



LED notched fibre system

short HBU0 party with QMB6

Ivo Polák

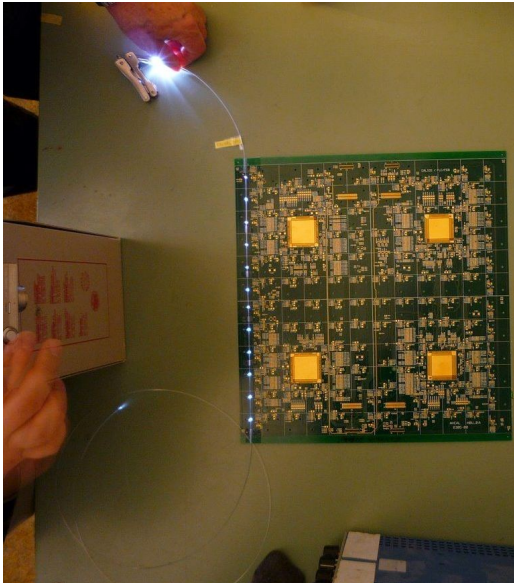
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1. Notched fibre light distribution systems
2. A Set-up, with provisional fibre layout
3. QRLED driver generate single p.e. Spectra at HBU0
4. Saturation curve needs better light coupling
5. Conclusions



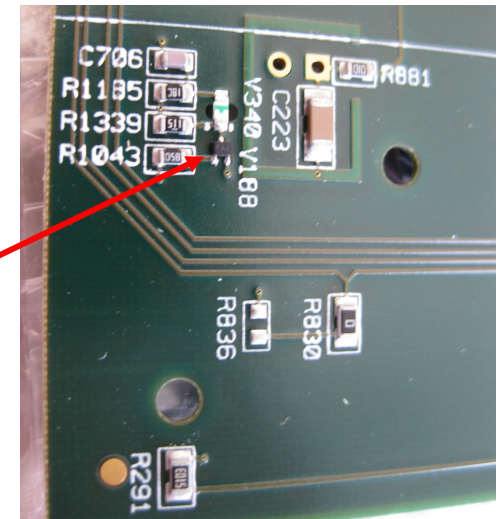
Flashing UVLED - 2 methods

- Light distributed by **notched fibres**
- Light distributed directly by microLED to the scintillator - **distributed LEDs**



Institute of Physics ASCR, Prague, (= FZU)
Kobe University

main HCAL, DESY



smd
UVLED

DESY Hamburg
UNI Wuppertal

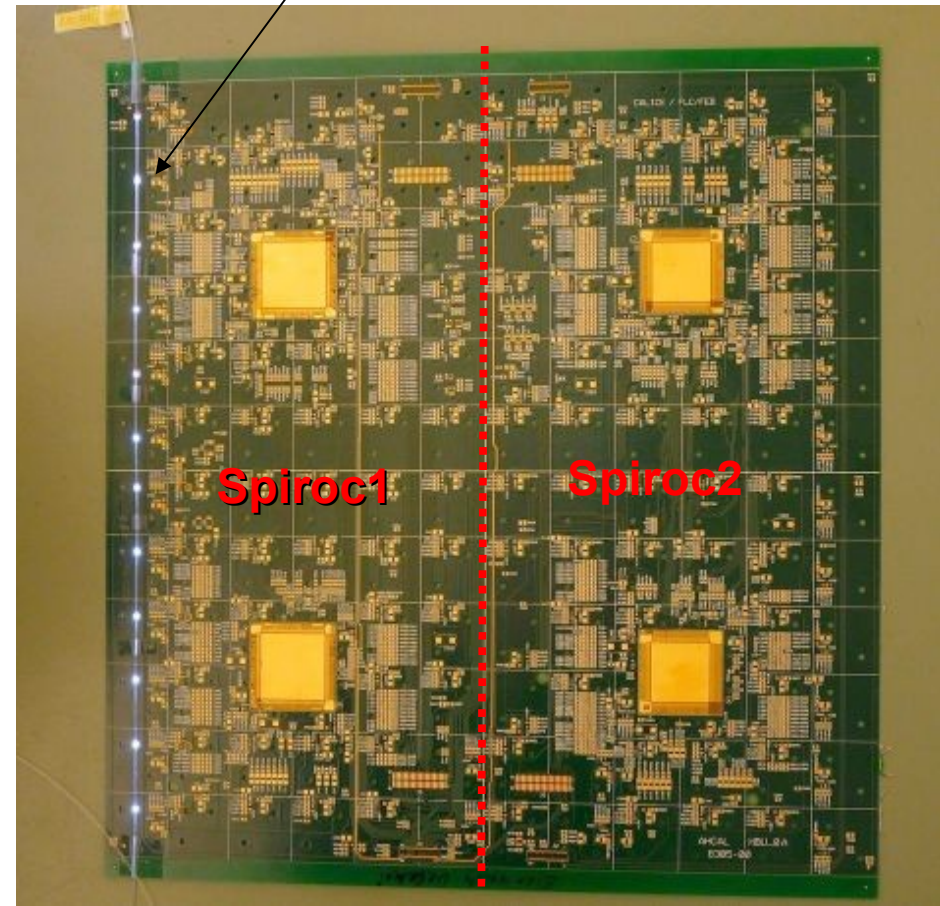
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Notched fiber system

Notched fibre routed at HBU0, taps illuminate the scintillators via special holes

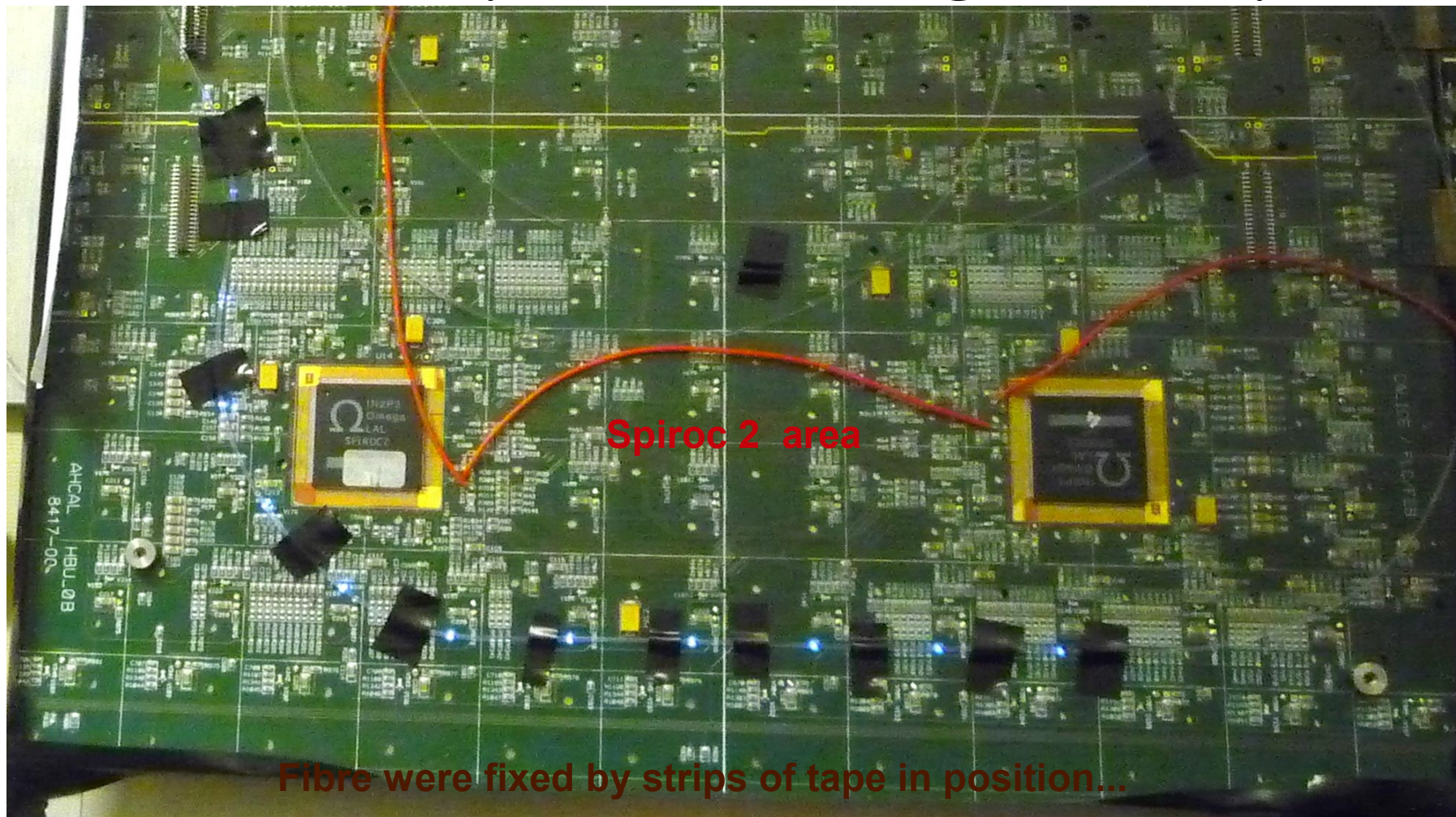
- **advantage** – tuneable amplitude of LED light from 0 to 50 mips
- Variation of LED amplitude does not affect the SiPM response readout
- LED circuit and LEDs enable optical pulses with around 1ns width
- Spread of light intensity from notches can be kept under 20%
- **disadvantage** LED with control unit outside the detector volume
- Notched fibre production is not trivial

**Nice idea, but...
Spiroc1 area is
not working**

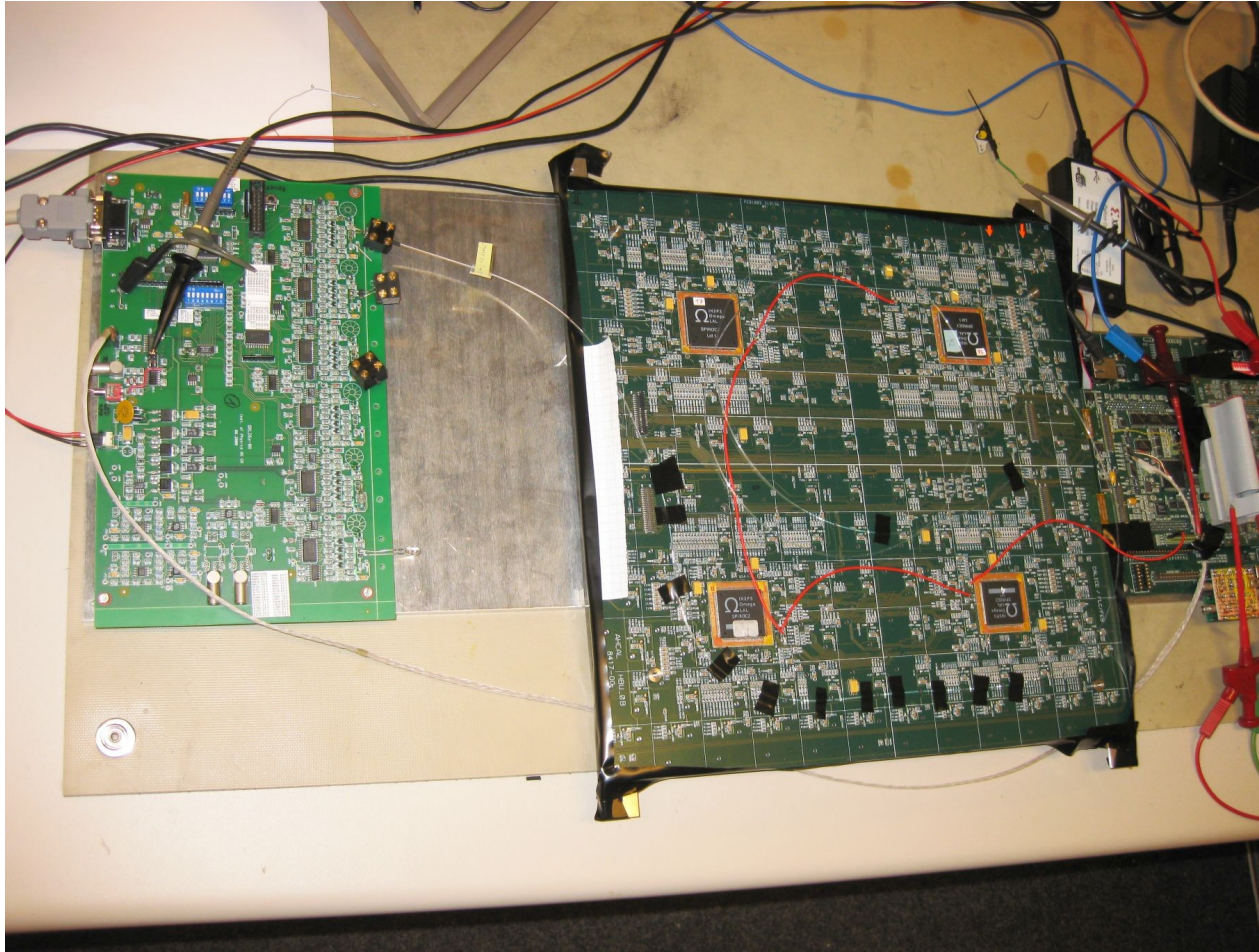


Notched fibre layout

nice blue taps shins to alignment pins



Setup QMB6 + HBU0



- From HBU0 (calib board):
 - signal T-calib LVDS only
 - 60ns Delay
 - power +15V/0.16A
 - CANbus slow-control
 - One UVLED 5mm
 - One Notched fibre

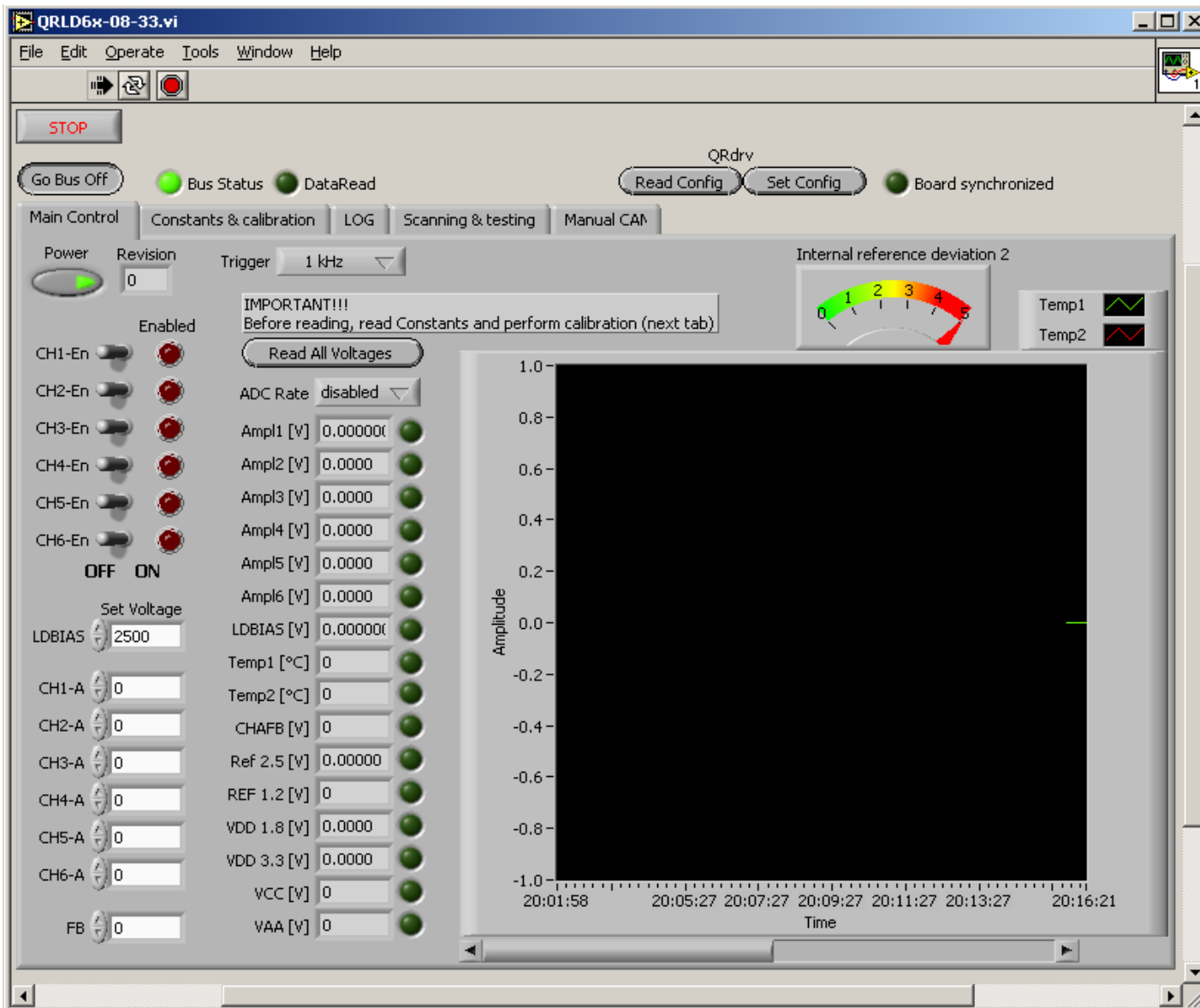
Control: LabView 8.2 exe-file, One PC with DAQ, USB --> CAN

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Almost **plug and play**

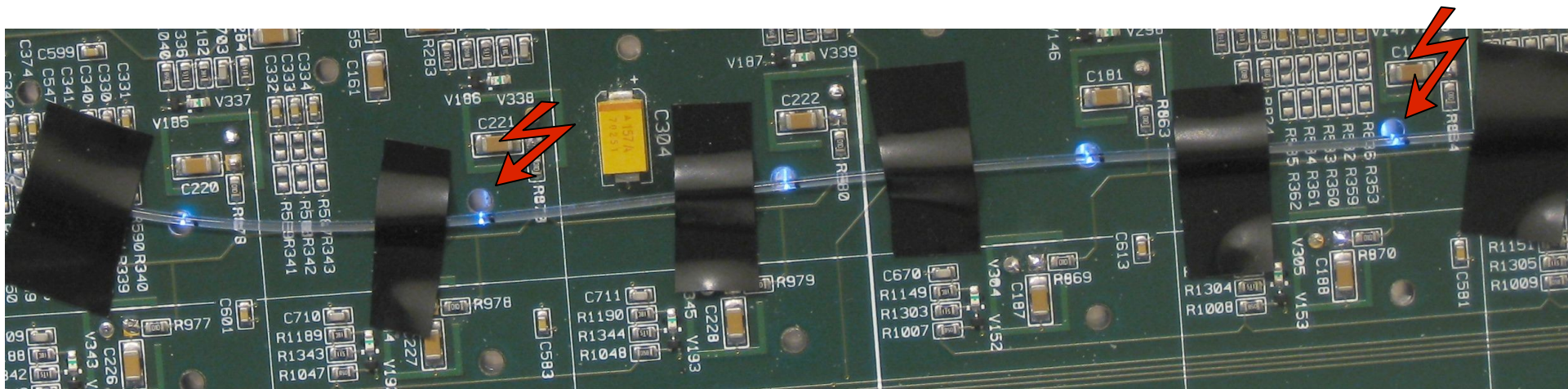
Control panel of QMB6 in LabView 8.2



- Controls individual LED amplitude
- LED Enables
- Trigger mode ext/internal
- Measure temperature
- CANbus control
- It can work as Exe file

Next day we found a misalignment of the fibre

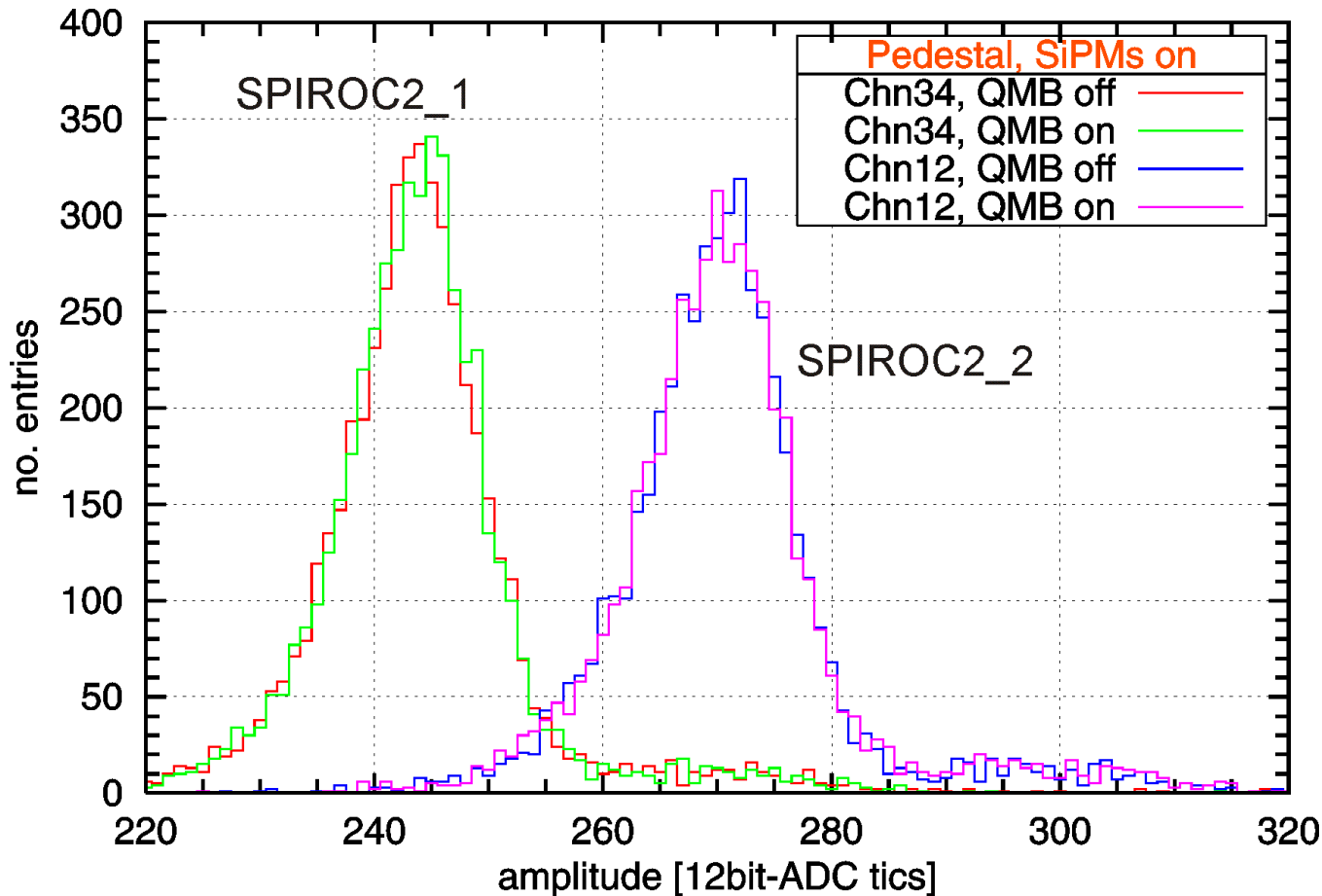
Electrical tape and bended fibre is not the right combination!



QMB6 **ON/OFF** test

ON means T-calib on, LED off

OFF means +15V power off



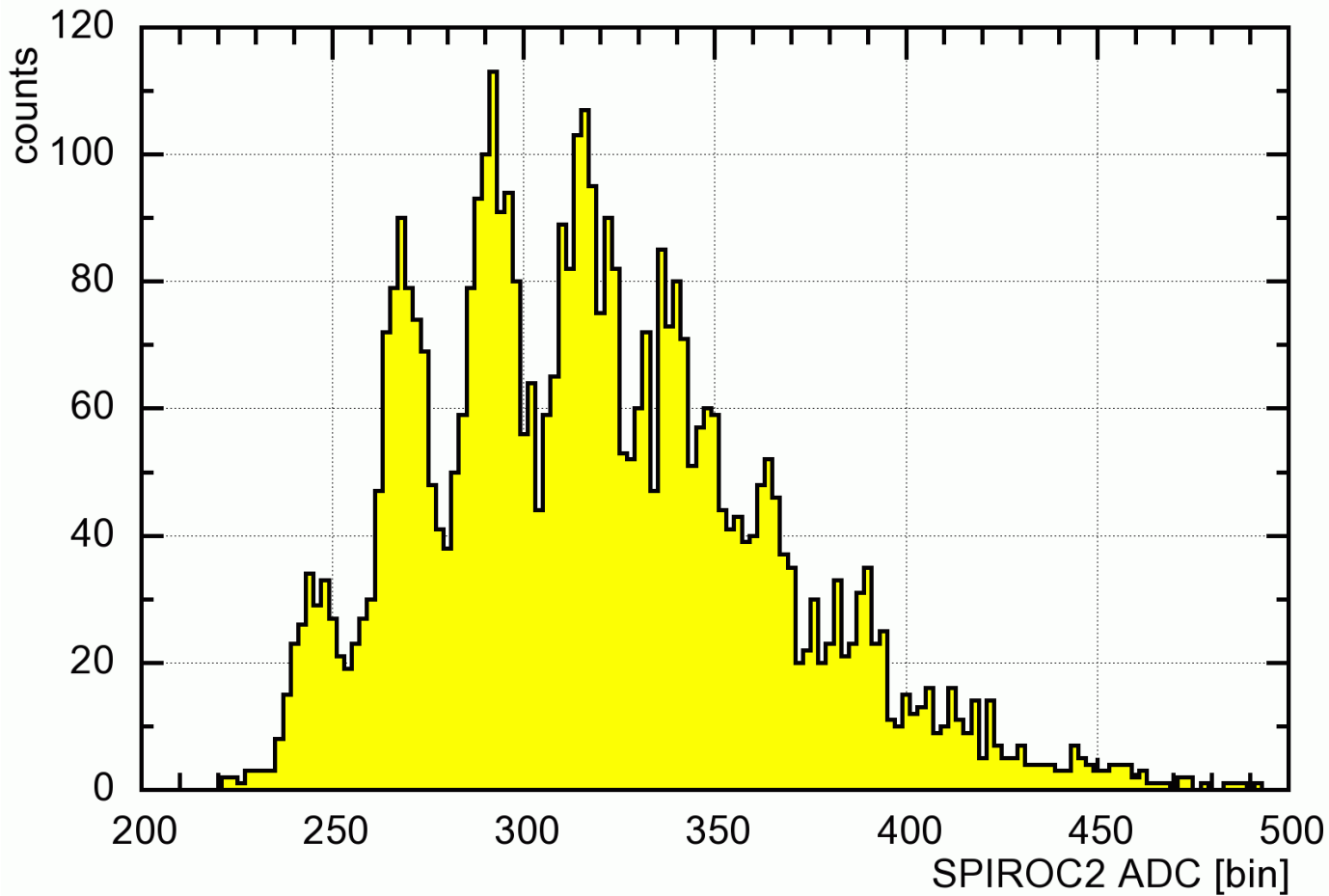
NO pedestal shift!
NO unwanted ground coupling!



Single p.e. spectrum

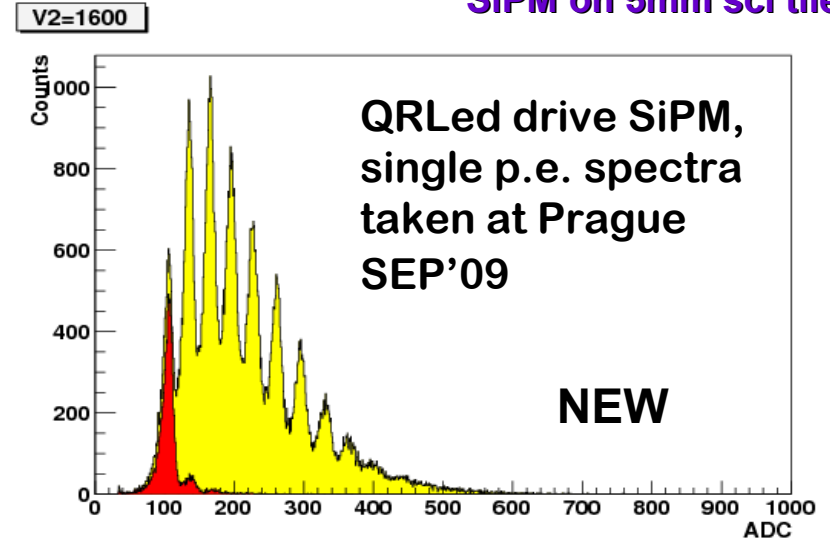
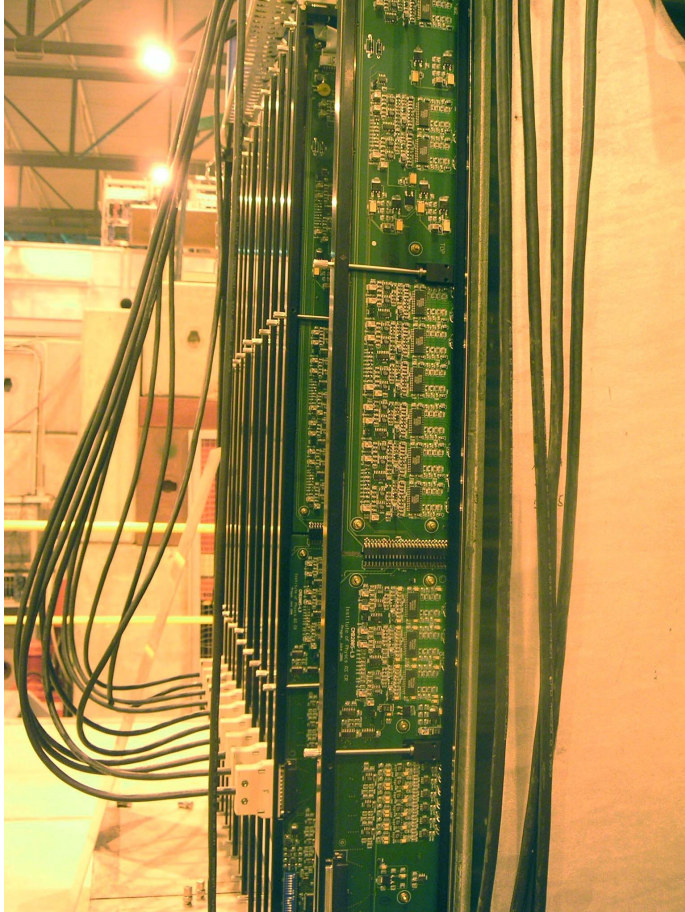
Channel 25, ASIC 0, memory 2

Calibration mode,
High Gain



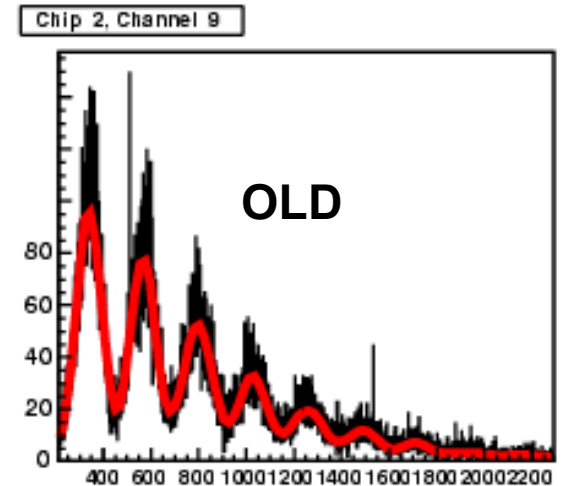
Single photoelectron spectra with **CMB** and **QRLED**

LED light 400nm to
SiPM on 5mm sci tile



← **CMB** in tuning
position at
AHCAL
TB 2007 CERN

one of the
single p.e.
spectra →



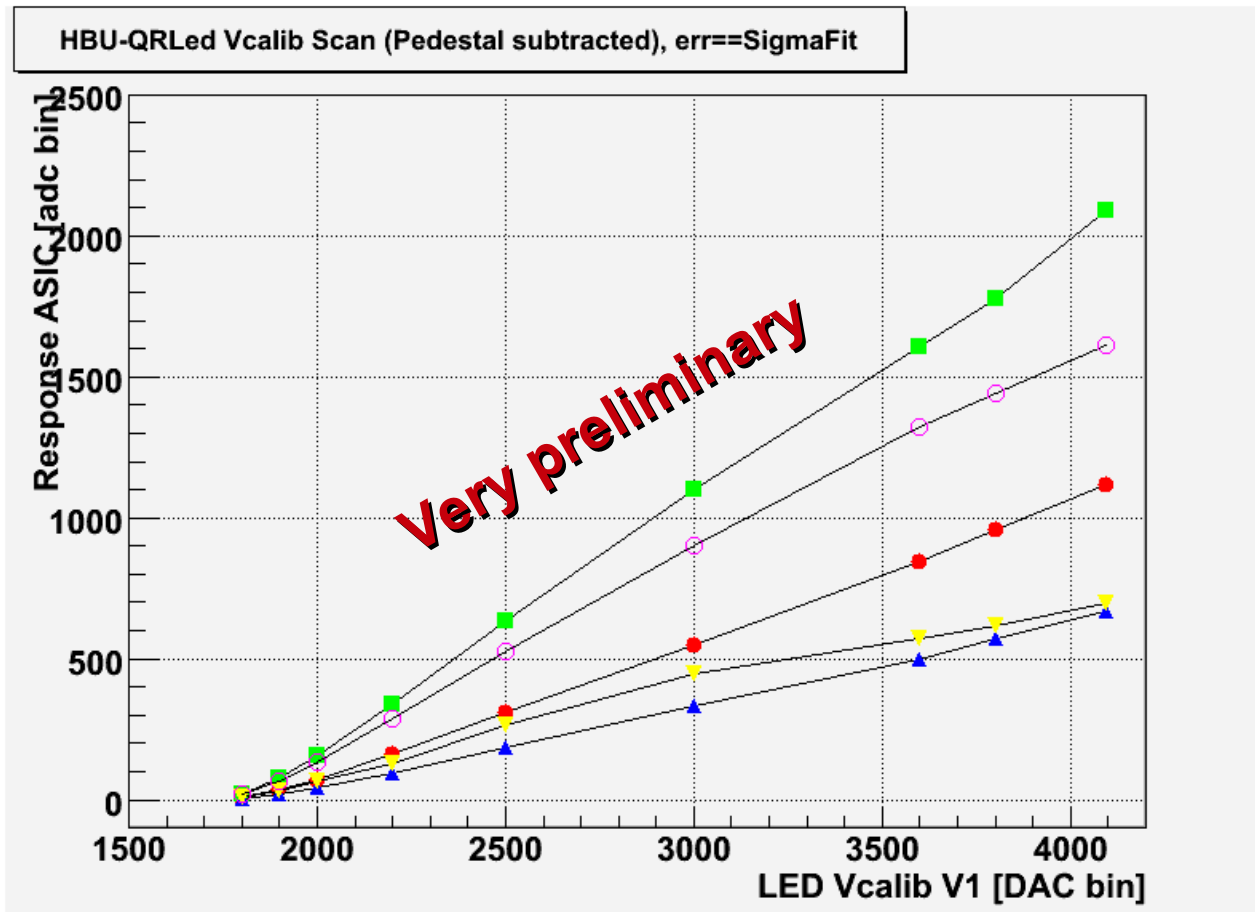
More info about CMB can be found at:

[http://www-
hep2.fzu.cz/calice/files/ECFA_Valencia.Ivo_CMB_Devel_nov06.pdf](http://www-hep2.fzu.cz/calice/files/ECFA_Valencia.Ivo_CMB_Devel_nov06.pdf)

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Linearity test (it means a saturation curve)



Settings:

Cf = 400fF
Low gain mode

- We do not see saturation effect, yet.
- Better optical coupling alignment is a must.
- Higher LED pulse can be made with larger pulse-width (3.7 → 7ns)

Conclusions to common test HBU0 with QMB6

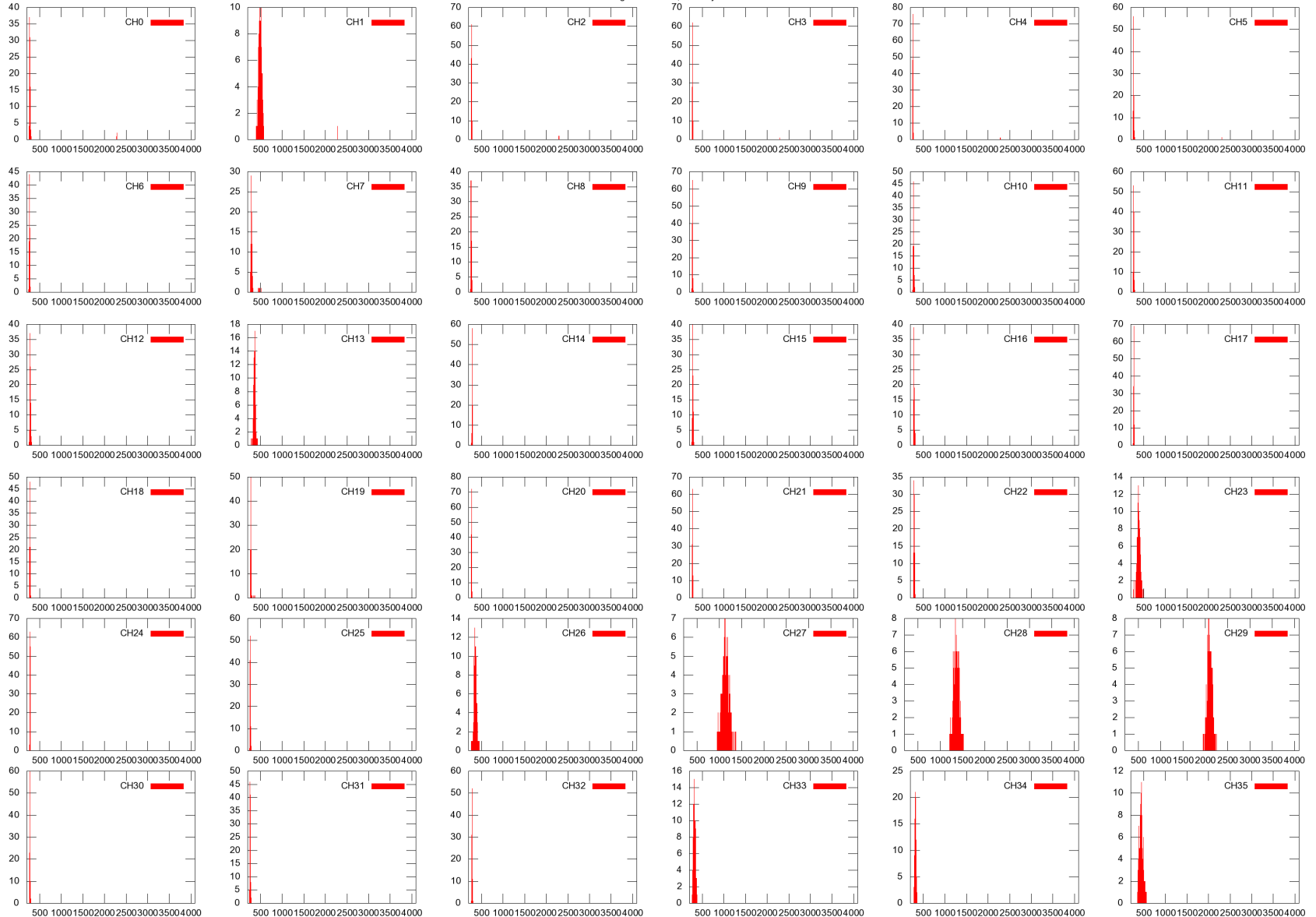
- Easy implementation, almost **plug and play** installation
- QRLED driver has tunable light amplitude
- Both methods of light distribution are tested in HBU0 EUDET prototype
- With QMB6 we can see a nice single p.e. spectra, similar to distributed LEDs
- We do not see saturation of SiPM yet, better optical coupling is a must. We have to focus on this detail.
- We would like to make more tests in the future, focusing on the optical coupling
- Special thanks to Mathias Reinecke and FLC group.

Back up

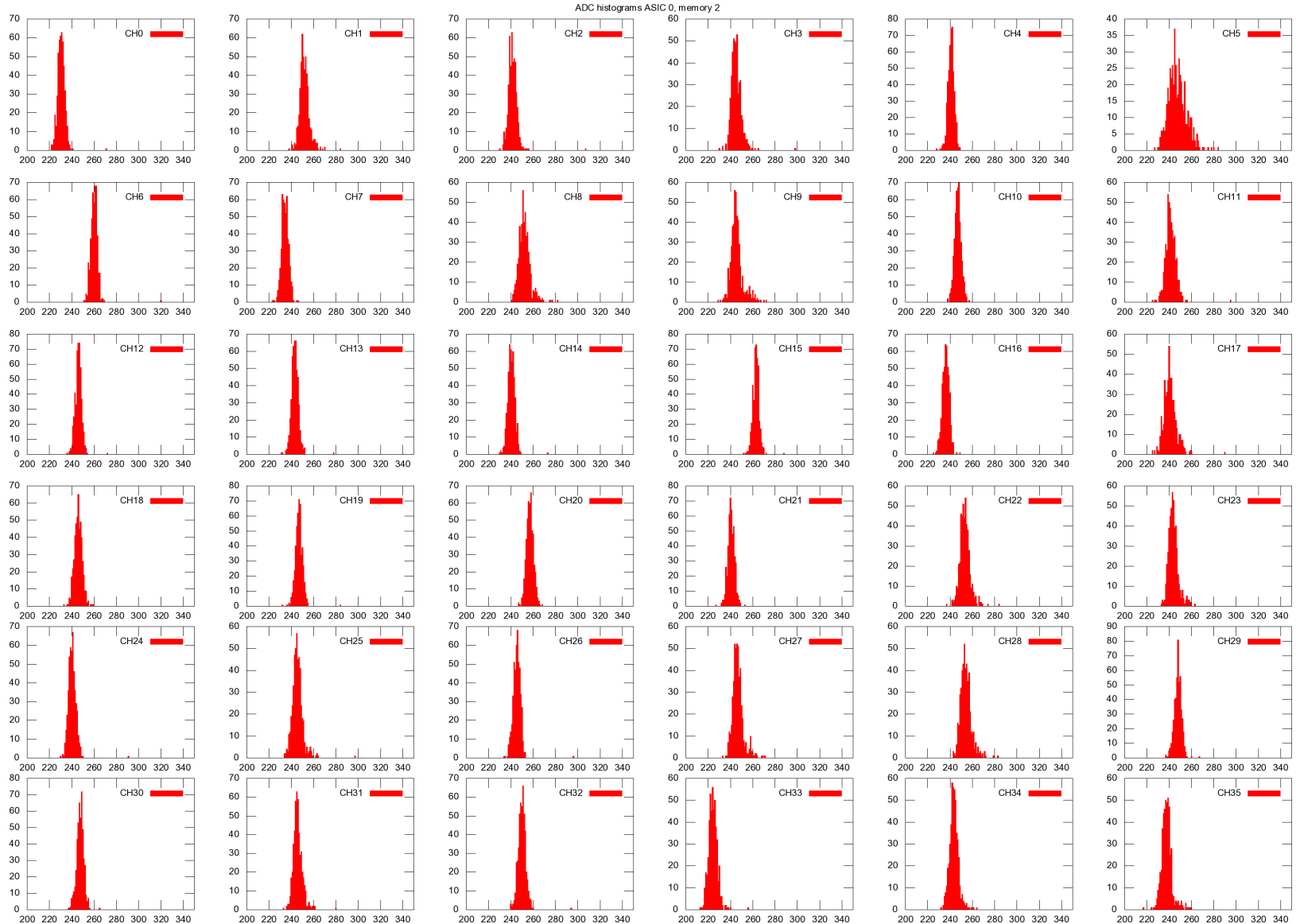
Max. Optical power, ASIC 0

histograms

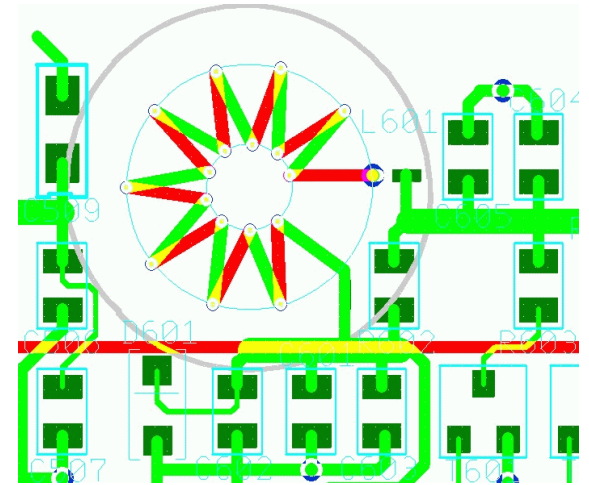
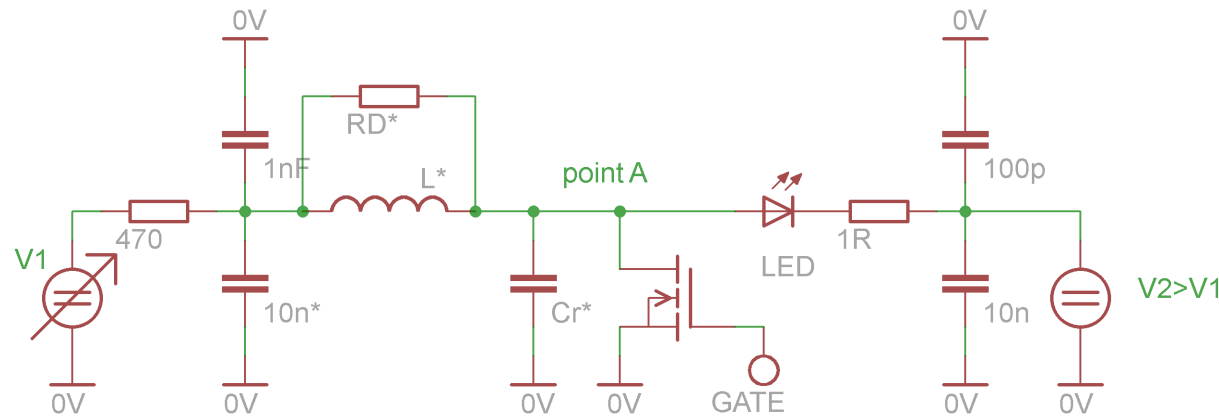
ADC histograms ASIC 1, memory 2



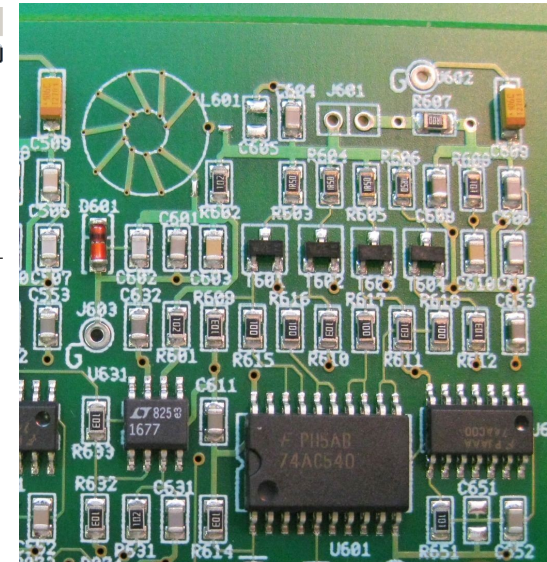
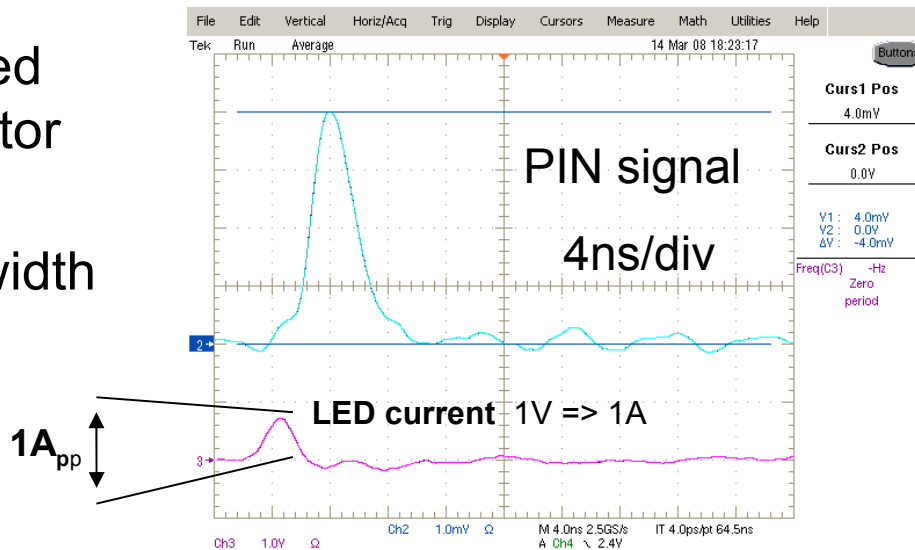
Pedestal ASIC 0, channel 1..36



Quasi-Resonant LED driver



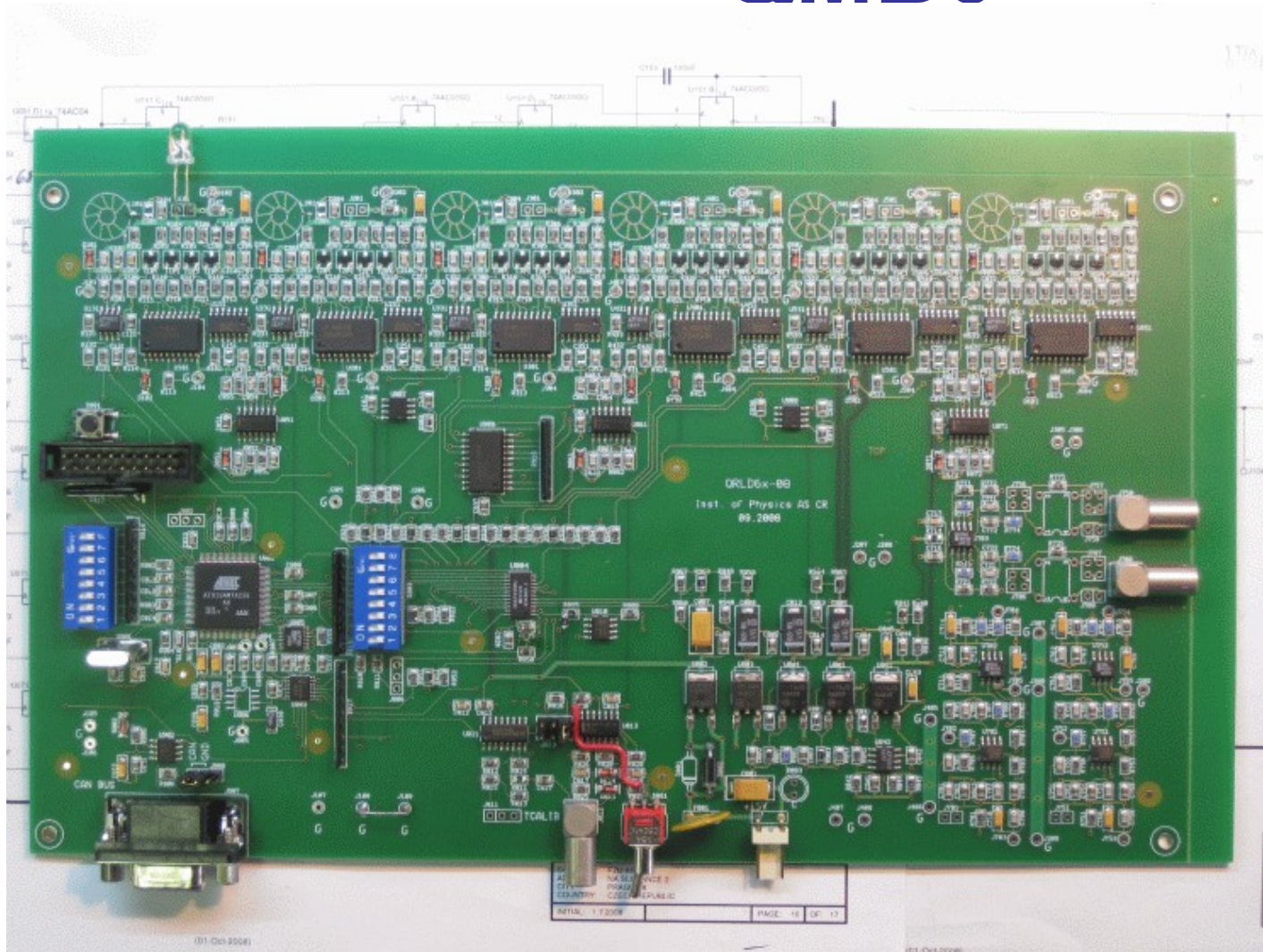
- Less RFI
- PCB integrated toroidal inductor (~35nH)
- Fixed pulse-width (~4ns)



6-LED QR driver Main Board = QMB6

Consists:

- 6 QR LED drivers
- 2 PIN PD preamps
- CPU + communication module, CANbus
- Voltage regulators
- temperature and voltage monitoring



Details of distributed LEDs

Small UV LED, smd size 1206 and 0603

