**TARGET APPLICATIONS**

**Process Gas Analysis in Refineries**
- Multi-component process gas analyser
- Fast response time allows rapid control decisions
- Low maintenance and low sampling effort

**Gas Leak Detection in Petrochemical Plants**
- Wireless sensor network for continuous monitoring
- Mobile robot inspection vehicles for pipelines
- Low power consumption and high dynamic range

**Protein Analysis in Liquids for the Dairy Industry**
- In-line protein monitor on milk collection tank
- Instant information on fat and protein content
- Can discriminate between different fat proteins

**TECHNOLOGIES**

**Integrated Mid-Infrared Multi-Wavelength Laser Arrays**
- On-chip widely tunable laser module in the 2-8 µm range
- Up to 30 lasers multiplexed into a small no. of outputs
- Combines bonded QCLs, hybrid PhC lasers and GaSb on Si

**On-Chip Photo-Acoustic Spectroscopy Sensors**
- Miniature PAS cell capable of sub-ppm chemical detection
- Fully integrated µm-size PAS cell on Si will be realised
- Proof of concept of intra-cavity PAS (enhanced signal)

**On-Chip Sensors for Liquids**
- Mach-Zehnder interferometer PIC for proteins in liquid
- Outperform standard ATR spectroscopy on-chip
- a-Lactalbumin and casein initial protein targets

**TOOLS**

**SiGe Platform**
- Well-developed SiGe on Si and SiGe on insulator processes
- SiGe allows low propagation losses in whole 3-8 µm range
- PIC structures fabricated in pilot line environment

**III-V on Si Integration Capabilities**
- Heterogeneous integration - direct bonding of QCLs
- Monolithic integration - growth of III-V on Si
- Hybrid integration - pick-and-place technology

**Hybrid Photonic Crystal Lasers**
- Gain chip coupled to SiGe/Si photonic crystal mirror
- PhC mirrors allow high Q-factors in the range of 50-100k
- Gain and wavelength selection can be optimised separately