



Istituto Nazionale di Fisica Nucleare
Sezione di Padova



Dept. of Physics and Astronomy
University of Padova

AGATA-MUGAST-VAMOS Comissioning Analysis Report

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University of Padova

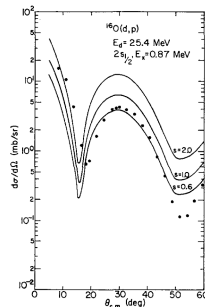
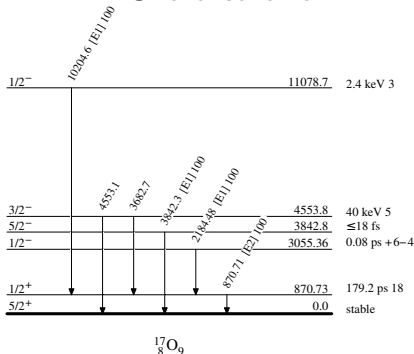
INFN-Sezione di Padova



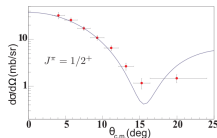
Reaction



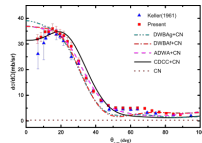
^{17}O level scheme



M.D. Cooper et al., NPA 218,249(1974)



T. Al Kalanee et al., PRC 88, 034301 (2013)

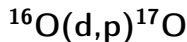


T.L. Ma et al., Nuclear Physics A 986 (2019) 26-23

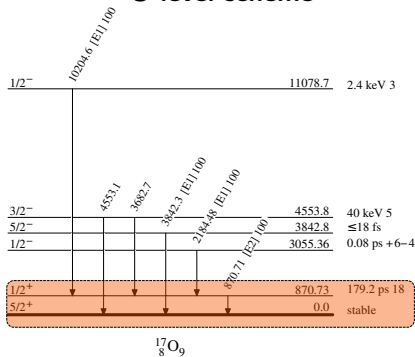




Reaction



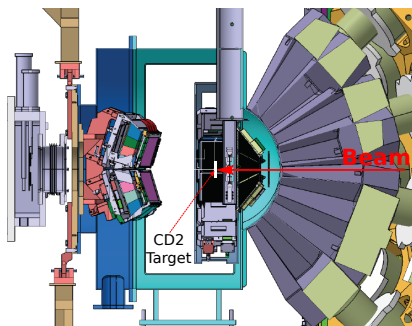
^{17}O level scheme



- Angular distribution for transfer to g.s. and 1/2⁺ of ^{17}O
- Proton-gamma coincidence for the 870 keV gamma decay
- AGATA efficiency estimate.



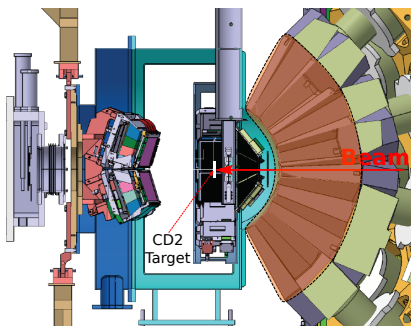
Setup



- ^{16}O beam on CD2 Target
 - 6 MeV/u - 10^4 pps
 - 1 mg/cm²
- AGATA - backward
 - 37 crystal
- MUGAST - backward
 - 5 trapezoidal DSSD
 - 1 annular DSSD
 - 2+1 square DSSD at 90°
- MUST2 - forward
 - 4 Telescope
- VAMOS



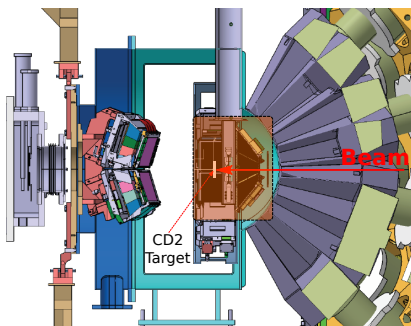
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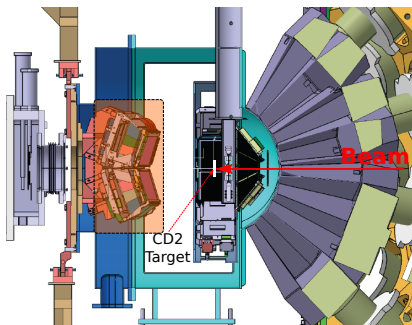
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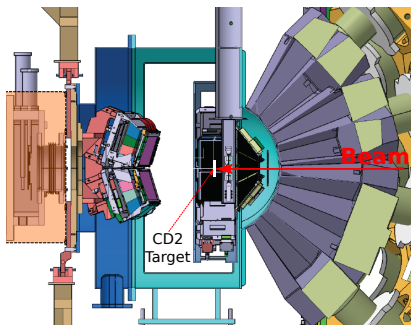
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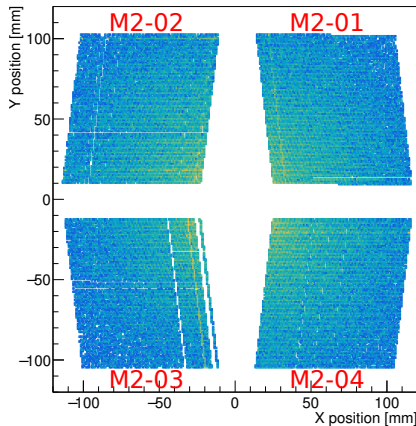
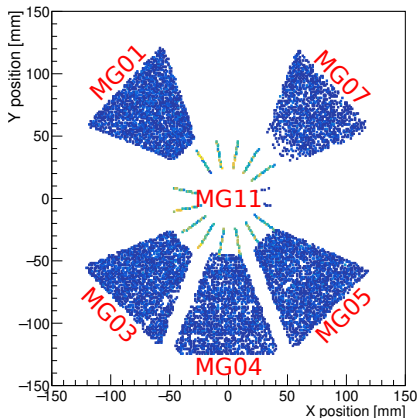
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Impact Matrix



11 h. acquisition long at $\sim 4 \cdot 10^4$ pps

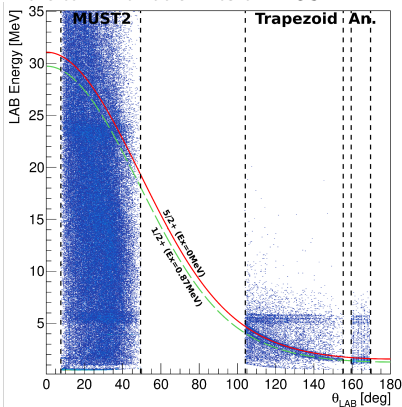




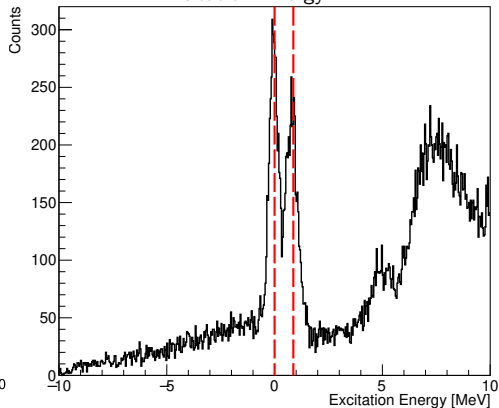
Kinematic Lines



No clear kinematic lines on MUST2



Excitation Energy

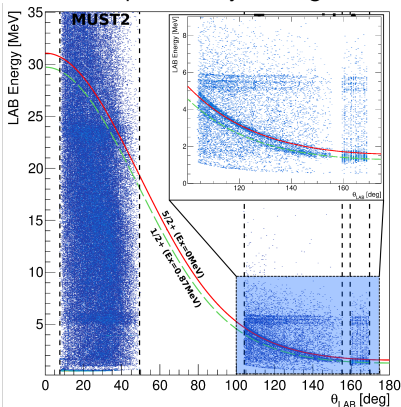




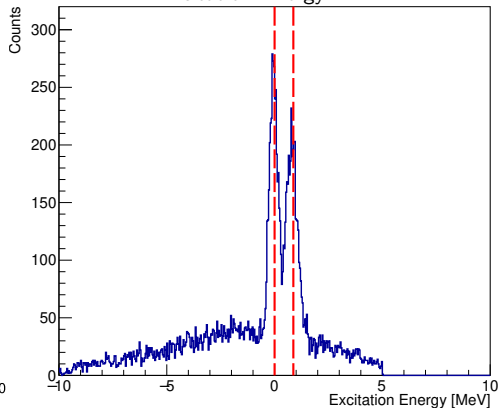
Kinematic Lines



Selection of particle only on Mugast

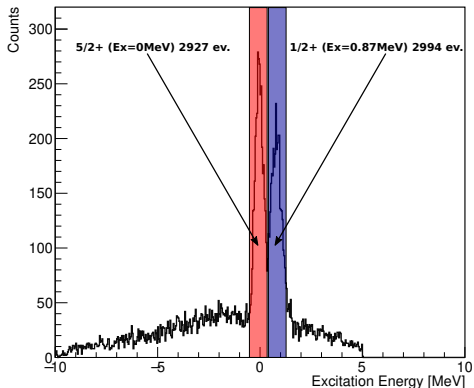
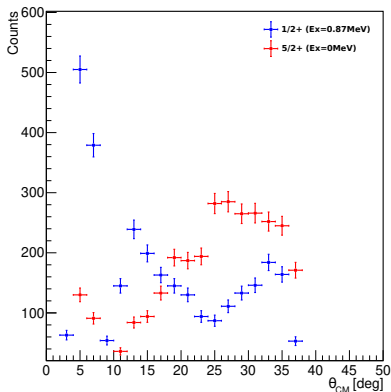


Excitation Energy





Angular Distribution





Differential Cross Section



Normalized with simulated
angular efficiency

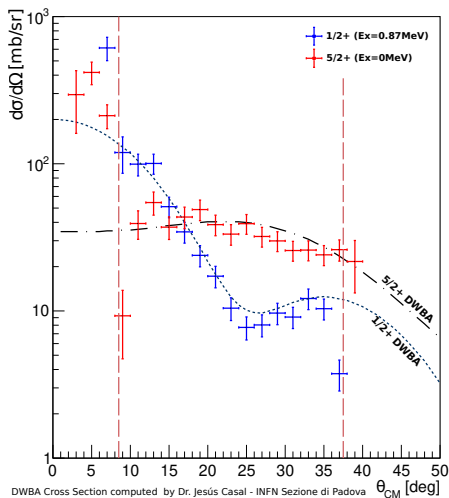


Fit over the theoretical
distribution

Efficiency normalization
obtained from alpha source
to be checked

DWBA calculation from Jesus Casal
Università degli Studi di Padova
INFN Sezione di Padova

Optical potential from
An et al., PRC 73.5 (2006)
Watson et al., PR 182.4 (1969)

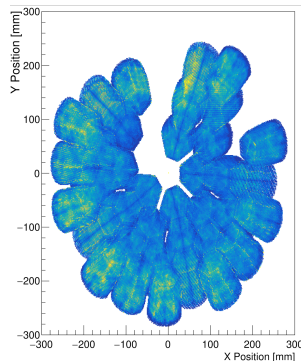
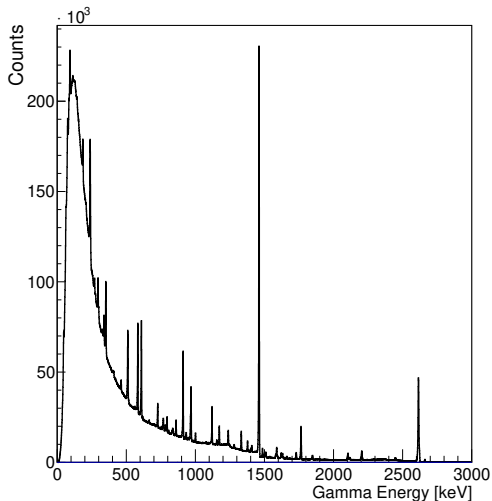


DWBA Cross Section computed by Dr. Jesús Casal - INFN Sezione di Padova

θ_{CM} [deg]



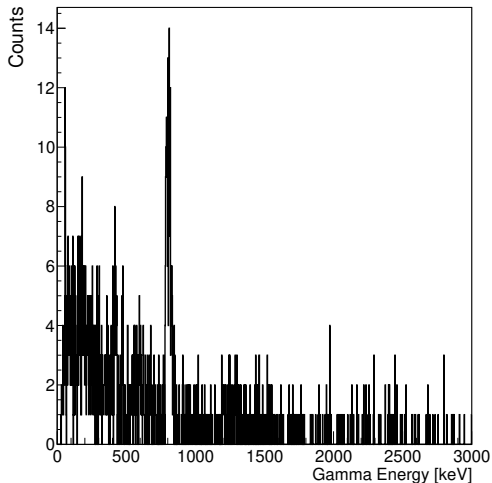
Gamma Spectra



Gamma spectrum w/o gate.
 $6.9 \cdot 10^7$ ev.



Gamma Spectra



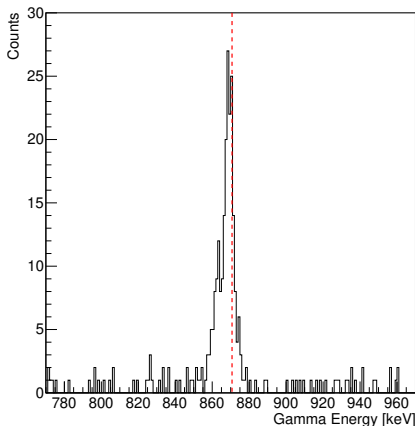
Proton gated spectrum.
 $1.6 \cdot 10^3$ ev.



**Doppler Correction
Needed.**



Doppler Correction



- Beta computation from proton direction
- First interaction from tracking (51 mm AGATA shift)

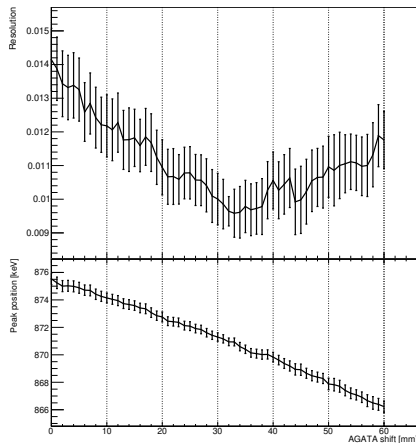
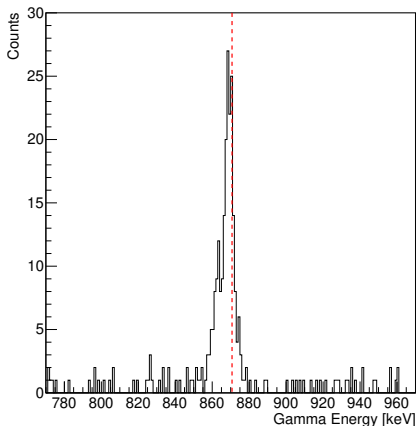
The peak is 1.8 keV shifted from $1/2^+$ state adopted energy.



Doppler Correction



Minimization of resolution with scan over different shifts

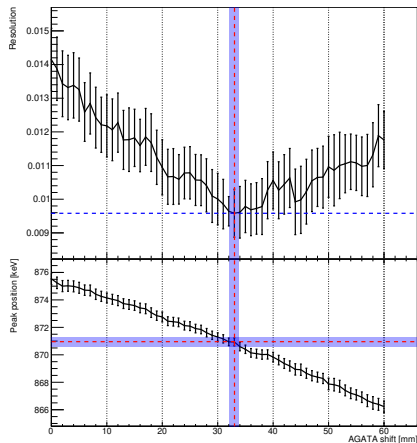
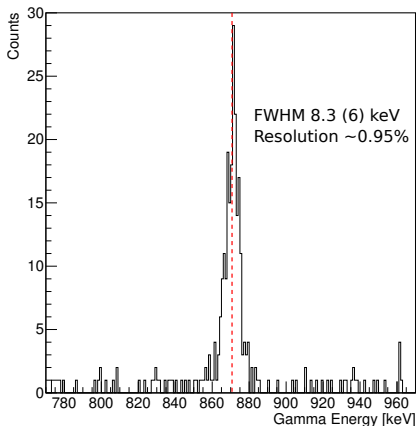




Doppler Correction

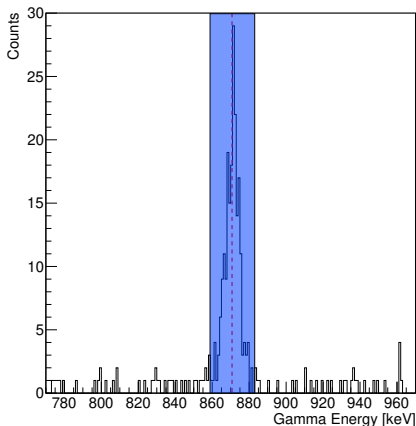


Best Resolution and Energy match with 33 mm shift





Deduced Efficiency



- 870 keV excitation peak integral (background removed)

↓
 2562 ± 50 protons

- 870 keV gamma peak integral (background removed)

↓
Add Back → $177 \pm 13 \gamma$

Tracking → $160 \pm 13 \gamma$

Efficiency Estimate:

Add Back → $7.0 \pm 0.5 \%$

Tracking → $6.3 \pm 0.5 \%$



Summary



- Kinematic of the outgoing proton and ^{17}O (5/2+ and 1/2+) final levels selection from excitation energy.
- Angular distribution normalized and fitted to the theoretical differential cross section.
- Coincidence with AGATA and 870 keV peak doppler correction.
- AGATA efficiency estimate

Perspectives

- Investigation on Mugast efficiency with alpha calibration source.
- Check VAMOS performance.
- Investigation of AGATA resolution.



Acknowledgments



Thanks to AGATA+GRIT+MUGAST collaborations and
thank you for attention!