

ITEA Success story

SoRTS

A system of real-time systems for more effective healthcare

Radiotherapy affects not only cancer cells but also healthy cells in the area that is being treated, so it is important that as little healthy tissue as possible is affected. The problem is that the movement of a tumour under the effect of respiration, for example, risks damaging surrounding tissue, whereas MRI, the only imaging modality that can visualise the tumour well, traditionally takes minutes to create the image.

While there have been considerable advances in recent years in the oncological and radiotherapy treatment of cancer, a major challenge still faced by image-guided intervention and treatment is the availability of coupled real-time feedback of the imaging and therapy systems during interventions. Nucletron, Philips, Technolution and UMC Utrecht in the Netherlands, Philips in Finland and Elekta in Sweden, all partners in the value chain for state-of-the-art image-guided intervention and treatment (IGIT), teamed up in an ITEA project to solve this challenge. The goal of the SoRTS project was to develop a system of real-time systems to support healthcare professionals in the transition from invasive, open surgery to minimally invasive IGIT.

The successful technological solution, real-time coupling of imaging and treatment systems was demonstrated in 3 use cases:

- The Magnetic Resonance Imaging (MRI) systems of Philips, for example, are made suitable for low-latency, real-time feedback during image-guided interventions while therapy systems, like brachytherapy, linear accelerator (Linac) and high-intensity focused ultrasound (HIFU) can destroy malignant tissue via a minimal or non-invasive method.
- UMC Utrecht developed and optimised clinical procedures to determine the most effective and efficient usage of automated image-guided interventional systems, validating such procedures in several radiotherapy applications.



- Finally, a Real-time Therapeutic Procedure Supervisor integrated image-controlled therapy by independent systems allowing the deployment of specific algorithms. These are developed according to the needs of any partner in the chain, without any upgrade or replacement of individual systems being required.

The SoRTS project resulted in state-of-the-art technology for Philips MR diagnostic systems and allows the exploitation of real-time motion correction. The innovations provide Philips with a competitive edge, creating a higher market share. With these key innovations Philips MRI will sell 50-100 systems in Europe in a new market, meaning an addition of more than 5% to the present MRI market of €4.5 billion. In 2017, Philips released a new MR clinical application, Compressed SENSE, an acceleration technique that can speed up all routine 2D and 3D clinical MR applications by up to 50% with virtually equivalent image quality. This development got additional relevance, since it is crucial for the the SoRTS real-time behaviour. Compressed SENSE is also featured in Philips' new 3.0T MR

solution, Ingenia Elition, which was announced in March 2018. The Ingenia Elition helps clinicians perform MRI exams up to 50% faster, with no compromise in image quality.

One of the key outcomes of the SoRTS project for Elekta was the MR-linac (Magnetic Resonance Imaging - Linear Accelerator) system, commercially introduced as the Elekta Unity. It is designed to improve the targeting of tumour tissue while reducing exposure of healthy tissue to radiation, allowing physicians to precisely target a tumour, even when tumour tissue changes shape, location, size or composition during treatment. The Elekta Unity is the only MR/RT system that integrates a premium quality 1.5 Tesla MR scanner from Philips with an advanced linear accelerator and intelligently designed software. In September 2017, 7 Elekta high-field MR-adaptive linear accelerator (MR-linac) systems were installed worldwide and by December 2018 Elekta got the CE-marking of the system with 510(k) approval. Furthermore, in March 2019, Elekta won the Red Dot Award, a world-renowned design prize for the Elekta Unity. This award further underlines the real benefits of an

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Medical pioneer

Sixty-five-year-old Barry Dolling, who is a prostate cancer patient, became a medical pioneer on 18 September, as he was the UK's first to be treated with Elekta Unity MR-linac at The Royal Marsden. The PRISM trial (Prostate Radiotherapy Integrated with Simultaneous MRI) is a 30-patient Royal Marsden study to assess the technical feasibility of delivering radical radiotherapy for prostate cancer using Elekta Unity, including the feasibility of changing the radiotherapy plan on a daily basis to mirror internal anatomy changes. Dr Tree explains: "I've been quite encouraged and pleased with the image quality we're getting with Elekta Unity. It enables me to contour the capsule of the prostate, while the cine MRI pulse sequence we use lets us easily track the motion of the target and surrounding organs while the beams are being delivered." Mr. Dolling recalls. "If I had chosen surgery, I could have been out of action for three months or longer, not to mention the complications that can happen with surgery. With radiotherapy I could still carry on working as usual."

Source: <https://focus.elekta.com/2019/03/the-era-of-mr-rt-in-the-uk>



First prototype of MR-linac, used for testing initial SoRTS developments

intelligent, evidence-based design approach in delivering success. In May 2019, around 39 Elekta Unity systems had already been sold.

On 19 May 2017, less than six months after the end of the SoRTS project, the University Medical Centre (UMC) Utrecht treated the first patient as part of a clinical study with Elekta Unity. In February 2019, UMC reported on a first series of patient treatments using the company's Elekta Unity MR-linac system. In the published study, "Feasibility of stereotactic radiotherapy using a 1.5T MR-linac: Multi-fraction treatment of pelvic lymph node oligometastases," the investigators used Elekta Unity to deliver stereotactic body radiotherapy (SBRT) treatments to five patients with lymph node lesions. The study demonstrated the feasibility of MR-guided radiotherapy by satisfying three criteria: treatment delivery using the MR-linac, with full online planning; maximum session time of 60 minutes and passing all quality assurance (QA) tests. Kevin Brown, Global Vice President Scientific Research at Elekta says: "The UMCU study, in particular, demonstrated that clinicians can – for each treatment session – use the MRI in Elekta Unity to determine the daily position and shape of the anatomy". (Source: <https://focus.elekta.com/2019/02/elekta-mr-linac-consortium-publishes-first-clinical-paper-on-mr-rt-feasibility/>) Until May 2019, about 175 patients had been treated by 7 clinical sites in Europe and the US.

Technology integrator Technolution benefited from its participation in SoRTS by improving its core business in providing solutions for real-time, multi-core hardware for medical and for non-medical applications. With the results of SoRTS, Technolution was able to develop its video-over-IP solution, SigmaXG, which is now used worldwide. The Erasmus MC university hospital in Rotterdam has selected Technolution partner Inter Visual Systems' Sensumed platform, within which SigmaXG performs video-over-IP, for 26 new operating theatres in its building. This new solution ensures flawless technical processing of image, sound and user input. Because the images are clearly presented on just one screen, this solution is much more user-friendly for doctors and operating theatre staff.

SoRTS has accomplished great benefits for all stakeholders; Philips, Elekta and Technolution have already achieved impressive business growth, physicians can work faster while maintaining quality and last, but not least, patients benefit from a less intrusive treatment enabling them to continue their daily lives.

More informaton

<https://itea3.org/project/sorts.html>

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