Photodigm

Distributed **B**ragg **R**eflector Lasers

The Laser Diode is the Instrument

Richardson, TX

Photodigm

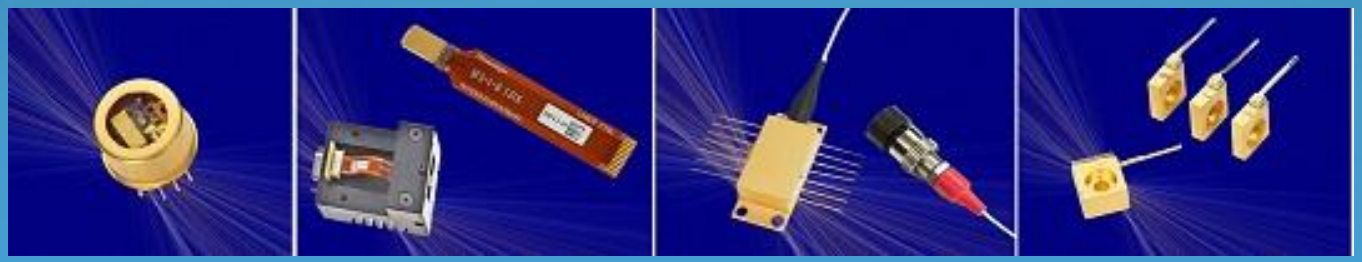
基本概要

- Our company
- Product offerings
- Performance and reliability characteristics
- Emission wavelengths
- DBR structure
- Applications

Photodigm Inc.

- Founded as a Texas Corporation by CEO John Spencer and CTO Gary Evans in early 2000
- We aimed at opportunities with single frequency lasers.
- Received NSF Phase IIB and Texas ETF grants to support commercialization
- As part of a reorganization in 2010 to provide clear market focus on identified markets. Clinched position as leading supplier of spectroscopic lasers; OEM customers emerge.

- Photodigm公司成立于2000年，创建人为John Spencer和Gary Evans。
- 公司主要致力于研发和生产高功率、单频可调谐DBR激光器产品。
- 公司曾多次受到美国国家自然科学基金和德州专项基金的资助。



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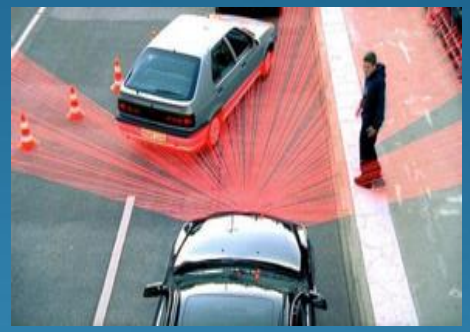
New Applications Require New Lasers

Lab Research



Automotive

Medical Diagnostics

Consumer Handheld

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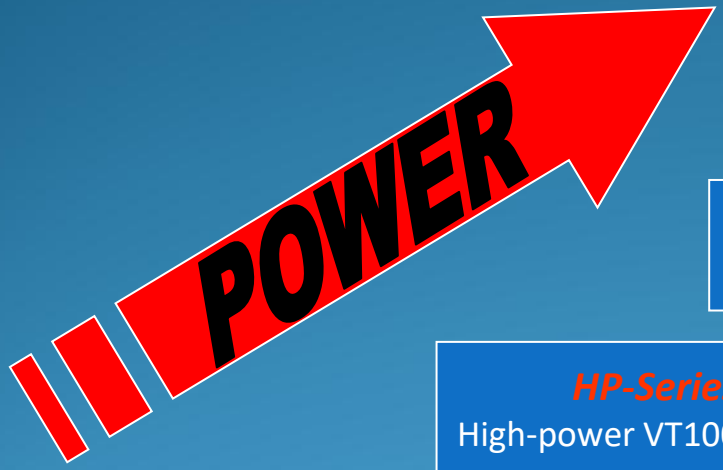
Single Frequency Laser Products



BA-Series
Broad-area DBR laser
> 1 W[1]

MP-Series
MOPA DBR laser
> 500 mW[1]

TP-Series
Tapered w large aperture
> 200 mW[1]

HP-Series
High-power VT100, VT150
120 – 500 mW[1]

S-Series
Standard V75, V100, V150
80 – 400 mW[1]

LP-Series
Low-power high-efficiency
10 – 20 mW

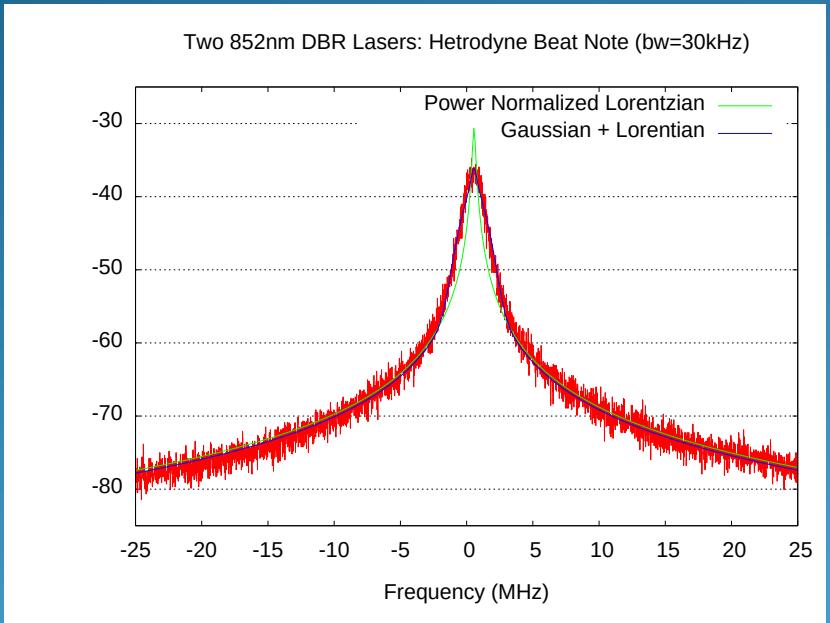
Available wavelengths:
- D_1 and D_2 of K, Rb and Cs
- He*
- 760 nm to 1100 nm

单频大功率输出

Emission wavelength (nm)	Slope efficiency (W/A)	Single-mode typical ***cw*** output power (mW)		
		LP	S	HP
1083	0.85	-	400	500
1064	0.72	-	400	500
976	0.72	-	250	400
920	0.68	-	200	300
852/895	0.85	<50	120	280
780/795	0.74	<50	80	180

超窄线宽

Photodigm's V100 DBR lasers



Estimated linewidth[1] is 600 kHz

Hyperfine structure[1] of Rb

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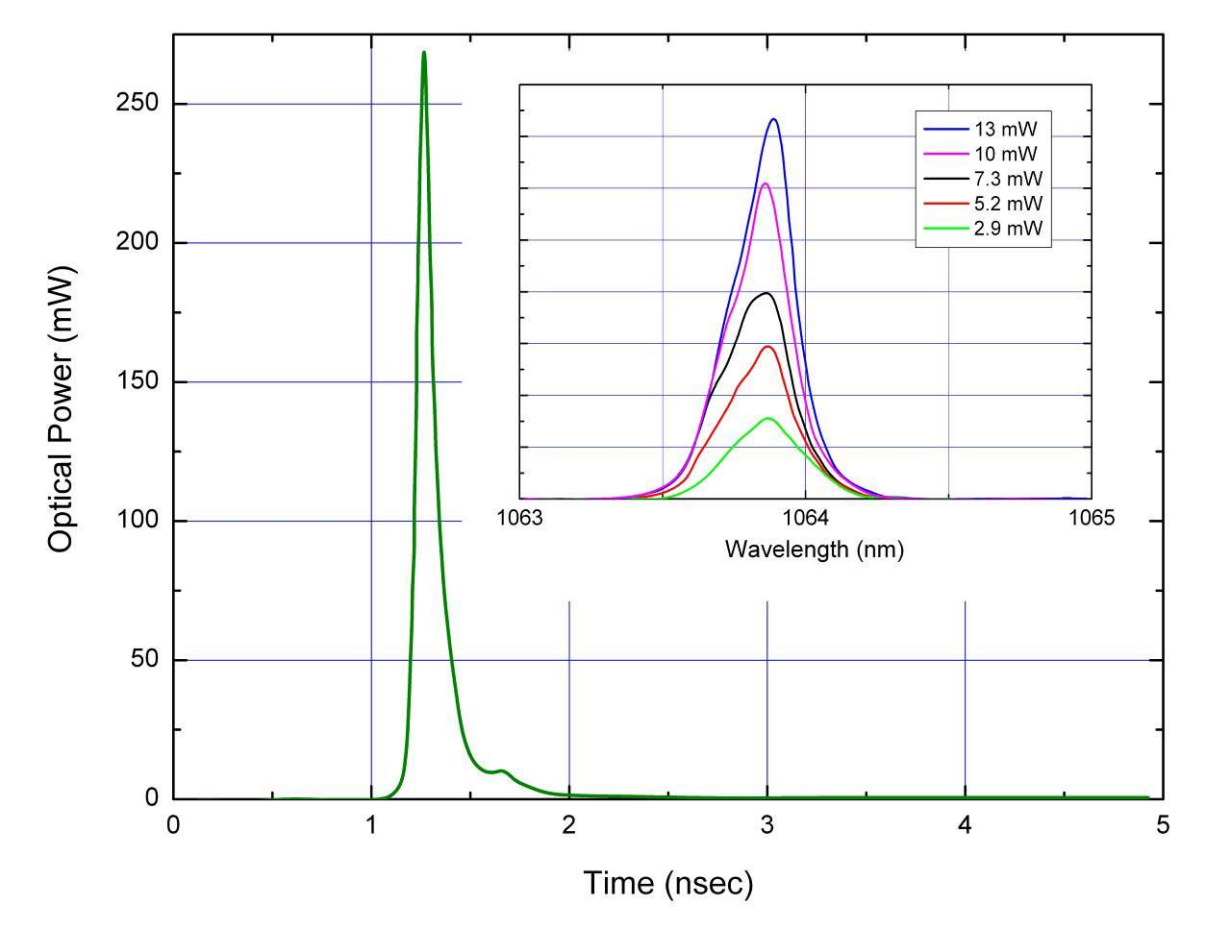
[1] Data provided by Vescent Photonics

部分波长及应用

Wavelength (nm)	Applications	Customers
1083	He magnetometer, lung imaging	Medical, Defense
1064 / 976 920	Frequency doubling, YAG replacement, Frequency stabilized Er/Yb pump source	Defense, Industrial
852 / 895	Cs absorption spectroscopy; atomic clocks, Terahertz spectroscopy	Communication, Universities, and Research Centers
780 785/795	Rb absorption spectroscopy; atomic clocks, Raman spectroscopy	
767 / 770	K absorption spectroscopy; atomic clocks	

… fast pulsing 皮秒脉冲输出



Pulse Width
< 100 ps

Spectral Width
< 0.25 nm

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Data Courtesy of PicoQuant GmbH

Temperature and Current Tuning
温度和电流调谐系数

Wavelength [nm]	Temperature Tuning Rate [Å/°C]	[GHz/°C]	Current Tuning Rate [Å/mA]	[GHz/mA]
780 / 795	**0.60**	**30**	**0.026**	**1.3**
852 / 895	**0.65**	**27**	**0.032**	**1.3**
920	**0.75**	**27**	**0.018**	**0.64**
976	**0.75**	**24**	tbd	tbd
1064	**0.75**	**20**	**0.020**	**0.53**
1083	**0.78**	**20**	**0.030**	**0.77**

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… long lifetime 超长的使用寿命

Wavelength	Operating Power	Operating Temperature	MTTF
780nm	60mW	25ºC	54,400hrs
852nm	100mW	25ºC	65,000hrs
920nm	60mW	25ºC	452,000hrs
1064nm	400mW	25ºC	244,000hrs
1083nm	100mW	25ºC	350,000hrs

不同结构激光器之间的对比

	Power requirements	Narrow linewidth	Monolithic	Deterministic wavelength behavior over lifetime
VCSEL	输出功率较小			
VBG-LD		输出线宽较大		
ECDL			整体性差，对震动敏感。	
DFB				在使用寿命中波长的漂移较大，老化比较严重。
DBR	20-500mW	线宽0.5-1 MHz	光栅刻在内部，一体化设计	保证在整个寿命中波长可锁定在需要的位置

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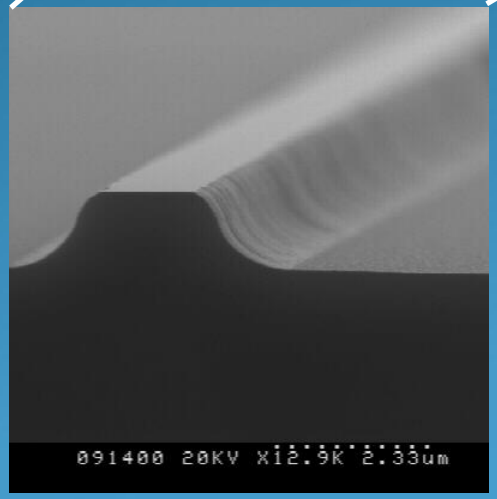
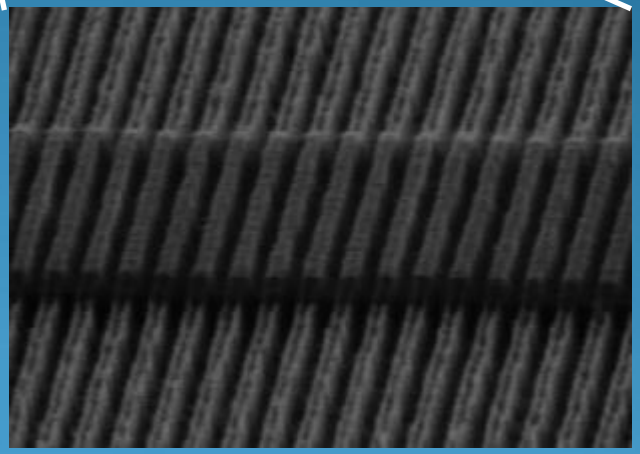
DBR的整体结构



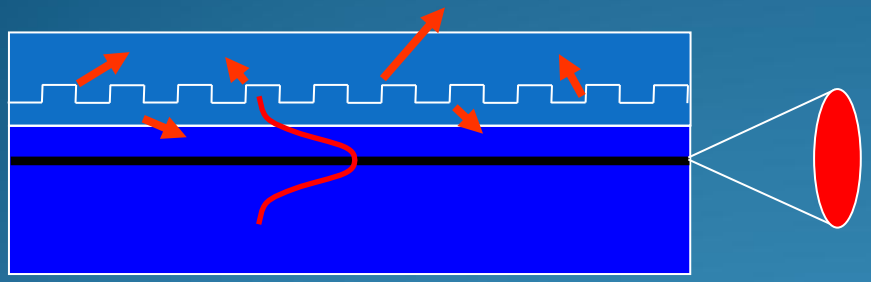


Gain region

Grating region

DBR与DFB结构的对比

DFB Laser

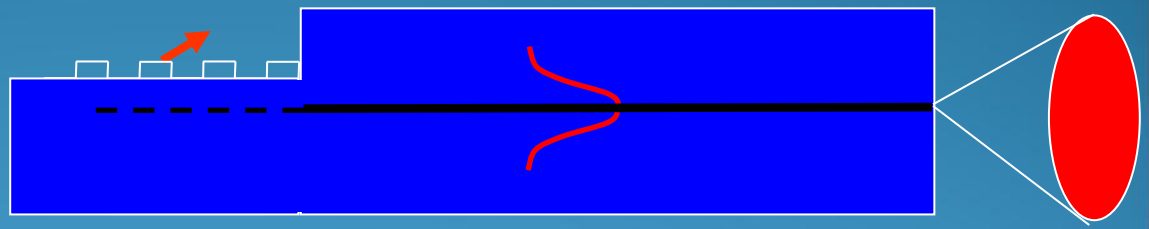


Re-growth Required

High Internal Losses

为了制作光栅，DFB需要复杂的二次外延生长工艺，且光栅刻在有源层内部，易老化并且对光的耗散严重。线宽在2-10MHz之间。

DBR Laser

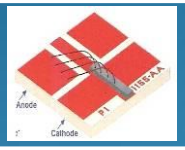
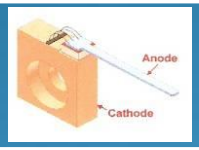
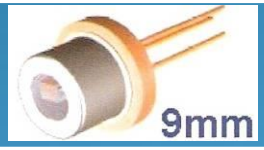
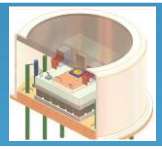
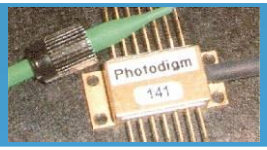


Single Growth

Low Internal Losses

DBR采用单次外延生长工艺，一致性更好。光栅刻在有源层外部，不易老化，内部耗散小，输出功率更高更稳定。线宽在0.5-1MHz之间。

封装外形

	Package Type	Thermo-electric Cooler	Fiber Coupled
	CoS	no	no
	C-mount	no	no
	SOT-9	no	no
	TO-8	yes	no
	Butterfly	yes	yes

封装外形

TOSA Mercury Package

Designed for OEM use:

- High power handling
- Low thermal mass
- High speed modulation
- <0.5 cm3- volume

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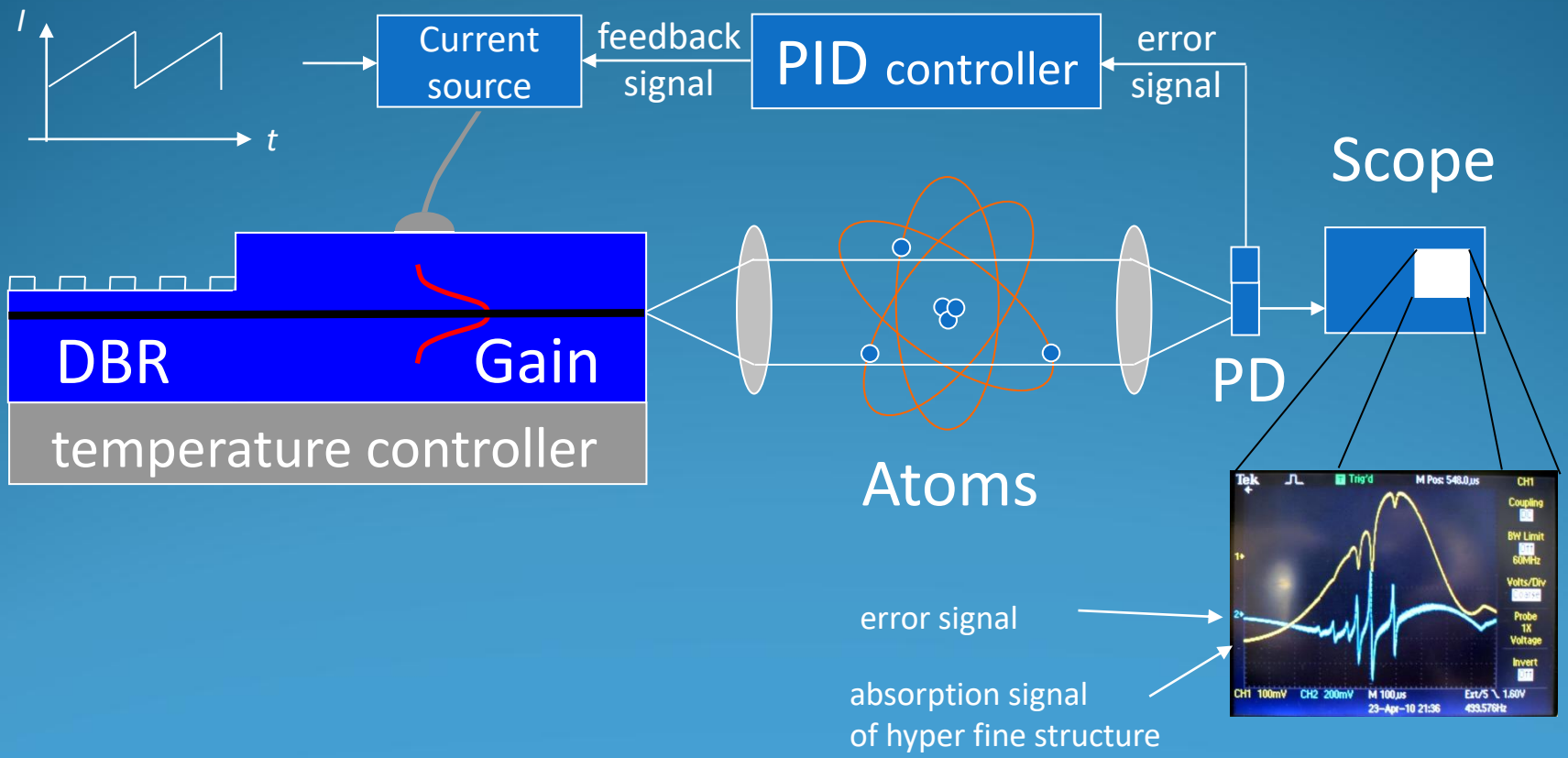
应用： 原子冷却与囚禁、原子钟、重力计、磁力仪、原子陀螺仪

wavelength scanning
by current ramping



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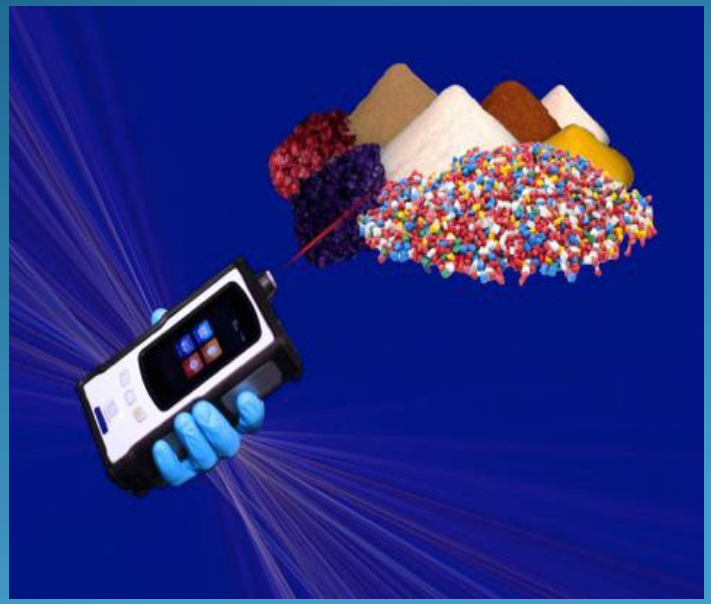
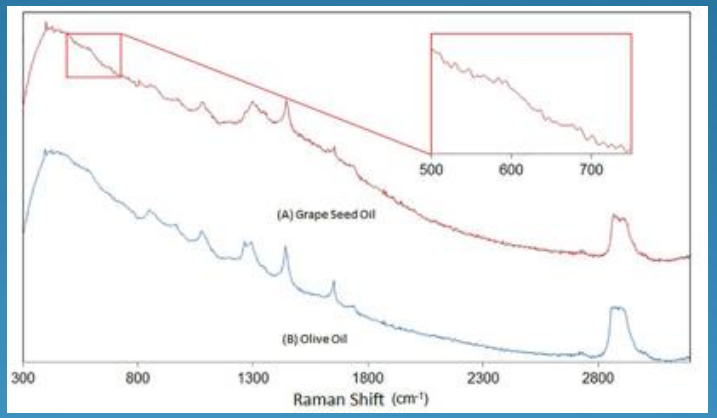
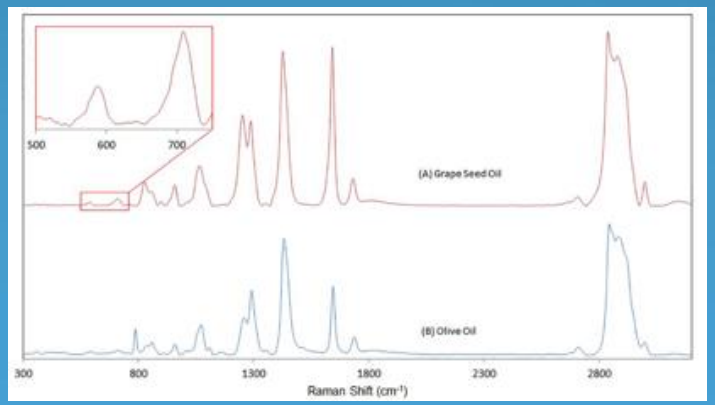
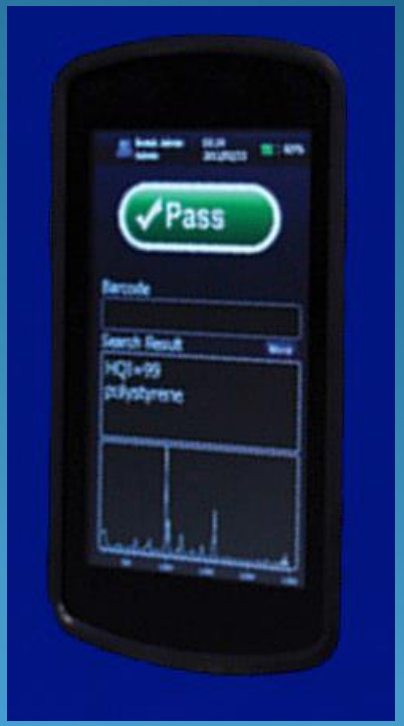
应用： Materials Characterization

Sequentially Shifted Excitation Raman Spectroscopy improves accuracy in Raman materials analysis









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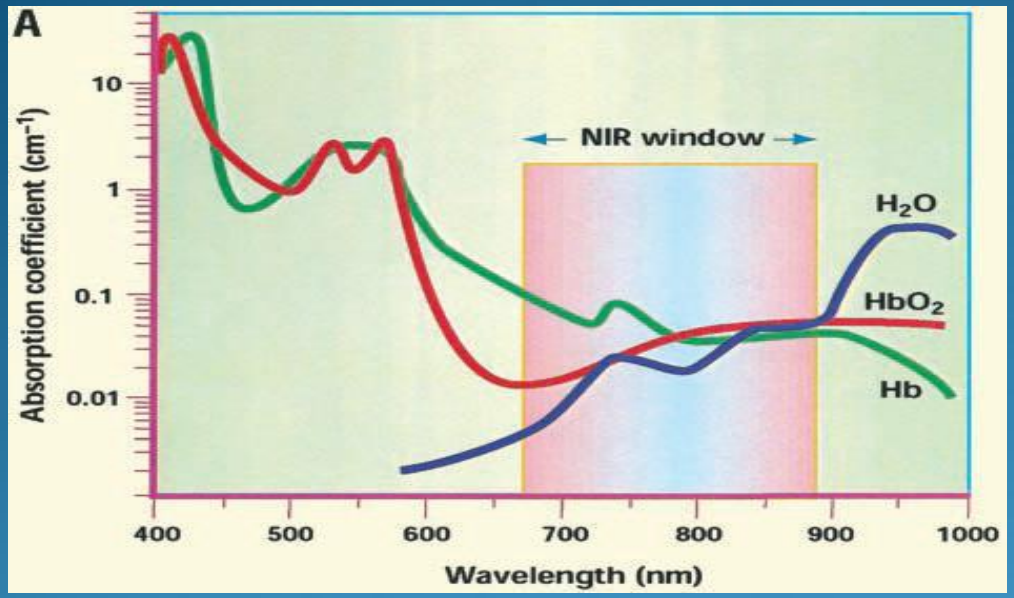
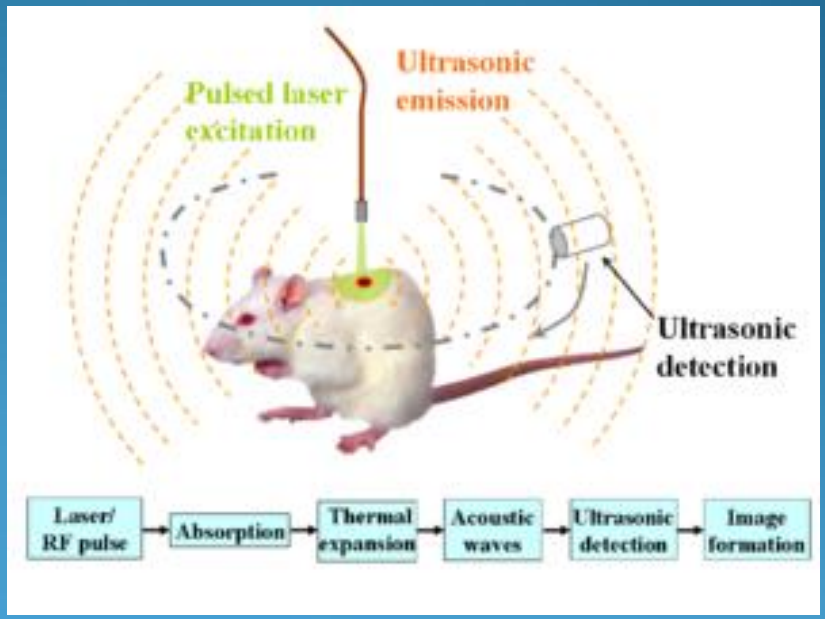
应用： Biological Imaging



Probing the biological window between 800nm and 1000nm



Photoacoustic tomography

Speckle imaging

Deep tissue optical coherence tomography

Deep tissue blood perfusion monitoring

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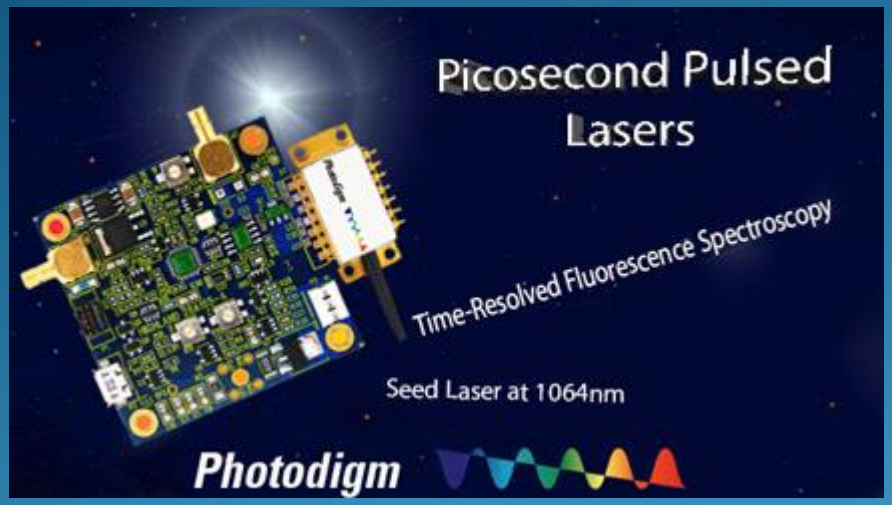
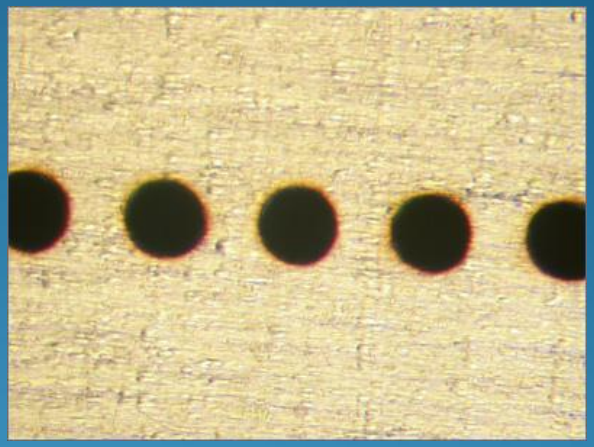
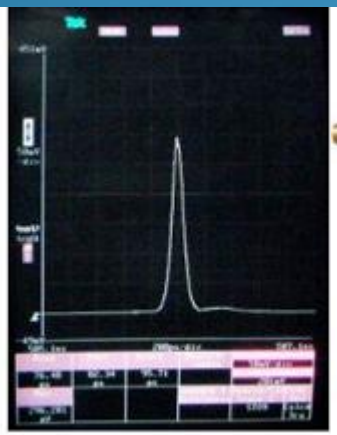
应用： Industrial Processing

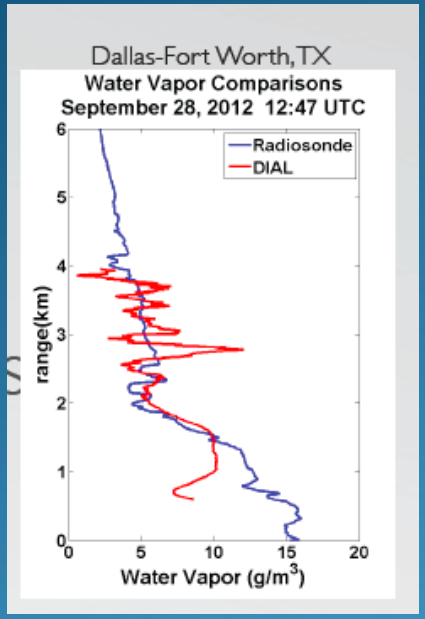






1064 nm DBR with Highland Technology pulser board for seeding fiber amplifier with sub-100 psec pulses for laser ablative hole drilling

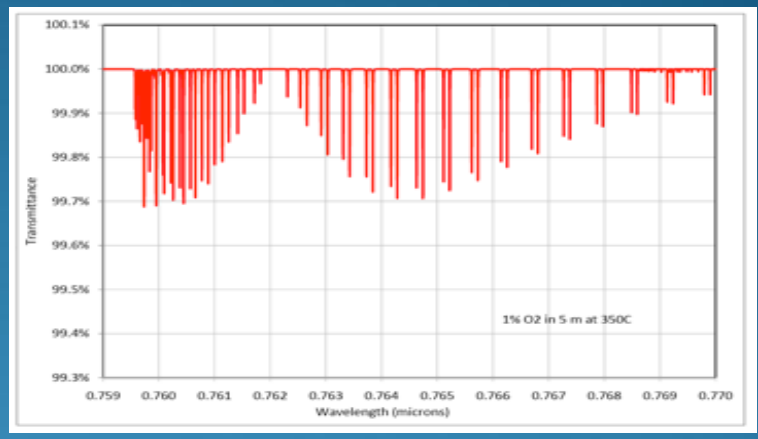
应用： Environmental Monitoring



Differential Absorption LIDAR (DIAL) for measuring water vapor column in atmosphere, with NASA and NCAR

水汽探测：828.1nm

O2 Spectrum around 760 nm



Long Path Length O2 Absorption. Photodigm DBR lasers have the power to perform in Dusty combustion chambers. 氧气探测

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