

## **A novel stereo-scanning tomosynthesis (STS) scheme and its application in image guidance for breast radiotherapy**

**Purpose:** In conventional digital tomosynthesis (DTS), images are generated by scanning an x-ray source and flat-panel detector pair on a one-dimensional trajectory. A novel stereo-scanning tomosynthesis (STS) is proposed in which the x-ray source is allowed to scan on a two-dimensional (2D) surface. By allowing the x-ray source to project from more stereo angles, the scanning scheme of STS provides more coverage in the spatial-frequency domain of the object, consequently better image quality. **Method and Materials:** The feasibility and effectiveness of STS is corroborated by computer simulations, using a three-dimensional (3D) numerical breast phantom in its natural shape. Iterative algorithm in the form of total variation regulated expectation maximization (TV-EM) is developed for image reconstructions. A STS scheme is proposed as the image guidance method for prone-position breast radiotherapy. **Results:** The STS images possess excellent image quality for online tumor targeting, superior to conventional DTS. STS outperforms DTS in restoring certain features of the object and reducing artifacts, due to its more frequency-domain coverage. **Conclusion:** By allowing more general scanning trajectories than conventional DTS, STS may provide more flexible imaging geometry or/and better image quality, in various clinical tasks of image guided radiotherapy and diagnostic imaging.