

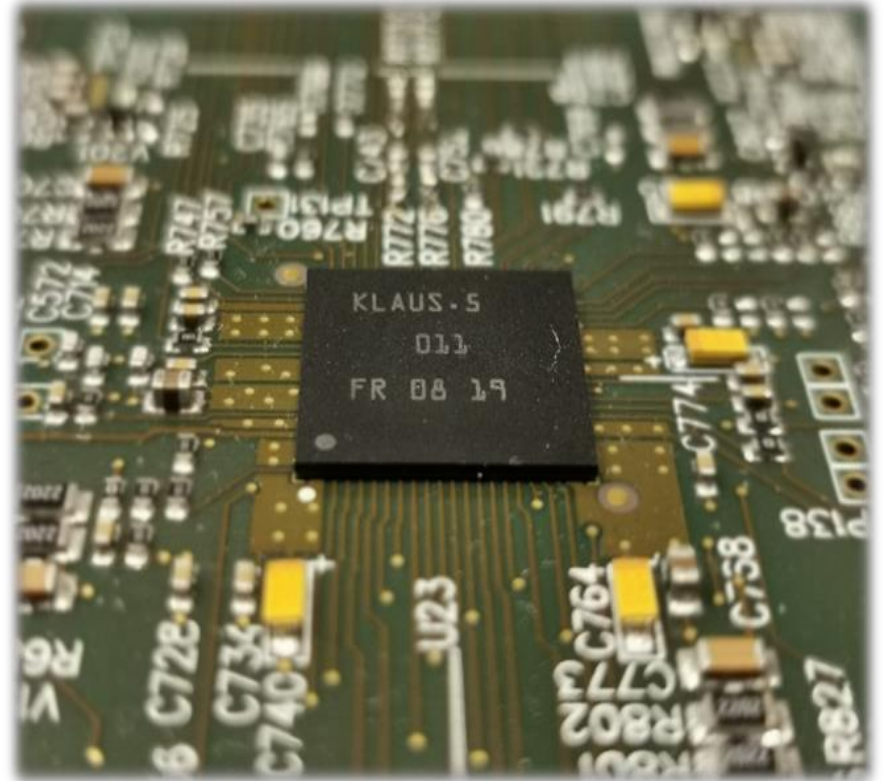
KLauS HBU in AHCAL

ASIC & BGA status,
Lessons from DESY testbeam,
Thoughts on “full-size” layers



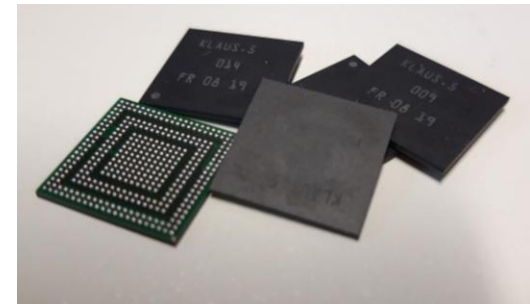
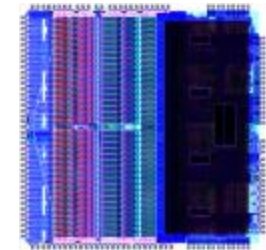
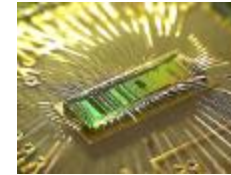
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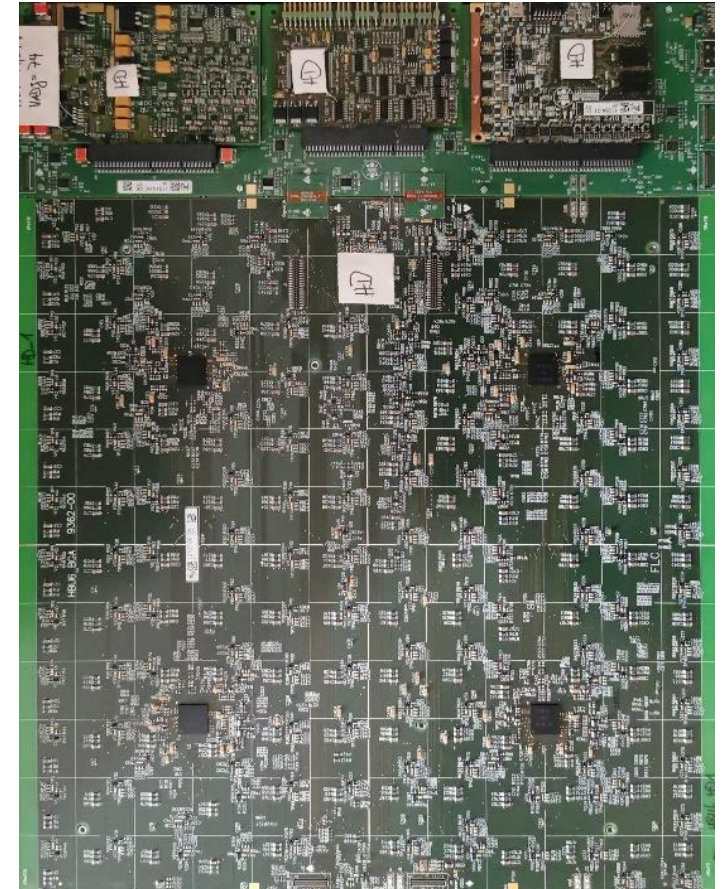
KLauS Versions & Availability

- KLauS5: First 36 channel version
 - Limited time measurement (100ns time bins on HBU)
 - 20 Packaged ASICs @ KIP left
- KLauS6b: Including TDC, digital bugs in TDC fixed, minor improvements
 - BGA was produced and tested for KLauS6"a" on a small batch of 50 BGAs
 - Awaiting delivery of more ASICs before packaging
 - Wafers delayed by several months due to ongoing semiconductor crisis
- HBU requires BGA-packaged chips
 - All 36-Channel versions of KLauS (5,6,6b) are pin compatible
 - Chips in BGA exist for KLauS5 (Novapack) and KLauS6 (APTasic)
 - Available bare KLauS6b ASICs (~40pcs) could be packaged on shorter time scale



HBU with KLauS (KBU?)

- One HBU with KLauS5 in operation
 - Design modification of HBU for KLauS by DESY
 - Minor adaptations on service cards (Power, DIF)
 - DIF firmware updated to work with KLauS5&6 ; LDA+CCC
- Various software tools to control and configure the HBU,
bypassing LabVIEW where needed
- Eudaq integration, can decode KLauS data packets to a SPIROC-Like structure
 - StdEvent converter for online monitoring and basic analysis
 - Tree and Histogram writers
- For multi layer/HBU synchronization:
 - ASiCs are configured in power pulsed mode
 - Working well during testbeam measurements (LEDs,Beam,Cosmics)



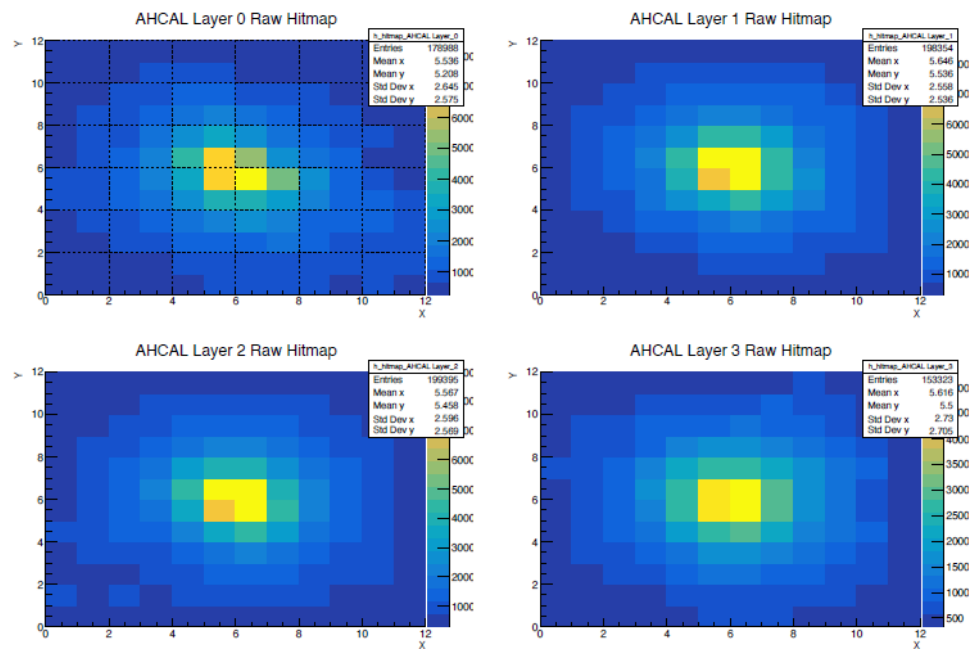
Testbeam at DESY / October 2021

Testbeam at DESY with in total 4 Layers end of October 2021

- Investigate common running & synchronization
- 1x KLauS5+Megatile ; 1x SP2E+Megatile ; 2x SP2E+StdTile
 - KLauS Layer is using 15um MPPCs with higher dynamic range
- DAQ with CCC & xLDA cards, BIF & Trigger scintillators

Measurement program

- Light yield scan (MIPs)
- Absorber runs with different geometry
- LED spectra
- Different KLauS autogain mode settings
- Data analysis pending

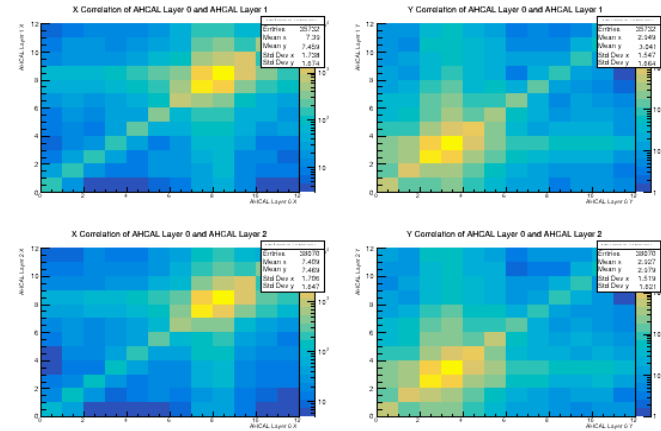


Testbeam at DESY / October 2021

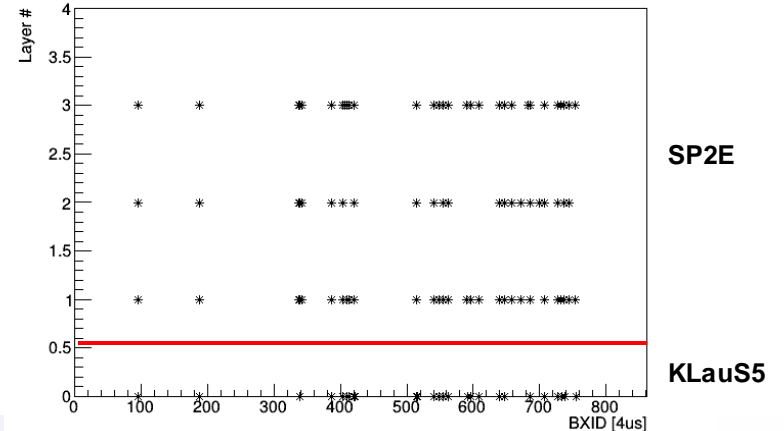
EuDAQ Event building

- ReadoutCycle based Events
 - Basic feature of the Readout mode with SPIROC
 - Long, varying event length in time
- BXID based Event building
 - Fixed 4us time slices
 - Use “software BXID” from TDC for KLauS data
 - Tools for time alignment have been developed
 - Time synchronization between layers
- Good spatial correlations with beam and also cosmics
 - Most pronounced with short BXID-based events

Spatial correlations



Time / BXID correlation



Lessons from DESY testbeam

Data taking with a common DAQ is working well & stable
Crash free continuous data taking over ~5 days

- System configuration transparent for the most part,
KLauS-HBU specific: command line tools.
-> Well established Labview setup flow + Additions
- Sometimes minor hickups after changing the configuration
Switch between AT/LED
Question of correct order of setting changes
- Temperature readout is not possible for KLauS layer
xLDA would change (all) ASIC data packets on the fly
Firmware or Labview modifications necessary
Also the case for WingLDA?
- LED readout is slow for KLauS HBUs, slowing down all layers
Limited by I2C readout speed
Small DIF and HBU changes might improve this
Parallel links can double the readout speed
Probably mandatory for a 2x2 HBU layer

No effect for Beam-Rates at DESY
Need for statistics in KLauS LED spectra is smaller
(No analog memory cells)
-> Can be overcome by setting a readout timeout



Menu for a 2x2-HBU Layer

Possible additional Layer using additional KLauS-HBUs in future Testbeams

- HBUs & Components
 - More boards produced but not assembled (?)
 - **SiPMs**: Delivery time around 6 Months if not in stock
 - Higher density 15um MPPCs on KLauS-HBU give good single pixel spectra
 - **ASICs**: Enough Klaus5-BGA and KLauS6a-BGA available
 - O(16) KLauS6b could be packaged on shorter time scales
 - K6b allows to study timing in greater detail
 - **Tile(s)** – Using Megatiles would be obvious candidates
- Readout & Control:
 - DIF Firmware prepared for all ASIC versions
 - Same chip on all HBUs simplifies the system greatly
 - Some changes with dual slab operation needed
 - Configuration needs to be tested, should work out of the box
 - Readout with multiple links
 - Software needs some modifications to map to/from side slab
- Software:
 - Basic tree & histogram writers from Eudaq Event data exist
 - LCIO integration does not include KLauS differences, to be checked

