EUDAQv2, a testbeam data acquisition software framwork

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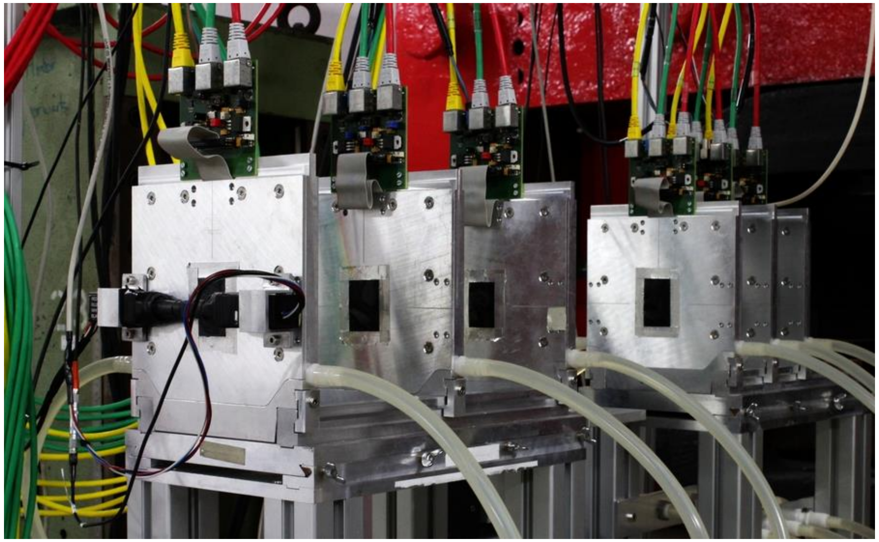
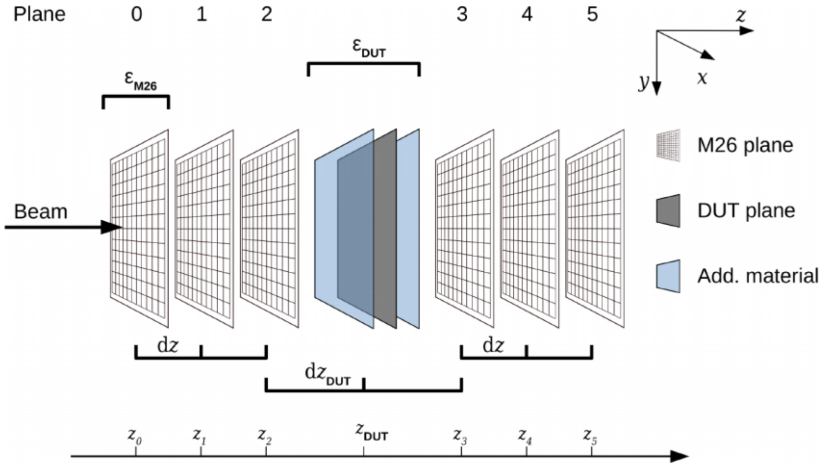
Code repository https://eudaq.github.io

BTTB 5th @ Barcelona

History: EUDAQv1 on EUDET telescope

- EUDAQ is originally developed as a DAQ system for EUDET-type telescopes.
- EUDET telescopes are used heavily at testbeam for the detector prototypes.
- The core sensor of telescope can not run faster than 115um/frame. The recent setup makes the system to wait all sub detectors to complete the readout.





Motivation(1): Update EUDET telescope to AIDA telescope

EUDET telescope

- A system trigger signal with trigger-ID is distributed in all telescope sub detectors.
- Sub detector reads trigger-ID and insert it to a triggered sub event.
- Trigger-ID is the key to merge sub events.

AIDA telescope

- A system clock will distribute to all telescope sub detectors.
- Sub detector counts the clock circle to generate timestamp and insert it to a triggered sub event.
- Timestamp is the key to merge sub events.

Motivation(2):Extend its use case as common DAQ

- Key features to be a common DAQ

	In EUDAQ 1
Distributed data taking	√
Central Control and configure interface.	√
Data collector/builder and data converter	√ *
GUI, Monitor	√ *
Extendable	√
Cross platform	√

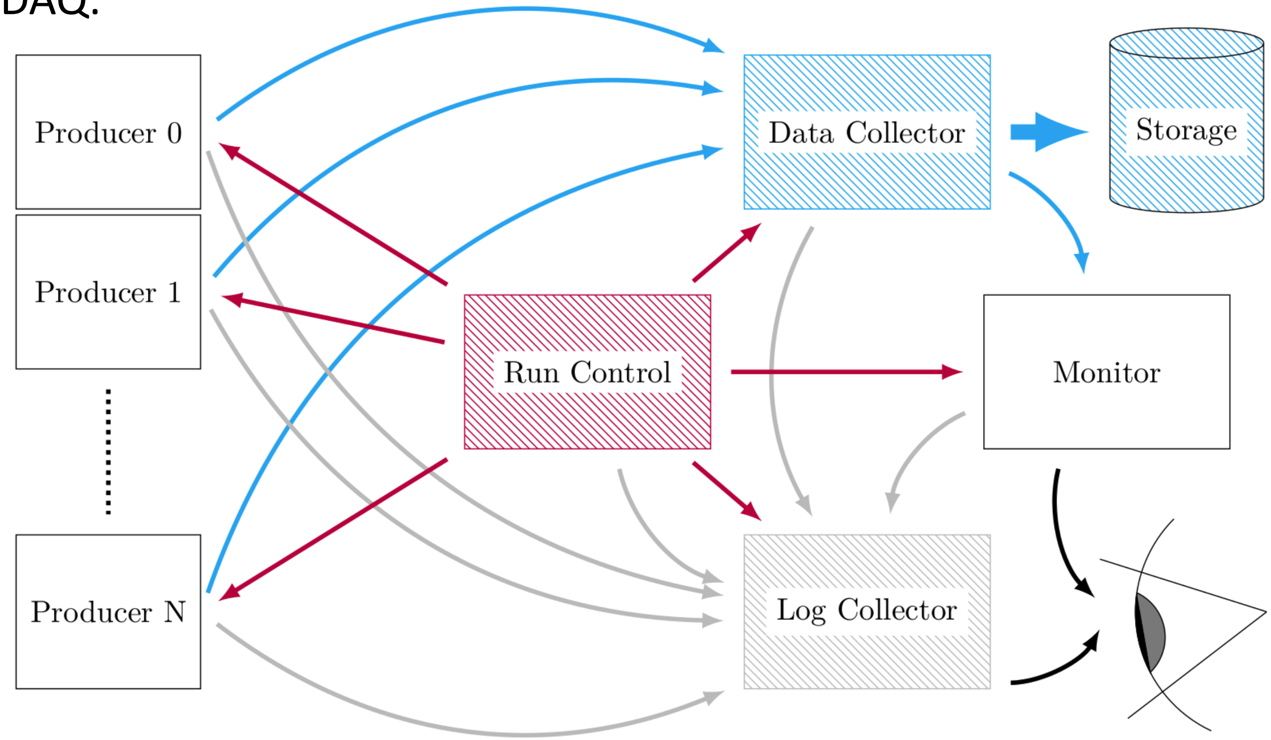
➢ EUDAQ1 has almost all required key features to be a common DAQ, (*) except its data collector and Monitor was designed for EUDET hardware

➢ EUDAQ2 is a major version release. Let’s take this chance to make a significate change of interface and improve to a nicer code.

Distributed data taking (On TCP/IP)

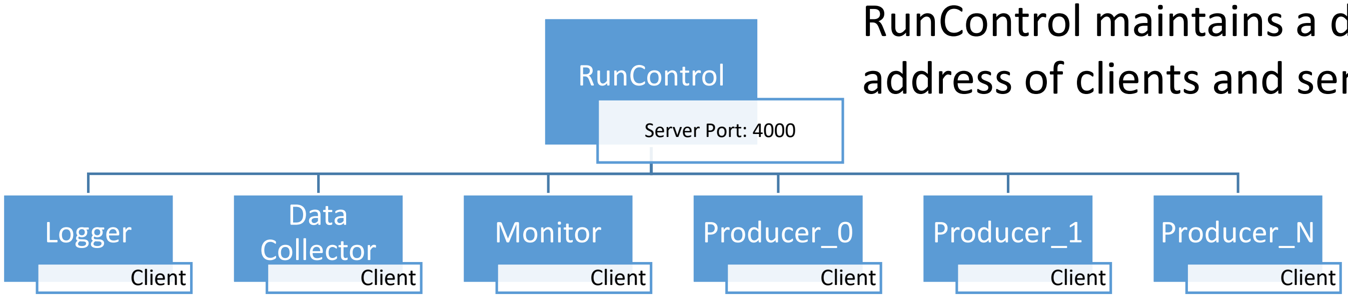
Main Components of EUDAQ:

1. RunControl
2. Producer
3. DataCollector
4. LogCollector
5. Monitor

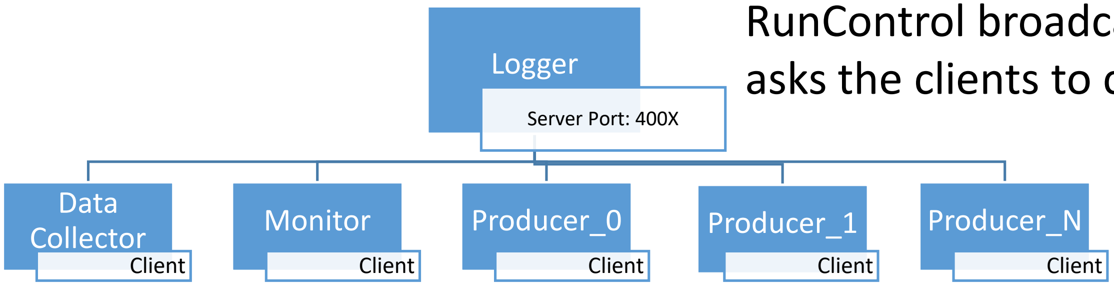


Schematic of the EUDAQ architecture

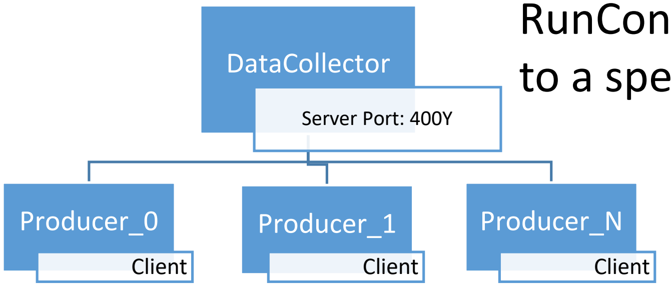
Distributed data taking (On TCP/IP)



RunControl maintains a database about the address of clients and sends command to them.



RunControl broadcast the logger address and asks the clients to connect to logger

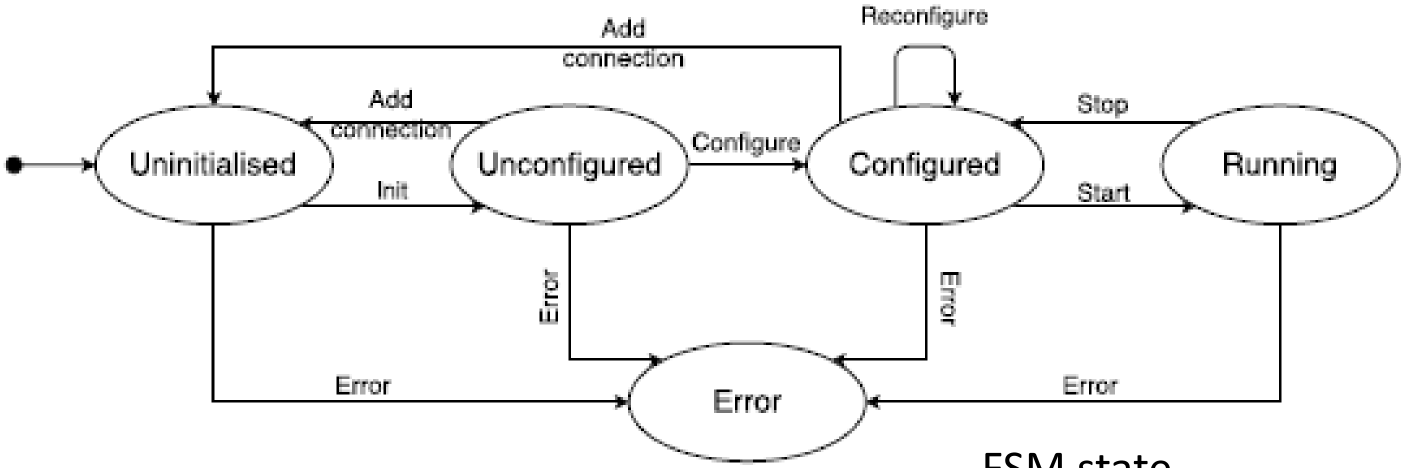


RunControl asks the producer to send its data to a specific DataCollcetor.

Component: RunControl

RunControl maintains a database about the address of clients and sends command to them.

- The Standard RunControl EUDAQ is enough for most user cases.
- Provide flexible to have dedicated RunControl to integrate with other DAQ system .
- The FSM states EUDAQ clients are checked by RunControl.

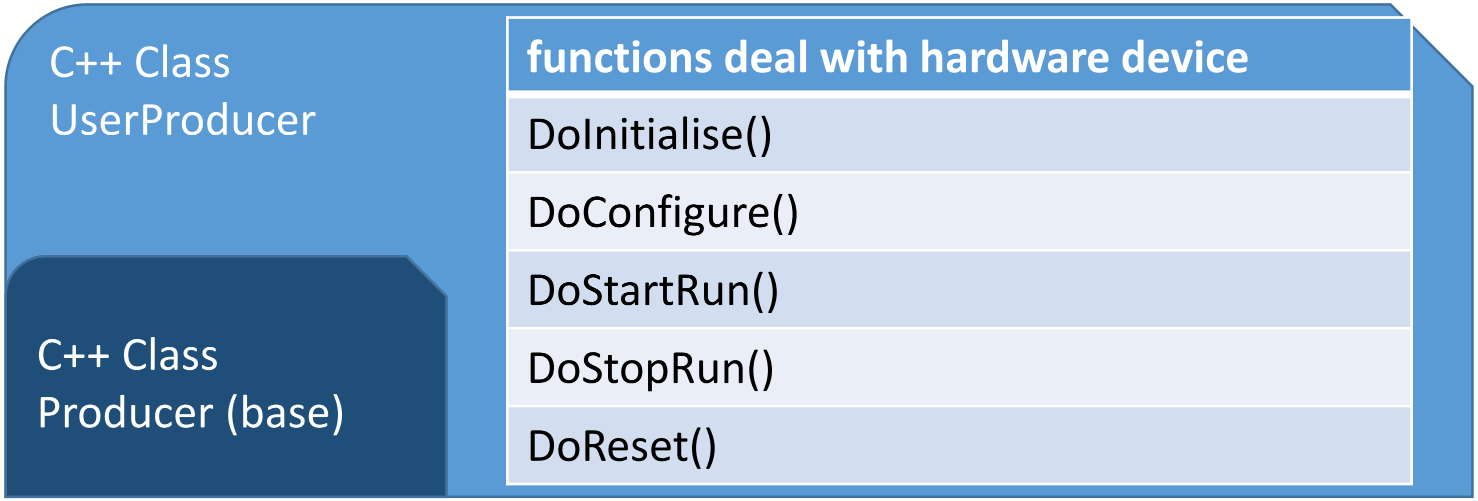


FSM state

Component: Producer

Producers are the binding part between a user DAQ and the central EUDAQ RunControl.

A Producer base class is provided in order to simplify the integration. The base class do all the common tasks for the derived Producer.



C++ Class
UserProducer

C++ Class
Producer (base)

functions deal with hardware device
DoInitialise()
DoConfigure()
DoStartRun()
DoStopRun()
DoReset()

Component: DataCollector

The Data Collector receives all the data streams from all the Producers, and combines them into a single stream.

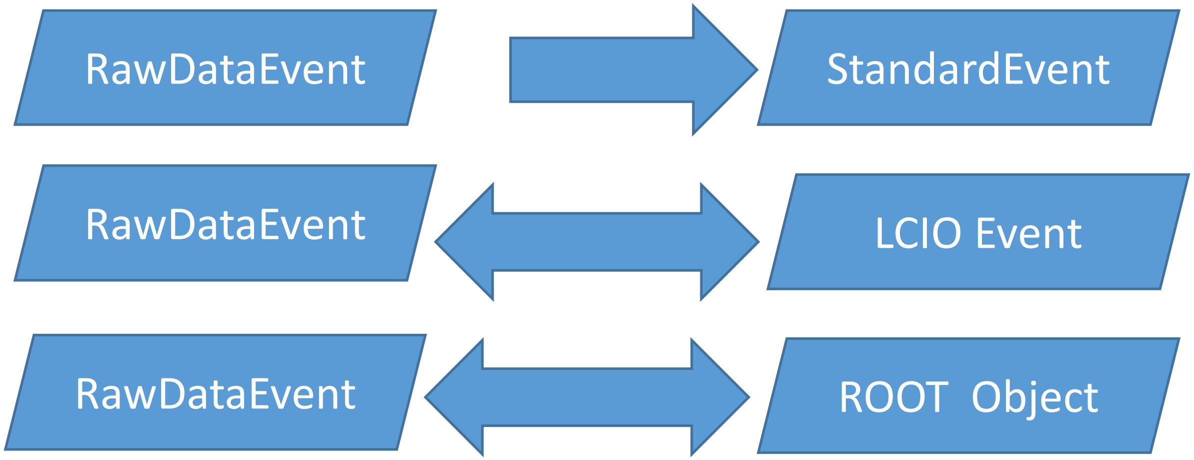
- DataCollector can write event data to different file formats by configuration.
- Multiple DataCollectors can run in one setup.
- Each DataCollector can be configured to receive Event from any collection of Producers.

Users recommend to implement theirs DataCollector if there is a dedicated synchronization method to merge the data.

Generic DataCollectors for direct synchronization by timestamp and trigger number cases are provides.

Component: DataConverter

- Modular designed for conversion between any kinds of data types.
- Conversion from EUDAQ RawDataEvent to LCIO Event is native supported.
- DataConverter can be called online by DataCollector/Monitor if they want data in another format instead of EUDAQ native format.



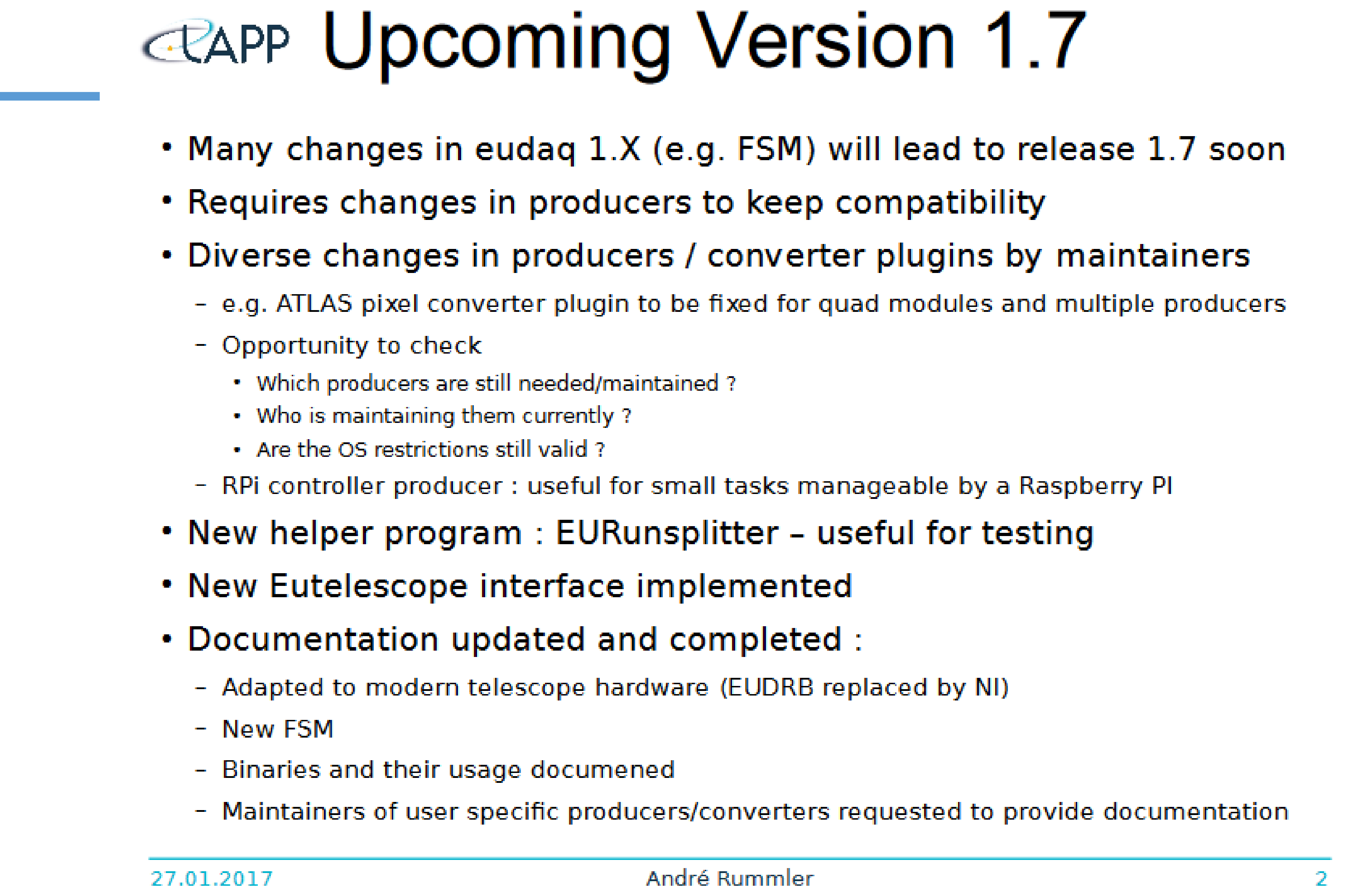
Code Maintaining

- EUDAQ is applied by GNU Lesser General Public License

- Codes is available on GitHub repository
  https://github.com/eudaq/eudaq

- Continuous integration to check compile time error of the code. (André Rummler)
  Linux/MacOS on Travis CI
  Windows on AppVeyor

EUDAQ v1 is still maintained.



Upcoming Version 1.7

- Many changes in eudaq 1.X (e.g. FSM) will lead to release 1.7 soon
- Requires changes in producers to keep compatibility
- Diverse changes in producers / converter plugins by maintainers
  - e.g. ATLAS pixel converter plugin to be fixed for quad modules and multiple producers
  - Opportunity to check
    - Which producers are still needed/maintained ?
    - Who is maintaining them currently ?
    - Are the OS restrictions still valid ?
  - RPi controller producer : useful for small tasks manageable by a Raspberry PI
- New helper program : EURunsplitter – useful for testing
- New Eutelescope interface implemented
- Documentation updated and completed :
  - Adapted to modern telescope hardware (EUDRB replaced by NI)
  - New FSM
  - Binaries and their usage documened
  - Maintainers of user specific producers/converters requested to provide documentation

27.01.2017 André Rummler 2

outlook

- Interface for user is frozen now.
- We are working with first user (CLAICE AHCAL) to test it and collecting feedback
- We are just starting the update of manual.
- Release with User Manual and Example codes in months.
- The EUDET telescopes in DESY will run EUDAQv2 by default.

Thanks to all the previous contributors.

https://github.com/eudaq/eudaq/graphs/contributors

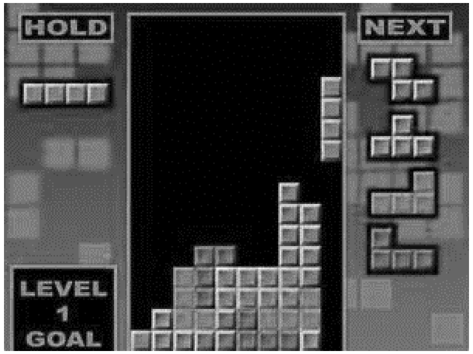
You are very welcome to open issues and push commits to the public repository hosted on GitHub.

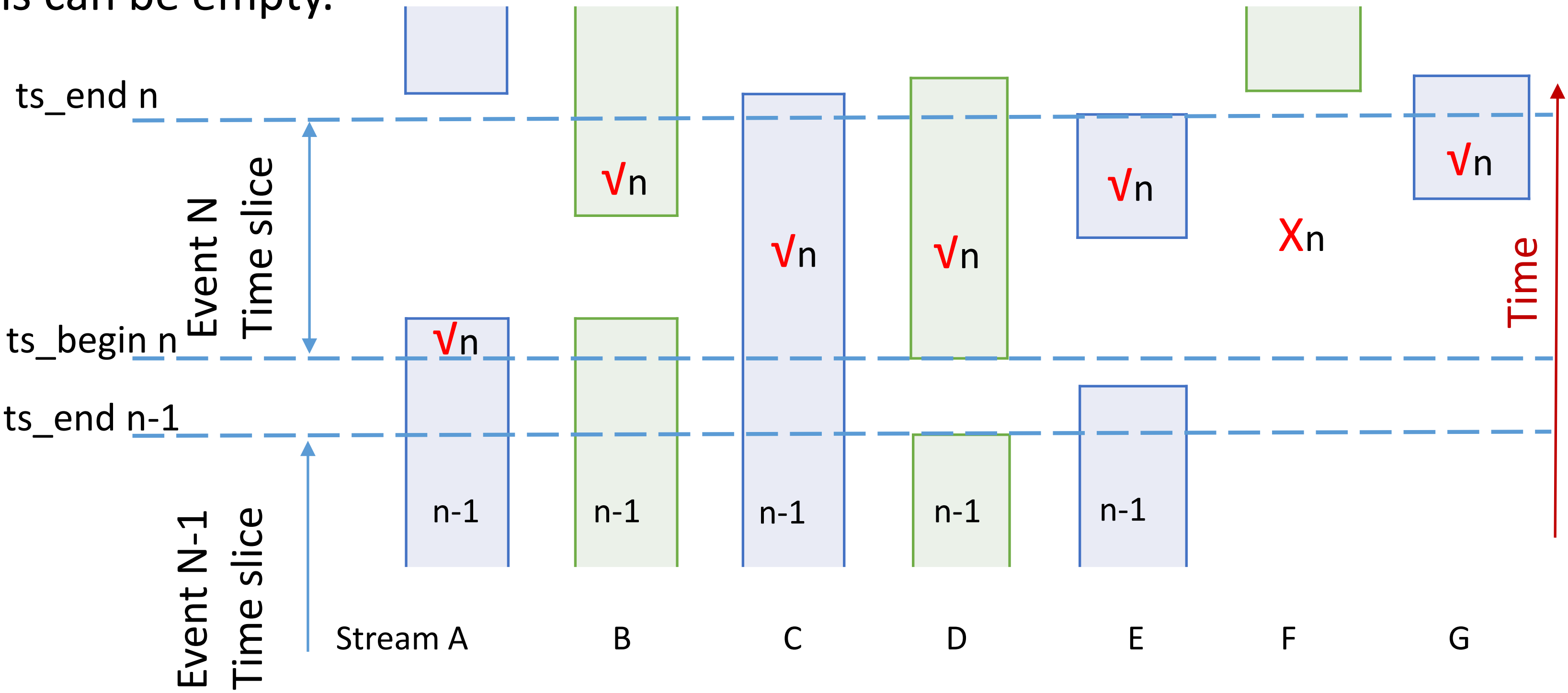
Thank you for your attention.

Event Synchronization By Timestamp

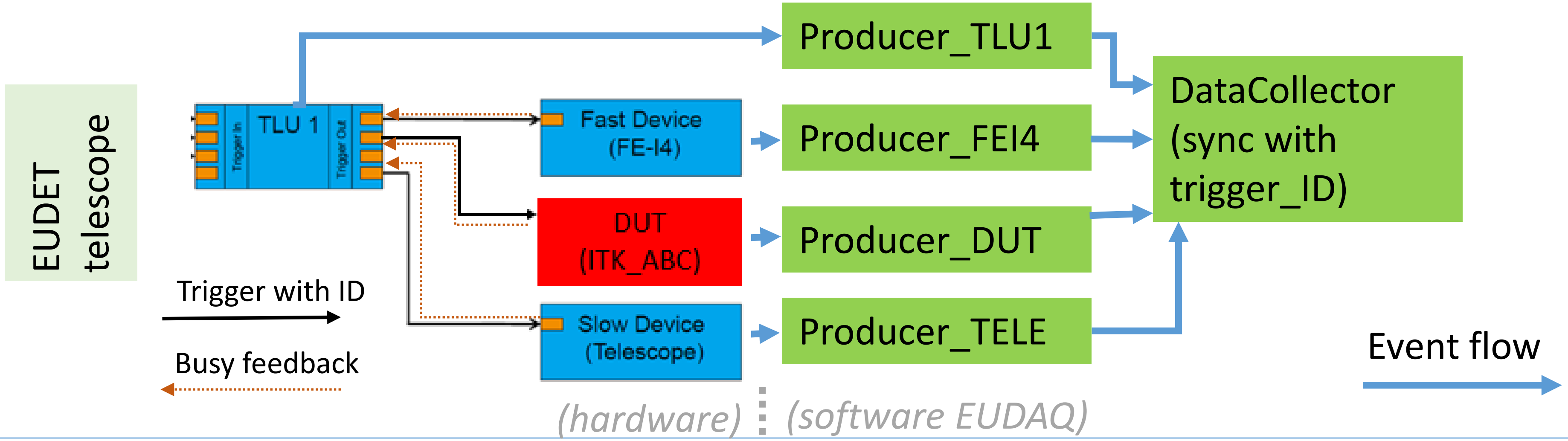
- Time length of sub events are flexible.
- Time slice of merged event is variable event by event in the same stream.
- All streams are equal to each others
- Streams can be empty.

Tetris





Update EUDET telescope to AIDA telescope



EUDET telescope

TLU 1

Fast Device (FE-I4)

DUT (ITK_ABC)

Slow Device (Telescope)

Producer_TLU1

Producer_FEI4

Producer_DUT

Producer_TELE

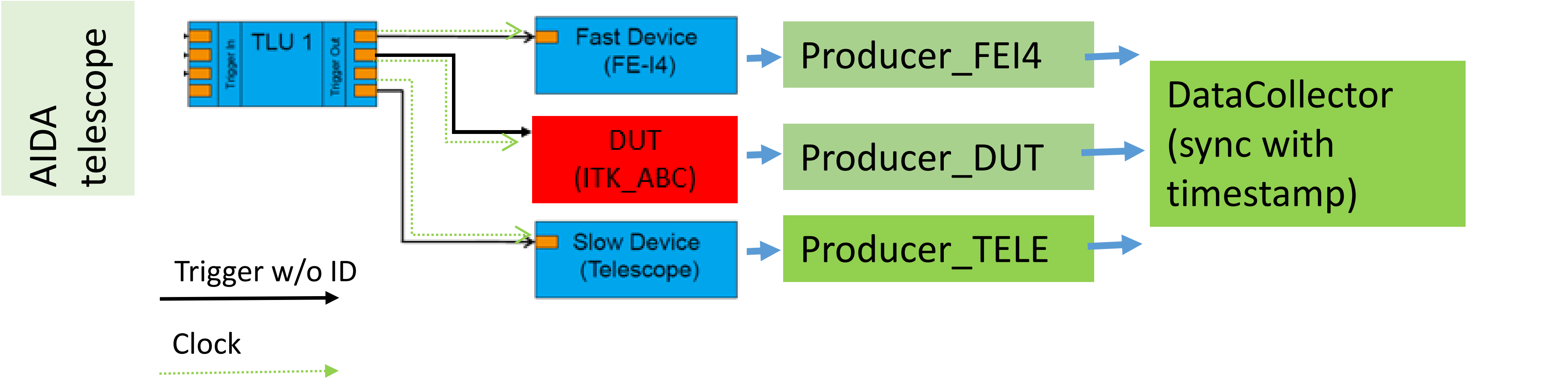
DataCollector (sync with trigger_ID)

Trigger with ID

Busy feedback

Event flow

(hardware) *(software EUDAQ)*



AIDA telescope

TLU 1

Fast Device (FE-I4)

DUT (ITK_ABC)

Slow Device (Telescope)

Producer_FEI4

Producer_DUT

Producer_TELE

DataCollector (sync with timestamp)

Trigger w/o ID

Clock