

# Report on EXP\_001

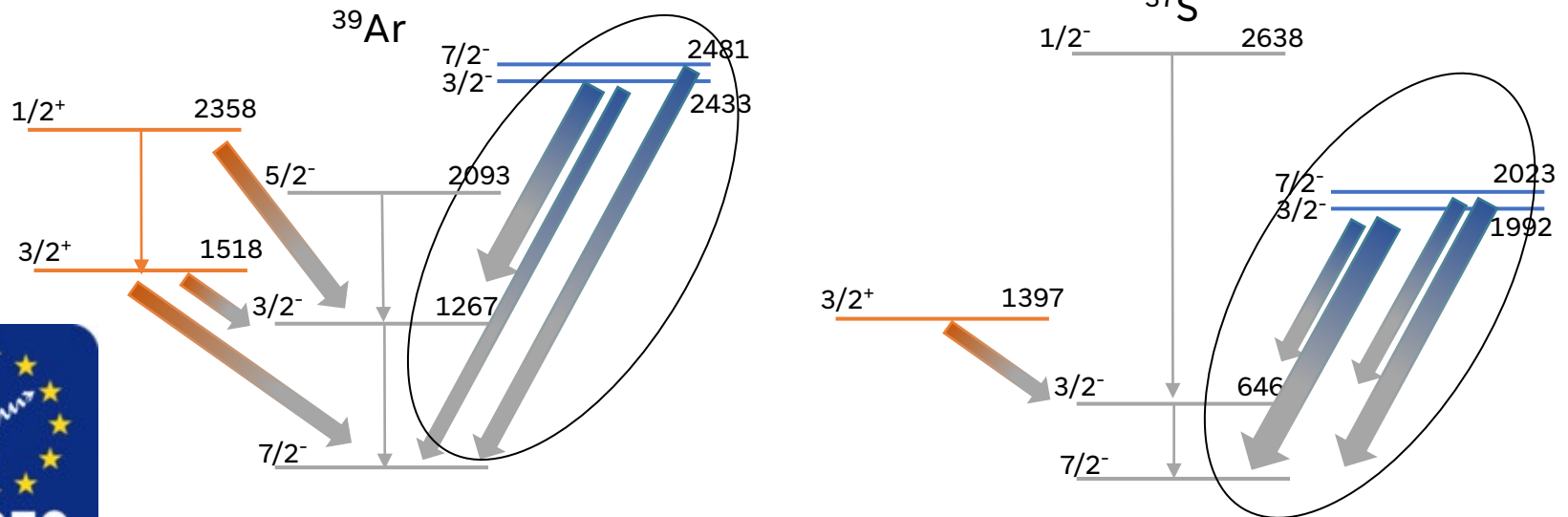
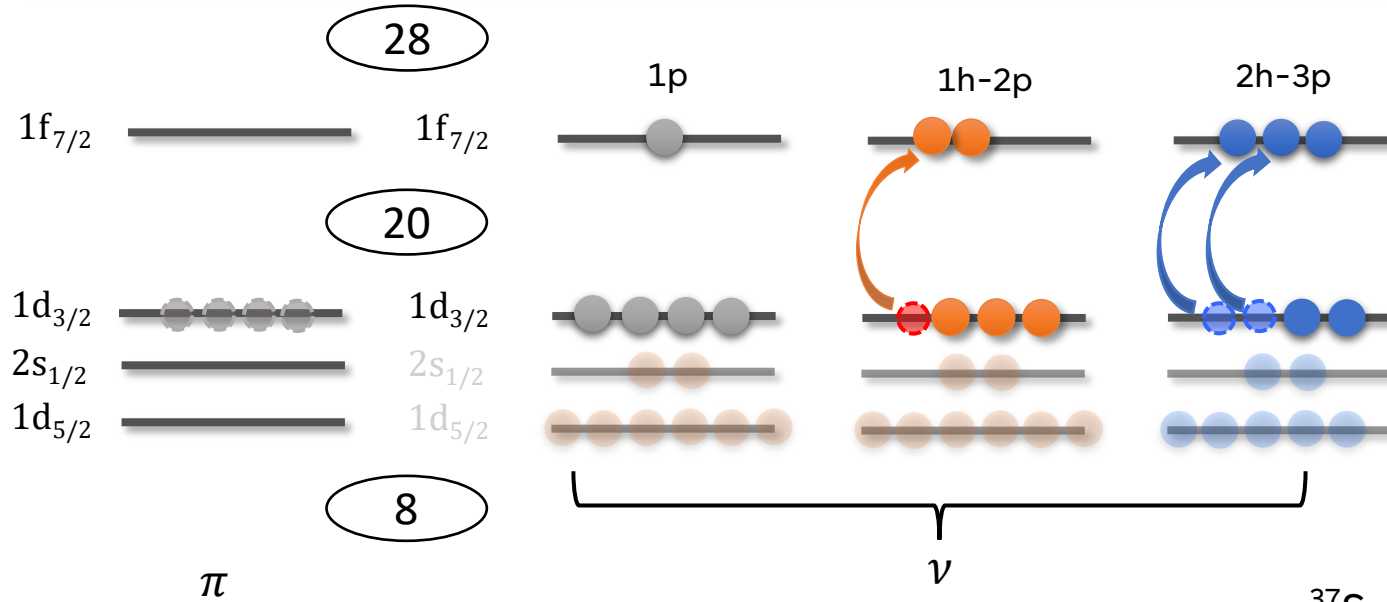
Mixing between single particle and intruder states  
towards the N=20 island of inversion: lifetimes in  $^{37}\text{S}$

L. Zago, *INFN LNL and UniPD*

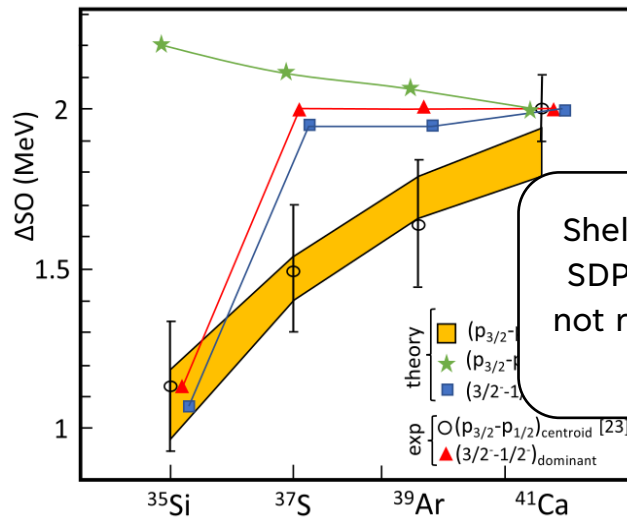
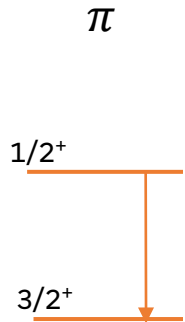
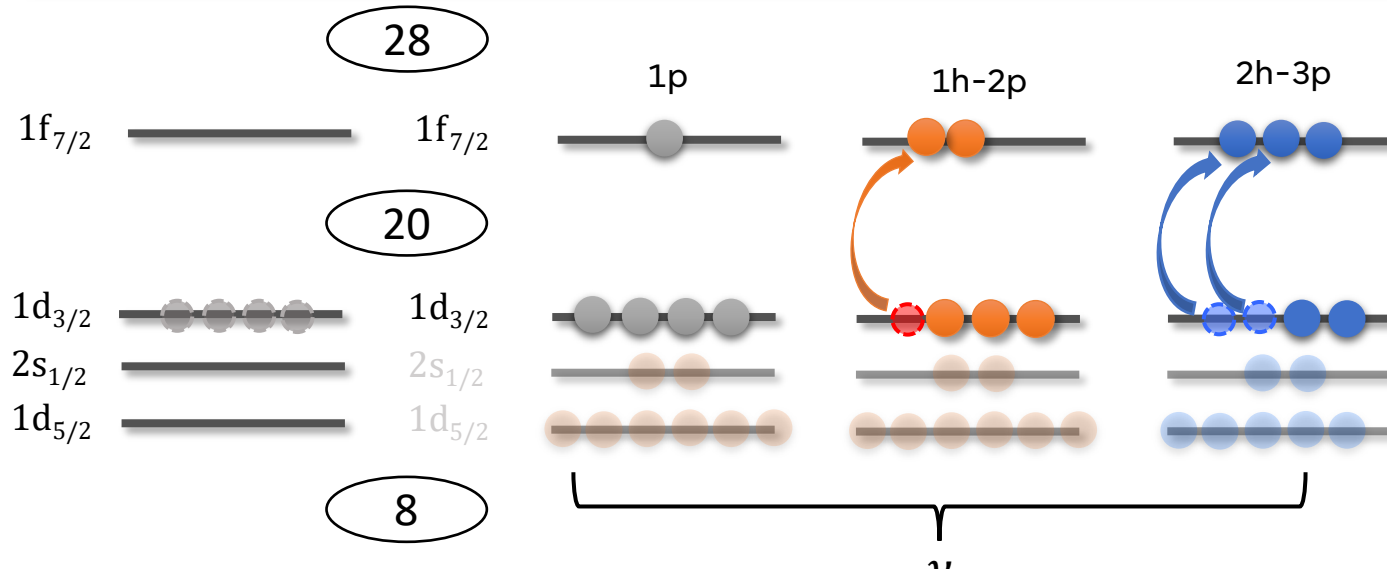




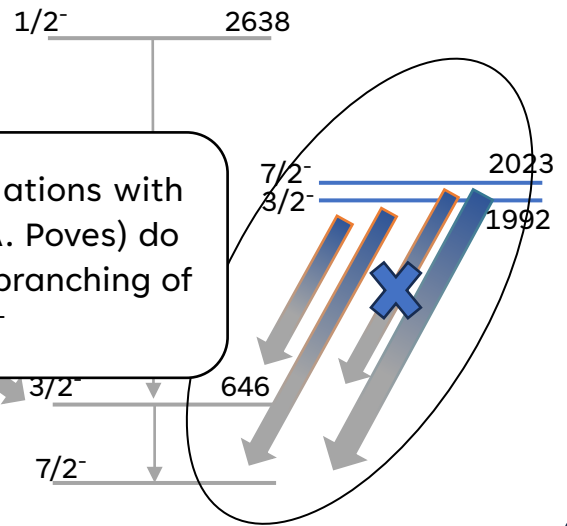
# $^{37}\text{S}$ as upper edge of $\nu$ ?



# $^{37}\text{S}$ as upper edge of Iol?



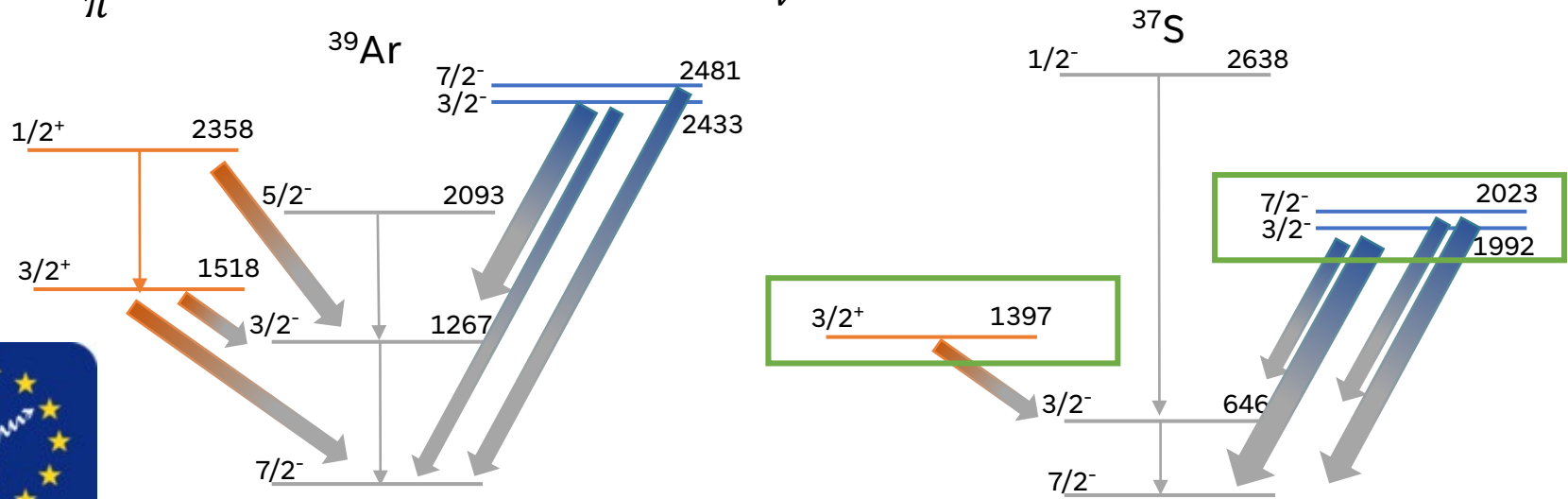
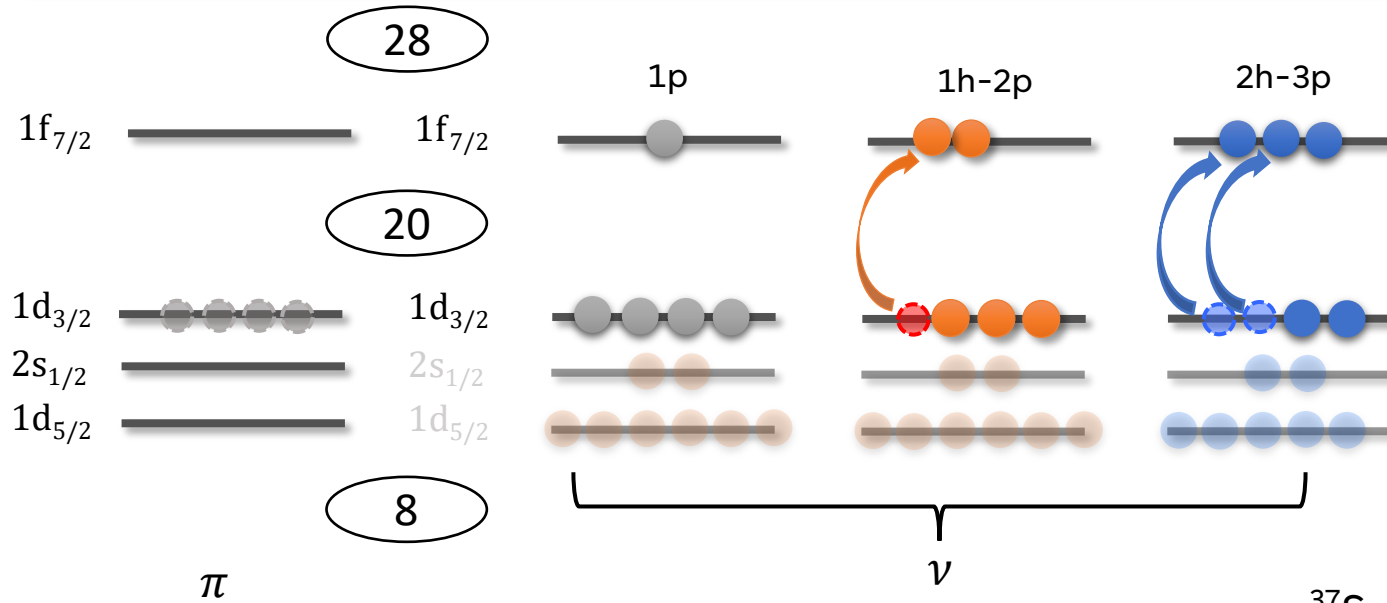
Shell-model calculations with SDPF-U-mix (by A. Poves) do not reproduce the branching of the  $7/2^-$



Sorlin *et al.*, PLB **809** 135740 (2020), Kay *et al.*, PRL **119**, 182502 (2017)



# $^{37}\text{S}$ as upper edge of $\nu$ ?

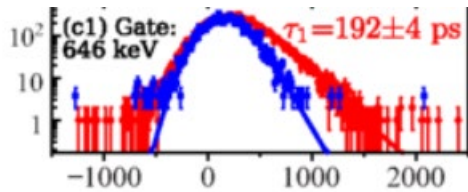


# $^{37}\text{S}$ : previous results

**CLARA+PRISMA  $^{36}\text{S}+^{208}\text{Pb}$  (~2004)**  
only spectroscopy

**AGATA+PRISMA  $^{36}\text{S}+^{208}\text{Pb}$  (June 2011)**  
5 plunger distances: 7-120  $\mu\text{m}$   
only upper/lower limits

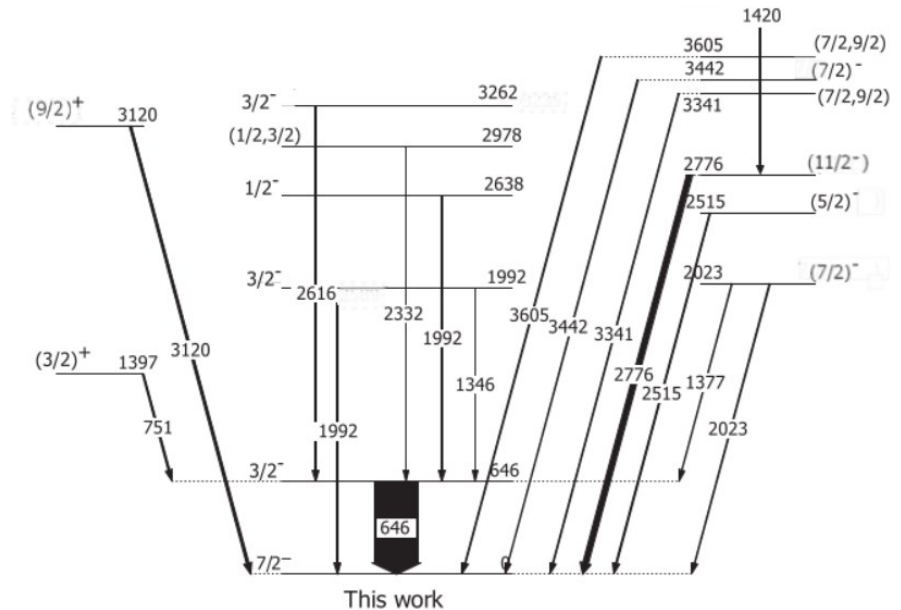
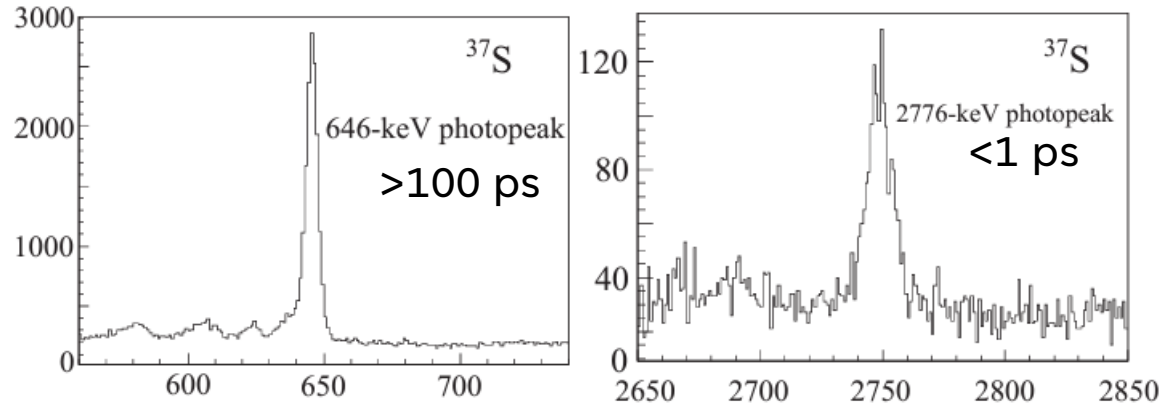
**Fast timing measurement (2014)**  
only 646-keV  $3/2^-$  lifetime



Wang *et al.*, Phys. Rev. C, **94** 044316 (2016)

**AGATA+PRISMA  $^{36}\text{S}+^{208}\text{Pb}$  (EXP\_010)**  
DSAM measurement, analysis in progress

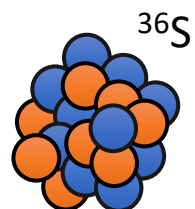
Grocutt *et al.*, Phys. Rev. C, **106** 024314 (2022)



Chapman *et al.*, Phys. Rev. C, **93** 044318 (2016)

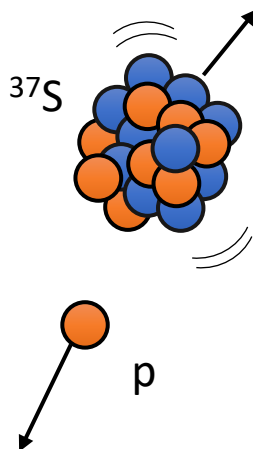


26th May – 3rd June 2022



4.5 AMeV

+



Two targets on regular target holder:

**1 CD<sub>2</sub> + 30 <sup>197</sup>Au**

**0.3 CD<sub>2</sub>**

for DSAM only measurements

Two targets on Cologne plunger cone:

**0.5 CD<sub>2</sub> + 4 <sup>197</sup>Au**

**0.5 CD<sub>2</sub> + 6 <sup>197</sup>Au**

all facing a <sup>181</sup>Ta stopper.

Distances covered

**0.7, 1, 1.5, 3, 3.8, 5, 7, 10 mm**

for about 1 day/distance

11 ATC present on the array:

**00, 01, 02, 04, 05, 06, 07, 08, 09, 10, 11**

Full traces written on disk:

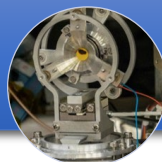
~31 TB/7 days

No trigger condition applied in data taking.

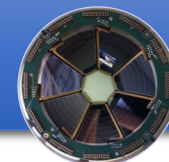
## AGATA



## Plunger

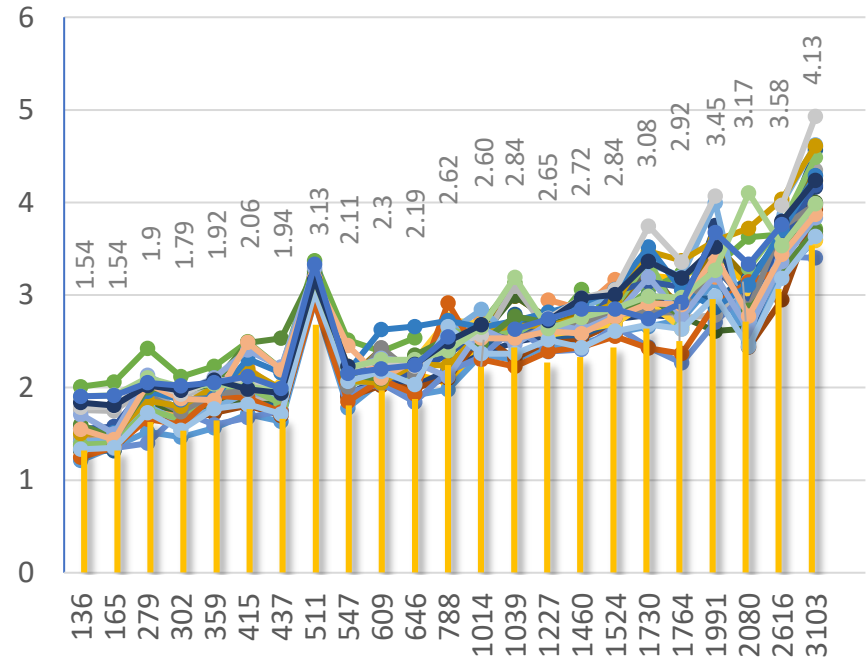
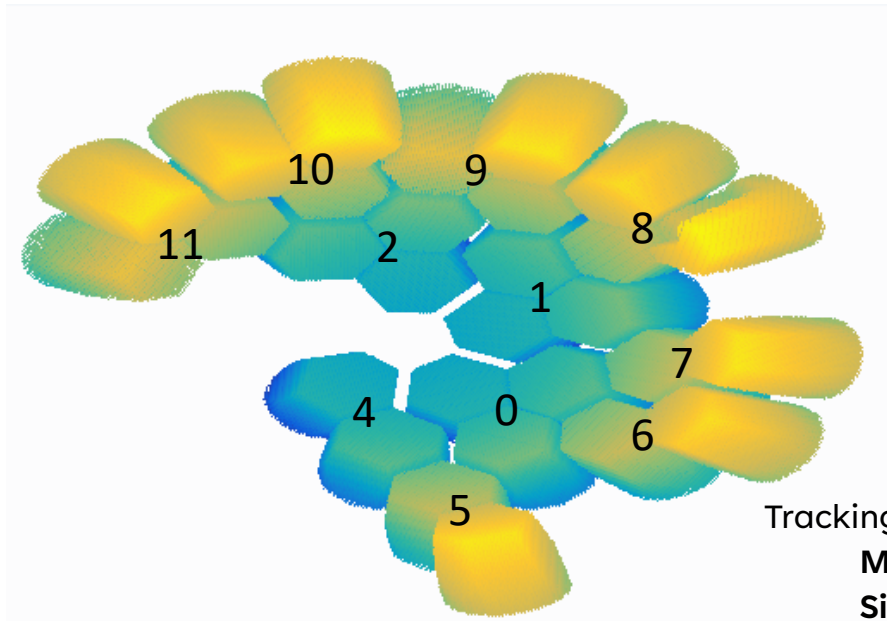


## SPIDER



# AGATA status

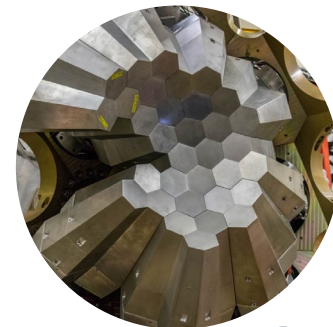
Low acquisition rate: ~900 Hz/cry, triggerless.  
 Full traces acquired: ~31 TB of data.  
<sup>226</sup>Ra for efficiency (ongoing) and final recalibration.  
 Spectrum dominated by  $\beta$  decay and FE  
 → in beam recalibration at high E



Tracking optimization carried out yielding

|                     |             |
|---------------------|-------------|
| <b>MinProbTrack</b> | <b>0.05</b> |
| <b>SigmaTheta</b>   | <b>1.8</b>  |
| <b>ClustRedFact</b> | <b>1.0</b>  |

using a FE line at 2.2 MeV.  
 Replay with tracking on going.



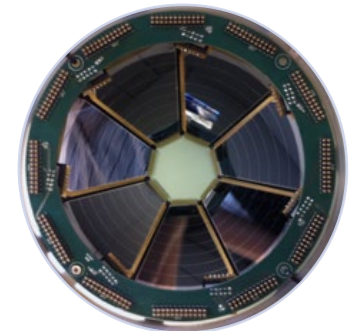
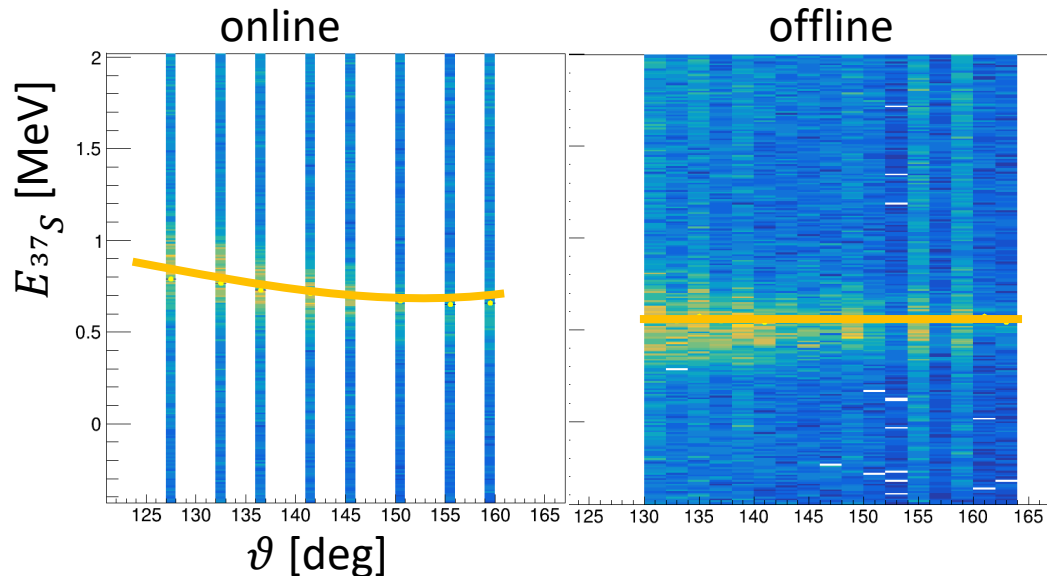
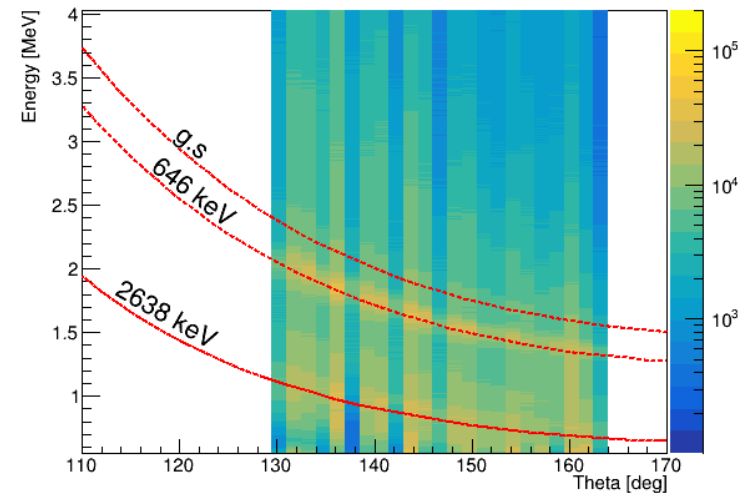


# SPIDER status

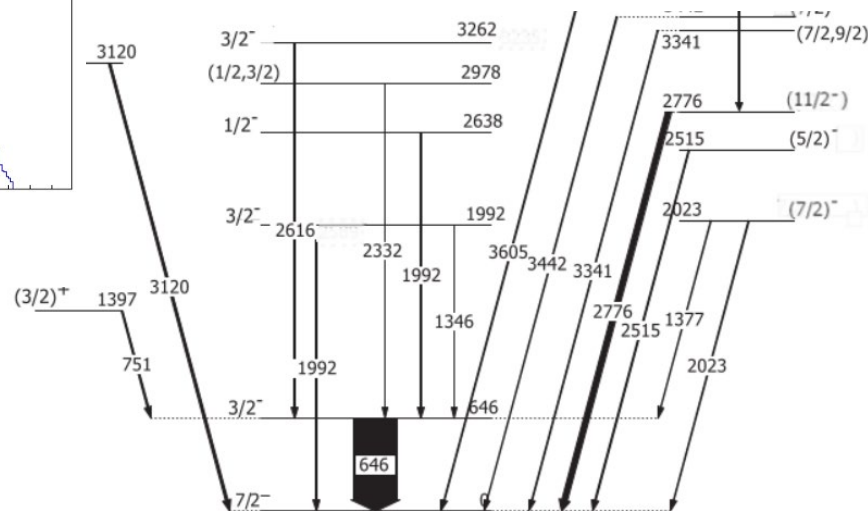
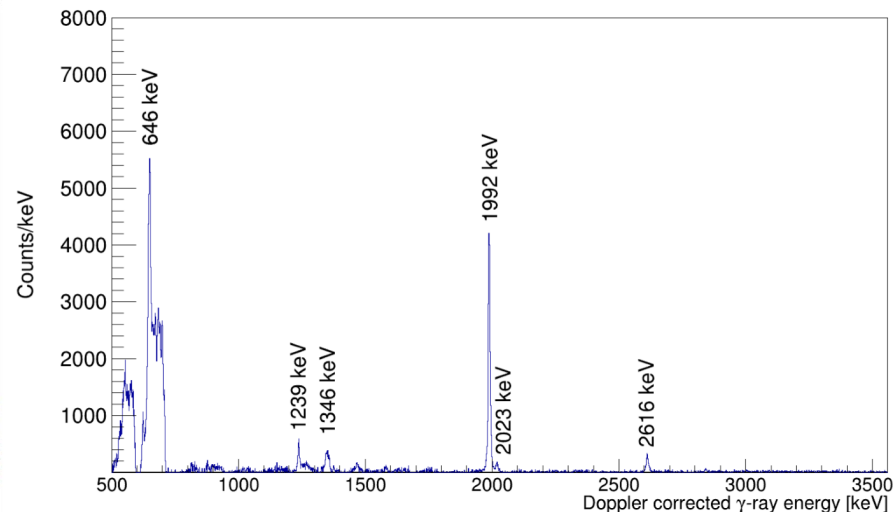
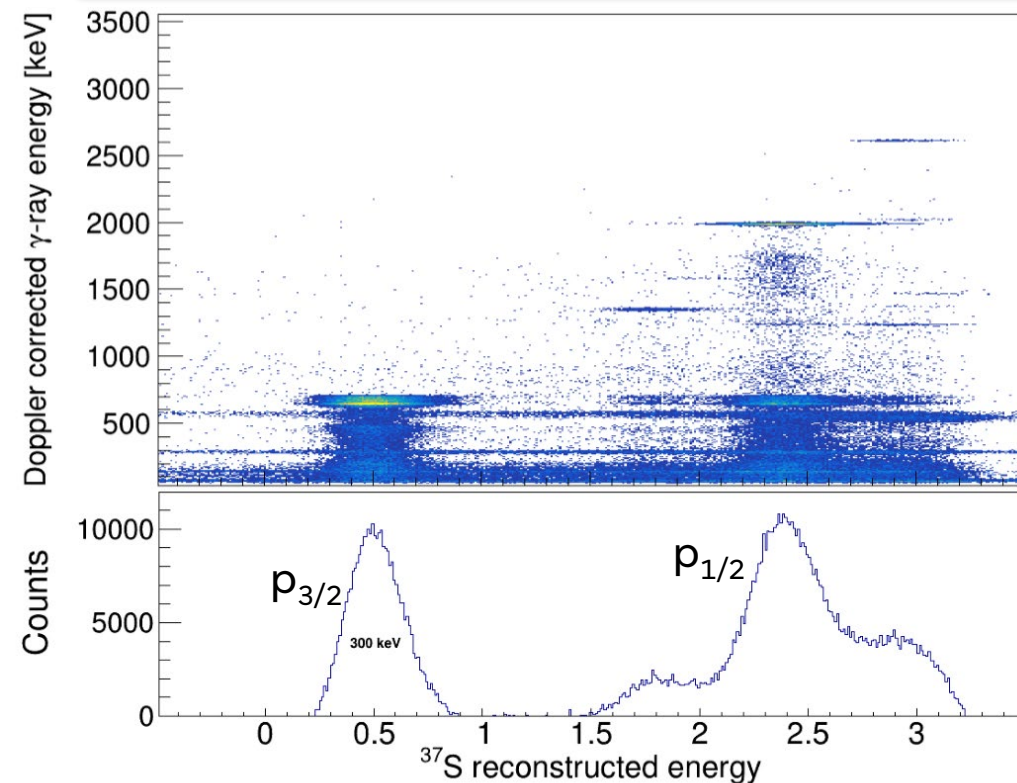
Calibrated with 3- $\alpha$  source  
No change of gain due to radiation damage observed

Reaction reconstruction taking into account energy loss in target (SRIM)

Optimization of SPIDER position using the  $^{37}\text{S}$  excitation spectrum  
FWHM: 500 keV (online)  $\longrightarrow$  300 keV (so far)



# First results: spectroscopy

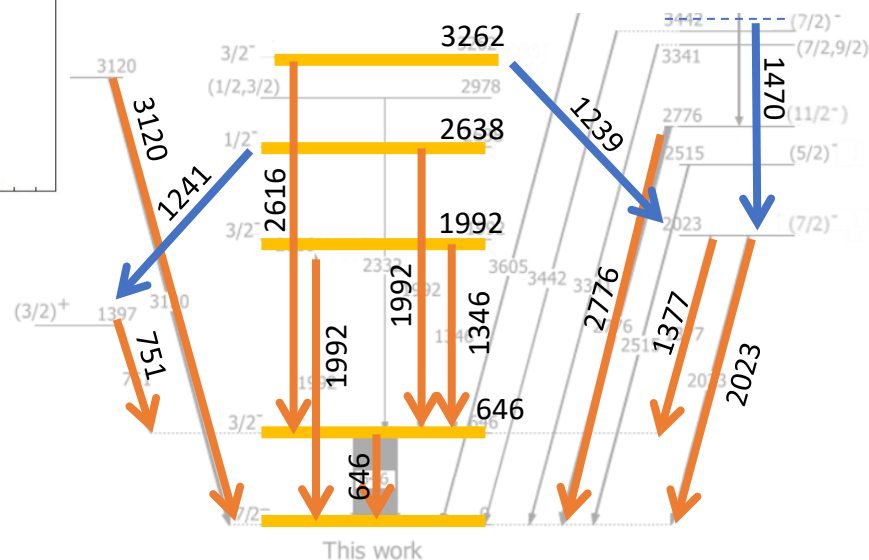
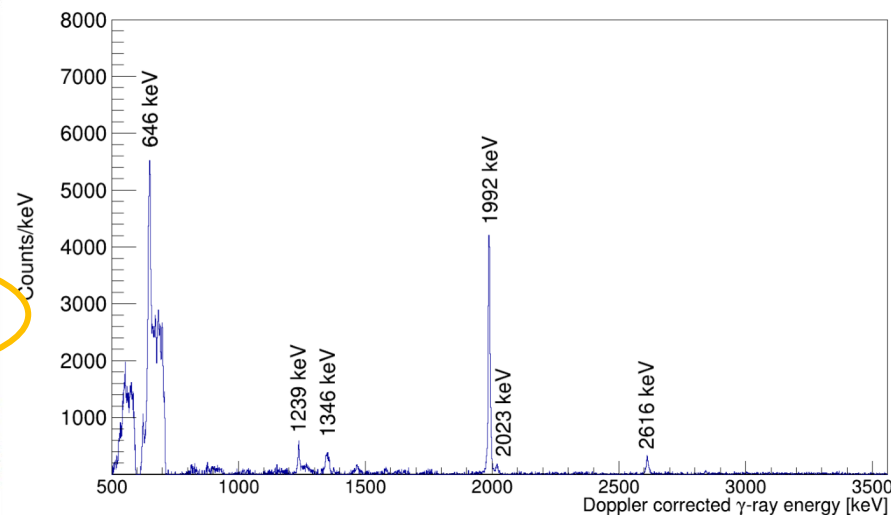
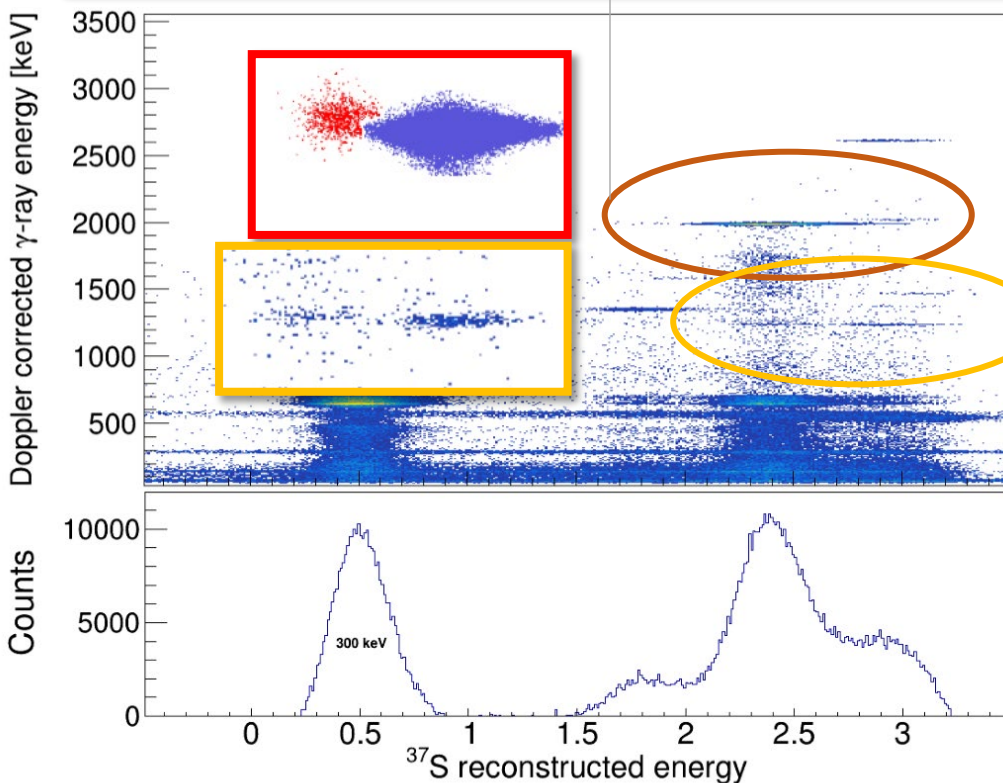


This work

Chapman *et al.*, Phys. Rev. C, **93** 044318 (2016)



# First results: spectroscopy

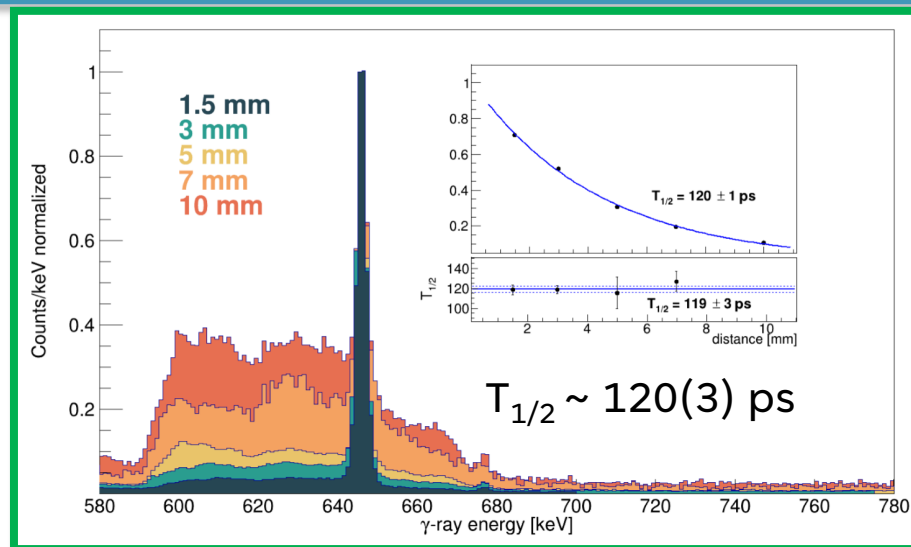


1241-keV line first observation? attribution seems clear thanks to reaction reconstruction.

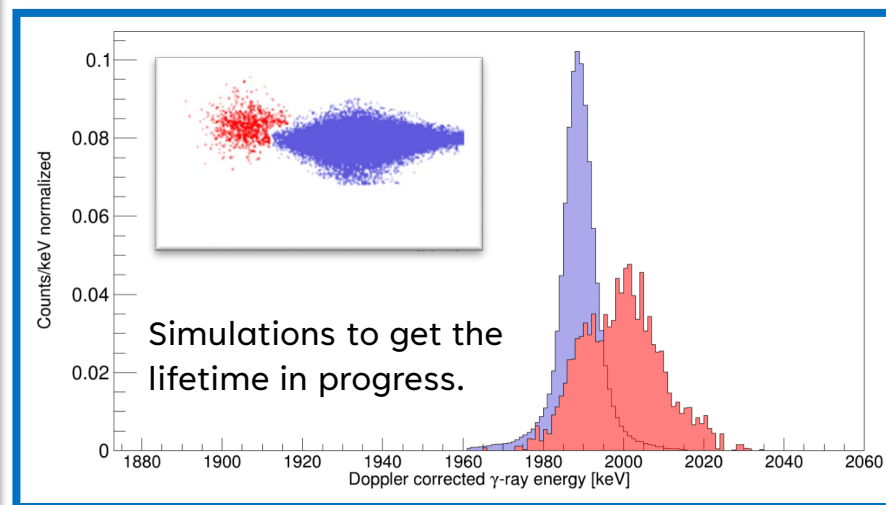
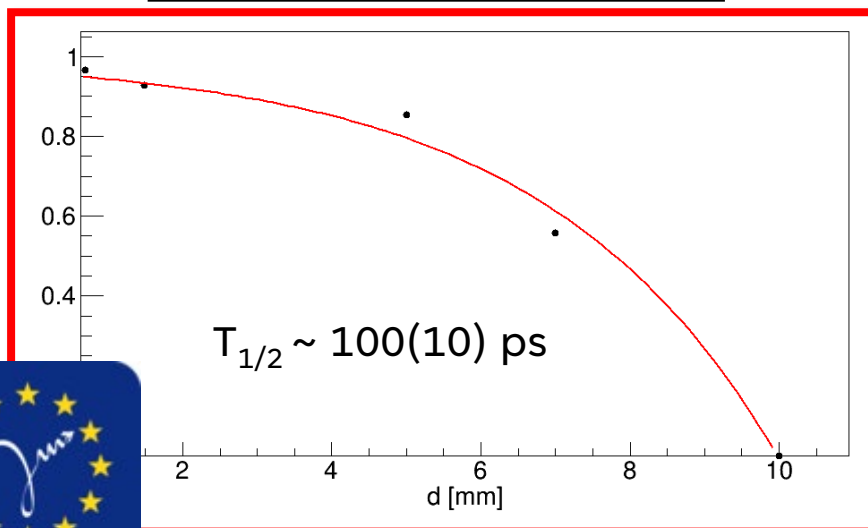
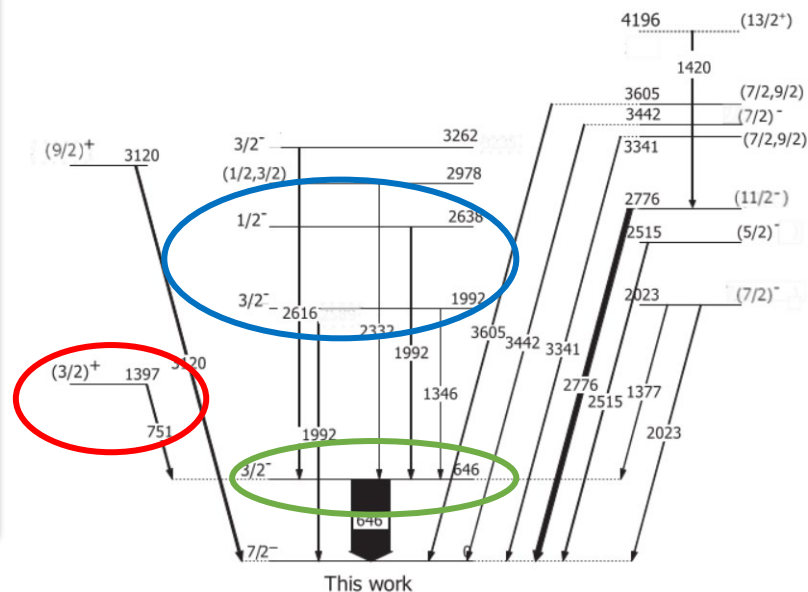
Statistics is fairly low for the intruder states, but 2d matrix is very clean.



# First results: lifetimes



Need careful error estimation



---

# THANK YOU FOR YOUR ATTENTION

---

## List of collaborators:

L. ZAGO, A. GOTTARDO, F. ANGELINI, M. BALOGH, D. BRUGNARA, J. COLLADO RUIZ, G. DE ANGELIS, A. ERTOPRAK, A. GOASDUFF, B. GONGORA SERVIN, A. GOZZELINO, T. MARCHI, D. R. NAPOLI, J. PELLUMAJ, R. M. PEREZ-VIDAL, M. SEDLAK, J. J. VALIENTE-DOBON, I. ZANON

*INFN LNL*

A. GADEA

*IFIC*

F. GALTAROSSA, N. MIANI, P.A. AGUILERA, D. BAZZACCO, J. BENITO GARCIA, S. CAROLLO, Z. HUANG, S. M. LENZI, R. MENEGAZZO, D. MENGONI, S. PIGLIAPOCO, E. PILOTTO, M. POLETTINI, F. RECCHIA, K. REZYNKINA, G. ZHANG

*UNIPD and INFN PD*

G. BENZONI, S. BOTTONI, G. CORBARI

*INFN MI and UniMI Statale*

N. MARCHINI, A. NANNINI, M. ROCCHINI

*INFN FI*

M. BECKERS, F. DUNKEL, C. FRANSEN, L. KORNWEBEL, C. LAKENBRINK, F. VON SPEE

*University of Cologne*

J. DIKLIC

*Ruder Boskovic Institute*