NUCLEAR MEDICINE PRACTICE ACCREDITATION

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UCLA School of Medicine

TOPICS

ACR Nuclear Medicine Practice Accreditation Program

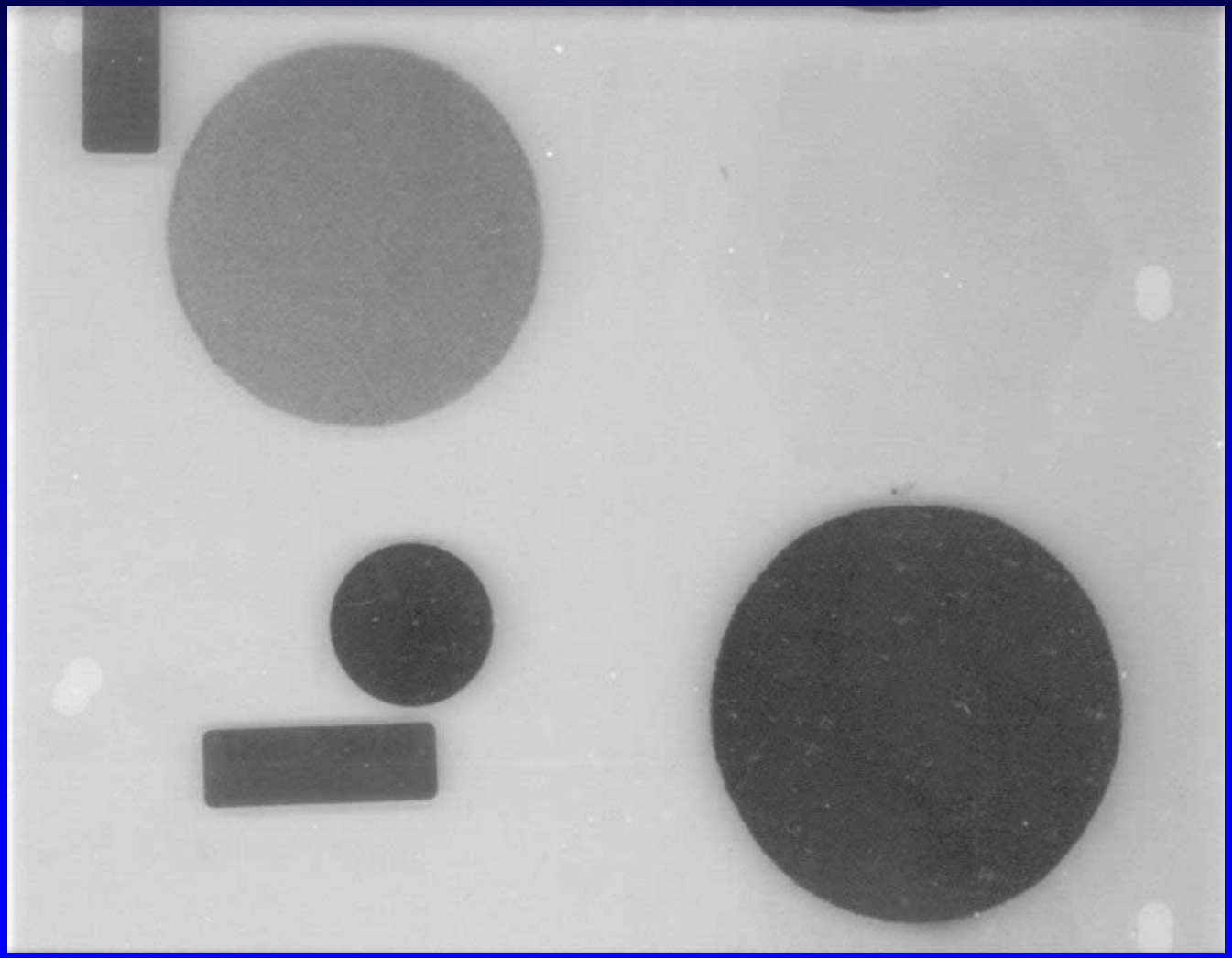
Society of Nuclear Medicine Practice Accreditation Program

Intersocietal Commission for the Accreditation of Nuclear Medicine Laboratories (ICANL) Practice Accreditation Program

INTRODUCTION

- There is considerable variation in the maintenance of nuclear medicine imaging instrumentation
  - Some facilities use a preventive maintenance program provided by vendors
  - Other facilities use a periodic testing program set up by medical physicists or “super” technologists

MISC QC FILMS



INTRODUCTION

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  - Other facilities use a periodic testing program set up by medical physicists or “super” technologists

INTRODUCTION - Cont.

The key element in quality assurance testing is determining the action that is needed

"A routine QC program must include a sufficiently comprehensive suite of individual measurements to ensure adequate sensitivity to detection of detrimental changes in performance. At the same time, the criteria used to judge the outcome of routine QC must not be so strict as to misleadingly identify insignificant changes as important."

Hines et al. J Nucl Med 41:383-389, 2000

INTRODUCTION - Cont.

". . . a routine . . . (SPECT) QC program should give technologists and clinicians the data with which to decide whether:

- **to image patients normally, or**
- **to image patients while putting in a call to have the system serviced, or**
- **to put off imaging patients until the system has been serviced and fixed."**

Hines et al. J Nucl Med 41:383-389, 2000

<u>Suggested edition:</u> Personnel should correct this problem the next time service is requested for any other reason

INTRODUCTION - Cont.

Third-Party Payers

- Beginning to recognize importance of image quality
- United Healthcare of Wisconsin will require outpatient facilities that provide Nuclear Cardiology Services be accredited by ICANL effective July 1, 2003
  - United stated that accreditation is “an important mechanism for setting objective standards of quality.”

INTRODUCTION - Cont.

Facilities involved in legal action and which are not accredited, or that do not have programs for managing medical equipment, will be at a disadvantage.

ACR NUCLEAR MEDICINE PRACTICE ACCREDITATION PROGRAM

- ACR Committee formed in 1996 under direction of Ronald Van Heertum, M.D. at Columbia University Medical Center
- Initial committee included two medical physicists but was later expanded to four members
  - The physics subcommittee developed parts of application dealing with regulations and quality control, and produced a program for evaluating the performance of imaging equipment

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ELEMENTS - Personnel Qualifications

- **Physicians - Trained, Board certified**
- **Medical Physicists - Board certified (Medical Nuclear Physics or Radiological Physics), Continuing Education in accordance with ACR Standard**
  - **Properly trained individuals can assist in acquiring test data if approved by the medical physicist**
  - **Medical physicist must be present during initial and annual surveys, approve all data and provide signed report**

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ELEMENTS - Clinical Data and Images

- **Facilities must submit complete patient studies and written reports and protocols**
- **Clinical Test Image Data Sheets must be completed**
- **Two different examination types must be submitted for each "Module"**
  - **Module 1 - Planar**
  - **Module 2 - SPECT**
  - **Module 3 - Nuclear cardiology**

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ELEMENTS - Facility Performance Tests

- **Quality Control Tests**
  - **Must be performed by technologists at the frequency specified in the application**
    - **Intrinsic or system uniformity - each day of use**
    - **Intrinsic or system resolution - weekly**
    - **COR or detector registration - as recommended by a Qualified Medical Physicist**
  - **Usual tests for dose calibrators and counting instruments**

ACR NUC MED ACCREDITATION

Facility Performance Tests - cont.

- Protocols for QC tests should include action levels
- As part of annual survey the qualified medical physicist should meet with the supervising physician and the QC technologist(s)
- Qualified Medical Physicist must perform acceptance tests
  - Tests may be performed by qualified nuclear medicine technologist or medical physicist-in-training under direct supervision by the medical physicist

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Facility Performance Tests - cont.

- **Qualified Medical Physicist must perform comprehensive QA tests at least annually**
  - **Intrinsic and system uniformity, intrinsic or system spatial resolution, intrinsic or system sensitivity, energy resolution, count rate performance, multiple window spatial registration, formatter/video display, overall system performance for SPECT systems, and checks of system interlocks and safety devices**

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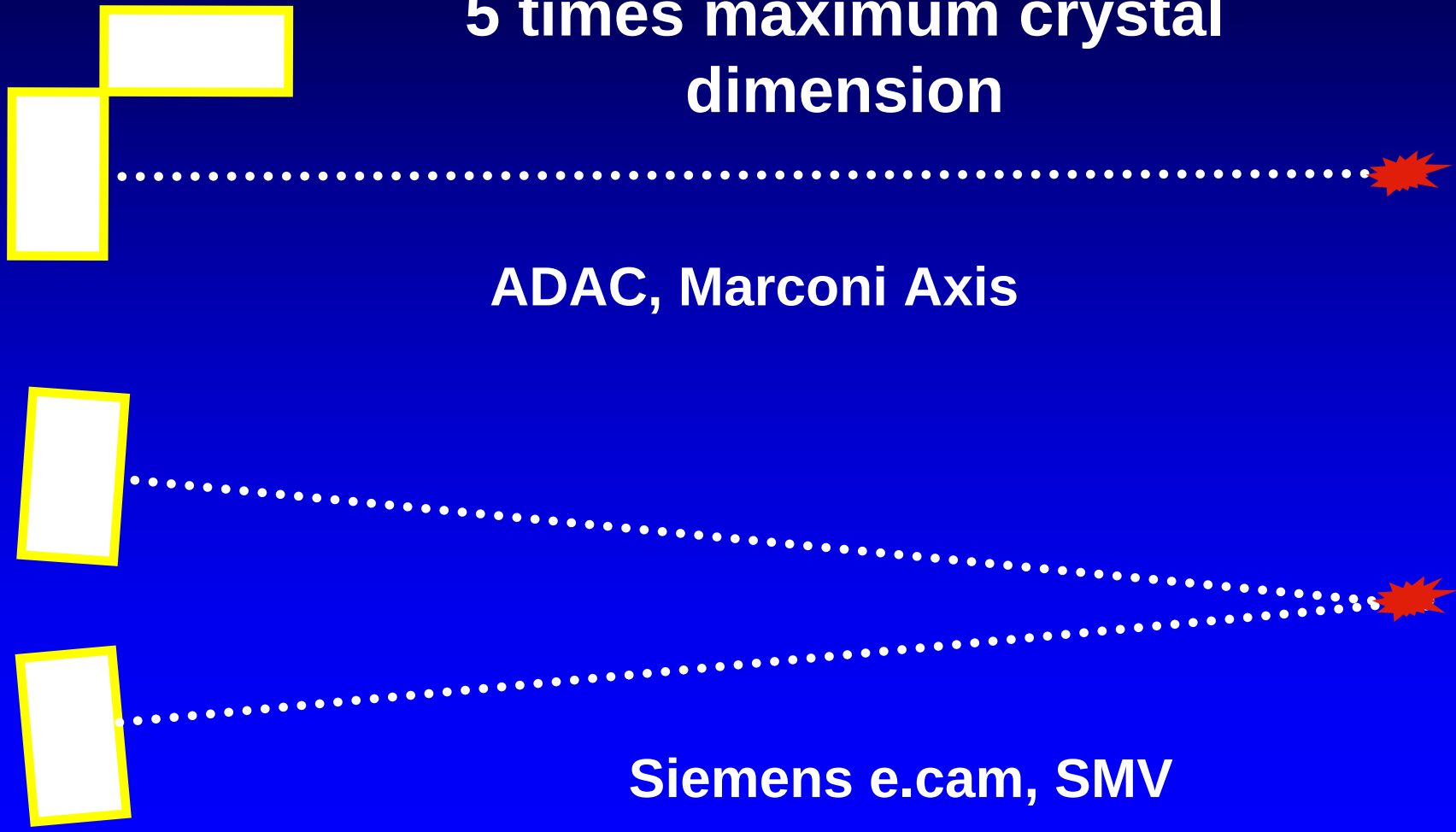
Phantom Images Required By ACR

- **Planar only systems**
  - **Intrinsic or system uniformity - Tc-99m or Co-57 and Tl-201 or Ga-67**
  - **Intrinsic or system spatial resolution Tc-99m or Co-57 and Tl-201 or Ga-67**
- **SPECT systems**
  - **Intrinsic or system uniformity as for planar systems**
  - **Planar spatial resolution by imaging ACR-approved SPECT phantom placed directly on collimator (Tc-99m and Tl-201 or Ga-67)**

INTRINSIC SETUP FOR DUAL HEAD SYSTEMS

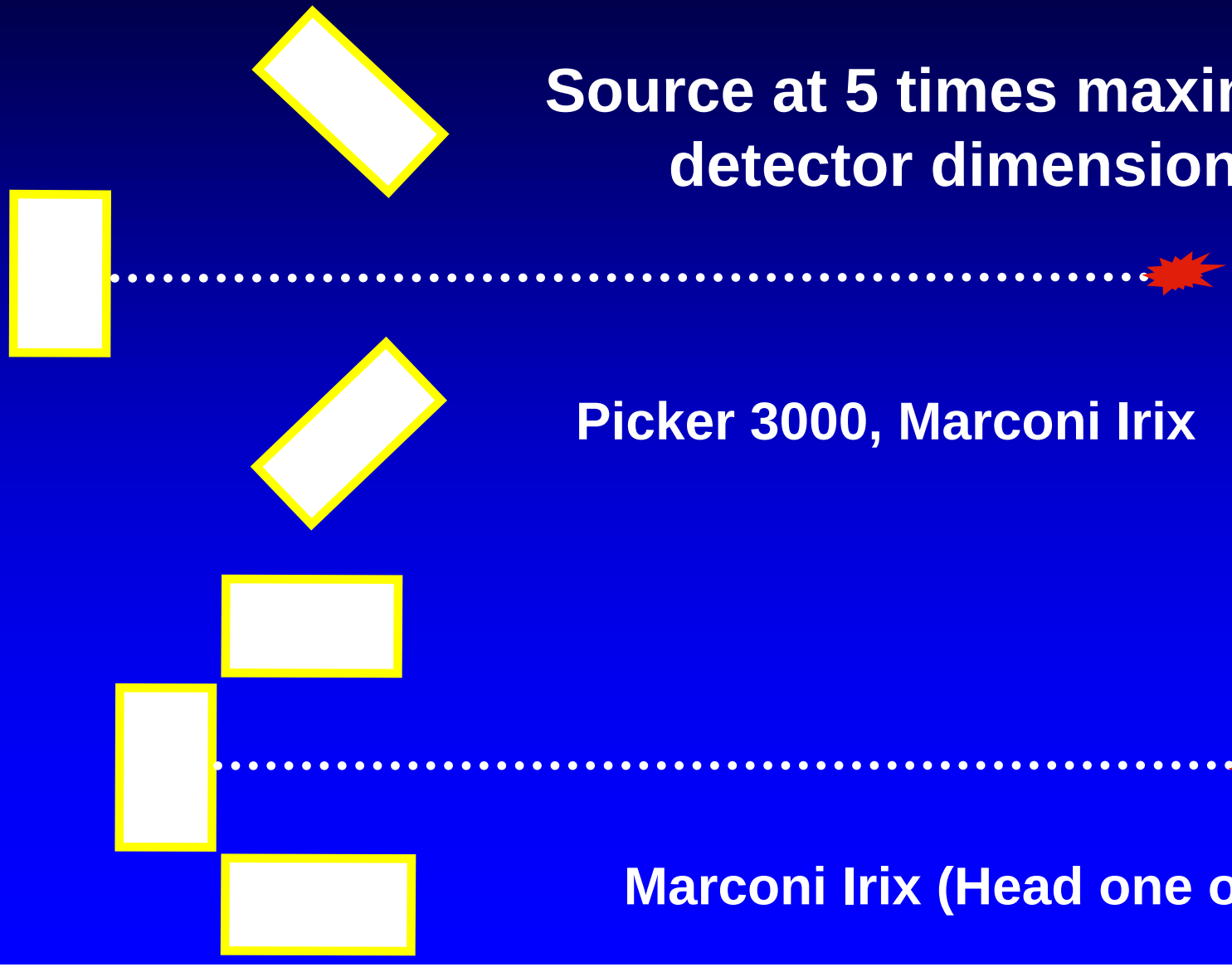


5 times maximum crystal dimension

ADAC, Marconi Axis

Siemens e.cam, SMV

INTRINSIC SETUP FOR TRIPLE HEAD SYSTEMS

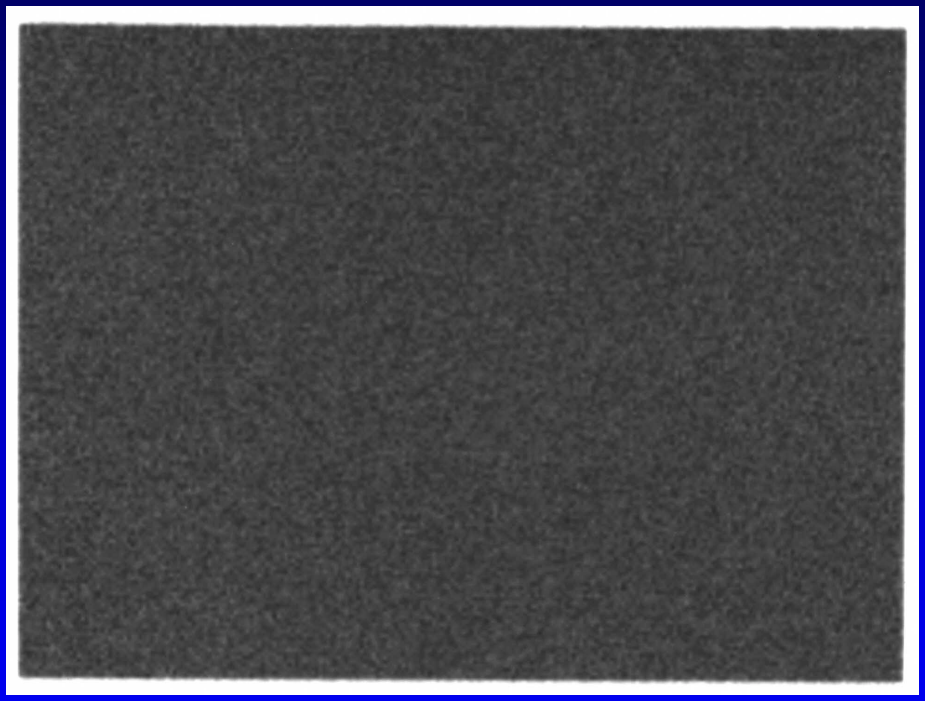


Source at 5 times maximum detector dimension

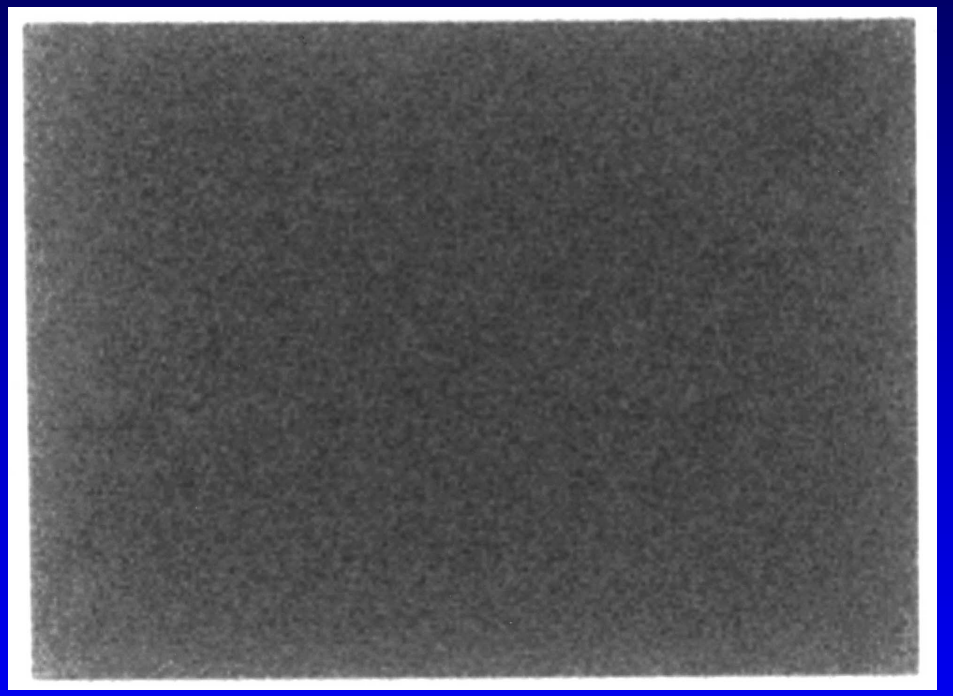
Picker 3000, Marconi Irix

Marconi Irix (Head one only)

INTRINSIC UNIFORMITY

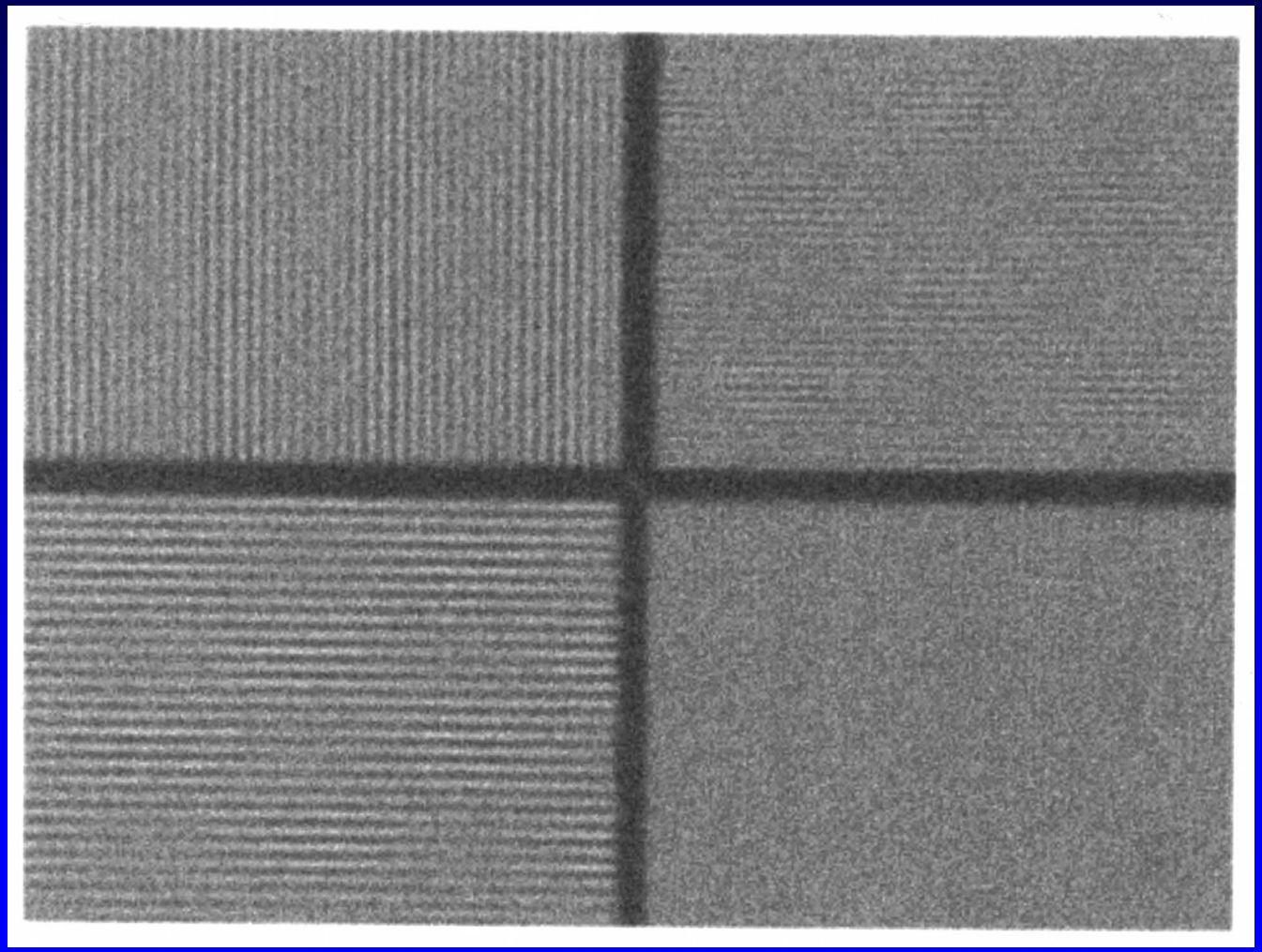


Tc-99m



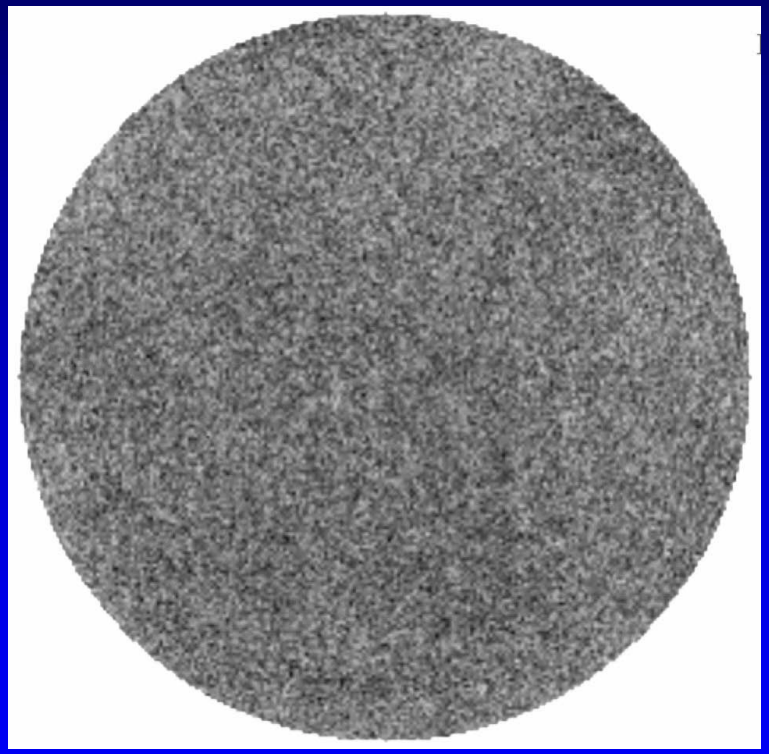
Tl-201

Tc-99m INTRINSIC SPATIAL RESOL'N (PLANAR SYSTEMS ONLY)

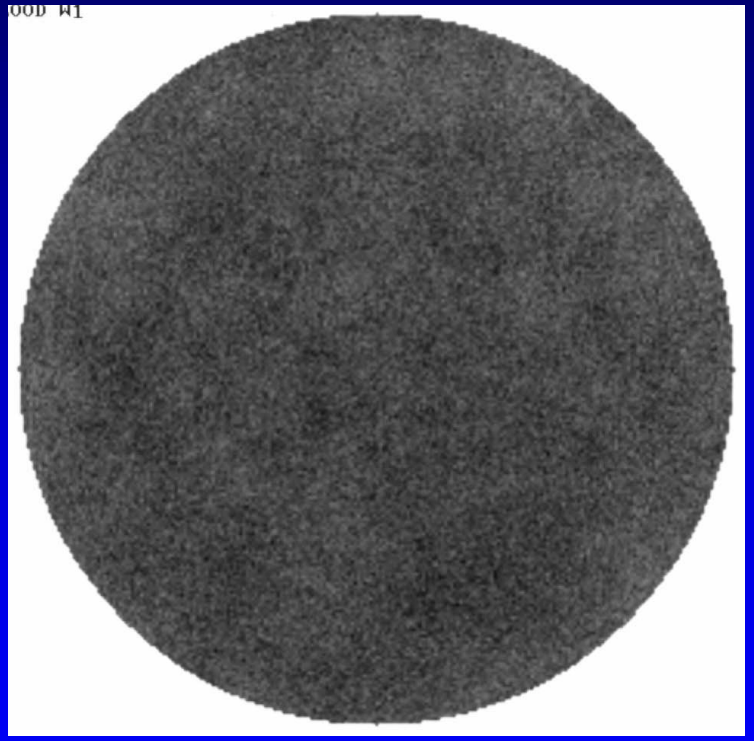


Tc-99m

INTRINSIC UNIFORMITY

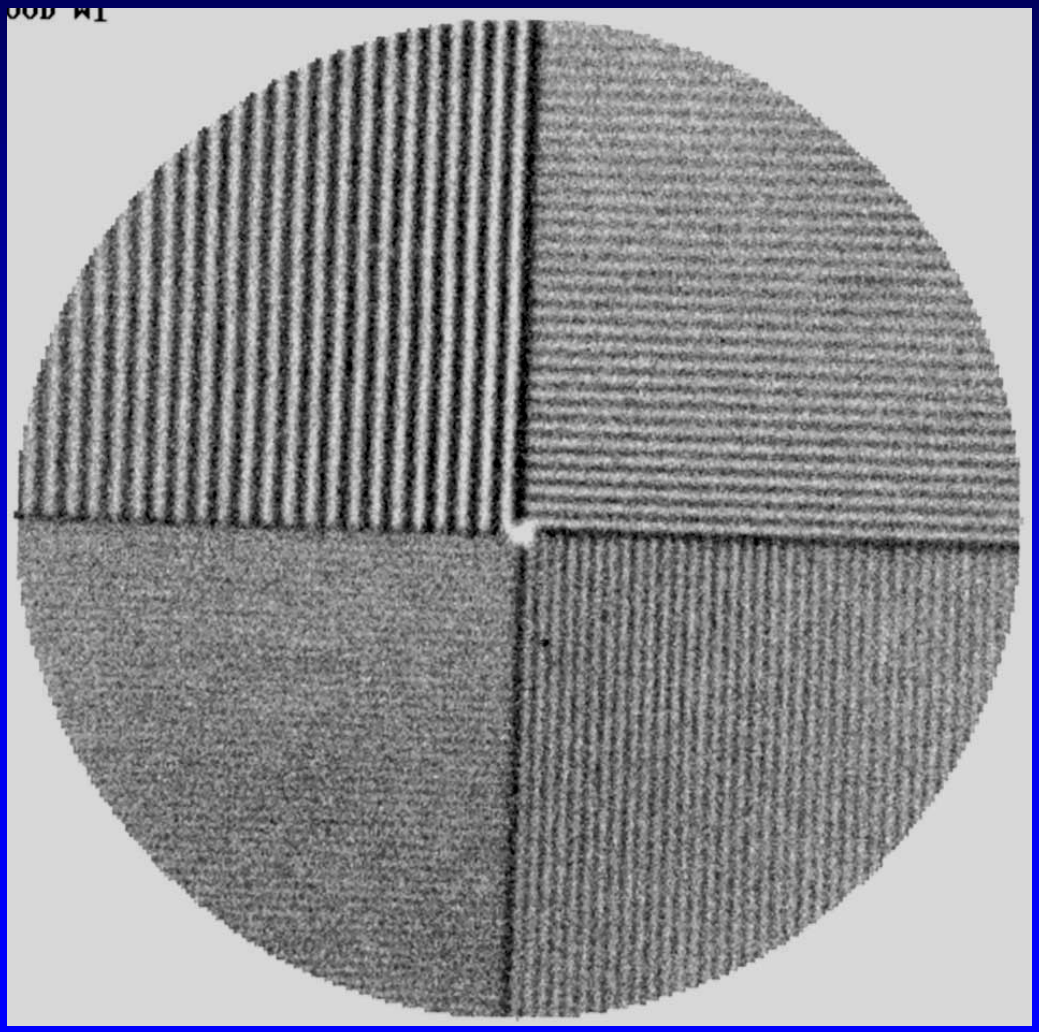


Tc-99m

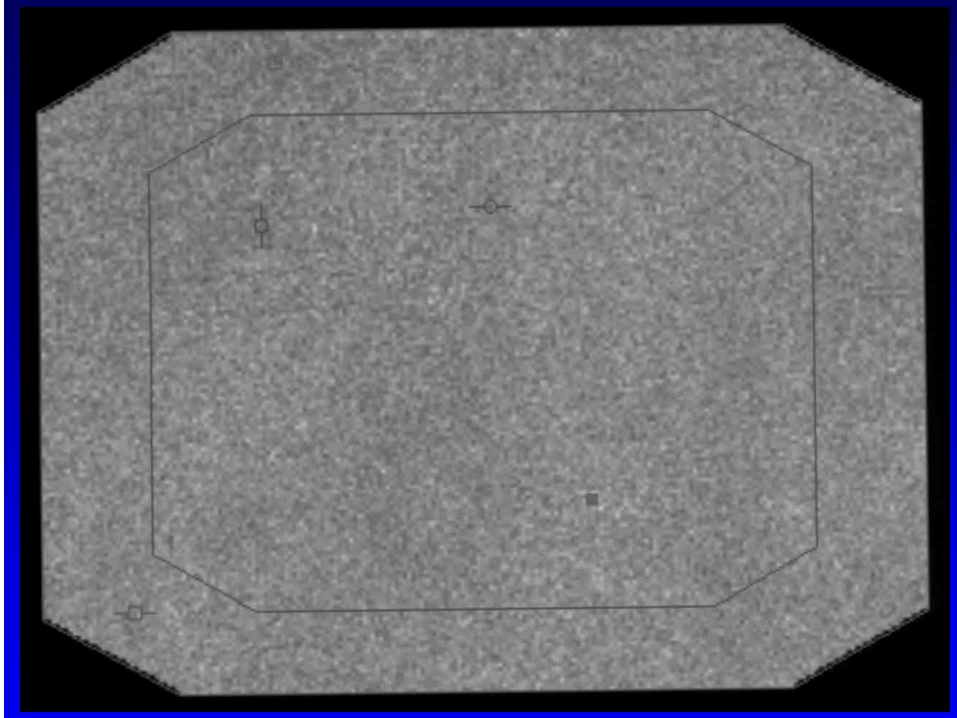


Tl-201

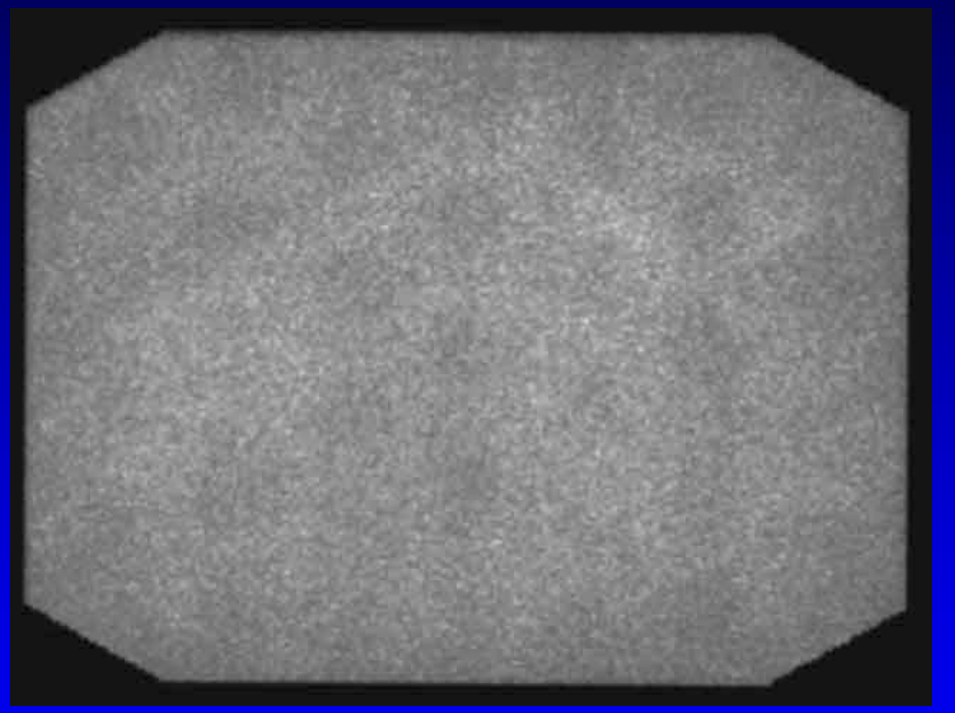
Tc-99m INTRINSIC SPATIAL RESOLUTION



INTRINSIC UNIFORMITY



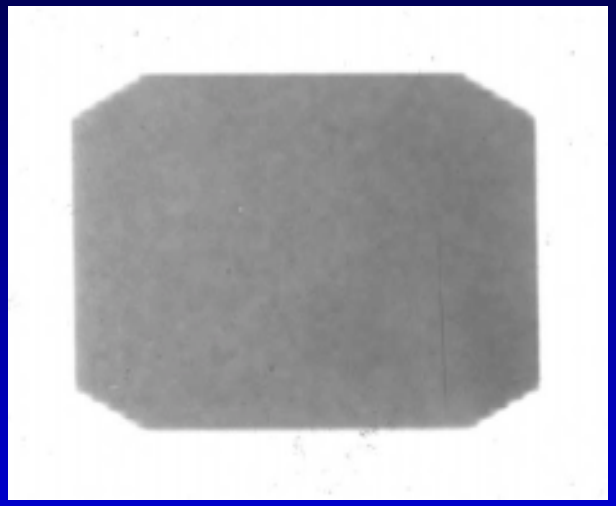
Tc-99m



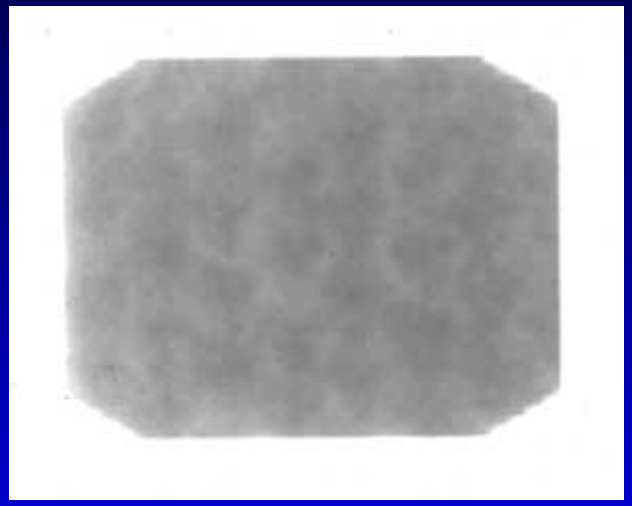
Tl-201

103-1

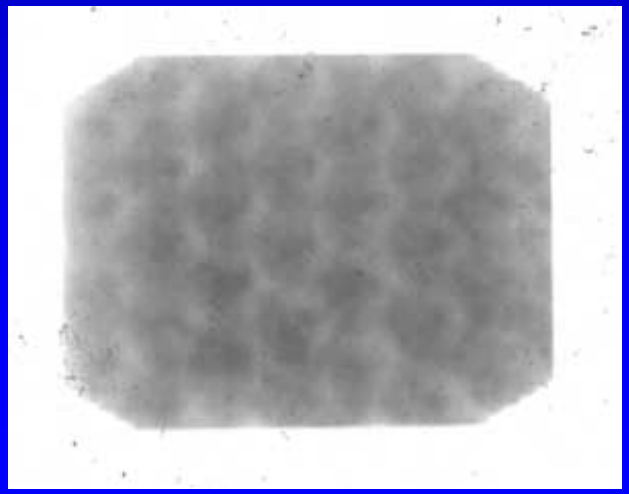
CORRECTED & UNCORRECTED INTRINSIC UNIFORMITY



Corrected Tc-99m



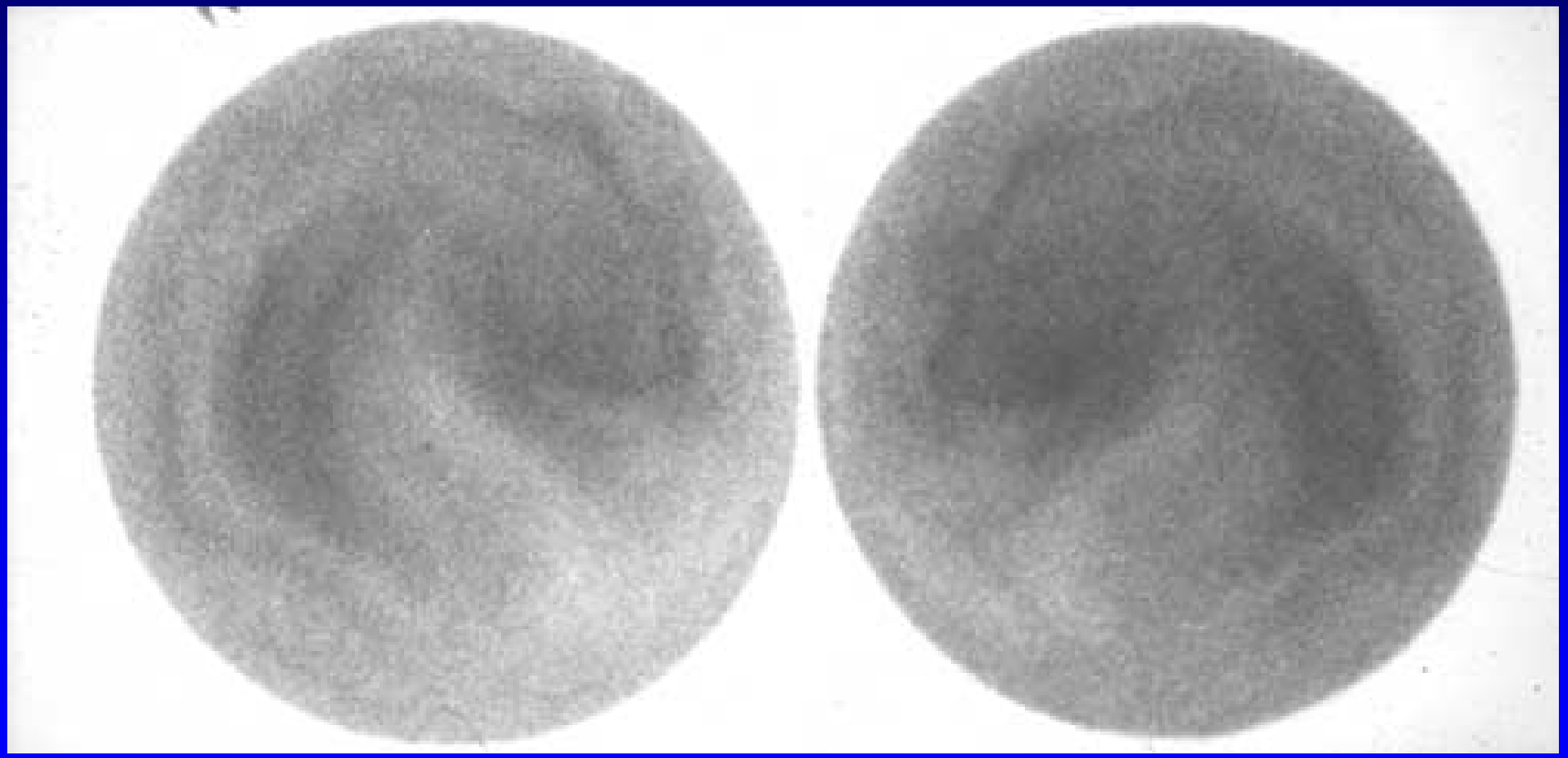
Uncorrected Tl-201



Uncorrected Ga-67

Co-57 & FILLABLE FLOOD

UNMIXED TC-99M FILLABLE FLOOD

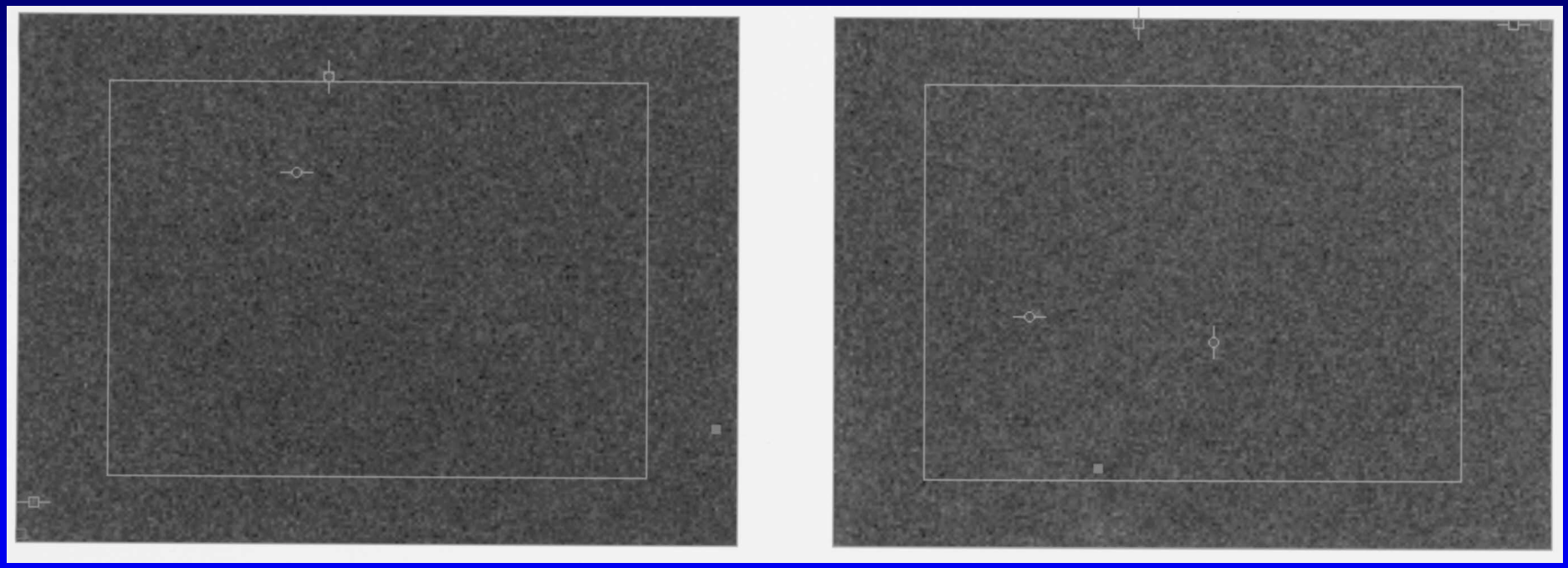


ACR NUC MED ACCREDITATION

Phantom Images Required By ACR

- Planar only systems
  - Intrinsic or system uniformity - Tc-99m and Tl-201 or Ga-67
  - Intrinsic or system spatial resolution Tc-99m and Tl-201 or Ga-67
- SPECT systems
  - Intrinsic or system uniformity as for planar systems
  - Planar spatial resolution by imaging ACR-approved SPECT phantom placed directly on collimator (Tc-99m and Tl-201 or Ga-67)

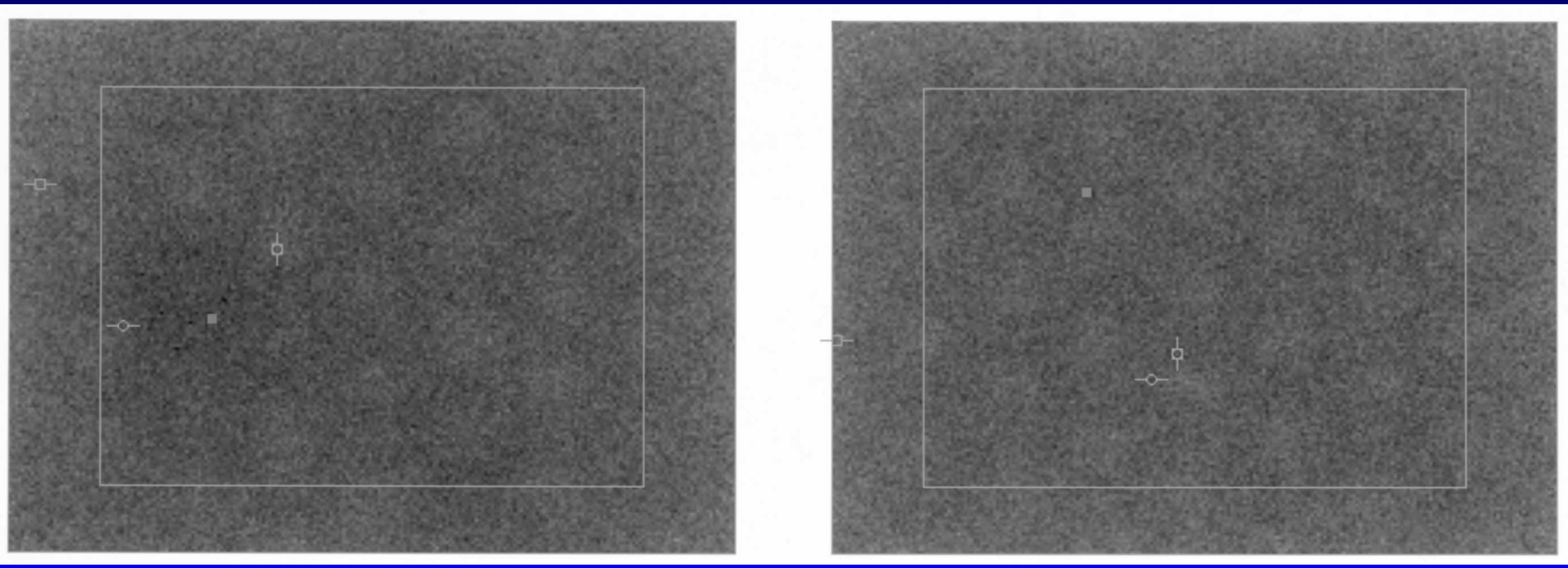
SPECT SYSTEM -
Tc-99m SYSTEM PLANAR UNIFORMITY



Head One **Head Two**

Tc-99m

SPECT SYSTEM -
SYSTEM PLANAR UNIFORMITY



Head One **Head Two**

Tl-201

ACR NUC MED ACCREDITATION

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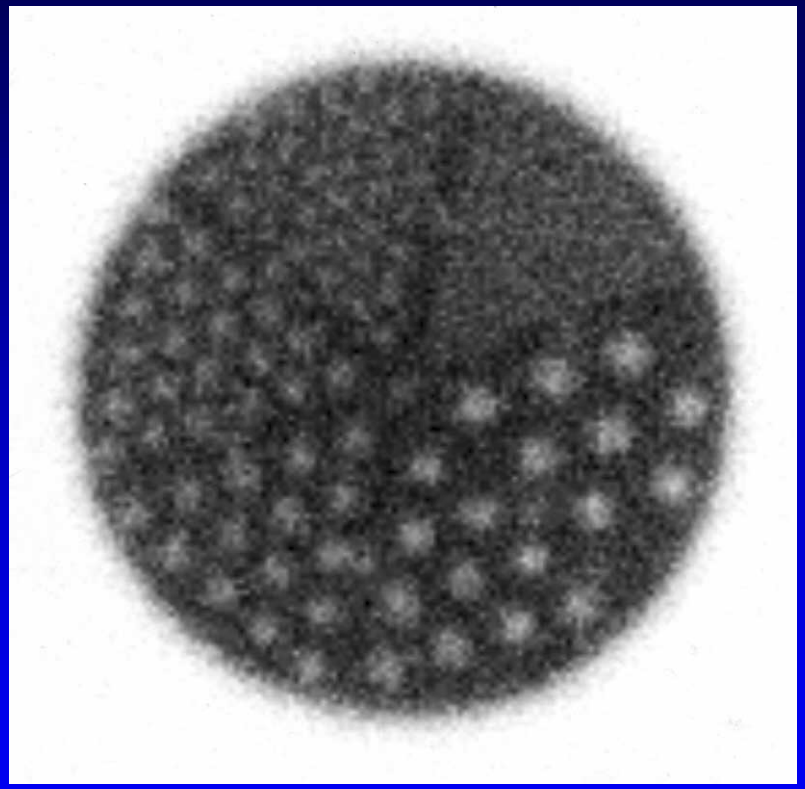
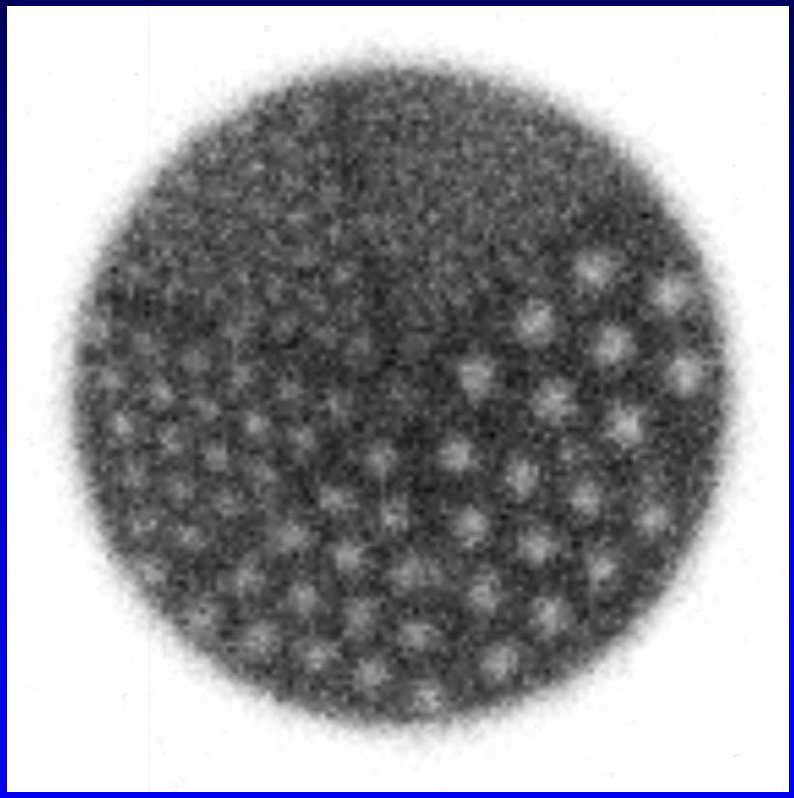
ACR PHANTOM - PLANAR RESOL'N

SPECT SYSTEM -
SYSTEM PLANAR RESOLUTION



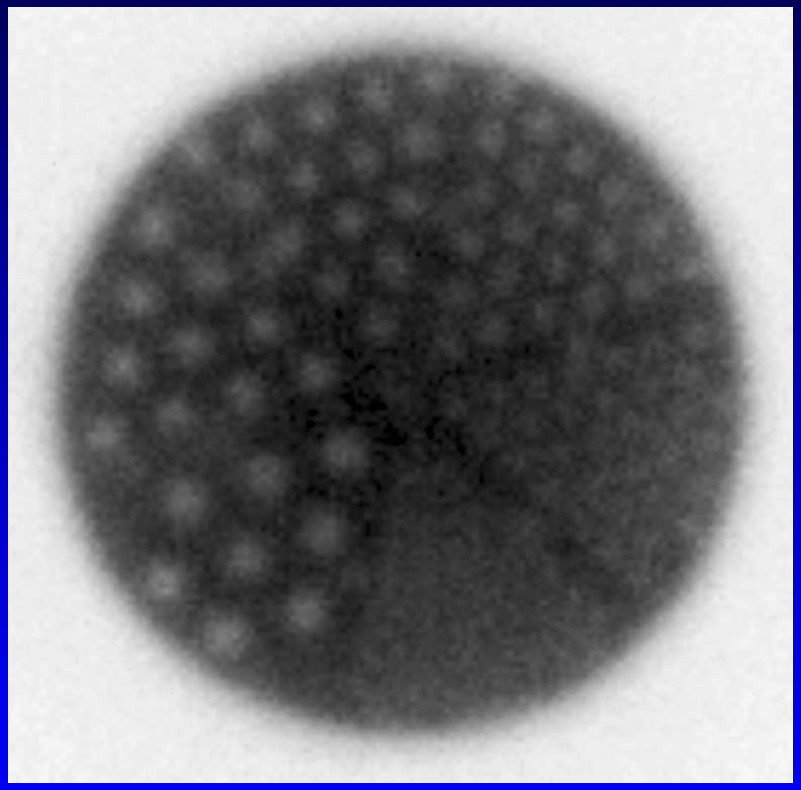
Head One



Head Two

Tc-99m

SPECT SYSTEM - SYSTEM PLANAR RESOLUTION



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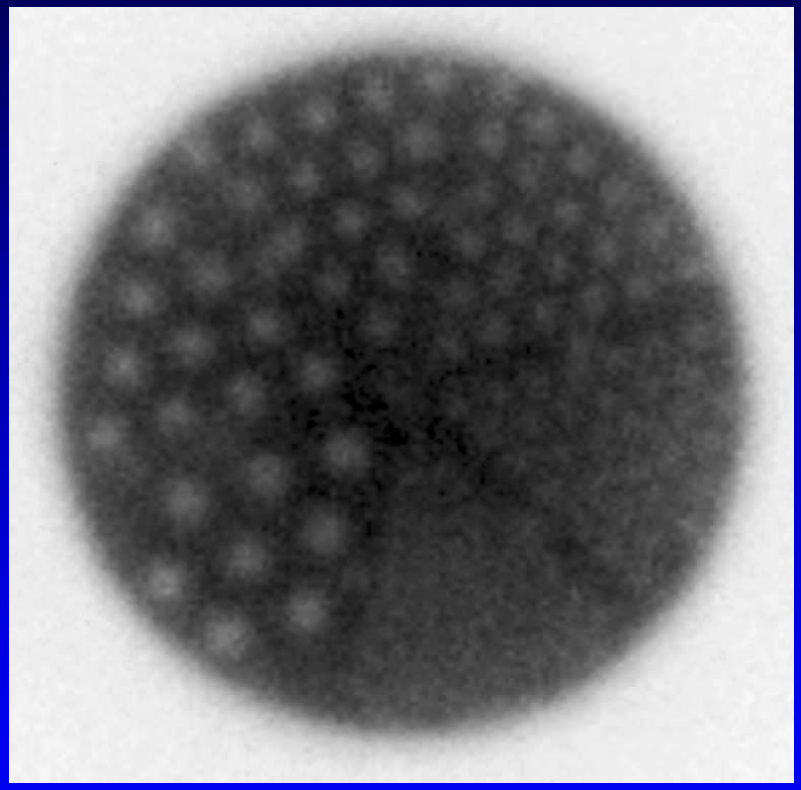


Head Two

Tl-201

ACR NUC MED ACCREDITATION

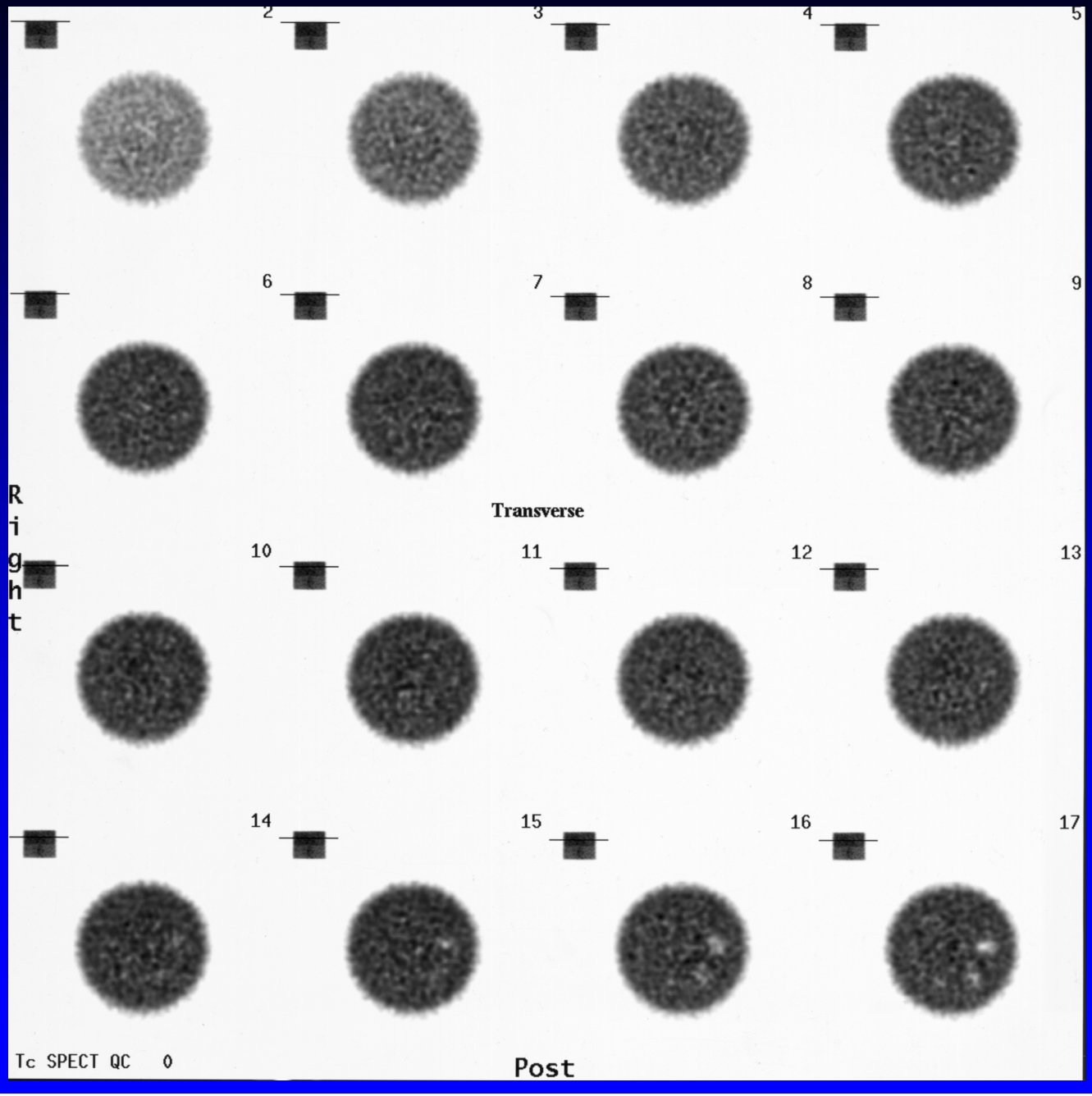
Phantom Images Required By ACR - cont.

- SPECT systems - cont.
  - Overall SPECT Performance (acquisition, processing and hard copy are specified)
    - Set of all reconstructed images
    - Tomographic uniformity (2 cm thick uniform section)
    - Tomographic spatial resolution (5 cm thick section of cold rods)
    - Tomographic contrast (2 slice thick section centered on cold spheres)

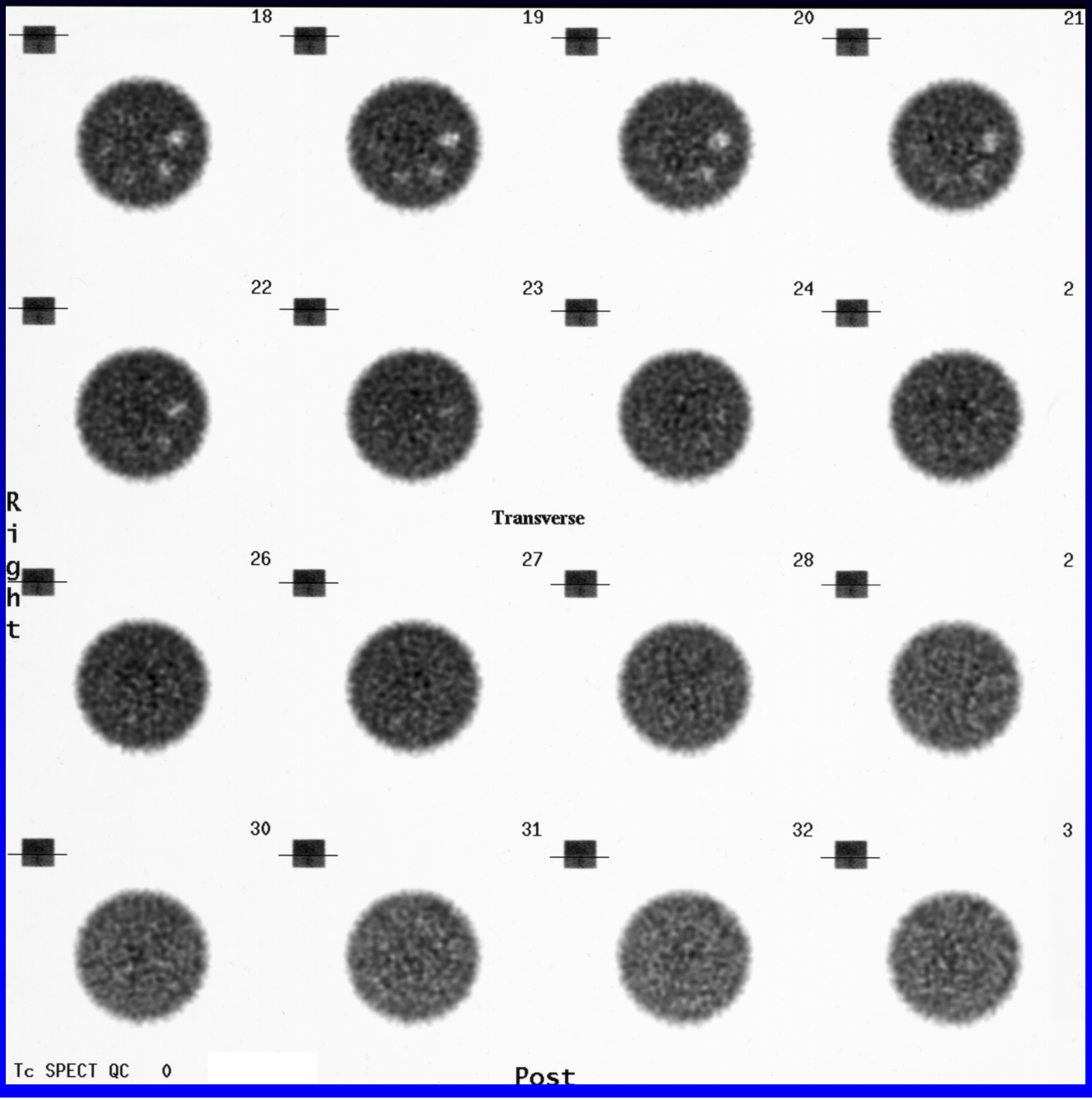
OVERALL PERFORMANCE SPECT PHANTOM

ACR PHANTOM SETUP

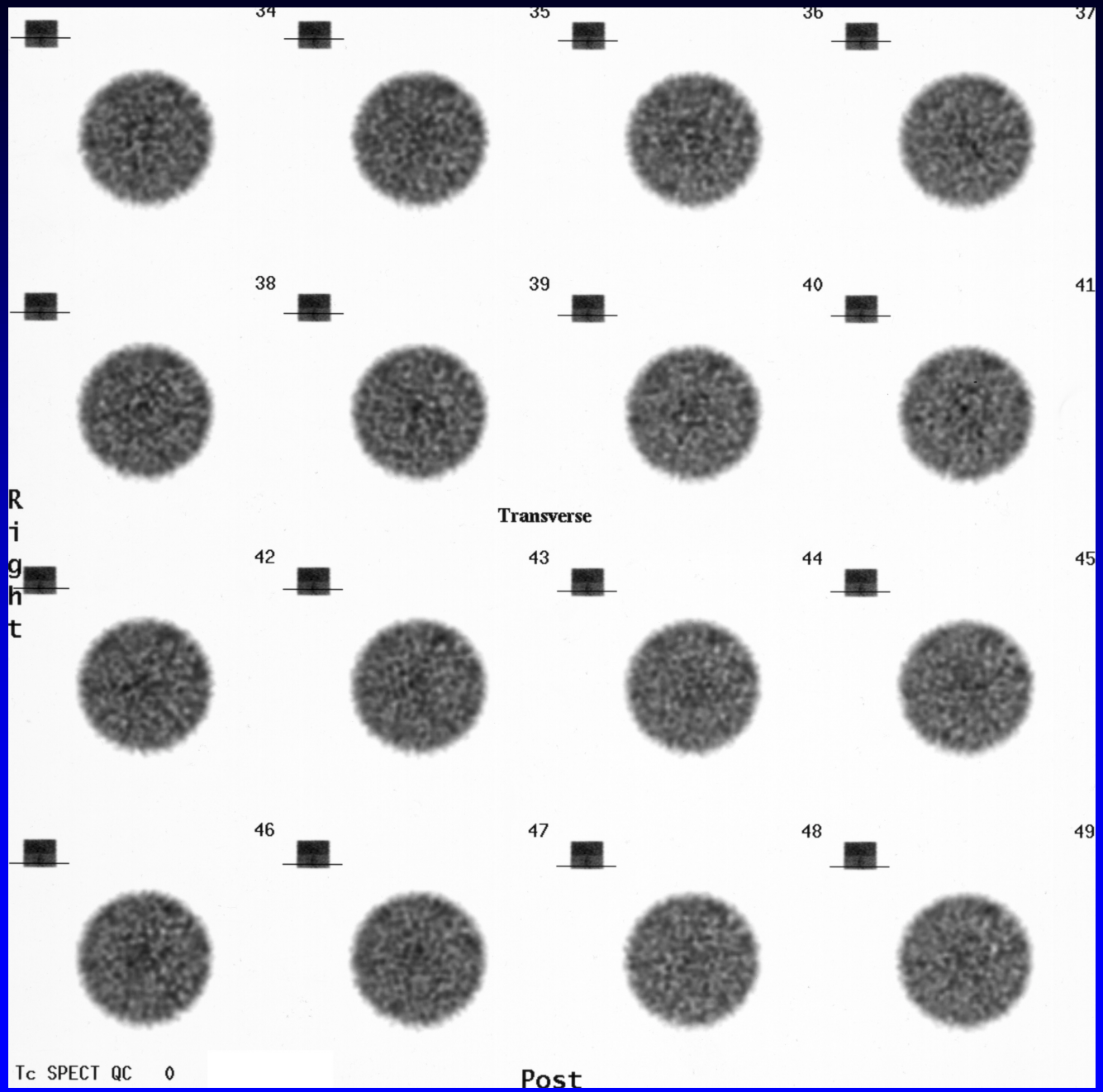
ACR PHANTOM (Tc-99m): SLICES 2 - 17



ACR PHANTOM (Tc-99m): SLICES: 18 - 33



ACR PHANTOM (Tc-99m): SLICES 34 - 49



ACR NUC MED ACCREDITATION

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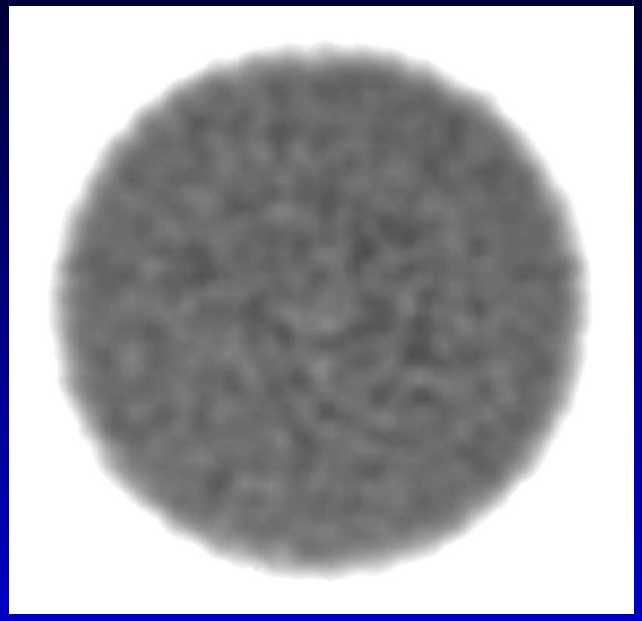
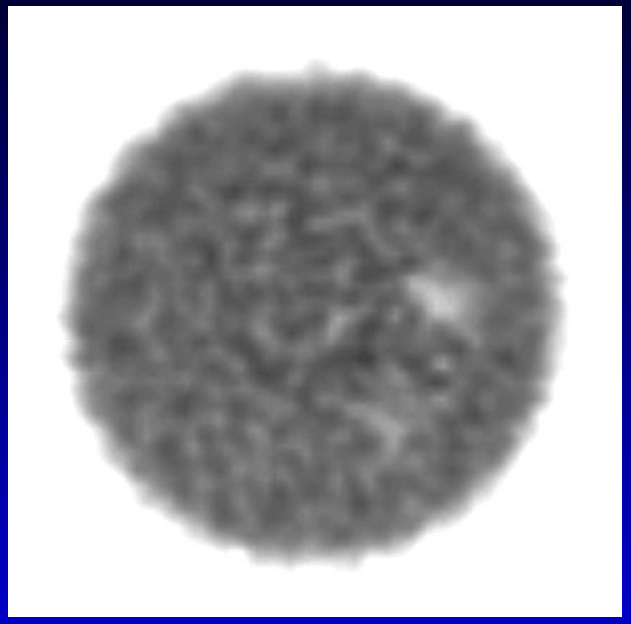
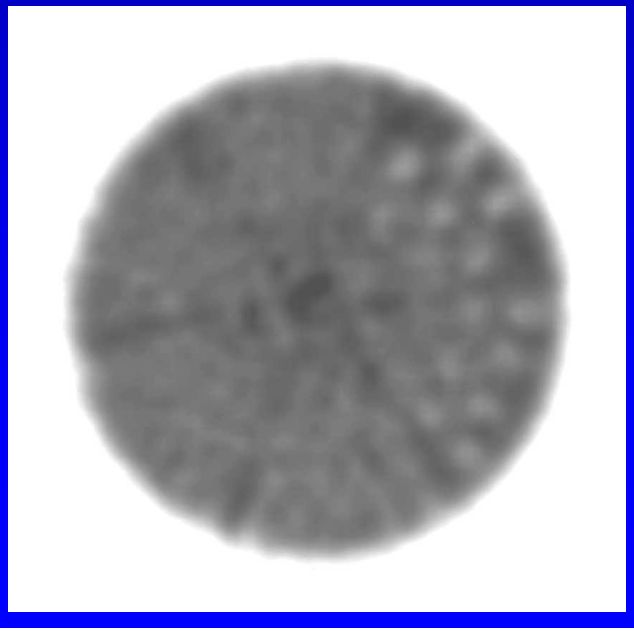
ACR PHANTOM (Tc-99m)



UNIFORMITY

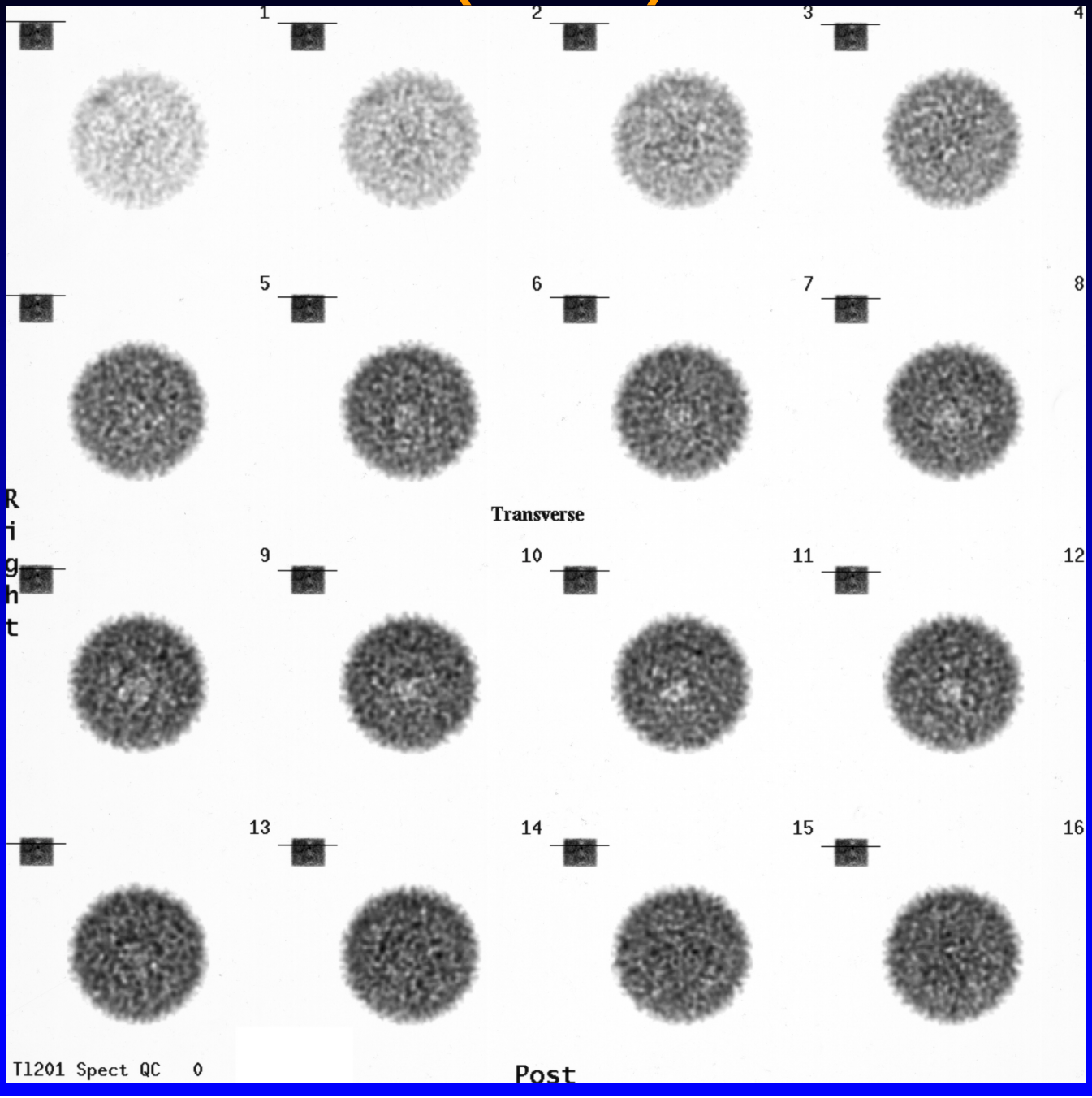


CONTRAST

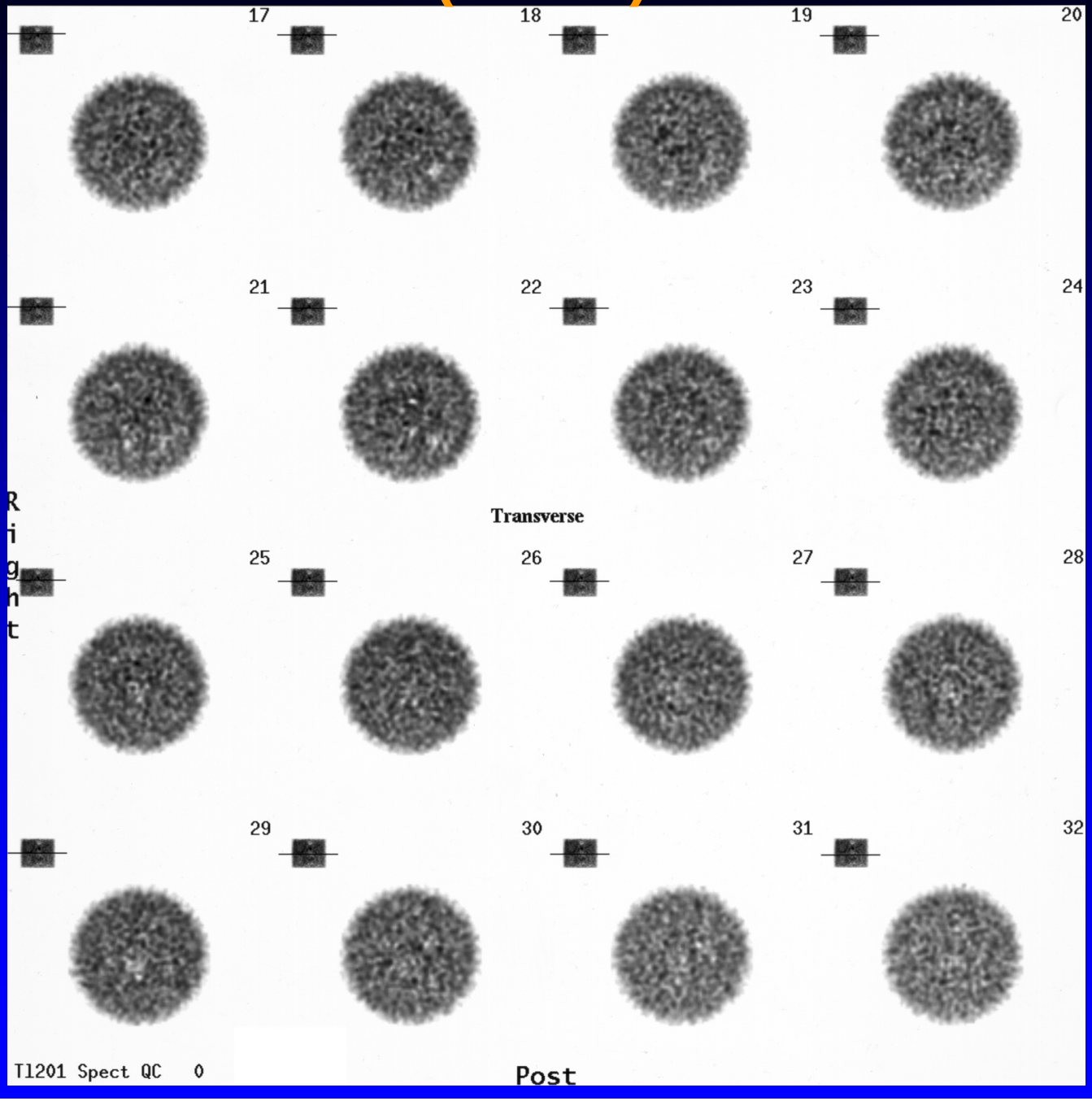


RESOLUTION

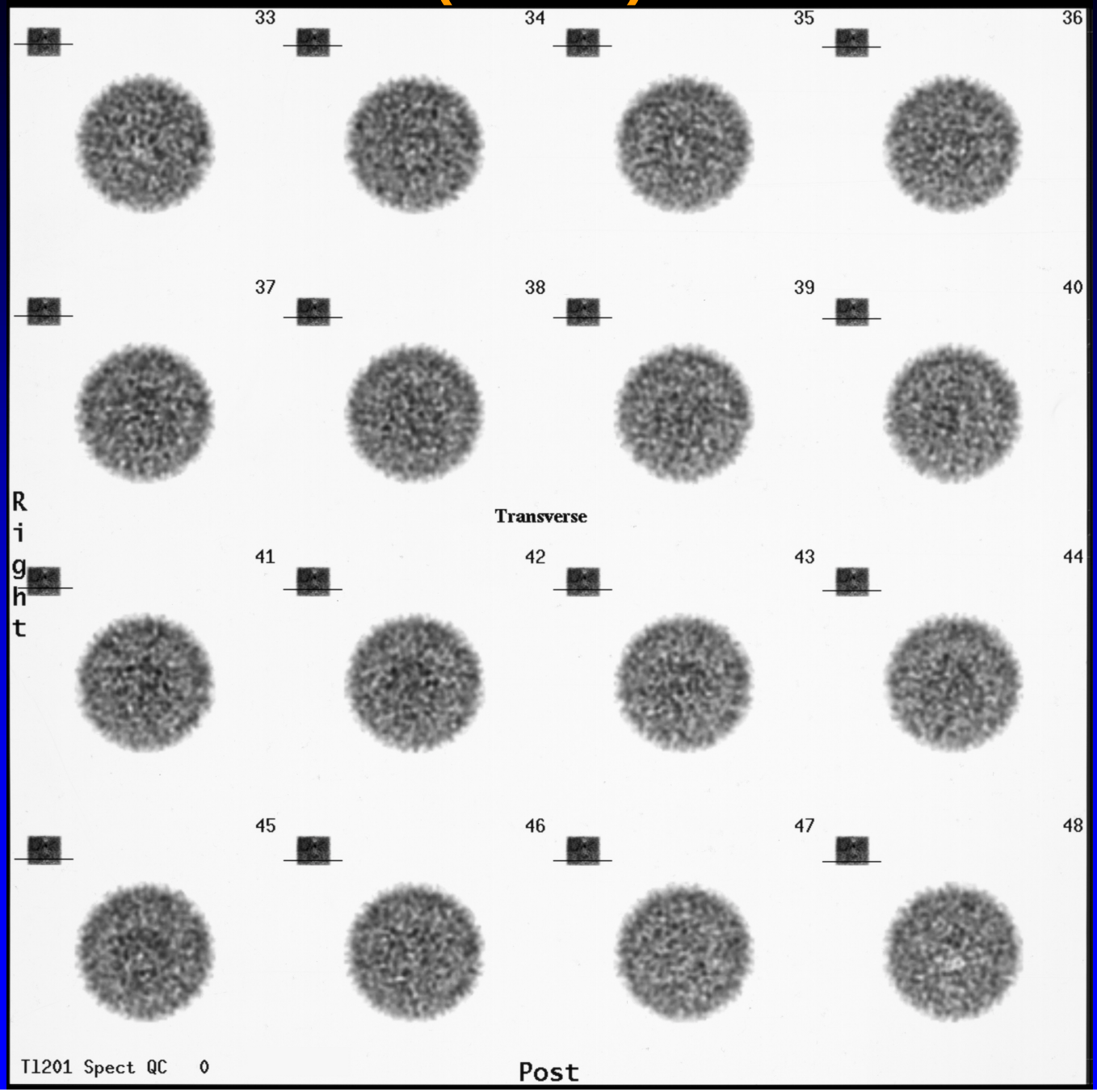
ACR PHANTOM (Tl-201): SLICES 1 - 16



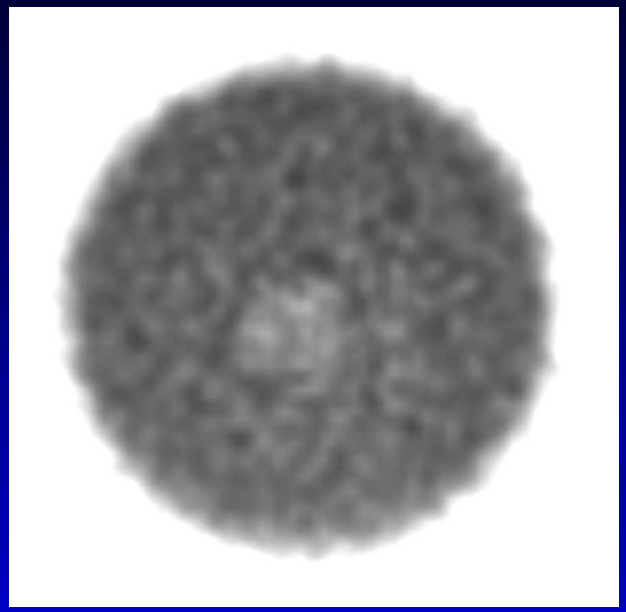
ACR PHANTOM (Tl-201): SLICES 17 - 32



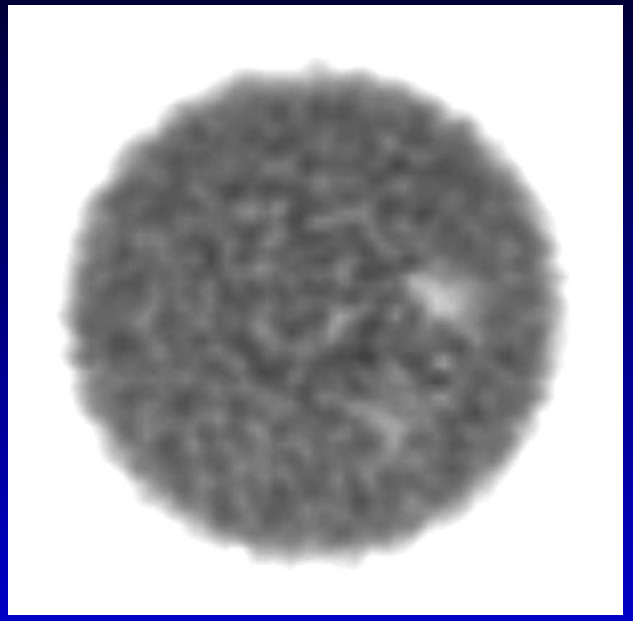
ACR PHANTOM (Tl-201): SLICES 33 - 48



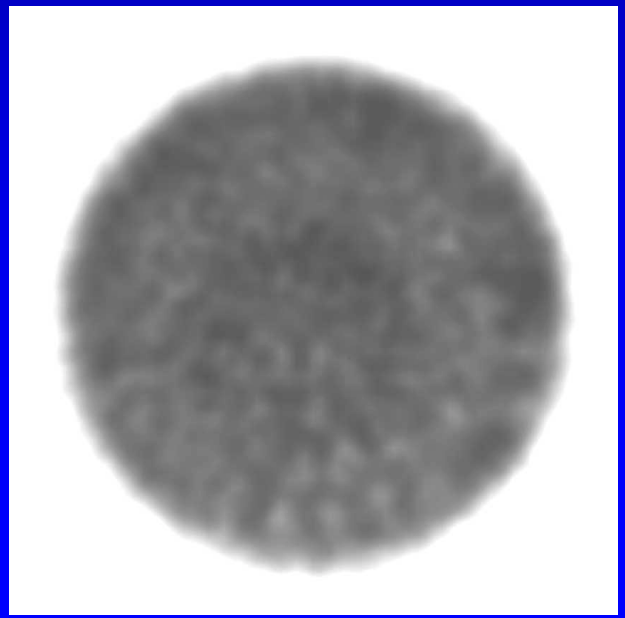
ACR PHANTOM (TI-201)



UNIFORMITY

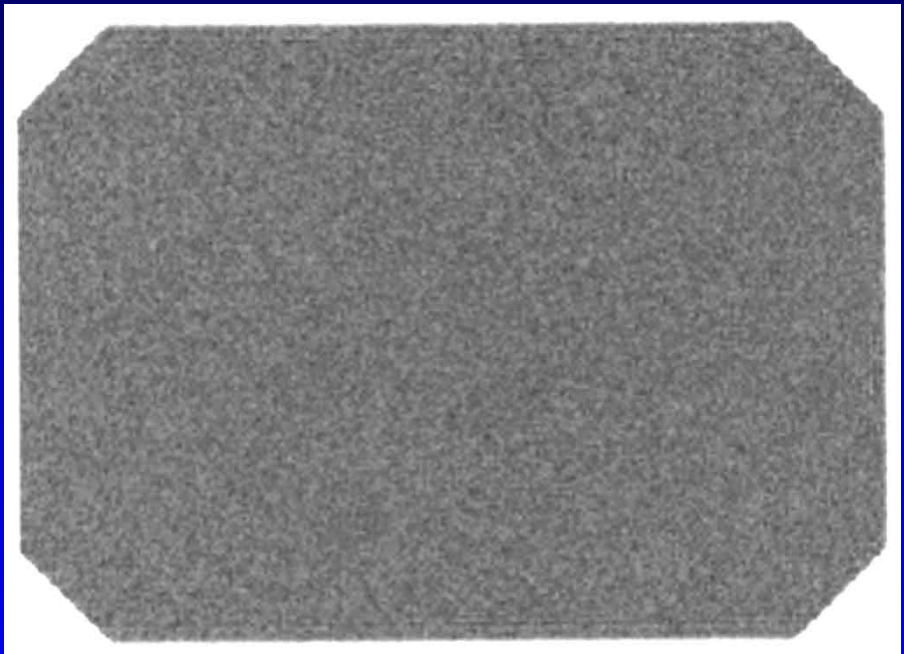


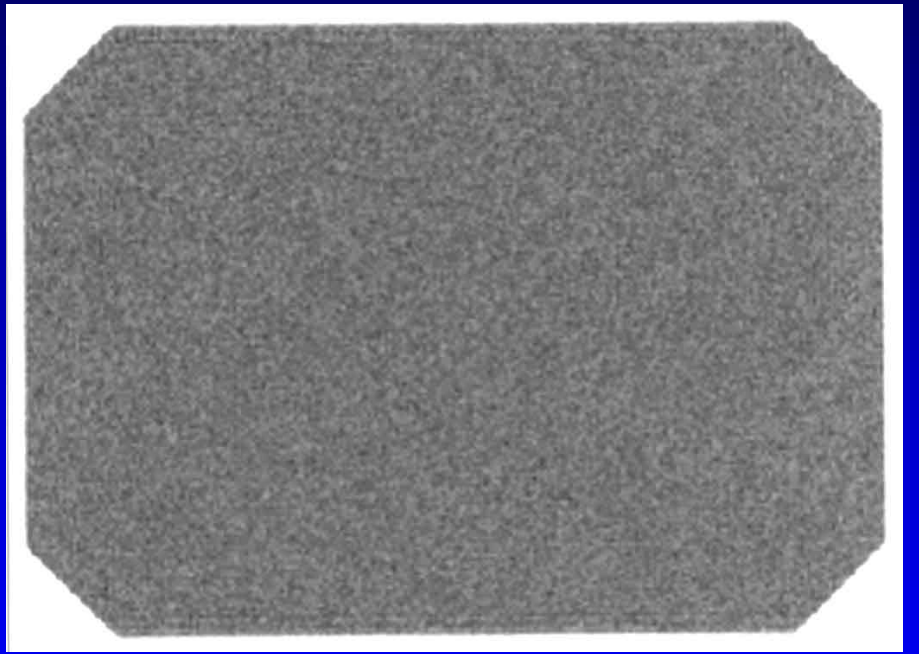
CONTRAST



RESOLUTION

SPECT SYSTEM -
SYSTEM PLANAR UNIFORMITY

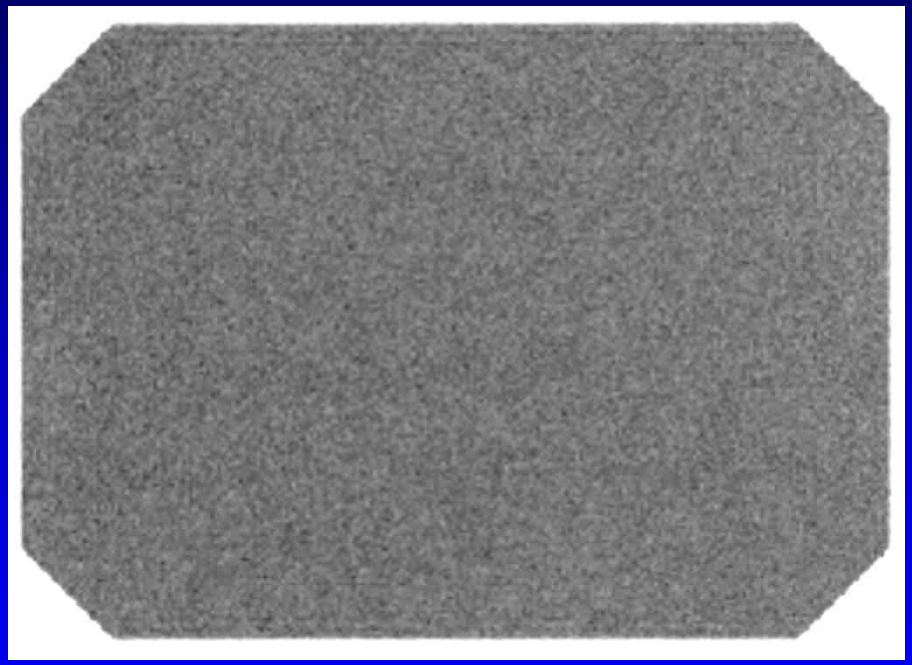


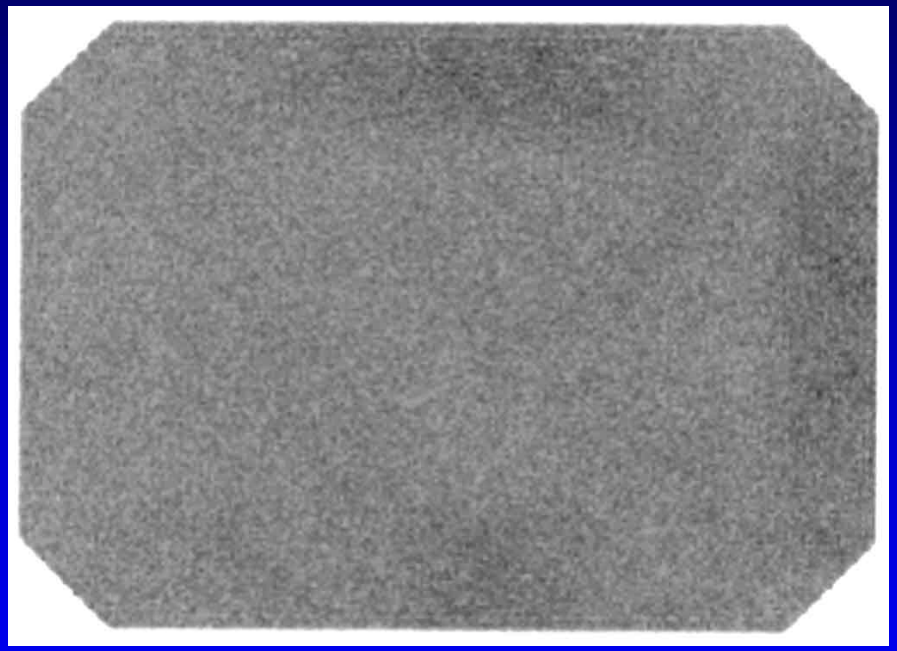


Head One **Head Two**

Tc-99m

SPECT SYSTEM -
SYSTEM PLANAR UNIFORMITY

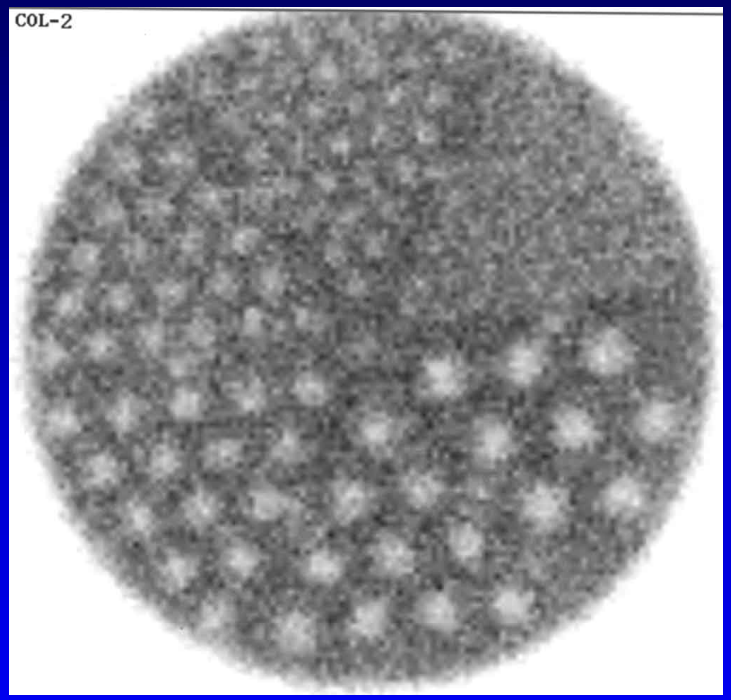




Head One **Head Two**

Tl-201

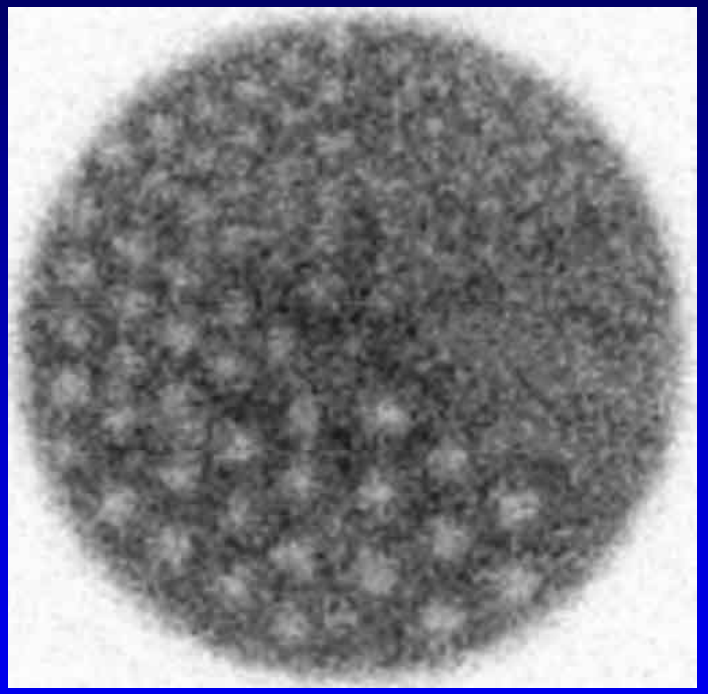
SPECT SYSTEM - PLANAR SPATIAL RESOLUTION



Head Two

Tc-99m

104-4AMB

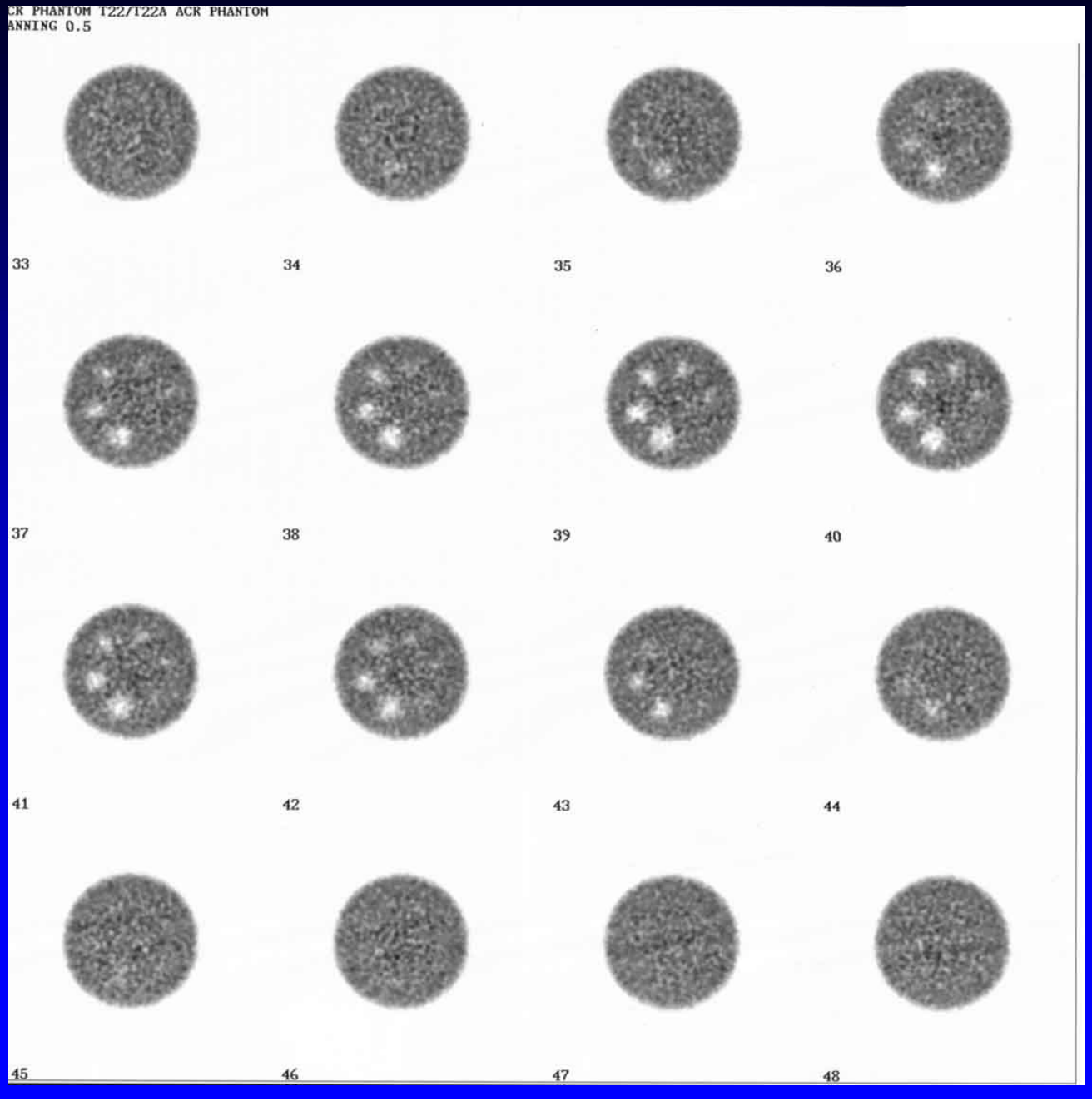


Head Two

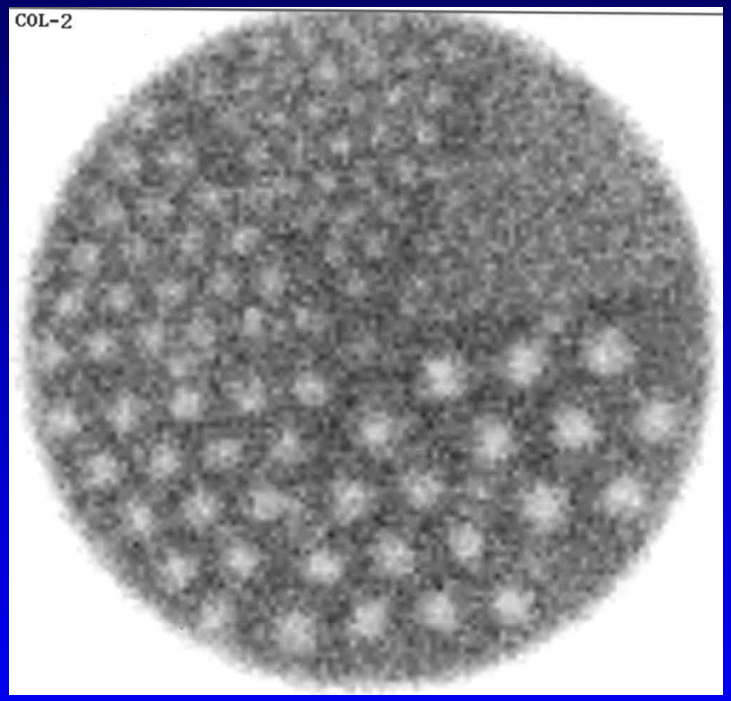
Tl-201

104-4AC

ACR PHANTOM (Tc-99m): SLICES 33 - 48

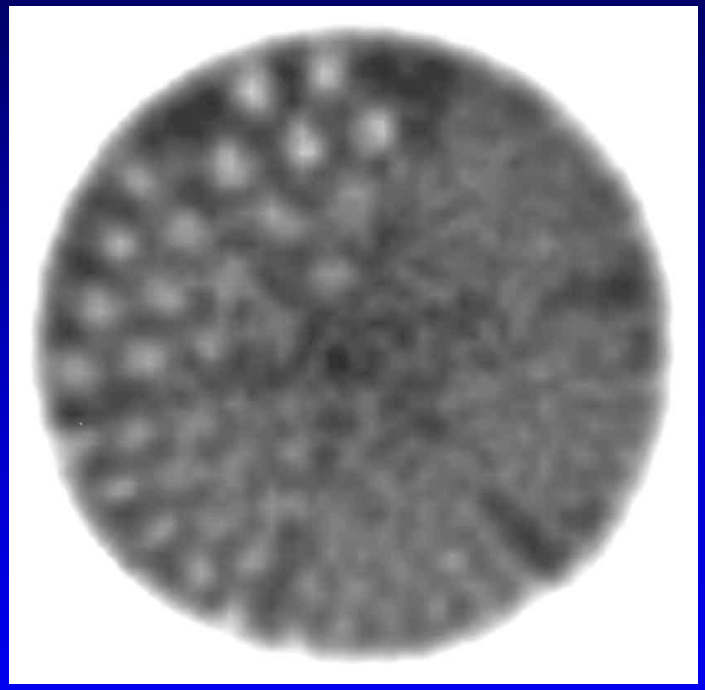


SPECT SYSTEM - SPATIAL RESOLUTION



Head Two - Planar

Tc-99m

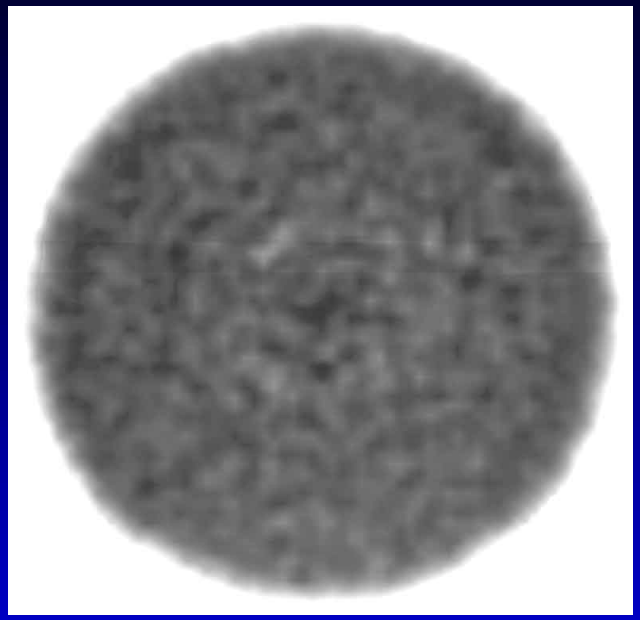


Both Heads - SPECT

Tc-99m

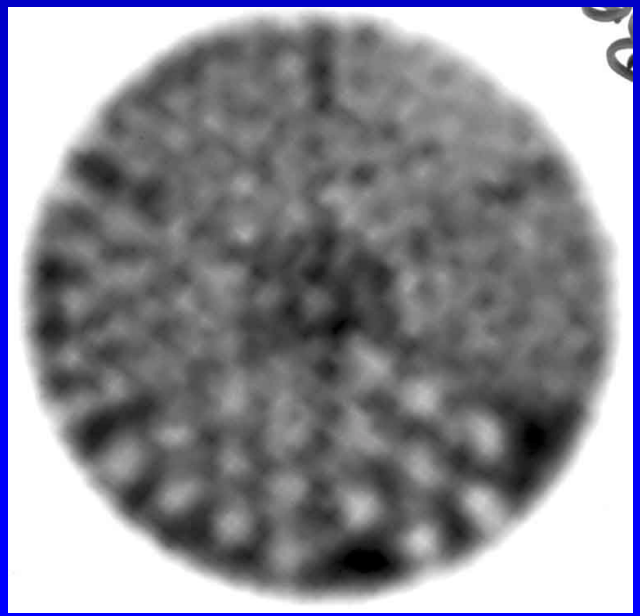
104-4AMB

ACR PHANTOM (TI-201)

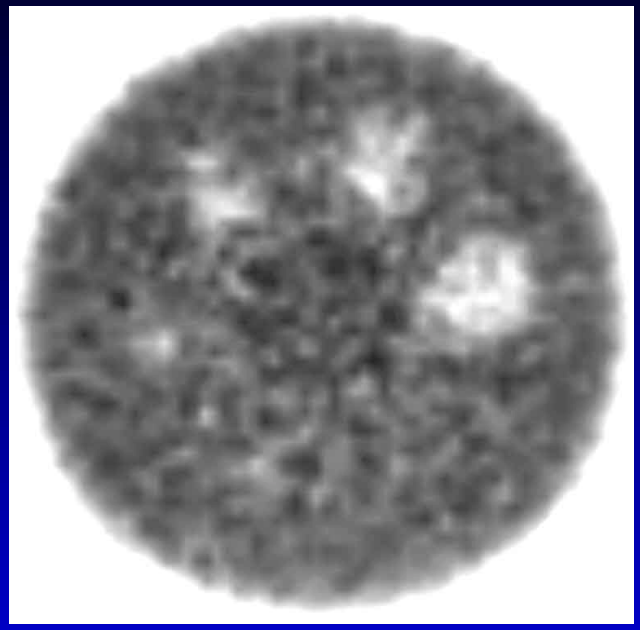


UNIFORMITY

104-17



104-16

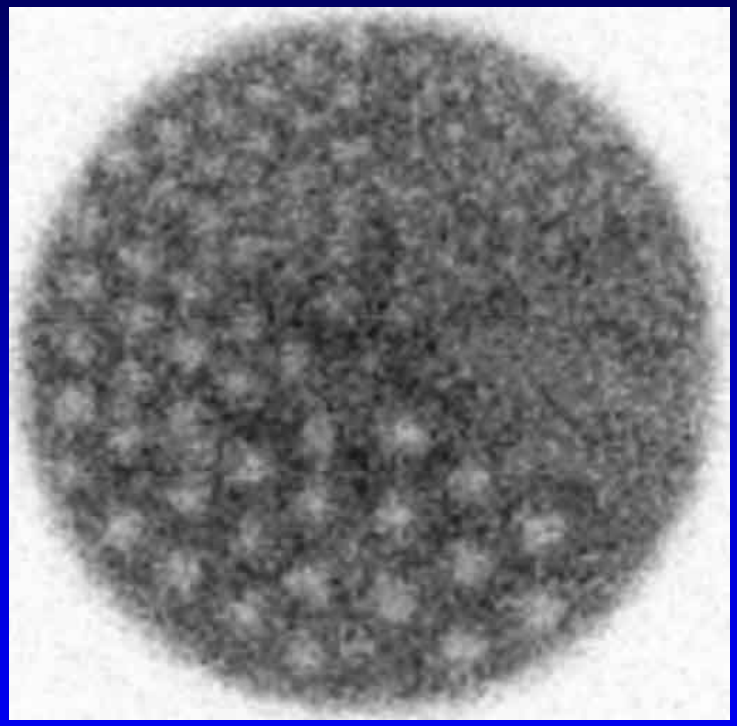


CONTRAST

104-18

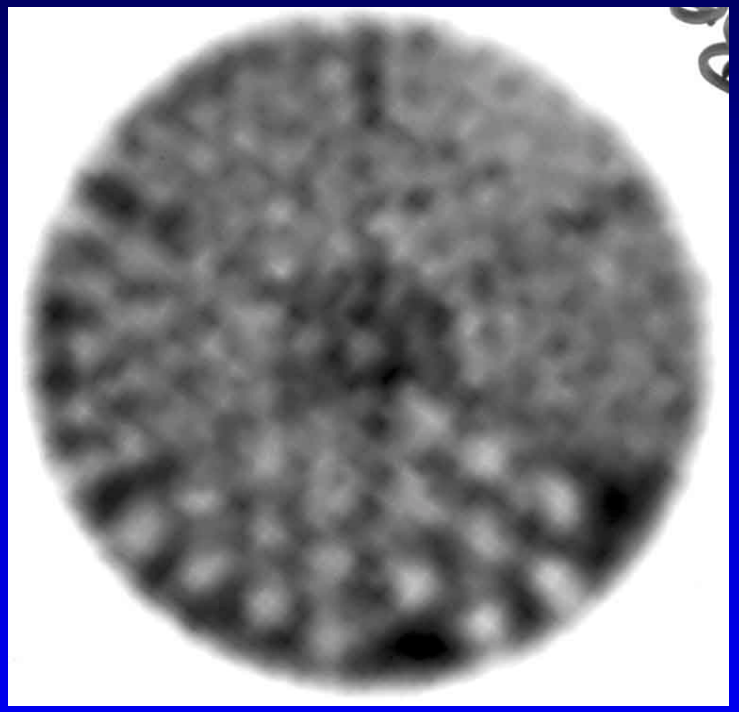
RESOLUTION

SPECT SYSTEM -
SYSTEM SPATIAL RESOLUTION



Head Two - Planar

Tl-201

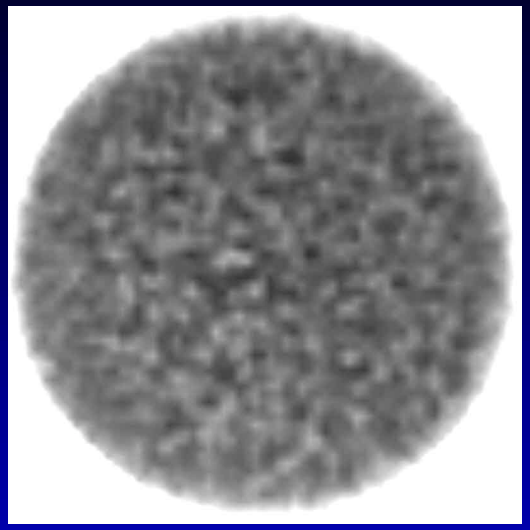


Both Heads - SPECT

Tl-201

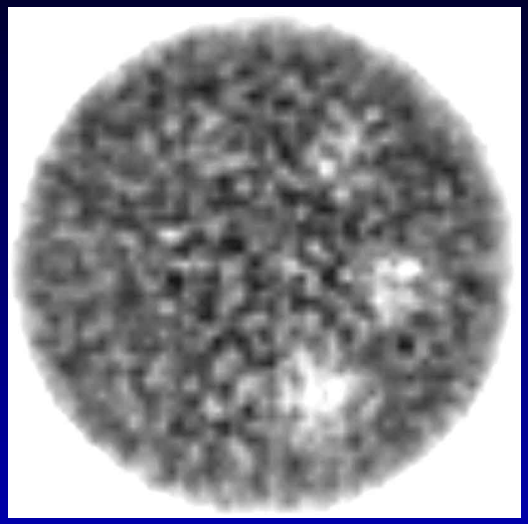
ACR PHANTOM (Tc-99m)

106-9



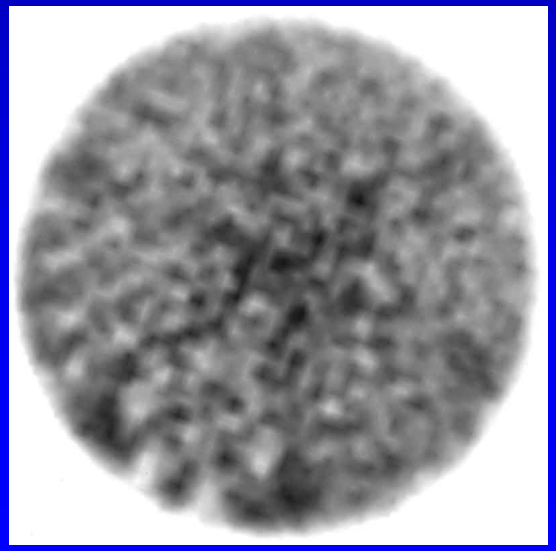
SPECT UNIFORMITY

106-10



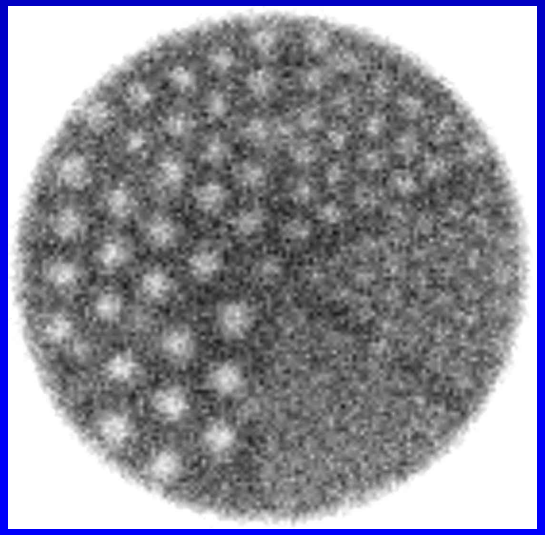
SPECT CONTRAST

106-8



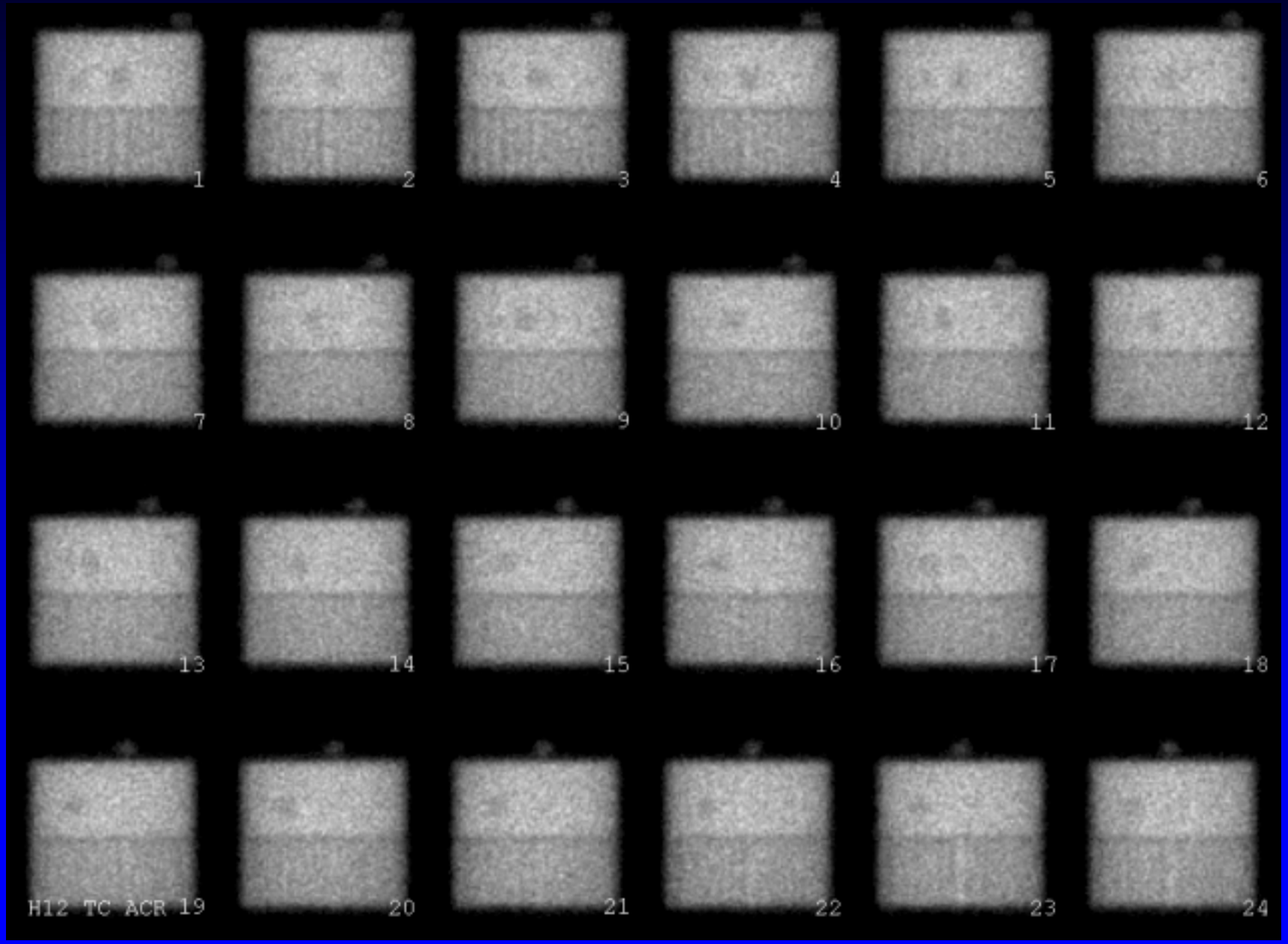
SPECT RESOLUTION

106-3

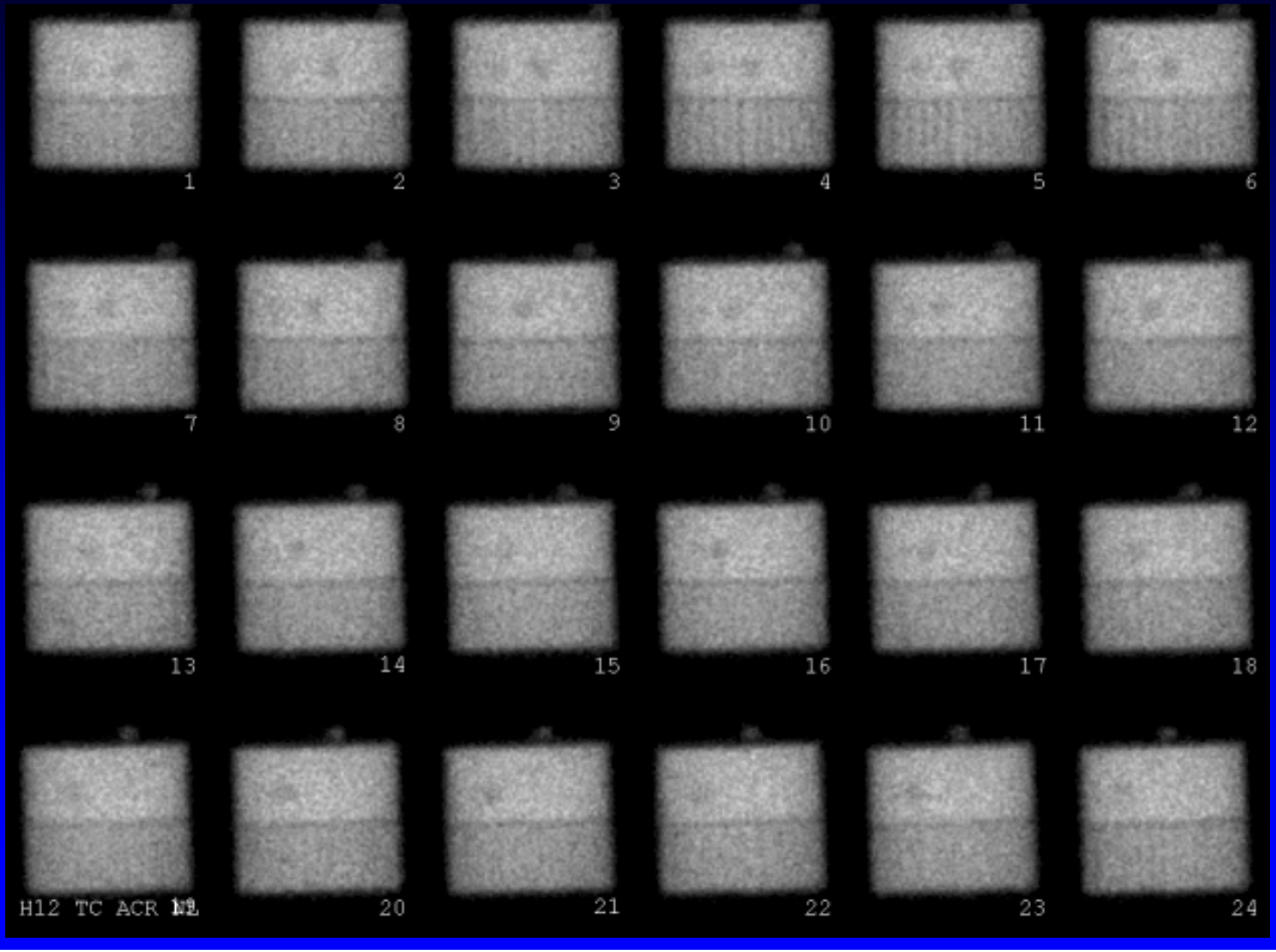


PLANAR RESOLUTION

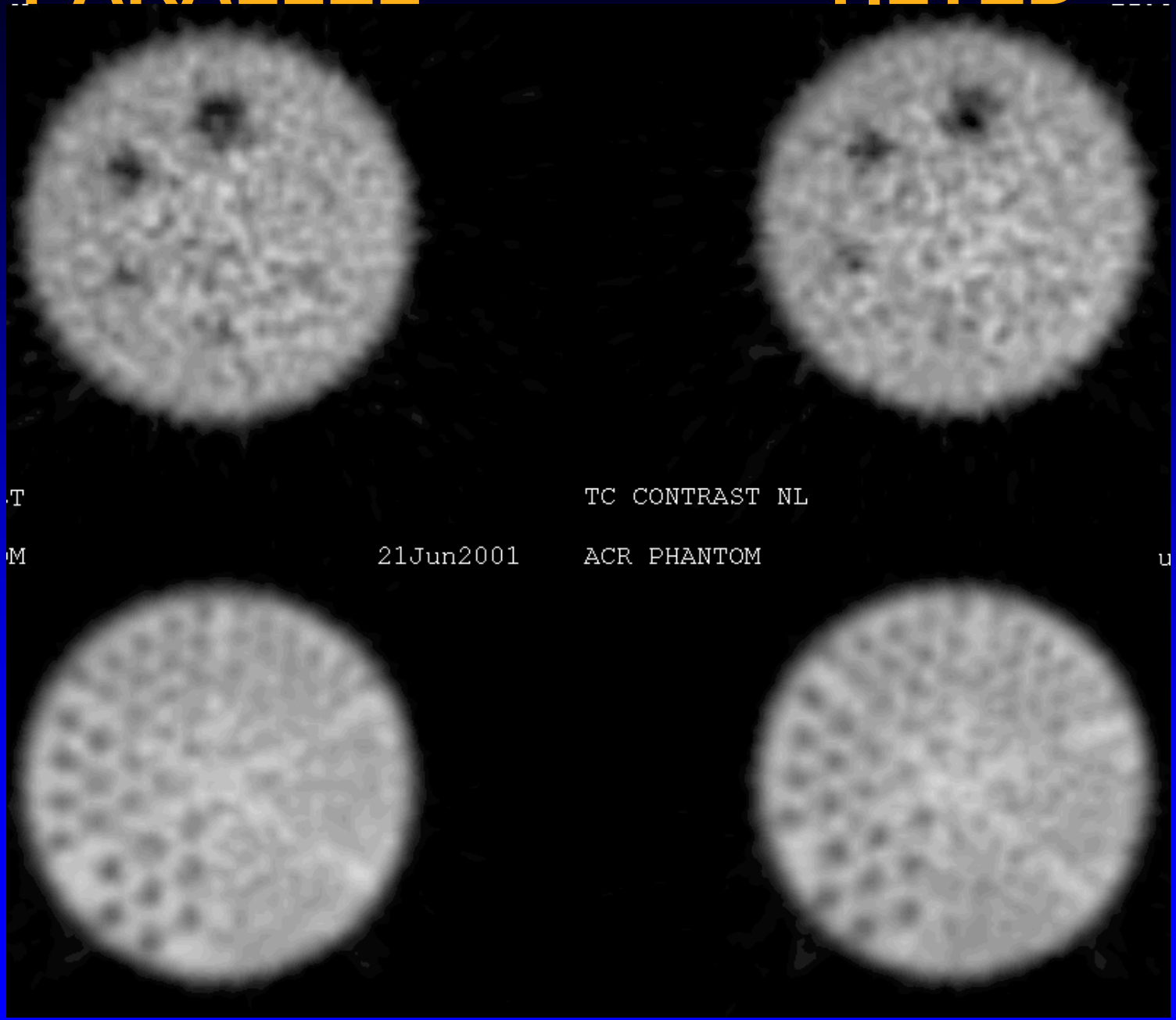
ACR PHANTOM PROJECTION DATA



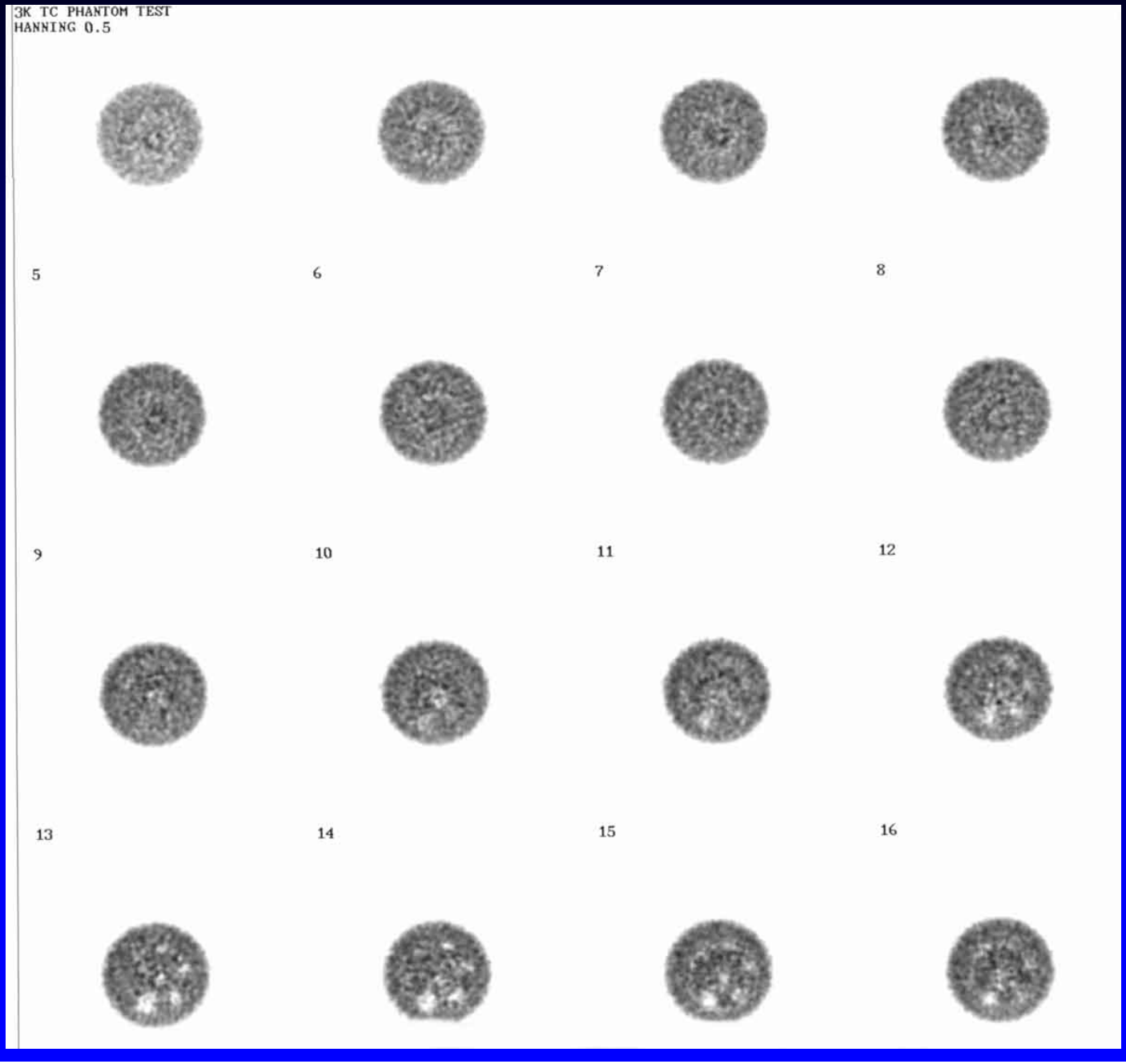
ACR PHANTOM PROJECTION DATA



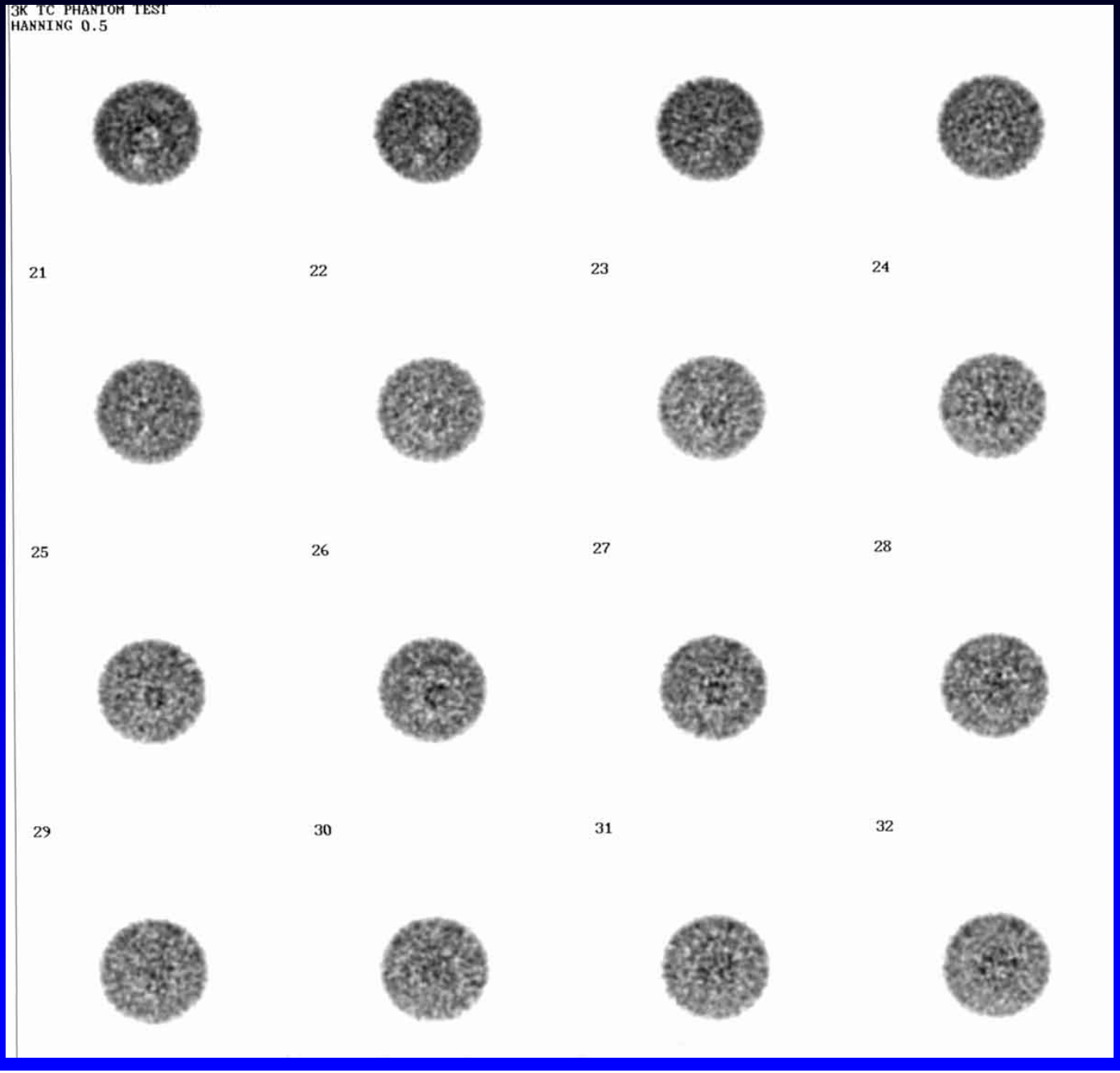
PARALLEL TILTED



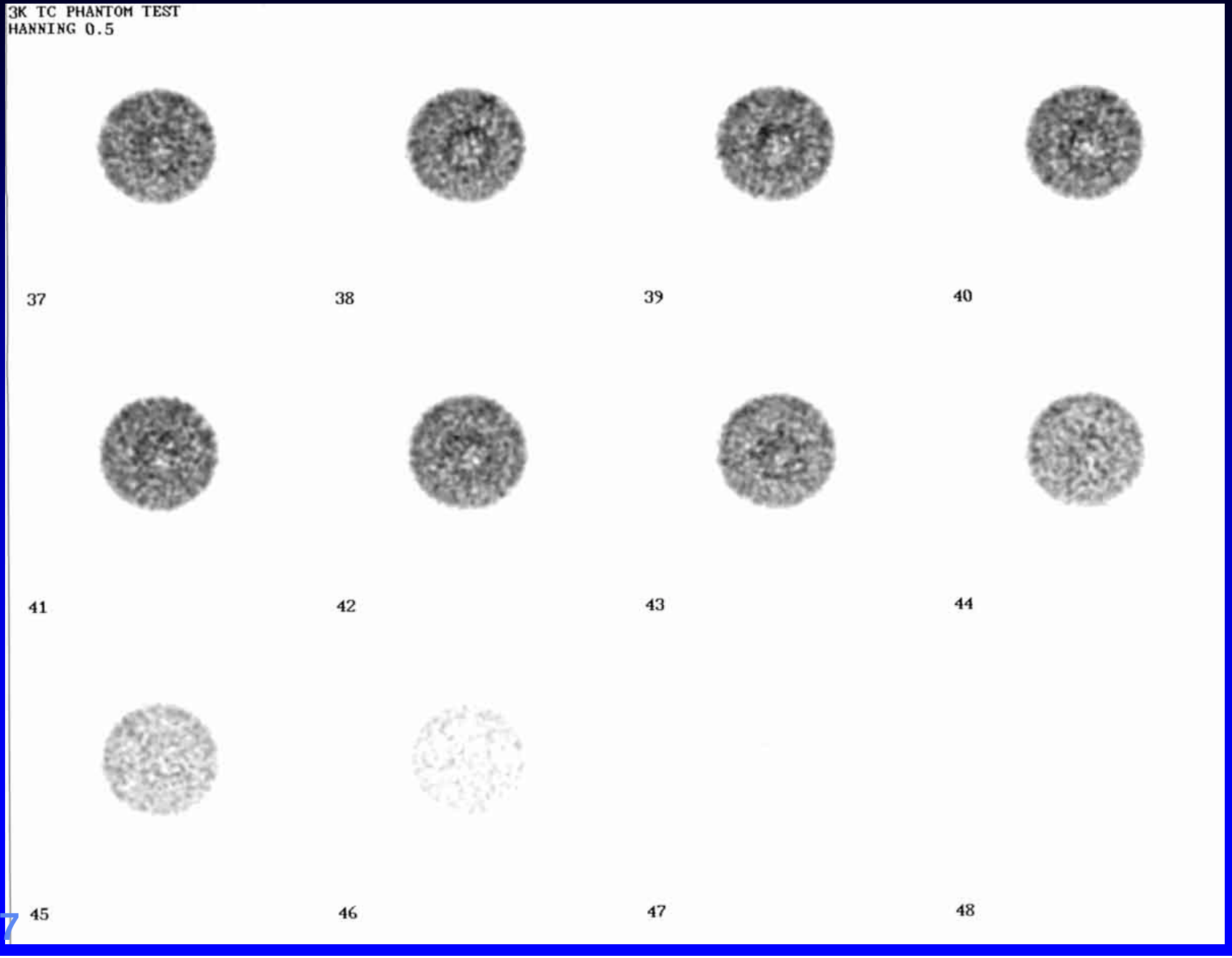
ACR PHANTOM (Tc-99m): SLICES 5 - 16



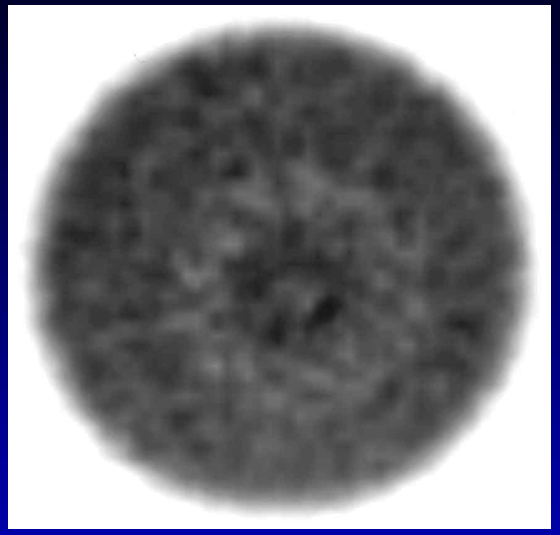
ACR PHANTOM (Tc-99m): SLICES 5 - 16



ACR PHANTOM (Tc-99m): SLICES 37 - 44

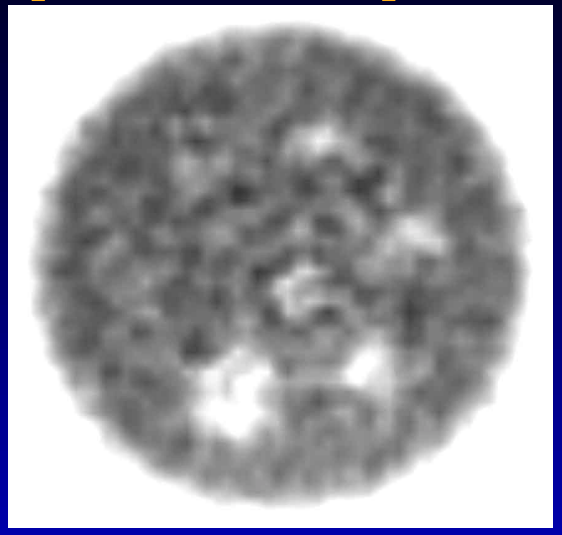


ACR PHANTOM (Tc-99m)



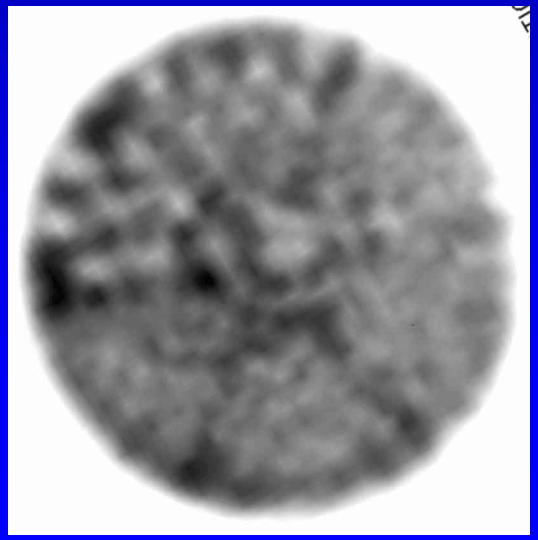
107-9

SPECT UNIFORMITY



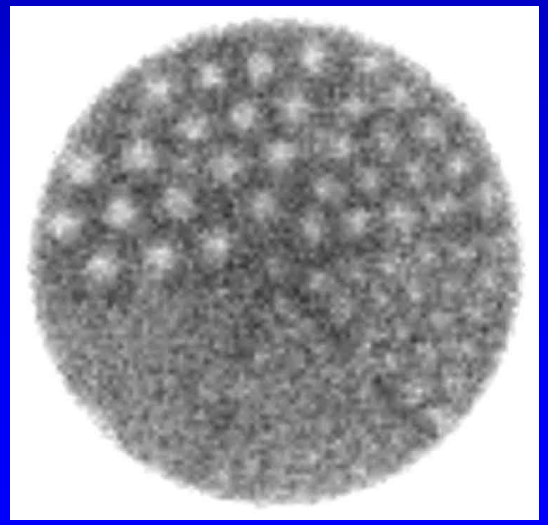
107-10

SPECT CONTRAST



107-8

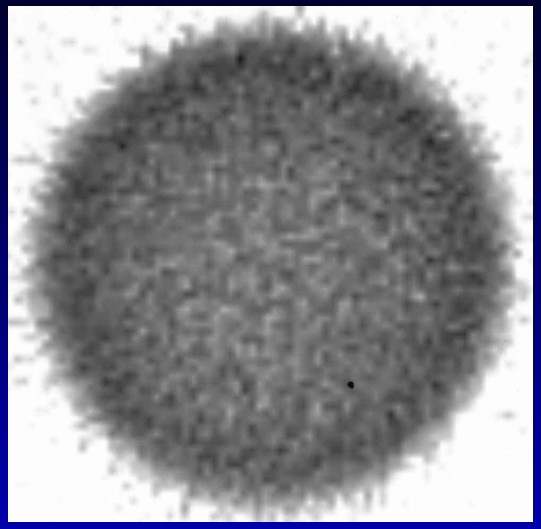
SPECT RESOLUTION



106-3

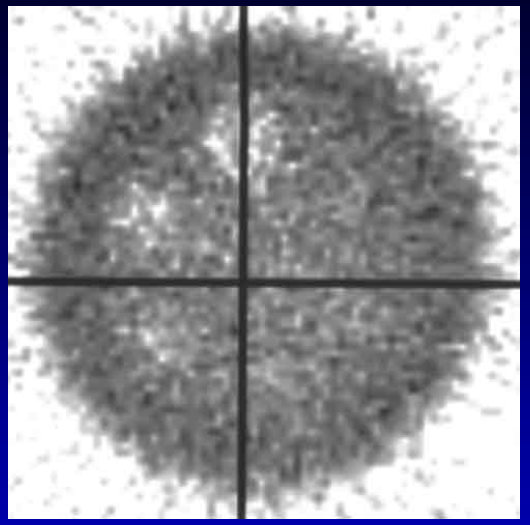
PLANAR RESOLUTION

ACR PHANTOM (Tc-99m)



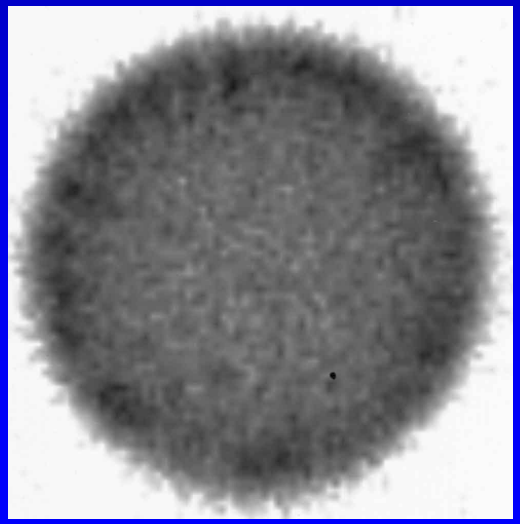
108-9

SPECT UNIFORMITY



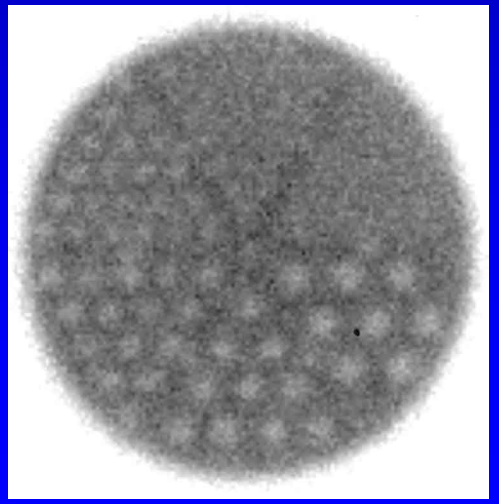
108-10

SPECT CONTRAST



108-8

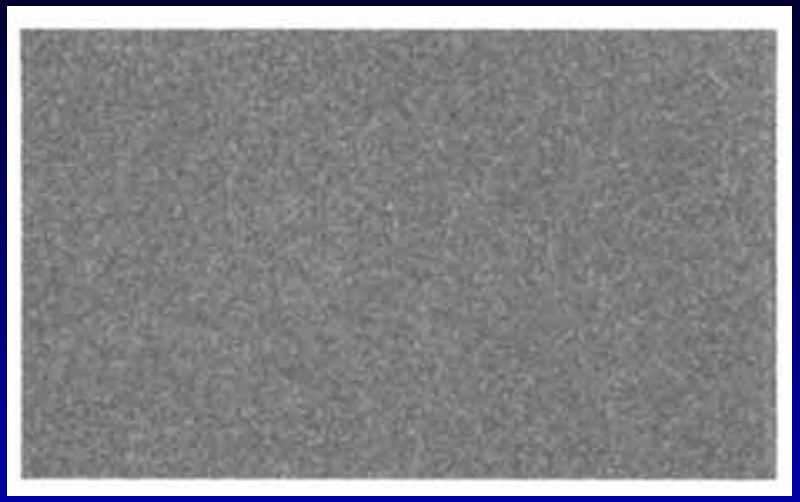
SPECT RESOLUTION



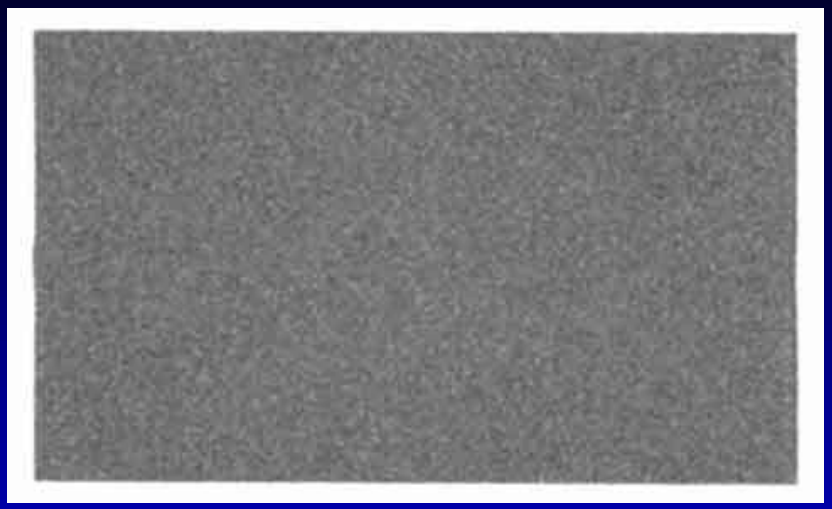
108-3

PLANAR RESOLUTION

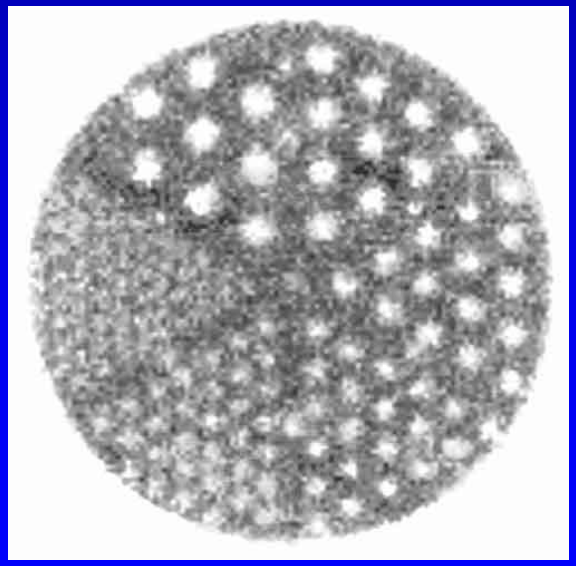
SPECT SYSTEM - PLANAR



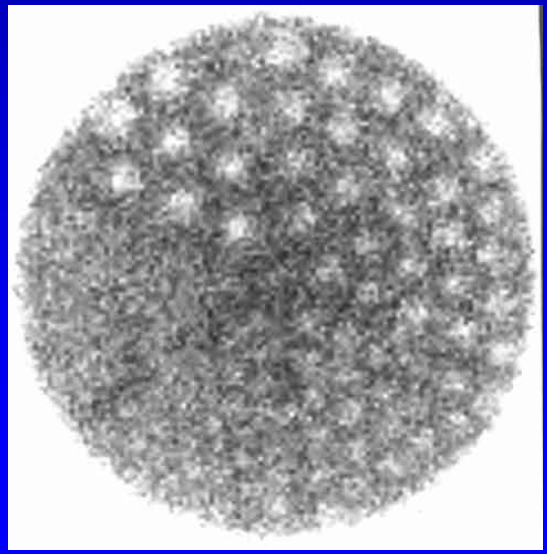
111-1 Tc-99m UNIFORMITY



Ga-67 UNIFORMITY 111-2



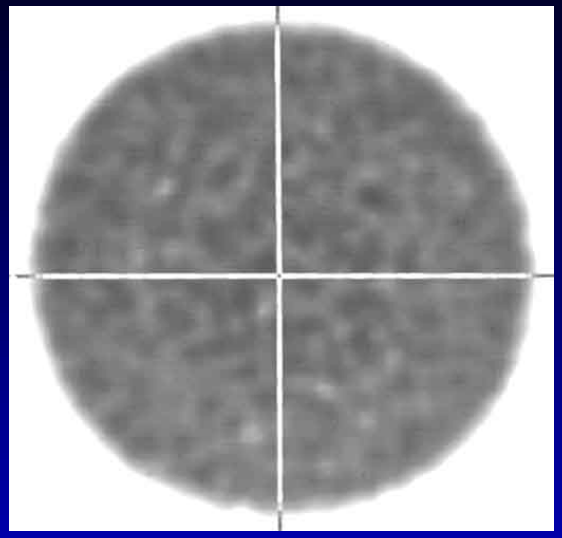
111-3 PLANAR RESOLUTION



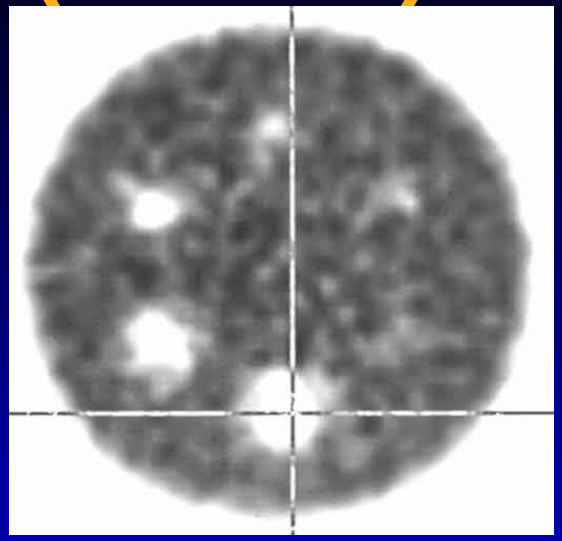
PLANAR RESOLUTION 111-4

ACR PHANTOM (Tc-99m)

111-8



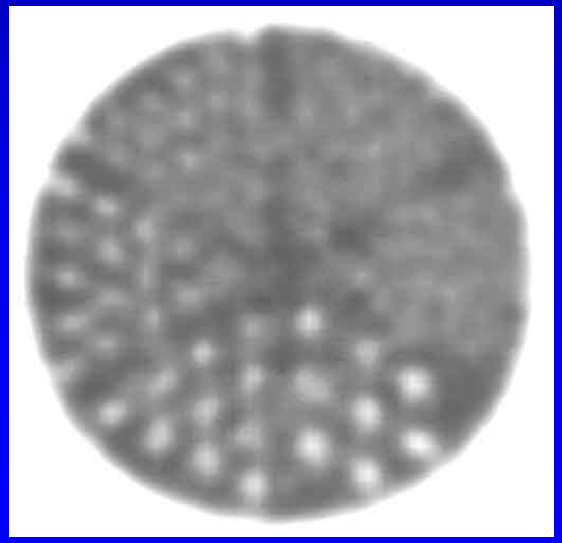
SPECT UNIFORMITY



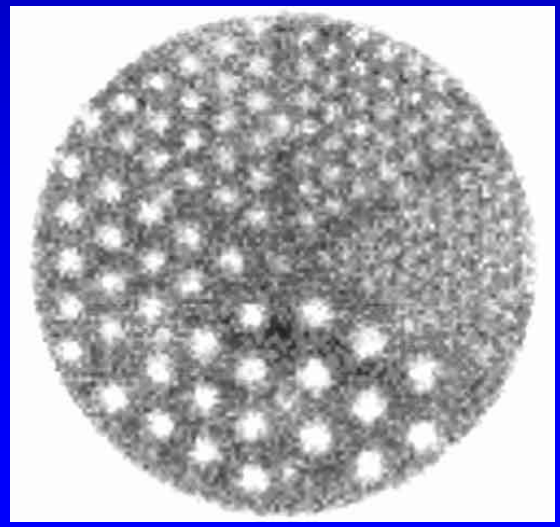
SPECT CONTRAST

111-8

111-8



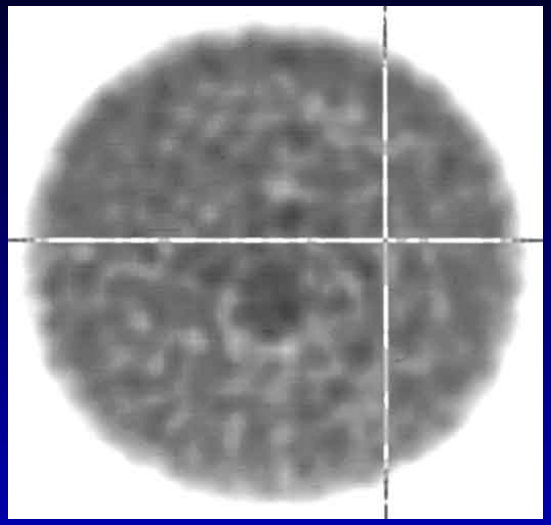
SPECT RESOLUTION



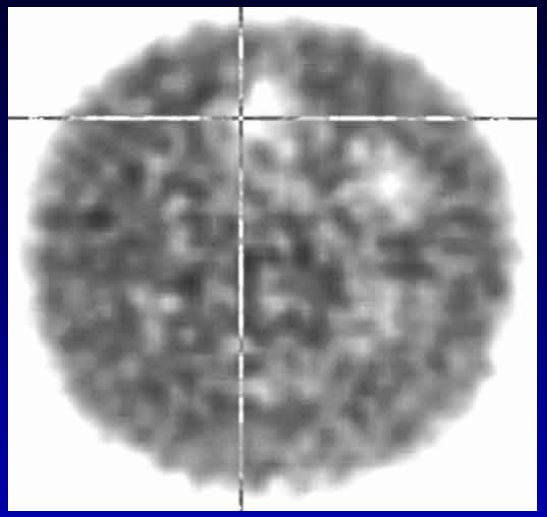
PLANAR RESOLUTION

111-3

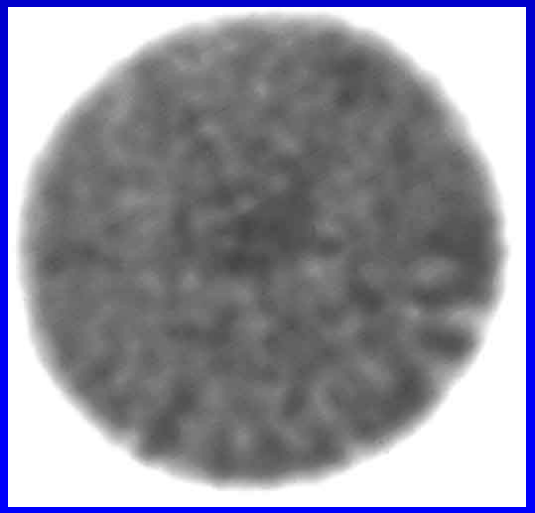
ACR PHANTOM (Ga-67)



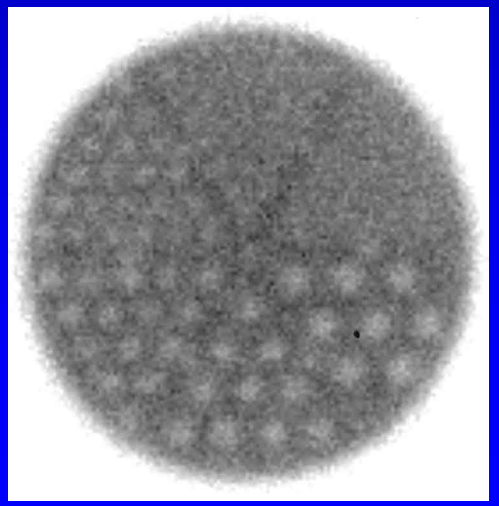
111-9 SPECT UNIFORMITY



SPECT CONTRAST 111-9

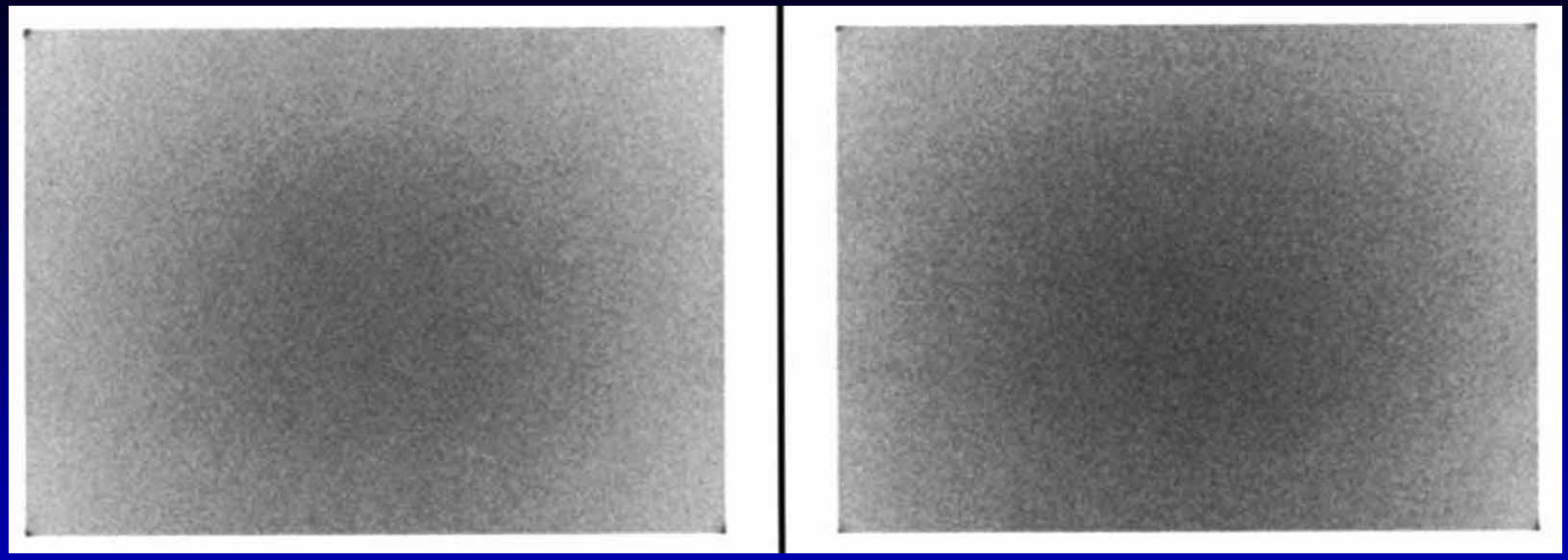


111-9 SPECT RESOLUTION

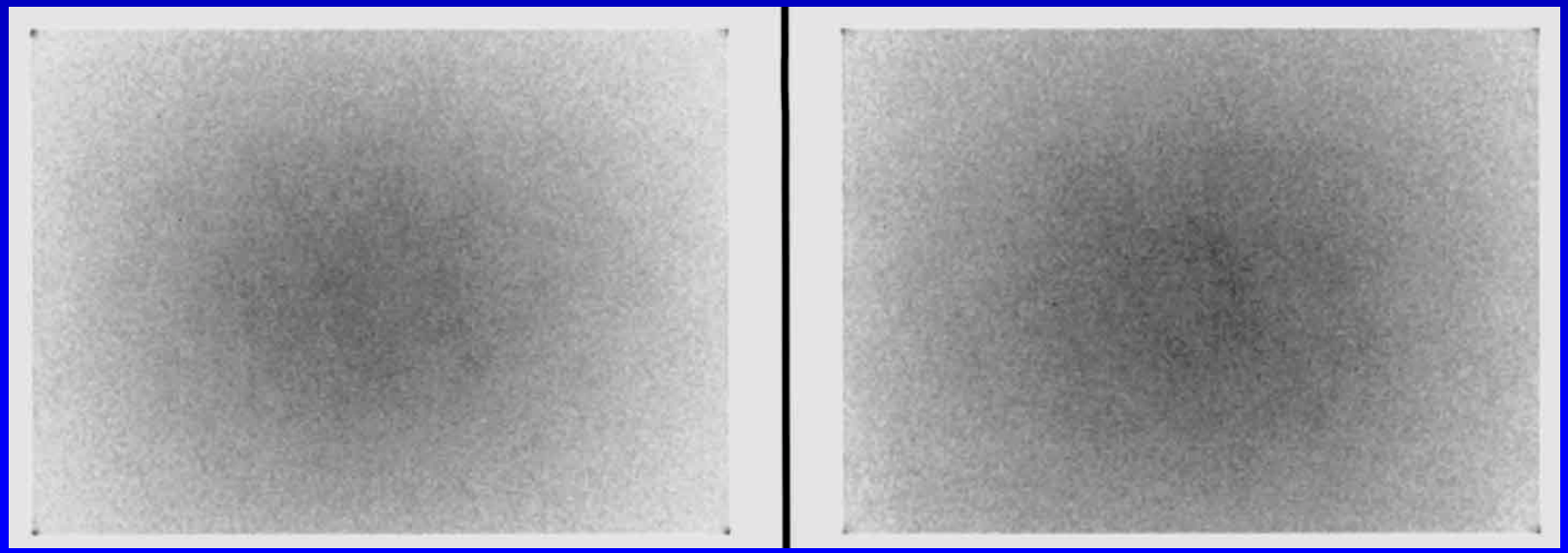


PLANAR RESOLUTION 111-4

ACR INTRINSIC UNIFORMITY

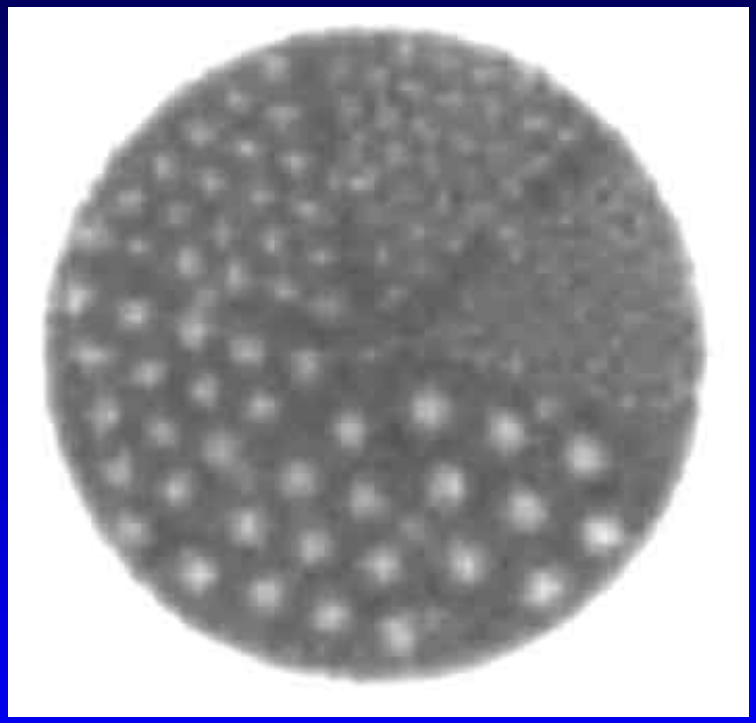


Tc-99m

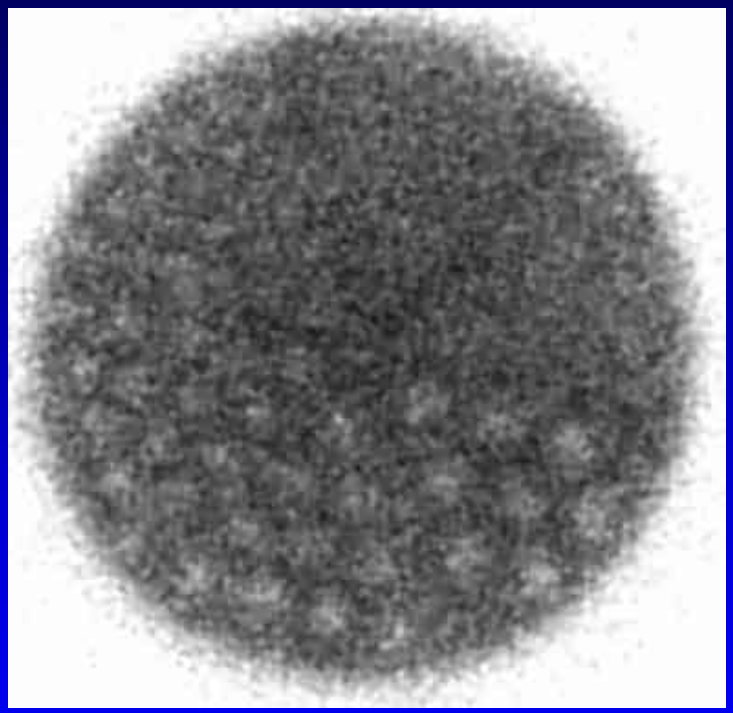


Tl-201

SPECT SYSTEM - PLANAR SPATIAL RESOLUTION



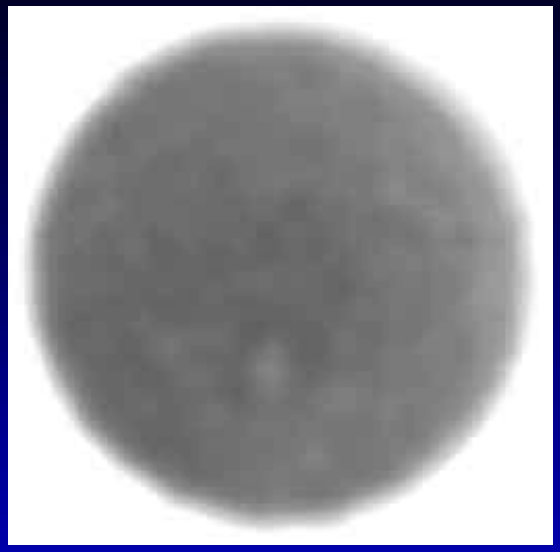
Tc-99m



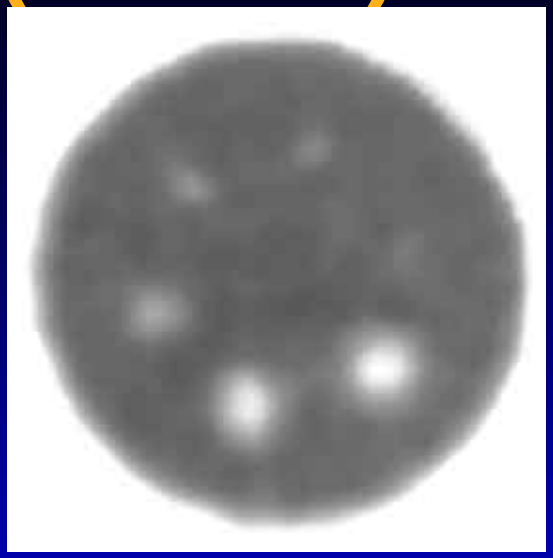
Tl-201

ACR PHANTOM (Tc-99m)

117-7



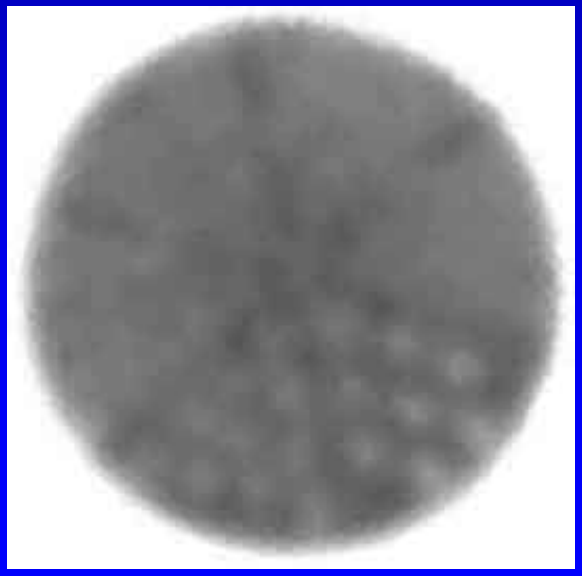
SPECT UNIFORMITY



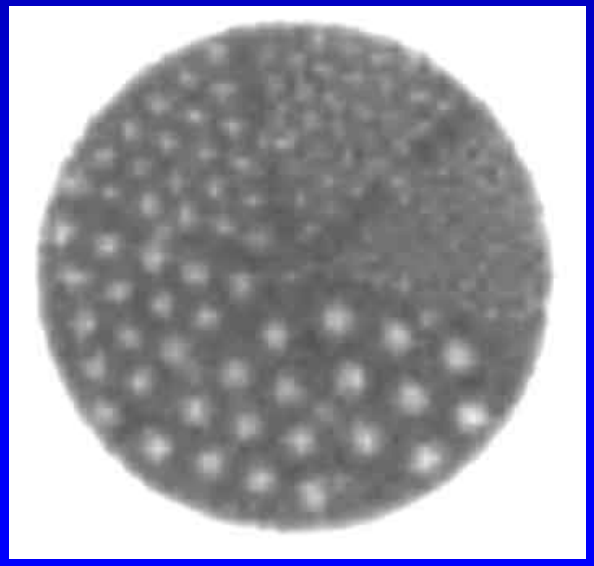
SPECT CONTRAST

117-8

117-6



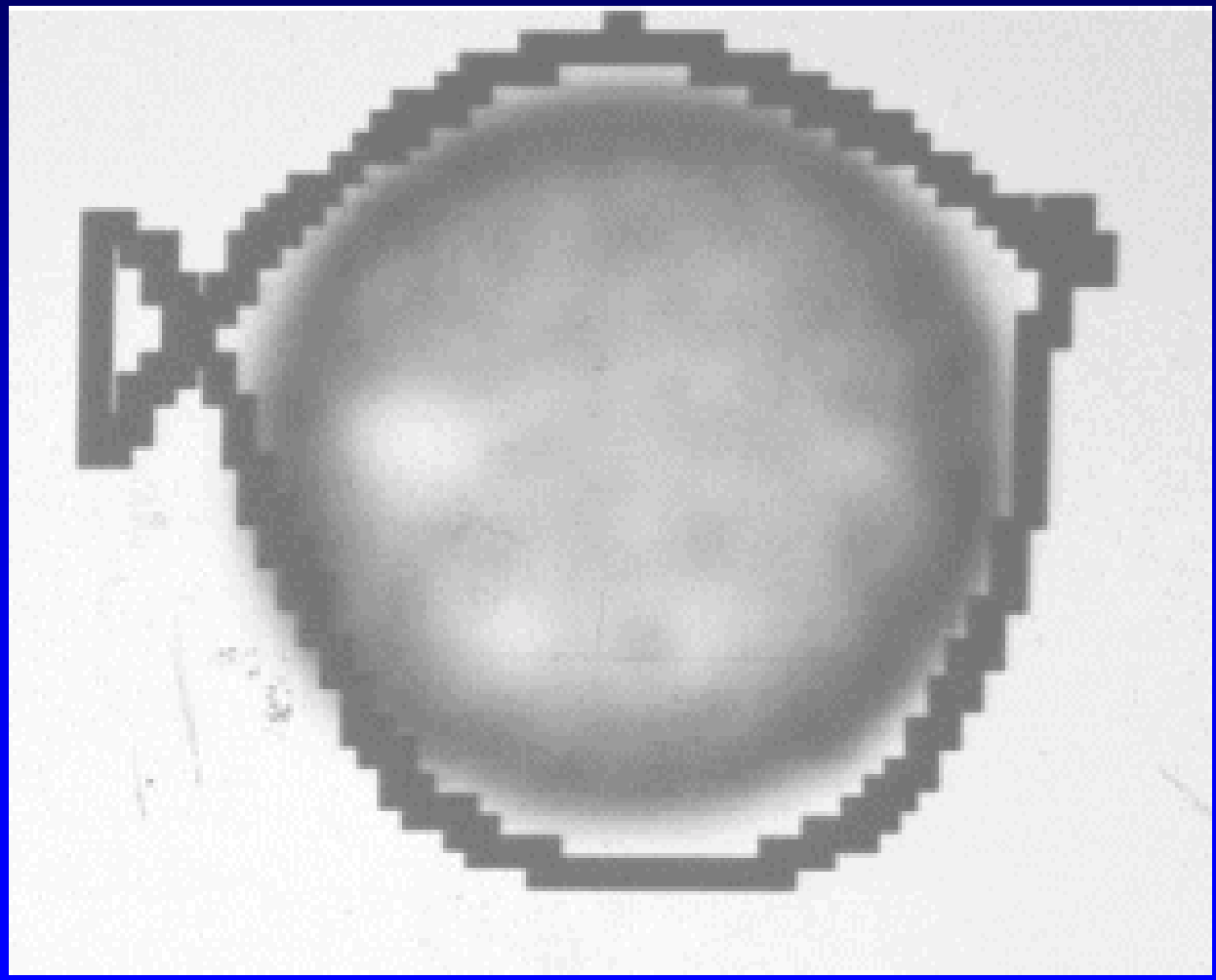
SPECT RESOLUTION



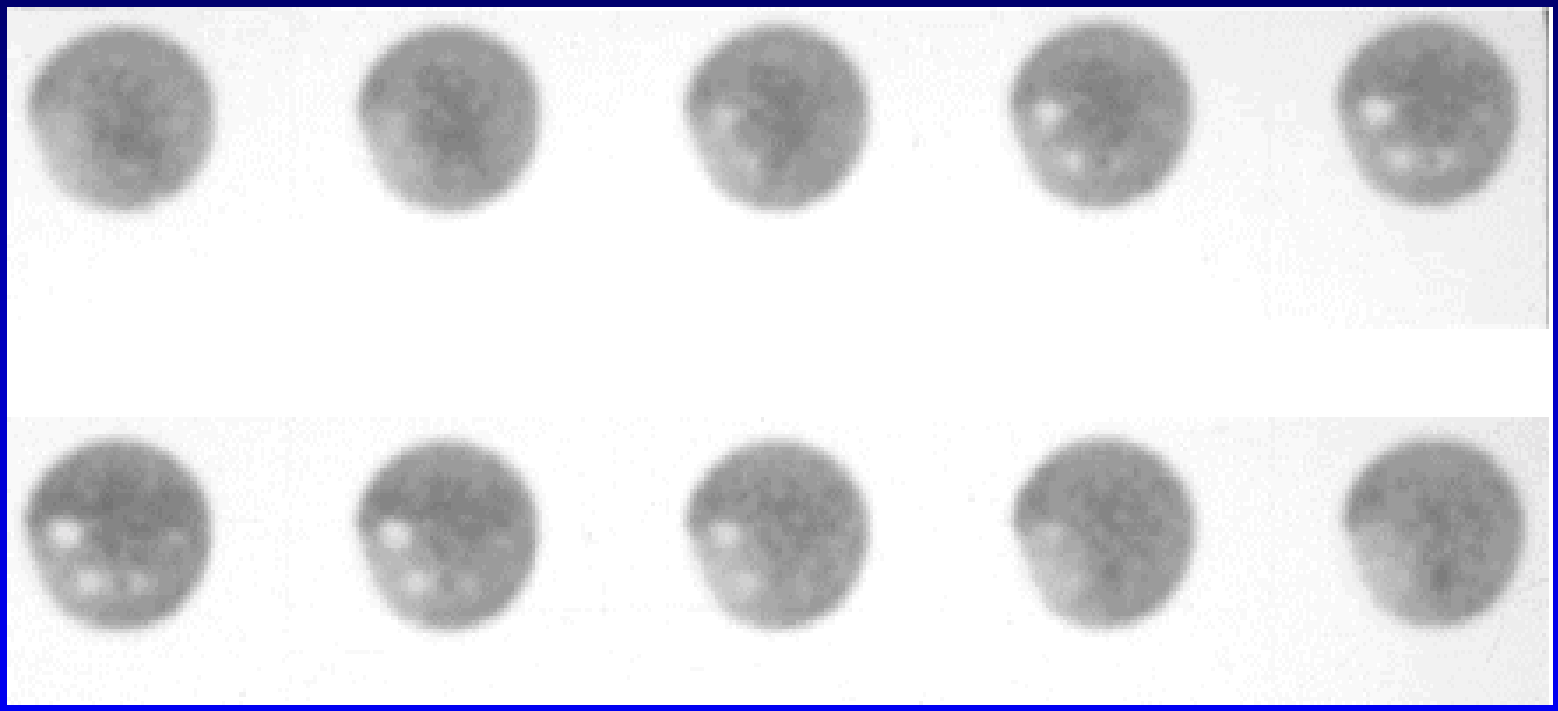
PLANAR RESOLUTION

117-3

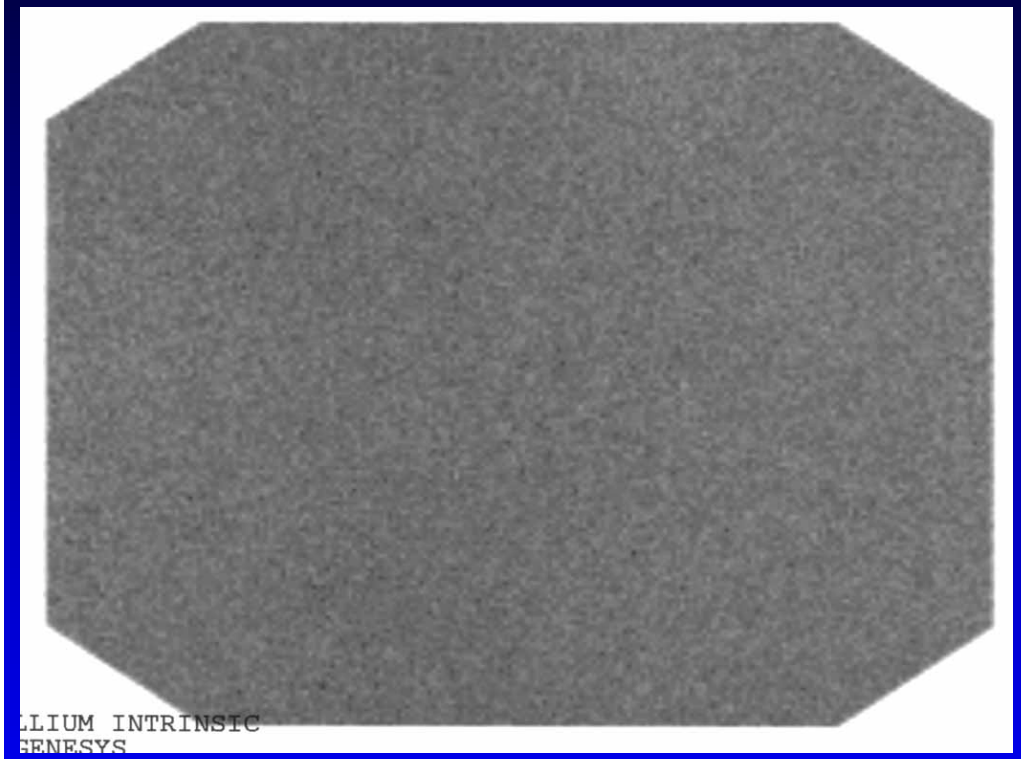
INCORRECT AUTOMATIC ATTENUATION CORRECTION BOUNDARY



EFFECT OF INCORRECT BOUNDARY

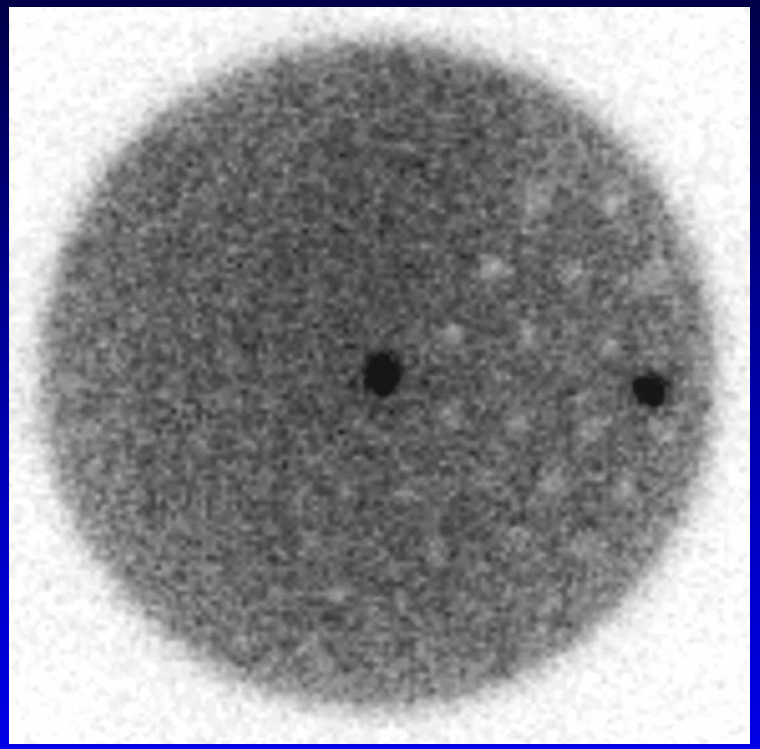


SPECT SYSTEM



TI-201 INTRINSIC UNIFORMITY

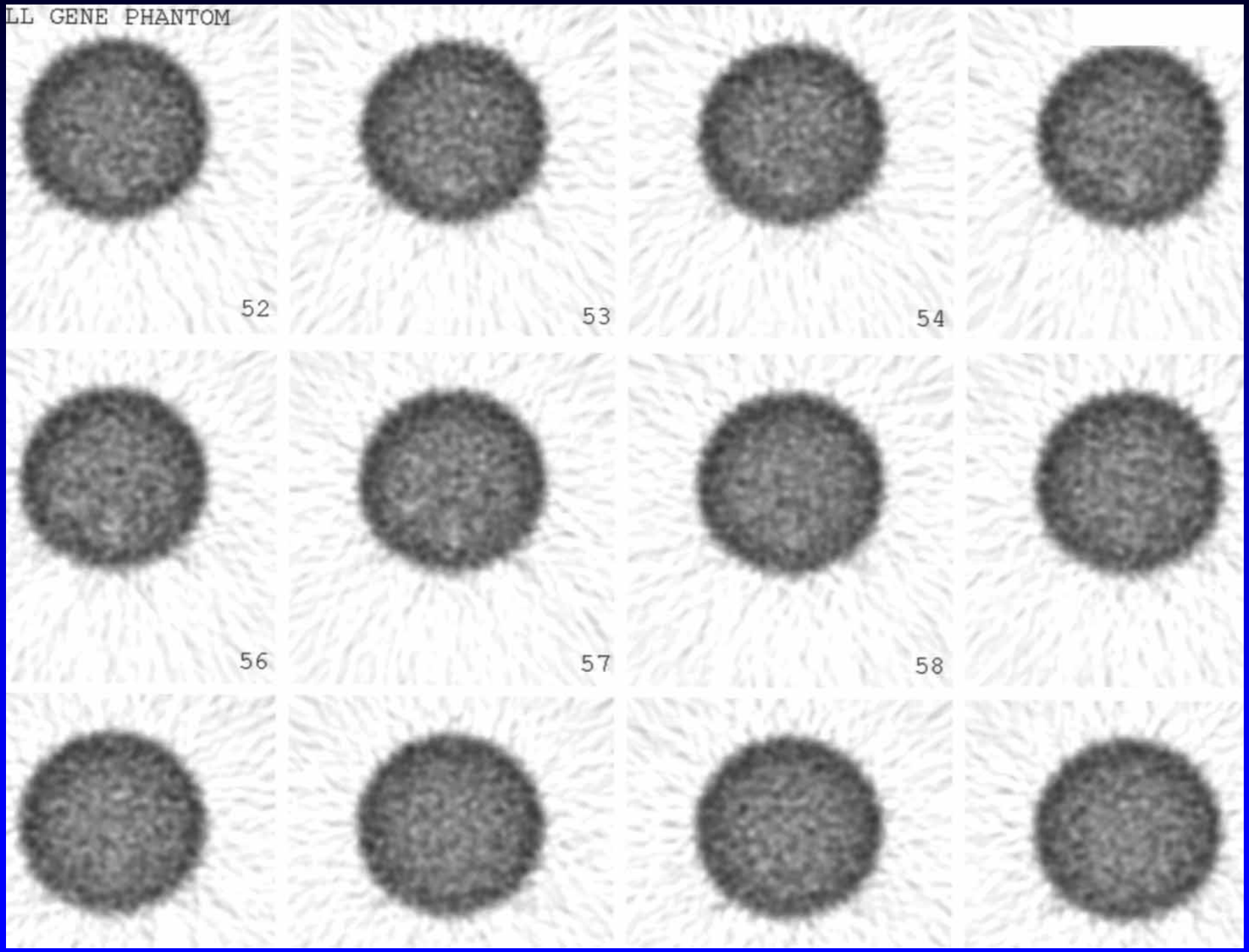
123-1



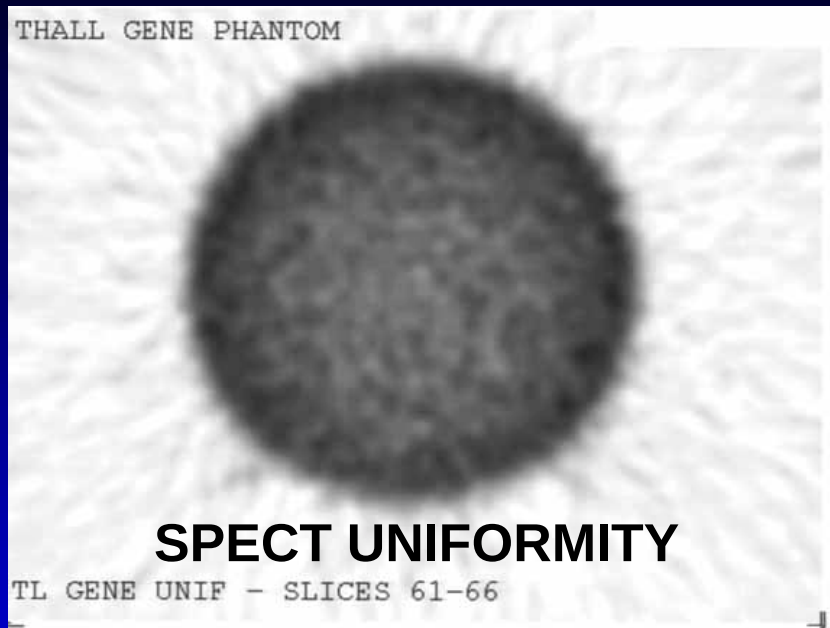
ACR PHANTOM TI-201 SPATIAL RESOLUTION

123-2

ACR PHANTOM (Tl-201): SLICES 52 - 63

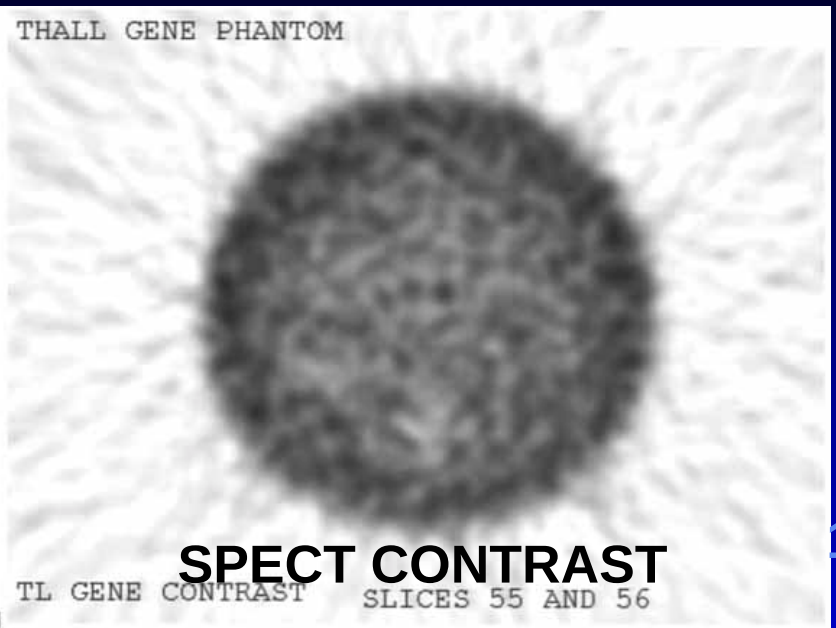


ACR PHANTOM (Tl-201)



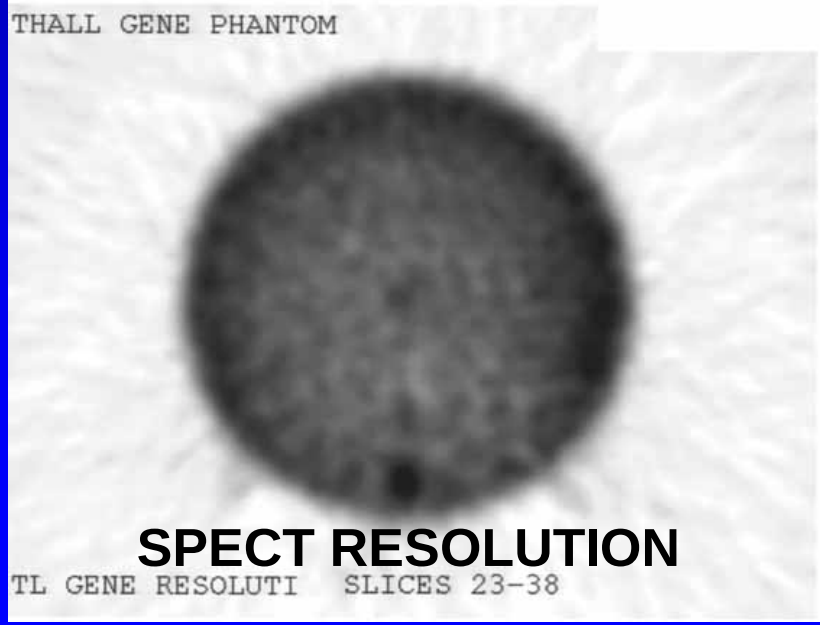
SPECT UNIFORMITY

123-6



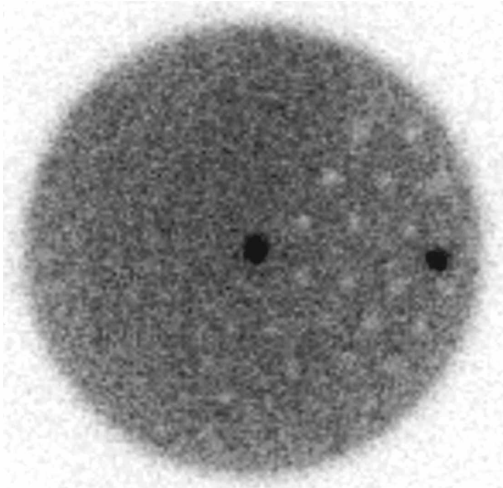
SPECT CONTRAST

123-6



SPECT RESOLUTION

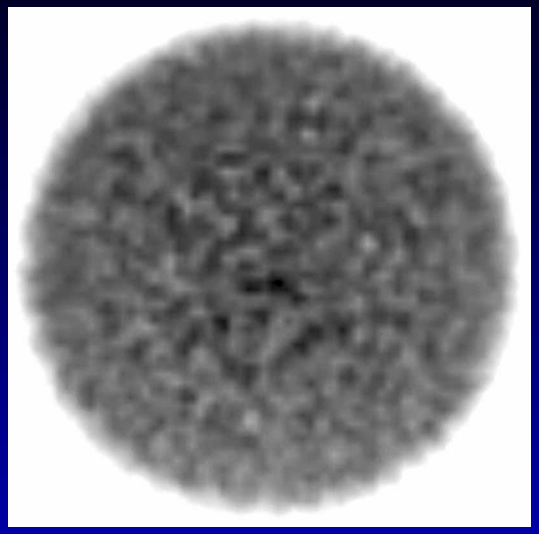
123-6



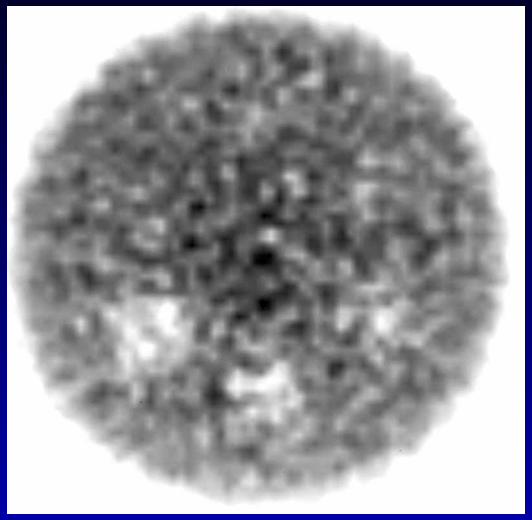
ACR PLANAR RESOLUTION

123-2

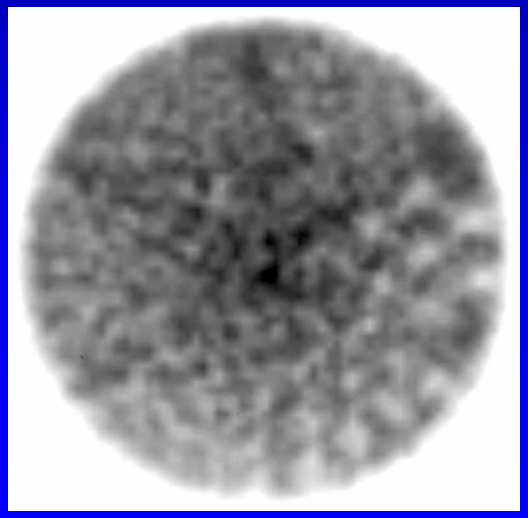
ACR PHANTOM (Tl-201)



120-18 SPECT UNIFORMITY

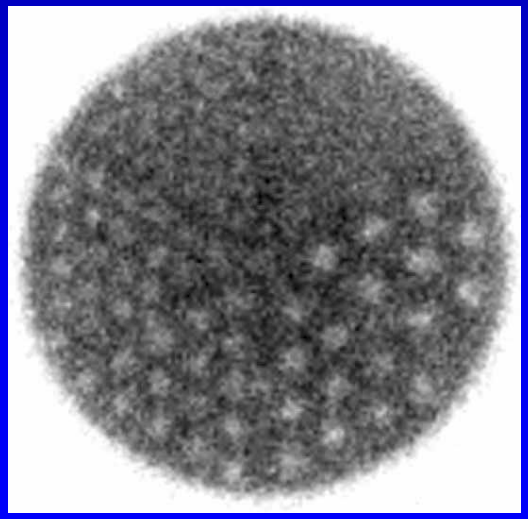


SPECT CONTRAST 120-19



SPECT RESOLUTION

120-17



ACR PLANAR RESOLUTION

120-6

ACR NUC MED ACCREDITATION

Evaluation of the Applications - General Description

- Clinical and phantom images for each camera are submitted to a review panel of physicians and medical physicists, respectively
- The final report includes specific assessments and recommendations
- 3-year accreditation is given to successful applicants
- A certificate and machine label are provided for each approved camera specific to the types of exams that can be performed

ACR NUC MED ACCREDITATION

Evaluation of the Applications - General Description - cont.

- **Facilities that fail**
  - **Specific recommendations for improvement are made**
  - **Individual cameras that fail cannot be used at an accredited site.**

ACR NUC MED ACCREDITATION

Evaluation of Phantom Images

- ACR Phantom is based on a phantom that is commonly used but the choice should not be considered as an endorsement
- All images are scored using one of five terms - excellent, good, satisfactory, marginal, and fail (descriptors are used for each term)
- Intrinsic and system uniformity variations in image intensity due to incorrect balance of the PM tubes, as well as CRT or video or/and formatter artifacts are considered
- The type of resolution pattern is considered in the evaluation

ACR NUC MED ACCREDITATION

Fee for Accreditation

Facility fee	$650.00
Each Additional Facility	$550.00
Per camera:	
One module	$300.00
Two modules	$600.00
Three modules	$900.00

Re-Application After Deficiency

Only the procedure that was deficient must be re-submitted

ACR NUC MED ACCREDITATION

On-Site Reviews of Accredited Facilities

- Random on-site surveys may be performed during accreditation period to validate consistent quality
- Sites will be notified in advance
- Survey team will include physician and physics reviewers and an ACR staff person

ACR NUC MED ACCREDITATION

Future Additions

- Development of a fourth Module on PET imaging is in progress
- Phantom is a modification of the phantom for Module 2 that includes “hot” cylinders

ACR SPECT/PET PHANTOM

AMERICAN COLLEGE OF NUCLEAR PHYSICIANS

Proficiency Testing Program (PTP)

- ACNP produced a phantom that simulated various clinical conditions on semi-annual basis for many years
- Program collected subscriber data on QC programs
- Participants identified location(s) of defect(s) and provided clinical interpretation that would be consistent with the defect(s)
- Also provided symptoms that might be observed

AMERICAN COLLEGE OF NUCLEAR PHYSICIANS

Proficiency Testing Program (PTP) - cont.

- Subscribers received individual report
- Also received summary critique that enabled them to compare their results to all other participants
- Critique included recommendations for future practice

SOCIETY OF NUCLEAR MEDICINE PRACTICE ACCREDITATION (2000)

Practice Accreditation Program and PTP

- Applicants are reviewed on site by physicians and scientists trained and certified as inspectors
- Components: Staff qualifications, patient records and reports, procedure manual, facilities and equipment, QC, imaging processes, radiopharmaceutical handling, QMP, and bone densitometry
- Accreditation period: 3 years
- PAP Fee: $3000

INTERSOCIETAL COMMISSION FOR THE ACCREDITATION OF NUCLEAR MEDICINE LABORATORIES (ICANL) PRACTICE ACCREDITATION PROGRAM (2000)

Societies

American Society of Nuclear Cardiology, Society of Nuclear Medicine, Society of Nuclear Medicine Technologists, American College of Cardiologists, ACNP, Institute of Clinical PET

ICANL PRACTICE ACCREDITATION

Comparison of ICANL and ACR Programs

- Wackers states that major difference is " . . . emphasis on the presence of laboratory- and camera-specific procedure protocols for each of the nuclear medicine examinations and on the submission and review of complete patient studies and reports."
  - ACR also requires complete patient studies
- ICANL requires at least three PET studies
  - ACR PET program is now in "pilot" phase

ICANL PRACTICE ACCREDITATION

Comparison of ICANL and ACR Programs - cont.

- **ICANL grants accreditation by body system**
  - **ACR focuses on the quality of submitted cases per camera**
- **Both ICANL and ACR accredit nuclear cardiology facilities**

ICANL PRACTICE ACCREDITATION

Comparison of ICANL and ACR Programs - cont.

- **ICANL does not require acceptance tests or that annual quality assurance tests be performed or supervised by a medical physicist**
  - **ACR does have these requirements**
- **ICANL does not require submission of SPECT phantom images but does accept them *if* done**
  - **ACR requires SPECT phantom images**

ICANL PRACTICE ACCREDITATION

Comparison of ICANL and ACR Programs - cont.

- **ICANL retains right to perform random on-site reviews and charges an administrative fee and travel expenses**
- **ACR retains right to perform random on-site reviews without charge**

CONCLUSION

- NM accreditation demonstrates to payers and regulatory agencies, and referring physicians, that the facility provides high-quality health care
- Immediate and long-term benefit is patient confidence and peer recognition
- Medical physicists play an important role in this process