ST 2: Poster Session

Time: Monday 16:15–17:30 Location: P

ST 2.1 Mon 16:15 P

Characterization of a multi-arm Compton-camera setup — •Henning Geesmann[1], Giullio Lovatti[1], Tim Fitzpatrick[1,2], Jennifer Zhou[1], Mohammad Safari[1], Florian Schneider[2], Vassia Anagnostatou[1], Katia Parodi[1], and Peter G. Thirolf[1] — [1]Ludwig-Maximilians-Universität, Munich, Germany — [2]KETEK GmbH, Munich, Germany

PET, γ-PET and prompt-γ imaging are all γ-ray based imaging techniques that can be used for beam range verification in particle therapy. They can all be realised by a multi-arm Compton camera (CC) setup.

We characterized a system where a single CC arm of the setup comprises a 16×16 pixelated GAGG crystal array as scatterer (26×26×6 mm^3, read out by one 25μm microcell SiPM array) and a monolithic absorber ($LaBr_3$:Ce or $CeBr_3$ crystal, 51×51×30 mm^3), read out by four 50μm microcell SiPM arrays). The characterization of the setup in terms of spatial resolution and efficiency is based on the use of different γ-ray point sources (511, 662 and 1274 keV) and several spatial arrangements of up to four CC arms. Further, the angular dependence of the Compton scattering kinematics can be exploited to identify spatial arrangements (scatterer/absorber) in a single CC arm that allow to select a certain regime of energies being deposited in the scatterer and, thus, allow for enhancing the performance of the setup. A summary of the latest status of the ongoing studies will be given.

This work was supported by the Bayerische Forschungsstiftung, by the ERC grant No. 725538 (SIRMIO) and by Sklodowska-Curie Individual Fellowship project HIPPOCRATE.

ST 2.2 Mon 16:15 P

Stabilization of magnetic fields in a low-field magnetic resonance tomograph for student learning — •Velda Azalia Abraham, Thomas Heinzel, and Mihai Cerchez — Condensed Matter Physics Laboratory (IPKM), Heinrich-Heine University Dusseldorf

EFNMR (Earth's Field Nuclear Magnetic Resonance) is a low-field NMR (Nuclear Magnetic Resonance) technique. Employing the Earth's magnetic field, this is an excellent tool for Medical Physics students learning as it is easy to operate and low-cost. However, EFNMR also has some downsides related to signal-to-noise ratio and magnetic field stability. Either natural fluctuations in the Earth's magnetic field or room-related changes may influence the long-time 3D imaging through changes in the Larmor frequency. Therefore a stabilization system, that would keep the magnetic field stable at all times is needed. We present here a two-directional Helmholtz correction coil system that compensates for changes of the homogeneous magnetic field in the room, leading to increased imaging quality.

ST 2.3 Mon 16:15 P

Image registration of CT and MRI scans using deep learning — •Alexander Ratke, Hannah Timm, Johannes Wintz, Göksu Ünlü, and Bernhard Spaan — TU Dortmund University, Dortmund, Germany

In radiation therapy, precise localisation of tumour and risk structures is important for therapy planning. Medical imaging methods, such as computed tomography (CT) and magnetic resonance imaging (MRI), offer different advantages due to the respective physical process, which can be combined by image fusion.

In this project, CT scans and T_1- and T_2-weighted MRI scans of different body regions are used. For their registration, two processing steps are performed. The preparatory part includes equalising the formats of the images, which is required for a neural-network-based registration. Deep learning is then used to filter structures of an image and to match them to a second image. The results of the registration of three-dimensional CT and MRI scans of the skull and the thorax will be presented as well as studies of quality and uncertainty, performed with a Shepp-Logan phantom.

ST 2.4 Mon 16:15 P

Design and validation of a Digital Twin for tumor stage prediction of prostate cancer patients — •Anna-Katharina Nitschke, Carlos Andres Brandl, and Matthias Weidemüller — Physikalisches Institut, Ruprecht-Karls Universität Heidelberg, Im Neuenheimer Feld 226, 69120 Heidelberg, Germany

Digital Twins (DT) are virtual representations of physical assets. In healthcare, DT can help to personalize diagnosis and treatment for complex diseases like prostate cancer.

To be able to generate a DT which is supporting the complete clinical journey of a cancer patient, a conceptual development for combining several individual algorithms is needed. This approach also ensures best possible practices for patient data protection during collaborative work. As interpretability and uncertainty quantification are crucial in medical applications, on hast to find a solution that meets these requirements as well as clinical guidelines. Through using ensemble methods, we develop a concept of a DT, which is combining machine learning algorithms and expert systems with the medical doctor's opinion to improve decision-making. We exemplify the approach with tumor stage prediction (TNM) before treatment planning.

This work is part of the project CLINIC 5.1 and is supported by the BMWi.