Dr.-Ing. Sven Bauer
I was asking about the ET A033 Synchronization Input Line Delay. If I remember correctly you said that there is a PLL board used internally? Here are my questions:

- Do you know the delay of the input line? Its delay itself should cause a small offset in its actual synchronisation to a PPS source such as a GPS receiver.

- Do you internally correct for this delay already to have the synchronisation correct?

- Is the PLL board also compensated for thermal variation as the A/B channels?

- What was the internal delay of the A/B channels? Not relative w.r.t. each other since it is the same line but absolute or total as you could say.

Yes, the timer uses a PLL to multiply the 10 MHz reference signal to 100 MHz.

Timer input circuits and PLL circuits have a delay of about a few nanoseconds. Temperature changes in these delays affect the logged timetags. Measures have been taken in the timer so that this temperature instability does not exceed 2 ps / deg.
The 1PPS timetag is recorded only relative to the 10 ns coarse timer clock. This quantum determines the accuracy of synchronization between the internal time scale of the timer and the external time scale from the GPS. At the same time, temperature changes in the delays of the input circuits of the timer and the PLL circuit are several orders of magnitude less than the 10 ns quantum and practically do not affect the synchronization accuracy of the internal time scale of the timer and the external time scale from GPS. In the new timer, we are considering the use of an interpolator for more accurate registration of the 1PPS signal. In this case, the influence of the delays of the input circuits and the PLL timer circuit on the accuracy of the synchronization of the scales will be more significant. With this in mind, we plan to use new PLLs in Zero delay mode and new low-latency speed comparators.

Peiyuan Wang (Graz) :

Q1: How many test modules are in the new design for A&B channels? If you use one single module for each input (as you said ???), how about the consistency in real time between two channels?

Q2: do you carry out realtime/on-line calibration interanlly?

Q1. A test module for direct timer testing must be capable of generating test signals with very high precision parameters, which will dramatically increase the cost of the timer. In the new timer, it is planned to introduce indirect monitoring of precision and take additional measures to stabilize the timer parameters.

The timer uses a two-input / one-channel design principle (input signals are combined according to the "or" scheme and fed to a common measurement channel). The application of this principle has the disadvantage of a dead time (50 ns), but provides high measurement stability. Before the "or" circuit, the signal delays at the inputs are different and this determines the presence of an inter-input offset. The offset value relative to the input connectors of the timer is about 100 ps (indicated in the passport of a particular timer), the temperature instability is 0.1 ps / deg. This value is orders of magnitude less than the offset of the entire measuring path for laser ranging. Undoubtedly, it is advisable to monitor in real time the offset of the entire measuring path of the laser ranging system (usually this is the calibration of the system using a stationary target or optical cable), however, real-time monitoring of the offset of the timer itself does not make sense.

Q2. The timer calibration procedure is used to maintain its precision under changing environmental conditions. Calibration is done in a computer and takes a few seconds. The implementation of the calibration in the FPGA timer has already been tested and will be used in the new timer, which will reduce the duration of the calibration by an order of magnitude and make its application more universal.

Zhipeng LIANG

Q1: Drivers for USB3 - who will provide them?

Q2: Do you plan USB3 support in Linux?

Q3: You are now using BNC connectors are you planning to switch to other more modern standards?

Q1. We are going to use in new timer device (and already using it in some our devices like multichannel photon counter)
The driver provided by:
FTDI FT60x family of USB 3.0 devices.

Q2. Yes we are planning.
libftd3xx is a Linux implementation of FTDI's D3XX Windows library
FTDI intends the APIs to behave the same on Windows and Linux,
Although,Linux version is currently at the beta stage, and
some functions are not implemented.

Q3. Yes, we are considering switching from BNC to higher frequency SMA connectors. However, it should be borne in mind that the real gain from using SMA connectors will be only if a high steepness of the edges of the input signals is provided (about 1 ns / V).

Matthew J. Wilkinson

Q1: The new timer will be capable to operate on MHz Laser ranging mode?

Q2: Question about usability: In SLR we are making measurements for a few hours and then waiting for better weather conditions. Does the timer need to be in operating mode, because I live it in "ON" mode to just count seconds? What are the preferred operation principles of timer?

Q3: How often internal calibration needs to be done on the Event timer? I make it every hour. What is a preference for better performance?

Q1. Timer version A033 with USB2 interface provides performance up to 1 Mevent / sec. In experiments using the USB3 interface, we got an increase in performance up to 20 Mevent / sec.

Q2. It is desirable to keep high-end measuring equipment in "ON" mode at all times. As for the A033 timer, only the limited resource of the fan should be taken into account.

Q3. The frequency of calibration is determined by the dynamics of the external environment. We know of users who use efficient climate control in the room where the timer is running. In this case, there is no need to calibrate every hour. Unfortunately, it is difficult to implement direct monitoring of precision in the timer, however, the timer has an internal thermal sensor, the change in the readings of which by how many degrees indicates the desirability of calibration.