



High-energy Custom Laser Update



Workshop on Laser Assisted H- Beam Stripping
Oakridge National Lab, February 18,2009

Continuum[®]
The High Energy Laser Company™

Outline

- Continuum Introduction
- Custom Laser Market
- Custom Laser Offerings
 - Genus
 - Large glass pump
 - OPCPA
 - Agilite
- ORNL laser
- Current laser technology

About Continuum

- Exclusively builds:
 - Flashlamp pumped Nd:YAG lasers
 - Frequency conversion devices
 - Dye lasers
 - OPOs
 - Harmonic Generators
- Majority of business is scientific
- Part of GSI as of Q3 2008
- Only significant custom house in the US

Current Custom Market

- Markets Served
 - Ti:Sapphire Amp Pumps
 - Laser diagnostics
 - OPCPA Pump lasers
 - Industrial Apps - Materials Processing
 - Prototypical platforms
 - Other (components, research)
- Customers include:
 - National Labs
 - Academia
 - Private industry

Custom Platforms

- High energy laser building blocks
 - Pump chambers
 - Rod diameters
 - Power supplies
- High energy
 - Genus
 - Large custom Nd:glass
- Variable pulsewidths
 - Agilite
 - OPCPA pump lasers
 - Modelocked, burst mode lasers

Genus 500



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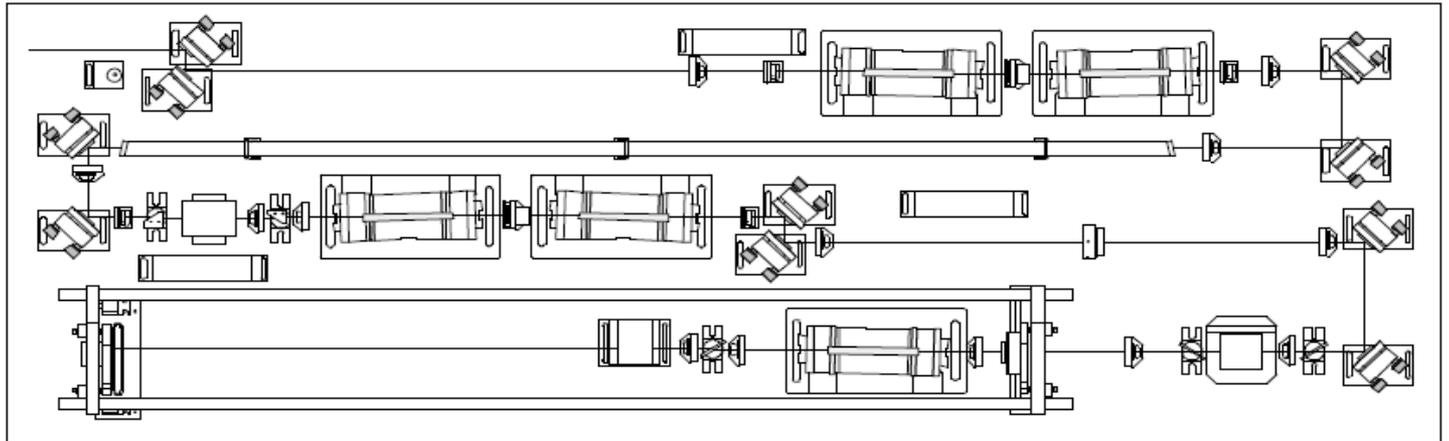
Genus Product Requirements

- A large frame Nd:YAG laser with at least twice the energy of current OSC/AMP platforms
- Replaces multiplexing smaller YAG lasers
- High value for diverse applications
 - Ti:Sapphire pumping
 - Material processing
 - Excellent beam quality
- Integrating Continuum's next generation power supplies
- Graphical User Interface

Genus 500

- 3 bar resonator at front
- Single pass amplification
- 2 amplifier pair sections - 12mm and 19mm
- 2' x 6' footprint and cover
- 8J IR, 4J Green, 10Hz
- Highest standard energy Nd:YAG on the market
- Super pump source for Ti:Sapphire

Genus 500

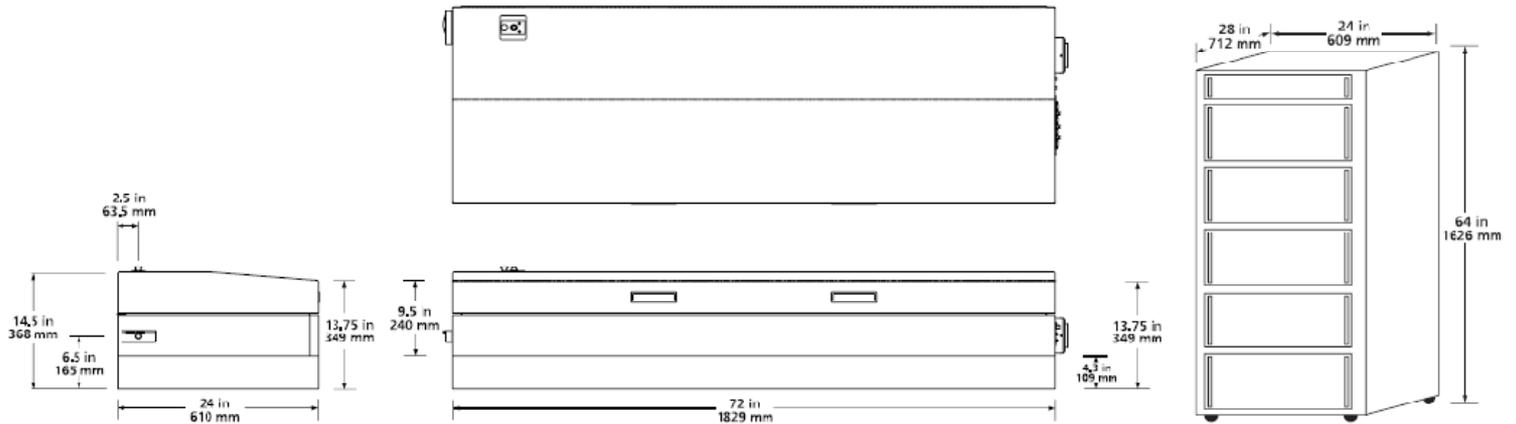


Genus Specifications

Genus Specifications

Repetition Rate (Hz)	10
Energy (mJ)	
1064 nm	8J
532 nm	4J
Pulsewidth (nsec)	
532 nm	8-10ns
Divergence ¹ (mrad)	0.45
Beam Pointing Stability ² ($\pm\mu\text{rad}$)	30
Warm up time ³ (<min)	5
Jitter ⁴ ($\pm\text{ns}$)	0.5
Energy Stability ⁵ ($\pm\%$)	
532 nm	3.0; 1.0
Power Drift ⁶ ($\pm\%$)	
532 nm	6.0
Beam Spatial Profile	super-Gaussian (Std) ⁷
Max Deviation from fitted Gaussian ⁸ ($\pm\%$)	
Near Field (<1m)	40

Genus 500

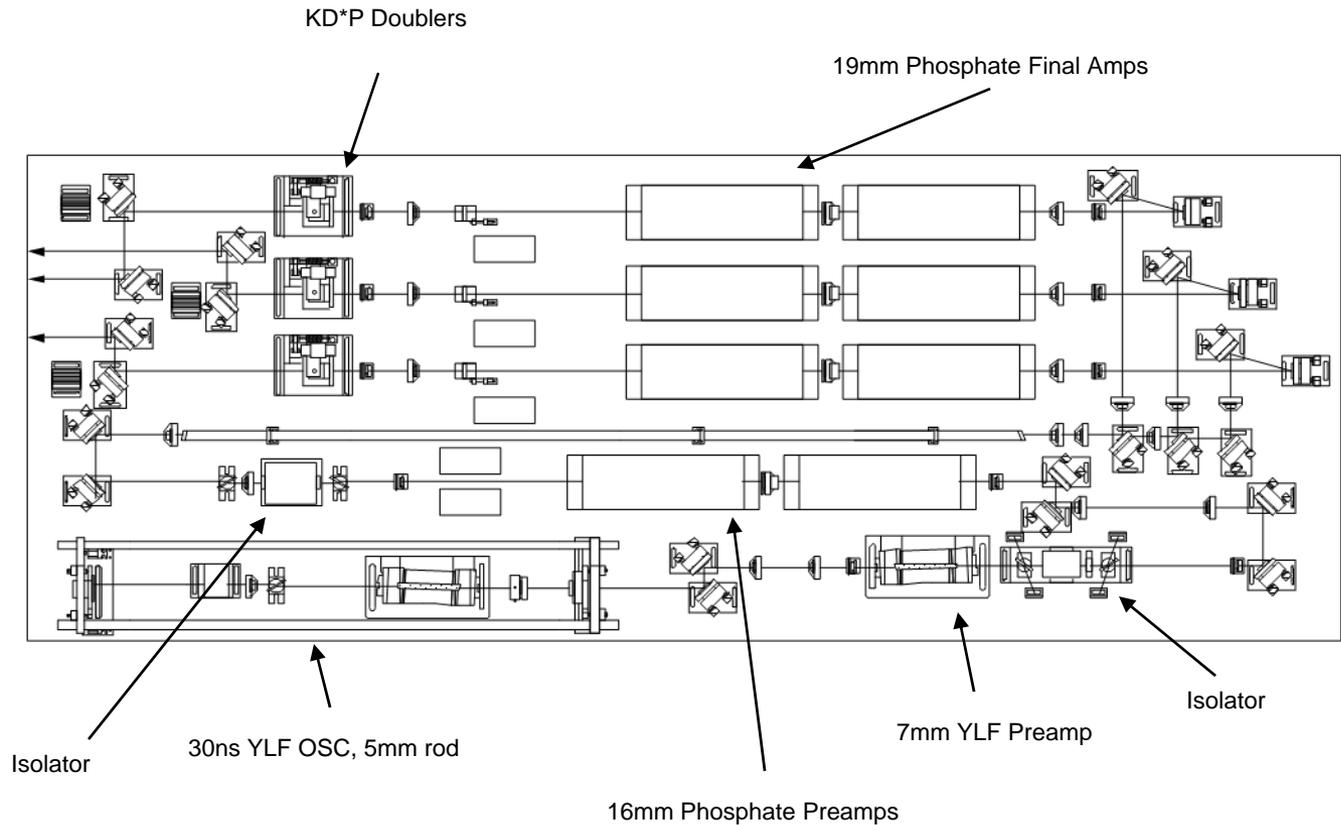


Large Glass Pump Laser

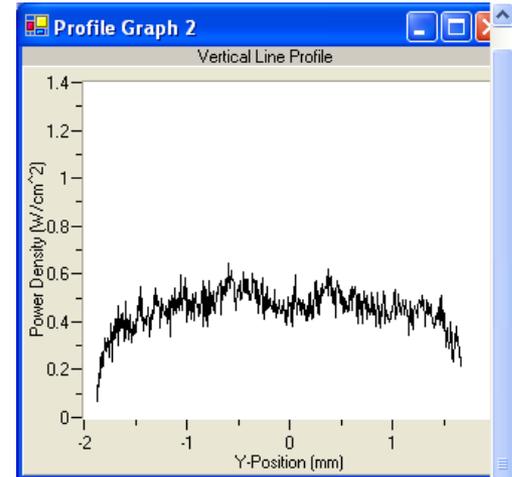
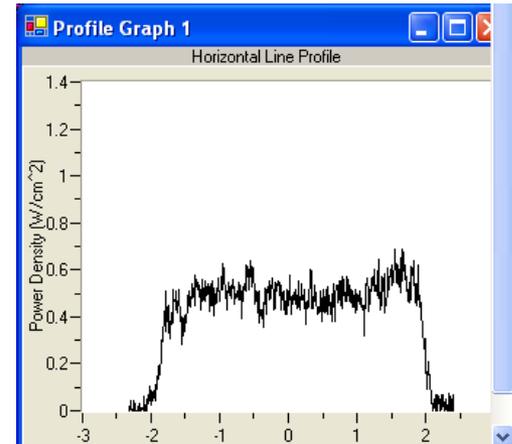
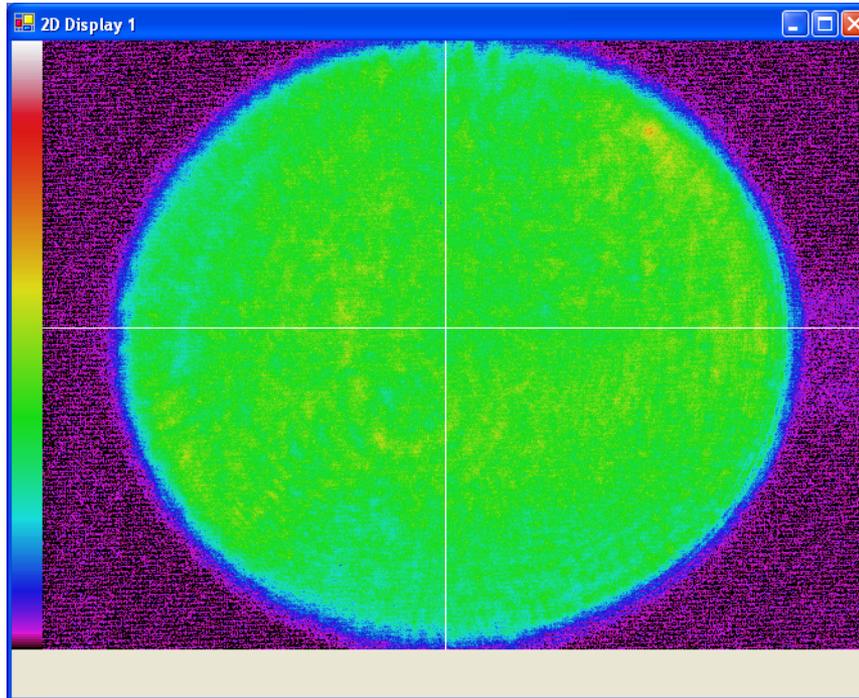
- 50J green (527nm)
- 0.1 repetition rate
- 6 output legs
- 30ns Pulseswidth
- Two tables
- Ti:Sapphire amplifier pump



Large Glass Pump Laser

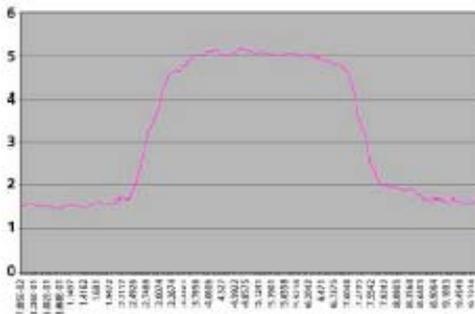


Large Glass Profile

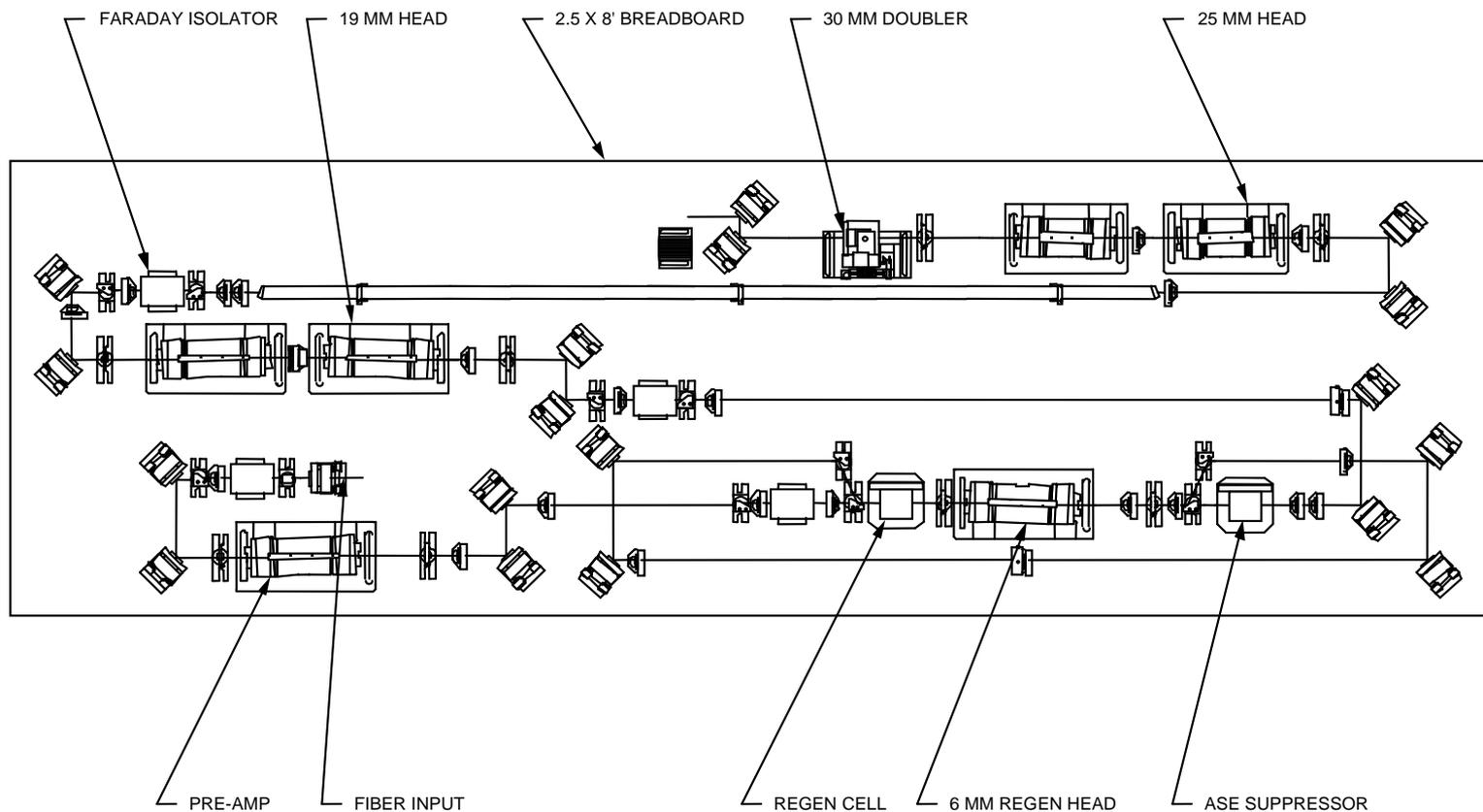


OPCPA Specifications

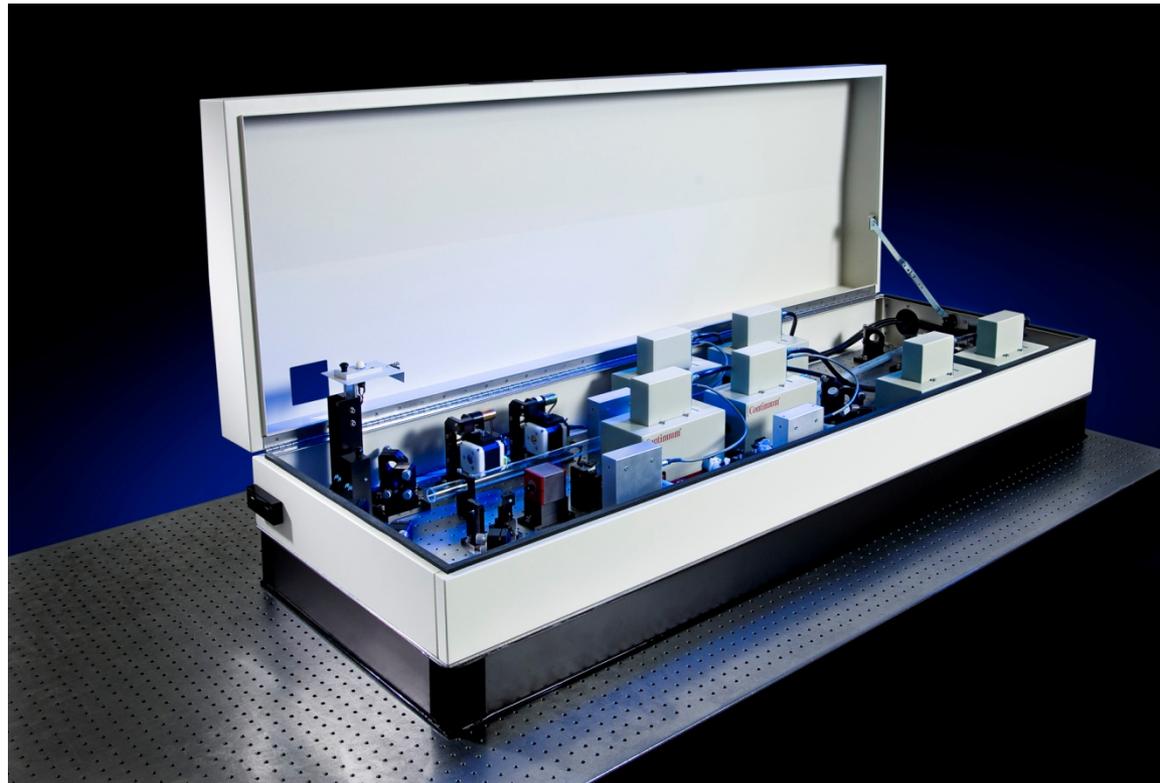
- 500mJ – 4.5J at 532nm
- Temporally flat (tailored) pulse
- Spatially flat for pumping OPCPA crystals
- Repetition Rate: 2Hz
- Pulsewidth: 3-6ns



OPCPA Layout



Agilite Variable Pulse Laser

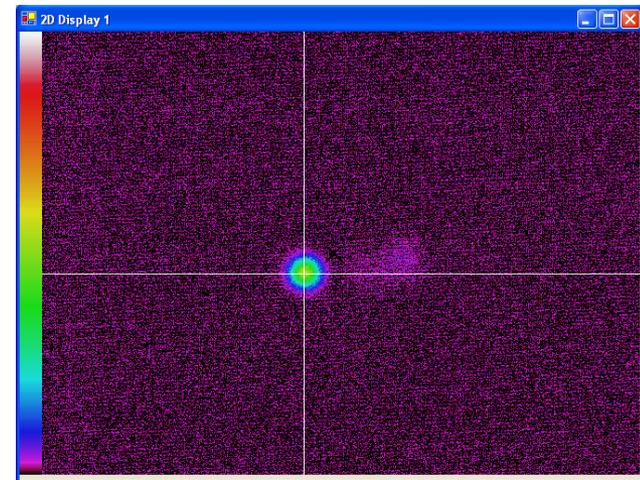
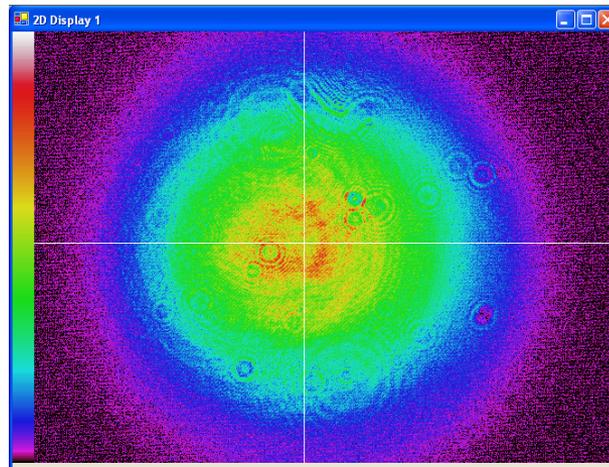


Agilite 500 Series - Specifications

Agilite 560/569 Specifications

Energy (mJ)	Agilite 560				Agilite 569			
Repetition Rate	10 Hz		20Hz		10 Hz		20 Hz	
Wavelength (nm)	1064	532	1064	532	1064	532	1064	532
Modulator 1								
50 ns	90	30	30	8	1300	585	700	305
100 ns	130	35	50	15	1400	610	900	385
200 ns	180	55	80	25	1500	655	1000	410
500 ns	250	85	130	40	1600	665	1200	495
1 μ s	310	100	180	60	1700	640	1300	500
2 μ s	360	120	240	80	1800	690	1400	510
5 μ s	440	145	310	100	1800	630	1500	495
10 μ s	500	150	360	85	1900	520	1600	405
Modulator 2								
5 μ s	440	145	310	100	1800	630	1500	495
10 μ s	500	150	360	85	1900	520	1600	405
20 μ s	550	110	420	70	2000	350	1600	270
50 μ s	620	65	490	40	2000	180	1700	140

Agilite - Near and Far Fields

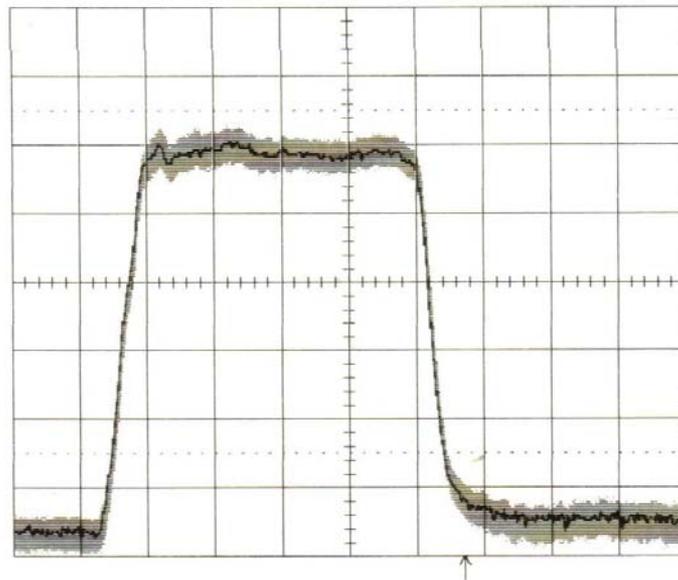


Agilite Temporal Profile



26-Mar-07
15:53:40

2
50 ns
10.0 mV



50 ns
1 1 V DC
2 10 mV 50Ω

8224 sweeps

1 DC -0.90 V

DISPLAY SETUP

Standard
XY

Persistence
OFF On

Dot Join
OFF On

Grids
Single Dual
Quad

Waveform+Text
intensity
90 %

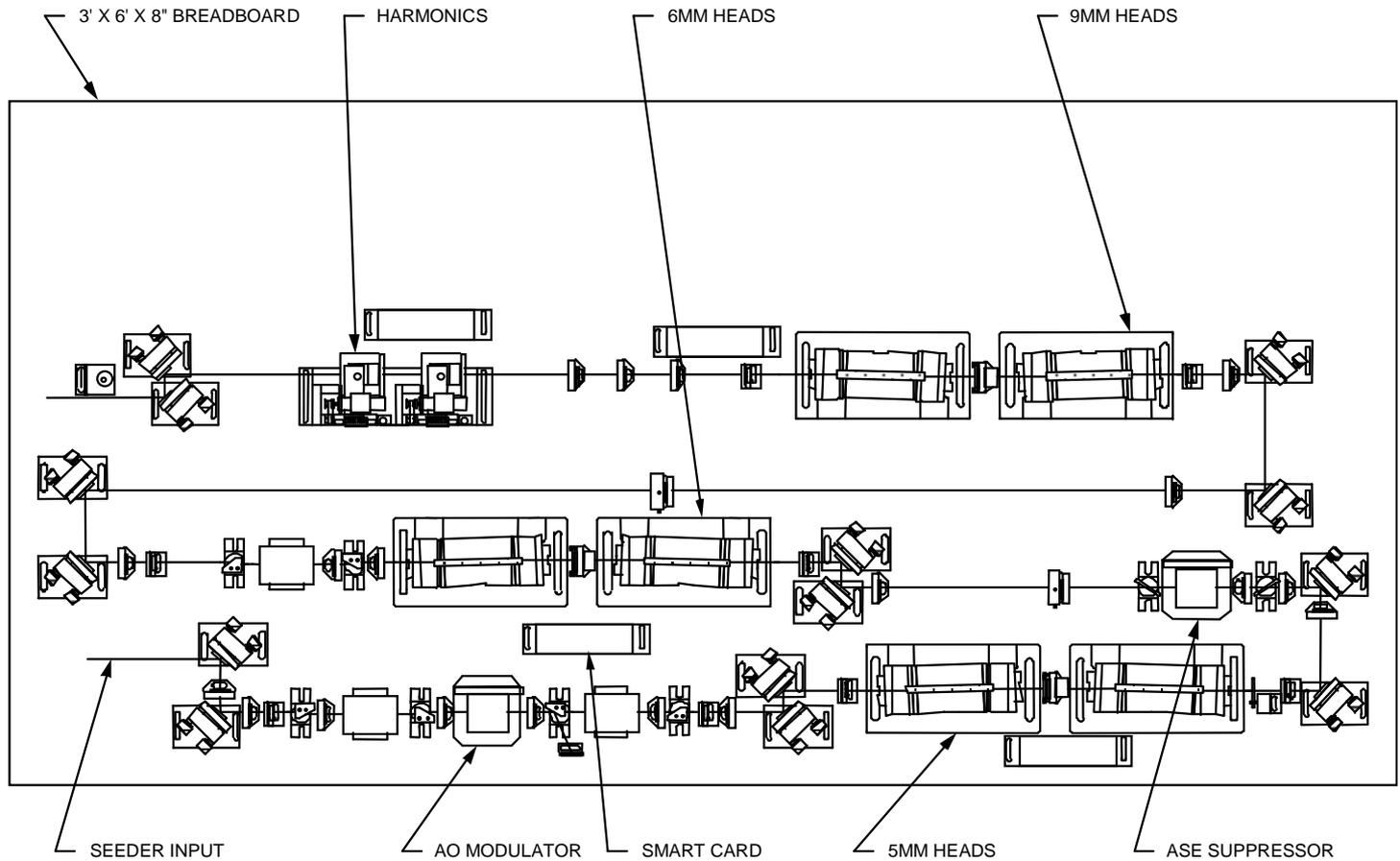
Grid
intensity
60 %

STOPPED
1 Res/

Modelocked Burst Lasers

- ORNL Laser
 - Modelocked front end laser
 - Pulse shaping
 - Macropulse specs
 - 10Hz macropulse rate
 - 10 μ s macropulse pulsewidth
 - >1J @ 1064nm, 120mJ @ 355nm
 - Micropulse specs
 - 400Mhz micropulse rate
 - 80ps @1064nm, 60ps @355nm
 - 30 μ J per pulse @ 355nm

ORNL Custom Layout



ORNL Upgrade Paths

- Energy – room for more pump chambers
- Macropulse length
 - 5-80 μ s – AOM
 - 50ns-10 μ s – EOM
- Rep rate – PFNs are not limited
 - Charging rate
 - Thermal loading
- Front end laser
 - Modelocked pulse length
 - Modelocked Rep rate

Custom Laser Control

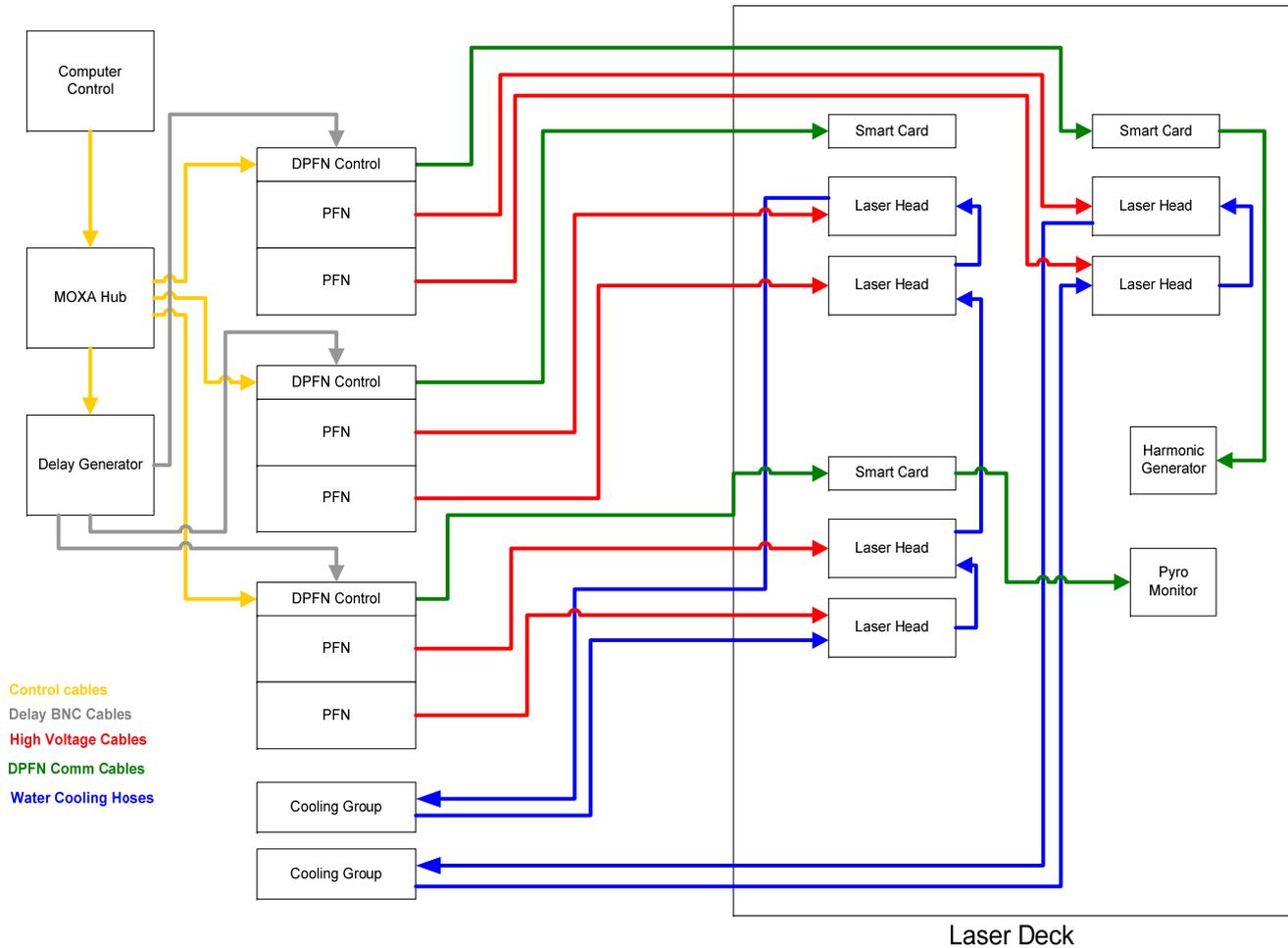
- Distributed Intelligence Control
 - Microprocessor base power supplies
 - Smart card technology
 - Backplane monitor
 - Links all power supplies into one unit
 - Links water cooling interlocks to each power supply
 - Global fault management
 - Facilitates GUI



Smart Card Technology

- Pump chamber temperature
- Crystal motor control
- Crystal heater control
- Interlocks
 - Delivery
 - Head cover
 - Head overtemp
 - HV cable interlock
- Shutter control
- Marx bank power and drive
- Pump chamber calibration
- Serial number
- Lamp shots

Distributed Intelligence Control



Laser Deck

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Graphical User Interface



- Full laser control on main screen
 - Lamp voltages
 - Delays
 - Waveforms
 - Recipes
- Full monitoring of laser performance and operation
- Works seamlessly with the distributed intelligence power supplies
- All custom lasers ship with a computer

Agilite Graphical User Interface



Agilite

File Tools Control Help

Cook Books [dropdown] [dropdown] Recipes [dropdown] [dropdown] WaveForm [dropdown]

[New] [Manage] [Capture] [Select] [Edit] [Select]

System Control

[Stop] [Stand By] [Flash] [Shutter]

Waveform Generator

[ON LINE] [Wave Form Editor]

Timing Generator

[ONLINE]

Critical Timing

Mod Delay [0.000] ns [Set]
ASE Delay [0.000] ns [Set]
AUX1 Delay [0.000] ns [Set]
AUX2 Delay [0.000] ns [Set]
AUX3 Delay [0.000] ns [Set]

Enable	Voltage	Delay	Head 1	Head 2
<input checked="" type="checkbox"/> 5mm Amp Set	[1000] v [Set]	[0] μs [Set]	[35] °C	[55] °C
<input checked="" type="checkbox"/> 6mm Amp Set	[1000] v [Set]	[0] μs [Set]	[35] °C	[55] °C
<input checked="" type="checkbox"/> 9mm Amp Set	[1000] v [Set]	[0] μs [Set]	[35] °C	[55] °C

System Status

9mm Amp Set: NORMAL

start [taskbar icons] 10:36 AM

Summary

- Custom Technology
 - Novel architectures for applications
 - Robust optics designs
 - High level computer control
- Optical and electrical technology is modular
 - Serviceable and low risk
- Highly scalable
- Custom graphical interfaces
- Active monitoring of laser parameters
- Easy integration into a customer's environment





Vision

Ingenuity

Power

Reliability

Versatility

Thank You!

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