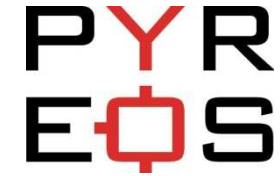


PYREDS

Registered in Scotland SC 328115

***Unique Thin-film Pyroelectric IR Sensor Components***



## Company History

2007

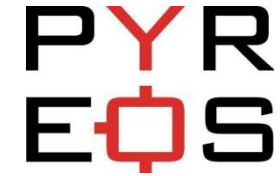
- Company is incorporated
- Acquires technology and patents from Siemens

2008

- Raises \$6.5 M of investment
- Develops manufacturing supply chain
- First product(s) launched
- First revenues & product shipments

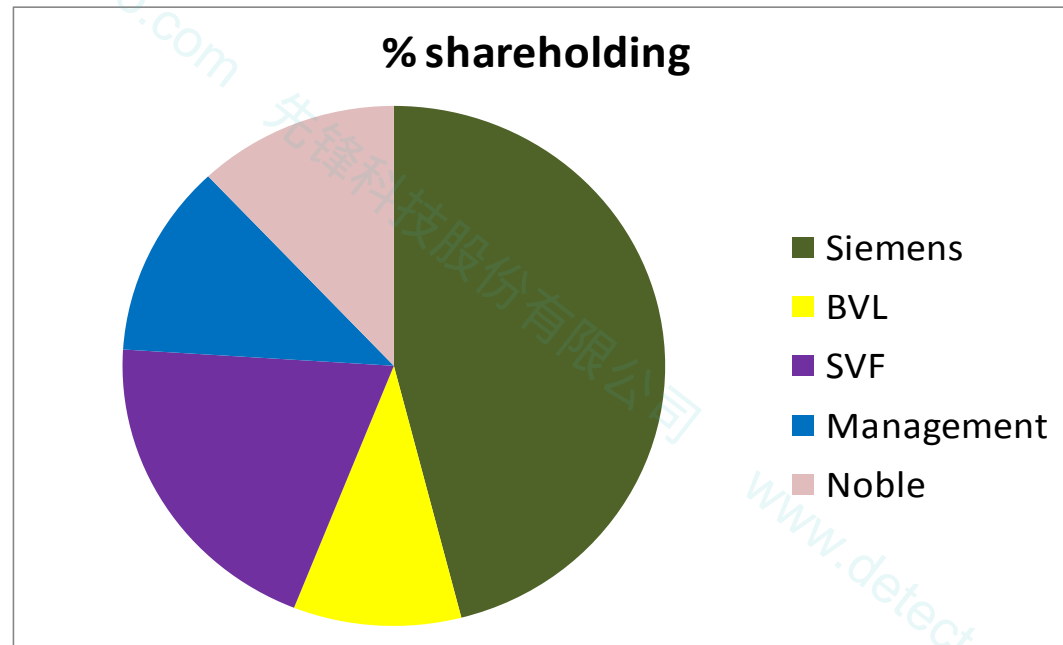
2009

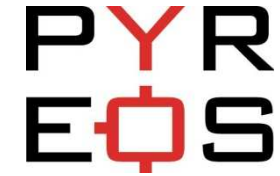
- First spectroscopy sensor products launched
- First FT-IR product launched
- Customer order book >\$10M
- Expanding global operation
- \$2M of follow-on investment



# Company Introduction

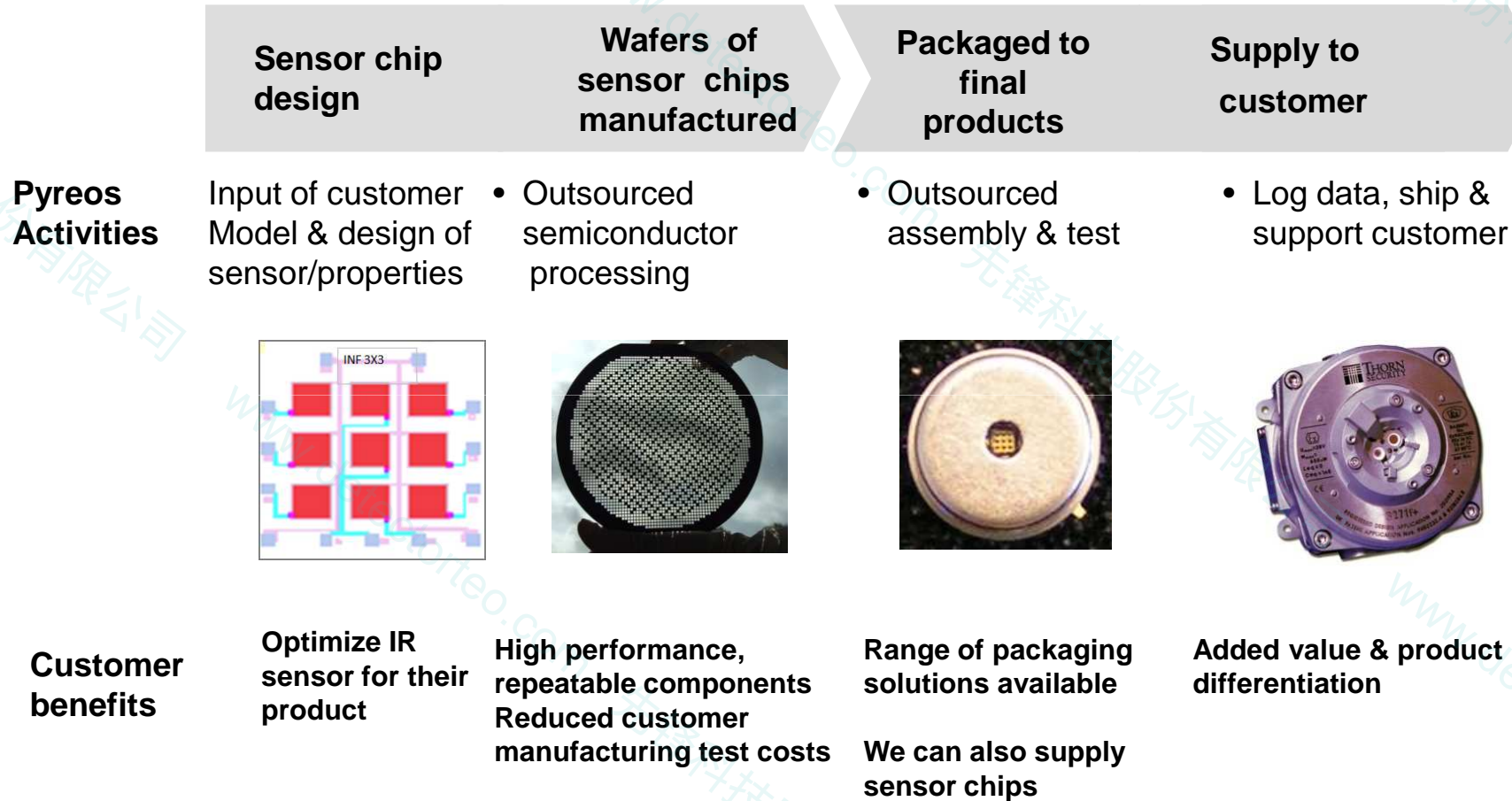
- Private Company
- Backed by Siemens
- Investment from leading UK VCs
- Strong Management Team
- Aim to be leading IR component supplier
- We bring unique flexibility in IR sensor product design



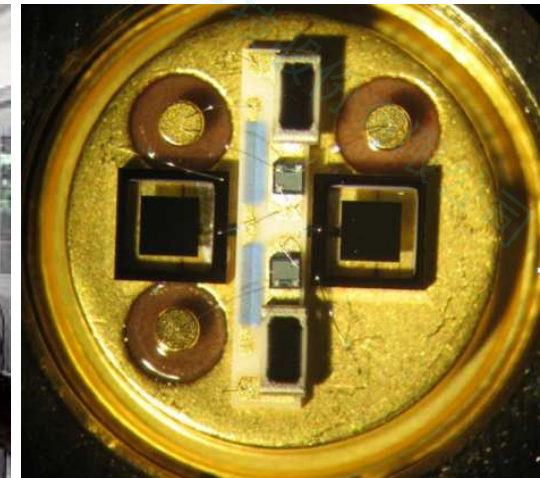
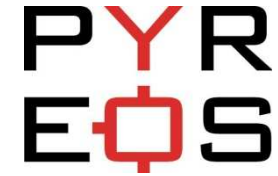


# Pyreos is an IR Component Supplier

Flexible and scaleable supply chain with dual sourcing in place



# Operations



## Corporate HQ in Edinburgh

- Direct sales & applications support
- Product Development
- Full product design capability
- Class 10 development cleanroom
- €30M tool-set
- Develop & improve our products
- Provide customer added value

## Outsourced wafer fab in Europe

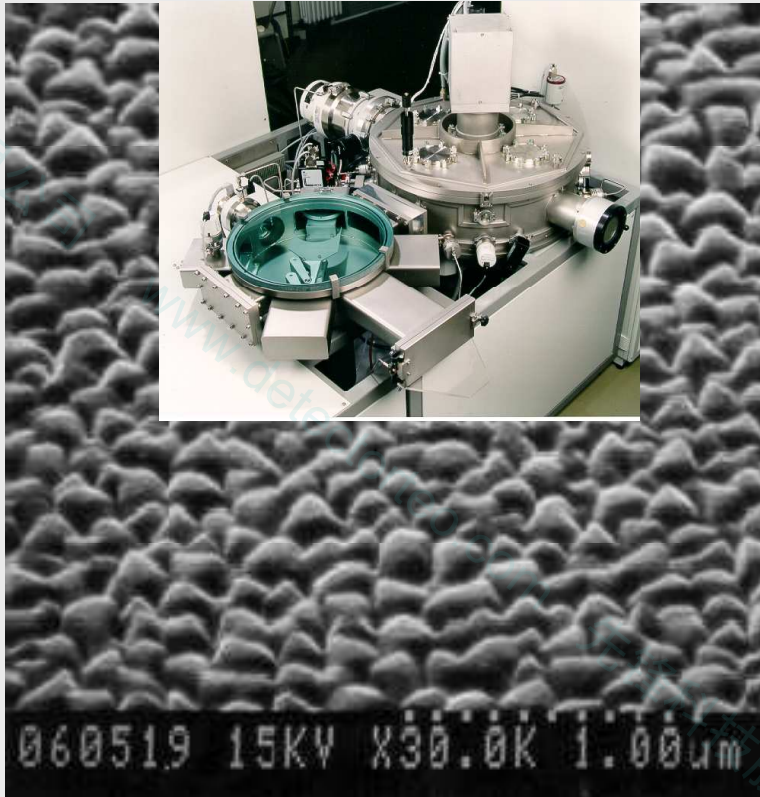
- ISO & automotive qualified foundry
- Foundry makes product for leading companies
  - Daimler, Audi, Nokia, etc
- Pyreos capacity ~ 100k sensors /mo. (depends on specific product)
- Dual sourcing in place

## Outsourced assembly

- Several assembly partners
- All ISO qualified
- Europe & Asia based
- Range of packages available
- Unlimited capacity

# Our Thin-Film Pyroelectric IR Sensor Technology

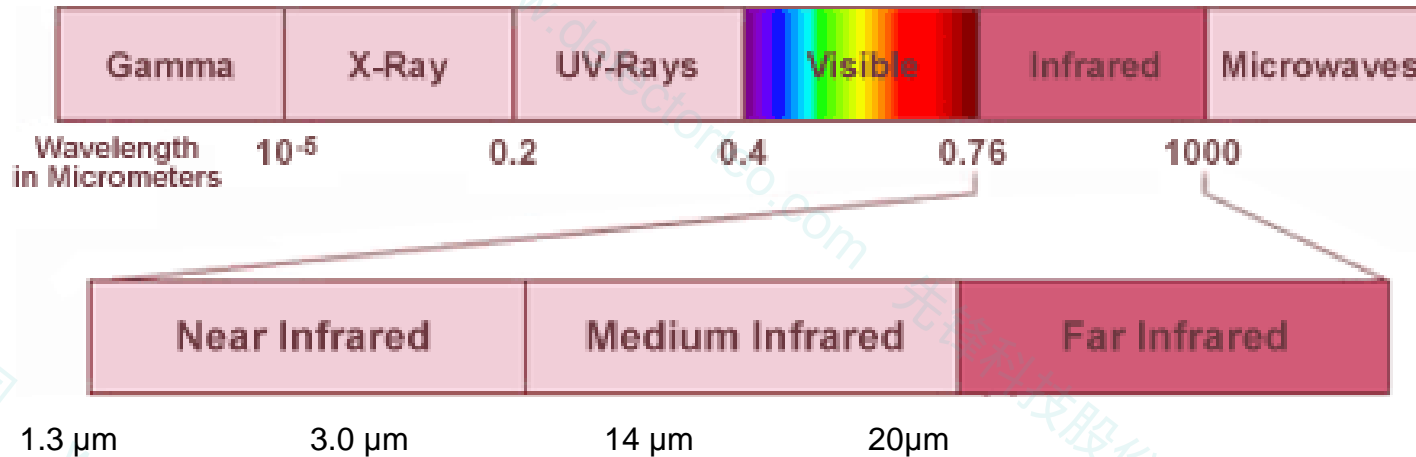
## Thin film Processing



## Developments

- 15 years of research into the thin film material & deposition process
- **Unique** PZT material & structure
- **Permanently self-polarized** –no performance decay **ever**
- Extremely versatile - performance can be fully tuned
- Fully researched & understood
- **Stable** mature technology

# Near-IR and Mid-IR Detectors



*One IR technology for all IR regions*

***Unique flexibility to address all IR markets***

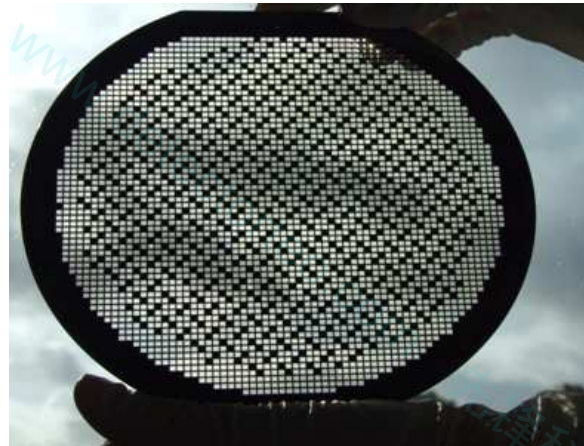
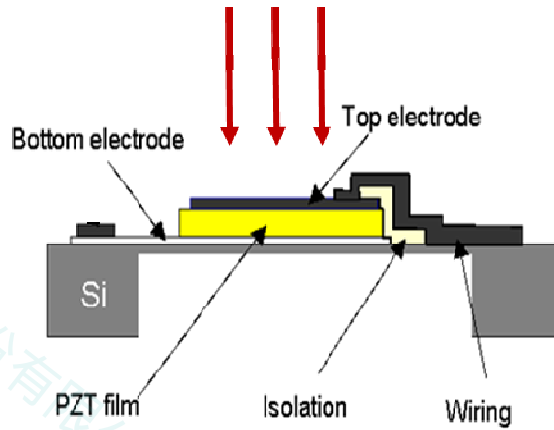
***Many environmental applications***

***Many security applications***

***Many medical applications***

***Consumer energy saving applications***

# Our Thin-film Pyroelectric IR Sensor Technology



## Core Technology

- Sputtered ~1 micron PZT film
- No poling required!
- MEMs style membrane structure
- Broad absorption range from 1.3 - 25 microns
- Cost effective customization of
  - Sensor product design
  - Sensor performance

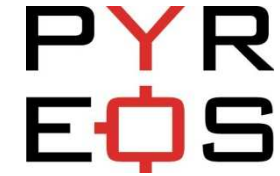
## Manufacturing Process

- Standard semiconductor manufacturing
- 6 inch wafer process
- Highly controlled and repeatable performance guaranteed
- Allows new product design possibilities
- Excellent cost-to-performance ratio
- Unique technology of Pyreos

## IP Protection

- 14 granted patents
- ~10 patent applications proceeding
- Process, equipment & design know-how
- Continuing to build IP portfolio





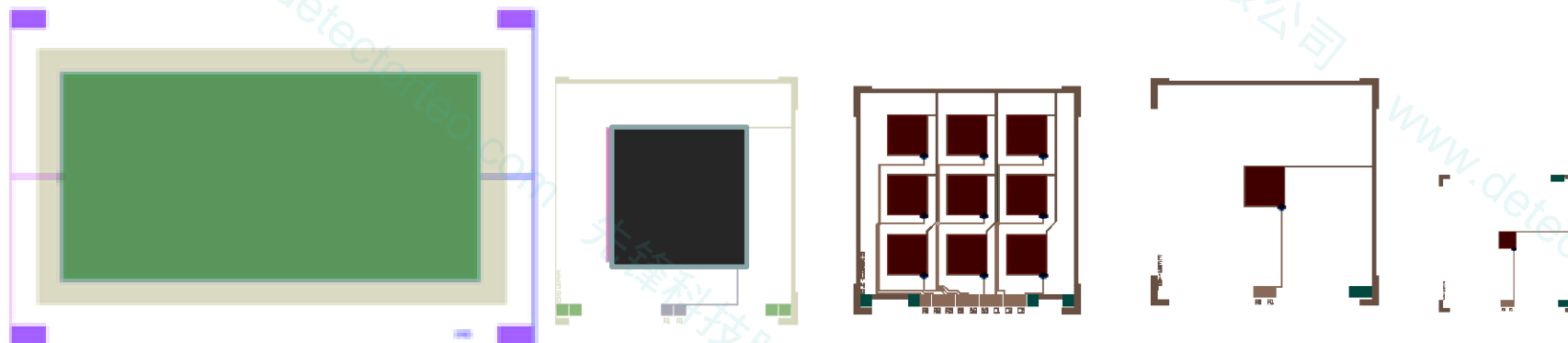
# Completely Tunable Sensor Performance

All parameters of device are controlled for the first time!

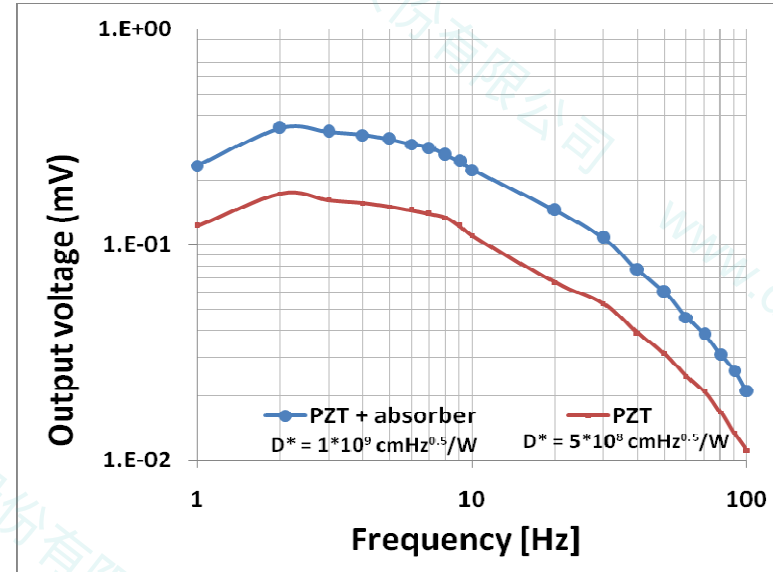
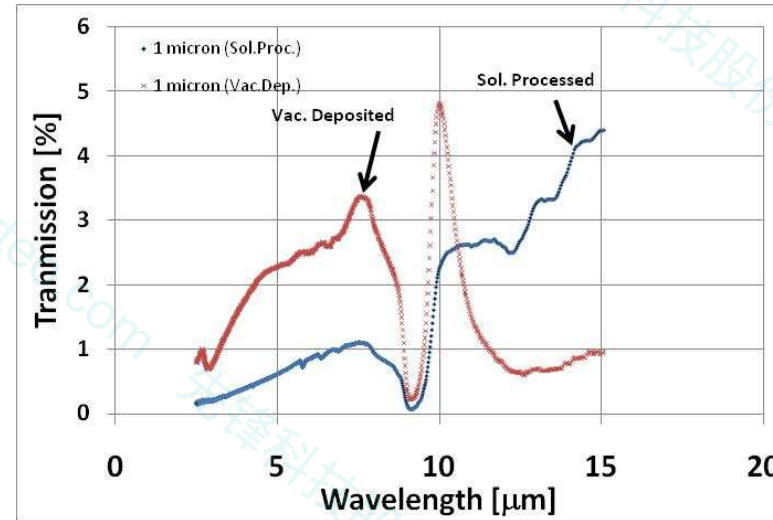
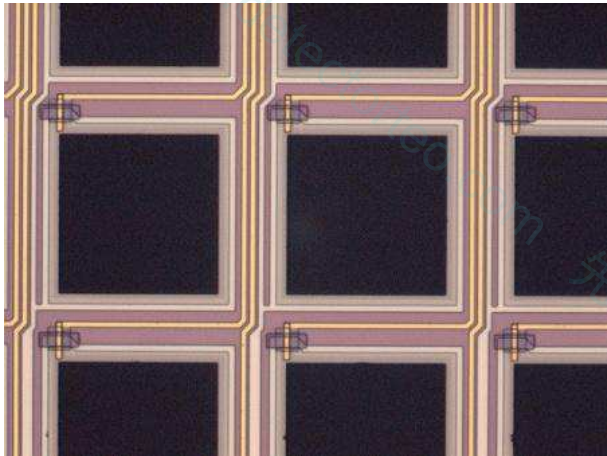
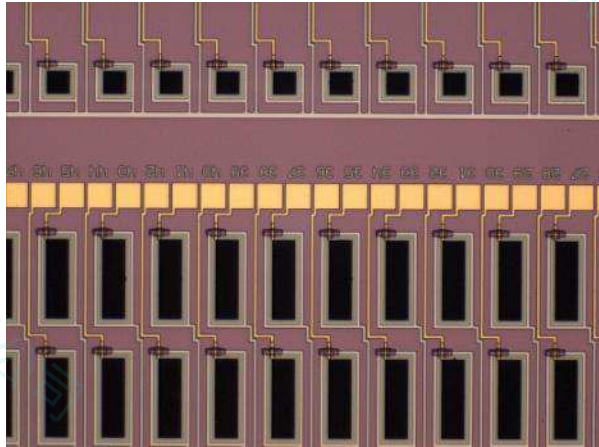
Control of

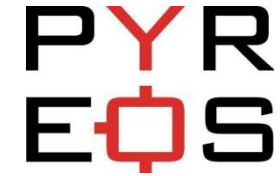
- Pyroelectric capacitance (layer thickness)
- Pyroelectric device area (small or large)
- Extent of thermal isolation (membrane size)

**Ability to provide new products never before possible at economic cost point**



# IR black absorber layer is compatible with Pyreos manufacturing process





# Benefit of Pyreos IR Sensors

- **Highly sensitive**

- $D^*$  can be tuned to reach  $> 1 \times 10^9$
- 1,000,000V/W responsivity with Op amp

- **Low noise**

- Noise stays low at elevated temperatures

- **Fast Response time**

- $\leq 5\text{ms}$  (is part of sensor design)

- **Rugged solid state construction**

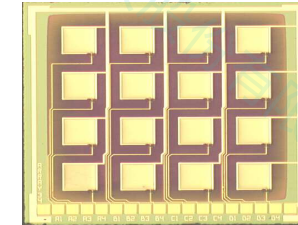
- SMD compatible, stable to  $500^\circ\text{C}$

- **Low microphonics**

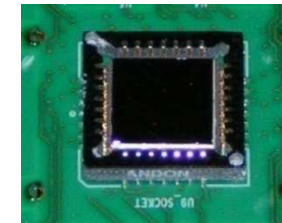
- Highly stable MEMs structure

- **Small or large sensors**

- Design flexibility, from  $150\mu\text{m} \times 150\mu\text{m}$  size to  $3 \times 2 \text{ mm}$



Sensor array die

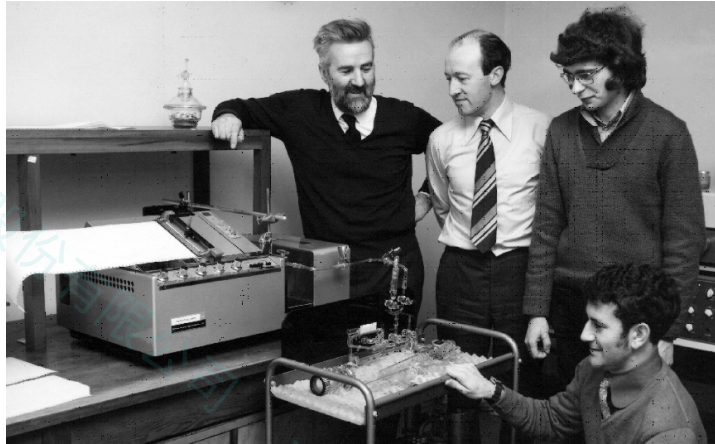


SMD compatible package



T0 packaged array

# New Opportunities for IR Spectrometers



1960's onwards

*Gratings Based IR*  
*First affordable lab based IR*

*Bulky, slow, fragile*  
*Expensive / Difficult to use*  
*Major advance in analytical science*



1980's onwards

*FT-IR*  
*Easy to use in lab.*

*Fast, flexible but \$\$\$*  
*Completely replaced gratings based IR equipment*

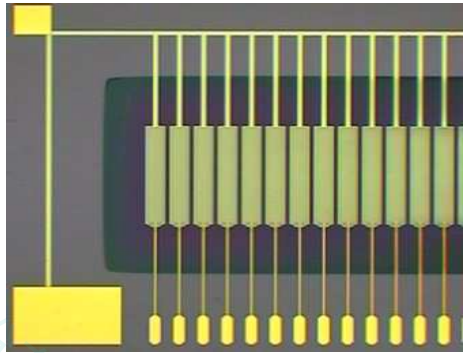


21<sup>st</sup> Century

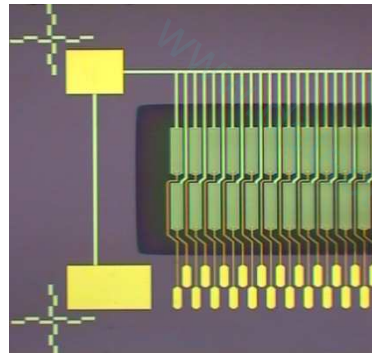
*Portable*  
*Simple to use & quick results*  
*Untrained users*

*Grating and FT-IR approaches*  
*work in portable*

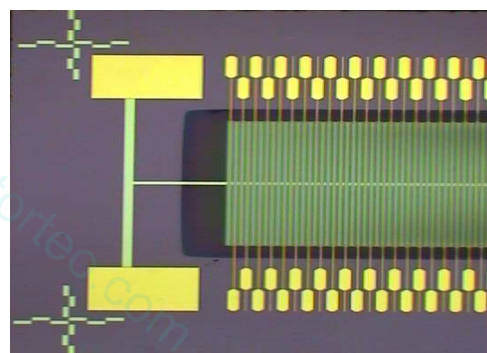
# Pyreos IR Line Sensor Products



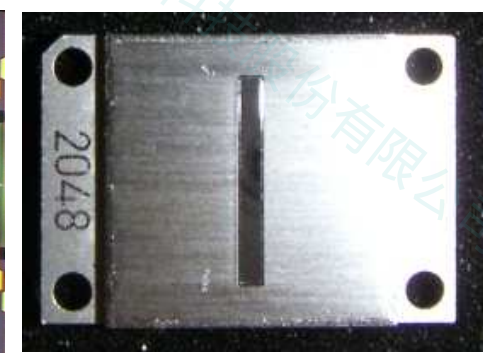
1 x 128 line sensor



2 x 128



1 x 512 line sensor



Common package type

Available with wavelength filter for;

*Near IR Filter (1.3 -3.2 microns) , Mid & Far IR Filter(2-20 microns) also Linear Variable Filters*

Brings new opportunities for personal & portable IR products

- Personal health monitoring devices e.g. blood, blood glucose levels, urine, saliva - healthcare “daily analysis at home”
- Lower cost miniature NIR spectrometers, New MIR miniature spectrometers
- Industrial process control at affordable price
- Security applications, - drug and explosive detection
- Laser calibration

# Pyreos Large Area FT-IR Detector Product



## Single Element Detector

Large area detector (3 x 2 mm) with good performance

Familiar TO can package

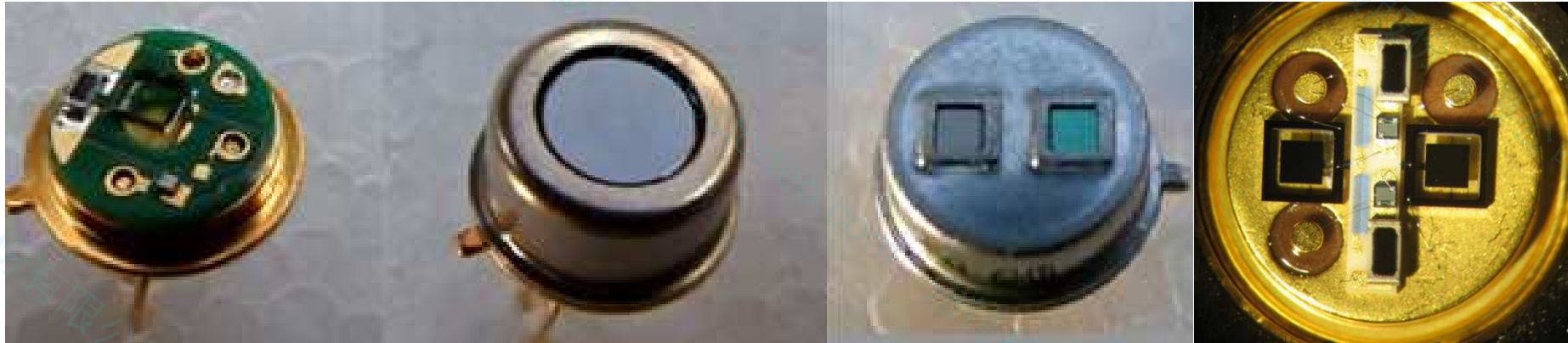
Solid state product (no window required)

High Curie point (600C) with low microphonics

***Excellent performance from 2-20 microns, at a very affordable price***

***A new option for FT-IR manufacturers***

# Gas Detection Products (Mid-IR Detection)



## Pyreos Product Range

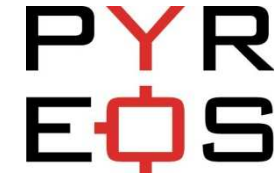
Aimed at most common gases - replacement type products  
Single & dual channel sensors e.g. CO<sub>2</sub> & Ref – see datasheets

## Competitive Advantages:

High responsivity 1,000,000 V/W with  $D^* = 3 \times 10^8$   
Low noise allows standard low cost amplifiers to be used  
Excellent reliability  
Good cost

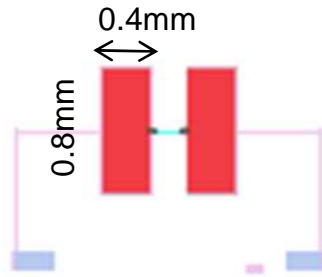
## Product Roadmap

4 channel TO-5 miniature gas sensor



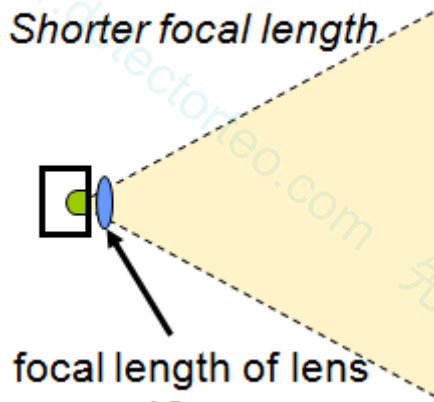
# Pyreos offers Small Sensors for Motion Detection

## Pyreos PIR



### Small size leads to:

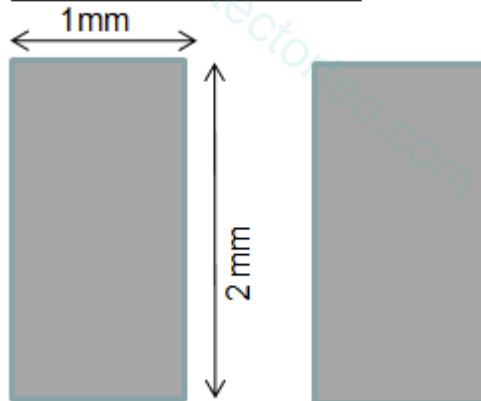
*Shorter focal length*



*Smaller products  
No performance loss  
More market share*

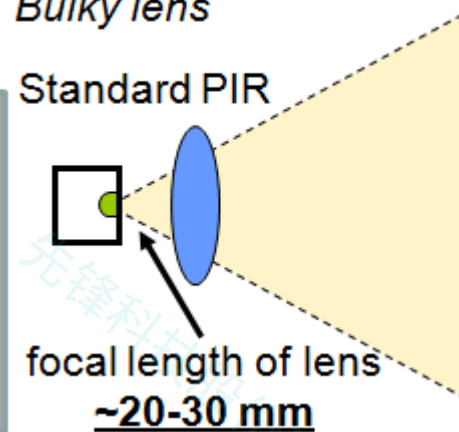


## Conventional PIR



*Bulky lens*

Standard PIR

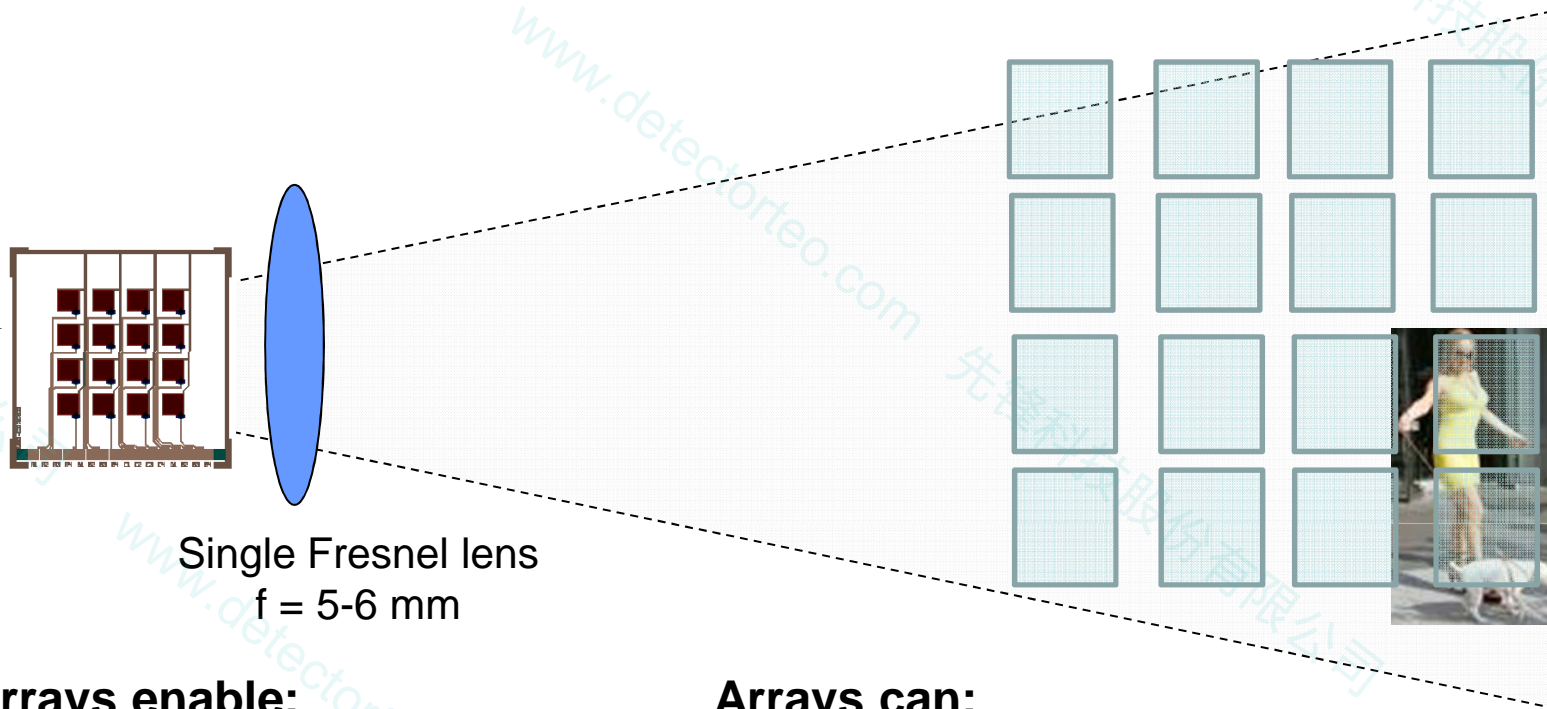


*Bulky, large products*





# Pyreos offers Sensor Arrays: People counting, security, transport



Single Fresnel lens  
 $f = 5-6 \text{ mm}$

## Arrays enable:

- True spatial location
- Accurate People counting
- Accurate tracking products
- Tailgating products

## Arrays can:

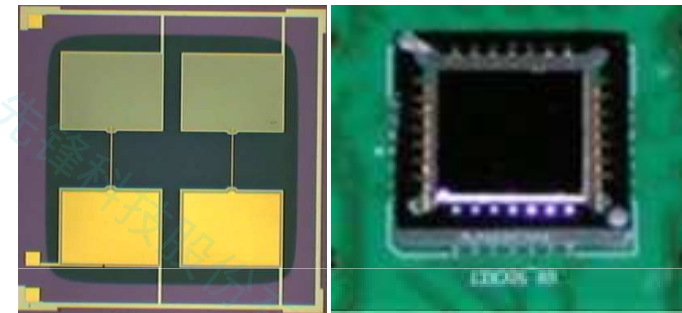
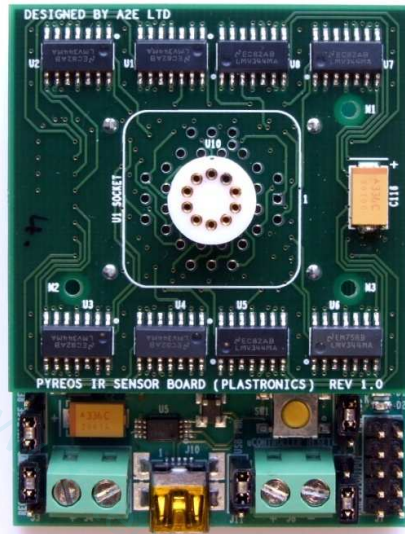
- Add value & functionality
- Differentiate between objects in FOV
- Reduce incorrect alarms
- Cope with all common false alarms
- Replace multiple PIRs in a small footprint

# Full Application Support Offered By Pyreos

Starter Kits to support all Products

OR

Sample Chips or Sensors



- Also available for **LCC package**
- Available for line sensors
- Confirm the high performance of *IR sensors*
- Application notes & white papers
- Helps build up your own app. Software
- Range of detectors & packages
- Will supply chips
- Paired & compensated designs available
- Analogue & new digital products available on request

# Infrared Sensor Market – Competitive Pricing

