

QUALITY CONTROL PROCEDURES AND PROGRAMS, L. Stephen Graham,
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Some professional organizations recommend/require that a comprehensive evaluation of nuclear medicine camera performance be completed on a regular basis. The purpose of this lecture is to describe a program that measures the performance of all key parameters.

A satisfactory program must involve measurement of flood field uniformity at low and high count rates, “uncorrected” and in the “high count rate” mode, if available. Off-peak images can be used to evaluate PMT balance, operation of the detector electronics and check for crystal hydration. Energy resolution should be measured but this is difficult on some systems. Floods of all collimators must also be acquired to check for damage. Intrinsic spatial resolution must be measured at low and high count rates and in the high count rate mode. An intrinsic bar pattern image of Ga-67 can be used to evaluate multiple window spatial registration circuit calibration.

Count rate performance can be measured by either one of two different methods (two source or count rate vs. activity curves) with each having certain advantages. Sensitivity can be measured intrinsically with a point source or extrinsically with a flask or a Co-57 flood. The computer display and hard copy must also be evaluated. A computer test pattern can be used for the monitor; a film/color print of a set of “identical” bar pattern images can be used for the formatter.

A protocol will be described by which the data for a comprehensive evaluation of planar camera performance for a single head system can be acquired in ≈ 1.5 hr. Some professional organizations indicate that these tests should be done at least once each year.

Evaluation of planar performance is a necessary, but not sufficient condition for ensuring that SPECT performance is optimal. Tomographic spatial resolution can be qualitatively evaluated from reconstructed images of a phantom that contains some type of resolution pattern; quantitative information can be obtained from a reconstructed line or point sources. Reconstruction of a simple cylindrical phantom reveals artifacts and indicates the level of noise in the image but a phantom with internal structures can be used to quantitatively assess both uniformity and contrast. Quantitative measures of these parameters can be obtained on all systems using standard keyboard operations. The highest recommended frequency for the tomographic tests is quarterly; the lowest is once each year.

The National Electrical Manufacturers Association (NEMA) will soon release a guideline for SPECT quality control. It is based on the thesis that the tests should not be “burdensome” and focuses on those parameters that are mostly likely to change.

Objectives:

1. To describe a comprehensive program for performance testing by a medical physicist;
2. To provide a summary of the recommendations of professional organizations with respect to the frequency of testing;
3. To summarize the important features of the NEMA SPECT QC guidelines.