

# PetroPhase

– INNOVATIVE EOS MODELING FOR RESERVOIR SIMULATION AND EOR –



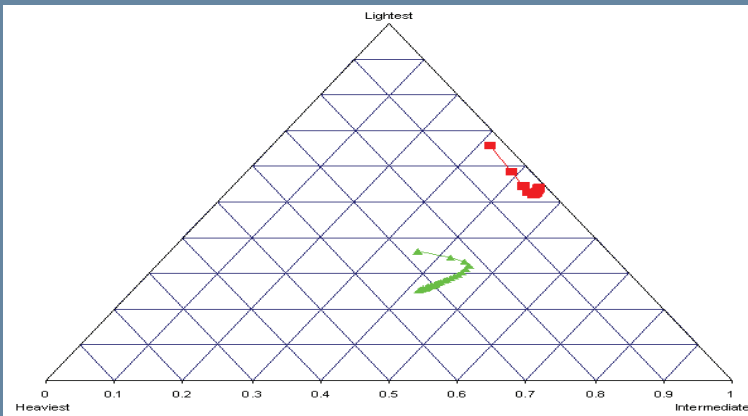
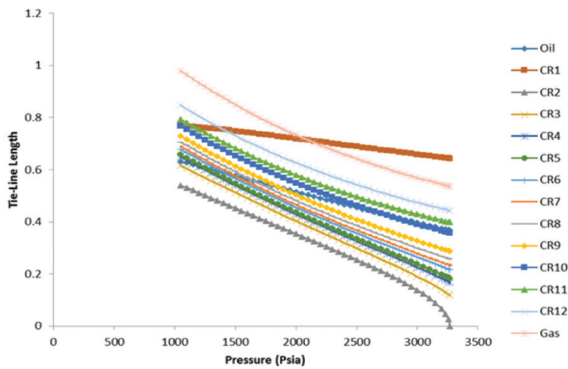
## FEATURES:

- EXCEL FRIENDLY INPUT, FLEXIBLE IMPORT FROM VARIOUS SIMULATORS
- SIMULATION OF DIFFERENT PVT EXPERIMENTS, INCLUDING MMP
- CHARACTERIZATION OF HYDROCARBON HEAVY ENDS WITH DIFFERENT MODELS AND CORRELATIONS
- ROBUST REGRESSION ALGORITHM WITH ABILITY TO TUNE MMP
- ABILITY TO HANDLE WAX AND ASPHALTENE PRECIPITATION
- QUALITY CHECK DATA AND CORRECTION MODULE

## BENEFITS:

- EASY AND INTUITIVE CHARACTERIZATION WORKFLOW
- FAST AND ACCURATE SIMULATION RESULTS
- PROVIDES ACCURATE CHARACTERIZATION FOR HEAVY COMPONENTS
- ALLOWS FOR ENHANCED EOS TUNING
- FACILITATES THE DESIGN OF OPTIMUM SEPARATOR CONDITIONS
- EXPORTS EOS FILES IN VARIOUS RESERVOIR SIMULATOR FORMATS

Estimation of MMP





**PetroPhase** is a Windows-based, state-of-the-art PVT phase package. Using a generalized three-parameter equation of state (EOS), PetroPhase can simulate laboratory experiments, characterize hydrocarbon components, match PVT data, investigate miscibility, facilitate the optimization of separator trains, and prepare PVT input data for black oil and compositional simulators. PetroPhase provides a simple and efficient user interface to input, validate, and save data. Its robust calculation engine provides reliable simulation, characterization, and regression results. PetroPhase also exports to Excel to streamline reporting and analysis.

### EOS Data Input

- Input data in different units
- Utilize Peng-Robinson or SRK EOS options
- Access component properties from a database, characterization method, or user input
- Determine binary interaction parameters from a database, user input, or different correlations
- Select volume shift parameters for PR or SRK EOS automatically
- Combine data from multiple feed compositions
- Use user-specified reference conditions
- Import EOS models from industry standard simulators

### Characterization

- Quality check and adjust composition, molecular weight, equilibrium data
- Automatic initial characterization option
- Use different distribution models (modified Whitson's method as default)
- Extend fluid analysis interactively using different procedures
- Select pseudo-component groups and different lumping schemes automatically
- Calculate component properties with different correlations

Component	Component E.	Molecular Wt.	Critical Pressure	Critical Temp.	Critical Volume	Acentric Factor	Specific Gravity	Orms
N2	N2	28.0200	493.00000	227.30000	1.442800	0.045000	0.470000	0.457
C1	C1	16.0400	667.80000	343.00000	1.589700	0.011500	0.530000	0.457
CO2	CO2	44.0100	1070.60000	517.60000	1.505200	0.231000	0.500000	0.457
C2	C2	30.0700	707.80000	549.80000	2.370000	0.090000	0.430000	0.457
C3	C3	44.0900	616.30000	665.70000	3.250500	0.145400	0.507700	0.457
IC4	IC4	58.1200	525.10000	774.70000	4.203400	0.175600	0.581300	0.457
NC4	NC4	58.1200	550.70000	765.30000	4.080500	0.192800	0.584400	0.457
IC5	IC5	72.1500	490.40000	828.80000	4.899000	0.227300	0.627400	0.457
NC5	NC5	72.1500	486.60000	845.40000	4.870700	0.251000	0.630100	0.457
C6	C6	84.0000	476.00000	914.00000	5.625800	0.271000	0.690000	0.457
C7+	C7+	98.5485	441.39080	1004.31575	6.491070	0.288455	0.740414	0.457
C9+	C9+	135.8432	362.72596	1135.080347	8.620800	0.338230	0.787885	0.457
C14+	C14+	206.6408	266.915595	1109.600471	12.650734	0.575503	0.935748	0.457
C22+	C22+	319.8258	191.153243	1490.341623	18.222311	0.831462	0.979642	0.457
C35+	C35+	500.0000	140.360969	1670.482590	24.609810	1.118503	0.922551	0.457

**Pseudo-Component Characterization**

Edit Feed

Component	Select Comp.	Molecular Wt.	Specific Gravity	True Boiling-P.	Feed 1	CO2	xi	To (R)
N2	<input checked="" type="checkbox"/>	28.0200	0.4700	139.3000	0.012600			Equipment
C1	<input checked="" type="checkbox"/>	16.0400	0.5300	150.4000	0.019000			CC
CO2	<input checked="" type="checkbox"/>	44.0100	0.5000	383.1000	0.017100			TD
H2S	<input checked="" type="checkbox"/>	34.0800	0.5000	383.1000	0.017100			Distribution
C1	<input checked="" type="checkbox"/>	16.0400	0.5300	201.0000	0.318100			Exponential
C2	<input checked="" type="checkbox"/>	30.0700	0.4500	332.2000	0.090400			Gamma
C3	<input checked="" type="checkbox"/>	44.0900	0.5077	416.0000	0.065500			Log Z vs. MW Plot

Plus Fraction: Feed 1, CO2, xi

Lumping Method: [Swapp-Laguna-Guadagnoli] Comparison for Critical Properties: [You]

Lumping Options for SCN: [Mole Fraction] Comparison for Acentric Factor: [Lee-Kesler]

Specific Gravity of C7+: [0]

Number of Pseudo-Components: [5]

Molecular Weight of the Last Pseudo-Component: [5175]

## PVT Experiment Simulation

- Unlimited number of experiments
- Constant composition expansion (CCE)
- Constant volume depletion (CVD)
- Differential liberation expansion (DLE)
- Saturation pressure (SAT)
- Minimum miscibility pressure or enrichment (MMP/MME) for different drive mechanisms
- Swelling Test (SWE)
- Multi-stage separator test (SEP)
- Multi-contact test (MCT)
- Wax precipitation
- Asphaltene precipitation
- Vapor-liquid two-phase flash (VLE)
- Multi-phase flash
- Compositional grading

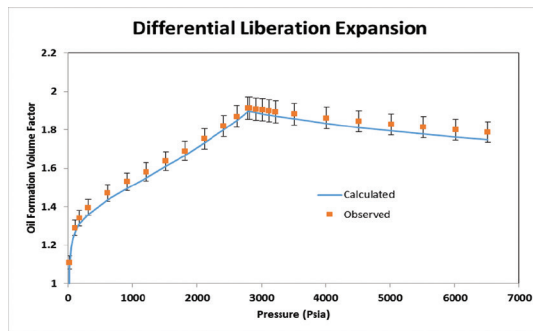
Differential Liberation Expansion

General Observed Weight | xi | yi | K-Value |

No.	Pressure	Oil FVF	Gas-Oil Ratio	Liquid Mole Fraction	Liquid Z Factor	Vapor Z Factor	Oil Densi
1	6514.7000	1.7880	1129.0000				
2	6014.7000	1.8010	1129.0000				
3	5514.7000	1.8140	1129.0000				
4	5014.7000	1.8280	1129.0000				
5	4514.7000	1.8440	1129.0000				
6	4014.7000	1.8610	1129.0000				
7	3514.7000	1.8810	1129.0000				

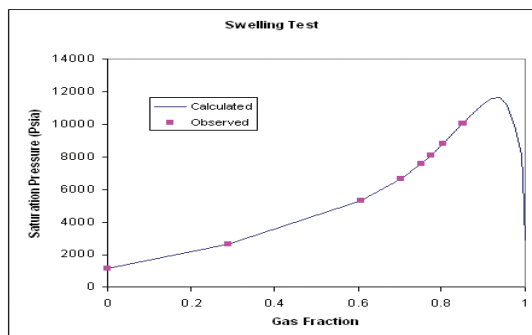
P (psia) | Viscosity (Cp) | V (ft<sup>3</sup>/bmol) | Density (lbm/ft<sup>3</sup>) | GOR (ft<sup>3</sup>/bbSTD)

OK Help Cancel



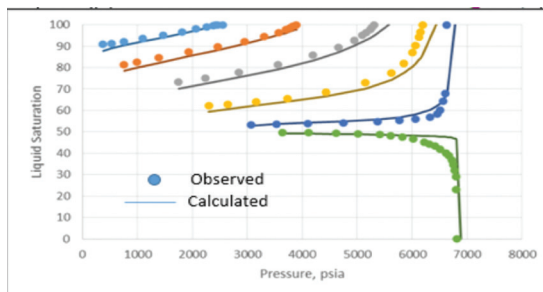
## EOS Tuning

- Multiple experiment selection, including MMP
- Multi-sample simultaneous regression capability
- Sensitivity analysis
- Audit, edit, and return to prior regressions conveniently
- Regression comparison chart
- Detailed regression report



## Outputs

- Generate Excel-compatible graphics and tables
- Detailed output report
- Generate outputs for multiple experiments with single click
- Export EOS information to black-oil or compositional simulators
- Produce pseudo-ternary diagrams, finger plots, and phase envelope illustrations





## ABOUT PLANO RESEARCH:

- Plano Research Corporation provides a wide array of sophisticated products for the oil and gas sector. Our proprietary technology has been designed to simplify and speed up the analysis of routine and complex problems faced by geoscientists and engineers during all phases of the oil and gas exploration and development. Currently, we offer the following products:

FlowSim (a black oil and compositional reservoir simulator),  
CAESAR (a well and reservoir management application),  
Transients+ (a pressure transient analysis package),  
Analytics (a waterflood optimization tool),  
PetroPhase (a phase behavior software package),  
PVT (a fluid property data application),  
Oil3D (a gas, oil, and water simulation tool),  
GeoTrak (a resource analysis and exploration toolkit),  
PetroTrak (an online well and field management application),  
CoreLog (a petrophysical interpretation tool),  
Galaxy4D (a reservoir characterization software),  
Sigma (a seismic interpretation package), and  
SmartEOR (an EOR screening tool).

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