The STAR Trigger System

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The Solenoidal Tracker at RHIC (STAR) is an experiment designed to study the charged particles produced in heavy-ion interactions at 100A GeV/c in the Relativistic Heavy Ion Collider (RHIC) at BNL. The main detector is a Time Projection Chamber, but STAR also includes a Silicon Vertex Detector, a Forward TPC and an Electromagnetic Calorimeter. The UCB group in STAR is responsible for the trigger system. Within the UCB group we have concentrated specifically on designing and building the custom hardware for the early levels of the trigger and on the control software for the complete trigger system. We have made a lot of progress over the past year.

All 120 trays of the Central Trigger Barrel were fabricated and tested on the bench. Every tray contains two scintillator slats, each with its own photomultiplier tube and an LED for aliveness tests. During November all the CTB cables were laid between the TPC and the electronics platform: a HV, signal and LED control cable for each of the 240 slats. On the electronics side the CDB module, that will digitize the CTB signals and present them to the trigger logic, was designed. It will be prototyped and tested early in 1999.

In parallel to this effort a LECROY 1440 HV system was investigated for use in the CTB system. We worked with the Slow Controls group to test their software with this hardware. After a successful test this setup was officially chosen as the HV supply for the CTB. Following that we are now working on the Slow Controls interface to the CDB modules.

All the commercial hardware, needed for the trigger logic when STAR starts up, was purchased and installed at BNL. This includes a SUN workstation that will control the rest of the trigger hardware and provide the interface to the STAR Online control system. Several VME CPUs were purchased. These control the three levels of trigger logic, the transfer of trigger data from the electronics platform to the DAQ room and, finally, the notification of DAQ when an event is accepted. SCI was selected as the internal trigger network on the electronics platform and in the DAQ room. SCRAMNET was chosen to provide the link between the two SCI rings since it is implemented in fiber. All of the CPUs have been configured, and their software will be developed in 1999.

In the middle of 1998 work on the custom hardware of the trigger logic resumed after an 18 month shutdown. The Data Storage and Manipulation Board design was modified and upgraded to reflect problems found in the prototype. Five new boards were also designed to complete the system: the interface cards for the DSM and Trigger Control Unit (TCU), the P3-Driver Card (PDC) that receives signals from the TCU/TCUI and presents them to the Trigger-Clock Distribution (TCD) system and the RHIC Clock and Control Board and its fanout card.

While a few of each board were being manufactured, the TCU was tested. This module had been manufactured before the shutdown, and it was the first piece of the trigger logic hardware that would be needed by other groups working on STAR electronics. All the basic functionality was tested and made to work by modifying the controlling FPGAs. No board-errors were found, so there are no additional wires on the TCU.

In December the TCU was used successfully in a mini-system test at LBL. Triggers were issued and sent via the PDC to the TCD, which correctly received and distributed them. The detector busy signals, generated by the TCD, were successfully sent back to the TCU and used in the trigger decision. In January 1999 we expect to use the TCU in a larger system test at BNL, and to start testing the remaining boards.