

Demonstration of low-concentration nanoparticle imaging for integrated treatment-diagnostic spectral CT

治療診断統合型スペクトラル CT に向けた低濃度ナノ薬剤イメージングの実証

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X-ray computed tomography (CT) has been widely used in medical diagnostic imaging. However, Conventional CT has some problems: high exposure dose per single scan and monochromatic CT images due to loss of energy information. Thus, to address these issues, spectral photon-counting CT (SPCCT) system has been proposed. While semiconductor-based SPCCT systems are demonstrated for in-vivo imaging, there are considerable difficulties for wide-spreading: detector size and cost. To solve semiconductor-based SPCCT problems, our research group has developed a SPCCT system consisting of a multi-pixel photon counter (MPPC) coupled with a fast scintillator. In our previous study, the SPCCT system is enabled to decrease the radiation dose to 1/100 of conventional CT without degrading the image quality. Furthermore, we succeeded in the reconstruction of the color image and density map of iodine and gadolinium.

Recently, as one of the SPCCT applications, visualizing and confirmation of therapeutic effects for drug delivery system (DDS) has been proposed owing to low-dose scan and multi-color imaging. In this presentation, we will introduce the verification of imaging towards DDS monitoring. At first, we determined the optimal thickness of scintillator for imaging phantom (i.e., AuNP, iodine) used in DDS. Subsequently, we performed imaging of mixed phantoms of AuNP / PtNP and iodine assuming clinical DDS by using the determined scintillator. Consequently, iodine and AuNP / PtNP can be correctly identified and imaged in color, as shown below:

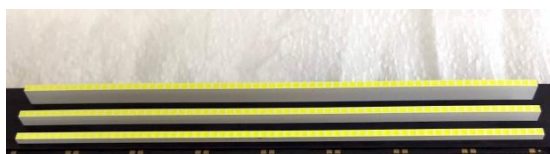


Figure1: Three different thicknesses of YGAG scintillator (1, 2 and 3 mm).

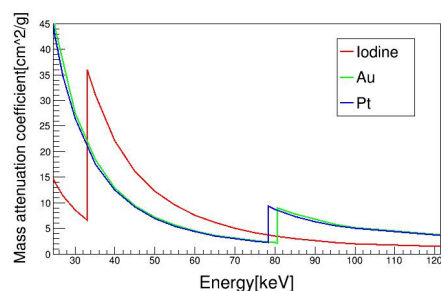


Figure2: Mass attenuation coefficient of Iodine, Au and Pt

✓ I : 1 mg/ml , PtNp : 1 mg/ml

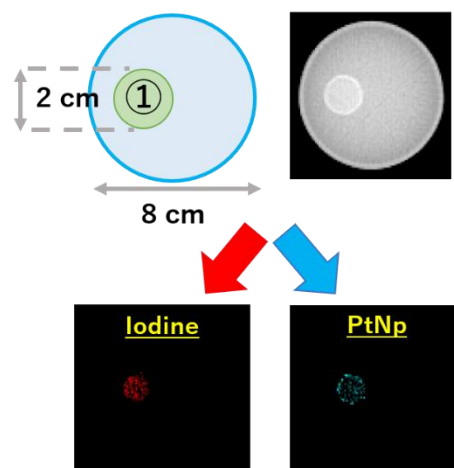


Figure3: Density image of mixed Iodine and PtNp