

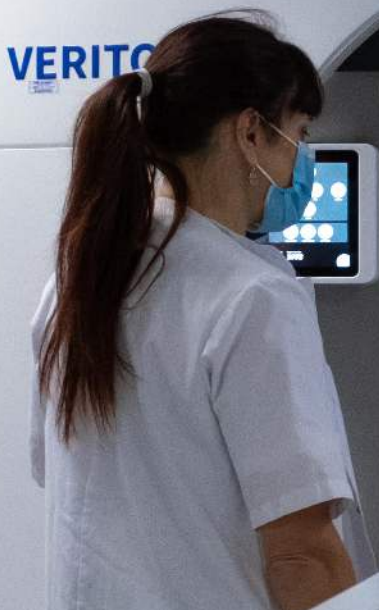
# SmartFocus on fast, total-body quantitative SPECT

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## Breaking the barriers to fast, quantitatively accurate SPECT

**HOW ADVANCED TECHNOLOGY IS  
BRINGING HIGHER-QUALITY IMAGING  
TO MORE PATIENTS**

# Tech transforms cancer treatment

High patient volumes in cancer, particularly prostate cancer, are challenging providers and leading to delays in diagnosis and treatment. The American Cancer Society estimates that there will be about 288,300 new cases of prostate cancer in the US this year.<sup>1</sup> Delays in care for these patients are a problem, as speed is often a key factor in positive patient outcomes.



Against this backdrop, theranostics is changing cancer treatment.<sup>2</sup> This combination of medicine and data science allows for better diagnosis, treatment monitoring and dosimetry. Fast, total-body quantitative SPECT and CT is essential for accurately planning and tracking response to therapy.

Close monitoring of response is important for patients' health outcomes and health plans' allocation of resources. Prostate cancer treatment can cost more than \$200,000 per patient, and monitoring patients over the course of treatment with high accuracy helps ensure those resources are going to treatments that will maximize effectiveness while maintaining patient safety. Fast and accurate treatment monitoring will guide dosimetry to ensure that, for each individual patient, critical organs are not receiving too much exposure to treatment-associated toxins.

As patient volumes continue to rise, providers require access to cutting-edge equipment that will provide the most accurate treatment monitoring data as soon as needed. With VERITON-CT®, a quantitatively accurate SPECT scan is now possible at the same speed as a PET scan.

## CURRENT CHALLENGES IN THERANOSTICS TREATMENT MONITORING AND DOSIMETRY

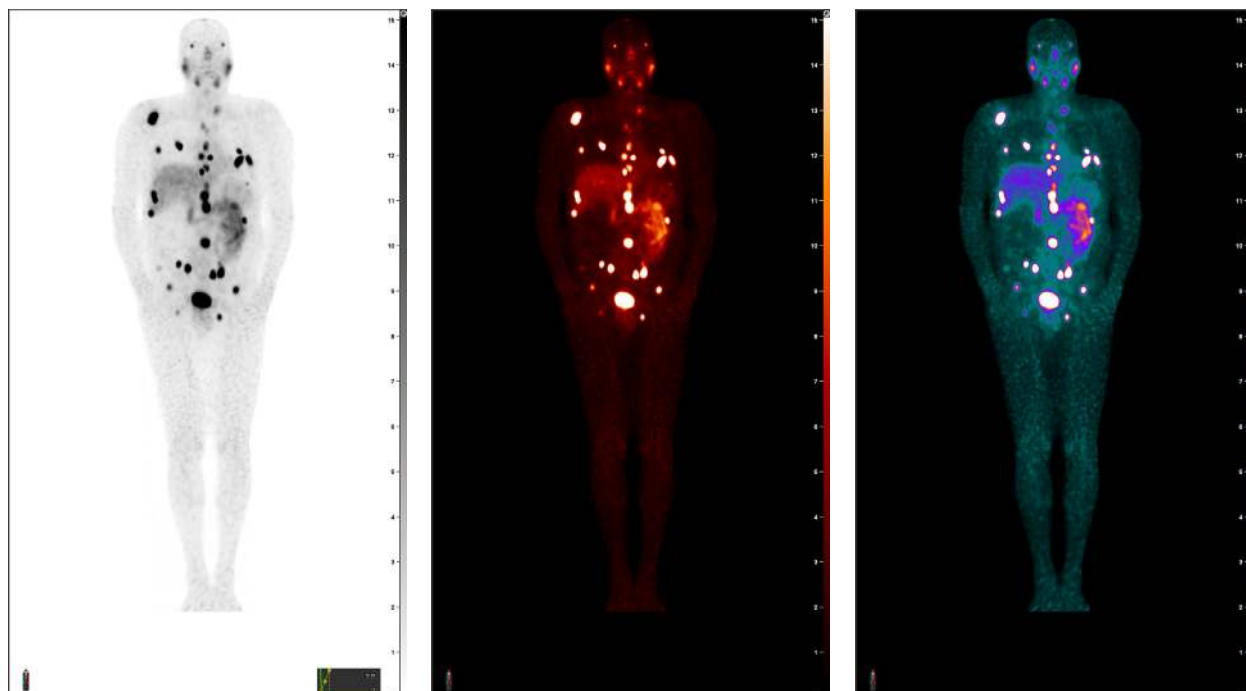
Traditional cameras used in treatment monitoring and dosimetry have a variety of limitations.

Existing SPECT and SPECT/CT cameras are based on analog, rather than digital, technology, which hasn't seen significant modifications that result in performance improvements over the past 50 years. Resolution and sensitivity characteristics are suboptimal compared to state-of-the-art digital technology, they require calibration more often to maintain accuracy, and they experience "dead time" when the amount of radioactivity needed for a scan is more than the system can handle, resulting in lost counts and inaccuracy that negatively affect quantitative accuracy.

Additionally, technicians must change collimators when performing different procedure types. Nuclear medicine most commonly requires low-energy collimation, while theranostics

applications typically require medium- or high-energy collimators. With traditional Anger-based analog equipment, technicians must change the collimators to obtain adequate image quality. These collimators are heavy, bulky, challenging and time-consuming to move when being changed multiple times per day for various procedure types. They also may take up significant space in imaging rooms.

Finally, acquisition of the scan on conventional equipment often cannot be performed tomographically from head to toe, so technicians will perform a higher-resolution scan over a smaller area, like the chest or the abdomen, and perform a low-resolution scan over the total body. This provides limited information and may take more than an hour, requiring additional technician time and affecting the experience of patients, who want a fast scan, as well as limiting daily throughput efficiency. Furthermore, to obtain reliable quantitative accuracy with conventional SPECT equipment, a specific collimator is required, and scan times must be increased.







“  
Now you can really  
look at an image  
and understand the  
exact quantitative  
value of a lesion.

Nathaniel Roth  
CHIEF R&D AND CLINICAL RESEARCH  
OFFICER AT SPECTRUM DYNAMICS

”

## A REVOLUTIONARY, PERSONALIZED SOLUTION

These challenges can now be addressed with VERITON-CT, a SPECT/CT system of 12 individual cadmium zinc telluride detectors combined with a conventional CT system.<sup>3</sup> During scanning, the digital detectors automatically follow the patient's body contour and move within millimeters of the patient's body, providing closer proximity, increased sensitivity and better image quality.

“Now you can really look at an image and understand the exact quantitative value of a lesion,” said Nathaniel Roth, Chief R&D and Clinical Research Officer at Spectrum Dynamics. “You can have a better understanding of the severity, a better understanding of the individual follow-up scan sessions during monitoring of therapy to determine whether you need to switch to an alternative therapy. You are able to evaluate how much radiation was introduced in the patient's organs so you know if you reached a

limit of toxicity or if you can repeat a theranostic therapy.”

As a digital system, the VERITON-CT also offers a fast and easy calibration process, delivering similar accuracy in quantitative, total-body SPECT/CT that can be used to monitor the patient throughout treatment. With VERITON-CT, calibration can be accomplished in about 10 to 20 minutes, and the system will remain stable for up to a year. Traditional systems, depending on their age, may need to be calibrated every month or week, and the process takes at least an hour or two. With the introduction of VERITON-CT, Spectrum Dynamics has introduced the ability to utilize advanced algorithms and capabilities not previously seen in conventional SPECT or SPECT/CT with a dual-head Anger camera.

Ben Auer, instructor in radiology at Brigham and Women's Hospital, noted the calibration process is “very straightforward,” with the correction factor built directly into the software so that

images are produced in the quantitative unit by default. "They can be easily imported into any dosimetry software for dose estimation in the context of theranostics, which is different from conventional systems that typically do not offer such capability at no extra charge," he said.

The system also provides three times the volumetric sensitivity for routine 3D hybrid imaging without compromising patient comfort or department workflow.<sup>4</sup> VERITON-CT can show activity occurring within a mL inside the human body, with accuracy to 5%, which is not possible with traditional SPECT.<sup>4</sup> The improvement in sensitivity is a "major advantage," of the system, Auer said, noting it can help significantly reduce scan times or injected dose. "We were able to reduce scan times in cardiac sarcoidosis from 15 minutes on conventional systems down to four minutes while maintaining image quality and quantitative accuracy."

With VERITON-CT, technicians can achieve an accurate scan for the whole body in nine minutes versus achieving the same accuracy in over an hour on a small part of the body with traditional technology. Additionally, it does not experience dead time and can perform accurately, even with large amounts of radioactivity.

Auer added that another advantage is the ability to enable quantitative 3D dynamic SPECT imaging. "This has the potential to bring the field forward by opening new doors previously only accessible with 2D planar imaging. It's always better to see what's going on in 3D. I think it's going to be the next trend in the nuclear medicine imaging field."

The industry standard MIM software platform is integrated into the TruView console, but the generated data is compatible with any common dosimetry or nuclear medicine viewing software. It also offers flexibility in data export, as the quantitative images can be used in any dosimetry package. An increased energy range up to 400



## Unique features

The VERITON-CT offers multiple unique features compared with traditional technology:



- **BroadView Technology**  
High sensitivity swiveling digital detectors.



- **Total Body 3D Imaging**  
200cm hybrid scan range, real-time body contour.



- **Wide Bore SPECT/CT**  
80cm NM and CT.



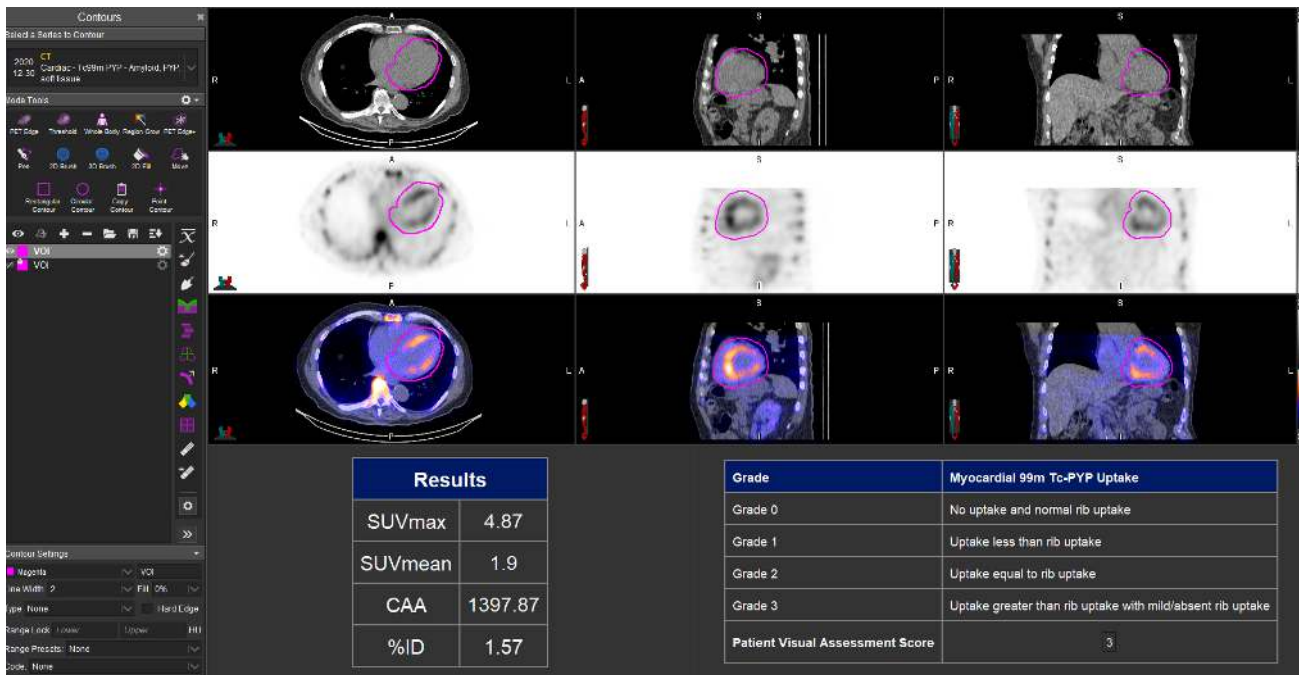
- **High Resolution CT**  
Choice of 16sl or 64sl, low dose CTAC.



- **TrueView Console**  
Acquisition, reconstruction and advanced quantitative analysis in one location.



- **Performance**  
Reaching new peaks in digital SPECT imaging up to 400 keV



keV and compatibility with Tc-99m, In-111 and Lu-177 isotopes support new and emerging nuclear medicine clinical applications.

## BETTER IMAGING IN ACTION

At Brigham and Women’s Hospital, quantification is used for multiple studies, Auer said. “Quantitation of myocardial tracer uptake in combination with robust automated or semi-automated segmentation techniques is really the key for advancing the detection of early disease in cardiac amyloidosis, assessment of patient prognosis, monitoring disease progression, identifying appropriate candidates for existing and emerging therapies and, finally, evaluation of treatment response.”

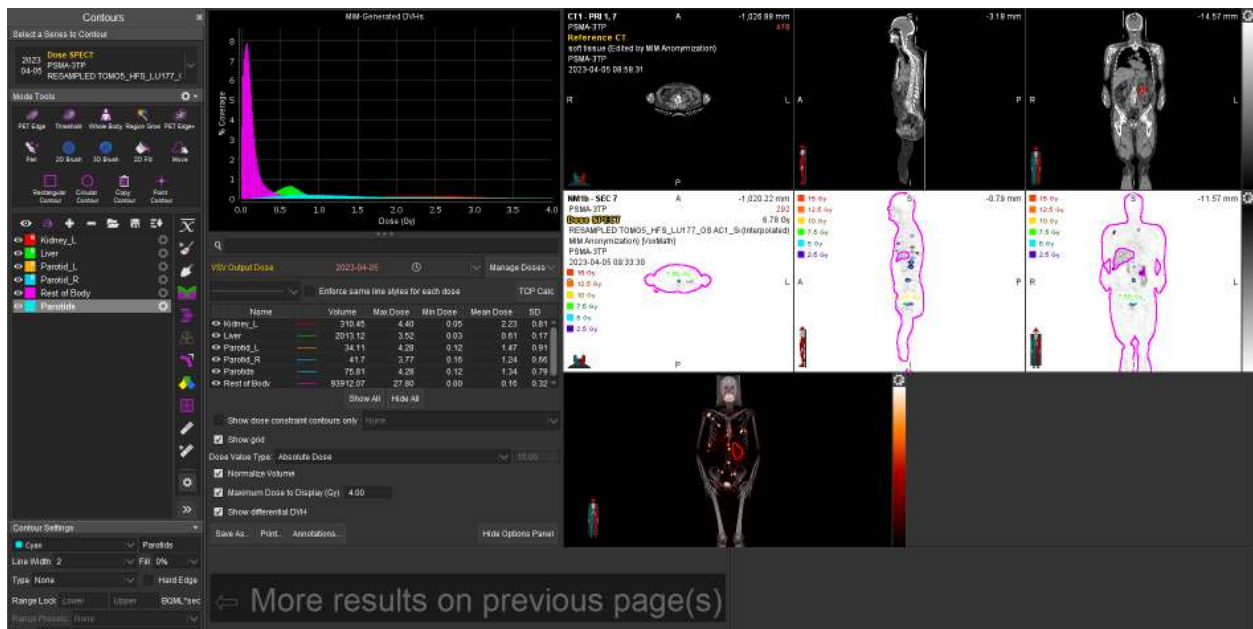
Another project at the hospital is investigating the use of quantitative 3D SPECT dynamic imaging when myocardial uptake is maximal to identify when imaging should be performed. This would be difficult to investigate with conventional systems not capable of 3D dynamic imaging, Auer said.

Finally, the hospital is using 3D quantitative dynamic imaging prior to liver resection to determine whether the patient is likely to have a favorable outcome. The current standard of care is planar imaging, but this has inherent limitations, as it must be performed when uptake in the liver is maximal and stabilized, so it can be difficult to get the timing right in practice, Auer noted. “3D dynamic SPECT imaging in combination with accurate quantitation alleviates these issues and increases confidence in the findings.”

“ 3D dynamic SPECT imaging in combination with accurate quantitation alleviates these issues and increases confidence in the findings. ”

Ben Auer

INSTRUCTOR IN RADIOLOGY AT BRIGHAM AND WOMEN’S HOSPITAL



## FASTER, MORE ACCURATE SPECT

Quantitative SPECT/CT imaging is set to play a key role in the foreseeable future and to be established as the imaging modality of choice for diagnosis and monitoring of cardiac amyloidosis, for myocardial perfusion imaging with flow quantitation and for theranostic applications, Auer said.

VERITON-CT represents the next generation in SPECT/CT imaging, with sensitivity and resolution not seen in multipurpose molecular imaging outside of modern PET/CT systems.<sup>3</sup> Its 3D hybrid digital scanner gives clinicians comprehensive information so they can diagnose and treat patients with greater accuracy.

Meanwhile, greater sensitivity allows for total-body (top of head to toe) imaging in less than

### REFERENCES

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3. Wacholz, C., Hruska, C., O'Connor, M. Veriton Multi-CZT Detector SPECT/CT System Acceptance Testing. Journal of Nuclear Medicine. May 2020. [https://jnmsnmjournals.org/content/61/supplement\\_1/3003](https://jnmsnmjournals.org/content/61/supplement_1/3003)
4. Spectrum internal data

20 minutes, ensuring the complete picture of each patient while freeing time to address growing patient needs.

With images automatically provided with quantitative values (Bq/ml or SUV) the VERITON-CT is a game changer for today's SPECT imaging, bringing it closer to what PET can do, said Roth. "Image quantification becomes automatic, easy and accurate for routine practice. The VERITON-CT is transforming oncology with faster, more accurate diagnoses and post-treatment monitoring, bringing better care to more patients than ever before." ■

## ABOUT Spectrum Dynamics

Spectrum Dynamics Medical is spearheading the transformation of nuclear medicine from analog to digital technology, enabling clinicians to provide superior healthcare services with improved image quality and efficiency at lower doses.

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