



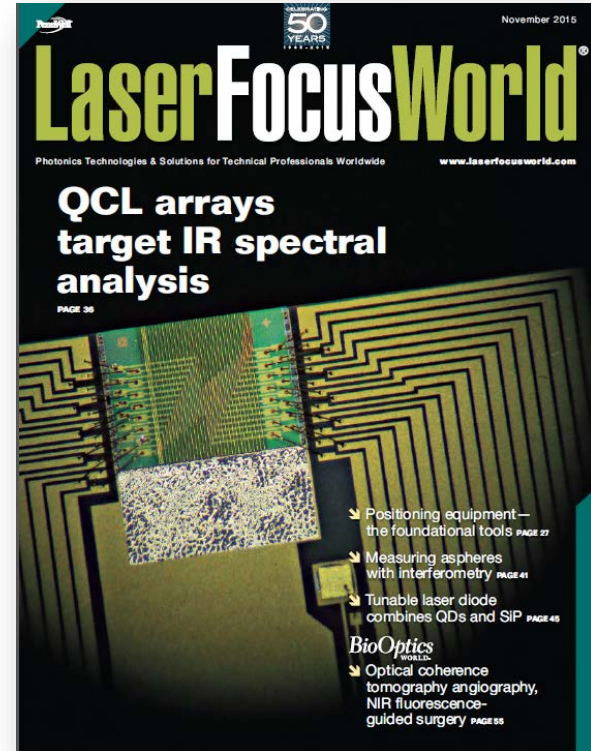
**Mark Francis Witinski**

Co-Founder, VP of Chemical Analysis

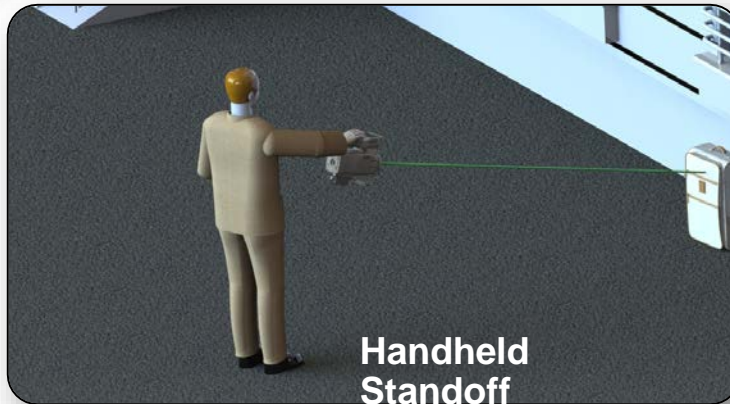
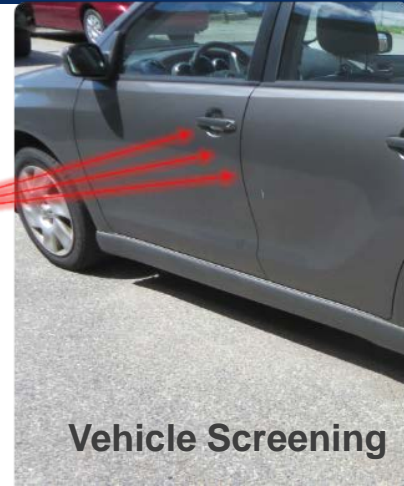
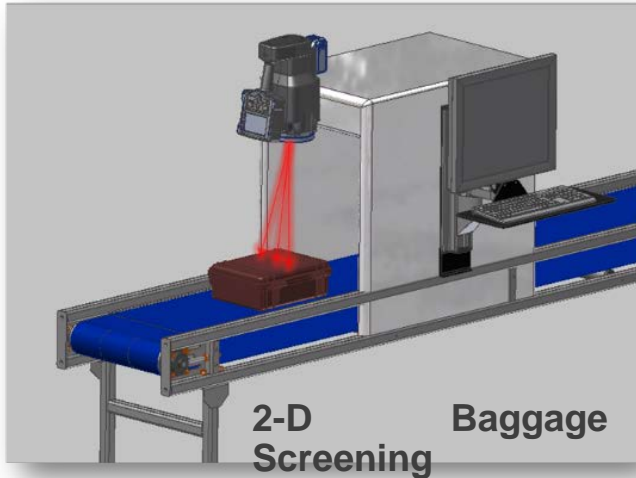
witinski@pendar.tech

607-351-5548

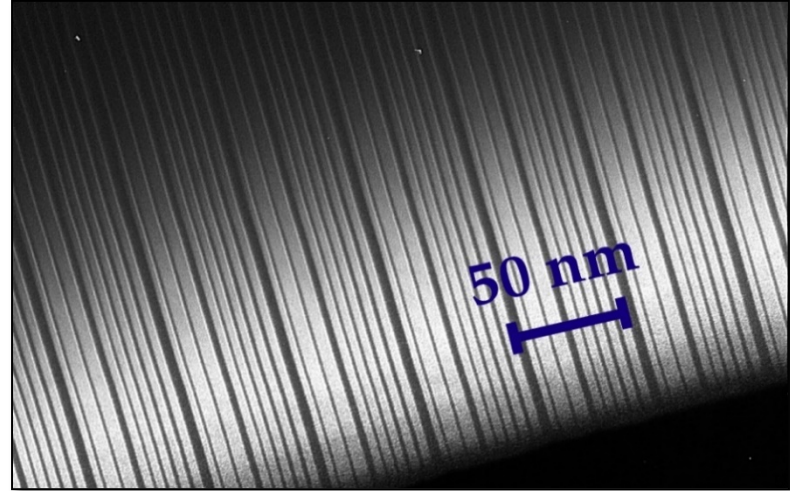
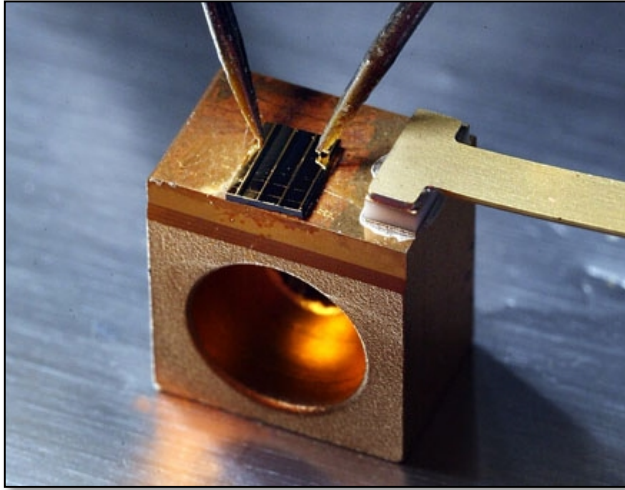
***QCL ARRAYS FOR EYESAFE  
STANDOFF  
DETECTION OF HAZARDS***



# Trace Explosives Detection Using IR Reflectance

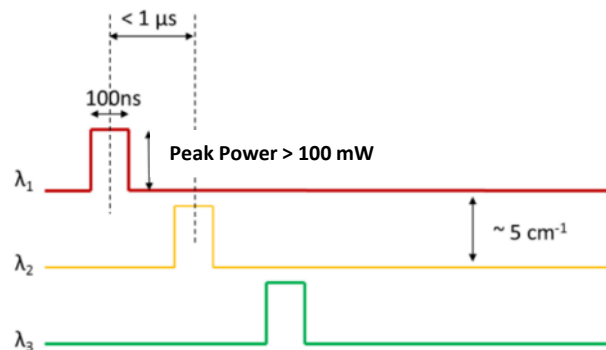
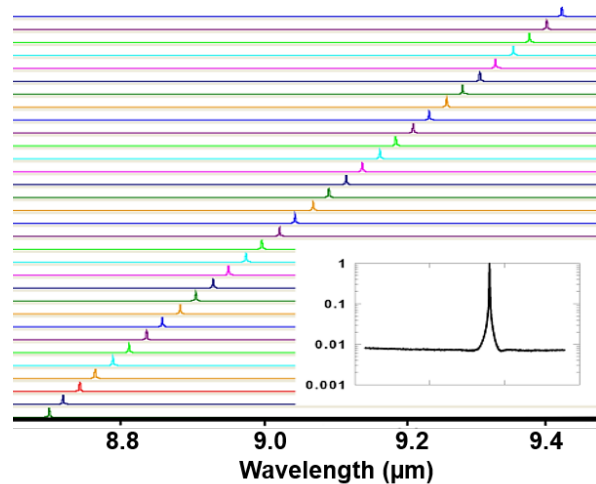
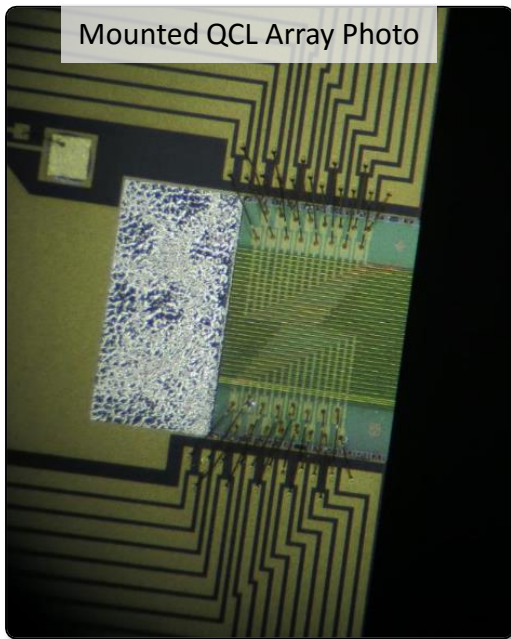


# What is a Quantum Cascade Laser?



- Only monolithic source for LWIR fingerprint
- Tailorable to almost any infrared wavelength
- Can replace FTIR for many things
- Invented by Prof. Federico Capasso, Pendar Co-Founder

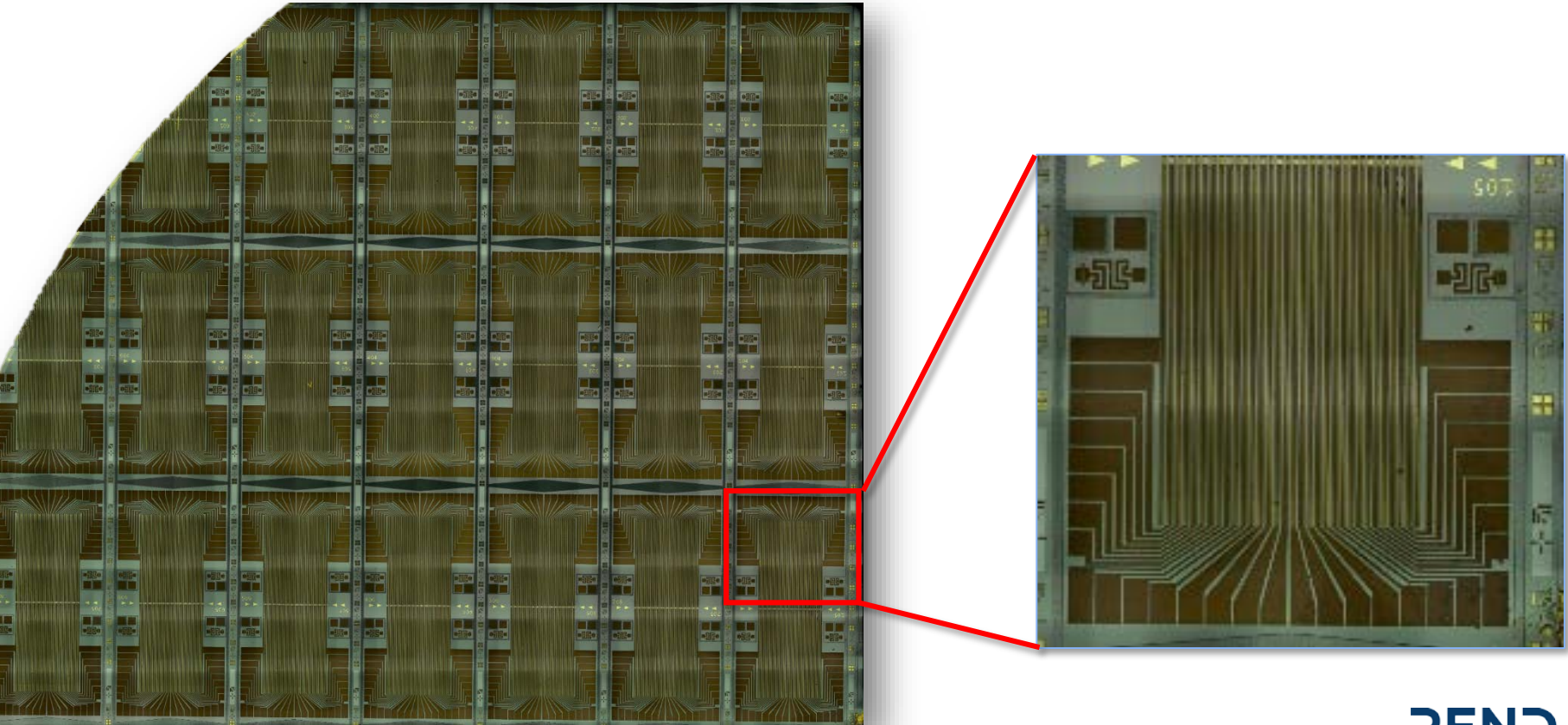
# What is a QCL Array?



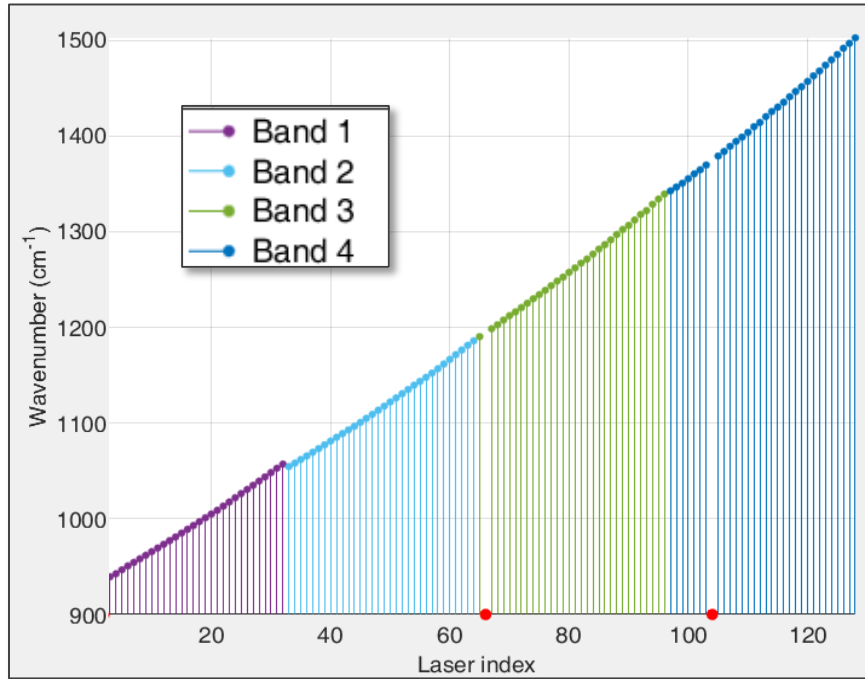
- A QCL Array is a monolith of many QCLs, each with its own unique, exact wavelength
- Allows fast tuning through IR with no moving parts



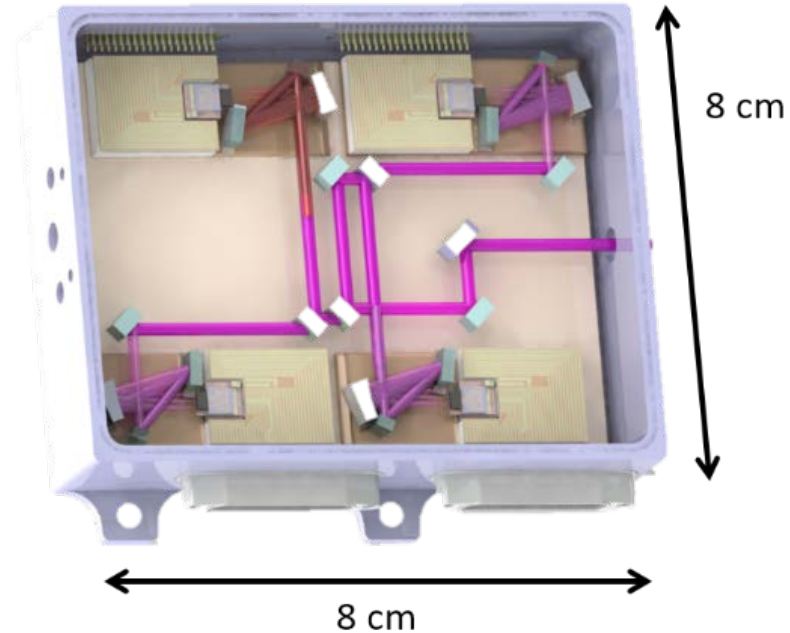
# Proven Scalability for Mass Market (Dual Use)



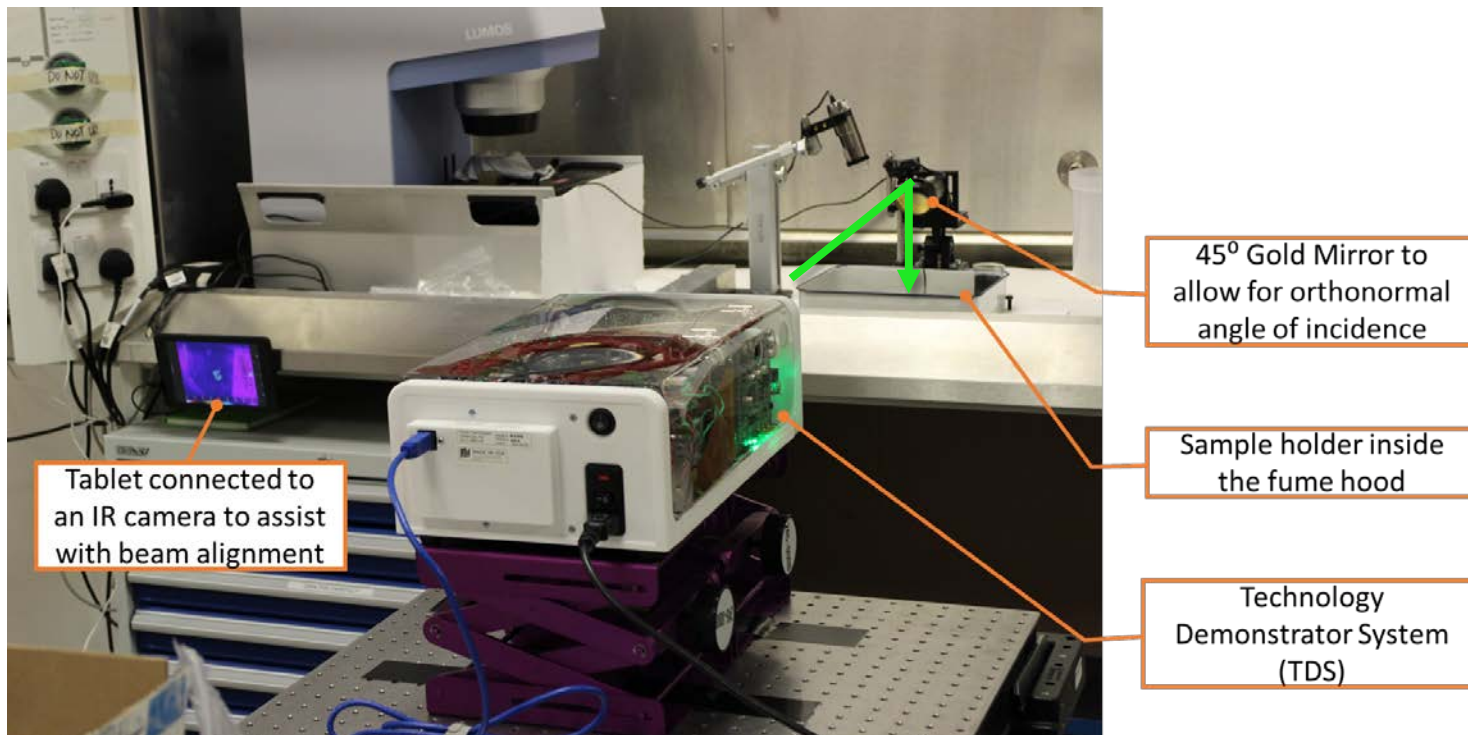
# Cover LWIR w/One Integrated System? → Combine Arrays!



**Experimental Result of 128 QCLs  
Integrated as Shown With Just 2 Lasers  
Not Meeting Spec**



# Instrumenting the Array



**Basic Condensed Phase Integration**

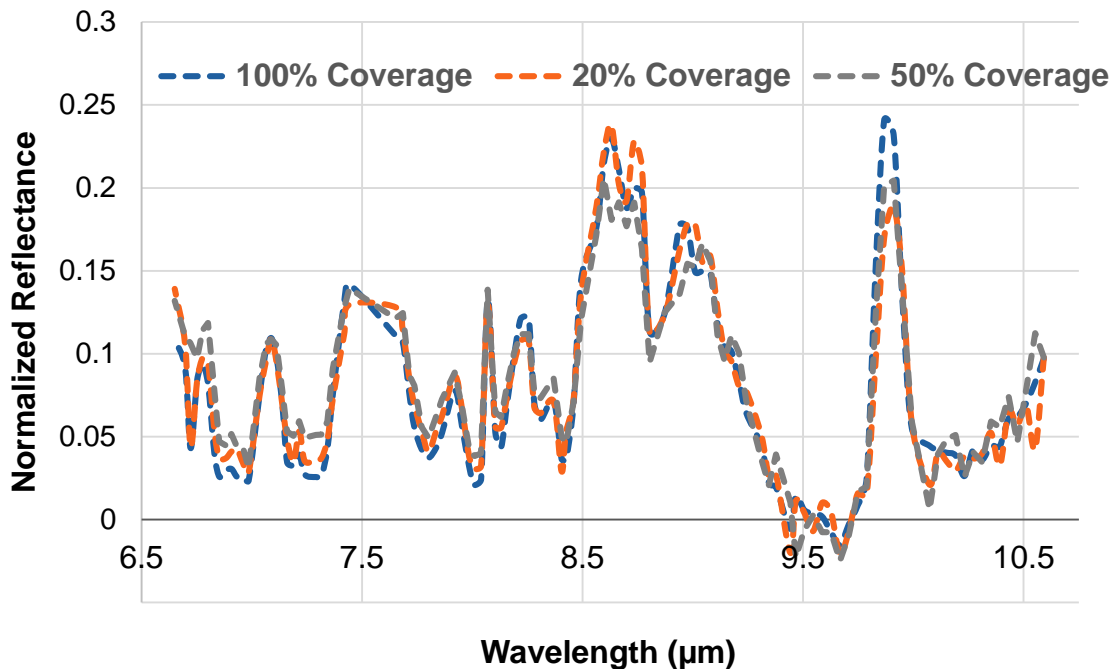
# Example: Condensed Phase Analysis from 1m in 1s



Experimental Data Using System of  
Slide Eight

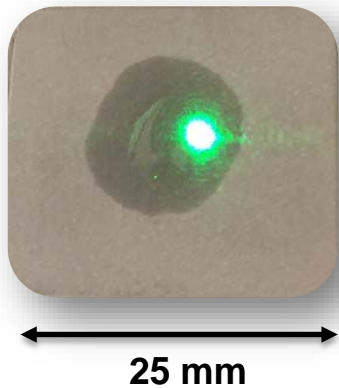


# Example: Condensed Phase Analysis from 1m in 1s



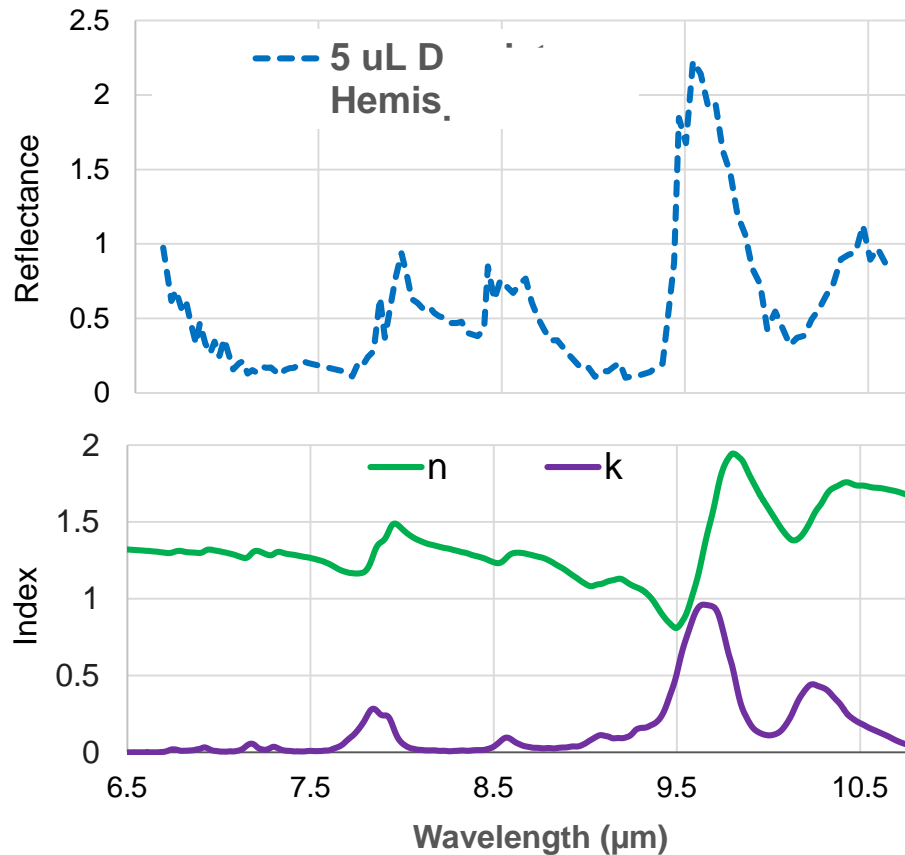
Experimental Data Using System of  
Slide Eight

# Liquids & Films



$$n_{eff} = \hat{n} + i\hat{k}$$

$$L_{abs} = \hat{n} + \frac{\lambda}{4\pi k}$$



# Handheld Using Autofocus Allows Range of Distances

