

**e-on**

**ruhrgas**



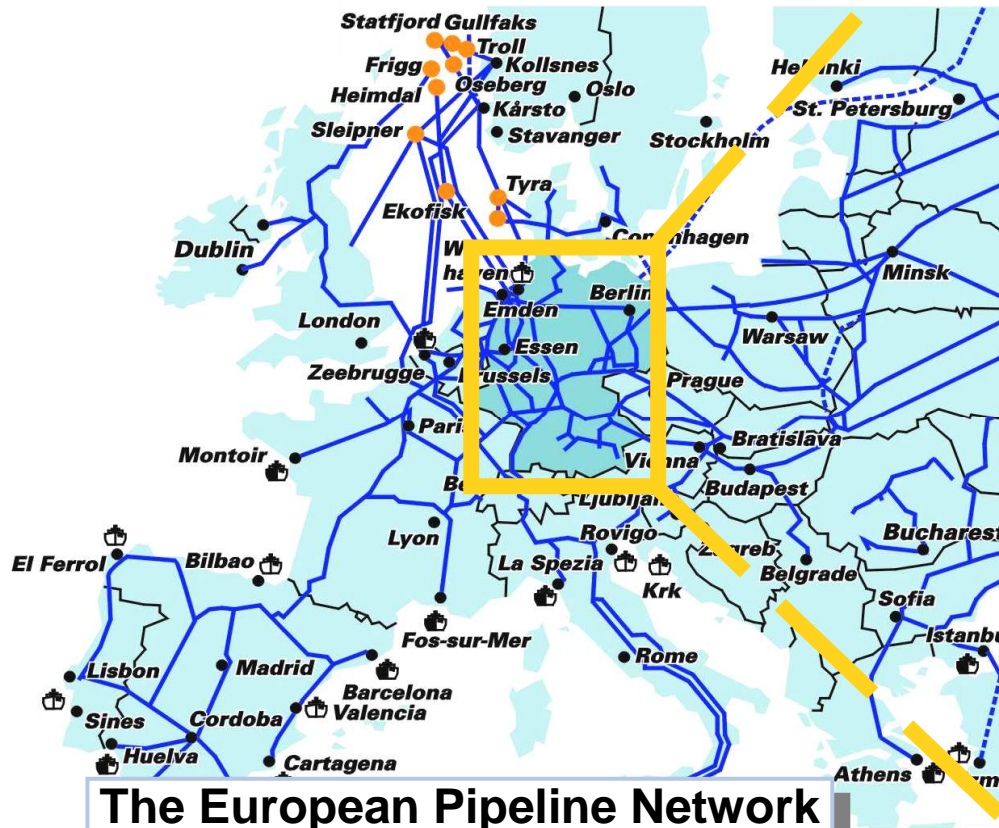
## **CHARM®**

**The Dawn of a New Era in  
Checking the Tightness  
of Natural Gas Pipelines**

**Werner Zirnig, E.ON Ruhrgas, Germany  
Matthias Ulbricht, Adlares, Germany**

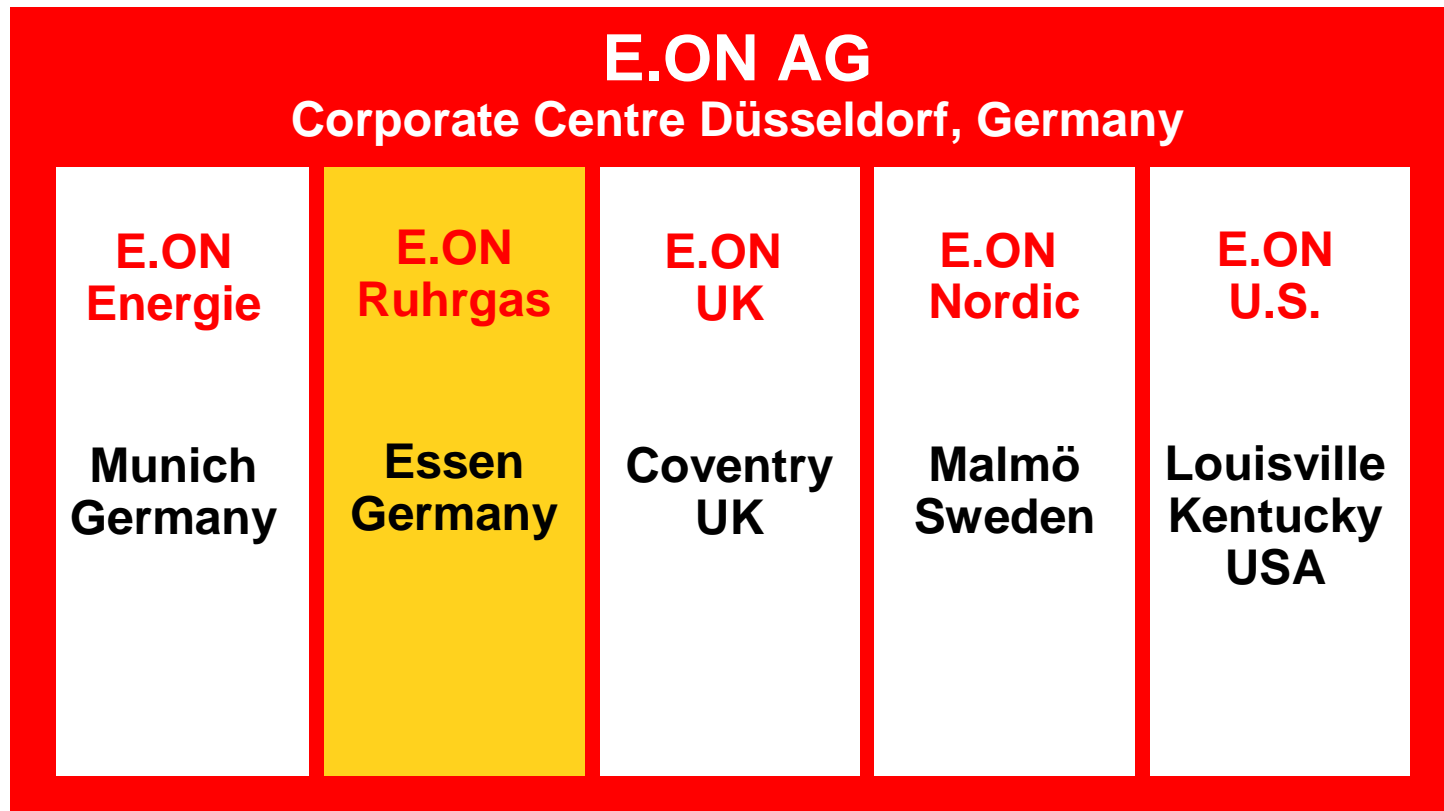
# E.ON Ruhrgas AG, Germany

- Germany's leading gas company
- Gas send out of 60 billion m<sup>3</sup>/a
- Pipeline system of 11,300 km



# The Company E.ON

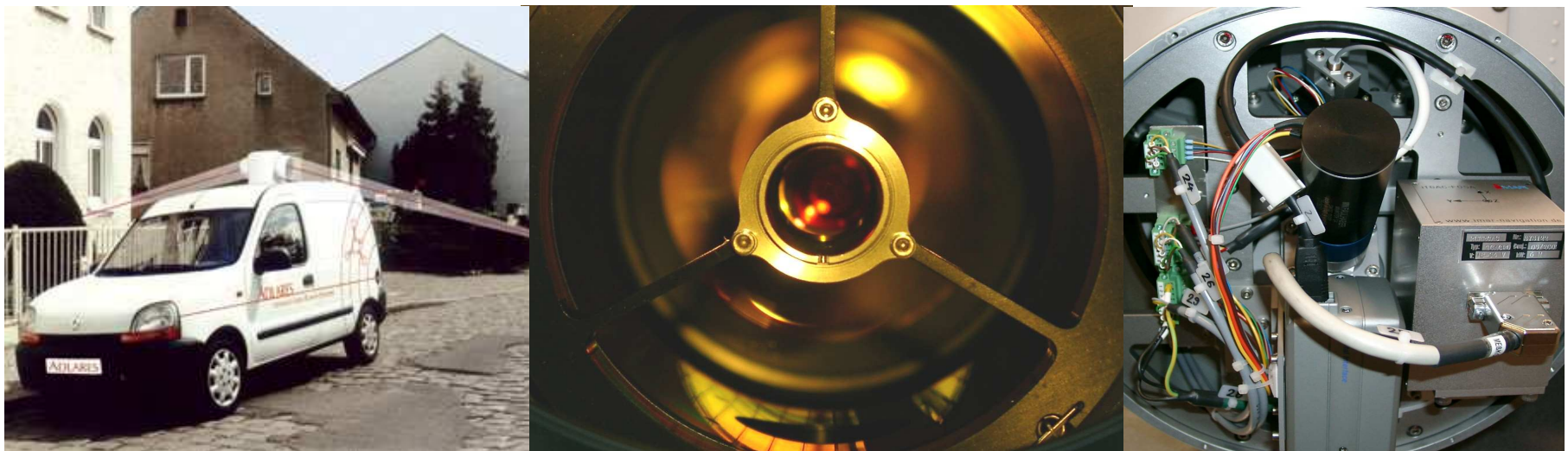
- E.ON is a worldwide integrated power and gas group
- E.ON is the world's largest investor-owned energy services provider with almost 80,000 employees



# Adlares GmbH, Germany

- Adlares is specialized in laser-based remote gas detection systems
- More than 10 years of experience in laser remote sensing:
  - ✓ design of lasers and optics
  - ✓ mechanical engineering and system integration
  - ✓ data acquisition
  - ✓ software development

**ADLARES**  
ADVANCED LASER REMOTE SENSORS



# Contents

- Pipeline operators' monitoring tasks
- Today's natural gas pipeline monitoring in Germany
- CHARM<sup>®</sup> - The helicopter-borne remote gas detection system
- Automatic measurement beam positioning by use of GNSS (Global Navigation Satellite Systems)
- Use of innovative technologies
  - the key to improved efficiency and safety in pipeline operation



# Natural Gas Pipeline Monitoring Tasks in Germany

- Prevent Third Party Interference
  - Inspect tightness of the pipeline system
  - Monitor ground movement
- ... by paying attention to very different surroundings



# Today's Pipeline Surveillance in Germany

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- Flying-the-line with small helicopters every month or every fortnight helps to identify Third Party Interference



# Today's Pipeline Inspection in Germany

- Walking-the-line with gas sensors in built-up areas once a year, or more frequently in mining influenced areas, helps to find hidden damages



Source: Sewerin



- ● ● Example of pipeline track in built-up area



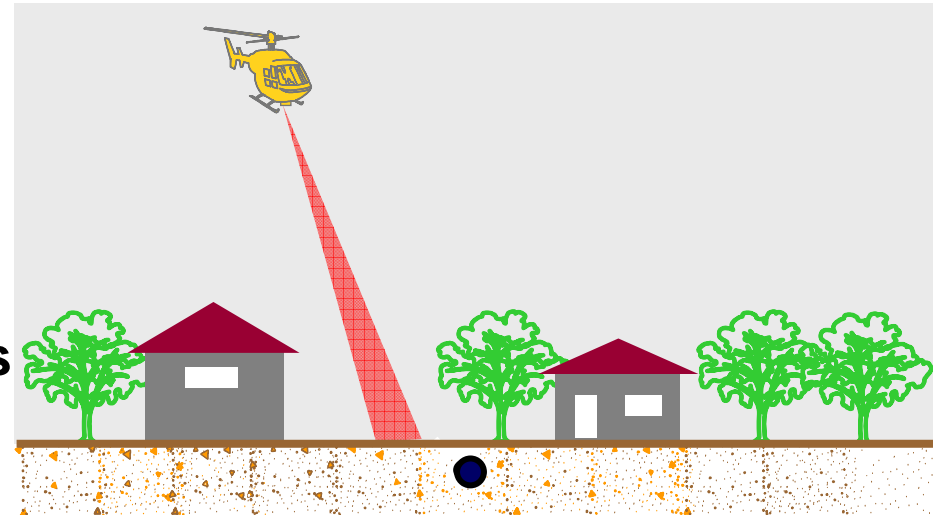
# CHARM<sup>®</sup> CH<sub>4</sub> Airborne Remote Monitoring



ruhrgas

## ➤ The Vision:

- Combine surveillance flights and inspection of tightness, especially in built-up areas
- Increase automation and efficiency of monitoring tasks while remaining high safety

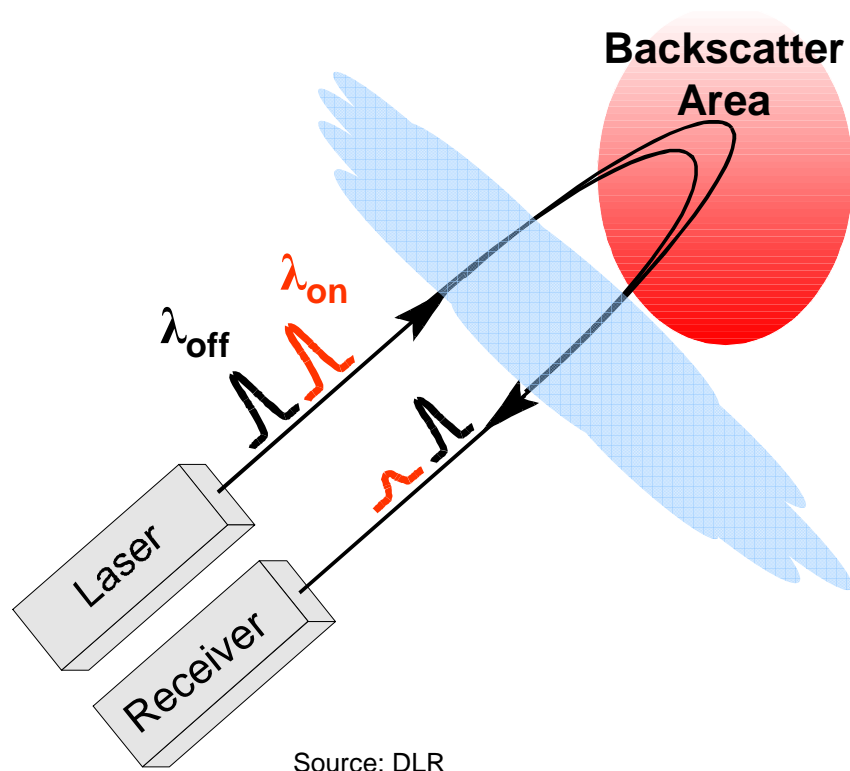


## ➤ Today's Reality:

Helicopter-borne laser gas detection system in operation

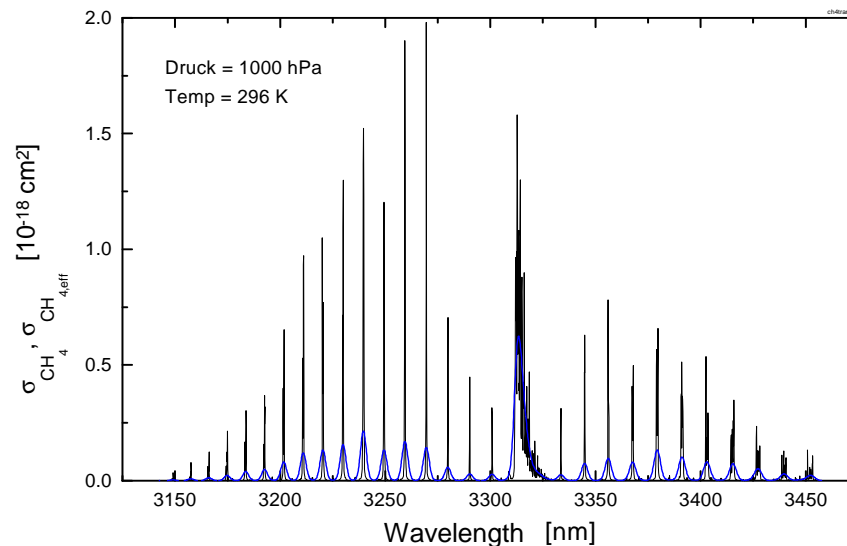
- Flight altitude: up to 150 m
- Travelling speed: ~ 70 km/hr.
- 100 measuring spots per sec.
- Automatic beam positioning
- Immediate alarm reporting

# Laser Measurement Principle

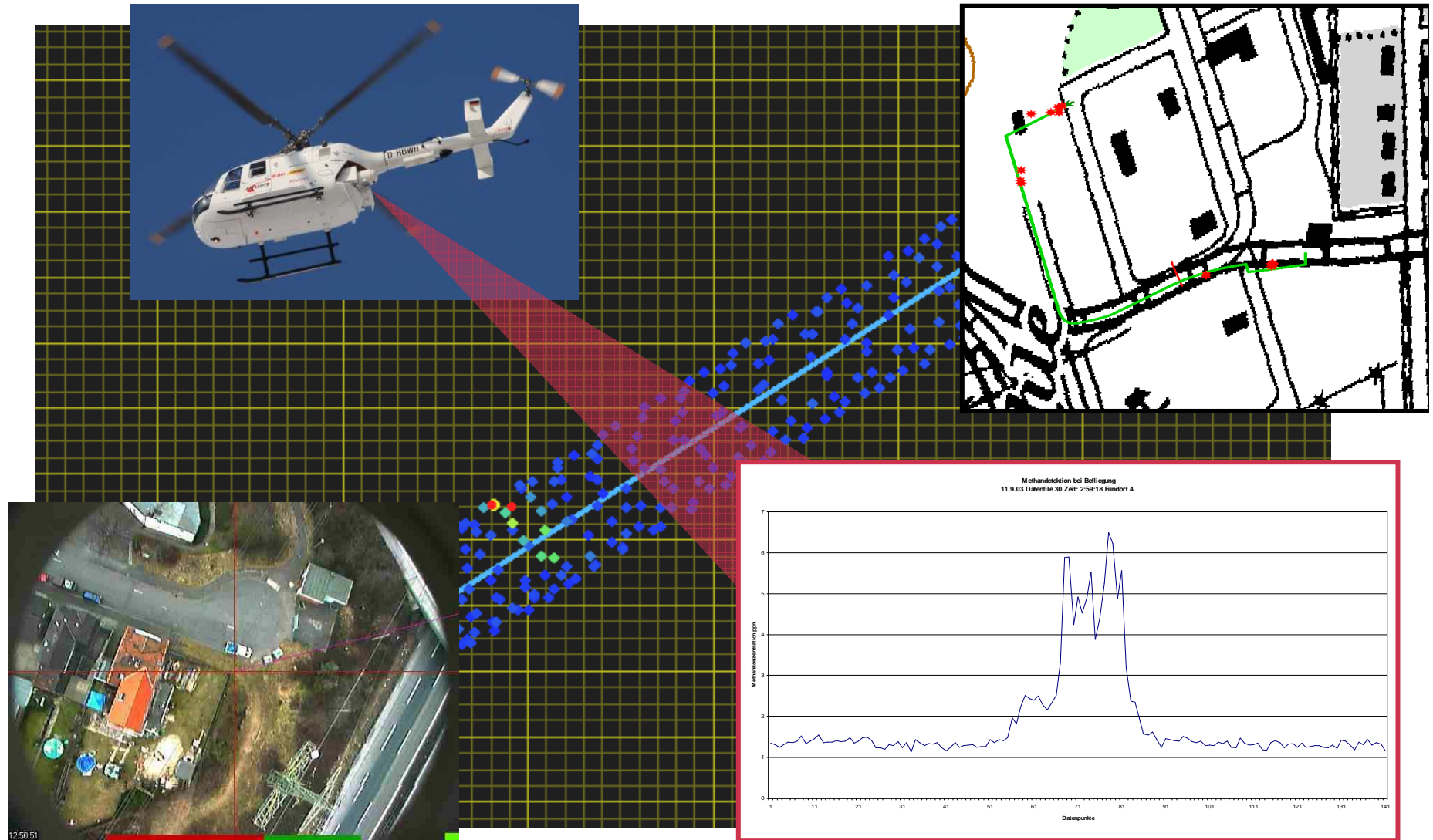


$\lambda_{on}$  Wavelength of methane absorption  
 $\lambda_{off}$  Reference wavelength

- DIAL  
Differential absorption Lidar
- Lidar  
Light detection and ranging
- Methane absorption lines  
at 1,6  $\mu\text{m}$  – 2,3  $\mu\text{m}$  – 3,3  $\mu\text{m}$

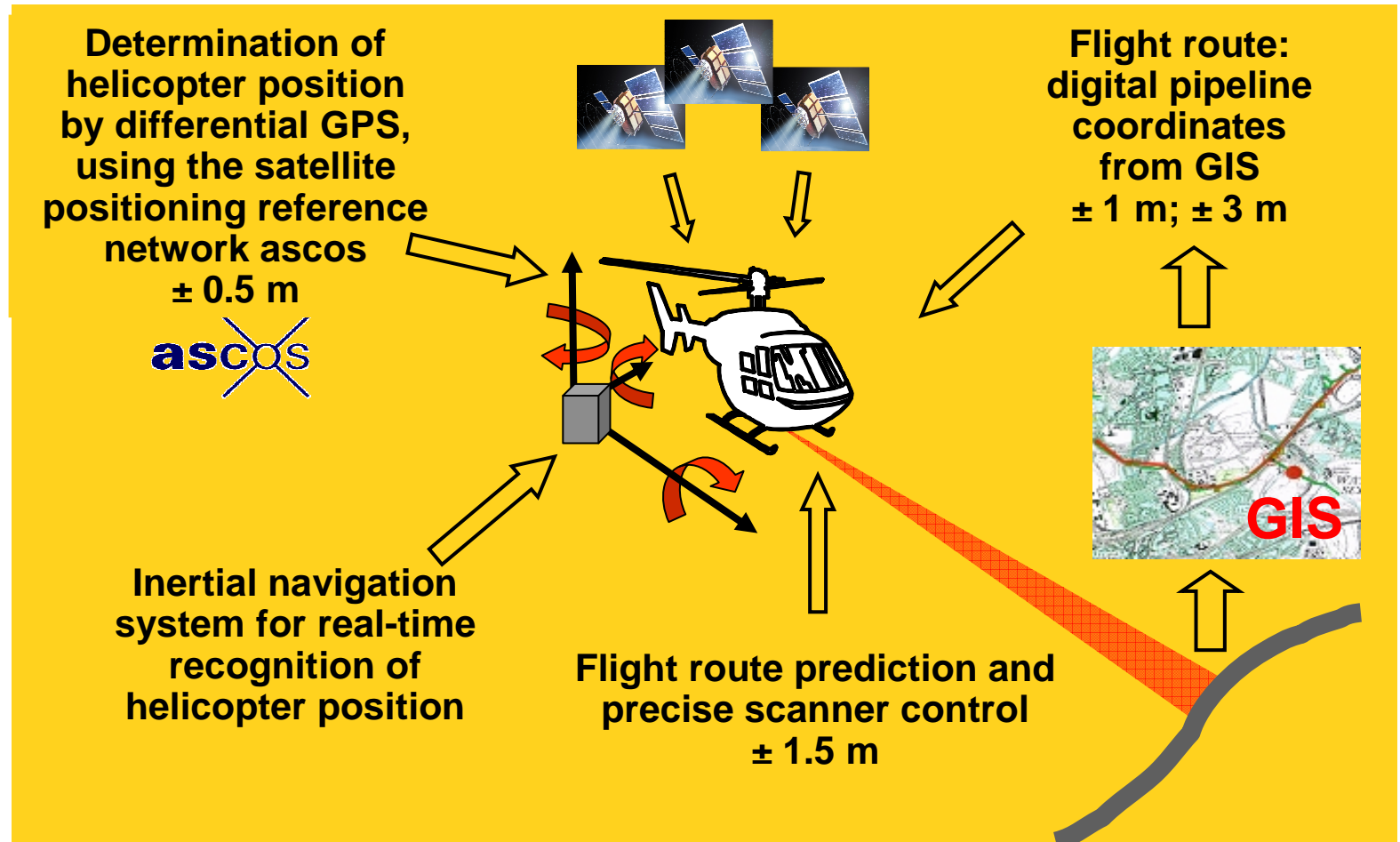


# Information Provided by CHARM



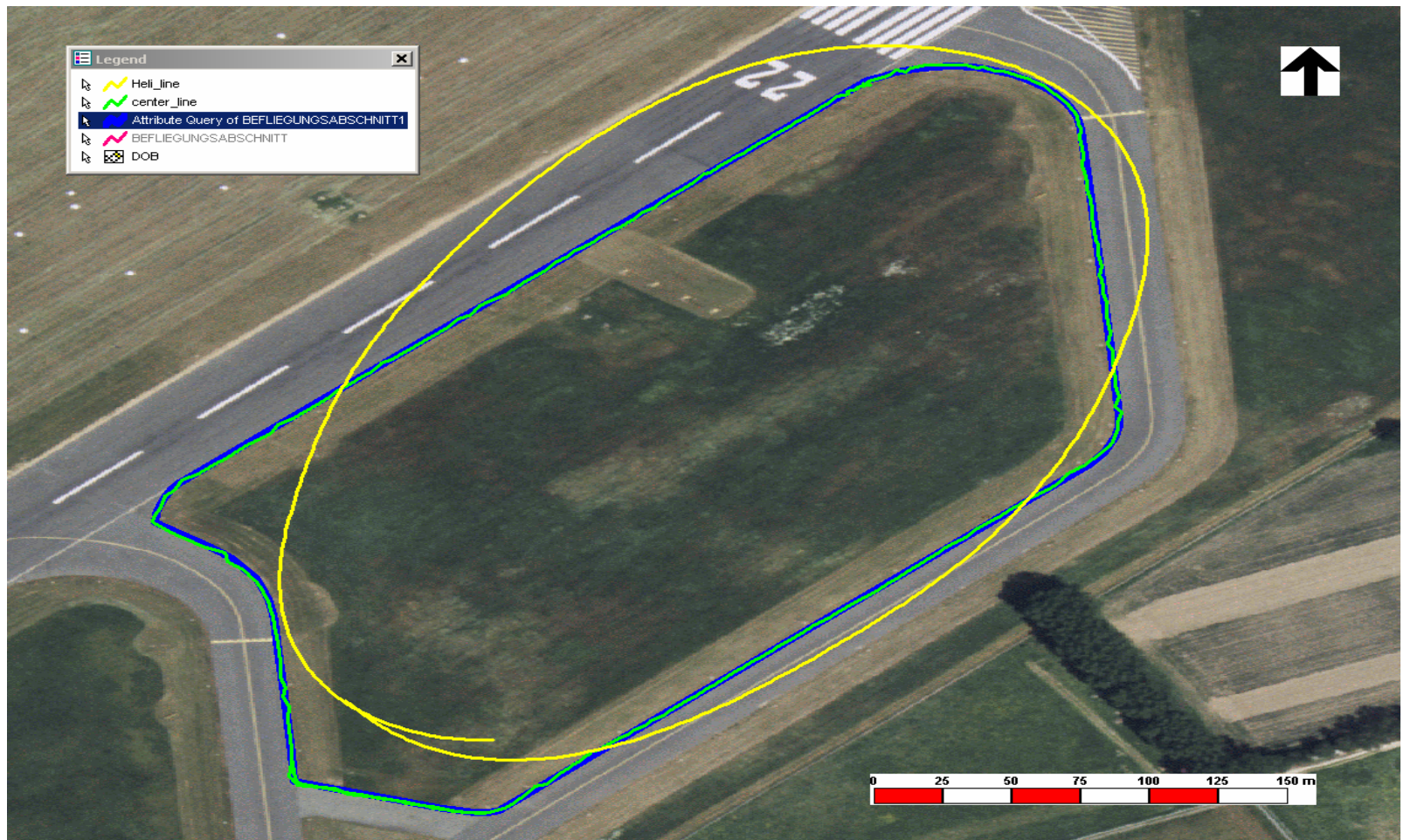
# Principle of Laser Beam Control

- Automatic laser beam positioning along the pipeline track by use of DGPS and Geographic Information Systems



# Precision of Laser Beam Control

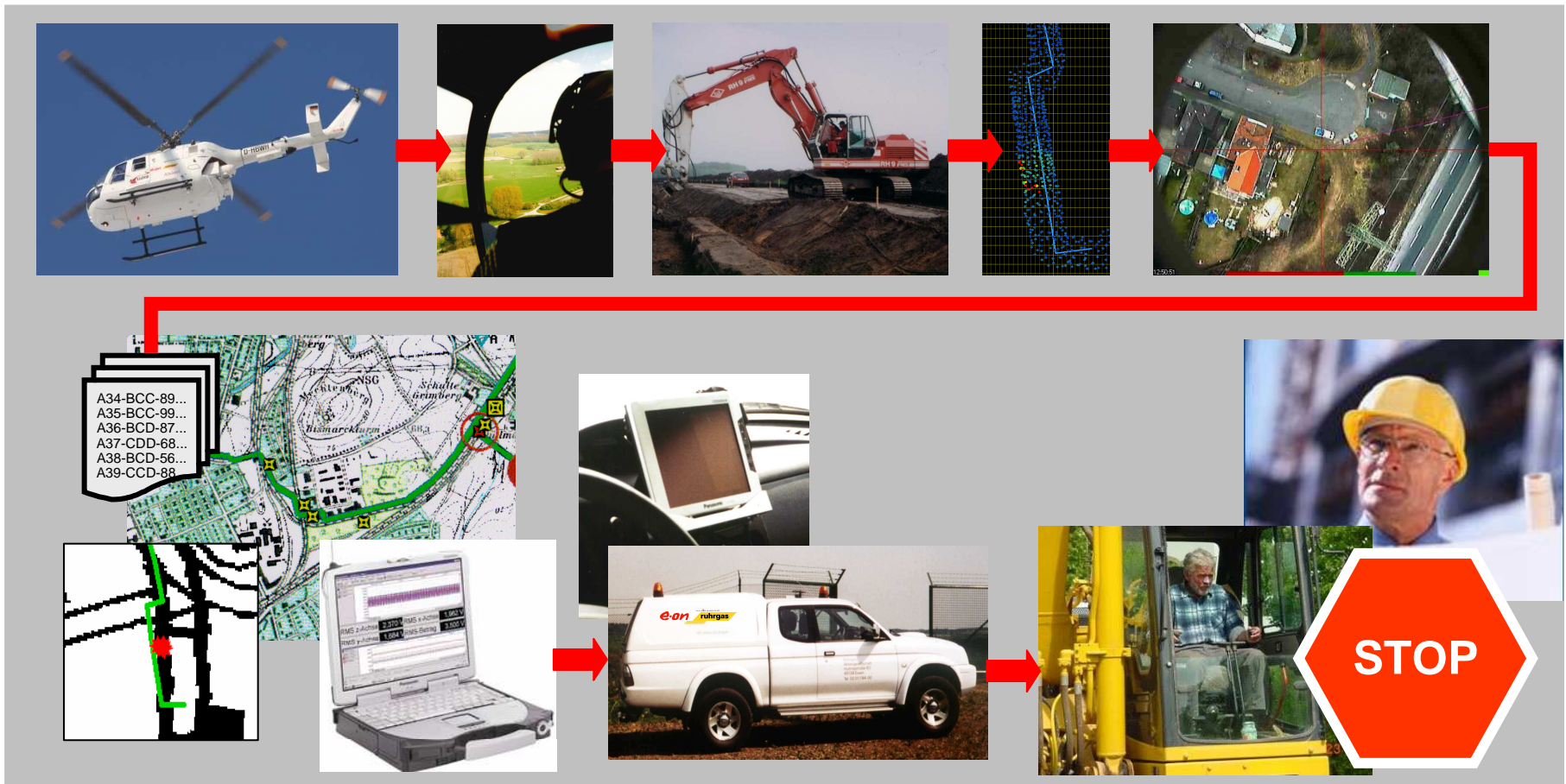
- Automatic laser beam positioning (green line) along the pipeline (blue line) within  $\pm 1.5$  m



# Use of Innovative Technologies – the Key to Improved Efficiency



- Swift and well-targeted response to any threats
- Efficient and safe natural gas pipeline operation





**Pipeline Inspection 1916**



**Pipeline Inspection 1926**





**Pipeline Inspection Today**



**CHARM<sup>®</sup> - The dawn of a new era in remote gas detection**