PULSE

Timing Distribution System

APPLICATIONS

Precise synchronization of distributed RF and laser sources in facilities such as:

- Free-Electron-Lasers
- Particle Accelerators
- Radio Telescope Arrays
- Laser Amplifier Chains
- Ultrafast Electron Diffraction Experiments
- Ultrafast Laser Labs

BENEFITS

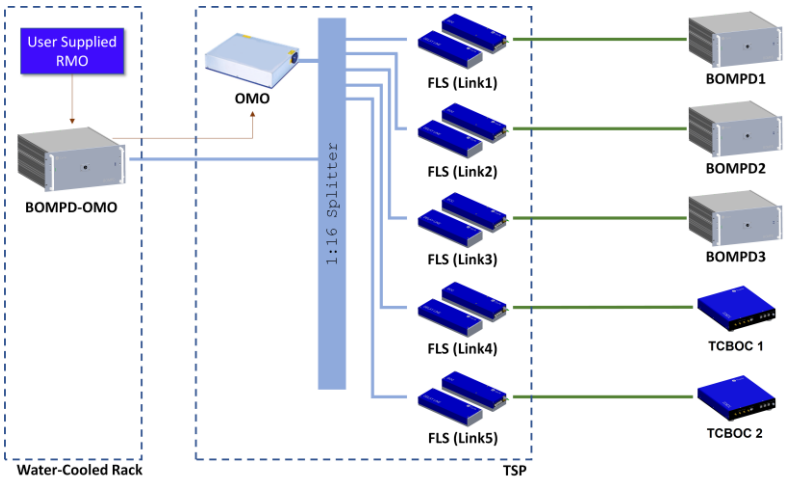
- Below **1 fs timing jitter and timing drift**
- Up to **10 km fiber link length** (longer custom links available on request)
- Standard **8 -16 links per unit** (scalable to >100 links)
- **Push-Button Operation**
- **No User Intervention required**

DESCRIPTION

PULSE timing distribution system (TDS) enables sub-femtosecond distribution of timing signals to remote locations. It takes advantage of the inherently low noise pulse trains of a mode-locked laser (i.e. optical master oscillator, or OMO in short) and uses it as its timing signal which can be referenced to an optical or RF clock. The carefully selected OMO timing signal is transferred through fiber-optic timing links to multiple end stations where transmission delays are detected with attosecond resolution using Cycle's patented balanced optical cross-correlators (BOC) and actively compensated.

At the output of the stabilized fiber links, either an ultrafast laser or a microwave source can be tightly synchronized to the output, thereby to the OMO timing signal. This can be done with Cycle's patented TCBOC (Two-Color Balanced Optical Cross-correlator for optical-optical synchronization) or BOMPD (Balanced Optical Microwave Phase Detector, for RF-optical synchronization). Naturally, PULSE has its own control system that fully automates the whole process and logs all critical system performance data, providing 24/7, 365 days/year sub-femtosecond timing distribution and synchronization from the click of a button.

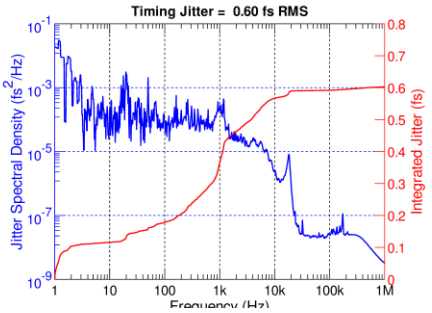
SAMPLE PULSE TDS SCHEMATIC



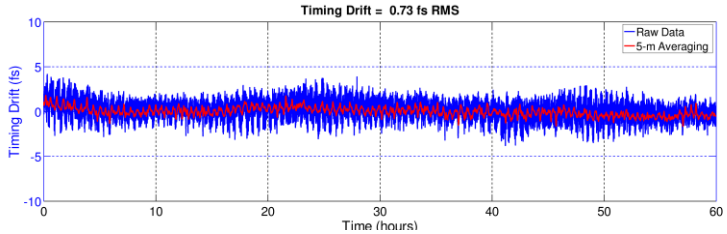
The OMO is tightly locked to the facility's RF master oscillator using Cycle's patented BOMPD. OMO timing signal is distributed using stabilized fiber links (Fiber Link Stabilizer consists of our patented BOC + Motorized Delay Line + Link Control components)
End-station equipment are synchronized by either our TCBOC (US patent) or BOMPD (US patent).

Parameters	Value	Unit	Comment
Timing jitter	<5	fs RMS	Within 35 µHz - 1 MHz bandwidth, between two stabilized fiber links
Fiber link length (up to)	10	km	Longer Links on request
Fiber links per PULSE TDS platform	8		Scalable to an arbitrary number of links by combining several platforms together
Fiber type	PM		SM available on request
Power per client	> 10	mW	Average power available at each fiber end
Optical wavelength	1550 ± 50	nm	Operating at pulsed mode
Pulse repetition rate	< 500	MHz	Tailored to the frequency of interest
Dimensions (L x W x H)	1.5 x 0.8 x 0.3	m^3	
Weight	270 kg		
Rack for Control System	Included		Temperature-controlled
Integrated feedback	included		Optimized PID parameters
Control system interfaces	included		Available in Epics, Tango and/or customized as required
Auto lock	included		

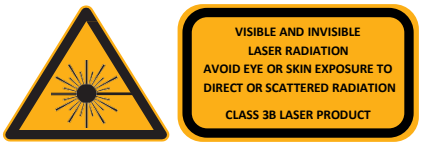
MEASUREMENT DATA



Out-of-loop timing jitter between two stabilized fiber link [1] above 1 Hz
[1]The length of each fiber link is 150 m.



Out-of-loop timing drift between two stabilized fiber links[1] sampled at 2 Hz



Cycle PULSE TDS is a Class 3B Laser Product

Contact sales@cyclelasers.com to discuss your requirements and receive a free white paper on timing jitter measurements.