Requirements for TOF connection to STAR Trigger

Original: 060201 HjC
http://www.star.bnl.gov/public/trg/run2006/TOF_TRG_Requirements.pdf
last update: 080327 JE

1. Requirement: TOF must return a multiplicity value to L0 that meets the physics requirements of the L0 trigger.

Justification: STAR requires a multiplicity measurement in L0 to operate the triggers needed for its physics program. This currently includes triggers for central and minbias HI collisions and for UPC.

Status: In run8 TOF sent 5 bits (a value of 0-24) of multiplicity data from a single tray to the TOF Layer 0 DSM via a 14 conductor twist and flat cable to a specially modified DSMI (DSM interface board). This multiplicity value was a sum of the MRPC channels "or"ed in groups of 8 (i.e. If any of the 8 in a NINO chip are above threshold, the value of 1 is added to the multiplicity sum from the tray). The data (e.g. run9067095) is being analyzed to determine how well the multiplicity values correlate with data from other detectors (e.g. TPX, BTOW, and TOF_in_DAQ) and for level of noise present in un-triggered crossings. When TOF is completely outfitted this scheme will give a maximum count of 2880 into L0 from TOF. The system is currently under simulation to investigate the efficacy of this arrangement for meeting STAR's multiplicity needs.

2. Requirement: TOF information must fit into the existing CTB DSM tree. The digital signals must be available at the DSM interface boards within 700ns of the interaction.

Justification: TOF is to use the existing Central Trigger Barrel DSM tree. There is no plan to alter this information path. TOF must not increase the time required to make an L0 decision.

Status: The data taken in run 8 clearly show the TOF data delivered to the Layer 0 DSM one RHIC strobe later than the CTB CDB's data. Note: this does not present a problem as the CTB tree currently holds its data for 3 strobes to align with the EMC tower data.

3. Requirement: TOF information must be synchronized with STAR clock.

Justification: To be correctly recorded the TOF data must be presented to the DSMs at the proper time to be latched in correctly and aligned with the other trigger detectors. The trigger DSMs are part of a pipelined system that is locked to the STAR clock.

Status: The DSMI board (discussed in requirement #1 status above) was modified to send a copy of the STAR clock (input to the DSMI from the RCC/RCF system) to the TOF tray. That clock signal was used by the firmware in the TOF tray to latch data out to the DSMI. During run 8 tests were run in which data in the form of a ramp (sync-ed to the clock signal received at the TOF tray) were latched out to the DSM. STAR data files (e.g. run9057080) configured with pre-post to be 5 clearly recorded that ramp for each set of those eleven crossings (i.e. 5*pre + triggered_crossing+5*post = 11).

3. Requirement: TOF hit information for each cell (23k bit map) must come into Level 2 within 200 micro-sec of the interaction.

Justification: needed for charged vs. neutral discrimination in the calorimeters so that electrons and photons can be identified for use in particle ID triggers. These triggers are used to enrich samples of rare particle production.

Status: TOF will provide this bit map. The current plan is to use an SIU-DRORC combination to push the 3kB of information per event into L2. A similar system was implemented and tested successfully for the BTOW and ETOW systems during run 8. The SIU on the TOF side is already implemented in the current TOF electronics used during run 8. There will be a total of 4 fiber pairs in the final electronics. Expanding the Level 2 system to accommodate the TOF detector is straight forward but will require additional hardware (e.g. 2 DRORC cards and an upgraded linux based cpu with sufficient PCI-X slots).

4. Requirement: TOF start detector must provide signals to Level 0 so that we can tighten the vertex position requirement, taking advantage of the timing resolution of the TOF start detector.

Justification: The current vertex cut based on ZDCs or BBCs leads to 20-30% of the data being unusable because the vertex selection is not tight enough.

Status: The current design for the upVPD (TOF start detector) electronics provides an analog copy of the output from each photomultiplier tube. These signals were input to L0 fast-z electronics (a CDB/TAC/DSM) in run 7. Although the system ran successfully in both runs 7 and 8, the performance was less than ideal. Plans to replace the current L0 fast-z electronics are currently in discussion.