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CT scan parameters: Translation of terms for different manufacturers

<u>Introduction</u>
For the CT technologist who operates multiple scanner models, perhaps from multiple manufacturers, the variability in names for important scan acquisition and reconstruction parameters can lead to confusion, reduced comfort and an increased potential for error. The intent of this CT terminology lexicon is to allow users to translate important CT acquisition and reconstruction terms between different manufacturers' systems.

This represents a first step in the terminology standardization effort undertaken by this working group. Phase 2 of our work will:

1. Identify relevant terms from established standard lexicons (e.g. RadLex and DICOM) and other relevant literature and publish an expanded lexicon including these terms.
2. Form consensus recommendations on preferred terms.

This website will be updated as the terminology standardization work progresses.

The generic descriptions or terms in the first column are intended to orient the user to the relevant concepts; they are not consensus "preferred terms." The generic descriptions are not based on any single existing or pending terminology standard; however the references cited below were consulted in developing the generic descriptions. Future efforts of this Working Group include making recommendations for standardized terminology.

A number of individuals and groups have advocated for terminology standardization in CT, including at a March 30-31, 2010 FDA public meeting entitled "Device Improvements to Reduce Unnecessary Radiation Exposure from Medical Imaging" (transcripts available at:
http://www.fda.gov/downloads/MedicalDevices/NewsEvents/WorkshopsConferences/UCM210149.pdf; see p. 153-155). Participants proposed a cooperative effort among professional organizations (AAPM, ASRT, ACR, etc.), industry, FDA, and standards organizations to accomplish this task, as is now being undertaken by this Working Group.

References

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AAPM Working Group on Standardization of CT Nomenclature and Protocols

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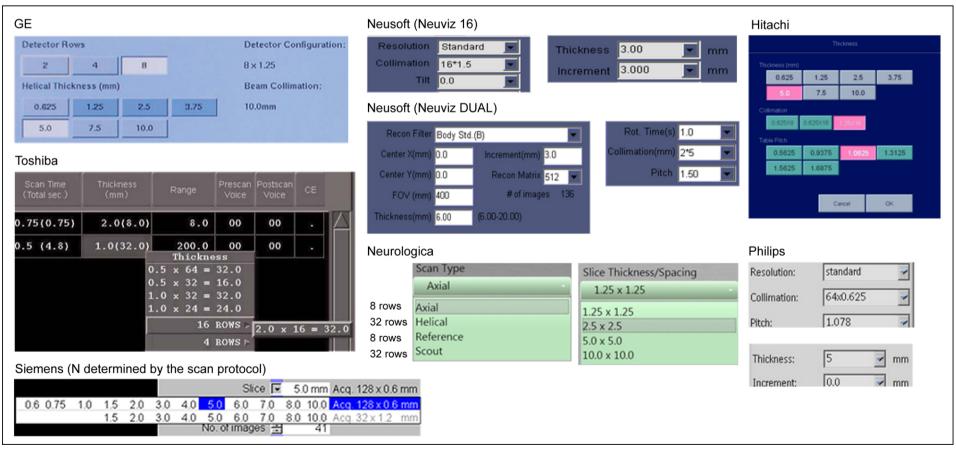| 1. Scan acquisition and user interface basics							
Generic description	**GE**	**PHILIPS**	**SIEMENS**	**TOSHIBA**	**HITACHI**	**NEUSOFT**	**NEUROLOGICA**
The portion of the **user interface** where scans are prescribed	Exam Rx	Scan Procedure	Examination	eXam Plan	Scan Protocol	Scan Procedure (Neuviz 16); Main Scan Interface (Neuviz DUAL)	Scan protocol
Other portions of the **user interface**, such as were reconstructed images are viewed	Desktop	Active viewer	Various "task cards", such as "Viewing"	Active display	Image Viewer	Image Display Area (Neuviz 16); Viewer (Neuviz DUAL)	Desktop
CT localizer radiograph (i.e. the scanned projection radiograph, often acquired by the CT system to allow the user to prescribe the start and end locations of the scan range)	Scout	Surview	Topogram	Scanogram	Scanogram	Surview	Scout
Axial scan mode: Data acquisition while the patient table remains stationary; the table position may be incremented between x-ray exposures to collect data over a longer z axis range.	Axial	Axial	Sequence	Scan & View, Scan & Scan, Volume, Wide Volume (Aquilion One)	Normal	Axial	Axial
Helical or Spiral scan mode: Data acquisition while the patient table is continuously moving along the z axis.	Helical	Helical	Spiral	Helical	Volume	Helical	Helical
Dynamic scan mode - single detector width: Data acquisition at multiple time points over the same anatomic location(s) while the patient table remains stationary; x-ray exposure can be continuous or intermittent	Cine or zero interval Axial	CCT (Continuous CT)	Dynamic (continuous) or Serio (intermittent); scan mode name: DynMulti or DynSerio.	Dynamic (Continuous or Intermittent)	Dynamic	CCT (Neuviz 16); N/A (Neuviz DUAL)	Dynamic
Dynamic scan mode - multiple detector widths: Data acquisition at multiple time points over the same anatomic location(s) while the patient table cycles back and forth between designated start and end locations in order image a region wider than the detector	Shuttle	Jog	Adaptive 4D Spiral; scan mode name: DynMulti4D or DynSerio4D (ECG triggered)	N/A	N/A	N/A	Dynamic
Interventional CT - Intermittent x-ray exposures	SmartStep	Single CCT	Model dependent: Biopsy or Intervention (i-Sequence/i-Spiral)	CT Fluoro (CTF)	guideShot	Single CCT (Neuviz 16); N/A (Neuviz DUAL)	CT Fluoro (CTF)
Interventional CT - Continuous x-ray exposures	SmartView	Continuous CCT	Model dependent: CARE Vision or Intervention (i-Fluoro)	CT Fluoro (CTF)	Not available	Continuous CCT (Neuviz 16); N/A (Neuviz DUAL)	CT Fluoro (CTF)
Table increment (mm) per 360 degree rotation of the x-ray tube (axial scan mode)	Interval	Increment (mm)	Feed (mm)	Couch movement (mm)	Table Feed (mm)	Increment (mm)	Increment (mm)

Scan acquisition and user interface basics, continued							
Generic description	**GE**	**PHILIPS**	**SIEMENS**	**TOSHIBA**	**HITACHI**	**NEUSOFT**	**NEUROLOGICA**
Table feed per 360 degree rotation of the x-ray tube (helical scan mode)	Speed (mm/rot)	Table speed (mm/rot)	Table Feed (mm/rot)*	Couch speed (mm/Rot)	Table Speed (mm/rot)	Table speed (mm/rot)	Pitch
Field of measurment: Diameter of the circular region within the scan plane over which projection data are collected. Nominally equal to the diameter of the primary beam at isocenter in the axial plane.	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)	Scan Field of View (SFOV, mm)	FOV	Full Field of View (FFOV, cm)
Tube current: Number of electrons accelerated across an x-ray tube per unit time, expressed in units of milliampere (mA)	mA	mA*	mA*	mA	mA	mA*	mA
Tube current-time product: The product of tube current and exposure time per rotation, expressed in units of milliampere • seconds (mAs). In axial scan mode, this is equal to tube current × (scan angle ÷ 360) × rotation time. In helical scan mode, this is equal to tube current × rotation time.	Not used on this system	mAs	mAs	mAs	Not used on this system	mAs	mAs
Effective tube current-time product: In helical scan mode, this is the product of tube current and rotation time (expressed in units of milliampere • seconds (mAs) ÷ pitch)	Not used on this system	mAs per slice (= mAs/pitch)	Effective mAs (= mAs/pitch)	Effective mAs (= mAs/pitch)	Not used on this system	mAs per slice (= mAs/pitch)	mAs
Tube potential: The electric potential applied across an x-ray tube to accelerate electrons towards a target material, expressed in units of kilovolts (kV)	kV	kVp	kV	kV	kVp	KV	kV
Pitch: Unitless parameter used to describe the table travel during helical CT; equal to table travel (mm) per gantry rotation ÷ total nominal beam width (mm)	Pitch	Pitch	Pitch	CT Pitch Factor	Pitch	pitch	Pitch
Automated patient instructions	AutoVoice	Auto voice	API (Automated Patient Instructions)	Breath Control	Auto Voice	Auto voice	Audio

* Not able to be directly modified on the user interface. Value is calculated/determined by other settings.

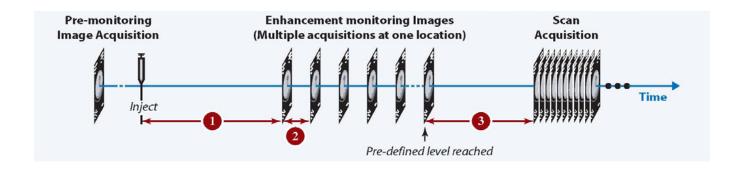| 2. Dose modulation and reduction tools							
Generic description	**GE**	**PHILIPS**	**SIEMENS**	**TOSHIBA**	**HITACHI**	**NEUSOFT**	**NEUROLOGICA**
Automatic exposure control (AEC): A scanner feature that automatically adapts the x-ray tube current to the overall patient size to achieve a specified level of image quality	Available in AutomA and SmartmA	Available in DoseRight Automatic Current Selection (ACS)	Available in CARE Dose4D	Available in SURE Exposure	Available in IntelliEC	DoseRight, ACS (automatic current selection) [Neuviz 16]; DoseSave, ACS (automatic current selection) [Neuviz DUAL]	N/A
Angular tube current modulation	SmartScan (CT/i only)	D-DOM (Dose Modulation)	CARE Dose	not available as a separate item	Adaptive mA	D-DOM (Neuviz 16); N/A (Neuviz DUAL)	N/A
Longitudinal tube current modulation	AutomA	Z-DOM	not available as a separate item	SURE Exposure	n/a	Z-DOM (Neuviz 16); N/A (Neuviz DUAL)	N/A
Angular and longitudinal tube current modulation	SmartmA (x, y, z)	Work in progress	CARE Dose4D	SURE Exposure 3D (X, Y and Z Modulation)	IntelliEC	ACS+DOM (Neuviz 16); N/A (Neuviz DUAL)	N/A
ECG-based tube current modulation	ECG Modulated mA	DoseRight Cardiac	All features available in HeartView package (except (3), only available for SOMATOM Definition Flash) (1) Retrospective gated spiral mode: use "Pulsing" settings in Trigger card (2) Prospective triggered sequence: use "Adaptive Cardio Seq." and "Pulsing" settings in Trigger card. (3) Prospectively triggered spiral ("Flash" mode)	ECG Modulation	ECG Dose Modulation	N/A	N/A
Image quality reference parameter for AEC	Noise Index	Reference image	Quality reference mAs	Standard Deviation or standard, low-dose, or high-quality	Standard Deviation (%) or standard, low-dose, or high-quality	reference image	N/A

3. Multi-Slice Detector Geometry							
Generic description	GE	PHILIPS	SIEMENS	TOSHIBA	HITACHI	NEUSOFT	NEUROLOGICA
Multi-slice detector array design	Fixed	Model dependent: Fixed or Asymmetric	Model dependent: Adaptive or Fixed	Fixed (32 row and above); Adaptive (16 row and below)	Asymmetric-16 slice; Fixed-64 slice	Asymmetric (Neuviz 16); Fixed (Neuviz DUAL)	Fixed
Detector configuration	Detector Configuration	Collimation N x T (mm)	Detector Configuration or Aqu (Acquisition) on Exam Card	Detector Configuration	Detector Configuration	Collimation N x T (mm)	Detector Configuration

Detector Rows (N) and Slice Thickness (T) selection console screen images

4. Image Reconstruction and Display							
Generic description	GE	PHILIPS	SIEMENS	TOSHIBA	HITACHI	NEUSOFT	NEUROLOGICA
Window width: Range of CT numbers (maximum - minimum) that are distributed over the viewable grey scale of the display device or film	Window Width	Window Width	Window width	Window width	Window Width	Window Width (Neuviz 16); WW Window Width (Neuviz DUAL)	Window width
Window center: The CT number in the center of the viewable grey scale	Window Level	Window Center	Window center	Window level	Window Level	Window Center (Neuviz 16); WL Window Level (Neuviz DUAL)	Window level
Reconstruction field of view: Width of the square region mapped to the reconstructed image matrix	Display Field of View (DFOV) (cm)	DFOV (mm)	FoV (mm)	DFOV (mm)	DFOV (mm)	FOV (mm) (Neuviz 16); Rec FOV (Neuviz DUAL)	FOV (cm)
Prescribing the reconstruction parameters prior to scan acquisition	Prospective recon	Recon and Additional Recons	Recon Job	Prospective recon	Multi Recon	Axial or helical reconstruction	Protocol
Prescribing the reconstruction parameters after scan acquisition	Retrospective recon	Offline Recon or Re-Recon	Recon Job	Retrospective or Raw data recon	Post Reconstruction	Offline reconstruction (Neuviz 16); Image Reconstruction (Neuviz DUAL)	Post Recon
Reconstruction property that determines sharpness or smoothness of image in the axial plane	Algorithm	Reconstruction Filter	Kernel	Filter convolution (FC)	Image Filter	Reconstruction filter (Neuviz 16); Recon Filter (Neuviz DUAL)	Kernel
Helical interpolation options to achieve a wider or narrower section sensitivity profile	Full (narrower) or Plus (wider) mode	Slice width independent of pitch	Slice width independent of pitch	Slice width independent of pitch	Slice width independent of pitch	Slice width independent of pitch (Neuviz 16); Thickness (Neuviz DUAL)	Slice width
Nominal width of reconstructed image along the z axis	Thickness (mm)	Thickness (mm)	Slice (mm)	Image thickness	Slice Thickness	Thickness	Slice thickness
Distance between two consecutive reconstructed images	Interval	Increment	Position increment	Reconstruction interval	Interval	Increment	Slice separation
Fast but lower-quality reconstructed images for rapid review of entire exam	QC Image Image Check	Evolving reconstructions	RT (Real-time reconstruction)	SUREScan	Real Time Reconstruction	Evolving mode (Neuviz 16); N/A (Neuviz DUAL)	Image Preview Image Check
Off-center reconstruction coordinates are called	RL Center; AP Center	Center x, center y	Center x, Center y	Center Position; (Vari Area)	Center x, y	Center x, center y	Center x, center y
Flip or rotate the image orientation is called	Flip/rotate	Flip/rotate	Mirroring (Flip in Viewing card); Rotate	Rotate/Mirror	Flip/Rotate	Flip/rotate	Flip/rotate
Image modifications to alter sharpness or smoothness (done in image space without reconstructing images)	Image Filters	Image enhancement filter	Evaluation > Image Manipulation (Viewing card)	Filter, QDS	Filter	IMAGE ENHANCE FILTER (Neuviz 16); DISPLAY MODE (Neuviz DUAL)	N/A

5. Contrast Media Tools							
Generic description	**GE**	**PHILIPS**	**SIEMENS**	**TOSHIBA**	**HITACHI**	**NEUSOFT**	**NEUROLOGICA**
Bolus tracking: Scanner feature to automatically initiate a prescribed axial, helical or dynamic scan when a threshold level of contrast enhancement is reached at a specified region of interest	Smart Prep	Bolus Tracking	CARE Bolus (includes Test Bolus and Bolus Tracking)	SUREStart	Predict Scan	Bolus Tracking	Bolus Tracking
Test Bolus: Scan mode used to measure the contrast transit time using a small injection of contrast media	Take axial scans at zero table feed and process with MIROI	Time Lapse	Test Bolus	Dynamic study	Not available	TIBT (Neuviz 16); Tracking layer (Neuviz DUAL)	Test Bolus
Time-attenuation curve (TAC): Graph of the contrast enhancement versus time	Smart Prep graph or MIROI graph	Time Lapse graph	Enhancement Curve	Time Density Curve	Monitoring Graph	Time Lapse Graph	Contrast curve
Threshold: CT number (HU) where bolus tracking tool will trigger the system to begin the scan	Transition ROI Threshold	Threshold	Level	Threshold ROI (HU)	Threshold	Threshold	CT threshold
Scanner feature used to quantitatively evaluate the TAC	MIROI (multiple image region of interest)	Tracker ROI Tools	DynEva (dynamic evaluation)	Real Time Monitoring	No special name	N/A	Algorithm
Monitoring delay: Time from injection to the start of monitoring scans (Time 1 in figure below)	Monitoring Delay	Post Injection Delay	Delay (on monitoring scan)	Delay (on SUREStart)	Scan Delay	(PIT) Post Injection Time	Time delay
Monitoring interval: Time between consecutive monitoring scans to (Time 2 in figure below)	Monitor ISD (InterScan Delay)	Cycle time	Cycle time	Real time monitoring or pulsed monitoring (seconds)	Monitoring Time	Cycle time (Neuviz 16); Bolus Timing (Neuviz DUAL)	Temporal resolution
Scan delay: Time from when threshold is reached and prescribed axial, helical or dynamic scan begins (Time 3 in figure below)	Diagnostic delay	Post Threshold Delay	Delay (on scan)	Delay (on helical)	Scan Delay	(PTD) Post Threshold Delay	Delay

6. Multi-planar formats and 3-D Processing

Generic description	GE	PHILIPS	SIEMENS	TOSHIBA	HITACHI	NEUSOFT	NEUROLOGICA
Reformatted image at an oblique plane (not an axial, coronal, or sagittal)	Oblique reformat	Oblique	Oblique	Oblique	Oblique MPR	oblique/curved surface	Digital tilt
Saving images at various viewing angles about a volume or surface rendered object	Batch Loop	Cine	Radial Ranges	Key Frame Movie	Multi-Slice /Angle	Cine	Capture
Saving images at various planes through a volume	Batch Reformat	Batch MPR	Parallel Ranges	Batch MPR	Multi planar reformat	batch MPR	Capture
Surface-rendered object	3D	SSD 3D (Shaded Surface Display – 3D)	Shaded Surface Display (SSD)	ShadedVol (Shaded volume rendering (SVR))	Shaded Surface Display (SSD)	SSD (Shaded surface display)	3D
Volume-rendered object	Volume Rendered image (VR)	Volume Rendering	Volume Rendering Technique (VRT)	Shaded Vol	Volume Rendering	Volume Rendering (VR)	Volume Rendered image (VR)

7. Service and Application Tools

Generic description	GE	PHILIPS	SIEMENS	TOSHIBA	HITACHI	NEUSOFT	NEUROLOGICA
X-ray tube warm up	Tube Warm-up (tube warm up)	Tube conditioning	Check-up (calibrate and check values); Calibrate (part of Check-up, can be performed separately)	Warm up	Warm up	tube warm up	Warmup
Daily calibrations	Fast Cals (done in daily prep)	Not necessary to do daily calibrations	Quality Daily	Selectable air calibrations can be scheduled after warm-up	Air cals built into Warm up	not required daily, recommend air calibration weekly	Daily Calibration
Application information	Learning Solutions or User Manual	On-line Help	On-line Help; CT Life (task card)	E-Learning Center	Sentinel (Remote Service)	On-line Help	On-line help
Application support assistance	Insite or Ilinq	Customer Care Solutions Center	Uptime	In Touch Center	CT Applications Helpline	Applications Specialist or Field Service Engineer	Service center

8. Workflow							
Generic description	**GE**	**PHILIPS**	**SIEMENS**	**TOSHIBA**	**HITACHI**	**NEUSOFT**	**NEUROLOGICA**
Scheduled (but not yet scanned) patient list is called	Patient Schedule	Scheduled (HIS-RIS) and Catalog-(manual list)	Patient Browser – Scheduler	Modality Worklist Manager	MWM-modality worklist management	Schedule	Modality Worklist Manager
Already scanned patient list is called	List/Select	Archive Manager	Patient Browser – Local Database	Directory	Patient List	Archive Manager (Neuviz 16); Archive Management Interface (Neuviz DUAL)	Patient Browser – Local Database
User comments or text added to an image is called	User annotation	Label (series) and Annotate (image)	Comment	Annotation	Comment	N/A	Annotation
Filming tools are called	Auto/manual film composer	Filming	Film Sheet on Filming task card	Filming	Filming	Filming	Printer
Data page summarizing scan parameters, CTDIvol and DLP	Exam Text Page or Series Text Page	Image Parameters	Patient Protocol (series number 501)	Summary and Exposure Record	Text Page	Information Display Bar on the right hand side of the Main Scan Interface & Dose Info series in Image Information List and Dose report at last series	Image Parameters
Sorting patient list	Sort	Click on sort field (name, date, etc.)	In Patient Browser: select "Sort" or "Filter" functions in menu bar	Click on sort field (name, date, etc.)	Click on sort field (name, date, etc.)	Select field to sort by (name, patient ID, etc.) and left click with mouse to sort.	Sort