Chapter 9

Data Acquisition

The architecture of the CMS Data Acquisition (DAQ) system is shown schematically in figure 9.1. The CMS Trigger and DAQ system is designed to collect and analyse the detector information at the LHC bunch crossing frequency of 40 MHz. The rate of events to be recorded for offline processing and analysis is on the order of a few 10^2 Hz. At the design luminosity of $10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$, the LHC rate of proton collisions will be around 20 per bunch crossing, producing approximately 1 MByte of zero-suppressed data in the CMS read-out systems. The first level trigger is designed to reduce the incoming average data rate to a maximum of 100 kHz, by processing fast trigger information coming from the calorimeters and the muon chambers, and selecting events with interesting signatures. Therefore, the DAQ system must sustain a maximum input rate of 100 kHz, for a data flow of $\approx$ 100 GByte/s coming from approximately 650 data sources, and must provide enough computing power for a software filter system, the High Level Trigger (HLT), to reduce the rate of stored events by a factor of 1000. In CMS all events that pass the Level-1 (L1) trigger are sent to a computer farm (Event Filter) that performs physics selections, using faster versions of the offline reconstruction software, to filter events and achieve the required output rate. The design of the CMS Data Acquisition System and of the High Level Trigger is described in detail in the respective Technical Design Report [188].

The read-out parameters of all sub-detectors are summarized in table 9.1. Each data source to the DAQ system is expected to deliver an average event fragment size of $\approx$2 kByte (for pp

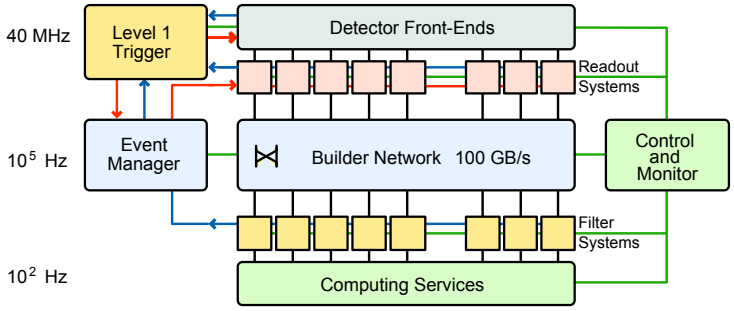

Figure 9.1: Architecture of the CMS DAQ system.