FLUKE®
Biomedical

Nuclear Associates 76-810, 76-814 76-815 & 76-818

Bar Phantoms and Test Patterns

Operators Manual

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Manual No. 76-810-1 Rev. 2

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Section 1
Introduction

1.1 Definition

Transmission test patterns provide an indication of both the intrinsic and system resolution capabilities of a gamma camera. They can also provide a measure of field size and linearity. It is important to obtain images of these patterns at the time the camera is tuned. These should be repeated periodically and compared with the original. The images provide a prompt and sensitive indication of any loss in image quality and alert the user to the need for service.

The image quality and resolution capabilities depend on many factors such as:

a. Gamma ray energy
b. Window width
c. Collimator
d. Information density
e. Count rate
f. Distance from collimator
g. Amount of scattering material
h. Type of data processing
i. Type of photographic system and film

Transmission test patterns provide a convenient means of studying how these different parameters affect image quality and can be helpful in optimizing their choice.

1.2 Equipment Required

- A transmission test pattern suitable for the resolution capabilities and size of the camera being tested such as one of the following:
  1. Quadrant Bar Test Pattern
     a. Standard Field Camera, up to 14 in (D)

Model No.	**Bar Widths** (inches)
76-818	3/8, 1/4, 3/16, 1/10

     b. Large-Field Camera, up to 16 in (D)

Model No.	**Bar Widths** (inches)
76-814	3/8, 1/4, 3/16, 1/8
76-815	3/8, 1/4, 3/16, 1/10

  2. Hine-Duley Test Pattern

Model No.	**Bar Spacing**
76-810	1/4, 3/16, 5/32

- Flood Phantom

  Three flood phantoms are available, Rectangle, Jumbo and Gigantic. Filler and vent ports are located on the face. Shipped empty; radioactivity is not included.

  76-801 Rectangle phantoms is 18 x 23 x 1 in thick with a 16 x 23 x ½ in (D) cavity, weight 10 lbs

  76-804 Jumbo phantom is 18 x 18 x 1 in thick with a cavity 17 x ½ in (D), weight 9 lbs

  76-807 Gigantic phantom is 23 x 23 x 1 in thick with a cavity 22 x ½ in (D), weight 13 lb

  or

  Flood Sources (Co-57)

  Model 67-296 for standard-field cameras

  Model 67-297 for large-field cameras

  Model 67-298 for large-field cameras

- Suitable sources of radioactive material and lead shielding.

- Masonite or Lucite sheets, 45 x 45 x 10 cm

Section 2
Test Procedures

2.1 Intrinsic Resolution

1. Adjust the window position and width for the radionuclide for which the resolution is to be measured. A good starting point is 1.5 FWHM. The count rate should not exceed 10,000 cps to avoid any spectral shifts due to pulse pile-up.
2. With the collimator removed, install the appropriate test pattern against the face of the crystal, using the adapter plate.
3. Raise the detector to its maximum height, at least 5 feet from the floor (see Figure 2-1).
4. Place a point source or vial of activity of the desired nuclide on the floor, and center it under the detector. Select the activity of the source to produce a count rate of less than 10,000 cps. Use appropriate shielding, making sure the source is able to see all of the crystal.

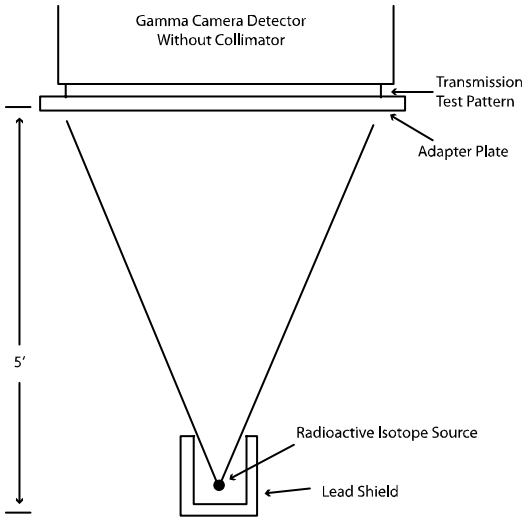

Figure 2-1. Intrinsic Resolution

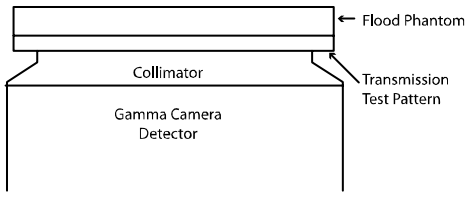

Figure 2-1. System Resolution

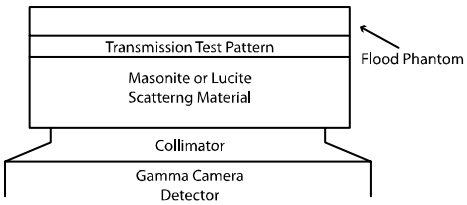

Figure 2-3. System Resolution with Scattering Material

5. Accumulate an image consisting of 1 million counts for standard field cameras and 2 million counts for large-field cameras.
6. Process the data or develop the film, and inspect the final image.

2.2 System Resolution

1. Put on the desired collimator and invert the detector.
2. Place the test pattern on top of the collimator.
3. Place the filled Flood Phantom or Co-57 Flood Source on top of the bar phantom (Figure 2-2). The Flood Phantom is filled with the desired isotope, using an activity that will produce less than 10,000 cps.
4. Accumulate an image consisting of 1 million counts for standard-field cameras, and 2 million counts for large-field cameras.
5. Process the data or develop the film, and inspect the final image.
6. Place 10 cm of the suitable attenuating and scattering material, such as Masonite or Lucite, between the bar test pattern and collimator (Figure 2-3),
7. Repeat steps 4 and 5.

2.2 Evaluating Of Results

Inspect each of the films to determine the smallest bar spacing that can be visualized. This is an indication of the resolution under the conditions of measurement. Note that the intrinsic resolution is better than the system resolution, due to the addition of the collimator. The addition of 10 cm of scattering material further reduces the resolution.

Inspect the images for linearity by observing how straight the images of the bars are. Check for barrel or pincushion distortion near the edges of the image.

The evaluation is somewhat subjective. However, if the images are kept in a logbook and compared with images taken when the camera is properly adjusted, it will be possible to detect any changes or deterioration of the images. Service can then be initiated immediately.

2.3 Additional Tests

Since each quadrant of the detector face sees a different size pattern when using the Quadrant Bar Test Pattern, it is desirable to make 3 additional images at 90-degree rotational increments. For the Hine-Duley Test Patterns, make an additional image at 90-degree rotation.

The resolution obtainable, as well as the overall quality of the image, will be a function of all of the parameters listed. It is desirable to repeat the procedure and vary each of these parameters in order to study how the image is affected by changes in window width, very high count rates, distance from the collimator, or information density.

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