Siemens Computed Tomography. Always Thinking Ahead.

Gegenwart und Zukunft der Multislice-CT

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Enhancement of MSCT Performance

Moore's Law Valid for CT ... ? 1.5 ... Doubling of Slices/Rotation every 2.5 Years





64-Slice CT: Double z-Sampling z-Flying Focal Spot Enabled by STRATON Tube



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64-Slice CT: Double z-Sampling Overlap Doubles Information



Clinical Advantages of Double z-Sampling Isotropic Resolution <0.36 mm at Any Pitch



Clinical Advantages of Double z-Sampling Isotropic Resolution <0.36 mm in the Entire SFOV





Sensation 64 Pitch 0.95 Center

Sensation 64 Pitch 0.95 100 mm off-center

Clinical Advantages of Double z-Sampling Elimination of Spiral Artifacts at Any Pitch Head Specimen Study: 0.5s, 150mAs, pitch 1.4

32x0.6mm – conventional



64x0.6mm – double z-sampling



Patient attenuation:

Strong Variation over

Organ regions und Projection angle (a.p., lateral)



CARE Dose 4D

Evaluate the ,Scan Projection Radiogram' (Topogram)

- 🖏 Done on-line during Topo-scan
- ℵ Attenuation for viewing angle (typ. a.p.) measured
- ℵ Lat./a.p. attenuation calculated anylizing extension and structure

Calculate appropriate a.p. and lat. mA settings

- Based on mAs-setting in user defined scan protocol (adult protocols shall be adjusted for a 70-80 kg standard patient)
- S, Optimal' mA calculated for every axial position
- 🖏 Tube load and system limits are checked
- On-line attenuation based mA-modulation during scan
- Calculation of mAs for every single image (image text)
- Calculation of average mAs, average CTDIvol and DLP

Results of Clinical Image Quality Assessment

MAs should not be proportional to object attenuation

- Noise in pediatric patients would be too high
- MAs for obese patients would deliver excessive dose levels and exceed the power limits of current scanners
- MAs should be adapted by an empirical function, according to diagnostic requirements
- AEC-scan of cylindrical water phantoms (10 to 40 cm)

 - Current default setting

Diameter, cm	10	14	20	25	30	40
ʻideal' mAs	20	33	50	80	130	250
Noise, HU	4.8	5.7	8.4	10.2	13.1	24.7

Modulation Type can be adjusted

mA is set proportional to (A/A_{ref})^b, Default settings for b:

Slim patients / low attenuation: b = 0.5Obese patients / high attenuation b = 0.33



CARE Dose 4D Topogram Evaluation: a.p. and lat.



CARE Dose 4D Optimal mA for a.p. and lat. Views: prospective mA estimates



Optimal mA for a.p. and lat. Views: On-line mA modulation



CARE Dose 4D: Whole body scan Optimal image for all organs (adult)



CARE Dose 4D

child, 6 y old, Adult Standard protocol (165 mAs) Average of 38 mAs



28mAs



65mAs



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Courtesy of Erlangen University, Germany

39mAs

System Gantry

Modified Siemens S16 gantry Variable rotation speed feasible Currently 20 s per rotation.



Digital Flat-panel Detector

- a-Si photocells
- Csl scintillator
- 40 x 30 cm² flat-panel
- (194µm)² detector size
- 25x25x18 cm³ FOV
- Imaging Matrix:
 - 2048 x 1536 pixels
 - 2 x 2 binning
 - 1024 x 768 projection
 - Resolution: 200µm
- Frame rate 30 fps



X-ray Tube

Custom X-ray tube Wide anode angle (16°) Small focal spot (0.5 mm) Pulsed operation 50% x-ray on time



MTF

Rho90 = 15.51 Rho50 = 18.84 Rho10 = 24.80 Rho05 = 26.47 Rho04 = 26.92 Rho03 = 27.48 Rho02 = 28.25 Rho01 = 29.76





Low Contrast Detectability: CATPHAN®

- Slice width = 10 mm
- 500 mAs, 120 kV
- CTDI_{100, center} = 64.2 mGy (16 cm PMMA phantom)
- Dose = std head MDCT
- LC detectability = 5HU
- Inferior to MDCT (~3 HU).
- Lower dynamic range





State of the Art in Coronary CTA Today: 16 - Slice CT

♦ Spatial resolution 0.6 x 0.6 x 0.6 mm³

Coronary artery phantom: stents with and without stenosis

Slice



Hint of lumen narrowing





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z-direction

Coronary CTA with Flat Panel Detectors: Potential

- ♦ Spatial resolution 0.25 x 0.25 x 0.25 mm³, z-coverage 18 cm
- Coronary artery phantom: stents with and without stenosis

Slice



Lumen narrowing can be precisely determined





z-direction

Comparison

MSCT



Siemens Medical Solutions that help