



CT Scanner Resolution

Modern clinical multi-slice CT scanners routinely acquire volume data with sub-millimetre resolution, yet the methods used to quantify spatial resolution are based on two-dimensional (2-D) techniques that were developed for use with slice based scanners. Standard 2-D CT phantoms (bar patterns, wires, or edges) that are used to quantify the modulations transfer function (MTF) have several limitations when used with clinical volume CT scanners:

- multiple scans are required to quantify trans-axial and axial resolution
- mechanical alignment or post-processing of the image data is required
- bar patterns are difficult to interpret at high spatial frequencies
- MTF data derived from scanning wires has low signal to noise and only approximates the points spread function (PSF)

As a result, measurements of spatial resolution are difficult to interpret and reproduce when applying existing 2-D techniques to multi-slice CT systems.

Volumetric CT Resolution Phantom

The C- 1025 volumetric CT resolution phantom requires only a single scan to quantify the spatial resolution accurately and reproducibly for all directions (AP, LAT, and SI), and does not require any mechanical alignment or image post-processing.



Fig. 1: C-1025 Volumetric CT Resolution Phantom

How It Works

The volumetric CT phantom is composed of a precision machined, high contrast sphere encased in silicone. The sphere surface samples image blur in all directions (3-D) from a single scan, producing data that is vastly over-sampled and results that are simple to interpret.

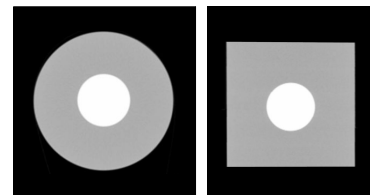
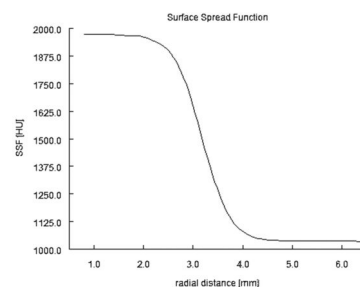


Fig. 2: Transverse and Coronal CT slices of the C-1025 resolution phantom required with the Siemens SOMATOM sensation 64-slice CT scanner.

The measurement procedure involves 3 simple steps:

1. Scan the volumetric CT resolution phantom
2. Save the scan as DICOM slices
3. Load the images into windows compatible software

Fig. 3: The volumetric CT resolution phantom scan images are used to derive the Surface Spread Function (SSF). The SSF represents the blur of the sphere surface. The blur is sampled in all directions allowing for the measurements of the trans-axial and axial resolution.



The automated analysis produces axial and trans-axial MTF and PSF plots, and calculates the respective spatial frequency of the 10% MTF and the FWHM for the PSF. The results can be saved as single page PDF file and printed. Results can also be saved to a data base file in order to track scanner performance over time.

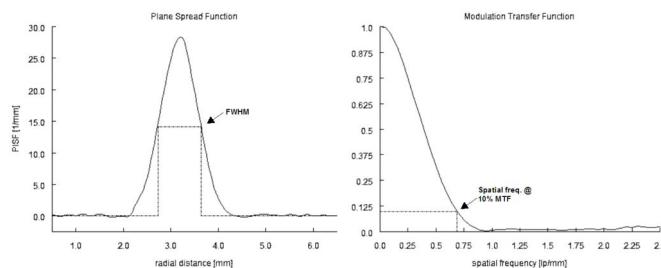


Fig. 4: The SSF is differentiated to produce the Plane Spread Function (PISF). The MTF is derived by calculating the Fourier transform of the PISF.



Patent Pending



Specification Data Sheet

Application:	Measurement of spatial resolution for Volume CT scanners
Compatibility:	Clinical full body CT scanners
Scan requirements:	One volume scan with the desired scan protocol to be evaluated
Data input:	Volume CT scan composed of a DICOM series of slices
Data output:	Plots of the Points Spread Function (PSF)* and Modulation Transfer Function (MTF), Full Width at Half Maximum (FWHM) of the PSF, 10% MTF value.
Directional data:	The spatial resolution is independently measured for the axial and trans-axial directions. The measurements may also be expressed as a function of L-R, A-P, and S-I.
Phantom:	1" (25 mm) diameter Teflon sphere encased in a 4" (100 mm) cylinder of silicone
Weight:	Approximately 2.2 lbs (1000g)
Software:	Windows compatible software to process image data.

Publication:

M. Thornton and M. Flynn, "Measurement of spatial resolution of a clinical volumetric computed tomography scanner using a sphere phantom," in Proceedings of SPIE Medical Imaging Conference (SPIE, 2006), Vol. 6142, pp. 1Z110.



S H E L L E Y M E D I C A L I M A G I N G T E C H N O L O G I E S

Sales Office

157 Ashley Crescent, London, Ontario N6E 3P9 Canada
 Phone: 1 (519) 690-0874 Fax: 1 (519) 690-0875
 Email: bob.gravett@simutec.com Web: www.simutec.com

Service Centre

41 Coldwater Road, Toronto, Ontario M3B 1Y8 Canada
 Phone: 1 (416) 447-6471 Fax: 1 (416) 447-9313
 Email: service@simutec.com

A D I V I S I O N O F S H E L L E Y A U T O M A T I O N I N C .