

Highlight Cerimed Newsletter N°2 July 2007

EDITORIAL

The CERIMED project obtained its formal approval and will be funded in the frame of the CPER (Contrat de Projets Etat-Région) set up for 2007-2013 by the French Government and by the political authorities of the PACA (Provence-Alpes-Côte d'Azur) Regional Government. A first allocation of €11.6 million (funded by a range of European, National and Regional funding agencies) is dedicated for the construction of a 3750 square-meter building in the campus of the Timone University Hospital in Marseilles. The CERIMED infrastructure will include a cyclotron and radiochemistry facility, clinical and preclinical validation units, a prototype assembly hall, workshops, laboratories, offices, and common administrative and meeting areas to hosting as best as possible research groups from all over Europe that will come to Marseilles to performing validation and evaluation measurements of innovative technology developed for biomedical imaging. Besides this building infrastructure budget, an additional funding of €3.7 million will be dedicated, as foreseen by the CPER, for specific imaging equipments.

The CERIMED management board acting as delegation from the Mediterranean University Aix-Marseille II undertook several actions :

- Process of consultation with the five major companies involved in the production and marketing of cyclotrons and radiopharmaceuticals ; discussion on possible cooperation schemes with CERIMED.
- Recruitment of the programming company Couzanne for drafting the user's requirements of the CERIMED building.
- Recruitment of a legal adviser company to help in the institutional setting up of the CERIMED project, especially with regards to the agreements that will have to be passed with private partner companies and to the accounting of European fundings

The schedule of these actions was set up during a project taskforce meeting that took place at CERN, Geneva, on June, the 22nd 2007. Mrs Elisabeth Goig, head of the University property office and Mr Frere and Dubois from the company Couzanne attended this meeting as well.

P.Lecoq, Technical Director
O. Mundler Medical Director
C. Oliver, Project Leader

CANCEROPOLE PACA – Provence-Alpes-Côte-d'Azur

The former French President Jacques Chirac launched in 2003 a large National Cancer programme. On this frame, the PACA Region approved a research programme for 2004-2007 on four unifying scientific themes: descriptive genomics of cancers, functional genomics of cancers, relations between host and tumour, immunotherapies and targeting treatment, socio-behavioural epidemiology and economic and social sciences applied to cancers.

For the period 2008-2011, two topics will be added: clinical research and **technological research**. The latter is coordinated by Pr. Jean-Pierre Gerard, head of the Antoine Lacassagne Centre in Nice, and Pr. Charles Oliver, from the Mediterranean University in Marseilles. The technological research topics include developments in medical imaging and radiotherapy. Of course, CERIMED will play a major role in this programme, which will strengthen the interactions between the Nice and Marseilles academic institutions (Universities, Hospitals, CNRS, INRIA, INSERM, ...) as well as with industry. An important aspect of this program consists in the funding opportunities that will be regularly offered by the French National Institute of Cancer on this new theme.

EDUCATION AND TRAINING

A meeting was organised on May, the 29th 2007 in Marseilles with members from the Mediterranean University (C. Morel, C. Oliver), from CERN (P. Lecoq), CNRS-LMA (S. Mensah), from the Engineering School of Marseille "Ecole Centrale" (C. Deumié), the University la Bicocca in Milano (M. Paganoni) and the Istituto Superiore di Sanita in Rome (F. Garibaldi).

An education programme at the interface between physics, engineering biology and medicine was proposed to the French Ministry of Education and Research as part of a Master of physics for 2008-2009.

A program on "Human Anatomy and Physiopathology" will be available to this master aiming at bringing basic knowledge in medicine and biology to physicists and engineers. Cooperation with the universities of Milan and Rome was also discussed in the frame of a European education programme based on the same interdisciplinary spirit. Last but not least, an in-depth analysis was launched on the Euromedim 2006 participants' comments regarding the venue and the programme. Based on this analysis, it was decided to organise Euromedim 2009 in a Mediterranean city to be selected (Italy, Monaco, French Riviera) with a scientific programme involving a larger participation of MD's and biologists.

BREAST IMAGING FROM SCREENING TO POST-TREATMENT FOLLOW-UP

This one-day workshop was organized on January, the 25th 2007 by CERIMED, Istituto Superiore di Sanita (Italy), Canceropole PACA and Canceropole Auvergne Rhône-Alpes and was chaired by P. Lecoq and O. Mundler.

The workshop had two goals:

- To reviewing the available breast imaging techniques ;
- To fostering discussions between physicist and medical doctors for designing new equipments.

This meeting was attended from more than 50 people, half of whose were physicist and half MD's. The programme included:

- An overview of breast cancer: A. Goncalves (Marseilles);
- A state -of-the-art on breast medical imaging (performance, limitations): V. Juhan (Marseilles), C. Balu-Maestro (Nice);
- A detection of "sentinel" lymph node: F. Cachin (Clermont-Ferrand);
- A follow-up: T. Bachelot (Lyon);
- A PET-CT in extension check-up of breast cancer: D. Coffic (Grenoble);
- A Description of the ClearPEM sonic project: P. Lecoq (CERN).

A round table moderated by O. Mundler gave the opportunity to physicists and MD's to discuss about the needs and perspectives in breast cancer screening and follow-up. Conclusions highlighted the fact that high specificity is highly required

and that hybrid techniques (association of PET, ultrasound, optics...) may be the answer to the investigation of difficult cases (dense breast for instance).

TECHNICAL NOTE ON CERIMED PROJECTS (1)

The ClearPET/XPAD project, development of small animal PET/CT scanner
Centre de Physique des Particules de Marseille (CPPM), CNRS-IN2P3 and
Université de la Méditerranée

In contrast to X-ray computerized tomography (CT) that allows to imaging the mass density of living tissues, positron emission tomography (PET) is imaging gamma rays directly emitted from the tissues. In this case, the emission of gamma rays results from the decay of radioactive nuclei used to label a radiopharmaceutical injected to the patient. Thus, in the contrary to transmission tomography using an external X-ray tube, emission tomography images the function rather than the structure of living tissues.

The development of combined PET/CT imaging systems led to a rapid expansion of this technique in clinical routine. Similarly, the development of dedicated PET scanners and micro-CT scanners for small animals pleads for joining these two modalities in a common gantry. However, like with clinical PET/CT, the juxtaposition of both modalities does not allow for extrapolating the exact position of the animal during the PET scan. Therefore, we intend to combine the ClearPET detectors [1] with the XPAD3 X-ray hybrid pixel detector [2,3] in a common rotating gantry. To achieve this goal, we redesigned the partial ring arrangement of the ClearPET detectors. As a result, both detection systems will be merged together with an X-ray tube in a fully integrated PET/CT device that will make it possible to acquire simultaneous emission and transmission scans for mice.

The small animal ClearPET scanners have been developed during the past years within the Crystal Clear Collaboration [4]. All scanners use the same detector technology based on the combination of crystal matrices coupled with multi-anode photomultiplier tubes (MaPMTs). Since the sensitive area of the MaPMTs is smaller than their outer dimension, there is always an empty space between two axially adjacent detector blocks. This leads to empty slices in the sinograms, which cause loss of scanner sensitivity and severe artefacts in the images. In its present configuration, the ClearPET demonstrator consists of 18 LSO/LuYAP phoswich detector heads [1] arranged in three adjacent partial rings. Each ring consists of 6 detector modules mounted asymmetrically so that only two modules are facing each other [5].

A new detector arrangement that does not have axial gaps between adjacent rings is achieved by avoiding axially adjacent detector modules. Then, thanks to the rotation of the detectors around the FOV, the complete set of 3D sinograms can be addressed completely. Sensitivities are evaluated for a 15 cm length and 12 cm diameter cylindrical phantom using the GATE Monte Carlo simulation platform [6].

The layout of the ClearPET/XPAD dual-modality scanner mounted on a rotating gantry is shown in Figure 1. A detector configuration is implemented with three partial rings of 7 detector modules. It provides a PET modality axial FOV of 54 mm and a transverse FOV of 110 mm. The CT components (an X-ray tube from RTW with 50 μm focal spot size and the 118x76 mm^2 XPAD3 X-ray imager with 130x130 μm^2 pixels) are positioned within the PET detector ring. The microCT

modality has an axial FOV of 59 mm and a transverse FOV of 38 mm with a magnification by a factor 2. The X-ray cone beam passes through the shared FOV without irradiating the PET detectors directly. Hence, the ClearPET/XPAD system will allow for simultaneous scanning of small animals. Impact of scattered X-ray on the LSO/LuYAP phoswich detectors modules are currently being studied using GATE and experimental measurements. This work is supported by the ANR Programme « Chaire d'excellence 2005 » under grant No. ANR-05-CEXC-01 and by the Conseil Régional PACA. It was labelled in 2006 by the pole of competitiveness 3Photonique/ systèmes complexes d'optique et d'imagerie", in collaboration with the IBDML, the APHM, Créatis, Vegatec sarl and raytest France sarl.

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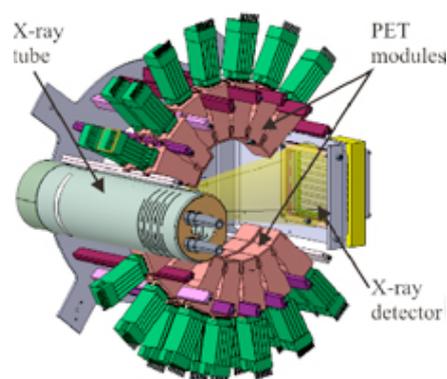


Fig. 1 The design of ClearPET/XPAD.

NEXT MEETING OF CERIMED COMMITTEES

The next meeting of the CERIMED executive and scientific policy committees will be held on September, the 26th 2007, from 9:30 a.m. to 5 p.m. at the Faculty of Medicine, 27 boulevard Jean Moulin, Marseilles. The CERIMED project enters now a new phase and decisions needs to be taken on the construction management of the CERIMED building in the lights of the French administrative rules, on the description of the equipment to be set up and on the CERIMED legal structure in the lights of the new European Commission guidance. Therefore it is now urgent to start working on specific objectives. The tentative agenda of the meeting is as follows:

- 9:30 – 12:30 a.m. (Executive committee)
 Status of the CERIMED project
 Evolution of CERIMED committee
- 2:00 – 5:00 p.m. (Scientific Policy commission)
 Report on the TRIMODAL and POCASI projects
 Towards a scientific policy for CERIMED

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