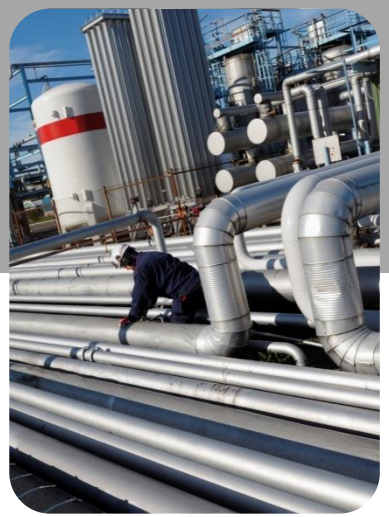
INFOCHEM

physical properties group of

KBC


Multiflash: real fluids and flow assurance solutions, from the reservoir to the refinery

APM

ADVANCED PROCESS MODELLING FORUM

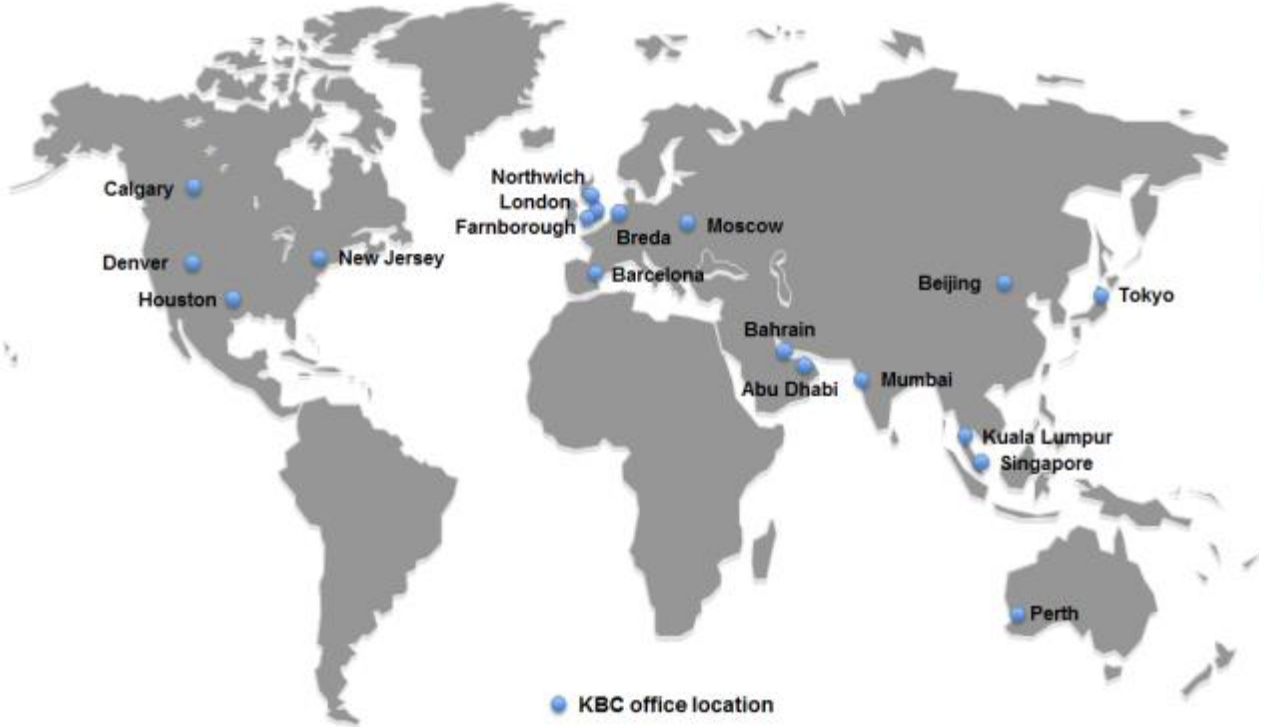
22–23 APRIL 2015

Overview

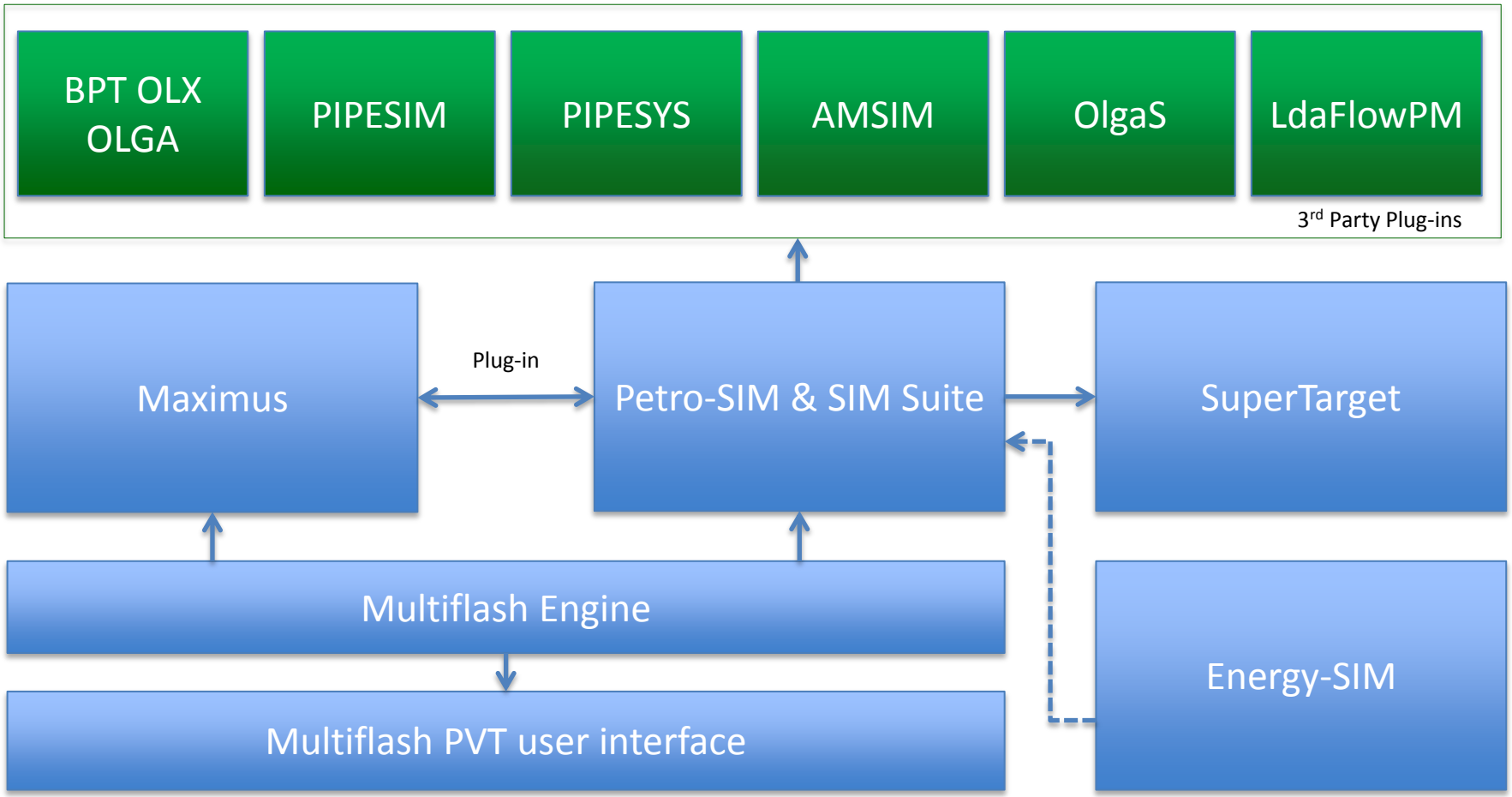
- Who is KBC?
- Multiflash: oil and gas and beyond
- Multiflash: engineering work-processes
- The future; what's coming up?

KBC Corporate Profile

- Leading independent consulting and technology group
- Deliver competitive advantage to owners, operators and investors in the oil and gas industry through risk management and improvements in business performance/asset value
- Established in 1979, AIM-listed, 2013 revenues ≈ £65 million
- Full service international consultancy – 350+ employees

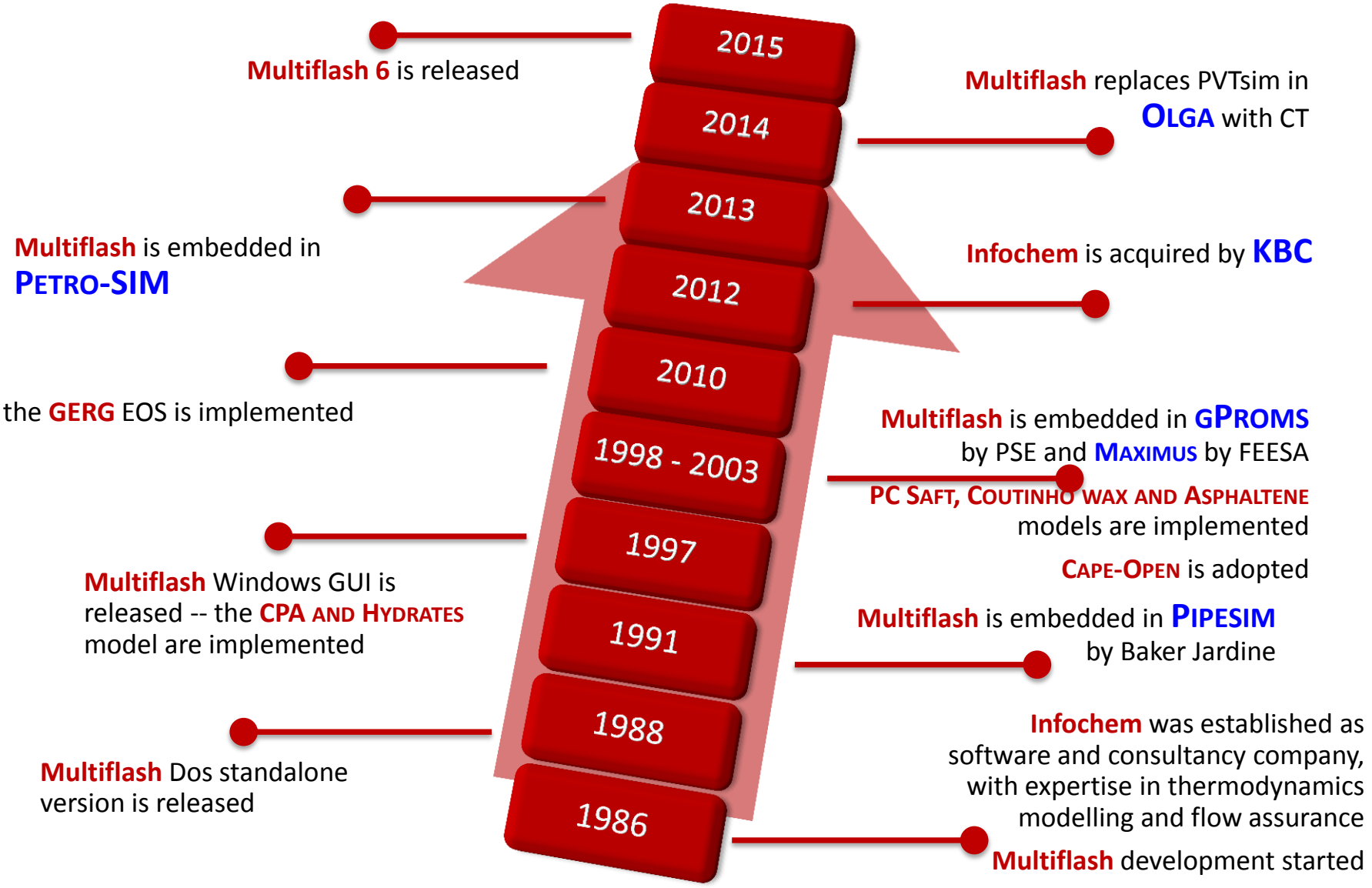


KBC Software Suite Overview

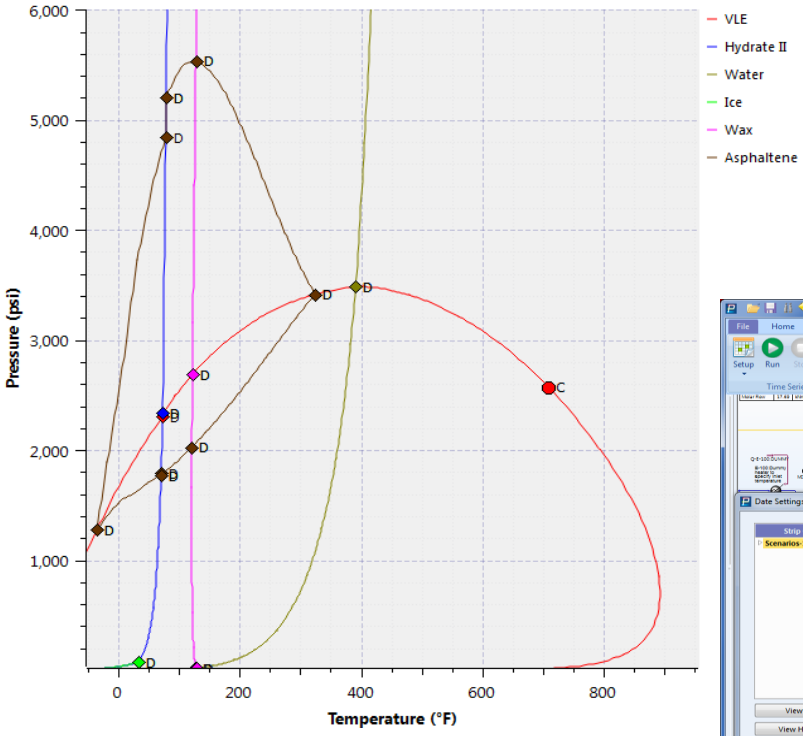


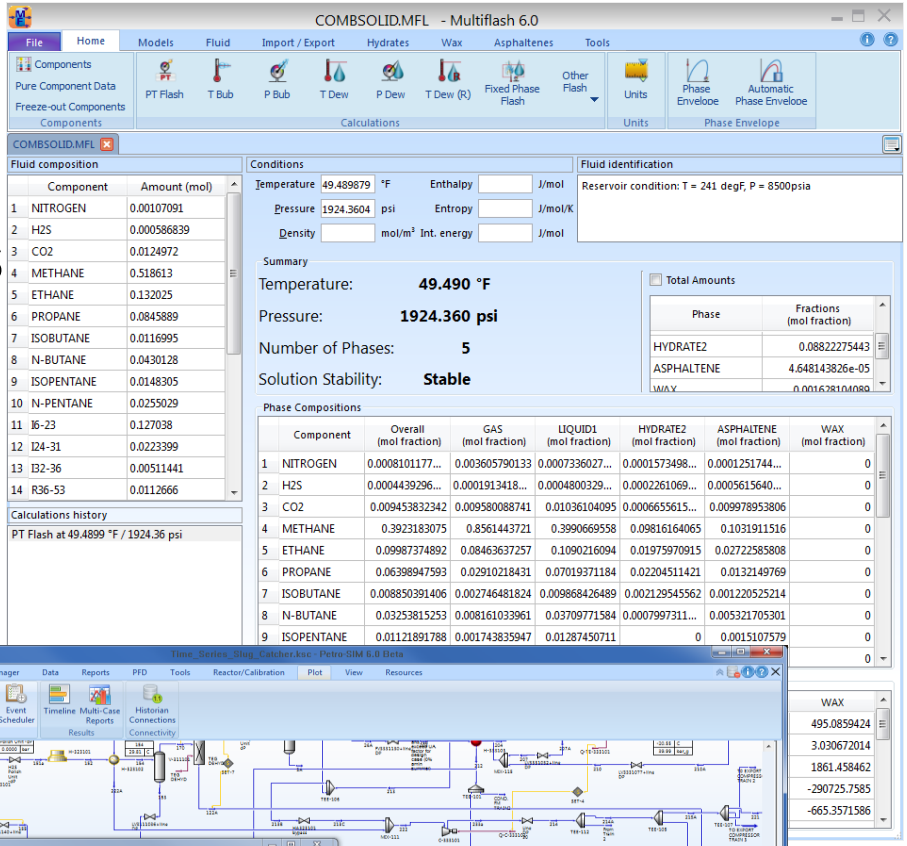
- **Multiflash** – Thermodynamic engine for multiphase equilibrium calculations
- **Petro-SIM** – Steady state and dynamic process simulator for upstream and downstream
- **Maximus** – Steady state thermal hydraulic simulator from snapshot to life of field
- **SuperTarget** – Pinch Analysis tool for heat integration
- **Energy-SIM** – Simulation and optimization of steam and power networks

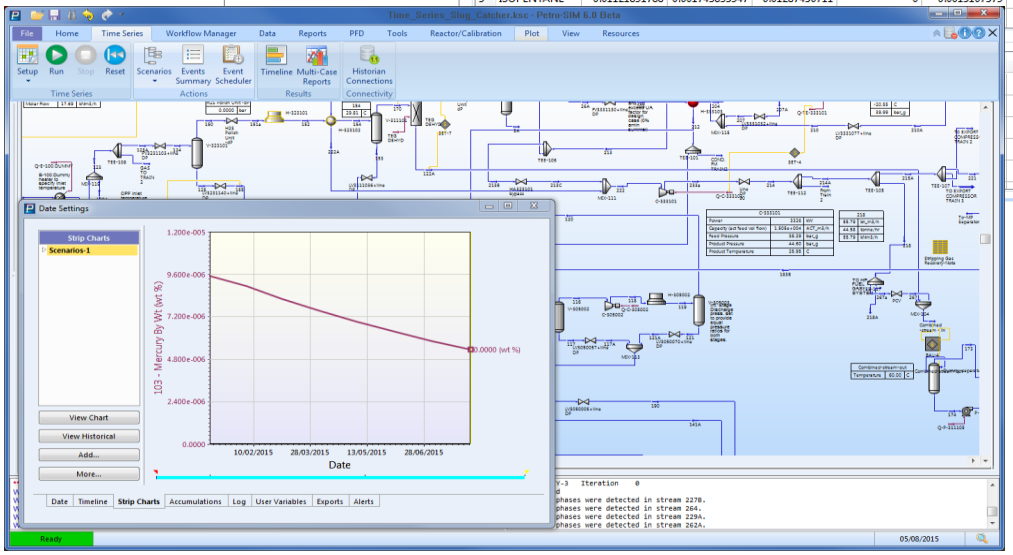
Almost 30 years of Multiflash



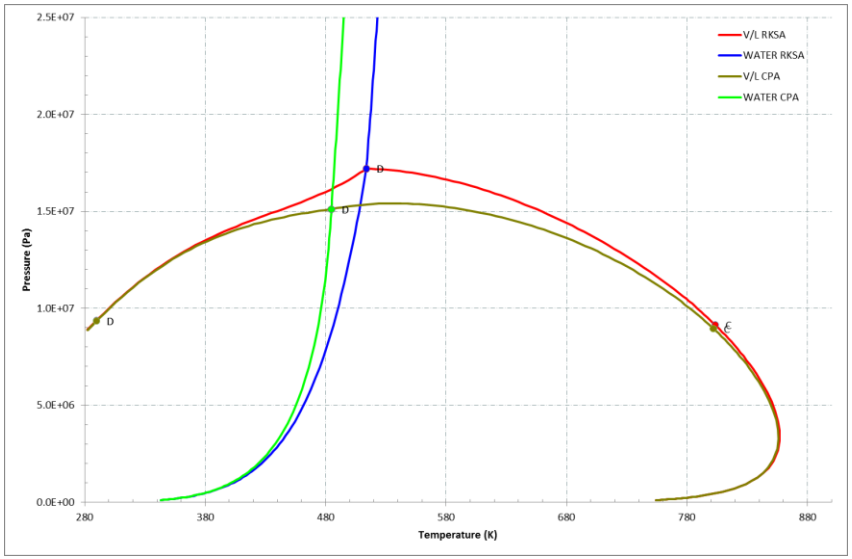
- (Model) REAL Fluids
- (Maximise) Production
- (Optimise) Work Processes

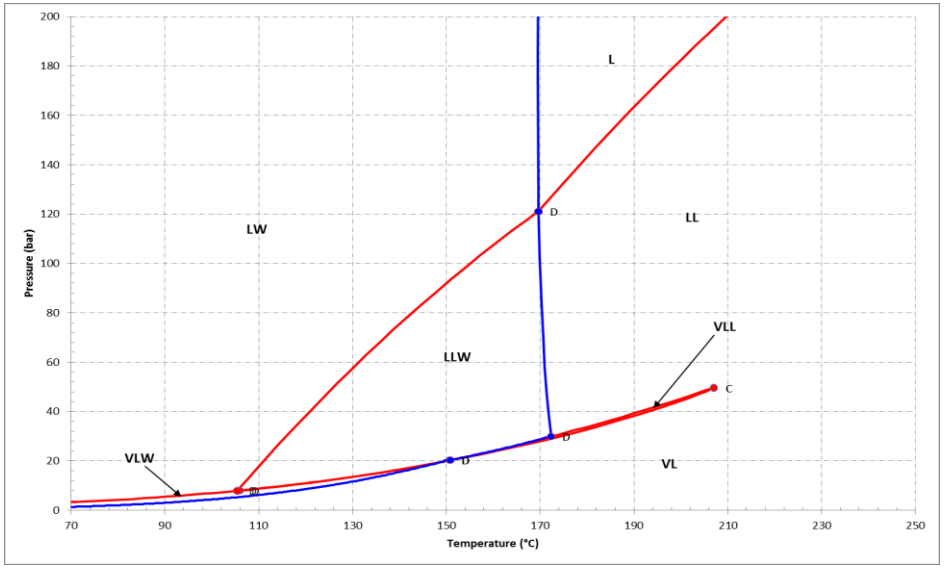




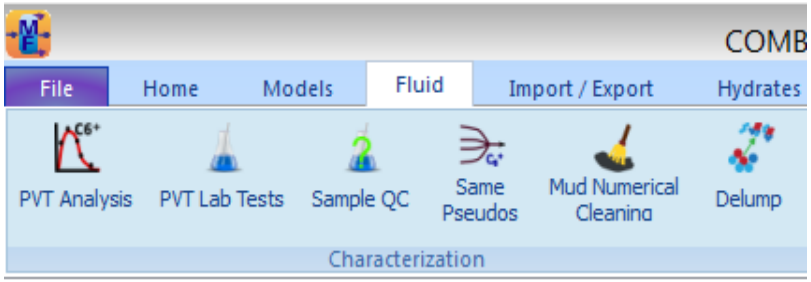


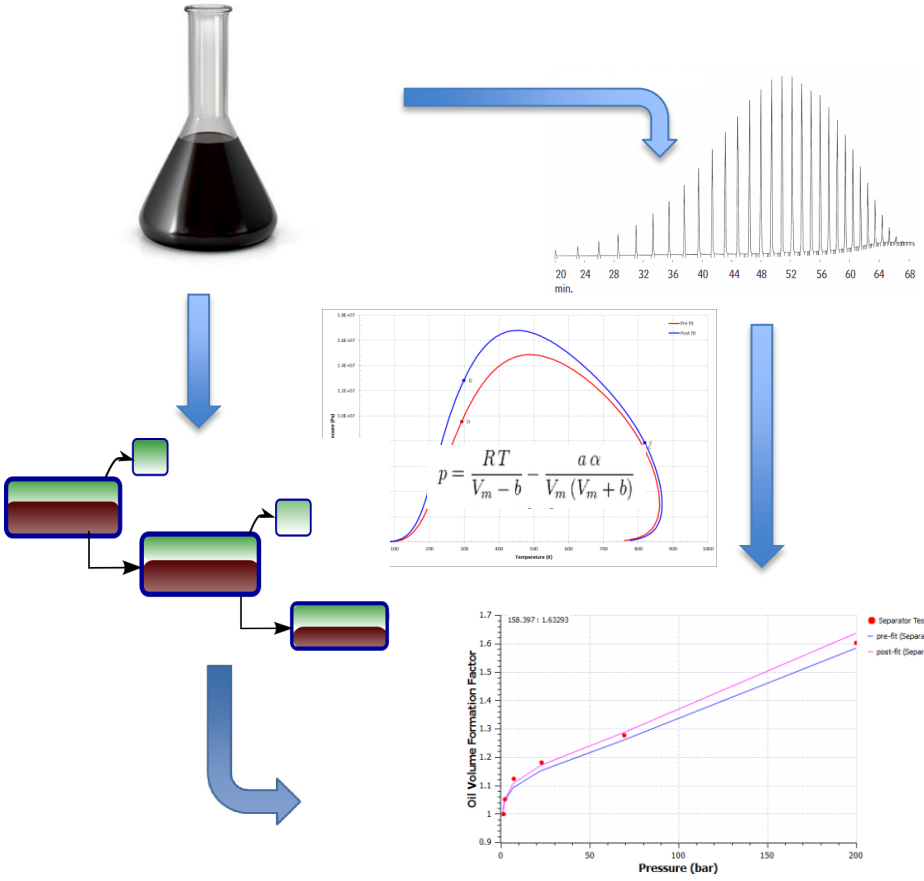
Model Real Fluids





Upstream and reservoir: PVT modelling

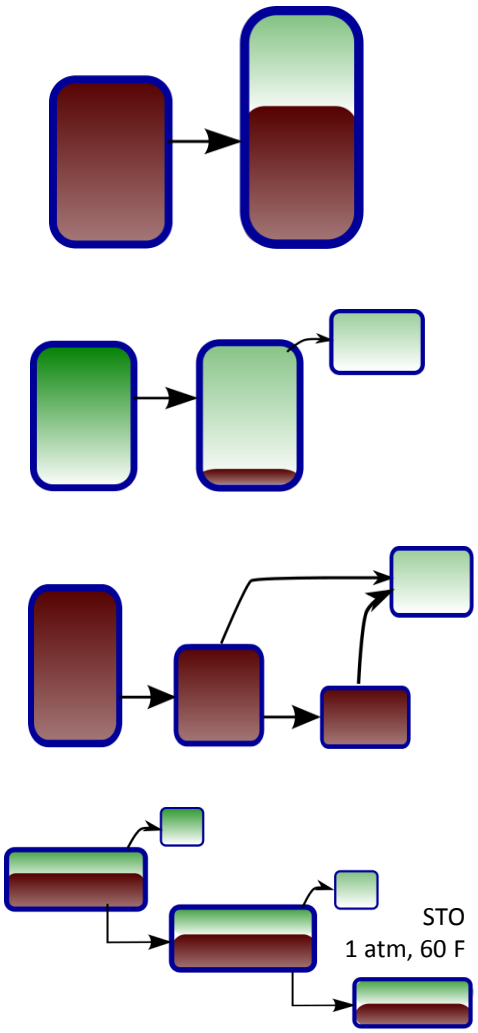




- Unified fluid characterisation method (compositional, black oil, up- and downstream)
- PVT experiments modelling and regression
- EOS tuning
- Sample QC
- Mud decontamination

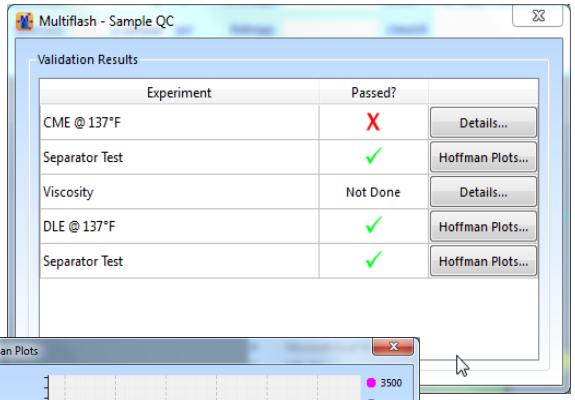
NEW! PVT Experiments

- Modelling and regression of PVT experiments
- Constant mass expansion
  - Pressure decrease along production lines
- Constant volume depletion
  - Liquid drop out during production on gas condensate reservoirs
- Differential liberation
  - Production of oil reservoirs (e.g., gas production during depletion)
- Multistage separator test
  - Amounts of gas and liquid produced from the reservoir

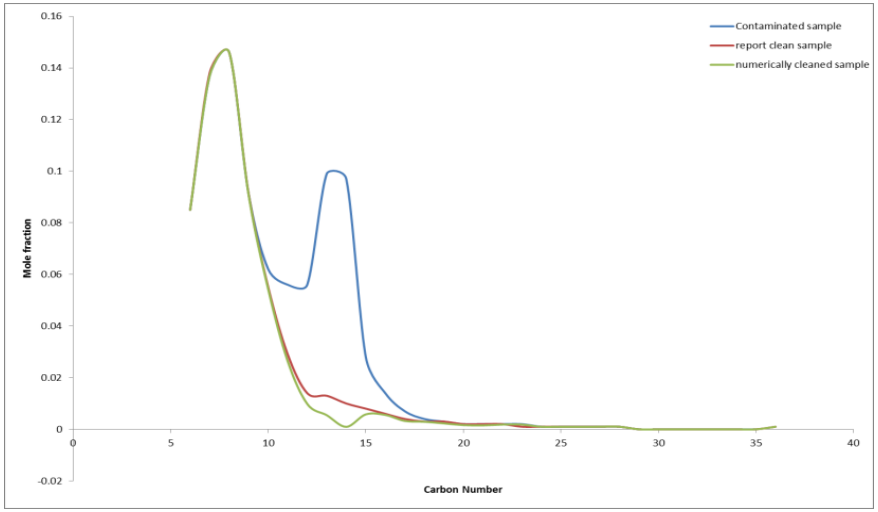


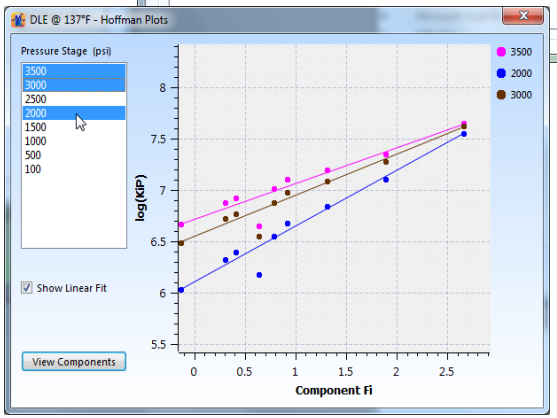
NEW! PVT Lab

- Sample QC: check PVT data consistency and sample quality

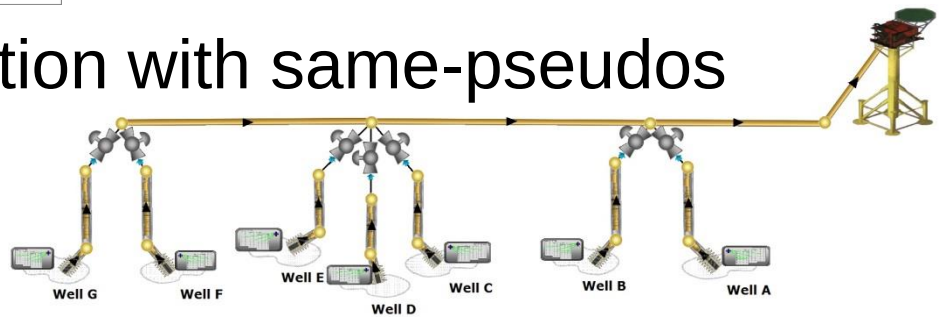


- Numerical mud decontamination



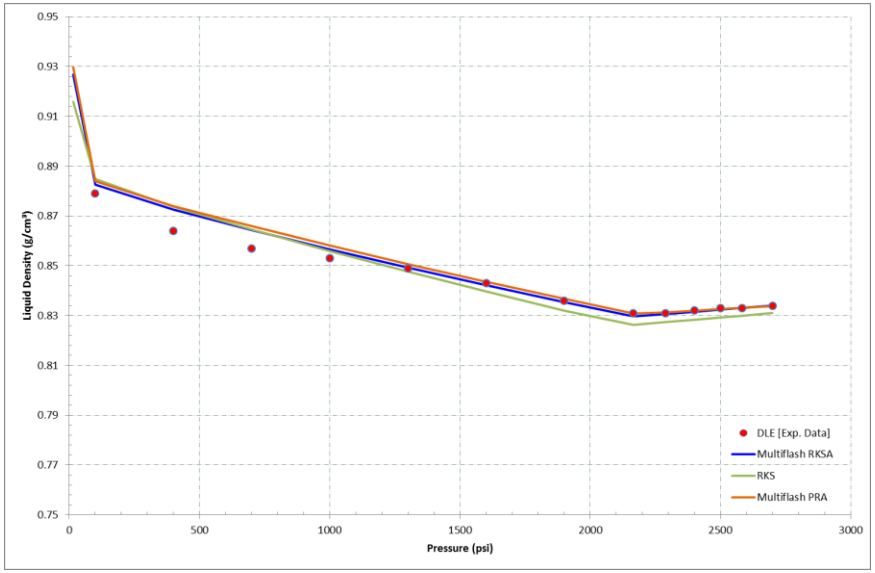


- Simultaneous characterisation with same-pseudos
  - Several wells
  - Converging streams



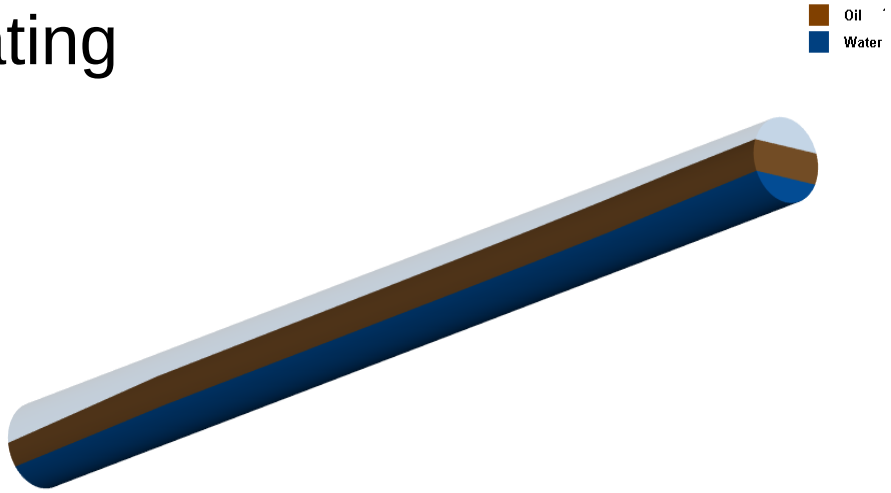
Production and transport

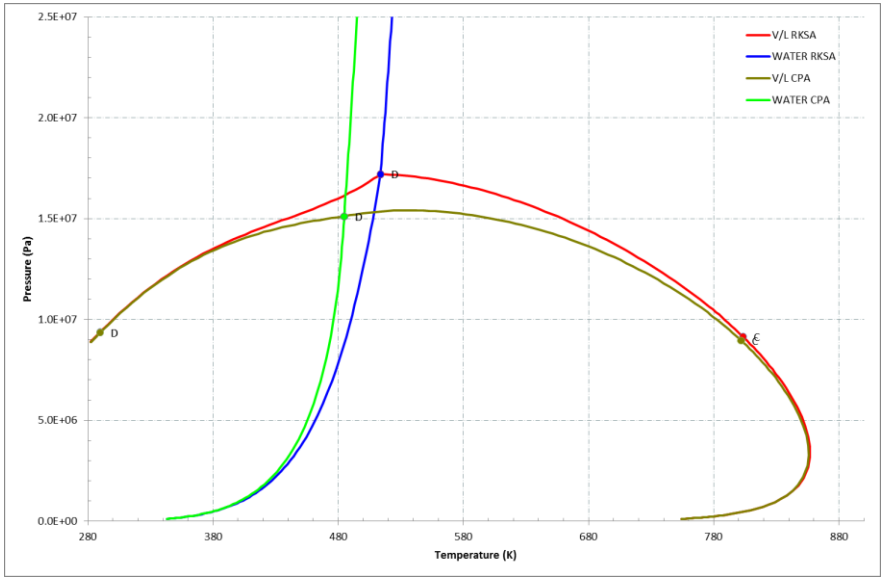
- Advanced fluid EOS (Equations of state)
  - Oil and gas applications
  - Multiple phases
  - Tuning options
- Accurate components and BIPs DB
- Highly accurate physical properties models
- High accuracy models for
  - Natural gas,
  - CO_2,
  - Water/Steam



Water and polar mixtures

- Dedicated model for associating and polar mixtures
- Accurately model
  - High water cuts
  - Water build-up
  - Partitioning of alcohols/glycols and polar components
  - Acid gases
- Fully consistent with Flow Assurance models
- Reduces to cubic EOS for non associating mixtures

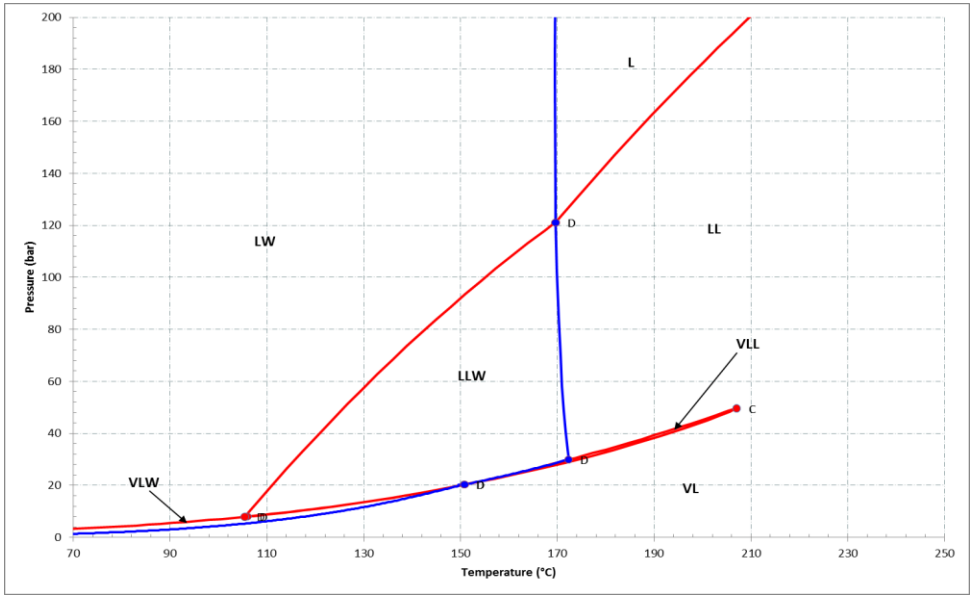




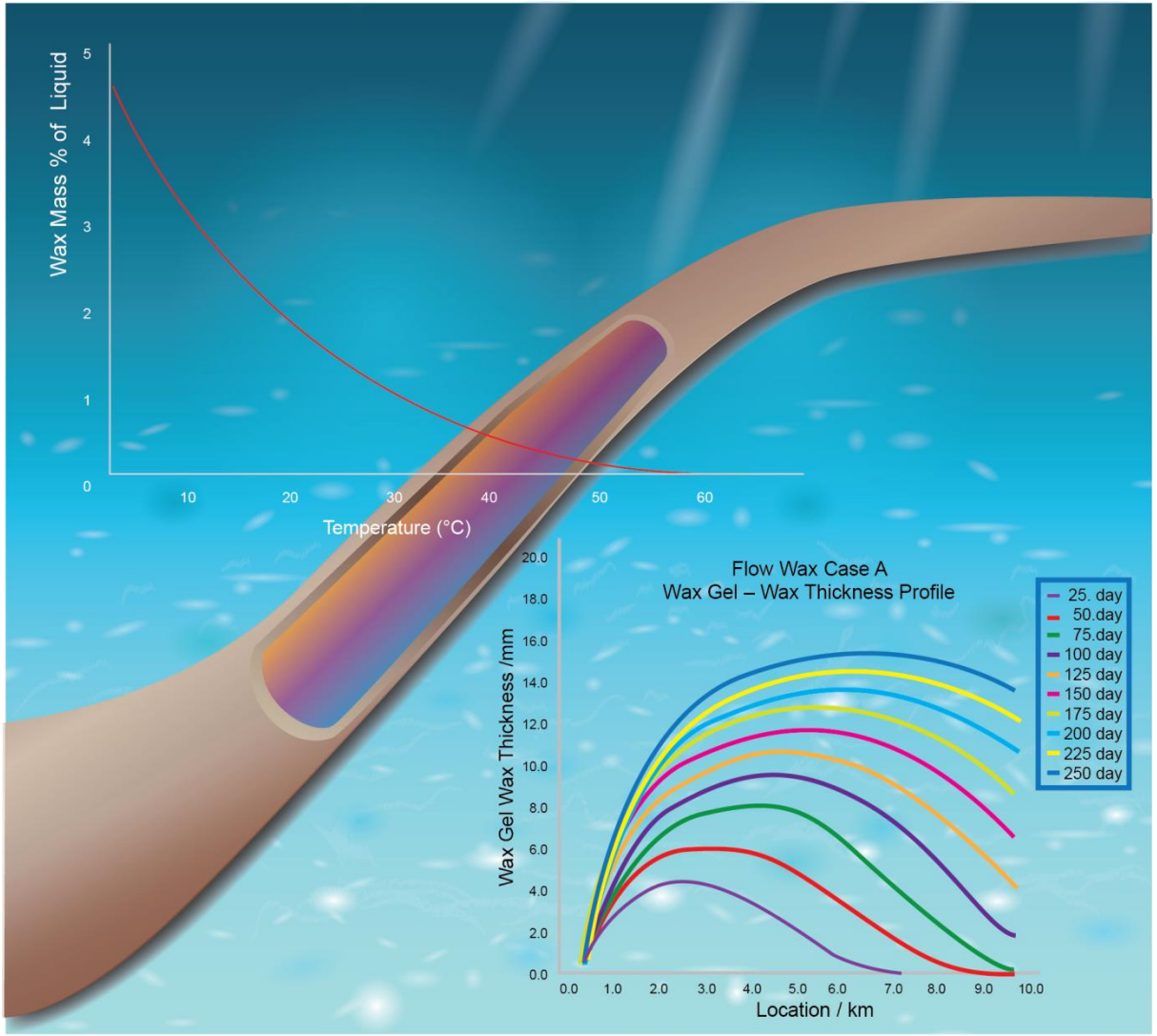
Polymers and petrochemicals

- Complex phase behaviour
- Chain length polydispersity and different species
- Simple attraction/repulsion terms are not enough
- ➔ PC-SAFT EOS

- Multiple LL, VLL demixing and strong fractionation
- Very accurate predictions of physical properties
- Full process solutions for chemical industry



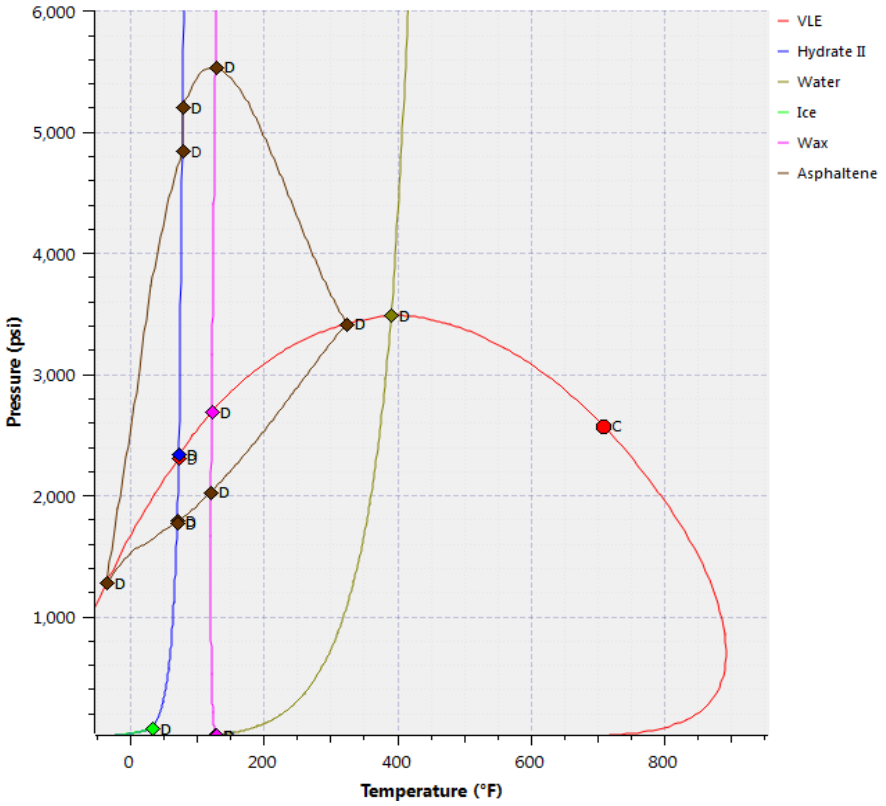
Flow Assurance modelling



The standard in Flow Assurance

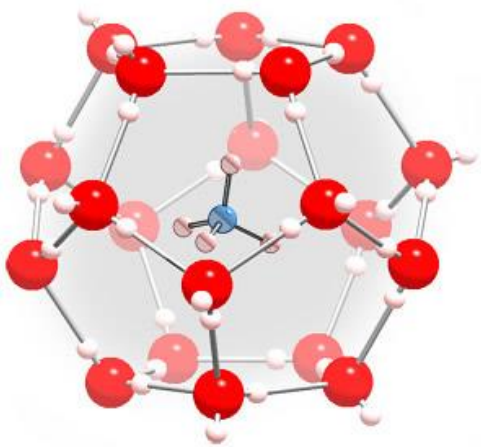
INFOCHEM
KBC

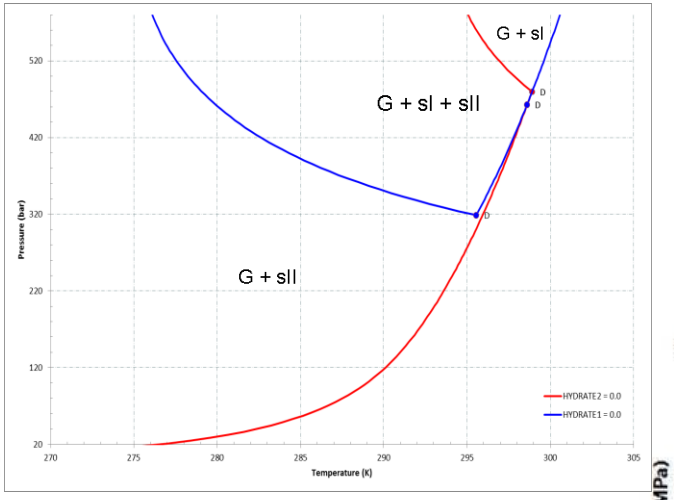
- Truly multiphase: any number of solid or fluid phases
- Accurate Hydrates and Inhibiyion, Wax and Asphaltene
- Inhibitor partitioning model
- Mercury partitioning model
- Pure solids and scales
- Embedded solutions
  Olga, Pipesim, Maximus …
- FloWax: wax deposition

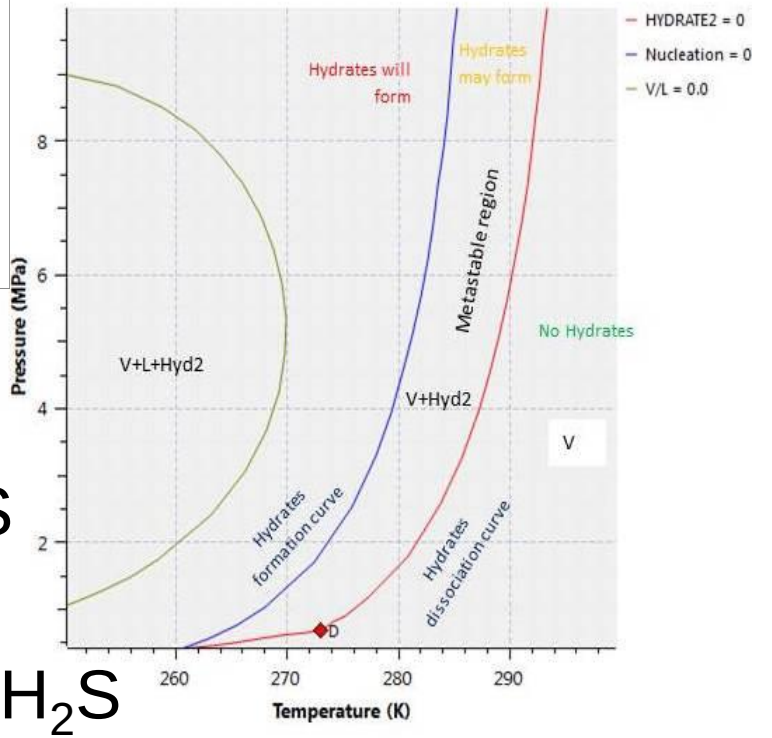


Multiflash Hydrates

- Ice cages with light hydrocarbons
- Can model types I, II and H



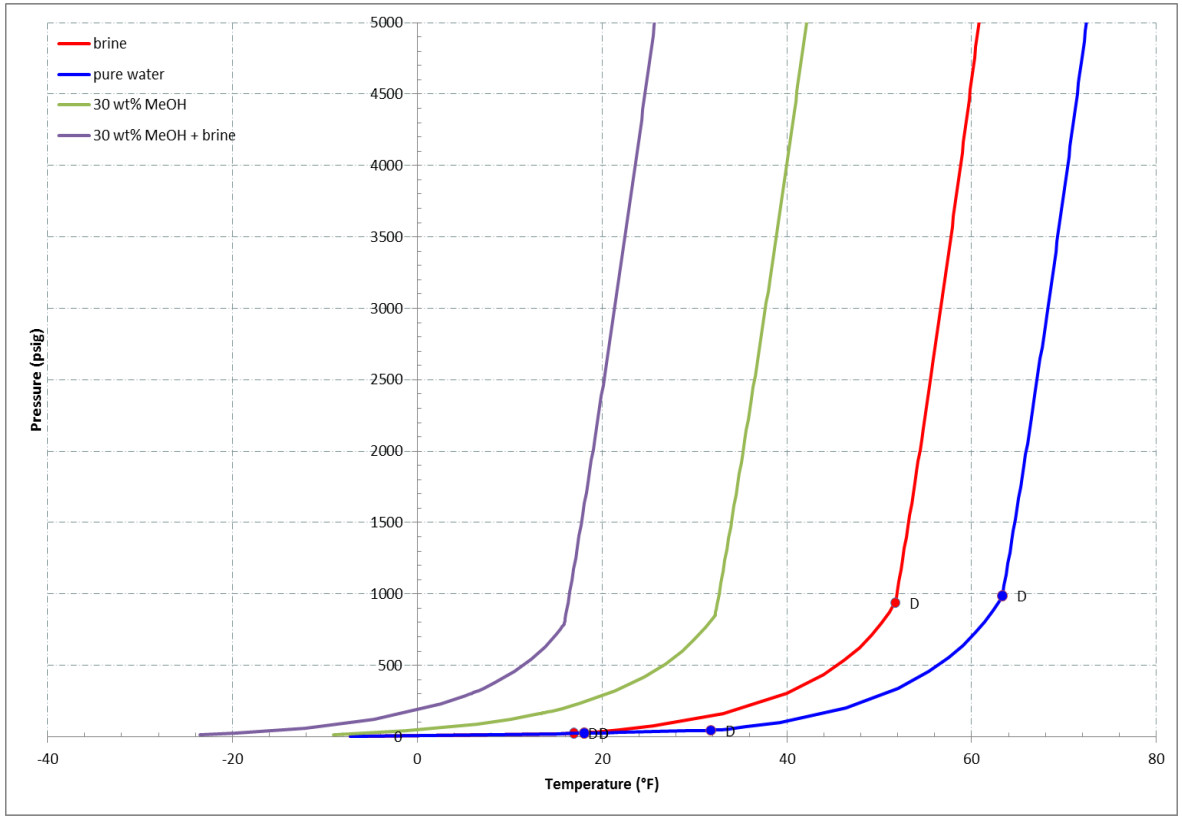


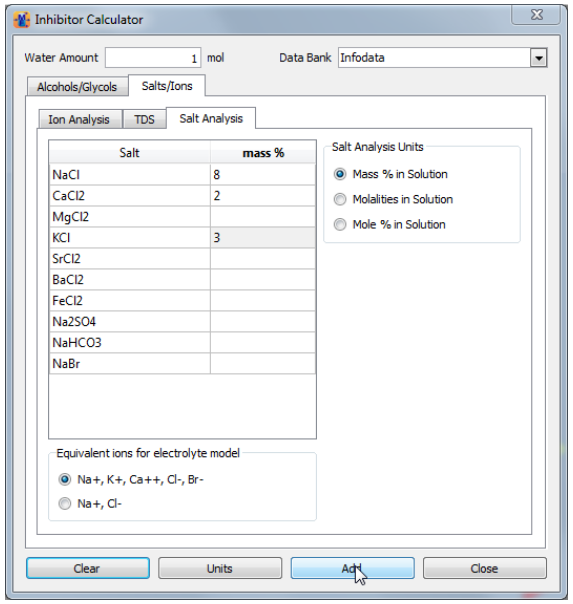


- Hydrates dissociation and formation (nucleation) curve
- Fully consistent with various EOS and other solid models
- Can model hydrates of CO_2 and H_2S

Inhibition and partitioning

- Compare effect of inhibition strategies
- Inhibitor calculator
- Include alcohols and glycols
  - Methanol, Ethanol
  - MEG, DEG, TEG

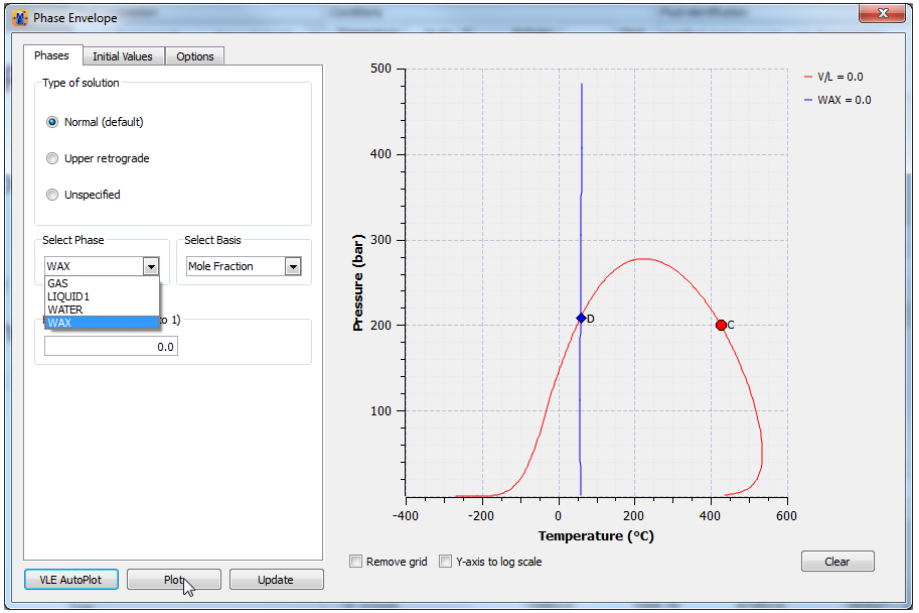


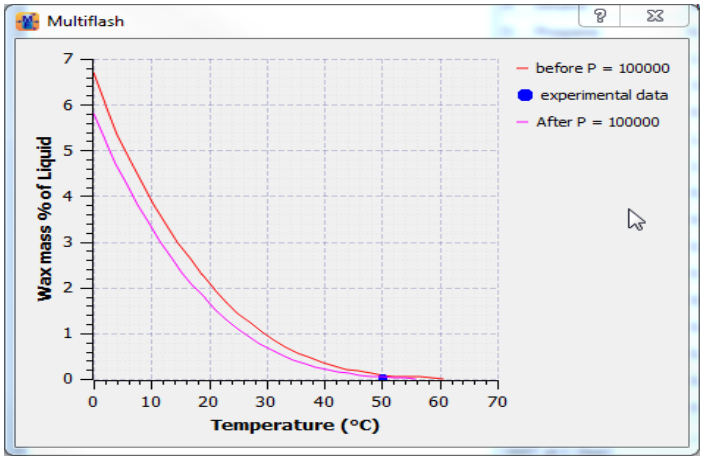


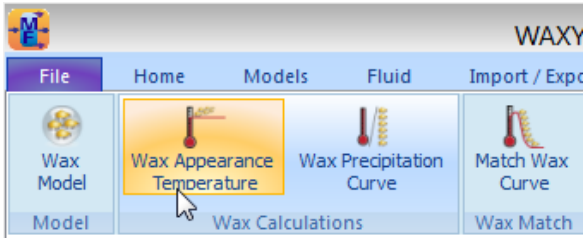
- … and salts inhibition
- Can model halide scales formation

Wax formation

- Wax phase: precipitation of solid n-paraffins
- Not pure SCN solids; mixtures of n-paraffins
- Wax precipitation:
  - WAT, WDT, Pour Point
  - WPC
- Characterisation method includes n-paraffins



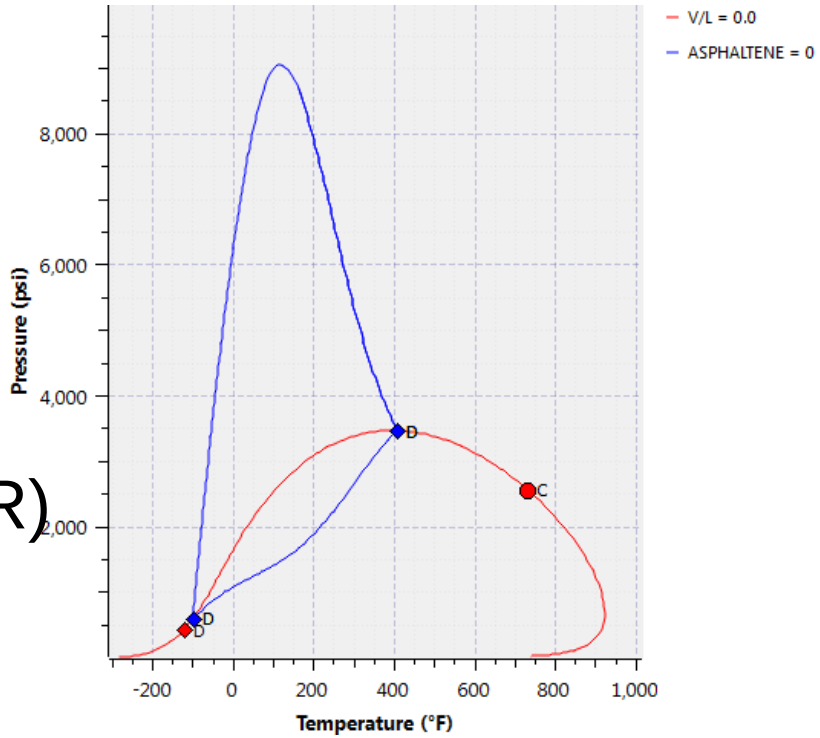


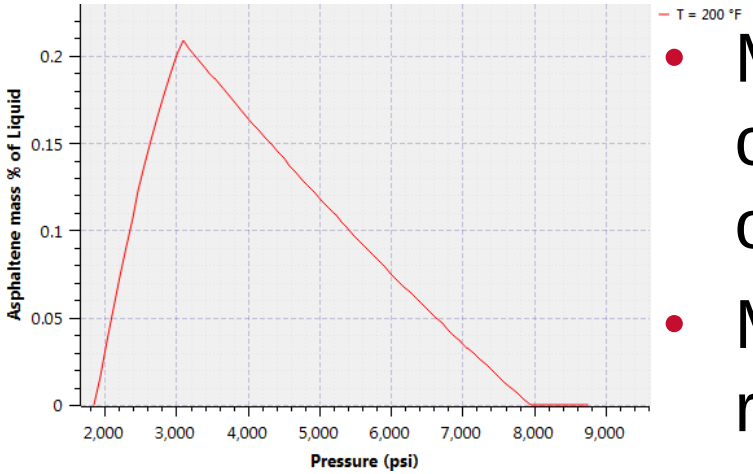


- Model's matching capabilities for WAT and WPC data

Asphaltene precipitation

- Asphaltenes - heaviest, most aromatic and complex fractions in crudes
- Nature: partially colloid-like, partially in solution
- Maximum precipitation at bubble point
- Enhanced by gas injection (EOR)

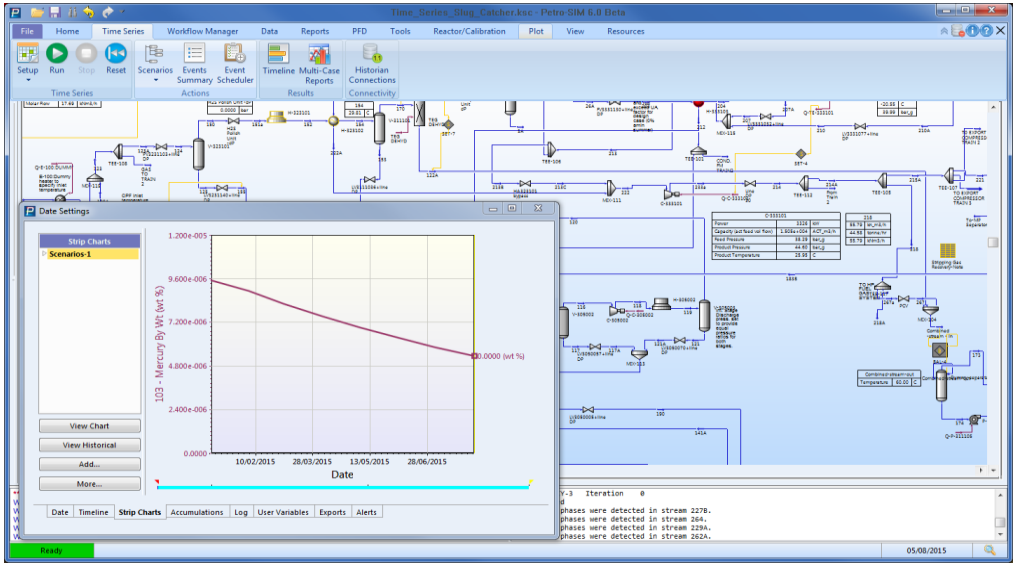


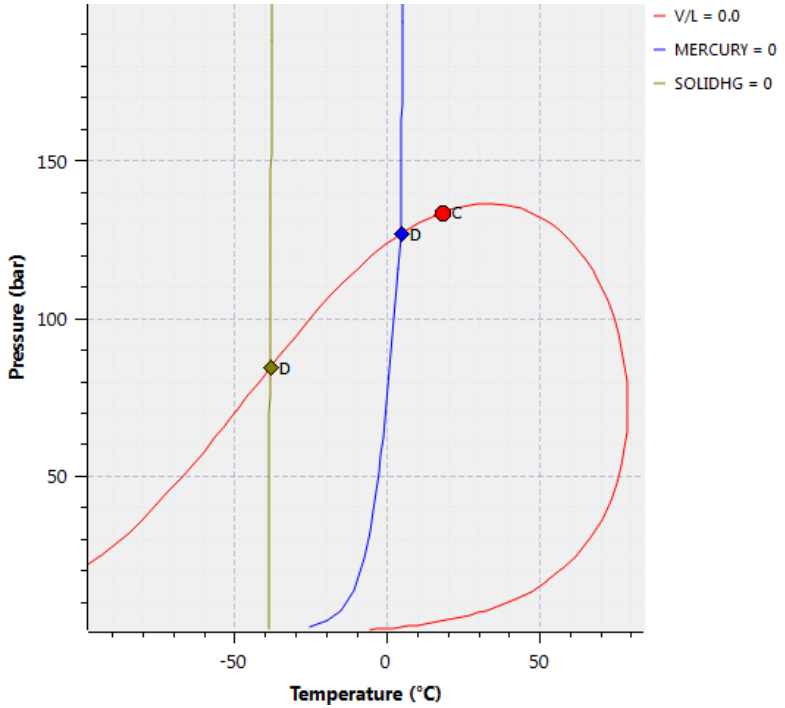


- Multiflash can model onset and precipitation curve
- Matching onset, bubble point and reservoir conditions

Mercury partitioning

- Mercury accumulation can damage facilities and represents health and safety hazard
- Multiflash can model metallic (liquid and solid) and organometallic mercury compounds
- Up- midstream gas plants and oil transport/processing facilities





Engineering workflows

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PVT modelling
Phase behaviour
Flow Assurance
Batch calculations
Process simulation
Point checks
Multi-phase physical properties

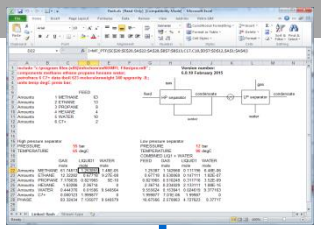
Conceptual study
FEED
Detailed design
Execution
On-line monitoring

Maximus
Pipesim
Olga
K-Spice
Petro-SIM
ReO
WellFlo
FlowManager/ Flow metering

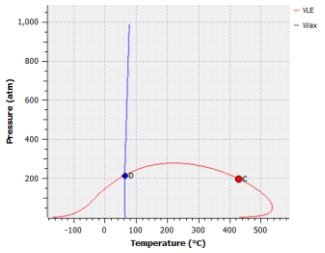
gPROMS
gPROMS

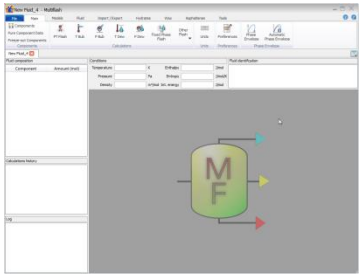
Unique connectivity

INFOCHEM
KBC



Multiflash
excel plugin





GUI

PVT Tables

OLGA

PIP

PROSPER

LedaFlow

MF

Custom
Interfaces

Petro-SIM

OLGA

PIP

LedaFlow

WELLFLO
SOFTWARE

REO SOFTWARE

gPROMS

CAPE – OPEN
Interface

K-Spice | HYSYS | UniSim | CoCo - COFE | Aspen Plus | PRO II | Simulis

What's coming up

- Integrate KBC software – from reservoir to refinery
- New PVT experiments for EOR and reservoir
- Integration of up- and downstream thermodynamics
- Multiflash MT – the new generation
- Hopefully – further collaboration with gProms (!)

Contacts

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