



**Euro-BioImaging**  
European Research Infrastructure for Imaging Technologies in Biological  
and Biomedical Sciences

WP9  
Medical Imaging – Emerging Technologies

**Task 9.4:**  
Proof-of-concept studies for user access to Innovative Technologies MI  
(Lead Beneficiaries: UKLFR, LMU-MUENCHEN, CEA)

**Deliverable 9.6**  
Report on proof of concept studies for UHF-MR, phase contrast CT and new  
emerging technologies

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## Introduction

The primary goal of proof-of-concept-studies (PCS) was to test and demonstrate the ability of Euro-Bioimaging to organize access to pertinent technologies and for the included providers to demonstrate that the technologies are ready for user access. In the evaluation of the pertinent requirements necessary to perform this task it became apparent, that these are largely identical for the different medical imaging technologies of WP9. Within WP9 proof-of-concept-studies were performed for UHF-MR and Phase-contrast-CT. For MR-PET alternative means for the demonstration of feasibility to provide user access were applied.

## Structure of PCS

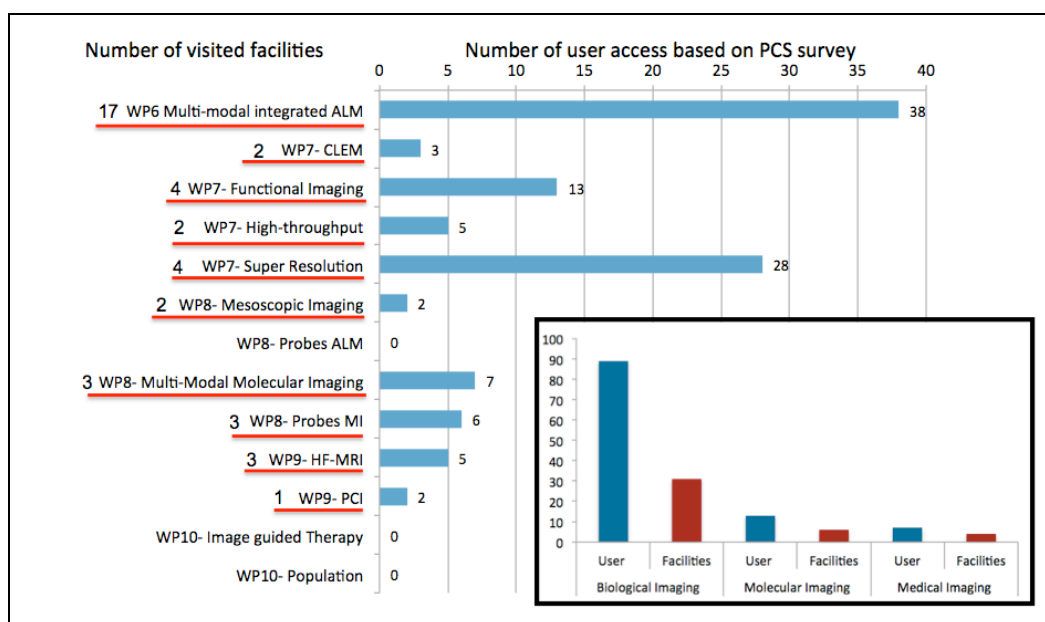
PCS were setup and conducted according to the Euro-Bioimaging survey on the requirements/needs for the Euro-Bioimaging technologies both from the view of potential users as well as providers. In a survey of providers key issues regarding the requirements and available resources were identified. In preparation of the PCS, guidelines were prepared for the two technologies to be included. These followed the general concept for PCS with modifications according to specific requirements of specific technologies. For the modalities included only minor differences were observed related to specific differences between modalities. From Oct 1<sup>st</sup> to Nov 30<sup>th</sup> 2011, Euro-BioImaging announced an open call for researchers, offering one-off free access to well established imaging facilities in European countries. This unique opportunity of free access to a broad portfolio of the most advanced imaging methods had been broadly advertised, and applicants from the PhD student level up to senior researchers were invited to submit their project proposals. Euro-BioImaging received applications, from both academic and industry researchers, of which more than 110 users were selected with peer-review process to conduct their experiments in the PCS provider laboratories. The selection was done in two steps, first by sending the applications to expert reviewers who evaluated the scientific merits of the project. After this the best applications were sent to providers who further checked the feasibility of the project and then contacted the applicants to agree on further details. After completion of the PCS a survey was performed for users as well as providers.

Details on the PCS procedure can also be found in D 12.6 *Report on proof-of-concept studies*.

## Results of PCS

The PCS turned to a success:

- 63 established facilities committed to contribute free user access in
- kind to support this Euro-BioImaging initiative
- 41 Facilities from 14 European countries received users
- 228 researchers from 25 European countries and abroad (academic and industry) applied
- 110 user projects were accepted and conducted at the imaging facilities



During their visit to imaging facilities, over 70% of the PCS users got results that are valid for publication and of very high quality. The average visit duration was 6 days, but varied from 1 day to more than 60 days. The essential factor that contributed to this outcome is in our opinion the teamwork of experts from different backgrounds, i.e. the staff of the imaging facilities and the users. Imaging facilities were involved already in the evaluation of the technical feasibility of users' proposals and in consultations for the preparation of their visit. Particularly, users acknowledged that through this consultation process they received helpful practical suggestions from the facilities and could adjust their project plan accordingly. Staff advised users on appropriate tests, controls, reagents and protocols for efficient imaging sessions. This consultation phase to prepare the visit was rated highly important by both users and technology providers.

### PCS for UHF-MR

For UHF-MR 6 facilities (out of approx. 15 in Europe) agreed to participate in the PCS, 14 project proposals have been received, 11 were accepted, 5 PCS were successfully finished at three facilities (see table below).

| Technology  | WP  | Country | Department  | Organization   | Number of users |
|-------------|-----|---------|---|--|-----------------|
| WP9- HF-MRI | WP9 | DE      | Leibniz Institute for Neurobiology & Otto-von-Guericke University | Leibniz Institute for Neurobiology & Otto-von-Guericke University  | 3               |
| WP9- HF-MRI | WP9 | DE/NL   | Erwin L. Hahn Institute for Magnetic Resonance Imaging,           | University Duisburg-Essen (D) and Radboud University Nijmegen (NL) | 1               |
| WP9- HF-MRI | WP9 | UK      | SPMRC,  | University of Nottingham   | 1               |

Given the nature and boundary conditions of PCS, the conducted projects were limited in scope, but still sufficient to test and demonstrate the key elements to demonstrate the feasibility of user access. Given the fact, that UHF-MR is far from being a routine modality, it is clear, that the actual scope of each PCS and the actual measurement protocol used had to be setup in close interaction between the users and providers. PCS were conducted by the provider's personnel.

Most users of the UHF-MR PCS were scientists with good to excellent previous experience in MR, most often coming from facilities operating MR-equipment at lower field strength (typically 3T).

Therefore their level of MR expertise was quite high. Nevertheless planning of the experiments, setting up the necessary sequences and protocols, the actual conductance of the studies as well as the post-processing of results required considerable effort and involvement of the providers. From an operational point of view alone it is unfeasible to provide just the instrument and let the user run his/her own experiments. Vice versa it was also apparent, that the conductance of PCS cannot be just contracted from the user to the provider, who then performs some prescribed experiment. Since UHF-MR is not (yet) standardized, the user needs to be present in order to make sure, that measurements and their results really solve the underlying scientific question.

It thus became clear – as anticipated – that access to UHF-MR is only meaningful with close interaction between users and providers. As a result of the PCS it became apparent that the involvement of the provider requires much more resources than originally anticipated. Teaching and educating users about the possibilities of UHF-MR, translation of the scientific question into a practical experimental protocol, setting up, testing and optimizing the protocol, performance of the experiment, post-processing and assessment of the results require considerable resources with respect to the providers personnel. It became very apparent that the mere provision of the instrument will be insufficient to operate a successful UHF-MR infrastructure.

All successfully finished experiments led to valid and relevant scientific results of high scientific quality, some of the results of the PCS were presented at scientific meetings or even led to journal publications. User satisfaction with the providers services was very high. The smooth running of the UHF-MR PCS was certainly facilitated by the fact, that providers already have more or less intensive experience in performing studies with external scientific partners.

### **PCS for Phase Contrast CT**

For PCI 1 facility (out of 2 in Europe) participated and received 11 project proposals, 3 were accepted, all 2 were successfully completed.

| <b>Technology</b> | <b>WP</b> | <b>Country</b> | <b>Department</b>              | <b>Organization</b>            | <b>Number of users</b> |
|-------------------|-----------|----------------|--------------------------------|--------------------------------|------------------------|
| WP9- PCI          | WP9       | DE             | Technical University of Munich | Technical University of Munich | 2                      |

The high rejection rate of project proposals reflects the fact that PCS-CT is a rather new technology, many potential users did not have a clear idea of the current status of this technology. The suggested studies therefore often were unfeasible. At the other end of the spectrum some suggested studies were trivial in the sense that the stated goals of the PCS were already well-known and therefore the PCS did not appear to be of scientific interest.

The 2 accepted studies were successfully completed, the feedback of the users clearly demonstrates a high users satisfaction and clearly documents the suitability of PCS-CT as a possible Euro-Bioimaging infrastructure.

### Proof of feasibility for MR-PET

For MR-PET as a new and emerging technology it was unfeasible to perform PCSs within the scope of the Call for PCS given the short time frame, which did not allow finalizing all regulatory issues. For MR-PET external access data from 3 facilities and 6 projects were documented in December 2012 outside and after the PCS. These were considered equivalent to PCS by WP chairs (1 opposing vote, 2 abstentions).

| WP  | User   | User country | Provider Facility   | Technology used |
|-----|--------|--------------|---|-----------------|
| WP9 | User 1 | Portugal     | PET/MRI facility at Forschungszentrum Juelich, Germany.                               | PET/MRI at 3T   |
| WP9 | User 2 | Italy        | TUM Munic, Dept. of Nucl. Medicine  | PET/MRI         |
| WP9 | User 3 | Germany      | PET/MRI facility at Forschungszentrum Juelich, Germany.                               | PET/MRI at 3T   |
| WP9 | User 4 | Portugal     | PET/MRI facility at Forschungszentrum Juelich, Germany.                               | PET/MRI at 3T   |
| WP9 | User 5 | Germany      | PET/MRI facility at Forschungszentrum Juelich, Germany.                               | PET/MRI at 3T   |
| WP9 | User 6 | Germany      | Univ. Essen, Department of Diagnostic and Interventional Radiology and Neuroradiology | PET/MRI, PET/CT |

### Summary

For all three modalities tested either by PCS or alternative means clearly demonstrate the need and acceptance of these modalities as Euro-Bioimaging infrastructures as well as their suitability and ability to give access to these new and exciting technologies and thus to serve the European scientific community. The main message from the PCS was the substantial requirement of highly trained personnel and resources necessary for successful operation of such an infrastructure.