\text{O},\text{p})^{14}\text{O}$  : Resonant elastic scattering

$^1\text{H}(^{14}\text{O})^{15}\text{F}^*(\gamma)^{15}\text{F}(\text{p})^{14}\text{O}$  : Gamma emission

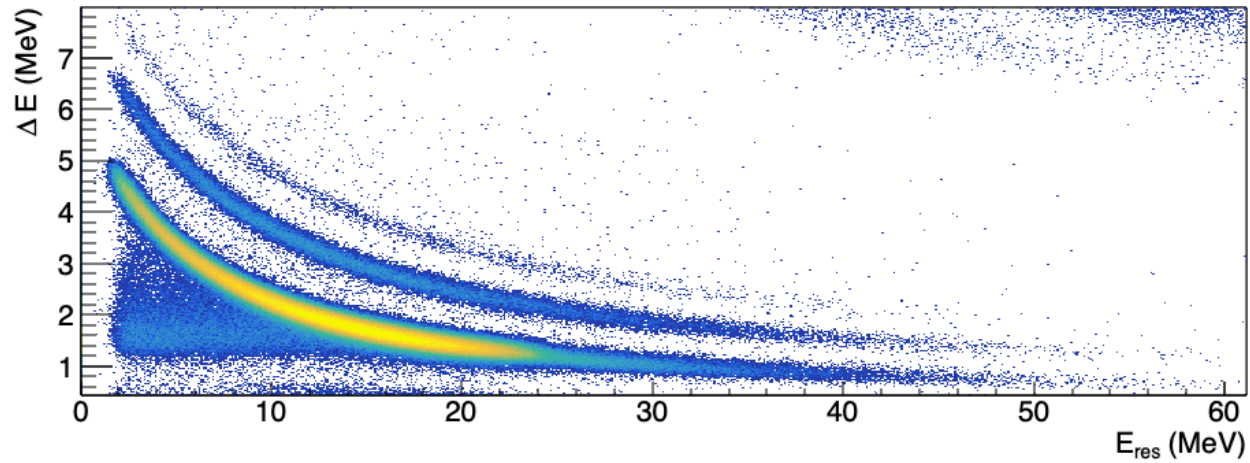
$^1\text{H}(^{14}\text{O},2\text{p})^{13}\text{N}$  : Simultaneous

$^1\text{H}(^{14}\text{O},\text{p})^{14}\text{O}^*(\text{p})^{13}\text{N}$  : Sequential



# Preliminary results

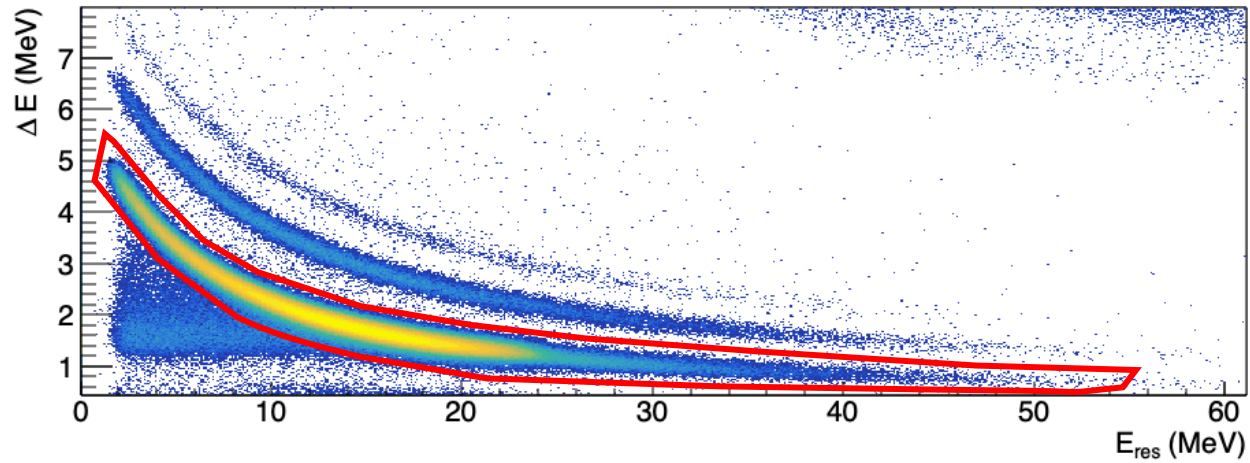
${}^1\text{H}({}^{14}\text{O},\text{p}){}^{14}\text{O}$  : Resonant elastic scattering





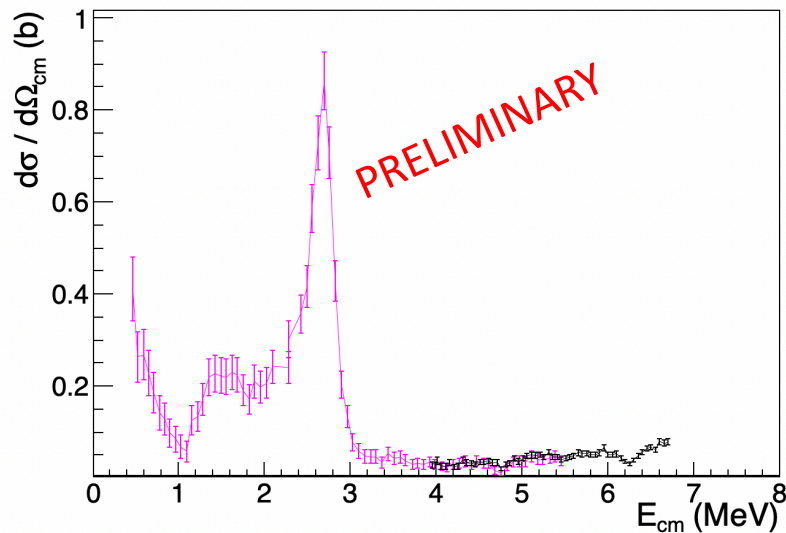
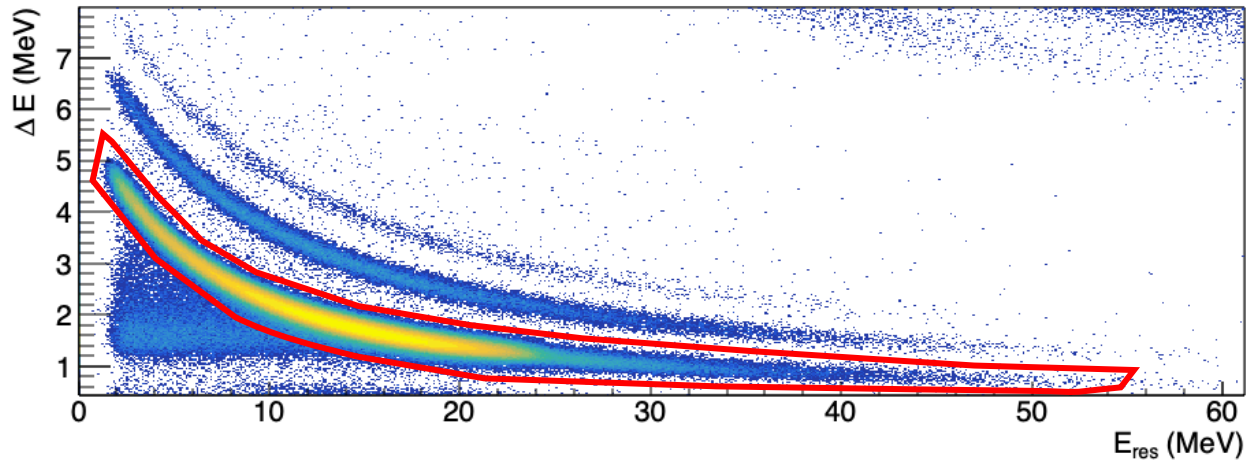
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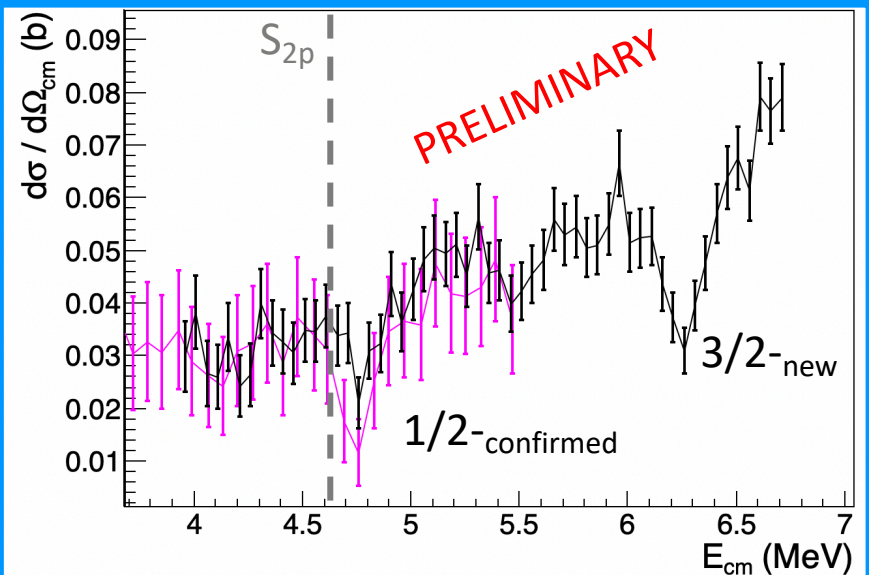
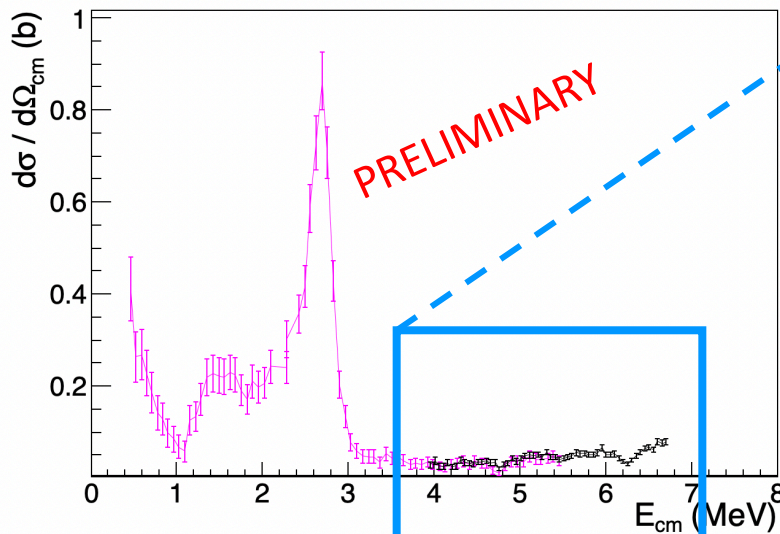
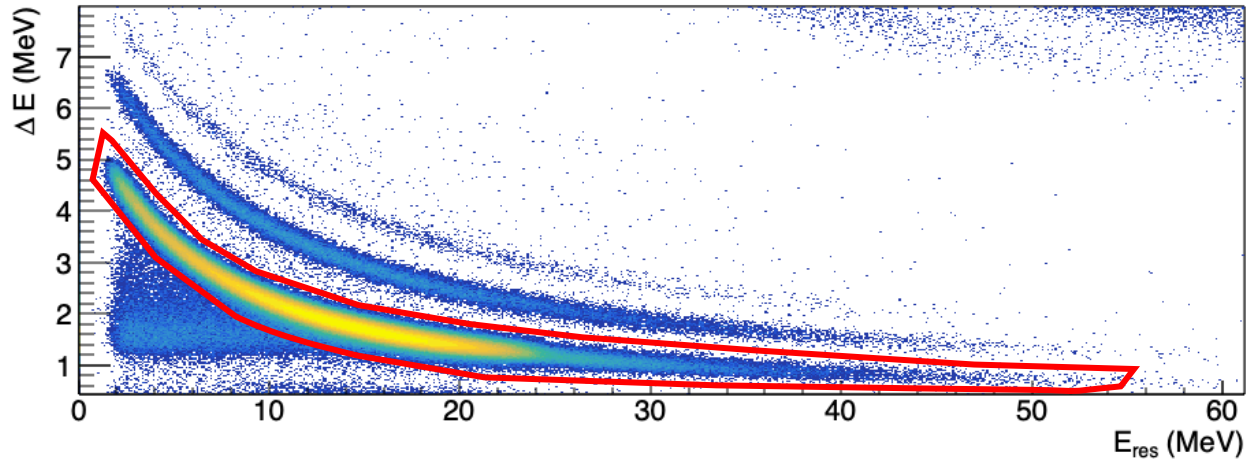
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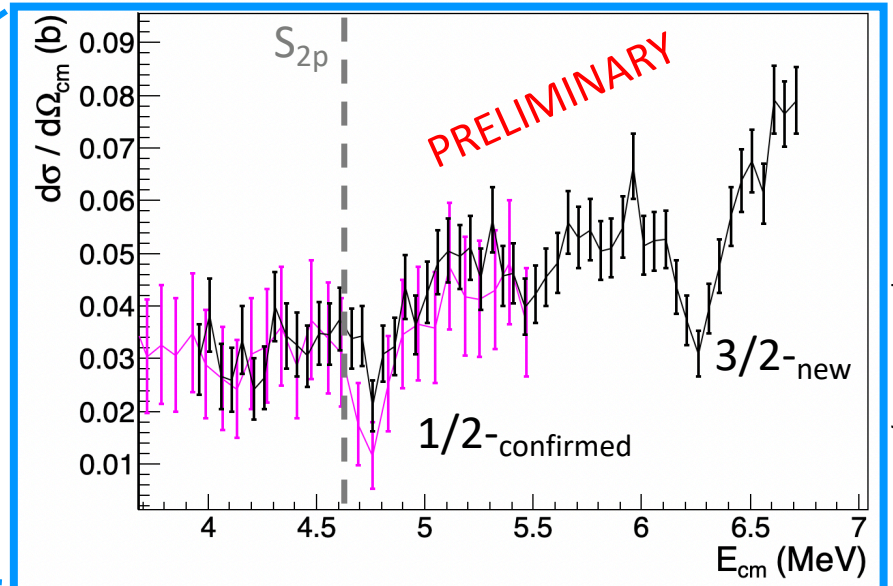
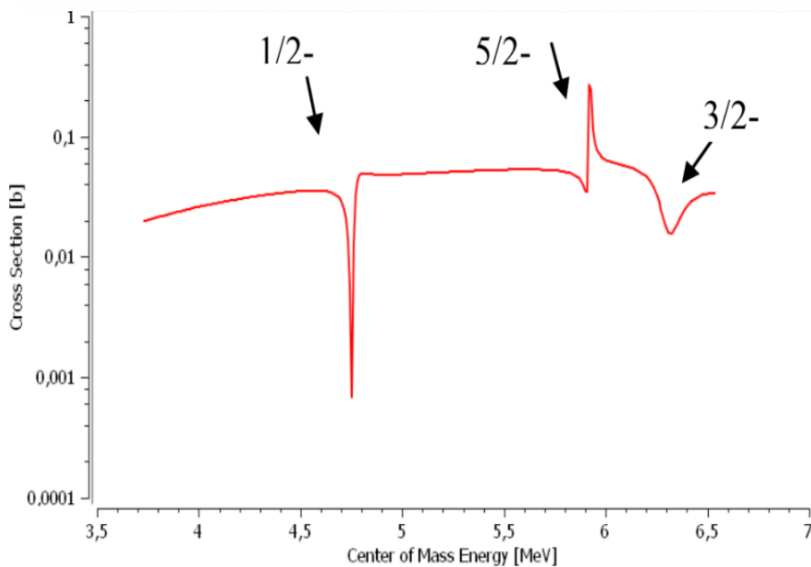
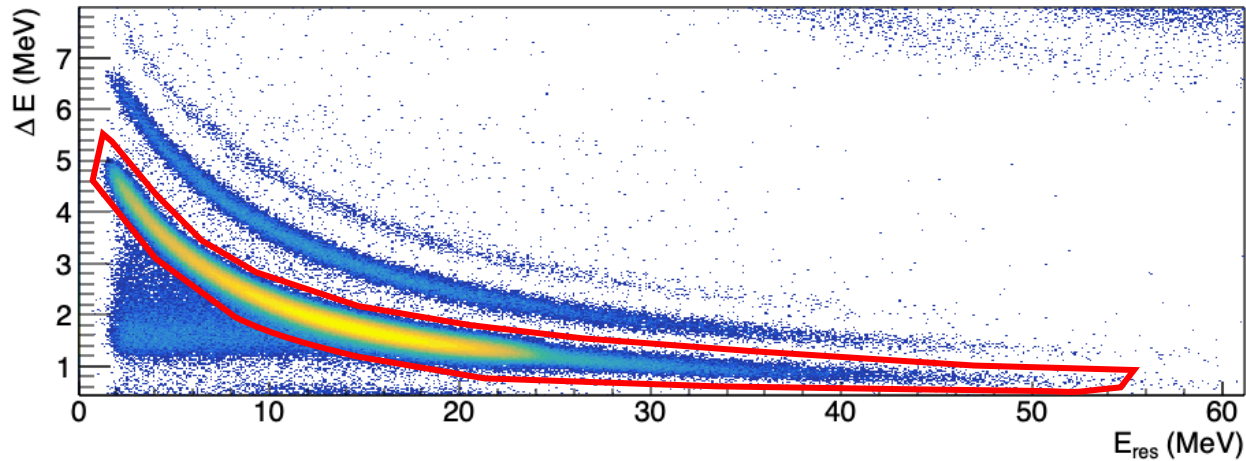
${}^1\text{H}({}^{14}\text{O},\text{p}){}^{14}\text{O}$  : Resonant elastic scattering



Taken from first experiment may 2018

# Preliminary results

${}^1\text{H}({}^{14}\text{O},\text{p}){}^{14}\text{O}$  : Resonant elastic scattering

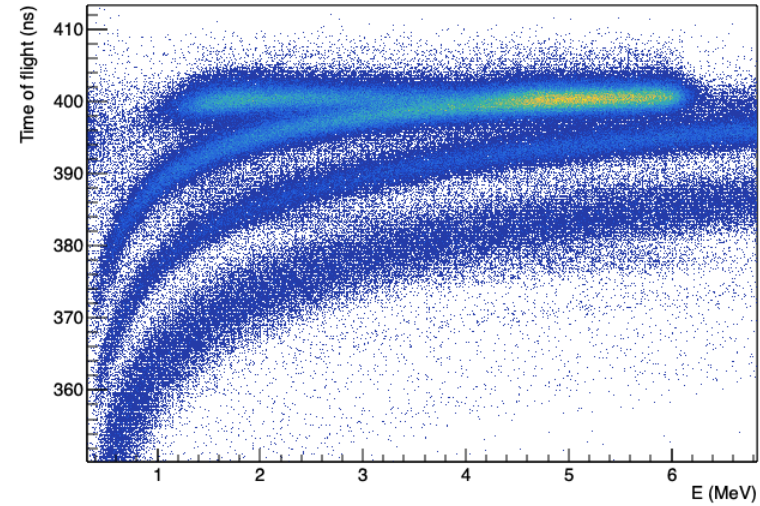
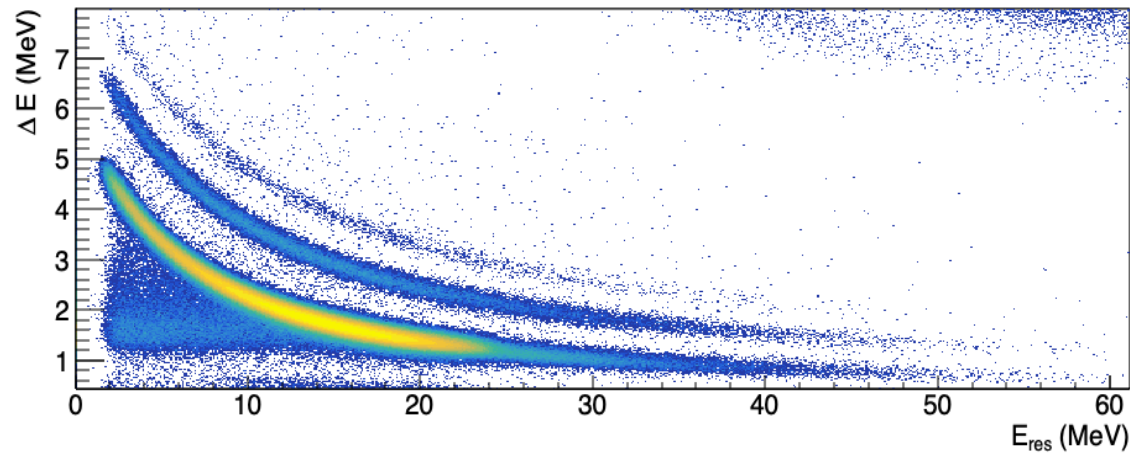


Taken from first experiment may 2018

# Preliminary results

$^1\text{H}(^{14}\text{O}, 2\text{p})^{13}\text{N}$  : Simultaneous

$^1\text{H}(^{14}\text{O}, \text{p})^{14}\text{O}^*(\text{p})^{13}\text{N}$  : Sequential

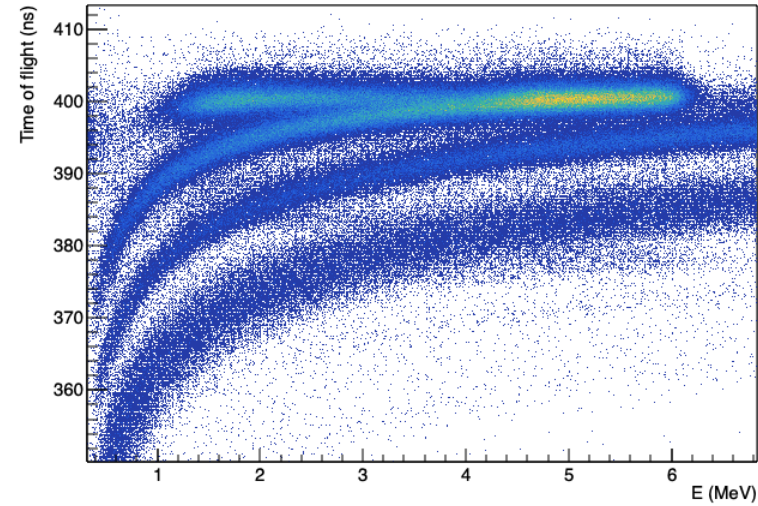
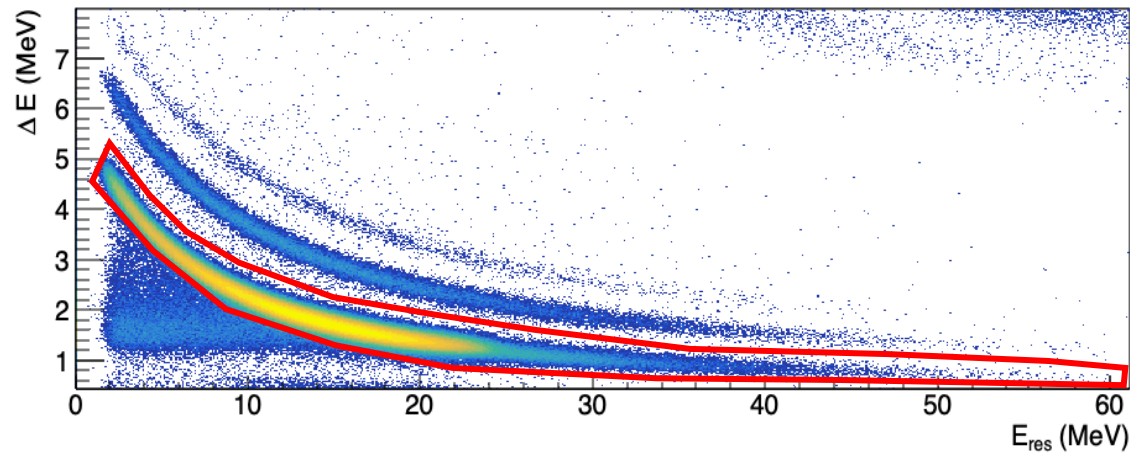




# Preliminary results

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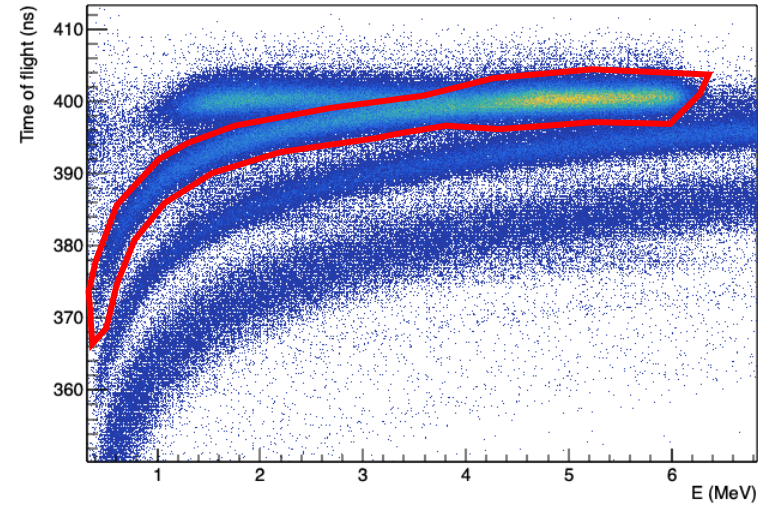
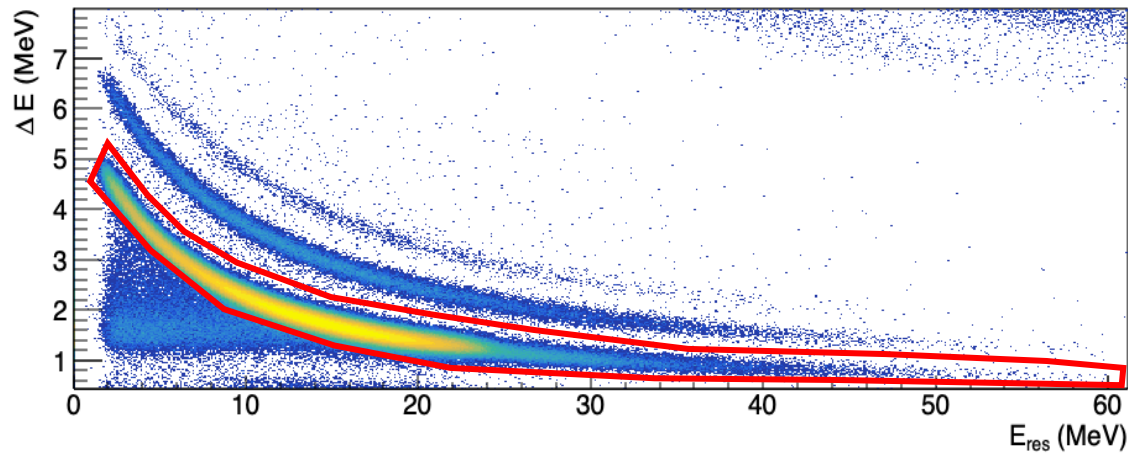
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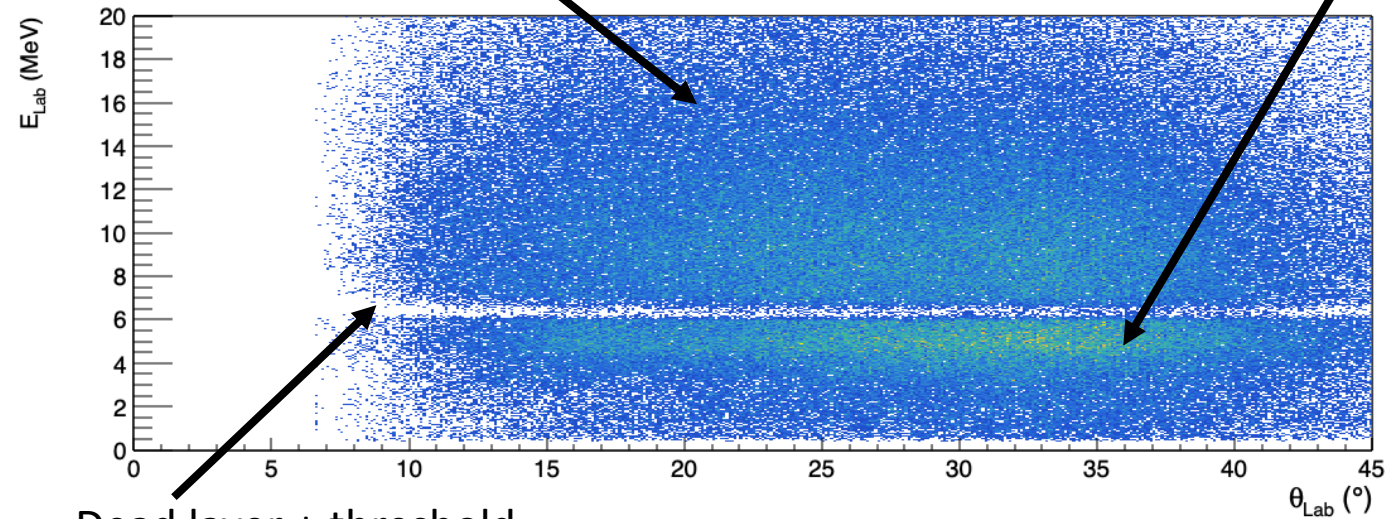
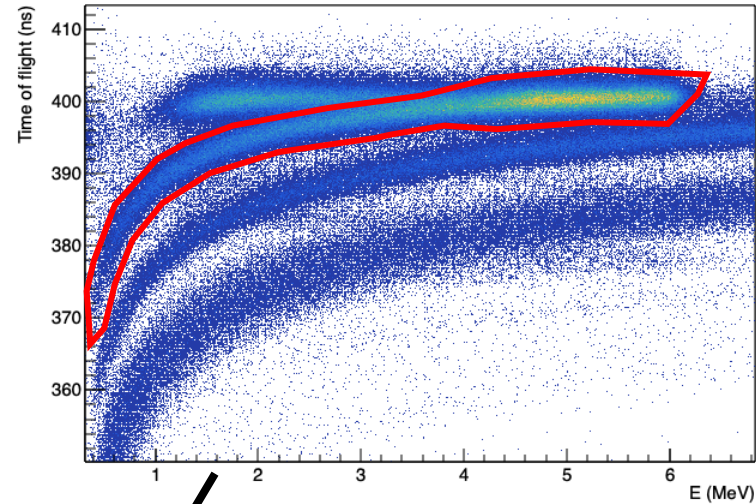
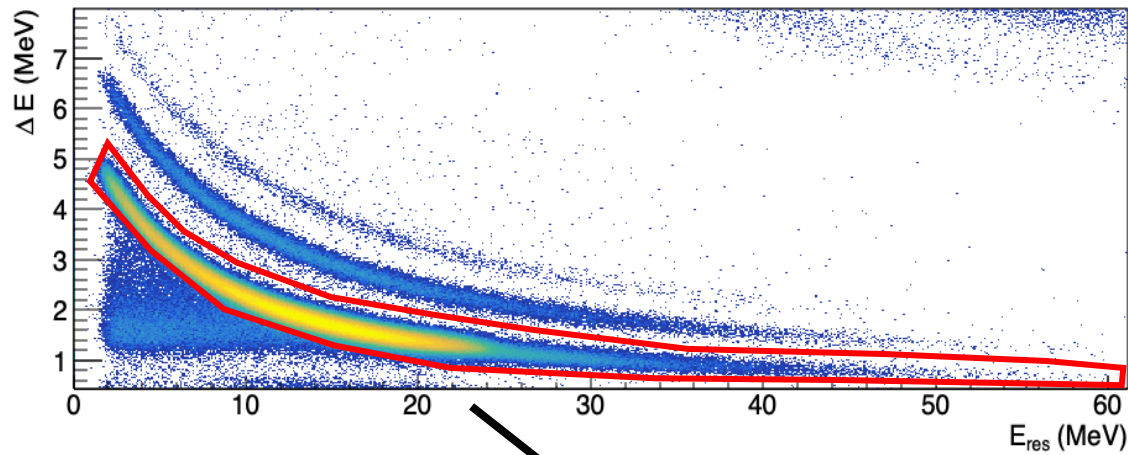
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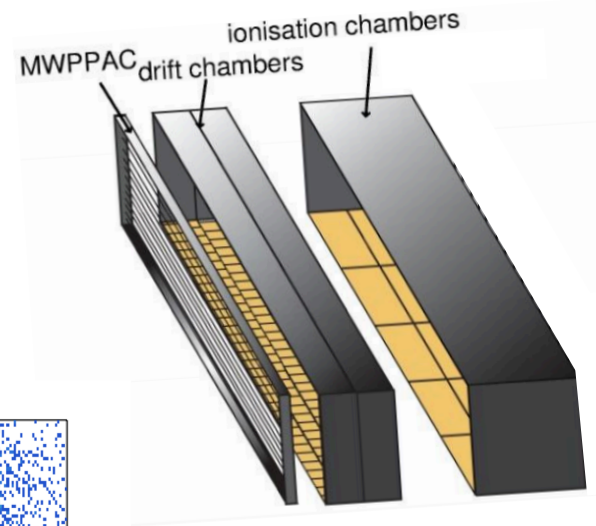
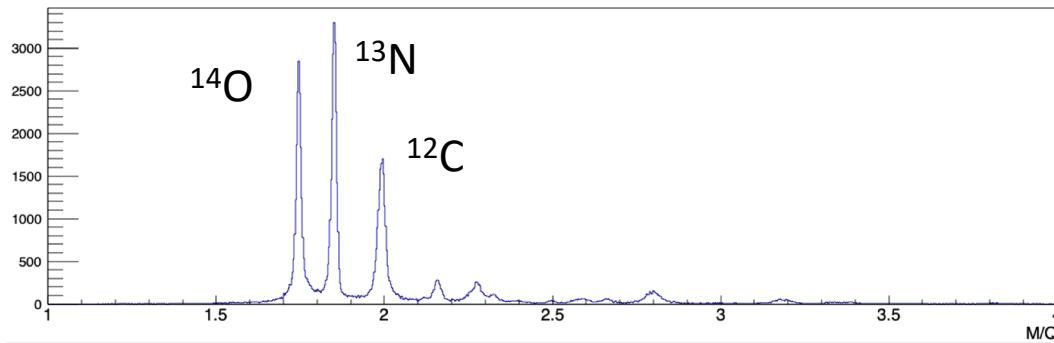


Dead layer + threshold

Selection on protons is needed, but not sufficient.

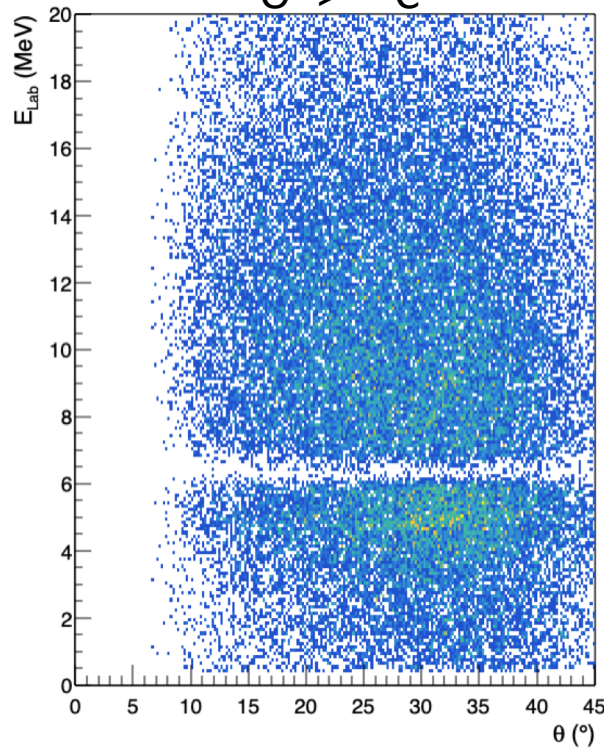
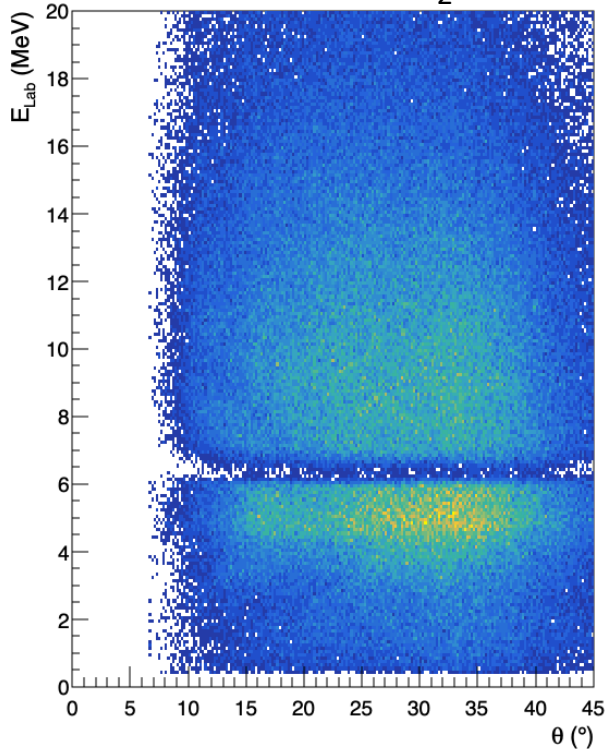


# Preliminary results



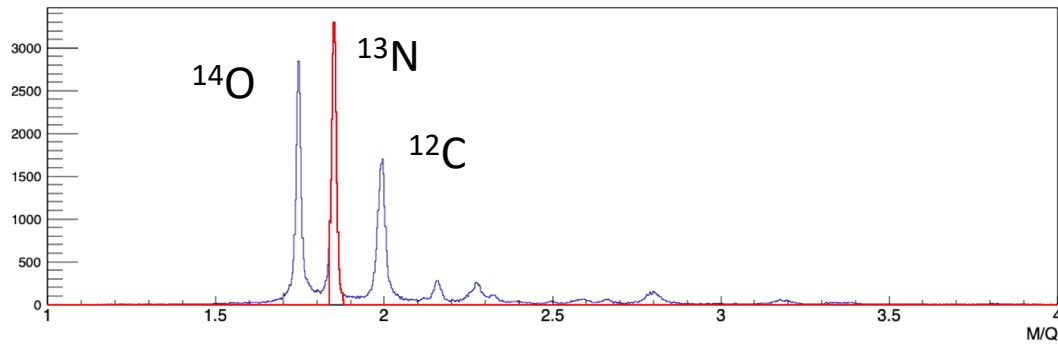
$^{14}\text{O} \rightarrow \text{CH}_2$

$^{14}\text{O} \rightarrow \text{natC}$



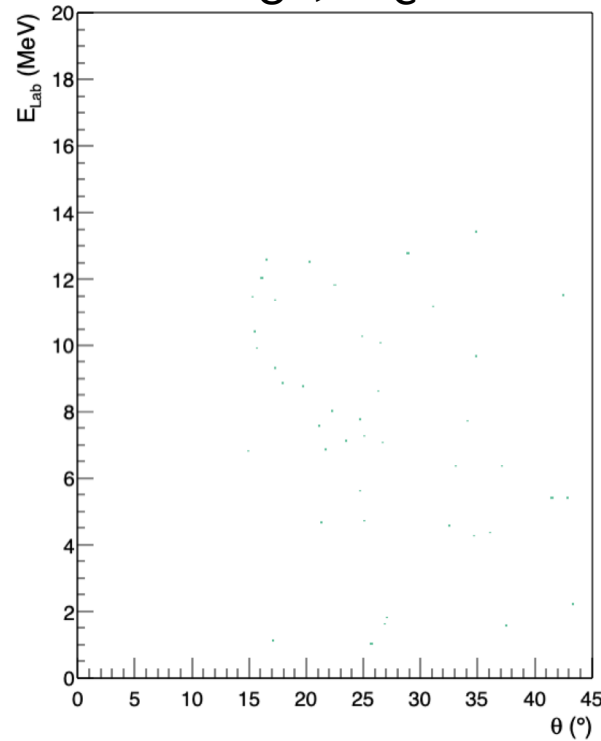
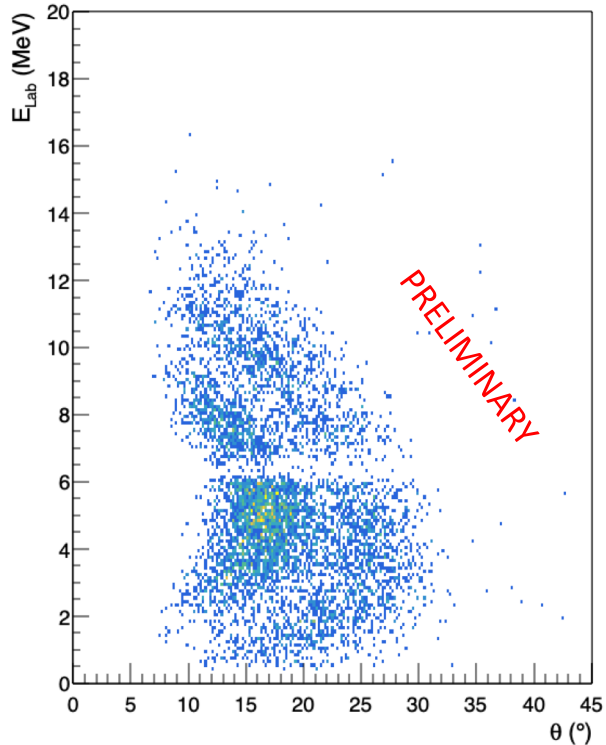
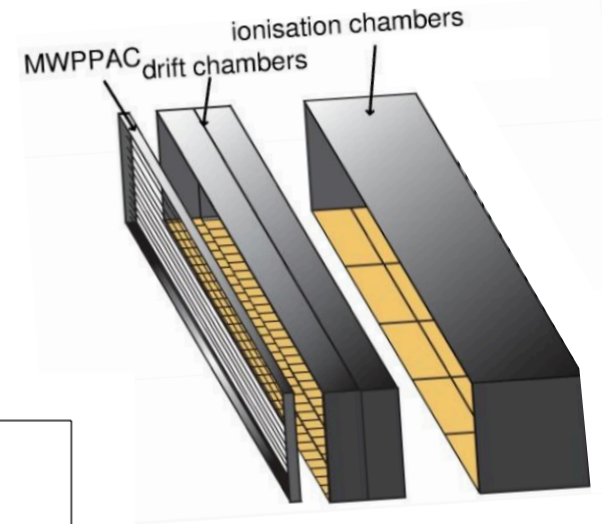
Without selection in VAMOS, only fusion evaporation background is visible

# Preliminary results



$^{14}\text{O} \rightarrow \text{CH}_2$

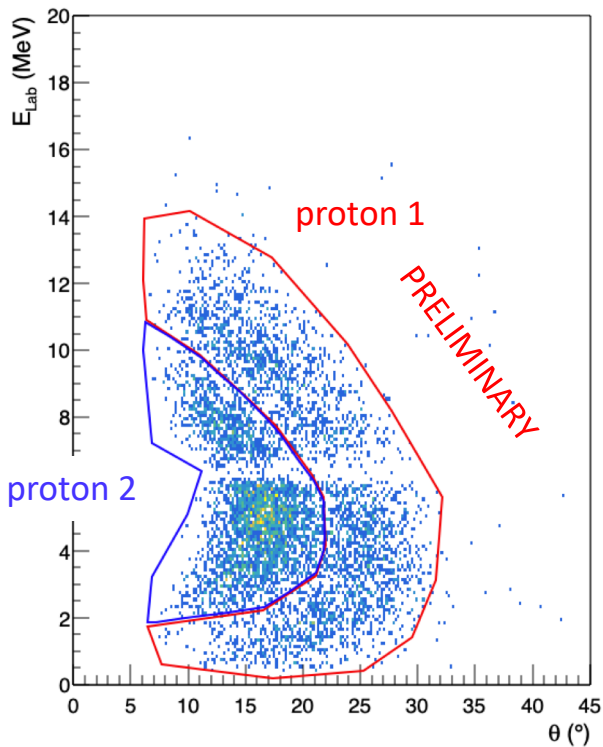
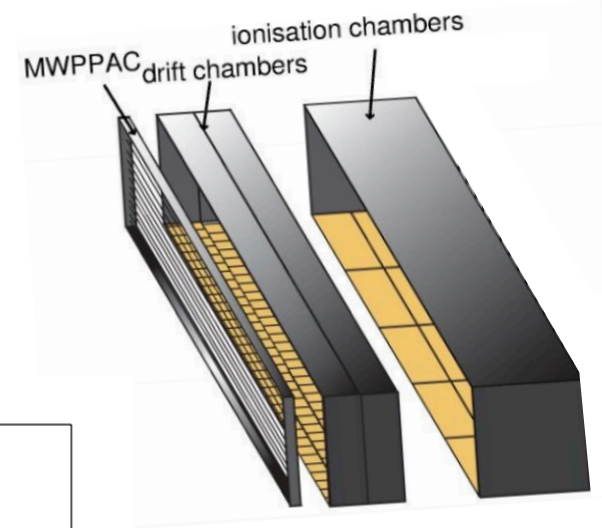
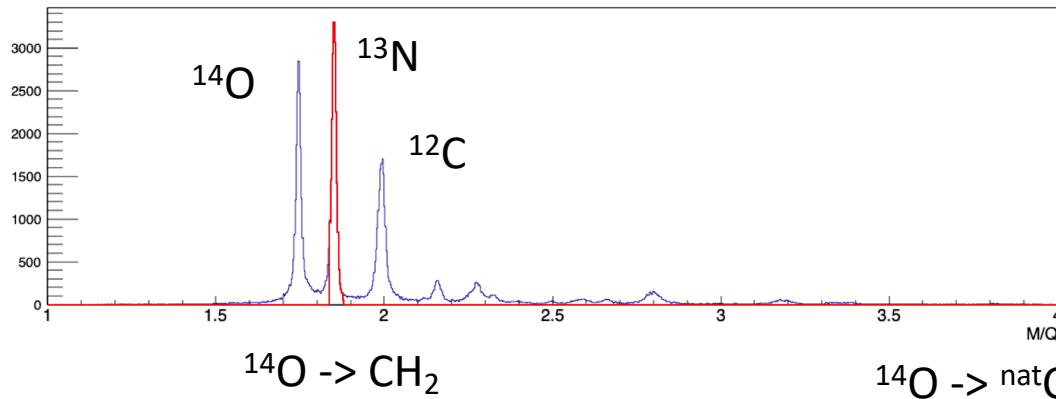
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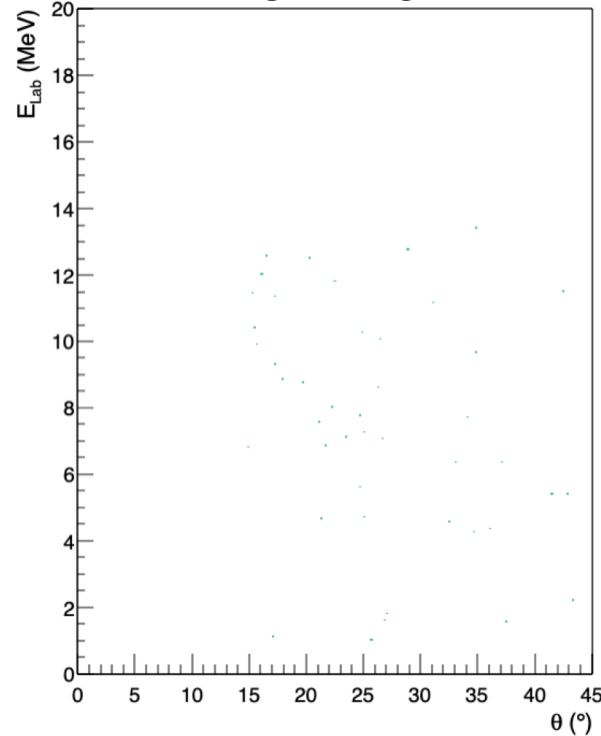
With VAMOS most of fusion evaporation background disappear



# Preliminary results



$^{14}\text{O} \rightarrow \text{natC}$

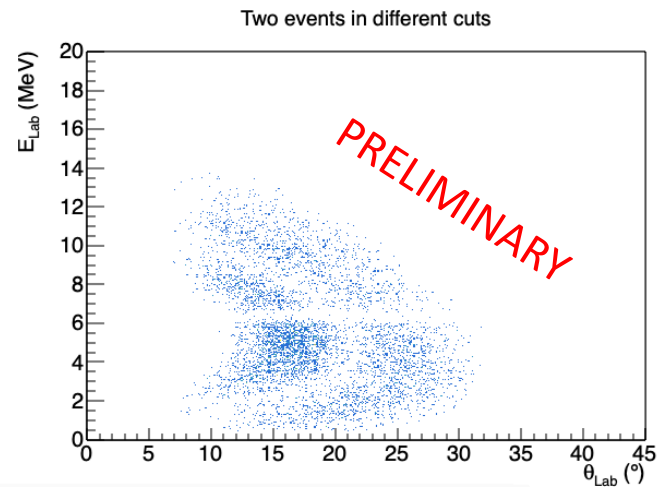
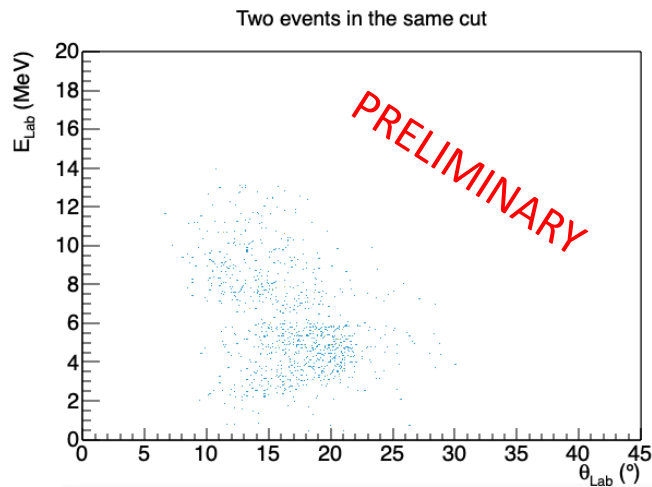
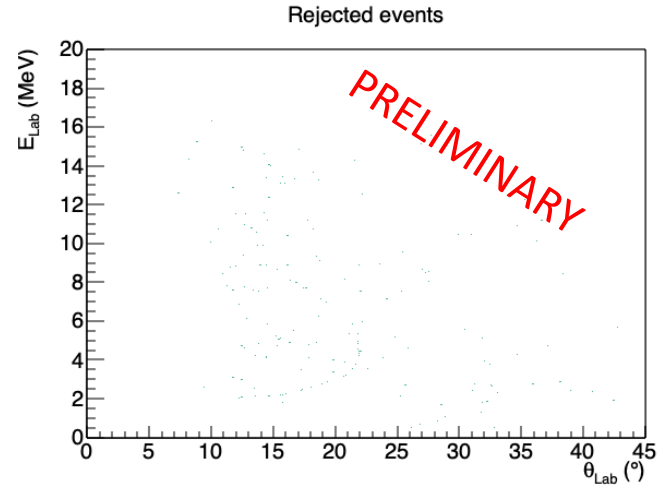
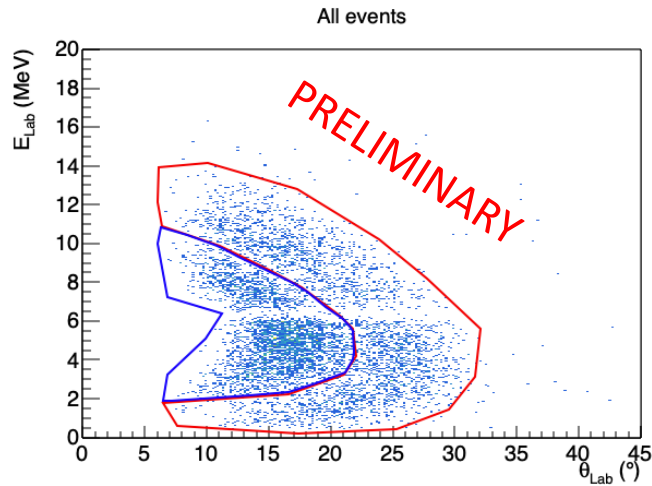


With VAMOS most of fusion evaporation background disappear

# Preliminary results

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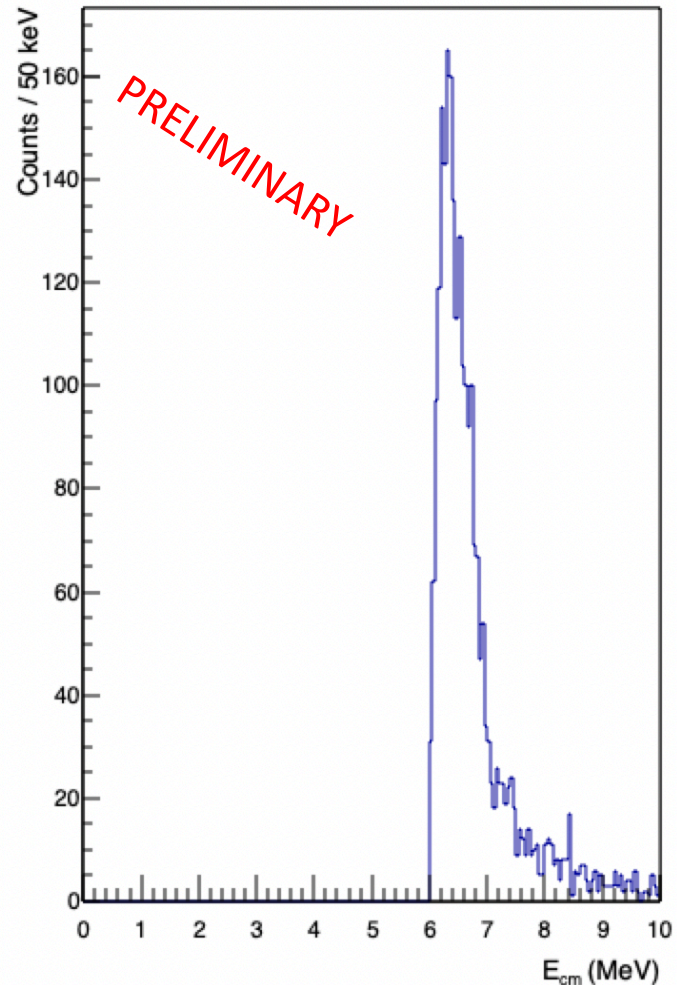
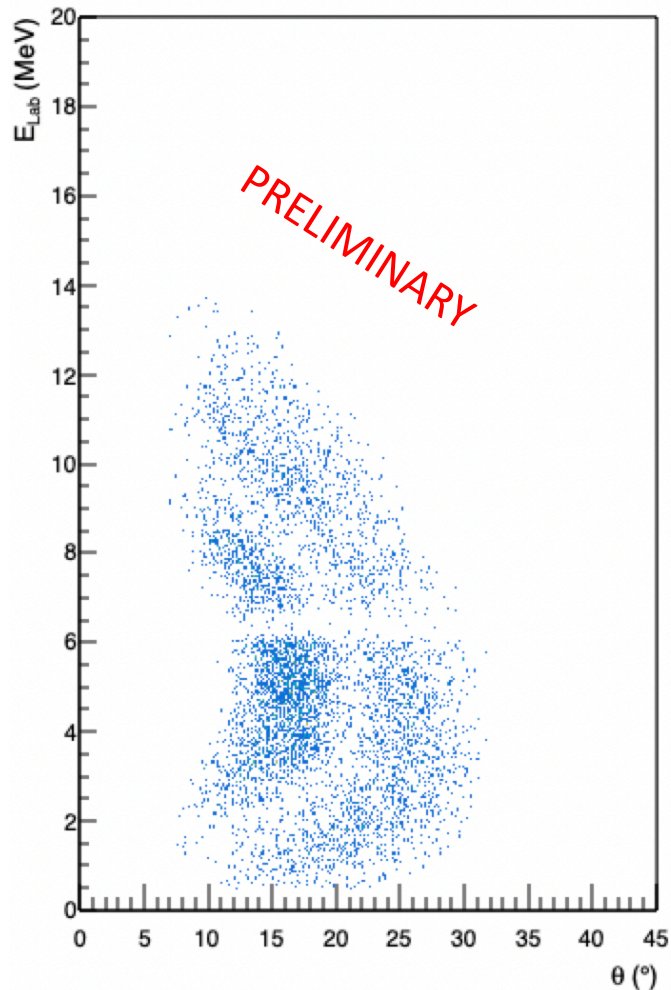


~80% of the two protons events are sequential events

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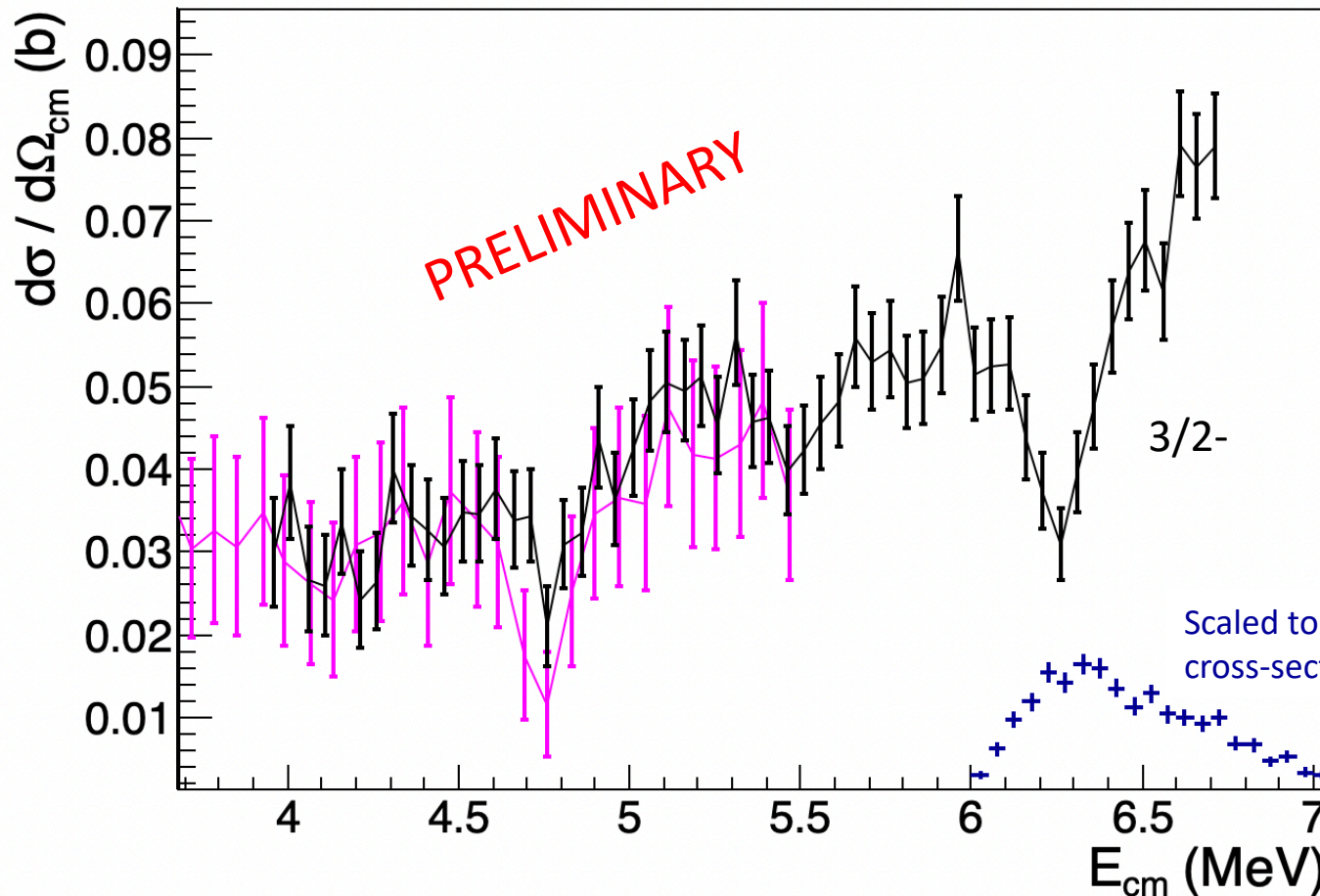


~ 6 MeV state

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~ 6 MeV state in agreement with the observed 3/2- state.

# Conclusion

- The previously measured  $1/2^-$  state has been confirmed
  - A new  $3/2^-$  state has been observed, but no  $5/2^-$  state is clearly visible
  - The observed  $3/2^-$  state does decay sequentially by two proton emission.
  - Next step, will be the analysis of the possible gamma decay from the  $1/2^-$  state to the ground state
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Thank you for your attention