

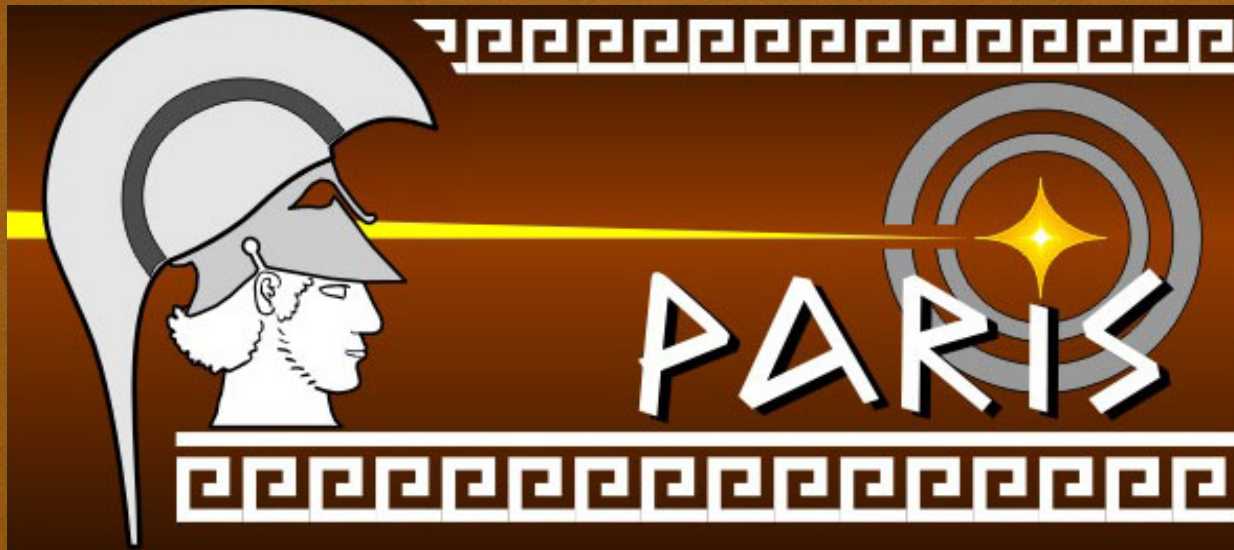


PARIS

PHOTON ARRAY FOR STUDIES WITH RADIOACTIVE ION AND STABLE BEAMS

PARIS@GANAS

Adam Maj



Aim of the PARIS collaboration:

**Design and build high efficiency detector
consisting of 2 shells (*or 1 phoswich shell*)
for medium resolution spectroscopy
and calorimetry of γ -rays in large energy range**

Main physics cases:

- Properties of exotic, hot and rotating nuclei studied by the GDR gamma-decay
- New excitation modes (PDR, GQR) in neutron- or proton rich nuclei
- Spectroscopy of nuclei far from stability
- Reaction mechanisms

Large collaboration (see paris.ifj.edu.pl) - ca. 140 people

1. THE PARIS - Collaboration

MAIN PARTNERS

COPIN (Poland)

IFJ PAN Kraków: M. Kmiecik, B. Fornal, J. Grębosz, A. Maj, W. Meczynski, K. Mazurek, S. Myalski, J. Styczen, M. Ziebliński, M. Ciemala, A. Czernak, B. Dulny, B. Sowicki, M. Krzysiek, M. Jastrząb; *Warsaw University*: M. Kicińska-Habior, J. Srebrny, M. Palacz, P. Napiorkowski, K. Hadynska-Klek; *IPJ Swierk, Otwock*: M. Moszynski; *UMCS Lublin*: K. Pomorski

IN2P3 (France)

IPN Orsay: F. Azalez, J.A. Scarpaci, S. Franchoo, I. Stefan, I. Matea, G. Hull, B. Genolini, J. Bettanem P. Rossier, J. Pouthas; *CSNSM Orsay*: G. Georgiev, R. Lozeva; *IPN Lyon*: O. Stezowski, N. Redon; *IPHC Strasbourg*: O. Dorvaux, S. Courtin, C. Beck, D. Curien, B. Gall, F. Haas, D. Lebherz, M. Rousseau, M.-D. Salsac, L. Stuttgé, J. Devin, Ch. Finck, P. Medina, J. Dudek; *LPSC Grenoble*: Gary Simpson

GANIL (France)

GANIL Caen (France): Ch. Schmitt, J.P. Wieleczko, S. Grevy, A. Chbihi, G. Verde, J. Frankland, M. Ploszajczak, A. Navin, G. De France, M. Lewitowicz, M. Tripon; *LPC-ENSI Caen*: O. Lopez, E. Vient

BARC/TIFR/VECC (India)

BARC Mumbai: D.R. Chakrabarty, V.M. Datar, S. Kumar, E.T. Mirgule, A. Mitra, P.C. Rout; *TIFR Mumbai*: I. Mazumdar, V. Nanal, R.G. Pillay, A.K. Gourishetty; *VECC Kolkata*: S.R. Banerjee, S. Mukhopadhyay, D. Pandit, S. Pal

INFN (Italy)

INFN Milano: S. Brambilla, F. Camera, S. Leoni, O. Wieland; *INFN-LNS, Catania*: D. Santonocito; *LNL Legnaro*: F. Gramegna, G. de Angelis, J.J. Valiente-Dobon; *INFN Napoli*: D. Pierroutsakou

University of York (UK)

D.G. Jenkins, M.A. Bentley, B.R. Fulton, R. Wadsworth, O. Roberts, P. Joshi

Romania

HH-INFN, Bucharest: F. Negoita, M. Stanoiu

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Bulgaria

INRNE, Bulgarian Academy of Sciences, Sofia: D. Balabanski; *University of Sofia*: S. Lalkovski, K. Gladnishki, P. Detistov

ASSOCIATED PARTNERS

ATOMKI Debrecen (Hungary): Z. Dombradi, D. Sohler, A. Krasznahorkay, G. Kalinka, J. Gal, J. Molnar

University of Surrey, Guildford (UK): Z. Podolyak, P.R. Regan, S. Pietri, P. Stevenson, W. Catford

COLLABORATING PARTNERS

STFC Daresbury (UK): J. Simpson, J. Strachan, A. Smith, M. Labiche

Nuclear Physics Group, The University of Manchester (UK): A. Smith

GSI Darmstadt (Germany): P. Bednarczyk, M. Górski, J. Gerl, H. Geissel

Flerov Laboratory of Nuclear Reactions, JINR, Dubna, Russia: Y.E. Piononzhkevich, A. Fornichev, S. Krupko, V. Gorshkov

RIKEN Tokyo (JP): P. Doornenbal

Institute of Nuclear Physics, NCSR "Demokritos", Athens (Greece): S. Harissopoulos, A. Lagoyannis, T. Konstantinopoulos

University of Edinburgh (UK): D. Watts

University of Oslo (Norway): S. Siem

DSM/Dapnia CEA Saclay (France): C. Simenel

NBI Copenhagen (Denmark): B. Herskind, G. Sletten

HMI Berlin (Germany): H.J. Krappe

LBNL, Berkeley, CA (US): M.-A. Deleplanque, F. Stephens, I.-Y. Lee, P. Fallon

iThemba LABS (RSA): R. Bark, P. Papka, Jakobus Lawrie

Uppsala University, Uppsala (Sweden): Henryk Mach

KVI, Groningen (The Netherlands): M. Haraakeh



PARIS Management board

A. Maj - project spokesman;

D.G. Jenkins, J.P. Wieleczko, J.A. Scarpaci - deputies

PARIS *Advisory* Committee

F. Azaiez (F) -chairman, D. Balabanski (BG), W. Catford (UK), D. Chakrabarty (India), Z. Dombradi (H), S. Courtin (F), J. Gerl (D), D. Jenkins (UK) - deputy chairman, S. Leoni (I), A. Maj (PL), I. Matea (F), Ch. Schmidt (F)

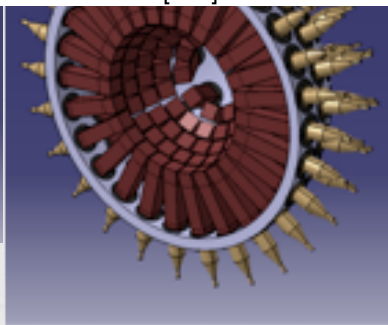
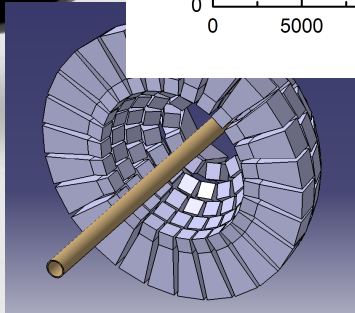
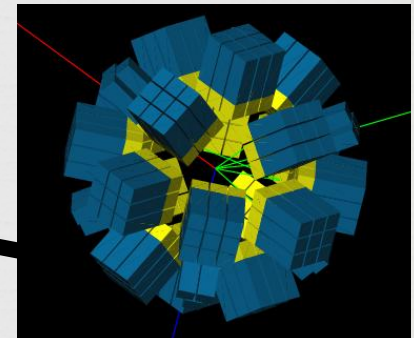
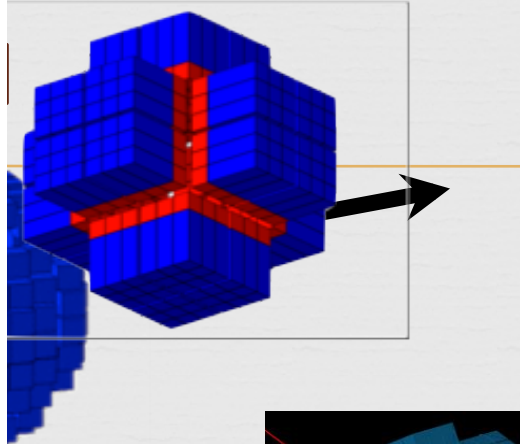
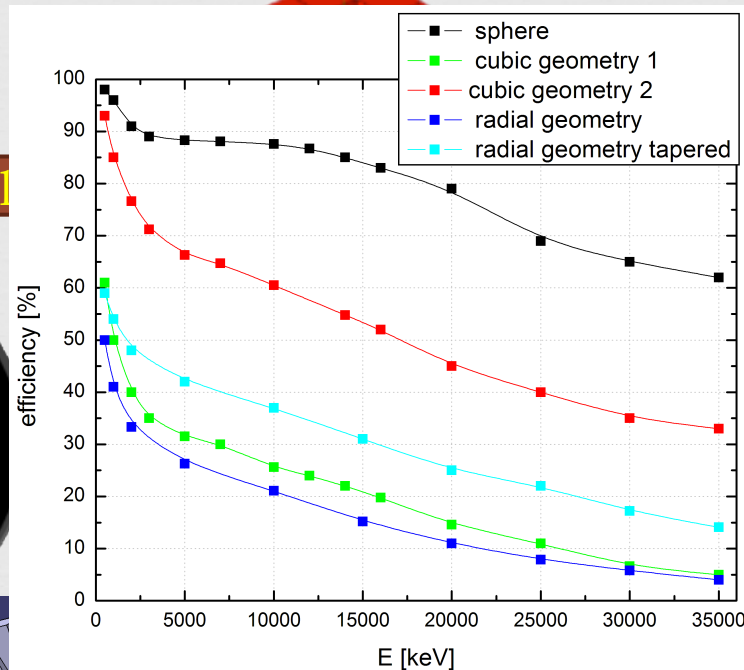
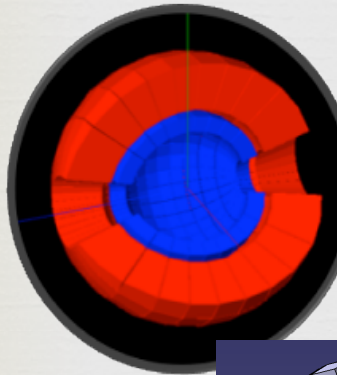
Active working groups

1. Simulations (O. Stezowski et al.)
2. PARIS mechanical design scenarios (S. Courtin, D. Jenkins et al.)
3. Physics cases and theory background (Ch. Schmitt et al.)
4. Detectors (O. Dorvaux et al.)
5. Electronics (P. Bednarczyk et al.)
6. PARIS-GASPARD synergy (J.A. Scarpaci et al.)

J. Pouthas – PARIS liaison to SPIRAL2 project management

Several geometries studied

'Ideal' - spherical



CONCLUSION:
PARIS made of clusters:
Cluster = 9 phoswiches
This allows cubic or semi-spherical geometry

Design: York, Daresbury, Strasbourg
Simulations: Lyon, Krakow,...

LaBr₃
2"x2"x2"

NaI
(2"x2"x6")

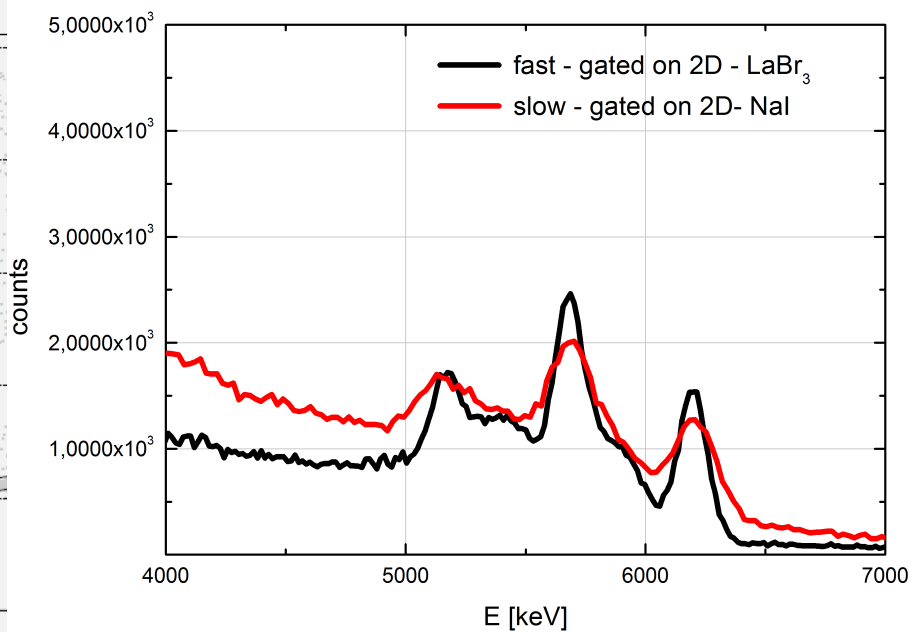
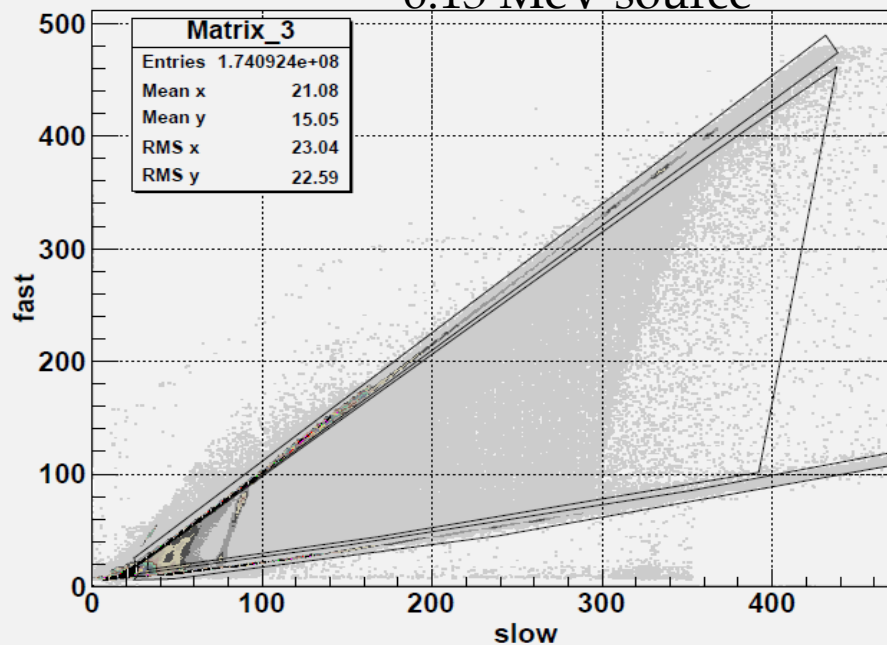
PMT

5 prototypes were delivered from Saint Gobain:
1 to Orsay, 1 to Strasbourg, 3 to Krakow



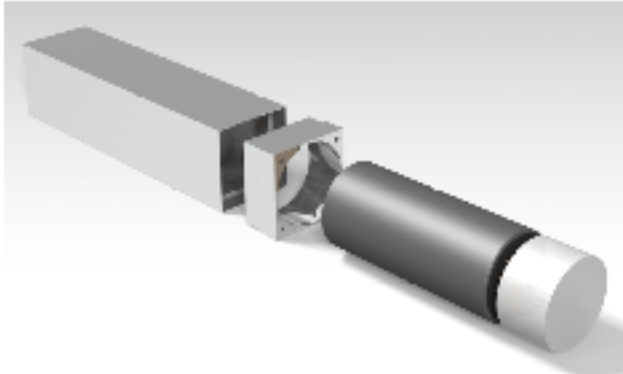
Matrix_3

6.13 MeV source



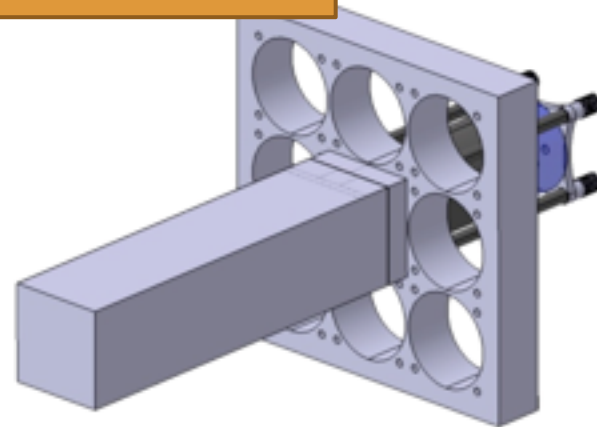
Constructing one cluster

a)

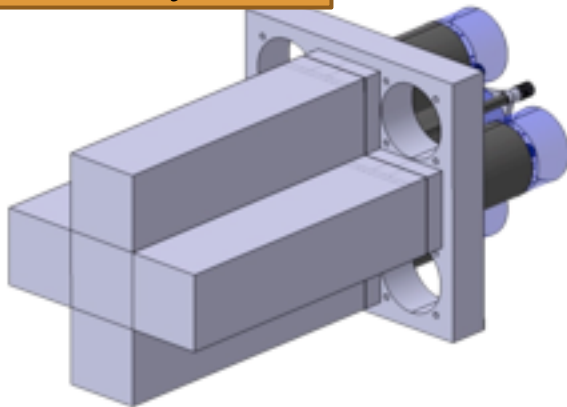


b)

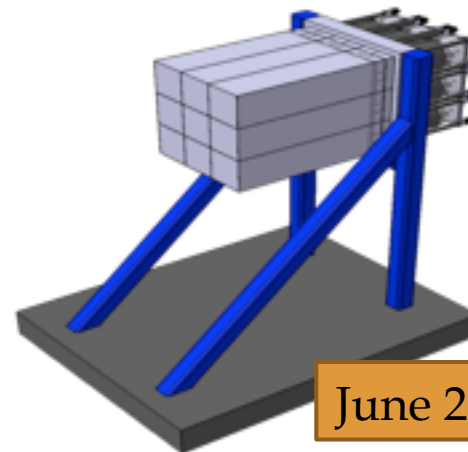
November 2011



February 2012



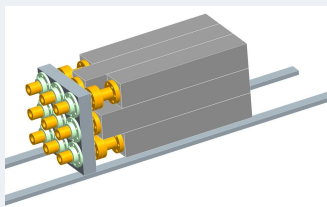
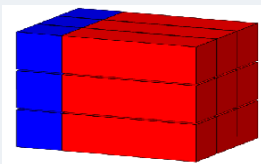
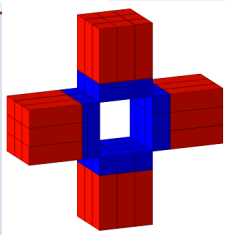
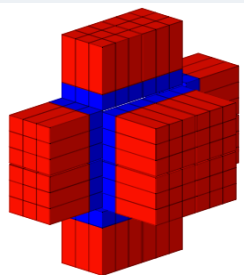
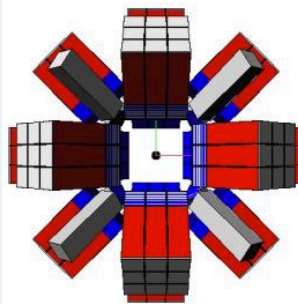
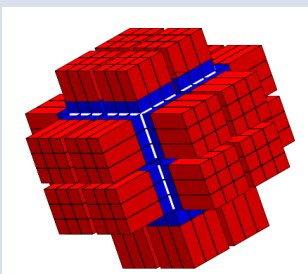
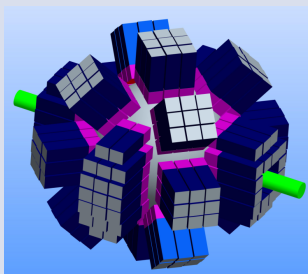
d)



June 2012



PARIS phases and cost estimates

Phase 1 2011/2012 PARIS Prototype	1 cluster: 9 phoswiches	 	250 k€	Decided Funds: SP2PP, ANR, Orsay, Strasbourg, Kraków, Mumbai Tests in-beam and with sources
Phase 2 2015 PARIS Demonstrator	4-5 clusters: 36-45 phoswiches		≈1 M€	Only if Phase1 validated Funds: MoU Ph1Day1 exp@S3
Phase 3 2017 PARIS 2π	12 clusters: 108 phoswiches	 	≈ 2 M€	Only if Phase2 validated Funds: MoU, PARIS consortium Ph2Day1 exp. with AGATA and GASPARD Other exp.
Phase 4 ≈2019 PARIS 4π	≥24 clusters: ≥216 phoswiches	 	≈ 4 M€	Only if Phase3 validated Funds: PARIS consortium Regular experiments in various labs

Indicated costs are approximations only. Include cost of LaBr3+NaI phoswiches, PMs, HV, electronics and mechanics. It is assumed that phoswich solution will work.



January-December 2011:

9 phoswiches for the PARIS prototype (PHASE1: cluster 3x3) are purchased from Saint Gobain):

2 France, 3 Poland, 4 India.

They were individually tested with sources and in-beam in Strasbourg, Orsay, Krakow and Mumbai.

PARIS prototype almost ready

January 2012:

MoU on PARIS Demonstrator 4-5 clusters ready to be sign by IN2P3, GANIL, Poland, India, Romania, Italy, UK, Bulgaria, Turkey

Table B.3.1 Summary table of the capital investment, personal resources for PARIS system and the planned sharing between the participating collaborating institutions of each country, Table includes the funds committed for the PARIS prototype and the funds planed or intentional until 2015 for the demonstrator phase.

Party or Country	Funds committed (before December 2011) (k€)	Personal resources already committed before December 2011 (person-month)	Planned (2012-2015) new capital investment (k€)	Planned (2012-1015) Personal resources (person-month)	Total capital investment (k€)	Total personal resources (person-month)
FP7 SP2PP	50				50	
FP7 CRISP				12		12
FRANCE-IN2P3	40	36	260	94	300	130
FRANCE-GANIL		29	180	22	180	51
POLAND	30	30	270	100	300	130
INDIA	80	6	100	44	180	50
UK		11		9		20
BULGARIA		5	15	15	15	17
ITALY			50	6	50	6
TURKEY			20	48	20	48
ROMANIA			70	24	70	24
Total	200	117	965	371	1165	488

On 16th of January the first 5 partners (IN2P3, COPIN, GANIL, IFIN-HH and Turkey) signed the MoU what means that the **MoU is effective**.
The signatures from other partners are expected soon.

Next steps

Detector tests:

- Assembling the first cluster (IPN Orsay)
- Testing the cluster with sources and in-beam (Orsay, Krakow, Debrecen?, ...)
- Tests of another 4 phoswiches (“clover”) within GANAS
- Using cluster(s) can clover and in real experiments (ALTO, GANIL, LNL Legnaro, Krakow, Warsaw, Jyvaskyla?...)

New PARIS Steering Committee will be formed from delegates of each MoU partner

PARIS Collaboration Council will be formed from delegates of each collaborating institution

Presentation of the partners: **IFJ PAN Krakow**

Experience in:

- Experimental and theoretical nuclear structure physics (discrete spectroscopy, gamma-decay of GDR, charged particle spectroscopy, relativistic beams,...)
- Electronics (digital and analog)
- GEANT4 simulations
- Detector testing

Main persons invoved in GANAS:

- Marcin Jastrzab – electronic engineer (WP3)
- Mirek Ziębliński – electronic engineer (WP5, WP4)
- Michał Ciemała – Ph.D. student (WP5, WP4)
- Mateusz Krzysiek – Ph.D. student (WP5, WP4)
- Kasia Mazurek – physicist (WP5)
- Piotr Bednarczyk – physicist (WP5, WP3)
- Bogdan Fornal -physicist (WP5, WP4)
- Maria Kmiecik – physicist (coordinator of WP5, WP4)
- Adam Maj – physicist (GANAS dep. coord., WP5, WP4)

IFJ PAN posses 2MV Van de Graaf
It can offer low-energy proton beams for calibration

