HOW TO BE A "MULTI-LINGUAL" CT TECHNOLOGIST: UNDERSTANDING SCAN PARAMETERS FROM DIFFERENT MANUFACTURER'S EQUIPMENT

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LEARNING OBJECTIVES

To translate important CT acquisition and reconstruction terms between different manufacturer's CT systems.

To review the underlying meaning of various CT scan parameters.

To increase the ability to translate protocols between CT systems from different manufacturers.

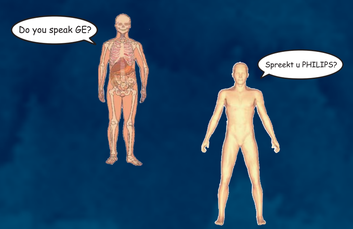
ABSTRACT

The debate over terminology within a modality is nothing new, and in CT the debate over "spiral" vs. "helical" lingers on. For the CT technologist who operates multiple scanner models, perhaps from multiple manufacturers, the inconsistency in names for important scan acquisition and reconstruction parameters can lead to confusion, reduced comfort and an increased potential for errors on the less-familiar system. A particularly confusing situation exists for the terms mAs, effective mAs, and mAs/slice. As our department operates 20 CT systems (4 vendors, 9 scanner models), our CT technologists have become well versed in translating protocols and navigating differences between various CT systems. We present a "translation" table for many common CT terms, as well as practical tips to help technologists to scan fluently across multiple CT platforms.

INTRODUCTION

Experienced CT technologists can quickly navigate the interface of a familiar scanner and accurately prescribe scan parameters as easily as most people can flip through TV channels with a remote. However, an unfamiliar interface—one where not only the buttons and fields are rearranged, but are also labeled differently—presents a challenge. Like learning a new language, the new terms are first mentally mapped to the known terms and then the meaning is inferred. The technologist repeats this multi-step process until the direct connection of the new term and its meaning is established. At this point, the individual has become a "multi-lingual" CT technologist.

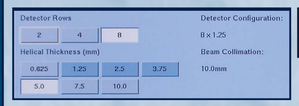
This exhibit is the "translator's guidebook" for communicating about common scan parameters and other features amongst CT scanners from different manufacturers. This exhibit focuses on items that CT scanners have in common, but that are described using different terms or phrases. Even though the installed base of CT systems includes other makes and models of systems, we focus here only on multiple detector-row product lines from four major CT manufacturers. A general description of each item is provided.



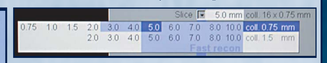
GENERIC DESCRIPTION	GE	PHILIPS	SIEMENS	TOSHIBA
Scan Acquisition and User Interface Basics				
Scan prescription user interface name	Exam Rx	Scan Procedure	Exam card	SCAN
A selectable region of the total viewing area	Viewport	Active viewer	Segment	Active display
Scanned projection radiograph (SPR)	Scout	Surview	Topogram	Scanogram
Image acquisition mode with stationary table	Axial	Axial	Sequential	Scan & View, Scan & Scan
Image acquisition mode with moving table	Helical	Helix	Spiral	Helical
Continuous x-ray exposure acquisition mode with stationary table	Cine	CCT (Continuous CT)	Dynamic/Serio	Dynamic
Interventional CT - single exposure mode	Smart Step	Single CCT	Biopsy mode	CT Fluoro (CTF)
Interventional CT - continuous exposure mode	Smart View	Continuous CCT	CARE Vision	CT Fluoro (CTF)
Table increment per 360 degree rotation of the x-ray tube (discrete table motion)	Table feed (mm)	Increment (mm)	Table increment per rotation (mm)	Pitch
Table increment per 360 degree rotation of the x-ray tube (continuous table motion)	Speed (mm/rot)	Table speed (mm/rot)	Feed (mm/rot)	Couch speed (mm/Rot)
Diameter of the scannable field of view	Scan Field of View (SFOV, cm)	*Not determined by tech; built into protocol*	*Not determined by tech; built into protocol*	CFOV *(Calibrated Field of View)*
X-ray tube current	mA	mA *(not directly selectable by tech)*	mA *(not directly selectable by tech)*	mA
Normalized tube current-exposure time product (discrete table motion mode)	*not used on this system*	mAs per slice *(= mAs)*	Effective mAs *(= mAs)*	*not used on this system*
Normalized tube current-exposure time product (continuous table motion mode)	*not used on this system*	mAs per slice *(= mAs/pitch)*	Effective mAs *(= mAs/pitch)*	*not used on this system*
Ratio of table motion (in continuous table motion mode) per total nominal beam width (as defined by IEC)	Pitch Ratio	Pitch	Pitch Factor	CT Pitch Factor
Automated audible patient instructions	Auto voice	Auto voice	API *(Automated Patient Instructions)*	Breath Control
Dose Modulation Tools				
Automatic exposure control (AEC) system	*Available in Auto-mA*	*Available in Dose Right*	*Available in CARE Dose4D*	Sure Exposure (Real EC)
X-ray tube modulation around patient x, y	SmartScan *(CT/i only)*	DOM (Dose Modulation)	CARE Dose	*not available as a separate item*
X-ray tube modulation in longitudinal (z) direction	Auto-mA	*Not available as a separate item*	*not available as a separate item (automatically used in head exams)*	Sure Exposure
X-ray tube modulation system in all dimensions (x, y, and z)	Smart-mA *(z or x, y, z)*	Z-DOM	*available in CARE Dose4D*	*Work in progress*
Cardiac x-ray tube modulation (based on ECG)	ECG Modulated mA	Cardiac Dose Modulation	ECG pulsing	*Available on Aquilion 64*
AEC combined with x, y and z tube modulation	Smart-mA	DoseRight ACS (Automatic Current Selection) *and* Z-DOM	CARE Dose4D	*Work in progress*
Image quality reference parameter for automatic exposure control (AEC) mode	Noise Index	Reference image	Quality Reference mAs	Standard Deviation (%) or standard, low-dose, or high-quality
Application Packages				
Tool for measuring diameter, area, and length of vascular structures	AVA (Advanced Vessel Analysis)	QCTA (Quantitative CT Angiography)	Vessel View	Vessel Probe *or* AVM (Auto Vessel Measurement)
Tool for viewing the interior of a vessel or structure in a virtual 3-D moving display	Navigator	CT Endoscopy	Fly	Fly Through
Tool for quantifying the amount of calcium in a coronary artery	Smart Score	Heart Beat CS	Calcium scoring	Calcium Scoring
Cardiac reconstruction mode that uses data from multiple heart beats to create a given image	Burst/Burst Plus	LVRV Analysis	ACV (Adaptive Cardio Volume)/Dual-sector	Adaptive Segmented reconstruction
Cardiac reconstruction and display package	Card IQ	Cardiac Viewer	Heart View	Sure Cardio
Quantitative bone mineral analysis package	BMD	QB Map	Osteo	Quantitative Bone Mineral Analysis
Dental analysis package	Dentascan	Dental Planning	Dental	Dental package *(not available in U.S.)*
Service and Applications Tools				
X-ray tube warm up	Daily prep *(tube warm up)*	Tube conditioning	Checkup *(does warm up and calibrations)*	Warm up
Daily calibrations	Fast cals *(done in daily prep)*	Air calibration *(includes tube warm up)*	Checkup *(does warm up and calibrations)*	*not necessary to do daily calibrations*
Computerized application information	Learning Solutions	*On-line* Help	*On-line* Help	*On-line* Tutorial
Application support assistance	Insite or Ilinq	Help Desk	Uptime	In Touch Center

GENERIC DESCRIPTION	GE	PHILIPS	SIEMENS	TOSHIBA
Multi-Slice Detector Geometry				
Multi-slice detector array design	Fixed	Asymmetric	Adaptive	Fixed
Configuration of number and width of detectors (see figure below)	Detector Configuration	Collimation N x T (mm)	Detector configuration	Detector Configuration

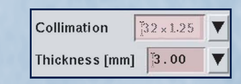
GE Detector Rows (N) and Slice Thickness (T) selection



Siemens Slice Thickness (T) selection (N determined by the scan protocol)



Philips Detector Rows (N) and Slice Thickness (T) selection



Toshiba Detector Rows (N) and Slice Thickness (T) selection

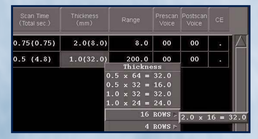
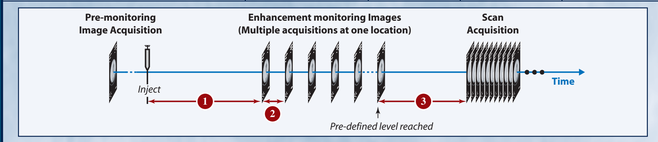


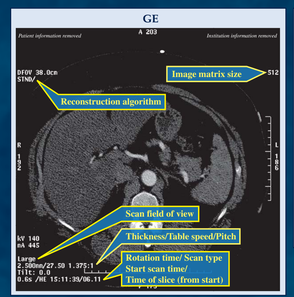
Image Reconstruction and Display				
The number of CT numbers spread over the viewable grey scale of the system	Window width	Width	Window width	Window width
The CT number used as the center value of the viewable grey scale	Window level	Center	Window center	Window level
Diameter of the reconstructed image across 512 pixels	Display Field of View (DFOV) (cm)	DFOV (mm)	FOV (mm)	DFOV (mm)
Prescribing the reconstruction parameters prior to scan acquisition	Prospective recon	Recon *and* Additional Recons	Additional Recon Jobs	Prospective recon
Prescribing the reconstruction parameters after scan acquisition	Retrospective recon	Offline Recon *or* Re-Recon	Additional Recon Jobs	Retrospective *or* Raw data recon
Reconstruction property that determines sharpness or smoothness of image in the plane of the image (x, y)	Algorithm	Recon Filter	Kernel	Filter convolution (FC)
Spiral interpolation options to achieve a wider or more narrow section sensitivity profile	Full or Plus mode	*Slice width independent of pitch*	*Slice width independent of pitch*	MUSCOT or T-COT
Nominal width of reconstructed image along the z axis	Thickness (mm)	Thickness (mm)	Slice (mm)	Image thickness
Distance between two reconstructed consecutive images	Interval	Increment	Recon increment	Reconstruction interval
Limited, lower-quality "quick-recon" images for rapid review of entire exam	*not used on this system*	Evolving reconstructions	Real-time reconstructions	SureScan
Off-center reconstruction coordinates are called. . .	RAS coordinates	Center x, center y	Center x, center y	Center x, y
Flip or rotate the image orientation is called . . .	Flip/rotate	Flip/rotate	Mirroring (Flip/rotate *in viewing card*)	Rotate/Mirror
Image modifications to alter sharpness or smoothness (done in image space without reconstructing images)	Filters	Image enhancement filter	Image manipulation *(on viewing card)*	Filter

GENERIC DESCRIPTION	GE	PHILIPS	SIEMENS	TOSHIBA
Contrast Media Tools				
Contrast media tracking tool (to automatically initiate scan at correct level of enhancement)	Smart Prep	Bolus Tracking	CARE Bolus/ Bolus Tracking	Sure Start
Tool to do a test measurement of delay time to reach the correct level of enhancement	*Take axial scans at zero table feed and process with MIROI*	Time Lapse	Test Bolus	Dynamic study
Graph of the contrast enhancement curve	Smart Prep graph	Time Lapse graph	Enhancement Curve	Time Density Curve
CT number (HU) where tracking tool will trigger the system to begin the scan	Threshold	Threshold	Level	Threshold ROI (HU)
Tool to evaluate the enhancement curve	MIROI (multiple image region of interest)	*No special name*	Dynamic *evaluation*	Real Time Monitoring
Time from injection to the beginning of monitoring images (Time 1 in figure below)	Monitoring Delay	Pre-scan delay	Delay *(on monitoring scan)*	Delay *(on Sure Start)*
Time between consecutive low-dose scans to measure contrast enhancement curve (Time 2 in figure below)	Monitor ISD (InterScan Delay)	Cycle time	Cycle time	Real time monitoring or pulsed monitoring (seconds)
Delay time between when target enhancement is reached and scan begins (Time 3 in figure below)	Diagnostic delay	Scan delay	Delay *(on scan)*	Delay *(on helical)*

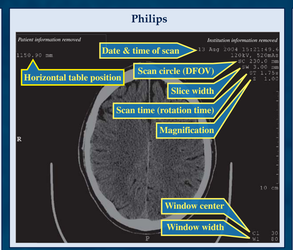


Workflow				
Scheduled (but not yet scanned) patient list is called …	Patient Schedule	Scheduled	Patient browser – Scheduler	Modality Worklist Manager
Already scanned patient list is called …	Patient List	Archive Manager	Patient browser – Local Database	Directory
User comments or text added to an image is called…	User annotation	Label	Comment	Annotation
Filming tools are called…	Auto/manual film composer	Master Film	Virtual Film Sheet *on filming task card*	Filming
Data page summarizing scan parameters	Exam Text Page or Series Text Page	Image Parameters	Patient Protocol Page	Summary *and* Exposure Record
Sorting patient list	Sort	*Click on sort field (name, date, etc.)*	Filters *(sort function on local database)*	*Click on sort field (name, date, etc.)*
Multi-Planar Reformats and 3-D Processing				
Saving images at various viewing angles about a volume or surface rendered object	Batch Loop	Cine	Radial Range	Rotate-MPR
Saving images at various planes through a volume	Batch Reformat	Batch MPR	Parallel Ranges	Multi planar reformat Movie
Volume-rendered object	Volume Rendered image (VR)	Volume Rendering	Volume Rendered Technique (VRT)	Volume Rendered
Surface-rendered object	3D	SSD 3D (Shaded Surface Display – 3D)	Shaded Surface Display (SSD)	SSD
Reformatted image at an oblique plane (not an axial, coronal, or sagittal)	Oblique reformat	Paraxial orthogonal views	Oblique	Oblique MPR

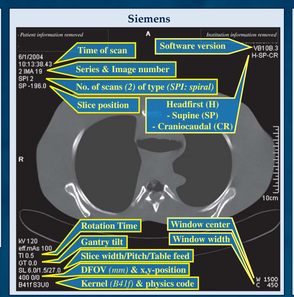
GE



Philips



Siemens



Toshiba