

Photodiode detectors for charged particles

General description

In particle physics experiments, square or rectangular CsI(Tl) crystals are combined into arrays or matrices to detect particles, usually in a E/ Δ E setup with silicon detectors in front of the units.

Scionix has developed a special detector unit for these applications for which the specifications are described. A CsI(Tl) scintillation crystal is read out with an 18 x 18 mm active area photodiode whose signals are detected with a charge sensitive pre-amplifier.

The electronic assembly is mounted at the back of the photodiode which is optimal for the signal-to-noise ratio. The board for the electronics is within the outer dimensions of the crystal so that multiple detector elements can be mounted together.

The electronics operate on a ± 12 V and a 30 V bias voltage, which is required to deplete the photodiode. These voltages are fed via a flat cable connector to the electronics. The signal is fed out via the flat cable or an optional Lemo connector.

The output gain can be chosen on order. A high gain may cause pulse clipping at high particle energies. Preamplifiers are interchangeable since they are mounted in an IC socket.



The crystal is wrapped in a special selected inert reflective material that will ensure many years of optimum crystal performance. The reflector is covered with 50 μ m aluminized mylar for protection. The entrance side of the crystal is covered with 6 μ m thick aluminized mylar.

Optional 1.5 – 2 μ m mylar is available for minimal absorption of particle energy.

The thickness of the crystal can be selected, but usually a thickness of 25 – 30 mm is advised. This is sufficient to stop 100 MeV protons.

Note: Other sizes and configurations upon request.

Specifications

Detector model :

V50PM25/18-E2-Cs-X

Scintillation crystal : 50 x 50 x 25 mm CsI(Tl), tapered from 10 mm high towards 18 x 18 mm

Maximum proton energy :

100 MeV protons

Readout : 18 x 18 mm photodiode Hamamatsu S3204-08

Preamplifier : Charge sensitive, 30 V/pC Max gain can be chosen (specify pulse output at 5.5 MeV alphas)

Power requirements:

+12 V (160 mW), -12 V (30 mW)

Output impedance: 50 ohm

Detector gain:

approx. $2.0 \cdot 10^4$ e-h / MeV gamma

approx. $1.2 \cdot 10^4$ e-h / MeV alpha



Si-CsI(Tl) CHIMERA detector LNS INFN Catania (It)

Energy resolution:

approx. 16% FWHM for 662 keV

approx. 3.8% FWHM for 5.5 MeV alphas (200 eV)

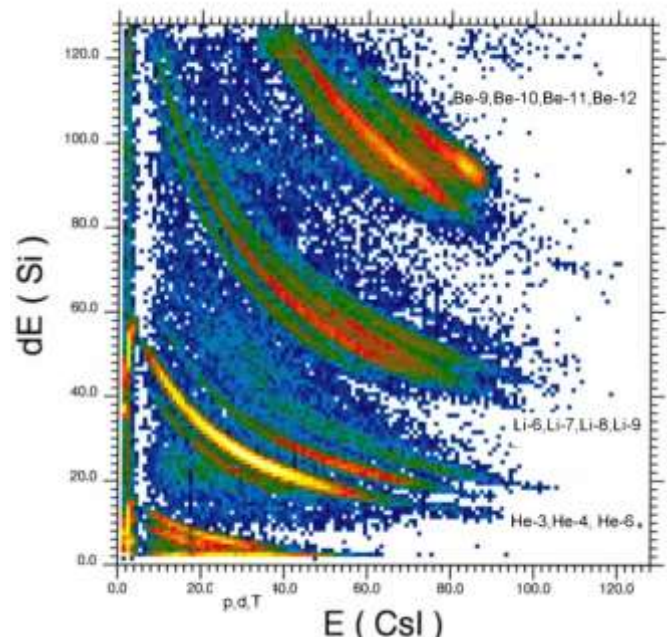
Noise level:

120-130 keV gammas (depending on shielding)

Gain variation between units: < 10% maximum

Note:

Unit is NOT light tight and should be used in a vacuum vessel where no light is present. Testing to be performed in a light tight testbox



Example of E/dE spectra