

# Characterization of the static and dynamic properties of a SiPM

## Task1: study of the static (DC) properties of SiPM

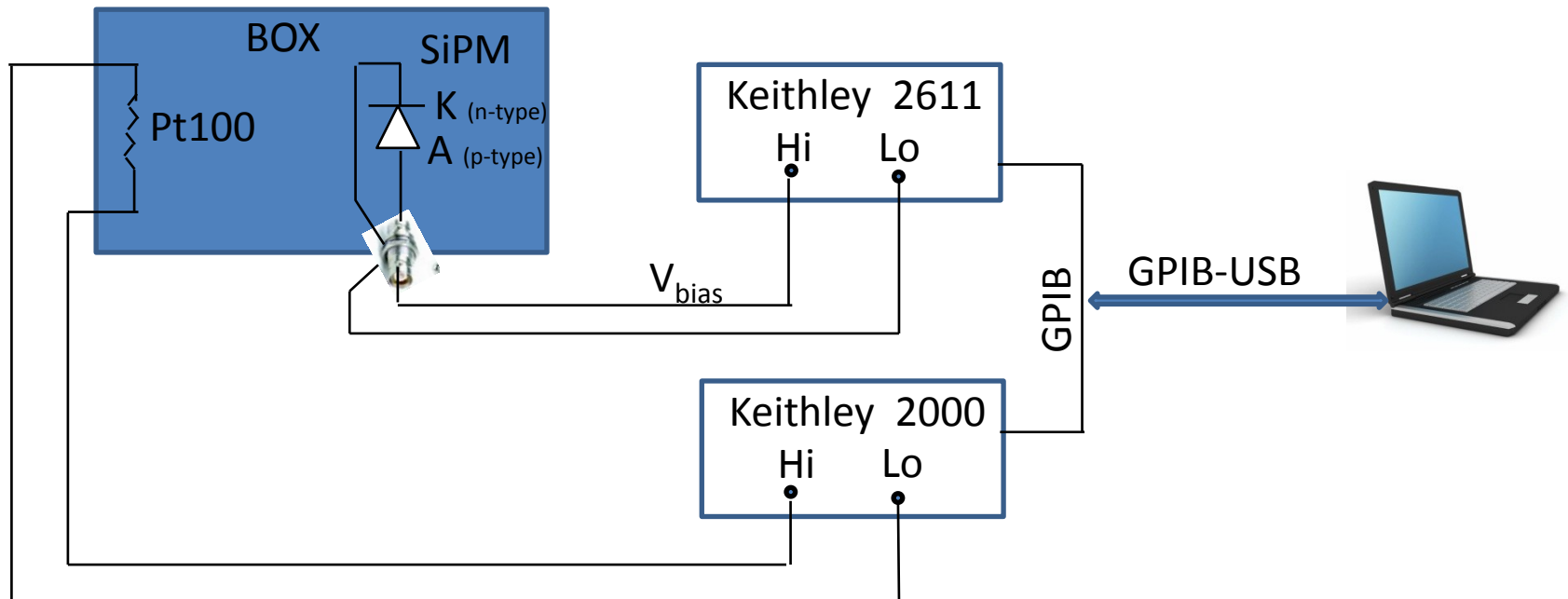
- SiPM in the dark; measurement of the current-voltage (IV) reverse characteristic; determination of the breakdown voltage  $V_{BD}$  and the Geiger-mode  $V_{bias}$  range

## Task2: study of the dynamic (AC) properties of the SiPM

- A. SiPM in the dark; measurement of the dark count rate (DCR) as a function of  $V_{bias}$  and threshold; analysis of different SiPM noise contributions: thermal generated carriers, afterpulses, cross-talk
- B. SiPM in the dark or light conditions; measurement of the charge histogram; gain calculation as a function of  $V_{bias}$

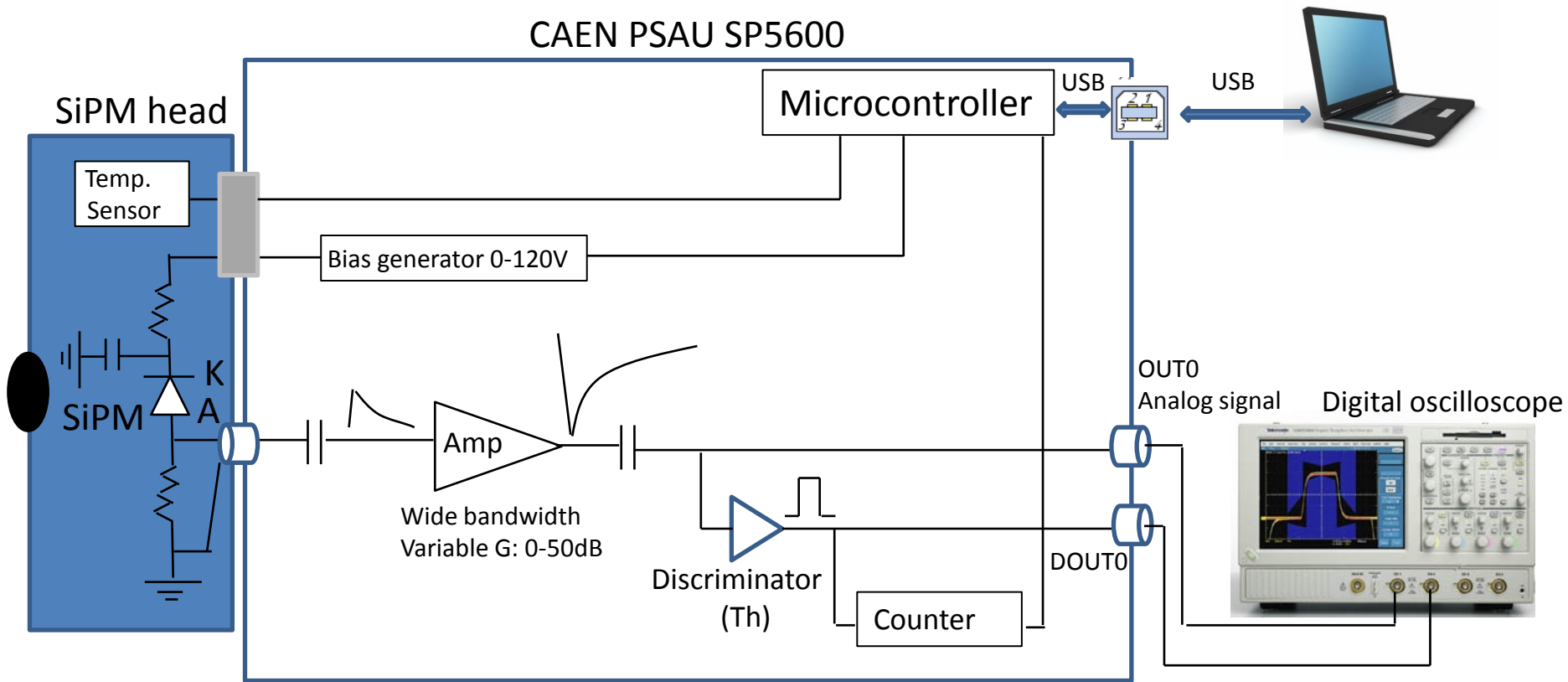
## Set-up of DC measurements (TASK1):

- SiPM: Hamamatsu MPPC S10362-11-050C\_499 (1mm<sup>2</sup> area, 50μm pixel size)
- Temperature sensor Pt100
- Keithley 2611 source-meter
- Keithley 2000 multimeter
- PC (Labview)



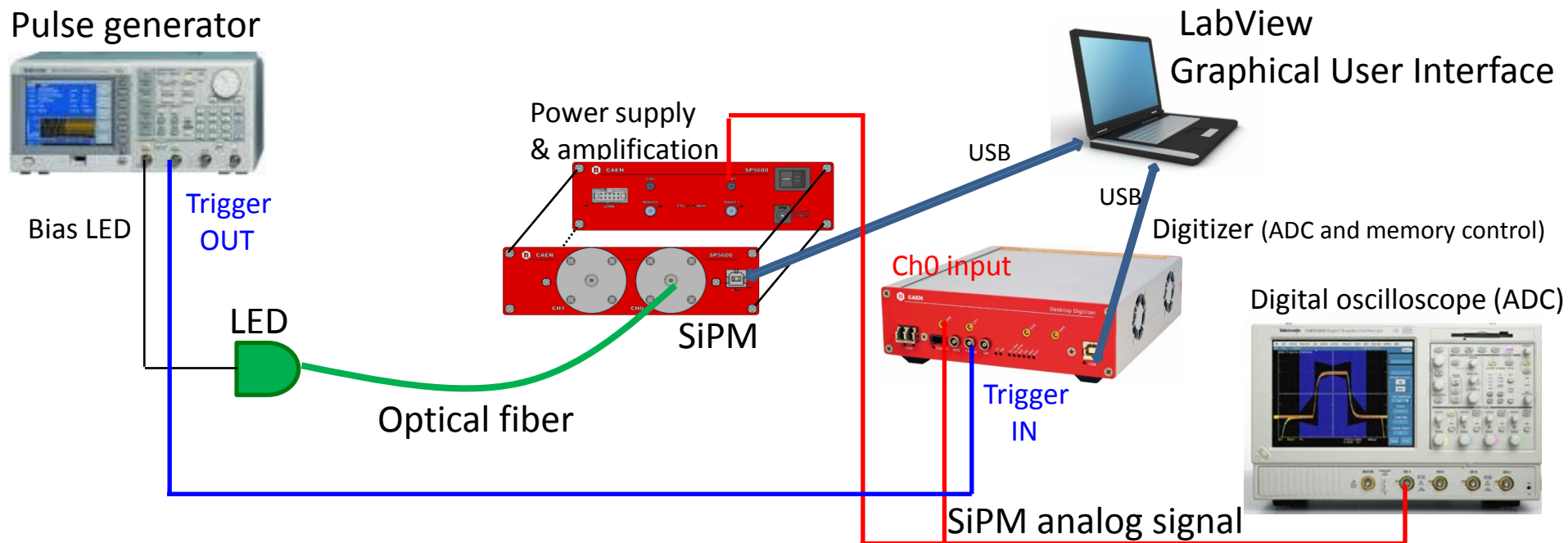
## Set-up of AC measurements TASK 2A (SiPM in the dark):

- SiPM : Hamamatsu MPPC S10362-11-050U\_3 (1mm<sup>2</sup> area, 50μm pixel size)
- CAEN SP5600 power supply & amplification unit & discriminator & counter
- Tektronix TDS 5054 Digital oscilloscope (digitization and visualization of SiPM signals)
- PC (LabView)



## Set-up of AC measurements TASK 2B (SiPM in dark or light conditions):

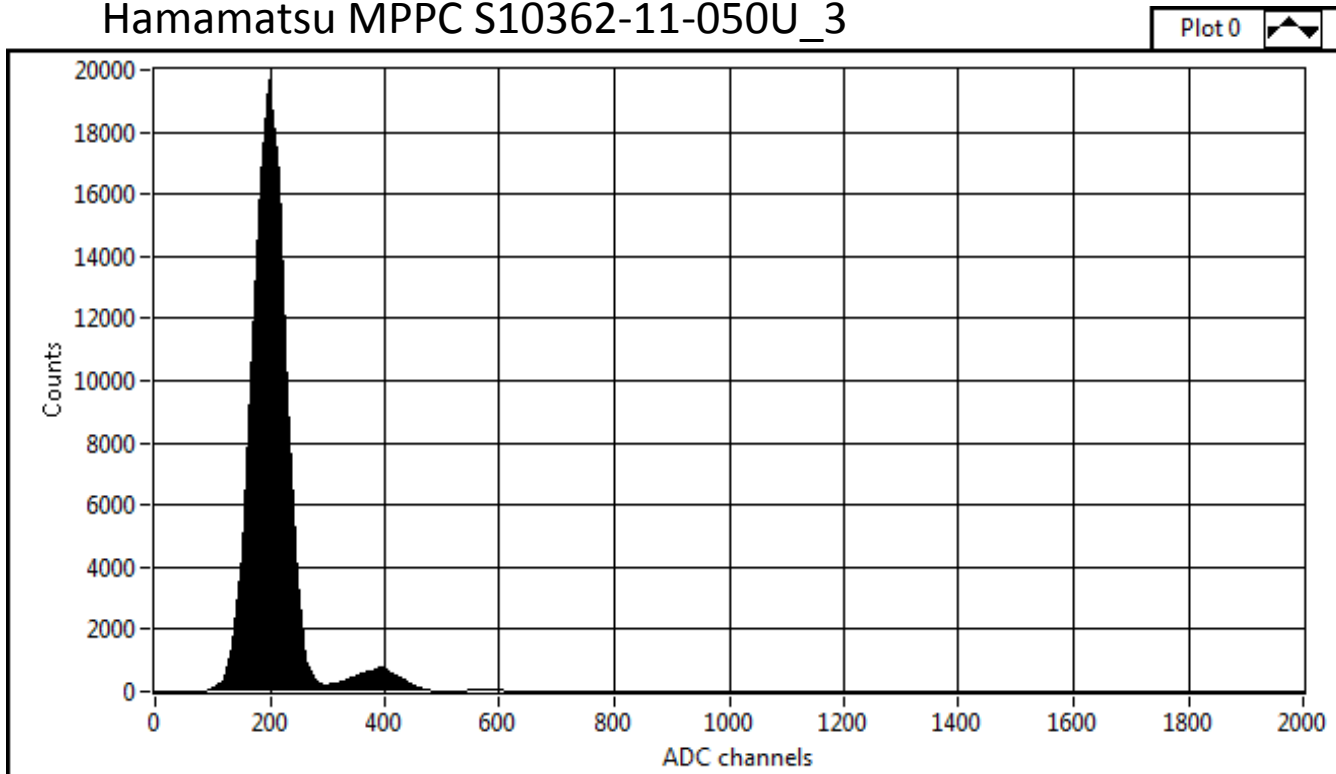
- SiPM : Hamamatsu MPPC S10362-11-050U\_3 (1mm<sup>2</sup> area, 50μm pixel size)
- CAEN SP5600 power supply & amplification unit (PSAU)
- Tektronix TDS 5054 Digital oscilloscope (digitization and visualization of SiPM signals)
- CAEN DT5720A desktop digitizer (digitization and analysis of SiPM signals; memory control)
- light source: green LED
- light transmission to the SiPM surface: optical fiber of FC type connectors
- Tektronix AFG 3252 pulse generator for LED pulsing
- PC (LabView)



## Principle of the G determination from the charge histogram

$$G_{SiPM} = \frac{Q_{pixel\ input\ amp}}{e} = \frac{Q_{output\ amp}}{e \times G_{amp}} = \frac{N_{ADCch} \times Q_{oneADCch}}{e \times G_{amp}}$$

Hamamatsu MPPC S10362-11-050U\_3

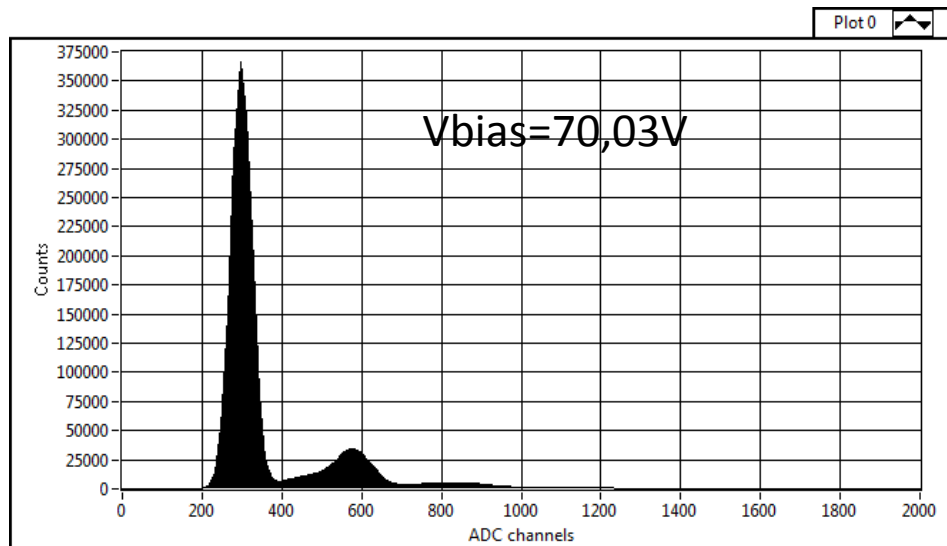
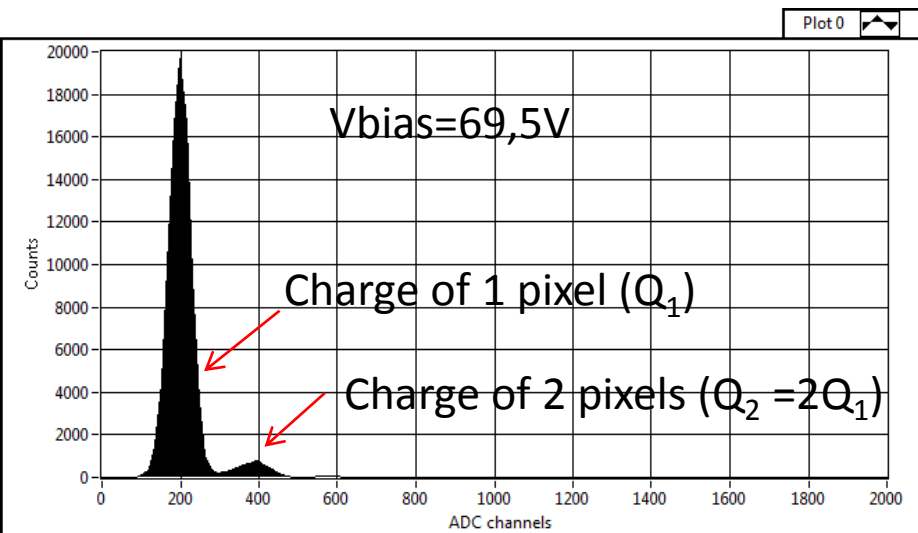


$$Q_{oneADCch} = 40\text{ fC}$$

$$G_{amp} = 10^{G_{amp\text{dB}}/20}$$

# SiPM charge histograms in the dark (self-trigger)

MPPC S10362-11-050U\_3



# SiPM charge histograms with pulsed LED (external trigger)

