
CERN

CERN EUDET/AIDA Telescopes

AIDA2020/WP5

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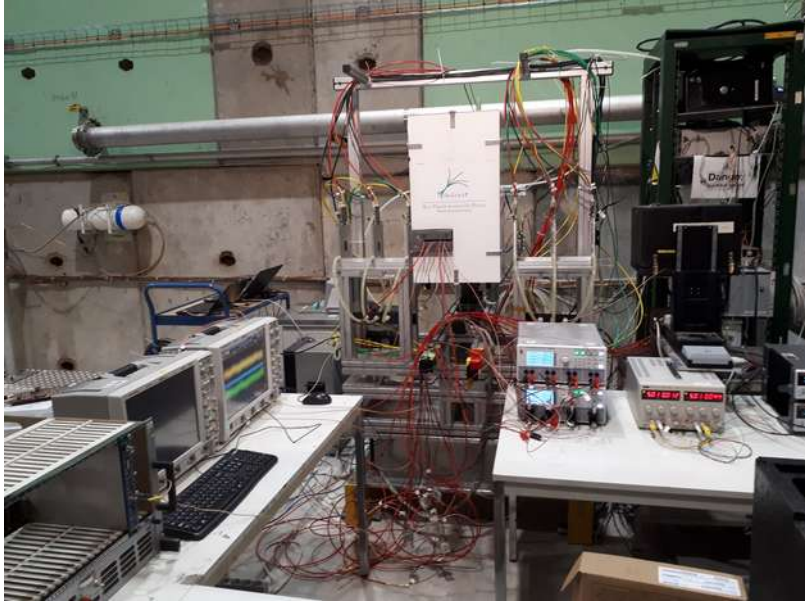
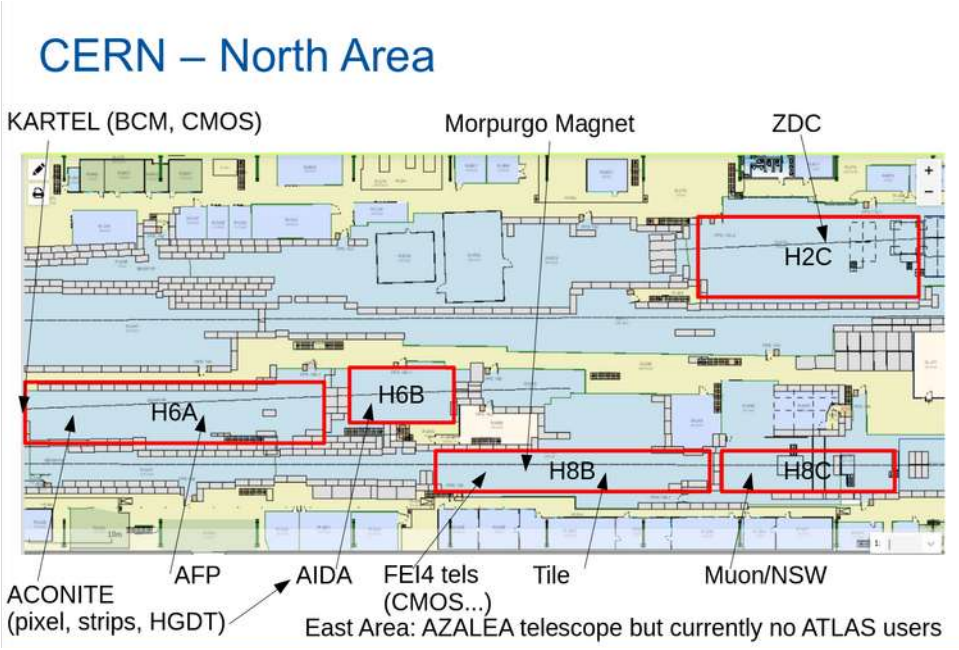
Telescopes at CERN

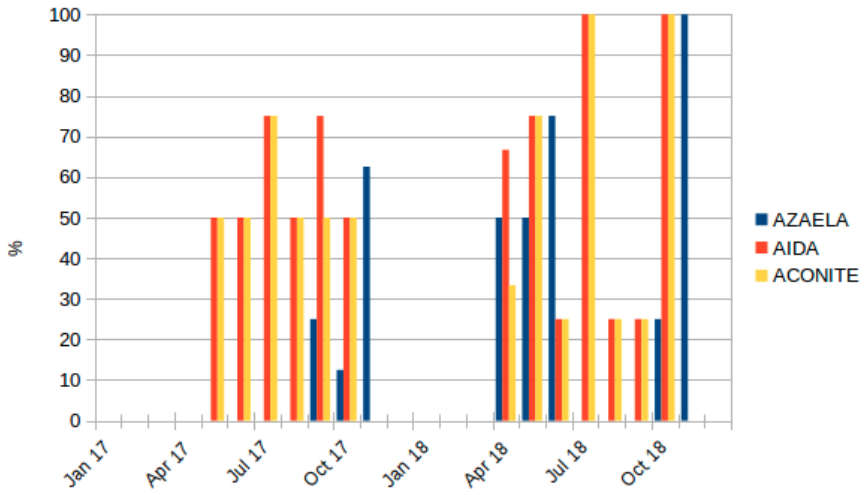
- SPS/NA
  - ACONITE mounted permanently on rails in H6A
    - Chiller based cold box -40°C
    - HV/LV and monitoring
    - AIDA telescope bought by ATLAS
  - AIDA mounted permanently on DESY table in H6B
    - Dry ice based cold box
    - HV/LV and monitoring
    - Upgraded EUDET telescope
- PS/EA
  - AZAELA mounted in T9/T10 on demand in T9/T10
    - currently on loan at DESY
    - AIDA2020 telescope
- FE-I4 timing plane for at least two telescopes simultaneously available and mounted for users
- For restart of beam at CERN:
  - Restructuring of H6B planned
  - East area completed renovated / AZAELA back from DESY
  - Newest AIDA TLU for all three telescopes
  - Repair of equipment (PI stage), upgrade computers, check planes, etc.
  - Work on better cold box





Usage of EUDET/AIDA telescope at CERN

- Users in 2018 before switched off for LS2
- ATLAS
  - ITk Pixel 9 weeks
  - ITk Strips 1 week
  - HGTD 3 weeks
- CMS
  - CMS MTD 3 weeks
  - CMS OT 6 weeks
- AIDA WP7 2 weeks
- LHCb TORCH 6 weeks



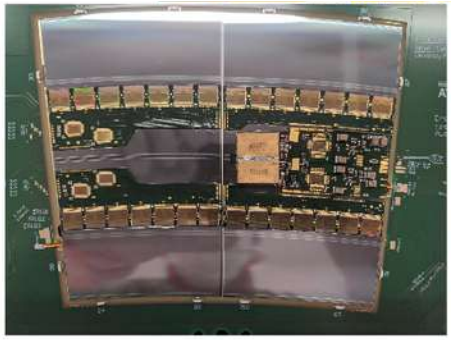
- Other test beam users either do not need a telescope or they have their own (there are cases like RD42 telescope using Mimosa but not TLU/EUDAQ and similar)
- Some telescope might become “AIDA-compatible”
  - CHROMIE
  - CERN FE-I4/MALTA telescope

Telescope User: ATLAS ITk Pixel

- Measurement of FE-I4, RD53A, …, with several DAQs (in the moment USBpix, USBpix3, BDAQ53, YARR) with the goal to converge to one software
- All DAQs have a full EUDAQ1 (latest tag 1.9.3) integration and are operating in full EUDET handshake mode with the EUDET TLU (v0.1c)
- Reconstruction: EUTelescope is used for reconstruction (now GBL for DESY); a standalone analysis framework called TBMON2 produces the plots
- FE-I4 is used as a track timing plane; mostly read out with the (more) modern MMC3 for readout
- DESY test beams are conducted in the same way with a reduced number of DUTs (2 instead of 4)
- Goal: move to EUDAQ2 + AIDA TLU + Corryvreckan but details (e.g. triggering scheme) have to be seen; the capabilities of the OnlineMonitoring have to be checked
- Purpose: achieve the maximum possible data rate at CERN base test beams using asynchronous readout and maintenance of hardware/software

Telescope User: ATLAS ITk Strips

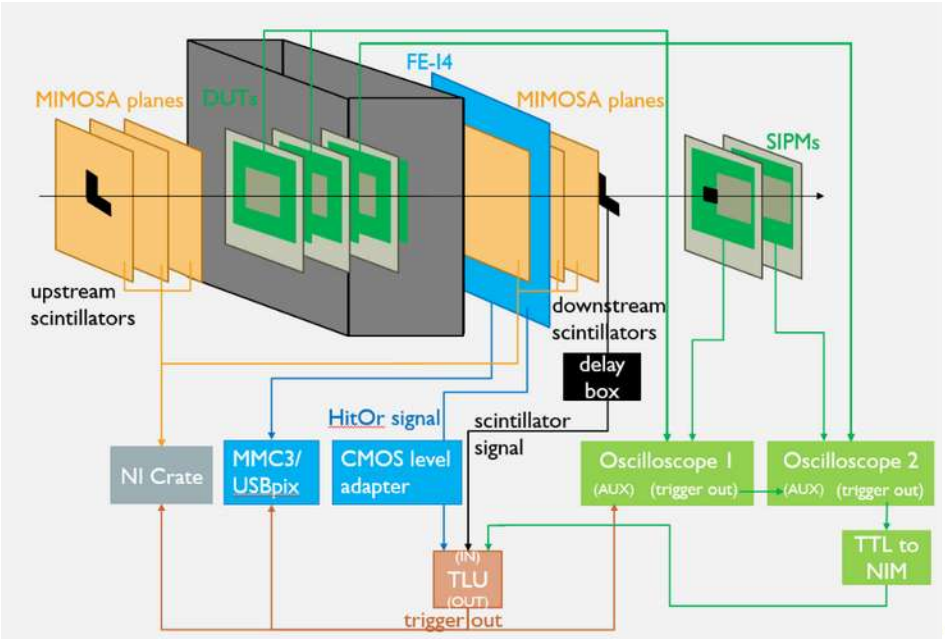
- Strip modules ABCStar, ...
- FE-I4 (mostly with old USBpix readout) for track selection timing; some campaigns with ALPIDE instead

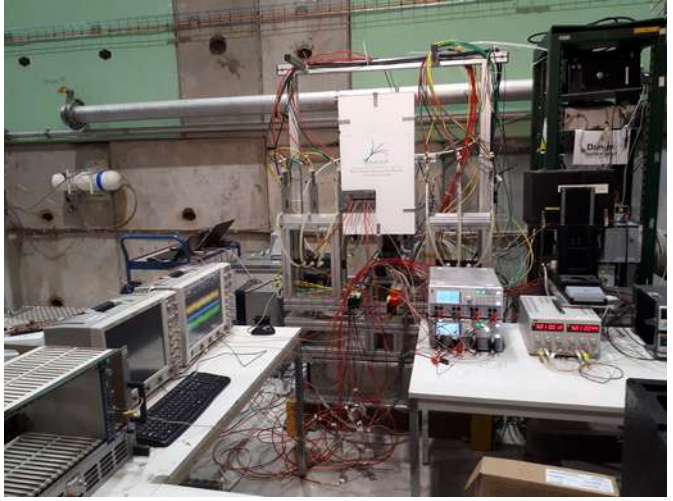


- EUDAQ2 integration of ITSDAQ; EUDET TLU (v0.1c) with fixed length trigger; time stamp based; not sure: regular modifications due changing geometry in converter plugin
- Reconstruction with EUTelescope (old version with custom modification for radial sensors); suggestion to switch to Corryvreckan in the future

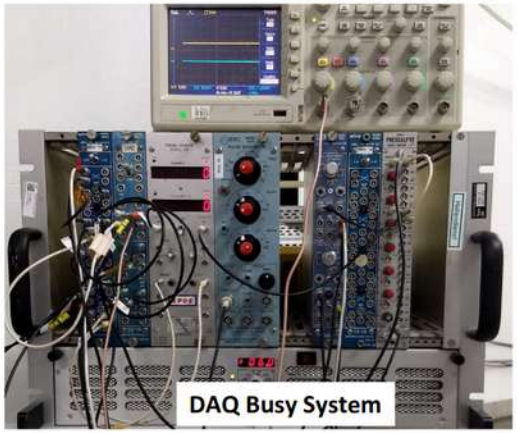
Telescope User: ATLAS HGTD

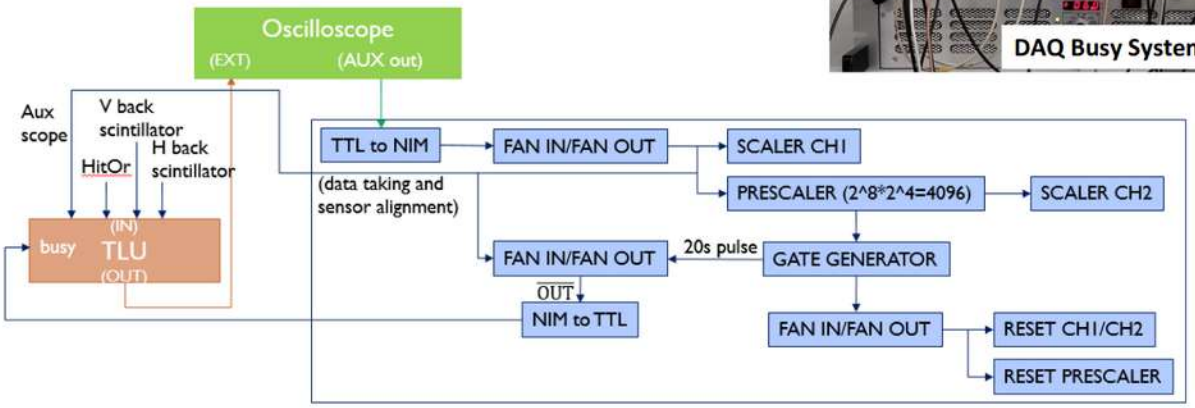
- Measurement of (segmented) LGADs; waveforms read out with preamplifiers and scope in fast frame mode or ALTIROC readout chip
- FEI4 with MMC3 readout for track selection timing and ROI-trigger (partially very small samples)
- Precise timing with dedicated quartz bars / SiPMs read out by the same scope(s)
- Usual EUDAQ1 integration used for telescope and FE-I4; TLU
- Data taking has to be stopped for scope readout; TLU trigger input used as veto and connected to scope aux; at CERN end of spill signal used to select readout time; spill signal emulated at DESY with NIM electronics
- Track reconstruction with EUTelescope (now GBL) and combination with waveforms using dedicated LGADUtils software by (counted) triggger number later





- Continuous beam at DESY
  - Oscilloscope needs time to empty the buffer
  - Need to simulate the SPS spill-like
  - NIM electronics BUSY (20 s long pulse) system assembled for this purpose (Thanks to DESY support!)
  - BUSY signal is input in the TLU and acquisition will be paused for 20 s





Backup