



## Report on TransNational Activities at KVI

### **Description of the publicity concerning the new opportunities for access**

As in the first reporting period, the opportunities for access were publicised by means of a dedicated website: <http://www.rug.nl/kvi/ensar>. For details, see the first periodic report. Additionally, a request for beam access proposals was sent out to the RUG-KVI mailing list in November 2013 and to a selected list of potential users in May 2014.

### **Description of the selection procedure**

No Selection Panel meetings were held in the reporting period. A recommendation for new beam access proposals was obtained from the Selection Panel via e-mail communication. In total, 2 new experiments (KVI-T36, KVI-T37) were given a positive recommendation while the continuation of a previously performed experiment (KVI-T29) was recommended (KVI-T29).

See Annex 1 (extracted from Database) for the list of the Selection Panel members.

### **Transnational Access activity**

Three projects have been supported during the reporting period:

1. KVI-T29: Radiation damage and defect studies in PWO crystals, and hadron response of inorganic scintillating fibres (spokesperson: R. Novotny, Justus-Liebig University Giessen, Germany);
2. KVI-T36: Tests with a LaBr3-SiPM telescope in proton and Carbon ion beams (spokesperson: C. Lacasta, Instituto de Física Corpuscular, Valencia, Spain)
3. KVI-T37: Proton measurement with MAPS (spokesperson: D. Roehrich, University of Bergen, Norway)

All experiments mentioned above are in the field of physics. Experiments KVI-T29 is in the discipline of nuclear physics, experiments KVI-T36 and KVI-T37 are in the discipline of other physics (medical physics).

See Annexes 2 and 3 (extracted from Database) for the List of User-Projects and the List of Users, respectively.

### **Scientific output of the users at the facilities**

Highlights of important research results from the supported user-projects:

- i. KVI-T29 (Radiation damage and defect studies in PWO crystals, and hadron response of inorganic scintillating fibres):  
Irradiated samples: Si films for MVD detector of PANDA experiment; LYSO fibres with lengths up to 23 cm and 1 and 2 mm diameters; full-size LYSO crystal (2x2x10 cm<sup>3</sup>) and set of small (1-3 cubic centimetres) samples of BaF<sub>2</sub>, DSB and DSL glasses, YAG:Ce, YAG:Pr, LuAG:Ce, LiF. Samples were irradiated with 150 MeV proton beam with integral fluence on the level of 5-6×10<sup>13</sup> p/cm<sup>2</sup>. The aim of the test was to investigate the



radiation hardness of the samples after irradiation with comparatively low-energy (150 MeV) protons. Results of the beam test were presented at the IEEE2014 NSS/MIC Conference, 8-15 November 2014, Seattle, WA USA. It was found that crystalline and glass materials constructed from light atoms are subject to a strong damage. In contrast, both crystalline and amorphous compounds composed of middle heavy ions demonstrate good resistivity. A high level of phosphorescence was observed in Lu-garnet doped with Ce compared to the isostructural Y-based garnet. It appears that high level phosphorescence is a genuine property of Lu-based oxide scintillation materials.

- ii. KVI-T36 (Tests with a LaBr<sub>3</sub>-SiPM telescope in proton and Carbon ion beams):  
During the 3-day measurement campaign performed at KVI-CART different proton beam intensities at a fixed energy of 150 MeV have been employed ranging between  $1.5 \times 10^6$  and  $5.0 \times 10^8$  p/s. Acquisitions have been performed in two modalities: single acquisition mode in order to recover the prompt-gammas energy spectrum in each layer of the device and coincidence mode employing different coincidence window (10, 20 and 40 ns). Different targets have been employed to study the emitted prompt-gamma spectra: a PMMA cylindrical target and a cubic Graphite target providing ( $p,^{12}\text{C}$ ) and ( $p,^{16}\text{O}$ ) emission lines from nuclear interactions. To preserve beam properties (lateral spread and longitudinal energy straggling) no degraders have been employed to modulate the beam energy but the target was moved with respect to the isocentre of MACACO to simulate Bragg peak shifts of +5, 0, -5 mm. Acquisition has been performed with two layers in coincidence and measured data will be analysed and reconstructed by means of a novel image reconstruction approach based on a Spectral ML-EM algorithm.
- iii. KVI-T37 (Proton measurement with MAPS):  
During the beam test we could measure the calorimeter response at different energies. In particular, we could check the expected behaviour of a proton at 120, 170 and 190 MeV. We measured the incoming track of the proton and at the end of its path an enhancement of the activated pixels was detected. We could take data at different sensor sensitivity. The analysis of the beam data is in progress. The main and the only difficulty encountered during the execution of the project was due to the tight schedule for the installation and the deinstallation of the equipment in experimental zone. To operate the detector, around 200 cables have to be connected and other cabling is required to get operational the front-end electronics, the acquisition and the trigger detector and system. Unfortunately, the total cabling requires 8 hours for the installation and the same for the deinstallation of the equipment. This time was only partially taken into account.

The Database and Annex 4 list the publications on work carried out under the present contract and published during the third reporting period. The list is at the moment of reporting (January 2015) rather limited. Many more publications are expected to appear over the next few years, once the users have fully analysed the data obtained during the ENSAR-supported experiments at KVI.

### **User meetings**

No user meetings have taken place in the reporting period.

### **Annexes**

The following Annexes are in the MS Database:  
Annex 1: List of Panel members



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Annex 2: List of User-Projects

Annex 3: List of Users

Annex 4: List of User's Publications

List of FP6 EURONS publications in attachment of the periodic report