Thesis Project Offer

Joint Research and Education Programme “Palestinian-German Science Bridge PGSB”
Forschungszentrum Jülich GmbH & Palestine Academy for Science and Technology

Thesis type*

- [ ] BSc
- [ ] MSc
- [X] PhD

Intended starting date (approx.): Autumn/Winter 2018

Contact details of supervisor/responsible host at Forschungszentrum Jülich

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Function* Institute and homepage of institute*

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- Wilhelm-Johnen-Straße
- 52428 Jülich, Germany
- http://www.fz-juelich.de/inm/inm-4/EN/

University affiliation in Germany*

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Co-Supervisor at Palestinian university (if applicable)

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Sponsored by the

- Federal Ministry of Education and Research
- PALAST
- JÜLICH FORSCHUNGSZENTRUM
Project description*

It is becoming increasingly evident that combining in vivo structural and functional imaging provided by Magnetic Resonance Imaging (MRI) and especially Ultra High Field (UHF) MRI with in vivo molecular information provided by Positron Emission Tomography (PET) has tremendous potential, especially in basic research. Within the INM-4’s (Institute of Neuroscience and Medicine 4 – Physics of Medical Imaging) activity of building a next generation Brain PET insert for MRI and UHF MRI with improved spatial resolution, axial field of view and sensitivity a high performance data acquisition system and the corresponding algorithms, software and firmware for data pre-processing and system calibration has to be developed and implemented. The newly developed UHF-MRI-compatible BrainPET insert is expected to offer a 3- to 4-fold increase in effective sensitivity and a markedly improved and more homogeneous spatial image resolution of 1.5–2.5 mm by using the latest detector- and production technology, as well as an improved system design.

Part of the data pre-processing has to be accomplished on-line and must be implemented into integrated Field Programmable Gate Arrays (FPGA). Less time critical tasks will be implemented on a multi-core workstation. The acquisition system has to allow very high data throughput and therefore both the FPGA firmware as well as the workstation software has to be highly parallelized. Focus of this research project is the development, implementation and evaluation of novel algorithms for system calibration, gamma ray detection with scintillation detectors, novel algorithms for data corrections such as random coincidence correction and dead time correction.

Applicants should have basic knowledge in MRI and PET imaging, excellent educational records in medical imaging and/or medical physics and/or biomedical engineering; and very good programming (Object Oriented C++) and data processing skills. The successful applicant will participate in interdisciplinary research related to the development, integration, commissioning, and evaluation of next generation PET head insert for MRI.

The Institute of Neuroscience and Medicine in FZ Juelich provides a world-wide highly reputed research in neuroscience a unique environment to support breakthrough discoveries. Among a stand alone PET scanner and dedicated PET brain inserts for simultaneous MR/PET imaging, and a 7T MR scanner, it runs internationally unique imaging equipment such as the Ultra-High Field 9.4-tesla magnetic resonance scanner.

Date*  Signature*

| 20.02.18 | Christoph Lerche |

* required field