Introduction

Over the last decades, the main development in positron emission tomography (PET) detector design has been the adoption of solid-state technology (Hutton et al., 2018). Conventional photomultiplier tubes (PMTs) have been replaced by solid-state read-out devices in recently introduced commercially available PET/CT systems. This detector technology has the advantage of being compact, but its insensitivity to a magnetic field makes it well-suited for PET coupled with Magnetic Resonance Imaging as well. The first clinical PET/MRI systems manufactured by Siemens (Siemens Healthineers, Knoxville, TN, USA) were equipped with avalanche photodiodes (APDs). More recently, further development of APDs resulted in the introduction of silicon-photomultipliers (SiPMs) which are implemented in the latest clinical PET/CT systems.

An APD is formed by a silicon p–n junction creating a depletion region free of mobile charge carriers. When a 511-keV photon is absorbed in a light-sensitive layer, silicon, an electron-hole pair is created (photo-electric effect). When applying a reverse bias to the photodiode, an electric field will be generated across the depletion region causing these charge carriers to be accelerated towards the anode (holes), or cathode (electrons). This way, an absorbed photon will result in a net flow of current in a reverse-biased APD. The applied electric field causes acceleration of electrons which in turn produce a secondary ionization, or avalanche, resulting in amplification of the electric signal. However this gain is not as high as with conventional PMTs. The slow rise time of the signal makes APDs unsuitable for implementation of Time-of-Flight (ToF). In ToF PET, the difference in the arrival times of the two photons on both detectors is measured with high precision, which helps localize the point of annihilation (with a certain probability) along the line of response (Vandenberghe et al., 2016).

However, when the applied reverse-bias voltage is increased sufficiently (approaching the breakdown voltage) a created charge carrier will be accelerated to such an extent that it carries sufficient kinetic energy to create secondary charge pairs; this process is referred to as impact ionization. Accordingly, a single absorbed photon can trigger a self-perpetuating ionization cascade spreading through the silicon volume subjected to the electric field. Breakdown of the silicon occurs making it conductive, effectively amplifying the original electron–hole pair into a macroscopic current flow. This is called Geiger discharge; the APD operates in Geiger mode. Then, a single incoming light photon produces a large signal and the device is referred to as a single-photon avalanche diode (SPAD) of very compact size (10–100 μm) (Rausch et al., 2018; Slomka et al., 2016). Once a current is flowing it should be stopped or “quenched.” Passive quenching is achieved through using a series of resistors which limit the current drawn by the diode during breakdown. This lowers the reverse voltage seen by the diode to a value below its breakdown voltage. The diode is then available to detect subsequent photons. Through this mechanism, a single SPAD functions as a photon-triggered switch, in either “on” or “off” state, resulting in a binary output. Proportional information the photon flux is not available. This lack of proportionality is overcome in the SiPM. An SiPM is comprised of an array of (between 100 and 10,000) SPADs which are read-out in parallel producing an electric signal proportional to the number of detected 511-keV photons in a small detector area (cell).
The gain and detection efficiency is comparable to conventional PMTs while using a smaller operating voltage and running at a higher speed. An array of SiPMs can be used instead of the conventional array of PMTs (Hutton et al., 2018). Currently, there are three different commercially available “digital” PET/CTs available which are equipped with SiPM-based PET detectors: the Siemens Biograph Vision PET/CT (Siemens Healthineers), the Philips Vereos PET/CT (Philips Healthcare), the GE Discovery MI PET/CT (General Electric Healthcare).

Two different types of SiPM-based PET detectors are currently implemented the abovementioned three systems. On the one hand there are so called analog SiPM-based detectors and on the other hand digital SiPM-based detectors or Digital Photon Counter (DPC).

The analog design incorporates the connection of multiple SiPM arrays together to sum the signals from each SiPM for a summed output (as implemented in the Biograph Vision and the GE Discovery MI PET/CT). The digital approach considers each SiPM separately to achieve a single readout for each SiPM (as used in the Philips Vereos PET/CT) (Slomka et al., 2016).

Three digital PET/CT vendors

The Siemens Biograph Vision PET/CT, the Philips Vereos PET/CT, and the GE Discovery MI PET/CT are presently the three commercially available systems equipped with SiPM-based detectors; so-called “digital” PET/CT systems. Their system specific technical properties and associated performance characteristics will be described in the subsections below.

System features

The Philips Vereos PET/CT

The whole-body Philips Vereos PET/CT is a SiPM based PET system coupled with a 64-slice helical CT scanner. The PET component of the Philips Vereos PET/CT consists of 18 detector elements arranged cylindrically into a single ring measuring 76.4 cm in diameter covering an axial length of 16.4 cm. A detector element consists of an array of 40 × 32 lutetium-yttrium-oxyorthosilicate (LYSO) crystals (each crystal is 4 × 4 × 19 mm), which are individually coupled to SiPM detectors (1-to-1 coupling). An SiPM consist of 3,200 APDs operated in Geiger mode. The arriving scintillation photons are read-out individually which is also known as digital SiPM or Digital Photo Counting (Rausch et al., 2018; Zhang et al., 2018).

The Siemens Biograph Vision PET/CT

The Siemens Biograph Vision PET/CT combines a 128-slice CT scanner with a whole-body lutetium oxyorthosilicate PET system. The system has a 78-cm bore and the PET component contains eight detector rings including 19 detector electronics assembly (DEA) units to form a ring; two adjacent detector blocks per DEA unit result in 38 blocks per ring. Each detector block contains a 4 × 2 arrangement of mini blocks which consist of a 5 × 5 array of 3.2 × 3.2 × 20 mm crystals coupled to an SiPM array of 16 × 16 mm. The arrangement of 4 × 2 miniblocks results in a 32-mm axial FOV for one block. The system configuration which uses eight blocks in the axial direction, results in a 25.6-cm axial FOV, or 26.1 cm including the spaces between the blocks. The detected photons are summed per SiPM detector to form a discrete output signal.

The GE Discovery MI PET/CT

The Discovery MI combines a 128-slice CT component with a four-ring PET LYSO system providing a 20-cm axial field of view (FOV); a three-ring configuration of this system is also available, however this book chapter only focuses on the 4-ring system with a larger axial FOV. Each PET ring uses 136 detector blocks, each of which comprises a 4 × 9 array of crystals coupled to a 3 × 6 array of SiPMs The crystal elements are 3.95 mm × 5.3 mm × 25 mm, and each SiPM array is composed of 2 × 3 pixels with an active area of 4 × 6 mm. Like in the Siemens Biograph Vision PET/CT the detected photons are summed per SiPM detector to form a discrete output signal.

Performance characteristics

Evaluation of physical performance of PET systems is done according to NEMA standards published by the National Electrical Manufacturers Association. Performance measurements in the three currently available digital PET/CT systems were performed following the NEMA NU 2-2012 standard (“National Electrical Manufacturers Association. Performance measurements of positron emission tomographs. NEMA Standards Publication NU 2-2012. Rosslyn, USA: National Electrical Manufacturers Association,” 2012) and the NEMA NU 2-2018 standard (“National Electrical Manufacturers Assoc. Performance measurements of positron emission tomographs. NEMA Standards Publication NU 2-2018. Rosslyn, USA: National Electrical Manufacturers Association,” 2018). These performance measurements include spatial resolution, scatter fraction, sensitivity, count-rate performance, image quality, coregistration accuracy, and timing resolution (i.e., ToF performance).

An overview of the performance characteristics in terms of spatial resolution, sensitivity, count rate accuracy, scatter fraction, ToF performance, and coregistration error for the three digital systems concerned is provided in Table 1. The performance characteristics regarding image contrast recovery and background variability (measured using the image quality phantom filled with a sphere to background ratio of 8:1) compared between systems is shown in Table 2.
Image quality

With improved hardware implemented in digital PET/CT systems and associated improved performance characteristics, enhanced image quality of obtained clinical \(^{18}\)F-FDG PET acquisitions was expected. Improved image quality is caused by a better ToF (all three systems) and increased sensitivity due to a larger field of view with more axial coverage (Siemens Biograph Vision and GE Discovery MI systems). Different study groups investigated \(^{18}\)F-FDG PET image quality and lesion detectability in oncology patients for the three PET/CT systems. Data were subsequently compared with a double scan performed on the analog predecessor of the specific system. The results of the studies on image quality for each vendor’s digital PET/CT system is described in the subsections below.

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**Table 1** Performance characteristics measured according to the NEMA NU 2-2012 and NEMA NU 2-2018 standards compared between systems (part 1).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Distance (a)</th>
<th>Philips Vereos PET/CT (Rausch et al., 2018)</th>
<th>Siemens Biograph Vision PET/CT (Van Sluis et al., 2019)</th>
<th>GE Discovery MI PET/CT (Hsu et al., 2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial resolution</td>
<td></td>
<td>FWHM (mm)</td>
<td>FWTM (mm)</td>
<td>FWHM (mm)</td>
</tr>
<tr>
<td>Radial</td>
<td></td>
<td>4.3(^b)</td>
<td>8.4(^b)</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>4.6</td>
<td>8.9</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>5.8</td>
<td>10.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Tangential</td>
<td></td>
<td>4.3(^b)</td>
<td>8.4(^b)</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>4.4</td>
<td>9.0</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>4.9</td>
<td>10.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Axial</td>
<td></td>
<td>4.2</td>
<td>8.8</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>4.4</td>
<td>9.1</td>
<td>4.3</td>
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<tr>
<td></td>
<td>20</td>
<td>4.6</td>
<td>9.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Sensitivity (kcps/MBq)</td>
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<td>0</td>
<td>5.1</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>5.2</td>
<td></td>
<td>16.3</td>
</tr>
<tr>
<td>Accuracy (kcps at kbq/BL)</td>
<td></td>
<td>153 at 54.9</td>
<td>306 at 32.6</td>
<td>186 at 21.7</td>
</tr>
<tr>
<td>Peak NECR</td>
<td></td>
<td>733 at 64.6</td>
<td>1306 at 54</td>
<td>827 at 34.8</td>
</tr>
<tr>
<td>Scatter fraction (%)</td>
<td></td>
<td>33.9</td>
<td>38.7</td>
<td>40.8</td>
</tr>
<tr>
<td>At peak NECR</td>
<td></td>
<td>31.7</td>
<td>37</td>
<td>NA</td>
</tr>
<tr>
<td>At low activity</td>
<td></td>
<td>31.7</td>
<td>37</td>
<td>NA</td>
</tr>
<tr>
<td>ToF resolution (ps)</td>
<td></td>
<td>310</td>
<td>210</td>
<td>377</td>
</tr>
<tr>
<td>Max coregistration error (mm)</td>
<td></td>
<td>NA</td>
<td>1.25</td>
<td>NA</td>
</tr>
</tbody>
</table>

FWHM, full width at half maximum; FWTM, full width at tenth maximum; NA, not applicable.

\(^a\)Radial distance (cm) from the center of the FOV.

\(^b\)Average value of radial and tangential measurements.

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**Table 2** Performance characteristics measured according to the NEMA NU 2-2012 and NEMA NU 2-2018 standards compared between systems (part 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sphere diameter (mm)</th>
<th>Philips Vereos PET/CT (Rausch et al., 2018)</th>
<th>Siemens Biograph Vision PET/CT (Sluis et al., 2019)</th>
<th>GE Discovery MI PET/CT (Hsu et al., 2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>54.4</td>
<td>9.3</td>
<td>86.8</td>
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<tr>
<td></td>
<td>13</td>
<td>75.9</td>
<td>7.5</td>
<td>77.2</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>81.6</td>
<td>5.7</td>
<td>85.0</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>86.5</td>
<td>4.3</td>
<td>89.8</td>
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<td></td>
<td>28</td>
<td>82.5</td>
<td>3.5</td>
<td>87.4</td>
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<td></td>
<td>37</td>
<td>85.8</td>
<td>2.6</td>
<td>89.6</td>
</tr>
<tr>
<td>Average lung residual (%)</td>
<td></td>
<td>6.4</td>
<td></td>
<td>3.5</td>
</tr>
</tbody>
</table>

Image quality

With improved hardware implemented in digital PET/CT systems and associated improved performance characteristics, enhanced image quality of obtained clinical \(^{18}\)F-FDG PET acquisitions was expected. Improved image quality is caused by a better ToF (all three systems) and increased sensitivity due to a larger field of view with more axial coverage (Siemens Biograph Vision and GE Discovery MI systems). Different study groups investigated \(^{18}\)F-FDG PET image quality and lesion detectability in oncology patients for the three PET/CT systems. Data were subsequently compared with a double scan performed on the analog predecessor of the specific system. The results of the studies on image quality for each vendor’s digital PET/CT system is described in the subsections below.
Clinical experiences and comparison with analog PET/CT

**Philips Vereos PET/CT**

In this comparison study, 21 consecutive patients were included. All patients underwent a single injection and a dual-imaging protocol including a clinical PET/CT scan performed using the conventional Philips Gemini PET/CT (Philips Healthcare) followed by an acquisition using the Philips Vereos PET/CT system. The obtained images using the digital system were scored significantly higher by two experienced interpreters in a (blinded for system type) side by side comparison regarding overall image quality (Nguyen et al., 2015). In five of 21 patients, lesions that were seen with the conventional Philips Gemini PET/CT were confirmed using the digital Vereos PET/CT. In addition, the digital system identified eight additional 18F-FDG avid lesions initially missed using the conventional analog system. For visual comparison, patient images obtained using the two systems are shown in Fig. 1. Furthermore, semiquantitative analyses showed a significantly higher lesion SUVmax obtained from images acquired on the digital Vereos PET/CT; association with time-delay between the paired acquisitions was explored and subsequently ruled out at a 5% significance level (Nguyen et al., 2015).

In a similar study, 100 patients were included and underwent double acquisitions using the conventional and digital system types (López-Mora et al., 2019). Three nuclear medicine physicians scored the obtained images regarding image quality and evaluated differences in detectability using the two systems by counting the number of 18F-FDG avid lesions. In 54 patients, the readers regarded the images obtained using the digital Philips Vereos PET/CT system of improved image quality; in the remaining 46 patients image quality did not differ between systems. With respect to lesion detectability, in only 80 out of the 100 included patients lesions were found, and in 61 out of these 80 patients an equal number of lesions was detected on images obtained using both systems. In the remaining 19 patients, additional lesions were detected on images obtained using the digital Philips Vereos PET/CT compared to images obtained using the conventional Philips Gemini PET/CT (López-Mora et al., 2019).

**Siemens Biograph Vision PET/CT**

In total, 20 consecutive patients referred for an oncologic clinical PET/CT were enrolled in the prospective comparison study. A single weight-based 18F-FDG injection was administered and patients underwent a dual imaging protocol including a PET/CT

![Fig. 1 Illustrative clinical image comparison of images obtained using the Philips Gemini PET/CT and images obtained using the Philips Vereos PET/CT. A 47-year-old woman with a history of left breast infiltrating ductal carcinoma underwent PET/CT acquisition for initial staging. The images acquired on the conventional Philips Gemini PET/CT are shown in the upper panel: (A) maximum intensity projection image showing the FDG avid breast primary (arrow); (B) axial PET; (C) fused axial PET/CT; (D) count profile of a level III axillary lymph node. FDG avid lymph nodes were noticed at level I and II of the left axilla, but no FDG avid level III node was diagnosed by both readers. PET/CT staging was T1N1M0 (stage II). The images acquired on the digital Philips Vereos PET/CT are shown in the lower panel: (E) MIP image; (F) axial PET; (G) axial fused axial PET/CT; (H) count profile of a level III axillary lymph node. Unlike on the images acquired using the conventional Gemini PET/CT, the readers identified this additional level III lymph node measuring 0.9 x 1.3 at CT (triangle). PET/CT scanning was T1N2M0 (stage III); no biopsy was obtained for this lesion. This lesion presented with a higher SUVmax and sharpness on the images obtained using the digital system (H) compared with images obtained using the conventional analogue system (D). Subsequent biopsy of a level I axillary node showed evidence of metastasis. This research was originally published in Nguyen JNM, et al. (2015) Image quality and diagnostic performance of a Digital PET prototype in patients with oncologic diseases: Initial experience and comparison with analog PET. The Journal of Nuclear Medicine 56: 1378–85. © SNMMI.](image-url)
acquisition on the digital Siemens Biograph Vision system and a PET/CT acquisition on the conventional analog Siemens Biograph mCT system (Siemens Healthineers) (van Sluis et al., 2020b). 60 min post injection, 10 patients first underwent a scan on the conventional system immediately followed by the paired acquisition using the Siemens Biograph Vision PET/CT. In the other 10 patients, acquisition order was switched around to control for increase of specific tracer uptake in the tumor over time. PET/CT images were subsequently blindly evaluated by three experienced nuclear medicine physicians who were not aware of the clinical indication of the PET/CT examination. In addition, the nuclear medicine physicians counted the number of $^{18}$F-FDG avid lesions for assessment of lesion detectability between systems. Regarding semiquantitative analyses, lesion SUVs were obtained from the acquired images and compared between systems.

Images acquired on the Siemens Biograph Vision PET/CT were scored significantly higher on image quality with respect to images acquired using the Siemens Biograph mCT system. Moreover, in seven out of 20 patients, one or more additional $^{18}$F-FDG avid lesions were found on the images obtained using the digital system which could not be identified using the conventional analog PET/CT. To illustrate, example patient images are shown in Fig. 2. Semiquantitative lesion measurement comparison between images obtained from the two systems showed a slight increase in lesion SUV_{max} (not significant) when using the Siemens Biograph Vision PET/CT. The slight increase in SUV_{max} using the digital system can be attributed to a higher spatial resolution and the use of smaller voxel sizes resulting in less partial volume effect and herewith a higher contrast recovery (van Sluis et al., 2020b).

**GE Discovery MI PET/CT**

A total of 50 oncology patients were enrolled in the image quality comparison study. After a single injection of $^{18}$F-FDG activity, the dual-imaging protocol consisted of a first scan on the conventional PMT-based analog GE Discovery 600 PET/CT or GE Discovery 690 PET/CT (General Electric Healthcare), followed by a second acquisition on the digital GE Discovery MI PET/CT.

Images obtained using the digital system were scored significantly higher regarding visual image quality by two blinded nuclear medicine physicians than images obtained using the conventional PET/CT. In addition, PET/CT scans acquired using the digital GE Discovery MI PET/CT identified all lesions seen on images obtained using the conventional PET/CT system, as well as 37 additional $^{18}$F-FDG avid lesions in 14 out of 50 patients (28%) (Baratto et al., 2017). For illustrative purposes, example patient images are shown in Fig. 3. Semiquantitative analyses showed a significant increase in mean lesion SUV_{max}. Increase in SUV_{max} was suggested to be a result of increased sensitivity of the digital system. However, as all acquisitions on the Discovery MI system were performed after conventional PET/CT images were obtained, the increase in SUV_{max} can partially be attributed to increased uptake time and herewith increased lesion-to-background ratio (Baratto et al., 2017).

**Fig. 2**  Illustrative clinical image comparison of images obtained using the Siemens Biograph mCT PET/CT and images obtained using the Siemens Biograph Vision PET/CT. Illustrative transaxial CT, fused PET/CT, PET, and maximum intensity projection PET images (from left to right) acquired on the Siemens Biograph Vision PET/CT (top row) and Siemens Biograph mCT PET/CT (bottom row) of a 59-year-old male (weight, 106 kg) with metastasized esophageal cancer. The position of the transaxial slice is indicated on maximum intensity projection (dashed line). Arrows indicate a small lesion found on the Siemens Biograph Vision images that did not appear as such on the Siemens Biograph mCT images. This research was originally published in Van Sluis JNM, et al. (2020) Image quality and semiquantitative measurements on the Biograph Vision PET/CT system: Initial experiences and comparison with the Biograph mCT. The Journal of Nuclear Medicine 61: 129–35. © SNMMI.
**Scan duration and activity reduction**

Due to the increased sensitivity of digital PET/CT systems, shorter scan durations and/or lower activity administrations can be achieved. To which extent the improved performance characteristics of the different digital systems allow such reductions has been explored by different study groups and their results are reported in the subsections below.

**Philips Vereos PET/CT**

To date, no clinical studies have been conducted to test the possibilities of reducing scan time and/or activity administration using the Philips Vereos PET/CT.

**Siemens Biograph Vision PET/CT**

In this prospective study, 30 oncological patients were enrolled. Three different malignancies were included to form homogeneous groups for optimal comparison of quantitative parameters (van Sluis et al., 2020a). PET list mode data were acquired using the Siemens Biograph Vision PET/CT at 180 s per bed position (s/bp). Reprocessing of list mode data allows recombination of PET data and timing information which was performed to simulate PET data acquired at reduced scan time which is equivalent to a lower amount of injected activity; reprocessed list mode data resulted in additional PET images at 10, 30, 60, and 120 s/bp. Patient images illustrating PET data acquired at different scan durations are shown in Fig. 4. Images acquired at 60 s/bp were semi-quantitatively still comparable to images obtained at 180 s/bp and three nuclear medicine physicians agreed on the diagnostic image quality of the images obtained with a factor three reduction in acquisition time (van Sluis et al., 2020a).

**GE Discovery MI PET/CT**

For this study, a total of 58 oncology patients were enrolled. Patients with different cancer types were included consecutively to capture a realistic clinical representation (Sonni et al., 2018). List mode data was acquired using the GE Discovery MI PET/CT with a reference standard acquisition time between 180 and 210 s/bp depending on BMI as recommended by the manufacturer. Reprocessing of list mode data resulted in additional PET images at 30, 60, 90, and 120 s/bp. Example patient images acquired using various acquisition times are shown in Fig. 5.
A factor two reduction in acquisition time (from 180 to 90 s/bp) allowed maintenance of sufficient image quality as rated blindly by two experienced nuclear medicine physicians (Sonni et al., 2018). Furthermore, semiquantitative analysis performed on a single representative lesion per patient identified by one of the nuclear medicine physicians showed acceptable mean percentage change in lesion SUVmax of 0.95% on images acquired 90 s/bp relative to images acquired at 180 s/bp.

**Future perspectives**

The latest development in new PET/CT system design has been the introduction of the total body PET/CT system which hold promising opportunities for the future. Although also equipped with SiPM-based detectors, these systems were left out of the comparison up to now as to only focus on regular clinical state of the art PET/CT systems. Such a total body PET/CT design, surrounding the patient with much more detectors in the axial FOV, comes with two major improvements (Vandenberghe et al., 2020):

1. longer axial extent of the FOV resulting in Higher detection efficiency as more photon pairs are captured
2. One bed position covers a much larger proportion of the patient, thus the same time frame can cover more anatomy

Three total body systems have just been released on the commercial market. These are the PennPET Explorer (University of Pennsylvania) (Karp et al., 2020) with a 70-cm-long axial FOV, the uExplorer (United Imaging Healthcare America) (Spencer et al., 2020) which has a 194-cm-long axial FOV, and the Siemens Biograph Vision Quadra PET/CT (Siemens Healthineers) (Conti et al., 2020) with a 102-cm-long axial FOV.
Improved performance characteristics of these total body PET/CT systems will allow an even larger reduction in scan time and/or activity administration, but these systems come with many other opportunities that can be explored.

The improved sensitivity of total body PET can be used for example to improve image quality with long lived isotopes such as $^{89}$Zr for immuno-PET imaging. A substantial improvement in image quality could allow a reduction in $^{89}$Zr activity administration which would make this radionuclide suitable for other applications besides oncology, for example inflammatory diseases. Furthermore, the larger FOV captures all relevant organs of interest and pharmacokinetic behavior of radioactive tracers can be observed (noninvasively) in more detail using whole-body dynamic imaging; this holds promising future prospects for application in research and clinical practice.

**Conclusions**

With the implementation of SiPM-based detectors in digital PET/CT systems, improved performance characteristics ensure better image quality with respect to conventional systems equipped with PMTs. Enhanced image quality leads to improved lesion detectability and possibilities to reduce scan duration for a higher patient throughput and/or lower the amount of $^{18}$F-FDG activity administration to reduce radiation exposure.

**References**


