PetVision Newsletter; 8th edition
June 2026

Welcome to the Eighth Edition of the PetVision Newsletter!

The PetVision framework spans nine dedicated Work Packages (WPs) covering everything from chip design to clinical evaluation. This month, we take a deep dive into the hardware core of our system:

- **Enabling Ultra-Fast Signal Processing (WP3):** Discover how our next-generation microchips have broken the sub-100 picosecond timing barrier.
- **Building the Core Detection Module (WP4):** Learn about our breakthroughs in sensor integration and new "glass-less" manufacturing methods.

In our next edition, we will shift focus to the system's integration phase, highlighting **Managing Data with Precision (WP5)** and **Bringing the System Together: Prototype Development (WP6)**.

Thank you for following our journey toward more accessible healthcare.

About the project

Over 2.7 million people in the EU were diagnosed with cancer in 2020, while 1.3 million people lost their lives to it. Cancer cases are predicted to increase by 24% by 2035, making it the leading cause of death in the EU. The current leading imaging diagnostic technique sensitive to cancer is Positron Emission Tomography (PET). Due to the high implementation cost of PET, this highly sensitive diagnostics is only available in less than 0,5 % of the medical centers in the world. One of the main components of the overall cost is the cost of PET scanners. The main objective of PetVision EIC Pathfinder project is to develop a flexible, modular PET scanner, based on planar detector panels with exquisite time-of-flight (TOF) resolution and sensitivity. It will enable affordable, fast and precise dynamic scanning, and hence improve access to early cancer detection and therapy follow-up, paving the way for personalized medicine.

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Enabling Ultra-Fast Signal Processing

Work Package 3 (WP3) focuses on developing the advanced electronic “brain” of the PetVision scanner. Its goal is to design and validate specialized microchips—known as application-specific integrated circuits (ASICs)—that process the extremely fast and faint signals generated by the PET detector. These chips are essential for achieving the scanner’s ambitious timing precision, energy measurement accuracy, and scalability to large detector systems.

In 2025 the team made significant progress in evaluating and improving the FastIC+ ASIC, a next-generation readout chip designed specifically for high-performance PET imaging. Tests confirmed that FastIC+ can achieve a coincidence time resolution (CTR) of approximately 85 picoseconds when combined with state-of-the-art scintillators and sensors. This is a major milestone, as FastIC+ is the first integrated chip with built-in time-digitization capabilities to reach sub-100 picosecond timing precision—an essential step toward achieving PetVision’s ultimate performance target.

Beyond individual chip performance, researchers also focused on scalability and system integration. A new System-in-Package (SiP) module, called FastIC32, was developed to combine multiple ASIC channels into a compact unit. This approach simplifies system assembly, reduces integration complexity, and allows early testing of the overall system architecture, helping to reduce technical risks and accelerate development.

At the same time, work began on an even more advanced ASIC, named PoETIC (Positron Emission Tomography Integrated Circuit). This next-generation chip is designed to further improve performance, efficiency, and scalability. It incorporates enhanced front-end electronics, precise time-to-digital conversion, and advanced communication features that allow multiple chips to operate together efficiently in large detector arrays. Several key building blocks of PoETIC have already been prototyped and tested, and the first complete prototype is planned for fabrication in 2026.

FastIC 32 BGA System in Package and PoETIC 16 channel ASIC block diagram

These developments represent a critical step toward realizing the full PetVision detector system. By demonstrating both excellent performance and scalable integration, WP3 ensures that the electronic readout system can support the project's innovative flat-panel PET scanner design.

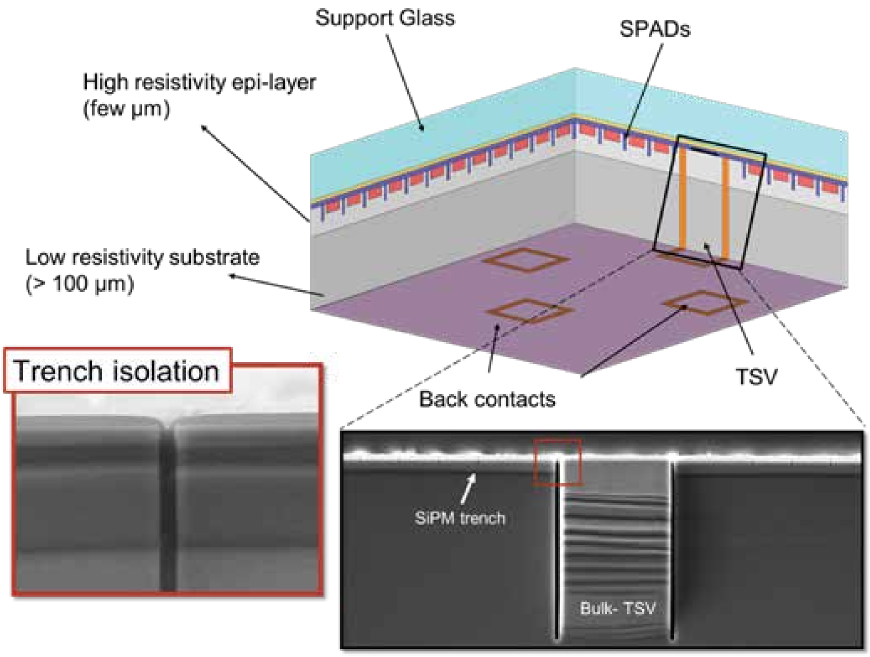
Overall, Work Package 3 has successfully validated core readout electronics, demonstrated world-leading timing performance, and laid the technological foundation for future large-scale integration. These achievements bring the PetVision project closer to delivering a new generation of PET scanners capable of faster imaging, improved sensitivity, and earlier disease detection.

Building the Core Detection Module

Work Package 4 (WP4) focuses on developing the Photon Detection Module (PDM), a key building block of the PetVision scanner. This module integrates advanced light sensors and readout electronics into a compact unit that captures and processes signals produced during PET imaging. Its performance and reliability are critical for achieving the scanner's goals of exceptional timing precision, sensitivity, and modular design.

Major progress was made in designing and testing next-generation silicon photomultiplier (SiPM) sensor arrays. These sensors convert light from scintillator crystals into electrical signals that can be precisely measured. A dedicated development cycle produced early prototypes, allowing researchers to evaluate new manufacturing approaches and refine the sensor design. The tests confirmed that the sensors can deliver timing performance comparable to the current state of the art, validating their suitability for the PetVision system.

A major technological focus was the development of advanced interconnection methods using Through-Silicon Via (TSV) technology, which enables electrical connections through the silicon sensor itself. This approach allows more compact integration and improved signal performance. While one experimental TSV method proved too complex for reliable large-scale production, an alternative "glass-less TSV" solution showed strong results, achieving high production yield and reliable electrical performance. This technology has now been selected as the baseline solution moving forward, reducing technical risk while maintaining excellent performance.



Schematic cross-section of the glass-less TSV concept based on isolated silicon columns.

In parallel, researchers successfully demonstrated key packaging and integration techniques required to assemble the Photon Detection Module. Dedicated test runs validated critical manufacturing steps such as solder bonding, chip-to-board connections, and electrical interconnections, achieving high reliability and low electrical resistance. These results confirm that the components can be assembled into robust detector modules suitable for future system prototypes.

Thermal management was also carefully studied to ensure stable operation. Computer simulations helped optimize heat dissipation from the electronics while maintaining stable temperatures for the sensitive sensors, which is essential for maintaining detector performance and reliability.

Based on these achievements, a staged development plan has been defined to progressively build and test increasingly complete detector modules, leading to the first fully integrated prototypes in the coming years.

Overall, Work Package 4 has successfully advanced the core sensor and module technology at the heart of the PetVision scanner. By validating new sensor designs, selecting a robust integration approach, and demonstrating reliable packaging solutions, WP4 has established the foundation for building fully integrated detector modules. These advances represent a critical step toward assembling the complete scanner and bringing the PetVision concept closer to clinical application.

You can meet us here:

- 6th Jagiellonian Symposium on Advances in Particle Physics and Medicine (Kraków, Poland, July 2026)
- TWEPP 2026" Topical Workshop on Electronics for Particle Physics (Barcelona, Spain, September 2026)
- 2026 IEEE NSS MIC RTSD (Granada, Spain, November 2026)

PET VISION

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