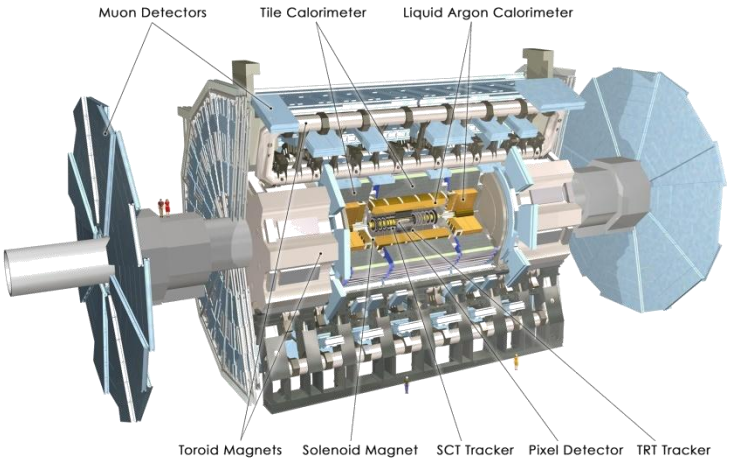


Detector status and upgrades

A. Gomes

(LIP and FCUL)

Phase 0

ATLAS detector upgrade plan

LS1 → PHASE 0 $\mathscr{L} = 10^{34}cm^{-2}s^{-1}$ $<\mu>=24$ 100 fb^{-1} (2014-2017)	LS2 → PHASE 1 $\mathscr{L} = 2x10^{34}cm^{-2}s^{-1}$ $<\mu>=50$ 350 fb^{-1} (2019-2021)	LS3 → PHASE 2 $\mathscr{L} = 5x10^{34}cm^{-2}s^{-1}$ $<\mu>=140$ 3000 fb^{-1} (2023-2030)
• Installation of the 4th Pixel Detector Layer (IBL) • Pixel Detector improvements • Topological L1 triggers • Silicon tracker cooling system replacement • Muon Endcap Extension chambers completion  • **Tile laser system** • **Tile D in L1 muon trigger** • **Tile DCS** In Progress…	• New Muon Small Wheel detector • Upgrade of the central L1 trigger processor • L1 Calo granularity increase  • **AFP detector** • **HLT jet trigger** • **Tile gap/crack scintillators** • **Tile DCS**	• New "All Silicon" tracker • New L0-L1 trigger schema • Inclusion of track info at L1 • Upgrade of the calorimeter readout • Upgrade of the muon spectrometer  • **Tile HV distributor system** • **Tile DCS**

Phase 0

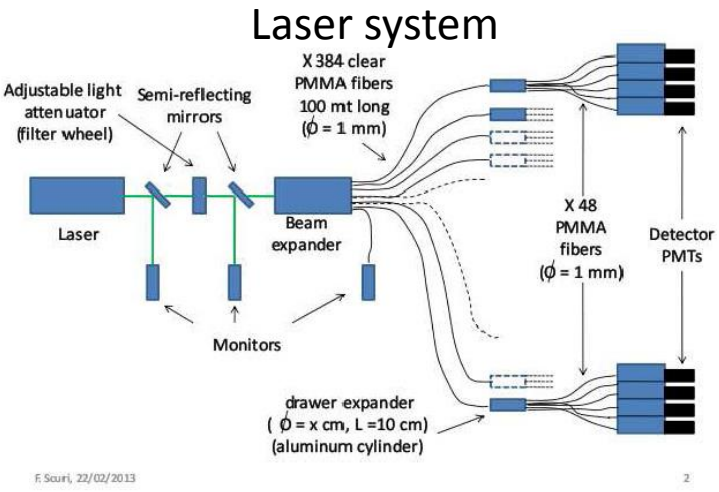
Tile calorimeter laser system

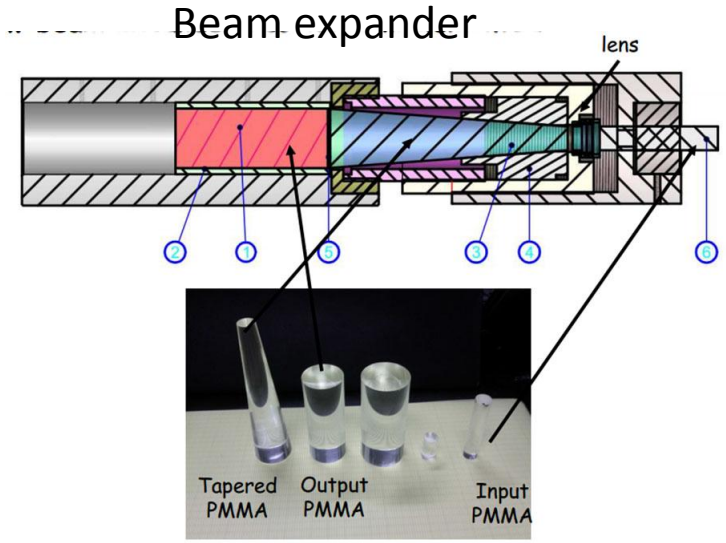
- Poor stability performance of the laser monitoring system in 2012
- Problems at the beam expander and light mixing identified. Diffusers installed inside beam expander
- Internal lenses and mixers modified
- PMMA guides inside beam expander improved light transmission (x2.8). Stability at level of 1%.

After implementation of new beam expander geometry, production for the laser system was done.

New optics box also in production.

A second set of laser system foreseen for the surface lab at CERN.

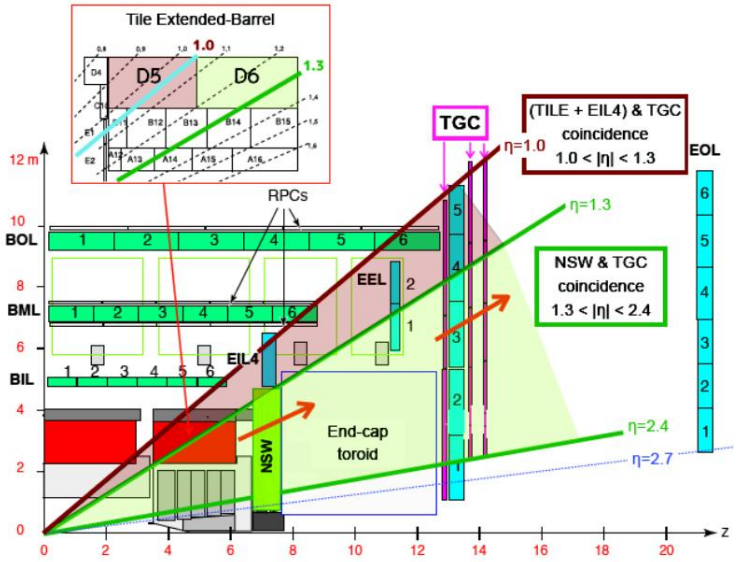


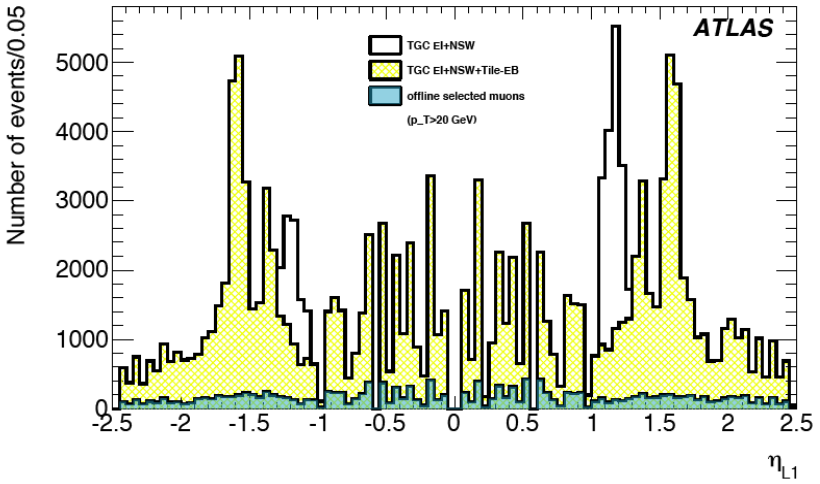


Phase 0

Tile-D project (L1 muon trigger)

- Inclusion of the Tile calorimeter in the trigger decision of L1 muon (EIL4 + TGC + Tile)
- Fake triggers produced by low momentum protons emerging from the toroid endcap magnets and beam shielding
- Increase the trigger rejection of fake muon triggers in $1.0<|\eta|<1.3$, from 51kHz to 32kHz, for $pT>20GeV@3x10^{34}cm^{-2}s^{-1}$
- New Small Wheel will reduce to 15kHz in 2018





Phase 0

Tile-D project (L1 muon trigger)

- Uses the D-layer of the Tile calorimeter, cells D5 and D6
- Part of the infrastructure in place: trigger cables with analog PMT signals installed since the beginning
- Dedicated electronics for digitization, reconstruction, etc in progress
- Simulation, DAQ and monitoring software in progress

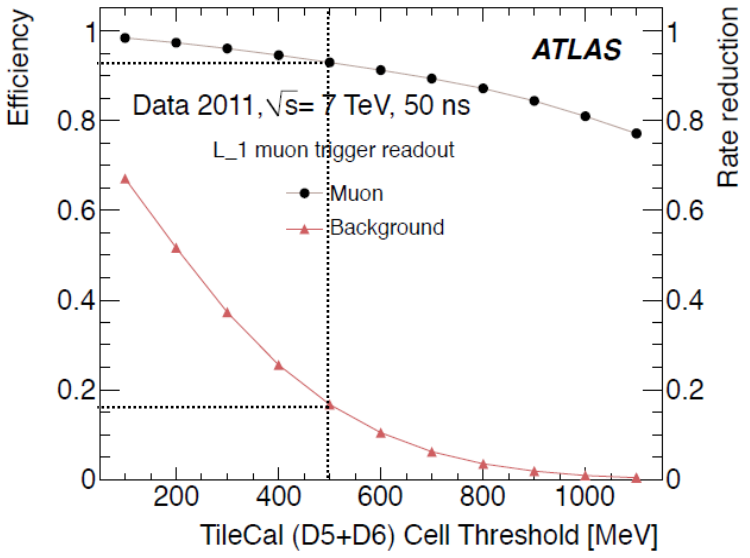
Contributions for:

•Simulation

•Tests

•Firmware

•Eventually assembly of boards



Phase 0 Phase 1

HLT Jet trigger

High Level Trigger changes motivated by

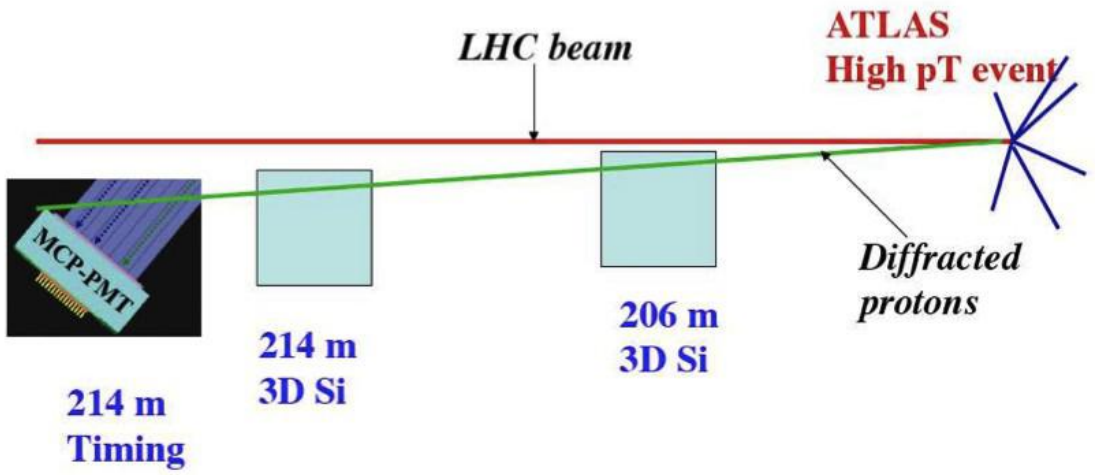
- New technologies (many-core processors)
- Improved L1 $\Rightarrow$ HLT closer to offline
- Larger pile-up $\Rightarrow$ develop better algorithms

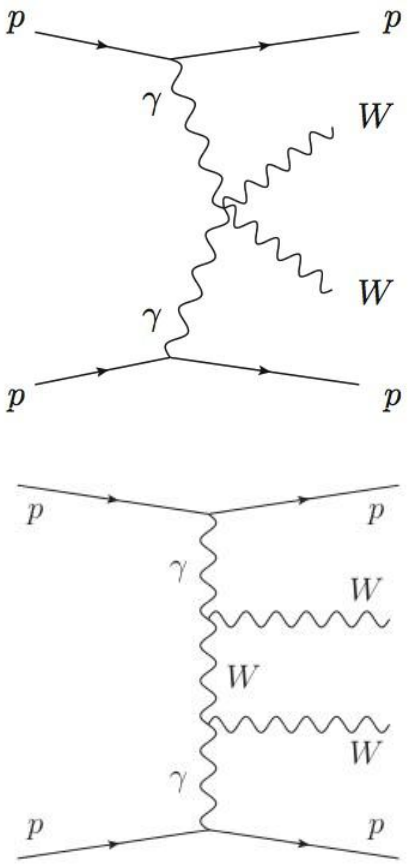
We will contribute to:

- Speed up the jet trigger algorithms
- Trigger menu reorganization and optimization for phase 1 conditions
- Optimization of the jet trigger chain structure in the new architecture of the HLT processing unit
- Test of new technologies based on GPU or new multicore processors and parallelization of the jet algorithms

Phase 0 Phase 1

ATLAS Forward Proton (AFP)





- Tag and measure protons at +/-210m
- Radiation hard edgeless 3D Silicon detectors
- 10 ps timing detectors

Allow running in high pile-up conditions

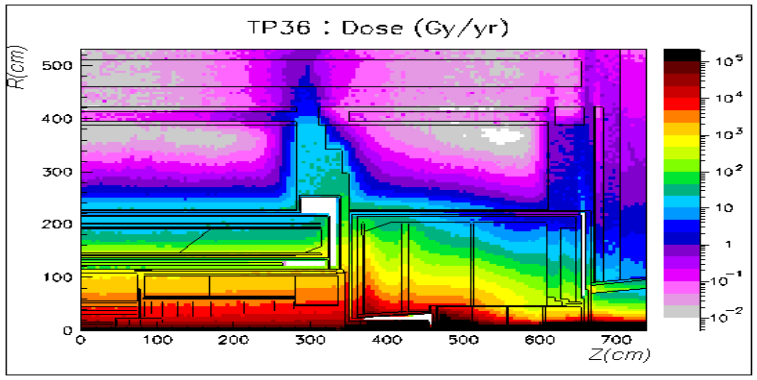
Associate protons with correct primary vertex

- Contributing on the design of the AFP Trigger
- HLT strategy

Phase 1

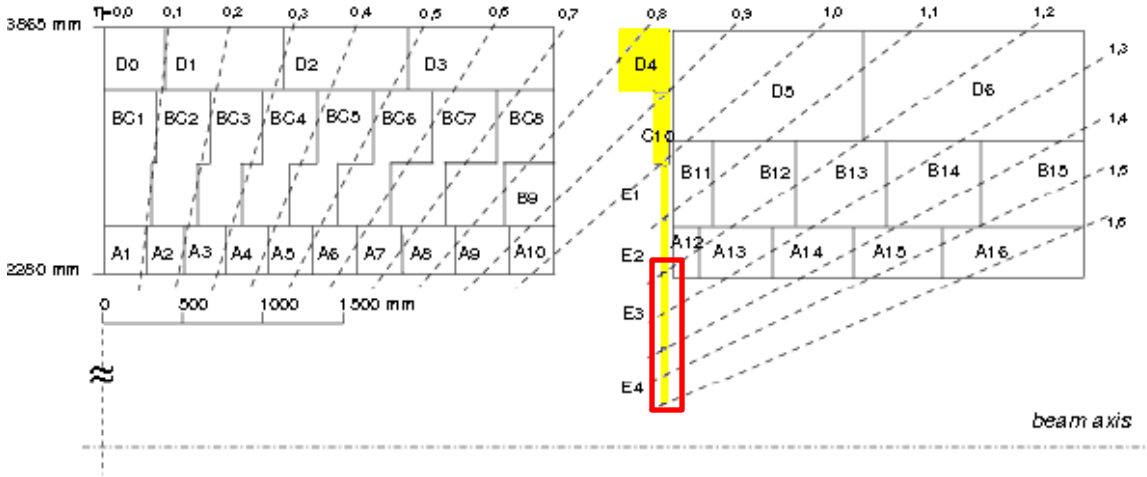
Tile gap/crack scintillators

The gap and cryostat (crack) scintillator detectors are designed to correct for energy losses in dead material between the Tilecal barrel and extended barrel and between the central and forward electromagnetic calorimeter cryostats.



Scintillators covering $1.2<|\eta|<1.6$ in a high radiation environment

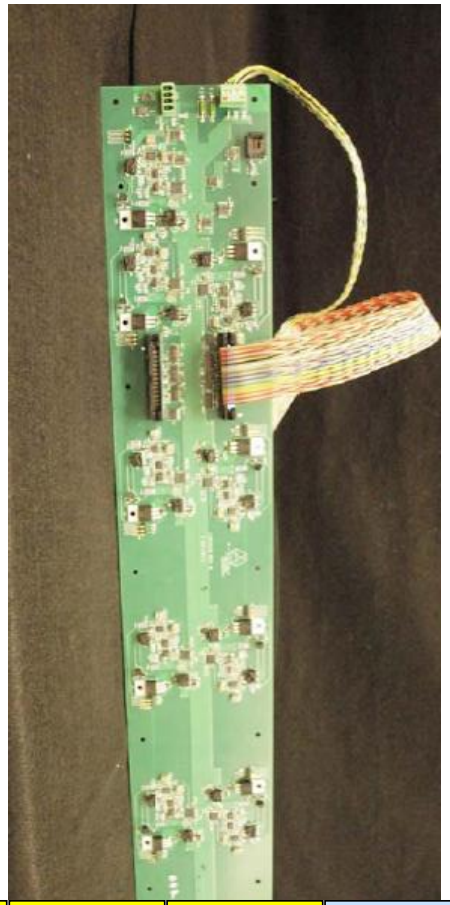
- ~1kGy/year
- Huge light loss
- Need replacement (scintillators + WLS fibers)

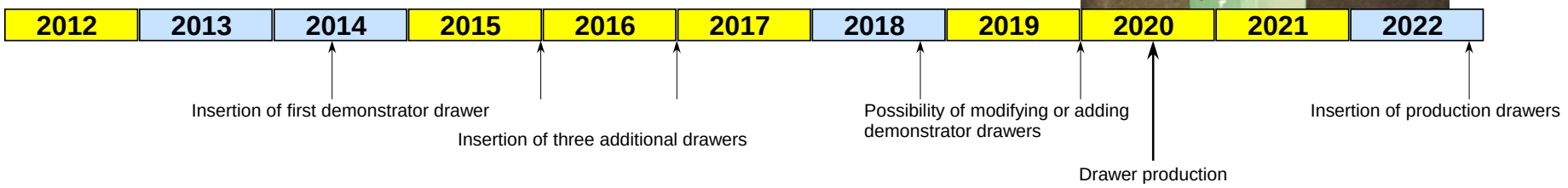


Phase 2

Tile HV distributor system upgrade

- HV distributor system located in the calorimeter – HV_Opto boards.
- Radiation damage and obsolescence force replacement.
- Based on a single external HV per module.
- Adjustment of up to 48 individual channels with different HV.
- External control – SPI bus connects with Daughterboard
- Demonstrator prototypes to be built and installed since 2014



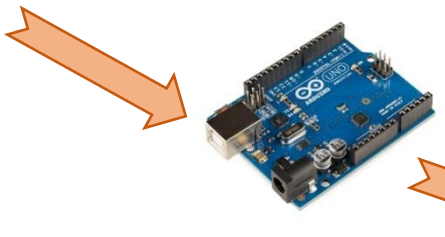


Phase 2

Tile HV distributor system upgrade

- Design and produce prototype for second demonstrator.
- Starting by radiation damage tests: test MAX1329 (DAC+ADC) and some alternatives.
- Designed boards to irradiate ADCs and DACs.

Setup for irradiation and monitoring



Interface Board

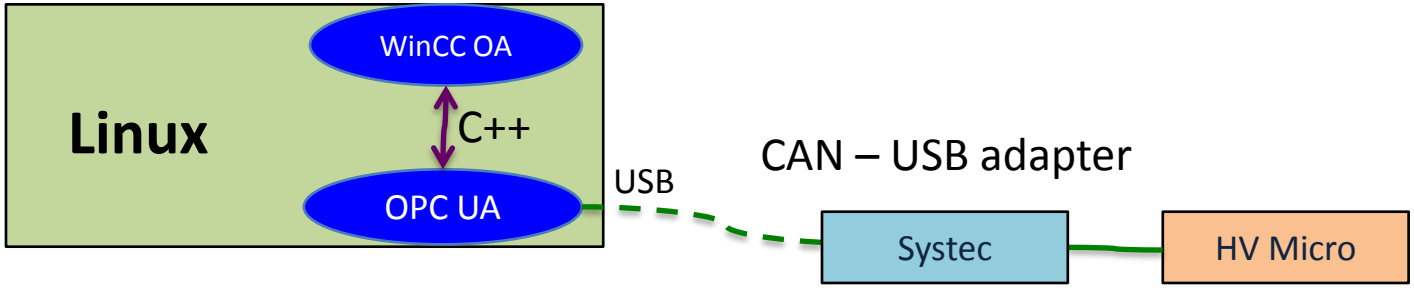
Boards designed ready for production

Radiation Tests Board

ICs in Test:

- **MAX1329**
- **TLV5630**
- **AD5516**
- **ADS8028**
- **AD7298**
- **MAX1202**
- **MAX186**

Tile Detector Control System (DCS)

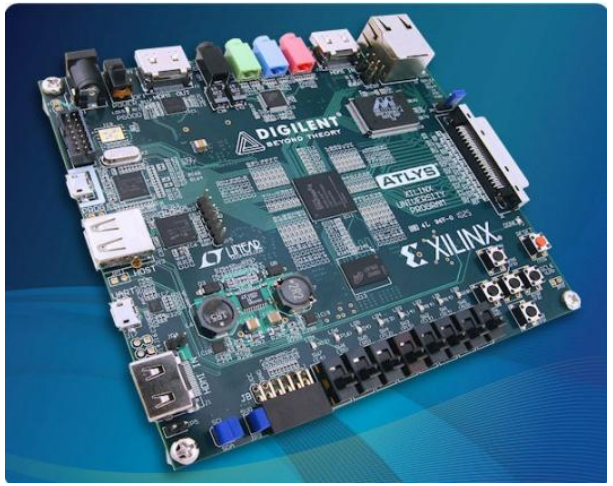


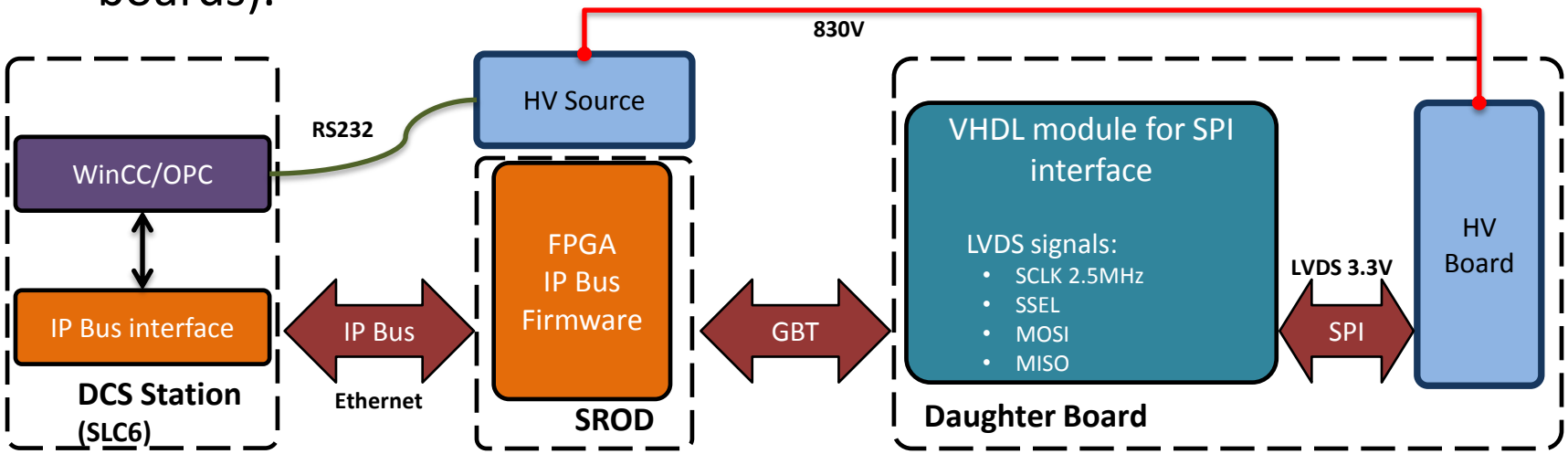
- The DCS upgrade is almost continuous!
- Currently in LS1, it is migrating from Windows to Linux and from PVSS3.8 to WinCC OA (doing also the same for the ALFA detector).
- New communication boards required for new machines.
- New hardware needs to be integrated.
- Continuous support to detector and surface labs
- Demonstrator prototypes need to be integrated with normal system

Phase 0 | Phase 1 | Phase 2

Tile Detector Control System (DCS)

- DCS data for HV distribution system will flow in parallel with physics data (transmission via optical links to sROD).
- sROD will act as router between DCS station and Daughterboard.
- For Phase 2, but being developed now for demonstrators (tests using ATLYS Spartan 6 boards).





Summary

ATLAS has a three stage upgrade plan, following the LHC upgrade

- We are working in Phase 0 and preparing Phase 1 and Phase 2
- Activities concentrated in
  - Tile calorimeter
  - Trigger
- Smaller contributions for
  - AFP
  - ALFA