AHCAL Series Production.

Status and Outlook

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CALICE main meeting

Palaiseau, March 22nd, 2017

HELMHOLTZ GEMEINSCHAFT

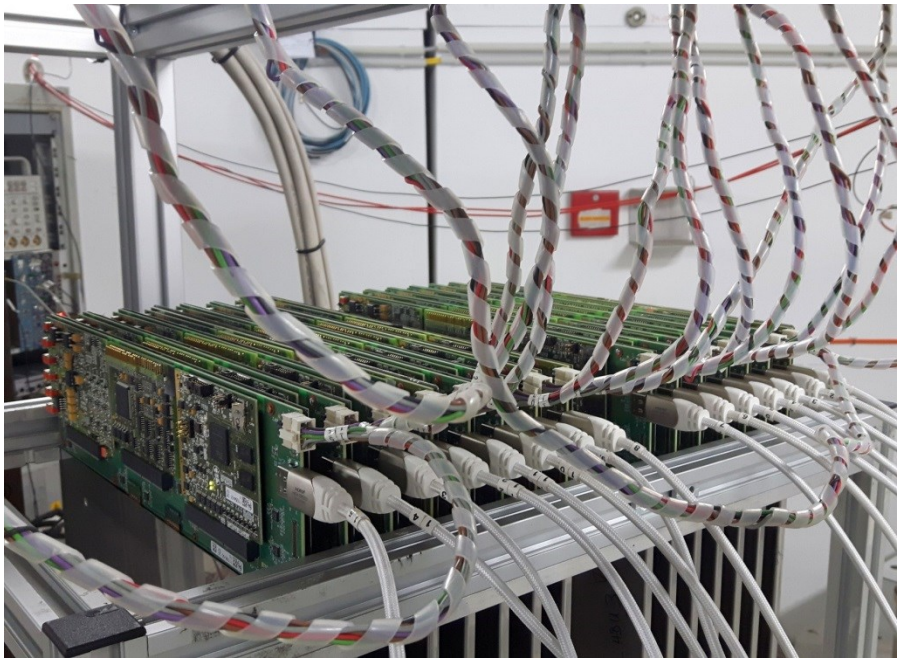
CALICE Calorimeter for ILC

AIDA 2020

DESY

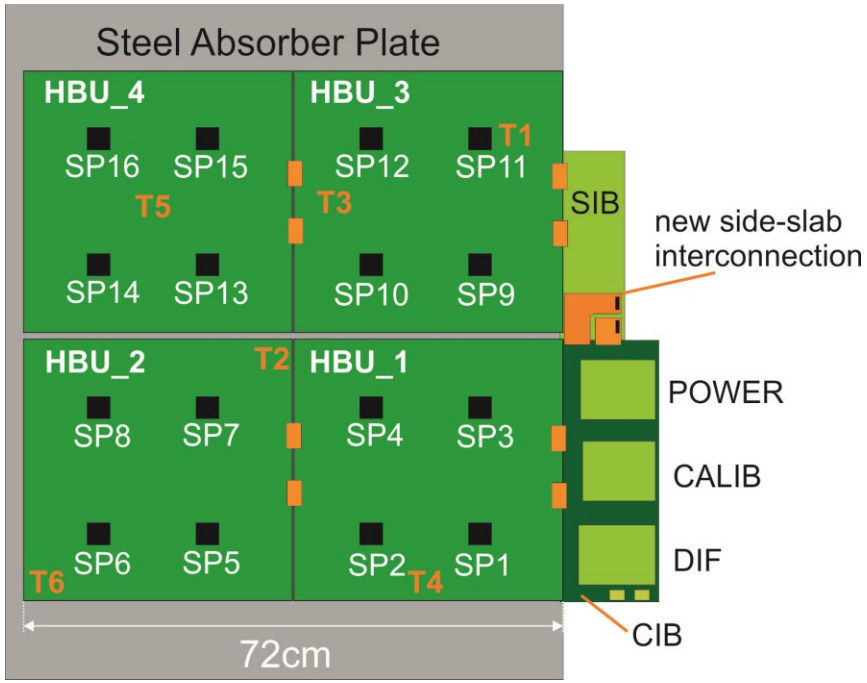
Outline

- AHCAL Series Production
- Test in magnetic field



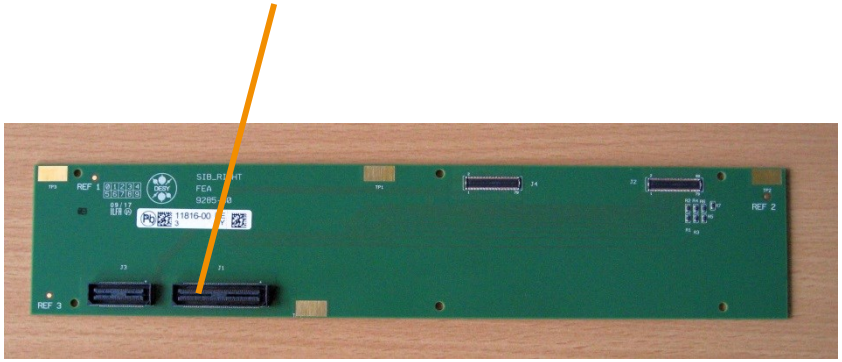
15 detector layers in DESY testbeam July 2016

Testbeam setup CERN 2018



CERN 2018 testbeam setup

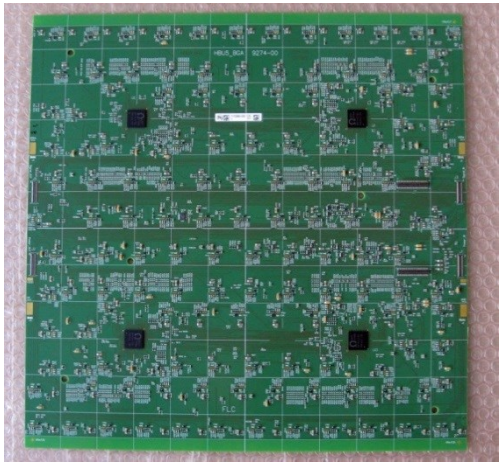
- Large scale testbeam planned for 2018: 40 detector layers in 2x2 HBU configuration.
- Setup as in previous testbeams – but with new HBUs and DAQ Interface modules.
- Improved side-slab interconnection for higher alignment tolerance.



New Side-Interface Board

Large Scale Hardware Production

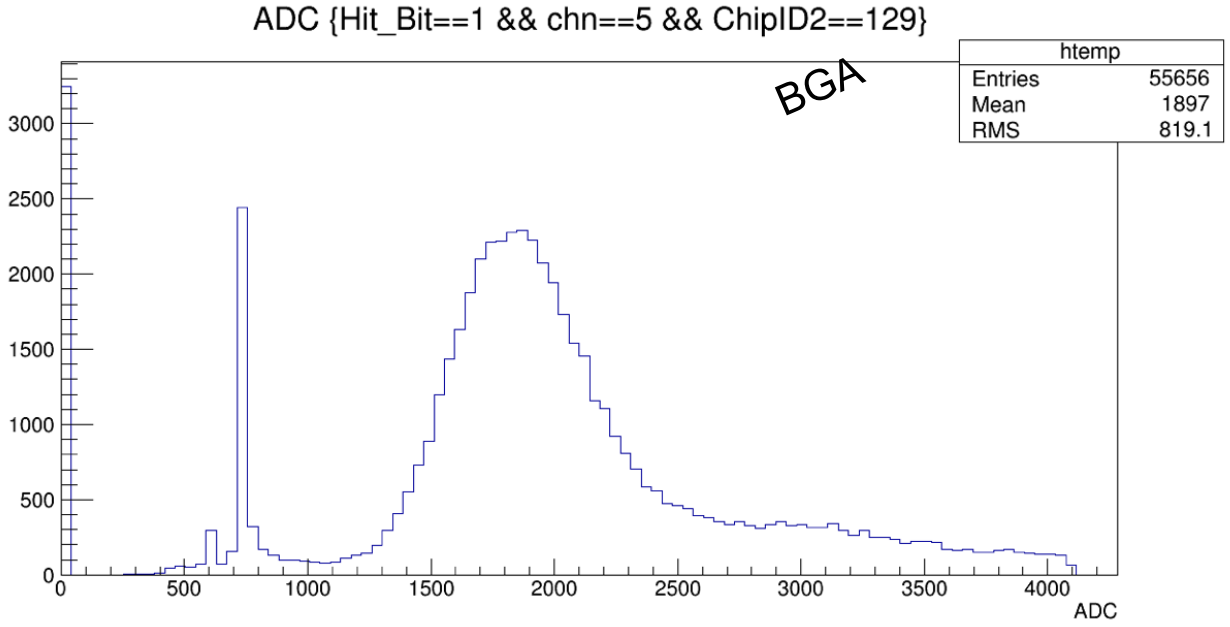
- Large scale production:
  - 160 HBUs with SP2E in BGA and 23k Hamamatsu S13360-1325PE – in two steps of 80 HBUs
  - 50 DAQ interface modules (DIF, CALIB, POWER, CIB).
- Widely shared electronics production:
  - SP2E ASICS: Omega; Chip-test: Uni Wuppertal
  - Tiles: Uniplast (Russia); Tile-check, wrapping: Uni Hamburg; Tile Assembly, cosmics tests: Uni Mainz.
  - MPPC sample test: Uni Heidelberg.
  - Tile checks, cassettes, small stack power supply: MPI München
  - PCBs, initial test, cassettes, module assembly, commissioning/calibration: DESY
- Assembly steps for series production required!
- Modules expected Aug./Sep. 2017



HBU5_BGA

Tests before big production

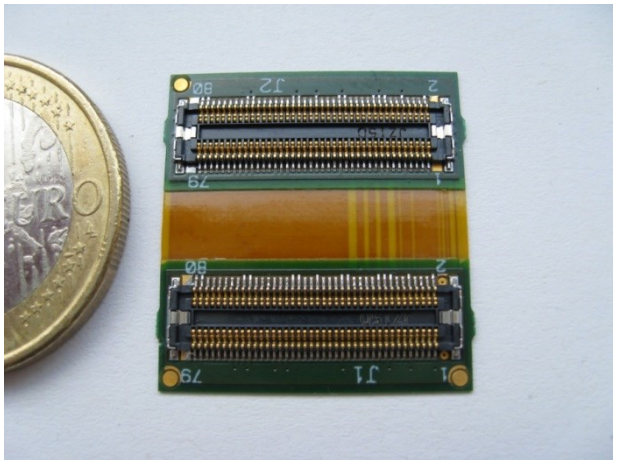
- HBU5_BGA and SP2E have been tested extensively before series production, see results presented on CALICE meeting 2016 in Arlington.
- One additional result: HBU5_BGA1 in DESY electron testbeam

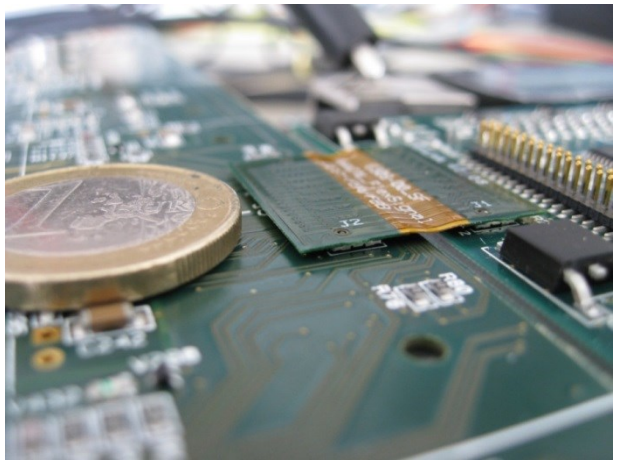


- Clear MIP response visible with very low threshold, without validation, high gain: PA=200fF.

Connector Obsolete!!

- HBU interconnect with Kyocera 5801 connectors: stacking height 0.8mm (1.2mm including flexlead).
- Kyocera connectors obsolete.
- New connectors as replacement: Panasonic F4S series (1.0mm stacking height): AXT5.., AXT6 (80 pins). 3000 MOQ.
- New connectors require redesigns of HBU5, flexleads and Central-Interface-Board (CIB)



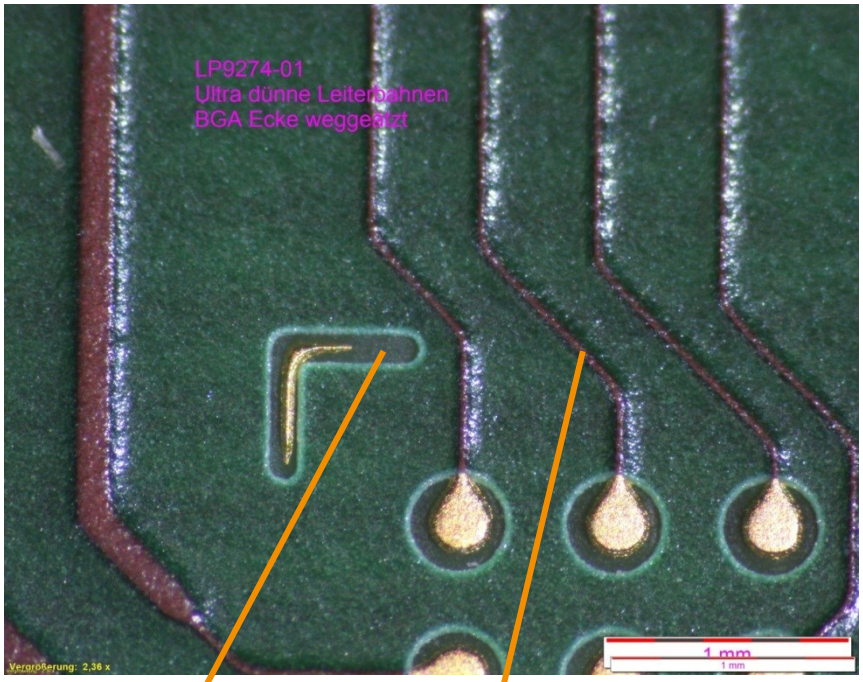


Old flexlead setup

HBU5_BGA: Problems with new PCB vendor

- First 4 prototypes produced with a new PCB vendor.
- Excellent PCB flatness and compliance with dimension tolerances.
- Silk screen missing on both sides.
- Traces show severe over-etching.

- First 80 HBU5_BGAs: Known-good vendor (slightly more expensive).
- Try prototypes with new connector with new vendor again.

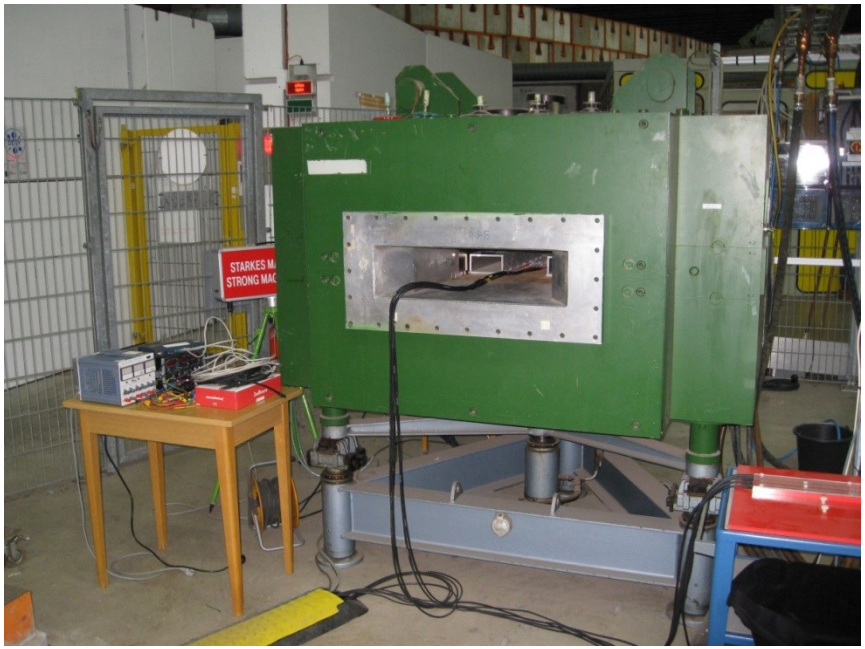


BGA alignment edge partly etched away

Thin traces: Down to 28µm (100µm nom.)

Magnet Test - Setup

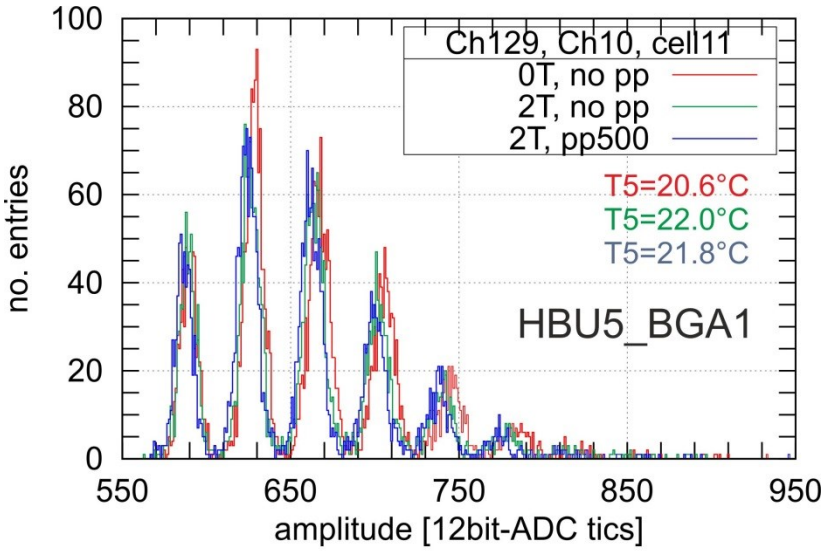
- For CERN testbeam in May 2017, Detektor- and DAQ modules must be suitable for operation in high magnetic field.
- AHCAL single-HBU modules (HBU + DAQ Interface modules) and DAQ module (mini-LDA) tested.
- Testmagnet at DESY: magnet field adjustable 0..2T, Hall probe readout.

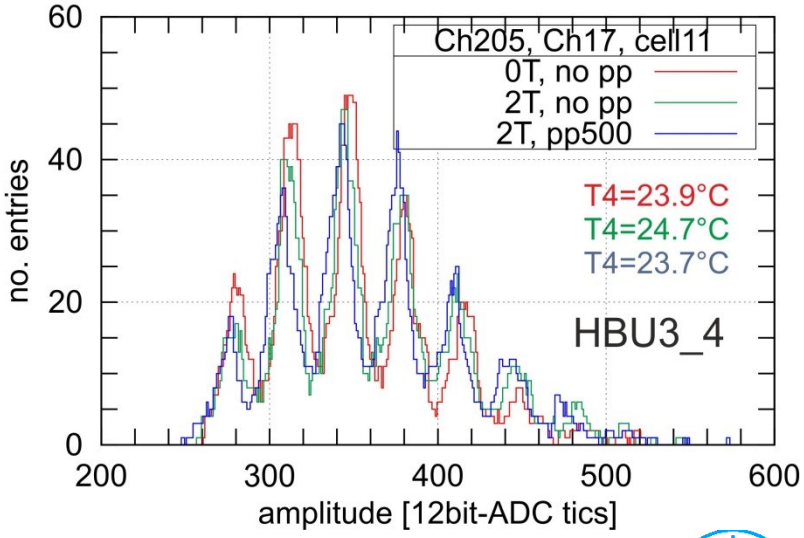


Test Magnet @ DESY

Magnet Test – Result HBU3 and HBU5

- Three test runs with LED system:
  - SPS with magnet off
  - SPS with 2T magnetic field
  - SPS with 2T field and power-pulsing (100µs switch-on time)
- HBU5 with SMD MPPCs and HBU3 with THT MPPCs show no influence by magnetic field.





Magnet tests by Jiri and Mathias

Magnet Test mini-LDA (Zedboard)

- Mini-LDA, CCC and Wing-LDA (e.g. MARS module) and Zedboard-mezzanines contain magnetic components (coils, connectors).
- They cannot be operated in high magnetic field!
- Mini-LDA tested: It works up to 40mT.
- Modules can be used at CERN testbeam in distance of several meters.
- Redesign required for later!

Hall-probe readout

Status and Outlook

- Large scale production for CERN 2018 ongoing.
- Tests in 2T magnetic field did not show problems for front-end modules, but the DAQ modules require redesigns.