

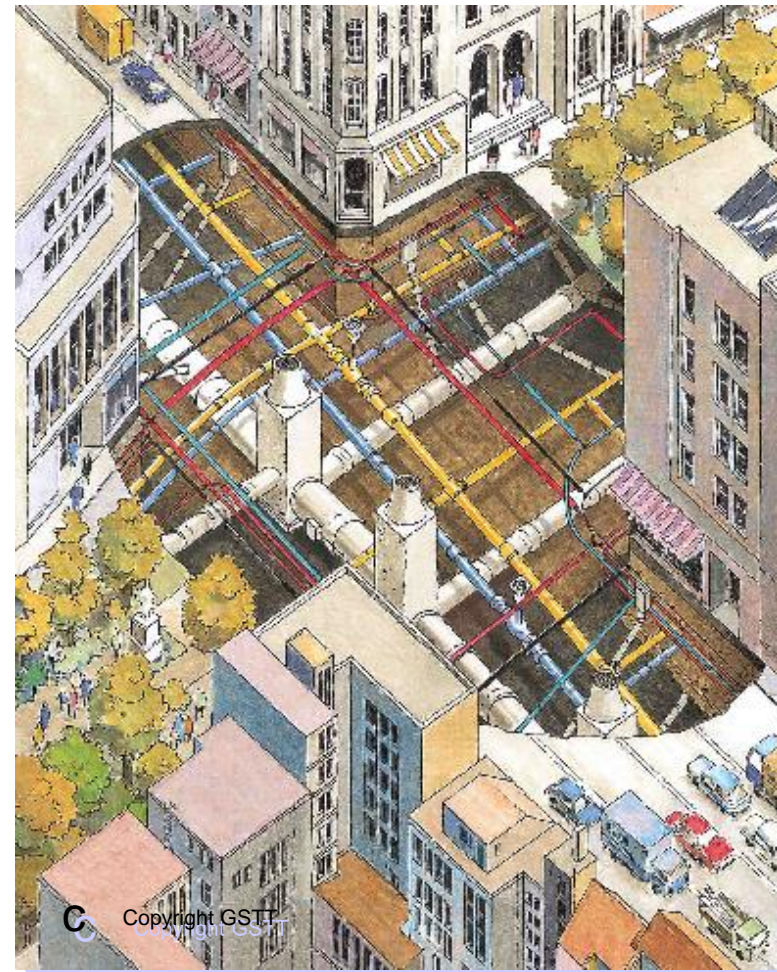
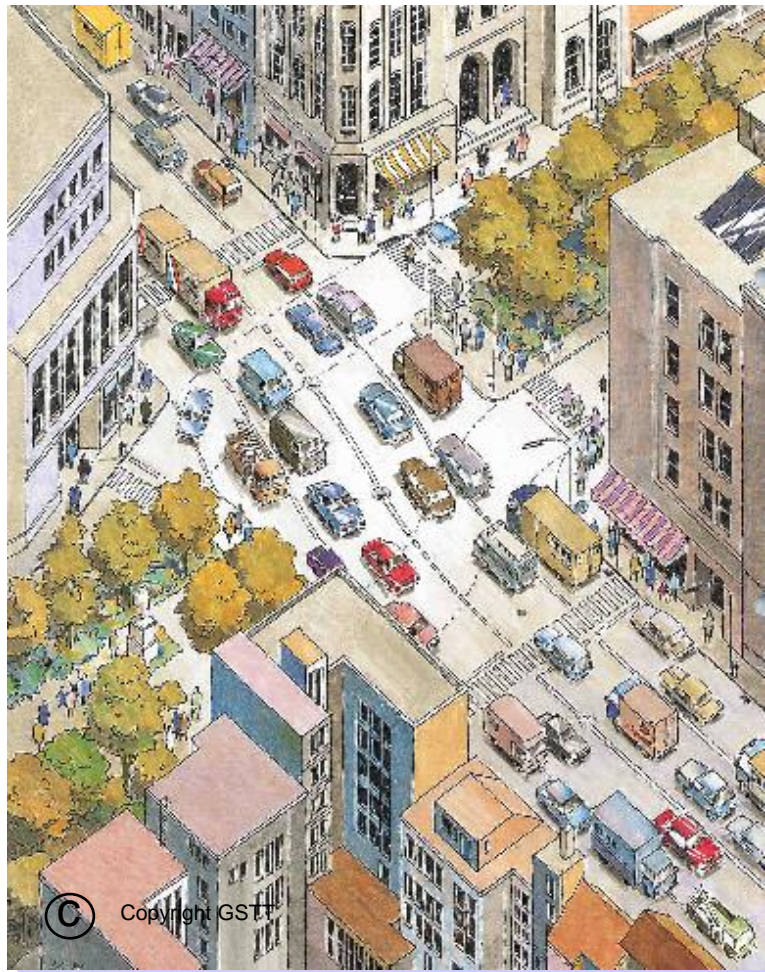
# Optical Telecommunication Links in Gas Pipes

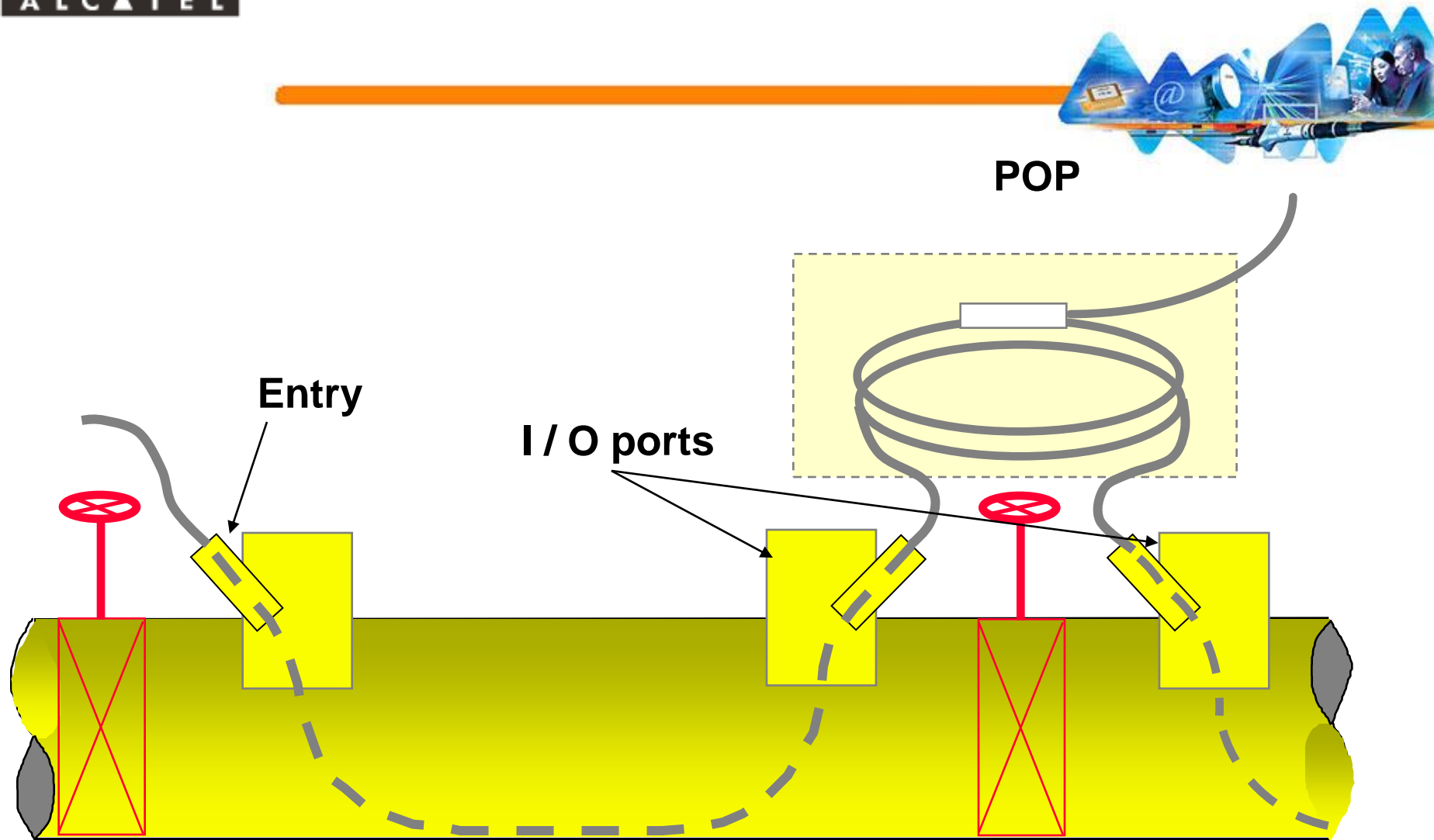
## Innovative RoW Solution

### Exclusively at Alcatel











## Gas pressure

Transport level	< 100bars
Distribution	< 20bars
Subscriber	< 0.1bar

## Typical composition of natural gas

Methane	50 - 90 %
Ethane	1 - 20 %
Propane	0 - 12 %
Nitrogen	1 - 12 %
Carbon Dioxide	1 - 10 %
Butane	0 - 4 %

## Pipeline diameter

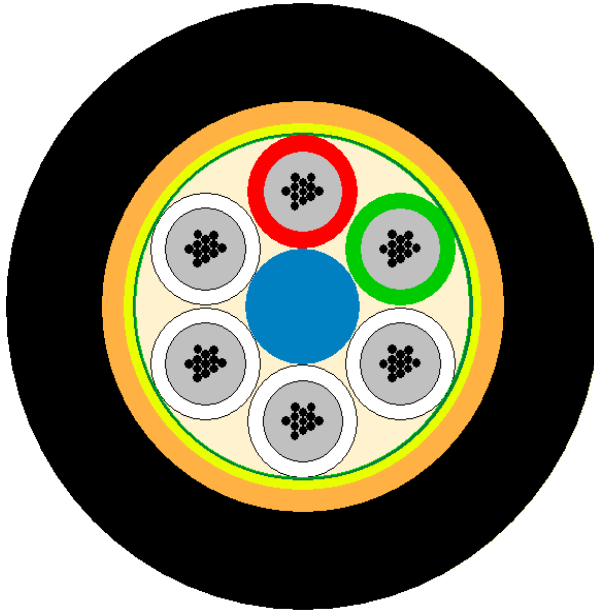
Transport level	up to 1000mm
Distribution	typ. 200 - 400mm
Subscriber	typ. 100mm

## General parameters

Temperature	0 ... 20 °C
Gas flow speed	0 ... 15 m/s

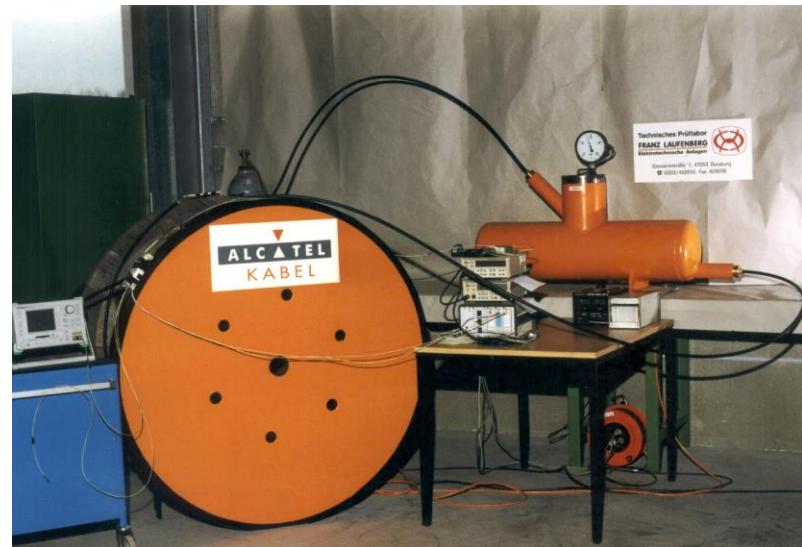
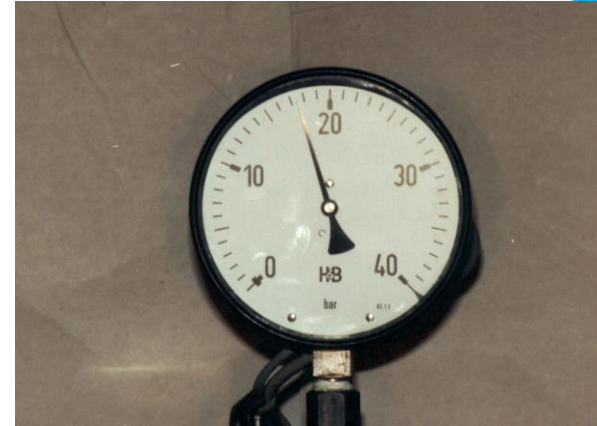
Trace gases:	helium hydrogen
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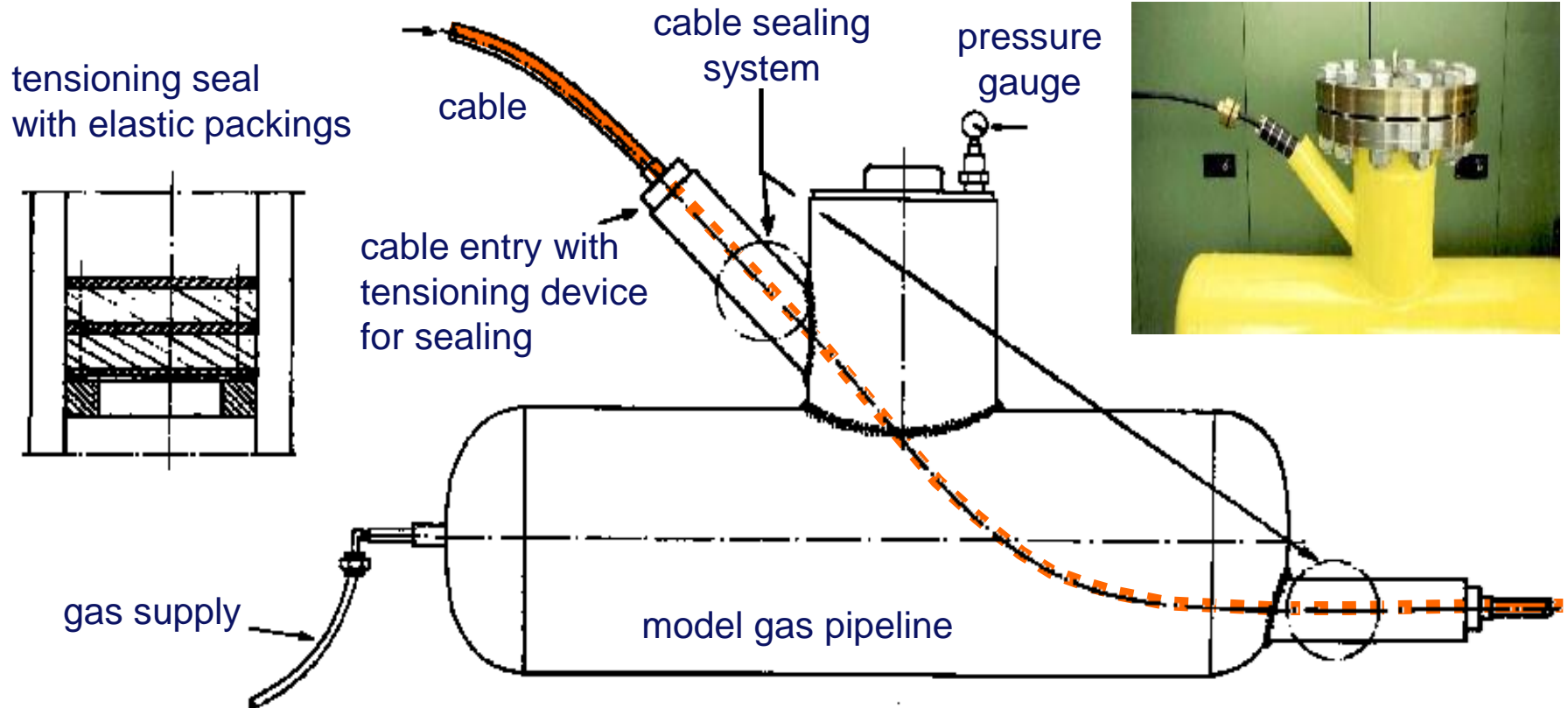


- ◆ Aluminium tape prevents the permeation of gas into the cable
- ◆ Special low-friction HDPE jacket is stable against natural gas
- ◆ High tensile strength (> 6000N) for optimum pulling performance
- ◆ Filled core to resist high gas pressure (18bars)
- ◆ Extra-thick jacket for increased stability against rough gas pipe surfaces

# Laboratory testing: Tightness of cable sealing



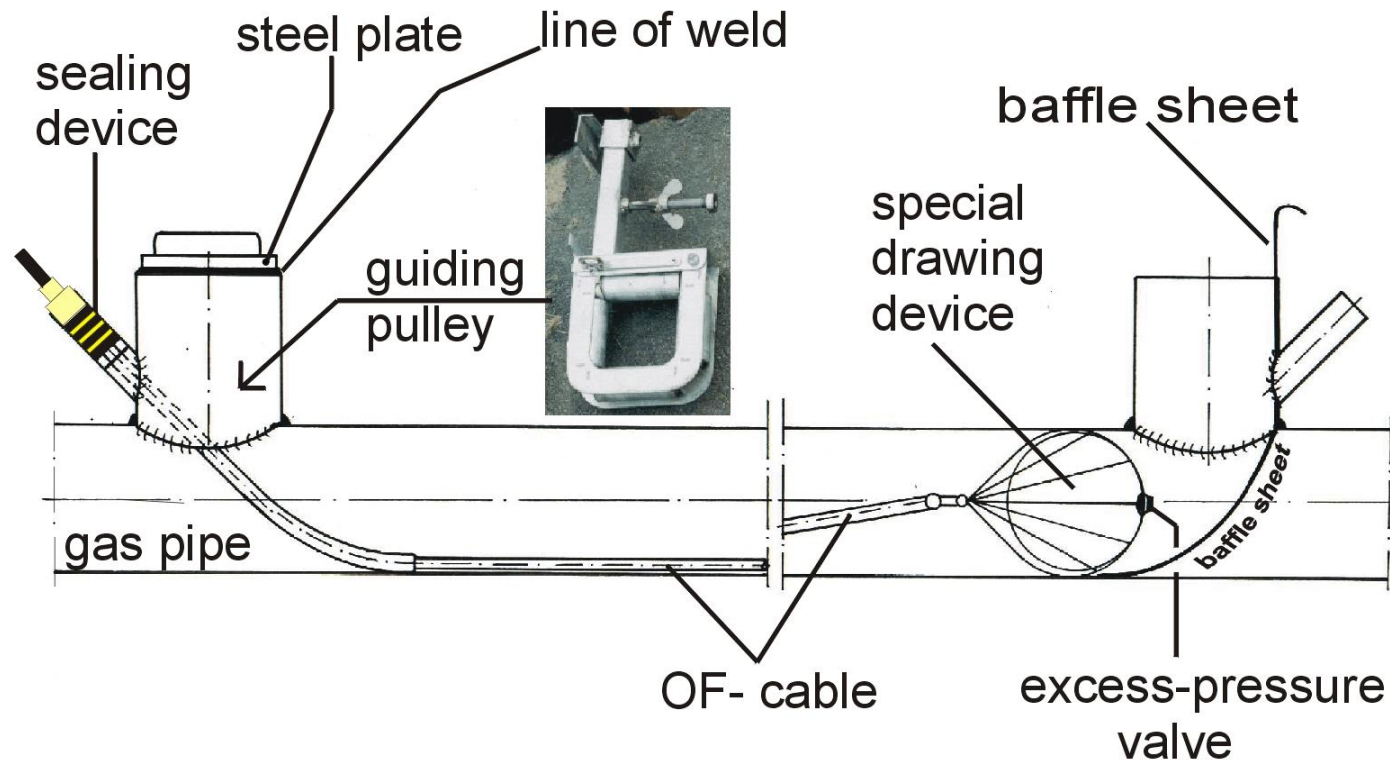
# Laboratory testing: Tightness of cable sealing



**High-pressure test - 80bars, 16 weeks: TIGHT!**



## Laying procedure schematic







## Preparations:

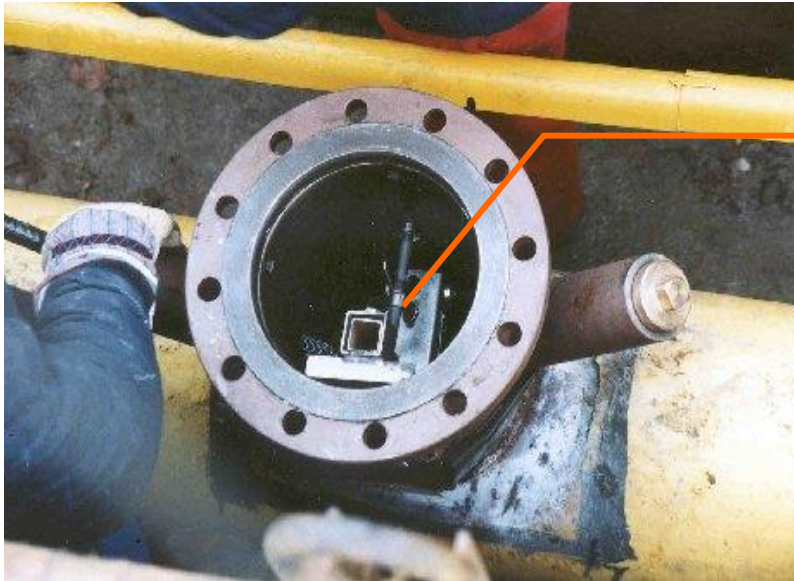
- ◆ manhole excavation; dismantling of pipeline shield
- ◆ weld-on cable entry flange

Weld-on flange which is used for the cable inlet and outlet respectively.



The balloon-drawn device (“go-devil”) enables the pulling in of the cable without additional equipment (cable winch, etc.) even when small bending radii occur along the network route.





During the installation phase a guiding tool is mounted inside the weld-on flange in order to guide the cable smoothly into the pipeline.

In regions with a high population density, compressed dry air is used for cable pulling instead of combustible gas.







welded-on cable entry flange system  
on gas pipeline with cable bend protection



- ◆ Manhole: only 1.5 x 3m
- ◆ Mounting of entry flange in live gas pipe conditions
- ◆ Cable pulling up to 250m/min
- ◆ Spare cable length for future customer access point

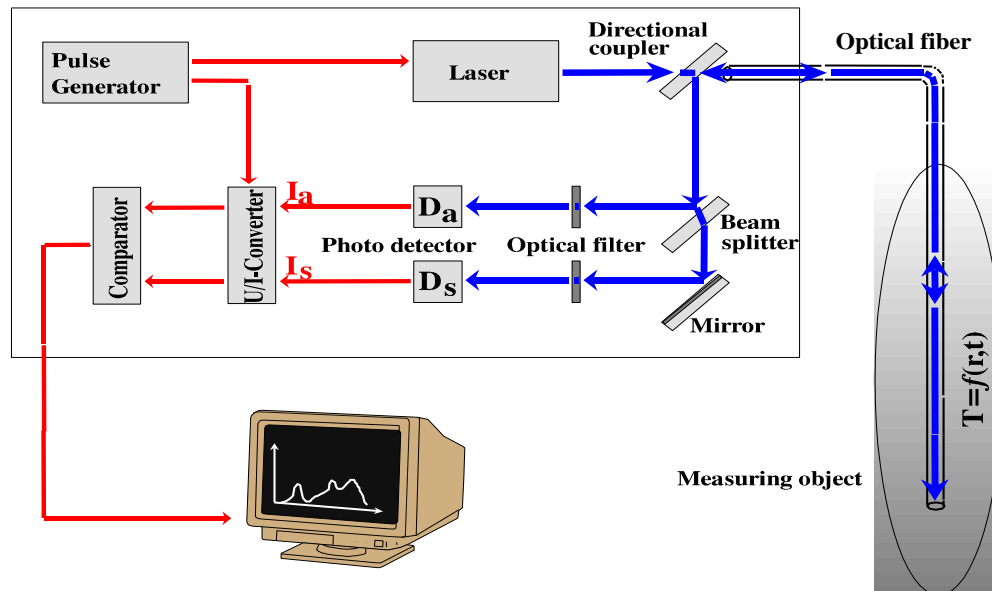
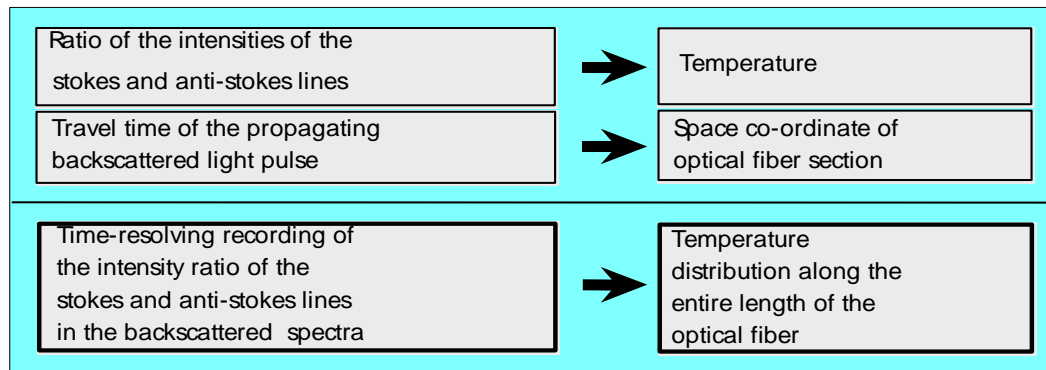








# Fiber optic temperature sensing system: Leakage detection and warning system





Efficient  
optical network  
deployment

- ◆ low cost (minimal civil engineering)
- ◆ fast realization time (typically, 2 complete sections per day)
- ◆ high reliability (perfect protection of cable)

Gas network  
undisturbed

- ◆ no impact on original medium
- ◆ no impact on operation and maintenance
- ◆ additional revenue

Environmentally  
friendly with minimal  
civil engineering

- ◆ fast completion of cable installation reduces disruption to citizens and impact on environment
- ◆ low impact on vegetation and trees
- ◆ avoids traffic jams and damage to road surfaces
- ◆ no visible installation gains acceptance by citizens

# Metropolitan optical links in gas pipelines: Examples



## Numerous projects

Germany: Several projects as part of city nets

Ongoing city ring projects in Taiwan:

- ◆ City of Taipei: 140km 192 o.f. cable
- ◆ Taipei suburb: 87km 192 o.f. cable
- ◆ Taichung: 138km 144 o.f. cable

## Typical parameters

gas pressure	avg. 4-8bars max. 10-20bars
gas pipe diameter	typ. 200-350mm
I/O ports	typ. 4-5 / km



