



Contribution ID: 151

Type: poster

## Development of the J-PEM for breast cancer detection and diagnosis using positronium imaging

*Tuesday, 25 June 2019 13:30 (1h 30m)*

The purpose of the presented investigations is to design, construct and to establish the characteristic performance of the J-PEM (Jagiellonian Positron Emission Mammography), which is imaging modality for the detection and diagnosis of breast cancer, based on a novel idea with plastic scintillator [1,2] and wavelength shifter (WLS) [3]. Out of all imaging modalities, J-PEM is a type of Positron Emission Mammography (PEM) which is a dedicated and well-recognized technique to diagnosis the breast cancer which is based on the same principle as that of PET. J-PEM can be an effective system for the detection and diagnosis of breast cancer in its early stage by improving sensitivity and specificity and it can be achieved by the combined use of plastic scintillators, which have superior timing properties, with the WLS. In addition, this device will be developed in view of the classification of malignancy based on the possibility of positronium mean lifetime imaging [4]. We have prepared a simulation program based on Monte Carlo method for optimizing the geometry and material for the J-PEM prototype. Next step will be to construct the first prototype using the above geometry and material. We will be taking the detector system into operation, performing hardware commissioning and calibration. We also intend to prepare the image reconstruction procedure for double module J-PEM and make measurements with radioactive sources (handling with proper safety) and phantoms for testing of the device focusing upon its imaging capabilities. Furthermore, data analysis and determination of the imaging characteristics prototype for Specificity, Sensitivity, Position spread function (PSF) and signal to noise ratio (SNR).

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**Session Classification:** Poster session