SSR-SPECT/CT device: a new method for the small animal imaging study

Over the past decade, there has been a rapid rise in the use of small animal models in in-vivo biomedical research. As a consequence, small animal imaging has become an important tool in preclinical research, because the use of these techniques enables to investigate new drug molecules for disease diagnosis and therapy. This increasing interest was driven by the development of new multi-modality molecular imaging systems with improved performance. Indeed, a multi-modality system can effectively integrate functional morphological techniques.

Recently, new generation preclinical imaging systems have been introduced that combine traditional techniques like positron emission tomography (PET) or the single-photon emission computed tomography (SPECT) and computed tomography (CT) or magnetic resonance imaging (MRI), with other imaging modalities such as optical and ultrasound.

![Digimouse phantom bone scan simulation with and without SSR.](image)

Our group has developed in the past several high-performance scintigraphic detectors for small animal imaging. Consequently, our interest is focused on developing small animal SPECT suitable for integration into multi-modality imaging systems. We modelled a four-headed preclinical SPECT scanner capable of the proper movements to obtain the SSR acquisition sequences. The whole system sensitivity was 164.1 cps/MBq. To assess the impact of the SSR this value must be divided by the number of the images acquired to perform this method. The average value of the trans-axial resolution improves from 2.4 mm to 1.54 mm, 1.21 mm and 1.03 mm by respectively applying the SSR based on two, three or four images. While the average axial resolution changes from 1.69 mm to 1.49 mm, 1.15 mm and 0.98 mm by respectively using the SSR based on two, three or four images. The mouse images obtained by using the voxel phantom have demonstrated the good capability of the system as a suitable tool for small animal imaging. Finally, a comparison with commercial preclinical scanners has proved that the presented SSR scanner provides an alternative to pinhole SPECT systems for many preclinical research studies.

Moreover, we expect to apply SPECT/CT in neurosciences aiming to demonstrate a correlation between neuroinflammatory mechanisms and their potential evolution into neurodegenerative diseases.

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