CMX ➔ L1 Topo fiber data format and protocol proposal

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Version 0.1, Dated 23 May 2013

Introduction

In this document the format of the data sent from CMX to L1Topo processor is proposed. The format builds on trigger object (TO) formats previously proposed by S. Hillier. It also specifies line encoding, positioning of the TO data within the transmission, provisions for data alignment and error checking.

Each CMX provides up to 24 fibers outputs. The current working assumption is that each type of CMX (Jet, EM/Tau and energy sum) provides 6 fiber outputs to a given L1Topo processor and this document follows this 6-fiber assumption. Within this limit up to 24 Jet TOs and up to 30 EM/Tau TOs can be sent per event. The CMX provides 0 suppression to this amount of TOs from a greater number sent on the backplane and signals backplane or zero-suppression overflow to L1Topo. At the time of writing preliminary studies suggest that limiting number of TOs to the number mentioned may jeopardize physics performance. If these findings are confirmed extending the number of fiber links between CMX and L1Topo following the patterns presented in this document will be straightforward. Duplication of the data stream (for instance to two L1Topo processors or L1Topo and topo function CMX) may be provided if required by duplicating data from fiber 0 on fiber 6, data from fiber 1 on fiber 7 etc.

Line rate and encoding

The line rate on the CMX -> Topo serial links is 6.4 Gbps. The data will be encoded using 8b/10b encoding providing sufficient number of transitions for PLL lock on the RX side and DC balancing of the lines. Virex 6 and 7 FPGAs provide hardware support for 8b/10b encoding making the implementation very convenient. Given the line rate and the encoding the data rate on a single serial link is 5.12 Gbps providing 128 bits of information per fiber per event. In the rest of this document this unencoded (or 'parallel') data will be discussed as this is the data available for processing in the FPGA logic

TO formats

The TO Formats were presented previously. The proposal is reproduced in Fig. 1 with a modification that the overflow bit has been removed from the JET and EM/Tau TO
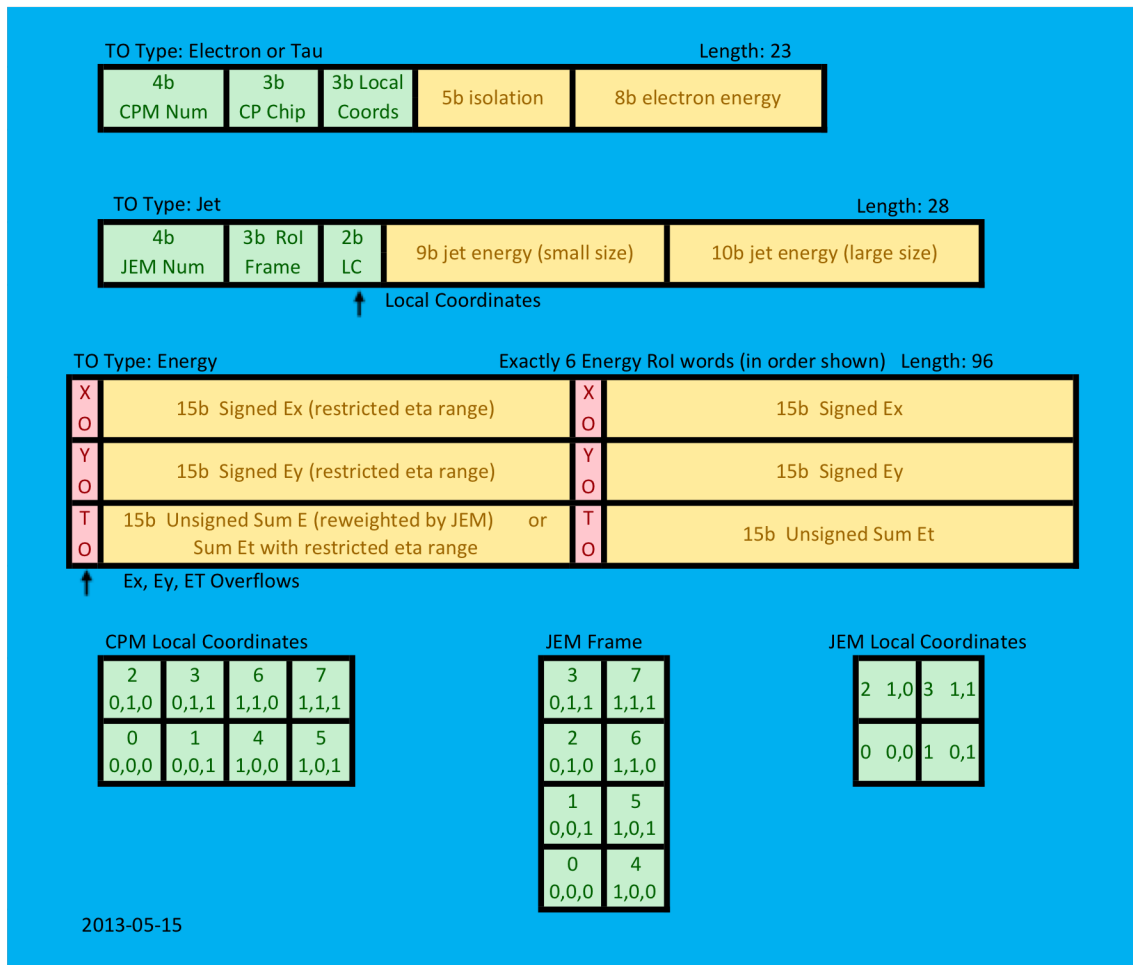

Figure 1.
Proposed Trigger Object formats

Trigger Object, alignment data, overflow bit and CRC checksum placement within the 128 bit transmission

The maximum number of EM/Tau trigger objects possible to transmit on a single serial link is five per event taking 115 bits of the 128 available. Maximally

four jet TO's can be sent per fiber using 112 bits. A single bit signaling presence of backplane or zero-suppression overflow also needs to be sent on at least one of the channels leaving 12 bits on any given channel for error checksum. Based on the available bandwidth for error checking a Cyclic Redundancy Check of length 12 was chosen for signaling transmission errors. The error-detection properties and the computation of the 12 bit CRC checksum are discussed in the next section. The formats of the Jet and EM CMX to L1 Topo data transmission are shown in Fig. 2 and 3.