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Once again, more than 60,000 participants (including professional registrants and exhibitors) registered for the world largest radiology congress this year. And again computed tomography (CT) played a prominent role at the convention. Developments in CT dominated many scientific sessions, however in the exhibition the atmosphere was more conservative; all manufacturers (GE, Philips, Siemens and Toshiba) consolidated the technology of 64 slice scanning. Two manufacturers (Philips, and Toshiba) announced, as work in progress, the development of a 256 slice scanner. Hitachi announced its ambition to enter the market of 64 slice scanning in 2007.

In addition to the established special applications of CT in radiotherapy (CT planning systems), and in angiography with fluoroscopy systems (3D rotational angiography), several manufacturers now offer dedicated systems for 3D dental imaging. This RSNA 2006 report focuses on the developments in regular diagnostic CT imaging.

General Electric

General Electric (GE) introduced the VCT-XT scanner; it is a further development of their 64 slice scanner. XT stands for extended, and the scanner offers enhanced software and hardware. The new scanner allows for the clinical application of the SnapShot acquisition technique. This technique, which has been developed and validated, allows for low dose CT coronary angiography (3-6 mSv) using prospective gated coverage of the entire heart in 3 or 4 steps, and within 6 to 8 heart beats. Previously in cardiac CT, prospective gating was used for calcium scoring protocols only; now GE is one of two manufacturers offering it for coronary angiography on current systems.

GE has also optimized the acquisition for the retrospective gated CT coronary angiography (5 Beat Cardiac); the performance of cardiac CT angiography reconstructions is enhanced by the development of an R-Peak Editor. For cardiovascular studies of the chest GE offers a dedicated Triple Rule Out protocol.

For the imaging of acute stroke, GE has introduced Volume Shuttle. With this technique the brain is repeatedly scanned by means of axial acquisitions at two adjacent positions, thus providing a total coverage of 8 cm. This technique can be used for perfusion studies of the brain and for 4D CT brain angiography.

In the future GE aims at better spatial resolution and lower dose. To achieve this, smaller detector elements will be developed in combination with a smaller focal spot. The data-acquisition system will be enhanced to be able to capture 2205 views during a 0.35 s rotation. GE is also developing an iterative reconstruction algorithm, Statistical Iterative Reconstruction (SIR), that will provide either better image quality

at the same dose compared to the usual filtered back projection algorithm, or similar image quality at lower dose compared to the back projection algorithm.

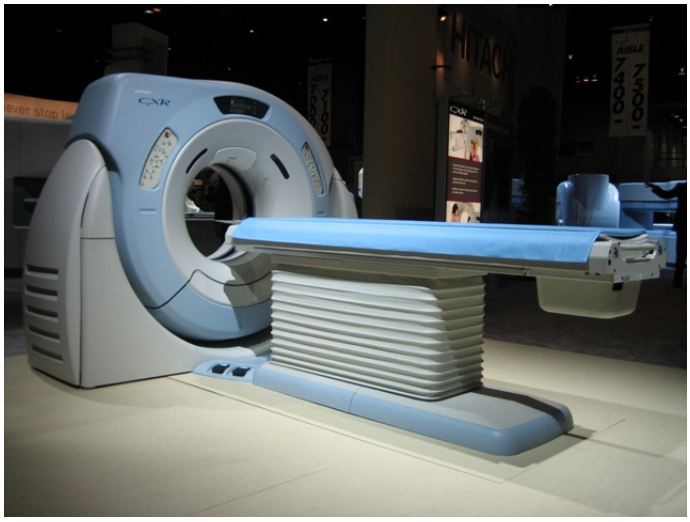
GE is developing the Volume Helical Shuttle, the next stage on from their axial Volume Shuttle. The Volume Helical Shuttle is a helical acquisition that is performed in successive inward and outward directions, thus registering the contrast enhancement of a large volume as a function of time. This application allows for coverage of up to 210 mm for dynamic CT angiography or CT perfusion studies.

GE is also developing dual energy applications; the implementation will be as two successive axial half scans at different tube voltages, followed by table translation.

General Electric introduced the LightSpeed VCT-XT scanner; it is a further development within their 64 slice scanner platform. It features the Volume Shuttle.

Hitachi

Hitachi has a long history in CT scanner production but in recent years has not developed new scanners at the pace of the other four major manufacturers of CT scanners. Currently, Hitachi is offering a 4 slice scanner, the model CXR4, but they have ambitions to become a competitive player in the European CT market in 2007. To achieve this, a new platform for multislice CT scanners has been developed; the prototype was presented at the Hitachi booth. In 2007 Hitachi will introduce new scanners based on this platform, starting in early 2007 with a 16 slice scanner, followed in the same year by a scanner with at least 64 slices. The CT detector of the new scanners is developed by the Hitachi Company and will be upgradeable to more slices. Performance of the new scanners should be at the high level that the current CT market demands.



Hitachi presented a new platform of multislice scanners, still work in progress but expected on the European market in 2007 as 16 slice and (at least) 64 slice scanners

Philips

Philips has developed a 2nd generation platform for the Brilliance scanner range, which is now on the market as the high end 64 slice scanner.

Philips has introduced 'Step & Shoot cardiac imaging' acquisitions. This means that the heart is covered in successive axial acquisitions, each with a coverage of 4 cm. This application is now available for clinical application. It allows for CT coronary angiography with a substantial reduction in patient dose, from 15 (+/- 5) mSv for the current ECG gated retrospective technique to 2 - 4 mSv for the Step & Shoot technique. Previously in cardiac CT, prospective gating was used for calcium scoring protocols only; now Philips is one of two manufacturers offering it for coronary angiography on current systems.

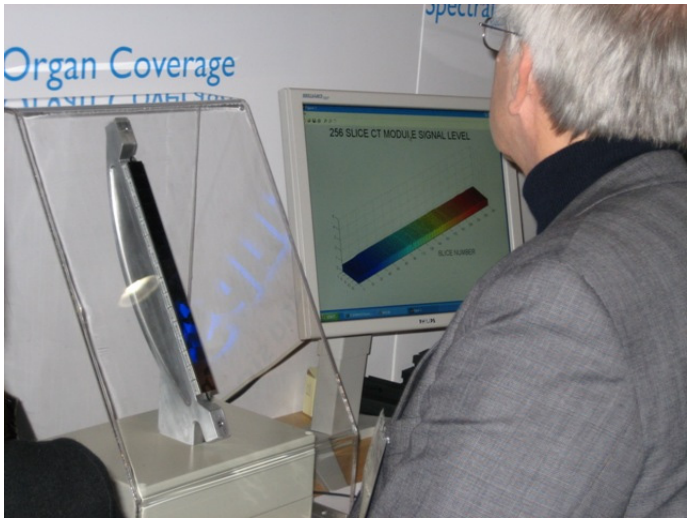
Philips has placed a lot of emphasis on the work flow around CT scanners and new applications such as CT Trueview have become available. CT Trueview enables the results of cardiac CT examinations to be used to facilitate easier interventional procedures for the cardiologists. This is achieved through integration of the 3D representation of the CT coronary angiography within the CathLab, utilizing the geometry of the same 3D representation to control the movements and positioning of the C-arm.

An application called Brilliance Everywhere offers a CT portal that is supported by a thick client configuration thereby enabling full functionality at any PC.

The future vision of Philips for the new scanner platform can be summarized by three features: wider coverage; spectral information and colour coding. Double layer detectors that allow discrimination of photon energy are now undergoing prototype testing at one clinical site. In the future Philips will strive for true photon capture, meaning that individual photons are detected and discriminated with regard to the photon energy. On the booth Philips displayed their 256 slice detector with a coverage

of 16 cm. Philips are developing a concept for colour coding, this should facilitate and improve the display of future CT techniques where besides morphology, functional information will also be able to be extracted from the CT scans.

Philips is also working on the development of dual energy acquisitions. To achieve this, new hardware has been developed that enables rapid switching between different tube voltages, in a single tube CT system. The dual energy concept is based on the implementation of the 64 slice scanner with an axial acquisition. For dual energy, two successive axial acquisitions will be made, shortly after each other. The acquisitions are made during a half rotation at, for example, tube voltages of 80 and 120 kV.



A module for the 256 slice CT detector was on display at the Philips booth (work in progress).
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Siemens

At the high end of the CT range Siemens consolidated its position with the Somatom Sensation 64 slice scanner, and the Somatom Definition 64 slice dual source scanner. At the low end of the CT scanner range, Siemens is offering the Somatom Spirit, a 2 slice scanner with full options including features for low dose CT scanning.

Workflow enhancement is achieved by the offer of "Engines" for specific applications, and by WebSpace for image reviewing at any PC. Four Engines are available; for cardiology, neuroradiology, oncology and acute care. The Engines provide a comprehensive solution for these specialised applications, from scan to diagnosis in order to achieve a streamlined workflow. For example, the cardiac Engine contains State-of-the-art ECG-synchronized acquisition and intuitive ECG editing for optimal image quality and lowest possible patient dose and dedicated applications for assessment of cardiac morphological and functional analysis. An automatic best phase selection will be available in 2007.

Syngo WebSpace makes CT images available for immediate review everywhere and allows for on-call case review, conferencing and teleradiology. WebSpace is available as a thin client solution. The Somatom Sensation Web Selection (64 slice

configuration) combines the established CT scanner and the newest thin-client solution of Siemens. Zero delay CT data availability is possible - after the CT scan the data is immediately available at the console. Because of a Shared Database the data is also immediately available at the additional CT workplace, and via fast data link at the Syngo WebSpace server.

At the scientific sessions, many users reported on their experiences with the dual source Somatom Definition scanners introduced last year. These mainly involved CT coronary angiography. The application of dual energy CT with the dual source scanner has been evaluated in research applications, and will become available in the first quarter of 2007. Dual energy scanning with the dual source scanner may be beneficial for bone removal (e.g. in cerebral CT angiography) and for lung perfusion studies.

The last year presented dual source scanner of Siemens (Somatom Definition) received attention, not only at the booth but also in the scientific session.

Toshiba

Toshiba consolidated its position with the Aquilion 64 CT system. The improvement of work flow received special attention. For cardiac applications PhaseExact allows for automated optimal phase selection, which improves workflow and clinical results. With this newest software, the reconstructed images of the best phase cardiac reconstruction will become available for the radiologist about 1 - 1.5 minutes after the radiographer started the examination. In addition Enhanced Dicom has been implemented, allowing for image distribution at a speed of 60 images per second. Another feature is the optional CAN1 software for intravascular enhanced contrast examinations, here the injection of iodine contrast can now be synchronized with the start of the CT sequences, in this case the injector triggers the start of the acquisition.

Toshiba received the attention of a large audience during the RSNA satellite event "The Promise of 256 CT". The 4, 16 and 64 slice Toshiba scanners all cover a maximum range of 3.2 cm, whilst the 256 scanner coverage will increase to 12.8 cm, enough for coverage of entire organs such as the brain and the heart. Scans will not only provide information about the morphology of the organs, but also about organ function. Special benefits of 256 slice CT are expected for cardiac CT. Acquisitions will be performed at a rotation speed of 0.35 s, and in combination with a half reconstruction, or segmented reconstructions, this will allow good temporal resolution. A half reconstruction comes with a temporal resolution of 0.18 s (in this case the entire heart is scanned within one heartbeat), with segmented reconstructions temporal resolution goes down to 0.09 s (two segments) or 0.06 s (three segments).

With prospective ECG triggered axial acquisition, and exposure only during the rest phase of the heart, there is a potential for dose reduction in CT coronary angiography, from 15 mSv with the current 64 slice scanner acquisitions towards the range of 1-6 mSv with the 256 slice scanner (depending on the number off included heart beats). Toshiba did not disclose the date for the introduction of the 256 slice scanner on the market.

Toshiba consolidated its position with the Aquilion 64 slice scanner; the scanner at the booth featured a transparent gantry housing to reveal gantry components.

Koos Geleijns for ImPACT, December 3rd 2006.

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