PET SCAN

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PET
[POSITRON EMISSION TOMOGRAPHY]

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INTRODUCTION

- **PET also called PET imaging or a PET scan.**
- **PET scan is a type of nuclear medicine imaging**
- **PET Machine that can image biological and chemical activities**

- PET scan gives physiological function of the body.
- PET scanner is used produce an image showing the distribution of the tracer in the body.
- PET is an imaging madality that produces 3 D images of the body that are capable of demonstrations the biochemical function of bodys organs and tissues.

HISTORY

- 1975 the first commercial PET scanner was introduced.
- 70s and 80s PET was mainly used for research.
- 1990s being used in clinics regularly.

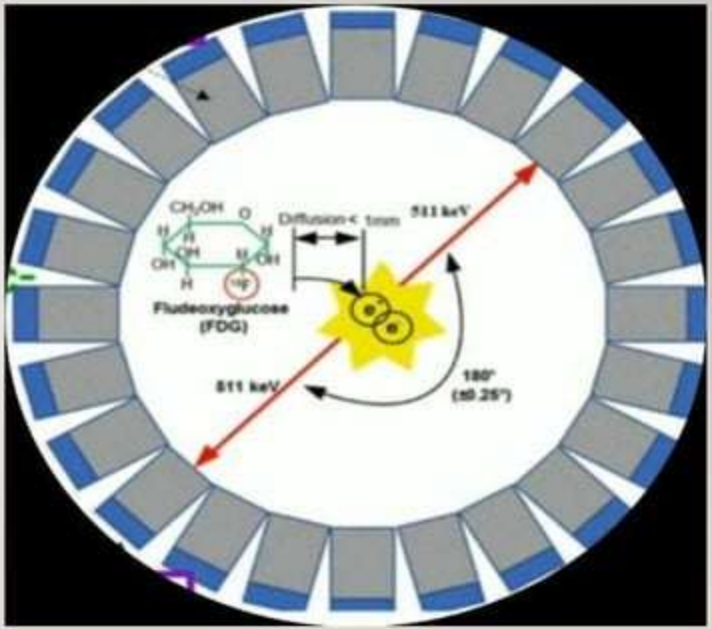
PRINCIPAL

- PET is uses radiotracer or pharmaceutical fluoro deoxy- glucose (FDG).
- Firstly, FDG is injected intravenously into the patient.
- FDG emits positron by going into the patient's abnormalities or malignancy tissue.

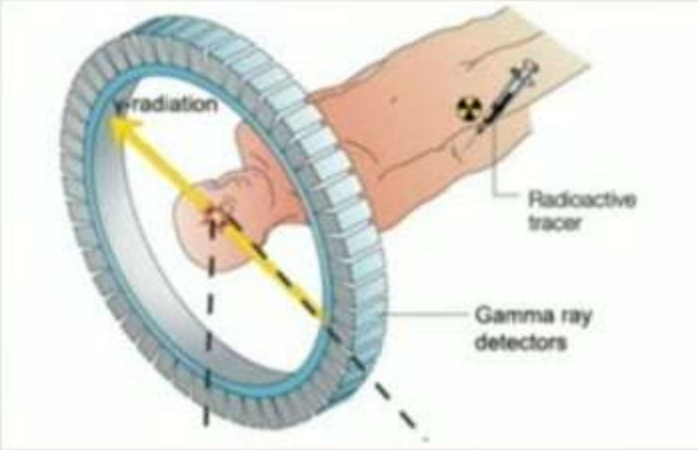
- The half-life of positron is very short.
- metabolism
- Glucose molecules--------→ Glucose-6 Phosphate.
- FDG is similar to our glucose molecule and travels in the body same way as glucose and undergoes metabolism
- metabolism
- FDG ----------→ FDG-6 Phosphate
- (Hexokinase)

- It the tissue is normal, this process continues during the metabolism.
- If there is any malignancy, presence of pathology, infection and other abnormality, the FDG gets trapped.
- FDG emits Positron from abnormal tissue.
- The emitted positron joints with an electron and undergoes annihilation.

- The positron annihilation produces 2 photons of energy 511 keV each emitted in opposite direc - tion (180°) in the body site.



- These photons detected by a set of ring detectors surroundings the patient .
- The detector sends these signals to the computer and the computer creates the final image from thesesignals.



COMPONENTS OF PET SCAN

- Scanner gantry
  - A. Detector
  - B. Septa
  - C. Coincidence circuit
- 2. Table
- 3. Computer
- 4. Cyclotron

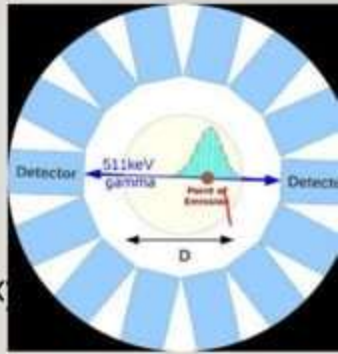
1. PET GANTRY

- Shape = Round donut shape
- Diameter = 70-80 cm
- A. Detector
- B. Septa
- C. Coincidence circuit

A. DETECTOR

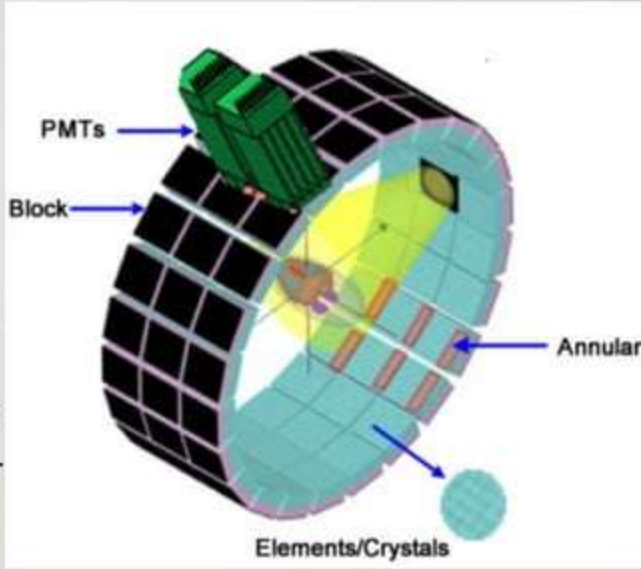
- PET equipment consist of a ring of detector surrounding the patient.
- Scintillation crystal (10000-20000) are used as detectors, e.g. – bismuth germanate (BGO),

lutetium oxyortho- -silicate (LSO), and gadolinium ox
-orthosilicate(GSO)



4 photo multiplier tubes arranged in a circular pattern around the patient.

- Generally, detectors must have high detection efficiency, less afterglow and energy resolution.
- Detectors are made in block format coupled with photo- - multiplier tubes (PMT).

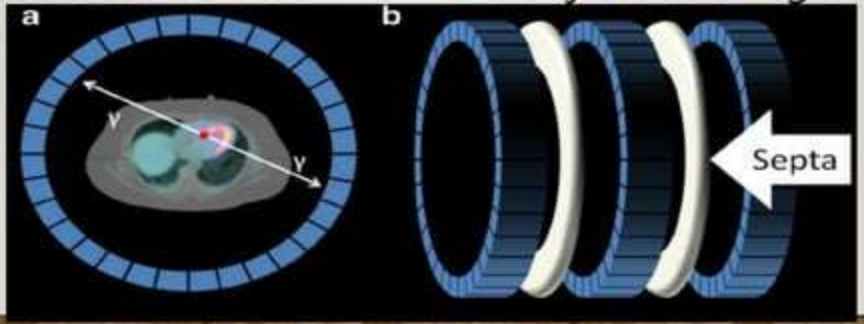


- The PET detectors detect the emission photons and convert them into light signals.

- This scintillation event is converted into an electric signal by PMT, which can be displayed on a monitor.

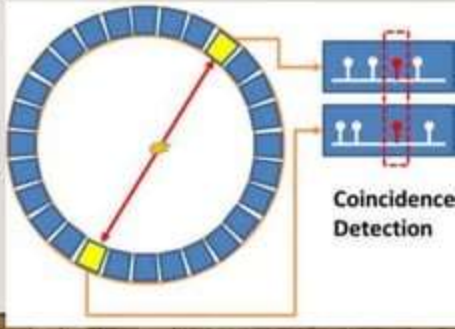
B. SEPTA

- Lead of tungsten circular shield mounted between the detector rin
- Limits scattered radiation from the object reaching the detector.

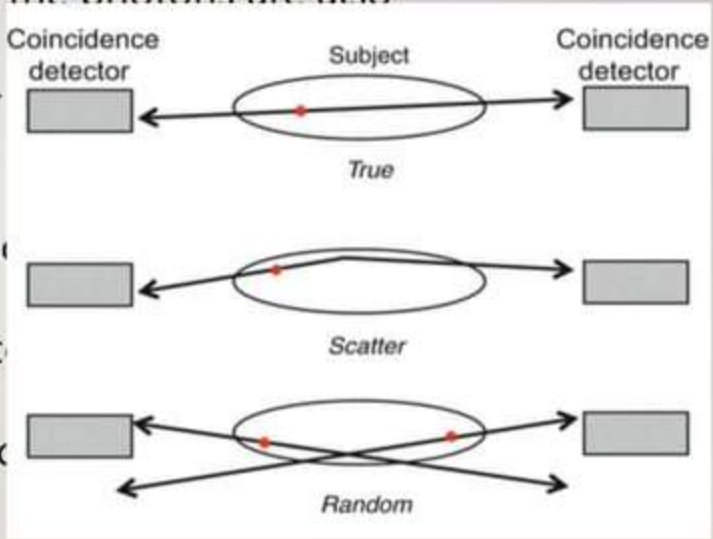


C. COINCIDENCE DETECTION

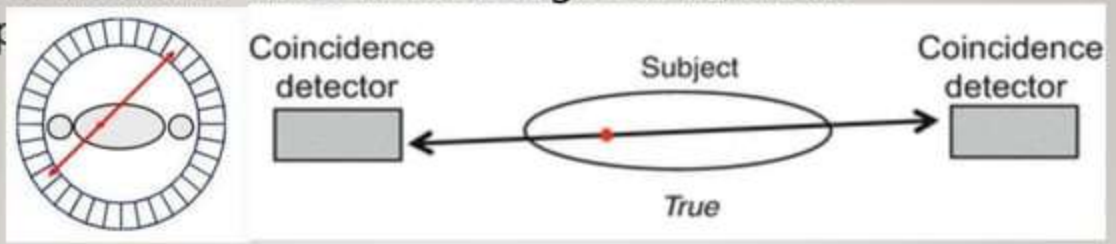
- Annihilation coincidence detection circuits, detects co- -incidence interaction with in each pair of detectors and obtain line of response (LOR)
- The effective attenuation suffered by the two Photons is determined



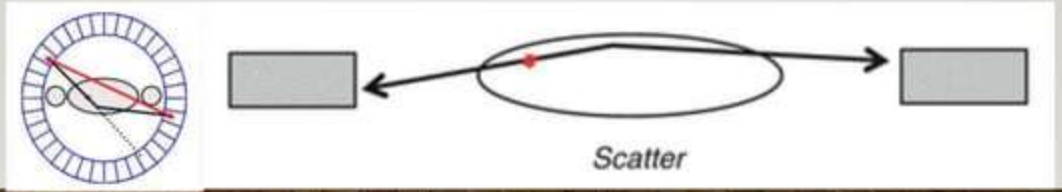
- The time of flight (TOF) of the photons are also detected
- The coincidence may be :-
- 1.True coincidence
- 2. Random coincidenc
- 3. Scatter coincidenc
- 4.Multiple coincidenc



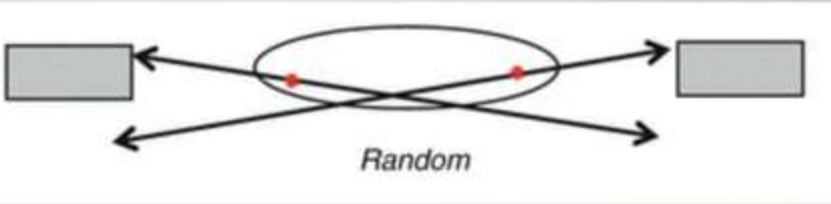
A true coincidence arises from a single event, in the same p



The scattred coincidence is due to single event, but in different plane, due to scatter.



The random coincidence is due to two independent events, not in the same plane.



Multiple coincidence is the detection of two independent events that are detected at the same time.

2.TABLE

- The bed is capable of moving in and out of the scanner to measure the distribution of PET radio pharmaceuti- -cals through out the body, and it adjusts to a very low position for easy patient access.

3. COMPUTER

- A computer analyzes the gamma rays and uses the information to create an image map of the orgen or tissue being studied.
- In 3D image reconstruction algorithm is us

4. CYCLOTRON

- The high energy particles produced in a cyclotron are used to bombard nuclei and study the resulting nuclear reactions and hence investigate nuclear structure.
- A machine used to produce the radioisotop

(radio - -active chemical elements) which ar

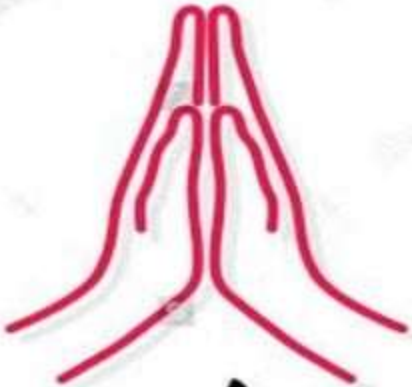
used to synthesize the radio pharmaceuti

APPLICATION OF PET SCAN

- Detect cancer.
- Determine whether a cancer has spread in the body.
- Determine if a cancer has returned after treatment.
- Determine blood flow to the heart muscle.
- Determine the effects of a heart attack, or myocardial infarctio
  on areas of the heart.

CONTINUE

- Evaluate brain abnormalities, such as tumors, memory disorders and seizures and other central nervous system disorders.
- To map normal human brain and heart function.



Thank you.