AHCAL Electronics.

integration status and open issues

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EUDET annual meeting

DESY Hamburg

Sept. 30th, 2010

HELMHOLTZ GEMEINSCHAFT

CALICE Calorimeter for ILC

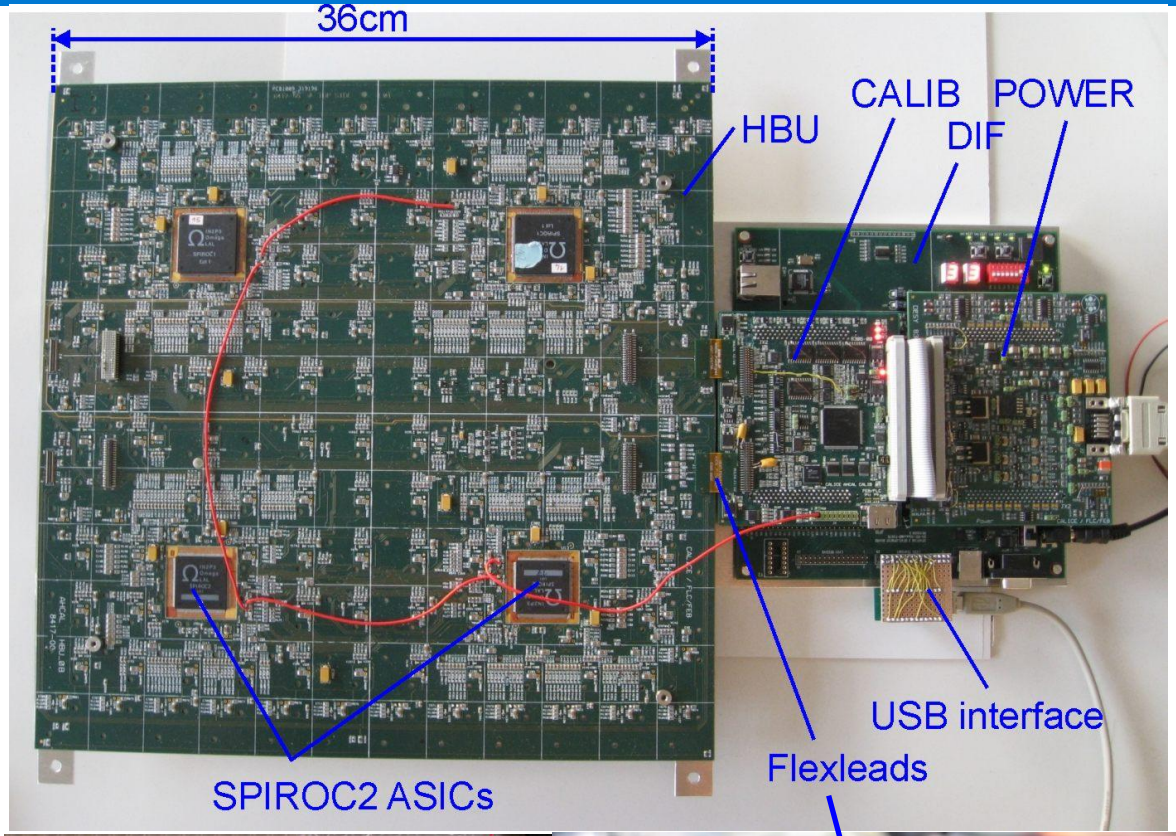
EUDET

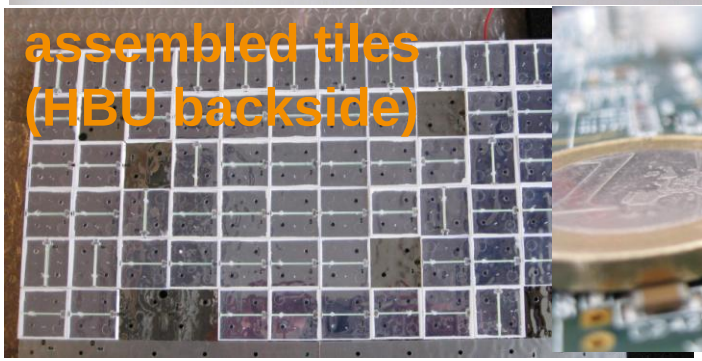
DESY

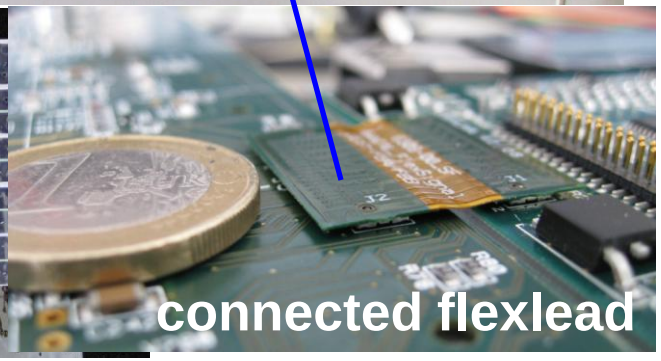
Outline

- Status Electronics / Hamburg Activities
  - Testbeam Setup (HBU_II)
  - Laboratory Setup (HBU_I)
- Next Generation (Full Layer EUDET Module)
  - Status Redesigns Boards (DESY)
  - Tiles
  - LED Systems for Calibration
- Status DAQ / Discussion about CALICE DAQ
- Conclusion

Current EUDET AHCAL Electronics setup



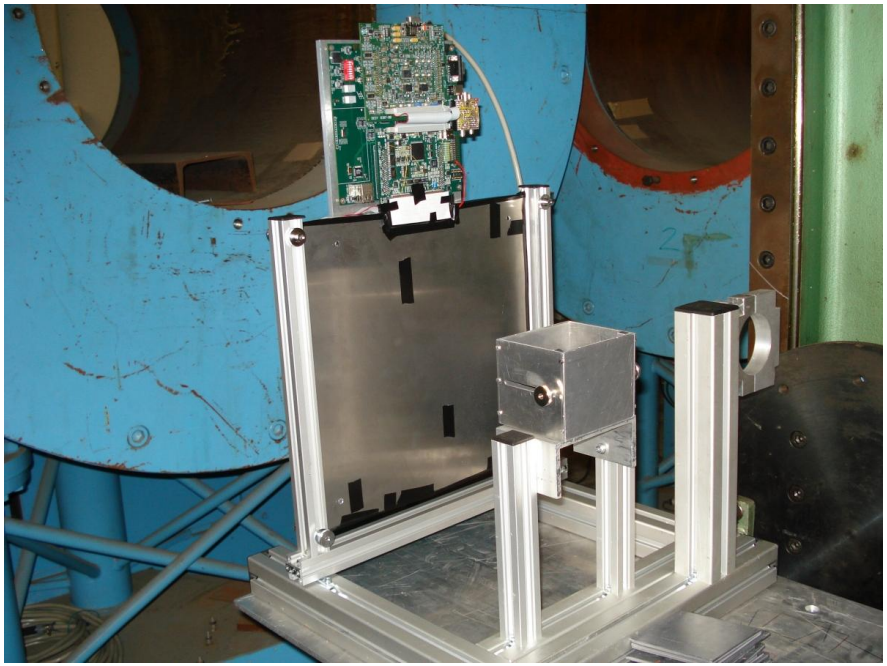


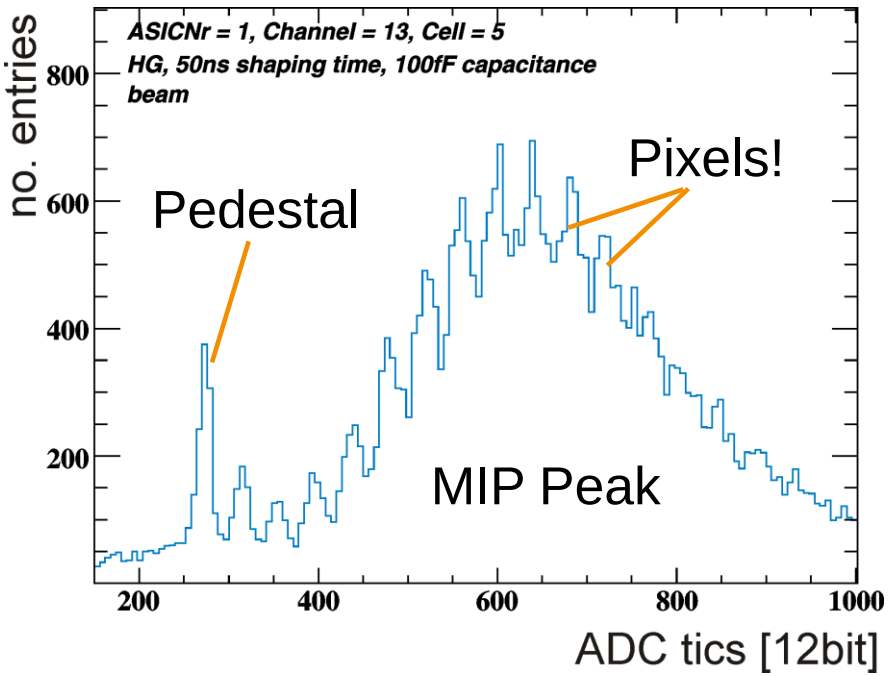


EUDET developments:

- HBU (detector module)
- CALIB (calibration system control)
- POWER (supply of inner detector)
- Flexleads (2 types for power and signals)
- DIF (detector-DAQ interface, based on commercial board)

DESY Testbeam Setup – HBU_II

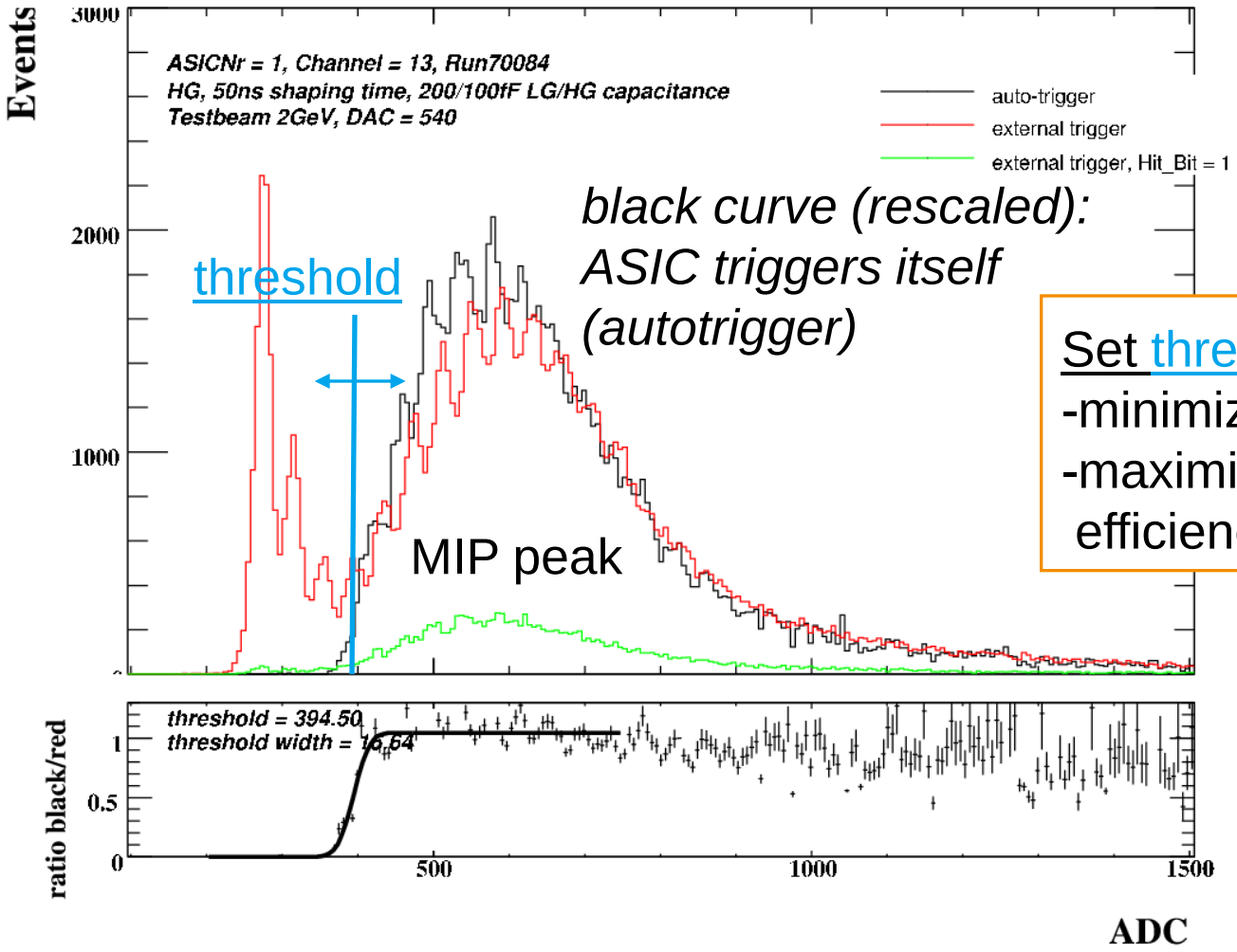




- DESY 6GeV electron Testbeam operation: Setup optimization, Channel-wise calibration with MIPs (Mark Terwort, DESY)
- Integrated LED System, uniformity studies / optimiz. (U. Wuppertal)

DESY Testbeam - Autotrigger

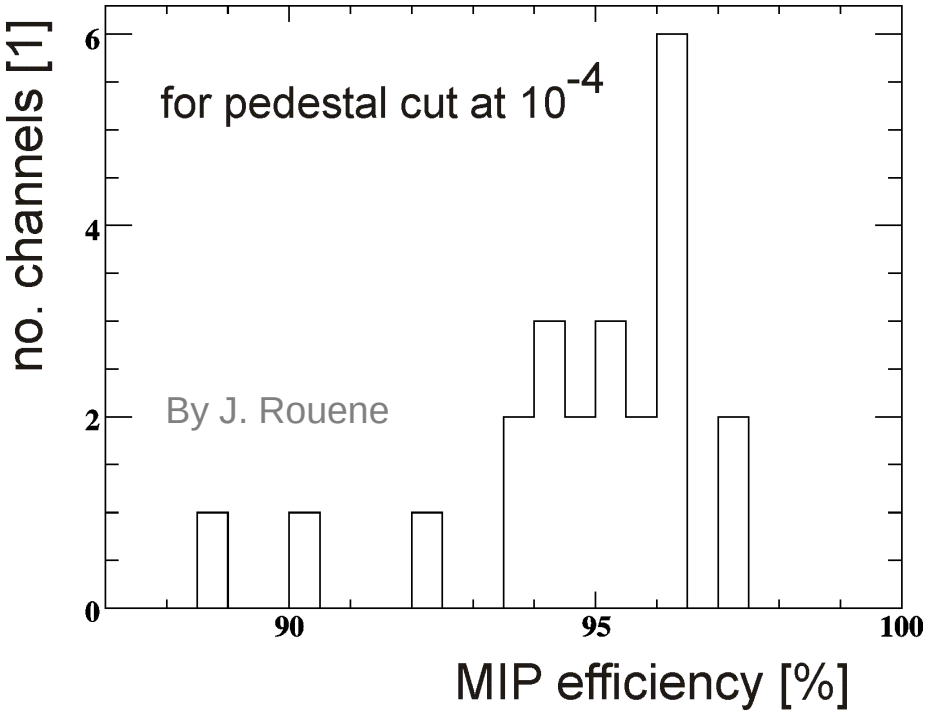
Autotrigger : mode of operation for ILC ➔ detailed tests necessary.

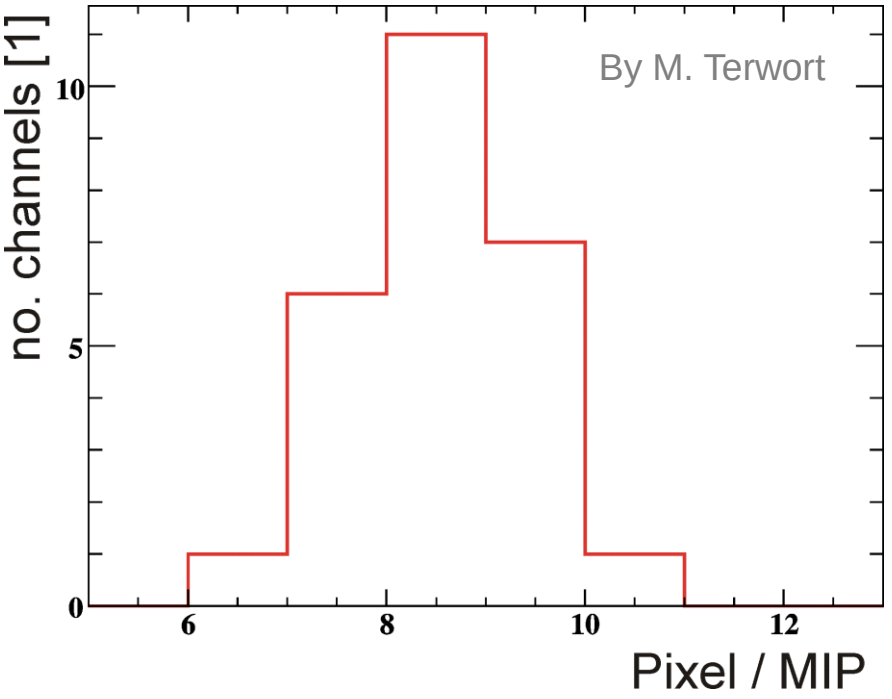


Set threshold to:
-minimize noise hits (10^-4)
-maximize MIP detection efficiency

Results by
Jeremy Rouene

Testbeam – multi-channel (system) studies



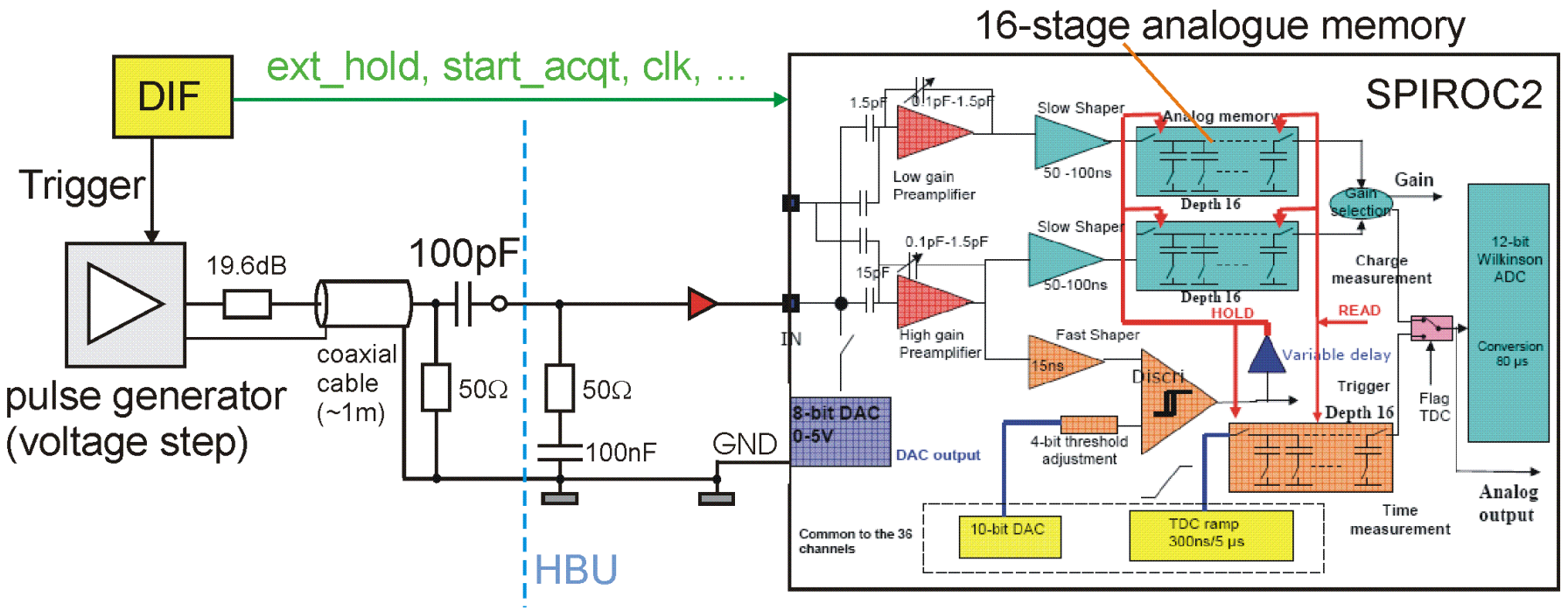


A **MIP efficiency of ~95%** can be achieved for a threshold-pedestal cut at 10^(-4) for most channels (autotrigger mode).

Preliminary tests show a lightyield of **~8.5pixels / MIP**

> Multi-channel Autotrigger and Timing (TDC) studies to be done

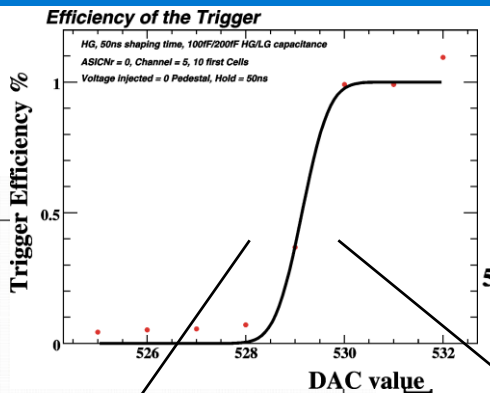
Charge Injection Setup – HBU_I in laboratory

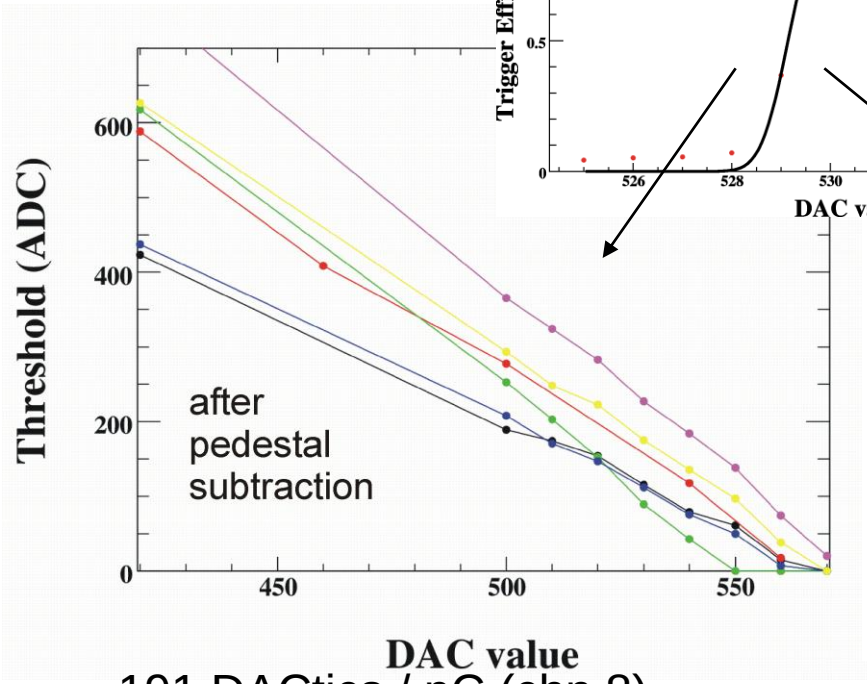


Advantage of charge injection: Amount of charge well defined.
=> single-channel SPIROC2 calibration / characterization.

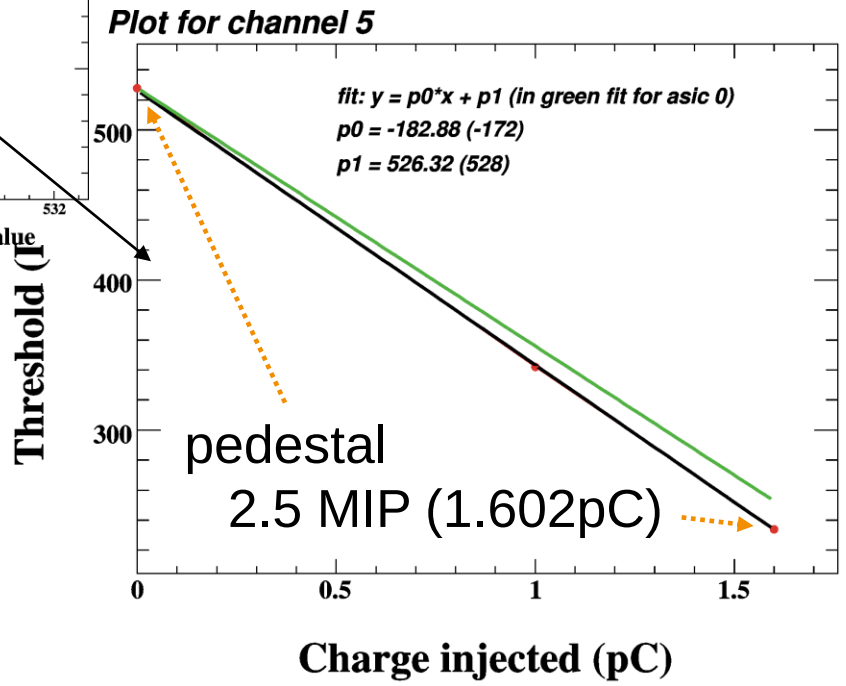
Autotrigger Threshold Adjustment

testbeam





charge injection



~191 DACtics / pC (chn 8)
~120 DACtics / pC (chn 33)

(8 pix/MIP ~ 350 ADC/MIP, SiPM gain 5*10^5)

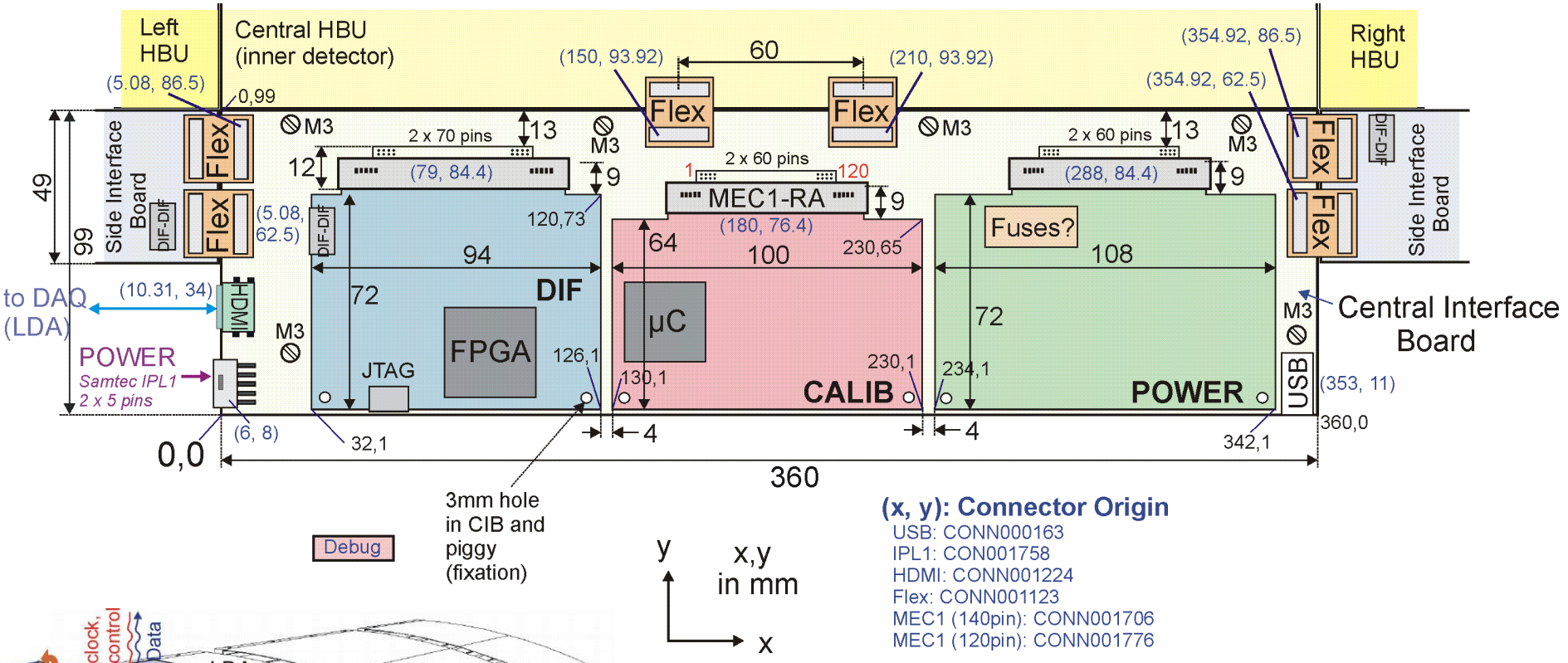
~ok!

~172 DACtics / pC (ASIC1)
~182 DACtics / pC (ASIC2)

Channel-wise threshold or ASIC gain adjustment necessary!
will be implemented in SPIROC 3

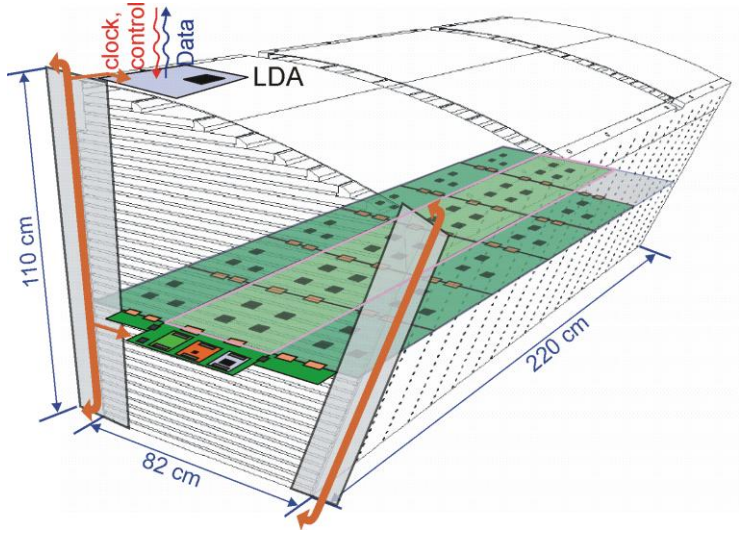
Results by
Jeremy Rouene

New generation's modules



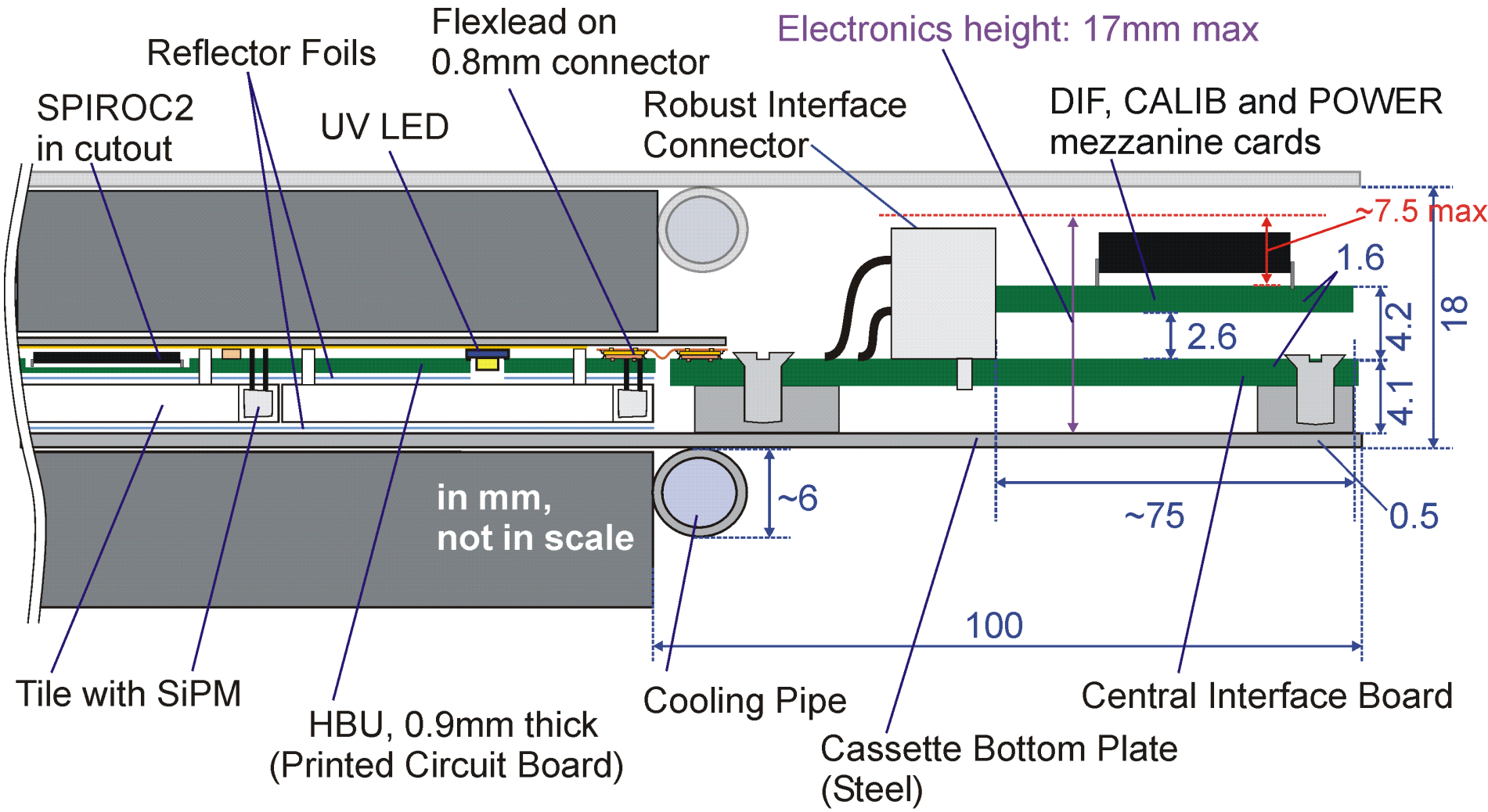
(x, y): Connector Origin

USB: CONN000163
IPL1: CON001758
HDMI: CONN001224
Flex: CONN001123
MEC1 (140pin): CONN001706
MEC1 (120pin): CONN001776



Designs to be done (final 'ILC' dimensions):
CIB, SIB, DIF, CALIB2, POWER2,
HBU2, (Flexleads)

AHCAL Layer – Cross Section (Height Limitations)



Compliant with Steel and Tungsten options.

Status Redesigns

	DIF	CALIB2	POWER2	HBU2	CIB	SIB	Flexleads
concept dev., circuit design	X	X	X	X	X	X	X
schematic entry	NIU X	X	X	X	X	X	X
Layout	NIU X	X	X	X	X	X	X
Production	NIU X	X	X	X	X	X	X

X done

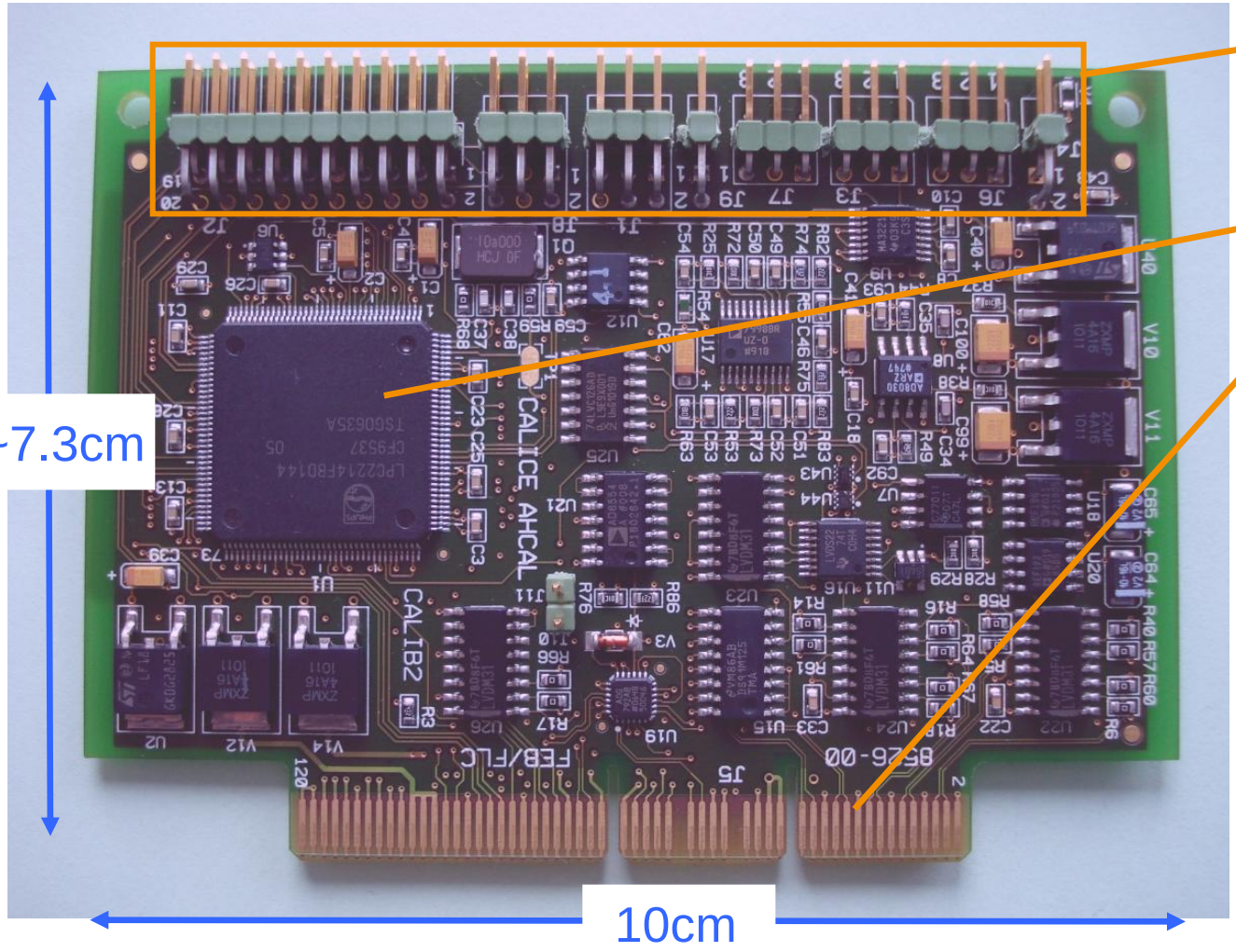
X in preparation

X not started yet

- Most critical part: HBU2 (depends still on results from ASIC tests, tile size definition). **HBU2 can carry SPIROC2, 2a or 2b.**
- SIB is not needed for layer module => delayed.
- all modules needed for EUDET layer-module.
- DIF design taken over by NIU – thank you!!

DESY Redesigns:
M. Zeribi, H. Wentzlaff,
M. Reinecke

CALIB2 module (realized)



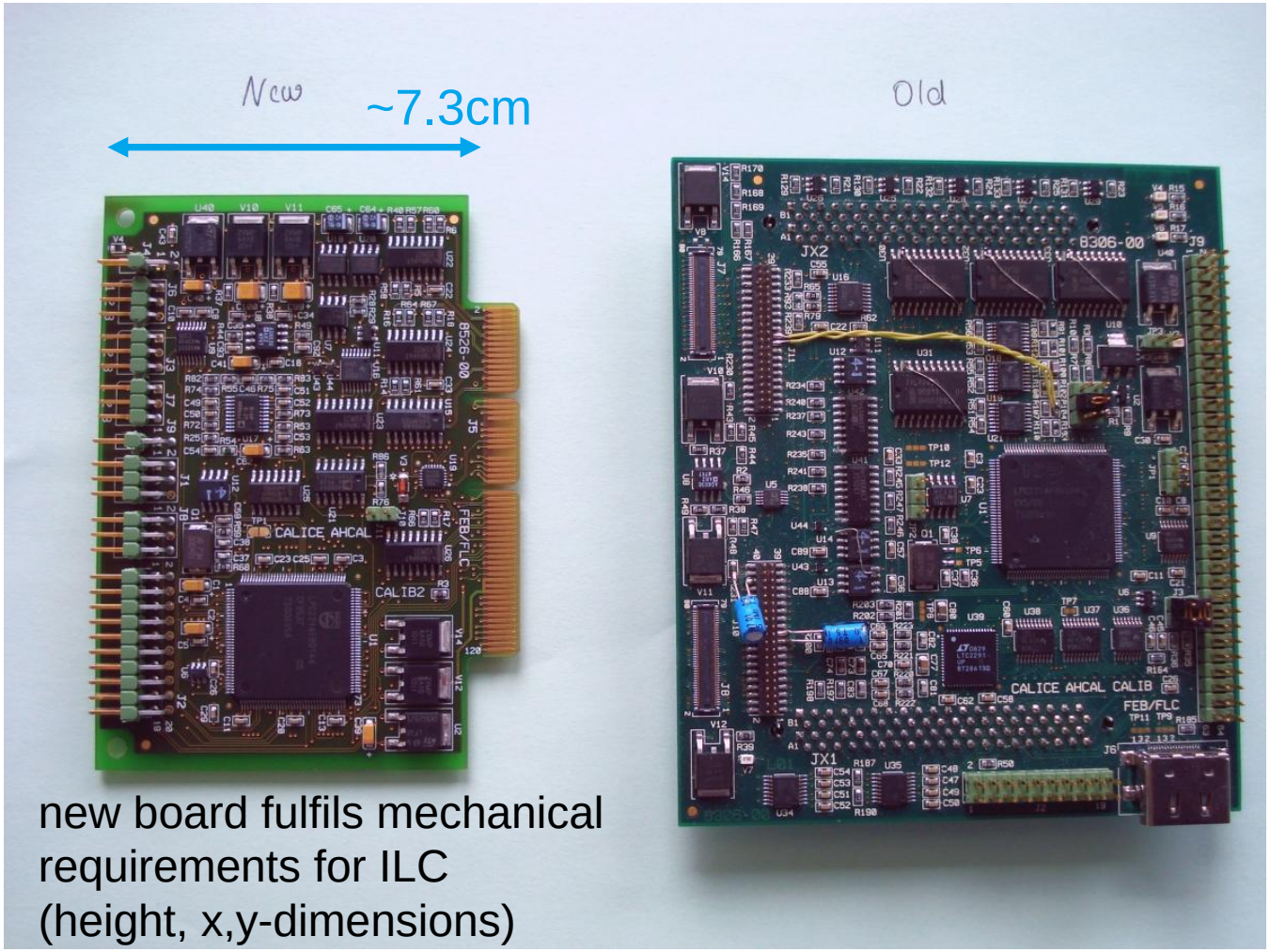
JTAG- and test-connectors

ARM7 µController

Connector to CIB

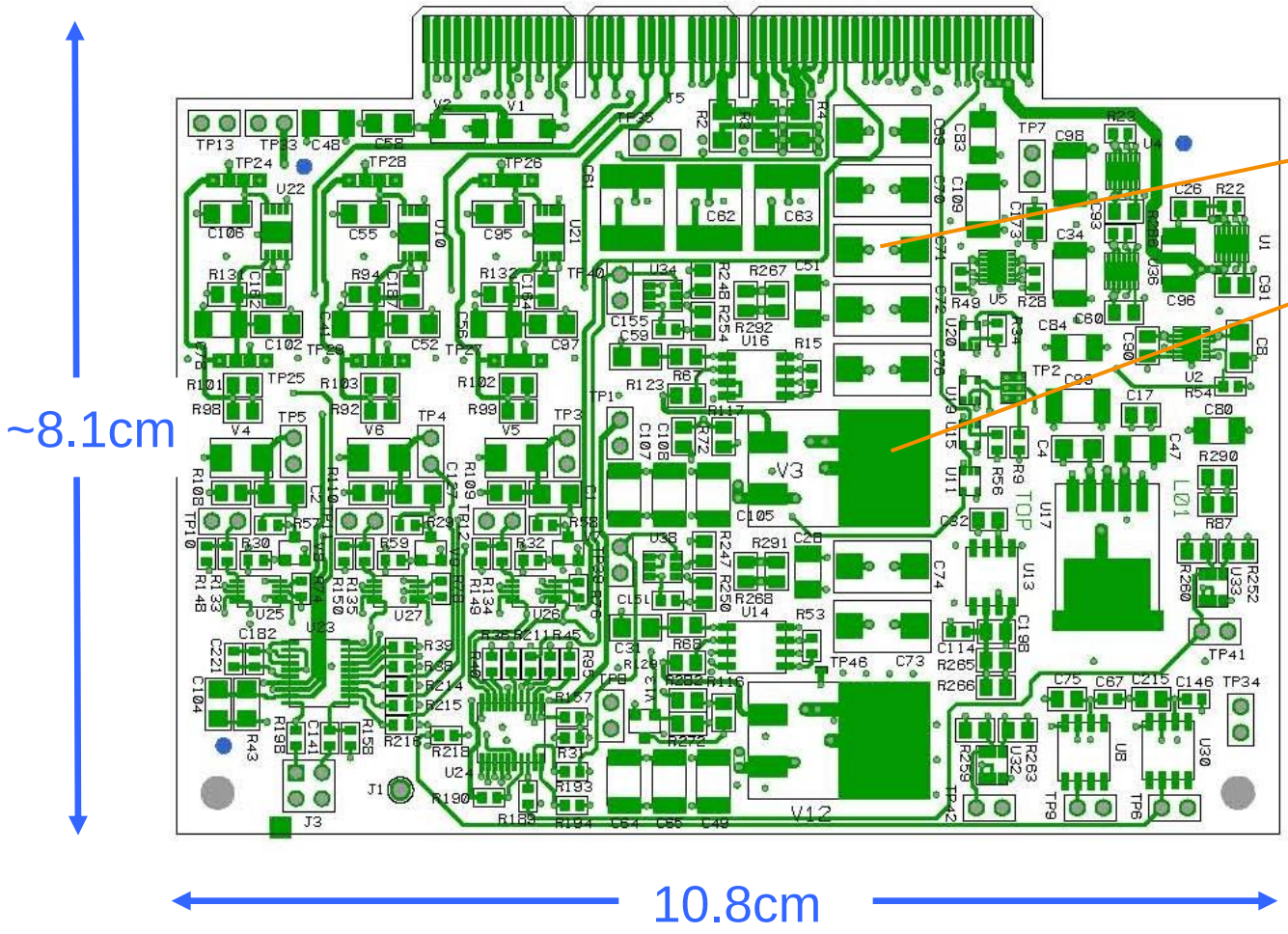
Board survived smoke test, µController is running with old code already.

CALIB2 module (left) vs CALIB1 module (right)



new board fulfils mechanical requirements for ILC (height, x,y-dimensions)

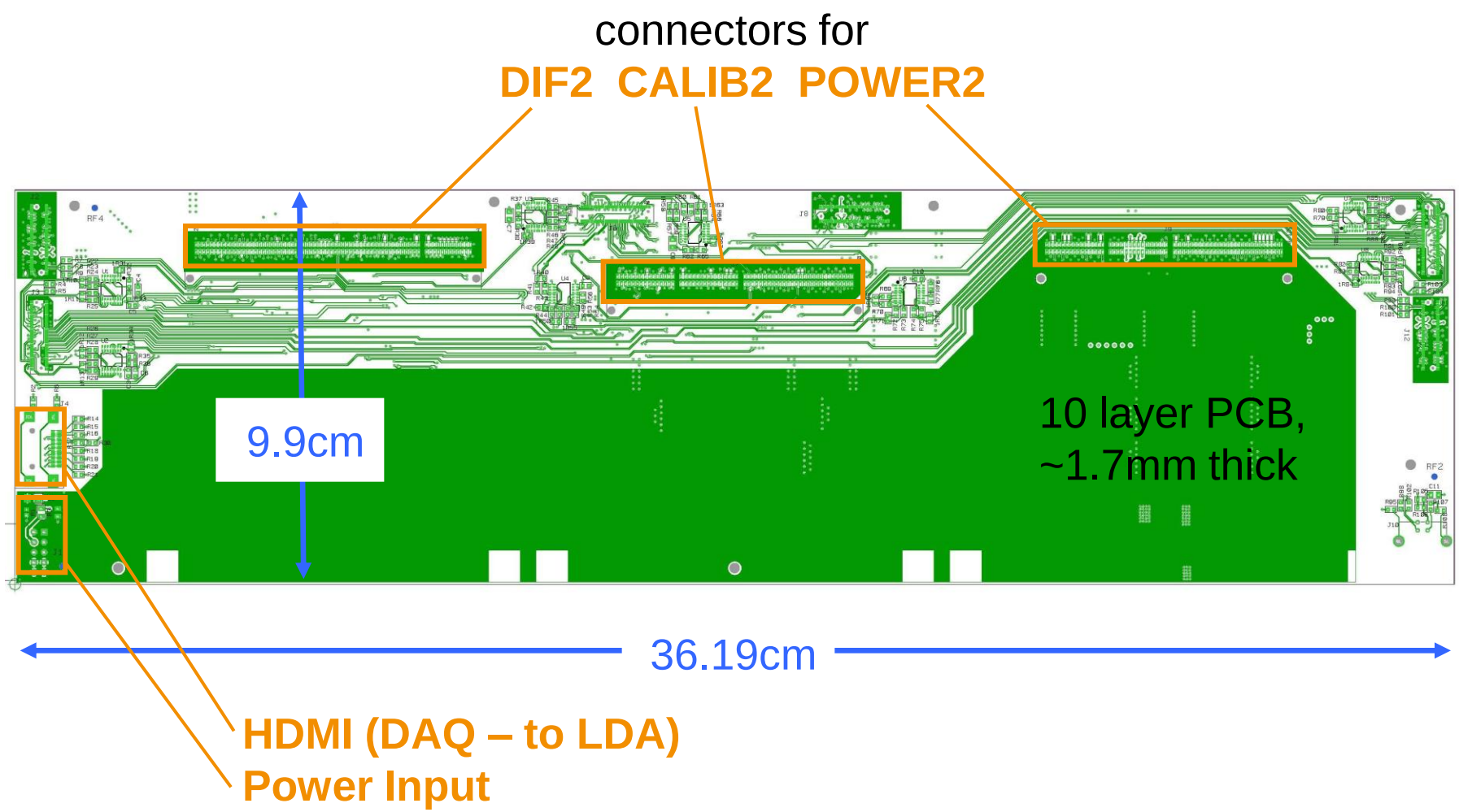
POWER2 Module (in production)



BIG capacitors
and
BIG regulators

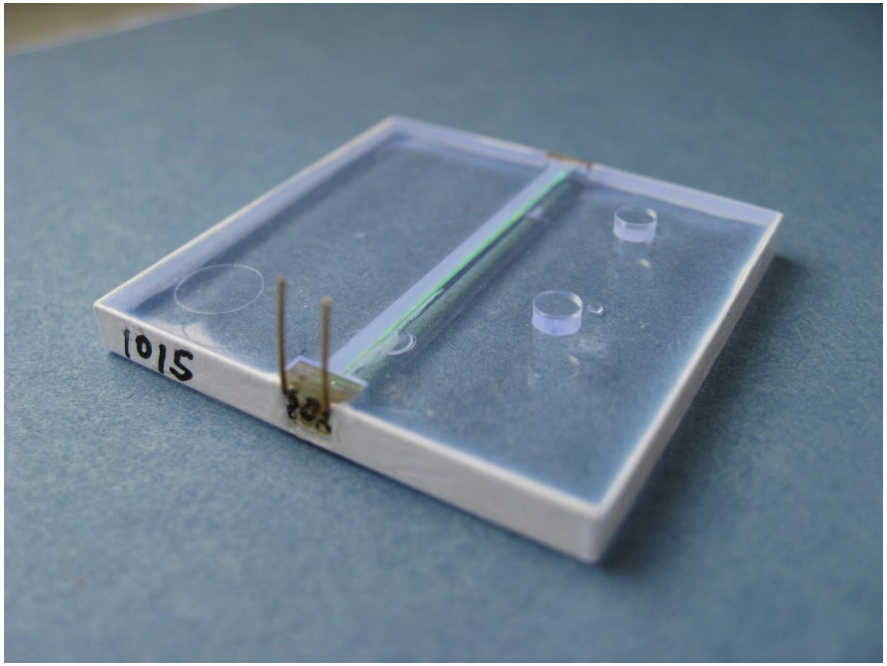
for ILC power-pulsing

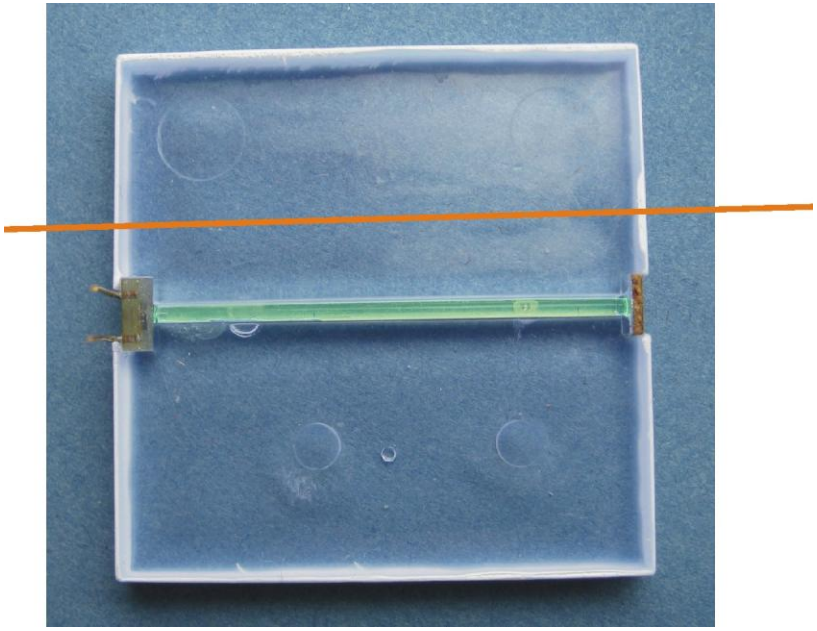
CIB Module (in production)



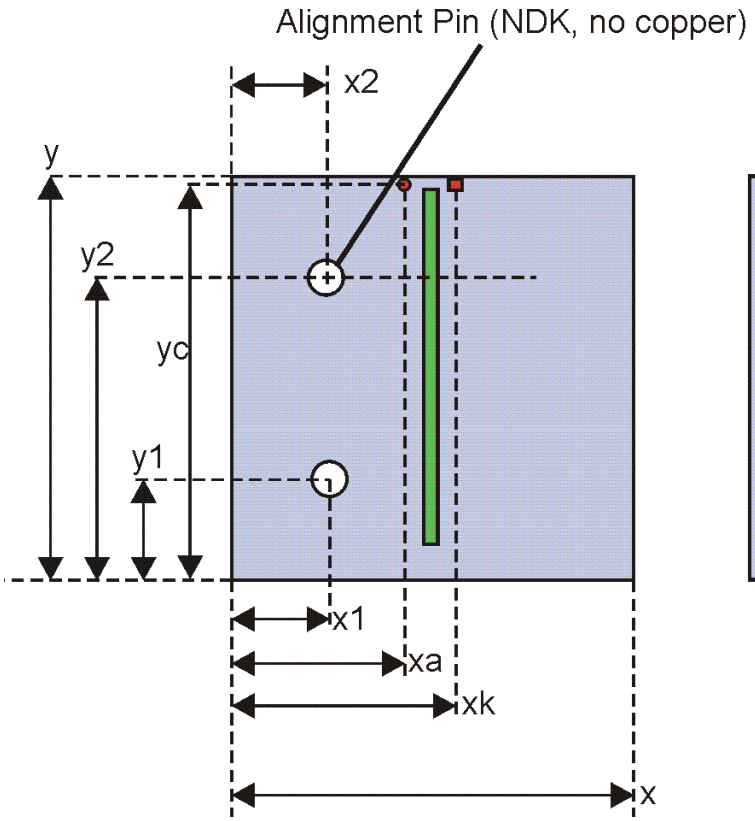
EUDET Tiles

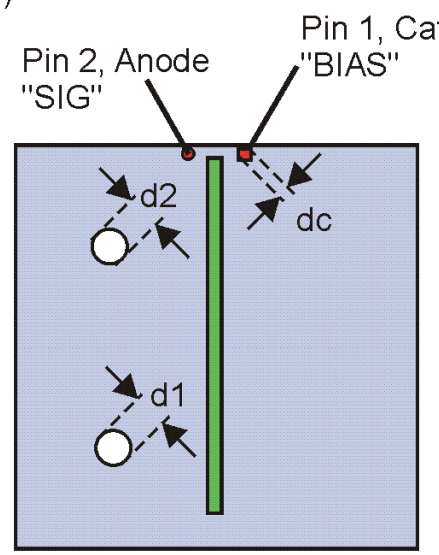
The first 50 have arrived from ITEP in Hamburg – Thank You!!!

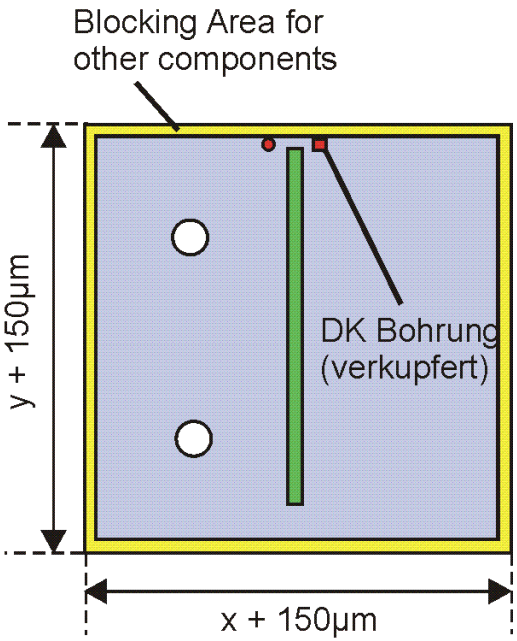




EUDET Tiles - Dimensions



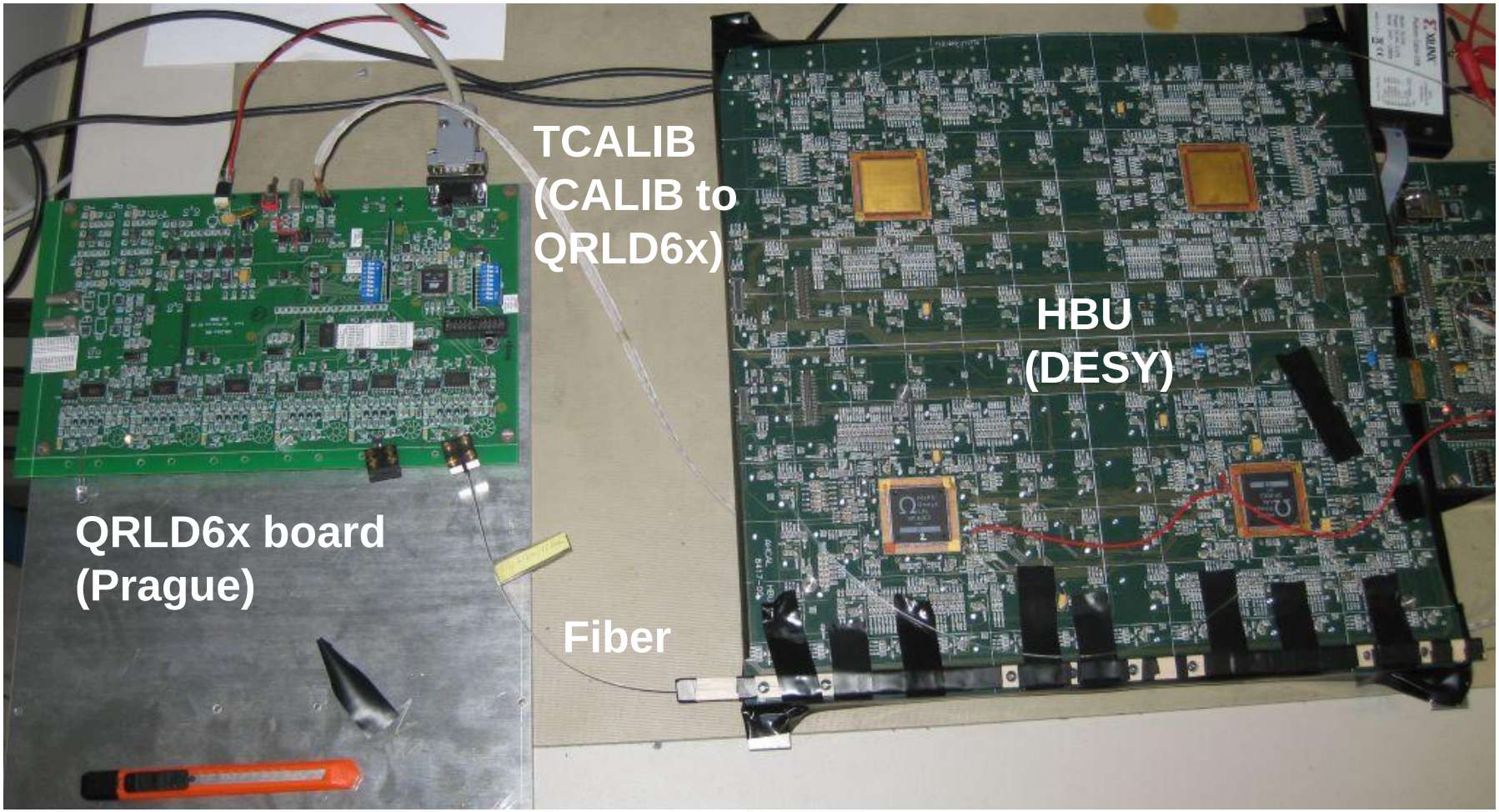




Nominal tile distance:
150 µm (conservative)
100 µm (tight)
(design tile size fixed to 30.0mm)

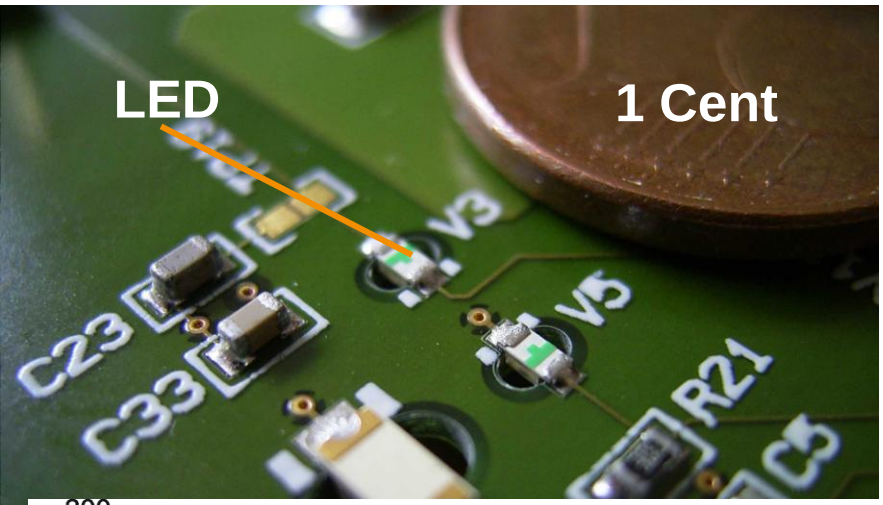
- Tile Dimensions still under discussion => HBU2 design delayed!
- Tile alignment testboard in design-phase (ITEP-DESY coordination)

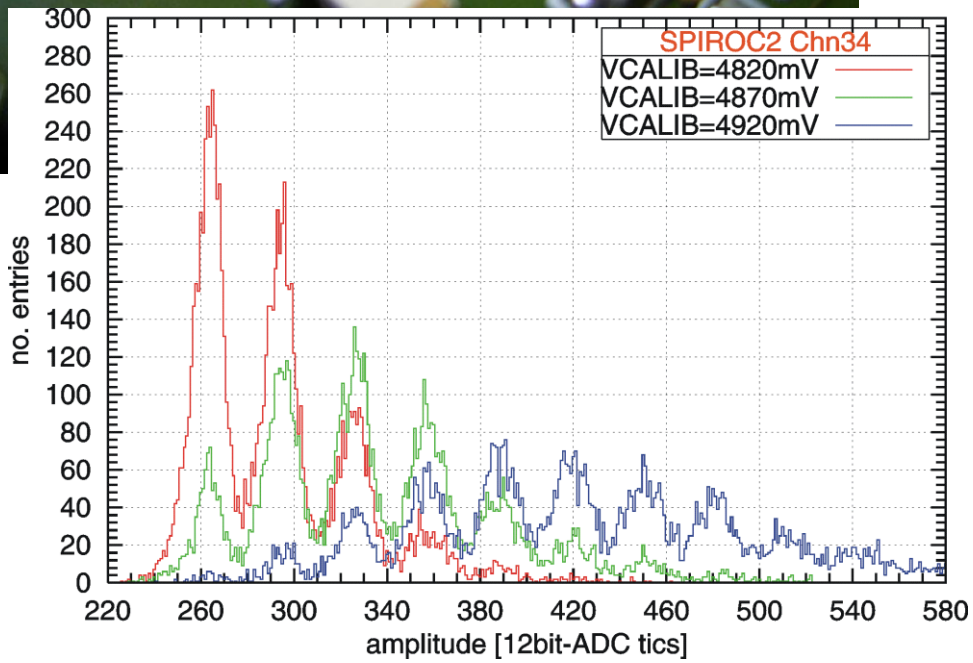
Integration of Prague LED system into DESY setup



See talk from our Prague colleagues!

LED Calibration Systems II – DESY + Uni Wuppertal

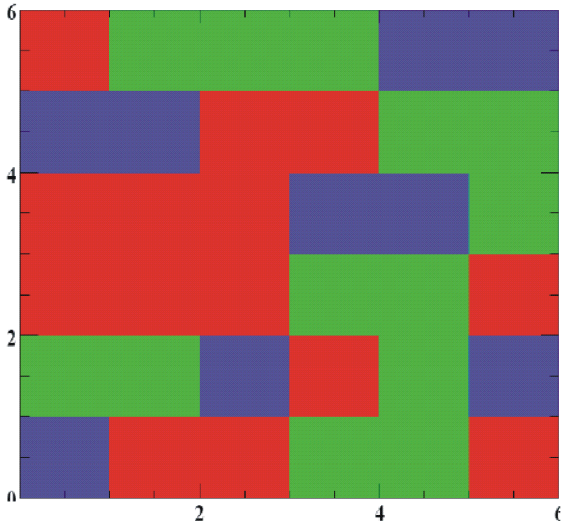




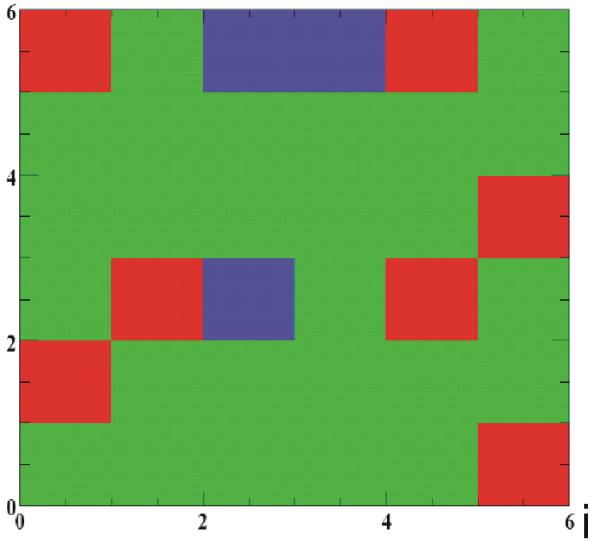
- LED uniformity under investigation
- Wuppertal recommended new LED driving circuit and new LED type with lower spread in output.
- HBU2 will contain solder parameter field in order to adjust LED power per channel.
- to be optimized: LED light output spread, dynamic range (saturation)

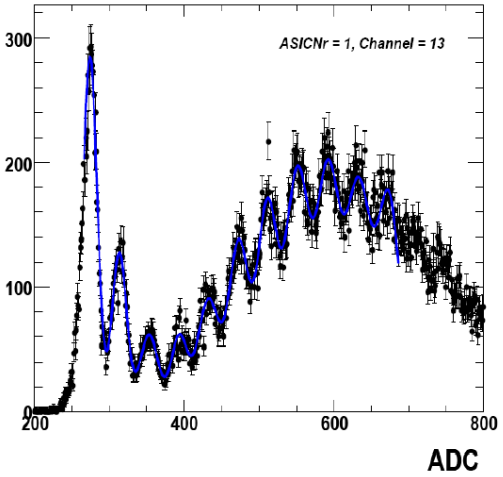
LED Calibration System – Current Activities

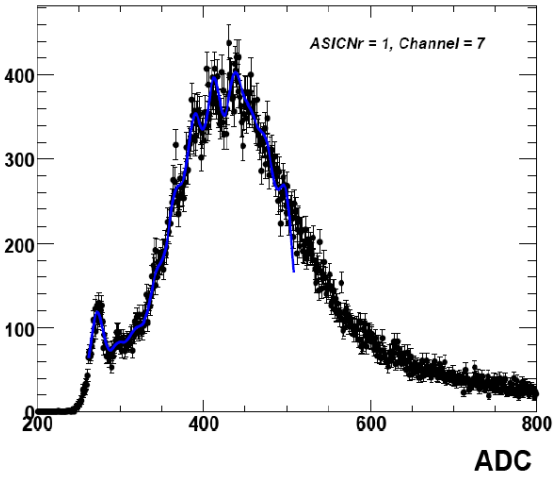
SPIROC2_2



SPIROC2_1







<u>HBU-wide charact. of SiPM single-pixel spectra</u>

green: good single-pixel spectrum

red: SiPM does not show single-pixels

blue: LED or SIPM dead (to be analyzed …..)

<u>Development of:</u>

Automatic fit and gain extraction routines (here: for testbeam MIP signals)

Results by Julian Sauer

AHCAL DAQ – currently still Labview and USB

- CALICE DAQ integration still not scheduled
  - hardware missing (e.g C&C to LDA, not all LDA outputs work)
  - DAQ operation/firmware: LLR did great progress, but parallel development @DESY does not make sense.
- DIF firmware structure/block definition within DIF task force
  - first step for CALICE DAQ integration
  - AHCAL DAQ runs with specified command set.
- AHCAL layer module cannot really run with USB DAQ – data taking will be very slow (~1Hz).

Conclusions and Outlook

- 2 prototype setups running in parallel in Hamburg:
  - testbeam: channel-wise calibration with MIPs
  - lab-setup: SPIROC2 tests
- redesigns are ongoing, but are delayed by ongoing system tests and optimization of tile tolerances.
- CALICE DAQ integration strongly delayed due to situation in UK.
- LED calibration system development ongoing with 2 options.
- Eagerly awaiting SPIROC 2a/2b.