AbstractID: 3073 Title: New detector for low dose cone beam computed tomographic (CT) mammography based on microchannel plate image amplifiers

Purpose: It is becoming recognized that tomosynthesis and/or full cone-beam CT mammography may provide more diagnostic information than standard two view projection mammography; however, current flat panel digital image receptors have limitations on image quality and low dose due to excessive lag and detector noise. Maintaining the same or lower total procedure dose can severely restrict the per-view exposure, or the number of views. A new high-resolution detector with adjustable high gain is being investigated to overcome these limitations.

Method and Materials: A detector design consisting of a CsI x-ray converter, fiber-optic taper, microchannel-plate-based image amplifier with variable gain of 6 orders of magnitude, and optical coupling to a high resolution rapid sequence, low noise, 1024^2-2048^2 matrix pixel CCD camera is being investigated for this application.

Results: A detector with a 16 cm diameter FOV can be achieved with the capability for total scan times of a few seconds. Additionally, off-center magnification modes of full-field-corrected truncated cone-beam CT are possible involving either geometric or optical magnification to improve spatial resolution. Initial tests of a small field-of-view prototype detector of the proposed design with 1024^2 matrix demonstrated linear response (quantum limited performance) for a range of detector entrance exposures from less than 0.2 microR to greater than 1 mR per view for pixels below 35 microns.

Conclusion: The proposed detector design has advantages over flat panel detectors of exhibiting virtually no ghosting or lag and of providing more than 10X lower exposure per view capability due to the huge gain dynamic range and low noise available. Further investigations involving optimization of voxel size, number of views, reconstruction algorithm, exposure per view, exposing x-ray spectrum, equalization filters, scatter reduction, patient positioning, and total scan times are proceeding.

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