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C-SPECT, a novel cardiac single-photon emission computed tomography system

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Single-photon emission computed tomography (SPECT) is the leading medical-imaging method of myocardial perfusion, important for the diagnosis and treatment of coronary-artery disease, the number-one killer in the western world. C-SPECT is a proposed novel cardiac SPECT system designed to achieve at least double the geometric efficiency compared to general-purpose dual-head gamma cameras, for the same resolution. This improvement can be used to reduce patient dose or achieve fast or/and dynamic imaging. The system consists of stationary detector modules of pixelated NaI(Tl), a slit-slat collimator with interchangeable slits, and an integrated CT for attenuation correction. The collimator slits provide pinhole collimation in the transverse plane, whereas the slats offer parallel-beam collimation in the axial direction. The adaptive power of the collimator allows us to adjust the sensitivity and resolution depending on the imaging task. This way, superior reconstructed-image resolution can be achieved if the system operates with the usual geometric efficiency of the industry benchmarks. The system gantry wraps around the patient's left-front thorax, and provides a transverse projection minification of ~50%, for a maximal number of non-overlapping projections, given the limitations from the spatial resolution of the pixelated detector. We will present the design principles and preliminary imaging performance using 3D iterative reconstruction with resolution recovery and data from the newly-built laboratory prototype as well as Monte-Carlo simulations of the full system.

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