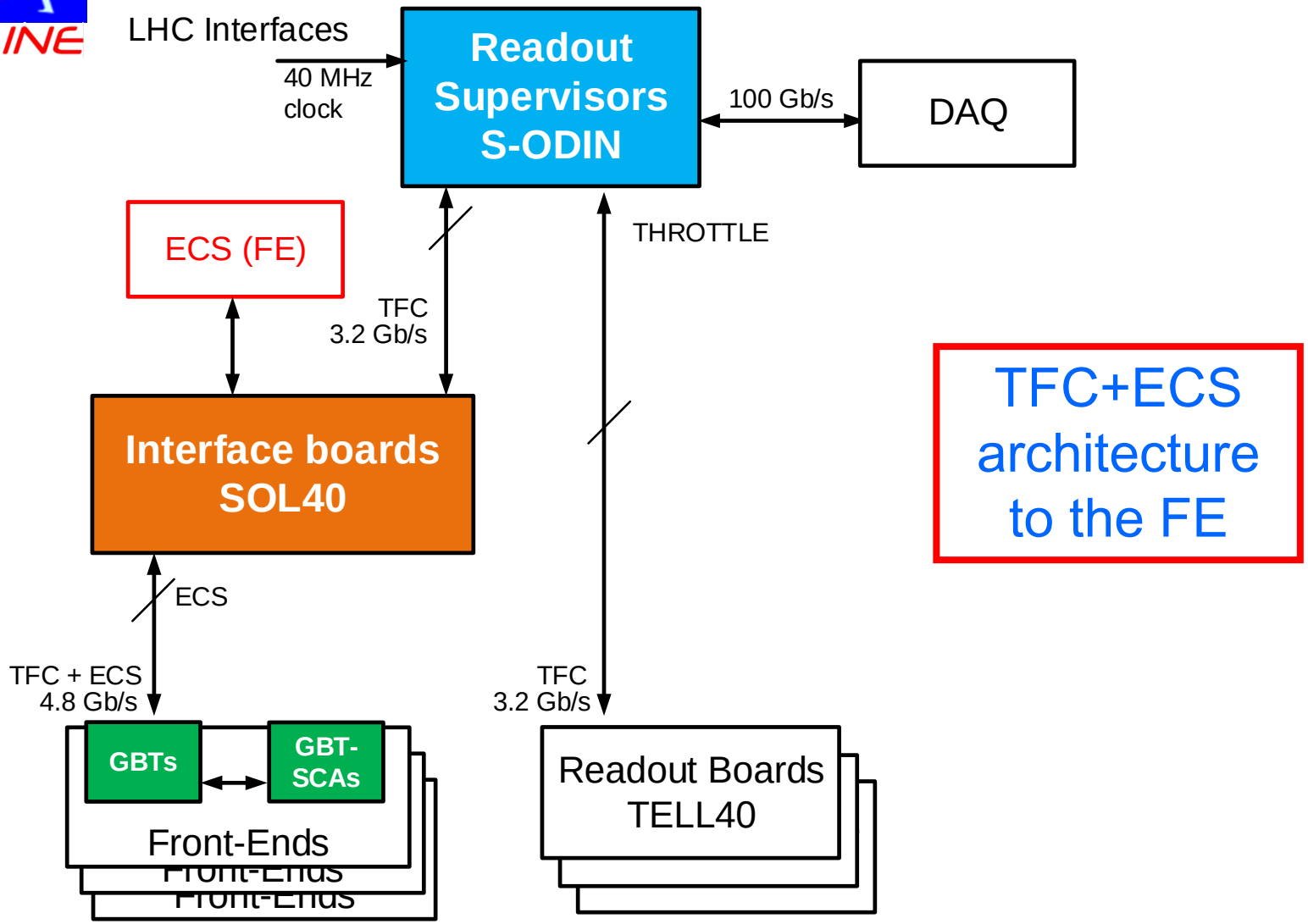
Developments for Front-End ECS

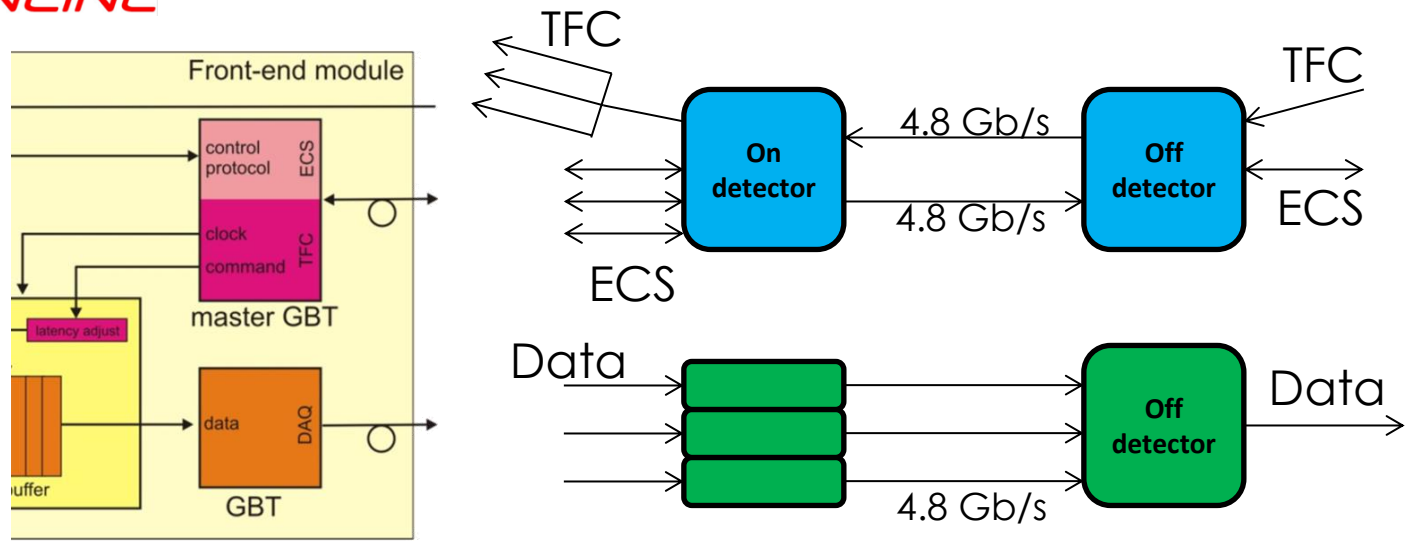
F. Alessio, C.Gaspar
(on behalf of all the people contributing to this)

LHCb Upgrade Electronics meeting
09-04-2015

Reminder: generic architecture



Reminder: Fast & Slow control to FE



Separate links between controls and data

- A lot of data to collect
- Controls can be fanned-out (especially fast control)

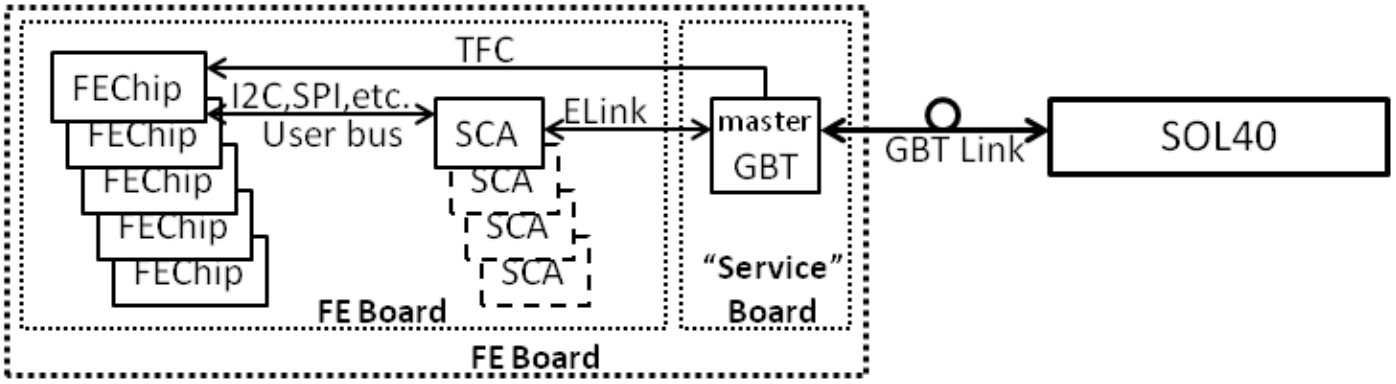
Compact links merging Timing, Fast and Clock (TFC) and Slow Control (ECS).

- Extensive use of GBT as Master GBT to drive Data GBT (especially for clock)
- Extensive use of GBT-SCA for FE configuration and monitoring

Main features

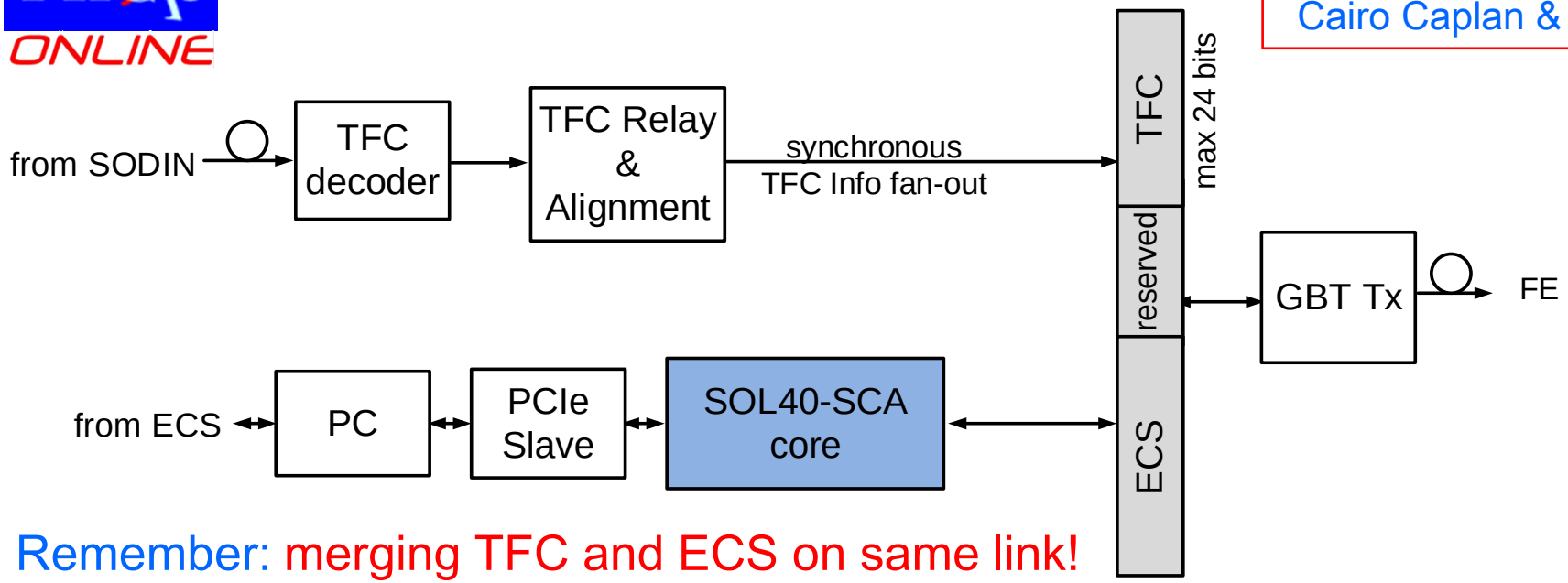
One (or more) SOL40 is used to control a slice of your FE:

- Propagate TFC information to the FE
  - Not covered here, see https://cds.cern.ch/record/1491666?ln=en
- Propagate ECS information to the FE
  - Configure/control Master GBTX
  - Configure/control Slave GBTXs
  - Configure/control GBT-SCAs
  - Configure/control FE chips
- Receive back ECS information from the FE
  - From all devices at the FE, return path
- Control all of this from WinCC, as usual
  - Within global LHCb ECS



Current developments: SOL40 firmware

Cairo Caplan & FA



Remember: merging TFC and ECS on same link!

→ SOL40 firmware will take care of doing all the complicated bit manipulations needed to control a GBT, its SCAs and your FE chipsets

- Responsible to generate right matrix of TFC commands to FE
- Responsible to delay TFC commands per partition/cluster of FE
- Single firmware for everybody with all necessary features and requirements → minimize unconformities, highly programmable
- Centrally provided

Current status: backbone ready, TFC part done, delays ready.

Current developments: SOL40-SCA core

It's a firmware core inside the SOL40 firmware which is responsible to:

- control the Master GBT and Slave GBTs at the FE
  - 1 Master GBT per link
  - Slave GBTs via I2C bus from Master GBT

- control all GBT-SCAs associated to that Master GBT
  - Up to 16(+1) GBT-SCAs per GBT link
  - Serialize/Deserialize with proper encoders (HDLC)
  - Targeting 36 GBTs to start with
  - Generic, no need to create specific commands at the ECS

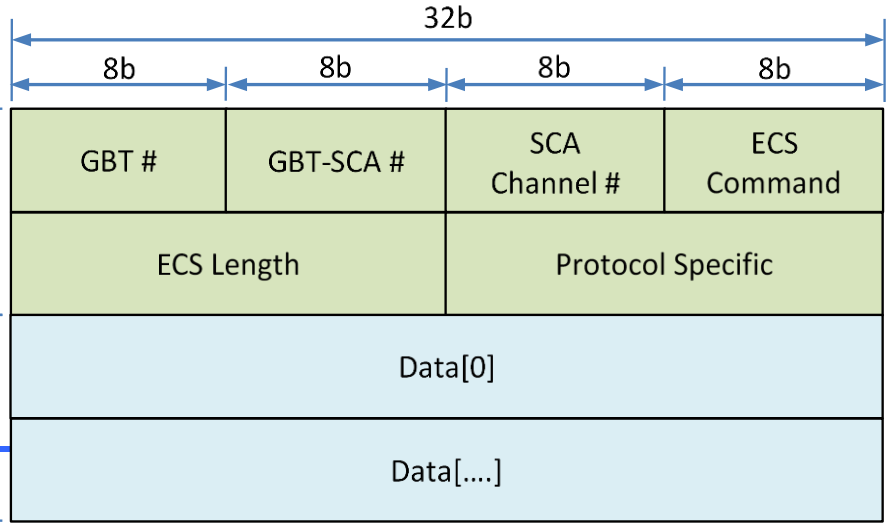
- control all the FE chips associated to those GBT-SCAs
  - Support for all GBT-SCAs buses in a programmable way

For more details, see Cairo's presentation at Electronics Meeting in October
https://indico.cern.ch/event/291724/contribution/2/material/slides/0.pdf

Current developments: SOL40-SCA core

Current status:

- Backbone core ready → aim at fully qualifying it by summer
  - Included the part to control the Master GBTx
    - Under test in these weeks with (real) GBT and Mini-DAQ
  - First full I2C chain implemented
    - Will be tested soon in April by Cairo and GBT-SCA team with (real) GBT-SCA and Mini-DAQ
  - To do:
    - generic matrix to assign GBT-SCA to pair of bits
    - to add the other SCA protocols
    - retransmission of packets
    - checking of transmitted packets
  - Compilation done and looks quite good
    - 48% of Stratix V for 8 GBTs and 16 GBT-SCA/GBT
  - Defined a first draft of generic interface to the ECS:
    - Generic ECS command with all necessary info for the core

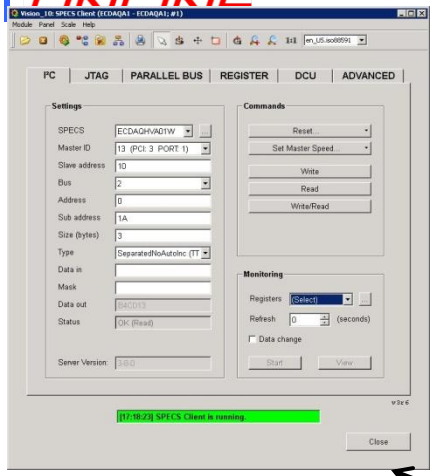


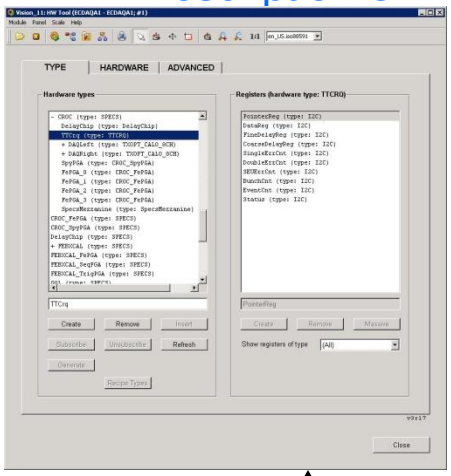
Current developments: software

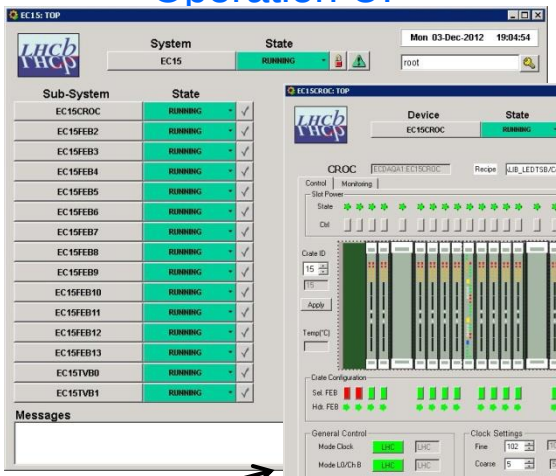
Clara, Luis, Pierre-Yves

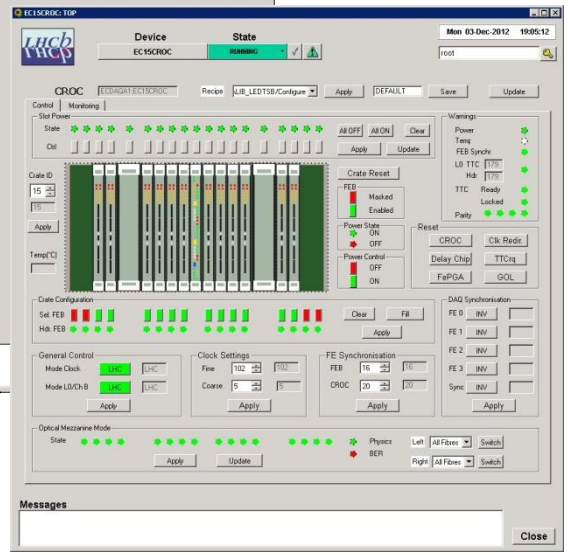
HW Description UI

Operation UI

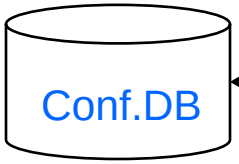


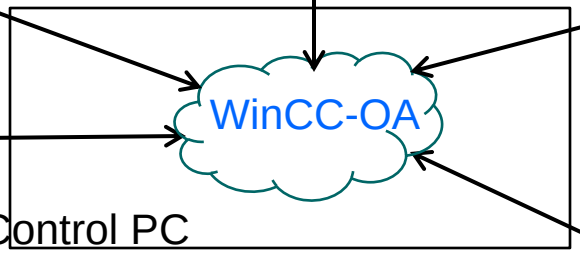


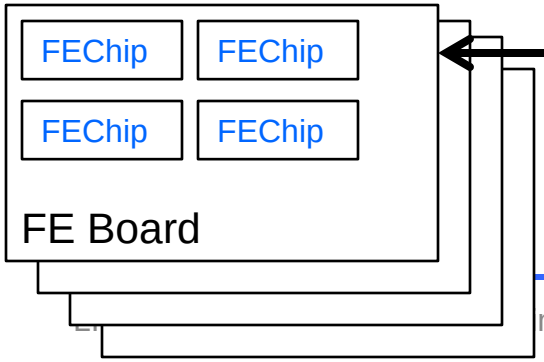




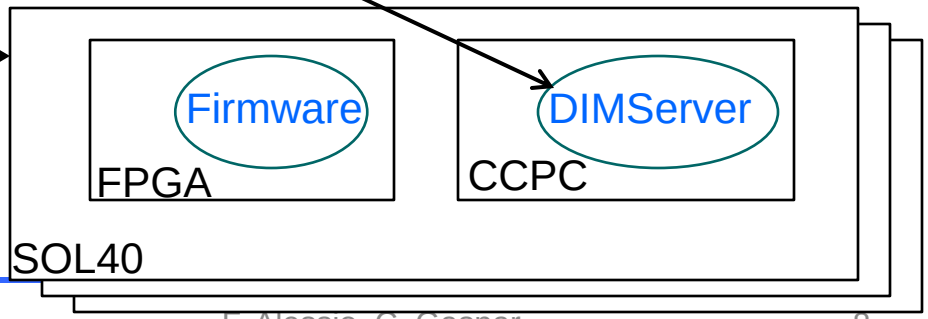
Test UI







GBT Link



Current developments: software

- Will be centrally provided
  - Low-level libraries and command-line tools for the PC of the SOL40
    - Will allow accessing the different FE chips
  - A DIM server running on the SOL40 PC
    - Will implement higher-level commands to configure and monitor the FE
  - A WinCC-OA component(s)
    - Providing the high-level description and access of all electronics components

Conclusions

- Developments for sub-detector Front-End are ongoing together with global software for Mini-DAQ and PCIe40
  - Time wise software will move in parallel with firmware over the summer
    - As soon as we have a qualified part of the firmware we'll start working on the software
  - Most of the tools are (basically) already there
    - Needs adaptations from current LHCb ECS, but know-how is there
    - Always very quick response
  - Sub-detectors are very much encouraged to come to any of us to discuss implementations, solutions, examples etc.
    - Even better if you have something as realistic as possible
    - Even better if you can test something with us during or after the summer

→ Note from the Wise Man: please, try to follow the specs as much as possible… unconformities are a pain to handle… ☺