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## Faster MRI Scans With Compressed Sensing from Siemens Healthineers



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- Siemens Healthineers underlines its position as innovation leader in magnetic resonance imaging with new acceleration technology
  - Compressed Sensing allows MR imaging up to ten times faster without compromising image quality
  - The first application, Compressed Sensing Cardiac Cine <sup>1</sup>, enables diagnostic cardiac imaging of patients with arrhythmias or of those with respiratory problems
  - Healthcare providers benefit from better economic utilization of their systems and higher competitiveness by increasing their patient population

At this year's Annual Meeting of the Radiological Society of North America (RSNA) in Chicago, USA, the separately managed healthcare business of Siemens AG is presenting itself for the first time under its new brand name, Siemens Healthineers. The new name underlines the company's pioneering spirit and its engineering expertise in the healthcare industry. With a new strategic direction, Siemens Healthineers aims to enable healthcare providers around the world to meet their current challenges and to excel in their respective environments. Through products and solutions designed to increase efficiency and to reduce costs, Siemens Healthineers is setting new trends in healthcare together with its customers – working under the motto "Engineering Success. Pioneering Healthcare. Together."

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At the 2016 RSNA, Siemens Healthineers unveils a groundbreaking technology that overcomes one of the major limitations in magnetic resonance imaging (MRI): Acquisition times can sometimes be long, which presents a significant challenge when scanning moving physiology. With Compressed Sensing, MRI scans can now be performed in a fraction of the time previously required for examinations. Rather than lasting roughly six minutes, Cardiac Cine imaging can now take just 25 seconds when using Compressed Sensing<sup>2</sup>. This is made possible by an innovative algorithm that drastically reduces the amount of data acquired, speeding up image acquisition drastically. The MRI scanner can accommodate more cases, and new patient groups can be treated. This represents Siemens Healthineers' contribution to the competitiveness and economic situation of healthcare providers in spite of growing financial pressure.

"Compressed Sensing enables scanning speeds that we could only dream of before," says Dr. Christoph Zindel, Vice President of Magnetic Resonance at Siemens Healthineers. "Working close with our cooperation partners, we have really been able to pioneer this technology. Compressed Sensing Cardiac Cine is just the first step; we are already working together with our partners to expand this technology, and will bring further applications to the market," says Zindel.

Due in particular to the unparalleled levels of tissue contrast it offers, its comprehensive and radiation-free visualization of morphology and functionality, as well as its ability to support physicians in gaining high diagnostic certainty, MRI has become a fixed component in radiological imaging. For cardiac cases, it is widely considered the gold standard for evaluating heart function. Yet, this method has a clear disadvantage when it comes to moving organs: Due to the long acquisition times, some examinations are limited in their application. Further increasing MRI scan speeds is therefore of critical importance – and this is where Compressed Sensing comes in.

### Only key data points acquired

Thanks to the new technology, fewer data points are needed in order to provide the radiologist with images of diagnostic quality. With the help of iterative reconstruction, high-resolution, high-quality images can be reconstructed – with no image information loss in the process. Additionally, the efficient inline reconstruction algorithm allows high clinical throughput. The acquired data is calculated directly at the scanner, requiring no export or external processing of the acquired data.

In cardiac imaging, Compressed Sensing Cardiac Cine takes full advantage of this algorithm: Rather than having to hold their breath 10 to 14 times, which can take roughly six minutes due to regenerative breaks during the scan, patients can breathe freely – as a result the acquisition roughly takes 25 seconds. To accurately assess additional quantitative information, such as ejection fraction, only a single breath hold is needed. Motion artifacts caused by breathing and heartbeats are effectively avoided. This is particularly beneficial for older and critically ill patients who are unable to hold their breath during the examination.

## **MRI for patients with cardiac arrhythmias**

With the high speed of Compressed Sensing Cardiac Cine, cardiac MRI has become accessible for entirely new patient groups, including those with cardiac arrhythmias. In the past, Cardiac MRI scans were never an option for these patients due to the low diagnostic quality of the images. This is no longer the case with the new application, as users can testify: "Since 38 percent of my patients suffer from arrhythmias, ten percent of which have atrial fibrillation, I use Compressed Sensing Cardiac Cine regularly," says Dr. Christoph Tillmans<sup>3</sup> from the diagnostikum Berlin clinic. "In patients with suspected constructive pericarditis, I'd like to visualize the movement of the cardiac septum as they breathe freely. And here Compressed Sensing Cardiac Cine provides me with diagnostic imaging quality," he emphasizes.

Thanks to adaptive triggering, the entire cardiac cycle – including diagnostic information about the late diastolic phase – can now be recorded in real time with only one breath-hold. As scientific studies have shown, Compressed Sensing Cardiac Cine also offers excellent visualization and quantification of the left ventricle function.

Taking the example of a single ventricular heart, a birth defect, Dr. François Pontana<sup>4</sup> of the University Hospital of Lille, France, draws the following conclusion: "The most important advantage of Compressed Sensing Cardiac Cine is that we can visualize the complete contraction of the heart chamber, of volumes and the ejection fraction, with only one breath-hold. It is particularly helpful in this case since the patients find it difficult to hold their breath. When monitoring patients undergoing treatment, this key benefit is hugely significant and clinically relevant."

The algorithm used by Compressed Sensing was developed by Siemens experts and won acclaim in 2014 at the Competition for Dynamic Imaging by the International Society for Magnetic Resonance in Medicine. Together with research partners, Siemens Healthineers further developed the algorithm and transformed it from an idea into a product. All over the world, selected customers have been using a so-called 'work-in-progress' (WIP) package for a number of years now, which is an imaging package for application in research. This Compressed Sensing technology has been tried and tested in a number of clinical settings; numerous studies attest to the advantages of the method.

**Source & Image Credit:** [Siemens Healthineers](#)

## **Reference:**

1 510(k) pending.

2 Sudarski et. al., Radiology. Jul 11:151002.

3 Dr. Christoph Tillmanns is engaged in collaboration activity with Siemens.

4 Dr. François Pontana is employed by an institution engaged in contractual collaboration with Siemens.

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