



# AGATA Community Meeting

Ryan. S. Kempley & The AGATA Collaboration

Department of Physics, University of Surrey, Guildford, Surrey, GU2 7XH



# Overview

- ▶ Software & Simulations
- ▶ AGATA Data Analysis Flow
- ▶ WP2 Milestones
- ▶ Multi-Geometry Simulation
- ▶ DANTE
- ▶ July 2009 Beam Test (DANTE)
- ▶ September 2009 Beam Test (AGATA)
- ▶ Summary

# Software & Simulations

- ▶ Installed & working, the essentials: ROOT, GEANT4, CLHEP, Gammaware, Enrico & Ceaser's Agata code's, MGS. These allow a good selection of Simulations to be done.
- ▶ Installed & working, data analysis: NARVAL live & Emulator (Live version not quite there yet), MGT, OFT, Gaspware. These will allow anyone to replay the stored Agata data and process it according to there needs. Very useful for changes to PSA Algorithms.
- ▶ Installed and working, non-essential/experimental: PRISMA C++ simulation code, AGATA-PRISMA data merger (Simulations), CRACOW & Vigru (Online data viewers).



# Analysis to Date

Source + Beam Simulations

Source test data

In-beam test data

AGATA + Dante in-beam test data (Covered today)

AGATA + AGAVA in-beam test data (Covered today)

AGATA + PRISMA simulated data (Currently)

AGATA + PRISMA in-beam data (Shortly)

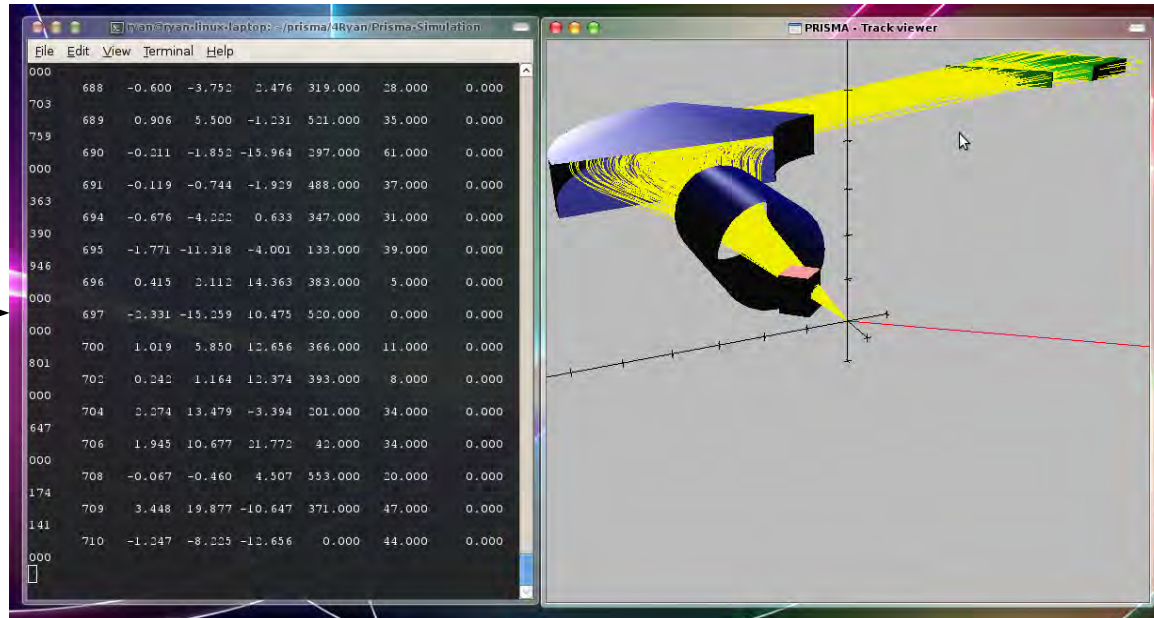


# AGATA Data Analysis Flow (Simulated Data)

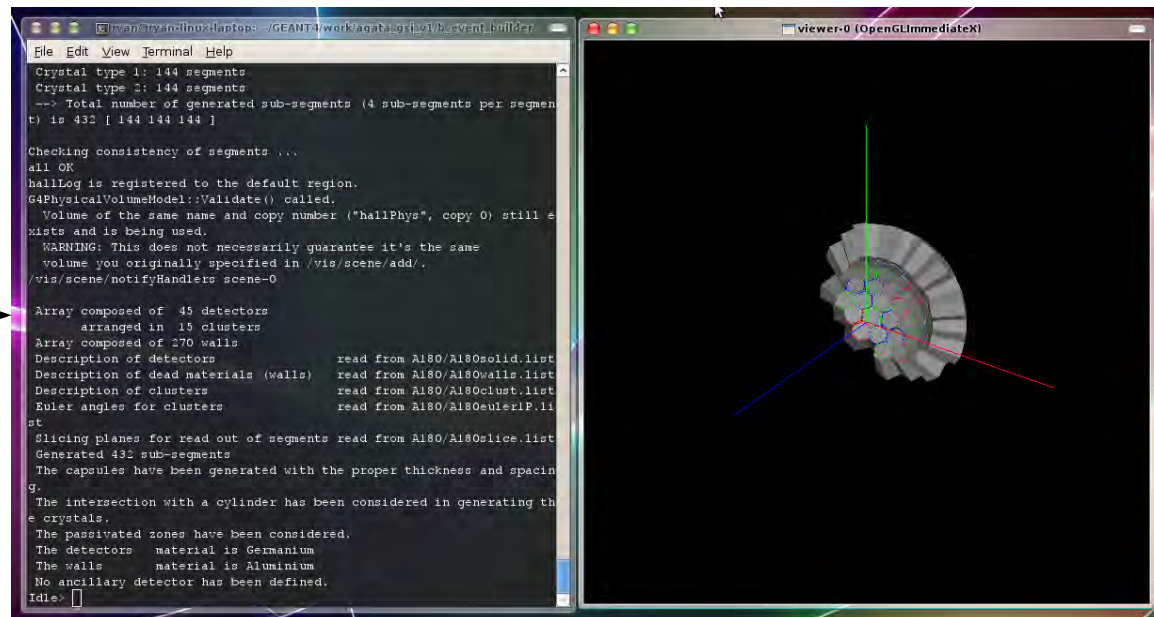
Prisma C++  
Simulation  
Code →

Event  
Generator

Agata GEANT4  
Simulation  
Code →

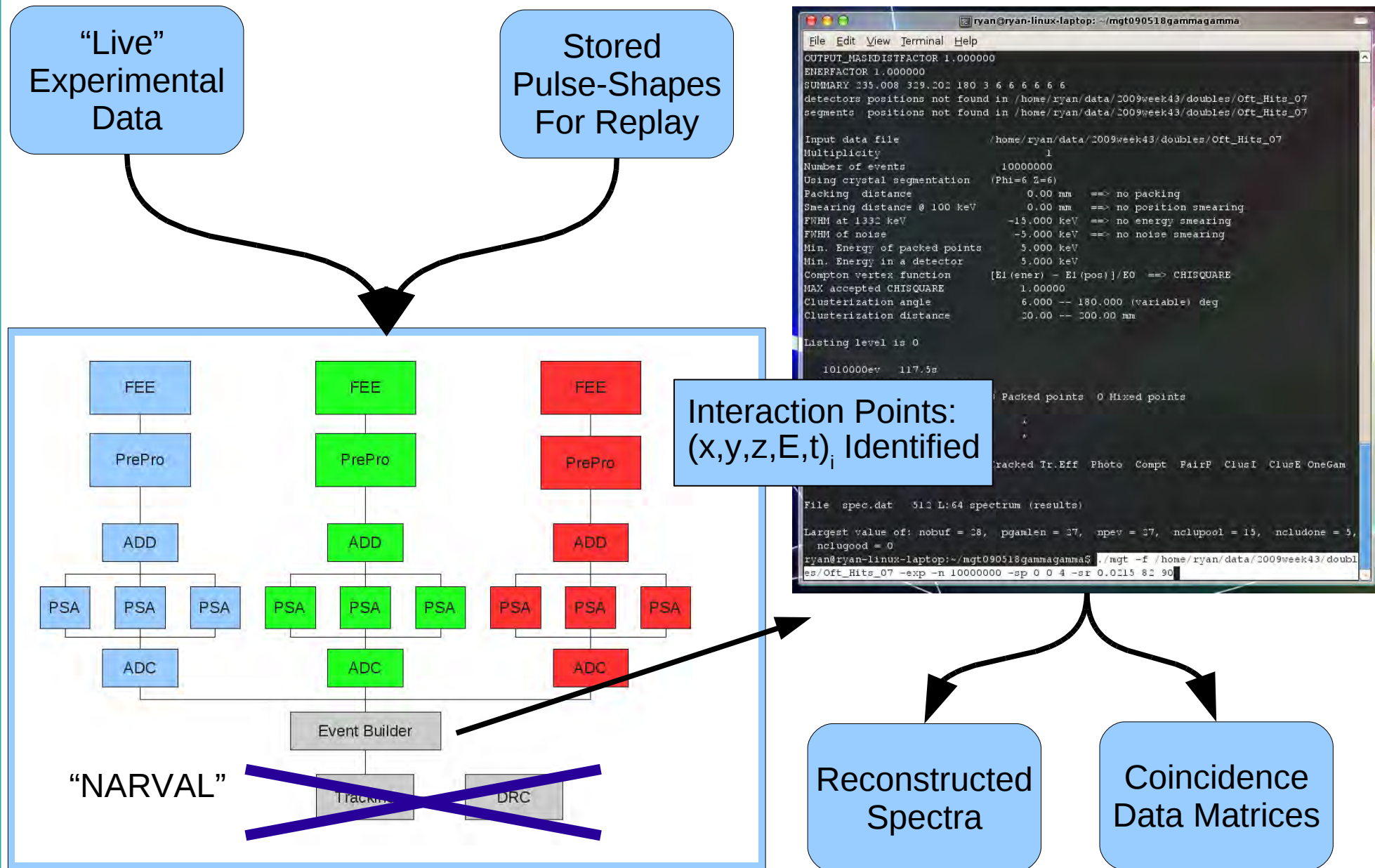


Data  
Merger





# AGATA Data Analysis Flow (NARVAL)



# AGATA Data Analysis Flow (Tracking & Doppler)

Data  
Merger

GEANT4  
Code

NARVAL  
Emulator  
or Live

```
ryan@ryan-linux-laptop: ~/mgt090518gammagamma
File Edit View Terminal Help
OUTPUT_MASKDISTFACTOR 1.000000
ENERFACTOR 1.000000
SUMMARY 235.008 329.202 180 3 6 6 6 6 6
detectors positions not found in /home/ryan/data/2009week43/doubles/Oft_Hits_07
segments positions not found in /home/ryan/data/2009week43/doubles/Oft_Hits_07

Input data file          /home/ryan/data/2009week43/doubles/Oft_Hits_07
Multiplicity              1
Number of events          10000000
Using crystal segmentation (Phi=6 Z=6)
Packing distance          0.00 mm ==> no packing
Smearing distance @ 100 keV 0.00 mm ==> no position smearing
FWHM at 1332 keV          -15.000 keV ==> no energy smearing
FWHM of noise              -5.000 keV ==> no noise smearing
Min. Energy of packed points 5.000 keV
Min. Energy in a detector  5.000 keV
Compton vertex function    [E1(ener) - E1(pos)]/E0 ==> CHISQUARE
MAX accepted CHISQUARE    1.000000
Clusterization angle       6.000 -- 180.000 (variable) deg
Clusterization distance    20.00 -- 200.00 mm

Listing level is 0

1010000ev 117.5s
1012414 Events (0.1 ms/ev)
2896853 Energy points 2896853 Packed points 0 Mixed points

Individual Total Response
Energy Emitt Effi P/T
Energy Emitt GEANT Proje Tracked Tr.Eff Photo Compt PairP ClusI ClusE OneGam
M2 M3 M4 M5 M6

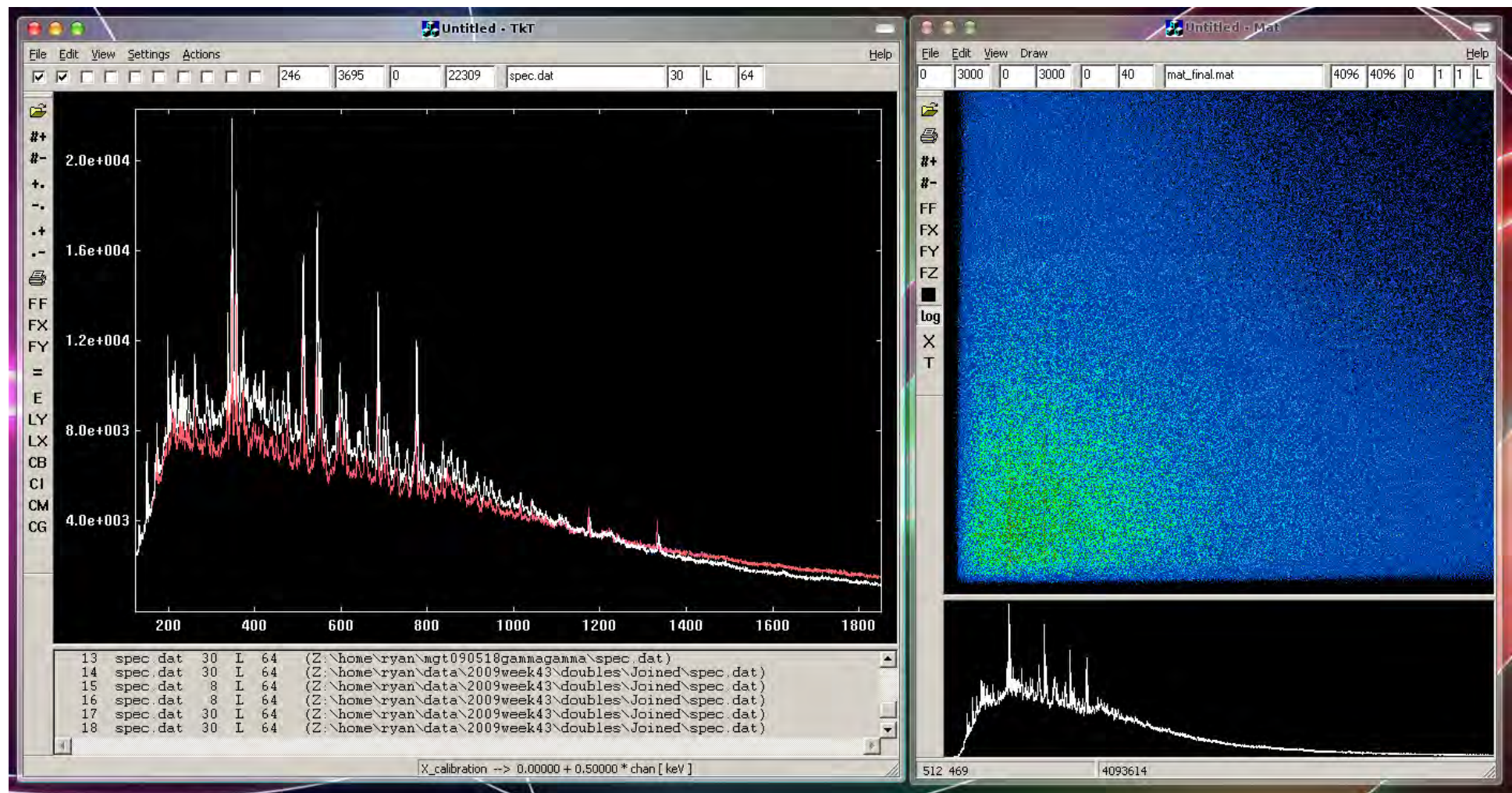
File spec.dat 512 L:64 spectrum (results)

Largest value of: nobuf = 38, pgamlen = 27, npev = 27, nclupool = 15, ncludone = 5,
nclugood = 0
ryan@ryan-linux-laptop:~/mgt090518gammagamma$ ./mgt -f /home/ryan/data/2009week43/doubl
es/Oft_Hits_07 -exp -n 10000000 -sp 0 0 4 -sr 0.0215 82 90
```

Spectra  
Analysis



# AGATA Data Analysis Flow (Doubles Data)



MGT

In: Spec.dat - Out: spec.mat

Matrix  
Output

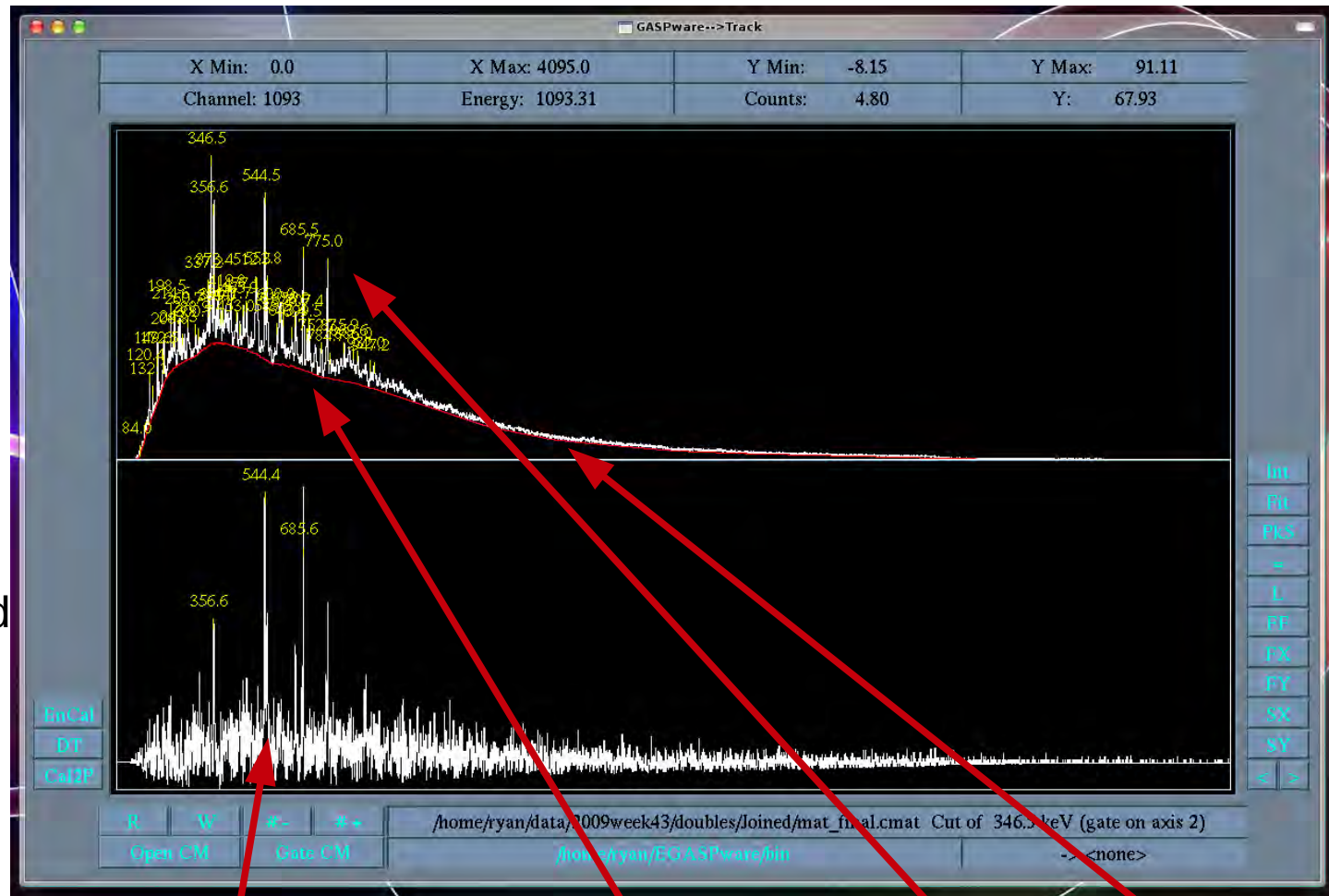


# AGATA Data Analysis Flow (Analysis & Physics)

Egaspware: Able to produce gated spectra, peak finding, fitting, integration and various other gamma spec tools.

Reads in compressed matrix, created in the last step by cmat.  
Produces a compressed matrix readable by the program.

All in all, data analysis is viable without ROOT. Although, for more advanced analysis, when The Physics campaign starts, ROOT will be needed.



Gated Spectra

Subtracted Background

Peaks

Raw Spectra

# Milestones(Current Work)

M2.11(WP2): Preliminary analysis of AGATA Stage 1 data complete. (02 February 2010)

Data analysis flow in good order. Able to process from start to finish. Including any relevant simulations.

Production of interpretable results from in-beam data

Now with the aim of using these acquired tools and skills to compare basis sets, and see how they effect results

Moving from NARVAL emulator to the Live version



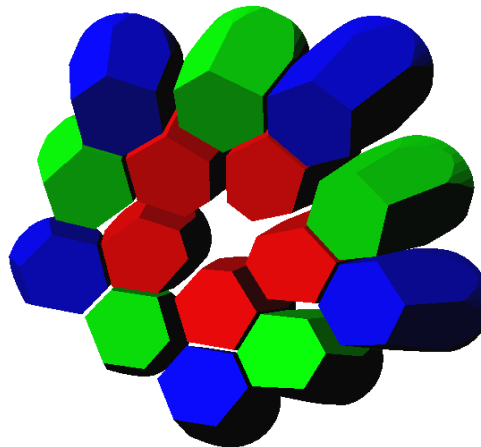
# Future Work and Milestones

Comparison of symmetric to asymmetric basis sets, and how these affect the experimental data. (Efficiency, resolution etc)

Main work ideas: Investigation of 15 degree detector orientation off-set from recent detector module

Continuation of these, covering multiple angles and looking at how this changes the experimental data from the in-beam tests.

Will use MGS to produce the needed basis sets, incorporating them into narval and replaying the pulse shapes.





# AGATA Data Analysis Flow (MGS)

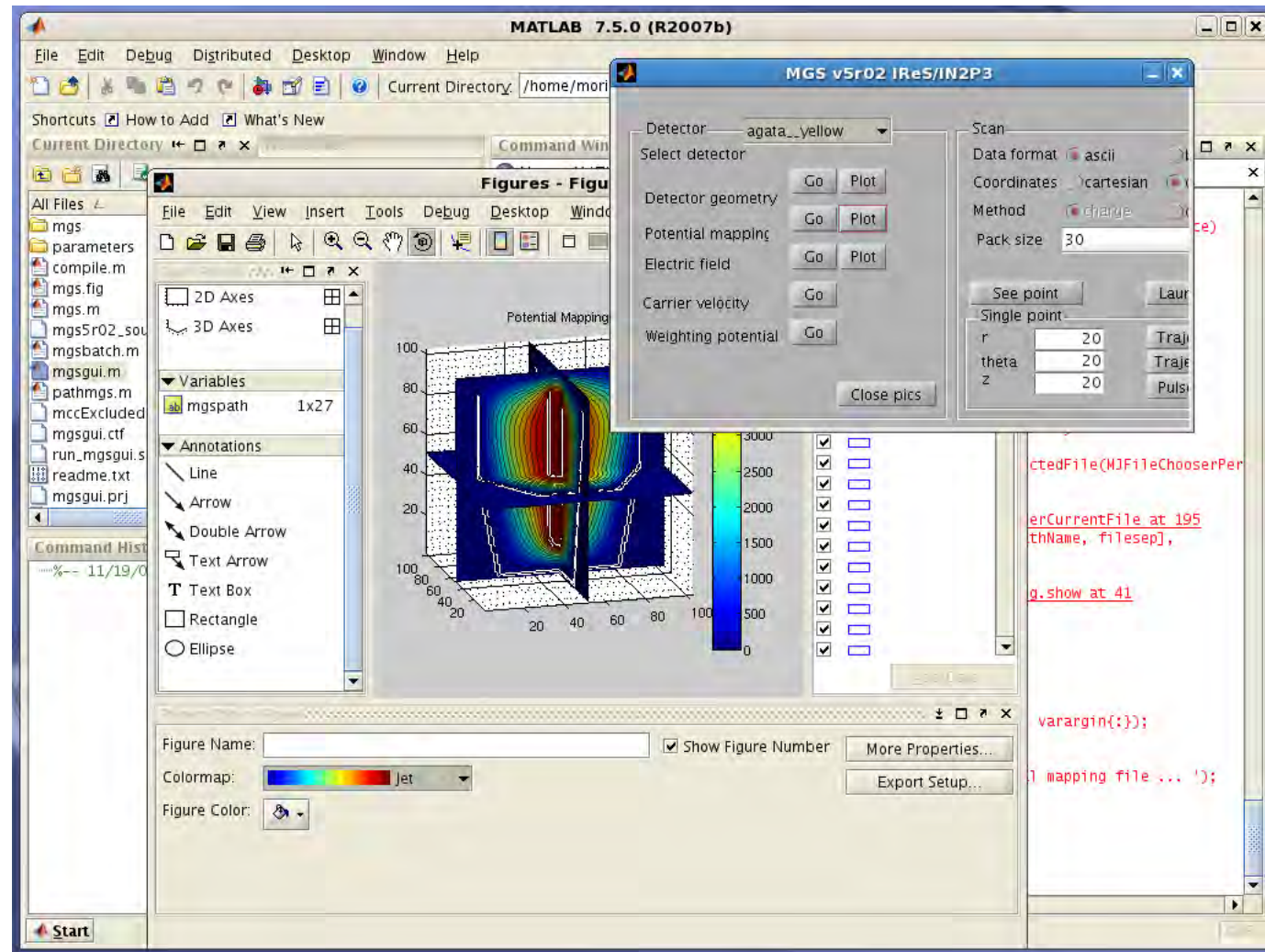
Multi-Geometry Simulation,  
Stand alone electric field  
Simulation.

No need for introduction

Now that data analysis  
flow has been learnt well  
will use this to produce  
varying basis data sets.

Many possibilities to  
investigate, as mentioned  
for WP2.

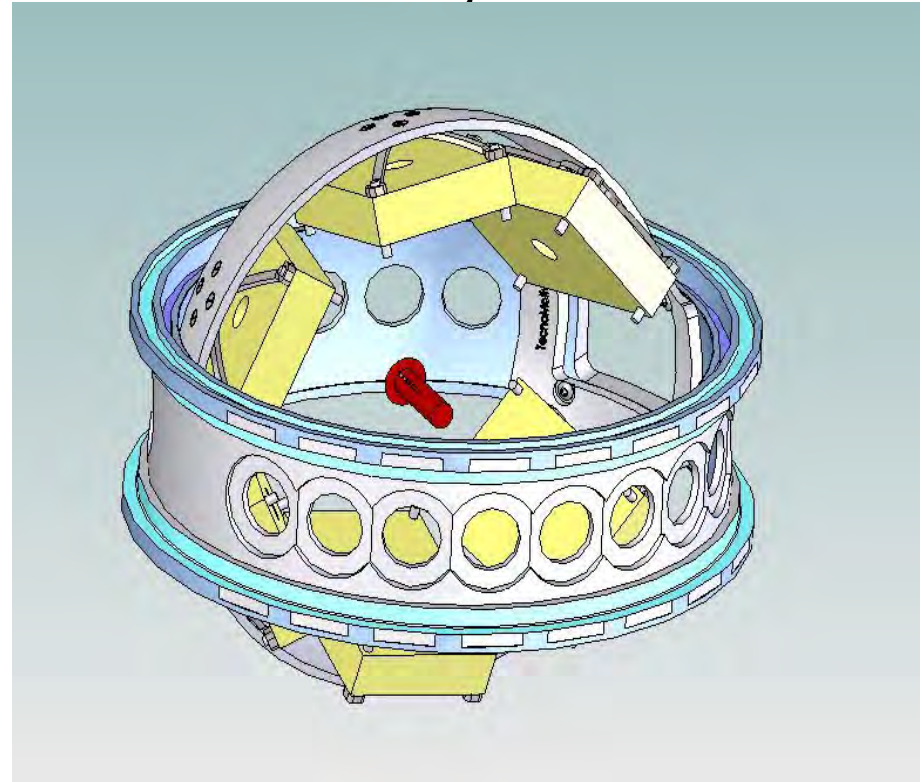
Suggestions welcome, work  
will also be done on the  
symmetric yellow detector.



Data-flow needs an integrated framework, but, low priority until the real Physics Starts!!

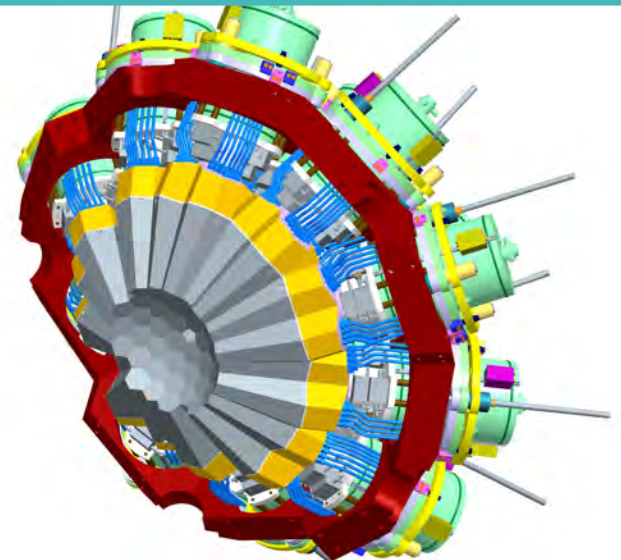
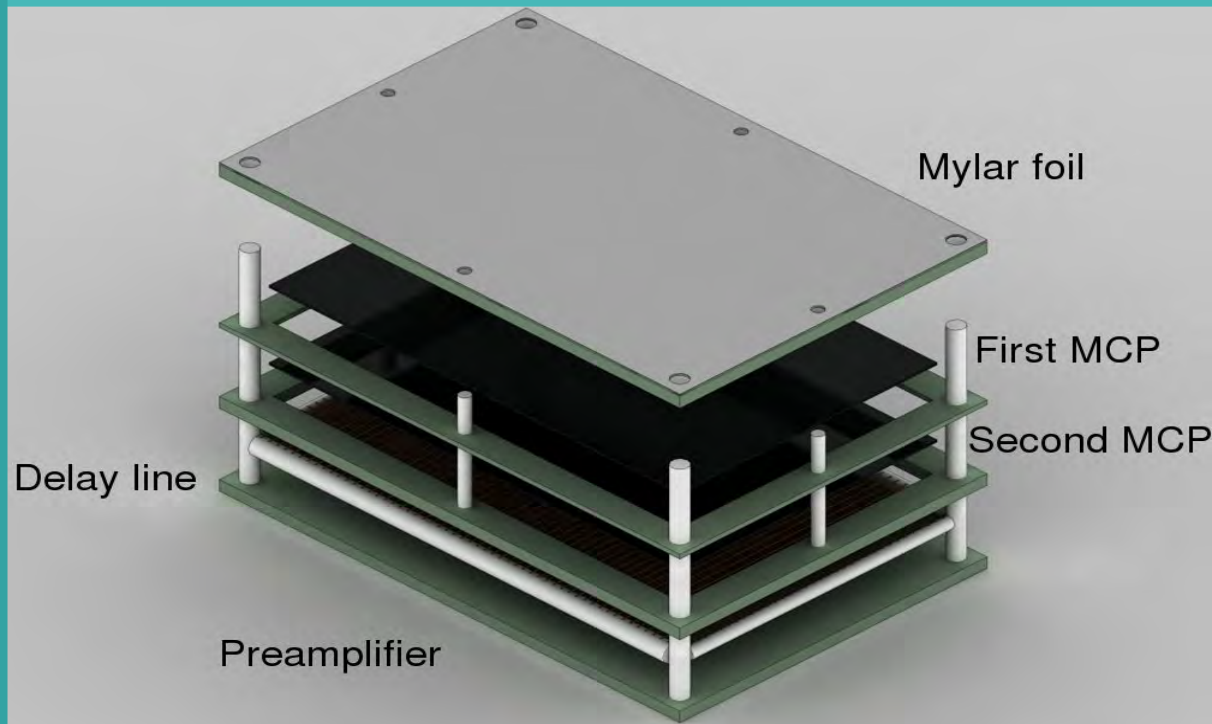
# DANTE: Ancillary Detector

- ▶ DANTE: Detector Array for multi-Nucleon Transfer Ejectiles
- ▶ Heavy-ion position-sensitive ancillary array
- ▶ Mylar foil to facilitate electron production at entrance
- ▶ Two Micro Channel Plates (MCP), Chevron configuration
- ▶ 2-3ns rise time of fast signals, position resolution >1mm
- ▶ TOF measurements give time resolution of 130ps
- ▶ efficient in detection of reaction products &  $\gamma$ - $\gamma$  coincidences





# DANTE

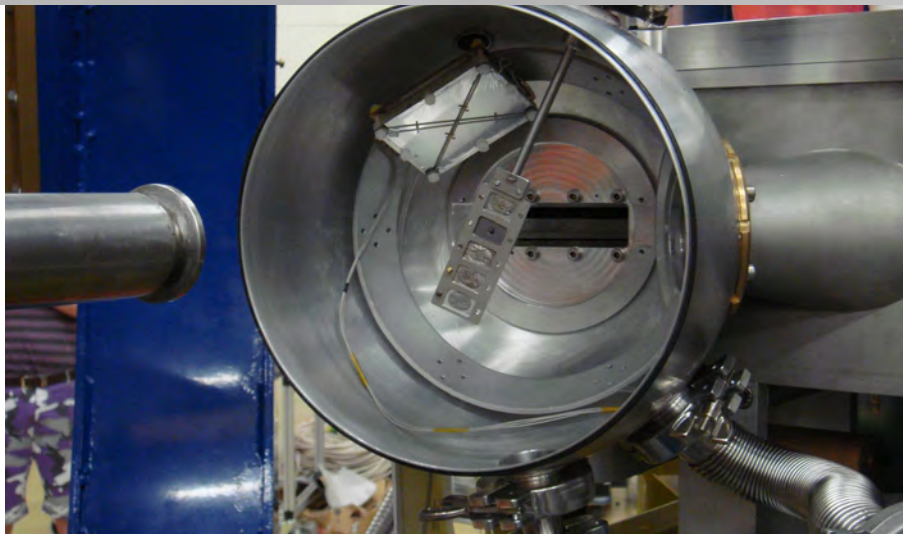


Device mounted to back of PRISMA

Behind target to capture recoil ions

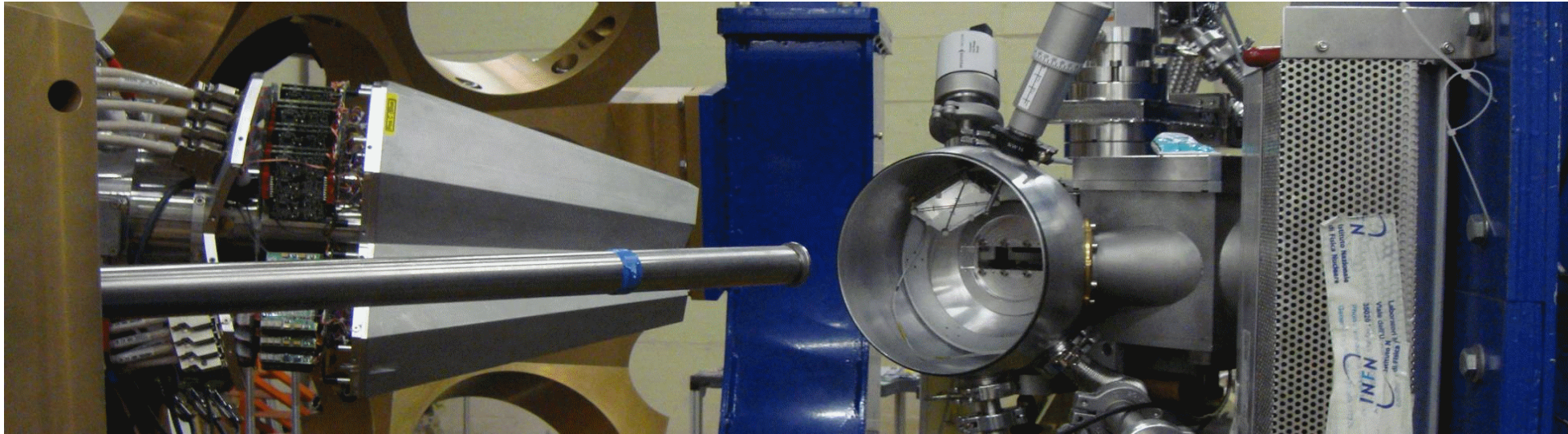
Held in vacuum reaction chamber

Single part of larger array





# July 2009 AGATA Test With DANTE



$^{56}\text{Fe}$  Beam on  $^{197}\text{Au}$  Target

DANTE = Coincidence + Doppler correction (Off-line)

DANTE treated as 4<sup>th</sup> AGATA module

Crystal rate  $\sim 3\text{kHz}$

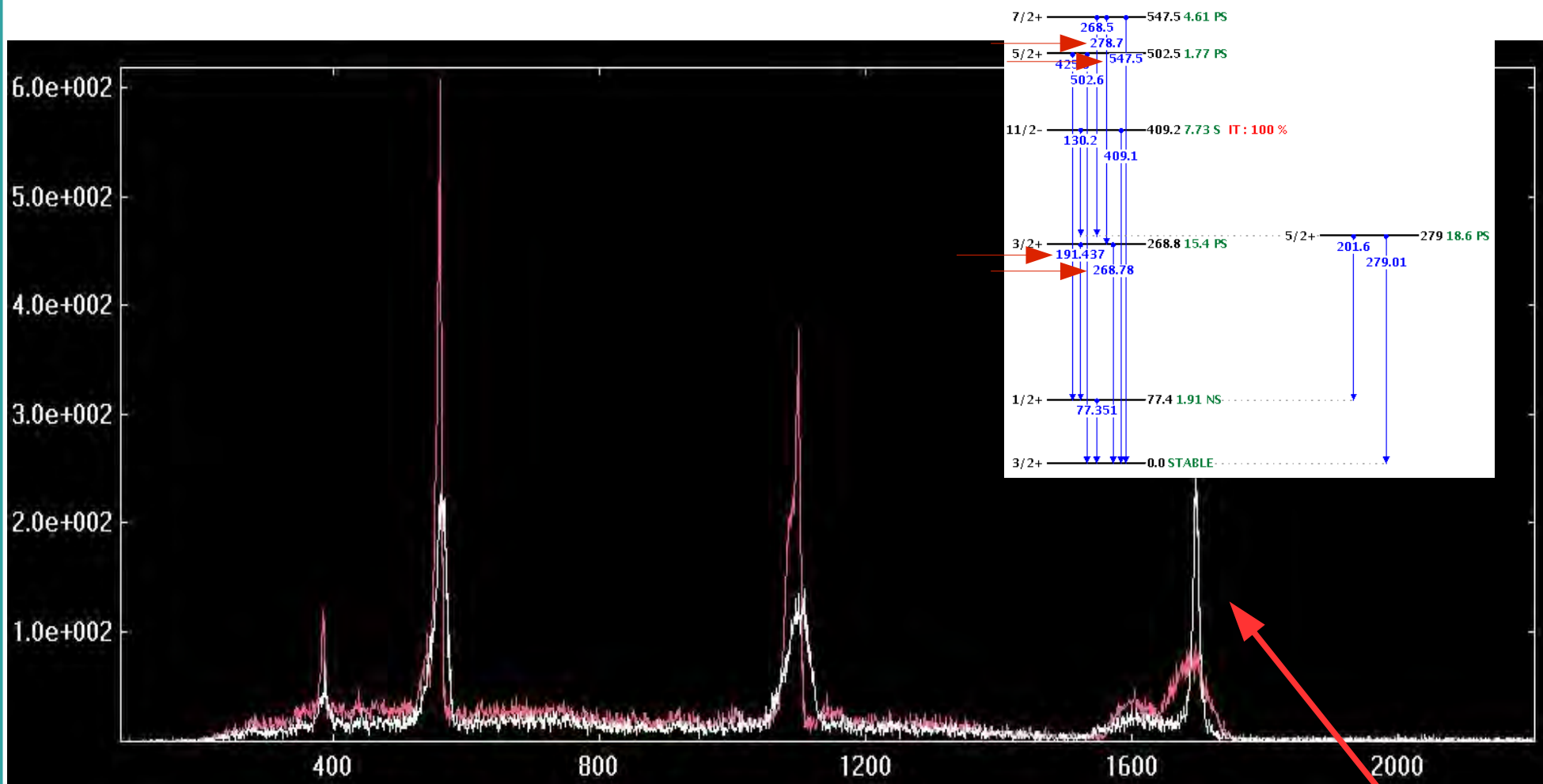
Coincidence rate  $\sim 150\text{-}200$  events/s

Tandem-XTU Accelerator @ LNL Italy @ 220MeV

Full on-line tracking, no Doppler correction



# Energy Tracked Spectra



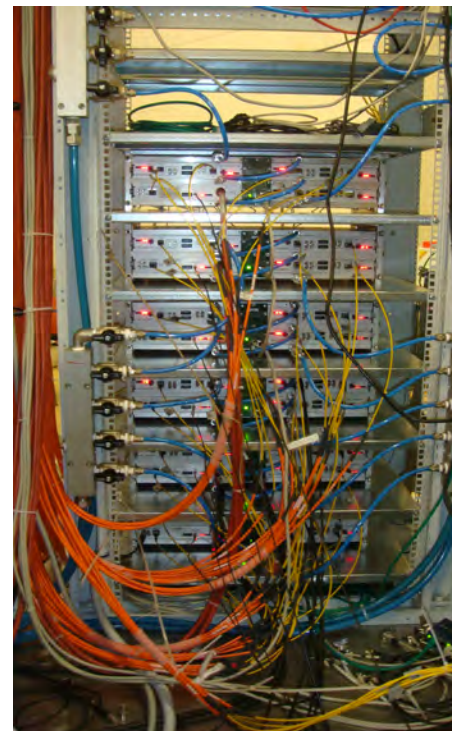
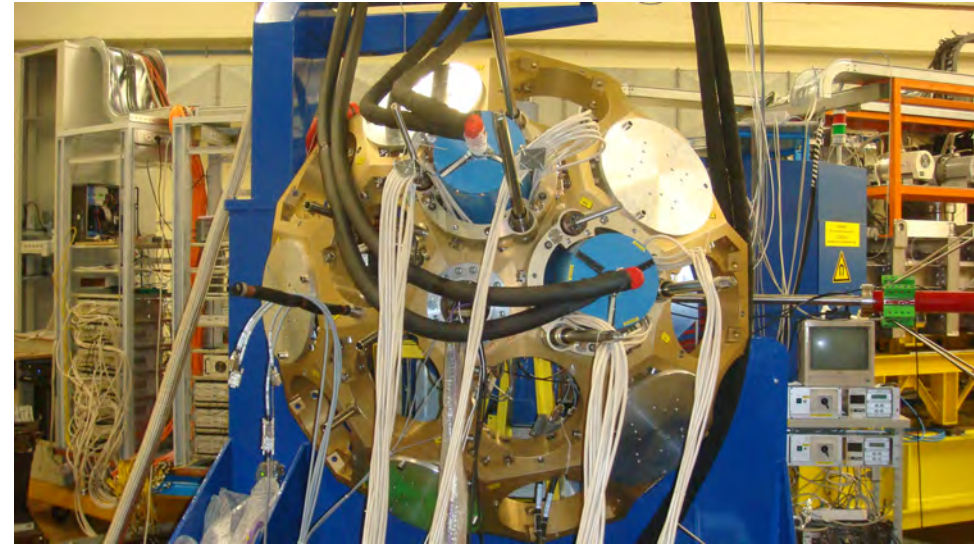
846.7Kev ( $\text{Fe } 2^+ - 0^+$ )

- ▶  $^{56}\text{Fe}/^{197}\text{Au}$  in Dante Doppler correction for  $^{56}\text{Fe}$
- ▶  $^{56}\text{Fe}/^{197}\text{Au}$  in Dante Doppler correction for  $^{197}\text{Au}$



# AGATA + AGAVA September 2009

- ▶  $^{32}\text{S} + ^{110}\text{Pd}$  @ 135 MeV
- ▶ Fusion Evaporation
- ▶ AGAVA Ancillirays
- ▶ LaBr + Silicon detectors
- ▶ Designed to be triggerless
- ▶ Data: Singles, Doubles, Triples
- ▶ Standard target ( $500\mu\text{g}/\text{cm}^2$ )
- ▶ Thick Target ( $670\mu\text{g}/\text{cm}^2 + 8\text{mg Au}$ )
- ▶ Populated Nuclei -  $^{138}\text{Sm}$

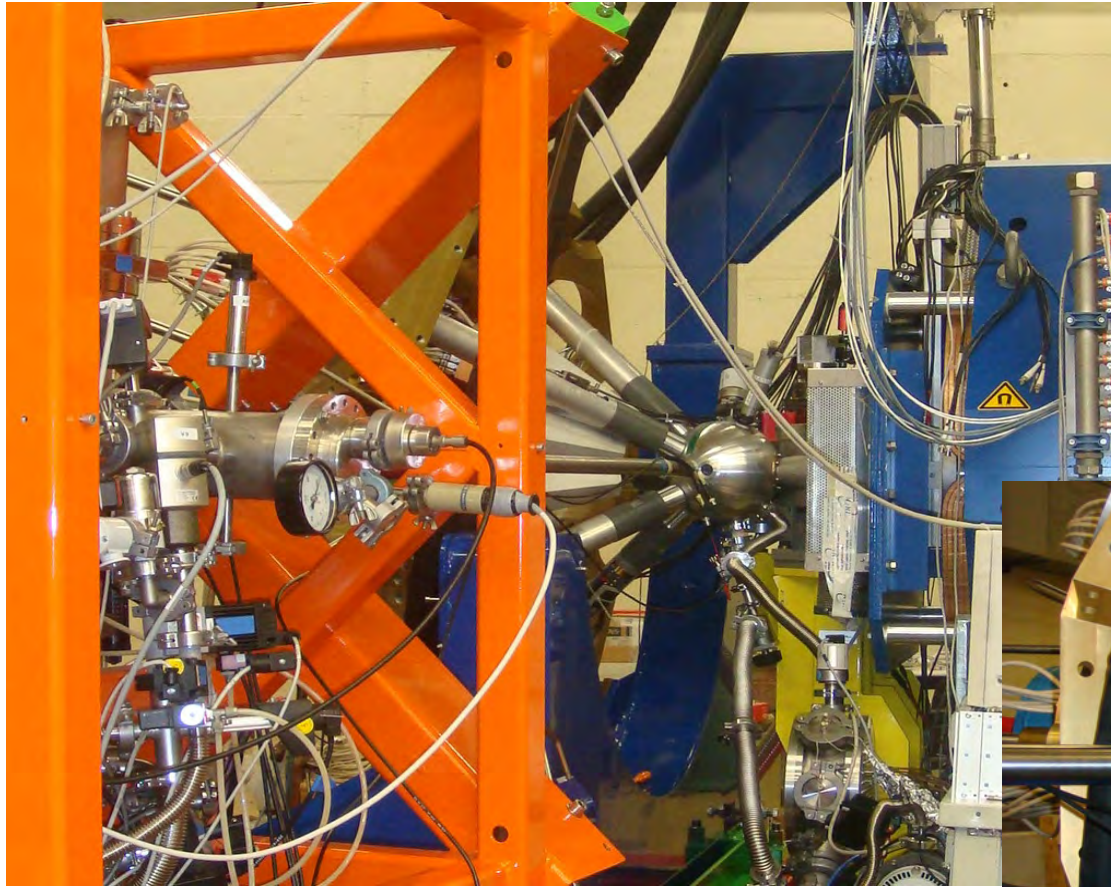


See "Shape coexistence in  $^{138}\text{Sm}$  and evidence for the rotational alignment of a pair of N=6 neutrons" E.Paul et al

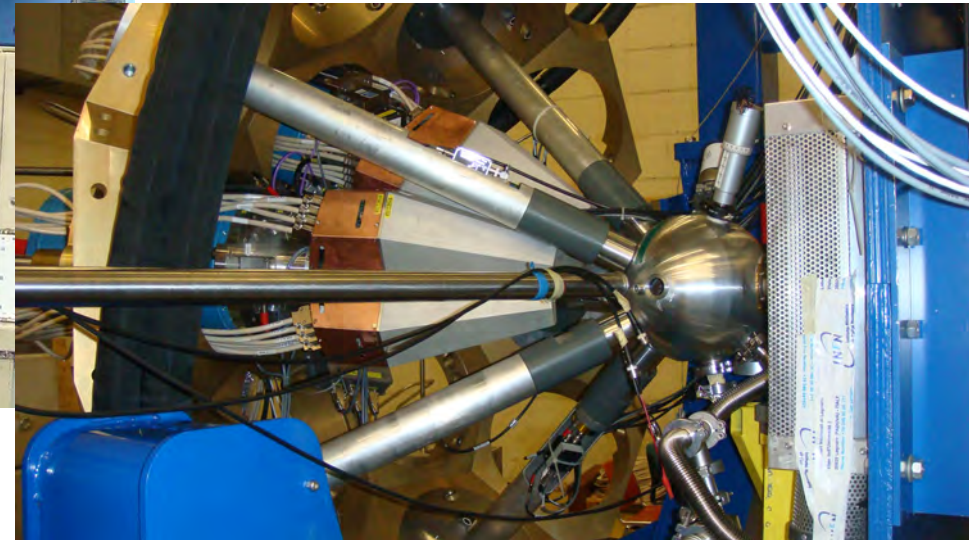




# AGATA + AGAVA September 2009



- ▶ Target Rotation =  $80^\circ$
- ▶ Prisma Angle =  $82^\circ$
- ▶ Silicon =  $40^\circ \pm 15^\circ$  (5x5cm)
- ▶ Limited to 60 enA (8Khz)



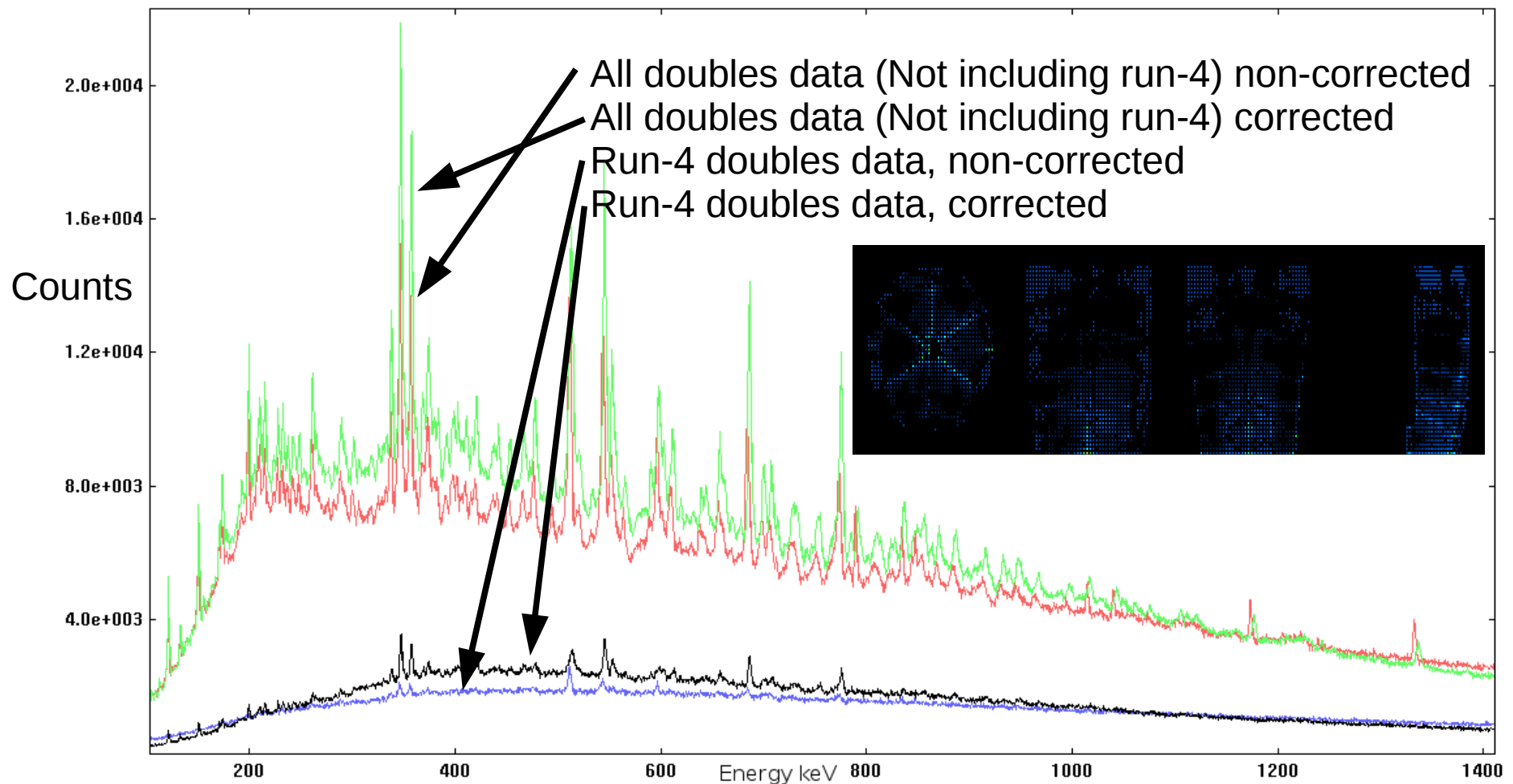
ATC's @  $90^\circ$  so average  
Doppler correction performed

GTS labeling: 1R(9) 1G(10) 1B(11) 2R(6) 2G(7) 2B(8)



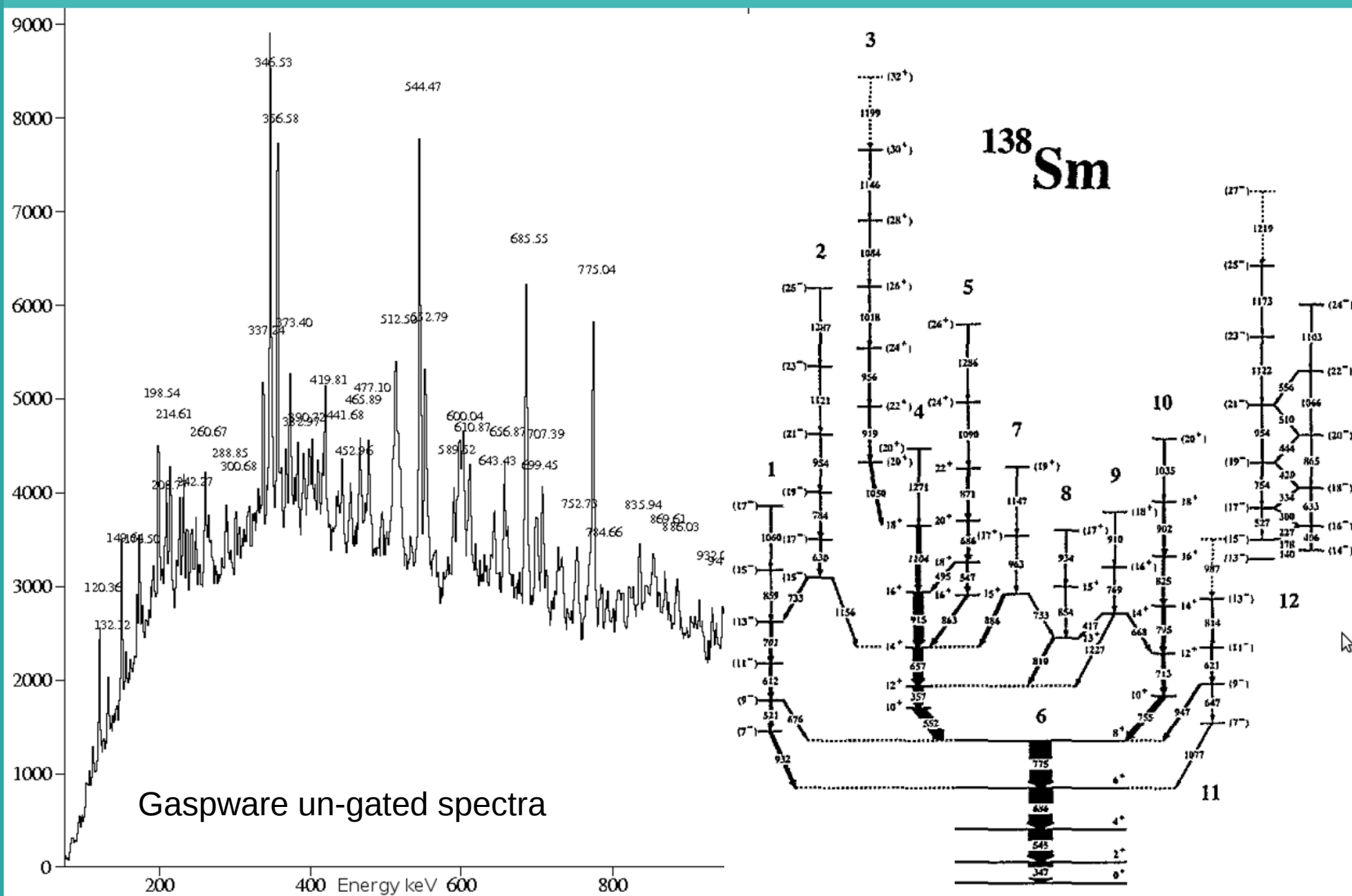
# Coincidence Data via Matrix

MGT output spec.dat – 1 x AGATA + 1 x AGAVA (Doubles)



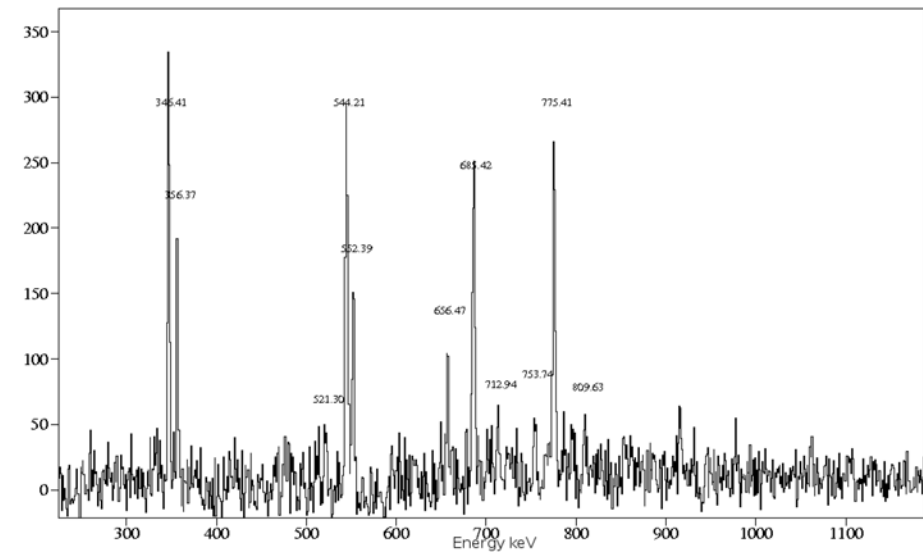
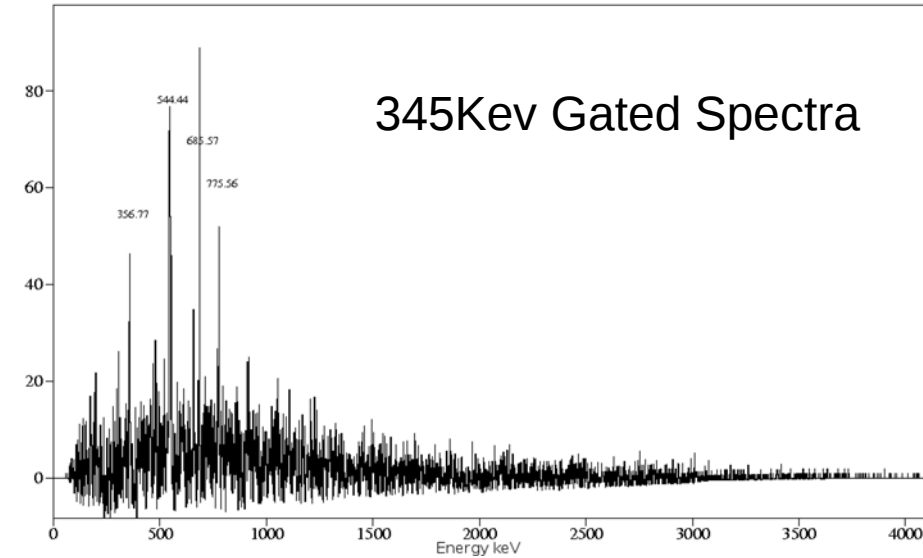
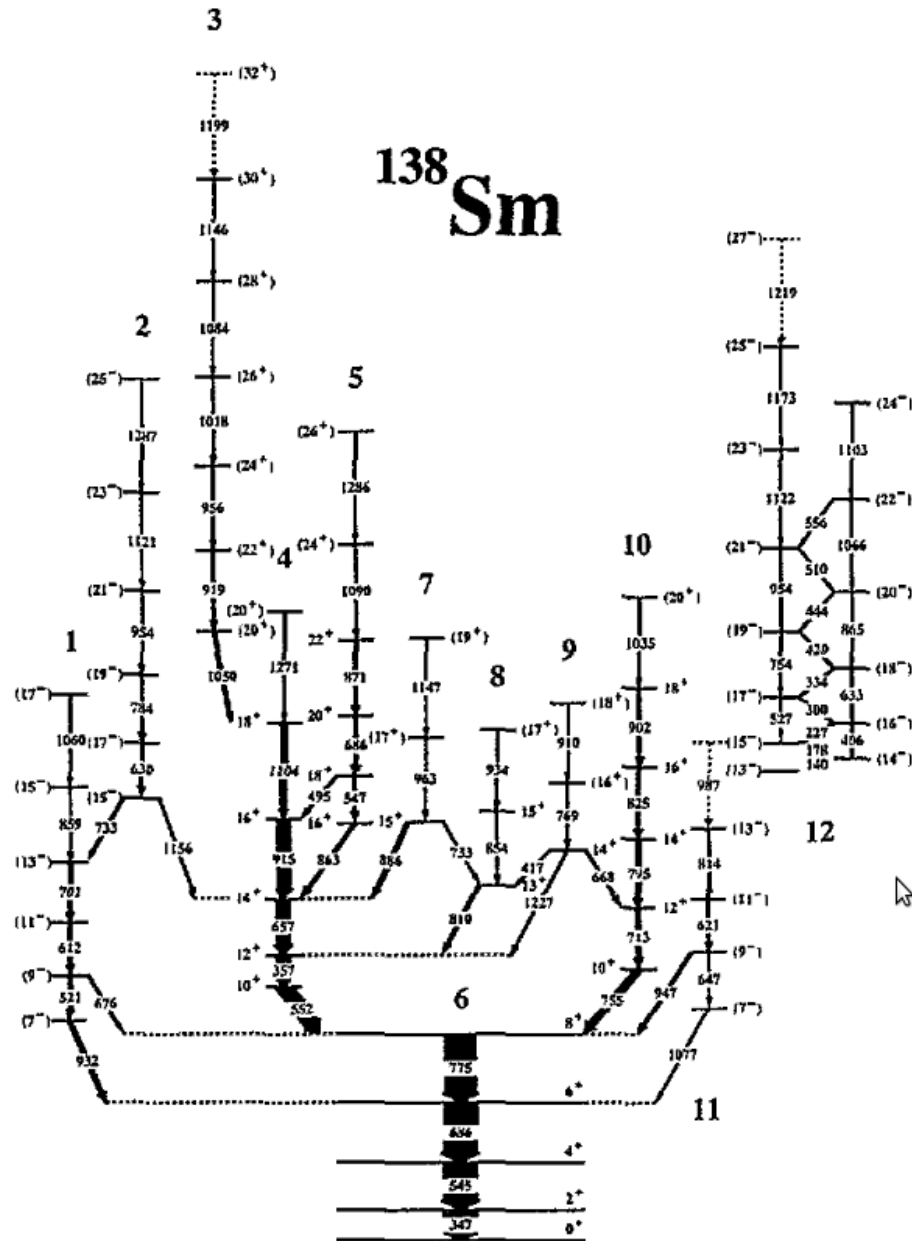
Run 4, was early on in the experiment. The first full nights run in fact. It is clear from the recorded spectra that there are issues with the data. After further analysis of spectra from individual segments, it was looking like a software problem.

# Egasware Gated Spectra





# Egasware Gated Spectra



Sum gates to 775Kev

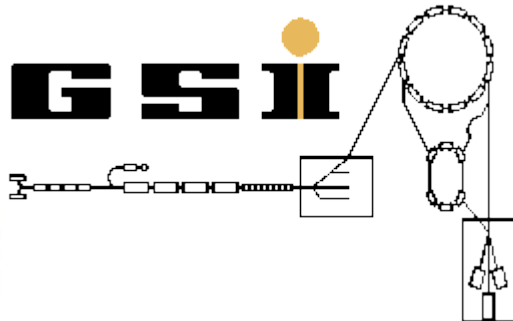
# Summary and Final Remarks

- Two ATC's now installed at Legnaro
- Electronics available for a third
- AGATA+PRISMA testing underway
- Beam tests in good order
- Data analysis flow well understood
- Work needed on further analysis
- Few issues with unexpected results need ironing out
- Mostly electronics problems, but few broken segments
- GTS memory leaks, Back-pressure in Narval





Many thanks to everyone in the collaboration, and  
thank you all for listening!



Universität zu Köln



UNIVERSITY OF  
LIVERPOOL

THE UNIVERSITY of York