

Lifetime measurement in ^{20}O via DSAM

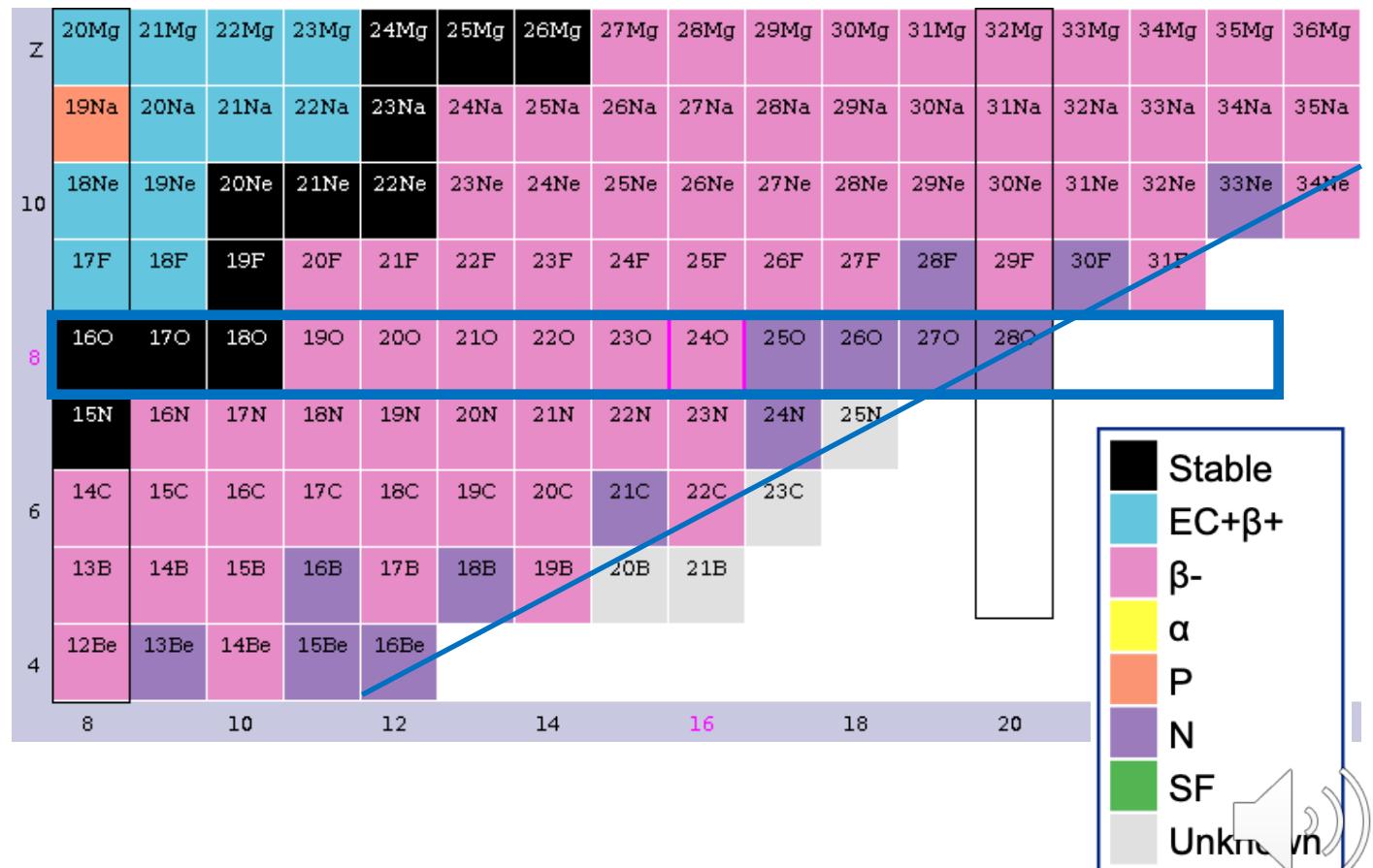
Irene Zanon

INFN - LNL
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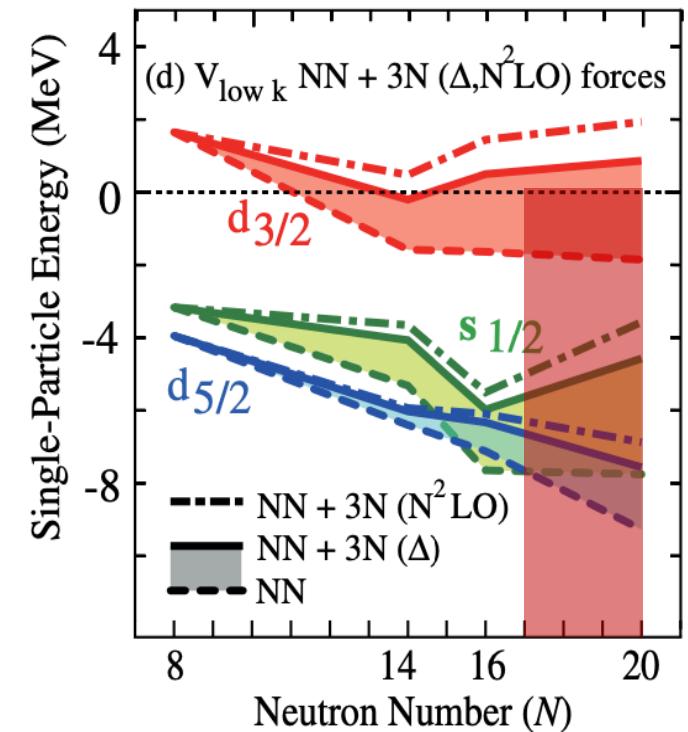
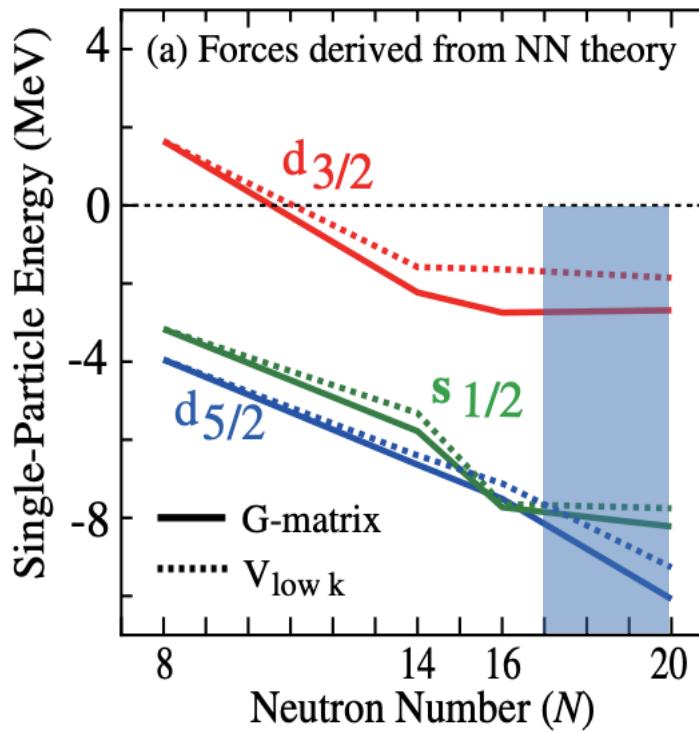
Scientific motivations

- Nuclei close to the drip-lines are fundamental to understand the nuclear interaction.
- Regular evolution of the drip line in the p-sd region **but** the oxygen represents an exception.
- According to the shell model, ^{28}O is expected to be the heaviest isotope.
 ^{24}O is observed to be the last bound isotope.



Scientific motivations

- The position of the drip line of the oxygen isotopic chain is reproduced by introducing the **3N forces**.
- The location of the drip line changes from the $0d_{3/2}$ orbital ($N=20$, ^{28}O) to the $1s_{1/2}$ ($N=16$, ^{24}O).
- Additional information on the relative position of **$1s_{1/2}$ and $0d_{3/2}$ orbitals** is needed.

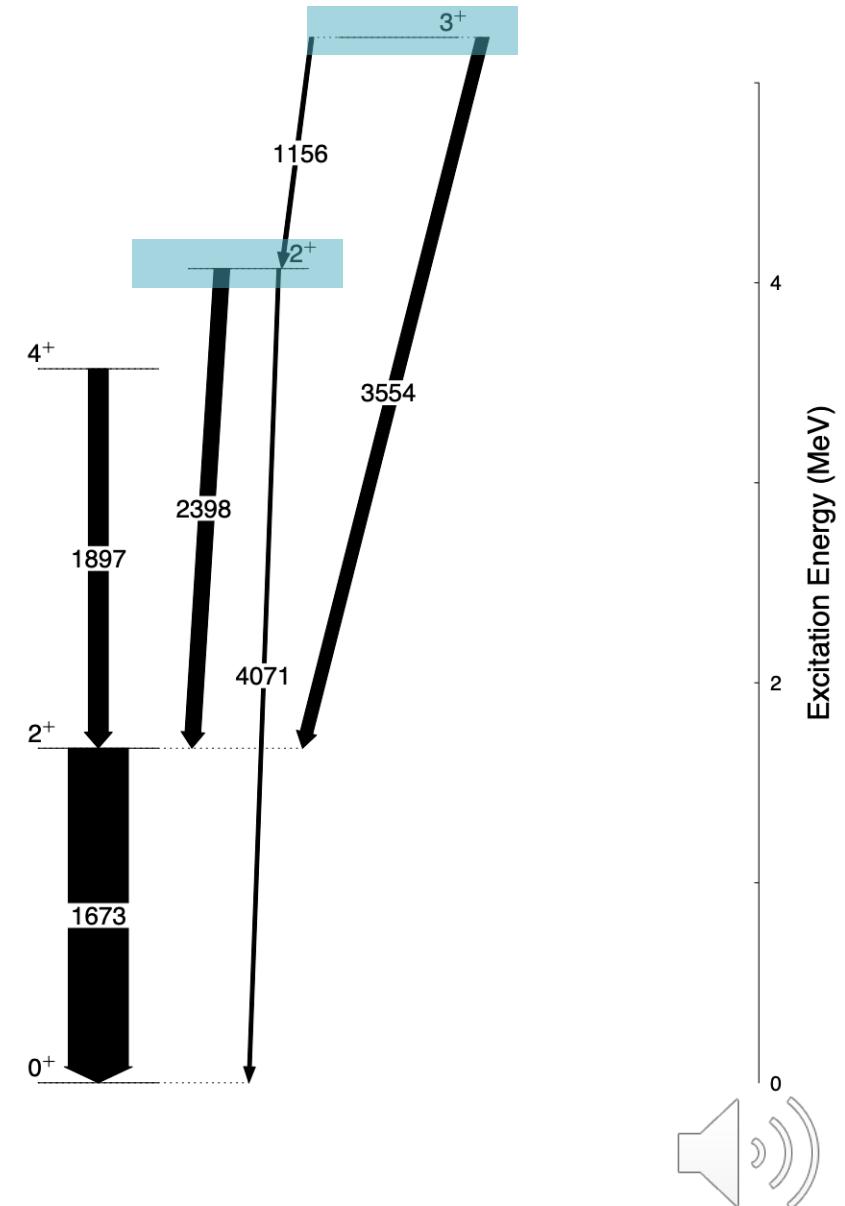


T. Otsuka et al., PRL **104**, 012501 (2010)



Non-yrast states in ^{20}O

The lifetimes of 2^+_2 and 3^+_1 of ^{20}O are sensitive to the $0\text{d}_{3/2}$ contribution.

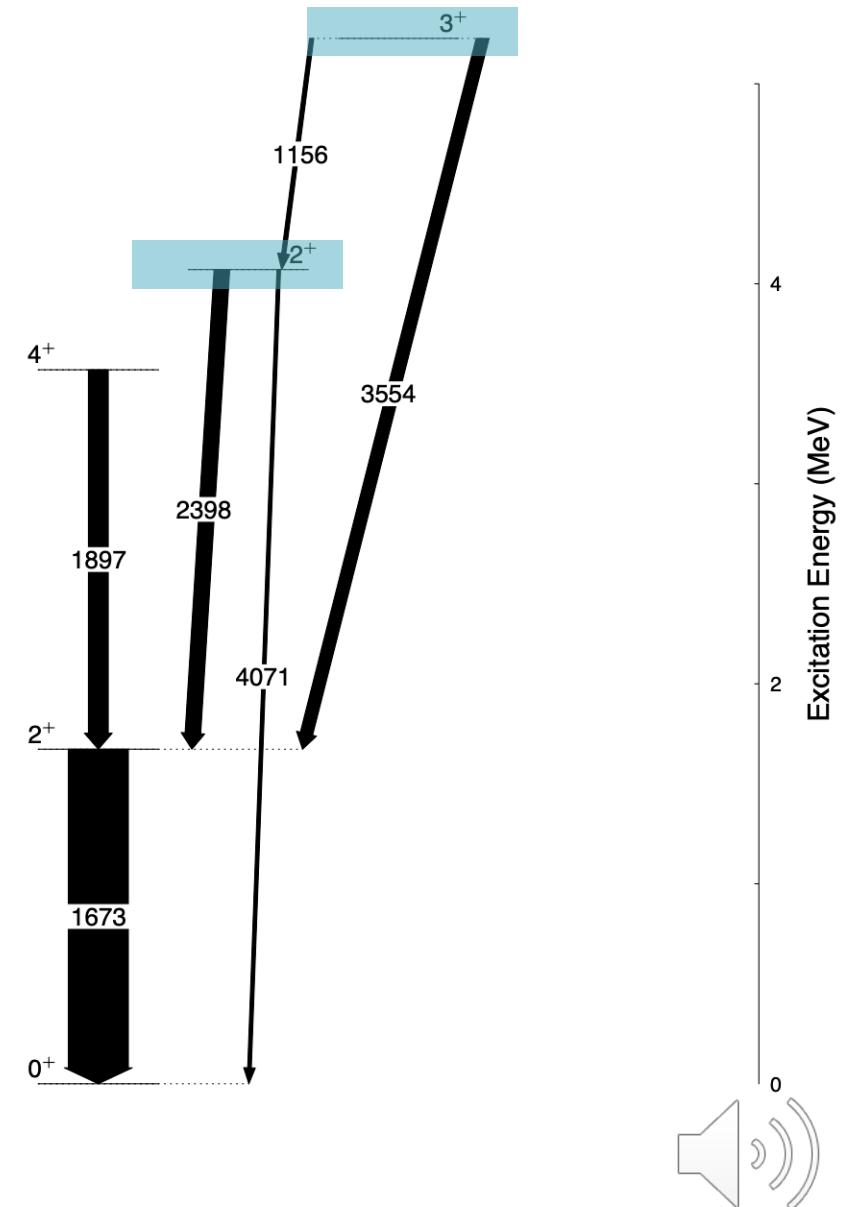


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	SM - NN	MBPT	Exp.
2^+_2 Lifetime	118 ps	217 fs	150^{+80}_{-30} fs

*M. Ciemała, PRC **101** 021303 (2020)*



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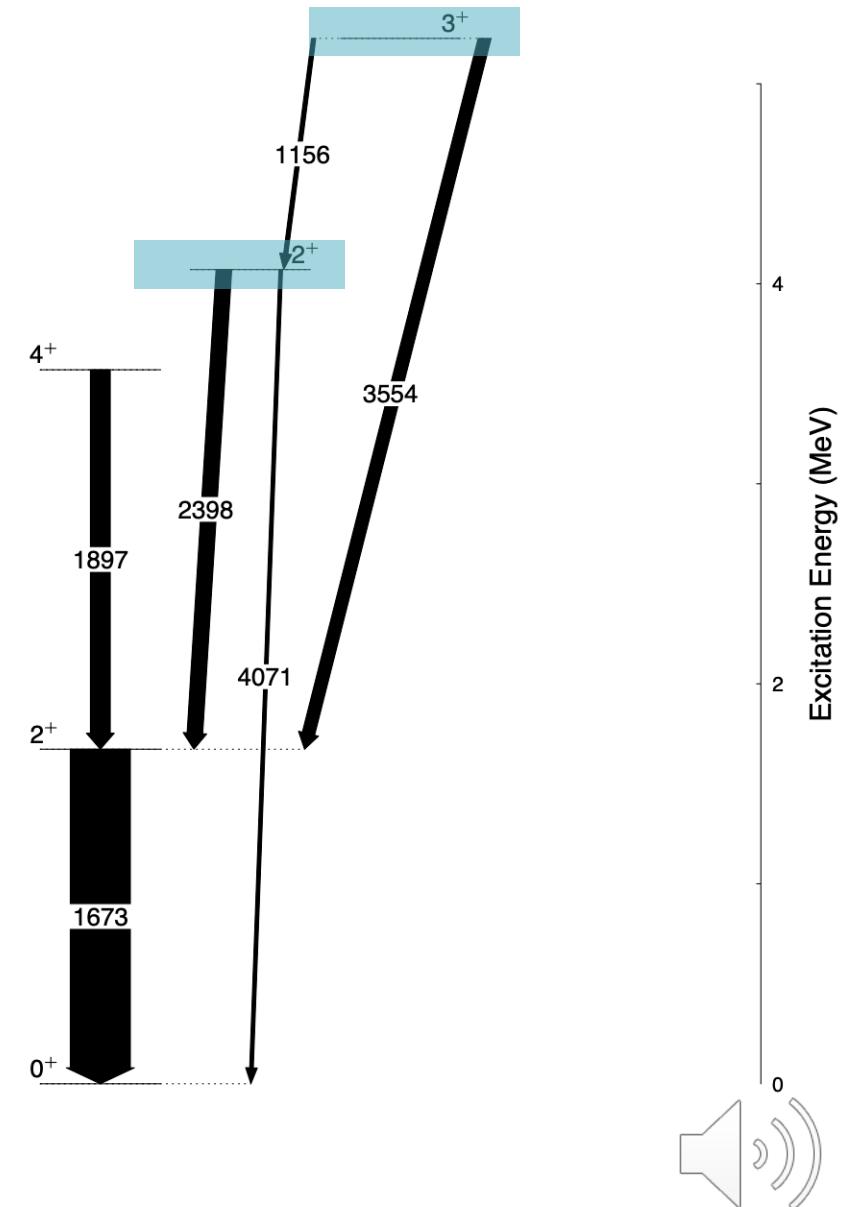
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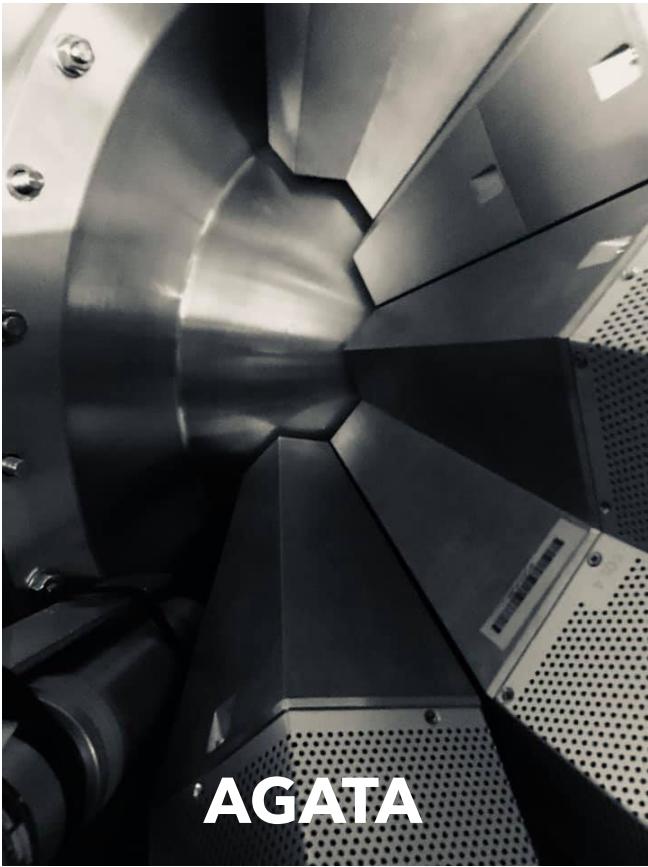
M. Ciemała, PRC **101** 021303 (2020)

Why remeasure the ^{20}O ?

- Control on the feeding on the 2^+_2
- Obtain a smaller error
- Measure the 3^+_1



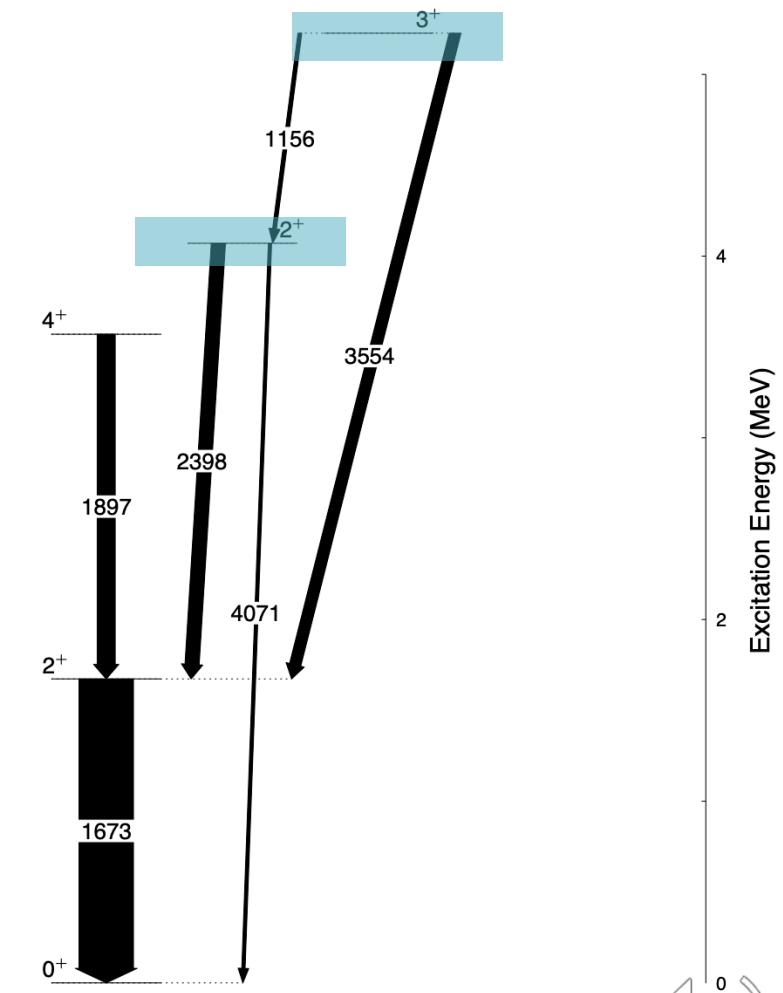
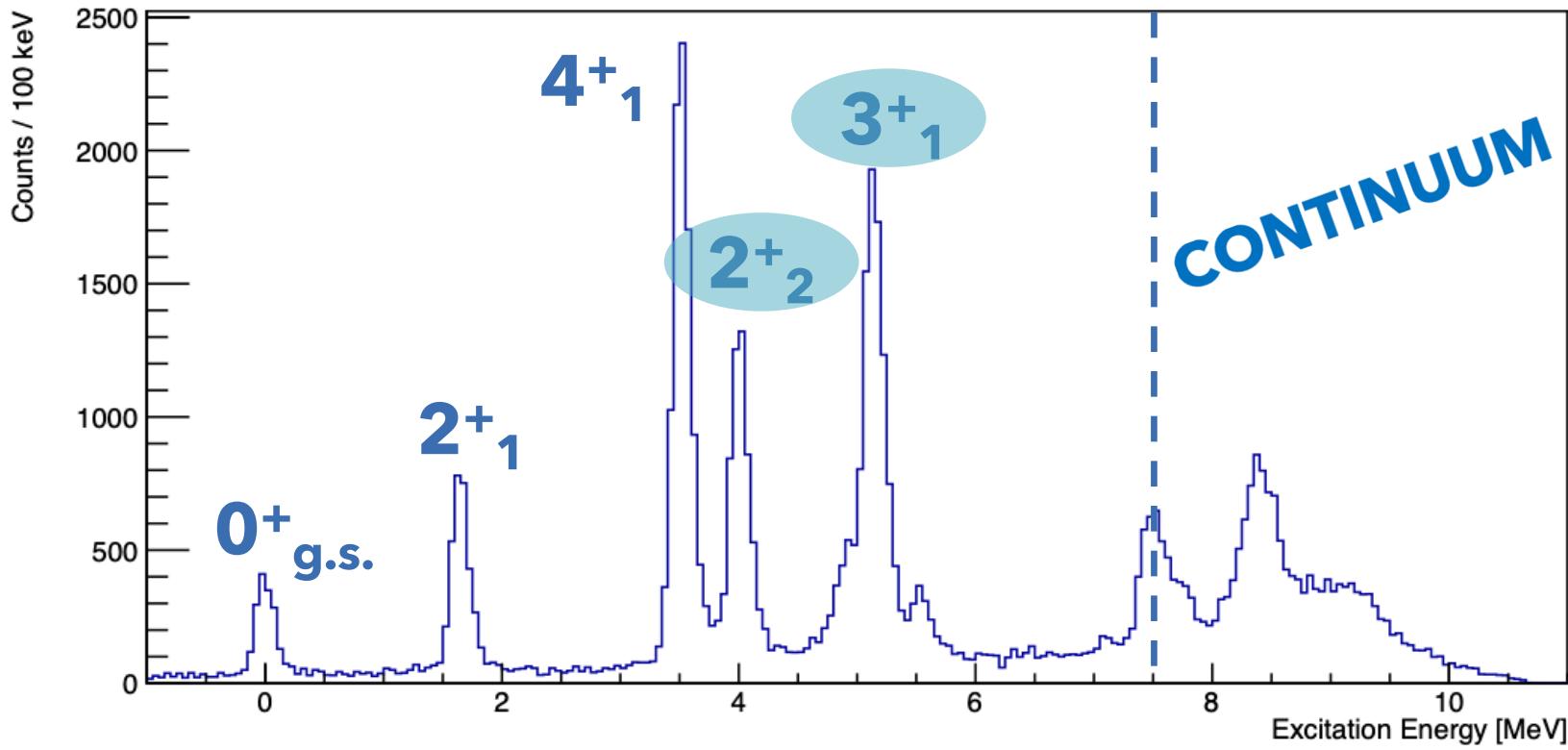
The Experiment e775s



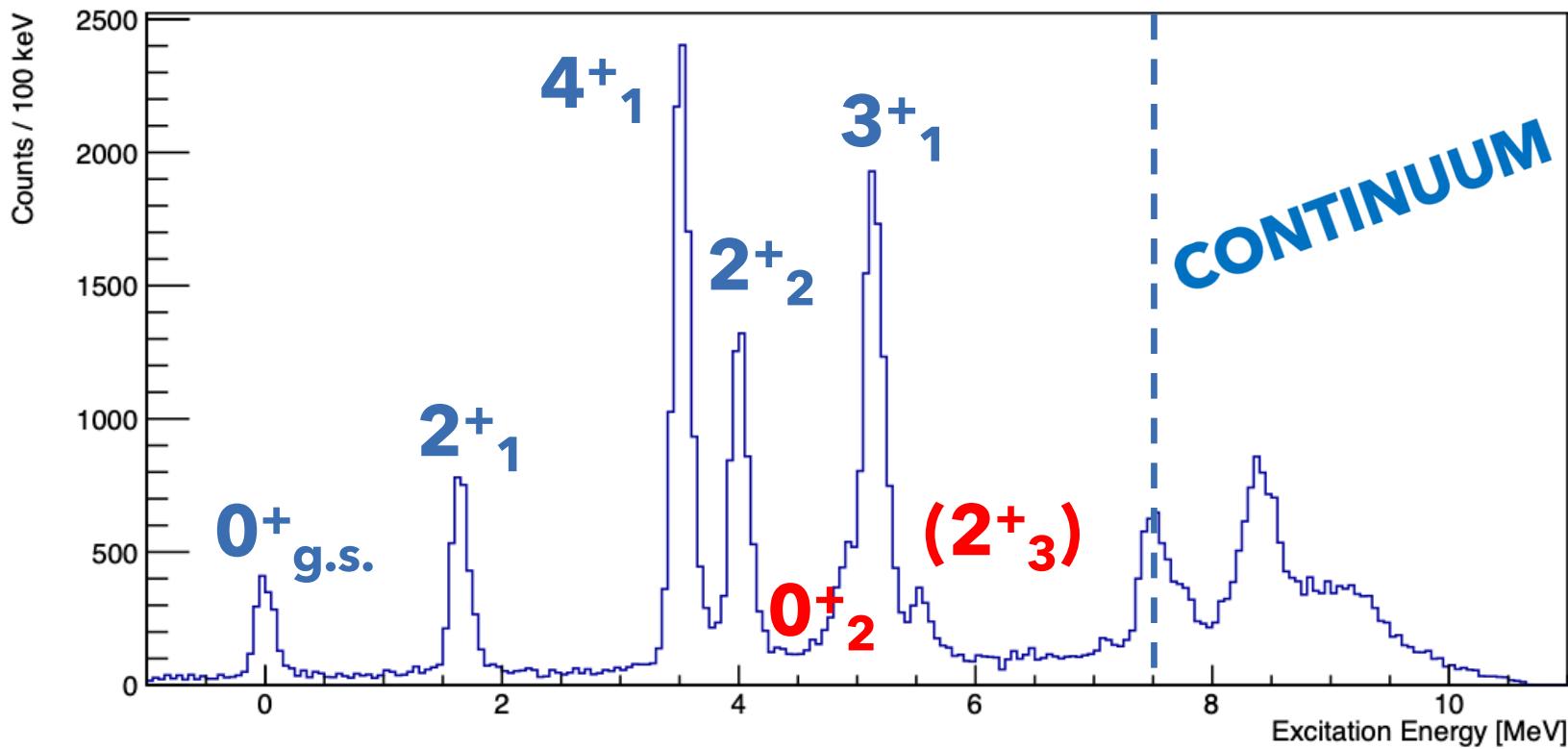
- E775s at GANIL February 2020.
- Beam ^{19}O 8 MeV/A (152 MeV), $i: 3 \times 10^5$ pps.
- Target CD_2 0.3 mg/cm 2 + $^{\text{nat}}\text{Au}$ 20 mg/cm 2 .
- AGATA array + MUGAST + VAMOS.



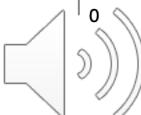
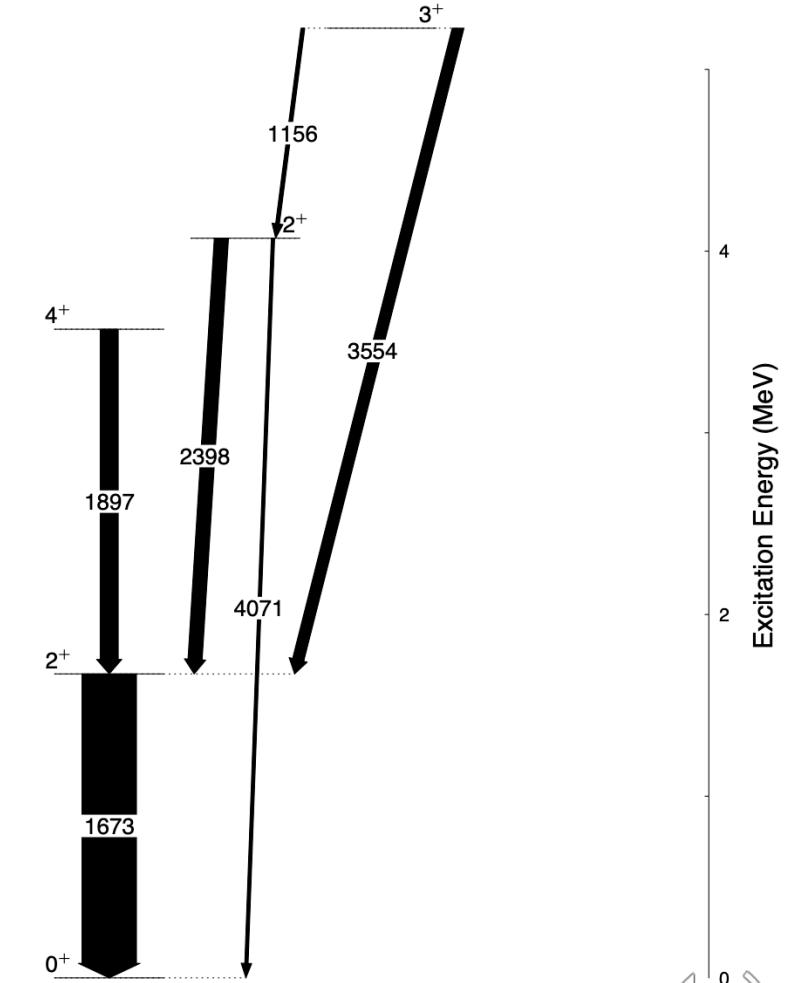
Analysis



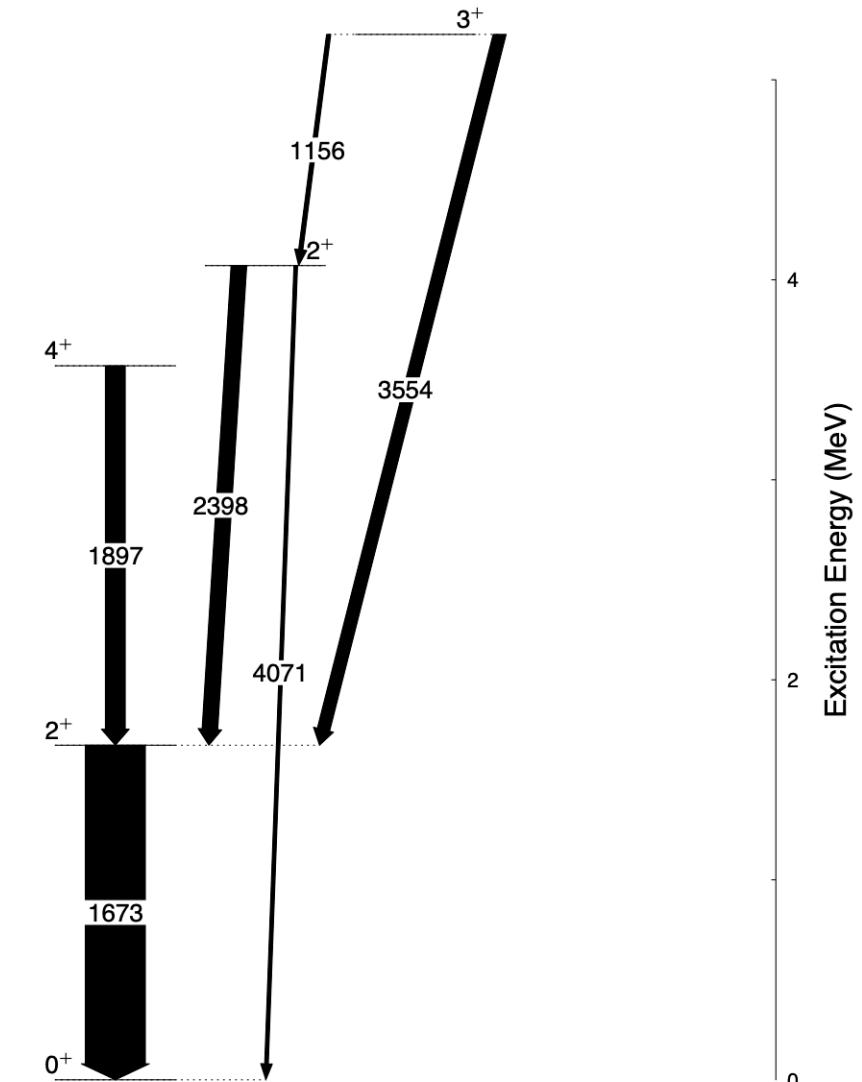
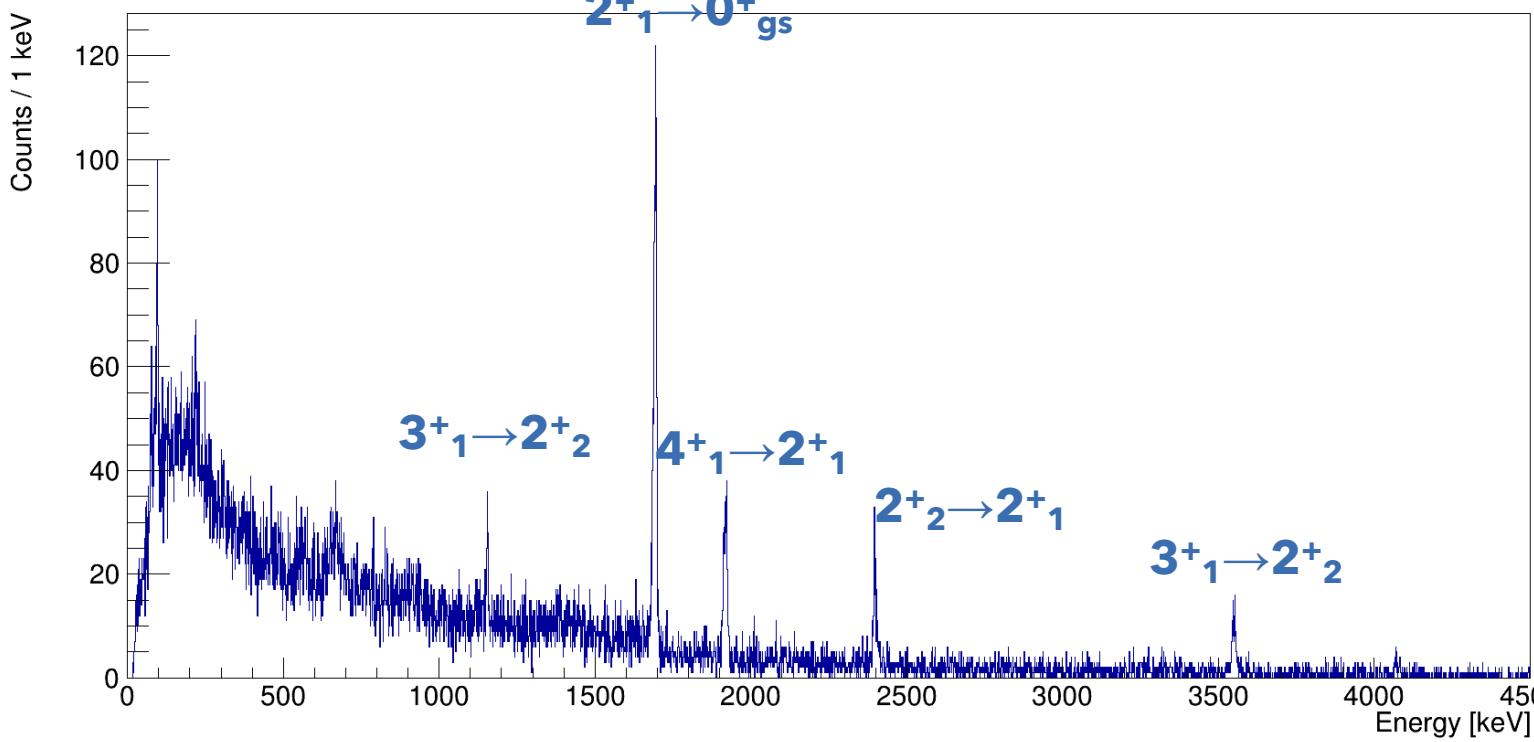
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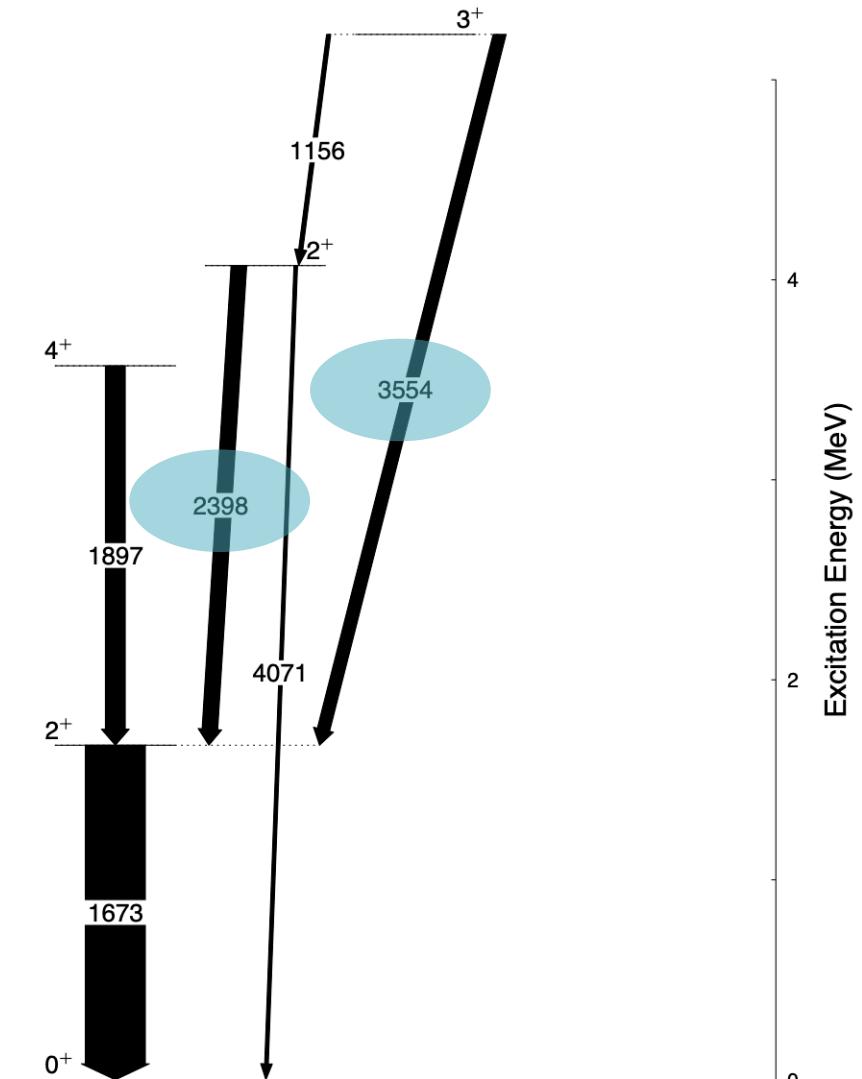
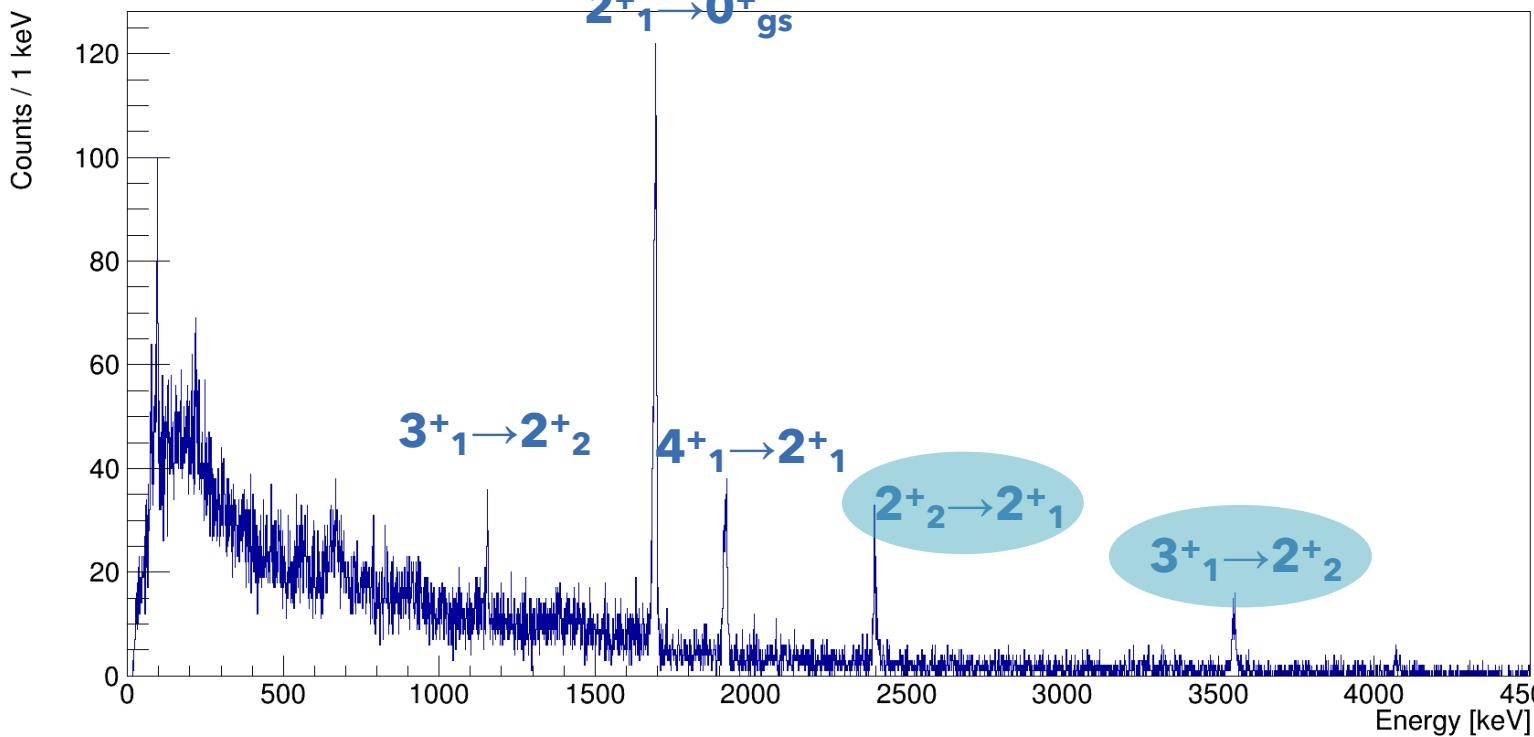
Ref: C.R. Hoffman, PRC **86** 054318 (2012)



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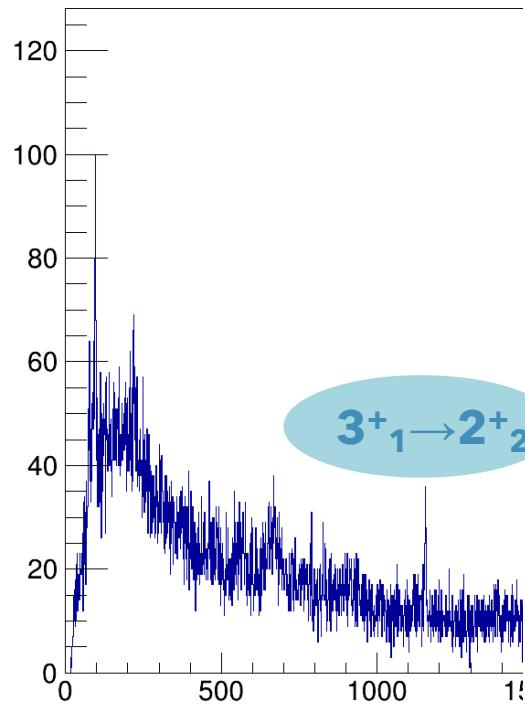


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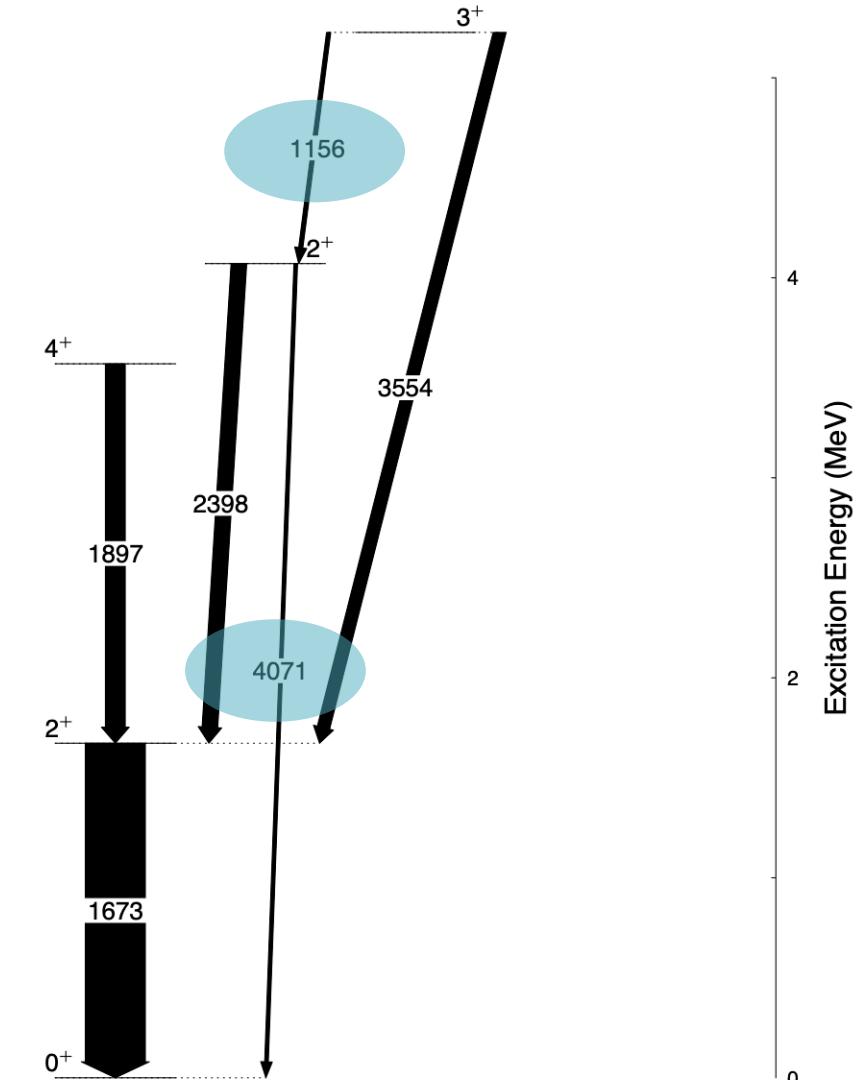
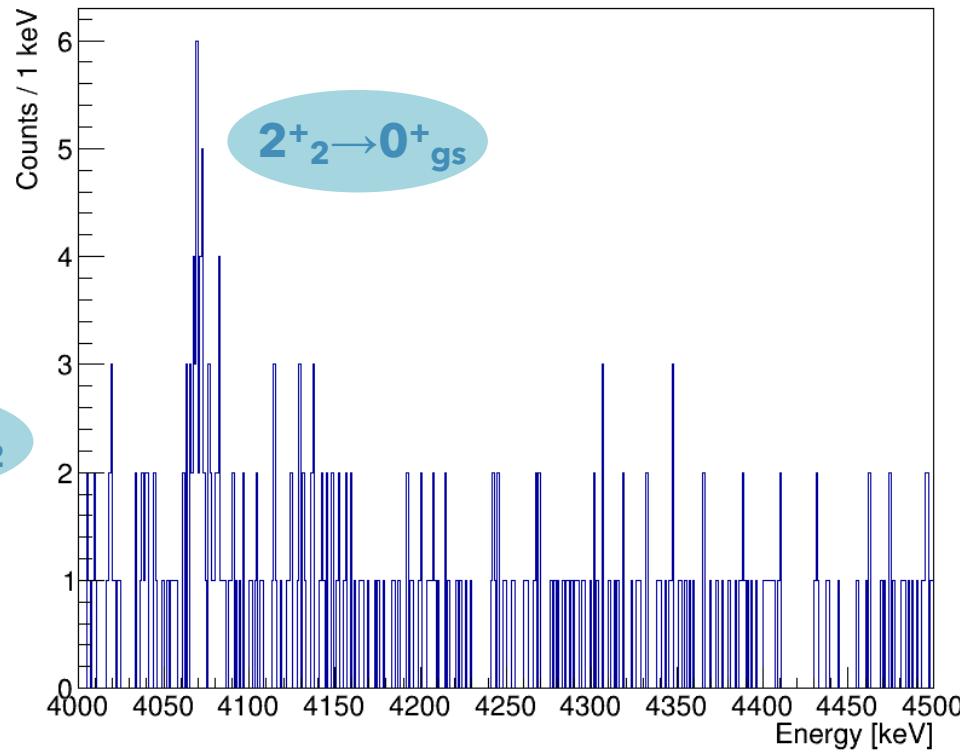


Analysis

Counts / 1 keV



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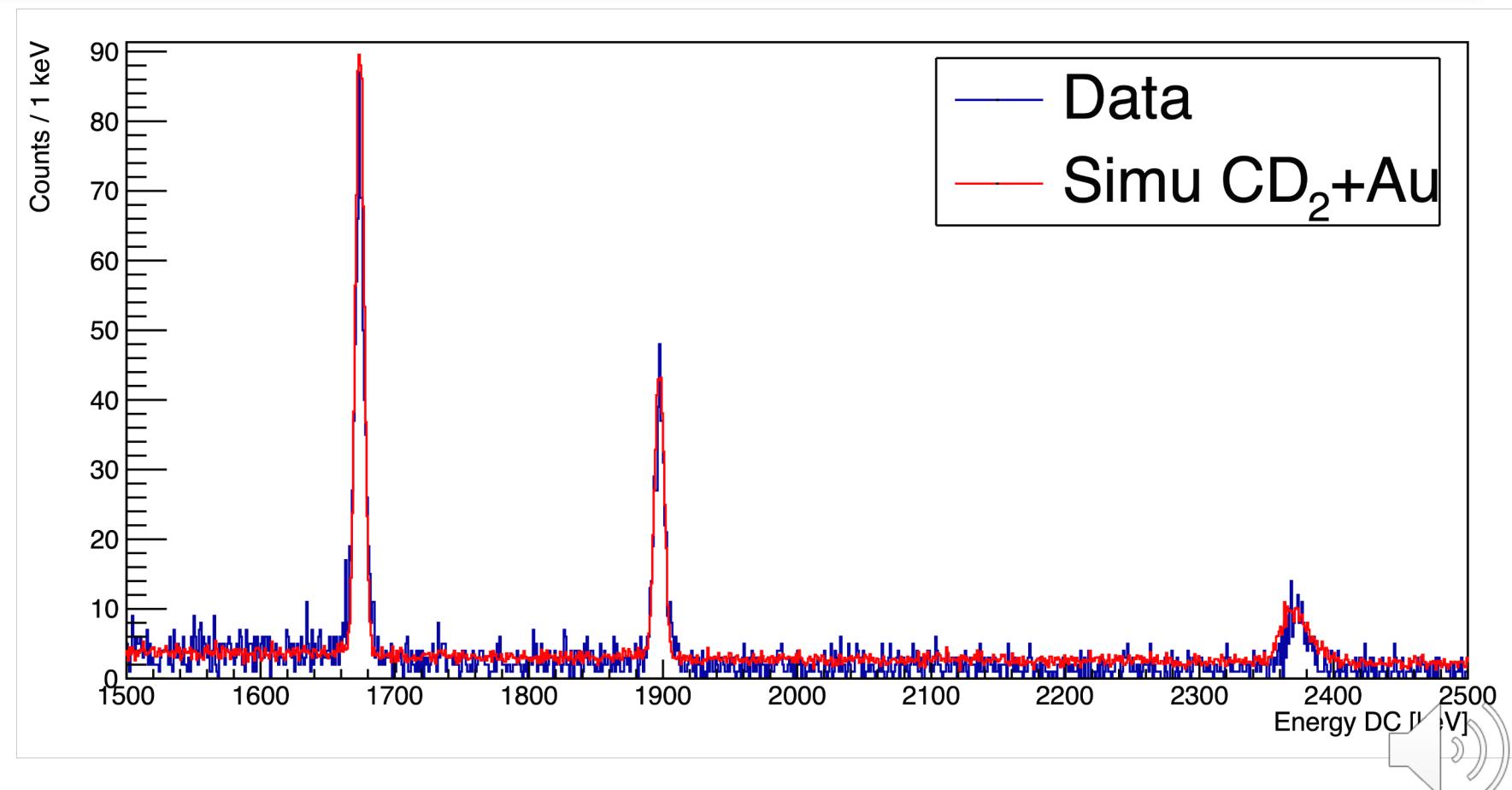


Lifetime measurement of 2^+_2

Comparison between data and simulation suggests:

$$\tau \sim 120 \text{ fs}$$

Further investigation using the χ^2 test.

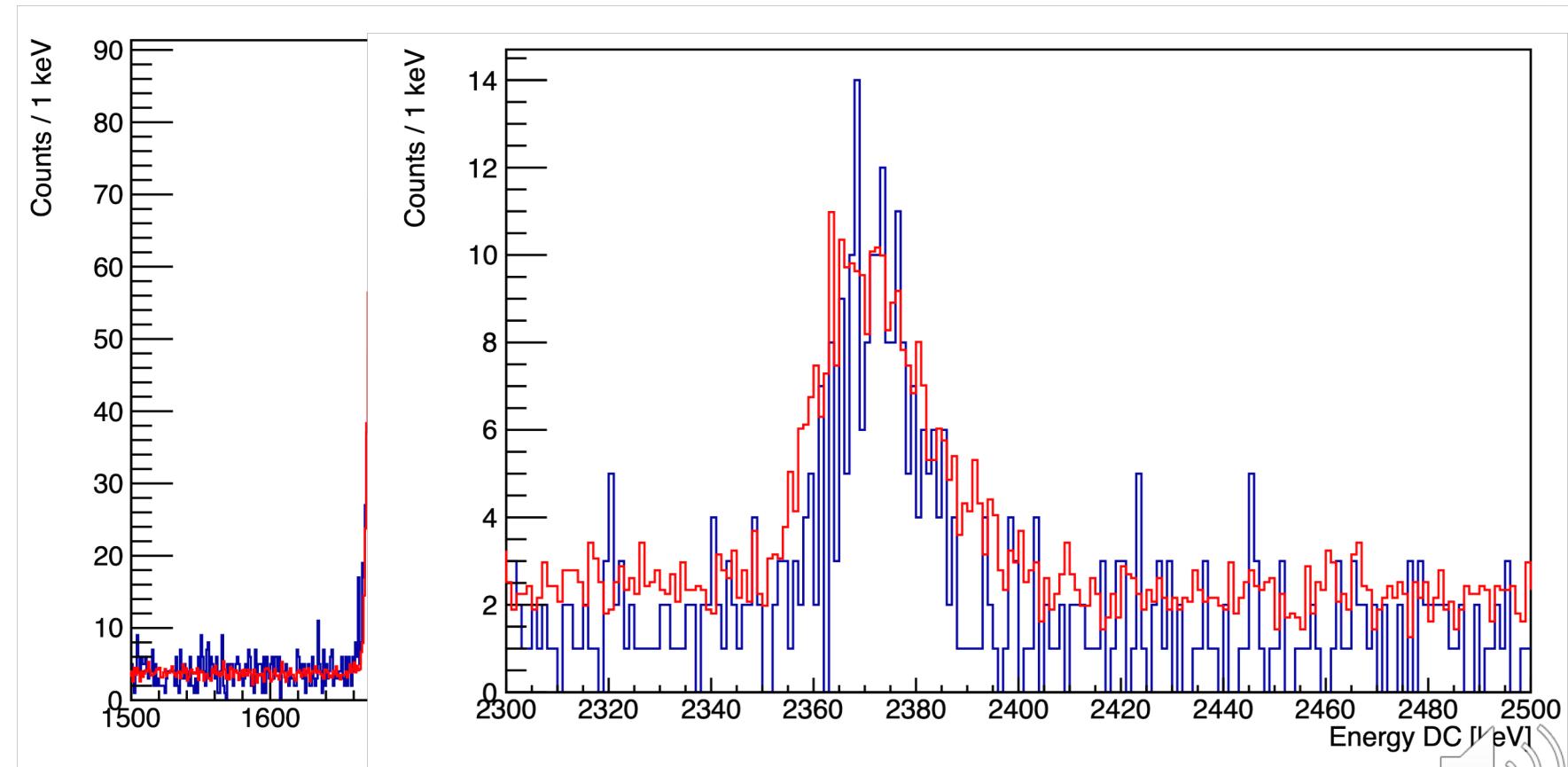


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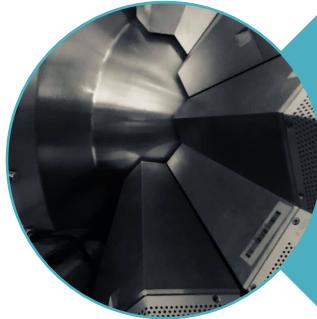
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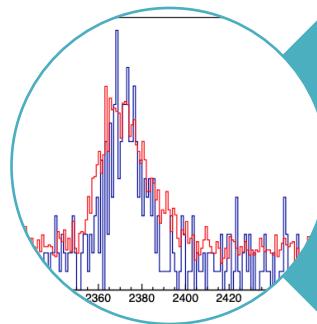
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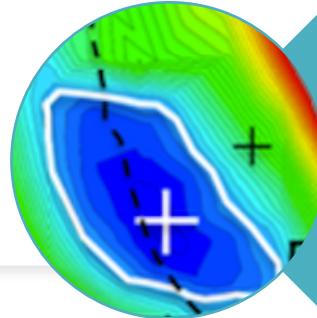
Conclusions



AGATA+MUGAST capabilities
for kinematic reconstruction
and Doppler correction



Measurement of the 2^+_2
lifetime via DSAM technique



Measurement of the 3^+ and
theoretical interpretation.



Thanks to the collaboration

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On behalf of the AGATA, VAMOS and MUGAST collaborations



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