

## **Non-Confidential Summary for M<sup>3</sup>Phantom**

Phantoms are necessary tools to validate and calibrate imaging modalities and medical algorithms, to investigate many important factors that limit the performance of the imaging procedures and diagnosis, as well as to evaluate the medical procedures before patient exams. Advanced anthropomorphic phantoms which perform thoracic motions and allow to perform and evaluate diagnosis are highly desirable. This invention (phantom assembly) overcomes many limitations of previous phantoms, and it can optimize the early diagnosis of many thoracic tumor-based imaging procedures and the early diagnosis of coronary artery disease (CAD), which is the most common form of heart disease worldwide. The invention consists of human-sized and -shaped thoracic phantoms (left ventricle of the heart, lungs and liver) which are anatomically positioned and physiologically move within an existing anthropomorphic thorax.

Key innovations are the precise motions of: (a) the ECG beating left ventricle, (b) the inflatable lungs, and (c) the cardiac-lungs-liver respiration motion in the cranio-caudal (head-to-bottom) direction. The developed motions can function simultaneously or independently to each other via a user-friendly interface of a programmable logic controller (PLC). Heart rate and ejection fraction, breath rate and lungs volume, respiration motion amplitude and other motion parameters can be chosen via the PLC. Radiopharmaceuticals can be injected within the thoracic phantoms, and within the breasts when using the female body-type of the thorax. Any sizes of cardiac defects or tumors can be positioned anywhere within these phantoms. Thus, different diseases can be simulated to perform and evaluate diagnosis.

Thoracic motions may cause false diagnosis due to artifacts, and there is an imperative need to optimize diagnosis with motion phantoms of known diseases (defects / tumors) so as to provide correct individual treatment, monitor the efficacy of the treatment, improve health care services and reduce the healthcare cost. This assembly can be imaged not only in supine position but also is the first phantom assembly with motions that can be imaged in prone position with SPECT, CT, PET modalities providing useful conclusions to physicians.

This invention holds immense relevance across various sectors, including healthcare institutions (Imaging Departments and Oncology Centers), research laboratories, universities, and medical equipment companies. Medical professionals, such as nuclear medicine physicians, any kind of radiologists, medical physicists, and medical technologists can use it to optimize CAD and tumor-based imaging procedures and diagnosis, and to perform quality assurance and calibration of these imaging modalities. Researchers and students in many medical and biomedical fields can use it to leverage their capabilities in developing and validating imaging algorithms and experimental such modalities, thereby advancing healthcare technology. Moreover, it is an invaluable resource for universities and training programs of the abovementioned specialties, preparing professionals for all the above. As a forward-thinking, medical equipment companies can also explore opportunities to incorporate this solution into their product offerings, or to collaborate with us in providing to customers a comprehensive toolkit for advanced CAD and thoracic tumor-based imaging. This assembly with such a multi-purpose and extensive imaging use is a valuable asset to hospitals, research labs, universities, and medical companies.