ModBox

ModBox-FE-NIR-10Gs-ULJ

ModBox Pulse shaper sub-ns

The Exail ModBox-FE-NIR-10Gs is a pulse generation system designed to be used as a seed source in solid state o fiber laser. The system is available at various wavelength and it allows to generate 100 ps to 400 ns, custom shapped optical pulses with high stability and high extinction ratio (40 dB or 60 dB) The short pulse generation is based on the combination of a high performance continuous laser source combined with a large bandwidth modulation stage based on a high extinction ratio external $LiNbO_3$ modulator. An automatic bias control circuitry (MBC) guarantees the extinction ratio stability over time and the optical pulses are carved out with an external Arbitrary Waveform Generator (user supplied ARB RIDER AWG7102D). A multi year collaboration experience with famous intense laser facilities all over the world allows Exail to propose high performance, reliable and easy to use systems perfectly suited to the various applications related with high energy optical pulse generation.



FEATURES

- Optical waveform flexibility
- Ultra Low jitter
- Low rise & fall times
- Very high extinction ratio
- Proven solution
- High vertical resolution
- Synchronization to external RF clock

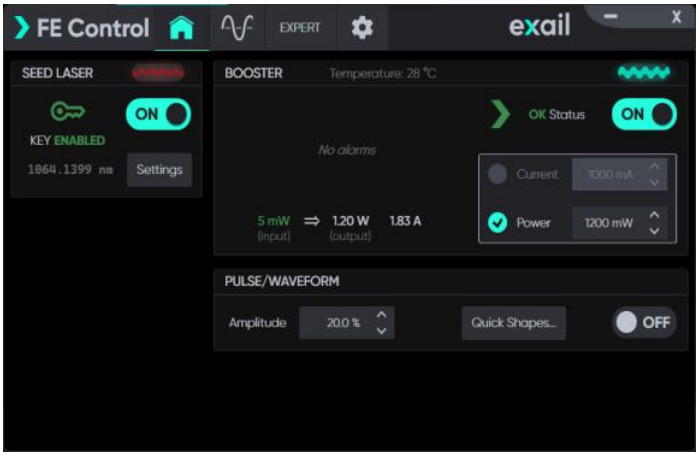
APPLICATIONS

- Inertial confinement fusion
- Interaction of intense light with matter
- OPCPA pump laser

PERFORMANCE HIGHLIGHTS

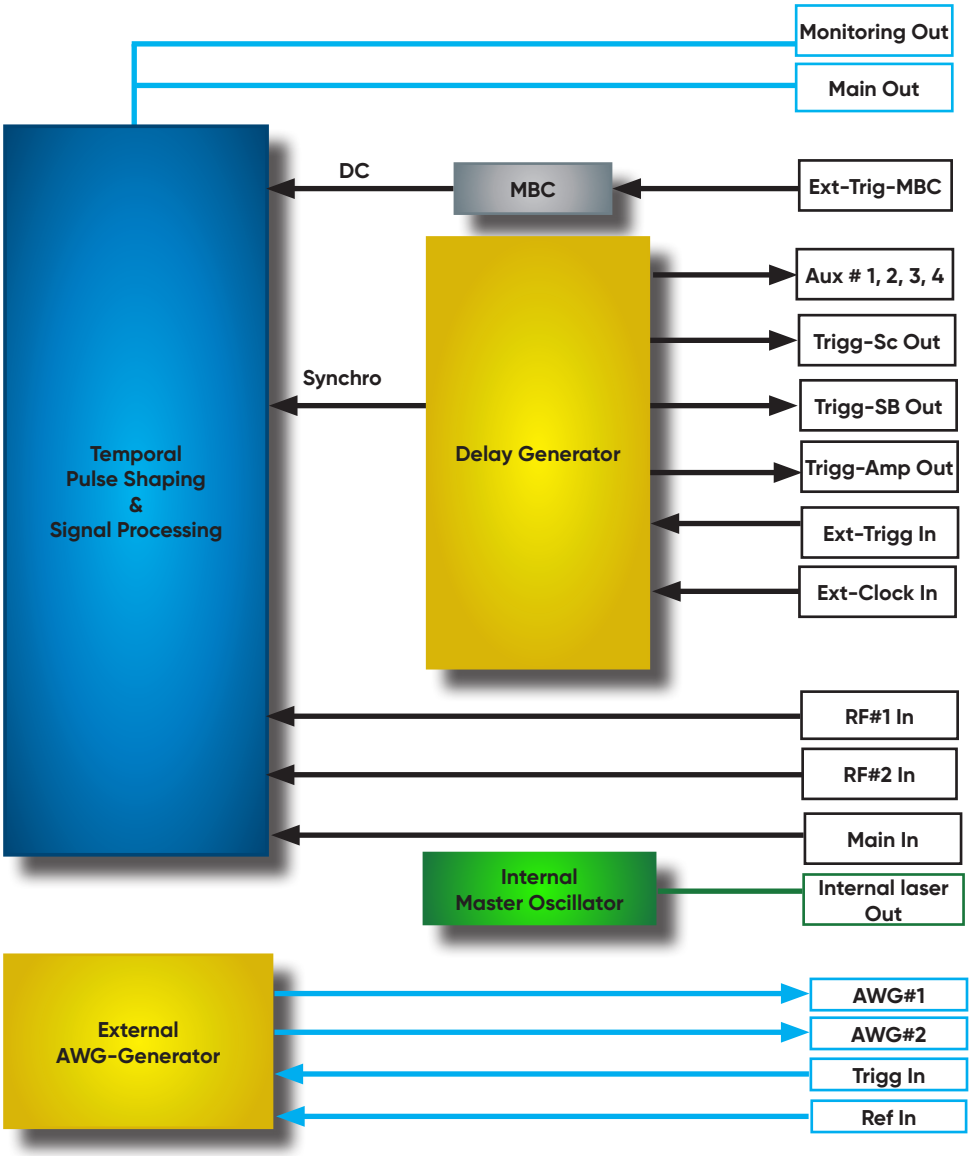
Operating wavelength	1030 nm / 1053 nm / 1064 nm
Pulse contrast	40 dB /60 dB
Pulse waveform	Arbitrary, user adjustable
Pulse width	From 100 ps
Optical Jitter	2.5 ps RMS

GRAPHICAL USER INTERFACE



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FUNCTIONAL BLOCK DIAGRAM



The ModBox Front-End integrates:

- a temporal pulse shaping block based on modulator set to ensure a very high optical pulse extinction ratio and flexible pulse shaping,
- an automatic Modulator Bias Control circuitry (MBC) to garantee high extinction ratio stability over time,
- a delay generator for AOM & MBC synchronization,
- a master oscillator.

The ModBox offers several electrical outputs and input:

- a "Trigg-Sc" : for scope synchronization,
- a "Trigg-SB" : for pulse synchronization with the ModBox-Spectrum-Broadening,
- a "Trigg-Amp" : for optical amplifier synchronization,
- an "Ext-Trigg In" : external trigger input,
- an "Ext-Clock In": external clock input,
- an "Ext-Trigg-MBC": external trigger for MBC
- a "Monitoring Out": main out monitoring output
- four additional auxiliary trigger outputs

The AWG-Generator has the following input/output:

- Ref In to synchronize the AWG to minimize Jitter
- Trig In to synchronize the AWG and select the repetition rate

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ELECTRICAL INPUT SPECIFICATIONS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
External trigg input	-	+5 V -50 Ω - Pos or Neg slop	single shot	-	1	MHz
MBC trigg input	-	+5 V -50 Ω - Pos slop > 500 µs width	single shot	-	1	kHz
External AWG Ref In input	-	-	-	100	-	MHz

ELECTRICAL OUTPUT SPECIFICATIONS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
		Trigg-SC / Trigg-SB / Trigg-Amp outputs				
Delay range	-	-	0	-	10	s
Delay resolution	R	Trigg-Amp / Trigg-SB	-	1	-	ps
		Trigg-Sc (optionnal)	-	1.25	-	ns
Delay RMS jitter	J_{RMS}	Internal trigger w/o additionnal delay	-	7	10	ps
		External trigger w/o additional delay	-	10	25	ps
Delay accuracy	-	-	-	-	150	ps
Trigger delay	-	(Insertion Delay)	-	-	100	ns

OPTICAL OUTPUT SPECIFICATIONS*

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operating wavelength	λ	In air / select wavelength		1030 / 1053 / 1064		nm
Wavelength tunability	dλ	By temperature	-	1	-	nm
Linewidth [1]	Δλ	-	-	1	10	MHz
Ouptut pulse shapes	-	-	Arbitrary, user adjustable			
Sample rate	-	-	-	10	-	Gs/s
Number of samples	-	Per pulse	-	4800	-	-
Pulse width	PW	Remotely adjustable	100 p	-	400 n	s
		Optimized value	-	10	-	ns
Frequency repetition rate	FRR	Adustable by the trigger frequency	Single shot	-	1 M	Hz
Delay	D	Between ext trig and optical pulse	-	0.5	1	µs
Vertical resolution	-	-	-	14	-	bit
Rise time / Fall time	t_r/t_f	20 % - 80 % / 10 % - 90 %	-	60 / 80	-	ps
Extinction ratio	ER	40 dB	35	40	-	dB
		60 dB	55	60	-	dB
Extinction ratio stability	ΔSER	Over 8 hours - 40 dB / 60 dB	-	0.5 / 1	1 / 2	dB
Polarization extension ratio	PER	-	20	-	-	dB
Jitter with external RF clock 10 MHz	J_{RMS}	External trigger, < 100 kHz	-	2.5	3	ps
	J_{PK-PK}	External trigger, < 100 kHz	-	15	20	ps
Pulse energy (1 ns)	E	40 dB / 60 dB contrast	700 / 250	800 / 300	-	pJ
Pulse enery stability	ΔE	100 Hz over 1 min	-	0.3	0.5	%rms
Pulse power stability	ΔP_{peak}	8 hours @10 kHz	-	0.5	0.8	%rms

[1] kHz linewidth seed available as an option

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PANELS

Parameter		Condition
Local supervisory control	Human-machine interface	Touch-screen user interface / Embedded windows PC
	Remote	Ethernet port
	LEDs indicator	LED reports On/Off operations, Alarms
	USB port	Keyboard, mouse, memory stick (to download waveforms)
		Rear panel
Optical ports	«Main Out»	Isolated, gland and armed cable, 5 m fiber length, connector FC/APC
	«Main In», «Monitoring Out», «Internal laser Out»	FC/APC connector
Optical fiber	-	Polarization maintaining fiber, Corning PM98-U25A
Trigg output	«Trigg-SB», «Trigg-SC», «Trigg-Amp», «Aux»	BNC connector
Trigger & clock input	«Trigg In», «Clock In», Trigg-MBC»	BNC connector
RF Input	RF In: 1 RF 2 In	SMA connector
Main power socket	-	IEC 60320, C14 inlet

(2) 10m or 15m fiber length available as an option

ENVIRONMENT

Parameter	Condition	Min	Typ	Max	Unit
Operating / storage Temp	-	+20 / -10	-	+25 / +30	°C
Operating / storage humidity	-	30 to 60 / 30 to 80			%

COMPLIANCE AND SAFETY

Parameter	Condition	Min	Typ	Max	Unit
Laser safety		Class 3B 			
Compliance	-	BS EN 60825 - CE certified			
Interlock response time	From laser system	-	-	1	ms
Remote interlock	-	Lemo controlled			

DIMENSIONS

Parameter	
Size	19 inches 6U
Weight	18 kg
Power supply	100 - 120 V / 220 - 240 V automatic switch, 50 - 60 Hz



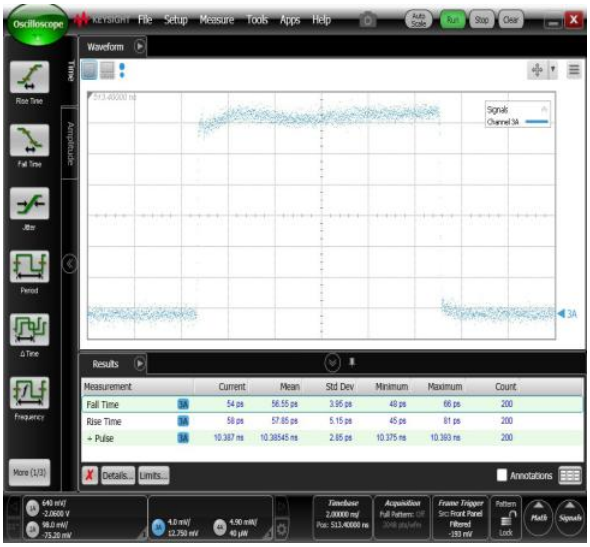


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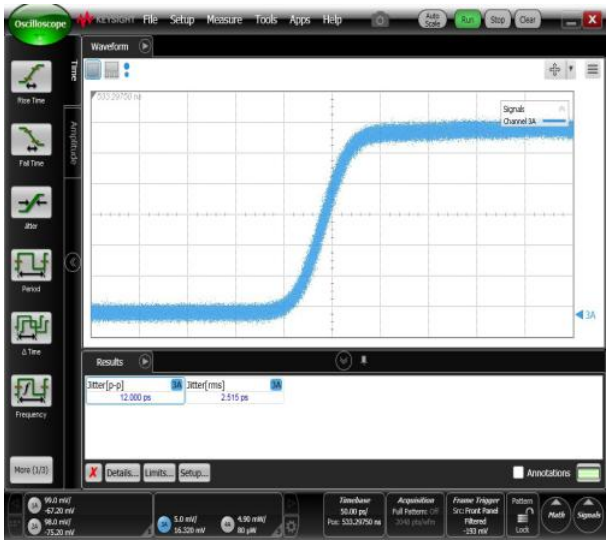
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MODBOX ELECTRICAL AND OPTICAL OUTPUTS

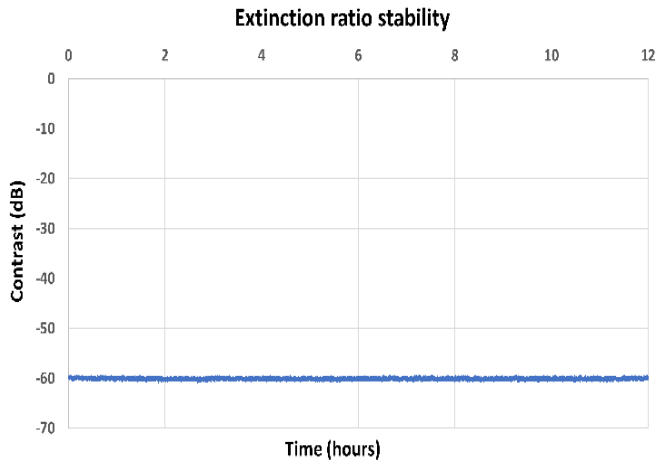
The following equipment was used to obtain below results:
- Oscilloscope Keysight DCA-X 86100D



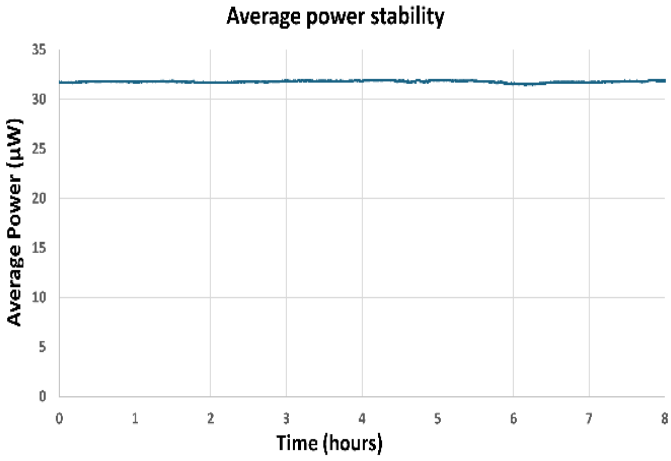
Optical square pulse



Temporal jitter with external reference clock



Optical extinction ratio stability over 8 hours



Optical power stability over 8 hours