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High-rate Photon Counting Imaging for Mammography at the SYRMEP Beam-line

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During 2006 the SYRMEP (Synchrotron Radiation for Medical Physics) collaboration performed worldwide unique clinical mammographic examinations using X-rays generated by one of the bending magnets at the synchrotron radiation facility Elettra (Trieste, Italy). While these examinations have been performed with traditional screen-film systems, recently a major effort has been pursued in order to exploit the so-called phase contrast imaging with a monochromatic laminar high-rate X-ray beam in combination with a suitable digital detector. The INFN MATISSE project (Mammographic and Tomographic Imaging with Silicon detectors and Synchrotron radiation at Elettra) and the Paul Scherrer Institut have developed a digital detector based on a microstrip silicon sensor (50 μm pitch) coupled to the Mythen-II high-rate photon counting ASIC. This detector, which uses the edge-on technique to improve the detection efficiency, features a total of 2368 readout channels covering a beam width of about 12 cm. The system, which can be modeled as a paralyzing single photon counter, enables X-ray imaging at the quantum limit for photon fluence as high as 70 MHz/mm². This contribution presents the characterization of the device in terms of its detective quantum efficiency (DQE) and the images of standard and lowcontrast phantoms recorded in standard absorption geometry and in the phase contrast imaging modality.

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