Kongsberg Oil & Gas Technologies

CAPE-OPEN meeting – September 2014

Roar Nilsen
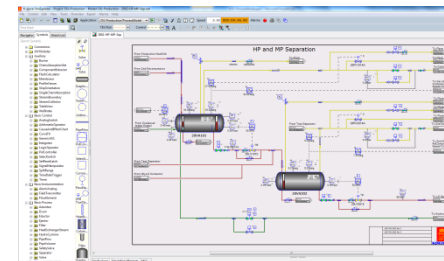
K-Spice Product Manager

K-Spice®
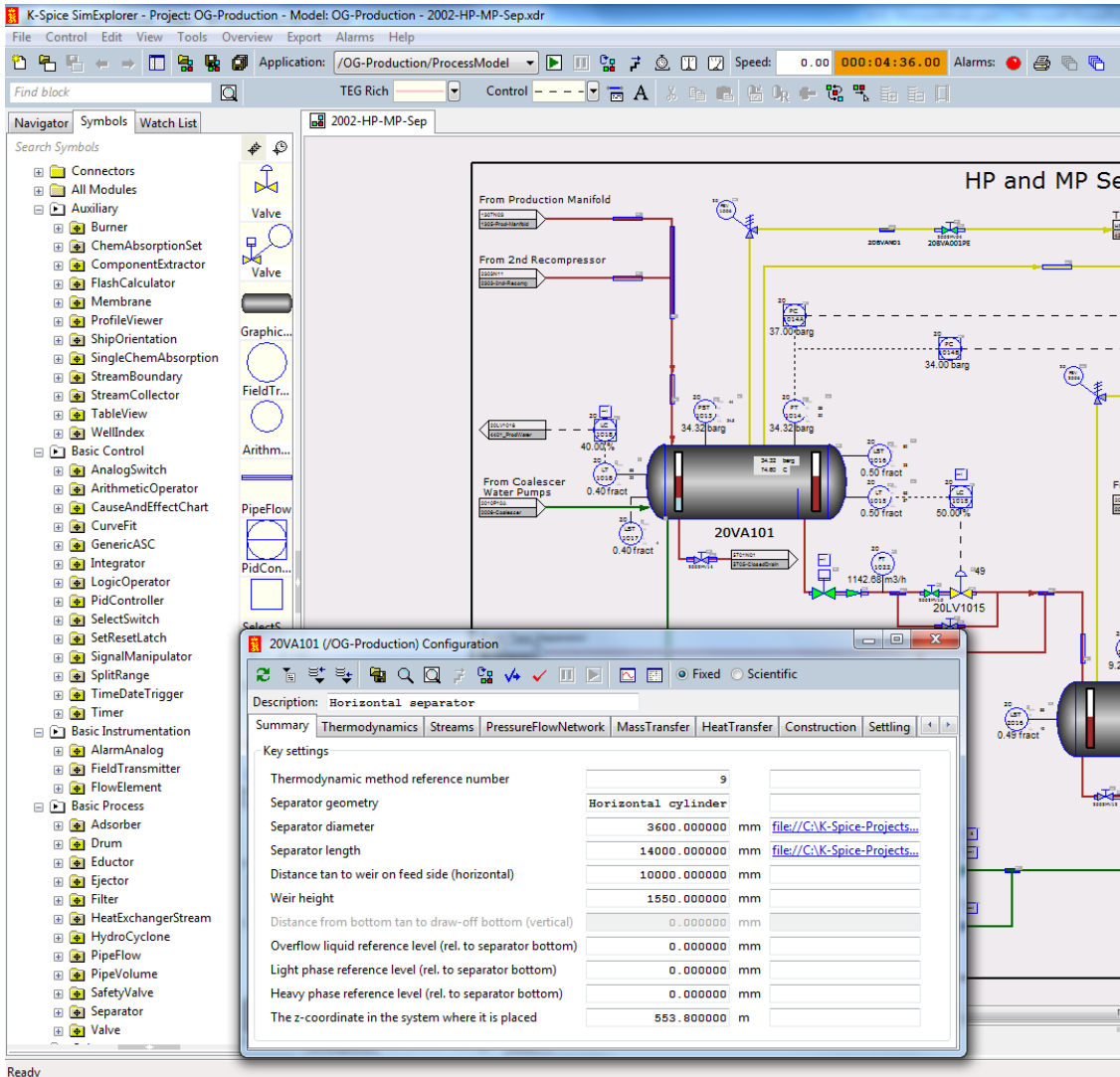# - CAPE-OPEN compliant for thermodynamics

- Background
  - Dynamic Process Simulation
  - Life-Cycle Simulation Concept

- CAPE-OPEN interface for thermodynamics
  - Technical Solution

- Demo

Building a Dynamic Process Model in K-Spice

- High fidelity models

- Produced with a sound basis in first-principles physics, chemistry and engineering

- Usually a one-to-one correspondence between an entry on an equipment data sheet and an item in the model

- Multiphase Flow Models (LedaFlow®)

- Control Modules

- Shutdown Systems (C&E)

- Sequences

- Compressor Control Algorithms

Building a Dynamic Process Model in K-Spice

Utilizing the evolution of the model and knowledge throughout the whole Life Cycle

Example of LedaFlow
Multiphase flow in Flowline and Riser

Flow Assurance
LedaFlow

Engineering Studies
K-Spice
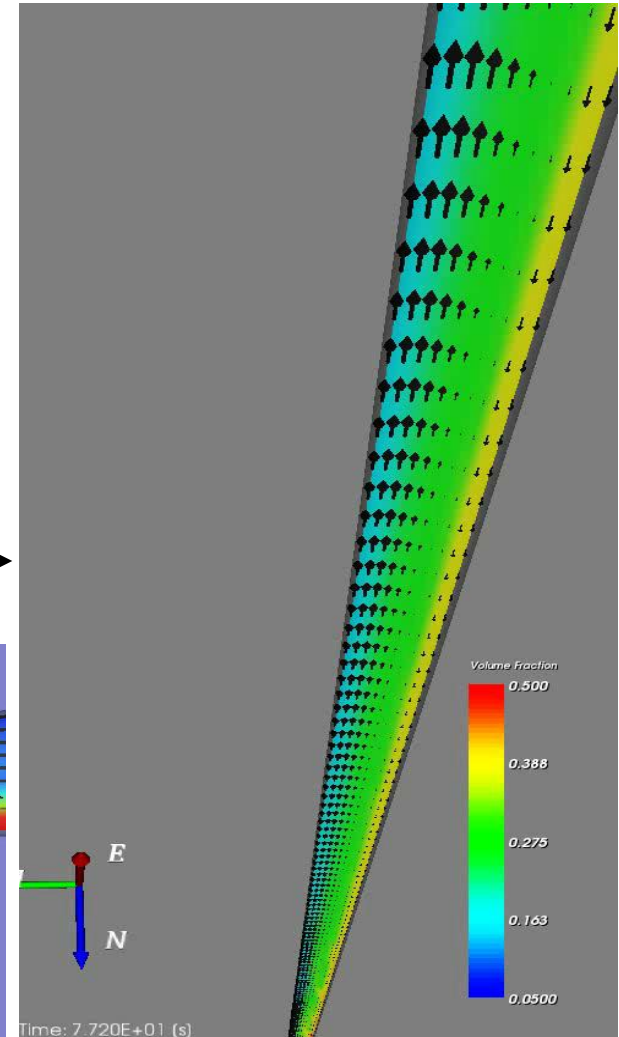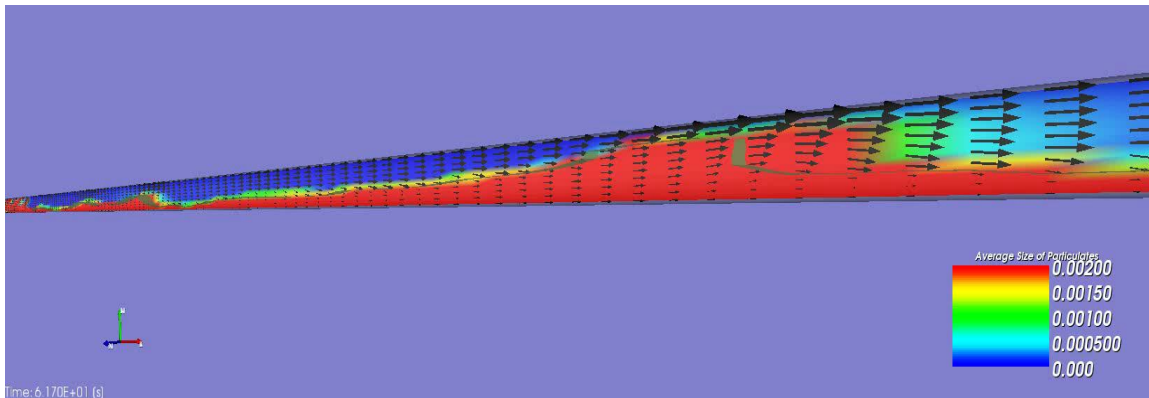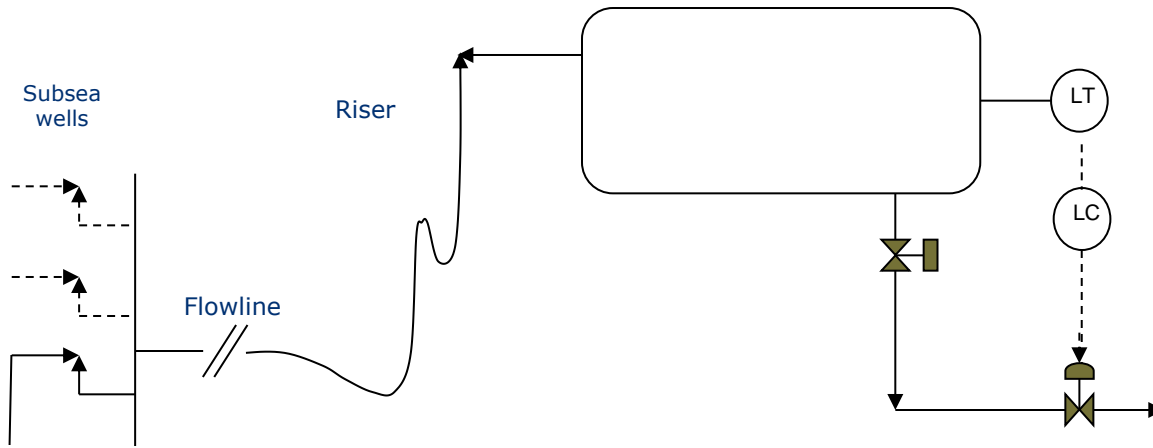
Reuse existing model in decision support applications

Online Simulator

Engineering Simulator

Operator Training Simulator
K-Spice®*Train*

Flow Assurance with LedaFlow®

Subsea wells

Riser

Flowline

Engineering Studies
K-Spice®*Design*

DCS Check-out
K-Spice®*Verify*

DCS Logic

LT
LC
LI
LC
XY
LY
LIC

DCS OPC Link

I/O Database

Production Assurance
K-Spice®*Assure*

Look-ahead predictions
Slug management
Scraper management
Leak detection
Hydrate prediction
Inhibitor management
Measurement
Reconciliation
Multi-well virtual metering
Production allocation
Sensor validation
Environmental monitoring
Condition monitoring

Online OTS
K-Spice®*Match*

Model validation
Model tuning
Analysis of process upsets
Modification studies
OTS initialization

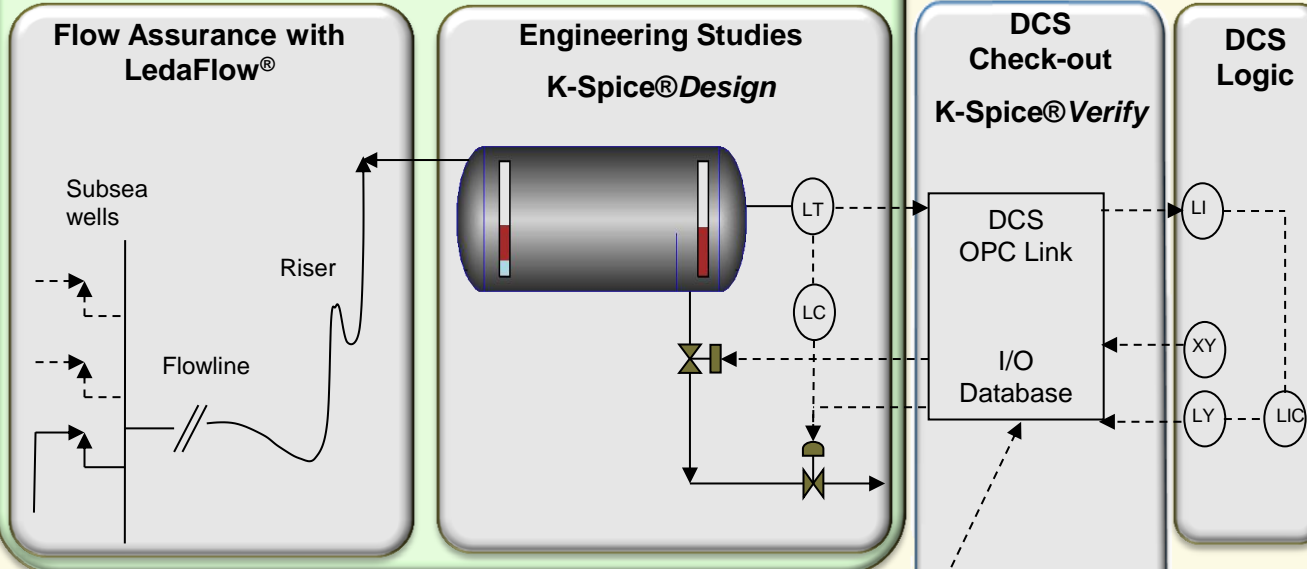| KsimTag	KsimVar	ItemName	DataType	StaticValue	Max	Tolerance	Connected
20lt0179	NOUT	Applications.C25_OIL_PROCESS.LT_20_0179_Value	12		100	0.001	☑
20lw0179a	REMSET2	Applications.C25_OIL_PROCESS.LY_20_0179A_Value	12		100	0.005	☑
20lw0179b	REMSET2	Applications.C25_OIL_PROCESS.LY_20_0179B_Value	12		100	0.005	☑

Record: 1 of 3 (Filtered)

K-Spice®
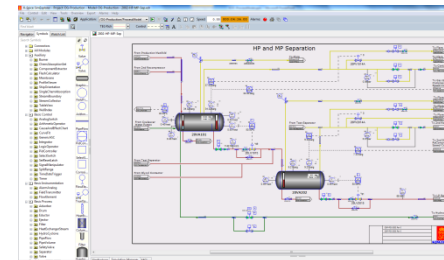# - CAPE-OPEN compliant for thermodynamics

- Background
  - Dynamic Process Simulation
  - Life-Cycle Simulation Concept

- CAPE-OPEN interface for thermodynamics
  - Technical Solution

- Demo

Two thermo types available in K-Spice

ThermoTable (CAPE-OPEN compliant)

Generate thermodynamic look-up tables (offline) to be loaded into memory during initialisation of a K-Spice model
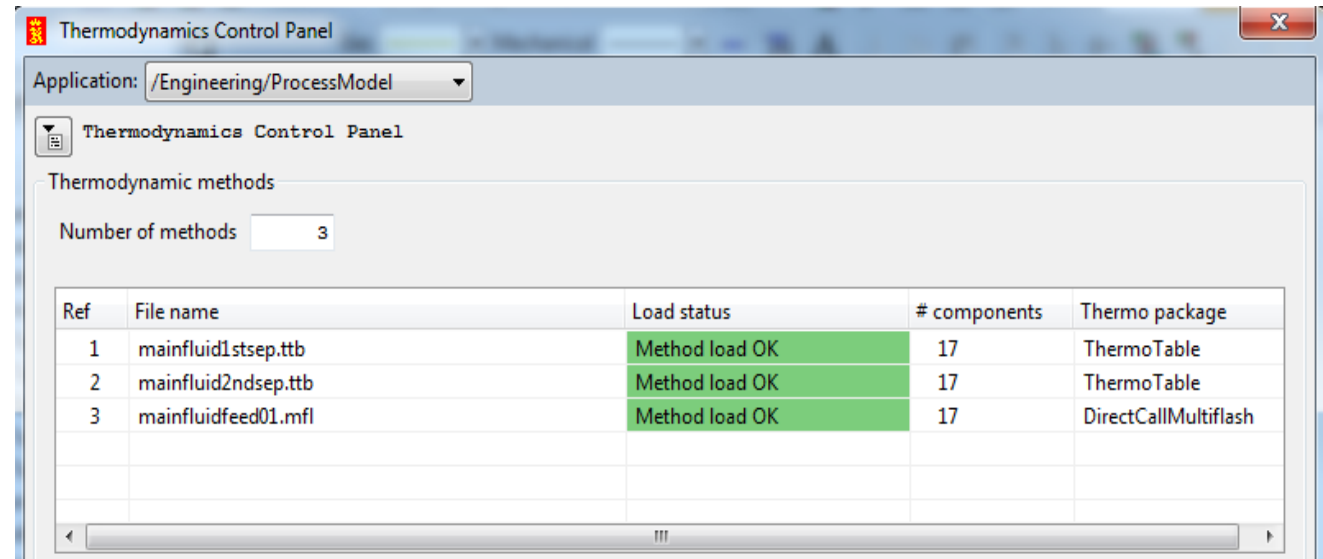
DirectCallMultiflash (Optimized solution for Multiflash)

Using Multiflash in direct calls (Rigorous method), load a *.mfl file during initialisation of a K-Spice model

Example:

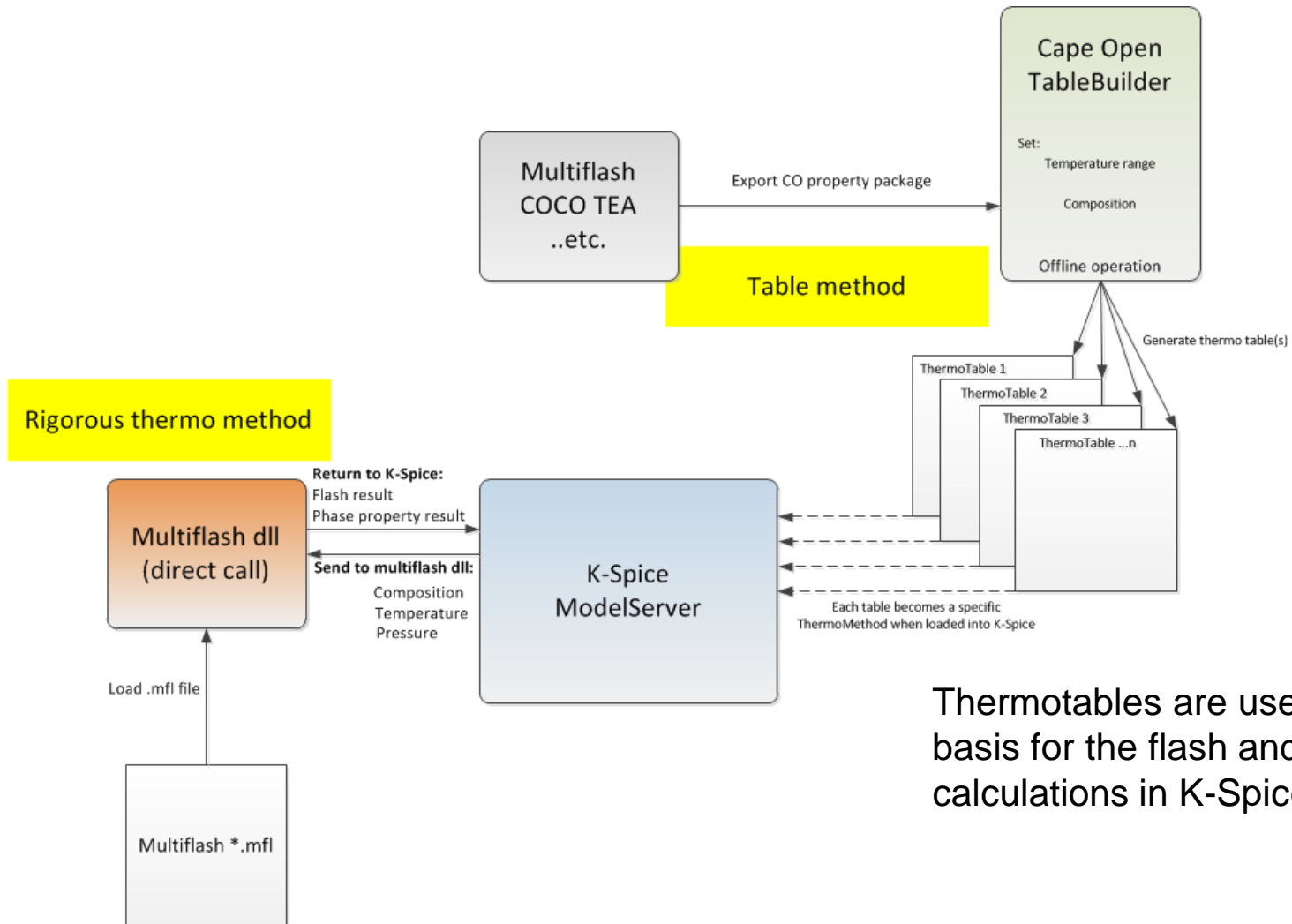2 ThermoTable methods

1 Rigorous method

K-Spice thermodynamics

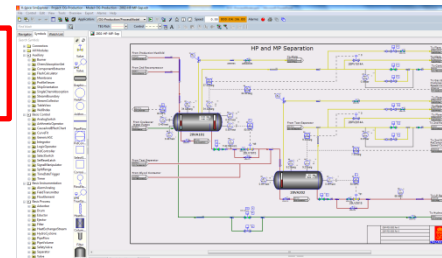**..how it interacts with the K-Spice simulator**

K-Spice®
- CAPE-OPEN compliant for thermodynamics

- Background
  - Dynamic Process Simulation
  - Life-Cycle Simulation Concept

- CAPE-OPEN interface for thermodynamics
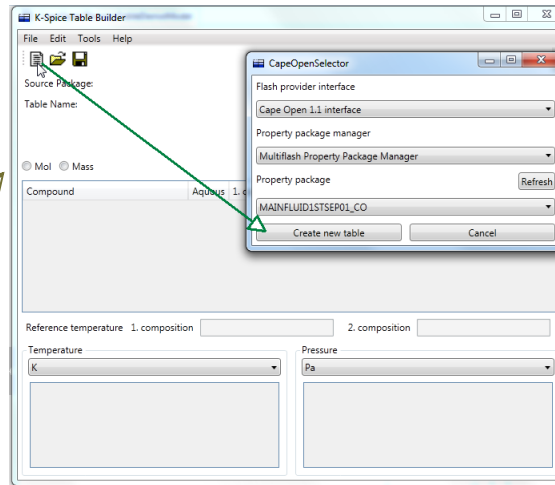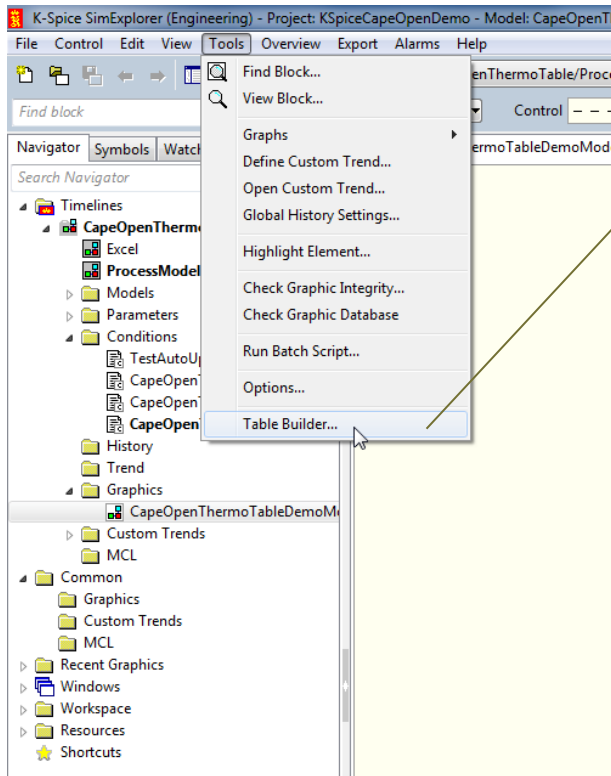 - Technical Solution

- Demo

K-Spice thermodynamic table builder using CAPE-OPEN
- Demo

- Demo..

  - ➢ Create a thermodynamic look-up table based on a Multiflash CO Export file

  - ➢ Load the look-up table into a K-Spice process model

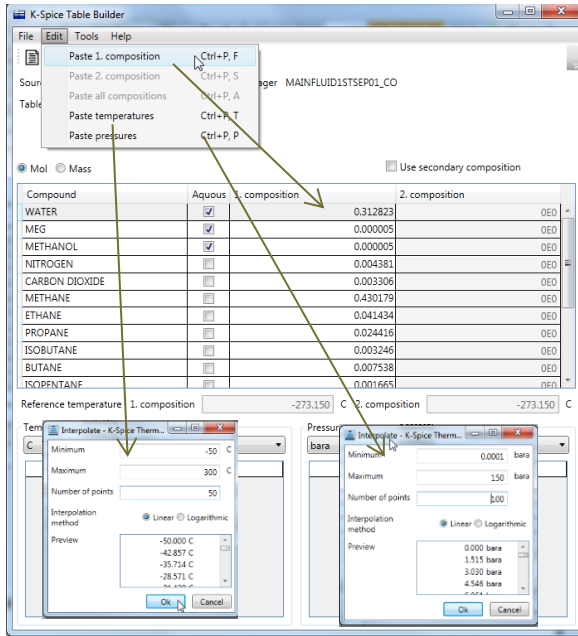# K-Spice thermodynamic table builder using CAPE-OPEN
- Demo

Select a CAPE-OPEN Property Package. In this case generated in Multiflash (mfl-file, MAINFLUID1STSEP01_CO.MFL)
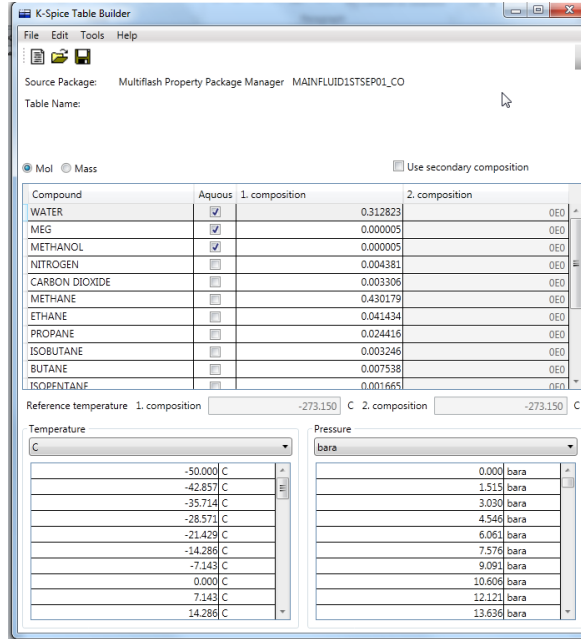
Open the Table Builder interface

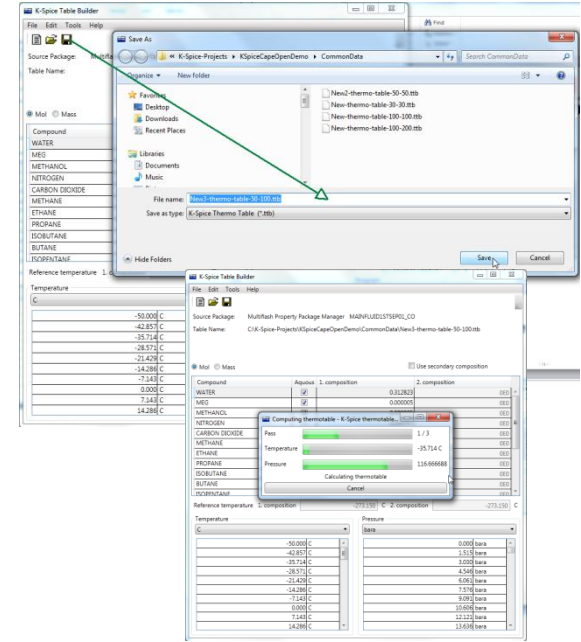# K-Spice thermodynamic table builder using CAPE-OPEN - Demo

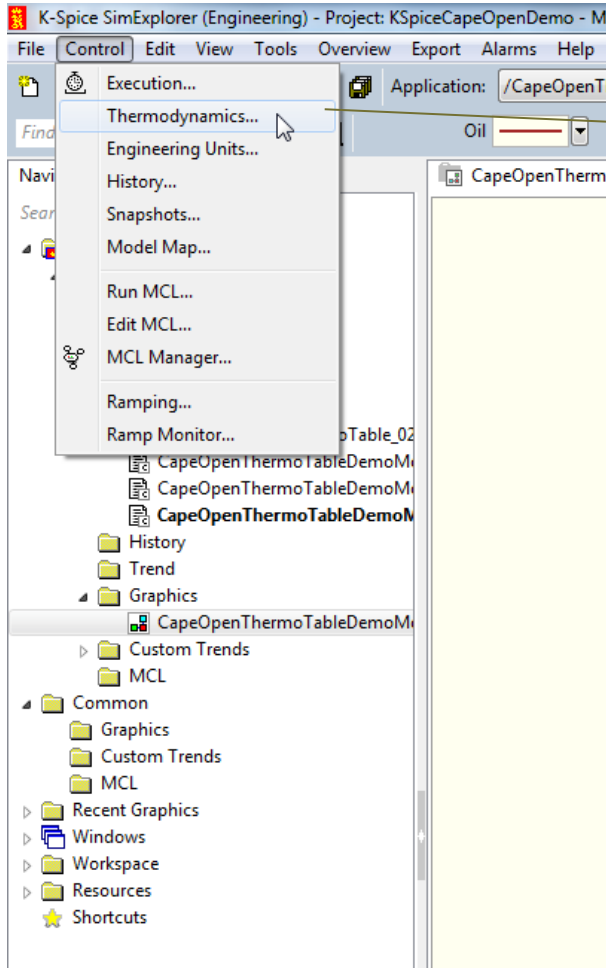Populate data; composition, temperature and pressure
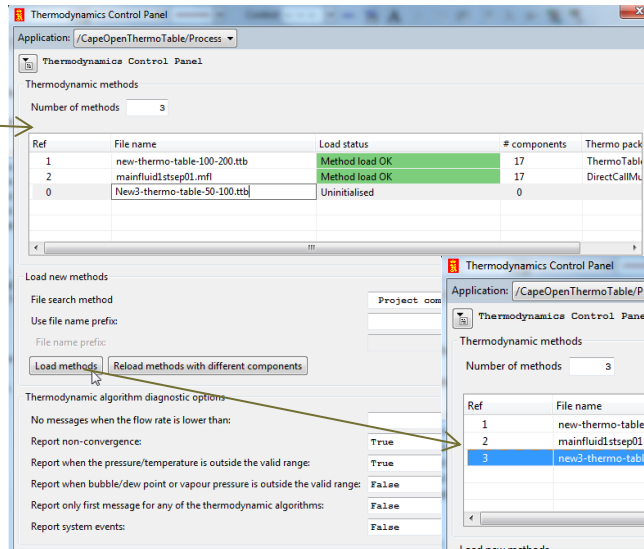

Ready to generate tables

Save command will start generating tables in to ttb-file

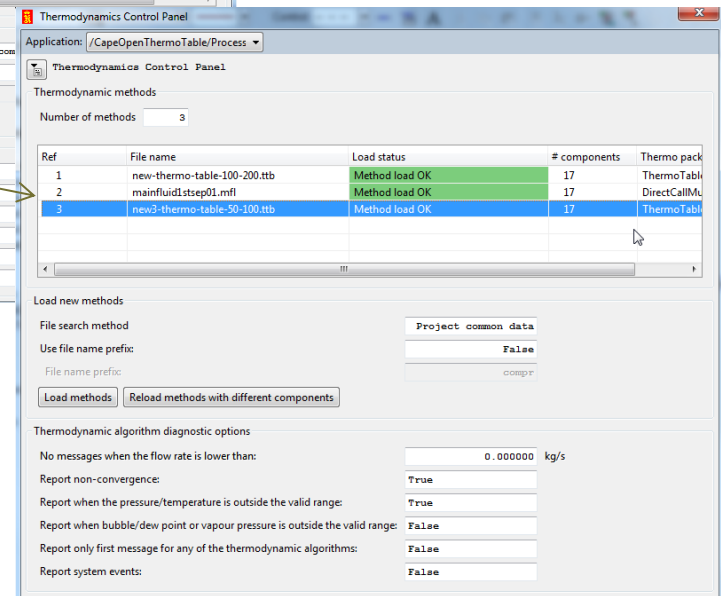# K-Spice thermodynamic table builder using CAPE-OPEN - Demo

Use the new thermo-table

Load the new thermo-table

Ready to use the new thermo-table

kongsberg.com

KONGSBERG
200