

Timing System for the Laser Altimeter for Planetary Exploration Technology Demonstrator

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General Goals

- Technology demonstrator of a Compact Laser Rangefinder applicable in future space projects :
 - Mercury planet altimetry
 - Lunar altimetry and surface mapping
 - on-board optical transponder(s) for Earth orbiter(s)
 - airborne range finder
 - ground based Satellite Laser Ranging (SLR)
- Desired altimeter parameters:
 - one meter ranging precision (no costly interpolators)
 - multiphoton approach
 - diode pumped laser, ns pulses
 - modular construction
 - existing / available technology

Application

- Technology demonstrator of a Compact Laser Rangefinder
- modular construction
- based existing / available technology
- test bench operation at (any) Satellite Laser Ranging site
- reduced timing resolution (ns- pulse altimetry!)

Schedule & responsibilities

July 31 st	decision, proposal, quotation	CTU Prague
August 31 st	DLR acceptance, contract	DLR
October 30	first version operational	CTU Prague
November	on-site testing	CTU / DLR
November 30	delivery	CTU
December 15	integration at DLR	CTU / DLR

Altimeter Timing System Characteristics

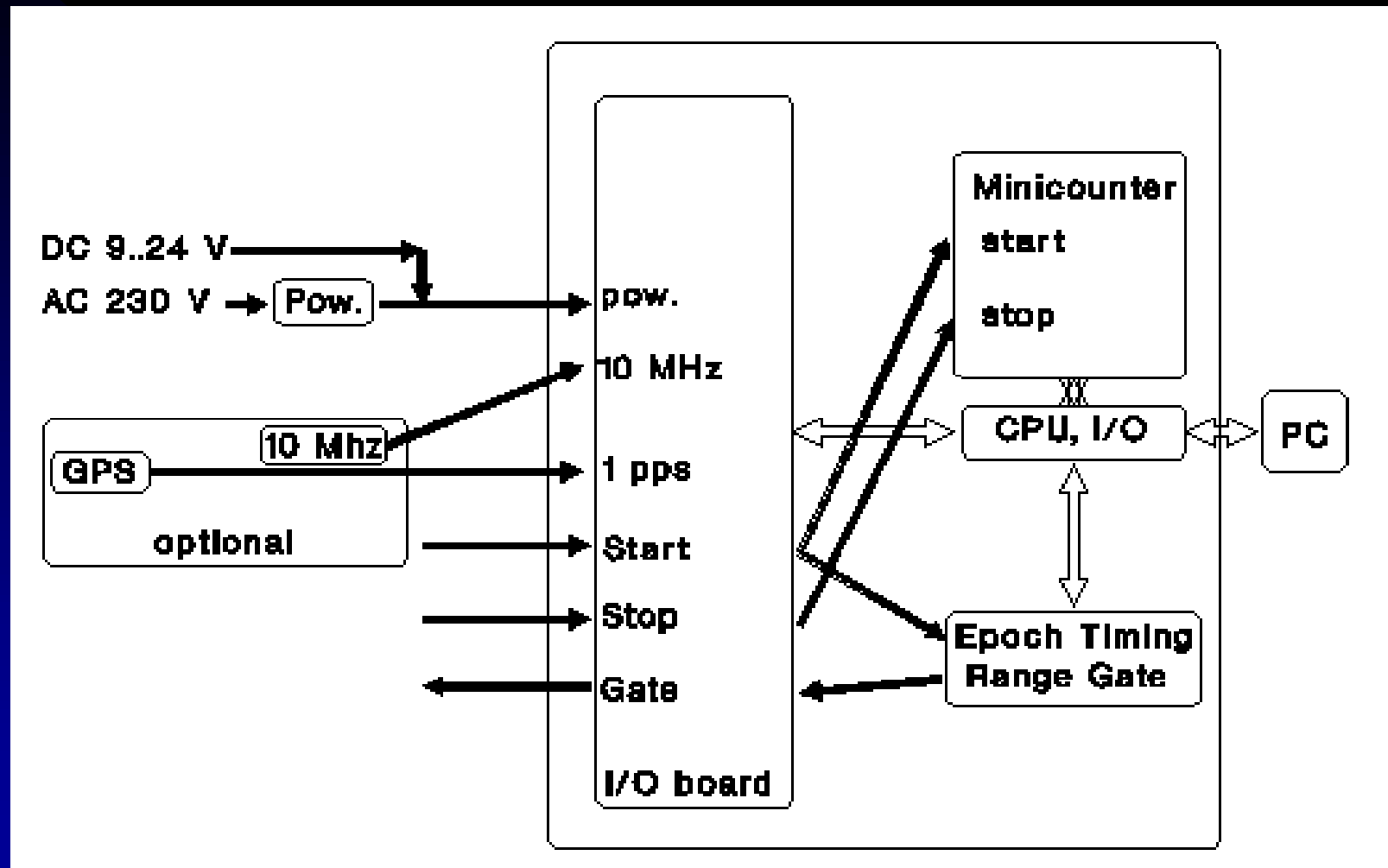
- GENERAL
 - universal timing system for laser ranging with sub-ns resolution
- FUNCTIONS
 - determining the epoch of laser fire
 - measuring the time-of-flight of the laser pulse
 - generating the range gate pulse for the echo signal detector
 - data acquisition and process control.
- PROPERTIES
 - compact, low power (battery operated), low cost
 - based on field - tested components HW & SW
 - simple to integrate into final device

Altimeter Timing System Concept

- Based on existing P-PET hardware and software concept, the Dassault modules are replaced by integrated TDC chips .
- The timing system consists of the range counter module, the epoch timing and range gate generator module, the control processing unit, the input / output circuits and of the power supplies.
- The entire control logic hardware, epoch timing, range gate, and input/output board is based on the FPGA (ispGAL) programmable logical arrays.

This ensures the maximum device flexibility and upgradability.

Timing System Technology Demonstrator Block scheme

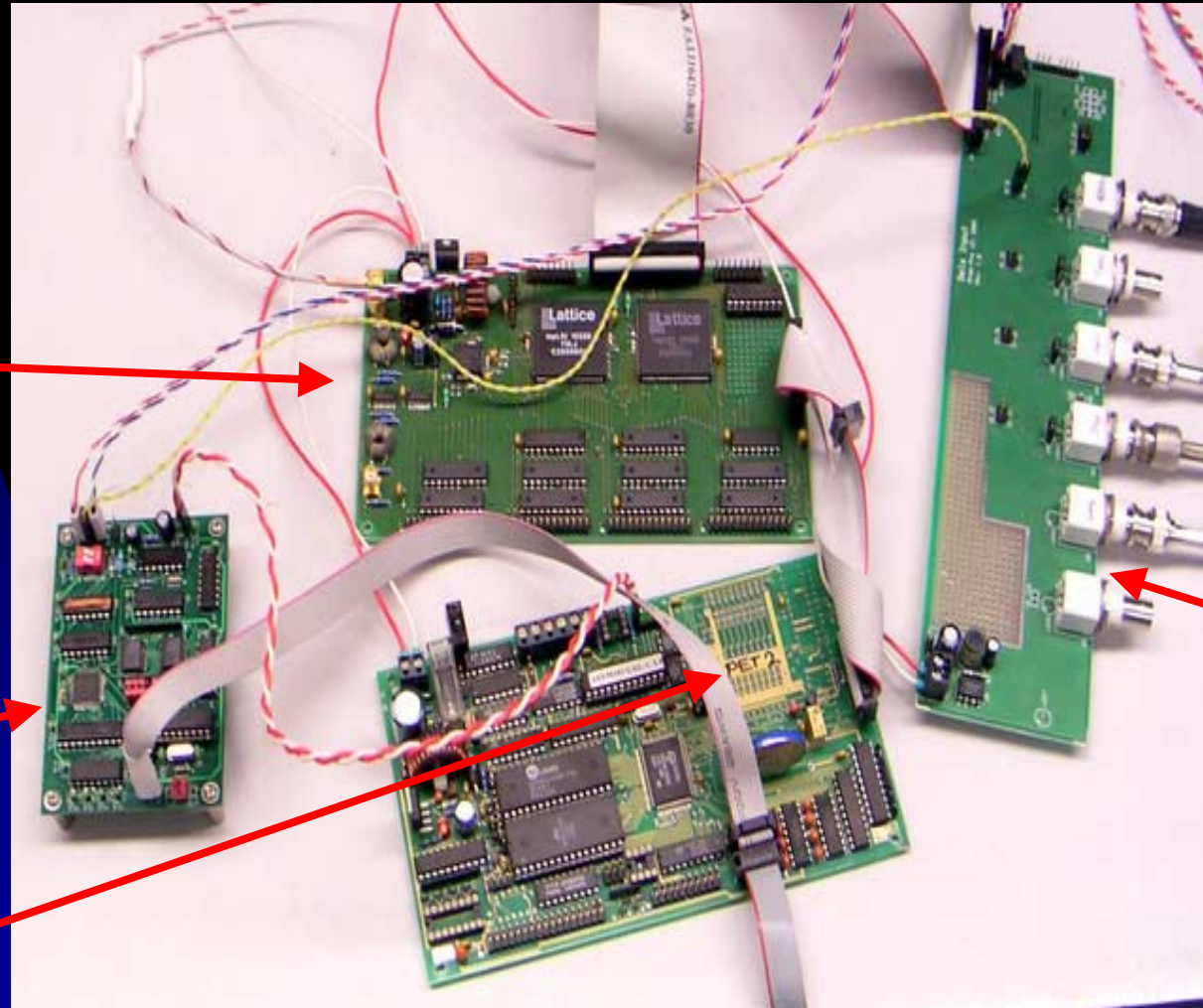


Timing System Technology Demonstrator Electronics boards

Range gate logic
PET 2 version

TDC timing board

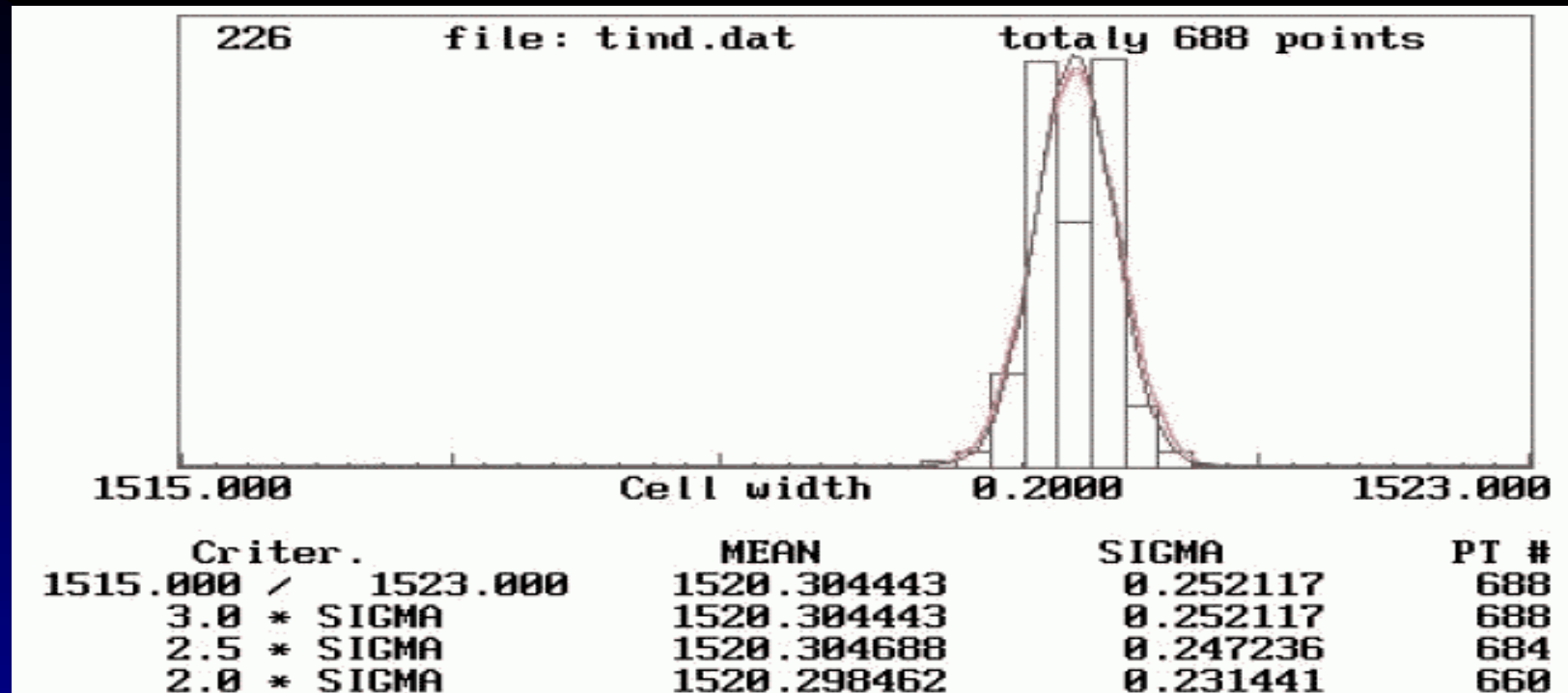
CPU board
PET 2 version



I/O
board

Timing System Technology Demonstrator

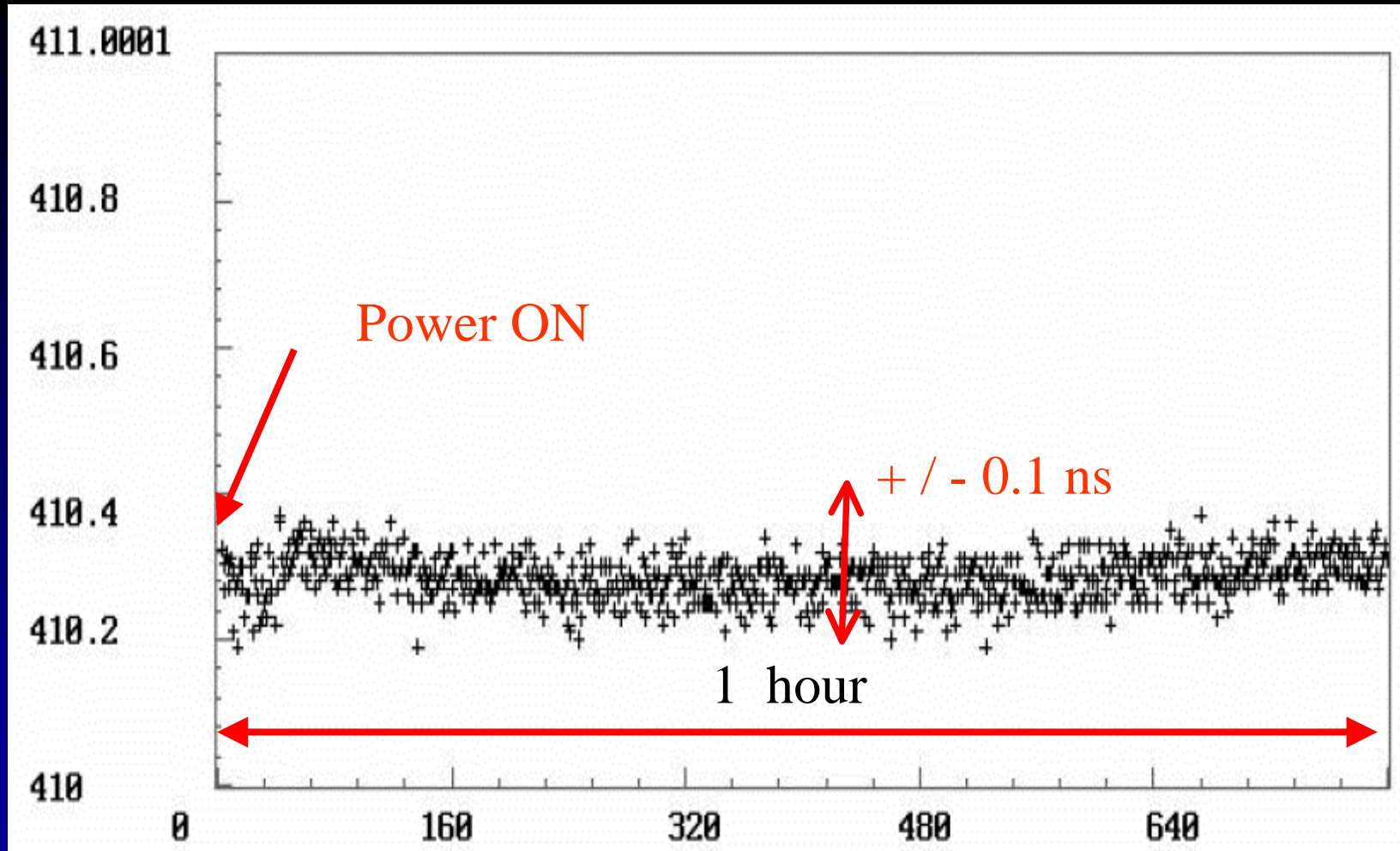
Temporal resolution



measured time 1.52 μ s
the timing resolution of 0.25 ns
normal data distribution

Timing System Technology Demonstrator

Long-term temporal stability



Timing System Technology Demonstrator Parameters

- universal timing system for laser ranging with sub-ns resolution



- resolution, precision 0.25 ns, 0.25 ns rms
- non-linearity, stability < 0.1 ns, < 0.1 ns/hour
- range gate delay,width 40 ns steps
- repetition rate 24 Hz max.
- mass 2.5 kg
- power DC 9-38 V, 7 VA
> 3 hr operation on AA cells (8x)

Demonstrator Timing System Technology Summary

- the universal timing system for laser ranging: ground-ground, air-ground and ground-satellite with sub-ns resolution has been developed and tested
- simple to implement: SW package identical to PET devices
- based on tested technology and components development period < 3 months :-)
- In perspective the Altimeter Timing System may be applied in deep space laser transponder experiments