Introduction

The architecture of the central detector control system consists of two separate domains (Figure 1):

- The detector control domain, under the responsibility of the DCS team, provides all detector control logic and acts as the brain of the system;
- The CRU domain, under the responsibility of the FLP team, provides a simple proxy to the CRU (ALF).

The high-level control is located in the DCS part of the system including complex sequences with control and monitoring semantics. Some of these sequences must be executed as atomic commands in order to provide reliable results. The sequences can be iterated thanks to iMAPI. FRED relays them to ALF in one single transfer. This architecture is described in the FRED documentation [1].

ALF runs on the FLP servers and accepts requests from ALF via DIM RPC. It provides SCA, SWT and IC operations, as well as simple register read/write.

All measurements done so far with different detector teams (ITS, MCH, MFT, etc) have demonstrated that such an architecture delivers the required performance to operate the experiment efficiently. It is the opinion of the FLP and DCS teams that it is urgent to continue the tests and benchmark the overall system with more detectors in order to test it with as many different use cases as possible. The tight schedule of the commissioning at P2 requires that this is done during the tests on surface.

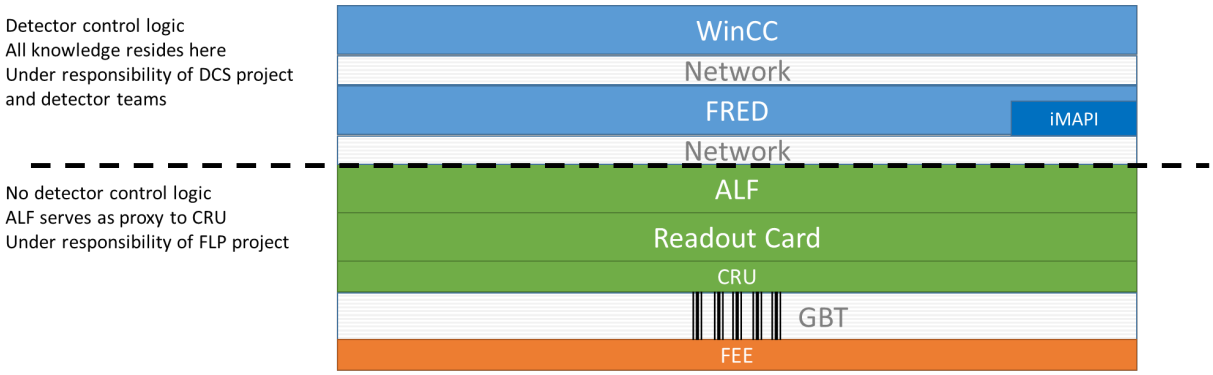

Figure 1 Detector control central system. Green components are under the responsibility of the FLP project, blue of the DCS project and orange of detector teams

During the discussions in December 2019, the TPC and ITS detector teams requested the possibility to run debug tools on the FLP servers concurrently to ALF.

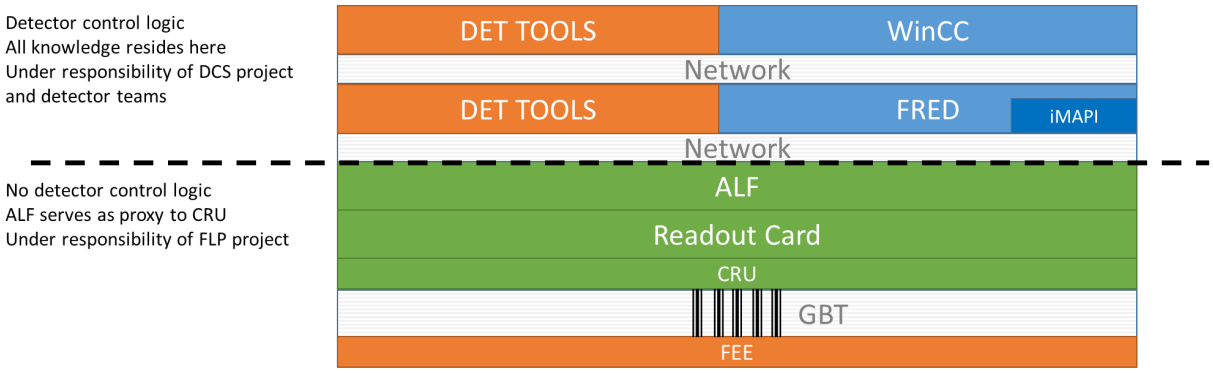

Figure 2 Detector debug tools plugging in to the existing central system

At the end, a compromise was reached which consisted on adding a low-level arbitration layer to manage the concurrent access to the CRU (for detector control purposes) by ALF and debug tools (Figure 3).

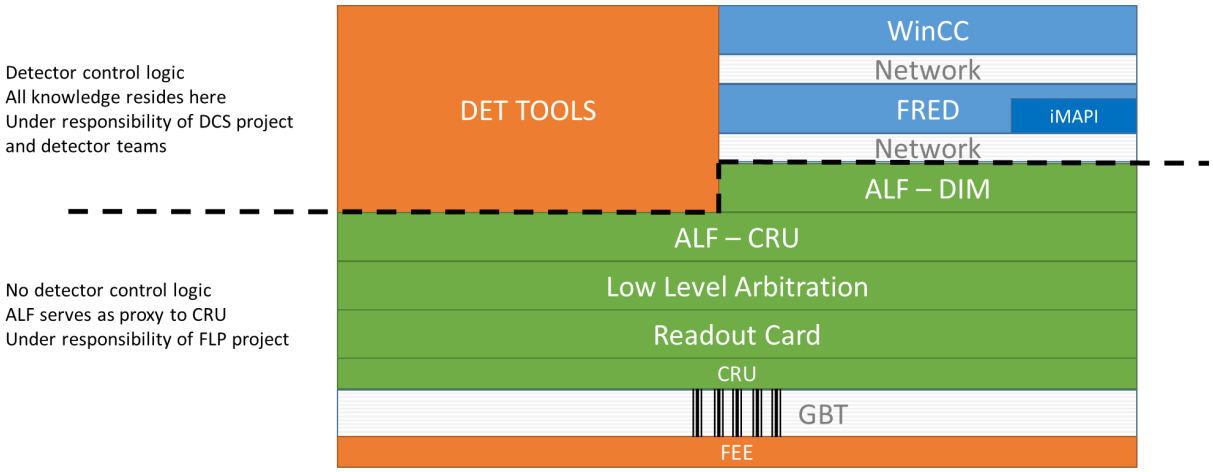

Figure 3 Detector debug tools using the FLP provided stack to safely execute detector control operations concurrently with ALF

This new Low Level Arbitration layer will:

- Provide a locking mechanism to allow both the central framework and the debug tools to explicitly start sessions and execute arbitrarily long sequences (from simple read/write register operations to sequences of sequences);
- Block access to other actors if there's an active session;
- Keep track of active sessions and report back to the central framework for accounting, logging and centralized access control decisions.

A compromise proposal is shown in Figure 4:

- The TPC team implements, maintains and supports the new layer (DET TOOLS/I2C);
- It can be used by all detector teams that require such a functionality;
- The central system maintains the architecture based on the December 2019 agreements.

This proposal allows to keep the flexibility needed by the detector debug tools and to continue to perform tests with the central system without any further delay.

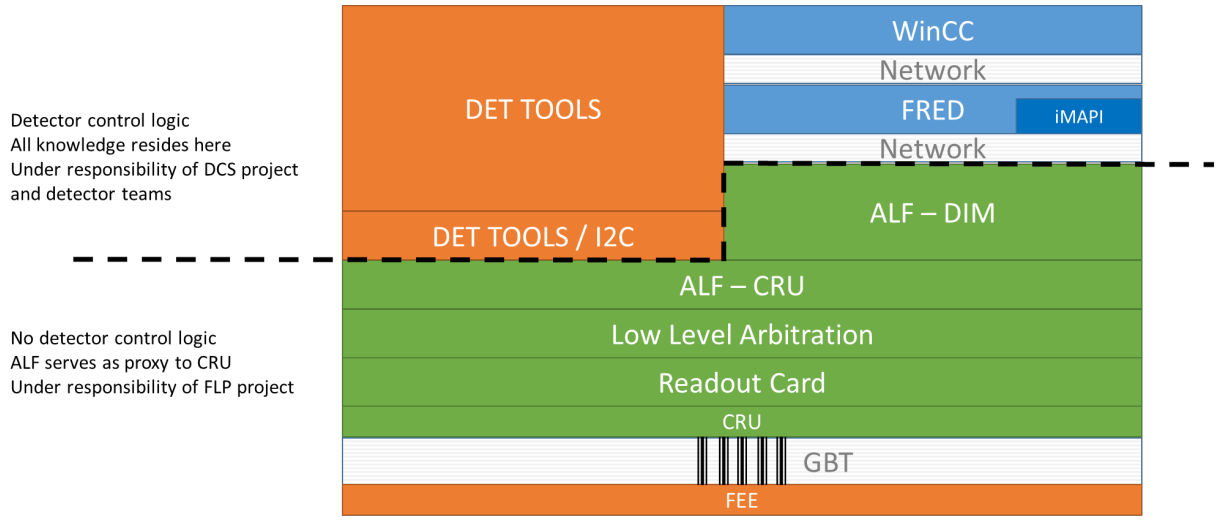

Figure 4 New layer providing I2C provided by the TPC team and made available to detector debug tools.

Support for 2 SCA cores (CERN and TPC)

Another request made by the TPC team is the introduction of support for two different SCA cores (CERN-EP-ESE and TPC). The FLP and DCS teams' position is the following:

- Supporting 2 cores would add complexity and heterogeneity.
- The current core supported in the central system is the CERN core. Switching to the TPC core would require changes in the CRU firmware and the central system;
- According to the TPC, their debug tools already support the CERN-EP-ESE core (same for the central system);
- The additional FPGA resources used by the CERN-EP-ESE core is not an issue, now that the TPC Cluster Finder was moved to the EPN farm.

Conclusion

The FLP and DCS teams recommend the following:

- The FLP team will implement the low level arbitration layer as agreed in December 2019;
- The TPC team will implement, maintain and support a high-level API based on the software stack provided by the FLP team that can be made available to other detector debug tools;
- DCS team prepared an example of SCA API commands implemented in FRED and is ready to extend it to full set of SCA commands, after receiving feedback from TPC
- The central system maintains the architecture based on the December 2019 agreements;
- ALICE will use a single SCA core. Given the current situation, the CERN-EP-ESE core seems the most logical choice;
- The DCS and TPC teams will continue to test and benchmark the central system with the TPC on the surface.

References

[1] FRED User Guide
https://espace.cern.ch/alicecontrols/DCSDocuments/Guidelines/ALFRED/FRED_Guide.pdf]