COHERENT®

Lasers for Flexible Packaging
FlexPak Seminar 2012

COHERENT®

Overview

- Coherent the largest OEM Laser manufacturer worldwide
  – a company introduction

- In depth laser technology expertise to support LasX Industries products and FlexPak applications and process development.

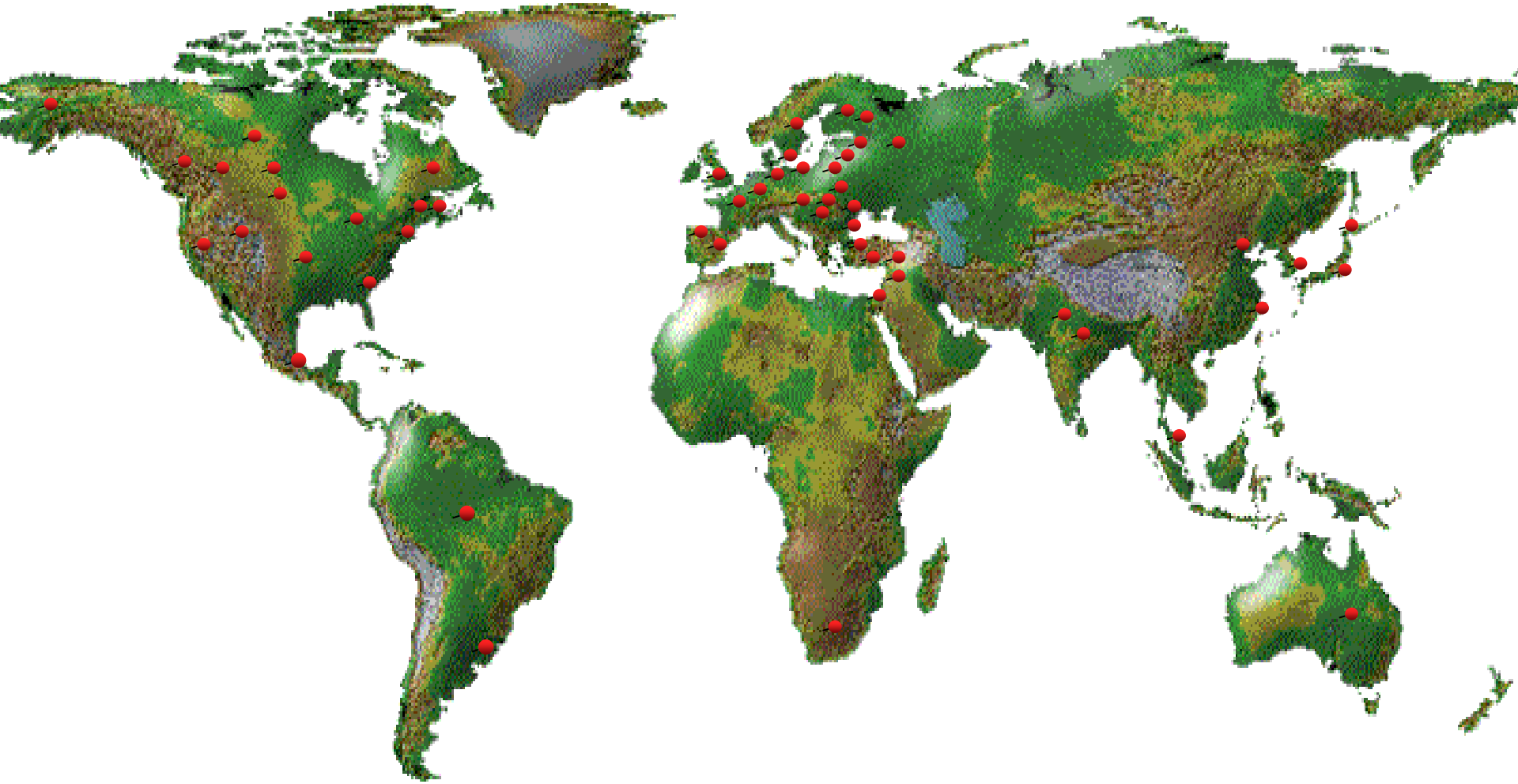
- Global product service infrastructure to support LasX industries and FlexPak worldwide presence.

- The CO_2 Laser Product Line
- Sample Applications
- About Laser Power:
  - Average Power, Peak Pulse Power, and Pulse Energy
  - Super-Fast Rise and Fall Times

A Spectrum of Technologies

	Microelectronics	Materials Processing	Scientific Research & Gov Programs	OEM Components & Instrumentation
CO2	●	●	●	●
CW Tunable			●	
Diode Lasers	●	●	●	●
Diode Pumped	●	●	●	●
Dye			●	●
Excimer	●	●	●	●
Fiber Based	●	●		
Ion	●	●	●	●
OPSL	●		●	●
Measurement & Control	●	●	●	●
Terahertz			●	
Ultrafast	●	●	●	

Sales & Service Facilities



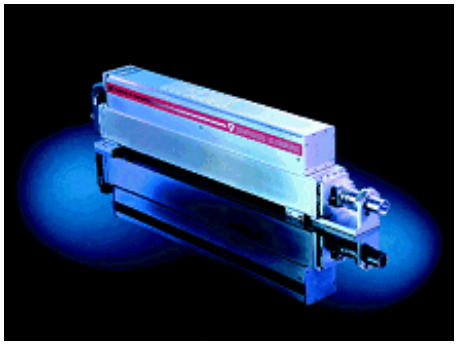
Coherent Service and GLS Locations Worldwide
Rapid global service response for LasX Industries and FlexPak installations worldwide.

Broadest Sealed Off CO_2 Laser Portfolio

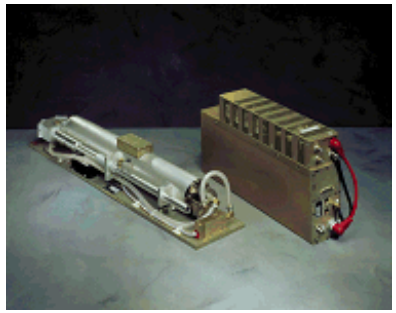
LasX Industries uses the full power range of Coherent CO_2 Lasers.

C & GEM Series

G Series



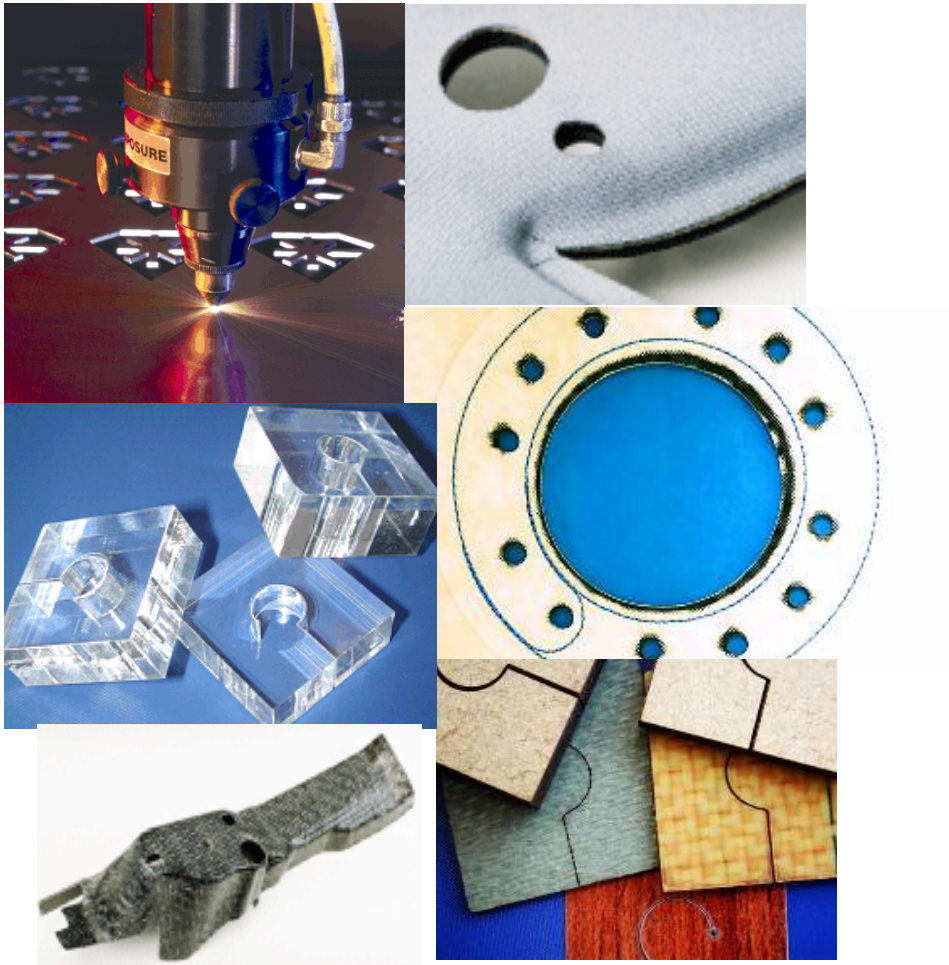
K Series



E Series

30W **100W** **250W-500W** **400W-1000W**

Laser Cutting



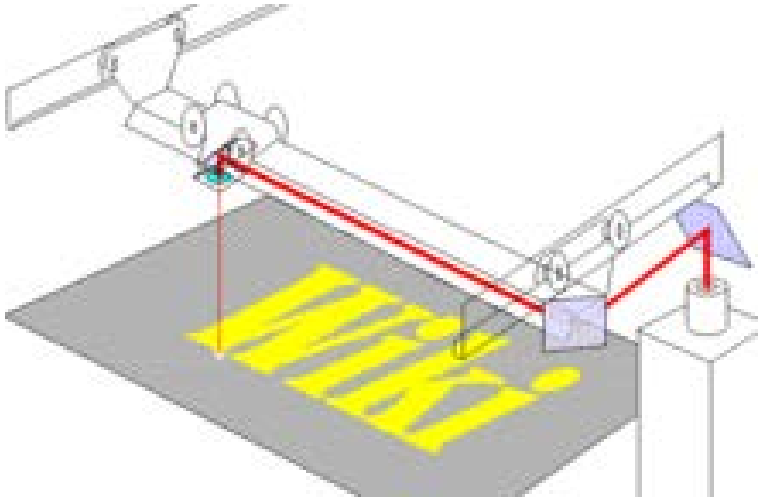
- Plastics
- Fabrics
- Dieboard
- Metal

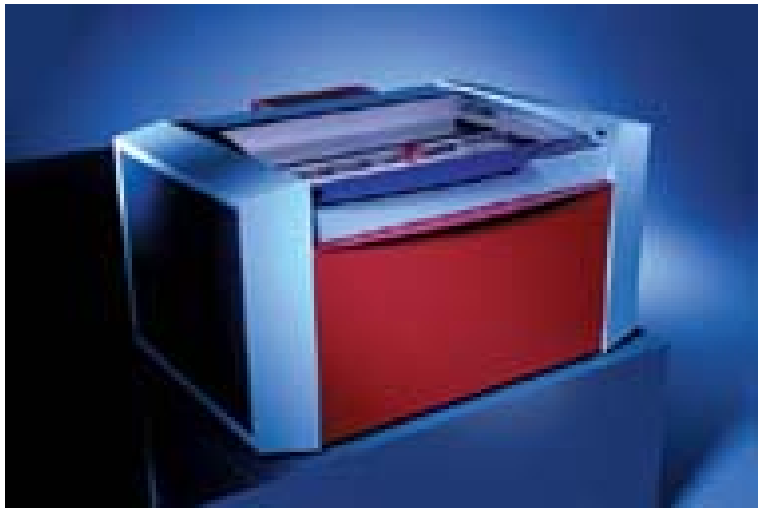
Laser Marking

- **Packaging**
- **Semiconductor**
- **PCB Boards**
- **Organic Materials**
  - Wood
  - Glass
  - Textiles
  - Horn

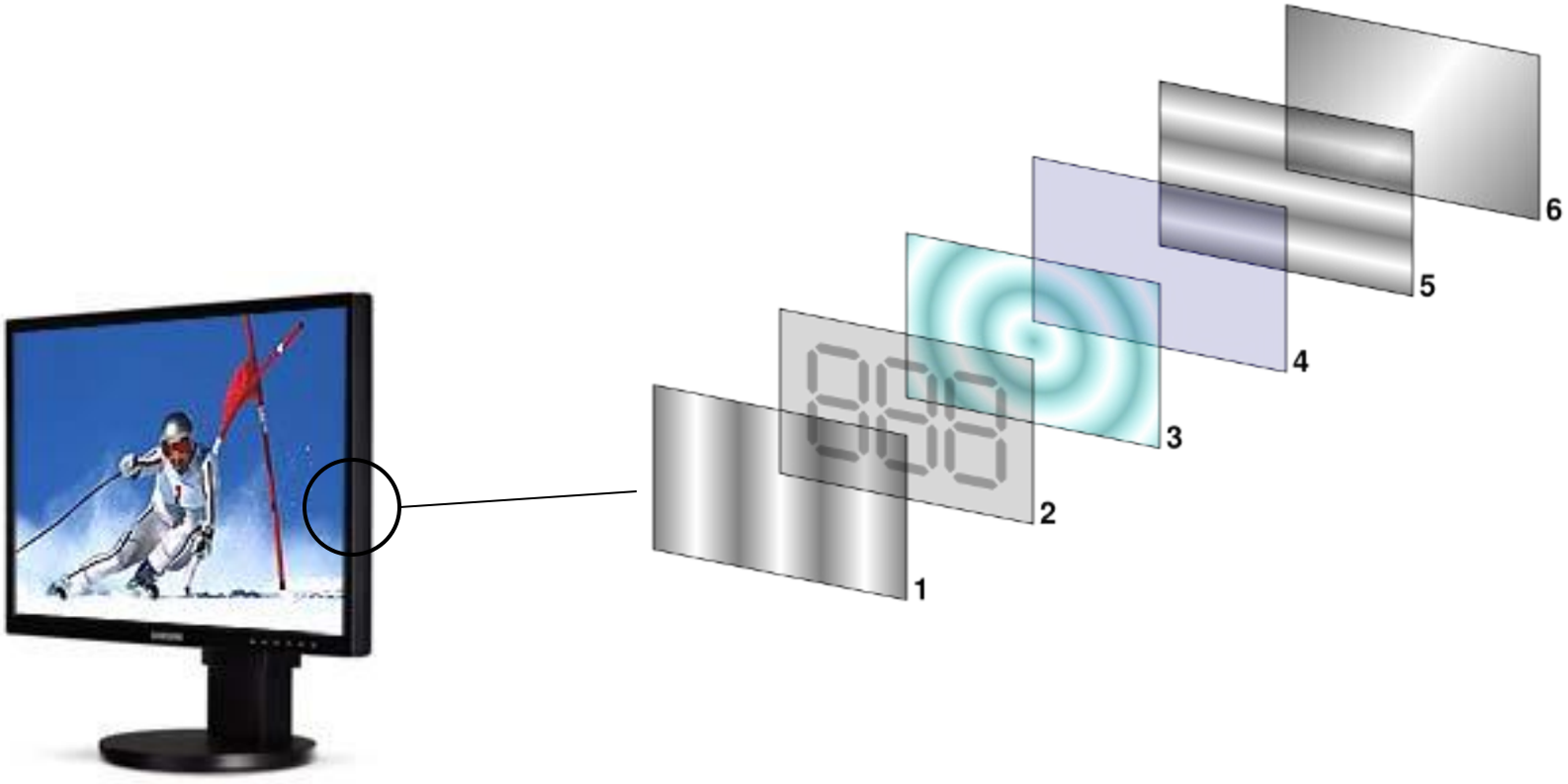
Laser Engraving

- Plotter style systems with flying optics
- From small desktop to large flat bed system
- Endcustomers mainly gift shops, rubber stamps but also industrial applications (tag marking, low volume components)





Flat Panels for TV or Mobile Devices



Need Laser Cut

1. **Vertical filter film to polarize the light as it enters.**
2. **Glass substrate with ITO electrodes.**
3. **Twisted nematic liquid crystals.**
4. **Glass substrate with common electrode film (ITO)**
5. **Horizontal filter film to block/allow through light.**
6. **Reflective surface to send light back to viewer.**

Medical Applications

Dental:

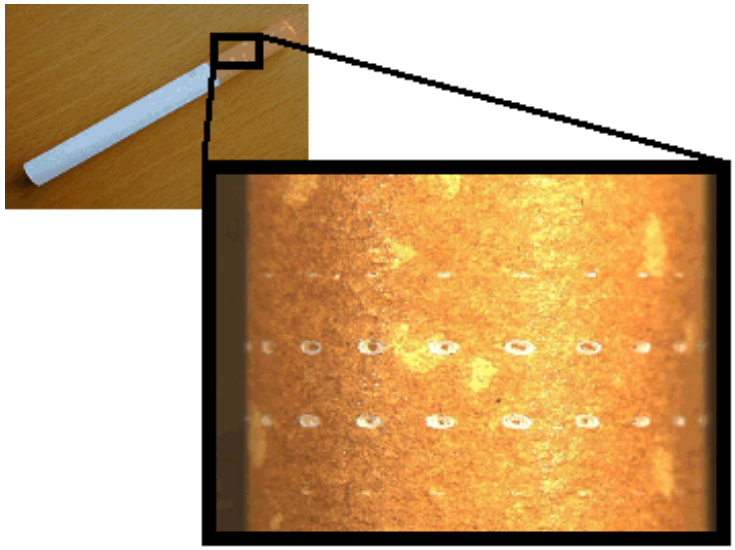
Surgery

Tooth Drilling

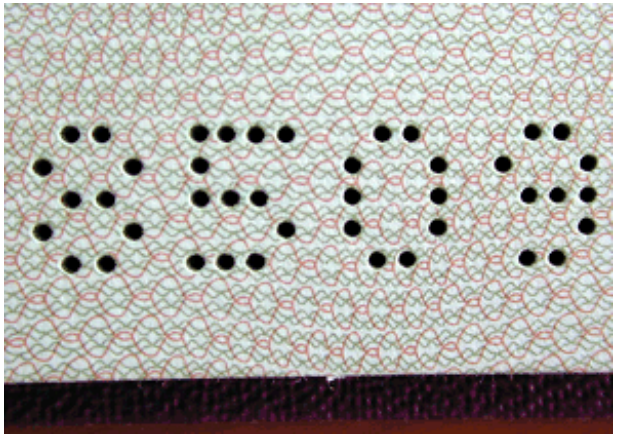
Aesthetic:

Laser Resurfacing

Paper Drilling



- Cigarettes online perforation (up to 22.000 cigarettes per minute)
- Cigarette paper offline perforation (perf. of paper only)

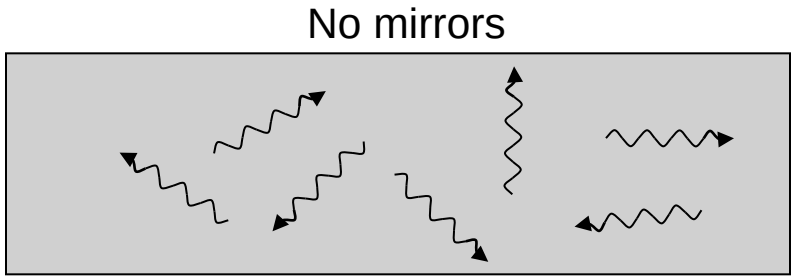


- Passport perforation
- Perforation of tapered holes (security feature) through several pages, also through carton cover

Laser Basics

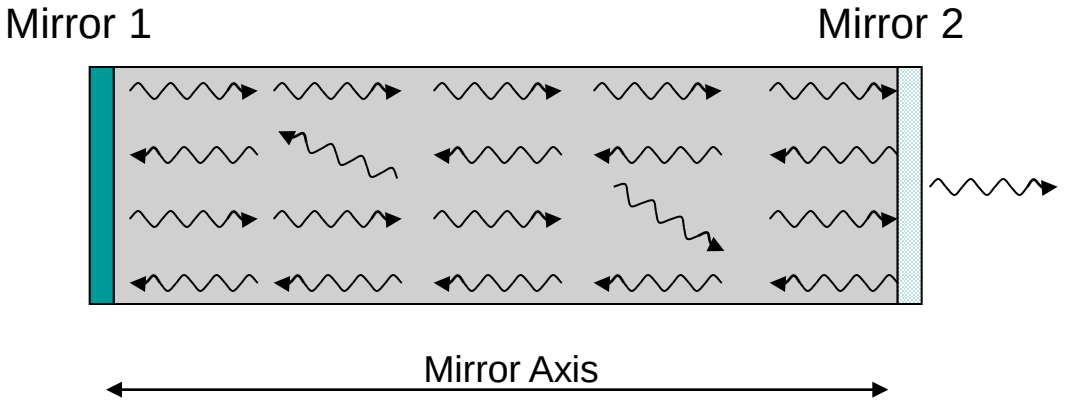
Spontaneous Emission

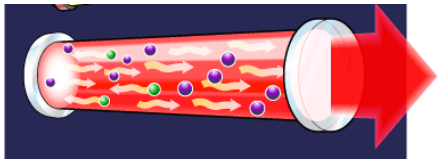
- Light is given off without a ‘seed’
- Emission is equally probable in all directions.



Stimulated Emission

- Light is given off WITH a ‘seed’ from other light
- Light is created by ‘cloning’ (same wavelength, same direction, same phase)
- For laser, emission happens mostly along mirror axis.

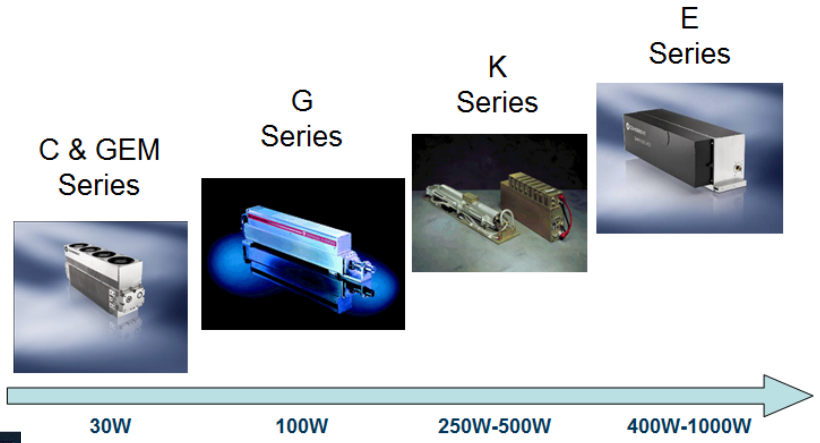




- Laser
  - Has Gain AND Feedback
  - STIMULATED emission
  - Narrow wavelength emission
  - Coherent Light – narrow beams rather than spraying light

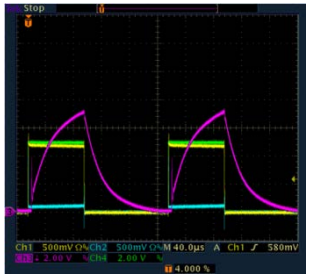
Complete Portfolio of CO_2 Laser Technology Solutions

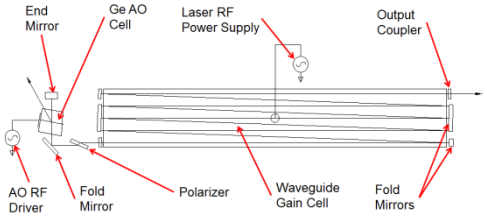
Optimizing the application requires more than just selecting the right average laser output power.

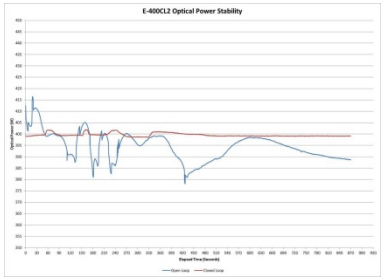


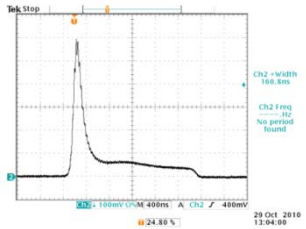
Other critical parameters:

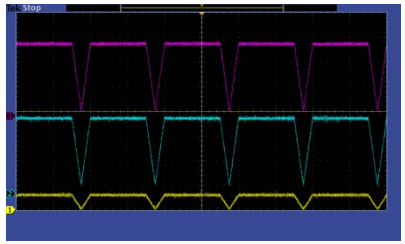
- Wavelength
- Pulse Peak Power
- Pulse Energy
- Power Stability
- Power Ramping Control
- Pulse Energy Stability

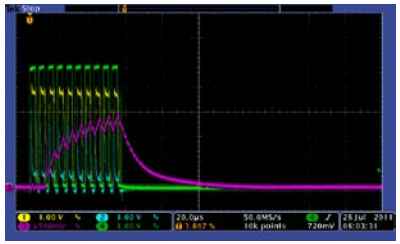










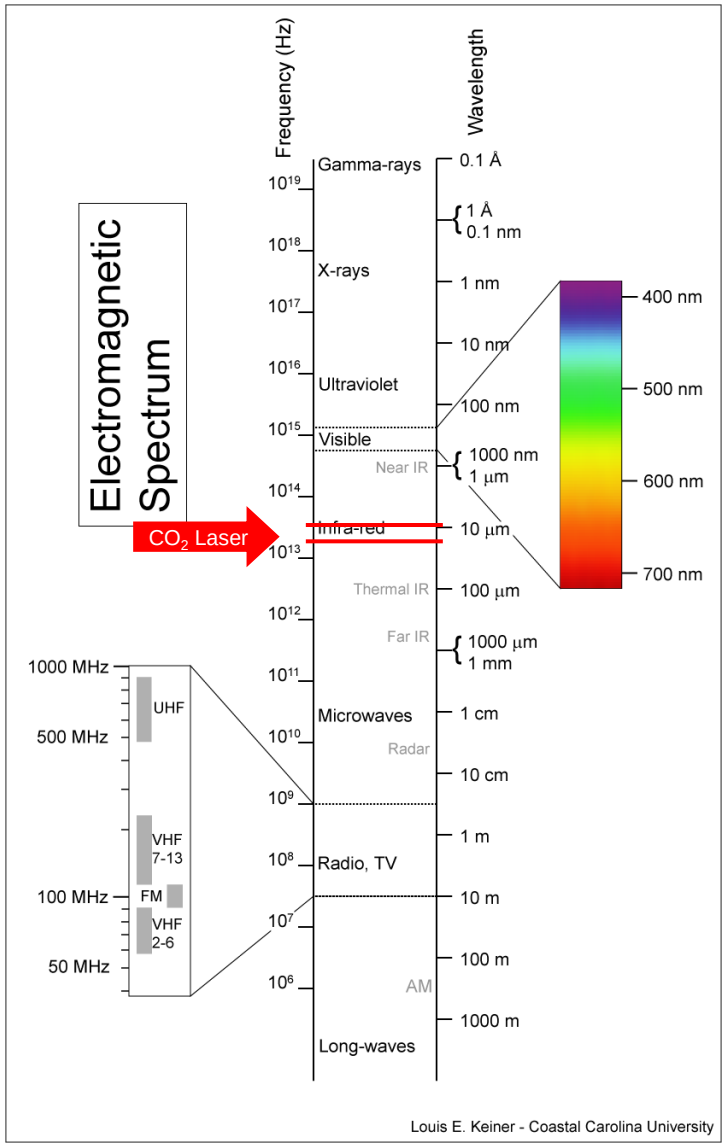


The Coherent - LasX team have the design, manufacturing, and applications engineering expertise to optimize all the above laser parameters for ultimate process performance.

CO_2 Lasers Emit in the Infrared

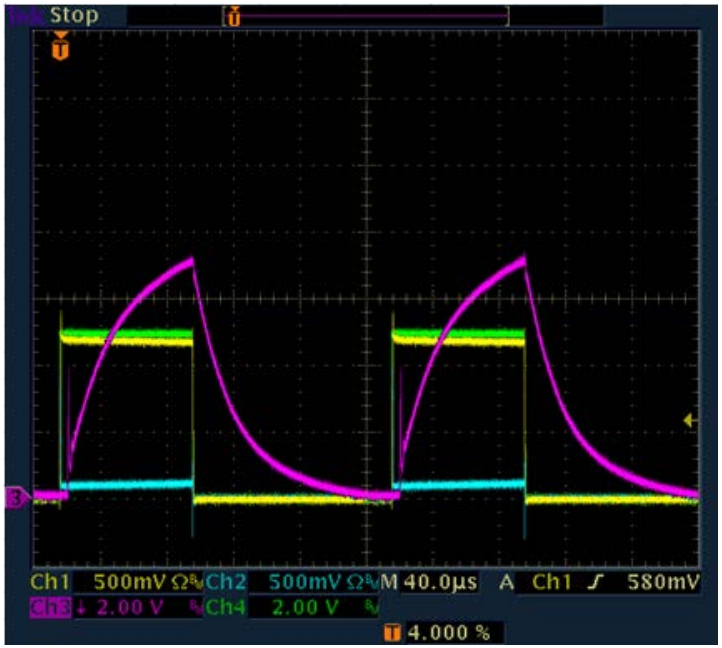
- Electromagnetic Spectrum is the range of ***wavelengths*** (“colors”)
  - Gamma Rays – nuclear reactions
  - X-Rays – Medical imaging
  - UV – sunburn, black light
  - Visible Light - ROYGBIV
  - IR – Heat, telecommunications
  - Terahertz - Imaging
  - Microwaves – Cooking, communications
  - Radio – communications

- Common CO_2 Laser Wavelengths
  - 9.2um, 9.4um, 10.2um, 10.6um
  - Laser wavelength is selected based on absorption band of material to be processed.



Average Power vs. Peak Pulse Power

- Average Power = Energy / Time
- Pulsed lasers deliver energy in discrete pulses, therefore the power delivered during the pulse is higher than the average power.
- Pulse Energy = Average Power x Pulse Period
- Pulse Energy = Average Power / Pulse Rep Frequency (PRF)
- Peak Pulse Power = (Pulse Energy / Area) x V_{peak}
- *The highest Average Power operating condition is <u>not</u> the highest Peak Pulse Power operating condition.*

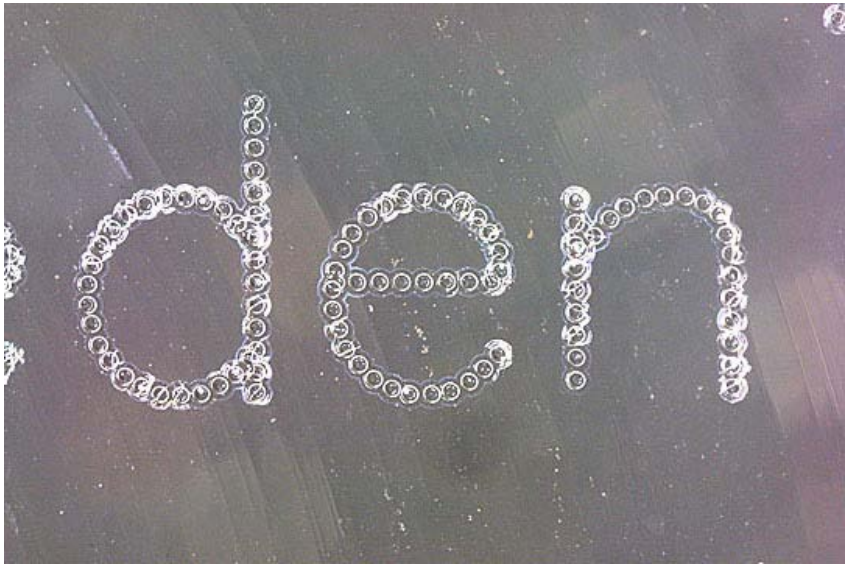


High Peak Pulse Power important for many Material Processing Applications.

- *Deliver most power in shortest time to minimize HAZ (Heat Affected Zone)*

Marking and Cutting Glass with Q-switched CO_2 Lasers

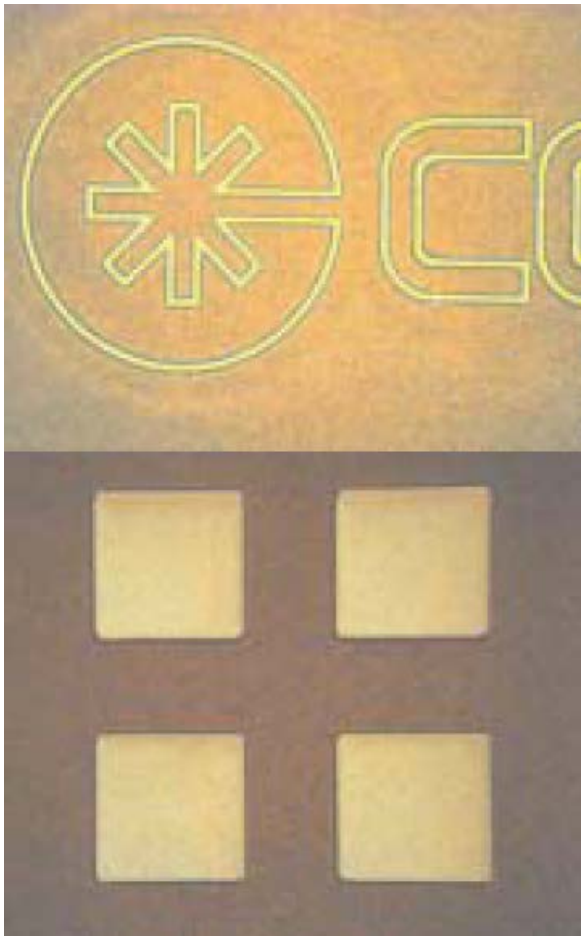
Goal: generate clean, clear marks in glass without micro cracks



Above-
Processed with Q-switched (pulsed) CO_2 laser
– spot diameter 120 um
– spot spacing 120 um
- **no cracking**

Left –
Same marks with conventional CW CO_2 laser
- note cracking

Q-Switched CO2 - Flex Circuit Processing



Polyimide removal from copper on flex circuit boards

Selective, clean and complete removal of polyimide coatings from large areas as well as copper leads

No charring, no heat affected zone and no post processing

Conclusion

- Packaging applications success requires laser energy/power characteristics for the specific material processing application.
  - Wavelength
  - Average Power
  - Peak Pulse Power
  - Pulse Energy
  - Fast Rise/Fall Times

- Coherent's Laser technology combined with LasX and FlexPak systems and applications expertise provide the ultimate solution for flexible packaging applications.