

# ENSAR JRA04

Innovative solutions for nuclear physics detectors:  
“From basic R&D to applications for the society”

*J. Gerl - GSI*

GAMMAPOOL Workshop

PARIS 2008

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## Goals of the JRA

- Identify and investigate the properties of new scintillation materials and photo-sensors.
- Investigate the implementation of these innovative solutions in real gamma and neutron detector devices.
- Study the impact of these detection technologies on applications to industry and society in general.

*This new Joint Research Activity aims to bring together the expertise in the community to improve the design of gamma and neutron detectors based on scintillation materials. The development of novel technologies based on innovative or already existing materials and photo-sensor devices is crucial for experiments improving the present capabilities of European Nuclear Physics infrastructures.*

# Task 1: R&D on new and existing scintillation materials (USC,IPNO,CIEMAT,IFJ PAN,JYFL,GSI, INFN-Milano)

**Subtask 1:** Study of new (LaBr<sub>3</sub>, LaCl<sub>3</sub>) and existing inorganic scintillation materials with commercially available photo-sensors (LAAPD, SiPM, PM). Comparative study of the best commercial combination (USC,INFN-Milano, IPNO)

**Subtask 2:** Characterization of organic scintillation materials to extend the neutron detection to lower energies. Investigate the use of LAAPD arrays and SiPM as photo-sensors of large volume liquid scintillation cells. Comparative study of the best commercial combination (CIEMAT,JYFL)

**Subtask 3:** Characterization of light production, propagation and collection of new inorganic scintillation crystals to predict the response of these materials as standalone crystals or integrated in sophisticated devices. Implementation of a software tool able to define the best detector geometries (IFJ PAN,USC)

**Subtask 4:** Characterization of light production, propagation and collection of liquid scintillators. Determination of detector cell geometries in terms of light collection and compacting (CIEMAT,JYFL)

**Subtask 5:** Test of new scintillation materials with neutrons, gammas and light charged particles with radioactive sources and dedicated irradiation at reference facilities (accelerators) (USC,INFN-Milano, IPNO,CIEMAT,JYFL,IFJ PAN)

## **Task 2: Detectors coating and compacting** **(IPNO,GSI, U-Liv, USC, LNL)**

**Subtask 1:** *Application to new scintillation materials. Investigation of the performance of materials with both low photon and neutron interaction cross sections (i.e carbon fiber) for detector housings. Development of a single prototype based on carbon fiber technologies to replace the present encapsulation of hygroscopic crystals (IPNO,USC)*

**Subtask 2:** *Application to germanium detectors. Development of compact minimal interacting protective cover for Ge detectors. (GSI,U-Liv, LNL)*

# Task 3: Applications for the society

(GSI, U-Liv, CIEMAT, USC)

**Subtask 1:** *Adaptation of detection and imaging methods for technical applications and investigation of new applications. (GSI, U-Liv)*

**Subtask 2:** *Investigation of the performance of new inorganic scintillation materials ( $\text{LaBr}_3$  and  $\text{LaCl}_3$ ) as gamma ray detectors for gamma-ray imaging and neutron inspection techniques, in particular at high energies (CIEMAT, GSI)*

**Subtask 3:** *Communication of novel techniques, methods and resulting opportunities to industry and society in general. (GSI, U-Liv, CIEMAT, USC)*

# Milestones

Milestone number	Milestone name	Work package(s) involved	Expected date [1]	Means of validation [2]
M-JRA04-1.1	Detailed characterization of inorganic scintillation materials LaBr, LaCl and CsI	JRA04	36	
M-JRA04-1.2	Detailed characterization of organic scintillation materials BC501 and EJ301	JRA04	36	
M-JRA04-1.3	Implementation of the results on light production and propagation in existing or new software codes	JRA04	40	
M-JRA04-1.4	Detailed characterization of the tested detectors with the main results of the tests performed with neutrons, gammas and light charged particles under realistic conditions	JRA04	48	
M-JRA04-2.1	Characterization of housing for new scintillation materials. Construction of a prototype with carbon fiber	JRA04	40	
M-JRA04-2.2	Characterization of optimum covering for Ge detectors	JRA04	40	
M-JRA04-3.1	Definition of the adaptation activities	JRA04	42	
M-JRA04-3.2	Definition of the different possibilities for the use of novel technologies in neutron monitors	JRA04	42	
M-JRA04-3.3	Organisation of a Workshop on novel techniques, methods and resulting opportunities for gamma detection and imaging	JRA04	47	

## EU request

Task 1: 332 k€

Task 2: 167 k€

Task 3: 138 k€

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Total: 637 k€

Personnel: 595 k€

Travel: 42 k€

Collaborating institutes: 8

Duration: 48 months