



# DISCOVERY™ MI

Meaningful insights.  
From your patient to every patient.

Discovery is a trademark of General Electric Company.



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# 25 YEARS OF INNOVATION



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# CLINICAL WORK THAT EXCELS BEYOND WHAT YOU THOUGHT WAS POSSIBLE



Continue your efforts to diagnose and stage disease earlier with technology that detects smaller lesions<sup>1</sup>



Expand your diagnostic service offerings



<sup>1</sup>Improved detectability as demonstrated in phantom testing



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# INTRODUCING DISCOVERY MI

## LIGHTBURST DIGITAL DETECTOR

- Up to 2x improvement in volumetric resolution<sup>1</sup>
- Highest NEMA sensitivity of any TOF PET/CT system<sup>2</sup>
- Highest NECR of any TOF PET/CT system<sup>3</sup>

## Q.CLEAR

- Up to 2x improvement in quantitative accuracy (SUV<sub>mean</sub>)
- Up to 2x improvement in image quality (SNR)
- Q.CorePower+ Dual reconstruction for advanced needs

## REVOLUTION™ EVO

- HiLight Clarity Detector – 0.28 mm resolution
- Up to 82% reduction in CT dose with ASiR-V™<sup>4,5</sup>
- Smart MAR – One stop shop PET/CT

## DIGITAL MOTIONFREE

- Q.Static – MotionFree for all patients
- Q.Freeze – 100% counts, 100% motion correction
- Q.Flow – Patient centric workflow

<sup>3</sup> Comparing Discovery MI to other TOF PET/CT scanners reported in ITN online comparison charts (May 2016), Up to 20 kBq/ml

<sup>4</sup> In clinical practice, the use of ASiR-V 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. Low Contrast Detectability (LCD), Image Noise, Spatial Resolution and Artifact were assessed using reference factory protocols comparing ASiR-V and FBP. The LCD measured in 0.625 mm slices and tested for both head and body modes using the MITA CT IQ Phantom (CCT183, The Phantom Laboratory), using model observer method.

<sup>5</sup> Image quality as defined by low contrast detectability.







LightBurst Digital Detector

ENGINEERED FOR  
PRECISION



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# LIGHTBURST DIGITAL

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# LIGHTBURST DIGITAL DETECTOR

ENGINEERED FOR PRECISION

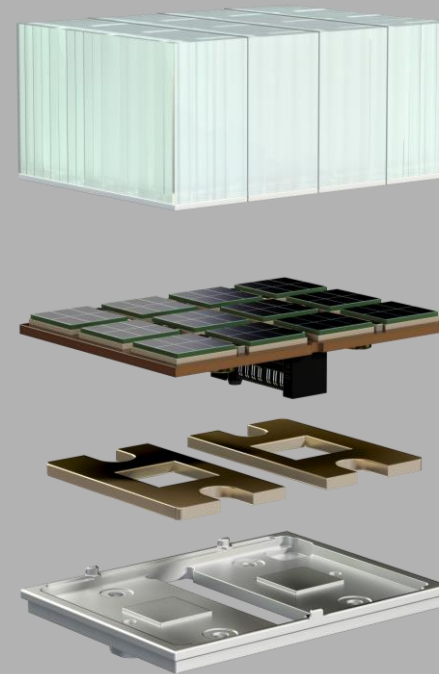
## Conventional PET



Large to medium scintillator crystal array share a common light guide

Photomultiplier (QUAD-PMT) without electronics

## LightBurst Digital Detector



Small Scintillator crystal and Enhanced Spectral Reflectors

Excellent count-rate performance and system resolution

Silicon Photomultiplier (SiPM) with ASIC

Excellent timing and energy resolutions

Digital Compton scatter recovery with no resolution trade off

High thermal conductive pad

Extracts heat from detector improving stability



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# LIGHTBURST DIGITAL DETECTOR

ENGINEERED FOR PRECISION

## Conventional PET

### Sensitivity

7.5 cps/kBq

30 kcps @ 2.3 kBq/ml (FDG)

### Coverage

15.6 cm axial FOV

7-8 bed per whole-body

### Technology

Analog TOF – 1024x PMT

549 ps TOF resolution

### Crystal - LBS

4.2 x 6.3 x 25 mm<sup>3</sup>



15.6 cm

20.0 cm



## LightBurst Digital Detector

### Sensitivity

**13.5 cps/kBq NEMA**

**46,6 cps/kBq Effective**

53 kcps @ 2.4 kBq/mL (FDG)

### Coverage

20.0 cm axial FOV

5-6 bed per wholebody

### Technology

Digital TOF – 9792x SiPM

385 ps TOF resolution

### Crystal – LBS

3.95 x 5.3 x 25 mm<sup>3</sup>



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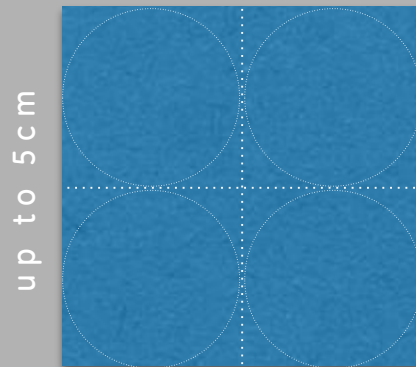
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# SMALLER BLOCK DESIGN

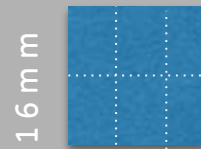
## RESOLUTION & SENSITIVITY

Conventional PET



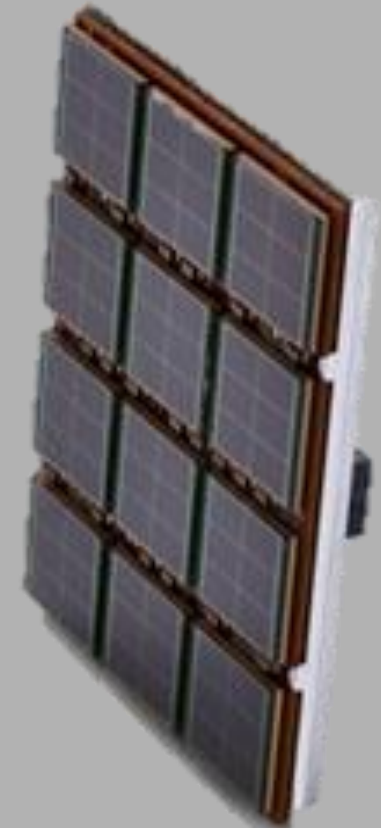
Lower Resolution

LightBurst Digital Detector



3.95 x 5.3 x 25 mm<sup>3</sup>  
4.2 mm typical resolution  
385 ps timing resolution

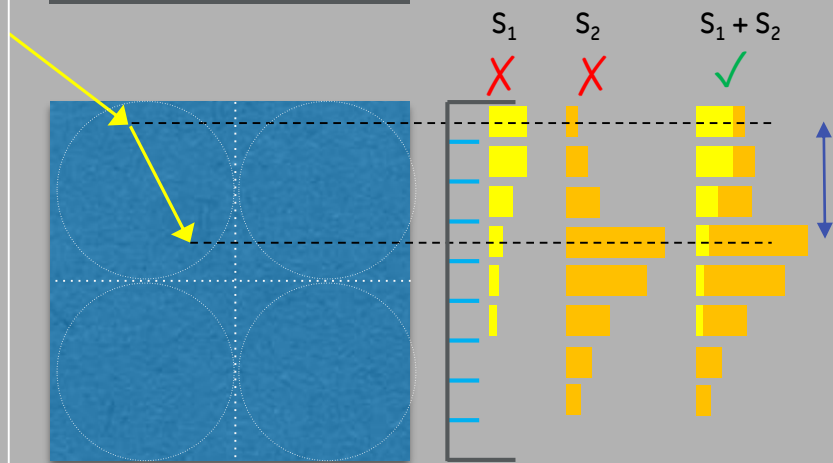
Higher Resolution



# COMPTON RECOVERY

## RESOLUTION & SENSITIVITY

Conventional PET



Low Resolution  
High Sensitivity

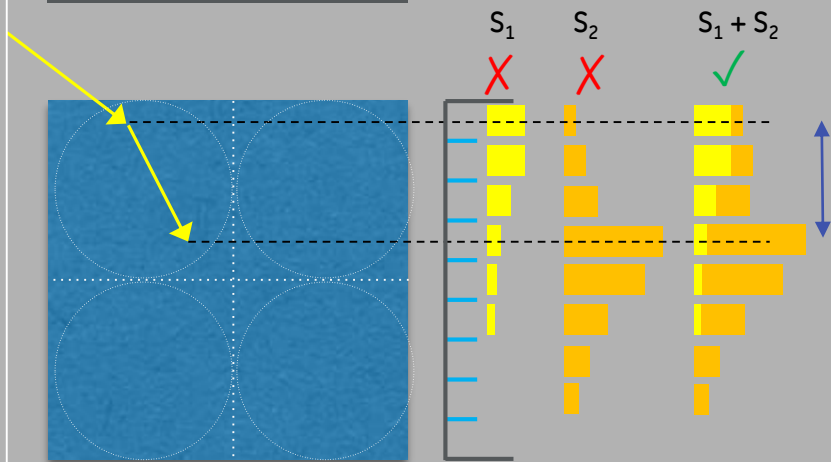
- UP TO 75% OF THE 511 KEV PHOTON COMPTON SCATTER WITHIN THE BLOCK DETECTOR
- LOSS OF SENSITIVITY ON THE DETECTOR EDGE
- LOSS OF RESOLUTION



# COMPTON RECOVERY

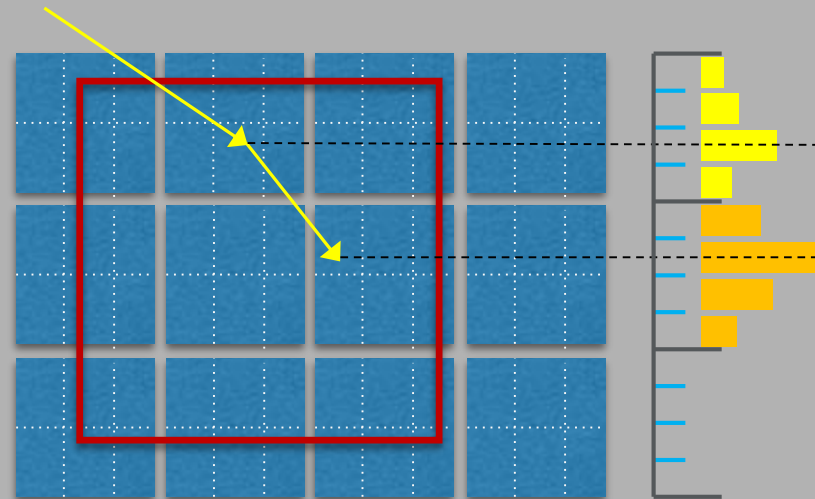
## RESOLUTION & SENSITIVITY

Conventional PET



Low Resolution  
High Sensitivity

LightBurst Digital Detector



Conventional

$S_1 = E_1; T_1; X_1Y_1$  X  
 $E_1: 211\text{keV}$   
 $S_2 = E_2; T_2; X_2Y_2$  X  
 $E_2: 300\text{keV}$

Compton Recovery

$E_1 + E_2; T_1; X_1Y_1$  ✓  
 $E_1 + E_2 = 511\text{keV}$

Higher Resolution  
Higher Sensitivity

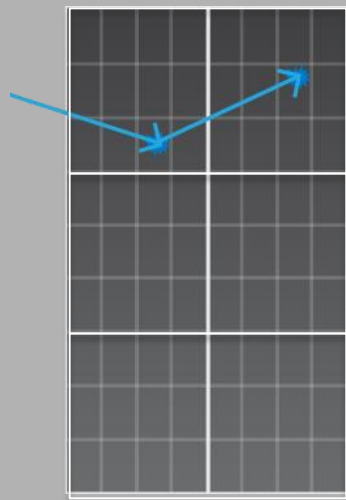


# COMPTON RECOVERY

## RESOLUTION & SENSITIVITY

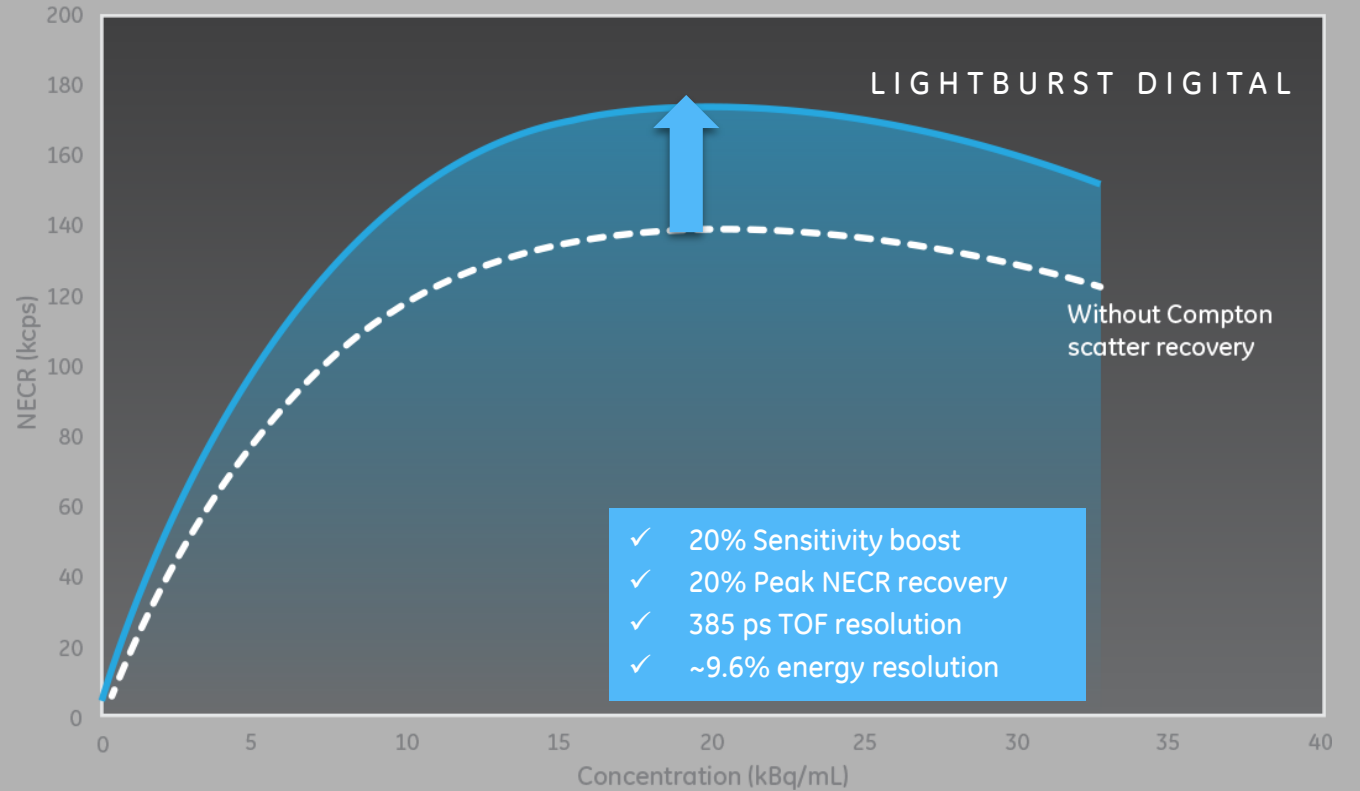


Analog Compton recovery within the block



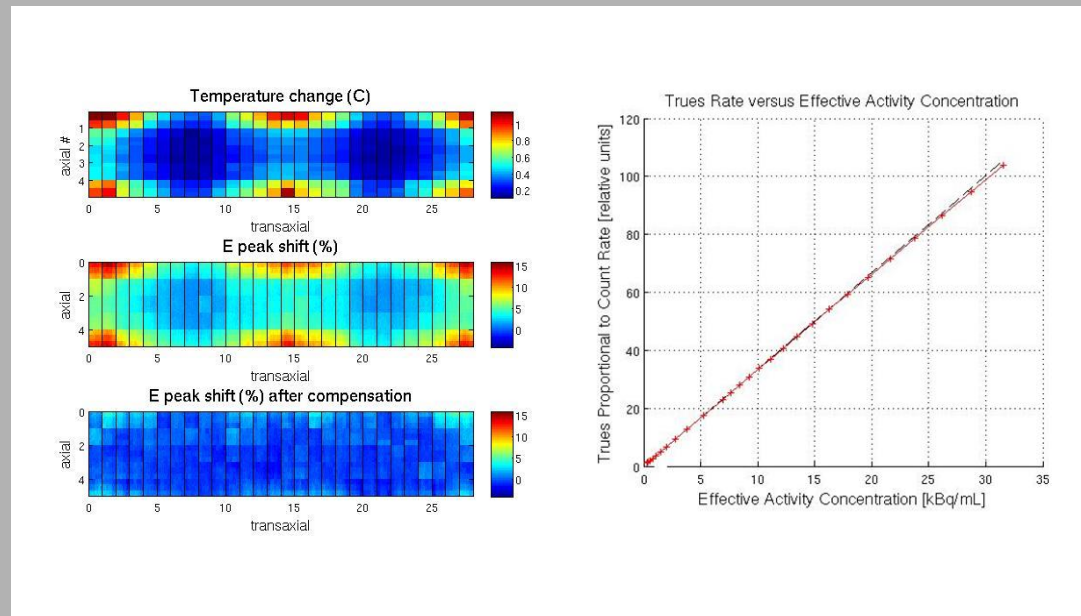
Digital Compton recovery from adjacent block

NECR Comparisons

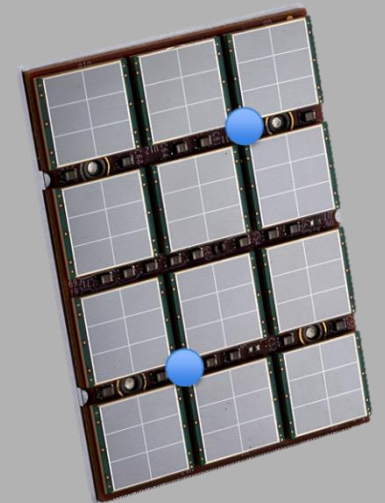
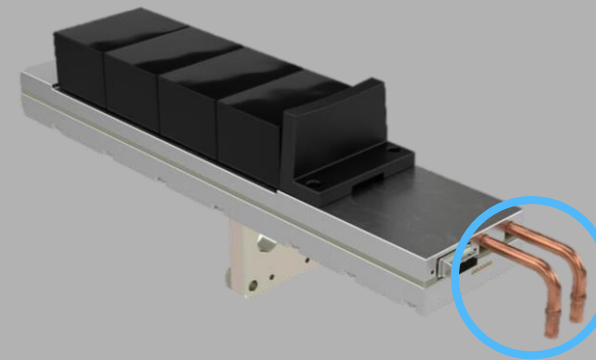


# Q.TEMP

## ACCURACY & STABILITY



### LightBurst Digital Detector



18°C PET detector  
liquid cooling



Temp. sensor &  
gain control



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# A BRILLIANT INTRODUCTION TO ALL DISCOVERY MI CAN DO

Significantly better small lesion  
detectability<sup>1</sup>

Up to 2x improvement in  
volumetric resolution<sup>1</sup>

Highest NEMA sensitivity of any  
TOF PET/CT system<sup>2</sup>

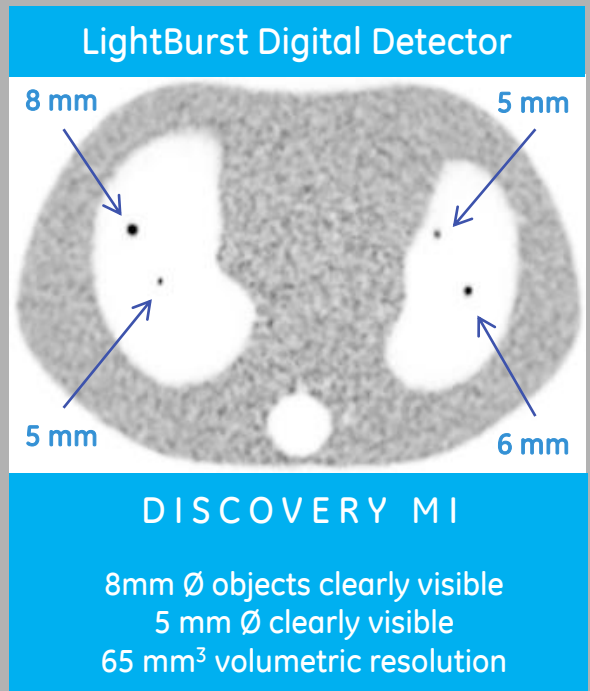
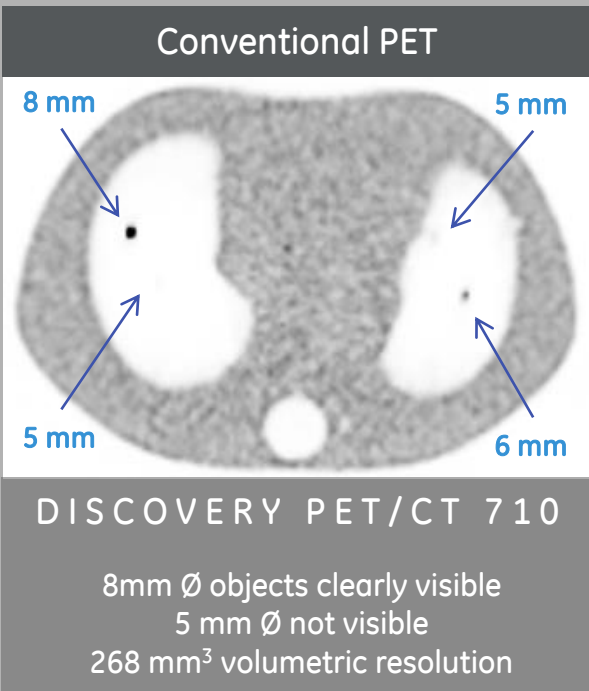
Highest NECR of any TOF PET/CT  
system<sup>3</sup>



# 2X IMPROVEMENT IN VOLUMETRIC RESOLUTION<sup>1</sup>



Anthropomorphic (Torso) Phantom with 5, 6 and 8 mm spheres in various regions  
Reconstruction: VPFXS





# SMALL LESION DETECTABILITY

DISCOVERY MI sensitivity and LightBurst Digital detector simultaneously provides excellent image quality and resolution. Discovery MI provides more confidence when looking for small metastatic disease in difficult areas such as the liver.

## Acquisition

15 minutes

298 MBq / 8 mCi FDG

96 minute uptake

## Patient History

Patient with history of Melanoma referred to PET/CT for restaging and metastatic evaluation

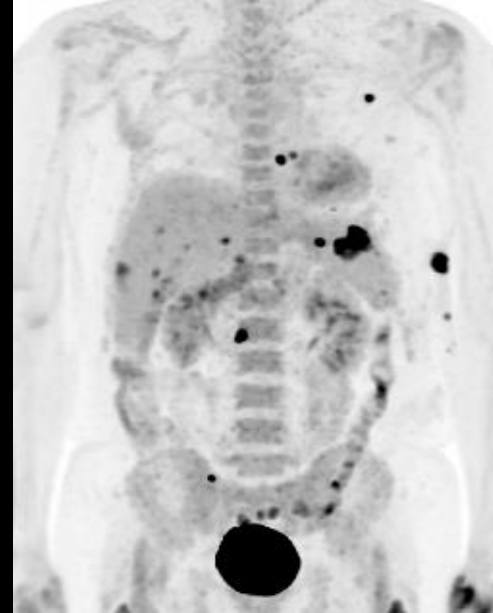
## Patient BMI

22.6

## Follow-up CT



## LightBurst Digital Detector



## Conventional PET



SUVmax: 4.5  
Lesion Size: 1cm



SUVmax: 2.1

Courtesy Stanford University, A. Iagaru, MD



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# SMALL LESION DETECTABILITY

## Acquisition

2 minutes / FOV  
329 MBq / 8.9 mCi FDG  
65 minute uptake

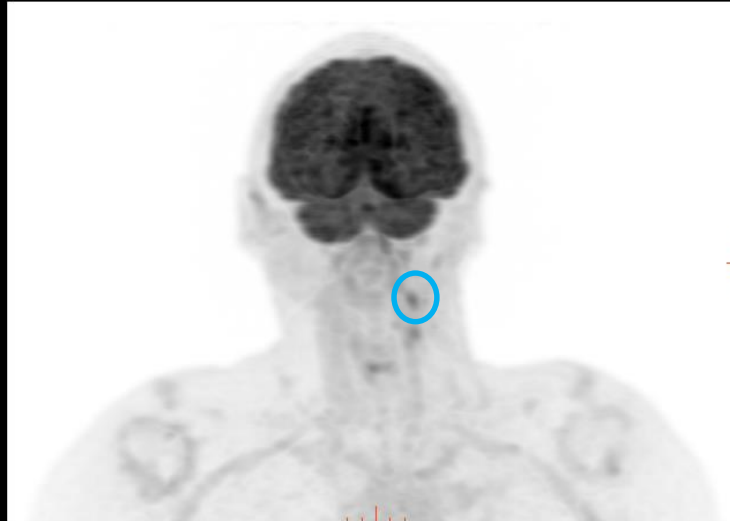
## Patient History

Patient with history of  
Head and Neck Cancer  
referred to PET for  
evaluation of lymph  
node involvement.

## Patient BMI

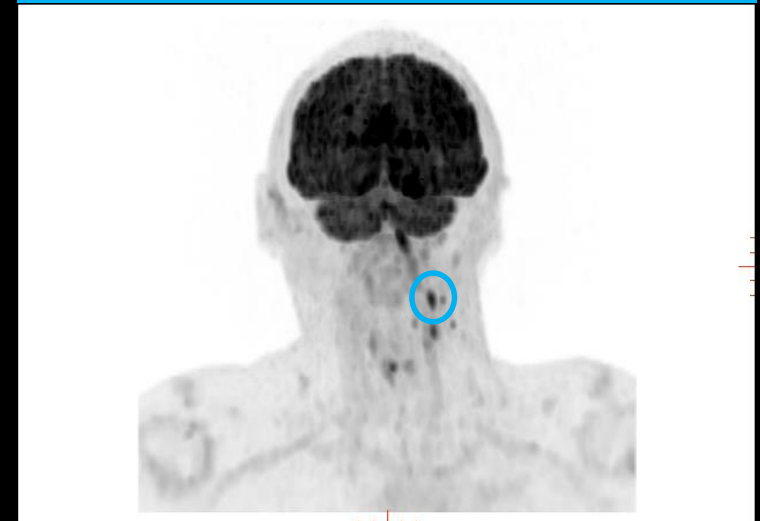
25.6

OSEM 70CM DFOV



SUVmax: 5.71 g/ml

Hi Res Q.Clear



SUVmax: 10.16 g/ml

Courtesy University of Zurich



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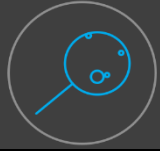
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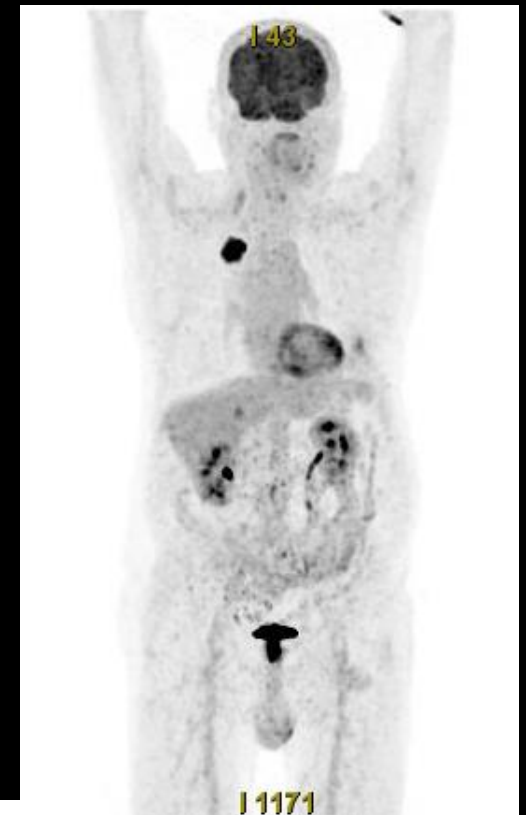
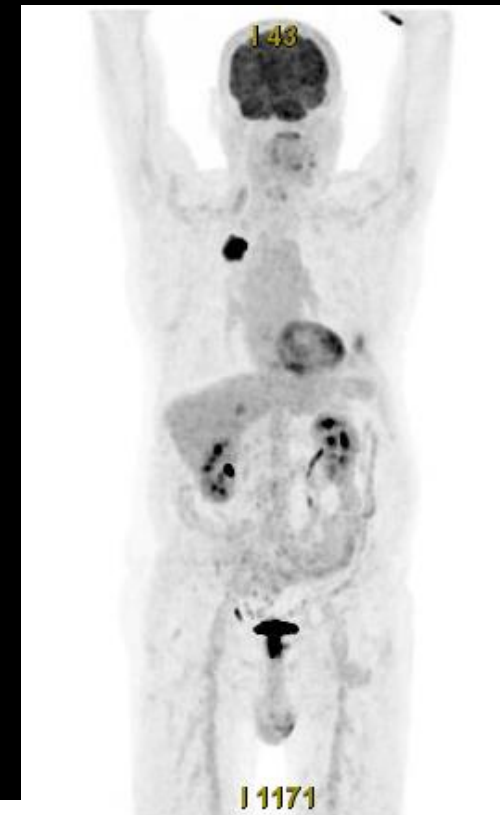
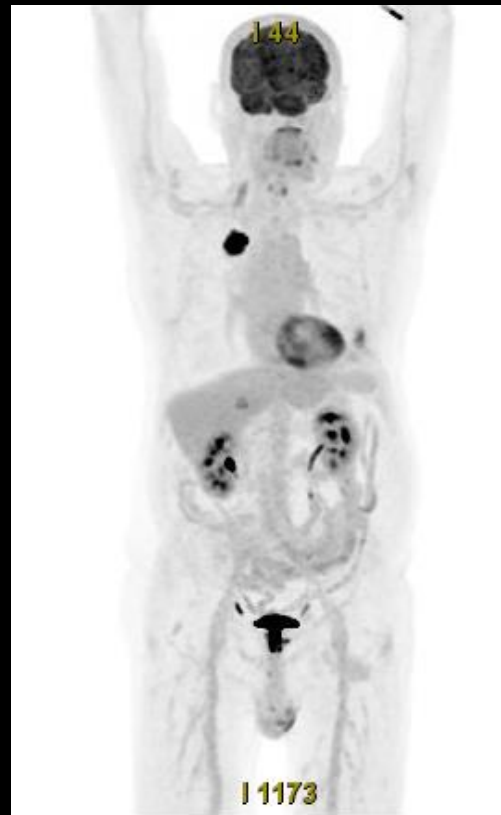
# ULTRA FAST ACQUISITION

**GE 2 min / bed**  
14 min Scan

**GE 30 sec / bed**  
210 sec Scan

**GE 15 sec / bed**  
105 sec Scan

Discovery MI	
Size & weight of patient	1.75 m / <b>80 kg</b>
<b>Injected activity</b>	<b>3.08 MBq/kg</b>
# bed positions / scan length	7 / 1.12 m

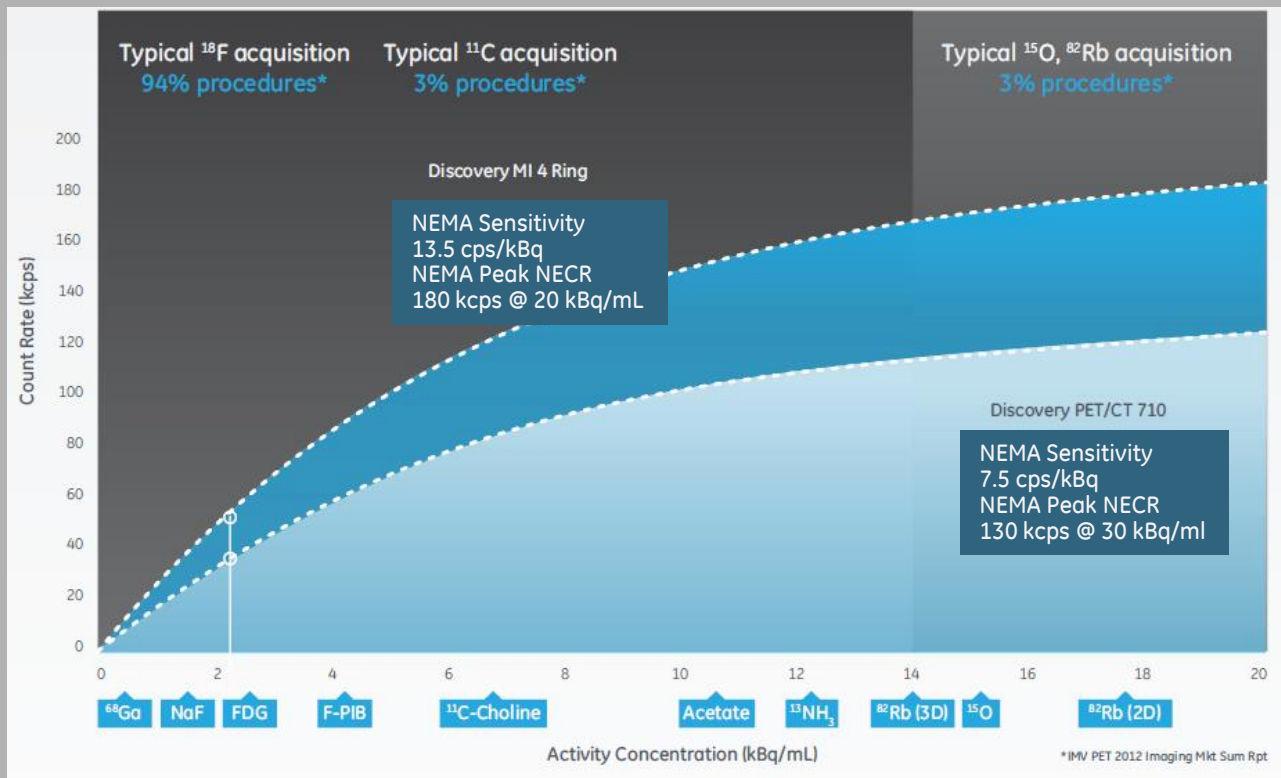


Courtesy University of Zurich





# ACCELERATE RESEARCH



- INCREASE LOW-YIELD TRACER CAPABILITY WITHOUT IMPACTING IMAGE QUALITY AND SMALL LESION DETECTABILITY<sup>1</sup>
- PURSUE GROUNDBREAKING RESEARCH WITH FASTER DECAYING TRACERS



# REVOLUTION EVO

## Performix 40 Plus tube

Designed for the most demanding exams - 0.35 s in routine

Performix 40 Plus tube



## ASiR-V

Up to 82% reduction in CT dose at same image quality<sup>4,5</sup>

## Dual Energy

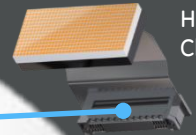
Tissue characterization using CT Dual Energy technique with AW

## Smart MAR

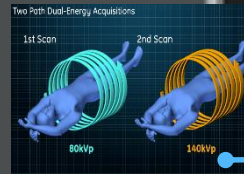
Metal Artifact Reduction for every PET/CT exam

## HiLight Clarity Detector

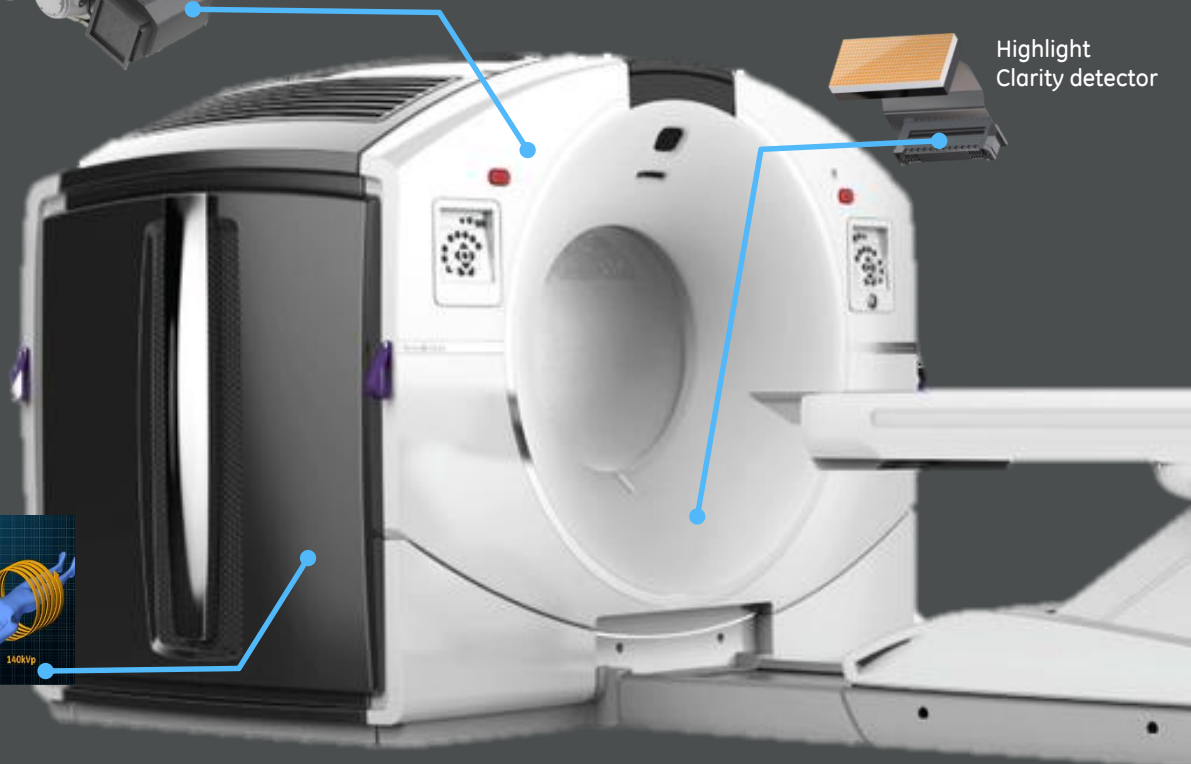
44% lower electronic noise than previous generation



HiLight Clarity detector



Dual Energy



# 0.35 sec

## IN ROUTINE EXAMS

### Gated acquisition

- **0.35 sec/rot**
- Cardiac pitch
- 63-68 BPM

### Helical acquisition:

- **0.35 sec/rot**
- 1.531 pitch
- 2.5 sec scan

### Total acquisition

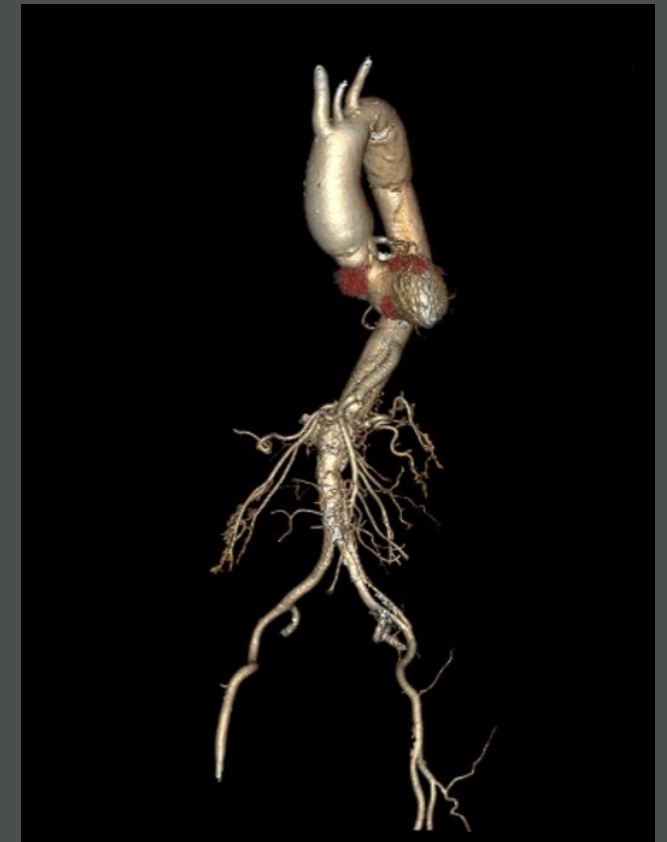
- 4.43 mGy CTDIvol
- 942 mGy-cm DLP
- Iodine: 80 cc @ 4.0 cc/s
- Saline: 40 cc @ 3.0 cc/s

TAVI planning in 14 sec with single contrast injection



Gated

Non-gated



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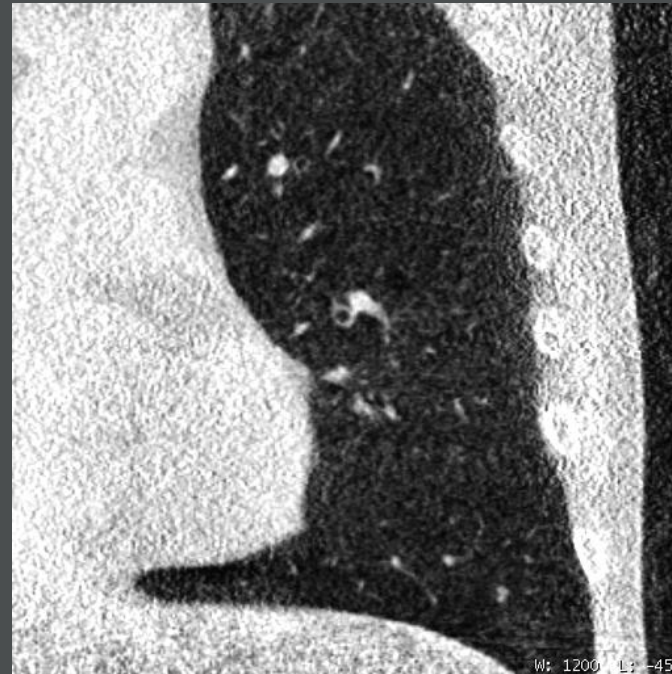
# ASiR - V

## IN ROUTINE EXAMS

82%  
Lower dose

Up to 82% reduced dose <sup>4,5</sup>

In routine imaging, ASiR-V has been shown to reduce dose by up to 82% compared to standard FBP reconstruction at the same image quality.



Ultra-low-dose chest (0.08 mSv) reconstruction with filtered back-projection



Same study reconstructed using ASiR-V

Obtained using a chest factor of 0.014\*DLP





# ASiR - V

## IN ROUTINE EXAMS

### Acquisition

09/02/14

120 kV

BMI 24

Helical

Standard kernel

ASiR 50%

12.2 mGy-cm DLP



ASiR - Optima CT 660)



ASiR-V - Revolution EVO

### Acquisition

09/09/14

100 kV

BMI 24

Helical

Standard kernel

ASiR-V 40%

5.0 mGy-cm DLP





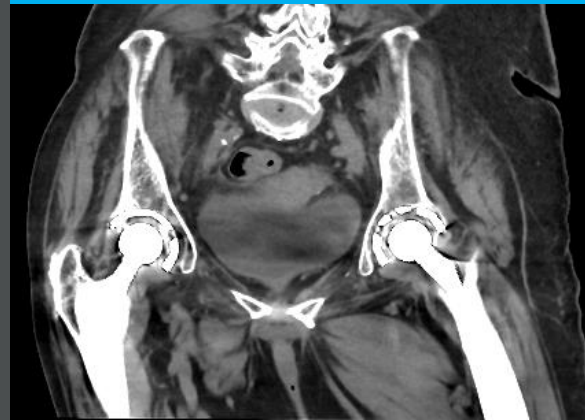
# SMART MAR

## METAL ARTIFACT REDUCTION

Conventional CT



Smart MAR



### AVAILABLE FOR ALL EXAMS

- ONLY ONE SCAN, REAL TIME RECONSTRUCTION
- PROJECTION BASED TECHNIQUE FOR BEST ACCURACY
- FULL VERSATILITY : HIP IMPLANTS, DENTAL FILLINGS, SCREWS OR OTHER METAL IN THE BODY





# SMALL LESION DETECTABILITY

DISCOVERY MI sensitivity and LightBurst Digital detector simultaneously provides excellent image quality and resolution. Discovery MI provides more confidence when looking for small metastatic disease in difficult areas such as the liver.

## Acquisition

15 minutes

298 MBq / 8 mCi FDG

96 minute uptake

## Patient History

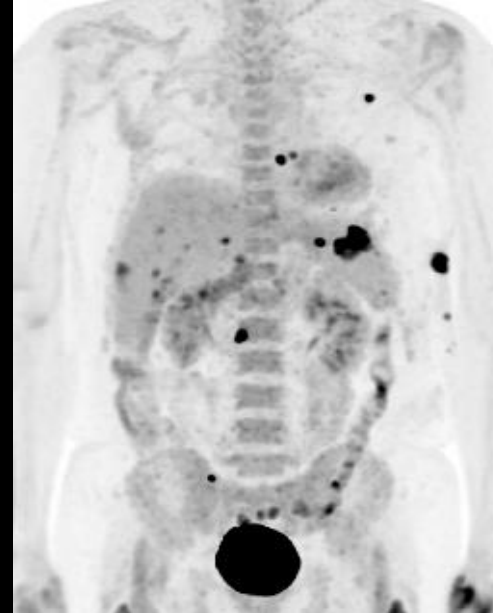
Patient with history of Melanoma referred to PET/CT for restaging and metastatic evaluation

## Patient BMI

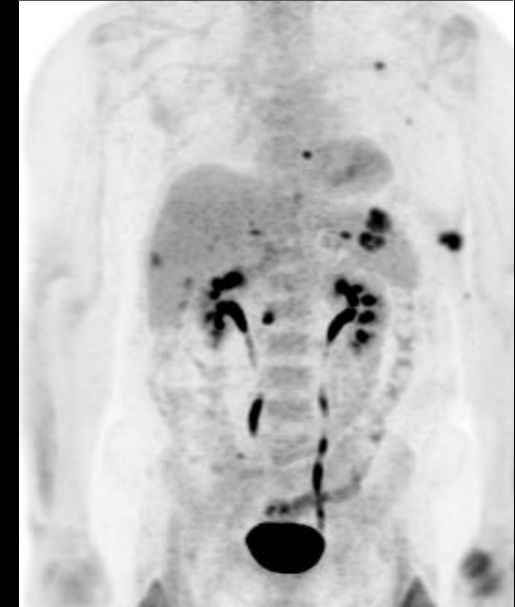
22.6

*Courtesy Stanford University, A. Iagaru, MD*

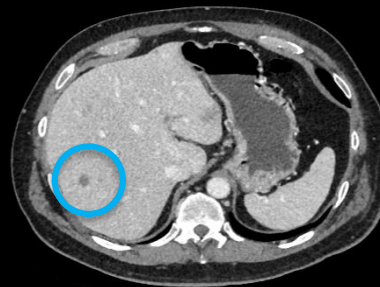
## LightBurst Digital Detector



## Conventional PET



## Follow-up CT



SUVmax: 4.5  
Lesion Size: 1cm



SUVmax: 2.1



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# SMALL LESION DETECTABILITY

## Acquisition

15 minutes

298 MBq / 8 mCi FDG

96 minute uptake

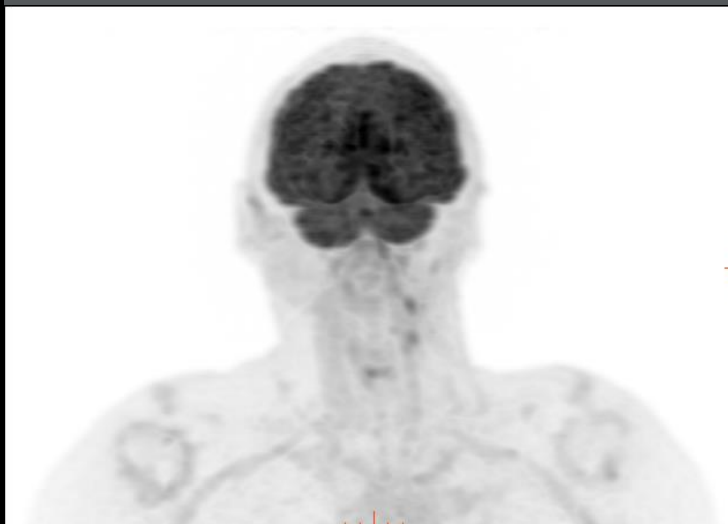
## Patient History

Patient with history of  
Melanoma referred to  
PET/CT for restaging  
and metastatic  
evaluation

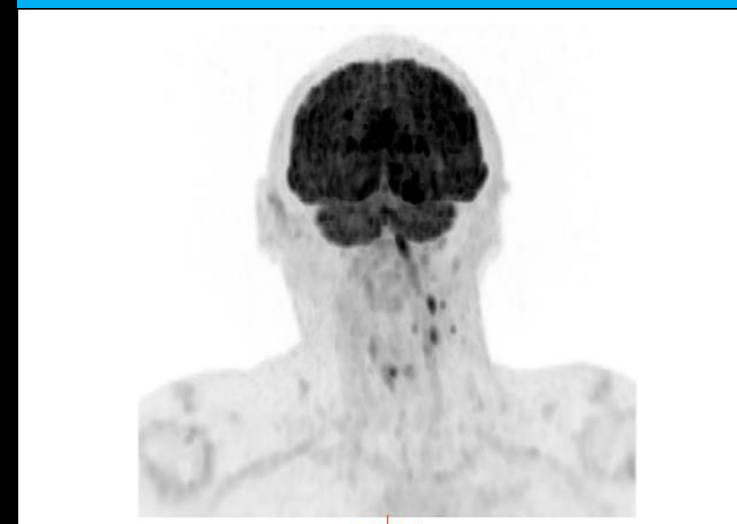
## Patient BMI

22.6

OSEM 70CM DFOV



Hi Res Q.Clear



*Courtesy University of Zurich*



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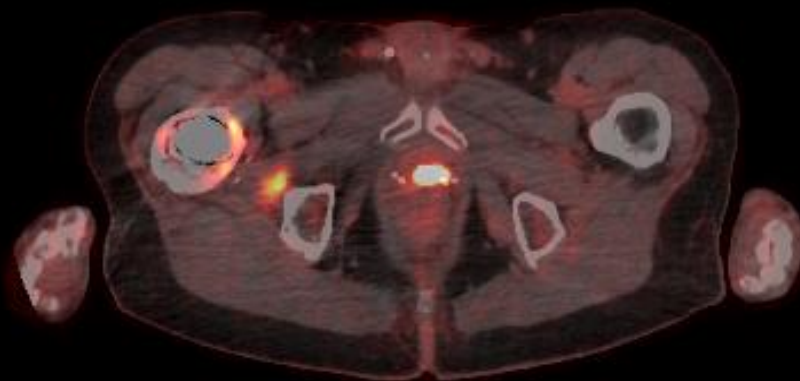
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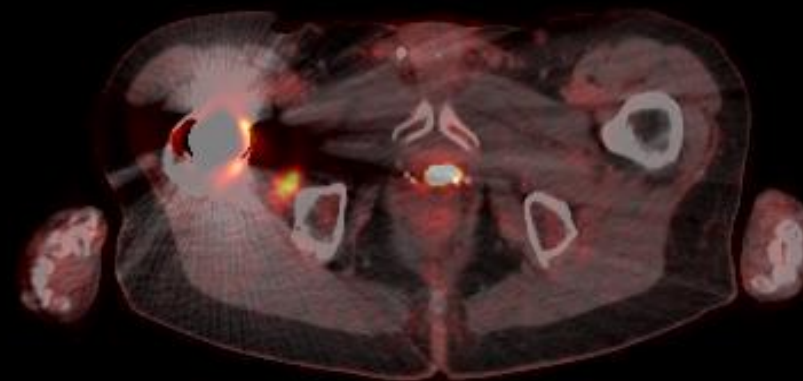


# CLINICAL EXCELLENCE AND EXPANSION

Smart MAR  
(metal Artefact Reduction)



Conventional CT



Seamlessly apply SmartMAR on every patient to improve CT image quality and confidence in localizing disease in the pelvis.



Courtesy Stanford University, A. Iagaru, MD



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# CONTRAST AND RESOLUTION FOR ALL PET TRACERS

## Ga-68 DOTATATE

### Left

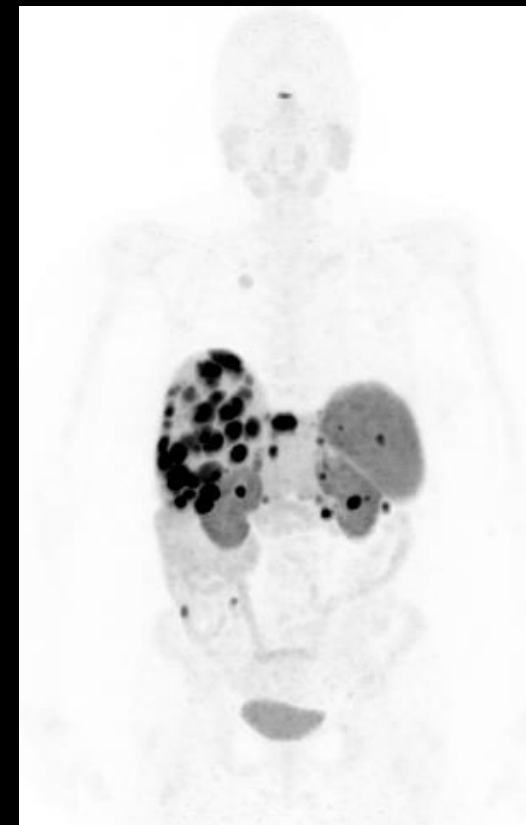
- 6 mCi / 222 MBq Injection
- 78 min uptake
- 2.6mCi / 96 MBq at Scan Time

### Right

- 6.7 mCi / 248 MBq Injection
- 104 min uptake
- 2.2 mCi / 81 MBq at scan time



Low noise imaging demonstrate  
excellent image Quality



Excellent image quality and  
small lesions detectability

Courtesy Stanford University, A. Iagaru, MD

PET Radiopharmaceutical may not be approved by ministers of health in all regions



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# 1/2 TIME, NO COMPROMISE

Full acquisition time  
12 min



SUVmax: 7.45 Liver SUVmean: 2.07

1/2 acquisition time  
6 min



SUVmax: 7.53 Liver SUVmean: 2.01

Full acquisition time  
12 min



1/2 acquisition time  
6 min



DISCOVERY MI sensitivity and LightBurst Digital detector provide reliable and consistent image quality, resolution and quantitative accuracy. With Discovery MI, research center will be able to free up scanner time for their research study without impact their daily clinical workload.

Courtesy Stanford University, A. Iagaru, MD





# SMALL LESION DETECTABILITY

LightBurst Digital



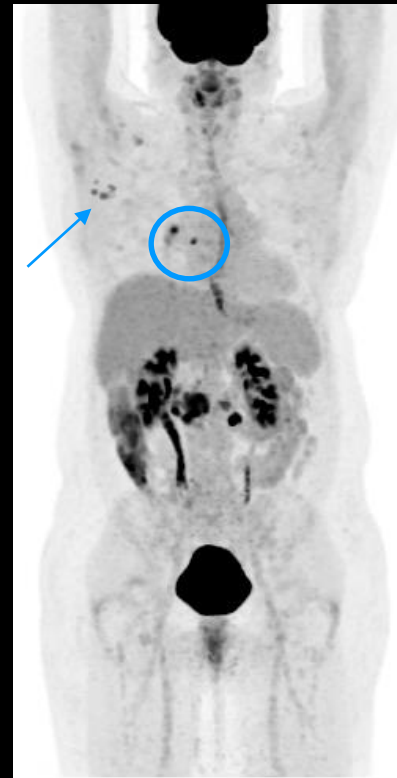
SUVmax: 7.4

Conventional PET



SUVmax: 3.7

LightBurst Digital



Conventional PET



DISCOVERY MI sensitivity and LightBurst Digital detector provide improvement in small lesion detectability giving you increased confidence in your communications to referring physicians.

Courtesy Stanford University, A. Iagaru, MD



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# EXCELLENT IMAGE QUALITY AND CLINICAL RESOLUTION

DISCOVERY MI sensitivity and 20cm Axial Field of View LightBurst Digital detector provide the ability to perform fast 2 meter scans without sacrificing image quality or resolution and improve patient comfort with shorter scan times.

## Acquisition

20 minutes

383 MBq / 10.35 mCi FDG

96 minute uptake

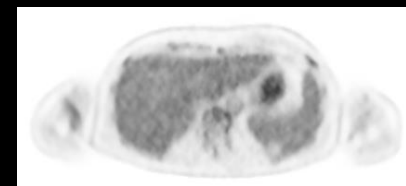
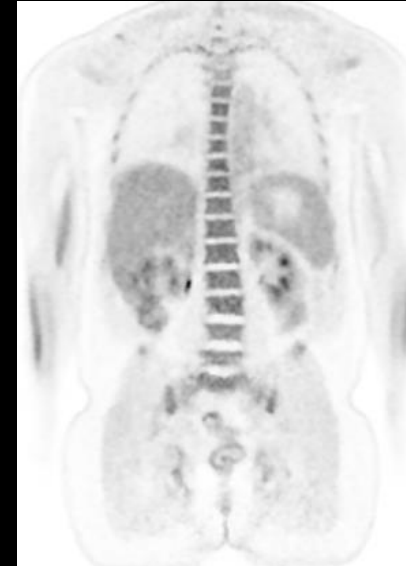
## Patient History

Patient referred to PET/CT for Restaging of Mantle Cell Non-Hodgkin's Lymphoma

## Patient BMI

28.4

Courtesy Stanford University, A. Iagaru, MD



Liver SUVmean: 2.22 g/ml  
Liver Noise (STD): 0.17 g/ml



TRUE DISCOVERY

DISCOVERY MI

CLINICAL IMAGES

LIGHTBURST DIGITAL

SCALABILITY

QUANTITATION

REVOLUTION EVO

DIGITAL INDUSTRIAL

SHAPING THE FUTURE

DISCLAIMERS

# EXCELLENT IMAGE QUALITY AND CLINICAL RESOLUTION

## Acquisition

10 minutes

388 MBq / 10.5 mCi FDG

77 minute uptake

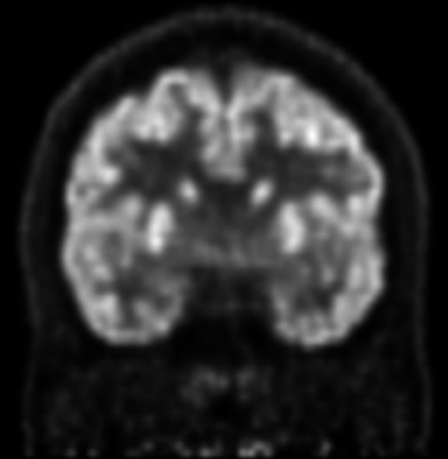
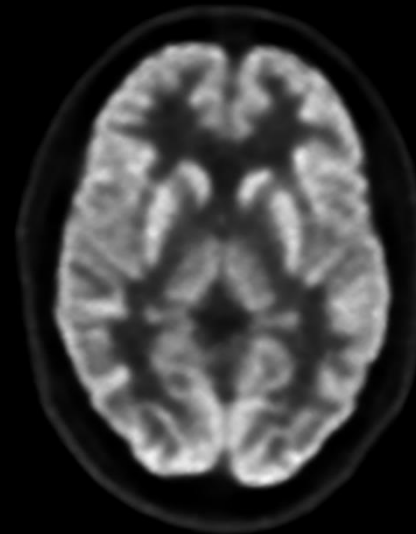
## Patient History

Patient referred to PET/CT for  
evaluation and localization of  
epilepsy foci

## Patient BMI

30.1

*Courtesy Stanford University, A. Igaru, MD*



DISCOVERY MI sensitivity and 20cm Axial Field of View LightBurst Digital detector provide the excellent image quality and clinical resolution necessary for complex neurology cases where the slightest changes in uptake can be the guide for Neurosurgeons.



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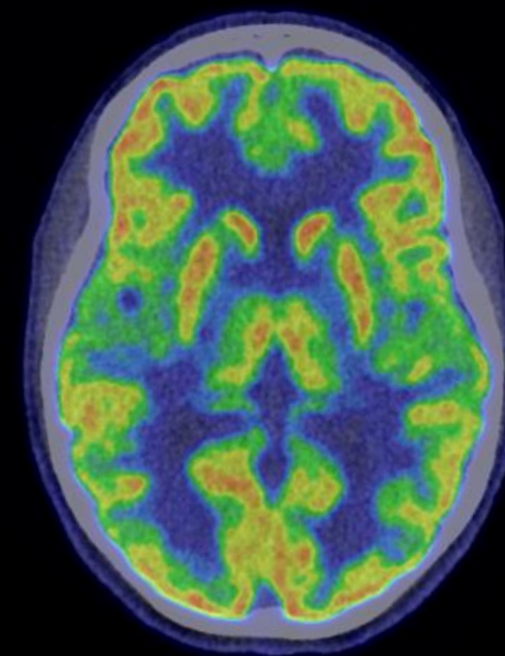
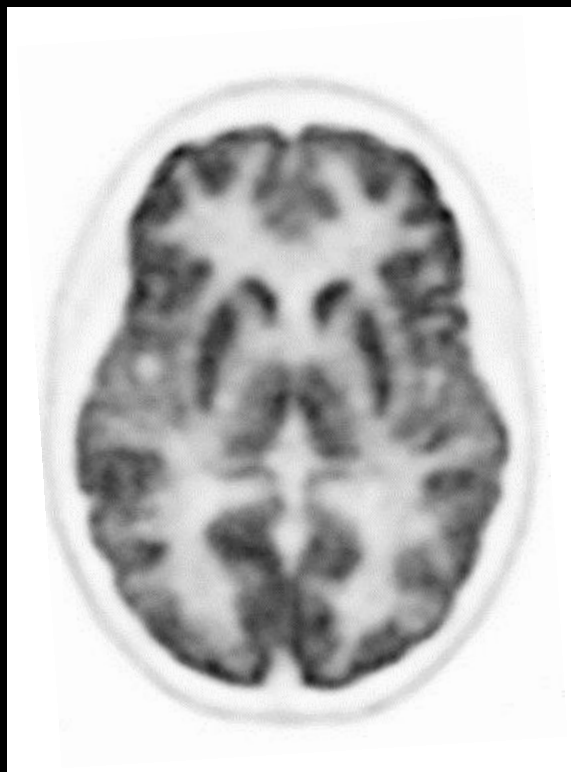
# CONTRAST AND RESOLUTION FOR ALL PET TRACERS

## Acquisition

196 MBq / 5.3 mCi FDG  
67 minute uptake

## Patient History

Patient referred to PET/CT for  
evaluation of Alzheimer's  
diseases



Low noise imaging demonstrate excellent image quality

*Courtesy PET Center Uppsala*



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# EXCELLENT IMAGE QUALITY AND CLINICAL RESOLUTION

DISCOVERY MI sensitivity and clinical resolution provide small lesion detectability for small bone lesions.

## Acquisition

20 minutes

270 MBq / 7.3 mCi  $^{18}\text{F}$ -NaF

113 minute uptake

## Patient History

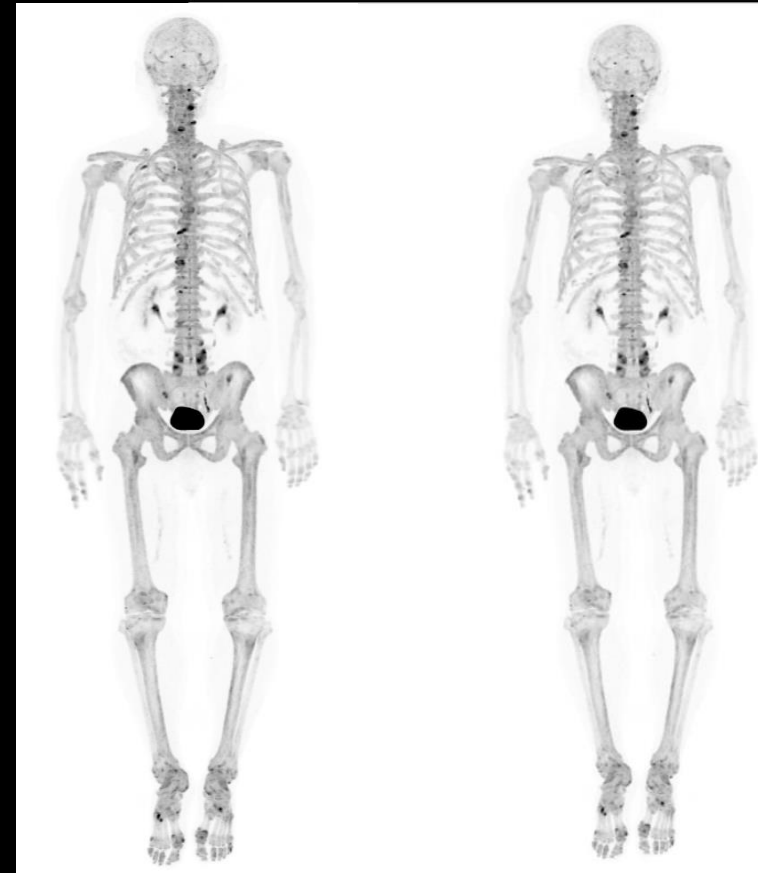
Patient with history of Prostate cancer referred to PET/CT for History of prostate cancer with new bone pain. Evaluation of metastatic disease.

## Patient BMI

27.4

Courtesy Stanford University, A. Iagaru, MD

PET Radiopharmaceutical may not be approved by ministers of health in all regions



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# SMALL LESION DETECTABILITY

## Acquisition

12 minutes

270 MBq / 7.3 mCi  $^{18}\text{F}$ -NaF

113 minute uptake

## Patient History

Patient referred to  
PET/CT for evaluation  
of metastatic  
prostate cancer.

## Patient BMI

26.7



Courtesy PET Center Uppsala

PET Radiopharmaceutical may not be approved by ministers of health in all regions



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## QUANTITATIVE SUV YOU AND YOUR PATIENTS CAN TRUST



Grow patient volumes as referring physicians value the accurate, reproducible results and diagnostic confidence you deliver



More accurately assess treatment response to guide your treatment planning decisions with more accurate SUVs



Improve communication with improved quantitation



[TRUE DISCOVERY](#)

[DISCOVERY MI](#)

[CLINICAL IMAGES](#)

[LIGHTBURST DIGITAL](#)

[SCALABILITY](#)

[QUANTITATION](#)

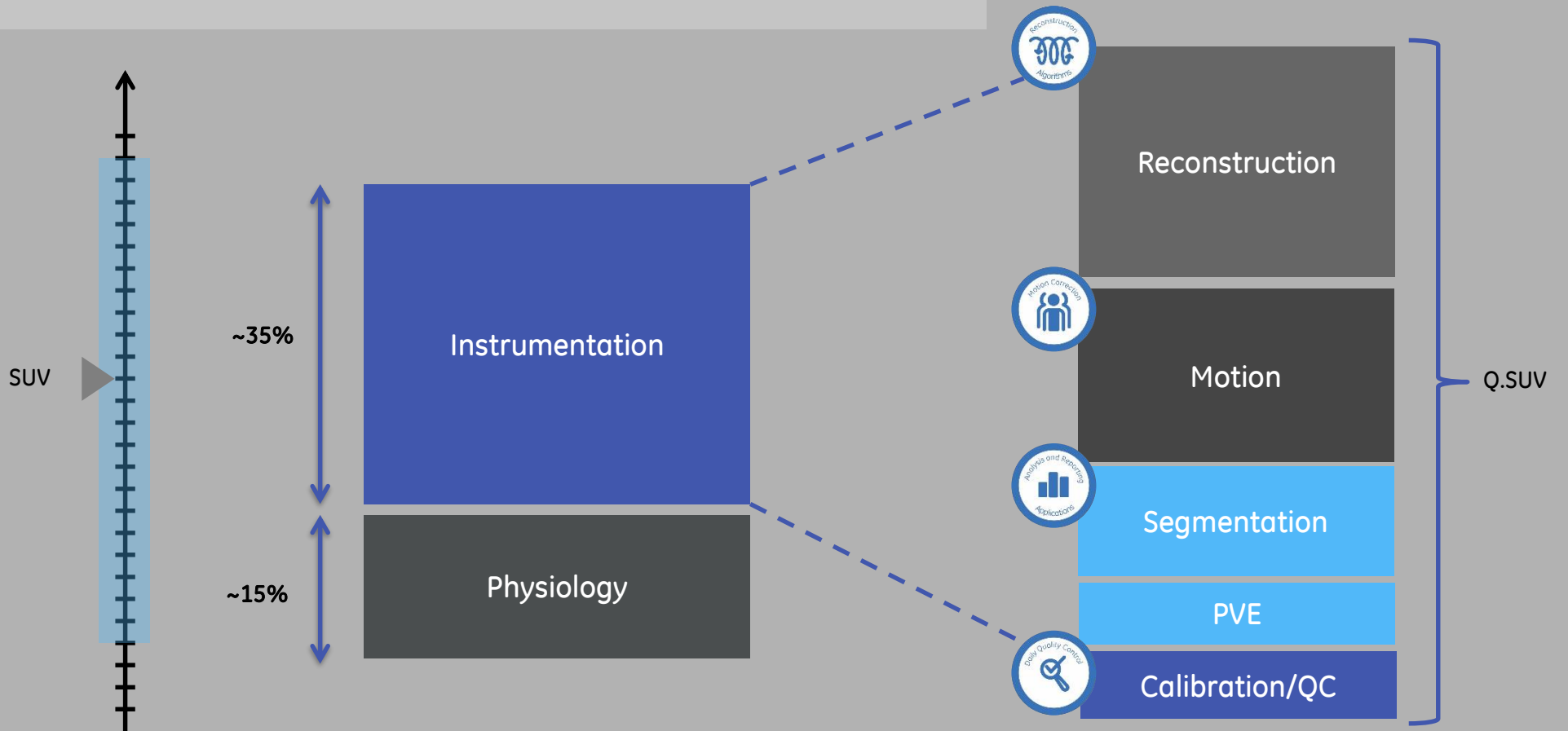
[REVOLUTION EVO](#)

[DIGITAL INDUSTRIAL](#)

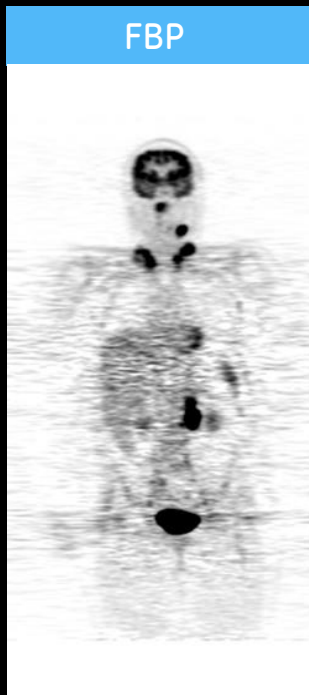
[SHAPING THE FUTURE](#)

[DISCLAIMERS](#)

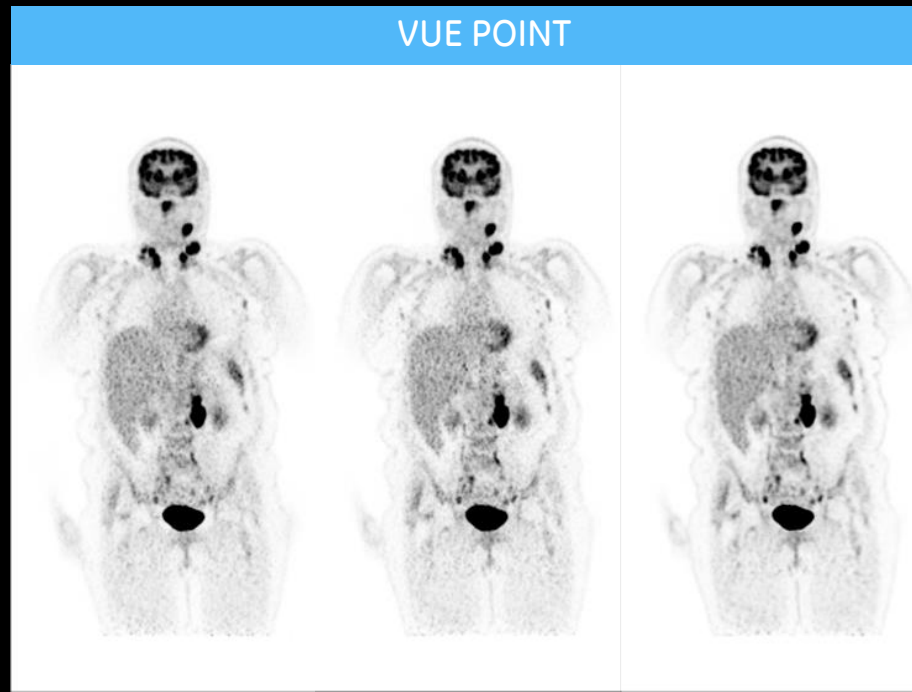
# QUANTITATIVE PET CHALLENGES



# ITERATIVE RECONSTRUCTION



2D/3D



OSEM - HD

OSEM - TOF

OSEM - TOF + PSF



BSREM

IMAGE QUALITY

IMAGE QUALITY  
& QUANTITATION



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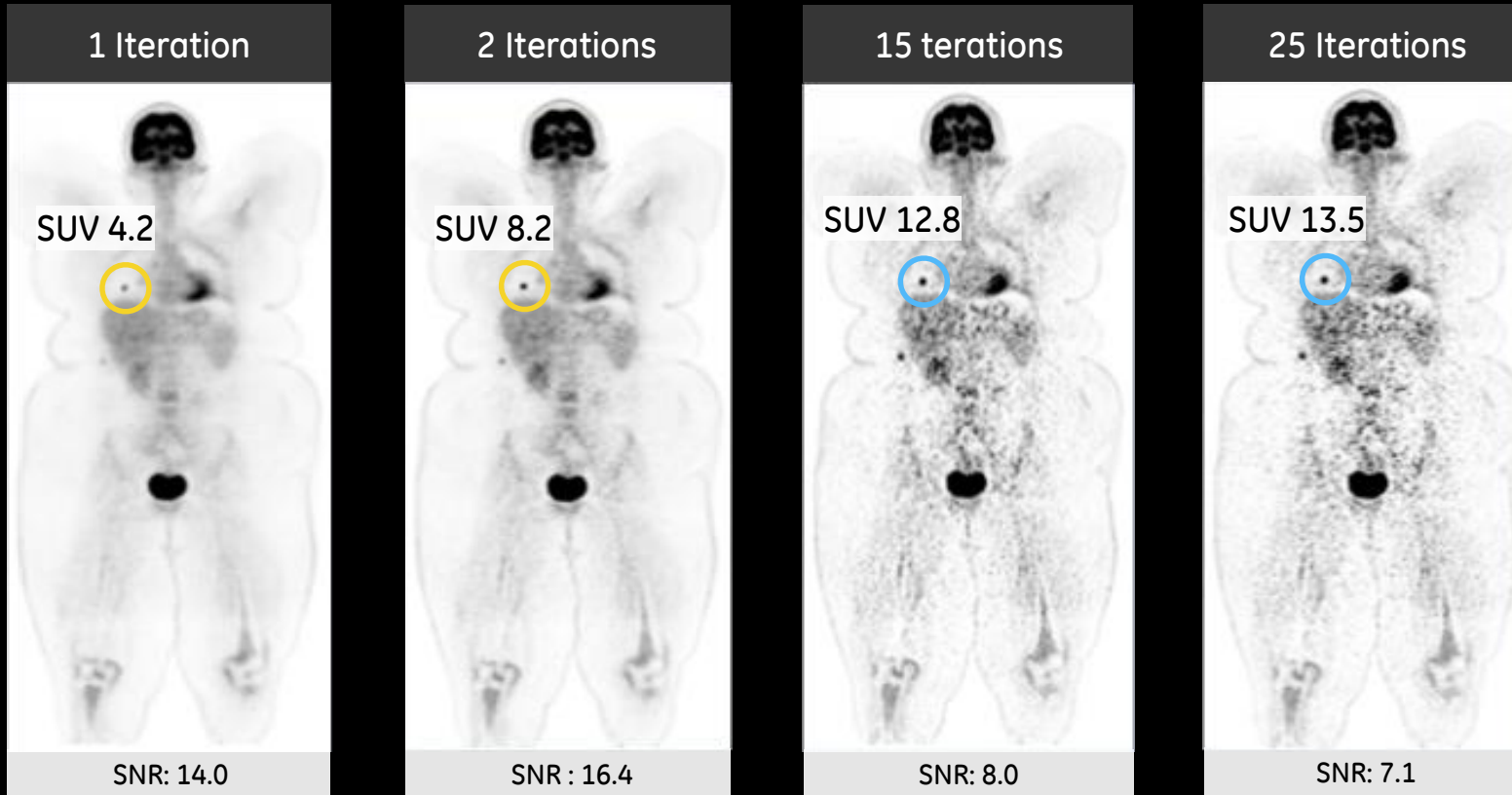
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# ITERATIVE RECONSTRUCTION CHALLENGES



# Q.CLEAR AND Q.SUV

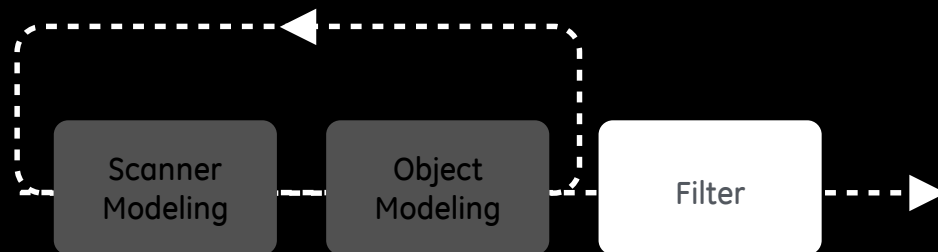




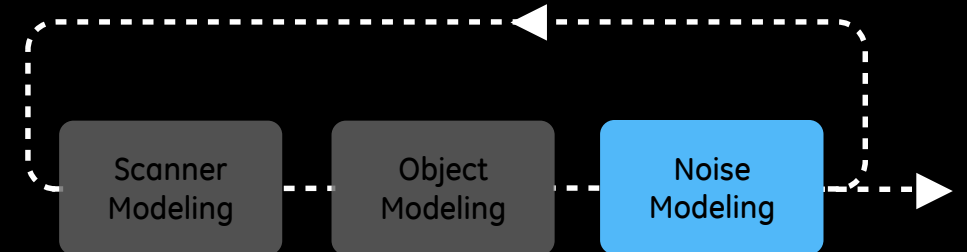
# CONSISTENT QUANTITATION

MORE ACCURATE AND CONSISTENT QUANTITATION WITH  
INTELLIGENT NOISE CONTROL. EVERY VOXEL. EVERY STEP.

Conventional Iterative Reconstruction

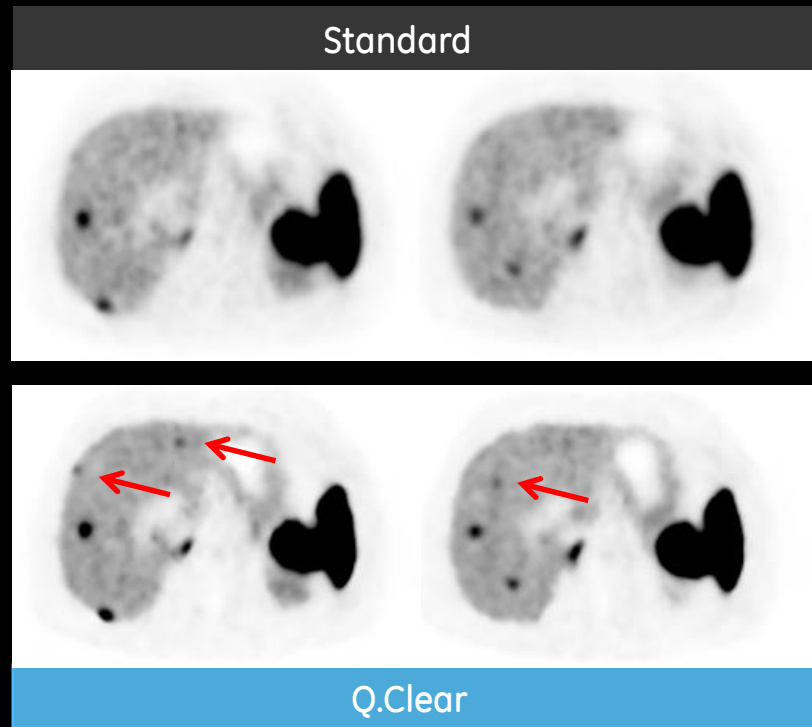
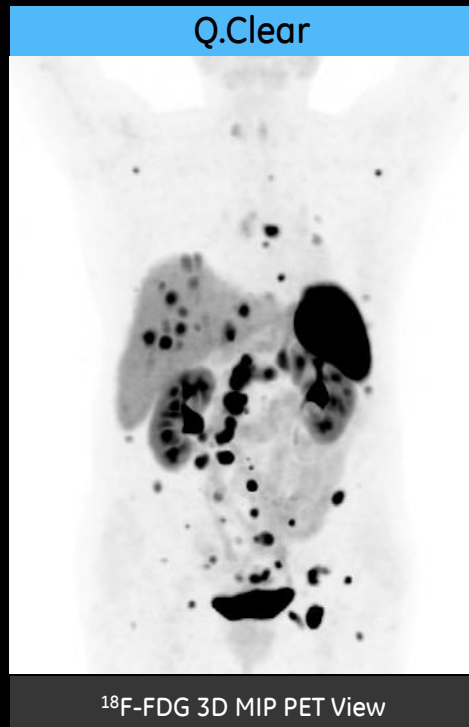


Q.Clear



# CONSISTENT QUANTITATION

UP TO 2X IMPROVEMENT IN IMAGE QUALITY (SNR)



- INCREASE CLINICAL SENSITIVITY
- CONFIDENTLY DETECT SMALL METASTATIC DISEASE
- IMPROVED QUANTITATIVE ACCURACY



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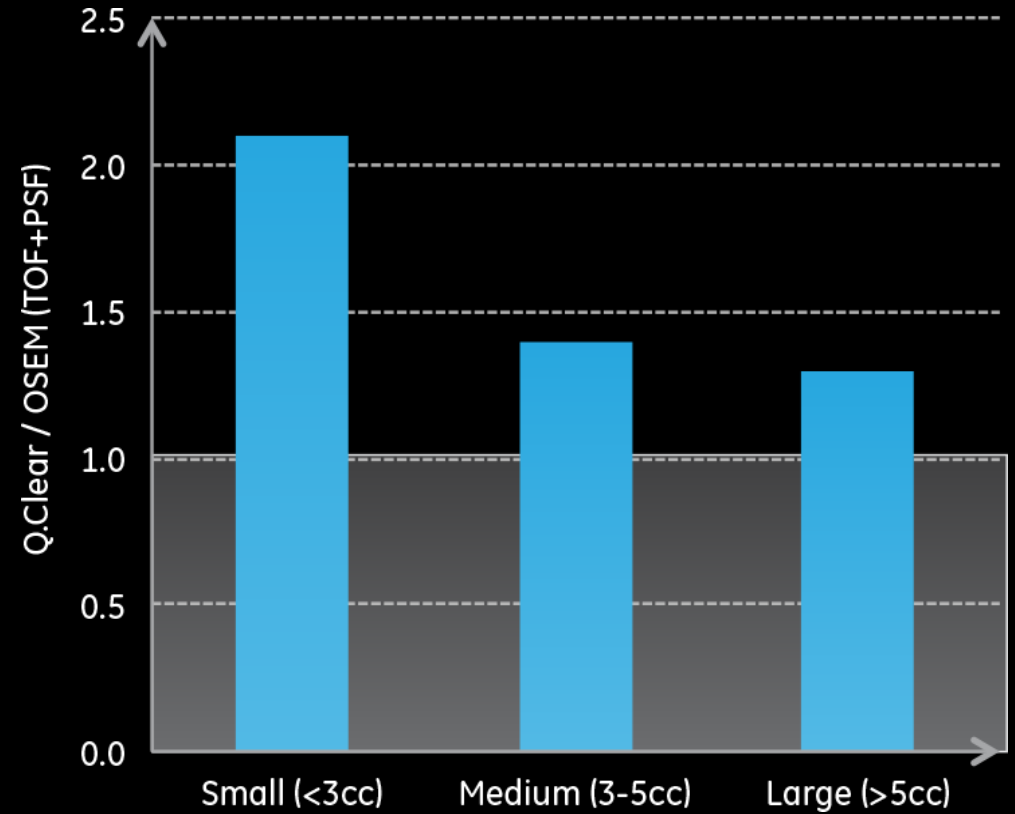
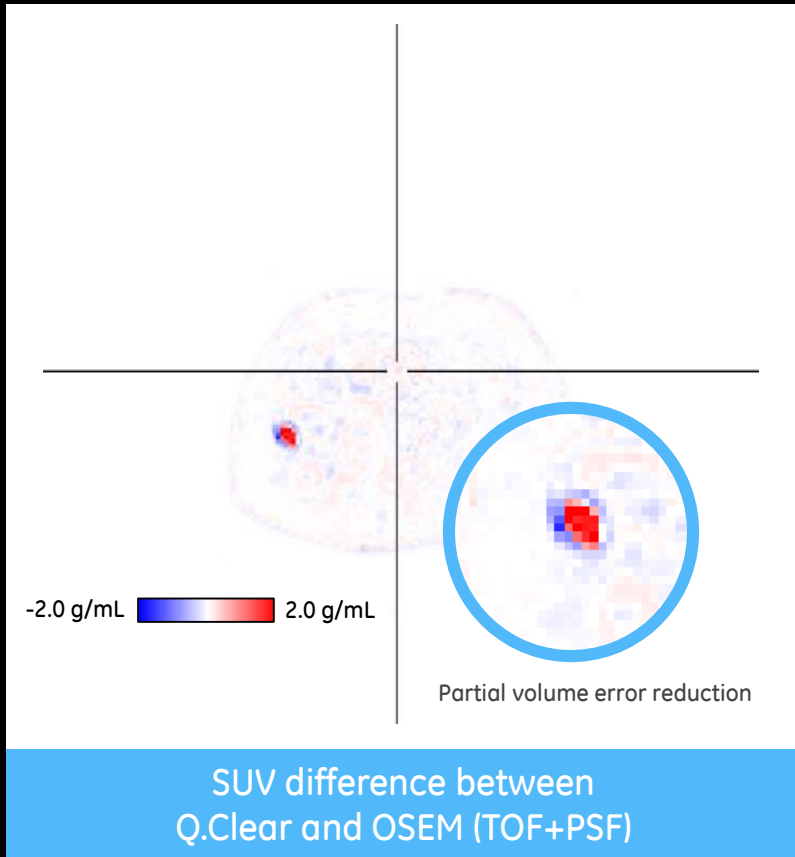
DIGITAL INDUSTRIAL

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# FULL CONVERGENCE

NO COMPROMISE

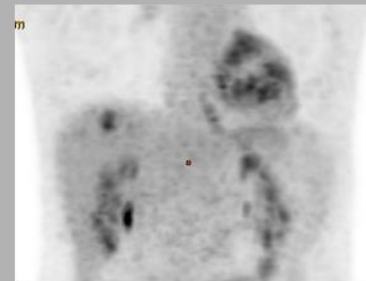
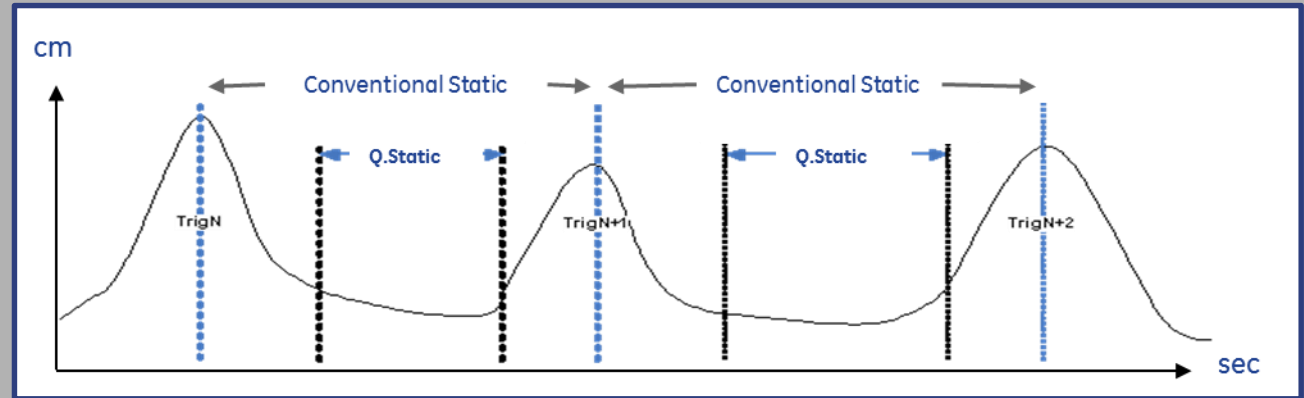


# Q.STATIC

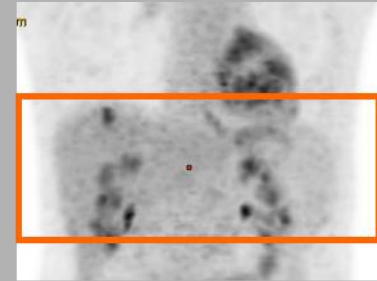
One-click PET protocol  
with prospective reconstruction

Based on static WB workflow  
for a static image series output

Reduces motion blurring  
for quantitative consistency



Conventional Static

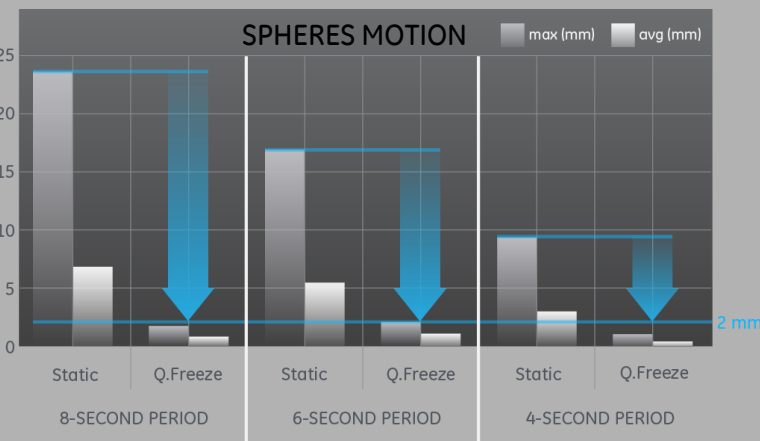
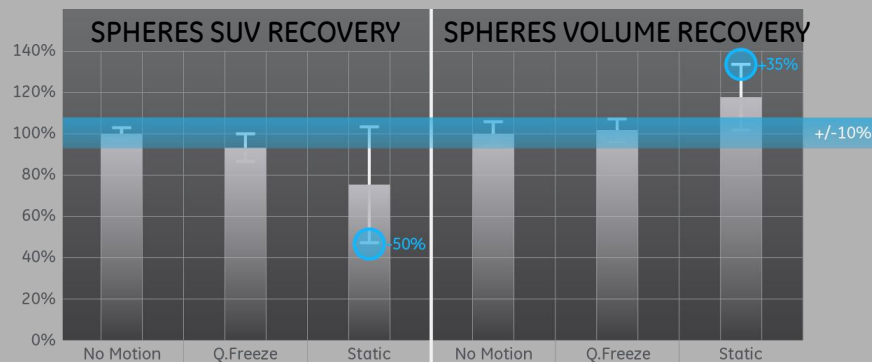
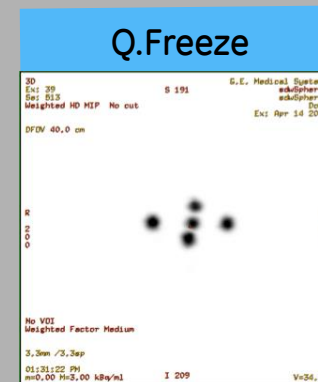
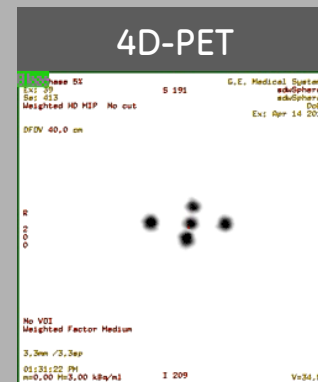


Q.Static



# Q.FREEZE

ONE IMAGE. ALL THE COUNTS. MOTION ELIMINATED.



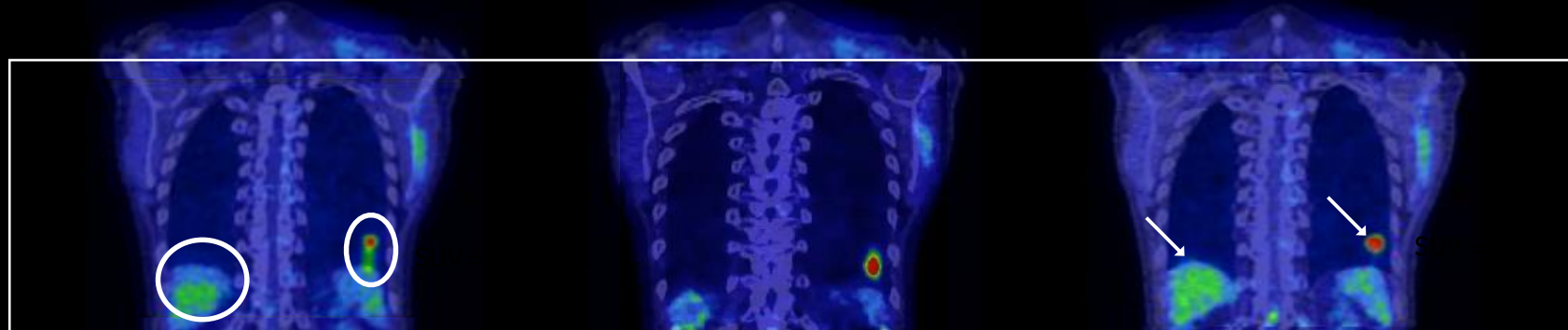
# Q.FREEZE

FULL THORAX COVERAGE FOR EVERY PATIENT

Whole-body PET/CT

Integrated 4D PET/CT

Q.Freeze



Axial FOV: 15.6 cm Overlap: 23% Total FOV: 28 cm

10 min

24 min

12 min



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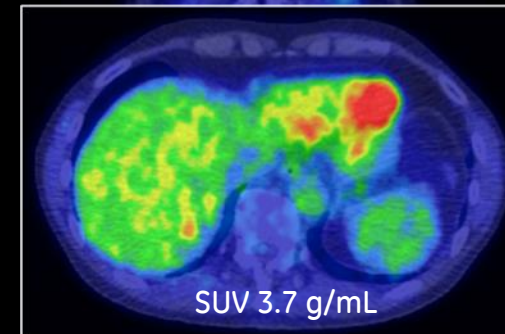
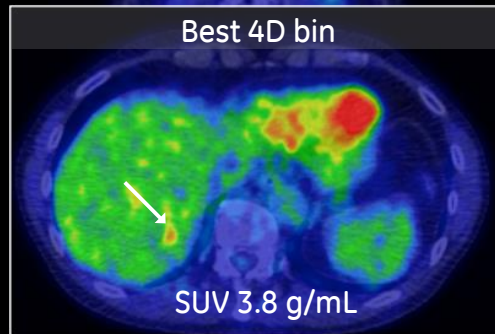
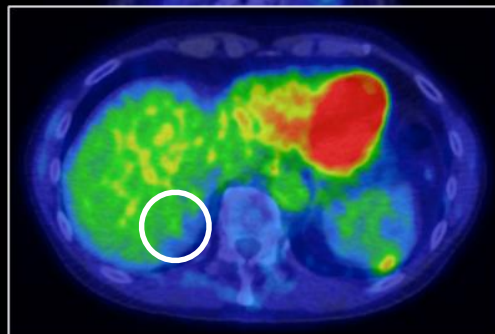
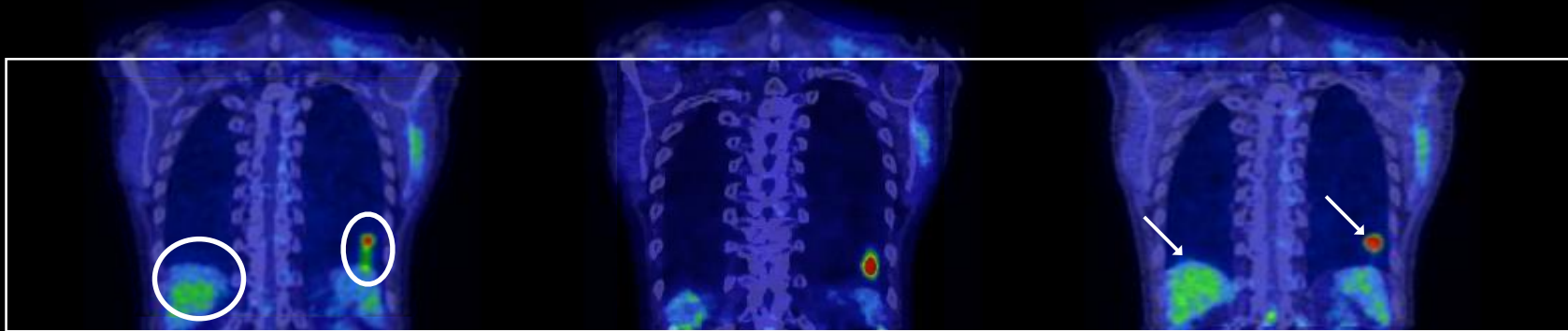
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