Sulphur Hexafluoride Gas Detection

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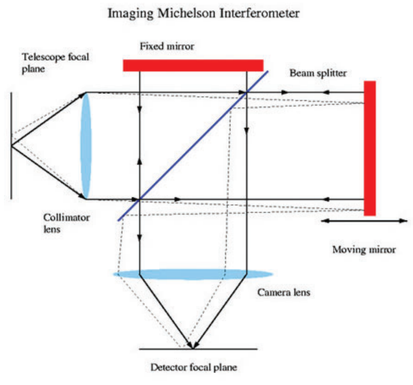
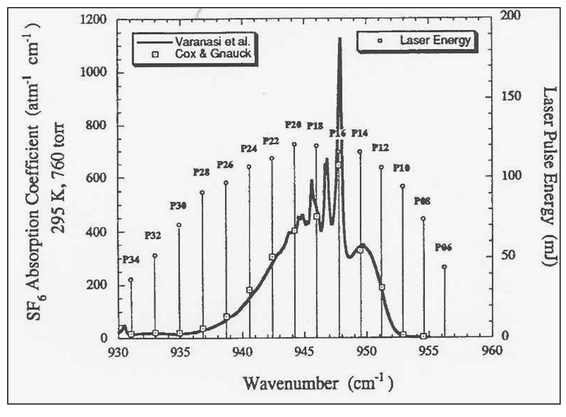
USER REQUIREMENTS FOR DETECTING AND LOCATING SF_6 GAS

- Quick response (real time)
- Geometric high accuracy (imaging)
- Severity of leak (sensitive)
- -20°C to 60°C
- No calibration procedures
- Ease of start-up
- Eye safety
- Cost <R750 000
- 1 Man handled
- Stand alone unit (no peripherals)
- Tripod (walkway problem)
- Indoor 75% vs outdoor 25%

PRINCIPAL TECHNOLOGIES



Imaging Michelson Interferometer

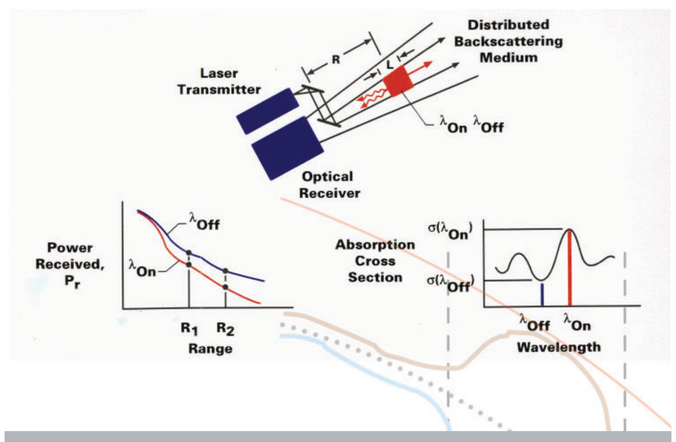


SF_6 absorption curve

Fourier Transform IR Interferometry

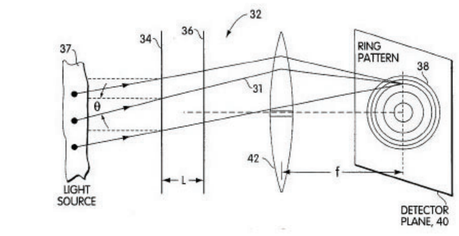
- High throughput
- Full aperture
- Big system
- Spectrally sensitive
- Complex and sensitive instrument
- *Needs a sensitive IR detector*
- Expensive to manufacture
- Need temperature difference between the gas and background
- No reflecting background needed
- Essentially a non-imaging solution
- Versatile since it can measure at different wavelengths
- A sensitive, yet expensive system, but it still requires a temperature difference in order to detect gases
- Developing costs > R1 Million
- Development time > 1 year

DIFFERENTIAL ABSORBING LIDAR

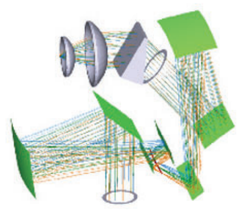


Differential LIDAR concept

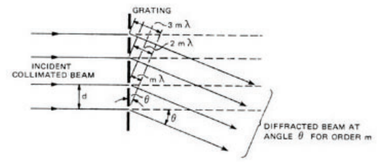
- High throughput
- Full aperture
- Potentially big
- Spectrally less sensitive
- Non-sensitive instrument
- Off-the-shelf technology
- Potentially expensive
- No temperature difference needed between the gas and background
- No reflecting background needed
- Throughput > 60%
- Full aperture
- Potentially small system
- Spectrally sensitive
- Sensitive instrument Fabry-Perot etalons
- Off-the-shelf technology
- Potentially expensive
- Need temperature difference between the gas and background
- Big advantage is no temperature difference is required
- Relies on particles to backscatter the CO_2 laser energy
- Fast optics needed to gather the little energy that is received
- *Potentially big CO_2 laser with expensive cooled detector needed*
- Development costs > R1 Million
- Development time < 1 year
- No reflecting background needed
- Using Fabry-Perot etalons, different wavelengths can be scanned, but the system transmission drops to 60%
- *Sensitive IR imaging detectors are very expensive*
- Still requires a working temperature difference
- Development costs > R1 Million
- Development time = 1 year



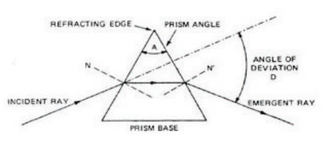
Fabrey-Perot Etalon imaging solution



Prism Spectrometer

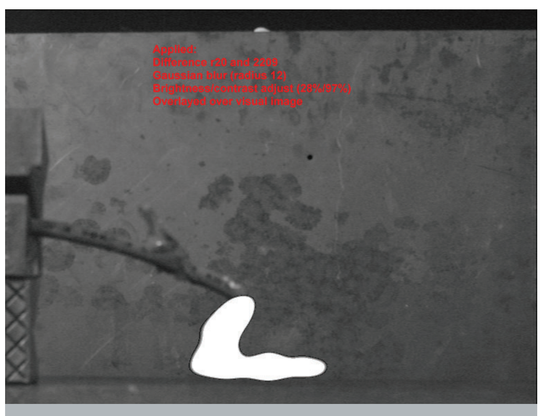


Grating Spectrometer



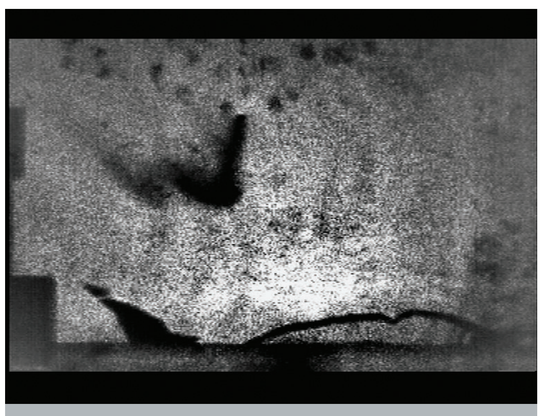
Wavelength split using prisms

BACKSCATTER ABSORPTION GAS IMAGING



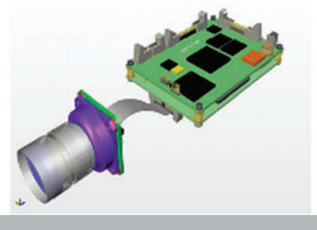
Processed wavelength differentation P16-R22

SF_6 gas appearing



SF_6 gas absorption at 10.55um wavelngth

- High throughput
- Full aperture
- Potentially small
- Spectrally less sensitive
- Non-sensitive instrument
- Off-the-shelf technology
- Inexpensive for this application
- No temperature difference between the gas and background
- Reflecting background needed
- System is smaller and less CO_2 laser energy is needed for the measurements
- Versatility limited to the type of laser
- *Inexpensive uncooled IR detectors can be used*



Uncooled IR sensor

Small CO_2 laser