Materials and methods. Radium-223 has a half-life of 11.4 days. 95.3% fraction of its energy is emitted as α-particles, 3.6% as β-particles and 1.1% as γ-radiation. The γ-rays associated with Ra-223 decay and its daughters allow for radioactivity measurements of Ra-223-Chloride by standard Capintec-CRC-15R and spectrum creation, peak selection in imaging by SPECT-γ-camera.

The most prominently γ-emissions of Ra-223 and its daughters are 269.5 KeV (14%) Ra-223, 271.2 KeV (11%) Rn-219 and 351 KeV (13%) Bi-211.

Results. Capintec-CRC-15R-s/n158895 (pure Argon gas ionization chamber) was calibrated for accuracy, constancy, linearity and geometry.

It was also calibrated with two NIST traceable radium-223 standard vials. Calibration setup in 29-6-2015 determined the calibration number and storage of Ra-223 in calibrator's memory and a user key was created.

Energy spectra of the two samples positioned on the ElScint-SPECT-γ-camera head surface were recorded graphically to study the energy distribution, decide the energy peak selection, the net area under each γ-ray peak, the full-energy-peak efficiency and put right factors.

Conclusion. Correction factors found that should be applied for accurate quantitative imaging measurements in patient-specific therapy by Ra-223-chloride. A protocol with all Ra-223 therapy steps in our institute has completed.

http://dx.doi.org/10.1016/j.ejmp.2016.07.476

MOBILE PET INSERT FOR SIMULTANEOUS PET/MRI IMAGING

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Access to the anatomical and functional information about the body interior is possible with tomography techniques relying on the registration of radiation from the tissues. Modern medicine offers: Positron Emission Tomography, Magnetic Resonance and Computer Tomography. One of the present technological challenges is to combine the PET and MR scanners to work as single device to provide PET/MR images.

Presented solution of a portable-PET scanner will allow simultaneous registration of PET and MR images utilizing existing MR scanners. The developed device is based on the strip-PET concept consisting of detection modules, each build from a plastic scintillator strip connected at both ends with silicon photomultipliers array. In the proposed solution determination of the point of annihilation along the direction of the gamma quanta flight path, is based on the time difference registered in various detection modules. It is important to stress that the utilized silicon photomultipliers are insensitive to the MR magnetic field. In order to position two tomographic images with respect to each other we will use watermarks, seen by MRI system. Since this method explicitly specify the position of the MRI with respect to PET scanner therefore it enables for synchronize both tomographic images. The advantage of this solution is to eliminate the possibility of artifacts in tomographic images hindering the identification of potentially cancerous lesions.

In the talk we will present developed solution of a mobile-PET insert to MR scanners. The presentation will include the characteristics of a proposed device together with the advantages over present solutions.

http://dx.doi.org/10.1016/j.ejmp.2016.07.477

NOVEL J-PET SCANNER COMBINED WITH POSITRON ANNIHILATION LIFETIME SPECTROSCOPY TECHNIQUE AS A TOOL FOR MORPHOMETRIC IMAGING

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Positron Annihilation Lifetime Spectroscopy (PALS) allows examining structure of materials at nano and sub-nanometer level. This technique is based on the lifetime and production intensity of ortho-positronium atoms in free volumes of given structures. It is mostly used for studies of organic materials. However there exist also few results, e.g. by groups of Y. C. Jean and R. Pietrzak, showing that morphology of cells is correlated with the PALS parameters.

Jagiellonian Positron Emission Tomograph (J-PET) is a multipurpose detector which will be used for investigations with positronium atoms in life-sciences as well as for medical diagnostics. Such prototype based on plastic scintillators and fully compatible with MRI is currently being developed at the Jagiellonian University in Krakow, Poland.

In this talk results of the first experiments conducted by the J-PET collaboration will be presented.

We performed PALS studies of well known structures such as silica and of some model micro-organisms, e.g. *Saccharomyces cerevisiae* both with dry and aqueous samples allowing to determine the correlation between hygroscopicity of the cell and PALS parameters. As a result, we proved that PALS can be successfully used for studies of living organisms their dynamics and its relation to the cells morphology.

This result opens perspective for simultaneous determination of early and advanced stages of carcinogenesis by observing changes in biomechanical parameters between normal and tumour cells and standard PET examination. J-PET detection system combined with PALS technique will be more accurate and affordable for cancer diagnostics.