

A new chapter in MR



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Welcome to the 2024 Autumn Edition of *SIGNA™ Pulse of MR*. I am honored to once again be the Guest Editor, and in this issue we have several articles focused on the increasingly important role of MR and PET/MR in the planning and monitoring of radiation therapy. You will also find in this edition a range of articles that highlight the role of recent innovations in both software and gradient hardware as well as cutting-edge AI approaches that are all helping to improve image quality and reduce scan times.

A significant news announcement is the recent FDA clearance of *SIGNA™ MAGNUS*¹, a novel head gradient insert designed to enhance the capabilities of traditional MRI systems. This cutting-edge technology allows for much higher resolution imaging that captures the intricate microstructural details of the brain, paving the way for improved diagnostics and treatment evaluation. I am looking forward to the installation of our *MAGNUS* over the next few months. We will be focusing on its use in psychiatry and developmental disorders where MR has improved our understanding of mental health. Traditional assessment methods often fall short in capturing the complex interplay of biological, psychological, and social factors that contribute to mental health conditions. MR, particularly when enhanced by technologies like *SIGNA MAGNUS*, will provide a non-invasive means to investigate structural and functional changes in the brain. Alterations in brain connectivity and microstructure in conditions including autism, depression, anxiety, psychosis and dementia will be investigated and we will develop more nuanced understandings of the brain, opening the door to new therapeutic strategies.

In radiation therapy, precise targeting is crucial. Drs. Maria Picchio and Paola Scifo at IRCCS San Raffaele Scientific Institute share an in-depth summary of their clinical evaluation of *SIGNA* PET/MR in diagnosing, monitoring and

staging soft-tissue cancers. The precision of simultaneous PET and MR imaging can be instrumental in tailoring individual treatment plans, enabling oncologists to prescribe treatments that maximize the effectiveness of radiation while minimizing damage to surrounding structures, making radiation therapy safer and more effective. This issue also shares the impact of MR imaging in Gamma Knife treatments, discusses the first European installation of *AIR™* Open Coil Suite on *SIGNA Premier* and highlights the value of *AIR™* Recon DL and motion insensitive imaging for more confident tumor diagnoses.

Being a Luddite, I was initially cynical about the role of AI in certain areas of medicine, but I am a recent convert! AI approaches such as *AIR Recon DL 3D* are going to be a game changer for radiology. This innovative technology utilizes advanced deep-learning algorithms to enhance SNR, ensuring clearer and more detailed images in shorter scan times. This will undoubtedly reduce patient discomfort and improve workflow efficiency in busy clinical settings. You will see in this issue that *AIR Recon DL* is so adaptable that it is being used in a wide range of applications, from neurology to orthopedics. It can be applied to over 90% of GE HealthCare's pulse sequences, including motion insensitive techniques such as *PROPELLER*, which is featured in several case studies. To summarize, *AIR Recon DL* enhances clinical diagnoses and elevates the standard of care, making it a fabulous asset for healthcare professionals and patients alike.

Welcome to a new chapter in MR innovation, I am delighted to share all these recent advances with you. 

¹ *SIGNA MAGNUS* is 510(k) cleared with the US FDA. Not yet CE Marked. Not available for sale in all regions.

SIGNA MR: See the future. Change the outcome.



Kelly Londy
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We at GE HealthCare are proud of the innovations we have made over the past 40 years, and the meaningful contributions to clinical care our SIGNA™ MR portfolio has enabled since the first SIGNA MR was launched in 1983.

Today, while we continue to celebrate achievements from the past and those who made them happen, we also set out to conquer the next milestone in our SIGNA journey—today we see the future, and we challenge ourselves to change the outcome. As a community of scientists, engineers and clinicians, our journey has been nothing short of exciting, and a remarkable example of the wonderful things that can happen when determined people come together with a common mission: create a better experience for patients and clinicians alike.

In a world where worldwide access to MR is four times below the OECD average¹ and the demand for MR procedures continues to grow at an accelerated pace, increasing access to MR while balancing staff shortages and tackling clinician burnout is paramount. This, combined with the economic burden brought by some of the most debilitating diseases—such as cancer and neurological disorders—drives our community to create a world where healthcare has no limits.

Artificial intelligence (AI) and deep learning (DL) deliver industry-leading tools that shorten scan times and improve image quality (see the articles on pages 8 and 66). Through our SIGNA™ Continuum™ program, we've activated 30+ upgrade paths for you to benefit from the latest technology while simultaneously reducing carbon footprint, helium dependency and financial constraints, making MR imaging more accessible to those who need it.

Our community has made significant strides, but there is more to be accomplished. By continuing to use AI as a force multiplier to the medical advancements we know today, we're committed to changing the outcome for the benefit of entire populations.

We envision a future, not far from now, where we can train our AI and DL models in a fraction of the time than we do today, with trillions of data-points to aggregate, correlate and translate into accurate outcome predictions. A future where the promise of Effortless Imaging becomes a standard practice that alleviates patient and clinician stress, standardizes the examination process from scheduling to reporting, and allows for fully remote scanning.

We also see the opportunity to increase patient access to MR, enabled by lightweight and compact scanners that can be quickly deployed anywhere. It is a future where MR imaging can be more easily and efficiently performed regardless of location and user's level of experience.

A key to making these ambitions actionable will be the ingredient that blends it all together: strong partnerships and a sharp collective focus on innovation, fueled by our shared determination to enable groundbreaking discoveries that will help us move the needle from good to best and from care to cure.

I am excited to join you for the first time as the GE HealthCare MR leader at this year's Radiological Society of North America (RSNA) meeting in Chicago. I also hope you will enjoy this issue of *SIGNA Pulse of MR*, where several collaborators and colleagues have shared their excitement, research and progress as a meaningful way to create a world where healthcare has no limits.

Happy reading,

¹OECD data (2022 or latest available) | <https://data.oecd.org/healthqt/magnetic-resonance-imaging-mri-units.htm>

Intelligent, future-forward MR



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It's an exciting time to be in MR. The continuous demand for MR imaging, fueled by the increasing disease burden and population demographics, continues to feed MR procedures growth and expansion across multiple clinical specialties, from neurology and oncology to cardiology, pediatrics and sports medicine. In China we see growing interest in high precision tools for neuro and oncology assessment, such as PET/MR and 7.0T. In Europe, several institutions seek to incorporate more sustainable solutions to their departments to remain energy, helium and operationally efficient. In North America, the clinical pressures of complex imaging examinations, increasing referral backlogs and staffing shortages demand higher productivity and more efficient and patient-friendly workflows.

At GE HealthCare, we are preparing for tomorrow with intelligent, future-forward MR systems and technologies. As Kelly Lundy writes, our focus is to solve our customers' primary needs: fast, accurate MR imaging, increased geographical, demographical and clinical access to care for all patients, and actionable diagnostic insights. We're excited to share that our latest innovations deliver on the promise of more accurate, accessible and actionable health outcomes.

This year at the 2024 Annual Meeting of the Radiological Society of North America (RSNA), we are excited to announce the US FDA clearance of SIGNA™ MAGNUS[†], an ultra-high performance 3.0T head-only MRI system designed to advance both clinical imaging and neuroscientific discovery. We also unveil the US FDA-pending Sonic DL™ for 3D[‡], enabling up to 12-times acceleration factors for brain, spine, orthopedic and body imaging, as well as the compatibility of Sonic DL with AIR™ Recon DL for an altogether better diagnostic result at ultra-high speed with ultra-high clarity. Finally, we are happy to showcase our latest 1.5T MRI system, SIGNA™ Champion, a high-throughput, scalable and sustainable platform designed for patients everywhere.

Accuracy, accessibility and adaptability are the words that best describe the latest advancements in MR from GE HealthCare. From the neurological precision of SIGNA MAGNUS to the equitable access the SIGNA™ Continuum™ upgrade program offers across the GE HealthCare MR fleet and to the adaptability and versatility of deep-learning techniques such as Sonic DL and AIR Recon DL, we are committed to innovating MR for everyone by making our solutions available across our portfolio. Our oath to you is that GE HealthCare will continue to enable clinicians to improve access and outcomes for patients everywhere. **S**

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Life-speed imaging in 3D

Building on the success of Sonic DL™ for Cine imaging in cardiac MR, GE HealthCare is introducing Sonic DL for 3D[‡] MR sequence. Sonic DL is a deep-learning-based image acquisition acceleration technique that will be available for use on GE HealthCare 1.5T, 3.0T, and 7.0T* MR systems. Sonic DL reconstructs MR images from highly undersampled data, and thereby enables acceleration factors up to 12 times compared to fully sampled datasets—an 86% reduction in scan time versus a fully sampled acquisition. Its underlying technology is a Convolutional Neural Network (CNN) powered iterative reconstruction technique for vastly under-sampled data.

When compared to equivalently under-sampled—but conventionally reconstructed data—Sonic DL images will demonstrate image quality approaching that of a fully sampled dataset. When used in sequences while holding time constant, Sonic DL can decrease the acquired voxel size, enabling resolution improvement. Images acquired with Sonic DL can be reconstructed with AIR™ Recon DL^{‡‡} to further improve image quality by removing noise and ringing.

In this issue of *SIGNA Pulse of MR*, see the articles on pages 8 (The democratization of cardiac MR) and 66 (Introducing Sonic DL for highly accelerated isotropic acquisitions). **S**

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*Sonic DL for 2D FIESTA Cine not available on SIGNA™ 7.0T.

^{‡‡}AIR Recon DL available as a separate option.

More to explore with SIGNA MAGNUS

The latest MR technology for neuroscience and neuroimaging is now US FDA cleared. SIGNA™ MAGNUS² is a cutting-edge MR scanner for both clinical and research users. At the heart of the new system is the MAGNUS head-only, high-performance gradient coil developed in collaboration between GE HealthCare, the United States Department of Defense (DOD) and National Institutes of Health (NIH). Since 2020, a growing number of conference presentations and published papers have further established the broad capabilities in both clinical and academic neuroscience by enabling high-performance gradient coil technology, without the conventional peripheral nerve stimulation (PNS) limitations observed on whole-body scanners.

The unique head-only, asymmetric gradient coil inside SIGNA MAGNUS builds on previous high-performance gradient technology by delivering 300 mT/m peak amplitude with 750 T/m/s slew rate with the same infrastructure requirements as a clinical 3.0T scanner. SIGNA MAGNUS aims to deliver significant new capabilities for clinicians and researchers working in neuropsychiatry, neurodegenerative disease and neuro-oncology, as well as a broad range of structural and quantitative imaging disciplines.

SIGNA MAGNUS enables clinicians and researchers alike to see further and go deeper. With SIGNA MAGNUS, there will always be more to explore. 

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GE HealthCare collaborates with NBA, NBPA, NGBPU and establishes sports medicine user group

National Basketball Association (NBA), the National Basketball Players Association (NBPA) and the Next Gen Basketball Players Union (NGBPU), in collaboration with GE HealthCare and MedStar Health, have embarked on a longitudinal pilot study of NBA G League players designed to collect data that could help promote player health and wellness and reduce injuries.

As the largest assessment of training and game load on athletic performance across a full professional basketball season, the study monitored musculoskeletal and joint health of NBA G League players from four teams during the 2023-24 campaign.

The study performed prospective, longitudinal assessments on athletes by combining daily use of wearable technologies to provide consistent measures of game and training loads with serial biomechanical, kinematic, and force-producing assessments. Advanced imaging techniques used in the study included ultrasound shear wave elastography, MR equipped with deep-learning reconstruction and image-based muscle analysis by Springbok Analytics. This study features SIGNA™ Premier 3.0T wide-bore MR scanner enabled with AIR™ Recon DL deep-learning-based reconstruction software for fast high-resolution imaging,

and specialized ultrashort-TE T2* research sequences to identify structural and compositional changes in the knee joint.

To further facilitate collaborations with GE HealthCare imaging users in sports medicine, the company has recently established a Sports Medicine User Group. The vision is to advance imaging innovation in athlete performance, injury prevention and rehabilitation by fostering a vibrant GE HealthCare user community that shares collective knowledge and experiences. The first meeting was held in July 2024 with a focus on muscle DTI. Experts from the University of Wisconsin-Madison Badger Athletic Performance, Emory University School of Medicine Sports Performance And Research Center, Hospital for Special Surgery and Springbok Analytics presented their research and experience using muscle DTI and muscle quantification to examine sports injury and recovery.

Bi-annual virtual meetings will be held with various focused topics, such as ACL injury, cartilage quantification, muscle health, bone health and concussion. To join the GE HealthCare Sports Medicine User Group forum, please register at <https://weconnect.gehealthcare.com/>. You will be notified on latest events and be able to view recordings from past events. 