Elite Clinical Solution enhances breast imaging

Achieva 3.0T TX with MultiTransmit RF technology
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Munson: shoulder coil added value to Panorama HFO
Patient throughput boosted at Klagenfurt institute
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“With the Elite Breast Clinical Solution, Philips has brought everything together to make a very reliable breast imaging system.”

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Philips presents Achieva 3.0T TX with MultiTransmit RF technology

Philips continues to drive the innovation of 3.0T imaging with the launch of its Achieva 3.0T TX, featuring MultiTransmit RF technology. This multi-source RF transmission boosts scan speed and enhances image quality by better signal uniformity, thereby providing more consistent results. The intelligent RF management of MultiTransmit benefits particularly breast and body imaging.

Inventor of parallel receive imaging now introduces parallel transmit

About a decade ago Philips was the first to introduce parallel imaging using multi-channel RF receive coils. The invention of this SENSE parallel imaging technique led to higher temporal resolution and improved spatial resolution without increased scan time.

Now, Philips offers MultiTransmit RF technology, built into the Achieva 3.0T TX system. This technique uses multiple RF transmission sources for sending RF signals in contrast to the traditional single RF transmit source.

Breast and body MR benefit from more robust imaging

MultiTransmit technology enables uniform distribution of the RF signal and makes it possible to adapt the RF signal to the shape and size of each patient’s body. Thus it addresses the high-field challenges like dielectric shading and SAR, thereby enhancing imaging speed and refining consistency and image quality. Its high quality particularly benefits breast and body imaging. Achieva 3.0T TX enables higher patient throughput by speeding up scan time in various applications, and provides enhanced images so there may be less need for rescanning.
Dear Friends,

At this year’s RSNA, Philips showcases innovative products that help customers meet their clinical and business challenges.

First and foremost, the Achieva 3.0T TX boosts 3.0T imaging in the market. Using proprietary MultiTransmit RF technology, it enhances scan speed and image quality across a broad range of clinical applications and patient sizes. With Achieva 3.0T TX, Achieva 3.0T X-series and Achieva 1.5T XR, which easily upgrades from 1.5T to 3.0T, we are taking the lead in migrating the market to 3.0T.

Philips’ Elite Clinical Solution for breast imaging is now commercially available. It includes the MammoTrak dockable patient support, diagnostic and biopsy coils, and the DynaCAD Enterprise breast software for analysis and biopsy planning from the MR console. This remarkable solution provides our customers a comprehensive set of tools for their breast MRI needs.

Philips is committed to keeping our customers at the forefront of technological innovation. Our MRI solutions will continue to evolve and improve to give customers exactly what they need to do so.

I hope you enjoy this issue of Field Strength.

Deepak Malhotra,
Vice President, Marketing and Strategy, MRI
Philips Healthcare
Philips drives innovation, efficiency at 2008 RSNA

Philips presents two Achieva scanners and a range of equally innovative solutions

This year’s RSNA includes a very strong showing by Philips MR, with exciting new product launches, announcements of upgraded systems and affirmation of the high quality and reliability of existing Philips products and services. Highlights are Achieva 3.0T TX for superb 3.0T imaging; Achieva 1.5T SE for high-performance scanning at reduced running costs and advances in clinically effective solutions that simplify MR imaging.

**Achieva 3.0T TX with MultiTransmit RF technology**

The Achieva 3.0T TX is making its debut at RSNA 2008. New technology built into the Achieva 3.0T TX boosts scan speed and enhances image quality with fewer artifacts. Achieva 3.0T TX’s MultiTransmit RF technology enables very uniform distribution of the RF signal. Thus, it addresses the high-field challenges of dielectric shading and SAR by adapting the RF signal to the shape and size of each patient’s body. TX functionality will also be available as an upgrade for Achieva 3.0T systems.

As evidenced by the success of the Achieva XR system, which can be ramped from 1.5T to 3.0T, and the development of the Achieva 3.0T TX, Philips continues to drive the adoption of 3.0T MR, opening up more clinical areas that can be imaged with 3.0T in clinical routine.
Achieva 1.5T SE — Smarter Economics
The Achieva 1.5T SE combines excellent performance with savings on running cost and total cost of ownership. The system is easy to install, easy to operate, and offers advantages such as energy savings of up to 50 percent and a compact siting size. The Achieva 1.5T SE is optimized for mainstream use. It reaches its high level of clinical performance with powerful Pulsar HP+ gradients and the full capabilities of Philips’ higher-end systems.

New additions to the high field open Panorama
Panorama High Field Open (HFO) has all-new gradients and a new set of Panorama coils for body, shoulder and knee, enabling SENSE parallel imaging in all applications. This enables higher speed and better spatial resolution in images.

Elite Clinical Solutions fit Care Cycle approach
The Care Cycle approach is increasingly used to model healthcare delivery, especially in cardiac care, women’s health and oncology. The cycle of care is a series of linked stages: prevention, screening, diagnosis, treatment, management and surveillance. Philips provides solutions for the different stages in the chain, and uses the model’s insights to help make the cycle more efficient and each step more effective.

Philips MR Elite Clinical Solutions are a vital component of care cycles. Developed as a meaningful offering of imaging techniques, supporting coils and peripherals and workflow support tools, Elite Clinical Solutions open up new clinical areas in Neuro, MSK, Body, Cardio, Breast and Vascular MR.

Philips’ RSNA exhibit shows many enhancements to the Elite Clinical Solutions, such as better coils and workflow improvements. New is the Elite Pediatric Clinical Solution that provides dedicated methods, coils and peripherals for pediatric imaging.

Visit also: www.philips.com/rsna

3-month-old child with tethered cord.
Courtesy: Hospital for Sick Children, Toronto.

Pediatric SENSE Head Spine coil, part of the Elite Pediatric Clinical Solution.
Philips investigated current issues surrounding breast MR, seeking one solution that would benefit both physicians and patients. The resulting Elite Breast Clinical Solution includes the new MammoTrak dockable patient support, DynaCAD Enterprise solution for advanced imaging data analysis and efficient biopsy planning at the MR console.

The Elite Breast Clinical Solution is just one aspect of Philips’ focus on the Care Cycle, a representation of linked stages in the delivery of healthcare that includes prevention, screening, diagnosis, treatment, management and surveillance.

**MammoTrak with integrated coil improves workflow and scan quality**

Time and efficiency are significant considerations when preparing patients for a breast MR scan. To that end, the new MammoTrak dockable patient support with its integrated breast coil allows patient preparation outside scanner room, so, while one patient is being scanned, another can be prepared away from the magnet, and simply rolled into the scanner room at the appropriate time, where the trolley is then docked over the existing patient table of the scanner. This provides considerable improvement in workflow efficiency.

The integrated MammoTrak breast coil comes in two versions. The new open design 7-channel SENSE Breast coil with integrated lighting enables imaging and biopsy. The new 16-channel SENSE Breast coil enables superb temporal and spatial resolution to facilitate early diagnosis. The new coils also allow better visualization of the axilla, an important region to evaluate in breast patients. The excellent image quality is combined with the high reproducibility offered by new SmartExam Breast.

**Patient comfort**

Especially if a patient enters head first into the scanner, she may feel uncomfortable during a breast MR exam. MammoTrak brings the patient into the scanner feet first, and uses materials and a design that are focused on patient comfort such as an adjustable headrest with a mirror.
Since July, General Hospital St. Jan (Brugge, Belgium) has been scanning about 10 to 15 breast patients a week using the Philips Elite Breast Clinical Solution on its Intera 1.5T with 16-channel FreeWave upgrade. In October, the hospital began patient biopsies.

Jan Casselman, M.D., Ph.D., Radiologist, Head and Neck Imaging, and Chairman of the Department of Radiology at General Hospital St. Jan, says there are many differences between conventional breast MR and the Elite Breast Clinical Solution.

“With the new 16-channel coil, the resolution is higher, so we have far more detail and we can pick up smaller lesions. Because of the integrated coil, the patient is also lower on the coil, so there’s less chance of the patient’s back being at the roof of the tunnel.”

“Patients go into the magnet feet first, so they don’t have the claustrophobic effect they might have had in the past, when they went in head first through the complete tunnel. Patients who have been scanned without the Elite Breast Clinical Solution and with it, say the latter is much more comfortable.”

“Most importantly, both new MammoTrak Breast coils have higher sides, so we see the axilla. We can now evaluate the lymph nodes without artifacts from the heart.”

**Easy and high quality Elite Breast imaging**

Example of the excellent image quality offered by MammoTrak with 16-channel SENSE MammoTrak Breast coil. The T1-weighted FFE, THRIVE and VISTA have 0.8 mm isotropic voxels. The ExamCard used enables immediate, automatic generation of the sagittal MPR views and MIPs.
Intuitive biopsy planning from MR console

Also contributing to time savings is the DynaCAD Enterprise solution for breast MR, that provides simultaneous access to a patient’s breast exam data from different computers within the hospital – including the MR operator’s console. User specific viewing protocols help clinicians navigate through the large amount of breast MR data. DynaCAD includes integrated reporting according to BI-RADS standards. It allows intuitive and efficient biopsy planning directly from the MR console – exactly where it’s needed. An in-room display near the magnet shows the optimal trajectory to breast lesions using the biopsy grid or the pillar that enables biopsy from feet-head, lateral or medial directions.

Philips Breast MR network

Philips MR has also initiated an Ambassador network among key opinion leaders in breast MRI. Ambassador sites offer breast MR courses that teach other physicians the best practices in breast MR diagnostics and intervention with the confidence of the Elite Breast Clinical Solution.

Biopsies performed quickly, comfortably at General Hospital St. Jan

“With the Elite Breast Clinical Solution, Philips has brought everything together to make a very reliable breast imaging system.”

“With the MammoTrak patient support, we can completely prepare biopsy patients outside the MR room,” explains Dr. Casselman. “Then, when the patient is ready, she can be easily brought in and scanned. With Elite Breast the biopsy planning is done on the MR console. The in-room display allows us to check the correct needle block or pillar position at the magnet, and shows how far the needle has been inserted to position it at the lesion. When the needle is in the correct position, we just undock the MammoTrak and roll it with the patient on top to the prep room, where the vacuum assisted biopsy (VAB) can take place. These VAB procedures can take considerable time, up to 30 minutes, since in our institution we continue to take samples until there is no breast tissue coming back anymore. As soon as the MammoTrak is removed, the next patient can be scanned, thereby drastically reducing the non-scanning time.”

“With the Elite Breast Clinical Solution, Philips has brought everything together to make a very reliable breast imaging system.”
Pediatric MR users to gather in Dallas

The 5th Philips Pediatric MR User Network meeting will be held in Dallas (Texas, USA) on February 1-3, 2009. Topics focusing on pediatric neuro, cardiac, MSK and body imaging will be discussed, as well as fetal imaging, interventional MR and safety.

Those interested in contributing to the program should contact Elizabeth.van.Vorstenbosch-Lynn@philips.com.

Immediately following the meeting, on February 4-6, a pediatric hands-on training course will take place, held in collaboration with Nancy K. Rollins, M.D., F.A.A.P., Medical Director, Department of Radiology, Children’s Medical Center Dallas, and the staff of Children’s Medical Center. The course will be geared to radiologists and technologists, and will cover aspects of pediatric imaging at 1.5T and 3.0T.

Dutch Princess opens new Philips Healthcare buildings

On September 29, her Royal Highness Princess Margriet – sister to Dutch Queen Beatrix – opened new Philips Healthcare buildings in Best, the Netherlands.

Philips CEO Gerard Kleisterlee also attended the inauguration of the new buildings on both sides of the main entrance. To mark the occasion, Philips donated a check for 25,000 Euros to the Dutch Red Cross. Best is the largest development and assembly center for Philips Healthcare worldwide with more than 3,000 employees. Main activities in Best are (pre) development and production of x-ray systems, MR scanners and Healthcare IT.
Non-contrast-enhanced MRA is routine at Thompson Peak

Breath-hold technique for imaging renal arteries provides efficient non-CE scans

Clinicians have been looking for fast, high-resolution MR imaging techniques that do not require contrast agents, since MR contrast agents are suspected to be related to NSF in patients with renal insufficiencies. Thomson Peak Hospital is using non-contrast-enhanced MR imaging on their Achieva 1.5T with good results.

Thompson Peak is one of three hospitals in the Scottsdale (Arizona, USA) Healthcare system. Opened in November 2007 as a 64-bed facility, Thompson Peak will soon expand to 184 beds. Its five to seven MR patients daily are seen mainly for abdominal, musculoskeletal or neurological problems. The hospital operates an Achieva 1.5T MR scanner.

Need for non-CE MR is growing

In 2007 the MR community became aware of the increased risk for Nephrogenic Systemic Fibrosis (NSF), following exposure to gadolinium-based contrast agents in patients with renal insufficiency. If contrast agent use is contraindicated because of these conditions, non-CE MRI methods have to be used.

Bob Macauley, ARRT, MBA, MRI technologist at Thompson Peak, says non-contrast-enhanced (non-CE) MRA is routinely used on all kidney-related MR exams at Thompson Peak. “We use non-CE imaging as a backup to bolus failure and for patients who cannot receive gadolinium. We also do all our carotid studies with non-CE MRA, and some extremity studies.”

Non-CE scans are now fast, effective with Philips

Macauley says Philips offers fast, easy scan protocols for non-CE exams. “Our non-CE renal images, for instance, are scanned from a preloaded sequence on the Philips scanner,” he explains. “It’s a balanced TFE protocol, specifically designed to image the renal arteries in a breath hold. The parameters are set, and we just place saturation bands on the most lateral aspect of both kidneys and inferiorly to reduce venous flow.”
A 29-year-old female with hypertension was admitted through ER. History of migraine and hypertension since early age. Images show subtle beading appearance of the right renal artery, raising the possibility of fibromuscular dysplasia. SENSE XL Torso coil, scan time 27 sec., breath hold, FOV 300/105, voxel size 1.25 x 1.25 mm, recon voxel 0.586 x 0.586 mm.

“Our radiologists like the non-CE technique so much, they’re asking other sites that use systems from other manufacturers to do the same,” says Macauley. “So far, though, the results have not been as good in comparison to our Philips Achieva 1.5T images.”

Ronald Newbold, M.D., Thompson Peak radiologist, says, “We have found, in our experience, that the non-CE sequences are of diagnostic quality. We are reviewing further cases of renal artery stenosis and are considering dropping the CE sequences for renal artery stenosis.”

MRI technologist Linnea Brock, R.T., agrees “It’s a very valuable technique. We were very excited when we were first saw results of this non-CE technique.”

“Our radiologists like the non-CE technique so much, they’re asking other sites that use systems from other manufacturers to do the same.”
Ambient Experience helps patients relax during scan

In addition to providing patients with fast non-CE scans, Thompson Peak is the only hospital in the state of Arizona to offer Philips Ambient Experience (AE). AE allows patients to customize their scanning environment through light, sound and imagery, by using a touchscreen to program their choice of calming themes.

Jean Knoedler, administrator of Thompson Peak, chose AE for patients who might be fearful of having an MR scan. “We find that AE helps patients change their mental outlook,” she says. “It helps them take their mind off their fears and relax. It also significantly reduced the number of patients that require sedation before their MRI scan.”

MRA to evaluate hypertension, renal stenosis

A 31-year-old female presented with severe hypertension accompanied by headaches, blood pressure 237/147 upon admission to hospital. Non-CE imaging reveals single bilateral renal arteries with no evidence of stenosis, confirmed by contrast-enhanced imaging. SENSE XL Torso coil, scan time 27 sec., FOV 300/105, voxel size 1.25 x 1.25 mm, recon 0.586 mm.

Ahead of the curve

“We are moving away from contrast agents for many types of MR exams,” says Michael Sclafani, manager of Diagnostic Imaging at Thompson Peak. “Contrast agents will still have a place in imaging, but much less so in the months to come, especially since we have the ability to do non-CE scans.”

“Philips has always been ahead of the curve on abdominal and angio work, especially cardiac,” says Macauley. “Having Philips equipment – both the Achieva scanner and Ambient Experience – sets us apart. We might not do the most scans in the area, but we’d like to think we do the best.”
B-TRANCE for free breathing, non-CE renal MRA

The Elite Vascular Clinical Solution offers imaging techniques, workflow support tools, and coils and peripherals for high quality MRA. One of the methods included is B-TRANCE (Balanced-SSFP – Triggered Angiography Non-CE), a technique developed for non-CE evaluation of the renal arteries [1-2].

B-TRANCE is a free-breathing, cardiac triggered 3D SSFP sequence, combined with a slab-selective inversion prepulse. Free-breathing is enabled by use of navigator gating. Suppression of the renal parenchyma and the venous structures is achieved by appropriate selection of the inversion delay time, in combination with saturation bands overlying each kidney and inferior to the imaging slab. The renal arteries appear bright due to the inflow of non-saturated blood from the aorta within the inversion delay time.

Studies have shown that this technique has a high sensitivity and a high negative predictive value, which makes it an efficient tool for renal MRA.

References

Reducing examination waiting time and boosting patient throughput

Utilization Services and Kaizen Event help to tackle patient changeover delays

The MRCT Diagnoseinstitut (diagnostic institute) in Klagenfurt is the largest practice of its kind in the southern Austrian province of Kärnten. It has a 6-slice CT and two 1.5T MR systems. The newest of these MR systems is a Philips Achieva 1.5T, in use since 2005. Both MR machines handle the standard examinations, such as joints, spine and brain. The Achieva also handles more complex cases such as abdomen, mamma and vascular examinations.

Reimbursement from the health insurers is almost independent of the examination type. So Dr. Krzysztof Staniszewski and Dr. Thomas Riepl are keen to ensure the highest possible examination throughput on the Achieva, both to recoup their investment and keep the waiting list under control. In April 2008, a Kaizen Event with Philips Utilization Services helped them achieve that.

Before optimizing processes, the ratio of scanning time to the total examination duration was around 55%. They had identified the causes of the examination waiting time – all non-scan time during and between examinations – as patient no-shows and the time taken for changeovers of patients arriving late or with incomplete paperwork. Trying to tackle this themselves ran into problems.
“This was not about increasing the workload, it was about improving organization for everybody’s benefit.”

Between reporting on 100 examinations a day and administration from bureaucracy to maintaining the PACS, the two doctors did not have the time to follow the project through. Dr. Staniszewski identifies the first attempt as being not effective enough and the supervision “not objective enough”. He decided to get professional, external help.

Objectivity and common benefits
The doctors read an article in Field Strength about Philips Utilization Services that got their interest for its objective approach. Dr. Riepl and one of the radiographers then met with Philips representatives at an MR users meeting in Vienna. The convincing point for the radiographers and administrative staff was that this was not about increasing the workload, it was about improving organization for everybody’s benefit. “This was important in overcoming skepticism,” says Dr. Riepl.

The Philips team first analyzed the situation with a Utilization Quick Scan in the first quarter of 2008. The change then took place in three days in April, in a so-called Kaizen Event. Kaizen is Japanese for improvement, and a Kaizen Event aims for a rapid improvement that optimizes a small, self-contained process in a single burst of change. The “Kaizen team” included doctors, radiographers and administrative staff, working together. The Kaizen Event started by describing and observing the patient changeover, using brainstorming, video and interviews. This turned out to have more than 30 steps. Next came identifying possible changes in further brainstorming, and on the third day, making and securing the changes.
“Apart from reducing no-shows, reminder calls improved punctuality: less than 1% late, compared with 11% late before.”

Concrete actions, immediate benefits
To reduce patient no-shows and their impact, the first change was to call patients to confirm appointments the day before the examination. They also were asked to show up 15 minutes earlier for their examination. Analysis had shown there was overcapacity in the overlap of the two shifts of radiographers. Now one of them uses this time and a standardized script to call patients who seem most likely not to come, or those with long examinations where a no-show would mean a lot of time wasted. Patients report liking this reminder service, and apart from reducing no-shows, it improves punctuality (<1% late, compared with 11% late without a reminder call). The radiographer also asks the patient – in cases where the patient is undergoing two MRI studies – to fax or bring their paperwork a day before the examination, or even when they are making the appointment. This more than halves the number of delays associated with incomplete paperwork.

They also started overbooking patients – as Dr. Staniszewski points out, airlines have been doing this successfully for years. Based on the statistical analysis of the no-show occurrences, they started with 4 extra patients, at key times every day.

They also now start the changeover 5 minutes earlier. This ensures better screening, instruction and preparation before entering the scanning room. For the radiographer’s preparation, they adjusted ExamCards based on a Pareto analysis of the utilization data, to focus on the most used examinations and define specific ExamCards for frequent requests. They standardized other aspects of the preparation too, such as making contrast injections consistent between radiologists. SmartExam technology, for routine examinations, and various other measures to reduce artifacts and improve consistency have helped reduce retakes.
Direct and indirect contributions
Dr. Staniszewski and Dr. Riepl agree that Philips contribution was key to the success of the Kaizen Event. “Philips consultants moderated the brainstorming to find solutions,” says Dr. Riepl. “We had the ideas, but the Philips consultants contributed the arguments for and against them. It is hard to know which ideas we had, and which they guided us to.” Dr. Staniszewski agrees, and confirms the significance of Philips moderation. “Ideas or even just approval by an external source, with external authority, get greater acceptance,” he notices.

Dr. Staniszewski measures success as the benefit against the effort taken. “The effort during the Kaizen Event was not extraordinary, and we were surprised how the change happened without any disruption in the institute,” he says. Further utilization scans have shown a 12% increase in patient numbers on Mondays to Thursdays (when the practice is open 14 hours), and 22% on Fridays, when the practice is open until lunchtime.

“The sustainability of the improvement is assured by everybody’s participation from the start,” Dr. Staniszewski continues. This participation continues in monitoring the patient numbers, and in re-examining throughput to fine-tune the overbookings. Of course, the staff wanted to know what was in increasing the patient throughput for them personally. They decided to set up a bonus fund, shared out among them, based on the increase in patient numbers. This reinforces the motivation to sustain the improvements.

While the 8 radiographers and 9 administrative staff have accommodated the increase by reducing non-scan time, the 2 doctors have had to engage a further, part-time radiologist to cope with the increased caseload. The result has helped them reduce waiting times – to the satisfaction of the referring doctors and the patients – and ensure the best possible return on their investment in Philips MR.
Munson Community Health Center (Traverse City, Michigan, USA) began using the Philips Panorama High Field Open (HFO) MR scanner in April 2008. Since then, it has made a difference in the lives of patients from all over the state of Michigan, who no longer have to travel long distances with overnight stays to be scanned. And the recent addition of the Philips ST Shoulder coil (Shoulder coil 1TSH), helps create high quality images.

“After years with conventional MR units at Munson Medical Center and a mobile unit at Munson Community Health Center, the addition of the Panorama HFO has enabled the Center to scan more patients than before. Many hospitals in northern Michigan refer patients to the Center because they don’t have the ability to scan large patients. The Center now performs about 70 scans each week for a variety of MR scanning. And since it’s an open MRI, patients are much more comfortable than in a closed bore scanner.”

“The Panorama is definitely an asset to our community,” says Patricia Romberg, R.T. (R) (MR). “Now we can reach out to a much broader geographic area.” Traverse City is located in northern Michigan, so the Panorama is now accessible to residents in that region who previously had to travel to larger facilities in the southern part of the state.

“We can scan many more large patients with the Panorama,” Ms. Romberg adds. “They are so grateful. Many were unable to get an MRI exam previously, because they couldn’t fit into closed bore scanners.”

The Panorama HFO has not only increased the comfort level of large patients, but those who are claustrophobic as well. At Munson, the scanner is near a window, through which patients can see the trees and flowers outside the facility.

It’s also a boon to pediatric patients and their parents and caregivers, Ms. Romberg says. “Because of the open aperture of the Panorama, pediatric patients can actually have a loved one very close to them during the scan. That comforts both the child and the parent.”

**ST Shoulder coil offers ease of use, strong signal**
The new ST Shoulder coil (Shoulder coil 1TSH) has added value to Munson’s use of the Panorama. “It’s easier to use on shoulders than the Multi-Purpose (Flex) M coil and it’s more comfortable for the patients,” Ms. Romberg explains. “The patients just lie down and the cup molds right onto their shoulders. When we used the loop coils, we used sandbags to hold them in place so we didn’t lose
any signal. With the new dedicated shoulder coil, the fit is better and the signal is much stronger; the quality of the images is vastly improved.”

Radiologist Todd Kennell, M.D., agrees: “The new shoulder coil is significantly better for us and for our patients. We have a very good, homogeneous signal intensity throughout the shoulder, and much more reproducible imaging for different sized patients. When we were using the Multi-Purpose Flex coil with some of our larger patients, we couldn’t always get the coil in the right spot, and I didn’t want to water down the protocol.”

Now, however, the dedicated shoulder coil provides high quality, reproducible images for the majority of Munson’s patients. The Center recently added the ST Knee coil (Knee coil 1.0T) as well, which has provided very good knee images. “We’re very happy with the new knee coil,” Dr. Kennell says. “The images from the Panorama with this knee coil are comparable to our 1.5 Tesla imaging.”

Overall, the two new Philips coils have impressed the staff at Munson. “You click them on the patient and they’re in the proper place,” says Dr. Kennell. “We’ve got good techs and they do a great job; this just makes the images so much more clear and reproducible.”

### Rotator cuff tear with ST Shoulder coil

A 63-year-old male presented with chronic shoulder pain. The MR images show full thickness rotator cuff tear with retraction of the supraspinatus tendon. Use of the dedicated ST Shoulder coil (Shoulder coil 1TSH) allowed to reduce slice thickness from 4.1 mm to 3.5 mm in the same scan time and significantly increasing SNR.

### Supraspinatus muscle tear with ST Multi-Purpose coil

A 68-year-old man presented with shoulder pain after falling on ice two weeks ago. MR images show edema throughout the supraspinatus muscle, with an intact rotator cuff. Partial tear of supraspinatus muscle is diagnosed. With the ST Multi-Purpose (Flex) M coil the images are diagnostic, but have less SNR than is desirable.
**Voxel size, bandwidth and water-fat shift**

Pixel size is a more convenient parameter than matrix for representing in-plane spatial resolution. Voxel size is used similarly for spatial resolution in three dimensions. This application tip also explains the relation between water-fat shift (in pixels) and bandwidth and shows how to use water-fat shift when optimizing image quality.

**Contributed by Johan de Jong and Marjolijn Guerand, MR Applications, Best**

**Pixel size better describes spatial resolution than matrix**

In MR images pixel size depends on both the selected field of view (FOV) and matrix. In-plane pixel size is determined as:

\[
\text{Pixel size} = \frac{\text{FOV}}{\text{Matrix}}
\]

The images below have different FOV and matrix, but the same pixel size, and thus the same spatial resolution in the area of interest within the orange square.

As this example demonstrates: pixel size, not matrix, determines spatial resolution.

While pixel size reflects in-plane resolution, voxel size represents three-dimensional resolution by taking slice thickness into account as well. Voxel size is inversely proportional to spatial resolution. In other words: high spatial resolution is equivalent to small voxels.

A voxel is a small volume element that represents resolution in measurement, phase encoding and slice encoding directions.
Combining a matrix size of 512 with different FOVs generates different pixel sizes.

<table>
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<th>Matrix</th>
<th>FOV</th>
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<tbody>
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<td>160 microns (0.16 mm)</td>
<td>512</td>
<td>85 mm</td>
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<tr>
<td>330 microns (0.33 mm)</td>
<td>512</td>
<td>170 mm</td>
</tr>
<tr>
<td>660 microns (0.66 mm)</td>
<td>512</td>
<td>340 mm</td>
</tr>
</tbody>
</table>

High spatial resolution (0.166 mm pixels) can be obtained with a range of different combinations of FOV and matrix.

<table>
<thead>
<tr>
<th>Pixel size</th>
<th>Matrix</th>
<th>FOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>166 microns (0.166 mm)</td>
<td>512</td>
<td>85 mm</td>
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<tr>
<td>166 microns (0.166 mm)</td>
<td>1024</td>
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<tr>
<td>166 microns (0.166 mm)</td>
<td>2048</td>
<td>340 mm</td>
</tr>
</tbody>
</table>

**Use voxel size to directly control resolution**

In MSK imaging, the most frequently changed parameters are number of slices and FOV. However, changing FOV also changes resolution, bandwidth and gradient waveform. So, changing FOV also changes image quality.

When optimizing spatial resolution, **first determine the FOV and pixel size needed, then derive the matrix size** needed to achieve this.

Philips scanners enable direct control of voxel size. This avoids changes in gradient waveform and thus helps with easier planning and maintaining consistent image quality.

The Info page displays ACQ voxel MPS which is the voxel sizes in measurement, phase and slice encoding directions respectively.

Visit NetForum to view more Application Tips on this or other subjects.
Water-fat shift and bandwidth

Fat protons resonate at slightly lower frequencies than water. The frequency difference is called chemical shift. It depends on the magnetic field strength:

<table>
<thead>
<tr>
<th>Field strength</th>
<th>Frequency difference between fat and water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0T</td>
<td>147 Hz</td>
</tr>
<tr>
<td>1.5T</td>
<td>220 Hz</td>
</tr>
<tr>
<td>3.0T</td>
<td>440 Hz</td>
</tr>
</tbody>
</table>

Because MRI also uses resonance frequencies for spatial encoding, this frequency difference causes a small shift between the fat and water position in the frequency direction in the MR image. Water-fat shift (WFS) is defined as the displacement of the water signal with respect to fat signal in the image. Water-fat shift is expressed in number of pixels (e.g. 3 pixels).

Example: if bandwidth is about 30 kHz for the full FOV, and matrix is 512, then a pixel’s width is 30 kHz/512 = about 60 Hz. The water-fat frequency difference at 1.5T is 220 Hz, which then corresponds to 220/60 = 3.7 pixels.

The anatomy imaged determines how much water-fat shift is acceptable. The parameter water-fat shift can be used to optimize a scan. The table summarizes its effects and compares it to the bandwidth effect:

<table>
<thead>
<tr>
<th>Water-fat shift</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce water-fat shift to reduce chemical shift artifacts</td>
<td>Increase bandwidth to reduce chemical shift artifacts</td>
</tr>
<tr>
<td>Reduce water-fat shift to reduce metal artifacts</td>
<td>Increase bandwidth to reduce metal artifacts</td>
</tr>
<tr>
<td>Increased water-fat shift increases SNR</td>
<td>Narrowing bandwidth increases SNR</td>
</tr>
<tr>
<td>Reduce water-fat shift to reduce readout duration and echo spacing, and limit blurring</td>
<td>Increase bandwidth to reduce readout duration and echo spacing, and limit blurring</td>
</tr>
</tbody>
</table>
Adapting water-fat shift to improve image quality

In the shoulder, fat shift (or chemical shift) may cause fat of the bone to overlap with the cartilage. **Decrease WFS while maintaining resolution to separate bone and cartilage** in the image, enabling good reviewing of the shoulder joint. These three images are acquired with the same 0.3 mm acquisition resolution. With the smallest WFS the separation is clearly visible.

These images show that decreasing resolution (= larger pixels) leads to larger water-fat shift in millimeters (BW decreases), causing severe overlap in the image.

**Decrease WFS to separate bone and cartilage:**

<table>
<thead>
<tr>
<th>Acq. resolution</th>
<th>WFS</th>
<th>BW</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 mm</td>
<td>1 pixel = 0.3 mm</td>
<td>95 kHz</td>
</tr>
<tr>
<td>0.3 mm</td>
<td>1.5 pixel = 0.45 mm</td>
<td>63 kHz</td>
</tr>
<tr>
<td>0.3 mm</td>
<td>3 pixel = 0.9 mm</td>
<td>32 kHz</td>
</tr>
<tr>
<td>0.5 mm</td>
<td>1 pixel = 0.5 mm</td>
<td>57 kHz</td>
</tr>
<tr>
<td>0.5 mm</td>
<td>3 pixel = 1.5 mm</td>
<td>19.2 kHz</td>
</tr>
<tr>
<td>0.8 mm</td>
<td>3 pixel = 2.4 mm</td>
<td>12 kHz</td>
</tr>
</tbody>
</table>
Setting the water-fat shift parameter

The Water-fat shift parameter appears on the Contrast page. Possible values are:

Minimum: smallest possible WFS
User defined: WFS will not exceed the user defined value
Maximum: largest possible WFS

Make sure to always check the actual WFS on the Info page.

Practical guidelines for setting WFS:

- For most MSK protocols a WFS of 1 to 2.5 pixels is recommended
- The anatomy determines how many millimeters of fat shift in can be tolerated
- With smaller pixels a slightly higher WFS may be acceptable

Calculating bandwidth from WFS or vice versa

To calculate bandwidth from WFS for 3.0T:

\[ \text{BW [kHz]} = 0.22 \times \frac{\text{matrix freq}}{\text{WFS [pixels]}} \]

Example: if WFS is 1.76 pixels for a 3.0T scan with matrix 512, then \( \text{BW} = 0.22 \times 512 / 1.76 = 64 \text{ kHz} \)

To calculate WFS from bandwidth for 3.0T:

\[ \text{WFS [pixels]} = 0.22 \times \frac{\text{matrix freq}}{\text{BW [kHz]}} \]

Example: if bandwidth is 62.5 kHz for a 3.0T scan with matrix 384, then: \( \text{WFS} = 0.22 \times 384 / 62.5 = 1.35 \text{ pixels} \)

For other field strengths the same formulas apply, but replace 0.22 by 0.11 for 1.5T, or by 0.074 for 1.0T.
Tokai University Hospital has been operating a magnetic resonance/x-ray/operating suite (MRXO) since 2006. Developed with the support of Philips Healthcare, the MRXO is an operating suite equipped with radiological diagnostic systems.

Mitsunori Matsumae, M.D., is Professor of Neurosurgery and Chair of the Department of Neurosurgery at Tokai University School of Medicine (Tokyo, Japan), as well as Neurosurgeon-in-Chief at Tokai University Hospital. Before the hospital was built, he helped develop a system for the new hospital in which MR, CT and angiography systems are all housed within an operating theater that can accommodate advanced surgery such as neurosurgery. “We named this facility the MR/x-ray/operation suite (MRXO),” says Prof. Matsumae.

Smartly designed concept
The arrangement of the MRXO suite allows each machine to be used separately as a diagnostic device, or in combination to provide imaging for assisting a neurosurgical procedure. The system is located in the emergency department so that the emergency, radiology and neurosurgery departments can utilize radiological diagnostic systems efficiently. Its location allows the system to be used 24 hours every day; if it were in an operating theater, its use would most likely be limited to weekdays only.
The Tokai University Neurosurgery Department – in collaboration with Mizuho Ika Kogyo Co., Ltd – developed a new MR-compatible operating tabletop comprising three parts with four joints. “This operating table and tabletop make it easier to perform intraoperative MR and allow operations – especially neurosurgical operations where the head must be raised – to progress smoothly,” says Prof. Matsumae.

The MRXO system uses MR (Achieva 1.5T with modifications*), CT (Brilliance 40) and angiography (Allura Xper FD20). During the first month following the opening of the hospital and installation of the MRXO suite, each diagnostic system was used separately to train the radiology technologists. Once they had acquired the skills to use each system, neurosurgery and interventional radiology (IVR) simulations using volunteers were performed repeatedly.

Intraoperative MR during neurosurgery
“As a neurosurgeon, I was fully aware of the significance

--

*Telemetry integration and other modifications.
of having an MR system in an operating room to monitor the progress of surgical interventions," says Prof. Matsumae.

MR images that are updated during neurosurgery enable a surgeon to see anatomical structures and monitor changes occurring during the neurosurgical procedure. “For instance, we are currently using MR during tumor resections using craniotomy to determine the location of important nerves or blood vessels. By monitoring MR images that are updated during surgery, we can remove cerebral lesions as completely as possible.”

At present, one to two operations are routinely performed for neurosurgery and for IVR in the MRXO each week. A noteworthy point is that the suite is located in the ER, and as a result, approximately 40 CT scans, 16 MR scans and one angiography are performed each day. This efficient and routine use of the diagnostic machines illustrates the features of the MRXO suite very well.

**Versatility of MRXO**

The MRXO suite is currently used for interventional radiology procedures, intraoperative MR and angiography for neurosurgery, but applications may broaden in future. The MRXO suite has multiple modalities that can be used individually, but can offer combinations of modalities as well, namely, MR and surgical function, surgical function and angiography, surgical function and CT, MR and angiography, angiography and CT, MR and CT and more. In addition, the MRXO can be further developed into a high-end suite by incorporating PET-CT and/or 3.0T MR.

*Not commercially available.*
MR-guided high intensity focused ultrasound (MR-HIFU)

An alternative form of non-invasive out-patient treatment in oncology

MR-guided high intensity focused ultrasound (MR-HIFU) is an emerging therapy technique using focused ultrasound to heat and coagulate tissue deep within the body, without damaging intervening tissue. Philips Healthcare is collaborating with Professor Chrit Moonen at the University of Bordeaux in the development of a dedicated MRI-guided HIFU system.

The HIFU concept

In high intensity focused ultrasound (HIFU), a specially designed transducer is used to focus a beam of ultrasound energy into a small volume at specific target locations within the body. The focused beam causes localized high temperatures (55 to 90°C) in a region as small as 1 x 1 x 5 mm. The high temperature, maintained for a few seconds, produces a well-defined region of necrosis. This procedure is referred to as ultrasound ablation. The tight focusing properties of the transducer limit the ablation to the target location.

In many applications, the HIFU therapy is guided using diagnostic ultrasound. However, ultrasound imaging does not provide the high resolution images, real-time temperature monitoring, and adequate post-treatment lesion assessment required for fast and effective therapy.

In contrast to ultrasound, MR imaging offers excellent soft tissue contrast, 3D imaging capabilities, and non-invasive temperature measurement techniques.

Philips investigational MR-HIFU system

The Philips MR-HIFU system, under clinical investigation, is designed to address some of the problems encountered with currently available HIFU systems.
The Philips investigational MR-HIFU system uses the Achieva 1.5T or 3.0T MR platform, and comprises the following interconnected subsystems:

- Achieva MR system to monitor the procedure and provide real-time images.
- MR-HIFU patient tabletop with integrated MR-compatible high power phased array transducer with mechanical and electronic positioning.
- MR-HIFU therapy console to plan treatment, calculate real-time temperature maps, and control HIFU delivery.
- HIFU electronics for ultrasound power (energy) delivery and beam positioning.

The separate HIFU therapy console is used for treatment planning and control of the procedure. The intuitive and easy to learn graphical user interface offers multiple tools for safe procedure planning, based on freshly acquired 3D MR images.

During treatment, the therapy console calculates and displays real-time MR temperature maps in multiple planes or 3D, and implements a temperature feedback loop for energy control.

The real-time temperature imaging can be used to provide feedback to the HIFU system to control the amount of energy delivered to the tissue. Parts of the procedure that require repetition of the same step are automated, but allow for user interruption/interaction.

**Volumetric HIFU**

Normally, HIFU ablation is done using point-by-point ablation, which is time-consuming and can leave gaps between the treated points. Philips’ investigational MR-HIFU system enables volumetric heating of a much larger area.

Theoretical models and animal studies indicate that the volumetric heating approach offers more effective treatment and has the potential to reduce the treatment time by a factor of 3 to 4.6.

**Uterine fibroids**

HIFU is currently marketed in the United States for the treatment of uterine fibroids. Fibroids are non-malignant growths, which are estimated to affect four out of seven women in the United States, between the ages of 30 years and the onset of menopause. Approximately 10% to 20% of women with fibroids have symptoms severe enough to need treatment. The primary symptoms are pain and hemorrhage. In some 300,000 cases, hysterectomy is performed.

HIFU offers an alternative in the form of non-invasive outpatient treatment with minimal to no sedation.
Philips 7.0T User Meeting a resounding success

Researchers gather to share results and ideas in Zurich, Switzerland

More than 70 participants from around the world gathered at Kartause Ittingen (Zurich, Switzerland), July 2-5, to discuss current work at 7.0T. This included attendees from 7.0T partner sites, Philips staff members and several prospective customers, who exchanged ideas and results related to their clinical, methodological and technological MR research.

Hosted by Prof. Peter Boesiger Ph.D., Prof. Klaas Pruessmann, Ph.D. and their groups at the Institute for Biomedical Engineering of Zurich’s Swiss Federal Institute of Technology (ETH Zurich), the meeting encouraged current and prospective 7.0T users to establish relationships and build affiliations for the future. Attendees shared the status of their 7.0T research, and were updated on Philips’ plans for the future of imaging at 7.0T.

During a tour through the University Hospital Zurich and the ETH Zurich, participants could learn about the history of the center, review the RF and hardware labs and receive a demonstration of Functional MRI at the Achieva 7.0T research system.

Scientific program presents progress in 7.0T research

Remarkable progress in method developments and applications on the Achieva 7.0T research system were presented, and many scientific discussions took place. Imaging at 7.0T is opening new perspectives both for clinical diagnostics and for the investigation of physiological processes. “The scientific sessions reflected that during the past year we have gained an improved understanding of the opportunities and challenges of 7.0T in the user community, as well as inside Philips,” remarks Anke Henning, Ph.D., researcher and one of the organizers at ETH Zurich.
Matters related to skeletal and brain MR spectroscopy were discussed, as well as functional MRI, brain MR angiography and optimized sequences and new or improved methods for imaging at 7.0T. Several presentations were devoted to RF coils, including specialty coils, safety validation, absorption rates and the bio-effects of magnetic and induced electric fields.

B0 and B1 fields were discussed in terms of improved image quality, with presentations on mapping, B1 inhomogeneity and corrections, dynamic B0 shimming, multi-channel transmission and asymmetric spin echo imaging.

Traveling wave MR holds promise

David Brunner, Ph.D. of ETH Zurich explained the concept and implementation of traveling wave MR, a promising approach to imaging beyond the brain, which was earlier presented at this year’s ISMRM. Traveling wave MR research seeks to overcome shrinking wavelengths and the resulting inhomogeneity of RF fields at 7.0T. The Zurich team designed a transmit-receive RF probe that generates propagating waves instead of the usual near RF regime. This antenna is placed at the end of the bore, about 60 cm away from the isocenter. Imaging of small samples produced high resolution images with excellent SNR. Large phantom experiments demonstrated that signal from a 50 cm FOV can be acquired.

Next year’s 7.0T meeting in Dallas

The 7.0T User Meeting will take place on May 18-21, 2009 in Dallas (Texas, USA). Hosted by Prof. Craig Malloy, M.D. and Prof. Dean Sherry, Ph.D. at the University of Texas Southwestern Medical Center, the meeting will be held in conjunction with the $^{13}$C MRS Workshop and Hyperpolarization Symposium.

Reference

1. D O Brunner, D De Zanche, J Paska, KP Pruesmann
   Traveling wave MR on a whole-body system
3.0T

**AMIGENICS/NIC 3.0T courses**
Las Vegas, Nevada, 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.

Breast MRI

**Advanced Breast MRI Workshop**
Cleveland, Ohio, USA
Date: Spring 2009
Two-day course for radiologists, technologists. Participants have basic knowledge of MRI, breast imaging. The course combines lectures and the clinical practice of breast MR. Note that class size for this course is limited.
Info: charlotte.dangelo@philips.com

**Erasmus Course on Breast/Female MRI**
Wroclaw, Poland
Date: June 1-5, 2009
Info: www.emricourse.org

**The Chicago International Breast Course**
Chicago, USA
Date: October 1-4, 2009
Info: www.radiology.northwestern.edu/education/cme/the-chicago-international-breast-course-2009

**Applications and Interpretation of Breast MRI**
Santa Monica, CA, USA
Date: January 17 – 18, 2009
Info: www.sbi-online.org

**Annual Advanced Breast Imaging and Interventions**
Las Vegas, USA
Date: March 4 - 7, 2009
Info: radiologycme.stanford.edu/2009breast

Cardiac MR

**Cardiac MR courses at CMR Academy**
German Heart Institute, Berlin
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

**Fellowship**
Dates: Feb. 9-20 and Mar. 21 – May 1; Oct. 19 – Nov. 27 and Nov 28 – Jan 9, 2010
Intensive course including hands-on training at the German Heart Institute, and reading and partially quantifying over 250 cases

**Compact course**
Dates: February 9-13, October 19-23
CMR diagnostics in theory and practice, including performing examinations and case interpretation.

**CVMRI Practicum: New Techniques and Better Outcomes**
St. Luke’s Episcopal Hospital, Houston, Texas
Date: T.b.d.
On principles and practical applications of Cardiac MRI.
Info: rose@slleh.com Tel. +1-832-355-4201, Fax: +1-832-355-4741

**International Cardiac MR course**
Leeds, England
Dates: June 15-19, Oct. 18-22
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 Mgreen@leedscmr.org

**Erasmus Course on Cardiovascular MRI**
Leiden, Netherlands
Date: October 8-9
Focuses on clinical applications of cardiac MR.
Info: www.emricourse.org

**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

Cardiac MR Imaging in Clinical Practice
Leeds, England
Date: March 9-10
Designed by cardiologists for cardiology trainees and cardiologists. Includes the basics of CMR methodology and its daily applications. Lectures are presented with firmly clinical focus in a case-based format.
Info: www.cmr.leeds.ac.uk j.c.beeton@leeds.ac.uk Tel. +44-113-3922735

CMR case review
Leeds, England
Date: T.b.d.
50 cases in a day — intensive course for cardiology or radiology trainees or physicians.
Info: www.cmr.leeds.ac.uk j.c.beeton@leeds.ac.uk Tel. +44-113-3922735

Cardiovascular MR training courses and fellowships
St. Louis, Mo., USA
Date: Spring 2009
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: ctrain.wustl.edu cme@wustl.edu Tel. +1-314-454-7459

MR Spectroscopy

**MR Spectroscopy course (1.5T and 3.0T)**
Zurich, Switzerland
Date: T.b.d.
Theory sessions and daily practical scanning and post-processing sessions in small groups.
Info: www.gyrotools.com, courses@gyrotools.com Tel. +41 44 632 3894, Fax +41 44 632 1193

**Advanced MR Spectroscopy**
Cleveland, Ohio, USA
Dates: T.b.d.
Four-day course for clinical scientists, MR engineers, research technologists, physicians, and physicists of Philips MR sites, interested in MR spectroscopy. Participants require basic MR scanning experience. Note that class size for this course is limited
Info: charlotte.dangelo@philips.com

Musculoskeletal

**Erasmus Course on Musculoskeletal MRI**
Birmingham, England
Date: January 26-30
Info: www.emricourse.org, erasmusroh@yahoo.co.uk

MR Angiography

**Contrast-enhanced MRA in clinical practice**
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
### General MR

**Essential Guide to Philips in MRI**

**Different locations, UK**

**Dates:** June 22-25; Oct. 12-15

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

**MRI self-directed visiting fellowship**

**ProScan Education Foundation**

**Cincinnati, Ohio, USA**

**Date:** continuously throughout the year.

**Info:** [http://www.proscan.com/fw/main/Visiting_Fellowships-448.html](http://www.proscan.com/fw/main/Visiting_Fellowships-448.html), mrieducation@proscan.com

Tel. 1-866-MRI-EDUC

### North American off-site training courses

**Dates:** upon request

**Info:** lori.hawkins@philips.com

Tel. 1+440-483-2260

Fax: +1-440-483-7946

**MR Basics**

**Chattanooga, Tenn., USA**

Designed for beginner technologists with little or no previous MR experience. Lectures cover the basic concepts and theory of MRI.

**MR Essentials for Achieva, Intera and Panorama HFO users**

**Cleveland, Ohio, USA**

This comprehensive course for technologists covers all basic scanning and system functionality. Lectures cover MRI safety, scan parameters, and pulse sequences.

**MR Advanced for Achieva, Intera and Panorama HFO users**

**Cleveland, Ohio, USA**

Didactic and hands-on course covering advanced applications including advanced scan parameters, pulse sequences, advanced Neuro, Ortho, Body, and Breast imaging techniques, fMRI, and spectroscopy.

### Extended MR Workspace for Achieva, Intera and Panorama HFO users

**Cleveland, Ohio, USA**

Didactic and hands-on course covering basic system maintenance, EWS functionality, and all MR analysis packages with lectures in Cardiac imaging, fMRI and Diffusion Tensor imaging and Fiber tracking.

### Cardiac Imaging for Achieva, Intera and Panorama HFO users

**Cleveland, Ohio, USA**

Didactic and hand-on course covering all cardiac views, heart valves, Q-flow, coronary arteries and the postprocessing packages on the EWS.

### Events calendar 2009

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>More information</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 26-29</td>
<td>Arab Health</td>
<td>Dubai, UAE</td>
<td><a href="http://www.arabhealthonline.com">www.arabhealthonline.com</a></td>
</tr>
<tr>
<td>January 29-February 1</td>
<td>Society for Cardiovascular Magnetic Resonance – SCMR</td>
<td>Orlando, FL, USA</td>
<td><a href="http://www.scmr.org">www.scmr.org</a></td>
</tr>
<tr>
<td>March 6-10</td>
<td>European Congress of Radiology – ECR</td>
<td>Vienna, Austria</td>
<td><a href="http://www.mycr.org">www.mycr.org</a></td>
</tr>
<tr>
<td>March 7-12</td>
<td>Society of Interventional Radiology – SIR</td>
<td>Washington DC, USA</td>
<td><a href="http://www.sirweb.org">www.sirweb.org</a></td>
</tr>
<tr>
<td>March 29-31</td>
<td>American College of Cardiology – ACC</td>
<td>Orlando, FL, USA</td>
<td><a href="http://www.acc.org">www.acc.org</a></td>
</tr>
<tr>
<td>April 4-7</td>
<td>Charing Cross Symposium</td>
<td>London, UK</td>
<td><a href="http://www.cxsymposium.com">www.cxsymposium.com</a></td>
</tr>
<tr>
<td>April 16-19</td>
<td>Japan Radiology Congress – JRC</td>
<td>Yokohama, Japan</td>
<td><a href="http://www.j-rc.org">www.j-rc.org</a></td>
</tr>
<tr>
<td>April 18-24</td>
<td>International Society for Magnetic Resonance in Medicine – ISMRM</td>
<td>Honolulu, Hawaii</td>
<td><a href="http://www.ismm.org">www.ismm.org</a></td>
</tr>
<tr>
<td>April 21-25</td>
<td>Society for Pediatric Radiology – SPR</td>
<td>Carlsbad, CA, USA</td>
<td><a href="http://www.pedrad.org">www.pedrad.org</a></td>
</tr>
<tr>
<td>April 30 – May 3</td>
<td>Jornada Paulista de Radiologia - JPR</td>
<td>Sao Paolo, Brazil</td>
<td><a href="http://www.spr.org.br">www.spr.org.br</a></td>
</tr>
<tr>
<td>May 19-22</td>
<td>Paris Course on Revascularization – EuroPCR</td>
<td>Barcelona, Spain</td>
<td><a href="http://www.europenr.com">www.europenr.com</a></td>
</tr>
<tr>
<td>May 20-23</td>
<td>Deutschen Röntgenkongress</td>
<td>Berlin, Germany</td>
<td><a href="http://www.drg.de">www.drg.de</a></td>
</tr>
<tr>
<td>May 29 – June 2</td>
<td>European Society of Paediatric Radiology – ESPR</td>
<td>Istanbul, Turkey</td>
<td><a href="http://www.espr.org">www.espr.org</a></td>
</tr>
<tr>
<td>June 8-10</td>
<td>UK Radiological Congress - UKRC</td>
<td>Manchester, UK</td>
<td><a href="http://www.ukrc.org.uk">www.ukrc.org.uk</a></td>
</tr>
<tr>
<td>July 26-30</td>
<td>American Association of Physicists in Medicine – AAPM</td>
<td>Anaheim, CA, USA</td>
<td><a href="http://www.aapm.org/meetings">www.aapm.org/meetings</a></td>
</tr>
</tbody>
</table>
because no two patients are alike, we designed an MR unlike any other.

The Achieva 3.0T TX automatically adjusts to each patient's unique anatomy. Proprietary parallel RF transmission technology tailors signals for enhanced image uniformity, reduced scan times and improved throughput across a broad range of clinical applications. Fast, robust and versatile. It just makes clinical and economic sense. Learn more at www.philips.com/rsna.