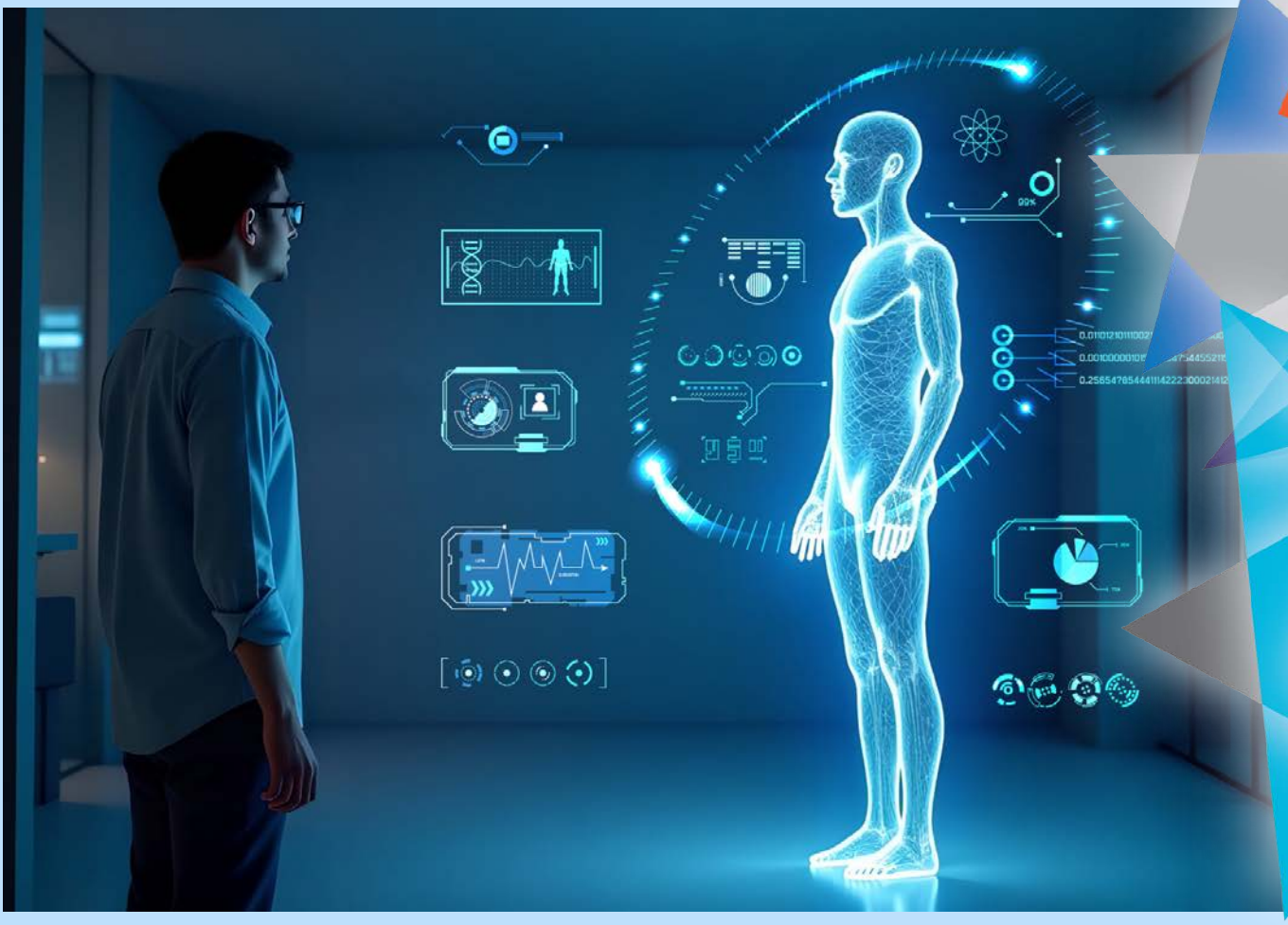

PHOTONICS21

A European Grand Challenge for Sovereign, AI-Enabled and Preventive Healthcare

Europe's Preventive Health Mission

Powered by the Personalized Optical Digital Twin (PODT)

Developed within the Photonics21 Grand Challenge process as a potential FP10 flagship initiative, uniting leading European stakeholders across photonics, healthcare, AI, microelectronics, industry, and clinical practice to advance a sovereign ecosystem for preventive and precision healthcare.

We invite European companies to help shape the Personalized Optical Digital Twin (PODT) initiative. Join the discussion, contribute your perspective, and become part of the growing European community working towards the next generation of preventive and precision healthcare.

Just as Airbus, Galileo, and Copernicus established European leadership in aviation, navigation, and Earth observation, PODT aims to establish that leadership in preventive and precision healthcare. It would combine photonic sensing, complementary physiological sensors, and clinically validated AI into a continuously updated, individualized picture of human health, enabling earlier detection, better monitoring, and more personalized care. Early engagement lets your organization help define the priority use cases and position itself within the European consortium that takes this forward. A Letter of Intent carries no financial commitment.



The Challenge

From reactive treatment to proactive health

Europe's health systems face converging pressures – aging populations, the rising burden of chronic disease, cost escalation, staff shortages, and the need for stronger pandemic resilience. Yet most care remains reactive: disease is detected only once symptoms appear, when treatment is more expensive, more invasive, and often less effective. Europe needs a decisive shift toward earlier detection, continuous monitoring, and personalized intervention – built on technologies that Europe itself controls.

Why Europe must act now

Europe has the oldest population of any major world region, chronic diseases account for an estimated 70–80% of healthcare expenditure, and workforce shortages continue to grow across Member States. At the same time, global competition in AI-enabled healthcare is accelerating. Without strategic investment, Europe risks dependence on non-European health technologies, AI platforms, and digital-health ecosystems.

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The Idea

A Personalized Optical Digital Twin

PODT would build a continuously updated, individualized model of a person's health by combining photonic measurements, complementary physiological sensors, and clinically validated AI. It is designed to support clinicians, not replace them, by providing more meaningful information between hospital visits and enabling patients to take a more active role in prevention and long-term disease management.

Photonics is the differentiator. Today's wearables track indirect signals such as heart rate, oxygen saturation, movement, and temperature. Light can go further, reading molecular and functional information from tissues and biofluids – signatures of inflammation, metabolism, immune activity, and tissue state. Established optical methods, among them Raman and infrared spectroscopy for molecular fingerprints and optical coherence tomography and fluorescence-lifetime imaging for tissue, can – once integrated into compact photonic platforms and fused with physiological data – form the basis of a dynamic, individualized health model. Achieving this at clinical quality and consumer scale still requires significant invention, and that is the core of the challenge.

Where we would start

Priority entry fields

To stay concrete and implementation-oriented, PODT would begin with a small number of fields where clinical need, market relevance, and photonic added value clearly overlap:

- **Oncology** – earlier detection, therapy-response monitoring, recurrence surveillance, and more personalized treatment decisions through non-invasive or minimally invasive molecular monitoring of tissues and biofluids.
- **Infectious and immune monitoring** – monitoring of immune response, inflammation, infection severity, and recovery to strengthen pandemic preparedness, extending to chronic inflammatory and autoimmune disease, sepsis risk, and immunotherapy.
- **Cardiometabolic disease** – prevention and long-term monitoring of cardiovascular disease, diabetes, and metabolic disorders by combining optical metabolic information with physiological signals such as heart-rate variability, oxygenation, and blood flow.

A European opportunity

Beyond transforming healthcare, PODT is an opportunity to build a new European innovation ecosystem at the convergence of photonics, semiconductors, AI, medical devices, and digital health – creating new value chains and accelerating the translation of scientific advances into market-ready solutions. The global digital-health market is expected to exceed €800 billion by 2030, making it one of the fastest-growing technology markets worldwide.

PODT would stimulate innovation across the entire value chain – from photonic integrated circuits, sensors, and diagnostic platforms to AI-enabled health services – supporting high-value jobs, deep-tech ecosystems, and Europe's long-term technological sovereignty in healthcare. It aligns directly with European strategic priorities: the European Health Data Space, trustworthy and clinically validated AI under the AI Act, the Digital Decade, the EU Chips Act, and the One Health strategy.

Europe has built strategic infrastructures before – in aviation, navigation, and Earth observation. The next is preventive and personalized healthcare: a European health infrastructure able to monitor health status continuously, support prevention, and enable AI-driven innovation while preserving European values of privacy, trust, and data sovereignty.

By combining Europe's global strengths in photonics, medical technology, healthcare, and trustworthy AI, PODT offers a unique opportunity for Europe to become the global leader in preventive and precision healthcare.



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Why engage now?

What is in it for your organization

Help shape the vision. Contribute your expertise and perspectives while the initiative is still being defined.

Discuss real-world needs. Exchange ideas on clinical priorities, industrial requirements, regulatory pathways and future applications.

Connect with Europe's emerging PODT community. Meet leading stakeholders from photonics, healthcare, AI, medical technology, industry and policy.

Prepare future collaborations. Identify potential partnerships and explore opportunities for future European flagship activities and funding initiatives..

Europe's Vision for 2040

Picture a future in which health status is assessed continuously through non-invasive optical technologies – diseases caught months or years before symptoms appear, hospitalizations reduced through earlier intervention, healthy ageing supported, and citizens empowered to manage their own health. PODT aims to make this a European reality.



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You are invited

Join the PODT Industry Dialogue

We are bringing together companies, clinicians, researchers, and innovation stakeholders to discuss how Europe can build a sovereign ecosystem for preventive and precision healthcare. At this stage, we invite you to exchange ideas, identify priorities, and help build a strong European stakeholder community around PODT.

Next steps

How you can contribute

- Share industrial perspectives
- Discuss future use cases
- Identify technological challenges
- Connect with European stakeholders

How to stay involved

- Register your interest
- Receive updates
- Join future stakeholder meetings
- Participate in networking events
- Explore future collaborations

Contact us

PODT initiative contacts

Prof. Dr. Juergen Popp

Working Group Leader Health, Photonics21 · Member of the Photonics21 Executive Board

Scientific Director, Leibniz Institute of Photonic Technology (Leibniz-IPHT)

Professor of Physical Chemistry, Friedrich Schiller University Jena

juergen.popp@leibniz-ipht.de

PD Dr. Thomas Mayerhöfer

Institute of Physical Chemistry, Friedrich Schiller University Jena · Leibniz-IPHT

thomas.mayerhoefer@uni-jena.de

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