Scoring phantom images is an integral part of quality control for diagnostic imaging, but the process has traditionally been cumbersome and subjective. That’s why the introduction of software to automatically score the ACR CT phantoms—and track these data over time—is so needed.

“We used to record all the values from our ACR CT phantom testing by hand,” said Allen Goode, MS, a diagnostic medical physicist in the Department of Radiology at the University of Virginia in Charlottesville. “It’s very time-consuming, and it’s prone to errors because there are just so many numbers to record.” There’s also no way to view trends over time without filling out Excel spreadsheets.

Goode’s process changed in March of 2010, when he decided to purchase a software program called Radia (Radiological Imaging Technology; Colorado Springs, CO) for the four CT machines in his hospital (Radia was launched in August 2009). Goode has since purchased three more copies of Radia for use in the institution’s outpatient facilities.

“Now that all these values are being captured for us in the database and trended over time, we can look at values like contrast ratios and spend much more time analyzing.”

He also pointed out that using the program can help with accreditation, which is a major concern for anyone involved in medical imaging. The four outpatient CT units already have their ACR accreditation, and Goode has applied for accreditation for his hospital CT units even though this is not yet required for hospital CT. Institutions that wait until accreditation is a requirement risk being affected by significant delays.

What Radia Does

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The Radia ACR CT/MR module goes through all the ACR-required analyses for positioning CT number accuracy, slice thickness, low-contrast resolution, image noise, bar pattern modulation, signal-to-noise, image uniformity, MTF (GD Method), contrast-noise, and CT number uniformity. The MR module tests geometric accuracy, high contrast spatial resolution, slice thickness accuracy, slice position accuracy, image intensity uniformity, percent signal ghosting, low contrast object detectability, and more.

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SPECIAL FEATURE

Quality Control Report

FALL / 2010
"A third of what the ACR recommends for [the image analysis portion of] their whole accreditation, we’re now able to do every week."

A Three-Tiered Quality Control Program

Goode said that his institution uses a three-tiered quality control program for checking the CT machines that comprises daily, weekly, and annual checks.

Daily quality control is carried out every 24 hours using the manufacturer’s specified tests and the manufacturer’s phantom, which is usually a water phantom. “We also do basic things like looking at the scanner overall to make sure the cameras and monitors are functioning and the radiation symbols are in place,” said Goode.

The institution’s weekly quality control, which can also be performed if there’s a problem, involves a more rigorous check of the system using the ACR CT phantom. He said that the money spent on Radia can save money in the long run. “For about the cost of the submit of one image set, you can get Radia. It works out to $2500 for each copy of the Radia software, plus $500 annually for user support and upgrades starting the second year. One copy of Radia can be used to analyze images from any number of CT and MRI machines. “For about the cost of the submital of one image set, you can buy this software,” he said.

ACR Certification

A defined quality control program is more important than ever because it’s an essential part of accreditation. Insurer United Healthcare began requiring accreditation for advanced imaging procedures performed outside of a hospital starting in late 2009. If a center is not accredited, United doesn’t reimburse for the procedure.

The 2008 Medicare Improvements for Patients and Providers Act (MIPPA) has decided to put accreditation requirements in place for outpatient facilities starting in January 1, 2012. It’s only a matter of time before more private insurers follow suit. That’s why CT providers need to seek accreditation soon, from either the American College of Radiology (ACR) or the Intersocietal Commission for Accreditation (ICA).

Matt Whitaker, who’s involved in both software design and sales for RIT, pointed out that Radia can help centers with certification in at least two ways. First, the software can be used to prepare images to be sent to the ACR for certification. Second, use of the product can help centers avoid sending poor-quality images. This is of special concern because certification costs $2300 to $2400 per unit and takes 6 to 9 months.

“If you do something silly and have poor quality on one of the images, you may not find out for months that you messed up, then you’ll have to do it all over again,” he said. This means paying additional fees and falling behind schedule on accreditation. Outpatient centers that fall behind schedule risk losing the ability to bill for services. As for Goode, he’s planning to purchase additional Radia modules for the four or five CT machines his institution will need when it launches its new oncology center.

“Accreditation is here to stay, and it’s only going to get more rigorous,” said Goode. “We need products like Radia to help us with quality control.”

Future Directions

In addition to the module for ACR CT and MR phantom, Radia modules are available for the Catphan/OBI phantom, the Siemens image quality phantom (for radiation therapy), and the EPID QC phantom from PTW. The company plans to introduce additional modules for mammography, fluoroscopy, and nuclear medicine.

He said that the money spent on Radia can save money in other ways. For example, detecting drift before it becomes clinically relevant allows the center to plan maintenance as needed rather than shutting down for repairs. Running the program after repairs are done is an efficient way to confirm that machine has good image quality before the field service engineer leaves.

Dot Rayty, a CT QA technologist who works with Goode at the University of Virginia, said that using Radia helped prepare her for the accreditation process. “Having an understanding of what the model represented, how the phantom is put together, and how to get it centered on the table … all of that helped in the application process for me as a technologist,” she said. She said that the center will use Radia to submit information to the ACR when it’s time to renew their accreditation.

Additional Checks

Goode said that his center often uses Radia as a “just in case” step. “Anytime there’s any doubt, you put the phantom on the scanner and run the software,” he said.

For example, he said, a minor software upgrade doesn’t require the medical physicist to carry out a full evaluation of the machine. Nor is a complete evaluation in order when the power goes off overnight and everything looks fine when the system comes up in the morning. Still, when even a remote possibility of a problem exists, running the software “gives us assurances that everything is working properly, even if it’s two o’clock in the morning,” he said.

Goode recalled one time in particular when Radia caught an error. One of the scanners had a corrupted calibration file, and the service engineer replaced it with a slightly older calibration file in order to check it. When we ran Radia, we found that the linearity values were slightly off because the older file was inadvertently left in place,” he said. Although the error wouldn’t have had a worrisome impact on patient dose or image quality, some of the Hounsfield unit values were outside of the recommended acceptable range. Finding the error allowed the center to request a new calibration file, which was inserted right away.

“RunQueueC allows you to batch analyze historical data and put that into a trend database.”
CT number uniformity, and image noise. In addition, the module analyzes bar pattern modulation, signal/noise, image uniformity, MTF, and contrast/noise.

RunQueueC is a feature that allows users to batch process multiple images and get immediate feedback on which images are acceptable. If an image is unacceptable, the operator can click on the image and view it using the software.

Dan Ritt, president and chief engineer of RIT, emphasized that the product goes beyond simply measuring image quality. “RunQueueC allows you to batch analyze historical data and put that into a trend database. We have a customer who has done this for all his data back to 2001! This is perfect for accreditation agencies such as JACHO,” he said.

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The institution’s weekly quality control, which can also be performed if there’s a problem, involves a more rigorous check of the system using the ACR CT phantom. He said that his institution uses a protocol that mimics their adult abdomen profile. “This is the level where we use Radia,” said Goode. “A third of what the ACR recommends for [the image analysis portion of] their whole accreditation, we’re now able to do every week.”

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**Software For Scoring ACR CT Phantoms**
Aids in Quality Control

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