AGATA: Advanced Gamma Tracking Array, Project Status

AGATA UK



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Science & Technology Facilities Council



AGATA



(Design and characteristics)

 $4\pi \gamma$ -array for Nuclear Physics Experiments at European accelerators providing radioactive and stable beams



Main features of AGATA

Efficiency:43% $(M_{\gamma} = 1)$ 28% $(M_{\gamma} = 30)$ today's arrays~10% (gain ~4)5% (gain ~1000)Peak/Total:58% $(M_{\gamma}=1)$ 49% $(M_{\gamma}=30)$ today~55%40%Angular Resolution:~1° \rightarrow FWHM (1 MeV, v/c=50%)~ 6 keV !!!today~40 keVRates:3 MHz $(M_{\gamma}=1)$ 300 kHz $(M_{\gamma}=30)$ today1 MHz20 kHz

- 180 large volume 36-fold segmented Ge crystals in 60 triple-clusters
- Digital electronics and sophisticated Pulse Shape Analysis algorithms allow
- Operation of Ge detectors in position sensitive mode $\rightarrow \gamma$ -ray tracking



The AGATA Collaboration		
		Memorandum of Understanding 2003-07
		Research and Development phase
	Bulgaria :	Univ. Sofia
	Denmark:	NBI Copenhagen
	Finland:	Univ. Jyväskylä
	France:	GANIL Caen, IPN Lyon, CSNSM Orsay, IPN Orsay, CEA-DSM-DAPNIA Saclay, IreS Strasbourg
	Germany:	GSI Darmstadt, TU Darmstadt, Univ. zu Köln, LMU München, TU München
	Hungary:	Debrecen
	Italy:	INFN and Univ. Firenze, INFN and Univ. Genova, INFN Legnaro, INFN and Univ. Napoli, INFN and Univ. Padova, INFN and Univ. Milano, INFN Perugia and Univ. Camerino
	Poland:	IFJ PAN Krakow, SINS Swierk, HIL & IEP Warsaw
	Romania:	NIPNE & PU Bucharest
	Sweden:	Chalmers Univ. of Technology Göteborg, Lund Univ., Royal Institute of Technology Stockholm, Uppsala Univ.
	UK:	Univ. Brighton, STFC Daresbury, Univ. Edinburgh, Univ. Liverpool, Univ. Manchester, Univ. Paisley, Univ. Surrey, Univ. York
C*	Turkey:	Univ. of Ankara, Istanbul University

The AGATA Organisation

AGATA Steering Committee

Chairperson: W.Korten (and EURONS) Vice Chairperson: P.J. Nolan

G.deAngelis, A.Atac, F. Azaiez, D.Balabanski, D.Bucurescu, B.Cederwall,

J. Gerl, J.Jolie, R.Julin, W.Meczynski,, M.Pignanelli, P.M.Walker

AGATA Management Board

J.Simpson (Project Manager) D.Bazzacco, G.Duchêne, P. Reiter, A.Gadea, J.Nyberg, Ch. Theisen, E. Farnea





The First Step: The AGATA Demonstrator Objective of the final R&D phase 2003-2008



symmetric triple-cluster 5 asymmetric triple-clusters 36-fold segmented crystals 540 segments 555 digital-channels Eff. 3 - 8 % @ M_y = 1 Eff. 2 - 4 % @ M_y = 30 Full EDAQ with on line PSA and γ -ray tracking In beam Commissioning Technical proposal for full array

Cost ~ 6 M € Capital

UK Demonstrator phase

EPSRC-STFC Grant 2004 to April 2008 **Liverpool and Daresbury** ~£2.3M Mechanical design **Electronics** Detector characterisation Project management





AGATA UK INVOLVEMENT



AGATA Detectors



Symmetric detectors

- 3 delivered

- Asymmetric detectors
 - 19 ordered (9 accepted, rest under test
 - or repair)
- Preamplifiers available

- Core (Cologne); Segment (Ganil & Milano)

Test cryostats for characterisation

- 5 delivered

Triple cryostats

- 5 ordered, 3 working

~10 0.6 mm spacing 0.8 mm thickness 37 vacuum feedthroughs

AGATA detectors

Summary: Twelve AGATA detectors are available: A001, A002, A003, A005, A006 B002, B003, B006 C001, C002, C003, C005

Location and usage of available detector:

- Three asymmetric triple clusters ATC: ATC1 at Legnaro: A001, B002, C002 ATC2 at IKP: A003, B003, C005 ATC3 at IKP: A002, B006, C003
- Customer acceptance test: A005 at CEA, A006 at CEA B001 at IKP
- Scanning: C001 at Liverpool

Four AGATA detectors are not available: at Ankara: A004, B004, C004 at Canberra for repair: B005, soon B001 again

Future use of AGATA detector

Location and usage of available detector:

• Three asymmetric triple clusters ATC:

ATC1 at Legnaro:A001, B002, C002ATC2 at IKP:A003, B003, C005ATC3 at IKP:A002, B006, C003

Future need: ATC4 : A006, B00?, C001 Scanning: Orsay A005 Scanning: Liverpool B00?

Available AGATA detectors: from Ankara: A004, B004, C004 ? from Canberra for repair: B005 ? From Liverpool: C001 April 2009 After CAT: A005 (February March, A006 after CAT)



First AGATA triple cluster detector IKP Cologne, H.-G. Thomas CTT Montabaur









AGATA Triple Clusters: ATC 1-3



Constrained by capsules



Characteristation and Scanning

Comparison of real and calculated pulse shapes. Validate codes.



662 keV Coincidence scan for 3D position determination

Two symmetric capsules scanned in Liverpool

Further scanning systems at Orsay operational? and GSI no COO1 scanning in progress in Liverpool Well maybe??

AGATA Design and Construction

VECCCCCCCCCC



180 geometry defined Conceptual design of 180 array done Specifications of infrastructure parts done Design of AGATA demonstrator for LNL done Flanges manufacture done, support manufacture ongoing Assembly in LNL, 2008

AGATA Flange Shell







Production completed final mounting ongoing Design: STFC Daresbury Production: INFN-Padova, Milano e LNL

AGATA Demonstrator mechanics: from the AGATA Flange to the full structure. (Design: STFC Daresbury, Construction: INFN-Padova, Milano, LNL)

ery strict tolerances or construction and mounting.

3 mounting attempts and 2 survey expeditions to reach acceptable tolerances







AGATA Demonstrator support frame. (Design: STFC Daresbury, Construction: INFN-LNL and Padova,)



Mounting the Flange shell in the Frame. (STFC Daresbury, INFN-Padova, Milano, LNL, GANIL)



Detector Adjustment Frames



Constructed and sent to Legnaro









AGATA Demonstrator at PRISMA

AGATA Digitiser Module 36+1 channels, 100 MhZ, 14 bits (Strasbourg – Daresbury – Liverpool)

400W

- Mounted close to the Detector 5-10 m
- Power Dissipation around
- Water Cooling required
- Testing in Liverpool
 (December 2006)
- Production in progress
 (for 18 modules)
- 7 LNL
- X downstairs
- Y Strasbourg etc.



First production digitizer at Daresbury

The new AGATA pre-processing electronics



CO-ordination Ian Lazarus Carrier cards Segment and core mezzanine cards



Source test February 2009

Full chain to storage Tracking included Status Report



In Beam test March 2009

Full chain to storage Tracking included No ancillary detector ⁸²Se (275 MeV) + ¹²C v/c 7.5%



ology

Status and Evolution

AGATA demonstrator 2003-2008 Commissioning of first full electronics chain summer 2008 Assembly of array and infrastructure 2008 Commissioning of sub array at Legnaro 2009

AGATA Physics campaign and build up

First physics campaign at LNL in September 2009-Further campaigns at GANIL, GSI

New AGATA MoU Rate of construction depends on production capability and financing Stages of physics exploitation, facility development

AGATA MoU

To provide a framework for AGATA to the full array Build up, operation, management, funding First phase 1/3 array Being Signed Specifies a requested funding profile for 2009-2012 Specifies "systems" for each country





AGATA Experimental Program ?



 $2009 \rightarrow LNL$

AGATA + PRISMA

→ GANIL/SPIRAL ≥8TC



AGATA D. ≥8TC EXOGAM 8 seg. Clovers Total Eff. > 10% Setup works also as Compton Polarimeter



→ GSI / FRS ~15TC

AGATA @ FRS

CAN.



AGATA at GSI-FRS (PRESPEC)



AGATA at GSI-FRS leading to HiSpec (FAIR) PRESPEC

Main physics opportunities: Gamma-ray spectroscopy with reactions at relativistic energies (> 50 A.MeV) Coulomb excitation, few nucleon removal etc.







UK Phase 1

New STFC Grant

2009 four years

Universities Liverpool, Manchester, Surrey, WoS and York and Daresbury

~£3.8M

(Capital as defined by the project 893keuro) Mechanical design

Electronics design and upgrade

Detector characterisation and support

Data understanding and commissioning

Running Costs

Project management



http://www.stfc.ac.uk/PMC/PRel/STFC/AGATA.aspx



THANKS