SCINTILLATION COUNTER

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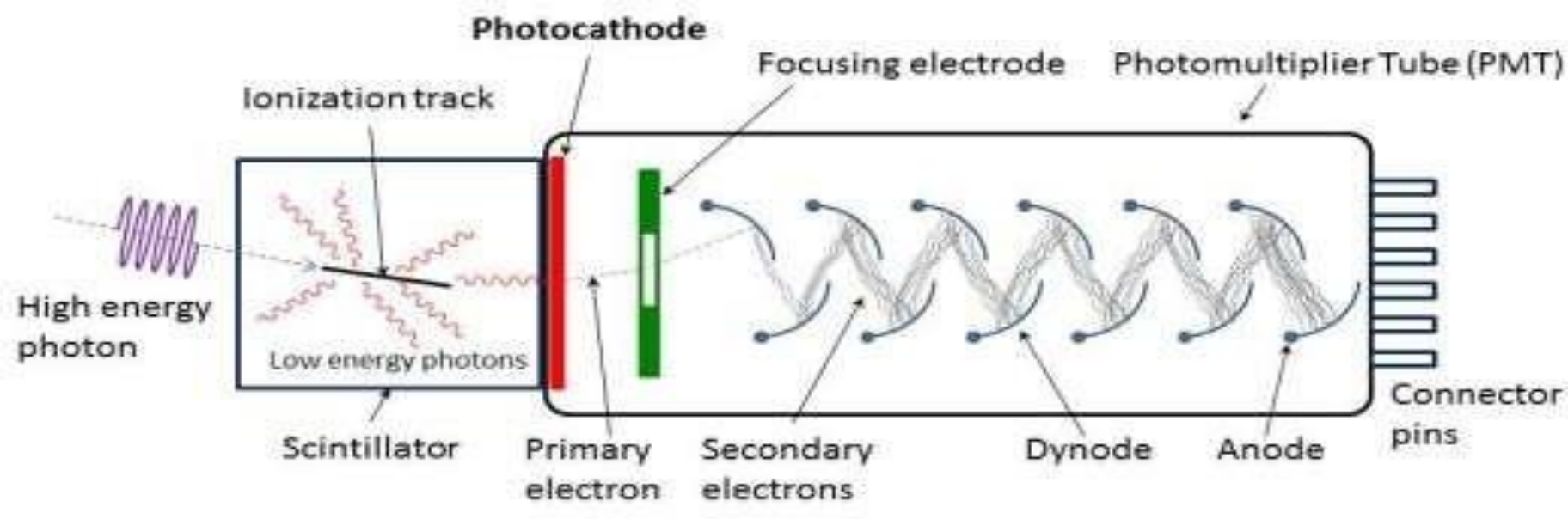
Scintillation Counter

Scintillation Counter is a nuclear detector that is used for detecting and measuring ionizing radiation by using excitation effect of incident radiation on a scintillator material.

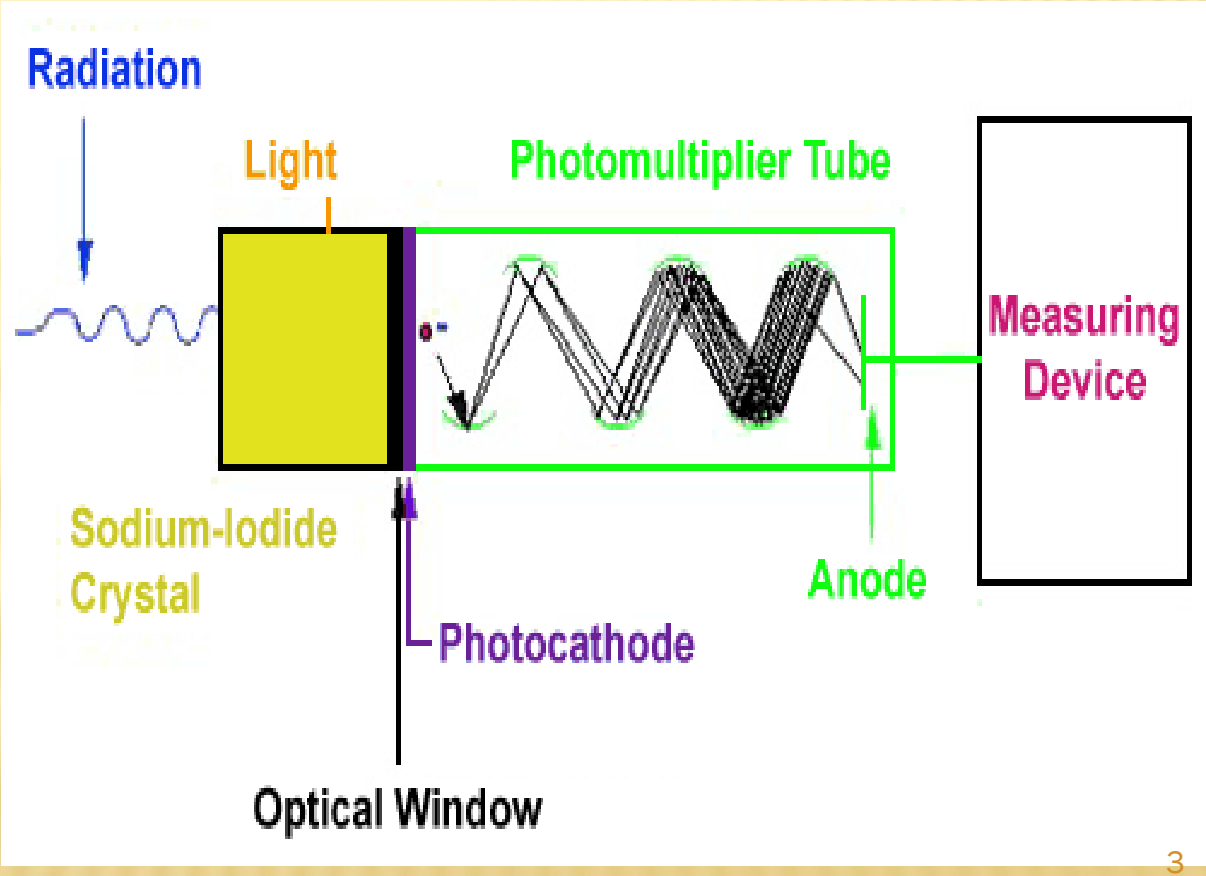


Construction

It consists of

1-Scintillator

2-Photomultiplier (PM) Tube



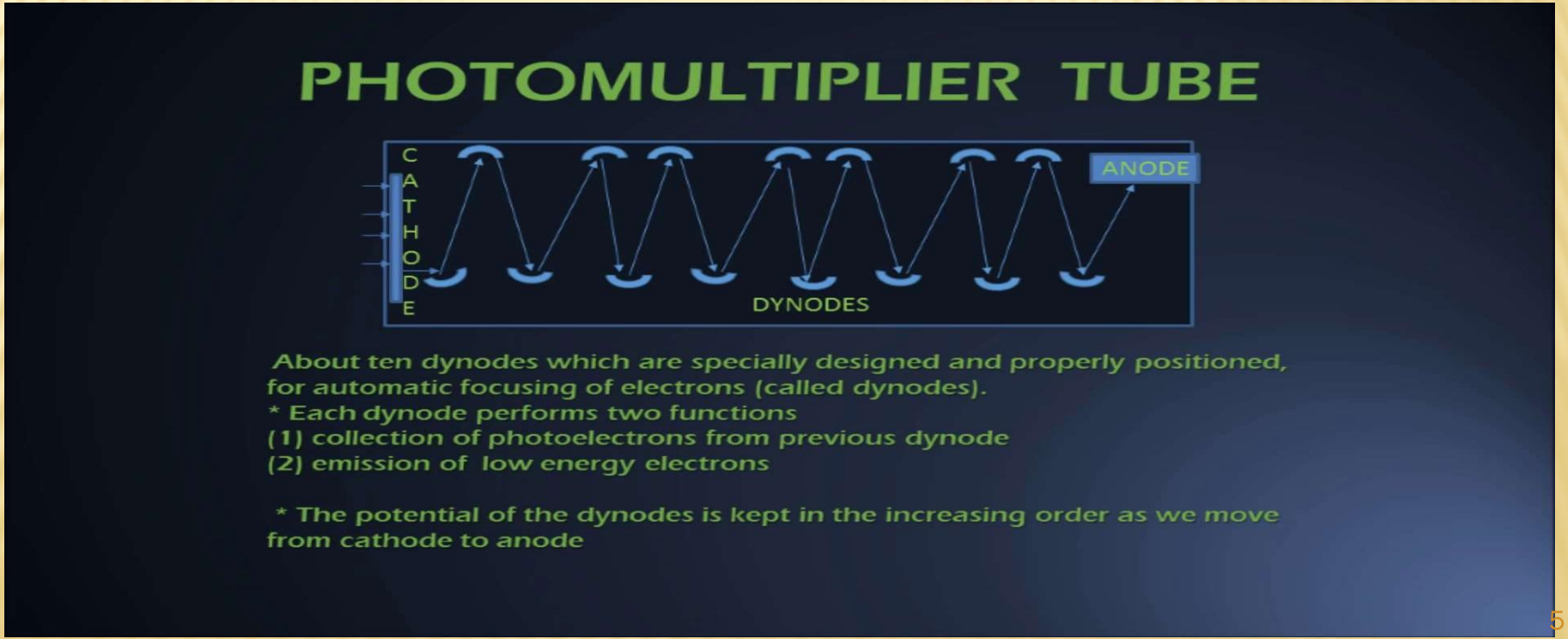
Scintillator

Scintillation is the act of giving off light. Scintillator material has the ability to scintillate when exposed to radiation which generates photons in response to incident radiation. Following scintillation material is used

- Zinc sulfide (ZnS) is widely **used** for alpha particles
- Cesium iodide (CsI) for the detection of protons and alpha particles.
- Sodium iodide (NaI) containing a small amount of thallium for the detection of x-rays and gamma rays
- For detection of beta particles, organic Scintillator can be used. Pure organic crystals include crystals of anthracene $C_{14}H_{10}$ and naphthalene $C_{10}H_8$

Photomultiplier(PM)Tube

The PM tube uses a photocathode material to convert each pulse of light into an electron, and then amplifies that signal significantly in order to generate a voltage pulse that can then be read and interpreted by measuring device.



WORKING

•The radiations are allowed to enter the scintillator through a window made of Pyrex-glass.

•When high energy radiations strike the crystal, short duration scintillations are emitted.

•The photons of light emitted by the scintillator, are made to strike the photo sensitive cathode of photomultiplier tube.

• The photoelectrons emitted from cathode, are directed towards 1st dynode that gives rise to secondary emission of electrons.

•The secondary electrons, emitted from the surface of 1st dynode, get accelerated towards 2nd dynode.(at higher potential in comparison to 1st).

•This process repeats up to the last dynode and the electrons get much more multiplied in number. A high energy pulse is delivered to the counting device through the anode (also called collector of PM tube).

• The electric pulse from the PM tube, is amplified and is then delivered to the electronic counting device, through a discriminator (that removes the undesired noise pulses).

Applications:

Due to their high sensitivity and their potential ability to “identify” radioactive sources, scintillation detectors are particularly useful for radiation security applications.

1-Handheld devices used to screen containers for hidden or shielded radioactive material

2- Personnel and environmental monitoring for radioactive contamination

3- Medical imaging,

4- Nuclear security and nuclear plant safety

5- Border and ports security

6-National and homeland security.