

Monte-Carlo simulation based analysis of performance
parameters in the MiniPET scanner, developed for preclinical
studies

(Summary)

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One of the aims of the Debrecen MiniPET project is to develop a small animal PET instrument, appropriate for medical and biological experiments. In this PhD work related to this project we have aimed at the development of a complex PET-simulation system; the evaluation of performance parameters of the MiniPET-II instrument according to the appropriate standards; the development of measuring and image processing protocols for biological experiments.

During the work the Virtual PET software had been developed, comprising analytical and Monte-Carlo methods for simulation PET data. The software was validated using the MiniPET-I camera and later it was successfully used in developing the software system of MiniPET-II.

The quality parameters of the MiniPET-II instrument we have been determined according to the NEMA NU 4-2008 standard. We can state that the performance parameters of the developed instrument are very close to those of the available other systems with similar structure.

Having performed small laboratory animal experiments have confirmed that the image reconstruction protocol, determined using phantom measurements, assures high quality image reconstruction in real measurements, as well. We have used dynamic PET-studies

to demonstrate the appropriateness of MiniPET-II's time resolution to follow pharmacokinetic processes.

Several small animal measurements have been made with various radiopharmaceuticals available in our institute, in some cases followed by autoradiographical, CT or MRI experiments. The demonstrational materials based on these measurements proved that the MiniPET-II camera satisfies the requirements of R+D projects and biological experiments involving PET imaging techniques.

KEYWORDS:

PET

Small animal PET

MiniPET

Monte-Carlo based simulation

GATE

NEMA NU 4-2008

Performance parameters

KULCSSZAVAK:

PET

Kisállat PET

MiniPET

Monte-Carlo alapú szimuláció

GATE

NEMA NU 4-2008

Működési paraméterek