

# STAR EMC Tower Data Collector to DAQ and L2 Trigger Data Transmission Specification Draft 4/28/00

## Raw data transmission specifications

Fiber Cable	62.5/125um glass with SC style connectors
Optical Wavelength	830nm
Optical Transmitter	Finisar FTM-8510
Optical Receiver	Finisar FRM-8510
DAQ Data Baud Rate	720 Mbaud (20 bit word encoded to 24bits @ 30 MHz GLINK word rate)
DAQ Data Word Rate	30 Mwords/sec (12 ADC in 20 bit word)
L2 Data Baud Rate	12 Gbaud (16 bit word encoded to 20bits @ 60 MHz GLINK word rate)
L2 Data Word Rate	60 Mwords/sec (12 ADC in 16 bit word)
Data Serial Encoder	HP HDMP-1022
Data Serial Decoder	HP HDMP-1024

## Data Transmission Requirements

The Tower Data Collector (TDC) will transmit data to DAQ for each event accepted by L2 trigger. L2 trigger signals the TDC to send an event by placing a trigger command and the token number of the event on the clock trigger distribution input to the TDC. The TDC then must check its DAQ Busy Input to make sure that DAQ has buffer space to receive the event. After which, the TDC responds by sending the event to DAQ using the protocol explained here. The Data Collector also queues up L2 accept's should a TDC to DAQ be in progress. It's possible to queue up almost all 4096 token numbers in the TDC.

## Data Transmission General Format

A single event from the TDC to DAQ will consist of a event start GLINK CAV code, a delay, a 16 byte DAQ header, delay, data start GLINK CAV code, a delay, FEE header and FEE data words, a data end GLINK CAV code, and a delay. Delays will consist of minimum of 5 GLINK Fill Frame codes (often called NOP's or SYNC's). Also Fill Frames may be insert anywhere during the data transmission to allow the TDC to temporarily suspend because of a higher priority operation, such as sending to L2 trigger (future upgrade).

The FEE header and data consist of 4 words of FEE header and 160 FEE ADC words of data for each TDC input channel. For the Barrel Calorimeter there is 30 TDC input channels, thus the total data size is  $(4 + 160) * 30 = 4920$ . With the addition of the Endcap Calorimeter 6 more input channels are added, so the number becomes  $(4 + 160) * 36 = 5904$ .

## Data Transmission General Format Block

Event Start CAV
delay
<b>64 byte DAQ header</b>
Data Start CAV
delay
<b>FEE header and FEE data word</b>
Data End CAV
delay

**Data Transmission times (not including DAQ header, CAV's or delays)**

	EMC Barrel only	EMC Barrel and Endcap
TDC to DAQ	164uS	197uS
TDC to L2	82us	98uS

**TDC to L2 or DAQ GLINK Header Packet Format**

The TDC transmission GLINK packet will conform to the established TPC standard for STAR. The follow reiterates this format and expands on the exact TDC data bit positions.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
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Event Start    CAV code?
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Delay 5 Glink cycles minimum
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0		Trigger CMD
0		DAQ CMD
0		Token MSN
0	Token LSB	
0	Packet send 8 bit counter	
0		Detector ID
0	Readout Unit ID	
0	spare	
0	spare	
0	spare	
0	spare	
0	spare	
0	tagword 0xDE	
0	tagword 0xAD	
0	tagword 0xFA	
0	tagword 0xCE	

48 additional zero words
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**GLINK Data Packets Definitions**

Channel X = input fiber number on the TDC which ranges from 0 to 29 for barrel only, 0 to 35 with Endcap added  
 Crate X = FEE crate number; should be the same as the Channel number  
 ADC X = 12 bit ADC value numbered 0 to 159 for each FEE crate  
 Token = Event Token number passed down by Trigger

**TDC to L2 or DAQ GLINK Data Packet Format**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
----	----	----	----	----	----	---	---	---	---	---	---	---	---	---	---

Data Start CAV code?
Delay

0	Channel 0 Received Byte Count
0	Channel 1 Received Byte Count

repeat

0	Channel 29 Received Byte Count (Endcap 35)
0	Channel 0 TDC error flag bits
0	Channel 1 TDC error flag bits

repeat

0	Channel 29 TDC error flag bits (Endcap 35)
0	Channel 0 Token Number
0	Channel 1 Token Number

repeat

0	Channel 29 Token Number	
0	Trigger Command	Channel 0 Crate 0
0	Trigger Command	Channel 1 Crate 1

repeat

0	Trigger Command	Channel 29 Crate 29 (Endcap 35)
0	Channel 0 ADC0	
0	Channel 1 ADC0	

repeat

0	Channel 29 ADC0 (channel 35 with Endcap)
0	Channel 0 ADC1
0	Channel 1 ADC1

repeat

0	Channel 28 ADC159 (channel 34 with Endcap)
0	Channel 29 ADC159 (channel 35 with Endcap)

Data End CAV code ?
Delay