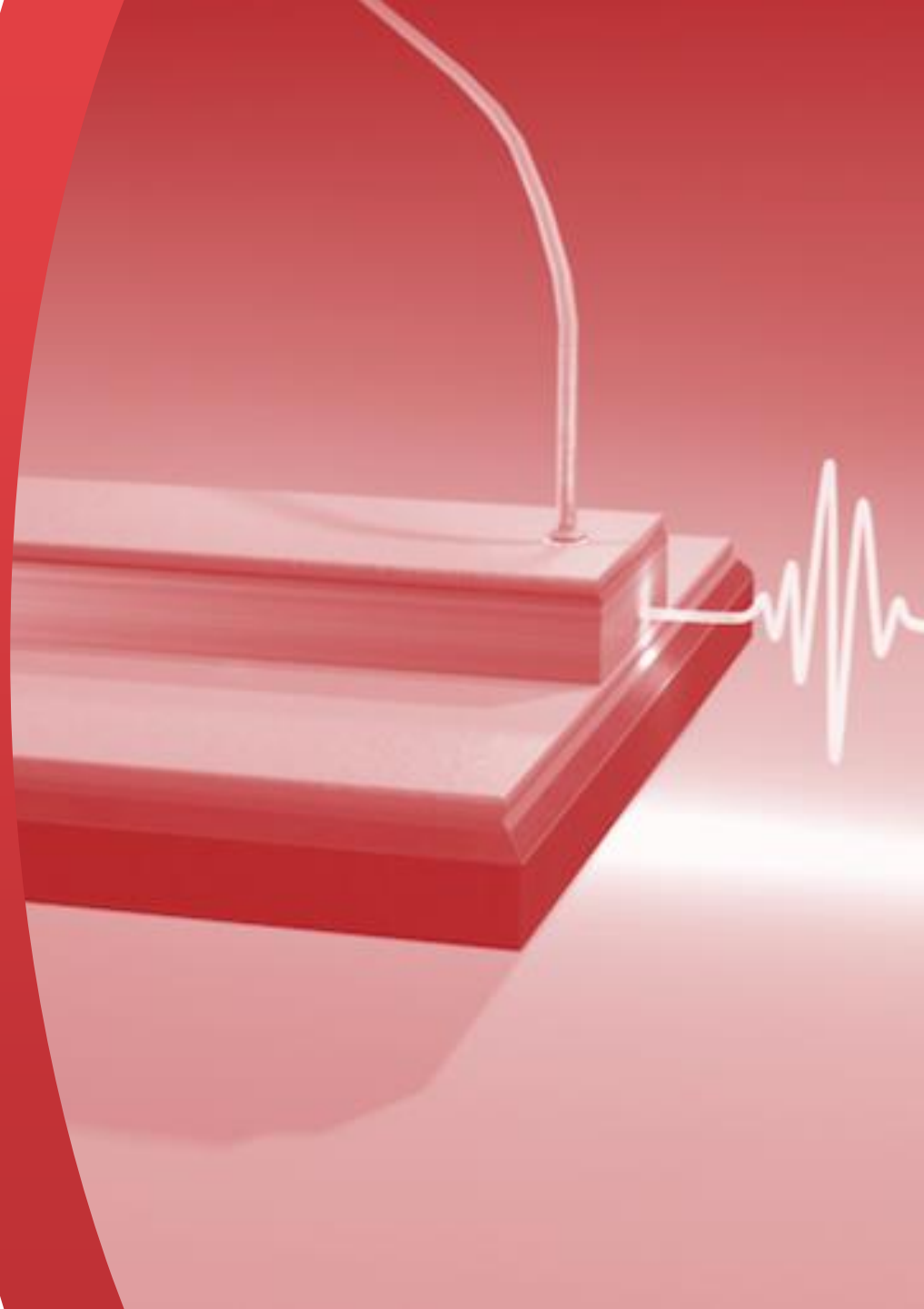
mirSense
laser is smart

# EXECUTIVE SUMMARY



November 2023 | Confidential

# MIRSENSE ADDRESSES TODAY'S MAIN SOCIETAL CHALLENGES: ENVIRONMENT & SAFETY

## CONTEXT

**Major strategic environmental and safety issues call for a dense, large-scale sensor network, to monitor or ensure:**

- CEM, Process control, GHG & Air quality ($CO_2$, $CH_4$, $CF_4$, $H_2O$, NOx, $NH_3$, Formaldehyde)
- Worker safety ($CH_4$, CO, $NH_3$, $H_2S$, Benzene)
- Airborne security (dissemination of manpads)
- Road safety (ethanol)

## PROBLEM

**Mid-Infrared laser-based sensors are needed to ensure adequate monitoring of those issues, but have serious limitations:**

- The are far too expensive (x 10 k USD)
- They are not suitable for embedded applications, in terms of compactness & robustness

## MIRSENSE'S SOLUTION

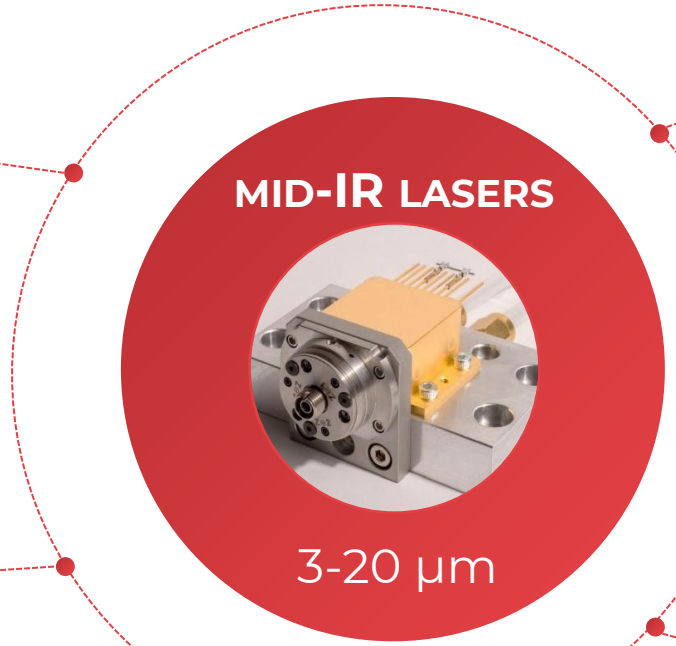
**mirSense provides unique, disruptive, patented Quantum Cascade Laser (QCL)-based sensors to unlock the potential of mid-IR laser-based solutions**

- Our integrated solutions are 100x less expensive and more compact, designed for embedded applications
- mirSense's addressable market exceeds **USD 2 Bn / year**

# MID-IR LASERS EMIT IN THE 3-20 µM WAVELENGTH BAND, WHICH IS OPTIMAL FOR KEY MOLECULE DETECTION AND FOR INFRARED COUNTERMEASURES

## AIR QUALITY
- $CO_2$
- $NO_2$ & NO
- Formaldehyde
- NH3

## WORKER SAFETY
- CH4
- CO
- Benzene
- NH3
- H2S




## CEM & GHG
- $CO_2$
- $CH_4$
- $CF_4$
- $H_2O$
- $N_2O$

## HEALTHCARE
- Glucose
- Ethanol

## IR COUNTERMEASURES
- Airborne protection against missiles

# QCLS ARE TAKING OVER THE MID-INFRARED LASER MARKET

- Quantum-Cascade Lasers (QCL) are semiconductor laser diodes that have unique mid-IR detection properties

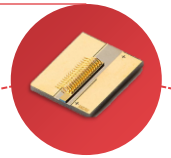
| | |
|---|---|
| **SPECTROSCOPY**<br>Gas detection & Molecular spectroscopy | **QCL have replaced other mid-IR laser solutions (leas-salt lasers, fiber lasers, Gas lasers, OPO*), thanks to a much better combination of compactness, affordability as well as wavelength availability & purity**<br><br>The new frontier for QCLs is to achieve integration into embedded solutions through miniaturization and cost-reduction |
| **DIRCM**<br>Directional IR Countermeasures | **QCL have won out over other technologies such as OPO* thanks to their compactness, affordability and power efficiency (> 10x)**<br><br>The new frontier for QCLs is to increase emission power to expand its application to any airborne and ground platform |

* Optical Parametric Oscillators

# MIRSENSE IS IN POLE POSITION FOR QCL-BASED EMBEDDED SOLUTIONS

## We drastically reduce QCL cost

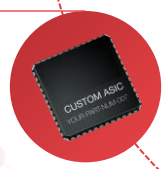
- 10-fold reduction of chip cost
- Ability to integrate non-packaged lasers
- Only player to cover the full mid-IR spectral range

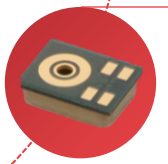


**FIRST MID-IR LASER INTEGRATED SENSORS**

**Compactness x100**

**Unit price ÷ 100**



## Industrial & business maturity :

- 100 000 installed laser chips production capability
- More than 50 clients have validated our lasers
- 20 sensors validation projects

## The first smart QCL ASIC

- Unique ASIC design for all QCL applications
- ~100-fold cost reduction vs. complex electronic boards

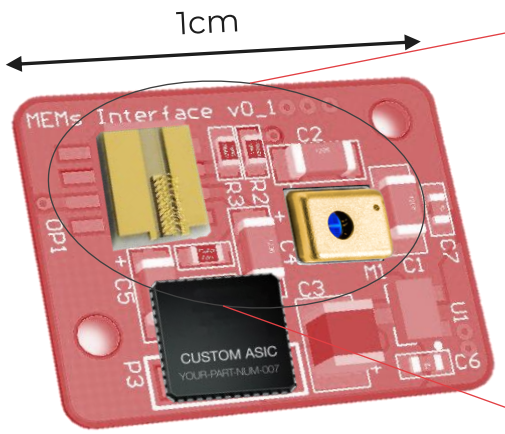
## MEMS microphones as a mid-IR detector

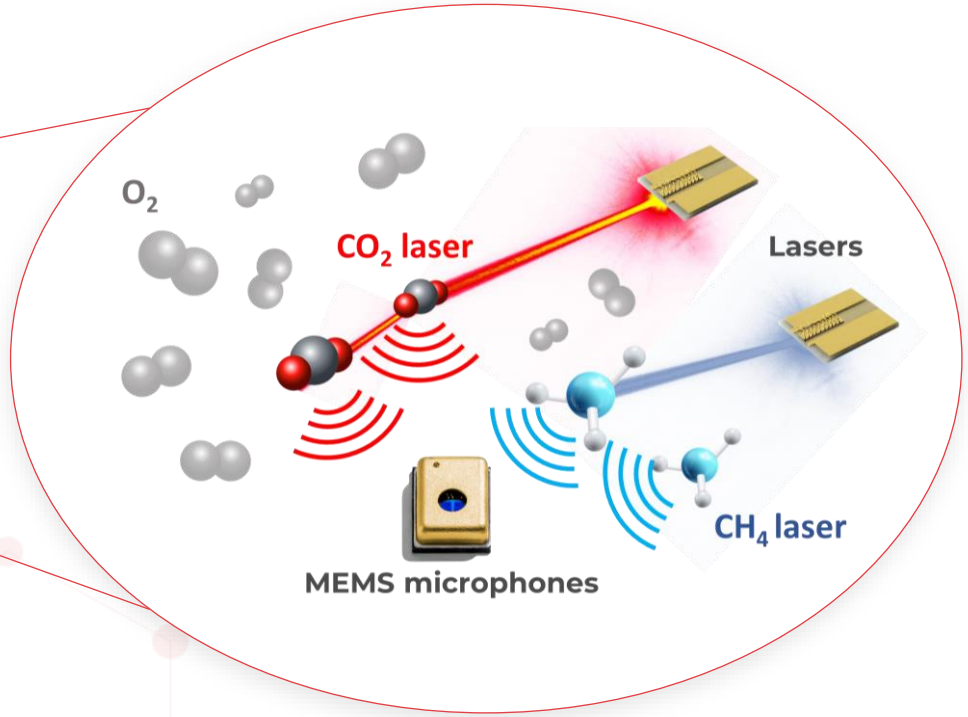
- Unique integration skills of photo-acoustics with QCL
- ~1000-fold cost reduction vs. complex optical detectors

# MIRSENSE'S UNIQUE QCL INTEGRATION WITH PHOTO-ACOUSTICS

- Using QCL chips and MEMS microphone, we can build a QCL Module based on photo-acoustics (sound induced by laser excitation)

## MIRSENSE SMART MODULE

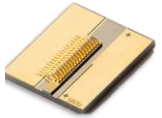


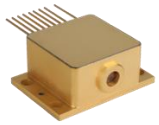




## Advantages of Photo-acoustics

- **Extreme compactness:** A breakthrough solution for embedded applications, without degrading sensitivity
- **Low cost:** MEMS-based photo-acoustics leads to a cost reduction by a factor of 1,000
- **Performance:** Delivers the performances of laser-based spectroscopy
- **Multi-gas:** Several laser chips on the same sensor, each for a given gas (acoustic multiplexing)

# MIRSENSE WILL DISRUPT THE AIR-QUALITY AND GAS DETECTION MARKETS

MIRSENSE'S  MID-IR LASERS (QCL)

| | LASER MODULE | SENSOR GEN. 1 | SENSOR GEN. 2 | SENSOR GEN. 3 |
|---|---|---|---|---|
| PRODUCT | **powerMir**  | **multiSense**  | **mirChip**  | **Components**  |
| AVAILIBILTY | 2022 | 2023-2024 | 2025 | 2027 |
| APPLICATION | Directional IR countermeasures  | GHG, CEM & Process control | Air quality & Worker safety | Air quality & Healthcare |
| TAM | **$200m/y**<br>Yearly vol.: '100s | **$300m/y**<br>Yearly vol.: '1,000s | **$700m/y**<br>Yearly vol.: '100,000s | **>$1bn/y**<br>Yearly vol. > 10 million |
| USP | Unique EU-based QCL manufacturer & vendor<br>► **Opens the non-US DIRCM market** | Unique integration of a photo-acoustic detector in a QCL Module<br>► **10x more compact**<br>► **2x less expensive** | First ASIC for QCL<br>Unique chip-level integration<br>► **100x more compact**<br>► **100x less expensive** | Unique QCL manufacturing process<br>► **QCL unit cost @ $ 0.2**<br>► **25x cheaper than potential competition** |

# A TEAM OF 26 INDIVIDUALS, INCLUDING THE FOLLOWING MANAGERS

**Mathieu CARRAS**
CEO, Co-founder

CENTRALE PARIS · THALES

**Mickael Brun**
COO, Co-founder

cea

**David Chauvel**
Sales director

apre

**Guillaume Aoust**
CTO

ÉCOLE POLYTECHNIQUE · IP PARIS · VE RI TAS · HARVARD

**Roland Teissier**
Laser expert

ENS CACHAN · cnrs

**26** People

**11** R&D engineers

**7** Manufacturing & Test

**4** Sales & Marketing

**4** Management & Admin

# FINANCIAL PROJECTIONS

- Gross margin on product sales: 60% at maturity
- EBIT Breakeven point in Q1 2025

| MILLIONS OF EUROS | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **REVENUES** | **3.0** | **5.9** | **11.1** | **22.6** | **50.4** | **78.0** | **106.5** | **127.0** |
| **SALES** | **1.8** | **4.5** | **9.5** | **21.1** | **48.8** | **76.3** | **104.8** | **125.2** |
| Incl. PowerMir | 1.5 | 3.4 | 6.7 | 13.5 | 20.7 | 23.7 | 25.0 | 28.0 |
| Incl. MultiSense | 0.2 | 1.0 | 2.2 | 3.4 | 9.1 | 15.6 | 23.5 | 32.0 |
| Incl. MirChip | 0.0 | 0.0 | 0.2 | 3.2 | 16.0 | 32.7 | 51.3 | 59.4 |
| Incl. Other | 0.0 | 0.1 | 0.3 | 1.0 | 3.0 | 4.2 | 4.9 | 5.8 |
| **OTHER REVENUES** | **1.2** | **1.4** | **1.6** | **1.5** | **1.6** | **1.7** | **1.8** | **1.9** |
| **COGS** | **-0.3** | **-0.8** | **-2.6** | **-6.1** | **-16.3** | **-29.9** | **-44.3** | **-52.3** |
| *As a % of Sales* | *10%* | *14%* | *23%* | *27%* | *32%* | *38%* | *42%* | *41%* |
| **OVERHEAD** | **-3.2** | **-4.7** | **-6.8** | **-9.4** | **-15.2** | **-20.2** | **-24.9** | **-30.1** |
| **EBITDA** | **-0.5** | **0.4** | **1.8** | **7.1** | **18.9** | **27.9** | **37.3** | **44.6** |
| Amortization & Depr. | -0.1 | -0.3 | -0.6 | -0.8 | -0.8 | -0.9 | -1.0 | -1.1 |
| **EBIT** | **-0.6** | **0.0** | **1.1** | **6.4** | **18.1** | **27.0** | **36.3** | **43.5** |
| **NET PROFIT AFTER TAX** | **-0.7** | **-0.2** | **1.2** | **5.4** | **13.8** | **20.5** | **27.5** | **32.9** |

## MIRSENSE PLANS TO RAISE €5M

- To finance mainly its CAPEX & Commercial growth
- Free Cash Flow breakeven point in early 2026

# KEY INVESTMENT CONSIDERATIONS

**WE ADDRESS TODAY'S TWO MAIN SOCIETAL CHALLENGES**
- Greenhouse Gases & Air quality
- Security & Safety

**UNIQUE, DISRUPTIVE, PATENTED TECHNOLOGY SOLUTIONS**

**MARKET OPPORTUNITY: OVER USD 2 Bn / Y**


**HIGH INDUSTRIAL MATURITY**
- 100k lasers produced & tested
- Secured roadmap to mass production

**HIGH-GROWTH IN RECURRING SALES**
- €1.8m sales in 2023
- Pipeline of €4,5m sales in 2024 (€2m backlog)
- Direct & indirect sales in Europe, Asia & the US

**SHORT TERM PROFITABILITY**
- EBITDA breakeven in 2024