Past, Present & Future of the Total-Body PET: Clinical Perspective

Axel Rominger

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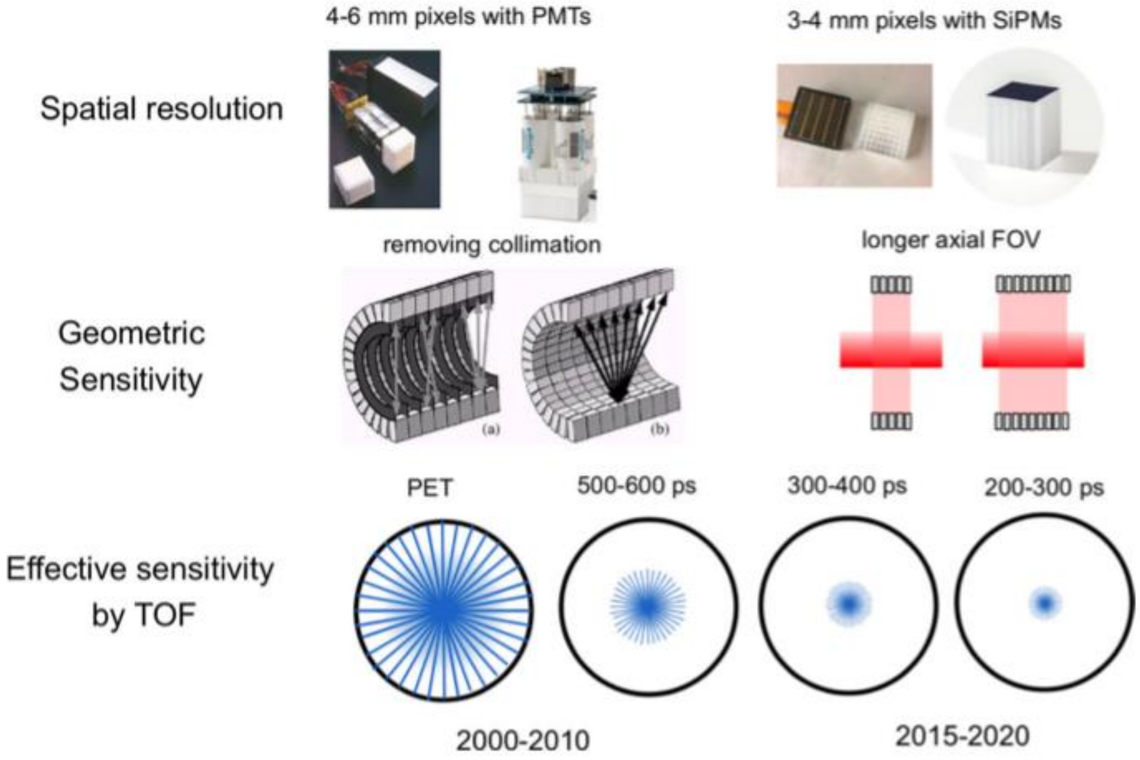
PET Technology Advancements



Vandenberghe et al 2020 EJNMMI Physics

European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-023-06534-4

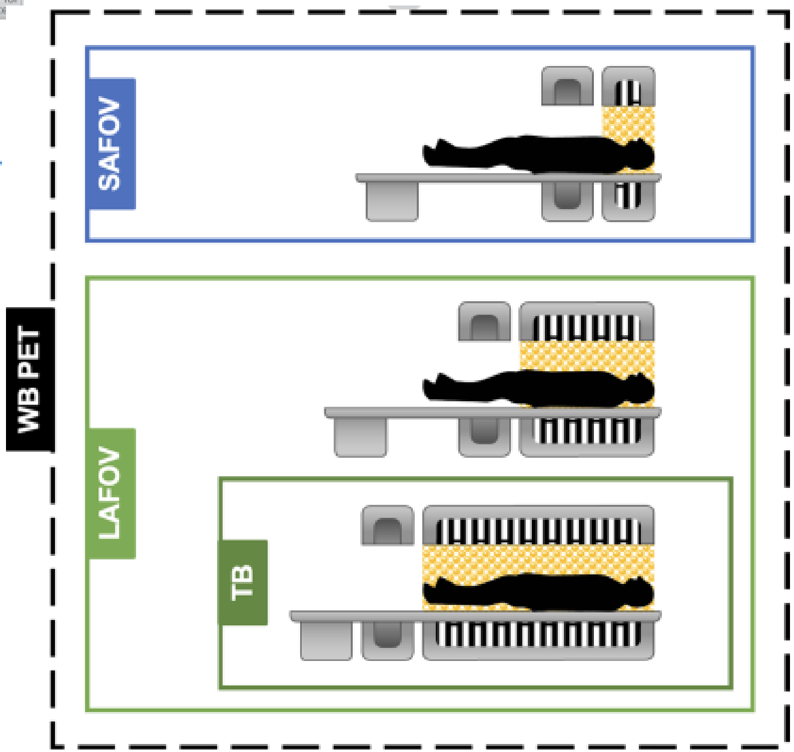
LETTER TO THE EDITOR

Total-body PET/CT or LAFOV PET/CT? Axial field-of-view clinical classification

Clemens Mingels[1,2] · Federico Caobelli[1] · Abass Alavi[3] · Christos Sachpekidis[4] · Meiyun Wang[5] · Hande Nalbant[2] · Austin R. Pantel[3] · Hongcheng Shi[6] · Axel Rominger[1] · Lorenzo Nardo[2]

Received: 9 November 2023 / Accepted: 17 November 2023

SAFOV < 100 cm
LAFOV > 100 cm



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PET Technology Advancements

Ea... T (1970s):
Na
PM
Si

1980-1990s:
BGO scintillators

2000-2010s:
LSO scintillators
PMT
Multi ring
...ial FoV ~ 20 cm

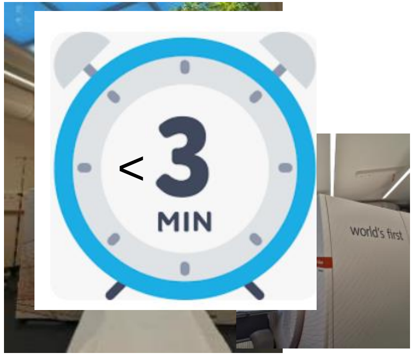
2010-2020s:
LSO scintillators
SiPM
Multi ring
Axial FoV ~ 25 cm

>2020:
LSO scintillators
SiPM
Multi ring
Axial FoV > 100 cm

>>60min ~15min

Analog PET

Digital PET



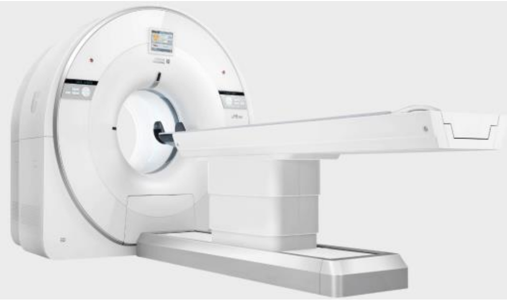
SAFOV-PET

LAFOV-PET

Overview commercial digital PET systems

GE Discovery MI
Omni Legend (- - -> LAFOV)

Siemens Biograph Vision 450/600
Biograph Vision X
Biograph Vision Quadra (LAFOV)



United uMI
Explorer (LAFOV)
Panorama
Panorama GS (LAFOV)

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Illustration of the Performance over the last 10 years

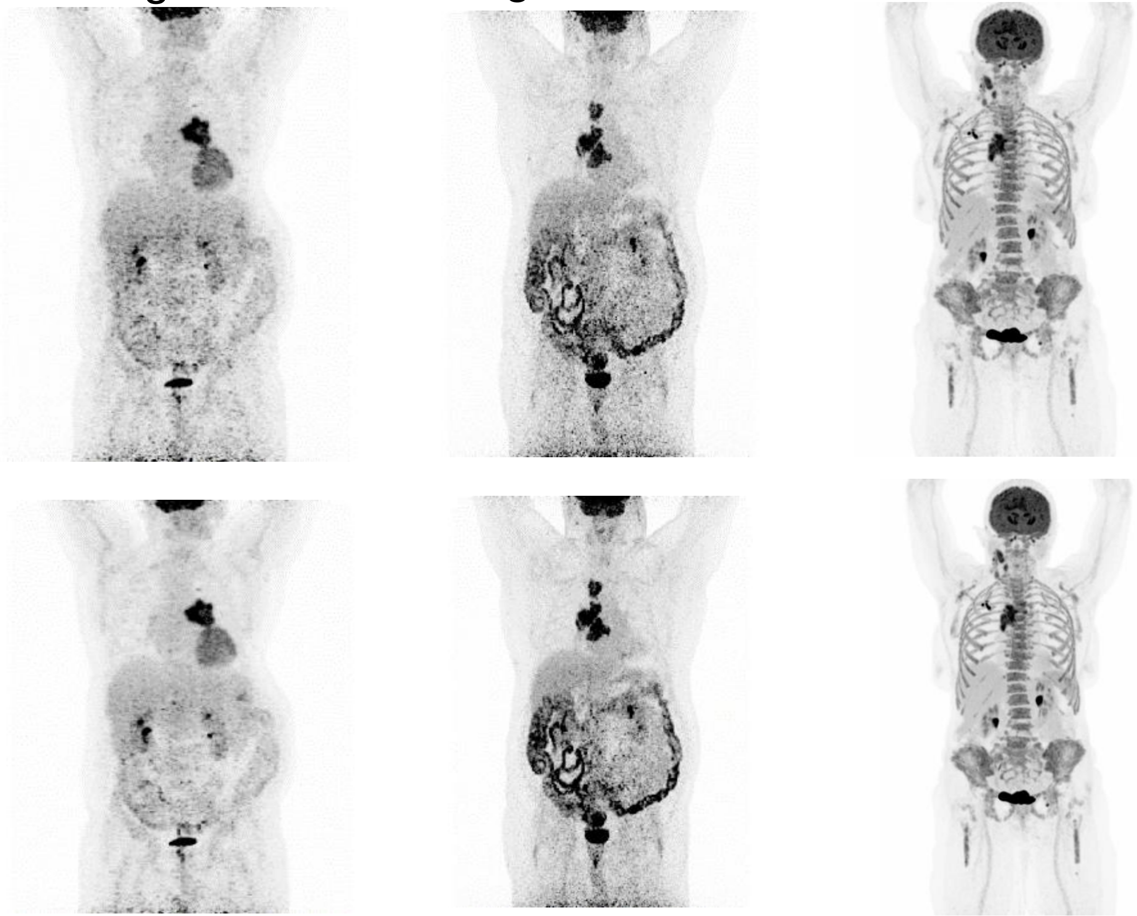
Analog SAFOV | Digital SAFOV | LAFOV

Acq time

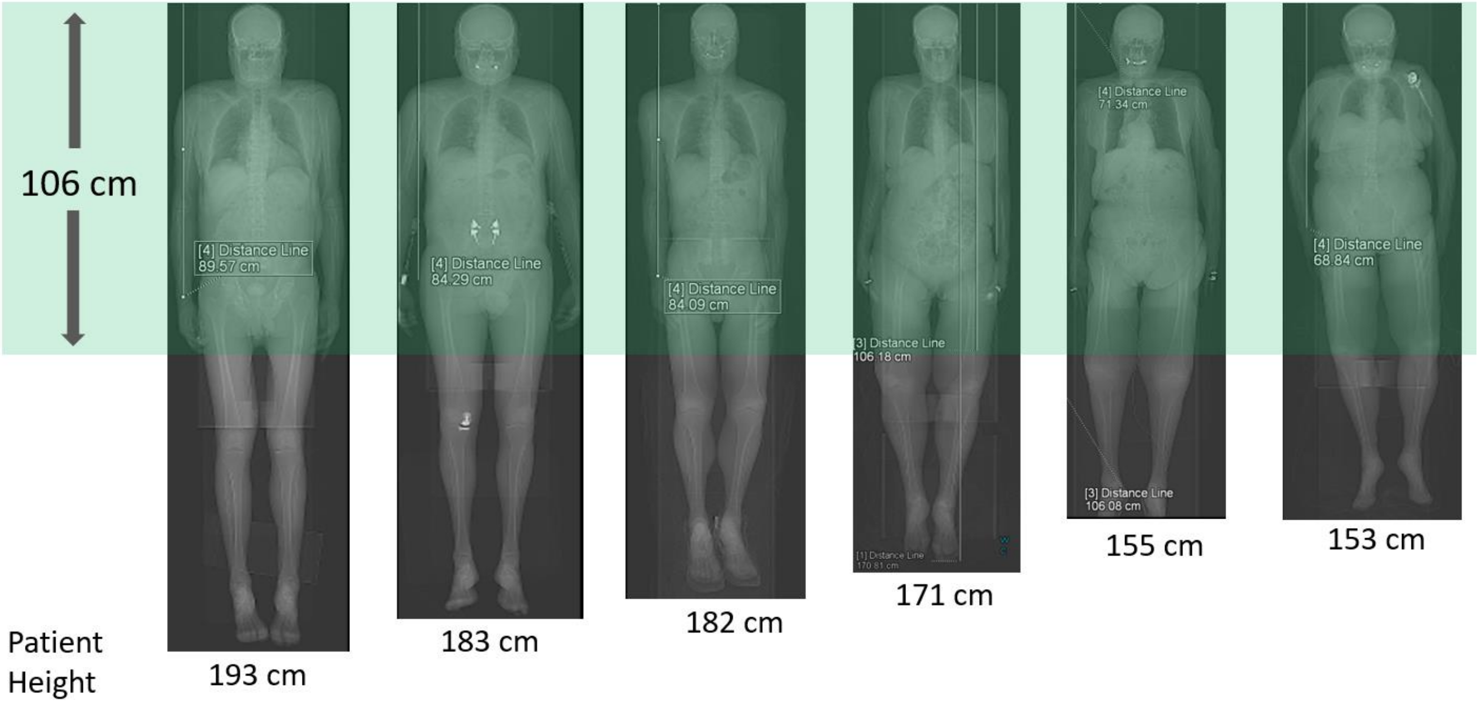
1 min

Acq time

2 min



Body coverage



All major organs are included!

European Journal of Nuclear Medicine and Molecular Imaging (2023) 50:3558–3571
https://doi.org/10.1007/s00259-023-06341-x

ORIGINAL ARTICLE

Flat Panel PET

Walk-through flat panel total-body PET: a patient-centered design for high throughput imaging at lower cost using DOI-capable high-resolution monolithic detectors

Stefaan Vandenberghe[1] · Florence M. Muller[1] · Nadia Withofs[2] · Meysam Dadgar[1] · Jens Maebe[1] · Boris Vervenne[1] · Maya Abi Akl[1] · Song Xue[3] · Kuangyu Shi[2] · Giancarlo Sportelli[4] · Nicola Belcari[4] · Roland Hustinx[2] · Christian Vanhove[1] · Joel S. Karp[5]

Received: 23 May 2023 / Accepted: 7 July 2023 / Published online: 19 July 2023

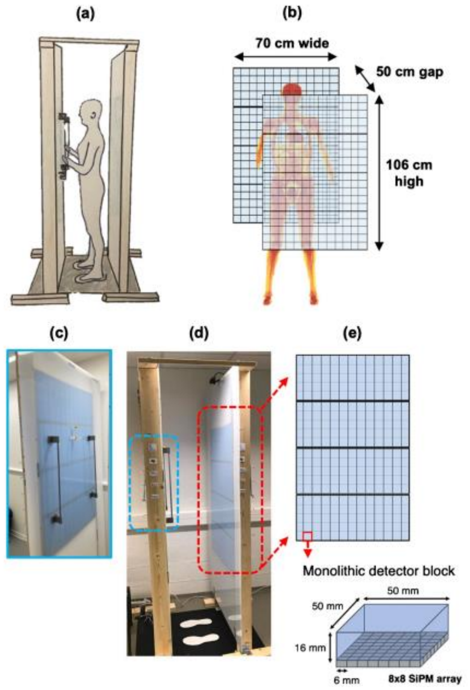


Table 3 PET component cost analysis (including the scintillator, SiPM, and electronics) comparing a standard PET-CT (SAFOV), a conventional 106 cm TB-PET-CT (LAFOV), and the proposed walk-through TB-PET system. Only the costs of the PET part are considered. The cost of the electronics was not calculated as it is harder as it is harder to estimate and depends strongly on the chosen detector concept and the amount of channels. Based on our first estimates the electronics of our design will be lower cost than for a full pixelated LAFOV scanner

	Scintillator	SiPM	PET component cost
Component cost	L(Y)SO: 30 Euro/cc BGO: 10 Euro/cc	1000 Euro/module One module: 5×5 cm surface (8×8 array of 6×6 mm SiPM)	
SAFOV (85 cm diameter, 20-mm-thick LSO, 26-cm axial FOV)	π×85 cm×2 cm×26 cm×30 Euro/cc =416 kEuro	π×85 cm×26 cm/(5 cm×5 cm)×1000 Euro =278 kEuro	694 kEuro
LAFOV (85 cm diameter, 20 mm thick LSO, 4×106 cm axial FOV)	π×85 cm×2 cm×26 cm×4×30 Euro/cc =1666 kEuro	π×85 cm×4×26 cm/(5 cm×5 cm)×1000 Euro =1112 kEuro	2776 kEuro
WT-TB-PET (2 panels of 70-cm width each, 106-cm axial FOV, 16-mm-thick BGO)	2×70 cm×106 cm×1.6 cm×10 Euro/cc =237 kEuro	2×70 cm×106 cm/(5 cm×5 cm)×1000 Euro =593 kEuro	830 kEuro
WT-TB-PET (2 panels of 70 cm width each, 106 cm axial FOV, 16-mm-thick LYSO)	2×70 cm×106 cm×1.6 cm×30 Euro/cc =711 kEuro	2×70 cm×106 cm/(5 cm×5 cm)×1000 Euro =593 kEuro	1304 kEuro

Advantages:
Low-cost
Fast throughput
High spatial resolution

J-PET

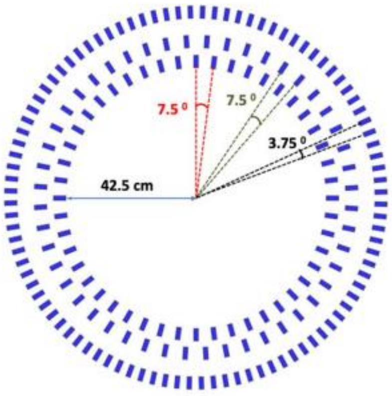
Sharma *et al. EJNMMI Physics* (2023) 10:28
https://doi.org/10.1186/s40658-023-00546-7

EJNMMI Physics

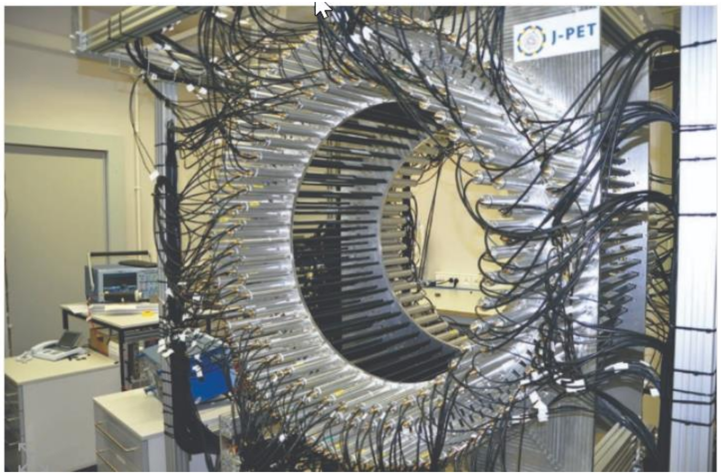
ORIGINAL RESEARCH **Open Access**

Efficiency determination of J-PET: first plastic scintillators-based PET scanner

S. Sharma[1,2,7*], J. Baran[1,2,7], N. Chug[1,2,7], C. Curceanu[3], E. Czerwiński[1,2,7], M. Dadgar[1,2,7], K. Dulski[1,2,7], K. Eliyan[1,2,7], A. Gajos[1,2,7], N. Gupta-Sharma[1,2], B. C. Hiesmayr[4], K. Kacprzak[1,2,7], Ł. Kapłon[1,2,7], K. Klimaszewski[5], P. Konieczka[5], G. Korcyl[1,2], T. Kozik[1], W. Krzemień[6], D. Kumar[1,2,7], Sz. Niedźwiecki[1,2,7], D. Panek[1,2,7], S. Parzych[1,2,7], E. Perez del Rio[1,2,7], L. Raczyński[5], Shivani Choudhary[1,2,7], R. Y. Shopa[5], M. Skurzok[1,2,7], E. Ł. Stępień[1,2,7], F. Tayefi[1,2,7], K. Tayefi[1,2,7], W. Wiślicki[6] and P. Moskal[1,2,7]



(b)



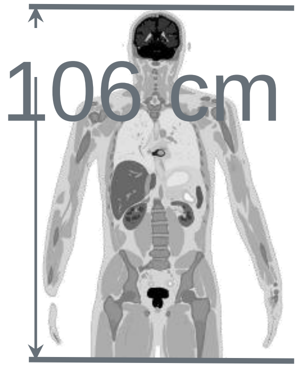
Perspectives

analog
PET/CT

digital
PET/CT

Total body
PET/CT

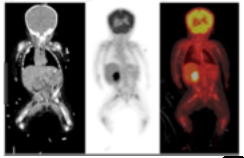
Total-Body PET/CT Imaging - Perspectives



High-sensitivity

Fast acquisition

Low radiation burden



Quantitative accuracy

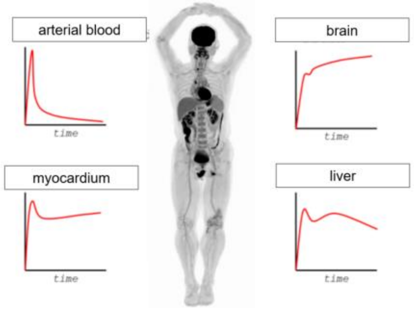
Multi-tracer studies

Organ interaction, e.g. brain-gut, brain-spine, brain-heart

Late low-dose Imaging
→ immune cells

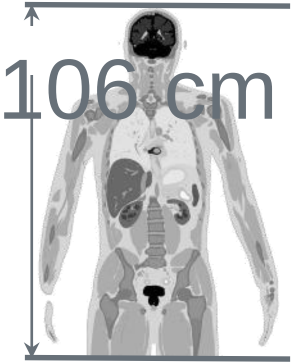
Drug discovery

High temporal resolution



Whole-body parametric imaging

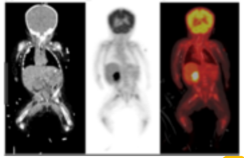
Total-Body PET/CT Imaging - Perspectives



High-sensitivity

Fast acquisition

Low radiation burden



Multi-tracer studies

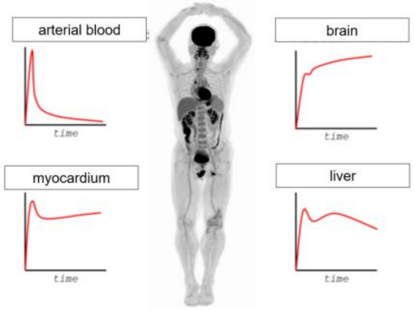
Organ interaction, e.g. brain-gut, brain-spine, brain-heart

Late low-dose Imaging
→ immune cells

Drug discovery

Quantitative accuracy

High temporal resolution



Whole-body parametric imaging

Which is the killer application?

FLEXIBILITY

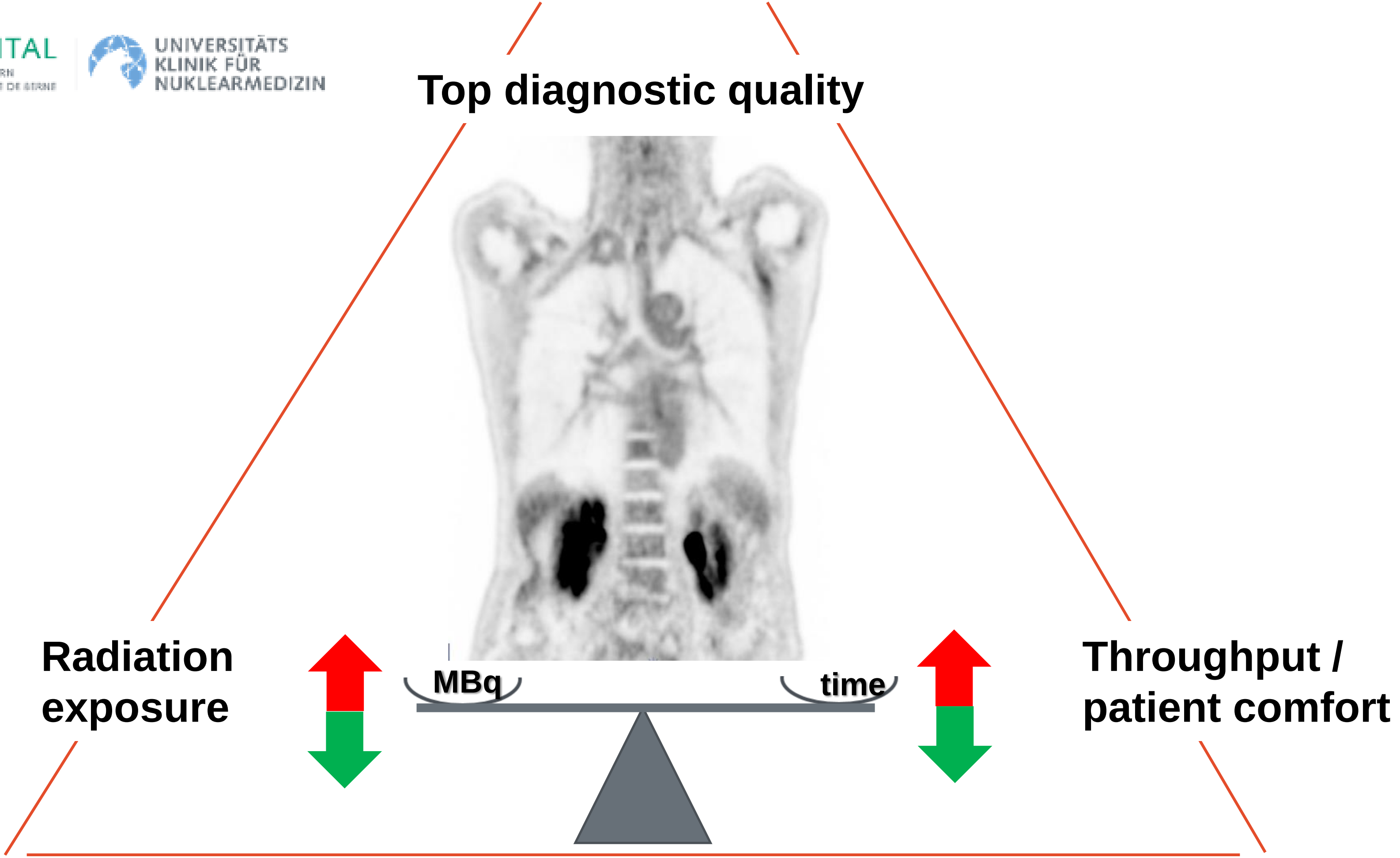

Top diagnostic quality
Radiation exposure
MBq
time
Throughput / patient comfort

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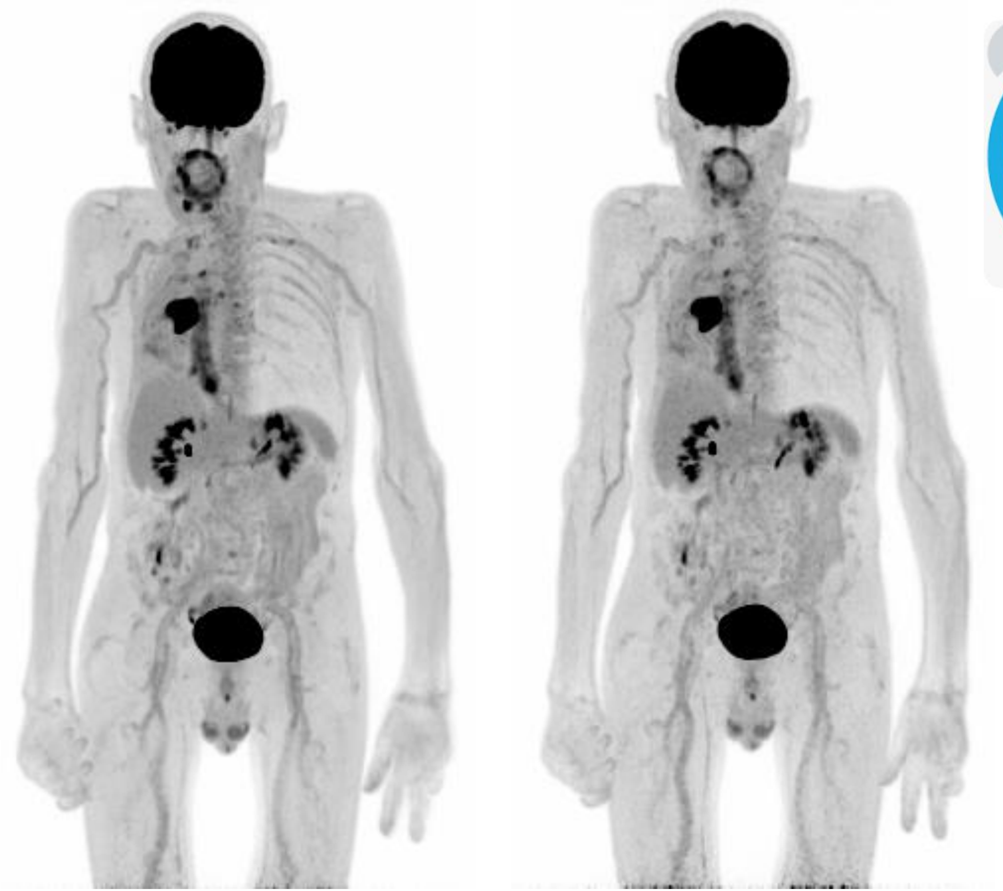
Image Impressions



10 min | 2 min

PET MIP

440x440 matrix
3MBq/kg FDG

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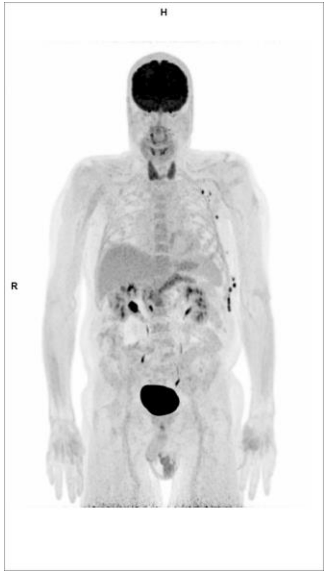
Malignant Melanoma
post immunotherapy
242 MBq FDG
80 kg / 176 cm



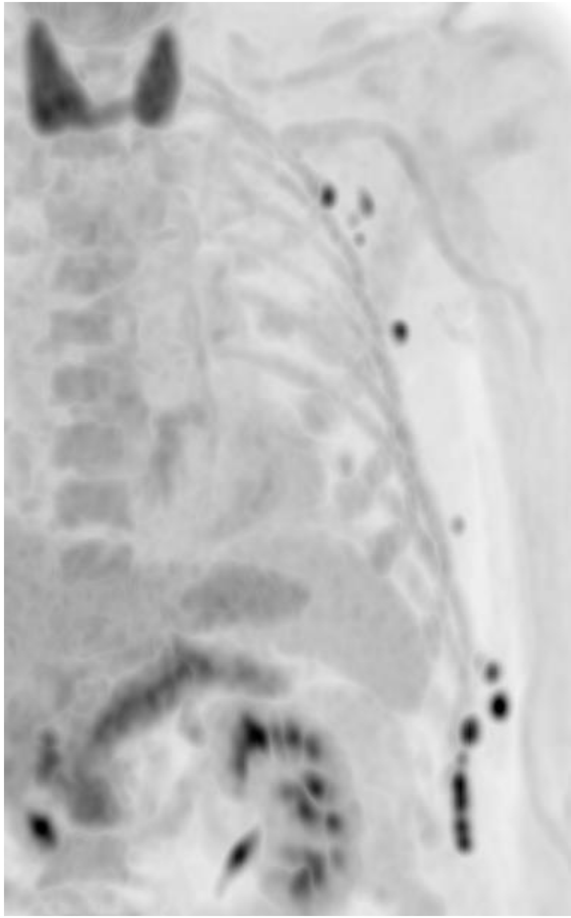
Vision Quadra
120 min. p.i.
180 sec
440x440 matrix

Vision Quadra
120 min. p.i.
120 sec
440x440 matrix

Vision Quadra
120 min. p.i.
90 sec
440x440 matrix

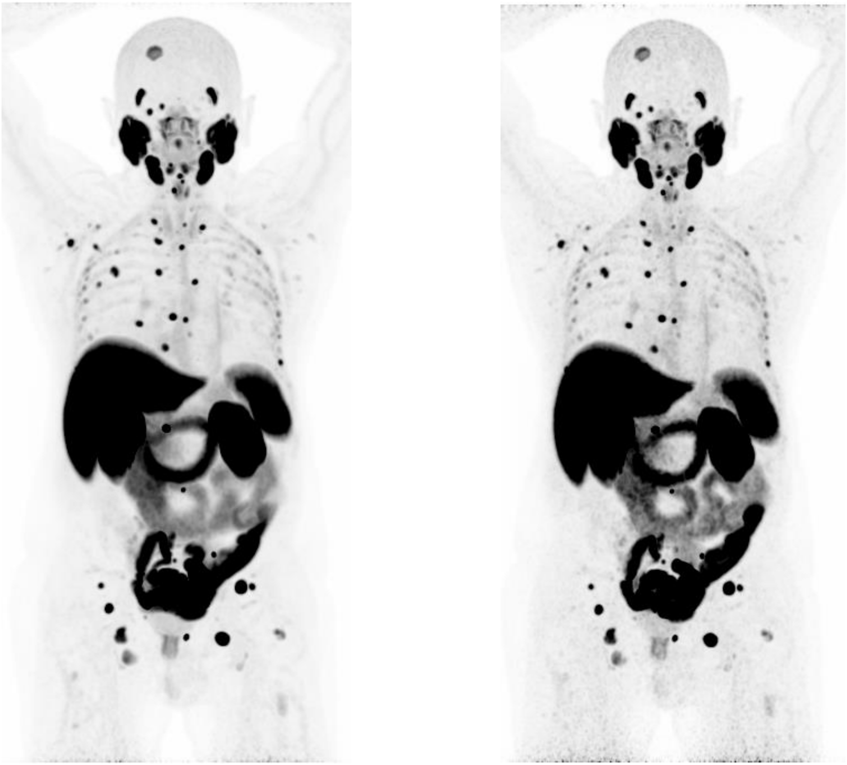
Vision Quadra
120 min. p.i.
60 sec
440x440 matrix

Vision Quadra
120 min. p.i.
30 sec
440x440 matrix



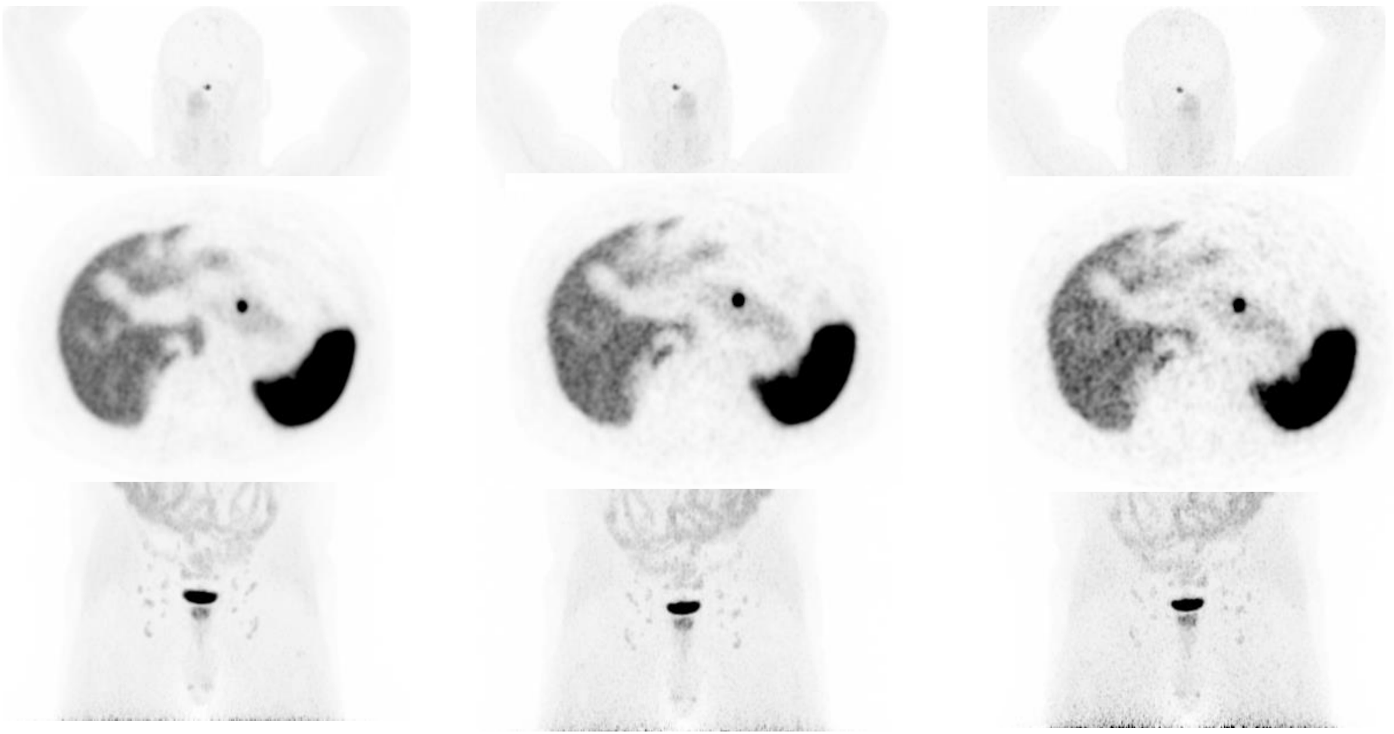
Vision Quadra
120 min. p.i.
2 min
440x440 matrix

PSA 24.8 ng/ml
238 MBq **F18-PSMA1007**
82 kg / 183 cm



10 min

2min



NET G1
163 MBq **Ga68-DOTATOC**
99 kg / 180 cm

10 min

4 min

2 min

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European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-021-05282-7

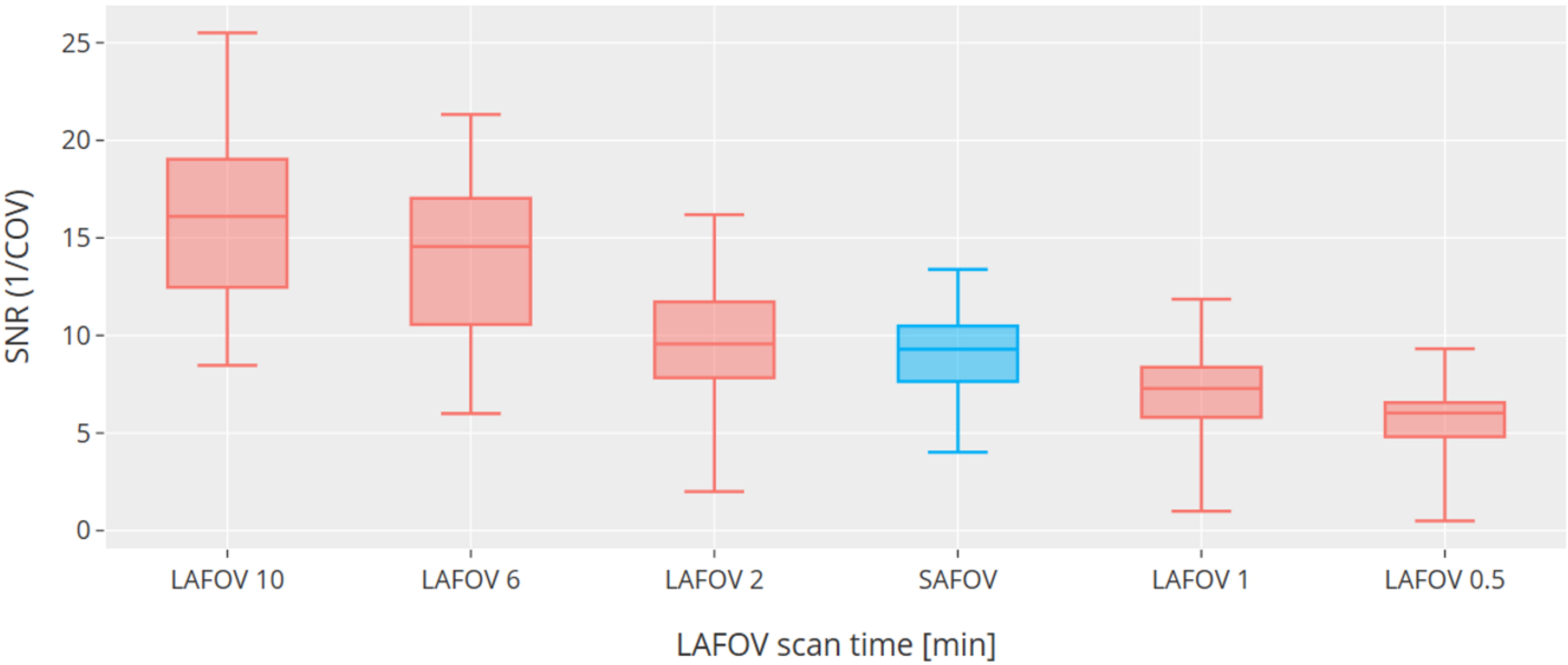
ORIGINAL ARTICLE

Check for updates

Clinical performance of long axial field of view PET/CT: a head-to-head intra-individual comparison of the Biograph Vision Quadra with the Biograph Vision PET/CT

Ian Alberts[1] • Jan-Niklas Hünermund[1] • George Prenosil[1] • Clemens Mingels[1] • Karl Peter Bohn[1] • Marco Viscione[1] • Hasan Sari[1,2] • Bernd Vollnberg[1] • Kuangyu Shi[1] • Ali Afshar-Oromieh[1] • Axel Rominger[1]

SNR in LAFOV compared to SAFOV

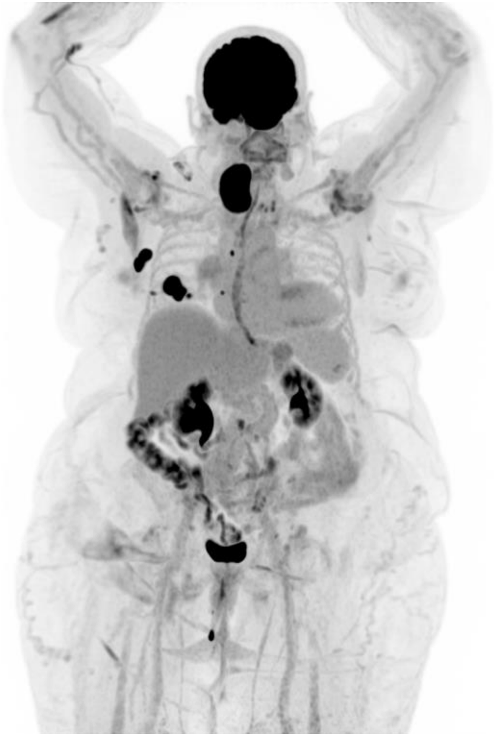


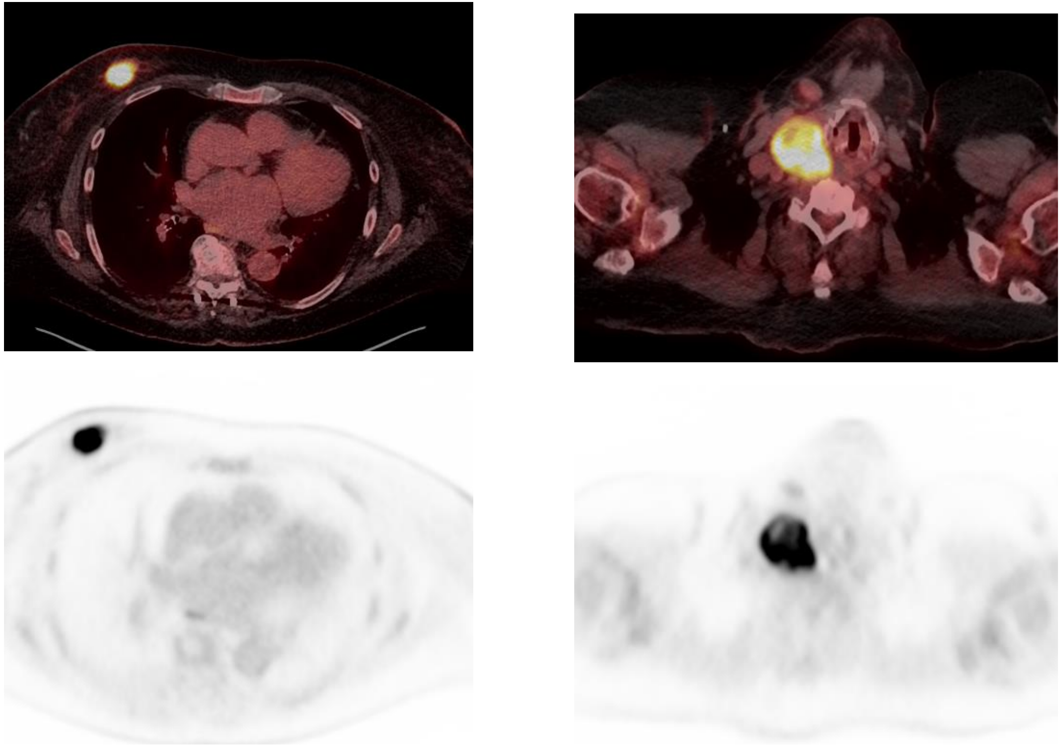
2 min in LAFOV correspond to 16 min in SAFOV

Business Cases are Possible

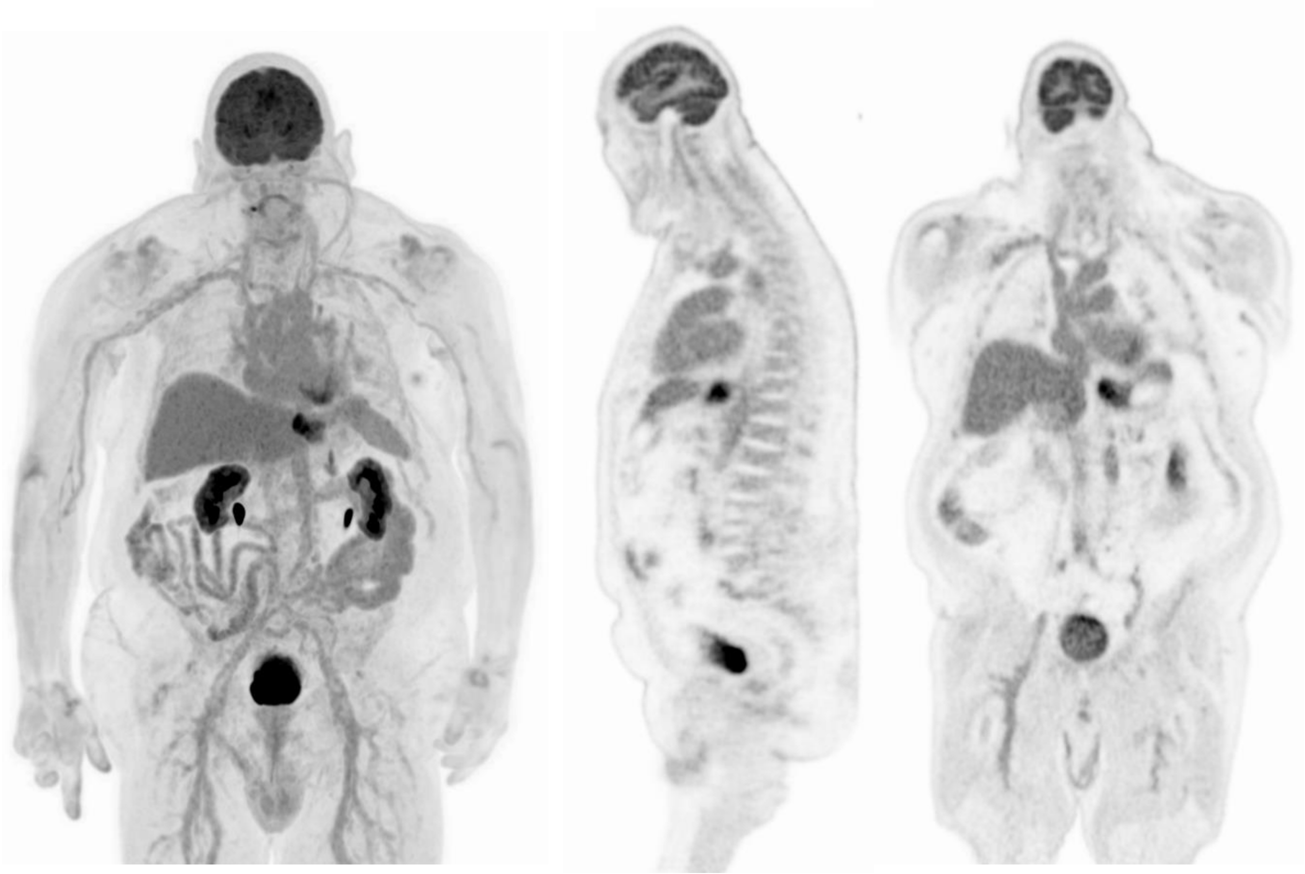
Triple negative Mamma-Ca, Staging. Adipositas permagna.
397 MBq F-18-FDG; 6 min acq.

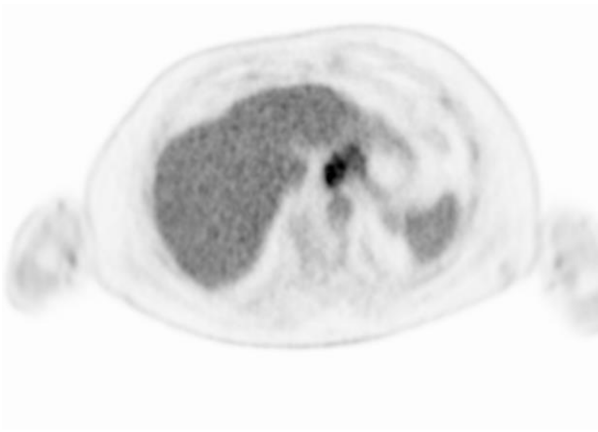
Non-optimal conditions





Non-optimal conditions





87y male patient with
adenocarcinoma AEG,
BG: 12.3 mmol/l, 1.64m 85kg
BMI 32kg/m^2
uptake time: 60min
6min acquisition

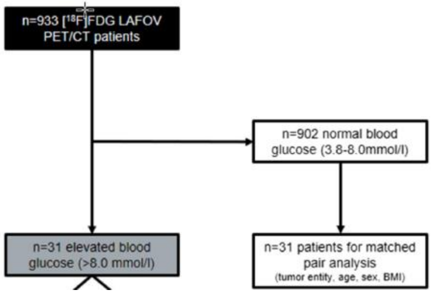
Mingels et al. SNM 2023

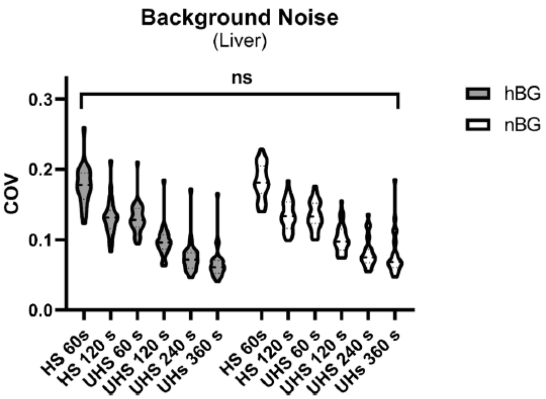
European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-024-06646-5

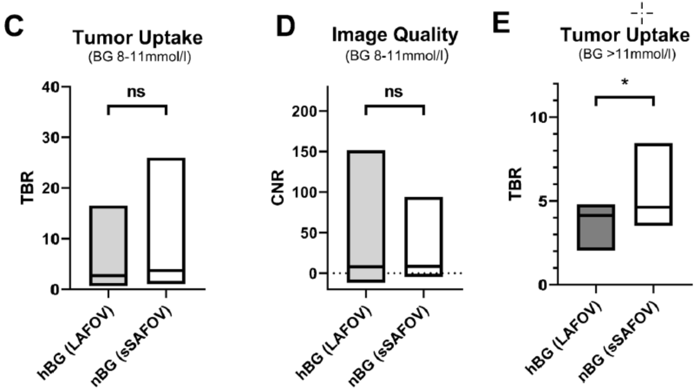
ORIGINAL ARTICLE

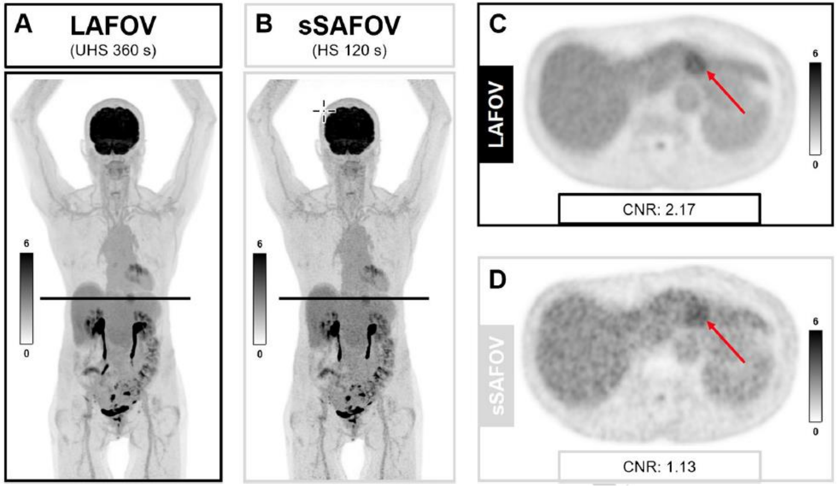
FDG imaging with long-axial field-of-view PET/CT in patients with high blood glucose—a matched pair analysis

Clemens Mingels[1] · Luis Weissenrieder[1] · Konstantinos Zeimpekis[1] · Hasan Sari[1,2] · Lorenzo Nardo[3] · Federico Caobelli[1] · Ian Alberts[4] · Axel Rominger[1] · Thomas Pyka[1]









If BG is elevated a longer acq. on a LAFOV system can compensate the altered biodistribution

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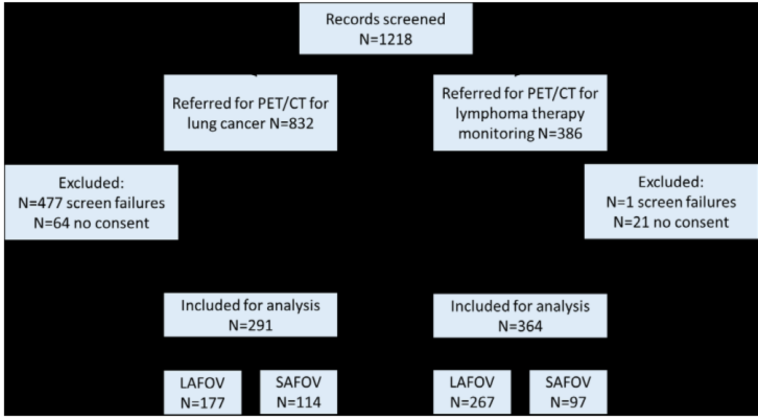


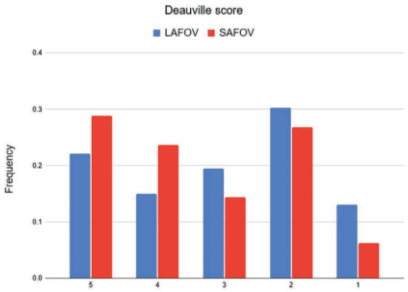
OPEN

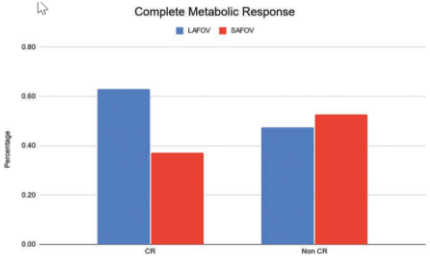
Original article

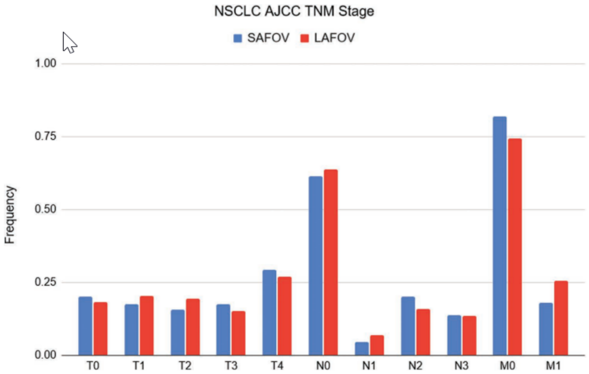
2023 Nuclear Medicine Communications

Investigating the influence of long-axial versus short-axial field of view PET/CT on stage migration in lymphoma and non-small cell lung cancer

Ian Alberts[a], Sigrid Seibel[a], Song Xue[a], Marco Viscione[a], Clemens Mingels[a], Hasan Sari[a,b], Ali Afshar-Oromieh[a], Andreas Limacher[c] and Axel Rominger[a]







- LAFOV system did not lead to upstaging in lymphoma nor NSCLC compared to a digital SAFOV system.
- Diagnostic accuracy was comparable between the two systems in NSCLC despite shorter acquisition times for LAFOV.

Expanding the Horizon

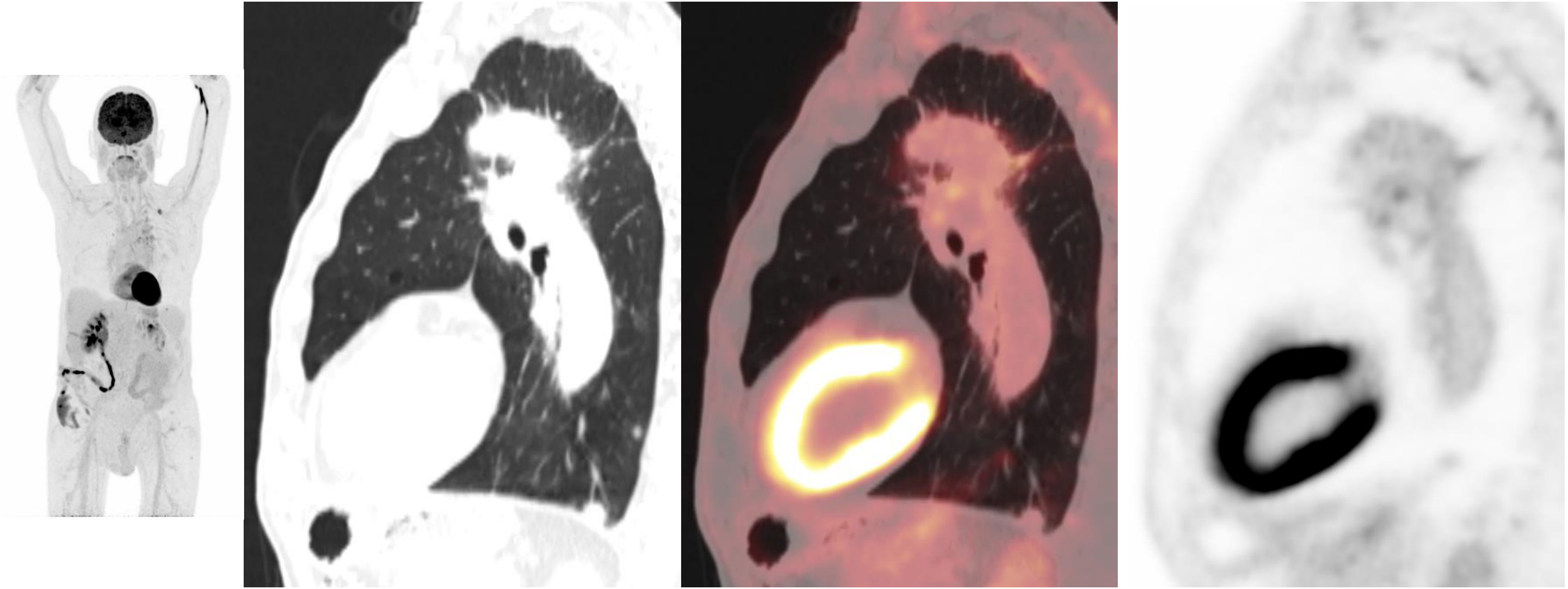
INDICATIONS

- diagnosis of tumor
- tumor metastasis
- rare diseases
- immunological disorders
- cardiovascular
- neurological

IMAGING

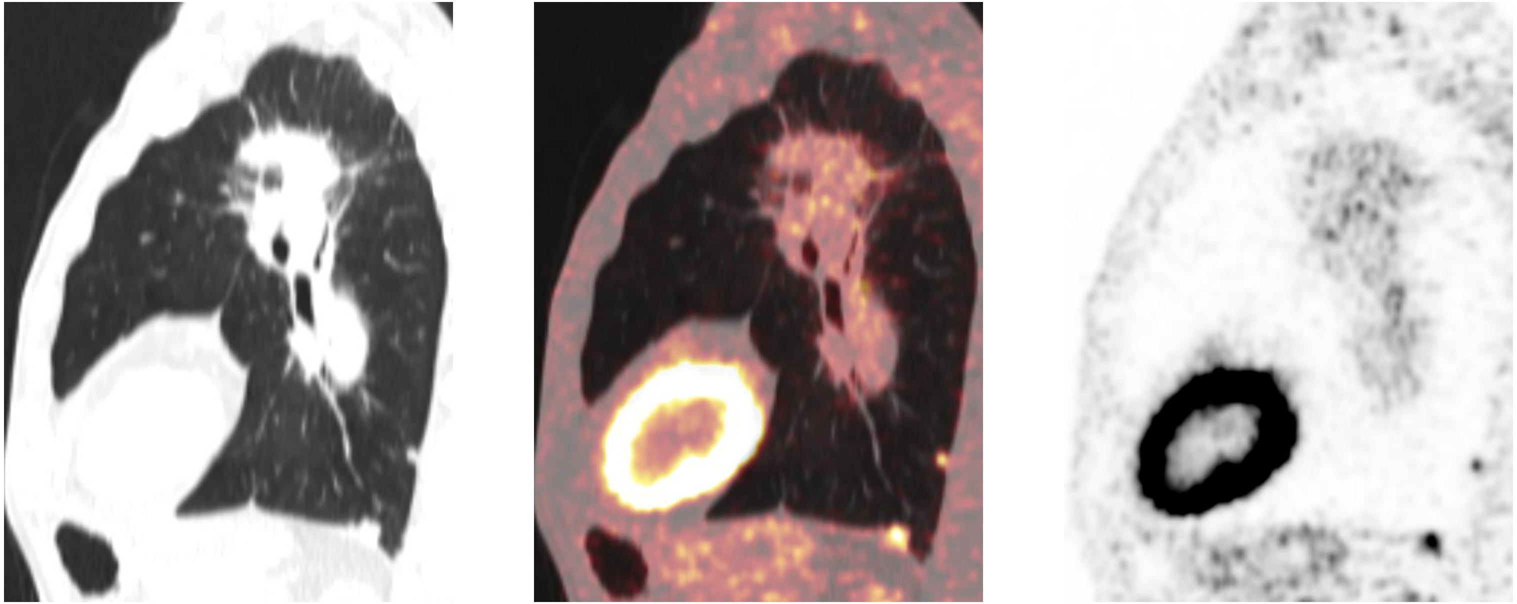
- ultrafast
- low-dose
- delayed
- dual tracer
- dynamic

post adenocarcinoma upper lobe L
190 MBq F-18-FDG



4 min acquisition during regular breathing

post adenocarcinoma upper lobe L
190 MBq F-18-FDG



10 sec DIBH

Scanning with Low Dose Activity

offers the possibility of…

- ALARA principle
- Multiple follow-up PET scans, also short-term FU
- Administration of **different radiotracers** for further characterization of tumors → personalized approaches
- Save cost for radiopharmaceuticals
- Bring **new radiopharmaceuticals** into humans
- Find new indications (non-oncological, early detection, screening)

HEALTH AND SCIENCE

Drugmakers bet billions that targeted radiation could become the next cancer breakthrough

PUBLISHED MON, SEP 16 2024•9:18 AM EDT | UPDATED MON, SEP 16 2024•11:30 AM EDT

Angelica Peebles
@IN/ANGELICAPEEBLES/
@ANGELICAPEEBLES

SHARE

KEY POINTS

- Bristol Myers Squibb, AstraZeneca, Eli Lilly and other pharmaceutical companies have spent some $10 billion on radiopharmaceutical acquisitions and partnerships over the past year.
- Drugmakers are trying to replicate the success Novartis has found with Pluvicto and Lutathera.
- Radiopharmaceuticals are currently available for some neuroendocrine tumors and prostate cancer. They could one day be used for numerous cancers.

Options with Children

Inject a regular dose

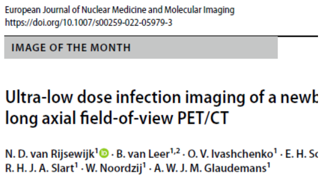
Do an ultra-fast acquisition

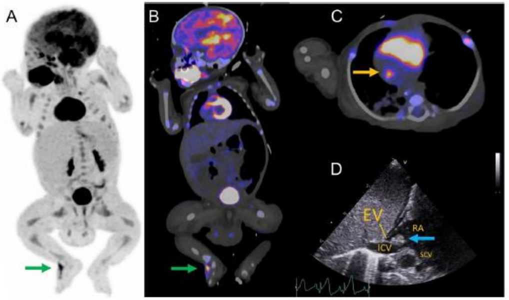
Avoid anaesthesia
Cope with a non-compliant kid

Inject a low/ultralow dose

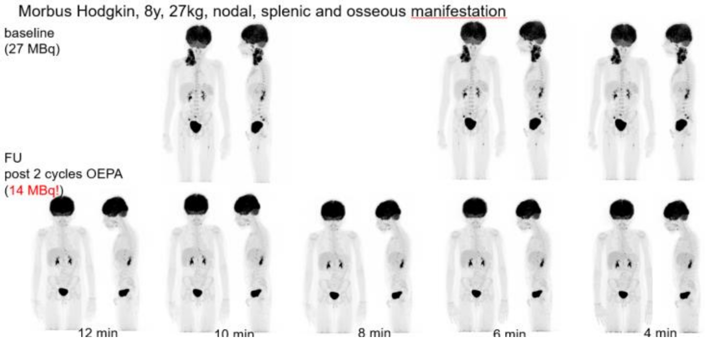
Do a longer scan

Avoid as much radiation burden as possible





12 MBq FDG
3min acq.



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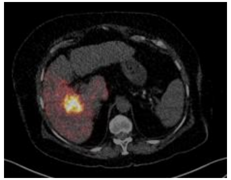
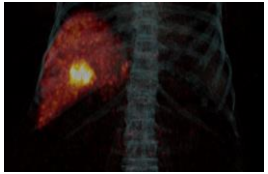
Low-count Statistics

HCC
SIRT 1 GBq 90Y-TheraSphere i.a.
PET/CT 1d p.i. on Quadra





→ Therapy control dosimetry

European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-024-06650-9

ORIGINAL ARTICLE

^{90}Y post-radioembolization clinical assessment with whole-body Biograph Vision Quadra PET/CT: image quality, tumor, liver and lung dosimetry

Konstantinos G. Zeimpekis[1] · Lorenzo Mercolli[1] · Maurizio Conti[2] · Hasan Sari[3] · Axel Rominger[1] · Hendrik Rathke[1]

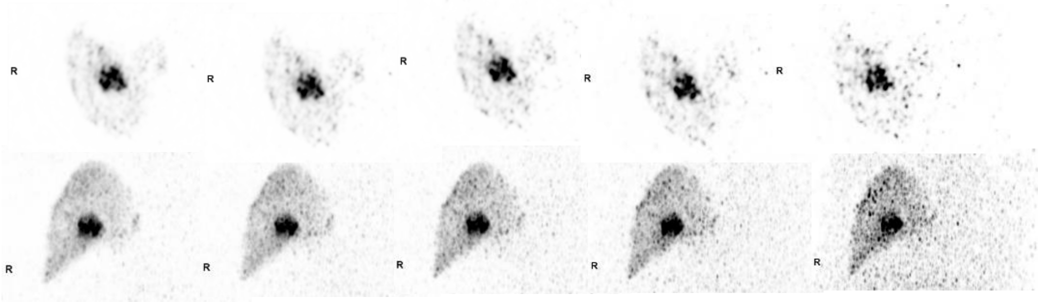
European Journal of Nuclear Medicine and Molecular Imaging (2023) 50:1168–1182
https://doi.org/10.1007/s00259-022-06074-3

ORIGINAL ARTICLE

Phantom-based evaluation of yttrium-90 datasets using biograph vision quadra

Konstantinos G. Zeimpekis[1] · Lorenzo Mercolli[1] · Maurizio Conti[2] · Hasan Sari[3] · George Prenosil[1] · Kuangyu Shi[1] · Axel Rominger[1]

Received: 6 August 2022 / Accepted: 4 December 2022 / Published online: 12 December 2022



Based on phantom and human studies 5 min acquisitions provide similar SNR compared to 30 min acq.

→ Ultra-Low-Dose Imaging

NIH U.S. National Library of Medicine

ClinicalTrials.gov

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Home > Search Results > Study Record Detail

☐ Save this study

Assessing Ultra-low Dose PET/CT and CT-less PET Using a Long Axial Field-of-view PET/CT System (ULD-PET)

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

ClinicalTrials.gov Identifier: NCT05496920

Recruitment Status: Recruiting
First Posted: August 11, 2022
Last Update Posted: August 19, 2022

See **Contacts and Locations**

Recruitment finished

Sponsor:
University Hospital Inselspital, Berne

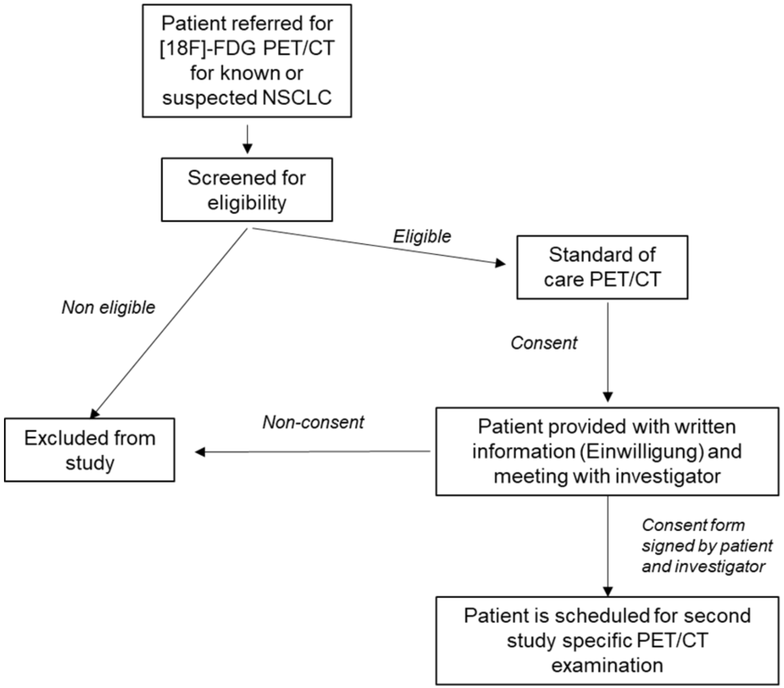
Information provided by (Responsible Party):
University Hospital Inselspital, Berne

https://clinicaltrials.gov/ct2/show/NCT05496920

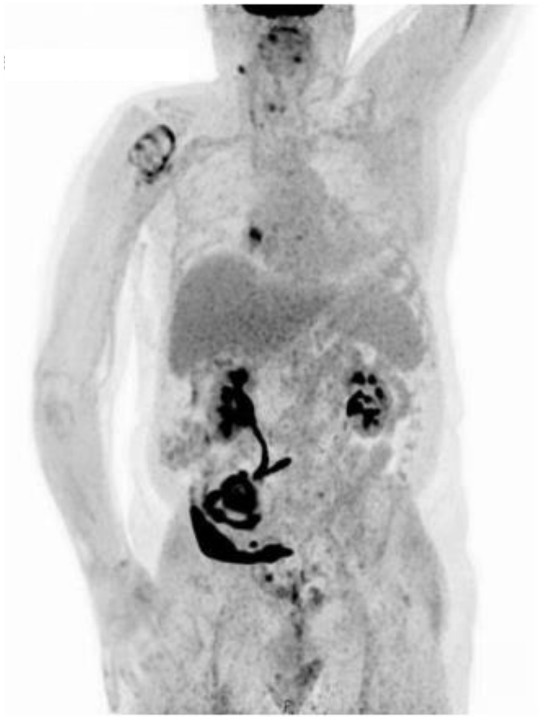
Single centre, single-blinded cross-over non-inferiority trial tests the non-inferiority of a low-dose PET/CT compared to a reference standard – SAFOV FD-PET/CT

Aim: To demonstrate in a clinical setting the non-inferiority of low-dose using a clinically relevant endpoint by means of a robust, hypothesis testing prospective study

Framework: comparison



Example



Vision
Full dose (3 MBq/kg, 2 min/BP)

Quadra
ULD (0.2 MBq/kg, 20 min)

Smith *et al. EJNMMI Physics* (2024) 11:45
https://doi.org/10.1186/s40658-024-00648-w

EJNMMI Physics

SHORT COMMUNICATION Open Access

Ultra-low foetal radiation exposure in ^{18}F-FDG PET/CT imaging with a long axial field-of-view PET/CT system

Charlotte L. C. Smith[1,2*], Maqsood Yaqub[1,2], Ruud H. H. Wellenberg[1], Jelijn J. Knip[2,3], Ronald Boellaard[1,2] and Gerben J. C. Zwezerijnen[1,2]

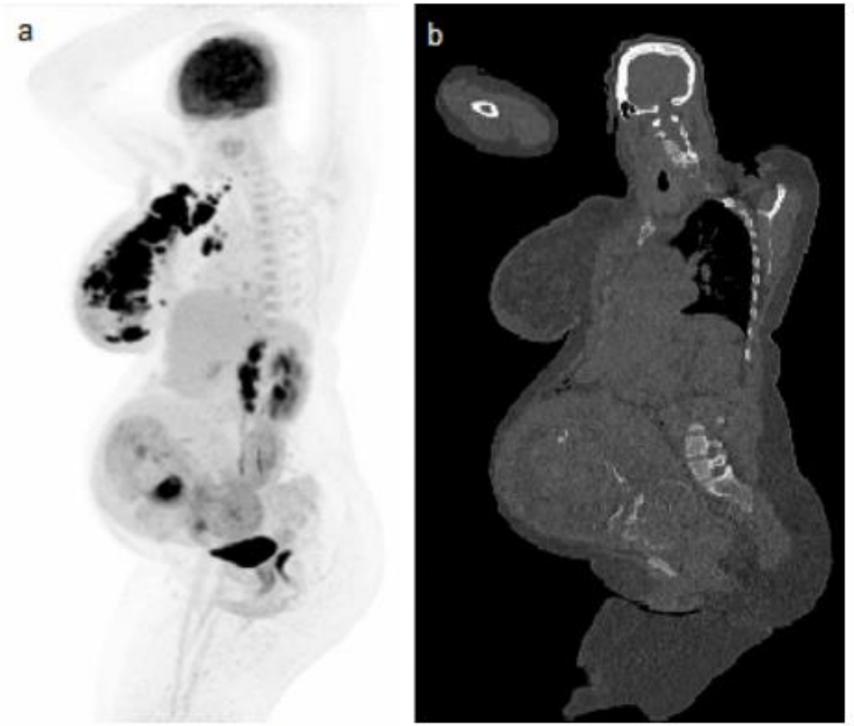


Fig. 1 ^{18}F-FDG PET/CT image including both the mother and the foetus with **(a)** a Maximum Intensity Projection (MIP) ^{18}F-FDG PET image and **(b)** a slice of the ultra-low-dose CT scan

0.3 MBq/kg FDG

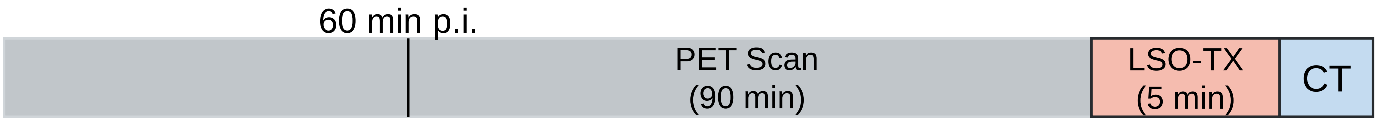
foetal radiation dose 0.11 and 0.44 mGy

CT: < 0.1-0.9 mGy

Total: < 1.5 mGy

….. → **Screening**

… in healthy volunteers Materials



- Four subjects received a single bolus administration of ^{18}F-FDG (mean activity: 7.92 ± 0.98 MBq, approx. 0.1 MBq/kg).
- PET emission data were acquired for 90 minutes starting from 60 min post injection using Biograph Vision Quadra (Siemens Healthineers) LAFOV PET system.
- Low-dose whole-body CT scans were performed with Care 4D, 100 kV and spectral shaping / tin filter.
    - CT-based μ-maps were generated.
- LSO-TX data were acquired for 5 minutes using a special acquisition protocol with open energy and coincidence timing windows.
- PET images were reconstructed with CT- and LSO-TX-based μ-maps using PSFTOF with 4 iterations and 5 subsets. Gaussian filter with 2 mm FWHM was applied.

Development and evaluation of a CT-less reconstruction framework for long-axial FOV PET scanners using LSO background radiation

- High sensitivity of LAFOV PET scanners can be utilized to detect background LSO radiation (LSO-TX) from lutetium-based scintillators.
- In this work, we explore use of a deep-learning based method to generate CT-less attenuation maps from LSO-TX data

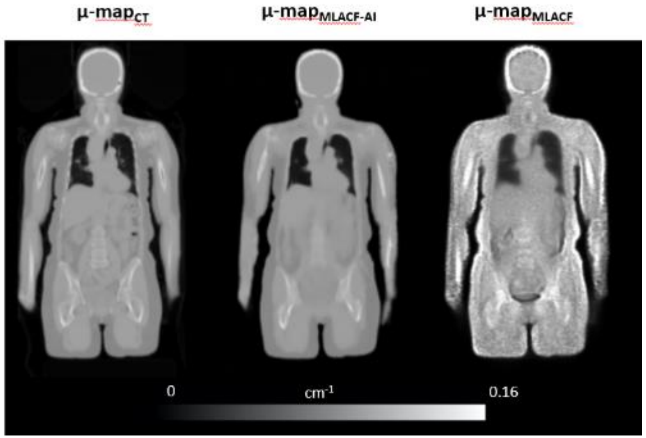
European Journal of Nuclear Medicine and Molecular Imaging (2022) 49:4490–4502
https://doi.org/10.1007/s00259-022-05909-3

ORIGINAL ARTICLE

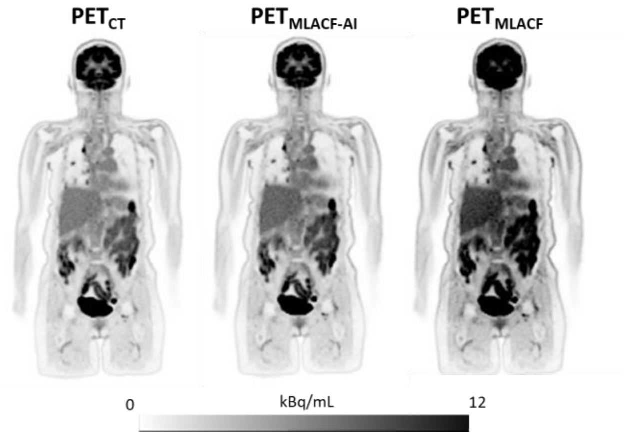
Quantitative evaluation of a deep learning-based framework to generate whole-body attenuation maps using LSO background radiation in long axial FOV PET scanners

Hasan Sari[1,2] · Mohammadreza Teimoorisichani[3] · Clemens Mingels[2] · Ian Alberts[2] · Vladimir Panin[3] · Deepak Bharkhada[3] · Song Xue[2] · George Prenosil[2] · Kuangyu Shi[2] · Maurizio Conti[3] · Axel Rominger[2]

Attenuation maps



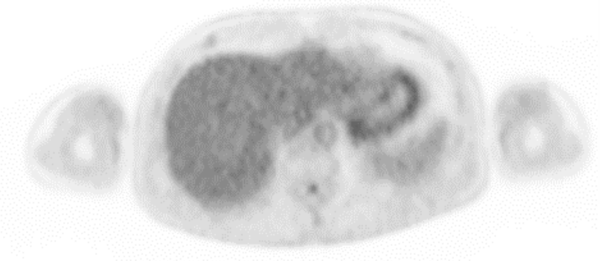
Reconstructed PET images



CASE 1

Injected Dose:
9.0 MBq
Patient Weight:
75 kg

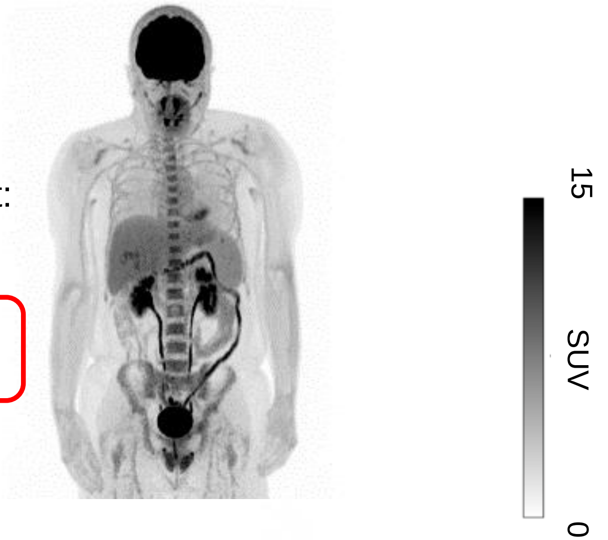
= 0.12 MBq/kg
= 0.17 mSv

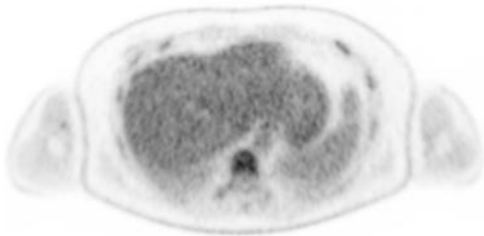


CASE 2

Injected Dose:
6.7 MBq
Patient Weight:
82 kg

= 0.08 MBq/kg
= 0.12 mSv

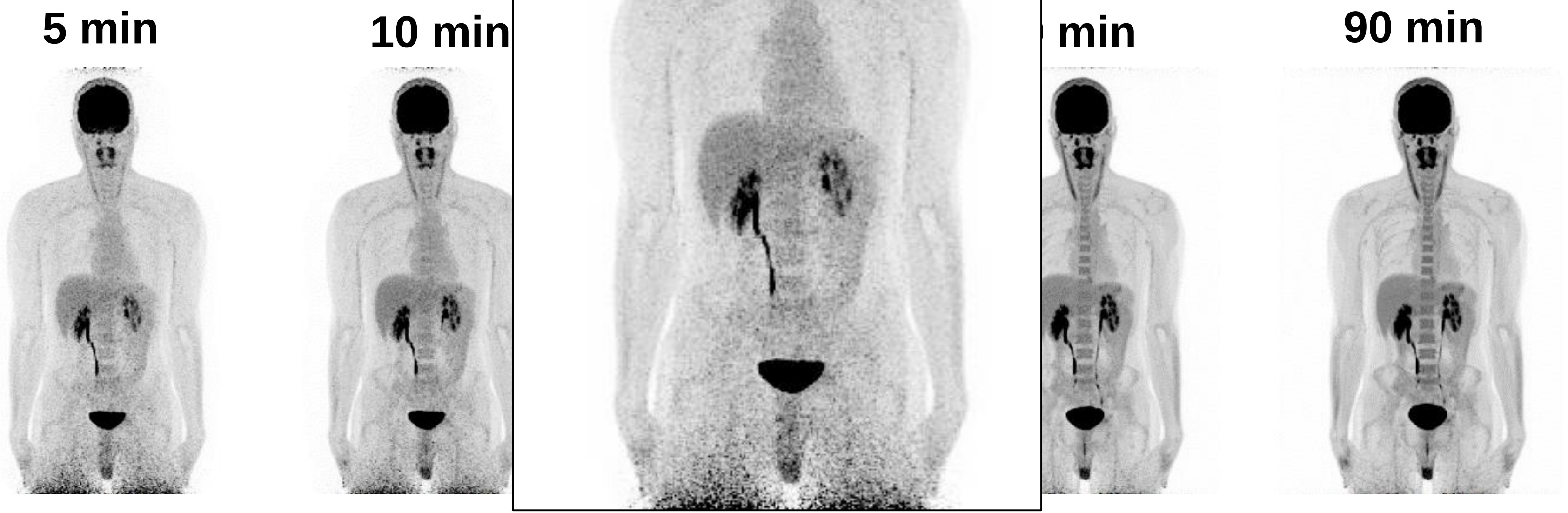




Acq. duration: 90 min, 60 min. p.i.
PSFTOF, 4i5s, 2 mm FWHM Gaussian filter, Matrix 440 x 440

Sari et al
TBPET 2024

Injected Dose: 9.0 MBq
Patient Weight: 75 kg
Acq duration: 90 minutes
CT-based AC

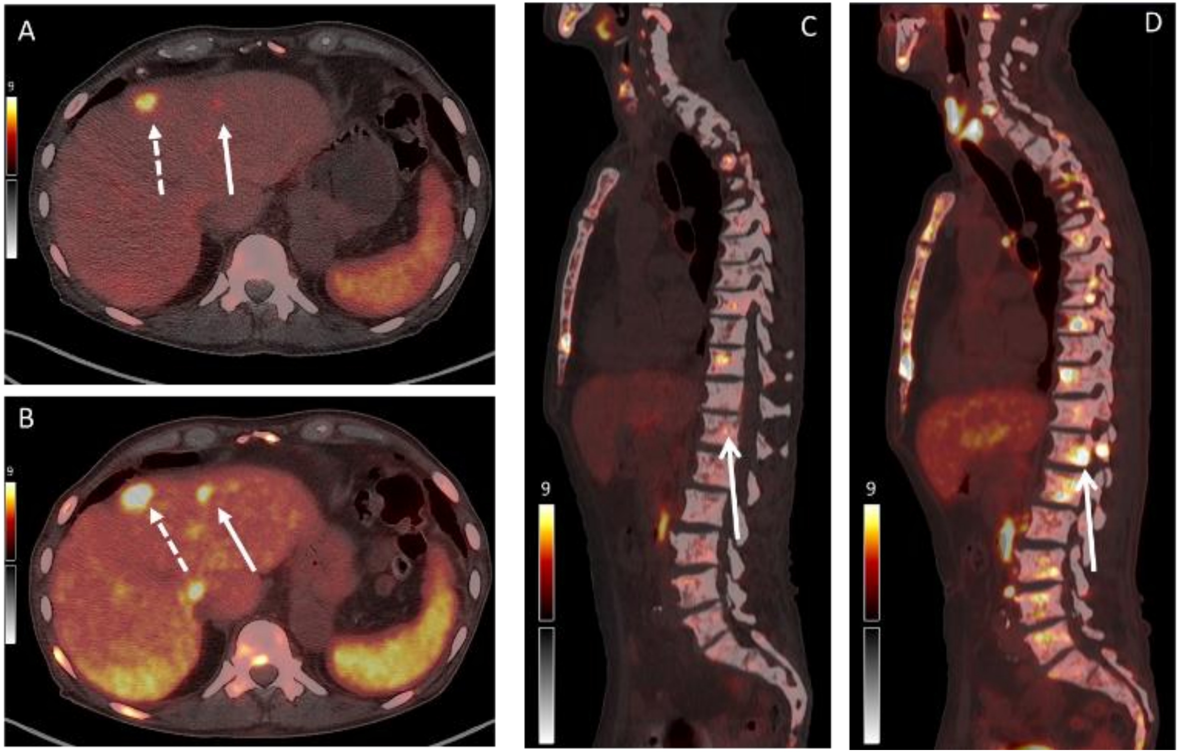


Dual Tracer

FDG chasing PSMA

150 MBq
Ga-PSMA11
1h p.i.

+ 40 MBq
FDG
1h later



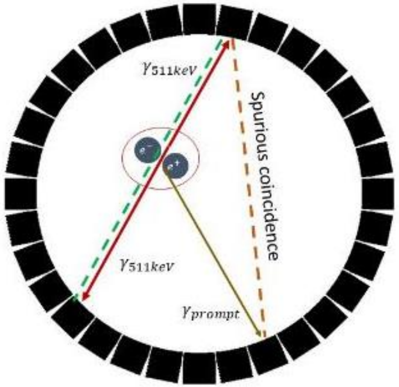
Ga-PSMA11 + FDG

→ 2h15min for a theranostic assessment of PSMA-RLT

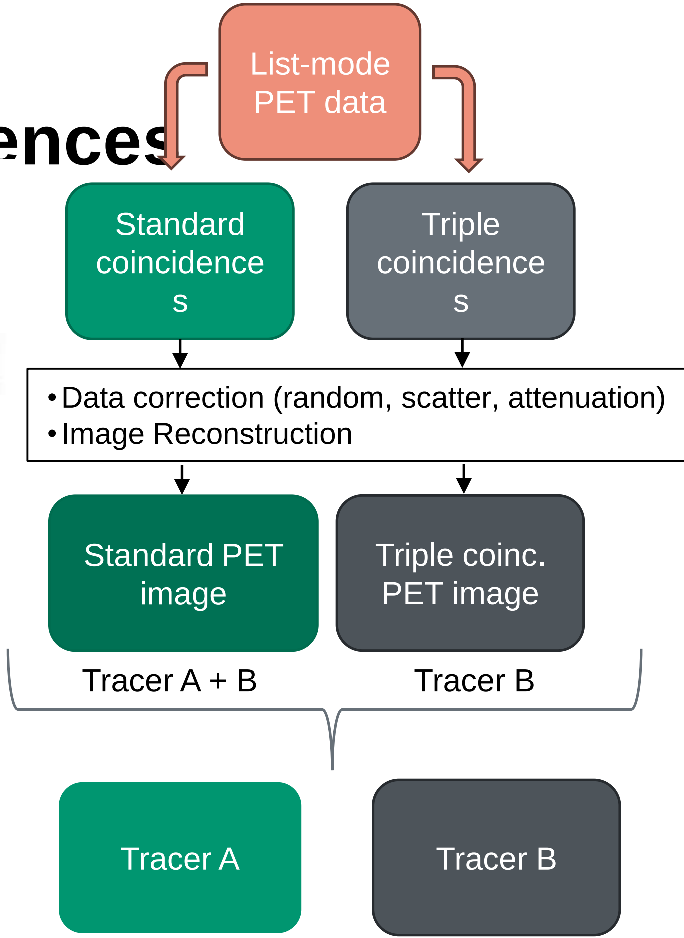
Alberts et al. EJNMMI 2022

Dual PET based on triple coincidences

- Some non-standard PET isotopes produce spurious γ rays at the same time as the positron.
- The detection of the γ rays in coincidences with photons from the annihilation of the positron produce "triple coincidences".



- Triple coincidences produced can be identified in the list mode from conventional scanners via:
    - Coincidences within the same time window sharing one of the crystals of interaction.
    - Identification of the energy characteristic of the additional γ rays.
- Some potential candidates for Dual PET: ^{124}I, ^{52}Mn, ^{44}Sc, ^{82}Rb, ^{60}Cu, ^{86}Y, ^{68}Ga

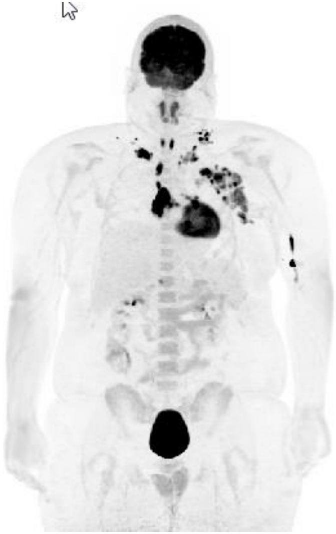


Improved Techniques for PET Imaging. Lopez-Montes, A. (2021). Thesis. https://hdl.handle.net/20.500.14352/3369

Dynamic Imaging

Multiparametric PET

SUV image
static

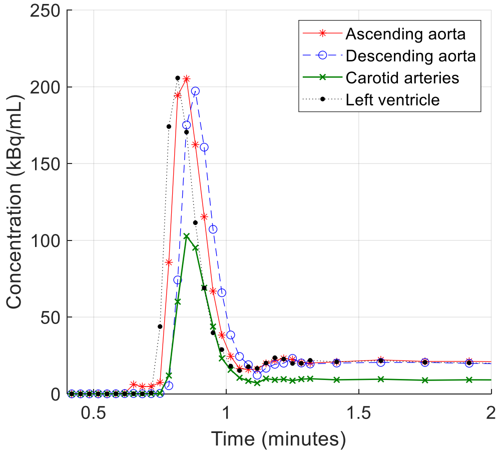


Patlak Ki image
[µmol/min/100ml]
(Slope)
= metabolically
trapped FDG

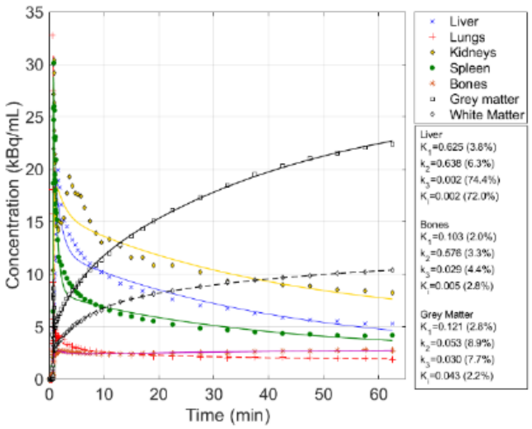
Patlak DV image
[%]
(Intercept)
= non-metabolized/
non-trapped FDG

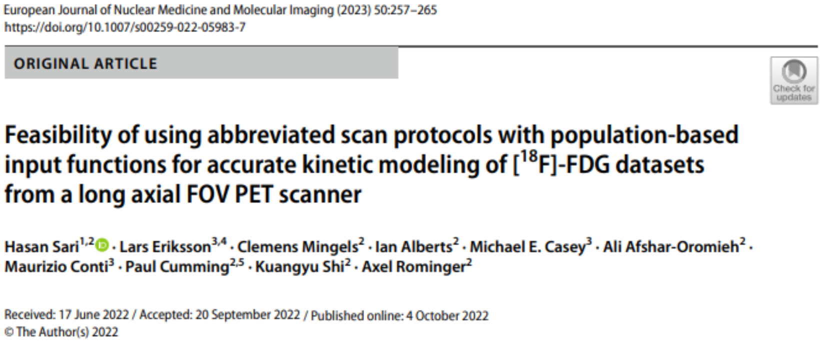
Multiparametric Imaging

IDIFs



Organ TACs





European Journal of Nuclear Medicine and Molecular Imaging (2023) 50:257–265
https://doi.org/10.1007/s00259-022-05983-7

ORIGINAL ARTICLE

Feasibility of using abbreviated scan protocols with population-based input functions for accurate kinetic modeling of [^{18}F]-FDG datasets from a long axial FOV PET scanner

Hasan Sari[1,2] · Lars Eriksson[3,4] · Clemens Mingels[2] · Ian Alberts[2] · Michael E. Casey[3] · Ali Afshar-Oromieh[2] · Maurizio Conti[3] · Paul Cumming[2,5] · Kuangyu Shi[2] · Axel Rominger[2]

Received: 17 June 2022 / Accepted: 20 September 2022 / Published online: 4 October 2022
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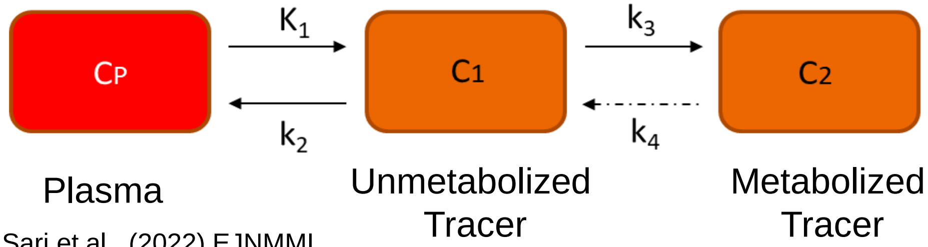
Available for clinical routine



We demonstrate the feasibility of performing accurate [18F]-FDG Patlak analysis using sPBIFs with only 15-20 min of PET data from a LAFOV PET scanner.

Sari et al. (2022) EJNMMI

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UNIVERSITÄTSKLINIK FÜR NUKLEARMEDIZIN

ACTIVE, NOT RECRUITING

Head-to-head Comparison of 68Ga-PSMA-11 and 18F-PSMA-1007

ClinicalTrials.gov ID NCT05079828

Sponsor Insel Gruppe AG, University Hospital Bern

Information provided by Insel Gruppe AG, University Hospital Bern (Responsible Party)

Last Update Posted 2024-06-07

Study Start (Actual)
2022-07-07

Primary Completion (Actual)
2024-05-01

Study Completion (Estimated)
2024-11-01

Enrollment (Actual)
100

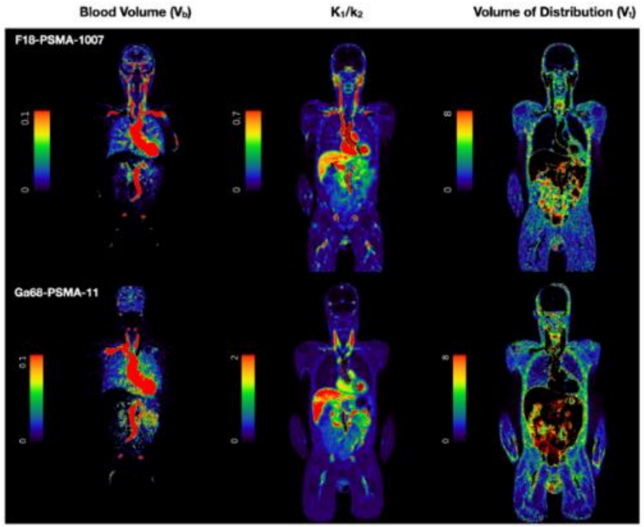
Study Type
Interventional

Phase
Not Applicable

Data acq. finished

^{18}F-PSMA-1007

^{68}Ga-PSMA-11



79 year old male, 55 kg

Injected doses:
18F-PSMA-1007: 270 MBq
Ga68-PSMA-11: 168 MBq

2 x 60 min long dynamic scans

PET data modelled using 2TC model

Sari H et al, TBPET 2024

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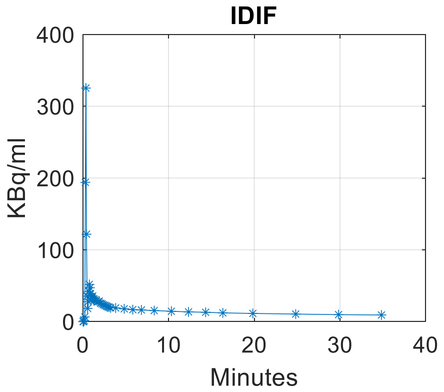
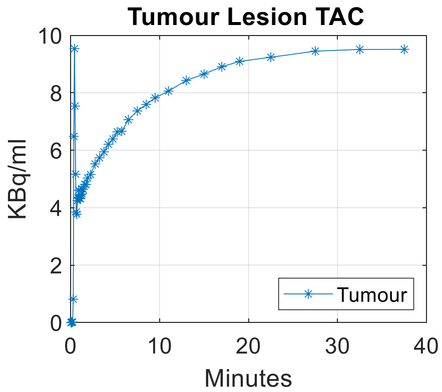
Dynamic ^{18}F-FET analysis with Biograph Vision Quadra

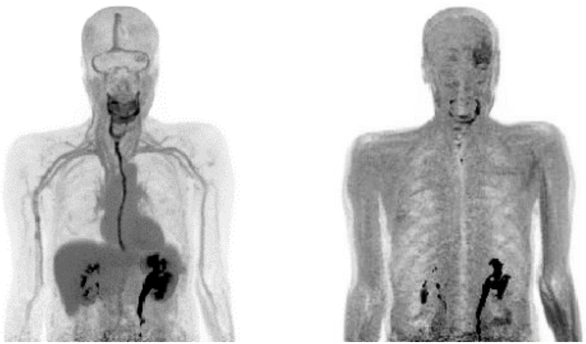
Dynamic ^{18}F-FET data

1 min | 10 min | 40 min





Patlak DV | Patlak Ki



Total-Body PET in Cardiovascular Disease

European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-023-06242-z

IMAGE OF THE MONTH

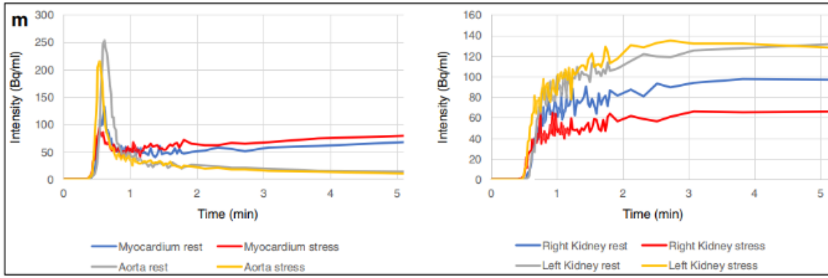
Check for updates

First-time rest-stress dynamic whole-body ^{82}Rb-PET imaging using a long axial field-of-view PET/CT scanner

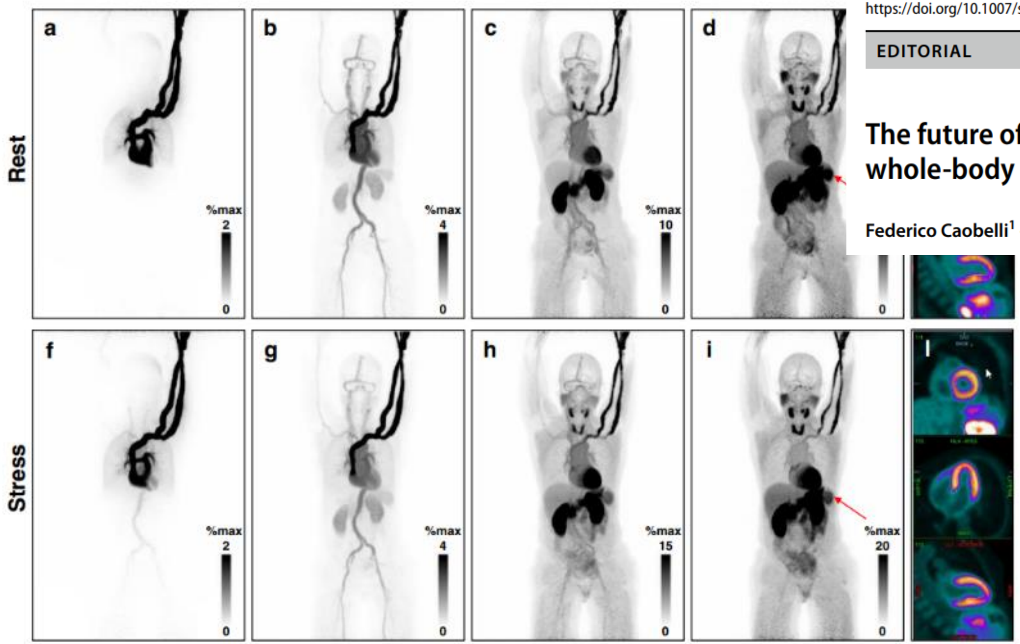
Federico Caobelli[1] · Sigrid Seibel[1] · Korbinian Krieger[1] · Carola Bregenzer[1] · Marco Viscione[1] · Angela Filipa Silva Mendes[1] · Hasan Sari[1,2] · Lorenzo Mercolli[1] · Ali Afshar-Oromieh[1] · Axel Rominger[1]

Received: 24 February 2023 / Accepted: 19 April 2023

Dynamic images



0-30 sec | 30-60 sec | 60-120 sec | 2-7 min



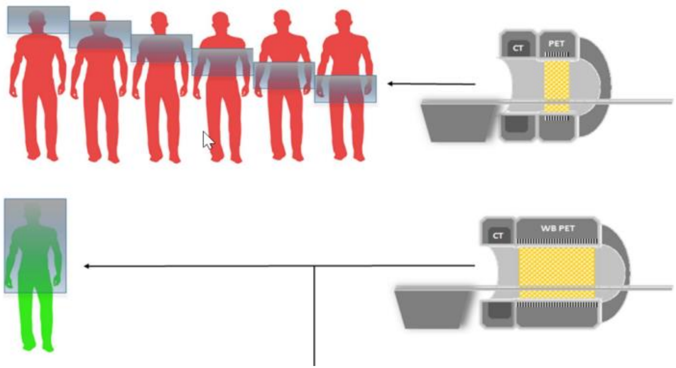
European Journal of Nuclear Medicine and Molecular Imaging
https://doi.org/10.1007/s00259-023-06292-3

EDITORIAL

Check for updates

The future of atherosclerosis assessment: dynamic and quantitative whole-body PET cardiovascular imaging

Federico Caobelli[1] · Christoph Gräni[2] · Axel Rominger[1]



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European Journal of Nuclear Medicine and Molecular Imaging (2024) 51:1869–1875
https://doi.org/10.1007/s00259-024-06660-7

SHORT COMMUNICATION

Internal dosimetry study of [^{82}Rb]Cl using a long axial field-of-view PET/CT

Lorenzo Mercolli[1] · Carola Bregenzer[1] · Markus Diemling[2] · Clemens Mingels[1] · Axel Rominger[1] · Hasan Sari[3] · Sigrid Seibel[1] · Antti Sohlberg[2,4] · Marco Viscione[1] · Federico Caobelli[1]

Table 1 Personal details of the three subjects and administered activity for the rest and stress examinations

Subject	Gender	Age [y]	Weight [kg]	Height [m]	Activity rest [MBq]	Activity stress [MBq]
P1	F	57	57	1.65	407.00	407.03
P2	M	29	88	1.96	404.59	409.19
P3	M	40	84	1.72	398.43	401.73

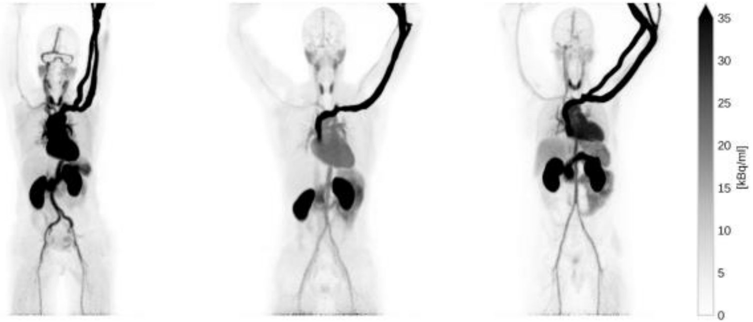
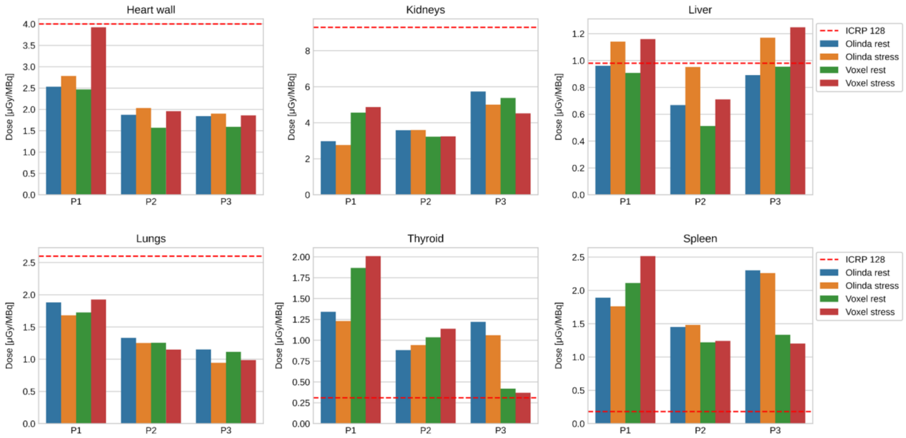
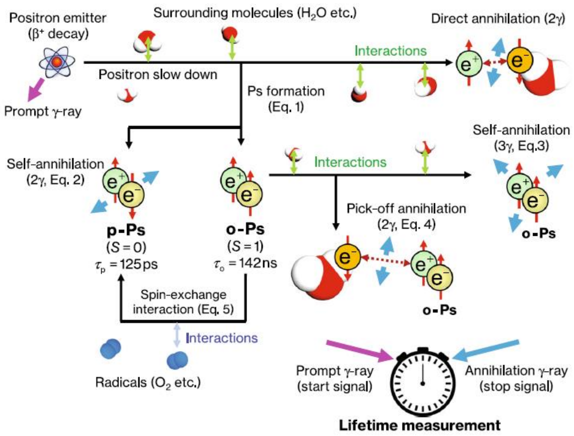


Fig. 1 Maximum intensity projection (MIP) of the three subjects at rest. The images depict the full scan integration

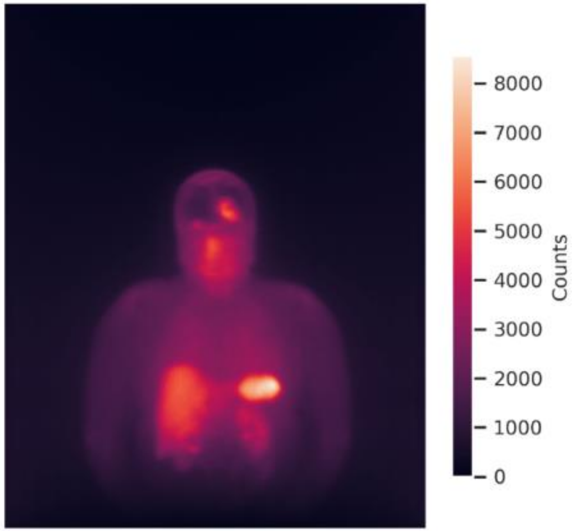


Total body effective dose
0.50 – 0.76 uSv/MBq

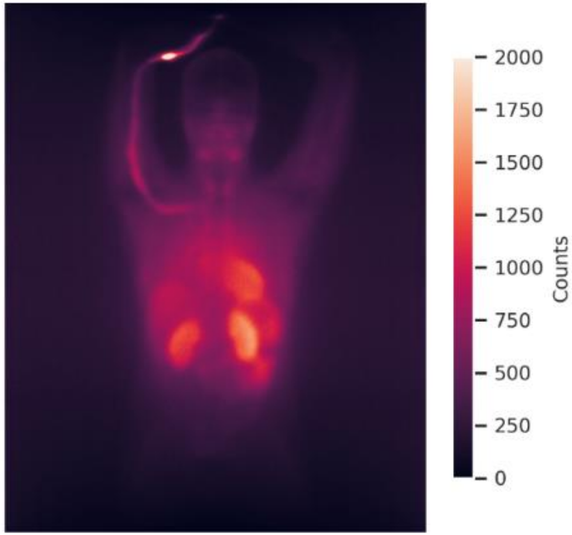
Positronium Lifetime Imaging – Histoimage of triplet events



Histoimage [68Ga]Ga-DOTA-TOC

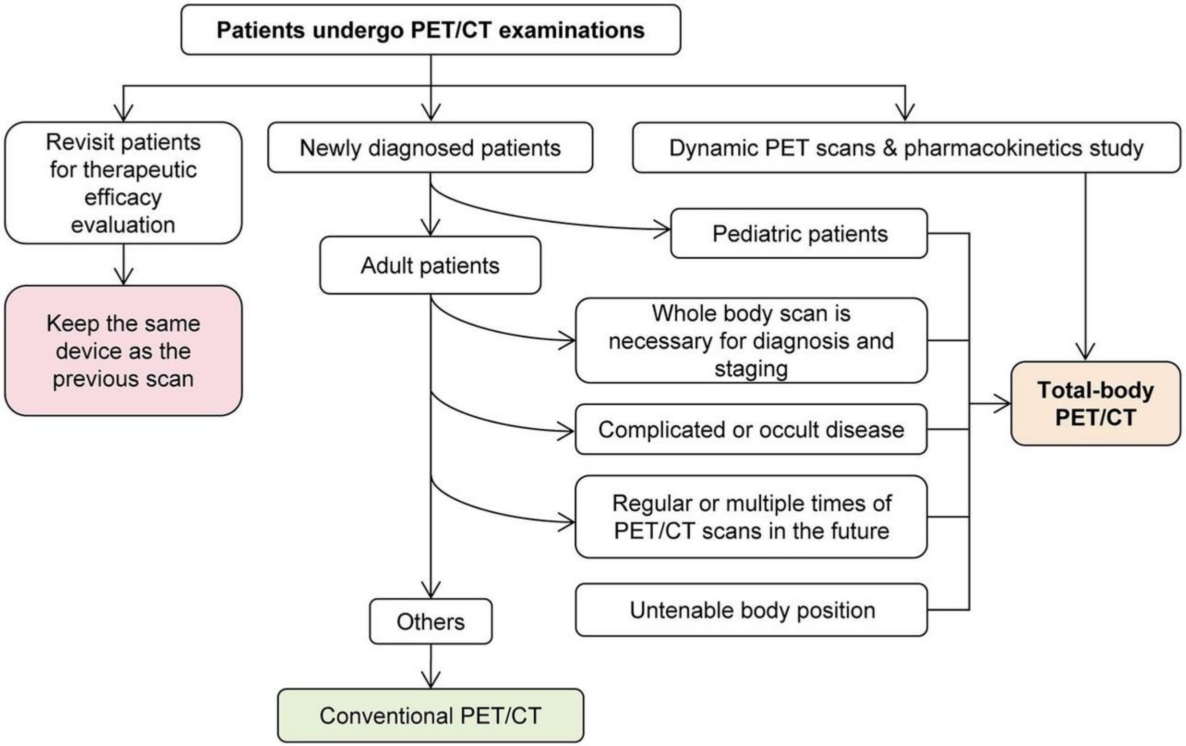


Histoimage [82Rb]Cl



«Weave» program / OPUS LAP

Patient Flow



Claustrophobia (not all)
Non-oncological indications

Chen et al. 2024 JNM

Trend over the last four years in our center

Conventional PET	LAFOV PET
30%	70%

INSELSPITAL UNIVERSITÄTSSPITAL BERN HÔPITAL UNIVERSITAIRE DE BERNE

UNIVERSITÄTSKLINIK FÜR NUKLEARMEDIZIN

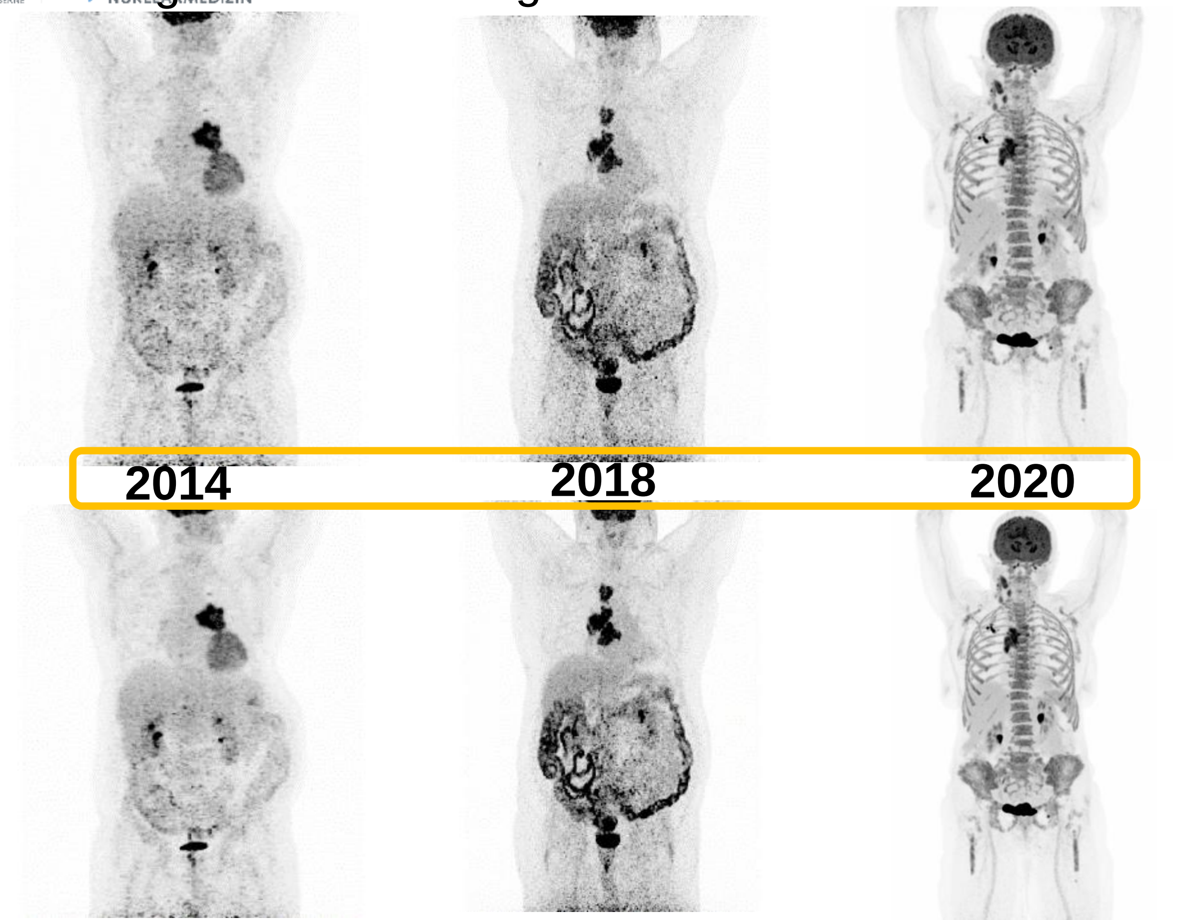
Analog SAFOV | Digital SAFOV | LAFOV

Acq time

1 min

Acq time

2 min



2030

- Non- oncological indications ↑
- Variety of radiotracers ↑
- PET in theranostics ↑
- Radiation burden ↓
- Acquisition time →
- Dual tracer studies ↑
- Multiparametric imaging ↑
- Total body information ↑
- PET data in healthy ↑

2024 - 2030

LAFOV Systems
>100 cm

SAFOV systems with
ultra-fast TOF

LAFOV systems

Scanner time is no bottleneck any more

Key Challenges

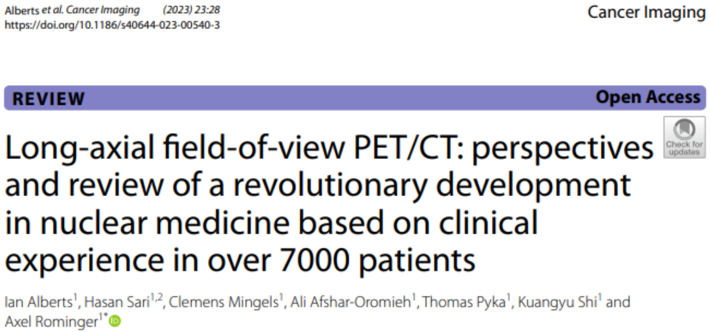
- To optimally exploit the flexibility of the systems
- LAFOV systems are packed → stratification of patients to different systems, everybody wants the best scanner → raising demand
- Reorganization of the tech staff team, reorganization of scheduling system
- Data storage and IT environment
- Dedicate enough research time on the system

Conclusion and Outlook

- Clear advantages compared to SAFOV scanners
  - clinically
  - scientifically
- A lot of clinical benefits derive from the high sensitivity
- Approval of new radiopharmaceuticals are facilitated by LAFOV scanners
- In future more radiopharmaceuticals will be available and administered to patients with lower doses
- Radiation-sensitive patient cohorts will be increasing in numbers

Conclusion after >10’000 Quadra Scans in Bern

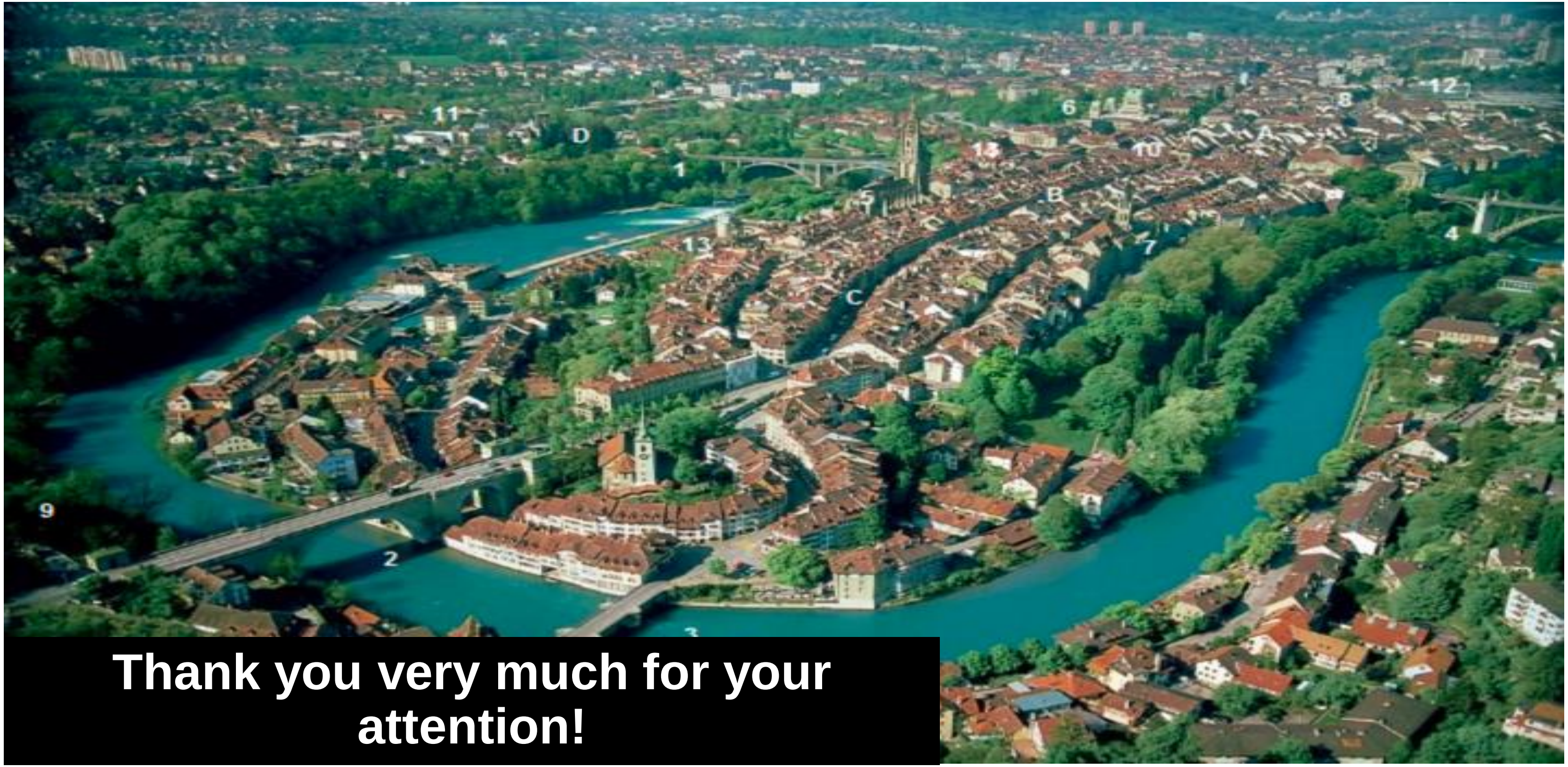
- Mature and robust systems
- Clear advantages compared to SAFOV scanners
  - clinically
  - scientifically
- All-in-one devices suitable for very many purposes


Alberts et al. Cancer Imaging (2023) 23:28
https://doi.org/10.1186/s40644-023-00540-3
Cancer Imaging

REVIEW Open Access

Long-axial field-of-view PET/CT: perspectives and review of a revolutionary development in nuclear medicine based on clinical experience in over 7000 patients

Ian Alberts[1], Hasan Sari[1,2], Clemens Mingels[1], Ali Afshar-Oromieh[1], Thomas Pyka[1], Kuangyu Shi[1] and Axel Rominger[1*]



Thank you very much for your attention!