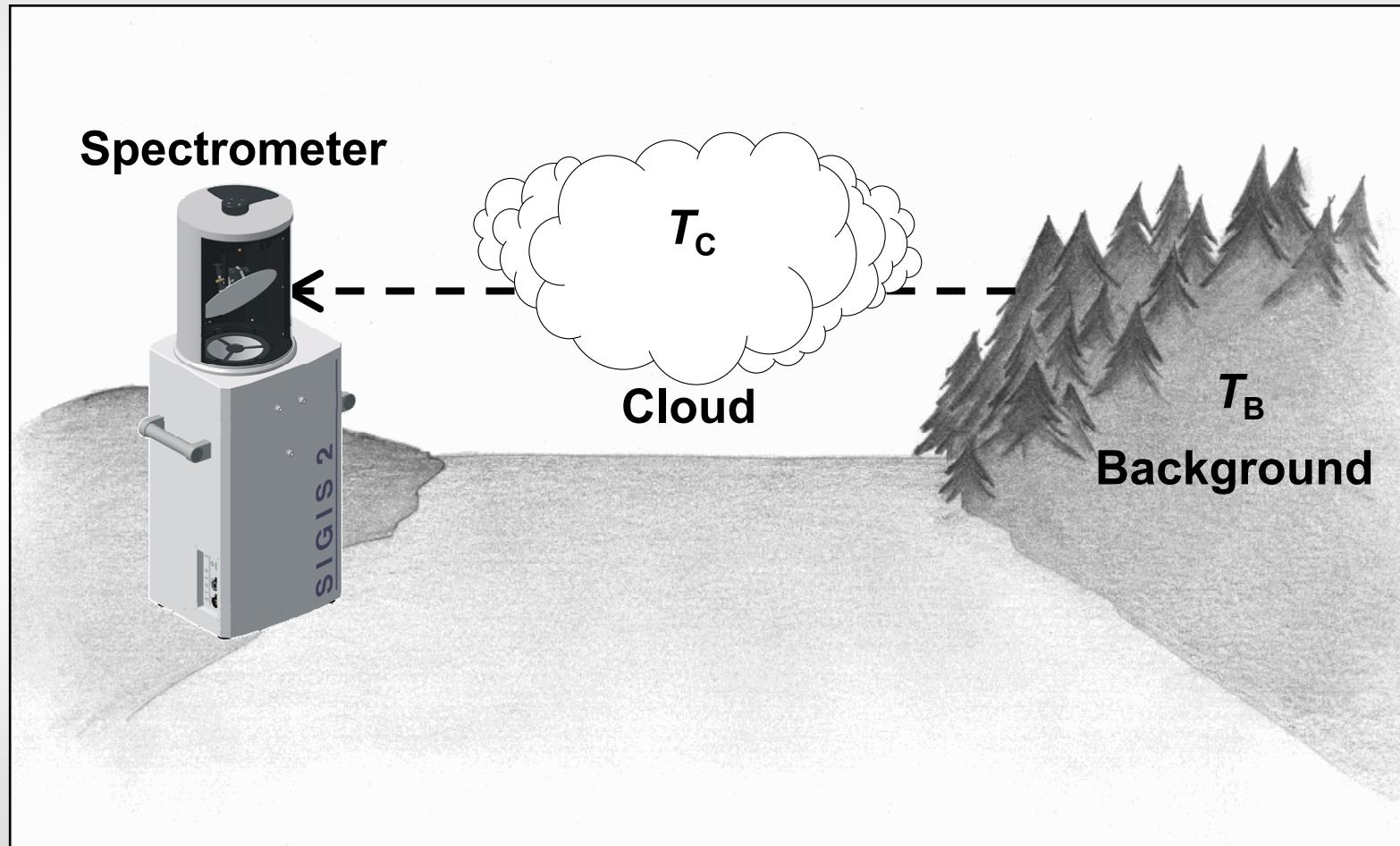


SIGIS 2



geo
Sigma ElectroOptics

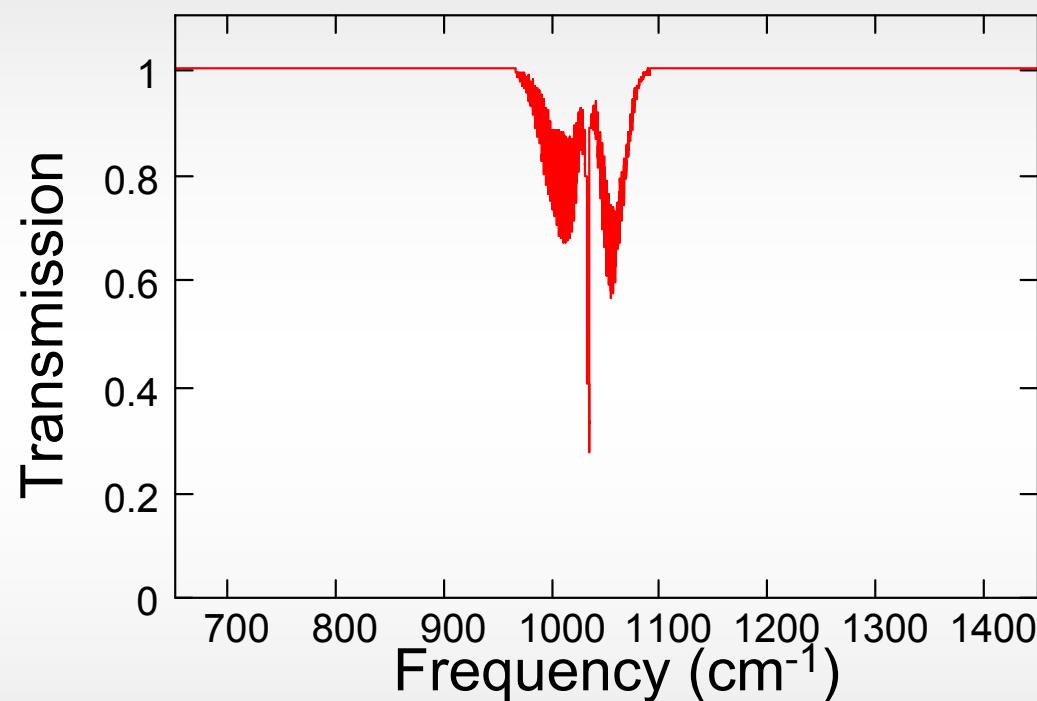
Remote Sensing of Gases by Infrared Spectrometry



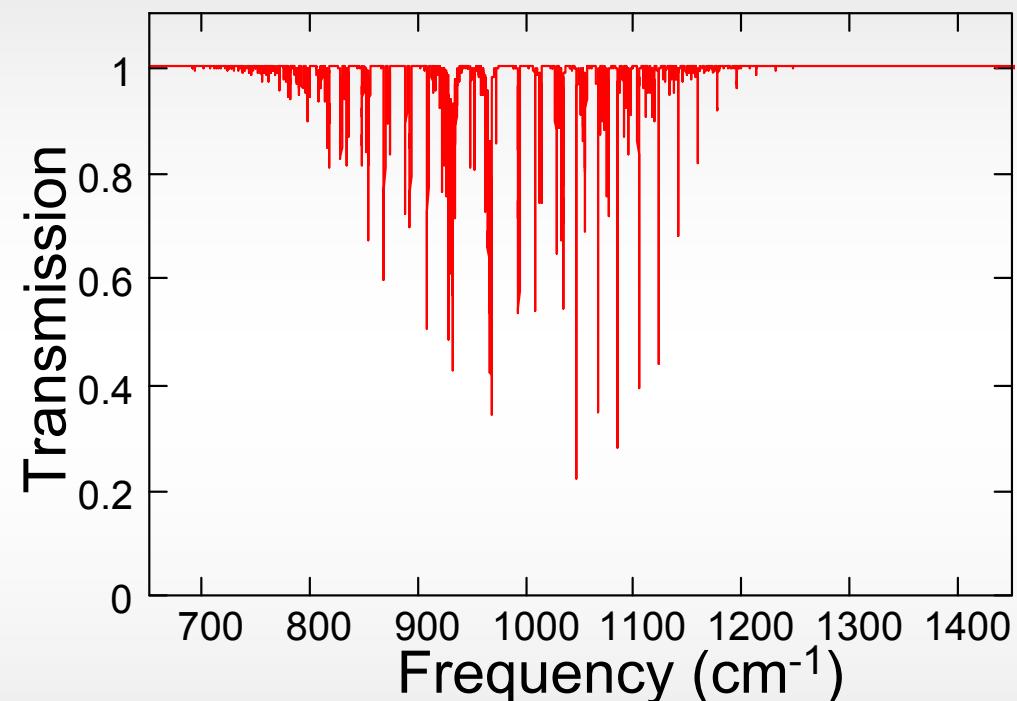
- Passive method: No artificial radiation source
- Principle corresponds to human eye

Identification

Methanol

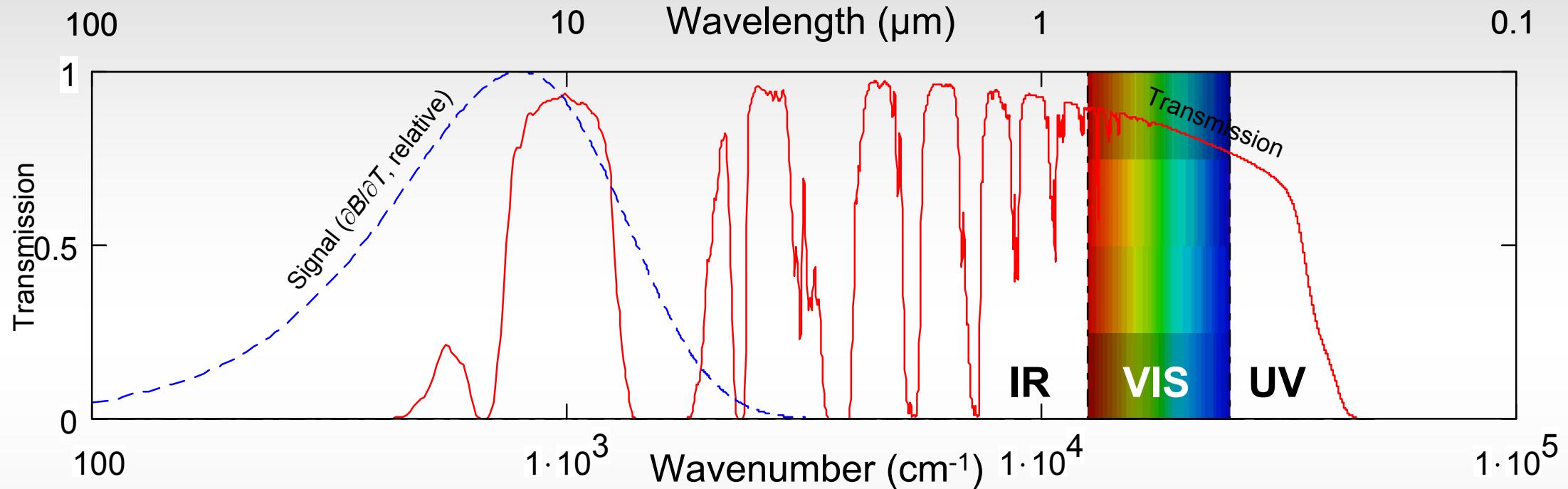


Ammonia



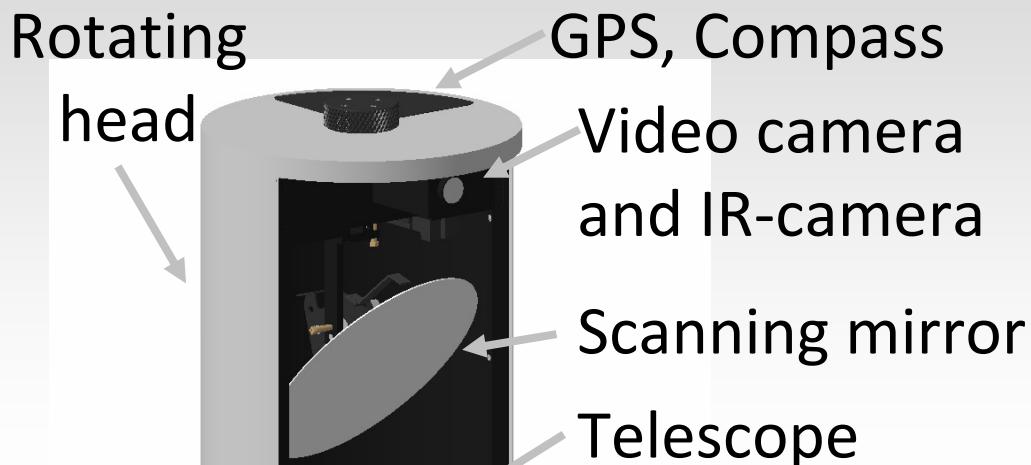
- Molecules have **fingerprint** in spectrum
- Molecules can be **identified**

Transmission of the Atmosphere



- Fascode simulation of the transmission of the atmosphere (1 km)
- Derivative of Planck's law at 300 K (relative)

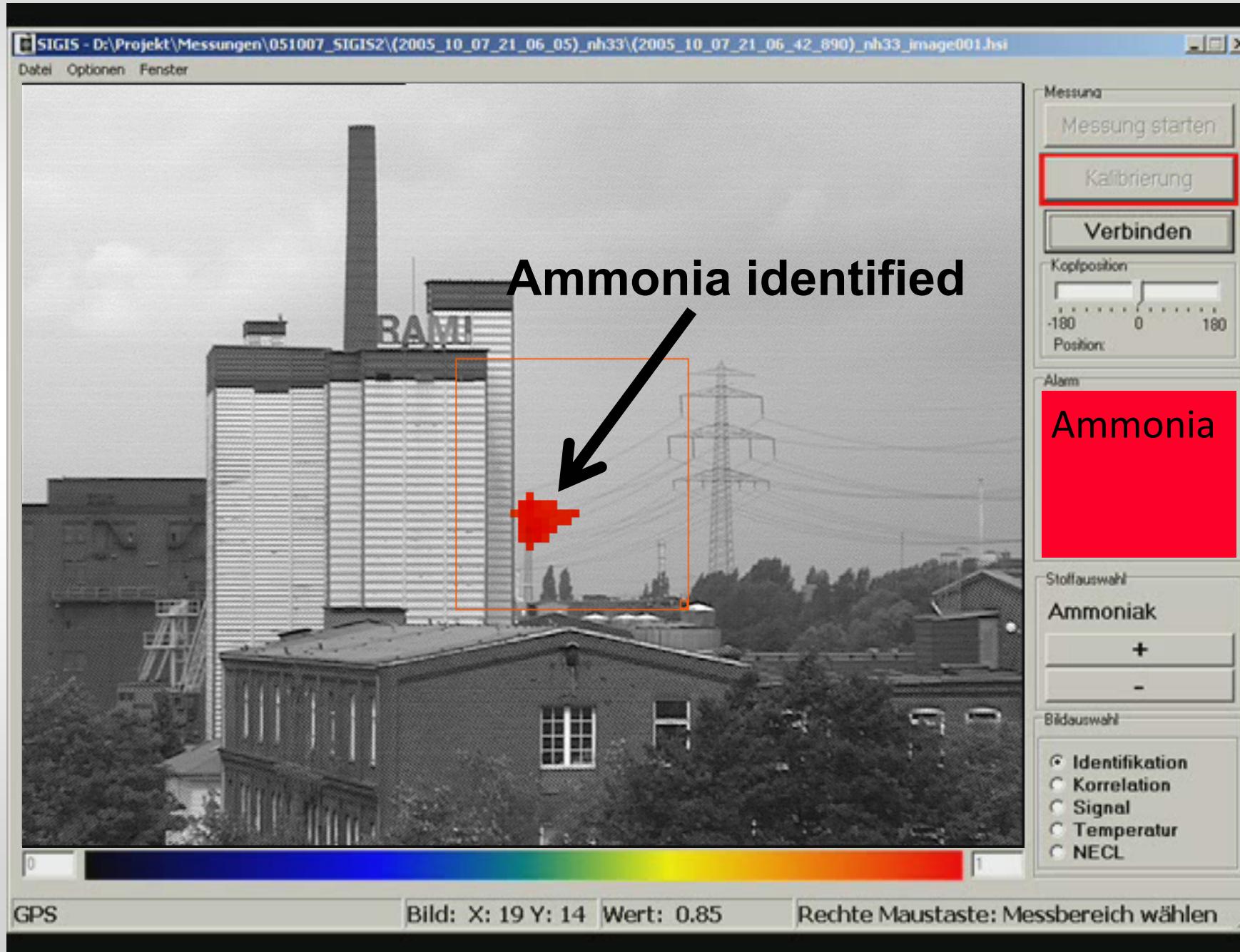
SIGIS 2



- 16 Spectra/s (OPD=0.225 cm, $\Delta\sigma = 4 \text{ cm}^{-1}$)
- Low noise: $\text{NE}\Delta T = 20 \text{ mK}$ (single scan, 44 ms)
- Telescope
 - Field-of-view: 10 mrad
- Scanner
 - Resolution: 1 mrad

User Interface of the Software

Measurement of Emissions, Distance: 2.5 km



Spectral Library SIGIS 2

Based on ETW (German equivalent of ERPG)

Compound	c _{min} (ppm) (typical, 50 m)	Compound	c _{min} (ppm) (typical, 50 m)
Acetone	1	Methanol	1
Acroleine	2	Methyl bromide	20
Acrylonitrile	2	Phosgene CG	0.1
Ammonia	0.4	Phosphine	2
Aniline	2	Nitric acid	0.4
Arsine	2	Sulfur dioxide	5
Benzene	4	Carbon disulfide	90
Hydrogen Cyanide AC	0.3	Hydrogen sulfide	380
Chlorobenzene	1	Nitrogen dioxide	40
Cyanogen chloride CK	6	Styrene	1.0
Chloroform	0.1	Tetrachloroethene	0.2
Acetic acid	0.4	Toluene	10
Ethanol	1	Diisocyanatoluene (2-,4-)	1
Formaldehyde	20	Trichloroethane (1,1,1-)	0.3
n-Hexane	30	Trichloroethane (1,1,2-)	1
Hydrazine	1	Trichloroethene	0.3
CO ₂ (1075 cm ⁻¹)	12000	Vinylchloride	1



Public Safety, Emergency Response



4 Systems deployed during World Cup 2006
3 Systems deployed at G8-Summit 2007
3 Systems deployed during European Cup 2008
Deployed during state visits

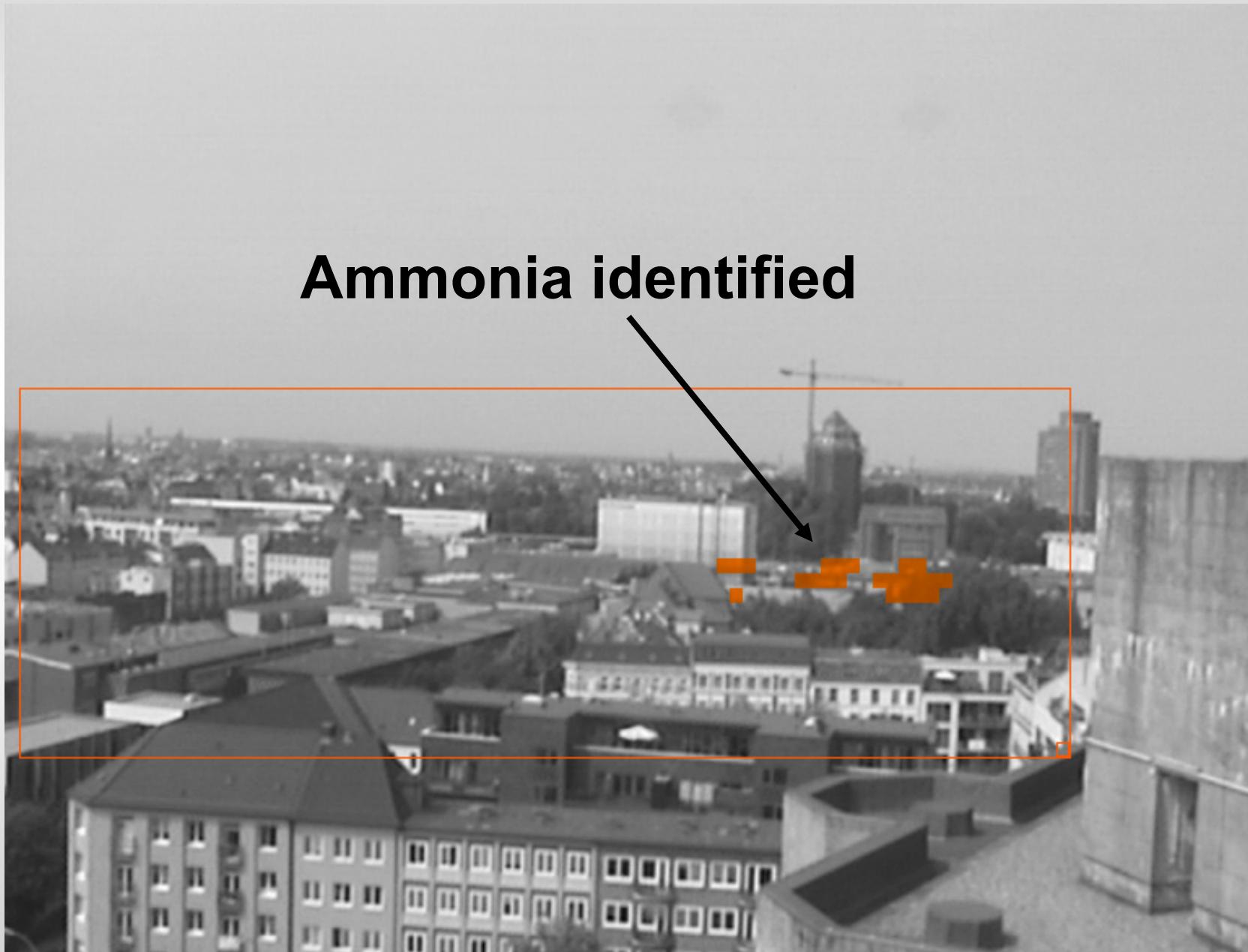
Surveillance of the Air Above the Public Viewing Area in Hamburg

FIFA Football World Cup 2006, Hamburg Fire Department



Ammonia Cloud Above Refrigerating Storage House

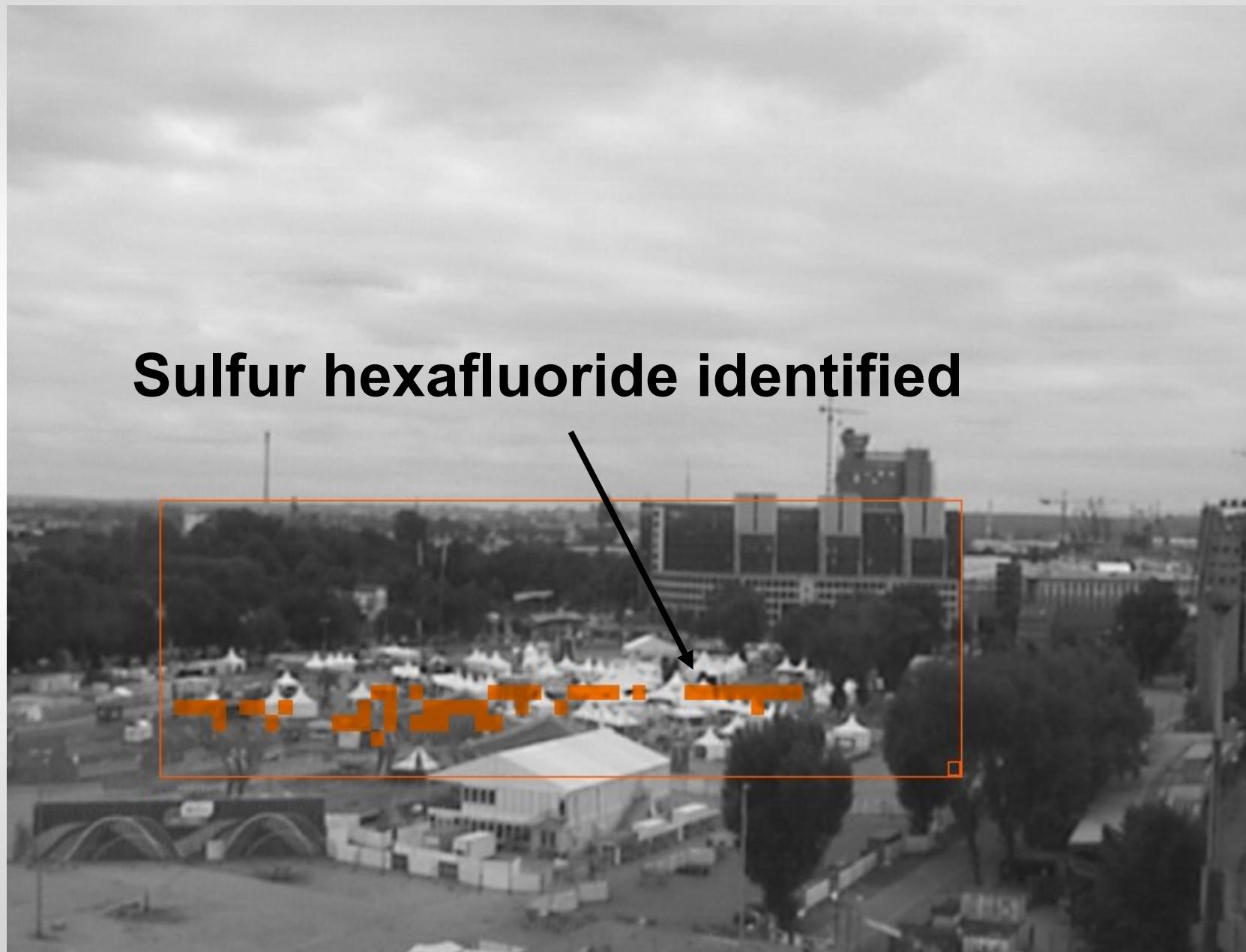
Measured During World Cup 2006



Hamburg Fire Department

Identification of SF₆ in the Public Viewing Area

World Cup 2006



Hamburg Fire Department

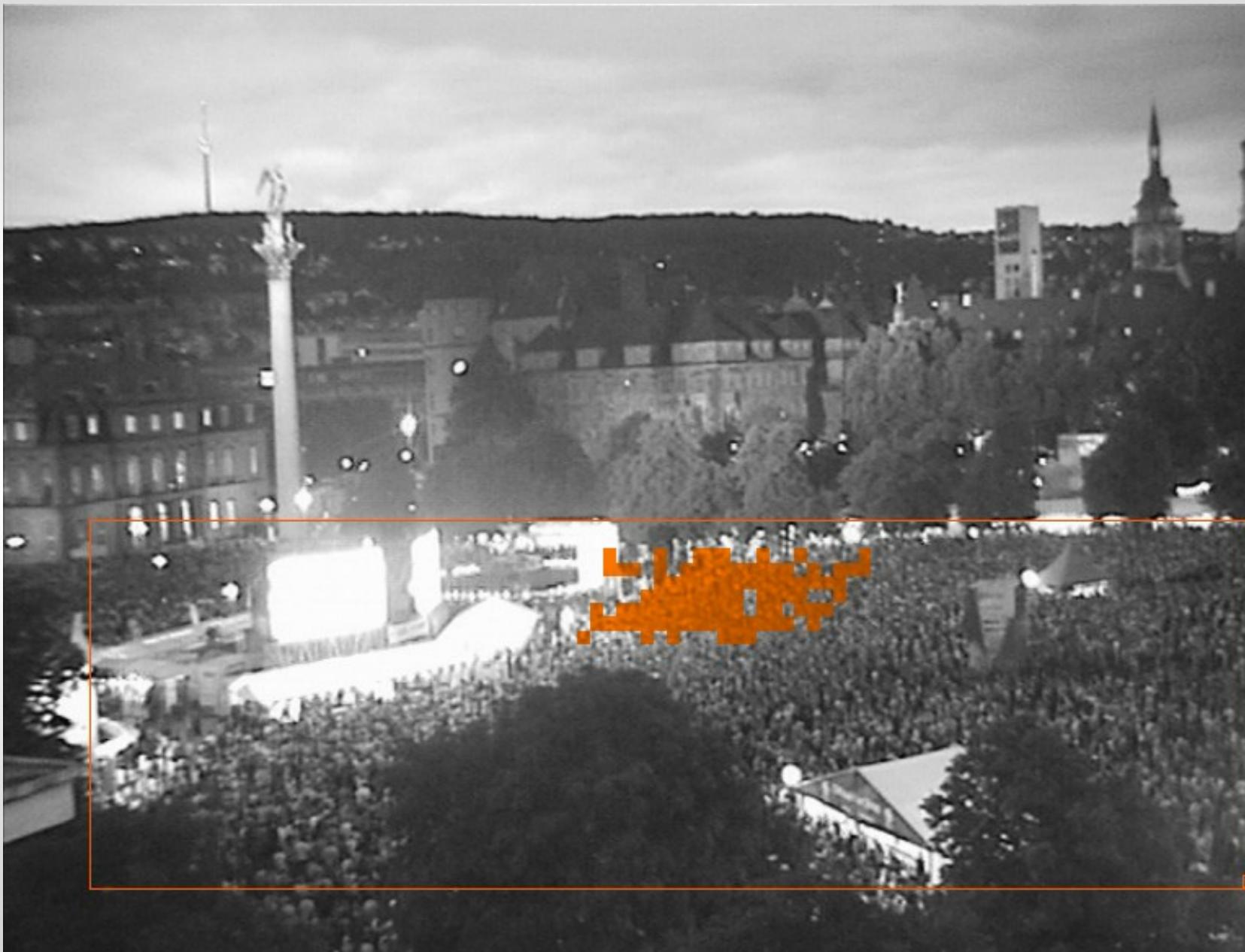
Surveillance of the Public Viewing Area in Stuttgart



Mannheim
Fire department

Surveillance of the Public Viewing Area in Stuttgart

High Sensitivity: Identification of Ethanol (Alcoholic Beverages)



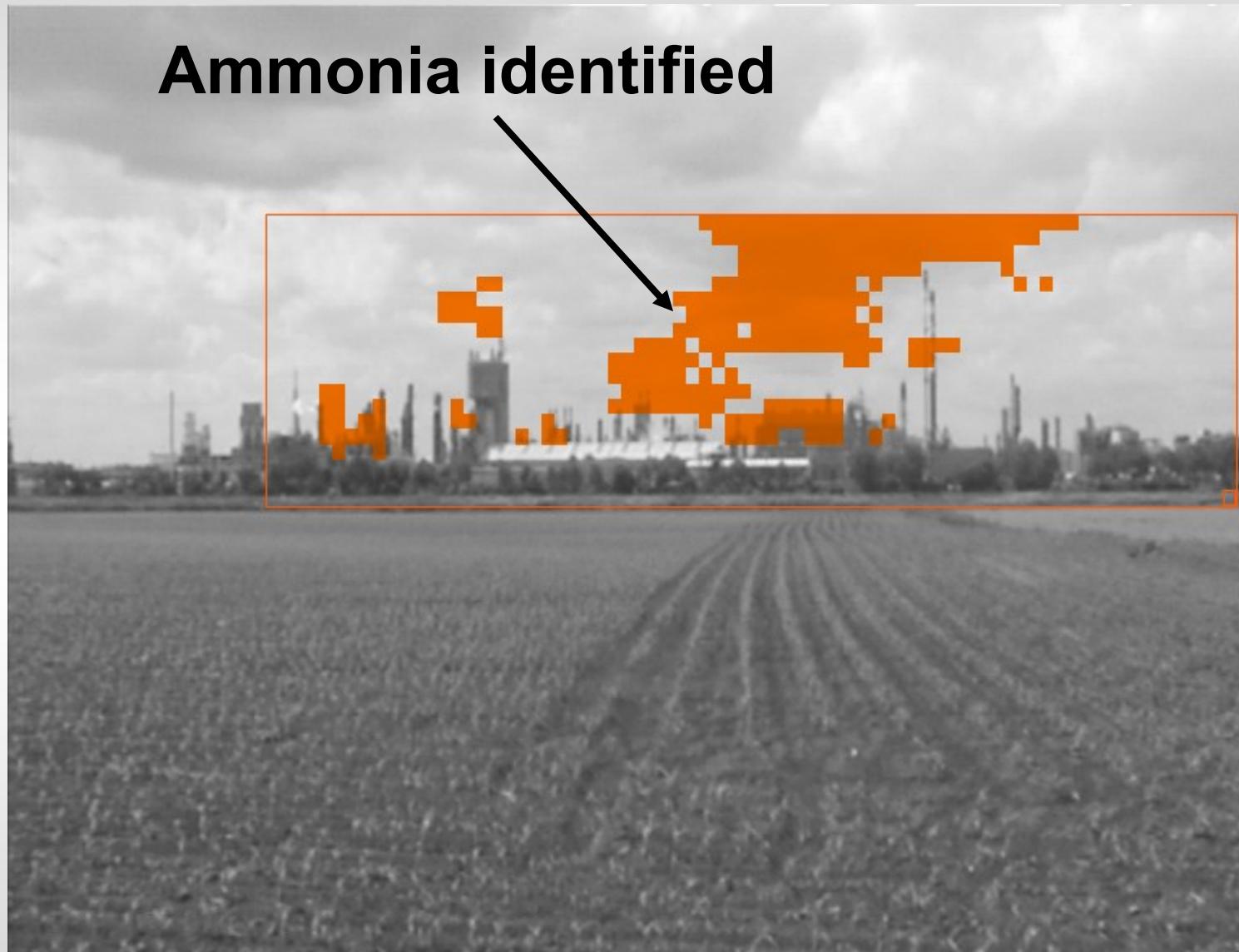
Mannheim Fire Department

Surveillance of Stadiums and Public Viewing Areas During the World Cup 2006

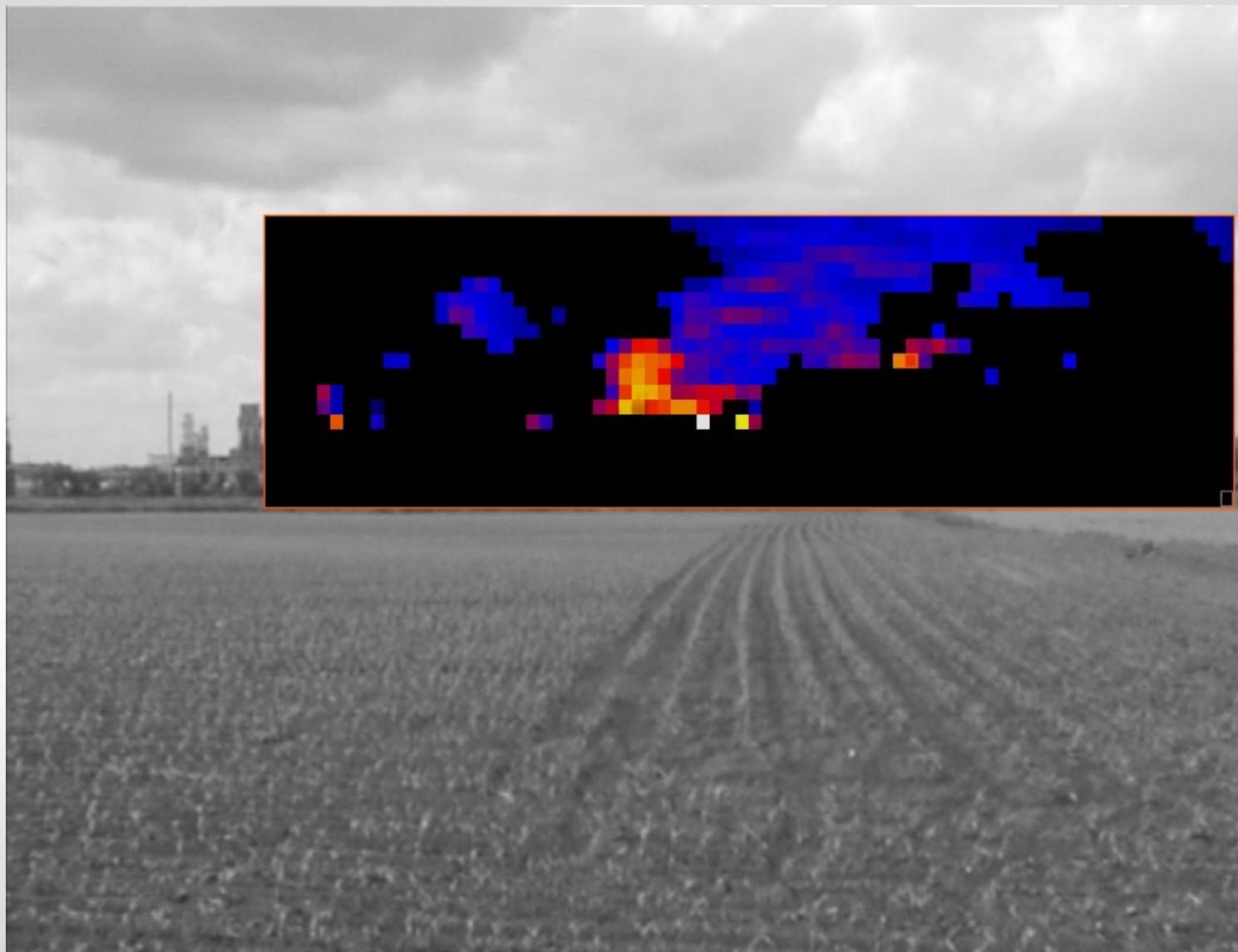
- Hamburg Fire Department
 - Identification of ammonia cloud (refrigerating storage house)
 - Identification of SF₆-cloud
 - Identification of methanol (incineration plant)
- Berlin (Police)
 - Identification of ammonia and ethanol in the stadium (alcoholic beverages)
- Mannheim Fire Department
 - Identification of ethanol in the public viewing area in Stuttgart (alcoholic beverages)



Ammonia Cloud



Quantification of Ammonia

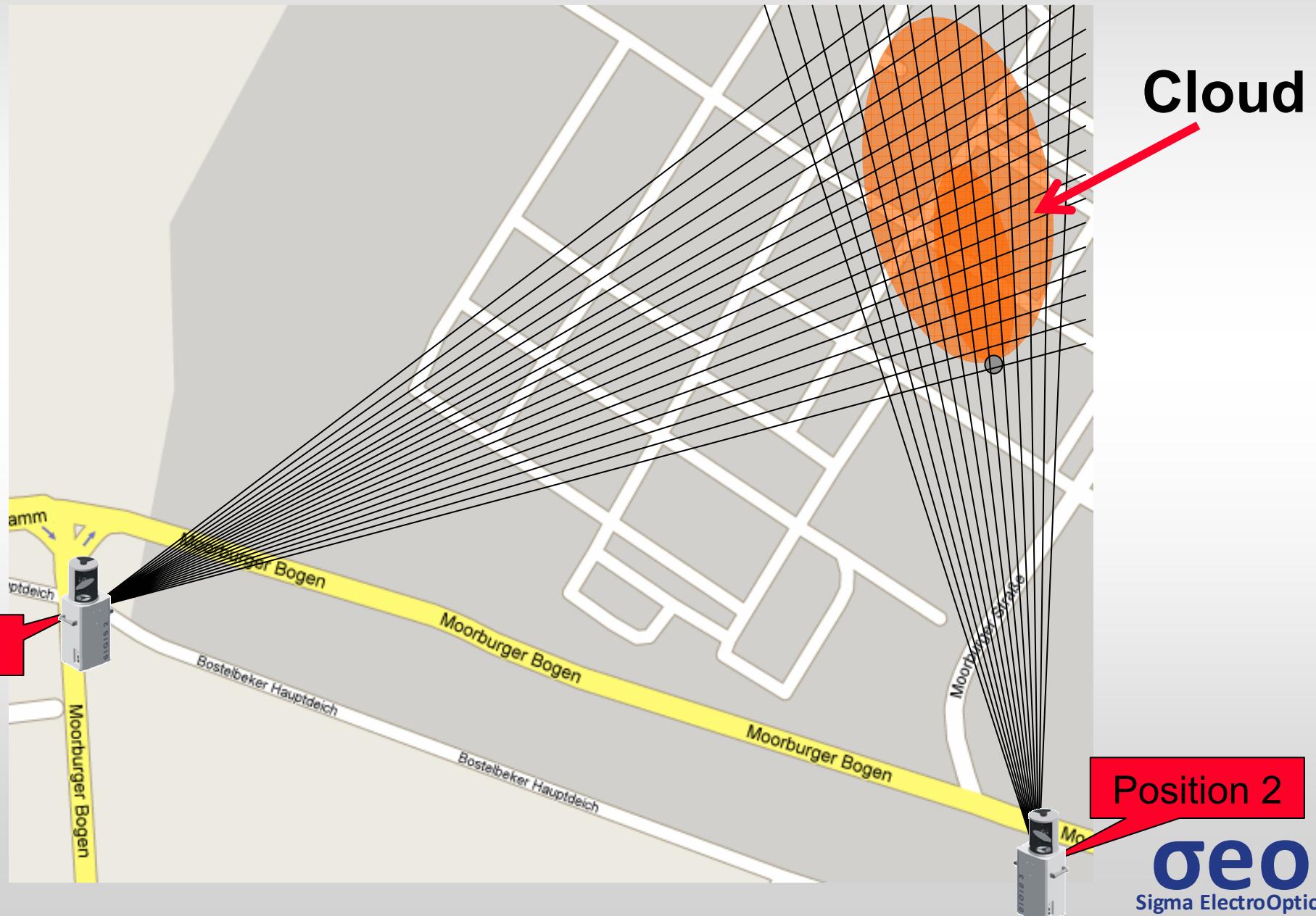


0

240

Column Density c / ppm m

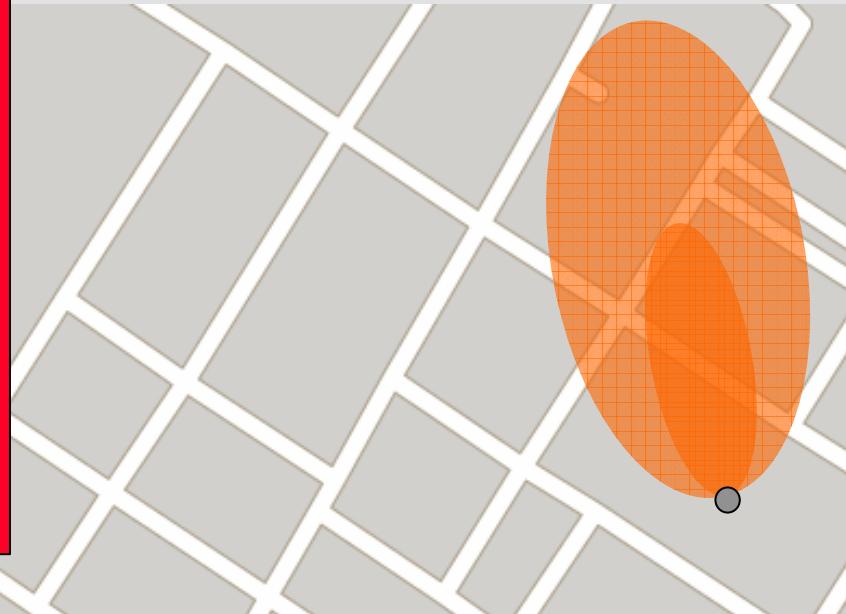
Tomography



Positions of the SIGIS Systems



Position 1

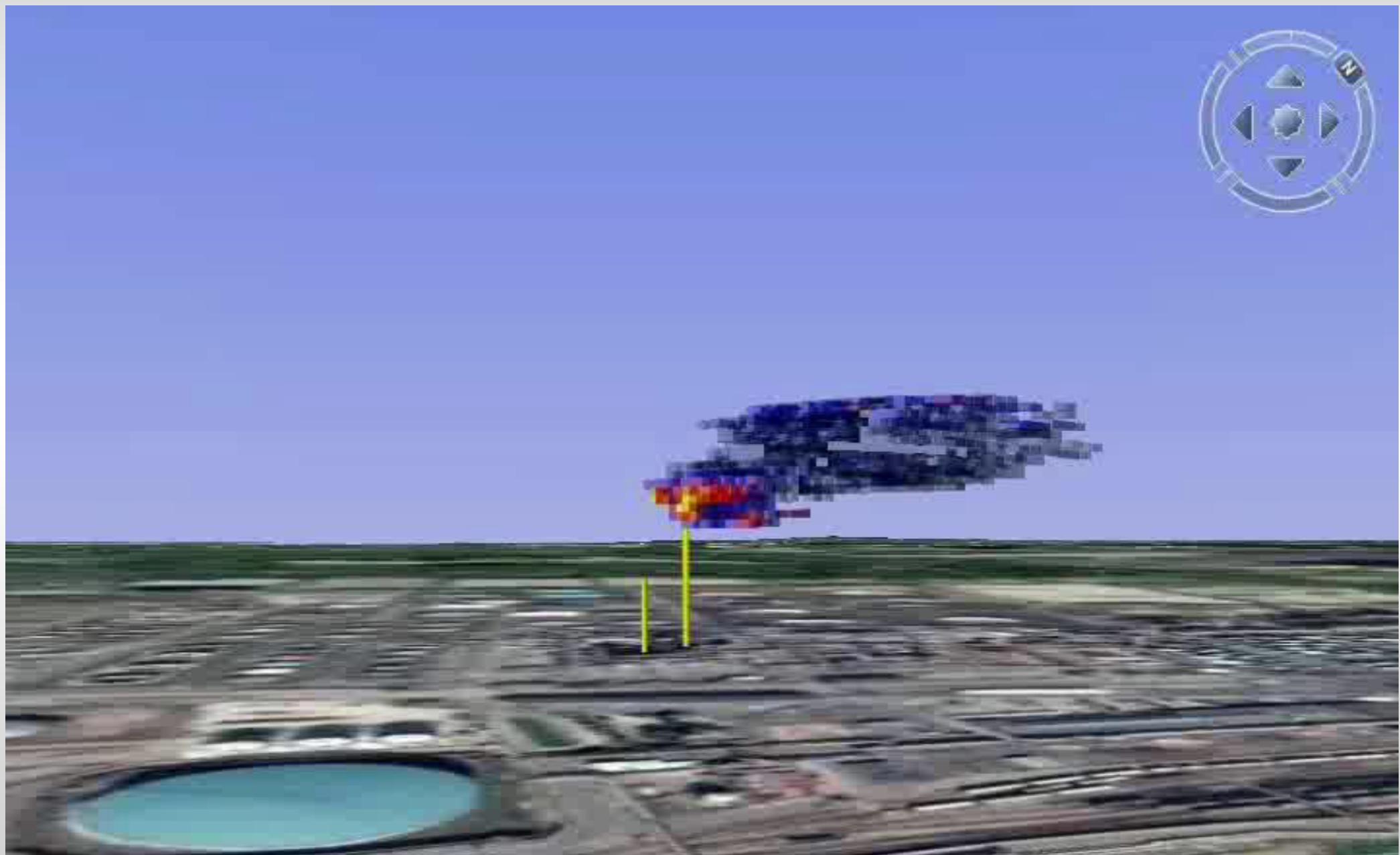


Position 2

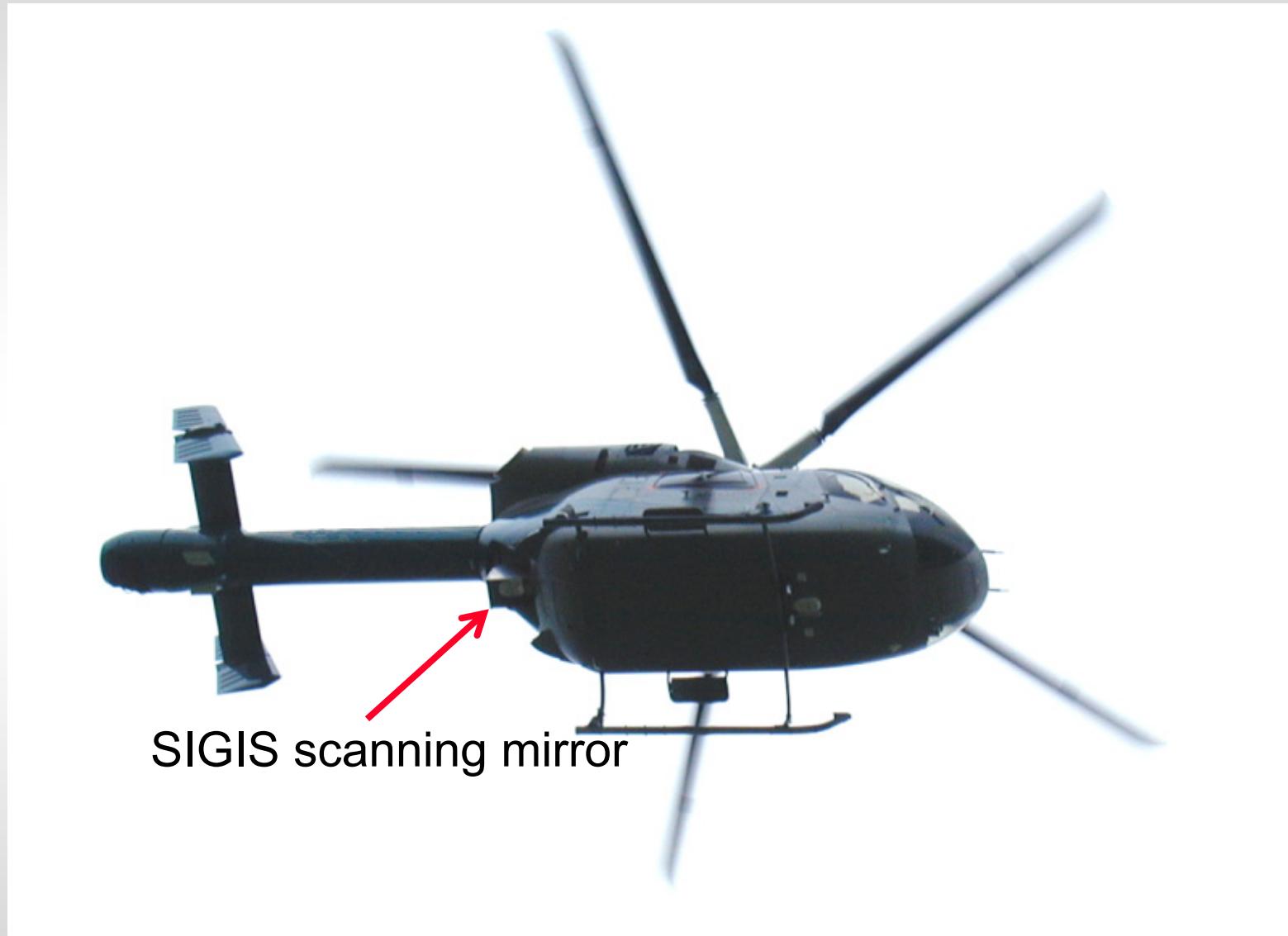
Cooperation TUHH, Hamburg Fire Department

3D-Reconstruction of Ammonia Emitted by a Stack

Automatic Export to Google Earth



Helicopter-Based Measurements



Measurement of Emissions of Volcanoes



- SIGIS 1, TUHH cooperation with UNAM, Mexico

Measurement of Emissions of Volcanoes

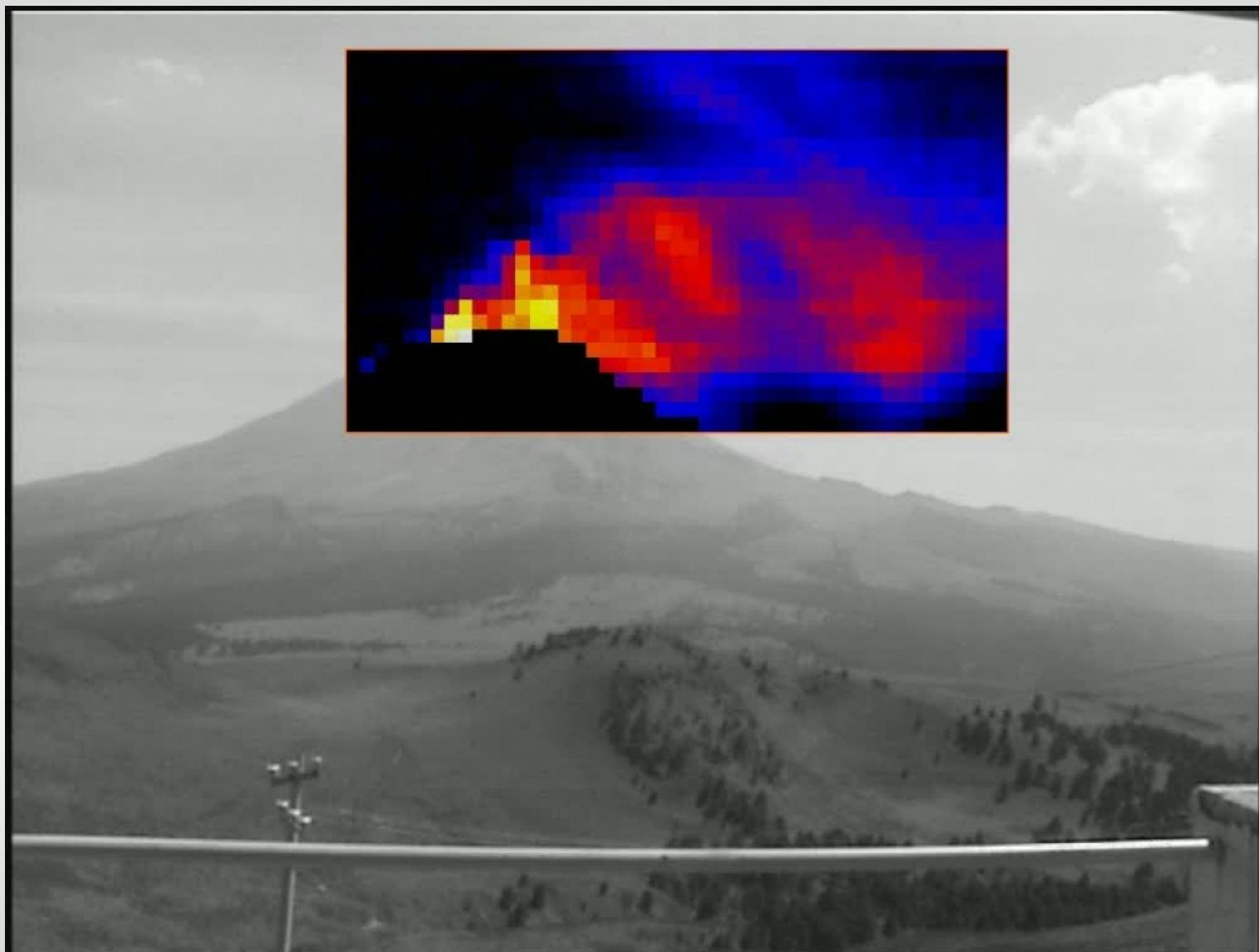
Video Image



TUHH cooperation with UNAM, Mexico

Measurement of Emissions of Volcanoes

Sulfur Dioxide



0



Column Density SO₂ (ppm m)

1500

TUHH cooperation with
UNAM, Mexico