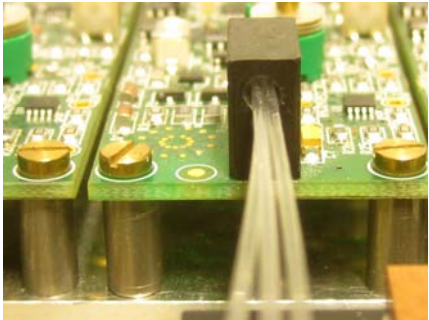
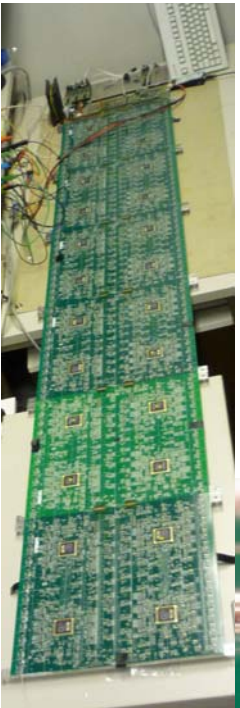




LED notched fibre distributing system **QMB1** with **6xHBU2** test



Ivo Polák, on behalf of Prague's group
polaki@fzu.cz

QMB1A specifications
Test with row of 6 HBU2
Analysis of light fibre distribution
Notched fibre triplet, semiautomatic machine
Conclusions

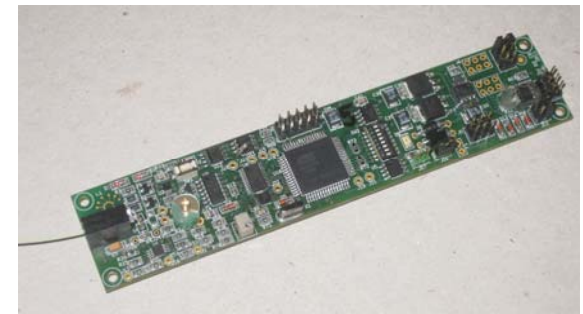


More info of QMB can be found at previous presentations:

[http://www-hep2.fzu.cz/calice/files/20110915-](http://www-hep2.fzu.cz/calice/files/20110915-Polak_I.CALICE_Heidelberg.pdf)

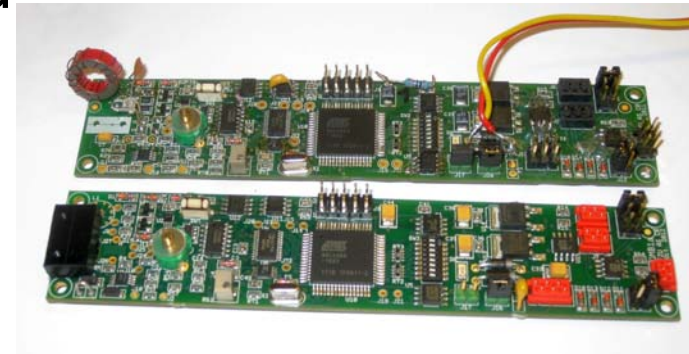
[Polak_I.CALICE_Heidelberg.pdf](#)

QMB1(A)



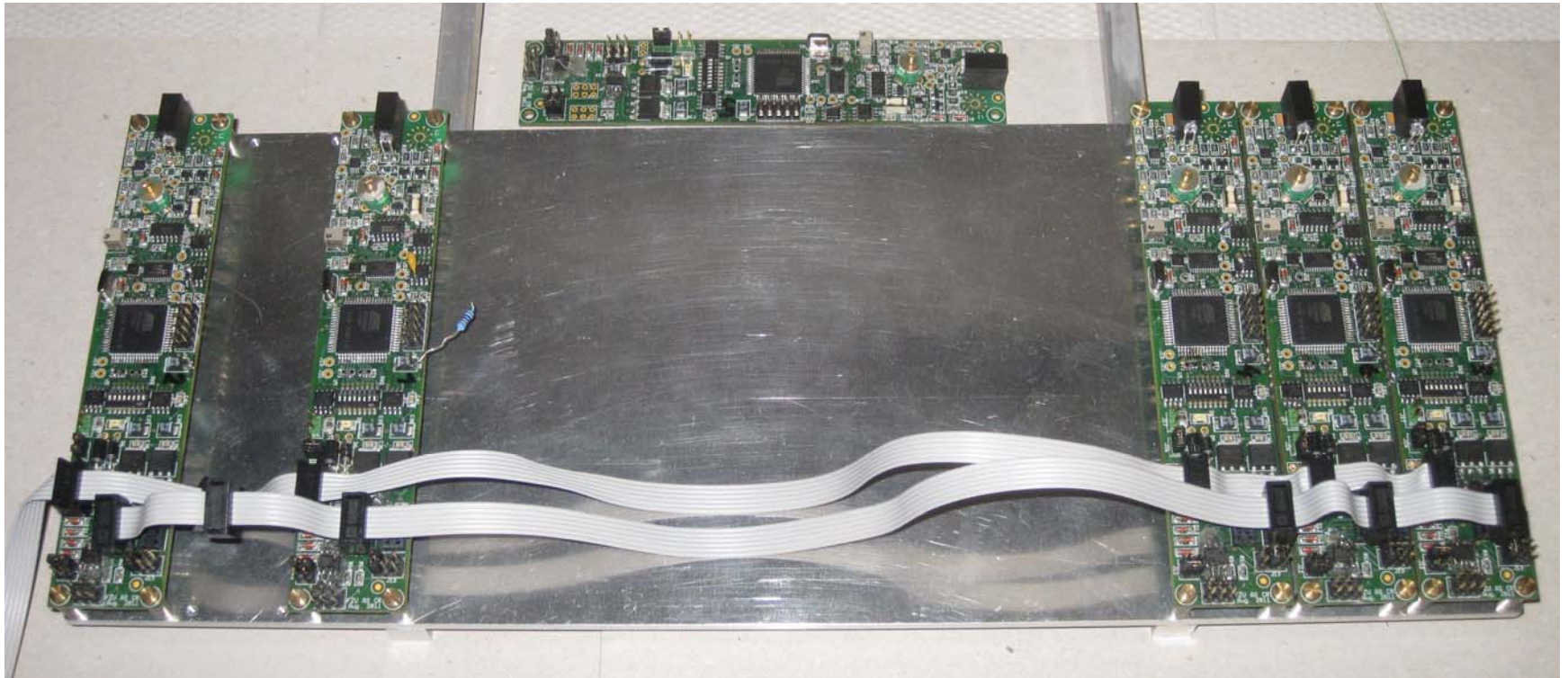
Single power 15V 65mA

- Quasi resonant Main Board
 - Modular system, 1 LED per board
 - Operation mode:
 - DAQ + CANbus control
 - stand-alone mode
 - LVDS Trigger distribution system
 - Variable amplitude, zero to maximum (~1Amp) smooth
 - Pulse width fixed to ~ 3.5ns STD (UV or blue LED) or ~30ns LONG pulse version (external inductor)
 - Voltages and temperature monitoring
 - Size of PCB: width 30mm, depth 140mm



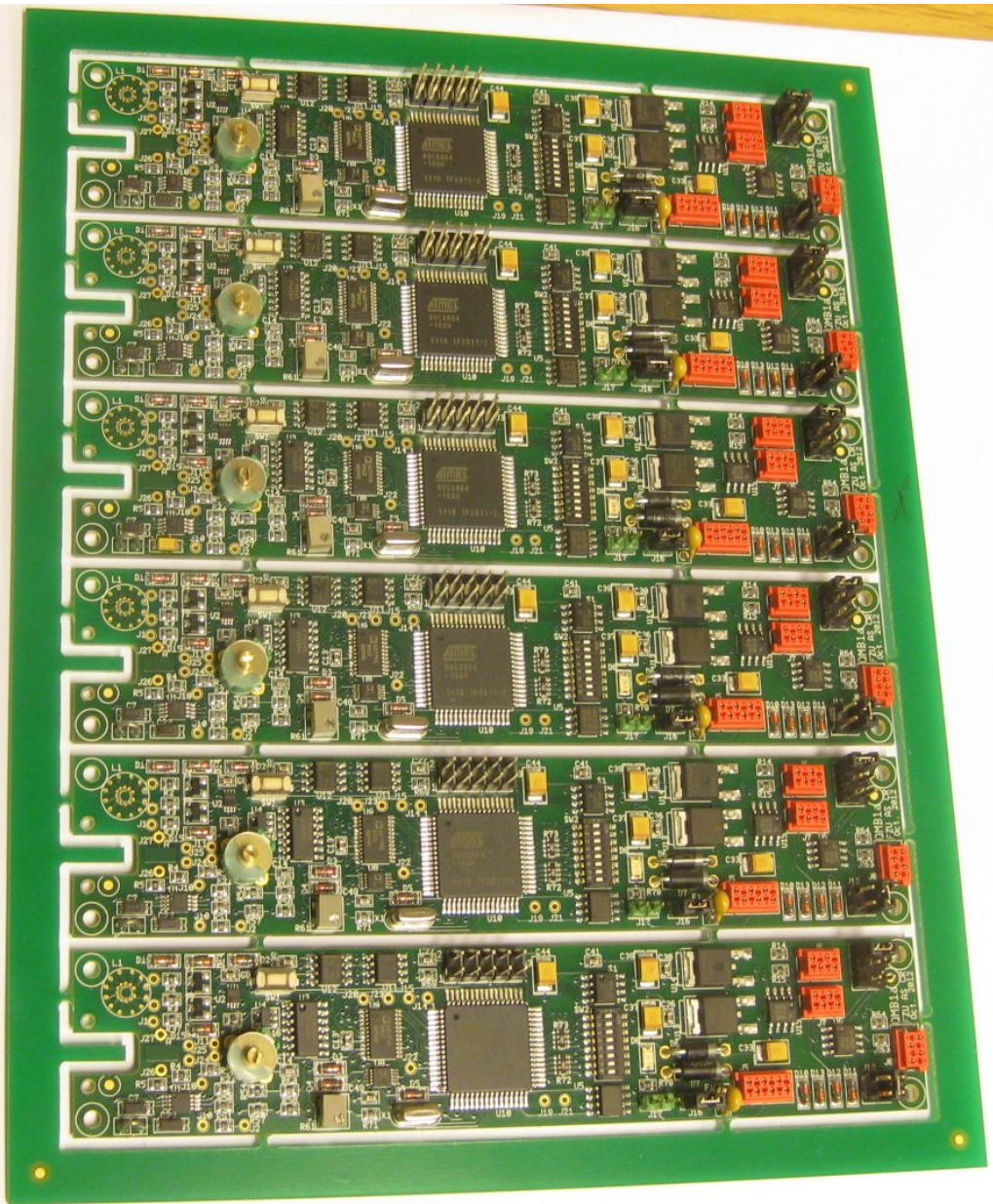
Frame with 5 QMB1 boards to match to HBU frame

(and 1 spare)

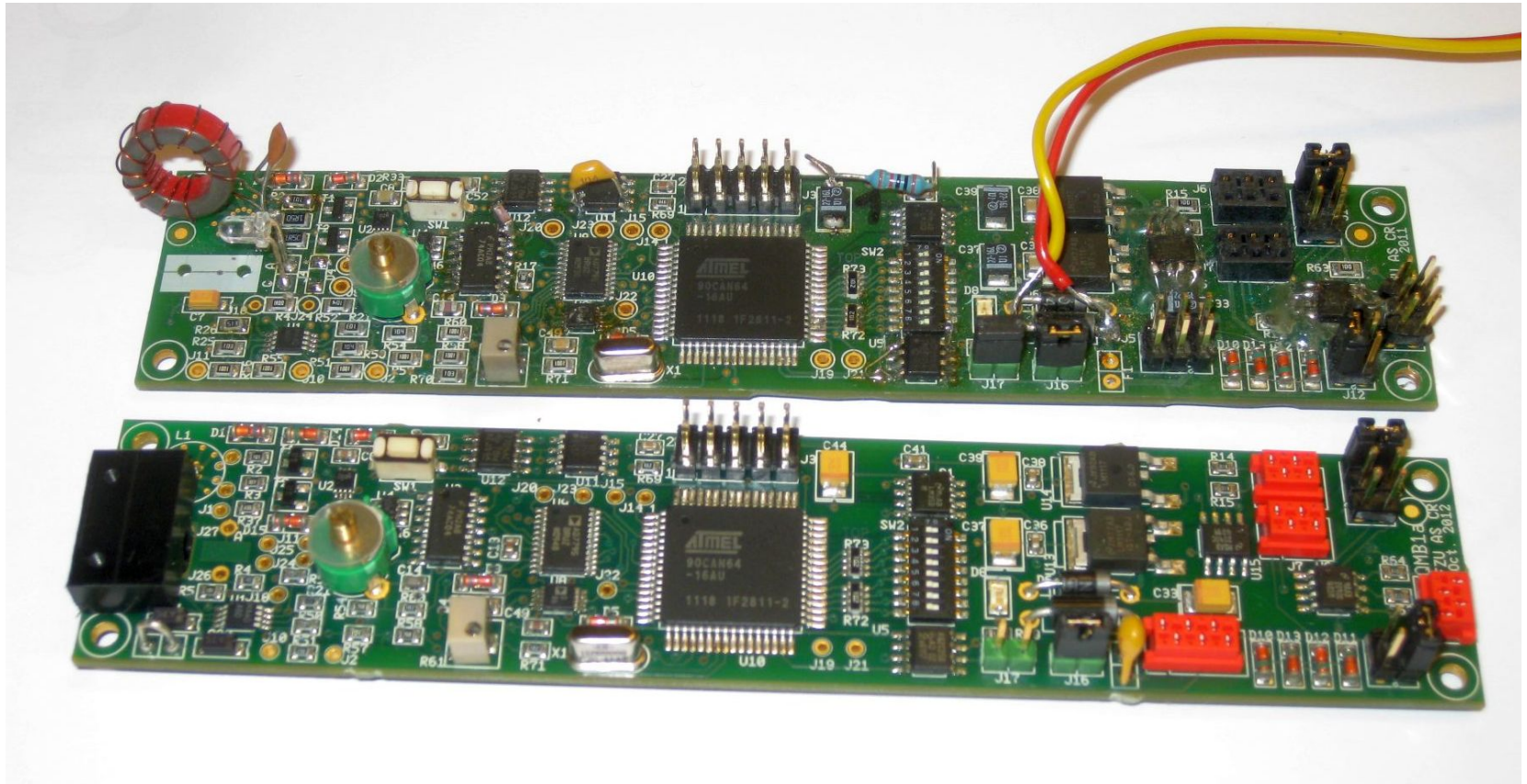


6x QMB1A

- PCBs after assembly in the frame (end of Nov 2012)
- Red connectors are for
 - Trigger LVDS distribution
 - PWR
 - CANbus
- Partially tested on shorts and voltage regulators.

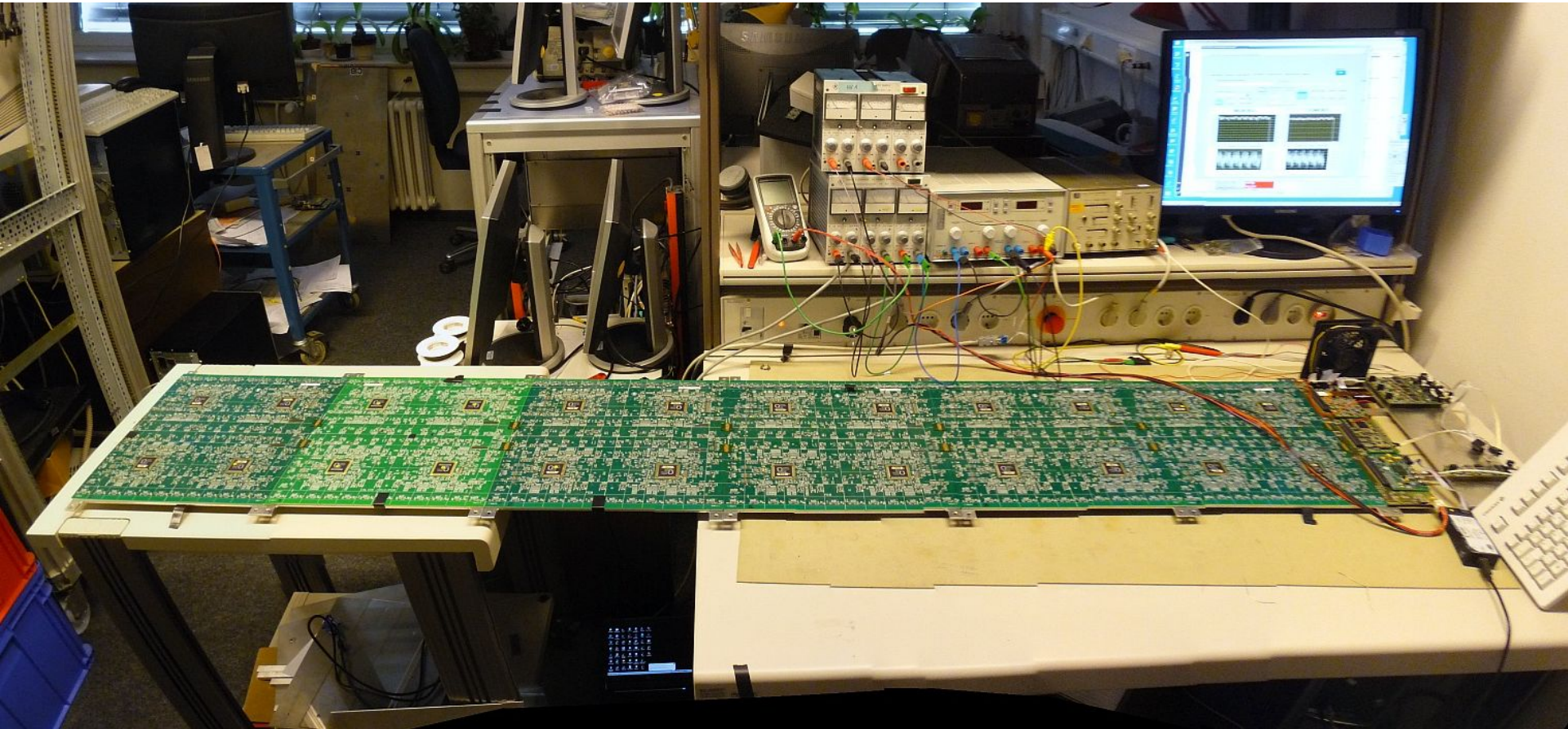


QMB1 to QMB1A



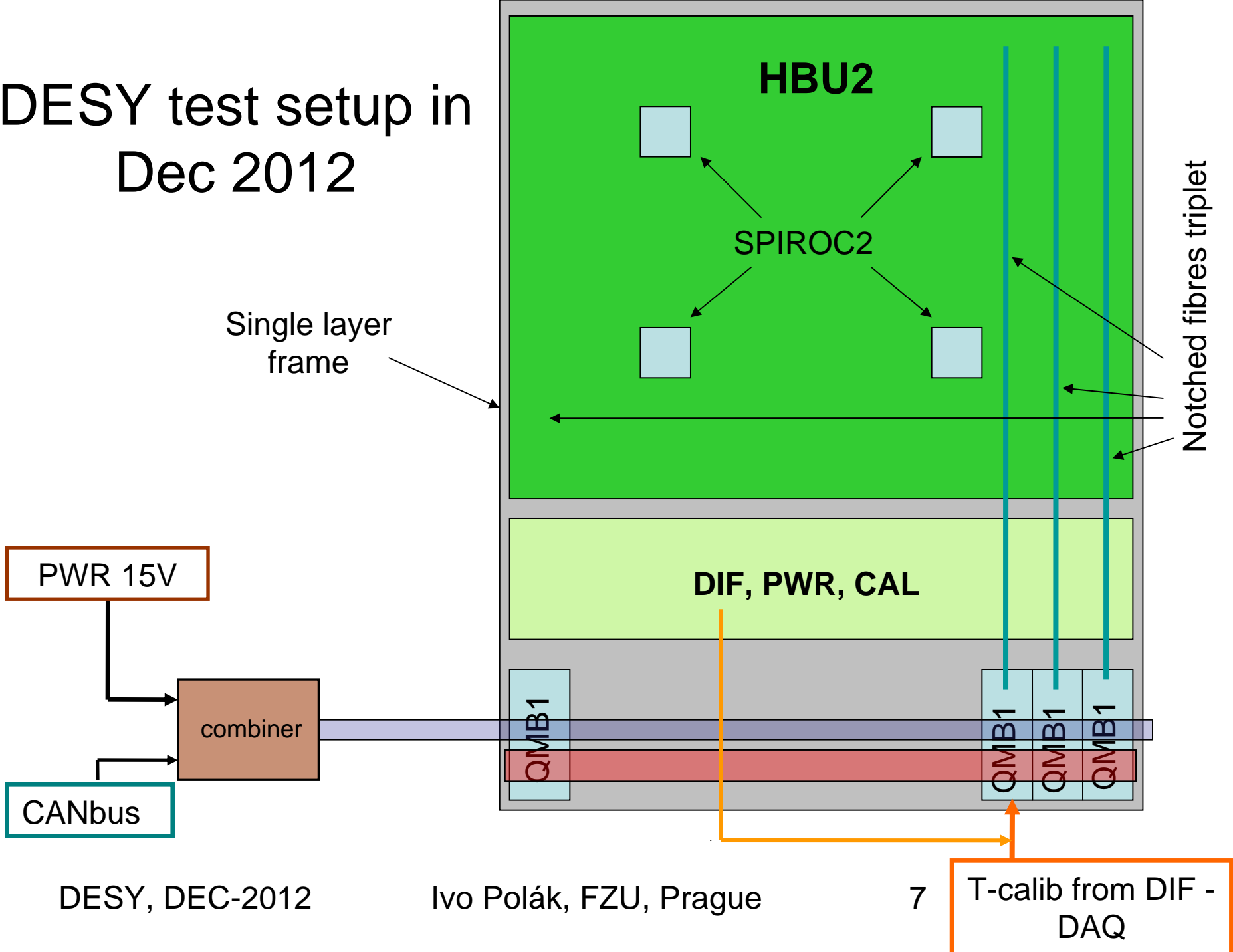
- **Fixing bugs** on PCB layout
- **Better sockets** for LVDS trigger, PWR & CANbus
- Minor changes around QRLED driver
- PCB pads for external inductor (long pulse version)

Setup 6HBUs panorama

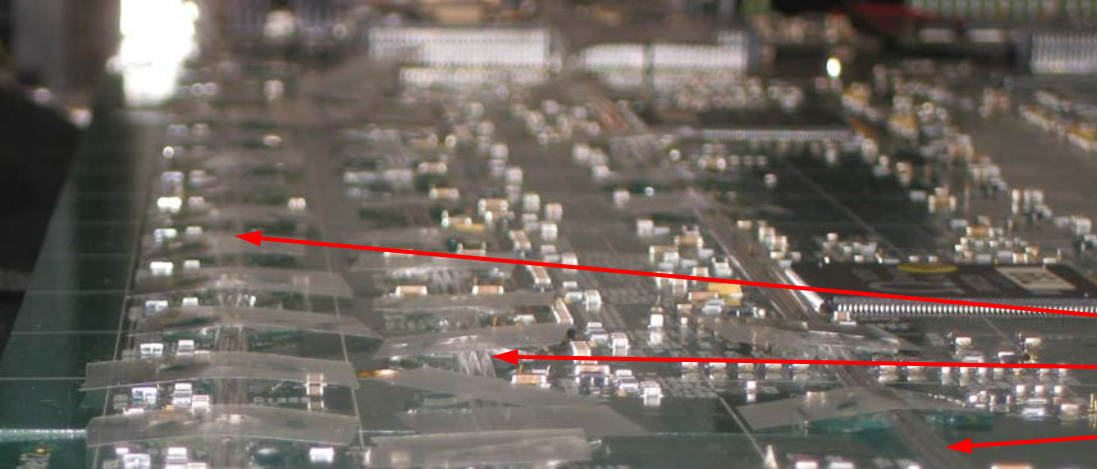


This is composition of 4 pics, made to get the straight lane of HBUs.

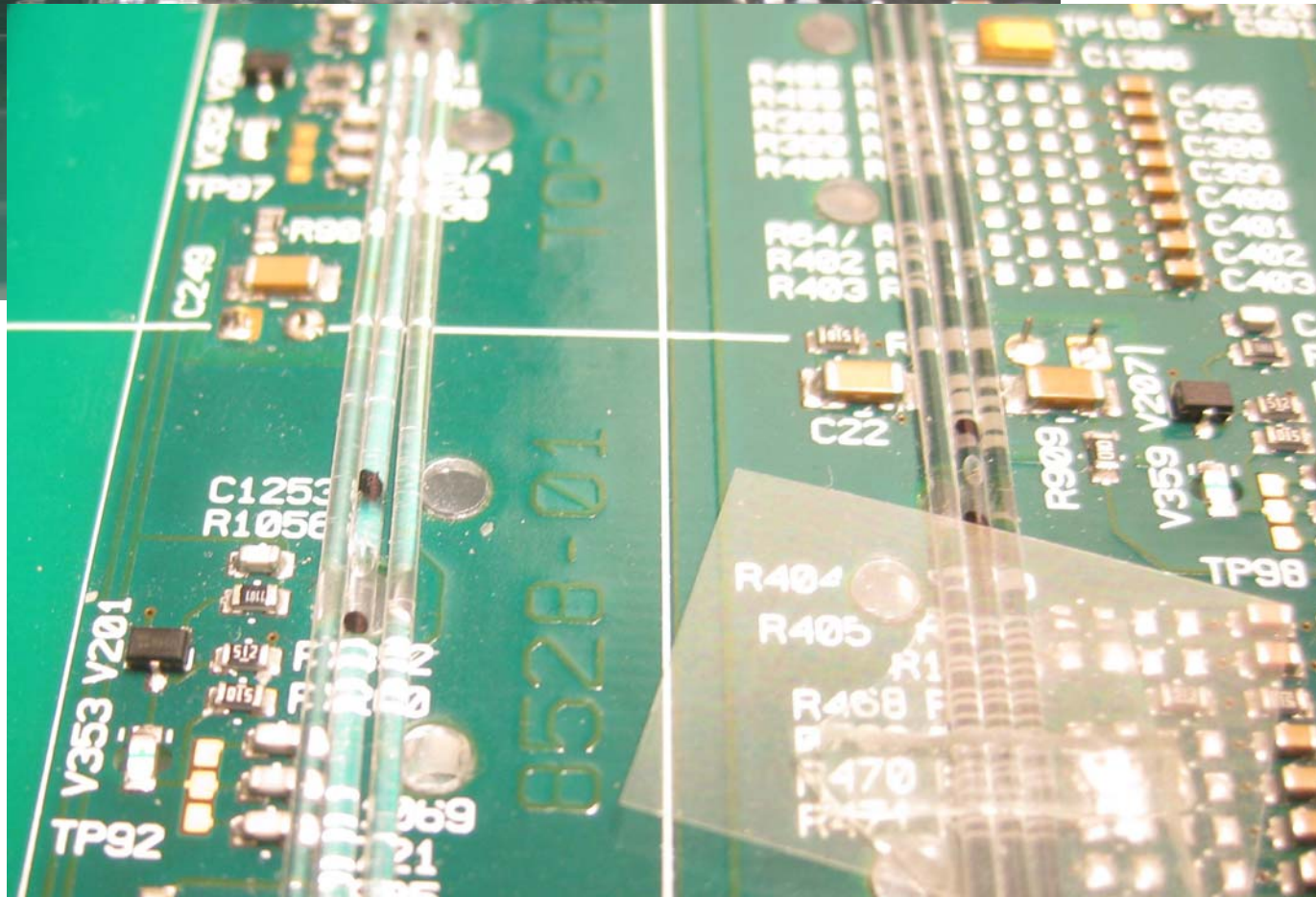
DESY test setup in Dec 2012



3 fibres triplet

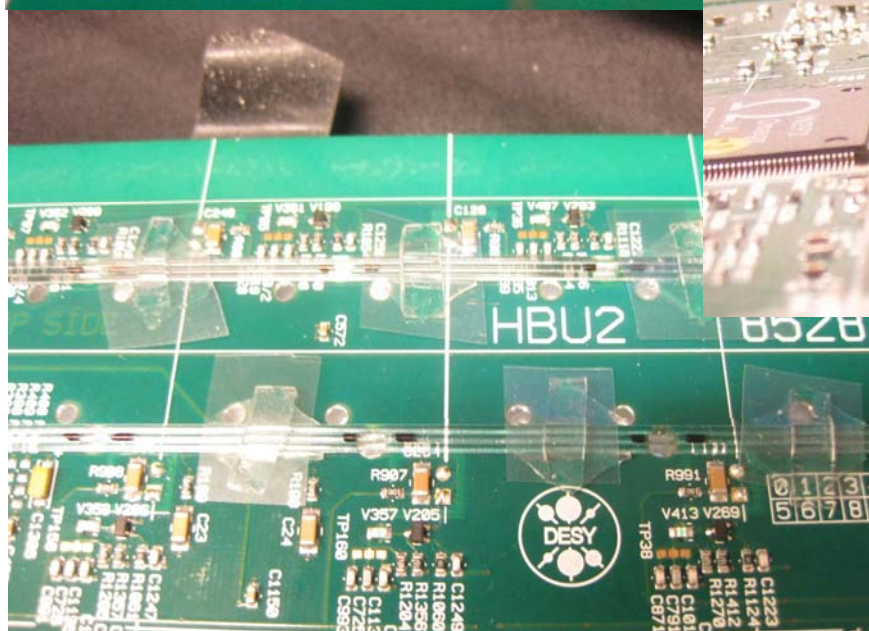
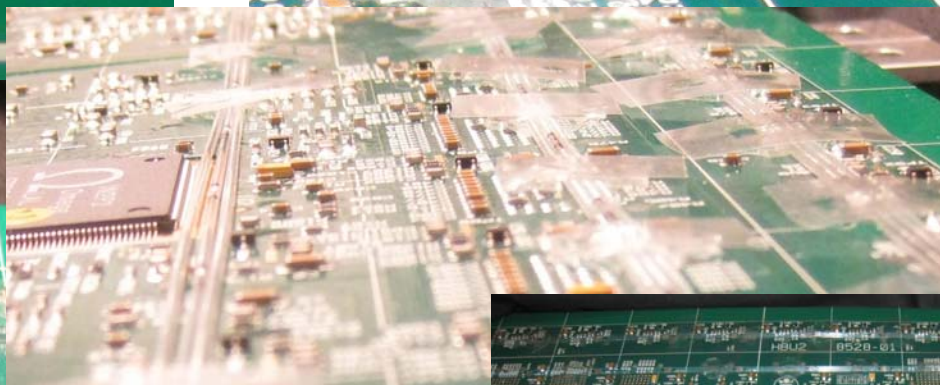
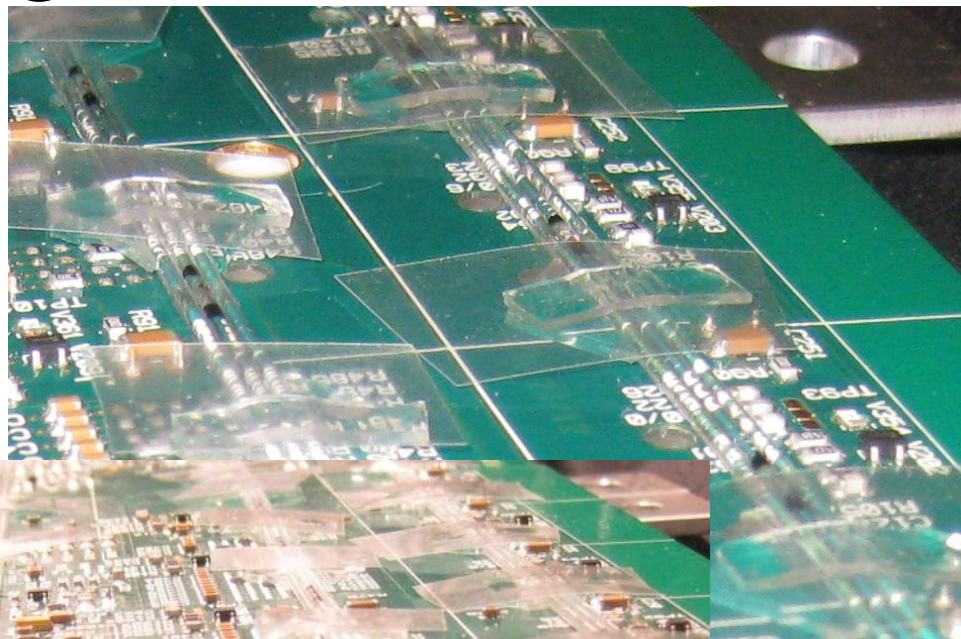


3 notched fibers triplets were routed



The foil lying on adhesive TESA pads separates a dark cloth to be stick

Detail of sticking fibres to PCB



2 triangles and 1 bridge of TESA pads can fix fibres perfectly to the position.

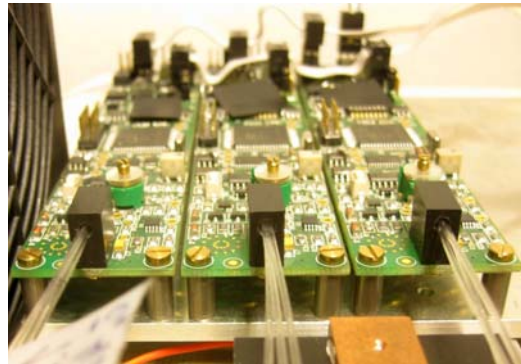
DESY, DEC-2012

Ivo Polák, FZU, Prague



6 of HBUs Test at DESY

- **Full** 6 of HBU2 (two SPIRoc2b ASICs) equipped with 3 rows of scintillators & SiPMs
- At DESY 2012 DEC 3 - 12

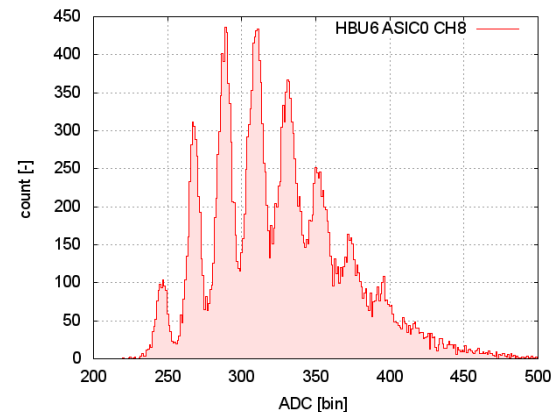
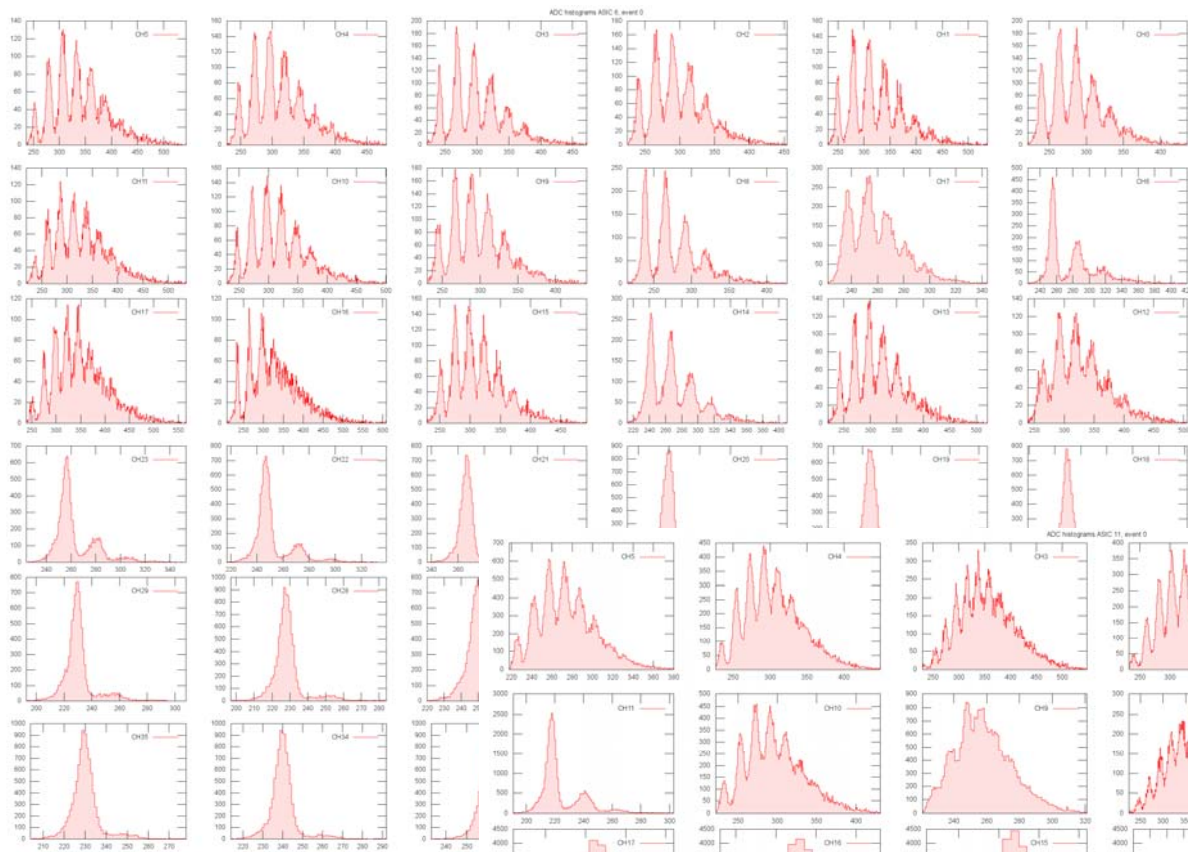


- Low Gain
- High Gain

- Linearity & Amplitude scan
- Single photon electron spectra
- Analysis mainly done by Jiří Kvasnička
- Thanks to Mathias Reinecke with his effort to set up HBU2

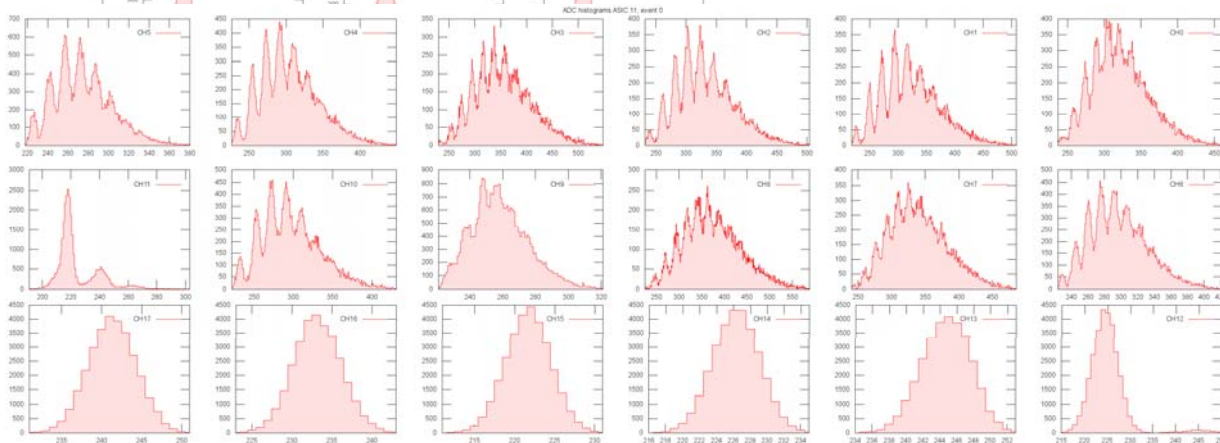


HG - SPeS 2 rows of notched fibres

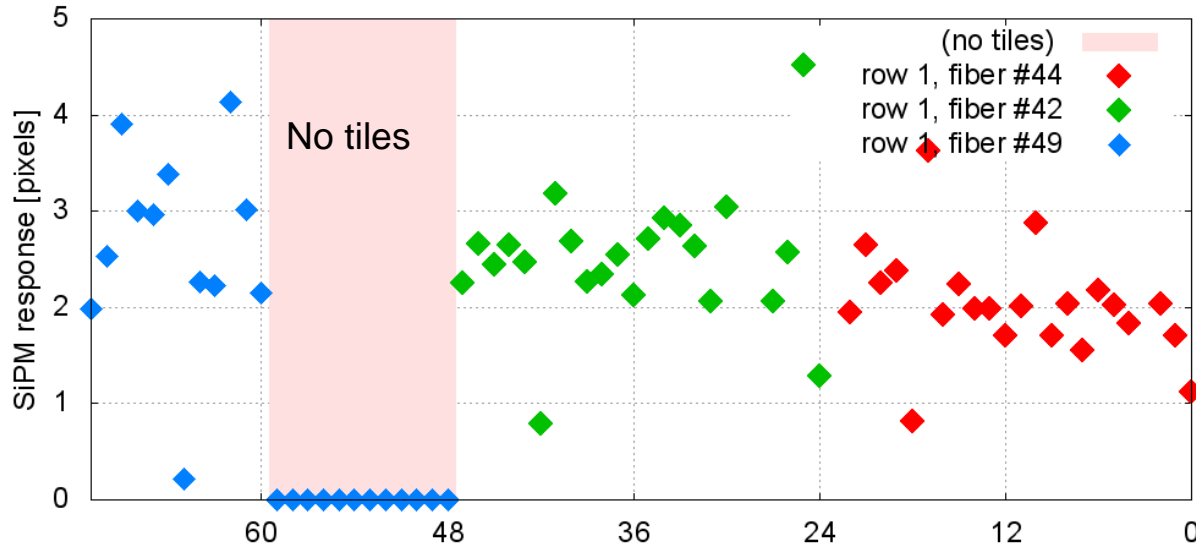


Some of the spectras

30k events statistics

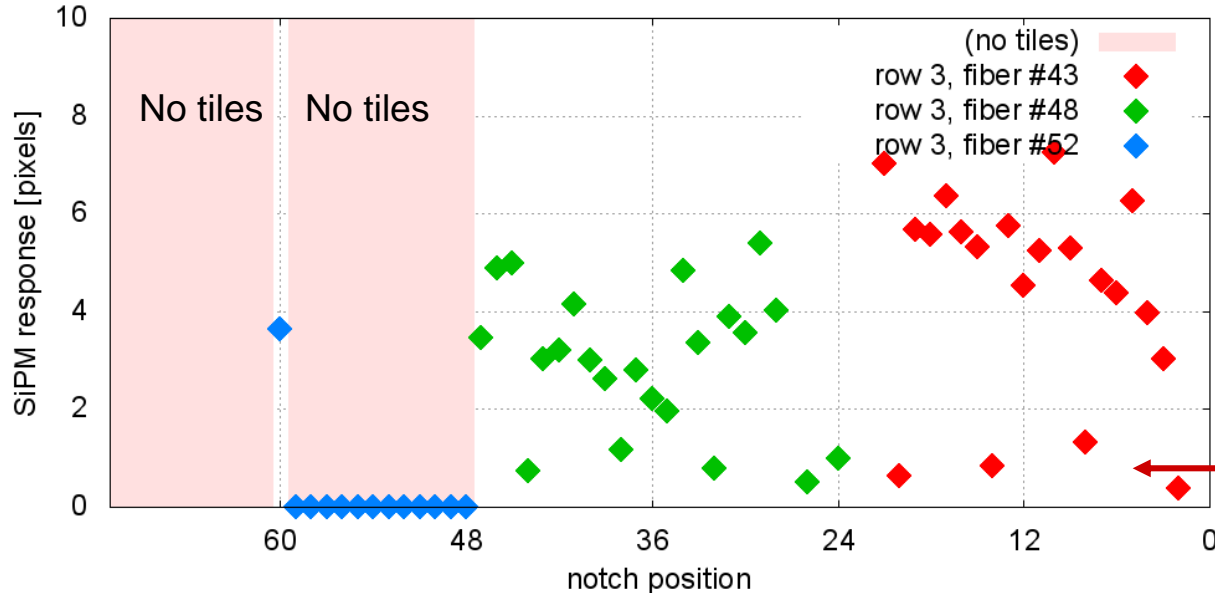


Notched fibers spread (triplet)



Spread of Light
distribution in HG

Preliminary

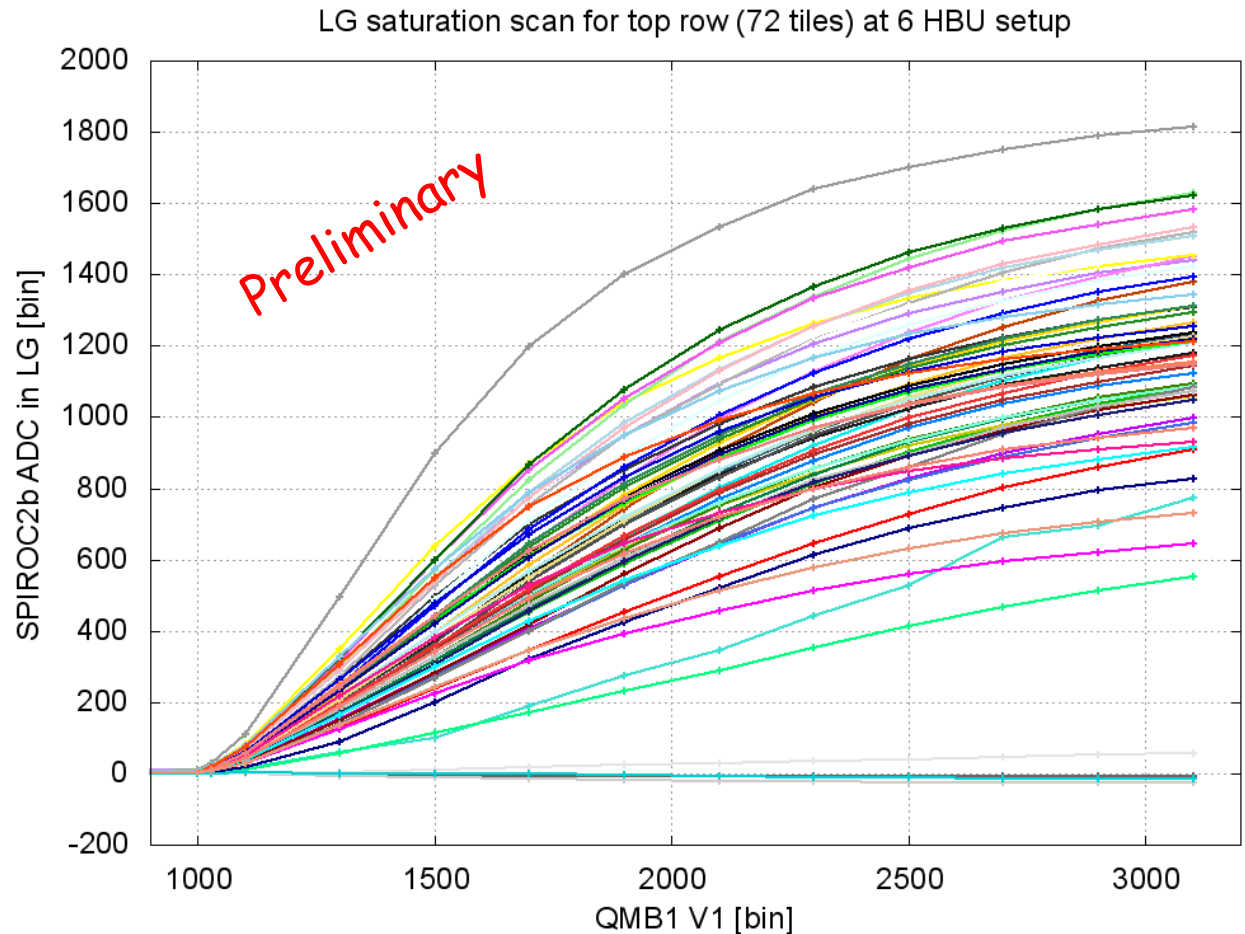


Missing holes in HBU
PCB

Amplitude scan LG

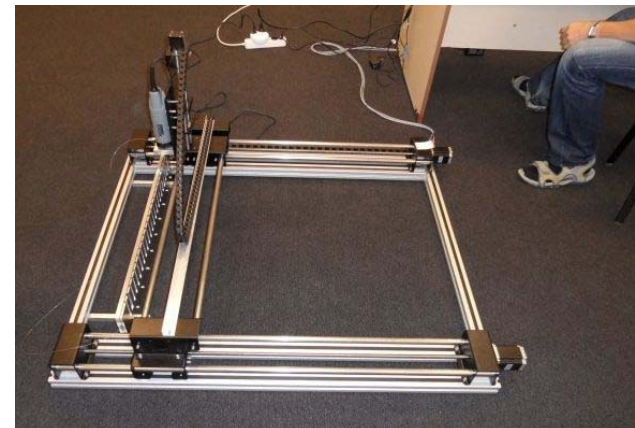
(Saturation curves)

- 1st row (notched fibre) 72 channels
- Raw data: SPIROC ADC bins, pedestal subtracted vs. QMB1 V1 amplitude



Conclusions

- Full size 6 HBUs test successful
 - It is working, no major troubles occurred
 - First sets of triplet notched fibres we have in hand, 2.2m long and 72 notches
 - QMB1 is working stable and smooth
 - One LED illuminates all 72 optical taps (scintillator tiles)
- Analysis is ongoing, presented preliminary plots
- Upgrade to QMB1A (v2.0) is foreseen at beginning of 2013
- Notched fibre semiautomatic machine is hw ready, production is still in tuning phase, in 2013 new set of fibres to test at DESY



Behind a scene...



Calib LED
in the dark,
of course



AHCAL mafia makes plans in a dark... 😊

Analysis precedes work with
lapping the ends of fibers.

Now it is a bit
more clear who
is who... 😊



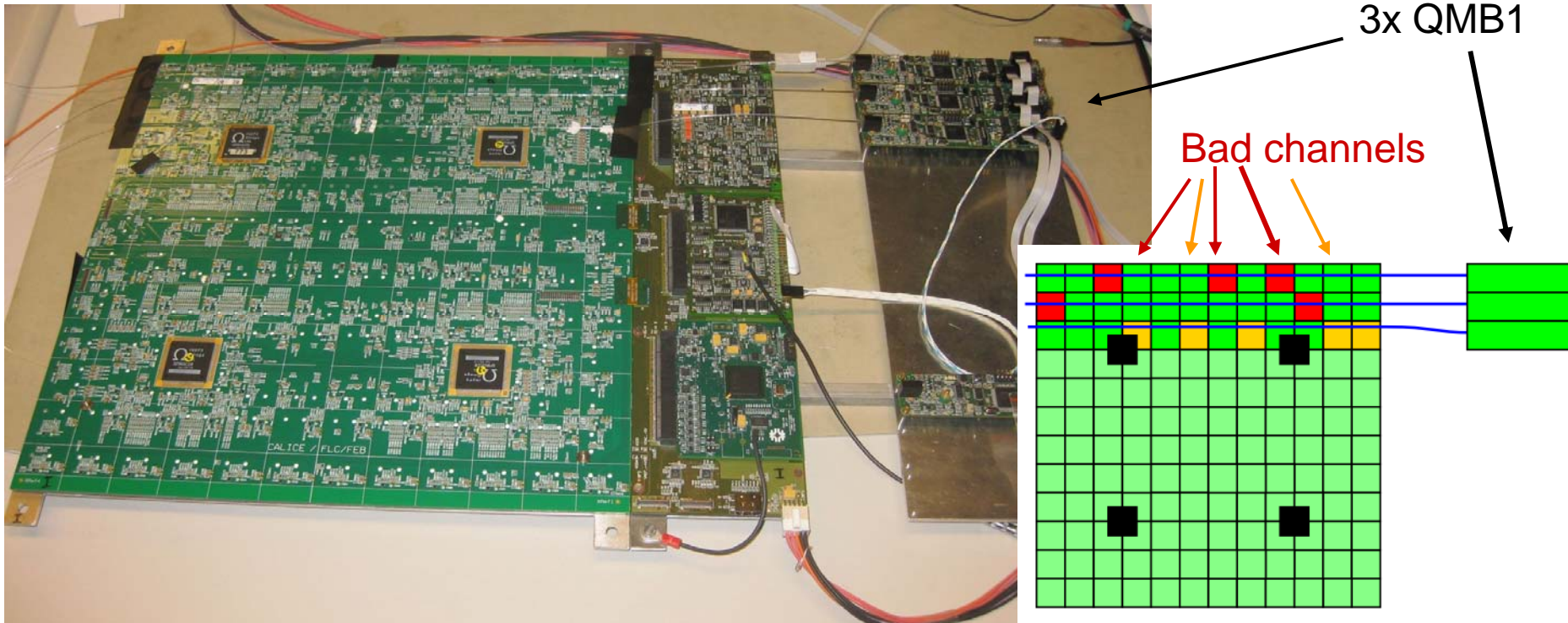
DESY, DEC-2012

Back-up slides

Setup with HBU2

- HBU2 (two SPIRoc2b ASICs) equipped with 3 rows of scintillators with SiPMs (delivered in Nov2011)
- 3 active QMB1s 3mm UV LED (395nm)

SiPM bias has not been set individually



2011 QMB1 linearity, amplitude scan

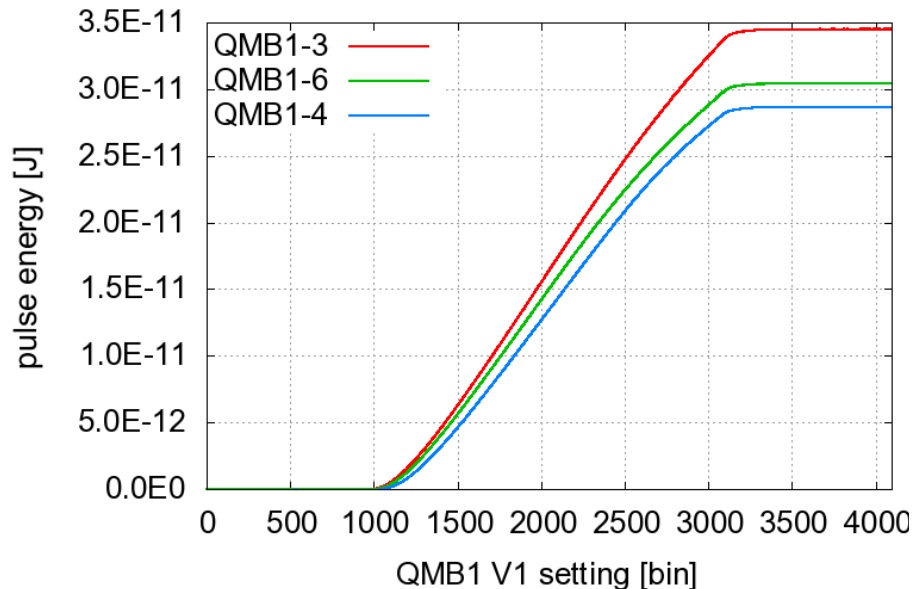
Standard LED pulses 3ns,
PWR measured by optical power
meter ThorLabs PM100D



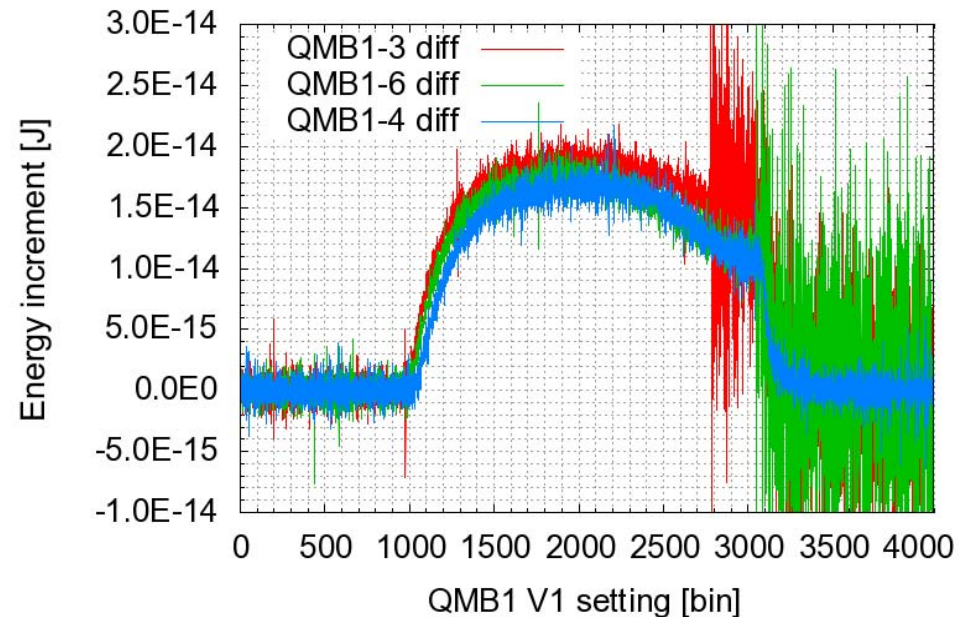
Approved in
december 2012 as
well.

Differential Nonlinearity

Output optical power vs V1 setting,
QMB1, optical fibre 7m in length, 1mm in diameter,

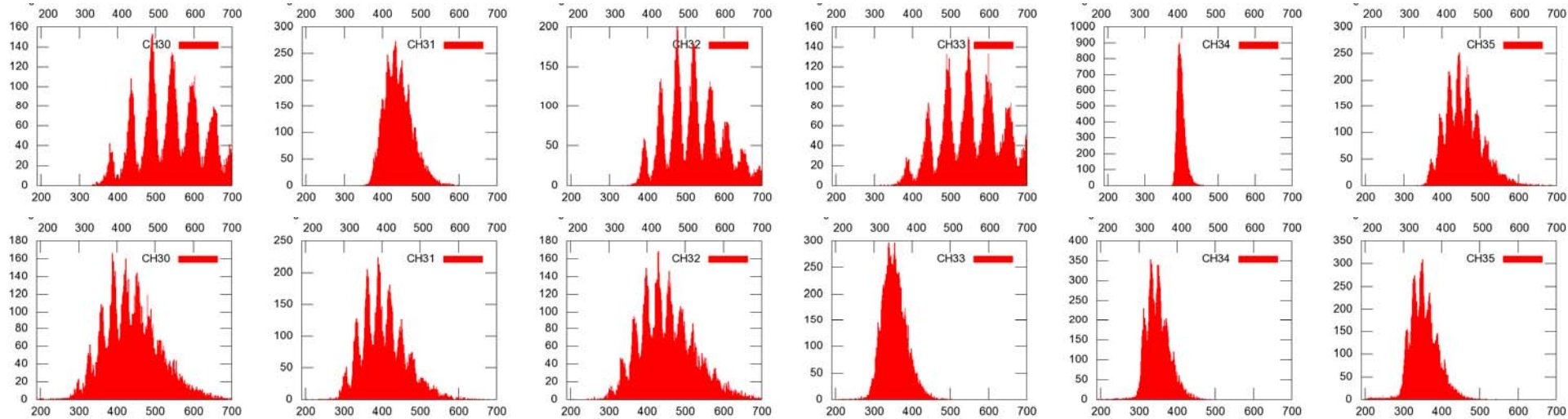


Output optical power vs V1 setting,
QMB1, optical fibre 7m in length, 1mm in diameter,



Reminder: nice spectra 2010

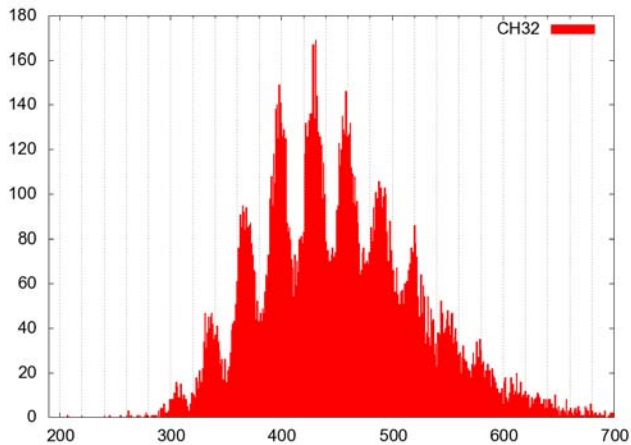
Single p.e. spectra QMB6 to SPIROC1 & SPIROC0



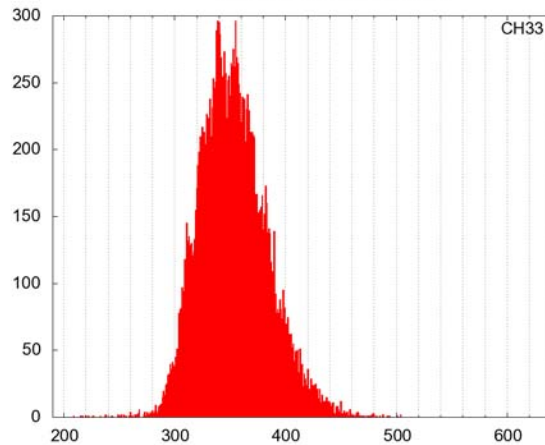
different SiPMs in the 2010 and 2011 batches

Spread of SiPM gain is about factor 3, it corresponds to data from ITEP.

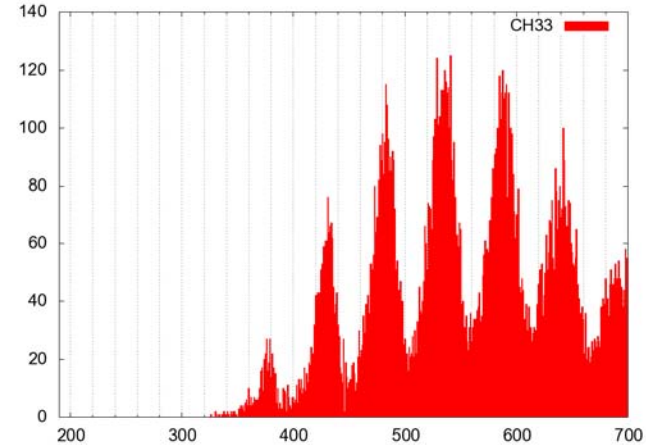
Channel 32, ASIC 0, memory 8



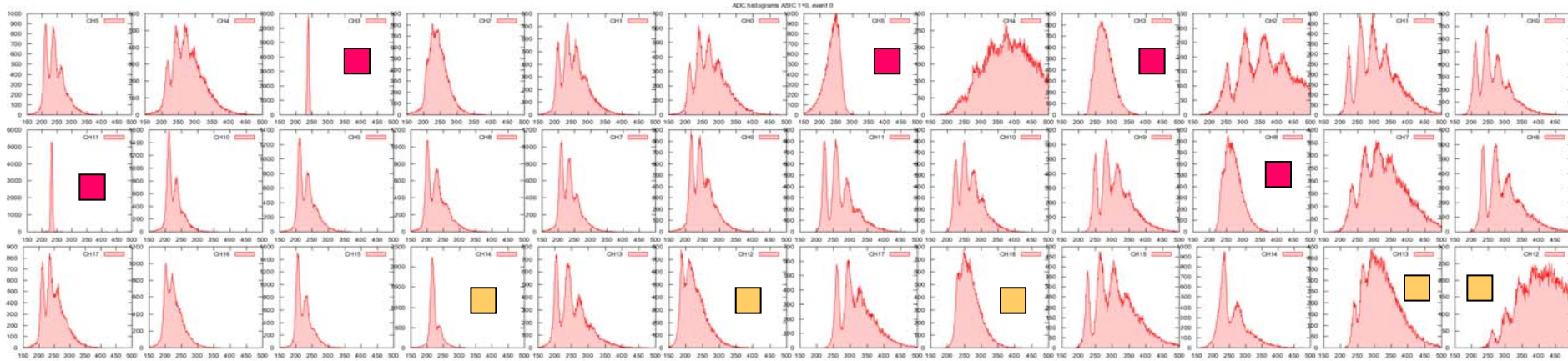
Channel 33, ASIC 0, memory 8



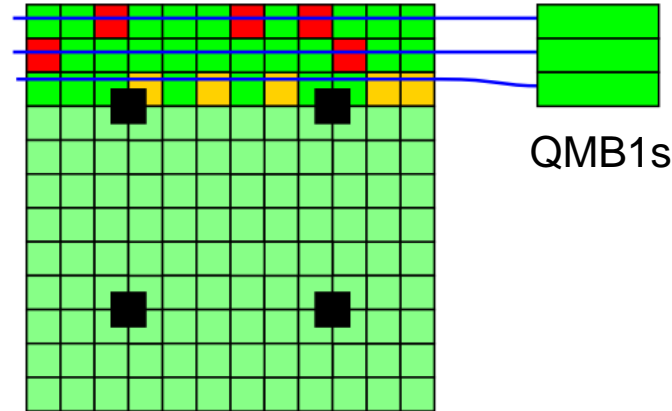
Channel 33, ASIC 1, memory 8



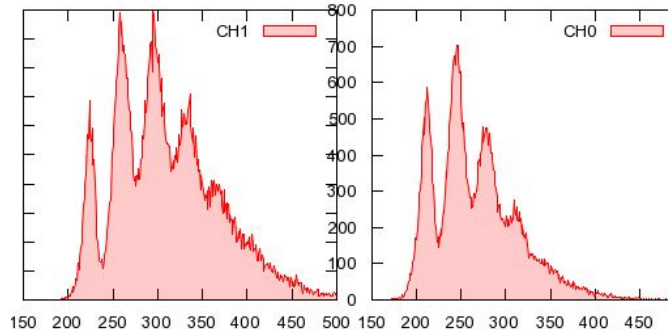
HG - SPeS 3 rows of notched fibres



- squares indicates bad channels (SiPM, sci, or SpiRoc2b channel)
- 10 bad (unusable) channels of 36 (= 28%)
- Nov2011 SiPM tiles are different to 2010 tiles, seems to get worse spectra



Two best p.e. spectra of 2011 SiPM batch



DESY, DEC-2012

Ivo Polák, FZU, Prague

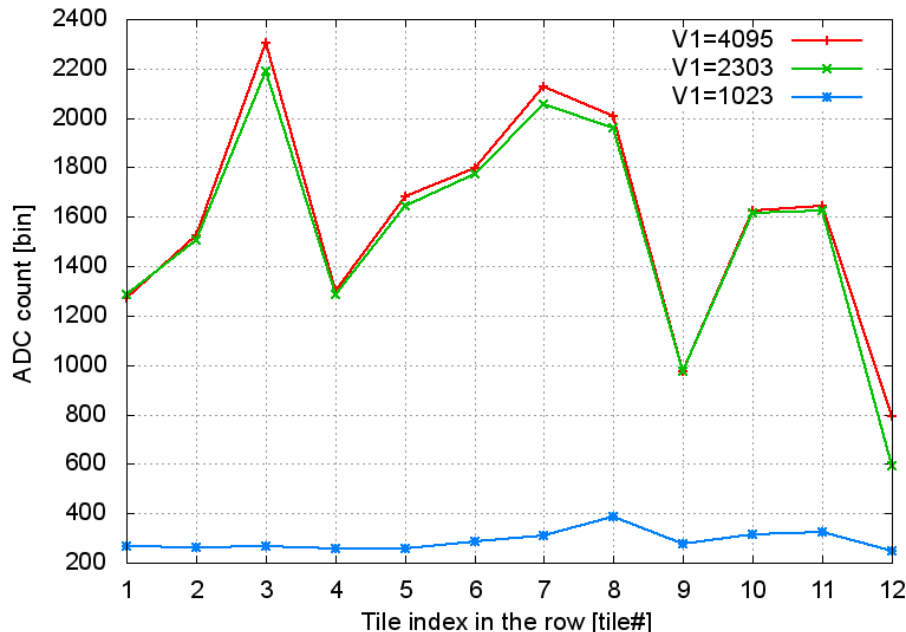
20

Quick Friday's QMB1 test with HBU2

System is working! 😊 , but
Big spread due to combination
of factors: Bad fibre, hold scan
did not matched 2011

Distribution will be better, do not
worry!

Response of QMB1 with 12-notched fibre, LG_100fF



- Some config troubles occurred
- Generally, system is working easily, run in stand-alone mode
- Pulse position at different LEDs can be easy tuned within 1ns
- Near future plans (tomorrow)
 - Hold scan
 - Better notched fibre to install
 - Single p.e. peak spectra
- Next year plan (February)
 - More channels equipped with scintillators
 - Xtalk and light spread study

Notched fibres

Semi-automatic tool

Now in operational debugging
& sw development stage

Frame with x-y stepper motors

Drill machine used as milling cutter
to groove the notch

Alu/PCB Template with moving
scint tile

PCB with 3mm
holes

Scintillator tile w SiPM

