PET/MR and SPECT/MR: New Paradigms for Combined Modalities in Molecular Imaging Conference

Abstract ID : 12

An MR-compatible shutter mechanism for stationary multi-pinhole SPECT of large objects

Content :

Introduction: A traditional SPECT system mainly consists of a detector, a collimator and a gantry responsible for rotating the collimator and/or the detector. To develop an MR-compatible SPECT system, each of these elements must be able to operate in a strong magnetic field. Also, the magnetic field distortion by the SPECT insert is preferably stationary because then shimming can be used to correct for it. It is our goal to find an alternative solution for a rotating gantry to facilitate the integration of SPECT and MR.

Methods: To reconstruct an image from a SPECT scan, it is necessary to acquire projections from different angles. In a static multi-pinhole collimator, the number of projections is defined by the number of pinholes, which is limited by the number of projections that fit on the detector without causing overlap. If this is not enough for complete angular sampling, which is often the case for large objects like the human brain and body, the collimator is typically rotated, often with the detector attached. However, rotating a heavy collimator is technically challenging, certainly when the rotation motor needs to be MR-compatible.

We developed a shutter mechanism for a full-ring multi-pinhole collimator to guarantee sufficient angular sampling without rotating the heavy collimator. The collimator is equipped with collimating shutters that block all radiation when they are moved in front of a pinhole. This allows including more pinholes on the collimator, without causing overlap. A limited amount of pinholes is selected to obtain a first set of projections. After a certain acquisition time, these pinholes are closed and the neighboring pinholes are opened. This process can be repeated multiple times. A sequence of shutter movements is thus performed to obtain an acquisition setup that is equivalent to a rotational movement. To obtain rectangular projections, each shutter also has a collimating element that is used to cut off the neighboring pinhole projections [1]. In the practical implementation, the tungsten shutters will be held together in a nylon ring. The ring will slide over the collimator ring and will be driven by pneumatic cylinders.

Results: A validation setup is currently being built. The nylon ring still needs to be manufactured but the cylinders, the valves and the controller are operational. The

cylinders are made of plastic to ensure MR-compatibility. The valves and the controller are not MR-compatible but they can be placed in the controller-room of the MR.

Conclusions: A shutter mechanism is designed to obtain equivalent data with a stationary multi-pinhole SPECT system as in rotational clinical pinhole SPECT systems. This will facilitate the integration of SPECT and MR.

[1] K. Van Audenhaege, R. Van Holen, K. Deprez, J. S. Karp, S. Metzler, S. Vandenberghe, "Design of a Static Full-Ring Multi-Pinhole Collimator for Brain SPECT", in Proceedings of the IEEE NSS and MIC, 2011.

Student Award :
YES

Primary authors : Ms. VAN AUDENHAEGE, Karen (MEDISIP, IBBT-IBiTech, Ghent University)

Co-authors : Mr. BOVIJN, Dries (Industrial Design Center, University College West Flanders) ; Prof. VAN HOLEN, Roel (MEDISIP, IBBT-IBiTech, Ghent University) ; Mr. DEPREZ, Karel (MEDISIP, IBBT-IBiTech, Ghent University) ; Prof. VANDENBERGHE, Stefaan (MEDISIP, IBBT-IBiTech, Ghent University)

Presenter : Ms. VAN AUDENHAEGE, Karen (MEDISIP, IBBT-IBiTech, Ghent University)

Track classification : Human brain PET-MR and SPECT-MR imaging ; Whole-body PET-MR and SPECT-MR imaging

Contribution type : Either

Submitted by : Ms. VAN AUDENHAEGE, Karen

Submitted on Thursday 01 March 2012

Last modified on : Thursday 01 March 2012

Comments :