18 Workplan and schedule

This chapter outlines the post-TDR workplan for the major activities in the DAQ and HLT systems. The global HLT/DAQ development schedule is presented (Section 18.1) as the basis for the definition of the workplan. This detailed workplan, still in preparation, is introduced and a number of issues which will have to be addressed are indicated (Section 18.2). The strategy developed for the detector integration and commissioning is described in Section 18.3.

18.1 Schedule

This section presents the overall schedule for the HLT/DAQ up to LHC turn-on in 2007. The development of the HLT/DAQ system, both hardware and software, is mapped onto the ATLAS detectors installation plan [18-1].

18.1.1 System hardware

For the system hardware, the planning is dictated by the production schedule for the custom read-out components:

- the S-LINK Link Source Card, to be installed on the RODs.
- the ROBin, the receiver part of the ROS (S_LINK receiver and ROL multiplexer).

An analysis of the detectors' installation schedule points to the first quarter of 2004 as the moment for the Final Design Review of the LSC and the ROBin. The latter review requires the I/O optimization studies (see Section 18.2.1) to have been completed beforehand.

The global HLT/DAQ production schedule is shown in Figure 18-1. It identifies the principal milestones coming from the detector needs for TDAQ in installation, the TDAQ component production (in the case of custom components), the component purchasing and associated tendering (in case of commercial components), as well as their testing and commissioning.

18.1.2 System software

The need for six major releases of the system software has been identified (dates are indicative at this stage and will be adapted if necessary). The release strategy is driven by detector operations (e.g. test beams and cosmic run) and commissioning (see section 17.3 on 'Commissioning' which does ot exist yet).

1. Current DAQ release, integrating Online Software and DataFlow. It is targeted to the needs of the ATLAS H8 2003 test beam operations and to the I/O optimization and system performance measurements. The release has been operational since May 2003.
2. 'Combined test beam' release for the combined run in 2004.
3. 'Sub-detector read-out' release for initial detector commissioning with single stand-alone ROD Crate DAQ (RCD).
4. 'HLT/DAQ installation' release for commissioning of the HLT/DAQ components and global detector commissioning in fall 2005.

Figure 18-1 Schedule of the overall HLT/DAQ project.

5. ‘Cosmics run’ release for global HLT/DAQ and global detector commissioning, as well as for the ATLAS cosmics run in fall 2006.
6. ‘LHC start-up’ release for the start of LHC operation in April 2007.

The software development schedule is shown in Table 18-1 for the software of the three sub-systems, Online Software, DataFlow and High Level Trigger.

Table 18-1

RELEASE	Online Software	DataFlow	High Level Trigger
TDR release (Jun 03)	As described in TDR - Mar 03	As described in TDR, first full DataFlow - May 03	As described in TDR
Combined test beam (Summer 04)	Prototype versions of control, configuration and monitoring services - Feb 04	Consolidation of TDR release, evolution of ROD Crate DAQ - Apr 04	
Sub-detector read-out (Fall 04)	Full support of final ROD Crate DAQ - Jun 04	First release of final Dataflow, including ROD Crate DAQ - Dec 04	
HLT/DAQ installation (Fall 05)	Full functionality of control, configuration and monitoring services, including I/F to conditions DB - Apr 05	Consolidation of previous release, completion of DataFlow functionality - Jun 05	
Cosmics run (Fall 06)	Final large scale performance and support for partitioning - Mar 06	Final large scale release - Jun 06	
LHC start-up (Apr 07)	Final implementation ready for tuning - Dec 06	Consolidation of previous release - Dec 06	

18.2 Post-TDR workplan

The detailed workplan to meet the objectives defined in the schedule of the previous section is in preparation and will be finalized and documented soon after the TDR publication. Its description goes beyond the scope of this document, which specifically addresses the workplan of the post-TDR phase, characterised by the completion of the studies for the optimization of the HLT/DAQ baseline, both in the DataFlow (Section 18.2.1) and in the HLT (Section 18.2.2). Section 18.2.3 lists some of the other issues that will be addressed.

18.2.1 DataFlow workplan

In the baseline design, the flow of data and of control messages between the ROS and the HLT can be implemented with two techniques, a bus-based or a switch based data collection (see Section 5.4), for the aggregation of data of a number of Read Out Links into each port of the DF network.

The work up to the Final Design Review (FDR) of the custom hardware in the DataFlow (first quarter of 2004) will address, in priority, studies for the optimization of the data flow at the ROS level.

As described in Section 8.?, a full system prototype has been developed supporting simultaneously the two techniques, by means of a ROBin prototype with two Read Out Links at the input and output to PCI-bus and GEth (see Section 8.?). Performance measurements, as reported in Chapter 8 and Chapter 14, indicate the overall viability of the baseline architecture. The measurement program is continuing with the deployment of a number of ROBin modules in the 10% prototype system, allowing a direct comparison of functional and performance aspects which will lead to the choice of the optimal Input/Output path in time for the FDR of the ROBin.

The results of the measurements will continue to be used in the discrete event modeling aimed at providing a description of the behaviour of the system scaled to the final size.

Further specification from Chapter 8

18.2.2 High Level Trigger workplan

In preparation, addressing software performance

18.2.3 Other issues to be addressed

During the deployment of the full system prototypes for measurements and optimisation of performance, a number of other issues will be addressed which are important for the system functionality and the definition of certain services. Amongst these issues, the following have so far been identified:

- processor and process management in the HLT farms
- overall experimental control, beyond the one already implemented in the Online Software
- flow of data in databases (production, conditions, configuration)
- TDAQ output and computing model
- fault tolerance
- system scalability and robustness against variation of parameters, eg LVL2 rejection power.

As an illustration, the last of the previous points is developped briefly here. The feasibility of the baseline architecture stands also on a number of assumptions regarding both external conditions (such as the data volume of a region of interest) and extrapolations of measurements performed today. The robustness of the baseline architecture with respect to reasonable, and maybe foreseeable, variations of these assumptions will be an item for the short term TDR workplan.

Table 18-2 summarizes some of the main assumptions the baseline architecture is based upon, their value (where applicable), and the main implications should reality be less favorable.

Table 18-2 Variations of baseline parameters.

Assumption	Current value	Remarks
RoI data volume	~ 2%	Implications on ROL multiplexing factor, ROB multiplexing factor, and LVL2 switch concentrator size.
RoI request rate / ROB	Uniform distribution	This will not be the case. Similar implications as above (average RoI size) with additional implications for the traffic pattern through the level-2 network: hot spots in the ROS and the networks
LVL2 acceptance	30:1	A more pessimistic figure implies an higher rate into the EB, hence an effect on the ROL and ROB multiplexing factors and the number of SFIs. Thus a large EB network, as well as a related impact (higher EB rate) on the EF farm size.
HLT Decision time / event	10 ms @ Level-2 1 s @ EF	Variations of O(10%) have a dramatic effect on the size of the farms and the related central (Level-2 or EB) networks
SFI Input / Output capability	70 Mbyte / s In 70 Mbyte / s Out	Impact the size of the EB network (because of additional SFIs) Impact the organization of the EF farm. Less events output by the SFI will mean smaller sub-farms (or more SFIs per sub-farm)

18.3 Commissioning

During the detector installation, their read-out elements will have to be tested and commissioned. In this section is presented the strategy developed so that the detector commissioning requirements can be met throughout the commissioning of the TDAQ elements themselves.

Three phases are anticipated in the commissioning, namely the readout of a single ROD crate, the readout of multiple ROD crates, and the readout of multiple sub-detectors. The necessary tools for the implementation of such a strategy are briefly described here. Some of these tools are already available today and used in test beam, test beds and test sites.

A more detailed description of the commissioning plan can be found in the relevant documentation of the ATLAS Technical Coordination [18-2].

18.3.1 Tools for detector commissioning

18.3.1.1 ROD Crate DAQ

The first need of a sub-detector will be to check the functionality of the front-end electronics via the FELs readout into the ROD modules. For this first functionality check, the ROD Crate DAQ will be used.

The ROD crate DAQ is the minimal infrastructure to readout the sub-detectors' RODs. The readout will be done initially via VMEbus, by the ROD Crate Controller (RCC) as in Figure 18-2. Data processing can be done at the level of the RCC or at the level of an external workstation (conected via Ethernet to the RCC) running the ROS application. Data in the workstation can then be stored to disk. The necessary infrastructure will be in place in USA15, including the DCS, the TTC, the Local Trigger Processors, and the Conditions Database for the storage of calibration data.

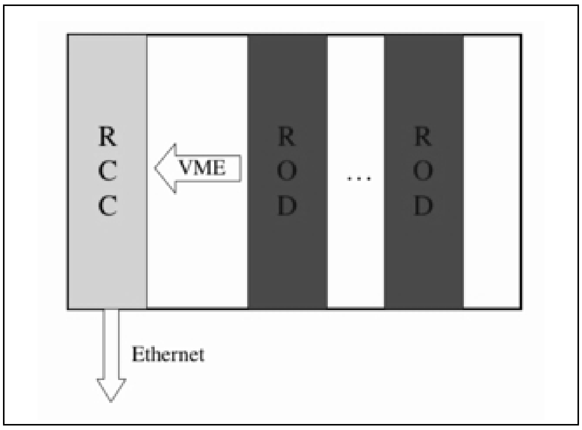

Figure 18-2 Readout of ROD modules via VMEbus by the ROD Crate Controller.

The second step will implement the ROD readout via the standard Read Out Link (ROL) into a stand-alone ROS, as in Figure 18-3. This setup will enable the data integrity over the ROLs to be checked simultaneously for a number of RODs and is the first major step in the detector-DAQ integration. The setup mentioned above is very similar to the one already in use and well tested at the H8 ATLAS test beam.

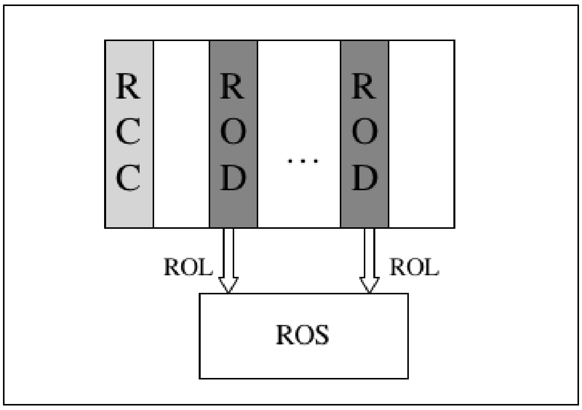

Figure 18-3 Readout of ROD Modules via ROLs connected to a minimal ROS system.

18.3.1.2 Readout of multiple ROD crates

In the second phase, data taking from multiple ROD crates will be implemented. This will allow the complete readout of one or more TTC partitions, requiring multiple ROS units and a minimal Event Builder (Figure 18-4). In all cases the storage of the data to disk or to the Conditions Database will be allowed.

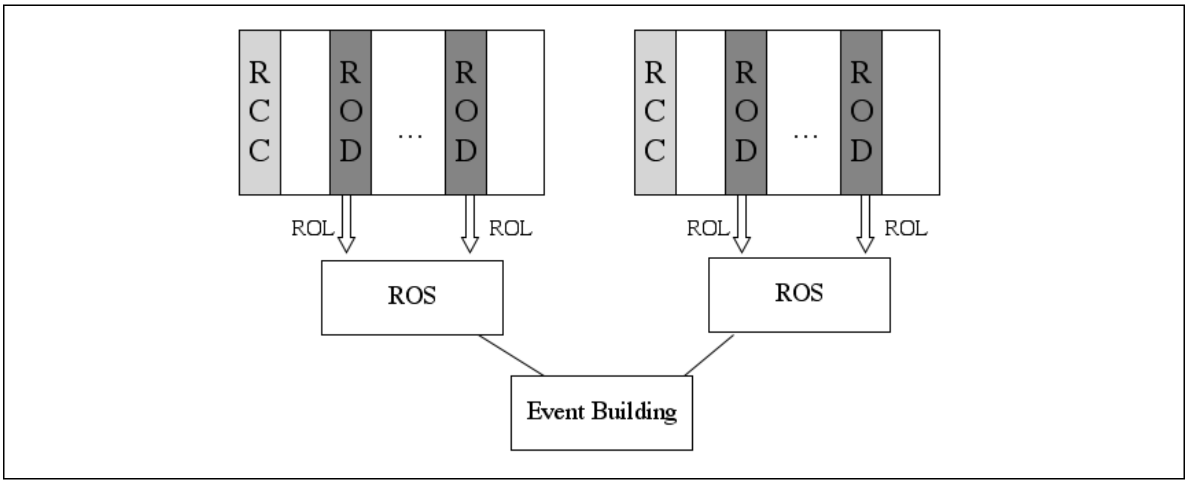

Figure 18-4 Readout of multiple ROD crates via ROLs with a minimal Event Building infrastructure.

18.3.1.3 Readout of multiple sub-detectors

In preparation for the Cosmic Ray run and during the final phase of the ATLAS Commissioning, there will be the need for reading out multiple sub-detectors simultaneously. The time scale for these operations matches the time scale for the completion of installation of the final TDAQ elements. A possible configuration for the readout of more than one sub-detector is very similar to the one presented in Figure 18-4. The number of hardware elements involved may vary significantly, however the major change will be the addition of Event Filter sub-farms (only needing minimal processing power) to complete the data flow chain. In the case of multiple sub-detector readout, the CTP infrastructure and the DCS supervisor will also be needed.

18.4 References

18-1 ATLAS installation schedule

18-2 ATLAS Technical Co-ordination, *ATLAS Commissioning - Sub-Detectors needs of TDAQ for readout*, ATC-TD-IN-0002 (2003), https://edms.cern.ch/file/375183/1/