Wide Detector CT
Axial versus Helical

DENNIS FOLEY
MEDICAL COLLEGE
WISCONSIN
**4 cm Detector Scanner**

**Operational Features**

- **64 Channel**
  - 40 mm beam
- **PITCH**
  - 0.18 – 0.25
    - CARDIAC
  - 1.0
    - ARCH/CAROTID
    - AORTO ILIAC
  - 1.375
    - THORACO ABD AO
    - AORTO ILIAC
    - LOWER EXTREMITY
- **SCAN ROTATION**
  - 0.4/0.5 / 0.6 SECS
  - 0.35 SECS (CARDIAC)
- **DUAL HEAD INJECTOR**
BAE K T: Peak Contrast Enhancement in CT and MR Angiography: When does it occur and why? Pharmocokinetic Study in a Porcine Model

Radiology 2003; 227: 809-816
Coronary Angiography Gated
4 cm Detector Freeze Frame

Contrast

Saline

10

20

30

6 ML/ SEC  12 SECS

6 ML/ SEC  8 SECS

64 X 0.625 MM, 0.35 SECS, 2 CM/ SECS
Coronary Angiography Gated Wide Detector 16 cm Snap Shot

Contrast

Saline

6 ML/SEC 8 SECS

256 X 0.625 MM, 0.28 - 0.35 SECS
Gated Cardiac CT

ADVANTAGES WIDE DETECTOR 16 CM SCANNER

- UNIFORMITY
- RADIATION DOSE
- CONTRAST LOAD
Taylor C A et AL. Computational Fluid Dynamics applied to Cardiac Computed Tomography for Non Invasive Computation of Fractional Flow Reserve. JACC. 2013;61 (22) 2233-2241
Taylor CA et Al: Computational Fluid Dynamics applied to Cardiac Computed Tomography for Non-Invasive Computation of Fractional Flow Reserve.

*JACC 2013; 61 (22): 2233-2241*
BICUSPID AORTIC VALVE
Thoracic CT Aortography
Prospective Gating
4 cm Detector Freeze Frame

Contrast

Saline

10  20  30

6 ML/SEC 16 SECS
6 ML/SEC 8 SECS
64 X 0.625 MM, 0.35 SECS, \(2\) CM/SECS
INJECTION 125 ML @ 5 ML/SEC
INJECTION TO SCAN DELAY 26 SECS

4 CM DETECTOR

Dose Report

<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Scan Range (mm)</th>
<th>CTDIvol (mGy)</th>
<th>DLP (mGy•cm)</th>
<th>Phantom cm</th>
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Thoracic CT Aortography
Prospective Gating
Wide Detector 16 cm Snap Shot

Contrast

Saline

10

20

30

6 ML/ SEC 10 SECS

6 ML/ SEC 10 SECS

256 X 0.625 MM, 0.28 - 35 SECS
WIDE DETECTOR
16 CM

91 ML @ 6 ML/SEC
INJECTION TO SCAN DELAY 24 SECS
Wide Detector 16 cm Scanner

**AXIAL MODE (GATED OR NON GATED)**

- 4, 8, 12, 14, 16 cm Z Axis Coverage

- **INTER SCAN DELAY**
  - 1 SECS (without change in rotation speed)
  - 5 SECS (maximum time for change in rotation speed)

- **EFFECTIVE TABLE SPEED**
  - 4.5 ~ 10 CM/S
Gated Thoracic Aortic CTA

ADVANTAGES WIDE DETECTOR 16 CM SCANNER

- UNIFORMITY
- RADIATION DOSE
- CONTRAST LOAD
Aortic Flow Velocity

- **MEAN**: 13 CM/S
- **SD**: 11.5 CM/S
- **RANGE**: 2.1 – 25 CM/S
Aorto Iliac CTA
4 CM Detector Helical

Contrast

Saline

6 ML/ SEC 16 SECS
6 ML/ SEC 8 SECS
64 X 0.625 MM, 1.0, 0.5 SECS, 8 CM/ SECS
Aorto Iliac CTA
64 Channel MDCT

Velocity Compensated

15 24 30 45 60 75

64 x 0.625 MM, 1.375 – 0.5, 0.4 – 1.0 SECS  TABLE SPEED  14 – 2 CM/SEC

FIRST CIRCULATION

6 ML/SEC, 10 – 20 SECS
Aorto Iliac CTA
Wide Detector 4-8 cm Helical

Contrast

Saline

6 ML/SEC 16 SECS
6 ML/SEC 8 SECS
128 X 0.625 MM, 1.0, 0.5 SECS 16CM/SEC
4 CM DETECTOR

INJECTION  90 ML @ 5 ML/SEC
INJECTION TO SCAN
DELAY 27 SECS

<table>
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<td>6.250–1356.250</td>
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Total Exam DLP: 1224.83
WIDE DETECTOR
16 CM

INJECTION 110 ML
@ 5 ML/SEC
INJECTION TO SCAN DELAY 24 SECS
4 cm Detector Scanner

**HELICAL MODE**

- 4 CM COLLIMATION, PITCH 0.5 -1.0
- SCAN ROTATION TIME
  - 0.5 – 1.0
- TABLE SPEED
  - 2- 8 CM /SEC
Wide Detector 16 cm Scanner

**HELICAL MODE**

- 4 CM COLLIMATION, PITCH 0.5, 1.0, 1.3
- 8 CM COLLIMATION, PITCH 1.0

**SCAN ROTATION TIME**

- 0.5 ~ 1.0

**TABLE SPEED**

- 2 ~ 16 CM/SEC
Helical Aorto Iliac CTA
Dual Energy (4 cm Detector)
versus 16 cm Detector

- ACQUISITION INTERVAL
- CONTRAST VOLUME
- RADIATION DOSE
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<th>4 CM (DE CT)</th>
<th>16 CM</th>
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<tr>
<td><strong>ACQ INTERVAL</strong></td>
<td>8 +/- 3 secs</td>
<td>9 +/- 4 secs</td>
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<td><strong>CONTRAST VOL</strong></td>
<td>90 +/- 21 ml</td>
<td>115 +/- ml</td>
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<td><strong>CNR, SNR</strong></td>
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<td>~</td>
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<tr>
<td><strong>RADIATION DOSE</strong></td>
<td>1824 +/- 900 mg/cm</td>
<td>1416 +/- 531 mg/cm</td>
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Thoraco Abdominal Aorta CTA

- **THORACIC GATED AXIAL**
  - CT CORONARY ARTERIOGRAPHY
  - CT THORACIC AORTOGRAPHY

- **THORAX/ABDOMEN INTERSCAN DELAY**

- **AORTO ILIAC HELICAL / AXIAL**
4 CM DETECTOR

210 ML @ 6 ML/SEC INJECTION TO SCAN DELAY 22 SECS
### Dose Report

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<td>160–160</td>
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### Dose Report (Continued)

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Total Exam DLP: 1441.62
**THORACO ABDOMINAL AORTA**

**WIDE DETECTOR 16 CM**

**INJECTION 6 ML/SEC  90 ML OMNI**

**INJECTION TO SCAN DELAY 19 SECS**

### Dose Report

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**Total Exam DLP:** 820.57
Gated Thoracic to Abdominal CTA

- **TRANSITION TIME**
  - ROTATION TIME RESET
  - COLLIMATION RESET
  - TABLE POSITION RESET

- **ABDOMINAL CTA ACQUISITION TIME**
  - WIDE DETECTOR (SEQUENTIAL SNAPSHOT)
  - HELICAL (SELECTABLE SPEED)
Summary (1)

- **WIDE DETECTOR CT SCANNER**
  - SNAP SHOT ACQUISITION
  - SPATIAL RESOLUTION / UNIFORMITY
  - *SINGLE INJECTION* THORACO ABDOMINAL CT ANGIOGRAPHY
    DEPENDENT ON *SHORT INTERSCAN DELAY* AT THORACO ABDOMINAL JUNCTION
Summary (2)

- **AORTO ILIAC ACQUISITION** is tailored to **FLOW VELOCITY**
- **DUAL ENERGY CT ANGIOGRAPHY** requires **LESS CONTRAST LOAD**