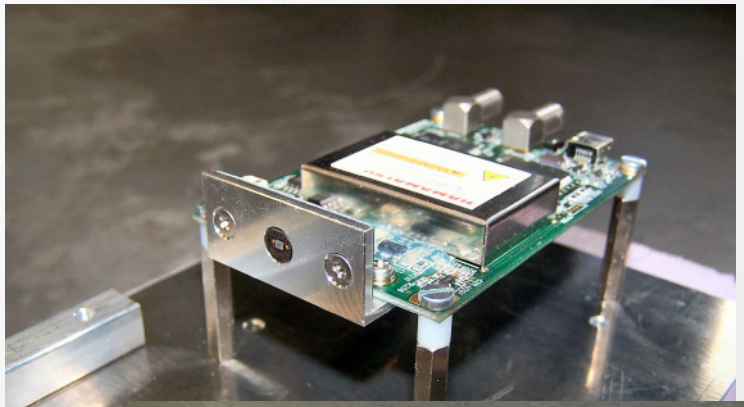
News on
Embedded LED calibration system

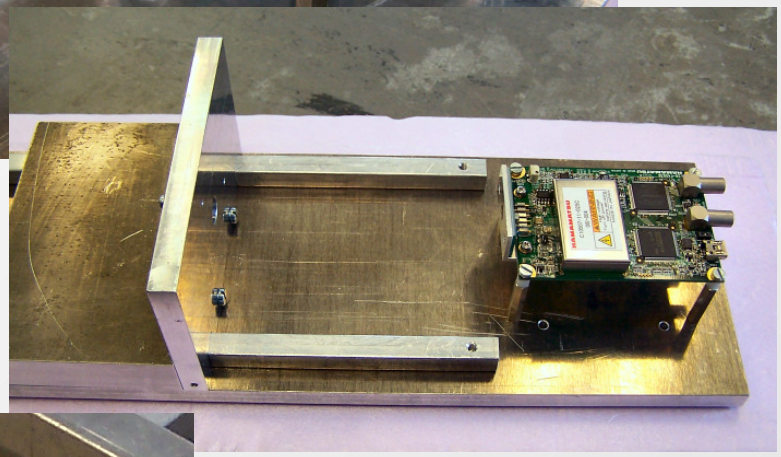
- Sebastian Weber -
University of Wuppertal

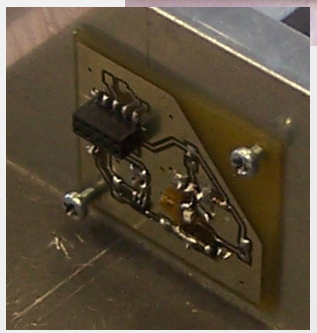
Overview

- Hamamatsu MPPC module
  - Optimizing LED pulsing circuit
  - Find suitable LED
- First surface scan of HCAL tiles with embedded LED pulsing circuit

Hamamatsu setup





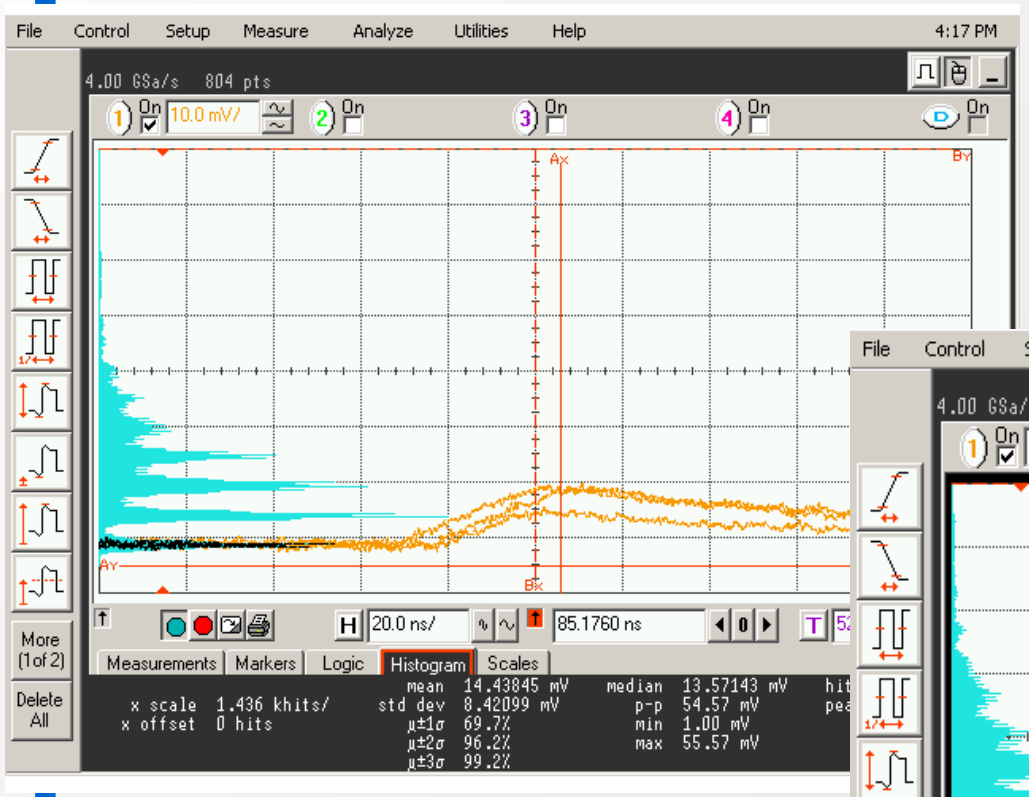


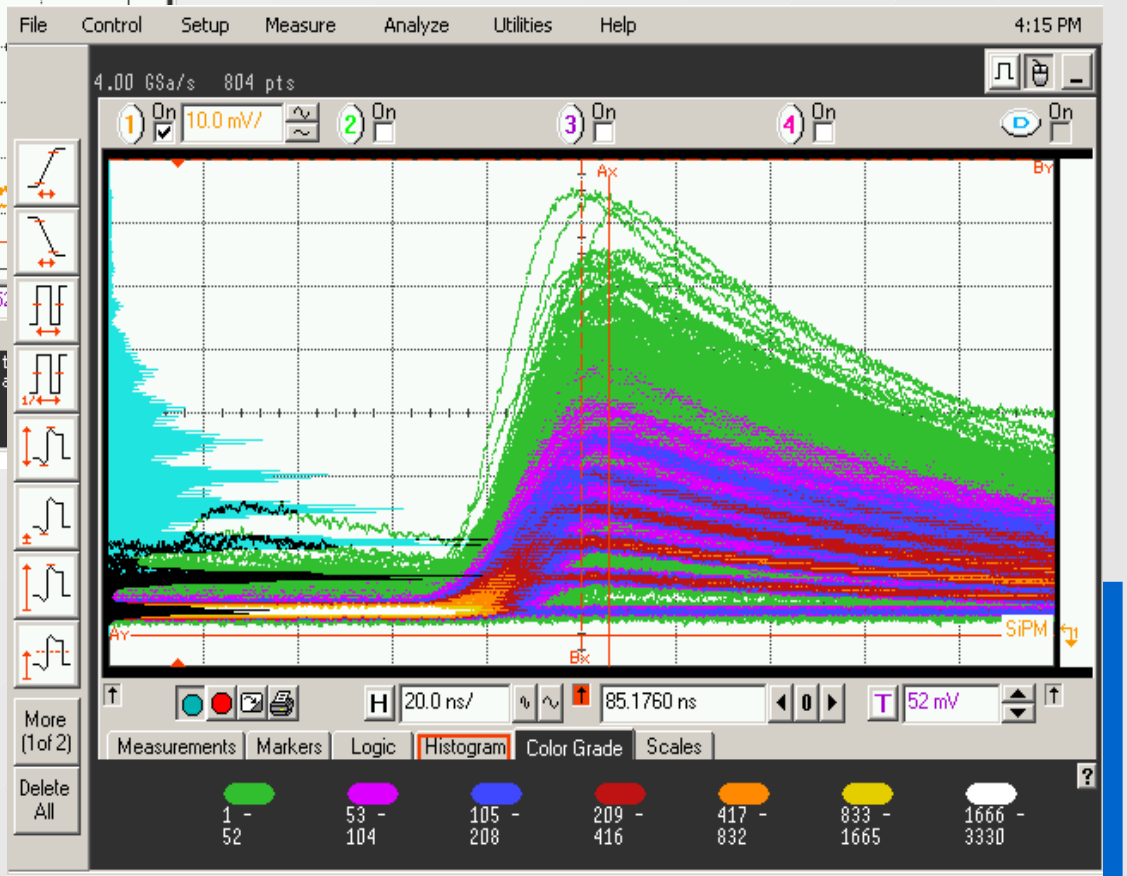
- MPPC-Module from Hamamatsu
- 1600 pix SiPM (blue sens.)

- Analog out
- Comparator TTL out (0.5 – 3.5 single photon signals)
- USB
  - Power
  - Comparator config
  - „high performance“ software

- Slide with small LED PCB
  - Change intensity w/o changing el. characteristics

Readout

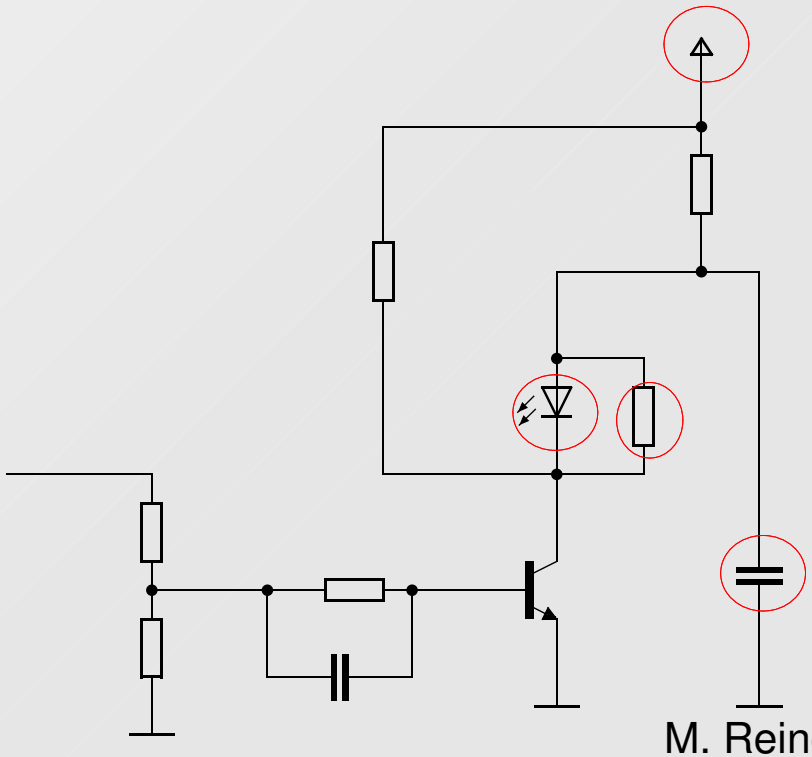




- 6MHz low-pass as shaper
- Histogram signal on oscilloscope

Test program

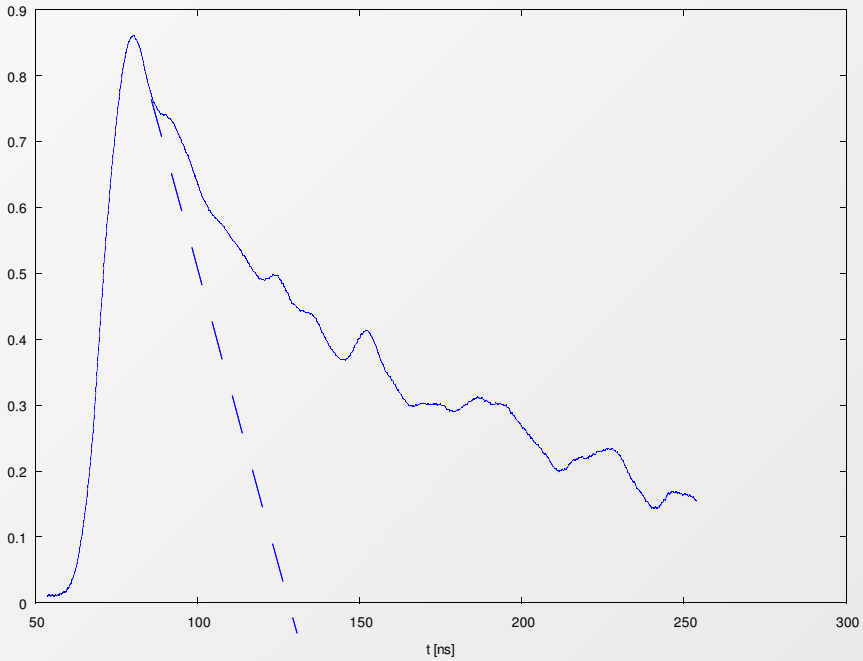
- Try different LEDs (UV, **blue**, green)
  - Blue would be better than UV
- Optimize Histogram and signal shape via
  - loading capacitor (100p-1n)
  - Resistor (100-1k)
  - Vcalib (up to 15V)
- Goal:
  - Short pulse
  - Good histogram
  - *for wide range of Vcalib & parts*



M. Reinecke

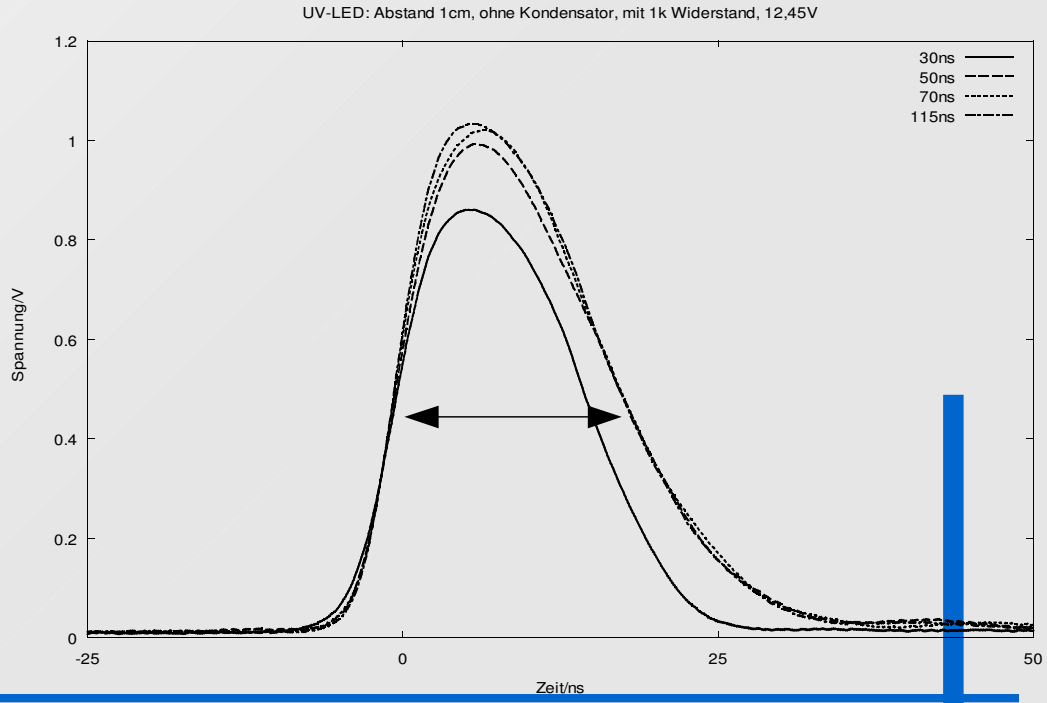
Resistor parallel to LED

- LEDs often show some afterglow
  - Slow discharge



16x averaged pulse signal

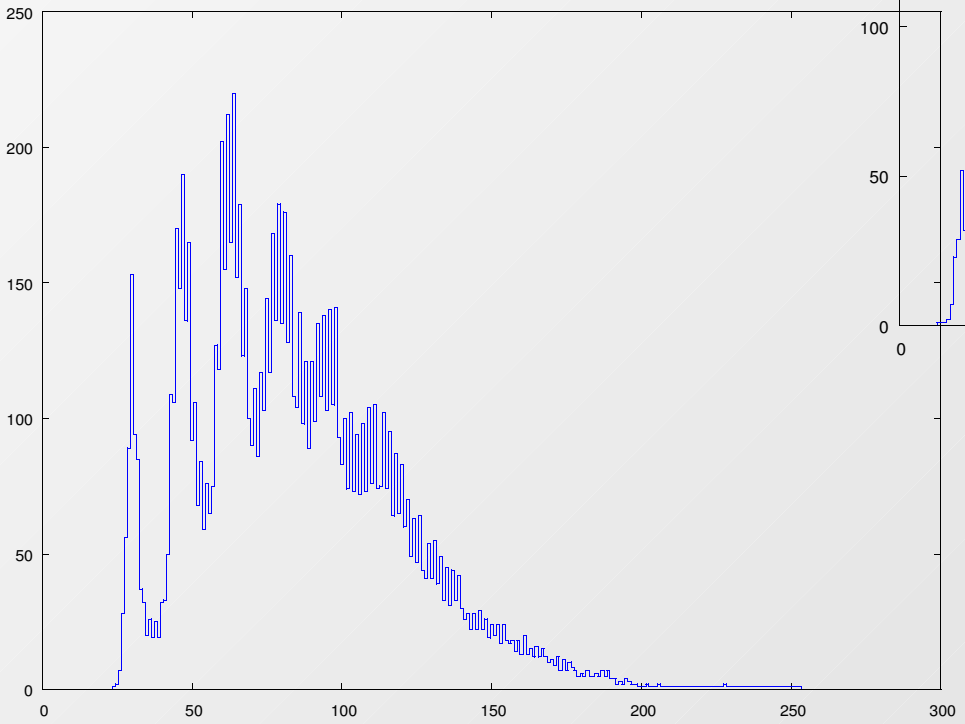
- 100-1k in parallel:
  - Shorter
  - Cleaner
  - Better time response
  - *Independend from input pulse!*
- But higher Vcalib needed
  - Sometimes too high for parts

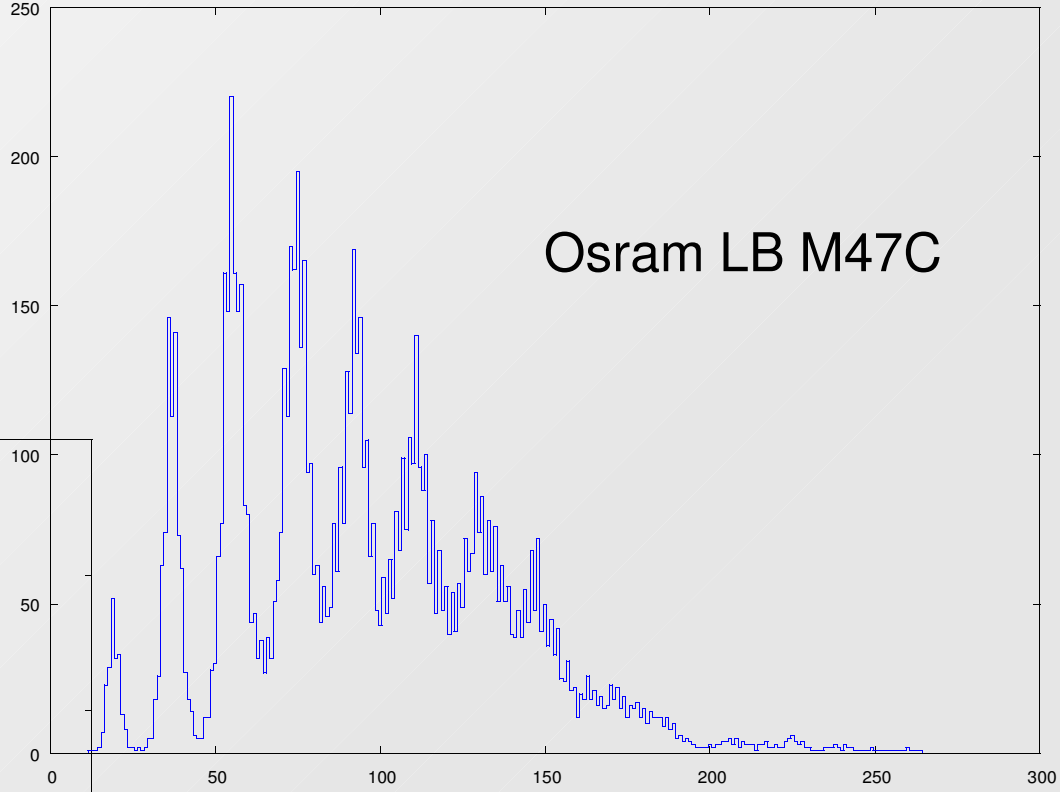


Several LEDs tested

- All LEDs show spectra
- Not all suitable

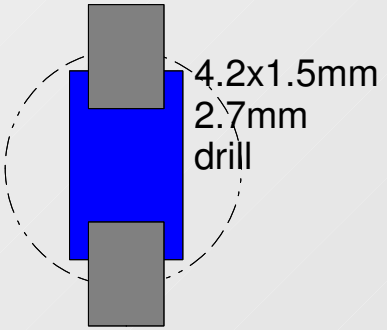
- 2 types of blue LEDs:

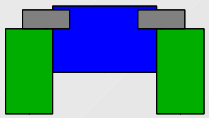




Some words about the blue LED

- Osram LB M47C
- Huger than 0603
- Made for low profile through-PCB mounting
- Only 0.4mm profile above PCB
- Good narrow preselection
  - wavelength
  - Brightness
- Specified for 300mA pulses
- **May be good candidate**



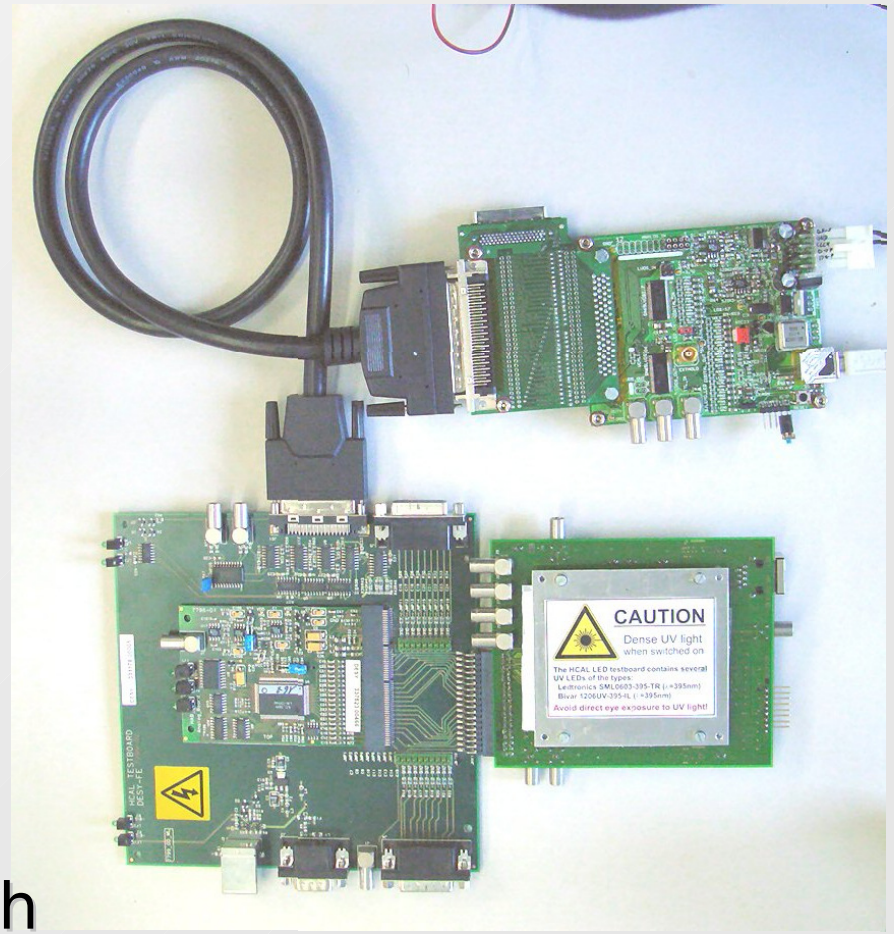


Summary so far

- Several LEDs show spectra
  - Have to adjust all components for LED types
  - e.g. Capacitor: 1p up to 1n
  - Not all show good spectra
- One suitable blue LED found for Hamamatsu SiPM
- But what about HCAL?

„HCAL“ electronics setup

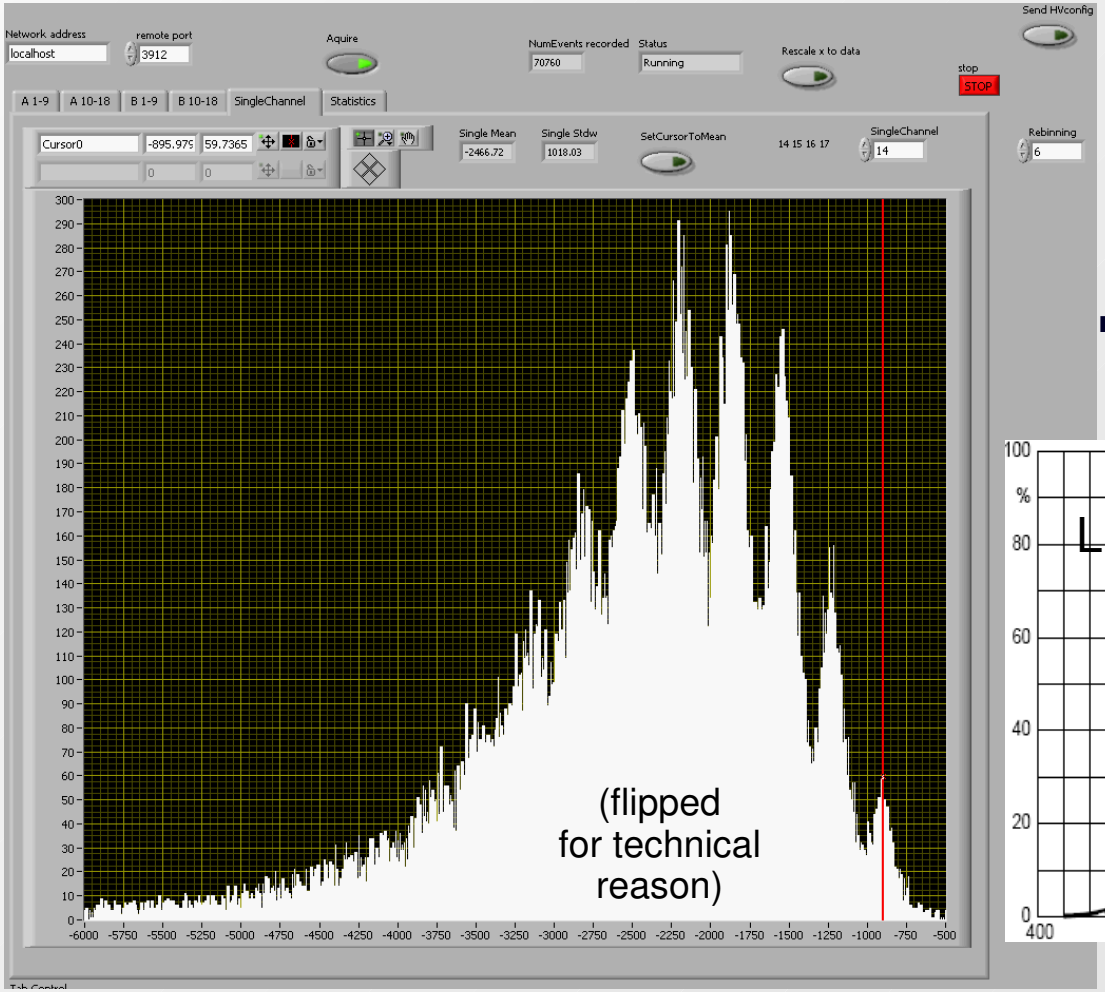
- 4 tiles connected to HAB
  - 2 defect SiPMs
- Read out by µDAQ
- No suitable spectra seen with UV-LED circuits embedded on testboard
- → Single tile together with LED PCB in a Box...

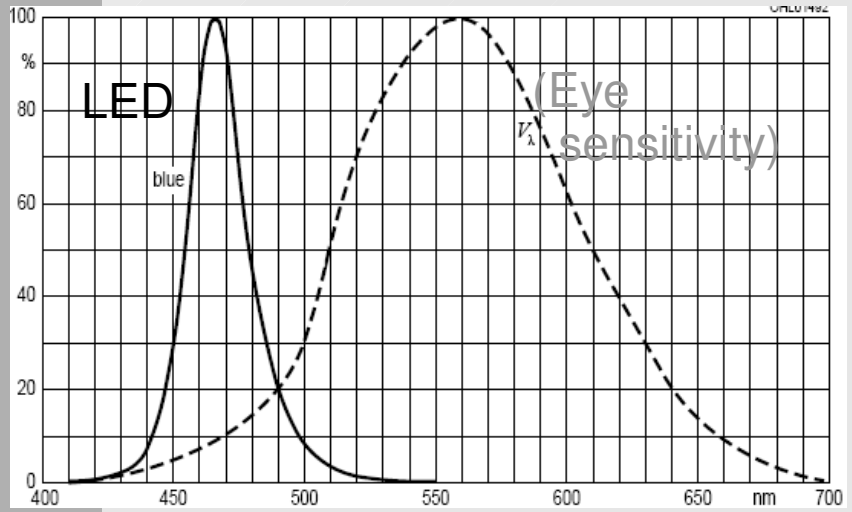


First single photon spectrum from HCAL SiPM

- Up to 8 peaks visible
- This is the best result ever seen with embedded LED system!

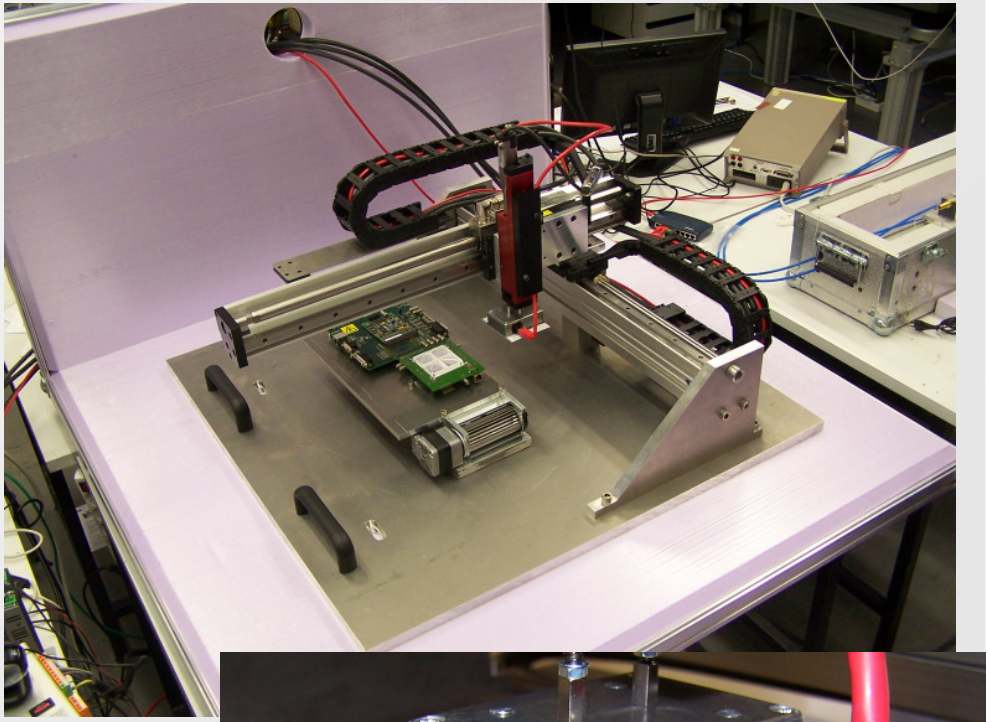
- **And it's a BLUE LED**

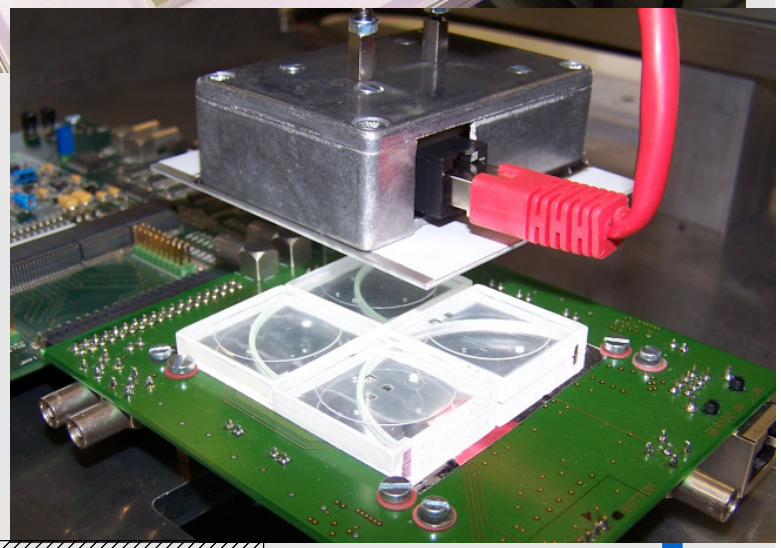


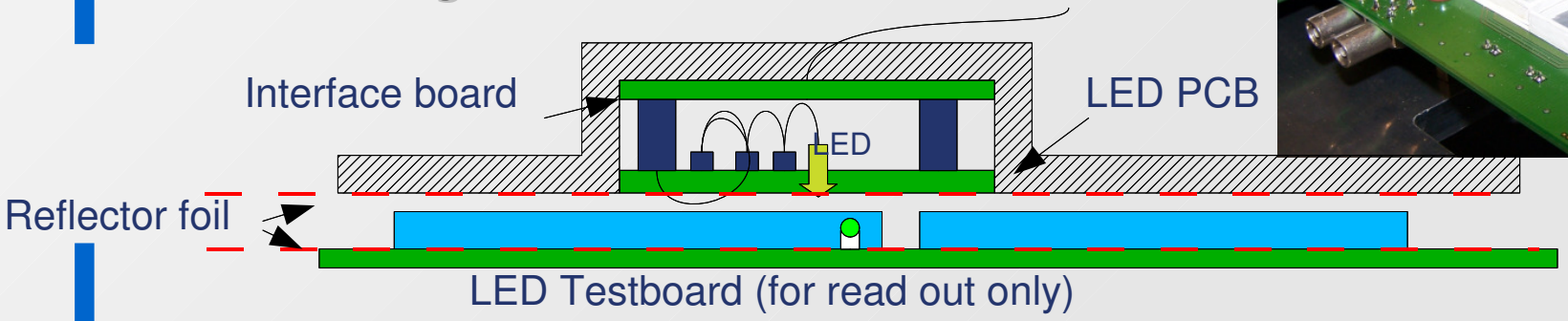


Mechanical setup

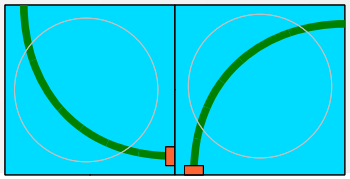
- xyz-stage build of linear axes
- Contained in light tight temperature controlled box
- Scanning head with support for LED PCB
- LED PCB easy to exchange

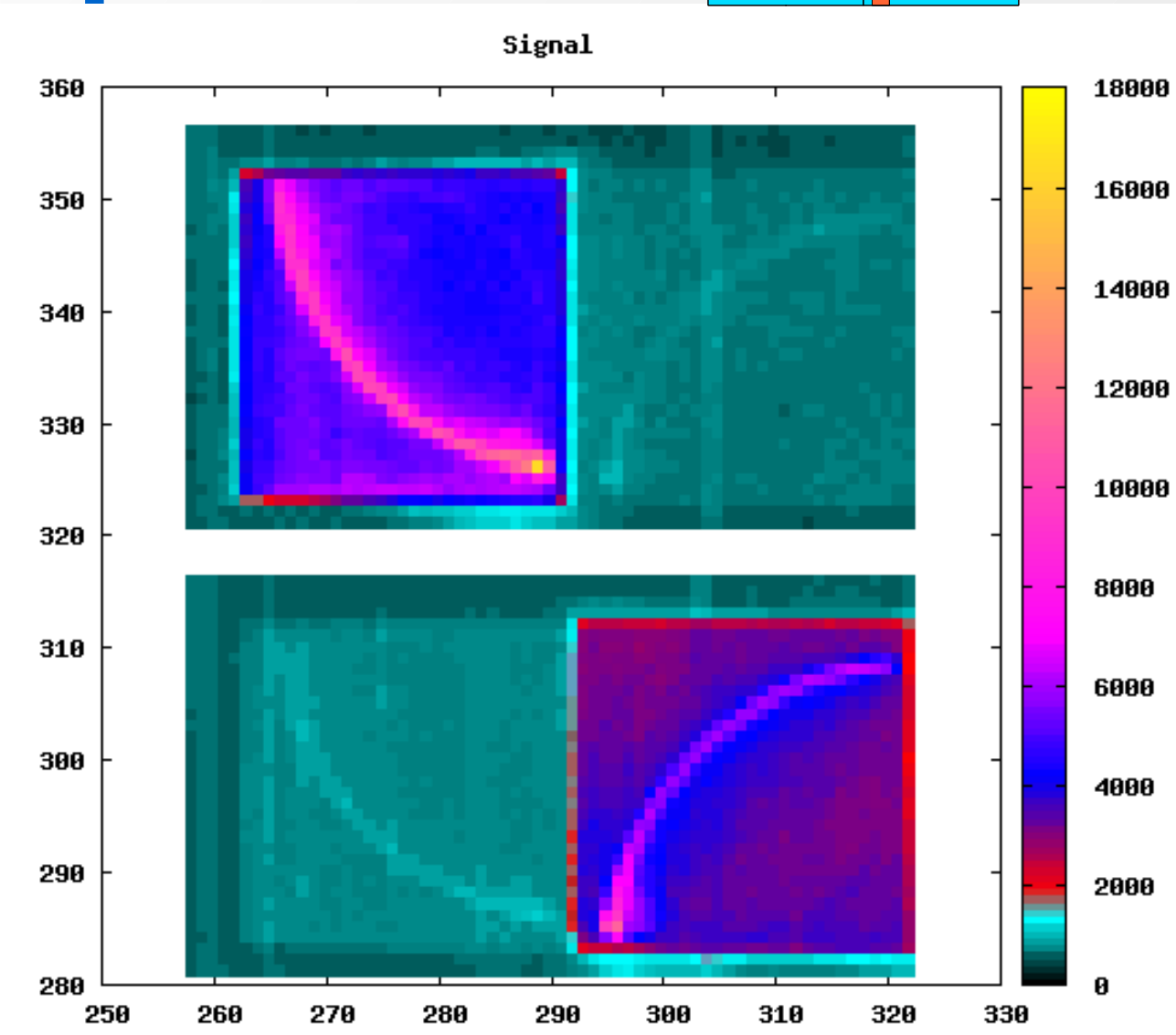






First surface scan with blue LED over 2 tiles





- 1mm scan with blue LED
- Much higher gain when shining into fiber
- Electrical(?) crosstalk seen on both tiles
  - More homogenous than expected for opt. crosstalk
  - Fiber
- You may notice the circle imprinted on the tiles!

Summary

- Irradiating fiber increases signal gain by ~2
- Still some noise problems
  - No deeper look into data

- First spectra from within setup seen this week
  - Detailed look into behavior of LED at different positions soon

- But in principle blue LED works on HCAL tiles