

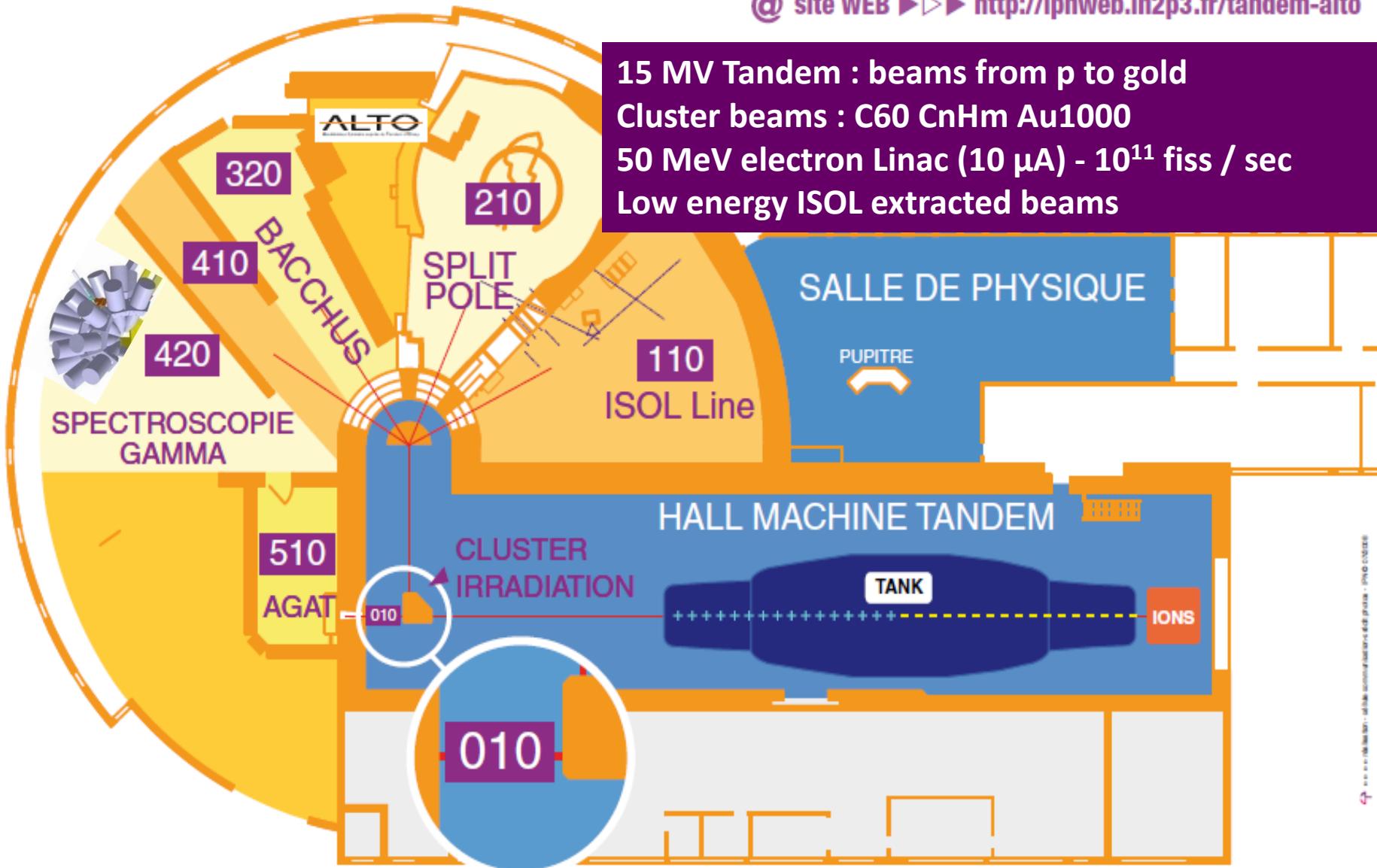
Gamma Spectroscopy at IPN Orsay

Present and Future

1. *The TNA Tandem-ALTO facility at Orsay*
2. *The ORGAM array*
3. *The ORGAM campaigns: 2009-2011*
4. *Near future – ORGAM2*
5. *Perspectives – ORGAM3*

Linear
Accelerator
and
Tandem
at Orsay

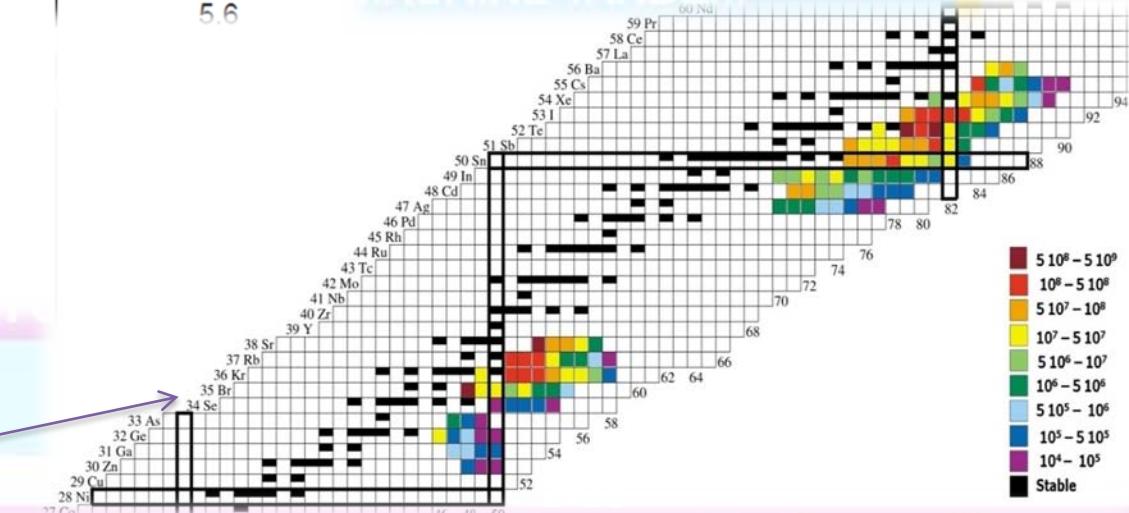




Tandem – stable beams

Injected ion species	Injected intensity (μA)	Energy (MeV)	Intensity analysed (pps $\times 10^{10}$)
^1H	2.5	25	600
^2H	1.6	29	113
^4He	1.9	36	900
^6Li	0.07	50	1.8
^7Li	0.09	56	13
^9Be	0.0025	62	0.56
^{11}B	0.0042	77	4.3
^{12}C	0.92	69	94
^{13}C	1.8	70	2.6
^{14}C	0.11	72	15
^{16}O	4	90	100
^{19}F	0.2	104	3.3
^{24}Mg	0.06	130	6
^{27}Al	0.18	120	8
^{28}Si	0.14	150	0.063
^{31}P	0.07	155	0.95
^{32}S	0.75	154	29
^{34}S	0.09	130	5.6
^{35}Cl	0.2	154	
^{40}Ga	0.12	168	
^{48}Ti	0.014	210	
^{56}Fe	0.0025	99	
^{58}Ni	0.18	182	
^{81}Br	1.5	217	
^{127}I	0.5	297	
^{197}Au	0.2	172	

$E \approx 1 \div 10 \text{ MEV/NUCLEON}$



$E = 30 \text{ KEV}$

ALTO – ISOL RIB

GammaPool @ IPNO for 2 years (2009-2011)



IPN is the Home Base of the french-english LoanPool



4 OSCAR detectors

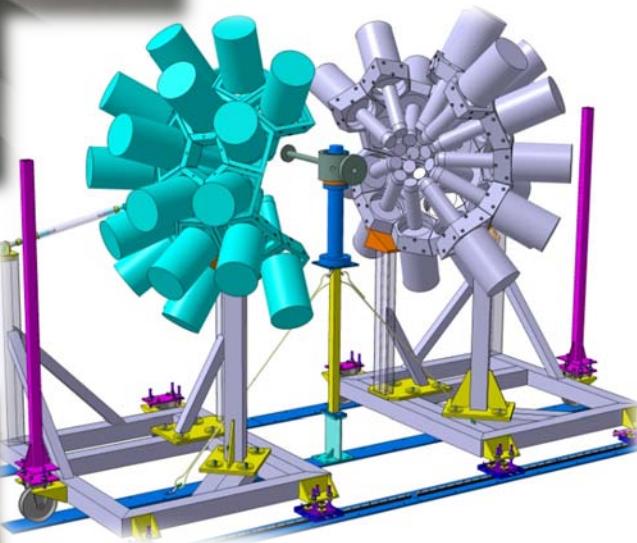
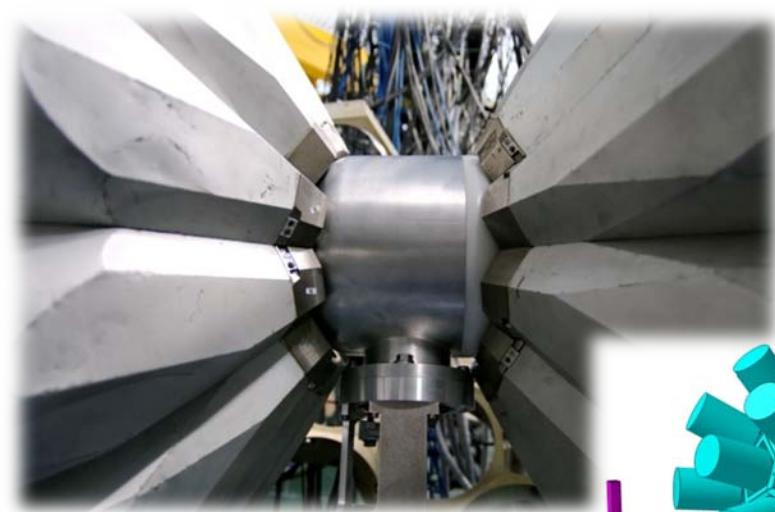


First Aid Laboratory (only 2 in France with EXOGAM)



The ORGAM (ORsay GAMma) Array

ORGAM



45 Eurogam mechanical cells

Auto Cooling capacity : 24 det.

BGO focal point : 180 mm

Efficiency/Ge : 0.1 % @ 1MeV

DAQ channels : 30 (COMET) triggerless

New reaction chamber in 2011



Spokesperson	Institution	Proposal	Used ORGAM	Performed	Status
Ricardo Orlandi	University of the West of Scotland (UK)	Magnetic properties of ^{67}As : a test of isospin symmetry	4 detectors (stand alone)	September 2008	Ongoing analysis
Radomira Lozeva	CSNSM (France)	Quadrupole moment studies of isomeric states in ^{66}Cu	8 detectors (stand alone)	March 2009	Published (PLB 2010)
Mathieu Ferraton	IPNO (France)	Exploration of the horizontal ridge of the Wilczynski-plot with and for gamma-spectroscopy	16 detectors (ORGAM config)	July 2009	PhD Defence in July
Radomira Lozeva	CSNSM (France)	Investigation of the population of Cu/Ni isomers in MNT reactions	19 detectors (ORGAM config)	July 2009	Ongoing analysis
Dimiter Balabanski	INRNE, BAS (Bulgaria)	Gyromagnetic factors of high seniority, high-K isomeric states in $^{174,175}\text{Hf}$	4 detectors (stand alone)	September 2009	Ongoing analysis
Isabelle Deloncle	CSNSM (France)	DSAM lifetime measurements in ^{168}Yb	18 detectors (ORGAM config)	February 2010	Ongoing analysis
Mourad Aiche	CENBG (France)	Validating the surrogate method applied to capture cross sections	6 detectors (stand alone)	February-March 2010	Ongoing analysis
J.F. Sharpey-Schafer	University of Western Cape (South Africa)	Establishment of the Exact Quantum Numbers of Critical Rotational Bands in ^{155}Gd	18 detectors + 1 clover detector (ORGAM config)	March 2010	Ongoing analysis
Dominique Curien	IPHC (France)	Test ELMA : excitation function of ^{234}U	17 detectors (ORGAM config)	April 2010	Finished Analysis

Quadrupole moment studies of isomeric states in ^{66}Cu and ^{63}Ni isotopes using Multi-Nucleon Transfer reactions - a step towards the radioactive beams

R. Lozeva¹, D. Balabanski², G. Georgiev¹, J.M. Daugas³, G. Deyanova⁴,
E. Fiori¹, L. Gaudefroy³, K. Gladnishki⁴, H. Haas⁵, S. Lalkovski⁴, I. Matea⁶,
P. Morel³, S. Szilner⁷ and D. Verney⁸

1. *CSNSM, Orsay, France*
2. *INRNE, BAS, Sofia, Bulgaria*
3. *CEA/DIF/DPTA/SPN, Bruyères le Châtel, France*
4. *Faculty of Physics, University of Sofia, Sofia, Bulgaria*
5. *ITN, Sacavem, Portugal and CERN, Geneva, Switzerland*
6. *CEN, Bordeaux - Gradignan, France*
7. *RBI, Zagreb, Croatia*
8. *IPN, Orsay, France*

Tetrahedral Symmetry in the Actinides: *ELMA Project*

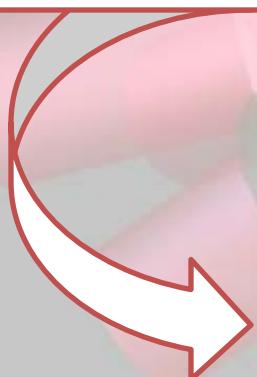


N-SI-41 : "Lifetime of the second 0^+ state in ^{160}Er " (16-22 May)

- extraction of the E0 strength of the decay to search for a X(5) critical point
- 14 Phase I Germanium + 14 BGO shields
- 8 LaBr₃(Ce) for Fast Timing measurement

I-SI-13 : "Test experiment for the CSNSM/IPNO/GANIL Plunger" (6-10 June)

- commissioning of a new Plunger for low and medium energies
- 24 Phase I Germanium + 24 BGO shields
- study case: excited states in ^{76}Kr



OUPS !

The Orsay Universal Plunger System (The Oups)

J. Ljungvall, G. Georgiev, Stéphane Cabaret, Gregory Sedes (CSNSM) and NESTER (IPNO) groups

Commissioning experiment: $^{45}Sc(^{35}Cl, 2p2n)^{76}Kr$, 126 MeV

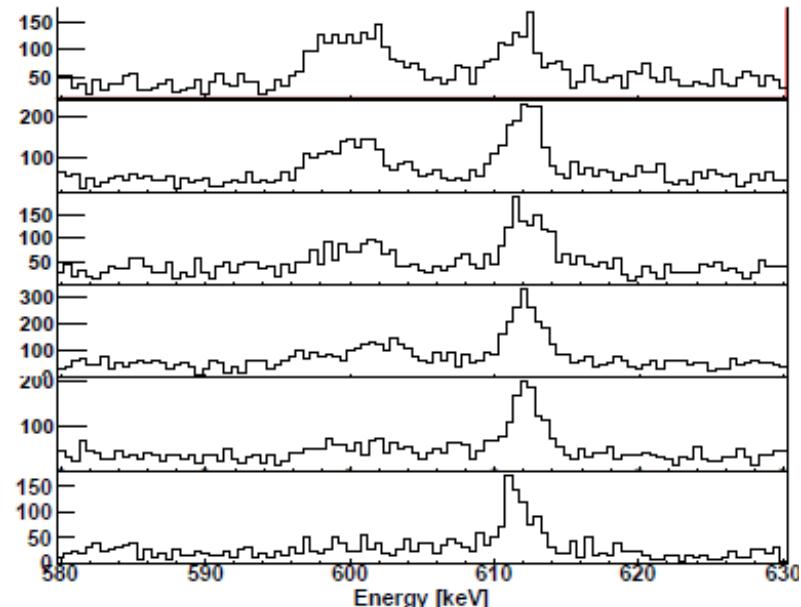
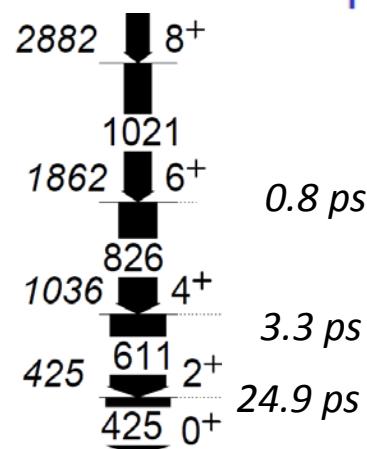
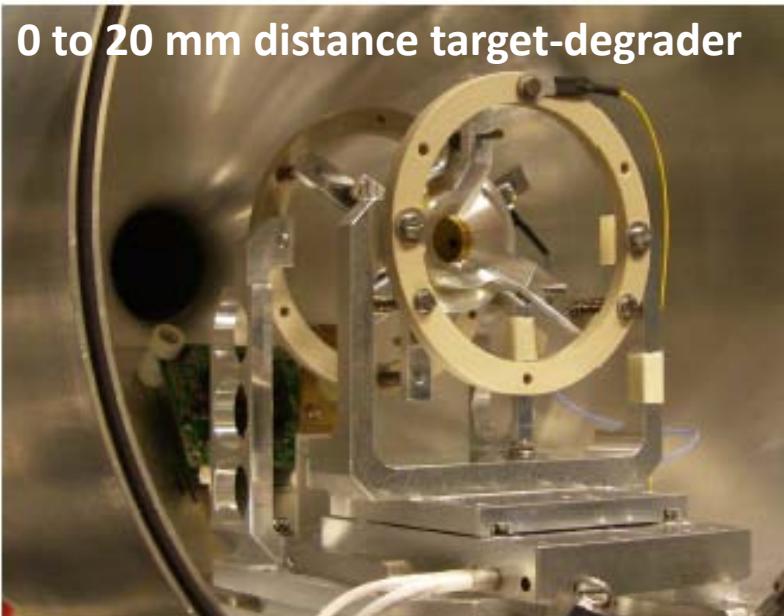
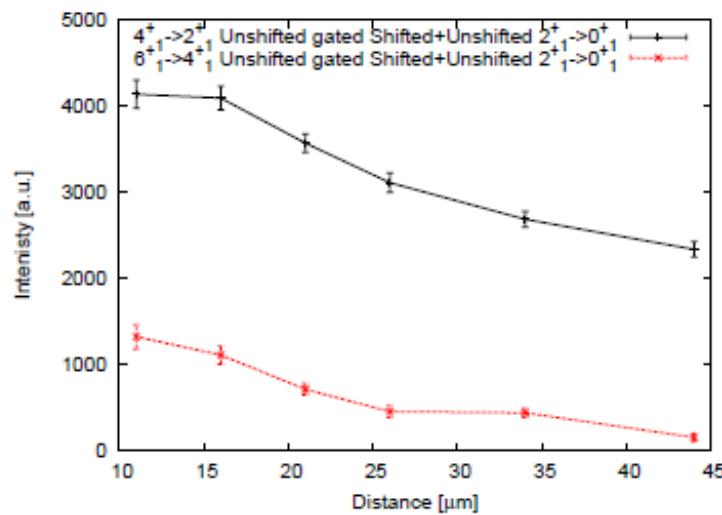
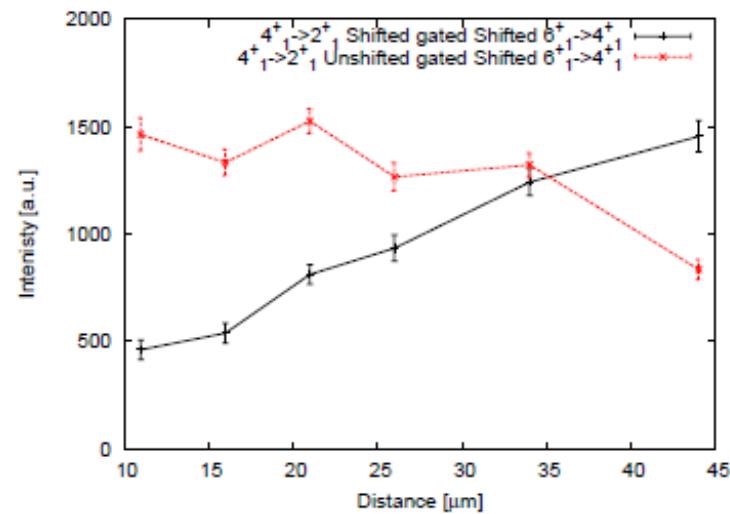


Figure: $4_1^+ \rightarrow 2_1^+$ gate on shifted $6_1^+ \rightarrow 4_1^+$

Courtesy of J. Ljungvall



(a) Singles



(b) Coincidences

- Successful commissioning
- Ready for “Real physics”
- To be used at IPN Tandem, GANIL and ?



EAGLE

central European Array for Gamma Levels Evaluation
current status and future plans



Henryk Mierzejewski¹, Jan Mierzejewski^{2,3}, Julian Srebrny², Magda Zielińska² on behalf of the EAGLE collaboration

¹ Faculty of Production Engineering, Warsaw University of Technology, Poland

² Heavy Ion Laboratory, University of Warsaw, Poland

³ Institute of Experimental Physics, Nuclear Physics Division, University of Warsaw, Poland

Orsay, October the 29th, 2009

Agreement between the EAGLE and ORGAM collaborations

Two different collaborations have been formed to exploit the EUROGAM (phase 1 detectors) resources: one at the ALTO/Tandem facility – IPN Orsay with the ORGAM array (the Orsay Gamma Array, campaign manager: D. Verney) and the other at the Heavy Ion Laboratory (Warsaw) with the EAGLE array (central European Array for Gamma Levels Evaluation, campaign manager: J. Srebrny).

In order to optimize the use of the Gammapool resources, the two campaign managers (CM) took the initiative to set up collaboration to ensure a smooth transition between the two campaigns and a more effective exploitation of the detectors.

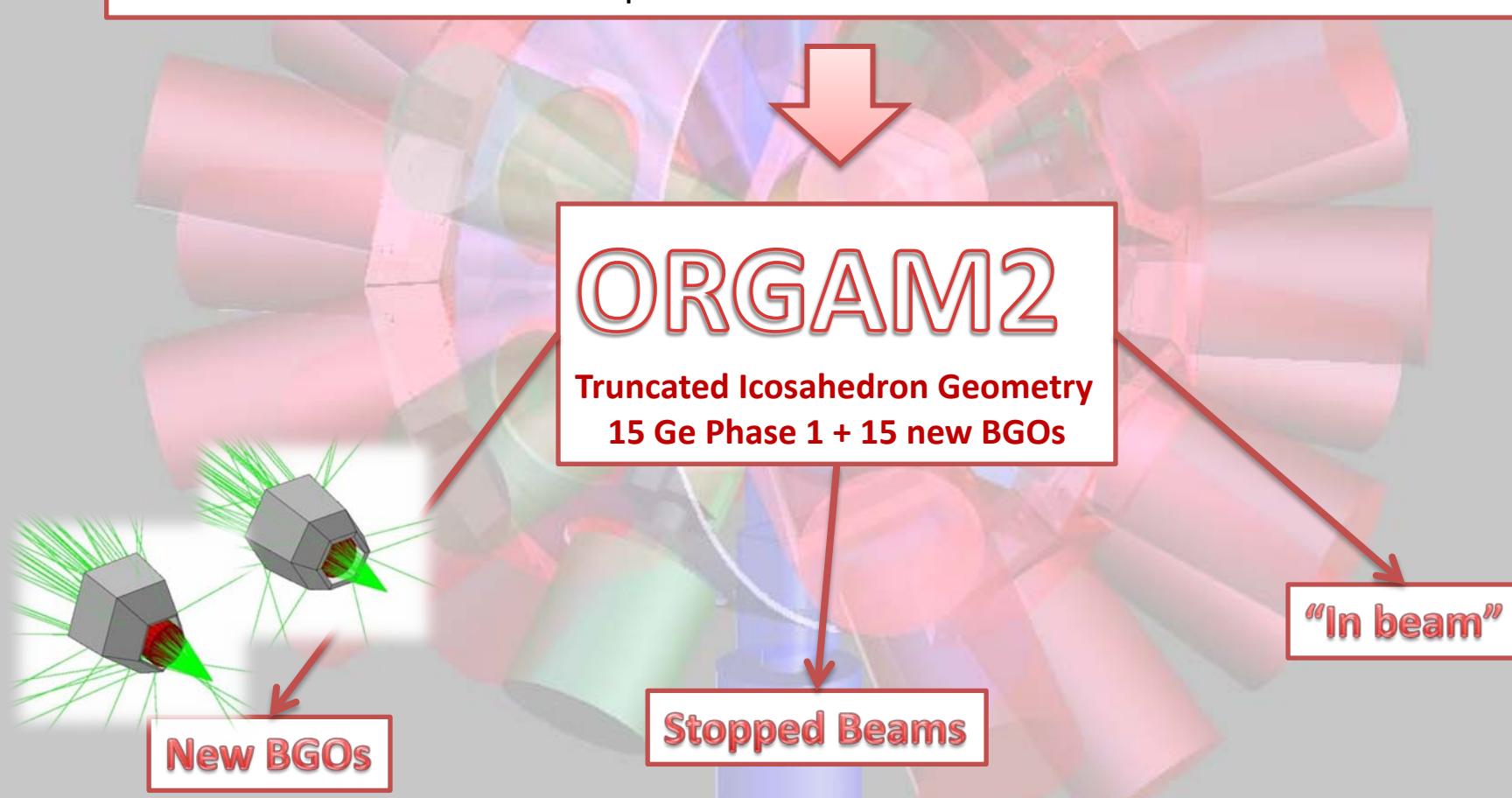
1° Schedule of the campaigns:

The two CM agreed on the following compromise:

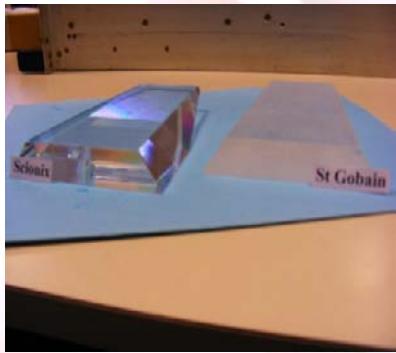
- The ORGAM campaign will continue running up to June 30th 2011. The ORGAM CM guarantees that the dismounting of the detectors will not suffer from unnecessary delay and will be made as early as possible in year 2011 after the scheduled experimental program is fulfilled, and in any case, not later than June 2011.
- The follow-on bid from ORGAM covering the period from July 1st 2011 to June 30th 2013 will concern detectors which are not in the set of the 20 Ge+AC allocated to EAGLE. In this way it is expected that the EAGLE campaign can count on a 2 year period of continuous running.

ORGAM drawbacks :

- Reaction channel selection (except for cases when Si detectors can be used)
- low geometrical efficiency (fixed by EUROGAM1 geometry): now 180 mm focal dist.
- limited number of BGO compared to Ge detectors



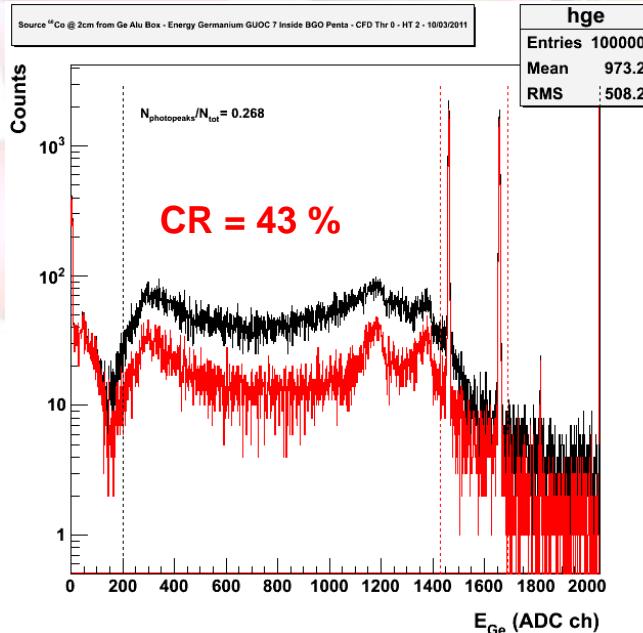
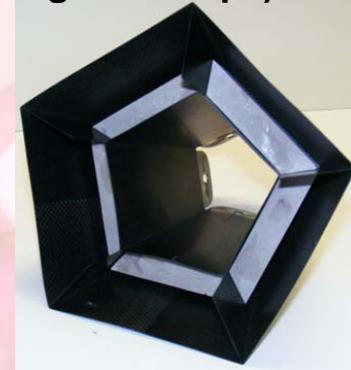
Pentagonal shape:
5 BGO Crystals



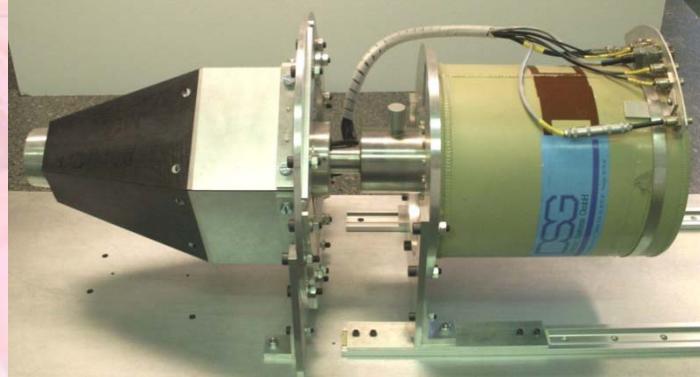
VM2000 + 2 PM
Hamamatsu® R7899-01



BGO mounting in Carbon cells
(pentagonal shape)



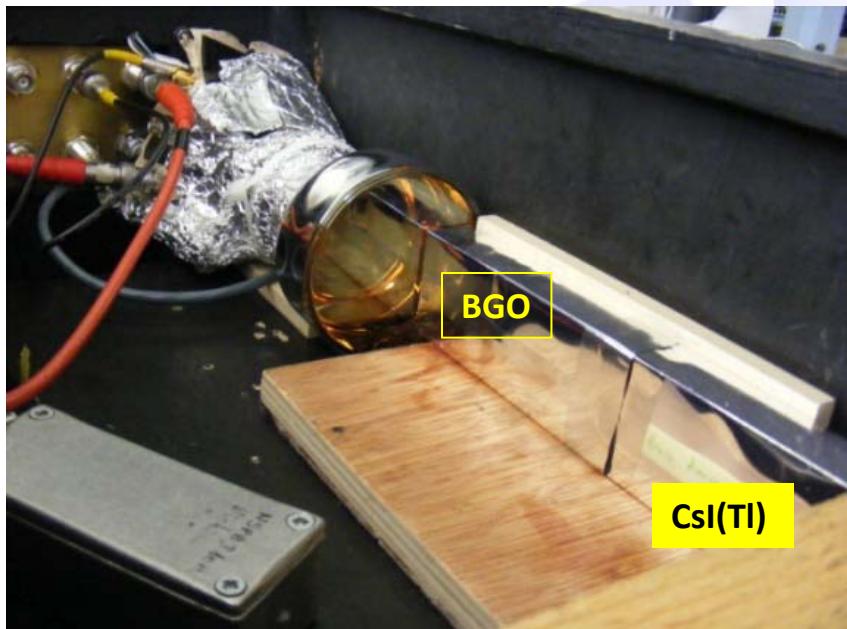
Ge + BGO shield



Prototype : ready

Courtesy of T. Zerguerras

Phoswich R&D: BGO + CsI



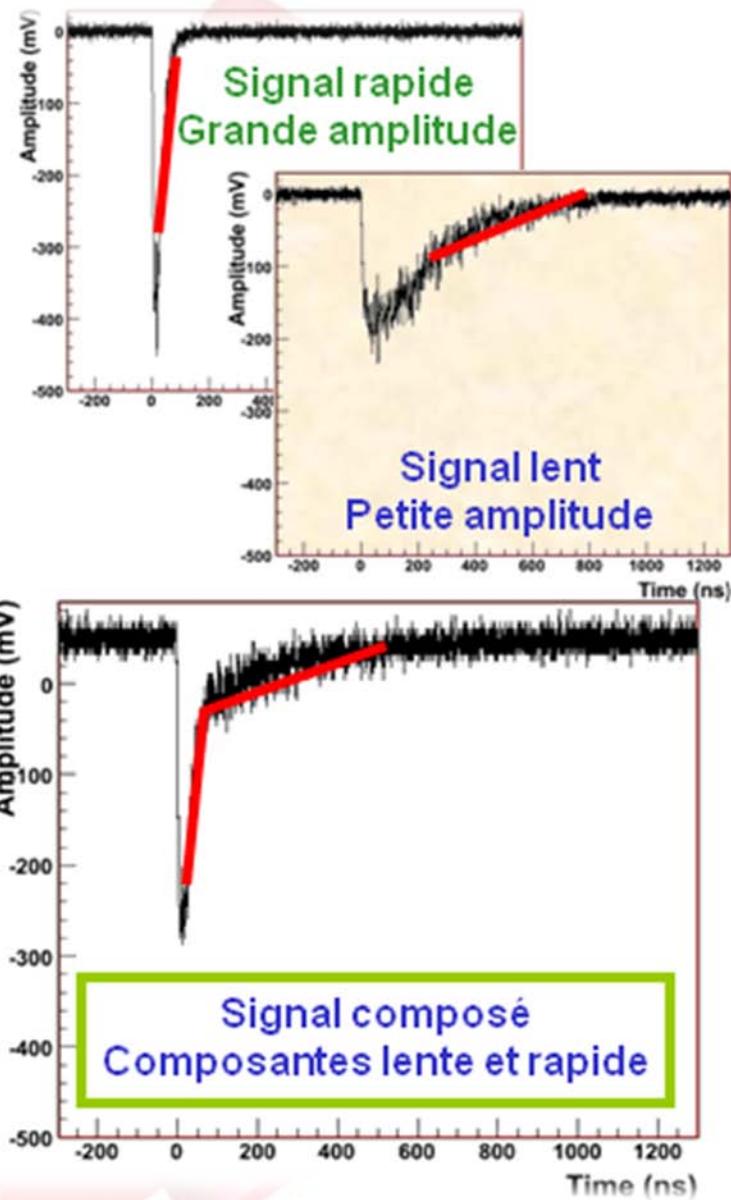
Adding CsI(Tl) :

- cost reduction
- higher resolution
- possibility of low resolution addback procedure

R&D phase:

- Other scintillators ?
- what PMT ?
- what readout ?
- ...

New BGOs for ORGAM2

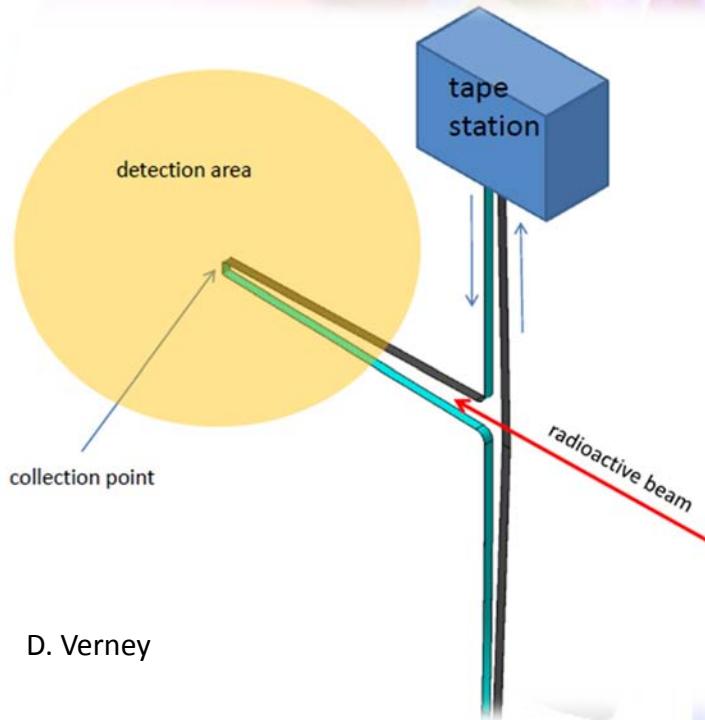


Courtesy of J. Peyré

High efficiency gamma detection for BEDO (BEta Decay studies at Orsay)

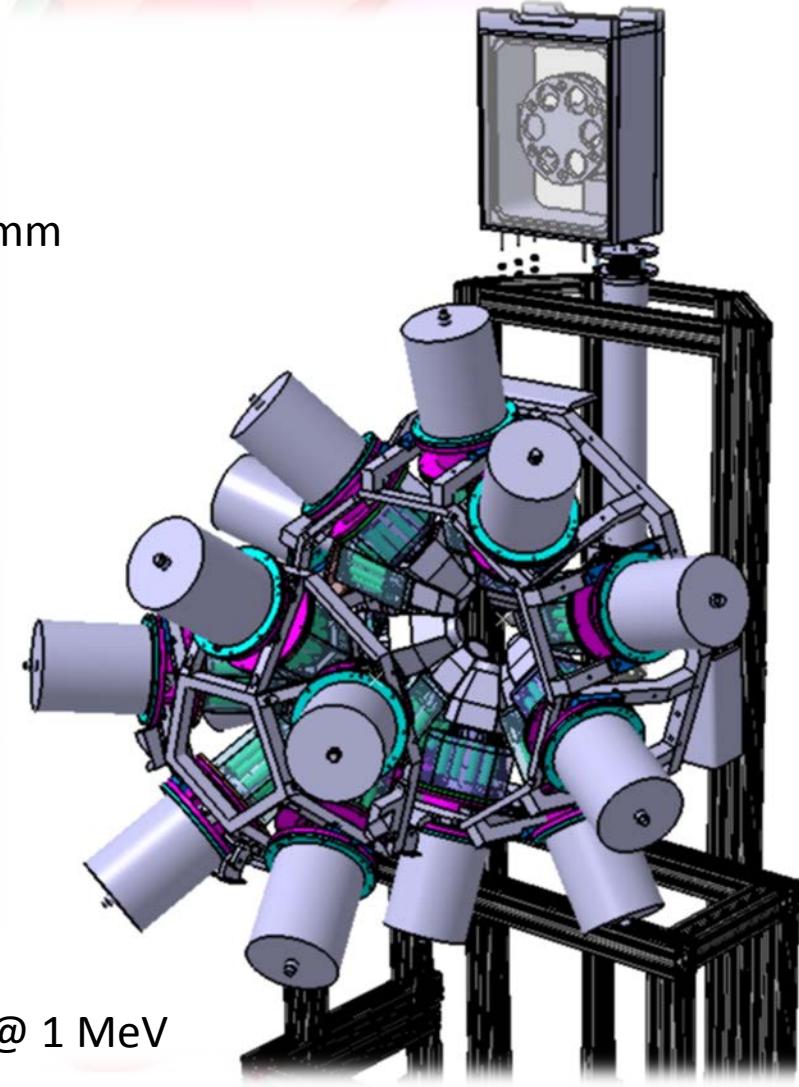
Low energy **ISOL** extracted beams for:

- beta delayed gamma spectroscopy
- fast timing measurements
- neutron branching ratios ...
- distance Ge – collection point : 117 mm



D. Verney

~ 8% efficiency @ 1 MeV



J. Bettane

LoI for D-1 LINAG experiment

In-beam gamma spectroscopy of neutron-rich nuclei studied with EXOGAM2 and PARIS at the intermediate focal plane of S3

Spokesperson: I. Stefan (IPN-Orsay)

Collaboration:

IPNO: F. Azaiez, F. Ibrahim, S. Franchoo, D. Verney, I. Matea, I. Stefan, B. Mouginot
IFJ PAN Krakow: M. Kmiecik, B. Fornal, A. Maj et al.

GANIL: H. Savajols, G. Defrance, N. Alahari, S. Grevy, O. Sorlin, M. Rejmund
L.Caceres, J. Ch. Thomas

LNL : G. de Angelis, D.R. Napoli, E. Sahin, J. Valiente Dobon,

Debrezen : Zs. Dombradi et al.

CSNSM: G. Georgiev et al.

and the S3, PARIS and EXOGAM2 collaborations

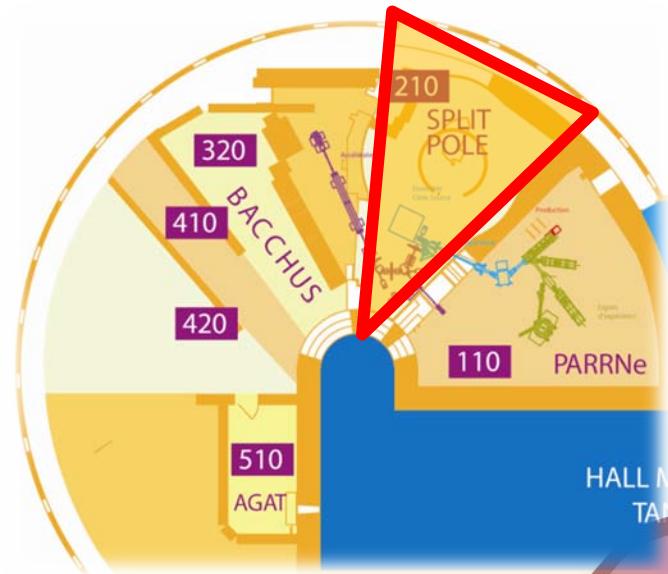
Abstract:

The basic idea we are putting forward is to use deep-inelastic or quasi-fission reaction mechanism in order to produce neutron-rich secondary beams using high intensity stable beams from LINAG and high power rotating target. The secondary beams will be separated from the primary stable beam and selected in flight using the first half of S3. Secondary reactions will be subsequently induced at the mid-point focal plan of the S3 spectrometer in order to populate excited states in even more neutron rich nuclei and measure their gamma-decay using combined EXOGAM2 and PARIS arrays. The final products, for which gamma spectroscopy will be performed, are going to have one or two neutrons more than the secondary beam nuclei – they will be identified in the second half of the S3 spectrometer.

The experiment will be using a 10 MeV/u ^{48}Ca beam from LINAG. The primary target will be a 1 mg/cm² foil of pure ^{238}U . As the secondary target we will plan to use 208Pb with thickness of 0.5 mg/cm². The total requested beam time is 3 days for S3 tuning and 7 days for data taking.

Gamma Spectroscopy with a 0 degree Spectrometer

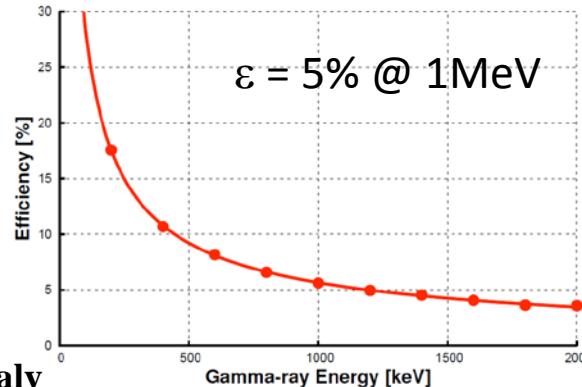
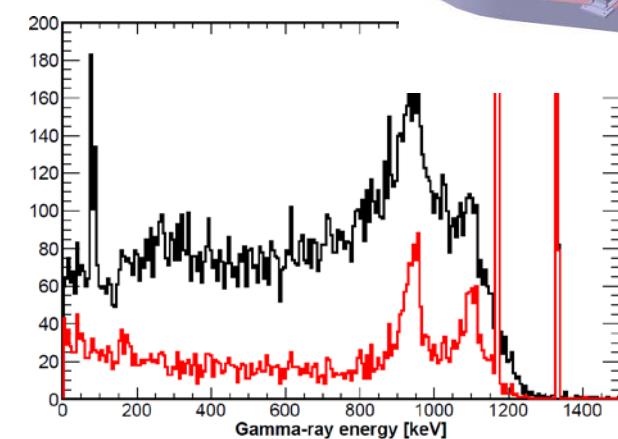
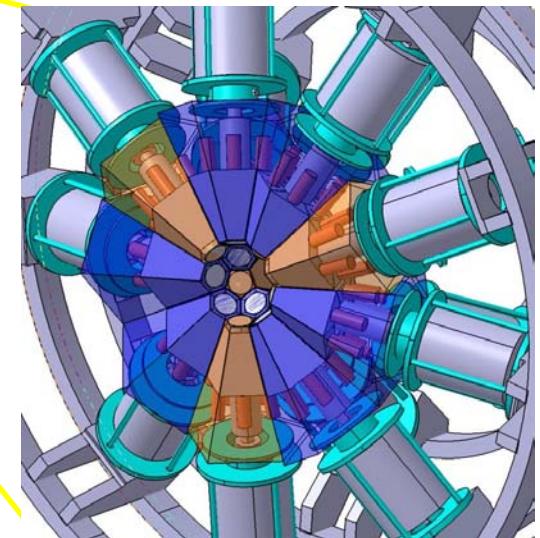
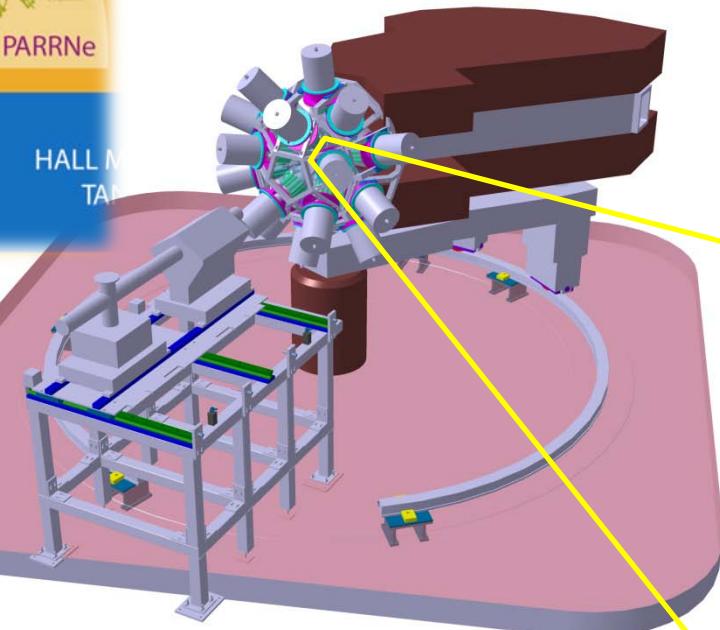
ORGAM2: "in beam" geometry



Split-Pole Spectrometer

Brho max: 1.65 Tm
Angular acceptance: 4 msr
E/DE~2000

Focal plane detection:
Horizontal position and DE



Gamma Detection:

Phase 1 Ge detectors

4 EXOGAM 1 Clovers : OSCAR

EUROBALL Cluster detectors

+

Charged Particle Detection:

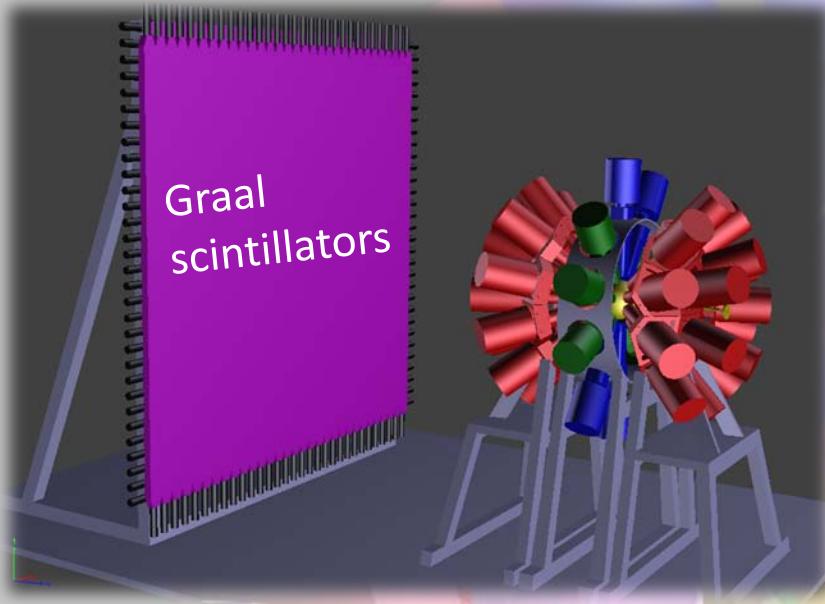
Cluster of the FAZIA demonstrator

+

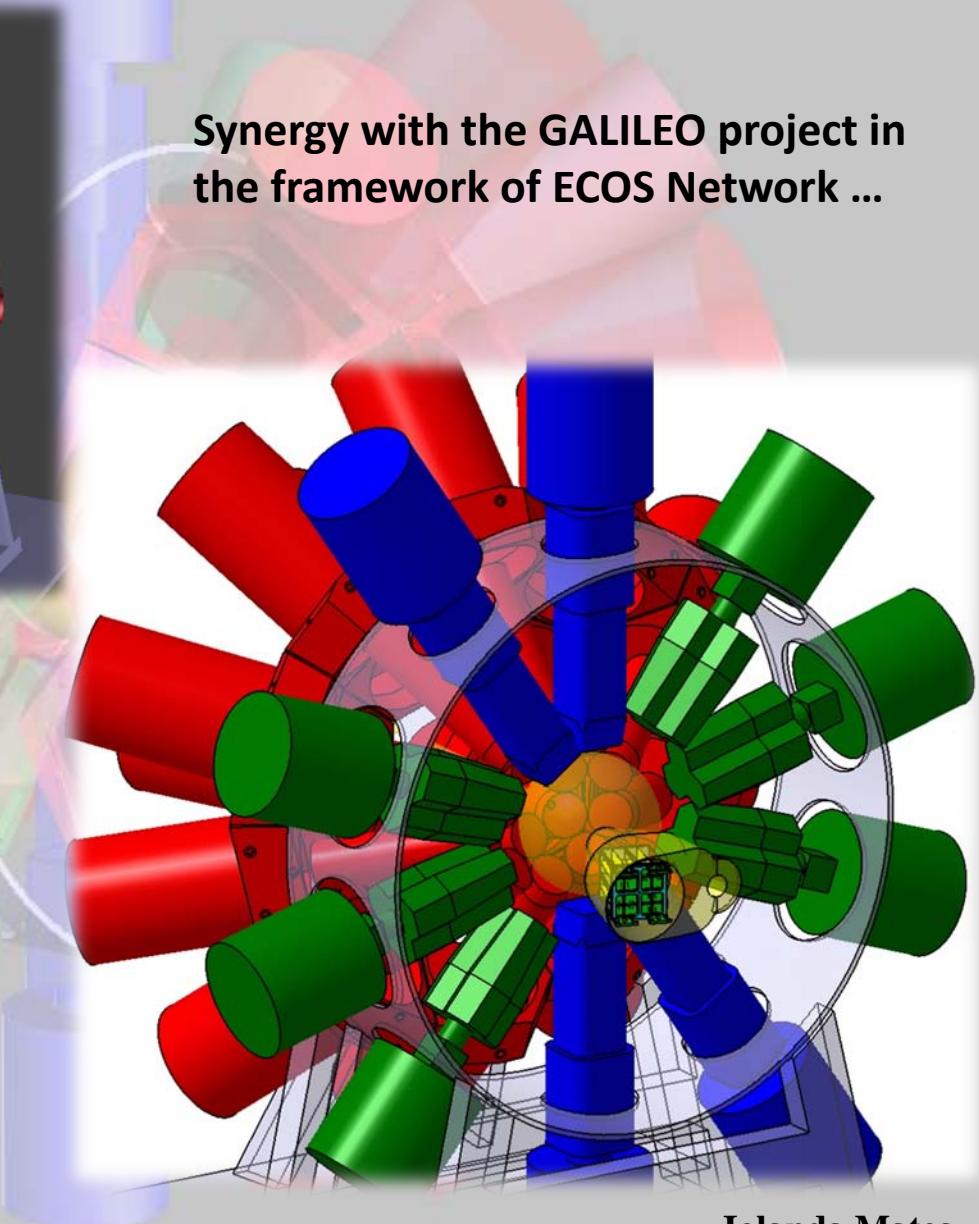
Neutron Detection:

Neutron Wall

Graal scintillators



Graal
scintillators



Synergy with the GALILEO project in
the framework of ECOS Network ...

Ongoing work on simulations ...



A faint background image of a particle detector, likely a calorimeter, composed of many cylindrical and rectangular lead bricks of various colors (pink, purple, blue, green) arranged in a complex, overlapping pattern.

Thank you!