16 Costing

The cost estimate of the ATLAS TDAQ system is based on a detailed model of its size (i.e. number of components) as a function of the input Level-1 trigger rate. The model is parameterized by the assumptions described in (TABLEXXX OF CHAPTER5); conservatism and safety factors are applied in particular for the performance (processing time per event and rejection power) of the HLT and the estimated unit cost of both custom (e.g. the ROBin) and commercial components (e.g. processors). In the following are described the TDAQ system evolution from commissioning to its expected final performance, the rationale behind the costing of individual components, the subdivision of the system cost in terms of functional categories, and a summary of the expenditure profile.

Should make refs here also to the caveats on processing time which will be discussed in Chapter 14.

As for DCS the expenditure profile is still being discussed, only the total figure of 3125 MCHF is quoted. DCS is included in figures 16-2 but not yet in 16-3 (missing profile).

16.1 System evolution and staging

The ATLAS TDAQ system has been designed to be staged, with the size and performance of the system evolving as resources become available. The final performance corresponds to a Level-1 rate of 100 kHz. Table 16-1 indicates, for the period 2004 to 2009, the performance capability (second column) and the functional capability (third column) of the installed system. The dates of 2008 for the nominal 75 kHz system, and 2009 for the final TDAQ performance, are indicative, in so far as they depend on the availability of resources, the luminosity performance of the LHC and experience from initial running.

Table 16-1 TDAQ performance profile

Year	Sustained Level-1 rate (kHz)	Notes
2004	N/A	Pre-series only
2005	N/A	Detector & TDAQ commissioning. 75% of detector read out Use pre-series HLT farms
2006	N/A	ATLAS cosmics run Use pre-series HLT farms
2007	37.5	LHC startup 37% HLT farms
2008[a]	75	Nominal LHC Luminosity 100% of detector read-out 75% HLT farms
2009[b]	100	Final TDAQ performance 100% HLT farms

a. Indicative date.
b. Indicative date.

SECTION5.XXX discusses how the baseline architecture supports the staging of the TDAQ system. The detector read-out procured and installed in 2005–2006 is just for the non-staged part of the detector (which represents ~ 75% of the ROLs). For the purpose of uniformity, custom components, in particular the ROBin modules, are fully procured in 2005, although part of them will be physically installed later (indicatively in the year 2008) with the staged parts of the ATLAS detector. The other parts of the ROS system are, however, procured following the staging of the detector (i.e. 75% in 2005–2006 and the remaining 25% in 2008). The strategy for staging the TDAQ system is based on the staging of the LVL2 and EF farms and, as a consequence, of the Event Builder (in particular the SFIs) and the central networks.

16.2 Costing of components

The majority of the ATLAS TDAQ system is based on Commercial Off The Shelf (COTS) components: commodity computer and communications hardware (e.g. PCs and Gigabit Ethernet) and related equipment. The estimated unit cost of these components is based on a conservative extrapolation of today's costs. In addition, for the HLT farms, a 30% overall safety factor is added to allow for the large uncertainties which are discussed in SECTION 14.XXX.

The unit cost of custom components, i.e. the ROBin and RoIB, has been established on the basis of R&D prototypes.

16.3 Categories of expenditures

For the purpose of describing the cost and its evolution in time, the TDAQ system has been organized in terms of categories of expenditure, closely related to the TDAQ baseline architecture:

- DCS: includes the components needed for the operation of the detector and for the supervision of the infrastructure of the experiment: operator workstations, servers, detector master stations, custom modules, DSS, and control room equipment.

- Detector Read-Out: this category includes the ROBins, the ROSs, and the related infrastructure.

- Level-2: includes the RoIB, the LVL2 Supervisor, the Level-2 processor farm, the Level-2 network, and the infrastructure.

- Event Builder: includes the DFMs, the SFIs, the Event Builder network, the SFO (with the local data storage), and the related infrastructure.

- Event Filter: includes the Event Filter processor farm, the network internal to the Event Filter, and the infrastructure.

- Online: includes processor farms for running the online software, TDAQ operations and monitoring, the central online network, and the related infrastructure.

- Other: includes items such as contributions to high speed data links in and out of the experimental area, and the acquisition of software products such as farm and network management tools.

- Pre-Series: includes a small scale version of the system for the purpose of validating the TDAQ implementation.

16.4 Expenditure profile and system cost

The expenditure profile is summarized in Table 16-2 and Figure 16-1. The former indicates the cost for the ATLAS TDAQ system in each year. Figure 16-1 shows the expenditure profile including its split on the basis of the categories of expenditure.

Table 16-2 TDAQ system cost profile

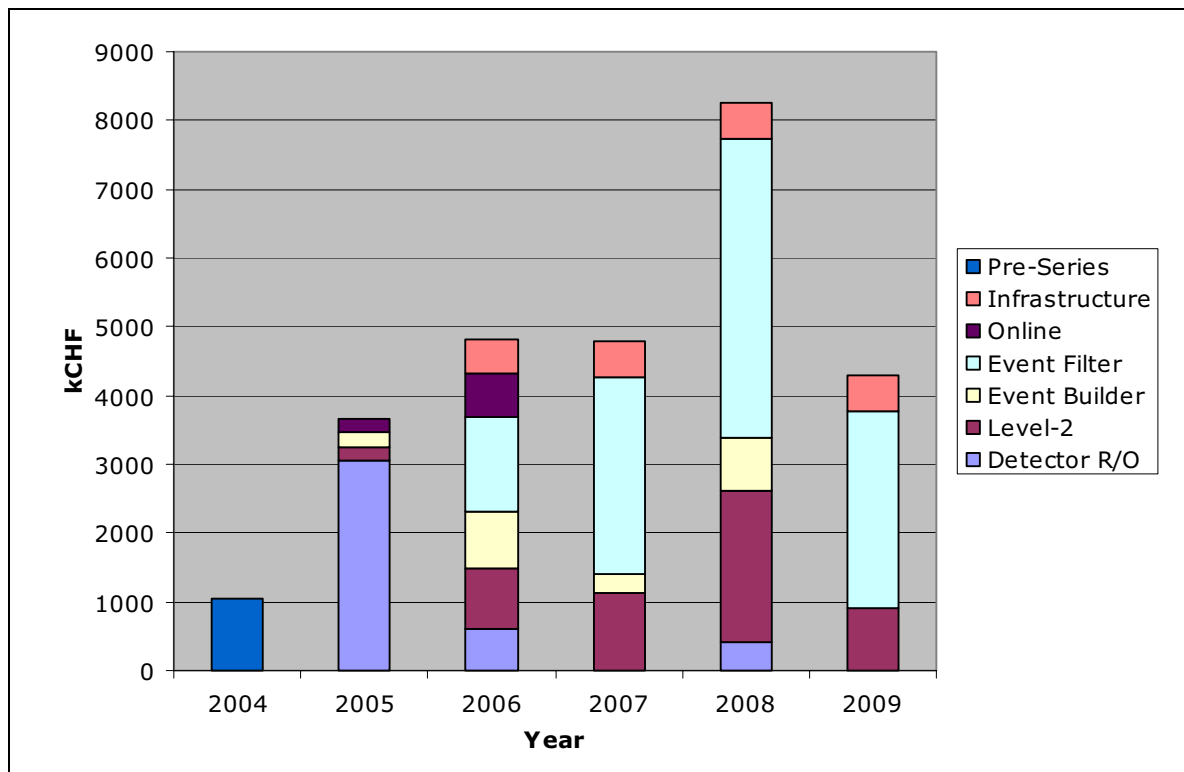|	Up to 2003	2004	2005	2006	2007	2008	2009	Total
DCS	PROFILE UNDER DISCUSSION							3125
Pre-series		1048	0	0	0	0	0	1048
Detector R/O		0	3049	606	0	405	0	4060
Level-2		0	200	880	1137	2216	915	5348
Event Builder		0	208	834	274	768	0	2048
Event Filter		0	0	1375	2863	4351	2862	11451
Online		0	208	622	0	0	0	830
Infrastructure		0	0	508	508	508	508	2032
Total		1048	3665	4825	4782	8248	4285	29978

Figure 16-1 Expenditure Profile

The sharing of the cost (for the final 100 kHz system) between the categories of expenditure, is shown in Figure 16-2.
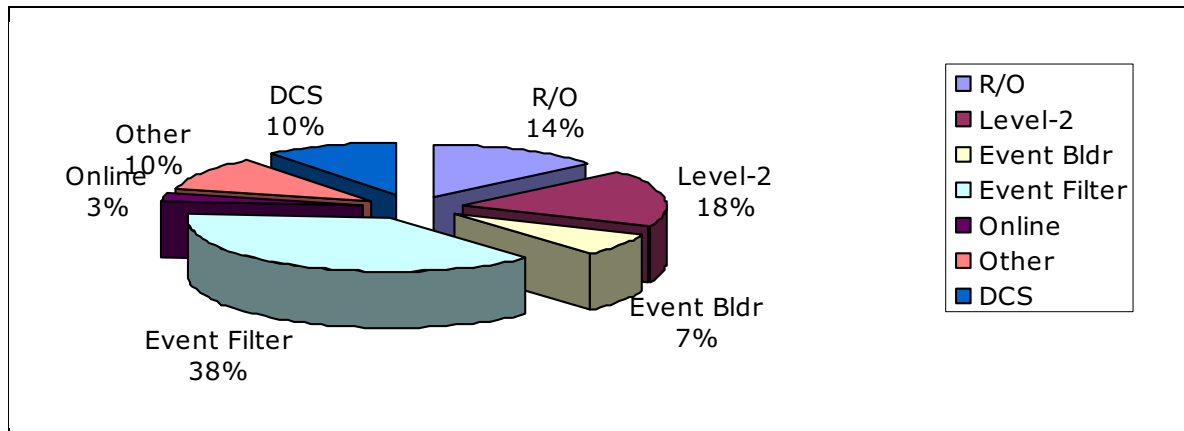

Figure 16-2 Relative cost per category of expenditure (at a 100 kHz Level-1 rate)

The total TDAQ system cost, as a function of the Level-1 rate and not including pre-series, is shown in Figure 16-3.
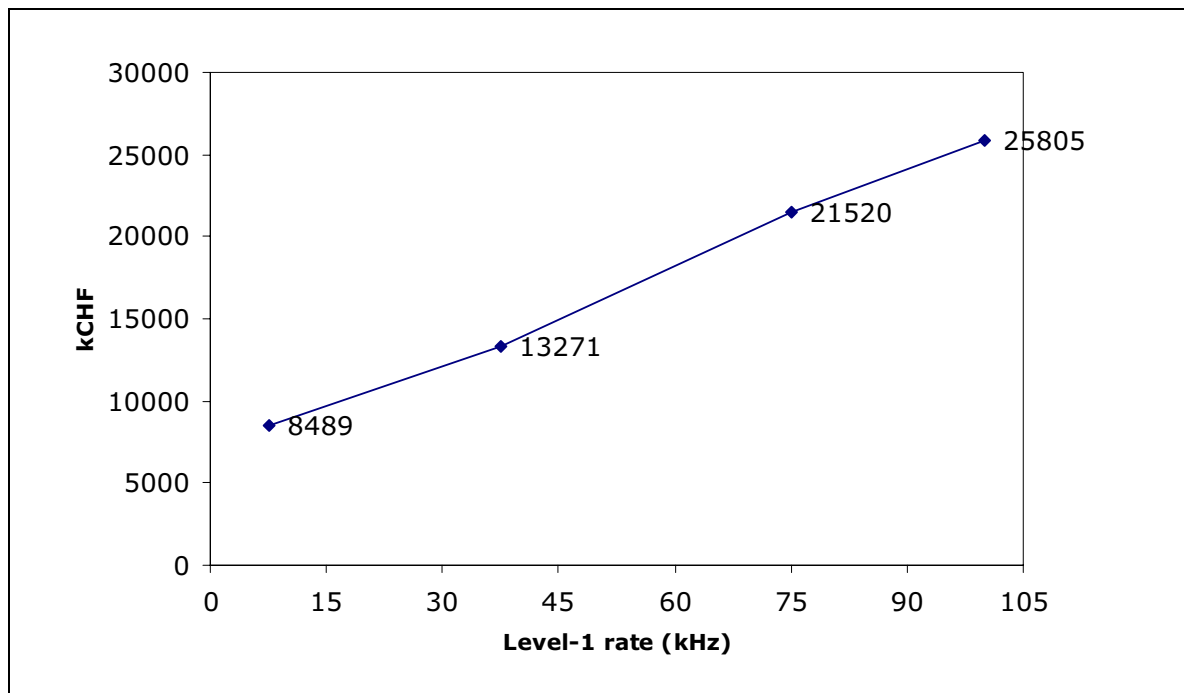

Figure 16-3 TDAQ cost versus Level-1 rate

16.5 References

16-1

16-2