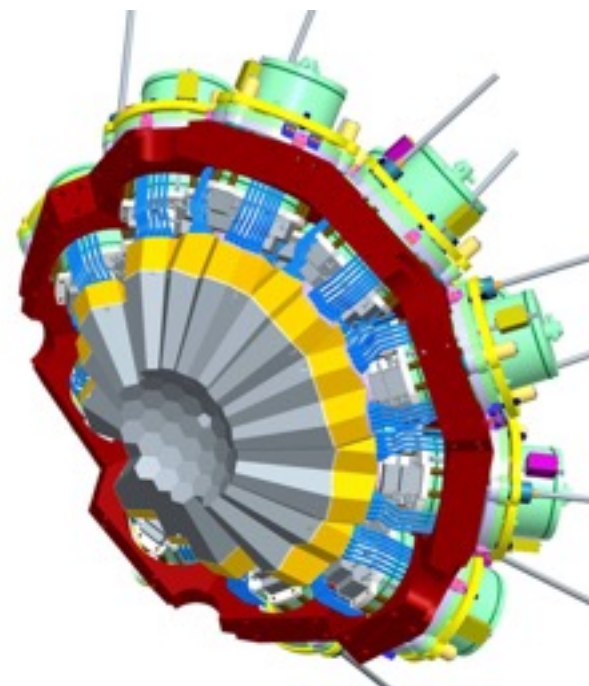


AMB Report: Status of the AGATA Project



Andres Gadea (IFIC-CSIC, Spain)
on behalf the AMB and AGATA Collaboration



17th AGATA week, CSNSM and IPNO Orsay 5th– 7th October 2016



AGATA MANAGEMENT BOARD AND TEAMS

A. Gadea (Project Manager)

**A. Boston, B. Million, A. Korichi, P. Reiter F. Recchia, G. Duchêne, (ASC) and J.Nyberg (ACC).
J. Gerl (LCM-GSI), E. Clement (LCM-GANIL)**

AGATA Working Groups

AGATA TASKS

**AMB Chairman
Project Manager
A.Gadea**

**Resource
Manager
(G.Duchêne)**

**Detector
Module
P. Reiter**

**Front-end
Electronics
A. Gadea**

**Data Flow
A.Korichi**

**Data Analysis
A.Boston**

**Infrastructure.
Comp. Det.
B.Million**

**Performance
and Simulation
F.Recchia**

**Detector &
Cryostat
H.Hess**

**Pre-Amplifier
Digitizer
A. Pullia**

**Software: Flow,
Services & GRID X.
Grave**

**Data Analysis
& TRACKING
O. Stezowski
A. Lopez-Martens**

**Detector array
Infrastructure
R.Menegazzo**

**AGATA
Performance
C.Michelagnoli**

**Detector
Characterisation
H.Hess**

**Global Trigger &
Synchronization
M. Bellato**

**Hardware: Local
Infr. & Network
N. Ménard**

**PSA Algorithm
Development
L. J. Harkness**

**Complementary
Detectors
J.J. Valiente**

**AGATA
Commissioning**

**Detector
CAT & Testing
H. Boston**

**Pre-processing
I. Lazarus**

**GRID
Data managing and
Analysis**

**Mechanical
Infrastructure
A.Grant**

**AGATA Physics &
exp. Simulation
M. Labiche**

**R & D on gamma
Detectors &
Applications**

**Slow Control
& FEE Monitoring
E. Legay**

**Technical
Coordinator
Engineering Advi.**

**Compatibility
EMC, Interfacing**

**Specification
control**

**Quality
Control**

Documentation

Local Campaign Managers (LCM)

**INFN-LNL
Legnaro**

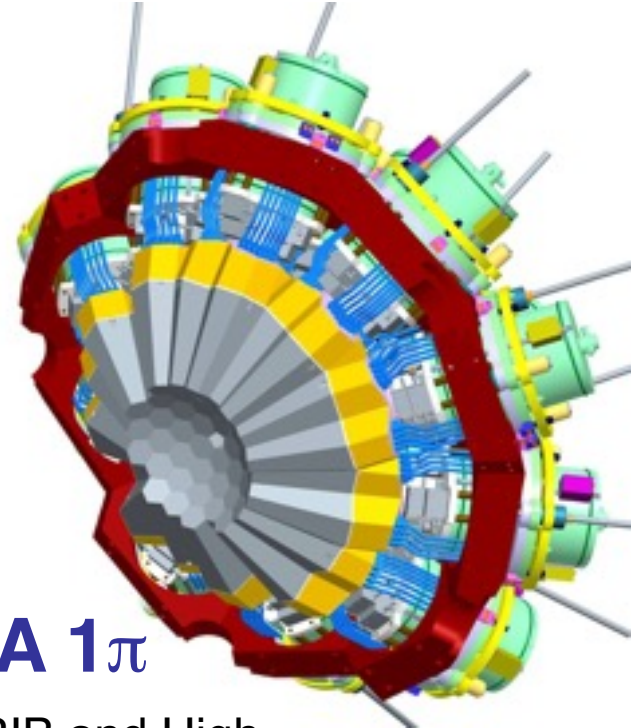
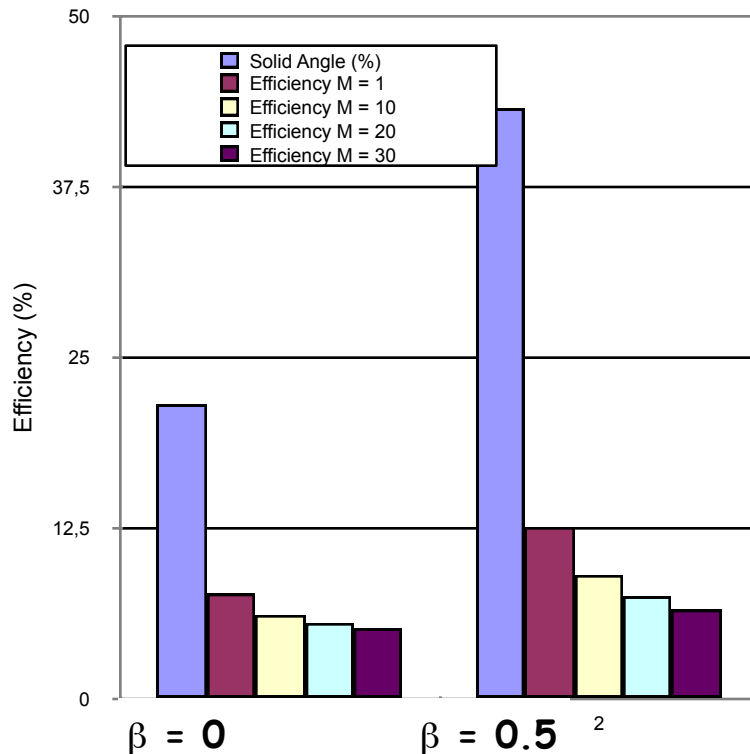
**GSI
Darmstadt
J.Gerl**

**GANIL-SPIRAL2
Caen
E.Clement**

The AGATA Phase 1

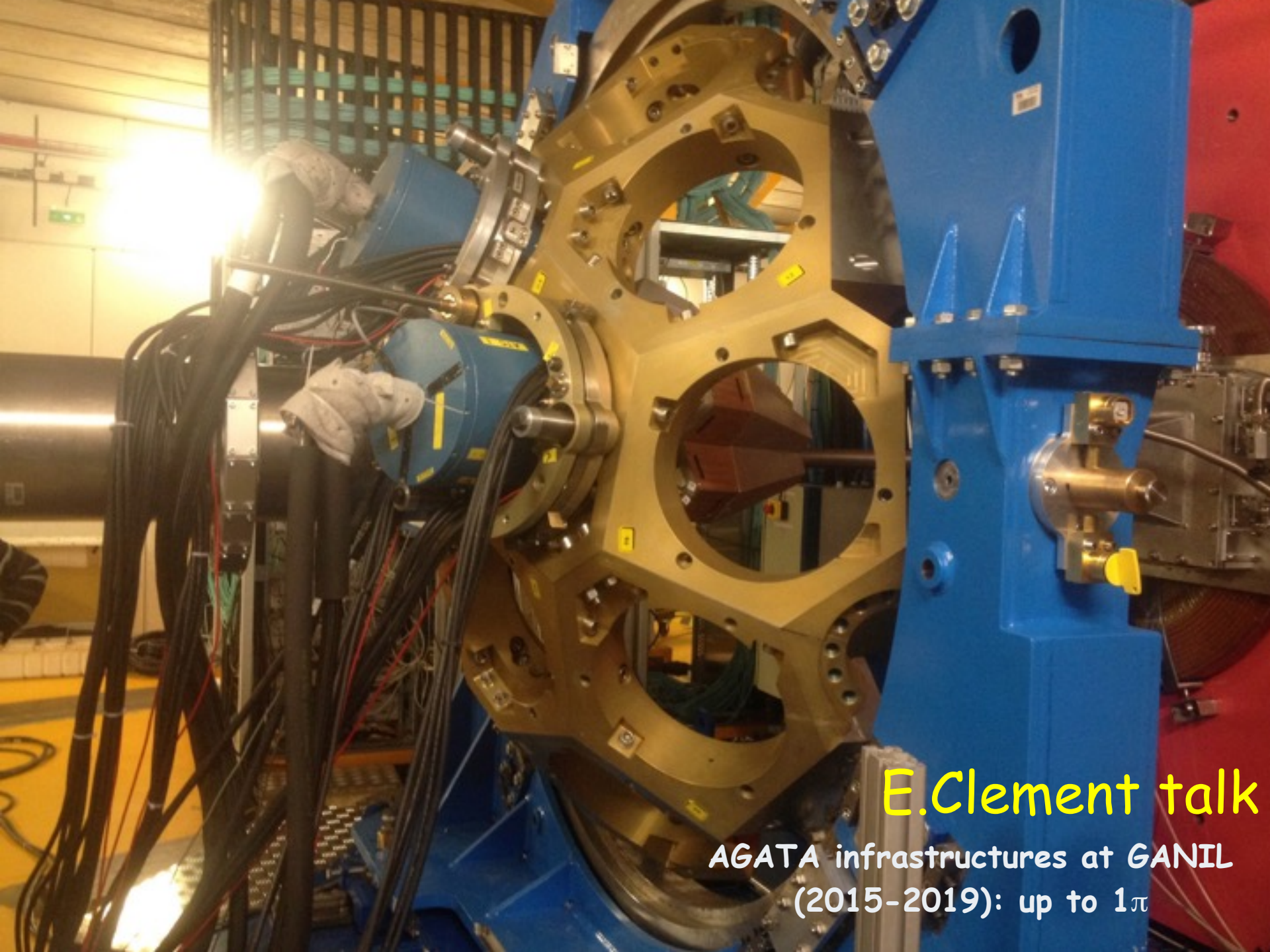
2009-(2015) 2020

- Phase 1 of AGATA ($>1\pi$) \rightarrow 60 crystals
- **MoU ongoing, only 70% achieved, decided prolongation till 2020**
- Triple and Double clusters
- The first “real” tracking array



AGATA 1π

To be used at RIB and High Intensity Stable beam facilities (**FAIR-HISPEC, SPIRAL2, SPES, GSI, LNL, GANIL, ...**)
Coupled to spectrometers, trackers neutron and LCP arrays...



E.Clement talk

AGATA infrastructures at GANIL
(2015-2019): up to 1π

AGATA Capsules Summary

October 2016

40 detectors delivered:

A001, A002, A003, A004, A005, A006, A007, A008, A009, A010, A011, A012

B001, B002, B003, B004, B005, B006, B007, B008, B009, B010, B011, B012, B013, B014

C001, C002, C003, C004, C005, C006, C007, C008, C009, C010, C011, C012, C013, C014

A013-A015, B015-B016 and C015-C016 ordered

No detectors with leakage current or any other issue.

The 7 detectors being produced: 1 France (2018) + 6 Germany (end 2016-17).

Colorcode:

Working

broken

CAT pending

Usage of the available detectors:

See H.Hess, Ch.Theisen, and A.Boston Talks

A008	A003	A002	A007	A005	A001	A006	A009	A004	A010	A011	
B001	B003	B010	B007	B002	B004	B013	B005	B008	B012	(B006)	B011
C003	C005	C001	C007	C009	C010	C006	C008	C013	C014	(C012)	C011
ATC1	ATC2	ATC3	ATC4	ATC5	ATC6	ATC7	ATC8	ATC9	ATC10	ATC11	ADC3

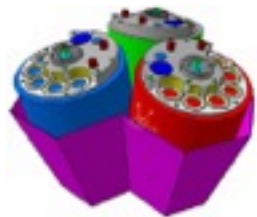
32 Capsules in detectors at GANIL, 40 available. CTT Mounting ATC11.

ATC11 to be delivered within October 2016.

ATC7 repaired on-site of a major mechanical failure by IKP-Cologne, IRFU-Saclay and GANIL teams.

CAT done at Liverpool Uni. and CEA-IRFU Saclay, maintenance at IKP-Cologne, Acknowledgement to H.Hess, IKP, IRFU and GANIL teams for the prompt and efficient maintenance work.

IKP-Köln, Uni. Liverpool, CEA IRFU-Saclay, GANIL



AGATA Cryostats & characterization



- 10 Triple + 3 Double Cluster Cryostats “Comissioned by CTT
- 2 Triples ACT9, ATC10 delivered in 2015,
- ATC11 is ADC2
- 2 new ATC cryostats ordered by Germany
- 2 ATC cryostat to be order by France (2017) and Italy (2018)
- ADC4 to be transformed into a ATC, all parts existing (CTT)
- Expected in 2018-2019: 15 ATC + 2 ADC
- Only 15 in total ATCs + ADCs could be installed at GANIL
- Symmetric Triple Cluster
Mechanics and electronic reassembled.
The goal is to make it compatible (in technology, not mechanically) with present clusters. It will be use for testing and technology developments.

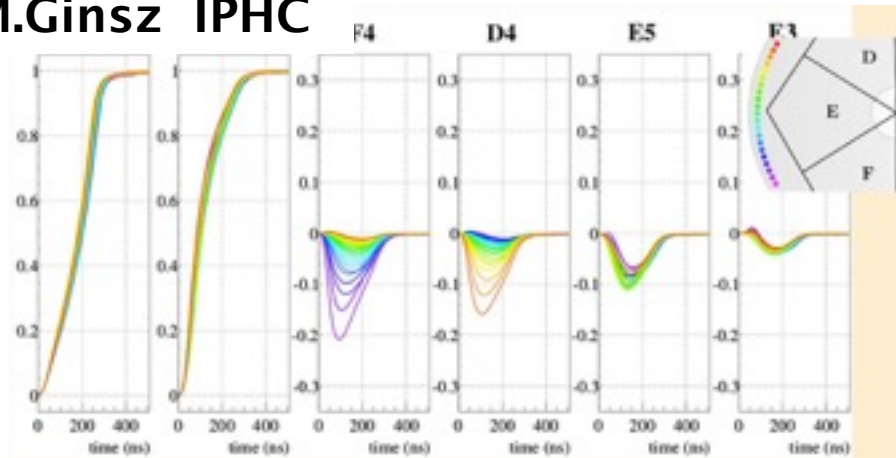


Detector Characterization

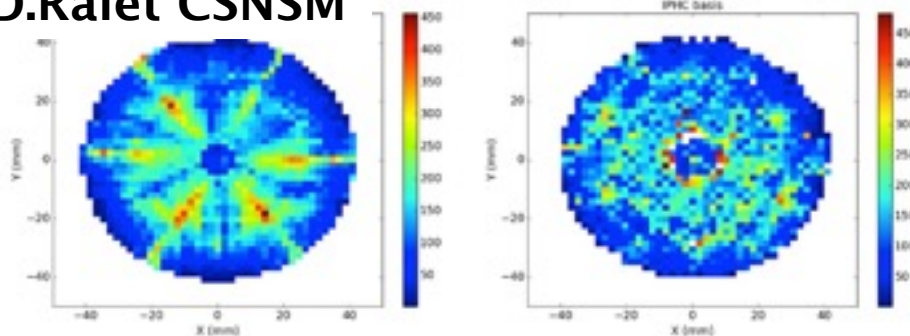
- Still very reduced activity due to capsule issues and the priority to have Clusters completed. Scanning sites: University of Liverpool, CSNSM Orsay, GSI
- The IPHC Strasbourg Scanning table based on the Pulse-Shape Comparison Scanning fully operational. First experimental pulse databases.
- The University of Salamanca scanning table now being commissioned with B014, follows the GSI design with PSCS + ^{22}Na source.

See F. Didierjean, B.Quintana and D.Ralet, talk

M.Ginsz IPHC



D.Ralet CSNSM

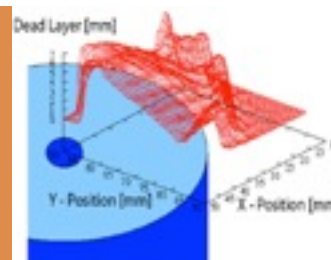
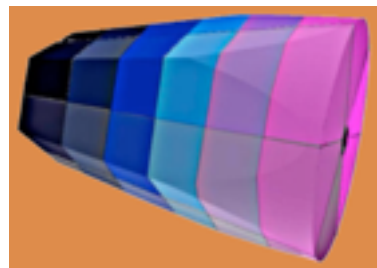


B014 @ SALSA B.Quintana USAL

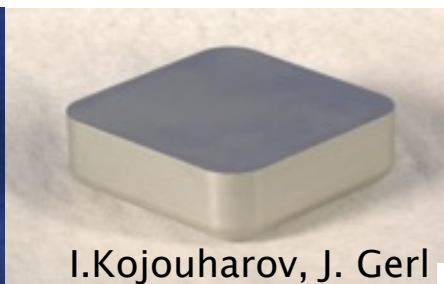
Uni. Liverpool, CSNSM Orsay, TU-Munich, IKP-Köln
INFN-Padova, INFN-Milano, IPHC Strasbourg, GSI, LRI Salamanca

ENSAR2 JRA – PSeGe : R&D on Position– Sensitive Germanium Detectors for Nuclear Structure and Applications

Task 1: New technologies on passivation and segmentation (INFN–LNL & IKP–Cologne et al.)



J. Eberth &
J. Simpson,
Prog.Part.Nucl.
Phys.60,283.
D.R.Napoli et al



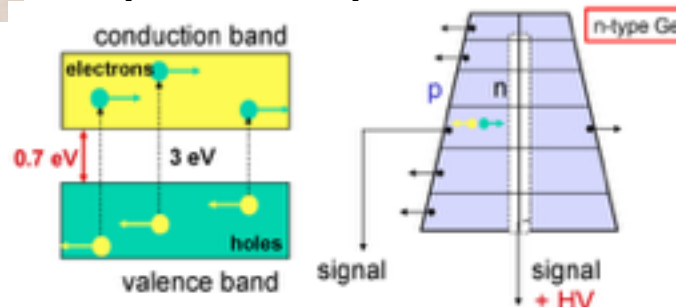
Quasi-planar Ge

I.Kojouharov, J. Gerl

Task 3: R&D on segmented p-type coaxial detectors. (IFIC et al.)

Task 4: Network activity: Demonstration of imaging applications and associated detector technologies (Uni.Liverpool et al.)

Task 2: R&D on novel Ge-detector geometries for ultimate position resolution and efficiency (GSI et al.)

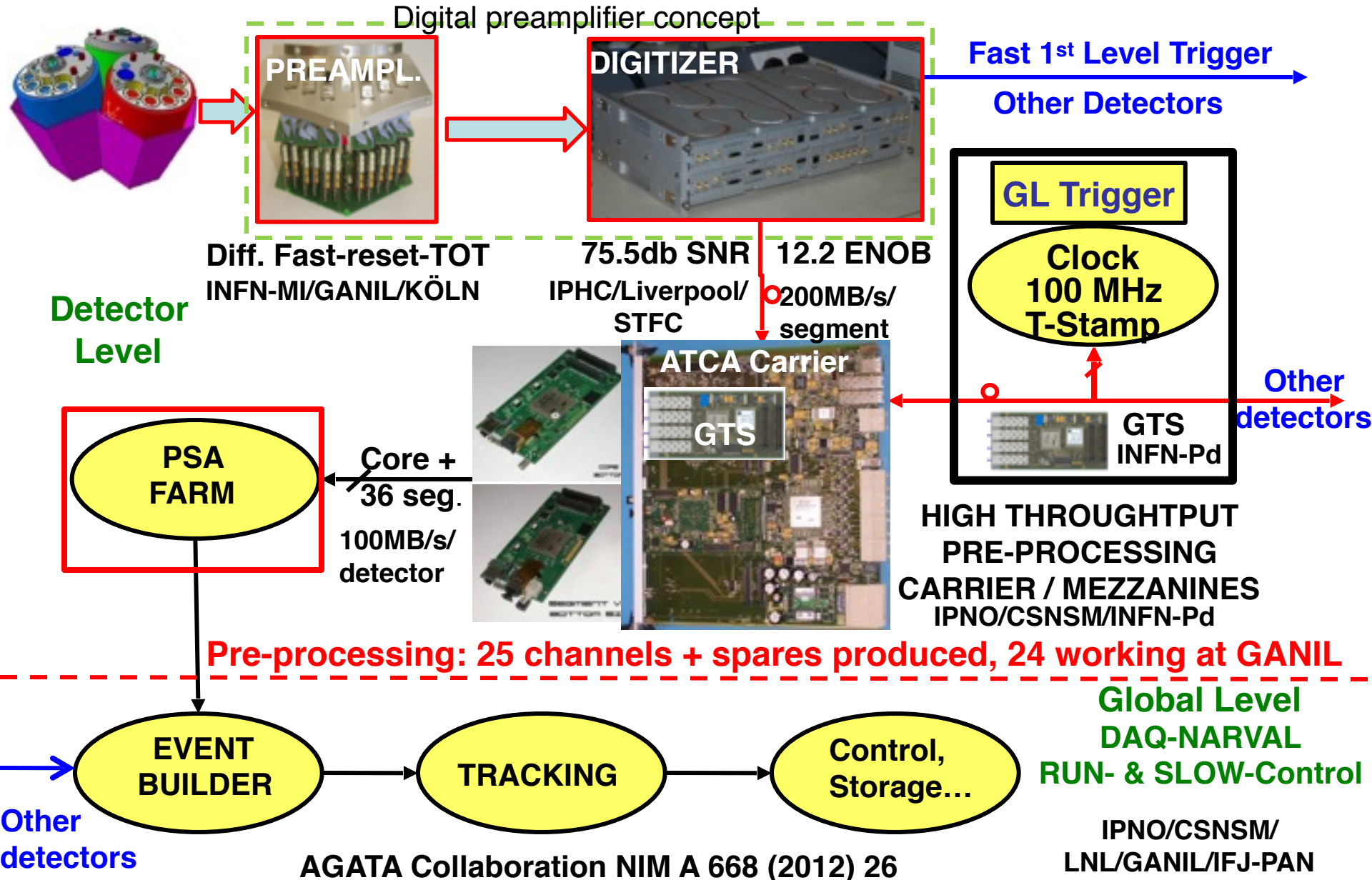


R&D on p-type
Contacts &
hole barriers

ENSAR2 Kick-off meeting on 16th–17th March. To be organized the PSeGe management kick-off meeting.

First workshop 3rd and 4th October 2016 together with AGATA week

Structure of Early Electronics and DAQ



interface to GTS, merge time-stamped data into event builder, prompt local trigger from digitisers

AGATA Pre-Processing Phase 0/ Early 1

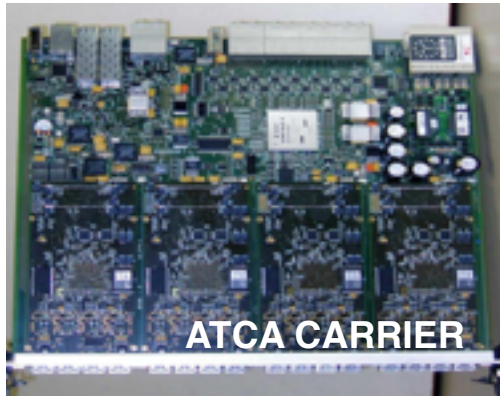
DIGITIZERS:

All dual core upgraded in June 2014. Available 26 GANIL + 1 CSMSN. Repairs performed at STFC. 2 segment Cards failed after Christmas break



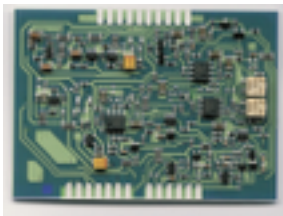
ATCA CARRIER: See N.Karkour talk

23 pairs at GANIL gained stability by fusses upgrade by CSNSM. 2 sets of cards to be repaired at CSNSM/IPNO. Established a programme for limited maintenance. Maintenance Center at CSNSM V4 and IPNO V3. Test system now under maintenance.



SEGMENT & CORE MEZZANINES:

181 (seg) & 25 (core) functional. Installation of Core Mezzanines on stand-by



PRE-AMPLIFIERS

GANIL, IKP-Köln, INFN-Milano

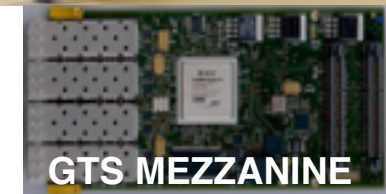
TCLK CARDS: 25 available

GTS MEZZANINES: 37 available

LINCO2 CARDS: 25 available.

GTS VME CARRIERS: 20 available

AGAVA VME Interface: 8 available



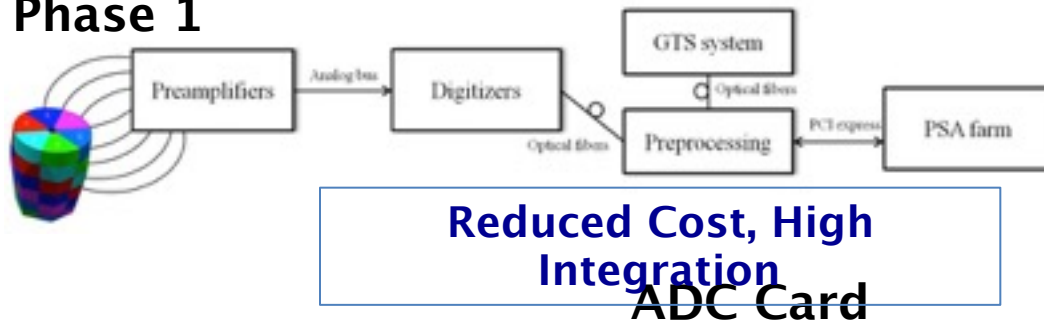
GTS MEZZANINE

CSNSM Orsay, INFN Padova, STFC Daresbury/RAL, IPN Orsay, IFJ-PAN Cracow

Advanced Phase 1 Electronics

INFN-Padova INFN-Milano INFN-LNL
IFIC-Valencia ETSE-Uni.Valencia

Phase 1



Control Card



D. Barrientos, et al., IEEE TRANS. NS

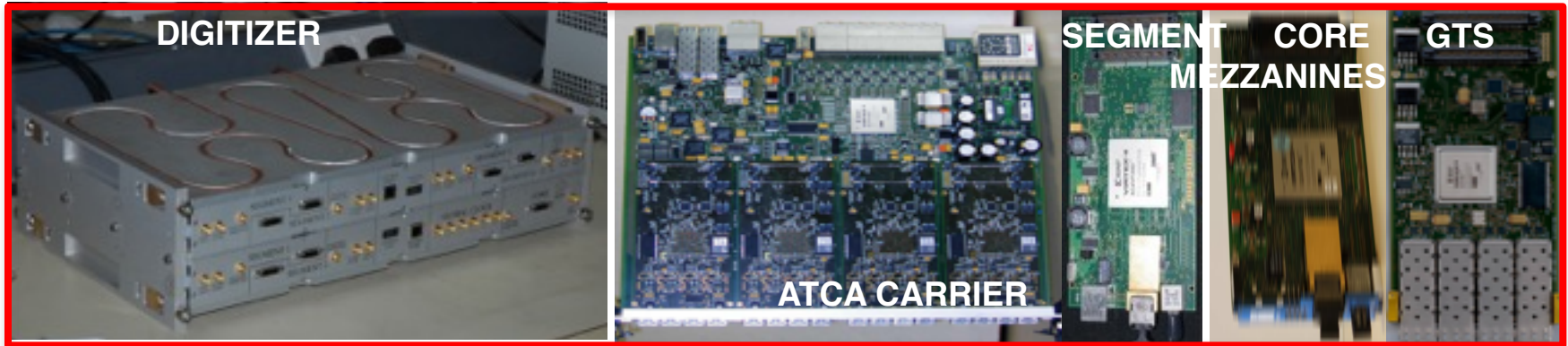
See A.Pullia, X. Egea and V.Gonzalez talks

PCI Pre-Processing Card GGP



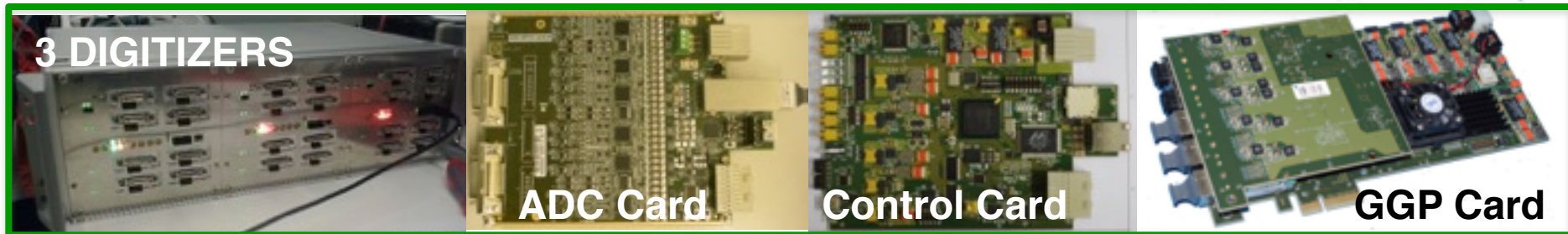
- Electronics shared with GALILEO.
- GTS Integration was complex and last till February 2016.
Integration in Narval 23 ATCA channels + 7 GGPs on 4th March.
- 11 Digitizers + 10 GGP at GANIL.
In total 13 channels produced
- Efforts complete as many channels as possible in fall 2016
- Firmware Improvements in the synchronization procedure ongoing.

AGATA Electronics Phase 0/Early1



23 channels available (might reach 25)

AGATA Electronics Advanced Phase 1



10 channels available at GANIL 3 to be delivered

INFN initiating production to instrument up to 45 capsules

Severe issues with the obsolescence of Transceivers

IPHC Strasbourg Uni.Liverpool STFC Daresbury IPNO, CSNSM-Orsay INFN-Padova

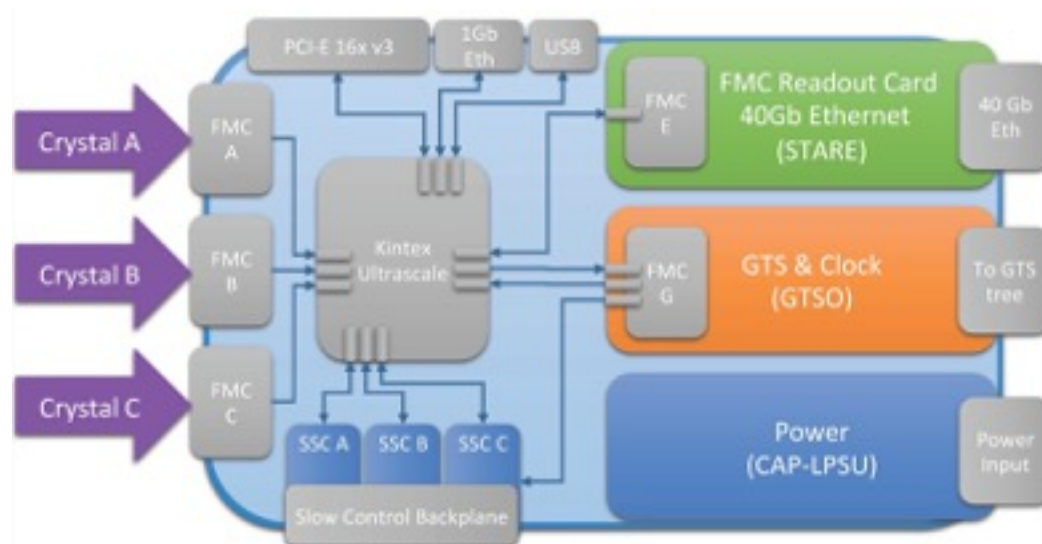
INFN-Milano INFN-Padova INFN-LNL IFIC-Valencia ETSE-Uni-Valencia

Electronics production and R&D

The AMB, discussing how to proceed following the January Town Meeting, arrived to the following conclusions:

-the need of 45 channels before the end of the campaign in GANIL requires an extra production of the GGP / DIGI-OPT12 Electronics. It has been proposed to do a sufficient production of GGP and Digitizers, about 10 channels + spares. Production started, target schedule for production: end 2017

-The AMB encouraged the R&D of a medium term Electronics (~2020) proposed by CSNSM-Orsay, ETSE-Valencia and INFN-Milano, processing an ATC and with Ethernet readout.



See A.Pullia and J.Collado Talks

GTS and Trigger Processor Issues

Trigger Processor strong limitation to 40 TR due to the hardware used.
Severe problem for NEDA and Diamant **GTS design limited to 256 leaves**

- During the January town meeting was discussed as well the situation of the GTS Trigger processor. M.Tripon (GANIL) reports that the engineer that was working with him on the EXOGAM2 GTS Trigger Processor for 255 Trigger Request has left the group. M.Tripon informs that he is taking over the work and he will do the best to finish the development.

See M.Tripon talk

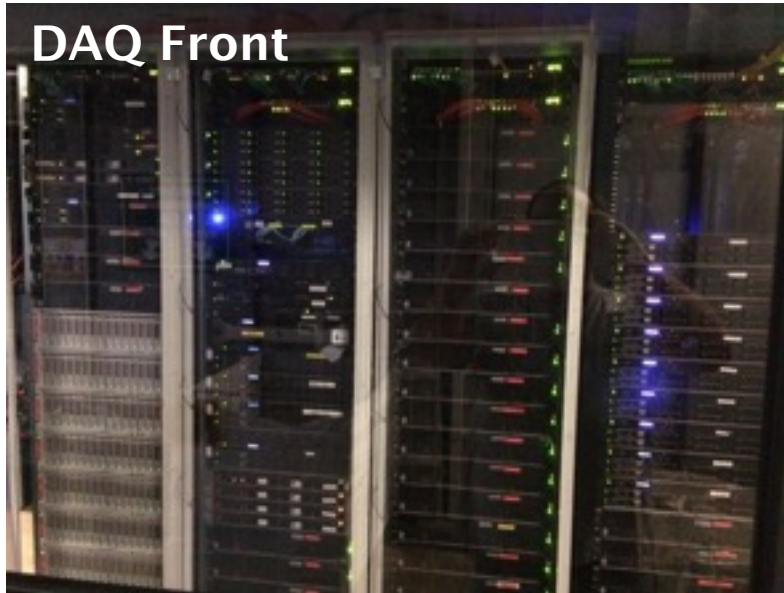
- Software trigger processor under investigation

See X.Grave talk

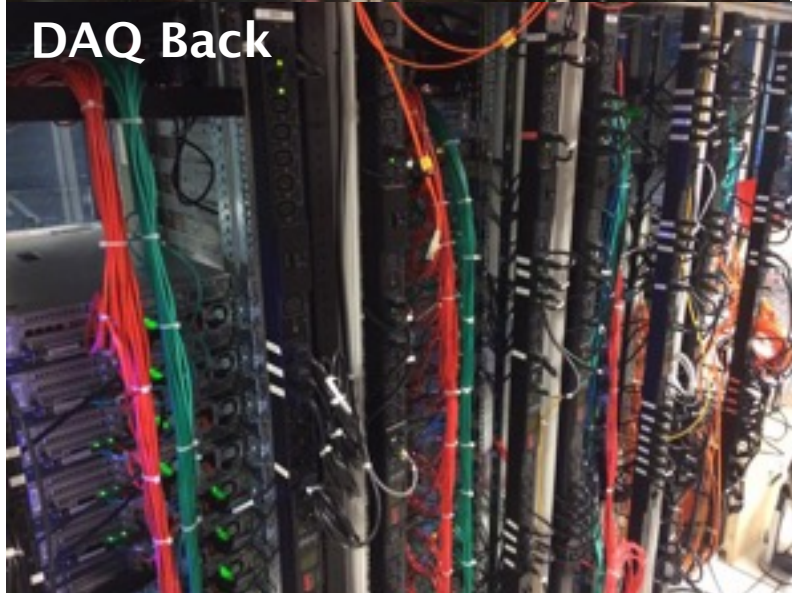
- We have been informed that there is still possibility to produce GTS mezzanines, a company is producing them for INFN-Padova, producing 10 presently. It is relevant considering that we are planning to go for 45 detector system within 2 years.
- The colleagues from IFJ-PAN Cracow (A. Czermak, P. Bednarczyk) informed as well that they are considering the production of the future GTS interface cards for external instrumentation. Will be similar to “AGAVA” but for interfacing future digital electronics with different synchronization clocks.

Phase 1 AGATA Data Flow NARVAL at GANIL

DAQ Front



DAQ Back



Hardware: Maintenance of the Servers

- Constrains due to the aging of Servers and issues with LINCO2, redistribution of resources:

24 Servers –in user– for the LINCO2 cards
+ 5 Servers as spare (~20%)

15 new Servers for the 13 GGP's + 2
Spares (~20%)

- New Control servers and 10 Gb switch + 5 local switches

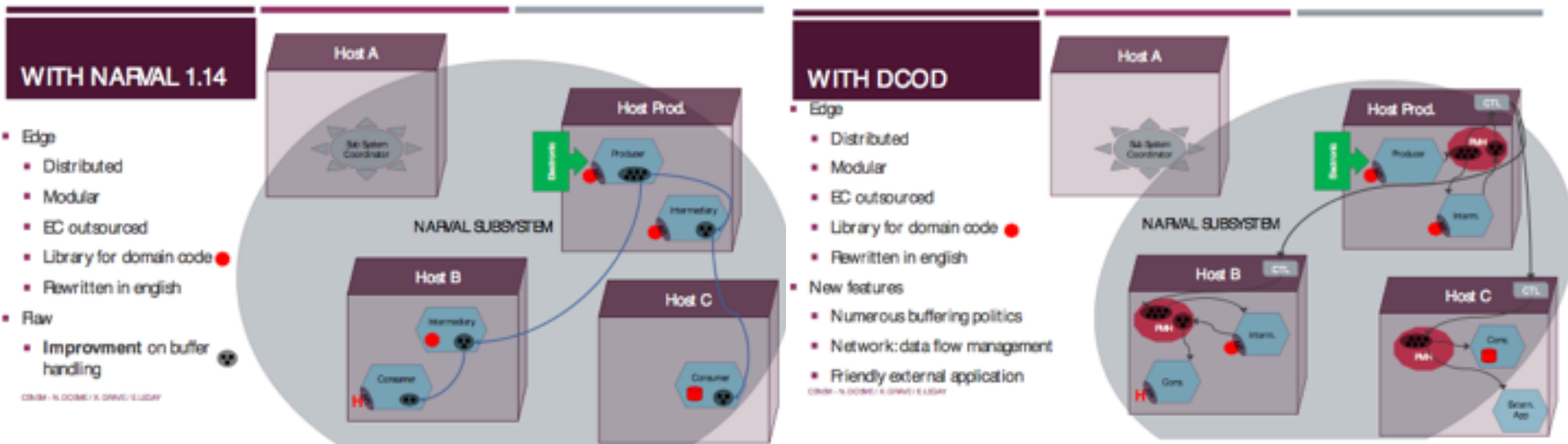
- The new CEPH Cluster (replacing the old disk storage) has been tested in Orsay and installed at GANIL. Now 122 TB available.
Improved performance: bandwidth x 6

Software:

- GGP data acquisition and RC working
- The test integration of the distributed system “DCOD”, GEC upgrade and software trigger processor test scheduled October–December.

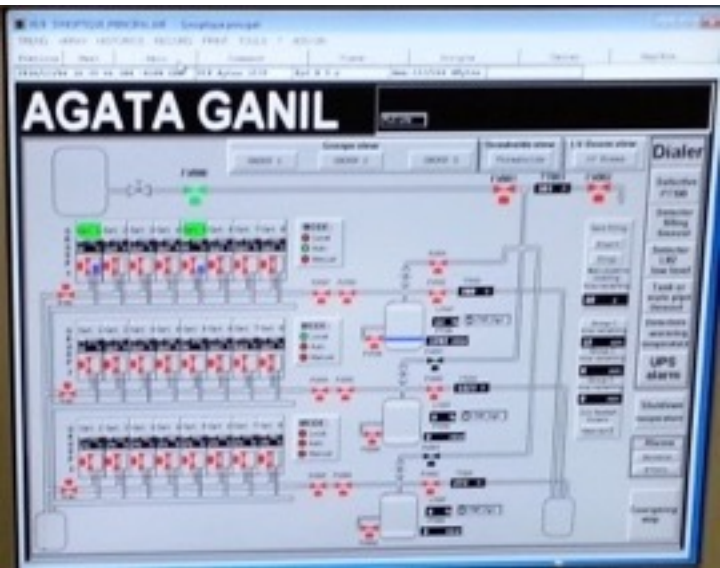
**See A.Korichi talk on behalf
the CSNSM and GANIL DAQ
Teams**

Phase 1 AGATA Data Flow NARVAL at GANIL



- NARVAL distributed Data Flow system dealing with the complexity of AGATA. Large number of data producers supported now. Next step DCOD.
- The Event-Builder and Merger tested and available for the users. Some problems with the watchers.
- Long Stop/Start procedures due to interplay between GANIL RCC (Run Control Core) and AGATA RC: team trying to find solutions.
- RCC and Topology Manager (TM) interconnected – a major step in the data flow tasks – thanks to a huge improvement of the TM.
- Software Trigger Processor prototype ready to be tested.

Infrastructure: Detector Support System



Muscade GUI for the Autofill system

• **LN2 Autofill system:**

Excellent stability of the system.

LN2 Autofill system is ready for 24 detectors:

- 3 Valve Control Crates + 3 Profibus Crates, PLC
- 1 external LN2 tank + 3 buffer tanks, LN2 manifolds, valves, PT100, ...

A minor update in order to include the second PT100 monitoring is done: The integration of the new Siemens PT100 cards done

No major issues even through summer breaks.

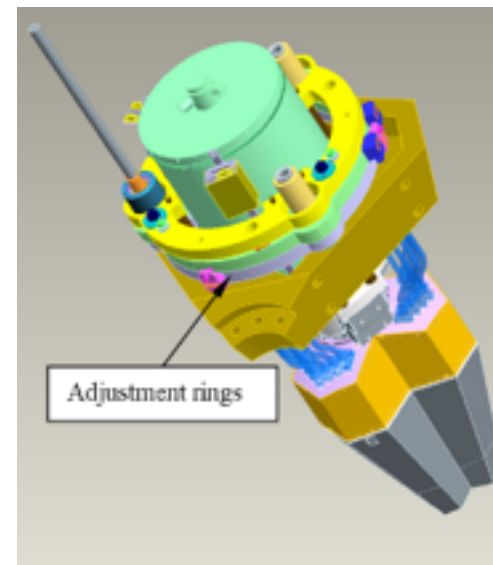
See R.Menegazzo talk on behalf the Detector and Mechanical Infrastructures Teams.

- Detector infrastructures and cabling up to 11 ATC and 1 ADC are ready at GANIL possible to extend to 15 ATCs.
- HV: Tests done on commercial HV CAEN and ISEG. We are using 20 years old CAEN mainframes and HV cards.
- A major upgrade will be needed to improve the control and hardware of the autofill system. The present concept (1 buffer tank/8 Clusters) will be a problem. Future Autofill and DSS interface under discussion on the Working Group. Estimated development time: ~ 2 year, nevertheless the prolongation of the MoU has prevented the possibility to go for this upgrade.

IRFU-CEA Saclay, INFN-Padova, INFN-Milano, GSI, CSNSM-Orsay
STFC-Daresbury, IPHC-Strasbourg, GANIL, INFN-LNL, JYFL-Jyvaskyla,

Mechanical Infrastructures

- I. Burrows STFC together with local GANIL team checked the coherence of the detector positions between CAD numbers and on-site measurements. Report from surveyor team has been delivered.
- A new tool to mount the ATC in the honeycomb under discussion in the Working Group.
- Production of the last 3 alignment completed and they were delivered to GANIL. Mechanics completed up to 1π
- Team working with the Complementary instrumentation collaborations for the integration into the AGATA set-up



AGATA PSA & Data Analysis

Pulse Shape Analysis and *Detector Characterization*:

- L. J. Harkness started as PSA team leader. Already 3 meetings, getting the status and organizing the team.
- IKP are able to provide databases using ADL3
- CSNSM and IPHC working at the integration of the experimental PSCS databases in the PSA analysis.
- Any work related to the clustering issues is now focussed on the PSCS databases, that are expected to improve the performance of AGATA detectors
- No recent significant PSA algorithm development reported. Optimization of PSA being done by IKP-Cologne. Liverpool taken over with the Particle Swarm PSA.

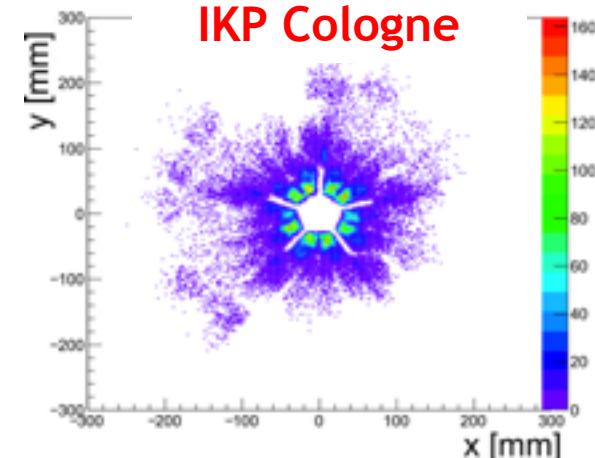
Tracking:

- Upgrades to the OFT code done
- OFT tracking efficiency & P/T under investigation with source data.

See L. J. Harkness, A. Lopez-Martens, talks



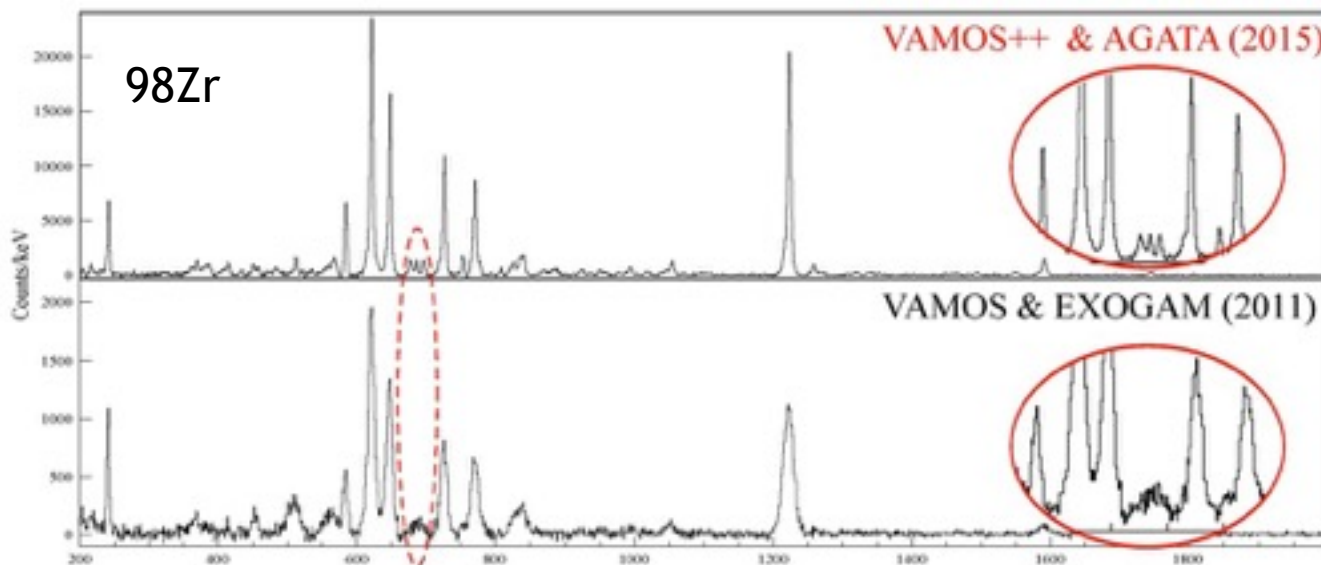
L. Lewandowski
IKP Cologne



AGATA PSA & Data Analysis

Data Analysis

- Online and Offline Watchers working and stable
- New tool to monitor the Crystal gains along the time
- Data Analysis: VAMOS fully integrated in GammaWare and working!
- The Cubix software: An adaptable spectroscopy analysis tool (G. Macquart, J. Dudouet). Based on ROOT and Gammaware libraries, available for AGATA-VAMOS data.
- Efforts to improve the coordination on the Data Analysis regarding the ongoing data analysis, in particular for the GANIL campaign. Meeting being organised to share questions and experience on data analysis.



See J. Dudouet Talk
On behalf of the Data
Analysis Team



Simulations, Experimental Commissioning and Performance

Experimental Commissioning and Performance:

Efforts from several collaboration members to understand and improve the performance of AGATA.

The newly appointed Performance Team lead is C. Michelagnoli. Performance source measurement previous to the in-beam March VAMOS-AGATA commissioning.

New measurements with ^{22}Na performed between experiments.

An ambitious programme is ongoing with measurements with ^{60}Co , ^{152}Eu , ^{133}Ba , etc... aiming to: detector status, n damage correction, peak to total, efficiency with sum peak method (effi and P/T with 1% precision), fixing thresholds and timing, efficiency with external detector, linearity studies and angular correlations/polarization.

See C. Michelagnoli talk, and the contributions of Wednesday afternoon session

Simulations, Experimental Commissioning and Performance

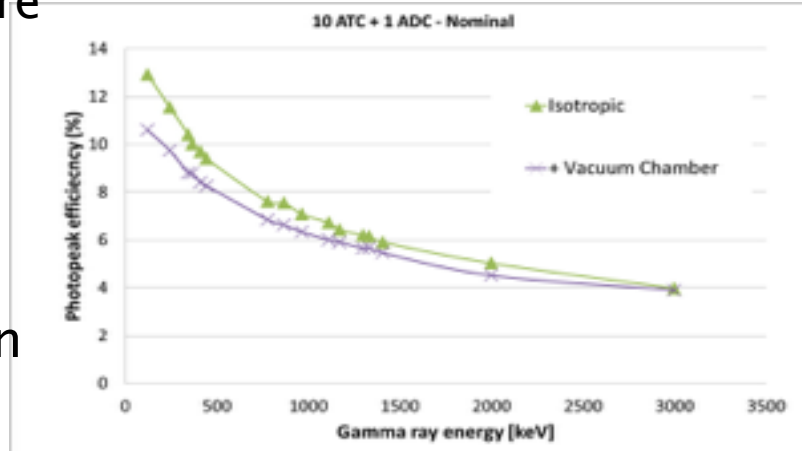
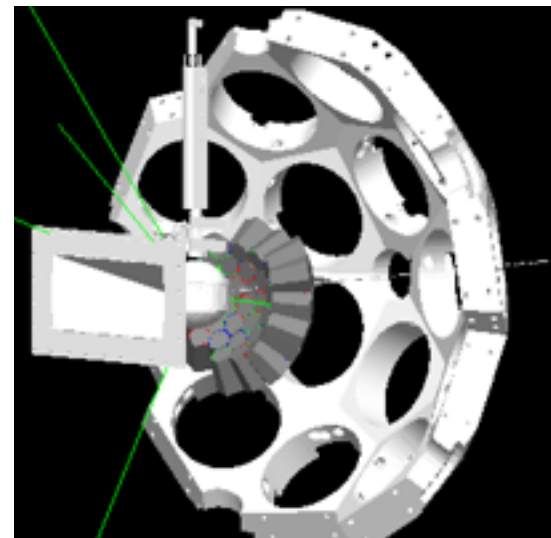
AGATA Simulations

See M.Labiche and J.Ljungvall talks

Simulated efficiency & P/T curves for GANIL Configurations integrating the target chamber have been performed. Angular distributions being included.

Implementation of General Particle Source and the Geometry Description Markup Language (CAD) Modules to the AGATA Code. Ongoing the implementation of the mechanical elements of the detectors, that are relevant for absorption. The geometry of ACT11 is being carefully measured to get a better understanding on how the detectors are located in the setup.

Organized the ICC Workshop on simulation (November 2015)



Capital resources 2016

Funds allocation

- France: 204 k€ allocated
 - ❑ IN2P3: 204 k€ for one capsule -> order placed on Sept. 2, 2016 (192.64 k€)
 - ❑ IRFU : 3rd capsule already taken into account in 2015 (193.05 k€ ordered - 2nd payment this year = 144.79 k€)
10 k€ allocated for GANIL installation capital investment
- Germany: 1433.0 k€ invested for period 2015-07 to 2018-06
for 6 capsules + 2 triples cryostats (half IKP Köln and half TU Darmstadt)
- Italy: ~240 k€ requested for 10 + spare phase 1 electronics
- Spain: no core money for period 2015 - 2017. Some contributions of few 10 k€ on mechanics and power supplies for digitisers.
- Sweden: some hope for 1 ATC (full chain) for coming years ~2018
Swedish request rejected
1 bare AGATA TC approved for DEGAS (2015 - 2016)
- Poland: ready to apply on the basis of a running MoU (need a valid prolongation)

Operational costs 2016

OC 2016

➤ Finland:	13.52 k€ / (13.7 k€)
➤ France:	46.6 + 11.7 + 11.7 = 70 k€ (70 k€)
➤ Germany:	70.0 k€ (70 k€)
➤ Italy:	74.9 K€ (70 k€)
➤ Spain:	18.5 k€ / (23.6 k€) -> available in Jan 2017
➤ Sweden:	0 k€ (39 k€)
➤ UK:	43.5 k€ (43.5 k€)
Total	290.42 k€ (~219 k€ available for repair costs, ~71.4 k€ for det. Lab)

➤ OC from MoU for 2016 = **396.9 k€**

- ❑ **Finland:** Funds in principle available for late 2016
- ❑ **Poland:** has applied for 2016-2018 period. Funds available in 2017
- ❑ **Spain:**
 - ❖ OC for 2013 and 2014 are available (14.5 k€ and 15 k€)
 - ❖ OC 2015 available at Valencia university (18.7 k€)
 - ❖ OC for 2016-2017 to be both available at Salamanca university (18.5 k€ and 22 k€) in Jan 2017
- ❑ **Sweden:** OC application rejected. No OC funds for 2016 and 2017!
- ❑ **UK:** Approved OC for 2016 (43.5 k€) and 2017 (55 k€). Result of OC application not yet known for 2018 and 2019
- ❑ **Missing contributions from** Bulgaria, Turkey and External resources (experiment fees ?)

Operational costs expenses for 2016

OC funds already allocated

➤ 32.5 k€	DAQ - 10 servers replaced	} DAQ (Fr)	(Fr)
➤ 7.5 k€	DAQ - Switches		(Fr)
➤ 5.0 k€	DAQ - 10 Gbit switch		(Fr)
➤ 62.4 k€	Electronics maintenance (channels replacement)	} Maintenance	(It)
➤ 12.5 k€	Bologna CNAF		(It)
➤ 4.165 k€	Repair of Spanish test cryostat		(G)
➤ 17.16 k€	Double to triple cryostat conversion (CTT)		(G)
➤ 13.522 k€	LN2 at GANIL		(Fin)
➤ 4.0 k€	ADA licence 2015		(Fr)
➤ 6.939 k€	ATCA repair/upgrade		(Fr)
❑ 1.61 k€	Front face of carriers - Pentair technical solution		
❑ 1.26 k€	STAE cables for the carrier remote boot		
❑ 1.33 k€	ARROW ECS terminal for the carrier remote boot		
❑ 2.27 k€	STAE IOLAN cables for the carrier remote reboot		
❑ 0.35 k€	Screw repair for the carrier - IMPULSION		
❑ 0.115 k€	Fuses for carrier		
➤ 0.409 k€	Shipment CSNSM to GANIL		(Fr)
➤ 13.517 k€	QSFP transceivers		(Sp + Others)

Total expenses = 179.61 k€

+71.4 k€ det. lab. Maintenance (IKP, Liverpool, Saclay)

Remaining ~ 39.4 k€ for other maintenances till end of 2016



Summary and Outlook

- The Construction of AGATA is progressing slowly due to budget limitations on research in several countries. MoU for 60 Capsules extended to 2020 now under signature.
- Upgrade to 32 capsules now installed at GANIL. Installation of the electronic channels ongoing. For the next runs probably 35 channel available –close to the maximum if spares are kept–. Planning about 45 capsules for 2018.
- Urgent to investigate on detector response and improving PSA (maximizing tracking efficiency)
- Congratulations for the great work performed during the last year, shown in the AGATA week!

Thank You!



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