

News from the IN2P3/STFC French-UK Gamma-ray Loan Pool (=GLP)

Last presentation about GLP activities in:

Workshop for the European Gamma-ray Spectroscopy Network - Padova, May 10-11, 2007

ADDENDUM TO THE FRENCH/UK (IN2P3/EPSRC) GENERAL AGREEMENT IN NUCLEAR PHYSICS (April 1997)

This addendum defines the mechanisms for the management and maintenance of EUROGAM resources which can be divided into items committed to the EUROBALL project and items which are available for the exploitation by other parties within the framework of the original UK/France collaboration.

The Loan Pool
Management
committee (LMC)

Curien Dominique IPHC (Vice-) Chairman
Freeman Sean Univ. Manchester (Vice-) Chairman
Korichi Amel CSNSM
Nolan Paul Univ. Liverpool
Simpson John Daresbury Lab.
Verney David IPN Orsay (homebase)
Wadsworth Robert Univ. York

The LMC will assign these resources to experimental collaborations with a strong UK and/or French-led participation, based on the scientific merits of the requests. In the case of a

A N N E X E 2

GLP RESSOURCES

1. - Ge tapered detectors (23 units)

- 11 units coming from EUROGAM phase 2

GUOC4, GUOC7, GUOC9, GUOC10, GUOC11, GUOC15, GFOC20, GFOC23, GFOC24, GFOC27, GUOC29.

- 10 units coming from EUROGAM phase 1

GFIC37, GFIC38, GFIC39, GFIC40, GFIC41, GFIC42, GFIC44, GFIC45, GFIC47, GFIC48

- 2 units from Château de Cristal

GV1 and GV13

2. - 15 BGO tapered Ge shield (15 units)

STR-DAR 90-02, 90-03, 90-05, 90-07, 90-08, 90-09, 90-11

LIV-DAR 90-01, 90-02, 90-04, 90-07, 90-08, 90-09, 90-10, 90-11

Notable events in the GLP's last 5 years and loans

2007
2008
2009
2010
2011
2012

Workshop for the European Gamma-ray Spectroscopy Network - Padova, May 10-11, 2007

Ge Lab transferred



Orsay: new home base for the GLP resources

end of the JUROGAM1 campaign

short-term loans small numbers of detectors	short-term loans large numbers of detectors	long-term loans large numbers of detectors
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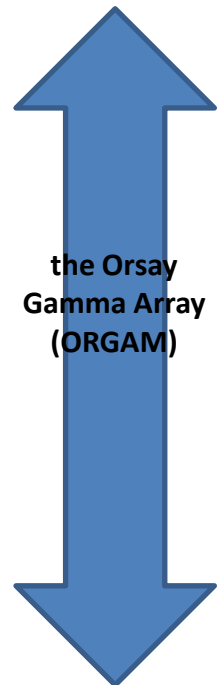
GABRIELA@VASSILISSA
Dubna



TRIUMF
Vancouver



RCNP Osaka



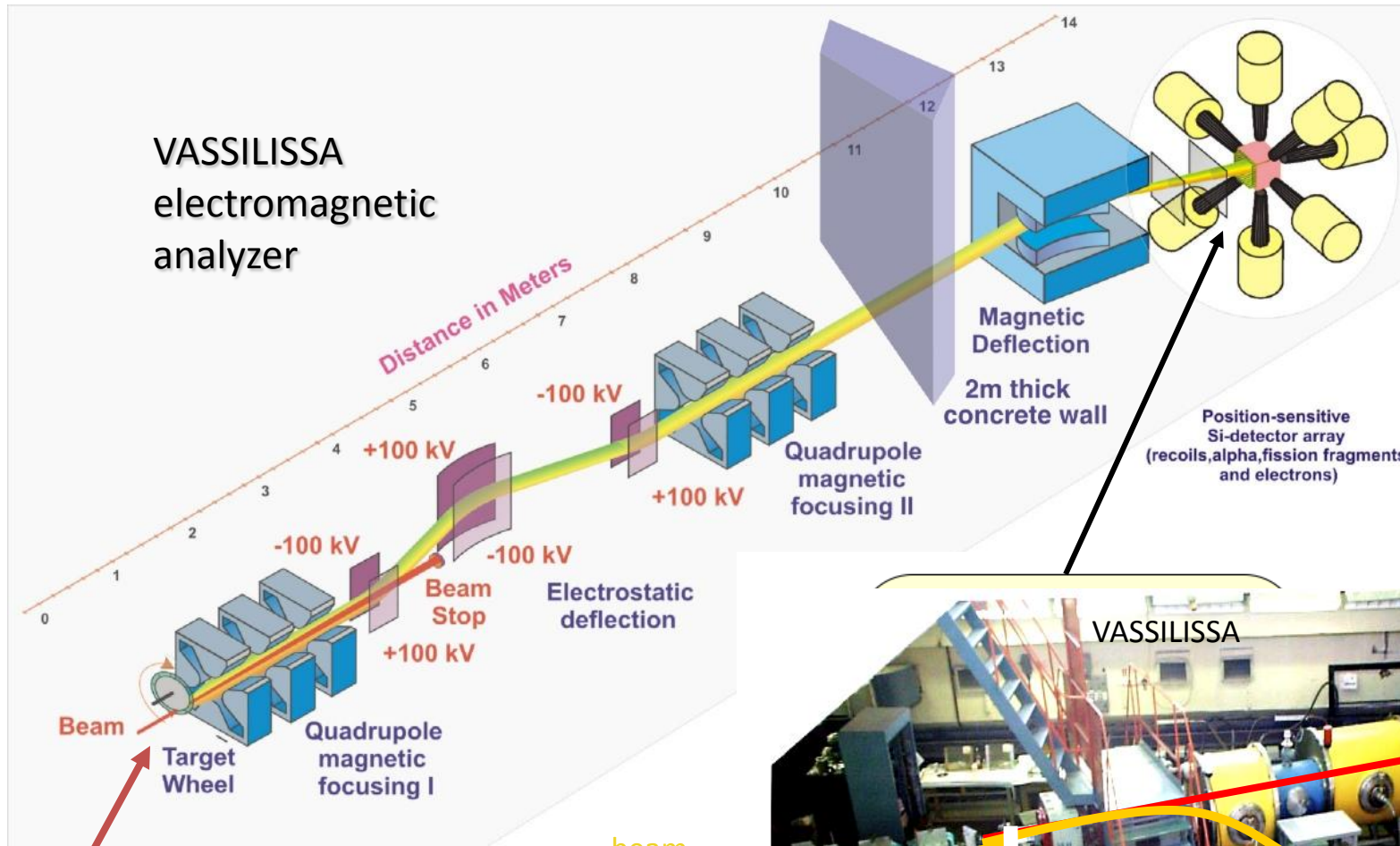
a few selected highlights

Gamma **A**lpha **B**eta **R**ecoil **I**nvestigations **E**lectromagnetic **A**nalyser

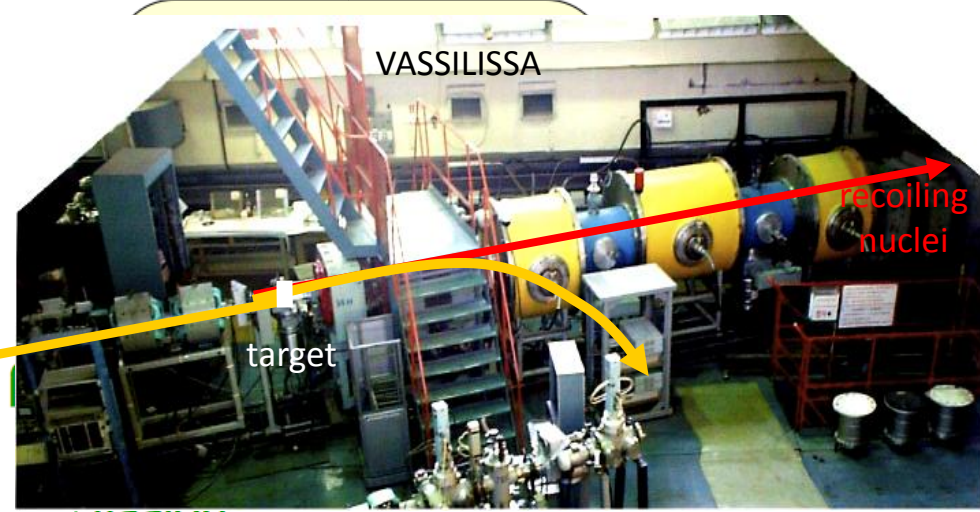
coll. Dubna, CSNSM Orsay and IPHC Strasbourg

Gamma spectroscopy towards super heavy nuclei at the FLNR

Collaboration JINR (FLNR) - IN2P3 (CSNSM-IPHC)



-intense beams
-stable & radioactive targets



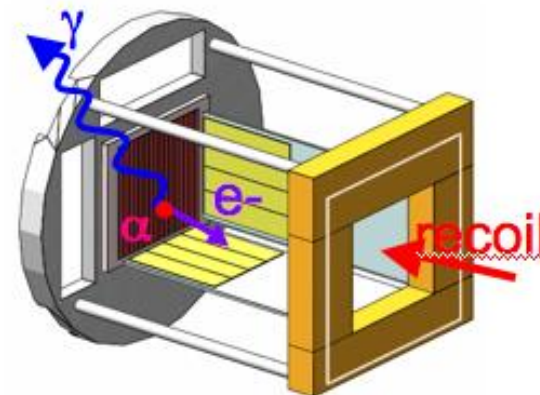
Z-2,A-4

G A B R I E L A

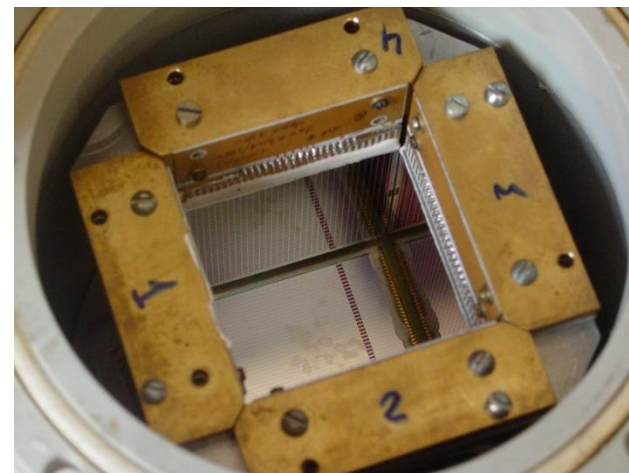
Gamma Alpha Beta Recoil Investigations Electromagnetic Analyser

<http://www.csns.in2p3.fr/-GABRIELA->

K. Hauschild et al., Nucl. Instr. Meth. A 560 (2006) 388

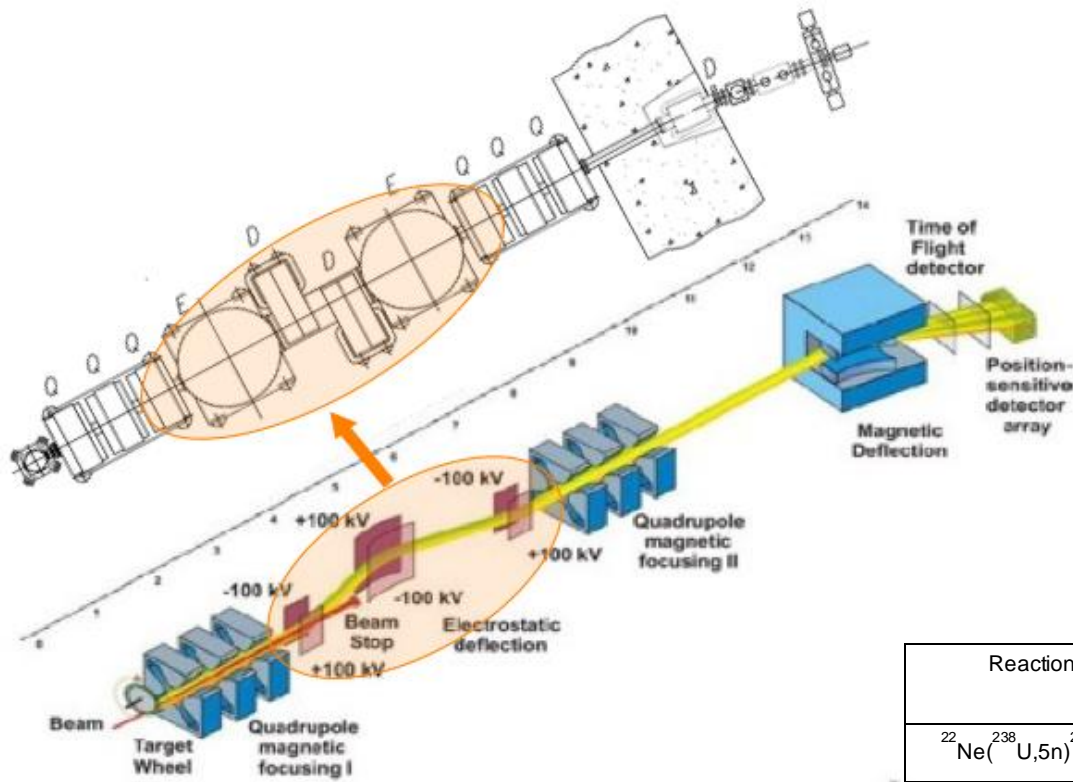


$\epsilon_{\gamma}(100 \text{ keV})=17\%$
 $\epsilon_e(100-400 \text{ keV})= 19\%$



- 1st tests with beam: spring 2004
- 1st campaign: fall 2004
- 4 campaigns in 2005,2006,2008 et 2009
- constant improvements to the setup (chamber, detectors & electronics)

Separator for Heavy Element Spectroscopy



- Commissioning end 2012-early 2013

- Physics campaign with new GABRIELA and modernized separator mid 2013

Reaction	$E_{p/2}$ MeV	Target thickness ² mg/cm ²	Transmission
$^{22}\text{Ne}(^{238}\text{U},5n)^{255}\text{No}$	115	$\text{U}_3\text{O}_8 \checkmark 0.2$	0.09
$^{22}\text{Ne}(^{238}\text{U},5n)^{255}\text{No}$	115	Met $\checkmark 0.2$	0.12
$^{22}\text{Ne}(^{197}\text{Au},5n)^{214}\text{Ac}$	110	Met $\checkmark 0.2$	0.14
$^{40}\text{Ar}(^{181}\text{Ta},4n)^{217}\text{Pa}$	182	Met $\checkmark 0.3$	0.28
$^{40}\text{Ar}(^{162}\text{Dy},7n)^{195}\text{Po}$	198	$\text{DyO}_2 \checkmark 0.3$	0.28
$^{48}\text{Ca}(^{174}\text{Yb},4n)^{218}\text{Th}$	200	$\text{YbO}_2 \checkmark 0.35$	0.48
$^{48}\text{Ca}(^{208}\text{Pb},2n)^{254}\text{No}$	216	Met $\checkmark 0.4$	0.42

« old »
Transmission

0.015

0.02

0.25

a few selected highlights

exp. at RCNP Osaka

Study of metastable states in nuclei around the $N=82$ closed shell

C. Petrache (IPN / CSNSM Orsay)
Collaboration Orsay, Lyon, Strasbourg, Osaka

Some preliminary results

Ge γ -ray array

Spherical chamber was constructed and 12 Ge detectors were placed around to increase the detection efficiency.

136 mm diameter spherical chamber to place the Ge detector as close as possible to the target.



Large Ge detectors (70%) - 12 Units

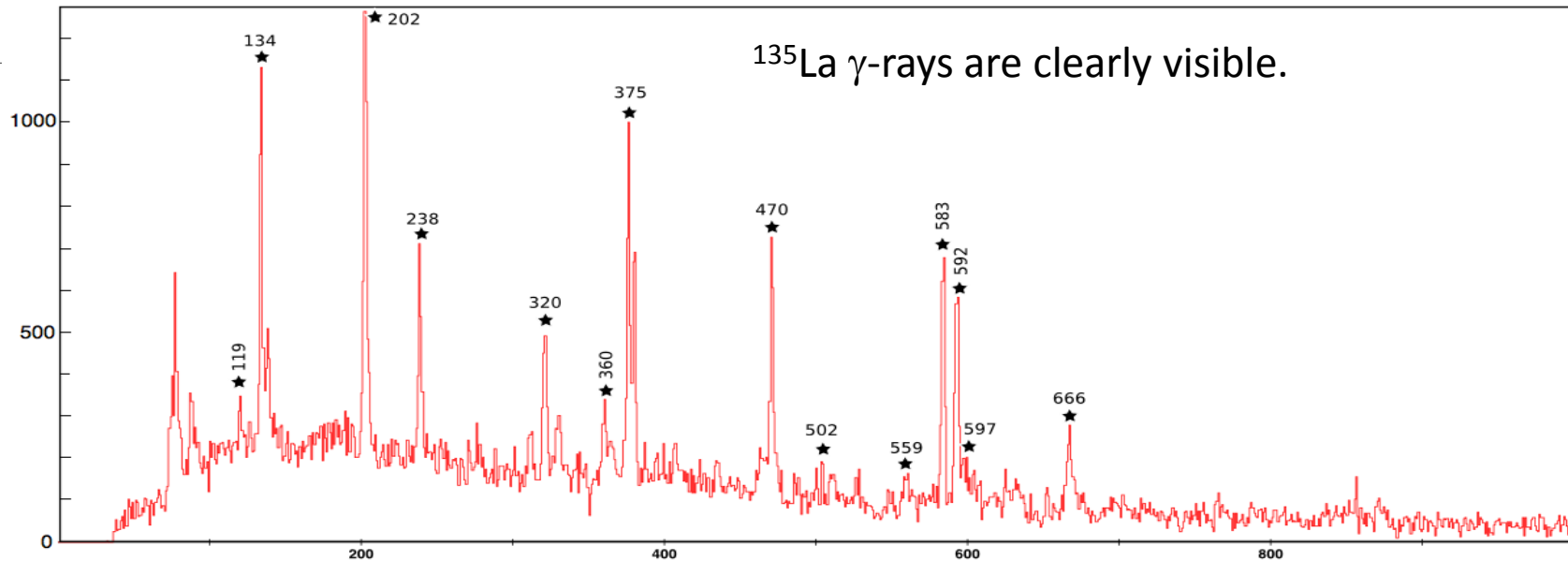
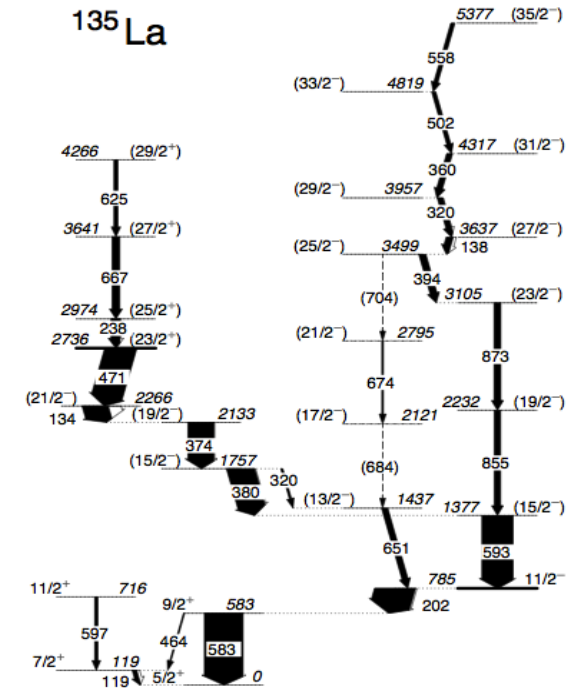
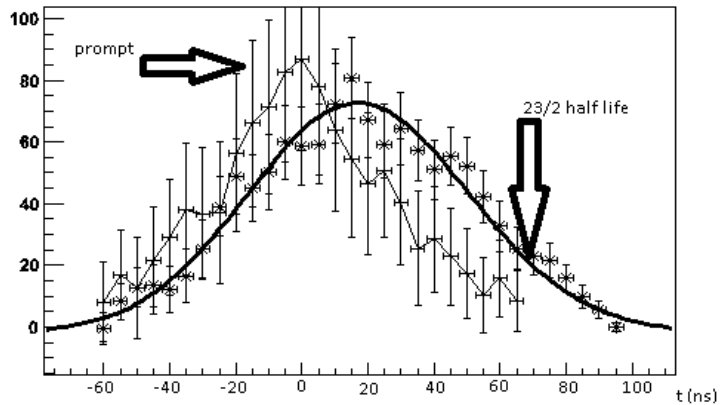
BGO - 8 detectors

Total detection efficiency
3%@1.4MeV

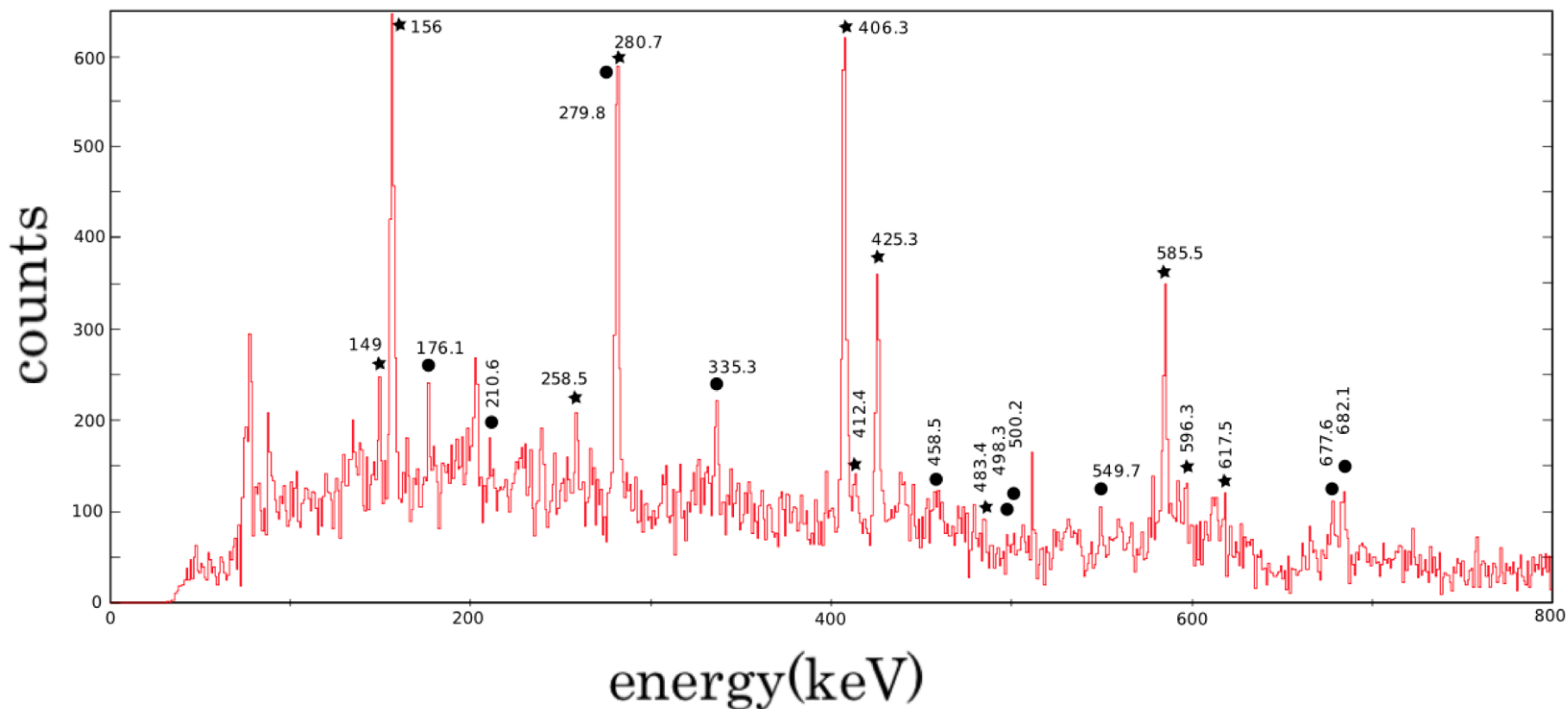
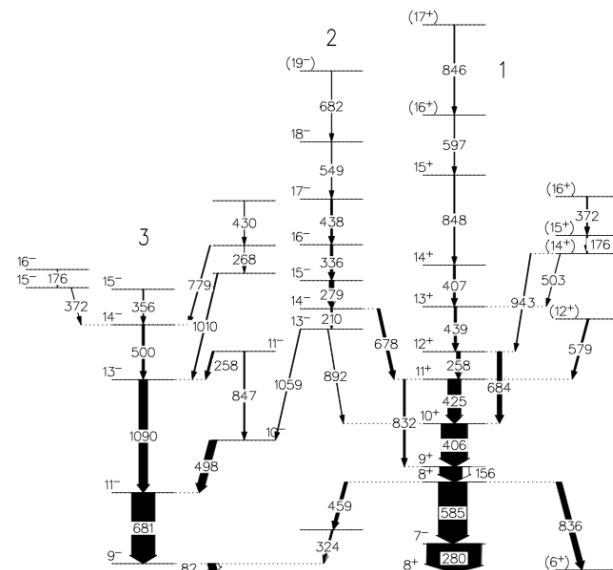
^{135}La

Lifetime of the $23/2^-$ state: 24(10) ns

Lifetime of the $11/2^-$ state: < 10 ns



^{136}La



a few selected highlights

exp. at TRIUMF

Structure of ^{30}Mg studied by using
beta-delayed decay of **spin-polarized** $^{30}\text{Na II}$

T. Shimoda

Department of Physics, Osaka University

in collaboration with KEK, TRIUMF, Univ. Paris and IPN Orsay

a new method to investigate exotic nuclear structure

structure of neutron-rich nuclei
in the vicinity of **island of inversion**

^{28}Mg , ^{29}Mg , ^{30}Mg

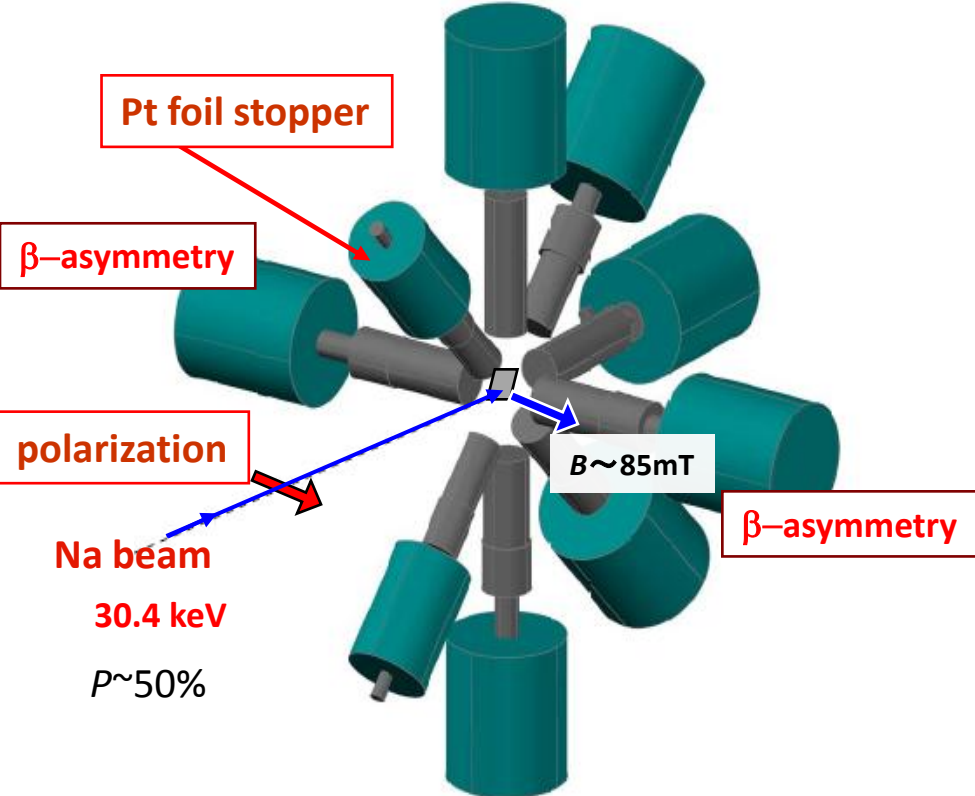
shell evolution as a function of neutron number

28,29,30,31,32Na decay at TRIUMF

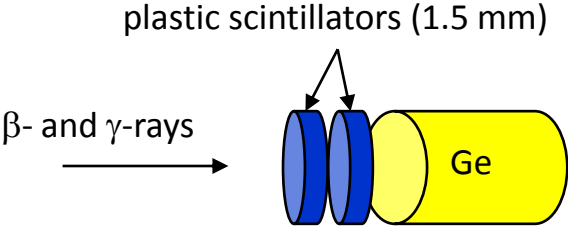
9 HPGe detectors + plastic scintillator telescopes

β -asymmetry: β - γ , β - γ - γ , γ - γ

total efficiency
2.5% @1333keV



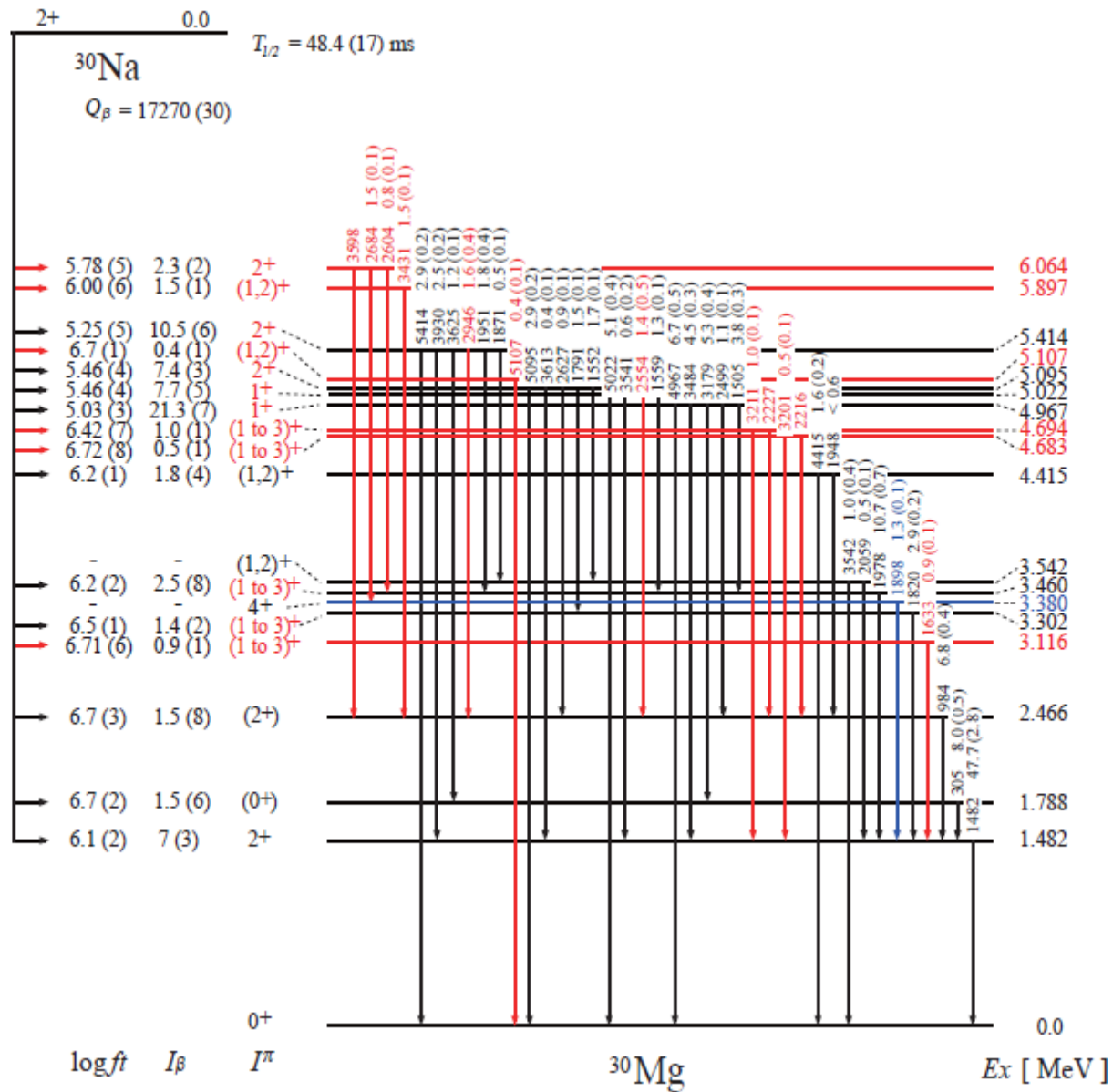
*28Na and 29Na in Nov. 2007
30Na in Aug. 2010*



β energy threshold: eliminates Al contaminants from trigger
 β energy : assigns β -decay branch

Revised Decay Scheme of ^{30}Na and New Levels in ^{30}Mg

Red: newly found
Blue: previously reported in 14C(18O,2p) exp.,
 and newly found in b-decay in this work



13 γ rays & 7 energy levels
Spins & parities of 11 levels

TRIUMF Experiment S1114

K. Tajiri, K. Kura, Y. Hirayama^A, T. Shimoda, T. Fukuchi, N. Hamatani, T. Hori, N. Imai^A, K.P. Jackson^B, M. Kazato, R. Legillon^C, C.D.P. Levy^B, T. Masue, H. Miyake^A, H. Nishibata, A. Odahara, M. Pearson^B, C. Petrache^C, M. Suga, T. Suzuki, A. Takashima,

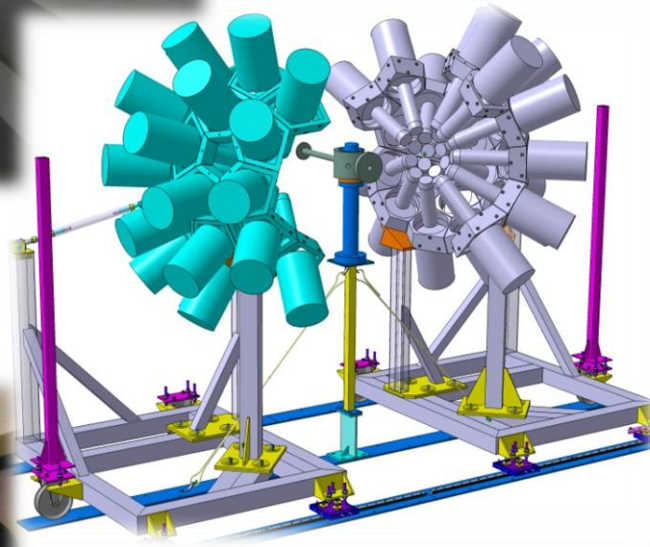
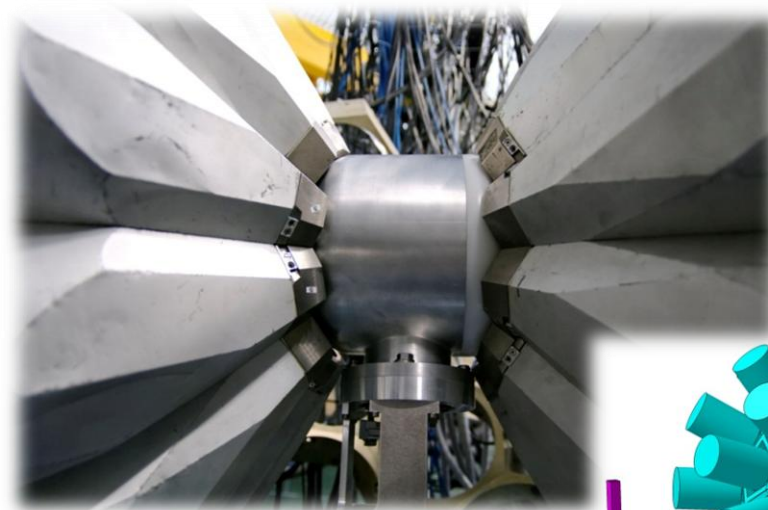
Osaka Univ., KEK^A, TRIUMF^B, Univ. Paris and IPN Orsay^C

Aug. 2010



a few selected highlights

the 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	Published

The Orsay Universal Plunger System (The Oups)

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

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

0 to 20 mm distance target-degrader

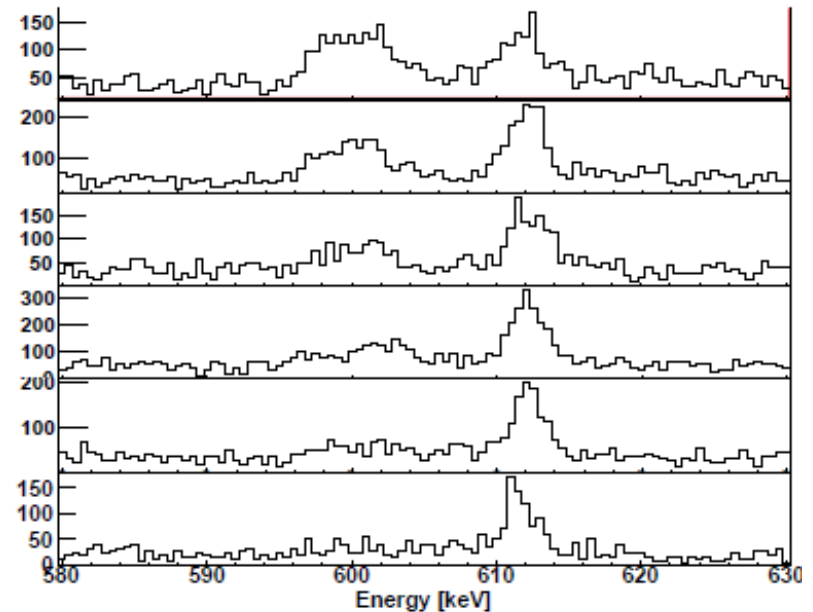
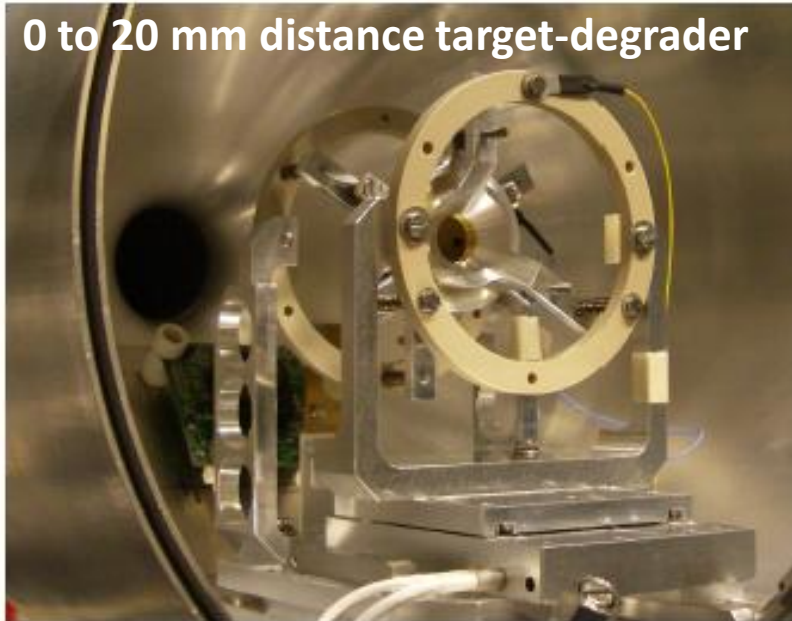
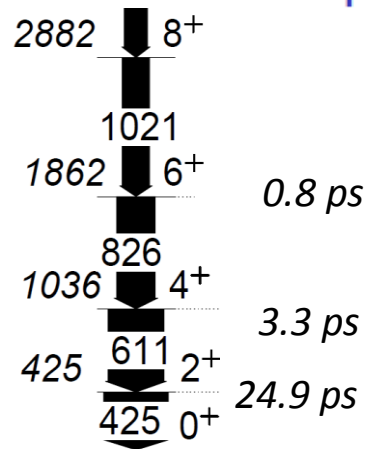


Figure: $4_1^+ \rightarrow 2_1^+$ gate on shifted $6_1^+ \rightarrow 4_1^+$



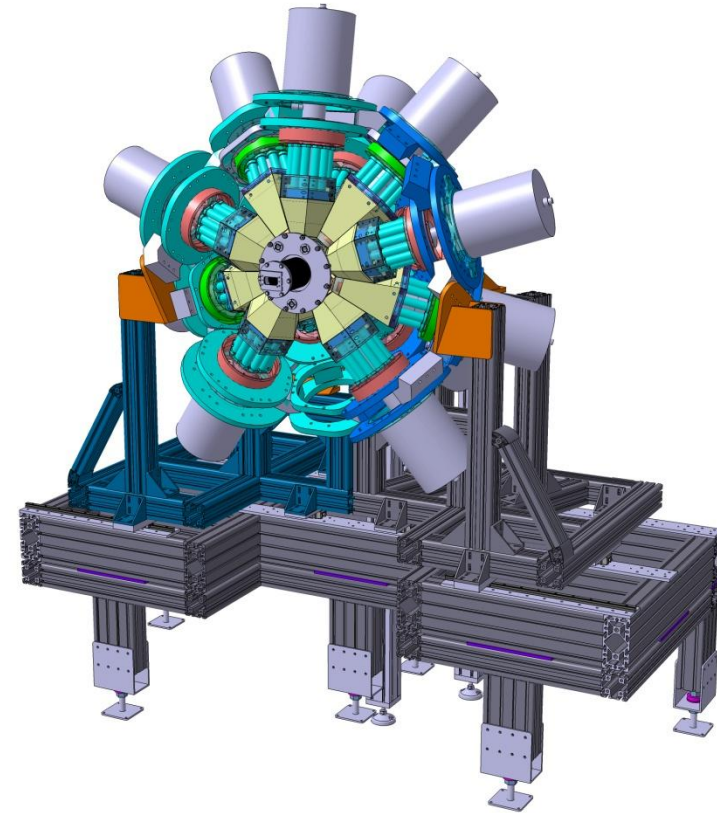
Courtesy of J. Ljungvall

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

ORGAM2

**Truncated Icosahedron Geometry
15 Ge Phase 1 + 15 new BGOs**



New BGOs

Stopped Beams

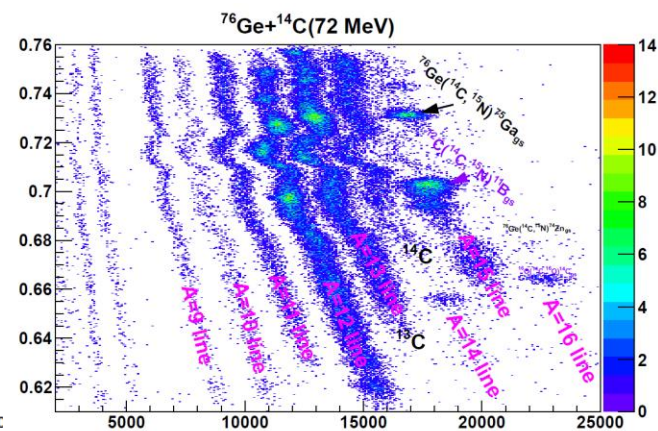
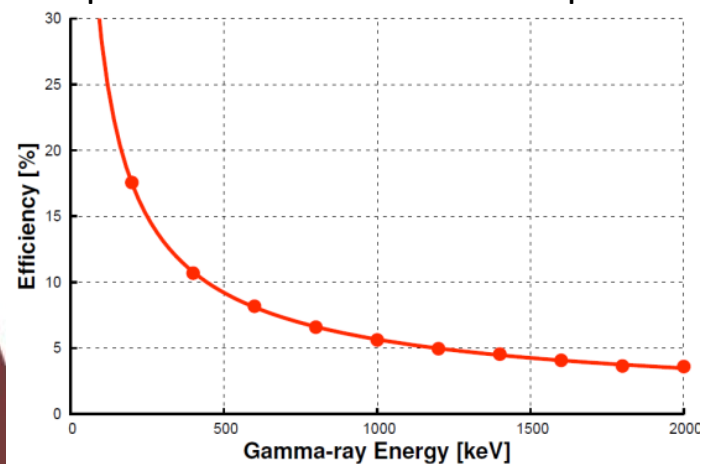
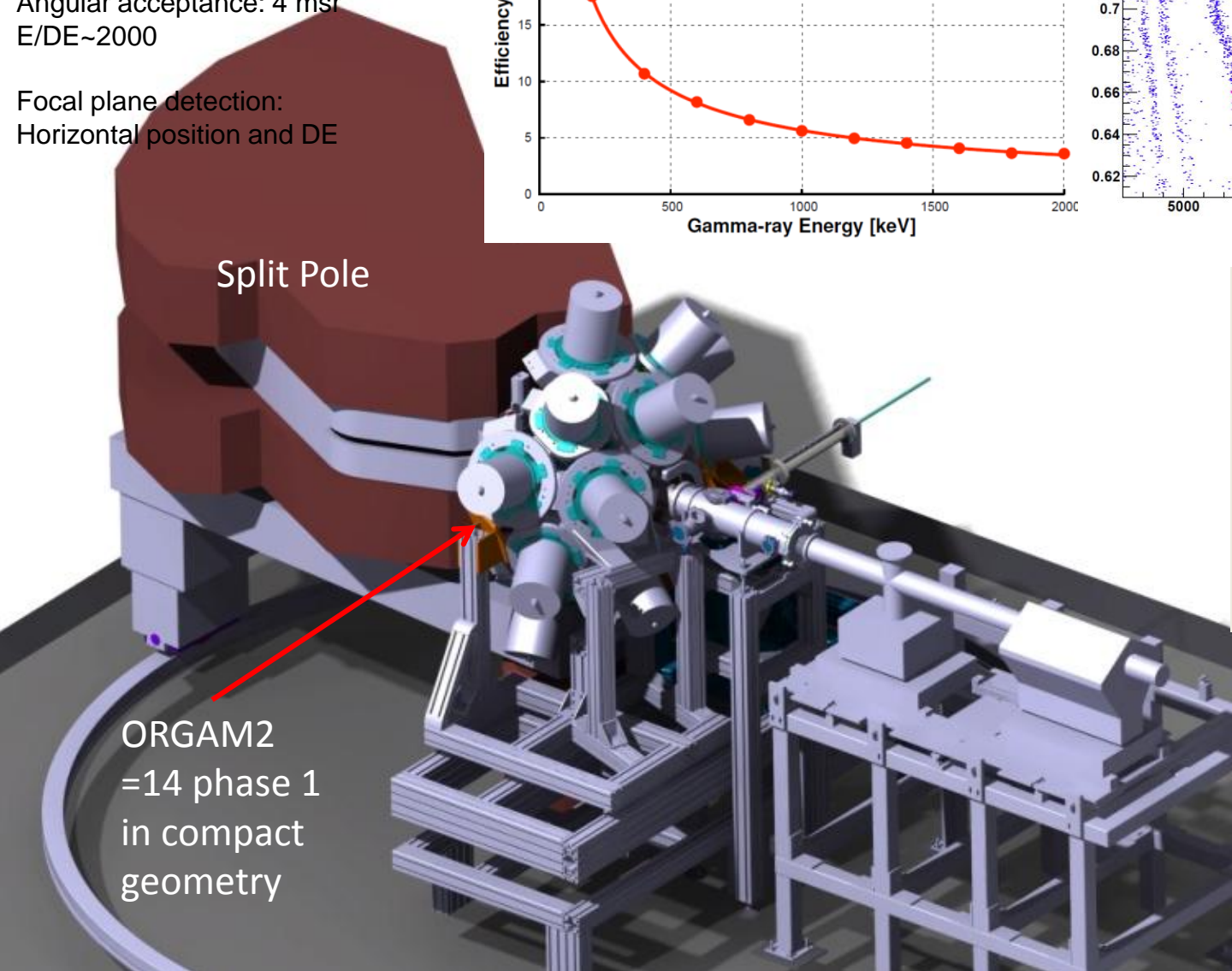
"In beam"

coupling ORGAM2 to the Split Pole spectrometer for HI beam experiments

Split-Pole Spectrometer

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

Focal plane detection:
Horizontal position and DE



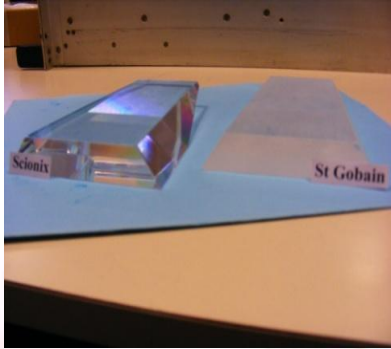
first heavy-ion experiment with split-pole : last month (successful) $^{76}\text{Ge}(^{14}\text{C},x)\gamma$

Natural physics case :

- astrophysics,
- search for 0^+ states,
- deep inelastic collisions and more...

ORGAM2
=14 phase 1
in compact
geometry

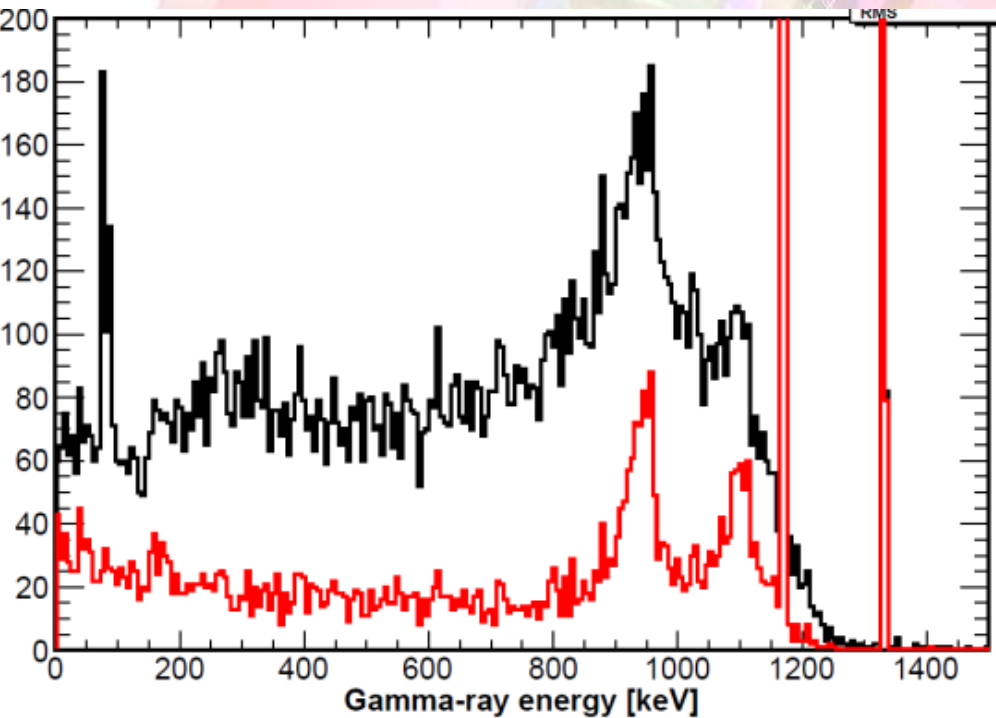
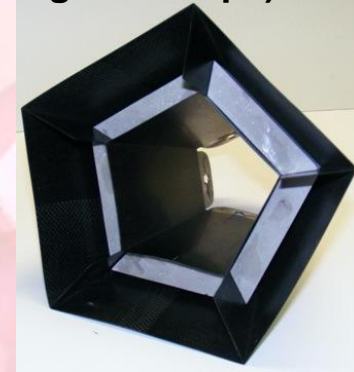
**Pentagonal shape:
5 BGO Crystals**



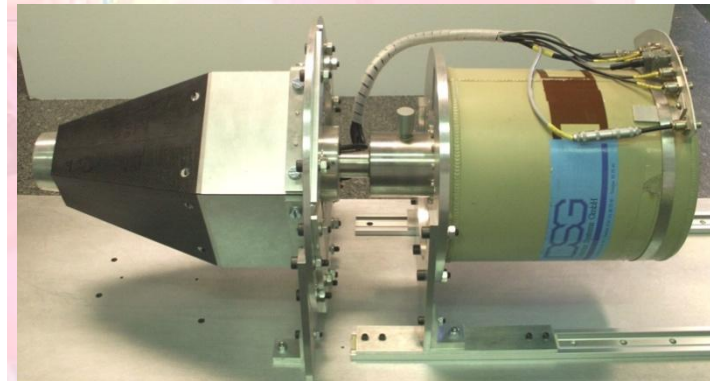
**VM2000 + 2 PM
Hamamatsu® R7899-01**



**BGO mounting in Carbon cells
(pentagonal shape)**

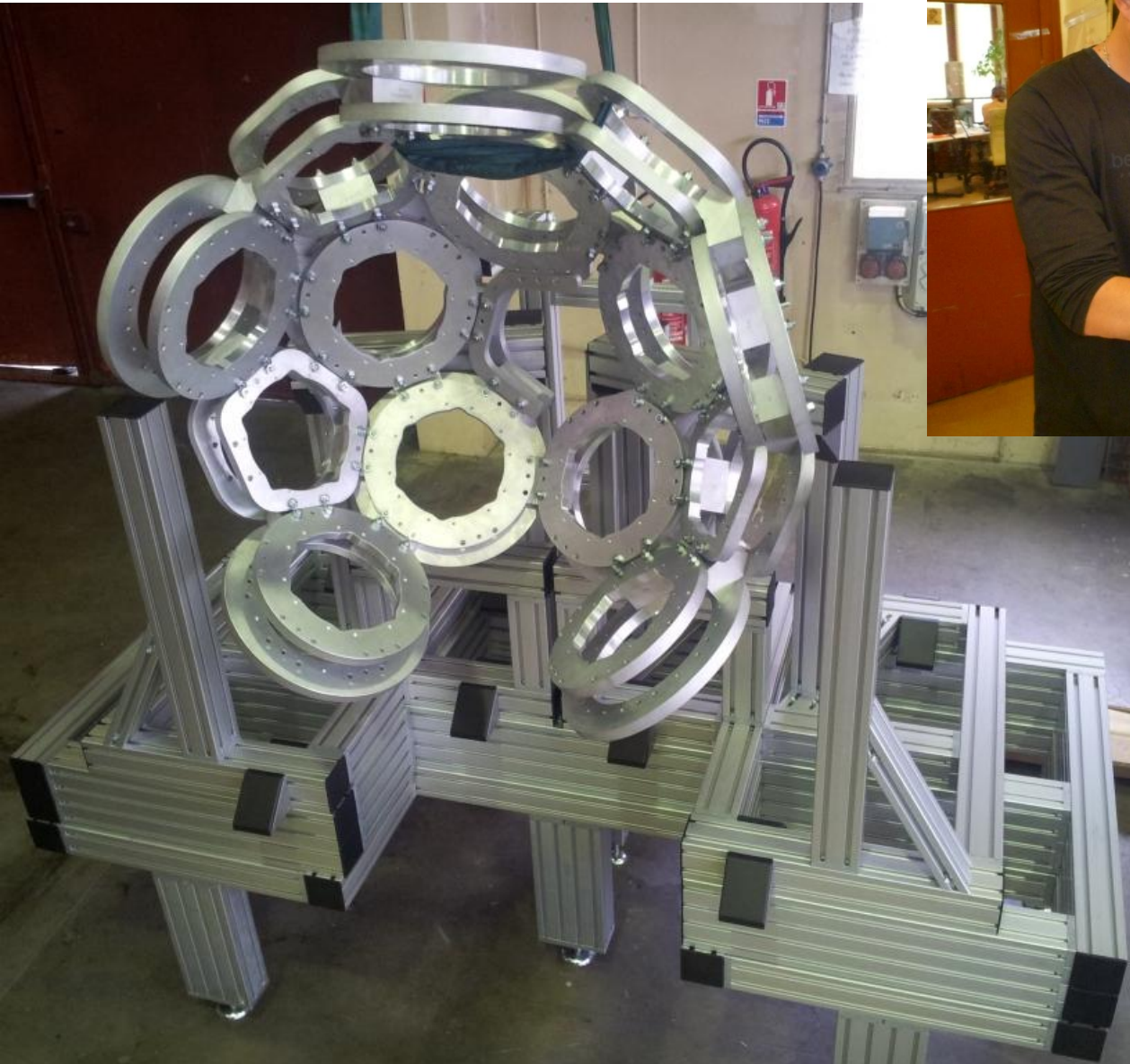


Ge + BGO shield



Prototype : ready

mechanical structure for the ORGAM2 array



will be installed in 2013

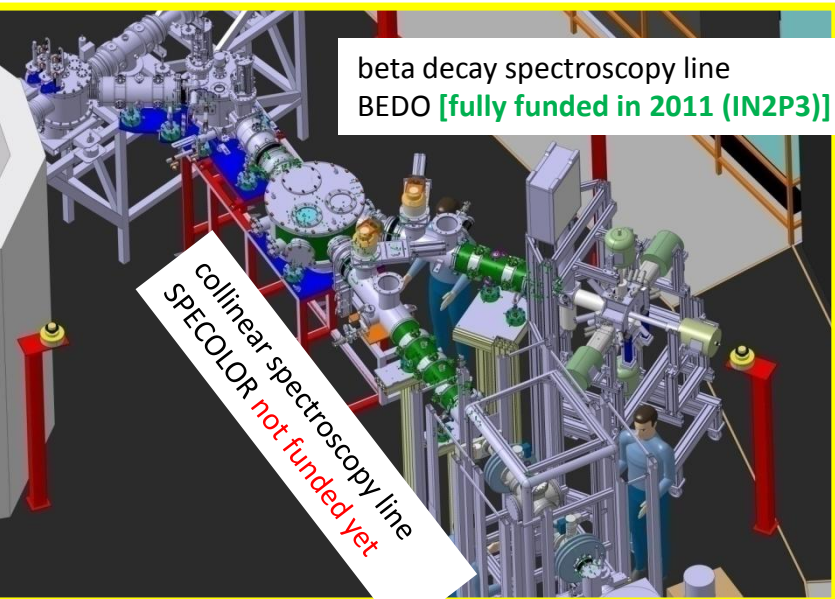
next ORGAM campaign oct.-Nov. 2012

Orsay-PAC-2012 approved experiments :

- ▶ **Search for X(5) symmetry ^{168}W nucleus (Spokesperson: K. Gladnishki)**
- ▶ **Development of the Time Dependent Recoil in Vacuum technique for “radioactive beam geometry” and measurement of the first 2+ state g-factor in ^{26}Mg (Spokesperson: G. Georgiev)**
- ▶ **Study of Superdeformed Shell Structure and Beyond in $A \sim 40$ Nuclei (Spokesperson: E. Ideguchi)**
- ▶ **Probing the boundary of shape coexistence south of $Z = 82$: lifetime measurements of excited states in ^{170}Os using the RDDS method (Spokesperson: J. Ljungvall)**
- ▶ **Toward the excitation and de-excitation of nuclear isomers in plasma (Spokesperson: F. Hannachi)**

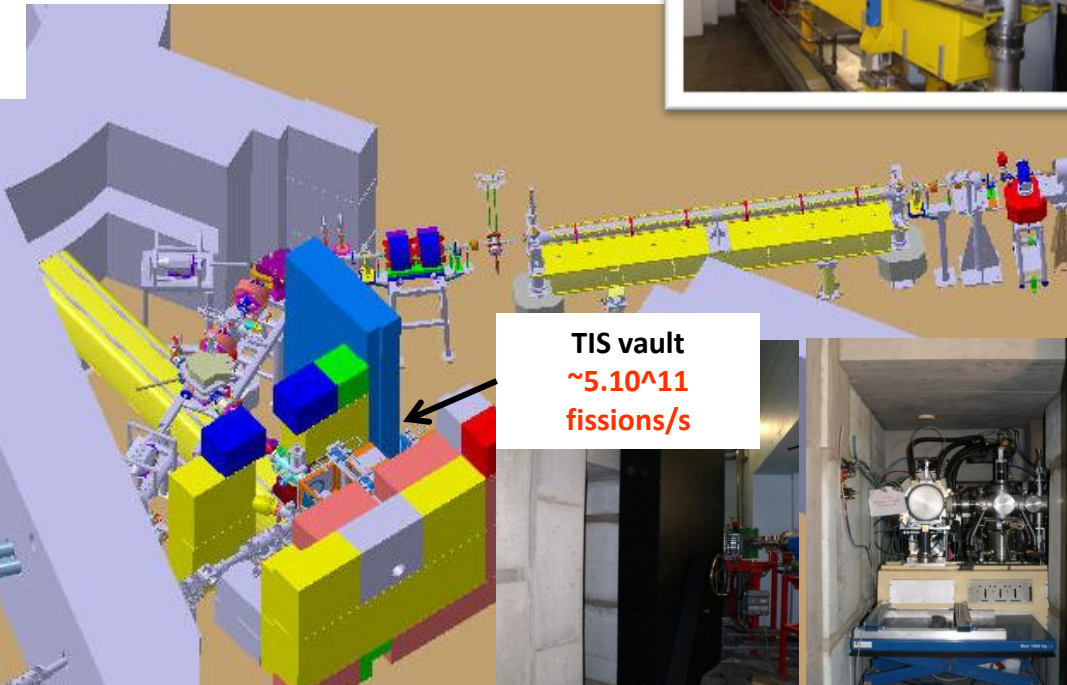
+ 1 backlog Spohr et al. (continuation)

e-LINAC
10 μ A
50MeV



beta decay spectroscopy line
BEDO [fully funded in 2011 (IN2P3)]

collinear spectroscopy line
SPECOLOR *not funded yet*

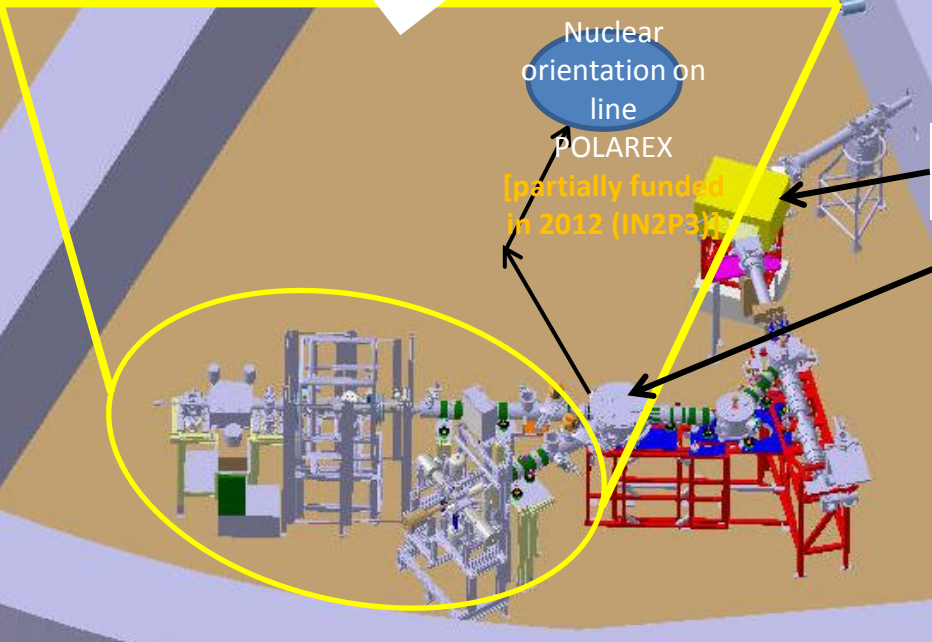


TIS vault
 $\sim 5 \cdot 10^{11}$
fissions/s

PARRne
mass separator

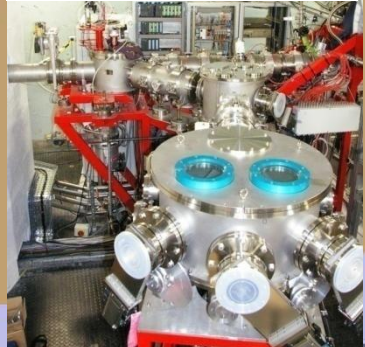


Target Ion-source ensemble



Nuclear
orientation on
line
POLAREX
[partially funded
in 2012 (IN2P3)]

kicker - bender



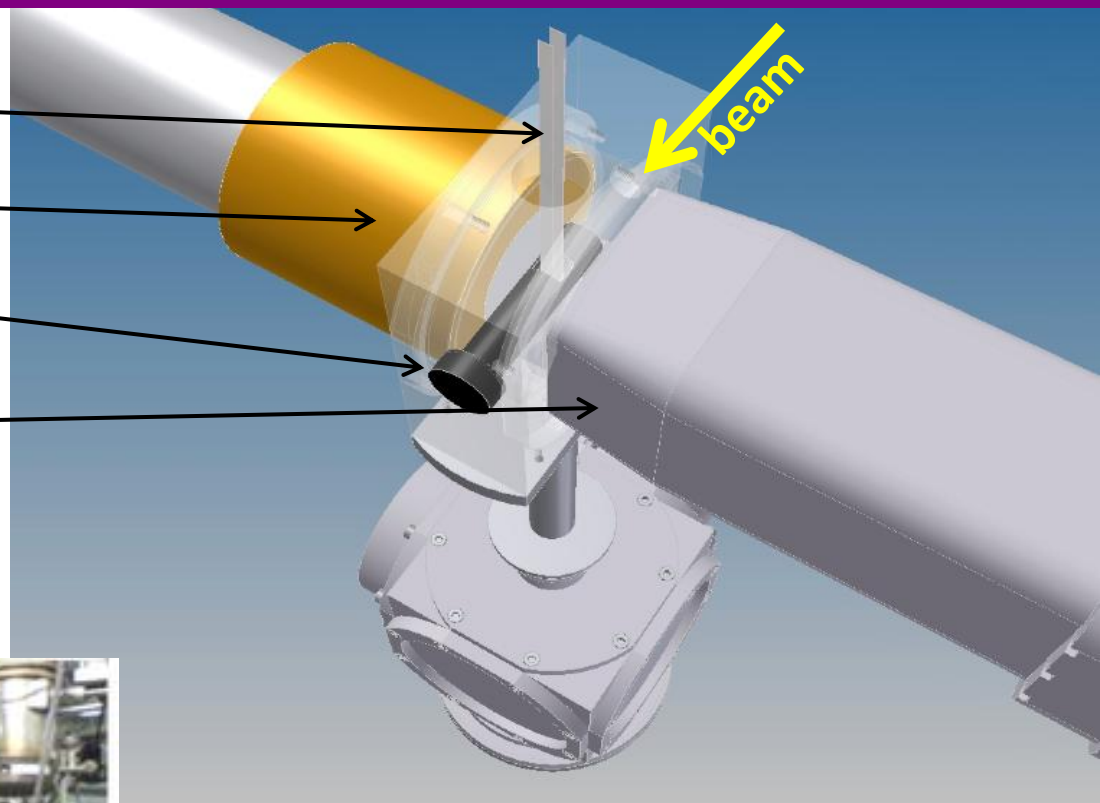
Detection setup for beta decay at PARRNe mass separator (ALTO)

Large volume Ge detector
(EUROGAM-1 French-UK
loan pool)

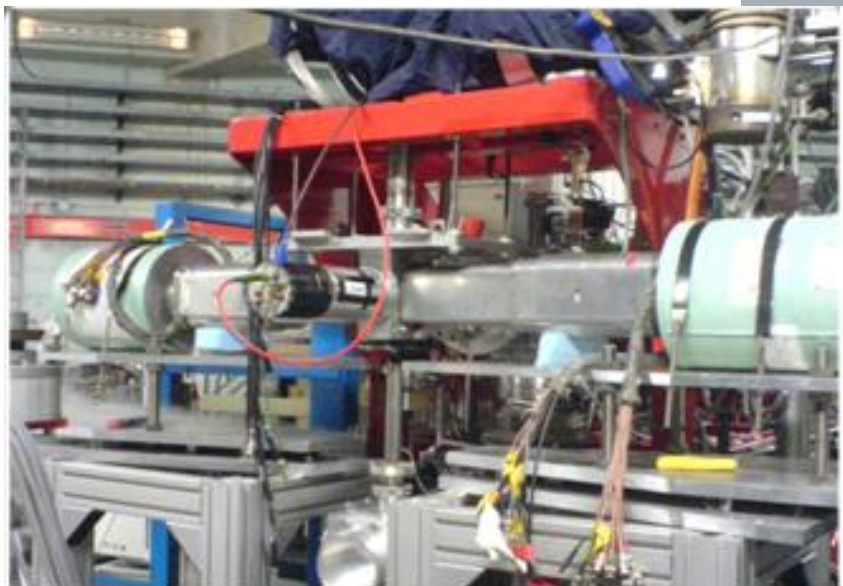
Mylar tape

plastic scintillator

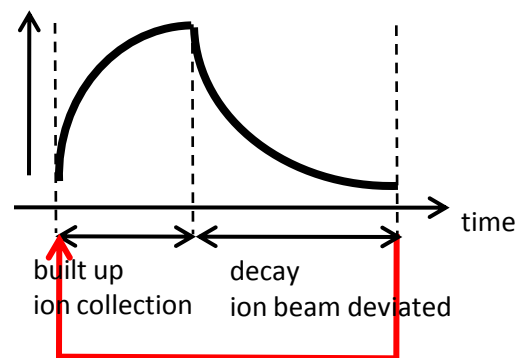
Ge CLOVER
(proto EXOGAM)



$\epsilon_{\text{total}}(\text{photo-pic } 1.3\text{MeV}) \sim 2\%$



T1/2 measurement: tape motion cycling
Triggerless DAQ 400ps resolution time stamping



The pool is run using two calls for requests. One in January for loans during the period July-Dec, and one in July for loans during the period January-June.

Any requests that are received outside of these bids will be discussed and accommodated subject to the availability of detectors.

- 1 continuation of the Orsay Gamma Array (OrGam) campaign : oct.-nov. 2012
- 2 request for 12 detectors to be sited at ILL for a period totalling 6-7 months from mid-September 2012.
→to be considered in 2013.
- 3 continuation of the GABRIELA campaign : spring 2013 ?