Biomedical Imaging Division
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# Results in the Past

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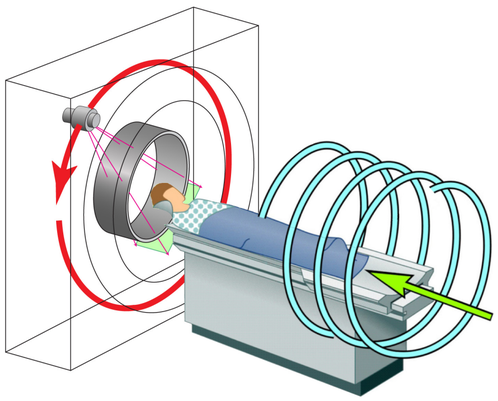
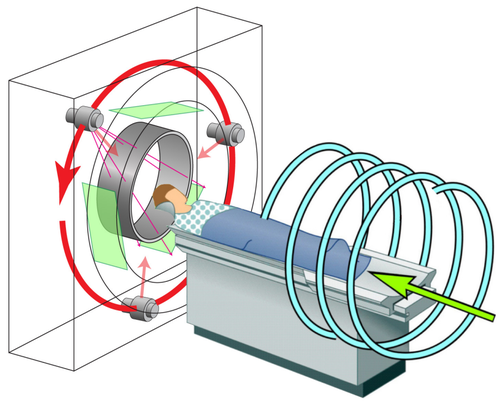
## Spiral Cone-beam CT



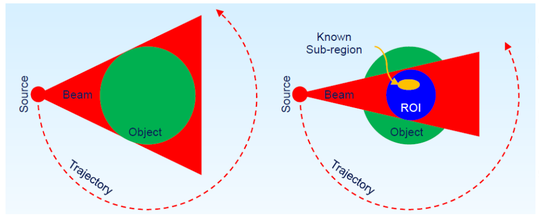
*Wang G, Lin TH, Cheng PC, Shinozaki DM. IEEE Trans. on Medical Imaging 12:486-496, 1993*



*Lv Y, Katsevich A, Zhao J, Yu H, Wang G. To appear in IEEE Trans. Medical Imaging, 2010*

We published the first paper on spiral/helical cone-beam CT in a 1991 SPIE conference. The subsequent 1993 IEEE paper on spiral cone-beam CT has been the most cited in this area. We also made recent contributions to exact cone-beam reconstruction methods, partially in collaboration with Dr. Katsevich. The modern CT scanners use spiral cone-beam scanning and perform >100-million scans annually in the USA.

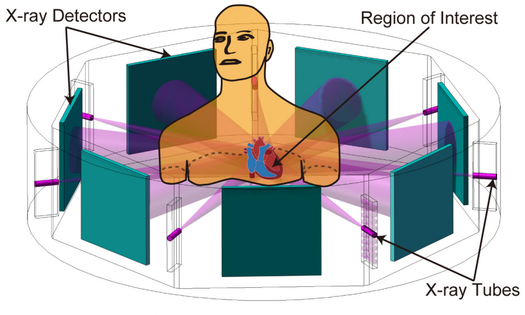
## Interior Tomography



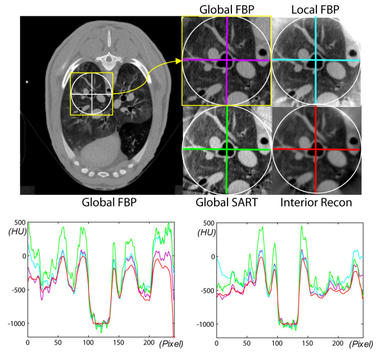

Conventional tomography allows exact reconstruction of an object from complete projections.

The long-standing interior problem is to reconstruct an interior ROI accurately only from local projection data.

Interior tomography solves the interior problem with knowledge such as known sub-region or compressive sensing.




Multi-source interior tomography for cardiac imaging

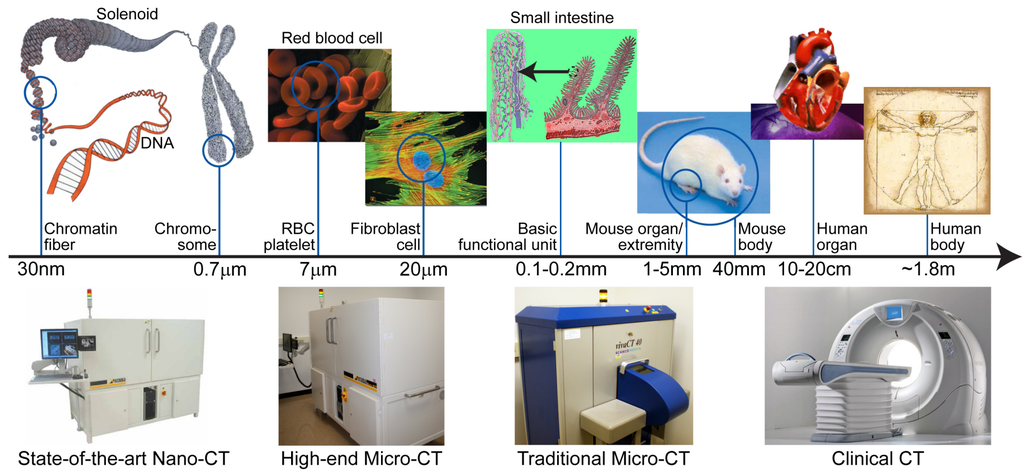



Feasibility demonstration with a sheep scan

*Wang G, Yu H, Ye YB. Virginia Tech Patent Disclosure VTIP 07-071 on May 15, 2007, US Patent 12/362,979 allowed on October 21, 2009*
*Ye YB, Yu HY, Wei YC, Wang G. International Journal of Biomedical Imaging, Article ID:63634, 2007*
*Wang G, Yu H, Ye Y. Medical Physics. 36:3575-3581, 2009*

Interior tomography can handle large objects, reduce radiation dose, and improve temporal resolution, which is a new research direction. We have extended interior tomography to SPECT, MRI and other imaging modalities.

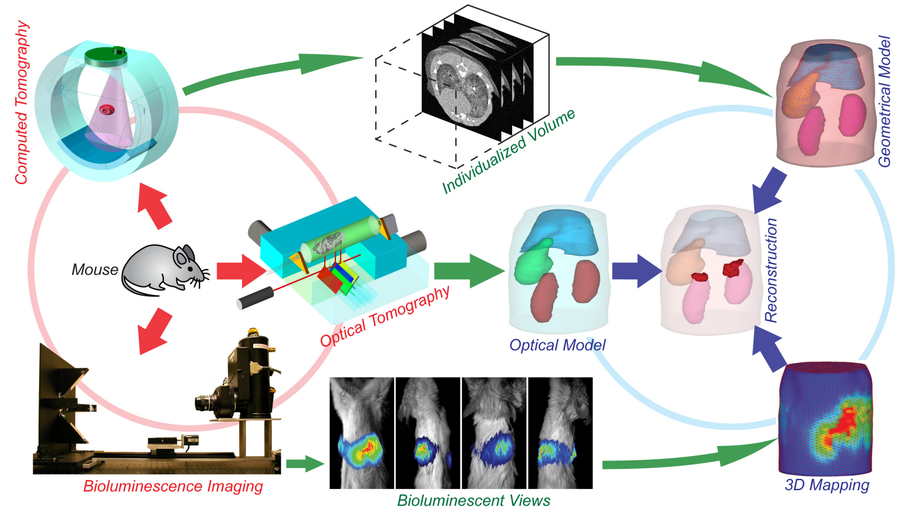
## SBES Advanced Multiscale (SAM) CT




*Wang G, Yu HY, Sharma KS, Wyatt C, Wang L, Andric T, Freeman J, Wang S, Feser M, Lau SH, Yun WB. To appear in the Proceedings of The First International Meeting on Image Formation in X-Ray Computed Tomography, Fort Douglas/Olympic Village, Salt Lake City, Utah, USA, June 6-9, 2010*

SAM-CT is an x-ray imaging facility for basic and applied research in diversified fields, including the only 500nm resolution micro-CT system on the East Coast and the only 50nm nano-CT system with the interior tomography capability in the world. These micro-/nano-CT scanners cost $3M and were made possible by funding from NIH, NSF, and SBES.

## Bioluminescence Tomography




*Wang G, Li Y, Jiang M. Medical Physics, 31:2289-2299, 2004*
*Wang G, Cong W, Kumar D, Qian X, Shen H, Sinn P, Hoffman E, McLennan G, Henry M. Optics Express, 14:7801-7809, 2006*

A mouse with an embedded bioluminescent source is imaged in a bioluminescent mode to capture external views, in a tomographic mode (CT or MR) to reconstruct an anatomical volume, and in an optical mode to estimate optical parameters. An imaging model is then built linking the bioluminescent measurement and the source distribution, and inverted for 3D analysis of the underlying molecular/cellular activities (*RSNA News: Molecular imaging advance watches tumors grow, shrink. Nov. 2007)*. This scheme can be simplified with various approximations.