

CMS Requirements on TTCvi Upgrade

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DRAFT

1. Introduction

This document describes the requirements of the CMS experiment for an upgrade of the TTC-VMEbus Interface (TTCvi - MkII), Rev1.6 May 2000. These requirements reflect the present understanding of the Trigger and Timing Control in CMS as described in the Level-1 Trigger TDR.

In CMS, the distribution of the level-1 trigger and fast control data is based on the TTC system. In this context the TTCvi module is the top element of each TTC partition. A maximum of 32 partitions, corresponding to major sub-detector components, are foreseen in CMS.

When CMS operates in physics mode, the Trigger Control System (TCS) associated to the Global Trigger box has the control of the TTC partitions. Besides the Level-1 Accept (L1A) signal, the TCS distributes to the TTCvi modules other fast control signals for synchronization, test, calibration and resetting purposes. Most of the present upgrade requirements are intended to give more flexibility to the interface between the central TCS and the TTC partitions.

In standalone mode, the sub-detectors have control over the TTC partitions. The TCS functions are taken over by the TTCvi module itself, namely the trigger and fast control signals generation. Part of the upgrade requirements aim an increment of the TTCvi standalone capabilities.

The CMS TTCvi upgrade requirements were drawn taken into account the present module design. These requirements do not add any new major concept to the board functionality. We believe that its implementation do not require a major board re-design.

2. Requirements on B-Channel External Access

- Addition of 16 extra B-Go channels. Each new channel is associated to a single 8-bit register where short-format broadcast commands can be stored.
- The single register B-Go channels are numbered 0:15 and the FIFO B-Go channels are numbered 16:19. B-Go[0] has the highest priority and B-Go[19] has the lowest priority.
- The basic mechanisms used to initiate the actual command transmission are the same for all B-Go channels (present version).
- When use is made of external B-Go signals, the command transmission is started at the end of the Inhibit signal. The Inhibit delay is counted from the arrival time of the external B-Go signal.
- The B-Go external inputs consist of the B-Go channel number in binary code and the B-Go strobe. A 6-signal input connector could be used for B-Go input.

Justification:

The B-Go channel is the TTCvi tool used to send fast commands synchronously with the Orbit signal or with an external input signal. This TTCvi facility is considered one of the most important and more widely used in the CMS application. The present number of different pre-loaded commands (four) is not sufficient for CMS.

The external input B-Go is the normal way to broadcast fast commands from the central Trigger Control to all TTC partitions. The possibility of adjusting the timing of these commands per TTC partition is needed to achieve command synchronization in a number of cases.

3. Requirements on Synchronous B-Channel Cycles

- When in synchronous repetitive mode, for each B-Go channel add the possibility to define a Prescaling factor N, such that a pre-loaded command is transmitted every N orbits.

Justification:

Fast commands dedicated to test and calibration are foreseen to be distributed in CMS synchronously with the main orbit gap, at a sub-multiple of the Orbit frequency. In CMS this feature is specially important for the continuous monitoring of the ECAL crystals behavior. The sampling frequency need to be adjusted to the capacity of acquiring calibration data.

4. Requirements on Internal Generation of L1A

- Addition of the possibility of generating L1A signals on the A-Channel synchronous with the Orbit signal. Associated with this feature a Delay and a Prescaling factor are defined, with the same functionality as in the B-channel synchronous cycles.

Justification:

The generation of L1 Accept signals at a precise bunch crossing number is one of the tools needed to set the timing of the L1A signal relative to the front-end pipeline data. In CMS this feature will be implemented in the Trigger Control. However its implementation in the TTCvi will allow the sub-detectors to perform synchronization tests in standalone mode.

This feature, combined with the generation of a B-channel Test Enable command, allows the generation of calibration trigger sequences internally to the TTCvi, allowing more flexibility in standalone operation.

5. Requirements on the Transmission of Trigger Type

- Addition of the possibility of transmitting after L1A, through B-channel, the Trigger Type only.

Justification:

The present TTCvi version has an option that allows to transmit after L1A the Trigger Type and the Event Number (transmission time about 4 μ s) for test purposes.

The possibility of transmitting the Trigger Type to all TTC partition at each L1A is still being considered in CMS as a way to optimize the front-end detector readout, adjusting the readout mode to the trigger type. For this reason it is important to have the possibility to transmit the Trigger Type alone, independently of the Event Number, reducing the usage of the B-Channel bandwidth (transmission time about 1 μ s).