



Quantum Cascade Lasers and Systems:  
Leveraging Proven Security Opportunities  
Into High Growth Markets

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# 1. Executive Summary

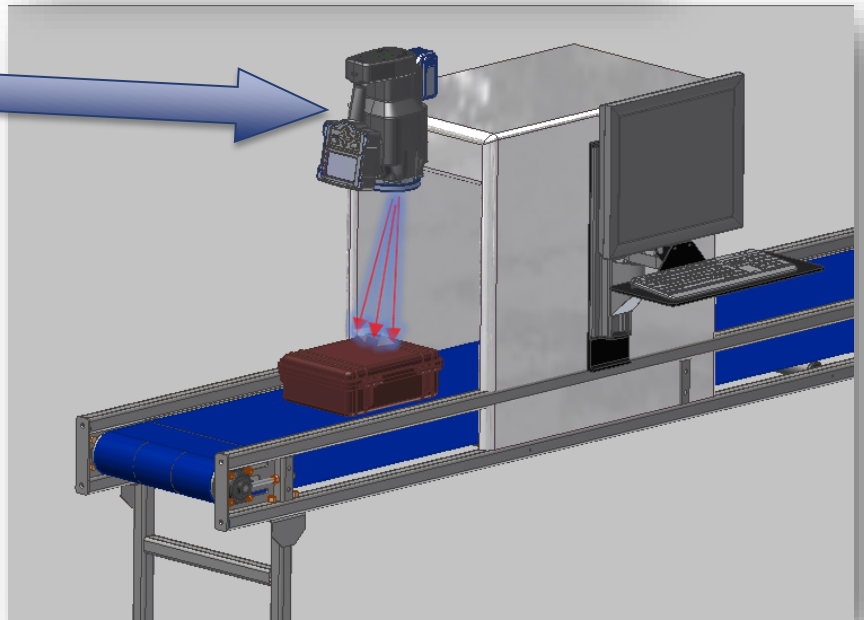
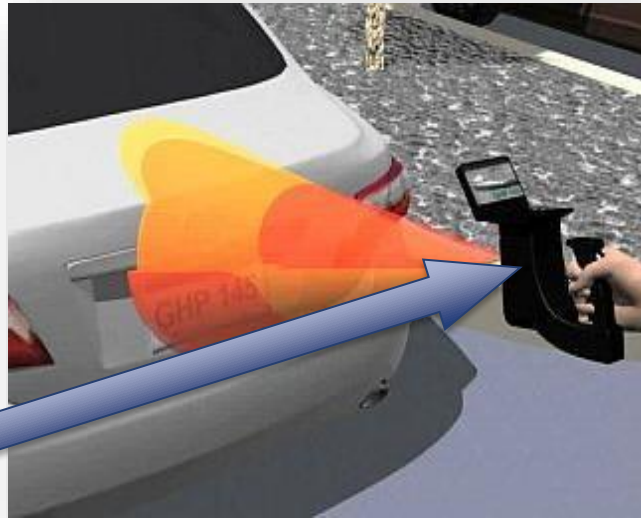
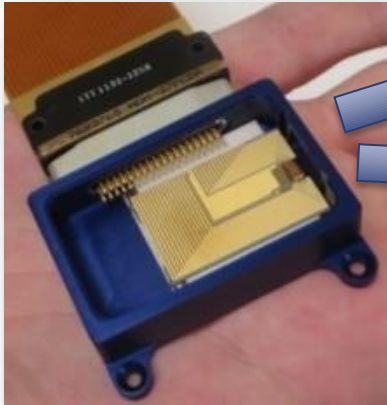


Portable Optical Analysis

- ✘ Eos designs and manufactures tunable quantum cascade lasers targeting handheld, real time **portable** spectroscopy markets
- ✘ Company began in 2011 and has 2014 revenue of >3M, is debt free, and is growing.
- ✘ Licensed Granted IP invented by founders and Federico Capasso of Harvard Univ.
- ✘ Working with large suppliers to bring out a hand held spectrometer

# 1. Standoff Detection of Explosives (ETD)

The Matchbox is the light engine for a new generation of standoff ETD systems



## 2. Eos Photonics: The Team

Prof. Federico Capasso



Christian Pfluegl



Laurent Diehl

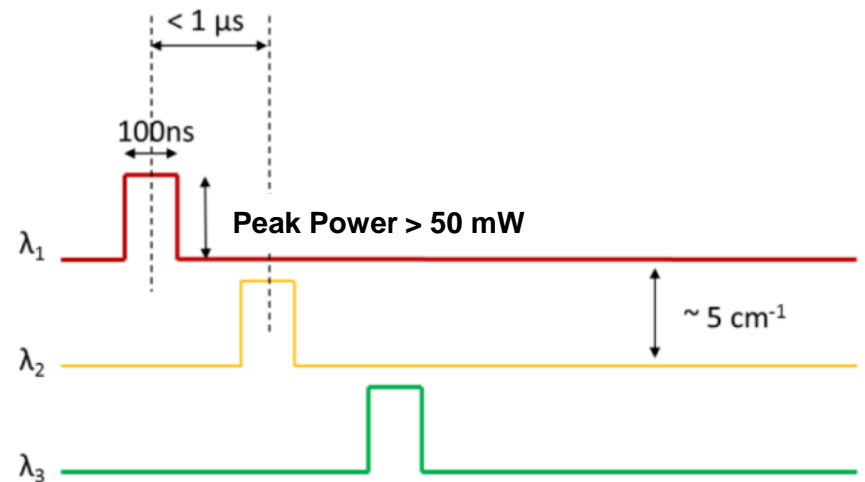
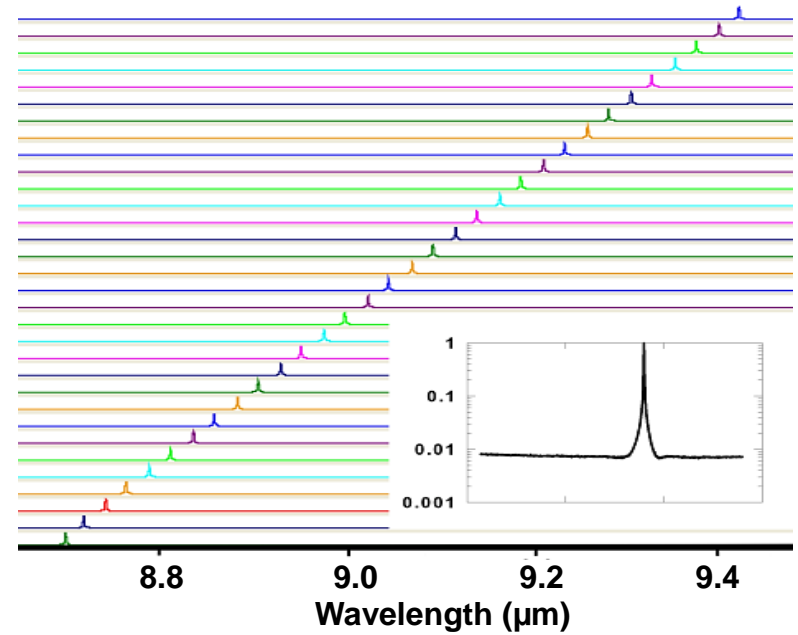
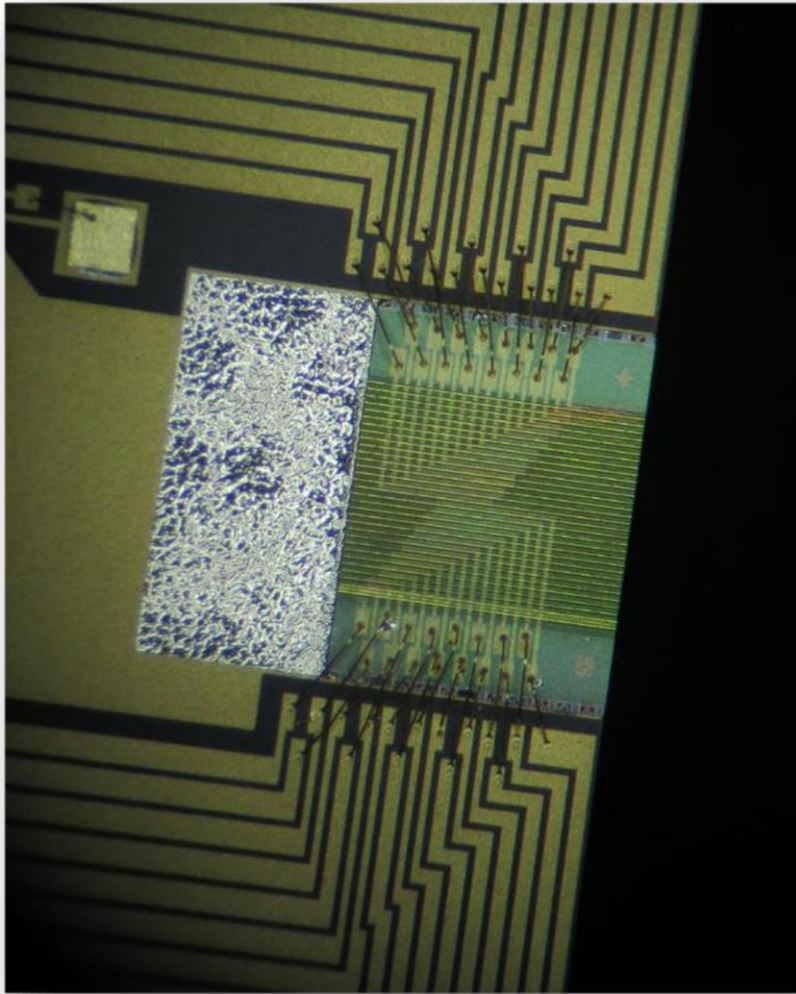


Mark Witinski

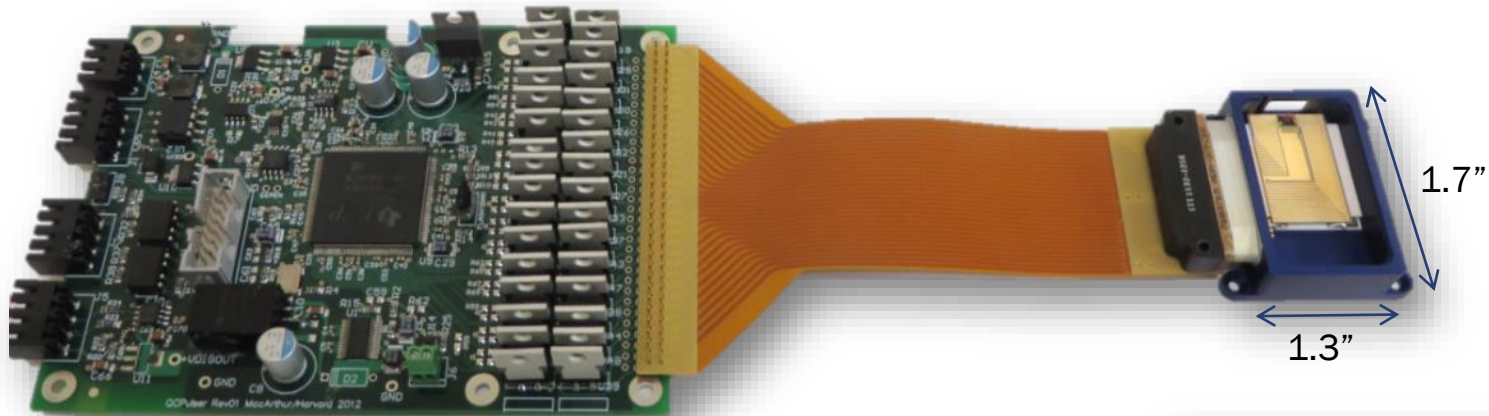


- ✘ Formed by Capasso and Jim Anderson postdocs, has grown to 15 people since founding without venture financing (Capasso is Chairman)
- ✘ Massive combined experience in QCL R&D, packaging, and field applications
- ✘ Focused on QCL array concepts that enable portable spectroscopy with unprecedented sensitivity, robustness, speed
- ✘ Unique end-to-end mastery from bandstructure to instrument building enables greater agility in the market, high growth potential, and strong partnerships with customers

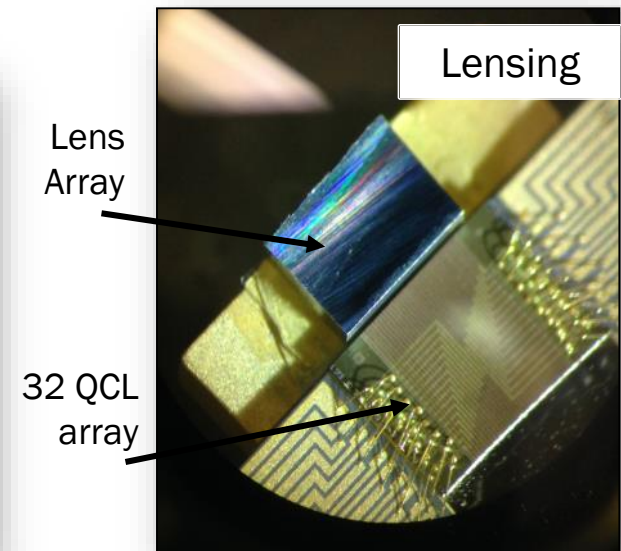
### 3. Core Technology: Monolithic QCL Arrays



## 4. Status: The Matchbox (Prototype) Products



- ✘ Packaged 100, 150, 200  $\text{cm}^{-1}$  arrays available in LWIR and MWIR
- ✘ Includes QCL pulser and software for sync. high speed laser control, DAQ, and signal processing
- ✘ Insertion into full sensor systems is ongoing

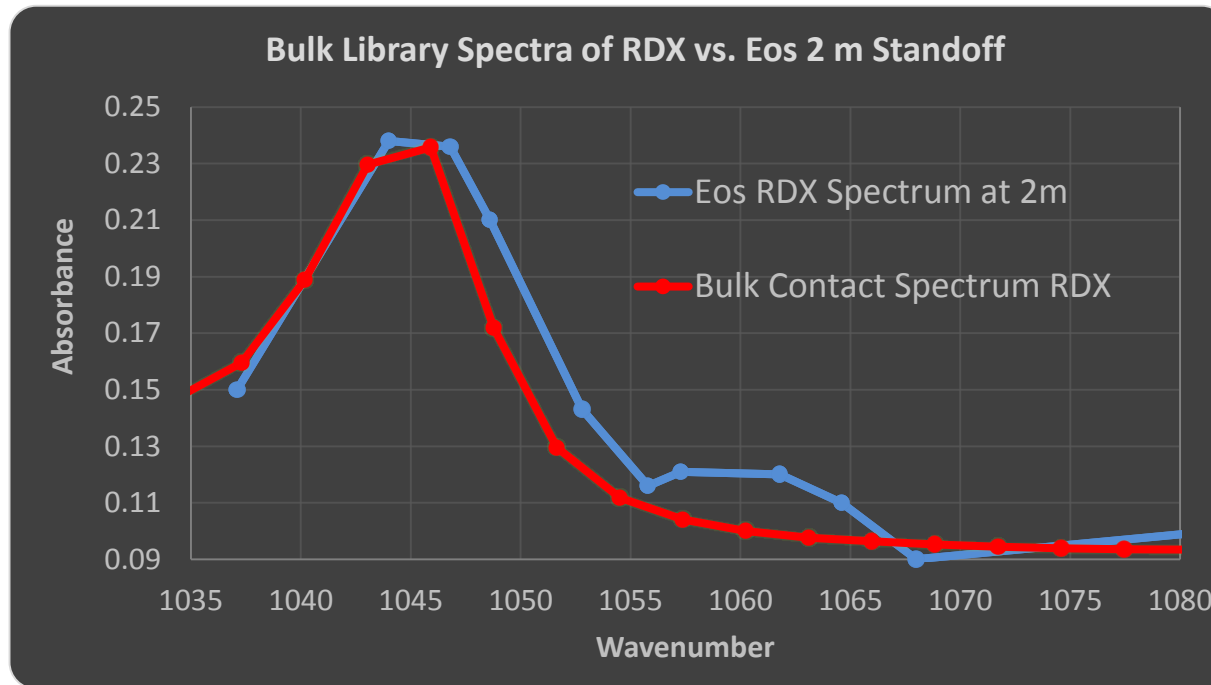


## 4. Status: Producing Handheld With No Moving Parts



- ✘ Eos has already build a handheld QCLA-based spectrometer that provides better performance than any tool in the space, some of which cost 100k.
- ✘ For use in security and material analysis generally
- ✘ Contacts in many gov. agencies verify that the design, performance, price, etc... are ideal.
- ✘ Broad industrial utility in field such as pharma, chemistry, energy,...

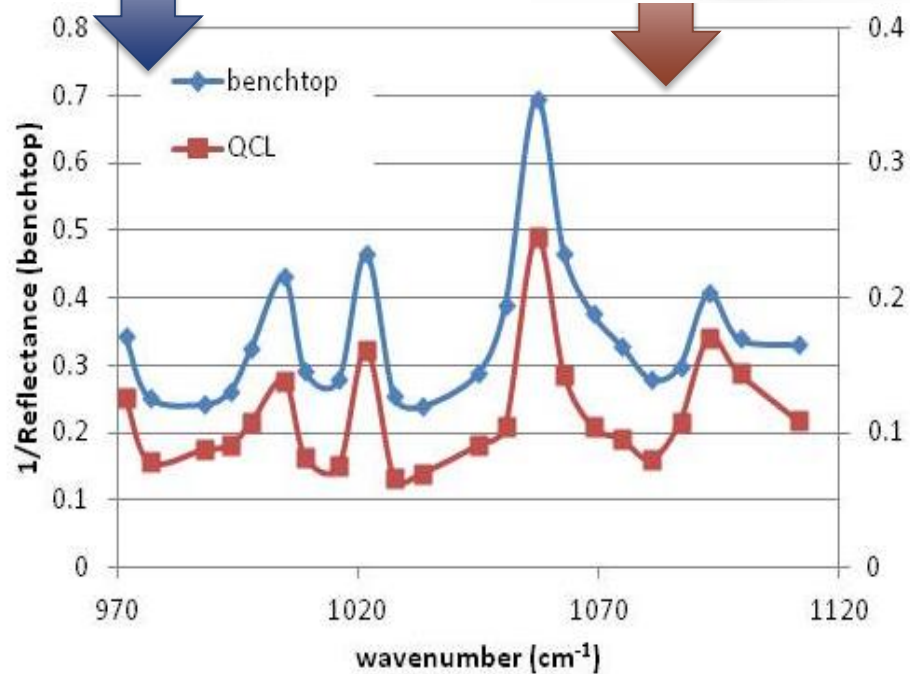
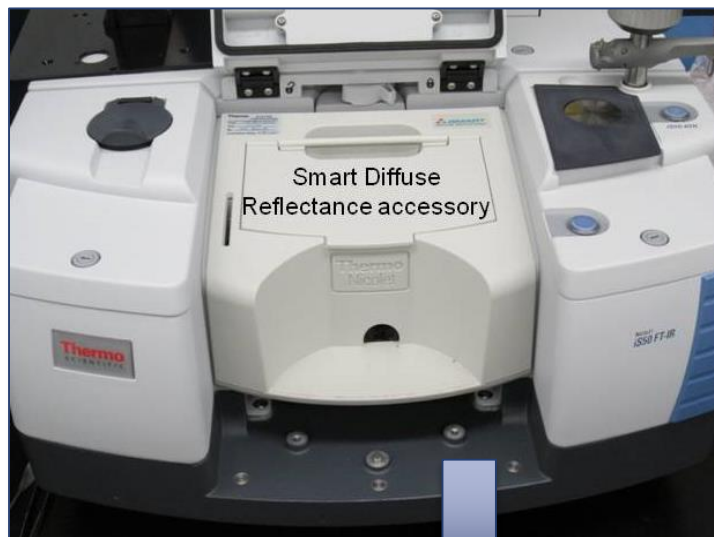
# Our Handheld – Trace RDX at 2m in 1 sec



- × Experimental reflectance spectra of 100  $\mu\text{g}/\text{cm}^2$  of RDX deposited onto Al



## 5. Application Example: Ibuprofen/Pharma

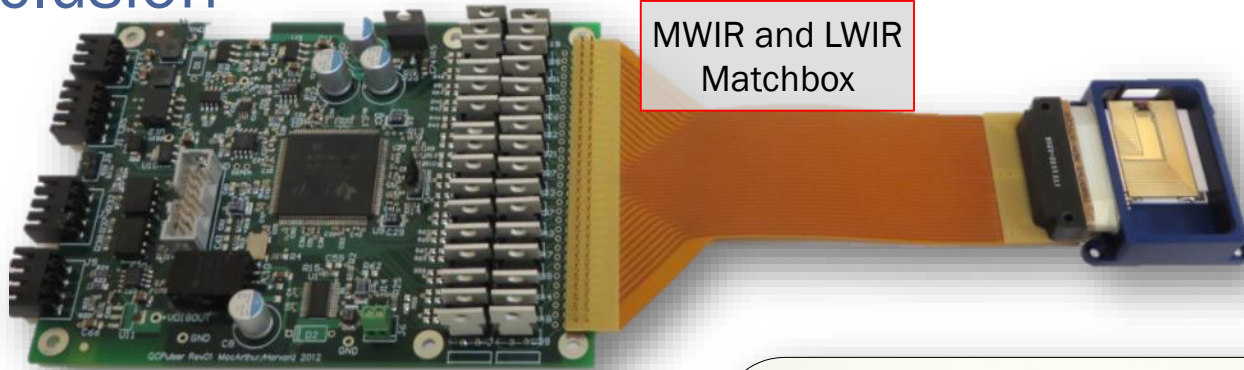


## 6. Standoff Reflectance – The Need for Speed



- × From trace to bulk – there’s only so many ways to build a molecule
- × *Pharma* particularly appealing due to “known knowns”
- × *Speed* is the differentiator for both cleaning of vessels and material ID  
(Industry currently well-served by slow techniques that badly undersample)

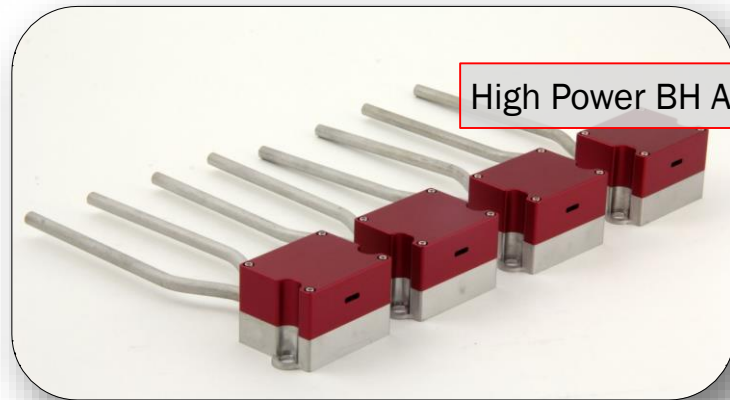
# Conclusion



MWIR and LWIR  
Matchbox



Full Portable Systems



High Power BH Arrays

The Future is Bright, Slow, Deliberate

- × Production scale-up
- × On Chip Beam Combining
- × Imaging (!!!)

Questions?

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