PhaseOpt – Online tool for hydrocarbon dew point monitoring

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Outline

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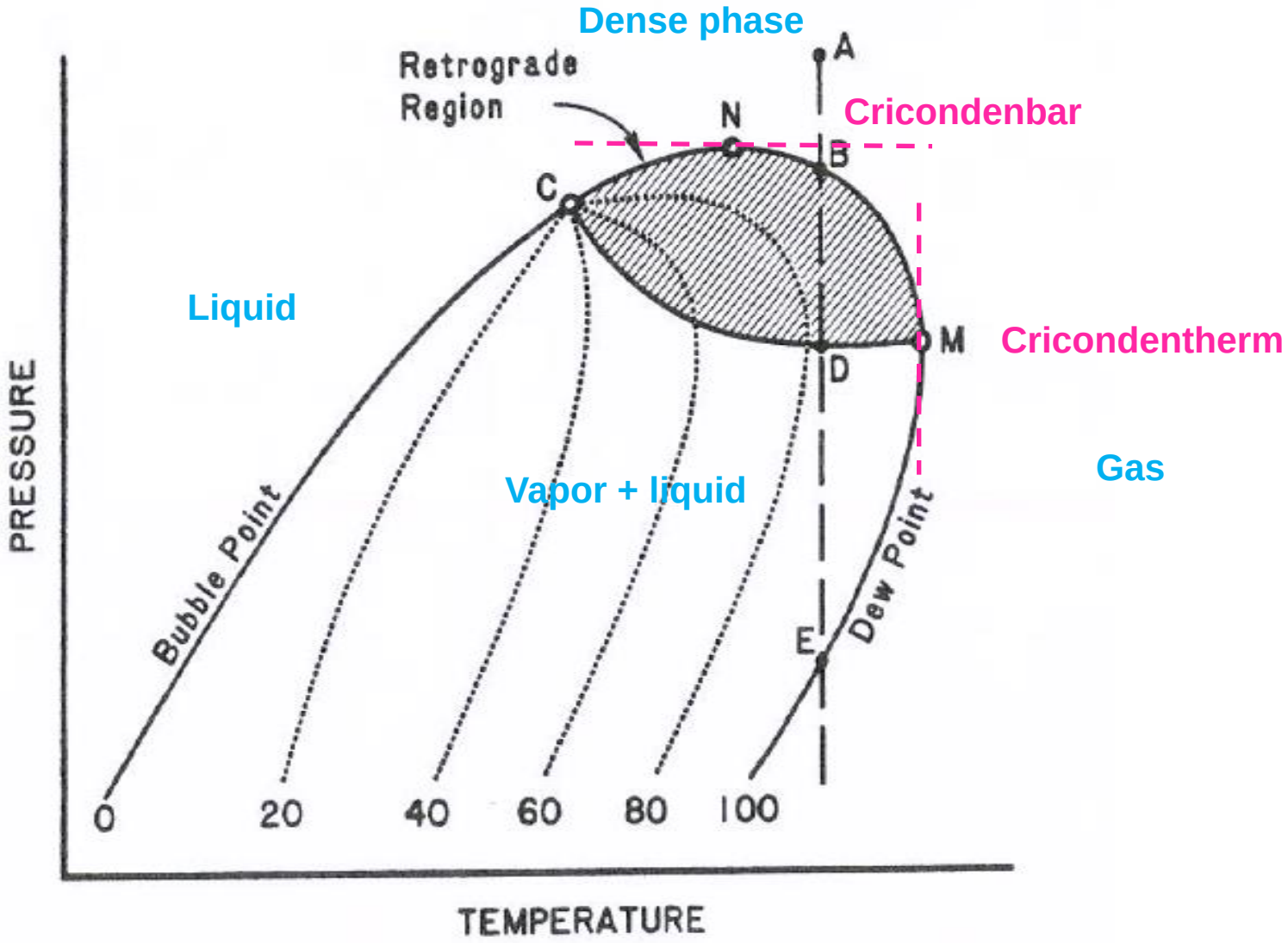
PhaseOpt	• Business needs and technology objective • Technology description • Technology qualification and results from field tests • Overall evaluation
Closing remarks	• Future use of the technology • Summary

Phase envelope – Natural Gas



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Specifications for gas transport in NCS

- **8000km of pipelines**
  - Rich gas pipelines (offshore to onshore)
  - Sales gas pipelines (onshore to Continental Europe)
- **Rich gas pipelines / Cricondenbar spec.**
  - Statpipe (1985): 110 barg
  - Åsgard Transport (2000): 105 barg
  - Polarled (new): 0˚C@max.110barg
- **Sales gas pipelines / Cricondentherm spec.**
  - Europipe II: < -10˚C @ 50barg

Source: Gassco AS

Business needs and technology objective

Optimise the gas transportation network and the processing facilities

- **Pipelines**: Increase transport capacity by better control of the cricondenbar
- **Process plants:** Safe operation with less margin to cricondenbar at inlet facilities
- **Offshore producers:** Control delivered gas quality and optimise operations

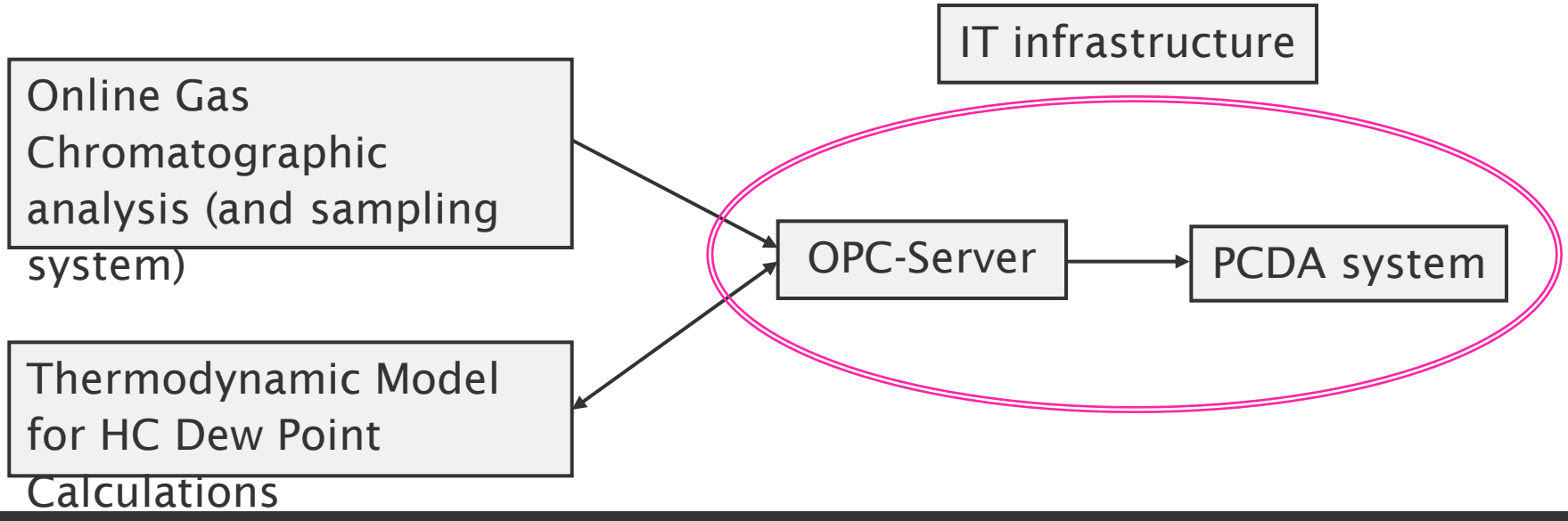
PhaseOpt objective

- Develop and qualify a technology for cricondenbar monitoring in rich gas pipelines

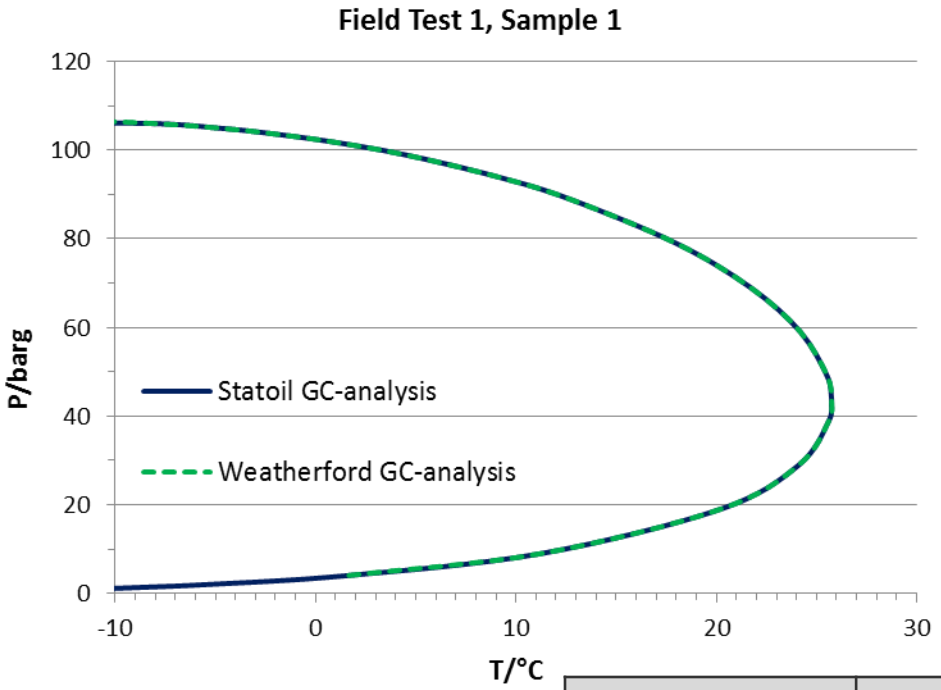
Technology description

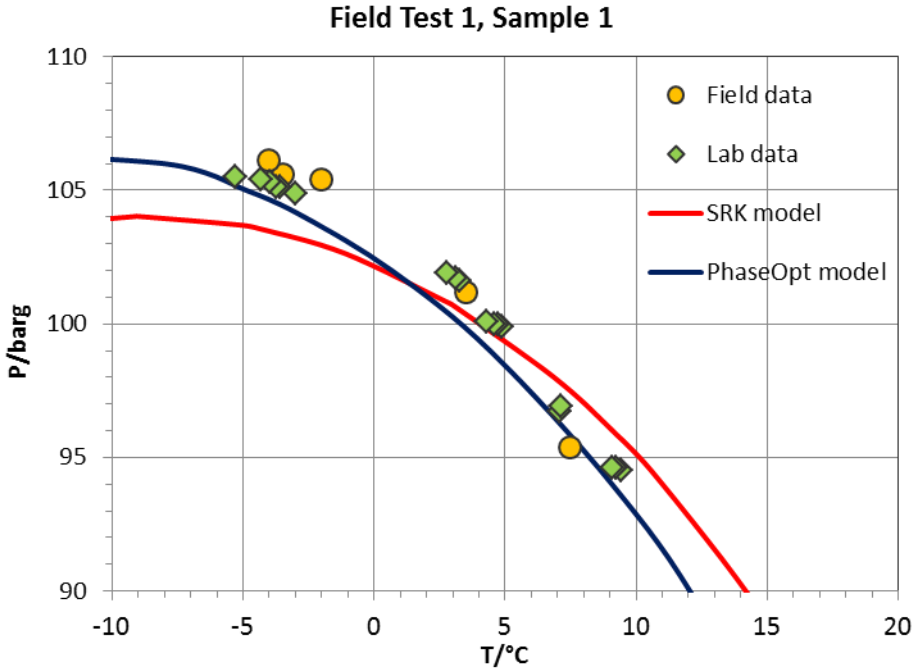
Elements

1. Sampling system for representative samples in gas pipelines
2. Online GC-analyser for extended compositional analysis - up to C_{12}
3. Reliable thermodynamic model (UMR-PRU) for HC dew point calculations
4. IT infrastructure for data processing and reporting



Technology qualification – Field test 1





	Field test 1 – Sample 1	
	Cricondenbar (barg)	Deviation (bar)
Lab data	105.9	-
Field data	106.1	+ 0.2
PhaseOpt	106.7	+ 0.8
SRK EoS	104.0	- 1.9

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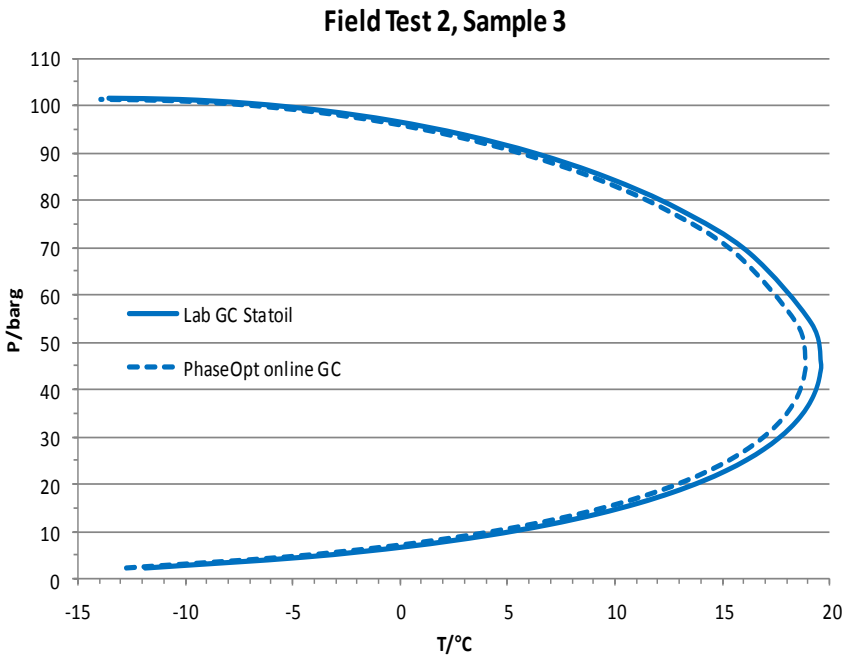
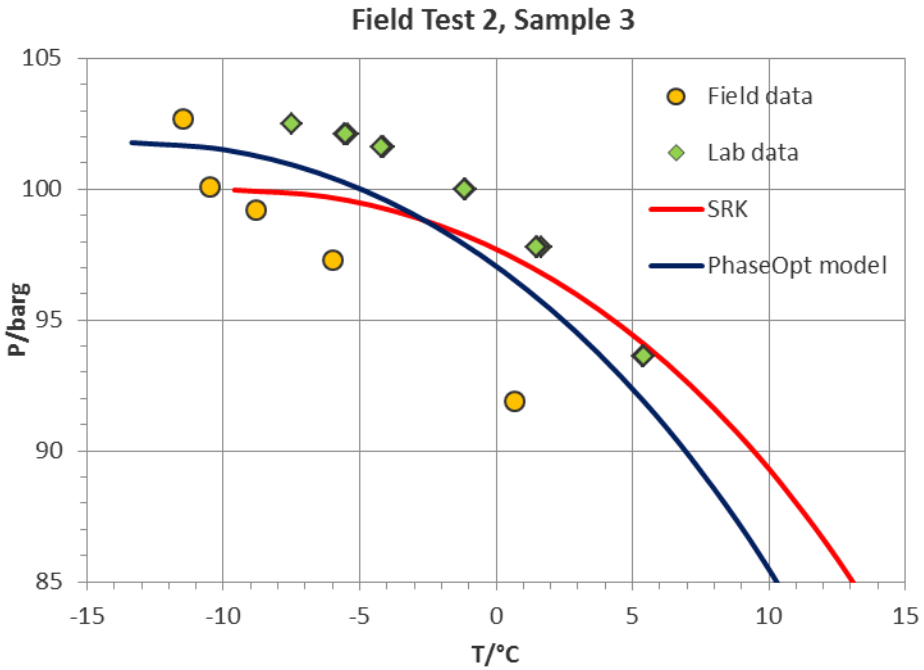
Technology qualification – Field test 2





	Field test 2 – Sample 3	
	Cricondenbar (barg)	Deviation (bar)
Lab data	102.5	-
Field data	102.7	+ 0.2
PhaseOpt	101.3	- 1.2
SRK	99.6	- 2.9

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Overall evaluation

- The uncertainty in the cricondenbar with PhaseOpt is **± 2 bar**
- The lag time between each cricondenbar analysis is **10 min**
- The shape of the model dew point curve is in very good agreement with the measured data
- A systematic “temperature offset” is observed, but a T-correction factor can be applied based on field tests for the specific gas
- PhaseOpt model (UMR-PRU) performs better than SRK (and PR) EoS in the cricondenbar and high pressure area (> 95 bar)

Future use of the technology

- PhaseOpt currently implemented at Kårstø plant to optimise operations at inlet facilities and increase capacity in Åsgard pipeline (2014 - 2016)
- PhaseOpt will be installed at Aasta Hansteen field for monitoring export gas quality to Polarled pipeline (2017)
- PhaseOpt to be considered for all new field developments at the NCS
- PhaseOpt to be qualified for cricondentherm monitoring
- PhaseOpt is a candidate for monitoring hydrocarbon dew point in subsea installations

PhaseOpt – Summary

- An online tool for monitoring HC dew points in pipelines and process plants
- Optimise the gas transportation network/processing facilities and increase capacity
- The two main elements in the technology are:
  - An online GC-analyser for extended composition analysis up to C_{12}
  - A reliable thermodynamic model (UMR-PRU) for dew point calculations
- The technology is qualified and currently at first-user implementation at Kårstø plant
- The expected accuracy for cricondenbar calculations is **± 2 bar**
- The lag time is **10 min**

Thank you

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- **Gassco** is the operator for the Norwegian gas transport system and of several gas processing and receiving terminals in Norway and in Europe
- **Statoil** is an integrated oil and gas company with substantial international activities and the operator of a large part of Norwegian oil and gas production

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