DAQ data structure for the Muon g-2 experiment

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Abstract

This document outlines the DAQ data structure of the Muon g-2 experiment.

1 DAQ output in a nutshell

The main DAQ framework for the Muon g-2 experiment is based on MIDAS [cite].

2 MIDAS Bank list

Table 1: MIDAS bank list for the calorimetry data.

Bank name			Description							
muon fill	laser fill	pedestal fill	Description							
CA	LA	PA	AMC13 Header							
СВ	LB	PB	WFD5 header							
CC	LC	PC	GPU timing data							
CF	LF	PF	GPU fitted data							
СН	LH	PH	Per crystal Q-method data (N-th event, end of run)							
CL	LL	PL	Clock data							
CP	LP	PP	Pedestal							
\overline{CQ}	LQ	PQ	Per calo Q-method data (every event)							
CR	LR	PR	WFD5 raw data							
CT	LT	PT	T-method islands							
CZ	LZ	PZ	AMC13 CDF trailers							

Table 2: MIDAS bank list for auxiliary T/Q data. This is mainly for the fiber harps, quads and kickers.

Bank name	Description
KH	Per aux. detector channel Q-method data (N-th event, end of run)
KQ	Per aux. detector Q-method data (every event)
KT	T-method data

Table 3: MIDAS bank list for the CCC data.

TTCA	AMC13 Header
TTCR	CCC AMC13 Payload
TTCZ	AMC13 Trailer

3 Bank contents

This section details contents of each MIDAS bank.

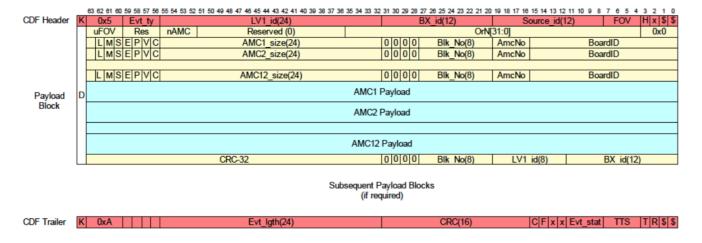


Figure 1: Data structure for AMC13 to DAQ.

	63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 4	5 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25	24 23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0								
AMC13 Header	0 0 0 0 AmcNo L\	V1_id(24) BX_id(12)	Data_lgth(20) [1]								
AMC13 Header	User[31:0]		DrN[15:0]	BoardID[15:0]								
	Rider Data											
AMC13 Trailer	CRC-32 [3]	LV1_id[7:0]	0000	<u>Data_lgth(</u> 20) [2]								

Figure 2: Data structure for Rider to AMC13.

4 C++ Parser

Muon g-2 offline analysis framework relies on parsers in the gm2parser namespace hosted under repository gm2unpacker to decode the data.

63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0												
Channel Header	0 1 Channel Tag [15:0]	Waveform Gap [2	21:0]	Waveform Count [11:0] DDR3 Start Address [2								
Channel Header	DDR3 Start Address [13:0]	Waveform Length [22:0]	FT	Trigger Number [23:0]								
Waveform 1 Header	Waveform Count [11:0]	DDR3 Start Address [25:0]	FT	Waveform	Length [22:0]							
Waveform 1 Header	0 1 0	Channel Tag [15:0]	Wavefor	n Gap [21:0]	Waveform Index [11:0]							
	Waveform 1 ADC Data											
Waveform 2 Header	Waveform Count [11:0]	DDR3 Start Address [25:0]	FT	Waveform	Length [22:0]							
Waveform 2 Header	0 1 0	Channel Tag [15:0]	Wavefor	rm Gap [21:0] Waveform Index [11:0]								
		Waveform 2 ADC Data										
Waveform N Header	Waveform Count [11:0]	DDR3 Start Address [25:0]	FT	Waveform	Length [22:0]							
Waveform N Header	0 1 0	Channel Tag [15:0]	Wavefori	Waveform Gap [21:0] Waveform Index [11								
	Waveform N ADC Data											
Channel Trailer		Channel	Checksum									
Channel Trailer		Channel	Checksum									
Channel Trailer	Data Integrity Check Data Transfer Time											

Figure 3: Data structure for Rider.

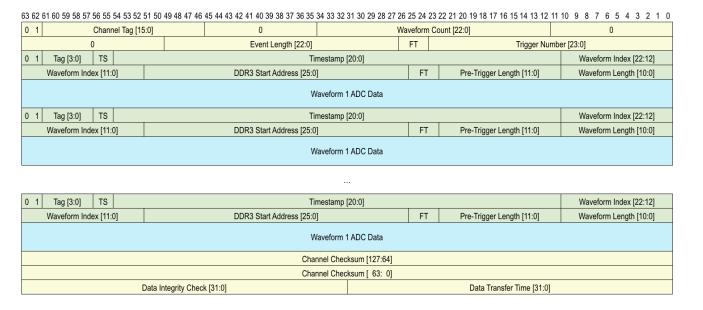


Figure 4: Data structure for asynchronous mode for Rider.

	63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0										
AMC13 Header	0 0 0 0 AmcNo		Trig_Num[23:0]	Timestamp[43:32]	Data_Length[19:0]						
AMC13 Header	User[12:0]	TT	Timesta	mp[31:0]		oard_ID[12:0]					
FC7 Data		Laser_Delay[31:0] Trig_Delay[31:0]									
FC7 Data	FC7_Status[55:0] L12_Ports[7:0										
AMC13 Trailer	CRC[31:0] Trig_Num[7:0] 0 0 0 0 Data_Length[19:0]										

Figure 5: Data structure for encoder FC7.

	63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6												7 6 5 4	3 2 1 0		
AMC13 Header	0 0 0 0	0 0 0 0 AmcNo Trig_Num[23:0]							Tir	mestamp[43:	32]	Data_Length[19:0]				
AMC13 Header	1	User[12:0]	er[12:0] TT Timesta							imp[31:0] BT Board_ID[12:0]						
FC7 Data	Laser_Delay[31:0]								Trig_Delay[31:0]							
FC7 Data		FC7_Status[47:0]								L8_Ports[7:0]				L12_Pc	L12_Ports[7:0]	
FC7 Data	TTS16 TTS15 TTS14 TTS13 TTS12 TTS11 TTS10 TTS9							TTS9	TTS8	TTS7	TTS6	TTS5	TTS4	TTS3	TTS2	TTS1
AMC13 Trailer	CRC[31:0]							Trig_N	um[7:0]	0 0 0 0	Data_Length[19:0]					

Figure 6: Data structure for fanout FC7.