DAQ for LIME: current system and near-future needs

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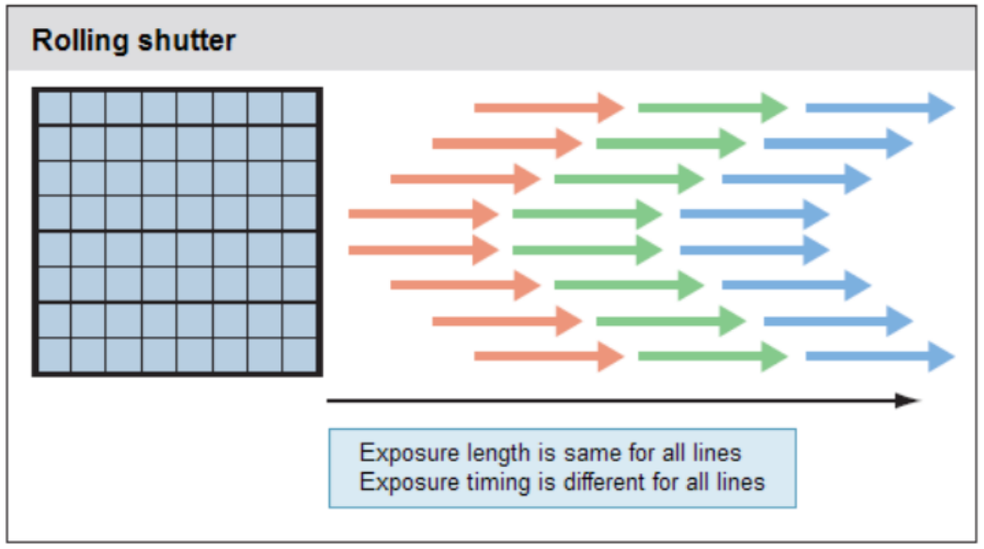
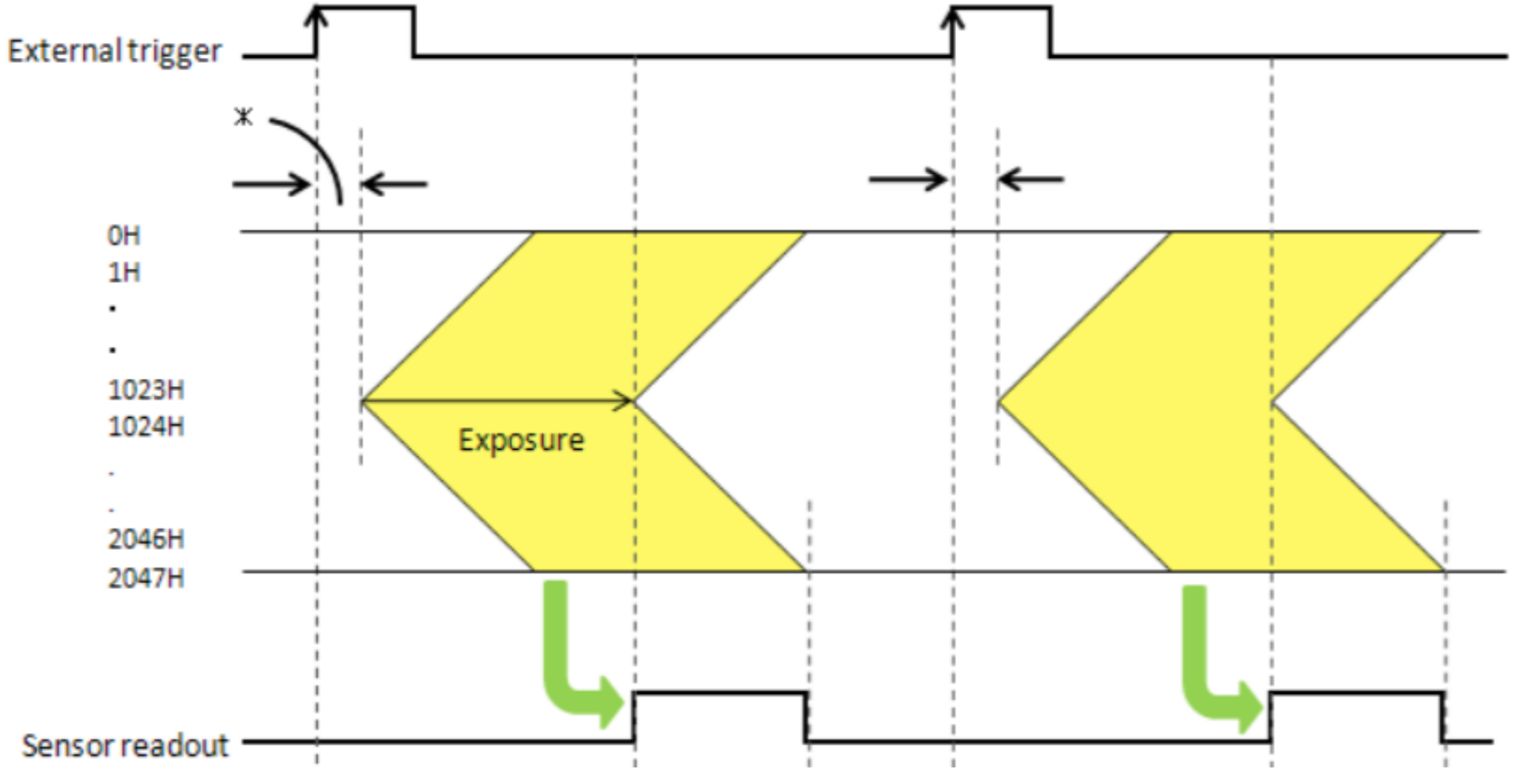
Current status

- We currently have a DAQ system that combines:
  - camera acquisition (USB on PC)
  - PMT digitisation (VME digitiser)
  - Trigger logic (VME discriminators and logic units)
- A MIDAS framework manage the DAQ:
  - Also provides slow control tools

Camera

- An important feature of CMOS cameras is that the exposure of the pixel does not start at the same time for all pixel rows





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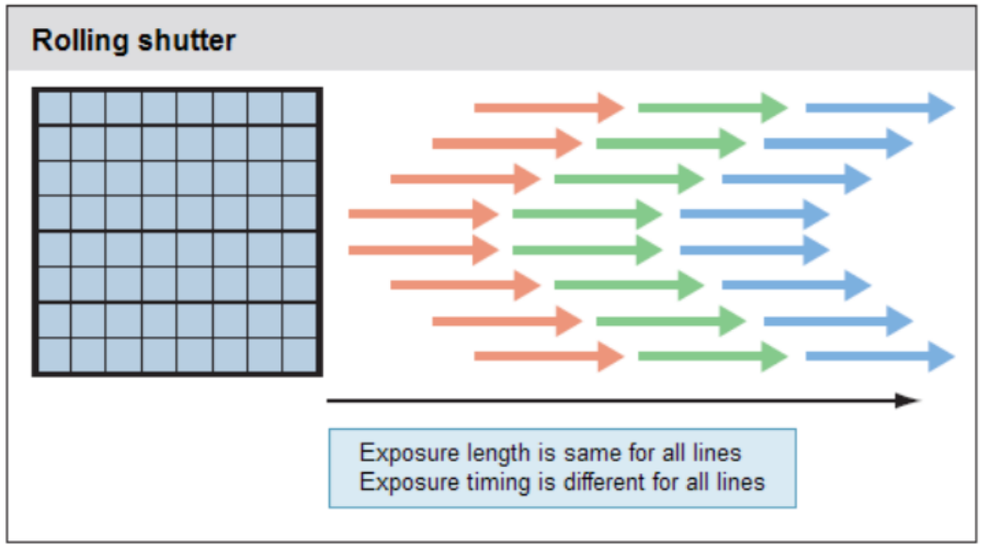
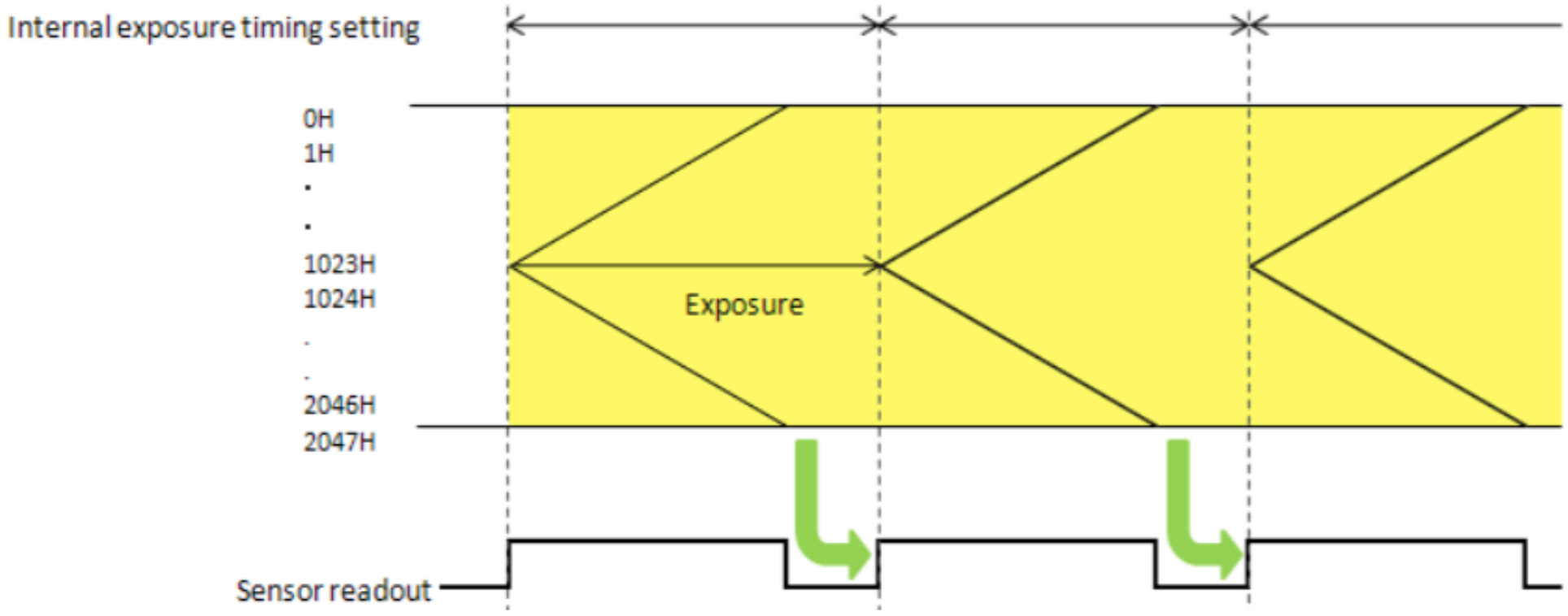
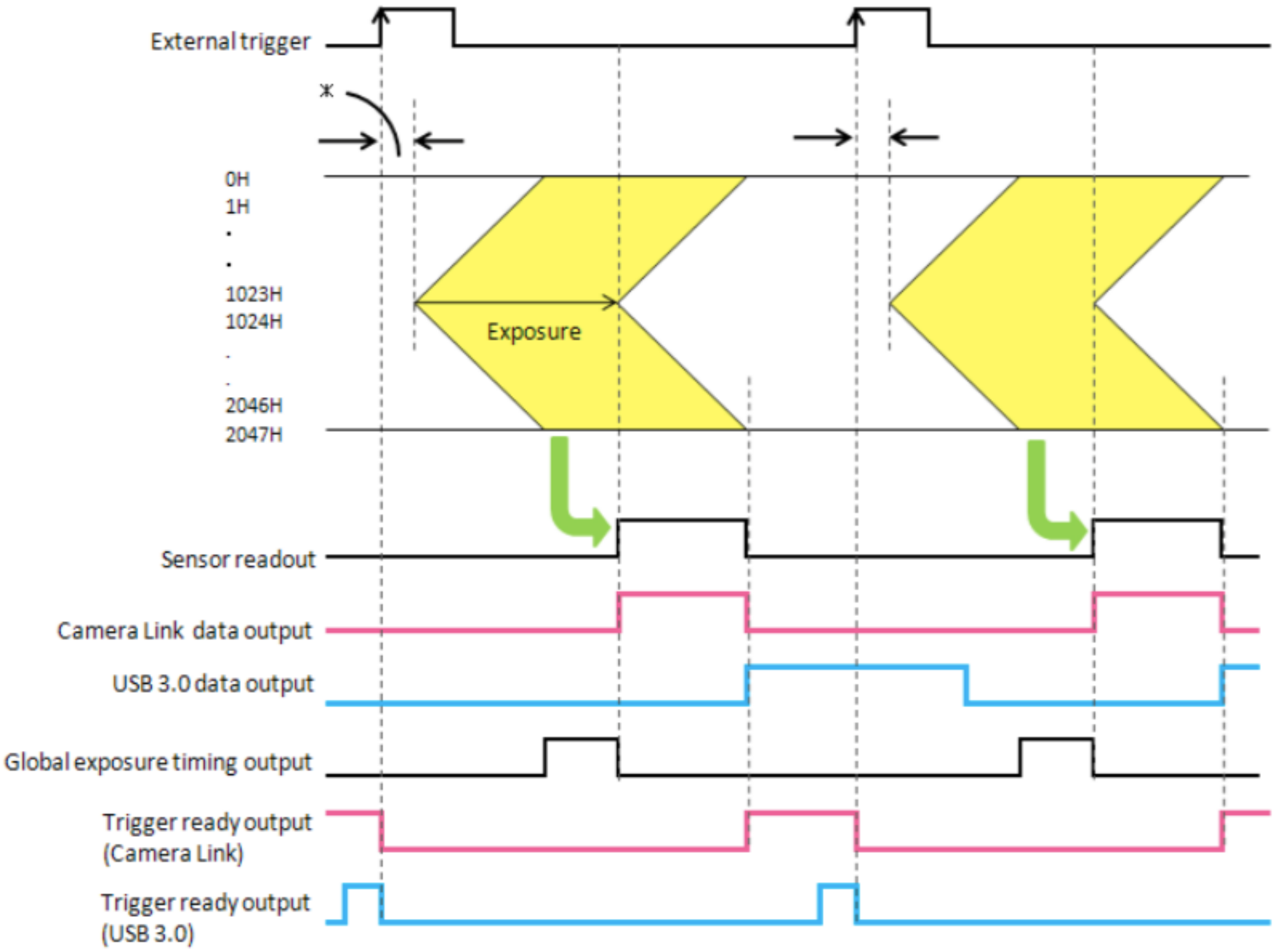




Camera

1H ~ 9.74436 μs —> 1024H ~ 10 ms



Current DAQ sequence

- The camera is triggered on software
- The *global exposure* signal of the camera is used as a gate for triggers coming from the PMTs and directed to the digitiser
    - OR of multiple discriminator channels — different logic can be easily implemented)
- When the camera completed the acquisition of one picture, the digitiser is polled to see if at least one trigger arrived
- If one trigger arrived, the picture and the digitiser's waveforms are stored
    - if the digitiser received multiple triggers, multiple waveforms corresponding to the same picture are stored
    - waveforms are acquired for all PMTs irrespective of what PMT(s) produced the trigger
- The systems are cleared
- The camera is newly triggered on software

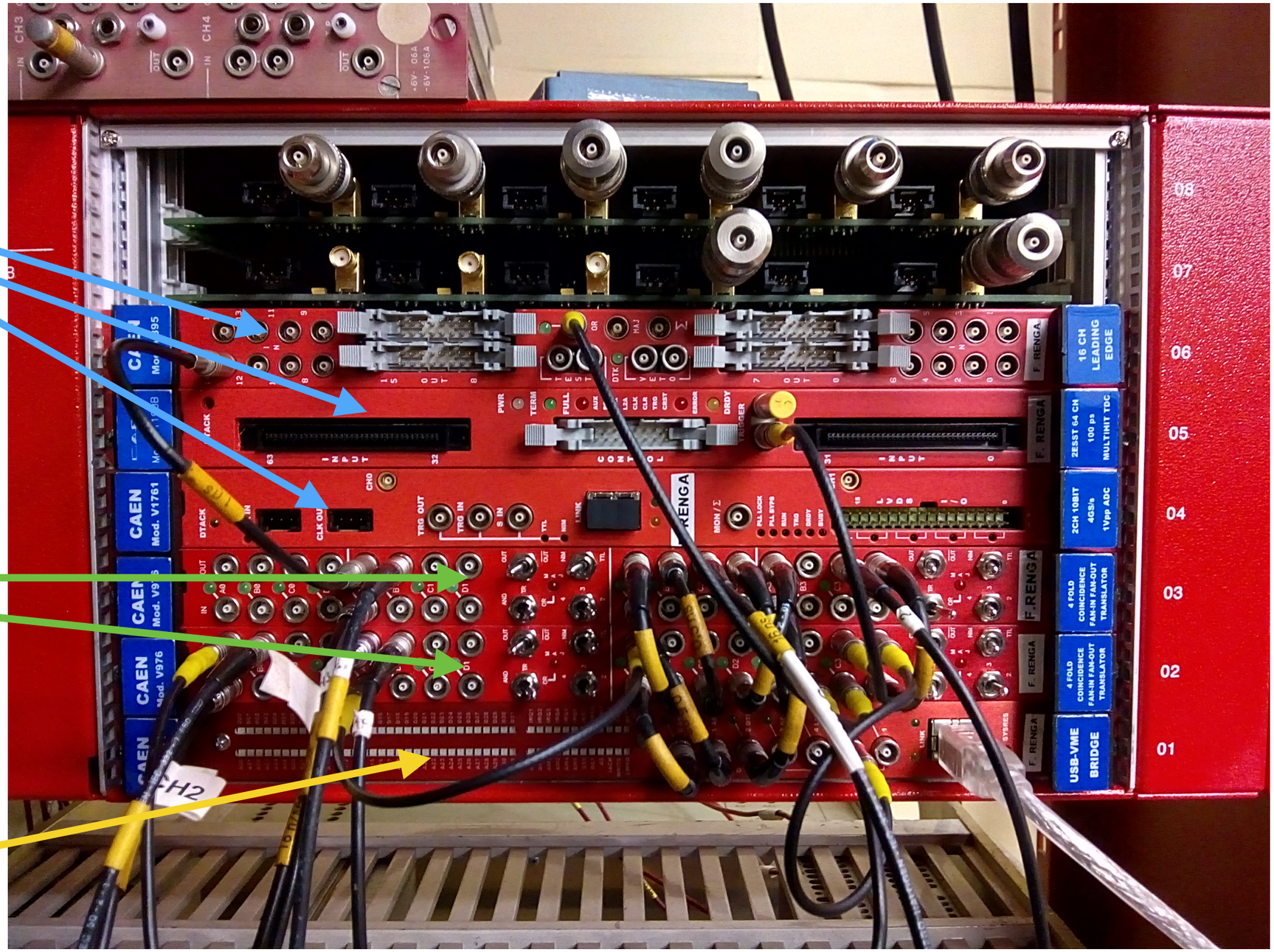
VME + MIDAS implementation

HARDWARE

SIGNAL PROCESSING

LOGIC UNITS (AND, OR, FAN-IN/FAN-OUT, NIM-TTL)

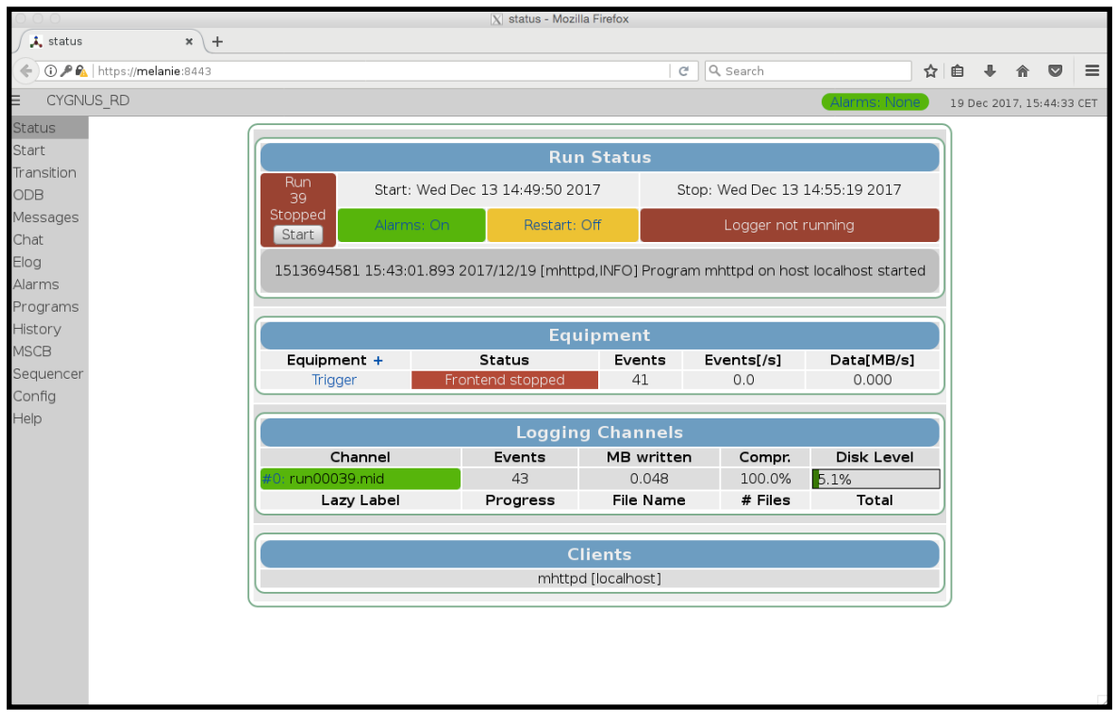
VME BRIDGE (communication, pulser, gate generator, I/O)



VME + MIDAS implementation
SOFTWARE

- A software based on the **MIDAS** framework (C) handles the initialization of the devices and the **DAQ cycle**:

    1. polling
    2. data readout
    3. data writing
    4. device clearing



- Smart **web interface**
- MIDAS also provides **slow control utilities**
- The software can be natively interfaced with the **ROME analysis framework** (C++/ ROOT) for online or offline monitoring, event display and data analysis

Near-future needs

- We should prepare a DAQ system for the acquisition of LIME at LNGS in the late spring/early summer 2021

- The system should be able to:

  - acquire one photo camera (ORCA Fusion)

  - acquire waveforms from up to 4 PMTs

  - implement some simple trigger logic (AND/OR/majority) on PMT discriminated signals in coincidence with the global exposure of the photo camera

  - allow for multiple triggers in the same event.

  - allow the remote selection (no hw intervention) of a trigger logic among a few possibilities