

Fully-3D Image Reconstruction from Planograms

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I will briefly discuss the problem of sufficient but non-trivial sampling of the multidimensional k-plane transform and its applications to medical imaging. A specific example I will present in more detail present is a method of performing fast and accurate 3D backprojection using only Fourier transform operations for line-integral data acquired by planar detector arrays in Positron Emission Tomography.

This approach is a 3D extension of the 2D-linogram technique of Edholm. By using a special choice of parameters to index a line of response (LOR) for a pair of planar detectors, rather than the conventional parameters used to index a LOR for a circular tomograph, all the LORs passing through a point in the field of view (FOV) lie on a 2D plane in the 4D data space. Thus backprojection of all the LORs passing through a point in the FOV corresponds to integration of a 2D plane through the 4D "planogram". The key step is that the integration along a set of parallel 2D planes through the planogram, that is, backprojection of a plane of points, can be replaced by a 2D section through the origin of the 4D Fourier transform of the data. Backprojection can be performed as a sequence of Fourier transform operations, for faster implementation.