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HYBRID TOF-PET/MRI LOCAL TRANSCIEVER COIL

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In order to enhance diagnostic capabilities Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI) devices are combined into a single hybrid device providing an access to both metabolic and morphological information during a single examination. Typically the PET detectors are placed inside the diagnostic volume of the MRI scanner, however being outside the commonly used local transmit-receiver (transceiver) coils such as head or chest coils. Coils are made of plastic parts and metal conductors on which annihilation gamma quanta may scatter before reaching the PET detectors scintillating material. This fact could cause the worsening of PET images spatial resolution and the field-of-view for the PET detectors.

We propose a solution based on a novel PET tomograph concept comprising multiple detection modules, built from polymer scintillation strip ended with silicon photodetectors, arranged circumferentially inside the working volume of the MRI local transceiver coil. The adaptive of the polymer scintillators in both shape and size properties allows for a use of a standard MRI coils constructions to be combined with PET detection system without influence on the coil shape, geometry and material properties optimized so far.

Current work is focused on a dedicated detection electronics development based on silicon photodetectors arrays and digital signal processing unit that will operate in high static magnetic field as well as radiofrequency waves environment of MRI scanner.

The novel approach to the hybrid local coil construction would allow for using any existing MRI system extending its functionality by the PET imaging feature.

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NOVEL PLASTIC SCINTILLATORS FOR THE FULLY DIGITAL AND MRI COMPATIBLE J-PET SCANNER

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Jagiellonian Positron Emission Tomography (J-PET) scanner based on plastic scintillators has been developed at the Jagiellonian University. This innovative solution enables cost effective construction of PET detector with large field of view. At present we are working on the solution which would allow for the simultaneous PET and Magnetic Resonance Imaging (MRI). For that purpose we will use silicon photomultiplier (SiPM) readout which can be applied in the strong magnetic field of the MRI scanner.

In this talk we will present results of the development of a novel scintillator material (referred to as the J-PET scintillator). The purpose of the development was the elaboration of scintillator with optical properties allowing for more efficient registration of photons with SiPM array with respect to the presently available plastics scintillators and at the same time with the superior timing characteristics. The novelty of the elaborated concept lies in usage of 2-(4-styrylphenylbenzoxazole) as a scintillation additive – wavelength shifter. The substance has been used for the first time as a scintillator dopant. J-PET scintillators were manufactured via bulk polymerization of styrene or vinyltoluene and the optimal concentration of the 2-(4-styrylphenylbenzoxazole) was set by maximizing the light output and timing properties.

In the talk properties of J-PET scintillators will be presented and discussed in view of its application for the PET/MR imaging, and the performance of the developed material will be compared to the properties of commercially available scintillators.

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SPECTRAL CT: ON THE ACCURACY OF CONCENTRATION AND EFFECTIVE ATOMIC NUMBER ESTIMATION

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Introduction. Spectral CT has been an emerging new clinical innovation that enables better discrimination and characterization of tissues.

Purpose. To assess the accuracy of a new fast kVp-switch spectral CT scanner in estimating the concentration and effective atomic number (Z_{eff}) of iodine (I) in contrast enhanced tissue mimicking vessels.

Materials and methods. A cardiac CT phantom that simulates the chest of a medium-sized patient with respect to density and attenuation characteristics was coupled with four cylindrical vessels filled