

Cremlin+ Workshop: Silicon Photomultiplier Readout

Hands-On Review

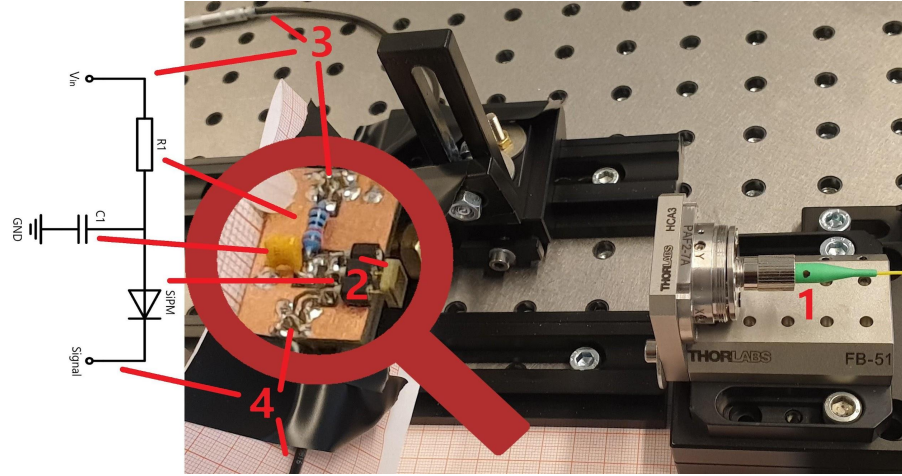
Experimental Setup

Originally proposed by Avetik

Picosecond laser light source with controls on pulse frequency and output intensity

SiPM with 3mm x 3mm effective area mounted to a simple readout circuit with 100k Ω resistor and 100nF capacitor

Power input of $\sim 31V$



Oscilloscope

WaveRunner 6 WR640ZI

Analog bandwidth (50 Ohm/1 MOhm): 4 GHz/400 Hz

Rise time: 100 ps

Up to 40 GS/s samplerate

12.1" touch screen display

Possibility to do online mathematical operations (creating histograms)

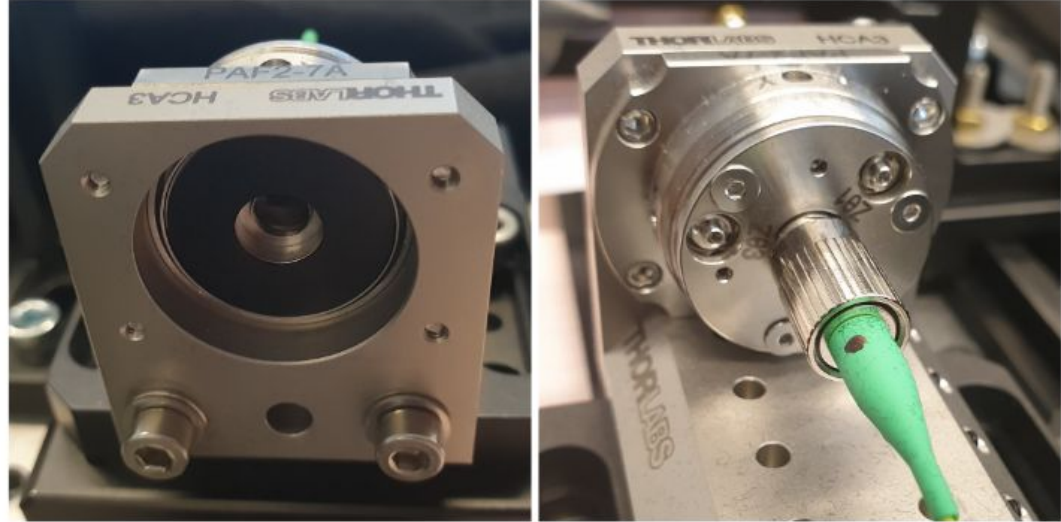


Laser & Collimator

Using collimator with
convex lens

Fiber optics with
FC/APC connector

Three screws for
adjusting distance
between lens and
optical fibre



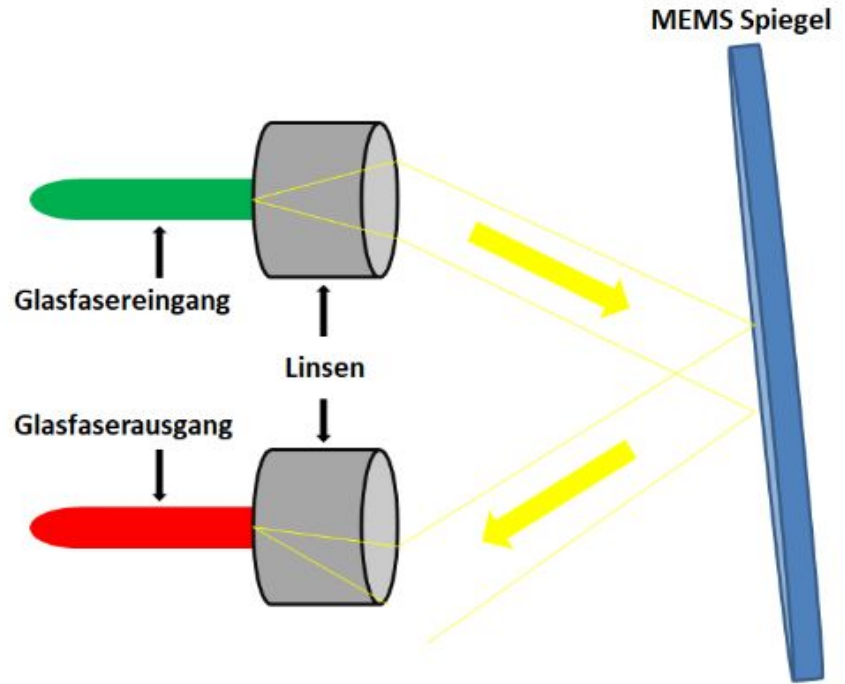
Attenuator

Attenuator required for reducing laser intensity

Tested with MEMS Variable Optical Attenuator (Micro-Electro-Mechanical Systems)

Voltage between 0 and 5 V to change mirror angle

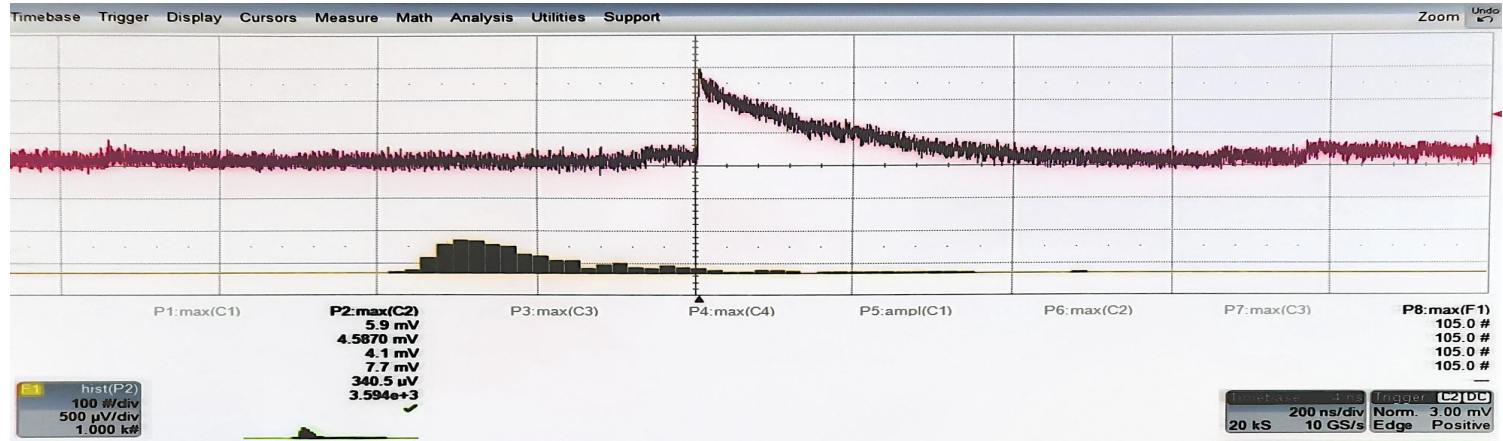
Voltage dependent output signal



Measuring Dark Counts

Triggering on dark counts with oscilloscope

Measuring rate/amplitude spectrum online with oscilloscope and offline by exporting data to ASCII

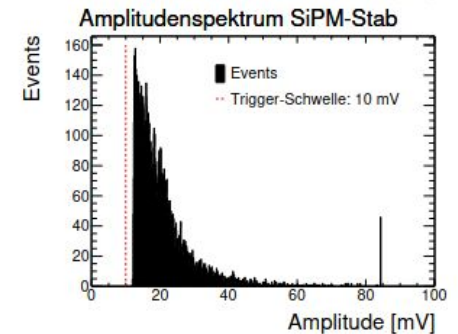
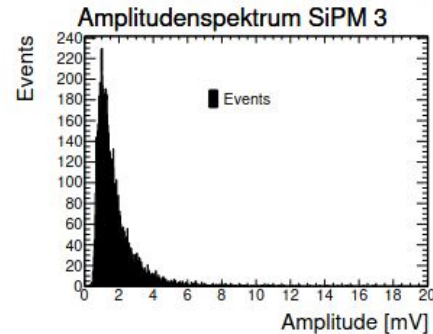
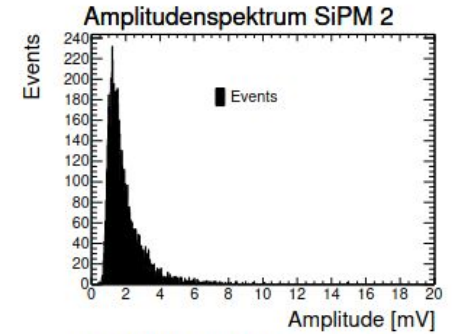
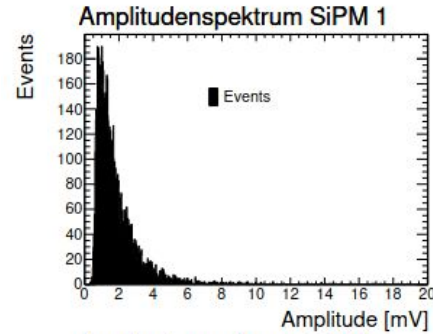


Amplitude Spectrum

Adjusting trigger threshold
to obtain clear signals

Measuring amplitude
spectrum with different
attenuator and bias voltages

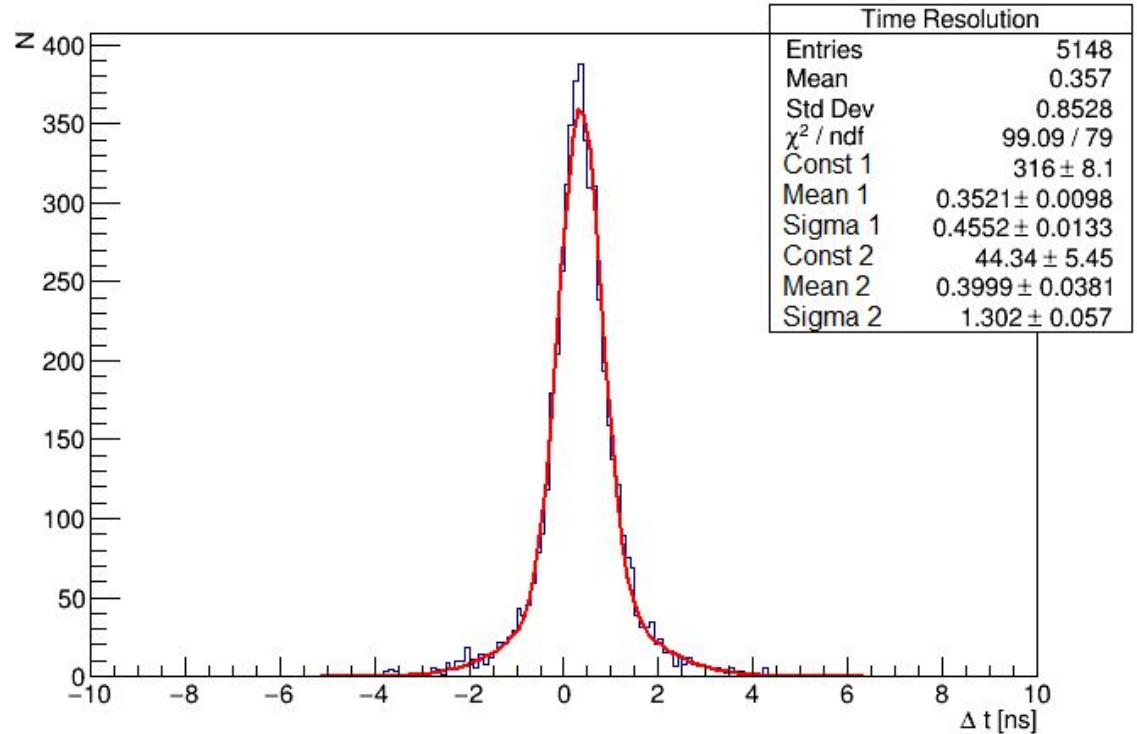
Plotting results with
ROOT/Gnuplot/PyPlot



Time Resolution

Using output signal from laser trigger and SiPM to determine time resolution

Many measurements with SiPMs, PMTs and MCP-PMTs in the past



Learning goals

Building simple setup with laser and single photon detectors (SiPMs/PMTs)

Using oscilloscopes for measuring detector signals

Understanding signal shapes, trigger thresholds, coincidence measurements

Creating histograms online with oscilloscope and offline with computer

Discussing amplitude spectrum with background

Determining time resolutions of single photon detectors