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Department of Biomedical Engineering

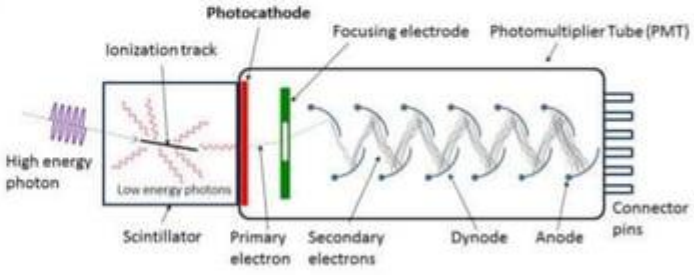
Course Name: 19BME301 – Medical Physics

III Year : V Semester

Unit IV –PRINCIPLES OF RADIATION DETECTOR

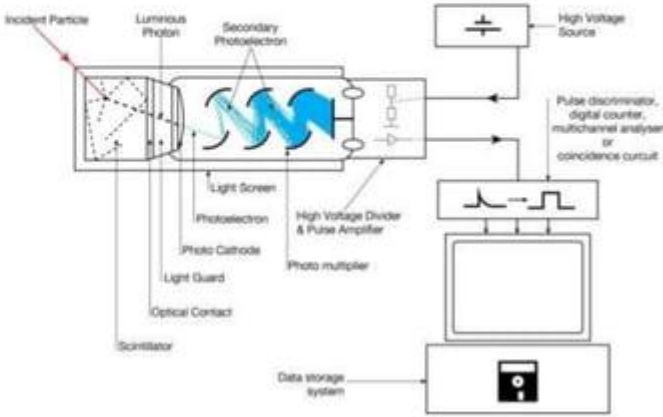
Scintillation counter

scintillation counter is an instrument for detecting and measuring ionizing radiation by using the excitation effect of incident radiation on a scintillator material, and detecting the resultant light pulses.



Structure of Scintillation counter

- It consists of a scintillator which generates photons in response to incident radiation. a sensitive photomultiplier tube (PMT) which converts the light to an electrical signal and electronics to process this signal.
- Sciontillator consists of a transparent crystal, usually a phosphor, plastic or organic liquid.

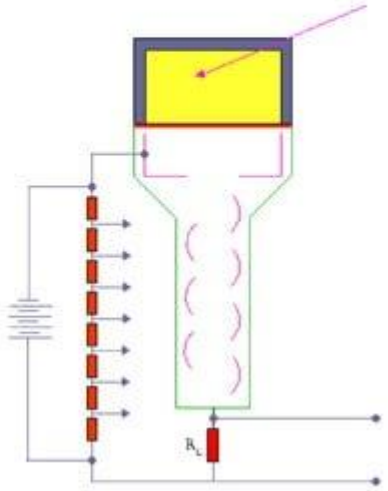


Principle

- When high energy atomic radiations are incident on a surface coated with some fluorescent material, then flashes of lights are produced.
- The scintillations are detected with the help of a photomultiplier tube that gives rise to an equivalent electric pulse.

Working

- When an ionizing particle passes into the scintillator material, atoms are ionized along a track.
- The photon from the scintillation strikes a photocathode and emits an electron which accelerated by a pulse and produce a voltage across the external resistance
- This voltage is amplified and recorded by an electronic counter.

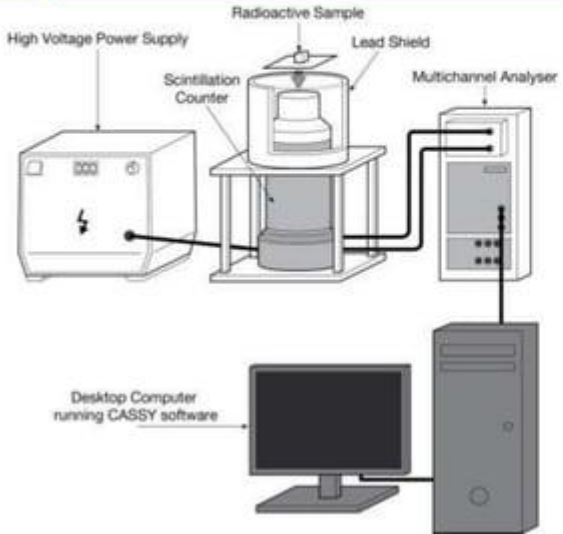


Application

- Scintillation counters are used to measure radiation in a variety of applications including hand held radiation survey meters, personnel and environmental monitoring for radioactive contamination, medical imaging, radiometric assay, nuclear security and nuclear plant safety.
- scintillation counters designed for freight terminals, border security, ports, weigh bridge applications, scrap metal yards and contamination monitoring of nuclear waste.

Important: There are variants of scintillation counters mounted on pick-up trucks and helicopters for rapid response in case of a security situation due to dirty bombs or radioactive waste.

Scintillation counter as a spectrometer



- The spectrometer consists of a suitable scintillator crystal, a photomultiplier tube, and a circuit for measuring the height of the pulses produced by the photomultiplier.
- The pulses are counted and sorted by their height.
- A monochromatic gamma radiation produces a photopeak at its energy. The detector also shows response at the lower energies, caused by Compton scattering.
- . Higher energies can be measured when two or more photons strike the detector almost simultaneously

Thank You