



Presentation to the 2002 Meeting of the
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Diode-Pumped Er,Yb:glass Micro-Laser

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MegaWatt Lasers



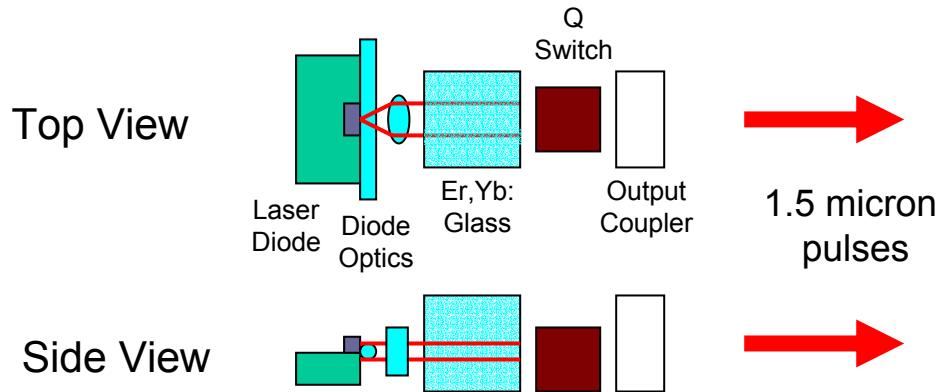
Eyesafe Laser Rangefinder Transmitters Requirements



- Lightweight
- Small
- Low cost
- Works over temperature
- Battery operated, low power consumption
- Single shot up to 10 pulses/sec.
- Energy : 0.05 to 5 mJ
- Pulse width: < 5 nsec



Micro Eyesafe Solid State Laser Diode-Pumped Er,Yb:glass Approach



End Pumped Laser

- Good pump/laser mode overlap
- Long pump absorption length
- Wide Temp range for laser diode
- High Efficiency

Er,Yb:glass

- Direct 1.5 micron output (no OPO)
- Long fluorescence Lifetime (20x Nd:YAG)
- Single stripe pump laser diode
- Low cost material

Performance Results:

Single laser diode: 4 watts at 918nm, 4 milliseconds pump time, 16 mJ pump energy

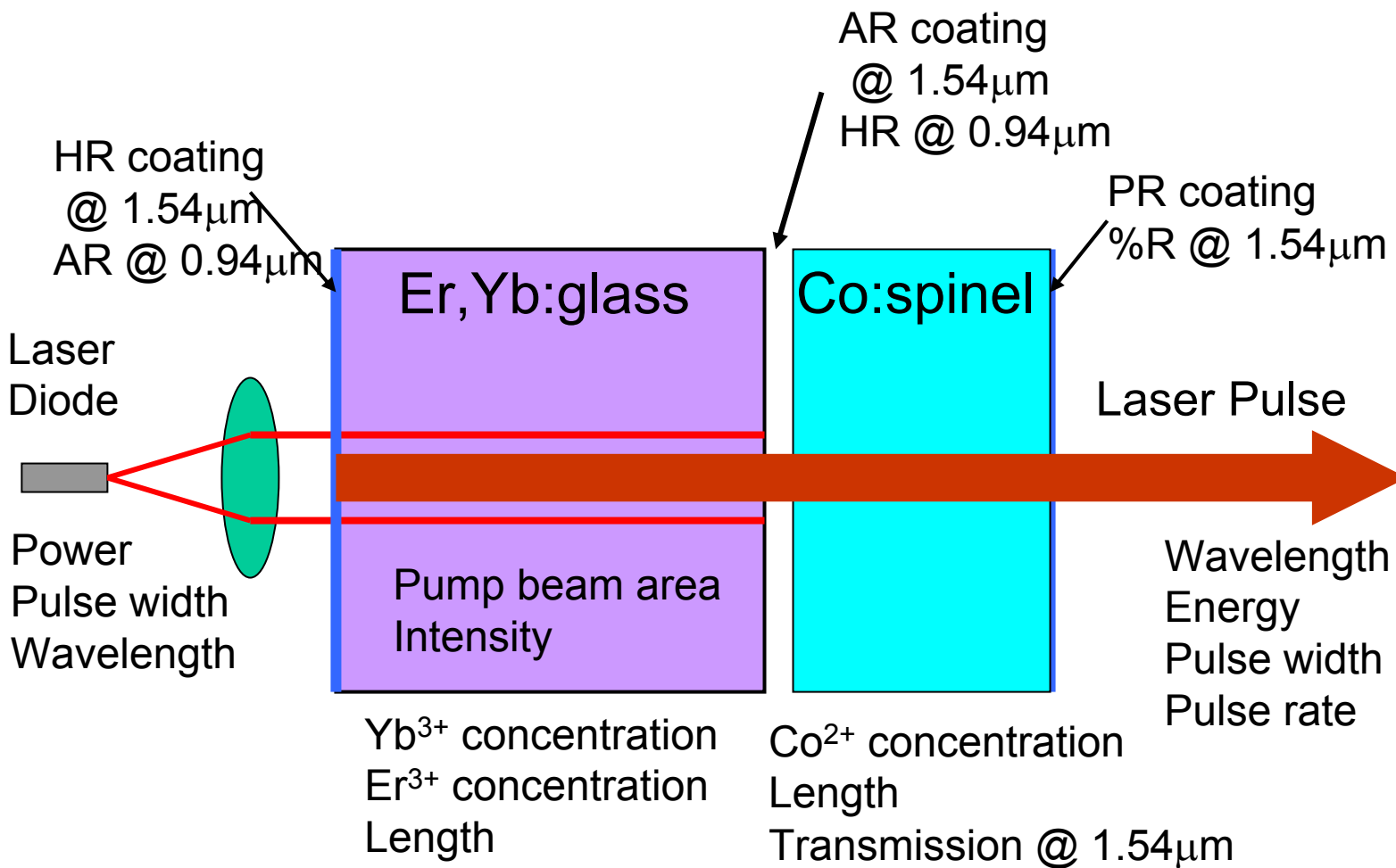
Energy Output at 1.54 microns: 105 to 140 micro-joules, 3 ns pulse, 10 Hz.

Peak Power: 35 kW to 50 kW

Electrical input: 40 mJ/pulse at 10 Hz = 400 mW



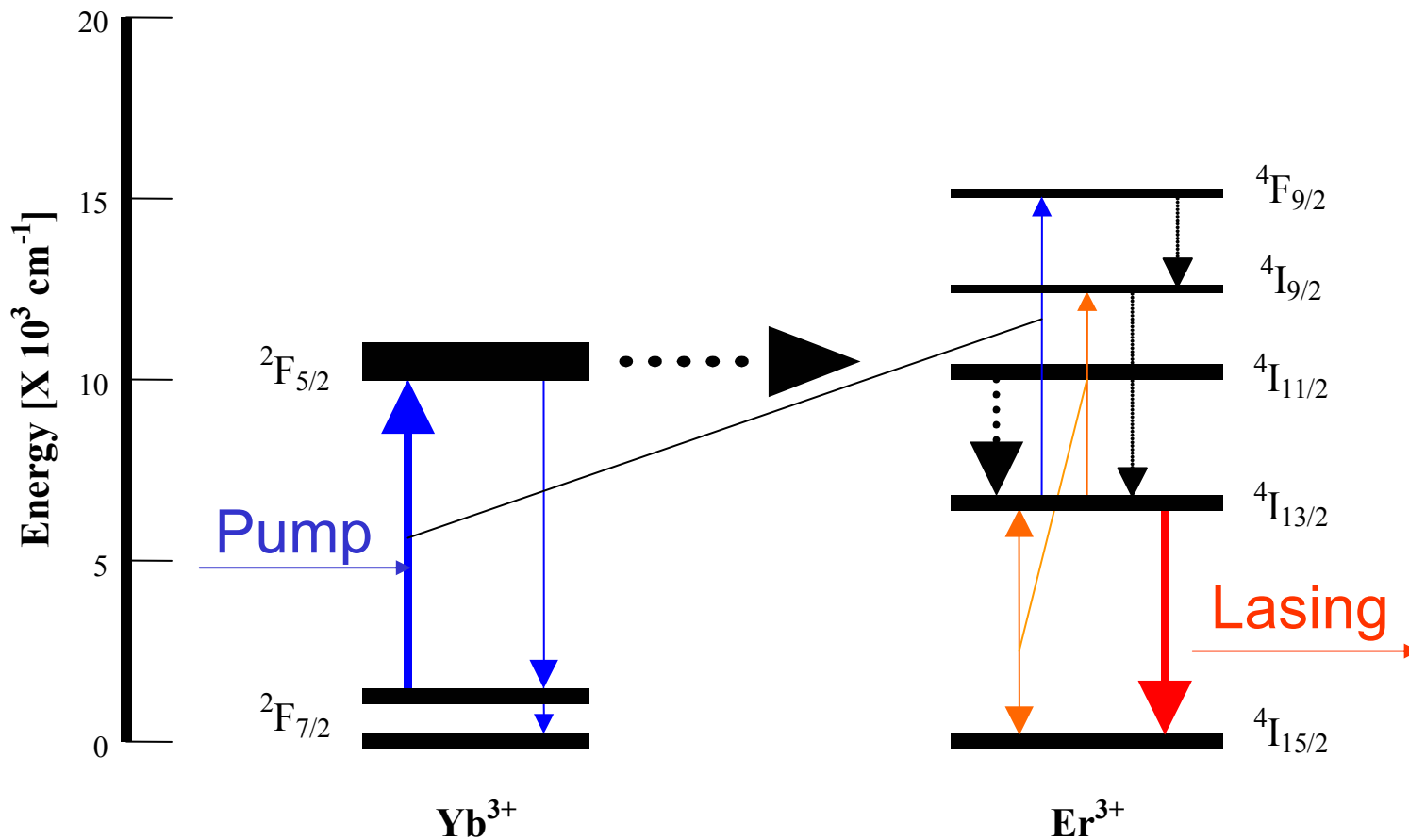
Diode-pumped Er,Yb:glass laser input and output parameters





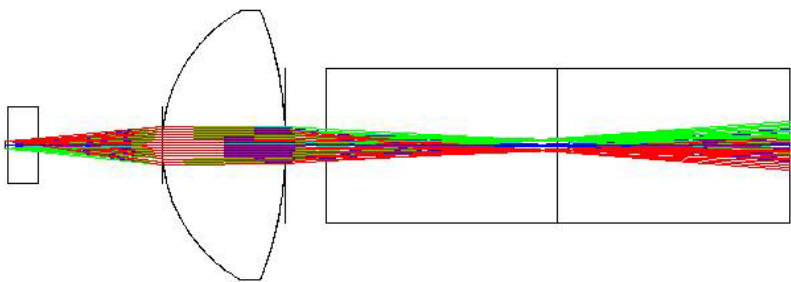
Ytterbium-Erbium Kinetics

Yb^{3+} , Er^{3+} : Phosphate Glass System





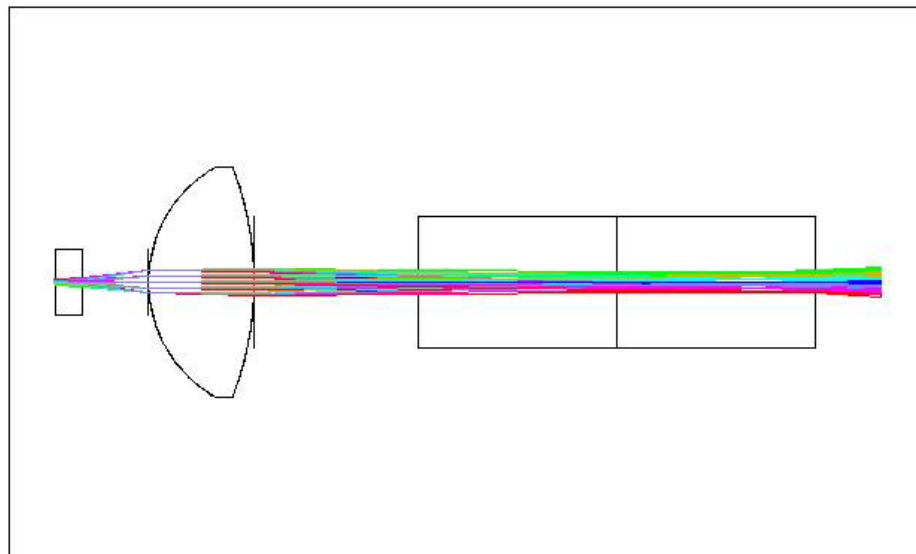
Diode Pump Optics Design using ZEMAX



3D LAYOUT

ALAN HAYES'S CURRENT DIODE SETUP (FAST AXIS)
MON JUN 17 2002

C:\PROJECTS\WDM\ALANS DIODE EX + DELCYL VERS SLOW B 6-14-02.ZMX
CONFIGURATION 1 OF 1



3D LAYOUT

ALAN HAYES'S CURRENT DIODE SETUP (FAST AXIS)
MON JUN 17 2002

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CONFIGURATION 1 OF 1

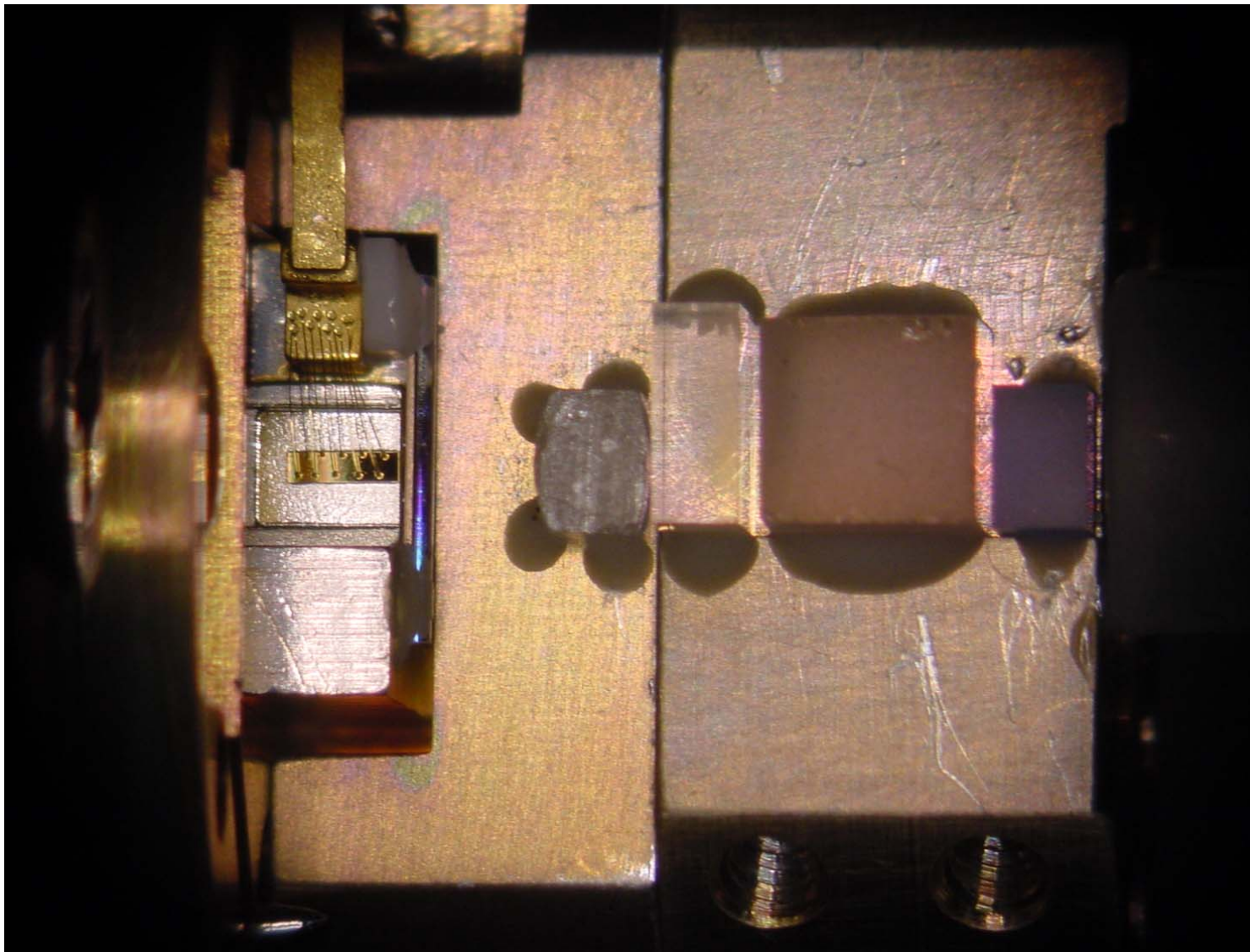
Unit #2 Design

New design with more
uniform pump beam

ZEMAX model by Jerry Franck



Diode Pumped Er:Yb:glass Micro-laser Packaged in TO3 can



MegaWatt Lasers

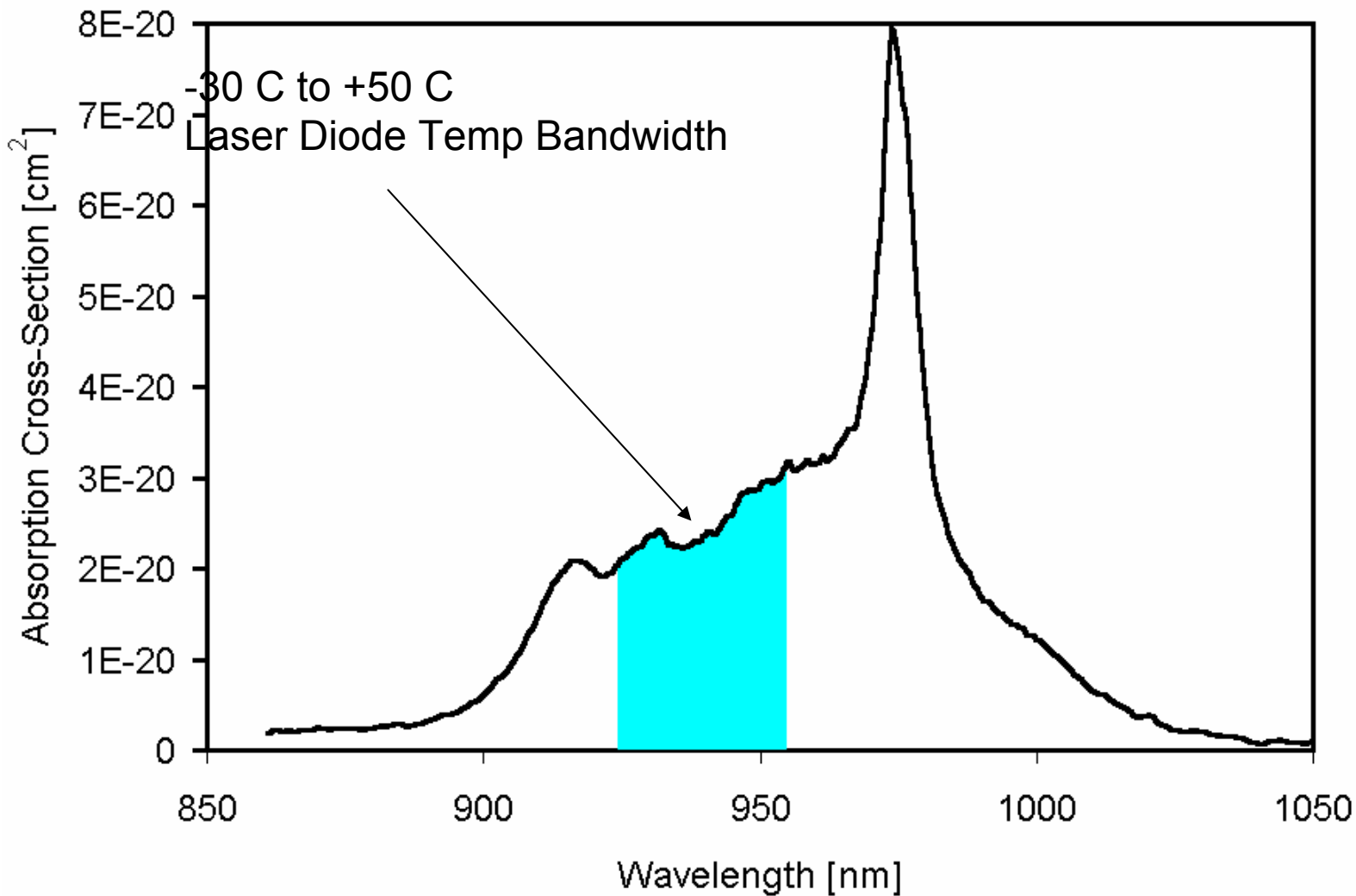


Er,Yb:glass micro-laser packaging design by Alan Hays (NVESD)





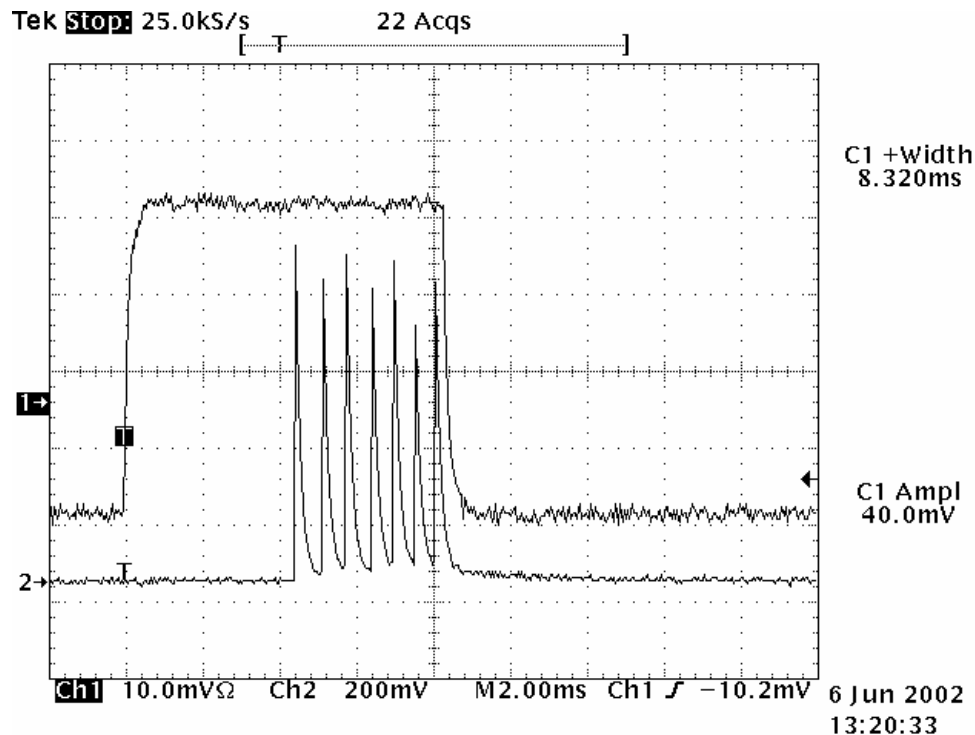
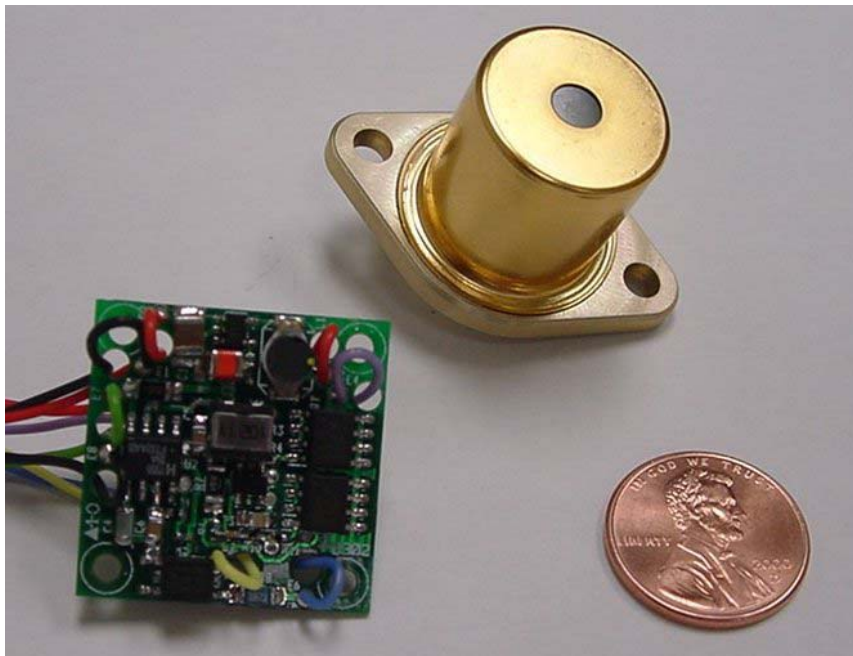
Yb^{3+} Absorption with Temperature Shift of Pump Laser Wavelength





Diode Pumped Er:Yb:glass Micro-laser

Recent results with TO3 package

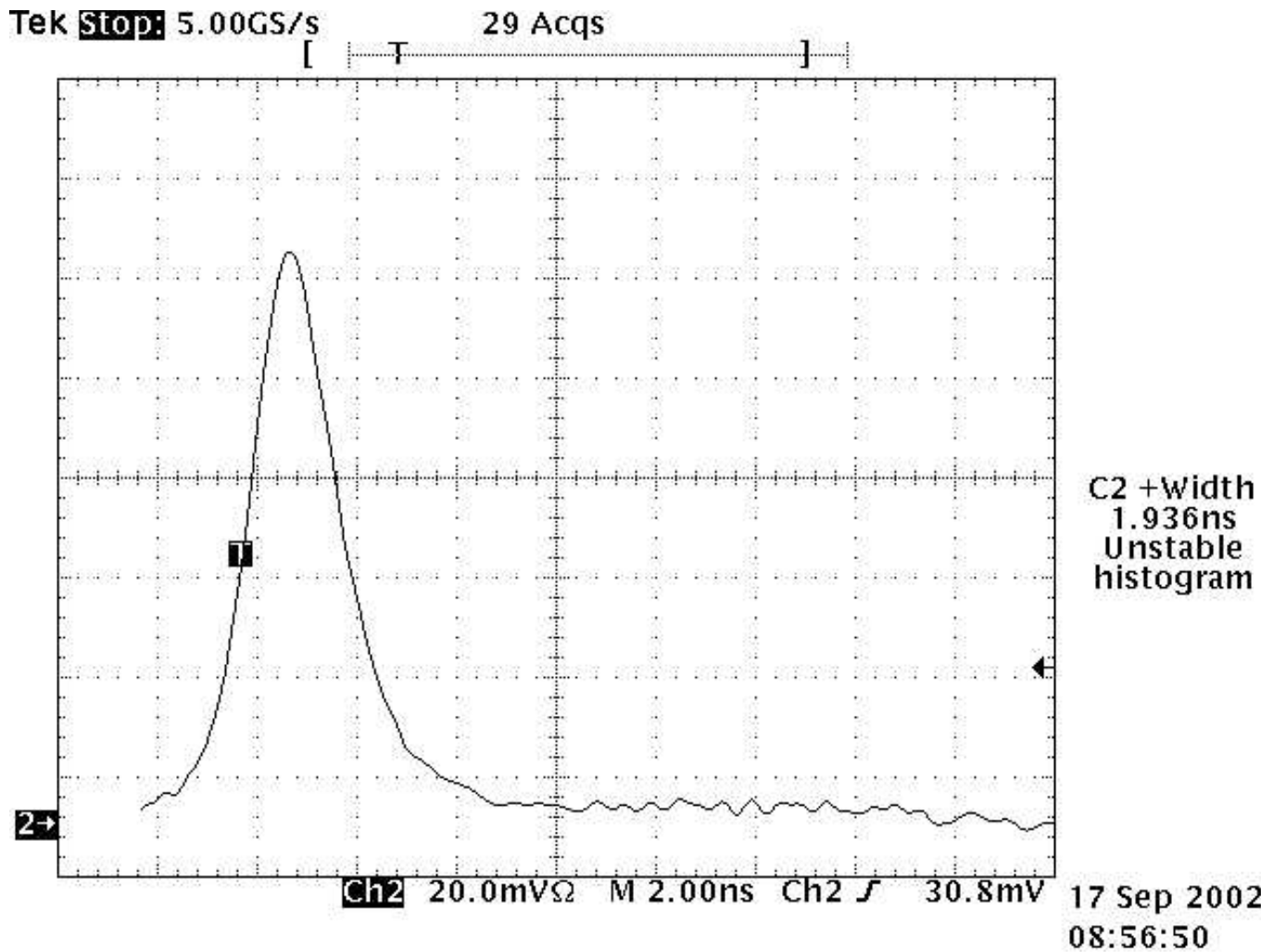


Micro-laser in TO3 package and Diode drive circuit for use with L123 Battery.

Oscilloscope traces showing diode pump current for 8 milliseconds and 7 q-switched pulses with approximately 80 micro-joules/pulse. Pulses are stretched for display. Actual pulse width is 2 ns.

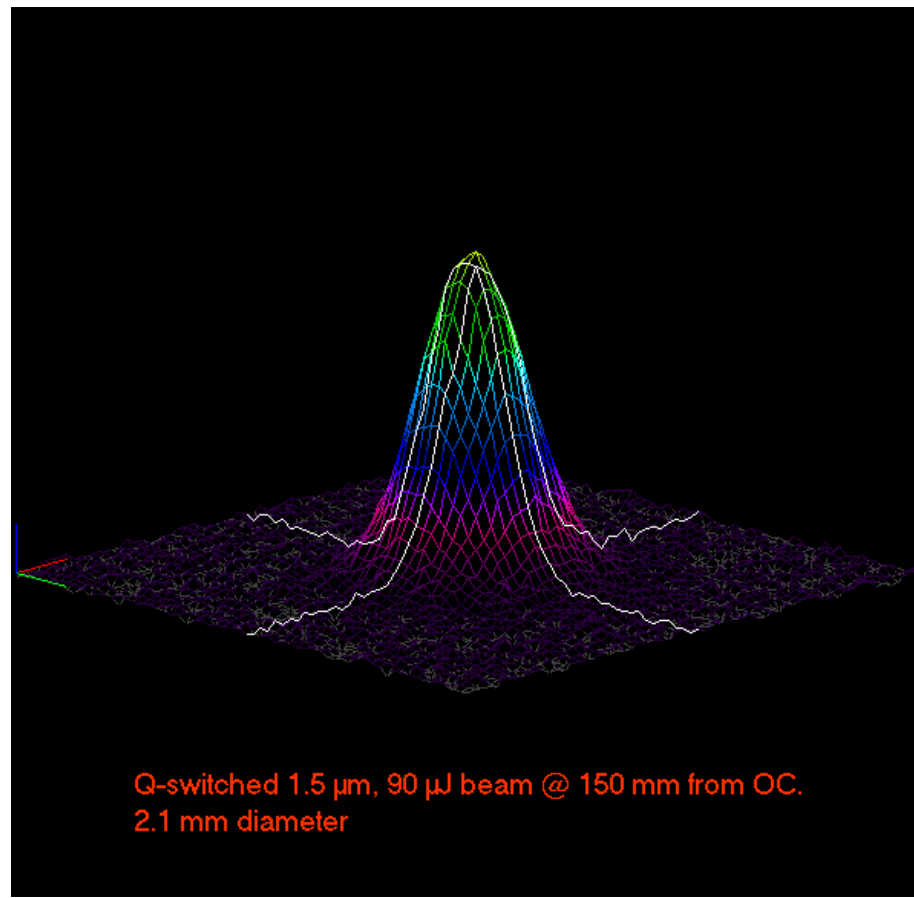
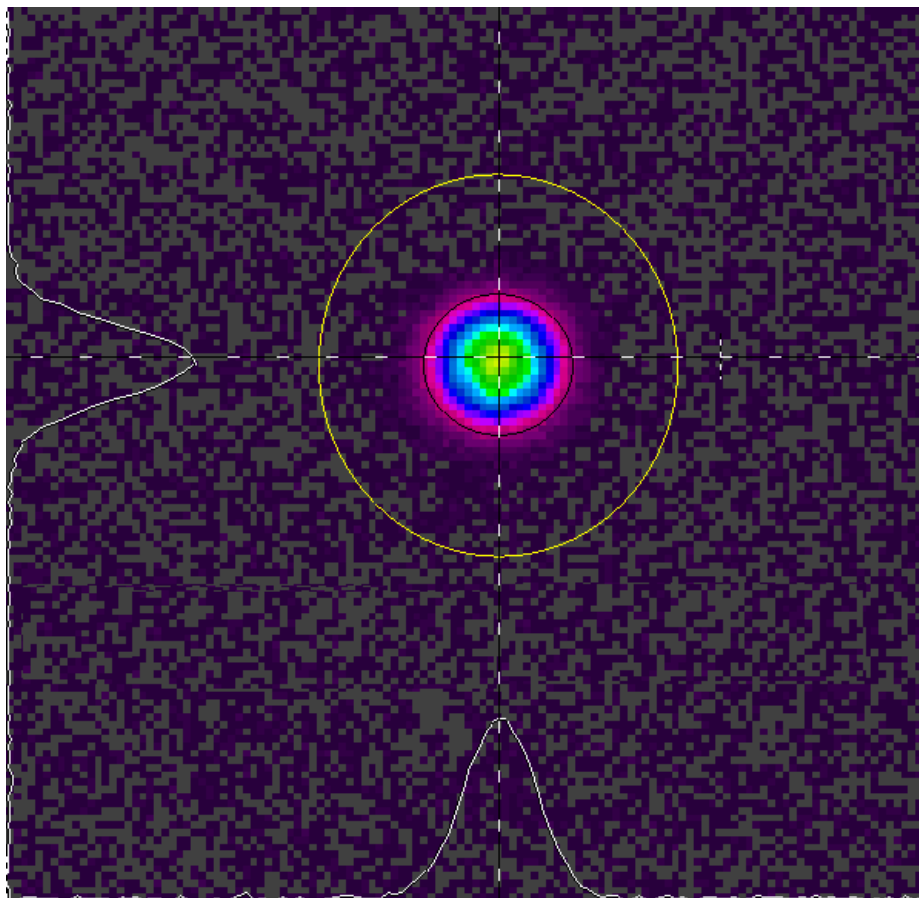


Eye-Safe Laser Output Pulse





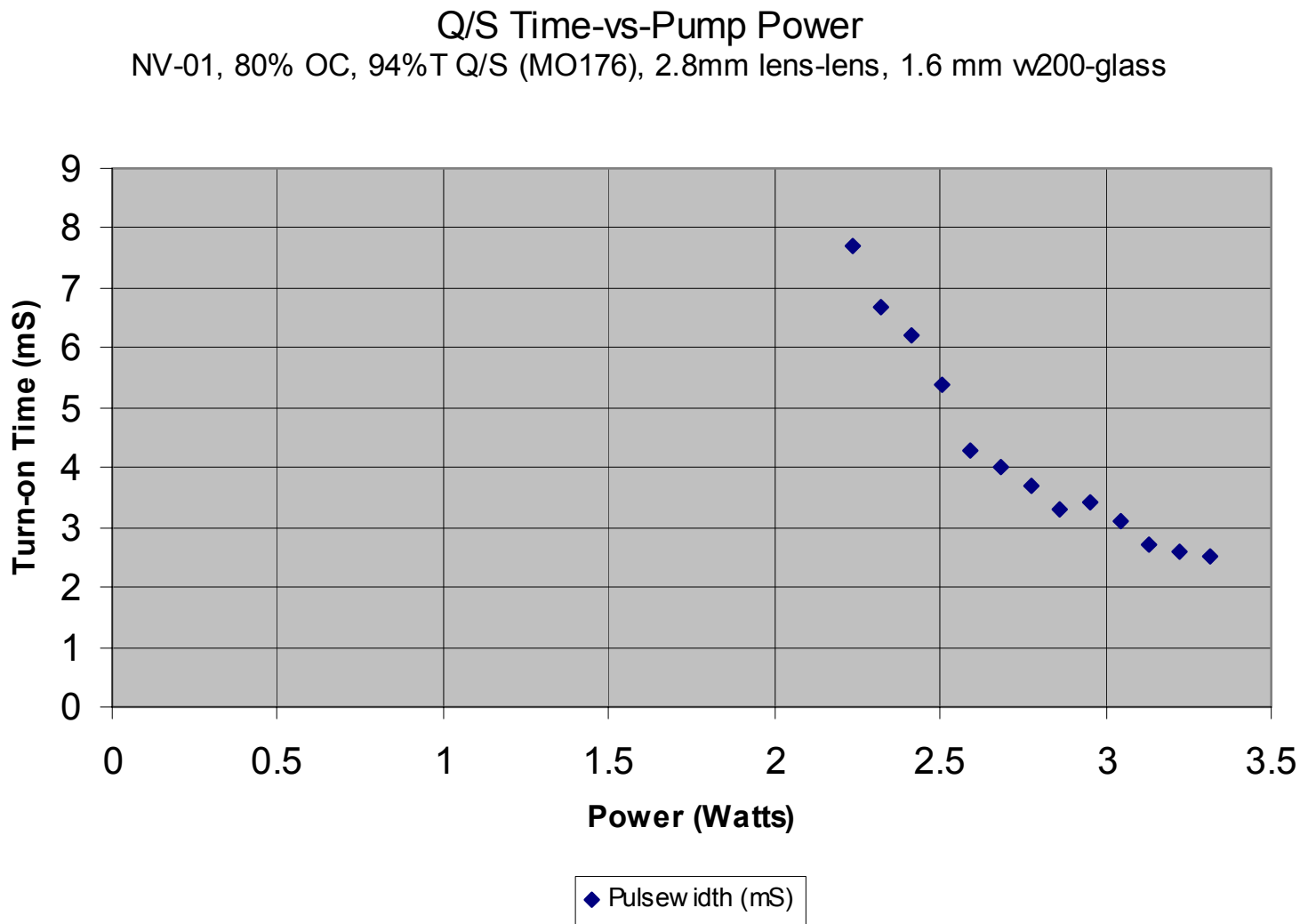
Beam Quality



Beam Quality < 2.6 mm-mrad



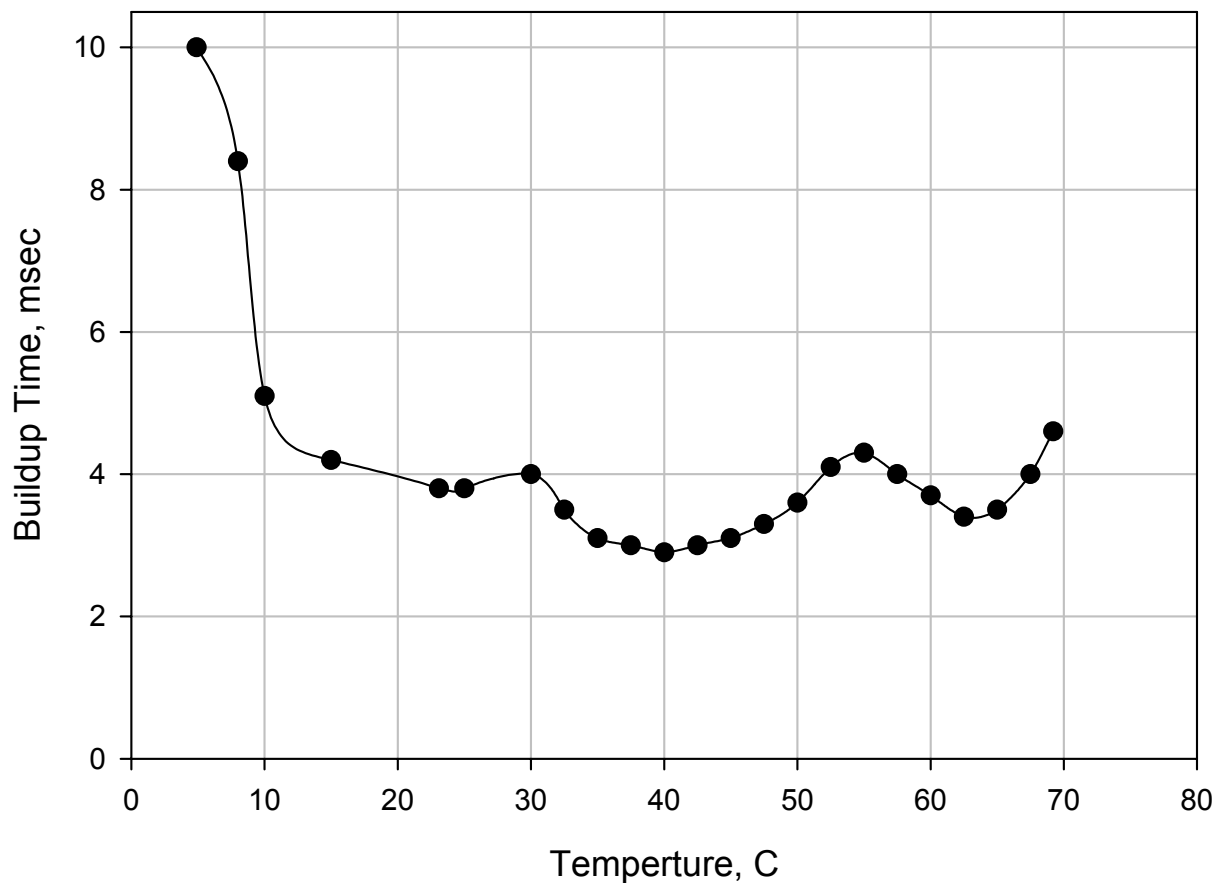
Time to Q-switch vs. laser diode power NV01 glass





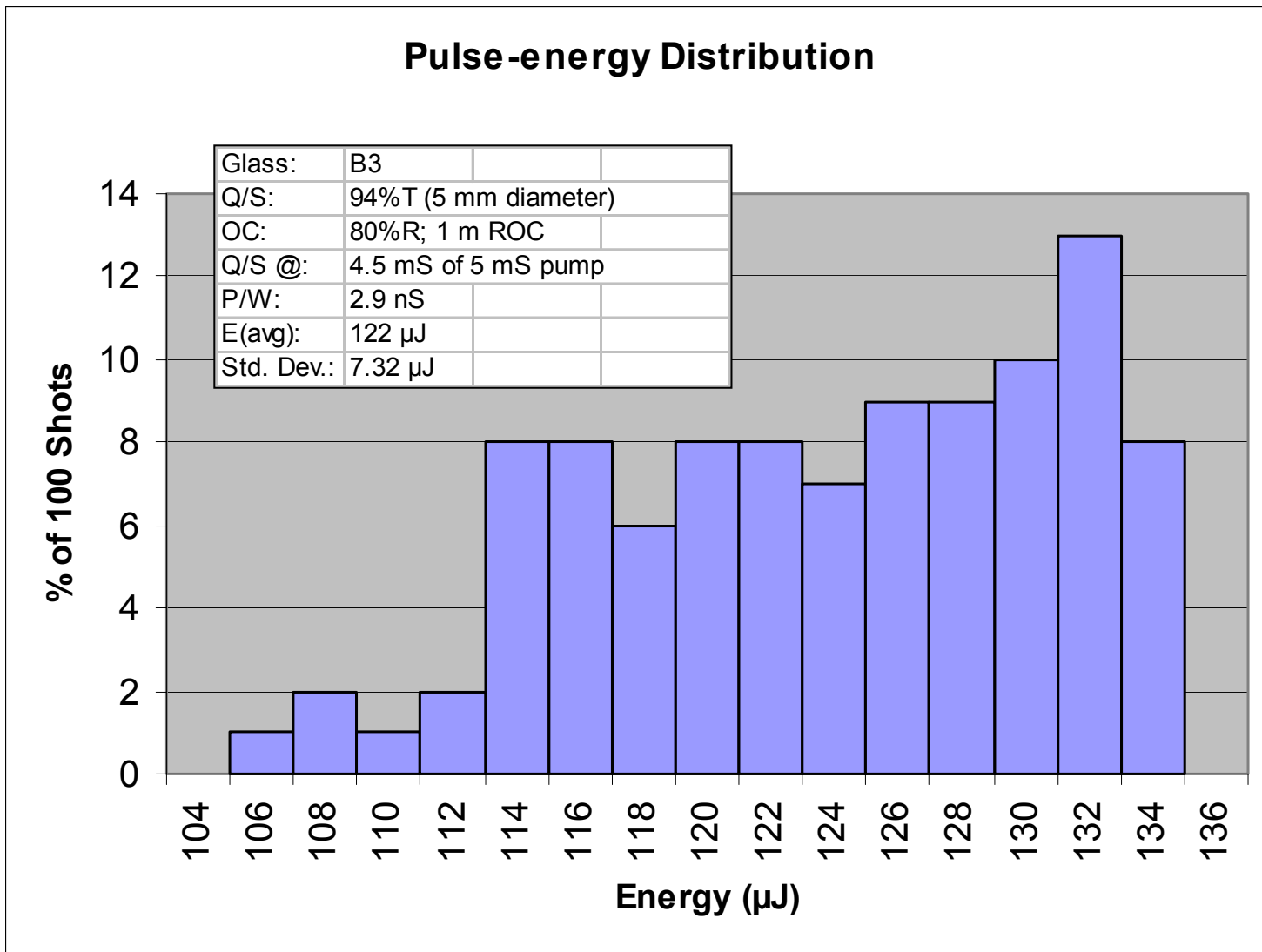
Eye-Safe Laser Environmental Test

Erbium Laser Performance over Temperature





Diode Pumped Er, Yb:glass Microlaser Energy Histogram Data





Diode Pumped Er,Yb:glass Micro-Laser Summary

- Lightweight Eyesafe Micro-Laser developed for Rangefinder Applications: 12 gm
- Wavelength: 1.54 μm for eyesafety
- Energy: 80 to 140 μm
- Pulse Width: 2.0 nsec
- Peak Power: up to 50 kW
- PRF: 1 to 20 Hz
- Ranges up to 2 km demonstrated
- Tested to 5×10^6 with No Degradation @ 60 °C
- Low cost projected