



**PiMSOFT**  
INNOVATIVE SOLUTIONS

# Sigmafine<sup>®</sup> App for LNG, LPG & NGL

For use with the OSIsoft<sup>®</sup> PI System<sup>®</sup>

Product Overview

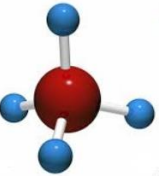


# Scope of the Sigmafine App



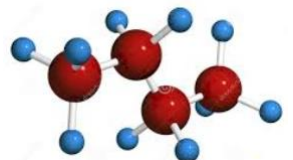
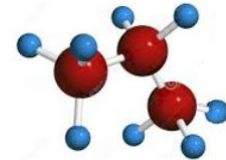
- LNG - **Liquefied** Natural Gas (Predominantly methane)

- Liquefaction
- Regasification
- Both



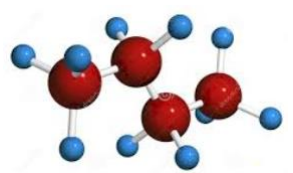
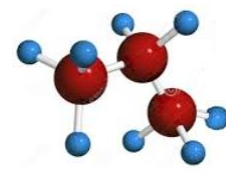
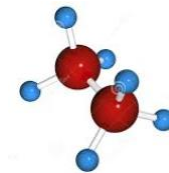
- LPG – **Liquefied** Petroleum Gases (Mainly propane and butane)

- LPG Terminal
- Refinery Storage



- NGL – Natural Gas **Liquids** (Ethane, propane, butane, others)

- Gas Plant
- NGL Terminal & Pipeline



# Supported Calculations



- Density Calculation (Klosek McKinley)

$$Density = \frac{\sum (X_i * MW_i)}{\sum (X_i * MV_i) - X_m * \left( k_1 + \frac{(k_2 - k_1) * X_n}{0.0425} \right)}$$

- Compressibility

$$Z = 1 - P_{std} \left( \sum_i^n (X_{ind} * b_i)^2 \right)$$

- Tank Energy

*Tank Energy = Volume \* Density \* Mass Calorific Value*

# Supported calculations(Cont'd)



- Wet to Dry Basis Conversion

$$(\text{N. Mole}\%)_i (\text{Dry Basis}) = \frac{X_i}{1 - X_{\text{water}}}$$

- Normalization

$$X_{in} = (\text{N. Mole}\%)_i = \frac{(\text{Mole}\%)_i}{\text{Total Mole}\%}$$

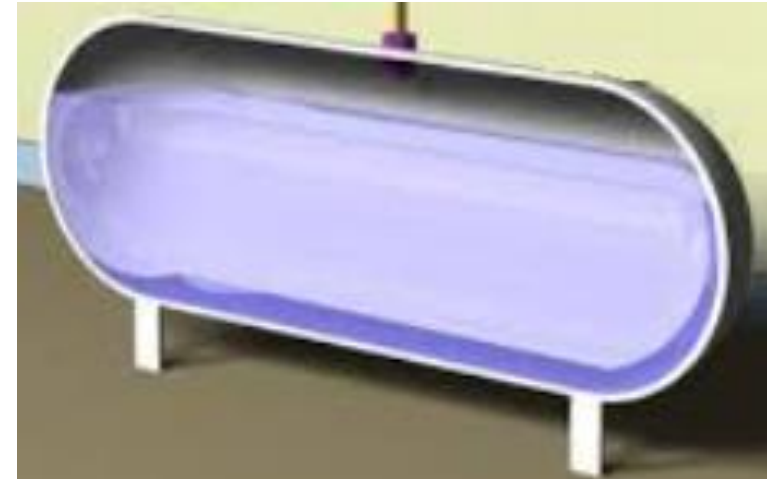
- Mass Calorific Value

$$\text{Mass calorific value} = \frac{\sum X_{in} * MW_i * H_i}{\sum X_{in} * MW_i}$$

# Supported Calculations (cont'd)



- Implementation of GPA TP-27 (24E)
- Covers the following:
  - Liquid phase
  - Temperatures from -51 to 200 °F
  - Densities from ethane to n-heptane
  - Temperature correction only
  - Saturation pressure assumption



# Input & Output



↓	☑	i_Compressibility_Factor	0.994290078736801	LNG Calculation
↓	☑	i_Density	563.508210552965 kg/m3	LNG Calculation
	☑	i_GHV_Ideal	1523.59464 Btu/scf	LNG Calculation
↓	☑	i_Mass_Calorific_Value	52.6263539147188 MJ/kg	LNG Calculation



**LNG Calculations**

Select the Calculation

Compressibility Factor       Mass Calorific Value  
 Density                               Tank Energy  
 Gas Meter - Heating Value       Liquid Meter Energy  
 Gas Meter Energy

Selected Attribute Information

Calculated Attribute Name : i\_Mass\_Calorific\_Value  
 Unit of Measure Class : megajoule per kilogram  
 Element Name : TK\_3

Next >    Cancel



**Compressibility Factor Calculation**

Select Attribute Input

Component Data: i\_Component\_Molar\_Fraction\_dry

Select Column from Component Table

Summation Factor: SummationFactor@60F

< Back    Finish    Cancel



**Gas Meter Energy Calculation**

Select Attribute Inputs

Component Mole Fraction: i\_Component\_Molar\_Fraction\_dry

Select Columns from Component Table

Heating Value: GHV@60F\_IdealGas

< Back    Finish    Cancel



**Tank Mass Calorific Calculations**

Select Columns from Component Table

Component Data: i\_Component\_Molar\_Fraction\_dry

Molecular Weight: MolecularWeight

Enthalpy: GHV@15C\_MassBasis

< Back    Finish    Cancel

# Input & Output (cont'd)



- Read Temperature
- Read Density
- Interpolate critical properties
- Perform calculations based on the standard

		i3_VCF	0.96579833342697508
		i3_VCF_Vapor	0.0430134756317569



Propane Calculation

Option

Liquid Volume VCF  Gas Volume VCF

Input Attributes

Material: Material

Temp: i3\_Temp

Density: i3\_Density

Calculated Attribute Information

Calculated Attribute Name: i3\_VCF

Unit of Measure Class: <Dimensionless>

Element Name: TC Stock - C3

OK Cancel