

Equipment Quality Control for Computed Tomography Scanners

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Imaging Physics CancerCare Manitoba

Purpose

An equipment quality control (QC) program establishes baseline performance levels, tracks system performance over time and reveals performance trends. This document outlines the tests that are typically part of a QC program for computed tomography scanners. Contact Imaging Physics for assistance in setting up a program.

What are the benefits of a QC program?

- Performance degradation can be identified leading to preventative action.
- Patients benefit when equipment performance is maintained at acceptable levels.
- A QC program is an important element in achieving accreditation.

What are the components of a QC program?

The QC program is set up by the facility under the guidance of a medical physicist certified by the Canadian College of Physicists in Medicine. The program consists of acceptance testing, on-going quality control, and periodic review of QC data and outcomes. Typically, the routine QC activities are carried out by a technologist while in-depth checks are performed by, or under the guidance of, a medical physicist. A typical QC program includes the following:

Acceptance Testing

Acceptance testing must be performed by or under the oversight of a medical physicist when a system is installed, relocated or undergoes significant upgrades or maintenance. Acceptance testing verifies vendor specifications and establishes performance baselines. It is the facility's responsibility to make arrangements for acceptance testing by a medical physicist.

Daily

1. Follow the start-up and calibration procedures specified by the scanner vendor.
2. Clean the scanner table and cushions and ensure they are free of foreign objects which may appear in the scan. Make sure no residual contrast agent remains on the table or cushions.

Weekly

1. Scan the weekly QC phantom provided by the manufacturer using the QC protocol. Use the phantom scan to perform the following tests:
 - a. Measure the water mean CT number and standard deviation, The mean CT number should be +/- 4 HU or per the vendor specification, whichever is less. The standard deviation should be within the range specified by the vendor.
 - b. Measure the CT number uniformity in a uniform section of a QC phantom. Measure the CT number in the centre and periphery of the image. The difference in the CT number between the centre and periphery of the image must not exceed 5 HU.

- c. Examine an image of the uniform section of the phantom for artefacts. The image should be free of artefact.

With QC scan techniques pre-programmed into the scanner, the weekly tests take approximately 10 to 15 minutes.

Monthly

1. Perform a visual inspection of the proper operation of patient bed transport, alignment and system indicator lights, intercom, room safety lights, signage, and monitors.
2. Verify performance of modality displays qualitatively by displaying and evaluating an image of the SMPTE pattern or equivalent. Verify visibility of the 5% contrast patches and the absence of distortions or artefacts. Refer to the modality display QC instructions available on the Imaging Physics website.

The monthly tests take approximately 10-15 minutes.

Annually

1. Annual testing by or under the oversight of a medical physicist to evaluate performance against vendor specifications and baseline levels established at acceptance.
2. Annual equipment QC review by a medical physicist.

QC data should be recorded in a manner that allows monitoring of the trends in performance levels. It is recommended that QC data trends be reviewed at least quarterly.

In the case of dual modality equipment, e.g. SPECT/CT, PET/CT; each component must comply with the appropriate modality standards.

Note that vendor-supplied QA software that only provides a pass or fail result is not adequate.

Where to go for help?

Imaging Physics at CancerCare Manitoba provides physics testing for diagnostic imaging systems, and can assist diagnostic imaging departments in setting up QC programs, training staff to perform QC tests and identifying appropriate QC tools. You can contact Imaging Physics at Imaging.Physics@cancercare.mb.ca or by calling 204-787-4145.

The CT specialists are Dr. Idris Elbakri (204-787-2856) and Dr. Harry Ingleby (204-787-2126).

Annual Medical Physics QC Review – Computed Tomography

This is a sample form of the annual QC review to be conducted by a medical physicist. This form is required by MANQAP to demonstrate ongoing compliance with the QC requirements.

Facility		Department	
System make/model		System Location	
Date of review		Contact Person	
Overall QC Program Assessment	() ACCEPTABLE () ACCEPTABLE but requires remediation () NOT Acceptable. Immediate action required	Review time period (mm/yy to mm/yy)	

QC Test	Status	Comments
Daily scanner startup and calibration		
Daily cleaning of scanner table and cushions		
Weekly water Mean and STD measurement		
Weekly artifact evaluation		
Weekly image uniformity measurement		
Monthly System Visual Inspection		
Monthly Modality Display Performance Test		
Annual Physics Testing (or acceptance if Equipment is new or relocated)		

Overall QC Program Assessment:

Required changes:

Review conducted by

Signature