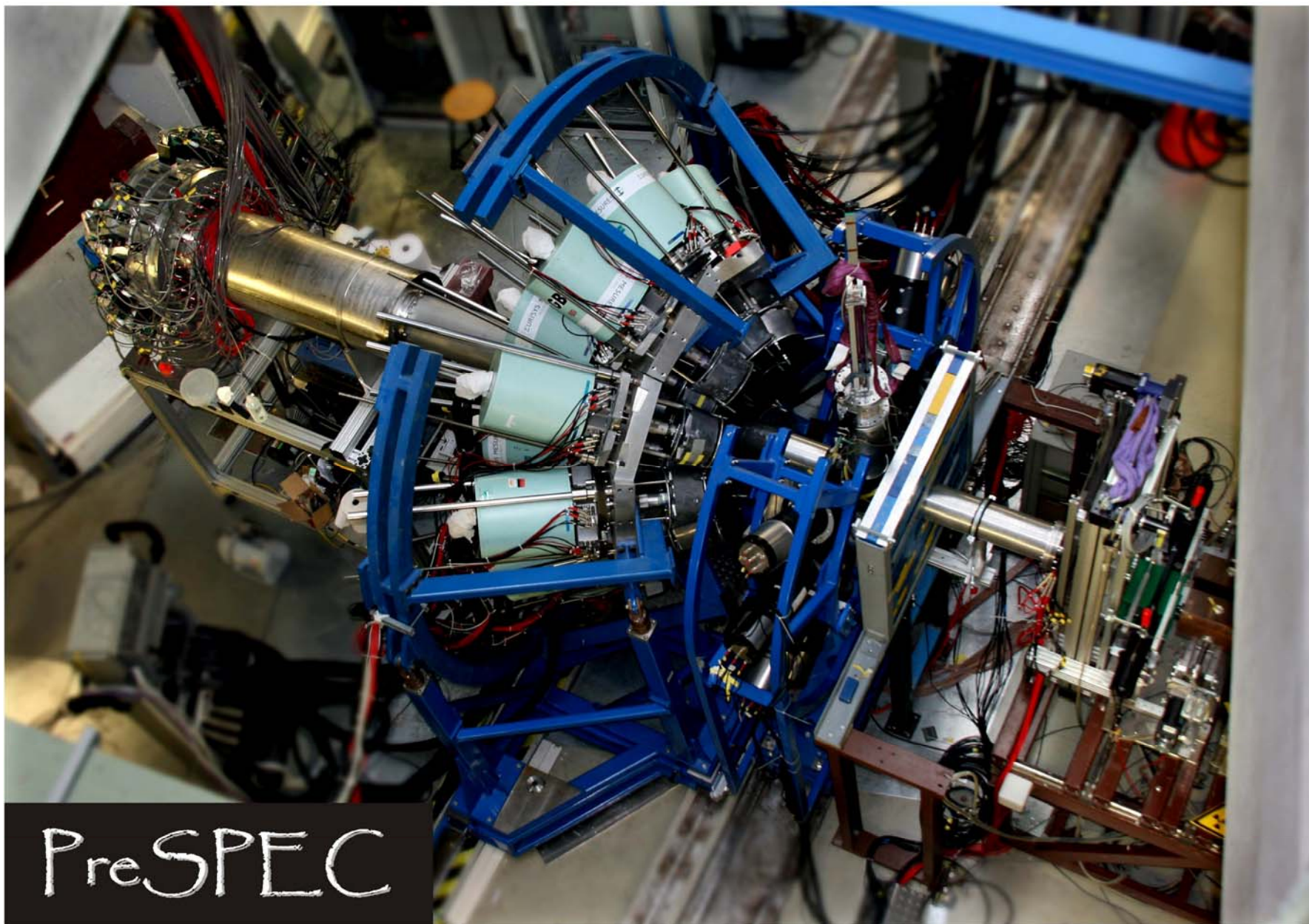




# AGATA@GSI status report

Stephane Pietri, FRS/SFRS, GSI  
On behalf of the AGATA collaboration

AGATA@ FRS, follow up of PRESPEC phase 0

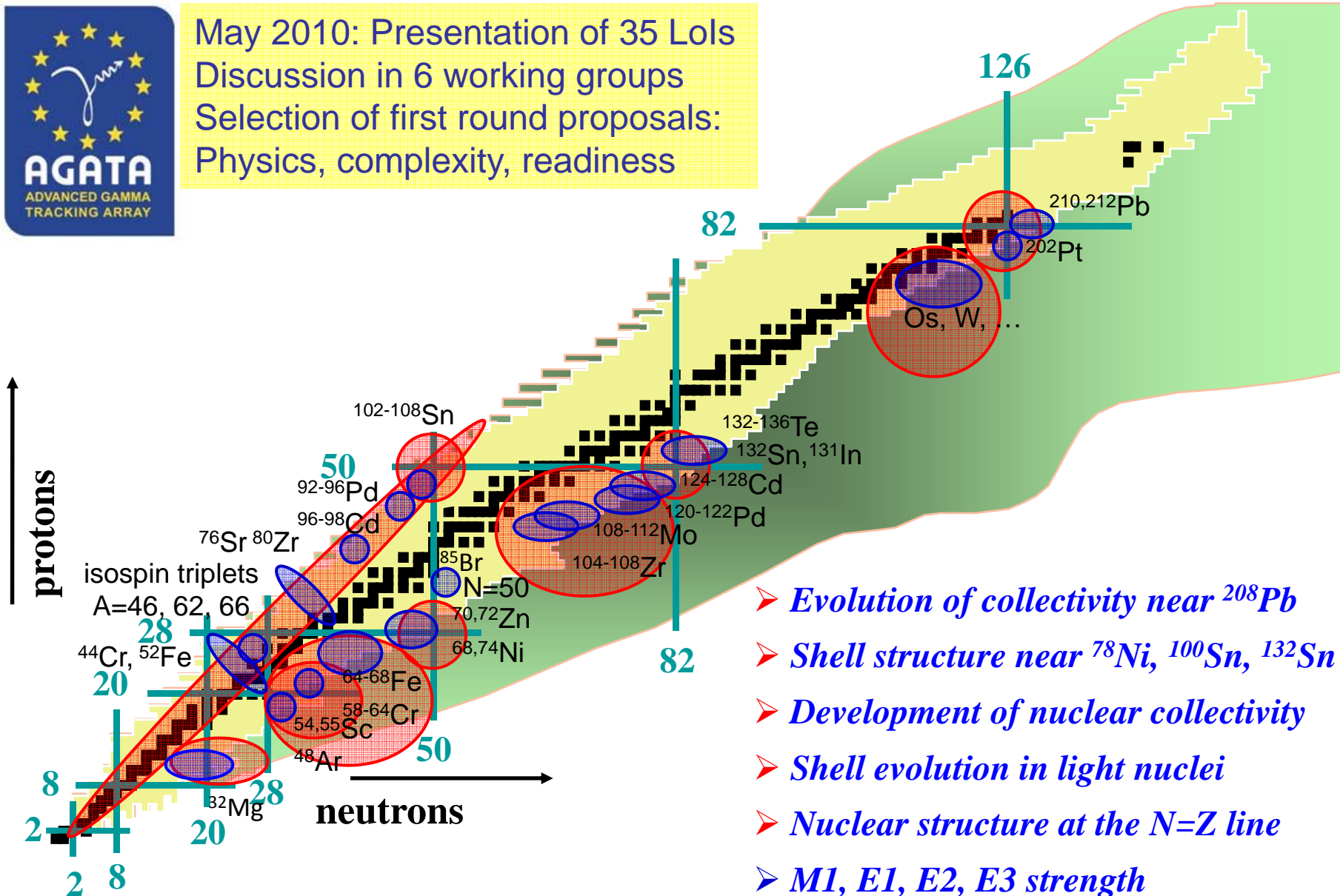


PreSPEC

# AGATA@ FRS, follow up of PRESPEC phase 0



May 2010: Presentation of 35 Lols  
 Discussion in 6 working groups  
 Selection of first round proposals:  
 Physics, complexity, readiness



- *Evolution of collectivity near  $^{208}\text{Pb}$*
- *Shell structure near  $^{78}\text{Ni}$ ,  $^{100}\text{Sn}$ ,  $^{132}\text{Sn}$*
- *Development of nuclear collectivity*
- *Shell evolution in light nuclei*
- *Nuclear structure at the  $N=Z$  line*
- *$M1, E1, E2, E3$  strength*



# AGATA@ FRS, follow up of PRESPEC phase 0

- Prespec : 2010/11 → **EUROBALL** detectors (8 years operated at GSI)  
→ **FRS** (20 years operated at GSI ;= )  
→ **LYCCA** (first commissioning and utilization)  
→ **HECTOR** (BaF2 array)



## Three successful experiments :

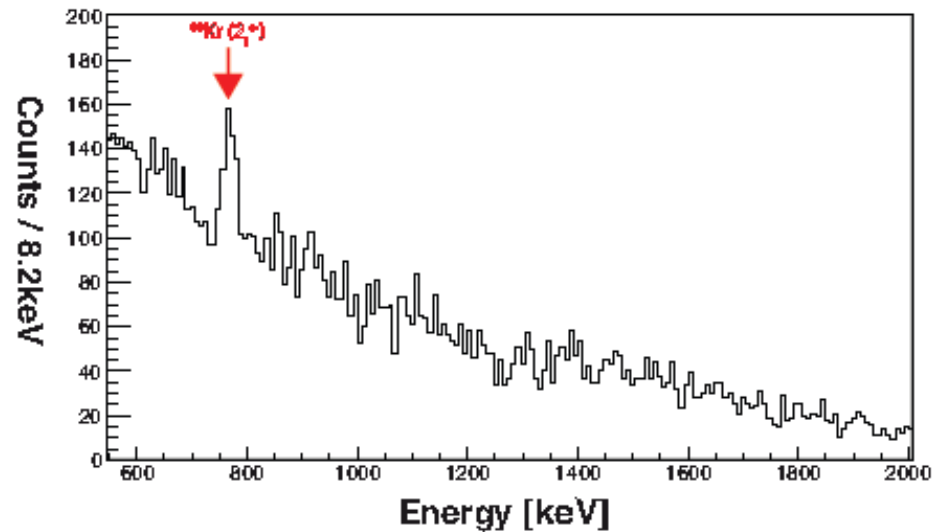
- $^{104}\text{Sn}$  coulomb excitation
- $^{88}\text{Kr}$  coulomb excitation
- $^{33}\text{Ar}$  coulomb excitation

+ some commissioning test to prepare AGATA(  $\text{IH}_2$  target and plunger)

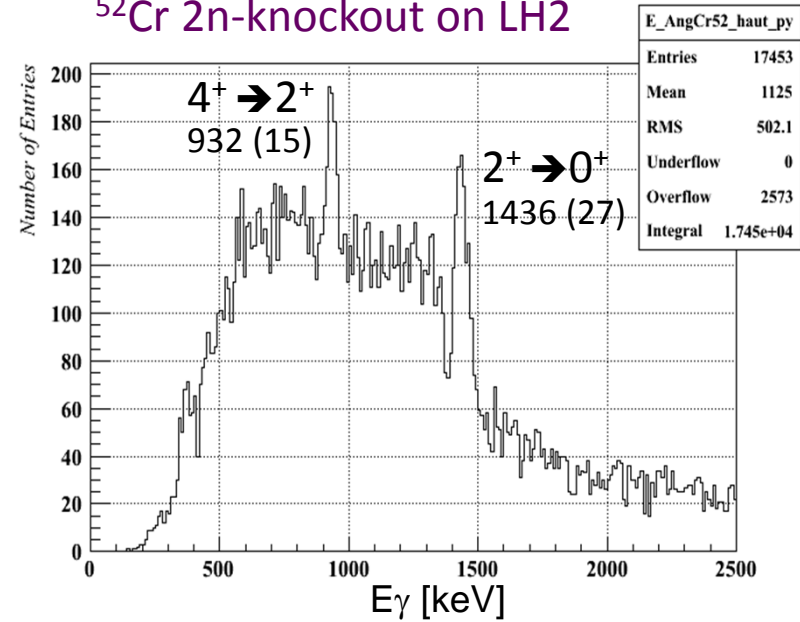


# Typical RISING gamma spectra

$^{88}\text{Kr}$  Coulex on Au



$^{52}\text{Cr}$  2n-knockout on LH2



RISING Cluster Ge detectors:  $P_{pe} \approx 3\%$ ;  $\Delta E = 1.2\%$

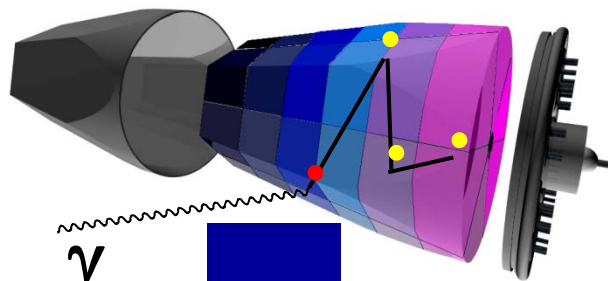
Doppler correction needed  $\rightarrow$  without Doppler 100 keV @ 1 MeV resolution at 100 MeV.U

Pictures from K. Moschner, C. Louchart

# Gamma tracking



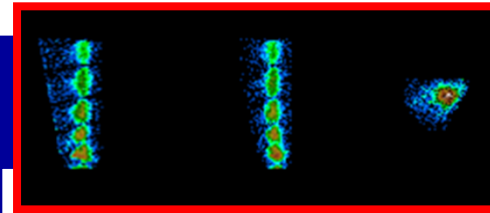
Highly segmented  
HPGe DETECTORS  
NOVEL PRE-AMPS  
CLUSTER CRYOSTATS



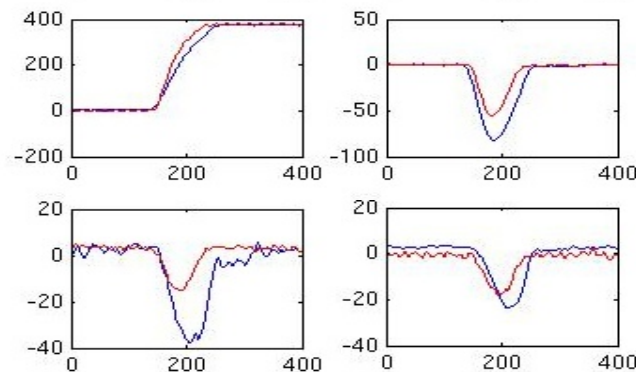
$\gamma$   
Synchronized digital  
electronics  
record and process  
the segment signals  
DIGITIZERS +  
PRE-PROCESSING

Identified  
interaction points

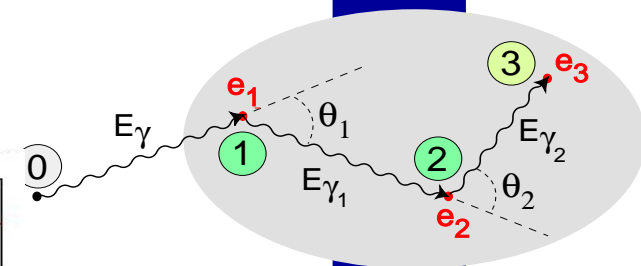
$$(x, y, z, E, t)_i$$



Pulse Shape Analysis  
to de-convolute the  
recorded waves  
DAQ PSA - FARM

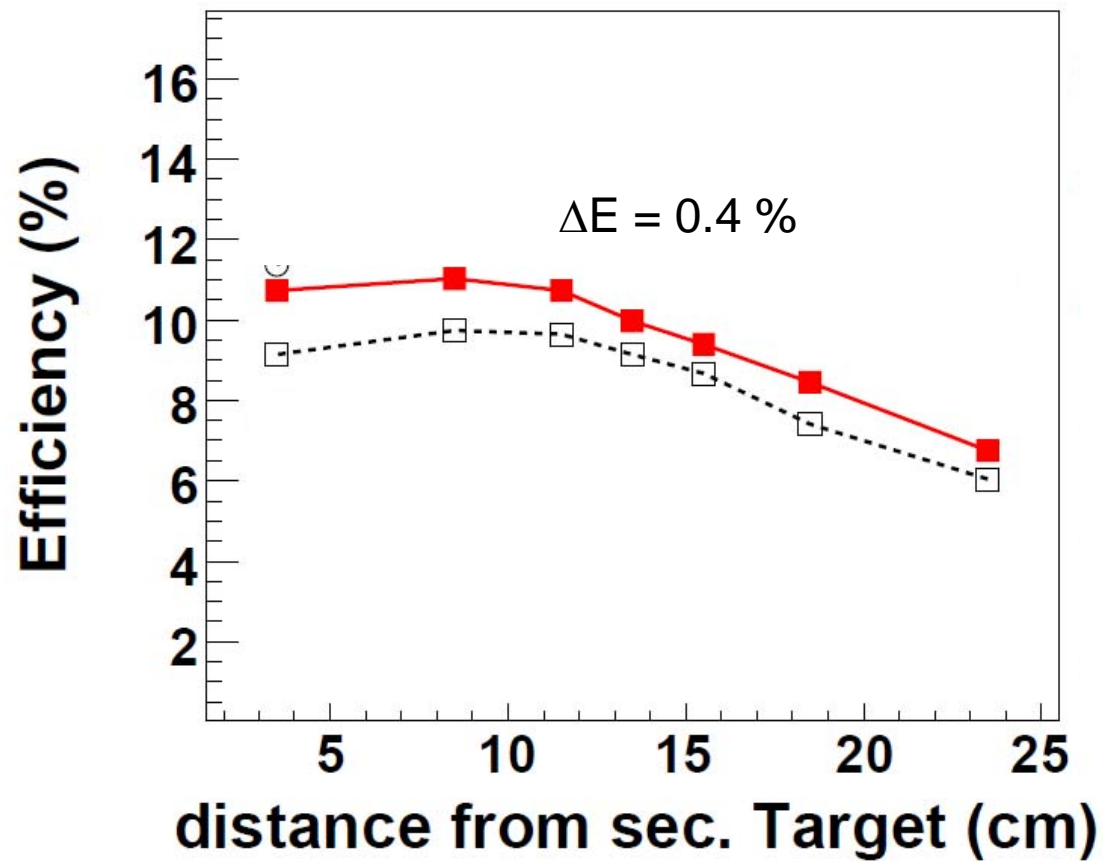


Reconstruction of  
interaction tracks  
(tracking algorithms  
on interaction points)  
DAQ TRACKING-FARM



On-line reconstruction  
of  $\gamma$ -rays

# AGATA@ FRS, follow up of PRESPEC phase 0



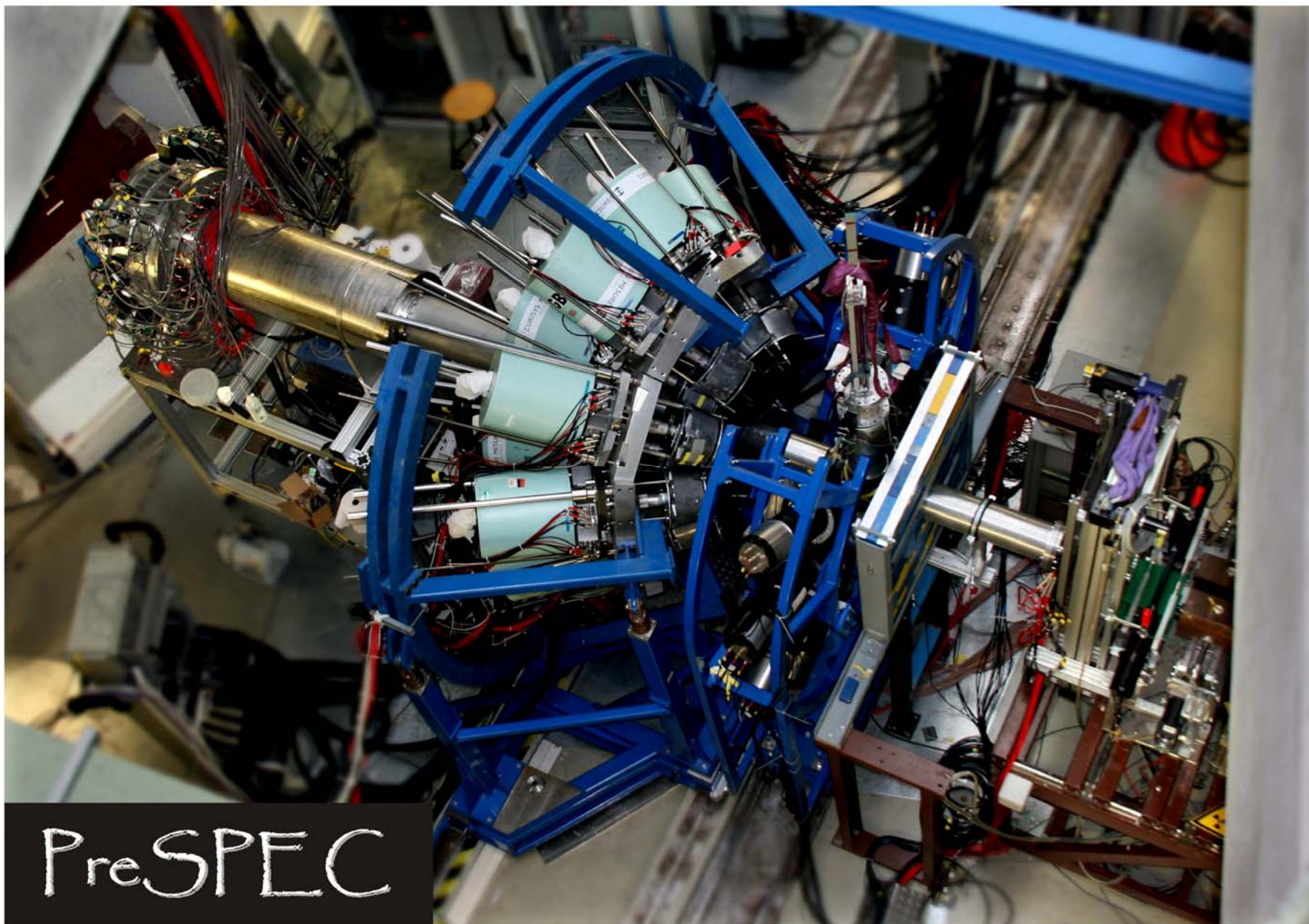
Compare with RISING efficiency :  $P_{ph} \approx 3\%$ ;  $\Delta E = 1.2\%$

Picture from C. Domingo





AGATA@ FRS, follow up of PRESPEC phase 0



PreSPEC

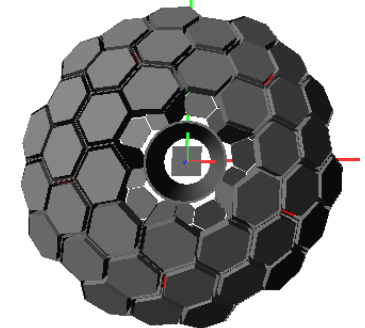
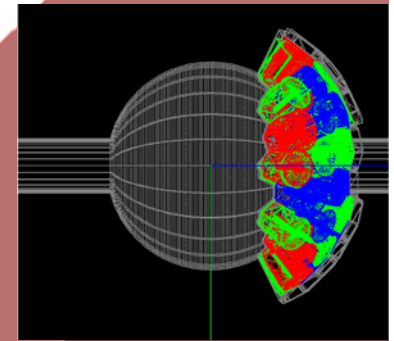


# AGATA@ FRS, follow up of PRESPEC phase 0

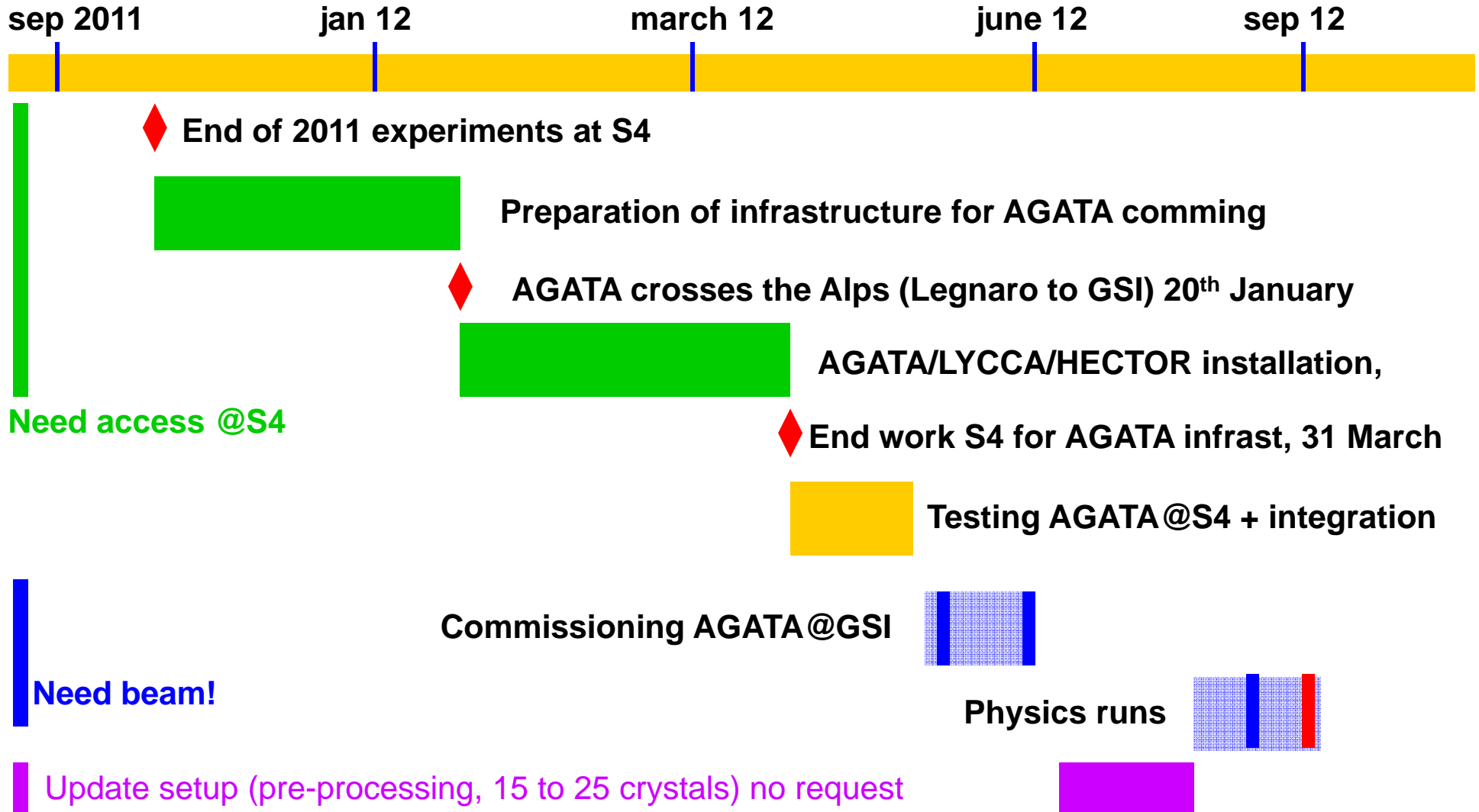
AGATA  
Tracking array  
5x2+10x3 crystals  
R = 12 – 40 cm  
 $\epsilon_{ph} \approx 13\%$   
 $\Delta E \approx 0.4\%$



PreSPEC



# Time planning, coming ahead



From scratch to ...



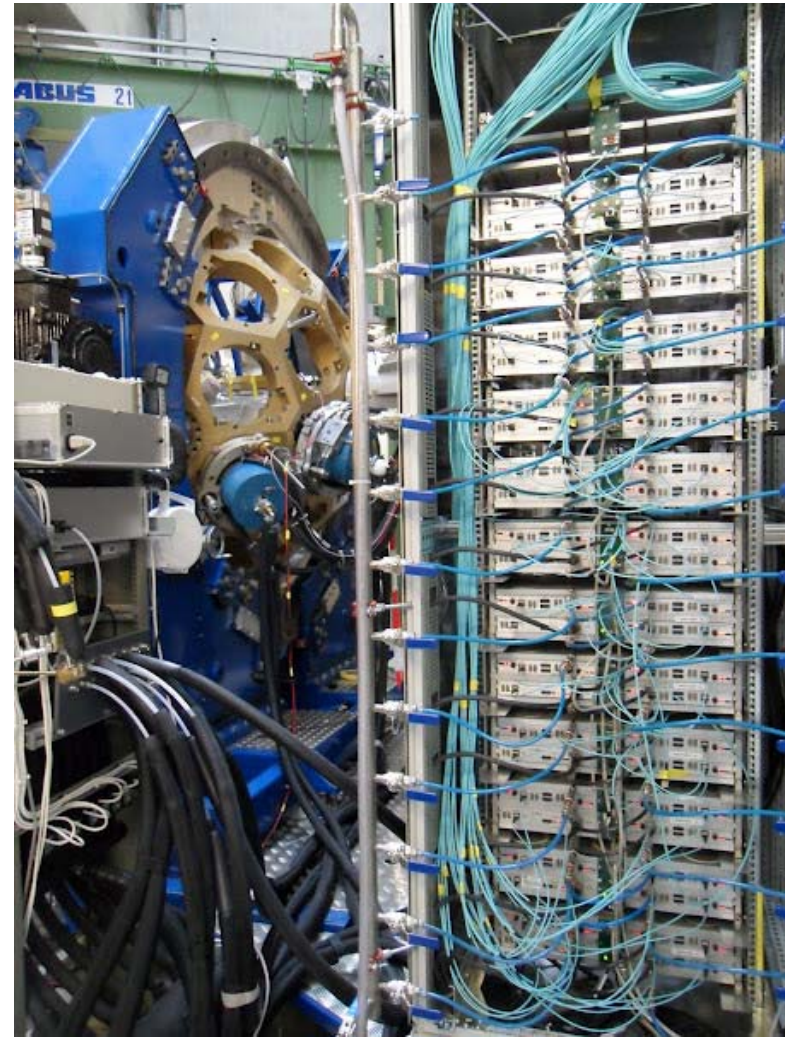


.... in between ....



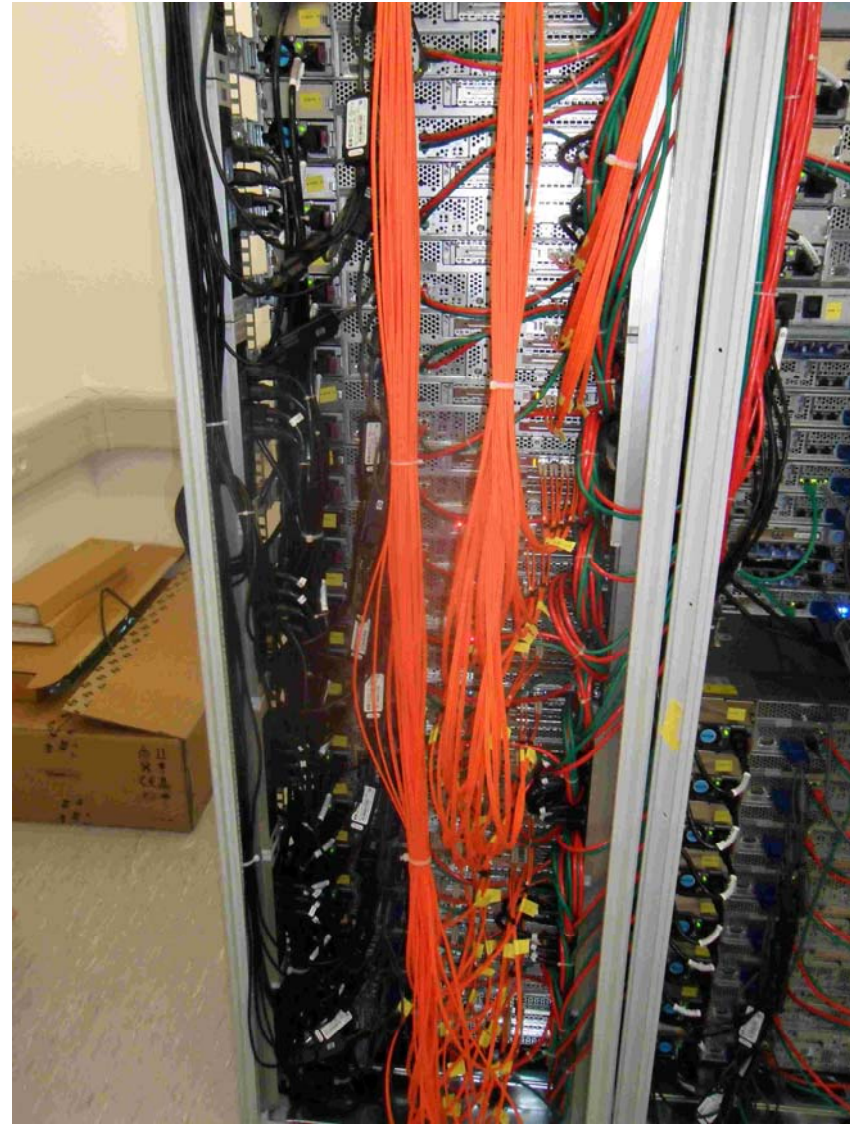
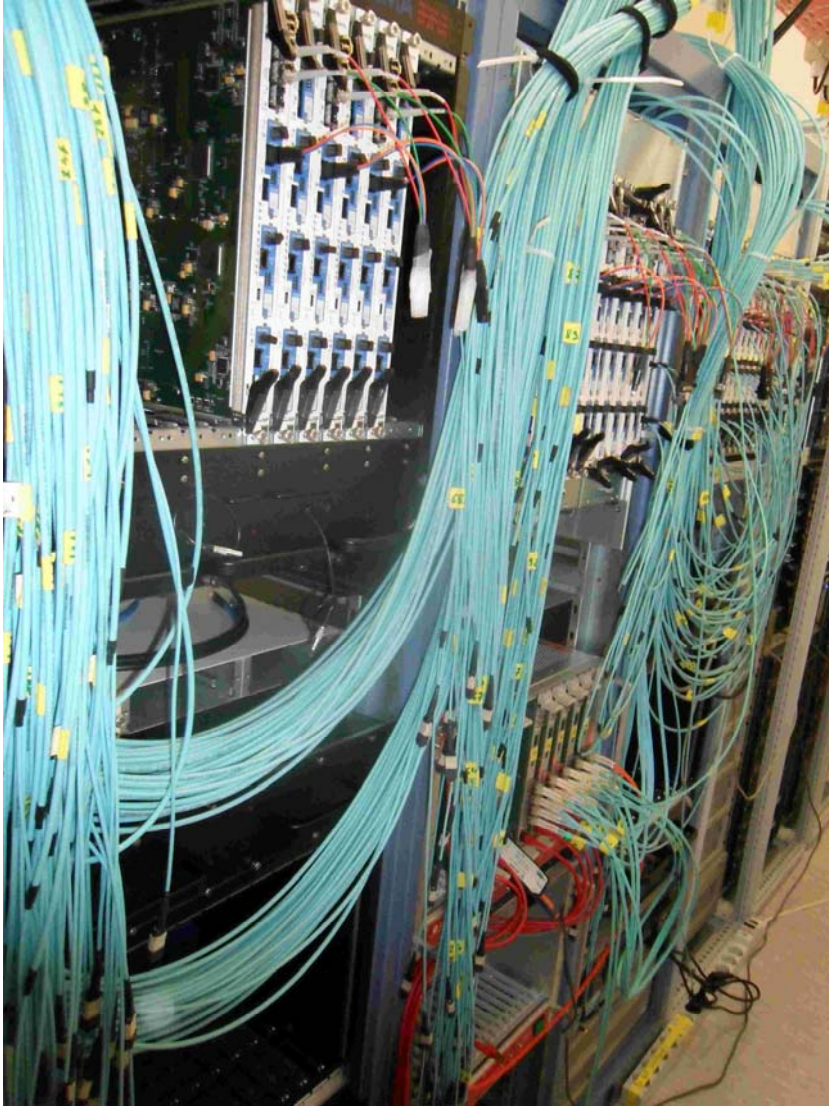


... to the end



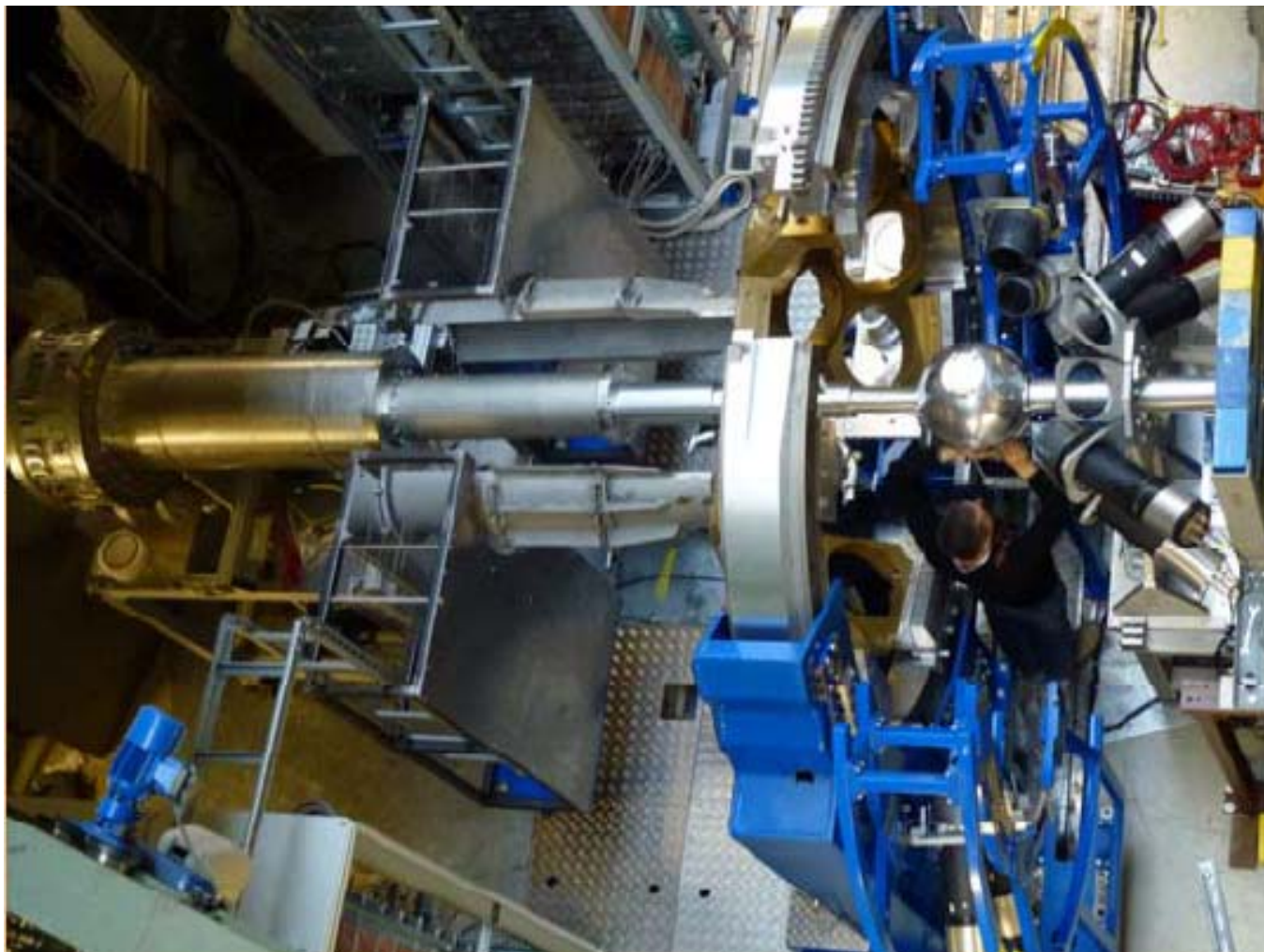


And above





AGATA@ FRS, follow up of PRESPEC phase 0

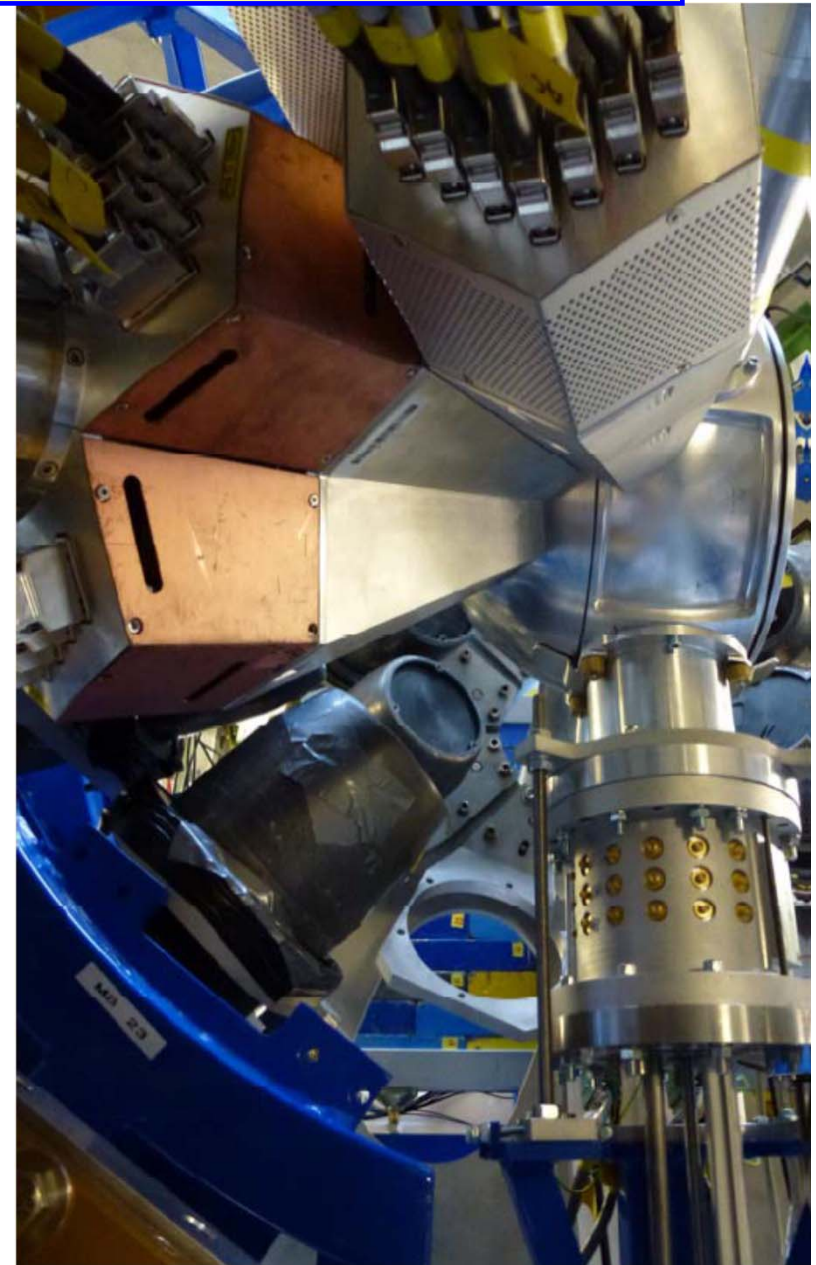


## AGATA@ FRS, follow up of PRESPEC phase 0



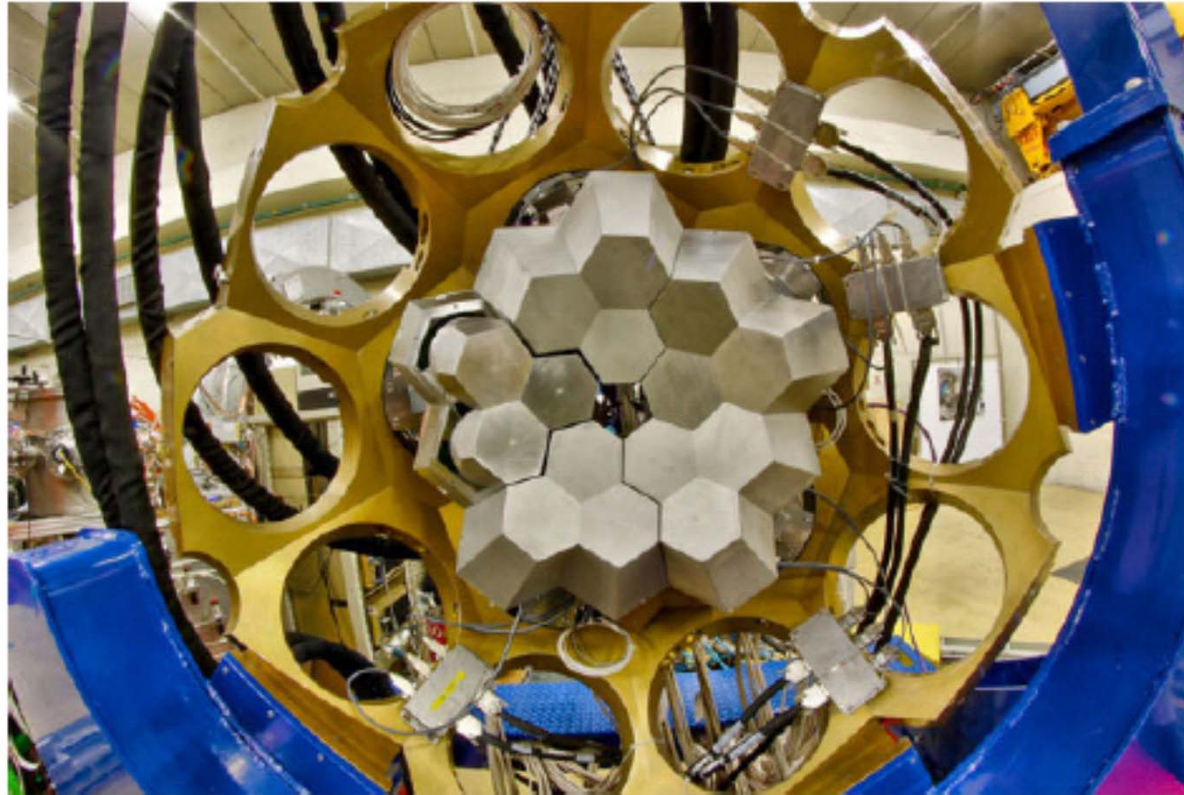
Target chamber → two position for the target

Very compact geometry around the target





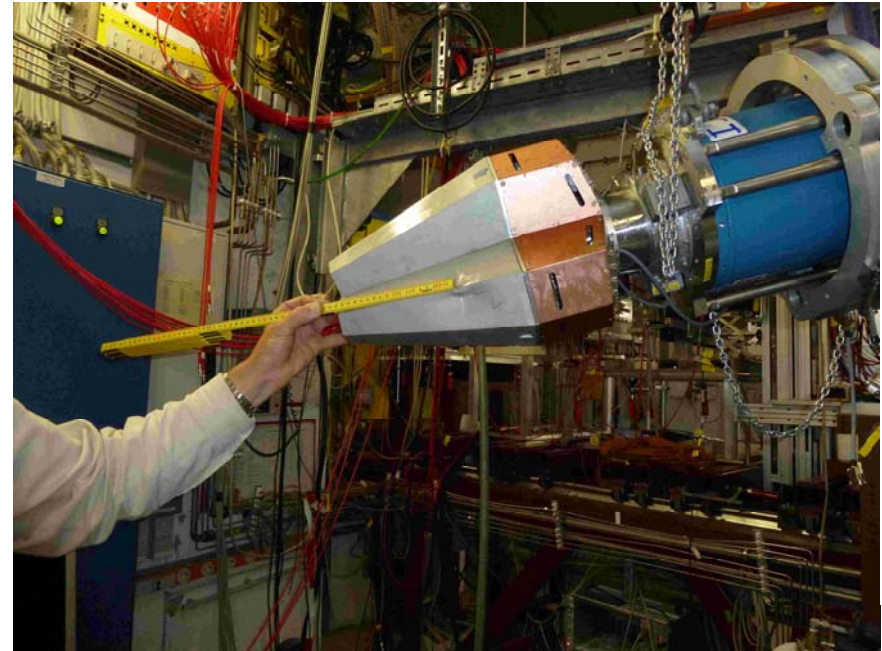
## Nicer view from Legnaro



A rotating structure also allows for the required position accuracy ( $< 0.25$  mm) for an empty or completely filled AGATA Cluster detector.



## AGATA incident...



- One pre-amplifier from the target DSSD not mounted where it should
- Structure was rotated
- A noise was heard
- Detector was hit 18 cm from the front face
- Visually no damage on the crystals... later confirmed by Cologne

# We learn to operate FEE electronic and NARVAL

The screenshot displays a Linux workstation interface for operating FEE electronics and NARVAL. The main window, titled "carrier LSC GUI", shows the status of various crystals. The "Global Status & Control" section indicates the system is "going" with a total count of 2.3 k. The "Per Crystal Status & Control" section lists individual crystals and their counts:

Crystal	Status	Count
1B	going	3.2 k
1C	going	3.2 k
4A	going	2.3 k
4B	going	1.6 k
4C	going	2.1 k
10B	going	1.5 k
10C	going	1.3 k

The "MainWindow (on ag05)" displays a histogram plot with a peak at approximately -125. The x-axis ranges from -400 to 400, and the y-axis ranges from 0 to 1,200. The plot includes a red dashed line at -250 and a black dashed line at -125. Below the plot are sliders for "Min: -250", "Max: 0", "Position: -125", and "Width: 250". There are also input fields for "Histogram" and "Coincidence", both set to 0, and "Reset" and "Quit" buttons.

The terminal window, titled "gts (on scgw1)", displays a table of data for various crystals:

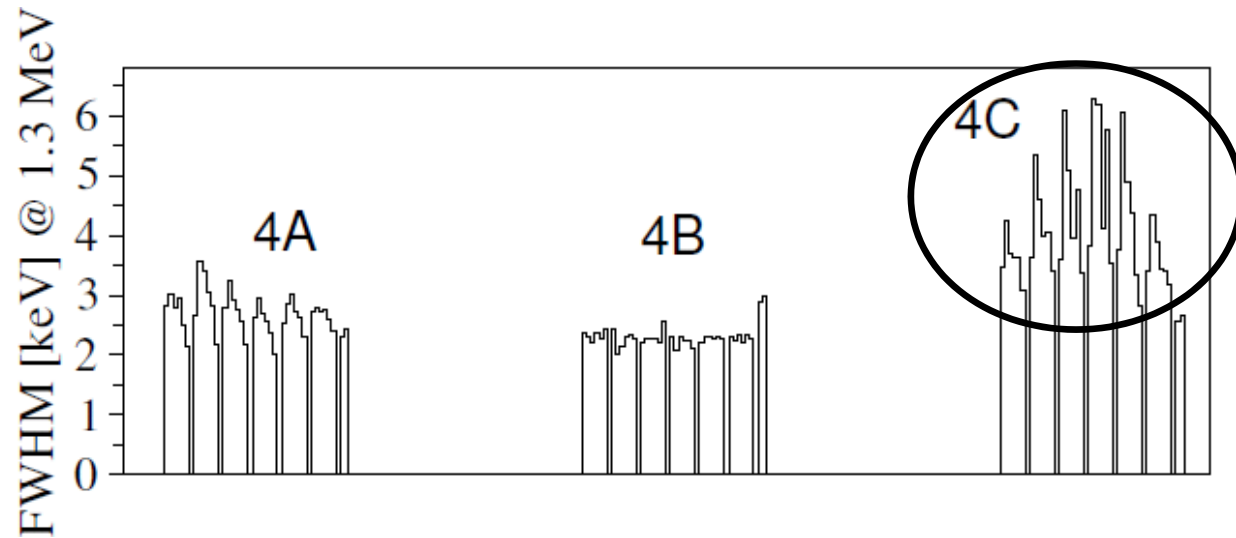
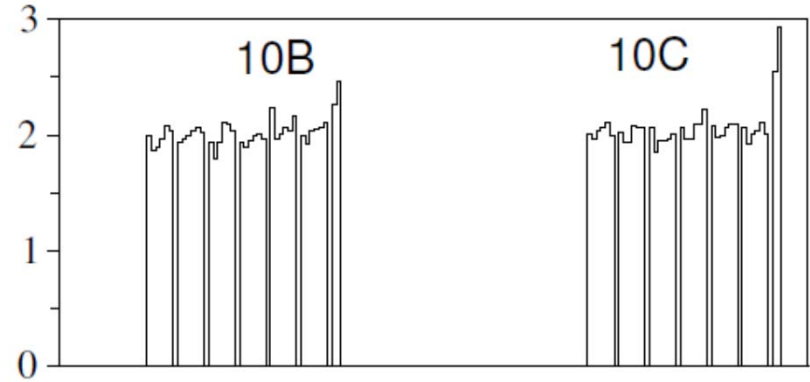
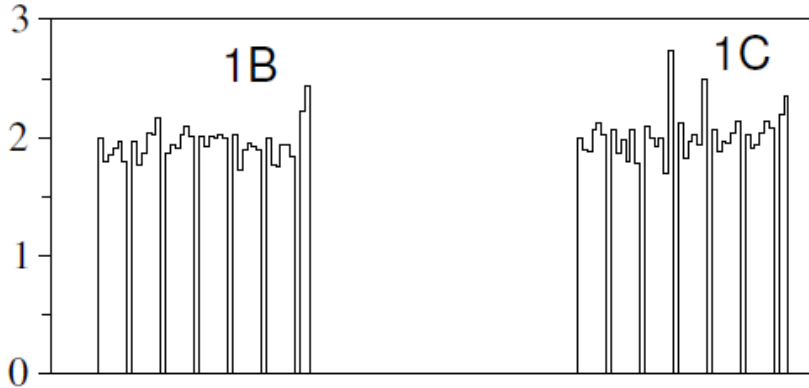
gts	carr	det	req	val	rej	bkp	lat
gts06	039	1C	936	198	1674		11.7
gts15	025	4A	1532	254	1278		11.8
gts09	038	10C	854	316	538		11.6
gts39	agava	FRS	1164	988	176		13.2

The terminal also shows configuration parameters:

```
tnresno0 2: 255
threshold 3: 255

partition: 3
sumbus_window: 0
threshold 0: 255
threshold 1: 255
threshold 2: 255
threshold 3: 255
~/cfg
gammadaq@ag05:~/cfg$
```

# Resolution of the mounted detecotrs



Solved?

Picture from C. Michelagnoli, G. Guastalla

## Cluster in GSI : status as of today

**ATC 1 : mounted and then accident**

**ATC 2 : mounted, to replace ATC1, still in the setup**

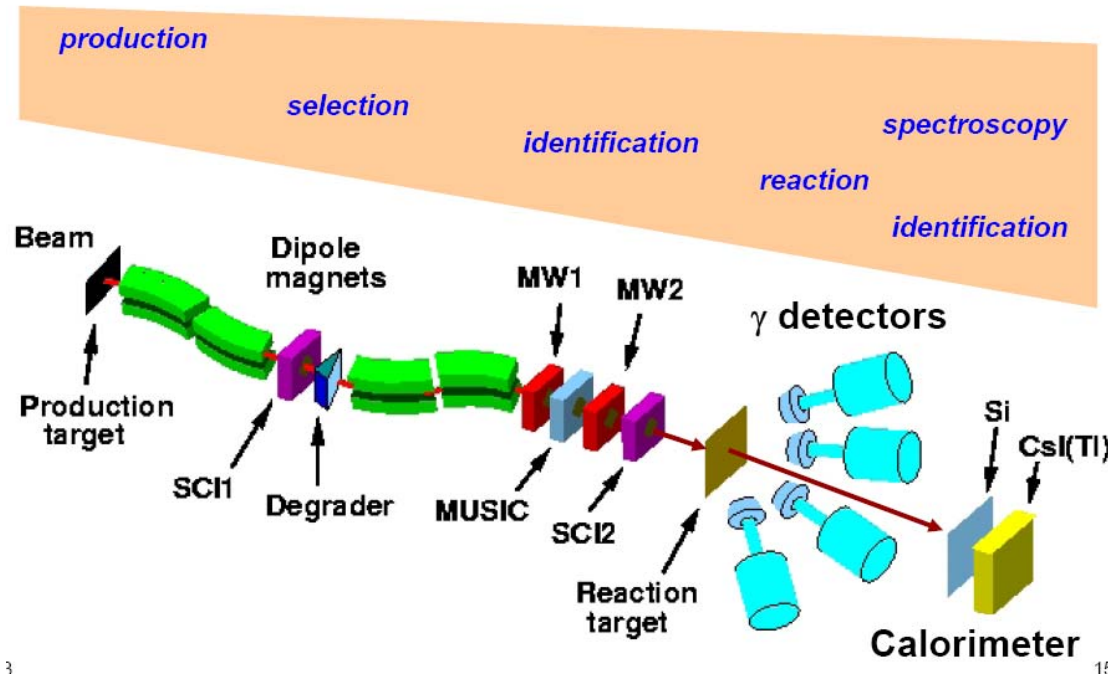
**ATC 3 : mounted, one PA not answering, dismantled**

**ADC 1 : mounted, concerns on the signal, still in the setup (plan?)**

**ADC 2 : mounted, work nice with Xe commissioning, exhibited ringing during U commissioning. dismantled.**

**→Need to know which crystal in which detector and when mounted/dismounted  
→DATABASE?**

## Then the complementary setup :



Two spectrometers :

- FRS (selection/identification)  
→ 4 VME crates

LYCCA → tof-E-DE  
→ 4 VME crates

Trigger logic → 1 VME crate  
→ Contains AGAVA + TRLO

Hector → 1 VME crate

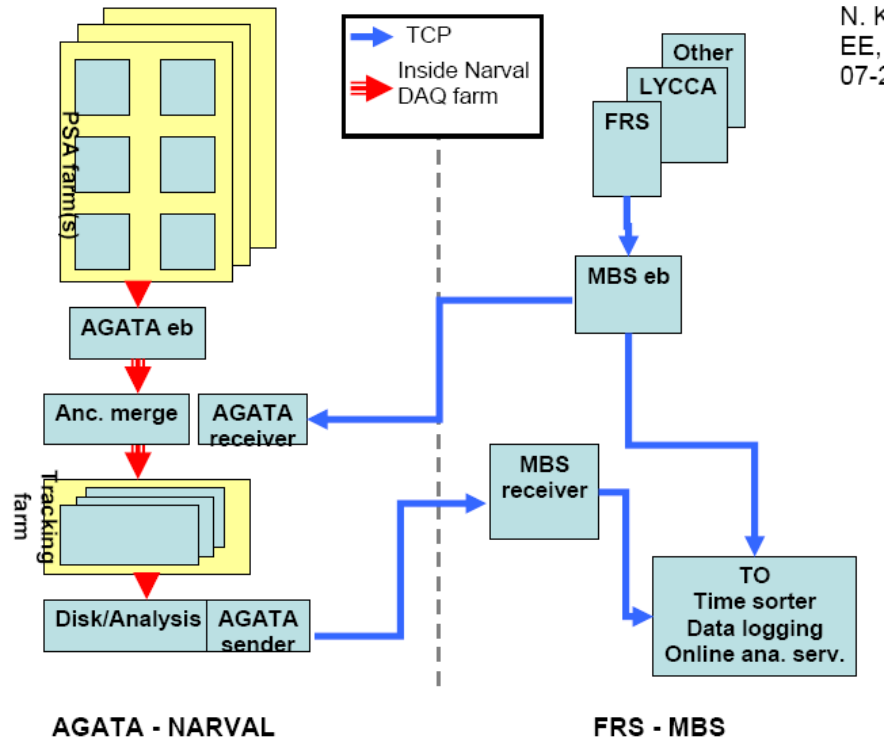
Usual trigger → particle-gamma coincidence + normalization

GSI built acquisition system : Multi Branch System

→ easy for 10 VME crates running synchronously



# PRESPEC and AGATA merging



Two parallel data flow

Two options :

→ “MBS ed” send simply unprocessed data

→ “MBS eb” process data and send to the AGATA stream together with the unprocessed data the information needed by AGATA tracking

Trigger coupling : → Like in Legnaro → coincidence done in analogue and sent to AGAVA as request → send always FRS data

## Technical commissioning goals

### **First ideas, September 2011 (see minutes, mostly Roman ideas) :**

- First beam test  $^{50}\text{Ti}$ , technical test of the setup and integration, plus ITAG with AGATA and time spectra study with several target position
- Second beam test  $^{48}\text{Ca}$  neutron knock out and then put heavier target
- Third beam test heavy beam and test several secondary target/secondary beam combination for background
- Fourth test, performance commissioning (requires most of the detectors mounted and  $^{80}\text{Kr}$  beam)
- Fifth test, U primary beam for position resolution, this could be done before or after the fourth test

→ PAC granted us 90 shifts parasitic (technical commissioning) and 3 days for the performance commissioning

## Technical commissioning goals

Debug new TRLO PRESPEC system

Test new electronic and detectors for LYCCA

Test AGAVA coupling PRESPEC/AGATA

Test data flow merging

Build data base background rate depending :

- sec beam (Ti, Xe, U)/sec targ (Be, Au)
- position secondary target (23 cm or 13cm)
- lead shielding
- threshold

Ti knock out statistics


Xe fragmentation statistics

Use U doppler shifted x-rays to



check Doppler position resolution

# Time planning commissioning


April 2012															Schedule as of 23-Apr-2012														
Week 15					Week 16					Week 17					W														
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30										
Salabura/Pietraszko, Traxler, Stroth, 197Au, (MEVVA), 10e7 pro Spill HAD																													
S417, Nociforo, Au, FRS /spill, FRS					S412, Aumann/Boretzky, 136Xe(EZR), 500 MeV/u, slow extraction, HTC										S424, Korten/Gerl, 50Ti, 400-800 MeV/u, 1E3-1E7 /spill, FRS					b)									



1 / 2012												May 2012												Schedule as of 23-Apr-2012											
Week 18						Week 19						Week 20						Week 21						Week 22											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
S407, Salabura/Pietraszko, Traxler, Stroth, 197Au, (MEVVA), 10e7 pro Spill HAD						c)						SBIO, Scholz/Scholz, 12C (EZR), 100-600, 1e3 - 1e8/spill, therapy conditions						S412, Aumann/Boretzky, 136Xe (MUCIS), 500 MeV/u, 3e10, 3e9, slow extraction, FRS/HTC																	
S417, Nociforo/Simon, Au, 300-1000 MeV/u, 1e8/spill (SIS), slow extraction (1-10s), FRS						d)						e)						S424, Korten/Gerl, 136Xe, 400-800 MeV/u, 1E3-1E7 /spill, block sharing with R3B, FRS																	

1 / 2012										June 2012									
Week 22					Week 23					Week 24									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
S412, Aumann/Boretzky, 238U (MEVVA), 500 MeV/u, 3e10, 3e9, slow extraction, HTC																			
S424, Korten/Gerl, 238U, 400-800 MeV/u, 1E3-1E7 /spill, FRS																			

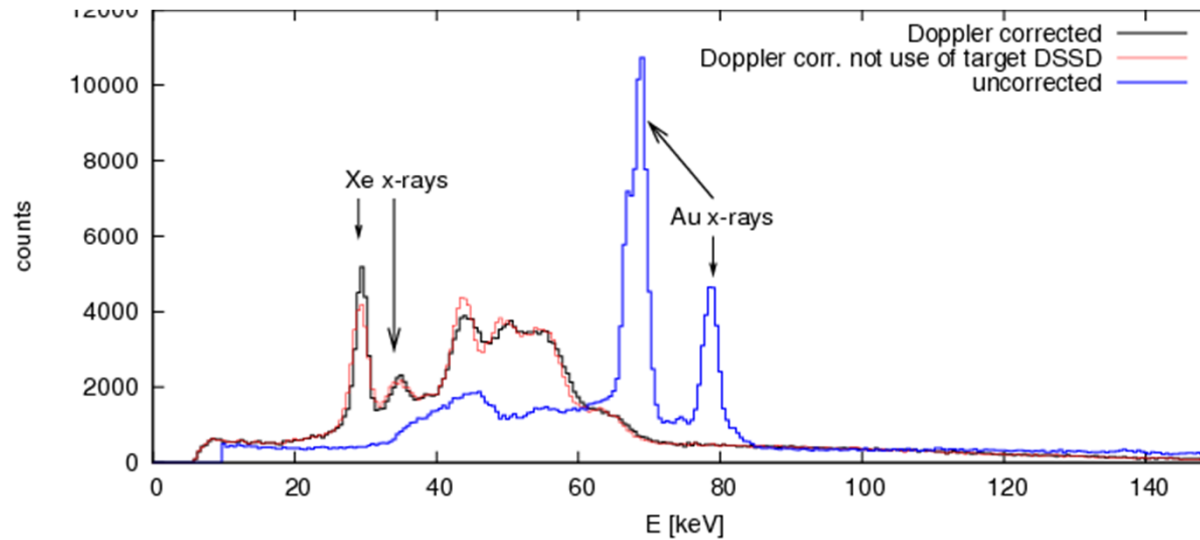
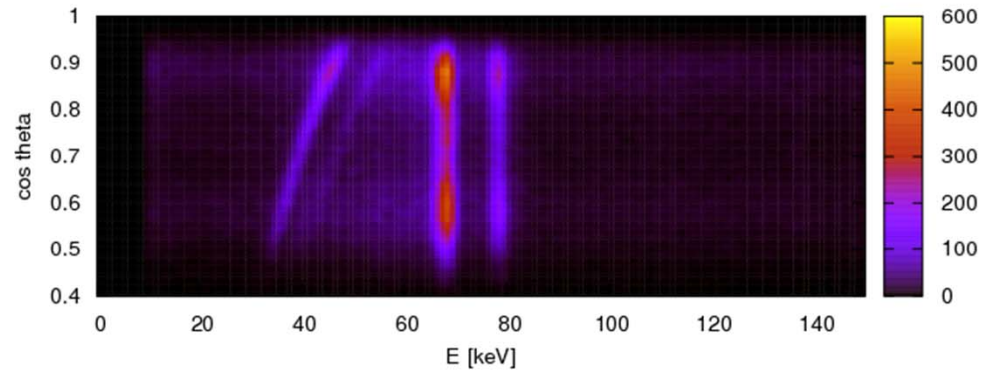
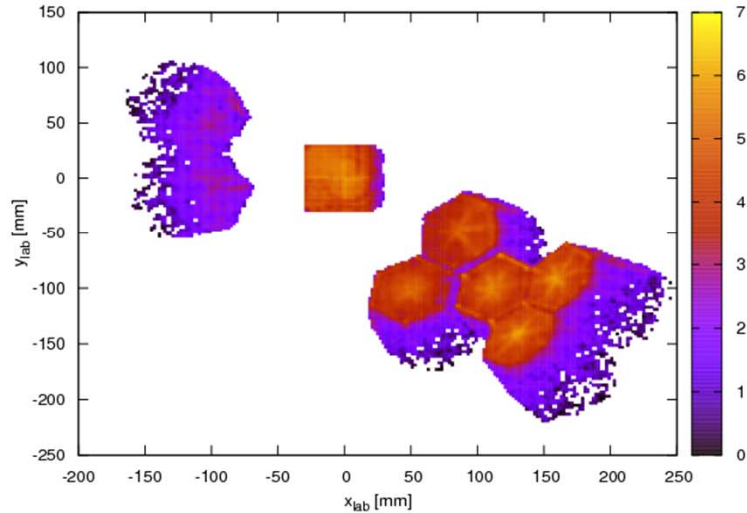


## Technical commissioning results

- Debug new TRLO PRESPEC system → Done
- Test new electronic and detectors for LYCCA → Done
- Test AGAVA coupling PRESPEC/AGATA → Done
- Test data flow merging → Done (60%)
- Build data base background rate depending : → Done (80%)
- sec beam (Ti, Xe, U)/sec targ (Be, Au)
  - position secondary target (23 cm or 13cm)
  - lead shielding
  - threshold
- Ti knock out statistics → Done (analyzing)
- Xe fragmentation statistics → Done (analyzing)
- Use U Doppler shifted x-rays to  
check Doppler position resolution → Done with Xe ☺



# Xe x-ray Doppler corrected...



➔ but this was the plan for the U beam time!!!!

Michael Reese et al.

# GSI beam planning for the next months

Open the frame ⇔ losing rotation, no more detector mounting : 22 June to mid Aug?

2 / 2012								July 2012								Schedule as of 01-Jun-2012															
W	Week 27							Week 28							Week 29							Week 30							Week		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
																B, Scheeler, 238 U, 200		S000, Spiller, 238U, 300MeV/u, 5e10/spill, SIS											S411, Dendooven/Purushothaman, 238U, 1000 MeV/u, 10 <sup>49</sup> /s, both slow and fast extraction, pulse duration 4s - 30 ms, 1:1 sharing with S370, FRS		

2 / 2012					August 2012										Schedule as of 01-Jun-2012																		
Week 31					Week 32					Week 33					Week 34					Week 35													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
S411, Dendooven/Purushothaman, 238U, 150-250 MeV/u, 5e8/spill, 1s	SMAT, Schuster/Trautman, 238U, 150-250 MeV/u, 5e8/spill, 1s											S388, Mukha/Litvinov, 36Ar (MUCIS, enriched), 1000 MeV/u, 3e10/spill, 4 s extraction, FRS							S415, Taieb/Simon, Kelic, 238U MEVVA, 700 MeV/u, 1E9 /spill, 10 s extr., FRS/HTC							S411, Dendooven/Purushothaman, 238U, 1000 MeV/u, 10 <sup>49</sup> /s, both slow and fast extraction, pulse duration 4s - 30 ms, 1:1 sharing with S370, FRS	S411, Dendooven/Purushothaman, 238U, 1000 MeV/u, 10 <sup>49</sup> /s, both slow and fast extraction, pulse duration 4s - 30 ms, 1:1 sharing with S370, FRS						b)

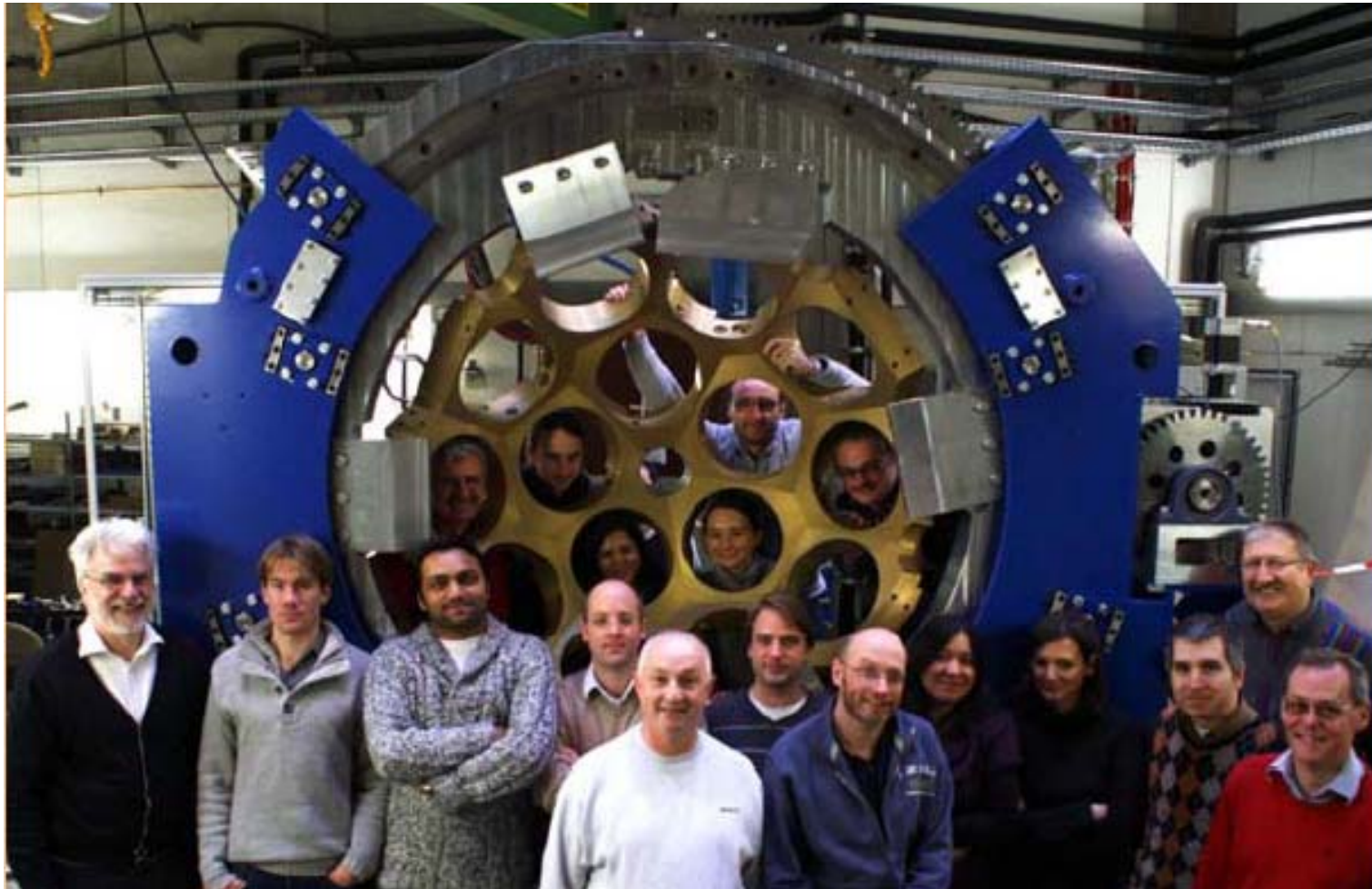
AGATA performance commissioning →

2 / 2012									September 2012													
Week	Week 36								Week 37								Week					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
										S424, Korten/Gerl, 80Kr, EZR 400 MeV/u, 1E6/spill, FRS												



- Need planning : Data flow/replay tests (filter, tracking, watchers,...)
- Electronic for 25 crystals mounted and tests
- Mounting of the Ge detectors in the short time present

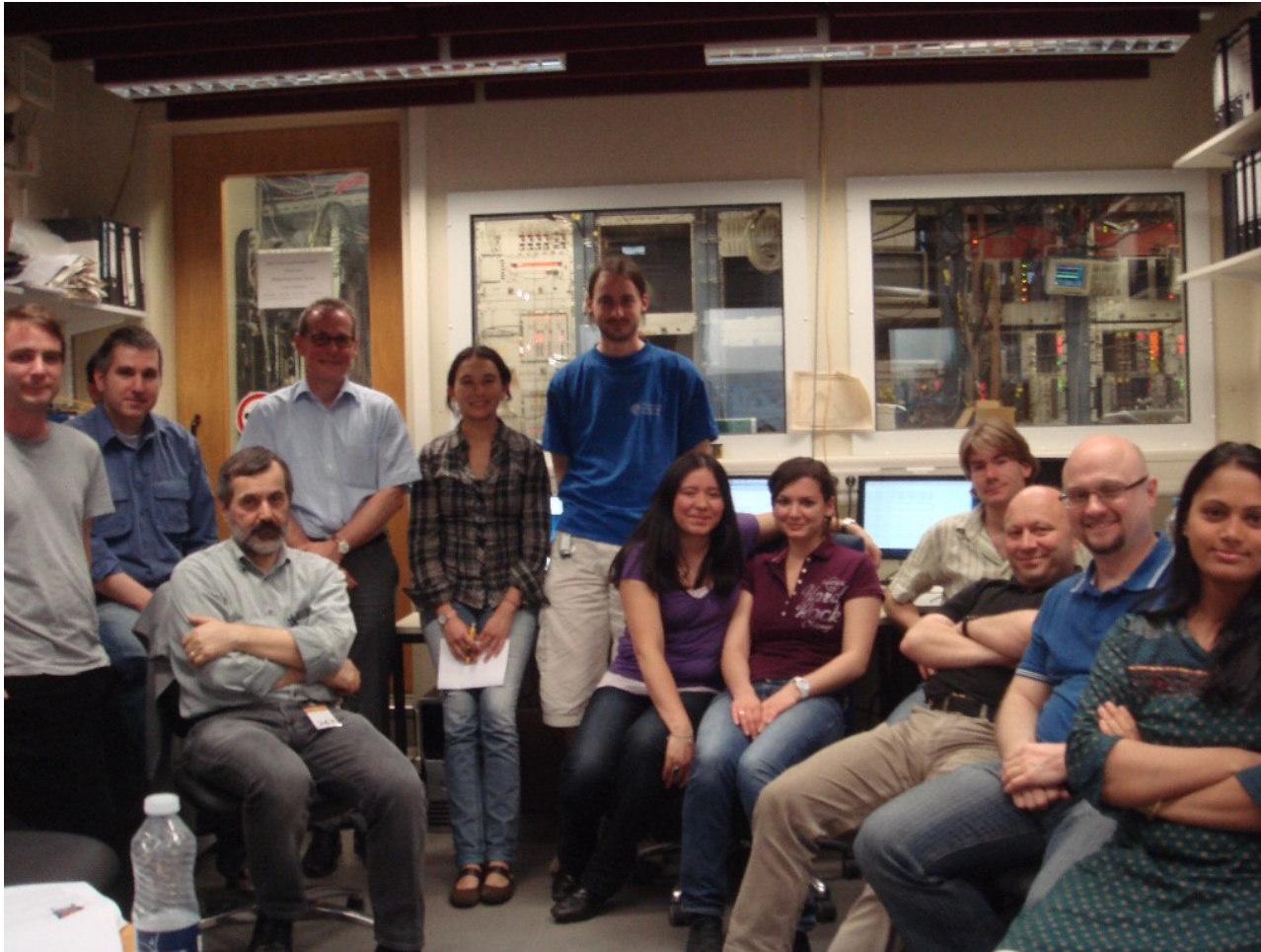
# Galleries



Picture taken by Y. Aubert



## During commissioning



**And thanks from all of us to all AGATA people who contributed to the mounting of the system here**

$E_{\gamma,0}$ (keV)	distance target-array (cm)							
	23.5	18.5	15.5	13.5	11.5	8.5	3.5	
500 keV	3.5	4.5	5.5	6.4	7.4	8.6	10.2	(%)
	2.6	3.5	4.2	4.6	5.1	6.3	7.8	(keV)
1 MeV	2.6	3.5	4.2	4.8	5.3	6.3	7.7	(%)
	4.1	5.5	6.4	7.4	8.4	10.4	13.0	(keV)
1.5 MeV	2.1	2.6	3.3	3.9	4.4	5.1	6.3	(%)
	5.5	7.5	9.0	10.5	11.6	13.9	18.0	(keV)
2 MeV	1.8	2.4	2.8	3.4	3.8	4.5	5.6	(%)
	7.4	10.3	12.7	14.0	16.5	19.3	25.3	(keV)
2.5 MeV	1.4	1.8	2.2	2.5	2.8	3.4	4.2	(%)
	8.2	11.4	14.0	16.1	17.5	21.4	27.1	(keV)
3 MeV	1.3	1.8	2.1	2.4	2.8	3.4	4.1	(%)
	11.3	14.6	18.0	21.3	23.8	28.8	35.6	(keV)
3.5 MeV	1.0	1.5	1.8	2.0	2.2	2.8	3.5	(%)
	13.0	16.9	19.9	23.2	26.1	31.1	38.9	(keV)
4 MeV	1.0	1.4	1.8	2.1	2.4	2.9	3.7	(%)
	16.2	21.9	27.0	30.1	35.2	42.0	51.8	(keV)