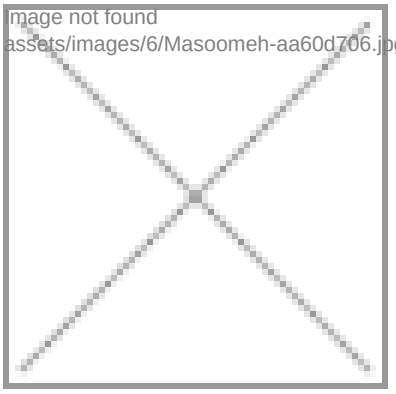
Hybrid PET/MRI for improved tumour grading and detection of recurrent disease in Neuro-Oncology

HOST INSTITUTION: University of Leuven (KU Leuven)

KU Leuven is Belgium's largest university and, founded in 1425, one of the oldest and most renowned universities in Europe. Situated in the University Hospital Leuven, the Medical Imaging Research Center (MIRC) is an interdisciplinary research center with focus is on fundamental and translational research in the area of medical imaging and image processing. This research center is a joined initiative of the KU Leuven (Biomedical Sciences) and the University Hospital Gasthuisberg Leuven. Over 100 engineers, physicians and physicists are working closely together with bioscientists and clinicians. MIRC-partners are the Dept of Electrical Engineering (PSI), the Dept of Imaging and Pathology (Radiology, Nuclear Medicine and Molecular Imaging), the Dept of Cardiovascular Sciences, the Dept of Neurosciences and the Dept of Radiotherapy.

The medical physics team of the division of Nuclear Medicine and Molecular Imaging resides in the MIRC of the University Hospital Leuven. Its mission is centered around the four poles of a university hospital: health care, research, education and community service. Having access to two state of the art PETCT systems and an integrated PETMR system, the medical physics team has extensive expertise in hybrid medical imaging, and in particular PET, SPECT and CT image reconstruction, tracer kinetic modeling and PET quantification.



DESCRIPTION OF THE PROJECT (ESR6 - Masoomeh Rahimpour)

The ESR will develop an optimal clinical workflow and multi-parametric quantitative analysis for hybrid PET/MR imaging of gliomas. Combining amino acid PET imaging of tumour metabolism with appropriate structural and perfusion MRI sequences has shown to improve the tumour grading of gliomas or the detection of residual disease after therapy. In particular, dynamic amino acid PET attains a high sensitivity and specificity for differentiating glioma from healthy tissue and local tumour recurrences from radio necrosis after radiotherapy. However, diagnostic accuracy is compromised by a low uptake in low grade gliomas and by a suboptimal, visual analysis. The aim of this project is to take advantage of hybrid PET/MRI for simultaneous imaging of brain tumour metabolism using PET and tumour angiogenesis and morphology using MRI. In a first stage, the ESR will develop an automated analysis of dynamic amino acid PET data to provide the end user with an objective and accurate metabolic profile of the primary tumour or potential local recurrences. Next, a multi-parametric approach combining this metabolic profile with structural and perfusion MRI will be evaluated for improved tumour grading and enhanced therapy response prediction, evaluated by clinical follow-up and post therapy PET/MRI scanning. This approach will involve the evaluation and further development of multi-parametric segmentation and classification

techniques for brain tumour lesions.

This work will be done in collaboration with Philips Medical and will include secondments to the University Medical Center Groningen (UMCG), the Netherlands and to the In-vivo Molecular Imaging Lab (IMIV, CEA) in Orsay, France. In addition, the project may include short-term visits to other HYBRID partners for training of specific research and soft skills.