Computed Tomography
SOMATOM Force

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Forchheim, Germany
Is CT nog het stralingskanon van de radiologie?
SOMATOM Force
Key components

**Vectron™ X-ray tubes**
- 2 x 1,300 mA @ 70 - 150 kV
- 2 x 120kW generator

**StellarInfinity detectors**
- 2 x 96 rows (2 x 6 cm)
- 3,120 detector channels

**High-speed patient table**
- 737 mm/s speed
- up to 22 cm perfusion range
- up to 80 cm dynamic range
- Turbo Flash or High Pitch scan
Low-dose early detection with Tin Filter CT imaging at the dose of conventional X-ray\textsuperscript{1)}

SOMATOM Force

Collimation: 192 x 0.6 mm
Scan time: 0.4 s
Scan length: 289 mm
Rotation time: 0.25 s
Sn100 kV, 68 mAs
CTDI\textsubscript{vol}: 0.23 mGy
DLP: 8 mGy cm
Eff. dose: 0.1 mSv

Lung examinations with significantly improved air-to-soft-tissue contrast allow doses of conventional X-ray\textsuperscript{1)}

Table 1

<table>
<thead>
<tr>
<th>Examination</th>
<th>Average Effective Dose (mSv)</th>
<th>Values Reported in Literature (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td>0.1</td>
<td>0.03–0.22</td>
</tr>
<tr>
<td>Cervical spine</td>
<td>0.2</td>
<td>0.07–0.3</td>
</tr>
<tr>
<td>Thoracic spine</td>
<td>1.0</td>
<td>0.6–1.4</td>
</tr>
<tr>
<td>Lumbar spine</td>
<td>1.5</td>
<td>0.5–1.8</td>
</tr>
<tr>
<td>Posteroanterior and lateral study of chest</td>
<td>0.1</td>
<td>0.05–0.24</td>
</tr>
<tr>
<td>Posteroanterior study of chest</td>
<td>0.02</td>
<td>0.007–0.050</td>
</tr>
<tr>
<td>Mammaryography</td>
<td>0.4</td>
<td>0.10–0.60</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.7</td>
<td>0.04–1.1</td>
</tr>
<tr>
<td>Pelvis</td>
<td>0.6</td>
<td>0.2–1.2</td>
</tr>
<tr>
<td>Hip</td>
<td>0.7</td>
<td>0.18–2.71</td>
</tr>
<tr>
<td>Shoulder</td>
<td>0.01</td>
<td>...</td>
</tr>
<tr>
<td>Knee</td>
<td>0.005</td>
<td>...</td>
</tr>
<tr>
<td>Other extremities</td>
<td>0.001</td>
<td>0.0002–0.1</td>
</tr>
<tr>
<td>Dual x-ray absorptiometry (without CT)</td>
<td>0.001</td>
<td>0.001–0.035</td>
</tr>
<tr>
<td>Dual x-ray absorptiometry (with CT)</td>
<td>0.04</td>
<td>0.003–0.06</td>
</tr>
<tr>
<td>Intravenous urography</td>
<td>3</td>
<td>0.7–3.7</td>
</tr>
<tr>
<td>Upper gastrointestinal series</td>
<td>6\textsuperscript{*}</td>
<td>1.5–12</td>
</tr>
<tr>
<td>Small-bowel series</td>
<td>5</td>
<td>3.0–7.8</td>
</tr>
<tr>
<td>Barium enema</td>
<td>8\textsuperscript{*}</td>
<td>2.0–18.0</td>
</tr>
<tr>
<td>Endoscopic retrograde cholangiopancreateography</td>
<td>4.0</td>
<td>...</td>
</tr>
</tbody>
</table>

\textsuperscript{1)} Invest Radiol. 2014 Jul;49(7):465-73.

Courtesy of UMM, Mannheim, Germany
Early detection with low-dose lung scans
Outstanding image quality even in obese patients

SOMATOM Force

Collimation: 192 x 0.6 mm
Scan time: 2.0 s
Scan length: 274 mm
Rotation time: 0.5 s
110 kV, 79 mAs
CTD\text{vol}: 4.13 mGy
DLP: 134 mGy cm
Eff. dose: 0.28 mSv

Early detection low-dose lung scan in an obese patient with a very low dose of 0.28 mSv with outstanding image quality.

Courtesy of Hospital Saint Joseph, Marsaille, France
Cardiac imaging with high heart rates – ultra-low-dose Turbo Flash Spiral at a heart rate of 117 bpm

SOMATOM Force

Collimation: 2 x 192 x 0.6 mm
Scan time: 0.12 s
Scan length: 93 mm
Rotation time: 0.25 s
80 kV, 289 mAs
CTD1vol: 1.33 mGy
DLP: 19.7 mGy cm
Eff. dose: 0.28 mSv
HR: 117 bpm
CM: 30 mL

Rule out of coronary disease within 0.12 s at average heart rate of 117 bpm with Turbo Flash mode.

Courtesy of Baotou Central Hospital, Baotou, Inner Mongolia
Is CT nog het stralingskanon van de radiologie?

Dosis reducerende technologie in de Siemens SOMATOM Force
CARE technology
Combine Applications Reduce Exposure

- CARE Dose Configurator
- CARE Contrast
- CARE Profile
- CARE Dashboard
- CARE Child
- CARE Dose4D
- CARE kV
- Iterative Reconstruction

Scan preparation → Parameter adjustment → Scan → Image recon → Reading

SOMATOM Scanner → syngo.via

Dose Management → Dose Visualization

Dose Reduction → Iterative Reconstruction

Composed Tomography
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More precise configuration of dose modulation

- Configuration for different body habitus and organs individually
- New and more specific modulation curves
- Definition of threshold values for Dose Alert according to IEC regulations
CARE Dose4D and CARE kV

Dose relevant scan parameters
- Patient's body habitus
- Effective current (mAs)
- Voltage dep. on examination (kV)

Current modulation w/ CARE Dose4D
- Automatic patient and organ specific protocol adaption
- Automatic modulation in X,Y & Z direction in real time

Voltage setting with CARE kV

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CARE kV

Example: Abdomen @ 100 kV

Dose (CTD\text{vol}): 9.7 mGy
Dose reduction compared to:
- Siemens 120 kV stand. prot.: 14 mGy
- Competitor's 120 kV protocol*: 25 mGy

ADMIRE
The newest generation in iterative reconstruction

ADMIRE in three steps

- **Raw data statistical modeling:** Statistical weighting of all projections in raw data space
- **Model based noise cancelation:** Noise cancelation based on an intelligent approach in image space
- **Advanced system modeling:** Advanced modeling is the base for the forward projection and eliminates artifacts
ADMIRE
Excellent image quality

*) Weighted Filtered Back Projection (WFBP*)

Courtesy of UMM, Mannheim, Germany
Patient with dissection
Low kV imaging with reduced contrast media (20 mL)

**SOMATOM Force**

Collimation: 2 x 192 x 0.6 mm
Scan time: 1.1 s
Scan length: 740 mm
Rotation time: 0.25 s
80 kV, 140 mAs
CTD\text{vol} : 2.09 mGy
DLP: 155 mGy cm
Eff. dose: 2.32 mSv

Gated, examination with
20 mL\(^1\) of contrast media without breath-hold
in patient with
limited function in right kidney.

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\(^1\) 400 mg/mL
Two steps ahead in Freezing Motion “Free-breathing” CT imaging

Ultra-high-speed imaging with the unique SOMATOM Force in combination with ADMIRE

Next generation Dual Source CT (DSCT) with

- Two Vectron™ tubes
- Two Stellarfinity detectors with 25% more detector channels (1,840)
- Up to 22 lp/cm (0.24 mm) spatial resolution
- Advanced Modeled Iterative Reconstruction (ADMIRE)\(^1\) for lowest possible dose

Up to 66 ms native temporal resolution utilizing DSCT at 250 ms rotation speed

\(^1\) Image quality as defined by low contrast detectability using a model observer method for evaluation. Equivalent low contrast detectability can be achieved with 80% to 85% less dose using ADMIRE at highest strength level for thin (0.6 mm) reconstruction slices in measured and simulated body and head phantoms for low contrast objects with different contrasts. See ADMIRE data sheet for further information. In clinical practice, the use of ADMIRE may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.
“Free-breathing” CT imaging
No anesthesia, no sedation\(^1\) for babies/kids

Baseline (previous high-end CT)
Standard low-dose thorax CT
3 mSv effective dose
11 s scan time

Follow-up (SOMATOM Force)
 Turbo Flash ultra-low-dose thorax CT
0.4 mSv effective dose; 0.3 s scan time
Pediatric imaging without breath-hold and sedation\(^1\)

\(^1\) The inherent temporal resolution—the ‘native’ temporal resolution acquired by the scanner—is highly important to freeze patient motion, e.g. in lung exams or in patients who cannot hold their breath long enough. This is also important, in pediatric CT where it also can help reducing the need for potentially harmful sedation.
Preventive care in cardiac imaging
Ultra-low-dose Turbo Flash Spiral with 0.09 mSv

SOMATOM Force

Collimation: 2 x 192 x 0.6 mm
Scan time: 0.2 s
Scan length: 142 mm
Rotation time: 0.25 s
70 kV, 128 mAs
CTDI<sub>vol</sub>: 0.36 mGy
DLP: 6.6 mGy cm
Eff. dose: 0.09 mSv
HR: 56 bpm
BMI: 24

Rule out of coronary disease within 0.2 s and with ultra-low-dose with only 0.09 mSv.

Courtesy of Adventist Hospital Sydney, Australia
Two steps ahead in Decision Making
Precise Dual Energy quantification

Dual Energy (DE) imaging with improved energy separation

Vectron™ tube plus Stellar™Infinity detectors

• New energy pairings, e.g. 90 and 150 kV Sn for imaging of obese patients
• Up to 35 cm DE field of view (FoV)
• Up to 258 mm/s DE scan speed
• Tin Filter (Selective Photon Shield II) utilization

Up to 30% increased energy separation for better DE imaging outcomes
Precise Dual Energy quantification – pancreatic head tumor illustrated with different DE reconstructions

SOMATOM Force

Collimation: 2 x 128 x 0.6 mm  
Scan time: 4.35 s  
Scan length: 207 mm  
Rotation time: 0.5 s  
100/Sn150 kV, 117/60 mAs  
CTDvol: 6.88 mGy  
DLP: 162.9 mGy cm  
Eff. dose: 2.4 mSv

Advanced diagnostic information:  
Monoenergetic Plus allows energy spectrum shift to lower levels which **significantly improves** image quality and **pancreas-to-lesion contrast**\(^1\).

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Precise DE quantification – tissue differentiation and therapy response assessment of liver cancer

SOMATOM Force

Collimation: 2 x 192 x 0.6 mm
Scan time: 4 s
Scan length: 182 mm
Rotation time: 0.5 s
100/Sn150 kV, 202/190 mAs
CTD\textsubscript{vol}: 11.99 mGy
DLP: 254 mGy cm
Eff. dose: 3.81 mSv

Dose neutral Dual Energy enables advanced diagnosis of liver metastases and cyst tissue.
Kidney-friendly scanning – change treatment decisions with more comprehensive 4D imaging

SOMATOM Force

Collimation: 48 x 1.2 mm
Scan time: 36 s
Scan length: 222 mm
Rotation time: 0.25 s
70 kV, 200 mAs
CTDvol: 43.46 mGy
DLP: 905 mGy cm
Eff. dose: 13.6 mSv
CM: 12 mL

Kidney-friendly dynamic angiography of EVAR, Type II endoleak scanned with only 12 mL of contrast media in 72 year old patient.

Courtesy of UMM, Mannheim, Germany

1) 400 mg/L/mL
**SOMATOM Force**  
**Two steps ahead**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slices</td>
<td>2 x 192 (2 x 576 recon)</td>
</tr>
<tr>
<td>mA</td>
<td>1,300 mA@70 kV, 1,300 mA@80 kV</td>
</tr>
<tr>
<td>Rotational coverage</td>
<td>184 mm/rot</td>
</tr>
<tr>
<td>kV</td>
<td>70 - 150 kV, 10 kV steps</td>
</tr>
<tr>
<td>Max. scan speed</td>
<td>737 mm/s</td>
</tr>
<tr>
<td>Temp. res.</td>
<td>66 ms</td>
</tr>
<tr>
<td>Power</td>
<td>240 kW (2 x 120 kW)</td>
</tr>
<tr>
<td>Channels</td>
<td>1,840</td>
</tr>
</tbody>
</table>

**Freezing motion – avoiding artifacts**  
Dual Source CT with Turbo Flash Spiral

**Kidney-friendly scanning**  
Vectron™ X-ray tubes with maximum power at low kV

**Perfusion imaging in routine**  
Dynamic imaging with low kV and unique Adaptive Dose Shield

**Outstanding quantitative certainty**  
Fast Dual Energy acquisition with improved spectral separation

**More channels. More coverage.**  
Excellent image quality. StellarInfinity detectors – with anti-scatter 3D collimator grid

**Low-dose early detection**  
Tin Filters with ADMIRE

**Computed Tomography**

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Is CT nog het stralingskanon van de radiologie?
Dank voor uw aandacht

Computed Tomography
Listen.
Care.
Improve.