

Compact Event Timing and Laser Fire Control Device for One Way Laser Ranging

16th International Workshop on Laser Ranging

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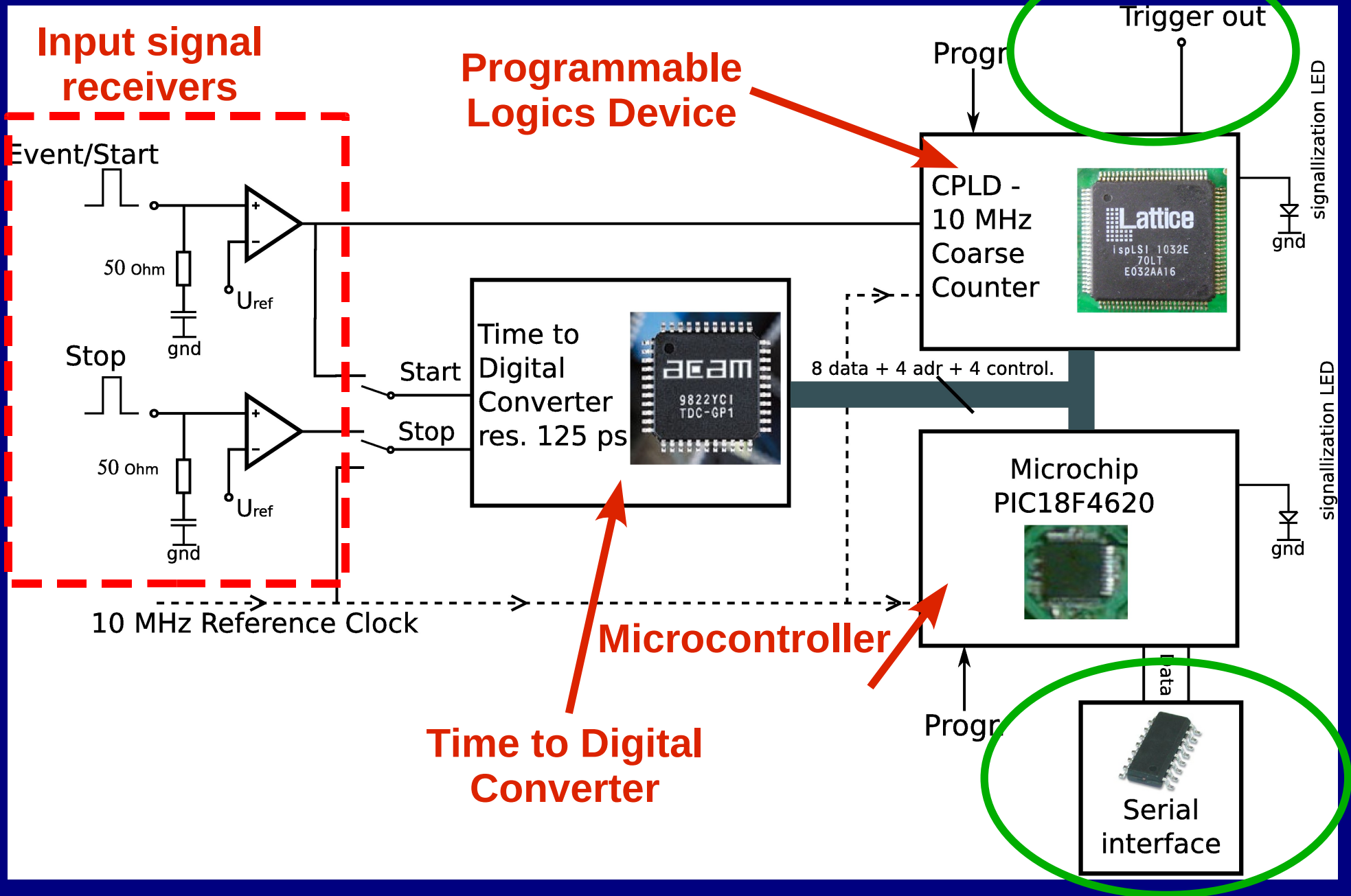
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Goals

- Design a device for accurate measurement of time epoch with resolution of hundreds picoseconds, based on Time to Digital converter from Acam company (TDC-GP1 chip).
- The device must be able to generate programmable Trigger pulse, 100 ns res.
- Design and construct the prototype of the device
- Verify it's function with standard (PET2k)

Timing Unit concept

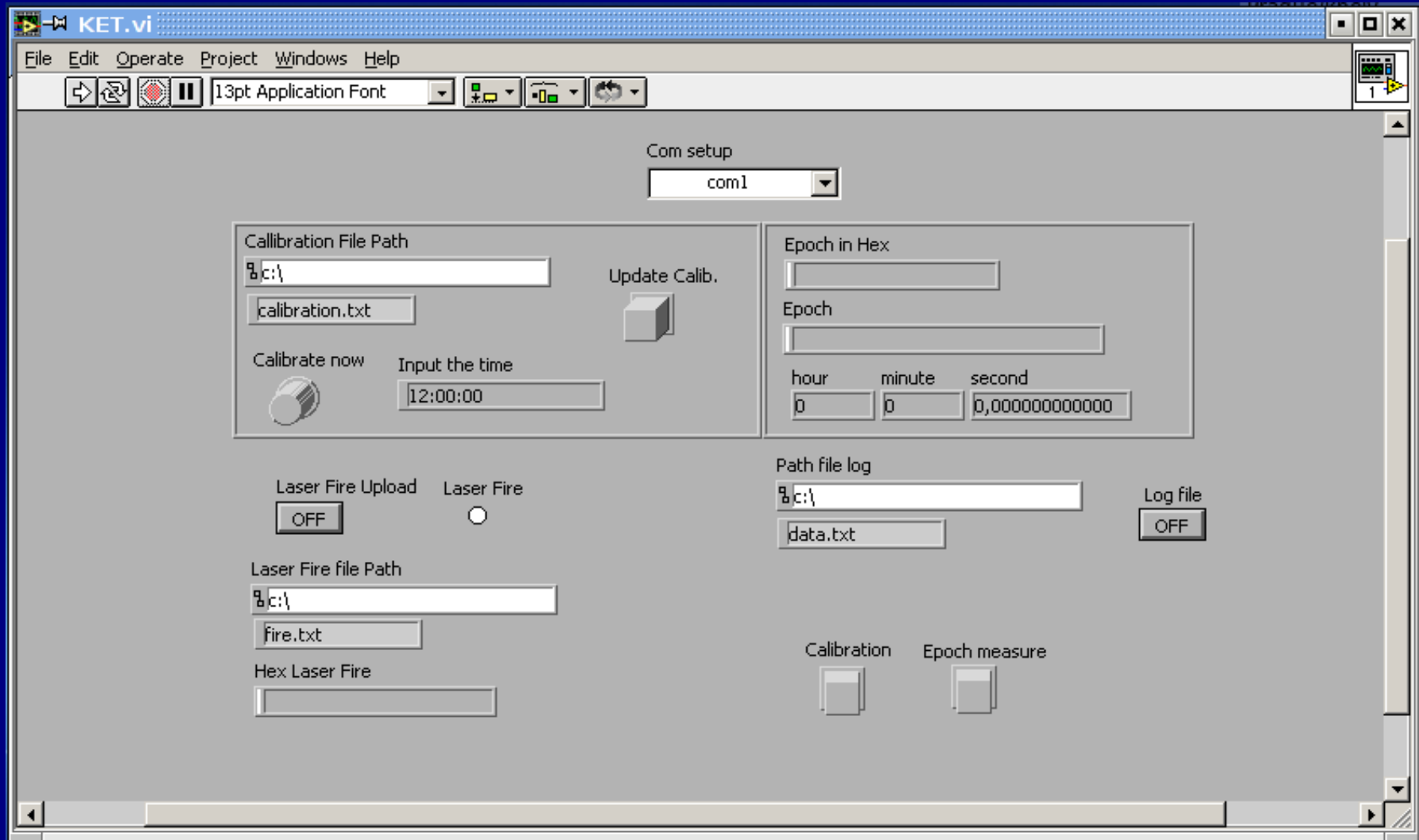


Timing Unit Construction

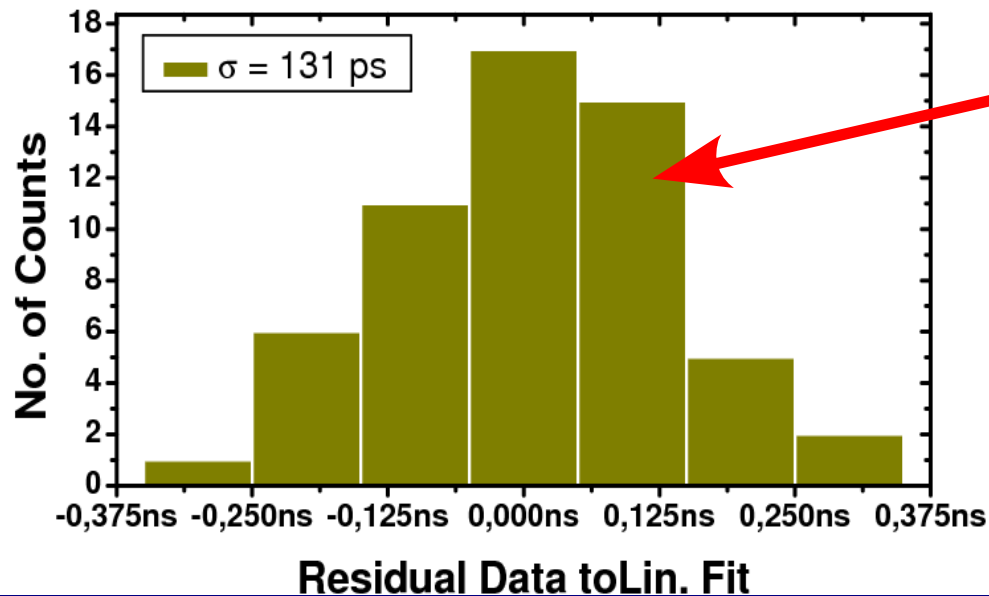
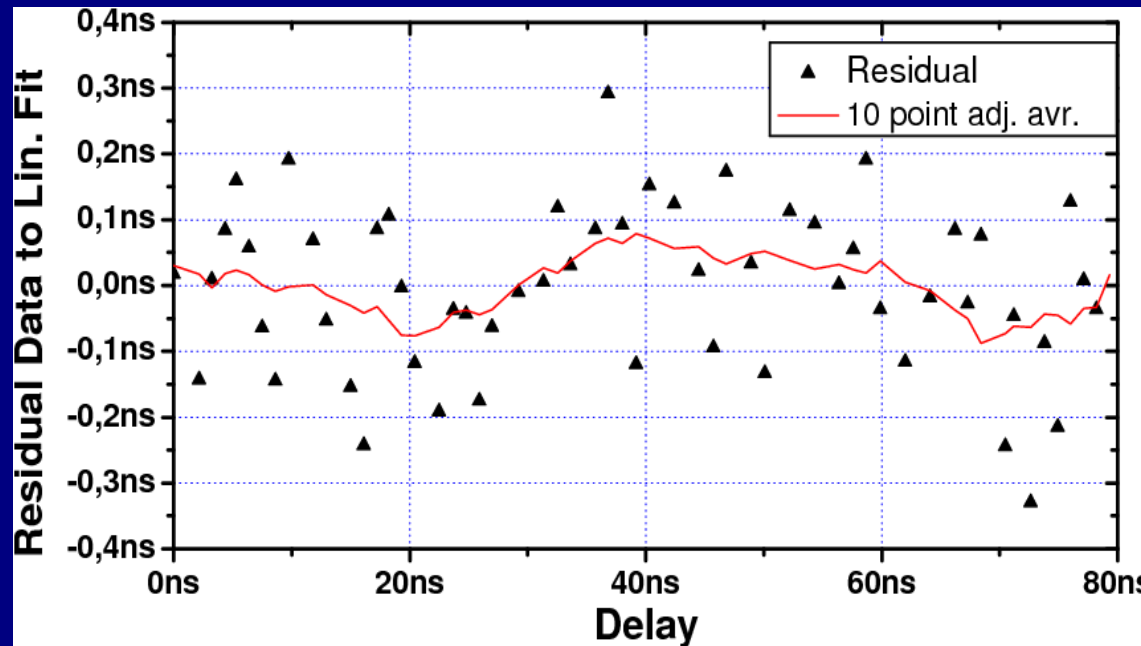


- Inputs/Output – SMA connectors
- NIM input
- TTL input
- Programmable trigger
- 10 MHz ref. Clock
- Communication – RS232 – ASCII strings
- Power supply 5 – 9 Volts

Control Program Demo - Labview

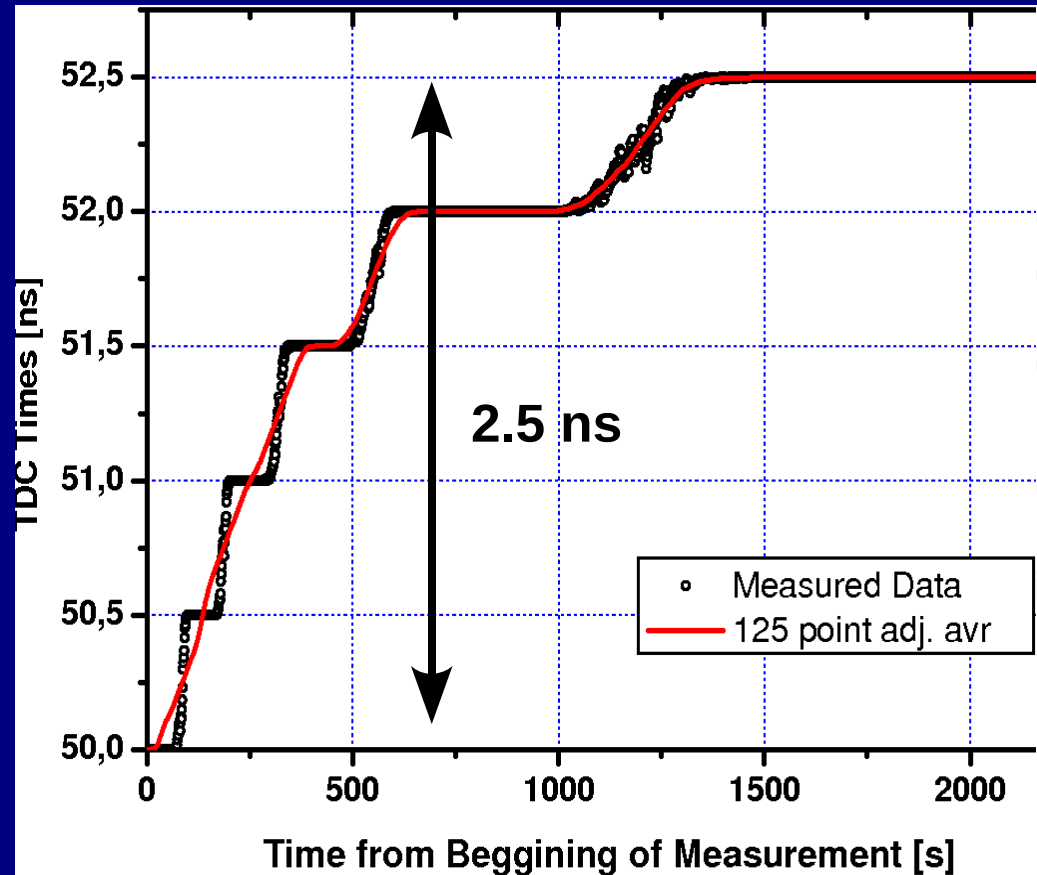


Timing Unit test: Linearity / P-PET

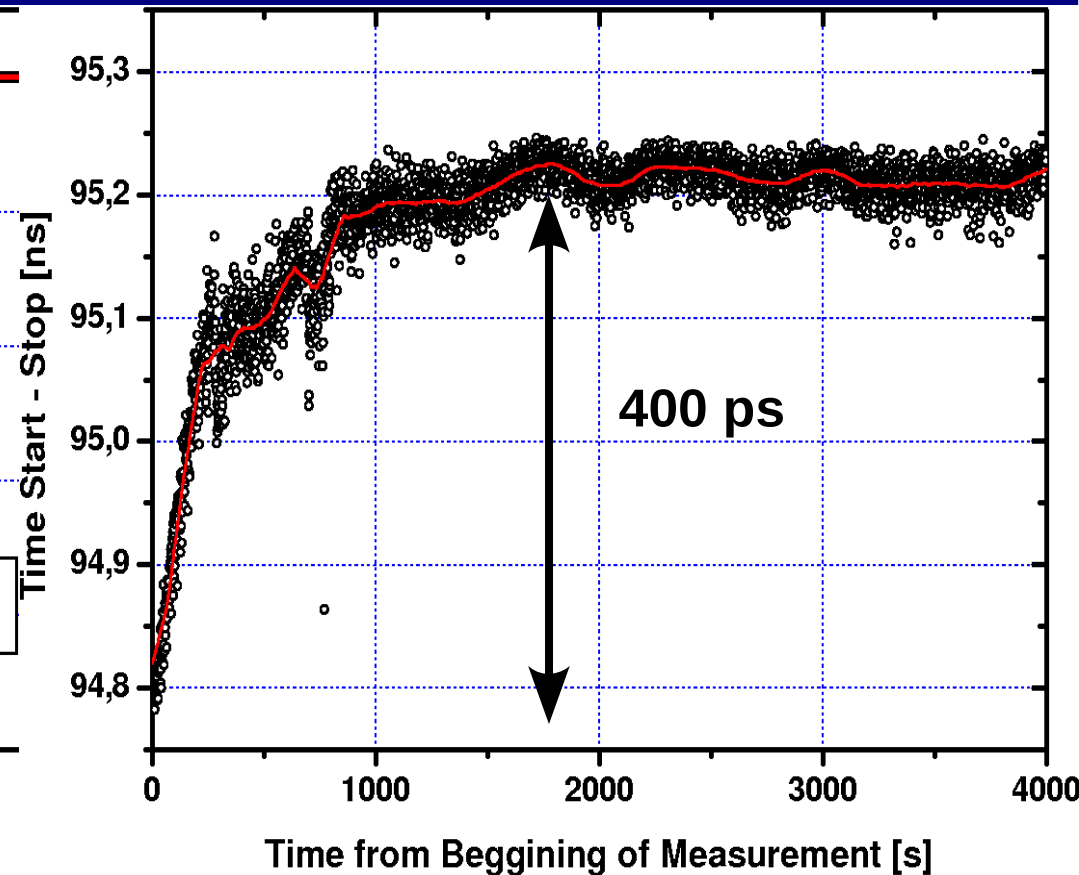


Warm up Characteristics

Event Timing



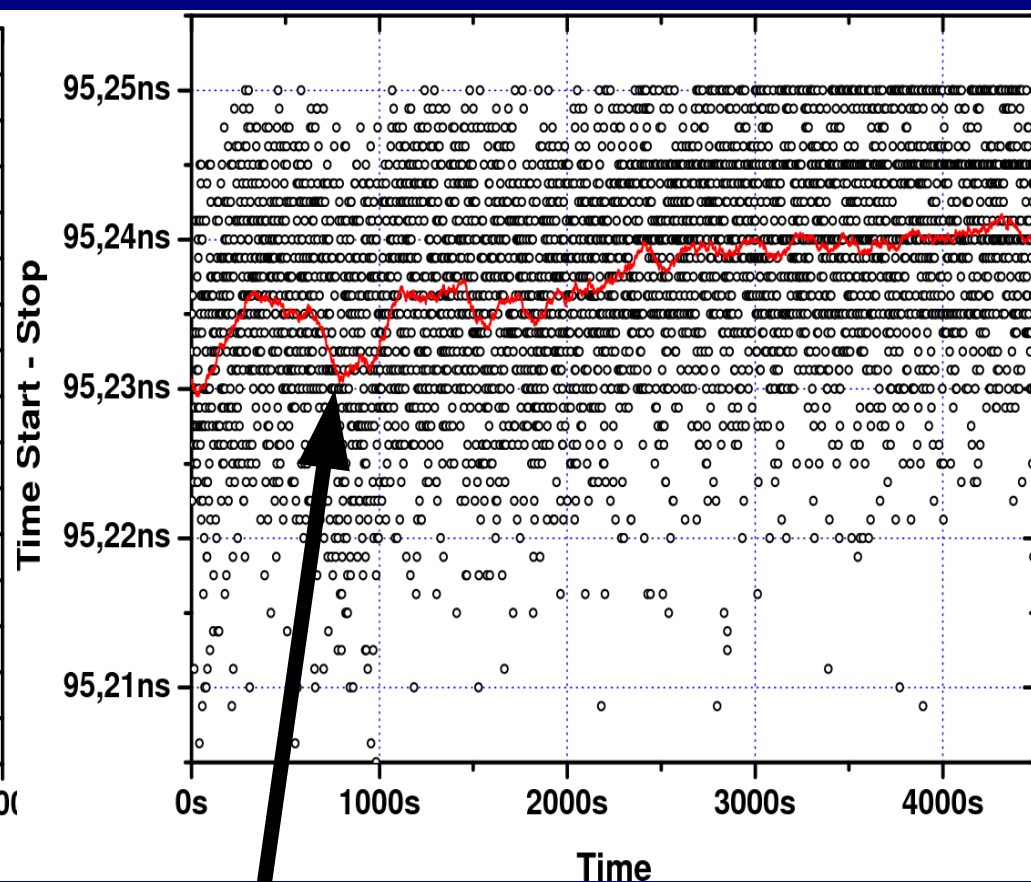
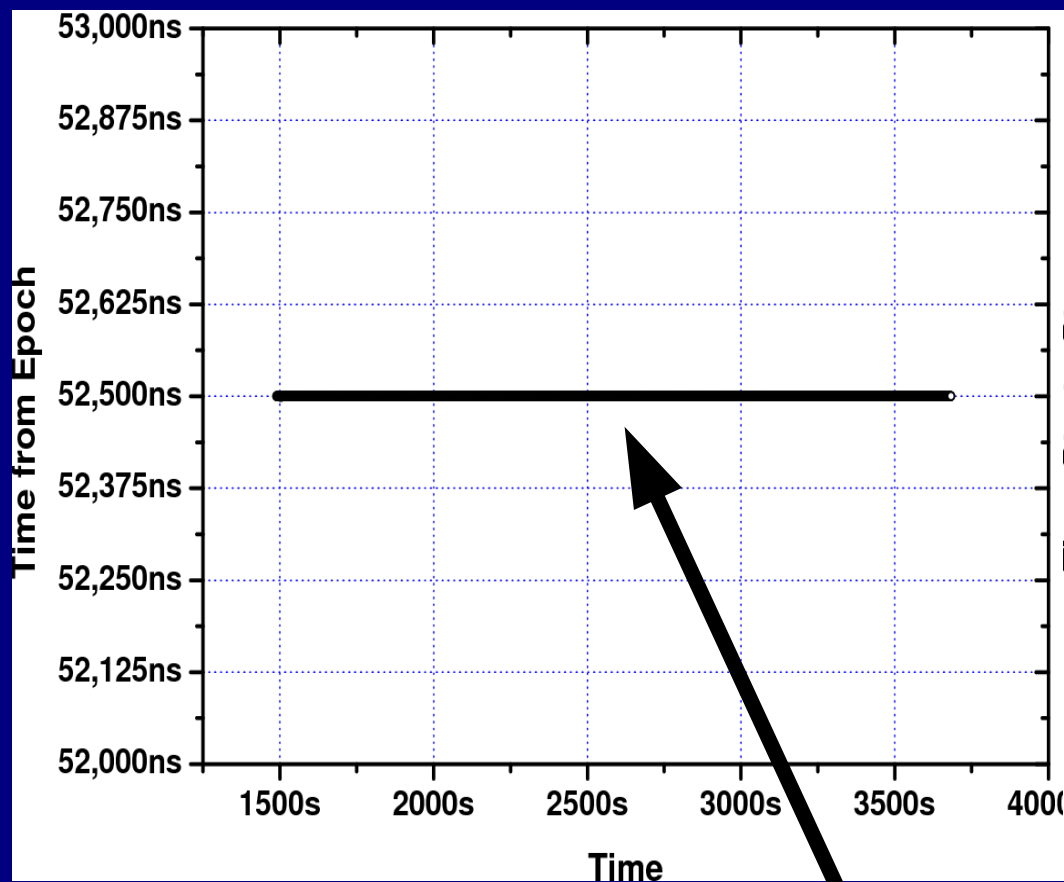
Time Intervals



Long Term Stability after 1 hour warm up

Event Timing

Time Intervals



45 minutes
constant

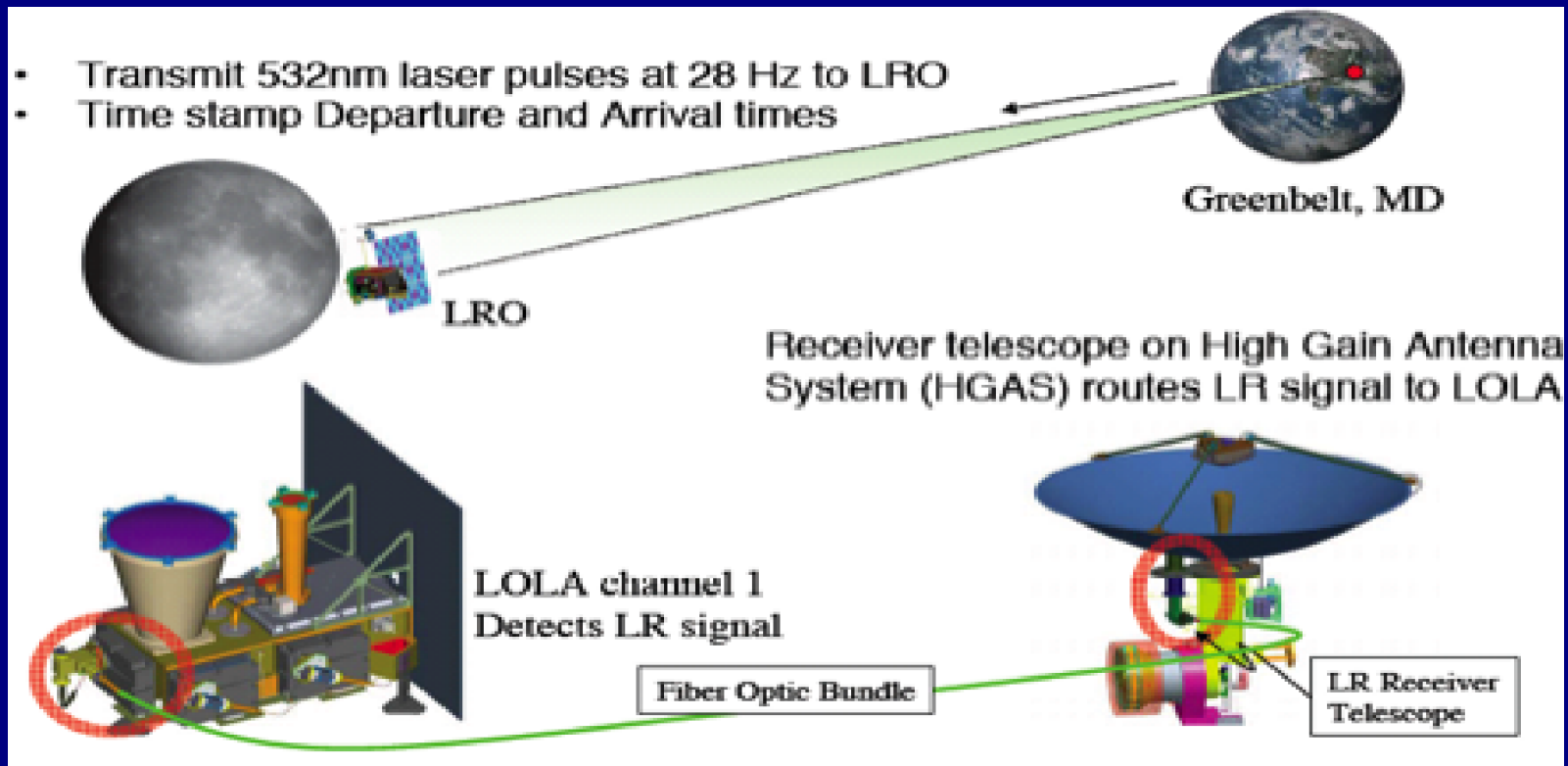
< 1 hour
change of 10 ps

The Measured Parameters of Timing Unit

	Event timing	Time intervals
Linearity	130 ps	130 ps
Warm up Characteristics	167 ps/°C	38 ps/°C
Long Term Stability	$\ll 10$ ps / h	~ 10 ps / h

Possible applications

Lunar Reconnaissance Orbiter - one way ranging



Mark Torrence. LRO-LR. http://ilrs.gsfc.nasa.gov/satellite_missions/list_of_satellites/lrol_general.html.

- Ground System Requirements
accuracy < 200 ps, max rep. rate 28 Hz, easy to implement
- Quantum Key Distribution
- Time Correlated Single Photon Counting

Conclusions

- I've constructed the prototype of the device for event timing and time interval measurement
- Timing resolution 130 ps, 65 ps available on request
- The device has programmable trigger output, the resolution is 100 ns
- Device is reliable pocket size and easy to use
- The device characterization set of measurement has been completed