

GREENFIELD TECHNOLOGY



Timing system for the HALPS/L3 ELI project

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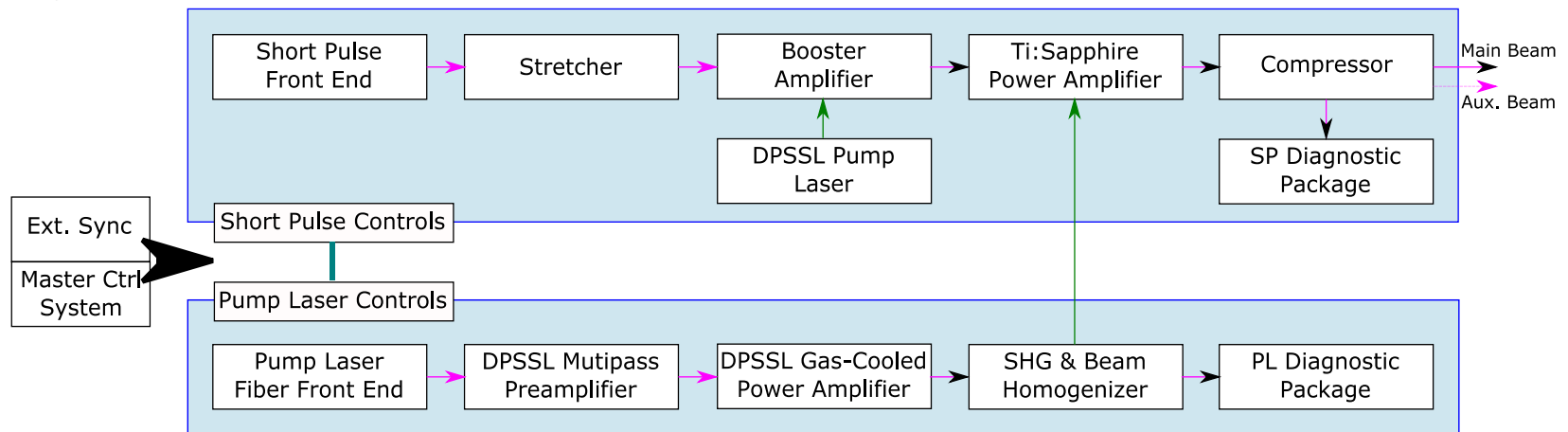
GFTy Electronic Timing system

GFTy involved in several TS for big physic instruments

- France:
 - SOLEIL synchrotron (cPCI solution)
 - LULI (1U, 19 inches)
 - APOLLON (1U, 19 inches)
 - LMJ (1U/2U, 19 inches)
 - RX (detonic application – cPCI solution)
- Europe
 - AWE
 - Aldermaston
- USA
 - Jupiter (1U, 19 inches)
 - NIF (FTT) (1U, 19 inches)

HALPS Generality

- The High Repetition-Rate Advanced Petawatt Laser System



- Synchronization pump laser beam/short pulse laser beam => several precisely timed triggers needed
- Master oscillator common to the 4 lasers



HALPS Timing System

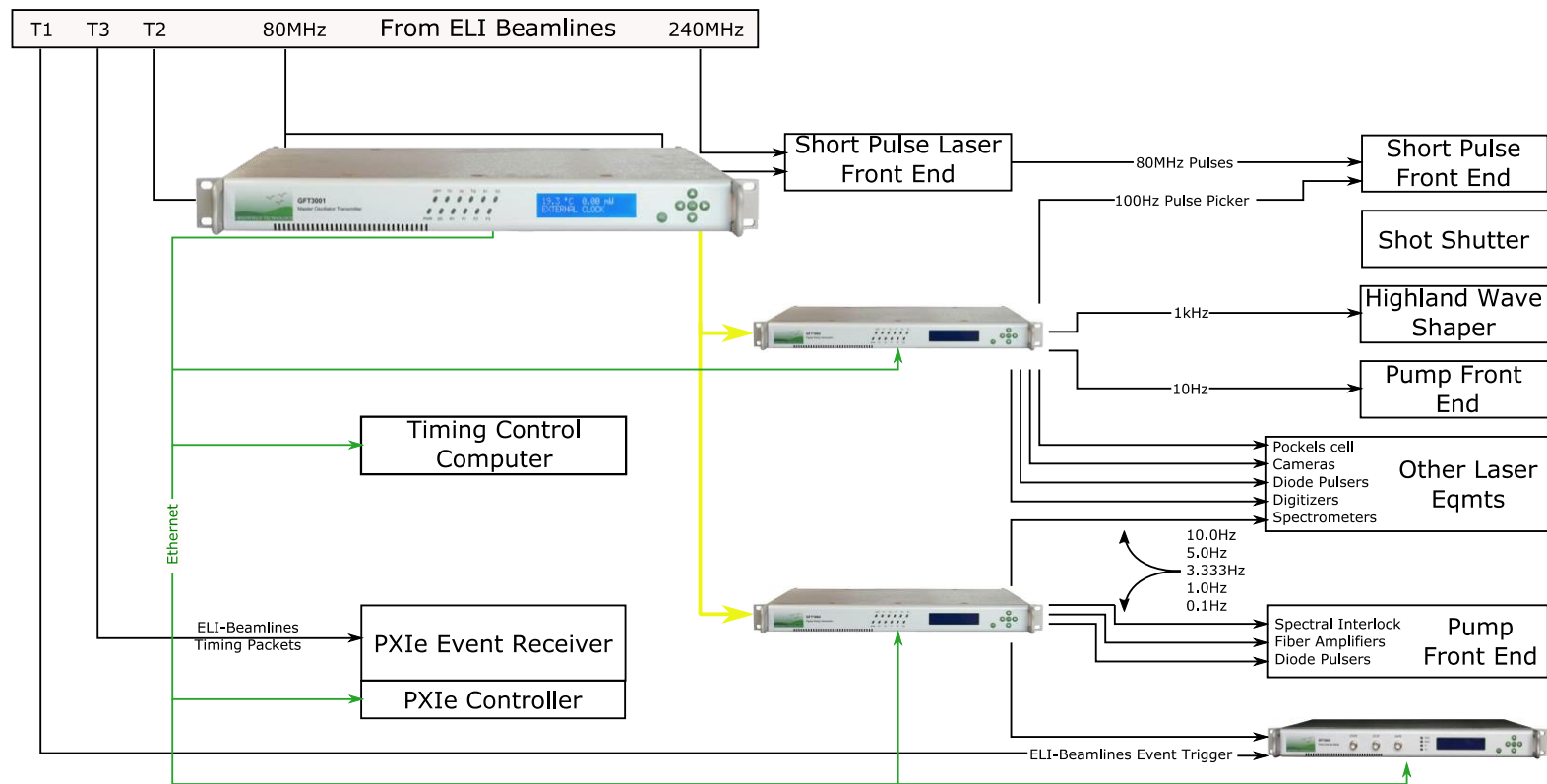
- Common reference CLK + precisely timed triggers
- Require a low jitter high precision ETS, independent or synchronous to the ELI's TS
 - Master Timing Generator (MTG) optically linked to local multi channel delay generators
 - 1ps delay resolution
 - MTG phase locked to the 80MHz system clock, jitter <10ps rms
- Greenfield Technology ETS selected
 - Customized its ETS

HALPS Timing System

Low jitter – 1ps ETS

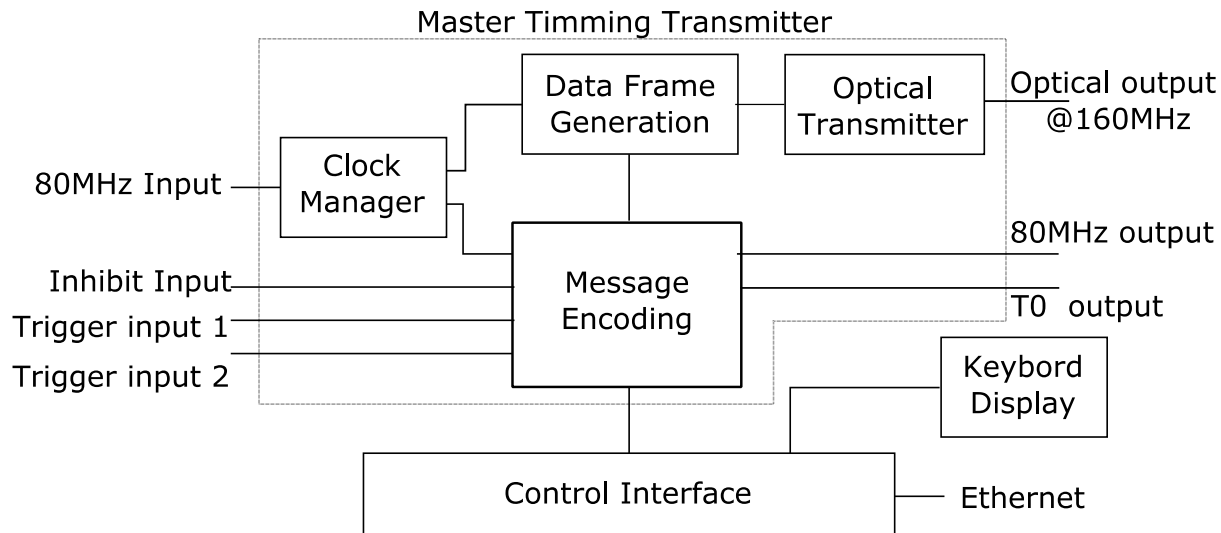


- Master Timing Generator/ Multichannel Delay Generators / Time Interval Meter



GFTy ETS components

Master Timing Generator 1/2



- 4 main blocks

- CLK Manager: ensure phase lock to the ref. CLK (80MHz) and low jitter btw ref clk and optical output (<10ps rms)
- MSG encoding: 6 Epochs and 4 Keys coincident to ref. clk
- Data frame generation: 1B/2B encoded @160MS/s
- Optical transmitter: 6dBm @ 1550nm



GFTy ETS components

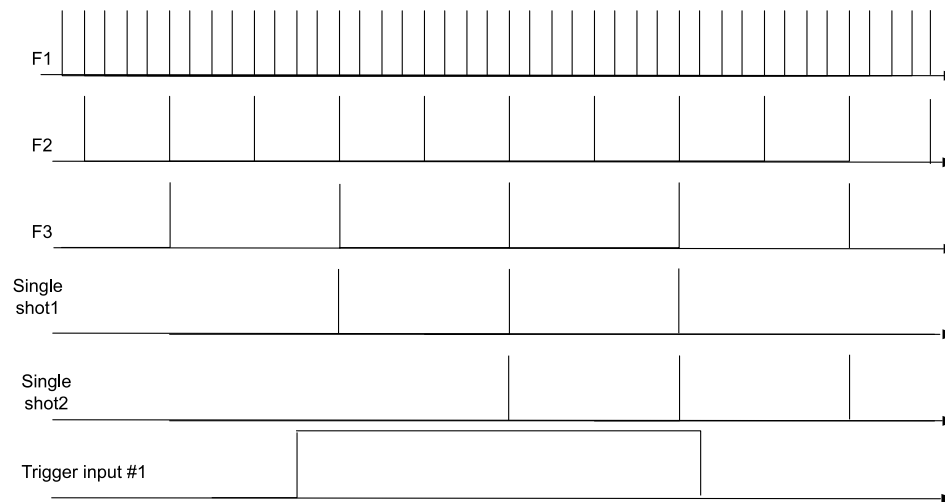
Master Timing Generator 2/2

- Encoded message

- 3 fixed (1kHz, 100Hz, 10Hz) and 3 user specified Epochs (F1>F2>F3)

F1	1000	500	200	100	50	20	10	5	3.3	2				
F2			200	100	50	20	10	5	3.3	2	1	0.5		
F3					50	20	10	5	3.3	2	1	0.5	0.2	0.1

- 2 pairs of keys (SShot) + Burst mode on SS1/SS2 pair



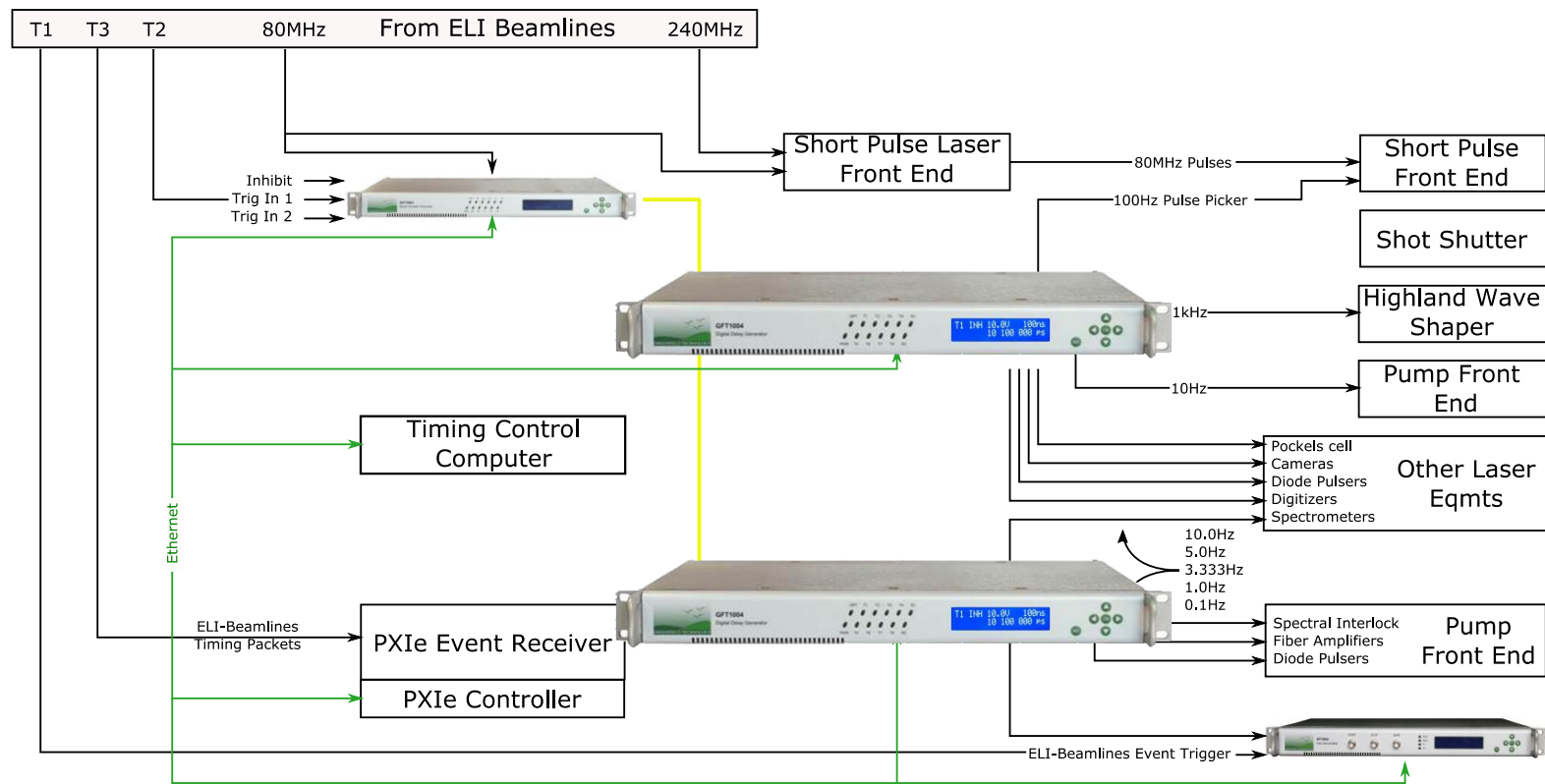
- 1 inhibit key (soft/hard) : data frame generation inhibition

HALPS Timing System

Low jitter – 1ps ETS

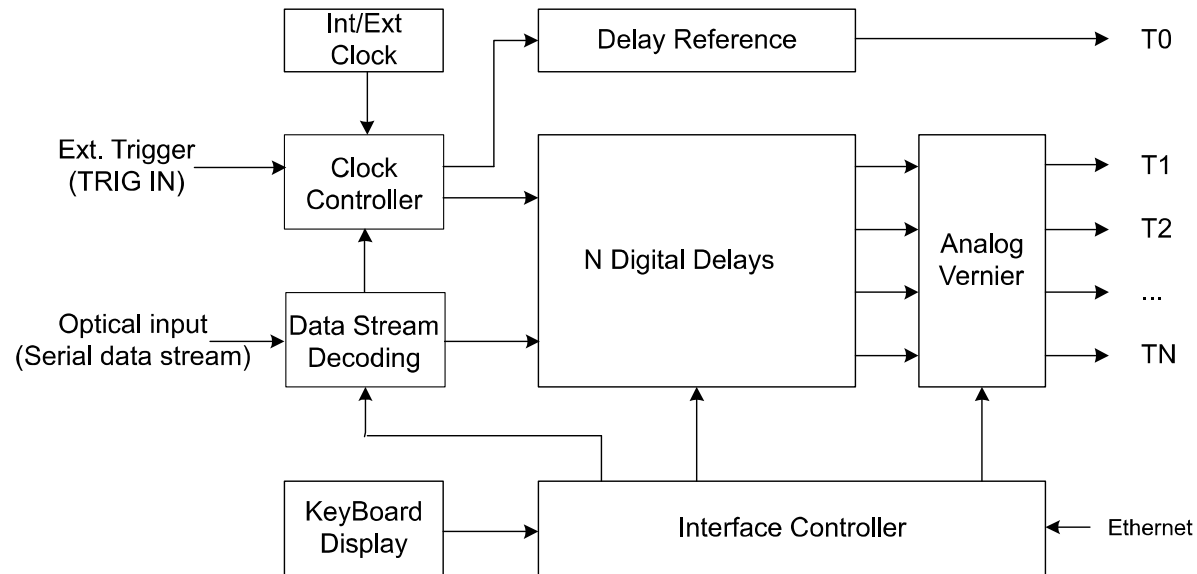


- Master Timing Generator/ Multichannel Delay Generators / Time Interval Meter



GFTy ETS components

Multichannel Delay Generators



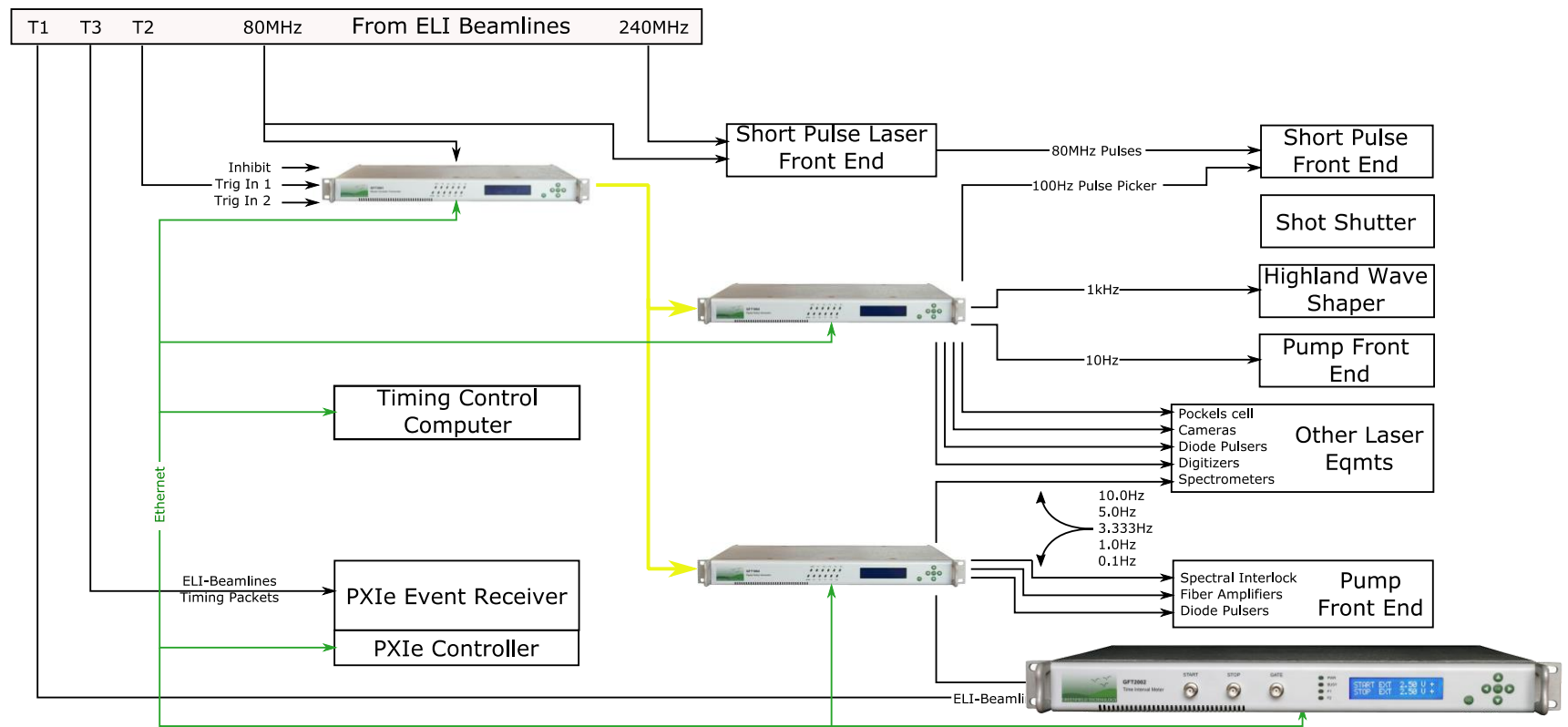
- MTG => Data pattern distributed to multiple zones
- 3 main delay generator blocks
 - Data stream decoding: MTG triggers and ref. clock recovering
 - Clock controller: clock selection
 - Delay generation: digital (6.25ns) + analog (1ps).

HALPS Timing System

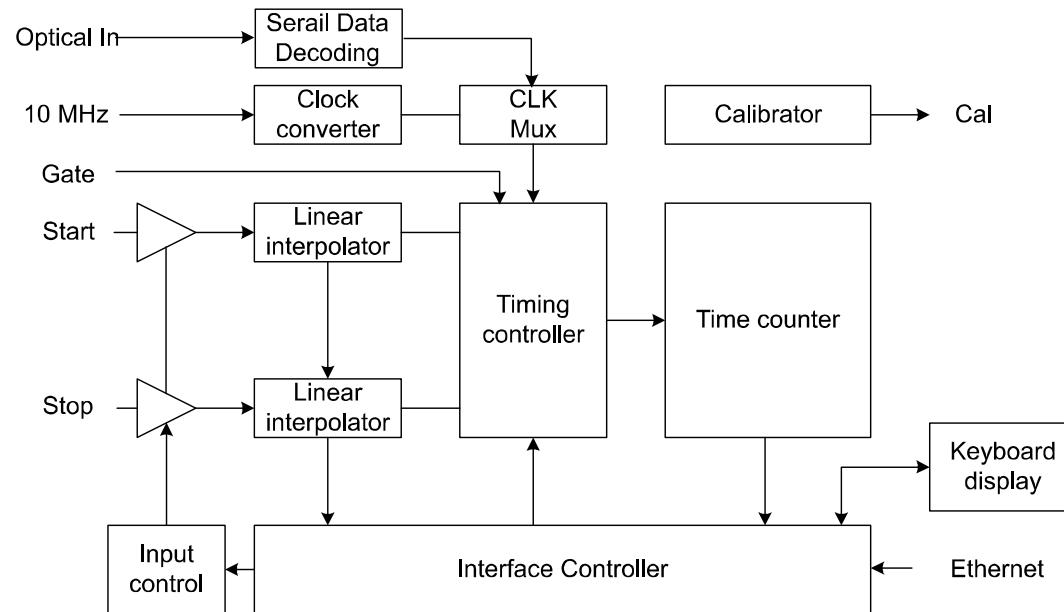
Low jitter – 1ps ETS



- Master Timing Generator/ Multichannel Delay Generators / Time Interval Meter



GFTy ETS components Time Interval Meter



- 2 main blocks

- Timing controller / CLK mux
- Time counter + linear interpolators => 1ps meas. resolution

Note: Arming mode : Start, Stop, Gate, Optical input

- Enable 2 independent high precision TS to operate as a single time coordinate TS

GFTy ETS Results



- Achieved by GFTy ETS

- Runs @ 160MHz

MTG

- Phase locked to the 80MHz reference clock
- < 10ps rms jitter: ref. CLK \Leftrightarrow optical data stream
- Trigger frequency range : 1000 – 0.1 Hz
- 2 Single Shot pairs + Burst mode

DGs

- 0 to 10s delay range with 1ps res., jitter < 15ps rms (T0-channel)
- acc. < 250ps + delay * t_c (rubidium $t_c \sim 10^{-12}$)

- Under test at the LLNL Facility

- GFTy proposed a customized ETS

- controlled via front panel, web browser or ethernet link (simple cmds, LXI std)
- Upgrade up to 256 channels

GFTy Devices



- Products

- Timing system (Master unit + slave units, Opt-Elec)
- Delay generator (up to 20 chan./20V)
- Time interval Meter
- Signal generator
- Opt ↔ Elec converters
- Digitizer (10GHz – 8/10/12bits – 3GHz BW)
- Streak camera
- High BW scope (FTD10000 – 7GHz)



- Form factor

- PXI, cPCI
- Benchtop, OEM
- rack

