

SIEMENS 1

State-of-the-Art Technology in Cardiac CT

Stefan Ulzheimer, PhD
Global Director of Collaborations CT
Siemens Medical Solutions

Siemens Medical Solutions that help

SIEMENS 2

Next Step – Evolution or Revolution?

Major Innovations in CT

CT in 2000 Multislice CT ?

4 16 64 Slice-Number

The 90's Spiral CT

2s 1s 0.75s Rotation Time

The 80's Axial CT

Head Lung Body Body Regions

Time

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SIEMENS 3

Technical Progress of MSCT

Moore's Law Valid for CT ... ?

... Doubling of Slices/Rotation every 2.5 ~~Years~~ ^{1.5}

Number of Detector Rows

Year

64/

Sensation 16

Volume Zoom

Plus Classic

1 2 4 8 16

1986 1990 1994 1998 2002 2006 2010

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SIEMENS 4

From Slices to Applications

Diagnostic Oncology

Neuro

Cardio-Vascular

Acute Care

syngo

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SIEMENS 5

SOMATOM Sensation

64-slice config. with z-Sharp

9 sec for 479 mm

64 x 0.8 mm

Resolution < 0.4 mm

Rotation 0.33 sec

120 kV

200 effective mAs

Courtesy of University Medical Center Grosshadern / Munich, Germany

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SIEMENS 6

Our Vision for the Future of CT

Make CT the first imaging test in management of CAD patients

Establish CT as the „first line“ test choice in acute care

Exploring ways to add new contrasts to CT

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More and More Slices?



SOMATOM Definition

The World's First Dual Source CT

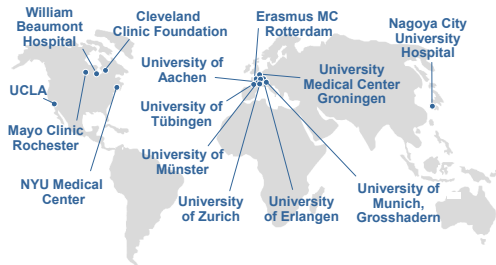
Faster than Every Beating Heart

Full Cardiac Detail at Half the Dose

One-Stop Diagnosis in Acute Care

Beyond Visualization with Dual Energy

SOMATOM Definition Already 14 Installations in Leading Institutions



SOMATOM Definition 150 installations by the end of the year



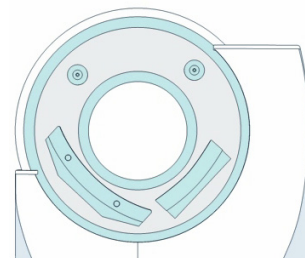
Scientific Evaluation

- Thomas Flohr, Ph.D.
First performance evaluation of a Dualsource CT system
- Stephan Achenbach, M.D.
Contrast-enhanced coronary artery visualization by dual-source CT
- Thorsten Johnson, M.D.
DSCT – cardiac imaging, initial experience



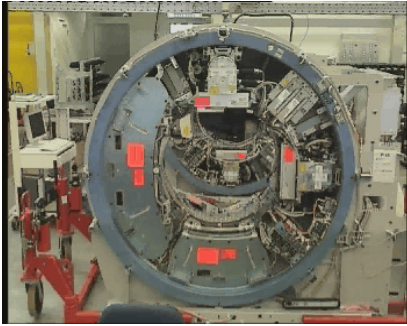
SOMATOM Definition

Excellence in CT



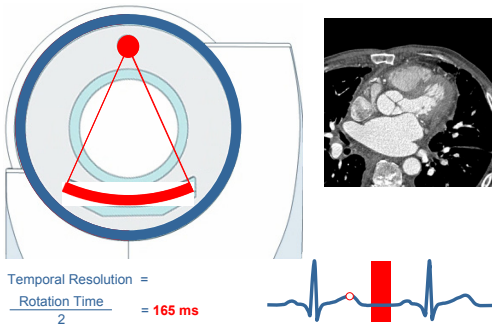
The idea behind SOMATOM Definition is as simple as ingenious. It uses two X-ray sources and two detectors at the same time.

SOMATOM Definition 0.33 seconds rotation speed of 1.6 tons

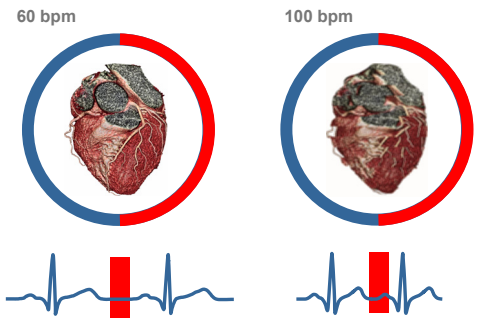


Faster than Every Beating Heart

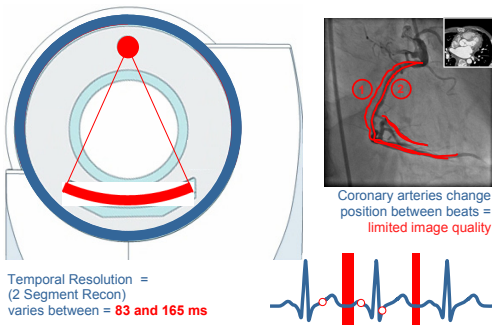
Single Source CT Temporal resolution of maximum 165 ms



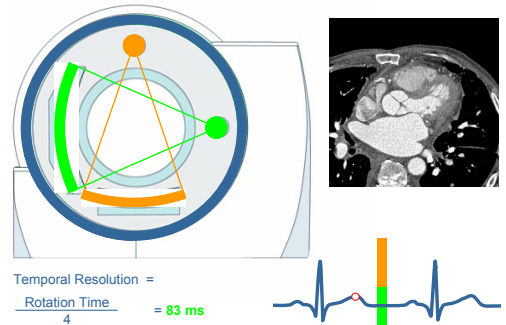
Single Source CT Technical challenge with high heart rates



Single Source CT with Multisegment Recon. Software attempt to increase temporal resolution



Dual Source CT Heart rate independent temp. resolution of 83 ms



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Dual Source CT

Reliable imaging of all heart rates

60 bpm 100 bpm

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SIEMENS 20

Export Transfer Edit View Image Tools Scroll Options Help

SOMATOM Definition
World's first DSCT

HR independent temp Res. 83 msec
Spatial Res. 0.33 mm
5 sec for 150 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
HR 65 bpm

Accurate visualization of valve motion, enabling exact surgery planning of valve replacement

Courtesy of University Medical Center Grosshadern / Munich, Germany

SIEMENS 21

Export Transfer Edit View Image Tools Scroll Options Help

Excellent visualization in both, end systolic and end diastolic phase.

SOMATOM Definition
World's first DSCT

HR independent temp Res. 83 msec
Spatial Res. 0.33 mm
7 sec for 140 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
HR 72 bpm

End Systolic

End Diastolic

Courtesy of Friedrich-Alexander University Erlangen-Nueremberg - Institute of Medical Physics / Erlangen, Germany

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Export Transfer Edit View Image Tools Scroll Options Help

Precise RCA and LAD in-stent visualization with dramatically reduced blooming and without any motion artifacts.

SOMATOM Definition
World's first DSCT

HR independent temp Res. 83 msec
Spatial Res. 0.33 mm
5 sec for 103 mm
Rotation 0.33 sec
120 kV
400 mAs/rot
HR 73 bpm

Courtesy of Erasmus MC - University Medical Center Rotterdam / Rotterdam, the Netherlands

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Export Transfer Edit View Image Tools Scroll Options Help

Excellent image quality of arrhythmic, limba bypass patient with a rapidly changing heart rate between 48 and 90 bpm.

SOMATOM Definition
World's first DSCT

HR independent temp Res. 83 msec
Spatial Res. 0.33 mm
13 sec for 137 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
HR 48 - 90 bpm

Courtesy of Friedrich-Alexander University Erlangen-Nueremberg - Institute of Medical Physics / Erlangen, Germany

SIEMENS 24

Export Transfer Edit View Image Tools Scroll Options Help

At higher or varying heart rates, the diastolic phase is too short for a single source CT scanner, resulting in poor image quality. DSCT delivers sharp and detailed cardiac images even at high HR.

SOMATOM Definition
World's first DSCT

HR independent temp Res. 83 msec
Spatial Res. 0.33 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
43% End-Systolic
HR 101 bpm

Single Source CT Dual Source CT

Courtesy of The CT Clinical Innovation Center, Mayo Clinic / Rochester USA

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Editor Transfer Edit View Image Tools Scroll Options Help

At higher or varying heart rates, the diastolic phase is too short for a single source CT scanner, resulting in poor image quality. DSCT delivers sharp and detailed cardiac images even at high HR.

SOMATOM Definition
World's first DSCT

HR independent
temp Res. 83 msec
Spatial Res. 0.33 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
6% End-Diastolic
HR 101 bpm

Tools Image View

Multiplan

Siemens Medical Solutions that help

Single Source CT Dual Source CT

Courtesy of The CT Clinical Innovation Center, Mayo Clinic / Rochester USA

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Editor Transfer Edit View Image Tools Scroll Options Help

Despite high heart rate of 122 bpm, motion free visualization of all coronary arteries and accurate display of right atrium dilatation.

SOMATOM Definition
World's first DSCT

HR independent
temp Res. 83 msec
Spatial Res. 0.33 mm
6 sec for 125 mm
Rotation 0.33 sec
120 kV
380 mAs/rot
HR 122 bpm

Tools Image View

Multiplan

Siemens Medical Solutions that help

Courtesy of University Hospital of Munich - Grosshadern / Munich, Germany

SIEMENS 27

Editor Transfer Edit View Image Tools Scroll Options Help

Scan of a 4 month old baby with high heart rate of 144 bpm and bland-white-garland-syndrome shows excellent, motion free visualization of anastomoses of LAD to aorta.

SOMATOM Definition
World's first DSCT

HR independent
temp Res. 83 msec
Spatial Res. 0.33 mm
5 sec for 109 mm
Rotation 0.33 sec
120 kV
120 mAs/rot
HR 144 bpm

Tools Image View

Multiplan

Siemens Medical Solutions that help

Courtesy of University Medical Center Grosshadern / Munich, Germany

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Full Cardiac Detail at Half the Dose

Siemens Medical Solutions that help

* compared with today's most dose efficient single slice spiral CT acquisition at heart rates above 75 bpm.

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Step 1: Dual Source CT images the heart 2 x fast, reducing the pulsing window by more than 1/2

Single Source CT

Dual Source CT

Siemens Medical Solutions that help

SIEMENS 30

Step 2: Single Source CT maintains slow acquisition even with higher heart rates

60 bpm single source CT

Slow Acquisition Speed

Siemens Medical Solutions that help

SIEMENS 31

Step 2: Dual Source CT increases the table speed and reduces the exposure at higher heart rates

60 bpm Dual Source CT

Normal Acquisition Speed

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SIEMENS 32

Full Cardiac Detail at Half the Dose Dual Source CT = 1/2 x Dose

* compared with today's most dose-efficient single-ray tube CT scanners at heart rates above 75 bpm

Relative Dose

Heart rate in bpm

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Source: Cynthia McCollough PhD, Mayo Clinic, Rochester, USA
RSNA 2005 abstr. 535-6-041 / Physics CT: Cardiac Imaging II / Monday, Nov 28 2005, 03:50 PM - 04:00 PM, S401AB

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SOMATOM Definition
World's first DSCT

HR independent
temp Res. 83 msec
Spatial Res. 0.33 mm
6 sec for 118 mm
Rotation 0.33 sec

Exposure ~ 5mSv
HR 78 bpm

Courtesy of University of Erlangen/ Erlangen, Germany

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One-Stop Diagnosis in Acute Care

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SIEMENS 35

Dual Source CT accumulates the power of 2 sources resulting in unprecedented 160 kW

Single source CT

Low Speed + Good IQ
■ Insufficient power for high-speed scanning of obese patients

Dual Source CT

High Speed + Good IQ
■ Sufficient power for sharp and detailed images at any scan speed

Siemens Medical Solutions that help

SIEMENS 36

Dual Source CT accumulates the power of 2 sources resulting in unprecedented 160 kW

Single source CT

High Speed + Low IQ
■ Insufficient power for high-speed scanning of obese patients

Dual Source CT


High Speed + Good IQ
■ Sufficient power for sharp and detailed images at any scan speed

Siemens Medical Solutions that help

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One-Stop Diagnosis in Acute Care


- Heart rate independent temporal resolution of 83 msec
- 87 mm/sec scan speed with 0.33 mm isotropic resolution
- 78 cm gantry opening and Field of View
- 200 cm scan range
- 160 kW power



Siemens Medical Solutions that help

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Patient was scanned to obtain a vascular status. Calcifications along the whole aorta were found as well as a horse shoe kidney.



SOMATOM Definition
World's first DSCT


Spatial Res. 0.33 mm
9 sec for 490 mm
Rotation 0.33 sec
120 kV
2 x 150 effective mAs

Tools Image View

Siemens Medical Solutions that help

Courtesy of Friedrich-Alexander University Erlangen-Nuernberg - Institute of Medical Physics / Erlangen, Germany

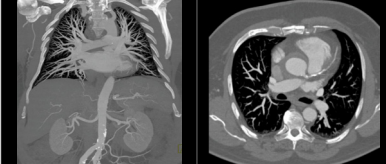
SIEMENS 39



SOMATOM Definition
World's first DSCT

Spatial Res. 0.33 mm
13 sec for 433 mm
Rotation 0.5 sec
120 kV
320 effective mAs

A non-gated scan was performed showing excellent visualization of the whole aorta without motion artifacts. The LAD showed severe calcifications in the proximal segment.

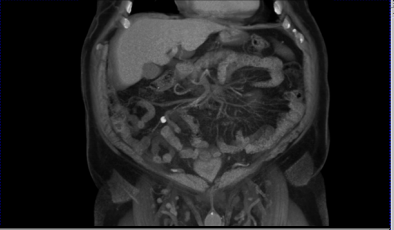


Tools Image View

Siemens Medical Solutions that help

Courtesy of University Medical Center Grosshadern / Munich, Germany

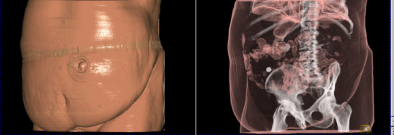
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SOMATOM Definition
World's first DSCT

Spatial Res. 0.33 mm
22 sec for 446 mm
Rotation 0.5 sec
120 kV
2 x 250 effective mAs
Weight: 287 lbs / 130 kg

Excellent display of obese patient staging post status rectum carcinoma.



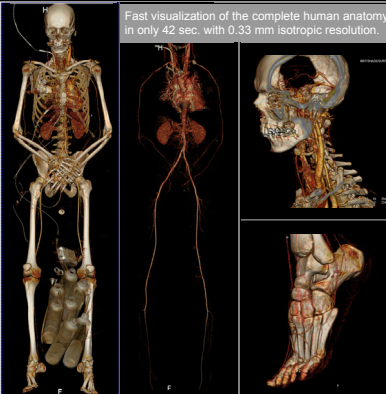
Tools Image View

Siemens Medical Solutions that help

Courtesy of University Hospital of Munich - Grosshadern / Munich, Germany

SIEMENS 41

Fast visualization of the complete human anatomy in only 42 sec. with 0.33 mm isotropic resolution.



SOMATOM Definition
World's first DSCT

Spatial Res. 0.33 mm
42 sec for 1980 mm
Rotation 0.5 sec
120 kV
120 effective mAs


Tools Image View

Siemens Medical Solutions that help

Courtesy of University Hospital of Munich - Grosshadern / Munich, Germany

SIEMENS 42

Excellent visualization of the complete peripheral artery tree with 0.33 mm isotropic resolution, showing an occlusion of the left iliac artery



SOMATOM Definition
World's first DSCT

Spatial Res. 0.33 mm
31 sec for 1380 mm
Rotation 0.5 sec
120 kV
200 effective mAs

Tools Image View

Siemens Medical Solutions that help

Courtesy of University Medical Center Grosshadern / Munich, Germany

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Beyond Visualization with Dual Energy

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SIEMENS 44

Dual Source CT Beyond Visualization with Dual Energy

80kV
Bone 670 HU Iodine 296 HU

140kV
Bone 450 HU Iodine 144 HU

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Potential clinical application and research area:
Direct subtraction of either vessels or bone during scanning.

SOMATOM Definition
World's first DSCT

Simultaneous operation of two X-ray sources at different energies

Sources A: 80 kV
Sources B: 120 kV

Tools Image View

Siemens Medical Solutions that help

*WIP: The information about this product is preliminary. The product is under development and not commercially available in this EU, and its future availability cannot be ensured.

Courtesy of University Medical Center Grossehadern / Munich, Germany

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Editor Transfer Edit View Image Tools Scroll Options Help

Potential Clinical Application and Research Area: Improved identification of cartilage and ligaments.

SOMATOM Definition
World's first DSCT

Simultaneous operation of two X-ray sources at different energies

Sources A: 80 kV
Sources B: 120 kV

Tools Image View

Siemens Medical Solutions that help

*WIP: The information about this product is preliminary. The product is under development and not commercially available in this EU, and its future availability cannot be ensured.

Courtesy of University Medical Center Grossehadern / Munich, Germany

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Editor Transfer Edit View Image Tools Scroll Options Help

Potential Clinical Application and Research Area:
Iodine removal from liver/ kidney images with contrast medium to generate a virtual unenhanced image.

initial scan contrast image

virtual non-contrast image

contrast image (red)

SOMATOM Definition
World's first DSCT

Simultaneous operation of two X-ray sources at different energies

Sources A: 140 kV
Sources B: 80 kV

Tools Image View

Siemens Medical Solutions that help

*WIP: The information about this product is preliminary. The product is under development and not commercially available in this EU, and its future availability cannot be ensured.

Courtesy of Friedrich-Alexander University Erlangen-Nuermberg / Erlangen, Germany

SIEMENS 48

From Slices to Applications

Diagnostic Oncology

Neuro

Cardio-Vascular

Acute Care

syngo

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