Eni experience and research with IR video-camera imaging

Patrizia Buttini
CR MR

Monterotondo
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Agenda

- Flaring, Venting and GHG emissions visualization
- Experimental Activity in Eni sites– Off shore Platform On shore applications (Oil Centre, Gas Plant)
- Results and Discussion
- Perspective for research

Introduction –GHG emissions

ENI is involved in some projects related to GHG (methane) reductions from industrial sources:

- Flaring / Venting
- Diffuse emissions (tanks and pipelines)
- Fugitive emissions

Evidence of reduced quantities can be obtained by Conventional methods (FID) and Optical system (FT-IR Remote Sensing to measure point source emissions without sampling ports chimneys, stacks and flares) but they are time consuming and expensive

➢Detection of losses of methane/VOC is of great interest for the oil, gas, chemical and power industry

Infrared spectral imaging systems may be used for

- Fugitive gas leak imaging
- Stack emission monitoring
- Flare analysis
- Safety and risk mitigation applications
- Greenhouse gas emission quantification

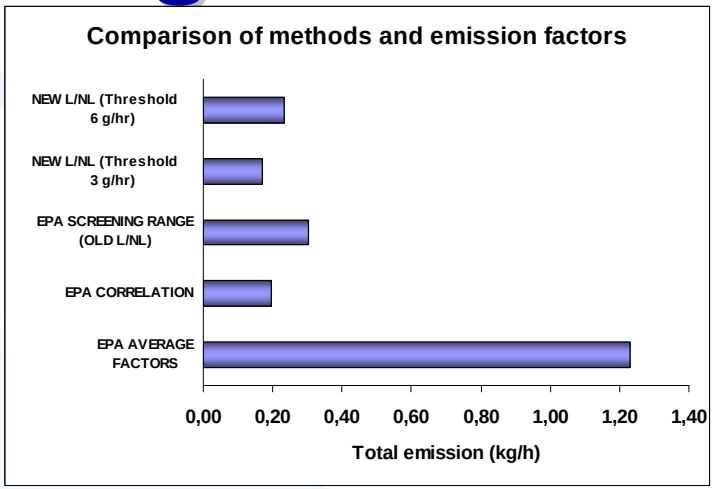
Facilities

- ➢Refineries
- ➢Processing plants
- ➢Offshore oil platform
- ➢Tankers
- ➢LNG terminals
- ➢Pipelines
- ➢Transmission lines
- ➢Gas compression facilities
- ➢Chemical plants
- ➢Power processing plants

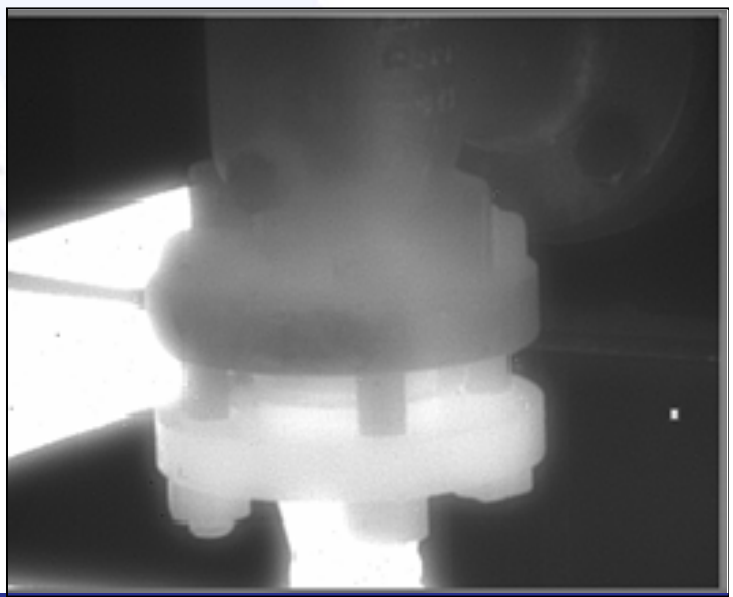
Driving force for video imaging

- A safer environment
- Reduction of emissions
- Minimization of product loss
- Inspection of all the sources
- Emission quantification according to the EPA alternative rule
- Less exposure of operators
- Responsible stake holder
- Emission's trading amongst multiple plants
- Kyoto treaty

Eni experience: Fugitive gas leaks

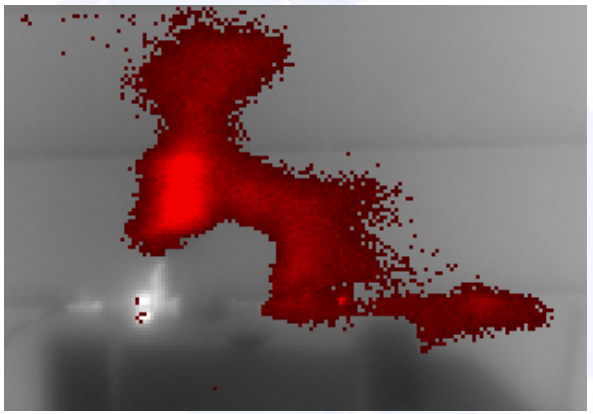


- Previous field activities demonstrated that the videocamera Sherlock can detect losses > 6 g/hr and quantifies big leaks
- Smart LDAR can be conducted more efficently than with FID
- Official standard for application of video cameras gives same results as reference Epa method 21correlation equation

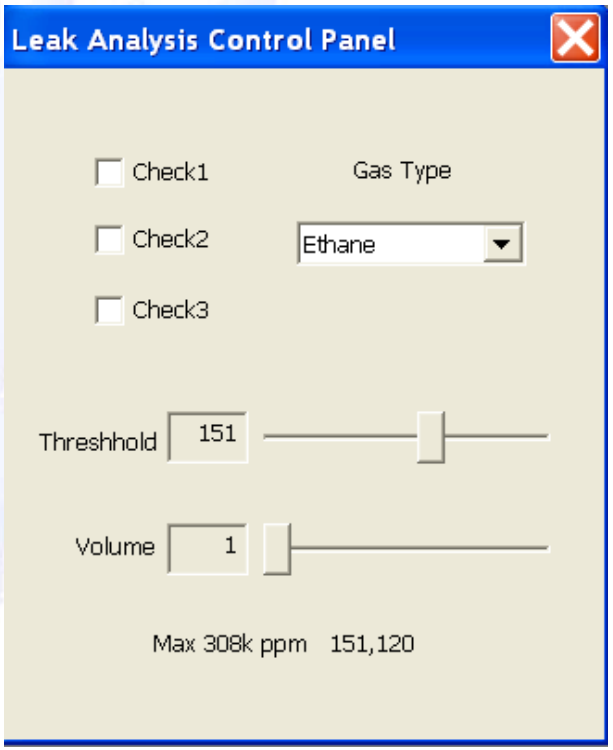


Quantitative analysis by videoimaging

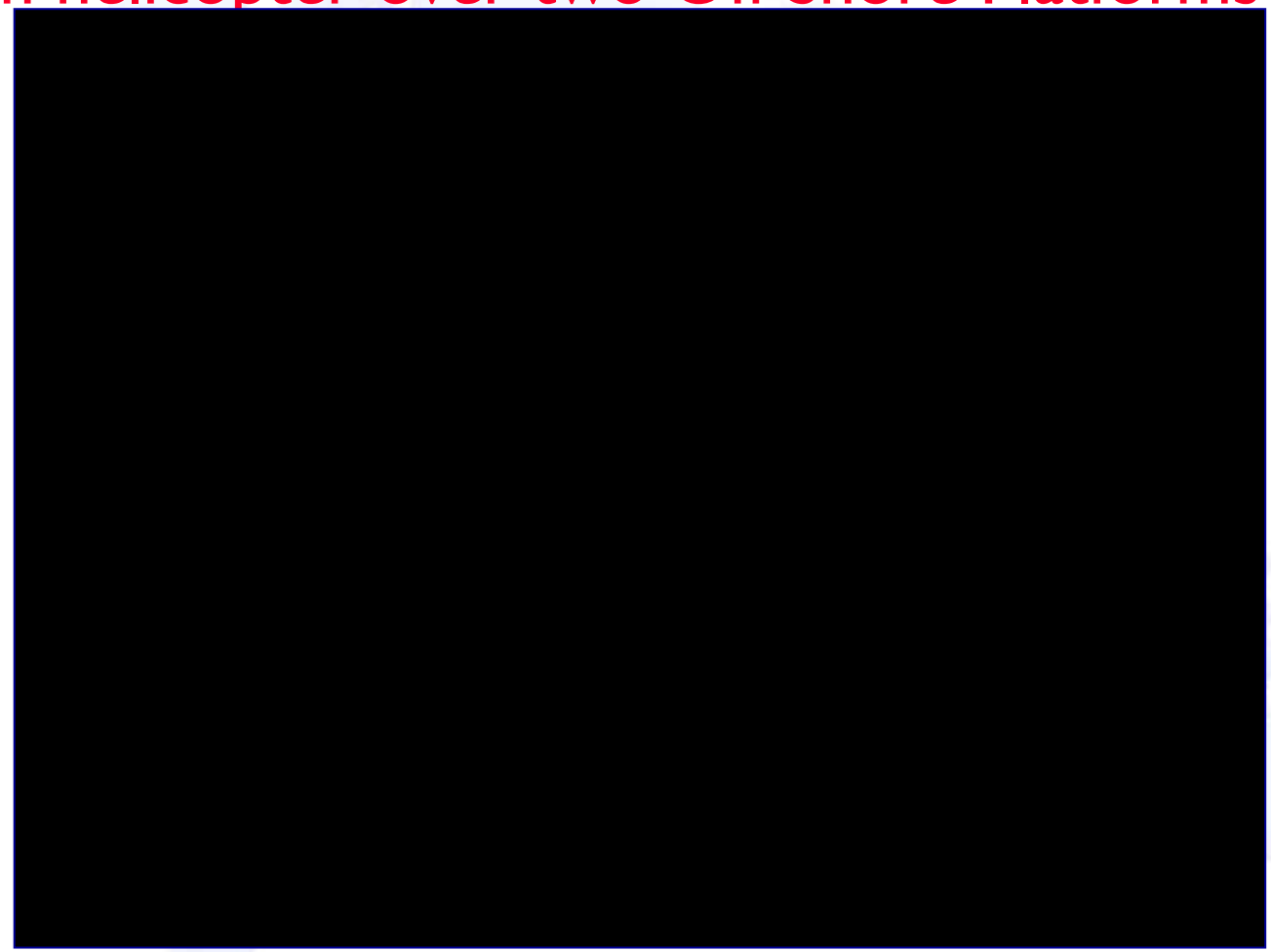
- The Sherlock imaging spectrometer quantifies the concentration of the gas as well as mass flow rate using a standard Beers Law



Shown above is an Ethane leak where the gas is colored red with the higher concentration shown in the brighter red. The concentration of any pixel within the gas cloud is shown on the right



From helicopter over two Off Shore Platforms



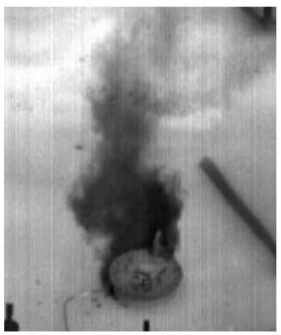
- **Data from PAT (it is not an ENI site)**

➢*Successful Airborne Test are also possible*

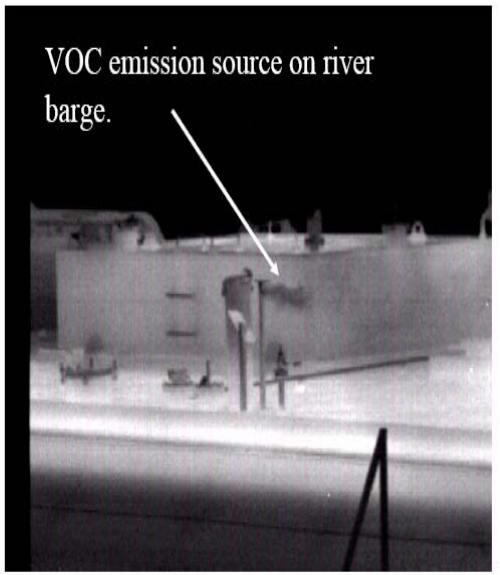
Test from helicopter

Gas Leak Detection

➢**Pipe leaks**



Thermal video showing VOC emission from a valve on a floating roof storage tank.

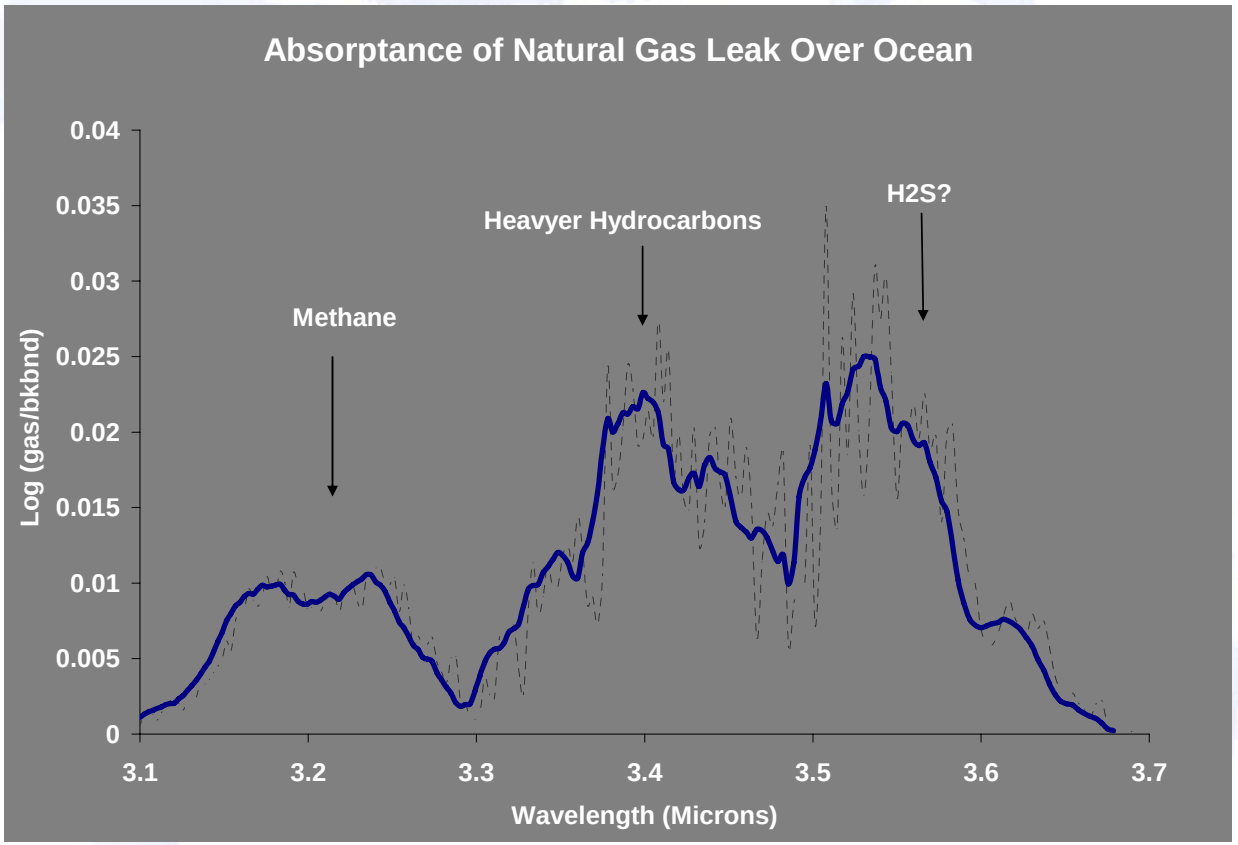


fugitive VOC emission sources

➢**Tank testing**

➢**Data from PAT**

Of f Shore Oil Platform
Natural Gas Venting



Eni experience off shore

- **No vents are visible**
- **Hot spot**

Eni experience off shore

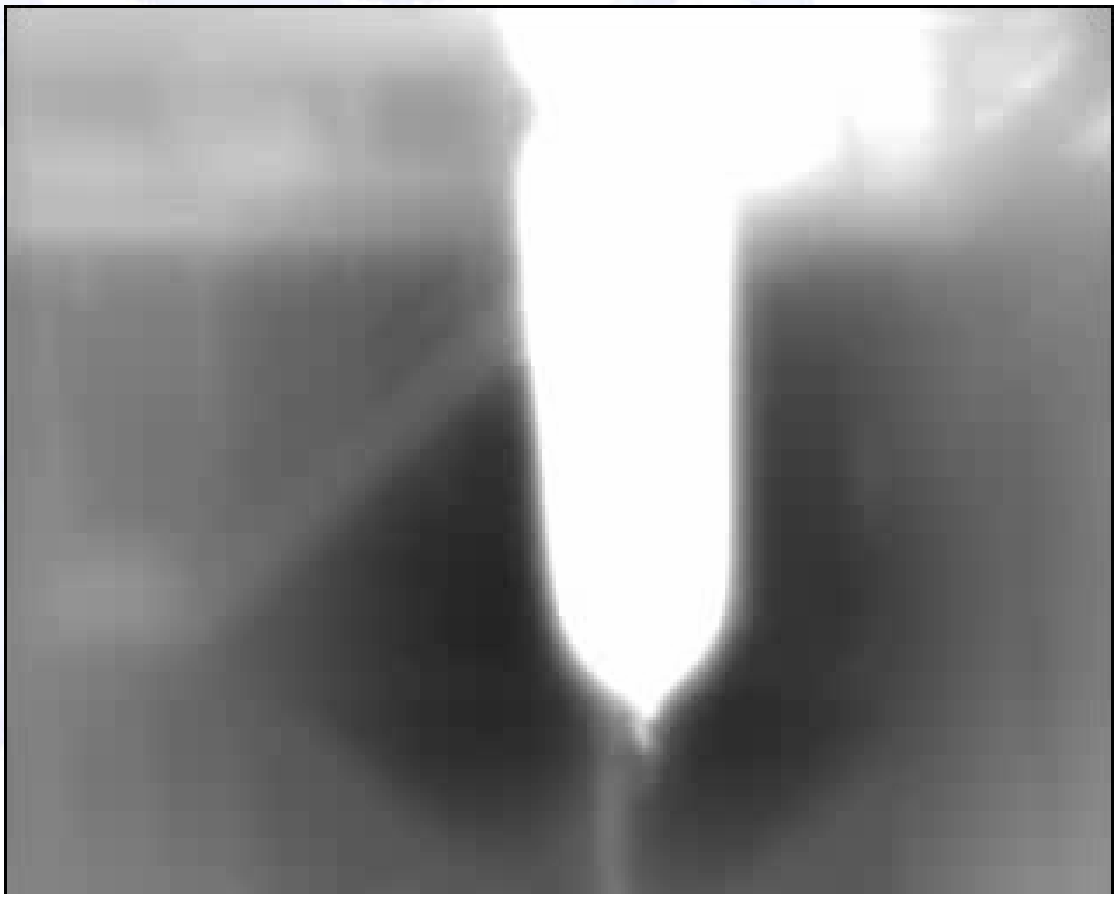
➢**Hot spots**

➢Off shore platform: DETAILS

➢**VENT**

of a generator

set



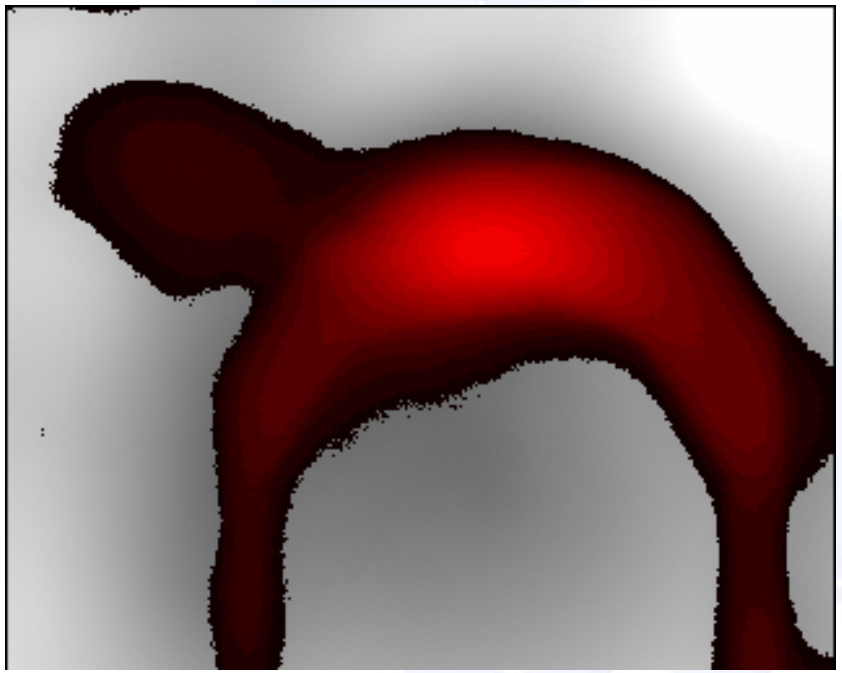
In situ survey

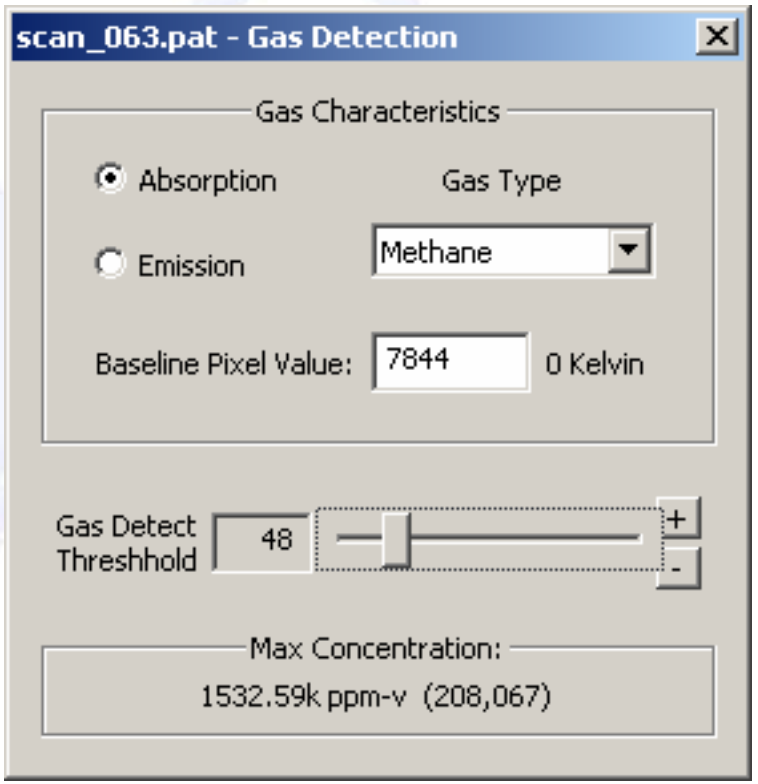
On site gas plant: Tank Inspection

➢Gas plant : Search of losses

On shore Gas facility:
vent

Data processing



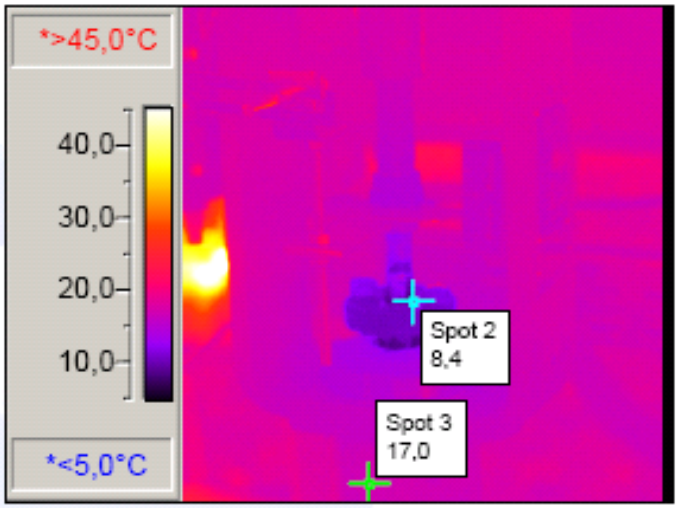


Losses from valves?
Neighbouring plant

➢Eni experience Thermal infrared camera

➢Valve: Methane

➢FID 11000 ppm



➢The valve is colder

➢ΔT 8 °C

Conclusions
IR imaging techniques

- Video imaging can be used to quantify vents and CH_4 losses and to give evidence of reduction actions
- can be used to detect losses in not accessible source
- can successfully be used to detect pollutant emissions from flaring and vents
- Can be used to prioritize maintainance work (tank inspections, LDAR)
- It also monitors temperatures that can be used for identifying and trending hot and cold spots for early maintenance planning.
- Other specific pollutants can be quantified
- Can be used in a corporate approach

Research perspective

- Protocol for Operative guidelines needs to be developed
- Scouting of other IR techniques (f.e. Raman) can be proposed
- International patners are invoked for a JIP
- Gas imaging is possible for H_2S and methane
- Suitable experimental field monitoring applications for qualitative purposes should be programmed

Aknowledgements

- The experimental activities have been conducted by ing. L. Gelpi, V. Vittori in a research project funded by R&D Eni Div R&M Centre of Monterotondo.