Symmetricom time coordination

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Abstract

This is the start of documentation which explores the appropriate way to have separate devices with distinct DAQ systems with the ability to record synchronized events. This is important for the LBCF veto shield, so that other devices can take coincident data.

1 LBCF veto timing

The diagram below shows a schematic of how the 1μ s accurate timestamps are currently obtained with the veto shield hardware.

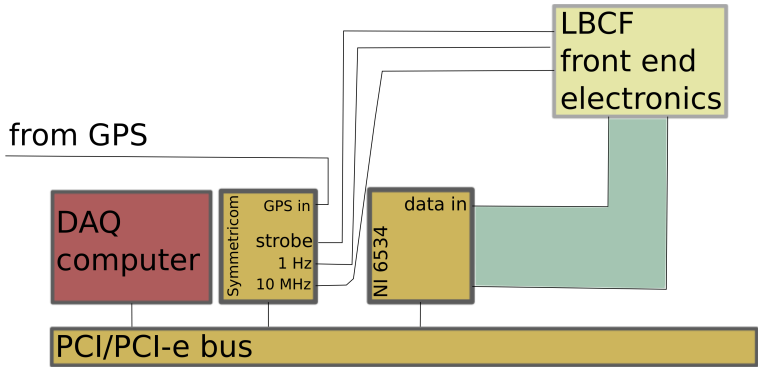

Figure 1: Current electronics layout.

The basic functionality of the above during a run is as follows:

1. the software sets up the symmetricom card to output 1 Hz and 10 MHz signals which are synchronos with the GPS clock (the 1 Hz rising edge will occur at the same time as the clock changes "seconds" value, this is also synchronous with the 10 MHz pulse)

2. the software tells the symmetricom to send a strobe at exactly "x" seconds in the future and the card returns the current time and the computer stores it

3. the strobe is accepted by the front end electronics card and the counter is cleared

4. the counter counts the 1 Hz and 10 MHz clocks to get a seconds and microseconds since strobe

5. when an event comes in to the front end electronics the value of this register is latched by the event signal and is then read back to the NI 6534 card along with all of the other data

The nice thing about the above scheme is that *every* trigger read back to the computer from the front end electronics has a timestamp that came from the counting of the 1 Hz and 10 MHz signals (diciplined on the Symmetricom card to be synchronous with the GPS signal). Every event that was read back has a time stamp, recorded at exactly the instant that the "event" signal arrived at the counter electronics. This is the property that we need to keep when implementing this using other detectors.

2 the possibility of coordinated timing

Work is still ongoing here to find the best way to read back counter values that get included in the data stream of coordinated detectors. There are a few ways to go. Assuming that we have a piece of electronics which includes some counting logic and a counter latch synchronous with an event, we can focus on the read back of this value.

1. try to get this digital value into the existing DAQ data stream on an event-by-event basis

2. store the value in some on-board memory and equip the new electronics with a read function which can empty this buffer

The first option is the safest in terms of synchronizing the time values that are read back. Since there the time value would always come at the same time as the data (presumably read in the same way), there isn't a chance of misalignment of trigger times. The second option has the advantage that it can be more independent of the users DAQ system, yet the list of times has to be linked properly with the events in software, where there is a danger of mismatch. Here, perhaps reduncancy values can be read back so that we have some way to sync the data streams.