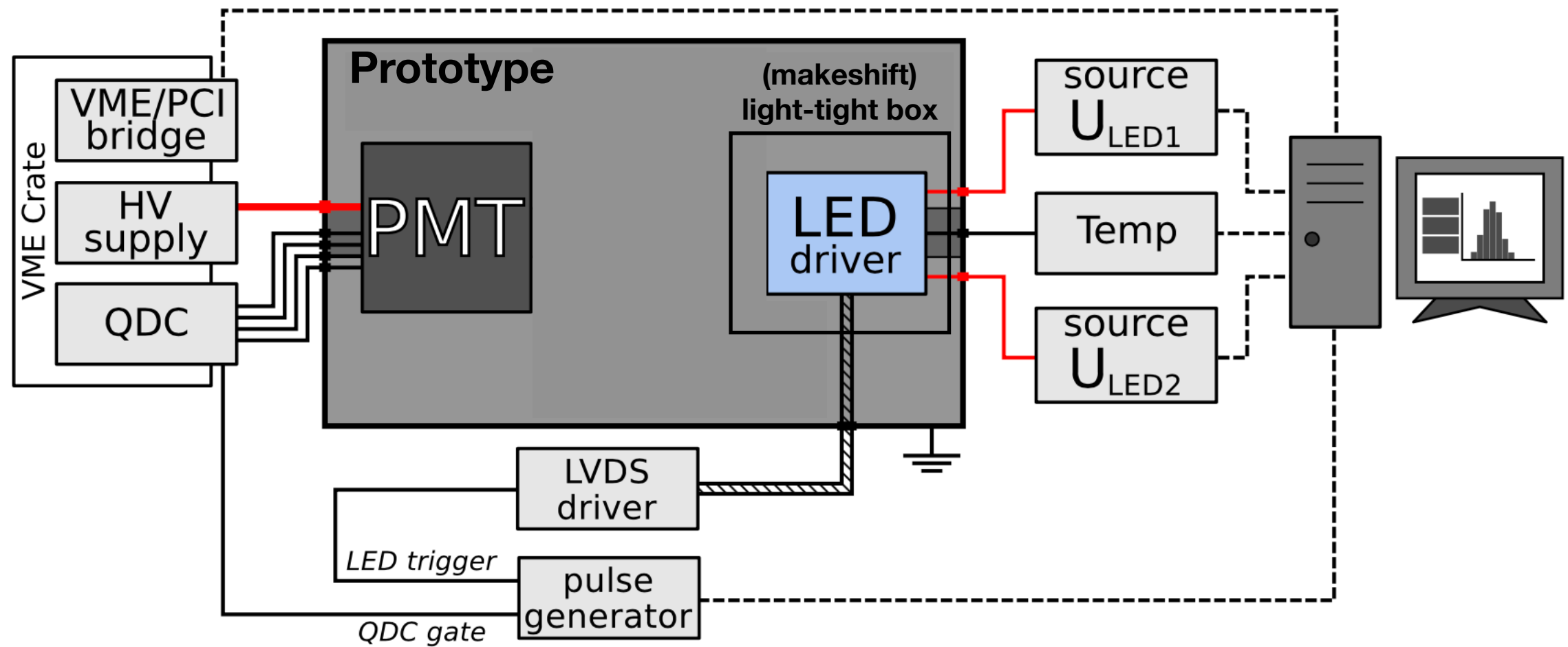# Čerenkov Detectors for Electron Detection in LUXE
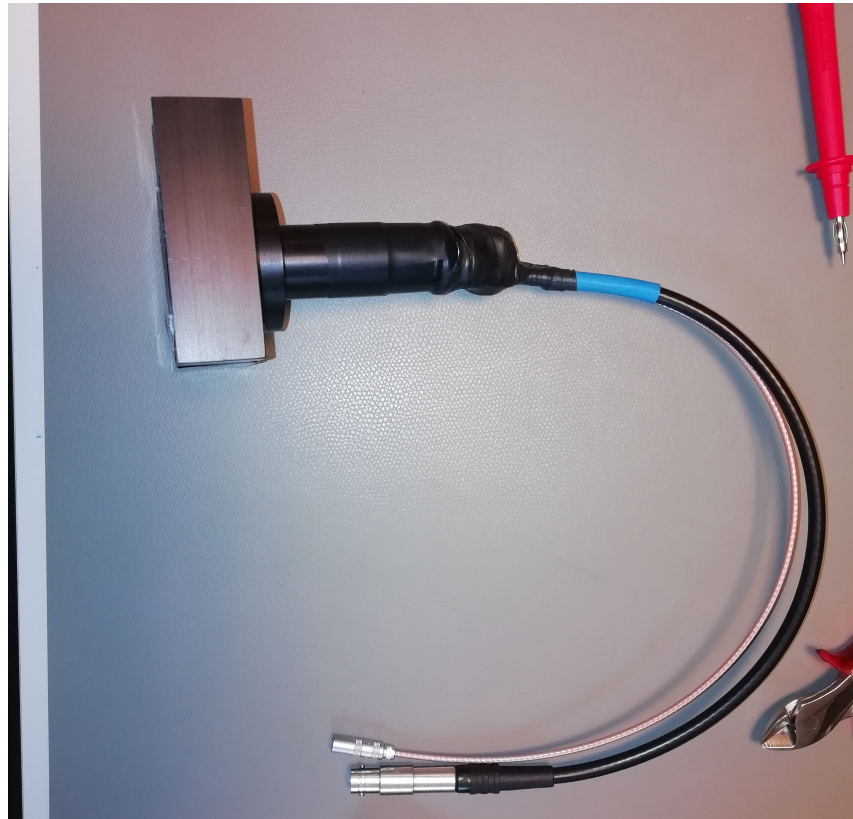
More updates from the Lab

Ruth Jacobs, Marius Hoffmann, Jenny List
Luxe Technical Meeting, 20th February 2020
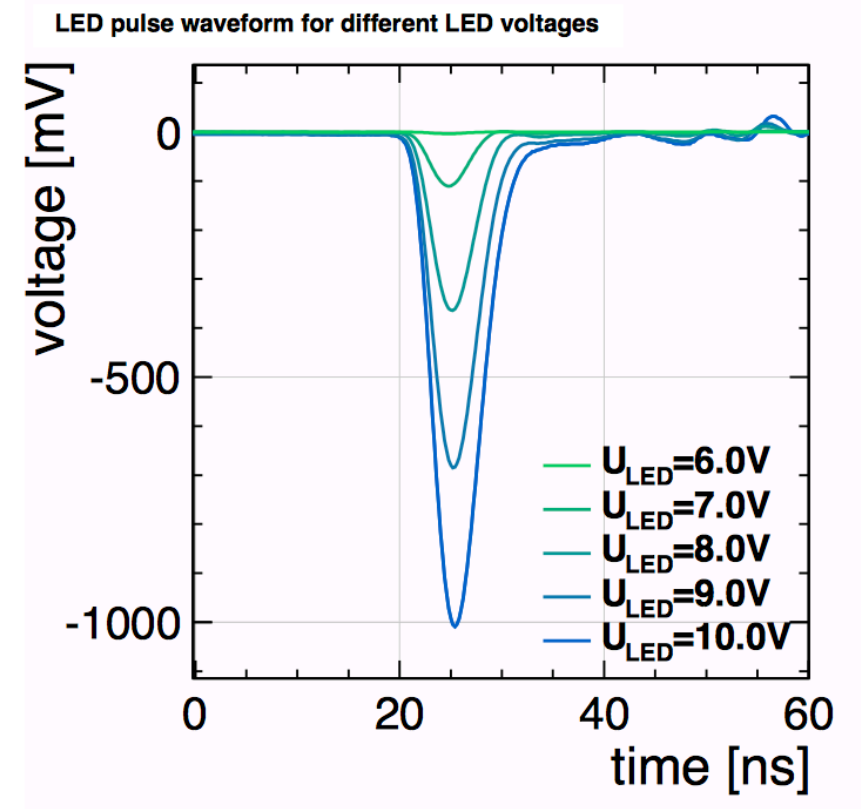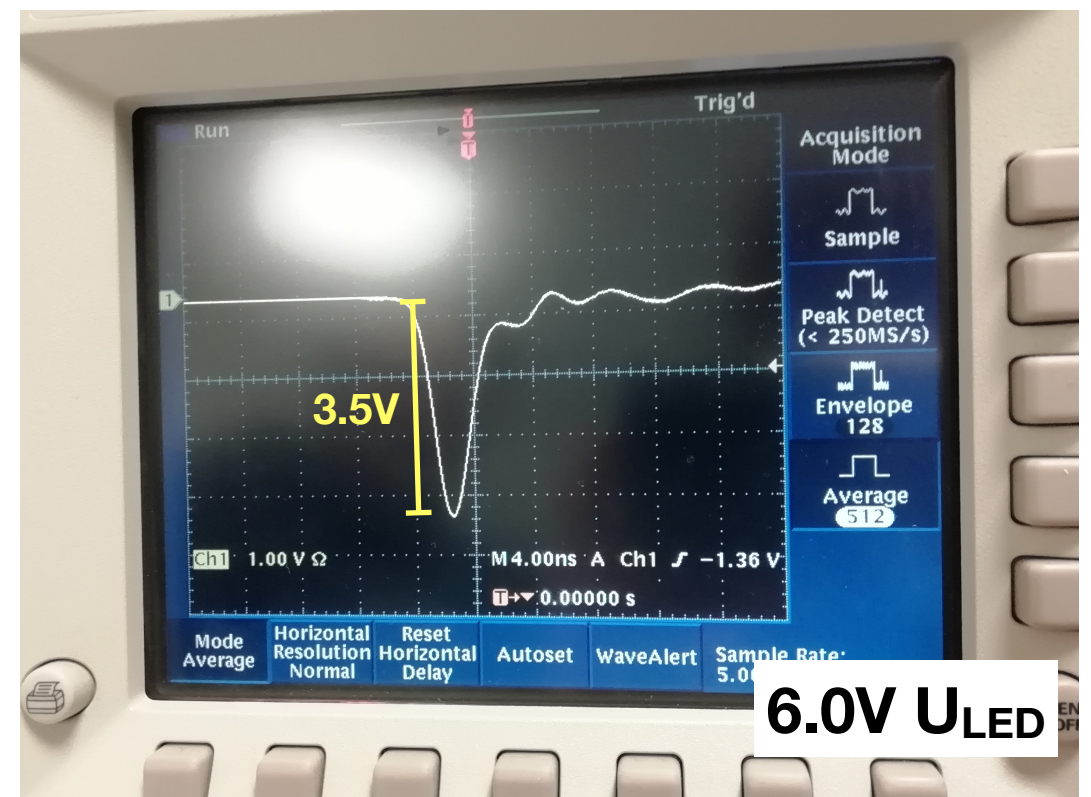
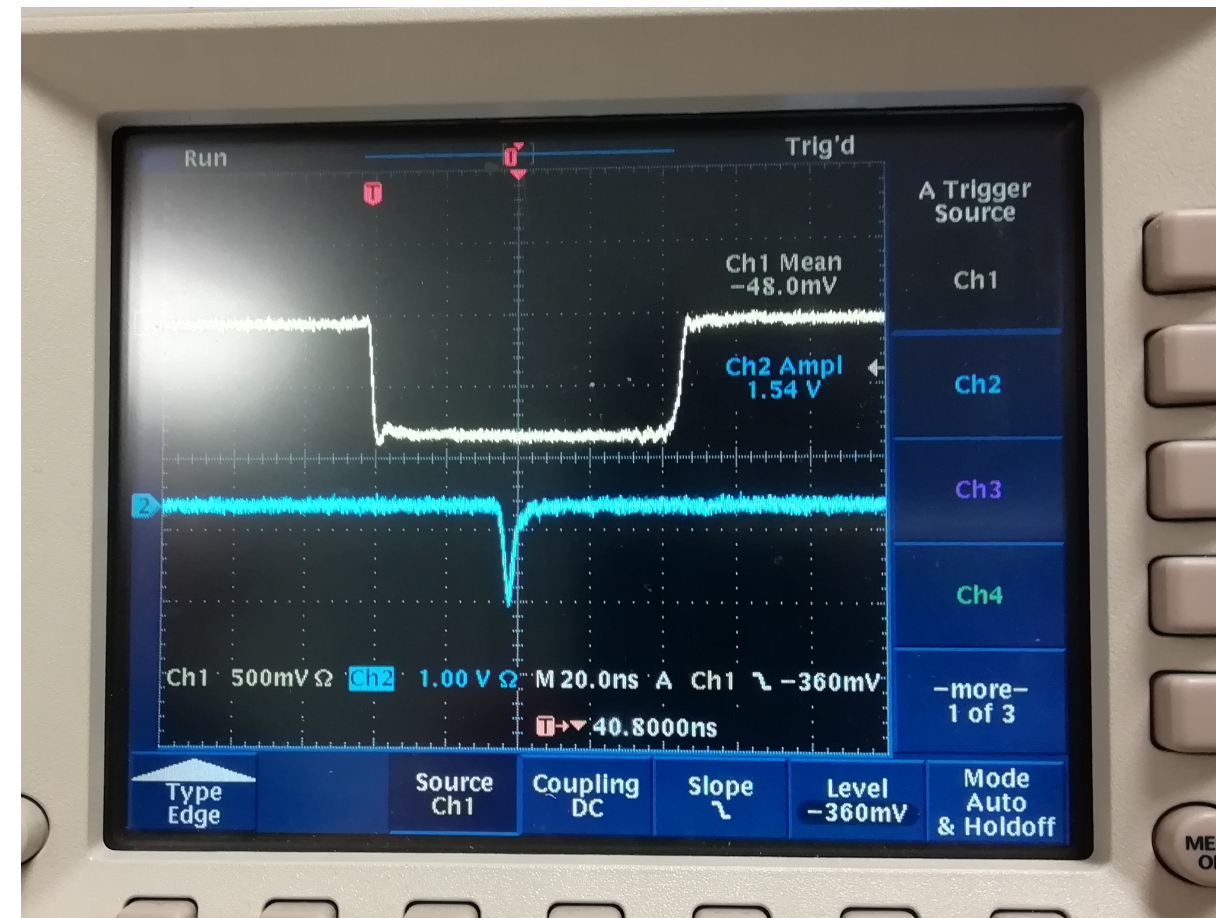# Reminder: Prototype with LED driver boards

Operating PMT with LED board

thesis B. Vormwald

LED pulse waveform for different LED voltages

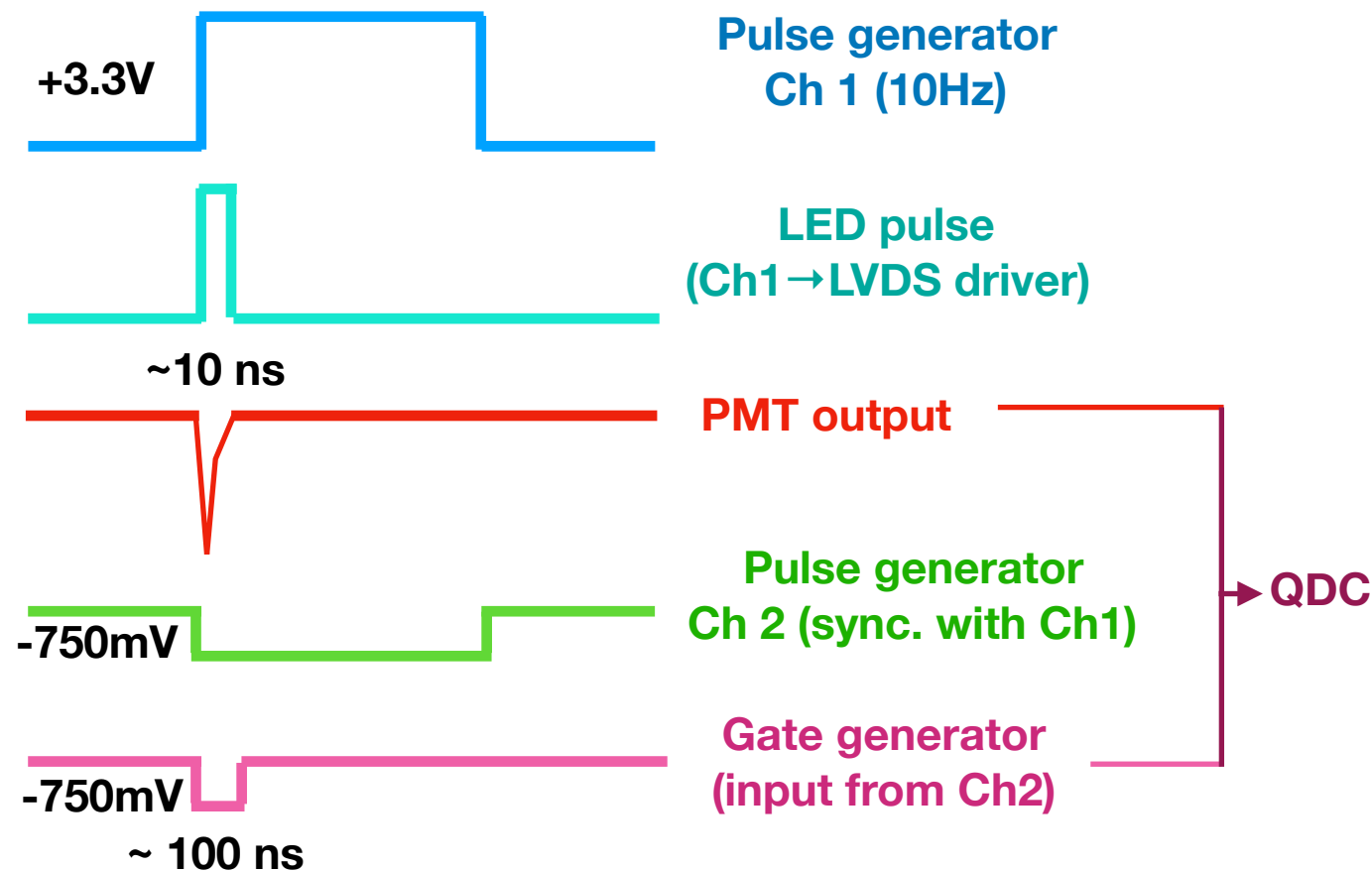U_{LED}=6.0V
U_{LED}=7.0V
U_{LED}=8.0V
U_{LED}=9.0V
U_{LED}=10.0V

- Used for first tests: Hamamatsu R4125, single anode, operating voltage 1500V

- use TestbeamGUI to steer VME Power supply

- PMT output to Oscilloscope

- observed signal: amplitude ~3.5V with 6V LED voltage

3.5V

6.0V U_{LED}

Gating the QDC

+3.3V — Pulse generator Ch 1 (10Hz)

LED pulse (Ch1→LVDS driver)

~10 ns

PMT output

-750mV — Pulse generator Ch 2 (sync. with Ch1)

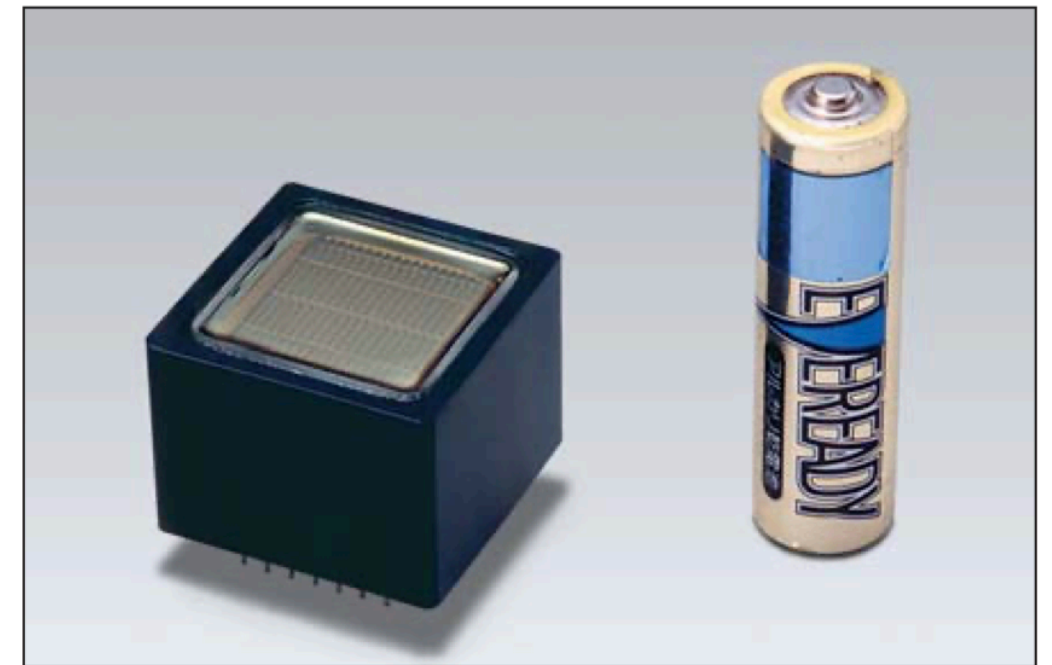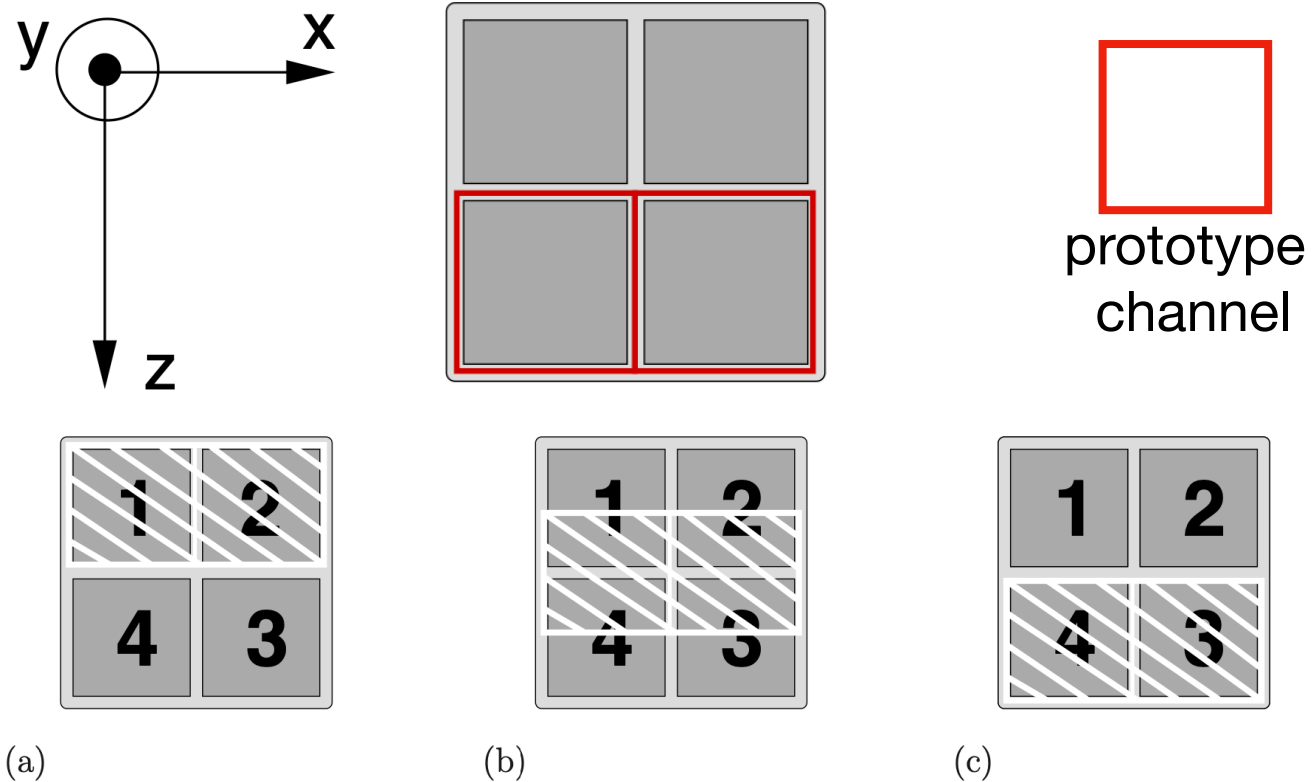-750mV — Gate generator (input from Ch2)

~ 100 ns

→ QDC

- need to tell the QDC when to look for signal → gating synchronized with pulse generator driving the LED

- Gate: - should arrive >14ns before the PMT pulse
  - wide enough to cover entire PMT pulse, but not too wide (integrate noise)
    width can be fine-tuned using screw at Gate generator (for now used 80ns)

- in TB setup, gates will be provided by TLU (+veto when Telescope is not ready)

Readout Software "PolDAQ"
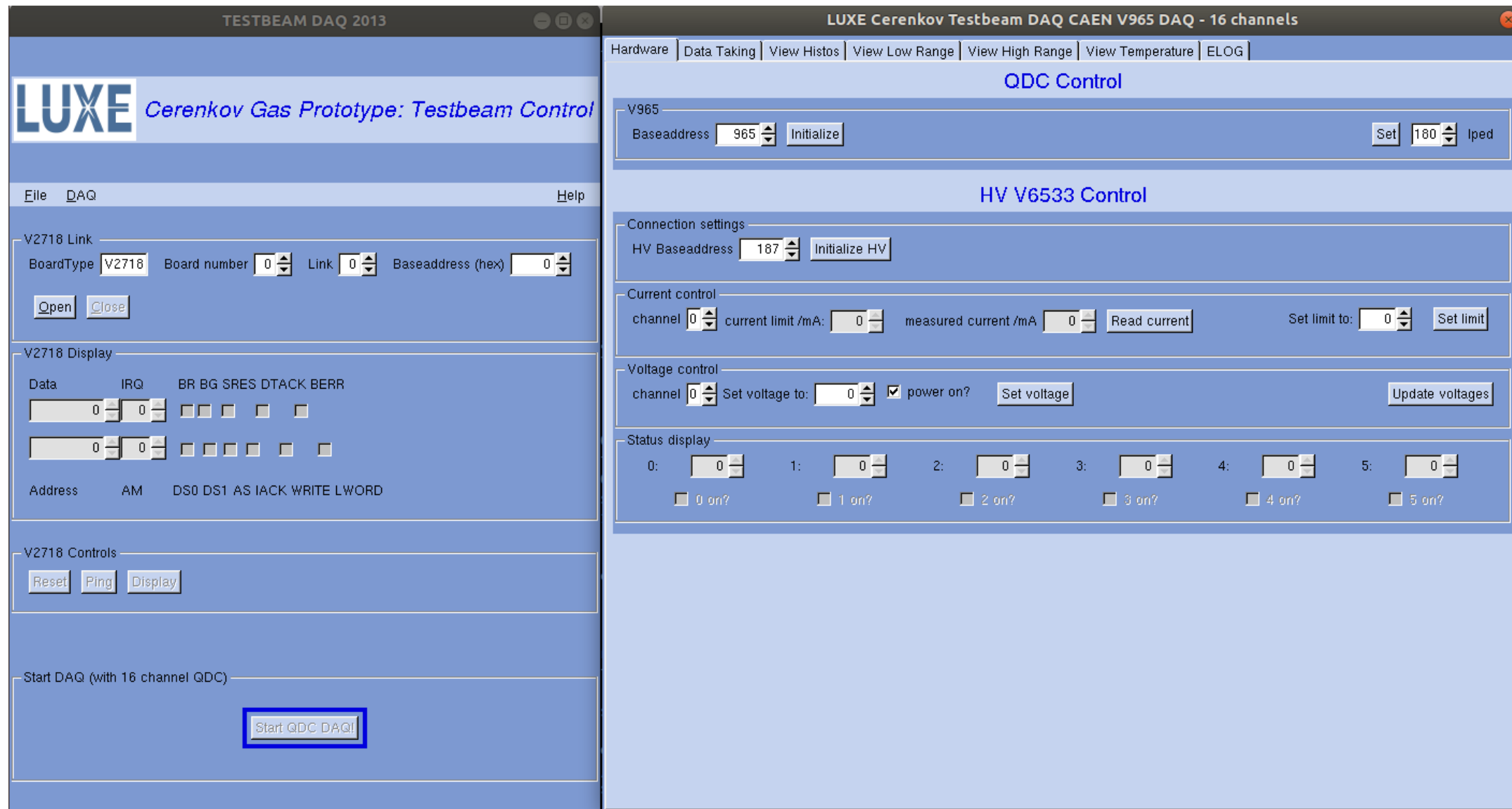
- ILC polarimetry Testbeam DAQ software for Quartz prototype

- operate HV, Run control: set and log Run parameters, start Data taking, ELOG
  → Output root-trees, histograms, overview pdf of QDC channel counts

- useable out of the box, some Quartz-specific superfluous things (2 PMTs, stepping motor)

- I played around with it a little bit, simplifying where necessary, adding temperature logging

Multi-Anode PMT

y x
z

(a)

1 2
4 3

prototype
channel

(b)

1 2
4 3

(c)

1 2
4 3

Figure 10.4: *Mounting positions of the M4 and M64 MAPMs relative to the detector channel. The detector channels are shown as the white hatched areas.*

Hamamatsu R7600U - 03 -M4
4-Anode PMT

- MA-PMT glued into light-tight box

- each anode fits exactly 1 prototype channel

- for now: configuration a)

- only 1 LED board was mounted (only pad 1 should see signal)

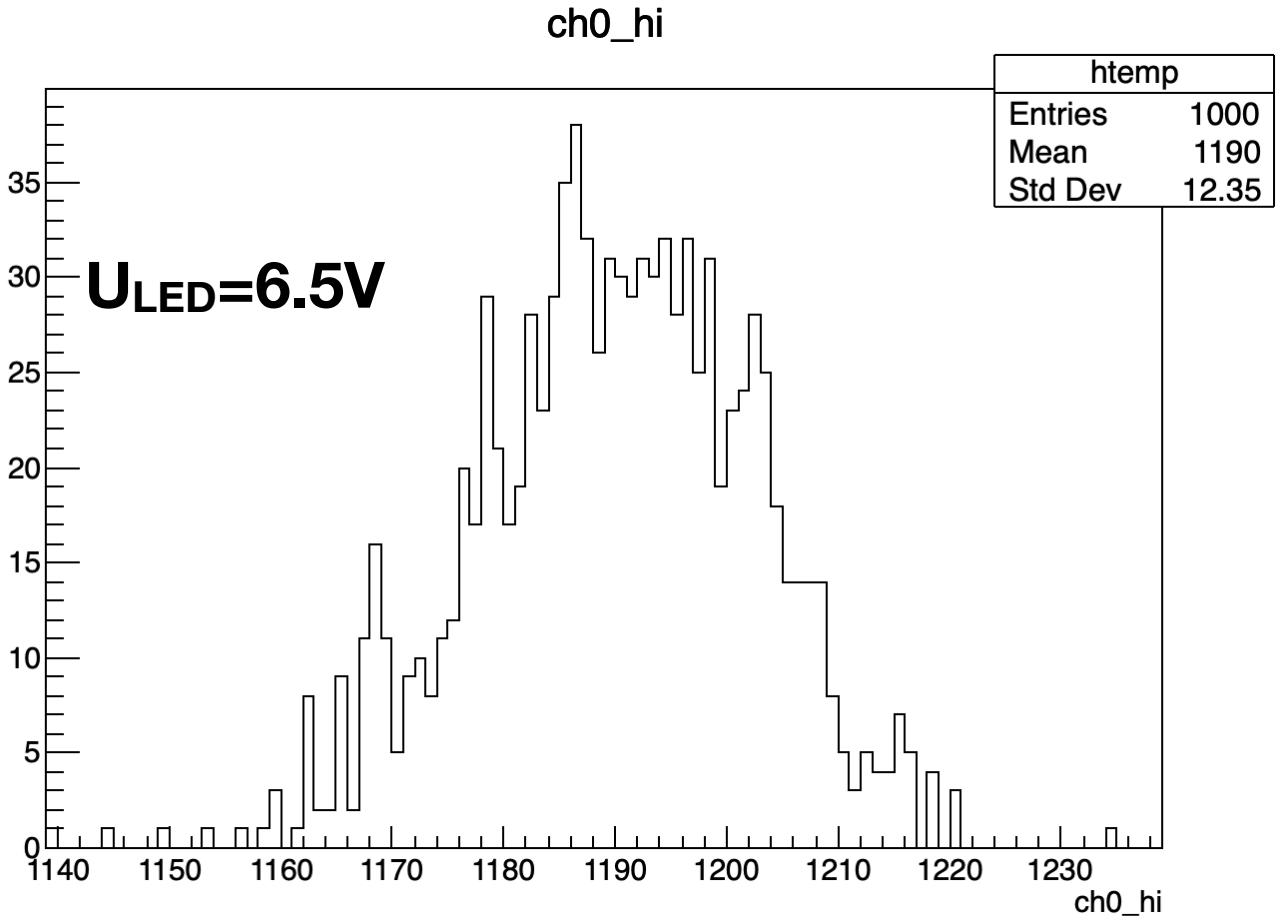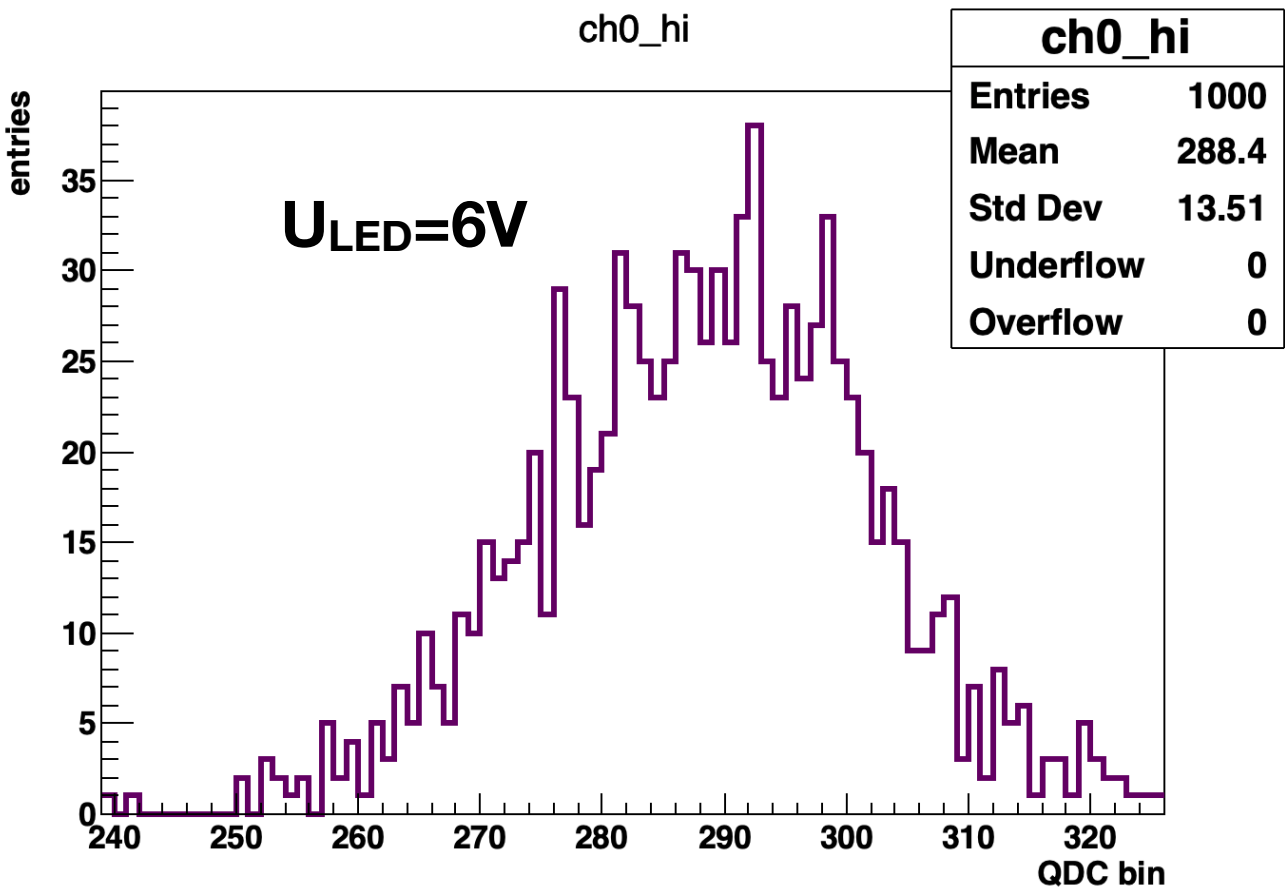1 2 HV 3 4 (tbc)

R 7600U - 03 - M4

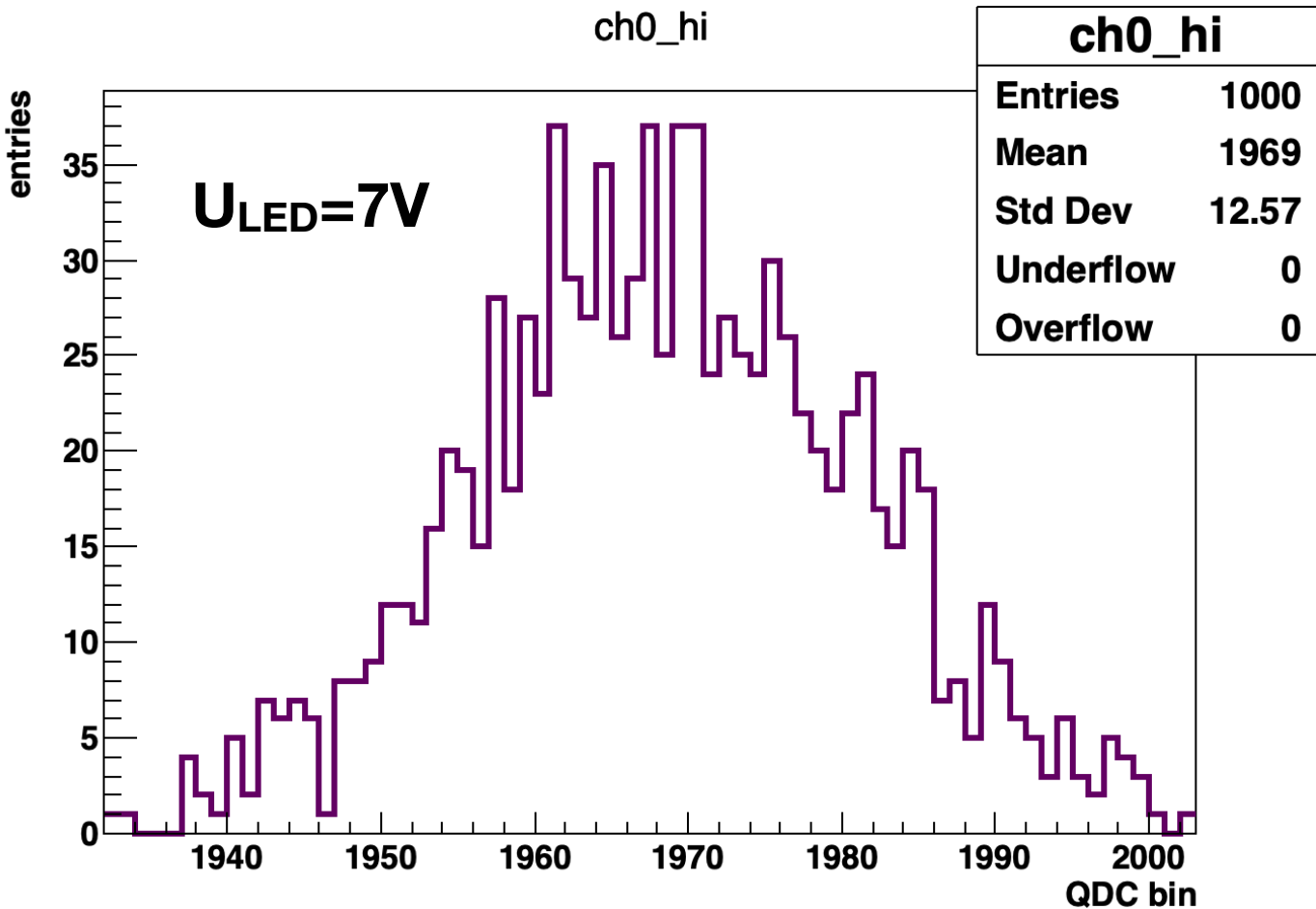

DESY.
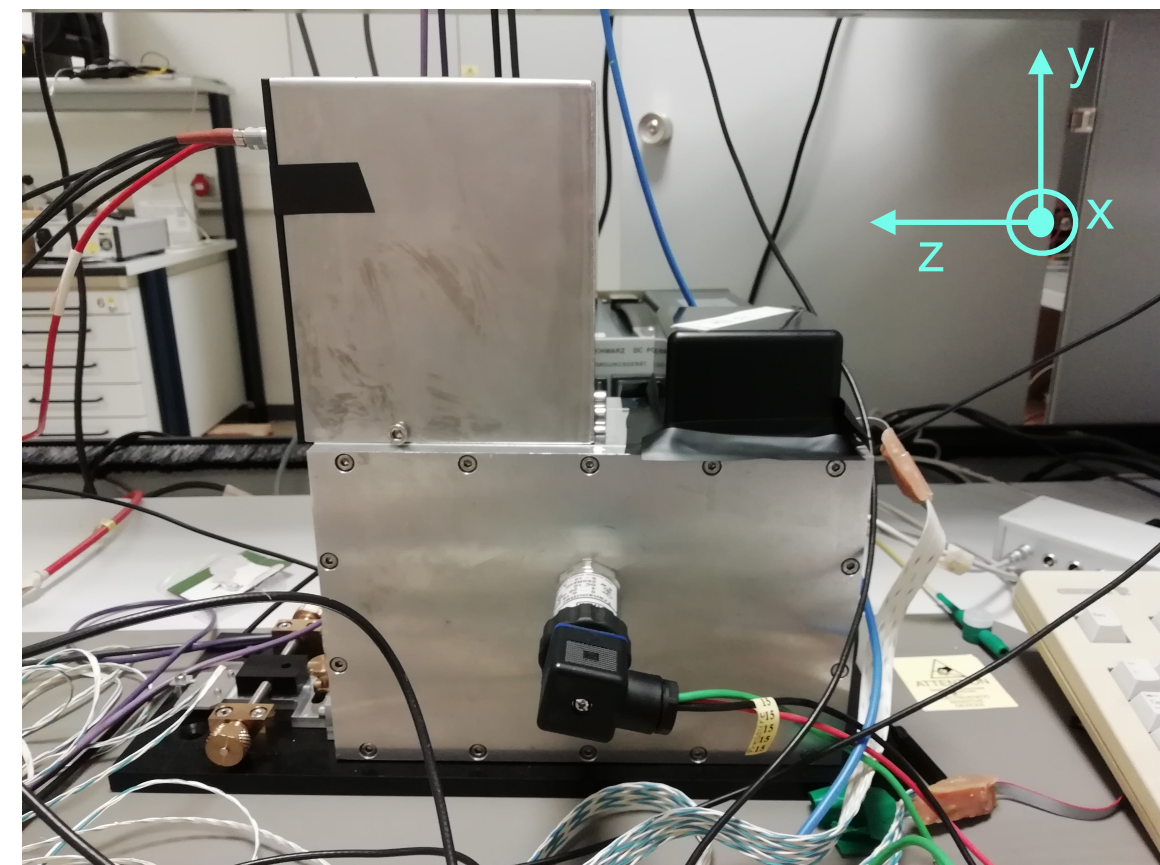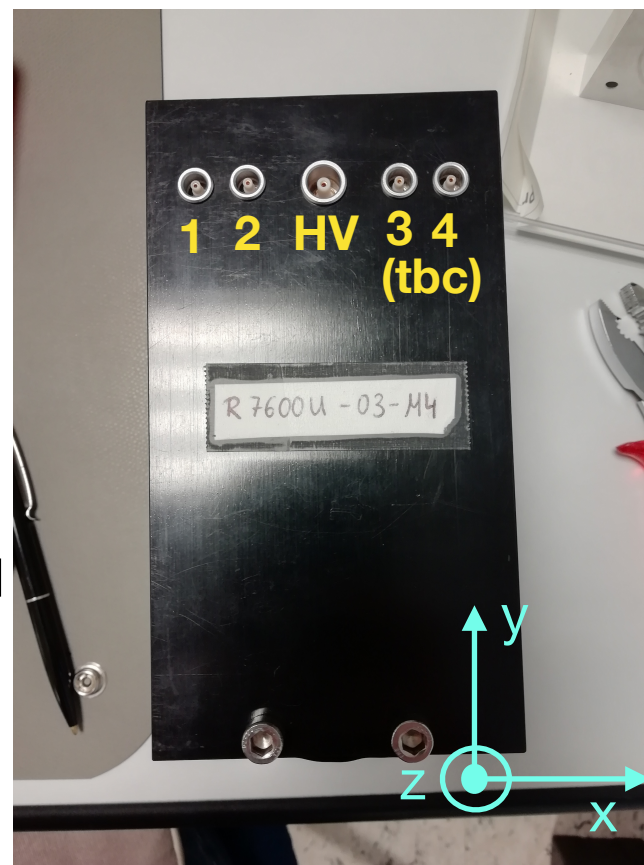
Anode Connections to QDC
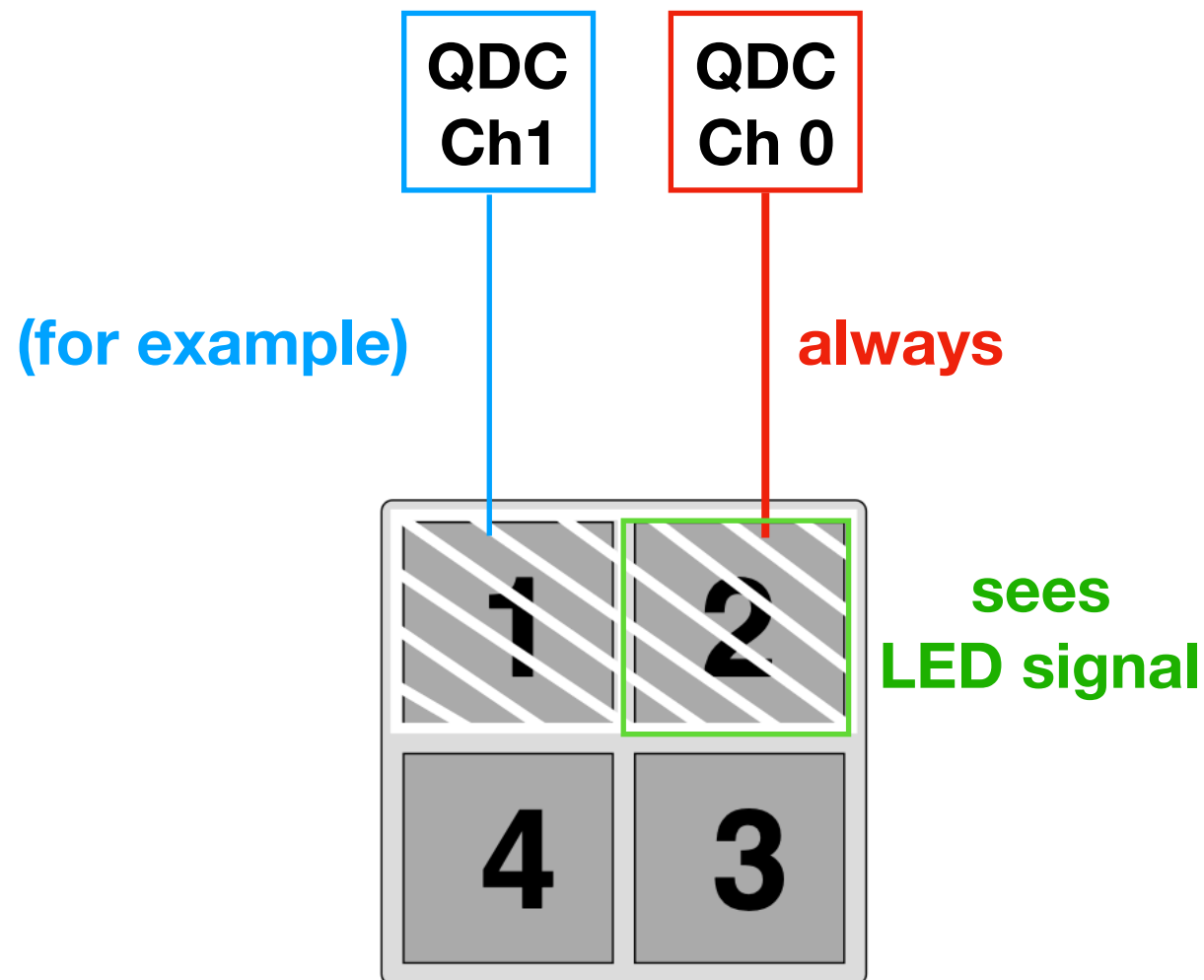
- Pad 2 (QCD Channel 0 sees LED signal through Prototype U-channel)

- Pad 1 sees adjoining Prototype U-channel (closed with black tape at LED end)

- Pad 3 and 4 see no channel

- Tested different configurations (ALWAYS QDC Ch0 is Pad2, Ch1 can be Pad 1,3 or 4)
  → 1k events for each test

(sorry, next time I will just connect all 4 channels to 4 QDC channels so it's unambiguous)
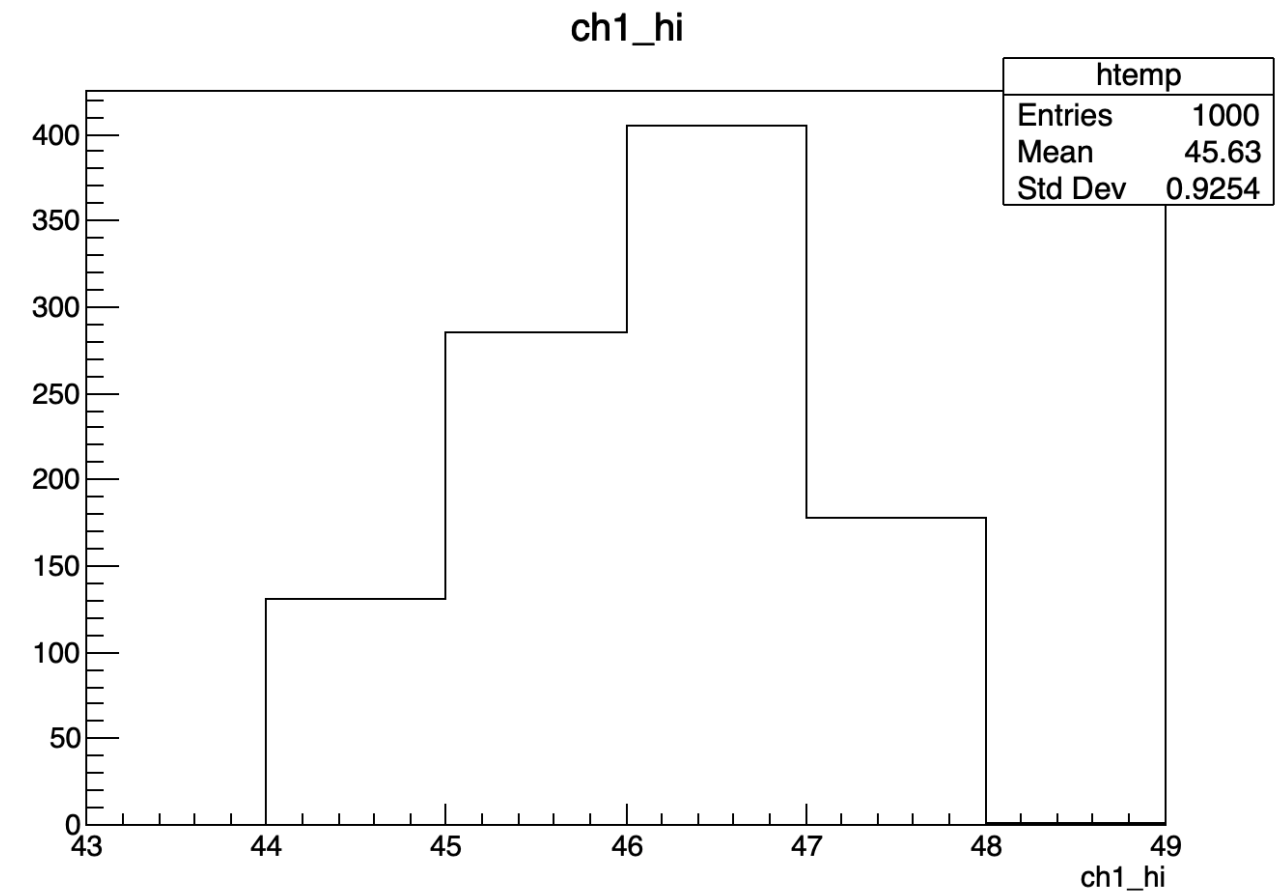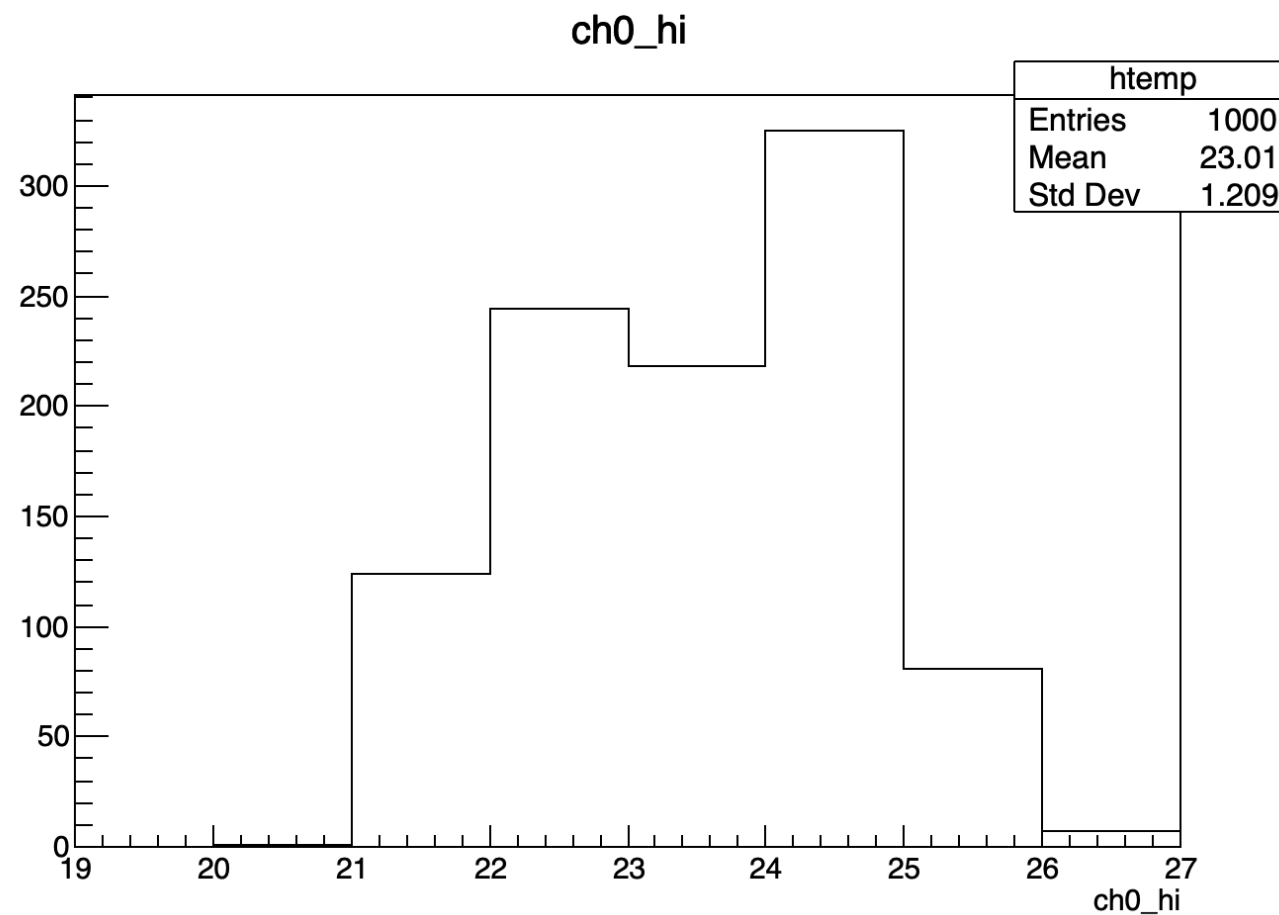
DESY.

LED signals

ch0_hi

ch0_hi	
Entries	1000
Mean	288.4
Std Dev	13.51
Underflow	0
Overflow	0

$U_{LED}=6V$

ch0_hi

htemp	
Entries	1000
Mean	1190
Std Dev	12.35

$U_{LED}=6.5V$

ch0_hi

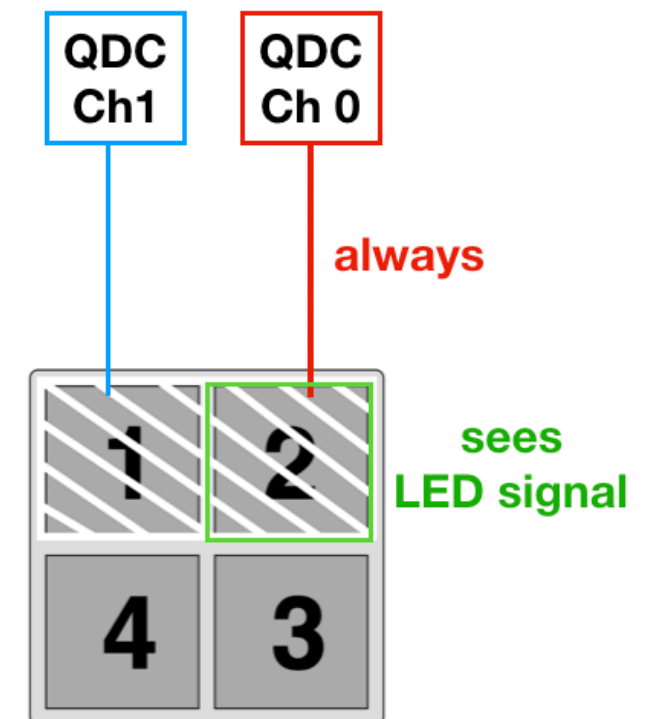| ch0_hi	
Entries	1000
Mean	1969
Std Dev	12.57
Underflow	0
Overflow	0

$U_{LED}=7V$

- 10Hz LED signal

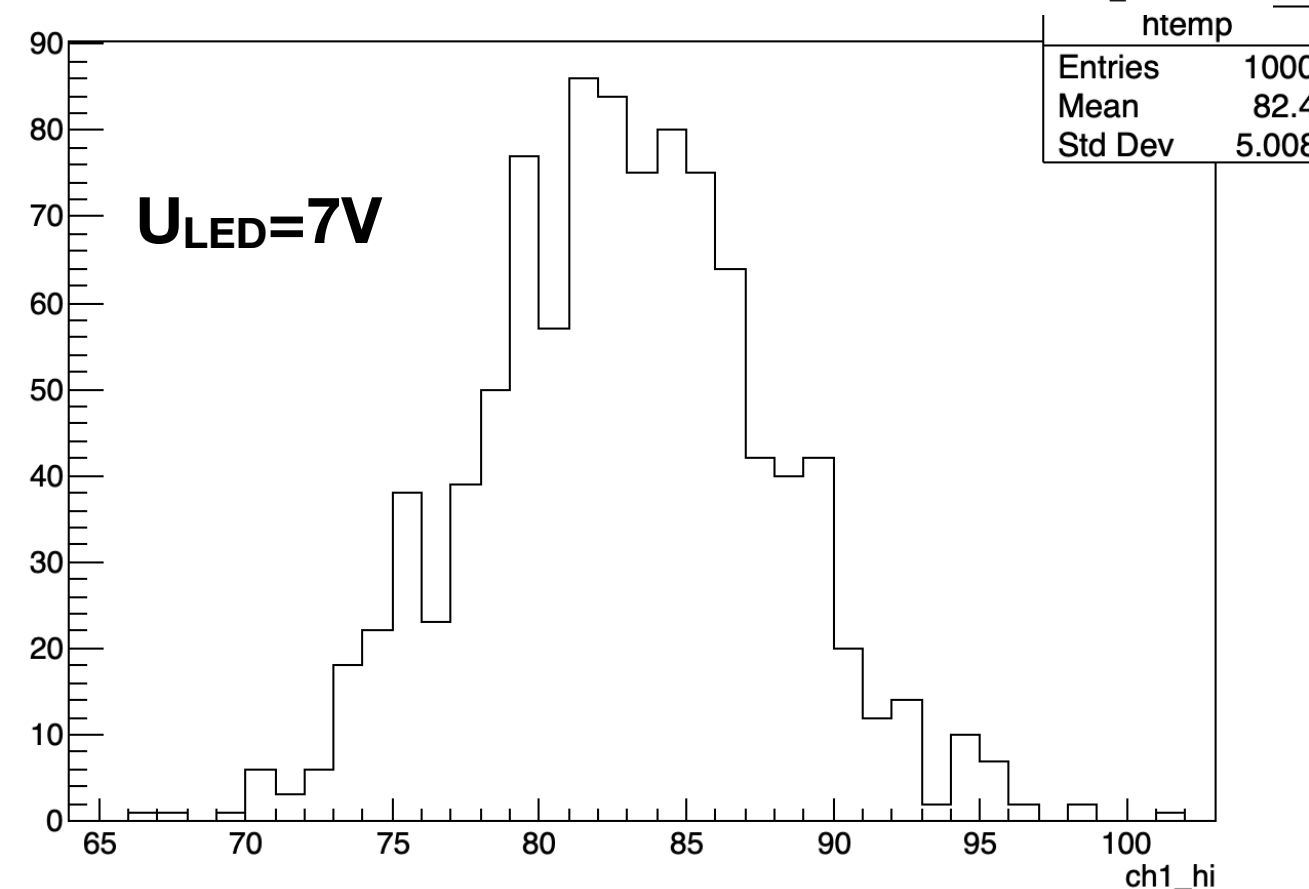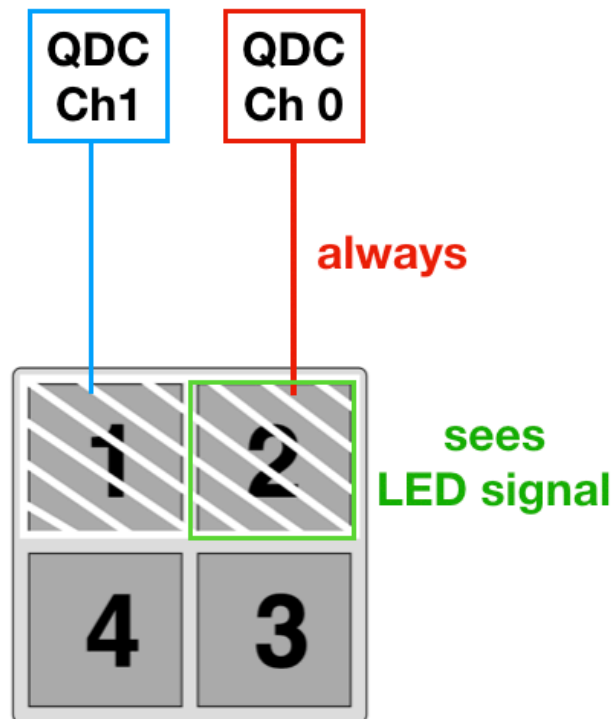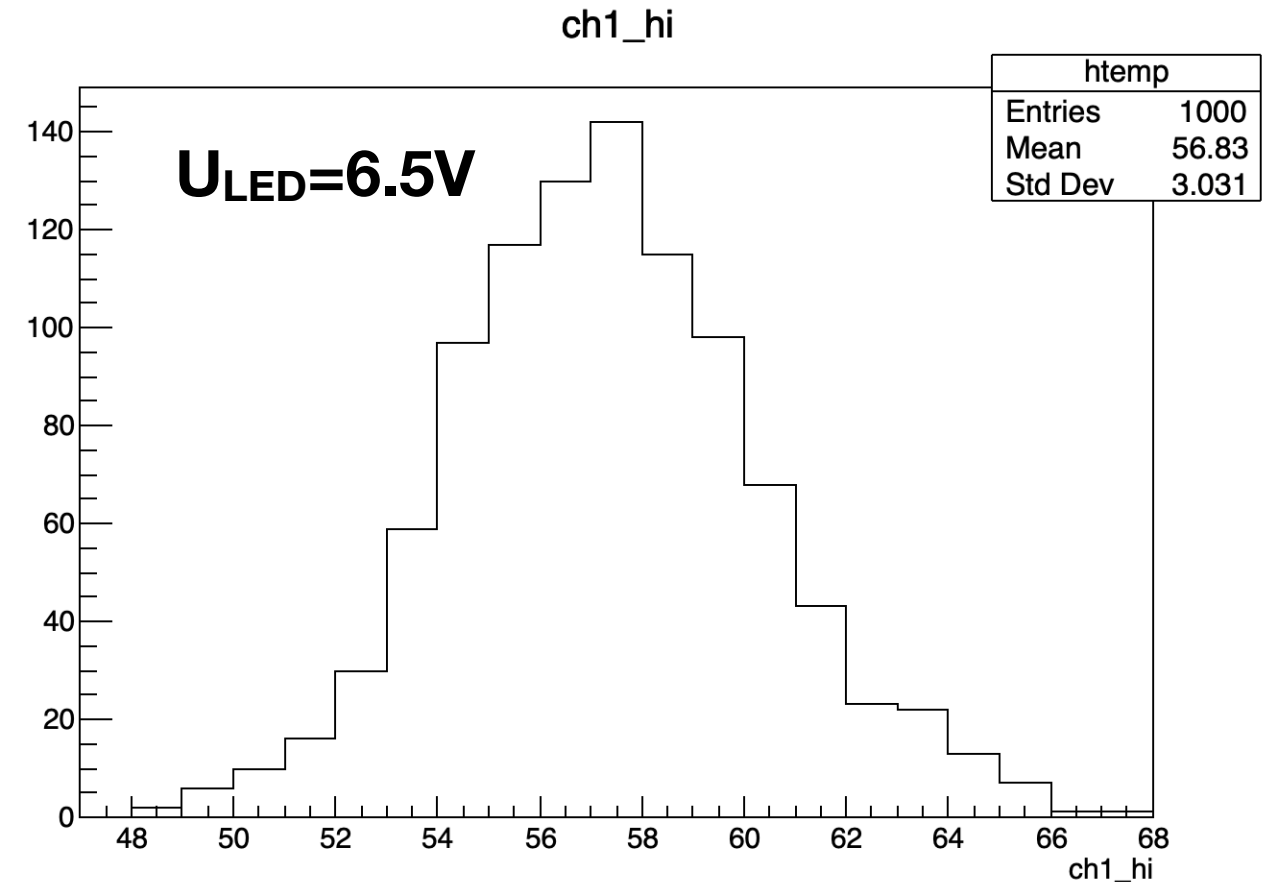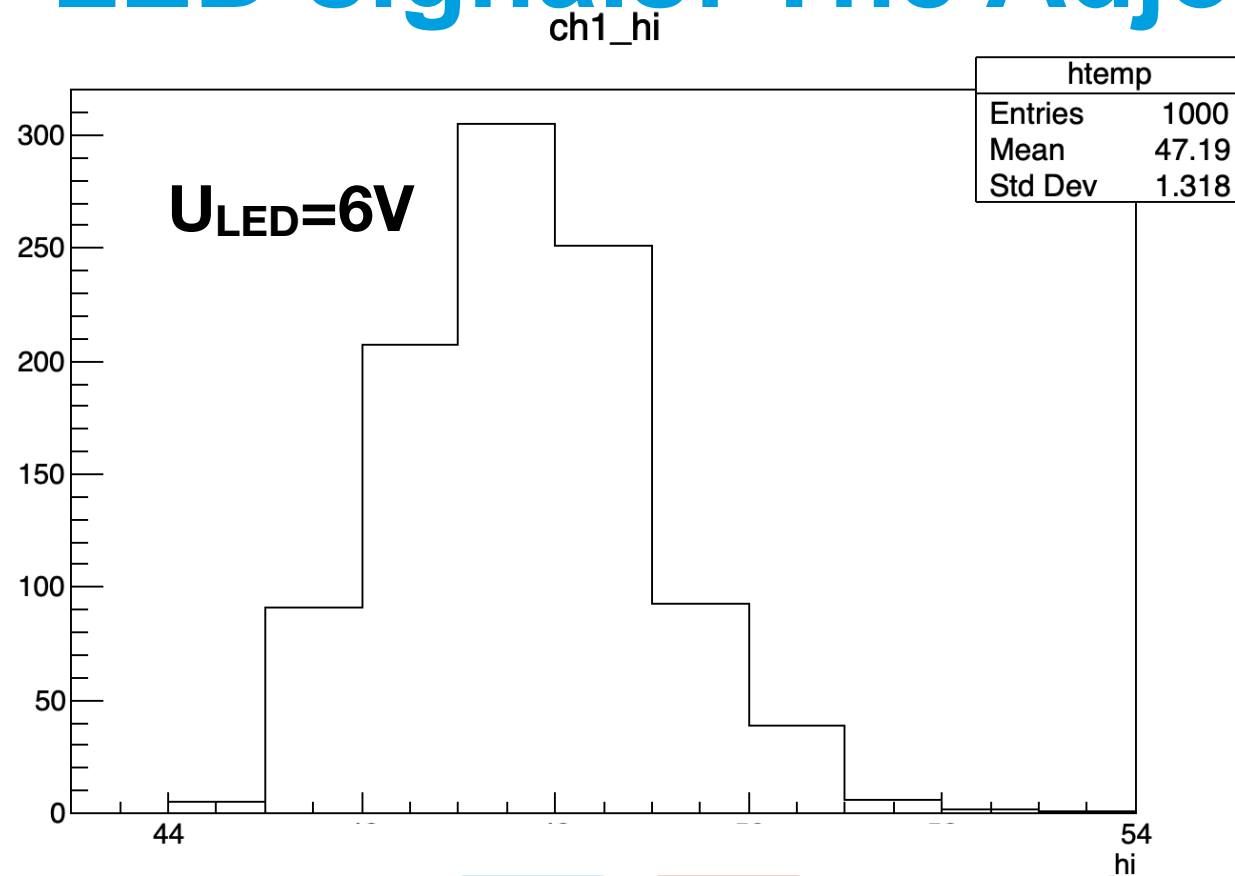- QDC count grows with increasing LED power as expected

DESY.

Pedestal: LED Trigger off

- without LED light, but still running 10 Hz trigger

- interesting: Pad 1 has higher pedestal than Pad 2

- could just be property of PMT

- could also be that our bricolage light-tight box on LED end
 is not 100% light-tight

DESY.

LED signals: The Adjoining Channel (Pad 1)

ch1_hi

htemp	
Entries	1000
Mean	47.19
Std Dev	1.318

$U_{LED}=6V$

ch1_hi

htemp	
Entries	1000
Mean	56.83
Std Dev	3.031

$U_{LED}=6.5V$

_hi

QDC Ch1   QDC Ch 0

always

1   2   sees LED signal

4   3

htemp	
Entries	1000
Mean	82.4
Std Dev	5.008

$U_{LED}=7V$

increase LED power → Pad 1 also sees more signal
LED mounting is make-shift, not 100% light-tight?
light from LED U-channel reaches Pad 1?

DESY.

Gas tightness
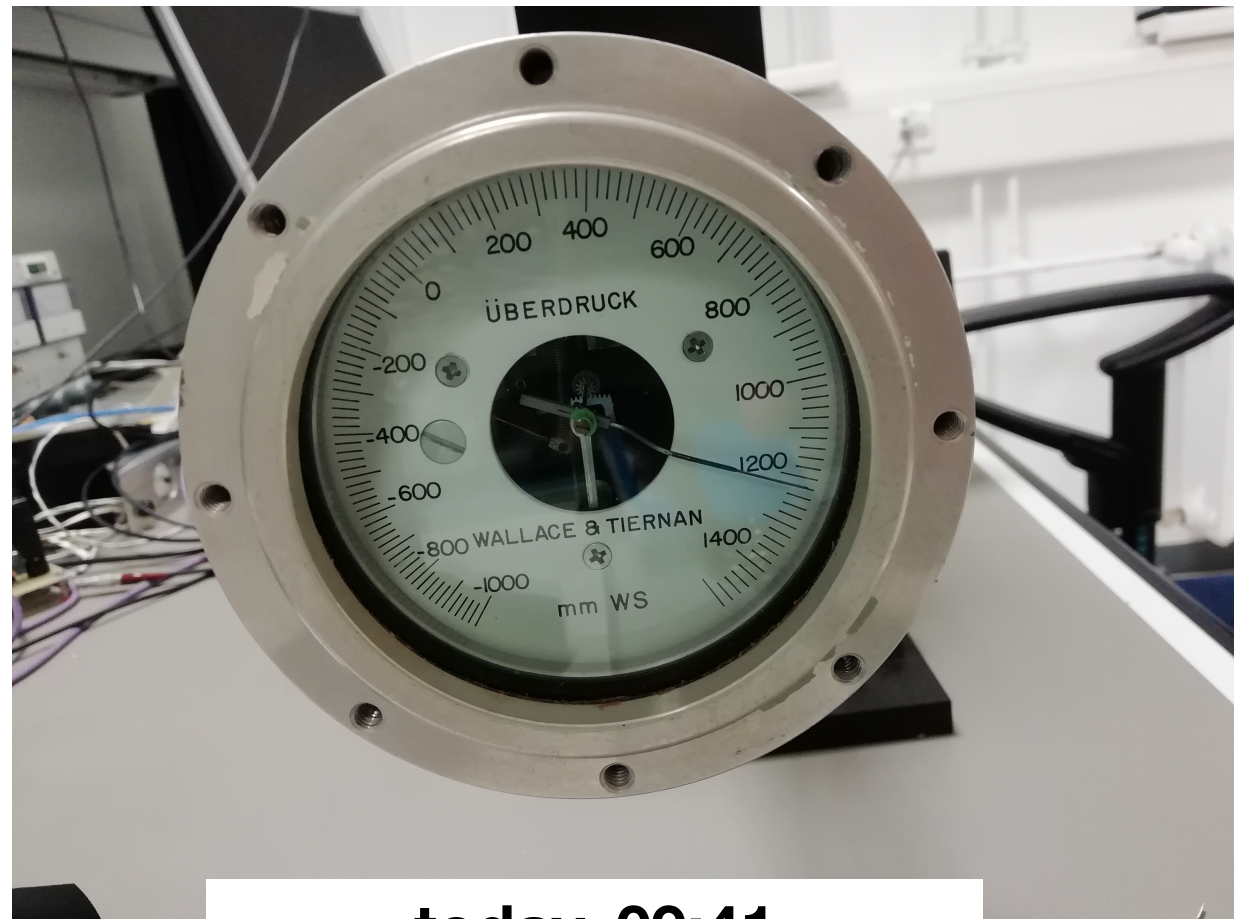
- glued second LED back into LED mounting (blackened Epoxy resin for light- & gas-tightness)

- test Gas tightness: test-fill with dry air in the lab

DESY.
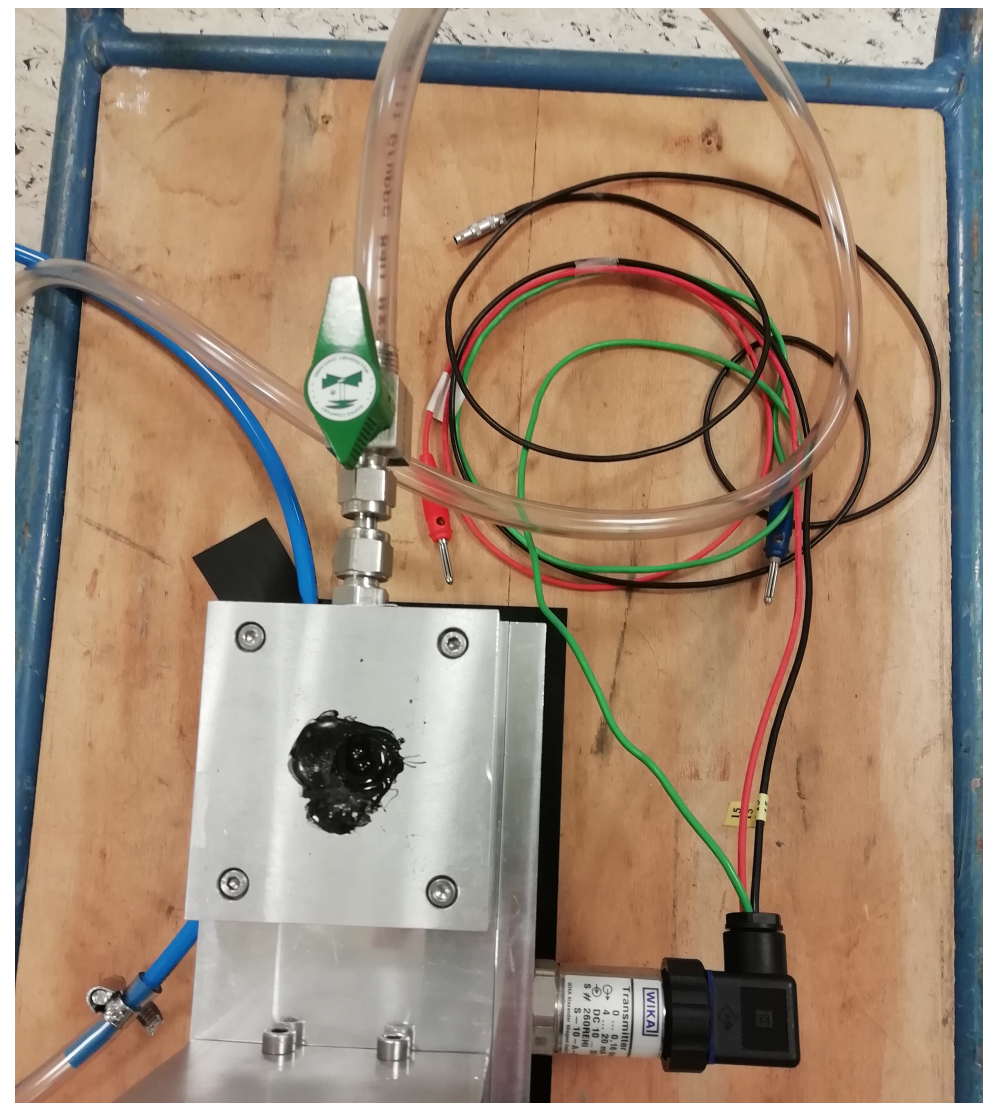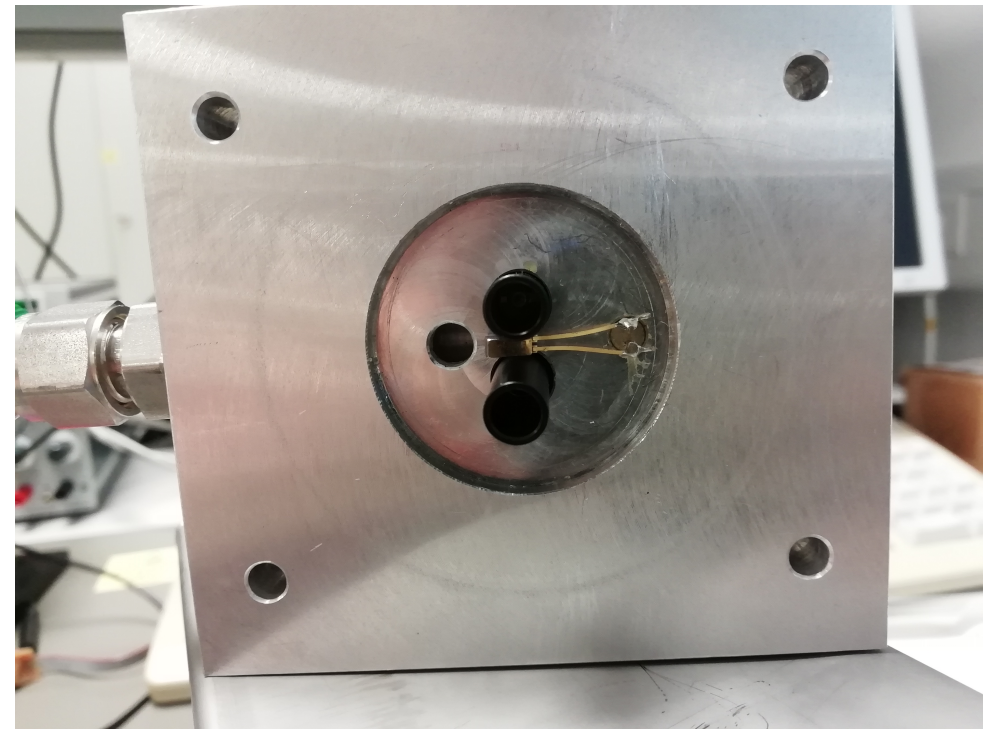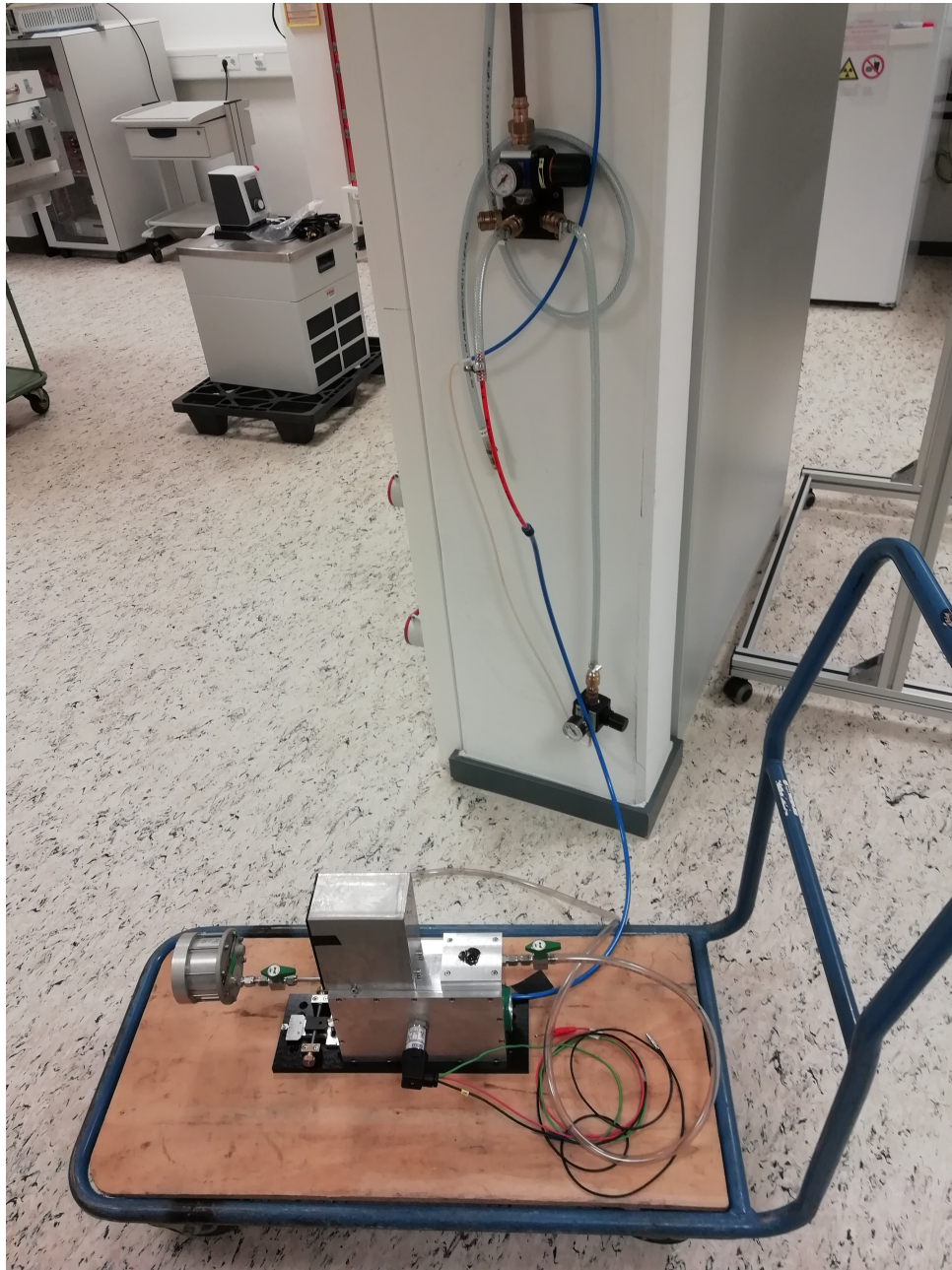
Gas tightness: Dry air test

today, 09:41
1220 mmH20 ≈ 122 mbar

yesterday, 16:41
1400 mmH20 ≈ 140 mbar

- for previous testbeams setup was filled with slight overpressure (140mbar), did the same

- after 17h lost 18mbar so ~1mbar/h

- should be ok for few hours Testbeam, will tighten some screws, can replace window O-rings if necessary

DESY.

Summary & ToDo

Setup is TB ready:

- tested 4-anode MAPD with pulsed LED

- successfully operated DAQ chain with LEDs

- setup is gas-tight (enough), check light-tightness with proper LED leg

1.) Necessary before TB:

- Gas supply: will go with Oliver to Hera West in next days to do a test-fill of the real Cerenkov gas

- do some trigger testing (we can borrow a TLU once one is free)

- TB safety training (next Monday)

2.) Would be nice:

- temperature logging (temperature sensor on LED leg works, also included in DAQ, need to test on Lab PC)

- Pressure sensor (can't get it to work…), not super urgent

BACKUP

Reminder: DAQ chain

gate generator

HV supply

QDC

VME bridge