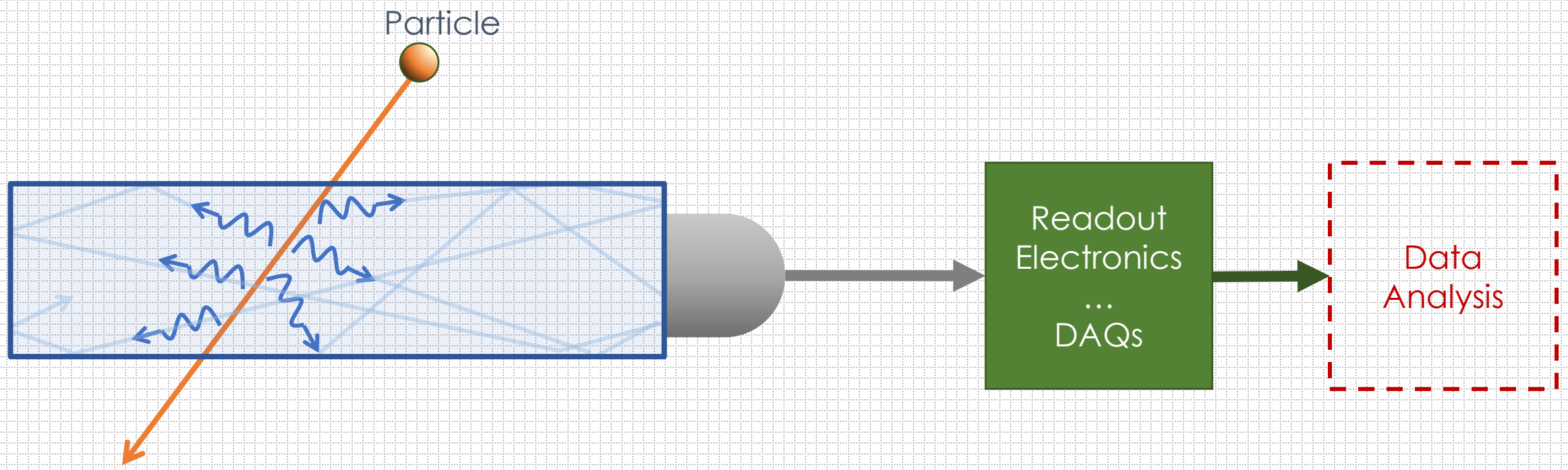
Mini Scintillator Detector for Charged Cosmic rays Detection

By POiS(ons)E

Overview of Detection Principle



Material with the luminescence property, when excited by ionizing radiation

Scintillated Light

Electronic Signal

Scintillator Detector

https://www.shalomeo.com/Scintillators/CsI-Tl%20/product-393.html

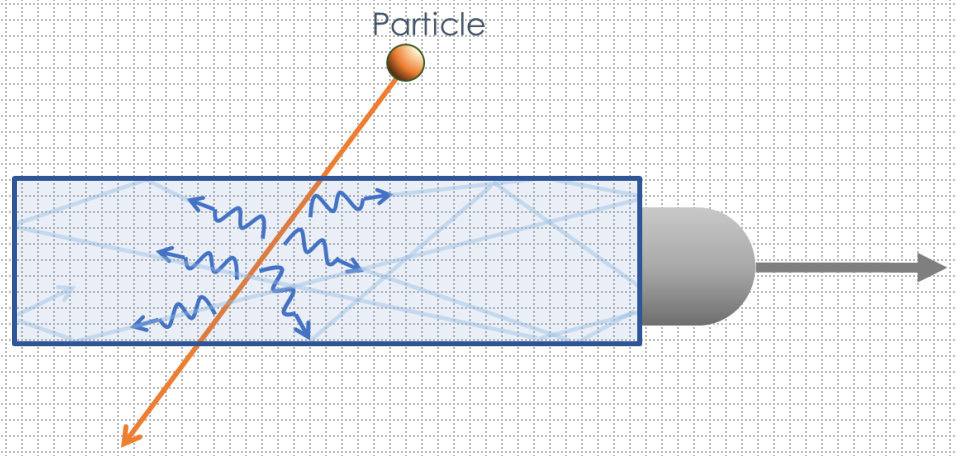
Inorganic Scintillator

- Usually crystals grown in high temperature
- Slow decay time
- High density

https://www.drdo.gov.in/drdo/sites/default/files/inline-files/CAT-A-PLASTIC_SCINTILLATOR_SENSORS.pdf

Plastic Scintillator

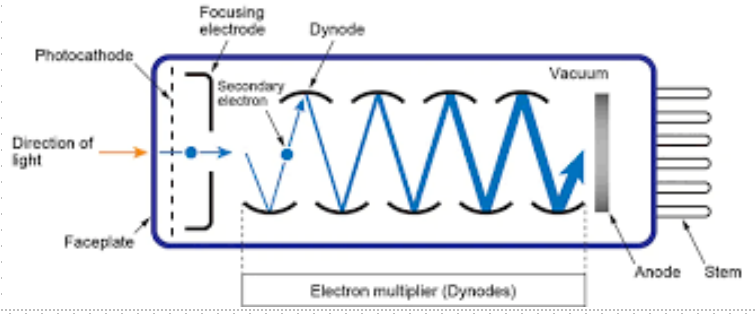
- primary fluorescent emitter in a solid polymer matrix.
- high light output
- relatively quick signal, with a decay time of 2–4 ns
- ability to be shaped



Material with the luminescence property, when excited by ionizing radiation

Scintillated Light
↕
Electronic Signal

Photomultiplier Tube

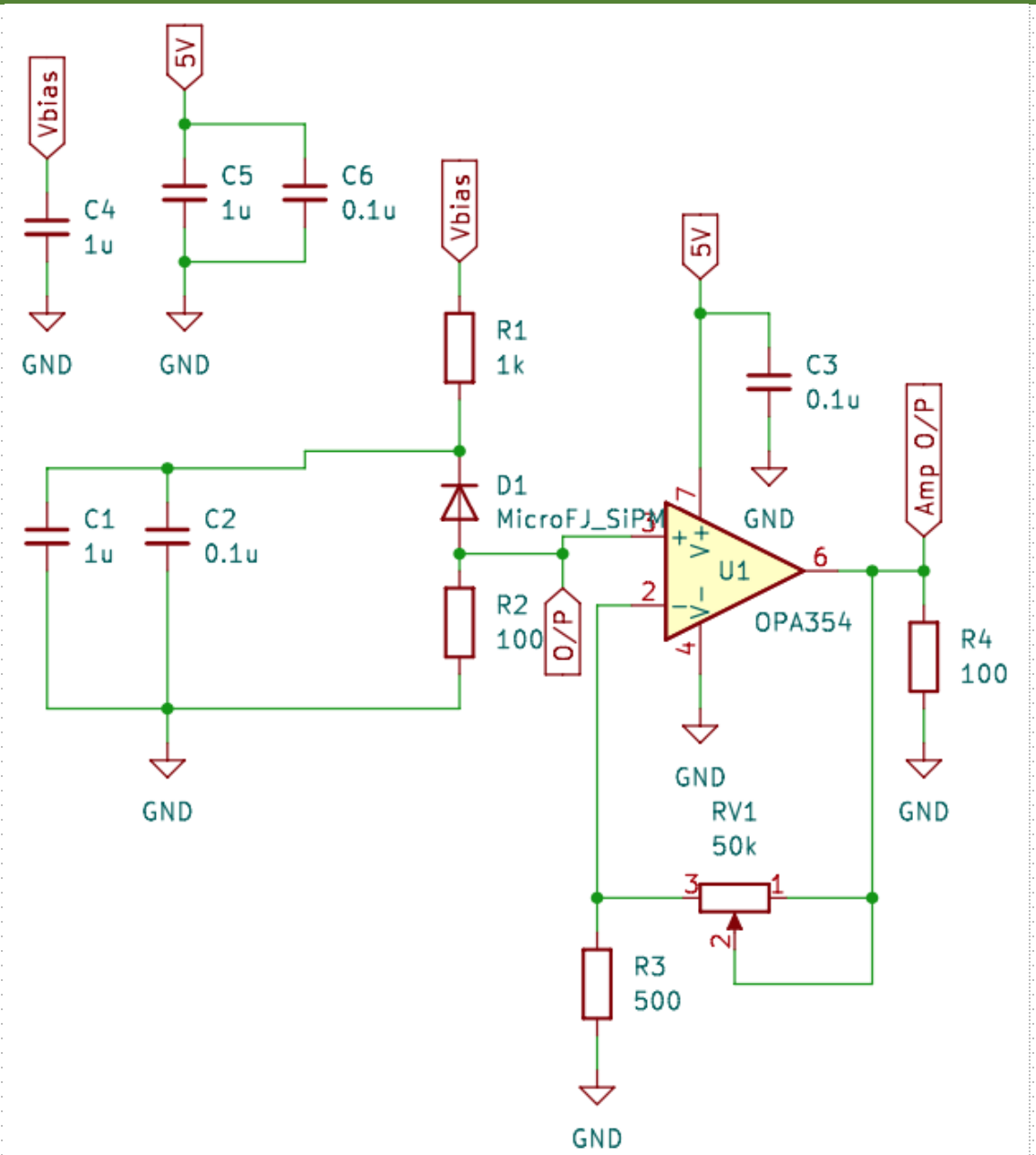


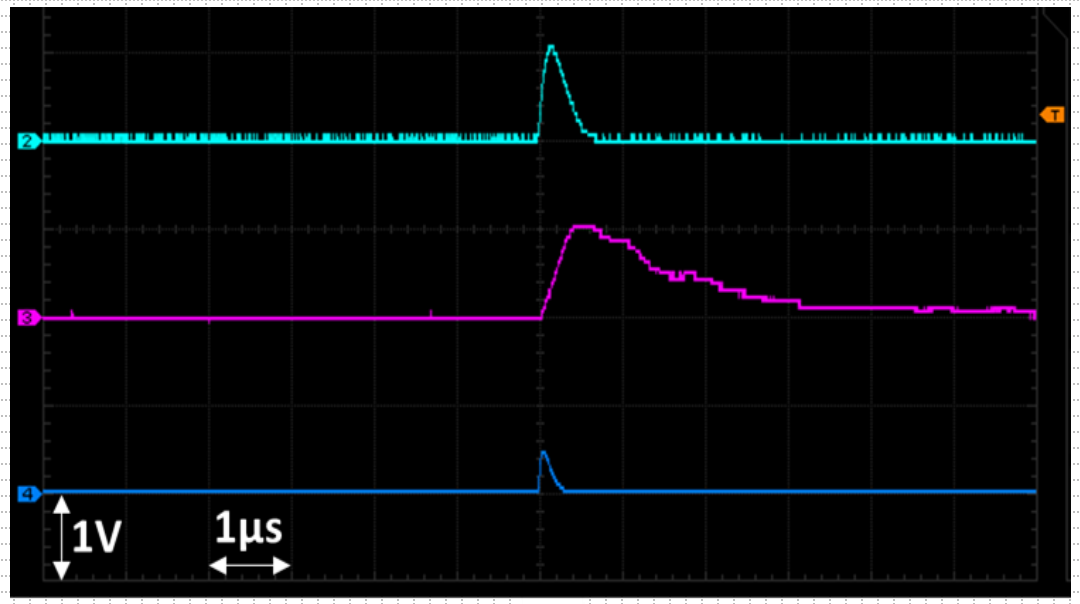
https://www.matsusada.com/application/ps/photomultiplier_tubes/

Si Photomultiplier

https://images.app.goo.gl/PFh7MgFbYHBo1Acy7

Readout Electronics : Preamplifier and Amplifier





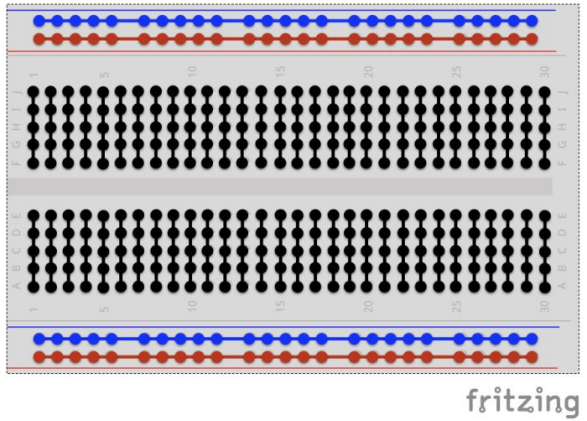
Scintillator Detector

TASK (1)

1. Seal the scintillator with reflector and light shield. (Leave a window for 3mm*3mm SiPM)
2. Connect SiPM to the scintillator using optical grease
3. Cover SiPM and the optical connection with the light shield
4. Connect the SiPM to the readout circuit

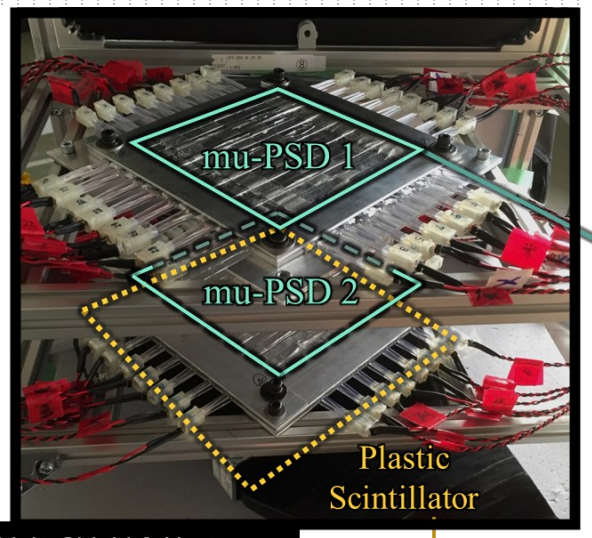
TASK (2)

Connections on Breadboard

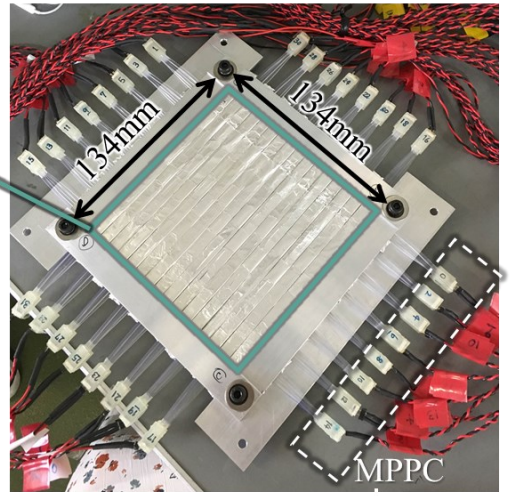


1. Prepare the preamplifier circuit on the breadboard
2. Connect to the SiPM, power board and oscilloscope
3. Test the circuit with the standard radiation source
4. Let's measure the charged cosmic ray!

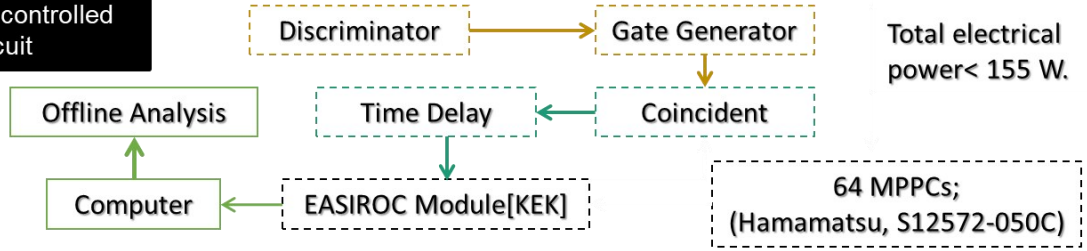
Muography



~ 8.4 mm x 8.4 mm of one-pixel detection area



- Light Shield & Heat Insulator
- Temperature controlled by Peltier circuit



Total electrical power< 155 W.

64 MPPCs;
(Hamamatsu, S12572-050C)