Disclaimers

- The University of Tennessee maintains collaborations with Siemens Healthineers

Agenda

- Hospital Overview
- Next Generation PET
- Software Technology
University of Tennessee Medical Center

- Not-For-Profit Academic Medical Center
- Magnet recognized
- TNCPE Excellence Award
- 609 beds
- Region’s Only Level I Trauma Center
- #2 Hospital in Tennessee – US News & World Report
- Referral center for Eastern Tennessee, Southeast Kentucky, and Western North Carolina

Clinical and Translational Research

- Full lab facilities
- Protein & peptide chemistry
- Radiochemistry

- Inveon PET/SPECT/CT
- microPET P4
- microCAT II + SPECT

- Biograph 6
- 4 ring PET
- HD PET
- 6 slice CT

- Biograph mCT
- 4 ring PET
- PSF+TOF
- 64 slice CT

NEXT GENERATION PET/CT
Detector Comparison

Key Detector Design Elements

Release Specifications

<table>
<thead>
<tr>
<th></th>
<th>Biograph mCT (TrueV)</th>
<th>Biograph Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bore diameter (cm)</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>Axial FoV (cm)</td>
<td>22</td>
<td>26.3</td>
</tr>
<tr>
<td>Number of crystals</td>
<td>32,448</td>
<td>60,800</td>
</tr>
<tr>
<td>Crystal size (mm)</td>
<td>4.0 x 4.0 x 20</td>
<td>3.2 x 3.2 x 20</td>
</tr>
<tr>
<td>FBP spatial res @ 1 cm</td>
<td>4.5</td>
<td>3.7</td>
</tr>
<tr>
<td>FBP volumetric resolution (mm³)</td>
<td>95</td>
<td>51</td>
</tr>
<tr>
<td>Sensitivity (cps/kBq)</td>
<td>10.2</td>
<td>16</td>
</tr>
<tr>
<td>Peak NEC (kcps)</td>
<td>180</td>
<td>300</td>
</tr>
<tr>
<td>ToF (ps)</td>
<td>540</td>
<td>214</td>
</tr>
<tr>
<td>Eff. Sensitivity (cps/kBq)</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Eff. NEC (kcps)</td>
<td>445</td>
<td>1870</td>
</tr>
<tr>
<td>TOF gain</td>
<td>2.5</td>
<td>6.2</td>
</tr>
</tbody>
</table>
Biograph Vision Performance

56% higher contrast recovery

High-resolution torso phantom
Sphere size (mm): 5.0, 7.9, 9.9, 12.4, 15.4, 19.8
6:1 contrast-to-background

Biograph Vision Performance

Axial resolution phantom

Biograph Vision Performance

Mini-Derenzo

Diameter (mm)

4.0
4.8
3.6
2.4
1.6
1.2

4 mm crystal

Biograph Vision

Same acquisition time for both phantom scans

4 mm crystal

Biograph Vision

5 mm sphere

5 mm sphere

5 mm sphere

5 mm sphere

5 mm sphere

5 mm sphere
SiPMs Cover Full LSO Array

- Time-of-flight performance depends on collecting light from all photons in the scintillation.
- SiPMs cover LSO-array maximizes light detection
- 100% coverage = fast temporal resolution

TOF Performance

Faster TOF amplifies sensitivity

Faster scanning & lower dose

1. Based on internal measurements available at time of publication. Data on file.
2. Gain calculated for a 20 cm cylindrical object.

Biograph Vision and its features and applications are not commercially available in all countries. Their future availability cannot be guaranteed. Please contact your local Siemens Healthineers organization for further details.

Timing resolution and activity

Activity (mCi) vs. Timing resolution (ps)
Phantom Comparison

**BIOGRAH MCT**

1.67 mCi
420x164 True + Scatter
TOF OSEM: 32x 4 mm Gaussian

**BIOGRAH VISION**

1.38 mCi
420x164 True + Scatter
TOF OSEM: 38x 4 mm Gaussian

Small Lesion Detection

- **non TOF**
- **TOF (540 ps)**
- **TOF (214 ps)**

High-resolution torso phantom
Sphere size (mm): 3.0, 5.0, 7.0, 9.0, 12.0, 15.0, 19.0

6:1 contrast to background

Clinical Comparison: Body

**BIOGRAH MCT**

**BIOGRAH VISION**

Images courtesy of Siemens Healthineers and the University of Tennessee.
Evaluate left lung lesion

Clinical Comparison: Brain
Brain Imaging: 18F-FDG

Dose: 158.2 MBq (4.3mCi)
Acquisition time: 15 min

SOFTWARE TECHNOLOGY

Respiratory Motion

- Decreases image quality
- Reduces quantitative accuracy
- Reduces diagnostic confidence
Improves Visualization

![Images showing improvements in visualization with motion and noise reduction.]

Standard PET vs. 4D Gated PET vs. Amplitude-Based Gating PET

- No Gating
- 4D Gating
- Amplitude Gating

Amplitude gating + MoCo

- Improved motion correction
- Minimal loss of counts
- Shorter scan times
Amplitude gating Only

Amplitude gating + MoCo

Amplitude gating only

Amplitude gating + MoCo

ECG + Data Driven Gating
Standard Gating vs. ECG+Data

Parametric Imaging

On-bed Injection
6 minutes over heart
Input function collection
Parametric Imaging

What are Kinetics?
- Dynamic images
- ROI or voxel-based
- Time-Activity Analysis
- TAC described by compartments
- Two-compartment FDG Model
- Compartment non-specific
- Equilibrium of plasma/tissue
- Patlak Methods

FDG in Plasma $C_p(t)$
FDG in Tissue $C_f(t)$
FDG-6-P in Tissue $C_b(t)$

$k_1$, $k_2$, $k_3$, $k_4$

Bq/ml

Kinetic Modeling

3 Images: SUV, MRGlu, DV

SUV
MRGlu
DV
Acknowledgements:

Shelley Acuff, RT(R), CNMT, CT: Clinical Research Leader

Chris Carr, CNMT: Lead PET/CT Technologist

Erica Carroll, RT(R), CNMT: PET/CT Technologist