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Design of image quality phantoms to evaluate positron emission mammography systems

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The lack of international protocols for the evaluation of positron emission mammography (PEM) systems has led us to design image quality phantoms based on the average compressed breast dimensions and the most common lesion sizes. The main body phantom consists of a polymethyl-methacrylate (PMMA) cylinder (63 mm diameter, 50 mm height) which can be filled with a small amount of activity to mimic a uniform background and placed inside a rectangular PMMA container (100×100×56 mm3). Two interchangeable inserts have been designed: a) a microDerenzo hot-rod phantom with diameters in the 1 to 5 mm range arranged in a pie-like distribution, and b) a micro-hollow sphere lesion detection phantom that simulates hot and cold spherical lesions with internal diameters between 4.93 and 10 mm. The phantoms were filled with F-18 or Ga-68, with maximum positron energy of 634 keV and 1899 keV, respectively, to include positron range effects in the studies. The phantoms have been used to evaluate the Naviscan Solo II, a commercial PEM system currently used in the clinic. The experimental results are compared to Monte Carlo simulations using GATE v7.2. We thank the support from PAPIIT-UNAM IN110616 and IN108615, Conacyt Problemas Nacionales 2015-612, PAEP-UNAM and Conacyt MSc scholarship (LF Torres-Urzúa).

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