

Mixed Mode for EUNET-type telescopes

Beam Telescopes Development Meeting
Thursday 30 Aug 2018, 15:00
Jan Dreyling-Eschweiler, Thomas Daubney (DESY)

EUDET-type beam telescopes

- Development started in 2006 with first telescope in 2009
- Today: 7 copies at 5 different test beam facilities
- Today: Common infrastructure for many Users:



- **Track resolution** up to 2 μm due to Mimosa Sensors and GBL tracking
- **Trigger/event rate** of maximum ~ 2 kHz due to NI crate based MimosaDAQ, EUDAQ 1 and EUDET TLU (**EUDET mode**)
 - **clear event definition and robust data taking**
 - **rate is limited by slowest device**
 - **using a time reference: one track with high timeprecision at 2 kHz**

Continuous Development and Upgrades

EUDET mode

- MimosaDAQ: NI crate
- EUDAQ 1
- EUDET TLU

Synchronisation by
Event ID

MIXED mode

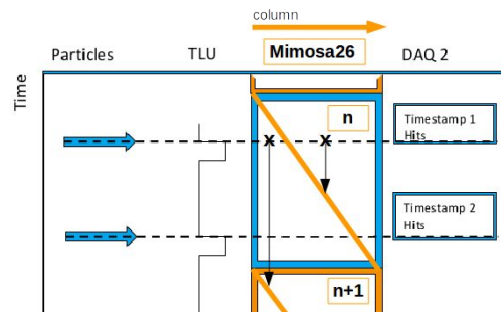
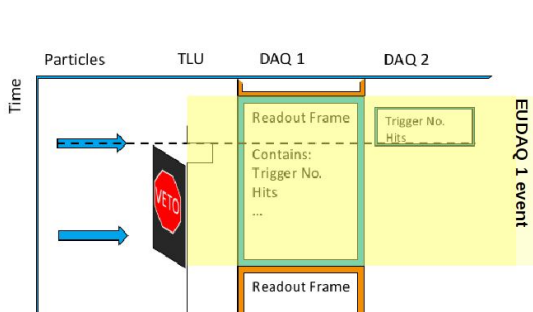
- MimosaDAQ: NI crate
- EUDAQ 2
- AIDA TLU

Synchronisation by
Trigger ID

AIDA mode

- *MimosaDAQ: MMC3*
- EUDAQ 2
- AIDA TLU

Synchronisation by
timestamp of common clock



Current Status of Mixed Mode

Data Taking (Online)

- Use the AIDA TLU with ignore MIMOSA busy to allow for other devices to continue triggering
- Take data with EUDAQ 2 and store individual device events in separate streams e.g. MIMOSA, DUT, TLU etc.

Event Building (Offline)

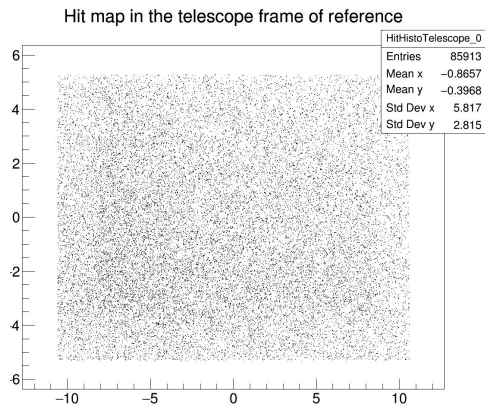
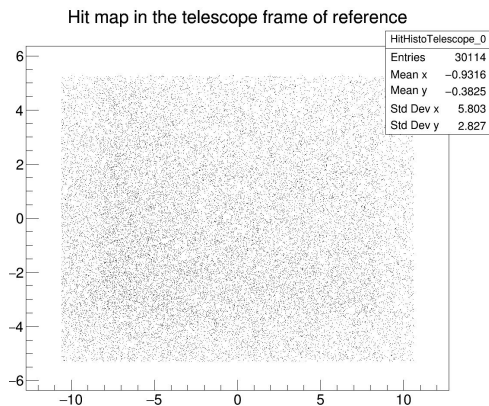
- Execute the `euCliMergerMixed` binary on RAW data files.
(Options: `-ni <MIMOSA input, etc...>`, `-tlu`, `-dut`, `-o <output file>`)

Reconstruction (Offline)

- Convert merged output to SLCIO files and then progress with EUTelescope in the usual way.

First results

- Trigger rate limited by time reference device or AIDA TLU (1 MHz)
→ Improvement of factor 500
- Data sample at DESY from end of May 2018
<https://github.com/beam-telescopes/eudag/blob/eudag2telescope/user/merger/README.md>
 - 5.4 GeV at DESY test beam
 - 13k Mimosa events and 33k FEI4/TLU events → factor of ~2.5
- Cluster Map (wo Noisypixel): standard vs. mixed



Done & Todos

- Proof-of-principle ✓
- Optimization/feedback of/for EUDAQ2, TLU ✓

- **Measurement:** Re-run sample data taking (FEI4 before last Mimosa plane) → *in Sept.*
- **EUTelescope:** finish analysis to quantify improved track rate; add a track rejection, if same Mimosa track is used twice → *ongoing*
- **EUDAQ sw:** Refactor & rename the MixedModeMerger to something more fitting with the community (e.g. EventBuilder) → *ongoing*
- **EUDAQ doc:** Document the use of the event builder → *ongoing*
- **TLU:** equip the telescopes with AIDA TLU → ?
- **Publish:** IEEE presentation or work/results Nov 2018; Produce short technical paper on the improvements to publish the results → *“end of year”*