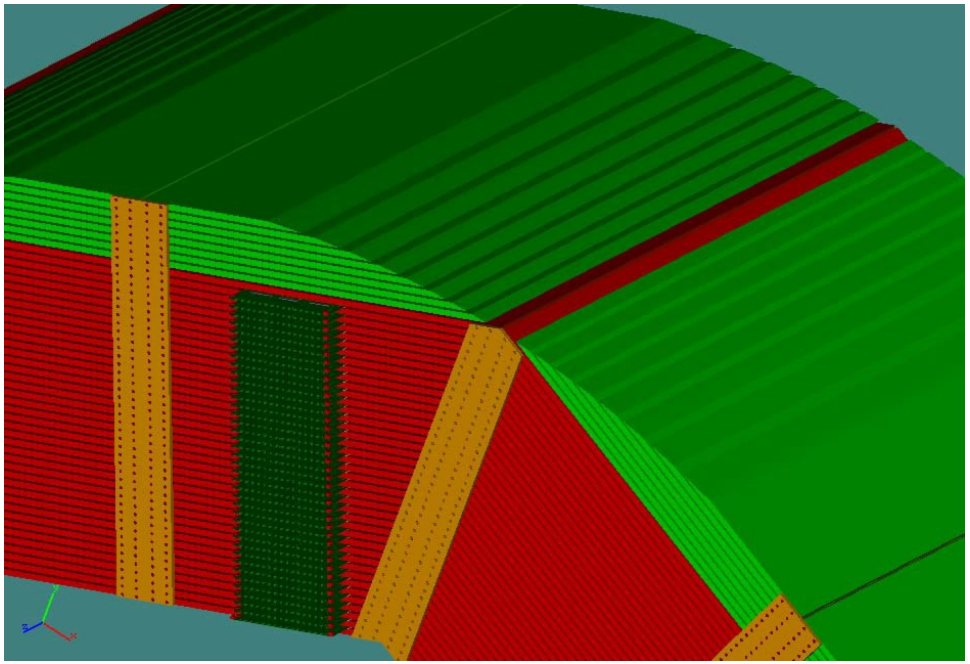
TESLA-Structure: Signal Paths and Electronics Accessibility/Reliability



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ILD Technical Task Forces Meeting
Orsay
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HELMHOLTZ ASSOCIATION

AIDA 2020

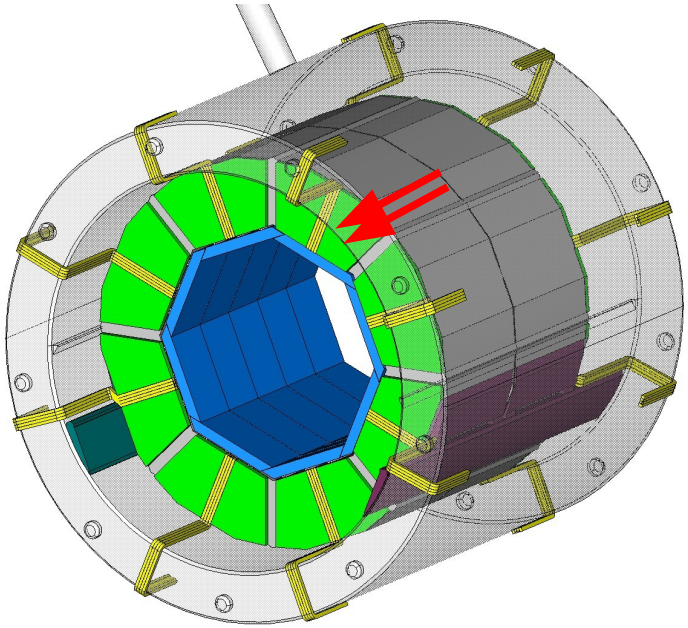
DESY

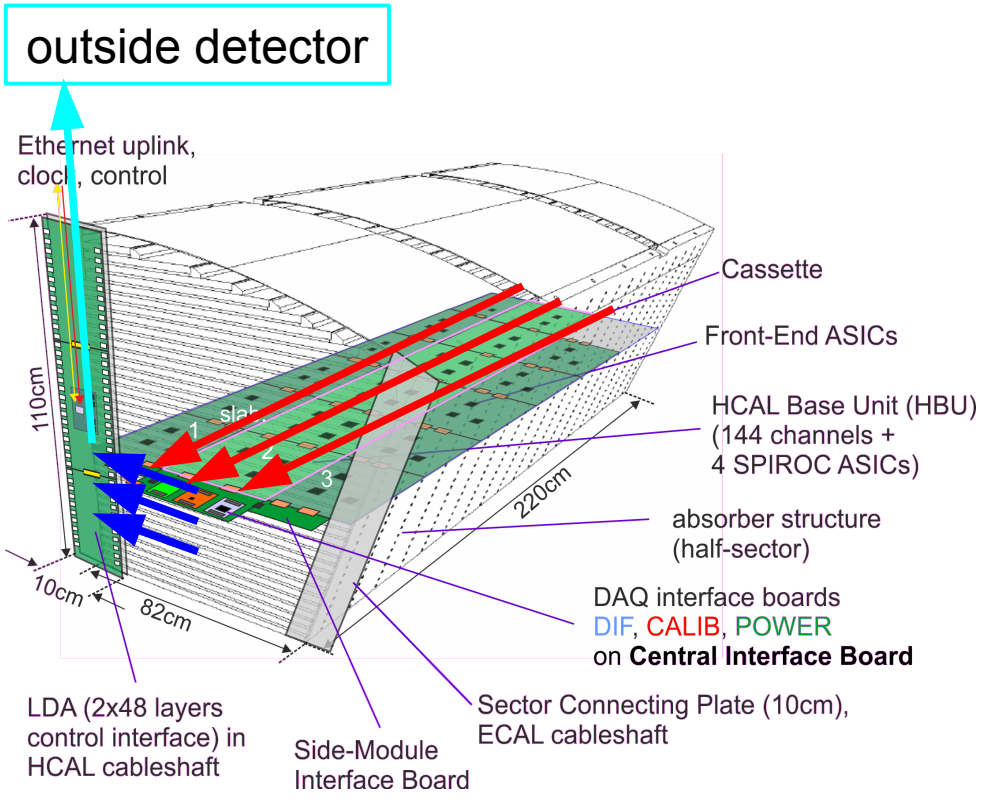
AHCAL design

- reliability of components studied in testbeams
  - principle of scintillator read out by SiPM demonstrated with physics prototype
  - operated successfully 2006-2011, several transports to testbeams at CERN, FNAL
- high-granularity HCAL is not sensitive to a few dead channels
  - resolution observed in beam tests (~5 % dead channels in physics prototype) compatible with ILD simulation (no dead channels)
- all components that could affect a large fraction of the detector are easily reachable and replaceable

Signal Paths in TESLA geometry

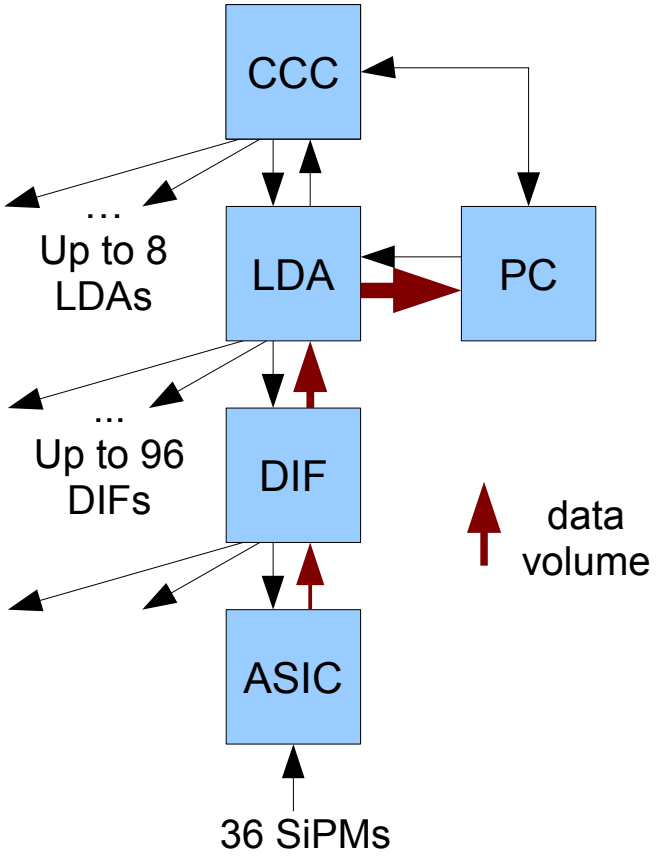
- signals are aggregated in stages
- central electronics components at the end face of the barrel, easily reachable





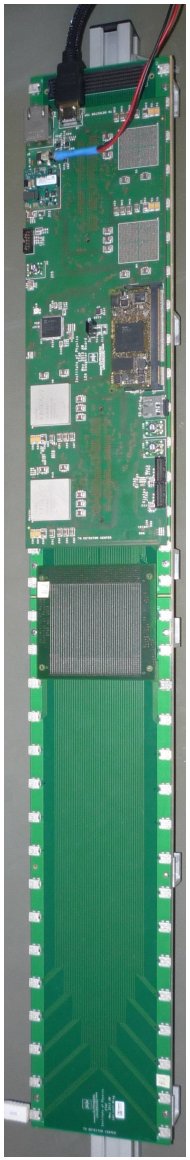
Components & Effects

- LDA
  - two barrel sectors (~250000 channels) missing
- interface boards (DIF, POWER, CALIB)
  - all channels in the layer (~2500 channels) missing
- flexlead connector HBU ↔ HBU
  - all further HBUs in the slab missing
- SPIROC ASIC
  - 36 channels missing
- SiPM
  - single channel missing



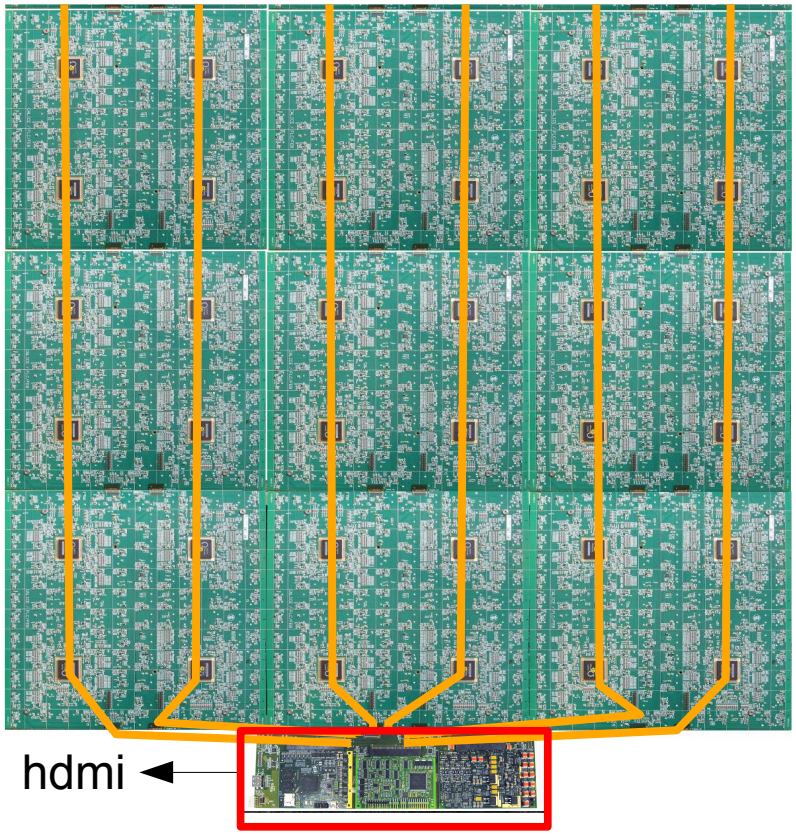
Components & Effects & Repairs

- LDA
  - two barrel sectors (~250000 channels) missing
  - repair very urgent
  - procedure to repair:
    - open detector ~1m
    - un-cable sector
    - replace LDA
    - re-cable & close
    - takes probably ~1-2 days



Components & Effects & Repairs

- interface board
  - all channels in the layer (~2500 channels) missing
  - repair urgent
  - boards connected to layer purely passive, so failure improbable
  - active boards easily replaceable:
    - open detector ~1m
    - replace board
    - close
    - takes probably ~1 day (opening of the detector)



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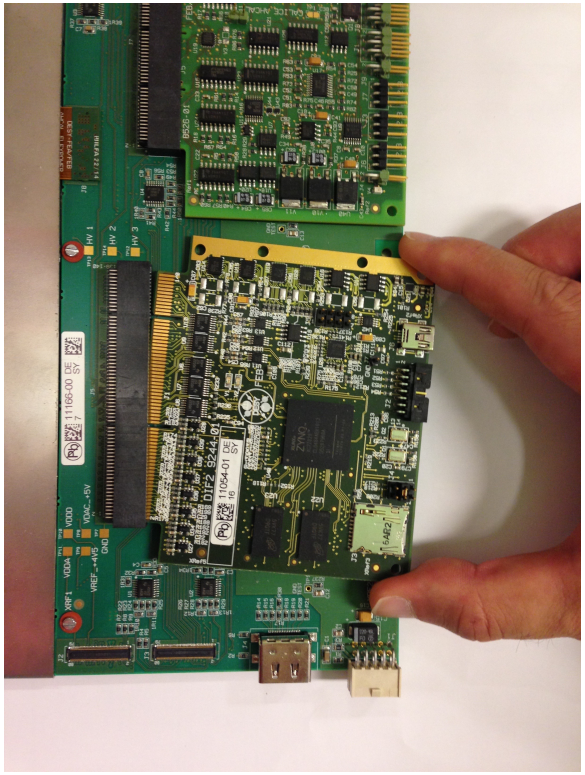
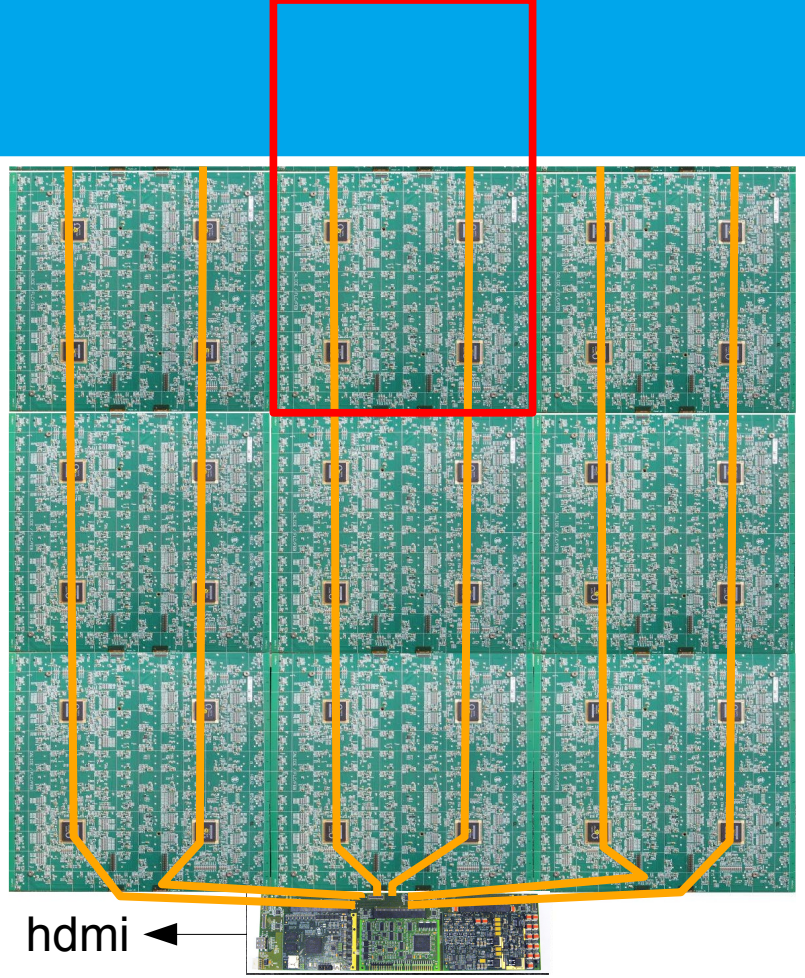


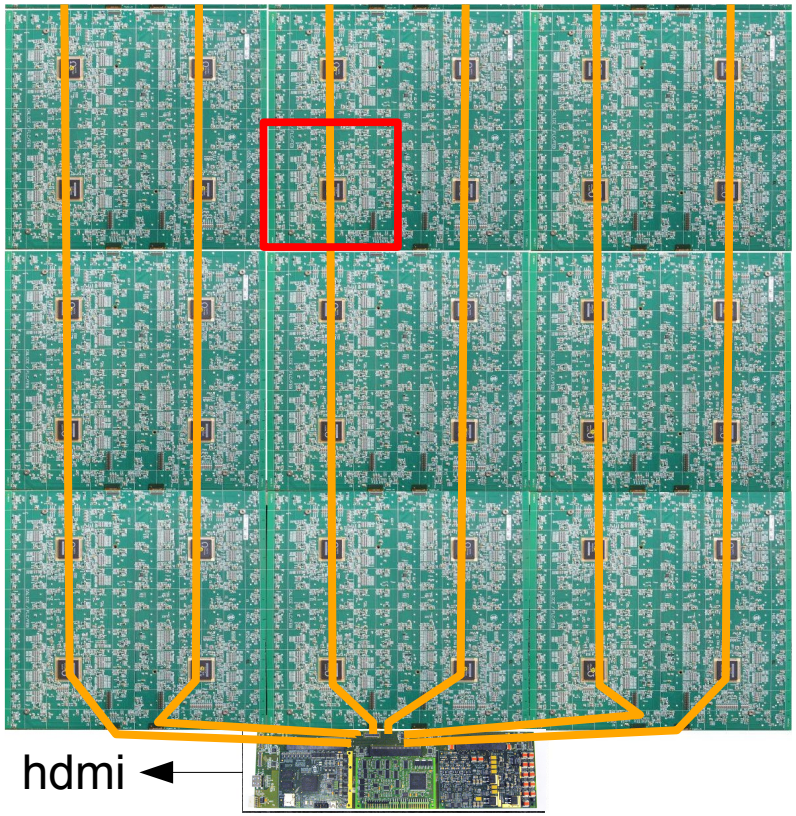
Components & Effects & Repairs

- flexlead connector HBU ↔ HBU
  - all further HBUs in the slab missing
  - experience from testbeam: flexleads sometimes difficult to connect, but once connected connection stays fixed
  - in final detector: add glue or similar
  - procedure to repair:
    - open detector wide
    - un-cable sector
    - pull out layer
    - replace connector
    - re-cable & close
    - takes probably a few days



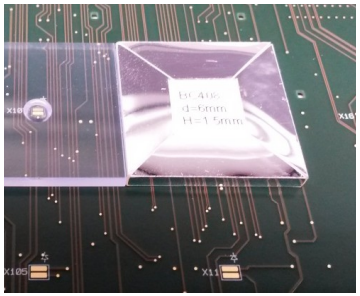
Components & Effects & Repairs

- SPIROC ASIC
  - 36 channels missing
  - not urgent to repair
  - procedure to repair:
    - open detector wide
    - un-cable sector
    - pull out layer
    - replace HBU
    - re-cable & close
    - takes probably a few days



Components & Effects & Repairs

- SiPM
  - single channel missing
  - not necessary to repair



Summary

- no reliability problems observed in testbeams
- TESLA structure allows easy access to all components that might affect a significant fraction of the detector
  - affecting a full layer or more: LDA and interface boards replaceable within 1-2 days
  - affecting a fraction of a layer: replacement possible during a (few days long) shutdown