



Delivering Better Patient Care with SIGNA Architect

As a regional leader in outpatient-based diagnostic imaging, the radiologists and staff at Inova Fairfax MRI Center are focused on one thing: the patient. The imaging center, a partnership between Inova Health Systems and Fairfax Radiological Consultants (FRC) is constantly striving to elevate the patient experience through faster scanning, higher resolution images, and a better-tailored treatment plan... to ultimately deliver greater peace of mind for their patients.

It's this commitment to the patient that drives the Inova Health/FRC

partnership to seek out the latest advancements in medical imaging. So, when GE Healthcare shared that there would be an upgrade path from the Discovery™ MR750w 3.0T system to its next-generation 3.0T wide bore system, SIGNA™ Architect, both Inova Health's and FRC's interests were piqued.

"Most obvious to us was the extremely high channel coils available with the SIGNA Architect," says Tom Schrack, ARMRT, CS, Manager of MR Education and Technical Development for MR Services at FRC. "When the number of channels and elements go up that significantly, we can achieve a higher

SNR that we can then use for higher image quality, reduced scan time, or some balance of the two."

In late February 2017, the Discovery MR750w at Inova Fairfax MRI Center was upgraded to SIGNA Architect. The practice also acquired several new coils: a 16-channel Shoulder, 18-channel Knee, 16-channel Hand/Wrist, and the 48-channel Head Coil. As soon as the system was installed, FRC began immediately scanning patients and they have made significant protocol adjustments that increase spatial resolution and/or reduce scan times, based on the SNR boost of the coils as well as the coil design.

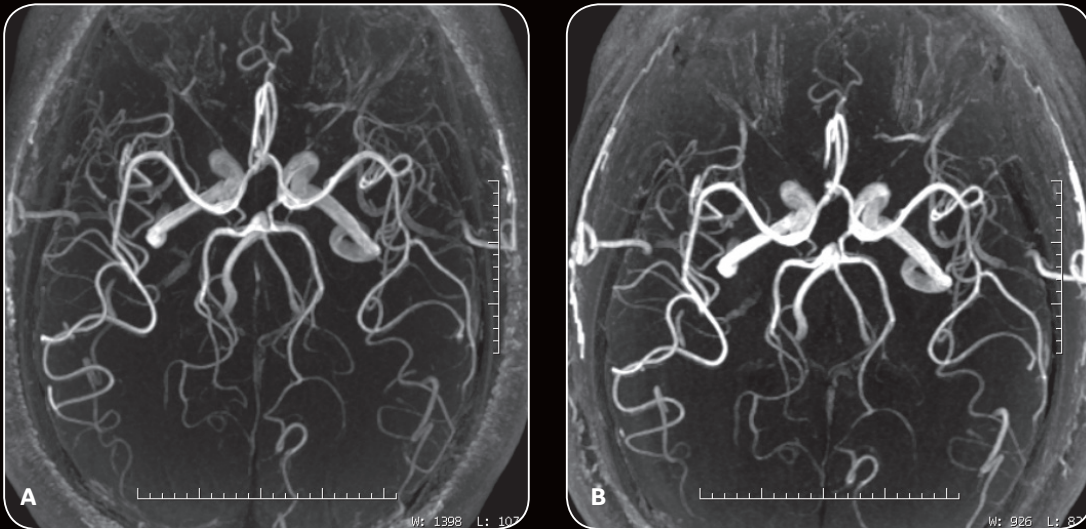


Figure 1. Intracranial 3D Time of Flight (TOF) utilizing the 48-channel Head Coil; (A) the scan time was 5:31 min. without HyperSense while (B) scan time was 2:25 min. with HyperSense and similar image quality.

In fact, technologist training at FRC is going much smoother than Schrack anticipated, even with all the new capabilities such as HyperSense, HyperCube, MAGiC DWI, PROPELLER MB, and the new READYView post processing software for multi-parametric exams.

“With SIGNA Architect, we have a new paradigm of what is an acceptable, diagnostic exam,” Schrack adds. “We have a much larger toolbox to deal with problematic patients, and so we are working with our staff to help them understand they don’t have to accept anything less than a high-quality scan.”

HyperSense, HyperCube, and MAGiC DWI

One significant advancement available on SIGNA Architect is HyperSense, GE Healthcare’s compressed sensing technique.

“Compressed sensing is the next wave of the future,” says Melany

Atkins, MD, a diagnostic radiologist specializing in body and cardiac imaging at FRC. “We don’t lose any quality with HyperSense—there is no loss of resolution—and it will provide a significant time savings for us.”

Schrack agrees, “It is so good that we can’t wait for it to become available in other sequences; we want to use it everywhere we can.” Currently, HyperSense is available on SIGNA Architect for volumetric acquired sequences, such as 3D Cube, 3D MRCP, and MR angiography (MRA); however, GE has plans to expand it to other imaging sequences.

As an example of the time savings using HyperSense, FRC was able to complete a non-contrast 3D TOF that typically takes 5 minutes in less than 2.5 minutes. A non-contrast carotid exam, from the Circle of the Willis to the arch, went from 7 minutes to 3.5 minutes. In each case, Schrack says the images were even better

than without HyperSense—he even felt the carotid exam was as good as a contrast-enhanced exam.

“The intracranial MRAs are now so fast we changed how we schedule these exams to a much shorter time slot.”

In pelvic imaging, HyperSense coupled with HyperCube is delivering amazing results. Dr. Atkins says that previously a lot of time would be spent capturing high resolution T2 images in multiple planes. Now, by using HyperSense with HyperCube, they can just acquire a 3D volumetric Sagittal sequence and then reformat to the other planes. Schrack estimates they are saving 10 minutes per pelvic exam and he sees great opportunity to apply these techniques in prostate, cervical, and endometrial exams. In fact, FRC plans to compare prostate exams with and without an endorectal coil to see if they can avoid using it, which Dr. Atkins believes may help increase patient comfort.

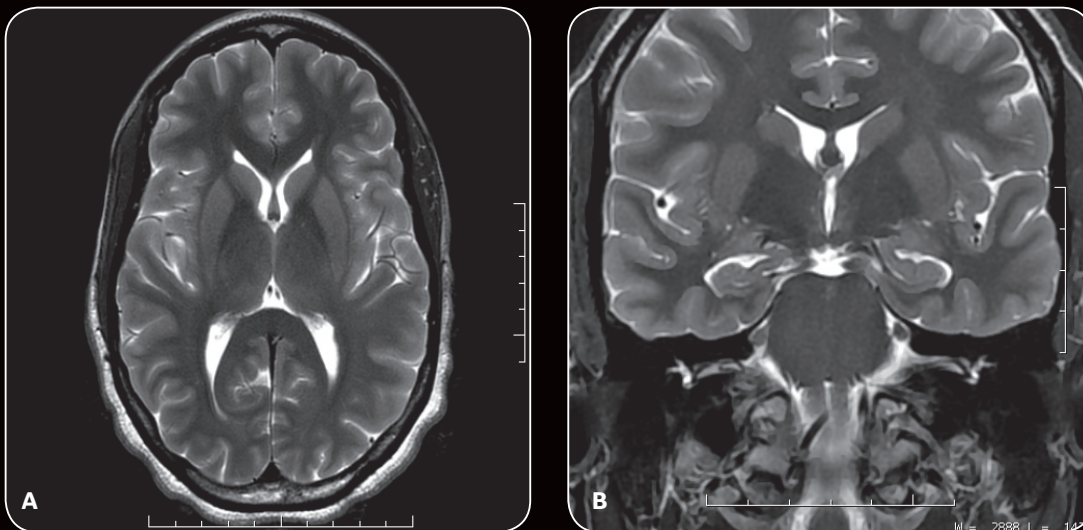


Figure 2. (A) Axial and (B) Coronal images using the 48-channel Head Coil. Note the excellent image quality and contrast resulting from the increase in SNR.

“We are getting beautiful images in less time,” Dr. Atkins adds. “I was a fan of Cube before, but this is a real advantage.”

MAGiC DWI is another new sequence for body and neuro imaging that promises to generate images with the greater diffusion sensitivity of higher b-values without the associated loss of SNR and with zero scan time penalty. In the body, Dr. Atkins believes it will provide value in rectal, uterine, and cervical cancer imaging and FRC is currently working on implementing the sequence. In the brain, Schrack says it has already been folded into all neuro imaging studies for the additional information it provides on the sensitivity for diffusion depths. With the extra b-values, radiologists have more information to find areas of low diffusion.

MSK and body imaging

In MSK imaging, high SNR is essential for radiologists to visualize small structures, such as meniscal or cartilage tears. While 3.0T provides a significant advance in MSK imaging, the higher channel counts from the new coils are also making a noticeable difference in image quality.

“With the new coils and improved SNR we are getting more signal, which we can then use to increase resolution or shorten scan time,” says Stephen A. Meyers, MD, an MSK radiologist with FRC. He adds that the team is working on the protocols to obtain higher resolution images from the increased signal.

The hips are another body area where gains in SNR are being utilized to shorten scan times. Schrack says that in one of the first routine hip exams performed on the SIGNA Architect, he was able to shave 10 minutes off the scan time with the boost in SNR. The

staff, under the guidance of Dr. Meyers, is currently working to further balance image quality with scan time.

In patients with MSK or other sports-related injuries, pain can often lead to patient movement. Says Dr. Meyers, “The new PROPELLER MB seems to provide a big improvement over the prior version. At times, I can’t tell the difference between a PROPELLER and non-PROPELLER image unless the patient moves, and then we’re getting a really good image. Previously, we only used PROPELLER in cases of severe motion due to the streaking artificial appearance that it had, but now that the scan looks just like a standard scan—but with no motion artifact—I’m more inclined to use it with any type of motion.”

Schrack says that he is also training the 20 staff technologists to use PROPELLER. “We don’t have to live with motion in joint imaging anymore. The T1 PROPELLER sequence is becoming very important in our MSK imaging protocol.”

Knee imaging with the 18-channel coil has also been put to the test. Dr. Meyers has made some “radical changes” to the protocol, such as using ARC parallel imaging—which the practice has not used in knee imaging before—and decreasing scan times. In Axial FatSat sequences, FRC can use acceleration without decreasing image quality. The practice is using ARC accelerations in Coronal and Sagittal planes in an effort to further reduce scan times.

“We have started rethinking how we schedule MSK exams,” says Schrack. “We can do a knee pretty fast, so we’ve already shortened those slots from 45 to 30 minutes. In fact, we can do most MSK exams—routine wrist, ankle, and foot—in 20 to 25 minutes without compromising image quality and SNR.

The same can be said with the new hand/wrist and ankle/foot coils. FRC can use ARC and still get great image quality—Schrack says the images are phenomenal and the choices available

with these new coils will be a big boon for MSK imaging. For example, the hand/wrist coil comes with an apparatus that allows positioning either on the side or in the superman position, making positioning easier for the technologist to achieve the perfect plane and minimize any movement. Currently, the site is acquiring wrist images that are less than 2 mm slice thickness at 1 NEX.

GE Healthcare’s new 16-channel shoulder coil is also a big win for FRC. Dr. Meyers has been pushing the limits of resolution with high matrixes on the edge of SNR. Positioning is easier, Schrack adds, and if the patient is breathing they don’t see motion artifacts. There is no question this coil delivers higher resolution and sharper image quality, says Schrack. “We are using surface coil corrections to even out the signal, because the image does get brighter as we get closer to the coil. That just shows how much SNR this coil has.”

The addition of Auto Navigators allows FRC to perform many abdominal imaging techniques during quiet free breathing. Dr. Atkins explains, “Therefore, with patients who are unable to hold their breath, we can reduce motion artifacts in a similar scan time.” The new Auto Navigation technique allows for improved efficiency over the previous Navigators with no need to use bellows. In addition, the technique is easier for the technologist.

MR neurography is another clinical area where FRC hopes to grow the practice. Dr. Meyers believes SIGNA Architect will provide additional benefits in areas that are difficult to image and also improve the quality of 3D images.

Neuro imaging

Schrack calls GE Healthcare’s new 48-channel Head Coil a “hot” coil. While there is clearly better SNR from the 32-channel Head Coil FRC was using, sites moving from an 8-channel or

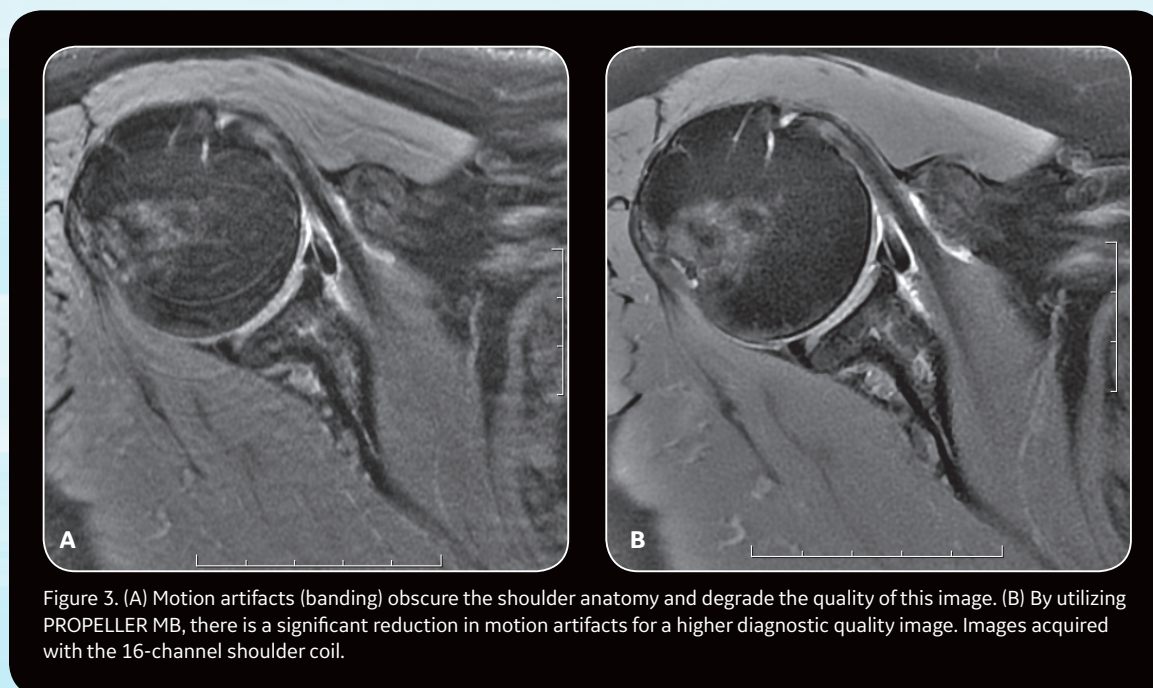


Figure 3. (A) Motion artifacts (banding) obscure the shoulder anatomy and degrade the quality of this image. (B) By utilizing PROPELLER MB, there is a significant reduction in motion artifacts for a higher diagnostic quality image. Images acquired with the 16-channel shoulder coil.

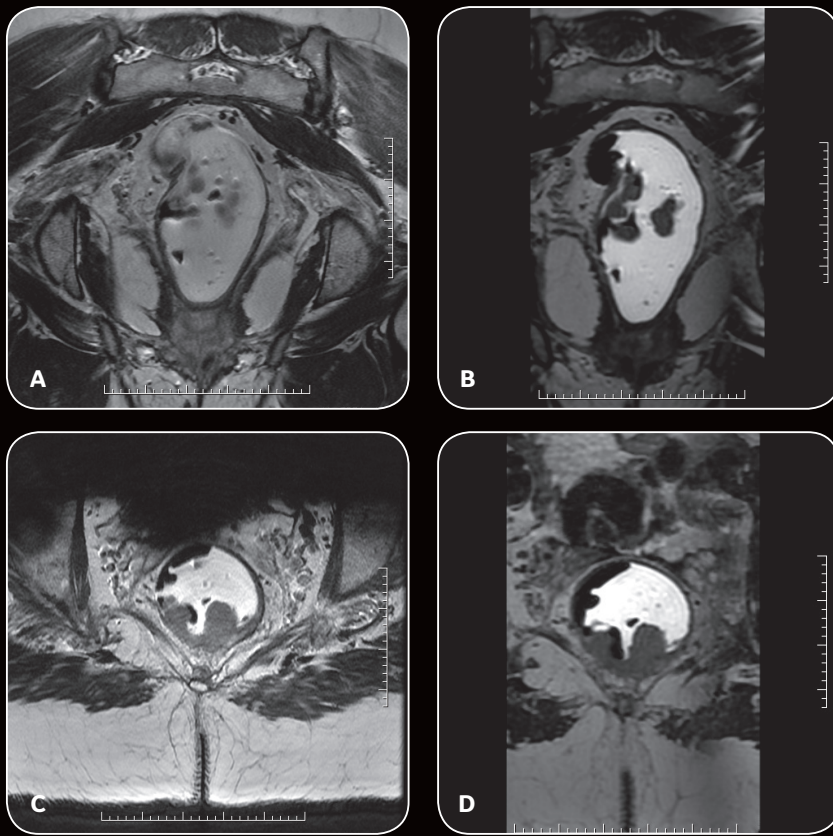


Figure 4. Pelvis rectal exam demonstrates the value of HyperCube. (A,C) Total scan time for Coronal and Axial was 4:15 min. (B, D) By using HyperCube, images are acquired in a total scan time of 2:59 min. with the ability to reformat in any plane without loss of image quality.

24-channel Head Coil, “will be blown away by the 48-channel Head Coil,” Schrack says.

For Schrack, the “wow” factor on the new head coil is the new expander, designed to help it fit 99.99% of the population, including professional football players with thick necks, large heads, and broad shoulders.

“We’ve already used the expander more often than we thought we would,” Schrack explains. “It has helped us clear the nose in several large patients—it is just a great design idea.”

The surprisingly light 48-channel Head Coil can also provide enough coverage for a C-spine if needed, adds Schrack. Protocol changes have also been made to accommodate the ability to apply new acceleration techniques to neuro imaging.

Cardiac imaging

Dr. Atkins believes that the improvements in the SIGNA Architect in conjunction with the new ViosWorks sequence is making a dramatic difference in cardiac patient evaluations. “The benefit is significant in cardiac imaging with the increased SNR—additional improvements allow for decrease in flow artifact as well as improvements in tissue contrast. Over time, we hope to utilize the 4D Flow to calculate both flow and function, but we’re not there yet.

“The speed of the 4D Flow reconstruction algorithm is faster and a big improvement from before, particularly with the cloud-based server,” Dr. Atkins continues.

“We are able to achieve a 20-minute turnaround for post-processed images

now with ViosWorks in a secure, protected environment.”

As a result of her experience with ViosWorks—both the prototype on Discovery MR750w and the newer version on SIGNA Architect—Dr. Atkins no longer acquires traditional phase contrast data. “I feel confident with the results from 4D Flow that I can rely on it for all flow data. We are still acquiring SA and HLA FIESTA stacks, but our future goal is to just acquire the 4D Flow and delayed enhancement when necessary.”

In early April, Dr. Atkins and Schrack had a chance to implement this revised protocol on a pediatric patient with Tetralogy of Fallot, which involves annual or every other year CMR exams to monitor the condition and/or help

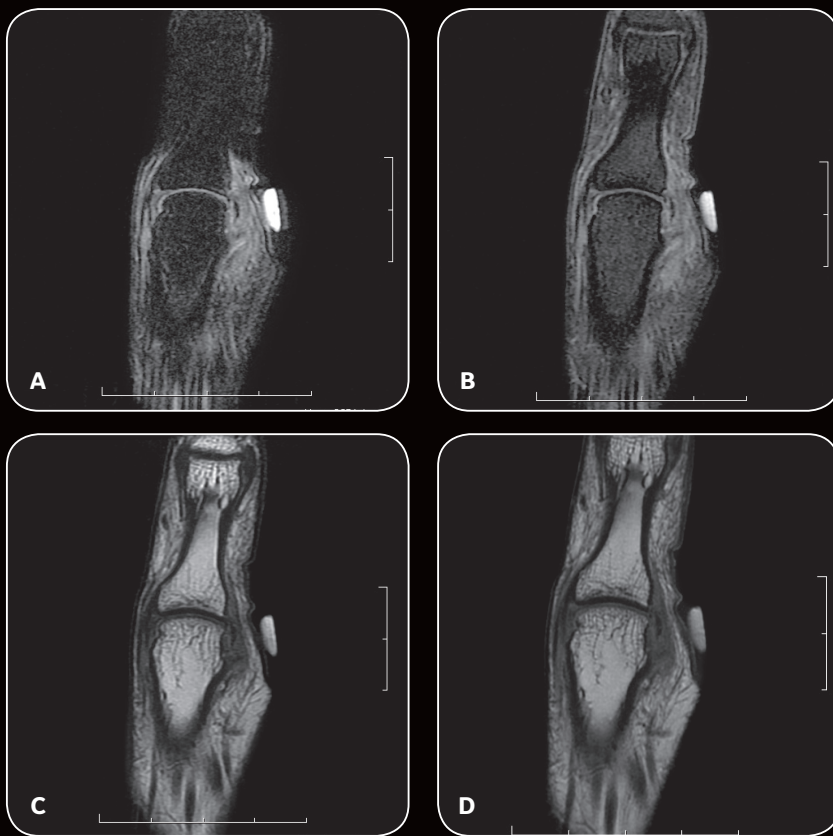


Figure 5. (A) Using conventional FatSat techniques in a 3:32 min. scan time, there is a failure of fat suppression in this thumb exam. (B) FSE Flex delivers more uniform fat suppression with time savings (2:31 min. scan time). (D) By using FSE Flex, the in-phase images are also acquired with no additional time, while (C) with conventional FatSat the in-phase is an additional scan, in this case 2:18 min. Total scan time with conventional FatSat is 5:50 min. Total scan time with FSE Flex is 2:31 min., shaving more than half the scan time from this type of exam.

evaluate treatment response. In the prior exam on the Discovery MR750w, the exam took 92 minutes; on SIGNA Architect with ViosWorks, the exam took 36 minutes.

A key success for Dr. Atkins was convincing one of FRC's cardiac imaging leaders who has been in practice for over 30 years to remove the traditional phase contrast sequences. "That just speaks volumes about the quality of the imaging we are obtaining with 4D Flow," she adds.

The goal, Dr. Atkins says, is to achieve 45-minute imaging slots for cardiac viability studies and adult cardiac congenital exams. Yet, it's not just the time savings that Dr. Atkins sees as a benefit. By moving all cardiac exams to the new 3.0T scanner, she has been able to take advantage of these

improvements, including increased SNR, improved T2 signal homogeneity, and decreased flow artifacts with the utilization of dual shimming. The ability to utilize dual shimming has also improved flow artifacts.

A scanner for the future... today

According to Schrack, the practice is striving to add at least two patient MR exams each day on SIGNA Architect—without increasing hours of operation. "We have an idea where that may occur and are looking at making changes in our scheduling to take advantage of all these enhancements. As an example, we've changed our scheduling for knees and ankles into shorter time slots. The same for intracranial exams. And we know there is more to come."

Beyond the boost in SNR and shortened scan times, Schrack also sees greater consistency in the same studies across different patient types. And that helps the radiologists provide better, more detailed reports which translates to more satisfied referring physicians and patients.

FRC is a busy imaging practice with an exceptional reputation for quality imaging and reporting. Although the new MR system is bringing new applications and capabilities to the practice, what is most important is the quality of the study and the reports. Adds Schrack, "SIGNA Architect makes it easier for the radiologists to deliver that same high quality diagnosis for which we are known." **S**