Ingenia’s dStream technology as upgrade for Achieva, Intera

Bonn proves the power of Ingenia 3.0T in prostate imaging

Leuven sees high quality, large coverage head-neck MRI with Ingenia

Partnership with Barrow: research to make clinical MR faster and better

Designed with patients in mind
Dear Friends,

Philips has successfully introduced Ingenia, the first-ever digital MRI system, with its remarkable image quality and simplified patient set-up. While I transition from leading the Philips MRI Customer Experience team to leading the Philips MRI business, I will focus on building on our track record of bringing meaningful innovation to our customers and their patients. One way to do so is through close collaboration with customers in both clinical and research environments, such as our new partnership with Dr. Jim Pipe of the Barrow Neurological Institute on making MRI even faster and better.

In this issue of FieldStrength, we feature users who have brought the innovations of our latest products to the clinical setting to benefit their patients. You can read, for instance, on advancements at University of Bonn in prostate imaging, at Seirei Mikatahara in body imaging, at both German Heart Institute and Oregon Health and Science University in cardiac MR, and at University Hospitals Leuven in head and neck imaging. ECH Otwock in Poland is using mDIXON and MultiTransmit to improve their pelvic and abdominal imaging.

The advancements featured in this issue are some of the best examples of what can be achieved in continuously enhancing MR uses through tight partnership with our customers. This is truly transforming care together. If you want to know more about what else we’ve been working on, don’t forget to read about the exciting new Philips offerings on display at this year’s RSNA.

Hope you enjoy this issue of Philips FieldStrength!

Eric Jean
General Manager, MRI, Philips Healthcare

User experiences

8 Bonn proves the power of Ingenia 3.0T in prostate imaging
Dr. Willinek sees excellent image quality and patient handling for prostate imaging.

27 A big step in MRI of neonates and young children
Dr. Willinek, University of Bonn, takes advantage of Ingenia 3.0T for improving MRI of their youngest patients.

42 New FieldStrength online appearance
Designed with patients in mind
Read how Philips MR products help users change their way of working and enhance patient experiences.

12 Abdominal, pelvic exams benefit from MultiTransmit and mDiXON
Dr. Kownacki uses Achieva 3.0T TX as the only MR scanner at European Centre of Health Otwock.

16 Large coverage, excellent DWI and fast scanning advance body imaging
According to Dr. Takahashi, Ingenia 3.0T meets expectations at Seirei Mikatahara Hospital.

21 Ingenia 1.5T proves exceptional for cardiac imaging
Dr. Shapiro, OHSU, sees very diagnostic exams with the robust, reliable Ingenia system.

24 A breakthrough in image quality for CMR
Dr. Gebker, German Heart Institute Berlin, sees high image homogeneity with Ingenia 3.0T.

30 High quality, large coverage head-neck MRI
University Hospitals Leuven clinicians invest Ingenia 3.0T’s high SNR in large coverage and more comprehensive imaging, and still save time.

37 Learning to use Ingenia easier than expected for Barrow technologist
Mrs. Maze shares her experiences with the site’s first Philips MRI scanner.

43 Add options and upgrades to your scanner

44 NetForum news
View most popular MR content on NetForum.

Research

34 Barrow Neurological Institute research strives to make clinical MR faster and better
New partnership between Barrow and Philips for using Ingenia 3.0T in research projects.

MR News

4 RSNA 2012
Philips highlights SmartPath to dStream, the latest Ingenia developments, Ingenia MR-OR, Multiva 1.5T® and much more.

Application tips

46 Education calendar 2013

47 Events calendar 2013

NetForum
www.philips.com/netforum

Visit the NetForum online community to download ExamCards and view application tips, case studies, online training and more.
Scan the QR code with your smartphone or use www.philips.com/netforum.
RSNA 2012: see Philips products that were designed with patients in mind

The theme of this year’s RSNA meeting, Patients First, fits Philips like a glove. Philips MR has a long tradition of patient-focused design, such as Ambient Experience, wide open Panorama HFO, and Ingenia with a wide bore, comfortable coils, smooth workflow and top performance. With partners and collaborators, Philips is continuously transforming care, together resulting in innovations and products that were designed with patients in mind.

Ingenia accelerating patient care

A wealth of clinical results from both Ingenia 1.5T and 3.0T demonstrates the capabilities of the first-ever digital broadband MRI system. At the Philips booth at RSNA you can find news on how Ingenia with dStream truly changes expectations of what is possible with MRI.

Not only does Philips focus on the latest clinical applications but also on the necessary workflow enablers, which simplify and address your economic concerns. With dS-SENSE, body imaging near the speed of CT is demonstrated with chest, abdomen and pelvis coverage in around 8 seconds with mDIXON 3D gradient echo acquisition. In every clinical area Philips MR offers a strong set of methods and tools that support you in your aims to accelerate patient outcomes.

New applications

Philips is developing the mDIXON TSE® method, a two-point technique designed for fat-free imaging with short scan times in all clinical areas.

For neuroradiology, the Philips ASL package is being expanded with the new highly sensitive pCASL® method designed for non-contrast whole brain perfusion imaging in color.

Volumetric imaging continues to grow in importance and now the next generation 3D VIEWS® techniques are being developed for bringing high quality results to spine and musculoskeletal applications.

For body radiology, Philips presents mDIXON-Quant®, a multi-echo technique designed to provide accurate 3D fat fraction quantification maps, and targeting anatomies such as the liver.

* Work in Progress
Ingenia’s dStream technology now available for Achieva, Intera

The revolutionary dStream broadband technology that Philips introduced with Ingenia, is now available as an upgrade for Intera and Achieva systems*. SmartPath to dStream provides enhanced image quality, improved workflow, easier coil handling and patient comfort.

dStream technology features signal digitization directly at the patient, delivering high SNR that benefits image quality and speed. The lightweight dStream digital coils are comfortable for patients and the easy coil handling significantly benefits workflow. SmartSelect automatically determines the coil elements to use, shortening scan setup time.

SmartPath to dStream builds on the existing Achieva or Intera magnet and is a cost-effective way to digital broadband MRI. Compared to system replacement it saves magnet cost, reconstruction cost and limits down time and disturbance for the facility.

* Consult your local sales representative to learn about the exact upgrade options for your system.
Streamlined anesthesia and monitoring in the MRI suite

A compact anesthesia and monitoring solution for use in the MRI suite is developed by Philips. The combined solution* simplifies cabling and tubing in the MR suite and is designed for use close to the magnet. Its convenient operation may help to focus more on the patient and streamline workflow.

* Not available in the USA

IntelliSpace Portal offers access virtually anywhere

Providing multimodality, multivendor, multispecialty image analysis and review, IntelliSpace Portal offers enterprise-wide access to vital patient data, allowing fast, simple collaboration. Task guidance and automation in applications like Tumor Tracking and Cartilage Assessment allow fast processing and flexible presentation of results.

Convenient intra-operative MRI with Ingenia MR-OR

Ingenia MR-OR enables performing MRI during surgery to help determine if a resection is complete or if continued surgery is needed. With Ingenia’s dual-room MR-OR setup, the MR system can be used for regular diagnostic imaging when not being used in surgery. With a triple-room OR-MR-OR setup, two ORs can utilize the same MR system. Transferring from OR to MR and back again is smooth and comfortable for both patient and clinician, and Ingenia’s wide bore and superb image quality can benefit workflow and patient care.
Multiva 1.5T is designed to deliver all-round MR application capabilities with high quality and high reliability. It has a 60 cm patient aperture, a large, homogenous 53 cm imaging field of view, powerful gradients and a Direct Digital Sampling (DDS) scalable 16-channel RF receiver. Combined with proven SENSE parallel imaging and new high-channel RF receive coils it is equipped to deliver superb image quality in short acquisition times.

At the heart of Multiva 1.5T is the FlexStream workflow with new Head/Spine/Torso (HST) and 8-channel SENSE MSK coils designed for fast and easy patient set up in brain, spine, MSK and body exams. Multiva benefits from Philips’ innovative and proven technologies in both Ingenia and Achieva platforms. It includes, for example, SmartSelect functionality that automatically determines which coil elements to use for highest SNR in the region of interest.

* Not available in USA and Canada
“Ingenia allows us to perform a prostate exam and a pelvis exam without coil change or repositioning the patient.”
Dr. Winfried A. Willinek is Professor of Radiology and Vice-Chair of the Department of Radiology at the University of Bonn, Germany. He received board certification from the German Board of Radiology in 2005. Within the Department of Radiology he holds a range of additional posts including Director of MR Imaging and Assistant Director of Medical Education.

Bonn proves the power of Ingenia 3.0T in prostate imaging

Excellent image quality and patient handling provide the best of all worlds for prostate imaging

Winfried A. Willinek, MD, Professor of Radiology at the University of Bonn (Germany), was one of the first radiologists in the world to evaluate Philips’ groundbreaking MultiTransmit technology in 2008. Impressed as he was with that development, his recent experiences with the Philips Ingenia 3.0T have convinced him that this system provides an even greater change in MRI. According to Dr. Willinek, two of the major beneficiaries of this system are prostate imaging and MRI-guided prostate biopsies.

Major requirements of prostate MRI are high spatial resolution and high signal-to-noise ratio (SNR) to be able to accurately visualize the fine anatomy of the prostate. In order to get high SNR at 1.5T an endorectal coil was inserted into the rectum close to the prostate. However, a disadvantage of endorectal coils is the limited field of view (FOV). The need for such coils has also been one of the main reasons for the limited patient acceptance of prostate MRI at 1.5T. Artifacts introduced by patient movement over the duration of the exam, as well as by the endorectal coil were also recognized problems, especially at 1.5T.

“The whole concept behind the Ingenia 3.0T makes it comfortable to work with,” says Dr. Willinek. “The system’s digital architecture provides high SNR that can be translated into higher spatial resolution. In combination with Ingenia’s excellent homogeneity this allows us to visualize prostate anatomy without the need to use an endorectal coil. In Bonn we simply use the dS Torso coil solution that consists of the integrated posterior coil and a lightweight, large coverage anterior coil – this is an easy approach for both patients and MR team.”

Easy adaptation of FOV for staging
Besides the small FOV needed for imaging the prostate itself, a comprehensive prostate imaging protocol must also include sequences with extended FOV to examine the entire pelvic region. “And here’s the real beauty of the Ingenia 3.0T. With the system’s advanced and user-friendly coil handling, the technologist can easily extend the FOV for performing staging of the pelvic region. The system will automatically select the coil elements for the larger FOV, and the patient and coils don’t need to be repositioned,” says Dr. Willinek.
Dr. Willinek regards multi-parametric imaging a reliable method to help detect lesions in patients who have had suspicious findings on PSA tests. This technique becomes even more powerful with the high SNR of the Ingenia 3.0T.

“We have developed a specific series of sequences for lesion visualization with good sensitivity and specificity,” says Dr. Willinek. “To study morphology, we start with T2-weighted imaging at very high resolution. We then proceed with functional assessment. With diffusion weighted imaging (DWI) on Ingenia 3.0T, we are now able to achieve convincingly better imaging quality than formerly with multiple b-values allowing us to get really exquisite, homogeneous DWI images. We continue with a 3D eTHRIVE dynamic acquisition at high temporal resolution. And we complete the exam with MR spectroscopy, which is valuable for providing molecular information in the prostate.” Development of protocols and clinical applications is performed in a close collaboration between the Department of Radiology and Philips Senior Clinical Scientist Jürgen Gieseke.

“In every patient we perform these four acquisition techniques: DWI, 3D eTHRIVE, and T2-weighted sagittal and transverse images with high spatial resolution, and additional T2-weighted sequences covering the hips. This means that examination time is around 45 minutes. For diagnosis, the gain of using the four techniques is tremendous, but of course, the patient has to stay comfortable over this time. The system’s wide bore can help to put patients at ease and to lie comfortably in the system, which I believe is one of the most important criteria for successful MRI exams. And, it makes patient handling much easier for the technologist.”

“In some cases, only one or two sequences of the multiparametric exam show suspicious lesions. Therefore we use a scoring method to standardize reporting.”

High image quality helps MR-guided biopsies
As biopsies are often stressful for patients, all MR-guided biopsies at Bonn are now performed on the wide bore Ingenia 3.0T system. “A biopsy will take upward of 40 minutes,” says Dr. Willinek. “If a patient is not comfortable, he will move and all stereotactic data is lost. Not only does the wide bore help to put patients at ease, but it also improves the workflow because we don’t have to take the patient out of the system to reposition the guide. Another big plus of the Ingenia 3.0T is that it gives the same image quality standard for biopsy guidance as for diagnostic imaging despite the different positioning of the patient.”

“Patients are put at ease and can lie comfortably in the system, which I believe is the most important criterion for successful MRI exams.”

**Prostate MRI before radiation therapy**
A 72-year-old patient with PSA 7.7 ng/ml and a histologically confirmed carcinoma with Gleason score 3+3 was examined on Ingenia 3.0T before radiation therapy. Both high-resolution T2-weighted and diffusion weighted imaging clearly depict the lesion in the prostate. Voxel size 0.45 x 0.45 x 3 mm. The large FOV including the area around the hips is achieved using the dS Torso coil solution. No endorectal coil is needed.
Dr. Willinek predicts a big future for MR-guided biopsies. “We have seen patients with positive findings after MR-guided biopsy who may have previously undergone up to three negative US-guided biopsies including sextant biopsies, twelve core biopsies and even saturation biopsies of 20 to 40 cores. In these cases subsequent MR-guided biopsies were performed with typically only one to three cores and histopathology confirmed positive findings.”

“Fewer core biopsies are not only preferred by the patients but also from a medical standpoint since each puncture through the rectum wall carries the risk of infection. This is of particular interest in times of increasing numbers of multi-resistant bacteria.”

Dr. Willinek does not recommend, however, that every patient with an elevated PSA should receive an MR-guided biopsy. “We don’t have the scanning capacity for that at present. I believe we should currently limit the patient cohort to men who have had one or more negative US-guided biopsies. We then already have a significant number of patients who can really benefit from this approach.”

“A big plus of Ingenia 3.0T is that it gives the same image quality standard for biopsy guidance as for diagnostic imaging.”

“The high SNR and excellent homogeneity of Ingenia 3.0T allow us to visualize prostate anatomy without the need to use an endorectal coil.”
Abdominal, pelvic exams especially benefit from MultiTransmit and mDIXON

European Centre of Health Otwock uses Achieva 3.0T TX as its only MR scanner

“We have seen Achieva 3.0T TX perform exceptionally well everywhere, but we feel that abdominal and pelvic scans are especially good.”

European Centre of Health Otwock, (Otwock, Poland) is the only private hospital in Poland that includes three academic clinics: Oncology, Urology and Cardioangiology. The clinics are part of the Polish Medical Centre of Postgraduate Education (CMKP).

About 3000 scans are performed on the Centre’s Achieva 3.0T TX annually, mainly for oncology and cardiology inpatients, as well as a wide variety of outpatient scans. Clinicians here are seeing excellent image quality in their abdominal and pelvic scans, with the mDIXON technique and without.

“Imaging at 3.0T opens many possibilities, and we wanted the opportunity to evolve and to have the highest possible obtainable image quality,” Lukasz Kownacki, MD, PhD, explains. “We understood the power of MultiTransmit in body and pelvic scanning – the most important areas for our patient group – and so decided to make Achieva 3.0T TX our only MR scanner. It was installed in 2010. We are very proud of it.”

Body scans benefit from Achieva 3.0T TX with MultiTransmit

Dr. Kownacki thinks abdominal and pelvic scans are where Achieva 3.0T TX with MultiTransmit really shines. “We have seen Achieva 3.0T TX perform exceptionally well everywhere,” he says. “But we feel that abdominal and pelvic scans are especially good. The signal-to-noise ratio is clearly superior to what I’ve seen on 1.5T systems. Body scanning at 3.0T can be difficult in large patients, but also in very thin patients, because dielectric shading makes delineation of the anatomy very challenging. But with MultiTransmit, this problem is diminished.”

“In our abdominal and pelvic scans, we primarily trace the tumor extent and infiltration, as well as the spread of metastases in our oncology patients,” says Dr. Kownacki. “Achieva 3.0T TX performs exceptionally well in large patients and even in patients who ingest a lot of fluid or in patients with ascites. We don’t have problems with dielectric shading in those exams.”

“I have a special approach of giving pineapple juice during the 12 hours period prior to the MR study to all the patients scanned for abdomen or pelvis,” says Dr. Kownacki. “The juice acts like a positive contrast medium on the liver on T1W images because it contains manganese – which is paramagnetic – that accumulates in the liver. If a patient with metastases drinks a lot of pineapple juice,
**Rectal cancer with liver and bone metastases**

A 53-year-old male with lower gastrointestinal tract bleeding symptoms. Colonoscopy revealed rectal carcinoma. Two focal liver lesions were seen using ultrasound. Two-station scanning was performed on Achieva 3.0T TX. The 16-channel SENSE XL Torso coil was carefully positioned to cover abdomen and pelvis.

In the pelvis, coronal T2W-SPAIR shows larger infiltration of the rectal wall on the right side, with surrounding edema and fat tissue infiltration. Metastatic lymph nodes and numerous bone metastases are seen. Abdominal Gd-enhanced mDIXON (water only) shows the metastatic lesion in the liver with a marked necrotic core.

The corresponding ADC map demonstrates restricted diffusion in the lesion but not in its necrotic core.

Coronal MPR from merged abdomen and pelvis mDIXON axial datasets demonstrates the metastatic lesions in the liver, as well as numerous suspicious bone lesions together with infiltrating primary tumor and surrounding fatty tissue. The sagittal MPR of the abdomen and spine region was derived from the first “arterial” phase of 3-dynamic mDIXON during Gd contrast administration. Numerous suspicious lesions with a very dynamic and strong contrast enhancement are seen in the vertebral bodies. In this case all lesions could be very well visualized with mDIXON method only.
Kidney cancer with retroperitoneal lymph nodes metastases

78-year-old male with kidney cancer and inconclusive CT (possible vena cava infiltration?) was scanned on Achieva 3.0T TX with the 16-channel SENSE XL Torso coil.

T2W TSE demonstrates the tumor of the kidney and two cysts on the left side. On T2W-SPAIR TSE giant retroperitoneal lymph nodes are seen as well as cysts in both kidneys.

The ADC maps show restricted diffusion in the primary tumor in the left kidney as well as in the metastatic lymph nodes. Coronal and coronal-oblique MRP/MIP DWIBS clearly demonstrate the restricted diffusion in the tumor and in a large volume of metastases.

On the first and second dynamic mDIXON images, the tumor and metastases are well visualized. The original axial images are from the level where the largest lesions are seen.

On the third dynamic, the sagittal image shows compression of inferior vena cava lumen by extensive retroperitoneal metastatic lymph nodes. No infiltration of venal lumen and wall is seen.

3D T1W-FFE mDIXON allows very high spatial resolution in dynamic abdominal scans. In this case all the lesions could be very well visualized with this method only.
I have observed that the lesions are easy to see, even without contrast. The pineapple juice in the intestines lowers their lumen signal on T2W/T2W SPAIR images – it is very useful in MRCP but also nicely differentiates peritoneal fluid (with lower signal due to Mn presence). On the other hand, intestinal lumen enhancement on 3D T1W images gives a very nice and interesting effect that really enriches the viewing experience in MPR mode. My patients like this ‘juice approach’ very much as it is natural and ecological.

**mDIXON is important in routine exam**

Dr. Kownacki optimizes his body ExamCards for both image quality and speed. “First we consider the breath hold. Because we want to reasonably achieve the highest possible resolution (reconstructed voxel size 0.94 x 0.93 x 1.7 mm), all of our abdominal and pelvic patients are given oxygen during their examinations to allow them to have comfortable breath holds. If a patient still cannot hold the breath as long, we downgrade the slice thickness somewhat (to 3 mm) to have fewer slices but still high quality.”

“We focus on the mDIXON sequence because of the high resolution it offers. We don’t have problems with dielectric shading.”

Then we go to dynamic contrast-enhanced imaging, where mDIXON gives us the possibility to scan the entire abdomen or pelvic region with high resolution in 3-4 dynamics followed by a late phase imaging. We typically use only axial mDIXON for further MPR, but occasionally we also perform coronal and sagittal mDIXON.” Dr. Kownacki appreciates the excellent quality of the mDIXON images made with Achieva 3.0T TX, as well as its significantly faster scanning and robustness.

“The team really likes mDIXON because it’s so fast and convenient. We prefer those images for diagnosis over CT in many cases, especially in pelvis,” Dr. Kownacki concludes.

**Achieva 3.0T TX is the right choice**

“Achieva 3.0T TX is very flexible,” Dr. Kownacki says. “MultiTransmit even benefits image quality in the head region, for instance when scanning patients with metallic implants or dental metal that could disturb the optimal performance. Another application that was difficult to scan before are patients with gastrointestinal stoppage, who have their intestines filled with fluid. Thanks to MultiTransmit we can now make diagnostic images even in these patients.”

“Achieva 3.0T TX has such big potential,” he adds. “The power of Achieva 3.0T TX, as of any Philips MR scanner, is its flexibility. It opens a great field for experimenting and developing new approaches for all MR professionals. We chose to have this 3.0T system as the one and only MR scanner on site, and we are very pleased with our decision. Every day brings new and exciting results to our experience.”

“**We focus on the mDIXON sequence because of the high resolution it offers.**”

“**We don’t have problems with dielectric shading.**”
Clinicians at Seirei Mikatahara General Hospital are impressed with the large coverage and excellent DWI on its Ingenia 3.0T.

Seirei Mikatahara is a prominent medical center in the region surrounding the Japanese city of Hamamatsu-shi. Last autumn an Ingenia 3.0T was installed in the Department of Radiology and it is now producing truly exquisite diagnostic images, even of the most demanding anatomies such as the liver, heart and whole body exams.

According to Seirei Mikatahara radiologist Mamoru Takahashi, MD, the Ingenia 3.0T system has more than lived up to the high expectations. “The Ingenia 3.0T is the first Philips MRI system in our hospital and we operate it in parallel with two 1.5T systems from other vendors. The Ingenia 3.0T performs well in all areas, but we use it mainly for imaging of the upper abdomen, pelvis, heart and breast. Our less challenging exams, such as head, spine and orthopedic exams are performed on our two other systems,” says Dr. Takahashi.

Easy coverage from chest to pelvis
Dr. Takahashi is particularly impressed with the system’s homogeneity. “The excellent field homogeneity combined with the 200 cm large coverage of the posterior coil in the table is a major benefit. This allows easy and clinically useful scanning with coverage from chest to pelvis. Even in large FOVs, we obtain beautifully uniform images and great fat suppression.”

Exquisite diffusion imaging in small and large FOV
The Seirei Mikatahara radiologists are excited about the DWI quality, which they credit to the extremely high magnetic field homogeneity and the Ingenia 3.0T’s high SNR. “Image quality in all our diffusion images is exquisite. For instance, DWI in breast with b-value 1500, in prostate with b-value 2000 and direct coronal DWI all exhibit exceptionally high SNR and are virtually free of distortion,” he says.

“We now use high-quality DWI scans on every organ, but it is also possible to perform a large FOV DWI scan with more extended coverage, for instance liver and pelvis. When we examine a patient with a tumor or inflammatory lesion, we can easily add direct coronal whole body DWI (DWIBS), as this takes only about 1 minute per stack on the Ingenia 3.0T.”
**AVM with non-CE dynamic MRA**

Male patient in his 20s. CINEMA-STAR is based on arterial spin labeling and helps to visualize a 2.5 cm AVM in the left occipital lobe (convulsions onset) without using contrast agent. Also the drainage vein is seen. No distortion is visible and there is extremely little signal drop off at the junction. 10 phases are acquired at 200 ms intervals, matrix 256, scan time 5 min.

---

**Excellent breast DWI with Ingenia 3.0T**

41-year-old female with known solid tubular carcinoma with ductal spread, G1, pT2 (2.2 x 1.7 x 1.4 cm) and lymph node metastasis in the axilla. DWI with high b-value (1500 mm²/s) shows high SNR and no disturbing distortion. Also the axillary lesions are well depicted.
Image quality in our diffusion images is exquisite with high SNR and virtually free of distortion.

User experiences

**Multiple myeloma**
Male in his 40s with known multiple myeloma. Countless lesions with abnormal signal are seen in bones. Scan time 3 x 1:24 min.

**Pancreatic cancer**
Male in his 50s with previously diagnosed multiple pancreatic tail cancer and liver metastases. Scan time 3 x 1:10 min.

Using 3-station direct coronal diffusion weighted imaging provides image quality similar to conventional axial DWI, but scan time is significantly shorter.

“Image quality in our diffusion images is exquisite with high SNR and virtually free of distortion.”
Liver imaging benefits from high SNR
According to Dr. Takahashi, the high SNR provided by the 3.0T field strength and the dStream architecture is used for both shortening imaging time and improving spatial resolution. “The high SNR provides important benefits in contrast-enhanced abdominal MRI. We perform contrast-enhanced MRI of the liver with extracellular or liver-specific contrast agents. In our routine exam, we include diffusion weighted imaging, T2-weighted imaging and e-THRIVE, pre-contrast and three dynamic phases using dS-SENSE. Without such high SNR, the SNR limitations in dynamic scanning using liver-specific contrast agents make it difficult to evaluate the liver lesion. But with Ingenia 3.0T this is no problem at all,” he says.

“We use DWI in particular for visualizing lesions in the liver. The Ingenia 3.0T provides excellent DWI in the liver and this method is very robust. We can calculate ADC values and generate ADC maps to help in diagnosis. These support qualitative assessment of the cell density of the lesion as this is related to ADC.”

Ingenia’s most appreciated strengths
“With the Ingenia, we can use larger dS-SENSE factors than a default scan or lower NSA to improve temporal resolution and spatial resolution even for whole body scans without an increase in scan time. For instance, in a patient with metastases in the lumbar spine, we can easily add DWIBS to the routine exam, because imaging two or three stacks adds only about 3 minutes.

“We are also impressed with Ingenia 3.0T breast imaging, thanks to its high spatial resolution and high contrast. The high SNR allows us to obtain high-resolution images of an affected breast to evaluate a mass and we can easily use b-values as high as 1500 for DWI. Furthermore, thanks to the high homogeneity, axillary fat suppression is also excellent on Ingenia.”

Dr. Takahashi also highlights the fast imaging in cardiac MRI. “The Ingenia 3.0T allows us to scan with a low number of breath holds, which is easier for patients. In cine with Balanced FFE we have managed to shorten repetition time TR to 2.3 ms thanks to MultiTransmit 4D, and as a result banding artifacts are almost completely eliminated.”

Ingenia is lowering the threshold for 3.0T MRI
In Dr. Takahashi’s view, the Ingenia 3.0T with dStream provides a major innovation, with full digitization in RF coils, combined with Xtend FOV and MultiTransmit for patient-adaptive B1 control. “We had given the move to 3.0T MRI very careful consideration, but with the Ingenia 3.0T we are able to scan in all regions of the body without any problems, and consistently generate diagnostic images of excellent quality,” he concludes.
Ingenia 1.5T proves exceptional for cardiac imaging

OHSU sees very diagnostic exams with the robust, reliable Ingenia system

Ingenia 1.5T, the first-ever digital broadband system, is an excellent choice for cardiac MR, with a 55 cm FOV, a wide 70 cm bore and lightweight coils. The combination of Ingenia’s high SNR and dS Torso coil is ideal for the high volume of cardiac work at OHSU, providing the beautiful image quality necessary for diagnostic confidence.

“In�think patients are very comfortable on this scanner.”

**Cardiac amyloidosis**

A 69-year-old male developed generalized fatigue, dyspnea, and malaise for 8 months. Prior to his recent admission he had developed severe exertional dyspnea which limited him to 10 feet of ambulation. He also reported pronounced three-pillow orthopnea, lower extremity edema and paroxysmal dyspnea. After ultrasound demonstrated concentric left ventricular hypertrophy and a restrictive filling pattern, he was referred to cardiac MRI for further evaluation.

Ingenia 1.5T cine images demonstrate stereotypical features of cardiac amyloidosis, including valvular regurgitation (arrows), pericardial effusion (asterisk), and biventricular hypertrophy (right image).
Oregon Health and Science University (OHSU, Portland, Oregon, USA) installed Ingenia 1.5T in April 2011, and is now scanning 15-20 cardiac patients a week for viability imaging, valvular heart disease, specifically aortic and mitral regurgitation, myocarditis, cardiac masses, evaluation of potential ARVD, congenital heart disease, pericardial disease, cardiomyopathy and ischemic heart disease. The only academic medical center in the state of Oregon, OHSU is a high-volume medical center that provides tertiary/quaternary care to patients throughout the state of Oregon, as well as parts of California, Washington and Idaho.

Michael Shapiro, DO, is Director of Cardiac MRI and CT within the Division of Cardiovascular Medicine at OHSU. He says cardiac MR at OHSU is generally reserved for specific applications when more conventional imaging is equivocal or non-diagnostic. For this, he says, Ingenia 1.5T is ideal. Ingenia’s dStream technology digitizes the signal directly in the coils and sends it by fiber-optics, providing up to a 40% increase in SNR compared to Achieva.

**Hypertrophic cardiomyopathy**
A 20-year-old female experienced several pre-syncopal episodes associated with palpitations. She also had episodic chest discomfort (lasting seconds and associated with activity) for about 5 months. EKG was abnormal, ultrasound was abnormal.

---

### “We get better SNR with Ingenia, so the image quality is excellent.”

**High SNR and patient comfort yield diagnostic confidence**

“As promised, we get a high signal-to-noise ratio with Ingenia, so the image quality is excellent and we have very good and diagnostic exams. The specific area where we really felt the advantages of this system, is in our IR prepared TFE imaging, which is critically important because many of our referrals for cardiac MRI are performed to evaluate for myocardial fibrosis. To have this very robust and reliable scanner is extremely helpful. That’s probably the biggest advantage we’ve noticed. Also from a patient perspective, having the wider bore and lightweight coils is very comfortable. And we have many patients who can go through an exam without needing sedation. I think patients are very comfortable on this scanner.”

Dr. Shapiro says that these advantages support diagnostic confidence. “It’s just a more satisfying exam to look at. We don’t leverage the options that would allow us to go faster because we put more of an emphasis on image quality than efficiency. This scanner allows you to be...”

---

**Prominent asymmetric septal hypertrophy measuring up to 25 mm.**
**Hyperdynamic left ventricular systolic function (LVEF=81%) with cavity obliteration at the apical level.**
**Mild systolic anterior motion (arrow) of the anterior mitral valve leaflet.**

---

**Left ventricular diastole**
**Left ventricular systole**

---

**Hypertrophic cardiomyopathy**
A 20-year-old female experienced several pre-syncopal episodes associated with palpitations. She also had episodic chest discomfort (lasting seconds and associated with activity) for about 5 months. EKG was abnormal, ultrasound was abnormal.
“Coil placement is never an issue – you just put the coil on and go. The large coil coverage is an advantage when we’re looking at extra-cardiac structures.”

Lightweight, easy-to-use coils provide large coverage too
Dr. Shapiro uses the dS Torso coil. “It’s an excellent coil for cardiac purposes,” he says. “The dS-SENSE factors are very high. We certainly use it in patients who can’t hold their breath for too long.”

With smaller coils, placement of the coil can be a challenge, he adds. “The goal of any exam is to optimize the signal-to-noise ratio in the body part of interest, and of course for a cardiac exam that means centering the coil exactly in the middle of the heart. You often have to do some scouts and maybe fine-tune the placement of the coil and do the scouts over again. But with this coil, that’s never an issue – you just put the coil on and go. And there’s plenty of coverage, which is an advantage when we’re looking at extra-cardiac structures, including the aorta and its branches. Because of this good coverage, we get to see things with good signal to noise and good homogeneity on a wider field of view, and that’s a great benefit.”

Overall, for cardiac imaging, Dr. Shapiro finds the Ingenia 1.5T an excellent system. “Ingenia 1.5T is a real cardiac scanner; it really was developed with cardiac MR in mind, and it is ideal for our work.”

Myocarditis
A 38-year-old male with no cardiac history developed a GI illness two weeks prior to admission. He recovered but then presented to the ED with chest pain. He had ST elevations on his ECG and modestly elevated troponin.
T2W images demonstrate signal hyperintensity (arrows) in the lateral of the left ventricle, seen in the horizontal long axis and short axis views. This is consistent with myocardial edema as a result of myocardial inflammation.

“We get to see things with good signal to noise and good homogeneity on a wider field of view.”
Ingenia 3.0T is a breakthrough in image quality for CMR

German Heart Institute sees high image homogeneity with MultiTransmit

The German Heart Institute Berlin (Berlin, Germany) was a pioneer in using CMR in a clinical setting, and now applies CMR to a broad range of clinical indications in about 150 patients a month using Ingenia 3.0T. This includes the development of CMR to assist in detection of myocardial ischemia, and improve diagnostic image quality in patients with coronary artery disease.

"It provides excellent images with high spatial and temporal resolution."

Cardiologist Rolf Gebker, MD, PhD, Head of Cardiovascular MR, says the Institute’s previous experience with Philips scanners broadened into an opportunity to implement Ingenia 3.0T. "We already knew the advantages of our Philips 1.5T scanner, and the upgrade to MultiTransmit on our 3.0T Achieva scanner was a major breakthrough regarding image quality and robustness."

"CMR has become an integral part of our diagnostic armamentarium," he says. "It’s an excellent imaging choice for so many patients, as it provides both morphologic and functional information with high spatial and temporal resolution. Our results are highly reproducible, and deliver information that we can use immediately to guide patient management."

Ingenia benefits include MultiTransmit 4D

One of the main benefits of Ingenia 3.0T for cardiac imaging, from Dr. Gebker’s perspective, is the ability to apply modern undersampling methods such as k-t SENSE or k-t BLAST. "Because we perform mostly functional cardiac imaging, it's one of the most important aspects. These techniques allow us to invest in higher spatial resolution and higher coverage, and they have been very helpful in improving stress MR imaging for the visualization of regional ischemia."

Ingenia’s MultiTransmit 4D technology provides parallel RF transmission, allowing patient-adaptive shimming and a very homogeneous B1 field. "It also improves the uniformity of the flip angle over the region of interest, which is particularly important for cine imaging with B-FFE," says Dr. Gebker. "This translates into better image quality, since the contrast between blood and myocardium increases, which has been a problem with conventional 3.0T systems. A major improvement in image quality could be seen during adrenergic stress testing. This type of testing was simply not possible on our former 3.0T system using B-FFE cine imaging, mainly because of increasing problems with dielectric shading.

"Because we perform mostly functional cardiac imaging, it’s one of the most important aspects. These techniques allow us to invest in higher spatial resolution and higher coverage, and they have been very helpful in improving stress MR imaging for the visualization of regional ischemia.”

"CMR has become an integral part of our diagnostic armamentarium,” he says. “It’s an excellent imaging choice for so many patients, as it provides both morphologic and functional information with high spatial and temporal resolution. Our results are highly reproducible, and deliver information that we can use immediately to guide patient management.”

"It provides excellent images with high spatial and temporal resolution.”
“With Ingenia 3.0T we simply have a high robustness throughout our whole imaging strategy.”

Improved cine B-FFE with Ingenia 3.0T has diagnostic impact

A 55-year-old male with suspected coronary artery disease, diabetes and arterial hypertension underwent stress CMR as a follow-up exam. A prior CMR exam on a 3.0T system without MultiTransmit had demonstrated both normal morphology and function of the left ventricle.

Ingenia 3.0T images acquired with dS Torso coil solution were compared with earlier results from Achieva 3.0T without MultiTransmit. Spatial resolution was 1.5 mm on Ingenia and 2.0 mm on Achieva. Breath hold 8-10 sec. in both exams.

Without MultiTransmit the contrast between blood and myocardium is reduced, particularly in the right ventricle, and more flow related artifacts are seen (even more so in movies). The Ingenia 3.0T images have high CNR, high spatial resolution and few artifacts. On the Ingenia 3.0T images, a myocardial crypt of the basal interventricular septum can be seen thanks to the high image quality.

during high heart rates. Previously we would do certain exams only on the 1.5T system; now we can do everything at 3.0T.”

“The biggest Ingenia benefit we’ve seen is clearly in B-FFE functional cine imaging. Also, the quality and homogeneity of spin echo techniques have improved tremendously.

This higher quality has a real diagnostic impact, as shown by the example images on this page. Overall, we simply have much better image quality with fewer artifacts. With Ingenia 3.0T we have a higher robustness throughout our whole imaging strategy.”

“The Institute is now also able to scan larger patients thanks to Ingenia’s larger bore size,” he adds. “These kinds of patients are the ones who need our attention most, because they are at the highest risk to develop cardiovascular diseases.”

“Ingenia offers fast scanning and a very smooth workflow that could increase throughput, but we are more interested in image quality than in speed,” explains Dr. Gebker. “With MultiTransmit we’ve overcome problems in cardiac imaging such as dielectric shading and dark banding artifacts.”

CMR easy and effective

Dr. Gebker uses the dS Torso coil solution, which combines a lightweight anterior coil with the integrated posterior coil. “You don’t have to move the patient around on the table, you just lay the patient down and it always works. It has a very large field of view which is beneficial as well.”

It wasn’t necessary to create new ExamCards for Ingenia, because they transferred easily from the Institute’s Achieva 3.0T system. “That was a very positive experience for us,” says Dr. Gebker. “Within the first week we had our routine ExamCards at hand.”

As far as scanning protocols, he took advantage of Ingenia’s high performance to improve image quality and improve temporal resolution, as well as increasing spatial resolution for cine images.
For postprocessing Dr. Gebker uses Cardiac Explorer on a routine basis. "The tool for semiautomatic detection of endocardial contours on short axis cine images helps to speed up an otherwise time consuming method to obtain cardiac volumes," he explains. "And we also appreciate the multi stress view functionality which allows us to look at multiple geometries as well as multiple stress levels during stress testing."

**Broadening applications with future functionality**

Dr. Gebker and his team have also begun using an mDIXON fat-suppression method for peripheral angiography and for the heart*. "It’s opening up a new chapter for us, because it has the potential to delineate small amounts of fat tissue, which can be helpful in patients with cardiomyopathies like arrhythmogenic right ventricular cardiomyopathy, but also in more common diseases like pericarditis. This technique may allow the suppression of signal from the pericardial fat layer, thus being able to see more clearly what’s inflamed and what’s simply fat tissue – that can be very helpful."

* mDIXON for vascular and cardiac imaging is not yet commercially available.

"Previously we would do certain exams only on the 1.5T system; now we can do these on Ingenia 3.0T."

---

**Acute myocarditis**

24-year-old male with new onset chest pain for 12 hours, ubiquitous changes of the ST-segment and elevated troponin levels. Immediately performed invasive angiography did not demonstrate any obstructive coronary disease. CMR was done the day after. The cine B-FFE movie (see NetForum) demonstrates a slightly depressed global LV-function with subtle regional wall motion abnormalities. T2-weighted images show diffuse myocardial edema. Ingenia 3.0T with dS Torso coil solution. Breath hold 8-12 sec. Voxel sizes between 1.5 x 1.5 and 2.0 x 2.0 mm.
A big step in MRI of neonates and young children

The University of Bonn takes advantage of Ingenia 3.0T for enhancing MRI of their youngest patients

Radiologists at the University of Bonn, Germany have been putting their Ingenia 3.0T through its paces with highly positive results. Pediatric imaging is one of the areas where the system performance is impressive, with the combination of high resolution and high speed producing excellent imaging. In addition, the large bore also makes handling of young children easier.

High spatial resolution and high speed are essential

“Although pediatric imaging covers a very broad spectrum of patients, it’s especially in the areas of neonates and very young children that the benefits of the Ingenia 3.0T can really be appreciated,” says Winfried A. Willinek, MD, Professor of Radiology at the University of Bonn. “For newborns in particular, the system’s exceptionally high spatial resolution allows us to easily visualize the tiny anatomy of our patients. And we can also invest the high SNR that comes from Ingenia’s digital architecture into developing fast protocols.”

“Fast imaging is particularly important for newborns, neonates and infants, because these patients are most of the time sedated or anesthetized during the exam, and it’s essential that the time under anesthesia should be kept as short as possible,” Dr. Willinek points out. “On a 1.5T system, especially whole body applications are time consuming, with even more sequences on the wish list. A fully comprehensive exam could easily double the examination time, which is not practical. Now, on Ingenia 3.0T we have developed comprehensive multiple-station protocols with exam times of less than 45 minutes. This is seen by our anesthesiologists and pediatricians as a really positive development in pediatric imaging.”

Wide bore benefits children and parents alike

“Much has already been written on the benefits of Ingenia’s wide 70 cm bore and how it eases patient stress and patient handling,” observes Dr. Willinek. “And in pediatric imaging these benefits go even further by also allowing a parent access to the child during the exam. The wide bore allows a parent to comfort the child during the exam.”
User experiences

“The Ingenia 3.0T’s large, homogeneous field of view plus its high SNR and advanced coil handling concept allow us to easily adapt to a whole body approach.”
Exams customized to each patient
Typical scans are difficult to describe since the patients’ conditions cover a broad spectrum from epilepsy to bone tumor. “If you talk about adolescents you can usually call on a typical ExamCard but with young children it’s very individual and much more of a challenge to the whole team,” Dr. Willinek explains. “Basically we have several ExamCards addressing the fact that even for the exact same clinical question we often need different protocols for, say, a neonate than for a 5-year-old. So, although we have several standard ExamCards covering each age group, these all have to be individually customized to each patient.”

Easy extension to whole body imaging
According to Dr. Willinek, referrals of small children for an MRI exam frequently have either neuro or oncology indications so that exam protocols may often have to extend to whole body imaging. “A typical indication is neuroblastoma, a malignant tumor that can metastasize to various locations in the body. The Ingenia 3.0T’s large, homogeneous field of view plus its high signal-to-noise ratio and advanced coil handling concept allow us to easily adapt to a whole body approach,” he explains. “If the tumor is located in the abdomen we can take advantage of the system’s exceptionally homogeneous signal to produce superb DWIBS (whole body DWI) images. And now we come to another important benefit of the system. We are also able to use DWIBS as a kind of PET-like imaging technique that can be used not necessarily for primary diagnosis but later to visualize lesions during follow-up after chemotherapy. This is completely different to our experiences at 1.5T.”

The Bonn team uses the same coils as are used for adults. According to Dr. Willinek a particularly useful coil is the dS HeadNeck coil, which serves as a very high quality whole body coil. “We find this works very well, especially for neonates, although we do have the dedicated Philips neonatal coil on our wish list.” For older children, they use a combination of the dS HeadNeckSpine coil solution with the anterior/posterior body coil. In addition, for more comfortable positioning a tunnel is used to avoid the direct positioning of the anterior coil on the child.

4 to 6 times faster imaging in clinical routine with dS-SENSE
The Ingenia’s high SNR can also be invested into higher parallel imaging factors, even in the range of dS-SENSE factors between 4 and 6 for body imaging. “Ten years ago we were talking of SENSE factors of 2 or 4 for the brain, never dreaming that we would be able to achieve these high factors for body applications, but this is now standard for us on the Ingenia 3.0T for both pediatric and adult imaging,” says Dr. Willinek.
Leuven sees high quality, large coverage head-neck MRI with Ingenia
Ingenia 3.0T enhances head and neck imaging at Leuven
High quality, large coverage head-neck MRI supports diagnostic confidence

University Hospitals Leuven (Leuven, Belgium) is one of the largest medical facilities in Belgium. About 150 patients are scanned each week on the hospital’s Ingenia 3.0T system, including about 15 head and neck patients. In both tumoral and non-tumoral pathology, Ingenia’s high SNR and homogeneity are boosting the diagnostic quality of the hospital’s head and neck MRI exams.

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

Vincent Vandecaveye, MD, PhD.
is Supervising Staff Radiologist and Professor at the Department of Radiology of the University Hospitals Leuven. He graduated from Catholic University of Leuven in 2001 in computer science. At University Hospitals Leuven, he performs research on diffusion weighted and dynamic contrast-enhanced MRI, leading to his PhD project on quantitative diffusion and perfusion imaging, which is ongoing.

Frederik De Keyzer, MSc.
graduated from Catholic University of Leuven in 2001 in computer science. At University Hospitals Leuven, he performs research on diffusion weighted and dynamic contrast-enhanced MRI, leading to his PhD project on quantitative diffusion and perfusion imaging, which is ongoing.

Uses experiences

Vincent Vandecaveye, MD, PhD.
is Supervising Staff Radiologist and Professor at the Department of Radiology of the University Hospitals Leuven. He graduated from Catholic University of Leuven in 2001 in computer science. At University Hospitals Leuven, he performs research on diffusion weighted and dynamic contrast-enhanced MRI, leading to his PhD project on quantitative diffusion and perfusion imaging, which is ongoing.

Frederik De Keyzer, MSc.
graduated from Catholic University of Leuven in 2001 in computer science. At University Hospitals Leuven, he performs research on diffusion weighted and dynamic contrast-enhanced MRI, leading to his PhD project on quantitative diffusion and perfusion imaging, which is ongoing.

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

“Investing Ingenia’s high SNR to get a larger FOV while maintaining spatial resolution and speed provides an advantage in our patients with lesions in the oral cavity.”

FieldStrength - Issue 47 - 2012 / 3
in our patients with lesions in the oral cavity. Whereas in the past they needed an additional CT exam for staging the rest of the neck, we can now do it all with MRI in one scan with a large field of view. We scan from the base of the skull down to the thoracic inlet, similar to how CT is done. So, patients come to MRI for a complete loco-regional staging, covering the primary tumor and all the neck stations including the lymph nodes."

“Our routine examinations have become much shorter with Ingenia 3.0T, especially ear and sinus exams. In applications like staging of cancers,

**Primary tumor staging and visualization**

Patient with right-sided glottis cancer showed cystic metastatic adenopathy in right neck (level II). As this is an unusual presentation for glottic cancer, the patient was referred to MRI with DWI to assess a possible second lesion. The T2-weighted image shows the right glottis cancer; the second image shows the cystic adenopathy in the right neck (level II). No apparent abnormalities are seen in the right tonsil (second row first images), but DWI shows a hyperintense lesion in the right tonsil. Histopathology proved this to be a second primary tumor. This lesion was not visible on CT and PET/CT. Ingenia 3.0T with dSHeadNeckSpine coil solution allows scanning of the entire head and neck with large coverage in acceptable scanning time. Compared to our 1.5T protocol the Ingenia 3.0T offers larger coverage in significantly less time.
“Patients now come to MRI for a complete loco-regional staging, covering from the base of the skull down to the thoracic inlet, similar to how CT is done.”

we are able to increase the coverage and do more functional imaging in the same time slot as a 1.5T MRI exam,” he adds.

**A convenient system for techs and patients**

“Ingenia’s SmartSelect automatic coil selection is a huge step forward. It saves a lot of time and effort by avoiding the need to reposition patients and coils,” says Frederik De Keyzer, MSc. “Another big advantage is the dS HeadNeckSpine coil solution. The spine coil is conveniently integrated in the table. The head coil is smaller and more open than previous coils but it gives the same image quality, and it’s so much lighter and thus easier for the technologist and the patient. It has a neck extension, and it allows us to scan patients in a slightly tilted plane. And, of course, we benefit from dStream providing high SNR and digitization in the coil and high ds-SENSE speed-up capability, for better image quality or reduced scan time or larger coverage.”

“Our patients are quite comfortable in the Ingenia. I can’t even remember in the last few weeks anybody having problems getting in the system due to kyphosis, scoliosis or claustrophobia,” says De Keyzer.

In Leuven, the wide-bore Ingenia 3.0T is combined with Philips Ambient lighting.

**Optimization multiplies advantages**

“When we received Ingenia 3.0T, we transferred our ExamCards from our Achieva 3.0T TX to optimize them for Ingenia,” says De Keyzer. “But to our surprise, we didn’t have to change much. We saw that SNR was better

---

**Ultrasound**

**T2W**

**DWI b1000**

**4D-THRIVE**

**Initial slope map**

---

**Nodal staging in recurrent thyroid cancer**

Patient underwent thyroidectomy 2 years ago for small papillary thyroid cancer. Follow-up ultrasound shows non-vascularized nodule anterior to the trachea. Clinically there is a slight elevation of the tumor marker.

Ultrasound shows a non-vascularized node anterior to the trachea. The node is heterogeneously intense on the T2-weighted image and clearly hyperintense at b1000 DWI. It has a calculated ADC b500-1000 (cellular fraction) of $0.68 \times 10^{-3}$ mm$^2$/sec, so suspect for metastasis.

The hypervascularity is confirmed by calculation of the initial slope map. Findings suggest recurrence of papillary thyroid cancer presenting as an abnormal node anterior to the trachea in level VII. This was proven by histopathology after surgery.

Ingenia 3.0T with dSHeadNeckSpine coil solution is used to scan the entire head and neck from skull base to thoracic inlet. DWI and 4D-THRIVE improve lesion conspicuity, and provide additional information on the node characterization and help differentiation of post-radiotherapy necrosis and inflammation from tumor recurrence.
Our routine examinations are much shorter with Ingenia 3.0T, especially ear and sinus exams.

Ingenia 3.0T, and we used that to get a larger coverage, a higher matrix. Ingenia also allows us to use higher dS-SENSE factors than before. Another example of improvement is DWI; we were used to diffusion MRI being sensitive to artifacts, but these are lessened on Ingenia 3.0T, due to the excellent field homogeneity allowing better fat suppression.

Shorter scan time and more diagnostic confidence
“We have invested the extra SNR gain of Ingenia into larger coverage and more comprehensive imaging, rather than decreasing total scan time,” says De Keyzer. “However, even after the addition of routine functional imaging, the entire scan time is still shorter than an equivalent examination at 1.5T in our center.”

“In terms of workflow, Ingenia 3.0T is an easy system to use. It has easy patient positioning, even in our whole body scans,” concludes Dr. Vandecaveye. “And because we can pack so much information into one MRI head and neck examination, we are more confident in our diagnosis.”

Recurrent head and neck cancer
Patient with prior history of floor of mouth cancer on the right side and multiple recurrences for which multiple surgical interventions and chemoradiation have been performed. There is clinical suspicion of small ulceration on the right lateral tongue. MRI is requested for pre-operative staging.

Top row images show the area of the clinically suspected small ulceration. On the T2-weighted images it is visible as a thin slightly hyperintense line (arrow). This area was proven to be in-situ squamous cell carcinoma. No clear abnormalities are seen on b1000 DWI.

The bottom row T1-weighted image shows no focal abnormality at the level of the base of the left tonsil. The b1000 DWI shows a hyperintense lesion in the left base of the tonsil. Histopathology proved this is synchronous tumor recurrence. This finding made the patient inoperable. Surgery was not performed.

Ingenia 3.0T with dSHeadNeckSpine coil solution is used to scan the entire head and neck from skull base to thoracic inlet. This case highlights the advantages of using combined DWI and perfusion imaging to help visualize potential tumor recurrence. DWI and 4D-THRIVE improve lesion conspicuity, nodal characterization and differentiation of post-radiotherapy necrosis and inflammation from tumor recurrence.

Recurrent head and neck cancer
Patient with prior history of floor of mouth cancer on the right side and multiple recurrences for which multiple surgical interventions and chemoradiation have been performed. There is clinical suspicion of small ulceration on the right lateral tongue. MRI is requested for pre-operative staging.

Top row images show the area of the clinically suspected small ulceration. On the T2-weighted images it is visible as a thin slightly hyperintense line (arrow). This area was proven to be in-situ squamous cell carcinoma. No clear abnormalities are seen on b1000 DWI.

The bottom row T1-weighted image shows no focal abnormality at the level of the base of the left tonsil. The b1000 DWI shows a hyperintense lesion in the left base of the tonsil. Histopathology proved this is synchronous tumor recurrence. This finding made the patient inoperable. Surgery was not performed.

Ingenia 3.0T with dSHeadNeckSpine coil solution is used to scan the entire head and neck from skull base to thoracic inlet. This case highlights the advantages of using combined DWI and perfusion imaging to help visualize potential tumor recurrence. DWI and 4D-THRIVE improve lesion conspicuity, nodal characterization and differentiation of post-radiotherapy necrosis and inflammation from tumor recurrence.

Recurrent head and neck cancer
Patient with prior history of floor of mouth cancer on the right side and multiple recurrences for which multiple surgical interventions and chemoradiation have been performed. There is clinical suspicion of small ulceration on the right lateral tongue. MRI is requested for pre-operative staging.

Top row images show the area of the clinically suspected small ulceration. On the T2-weighted images it is visible as a thin slightly hyperintense line (arrow). This area was proven to be in-situ squamous cell carcinoma. No clear abnormalities are seen on b1000 DWI.

The bottom row T1-weighted image shows no focal abnormality at the level of the base of the left tonsil. The b1000 DWI shows a hyperintense lesion in the left base of the tonsil. Histopathology proved this is synchronous tumor recurrence. This finding made the patient inoperable. Surgery was not performed.

Ingenia 3.0T with dSHeadNeckSpine coil solution is used to scan the entire head and neck from skull base to thoracic inlet. This case highlights the advantages of using combined DWI and perfusion imaging to help visualize potential tumor recurrence. DWI and 4D-THRIVE improve lesion conspicuity, nodal characterization and differentiation of post-radiotherapy necrosis and inflammation from tumor recurrence.

Recurrent head and neck cancer
Patient with prior history of floor of mouth cancer on the right side and multiple recurrences for which multiple surgical interventions and chemoradiation have been performed. There is clinical suspicion of small ulceration on the right lateral tongue. MRI is requested for pre-operative staging.

Top row images show the area of the clinically suspected small ulceration. On the T2-weighted images it is visible as a thin slightly hyperintense line (arrow). This area was proven to be in-situ squamous cell carcinoma. No clear abnormalities are seen on b1000 DWI.

The bottom row T1-weighted image shows no focal abnormality at the level of the base of the left tonsil. The b1000 DWI shows a hyperintense lesion in the left base of the tonsil. Histopathology proved this is synchronous tumor recurrence. This finding made the patient inoperable. Surgery was not performed.

Ingenia 3.0T with dSHeadNeckSpine coil solution is used to scan the entire head and neck from skull base to thoracic inlet. This case highlights the advantages of using combined DWI and perfusion imaging to help visualize potential tumor recurrence. DWI and 4D-THRIVE improve lesion conspicuity, nodal characterization and differentiation of post-radiotherapy necrosis and inflammation from tumor recurrence.
Barrow Neurological Institute research strives to make clinical MR faster and better

New partnership between Barrow and Philips focuses on advancing MR technology by using Ingenia 3.0T in research projects.

Barrow Neurological Institute is a center of neurological excellence contained within St. Joseph’s Hospital and Medical Center (Phoenix, Arizona, USA). It recently acquired its first Philips MR system, an Ingenia 3.0T. The system comes with a five-year agreement between Philips and St. Joseph’s to pursue research that will advance MR technology by accelerating MRI and improving image quality, for example, by reducing motion-related image disturbances.

“I think the big reason to have fast MR is because we can’t afford long MR scan times anymore.”

### Principle of PROPELLER and MultiVane techniques
Conventional methods collect data along horizontal lines that fan all of k-space. PROPELLER and MultiVane data are collected as rotating blades. One echo train collects all data for one blade. The images obtained by Fourier transforming each blade illustrate that the low spatial frequencies are collected by each blade (red circle), while edge information corresponds to the orientation of the blade in high-frequency space (blue and yellow arrows). When combined all data produce a complete sharp image.
Barrow Neurological Institute plans to use the Ingenia to help reach the goal of “making clinical MR faster and better,” according to Jim Pipe, PhD, director for neuroimaging research at the Institute. As the inventor of the PROPELLER (Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction) technique, which Philips applies in MultiVane, as well as chair of the 2012 International Society for Magnetic Resonance in Medicine (ISMRM) Meeting, Dr. Pipe is at the forefront of MR technology research, particularly in regards to fast sequences and motion correction.

### Developing spiral MR for robust and fast clinical use

One aspect of Barrow’s research is the development of spiral MR. “Spiral MR has been used in research for quite a while, but is not used clinically very much at all because it is not very robust,” Pipe says. “However, it has the potential to make it possible to generate images with the same SNR, quality and content as normal images, but collected in less time and with reduced motion artifacts.” He estimates that if technical hurdles are solved, spiral imaging could reduce neuro scan times – and ultimately exam times – by a factor of 2 to 3.

“The desire to go faster should follow patients, because they want to get the exam over as quickly as they can, and it also fits well with the economics of healthcare, because we have to become more efficient with these expensive tools.”

<table>
<thead>
<tr>
<th>Conventional acquisition</th>
<th>PROPELLER / MultiVane</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2W</td>
<td>T2W</td>
</tr>
</tbody>
</table>

### Motion reduction

Example images of a moving volunteer show PROPELLER / MultiVane techniques combined with motion correction reduce ghosting and mitigate blurring. Techniques like PROPELLER and MultiVane oversample the center of k-space by collecting data in groups. If in-plane motion occurs, it is evident in the low resolution frequencies from the center of k-space, and corrected in the individual data groups. The groups are then combined, resulting in sharper MR images.
**Speed addresses both clinical and economic issues**

Higher scan speed allows for faster imaging with less motion-related blurring, or higher resolution in the same scan time. In addition to the clinical benefits, Dr. Pipe sees an important economic benefit. “If we could change MR so that we could do five-minute exams that cost a couple hundred dollars, rather than 45-minute, thousand dollar exams, it would really change the paradigm of how we use MR,” he says. “In the United States, for example, we spend roughly 20 billion dollars each year on MR. If we could even cut those 45-minute times in half, and then charge 60% of the current charge so we are still making more per hour, we can save billions of dollars in healthcare costs without compromising patient care quality at all.”

Dr. Pipe acknowledges that not all exams will be as short as five minutes, and that such a change requires more than just technical advancement, but calls it the motivating factor. “When I give educational talks, I point out that we are not making fast images just because it is cool. I think the big reason to have fast MR is because we can’t afford long MR scan times anymore.”

He adds, “The desire to go faster should follow patients, because they want to get the exam over as quickly as they can, and it also fits well with the economics of healthcare, because we have to become more efficient with these expensive tools.”

**Additional areas of study include fMRI, MR angiography**

In addition to developing fast sequences, the Institute’s Ingenia system will be used to further develop non-cartesian motion reduction techniques, such as MultiVane, and for a wide variety of research. Leslie Baxter, PhD, also of Barrow, will use Ingenia 3.0T for fMRI studies of deep brain stimulation and depression, pre-surgical planning, and other fMRI applications. Barrow also may use the scanner for research on various other topics, including cardiovascular imaging and Alzheimer’s research, in cooperation with other Phoenix institutions including Mayo Clinic and Banner Health.

“The research changes all the time, but we are always interested in making clinical MRI really good, and we want to remove all the technical boundaries so that the only things limiting us are physics and physiology,” Dr. Pipe summarizes.

Although his scanning experience with Ingenia is still limited, Dr. Pipe is very positive about the system. “The neuro images are quite good,” he says. “This is our first system with a 70 cm bore, which is fantastic from a patient point of view. Our early impressions of dStream are really good, and there is a lot of flexibility that will be very advantageous to us.” But he reserves his highest praise for Philips personnel.

“My biggest incentive for working with Philips is the people. I have admired the work of a lot of folks within Philips for a long time, and I am thrilled to be able to work with them,” he says. “The desire at Philips to challenge the status quo of MR is very exciting to me. I think we share a lot of the same vision and enthusiasm.”

---

**Spiral imaging**

Spiral imaging has the potential to create images with the same quality as conventional methods, but in less time and with reduced motion artifacts. Spiral scanning measures more of the data in k-space each TR. If the technical barriers to making this technology truly robust can be solved, spiral imaging could improve nearly every type of MR scan.

Creative design of 3D spiral-based trajectories opens up the possibilities for improving more applications.
Learning to use Ingenia easier than expected for Barrow research technologist

Sharmeen Maze shares her experiences with the site’s first Philips MRI scanner

After receiving her training in MRI, Sharmeen Maze, RT (R) (MR), began working as an MRI Research Technologist at Barrow Neurological Institute nearly 10 years ago. A few months ago Barrow acquired its first Philips system, an Ingenia 3.0T. Maze notes that she was apprehensive about using a different manufacturer's system. “I was really hesitant about it,” she says. “But it has been a good experience. The transition to Ingenia was easy.”

Now, with a few months’ scanning experience, she shares her observations on transitioning to Ingenia.

**Image quality:** “I’m working on a nationwide clinical study. Those exams have specific parameters to ensure that results from across the country are comparable. When I started using the Philips system, I was running the same scans as I had run on our older systems, but with the Philips parameters. I found the images were quite excellent.”

**Working with a voxel-based system:** “I had heard that the Philips system was in voxels, and not matrix-based like I was used to. But it was surprisingly easy to learn.”

“With the Philips system, you set the voxel size, and it remains fixed, which is quite nice because you always know what your in-plane resolution and voxel size is, without having to do calculations.”

**Understanding parameters:** “I was kind of surprised by how many parameters there actually are that you can change and manipulate that we weren’t able to even see on our other systems.”

**ExamCards:** “There are a lot of parameters to go through. But it was quite easy once I got the hang of it. Once we had them created it was pretty easy to save them and to work on an ExamCard during the time I was scanning something else. I also used NetForum.”

**SmartExam:** “In research, you have to be consistent, and everything has to be exactly the same for every scan because they are usually longitudinal studies. So the ease of being able to lock your protocols and set up the exams the same way is key.”

**Post-processing:** “We don’t do a lot of post-processing in our research. But from a clinical perspective, I noticed that there were a lot of things that we can do on the system. I work clinical MRI on the weekends, and there are certain functions that we aren’t able to do on that non-Philips system, so there is a workstation for different types of processing. Whereas with Ingenia, it is all on the scanner, and you don’t need a separate workstation.”

**Patient comfort:** “I am doing an obesity study, and it has been a lot more comfortable for my patients. Because of the length of the table stroke, I can scan people head to toes without bringing them out and turning them around half way through the scan.”

**Short, and fewer, cables:** “When patients are in a high magnetic field, and with the research we’re doing, we don’t want a lot of cables or extra cords along the patient that could potentially create a current.”

**MobiView:** “MobiView is eye candy. It is an impressive image, and the detail is amazing for an approximately three-minute scan without a breath hold. It is also a great method for planning additional scans. For example, I can do a quick scan of the spine, and then set up all my other scans off of that, without doing several little localizers like we have had to do in the past. You get a nice image of the whole spine in one shot instead of three.”

**Gating instruments:** “We have two units that look like cell phones. They have rechargeable batteries, and a short cable that you can attach to an EKG lead, the cardiac or respirator belts or peripheral gating, and you get a really great signal. I’m used to long cords that were plugged into an external device such as a patient would have at the bedside, and then a monitor in the control room so the tech could see the gating. If we had patients on anesthesia, we would have EKG leads, pulse oximeters and CO2 monitors, and I’d have to be aware of all those cables and make sure they didn’t get caught on anything.”

**Advice to other technologists:** “It was a nice surprise how easy it was to transition to the Ingenia. The only thing I brushed up on was the names of the pulse sequences because they are different, and I still have a cheat sheet that tells me what they are in other vendors’ language and Philips language.”
Liver imaging beyond expectations with Ingenia

**TIP 1**

Use dS-SENSE for sharper T2 single shot imaging

Before the introduction of Ingenia, parallel imaging with SENSE was typically applied in the anterior-posterior (AP) phase encoding dimension and found to deliver high quality outcomes using typical speed up factors of 2 in multislice acquisitions. The advantage SENSE delivered to body imaging included higher temporal resolution, reduced blurring for single shot acquisitions, decreased distortions for EPI and shorter breath hold (BH) times.

With Ingenia, the next innovation in SENSE is made available. Improved robustness, image quality and speed can be demonstrated with dS-SENSE. This is made possible by next generation SENSE algorithms and the smart digital coil design. These advancements make higher SENSE factors feasible by changing phase encoding from AP to RL. This change allows for improved image quality in T2 single shot (SSH) acquisitions by shortening the shot length, which leads to sharper images.

*Ingenia’s* dStream architecture delivers the first fully digital RF coils to the market, with their high SNR and superb dS-SENSE performance providing the opportunity to create new strategies for abdominal imaging leading to enhanced patient care. Ingenia users can perform liver imaging at higher SENSE factors than ever before in order to increase image quality and reduce examination times.

By increasing SENSE factors, a shorter shot length can be demonstrated. This leads to reduced image blur due to improved point spread function (PSF).
**TIP 2**

Use high SENSE factors for sharper DWI

Applying the same approach to DWI leads to reduced EPI readouts and decreased bandwidth. This image comparison demonstrates reduced distortion and EPI ghosting due to the reduction in EPI factor and water-fat-shift (WFS).

**TIP 3**

Novel strategy for further improvement

The RL SENSE approach requires phase oversampling in order to avoid fold-over from the arms placed at the patient’s side. Oversampling requires additional phase-encoding lines, increasing the shot length or EPI encoding steps and leading to a lower effectiveness of this approach.

However, oversampling could be turned off if the arms were positioned above the head and therefore outside of the imaging field. Until now this has not been considered, since bore size limited the ability to position the patient comfortably for the period of time needed to acquire the exam (routinely 30-40 minutes).

Ingenia’s wider bore allows the arms to be placed over the head in a more comfortable position, which allows use of the smaller FOV in the RL direction. This reduces the number of acquired phase encoding steps and further improves the quality of the single shot and DWI images.

With the novel strategy of arms up and RL dS-SENSE, the shot length and image sharpness of single shot BH imaging approach those of a multi-shot gated technique.

Blurring is reduced due to the shorter shot lengths. Another advantage is the reduced aliasing artifacts seen, due to absence of additional tissue outside the anatomy of interest.
By applying the novel approach to 3D volumetric imaging, the advantage of reduced BH times at high SENSE factors is seen. This can improve BH compliance or be traded in for higher resolution in the currently accepted BH time.

A higher SENSE factor can be used to reduce scan time.

The higher SENSE factor can also be used to increase resolution within a reasonable BH time.
Improved examination workflow

As shown, the novel dS-SENSE strategy can improve image quality and/or reduce scan times. Comparing the same sequences acquired with AP to the dS-SENSE approach demonstrates a time saving of 38 seconds. This dS-SENSE approach provides the opportunity to further reduce total examination time by reducing the number of required breath holds, so that the total time saving increases to even further (55 seconds).

Shortened breath hold times also increase patient compliance and provide opportunities for interleaving the various scans to take advantage of so-called “dead time” in the exam strategy. Combining these time savings with the image quality improvements previously discussed, results in the possibility to obtain a high quality MRI study of the liver in examination times that now approach those of CT.

Routine liver exams

<table>
<thead>
<tr>
<th>3.0T SENSE conventional</th>
<th>Ingenia 3.0T dS-SENSE novel strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 Cor BH</td>
<td>T2 Cor BH</td>
</tr>
<tr>
<td>23 sec (2 x 12 sec)</td>
<td>18 sec</td>
</tr>
<tr>
<td>mDIXON All</td>
<td>mDIXON All</td>
</tr>
<tr>
<td>20 sec</td>
<td>13 sec</td>
</tr>
<tr>
<td>mDIXON W</td>
<td>mDIXON W</td>
</tr>
<tr>
<td>17 sec per phase</td>
<td>9 sec per phase</td>
</tr>
<tr>
<td>BB DWI BH</td>
<td>BB DWI BH</td>
</tr>
<tr>
<td>13 sec</td>
<td>11 sec</td>
</tr>
<tr>
<td>T2 Tra BH</td>
<td>T2 Tra BH</td>
</tr>
<tr>
<td>25 sec (2 x 13 sec)</td>
<td>17 sec</td>
</tr>
<tr>
<td>T2 FS Tra BH</td>
<td>T2 FS Tra BH</td>
</tr>
<tr>
<td>25 sec (2 x 13 sec)</td>
<td>17 sec</td>
</tr>
</tbody>
</table>

Examples from Ingenia 3.0T with the novel RL dS-SENSE approach:

- T2W coronal
- Dynamic mDIXON W
- DWI
- T2W
- T2W SPAIR
Have you seen FieldStrength online?

Visit www.philips.com/fieldstrength to experience the new features and appealing design.

Subscribe to make sure you don’t miss an issue

At www.philips.com/fieldstrength you can explore FieldStrength online. If you like it, subscribe to receive an email update when a new online issue is posted. Don’t forget to share FieldStrength with your colleagues as well!
Upgrades

Get mDIXON on your scanner

With mDIXON, four types of contrast can be generated in one scan: in-phase, out-phase, water only, fat only. mDIXON is available as an option for Ingenia and most Achieva and Intera configurations. Please contact your sales specialist for more specific information.

Compared to eTHRIVE, mDIXON improves image quality in high-resolution liver imaging. Fat suppression is improved and breath hold is shorter.

Achieva 3.0T
voxels 1.25 x 1.25 x 1.5 mm
SENSE factor 2 (AP) x 1.2 (FH)

SmartPath to dStream:
step up to a fully digital platform

If you currently operate an Achieva 1.5T/3.0T or Intera 1.5T scanner, you may be able to bring Ingenia’s digital architecture to your current magnet. See the article on page 5.

To learn more about this exciting proposition, visit www.philips.com/smartpathtodstream or contact your sales specialist for more specific information.

System after dStream upgrade
NetForum has a lot to offer for Philips MR users

Join the online community for users of Philips MR, CT and NM systems

NetForum is the online community for users of Philips MR, CT and NM systems. NetForum content helps you to learn more about Philips products from the people whose opinions you value the most: your peers. The content is organized in three sections: Explore, Operate and Grow. Learn more and sign up at:

www.philips.com/netforum

Don’t miss this on NetForum

An increasing number of Ingenia ExamCards
New Ingenia ExamCards have been added every month in the past period. Check back regularly to see which new ExamCards you can download. Or share your own favorite Ingenia ExamCard on NetForum.

Get there via: Operate > ExamCards > MRI

Interesting musculoskeletal content
Review the MRI musculoskeletal materials on NetForum. New content is added continuously for different system types. See for instance the Achieva 1.5T Zimmer knee protocol, the metal artifact reduction ExamCard and application tip, or the latest Ingenia additions.

Get there via: Operate > MRI > Musculoskeletal

Most popular MRI NetForum contributions in 2nd/3rd quarter of 2012

1. Clinical News NetForum reaches 20,000 registered users
2. Application Tip Metal artifact reduction for MRI of metal prostheses and implants
3. ExamCard 1.5T Hip with prosthesis using MARS protocol
4. Application Tip Tips for body diffusion weighted imaging (DWI)
5. ExamCard Ingenia 3.0T Lumbar spine in obese patient - Trier
Get FieldStrength by email. It’s faster. And it’s FREE.

FieldStrength is a professional magazine for users of Philips MR systems. Three times per year it provides results of MR studies performed by Philips users. Don’t miss any issue. Register now for your personal email subscription at: www.philips.com/fieldstrength

Visit NetForum now

NetForum
www.philips.com/netforum

EXPLORER
Share clinical results

OPERATE
Support your scanning

GROW
Support your business

Visit the NetForum online community to download ExamCards and view application tips, case studies, online training and more.

Scan the QR code with your smartphone for quick access. You can download a QR code scanner in your app store.

© Koninklijke Philips Electronics N.V. 2012
All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright holder.

Philips Medical Systems Nederland B.V. reserves the right to make changes in specifications or to discontinue any product, at any time, without notice or obligation, and will not be liable for any consequences resulting from the use of this publication.

Printed in Belgium.
4522 962 82891

FieldStrength is also available via the Internet:
www.philips.com/fieldstrength
www.philips.com/mri
www.philips.com/netforum

Editor-in-chief
Karen Janssen

Editorial team
Annemarie Blotwijk, Paul Folkers (PhD), Liesbeth Geerts (PhD), Diana Hoogenraad, Karen Janssen, Stephen Mitchell, Marc Van Cauteren (PhD).

Contributors
Ian Crick, Frederik De Keyzer, PJ Early, Rolf Gebker (MD, PhD), Jürgen Gieseke (PhD), Magdalena Gola (MD, PhD), Gwenael Herigault (PhD), Karen Janssen, Eric Jean, Lukasz Kownacki (MD, PhD), Simon Krijnen, Sharmeen Maze, John Penatzer, Jim Pipe (PhD), Polly Schmidt, Michael Shapiro (DO), Mamoru Takahashi (MD), Vincent Vandecaveye (MD, PhD), Winfried Willinek (MD).

Subscriptions
Please subscribe on www.philips.com/fieldstrength

Correspondence
FieldStrength@philips.com or FieldStrength, Philips Healthcare, Building QR 0119 P.O. Box 10 000, 5680 DA Best, The Netherlands

Notice
FieldStrength is published three times per year for users of Philips MRI systems. FieldStrength is a professional magazine for users of Philips medical equipment. It provides the healthcare community with results of scientific studies performed by colleagues. Some articles in this magazine may describe research conducted outside the USA on equipment not yet available for commercial distribution in the USA. Some products referenced may not be licensed for sale in Canada.
Breast MR

European Workshop on MRI-guided vacuum Breast biopsies
Bruges, Belgium
Dates: t.b.a.
European Workshop for radiologists with experience in breast imaging. Organized by Dr. Casselman, AZ St. Jan.
Info: jbenecke@mammotome.com
Phone: +49 40 593559116

Advanced Breast MRI Workshop
Cleveland, OH, USA
Dates: t.b.a.
2.5-day course for radiologists and technologists with basic understanding of breast imaging. Course includes didactic, hands-on and clinical reviews. Breast biopsy and post processing packages will also be covered.
Info: kara.grey@philips.com

Breast MRI - Case-Based Review
Lake Buena Vista, FL, USA
Dates: January 26-27
Info: www.sbi-online.org

Breast MR with guided biopsy
Reston, VA, USA
Dates: February 5-6; April 29-30
This 100-case course is designed to provide practicing radiologists with an intensive, hands-on experience in reading breast MRI. Participants will develop their interpretive skills through extensive case reviews at individual work stations.
Info: www.acr.org
Email: EDCTR-WebReg@acr-arrs.org
Phone: +1 800-373-2204

The Breast Course 2013
Budapest, Hungary
Dates: April 14-17
Info: www.thebreastpractices.com

Musculoskeletal MR

Current issues of MRI in orthopaedics and sports medicine
San Francisco, CA, USA
Date: August 25-28
Info: www.stollerscourse.com

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.cmrr-berlin.de
Email: info@cmr-berlin.de
Phone: +49-30-4502 6280

Compact course
Dates: Part 1: Feb. 11 - Mar 22; Nov. 4 - Dec. 13
Part 2 - home study;
Intensive course including hands-on training at the German Heart Institute, and reading and partially quantifying over 250 cases.

Compact course
Dates: Feb. 11-15; June 17-21; Nov. 4-8
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, TX, USA
Dates: t.b.a.
On principles and practical applications of Cardiac MRI.
Info: ddees@sleh.com and lvillareal@sleh.com

Clinical Workshop on Cardiac MR stress imaging
London, United Kingdom
Date: April 17-19; October 2-4
Dedicated, intense, individualized and hands-on CMR stress imaging training to a small number of participants (max 10). Aimed at cardiologists and radiologists. Theoretical and practical aspects will be addressed.
Info: www.cvtti.org.uk
Email: admin@cvtti.org.uk and enquiries@cvtti.org.uk
Phone: +44 20 8793 2216

Cardiac MRI Training
Washington Hospital Center, Washington, DC, USA
Date: 3-month fellowship
Open for cardiologists, radiologists and others interested in learning more about CVMR in a high-throughput clinical site focusing on a variety of clinical problems. Organized by Dr. Fuisz.
Info: www.cvrmi.com
Email: pamela.d.wilson@medstar.net
Phone: +1-202-877-6889

Hands-on technologist CMR training
St. Louis, MO, USA
Date: Offered monthly, by appointment
Two-day course is designed for technologists, nurses and sonographers interested in cardiac MRI. Maximum of 3 participants per class.
Info: ctrain.wustl.edu/ClinicalResearch/ TechTraining2.aspx
Phone: +1-314-454-7459
Fax: +1-314-454-7490

MR Spectroscopy

MR Spectroscopy course
Zurich, Switzerland
Date: t.b.a.
Theory sessions and daily practical scanning and post-processing sessions in small groups.
Info: www.biomed.ee.ethz.ch/education/
Email: henning@biomed.ee.ethz.ch

Advanced MR Spectroscopy
Cleveland, OH, USA
Date: t.b.a.
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: Vicki.milligan@philips.com

NetForum

Register on NetForum to have free access to online training modules on use of Philips MR scanners and packages, use of coils, use of EWS, MR safety.
General MR

**Essential Guide to Philips in MRI**
Cheltenham, UK
**Dates:** May 14-17, November 5-8
Designed for Philips users. Includes 2 days on basics of MR physics and 2 days on advanced concepts. The course can be attended for 2-4 days.
**Info:** education@cobalthealth.co.uk

**Philips North America off-site training courses**

**Dates:** upon request
**Info:** kara.grey@philips.com
**Phone:** +1-440-483-5355
**Fax:** +1-440-483-7946

**Regional Registry Review**
**Cleveland, OH, USA or facilities across U.S.**
Two day didactic course covering MR physics and cross sectional anatomy. This course is designed as an overview course to assist MR technologists in taking the ARRT MR registry exam.

**MRI Basics**
**Cleveland, OH, USA**
Designed for novice technologists with little or no previous MR experience. Lectures cover the basic concepts and theory of MRI. This program is entirely didactic and theory based.

**MRI Essentials for Philips users**
**Cleveland, OH, USA**
This comprehensive course for technologists covers all basic scanning and system functionality. Lectures cover MRI safety, scan parameters, and pulse sequences.

**Advanced MRI for Philips users**
**Cleveland, OH, USA**
Didactic and hands-on course covering advanced applications including advanced scan parameters, pulse sequences, advanced neuro, ortho, body and breast imaging techniques.

**Cardiac imaging for Philips users**
**Cleveland, OH, USA**
Didactic and hand-on course covering all cardiac views, heart valves, Q-flow, coronary arteries and the postprocessing packages on the EWS.

**1H Basic spectroscopy imaging**
**Cleveland, OH, USA**
Didactic and hands-on course covering Basic 1H Spectroscopy for the brain, prostate and breast. This course also covers postprocessing packages on the system.

---

**Events calendar 2013**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>More information</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 4-7</td>
<td>Indian Radiological &amp; Imaging Association – IRIA</td>
<td>Hyderabad, India</td>
<td>maindore2013.org</td>
</tr>
<tr>
<td>January 17-20</td>
<td>American Society of Neuroimaging – ASN</td>
<td>Las Vegas, NV, USA</td>
<td><a href="http://www.asnweb.org">www.asnweb.org</a></td>
</tr>
<tr>
<td>January 24-26</td>
<td>International MRI Symposium Garmisch</td>
<td>Garmisch-Partenkirchen, Germany</td>
<td><a href="http://www.mr2013.org">www.mr2013.org</a></td>
</tr>
<tr>
<td>January 28-31</td>
<td>Arab Health</td>
<td>Dubai, United Arab Emirates</td>
<td><a href="http://www.arabhealthonline.com">www.arabhealthonline.com</a></td>
</tr>
<tr>
<td>Jan 31 - Feb 3</td>
<td>Society for Cardiovascular Magnetic Resonance – SCMR</td>
<td>San Francisco, CA, USA</td>
<td><a href="http://www.scmr.org">www.scmr.org</a></td>
</tr>
<tr>
<td>February 14-16</td>
<td>Joint Interventional Meeting – JIM</td>
<td>Rome, Italy</td>
<td><a href="http://www.jim-vascular.com">www.jim-vascular.com</a></td>
</tr>
<tr>
<td>March 7-11</td>
<td>European Congress of Radiology – ECR</td>
<td>Vienna, Austria</td>
<td><a href="http://www.myesr.org">www.myesr.org</a></td>
</tr>
<tr>
<td>March 9-11</td>
<td>American College of Cardiology – ACC</td>
<td>San Francisco, CA, USA</td>
<td><a href="http://www.cardiosource.org">www.cardiosource.org</a></td>
</tr>
<tr>
<td>March 17-20</td>
<td>Society of Skeletal Radiology – SSR</td>
<td>San Antonio, TX, USA</td>
<td>skeletalrad.org</td>
</tr>
<tr>
<td>April 11-14</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 20-26</td>
<td>International Society for Magnetic Resonance in Medicine – ISMRM</td>
<td>Salt Lake City, UT, USA</td>
<td><a href="http://www.ismrm.org">www.ismrm.org</a></td>
</tr>
<tr>
<td>May 18-23</td>
<td>American Society of Neuroradiology – ASNR</td>
<td>San Diego, CA, USA</td>
<td><a href="http://www.asnr.org">www.asnr.org</a></td>
</tr>
<tr>
<td>May 27 - Jun 1</td>
<td>American Association of Neurological Surgeons – AANS</td>
<td>Miami, FL, USA</td>
<td><a href="http://www.aans.org">www.aans.org</a></td>
</tr>
</tbody>
</table>
Thanks to Philips Imaging 2.0, a revolutionary imaging approach, the Philips Ingenia 1.5T and 3.0T MR systems set a new standard in clarity, speed and expandability. Ingenia captures and digitizes the signal closest to the patient to improve SNR by up to 40%. Easier coil handling and improved patient comfort help increase productivity by up to 30%. And, Ingenia is designed to meet the growing needs in oncology imaging. Discover the revolution in MR technology at www.philips.com/Ingenia30T.

The first-ever digital broadband MR is changing expectations, and lives. That’s the power of Philips Imaging 2.0.

www.philips.com/ingenia30T