6/17/98 HjC, LG, JE, EJ

Calibration Strawman

This note describes the steps taken to produce a calibration trigger for the CTB and the TPC separately. We recognize two types of special trigger requests, one made through a cron job for a main data run, and another initiated by a collaborator (the Requester) requesting a series of spectial triggers for a separate data stream. We describe here the Requester path. The cron path can be viewed as a simple replacement of the Requester with the CronJob. We assume that the CronJob runs in the Trigger Clock Distribution CPU and always takes priority, and in fact locks out the Requester until a run is finished.

1. The Requester requests permission for CTB LED trigger events from ONLINE.
   We believe that ONL should have the role of data-stream-content coordinator.

2. ONL checks compatibility with existing runs. If OK, ONL requests appropriate LED firing mask files from Requester.

3. Requester sends mask to ONL.

4. ONL requests TRIG to load appropriate registers in DSM0[1] FPGA or TCU LUT[2] to allow CTB triggers. This could be through the ReadyToEnable, EnableToReady, command sequence.

At this point, ONL can step out of the loop. ONL does not need to be involved until it receives a request from Requester to terminate the calibration session, or ONL decides to remove permission for special triggers for some other reason.

5. Requester establishes communications with TRG trhough the TLC[3] Sun station

6. Requester asks that a file-specified CTB Digitizer Board (CDB) mask be invoked to arm individual LED arming switches.

7. TRG informs Requester that LEDs are armed.

8. Requester sends request for CTB LED trigger to TLC.

9. TLC sets request level for Rhic Clock Control (RCC) board.

10. RCC sends trigger pulse to CDBs.

11. CDBs issue LED pulser signals to armed LEDs. We expect it to take approximately 10 ticks to establish stability in the LEDs. If the CDB simply continues to send gates, then we will get 10 crossings in a row which have varying amounts of charge integrated in the PMTs. Thus, a trigger LED event can actually be 10 crossings in a row. We assume that these LED events will be taken in special separate runs when STAR is not otherwise on, since these events are only to determine slat aliveness. Charge calibration is performed using isolated single tracks as found in the TPC.

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[1] DSM0 is the last DSM board in the tree.

[2] Trigger Control Unit LookUp Table

[3] Trigger Local Controller - this is the firewall between trigger processors and the world. THis model now assumes that TRG controls the TCD (Trigger Clock Distribution) CPU.

12. A CDB sends a delayed signal to DSM so that it enters DSM0 with CDB ADCs from Calibration Event.

13. DSM0 checks compatibility (config data) and, if compatible with other run parameters, sets special trigger request (STR) flag and sends special trigger value to TCU.

14. TCU computes Trigger Word (TW) based on TCU input bits (8 of the 20 inputs arrive via the P3 backplane and indicate STAR BUSY status). TRG checks prescale for this TW, and, if 1, places TW and TAW on its information FIFO for distribution on P3.

15. Event propagates through DAQ like normal event.

16. Repeat steps 7-15 to fire same set of LEDs or 6-15 to change mask.

17. Requester informs ONL that task is finished.

18. ONL requests TRG to alter configuration accordingly.

19. TRG informs ONL that CTB calibration events are no longer active.

TPC Calibration events:

We assume there are two types of TPC calibration events, one which is slow and indeterminate in time, such as a "laser event" and one which is fast, such as a simple injection of charge onto the FEE input (called "pulser event"). There are actually 4 such calibration event types defined, but it is sufficient here to discinguish fast and slow types. We assume there are two paths for the calibration event to be requested, one through the cron job and one through the Requester, as above.

1. The Requester sends request to ONL to establish TPC calibration events in this run. This may be accomplished by entering appropriate values in the TCU LUT.

2. ONL checks compatibility with other types of triggers employed in the existing run.

3. If compatible, ONL sends request to TRG to configure for TPC calibration events in the data stream through the Ready-to-Enable and Enable-to-Ready sequence.

4. ONL sends TPC permission to generate calibration trigger requests.

Note that steps 1-4 are essentially identical to the steps 1-4 above.

5. TPC establishes communication path to TLC.

6. TPC sets up its own internal states appropriately (e.g. turns on the laser)

7. TPC sends request to TLC to fire a TPC calibration event.

8. TLC sends request on to TCD CPU.

9. TCD CPU sends request on to TPC TCD module. Note that the TCD module can determine the time of the request to the DSM0 if this is critical.

We assume that each STAR subsystem will have one TCD module whose mezzanine board controls communication of trigger information to the subsystem hardware. Each TCD mezzanine will have a set of up to 4 lines that go directly to the DSM0 inputs. These are set to high or low levels to inform trigger what type of special trigger is being requested. We assume that "collisions" involving simultaneous requests from different subsystems can be handled by appropriate priority configuration in the TCU LUT.

10. TPC TCD sets appropriate levels on its 4 lines to DSM0.

11. DSM0 recognizes the STR-TPC request and, if the crossing it is processing is otherwise empty (perhaps literally - we can demand that it correspond to a particular bunch number) and if the TPC Calibration Trigger bit is set in its register configuration, then it places the Special Trigger Request flag as input to the Trigger Control Unit (TCU). The remaining 12 bits of the TCU input can then indicate which type of trigger is being called special.

11.a. We need a clear understanding of how TPC is going to determine whether TRG is doing as it expects.

12. The TCU takes the input word, combines it with the BUSY bits describing STAR (not necessarily one per subsystem - we have 8 BUSY bits in our thinking), and decides whether to issue the corrsponding special trigger by the value in the trigger word lookup table addressing the appropriate prescale value. TRG either issues the trigger request with the appropriate Trigger Action Word (TAW) or it doesn't.

13. When TPC TCD sees the expected TAW it lowers the STR lines to the DSM0 and proceeds to take control of the event, issuing either laser pulses or charge injections as it so desires.

14 When TPC has collected enough calibration data, it sends a request to ONL to remove permission for TPC calibration events in this run.

11. ONL then requests TRG to alter its configuration file to remove TPC calibratiuon event permissions.