ITEA 4

Project Results

Winner
ITEA Award
of Excellence
2025

Exceptional
Excellence

SIGNET

Seamless MR-guided treatment in a single episode

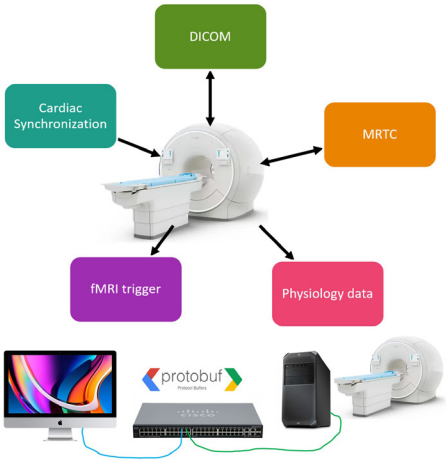
The ITEA project SIGNET (Sensing and Image-Guided Neurological therapies, cardiac Electrophysiology and Tumour treatments) aimed to replace complex medical workflows and procedures with single episodes of personalised, dose-adaptive, precision magnetic resonance (MR)-guided treatments and interventions, thereby improving the comfort, safety and outcomes of patients and the economic viability of healthcare.

Image-guided interventional procedures face a variety of adoption barriers. For instance, clinicians must access multiple modalities during diagnosis and treatment planning/delivery, each influenced by differing patient, compliance and safety factors. However, multiple user interfaces render it difficult to scale across use-cases and create the risk of confusion, possibly leading to mistakes or inefficiencies. These issues are compounded by the need for high image quality and contrast, as well as the potential for device settings and algorithms to compromise the geometric accuracy of treatment planning.

To tackle such bottlenecks, SIGNET developed a series of AI-enabled solutions and a generic Common Open MR Remote Acquisition and Data Exchange (COMRADE) interface between scanner and treatment devices. This allows them to bring together different MR-guided therapy devices and integrate them with an MR system in a scalable manner. Treatment accuracy is also improved via integrated device controls, a consolidated user interface and algorithms for better image quality. The project therefore paves the way to a single episode of care instead of multiple iterations of planning and scanning, resulting in shorter treatment times, better treatment quality and less healthcare congestion. Validated demonstrators have proven the efficiency and effectiveness of this digital ecosystem in three use-cases: cardiology, oncology and neurology.

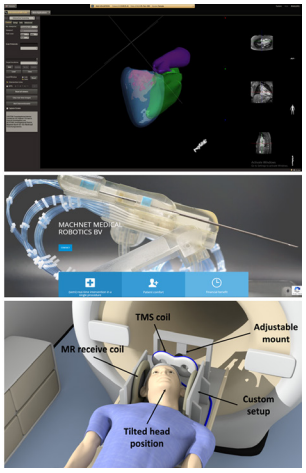
Technology applied

Based on the open cross-platform data format Protobuf, COMRADE provides a standardised interface through which MR-guided (therapy) devices from different companies can communicate with Philips' MR system for imaging, treatment control, physiology, functional magnetic resonance imaging (fMRI) triggering and cardiac synchronisation. In the cardiology use-case, for example, this was demonstrated using Imricor's catheter tracking system, Adas3D's 3D cardiology planning and LifeTec's platform that prompts harvested pig hearts to beat in the same manner as human hearts. These technologies were connected to the Philips MR system at Amsterdam University Medical Center, which also applied advanced algorithms and image processing techniques.



The result is one seamless process for integrated cardiac ablation.

The other use-cases follow similar principles. For neurology, integrated stereotactic neurosurgical planning and integrated transcranial magnetic stimulation (TMS) neurotherapy have each been demonstrated; the former focuses on the planning element ahead of surgery for diseases like epilepsy, while the latter addresses conditions such as depression or stroke. For oncology, SIGNET demonstrated robotics-mediated MR-guided biopsy, in which an integrated biopsy robot autonomously inserts a needle into the breast to perform tissue extraction without human intervention. This enables precise targeting, reducing the need for multiple hospital visits. Other elements that assist in this reduction include the cardiology use-case's integration with different phantoms for breathing simulation and SIGNET's broad application of AI-based algorithms to reduce scan time, such as Philips' SmartSpeed MRI acceleration technique for enhancing image reconstruction.



Realising MR-guided treatment innovation chain across cardiology, oncology and neurology.

Making the difference

With its TRL 5 demonstration of a single unified interface for treatment device manufacturers to integrate with MR systems, SIGNET has taken the first steps towards an innovation that does not currently exist on the market. This holds promising improvements for both patients and practitioners. The manual biopsy method, for instance, takes over 60 minutes and requires up to 12-14 biopsies; SIGNET's test setup reduced this to under 20 minutes with only one or two biopsies needed. Likewise, the number of manual data handling steps between neurology planning and treatment has been reduced from ten to four. Another key achievement was combining respiratory correlation imaging with breathing guidance for MR-SIM, which showed a 50.5% average improvement in delineation consistency and an up to 61% more predictable scan time. The next step for results like these is exploitation, for which SIGNET has already produced one patent, four invention disclosures and five upgrades to existing products, like a 60% decrease in the time taken for SmartSpeed to produce better image quality. These exploitation efforts will allow the consortium to improve and expand their offerings in the project's targeted therapy domains, which have a collective market size of over EUR 40 billion.

The future

With the progress generated by SIGNET, long-term benefits are expected for individuals and for society at large. First and foremost, full exploitation is estimated to reduce treatment time by 50%. This offers not only an intangible improvement to quality of life for patients but also a corresponding reduction in the use of consumables and in CO_2 emissions via less travel to hospitals. At the same time, the project positions European industry to compete more effectively globally and gives treatment device manufacturers a quicker path to clinical evaluation and market adoption. This creates a virtuous cycle that should quickly extend to treatments beyond the three use-cases. Through these factors combined – as well as four follow-up collaborations initiated by the project – the consortium can predict an annual societal gain of over EUR 1 billion by the end of this decade as a direct result of SIGNET.

Major project outcomes

Dissemination

- 2 publications and 13 presentations at conferences/fairs.

Exploitation (so far)

- New releases of Philips MR including MRTC, Imeka ANDI, Imricor NorthStar, Galgo stereoDiver, Adas3D, Modus QA, Brain Science Tools, Machnet.
- Joint exploitation between Imricor-Adas3D realised.
- Joint exploitation for the future: Imeka-Galgo, Philips-Brain Science Tools, Philips-Imricor.

Standardisation

- Ecosystem standardisation: The MR guided (therapy) devices from different companies like Imricor, Brain Science Tools, Galgo Medical, Machnet, etc. use the same **COMRADE interface format** to communicate with the Philips MR system for imaging, treatment control, physiology, fMRI trigger and cardiac synchronisation across different use cases of cardiology, neurology, and oncology (as applicable).
- Diffusion Tensor Imaging (DTI) standardisation, through standardised acquisition requirements including diffusion weighted imaging.
- Major contributions to standards like IEC 60601-2-33 Ed 4.1 (SC 62B MT40), MR Guided Radiation Therapy (SC 62C WG1), RSQR 2024 Remote Scanning roles and responsibilities definitions, etc.

Patents

- 1 patent application filed.
- 4 patent applications in preparation.

ITEA is the Eureka RD&I Cluster on software innovation, enabling a large international community of large industry, SMEs, start-ups, academia and customer organisations, to collaborate in funded projects that turn innovative ideas into new businesses, jobs, economic growth and benefits for society. ITEA is part of the Eureka Clusters Programme (ECP).

https://itea4.org

SIGNET

20052

Partners

Canada

- Imeka
- Modus Medical Devices Inc.

Spain

- Adas3D Medical SL
- Galgo Medical SL

Netherlands

- Academic Medical Centre Amsterdam
- Brain Science Tools BV
- Braincarta BV
- LifeTec Group BV
- Machnet Medical Robots BV
- Philips Electronics Nederland BV
- Philips Medical Systems Nederland BV
- UMC Utrecht

United States

- Imricor Medical Systems Inc.

Project start

November 2021

Project end

January 2025

Project leader

Saurav Baidya, Philips Electronics Nederland BV

Project email

saurav.baidya@philips.com

Project website

https://signetproject.com/

https://itea4.org/project/signet.html