

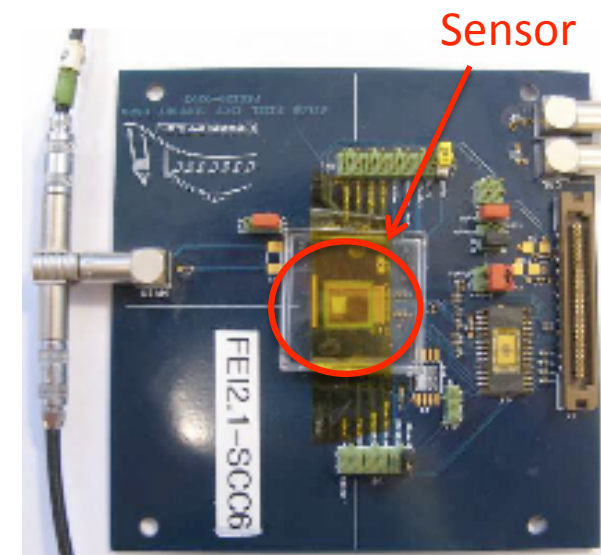
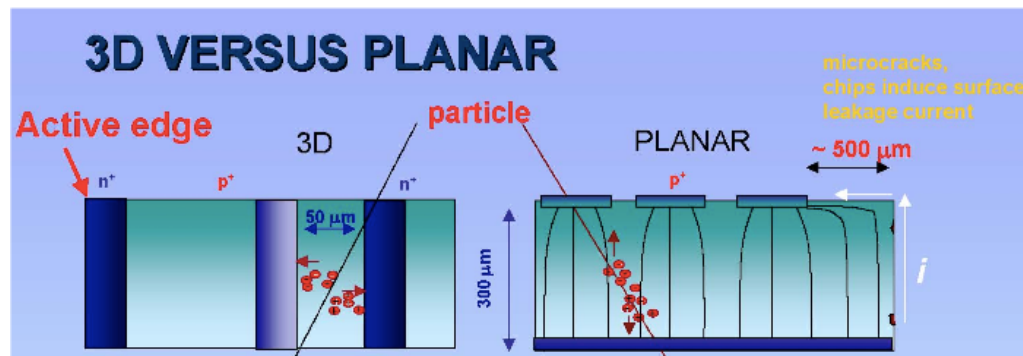
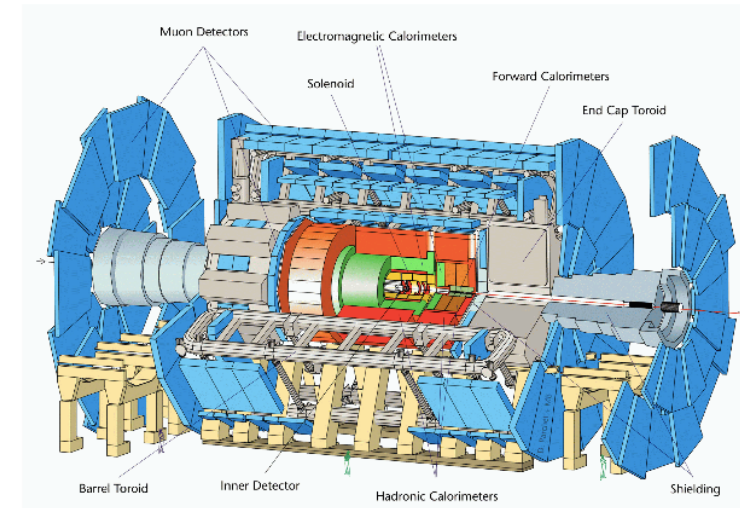
ATLAS Pixels with EUDET

Per Hansson (SLAC, Stanford University)

for the ATLAS pixel test beam users

ATLAS Pixel Sensors

- ATLAS pixels for Insertable B-Layer & SLHC
 - Innermost tracking: 3-4 cm from IP (IBL dose $\sim 200\text{MRad}$ during lifetime)
 - 40 MHz collision rate with $3.2\mu\text{s}$ “Lv1” latency to store all hits
 - 3 technologies: 3D, planar & diamond
- Test beam activity with EUDET in Oct/Nov
 - Silicon pixels $50\times 400\mu\text{m}$
 - Single chips: 160×18 pixels, bump-bonded to standard ATLAS front-end electronics
 - DAQ from pixel module production testing: “TurboDAQ”



Adaption for EUDET

TLU

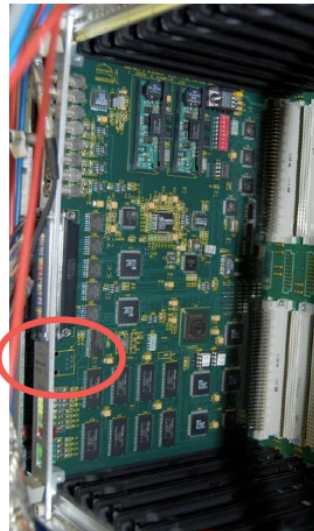
- Generates trigger from scintillator inputs to signal the read out for all connected devices
- Checks if devices are ready before sending trigger

ATLAS pixel-readout

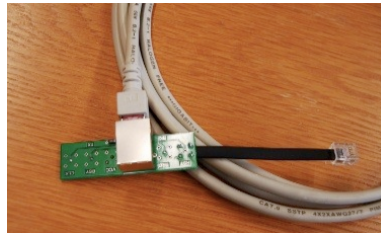
- ATLAS pixel readout (TPLL/TPCC) do not provide a trigger handshake
- No possibility to check for readiness and reply for each trigger
→ Loss of synchronization (“cured” by dead-time)

ATLAS modifications

ATLAS pixel readout TPLL



Level Adaptor Board



Hardware

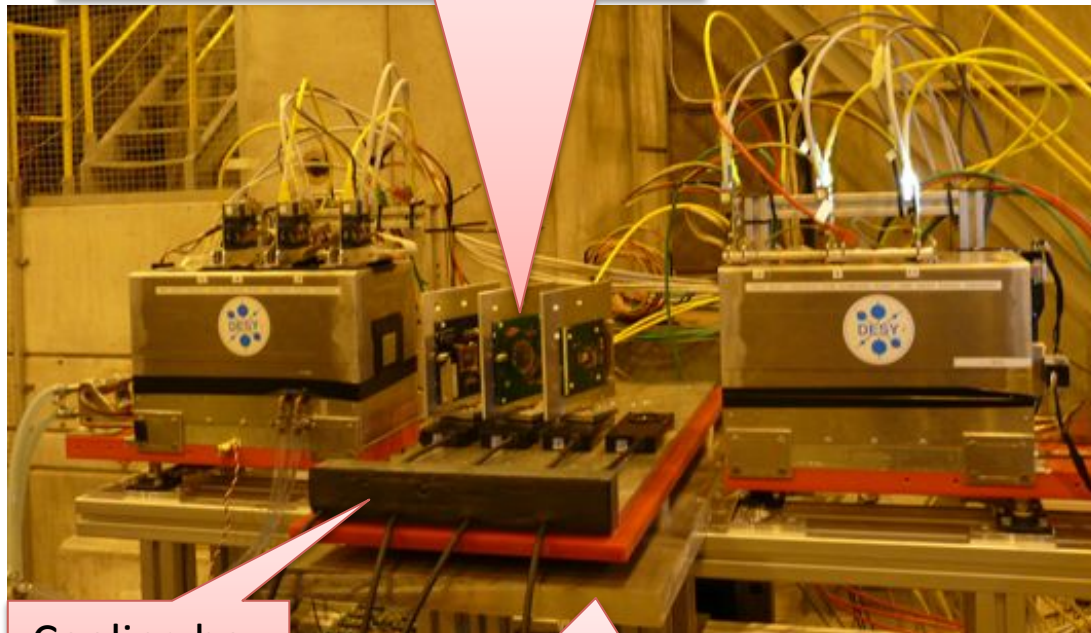
- Solder in connector for LVDS TLU signal
- Modify front panel for connector
- Change of PROMS

Software/FPGA Modifications (examples)

- Extension to TPLL VME interface for trigger
- Busy signal
- Added FIFO for storage of trigger info
- EUDET trigger ID
- Trigger ID (normal ATLAS pixel daq)
- Timestamps (UNIX time + 25ns)

Experimental Setup

DUT's (8x7.2mm² active area)



Cooling box
base plate

2cm aluminum support plate
on existing Bosch profiles

- Four single pixel chips boards on rotating stages
- Removed existing movable stage
- Placed in new cooling box (Peltier)
 - Sensor positions built-in (from EUDET drawings)
 - No cooling used yet
- Simple exercise to move EUDET planes to fit box
- Very quick setup
 - No NIM logic
 - Already aligned telescope

Very preliminary results

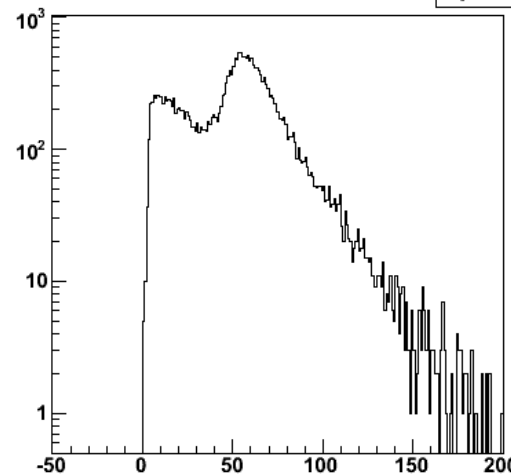
SPS Beam (H6)

120 GeV p+
10s spill every ≈ 40 sec
 10^6 p+ /spill

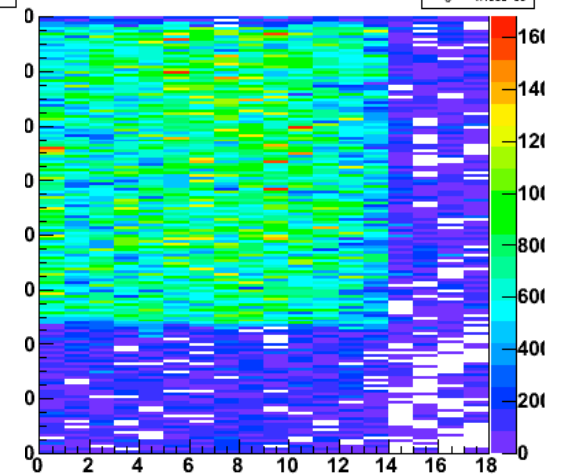
- 5 days of data taking
- Data taking efficiency of system (TurboDAQ+EUDET) $\sim 80\%$
- Collected around 30 million triggers
 - good fiducial region of scintillators
- Rates around 500Hz during spills
- Implementations of new plots
 - TLU trigger ID sometimes 0?

Triggers	Type
5000	/spill
450k	/hour
~ 30 M	Total for 3D TB

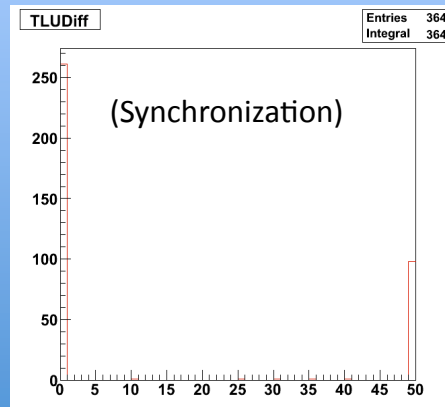
Time over threshold (\sim charge)



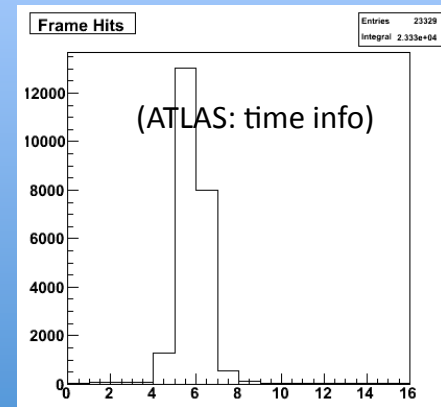
ATLAS pixel hit map



TLU nr cmp. streams (max)



Frame index of hits



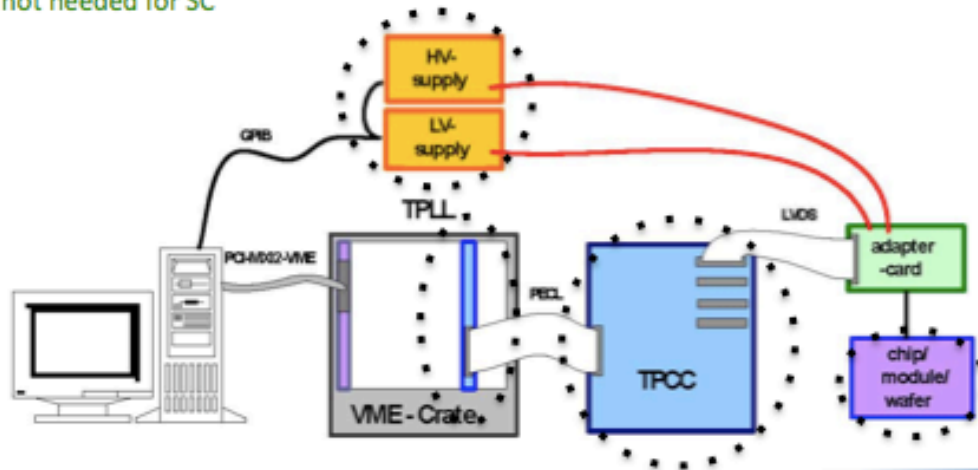
Summary

- Quick setup
 - no “external” NIM logic helps a lot!
 - Easy to find beam with already aligned table
 - (Had to solve some problems with internal TurboDAQ-EUDET synchronization the first few days)
- Good rate compared to earlier test beams ($\times 7$)
- Good support from EUDET
- Working in parallel on offline software
 - Plan to use EUTelescope reconstruction framework
 - Use our own simple analysis framework on dumped tracks
 - Transition to ILC framework not painless
- ATLAS pixels need also data in magnetic field
- Requests for beam time in 2010 are being organized

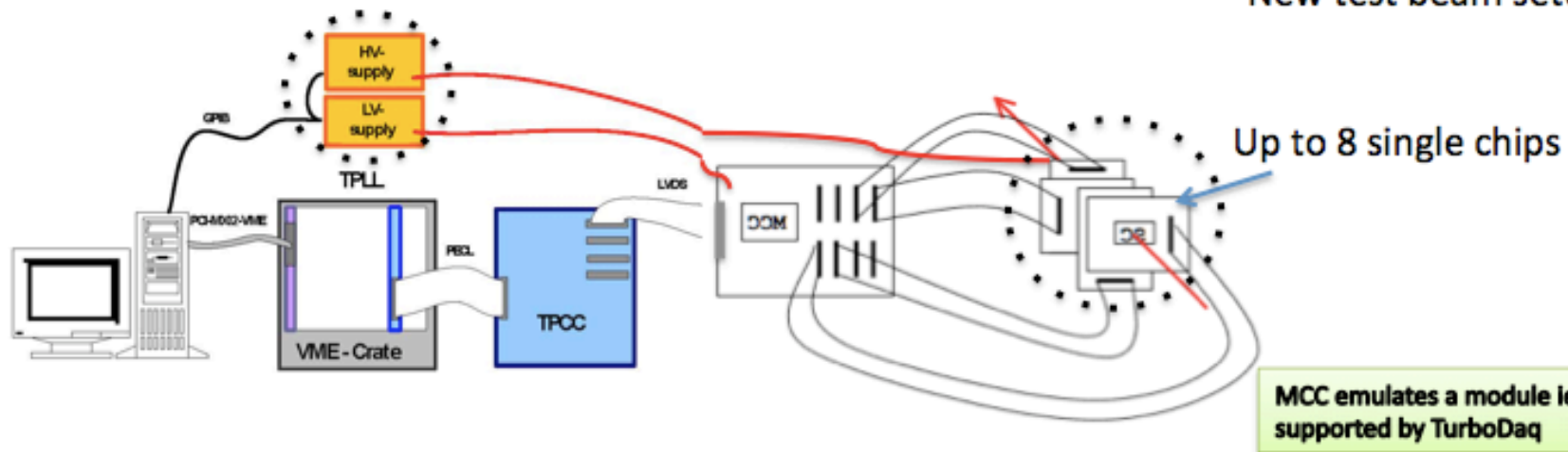
Note: Adapter card not needed for SC

MCC board

⋯ × nr of DUTs



Old test beam setup



New test beam setup