



# Perspectives of the $\gamma$ -ray tracking in the AGATA@GSI simulation

Edana Merchán

GSI

TU Darmstadt

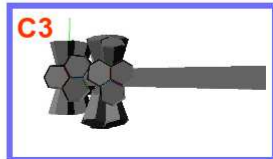
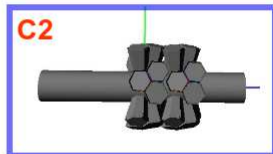
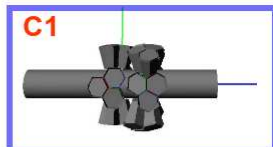
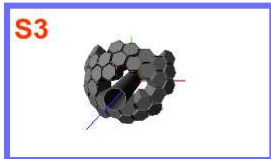
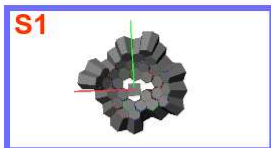
Agata Week, Legnaro, January 2010.

# Overview

- 1  $\gamma$ -ray tracking
  - S2 configuration.
  - S2' configuration. Preliminary!
  - $\gamma$ -ray cascades in configuration S2 tracked with `mgt`
- 2 Including Lycca0. Preliminary!
- 3 Outlook and perspectives

# Geometry of Agata@GSI

The  $\gamma$ -ray tracking depends on the Ge-clusters configuration



# $\gamma$ -ray tracking

Two different approaches to the  $\gamma$ -ray tracking:

- `mgt` [Dino]  
No modifications for shell structures.
- `forward_n` [Waely]  
Will be used for the selected geometry of `agata@gsi`.

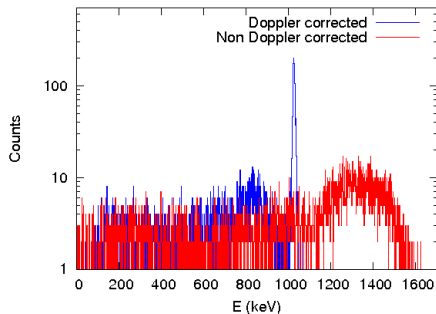
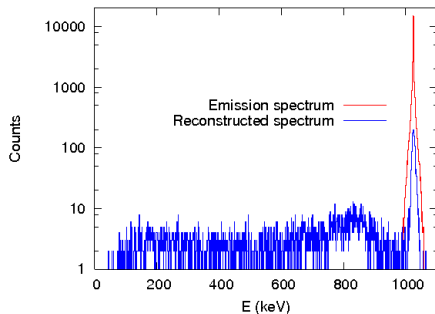
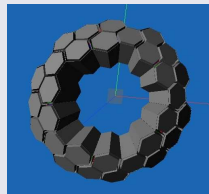
Other approaches ...

- Françoise Didierjean, Strasbourg  
It includes a different type of clusterization of the  $\gamma$  interaction points.

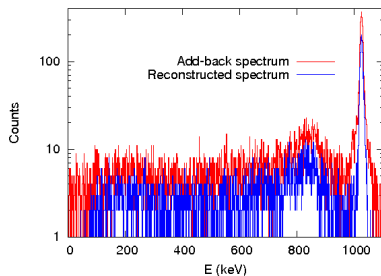
# $^{74}\text{Ni}$ in S2 configuration tracked with mgt

## Event Generator

- Beam isotope =  $^{75}\text{Cu}$ , Target = Fe (500mg)
- Recoil nucleus =  $^{74}\text{Ni}$
- Beam energy = 165 MeV/u
- **Gamma input = 1024 keV**

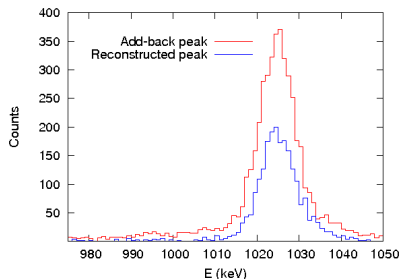


# $^{74}\text{Ni}$ in S2 configuration tracked with mgt



Add-back peak (Ideal):

- FWHM=10.96 keV
- Eff=7.95%
- Peak/Total=0.41

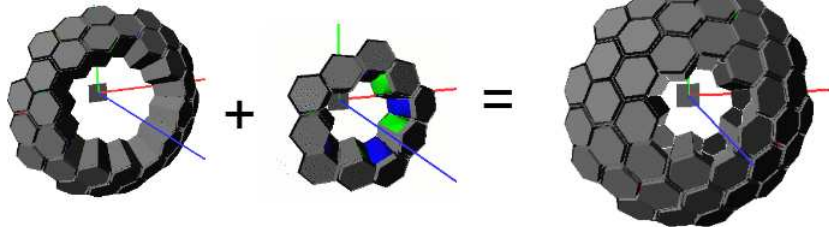


Reconstructed peak (S2):

- FWHM=10.18 keV
- Eff=4.11%
- Peak/Total=0.40

# S2' configuration. Preliminary!

AGATA S2 Geometry



10 triple Cluster

+

5 double Cluster

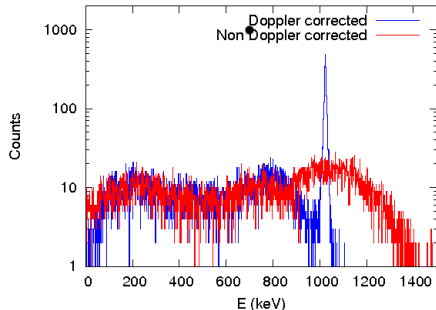
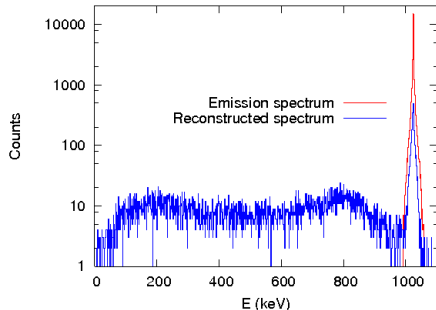
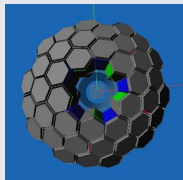
=

- S2' configuration includes, besides the 10 triple clusters of configuration S2, 5 double clusters that will fill the inner ring.

# $^{74}\text{Ni}$ in $S2'$ configuration tracked with mgt

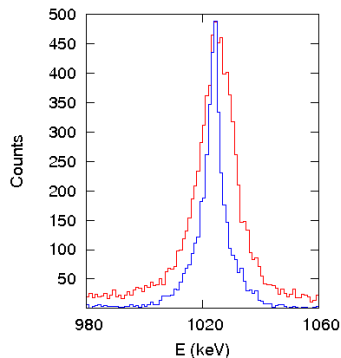
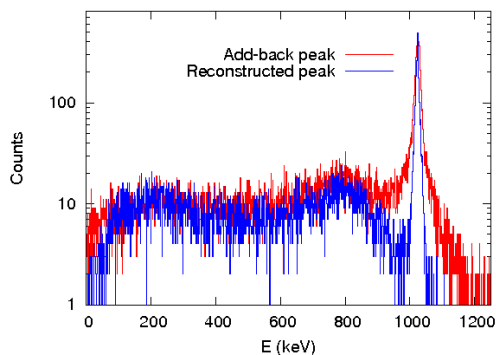
## Event Generator

- Beam isotope =  $^{75}\text{Cu}$ , Target = Fe (500mg)
- Recoil nucleus =  $^{74}\text{Ni}$
- Beam energy = 165 MeV/ $u$
- **Gamma input = 1024 keV**





# $^{74}\text{Ni}$ in $S2'$ configuration tracked with `mgt`



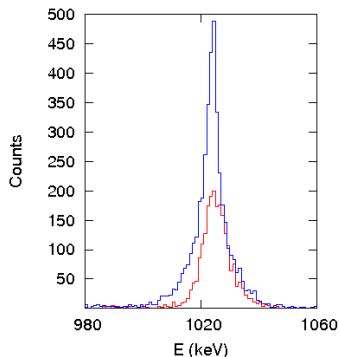
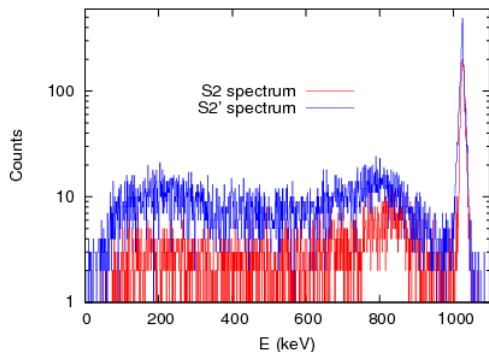
Add-back peak (*Ideal*):

- FWHM=10.18 keV
- Eff=16.15%
- Peak/Total=0.39

Reconstructed peak ( $S2'$ ):

- FWHM>7 keV
- Eff=8.41%
- Peak/Total=0.34

## S2 configuration and S2 plus double clusters



Reconstructed peak (S2):

- FWHM=10.18 keV
- Eff=4.11%
- Peak/Total=0.40

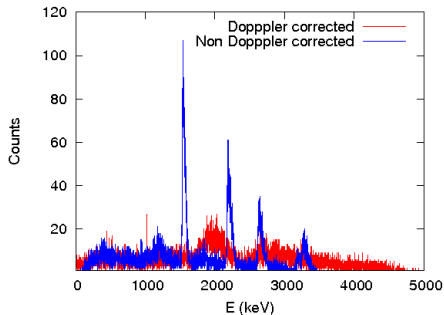
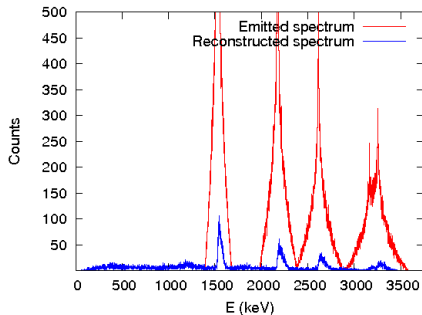
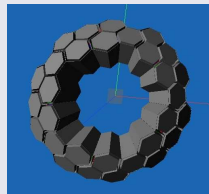
Reconstructed peak (S2'):

- FWHM > 7 keV
- Eff=8.41%
- Peak/Total=0.34

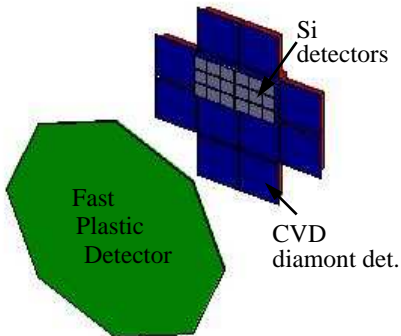
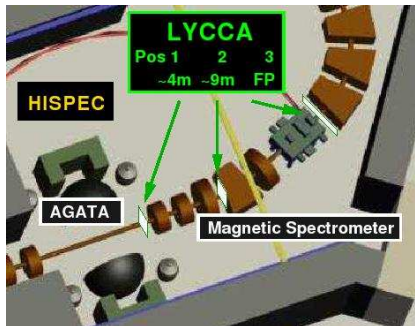
# $\gamma$ -ray cascades in configuration S2 tracked with mgt

## Event Generator

- Beam isotope =  $^{54}\text{Ni}$ , Target = Be (700mg)
- Recoil nucleus =  $^{50}\text{Fe}$
- Beam energy = 150 MeV/ $u$
- **Gamma input (5  $\gamma$ -cascade)**



# Lycca0 data in the agata@gsi simulation. Preliminary!



Detector type	ID	# of detectors
Diamond target	1-9	9
FPD	1	201
Si	601-612	12
CsI	801-836 937-944	45

[P.Joshi, York]

# Data format

The screenshot shows an Emacs window with the following menu: File Edit Options Buffers Tools Help. The toolbar contains icons for file operations and editing. The main window displays a data file with the following content:

```
1  
-100 0.43201 -0.00200 0.00000 1.00000  
-101 0.43201 -0.00204 0.00001 1.00000  
-102 -25.950 3.750 0.130  
-1 940.000 0.98967 -0.13795 -0.03899 0  
-101 0.43201 -0.00204 0.00001 1.00000  
-102 -25.950 3.750 0.130  
-8 5062457.644 -0.00204 0.00001 1.00000 1  
18008 303034.123 -25.970 3.750 10.007 00 0.076  
18201 1077234.096 -34.988 3.895 3101.039 00 24.596  
18465 400095.894 -34.666 3.945 3390.100 00 27.178  
Si 18603 375000.707 -34.673 3.962 3400.014 00 27.272  
CsI 18824 2849975.177 -34.683 3.973 3405.675 00 27.329  
18603 18.589 -34.674 3.965 3400.144 00 27.273  
18824 110.057 -32.057 4.690 3405.009 00 27.306  
18603 13.419 -34.676 3.962 3400.142 00 27.273  
18824 19.678 -35.791 3.140 3405.003 00 27.302  
18603 258.243 -32.872 4.073 3400.136 00 27.302  
18824 24.151 -35.947 4.287 3405.003 00 27.305  
18603 128.813 -37.039 3.429 3400.140 00 27.311  
18824 17.369 -32.683 2.973 3405.002 00 27.312  
18603 79.953 -33.264 4.144 3400.138 00 27.319  
--:-- save.Gammaevent.0000 (Fundamental) --L287--C46--14%----
```

Annotations on the left side of the window:

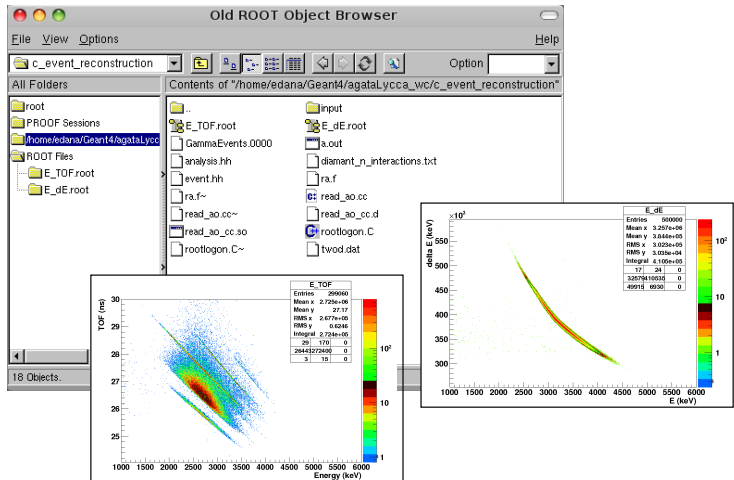
- DiTarget → 18008
- FPD → 18201
- Si → 18465
- CsI → 18603

Annotations at the bottom of the window:

- Energy: 5062457.644
- Position: -0.00204
- Time: 1

# Reading the data

Reading the data from the LYCCA0 detectors in a ROOT environment.  
read\_ao [G. Jaworski]



# Outlook

- $\gamma$ -ray tracking analysis with `mgt` was done for a mono-energetic events in configurations S2 and S2'.
- Using the configuration S2' shows to have an improvement in efficiency, but the inclusion of the double clusters in the tracking should be checked.
- One example of a  $\gamma$ -cascade was tracked in configuration S2.
- The inclusion of LYCCA0 in the simulated data was initiated.

## To do:

- Select the geometry configuration. It is possible to make it flexible? How much?
- Use `forward_n` and compare the results with `mgt`.
  - ▶ Include other approaches?.
  - ▶ Analyse the cascade tracking data.
- Use the Lycca0 particle tracking data to track the  $\gamma$ -rays.

Thanks