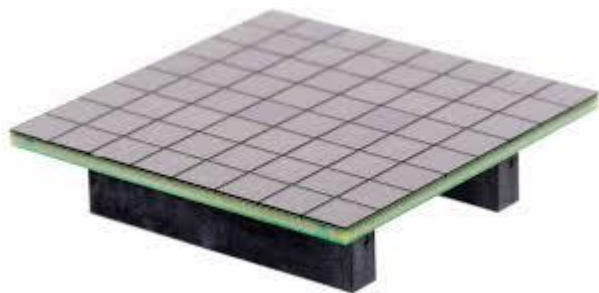


Scintillators with Silicon Photomultiplier readout



An alternative to the readout of scintillation crystals with photomultiplier tubes is the use of so-called silicon photomultipliers (SiPms)

- Low voltage operation (25-30 V)
- Insensitive to magnetic fields
- High gains (10^6)
- Mechanically compact
- Elements 3x3 of 6x6 mm

SiPm elements can be combined into matrices. SiPms can be reliably operated up to 60 degrees C.

Disadvantages of SiPms are :

- Linearity of pulse height spectrum strongly depending on bias and scintillator speed
- Temperature dependent gain
- noise at higher temperatures
- cost per cm^2

For applications where small size and low voltage operations are required, SiPm readout of scintillators can be a viable choice.

The gain of SiPms is a very strong function of the bias voltage which should be chosen carefully depending on the actual application of the detector.

The number of SiPms needed on a scintillation crystal depends on the requirements.

SCIONIX has developed a range of sensors equipped with SiPms for a great variety of applications.



SiPms behave totally different from classical photomultiplier tubes, as well with respect to signal processing as to spectroscopic behavior.

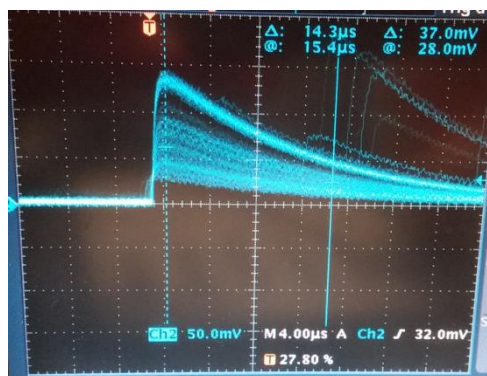


SCIONIX Application Note

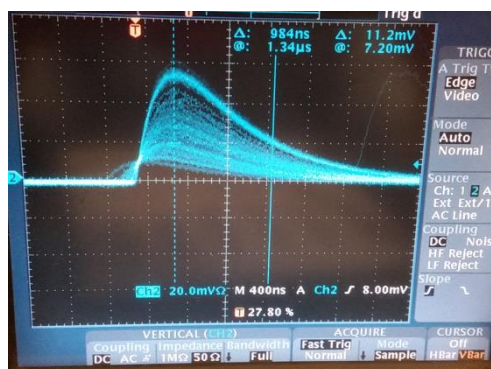
The energy resolution and noise level achievable with SiPm readout depends on the crystal dimensions, type of scintillator and area covered by the SiPm;

Signal shapes

The signal of a SiPm detector depends very strongly on the termination resistor. A typical example of a bare NaI(Tl) SiPm signal is shown below.

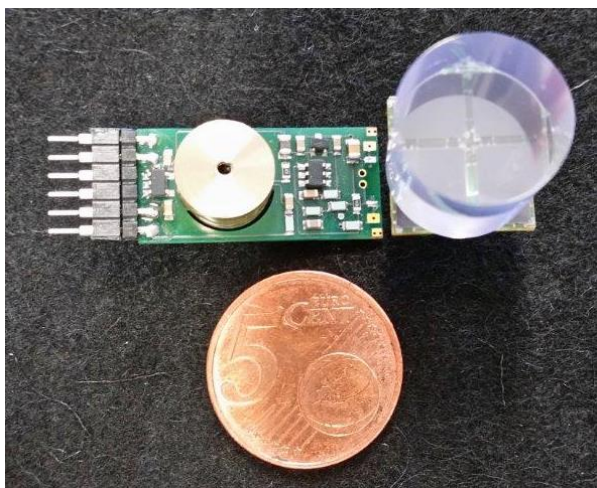


1 MΩ termination

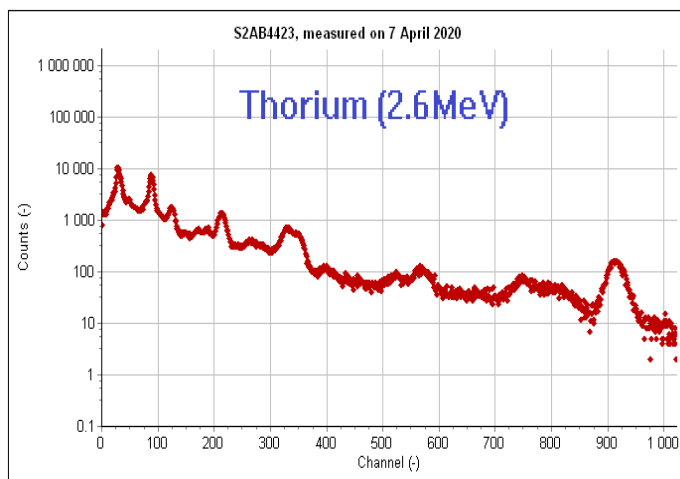


50 Ω termination

SCIONIX has developed bias generator / preamplifier modules for SiPm scintillation detectors. The gain drift as a function of temperature is internally corrected. Such modules operate at voltage 5.2 – 16V and consume less than 20 mW.



Bias generator / preamplifier for SiPms



Thorium spectrum of a 76x76 mm NaI(Tl) SiPm detector