

FlowMotion

Multiparametric PET

The first fully integrated solution for parametric PET imaging

One of the most important aspects of PET imaging is the ability to quantify the uptake of tracer in a specific tissue, and the implementation of Standard Uptake Values (SUV) based on static images was a key milestone to facilitate the utilization of semi-quantitative metrics in the clinic. However, PET tracer distribution — a dynamic process altered by a number of factors specific to each organ and region of interest — cannot always be accurately accounted for with SUV.

FlowMotion Multiparametric PET Suite

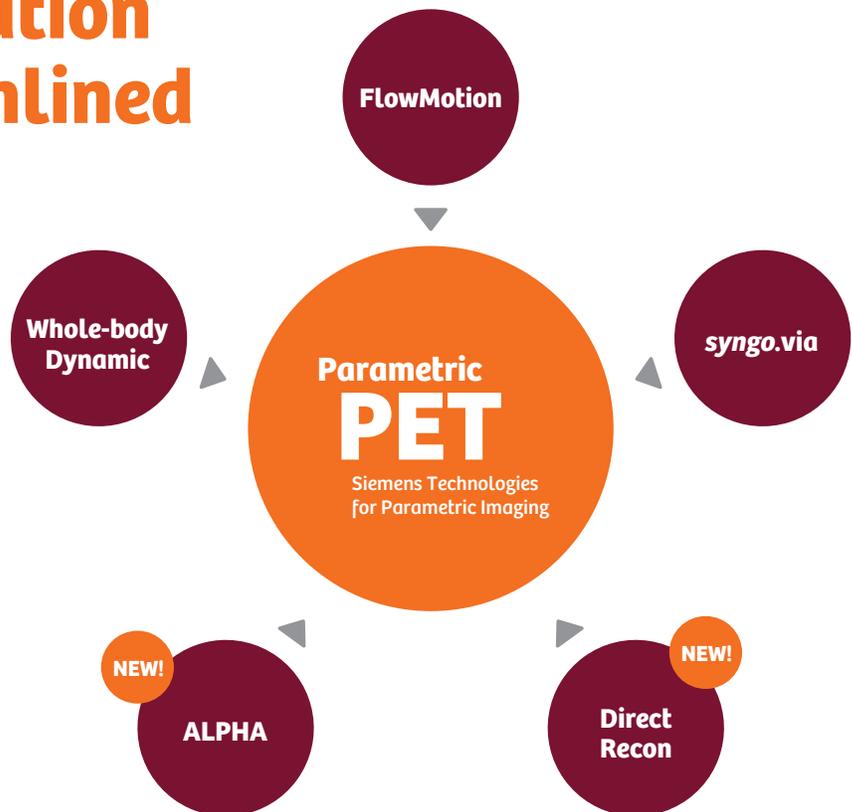
introduces an end-to-end clinical solution to provide multiparametric PET images outside of the research setting. The solution is completely automated and integrated into the PET/CT workflow, allowing users to obtain images of SUV, metabolic glucose rate (Ki) and distribution volume (DV) all at once, allowing for:

- More efficient information for planning and therapy strategy
- Acquisitions based on continuous bed motion for a more complete picture
- Fast reproduction from original data
- Flexible, fully automated acquisition protocol
- Whole-body dynamic acquisitions for more accurate images

More information for efficient planning and therapy diagnosis

Similar in concept to multiparametric MRI and based on the Patlak model,¹ FlowMotion Multiparametric PET Suite allows users to obtain SUV, Ki and DV using a more streamlined approach, with FlowMotion as a foundation. FlowMotion Multiparametric PET Suite reduces the variability of quantitative measurements due to differences in uptake time, patient body size and blood glucose levels, leading to better characterization of tracer uptake compared to SUV alone.

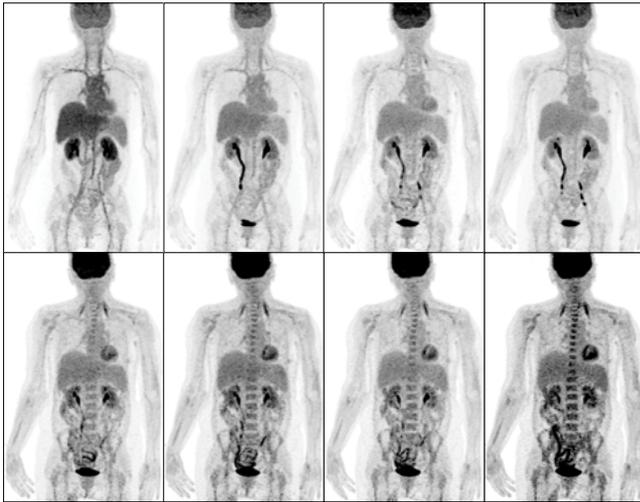
Fully automated implementation for a streamlined workflow



The implementation of FlowMotion Multiparametric PET Suite leverages several unique technologies to provide a robust solution – FlowMotion continuous bed motion technology, whole-body dynamic imaging, ALPHA technology, direct reconstruction and *syngo.via*.

FlowMotion continuous bed motion provides a more complete picture

Conventionally, PET images are acquired in a step-and-shoot mode: multiple pictures are taken and merged together to create an image of the entire body. FlowMotion enables PET acquisitions based on a continuous motion of the patient table. The continuous motion enables dynamic imaging of the entire body.



FlowMotion enables whole-body dynamic acquisitions

Dynamic imaging has been limited to a single-bed position, with the organ of interest positioned in the center of the detectors. With FlowMotion, you can obtain whole-body dynamic images by continually moving the bed through the gantry in a bi-directional motion along the entire body so you can visualize the tracer distribution over time.

Whole-body dynamic imaging allows for the acquisition of whole-body frames over time.

Image courtesy of Keio University, Tokyo, Japan

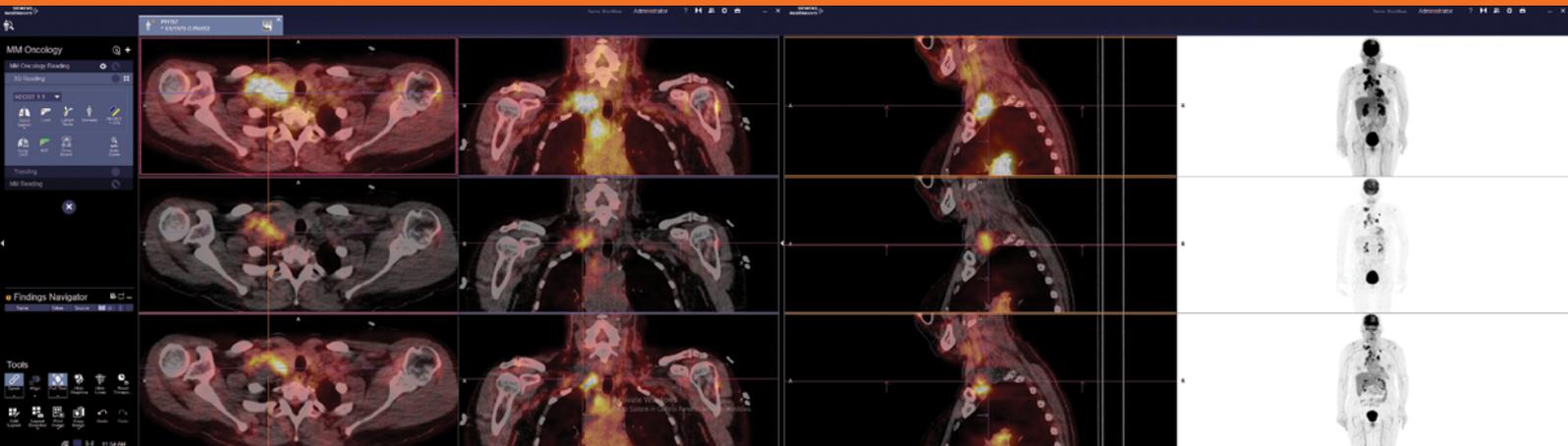


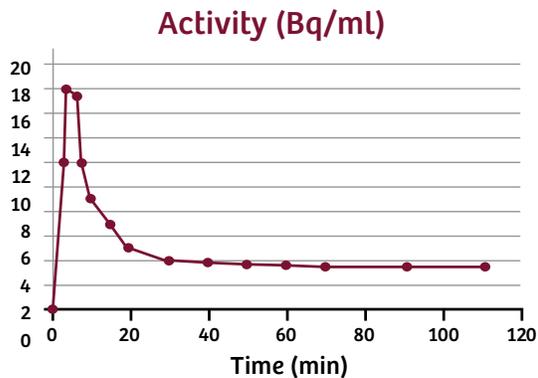
Image courtesy of Yale University, New Haven, Connecticut, USA

Visualize and quantify parametric PET data with *syngo.via*

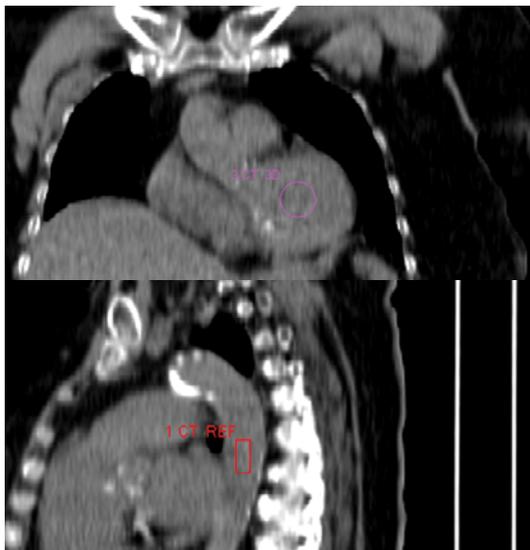
syngo.via is our unique platform to view and interpret images. It automates the end-to-end parametric workflow for preparation, reading, and reporting. It allows readers to view and measure SUV, Ki and DV images simultaneously with dedicated layouts that support appropriate units (mg/min/100ml).

Image-based acquisition of arterial input function

Parametric modeling requires the acquisition of an arterial input function (AIF). This is the amount of tracer available in the blood pool over time.



The gold standard is to perform multiple arterial blood samples over time – an operator-intensive process with a small risk for the patient. ALPHA technology identifies anatomical landmarks, so PET images can obtain the AIF by automatically measuring the uptake in a region of interest located in the descending aorta or in the left ventricle without the need for an invasive measurement.



Fast reconstruction

In the research setting, most parametric images are image-based and are obtained by post-processing conventionally reconstructed PET images. Our solution directly reconstructs parametric images from raw data. This means images are available more quickly and with less noise compared to image-based reconstruction². This further facilitates the use of multiparametric PET images into the clinic.

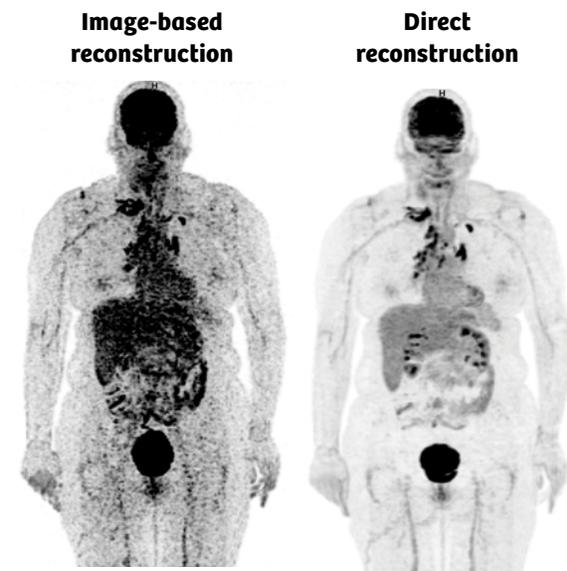


Image courtesy of Yale University, New Haven, Connecticut, USA

ALPHA technology identifies anatomical landmarks and automatically draws a volume of interest in the descending aorta and the left ventricle. An arterial input function is automatically obtained from those VOIs and can be used in the parametric model, eliminating the need for manual blood sampling. Image courtesy

Image courtesy of University of Geneva, Geneva, Switzerland

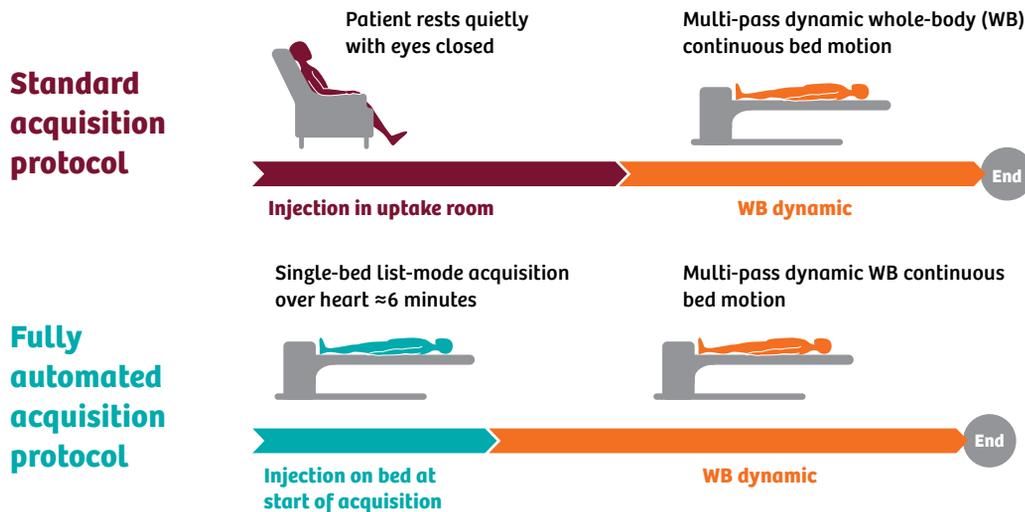
Flexible acquisition protocol

FlowMotion Multiparametric PET allows for both “standard” (i.e., what has typically been done in a research setting) and “fully automated” acquisition protocols for clinical and research uses.

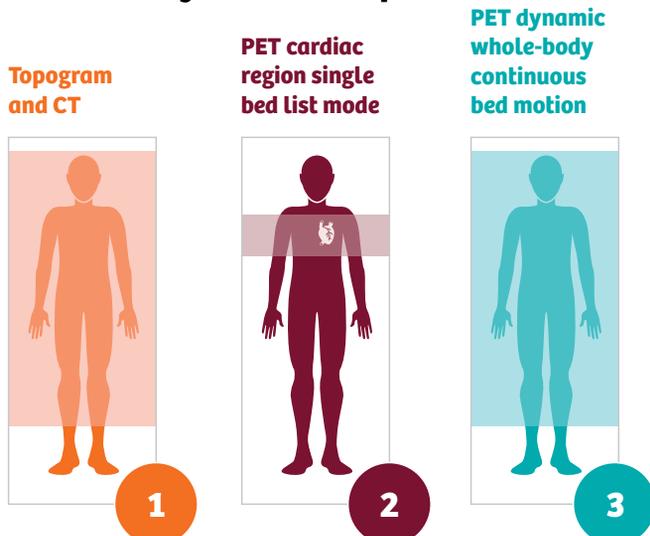
Standard protocol follows the clinical routine protocol. The patient is injected in an uptake room and rests until the examination, and a whole-body dynamic study is performed. The user then provides a CSV (comma separated values) file with the arterial input function, which could have been obtained by blood sampling or using external radiation probes, for example.

ALPHA technology positions the VOIs in the heart and the descending aorta, and the user-provided AIF is properly scaled and fitted to the image. Then the parametric images are generated.

Fully automated protocol leverages all the technical capabilities mentioned above to obtain parametric images in an easy, streamlined manner. The patient is injected at the patient table, and a single-bed acquisition of the heart is performed for the first 6 minutes. The whole-body dynamic acquisition starts, ALPHA technology positions the VOIs, and the parametric images are generated.



Fully automated protocol



- 1. Topogram and CT**
 - Define scan range
 - CT acquisition for attenuation correction and anatomical registration
- 2. Single-bed list mode**
 - Started at injection
 - Up to 100 dynamic frames or 125 when combined with whole-body cardiac region²
- 3. Flowmotion whole-body dynamic**
 - Passes can have up to 4 variable bed-speed regions²
 - Up to 25 passes for image-based modeling of the arterial input function²
 - Up to 6 contiguous passes for Patlak reconstruction with a minimum of 3 passes²

Key benefits of FlowMotion Multiparametric PET Suite

- Fully automated solution obtains whole-body images of metabolic glucose rate and distribution volume, in addition to SUV images
- Flexible acquisition protocols enable use in clinical research settings
- Reduces the variability of quantitative measurements due to differences in uptake time, patient body size and blood glucose levels, leading to better characterization of tracer uptake compared to SUV alone
- Provides additional information to evaluate therapy effectiveness based on metabolic glucose rates compared to SUV alone

To learn more, contact your Siemens Healthineers sales representative.

Reference:

1. Patlak, Clifford S., Graphical Evaluation of Blood-to-Brain Transfer Constants from Multiple-Time Uptake Data. Generalizations., Journal of Cerebral Blood Flow and Metabolism, 1985
2. Based on internal measurements at time of publication. Data on file.

FlowMotion Multiparametric PET Suite and the *syngo.via* functionality mentioned herein are currently under development and do not yet fulfill all the essential requirements according to the European Medical Device Directive (93/42/EEC) and its national implementations. They are not yet commercially available in the European Union and not available for sale in the U.S. or any other country. Future availability cannot be guaranteed.

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