Proceedings on embedded LED calibration system

## CALICE week IPNL Lyon, Sept. 2009

Sebastian Weber
University of Wuppertal

Overview

- Embedded LED calibration solution
  - One LED (+ circuit) above each tile

- Optimisation of LED circuit
- Position dependency of LED on tile
- First results of temperature behavior

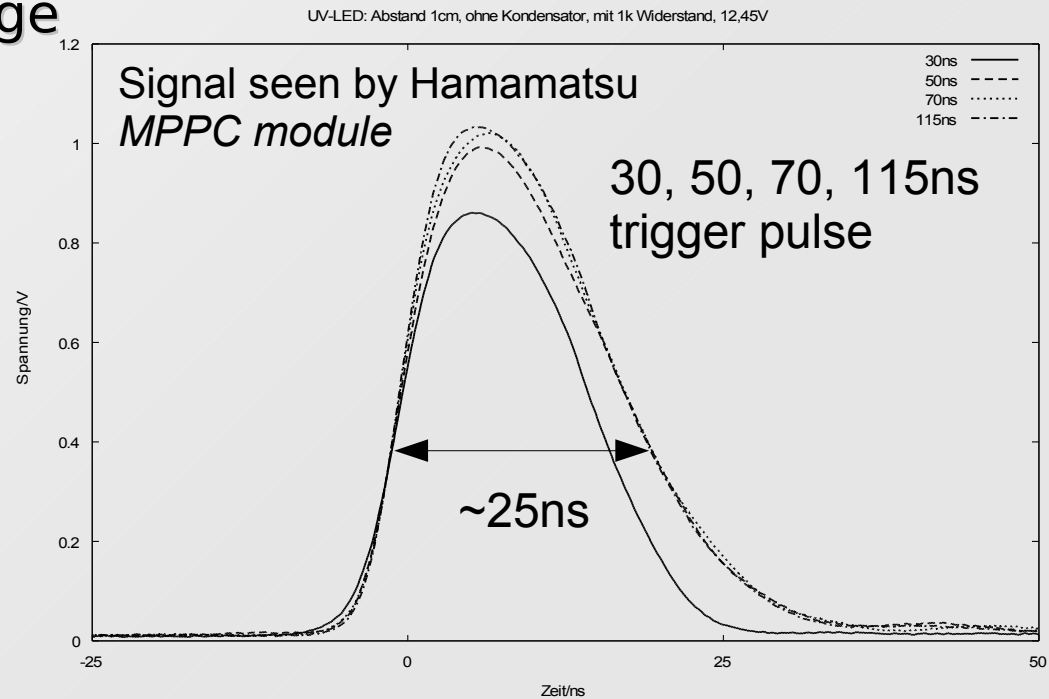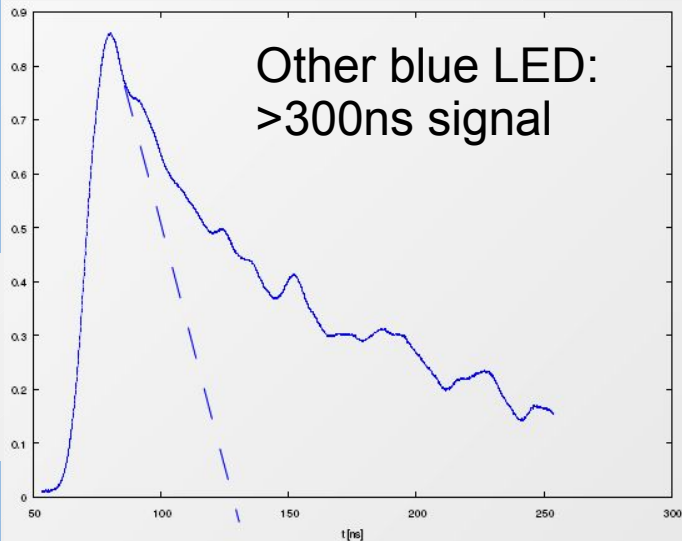## LED circuit optimisation

- Try different LEDs (UV, **blue**, green)
  - Blue would be better than UV

- Optimize Histogram and signal shape via
  - loading capacitor (100p-1n)
  - Resistor (100-1k)
  - Vcalib (up to 15V)
- Goal:

  - Short pulse
  - Good histogram

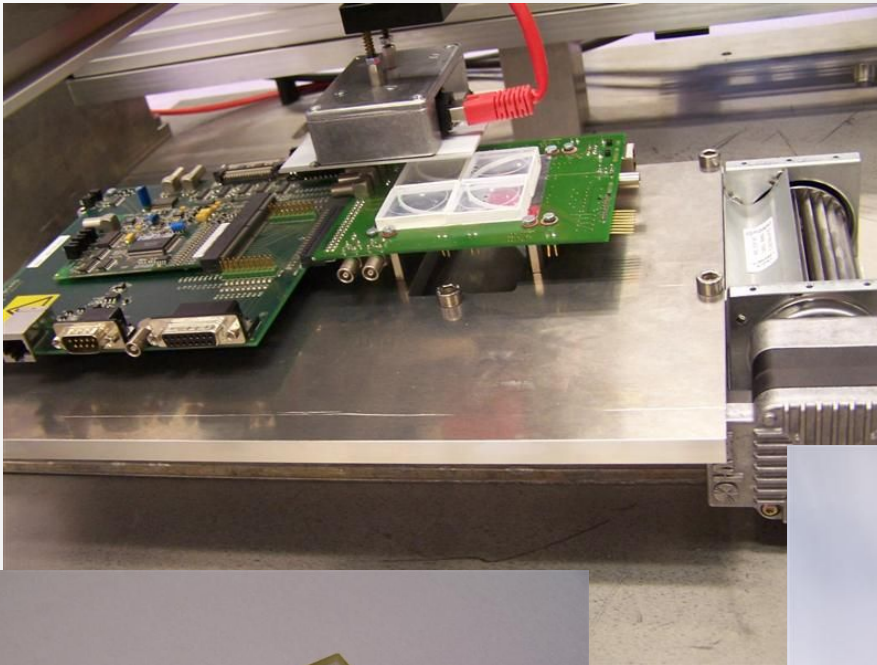 - *for wide range of Vcalib & parts*
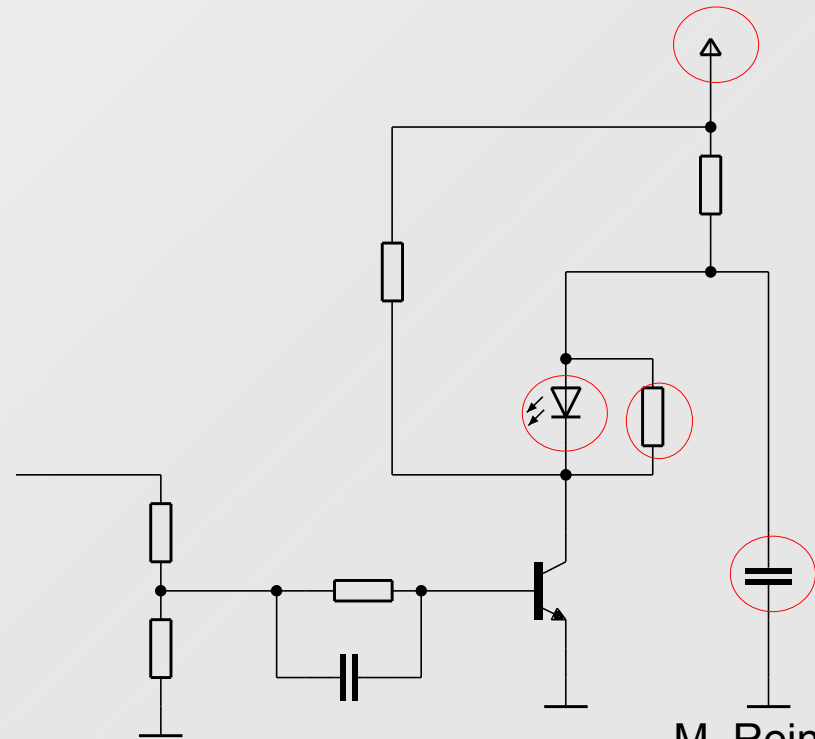
M. Reinecke

Results on circuit optimisation

- **Blue** LED *Osram LB M47C*
  - Good results in signal shape and timing behavior
  - Not the case for other blue LEDs
  - **We use this LED**

- Resistor in parallel to LED: independence from trigger pulse
  - But: larger capacitor, higher voltage (~11V instead ~4.8V) & sensitivy to voltage

UV-LED: Abstand 1cm, ohne Kondensator, mit 1k Widerstand, 12,45V

Other blue LED: >300ns signal

Signal seen by Hamamatsu *MPPC module*

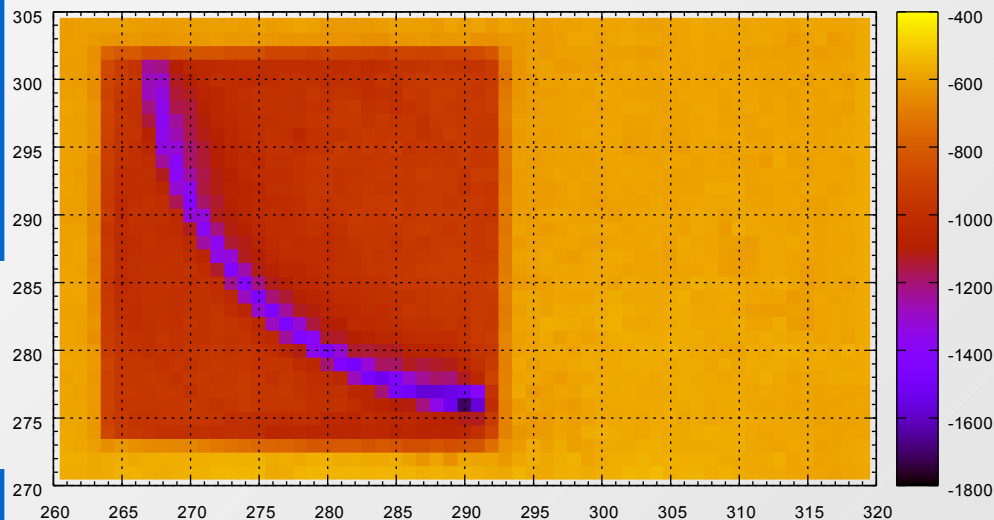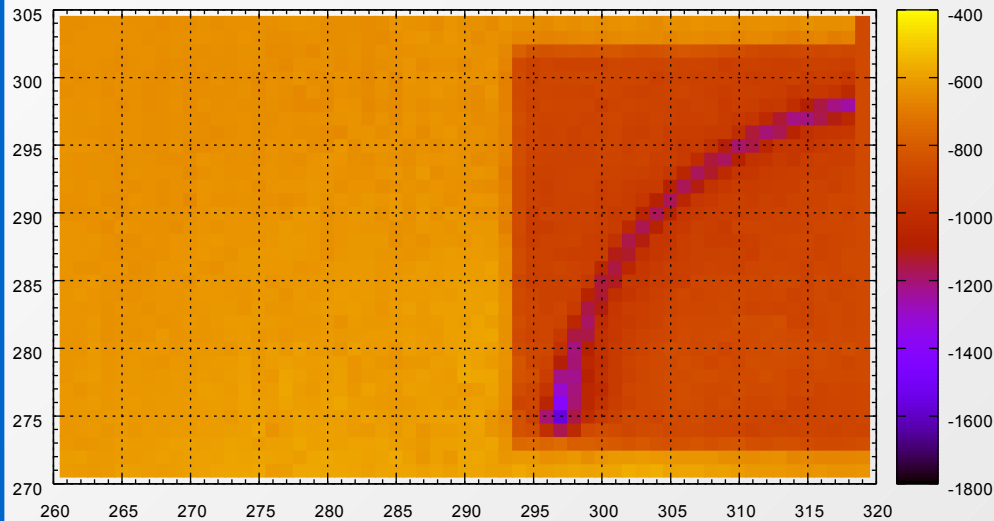30, 50, 70, 115ns trigger pulse

~25ns

XYZ-stage setup

- Tiles & HAB on heat exchanger
- Scanning head with exchangable LED PCB & mirror foil at positioning stage
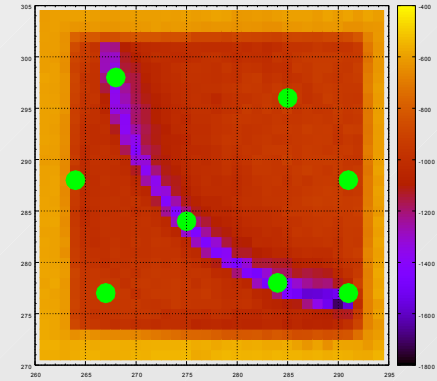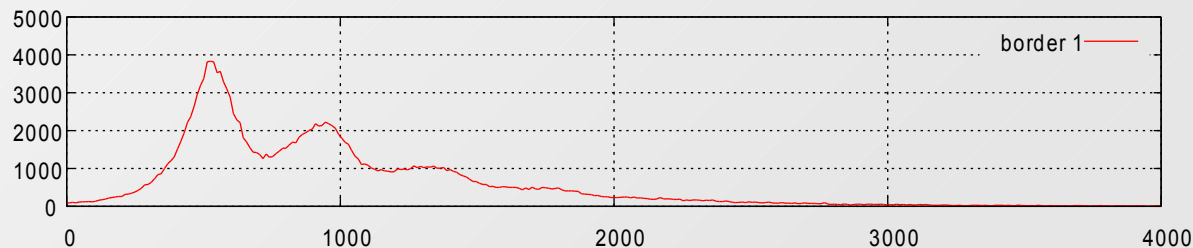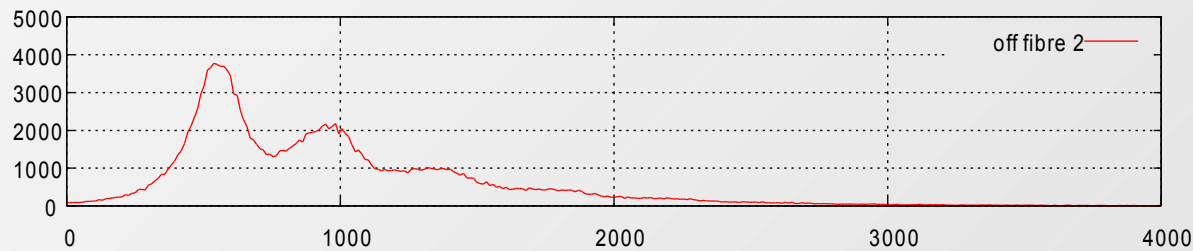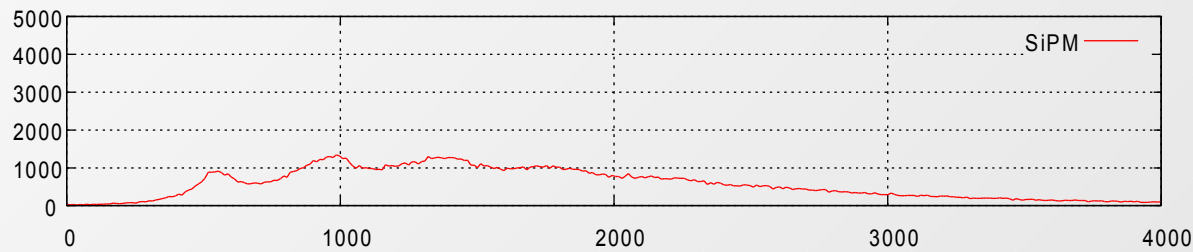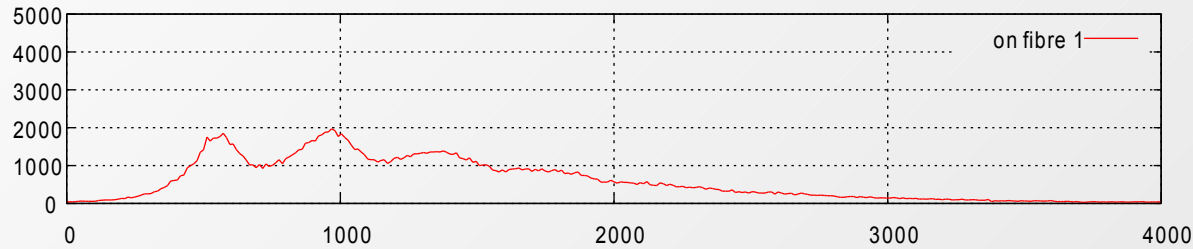- All inside insulating light-tight box
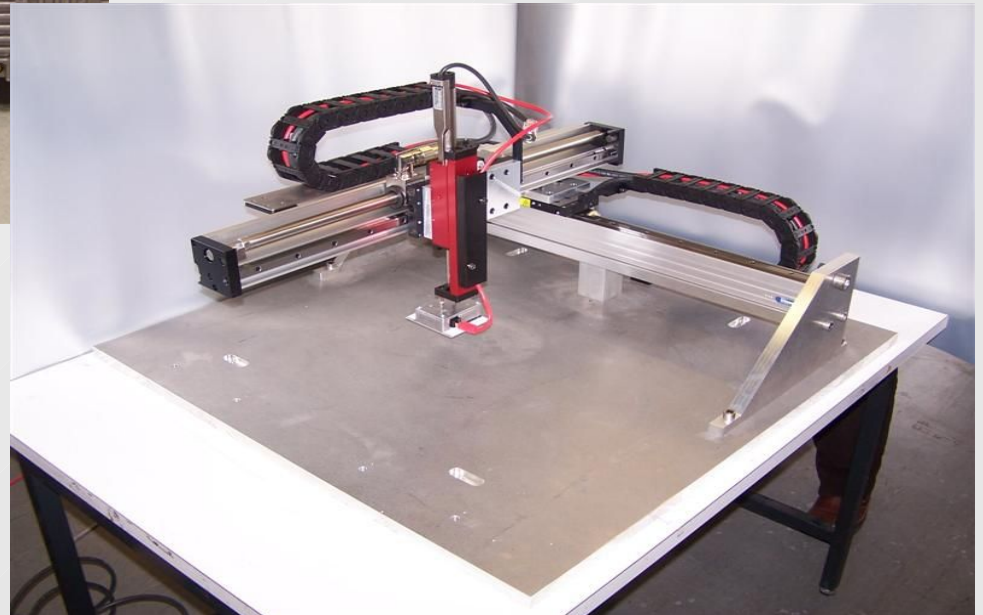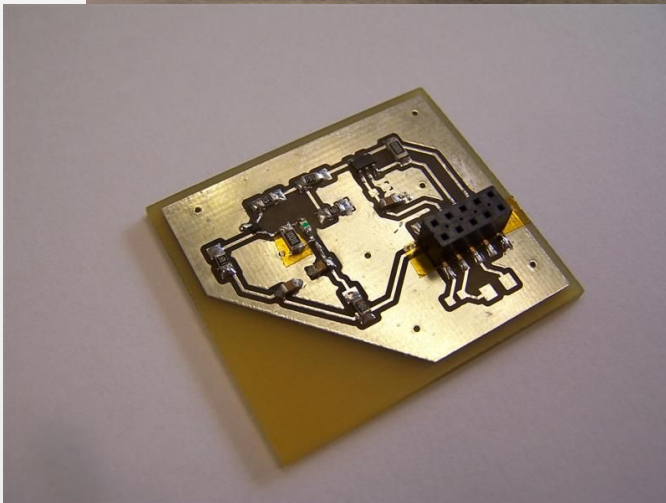
Positioning

- Avg. Amplitude on 1mm grid:

- Tiles, fiber & SiPM can be seen

- Map for selecting position

Single photon spectra at different positions

- On fiber higher but noisy signal
- On SiPM even more

- Lower LED voltage gives suitable SPE even on fiber

- *Voltage dependency?*

Temperature control

- Air from exchanger directely blown on tiles from PCB side

-

- Also heats/cools rest of setup

- Lots of material to cool/heat need some time for huge temp. Steps

- Small steps even faster (minutes)
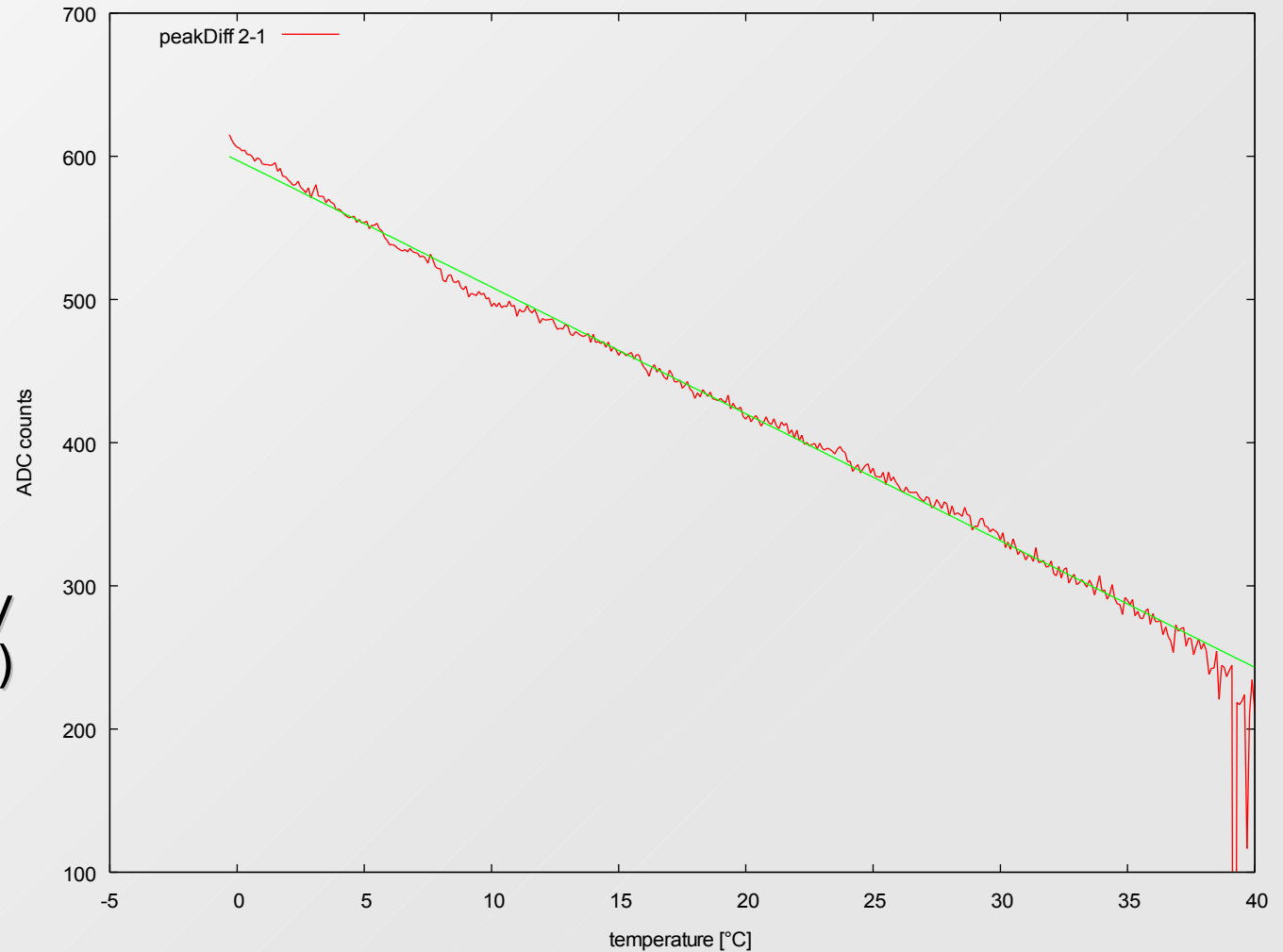 - Less dissipation

- Accurancy <0.4°C
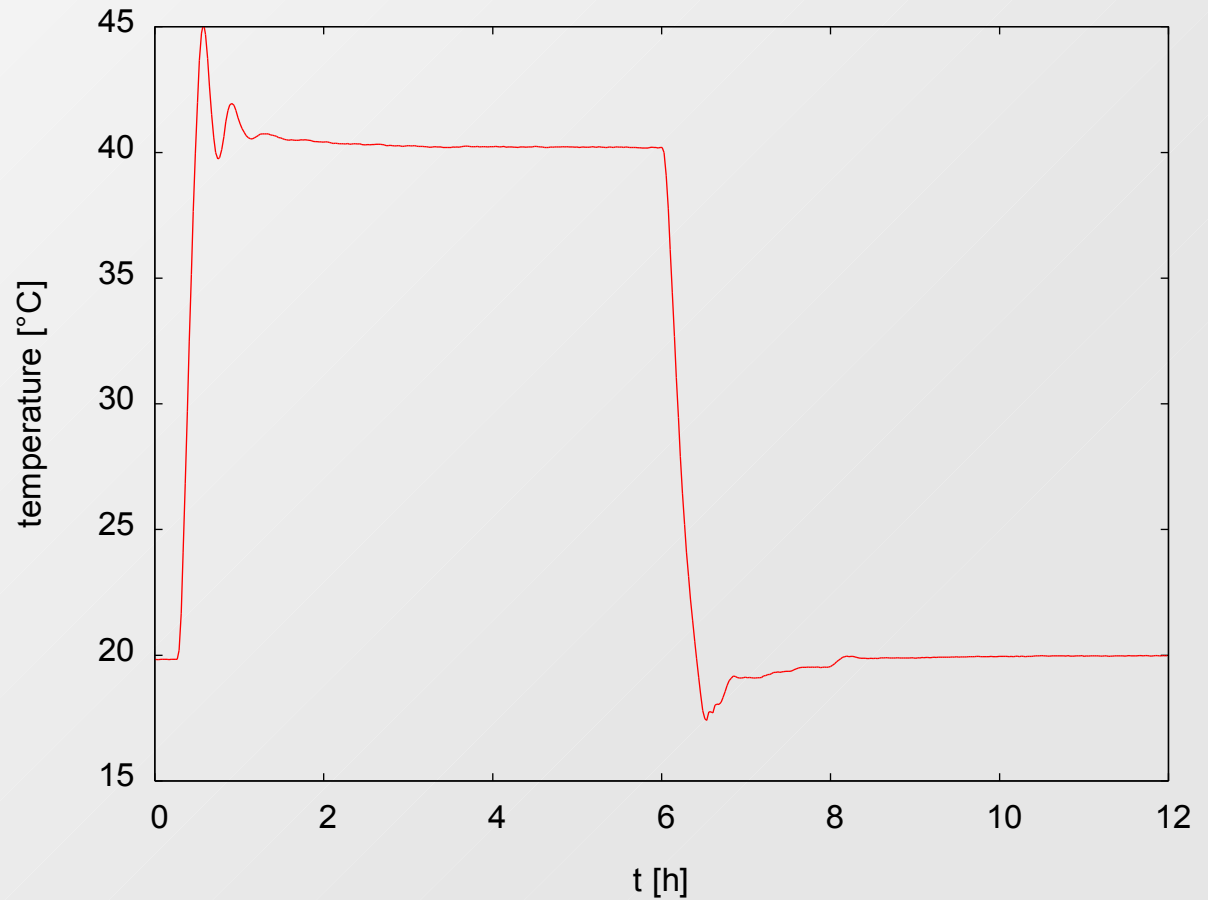
Temperature dependencies

- Peak positions for 0-45°C

- SPE get unusable above 38°C

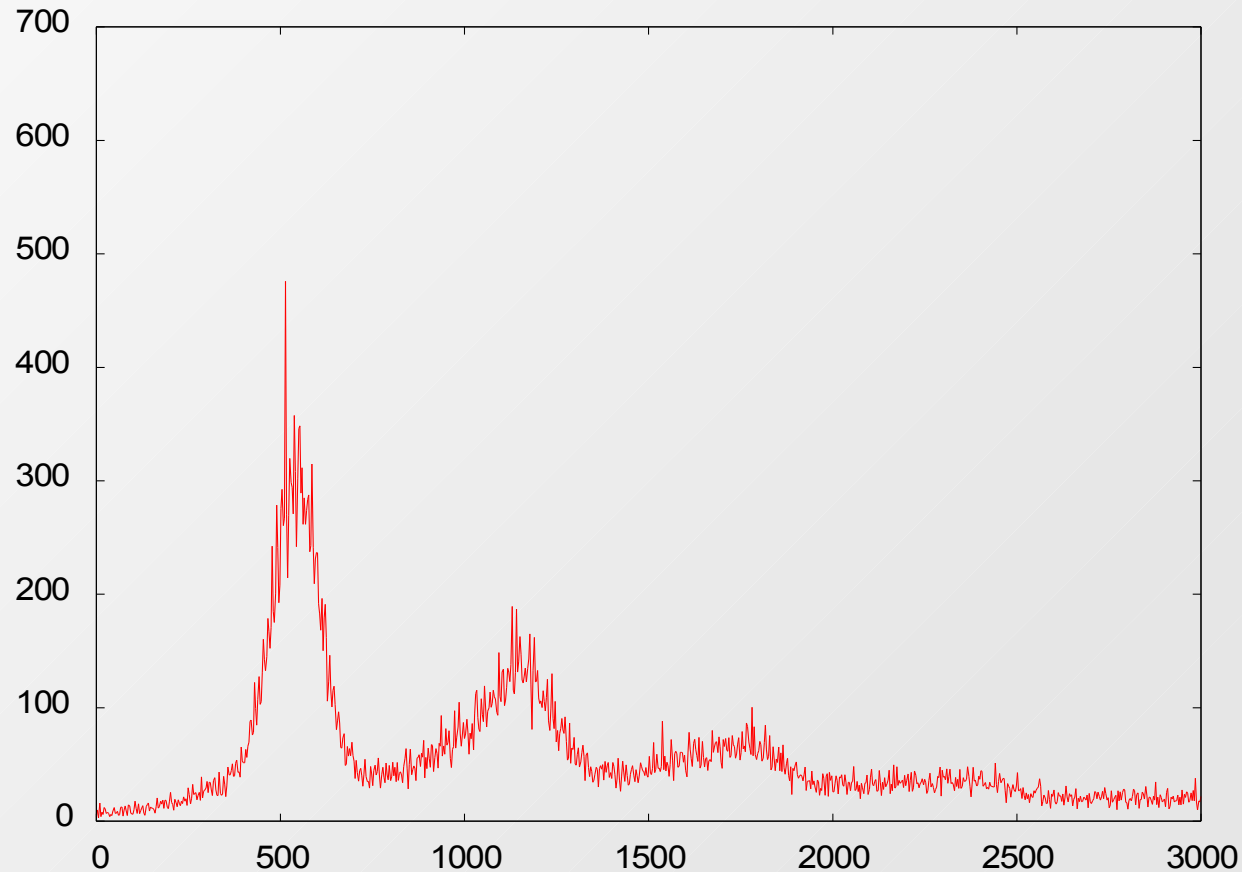- Unknown effect at 10°C
  - Seems to be technical
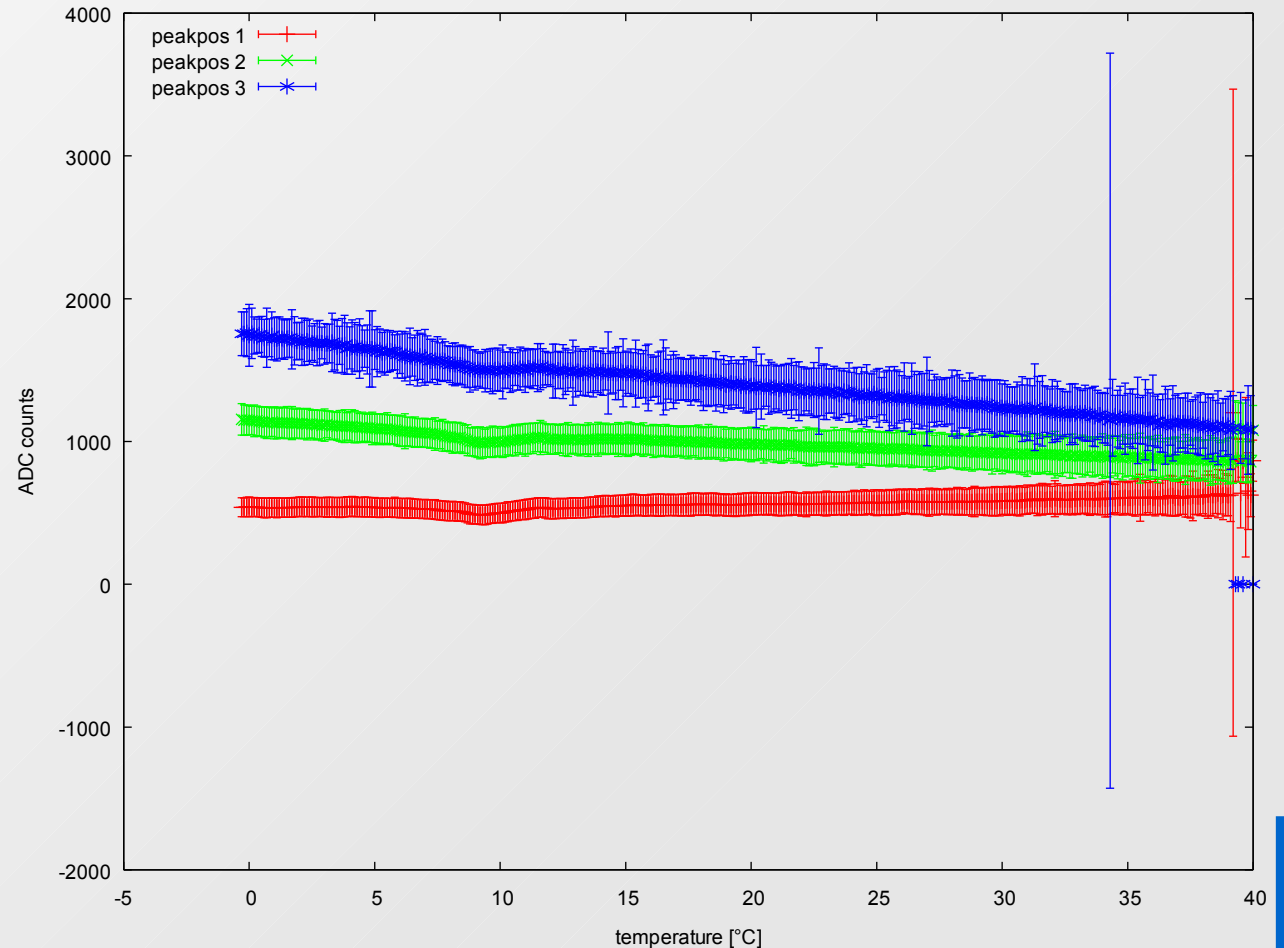
Temperature dependencies

- Gain from Peaks 1&2

- Almost linear 2.1% @ 20°C

- Less than expected although very high HV (40V)

- Poor SiPM?

SPE at low temperature

- Non-gaussian shape at low temperatures (0°C)
- Known effect?
- Possibly DAQ effect? (DAQ is inside box)

- *Have such measurements ever been done before?*

Summary & Outlook

- Blue LEDs are suitable for calibration

- Stage & temperature control is functional, first data taken

- Still have deeper look into data

- Further optimisation for better Spectra

- LED Voltage is critical point
  - Depending on circuit sensitive to 5mV
  - Spread of parts?

- LED pulse from external generator. Internal solution?