Unleash the Power of 3.0T Imaging

Redesigned from the ground up, the SIGNA™ Architect redefines productivity across an array of core and advanced imaging techniques. From reduced scan times to exceptional image quality, clinicians at two of the first worldwide installations of SIGNA Architect have great expectations for the future of MR imaging.

**Levanger Hospital**

As one of two hospitals in the Nord-Trøndelag county of Norway, Levanger Hospital is the first global installation of GE Healthcare’s newest 3.0T MR system, the SIGNA Architect. In 2016, the hospital performed 5,500 MR exams across all types of anatomies, including cardiac, neuro, and MSK. An existing SIGNA™ HDxt 1.5T system was upgraded to SIGNA HDxt Optima™ Edition 23 in 2014, yet the hospital wanted to address the long wait times prevalent throughout the country; patients can wait an average of 12 weeks to receive a non-urgent MR exam.

“The 128-channel RF chain opens up new opportunities to improve SNR and reduce noise,” says Rune Wagnild, Head of MR at Levanger Hospital. He and his colleagues were also interested in HyperSense, a compressed sensing technology that reduces overall scan time without appreciably compromising spatial resolution or image quality.
Currently, Levanger is scanning 8-10 patients each day just on the SIGNA Architect, although Wagnild is working with his team to increase this number. “An exam that takes one hour on the prior system we can now conduct in 40 minutes,” he adds. “That’s a big difference, and we believe we can increase the number of patients quite a bit. Our goal, once we are finished working with the protocols, is to scan at least 10 more patients each day.”

Trine How Olsen, MR radiographer, adds that not only will the scan time reduce, but the image quality will likely improve. “Both the coils and the scanner are great, and we really like the ability to see the gating on the screen in the scanner room.” In discussions with patients, she says they’ve commented on the wider, 70cm bore size, and how they are more comfortable in it compared to the other 60cm bore scanner.

The impact on workflow from the new drag-and-drop feature into the view ports and IntelliTouch have also made a difference in workflow. Yet the biggest impact on patient throughput and productivity is the higher resolution enabled by 3.0T, the overall system speed of SIGNA Architect, and the ability to move more complex exams from 1.5T to 3.0T. According to Wagnild, within two months of implementation, the hospital is already scanning 10-12 more patients each day between both MR systems. “This is because we have moved many of the complicated exams to the 3.0T system, where they take less time to complete. So we can perform more routine exams on the 1.5T system than we were able to do before we got the 3.0T installed.”

Using the HyperSense application in neuro time-of-flight (TOF), Wagnild and his team have been able to reduce scan time from 7 minutes to 4 minutes. Another new, impressive sequence is FSE Flex, a Dixon-based 2D and 3D dual echo fat-water separation technique for uniform fat suppression for large field-of-view (FOV) and off-center anatomies where uniformity is a challenge.

“We are already using FSE Flex quite often, as it is very robust with good image quality,” Wagnild says. “In one scan, we can get four contrasts—water, fat, in-phase and one out-of-phase. We obtain the same information from two sequences in the time it takes to do one.”

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With this imaging data, clinicians will examine the incidence of different brain findings in a representative general population and the impact of disease (e.g., hypertension, chronic pain) and/or positive and negative risk factors of disease (e.g., physical activity and obesity) on different brain structural and functional measures using both cross-sectional and longitudinal HUNT data.

Wagnild says that for the HUNT-3 study, each neuro MR exam took one hour to complete. “We think we can do this faster and with better image quality,” he says. “The speed of the scan will depend on the needed resolution, but we think we can decrease the scan time by one-third.”

The expected additional capacity will certainly make a huge impact in the backlog of patients waiting several months for their MR exam. And, it will also make a difference in the research conducted at Levanger Hospital—specifically the Nord-Trøndelag Health Study (HUNT).

HUNT is one of the world’s largest studies in population health. Every 10th year, all inhabitants 13 years and older are invited to participate by answering questionnaires, undergoing various clinical examinations and having blood samples drawn. In the fall of 2017, the HUNT-4 survey will commence with Levanger once again participating.

HUNT-4 will include a neuro MR sub-study acquired on the new GE Healthcare SIGNA Architect 3.0T scanner equipped with the TDI 48-channel Head Coil at Levanger Hospital. This sub-study will include a follow-up of the 1,006 participants who were 50 and 66 years old for the HUNT-3 MR study, plus a new, younger sample.

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Trine How Olsen, is an MR radiographer at Levanger Hospital.
In Practice

GESIGNAPULSE.COM 11 SPRING 2017

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One new impressive application is Flex for Cube and FSE. “In MSK you can use an isotropic Cube sequence to do secondary reconstructions for interactive 3-plane evaluation. In addition, with Flex Cube you get already available for a few years. The expectation (with SIGNA Architect) is that we will have better image quality in less time.”

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Another early adopter of GE Healthcare’s SIGNA Architect 3.0T MR is Theresienkrankenhaus Mannheim, a 580-bed general hospital in Mannheim, Germany. According to Jochen Hansmann, MD, Head of the Department for Diagnostic and Interventional Radiology, approximately 70,000 imaging exams are performed each year—6,000 of which are MR. With an older, more acutely ill population base, MR is increasingly becoming more important for diagnostic patient workup. That tendency to more frequently utilize MR rather than CT is often due to contraindications, such as impaired renal function or thyroid disease, as well as the enhanced performance of today’s advanced MR systems. The disadvantage of MR, he acknowledges, is the longer scan time compared to CT. However, it is an area where he is optimistic the SIGNA Architect will make an impact.

“The need for shorter scan times along with the well-developed technology is the reason to move to 3.0T,” Dr. Hansmann says. “When we looked at the available systems on the market, we realized with SIGNA Architect we have the opportunity to acquire a new-generation scanner with some promising technical innovations, compared to a scanner that was already available for a few years. The expectation (with SIGNA Architect) is that we will have better image quality in less time.”

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Figure 3. (A) Axial 3D LAVA Flex and (B) Coronal LAVA Flex water image of the complete abdomen at 5mm slice thickness and 7 sec scan time.

Images courtesy of Theresienkrankenhaus Mannheim.
In the past, 3D explorations with Cube required a scan time of 4-6 minutes, and Dr. Hansmann believes it is possible to reduce this scan time down to 2 minutes on the SIGNA Architect. He has also completed a non-contrast TOF of the complete supra, from the aortic arch to the Circle of Willis, with good image quality and resolution in just 6 minutes. That’s a scan that typically takes a minimum of 15 minutes to complete, he adds.

A non-contrast inflow exam of the renal vasculature also delivered advantages over a contrast-enhanced exam. Dr. Hansmann could visualize the vessels in the periphery of the kidneys thanks to the absence of contrast-enhanced parenchyma.

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“One important advantage the SIGNA Architect showed was that we can go to the limit of the sequence parameters without having any other problems,”
Dr. Hansmann explains. “It is possible to get good images from almost any MR scanner on the market on the expense of time. But when you drive the parameters to the limit to reduce scan times, the images are often too noisy. With SIGNA Architect, we got good image quality when we pushed the sequences to the limit using HyperSense and HyperCube.”

With SIGNA Architect, Dr. Hansmann believes that Theresienkrankenhaus Mannheim now has a competitive advantage in MR imaging throughout the area. While two university hospitals offer MR, the systems have similar capabilities as Theresienkrankenhaus Mannheim’s older scanner.

“To have a technical revolution is an advantage,” he says. “Many patients and referrers look for new opportunities, especially in oncology with multiparametric protocols. The better instrument I have, the better treatment the patient receives.”

**Rune Wagnild** is Head of MR at Levanger Hospital. After graduating as a radiographer, he worked in both private and public healthcare facilities; in 2012-2013 Wagnild completed additional education in MR imaging.

**Trine How Olsen** is a MR radiographer at Levanger Hospital.

**Levanger Hospital** is one of two local hospitals for the inhabitants of Nord-Trøndelag, Mid-Norway. Levanger Hospital, with approx. 1,650 employees, has an orthopedic and surgical ward, anesthesia, physiotherapy, medical, gynecology/maternity, children and adolescent psychiatric, neurological, imaging diagnostics, psychiatric, and ambulance service.

**Jochen Hansmann, MD,** is Head of the Department for Diagnostic and Interventional Radiology at Theresienkrankenhaus Mannheim. Dr. Hansmann received his medical degree from the University of Cologne School of Medicine and completed his residencies in Diagnostic Radiology and Internal Medicine at the University of Heidelberg. He is a member of DRG, ESR, RSNA, and ESGAR.

**Theresienkrankenhaus Mannheim** is a 580-bed general Catholic, non-profit hospital in Mannheim, Germany. In 1995 the hospital partnered with St. Hedwig-Klinik. Theresienkrankenhaus Mannheim is an academic teaching hospital of the University of Heidelberg.