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# **Nd:YLF Pump Laser Upgrade**

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**Caltech**

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# Benefits of Pump Laser Upgrade

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Quantronix discontinued DC Kr lamp pumped Nd:YLF laser in 2005, and replaced it with laser-diode pumped Nd:YLF laser with the following improvements.

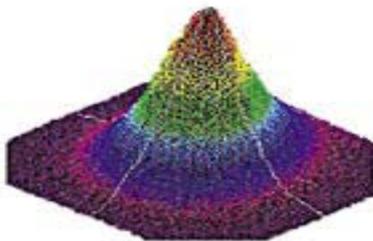
- Better pulse intensity stability;
  - Better long term stability over 10,000 h;
  - Less maintenance requirement;
  - Less power consumption; and
  - The lamp related consumables, such as DC Kr lamp, lamp socket and golden reflector etc., may not available in future.
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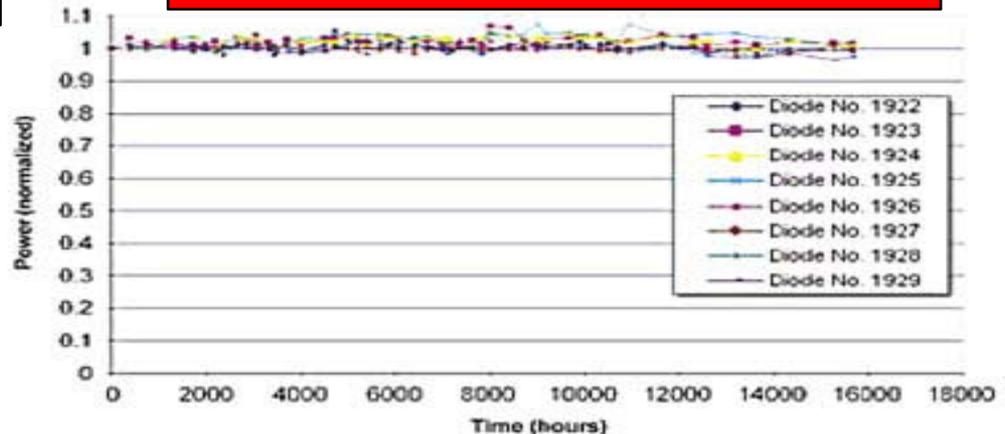
# Performance Specifications

Parameters at 1K Hz	DC Kr Lamp pumped 527DQ-S	Diode pumped Darwin 527-40-M
Average Output power (W)	20	25
Power instability (% , RMS)	2	0.5
Pulse energy (mJ)	20	25
Pulse width, typical (ns)	150	150
Beam pointing stability ( $\mu$ rad)	30	25
Beam diameter (mm)	3	2.5

DARWIN 3D BEAM PROFILE



DARWIN DIODE LIFETIME TEST





# User Reference

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Prof. Michael Fayer of Stanford university upgraded three Quantronix 527DQ Nd:YLF lasers to diode pumped lasers and provided the following comments.

- **Low maintenance:** water filters replaced once per three months; fine tuning optics some times.
  - **Good reliability:** These lasers have been running in 24/7 mode for about 18,000 hours with no significant degradation in the output power.
  - **The diode module needs to be run continuously for extended lifetime.**
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# Laser Cost Comparison

- DC Kr lamp pumped 527 DQ plus tunable Ti:S laser and its control ~\$150K
- Diode pumped Darwin 527-40-M: quotation \$60K plus an option for water cooling.



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East Setauket, NY 11733  
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California Institute of Technology

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### Quotation No

1009 - 001-09

CUST REF #: HHuang  
DATE: February 10, 2009  
VALID FOR: 30 Days  
PAGE NO. 1 of 2

Send Purchase Order to:  
Quantronix Corp  
41 Research Way  
East Setauket, NY 11733  
USA  
Phone 1-631-784-6100  
Fax 1-631-784-6125

### WE ARE PLEASED TO QUOTE THE FOLLOWING:

ITEM	QTY	DESCRIPTION	UNIT PRICE	TOTAL	
1	1	Darwin 527-40-M Nd:YLF Diode Pumped Solid State Laser  Wavelength: 527 nm Pulse energy: 25 mJ @ 1 kHz; 35 W Multimode Water to Air Chiller  Note: Replaces 527-OQE-0  Note 2: Water to Water chiller is available for an additional \$500	65,000.00	65,000.00	
	1	Discount	-5,000.00	-5,000.00	
			Subtotal	60,000.00	
F.O.B.		Payment Terms	Delivery	Sales Tax %	0.00
East Setauket, NY		Net 30 days	60 - 90 days ARO	Transportation	
				Total USD	\$60,000.00

All items in this quote is subject to the Quantronix Scientific Standard Terms and Conditions. Please Reference Quote Number When Ordering. Customs, Taxes Are Extra, if Applicable. All Prices in Quote Are in US Dollars.

ROBERT KUNKLE \_\_\_\_\_  
for additional information contact:  
Robert Kunkle, Director of Sales  
rkunkle@quantronixlasers.com



# Operation Cost Comparison

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- DC Kr Lamped pumped 527 DQ:

DC Kr lamp, lamp socket and golden reflector: ~\$4K/year/laser with a typical lamp life time of ~1,000 hours.

Power consumption: 10 kW.

- Diode pumped Darwin 527-40-M:

Diode module: ~\$7.5k/year/laser with lifetime of ~10,000 hours,

Power consumption: 2.5 KW.

While the M&S cost is doubled for the diode pumped laser the overall operation cost is lower taking into account the electricity cost.

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# Issues to be Addressed

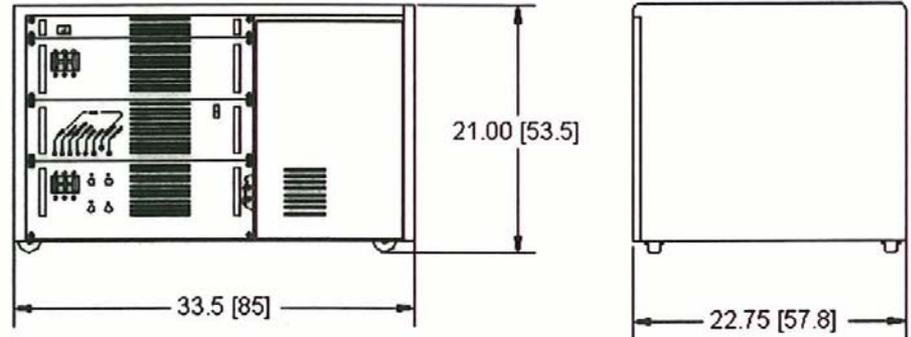
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Upgrading the DC Kr lamp pumped Nd:YLF laser to diode pumped model is not straight forward. Following issues are to be addressed.

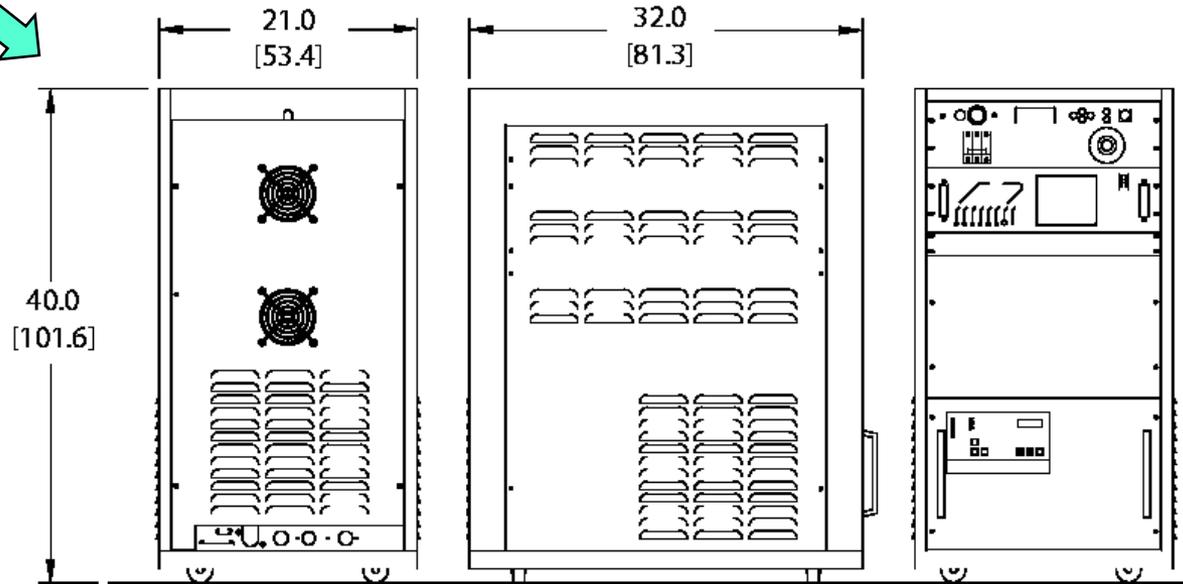
- Can the diode pumped Nd:YLF laser survive the residual B-field at the laser barrack at P5? Quantronix says OK for 50 gauss, but not guaranteed. A test is needed.
  - The coupling optics between YLF and Ti:S needs to be redesigned and tested, new optical parts may be needed.
  - The laser power supply for the diode pumped laser is a new model. The laser control software need to be updated.
  - While the laser head becomes more compact, the power supply is bigger than before, rearrangement of the laser room may be needed.
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# Power supply dimensions

Kr lamp pumped 527DQ:  
33.5"(L)×22.8"(D) ×21.0"(H)



Diode pumped 527-40-M:  
21.0"(L)×32.0"(D) ×40.0"(H)





# Proposed Plan

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- We may choose to procure one diode pumped Nd:YLF green laser, Darwin 527-40-M, first. It should be tested at P5 with the existing Ti:S laser. Quantronix has agreed to give us one month testing period. If we can not integrate it into our system successfully, we have an option to return it for a refund.
  - If the 527-40-M works, we'll put it online to test its long term performance. We can make decision if we want to upgrade other two Nd:YLF lasers after that test. This laser may also be used for beam tests at H4.
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