Introduction to a FELIX Based Data AcQuisition (DAQ) and Detector Control System (DCS)

Givoanna Lehmann Miotto, CERN/EP-DT-DI

Introduction

- Kick-off meeting in order to start working on a demonstrator DAQ/DCS system based on FELIX
  - General system introduction
  - The Warm Interface Board
  - The FELIX system
  - Task list for prototype development
  - Discussion
- Aim of this meeting is to
  - Clarify and improve the understanding of what a FELIX system is, and how it can be exploited as a generic DAQ approach
  - Clarify the role of the FELIX within the DCS chain
  - Start subdividing work among interested parties

Our Aims, at Large

- Define a generic DAQ/DCS system in which the use of COTS networks and servers are maximized
  - Focus on hardware / firmware development in the sole areas that require it due to detector specificity
  - Offer a clear pre-implemented interface to integrate the I/O into the detector specific Front End electronics
  - Allow for the possibility to profit from the technological progress and postpone components choice to the time of final purchasing
- The neutrino platform at CERN is an **ideal use-case** to highlight the advantages of such an approach
- ProtoDUNE is a very good candidate to construct a demonstrator
  - Agreed that 1/6 (1 APA) of the single-phase ProtoDUNE detector will be readout (and controlled) with such a system

The FELIX

- The FELIX = Front End LInk eXchange
  - Developed in the framework of the ATLAS upgrade program
  - Bridges data exchange from point-to-point links to switched networks and vice versa
  - Uses the GBT protocol on the point-to-point links
    - GBT implementations to be embedded into the on-detector electronics exist for several FPGAs and the GBTx ASIC chipset
    - From a detector point of view the interface to all external systems can be the FELIX via GBT

REUSABILITY

The FELIX

- The FELIX is the key ingredient that allows a fully PC based distributed DAQ and DCS to be designed and implemented
  - This includes detector control, configuration and monitoring; data readout; clock and trigger distribution; backpressure handling
  - Different detectors may use a sub-set of the offered functionality, depending on the experiment's needs

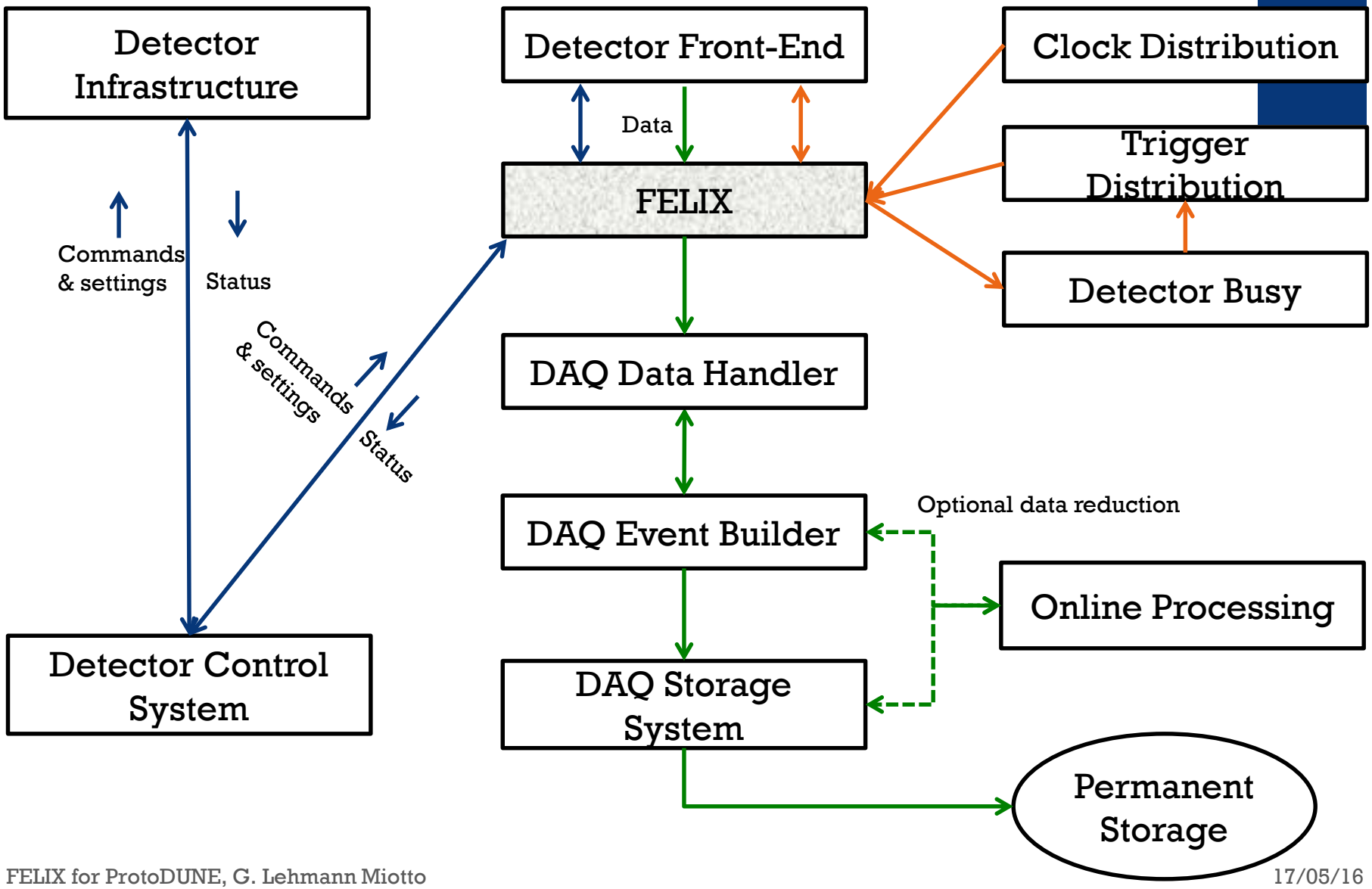
FLEXIBILITY

The FELIX

- The FELIX is inherently modular
  - Number of links to the detector can vary
  - Number of outputs from the FELIX as well as network link speed (and technology) can vary
  - The switched network allows to dimension the DAQ/DCS according to the experiment's needs

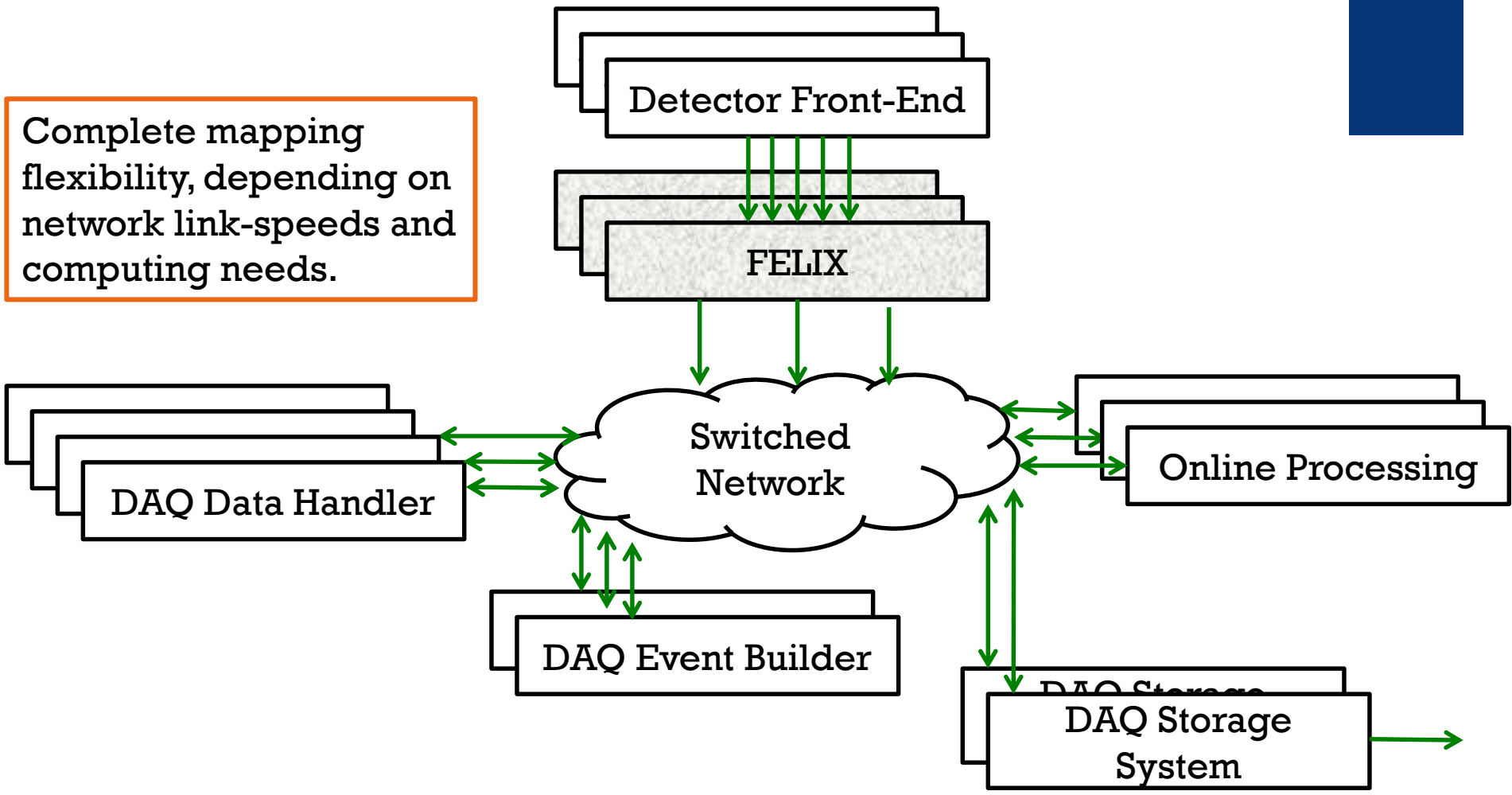
SCALABILITY

Functional Architecture

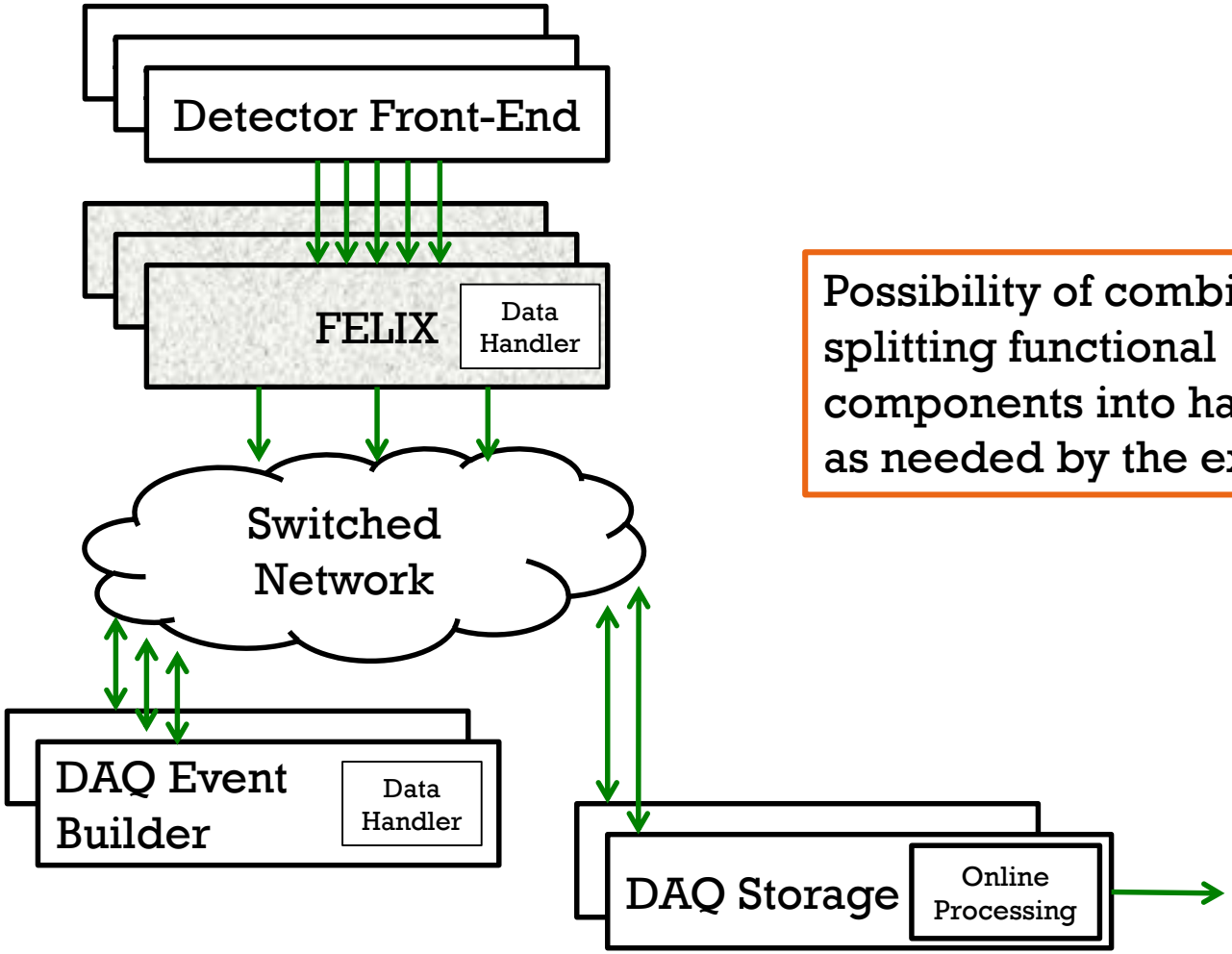


DAQ (1)

Complete mapping flexibility, depending on network link-speeds and computing needs.

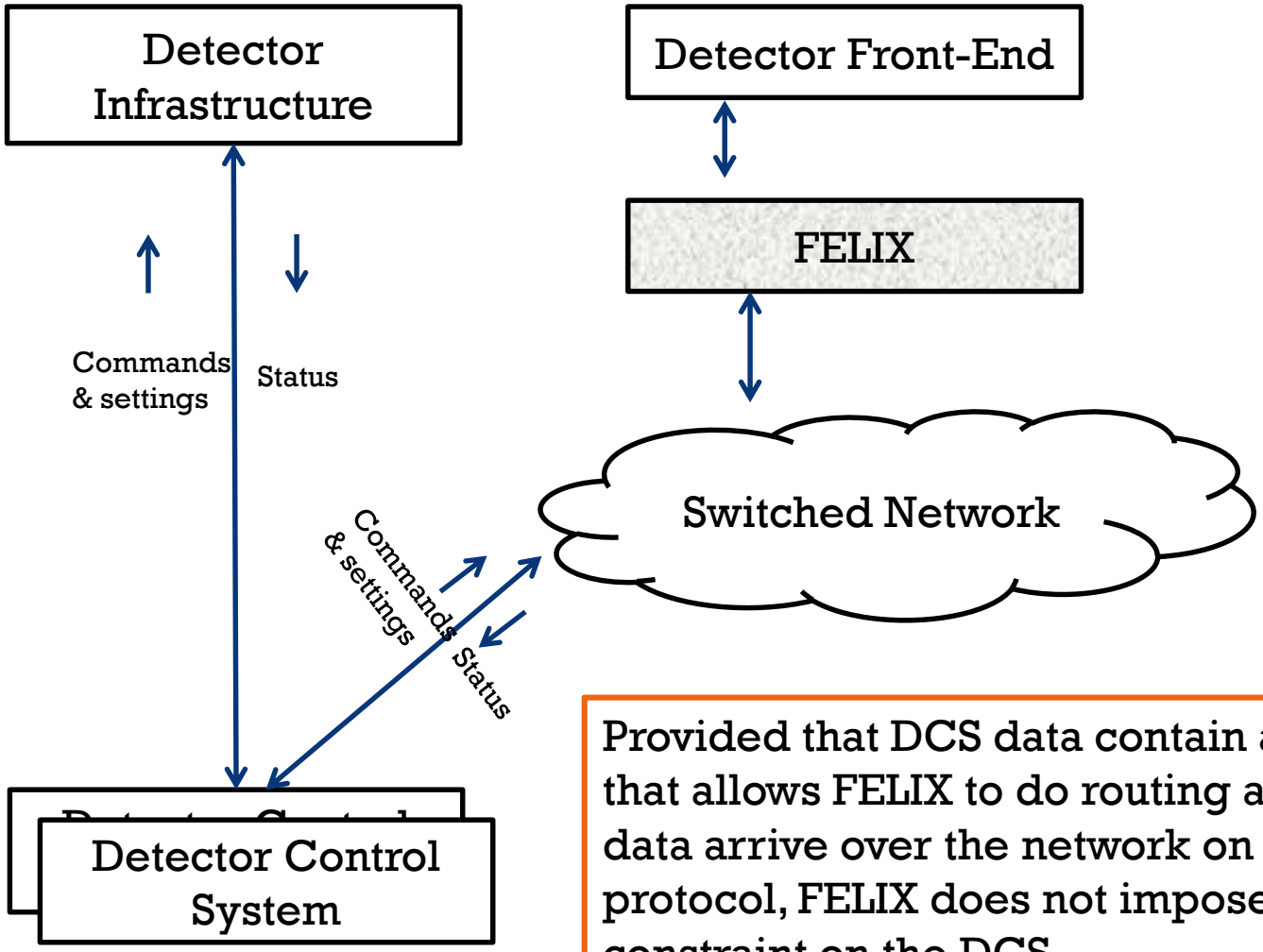


DAQ (2)



Possibility of combining or splitting functional components into hardware, as needed by the experiment.

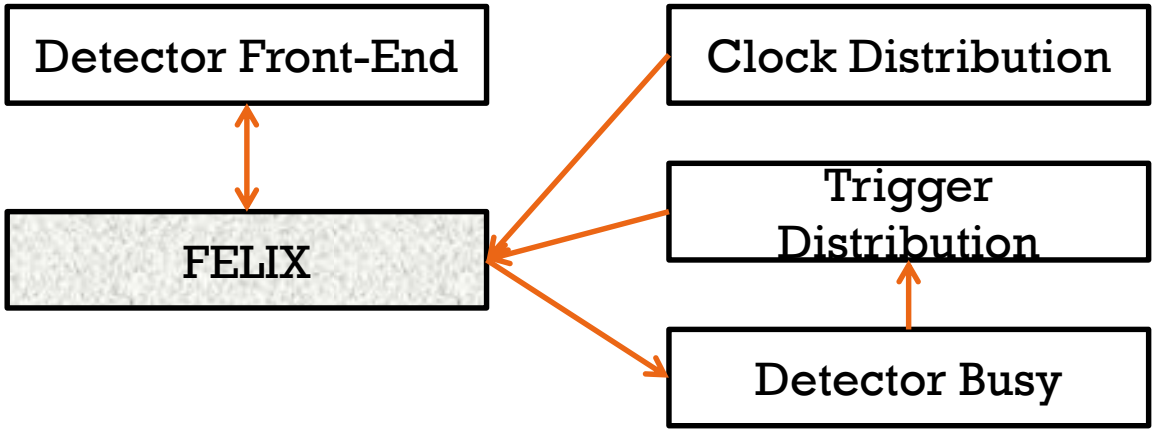
DCS



Provided that DCS data contain a header that allows FELIX to do routing and that data arrive over the network on an agreed protocol, FELIX does not impose any constraint on the DCS.

Clock and Trigger Distribution

- FELIX can be used as clock and trigger distribution system
  - Presently TTC (LHC experiments) supported
  - Interest to provide an interface to White Rabbit
  - Other systems may be included, if resources available and technically feasible
- Waiting for a decision on what ProtoDUNE decides to use



System for ProtoDUNE

- Detector Front-End is the so-called Warm Interface Board (WIB)
- Successful introduction of a FELIX based system strongly depends on good interaction with WIB developers
  - Agree on which functionalities can be tested on which timescales
  - Support early integration testing
  - Priority given initially to the readout path
- Remain compatible with artDAQ event builder, as used by the RCE based readout system
- Propose to carry out a first proof of principle keeping FELIX system as a "black-box"
  - Allow for parallel development and integration of different DAQ components

Summary

- Wish to develop a DAQ/DCS system with a single physical interface and protocol towards detector front-end and all other elements based on COTS networks, servers and software
- ProtoDUNE is an excellent use-case to prove the advantages of such an approach
- Solution for ProtoDUNE integrates with the WIB on one side and the common event builder and DCS on the other side
  - Other sw frameworks may be tried out in the course of development
- Next presentations:
  - Introduction to the WIB
  - Description of the FELIX
  - Tasks list and discussion

Subscribe to protodune-felix@cern.ch using egroups.cern.ch or send me an e-mail.