

Readout Formats GTFE-9U-CARDS

Status: preliminary

GT-part: A.Taurok

GMT-part: H.Sakulin

Update: 05. May 2010

Eventnumbers in PSB and FDL record return to X"00...00" after X"FF...FF"

Update: 16. Feb 2010

Trigger- and Eventnumber return to X"00...00" after X"FF...FF" since TCS_V1022 (Aug2009)

Update: 3. July 2009 Summary of Trigger and Event numbers added (actual status)

Comments to TCS-Eventnr corrected. See also TCS data format.

Update: 3. Apr 2009 Board-ID& length = 0x1153 ... programmable; value from database

Update: 9. Mar 2009 FDL: Source of BCNR added, if either from (*rd_addr*) or (*wr_addr*).

Update: 25. Feb 2009: DAQ_5BX_REGISTER added to DAQ record.

3/5bx_length bit for FDL also added to EVM record. See 3/5BX_DEFINITION FOR FDL

EVENT LENGTH calculated by firmware considering

ACTIVE_BOARDS and DAQ_5BX_REGISTER

Update: 18. Nov 2008: Trigger types corrected

Update: 11. June 2008: FDL record with 'PRESCALE_VERSION' included (since FDL firmware V0010)

Update: 19. May 2008: EVM record: 52 BST bytes included in GTFE part → EVM record length increased!!

Typing errors corrected.

Update: 15. April 2008: FDL record: ORBIT_NR(31:0) and LUM_SEGM_NR(15:0) added.

Update: 5. March 2008: Some more precise explanations.

Update: 11. June 2007: New TCS format of TCS firmware 2007

Update: 10. May 2007: **Please use the 'Event_type' from 1st TCS word. See implemented 'Event_types' in ch.1**

Update: 7. May 2007: Preliminary Length of EVM record with TCS firmware Version 0007(prototype)

Update: 4. May 2007: GMT format: Additional 64bit word per BC that contains the BCnrs of the SRT and IN chips

Length of Event Record for DAQ increases therefore. See updated values below.

Update: 23. April 2007: GMT format: Board_ID=0xdd12

Update: 23. April 2007: EVM record: FDL text corrected.

Update: 4. April 2007: Board_IDs defined.

Update: 29. March 2007: Text corrected for 'bx_in_event'.

Update: 22. Feb 2007: TCS: Luminosity Segment Number added

Update: 8. Jan 2007: TIM: Channel Link record with test-patterns, event number and bc-nr

Update: 11. Dec 2006: GMT ChannelLink record inserted as in ROP Version Dec2004

Update: 4.Dec 2006: Event Manager record:
 - BST bytes appended to GTFE data
 - TCS words changed to agree mostly with actual TCS_V0007 firmware version.

Update: Nov 2006: Order of boards in the DAQ record has been changed.
 The long GMT part has been moved to the last position to optimize the transfer time to the S-LINK.
 ACTIVE_BOARDS: bit definition changed so that the numbers agree with the order in the DAQ record and also with the 'channel numbers inside the chip and the bit numbers in some status registers.
 Board-ID should be programmed to reflect the VME slot number.

Update: Oct 2006: **DAQ record does NOT contain a valid Event_Type in the Header word.**
 Only the Event Manager record contains a valid Event_Type in the Header word.

Update: 3 july 2006: FDL Format: FINOR(15:0) replaced by 0000 000 NoAlgo, FINOR(7:0)

Update: 11+12 jan 2006: GPS data moved to 3rd payload position in EVM record
 New PARTITION_RUN_NUMBER in upper part of 2nd TCS word.
 New 32 bit SETUP_VERSION in 1. GTFE word
 ACTIVE_BOARDS: bit definition done

First Version: 9. Dec 2005

1 Header & Trailer of SLINK record

63-60	59-56	55- 32	31 - 20	19 - 8	7 -4	3	2	1	0
BOE_1	Evt_typ	LV1_id (24) Event-Nr	BX_id(12)	Source_id (10+2)	FOV	H	x	\$	\$
16 + 16 + 16 + 16 bits data words //record is of constant length									
EOE_1	xxxx	Event_length (24)	CRC(16); xxxx; Event_stat(8)			T	R	\$	\$

HEADER word:

Bit 63-60: BOE =Begin of event // **programmable register bits** // **BOE_1= ,5'**

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Bit 59-56: Event type =0           // → get Event Type from TCS part
Bit 55-32: Event Nr                // reference event number since last L1Reset
Bit 31-20: BX-id                   // reference BC number
Bit19-8: GT-identifier             // programmable register bits
                                   // = 813 =32D

Bit7-4: FOV =0                    // Format version ;programmable register bits
Bit3: H= 0                         // last header word; =1 another header word follows
Bit2,1,0: =0                       // undefined or used by S-Link hardware
TRAILER word:
Bit 63-60: EOE =End of event      // programmable // EOE_1= ,A'
Bit 59-56: 0000                   // undefined
Bit 55-32: Event Length           // length counter
Bit 31-16: CRC                    // calculated without last word ??
Bit 15-12: 0000                   // undefined
Bit 11- 4: Event_status           // 8bits; X"00" = without error, X"EE" = sync error
Bit 3: =0                          // last trailer word; =1 other trailer word follows
Bit2-0: =0                         // undefined or used by S-Link hardware

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<i>Evt_type</i>	<i>name</i>	<i>comment</i>	<i>status</i>
0001	Physics or Technical Trigger	FinOR	Implemented
0010	Calibration trigger	Calibration cycle	Implemented
0011	Random trigger		Implemented
0100	-----	-----	
0101	Traced event	for DAQ tests only	---
0110	Test Trigger	for tests only	Implemented
1111	Error Trigger	for tests only	To be implemented
other	undefined		

Technical triggers are merged with physics triggers in the FINAL_OR logic. Therefore Physics and Technical Triggers are delivered also with same Event type. In the data of the FDL module physics as well as technical trigger bits are contained.

Error triggers will be generated when Partition Controller (PTC) goes into the 'OUT_OF_SYNC' or 'ERROR' status.

Event_status: X"00" = without error, X"EE" = sync error
Sync error when a board sends an additional event too early.
Sync error when a Channel Link FIFO is full.

2 CRC computation

This component can be used "as is" in your FED firmware. When the trailer is given to the component for CRC computation, as it is containing the final CRC, the CRC field and the R bit must be forced to zero. Then when the event is complete, the current CRC value is substituted in the trailer word before transmission to DAQ whereas the R bit remains at zero.

When the event is received by the S-link sender card, the CRC is recomputed by the on-board FPGA : if the recomputed CRC value is different from the one computed by the FED, this later value overwrites the current CRC value in the trailer and the bit R is set to '1'. In case of CRC error detected during the event building process, this allows to determine if the problem is before/after S-link device.

3 Trigger & Event numbers

3. July 09: Actual status of GT firmware

CMS Header

EventNr (24 bits)

- 32 bits counter in GT firmware, but only the least significant (LS) 24 bits are written in header word
- increased by every event from each partition.
- cleared by "Start of Run"
- cleared by RESYNC/L1RESET
- cleared by RESET_EventNr (EC0)
- at 32 bits in counter: FFFF FFFF -> 0000 0000
- at 24 bits in header word: FF FFFF -> 00 0000 (take LS 24 bits from counter)

GTFE payload

TOTAL_TRIGNR (32 bits)

- increased by every event from each partition.
- cleared by "Start of Run"
- at 32 bits: FFFF FFFF -> 0000 0000 since TCS_V1022 (Aug 2009)

TCS payload (exists in EVM record only)

PART_TRIGNR (32 bits)

- increased by every event of ***one*** partition (partition number given by DAQNR from TCS payload)
- cleared by "Start of Run"
- at 32 bits: FFFF FFFF -> 0000 0000 since TCS_V1022 (Aug 2009)

(PART_)EVENTNR (32 bits)

- increased by every event of ***one*** partition
- cleared by "Start of Run"

- cleared by RESYNC/L1RESET
- cleared by RESET_EventNr (EC0)
- at 32 bits: FFFF FFFF -> 0000 0000

FDL payload

EVENTNR (24 bits)

- increased by every event from each partition
- cleared by RESET_EventNr (EC0)
- at 24 bits: FF FFFF -> 00 0000 since FDL_V1016
- can be extended (if needed) to 32 bits - DataFormats change

PSB payload

EVENTNR (24 bits)

- increased by every event from each partition
- cleared by RESET_EventNr (EC0)
- cleared by RESYNC/L1RESET
- at 24 bits: FF FFFF -> 00 0000 since PSB_V100B
- can be extended (if needed) to 32 bits - DataFormats change

GMT payload

EVENTNR (24 bits)

- increased by every event from each partition
- cleared by RESET_EventNr (EC0)
- cleared by RESYNC/L1RESET
- at 24 bits: FF FFFF -> 00 0000

4 EVM Slink64 record

Standard record: 1st BC = BC(L1A) -1, 2nd BC = BC(L1A), 3rd BC = BC(L1A)-1

Debug record: 1st BC = BC(L1A) -2, 2nd BC = BC(L1A) -1, 3rd BC = BC(L1A), 4th BC = BC(L1A) +1, 5th BC = BC(L1A) + 2

BST52 mode =0: =mode for obsolete BST format with 30 bytes

Record length of 3bx event: 1Header + 6 GTFE + 5 TCS + 21 FDL + 1 Trailer = **34 W64**

Record length of 5bx event: 1Header + 6 GTFE + 5 TCS + 35 FDL + 1 Trailer = **48 W64**

BST52 mode =1:

Record length of 3bx event: 1Header + 9 GTFE + 5 TCS + 21 FDL + 1 Trailer = **37 W64**

Record length of 5bx event: 1Header + 9 GTFE + 5 TCS + 35 FDL + 1 Trailer = **51 W64**

GTFE :

BOARD_ID = programmable 8 bit Board Identifier, **GTFE: 0x11**

BOARD_IDs for other boards (16 bits!!) see table for ACTIVE_BOARDS below

LENGTH = **0x53** // 3 for 3bx-events, 5 for 3bx-events; programmable number defining the record length types.

The record for 3 BCs contains 1 preceding BC, the BC of the L1A and one following BC.

The data are flagged by 'bx_in_event' = 'F', '0', '1'.

The debug record for 5 BCs contains 2 preceding BCs, the BC of the L1A and the 2 following BC.

The data are flagged by 'bx_in_event' = 'E', 'F', '0', '1', '2'.

BCNR = Bunch Crossing Number as counted in the GTFE board. It should be compared to the other BCNRs in the record.

SETUP_VERSION(31:0) = is loaded by TriggerSupervisor software. It could be used to link EVM and DAQ records to each other like a general RunNumber.

TOTAL_TRIGNR = total Trigger number = total number of L1A sent since start of run

ACTIVE_BOARDS = Boards contributing to the EVM record; 1= board is active, 0= board is disconnected

Default value: = **hex"0003"**;

!! Definition is different in DAQ chip!!

3/5BX_DEFINITION FOR FDL

EVM_5BX_REGISTER in EVM chip - BIT definition				
BIT#	BOARD	SLOT# in crate	Board Name	Remark
0	--	--	--	Not used
1	FDL	10	Final Decision board	
2 - 15	--	--	--	Not used

3/5bx for FDL = 1 → 5bx record;

= 0 → 3bx record from FDL board expected

Value has to agree with DAQ 5BX REGISTER(0) !!!

ACTIVE_BOARDS in EVM chip - BIT definition				
BIT#	BOARD	SLOT# in crate	Remark	BOARD_ID *)

0	TCS	7	Trigger Control board	0xcc07
1	FDL	10	Final Decision board	0xfd0a
2-15	---	<i>Not used</i>	<i>Nothing assigned</i>	<i>Nothing assigned</i>

LHC BEAM SYNCHRONOUS TIMING MASTER = BST

See document ~~LHC-BOB-ES-0001-00-10.pdf~~ ~~date 2005-09-29~~

~~BST_B4-1: Turn Count Number (31:0)~~

~~BST_B5: BST_Master Status~~

~~BST_B6: Machine Mode~~

~~BST_B14-7: GPS TIME (63:0)~~

~~BST_B18-15: LHC Fill Number (31:0)~~

~~BST_B19: Particle Type of Beam 1~~

~~BST_B20: Particle Type of Beam 2~~

~~BST_B22-21: Beam Momentum (15:0)~~

~~BST_B26-23: Total Intensity of Beam 1: 4 Bytes = integer *10e⁸~~

~~BST_B30-27: Total Intensity of Beam 2: 4 Bytes = integer *10e⁸~~

New format for 52 BST bytes: since EVM firmware version V0011

See Wiki pages about BST data.

Code for real BST data in last GTFE word: X"BEA0"

Code for simulated BST data in last GTFE word: X"DDDD"

- FDL:** bx_in_event(3:0) Bunch Crossing Number In Event: 3bx record (F,0,1), 5bx record (E,F,0,1,2)
- BCNR Bunch Crossing Number of actual bc (**Ring Buffer READ ADDRESS**)
- EVENTNR (23:0) Event Number since last L1Reset generated in the FDL chip.
- TECH_TRIG (63:0) Technical Trigger bits as received via PSB0 board (external triggers)
- ALGO (127:0) Algorithm bits = Physics triggers; ALGO (192:128) Algorithm bits for future upgrade
- FINOR (7:0) Final OR bits. FINOR(i) is connected to Partition (i); FINOR (15:8) not used
- localBCNR(11:0) local Bunch Crossing Number shows the BCNR of the FDL chip, when the data were written into the Ring-buffer.
(**Ring Buffer WRITE ADDRESS**)
It will be used to check the readout synchronization between different GT boards.

PRESCALE_VERSION(31:0) Version number for set of pre-scale factors loaded into the FDL chip.

PRESCALE_VERSION[15:00] = PRESCALE_FACTOR_INDEX_ALGO

PRESCALE_VERSION[31:16] = PRESCALE_FACTOR_INDEX_TT (Technical Trigger)

- TCS:** DAQNR(3:0) Number of DAQ Partition to which the L1A has been sent
 EVENT_TYPE (3:0) Event type generated in TCS
 STATUS (3:0) 1000 = Low rate=Warning; 0000 = Normal rate; // During other PTC states no triggers are sent.
 BCNR (11:0) Bunch Crossing Number of the TCS chip
 0000b 4 free bits for an optional extension of the Partition Trigger number to cover 166 h of 100 kHz trigger rate
 PART_TRIGNR (31:0) Partition Trigger number = total number of L1A sent since start of run to this DAQ Partition.
 When running with a 100 kHz trigger a 32 bit counter overflows after 11,8 h [$((2^{32})/10^5)/3600 = 11,8h$]
 PART_RUN_NR(31:0) can be different for each DAQ-partition. It is loaded by (TriggerSupervisor ?) software.
 Maybe the lower 8 bits could be used like a sub-Run_Nr
 00hex 8 free bits for optional extension of Event Number (to get unique event numbers for >11,8 h with a 100 kHz rate)
 EVENTNR((31)23:0)Event Number since last L1Reset generated in the TCS chip. *It should be equal to Event number in the Header word only when running with single Partition_0.*
 ASSIGNED_PARTITIONS(31:0) Bit ‘i’ corresponds to detector partition ‘i’. If the bit =1 then the detector partition is connected to the actual DAQ/TTC-partition.
 ORBITNR (31:0) Orbit number since start of run respectively since the last ‘Reset Orbit Number’ software command.
 Implemented: 32 bit OrbitNr → ~106 h = 4d+10h. Could be extended to 48 bit when required
 LUMINOSITY_SEGMENT_NR(15:0) since start of run.
 TECH_TRIG (i): Technical Trigger bits after pre-scaling, before being masked.
 ALGO(i): Algorithm bits after pre-scaling, before being masked. (‘Physics trigger bits’)
 NoAlgo : after prescaling; is true (,1’) when all ALGO bits are false(‘0’),

‘Event_type’ in the Header word is not valid, because of timing problems.

Please use the ‘Event_type’ from 1st TCS word.

63 -60	59-56	55 - 32	31 - 20	19 - 8	7-4	3	2	1	0	
BOE=0101	<i>Event_type*</i> <i>=0000; see</i> <i>TCS part</i>	Event-Nr low 24 bit	BX_id(12)	Source_id (12)	FOV	H=0	x	\$	\$	CMS HEADER WORD

63 -48		47-32		31-16		15 - 0		Comment
Board-ID& length = 0x1153		0hex, BCNR(11:0)		SETUP_VERSION(31:16)		SETUP_VERSION(15:0)		GTFE
ACTIVE_BOARDS(15:0)		3/5BX_DEFINITION FOR FDL		TOTAL_TRIGNR(31:16)		TOTAL_TRIGNR(15:0)		GTFE
BST_B7	BST_B6	BST_B5	BST_B4	BST_B3	BST B2	BST B1	BST_B0	GTFE
BST_B15	BST_B14	BST_B13	BST_B12	BST_B11	BST B10	BST B9	BST B8	GTFE
BST_B23	BST_B22	BST_B21	BST_B20	BST_B19	BST B18	BST B17	BST_B16	GTFE
BST_B31	BST_B30	BST_B29	BST_B28	BST_B27	BST B26	BST B25	BST_B24	GTFE
BST_B39	BST_B38	BST_B37	BST_B36	BST_B35	BST_B34	BST_B33	BST_B32	GTFE
BST_B47	BST_B46	BST_B45	BST_B44	BST_B43	BST_B42	BST_B41	BST_B40	GTFE
„BE“/“DD“ *	„A0“/“DD“ *	„00“	„00“	BST_B51	BST_B50	BST_B49	BST_B48	GTFE
Board-ID (15:0) = hex"CC07"		„0“ , BCNR (11:0)		„0“, DAQNR, EVENT_TYPE(3:0), STATUS(3:0)		LUMINOSITY_ SEGMENT_NR(15:0)		TCS chip
PART_RUN_NR(31:16)		PART_RUN_NR(15:0)		ASSIGNED PARTS (31:16)		ASSIGNED PARTS (15:0)		TCS chip
PART_TRIGNR (31:16)		PART_TRIGNR(15:0)		PART_EVENTNR (31:16)		PART_EVENTNR (15:0)		TCS chip
0000 hex		ORBITNR (47:32)		ORBITNR (31:16)		ORBITNR (15:0)		TCS chip
0000 hex		0000 hex		0000 hex		0000 hex		TCS chip
BOARD_ID = hex"FD0A"		bx_in_event(3:0), BCNR(11:0)		00hex, EVENTNR(23:16)		EVENTNR(15:0)		FDL 1 st BC
TECH_TRIG(63 : 48)		TECH_TRIG(47 : 32)		TECH_TRIG(31 : 16)		TECH_TRIG(15 : 0)		FDL 1 st BC
ALGO(63 : 48)		ALGO(47 : 32)		ALGO(31 : 16)		ALGO(15 : 0)		FDL 1 st BC
ALGO(127 : 112)		ALGO(111 : 96)		ALGO(95 : 80)		ALGO(79 : 64)		FDL 1 st BC
ALGO(191 : 176)		ALGO(175 : 160)		ALGO(159 : 144)		ALGO(143 : 128)		FDL 1 st BC
PRESCALE_VERSION(31:16)		PRESCALE_VERSION(15:0)		0000hex		0000 000 NoAlgo, FINOR(7:0)		FDL 1 st BC
ORBIT_NR(31:16)		ORBIT_NR(15:0)		LUM_SEGM_NR(15:0)		0hex, localBCNR(11:0) (<i>wr_addr</i>)		FDL 1 st BC
BOARD_ID = hex"FD0A"		bx_in_event(3:0), BCNR(11:0)		00hex EVNR(23:16)		EVNR(15:0)		FDL 2nd BC
TECH_TRIG(63 : 48)		TECH_TRIG(47 : 32)		TECH_TRIG(31 : 16)		TECH_TRIG(15 : 0)		FDL 2nd BC
ALGO(63 : 48)		ALGO(47 : 32)		ALGO(31 : 16)		ALGO(15 : 0)		FDL 2nd BC
ALGO(127 : 112)		ALGO(111 : 96)		ALGO(95 : 80)		ALGO(79 : 64)		FDL 2nd BC
ALGO(191 : 176)		ALGO(175 : 160)		ALGO(159 : 144)		ALGO(143 : 128)		FDL 2nd BC
PRESCALE_VERSION(31:16)		PRESCALE_VERSION(15:0)		0000hex		0000 000 NoAlgo, FINOR(7:0)		FDL 2nd BC
ORBIT_NR(31:16)		ORBIT_NR(15:0)		LUM_SEGM_NR(15:0)		0hex, localBCNR (11:0) (<i>wr_addr</i>)		FDL 2nd BC

BOARD_ID = hex"FD0A"	bx_in_event(3:0), BCNR(11:0)	00hex EVENTNR(23:16)	EVENTNR(15:0)	FDL 3rd BC
TECH_TRIG(63 : 48)	TECH_TRIG(47 : 32)	TECH_TRIG(31 : 16)	TECH_TRIG(15 : 0)	FDL 3rd BC
ALGO(63 : 48)	ALGO(47 : 32)	ALGO(31 : 16)	ALGO(15 : 0)	FDL 3rd BC
ALGO(127 : 112)	ALGO(111 : 96)	ALGO(95 : 80)	ALGO(79 : 64)	FDL 3rd BC
ALGO(191 : 176)	ALGO(175 : 160)	ALGO(159 : 144)	ALGO(143 : 128)	FDL 3rd BC
PRESCALE_VERSION(31:16)	PRESCALE_VERSION(15:0)	0000hex	0000 000 NoAlgo, FINOR(7:0)	FDL 3rd BC
ORBIT_NR(31:16)	ORBIT_NR(15:0)	LUM_SEGM_NR(15:0)	0hex, localBCNR(11:0) (<i>wr_addr</i>)	FDL 3rd BC

End of Record

63 - 60	59 - 56	55 - 32	31 - 16	15 - 12	11 - 4	3 - 0	Comment
EOE_1=A	xxxx	Event_length (24)	CRC(16);	xxxx	Event_stat(8)	TR x\$	TRAILER

*) "BEA0" = real BST data;

*) "DDDD" = simulated BST data

GTFE format for 30 BST bytes:

63 -48		47-32		31-16		15 - 0		Comment
Board-ID& length = 0x1153		0hex, BCNR(11:0)		SETUP_VERSION(31:16)		SETUP_VERSION(15:0)		GTFE
ACTIVE_BOARDS(15:0)		"0000"		TOTAL_TRIGNR(31:16)		TOTAL_TRIGNR(15:0)		GTFE
BST_B8	BST_B7	BST_B6	BST_B5	BST_B4	BST_B3	BST B2	BST B1	GTFE
BST_B16	BST_B15	BST_B14	BST_B13	BST_B12	BST_B11	BST B10	BST B9	GTFE
BST_B24	BST_B23	BST_B22	BST_B21	BST_B20	BST_B19	BST B18	BST B17	GTFE
"BE"/"DD"*	"A0"/"DD"*	BST_B30	BST_B29	BST_B28	BST_B27	BST B26	BST B25	GTFE

5 DAQ Slink64 record

Standard record: 1st BC = BC(L1A) -1, 2nd BC = BC(L1A), 3rd BC = BC(L1A)-1

Debug record: 1st BC = BC(L1A) -2, 2nd BC = BC(L1A) -1, 3rd BC = BC(L1A), 4th BC = BC(L1A) +1, 5th BC = BC(L1A) + 2

GTFE:

Remark: The GTFE data are common for all DAQ Partitions!!!!

BOARD_ID = **0x11** programmable **8 bit** Board Identifier

BOARD_IDs for other boards (16bits) see table for ACTIVE_BOARDS

LENGTH = 3 or = 5 programmable number defining the record length: 3 bx or 5 bx, # of contributing boards

BCNR = Bunch Crossing Number as counted in the GTFE board. It should be compared to the other BCNRs in the record.

SETUP_VERSION(31:0) = is loaded by TriggerSupervisor software. It could be used to link EVM and DAQ records to each other like a general RunNumber.

TOTAL_TRIGNR = total Trigger number = total number of L1A sent since start of run

ACTIVE_BOARDS = Boards contributing to the EVM resp. DAQ record; 1= board is active, 0= board is disconnected

ACTIVE_BOARDS in DAQ chip - BIT definition				
BIT#	BOARD	SLOT# in crate	Remark	BOARD_ID
0	FDL	10	Final Decision board	0xfd0a
1	PSB_0	9	Techn.Triggers for FDL	0xbb09
2	PSB_1	13	Calo data for GTL	0xbb0d
3	PSB_2	14	Calo data for GTL	0xbb0e
4	PSB_3	15	Calo data for GTL	0xbb0f
5	PSB_4	19	M/Q bits for GMT	0xbb13
6	PSB_5	20	M/Q bits for GMT	0xbb14
7	PSB_6	21	M/Q bits for GMT	0xbb15
8	GMT	18	Global Muon Trigger	0xdd12
9	<i>GMT_spare</i>	<i>18</i>	<i>Not used</i>	<i>0xde12</i>
10	<i>TCS_M</i>	<i>7</i>	<i>Not used</i>	<i>0xcd07</i>
11	<i>TIM</i>	<i>16</i>	<i>Not used</i>	<i>0xadad</i>
12-15	---	<i>Not used</i>	<i>Nothing assigned</i>	

DAQ_5BX_REGISTER

bit(i) = 1 → 5bx record;

bit(i) = 0 → 3bx record from this board expected

Same board/bit position assignment as in ACTIVE_BOARDS;

Value of DAQ_5BX_REGISTER(0) has to agree with EVM_CMD_REG(10) and with EVM_5BX_REGISTER(1)!

DAQ_5BX_REGISTER in DAQ chip - BIT definition				
BIT#	BOARD	SLOT# in crate	Board Name	Remark
0	FDL	10	Final Decision board	
1	PSB_0	9	Techn.Triggers for FDL	
2	PSB_1	13	Calo data for GTL	
3	PSB_2	14	Calo data for GTL	
4	PSB_3	15	Calo data for GTL	
5	PSB_4	19	M/Q bits for GMT	
6	PSB_5	20	M/Q bits for GMT	
7	PSB_6	21	M/Q bits for GMT	
8	GMT	18	Global Muon Trigger	
9	<i>GMT_spare</i>	<i>18</i>	<i>Not used</i>	
10	<i>TCS_M</i>	<i>7</i>	<i>Not used</i>	
11	<i>TIM</i>	<i>16</i>	<i>Not used</i>	
12-15	<i>---</i>	<i>Not used</i>	<i>Nothing assigned</i>	

FDL: Same data as in EVM record.

bx_in_event(3:0) Bunch Crossing Number In Event: 3bx record (F,0,1), 5bx record (E,F,0,1,2)

BCNR = Bunch Crossing Number of actual bc (**Ring Buffer READ_ADDRESS**)

EVENTNR (23:0) Event Number since last L1Reset generated in the FDL chip.

TECH_TRIG (63:0) Technical Trigger bits as received via PSB0 board (external triggers)

ALGO (127:0) Algorithm bits = Physics triggers; ALGO (192:128) Algorithm bits for future upgrade

FINOR (7:0) Final OR bits. FINOR(i) is connected to Partition (i); FINOR (15:8) not used

localBCNR(11:0) local Bunch Crossing Number shows the BCnr when the data were written into the Ringbuffer.
(**Ring Buffer WRITE_ADDRESS**)

It will be used to check the readout synchronization between different GT boards.

PRESCALE_VERSION(31:0) Version number for set of pre-scale factors loaded into the FDL chip.

PRESCALE_VERSION[15:00] = PRESCALE_FACTOR_INDEX_ALGO

PRESCALE_VERSION[31:16] = PRESCALE_FACTOR_INDEX_TT (Technical Trigger)

PSB 0...6:

PSB0 = slot 9 Technical Trigger,

PSB1= slot13 (1st for GTL), PSB2= slot14 (2nd for GTL), PSB3= slot15 (3rd for GTL),

Calorimeter Objects:

PSB1_ch0/1 => **CA4**, PSB1_ch2/3 => **CA3**, PSB1_ch4/5 => **CA2**, PSB1_ch6/7 => **CA1**,

PSB2_ch0/1 => **CA8**, PSB2_ch2/3 => **CA7**, PSB2_ch4/5 => **CA6**, PSB2_ch6/7 => **CA5**,

PSB3_ch0/1 => **CA10**, PSB3_ch2/3 => **CA9**, PSB3_ch4/5 =>xxxx, PSB3_ch6/7 =>xxxx,

Remark: PSBx_ch0 and PSBx_ch1 each receive 2 trigger objects interlaced at 80 MHz rate.

A_DATA_CH0 = from 1st trigger object, B_DATA_CH0 = from 3rd trigger object,

A_DATA_CH1 = from 2nd trigger object, B_DATA_CH1 = from 4th trigger object,

See CMS NOTE 2002/069 GCT to GT interface

PSB4= slot19 (1st for GMT), PSB5= slot20 (2nd for GMT), PSB6= slot21 (3rd for GMT),

MIP/QUIET bits:

PSB4_ch0/1 => **MQB1_xx**, PSB4_ch2/3 =>**MQB2_xx**, PSB4_ch4/5 => **MQF3_xx**, PSB4_ch6/7 => **MQF4_xx**,

PSB5_ch0/1 => **MQB5_xx**, PSB5_ch2/3 => **MQB6_xx**, PSB5_ch4/5 => **MQF7_xx**, PSB5_ch6/7 => **MQF8_xx**,

PSB6_ch0/1 => **MQB9_xx**, PSB6_ch2/3 => **MQB10_xx**, PSB6_ch4/5 => **MQF11_xx**, PSB6_ch6/7 => **MQF12_xx**,

Remark: PSBx_ch0 and PSBx_ch1 each receive MIP and QUIET bits interlaced at 80 MHz rate.

A_DATA_CH0 = MIP bits, B_DATA_CH0 = QUIET bits from same eta/phi tower

A_DATA_CH1 = MIP bits, B_DATA_CH1 = QUIET bits,

See CMS NOTE 2002/069 GCT to GT interface

GMT:

GMT_A = standard GMT Channel Link,

GMT_B = 2nd Channel Link on GMT board is not used (spare channel).

17 W64 per BC → 3bx: 51 W64

TCSM chip on TCS board:

Not used: TCS_D = Channel Link connected to TCSM chip for DAQ record is not used. One could append monitoring TCS-data.

TIM:

Used for TEST only: TIM = is not used, could be used to append some monitoring data to the DAQ record.

Tim-record: 6 W64

Board order in record:

GTFE → FDL → PSB0 → PSB1 → PSB2 → PSB3 → PSB4 → PSB5 → PSB6 → GMT

Record Length:

3bx_events: 1Header + 2 GTFE + 21 FDL + 126 (=7x18) PSB0_6 + **51** GMT + 1 Trailer = 202

5bx_events: 1Header + 2 GTFE + 35 FDL + 210 (=7x30) PSB0_6 + **85** GMT + 1 Trailer = 334

Record length for 3bx event = 202 W64

Record length for 5bx event = 334 W64

- Please note that the DAQ Record does not contain any RUN NUMBER, because the DAQ record should be sent with every trigger for each DAQ-Partition.
- The Event_type in the DAQ record is a constant value.

63 -60	59-56	55 - 32	31 - 20	19 - 8	7-4	3	2	1	0	
BOE_1=0101	Evt_typ	LV1_id (24) Event-Nr	BX_id(12)	Source_id (10+2)	FOV	H	x	\$	\$	HEADER WORD

63 -48	47-32	31-16	15 - 0	Comment
Board-ID& length = 0x1153	0hex, BCNR(11:0)	SETUP_VERSION(31:16)	SETUP_VERSION(15:0)	GTFE
ACTIVE_BOARDS(15:0)	DAQ_5BX_REGISTER(15:0)	TOTAL_TRIGNR(31:16)	TOTAL_TRIGNR(15:0)	GTFE

63 -48	47-32	31-16	15 - 0	Comment
BOARD_ID = hex"FD0A"	Bx_in_event(3:0), BCNR(11:0)	0 0, EVNR(23:16)	EVNR(15:0)	FDL 1 st BC
TECH_TRIG(63 : 48)	TECH_TRIG(47 : 32)	TECH_TRIG(31 : 16)	TECH_TRIG(15 : 0)	FDL 1 st BC
ALGO(63 : 48)	ALGO(47 : 32)	ALGO(31 : 16)	ALGO(15 : 0)	FDL 1 st BC
ALGO(127 : 112)	ALGO(111 : 96)	ALGO(95 : 80)	ALGO(79 : 64)	FDL 1 st BC
ALGO(191 : 176)	ALGO(175 : 160)	ALGO(159 : 144)	ALGO(143 : 128)	FDL 1 st BC
PRESCALE_VERSION(31:16)	PRESCALE_VERSION(15:0)	0000hex	0000 000 NoAlgo, FINOR(7 : 0)	FDL 1 st BC
ORBIT_NR(31:16)	ORBIT_NR(15:0)	LUM_SEGM_NR(15:0)	0 localBCNR(11:0) (wr_addr)	FDL 1 st BC
BOARD_ID = hex"FD0A"	Bx_in_event(3:0), BCNR(11:0)	0 0, EVNR(23:16)	EVNR(15:0)	FDL 2nd BC
TECH_TRIG(63 : 48)	TECH_TRIG(47 : 32)	TECH_TRIG(31 : 16)	TECH_TRIG(15 : 0)	FDL 2nd BC
ALGO(63 : 48)	ALGO(47 : 32)	ALGO(31 : 16)	ALGO(15 : 0)	FDL 2nd BC
ALGO(127 : 112)	ALGO(111 : 96)	ALGO(95 : 80)	ALGO(79 : 64)	FDL 2nd BC
ALGO(191 : 176)	ALGO(175 : 160)	ALGO(159 : 144)	ALGO(143 : 128)	FDL 2nd BC
PRESCALE_VERSION(31:16)	PRESCALE_VERSION(15:0)	0000hex	0000 000 NoAlgo, FINOR(7 : 0)	FDL 2nd BC
ORBIT_NR(31:16)	ORBIT_NR(15:0)	LUM_SEGM_NR(15:0)	0 localBCNR(11:0) (wr_addr)	FDL 2nd BC
BOARD_ID = hex"FD0A"	Bx_in_event(3:0), BCNR(11:0)	0 0, EVNR(23:16)	EVNR(15:0)	FDL 3rd BC
TECH_TRIG(63 : 48)	TECH_TRIG(47 : 32)	TECH_TRIG(31 : 16)	TECH_TRIG(15 : 0)	FDL 3rd BC
ALGO(63 : 48)	ALGO(47 : 32)	ALGO(31 : 16)	ALGO(15 : 0)	FDL 3rd BC
ALGO(127 : 112)	ALGO(111 : 96)	ALGO(95 : 80)	ALGO(79 : 64)	FDL 3rd BC

ALGO(191 : 176)	ALGO(175 : 160)	ALGO(159 : 144)	ALGO(143 : 128)	FDL 3rd BC
PRESCALE_VERSION(31:16)	PRESCALE_VERSION(15:0)	0000hex	0000 000 NoAlgo, FINOR(7 : 0)	FDL 3rd BC
ORBIT_NR(31:16)	ORBIT_NR(15:0)	LUM_SEGM_NR(15:0)	0 localBCNR(11:0) (<i>wr_addr</i>)	FDL 3rd BC

<i>63 -48</i>	<i>47-32</i>	<i>31-16</i>	<i>15 - 0</i>	<i>Comment</i>
BOARD_ID =PSB_0	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_0 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_0 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_0 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_0 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_0 1 st BC
0000	0000	0000	,000' localBCNR(11:0)	PSB_0 1 st BC
BOARD_ID =PSB_0	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_0 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_0 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_0 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_0 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_0 2nd BC
0000	0000	0000	,000' localBCNR(11:0)	PSB_0 2nd BC
BOARD_ID =PSB_0	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_0 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_0 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_0 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_0 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_0 3rd BC
0000	0000	0000	,000' localBCNR(11:0)	PSB_0 3rd BC
BOARD_ID =PSB_1	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_1 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_1 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_1 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_1 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_1 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_1 1 st BC
BOARD_ID =PSB_1	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_1 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_1 2nd BC

A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_1 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_1 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_1 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_1 2nd BC
BOARD_ID =PSB_1	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_1 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_1 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_1 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_1 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_1 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_1 3rd BC
<i>63 -48</i>	<i>47-32</i>	<i>31-16</i>	<i>15 - 0</i>	<i>Comment</i>
BOARD_ID =PSB_2	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_2 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_2 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_2 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_2 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_2 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_2 1 st BC
BOARD_ID =PSB_2	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_2 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_2 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_2 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_2 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_2 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_2 2nd BC
BOARD_ID =PSB_2	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_2 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_2 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_2 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_2 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_2 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_2 3rd BC
BOARD_ID =PSB_3	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_3 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_3 1 st BC

A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_3 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_3 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_3 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_3 1 st BC
BOARD_ID =PSB_3	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_3 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_3 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_3 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_3 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_3 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_3 2nd BC
BOARD_ID =PSB_3	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_3 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_3 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_3 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_3 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_3 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_3 3rd BC

<i>63 -48</i>	<i>47-32</i>	<i>31-16</i>	<i>15 - 0</i>	<i>Comment</i>
BOARD_ID =PSB_4	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_4 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_4 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_4 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_4 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_4 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_4 1 st BC
BOARD_ID =PSB_4	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_4 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_4 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_4 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_4 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_4 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_4 3rd BC

BOARD_ID =PSB_4	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_4 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_4 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_4 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_4 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_4 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_4 3rd BC
BOARD_ID =PSB_5	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_5 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_5 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_5 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_5 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_5 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_5 1 st BC
BOARD_ID =PSB_5	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_5 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_5 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_5 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_5 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_5 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_5 3rd BC
BOARD_ID =PSB_5	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_5 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_5 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_5 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_5 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_5 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_5 3rd BC
<i>63 -48</i>	<i>47-32</i>	<i>31-16</i>	<i>15 - 0</i>	<i>Comment</i>
BOARD_ID =PSB_6	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_6 1 st BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_6 1 st BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_6 1 st BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_6 1 st BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_6 1 st BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_6 1 st BC

BOARD_ID =PSB_6	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_6 2nd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_6 2nd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_6 2nd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_6 2nd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_6 2nd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_6 3rd BC
BOARD_ID =PSB_6	Bx_in_event(3:0), BCNR(11:0)	0 0 , EVNR(23:16)	EVNR(15:0)	PSB_6 3rd BC
A_DATA_CH3	A_DATA_CH2	A_DATA_CH1	A_DATA_CH0	PSB_6 3rd BC
A_DATA_CH7	A_DATA_CH6	A_DATA_CH5	A_DATA_CH4	PSB_6 3rd BC
B_DATA_CH3	B_DATA_CH2	B_DATA_CH1	B_DATA_CH0	PSB_6 3rd BC
B_DATA_CH7	B_DATA_CH6	B_DATA_CH5	B_DATA_CH4	PSB_6 3rd BC
0000	0000	0000	,000' localBCNR(12:0)	PSB_6 3rd BC

63 -48	47-32	31-16	15 - 0	Comment
Board-ID(15:0)	Bx_in_event(3:0), BCNR(11:0)	BCERR(7:0), EVNR(23:16)	EVNR(15:0)	GMT board, 1st BC //BCNR of ROP chip
DT1 (31:16)	DT1 (15:0)	DT0 (31:16)	DT0 (15:0)	GMT_IN: 4 DT muons of 1st BC
DT3 (31:16)	DT3 (15:0)	DT2 (31:16)	DT2 (15:0)	
bRPC1 (31:16)	bRPC1 (15:0)	bRPC0 (31:16)	bRPC0 (15:0)	GMT_IN: 4 bRPC muons of 1st BC
bRPC3 (31:16)	bRPC3 (15:0)	bRPC2 (31:16)	bRPC2 (15:0)	
CSC1 (31:16)	CSC1 (15:0)	CSC0 (31:16)	CSC0 (15:0)	GMT_IN: 4 CSC muons of 1st BC
CSC3 (31:16)	CSC3 (15:0)	CSC2 (31:16)	CSC2 (15:0)	
fRPC1 (31:16)	fRPC1 (15:0)	fRPC0 (31:16)	fRPC0 (15:0)	GMT_IN: 4 fRPC muons of 1st BC
fRPC3 (31:16)	fRPC3 (15:0)	fRPC2 (31:16)	fRPC2 (15:0)	
bGMT1 (31:16)	bGMT1 (15:0)	bGMT0 (31:16)	bGMT0 (15:0)	SORT: 4 bGMT muons of 1st BC
bGMT3 (31:16)	bGMT3 (15:0)	bGMT2 (31:16)	bGMT2 (15:0)	
fGMT1 (31:16)	fGMT1 (15:0)	fGMT0 (31:16)	fGMT0 (15:0)	SORT: 4 fGMT muons of 1st BC
fGMT3 (31:16)	fGMT3 (15:0)	fGMT2 (31:16)	fGMT2 (15:0)	
GMT1 (31:16)	GMT1 (15:0)	GMT0 (31:16)	GMT0 (15:0)	SORT: 4 GMT muons of 1st BC
GMT3 (31:16)	GMT3 (15:0)	GMT2 (31:16)	GMT2 (15:0)	
fSRK3, fSRK2	fSRK1, fSRK0	bSRK3, bSRK2	bSRK1, bSRK0	8 SORT RANKS (4 bits) of 1st BC

X''0'', BC_of_INF(11:0)	BC_of_SRT(11:8), BC_of_INC(11:0)	BC_of_SRT(7:4), BC_of_INB(11:0)	BC_of_SRT(3:0), BC_of_IND(11:0)	BCNR of SRT and IN chips of 1st BC
Board-ID(15:0)	Bx_in_event(3:0), BCNR(11:0)	BCERR(7:0), EVNR(23:16)	EVNR(15:0)	GMT board, 2nd BC //BCNR of ROP chip
DT1 (31:16)	DT1 (15:0)	DT0 (31:16)	DT0 (15:0)	GMT_IN: 4 DT muons of 2nd BC
DT3 (31:16)	DT3 (15:0)	DT2 (31:16)	DT2 (15:0)	
bRPC1 (31:16)	bRPC1 (15:0)	bRPC0 (31:16)	bRPC0 (15:0)	GMT_IN: 4 bRPC muons of 2nd BC
bRPC3 (31:16)	bRPC3 (15:0)	bRPC2 (31:16)	bRPC2 (15:0)	
CSC1 (31:16)	CSC1 (15:0)	CSC0 (31:16)	CSC0 (15:0)	GMT_IN: 4 CSC muons of 2nd BC
CSC3 (31:16)	CSC3 (15:0)	CSC2 (31:16)	CSC2 (15:0)	
fRPC1 (31:16)	fRPC1 (15:0)	fRPC0 (31:16)	fRPC0 (15:0)	GMT_IN: 4 fRPC muons of 2nd BC
fRPC3 (31:16)	fRPC3 (15:0)	fRPC2 (31:16)	fRPC2 (15:0)	
bGMT1 (31:16)	bGMT1 (15:0)	bGMT0 (31:16)	bGMT0 (15:0)	SORT: 4 bGMT muons of 2nd BC
bGMT3 (31:16)	bGMT3 (15:0)	bGMT2 (31:16)	bGMT2 (15:0)	
fGMT1 (31:16)	fGMT1 (15:0)	fGMT0 (31:16)	fGMT0 (15:0)	SORT: 4 fGMT muons of 2nd BC
fGMT3 (31:16)	fGMT3 (15:0)	fGMT2 (31:16)	fGMT2 (15:0)	
GMT1 (31:16)	GMT1 (15:0)	GMT0 (31:16)	GMT0 (15:0)	SORT: 4 GMT muons of 2nd BC
GMT3 (31:16)	GMT3 (15:0)	GMT2 (31:16)	GMT2 (15:0)	
fSRK3, fSRK2	fSRK1, fSRK0	bSRK3, bSRK2	bSRK1, bSRK0	8 SORT RANKS (4 bits) of 2nd BC
X''0'', BC_of_INF(11:0)	BC_of_SRT(11:8), BC_of_INC(11:0)	BC_of_SRT(7:4), BC_of_INB(11:0)	BC_of_SRT(3:0), BC_of_IND(11:0)	BCNR of SRT and IN chips of 2 nd BC
Board-ID(15:0)	Bx_in_event(3:0), BCNR(11:0)	BCERR(7:0), EVNR(23:16)	EVNR(15:0)	GMT board, 3rd BC //BCNR of ROP chip
DT1 (31:16)	DT1 (15:0)	DT0 (31:16)	DT0 (15:0)	GMT_IN: 4 DT muons of 3rd BC
DT3 (31:16)	DT3 (15:0)	DT2 (31:16)	DT2 (15:0)	
bRPC1 (31:16)	bRPC1 (15:0)	bRPC0 (31:16)	bRPC0 (15:0)	GMT_IN: 4 bRPC muons of 3rd BC
bRPC3 (31:16)	bRPC3 (15:0)	bRPC2 (31:16)	bRPC2 (15:0)	
CSC1 (31:16)	CSC1 (15:0)	CSC0 (31:16)	CSC0 (15:0)	GMT_IN: 4 CSC muons of 3rd BC
CSC3 (31:16)	CSC3 (15:0)	CSC2 (31:16)	CSC2 (15:0)	
fRPC1 (31:16)	fRPC1 (15:0)	fRPC0 (31:16)	fRPC0 (15:0)	GMT_IN: 4 fRPC muons of 3rd BC

fRPC3 (31:16)	fRPC3 (15:0)	fRPC2 (31:16)	fRPC2 (15:0)	
bGMT1 (31:16)	bGMT1 (15:0)	bGMT0 (31:16)	bGMT0 (15:0)	SORT: 4 bGMT muons of 3rd BC
bGMT3 (31:16)	bGMT3 (15:0)	bGMT2 (31:16)	bGMT2 (15:0)	
fGMT1 (31:16)	fGMT1 (15:0)	fGMT0 (31:16)	fGMT0 (15:0)	SORT: 4 fGMT muons of 3rd BC
fGMT3 (31:16)	fGMT3 (15:0)	fGMT2 (31:16)	fGMT2 (15:0)	
GMT1 (31:16)	GMT1 (15:0)	GMT0 (31:16)	GMT0 (15:0)	SORT: 4 GMT muons of 3rd BC
GMT3 (31:16)	GMT3 (15:0)	GMT2 (31:16)	GMT2 (15:0)	
fSRK3, fSRK2	fSRK1, fSRK0	bSRK3, bSRK2	bSRK1, bSRK0	8 SORT RANKS (4 bits) of 3rd BC
X"0", BC_of_INF(11:0)	BC_of_SRT(11:8), BC_of_INC(11:0)	BC_of_SRT(7:4), BC_of_INB(11:0)	BC_of_SRT(3:0), BC_of_IND(11:0)	BCNR of SRT and IN chips of 3 rd BC

End of Record

<i>63 - 60</i>	<i>59 - 56</i>	<i>55 - 32</i>	<i>31 - 16</i>	<i>15 - 12</i>	<i>11 - 4</i>	<i>3 - 0</i>	<i>Comment</i>
EOE_1=A	xxxx	Event_length (24)	CRC(16);	xxxx	Event_stat(8)	TRx\$	TRAILER

6 Channel Link formats

6.1 GMT to GTFE Channel Link

BCERR(7-5) = 0

BCERR(4) = 1 if bx(SRT) is not reference BCNR(11:0)

BCERR(3) = 1 if bx(INF) is not reference BCNR(11:0)

BCERR(2) = 1 if bx(INC) is not reference BCNR(11:0)

BCERR(1) = 1 if bx(INB) is not reference BCNR(11:0)

BCERR(0) = 1 if bx(IND) is not reference BCNR(11:0)

Version ROPROP 2004/12/16: IDLE = X"000 0000" should be changed to X"555 5555"

27-24 (ID)	23 -16	15 -0	Comment	Default values & remarks
A	X"00"	EVNR(15:0)	<i>1st BC data</i>	
B	X"00"	BCERR(7:0), EVNR(23:16)	<i>1st BC data</i>	
C	X"00"	Bx_in_event(3:0), BCNR(11:0)	<i>1st BC data</i>	BCNR=reference BC
D	X"00"	BOARD_ID	<i>1st BC data</i>	X"dd12" set by firmware
1	X"00"	DT0 (15:0)	<i>1st BC data</i>	1 = DT, muon0
1	X"00"	DT0 (31:16)	<i>1st BC data</i>	
1	X"00"	DT1 (15:0)	<i>1st BC data</i>	DT, muon1
1	X"00"	DT1 (31:16)	<i>1st BC data</i>	
1	X"00"	DT2 (15:0)	<i>1st BC data</i>	DT, muon2
1	X"00"	DT2 (31:16)	<i>1st BC data</i>	
1	X"00"	DT3 (15:0)	<i>1st BC data</i>	DT, muon3
1	X"00"	DT3 (31:16)	<i>1st BC data</i>	
1	X"00"	bRPC0 (15:0)	<i>1st BC data</i>	1 = bRPC, muon0
1	X"00"	bRPC0 (31:16)	<i>1st BC data</i>	
1	X"00"	bRPC1 (15:0)	<i>1st BC data</i>	bRPC, muon1

1	X"00"	bRPC1 (31:16)	<i>1st BC data</i>	
1	X"00"	bRPC2 (15:0)	<i>1st BC data</i>	bRPC, muon2
1	X"00"	bRPC2 (31:16)	<i>1st BC data</i>	
1	X"00"	bRPC3 (15:0)	<i>1st BC data</i>	bRPC, muon3
1	X"00"	bRPC3 (31:16)	<i>1st BC data</i>	
1	X"00"	CSC0 (15:0)	<i>1st BC data</i>	1 = CSC, muon0
1	X"00"	CSC0 (31:16)	<i>1st BC data</i>	
1	X"00"	CSC1 (15:0)	<i>1st BC data</i>	CSC, muon1
1	X"00"	CSC1 (31:16)	<i>1st BC data</i>	
1	X"00"	CSC2 (15:0)	<i>1st BC data</i>	CSC, muon2
1	X"00"	CSC2 (31:16)	<i>1st BC data</i>	
1	X"00"	CSC3 (15:0)	<i>1st BC data</i>	CSC, muon3
1	X"00"	CSC3 (31:16)	<i>1st BC data</i>	
1	X"00"	fRPC0 (15:0)	<i>1st BC data</i>	1 = fRPC, muon0
1	X"00"	fRPC0 (31:16)	<i>1st BC data</i>	
1	X"00"	fRPC1 (15:0)	<i>1st BC data</i>	fRPC, muon1
1	X"00"	fRPC1 (31:16)	<i>1st BC data</i>	
1	X"00"	fRPC2 (15:0)	<i>1st BC data</i>	fRPC, muon2
1	X"00"	fRPC2 (31:16)	<i>1st BC data</i>	
1	X"00"	fRPC3 (15:0)	<i>1st BC data</i>	fRPC, muon3
1	X"00"	fRPC3 (31:16)	<i>1st BC data</i>	
1	X"00"	bGMT0 (15:0)	<i>1st BC data</i>	5=SRT, bGMT muon0
1	X"00"	bGMT0 (31:16)	<i>1st BC data</i>	
1	X"00"	bGMT1 (15:0)	<i>1st BC data</i>	bGMT, muon1
1	X"00"	bGMT1 (31:16)	<i>1st BC data</i>	
1	X"00"	bGMT2 (15:0)	<i>1st BC data</i>	bGMT, muon2
1	X"00"	bGMT2 (31:16)	<i>1st BC data</i>	
1	X"00"	bGMT3 (15:0)	<i>1st BC data</i>	bGMT, muon3

1	X''00''	bGMT3 (31:16)	<i>1st BC data</i>	
1	X''00''	fGMT0 (15:0)	<i>1st BC data</i>	fGMT, muon0
1	X''00''	fGMT0 (31:16)	<i>1st BC data</i>	
1	X''00''	fGMT1 (15:0)	<i>1st BC data</i>	fGMT, muon1
1	X''00''	fGMT1 (31:16)	<i>1st BC data</i>	
1	X''00''	fGMT2 (15:0)	<i>1st BC data</i>	fGMT, muon2
1	X''00''	fGMT2 (31:16)	<i>1st BC data</i>	
1	X''00''	fGMT3 (15:0)	<i>1st BC data</i>	fGMT, muon3
1	X''00''	fGMT3 (31:16)	<i>1st BC data</i>	
1	X''00''	GMT0 (15:0)	<i>1st BC data</i>	5=SRT, GMT muon0
1	X''00''	GMT0 (31:16)	<i>1st BC data</i>	
1	X''00''	GMT1 (15:0)	<i>1st BC data</i>	GMT, muon1
1	X''00''	GMT1 (31:16)	<i>1st BC data</i>	
1	X''00''	GMT2 (15:0)	<i>1st BC data</i>	GMT, muon2
1	X''00''	GMT2 (31:16)	<i>1st BC data</i>	
1	X''00''	GMT3 (15:0)	<i>1st BC data</i>	GMT, muon3
1	X''00''	GMT3 (31:16)	<i>1st BC data</i>	
1	X''00''	bSRK1, bSRK0	<i>1st BC data</i>	8 SORT RANKS (4 bits)
1	X''00''	bSRK3, bSRK2	<i>1st BC data</i>	8 SORT RANKS (4 bits)
1	X''00''	fSRK1, fSRK0	<i>1st BC data</i>	8 SORT RANKS (4 bits)
1	X''00''	fSRK3, fSRK2	<i>1st BC data</i>	8 SORT RANKS (4 bits)
E	X''00''	BC_of_SRT(3:0), BC_of_IND(11:0)	<i>1st BC data</i>	
E	X''00''	BC_of_SRT(7:4), BC_of_INB(11:0)	<i>1st BC data</i>	
E	X''00''	BC_of_SRT(11:8), BC_of_INC(11:0)	<i>1st BC data</i>	
E	X''00''	X''0'', BC_of_INF(11:0)	<i>1st BC data</i>	
A		EVNR(15:0)	<i>2nd BC data</i>	
B		BCERR(7:0), EVNR(23:16)	<i>2nd BC data</i>	
C		Bx_in_event(3:0),	<i>2nd BC data</i>	

		BCNR(11:0)		
D		BOARD_ID	2nd BC data	
01		Trigger data (15:0)	2nd BC data	
.....	
E	X"00"	BC_of_SRT(3:0), BC_of_IND(11:0)	2nd BC data	not to SLINK
E	X"00"	BC_of_SRT(7:4), BC_of_INB(11:0)	2nd BC data	
E	X"00"	BC_of_SRT(11:8), BC_of_INC(11:0)	2nd BC data	
E	X"00"	X"0", BC_of_INF(11:0)	2nd BC data	
A		EVNR(15:0)	3rd BC data	
.....	
E		BC_of_chipN(11:0), BC_of_chipN-1(11:0),	3rd BC data	not to SLINK
F			End of GMT record	not to SLINK
5	IDLE=X"55"	IDLE-code = X"5555",	Space between records	

6.2 FDL to GTFE Channel Link

C-word: BCNR =Ring buffer address from which datum has been read. Common number for all chips on a board.

E-word: BCNR =Ring buffer address into which datum has been written. Number generated in each chip.

Check if all chips run in parallel: E-word_BCNRs should be equal to each other.

Check if local L1A-latency has been adjusted correctly: C-word_BCNR has to be equal to the E-word_BCNRs.

27-24 (ID)	23 –16 (mon)	15 -0	Comment
A	00	EVNR(15:0)	1st BC data word 0
B	00	BCERR(7:0), EVNR(23:16)	1st BC data <i>BCERR missing</i>
C	00	Bx_in_event(3:0), BCNR(11:0) (<i>rd_addr</i>)	1st BC dat: word 2
D	00	BOARD_ID	1st BC dat: word 3
1	00	TECH_TRIG(15 : 0)	1st BC dat: word 4

1	00	TECH_TRIG(31 : 16)	<i>1st BC dat: word 5</i>
1	00	TECH_TRIG(47 : 32)	<i>1st BC dat: word 6</i>
1	00	TECH_TRIG(63 : 48)	<i>1st BC dat: word 7</i>
1	00	ALGO(15 : 0)	<i>1st BC dat: word 8</i>
1	00	ALGO(31 : 16)	<i>1st BC dat: word 9</i>
1	00	ALGO(47 : 32)	<i>1st BC dat: word 10</i>
1	00	ALGO(63 : 48)	<i>1st BC dat: word 11</i>
1	00	ALGO(79 : 64)	<i>1st BC dat: word 12</i>
1	00	ALGO(95 : 80)	<i>1st BC dat: word 13</i>
1	00	ALGO(111 : 96)	<i>1st BC dat: word 14</i>
1	00	ALGO(127 : 112)	<i>1st BC dat: word 15</i>
1	00	ALGO(143 : 128)	<i>1st BC dat: word 16</i>
1	00	ALGO(159 : 144)	<i>1st BC dat: word 17</i>
1	00	ALGO(175 : 160)	<i>1st BC dat: word 18</i>
1	00	ALGO(191 : 176)	<i>1st BC dat: word 19</i>
1	00	0000 000 N0Algo, FINOR(7 : 0)	<i>1st BC dat: word 20</i>
1	00	0000hex	<i>1st BC dat: word 21</i>
1	00	PRESCALE_VERSION(15:0)	<i>1st BC dat: word 22</i>
1	00	PRESCALE_VERSION(31:16)	<i>1st BC dat: word 23</i>
E	00	0hex, BCNR(11:0) (<i>wr_addr</i>)	<i>1st BC dat: word 24</i>
E	00	LUM_SEGMENT_NR(15:0)	<i>1st BC dat: word 25</i>
E	00	ORBIT_NR(15:0)	<i>1st BC dat: word 26</i>
E	00	ORBIT_NR(31:16)	<i>1st BC dat: word 27</i>
A	00	EVNR(15:0)	<i>2nd BC data word 0</i>
B	00	BCERR(7:0), EVNR(23:16)	<i>2nd BC data BCERR missing</i>
C	00	Bx_in_event(3:0), BCNR(11:0) (<i>rd_addr</i>)	<i>2nd BC dat: word 2</i>
D	00	BOARD_ID	<i>2nd BC dat: word 3</i>
1	00	TECH_TRIG(15 : 0)	<i>2nd BC dat: word 4</i>

1	00	TECH_TRIG(31 : 16)	2nd BC dat: word 5
1	00	TECH_TRIG(47 : 32)	2nd BC dat: word 6
1	00	TECH_TRIG(63 : 48)	2nd BC dat: word 7
1	00	ALGO(15 : 0)	2nd BC dat: word 8
1	00	ALGO(31 : 16)	2nd BC dat: word 9
1	00	ALGO(47 : 32)	2nd BC dat: word 10
1	00	ALGO(63 : 48)	2nd BC dat: word 11
1	00	ALGO(79 : 64)	2nd BC dat: word 12
1	00	ALGO(95 : 80)	2nd BC dat: word 13
1	00	ALGO(111 : 96)	2nd BC dat: word 14
1	00	ALGO(127 : 112)	2nd BC dat: word 15
1	00	ALGO(143 : 128)	2nd BC dat: word 16
1	00	ALGO(159 : 144)	2nd BC dat: word 17
1	00	ALGO(175 : 160)	2nd BC dat: word 18
1	00	ALGO(191 : 176)	2nd BC dat: word 19
1	00	0000 000 N0Algo, FINOR(7 : 0)	2nd BC dat: word 20
1	00	0000hex	2nd BC dat: word 21
1	00	PRESCALE_VERSION(15:0)	2nd BC dat: word 22
1	00	PRESCALE_VERSION(31:16)	2nd BC dat: word 23
E	00	0 BCNR(11:0)(wr_addr)	2nd BC dat: word 24
E	00	LUM_SEGMENT_NR(15:0)	2nd BC dat: word 25
E	00	ORBIT_NR(15:0)	2nd BC dat: word 26
E	00	ORBIT_NR(31:16)	2nd BC dat: word 27
A	00	EVNR(15:0)	3rd BC data word 0
B	00	BCERR(7:0), EVNR(23:16)	3rd BC data <i>BCERR missing</i>
C	00	Bx_in_event(3:0), BCNR(11:0) (<i>rd_addr</i>)	3rd BC dat: word 2
D	00	BOARD_ID	3rd BC dat: word 3
1	00	TECH_TRIG(15 : 0)	3rd BC dat: word 4

1	00	TECH_TRIG(31 : 16)	3rd BC dat: word 5
1	00	TECH_TRIG(47 : 32)	3rd BC dat: word 6
1	00	TECH_TRIG(63 : 48)	3rd BC dat: word 7
1	00	ALGO(15 : 0)	3rd BC dat: word 8
1	00	ALGO(31 : 16)	3rd BC dat: word 9
1	00	ALGO(47 : 32)	3rd BC dat: word 10
1	00	ALGO(63 : 48)	3rd BC dat: word 11
1	00	ALGO(79 : 64)	3rd BC dat: word 12
1	00	ALGO(95 : 80)	3rd BC dat: word 13
1	00	ALGO(111 : 96)	3rd BC dat: word 14
1	00	ALGO(127 : 112)	3rd BC dat: word 15
1	00	ALGO(143 : 128)	3rd BC dat: word 16
1	00	ALGO(159 : 144)	3rd BC dat: word 17
1	00	ALGO(175 : 160)	3rd BC dat: word 18
1	00	ALGO(191 : 176)	3rd BC dat: word 19
1	00	0000 000 N0Algo, FINOR(7 : 0)	3rd BC dat: word 20
1	00	0000hex	3rd BC dat: word 21
1	00	PRESCALE_VERSION(15:0)	3rd BC dat: word 22
1	00	PRESCALE_VERSION(31:16)	3rd BC dat: word 23
E	00	0 BCNR(11:0) (<i>wr_addr</i>)	3rd BC dat: word 24
E	00	LUM_SEGMENT_NR(15:0)	3rd BC dat: word 25
E	00	ORBIT_NR(15:0)	3rd BC dat: word 26
E	00	ORBIT_NR(31:16)	3rd BC dat: word 27
F	FF	FFFF	End of record: word 28
5	IDLE code=5	IDLE-code = 5555	Space between records

6.3 PSB to GTFE Channel Link → 7 PSB boards in GT crate

Example for debug record with 5 bx

27-24	23-20	19-16	15-12	11-8	7-4	3-0	Name	Comment	Example
I	I	I	I	I	I	I	IDLE	Between records	555AAAA
A	0	0	e	e	e	e	HEADER A	EVNr(15:0)	A000001
B	0	0	0	0	e	e	HEADER B	EVNr(23:16)	B000000
C	0	0	bx-2	b	b	b	HEADER C	Bx_in_ev/bx of fifo	C00E017
D	0	0	n	n	n	n	HEADER D	Board identifier	D00ABCD
1	0	0	d	d	d	d	A_data ch0 of bx-2		
1	0	0	d	d	d	d	A_data ch1 of bx-2		
1	0	0	d	d	d	d	A_data ch2 of bx-2		
1	0	0	d	d	d	d	A_data ch3 of bx-2		
1	0	0	d	d	d	d	A_data ch4 of bx-2		
1	0	0	d	d	d	d	A_data ch5 of bx-2		
1	0	0	d	d	d	d	A_data ch6 of bx-2		
1	0	0	d	d	d	d	A_data ch7 of bx-2		
1	0	0	d	d	d	d	B_data ch0 of bx-2		
1	0	0	d	d	d	d	B_data ch1 of bx-2		
1	0	0	d	d	d	d	B_data ch2 of bx-2		
1	0	0	d	d	d	d	B_data ch3 of bx-2		
1	0	0	d	d	d	d	B_data ch4 of bx-2		
1	0	0	d	d	d	d	B_data ch5 of bx-2		
1	0	0	d	d	d	d	B_data ch6 of bx-2		
1	0	0	d	d	d	d	B_data ch7 of bx-2		
E	0	0	000b	b	b	b	End of bx-2	Ring addr of B_data	E000018
E	0	0	0	0	0	0	End of bx-2		E000000
E	0	0	0	0	0	0	End of bx-2		E000000
E	0	0	0	0	0	0	End of bx-2		E000000
A	0	0	e	e	e	e	HEADER A	EVNr(15:0)	A000001
B	0	0	0	0	e	e	HEADER B	EVNr(23:16)	B000000
C	0	0	bx-1	b	b	b	HEADER C	Bx_in_ev/bx of fifo	C00F019
D	0	0	n	n	n	n	HEADER D	Board identifier	D00ABCD
1	0	0	d	d	d	d	A_data ch0 of bx-1		
1	0	0	d	d	d	d	A_data ch1 of bx-1		
1	0	0	d	d	d	d	A_data ch2 of bx-1		

1	0	0	d	d	d	d	A_data ch3 of bx-1		
1	0	0	d	d	d	d	A_data ch4 of bx-1		
1	0	0	d	d	d	d	A_data ch5 of bx-1		
1	0	0	d	d	d	d	A_data ch6 of bx-1		
1	0	0	d	d	d	d	A_data ch7 of bx-1		
1	0	0	d	d	d	d	B_data ch0 of bx-1		
1	0	0	d	d	d	d	B_data ch1 of bx-1		
1	0	0	d	d	d	d	B_data ch2 of bx-1		
1	0	0	d	d	d	d	B_data ch3 of bx-1		
1	0	0	d	d	d	d	B_data ch4 of bx-1		
1	0	0	d	d	d	d	B_data ch5 of bx-1		
1	0	0	d	d	d	d	B_data ch6 of bx-1		
1	0	0	d	d	d	d	B_data ch7 of bx-1		
E	0	0	000b	b	b	b	End of bx-1	Ring addr of B_data	E00001A
E	0	0	0	0	0	0	End of bx-1		E000000
E	0	0	0	0	0	0	End of bx-1		E000000
E	0	0	0	0	0	0	End of bx-1		E000000
A	0	0	e	e	e	e	HEADER A	EVNr(15:0)	A000001
B	0	0	0	0	e	e	HEADER B	EVNr(23:16)	0000000
C	0	0	bx+0	b	b	b	HEADER C	Bx_in_ev/bx of fifo	C00001B
D	0	0	n	n	n	n	HEADER D	Board identifier	D00ABCD
1	0	0	d	d	d	d	A_data ch0 of bx+0		
1	0	0	d	d	d	d	A_data ch1 of bx+0		
1	0	0	d	d	d	d	A_data ch2 of bx+0		
1	0	0	d	d	d	d	A_data ch3 of bx+0		
1	0	0	d	d	d	d	A_data ch4 of bx+0		
1	0	0	d	d	d	d	A_data ch5 of bx+0		
1	0	0	d	d	d	d	A_data ch6 of bx+0		
1	0	0	d	d	d	d	A_data ch7 of bx+0		
1	0	0	d	d	d	d	B_data ch0 of bx+0		
1	0	0	d	d	d	d	B_data ch1 of bx+0		
1	0	0	d	d	d	d	B_data ch2 of bx+0		
1	0	0	d	d	d	d	B_data ch3 of bx+0		
1	0	0	d	d	d	d	B_data ch4 of bx+0		
1	0	0	d	d	d	d	B_data ch5 of bx+0		
1	0	0	d	d	d	d	B_data ch6 of bx+0		
1	0	0	d	d	d	d	B_data ch7 of bx+0		

E	0	0	000b	b	b	b	End of bx	Ring addr of B_data	E00001C
E	0	0	0	0	0	0	End of bx		E000000
E	0	0	0	0	0	0	End of bx		E000000
E	0	0	0	0	0	0	End of bx		E000000
A	0	0	e	e	e	e	HEADER A	EVNr(15:0)	A000001
B	0	0	0	0	e	e	HEADER B	EVNr(23:16)	0000000
C	0	0	bx+1	b	b	b	HEADER C	Bx_in_ev/bx of fifo	C00101D
D	0	0	n	n	n	n	HEADER D	Board identifier	D00ABCD
1	0	0	d	d	d	d	A_data ch0 of bx+1		
1	0	0	d	d	d	d	A_data ch1 of bx+1		
1	0	0	d	d	d	d	A_data ch2 of bx+1		
1	0	0	d	d	d	d	A_data ch3 of bx+1		
1	0	0	d	d	d	d	A_data ch4 of bx+1		
1	0	0	d	d	d	d	A_data ch5 of bx+1		
1	0	0	d	d	d	d	A_data ch6 of bx+1		
1	0	0	d	d	d	d	A_data ch7 of bx+1		
1	0	0	d	d	d	d	B_data ch0 of bx+1		
1	0	0	d	d	d	d	B_data ch1 of bx+1		
1	0	0	d	d	d	d	B_data ch2 of bx+1		
1	0	0	d	d	d	d	B_data ch3 of bx+1		
1	0	0	d	d	d	d	B_data ch4 of bx+1		
1	0	0	d	d	d	d	B_data ch5 of bx+1		
1	0	0	d	d	d	d	B_data ch6 of bx+1		
1	0	0	d	d	d	d	B_data ch7 of bx+1		
E	0	0	000b	b	b	b	End of bx+1	Ring addr of B_data	E00001E
E	0	0	0	0	0	0	End of bx+1		E000000
E	0	0	0	0	0	0	End of bx+1		E000000
E	0	0	0	0	0	0	End of bx+1		E000000
A	0	0	e	e	e	e	HEADER A	EVNr(15:0)	A000001
B	0	0	0	0	e	e	HEADER B	EVNr(23:16)	0000000
C	0	0	bx+2	b	b	b	HEADER C	Bx_in_ev/bx of fifo	C00201F
D	0	0	n	n	n	n	HEADER D	Board identifier	D00ABCD
1	0	0	d	d	d	d	A_data ch0 of bx+2		
1	0	0	d	d	d	d	A_data ch1 of bx+2		
1	0	0	d	d	d	d	A_data ch2 of bx+2		
1	0	0	d	d	d	d	A_data ch3 of bx+2		
1	0	0	d	d	d	d	A_data ch4 of bx+2		

1	0	0	d	d	d	d	A_data ch5 of bx+2		
1	0	0	d	d	d	d	A_data ch6 of bx+2		
1	0	0	d	d	d	d	A_data ch7 of bx+2		
1	0	0	d	d	d	d	B_data ch0 of bx+2		
1	0	0	d	d	d	d	B_data ch1 of bx+2		
1	0	0	d	d	d	d	B_data ch2 of bx+2		
1	0	0	d	d	d	d	B_data ch3 of bx+2		
1	0	0	d	d	d	d	B_data ch4 of bx+2		
1	0	0	d	d	d	d	B_data ch5 of bx+2		
1	0	0	d	d	d	d	B_data ch6 of bx+2		
1	0	0	d	d	d	d	B_data ch7 of bx+2		
E	0	0	000b	b	b	b	End of bx+2	Ring addr of B_data	E000020
E	0	0	0	0	0	0	End of bx+2		E000000
E	0	0	0	0	0	0	End of bx+2		E000000
E	0	0	0	0	0	0	End of bx+2		E000000
F	F	F	F	F	F	F	END of RECORD		FFFFFFF
I	I	I	I	I	I	I	IDLE	Between records	555AAAA

6.4 TCS to GTFE Channel Link for EVM record

11.6.2007 Final Version for 8 Partitions

27-24	23 -20	19-16	15-0	comment	
A	0	0	LUMINOSITY_SEGMENT_NR(15:0)	Word0	
B	0	0	X"0", DAQNR(3:0), TTYPE(3:0), STATUS(3:0)	Word1	DAQNR = PTCnr = Nr of Partition controller
C	0	0	X"0", BCNR 11:0	Word2	
D	0	0	Board-ID (15:0)	Word3	
1	0	0	ASSIGNED_PARTITIONS (15:0)	Word4	1= connected to this daq#, 0= disconnected
1	0	0	ASSIGNED_PARTITIONS (31:16)	Word5	----- " -----
1	0	0	PART_RUN_NR(15:0)	Word6	
1	0	0	PART_RUN_NR(31:16)	Word7	
1	0	0	EVENTNR (15:0)	Word8	
1	0	0	EVENTNR (31:16)	Word9	
1	0	0	PART_TRIGNR(15:0)	Word10	

1	0	0	PART_TRIGNR(31:16)	Word11	
1	0	0	ORBITNR 15:0	Word12	
1	0	0	ORBITNR 31:16	Word13	
1	0	0	(ORBITNR 47:32)	Word14	
1	0	0	FREE	Word15	
E	0	0	<i>RESERVED</i>	Word16	'E' = last W64
E	0	0	<i>for</i>	Word17	'E' = last W64
E	0	0	<i>other</i>	Word18	'E' = last W64
E	0	0	<i>Data words</i>	Word19	'E' = last W64
F	0	0	X"FFFF"		'F' = end of record ...not included in SLINK record
5	5	5	5555	IDLE	Between records

Bits 27 to 16 of the Channel Link are used for control information. The first word shows hex 'A' and the last word 'EE' in the most significant bits. Bits 19 to 16 the word number to help to reorder into 32 bit words on the GTFE board.

6.5 TIM to GTFE Channel Link

Test data

IDLE_code <= X"555AAAA" is sent between records.

27-24 (ID)	23 -16 (mon)	15 -0	Comment
A	00	EVNR(15:0)	Word 0: Event number L
B	00	x,,00“, EVNR(23:16)	Word 1: Event number H
C	00	X”0”, BCNR(11:0)	Word 2: BC number
D	00	BOARD_ID =“ADAD“	word 3: Board identifier
1	00	1111	word 4: test pattern
1	00	2222	word 5: test pattern
1	00	3333	word 6: test pattern
1	00	4444	word 7: test pattern
1	00	5555	word 8: test pattern
1	00	6666	word 9: test pattern
1	00	7777	word 10: test pattern
1	00	8888	word 11: test pattern
1	00	9999	word 12: test pattern
1	00	AAAA	word 13: test pattern
1	00	BBBB	word 14: test pattern
1	00	CCCC	word 15: test pattern
1	00	DDDD	word 16: test pattern
1	00	EEEE	word 17: test pattern
1	00	FFFF	word 18: test pattern
1	00	0000	word 19: test pattern
E	00	3210	word 20: test pattern
E	00	7654	word 21: test pattern
E	00	BA98	word 22: test pattern

E	00	FEDC	word 23: test pattern
F	00	FFFF	,END_OF_RECORD'