SCINTILLATION IMAGING EQUIPMENT

LESSON OBJECTIVES:

1. LIST THE DIFFERENT TYPES OF SCINTILLATION IMAGERS
2. DISCUSS THE USAGE OF THE DIFFERENT TYPES OF SCINTILLATION IMAGERS
3. DESCRIBE THE MAKEUP OF THE DIFFERENT TYPES OF SCINTILLATION IMAGERS

THERE ARE NO SPECIFIC FEDERAL REQUIREMENTS REGARDING THE QUALITY CONTROL OF IMAGING EQUIPMENT EXCEPT FOR MOBILE CAMERAS WHICH ARE MOVED FROM ONE PHYSICAL ADDRESS TO ANOTHER

10 CFR 35.80 SAYS THAT ALL TRANSPORTED EQUIPMENT MUST BE CHECKED FOR PROPER FUNCTION BEFORE IT CAN BE USED AT EACH ADDRESS.

TYPES OF SCINTILLATION IMAGERS

1. STATIONARY CAMERAS
2. MOBILE CAMERAS
3. TOMOGRAPHIC CAMERAS
4. MULTICRYSTAL CAMERAS
5. POSITRON EMISSION TOMOGRAPHIC CAMERAS

STATIONARY SCINTILLATION CAMERA (ALSO CALLED AN ANGER CAMERA OR GAMMA CAMERA)

USAGE: TAKES A PICTURE OF A LARGE OR SMALL AREA OF THE BODY AT ONE TIME

STILL AND MOVING PICTURES CAN BE ACQUIRED

SCINTILLATION CAMERA MAKEUP:

ONE OR MORE DETECTOR HEADS

SINGLE CRYSTAL:

1/4 - 1/2 INCH THICK CRYSTAL

THINNER CRYSTAL - BETTER RESOLUTION

THICKER CRYSTAL - BETTER AT STOPPING HIGHER ENERGY GAMMAS

10 - 25 INCH DIAMETER CRYSTAL

COLLIMATOR: SHEET OF LEAD WITH HOLE(S) IN IT. ALLOWS ONLY GAMMA RAYS OF INTEREST, WHICH WILL CREATE A CLEAR IMAGE, TO REACH THE CRYSTAL.

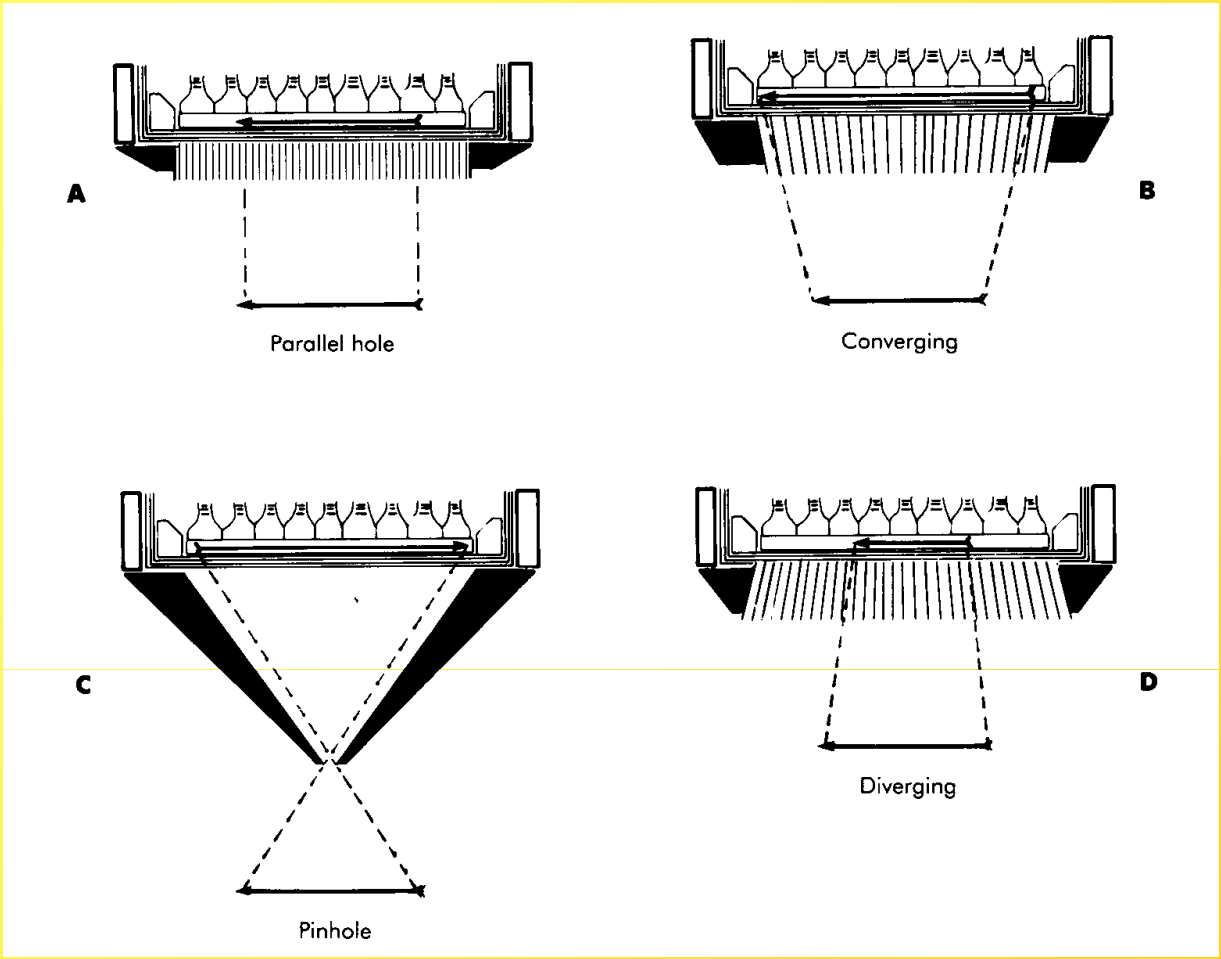
LOW, MEDIUM, AND HIGH ENERGY

TYPES: PARALLEL HOLE

CONVERGING HOLE

DIVERGING HOLE

PINHOLE


A
Parallel hole
B
Converging
C
Pinhole
D
Diverging

PHOTOMULTIPLIER TUBES (PMTs)

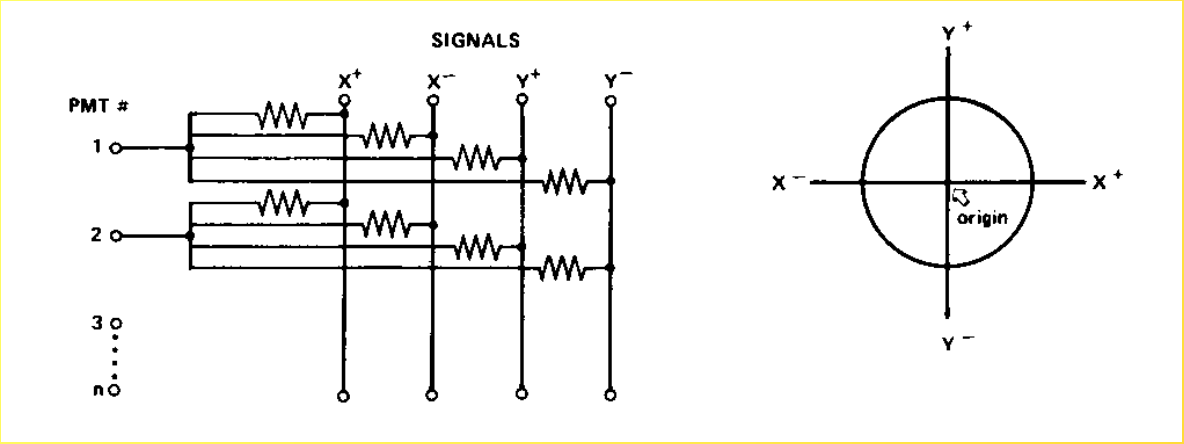
19 - 91 HEXAGONALLY SHAPED TUBES, PLACED NEXT TO EACH OTHER IN A HONEY-COMB FASHION, AND OPTICALLY COUPLED TO THE CRYSTAL

CONVERT CRYSTAL LIGHT FLASHES INTO ELECTRICAL PULSES

DELIVER THE POSITIONAL INFORMATION TO THE DISPLAY DEVICE (+X, -X, +Y, -Y)

DISPLAY DEVICES

- CAMERA OSCILLOSCOPE
- MULTIFORMATTER
- COMPUTER DISPLAY


SIGNALS
PMT #
1
2
3
n
X+
X−
Y+
Y−
Y +
X −
X +
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MOBILE SCINTILLATION CAMERA

- SCINTILLATION CAMERA ON WHEELS WITH A DRIVE MECHANISM
- CAN TRAVEL TO PATIENT'S ROOM OR INTENSIVE CARE UNIT
- COMPUTER ON BOARD

TOMOGRAPHIC SCINTILLATION CAMERA

- DETECTOR(S) MOUNTED ON GANTRY ROTATE AROUND THE PATIENT
- POWERFUL COMPUTER
- INFORMATION ACQUIRED DISPLAYED AT DIFFERENT PLANES WITHIN THE BODY:
  - CORONAL
  - SAGITTAL
  - TRANSVERSE
  - OBLIQUE

MULTICRYSTAL CAMERA

COUNTS EXTREMELY FAST

EXCELLENT FOR DOING FIRST PASS NUCLEAR CARDIOLOGY

IMAGES ARE NOT AS CLEAR AS THE STATE OF THE ART GAMMA CAMERAS

MAKEUP:

SINGLE CRYSTAL SUBDIVIDED INTO 400 INDIVIDUAL CRYSTALS BY PARTIALLY CUTTING INTO CRYSTAL BLOCK

EACH INDIVIDUAL CRYSTAL SEEN BY TWO PHOTOMULTIPLIER TUBES

PET CAMERA

USED TO STUDY PHYSIOLOGIC AND BIOCHEMICAL PROCESSES WITHIN THE BODY

MAKEUP:

RING OF CRYSTAL DETECTORS

TWO DETECTORS MUST RECEIVE THE TWO 511 keV GAMMA RAYS IN COINCIDENCE FOR AN EVENT TO BE RECORDED

SPECIAL DETECTOR CRYSTALS