

# AIDA-2020 WP5: Data acquisition tools for beam tests

David Cussans, 28/April/20



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654168.

- Work Package:
  - Aims
  - Milestones
  - Deliverables
- Hardware (TLU)
- DAQ software (EUDAQ)
  - Data reconstruction
- Monitoring software (DQM4HEP)
- Use of tools by other WP
- Summary



- Described at <https://aida2020.web.cern.ch/activities/wp5-data-acquisition-system-beam-tests>
- Four tasks:
  - 5.2 Interface, synchronisation and control of multiple-detector systems (TLU)
  - 5.3 Development of central DAQ software and run control (EUDAQ)
  - 5.4 Development of data quality and slow control monitoring (DQM4HEP)
  - 5.5 Event model for combined DAQ



D5.1	Interface definition	M15	05/09/2016
D5.2	Trigger Logic Unit ready	M30	15/12/2017
D5.3	Data acquisition software	M30	06/12/2017
D5.4	Data acquisition hardware	M30	22/12/2017
D5.5	Online event data model	M30	30/11/2017
D5.6	Common DAQ system used in combined beam tests	M57	31/01/2020



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- Deliverables delivered
- Milestones passed
- Congratulations to all involved.
  - Alas, Champagne / other sparkling wine / *etc.* virtual
- More technical detail about plans after AIDA-2020 during [WP5 parallel session](#)



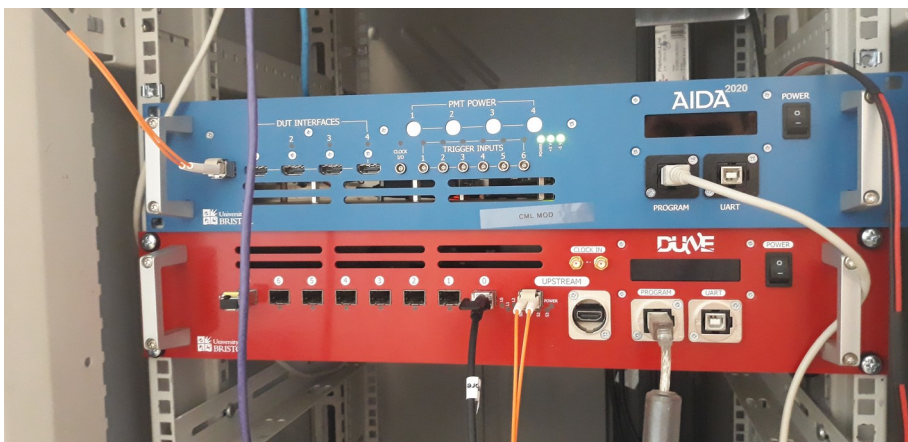
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CAD Drawing, 19-inch TLU



TLU in use, ProtoDUNE-SP



- New publication
  - <https://doi.org/10.1088/1748-0221/14/09/p09019> “The AIDA-2020 TLU: a flexible trigger logic unit for test beam facilities” , JINST
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  - Hardware design files
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- New hardware version
  - Minor bug fixes (saves effort hand-patching)
  - Three PCBs produced.
    - Delivery due 29<sup>th</sup> April
    - Only basic test facilities available (in a domestic setting)
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- Aim: (tens of) Picosecond Timing
  - EUDET TLU – Precision ~ 100ns
  - AIDA/AIDA-2020 – Precision ~ 1ns
- Use external TDC chip?
  - PicoTDC ?
- ADC for time-walk correction?
- ~ 8 inputs
- $\geq 4$  “DUT Interfaces”
  - Move away from HDMI → Display Port
    - Passive adaptor HDMI ← → Display port
    - More robust. Better signal integrity on trigger line





# AIDA<sup>2020</sup>

# DAQ Toolkit - EUDAQ

- Developed in EUDET and developed in AIDA , AIDA-2020
- Extended to make more useful for other detectors in addition to pixel trackers
  - CALICE , Lycoris strip tracker
- Publications:
  - EUDAQ—a data acquisition software framework for common beam telescopes, <https://doi.org/10.1088/1748-0221/15/01/P01038>
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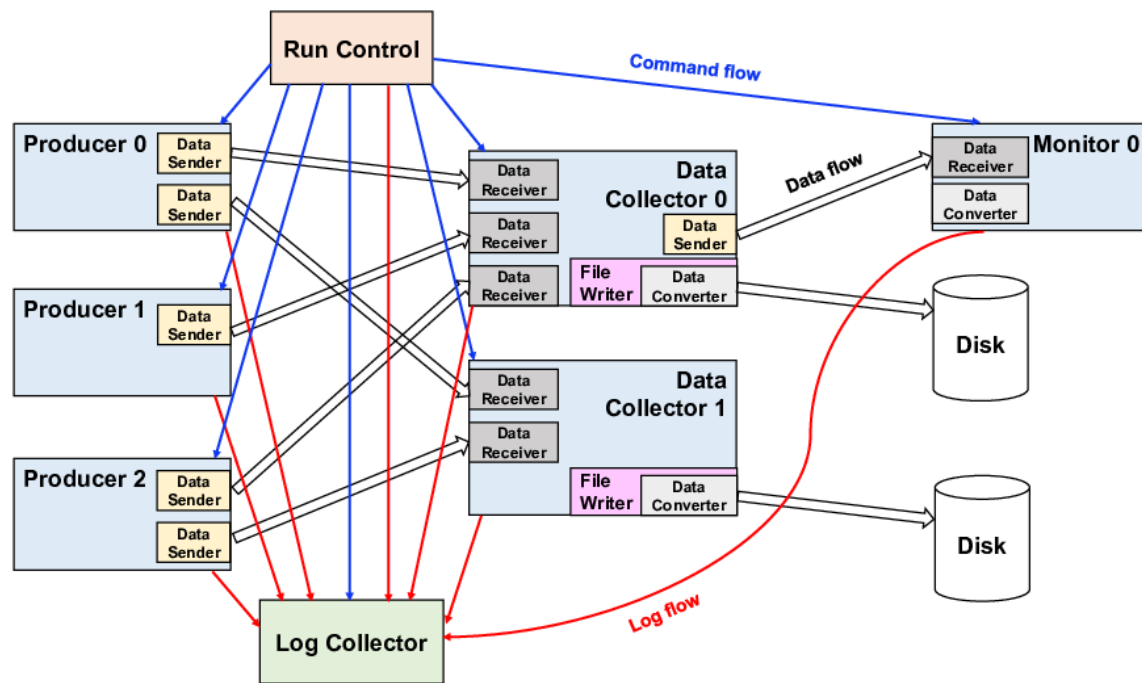


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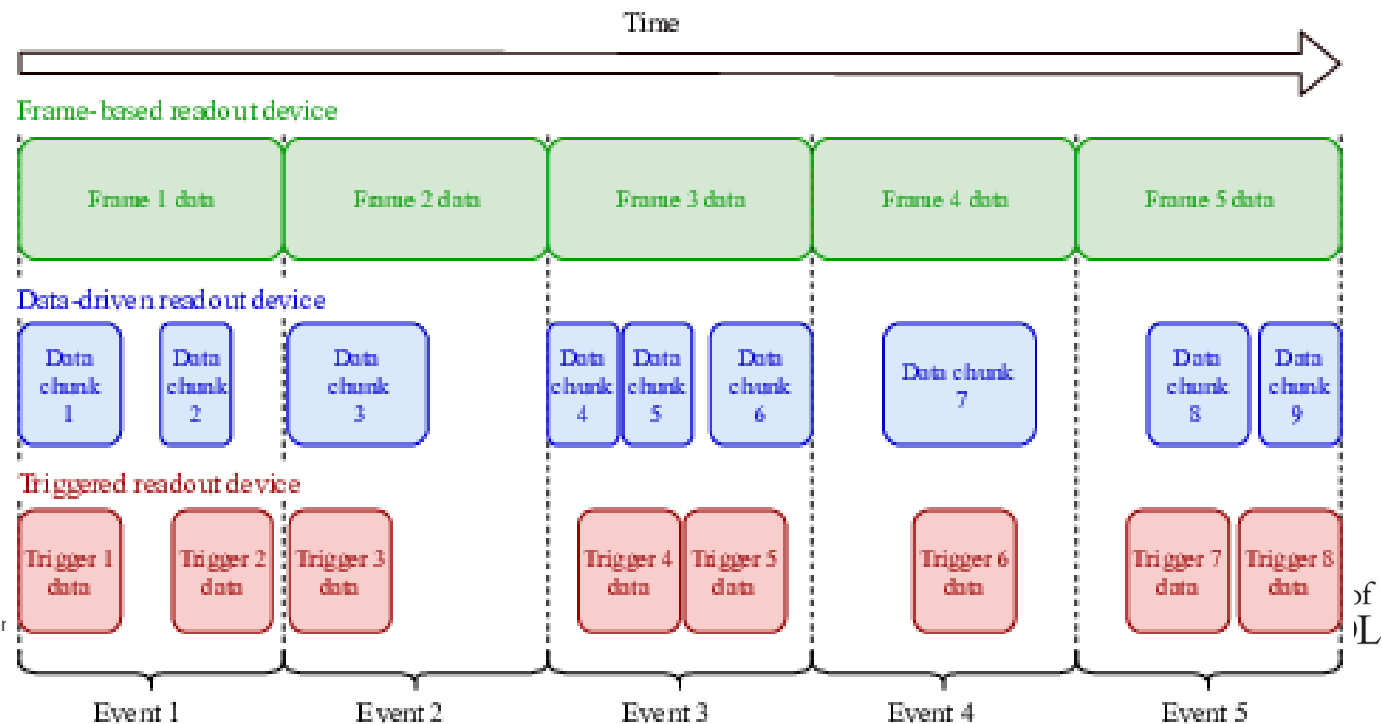
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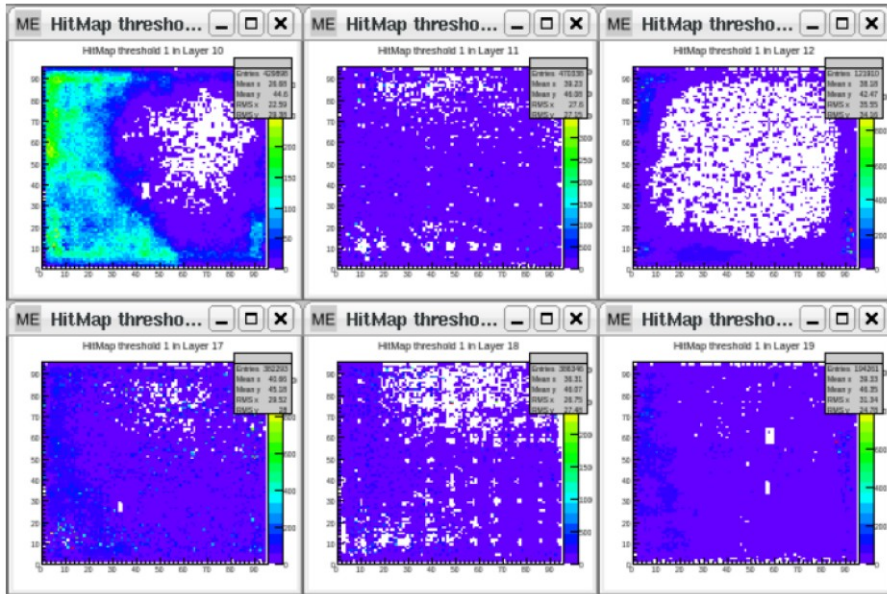


- Event data structure changed to allow trigger-less and/or self triggered detectors
- Data “frames” labelled with time-stamp and/or trigger number
- Can mix detectors with different integration periods
  - e.g. have multiple triggers associated with a single rolling-shutter pixel detector frame.
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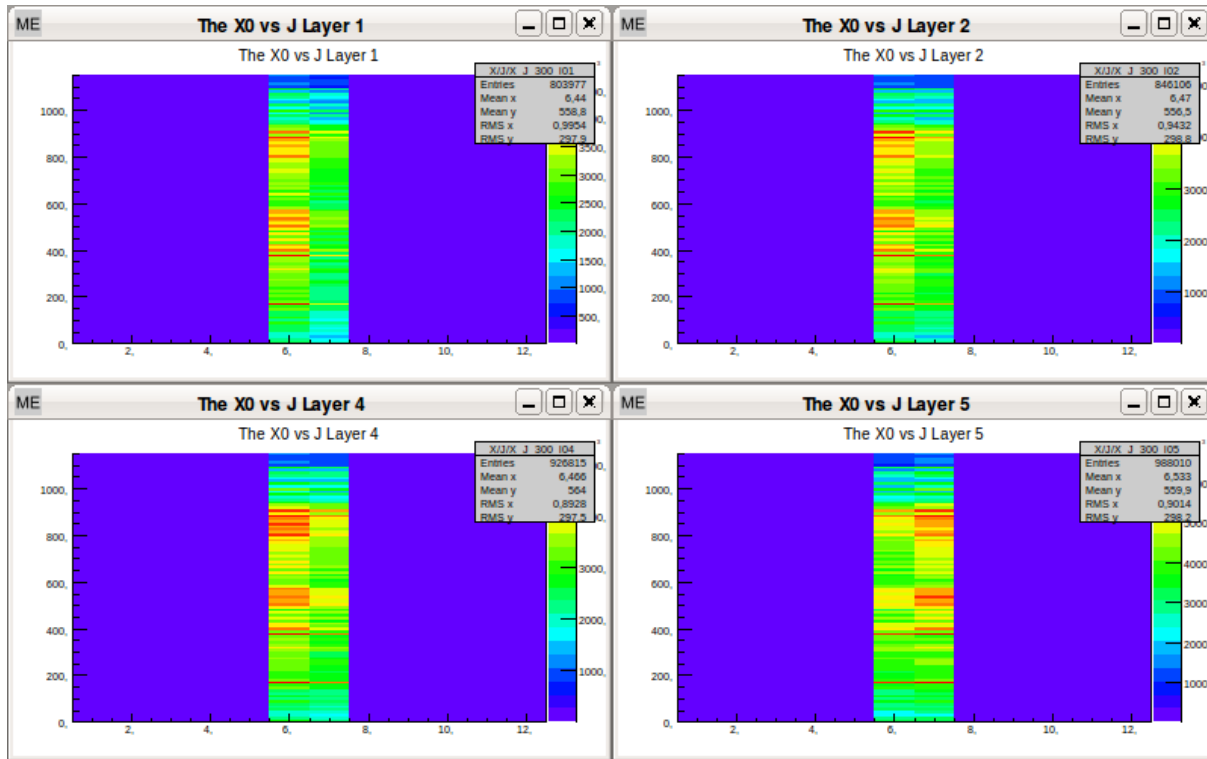
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- Extensive use of EUTElescope to reconstruct beam telescope data
  - Not well suited to mixing detectors with different integration periods
    - Needed for high rate with Mimosa telescopes
- Increasing use of Corryvreckan reconstruction framework.
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- Provided near-online DQM for Calice beam tests
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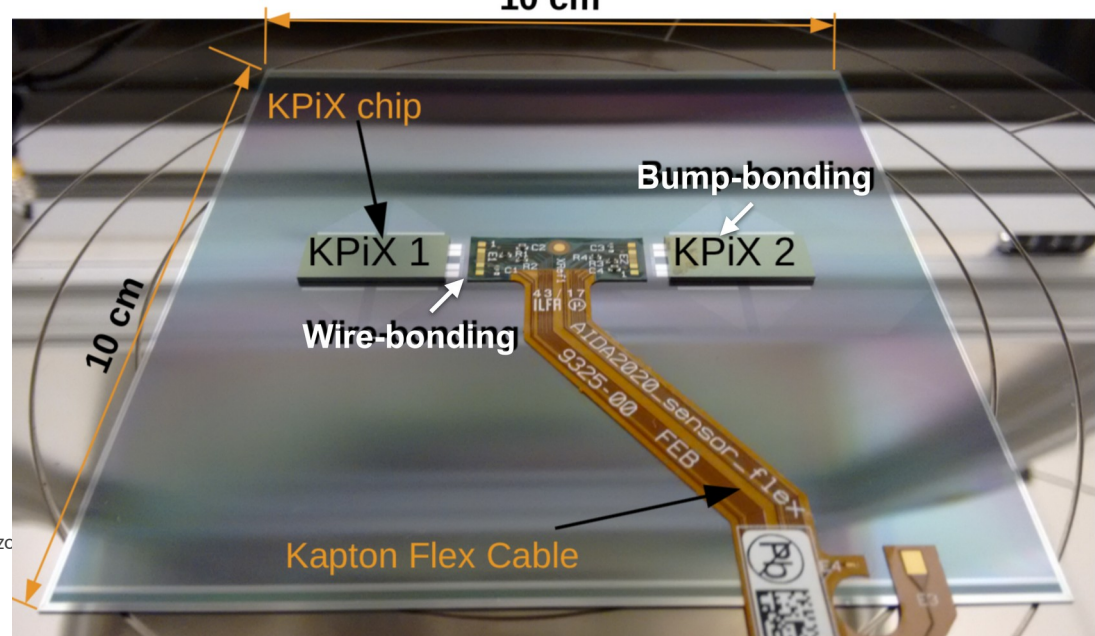
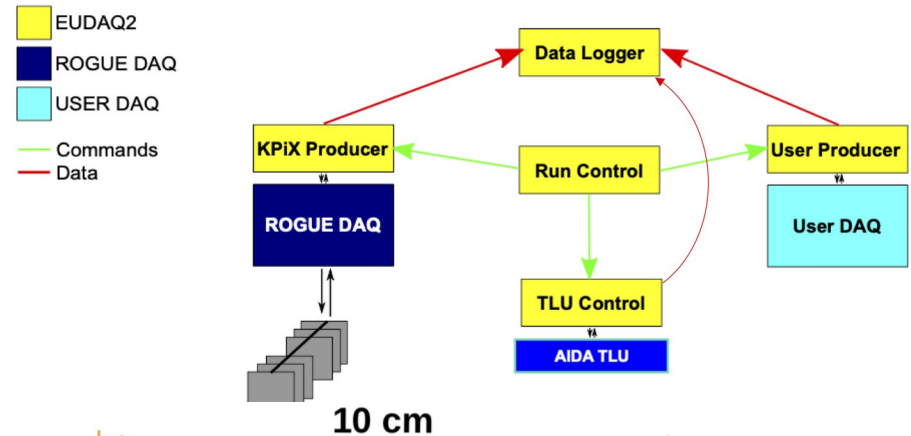


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- Online, as well as near-online, a goal of AIDAInnova





- Close relationship with other WP.
  - e.g. Calorimetry , Beam-telescopes.
  - Use of WP5 tools for WP15 silicon strip tracker.



- Consolidation and deployment of developments made in AIDA
- Addition developments allowing combined beam tests of different detector types
  - e.g. Calorimeter, pixel sensor, strip sensor
- Has provided a “standard” set of tools for beam-lines at DESY and CERN
  - Providing infrastructure that helps developers of detectors
- Well placed to Innovate in AIDAinnova.....





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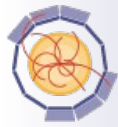
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**AIDA**<sup>2020</sup>

# Structure

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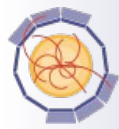
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## Project Status

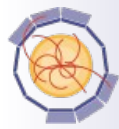
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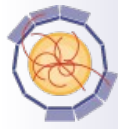
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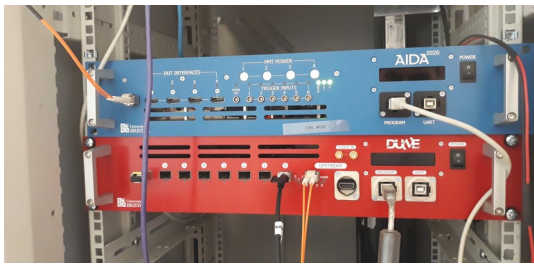
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# TLU - Documentation

CAD Drawing, 19-inch TLU



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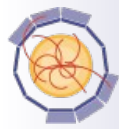
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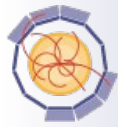
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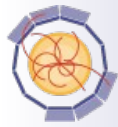
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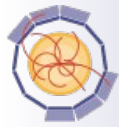
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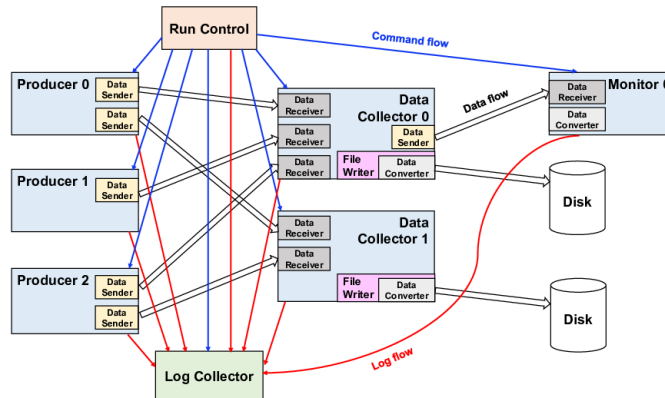


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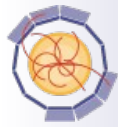




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## Event Model

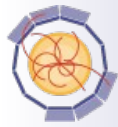
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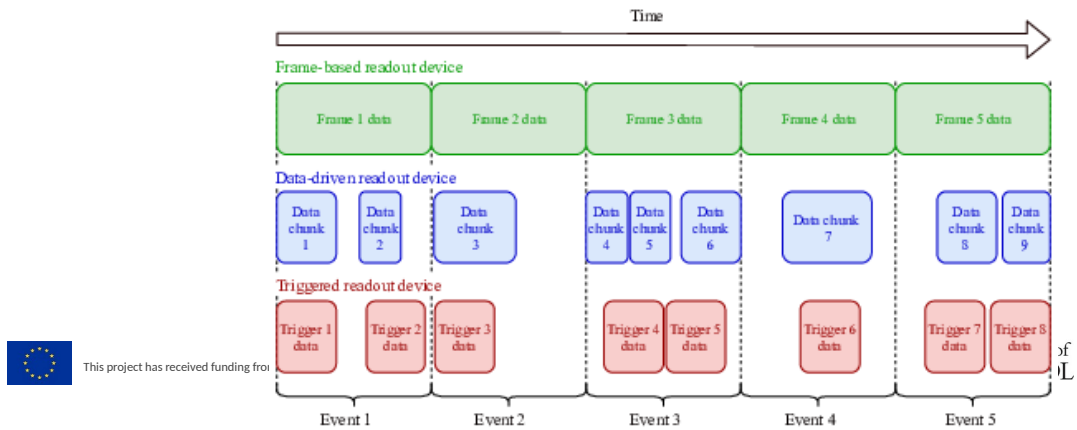
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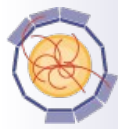
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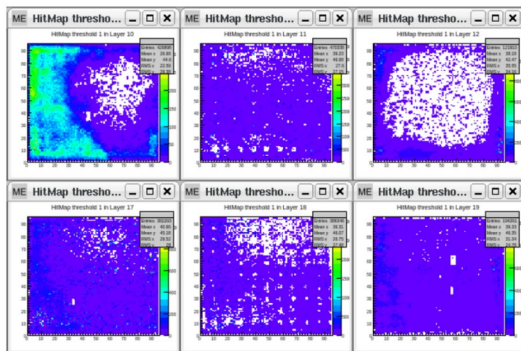






# AIDA<sup>2020</sup>

## Monitoring Tools

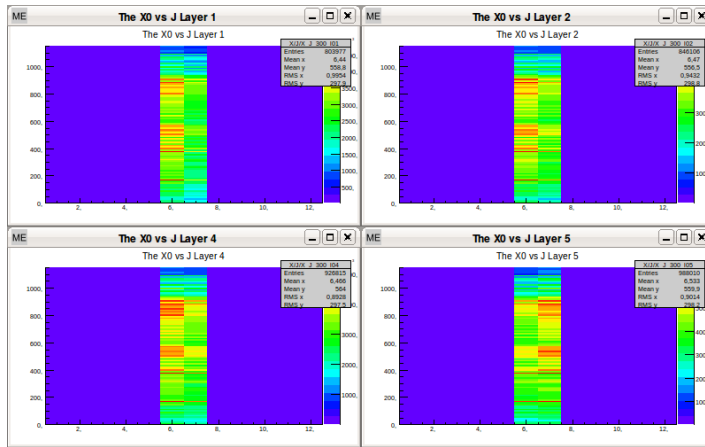
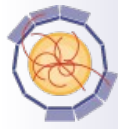


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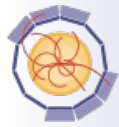


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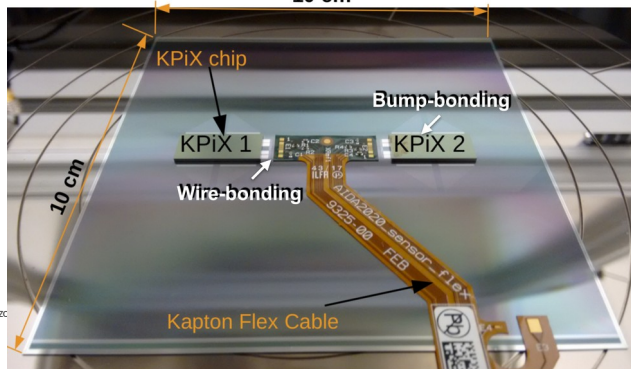
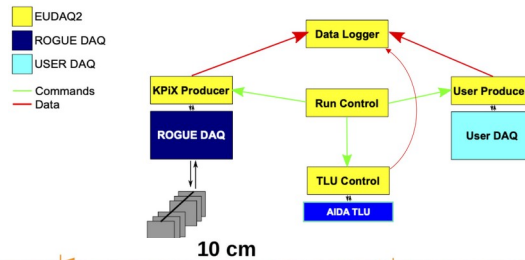


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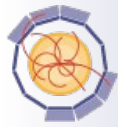


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