EUDAQ

A common data acquisition framework

HJ for the DESY beam telescope coordinators;
Talk mostly based on slides from Simon Spannagel
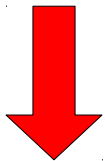
Structure

- Three main pillars of the EUDET beam telescope infrastructure

WP 15	WP 5	WP ?
EUDET-type beam telescope	**EUDAQ**	**EUTelescope**
Sensors, frame, T&DAQ HW,...	Modular, x-platform DAQ framework	Offline reconstruction software for data analysis
Talk by Jan D.E., Thursday, WP15	This talk	Any work foreseen on this?
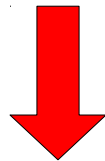
Outline

- Introduction to EUDAQ

- Success story of EUDAQ within EUDET and beyond

- EUDAQ architecture and core functionalities

- Data formats and conversion

- DUT integration into EUDAQ

- Plans and wish list

- Summary

Features of EUDAQ

CMake

- Generic framework for data acquisition
- OS independent: Linux, Mac OSX, Windows
- Integration of DAQ systems of devices under test (DUT) independent of the DUT's technology
- Modular and flexible design
- DAQ Run Control via GUI, also CLI interface available
- Online DQM using the OnlineMonitor
- Hardware communication done by coequal "producers":
  - e.g. "NiProducer" for the MIMOSA26 sensors via NI Crate
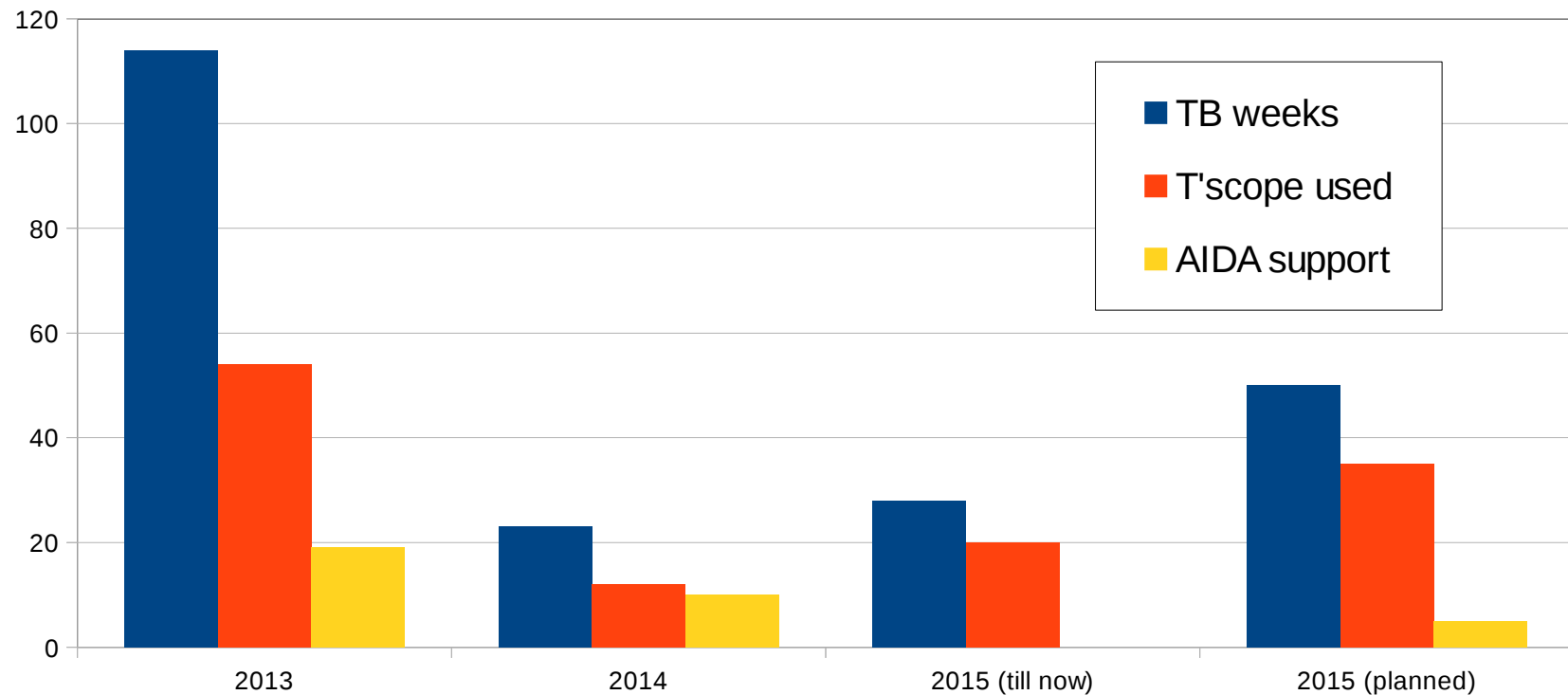- Used by many groups

Features of EUDAQ

- Generic framework for data acquisition

- [partially obscured]

- [partially obscured] (...UT)

- [partially obscured]

- [partially obscured] ...ble

- [partially obscured]

  **Altro (Bonn), APIX (Atlas Pixels),
  Atlas (TRT), CMS Pixel (DESY),
  DEPFET (Bonn), FORTIS/SPIDER (Bristol),
  MimoRoma (INFN), MVD (DESY),
  PixelMan (Freiburg), SITRA (Santander),
  Taki (Mannheim), Timepix (Bonn),
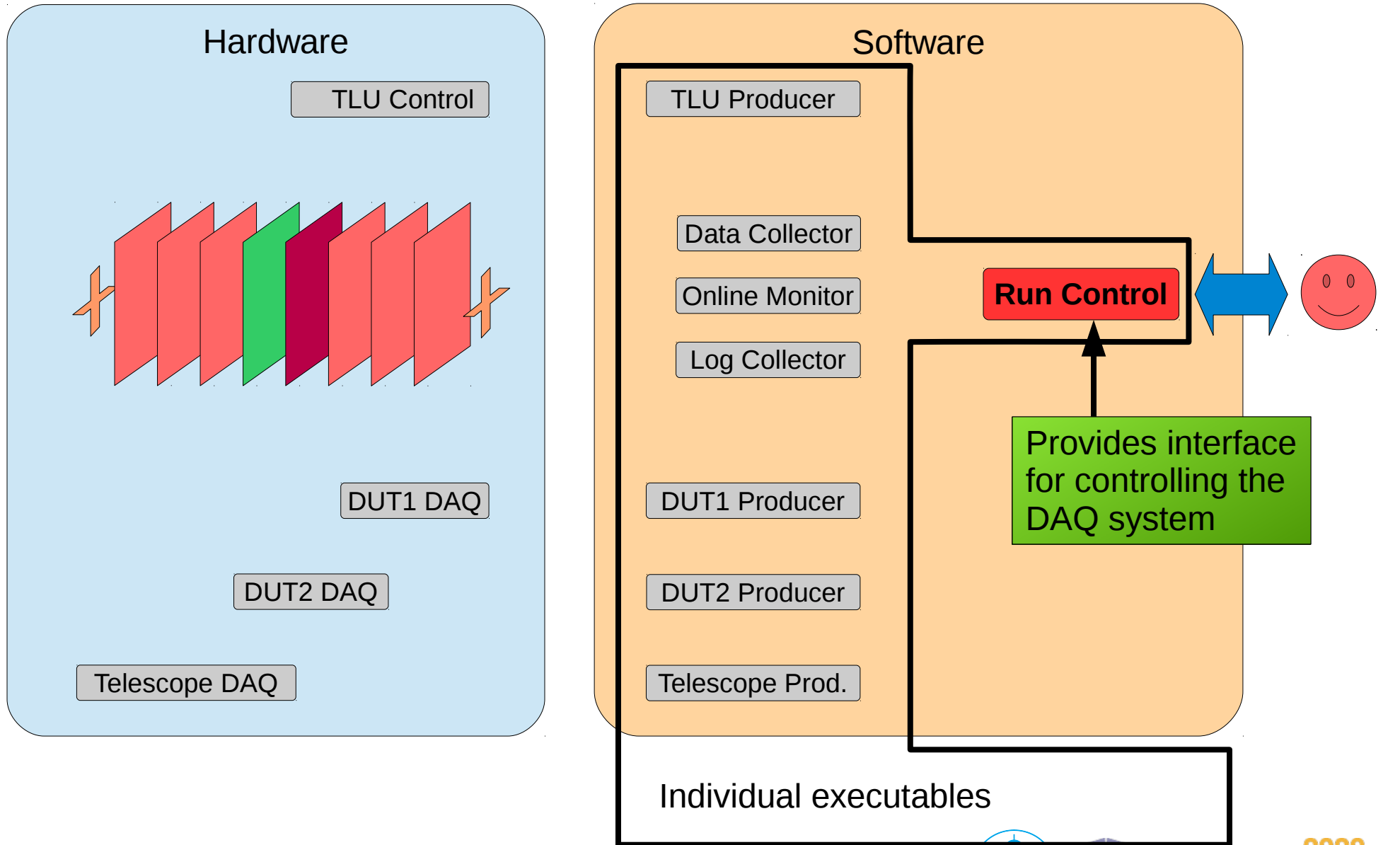 ClickPix (CERN), ...**

- Hardware communication done by sdedqal "producers":
  - e.g. "NiProducer" for the MIMOSA26 sensors via NI Crate

- Used by many groups
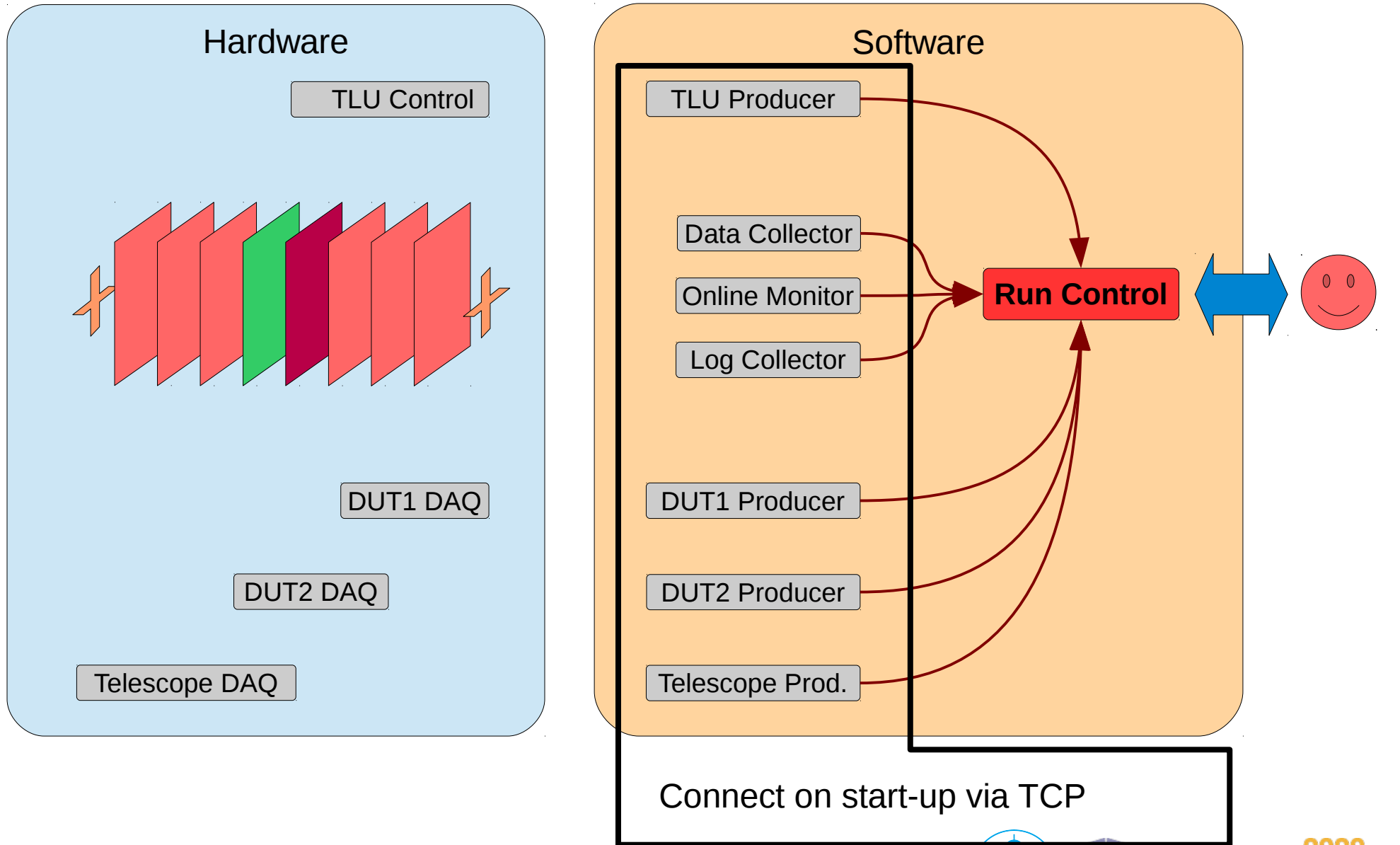
Success story of EUDET/EUDAQ

- "EUDET t'scope + EUDAQ + EUTelescope" answered the increasing demand by the sensor R&D community
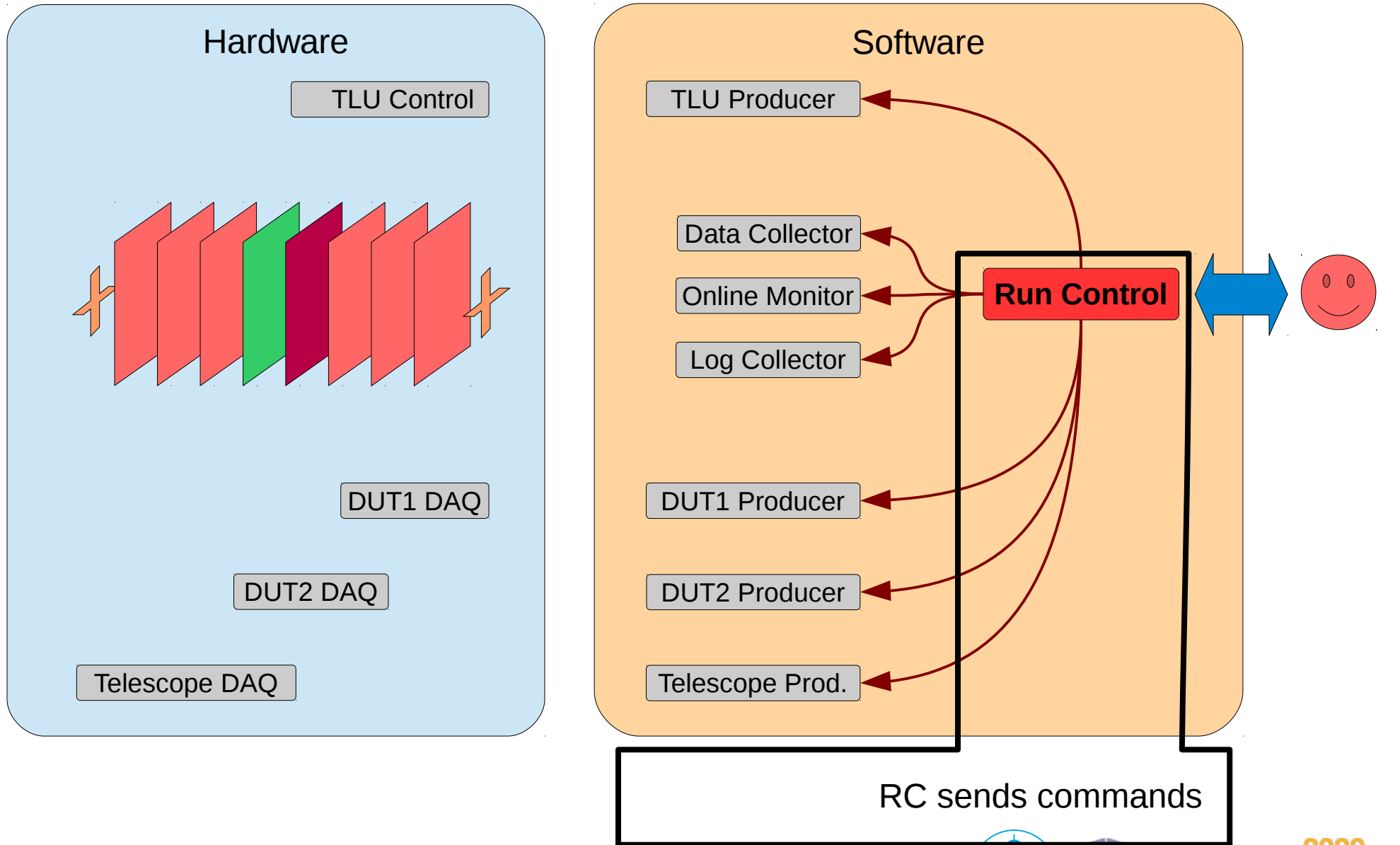
- User stats from 2013 on:
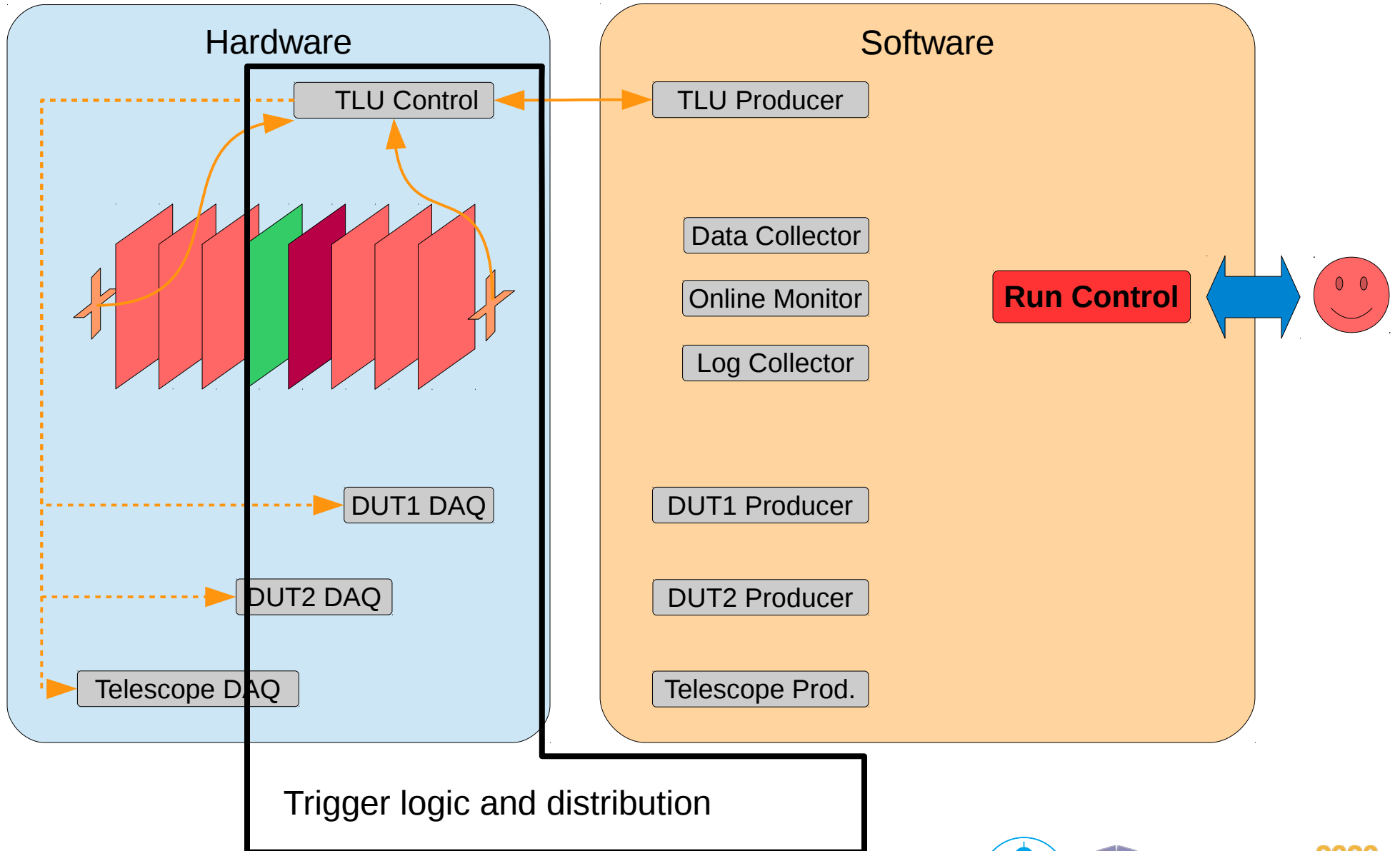
The EUDAQ system architecture

Hardware

TLU Control

DUT1 DAQ

DUT2 DAQ

Telescope DAQ

Software

TLU Producer

Data Collector

Online Monitor

Log Collector

DUT1 Producer

DUT2 Producer

Telescope Prod.

Run Control

Provides interface for controlling the DAQ system
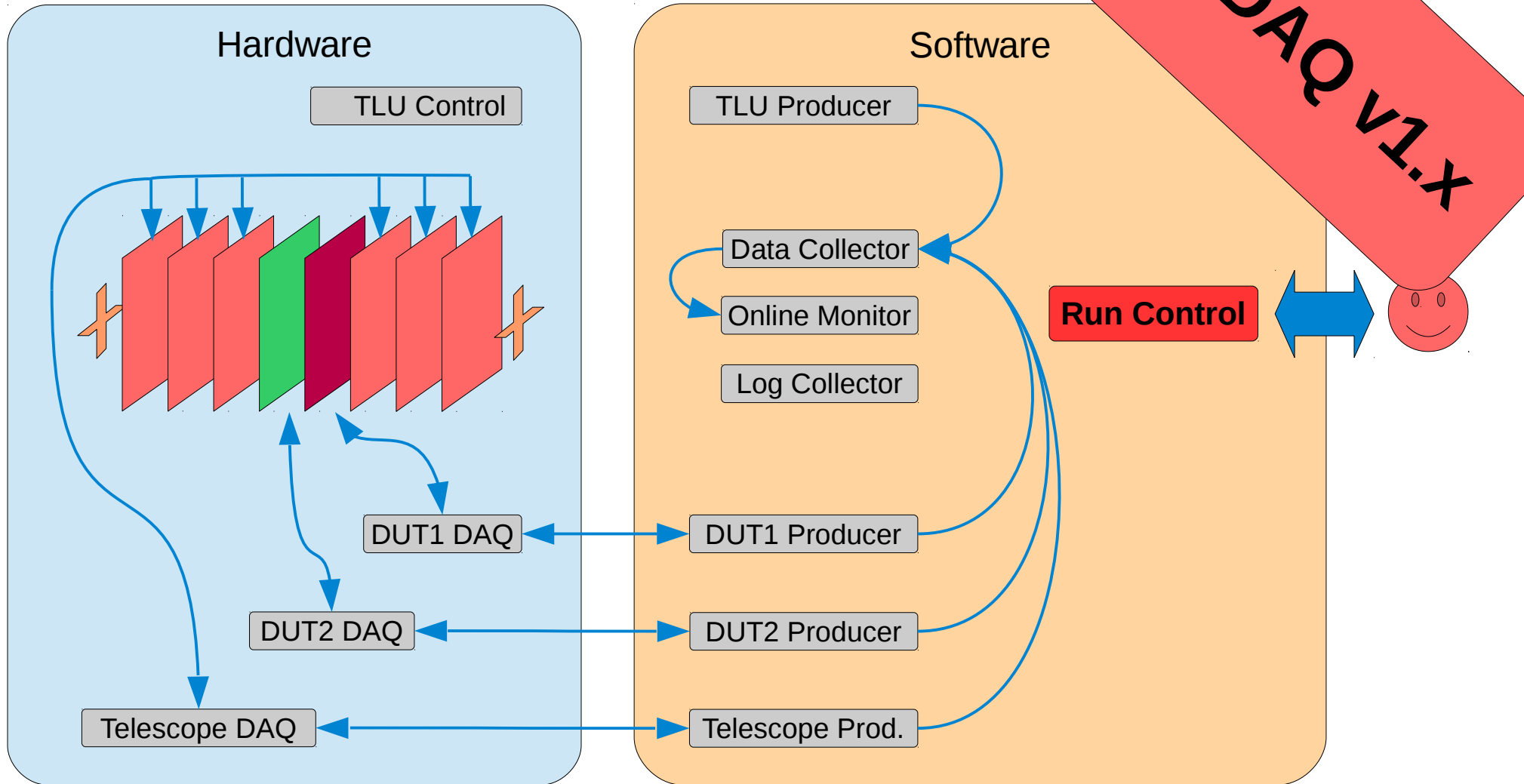
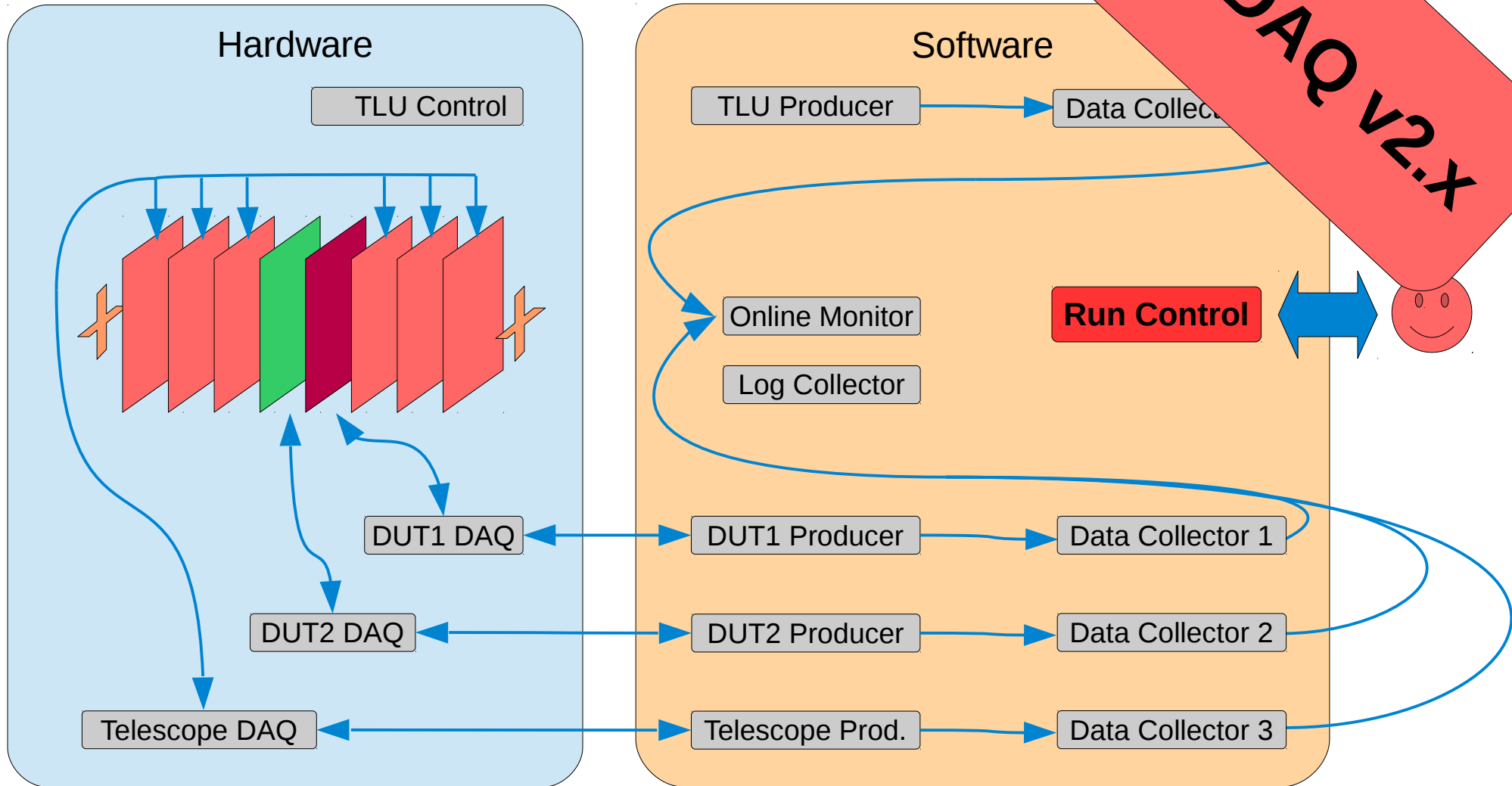Individual executables

Connecting

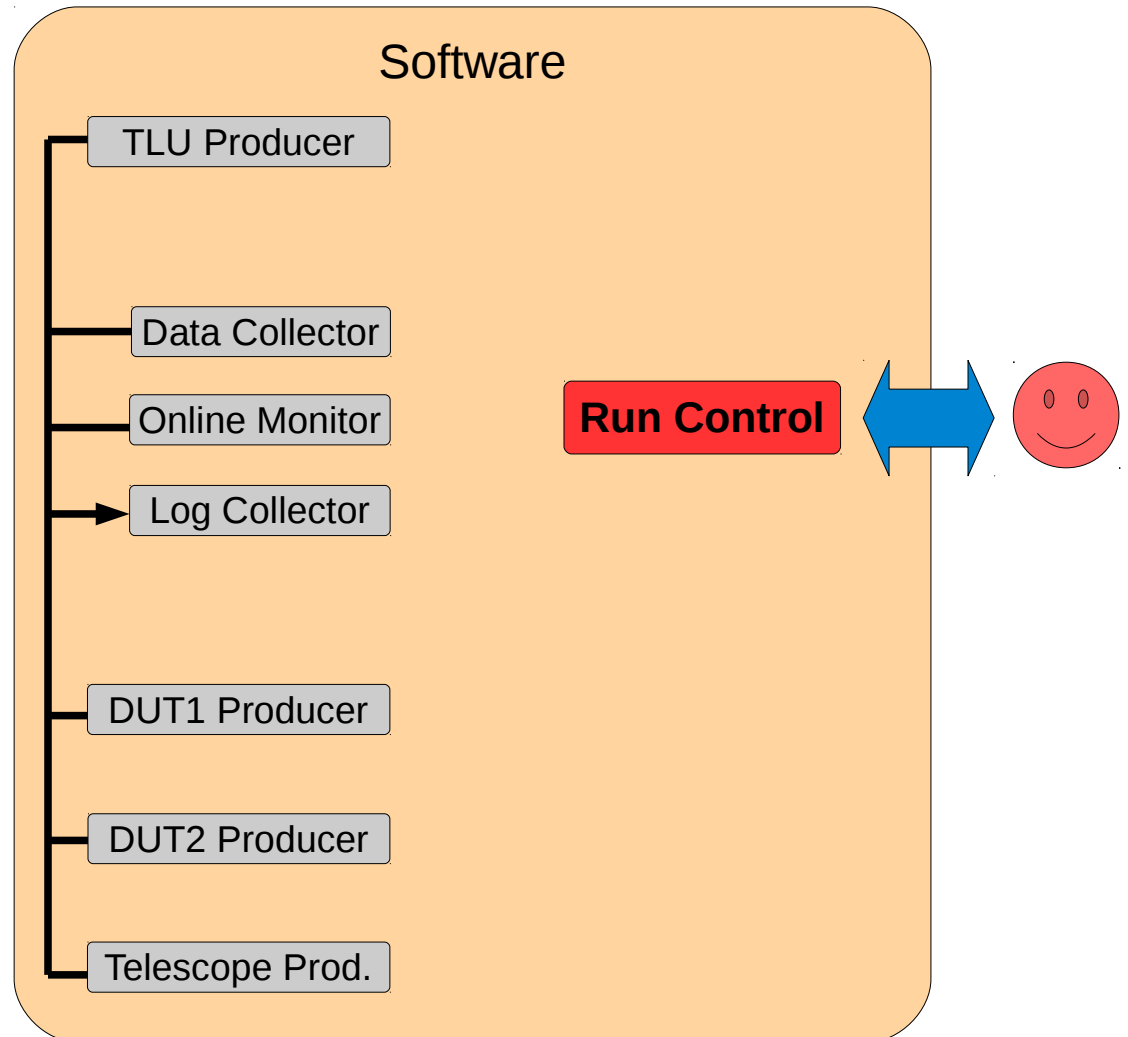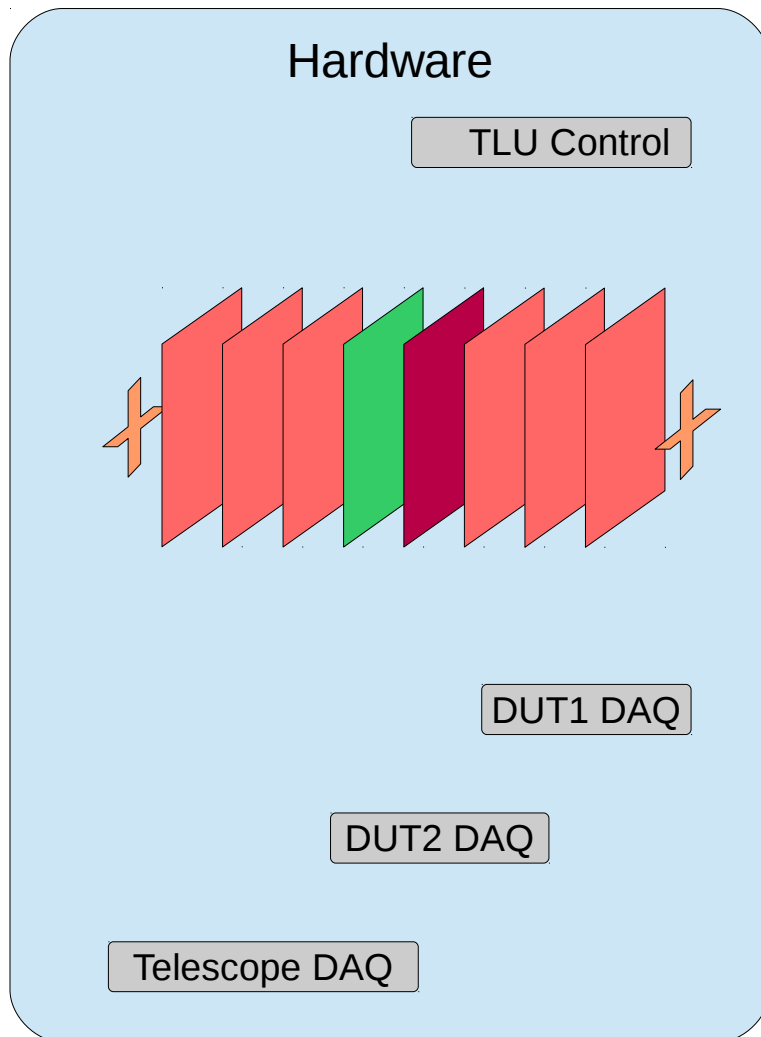# Configuring

Trigger system

Data flow

Data flow

Logger

Data formats and conversion

- Basic EUDAQ event data format: **RawDataEvent**

  - Generic container for unaltered, encapsulated detector response

  - Data input: raw block of memory or vector

  - Storage of additional information possible (custom tags, trigger numbers...)

  - Correct data decoder is chosen by unique identifier string for each producer

- Alternative: **StandardEvent**

  - Decoded detector data in "StandardPlanes"

  - Includes pixel dimensions of the respective detector

  - Can be read by e.g. the Online Monitor for direct processing

- Final analysis in EUTelescope: **LCIO Event**

  - Usually done within EUTelescope

DUT integration into EUDAQ

- ## DUT Producer

    – Talk to the DAQ hardware, receive events from there

    – Receive commands from Run Control:

      OnConfigure(), OnStartRun(), OnStopRun(), Terminate()

    – Send data to the Data Collector (either RawDataEvent or StandardEvent)

    – Configure itself with parameters received before data taking

    – Send log messages to the Log Collector

- ## DUT DataConverterPlugin

    – Convert the specific native detector data into StandardEvents

    – Needed e.g. for online monitoring of the DUT

    – Can be used to convert into LCIO for the final analysis using EUTelescope

Example code showing the usage of the base classes is provided

Plans and wish list

- Add slow control functionality for monitoring/storage of beam energy, temperature, HV settings of the DUT, …

- Use FE-I4 as trigger and track separation plane

- Maintain EUDAQ v1.x (single data stream)

- Finalise/maintain EUDAQ v2.x (parallel data streams)
  - → Only two maintainer left: Richard Peschke, Simon Spannagel
  - → One leaving this year, one next summer
    - → Knowledge transfer needed!
    - → New developers are invited to come to DESY

- EUTelescope accepts pointers to events
  - → no data duplication with PDSs

- Replace TLU by AIDA-TLU
  - → higher trigger rates with PDSs

Summary

- EUDAQ...
  - offers a modular and flexible framework for data acquisition
  - is well documented (see below)
  - was used and supported within EUDET and AIDA, now AIDA2020?

- Both simple and full integration of a DUT and its DAQ possible

- Also usable for detector DAQ w/o EUDET telescopes

- Yearly BTTB workshop at DESY (next: Feb '16)

  BeamTelescopesandTestBeams-Announcements@cern.ch

- We offer to organise a get-together @DESY for new EUDAQ developers with the current experts → knowledge transfer

- GitHub repository: https://github.com/eudaq/eudaq

- Extensive documentation (~60p) available, but needs update