CAPE-OPEN Update in PRO/II v9.2 - Part 2

Support for CAPE-OPEN Petroleum Fractions specification

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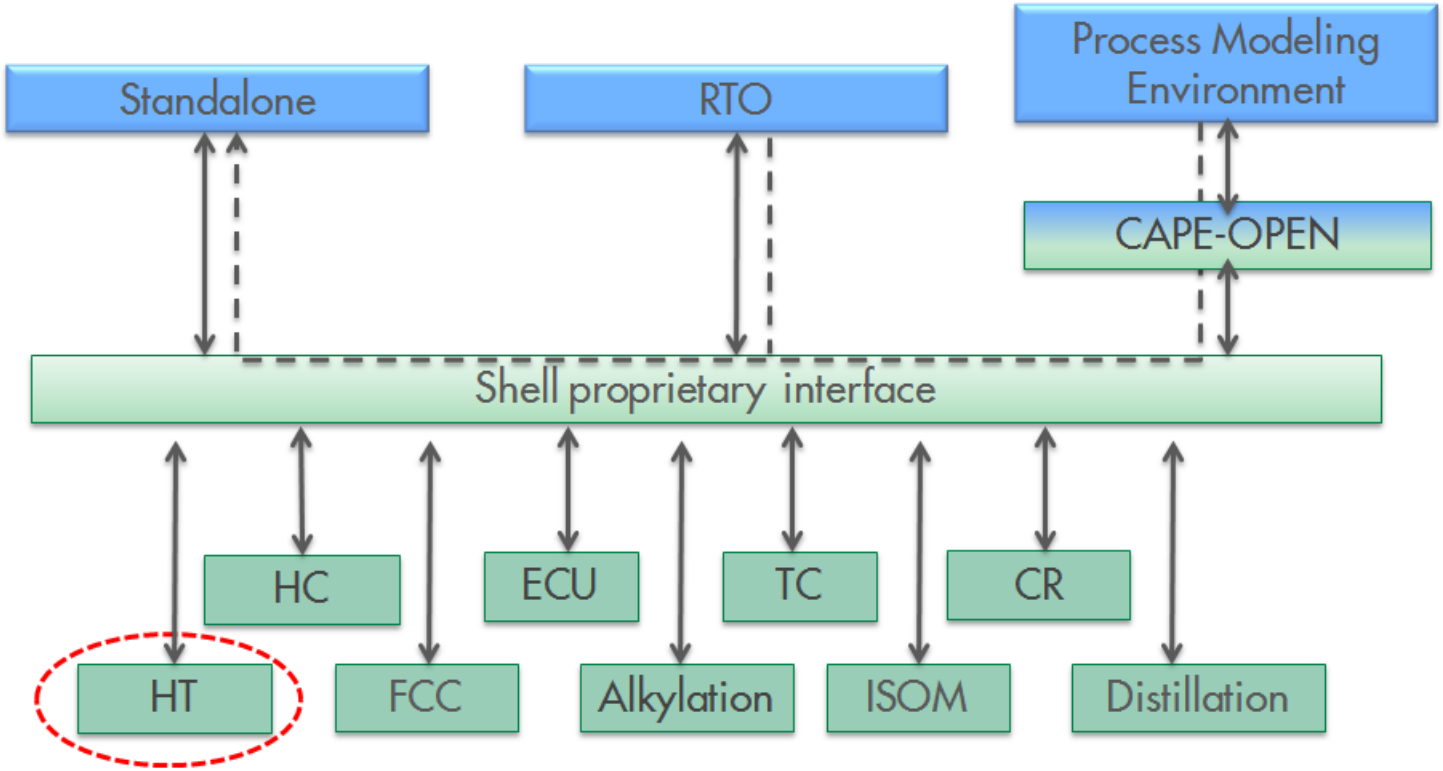
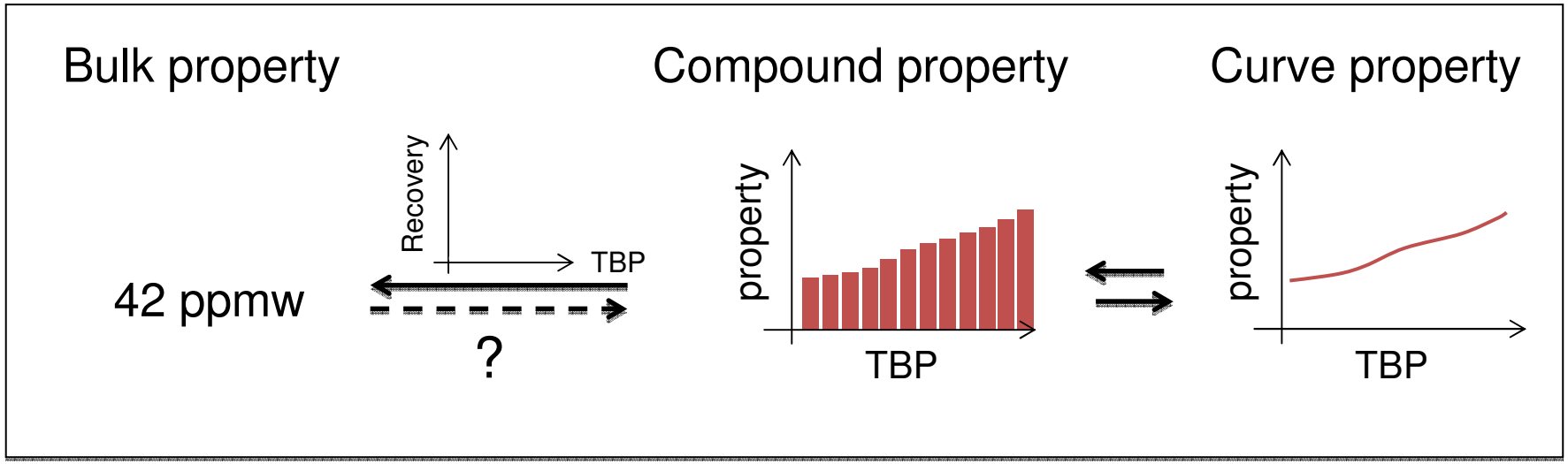
PROCESS MODELING FRAMEWORK



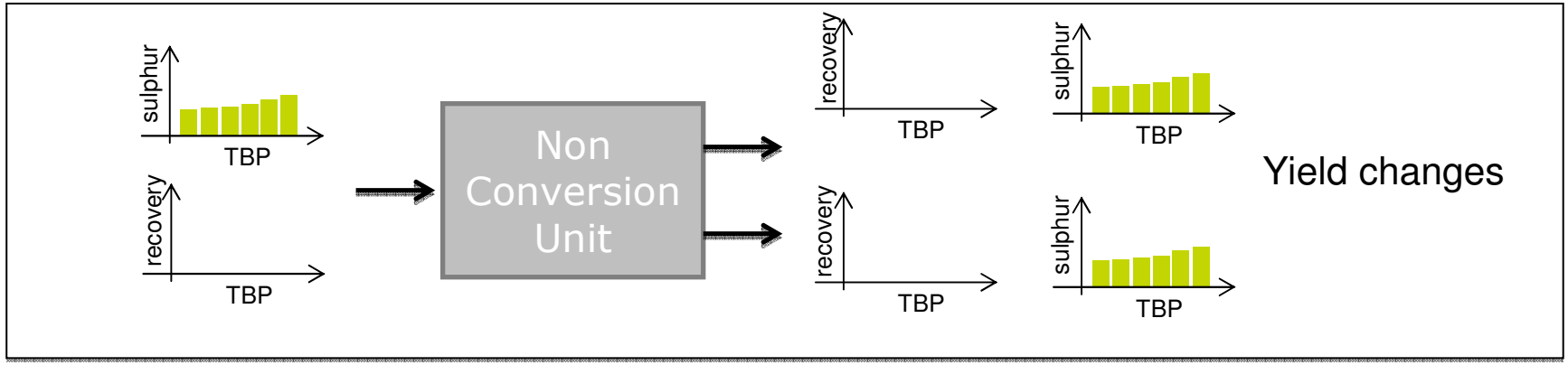
R. Baur et al., presentation given at the 244th ACS National Meeting, Pennsylvania, August 19-23, 2012.

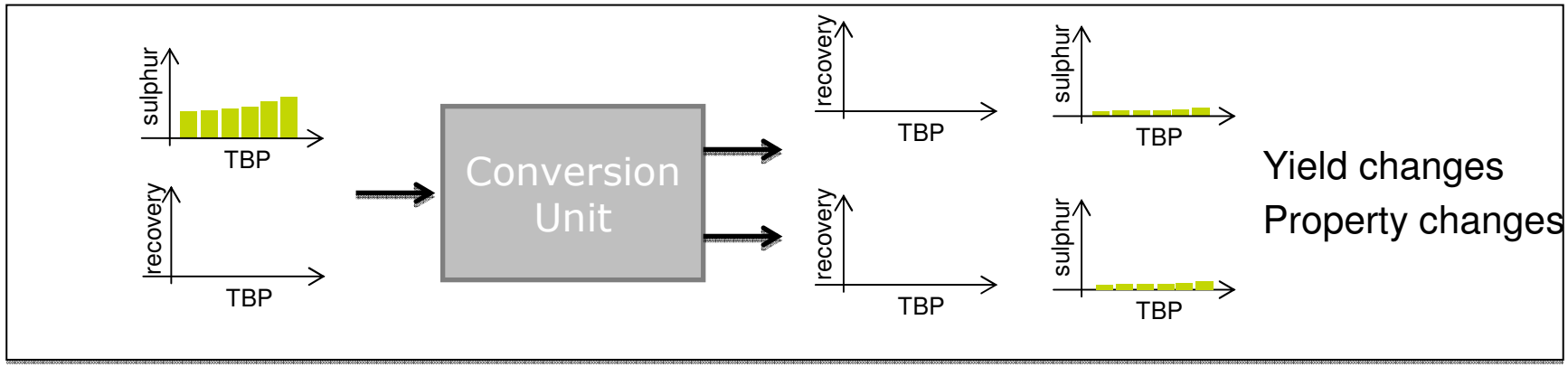
CAPE-OPEN Refinery Reactor SIG (2006-2008):



Property bases: mass, mole, volume, (none)
Example: aromatic content kg/kg, mol/mol, m^3/m^3

Conversion & non-conversion units





The unit decides which properties need to be modified at the outlet streams

CAPE-OPEN Petro Property requirements

- Standard list of properties?
- Which property values are known by default?
- Which properties are set by the unit operation?
- Which properties are affected?

Work flow:

Copy from source → Set properties → “Complete”

Copy from source → Set properties → "Complete"

- **PMC copy feed to product**
  - PMC decides which product is populated from which feed
- **PMC sets product composition, compound density and bulk sulphur**
  - PMC should provide finest granularity, e.g. compound sulphur if it can
  - PMC should not make conflicting specifications, so not both bulk and compound sulphur
- **PMC calls "Complete"**
  - PME now knows which properties have been modified and which other properties will be affected.
  - PME calculates recharacterization and compound sulphur. Note: PME decides on best way to convert bulk sulphur to compound sulphur

Copy from source → Set properties → "Complete"

When to call "Complete"?

Complete must be called before

- Flash calculation
  All product streams must be flashed by the PMC
- Property calculations
  PMC may require intermediate property calculations
  (e.g. to close enthalpy balance)

CAPE-OPEN Implementation

List of properties

Method summary

- Pseudo? GetCompoundConstant("Type")
- CopyPetroProperties(source material)
- Get/SetPetroBulkProp(property, basis, value)
- Get/SetPetroCompoundProp(property, comps, basis, value)
- Get/SetPetroCurveProp(property,X-basis,Y-basis,X-values,Y-values)
- CompletePetroProperties()

IDL/TLB available

Implementation at SimSci (Pro/II)

- **Support for the following bulk and compound properties:**
  Asphaltenes, BromineNumber, CetaneIndex, CetaneNumber, CloudPoint, ColdFilterPlugPoint, ConradsonCarbon, CriticalPressure, CriticalTemperature, CriticalVolume, FinalBoilingPoint, FlashPoint, FreezePoint, HydrogenContent, InitialBoilingPoint, IsoParafins, KinematicViscosity, LiquidDensity, MercaptanSulphur, MolecularWeight, MON, Napthenes, Nickel, Nitrogen, NormalBoilingPoint, Olefins, PourPoint, RefractiveIndex, ReidVaporPressure, RON, SmokePoint, Sulphur, Vanadium, ViscosityIndex, WatsonK

- **Support for the following curve properties:**
  CutPointCurve, D1160AtmCurve, D1160VacCurve, D86Curve, TBPCurve

Implementation at SimSci (Pro/II)

- **Support for the following functions:**
  GetListPetroBulkProp, GetListPetroCompoundProp, GetListPetroCurveProp, GetPetroBulkProp, GetPetroCompoundProp, GetPetroCurveProp, SetPetroCompoundProp, CopyPetroProperties, CompletePetroProperties

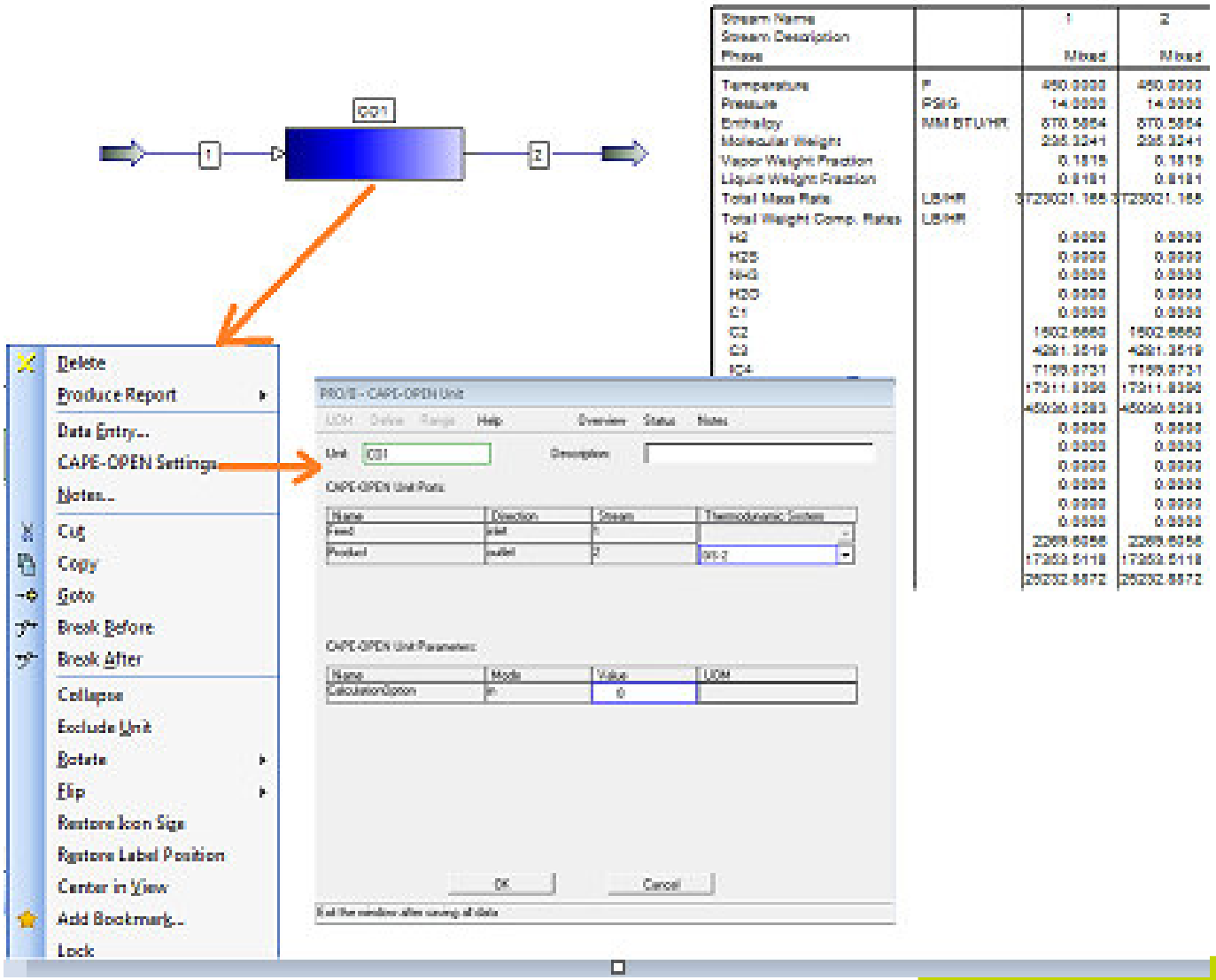
- **No support yet for setting curve properties:**
  SetPetroCurveProp

- **Currently, properties are only available in the basis in which they are defined**
  Example: if Sulphur is configured in a thermo set using a mass based blend rule, Sulphur can only be set and retrieved in mass basis

Live demonstration by

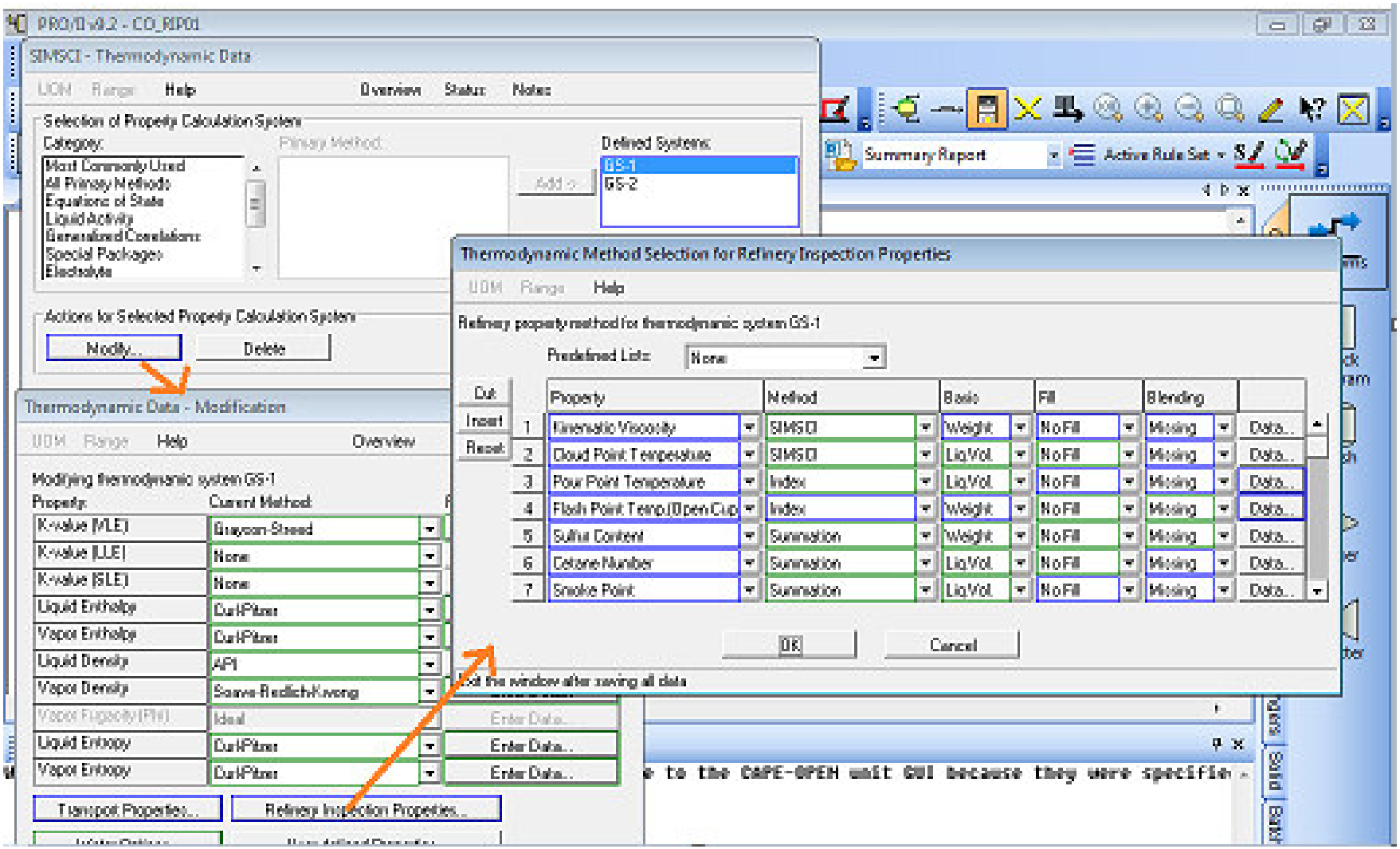
Krishna Murthy

SIMSCI Petro Test Unit



Stream Name Stream Description Phase		1 Mixed	2 Mixed
Temperature	F	450.0000	450.0000
Pressure	PSIG	14.0000	14.0000
Enthalpy	MM BTU/HR	870.5854	870.5854
Molecular Weight		226.3241	226.3241
Vapor Weight Fraction		0.1815	0.1815
Liquid Weight Fraction		0.8181	0.8181
Total Mass Rate	LB/HR	3723021.165	3723021.165
Total Weight Comp. Rates	LB/HR		
H2		0.0000	0.0000
H2S		0.0000	0.0000
N2		0.0000	0.0000
H2O		0.0000	0.0000
C1		0.0000	0.0000
C2		1602.6660	1602.6660
C3		4291.3519	4291.3519
IC4		7169.8731	7169.8731
		17211.8398	17211.8398
		450030.8283	450030.8283
		0.0000	0.0000
		0.0000	0.0000
		0.0000	0.0000
		0.0000	0.0000
		0.0000	0.0000
		0.0000	0.0000
		2269.6056	2269.6056
		17253.5118	17253.5118
		29232.8872	29232.8872

SIMSCI Petro Test Unit



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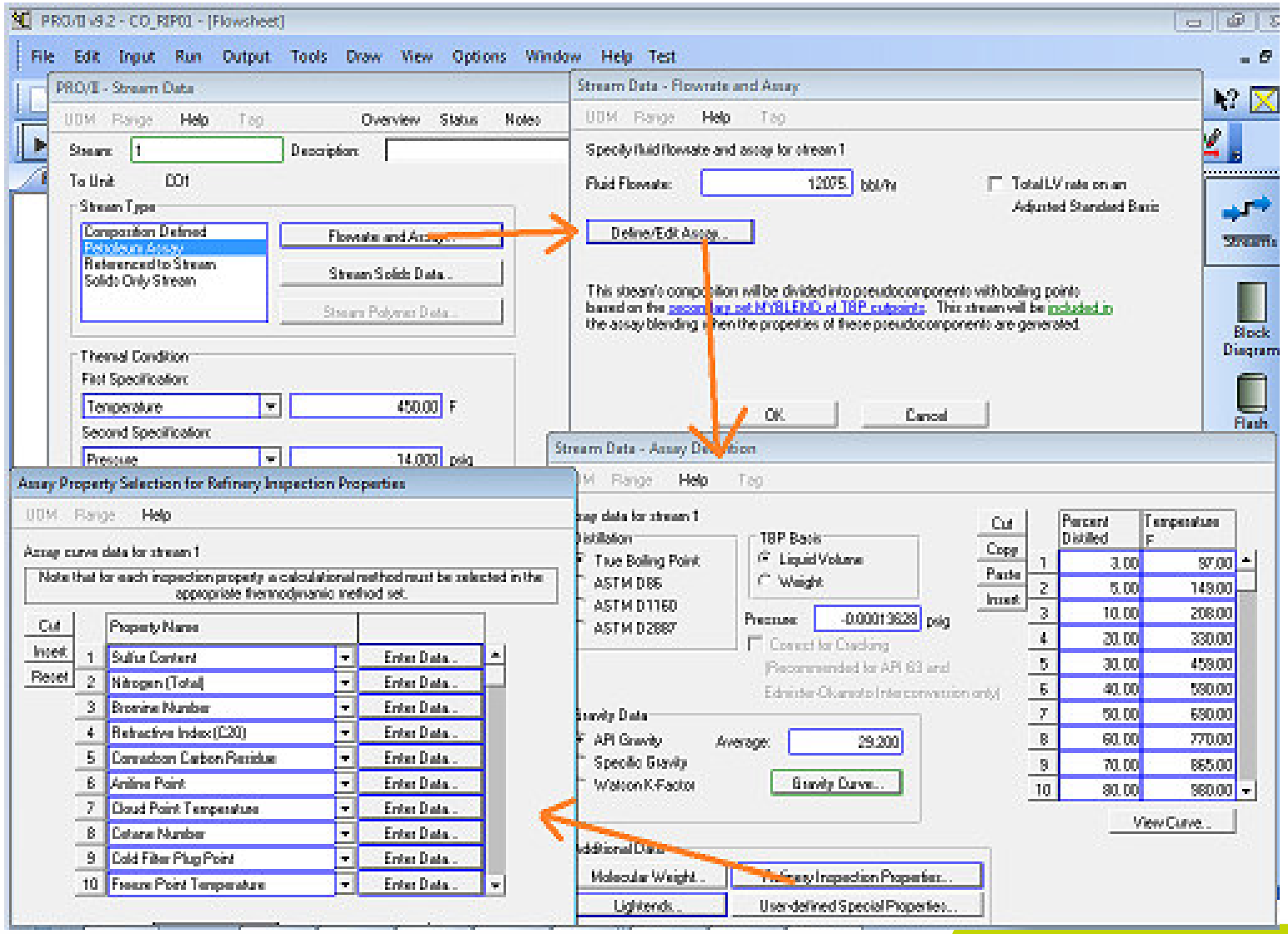

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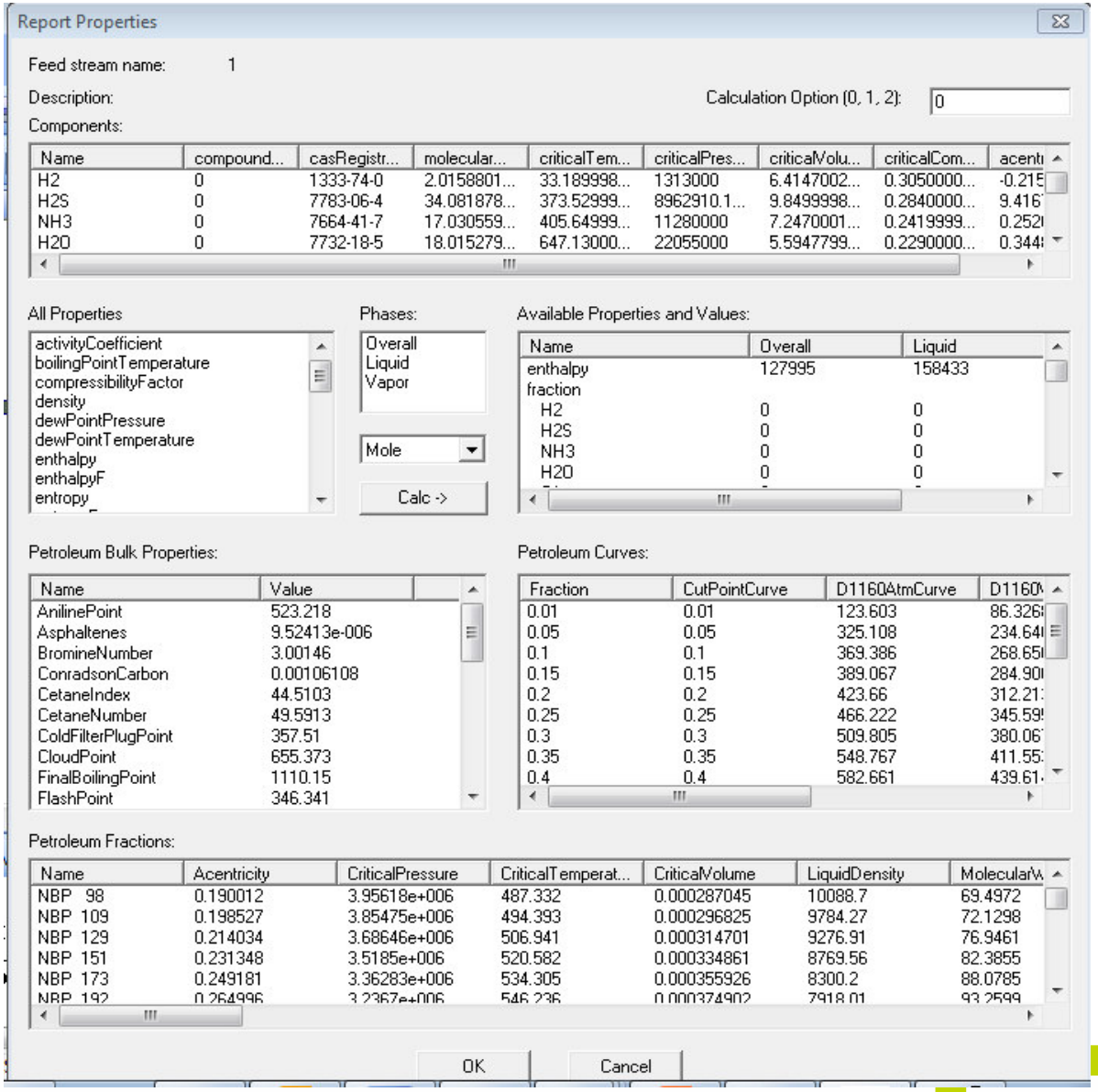

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Conclusions

- CAPE-OPEN unit that implements ICapeThermoPetroFractionsII can be plugged in to PRO/II9.2 and use this functionality.

- The petro property should be specified in the PRO/II Thermo set. Returns error if the unit request the petro property which is not selected in Pro/II Thermo set.

- The basis (if applicable) of the petro property selected in PRO/II should be same. Returns error if the unit request the petro property with a basis which is not the same selected in Pro/II Thermo set.

- Set petro compound property: PRO/II doesn't allow to set the compound petro property for real compounds. Returns error if the compound petro property for real compounds is set by the unit.

- Set petro bulk property: PRO/II do not scale up/down the property for real compounds but adjust its contribution in pseudo compounds. In this way the set value will match with calculated and get value.

- Set petro curve property: Not supported in PRO/II.

Thank you…

Q&A?