

AHCAL: Overview and Progress report



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Deliverables

- AHCAL mechanical structure
- AHCAL calibration system
- AHCAL readout integrated electronics

Mechanics

- Goal: a realistic absorber structure for tests of novel readout techniques
- Realistic: compact and scalable (& ILD-like)
- No full cubic metre needed, but should be extendible

Calorimeter module

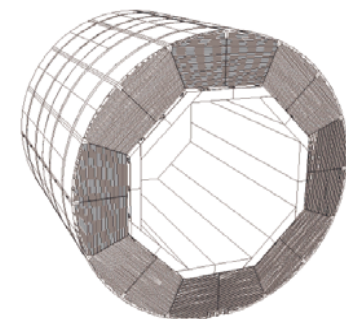
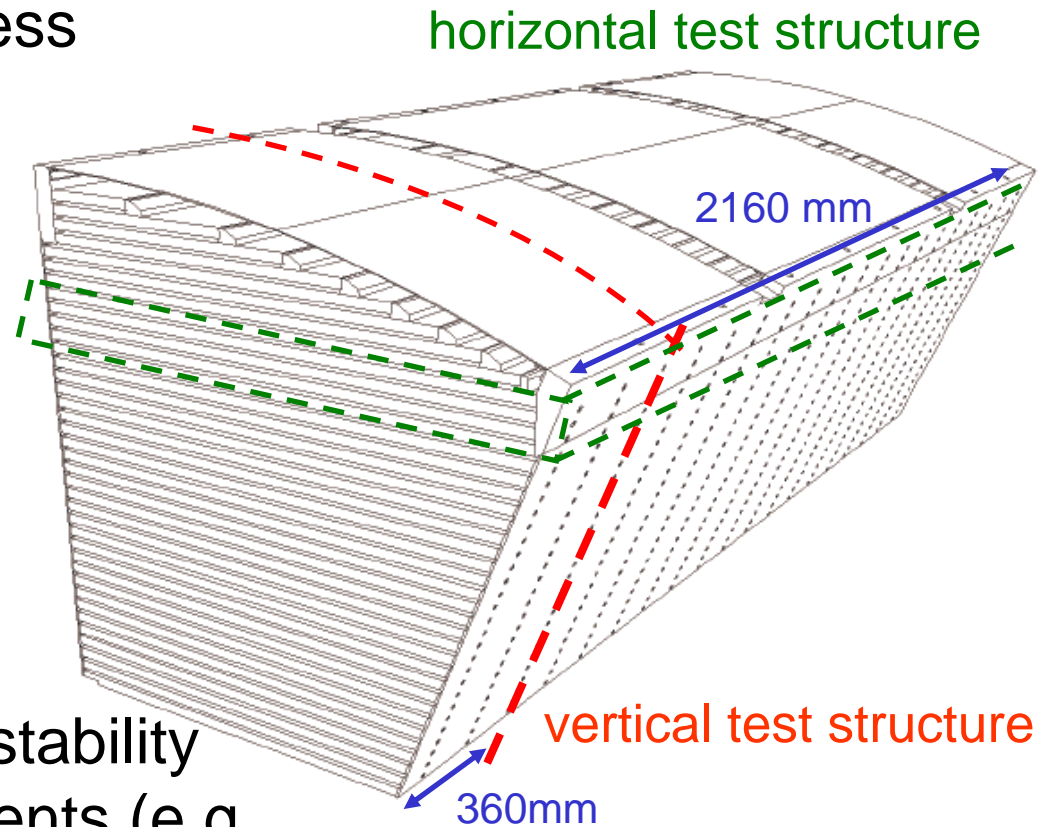
- ⇒ Side panel: 3 mm thickness
- ⇒ Screw size: M6

Advantage

- Slim support structure (small amount of φ -cracks)

Disadvantages

- Uncertainties regarding stability
- High tolerance requirements (e.g. holes for screws, flatness of absorber plates)



Mechanical structure: vertical test

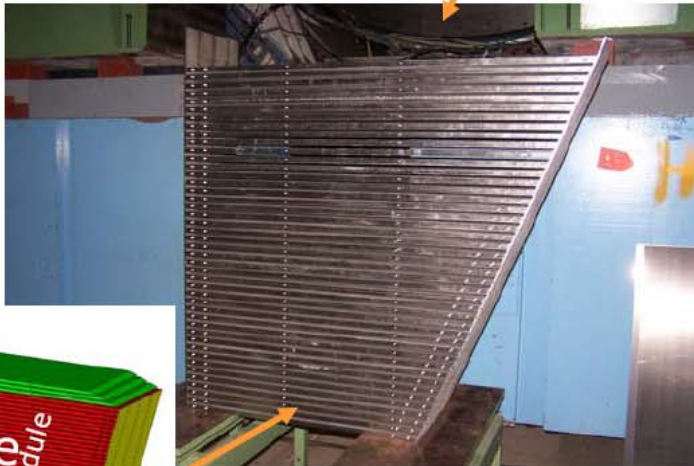
360 mm sub-module



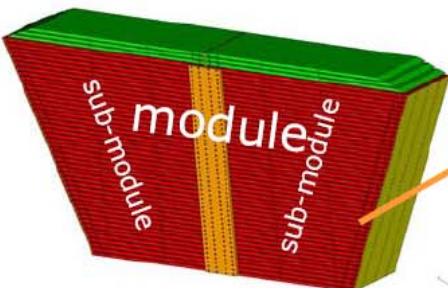
sub-module Nr.1 in horizontal position
gap size measured (front)

sub-module Nr.1 turned vertical
gap size checked by cassette prototype:

2 positions where the cassette
does not fit into the gap
gaps must be measured also in depth
plate position must be measured



sub-module Nr.2 production started
→ finish end of August



→ available

Mechanical structure: large module

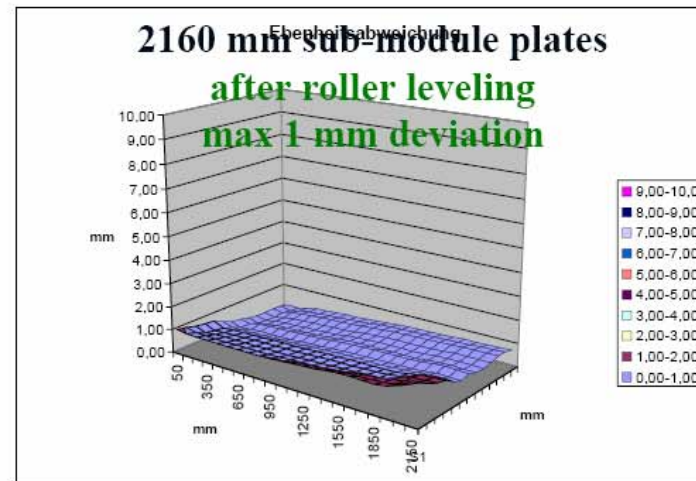
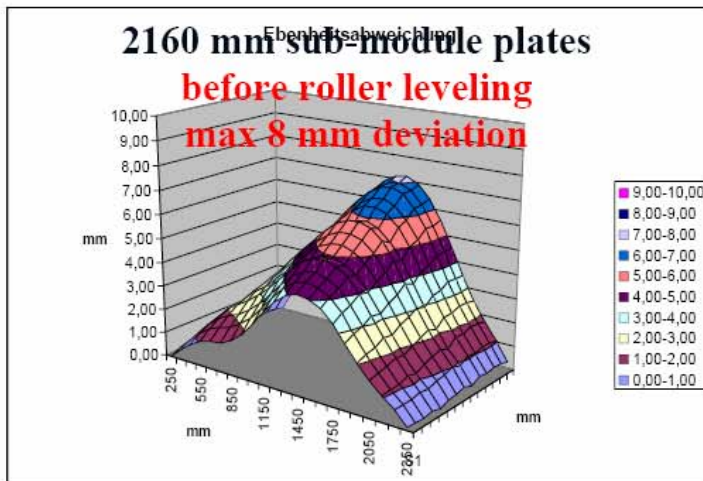


2160 mm sub-module plates
layer 43 to 46

roller leveling done

flatness measurement done

→ available



Calibration system

- Goal: scalable system addressing the needs we determine in the ongoing test beam experiment
- Many procedures developed during last year's analysis, but not finally proven yet
- Stability of saturation still an issue → need dynamic range
- **Two approaches:** optical or electrical signal distribution
 - **Central driver plus fibres, or one LED / tile**
- LED on board looks promising, further optimization in the hands of Wuppertal group

Central driver plus fibres option

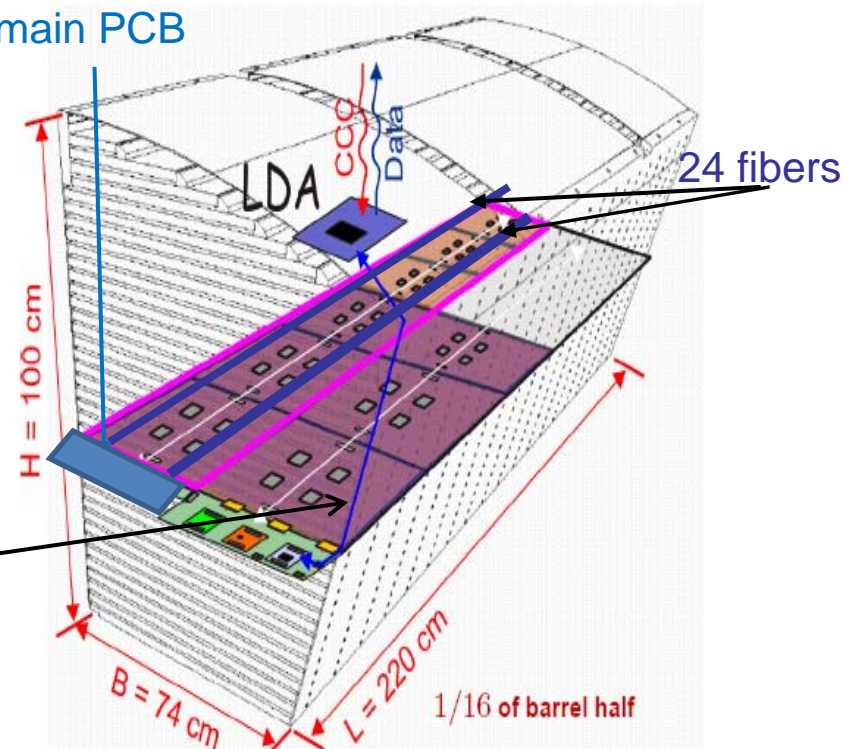
Two integration strategies:

1. **Fiber emitting light** for one row of tiles, QRLED driver sitting outside of module (endcap) → development of the light distribution system (main effort in 2008)

2. QRLED driver is sitting at HBU above the **scintillator**

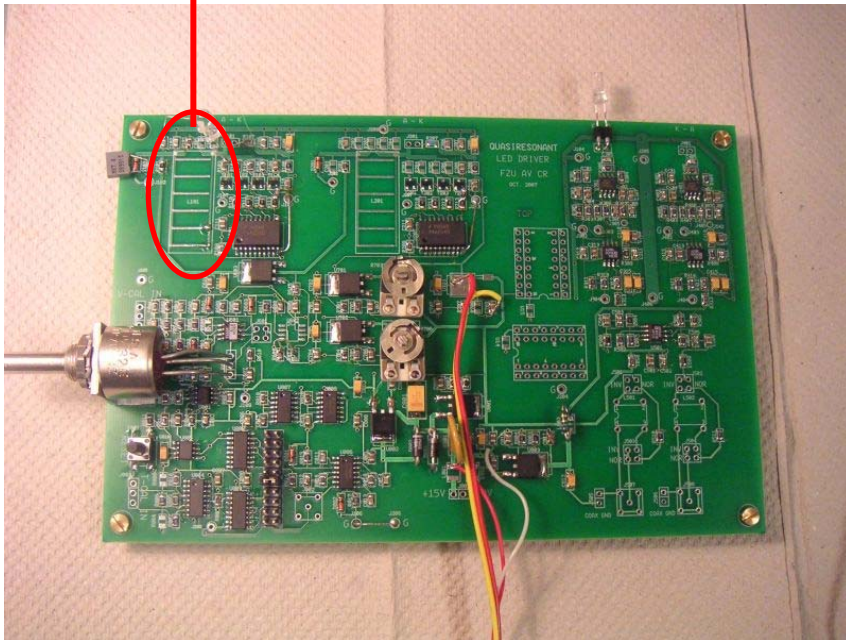
QR driver + LED

24*3cm² area needed at the main PCB



Deliverable 2007 – single channel LED prototype (ILC-DET-2007-024)

Inductor ~ 30 nH



Ivo Polák, Milan Janata

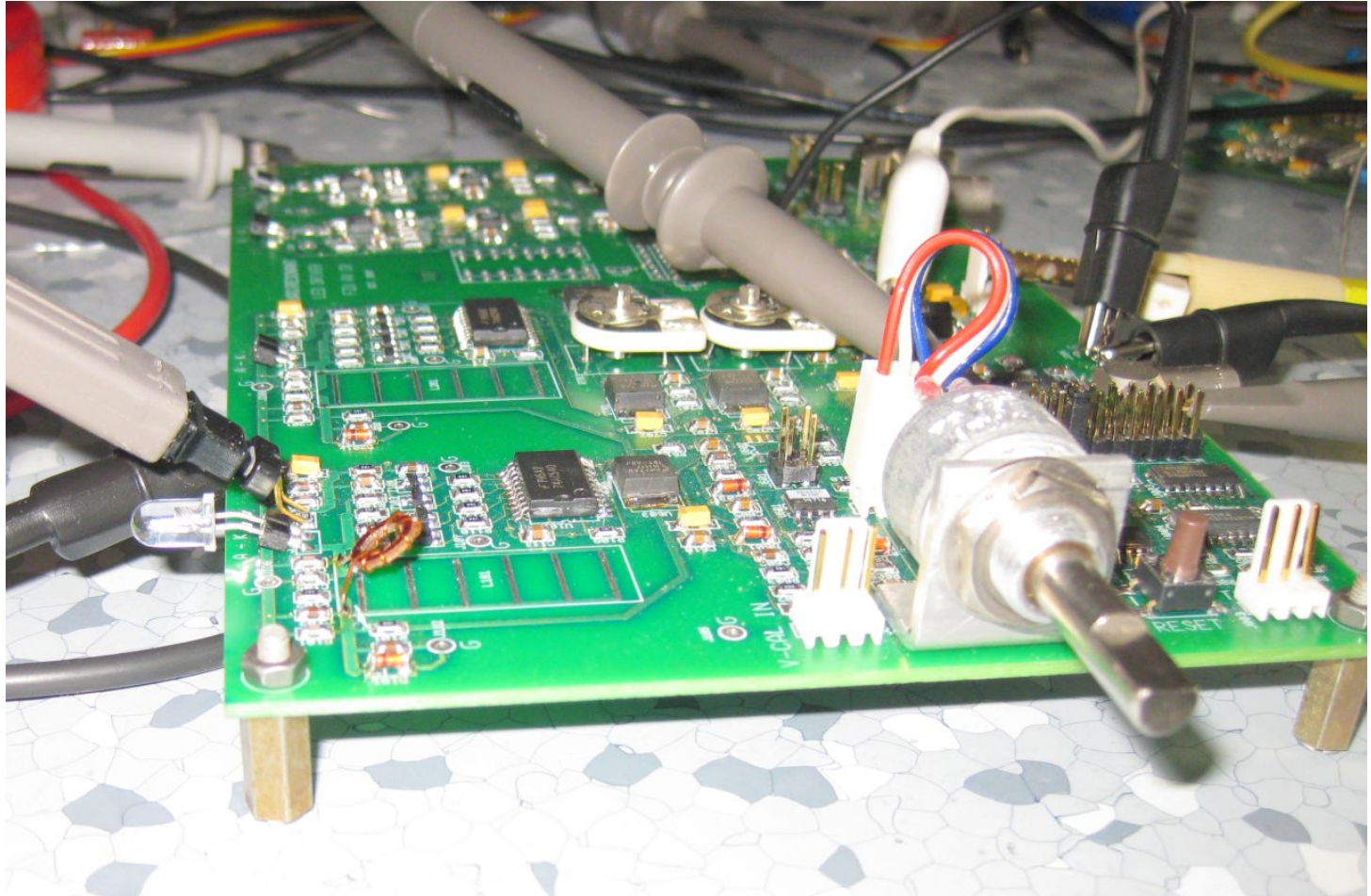
- Double sided PCB
- 2 quasi-resonant (QRLED) drivers
- 2 PIN photodiode preamp
- Rate generator 1 Hz to 10 kHz
- Voltage regulators
- Amplitude control
- V-calib and T-calib interface

Toroidal inductor soldered

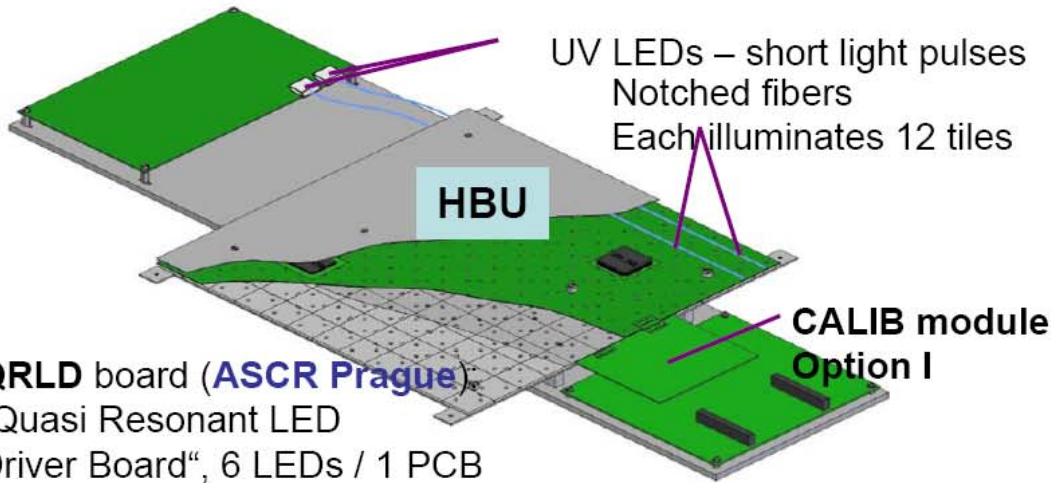
Compare the thickness of PCB and of the inductor



Toroid will be made in the PCB volume – no additional space needed



QRLD board: Magnetic field test



- ❑ Electronics: multi-channel prototype complete reasonably works incl. Slow control interfaces
→ can be implemented into EUDET AHCAL prototype
- ❑ Characteristics and function described in public paper **EUDET report 2008-7**

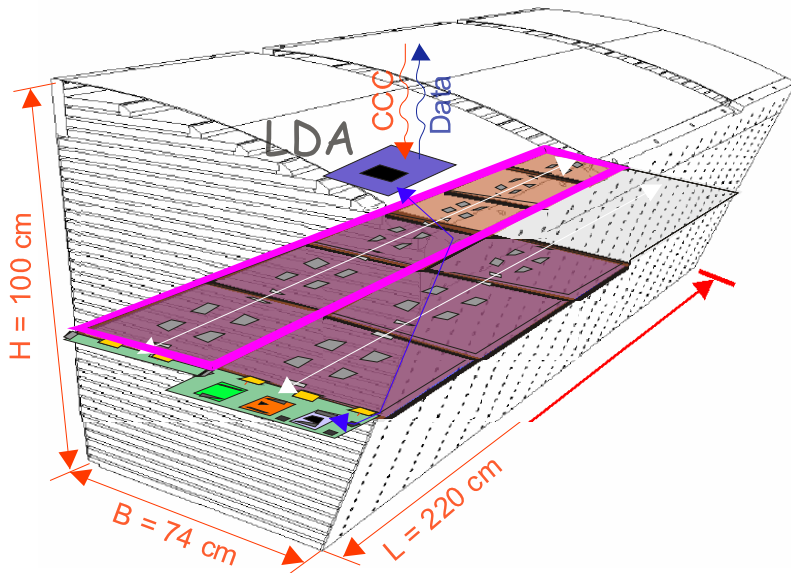
- ❑ Optical part: notched fibres in preparation
→ promising results

→ System successfully tested in 4T magnetic field at DESY



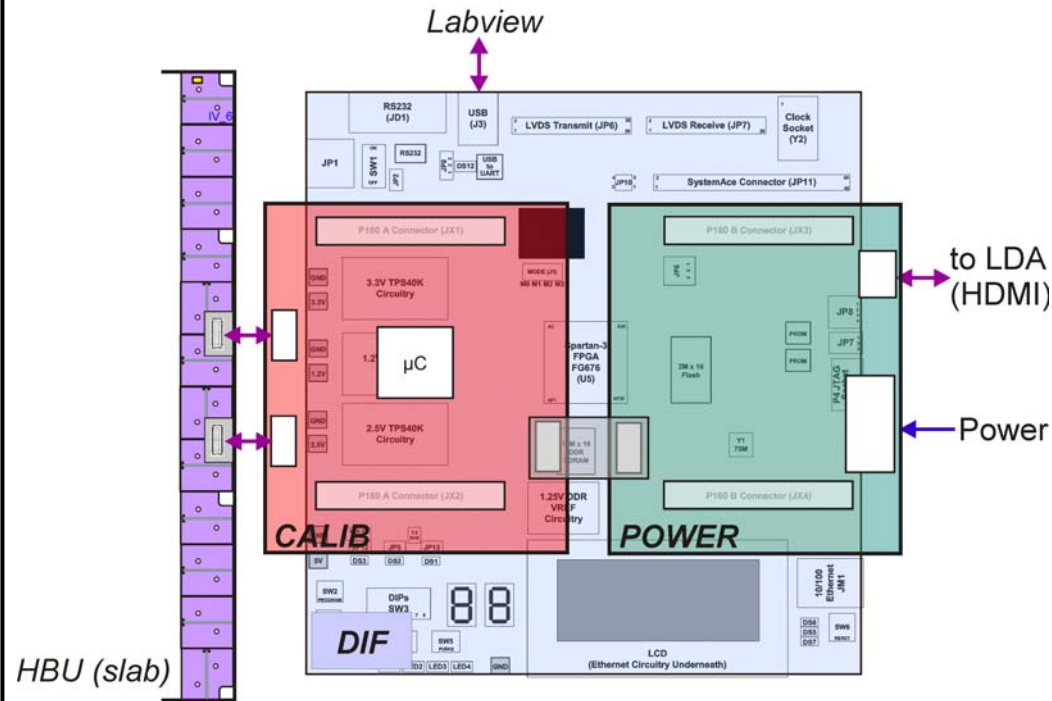
Next prototype: Architecture

the future ...



Slides from M.Reinecke

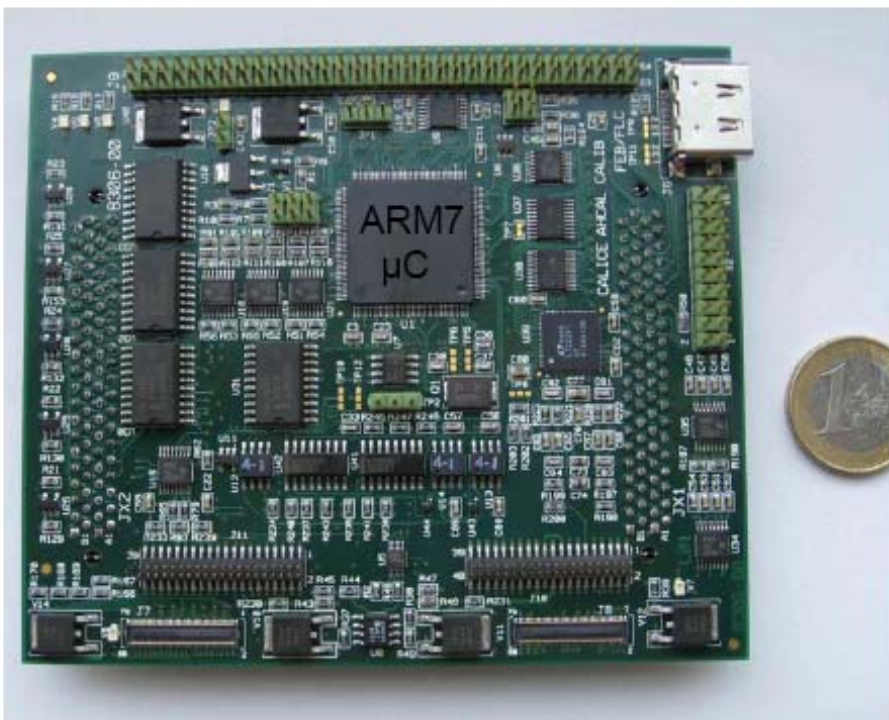
1st EUDET Prototype (1st step)



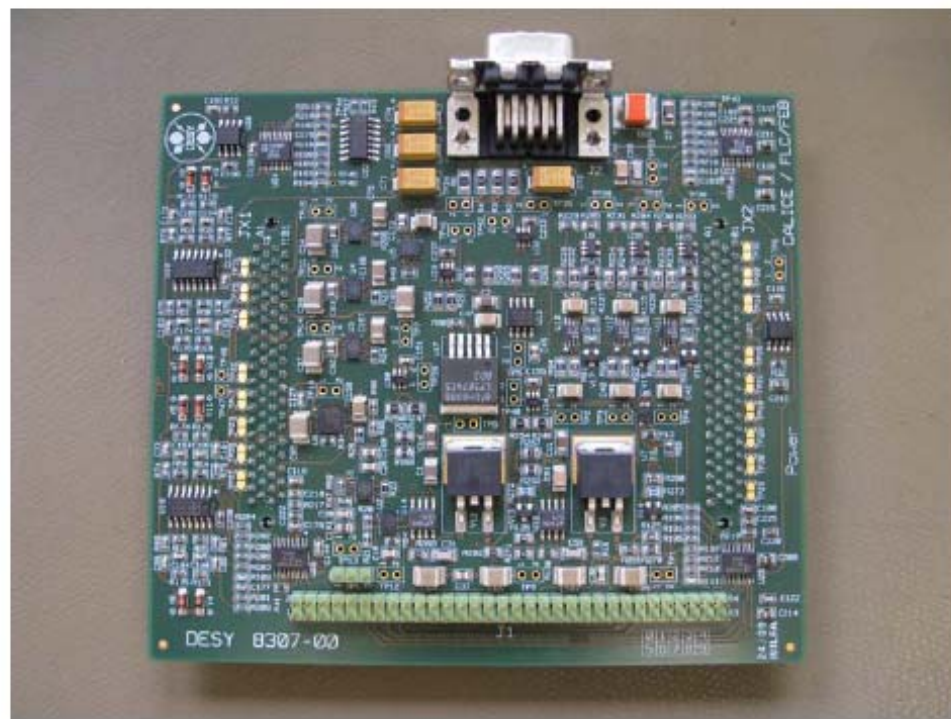
Commercial DIF, new mezzan.
(CALIB, POWER), 1HBU (later: 6)

Power and calibration modules

CALIB module: 11 x 10 cm²



POWER module: 12.5 x 11 cm²



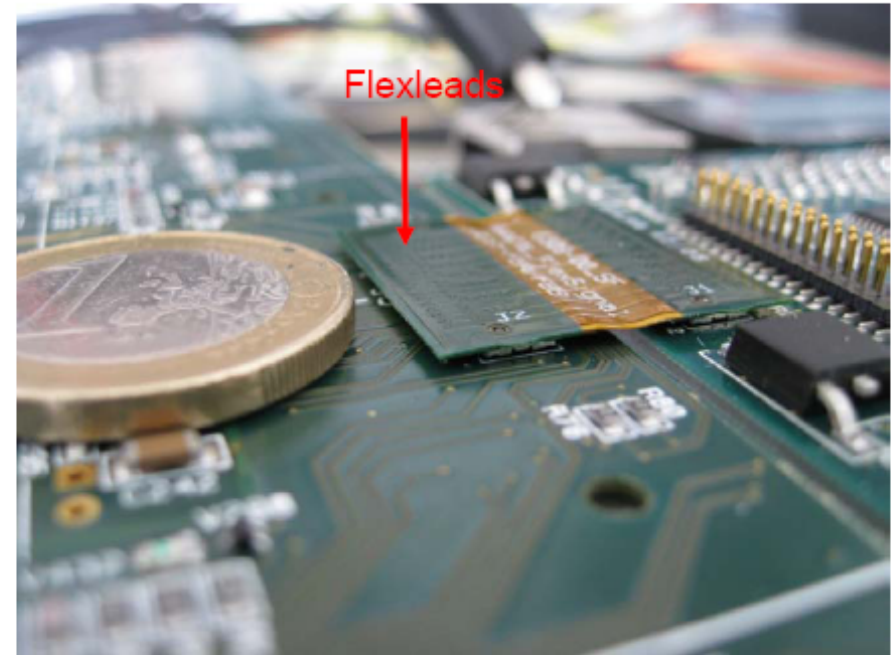
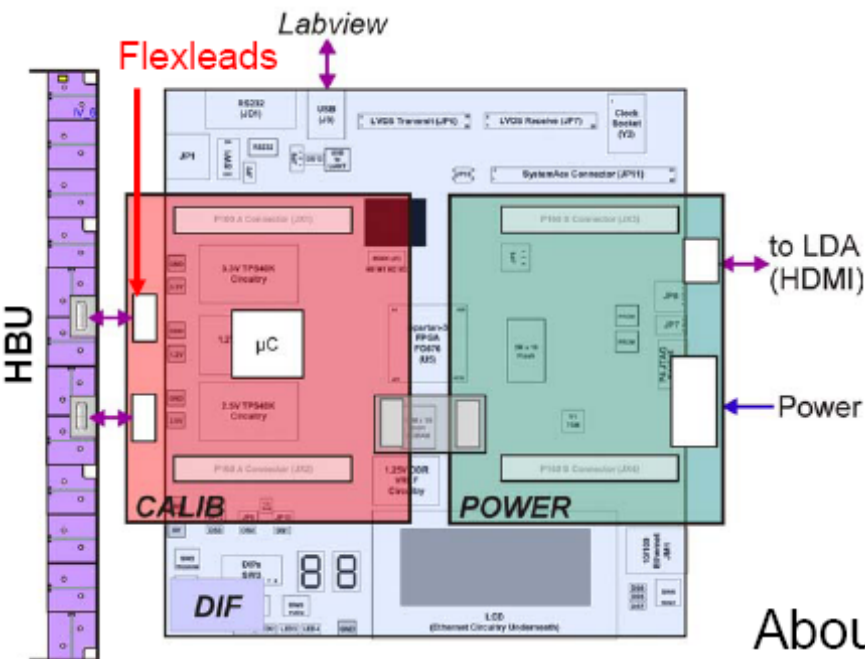
- 4 Modules finished, in operation.
- First tests successful.

- 4 Modules arrived at DESY.
- Tests will start now.

Sizes and heights: To be adapted to ILC mechanics later.

Power and signal connection

'old-fashioned overview'

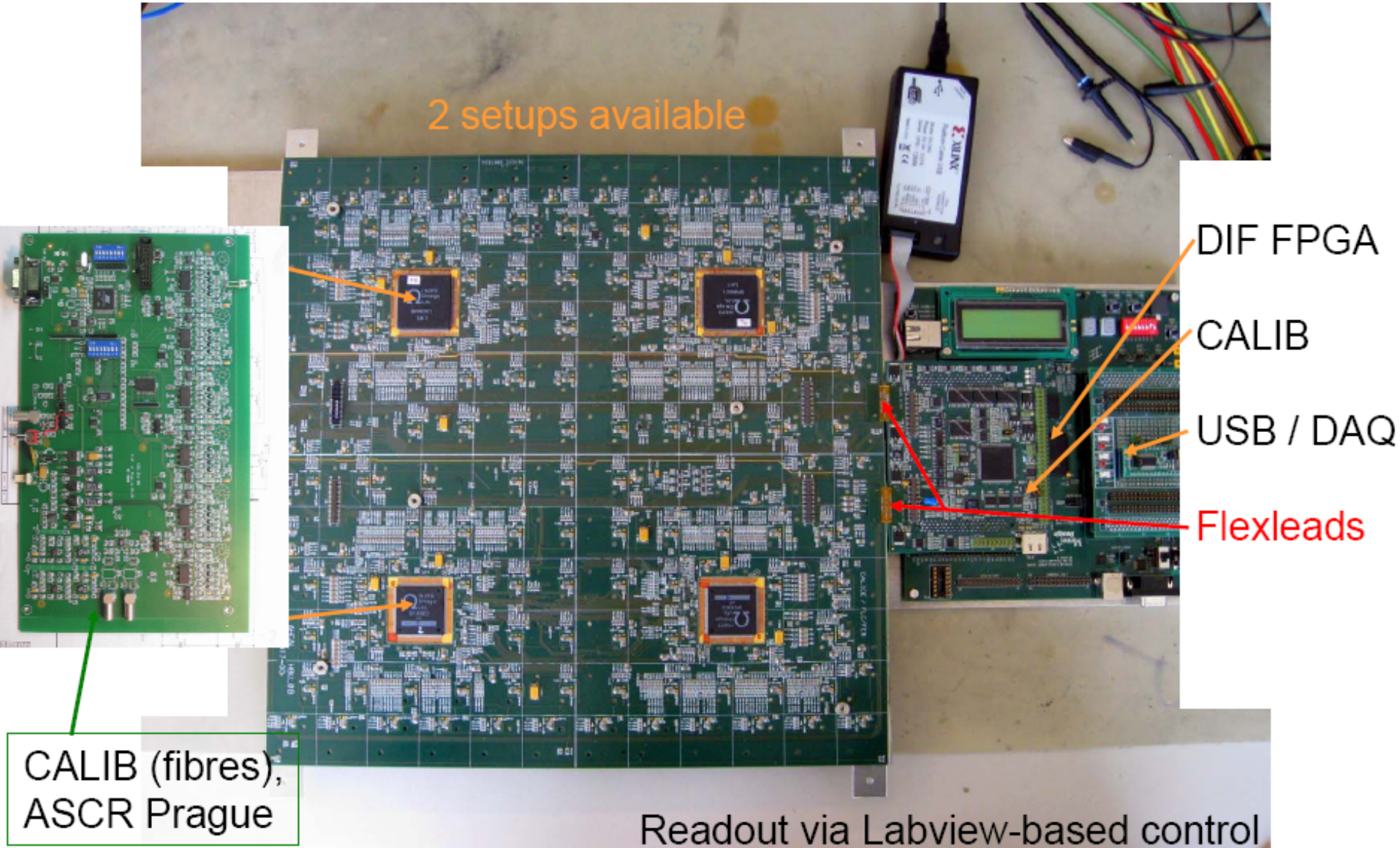


About 40 connection cycles up to now - still ok.
Compensate HBU misalignments in distance.
Fulfill AHCAL height requirements.

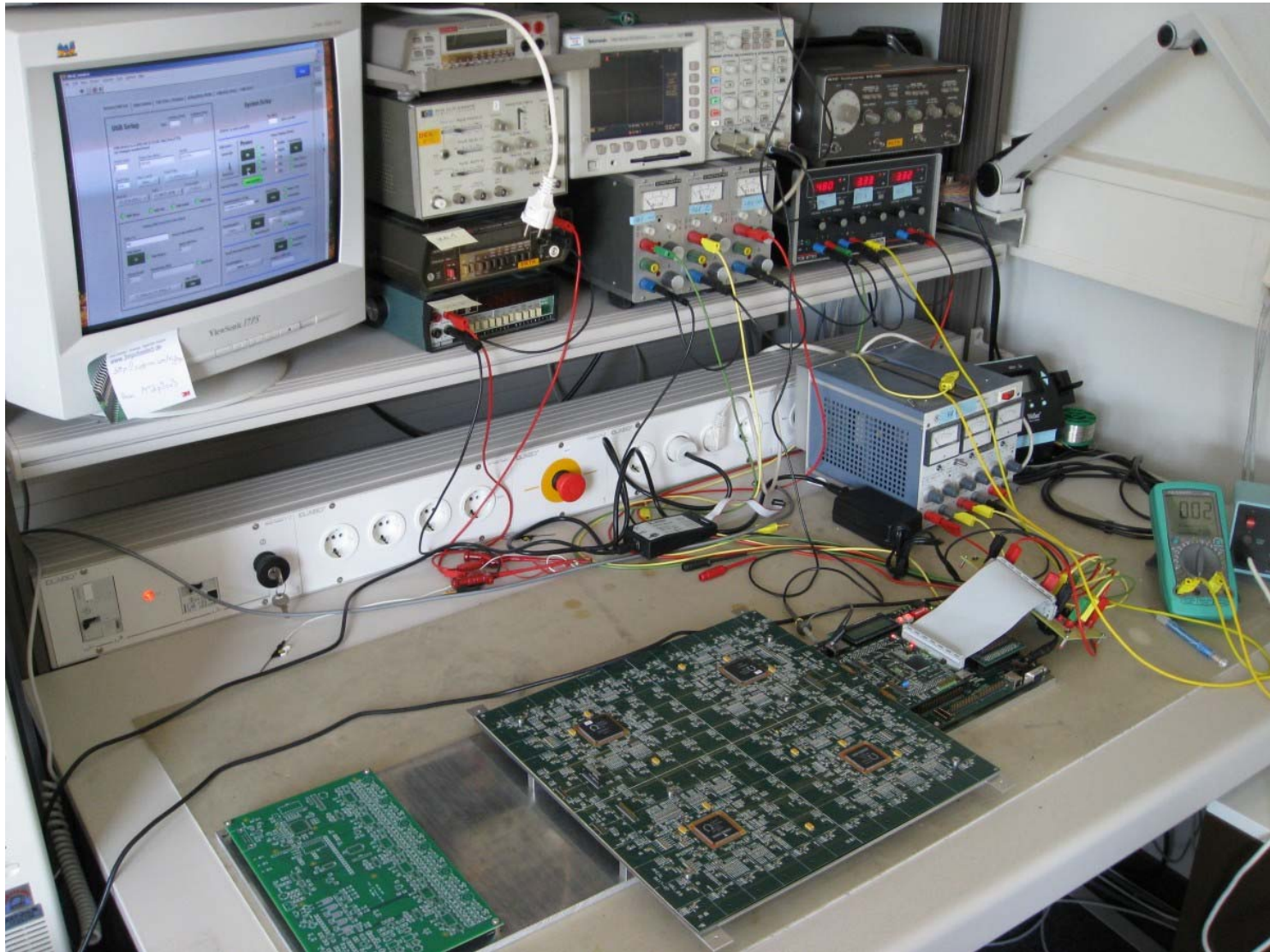
Tests ok concerning:

- Signal allocation
- Signal quality
- Resistance for power

HBU status: electronics



Prototype system commissioning

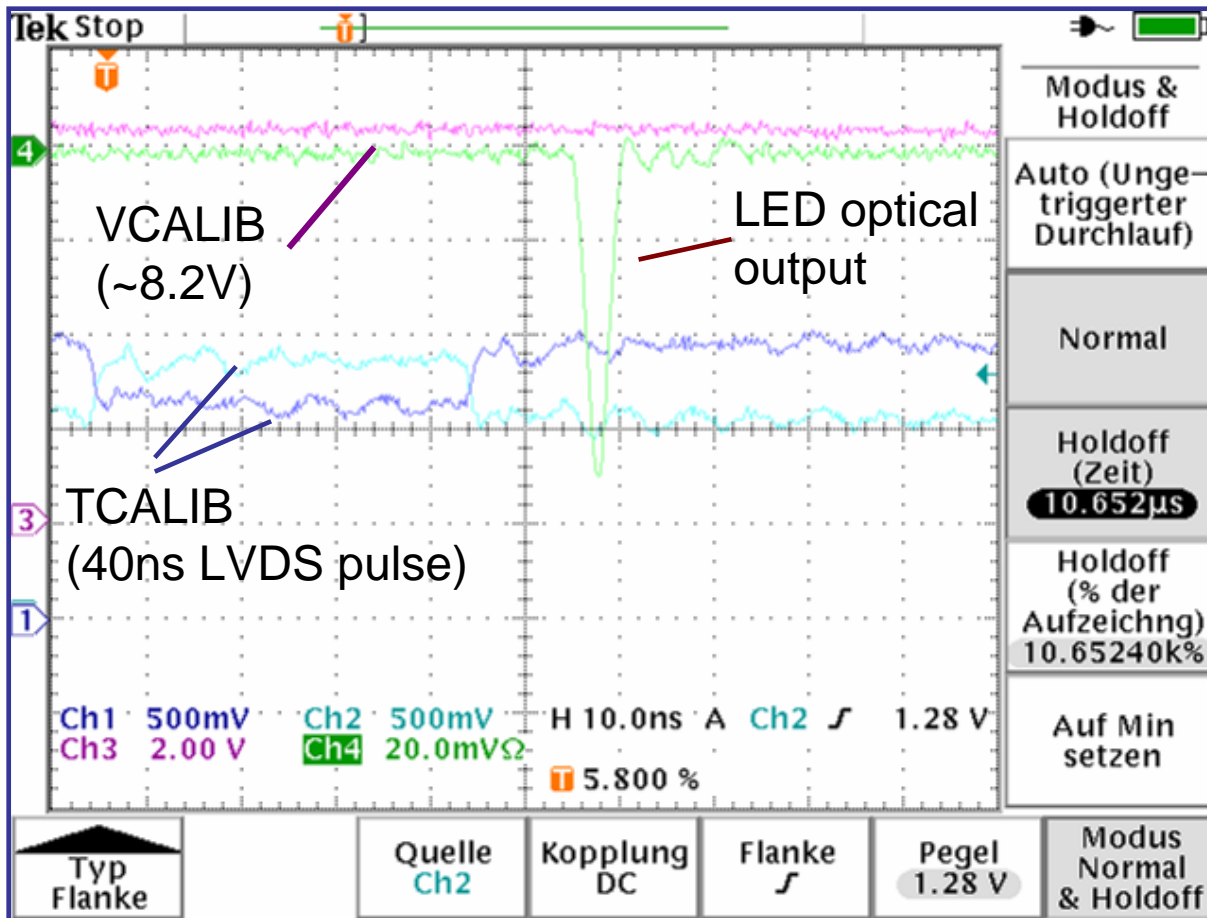


Prototype commissioning: status

- System tested using commercial DIF board + USB connected Labview readout.
- Labview software is still under debugging: single event acquisition possible, but not longer data-taking periods
- Both SPIROC1 and SPIROC2 connected and functional
- The readout/operation is fully established. SPIROC ASICs (generation 1 and 2) can be fully operated, switch between the two by hardware jumpers.
- Due to an error in the SPIROC1 probe register, only one SPIROC1 can be used at a time. Both SPIROC2s can be used in parallel

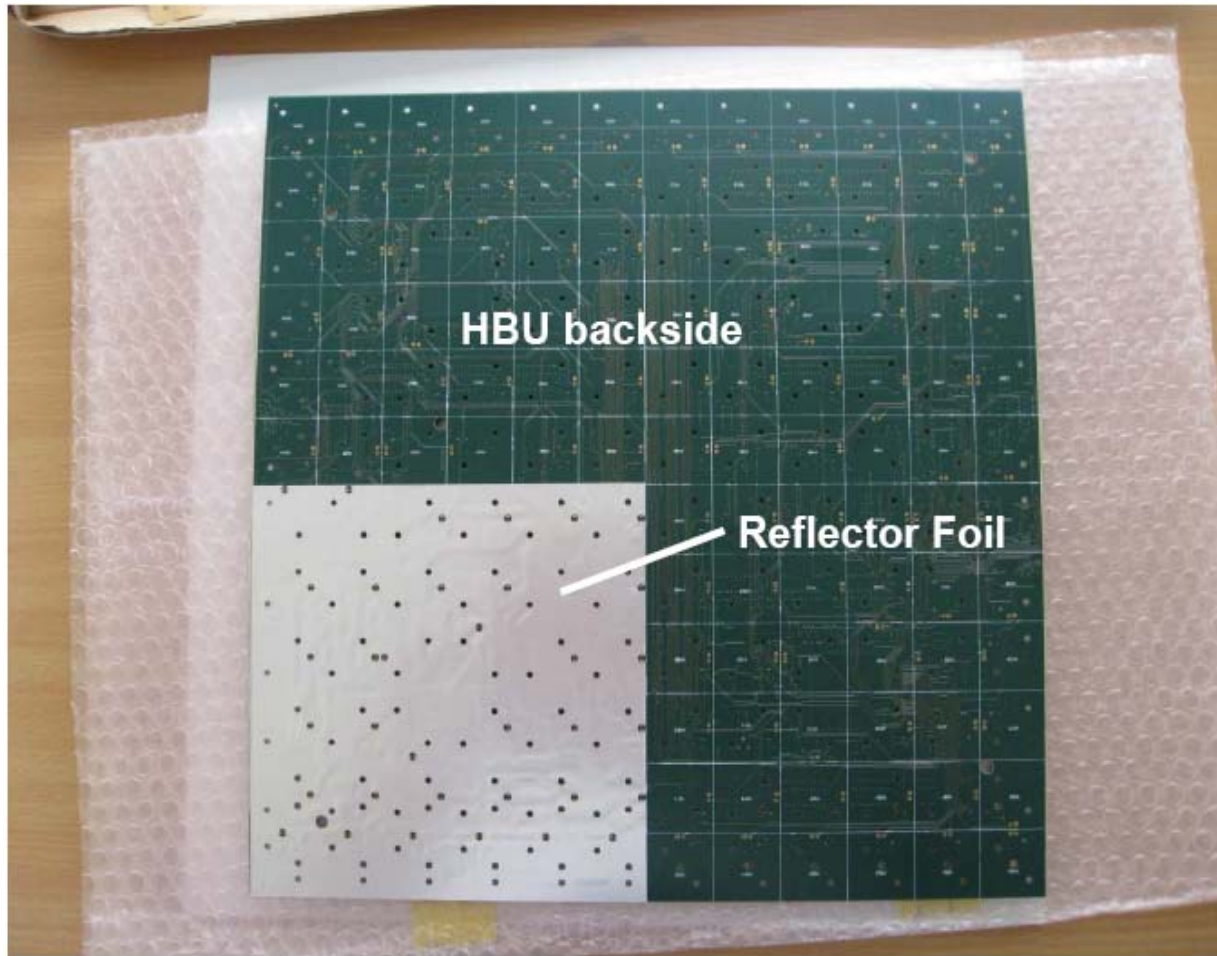
Next: test of tiles signals readout → ongoing

Integrated LED system



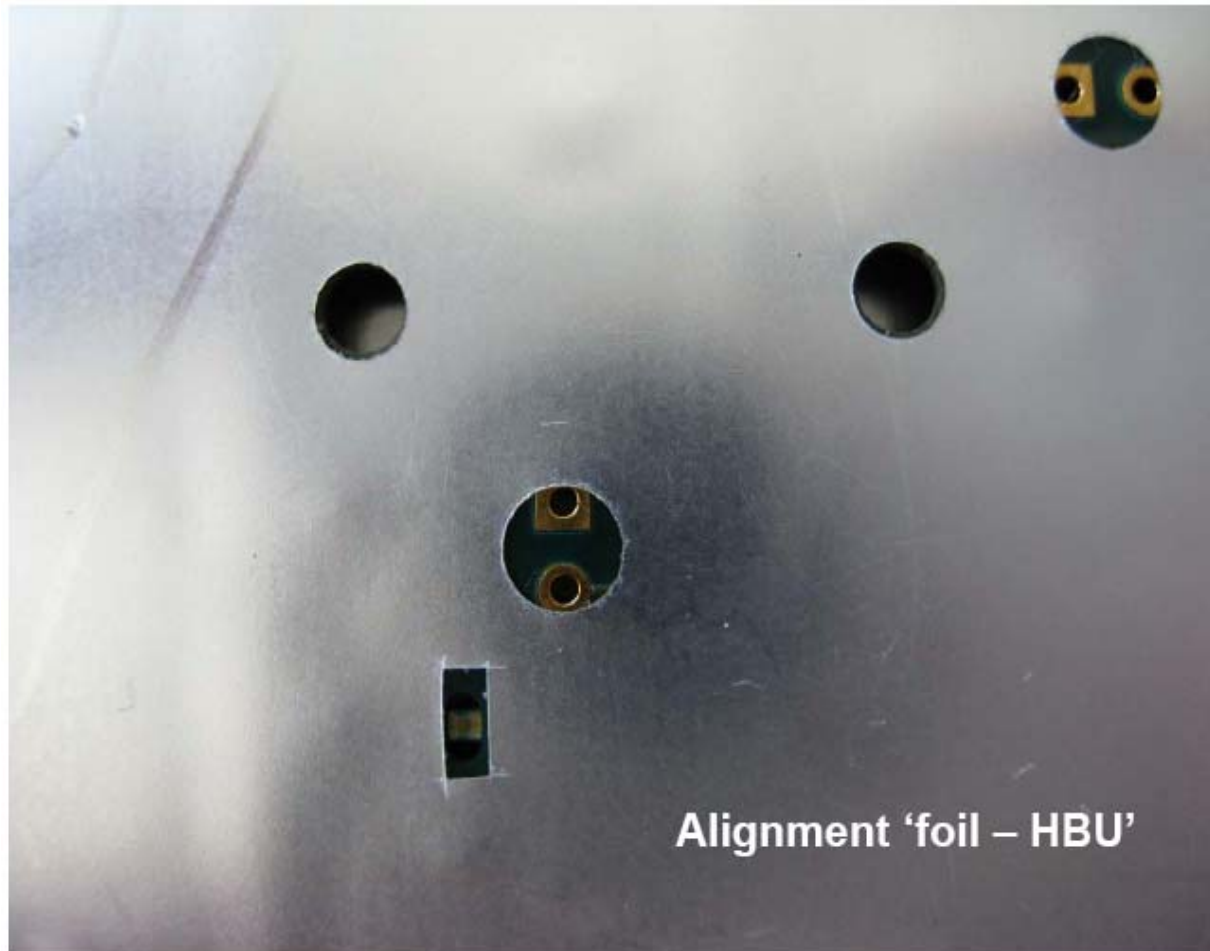
- Integrated LED multi-channel calibration system works
- <5ns LED light pulses measured on the HBU with PMT H9858-01
- Remaining problem: spread in the output intensity LED-to-LED

HBU status: reflector foil

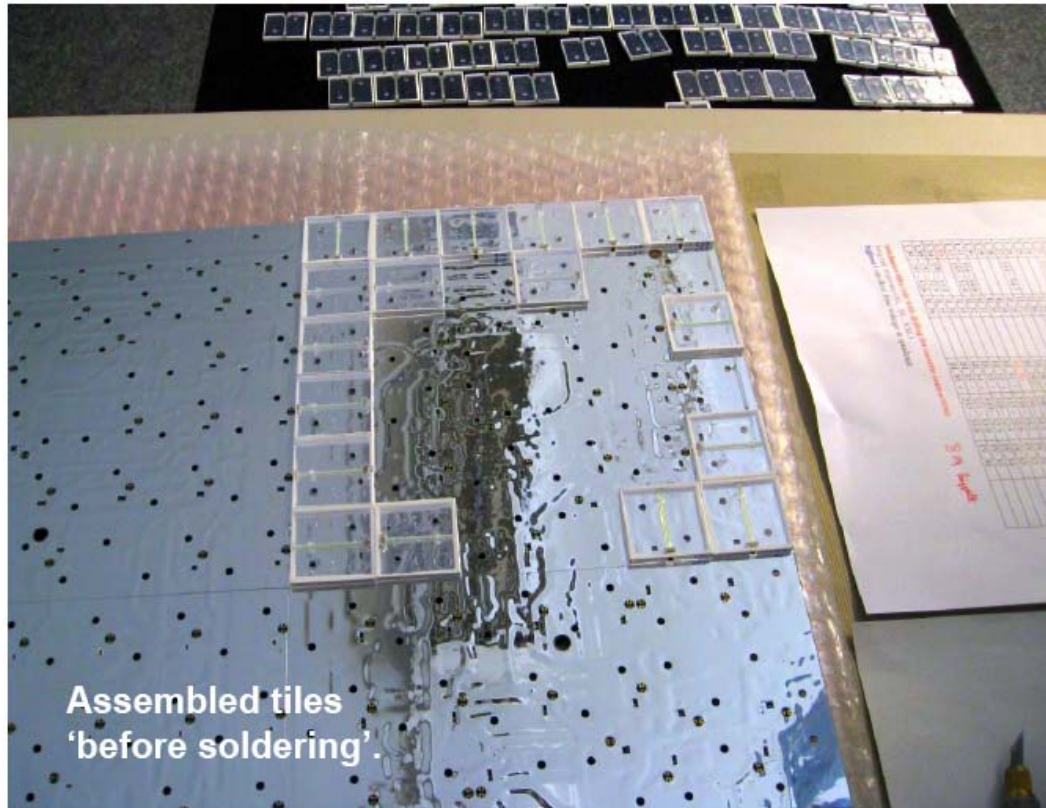


Cover back side with reflector foil in 4 pieces for better precision in alignment with holes

HBU reflector foil: detail

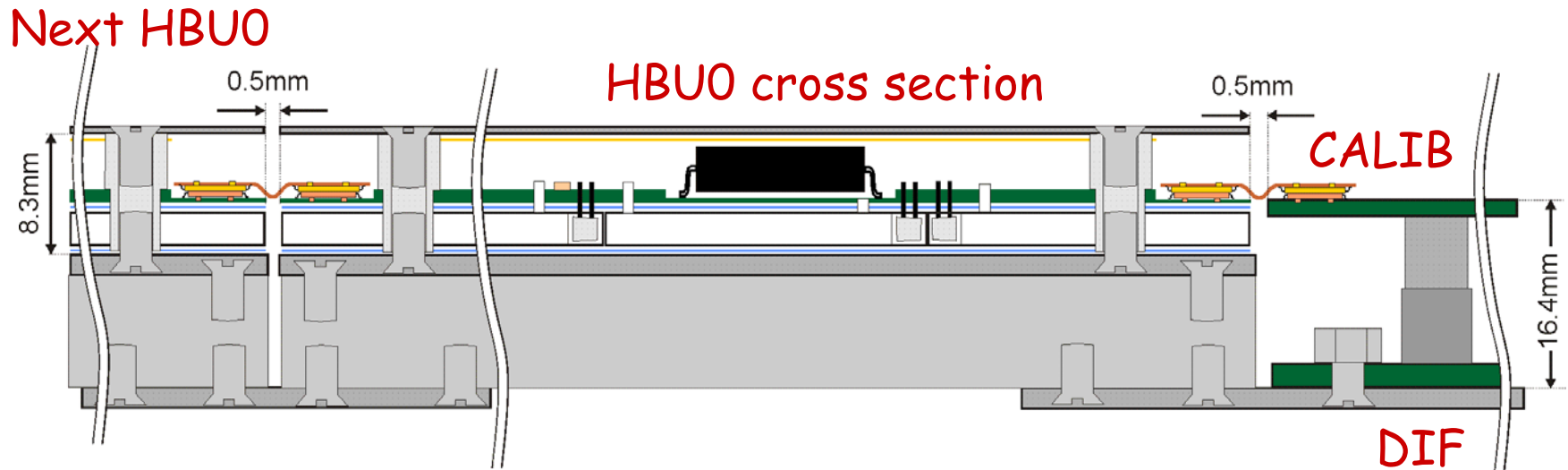


HBU status: tile assembly



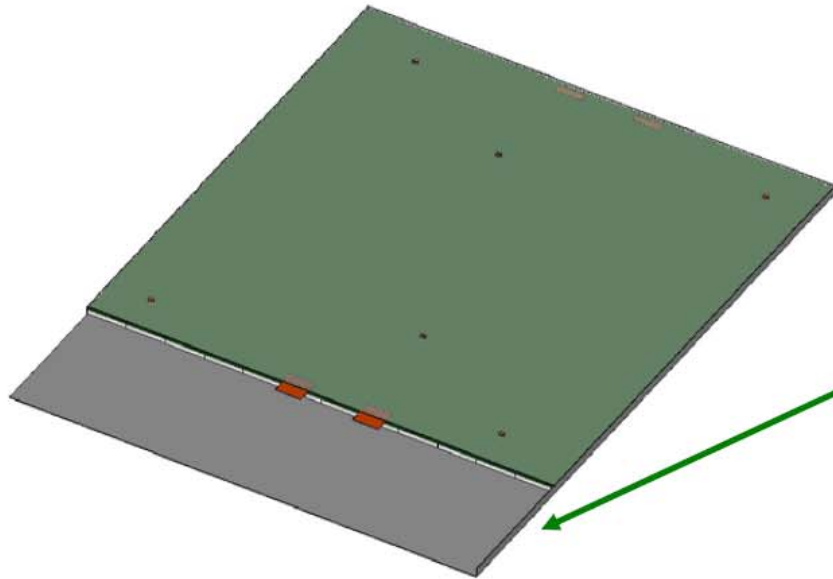
18 tiles connected and electronically checked
All tiles available to equip full HBU

AHCAL Slab Interface: Mechanics



- Mechanical proposal (cassette, interface to DIF) has been set up for the AHCAL prototype (HBU0, DIF as commercial board)
- Prototype housing ready

HBU status: housing



362 mm x 462 mm standard width housing

- contains 1 HBU unit for 360 mm sub-module
- 0.5 mm stainless steel
- One side border per bottom/cover plates
- 100 mm bottom plate extension for front end electronic
- 6 point welded fixation/distance bolts per HBU unit
- Cover plate and HBU fixed by 6 M2.5x4 screws per HBU unit
- total thickness 7 mm \pm 0.1 mm

362 mm x 2260 mm standard width housing

- contains 6 HBU units for 2160 mm sub-module
- other parameters see above

1HBU and 2HBU standard
width housing
prototypes available

Conclusions

- **Full system integration** (electronics + mechanics) incorporating tiles and SiPMs from first user is **ongoing**
- First prototype is being assembled and tested. All components delivered:
 - CALIB and POWER modules: **available**
 - Calibration multi-channel prototype: **both options available**
 - Mechanical structure: **available**

Outlook: AHCAL integration prototype to DESY test beam in 9/09

- Full scale area integration requires redesign of HBU
- Multi-layer integration requires redesign of end-face components (DIF, CLIB, POWER)