AHCAL Physics Prototype.

The Electronics Part

Mathias Reinecke
for the AHCAL developers
DESY, March 2nd, 2010

HELMHOLTZ GEMEINSCHAFT

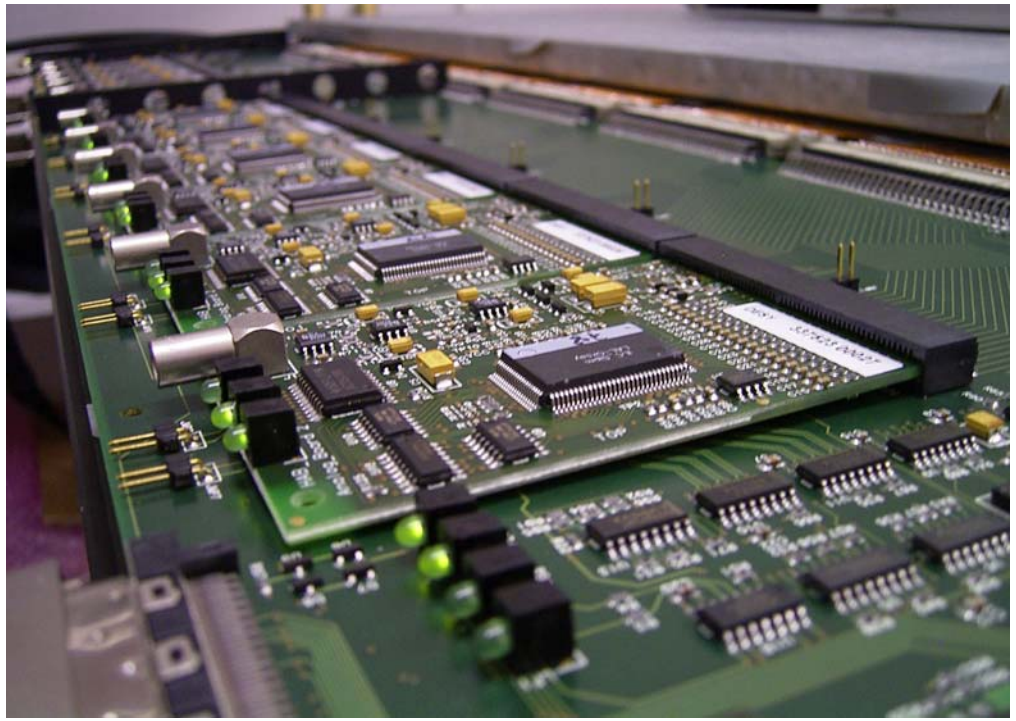
CALICE Calorimeter for ILC

EUDET

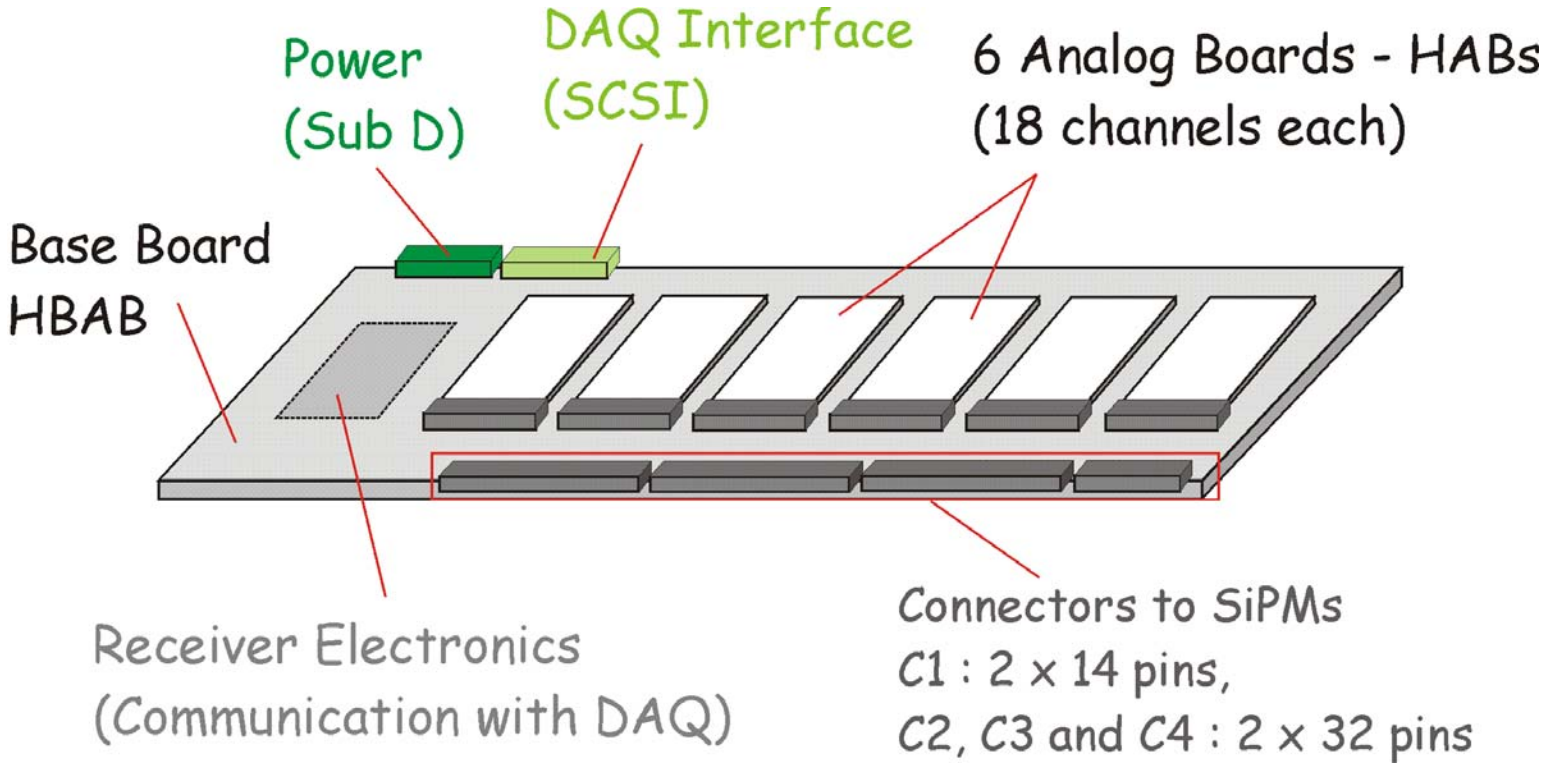
DESY

Outline

- Hardware Developments
  - HCAL Base Board (HBAB)
  - HCAL Analogue Board (HAB)
  - HCAL Testboard
- System Commissioning
  - Cable Interfaces
  - Safety
- Circuit Details
  - Slow Control Loading
  - Analogue Readout Path
- Light Calibration System (ASCR Prague)
- System Setup

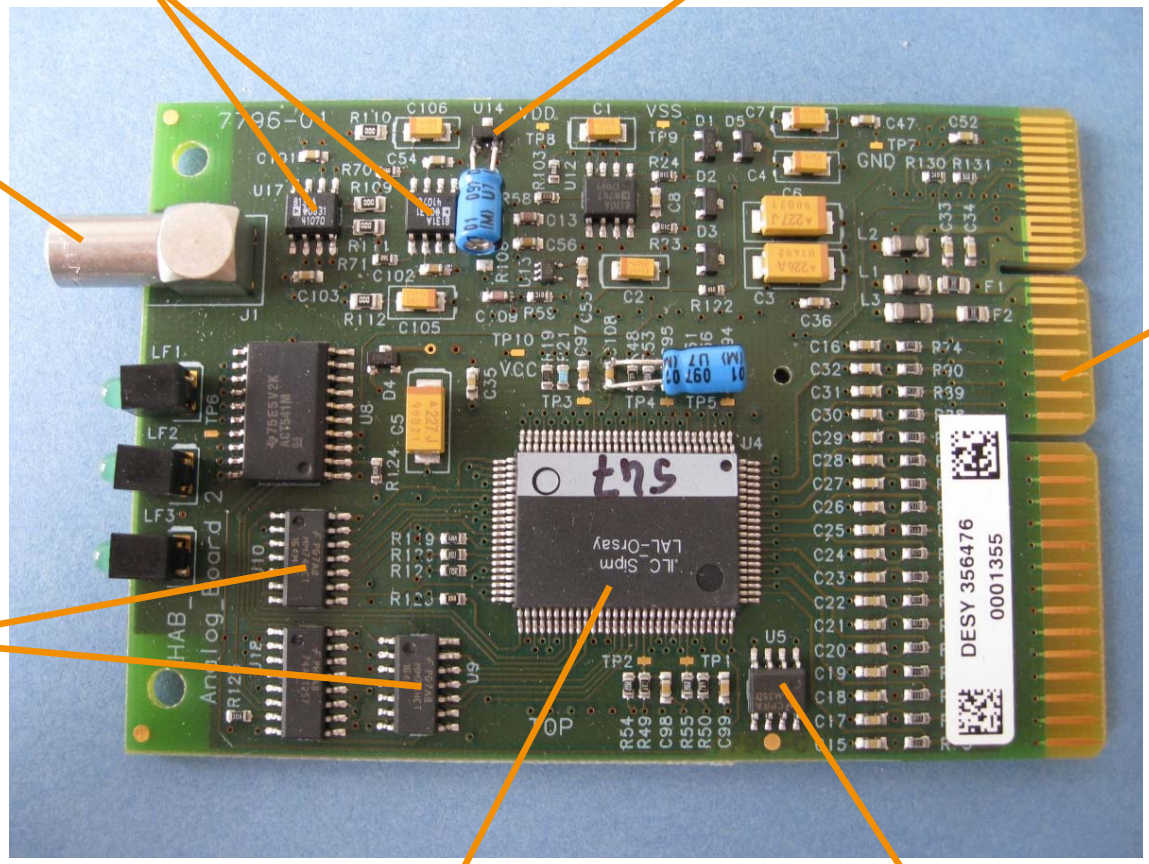


System Electronics Setup



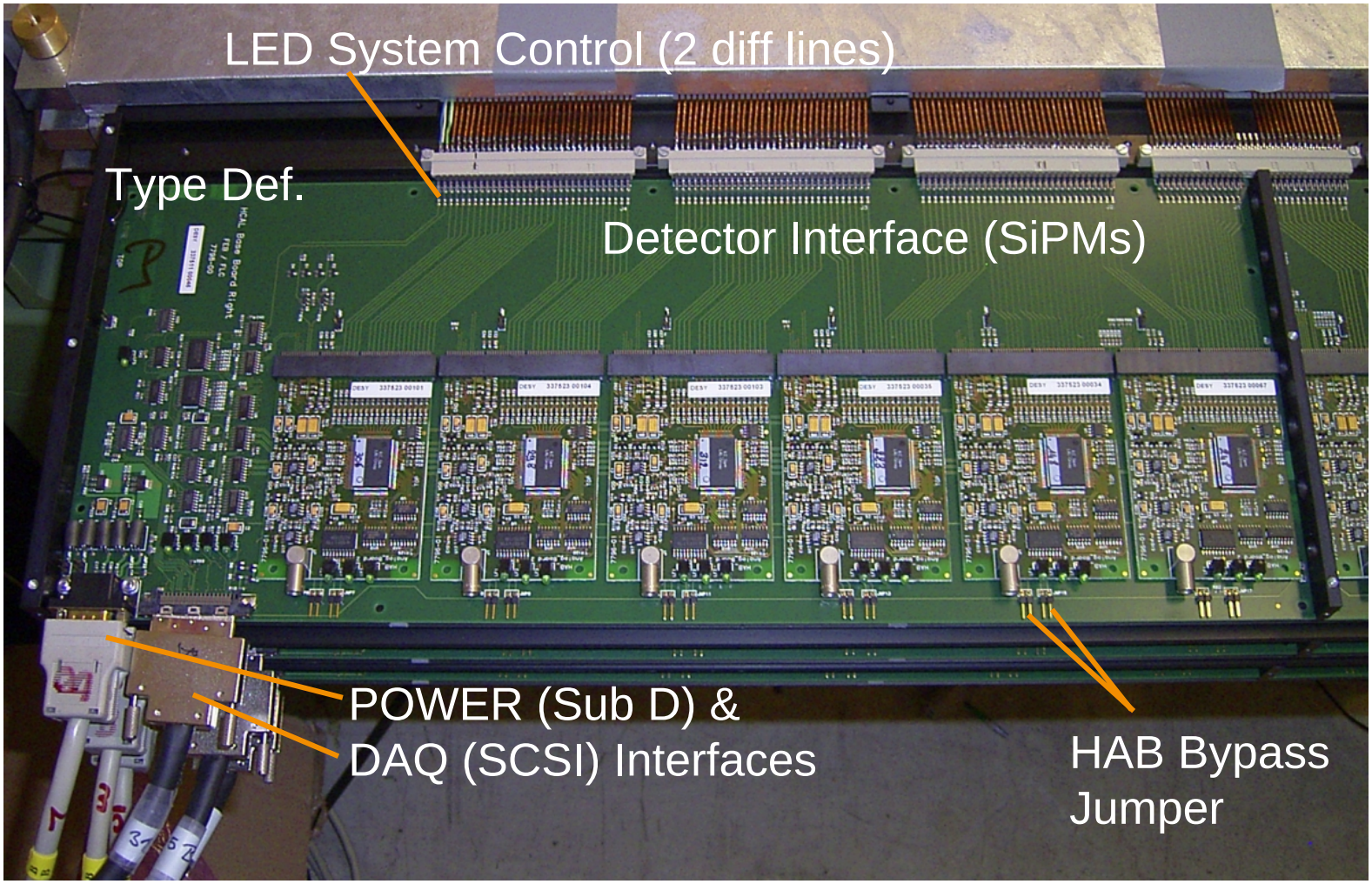
- Two types of HBABs realized: ‘Left’ and ‘Right’.
- One HBAB reads out up to 108 detector channels (SiPMs).

HCAL Analogue Board (HAB)



576 Boards produced.

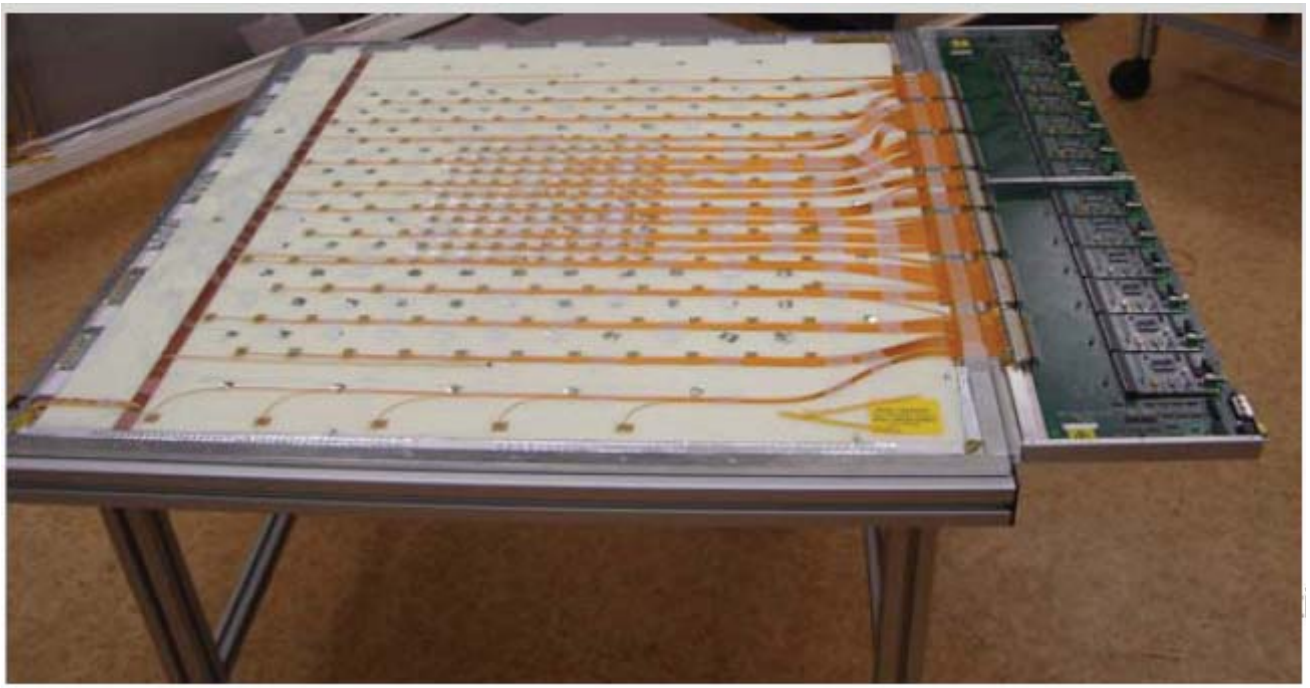
HCAL Base Board (HBAB)



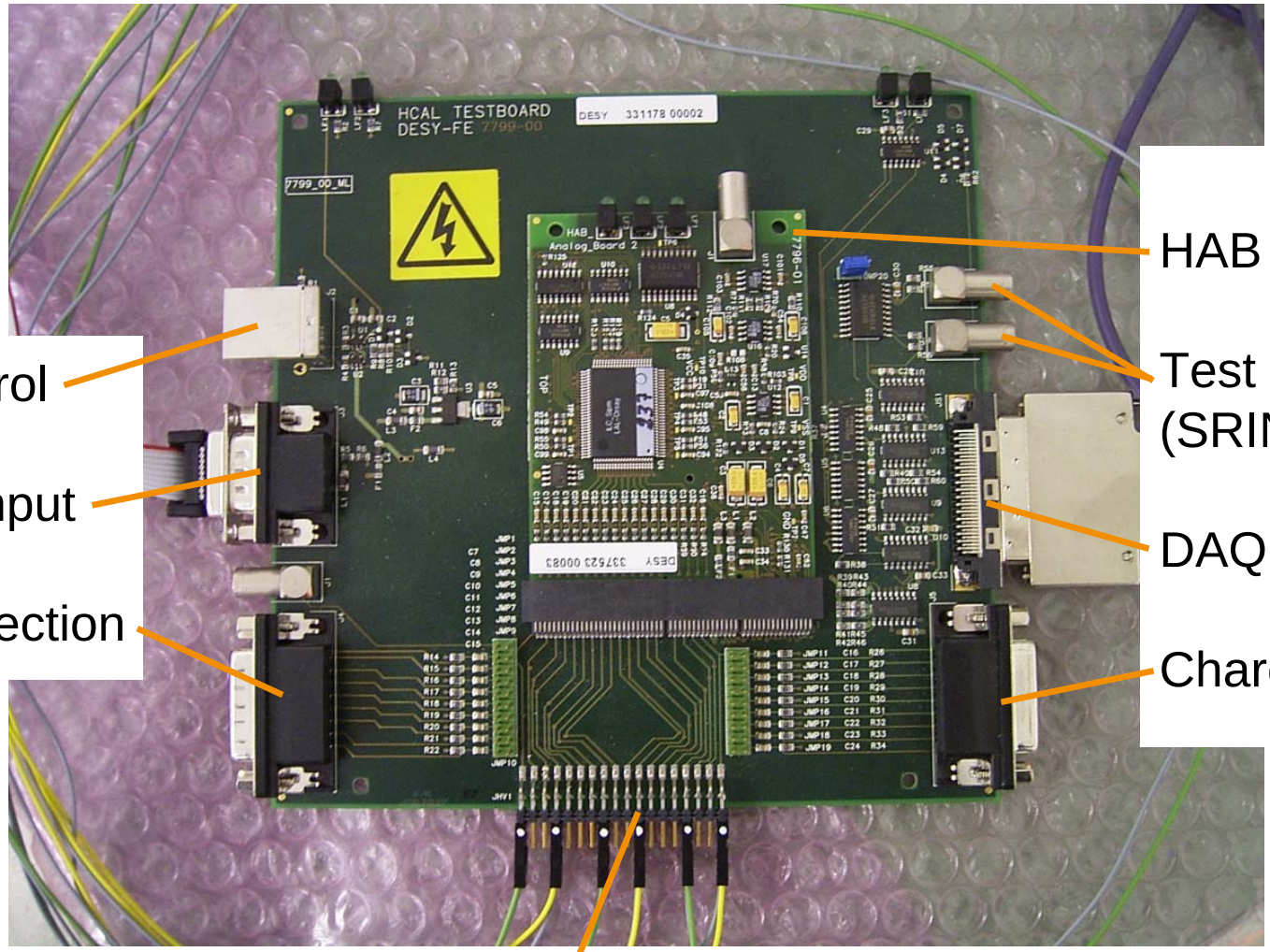
100 boards produced
(50 of each type)

SiPM to HBAB interconnection

Coaxial cable interconnection (Bias-V on cable shield)



HCAL Testboard



2 Boards available

Cabling and Safety

HBAB SCSI Connector			Signal Description
Pin No	left populated	right populated	(only differences to ECAL setup)
35, 1	Analog Out 1 (+, -)		
36, 2		Analog Out 7 (+, -)	
37, 3			
38, 4	Analog Out 2 (+, -)		
39, 5		Analog Out 8 (+, -)	
40, 6	HOLD_IN (+,-)	HOLD_IN (+,-)	
41, 7	VCALIB (+, -)	VCALIB (+, -)	
42, 8	SRIN_IN (+, -)	SRIN_IN (+, -)	
43, 9	RESET_IN (+, -)	RESET_IN (+, -)	
44, 10	SR_RES_IN (+, -)	SR_RES_IN (+, -)	'1' = Reset of Parameter Shift Register
45, 11	SR_D_IN (+, -)	SR_D_IN (+, -)	Data Input of Parameter Shift Reg.
46, 12	SEL_OUT (+, -)	SEL_OUT (+, -)	To DAQ : '0' = SROUT, '1' = SR_Q/SR_DAC
47, 13	CLOCK_IN (+, -)	CLOCK_IN (+, -)	
48, 14	Analog Out 3 (+, -)		
49, 15		Analog Out 9 (+, -)	
50, 16	SR_CLK_IN (+, -)	SR_CLK_IN (+, -)	Load Clock of Parameter Shift Reg.
51, 17	SW_HOLD_IN (+, -)	SW_HOLD_IN (+, -)	'0' = Send HOLD, '1' = Send logical '1' to HAB
52, 18	SW_DAC_IN (+, -)	SW_DAC_IN (+, -)	'1' : Connect ASIC DAC after Programming
53, 19			
54, 20	Analog Out 4 (+, -)		
55, 21		Analog Out 10 (+, -)	
56, 22	SROUT_OUT (+, -)	SROUT_OUT (+, -)	Output to DAQ : SROUT or SR_Q
57, 23	ADDRESS (+, -)	ADDRESS (+, -)	Drives an LED, only for test. **NOT on testboard**
58, 24	LED_SEL (+, -)	LED_SEL (+, -)	'0' = Drive LEDs, '1' = Calibrate ASICs (TCALIB)
59, 25	TCALIB_IN (+, -)		
60, 26		TCALIB2_IN (+, -)	
61, 27	TYPE0 (+, -)	TYPE0 (+, -)	
62, 28	TYPE1 (+, -)	TYPE1 (+, -)	
63, 29	TYPE2 (+, -)	TYPE2 (+, -)	
64, 30	Analog Out 5 (+, -)		
65, 31		Analog Out 11 (+, -)	
66, 32	TYPE3 (+, -)	TYPE3 (+, -)	
67, 33	Analog Out 6 (+, -)		
68, 34		Analog Out 12 (+, -)	

68-pin SCSI DAQ connector

Power Connector : 9pin Sub D male plug	
Pin No	Signal / Power
1	HV (+100V DC max)
2	GND
3	VM6 (-6V)
4	GND
5	VP6 (+6V)
6	Temperature 1, Current Out
7	Temperature 2, Current Out
8	GND
9	VP6 (+6V)

9-pin Sub D Power connector

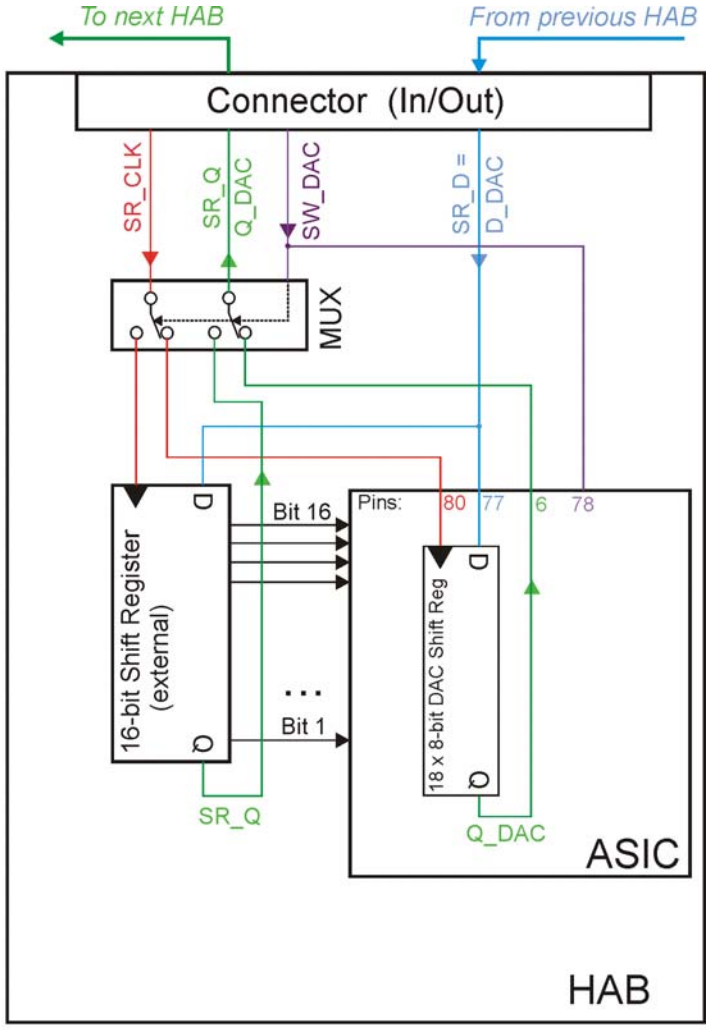
Up to +100V (DC)
SiPM Bias voltage
on all HCAL boards
on open traces

HAB Parameter Configuration (Slow-Control)

External Shift Register

1. sw_cr0 (Pin 35)
2. sw_cr1 (Pin 36)
3. sw_cr2 (Pin 37)
4. sw_cr3 (Pin 38)
5. sw_g (Pin 41)
6. sw_buf (Pin 48)
7. sw_cf0 (Pin 57)
8. sw_cf1 (Pin 58)
9. sw_cf2 (Pin 59)
10. sw_cf3 (Pin 60)
11. sw_cp0 (Pin 64)
12. sw_RC6_spe2 (Pin 65)
13. sw2_RC6 (Pin 66)
14. sw_RC6_spe1 (Pin 67)
15. sw_Rc6_spe0 (Pin 71)
16. sw_RC6 (Pin 75)

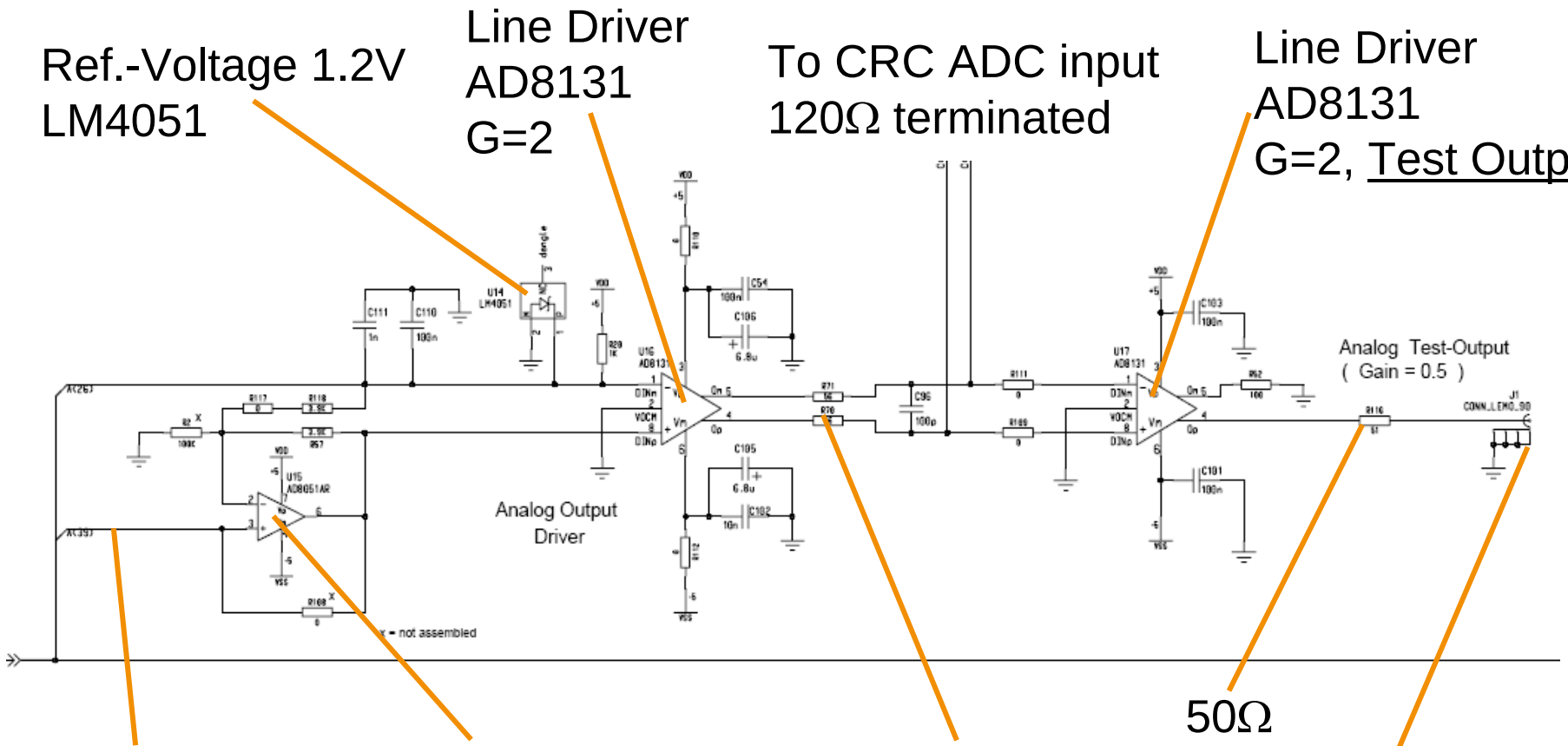
Bit 1 enters the HAB first !!
Numbers in brackets are ASIC pin numbers.



Step 1 : SW_DAC=1 :
Load ASIC DAC SR,
18 x 8 bits per HAB,
864 bits per HBAB for
6 HABs

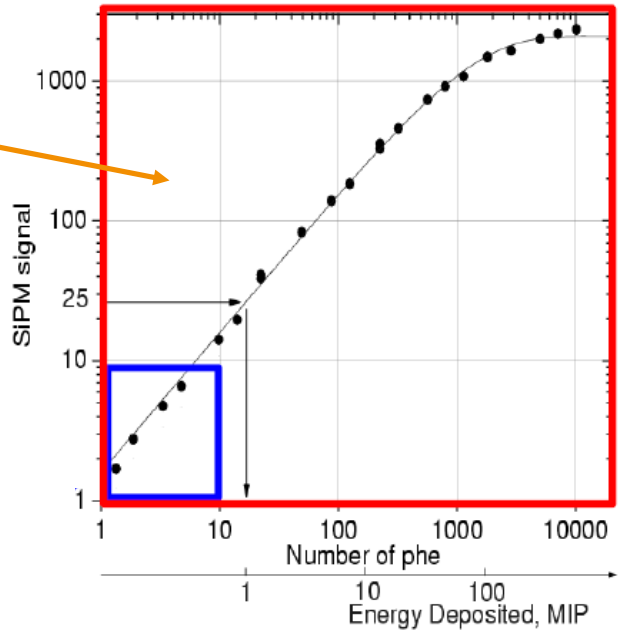
Step 2 : SW_DAC=0 :
Load external SR,
16 bits per HAB,
96 bits per HBAB for
6 HABs

HAB Analogue Output Stage



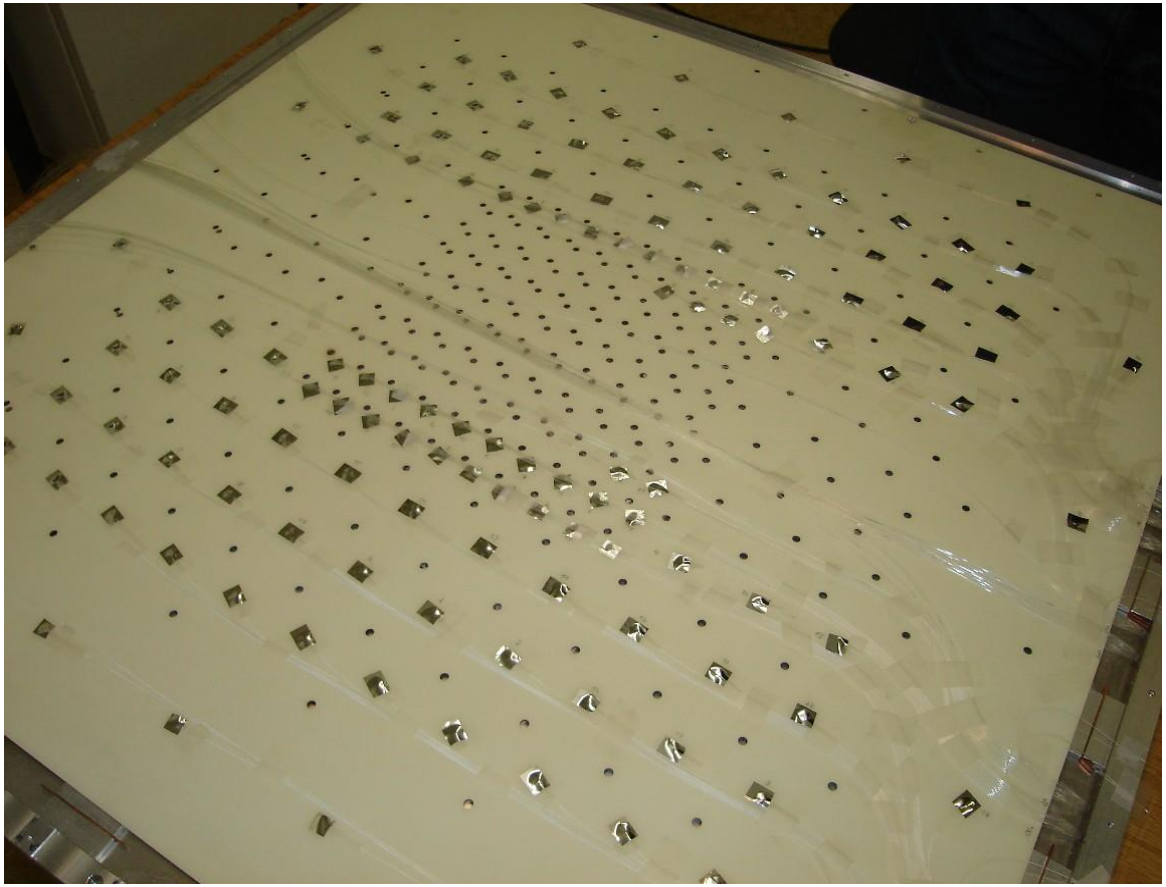
Light Calibration System

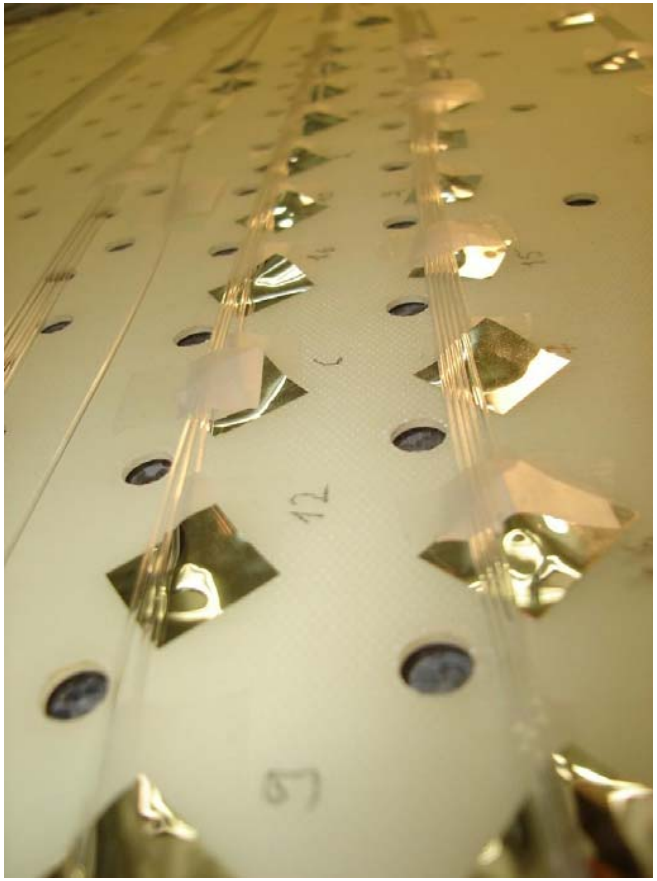
- Calibration and Monitoring of the non-linear detector response
- Based on UV LEDs and light distribution by fibers (one fibre per channel).
- CAN bus controlled by an extra PC.
- Light output monitoring by PIN-diode readout (with HBABs and HABs)
- Module Name: “Calibration and Monitoring Board” (CMB)

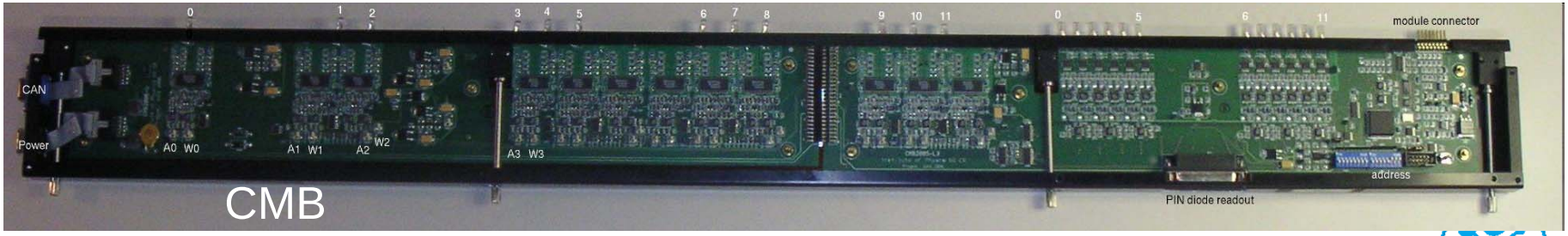


Developed by our Prague colleagues (ASCR Prague)

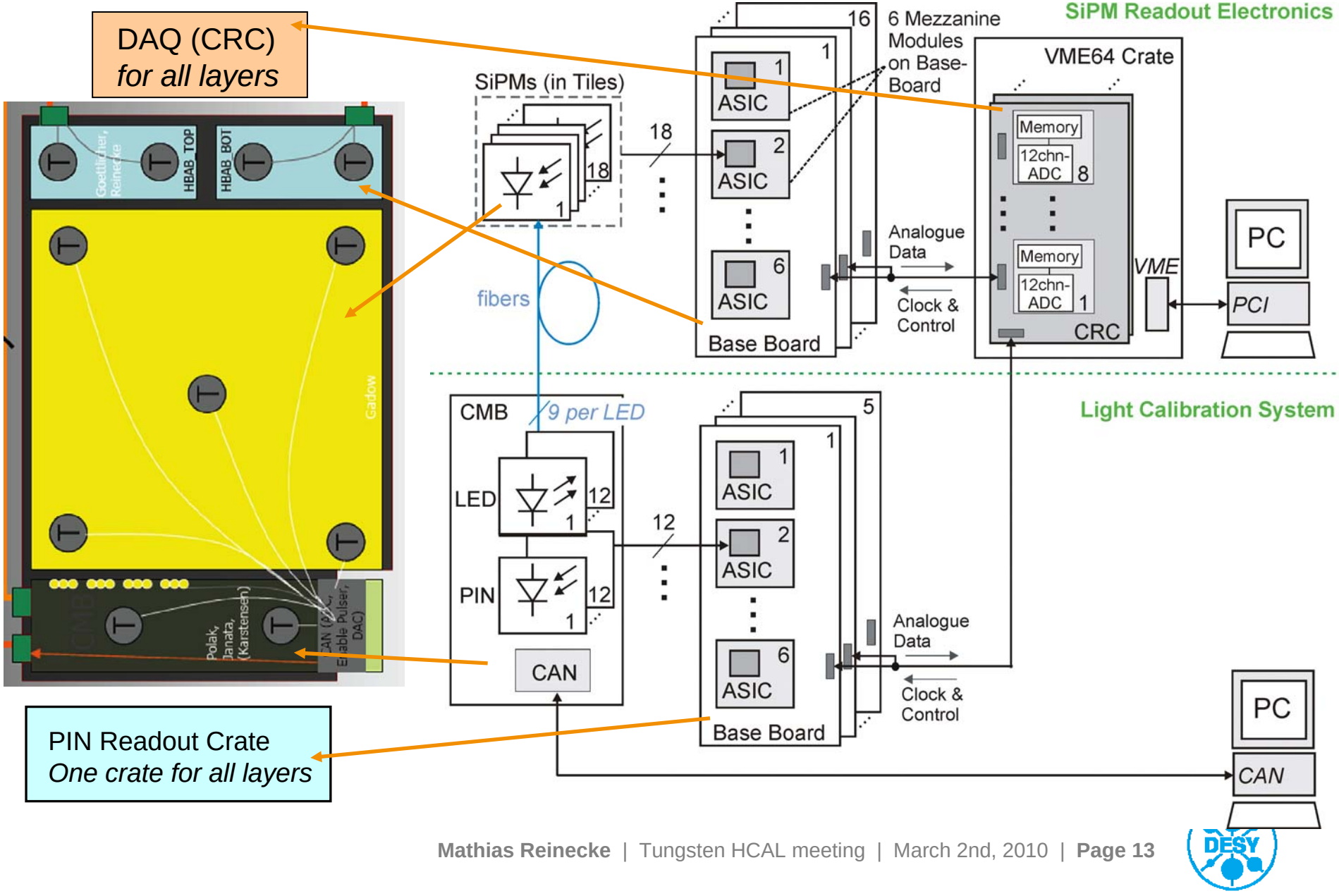
Light Calibration System



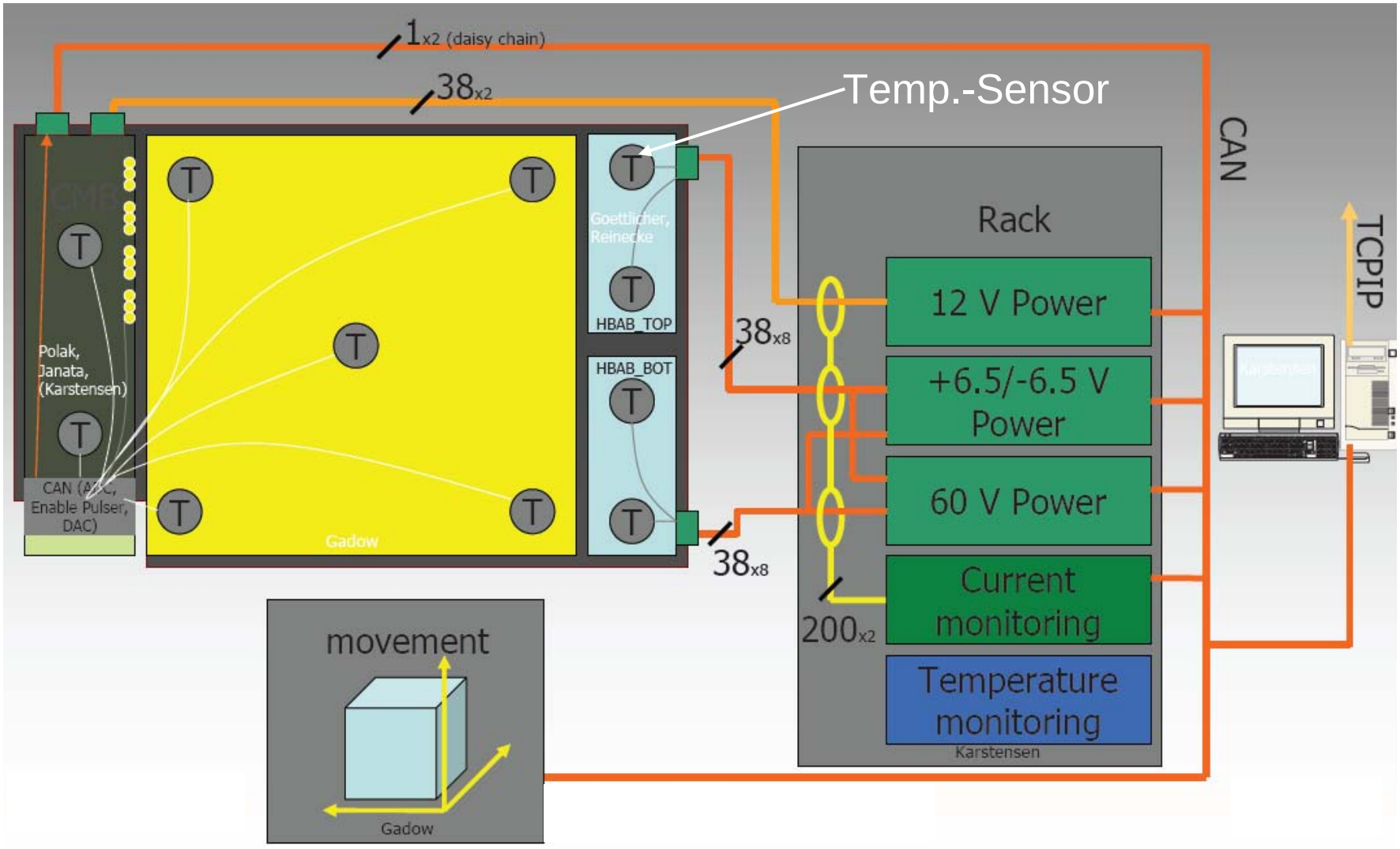




System Setup – Signal Chain



System Setup – Slow Control / Power



picture by Erika Garutti

Conclusions

- Schematics of all boards can be provided (email address?)!
- Simply contact us whenever support is needed!

Link to Manual (HCAL electronics):
http://adweb.desy.de/~reinecke/HCAL_Manual5.pdf