

Application Note

Photodiode detectors for charged particles

General description

In particle physics experiments, square or rectangular CsI(TI) crystals are combined into arrays or matrices to detect particles, usually in a $E/\Delta E$ 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(TI) 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 \pm 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 µm aluminized mylar for protection. The entrance side of the crystal is covered with 6 µm thick aluminized mylar.

Optional $1.5 - 2 \mu m$ 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.

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Specifications

Detector model : V50PM25/18-E2-Cs-X

Scintillation crystal : 50 x 50 x 25 mm CsI(TI), 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. $2.0.10^4$ e-h / MeV gamma approx. $1.2.10^4$ e-h / MeV alpha



Si-CsI(TI) 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



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