**DEPARTMENT OF BIOMEDICAL ENGINEERING**

**III Semester**

**BM3301 SENSORS AND MEASUREMENTS**

**UNIT – 5**

## 5.6 Photographic recorder

**PHOTOGRAPHIC RECORDERS :**

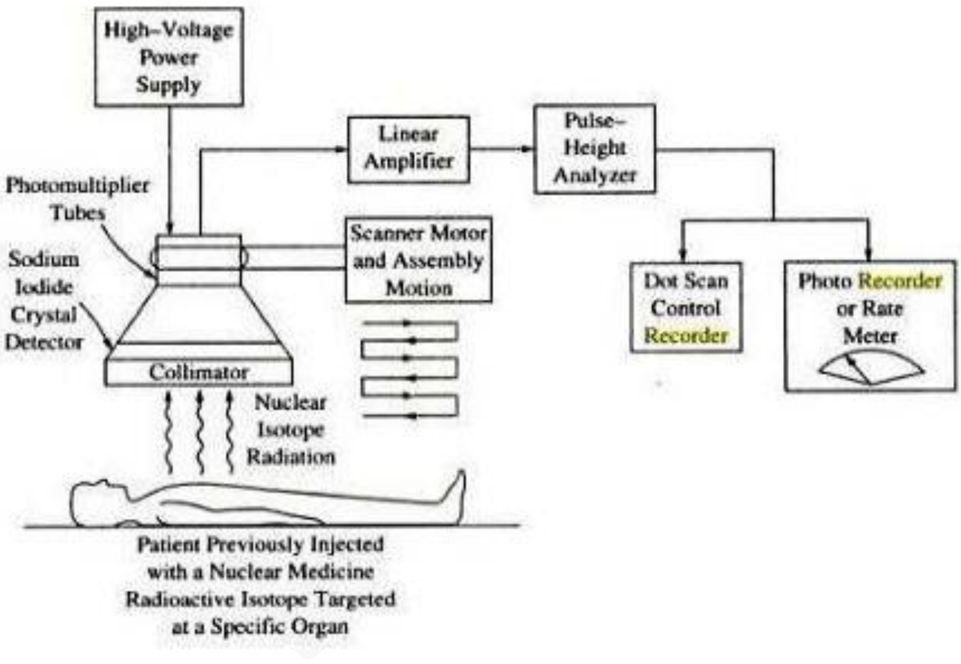


**Figure 1**: Simplified Block Diagram of a Nuclear Medicine system (Rectilinear Scanner)

The photographic recorder produces a photograph of light pulses. Recordings move simultaneously with the scanning device to produce one line scan in unison. Figure 1 illustrates the nuclear medicine system. The gamma rays camera is shown in figure 2, produces an image in a different manner than that of a scanner. Gamma rays interact with a large sodium iodide scintillation crystal in the camera and the scintillations (flashes) are observed by an array of photomultiplier tubes. Typically, 19 tubes are used, and a position analyzer evaluates the flashes from four crystal quadrants. Flashes are produced on an oscilloscope display when the gamma ray meets the pulseheight analyzer requirements. A Polaroid or 35mm camera photographs the flashes on the oscilloscope to produce a scintiphoto. Upto 500,000 counts, for e.g., may accumulate for brain scans on the CRT Screen.

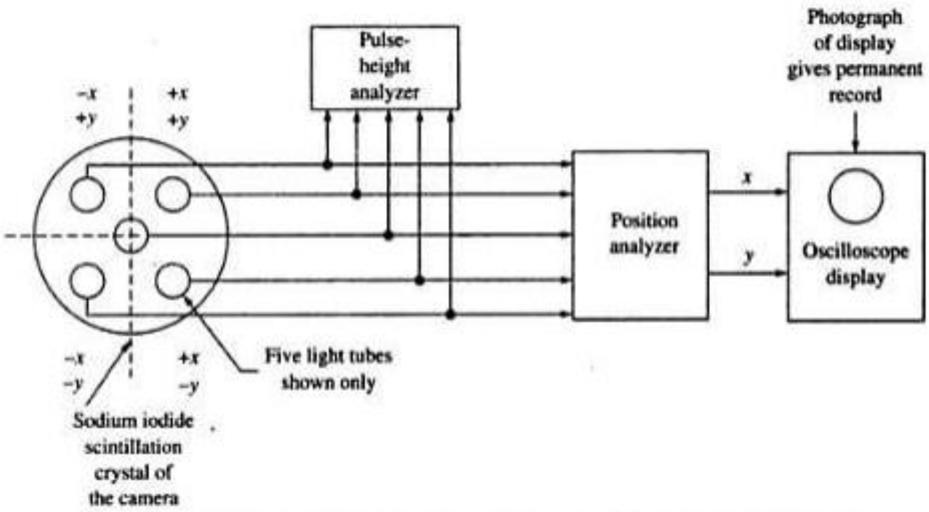


**Figure 2: simplified Block Diagram of Gamma Ray Camera.**

1. The radiopharmaceutical or medical tracer is processed by the body and **concentrates** in certain locations, depending on how the body transports the compound. Gamma photons are emitted from the tracer in all directions, with **emission intensity being proportional to the concentration of radiopharmaceutical** in that area.
2. Photons that travel towards the gamma camera first meet the **collimator**. The function of this component is to allow only those photons to pass that are travelling **parallel to the camera axis**. This is necessary because the camera only produces an image of the region directly below it. If off-axis photons were allowed to pass through, there would be no way to determine where they originated, which would reduce the accuracy of the image. The collimator consists of a **honeycomb-shaped grid of thin lead tubes**. This means photons that travel along the camera

axis will pass through the tubes, while an off-axis photon will hit the side of a tube and be absorbed.

3. After passing through the collimator, the photons arrive at the **scintillator** layer. This is a component that absorbs a **single high-energy gamma photon** and **emits thousands of lower-energy visible light photons**. The probability of a gamma photon interacting with the scintillator to produce this effect is about **1 in 10**, meaning 90% of gamma photons go undetected by the camera. There are several materials the scintillator can be made from, with the most common being **sodium iodide**.
4. The visible light photons emitted by the scintillator pass through a **light guide** into the **PhotoMultiplier Tubes** (**PMTs**). The function of these tubes is to convert the visible light photons into an electric pulse proportional to their intensity. The detail of how this is achieved is covered later. The PMTs are arranged in a **hexagonal grid**, with the electrical pulse output of each being connected to a computer. Software processes the arrivals of electrical pulses to calculate **photon impact positions** on the scintillator layer. These impact positions are then used to produce a high-quality representation of the medical tracer concentrations within the patient's body.

A key difference between x-ray imaging techniques and a gamma camera image is that while x-rays are used to see the **body anatomy**, the gamma camera is used to view the **body function and processes**.

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