Issue 32 - July 2007

Field Strength

Publication for the Philips MRI Community

- SmartExam helps to banish most repeat knee studies at Desert Medical Imaging
- Leaps in scanning efficiency at Nevada Imaging Center
- MidMichigan thrives with Panorama HFO and Achieva 3.0T X-series
- Vanderbilt University research probes form and function with MR
- HRP research project zeros in on stroke, heart attack triggers

PHILIPS

Dear Friends,

In this issue of *Field Strength*, we present you with a fascinating variety of articles covering several key product categories.

Desert Medical Imaging (DMI), a Panorama HFO pioneer, continues to accumulate "firsts" with this system, this time in the context of new SmartExam Knee. The sophisticated anatomy recognition that made SmartExam Brain an incredible workflow tool, now streamlines knee studies at DMI, reports Dr. John Feller. DMI also is showcasing the benefits of asymmetric TSE, for fast, high quality proton density imaging.

MidMichigan Regional Imaging desired the ability to perform the most advanced studies, while at the same time accomodating patients who could not or would not be scanned in a cylindrical system. Their "4T" solution – an Achieva 3.0T and a Panorama HFO (1.0T) – is ensuring they can scan virtually every patient that comes to their door.

Nevada Imaging Centers (NIC) is featured in a captivating story on a pilot project on Philips' utilization management tool. This tool uses data from the MRI system's service log to inform imaging centers about how efficiently they use scanner time. At NIC, Dr. William Orrison is reporting incredible productivity increases after implementing changes based on the tool's data.

With SENSE Breast coils and Invivo's incredible DynaCAD workstation, clinicians such as Mayfair Radiology's Dr. Mark Lawton now have exceptional solutions for scanning, post-processing and procedure planning.

Vanderbilt University and its faculty and staff at the Vanderbilt University Institute of Imaging Science (VUIIS) make their *Field Strength* debut with an article on VUIIS's imaging research. VUIIS investigators are using their Achieva 3.0T and other imaging modalities to explore the pathophysiology of disease, in studies of brain structure and function, presurgical mapping and many other areas.

We also report on the exciting multi-company HRP research project, in which Philips is a leading participant. The project will involve up to 6,000 high-risk volunteers, and it will entail – among other multi-modality studies of various anatomy – carotid artery MRI on a mobile Achieva 3.0T system.

Finally, our application tip on dual-coil imaging, provides tips on how two individual coils may be combined to one unified coil with more elements.

I wish you enjoyable reading!

Maurits Wolleswinkel
Head of Global Product Marketing MRI

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SmartExam helps to banish most repeat knee studies at Desert Medical Imaging

Total scan automation boosts efficiency, reproducibility

John F. Feller M.D.

The exceptional intelligence of SmartExam's anatomy recognition software has rendered knee scout and pulse sequence retakes virtually non-existent at Desert Medical Imaging (DMI, Indian Wells, Calif., USA), one of the first users of the Panorama HFO system. After just a few months of use, SmartExam has provided nearly flawless study reproducibility and major increases in operational efficiency via seamless scan automation. Desert Medical, the first clinical Panorama HFO site to validate SmartExam for the knee, also has enjoyed much improved proton density (PD) weighted imaging of the knee with asymmetric TSE, a new functionality that provides time-efficient PD imaging with high image quality.

Any strategy that may increase scanning efficiency is welcome at Desert Medical Imaging, as the Indian Wells, Calif. center strives to counterbalance the financial impact of the U.S. Deficit Reduction Act. While the impact of government regulations on imaging economics isn't isolated to the United States, the changes for American imaging centers have been drastic, according to DMI's medical director, John F. Feller, M.D.

"Panorama HFO and SmartExam helped us decrease scan slots to 30 minutes and increase throughput from 15 to 20-25 exams per day."

"We're facing a 25 percent reduction in revenues from Medicare, which represents 40 percent of our payor mix," he notes. "That translates into a 10-15 percent reduction in total revenues. We needed to increase efficiency. Switching from a low field open system to the high field open Panorama and implementing SmartExam for first brain and then knee studies, contributed to our ability to decrease scan slots from 45 minutes to 30 minutes and increase our throughput from about 15 exams per day to 20 to 25 per day."

New SmartExam Knee streamlines studies

By February 2007, Desert Medical had used SmartExam Knee – which plans examinations through 3D recognition of key bony anatomy (tibia, patella, femur) in both right and left knees – in over 100 examinations. During the previous two months, DMI clinicians had proven SmartExam Brain's clinical utility in more than 200 brain studies.

The first step was to help SmartExam "learn" how to plan knee studies, which was conducted by allowing SmartExam to develop plans under technologist supervision and correction. Remarkably, this teaching period comprised just 15 knee cases – and after a total of 30 knee cases, SmartExam had reached "mature" status for knee imaging.

"During that time, only two cases required significant technologist intervention," Dr. Feller recalls. "One was for a very large patient whose knee we had to scan with another coil, and in the other case, SmartExam had difficulty planning because the technologist had externally over-rotated the knee and SmartExam couldn't recognize the orientation."

Similar to SmartExam Brain, using SmartExam Knee has resulted in operational efficiency gains, he observes. "In addition to decreasing the duration of the scan slot from 45 minutes to 30 minutes, there have been obvious decreases in the number of repeat survey scans and repeat pulse sequences among our less experienced technologists," he says.

Technologists reap more time for other tasks

No longer burdened by scan planning duties, Desert Medical's technologists report that they now have time to engage in more rewarding tasks, including 3D processing, PACS processing and developing ExamCard protocols.

Gaining so much extra technologist spare time is not too surprising when comparing the number of discrete steps involved in a typical MRI scan from planning to end of acquisition. For a knee study alone, Dr. Feller calculated that 32 separate mouse clicks are required to manually perform the examination, as compared to just two with SmartExam.

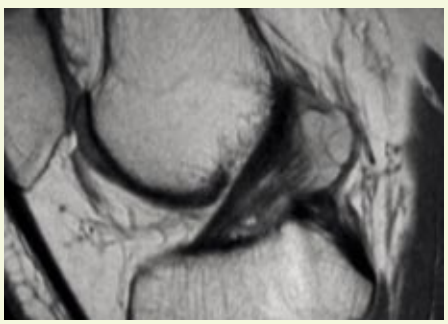
"It's very unusual to find a process for which you can so drastically reduce the number of steps without compromising quality," Dr. Feller observes. "In many ways, manual MRI scan planning involves many mindless clicking and dragging tasks, but SmartExam helps replace mundane activities with tasks that require higher order decision-making on the technologist's part."

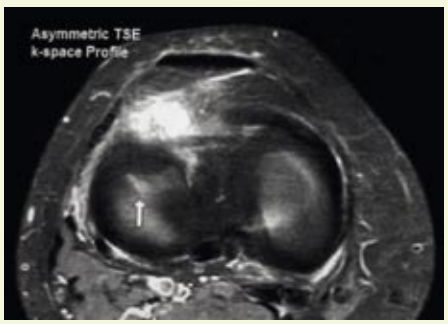
Asymmetric TSE improves proton density weighted imaging

An ingenious Philips-exclusive strategy that uses asymmetric profile ordering to fill k-space has reduced both proton density (PD) Turbo Spin Echo (TSE) blurring and PD TSE acquisition time. The emergence of asymmetric TSE (a-TSE) was good news for Dr. Feller, who counts on proton density TSE sequences for musculoskeletal imaging.

"For years, pulse programmers have devised many fancy k-space trajectories for things like cardiac imaging and contrast-enhanced MRI, but no one paid any attention to musculoskeletal imaging, for which proton density TSE is the workhorse sequence," Dr. Feller says. "Regrettably, PD TSE is susceptible to image blurring if your echo spacing is large (>120 ms), where shot length = TSE factor (TF) x echo spacing (ES). Historically, the ES depends on the TE you selected. For example, if you select a TE of 20 ms, then the ES also is, automatically, 20 ms, which tends to result in blurry images at reasonable TSE factors. The lower the ES, the less blurring. Generally, for orthopedic work, you want

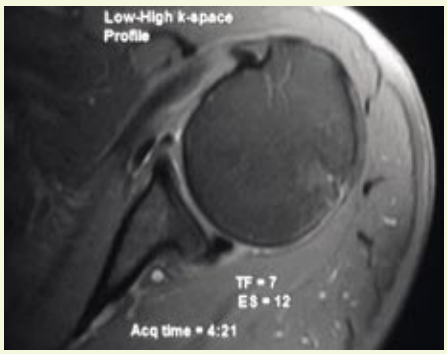
"Just two mouse clicks are required with SmartExam as compared with 32 to manually perform the examination."

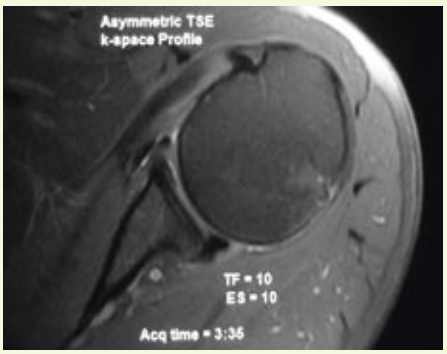




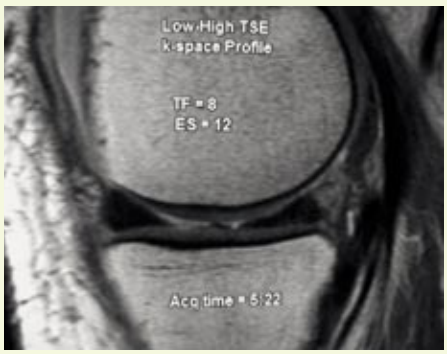
SmartExam automatically planned, scanned and reconstructed these Panorama HFO knee images.

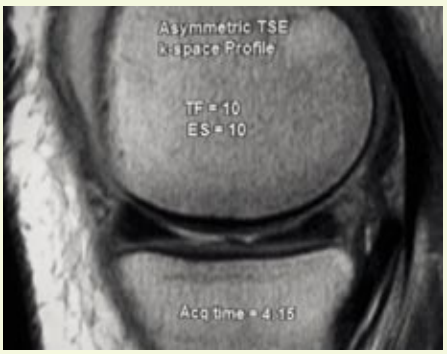
SmartExam improves workflow, efficiency, image quality reproducibility and throughput. It is especially effective for boosting throughput with less experienced technologists, because it reduces repeats of surveys and other scans.





Comparison of low-high profile order and asymmetric TSE in the shoulder demonstrates that a-TSE reduces PD TSE blurring and acquisition time.





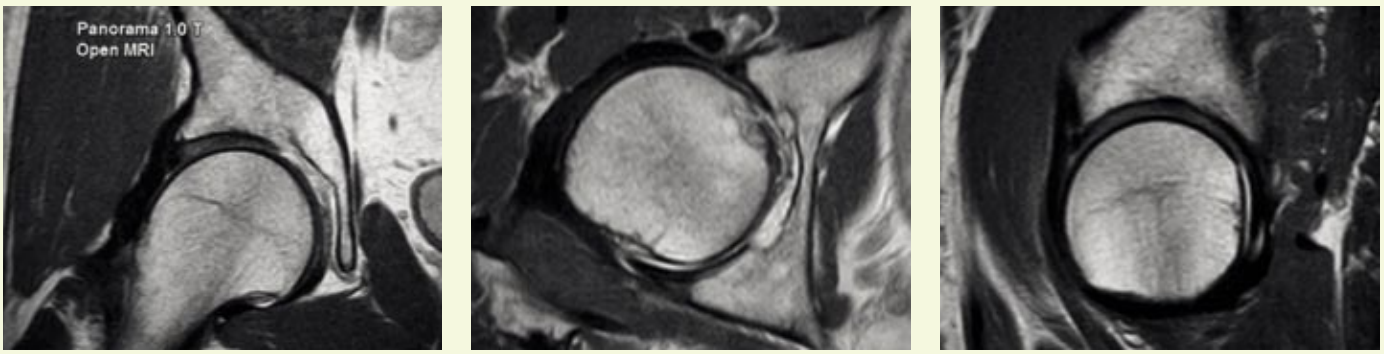
Comparison of low-high profile order and asymmetric TSE in the knee demonstrates that a-TSE reduces PD TSE blurring and acquisition time.

an ES of between 8 and 12 ms, and a shot length of ≤120 ms.

"Asymmetric TSE allows independent selection of TE, TF and ES," continues Dr. Feller, who has used a-TSE since October 2006. "So, I can pick a TE of 18 ms, for example, and an ES of 10 ms to avoid blurring. Then I know empirically – from having tested many different shot lengths – that my TF needs to be low enough to keep the shot length less than or equal to 120 ms. Accordingly, with my ES of 10 ms, I will select a TF of 10 to 12. Previously, using a TF of more than 8 would increase blurring. But with a-TSE, I get the best of both worlds – reduced blurring and reduced acquisition time."

Desert Medical Imaging, Palm Springs, Calif., USA.

At DMI, use of a-TSE has improved PD TSE knee studies, particularly imaging of subtle meniscal tears and chondral defects. Before availability of a-TSE, obtaining optimum image quality meant settling for a longer than desirable acquisition time due to the necessity to keep the TF at 8 or less. "Plus, you might be stuck with a TE that you don't especially like," Dr. Feller adds. "For example, if you wanted a higher TE, say 30 ms, to nicely visualize the articular cartilage, then the ES would also have to be 30 ms, thereby contributing to image blurring. With a-TSE, we can pick 30 ms as our TE, pick an ES of 10 ms and still get good cartilage contrast-to-noise ratio with



Asymmetric TSE in the hip.

no blurring at reasonable acquisition times. It's very nice to have these parameters independently selectable now."

As a bonus, a-TSE also can be used for T2- and T1-weighted TSE sequences to reduce acquisition time. In fact, DMI has documented a-TSE scan time reductions for many applications. (see table)

"Although a-TSE was first used in orthopedic imaging, it ends up being exceptional for TSE imaging in other anatomies, because it can reduce acquisition times," he says. "I'm very pleased. It's nice to see that Philips people worked hard to develop a method that directly addresses the problems with orthopedic imaging and actually spun off scan time reduction benefits for other TSE applications."

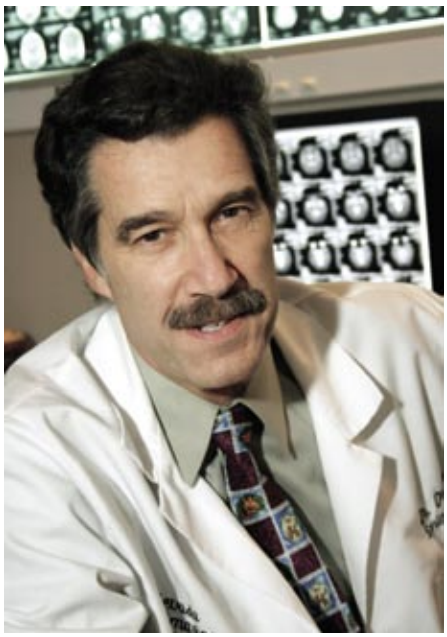
"Although asymmetric TSE was first used in orthopedic imaging, it ends up being exceptional for TSE imaging in other anatomies."

Summary of scan time reductions (min:sec) with asymmetric TSE

	T1 TSE	Ax PD TSE	Sag PD TSE	Cor T1 TSE	Cor PD TSE
Shoulder		1:45	1:21	1:05	1:17
Wrist	0.34	0:39	1:00		1:20
Hip		1:14	1:02		1:16
Knee		0:08	1:23	0:45	1:32
Ankle		0:07	0:01		1:16

Leaps in scanning efficiency on horizon

New Utilization Services tool pinpoints "time-wasters" in MRI system use; Nevada Imaging Center's scanner utilization jumps to 75 percent.



William W. Orrison, M.D.

Philips has developed an MRI system Utilization Services tool to analyze information routinely gathered in the scanner's service log. The new tool accesses data – such as system idle time, interval between scans, patient preparation time, sequence acquisition times and entire scan times – and provides it in a unified graphical format. The result is an immediate visual, and often dramatic, representation of the scanning efficiency of a center's MRI system and scanning practices. Nevada Imaging Centers (NIC, Las Vegas, Nev., USA), one of three sites testing the software in a three-month pilot project, was able to increase its system utilization from 60 percent to 75 percent soon after implementing practice changes, says NIC's William W. Orrison, M.D.

For years, Philips' Remote Service Network (RSN) has quietly monitored and gathered operational data from the hundreds of MR systems worldwide tethered to RSN via an ultra-secure Internet connection. Until recently, RSN's main benefit was the possibility to preemptively address system problems, but Philips has engineered an ingenious new way to repurpose RSN: probing the scanner's log files to analyze system utilization.

An opportunity for greater efficiency

In December 2006, Philips representatives approached NIC officials to solicit their participation in a 90-day utilization management pilot project involving three North American sites. NIC is a high-throughput imaging group with five locations in the Las Vegas area. NIC operates a Philips 3.0T system and a Panorama HFO. The 3.0T system enables the center to perform advanced studies, for example, those requiring high SNR and/or high spatial resolution, at a high patient volume per day.

"We knew for a long time that through RSN, Philips could monitor our Intera 3.0T for repair purposes," says William Orrison, M.D., NIC radiologist. "What we didn't know was that we could consolidate information from the system log files into a program that we could access on demand via the Web (NetForum Community) and examine. When they showed us the utilization data from our system in a graphical format we were astonished. Our scanner was idle – it was doing nothing – 30 to 40 percent of the time."

"When they showed us the data from our system in a graphical format we were astonished: our scanner was idle 30-40% of the time."

A significant additional incentive to evaluate the software is the impact that the Deficit Reduction Act (DRA) – which will reduce MRI study reimbursement by as much as 20 percent – will have on many American imaging centers, says NIC business advisor, Peter Cartwright. "The only way to survive in this environment is to increase efficiency. But, like many other centers we didn't appreciate exactly where our efficiencies and inefficiencies lie," he says. "The Utilization Services tool is enormously illustrative to use in terms of isolating the factors that are limiting our utilization."

The value of a graphic

The actual percentage of system idle time aside, Dr. Orrison recalls that this statistic had much greater impact when Philips representatives displayed it side-by-side with other time-related MR scan data in a color-coded graphic. (see graphic on page 11). Among other coding, dark blue is assigned to live scanning intervals and gray to system idle periods.

"Radiologists are visually-oriented. You can tell me that 40 percent of the time my system is not being utilized and I will probably dismiss it," he observes. "But, you show it to me on day-by-day, week-by-week graphs, including the hours each day and the gaps in the schedule where the system is just sitting there, then all of a sudden those pictures just slam you in the face and you realize how intensely you want less of that gray. For me, it was one of those 'aha!' moments."

Cartwright agrees: "Instead of simply telling our staff that we're not running very efficiently, we were able to show them graphically and they responded very well to that."

Pilot project helps identify sources of inactive scanner time

Not surprisingly, Dr. Orrison and his NIC colleagues volunteered to be one of the three North American pilot sites for utilization management and began using the software tool in January 2007. Dr. Orrison's team immediately identified time-wasters at NIC that contributed to excess gray space on their daily utilization log and set out to implement solutions.

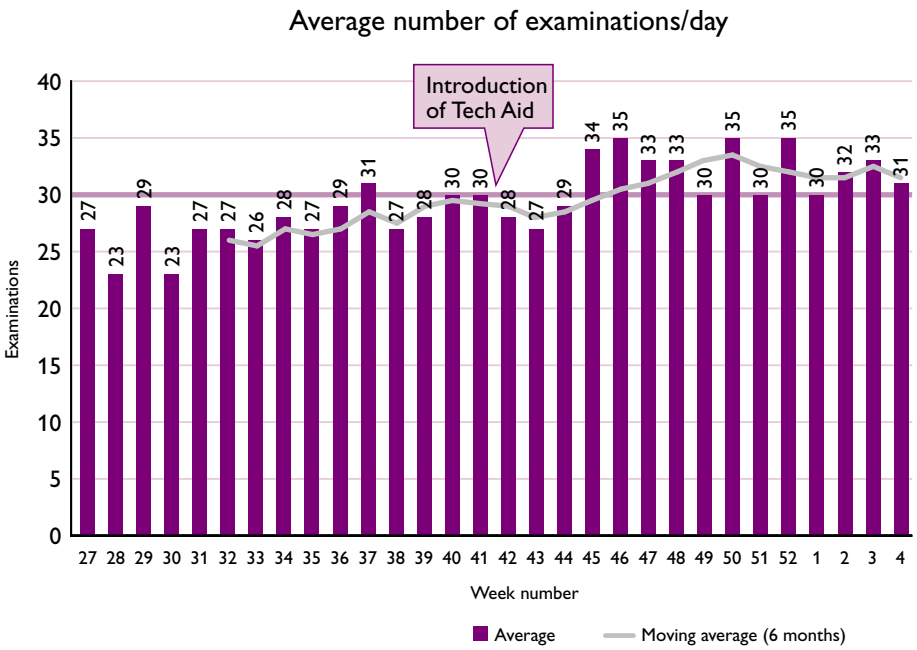
One the most significant contributors to gray space were "no-shows," in which patients not only did not show up for their scheduled scan, but also did not notify NIC about their impending absence. No-show-no-calls were a completely random problem that could not be predicted and preempted, according to Dr. Orrison.

"We implemented an aggressive 'call-the-patient-the-night-before' routine, so that if we were unable to reach the patient, we would start planning to bring in an alternate patient to fill the slot," he explains. "Frankly, we also had to move no-show-no-call patients to non-prime-time slots, such as last slot or first slot of the day so we didn't lose prime time to them. It is basically a 'one strike and you're out' rule as far as prime-time scheduling."

Another time-waster at NIC was the lag time between patients. The solution to this problem was to hire a full-time technologist aide, whose duties are to prepare the patient for scanning, have them fill out paperwork, discuss the upcoming scan and record relevant patient history. "Essentially, when the door to the system room opens, the patient is ready to walk in so the technologist can just continue preparing the scan," Dr. Orrison says.

Although a RIS upgrade hadn't yet been implemented in March 2007, the results from the Utilization Services tool made the upgrade inevitable. "For two years, we considered upgrading the RIS, but once we realized our overall inefficiencies with scanner use, we were determined to attack the problem in every way possible," he says. "Using the existing system, the technologist has to individually type in all the data, there is no worklist on the scanner. The new RIS has a technologist worklist, the data are all propagated automatically so names don't have to be typed, and it will track the patient through the scanning process. The new RIS will allow us to be much more efficient with our time.

Waiting to start intravenous lines until the patient is on the table means the scan won't start until this step is complete, adding to system idle time, Dr. Orrison adds. Therefore, patients requiring contrast receive their IV lines outside of the scan room now, to increase active scanning time.



This graph illustrates that the average number of patients scanned per day increased after hiring the technologist aide.

"We addressed the 'no-show' problem, hired a full-time technologist aid to prepare patients and upgraded our RIS."

Nevada Imaging Centers, Las Vegas, Nev., USA.

"Utilization Services is a terrific product and I think Philips is completely on the right track. They understand the needs of outpatient imaging centers."

Avoiding protocol "mission creep"

Because the Utilization Services tool also tracks overall examination times and the scan times of individual sequences comprising protocols, Dr. Orrison was able to appreciate very quickly that NIC was suffering from what he calls protocol "mission creep."

"All sites tend to add sequences to protocols – but it's unlikely that they would take them away. There is a 'mission creep' factor," he remarks. "What happens is you're doing a brain sequence and you decide that a particular sequence really ought to be performed in some of your patients. Accordingly, you add that sequence, then you add another, and pretty soon, protocols are getting longer and longer. Before you know it, 'Mrs. Jones' has been in the scanner from 8:00 to 9:30."

Dr. Orrison's solution was to create many new protocols tailored to narrowly defined applications. In the brain, for example, NIC went from four more or less omnibus brain protocols to multiple dedicated protocols. Selecting the right protocol for a given patient became a new radiologist responsibility at NIC, but the extra time was more than made up for in reduced scan times for many patients.

"'Mrs. Jones' still might need 90 minutes in the scanner, but the next patient might get a 15-minute protocol," he says. "We would save two, three or four minutes per protocol in many cases. In others, we would spend more time than usual, but the key is we're not spending more time on everyone."

Measuring progress is watching blue bars grow

The graphic product of the Utilization Services tool allowed NIC to easily measure the impact of their interventions on system use.

"We can take a snapshot of time periods from an hour, to a day, to a week, to a month," he says. "We looked at our graph in the beginning and then periodically to see how our solutions have affected system utilization. Finally, we are able to stop guessing about our efficiency, and start knowing about it."

Dr. Orrison reports that the practice changes his team has implemented have increased system utilization to 75 percent, with 90 percent utilization the ultimate goal.

He credits the explicitness of the Utilization Services tool's graphic interface as compelling the changes that NIC adopted. "The utilization times are presented in a way that makes the inefficiencies and discrepancies between different patients so obvious that the possible solutions overwhelm you," he says. "I am sure there are more things we can do to increase efficiency, but it was almost like a flash flood of solutions."

One idea to sustain NIC's improvements even arose from the utilization management program – bonuses based on efficient scanner use, he adds. "This will give the technologists some incentive to keep this going. It will be a very objective measurement of the employee's ability to effectively utilize the scanner."

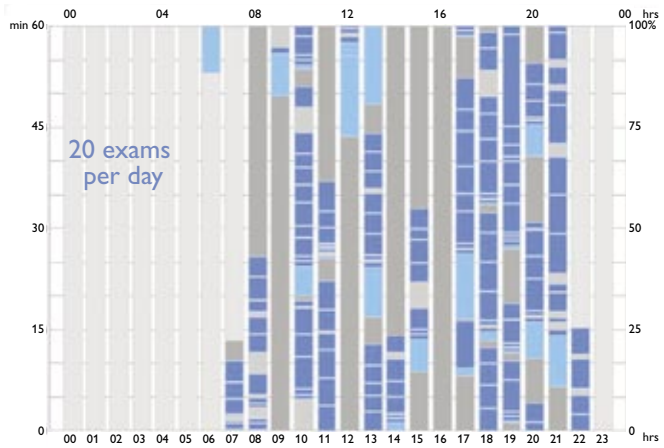
NIC's pilot-project experience with Philips' Utilization Services will change into an ongoing program, as NIC officials strive to see how far the software tool will take them.

"Utilization Services is a terrific product and I think Philips is completely on the right track," Cartwright says. "They understand the needs of outpatient imaging centers and realize that a tool like this is going to be an absolutely essential part of their overall management and operations."

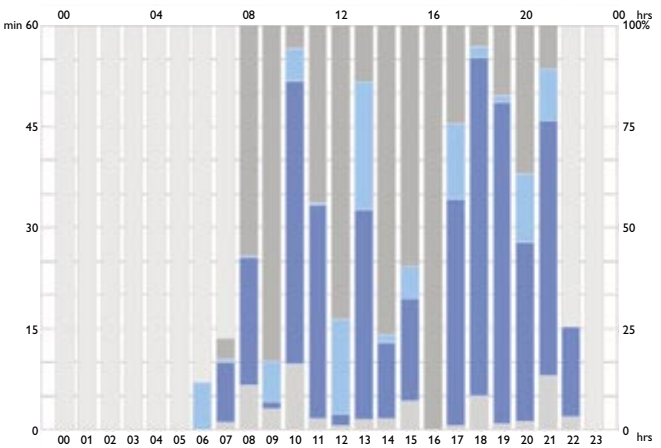
"We're still hammering away at this," Dr. Orrison adds. "I'm not convinced that we've run out of ways to increase efficiency with this product, but we've made amazing progress in three months. We'll make a lot more in the next three."

Initial system utilization

Examination Times September 20, 2007

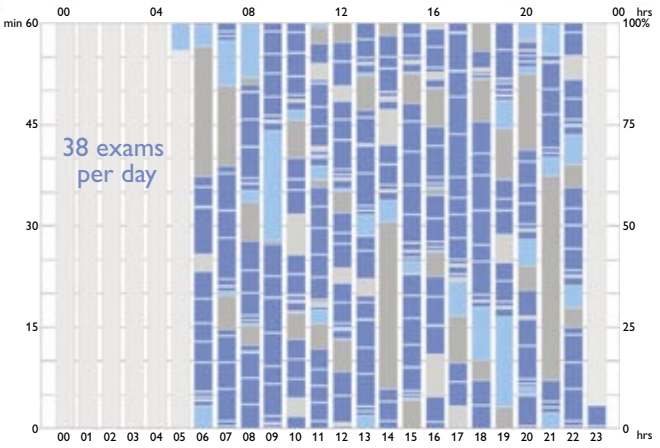


Total Examination time September 20, 2007

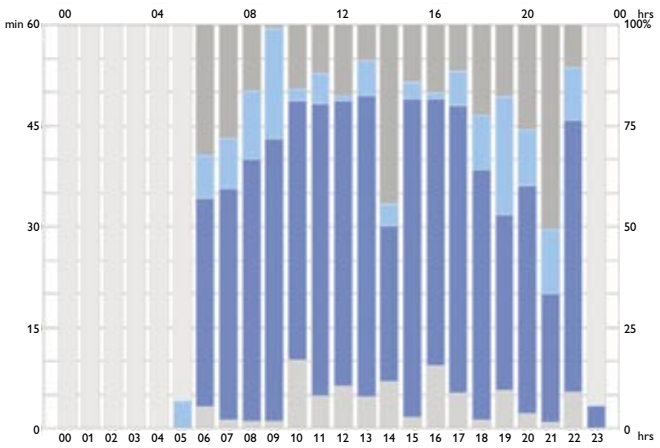


Improved system utilization

Examination Times April 03, 2007



Total Examination time April 03, 2007



System inactive | Examination time | Pause | Preparation | Scan time

Comparison of initial Intera 3.0T system utilization (left column, Sep. 20, 2006) and utilization after implementation of improvement solutions (right column, Apr. 3, 2007).
Top row: Actual system use during one day; the graphs show minute-by-minute scanner activity from 0:00 am to 24:00 pm, thus providing an instant view of scanner usage. Gray areas represent inactive time and waiting time, blue areas represent patient preparation and actual scanning.
Bottom row: Accumulation of scan time and inactive time for each hour in the day.

MR breast evaluation at Mayfair Radiology

Together, Philips Breast coil and DynaCAD™ offer excellent scanning, post-processing and procedure planning

Mark Lawton, M.D.

Philips provides clinicians with the full scope of products to both acquire exceptionally high quality images and streamline breast imaging workflow. Philips now offers not only dedicated breast RF coils, but also the DynaCAD digital imaging workstation by Invivo. DynaCAD also can be used for image processing and biopsy planning, while the dedicated Breast coil is compatible with the biopsy procedure.

DynaCAD workstation.

Entire tool supply available

The SENSE Breast coil enables simultaneous imaging of both breasts. High SNR permits high temporal resolution imaging of both breasts with complete coverage – from the nipples to the adjacent axillary thoracic regions. In breast imaging, SENSE enables acquisition of more data points, which increases the reliability of results. This coil is compatible with Invivo's localization/ biopsy devices.

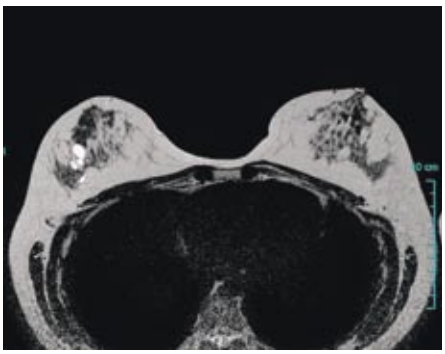
Philips offers the dedicated breast imaging coil in different versions. The SENSE Breast coil (7) for Achieva 1.5T and 3.0T has seven elements and offers the best SENSE performance. The SENSE Breast coil (4) is available for Achieva 3.0T, Achieva 1.5T and Panorama HFO systems.

Alternatively, Philips provides the Breast Mattress for imaging purposes only, a positioning device for breast imaging with SENSE Flex-M coils on 3.0T or the SENSE Body coil on 1.5T. The Breast Mattress incorporates sockets for the patient's breasts, enabling a more comfortable prone position.

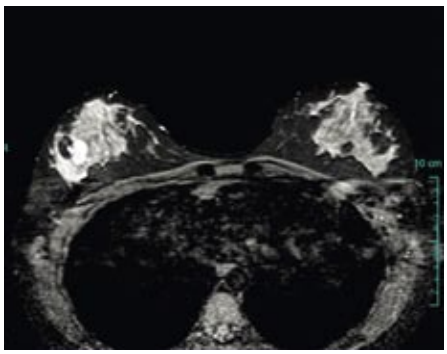
DynaCAD is a digital imaging workstation with an extensive set of computer-aided detection (CAD) tools for performing real-time image analysis and the planning of interventional procedures, such as biopsies or localization wire placement. The dedicated Breast coil biopsy devices are visualized in the interventional planning tools of DynaCAD for easy and optimized planning. DynaCAD provides radiologists with a comprehensive solution for significantly improved workflow for breast imaging and biopsies.

The work flows in breast MR at Mayfair Radiology

At Mayfair Radiology Associates (Milwaukee, Wis. USA), which operates 1.5T Intera and Panorama HFO systems, breast MRI is



T2-weighted axial image of both breasts



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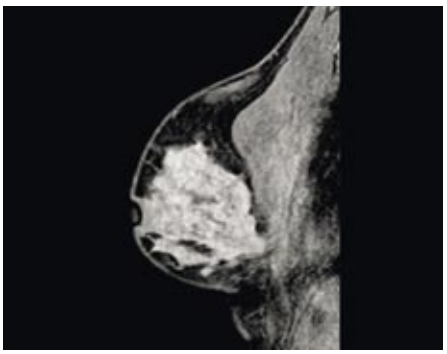


BLISS

typically used to confirm or refine the visualization of lesions seen with mammography or ultrasound. This requires high resolution imaging with good contrast. In addition, one to two MRI guided biopsy procedures are performed each month, according to radiologist Mark Lawton, M.D.

"The ability to use high resolution 3D sequences with SENSE enables the acquisition of high resolution images," he says. "However, before DynaCAD, I was spending so much time on the MR operator console doing post-processing that it was holding up the diagnostic studies. We had to find a way to improve our workflow. DynaCAD has significantly improved breast imaging workflow at Mayfair Radiology and increased my confidence tremendously.

"A couple of our referring physicians even come to look at their patients' images," he adds, "So, DynaCAD has had a dramatic impact on their confidence in MR breast imaging as well."

The DynaCAD system uses two 20-inch flat panel monitors to provide a large, flexible workspace for simultaneous, synchronous viewing of all image data in all three planes within a particular patient exam.

"Before we acquired DynaCAD, we were essentially doing our entire analysis on the MR console – just the single screen with small images," he says. "So, the two large screens, combined with user-friendly tools, have certainly made my life much easier. With the SENSE coils and DynaCAD, we're well equipped for breast MR applications."

SENSE Breast coil (7)

"4 Tesla," two-system solution spans widest spectrum of studies

MidMichigan Regional Imaging thriving with Panorama HFO and Achieva 3.0T X-series systems

MidMichigan Regional Imaging, Midland, Mich., USA.

The expansion, replacement or refitting of its MRI system array in 2006 was MidMichigan Regional Imaging (Midland, Mich., USA) opportunity to set the imaging service apart from its competition and enable it to diversify its patient demographics. MidMichigan decided to take advantage of what Philips calls a "4 Tesla" configuration: a Panorama High Field Open (HFO, 1.0T) system plus an Achieva 3.0T X-series scanner, enabling both patient-friendly, open high field scanning and the SNR to perform high resolution and advanced applications. The 4 Tesla solution (plus a mobile 1.5T system) is helping MidMichigan shoulder a busy seven-day, 105-hour scanning week.

Michigan is a certificate-of-need (CON) state; capital equipment acquisitions are carefully controlled, mainly to hold down healthcare costs. Essentially, imaging centers are required to obtain CON approval from state government to acquire higher-priced capital equipment, and this is based on the available patient volume for each system. In the case of MRI systems, CON regulations compel centers to maximize the versatility and efficiency of their scanners.

Panorama HFO at MidMichigan.

"In 2005, our competitive environment for MRI suggested that having both 3.0T and high field open systems would differentiate us from other MRI providers," says Jim Ferrier, president of MidMichigan Regional Imaging, an independent diagnostic testing facility. "No other MRI configuration would provide that kind of coverage for patients and study types, thereby keeping both systems optimally productive in this CON environment.

"The Panorama HFO would provide a solution for scanning patients that were claustrophobic or too large for our 1.5T scanner," he continues. "And we opted for the 3.0T to not only maintain our existing patient base, but also to gain from the potential to perform advanced applications when we begin to implement them here."

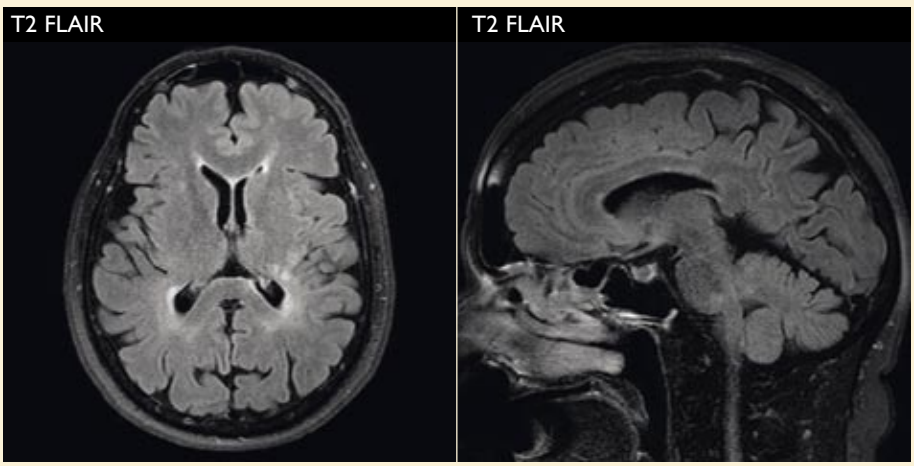
Building MidMichigan's reputation

MidMichigan Regional Imaging – established January 1, 2003 with a Gyroscan NT 1.5T mobile system – is a specialty service

affiliate of MidMichigan Health, a large family of healthcare organizations. MidMichigan Regional Imaging's mobile 1.5T serviced the MidMichigan Regional Medical Center-Midland. The service added a second system, an Intera 1.5T, in December 2003 and installed it at the Midland hospital. The mobile system then began serving the Clare and Gladwin medical centers.

The MR team in front of the Achieva 3.0T X-series.

"During our first two days of operation, we scanned a 360-pound patient we could not have scanned before."



Brain on Panorama HFO
67-year-old female patient with extensive involvement of cerebral white matter with demyelinating plaque formation, multiple sclerosis with progressive involvement particularly of the brain stem. Scanned on Panorama HFO with ST SENSE Head coil.

Wrist on Panorama HFO
Right wrist of a 47-year-old male patient scanned on Panorama HFO with ST SENSE Wrist coil. This patient has a history of ganglion cyst with prior resection. This image shows no evidence of recurrent ganglion cyst.

Jim Ferrier

Chris Wolschlager

Mike Vanderpol

"The Achieva 3.0T X-series has excelled at a variety of applications that demand high resolution, such as IAC and smaller MS plaques."

Panorama HFO up first and making an impact

In November 2006, MidMichigan's Panorama HFO became operational at MidMichigan Medical Center-Midland. "We had seen how we could get 1.5T-quality images on the open Panorama system," says Mike VanderPol. Vanderpol and Chris Wolschlager serve as MidMichigan's imaging supervisors. "That was key. We didn't want to replace the workhorse 1.5T system if the Panorama HFO wasn't capable of producing similar or better images."

The system's openness promised to eliminate claustrophobic rejection and reduce the need for pediatric and adult sedation, Wolschlager adds. "We have noticed a decrease in sedation to decrease anxiety," he says. "We also can scan a greater range of patient sizes. In fact, during our first two days of operation, we scanned a 360-pound patient we could not have scanned before. "

"For obese patients, the Panorama HFO has a high performance Integrated Body coil," VanderPol notes. "Therefore, positioning an RF coil is unnecessary to obtain a good lumbar image. And, for off-center anatomy, such as wrists and shoulders, there is a clear advantage in being able to position the patient in the isocenter."

"The referring neurosurgeons and neurologists are happy having their patients scanned on Panorama HFO," says MidMichigan neuroradiologist Michael Bartlett, M.D. "I have seen patients who have had satisfactory cervical spine studies on a 1.5T system, have subsequent scans on the 1.0T that were actually much better. And, in terms of MS lesion visualization, there is no drop-off in image quality going from 1.5T to HFO."

By March 2007, Panorama HFO had scanned 1,800 patients, averaging 15 patients per day over a seven-day week. This system's case volume comprises 60% neuro and 40% musculoskeletal studies.

Achieva 3.0T increases center's scope

Although Ferrier was concerned that some patients would have contraindications against 3.0T scanning, such as surgical implants and aneurysm clips, a visit to Nevada Imaging Centers (Las Vegas, Nev.) – a Philips show site – dispelled his concerns.

"We were impressed with the breadth of patients scanned on Achieva 3.0T," he says. "We believed 95-98% of our patients could be scanned on this system."

Adhering to CON requirements, MidMichigan's second system – the fixed Intera 1.5T – was decommissioned on February 4, 2007, to allow the Achieva 3.0T X-series to begin operation in February. MidMichigan then shipped out the Intera for refitting as a mobile system. It replaced the mature mobile Gyroscan NT 1.5T system in April 2007.

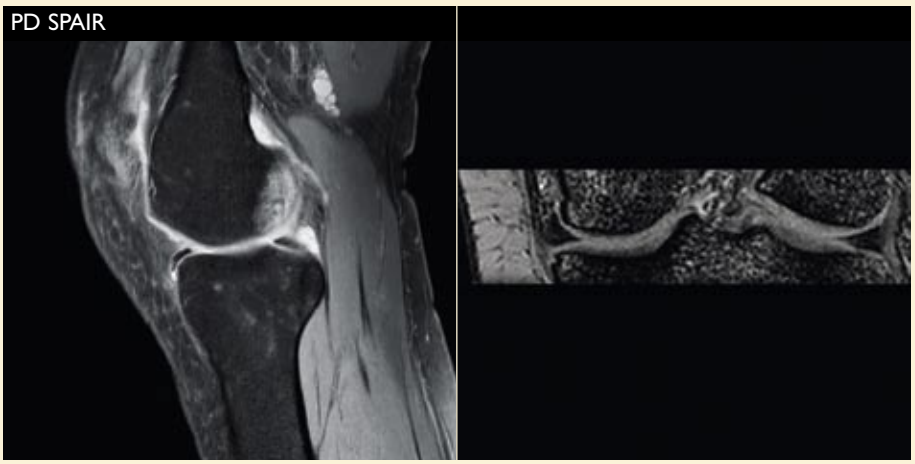
The Achieva 3.0T has excelled at a variety of applications that demand high resolution, such as IAC and smaller MS plaques. "We prefer doing IACs on the 3.0T unless the patient is claustrophobic," Dr. Bartlett says. "Two referring neurologists have asked that MS follow-ups be done on the 3.0T, because we're visualizing small plaques better than at 1.5T. In the 3D IAC studies, we routinely see the 9th, 10th, and 11th and sometimes 6th cranial nerves."

Enhanced definition of the circle-of-Willis is very noticeable on MRAs, he says. "You see the smaller, more peripheral branches of the cerebral arteries dramatically better on 3.0T than at 1.5T," Dr. Bartlett adds. "I'm also more confident in identifying small aneurysms and in cerebrovasculature evaluation after stroke."

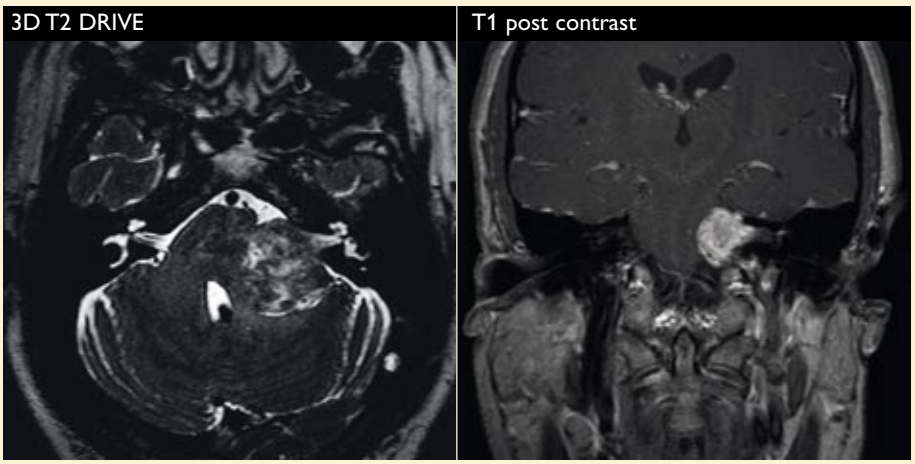
Achieva 3.0T X-series provides exceptional knee imaging, Wolschlager adds. "The Panorama HFO and the 1.5T do a very good job on knees," he says. "But with Achieva 3.0T, combined with the SENSE Knee coil, these studies, especially for cartilage imaging, have been just marvelous – they're beautiful."

Diffusion tensor imaging (DTI), cardiac MR to debut

MidMichigan clinicians will soon harness Achieva 3.0T for white matter fiber tracking, Dr. Bartlett says. The technique has been useful in presurgically determining the relationship of fiber tracts to brain tumors and in localizing fiber tracts in relationship to MS plaques.



Knee on Achieva 3.0T X-series
The sagittal left knee image of a 57-year-old female patient shows a small ganglion cyst posterior to the posterior cruciate ligament with Baker's cyst. The coronal image shows a small tear of the posterior horn of the medial meniscus. Scanned on Achieva 3.0T with SENSE Knee coil.



IAC on Achieva 3.0T X-series
41-year-old male patient with left-sided acoustic schwannoma. Scanned on Achieva 3.0T with SENSE Head coil.

In addition, in April 2007, MidMichigan staff are going to begin training on certain cardiac applications, including ventricular function imaging, VanderPol says.

4 Tesla combination adds up to wider patient variety and new applications

MidMichigan could have maintained a solid scanning service simply by adding Panorama HFO and keeping its fixed 1.5T system. "We could have chosen a more standard MRI configuration, but we believe that 3.0T is becoming the new 1.5T," Ferrier says. "We wanted to be the first to bring 3.0T to our market and patients in this area. Our expectations of a much wider patient/case demographic with 4 Tesla (Achieva 3.0T plus 1-Tesla Panorama HFO) have been borne out fairly rapidly.

"Acquiring both the HFO and 3.0T systems has provided both additional applications and the assurance that we can scan just about anyone who visits our centers," he adds.

"The HFO and 3.0T combination provides both additional applications and the assurance that we can scan just about anyone."

New Pediatric package for Panorama HFO

The open aperture of the Panorama High Field Open (HFO) is especially comfortable for pediatric patients because it allows the parent or caregiver to be close to the child to observe and comfort him or her. In addition, Panorama HFO provides high SNR and high spatial resolution that is beneficial for a child's smaller size field-of-view. To further improve the Panorama HFO exam experience for children, Philips has added a new pediatric package including several accessories.

A cradle for newborn patients (up to 1 year of age) enables preparation of the child outside the magnet room. The child in the cradle can then be placed on the FastTrak patient table. The cradle is compatible with the ST SENSE Head and ST Multi Purpose Flex L, M and S coils.

For children 1 to 5 years of age, a soft, thick mattress is available to raise the child to the magnet's isocenter for optimum image quality. The mattress can be used inside the ST Body/Spine M coil for thoracic, abdominal, pelvic, cardiac or hip imaging.

The package also includes a peripheral pulse sensor with three different sizes for pediatric patients. Plugged into the FastTrak patient table, sensors may be positioned on the finger, toe or foot.

Panorama HFO team receives accolades

The Philips Panorama HFO team has received the **2007 High Tech Systems Action Award** for the development of the Panorama High Field Open MRI scanner. In their summary, the judges commented that the Panorama is, "a technological breakthrough; a unique system developed by a professional and passionate team." The Dutch High Tech Systems Platform presented the award to Maurits Wolleswinkel, head of Global Product Marketing MRI, Philips Medical Systems, in a ceremony held on March 8.

MR studies play major role in new frontier of imaging science

Vanderbilt University Institute of Imaging Science (VUIIS) research probes basic form and function

Vanderbilt University Institute of Imaging Science.

Since 2002, physicians and scientists at Vanderbilt University Institute of Imaging Science (VUIIS, Nashville, Tenn., USA) have been employing medical imaging modalities to perform far more than their traditional clinical tasks of detection and visualization. In the new discipline of imaging science, investigators are using MRI, PET, CT, SPECT, x-ray, optical imaging and ultrasound to explore the pathophysiology of many diseases and to develop and apply measures of treatment response. In human research, researchers led by VUIIS director John Gore, Ph.D., are using the center's Achieva 3.0T system in many studies, including brain function and structure, presurgical mapping, automated contrast kinetics imaging, muscle DTI fiber tracking and neurotransmitter spectroscopy.

Medical imaging technology is being used in advanced research to help clarify biological and physiological processes, a major extension of traditional radiology that reflects advances in other areas, such as genomics, proteomics and molecular biology.

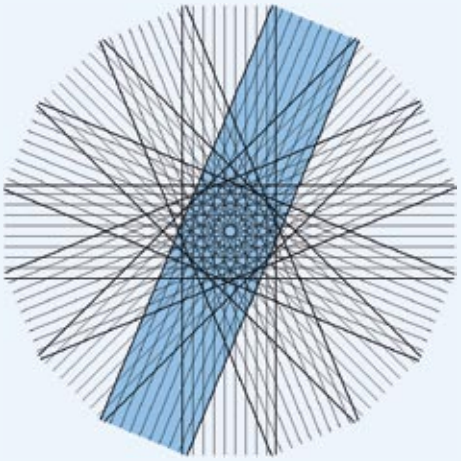
"*In vivo* imaging is being researched to measure tissue structure and for quantitative morphometry, such as assessing tumor growth or recession," says John Gore, Ph.D., director of VUIIS. "Imaging also is being developed to measure intrinsic tissue characteristics and composition, such as cell density or neural myelination and to map spatially varying metabolic and physiological properties, such as blood flow or oxygen use. Another application is being developed to detect and quantify specific processes at the molecular level – the expression of specific genes, for example."

Established in 2002, VUIIS is a trans-institutional center within Vanderbilt University, which invested more than $40 million in the facility's physical plant, equipment and personnel. Approximately 23 faculty, 15 staff and 54 trainees are engaged in VUIIS activities. A new four-level, 42,000 sq. ft. building was opened in November 2006 and now integrates all VUIIS disciplines and facilities under one roof.

Two important VUIIS facilities are the Center for Small Animal Imaging and the Center for Human Research Imaging. Equipment for the former includes 4.7T, 7.0T and 9.4T small bore MRI systems, microCT, microPET and microSPECT systems, optical imaging and ultrasound. The human research center houses research-dedicated Achieva 3.0T and 7.0T scanners. Included among the 3.0T research projects are those for GABA spectroscopy, DTI of muscle tissue, DCE and extended MultiVane motion correction techniques.

VUIIS's reputation has earned it the honor of hosting major international scientific meetings, including a conference for biomedical imaging scientists: Frontiers of Biomedical Imaging Science, which convened in Nashville, June 27-29. Immediately preceding this conference, June 24-26, VUIIS hosted the third meeting of Philips' Achieva 7.0T Users Group, which was attended by representatives of the Achieva 7.0T sites worldwide.

MultiVane k-space sampling method corrects for motion



Graphic depiction of MultiVane k-space data acquisition. Data are acquired in a series of rotating vanes (single vane is shaded), each of which collects data from a central area of k-space. Each vane contains several phase-encoding lines.

MultiVane employs an in-plane motion correction strategy that uses a novel MR signal sampling trajectory in k-space.

"MultiVane is a non-cartesian technique that oversamples the centers of k-space using separate cartesian vanes," says VUIIS-based Philips clinical scientist Brian Welch, who worked on MultiVane implementation. "Each vane contains k-space samples corresponding to the same low resolution image. If in-plane motion occurs, the low resolution images will move vane-to-vane.

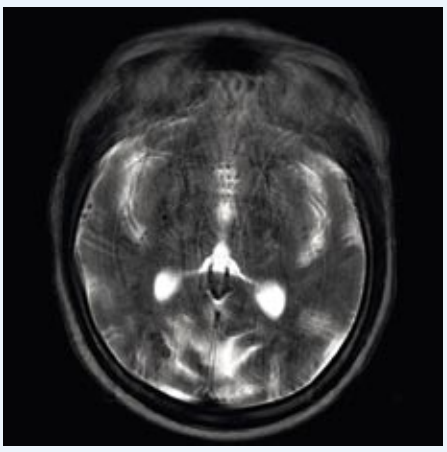
"Registering the low resolution images from each vane allows detection of in-plane motion – such as nodding or shaking the head – and correction of the individual vanes," Dr. Welch continues. "MultiVane is particularly well-designed because an individual vane is a Cartesian data set, which enables easier correction than with radial or spiral sampling schemes that are vulnerable to phase differences and off-resonance effects. All vanes are ultimately combined to create a single high resolution image that is sharp and artifact-free. If the low resolution image from a specific vane correlates poorly with other vanes, it is eliminated or underweighted during reconstruction."

MR protocols that collect many k-space lines in multiple snapshots, such as TSE or TFE, are best suited for MultiVane, because each vane can then be a quick snapshot that freezes the subject's motion. However, MultiVane can be combined with any sequence that is normally collected by a Cartesian trajectory, he explains.

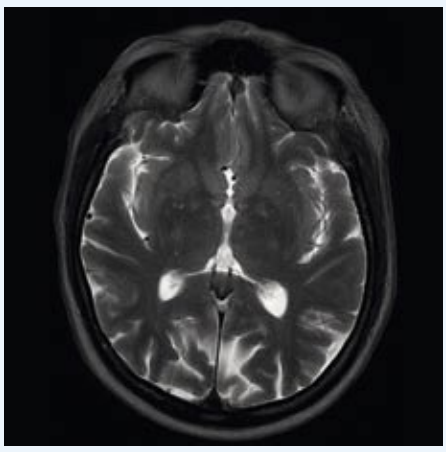
MultiVane is a strong competitor to other Cartesian motion correction strategies in its robust motion correction. If motion is occurring, Cartesian images will contain artifacts (primarly ghosts) that cannot be removed except through time-consuming iterative techniques or with the aid of fiducial markers or navigator echoes that must be acquired in addition to imaging to provide information about the motion. Furthermore, any residual motion inconsistencies in a MultiVane reconstruction will result in slight blurring, instead of distinct ghosts that may diminish the diagnostic utility of the images.

"MultiVane is elegant because the imaging data itself acts as a '2D navigator.'"

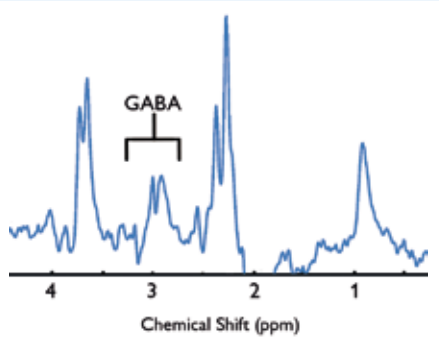
"MultiVane is elegant because the imaging data itself acts as a '2D navigator' – that is, the low resolution images contained within each blade," he observes. "The drawback is that the MultiVane trajectory is somewhat longer than the Cartesian equivalent. However, the literature shows that MultiVane can truly provide diagnostic quality images when Cartesian can't."

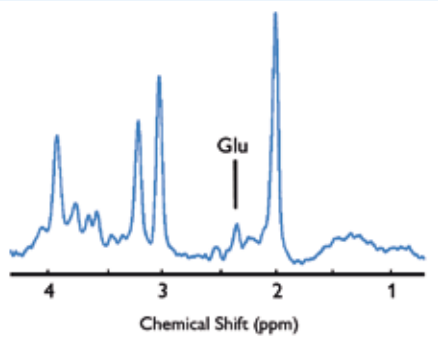


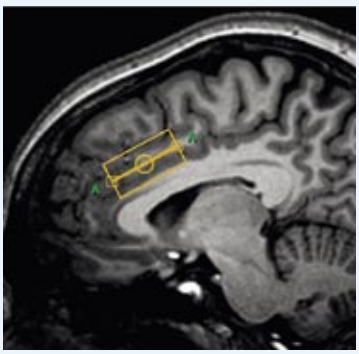
Without MultiVane



With MultiVane







Neurotransmitter spectroscopy. By using sophisticated editing methods, the neurotransmitters GABA and glutamate peaks can be distinguished in these spectra collected from an 18 ml volume in the anterior cingulate cortex. Acquisition times were 10:40 min. for GABA and 5:20 min. for glutamate.

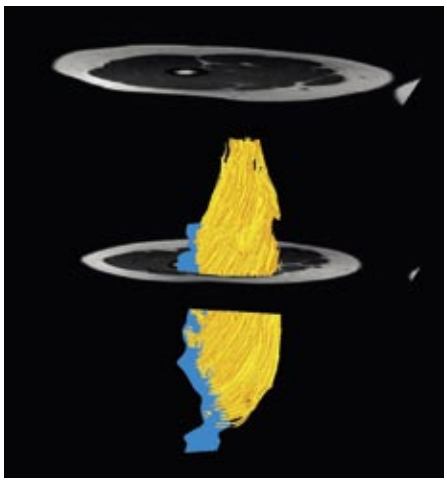
MR spectroscopy research clarifying GABA, glutamate roles

GABA (γ aminobutyric acid) is the brain's principal inhibitory neurotransmitter, while glutamate is the main excitatory neurotransmitter. "Many psychiatric and neurologic disorders are suspected to have altered glutamate and/or GABA neurotransmission," says VUIIS Professor Calum Avison, Ph.D. "For example, there is increasing recognition that altered cortical GABA levels are associated with clinical conditions, such as epilepsy, chronic alcoholism, schizophrenia and depression."

On MRS spectra, GABA and glutamate spectral peaks are small and often hard to discern among larger metabolic peaks in the brain (e.g., NAA, choline, etc.), even with 3.0T's high SNR and spectral resolution. Therefore, use of sophisticated editing methods is needed to pick out the GABA and glutamate peaks from the crowded background – allowing investigators to measure their levels in the human brain without contamination from other stronger brain metabolite signals.

"We're making the measurements robust and can gather these GABA spectra on normal walk-in volunteers."

From left to right:
John Gore, Ph.D., Bruce Damon, Ph.D., James Joers, Ph.D., Malcolm Avison, Ph.D., Adam Anderson, Ph.D., Brian Welch, Ph.D., Kevin Waddell, Ph.D., Thomas Yankeelov, Ph.D.



This figure shows a DT-MRI skeletal muscle fiber tracking result. The images are T1-weighted axial anatomical images taken at proximal (top image) and distal (bottom image) locations of the thigh. The gold and similarly shaded lines show the local muscle fiber orientations of the vastus medialis oblique muscle. These data are being used by Drs. Herman Kan, M.D., Anneriet Heemskerk, Ph.D., and Bruce Damon, Ph.D. as part of a clinical study of the anatomical and phsyiological basis for patellar subluxation syndrome.

"We developed a protocol to acquire the diffusion tensor of certain muscles – such as the hamstring and muscles comprising the gastrocnemius (calf)."

"While the literature notes the potential for significant GABA and glutamate editing errors with even slight patient motion, we're making these measurements robust, so our technologists can run it on normal walk-in volunteers. We have about a 95 percent success rate gathering these GABA spectra," he says. "We credit this to the specific MRS pulse sequences, our post-processing approach and artifact correction methods. The flexibility of the Philips Achieva platform has been essential in allowing us to develop these complex MRS methods, and the high homogeneity, stability and sensitivity of Achieva 3.0T will allow us to fully realize the potential of these exciting new probes of brain neurotransmitter status."

One of Dr. Avison's NIH grants is to study adolescents and young adults who have a history of cocaine and alcohol exposure in utero. "In cocaine-exposed animals, there are alterations in the cortical GABA neurons associated with executive function, and there is evidence that kids with a history of prenatal cocaine exposure have ADHD-like symptoms that persist for life, but interestingly may be unresponsive to Ritalin®," Dr. Avison observes.

Preliminary results include data on both glutamate and GABA editing in normal volunteers for validation purposes[1]. "The cocaine and schizophrenia studies are just beginning," he says. "But, we have spectra showing how GABA is edited from a typical volunteer – showing where it comes from and what spectra look like for both GABA and glutamate."

DTI fiber tracking finds extracranial application

Diffusion anisotropy applies to muscle tissue as well as to the brain's white matter fiber tracts. "Muscle fibers are about 50 µm in diameter and can be tens of centimeters long. Additionally, there is a network of protein filaments in muscle fibers that cause contraction and which also are longitudinally oriented," says Institute scientist, Bruce Damon, Ph.D. "This combination of elongated cellular geometry and longitudinal arrangement of contractual proteins causes water to move preferentially along the cell's long axis."

One basic aim of Dr. Damon's DTI research is explaining the role of muscle architecture in locomotion. "We developed a protocol to acquire the diffusion tensor of certain muscles – such as the hamstring, quadriceps and muscles comprising the calf – and determine how their architecture supports rapid shortening and the generation of high forces," he explains.

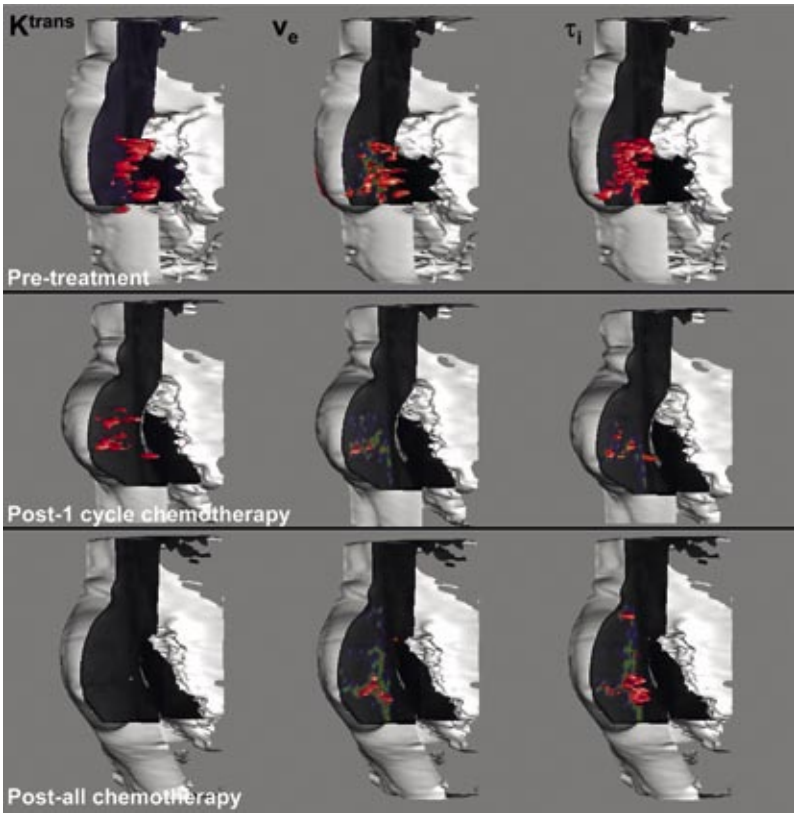
More clinically-oriented muscle DTI research focuses on muscle architecture in the vastus medialis and vastus lateralis muscles, which if functionally imbalanced relative to each other can cause patellar subluxation.

"In persons with patellar subluxation, the patella tends to be pulled out of alignment as they extend their leg," Dr. Damon says. "If the vastus muscles are imbalanced, the vastus lateralis pulls the patella from its natural position. We're doing fiber tracking to understand how the muscle architecture contributes to that problem."

This project is being spearheaded by Herman Kan, M.D., musculoskeletal radiologist at the Children's Hospital, and supported by additional fiber-tracking projects by Anneriet Heemskerk, Ph.D.

Another clinical study, headed up by post-doctoral fellow, Otto Sanchez, entails investigation of the diffusion properties of the hamstring muscle following acute strain. In T2-weighted imaging, clinicians would expect to see increased signal intensity from edema. "The problem is that edema is non-specific – it happens every time you hurt yourself," he observes. "We're hoping that diffusion measures will be more sensitive to the muscle membrane's structural integrity and that in the long term we can develop a practical measurement method."

Collaborating on this project with Otto Sanchez are musculoskeletal radiologist John Block, M.D., and athletic trainers from Vanderbilt Sports Medicine.



Dynamic contrast enhanced MRI (DCE-MRI) allows for characterization of various relevant physiological parameters including blood vessel perfusion and permeability (characterized by the parameter K^{trans}), the extravascular extracellular volume fraction (v_e) and tumor cell size (τ_i). These parameters can be mapped for each voxel in each slice of a DCE-MRI data set. The figure depicts how each of these parameters estimates (in a three dimensional rendering) the extent of tumor. Each row of the figure corresponds to a different time in the course of therapy and it is clear that these parameters are sensitive to longitudinal changes. Of note is the reduction in the K^{trans} parameter while the v_e and τ_i parameters still indicate residual disease. (All panels are rendered at 50% of the maximum value observed in the pre-treatment scan.)

Study of contrast kinetics contributes to understanding of lesion physiology

In the study of contrast kinetics, VUIIS researchers are clarifying the physiological mechanisms that determine why contrast moves through tissues or lesions at a given rate. From a clinical standpoint, the ultimate goal is to use these kinetic parameters to evaluate the patient after the first treatment cycle to assess the intervention's therapeutic value.

"We are developing a new mathematical model to analyze the contrast agent kinetics automatically in Dynamic Contrast Enhanced studies of volunteers," says Tom Yankeelov, Ph.D., VUIIS director of Cancer Imaging. "Our model is more closely related to lesion physiology and we are combining it with measurements of water diffusion to provide ADC maps as well."

Water diffuses in adipose and granular tissues, he continues, but once a benign or malignant mass begins to grow, cell populations increase, generating more barriers to diffusion, thereby slowing down diffusion time.

"Researchers have shown in small animal models of cancer that ADC changes actually happen before the changes in the dynamic contrast-enhanced analysis. These studies are now beginning in patients," he says.

VUIIS investigators are developing a PRIDE tool that will combine acquired ADC data with four other parameters. These are a T_1 map, K^{trans} (tissue perfusion and microvascular vessel wall permeability), v_e (extracellular volume fraction), and τ_i (time constant measuring persistence of water molecules in a cell).

"We hope our model will provide a more comprehensive characterization of tumor response," Dr. Yankeelov says. "We see patients pre-therapy right after diagnosis, then after the first therapy cycle, and subsequently just before they go to surgery at therapy completion. The idea is to study the four parameters and the ADC map and determine if some combination or perhaps individual parameters can predict therapy response. You could individualize treatment that way.".

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A practical guide to robust detection of GABA in human brain by J-difference spectroscopy at 3T using a standard volume coil.
Magn. Reson. Imaging: in press (2007).

HRP research project zeros in on stroke, heart attack triggers

Carotid MRI part of 2007 study to characterize unstable plaques

Chun Yuan, Ph.D.

Recognizing the importance of atherosclerotic plaque in worldwide morbidity and death, Philips is joining with a group of companies to study vulnerable plaque (HRP). The HRP initiative will set the groundwork for development, registration and commercialization of diagnostic tests and therapeutic interventions to manage vulnerable plaque. One of HRP's six roadmap tracks that will entail studies of up to 6,000 high-risk volunteers, will include carotid artery MRI on a mobile Achieva 3.0T system. The carotid protocol is an histology-based technique designed to enable full plaque characterization, according to Chun Yuan, Ph.D., a University of Washington (Seattle, Wash., USA) radiology professor and cardiovascular imaging specialist.

According to the World Health Organization (WHO), one-third of all deaths globally are caused by cardiovascular events in the heart and brain. Plaque rupture is estimated to cause 75 percent of these deaths. These high-risk, vulnerable plaques are the focus of the HRP research initiative, a group of companies that is joining forces to make vulnerable plaque a managed disease through an intensive outcomes-based study.

To fully evaluate vulnerable plaque, six parallel tracks will be implemented:

1) Biomarker discovery and validation
2) Animal HRP model development for drug discovery
3) Anatomical and functional imaging, in which MRI, CTA, and ultrasound studies will be performed for carotid, aorta and coronary arteries
4) Molecular imaging
5) Regulatory framework
6) Economic

The project will involve as many as 6,000 participants diagnosed as having risk factors for developing vulnerable plaque (e.g., high BP, family history, obesity, blood serum biomarkers).

Full plaque characterization sought

Chun Yuan, Ph.D., radiology professor and cardiovascular imaging specialist at the University of Washington, and his colleagues, have contributed the carotid MRI protocol that will be used on all eligible participants in the project. The studies will be performed on a mobile Achieva 3.0T system.

"Pathology originating in the carotid is directly linked with stroke, so early detection of vulnerable plaques will help prevent future strokes. The main goal of the carotid MRI studies is a comprehensive characterization of atherosclerosis in the carotids," Dr. Yuan says. "These studies will be complemented by MRI studies of the aorta and coronary arteries."

The carotid MR protocol that the HRP project will employ is an established University of Washington protocol that was validated based on histology, he notes. Patients scheduled for carotid endarterectomy had an MR scan just before their surgery, after which the plaque specimen was retrieved and subjected to comprehensive histology. "Histological validation of the protocol makes it ideal for the HRP initiative," Dr. Yuan adds.

The HRP Alliance

The HRP group of companies and entities includes AstraZeneca, Merck, Philips Medical Systems, Humana, and others. BG Medicine's CEO, Pieter Muntendam, M.D., will lead the HRP research project. "The HRP alliance is the strongest effort to date to try to identify those at highest risk of stroke or heart attack due to vulnerable plaque," Dr. Muntendam says. "Through a wide range of complementary modalities, this research will increase our understanding of how to best find those at highest risk and what modalities are most suitable to monitor development and progression of vulnerable plaque. Once we can reliably identify the individuals who have this condition it will open exciting new avenues for prevention and treatment with potentially a marked impact on cardiovascular morbidity and mortality."

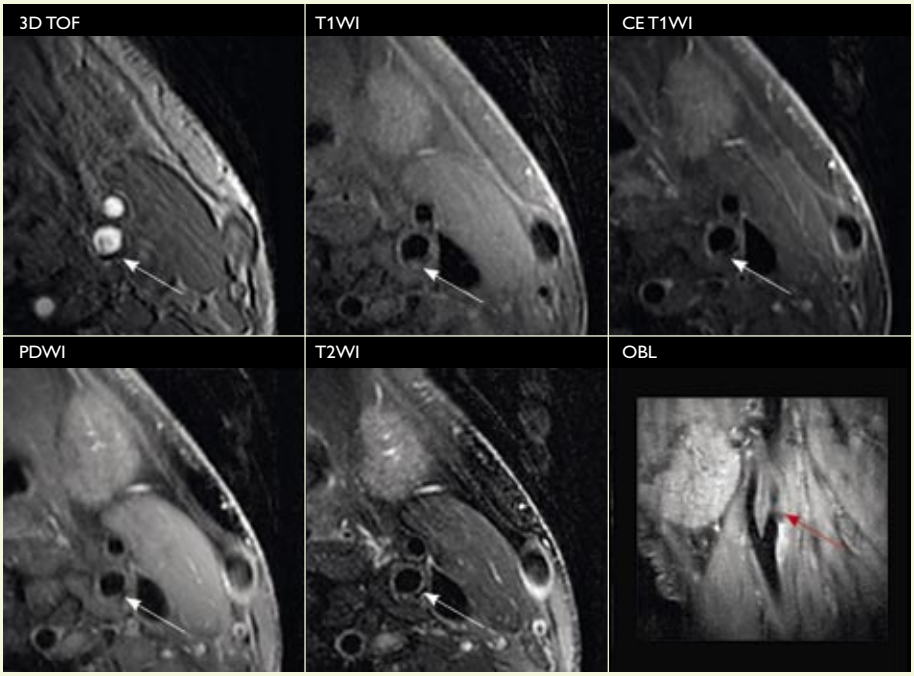
Protocol examines morphology, tissue composition and plaque inflammation

The carotid protocol consists of seven different sequences, including time-of-flight, black blood sequences with flow suppression (especially T1, T2), dynamic contrast sequences and steady-state post-contrast comparison versus pre-contrast. Bilateral carotid artery images will be obtained and the orientations are lateral and cross-sectional (i.e., axial). A 4- or 8-channel (optional) non-standard carotid phased array coil is used.

"With this protocol we want to measure vessel morphology – wall thickness, volume and plaque burden," Dr. Yuan notes. "Second, we want to analyze tissue composition and plaque inflammation, as these are closely linked with plaque stability. Assisted by the imaging processing tool, CASCADE, developed by the University of Washington group, we want to measure a series of quantitative parameters, such as normalized wall index, lipid-rich necrotic core size, fibrous cap thickness and inflammation status, and determine whether these parameters or a combination are better predictors of vulnerable plaques as compared with luminal narrowing (as measured by angiographic techniques).

Plaques that are likely to rupture are designated unstable or vulnerable, and through imaging, clinicians hope to identify those at high risk for a heart attack or stroke, he explains.

"Imaging can conceivably provide both qualitative and quantitative information for this determination – I don't think just looking at luminal narrowing is enough," Dr. Yuan says. "The quantitative information we obtain through the HRP project might be able to assist us in predicting future events."



3.0T carotid protocol images from a patient with intermediate left carotid atherosclerosis. There is a calcification (arrow) in the artery wall, which shows hypointense signal on all five matched cross-sectional images (3D TOF, T1WI, CE T1WI, PDWI, and T2WI) of the left internal carotid artery. The spatial resolution of the cross-sectional images is 0.6 x 0.6 x 2 mm^3. The proton density weighted, oblique image (OBL) demonstrates a longitudinal view of the left carotid artery. A hyperintense region on the OBL highlights the plaque distribution from common into the internal carotid artery (red arrow).

Achieva dual-coil imaging

Contribution by Sigrid Dalm,
MR Application Consultant
Philips Medical Systems, Best,
The Netherlands.

While Philips provides many dedicated coils for optimal imaging of specific anatomies, the region of interest may sometimes be larger than a single coil's coverage. In other cases, the patient may not fit into the coil due to size, injury or a plaster cast.

Combining coils to function as one large coil

In situations as outlined above, operators can exploit a new feature called **Combined coil imaging,** which is standard on Achieva from Release 2.1.3. In dual-coil imaging, two individual coils (specified in the table below) can be combined to function as a single coil with more elements.

Dual-coil imaging allows clinicians to increase anatomical coverage without repositioning the patient, thereby adding more local detail to routine examinations. Additionally, dual-coil imaging enables scanning of patients who will not fit into a regular coil and may facilitate occasional examinations for which a site has no dedicated coil available (e.g., pediatric patients). This method also permits the use of higher SENSE factors.

Coil combinations from Release 2.1.3 onwards:

Coil 1:	Coil 2:	Comment:
SENSE Flex	SENSE Flex	in any combination
SENSE Spine coil	SENSE Flex-L	
SENSE Neuro-Vascular coil 16	SENSE Spine 15	
Endo coil	SENSE Torso coil	3.0T only
Endo coil	SENSE Cardiac coil	3.0T only

* Contributions are subject to review before publication on NetForum.

Tips for optimal dual-coil imaging

Technologists should observe a few simple guidelines to obtain optimal dual coil imaging.

To ensure safe use:

- Use **appropriate padding** to ensure that cables and combiner boxes do not come into contact with the patient.
- Take care to keep **cables as straight as possible, avoid crossing cables.**

To optimize image quality:

- Position the coils to **envelop the anatomy.**
- Maintain a minimum distance of **10 cm** between the elements of a SENSE Flex coil.
- Do **not** use coils **in one line.**
- Always make a **reference scan** with a dual-coil setup.
- The **SENSE Flex-M** coil must be identified in the Service Software.

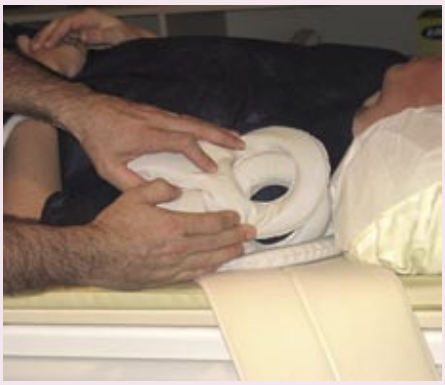
Applications for dual-coil combinations

Applications for dual-coil imaging include knees, shoulders and hips, total neuro, and pediatric heart and abdomen. If you have developed and evaluated a dual-coil setup, please submit your clinical case or ExamCard for NetForum*.

Application	Possible dual-coil combination	
Pediatric heart	SENSE Flex-S	SENSE Flex-S
Pediatric abdomen	SENSE Flex-S	SENSE Flex-M
Large knee	SENSE Flex-S	SENSE Flex-M
Shoulder	SENSE Flex-S	SENSE Flex-M
Long bones	SENSE Flex-M	SENSE Flex-L
Hips	SENSE Flex-L	SENSE Flex-L
Total neuro	SENSE Spine coil	SENSE Flex-L
Total neuro	SENSE Spine 15	SENSE Neuro-Vascular coil 16

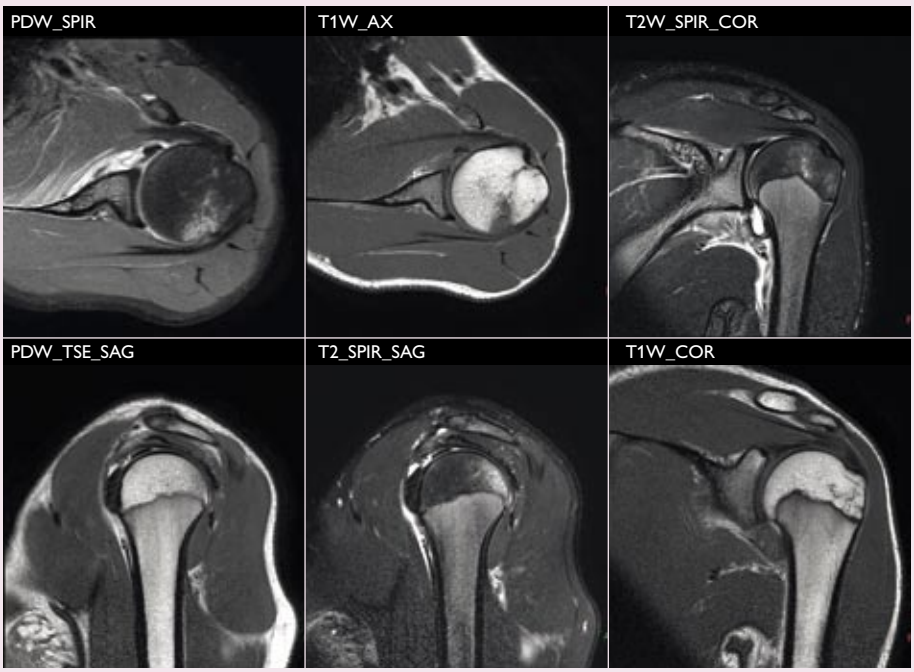
Shoulder imaging with SENSE Flex-M and SENSE Flex-S

Courtesy of CINOV, Yverdon, Switzerland.



Place the first element of the Flex-M under the shoulder of the patient. Apply the two elements of the Flex-S in "Olympic rings" manner to cover the top of shoulder.

Then, place the second element of the Flex-M on the shoulder. Be sure to wrap around all coils with a Velcro® strap.



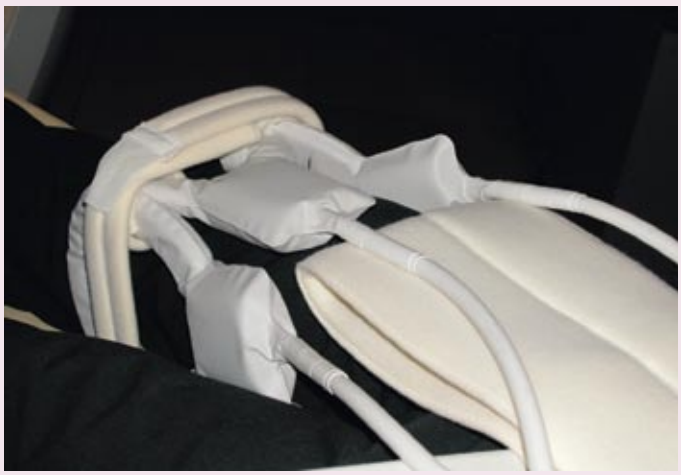
Net Forum
www.philips.com/netforum

Visit the MRI NetForum User Community to view or download the **ExamCard 1.5T Shoulder with Dual Coil (SENSE Flex-S and SENSE Flex-M),** contributed by CINOV, Switzerland.

Knee imaging with SENSE Flex-M and SENSE Flex-S

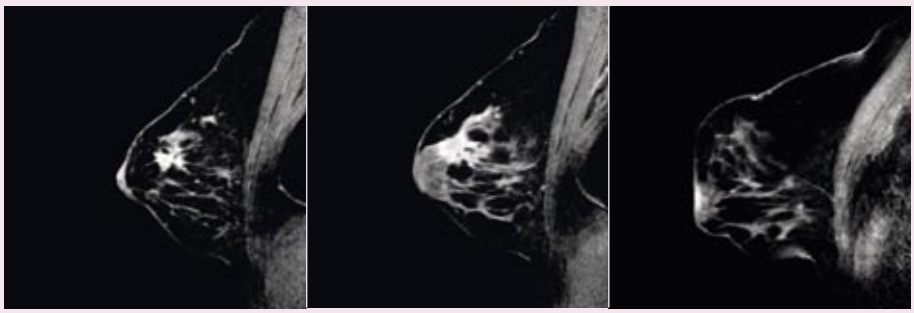
Position one element of the SENSE Flex-S coil under the knee in the popliteal fossa and position the other element on the patella.

- The SENSE Flex-M's two elements are positioned on medial and lateral sides of the knee.
- The top three elements are strapped together before the patient is postioned on the table.
- Use pads to create distance between the cables and the patient's skin.

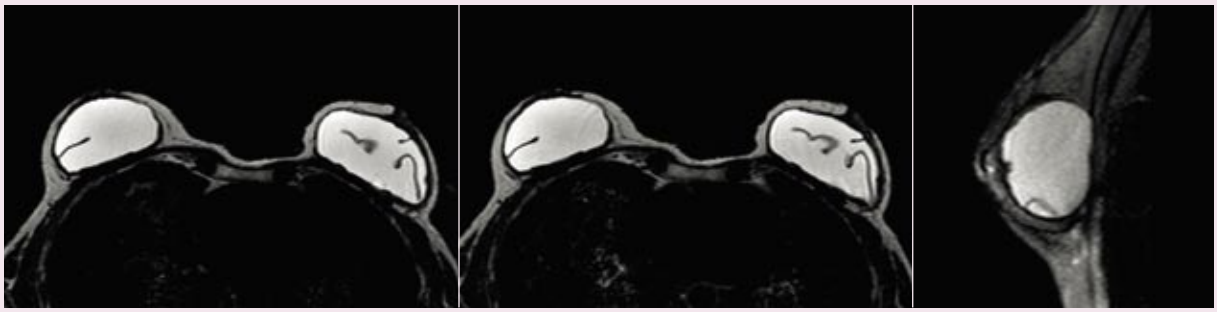


Breast imaging with SENSE Flex-M and SENSE Flex-L

The breast images below are acquired by combining SENSE Flex-M and SENSE Flex-L. Courtesy of Erasme Hospital, Brussels, Belgium.



Dual-coil BLISS imaging.



Dual-coil imaging using a dual inversion sequence with fat suppression and water suppression.

Online resource provides easy access to implant safety information

The new company MagResource LLC developed an online database for MRI users. MagResource enables healthcare professionals to quickly find and retrieve information about the safety status of medical implant devices prior to patient scans. The database contains information on more than 2,300 implants including hyperlinks to manufacturer websites; instructions for use; NIH and FDA documents. For example, many MR manufacturers now define appropriate SAR levels and types of tested sequences – information that is especially important as higher field strength scanners become more prevalent. For more information, visit MagResource at www.doctordoctor.biz

Saves time, enabling better focus on patient care

Developed by Jan Gardner, RT (R) (MR), a senior MRI technologist with more than 15 years of experience, the database is updated daily. Gardner says if an implanted device is not found in the database, MagResource will initiate research and provide its user with information on the device by email and then update the database. "This concept sprung out of my frustration resulting from searches for safety information, when my attention needed to be focused on patient care," says Gardner. "It eliminates duplicate research and saves technologists valuable time."

MagResource provides printable documentation to complete the patient's file or to inform referring physicians, who may question precautions such as the eight-week waiting period on some stents or the need to x-ray to determine the integrity of leads on some stimulators.

Discount for NetForum users

MagResource's monthly subscription fee is based on the number of scanners per site, so an unlimited number of PC's may be connected at no additional cost. Philips NetForum users can access MagResource through a link on the MRI NetForum homepage www.philips.com/netforum (then select MRI) and receive a free 2-day trial and a waiver for their registration fee.

Education calendar 2007

AMIGENICS/NIC 3.0T courses

Las Vegas, Nev., USA
Info: *Colleen Perone, cperone@niclv.com, Tel. (+1) 702-214-9741*

Visiting Physician Fellowship Programs

Combination of didactic lectures and Interactive MRI case reading with experienced 3.0T MR radiologists

Radiology Technologist Practicum

Hands-on experience and technical insights.

MRI self directed visiting fellowship Proscan Imaging

Cincinnatti, Ohio, USA
Date: *continuously throughout the year.*
Info: *http://www.proscan.com/fw/main/Visiting_Fellowships-448.html, mrieducation@proscan.com, Tel. 1-866-MRI-EDUC*

Erasmus Course on Breast MRI

Chios, Greece
Date: *July 1-6*
Info: *: www.emricourse.org, cradrew@az.vub.ac.be*

Breast MRI and MR-guided Interventions in Clinical Practice

University of Bonn, Bonn, Germany
Date: *t.b.d.*
Imaging, image interpretation and MR guided interventions, including needle localization and biopsy.
Info: *christiane.sonntag@ukb.uni-bonn.de, Tel. +49-228-287-9875*

Fetal MR course and Congress

Vienna, Austria
Date: *May 15-18, 2008*
Info: *www.meduniwien.ac.at/radiodiagnostik/fetal_MRI_vienna/, daniela.prayer@meduniwien.ac.at*

Hands-on Clinical fMRI Course

Leuven, Belgium
Date: *t.b.d.*
Teaching sessions, volunteer and patient scanning, image analysis and interpretation, and case presentations.
Info: *www.kuleuven.ac.be/radiology/Research/fMRI/ stefan.sunaert@uz.kuleuven.ac.be*

Contrast-enhanced MRA in clinical practice: a hands-on course

Maastricht, The Netherlands
Date: *t.b.d.*
For physicians and radiographers. Includes teaching sessions and volunteer and patient scanning.
Info: *Tim Leiner, M.D., Ph.D., leiner@rad.unimaas.nl*

MRI: Musculoskeletal Structured Fellowship

University of California at San Francisco, Calif., USA
Date: *t.b.d.*
Info: *www.radiology.ucsf.edu/postgrad/visit_fell_index.shtml nancy.mutnick@radiology.ucsf.edu, Tel. +1-415-502-2984*

Cardiac MR courses at CMR Academy

German Heart Institute, Berlin, Germany
All courses are for cardiologists and radiologists. Some parts will be offered in separate groups.
Info: *www.cmr-academy.com, info@cmr-academy.com, Tel. +49-30-4502 6280*

3-months fellowships 2007

Consists of three parts per course:

Part 1: *Six-week intensive course, including hands-on training at the German Heart Institute.*	***English*** *Feb. 28- Apr. 4*	***German*** *May 30- July 6*	***English*** *Sept. 26- Nov. 2*
Part 2: *Reading and partially quantifying over 250 cases. The CMR Academy provides the cases and the necessary hardware and software.*	*160 hours private study (>250 cases).*		
Part 3: *Two weeks of case reviews, discussion and further hands-on training.*	*Sept. 10-21*	*Nov. 12-23*	*Dec. 3-14*

Compact courses

CMR diagnostics in theory and practice, including performance of examinations and case interpretation.	***English*** *Oct. 1-5*

3-Tesla cardiovascular imaging

Two-day module.	***English*** *Oct. 23-24*

1-2 days modules

(e.g. Perfusion, DSMR, Infarct Imaging, Heart Failure, CAI, 3.0T CMR, etc).	*Details on www.cmr-academy.com*

International Cardiac MR course

Leeds, England
Date: *2008*
Deals with theoretical principles and practical applications of Cardiac MRI. Daily practical scanning and post-processing sessions in small groups.
Info: *www.leedscmr.org/cardiac_course/index.htm, Mgreen@leedscmr.org*

CVMRI Practicum: New Techniques and Better Outcomes

St. Luke's Episcopal Hospital, Houston, Texas
Date: *March 5-8, June 4-7, October 15-18*
On principles and practical applications of Cardiac MRI.
Info: *tmatthews@sleh.com, Tel. +1-832-355-4201*

Cardiac MRI Training

Washington Hospital Center, Washington, D.C., USA
Date: *Three-month fellowship*
Info: *www.cvmri.com, Pamela Wilson, Tel. +1-202-877-6889*

Erasmus Course on Cardiovascular MRI

Leiden, The Netherlands
Date: *October 4-5*
Focuses on clinical applications of cardiac MR.
Info: *www.emricourse.org*

Cardiovascular MR training courses and fellowships

St. Louis, Mo., USA
Date: *2008*
Lecture format (2.5 days) or lecture plus hands-on (4 days).
Also offered are hands-on technologist training courses and three-month fellowships.
Info: *cmrl.wustl.edu/education, CMRL@cvu.wustl.edu, Tel. +1-314-454-7459*

MR Spectroscopy courses (1.5T and 3.0T)

Zurich, Switzerland
Daily practical scanning and post-processing sessions in small groups.

IBT MR Spectroscopy course

Date: *t.b.d.*
Aimed at MR physicists, clinical scientists, and others looking for in-depth understanding of MRS methods. Theory and hands-on sessions
Info: *www.mr.ethz.ch/courses/spectro2006/ Michele.Pauwels@philips.com*

Gyrotools MR Spectroscopy application courses

Date: *July 2007*
Aimed at clinicians who will use MR spectroscopy in the clinical practice. GyroTools offers 5-day Spectroscopy Application course, 2-day 31P spectroscopy course, 3-day Release 2 refresher course.
Info: *www.gyrotools.com*

North American off-site training courses

Dates upon request.
Info: *kristan.harrington@philips.com, Tel. +1-440-483-2471, Fax: +1-440-483-7946*

MR Basics

Chattanooga, Tenn., USA
Designed for beginner technologists with little or no previous MR experience. Lecture covers the basic concepts and theory of MRI.

MR Essentials for Achieva Intera, Panorama 1.0T users

Cleveland, Ohio, USA
This comprehensive course for technologists covers all basic scanning and system functionality.

MR Advanced for Achieva Intera, Panorama 1.0T users

Cleveland, Ohio, USA
Didactic and hands-on course covering advanced applications including advanced pulse sequences, cardiac and spectroscopy.

Essential Guide to Philips in MRI

Different locations, UK
Date: *June 11-14, October 22-25*
Specifically designed for Philips users, past, present and future. It is designed to provide a modular approach to accommodate all levels of knowledge.
Info: *Helen.Scargill@philips.com*

Events calendar 2007

July 22-26	**American Association of Physicists in Medecine – AAPM**	Minneapolis, Minn., USA	www.aapm.org
September 1-5	**European Society of Cardiology – ESC 2007**	Vienna, Austria	www.escardio.org
September 7-9	**China Hospeq**	Beijing, China	www.chinahospeq.com
September 7-11	**Academy of Molecular Imaging & Society for Molecular Imaging – AMI & SMI**	Providence, R.I., USA	www.ami-imaging.org
September 20-23	**European Society of Neuroradiology – ESNR**	Genova, Italy	www.esnr.org
September 21-22	**6th International Symposium on Highfield MR in Clinical Applications**	Bonn, Germany	www.radiologie.uni-bonn.de
October 3-6	**MR Angiography Club – MRA Club**	Istanbul, Turkey	www.mr-angio.org
October 14-15	**High Field MRI - The Impact on Clinical Practice**	Las Vegas. Nev., USA	radiologycme.stanford.edu/2007highfield
October 18-20	**European Society of Cardiac Radiology ESCR**	Rome, Italy	www.escr.org
October 20-24	**Journees Francaises de Radiologie – JFR**	Paris, France	www.sfrnet.org
Oct. 28 - Nov. 1	**American Society for Therapeutic Radiology and Oncology – ASTRO**	Los Angeles, Calif., USA	www.astro.org
November 4-7	**American Heart Association Scientific Sessions – AHA**	Orlando, Fla, USA	www.americanheart.org
November 25-30	**Radiological Society of North America – RSNA**	Chicago, Ill. USA	www.rsna.org

Achieva 3.0T X-series - Leading Performance

The brand new Achieva 3.0T X-series MR scanner matches a full-size 50 cm Field of View with a tiny 157 cm magnet. Its equally new gradient and RF system is engineered to let you go full throttle. Its weight is so low that we've made a mobile version too. Its user interface is as easy and its anatomical reach as wide as our Achieva 1.5T. And, like every other Philips MR scanner, it too has SmartExam, the automatic one click exam for brains, spines and knees.

www.medical.philips.com/achieva

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