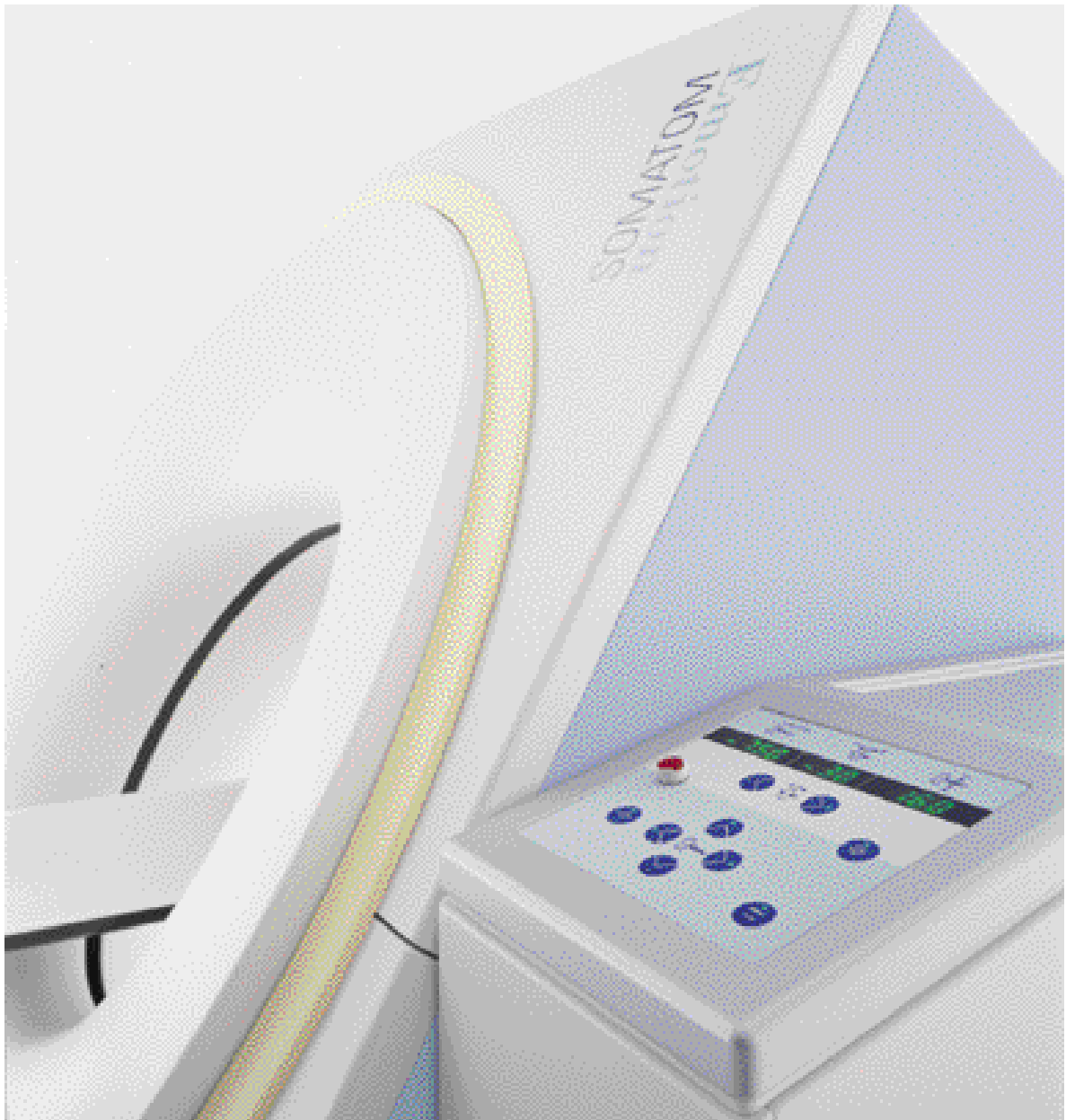


**SIEMENS**

# SOMATOM Emotion with Duo Option High Performance Solutions for Multislice CT



DATA

# SOMATOM Emotion with Duo Option

## A high performance CT scanner designed...

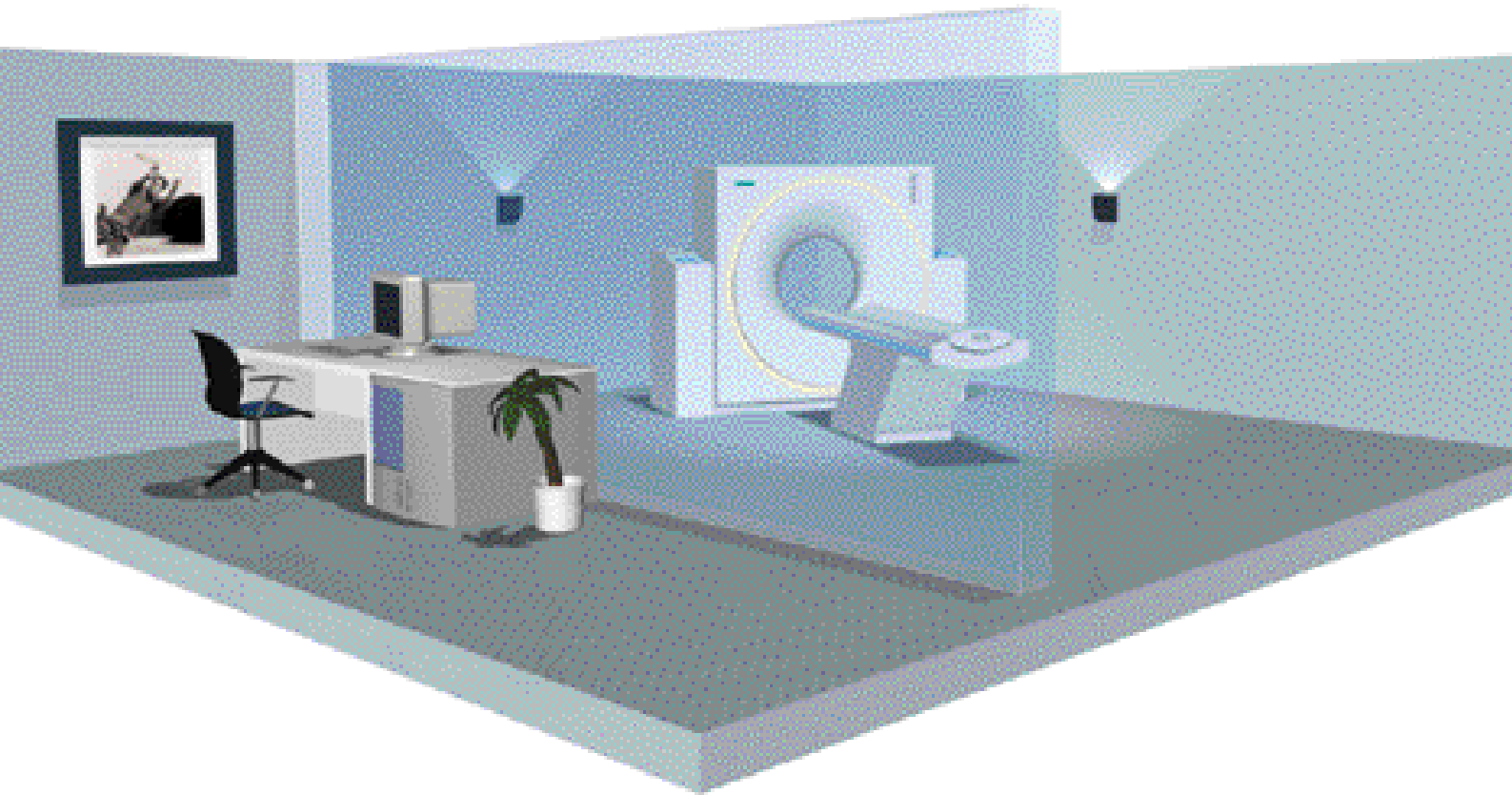
... For Multislice Scanning

... For a comprehensive range of clinical applications

... To be a complete solution for your CT needs

### Contents

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**Sub-Second Scanning**

0.8 seconds for a full rotation

**High Performance Spirals**

100 seconds of continuous spiral without any interruptions

**World's Slimmest Gantry Design**

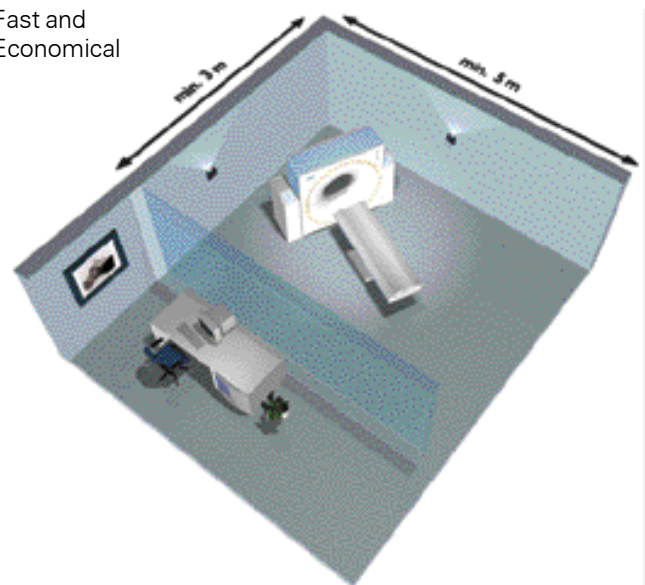
User and Patient Friendly

**Compact Installation**

Fast and Economical

**Multislice Technology**

Premium Clinical Performance



# Multislice Spiral CT

## Rapid volume scanning technique with continuous table feed

Optimized to all anatomic and physiological needs

Acquisition of an entire anatomical volume without interruption

Complete anatomic region in a single breath-hold

No misregistration of minute details between individual slices due to patient motion

Reduced examination time in the gantry—crucial for trauma patients

Well suited basis for reconstructions of secondary views

- MPR
- 3D
- MIP

## Rapid continuous scanning technique without table feed

Flow studies for differential diagnostics

Motion studies (e.g. joints)

## Application benefits

Optimal timing of contrast medium bolus

The contrast medium is more uniformly displayed throughout the images of the entire study

High temporal resolution

Improved detail recognition

## Spiral data

|                                      |                              |
|--------------------------------------|------------------------------|
| Rotation time                        | 0.8 s<br>1.0 s<br>1.5 s      |
| Pitch                                | 1–4                          |
| Scan time                            | 100 s                        |
| Scan length<br>(pitch 2, rot. 1.0 s) | 153 cm<br>(limited by table) |
| Interspiral delay                    | min. 5 s                     |

## Spiral image reconstruction

METRO RECON: Simultaneous reconstruction parallel to spiral acquisition

Retrospective reconstruction of raw data

Freely selectable position

Freely selectable increment and number of images

- contiguous
- overlapping

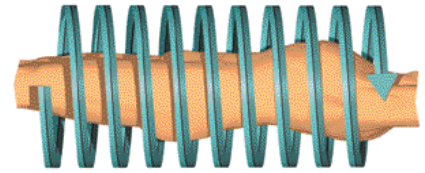
## SureView Spiral Reconstruction

|                             |  |
|-----------------------------|--|
| mAs                         | preselectable  |
| Effective slice width       | preselectable  |
| Pitch                       | 1–4<br>(freely selectable)   |
| Slice broadening with pitch | none   |
| Dose                        | Savings of about 20% due to noise reduction over sequential images |

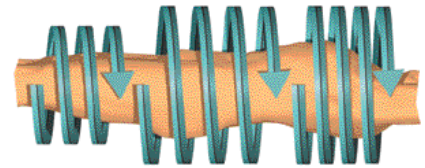
**Pitch.** Pitch is the ratio of table feed per rotation to collimation

**Increment.** Increment is the spacing between adjacent images

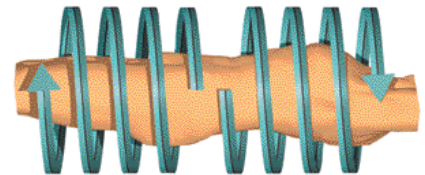
**Multislice Pitch.** In the case of multislice CT systems, the pitch is the ratio of table feed per rotation to single slice collimation



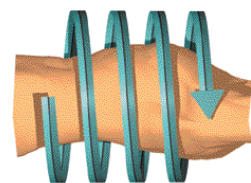
▲ Single spiral—fast uninterrupted scanning of large anatomic volumes



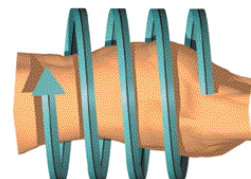
▲ Multiple spirals with delays, acquired in any direction—patient breathing pauses, change of parameters or modes



▲ Multiple spirals started from any desired position with different directions—utilization of a contrast medium bolus in different anatomical regions



Repeated acquisition of a region (scanned in same or opposite direction)—acquisition of different contrast medium phases of a bolus within an anatomic region



# Sequence

# Topogram

## Combi Scan

---

Freely selectable slice thickness for prospective and/or retrospective reconstruction

## Real-Time Display

---

Immediate image display parallel to spiral acquisition (e.g. for trauma and interventions)

## CARE Bolus [optional]

---

Operating mode for contrast medium enhancement triggered data acquisition

## Spiral performance Multispiral

---

| Spiral time (Aurorange) | Spirals with full image quality         |
|-------------------------|---|
| 40 s / 40 cm            | 3 spirals                               |
| Parameters:             | 130 kV,<br>100 mAs,<br>1.0 s<br>pitch 2 |
| 30 s / 38 cm            | 3 spirals                               |
| Parameters:             | 130 kV,<br>100 mAs,<br>0.8 s<br>pitch 2 |

## Fast axial scan sequence

Acquisition with or without table feed

Multitrotation scans to reduce motion artifacts

Automatic clustering of scans

## Sequence data

---

|  |                |
|--|----------------|
| Scan times                                 | 0.8 s          |
| full scan (360°)                           | 1.0 s<br>1.5 s |
| partial scan (240°)                        | 0.5 s, 0.67 s  |
| Number of uninterrupted scans              | 99             |
| Number of ranges in autorange              | 6              |
| Number of scans in autorange               | 99             |
| Standard scan cycle time (scan time 1.0 s) | 2 s<br>(±10%)  |
| Dynamic scan cycle time (scan time 1.0 s)  | 2 s<br>(±10%)  |

## Survey radiograph with diagnostic image quality for planning the complete examination

Real-Time Topogram

CARE Topo: manual stop once desired anatomy has been imaged

## Topogram data

---

|        |                         |
|--------|-------------------------|
| Length | 128 to<br>1,024 mm      |
| Views  | a.p.<br>p.a.<br>lateral |

# Image Quality

## Low-contrast detectability

5 parameters to compare low-contrast detectability between systems

Low-contrast detectability is the ability to see

- a small object (mm)
- with a certain contrast difference (HU)
- on a particular phantom (∅)
- at a mAs value (mAs)
- with a particular patient dose (mGy)

|  |                                  |
|--|----------------------------------|
| <b>Phantom</b>                                     | <b>CATPHAN (16 cm)</b>           |
| Object size  | 3 mm                             |
| Contrast diff.                                     | 3 HU                             |
| Dose at the surface                                | 19.7/20.5 mGy* at 100/104 mAs    |
| Technique  | 1.0 s / 0.8 s<br>10 mm<br>130 kV |
| *Air KERMA, measured on the surface of the phantom |                                  |

|  |                                  |
|--|----------------------------------|
| <b>Phantom</b>                                     | <b>CATPHAN (20 cm)</b>           |
| Object size  | 5 mm                             |
| Contrast diff.                                     | 3 HU                             |
| Dose at the surface                                | 15.8 mGy* at 90 mAs              |
| Technique  | 1.0 s / 0.8 s<br>10 mm<br>130 kV |
| *Air KERMA, measured on the surface of the phantom |                                  |

## High-contrast resolution

|                    |  |
|--------------------|--|
| <b>0% MTF ±10%</b> | 15.5 lp/cm<br>0.32 mm                  |
| <b>2% MTF ±10%</b> | 14 lp/cm<br>0.36 mm                    |
| <b>Technique</b>   | 60 mA<br>130 kV<br>1 s / 0.8 s<br>1 mm |

## Dose, CTDI<sub>100</sub> values

| Phantom ∅     |                    | kV:  |      |
|---------------|--------------------|------|------|
|               |                    | 110  | 130  |
| [mGy/100 mAs] |                    |      |      |
| 16 cm         | A                  | 14.4 | 21.7 |
|               | B                  | 15.7 | 23.3 |
| 32 cm         | A                  | 4.2  | 6.7  |
|               | B                  | 8.4  | 12.8 |
| A:            | at center          |      |      |
| B:            | 1 cm below surface |      |      |

PMMA phantom,  
Reference material is air  
Max. deviation ± 30%  
Expected deviation ± 15%  
Slice > 1 mm

## Homogeneity

|  |                            |
|--|----------------------------|
| <b>Cross-field uniformity in a 20 cm water phantom</b> | max. ± 4 HU<br>typ. ± 2 HU |
| Phantom positioned near center of rotation             |                            |

# Computer System

## Image Control System (ICS)

High performance Siemens proprietary computer platform for simultaneous scanner control and post-processing functionality

True multitasking environment achieved by combining state-of-the-art HW technology (CISC architecture) with highly efficient SW implementation

|                          |   |
|--------------------------|---|
| <b>Patient data disk</b> | 36 GB<br>13,000 images and 6,000 raw data sets of 0.8 sec. scan |
|--------------------------|---|

## Image Reconstruction System (IRS)

Advanced image reconstruction computer designed to provide high processing speed and overall system reliability

Multiple processor technology with an aggregate performance of almost **2 GHz** (word length up to 128 bits) is employed to meet the extreme demands of medical imaging devices

# Image Processing and Handling

## Image reconstruction

|             |   |
|-------------|---|
| Slice width | 2×1, 2×1.5,<br>2×2.5, 2×4, 2×5,<br>8, 10 mm |
| Scan field  | 50 cm                                       |
| Recon field | 5–50 cm                                     |
| Recon time  | 1 s   |

|                   |                    |
|-------------------|--------------------|
| Recon matrix      | 512 × 512          |
| HU scale          | –1,024 to +3,071   |
| Extended HU scale | –10,240 to +30,710 |

## Combi Scan

Freely selectable slice thickness for prospective and/or retrospective reconstruction

## Image display

|                      |                    |
|----------------------|--------------------|
| Monitor size         | 21" (53 cm)        |
| Monitor resolution   | 1,280 × 1,024      |
| Image display matrix | max. 1,024 × 1,024 |
| Flat screen monitor  | 18"                |

**CINE Display.** Display of image sequences

- interactively with mouse-controlled speed
- or automatically

|            |           |
|------------|-----------|
| Image rate | max. 10/s |
|------------|-----------|

## Windowing

Windowing width and center freely selectable

Single window

Multiple window settings for multi-image display

## Filming

Digital film documentation, if connected to a suitable digital camera  
Connection via DICOM Basic print

Automatic filming during scanning

Filming Interactive

Filming parallel to other activities

Independent scanning and documentation—no waiting time caused by camera delays

Freely selectable placement of images onto film sheet

Configurable image text

## Archiving

|                      |  |
|----------------------|--|
| CD-R                 | 0.7 GB<br>1,100 images or<br>125 raw data of<br>0.8 sec scan |
| MOD DICOM [optional] | 2.3 GB<br>3,700 images or<br>410 raw data of<br>0.8 sec scan |
|                      | 4.1 GB<br>6,500 images or<br>680 raw data of<br>0.8 sec scan |

## Image transfer/Networking

**DICOM.** Interface for transmitting medical images and information in the DICOM standard

Permits communication between devices of different manufacturers

Features

- DICOM Send/Receive
- DICOM Query/Retrieve
- DICOM Basic print
- DICOM Get worklist (HIS/RIS)

DICOM Conformance Statement:  
<http://www.siemens.de/med/e/dicom>

DICOM=Digital Imaging and Communications in Medicine

# Evaluation



## Image evaluations & annotation

---

Parallel evaluation of up to 4 Regions of Interest

- Circle
- Irregular
- Polygonal

Statistical evaluation:

- Area/Volume
- Standard deviation
- Mean value
- Min/max values

Profile cuts

- Horizontal
- Vertical
- Oblique

Distance measurement

Angle measurement

On-line measurement of a 5 × 5 pixels size ROI

Reference scales

Image annotation and labeling

## 2-D post-processing

---

Image zoom and pan

Image manipulations:

- Subtraction/Addition
- Averaging
- Reversal of gray-scale values
- Mirroring

Image filter functions

Dynamic evaluation to acquire time density curves

## Real-time MPR

---

Real-time multiplanar reformatting of secondary views

Viewing perspectives:

- sagittal,
- coronal
- paraxial
- oblique
- freehand (curvilinear)

## CT Angiography

---

Evaluation of spiral images and display of vessels, vascular anomalies, aneurysms, plaques, and stenoses

Further functions:

- MIP (Maximum Intensity Projection)
- Volume Editor (to eliminate interfering or irrelevant parts of the image)
- Sliding MIP

## 3D SSD

---

### Shaded Surface Display

Three-dimensional display of surfaces with different density values:

- Soft tissues
- Bones
- Contrast-enhanced vessels

## Dental CT [optional]

---

Reformatting of panoramic slices and paraxial sections through the lower and upper jaw for analysis in connection with implantation surgery

## Osteo CT [optional]

---

Quantitative determination of bone mineral density (BMD) of the vertebrae

## Pulmo CT [optional]

---

Quantitative evaluation of the lung tissue density

## User Interface

---

The SOMATOM Emotion Duo comes standard with *syngo*, the revolutionary Siemens Medical multi-modality user interface

DICOM is included and is the basis of all connectivity functions of the system

## HeartView CT [optional]

---

The sub-second ECG triggered acquisition, combined with the multi-row technology, yield high quality, low artifact imaging of the heart. Such high quality images allow good visualization of coronary calcified plaques.

## Calcium Scoring [optional]

---

Dedicated application that estimates the amount of calcium in CT images (for best results, ECG triggered images obtained with sub-second cardiac CT should be used). It calculates the Agatston score for calcium within user-defined regions, for up to four coronary arteries.

# Patient Handling

## Patient table

---

|                              |                         |
|------------------------------|-------------------------|
| Max. table load              | 200 kg / 450 lbs        |
| Table feed                   | 1–100 mm/s              |
| Vertical table travel range  | 45–83 cm (at table top) |
| Scannable range (metal-free) | 153 cm                  |

**Intervention with C-arm.** Table top allows use of a mobile C-arm during examination

|  |        |
|--|--------|
| Distance between gantry front and table base | 42 cm  |
| Scannable range with head holder             | 123 cm |

## Lateral light marker

---

Positioning aid for horizontal patient positioning

## Patient communication

---

Integrated patient intercom

Automatic Patient Instruction (**API**)

- Freely recordable

|                          |    |
|--------------------------|----|
| Number of API text pairs | 30 |
|--------------------------|----|

## Patient registration

---

Online registration

Preregistration of patients

### Overview of all options for customizing your system

#### HeartView CT

---

The sub-second ECG triggered acquisition, combined with the multi-row technology, yield high quality, low artifact imaging of the heart. Such high quality images allow good visualization of coronary calcified plaques.

#### Calcium Scoring

---

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#### Osteo CT

---

Quantitative determination of bone mineral density (BMD) of the vertebrae

#### Dental CT

---

Reformatting of panoramic slices and paraxial sections through the lower and upper jaw for analysis in connection with implantation surgery

#### Pulmo CT

---

Quantitative evaluation of the lung tissue density

#### Perfusion CT

---

Evaluation of dynamic multiscan data of the brain following contrast bolus injection

Aids in the assessment of cerebral perfusion disturbances

#### CARE Vision CT

---

Perform interventions at the CT scanner with realtime image guidance

**Foot switch.** Radiation release directly at the gantry

**Additional monitor.** For parallel image display in the examination room

|                    |           |
|--------------------|-----------|
| Monitor size       | 19"       |
| Distance from host | max. 30 m |

# Productivity Options

## Color choice

---

Select the color of the gantry side panels from 2 choices

- Blue/Yellow
- White/Blue

## Keyboard

---

- English
- German
- French

## Flat Screen Monitor

---

For the main console and 2<sup>nd</sup> (Wizard) console

|                      |               |
|----------------------|---------------|
| Monitor size         | 18"           |
| Monitor resolution   | 1,280 × 1,024 |
| Image display matrix | 1,024 × 1,024 |

## Archiving devices

---

- MOD DICOM for 2.3 GB and 4.1 GB disks

## Additional Monitor

---

Remote display of diagnostic information

|                    |            |
|--------------------|------------|
| Monitor size       | 19" or 21" |
| Distance from host | max. 120 m |

**Foot switch.** Radiation release directly at the gantry

## CARE Bolus

---

Operating mode for contrast medium enhancement triggered data acquisition

## Wizard Console [optional]

---

The Wizard Console can be installed in parallel with the main operator's console (Navigator) via a shared patient database link.

When the 2<sup>nd</sup> console is on site, only the basic scan functions are limited to the main console. Dedicated *syngo* task cards for filming, image review and 3D post-processing — MPR, MIP and SSD — are displayed on both consoles.

Optional task cards might also be displayed in the 2<sup>nd</sup> console if the related applications are licensed for this computer — Pulmo CT, Osteo CT, Dental CT and Calcium Scoring.

# Components

## Gantry

Continuously rotating tube–detector unit with optimized geometry for high-resolution data acquisition throughout the entire scan field

|            |  |
|------------|--|
| Aperture   | 70 cm                                  |
| Tilt       | ± 30°                                  |
| Scan times | 0.8 s,<br>1.0 s, 1.5 s<br>0.5 s (240°) |

### Patient accessibility

|                                     |       |
|-------------------------------------|-------|
| Distance gantry front to scan plane | 24 cm |
|-------------------------------------|-------|

## Data acquisition

### Ultra Fast Ceramic Detector UFC

**More power.** More or longer spirals because the required mAs for good image quality are very low

**Low patient dose.** Maximum care for the patient due to very low mGy required for good image quality

|                    |         |
|--------------------|---------|
| Elements           | 2×672   |
| Measuring channels | 2×1,344 |

Design effectively suppresses scattered radiation for precision quantitative CT

## X-ray generator

High-frequency generator  
DURAMATIC

|                  |        |
|------------------|--------|
| Max. power       | 40 kW  |
| Continuous power | 2.5 kW |

## Tube assembly

### Siemens DURA®

high-performance CT x-ray tube

Multifan principle with Flying Focal Spot

Computer-controlled monitoring of anode temperature

|                             |                 |
|-----------------------------|-----------------|
| Tube                        | DURA 352-MV     |
| Tube current range          | 30–240 mA       |
| Tube voltages               | 80, 110, 130 kV |
| Anode heat storage capacity | 3.5 MHU         |
| CARE Filter (Al equivalent) | 6.4 mm          |

### Anode heat dissipation

|       |             |
|-------|-------------|
| max.  | 700 kHU/min |
| cont. | 2.5 kW      |

### Focal spot size according to IEC 336/1993

|       |               |
|-------|---------------|
| small | 0.8×0.4 mm/8° |
| large | 0.8×0.7 mm/8° |

# Installation

## Dimensions

| Component       | Height mm | Width mm | Length mm | Weight Kg |
|-----------------|-----------|----------|-----------|-----------|
| Gantry          | ≤1,780    | ≤770/660 | ≤2,300    | ≤1,300    |
| Patient table   | ≤890      | ≤680     | ≤2,260    | ≤400      |
| Control console | ≤700      | ≤800     | ≤1,400    | ≤65       |
| UPS             | ≤158      | ≤358     | ≤137      | ≤15       |
| ICS/IRS         |           |          |           | ≤20/25    |

## Power supply

|                             |                    |
|-----------------------------|--------------------|
| Voltage nominal ±10%        | 190–480 V          |
| Line frequency nominal ±10% | 50; 60 Hz          |
| Power connection            | ≤ 48 kVA           |
| Power consumption           | ≤ 1.0 kVA standby  |
| Mean power consumption      | ≤ 5.5 kVA scanning |

## Room environment

|  |  |
|--|--|
| Temperature range                          | 18–30 °C                               |
| Relative air humidity without condensation | 20–85 %                                |
| Heat dissipation scanner                   | ≤ 4.7 kW scanning<br>≤ 0.85 kW standby |
| Heat dissipation computer                  | ≤ 0.7 kW                               |

## Protection against input power instability

|                          |           |
|--------------------------|-----------|
| X-ray                    | 20 ms     |
| Controllers              | 300 ms    |
| Computer, IRS, and ICS   | 3 min     |
| Frequency stability ±10% | 50; 60 Hz |

## Surface area for installation

| System         | minimal*            | recommend         |
|----------------|---------------------|-------------------|
| System         | 18.5 m <sup>2</sup> | 22 m <sup>2</sup> |
| Gantry & table | 15.0 m <sup>2</sup> | 17 m <sup>2</sup> |

\* Full performance in terms of gantry tilt and scannable range

## Electromagnetic compatibility

|                                |                          |
|--------------------------------|--------------------------|
| In compliance with IEC 601-1-2 |                          |
| Emissions class                | A, CISPR11               |
| Imissions class                | According to IEC 601-1-2 |

This product bears a CE marking in accordance with the provisions of directive 93/42/EEC of June 14th, 1993 for medical products.



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**Solutions that help**

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