Gas & Flame Detection

3M Personal Safety Division

Tech Days

François Ampe and Francesco Capuzzi

28 03 2019

3M stands for Minnesota Mining & Manufacturing

Founded:
in Two Harbors, USA in 1902

Headquarters today:
St. Paul, Minnesota, USA

From its beginnings as a mining company (= Mining), and later including further processing (= Manufacturing), 3M has now developed into a diversified technology company with worldwide operations

We bring solutions to markets through our business groups

2017 Results

3M $31.7B Revenue

Health Care

$5.8B

Safety & Graphics

$6.1B

Industrial

$10.9B

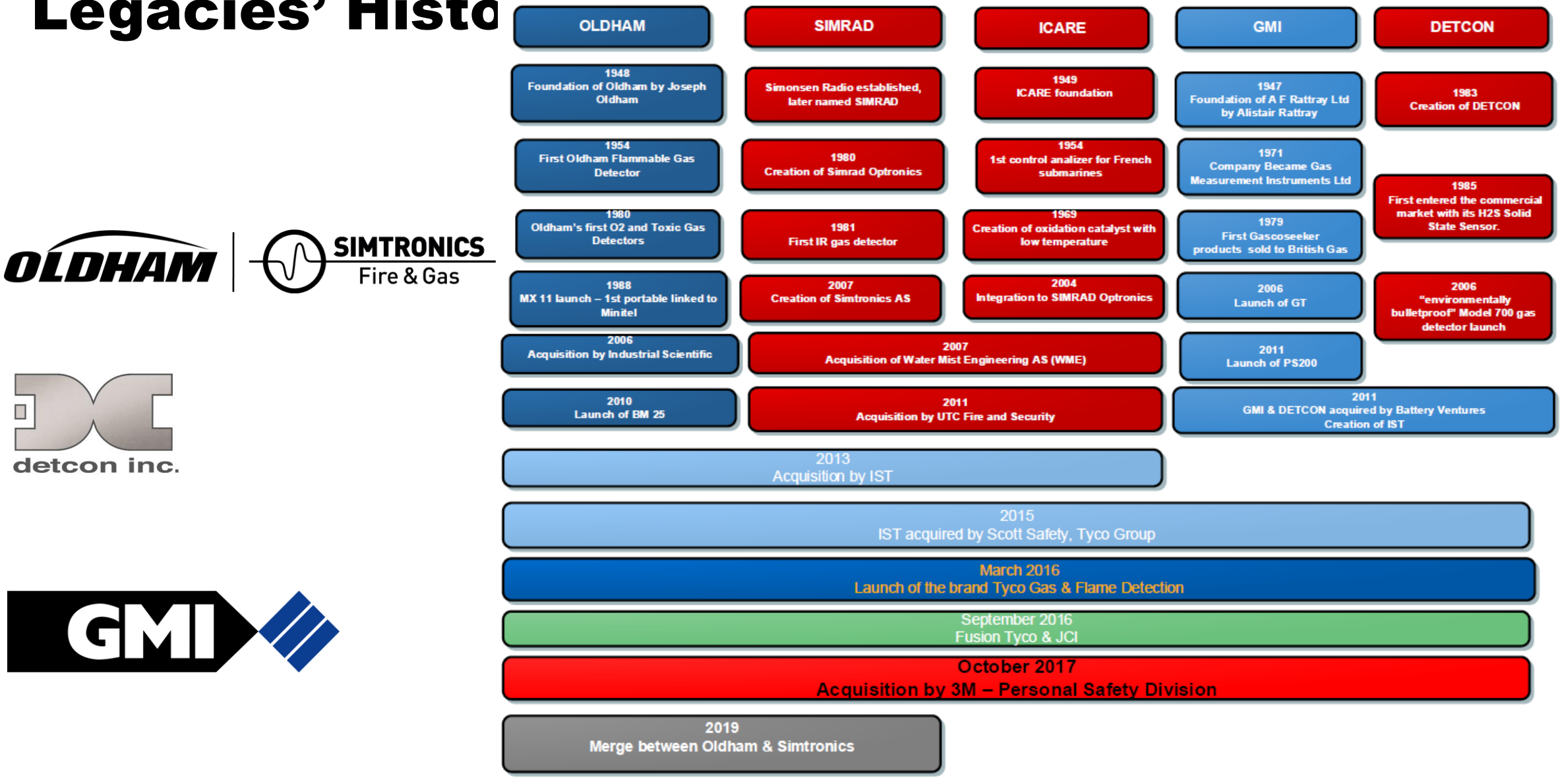
Electronics & Energy

$5.2B

Consumer

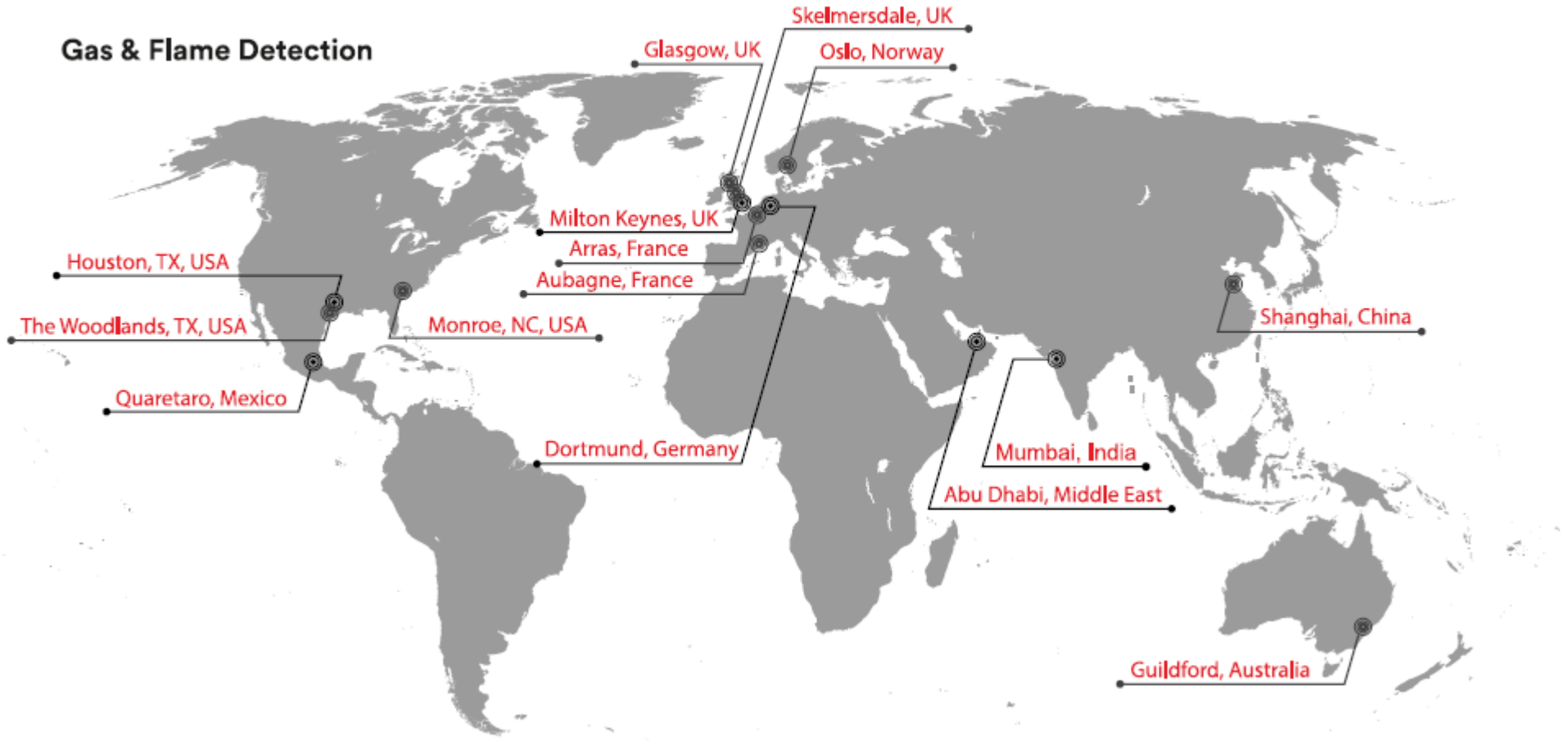
$4.6B

Legacies' Histo



3M Science. Applied to Life.™

Gas & Flame Detection



H_2S - Hydrogen Sulfide

Found in any location where decaying matter is present

5 ppm: Threshold limit value in Norway (TLV). Smells of decayed eggs.

>100 ppm: Loosing sense of smell.

> 500 ppm: Respiratory problems and collapse.

>1000 ppm: Unconsciousness and death without warning.

→ Knock-down gas

Ignites at 290 ºC.

Heavier than air → Accumulates in low areas

Corrosive.

Possibly the second-most deadly gas after carbon monoxide encountered in the industrial environment.

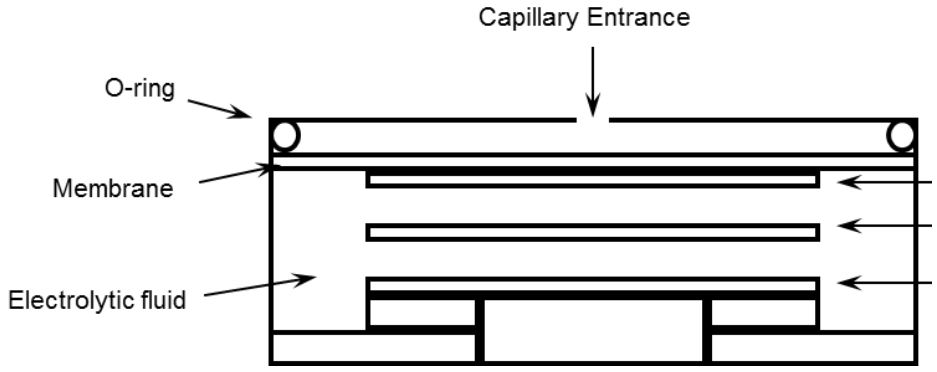
Environment: Very poisonous for organisms living in water.

Detection methods

H_2S detector technologies

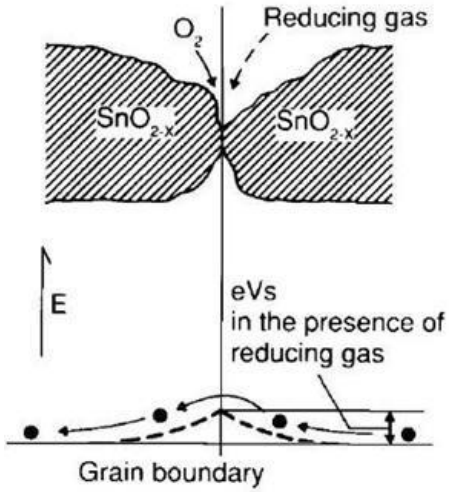
Electrochemical

- Low cost
- Limitations high temperatures and dry climate
- High humidity
- Cross-sensitive other gases
- Need regular calibration
- Consumables



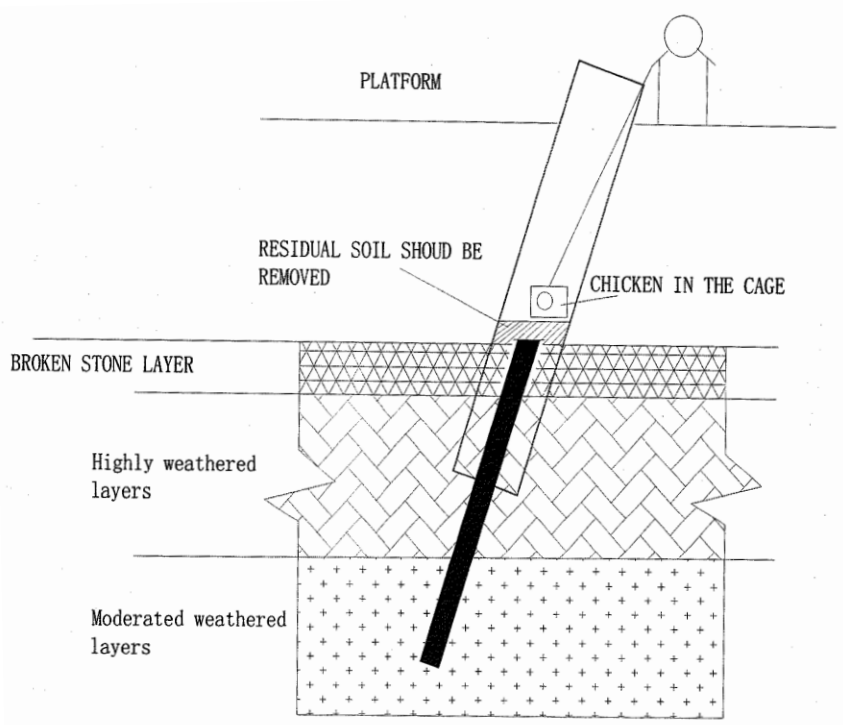
Metal Oxide Semiconductor (MOS)

- Reasonable cost
- Cross-sensitive other gases
- Need regular calibration
- Consumables



Other traditional approaches

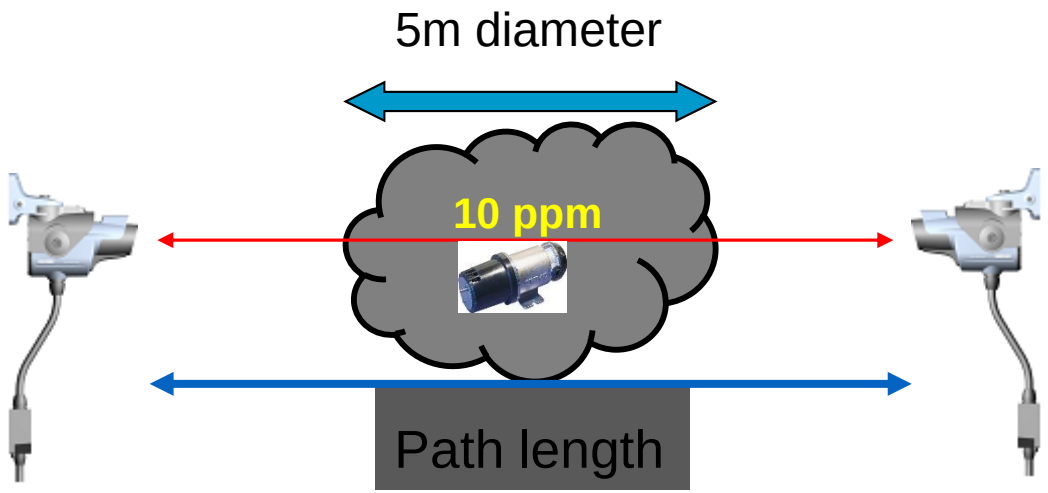
- ✓ Very low cost
- ✗ Non adjustable alarm levels
- ✗ Cross sensitive
- ✗ Consumables (food + chickens)



DRAWING 2
CHECK AIR IN THE PILE IS SAFE OR NOT

Chickens – not recommended

Readings on Point and Open Path Detectors



Point Detector: 10 ppm

Open Path Detector: 10 ppm x 5 m = 50 ppm*m

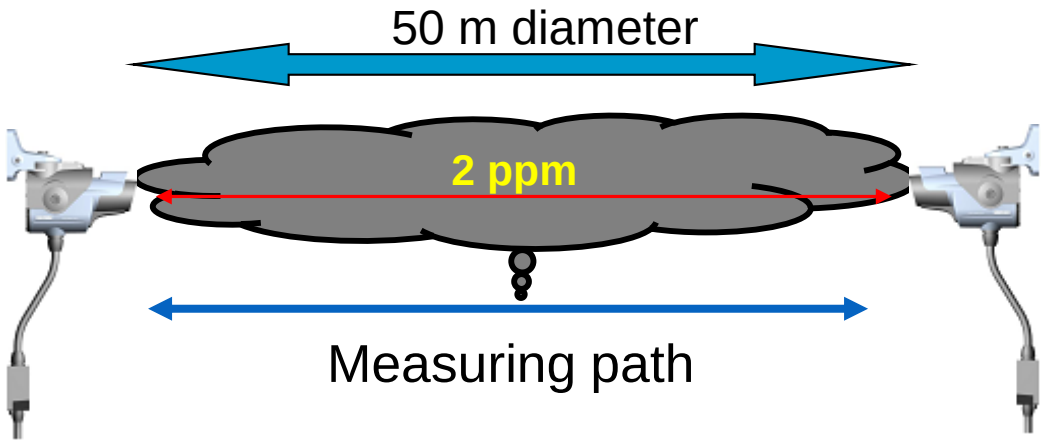
The *ppm*m* is the measured value and the path length is not used in the output value of H_2S.

→ Same cloud size will give same measurement irrespective of path length

→ If cloud size is known concentration can be calculated

→ More often used as a “safe fence” and *ppm* not so important.

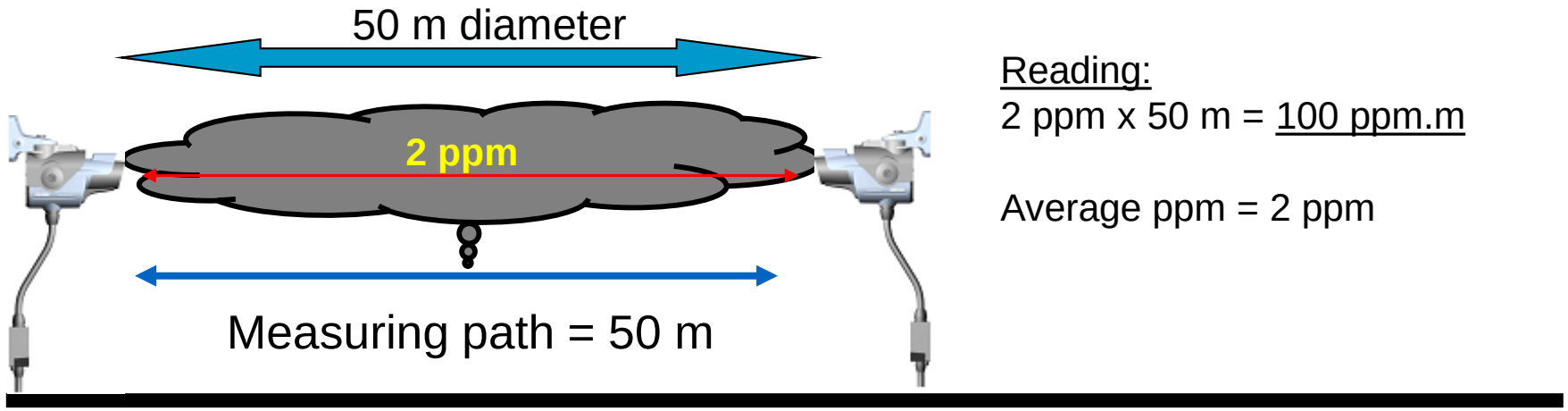
LOS measurement ambiguity



Reading:
2 ppm x 50 m = 100 ppm.m

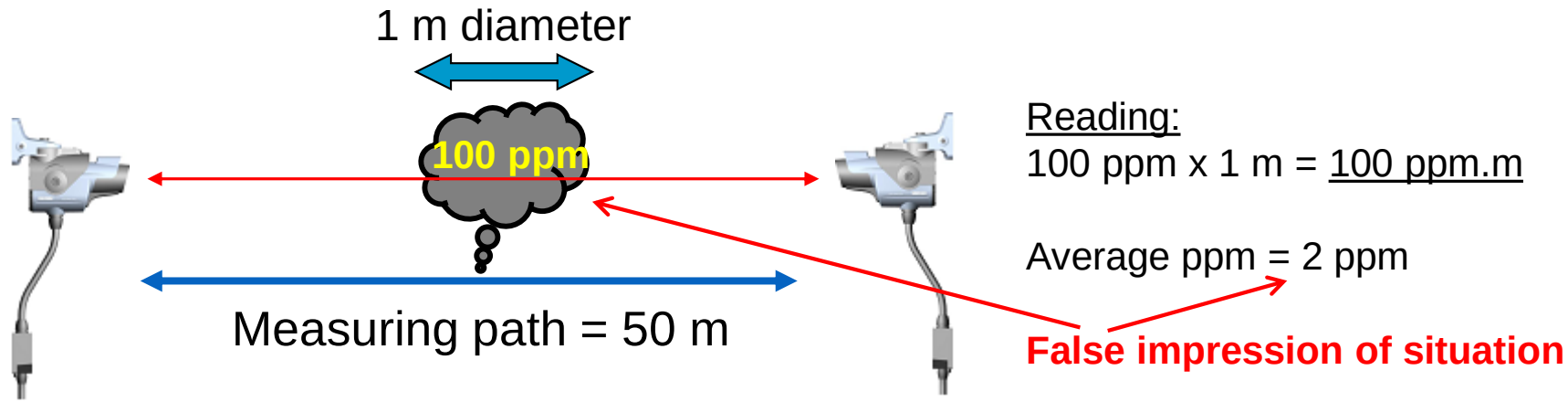
Average ppm = 2 ppm

LOS measurement ambiguity



Reading:
2 ppm x 50 m = 100 ppm.m

Average ppm = 2 ppm



Reading:
100 ppm x 1 m = 100 ppm.m

Average ppm = 2 ppm

False impression of situation

Laser diode
Detection principle

Principle of Operation: Near IR laser scanning

Scans a range of the optical spectrum, both amplitude and shape of the different gases.

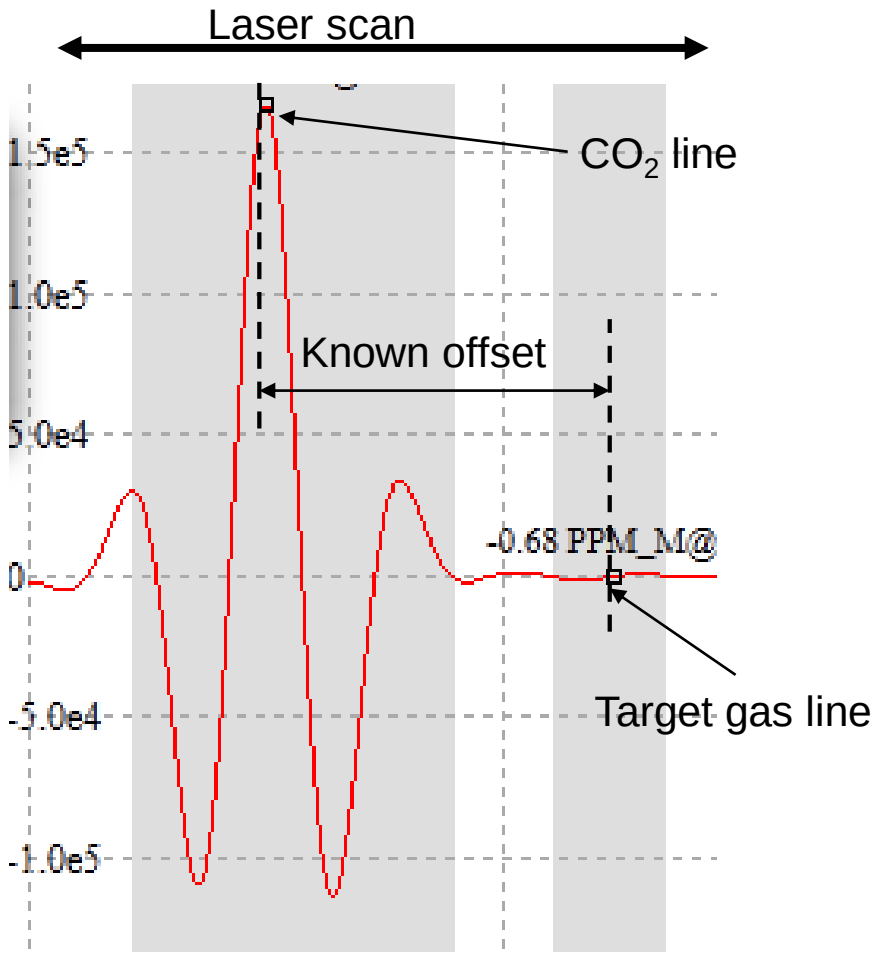
Atmospheric CO_2 is used as reference gas.

The laser is locked to the CO2 reference absorption line (independent of concentration).

The laser scans at 8 kHz across the CO_2 reference and the H_2S absorption line.

Advanced algorithms are used to determine the gas concentration

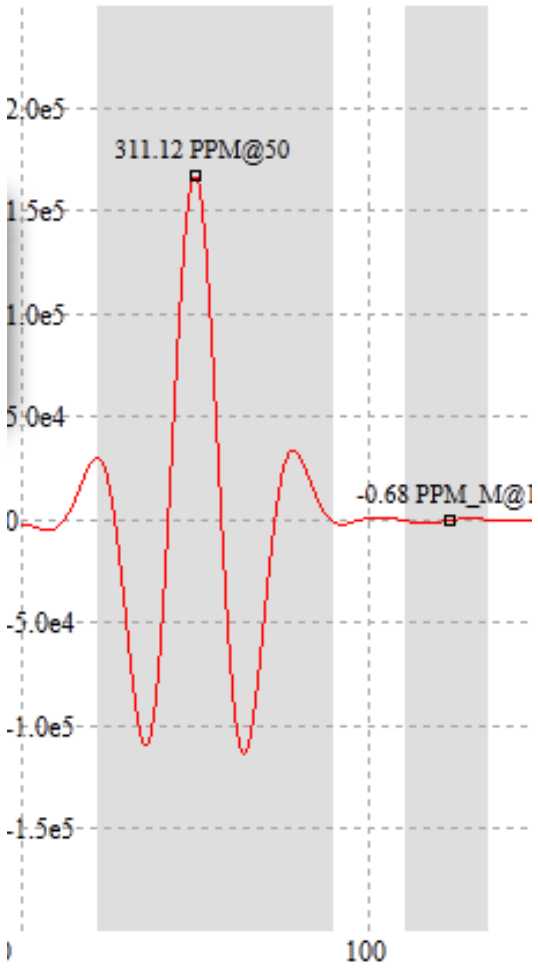
An internal CO reference is checked to verify correct CO2 peak



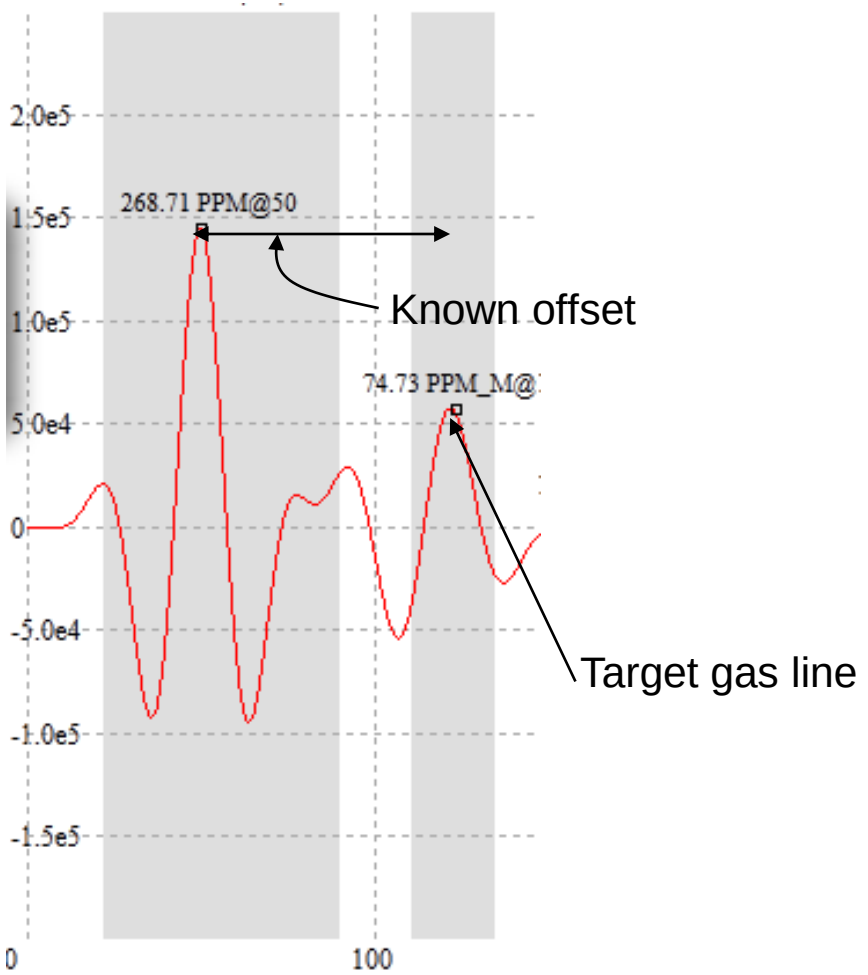
Laser used: Class 1, Eye safe

Detection scan – detecting H_2S

Normal operation

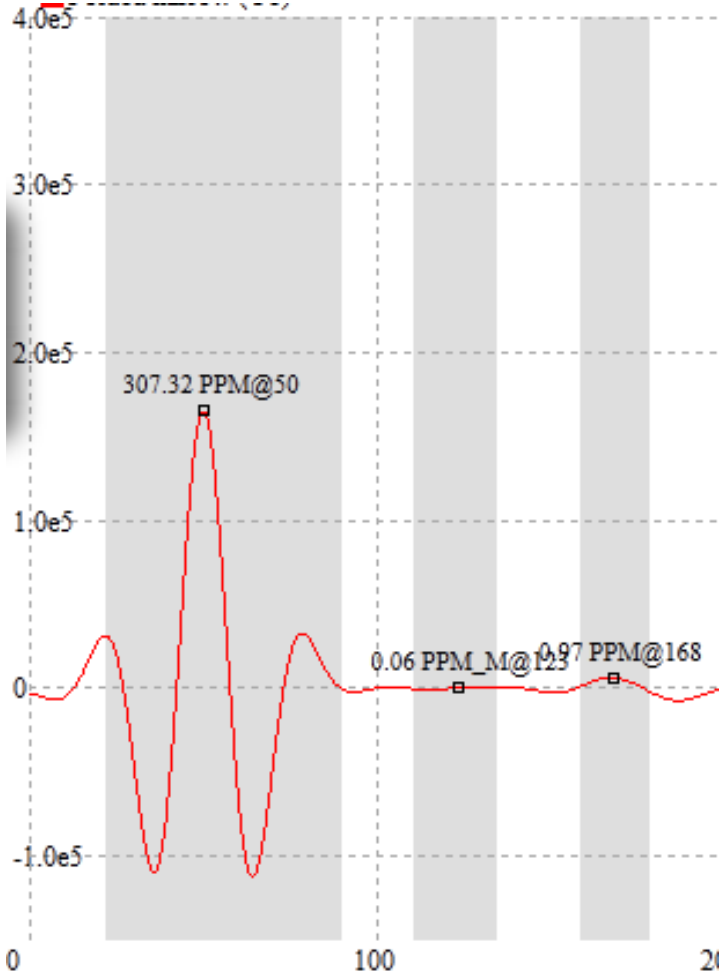


H_2S in measurement path

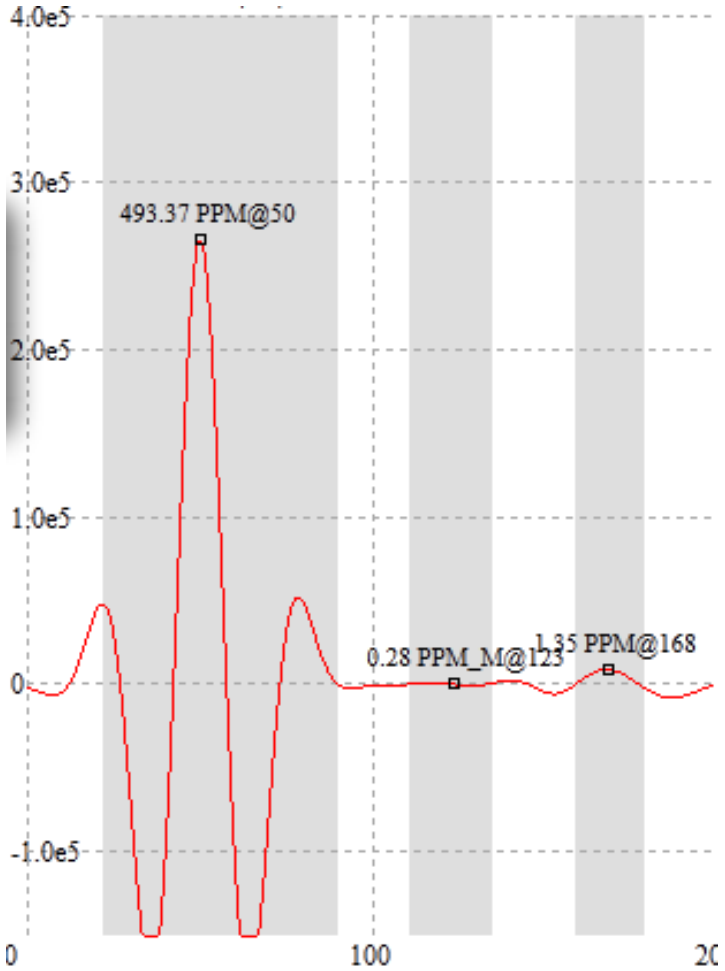


Detection scan – checking response with CO_2

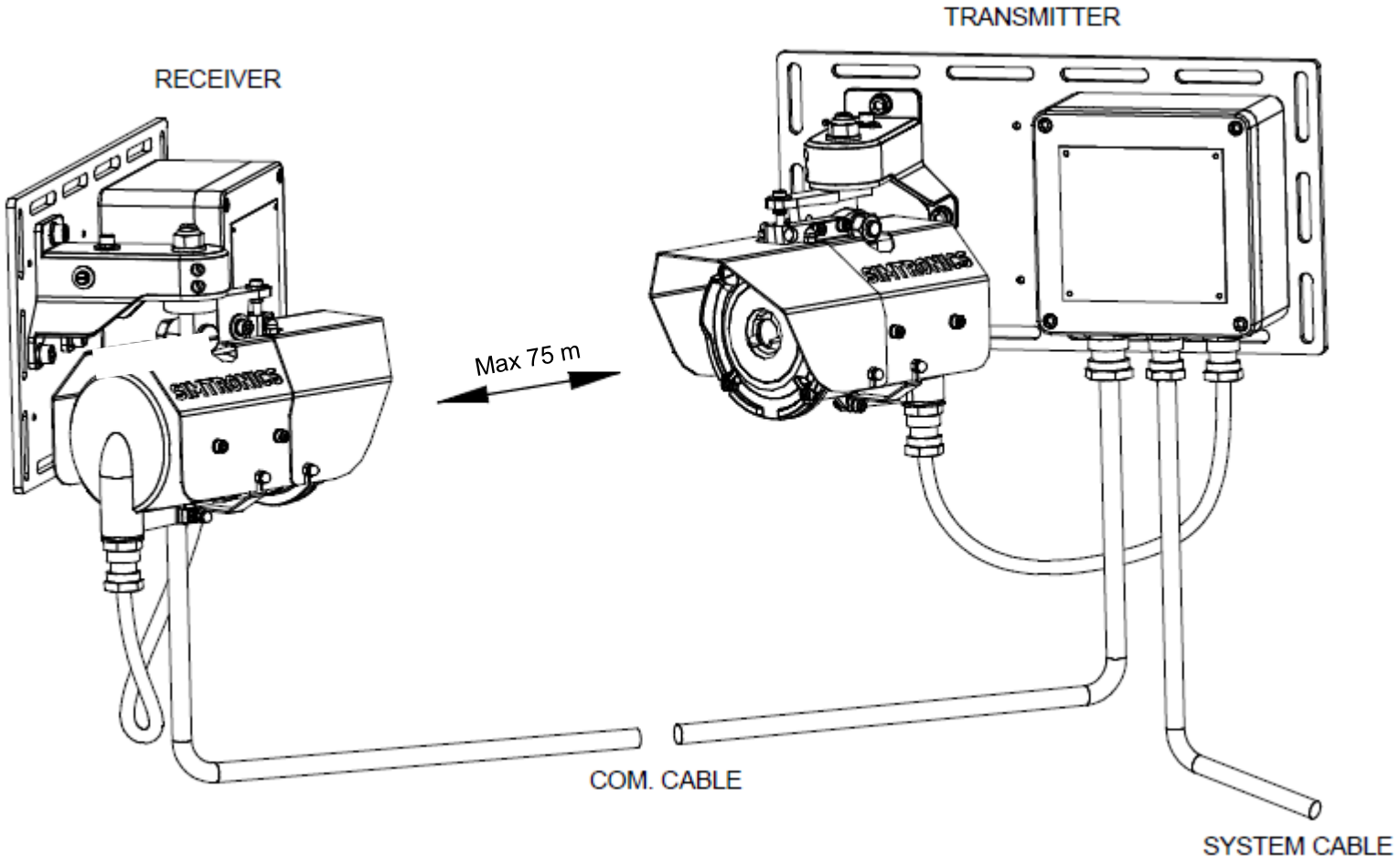
Normal operation



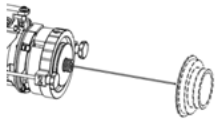
CO_2 in measurement path

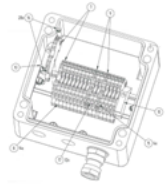


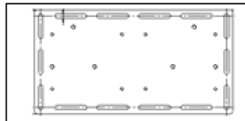
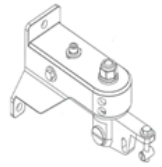
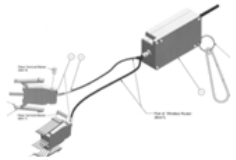
GD1 Open Path H_2S Detector Laser based



Accessories and spare parts

Accessory	Part Number	Description
	GD1-X00-TT01	Alignment Kit Laser alignment tools, Alignment Interface Unit and carry case.
	GD1-X00-TT05	Gas Test Cell Kit – long version Airtight chamber for function and calibration tests. The chamber has a length of 54 cm.

Spare part	Part Number	Description
	599-816662	Sunshade front
	599-816526	Junction box (temperature range -40 to +65°C)

	GD1-X00-TB01	Mounting plate
	499-816755	Adjustment bracket
	499-816649	Alignment laser unit
	499-816845	Wireless router
	419-906123	Laser glasses
	814-816855	Spare screws and nuts for the GD1.
	700-816859	All typical tools needed for alignment and service of the GD1.

Take Aways

➢Laser technology

- No cross sensitivity with other gases
- Fast response
- No consumable
- High sensitivity (detects low concentration for early detection)
- Lifetime > 10 years

➢ CO_2 verification and internal reference

- Lifetime > 10 years

➢SIL2 by design

➢Built for harsh environment

- Desert, offshore, arctic
- Unaffected by changing weather conditions
- Well proven measurement technique (since 2006)

THANK YOU


3M
Gas & Flame Detection
detcon inc.
OLDHAM
SIMTRONICS Fire & Gas
GMI
Now proudly part of 3M.