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CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

GANAS

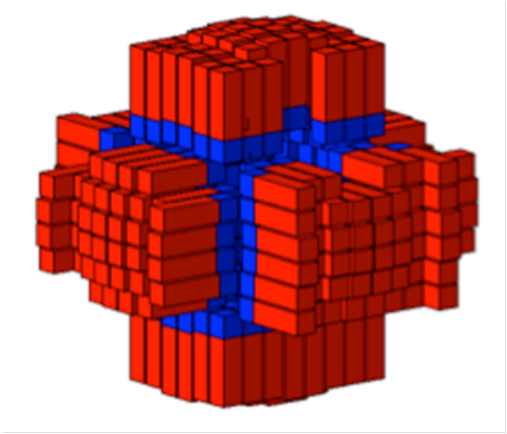
GAmma detection with New Advanced Scintillators

O. Tengblad

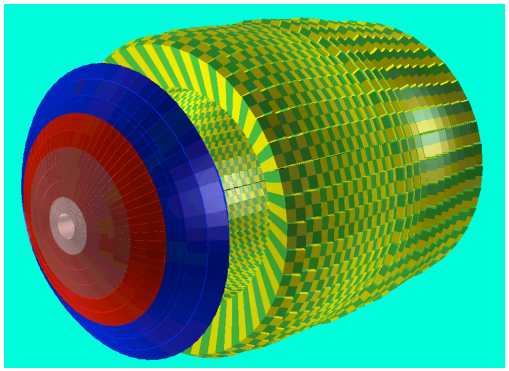
CALIFA WG @ R3B week
May 2-5 GSI

NUPNET PROPOSAL CALL 2011

R&D on new detector technologies in nuclear physics:
- Gamma and neutron detection technologies based on new scintillation materials and new photo-sensors (APDs, SiPMs…)



R&D collaboration



***PARIS** array consisting of 220 LaBr3(blue)+NaI(red) phoswiches)*
http://paris.ifj.edu.pl/

***CALIFA** calorimeter array:*
BARREL 3.000 CsI crystals with APD
Forward END-CAP of 800 Phoswich
http://fpsalmon.usc.es/r3b/calorimeterIndex.shtml

Partners

3 year project starting Nov. 2011 1.250.000 € (if succesful)

1:	**IEM-CSIC**	**Madrid Spain**	Olof.tengblad@csic.es
2:	**USC**	**Santiago de Compostela, Spain**	d.cortina@usc.es
3:	**IPNO**	**Orsay, France**	matea@ipno.in2p3.fr
4:	**IPHC**	**Strasbourg, France**	Marc.rousseau@iphc.cnrs.fr
5:	**TUM**	**Germany**	Roman.Gernhaeuser@ph.tum.de
6:	**U. Giessen, Germany**	(Jürgen Gerl)	Christoph Scheidenberger
7:	**IFJ PAN Krakow,**	**Polish Academy of Sciences,**	Adam.Maj@ifj.edu.pl
8:	**U. Warszawa, Poland**	(Pawel Napiorkowski)	pjn@slcj.uw.edu.pl
9:	**INRNE**	**Bulgaria**	Balabanski@inrne.bas.bg
10:	**U. York**	**UK**	david.jenkins@york.ac.uk
11:	**INFN U. Milano , Italy**		franco.camera@mi.infn.it
12:	**GANIL**	(Christelle Schmitt)	schmitt@ganil.fr

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Six Work Packages

WP0	coordination,networking	Spain	IEM-CSIC	Olof Tengblad
WP1	New Scintillator Materials	France	IPNO	Gulia Hull
WP2	Photosensors	UK	U.York	David Jenkins
WP3	Pulse Shape Analysis	Germany	TUM	Roman Gernhaeuser
WP4	Position Sensitivty in Large Crystals & Applications	Italy	INFN U.Milan	Franco Camera
WP5	Segmented Scintillator Arryas	Poland	IFJ PAN Krakow	Maria Kmiecik

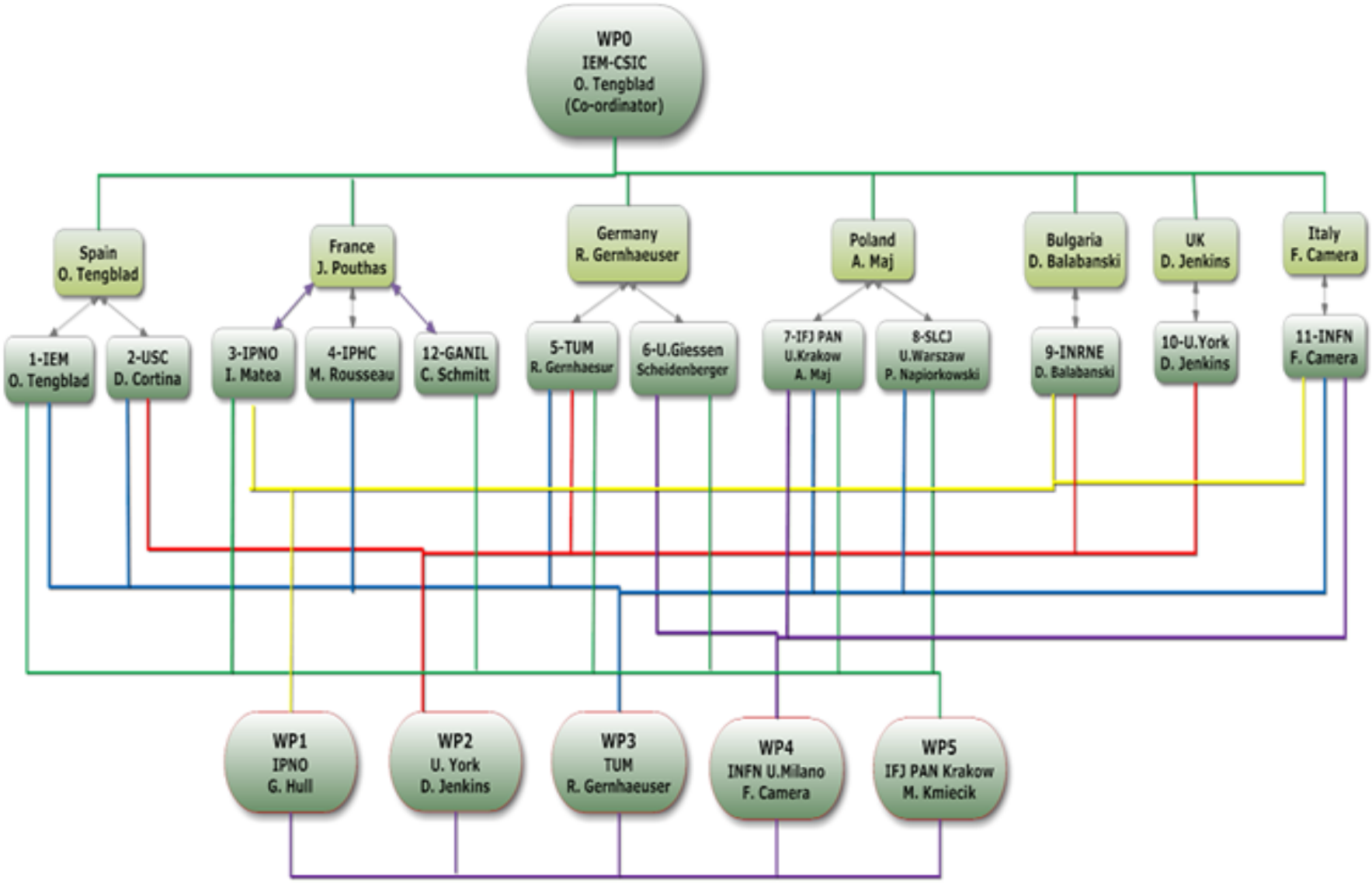
	Spain		France			Germany		Poland		Bulgaria	UK	Italy	
	P1 - IEM	P2 - USC	P3 - IPNO	P4 - IPHC	P12 - GANIL	P5 - TUM	P6 - Giessen	P7 - IFJ PAN Krakow	P8 - U. Warszawa	P9 - INRNE	P10 - U.York	P11 - INFN	tot
WP0	10	10	5	5		15	11	8	5	5	5	10	89
WP1			34						10	9			53
WP2		57		30		90				9,25	30		216,3
WP3	55					140		25	25				245
WP4							72	15			13	40	140
WP5	57	55			25		72	80	45				334
OH			6			44	31	22	15	1,75	53		172,8
tot	122	122	45	35	25	289	186	150	100	25	101	50	

Money to WP0 means travel and attending workshops

OH= Over Head

1.250 K€

12 Partners from 7 countries



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WP0: Managment

Spain, Olof Tengblad

- Each partner has reserved a certain amount of money to arrange and participate in an annual meeting, and other necessary travelling.
- The management team will supervise and make sure that the results obtained and other information important for the work of the WPs are distributed and made known to all partners. The management team will also make sure that the results are disseminated to the broader scientific community and to the public via appropriate channels.
- The management team will ensure that the milestones are fulfilled and that the relevant reports are received from the individual WPs.

WP0	0.1	2	GANAS webpage	IEM
	0.2	6	GANAS workshop 1 → start-up report	IEM
	0.3	18	GANAS workshop 2 → midterm report	IFJ PAN Krakow
	0.4	34	GANAS workshop 3 → report	IEM
	0.5	36	Final Report	GANAS

WP1: New Materials

France Gulia Hull

- The main objectives of this work package are the study of the detection properties of new advanced scintillator materials and to assess the performances for its use in a gamma spectrometer.
- The ideal inorganic scintillator should provide not only a high light yield but also a high effective atomic number for good stopping power, a short decay time constant for fast response, and a good level of linear response for good energy resolution. In addition, chemical and mechanical robustness are needed to allow the scintillator detector to be used in many different applications and environments.
- New proposed scintillators are still in the developing process and are not available in sizes suitable for our interest, such as $CeBr_3$ or SrI_2
- Another field of interest for the proposed study will concern scintillating transparent ceramics.
- study of different solution for the proper encapsulation and packaging of the crystals as well as in the optical coupling with the most suited photodetector

WP1	1.1	18	Network with Scintillator Manufacturers World Wide → Report	IPNO
	1.2	24	First Results on CeBr3 crystals → Report	IPNO

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WP2: Photosensors

UK David Jenkins

- The devices of interest are large-area avalanche photodiodes (APDs) and silicon photomultipliers (SiPMs).
- TUM are involved in a collaboration with Laser Components DG, Inc. to produce a fully functional 10 X 20 mm active area detector which is twice the size of commercially available devices at present.
- The USC group will also work in the evaluation of the new APD devices developed by Centro Nacional de Microtelectronica (CNM)/Instituto de Microelecronica de Barcelona (IMB) in Spain
- York will address the challenges of employing SiPMs for light collection in a 3T magnetic field.

WP2	2.1	12	Evaluation of new improved versions of two 100 mm^2 APDs packaged in a common frame. (Hamamatsu) →Report	USC
	2.2	12	Evaluation of prototype system of silicon photomultipliers coupled to LaBr in a magnet → Report	York
	2.3	18	Evaluation of new larger (20mm^2) APDs from Laser Components →Report	TUM
	2.4	24	Evaluation of APDs developed by CNM Barcelona. →Report	USC

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WP3: Pulse Shape Analysis

Germany Roman Gernhäuser

- **Algorithms for phoswich detectors.**
  - Digitising with high frequency sampling rate.
  - Mixed digitising with analogue shaping to reduce the sampling frequency.
  - Timing discriminator
- **Signal shape based PID**
  - neutron-gamma separation will be possible and also that the energies of particles not fully absorbed in the active medium might be reconstructed
- **Dynamic range:**
  - to cover a very wide range of energies ranging from hundred keV to several hundred MeV in the same measurement
- **Neutron/gamma discrimination with TOF**
- **System development:**
  - the amount of data has to be reduced as close as possible to the frontend electronics → all the algorithms described have to be reduced and simplified to run on a compact and low power FPGA or DSP based hardware close to the detector.

WP3 milestones

WP3	3.1	12	Optimized PSA of the LaBr+LaCl crystal response from milestone 5.1 → Report	IEM
	3.2	12	Optimized PSA of the LaBr+NaI(Tl) crystal response → Report	IPHC
	3.3	18	PSA algorithms for n-γ separation and particle identification in homogeneous scintillators → Report	TUM
	3.4	24	Optimized PSA for response and add-back from Milestone 5.2 → Report	IEM
	3.5	30	Optimized PSA for time of fly measurement of the LaBr+NaI(Tl) crystal → Report	IPHC
	3.6	36	In-beam tests with PSA to validate discrimination and ToF measurement LaBr+NaI(Tl) crystal → Report	IPHC
	3.7	36	Report on hardware implementation and experimental tests of PSA codes for the relevant phoswich detectors.	TUM

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WP4: Position Sensitivity in Large Crystals & Applications

Italy Franco Camera

- development of technology needed to localize the interaction points of a gamma ray inside a large volume crystal and to put the basis for the construction of a position sensitive large volume scintillator detector.

- This research project will concentrate on the measurement and calculation of the spatial resolution in 3D and the spatial linearity, in thick $LaBr_3$(Ce), $CeBr_3$ and CsI(Tl) detectors.

  - i) the simulation of the gamma-ray energy deposition in the crystal and the transport of the scintillation light from the generation points to the photocathode
  - ii) the development, production and testing of large volume position sensitive scintillator detectors
  - iii) the development of dedicated electronics and a Data Acquisition System (DAQ) and, finally, iv) the characterization of the produced detectors in terms of position, energy and time resolution.

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WP4 milestones

WP4	4.1	12	Evaluation of optimal light read-out to gain 3D position resolution → Report	Gießen
	4.2	12	Simulation of scintillation light transport inside large volume detectors → Report	Milano
	4.3	24	Design of Hybrid detector → Report	Gießen
	4.4	24	Development of algorithm for hit position identifications → Report	Milano
	4.5	35	Test of a 3D detector and a Hybrid detector demonstrator → Report	Gießen
	4.6	36	Construction of a position sensitive large volume scintillator and measurement of its performances → Prototype + Report	Milano

WP5: Segmented scintillator arrays

Poland Maria Kmiecik

- The objective of this Work Package is to
  - **investigate and develop prototypes of segmented gamma detection arrays.**
- Preparatory work for this subject has been already carried out within the two projects of innovative calorimeters CALIFA and PARIS (paris.ifj.edu.pl).
- The tangential segmentation can be achieved by packing different crystals together (using the position information as **developed by WP4**).
- The radial segmentation will be performed using
  - 2 (or more) layers of scintillators, either mechanically separated, or
  - Phoswich concept, where 2 crystals with different wave length of the light are glued together, while the composite signal read by common photo sensors is deconvoluted using the pulse shape analysis algorithms (see **WP3**).

WP5 Milestones

WP5	5.1	6	Test with gamms of a LaBr+LaCl truncated pyramide → Report	IEM
	5.2	6	Test of the cluster of LaBr3+NaI phoswich detectors with sources → Report	IFJ PAN Krakow
	5.3	12	In-beam test of the LaBr3+LaCl and LaBr3+NaI phoswich clusters and Hybrid detector → Report	U. Warszawa
	5.4	18	Test with protons of LaBr+LaCl 2x2 LaBr+LaCl encapsulated one can array. → Report	IEM
	5.5	24	Evaluation of the algorithms for separation of high-energy photons from shower of low energy gammas in phoswich detectors → Report	IFJ PAN Krakow
	5.6	33	Evaluation of gamma/proton PSA of LaBr+LaCl Phoswich array →Report	IEM
	5.7	34	Final evaluation of the demonstrator, consisting of PARIS type detectors, CALIFA type detectors and Hybrid detectors → Report	IFJ PAN Krakow

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Tentative Calendar of Events

- **14/02/2011 Launch of the Call**
- 31/03/2011 Production of shortlist of evaluators by Involved Funding Agencies
- **22/04/2011 5pm Deadline** for proposal submission (2.5 months after call publication)
- **06/05/2011 End of eligibility check of submitted proposals by NuPNET Common Call Secretariat**
- 12/05/2011 Composition of the final Peer Review Panel list as decided by Funding Agencies
- **13/05/2011 End of national eligibility check by Involved Funding Agencies**
- 17/05/2011 Assignment of eligible proposals to evaluators approved by Funding Agencies
- 18/05/2011 Proposals sent to evaluators by NuPNET Common Call Secretariat

- **30/06/2011Collection of evaluators' report**
- 07/07/2011 Panel board meeting to rank proposals and recommend project funding
- **20/07/2011 Selection of proposals to be funded by Involved Funding Agencies**

- **29/07/2011 Communication of the results of the transnational proposal evaluation to applicants**

- **30/09/2011 Deadline for submission of national application forms**

- **31/10/2011 Funding decisions on Involved Funding Agencies' level and national administrative procedures, including budget negotiations, have been finalised.**