EMC - DAQ Interface Document

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PRELIMINARY

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Change Log

June 30, 1998 V0.1 First preliminary version accepted at the EMC-DAQ-Trigger meeting in BNL during June 22-23, 1998.

General EMC

EMC Subdetectors

The EMC detector consists of two subdetectors: EMC Towers and EMC Shower Max. Detector (SMD).
DAQ will treat EMC-Towers and EMC-SMD as two completely separate detectors with separate data inputs, DAQ Detector BUSY outputs, detector-ID designators etc.

Data Inputs to DAQ

In both detector cases data will be sent to DAQ via fiber optic cables in the usual STAR manner (see *"Front-End Electronics ⇔ DAQ Receiver Board Interface Specification Version 1.0a"*) with the following additional modification:

- It was agreed following the acceptance of the 1.0a version of the above document that the maximum header length is limited to 64 bytes (instead of 512 in version 1.0a, Paragraph 2.3)

EMC Towers

Input data

The data from the EMC-Towers consists of 4800 channels with 10 bit resolution each. They will be transferred to the DAQ EMC-Tower Readout Board via one optical fiber running at a clock rate TBD with two 10-bit data encoded as a 20-bit object on the fiber optical interface.
This means that the total transfer time for the full 4800 channels would be 4800/2 X 16.7ns = 40 μs, if the clock rate were 60 MHz..

Data sequence

The correct mapping between the sequence of data on the fiber and the physical towers must be known to DAQ for later use in Level 3 processing, and for event building.

Data processing and output

DAQ will not do any pre-processing of the Towers' data on input i.e:

- no pedestal calculations need to be performed
- no pedestal subtraction
- no gain corrections

However, DAQ will promote the 10 bit input value to 16 bits (with the MS 6 bits equal to 0) for later convenience.
In view of the above the total event size at the output of DAQ will be 9600 bytes.

DAQ BUSY output

DAQ's EMC-Towers Receiver Board will generate one BUSY output level which will throttle the EMC-Towers Readout board and prevent it from sending the next event. BUSY will be asserted following receipt by DAQ of the beginning of event token.

DAQ's Receiver Board will have limited resources and must be able to prevent the Sender from overwriting its input buffers. The BUSY signal may or may not be further fanned out to the Trigger Subsystem.

Running modes

The EMC-Towers can take part in two different and exclusive running modes: The "Fast" or "EMC-Towers only" mode and the "Slow" mode. The modes are exclusive in the sense that the required performance for the two modes can only be maintained if the DAQ system is programmed at the beginning of a run to be in either of these two modes but not in both at the same time.

Fast mode

In "Fast mode" DAQ will input events from the EMC-Towers at a rate of up to 1000 Hz.

In this mode DAQ will:

- run with EMC-Towers only (no other STAR detector, apart from trigger detectors)
- not present the data to any Level 3
- write the EMC-Towers data to tape
- write the full Trigger Detectors and Trigger Summary data to tape
- present a (small) fraction of the data to Online for inspection
- calculate the necessary histograms for the EMC (to be defined later…) and write them to tape at the end of the run and present them to Online for inspection

Slow mode

In "Slow mode" DAQ will input events from the fiber at a rate of up to 100 Hz.

In this mode DAQ will:

- run together with any other detector
- present all the data to Level 3 for a further decision
- write the L3 accepted data to tape
- present a fraction of L3 accepted data to Online

EMC Shower Max Detector (SMD)

Input data

The data from the EMC-SMD consists of 36000 channels with 10 bit resolution each. They will be transferred to the DAQ EMC-SMD Readout Board via 8 optical fibers running at a (nominal) 60 MHz clock with two 10-bit data encoded as a 20-bit object on the fiber optical interface.

The fiber sequencing will be very similar to the current SVT setup with the SVT anodes being conceptually replaced by SMD channels and the SVT "timebins" being processed in a SMD specific manner:

- The first timebin shall be suppressed at the sender's end and will be replaced by idle tokens on the fiber. The first timebin seems to be noisy in the current setup so the data content is useless.
- At most two more timebins will exist (exact number will be specified later…) which the DAQ system must add together to produce the final channel value.
- Every 16^{th} channel should be ignored by DAQ since it's just a dummy channel used for padding at the sender's end.

The data on each fiber will be organized in 15 groups of 320 channels (out of which 20 are dummies) for a total of 4800 channels X 2 timebins.

Data sequence

The correct mapping between the sequence of data on the fiber and the physical pads(TBD) must be known to DAQ for later use in Level 3 processing, and for event building.

Pedestal Determination

The DAQ system will be able to determine pedestals on the input data for each channel and timebin separately.

The pedestals will be presented as 8 bit unsigned values.

Data processing and output

DAQ will pre-process the input data in the following order

- it will subtract the 8 bit pedestal value from the 10 bit input value, replacing the input value with the difference or zero, whichever is greater.
- it will sum up the two 10 bit timebin values to produce an 11 bit sum (TBD)
- it will apply a universal 11-to-8 bit transformation (TBD)
- it will suppress the dummy channels from the output (TBD)

In view of the above the total event size at the output of DAQ will be 36000 bytes.
DAQ will not suppress pedestal-only channels.

DAQ BUSY output

DAQ will generate one BUSY output level which will be passed on to the Trigger Subsystem.

Running modes

The EMC-SMD participates in Level 3 decisions and further event building in the same manner as any other “slow” detector.

DAQ will input EMC-SMD events at a rate of up to 100 Hz.

In this mode DAQ will:

- run together with any (or none) other detector
- present all the data to Level 3 for a further decision
- write the L3 accepted data to tape
- present a fraction of L3 accepted data to Online