

EFFECTS OF RAW SUGAR QUALITY ON THE DESIGN OF A SUGAR REFINERY

2023 SIT meeting

Scott Kahre

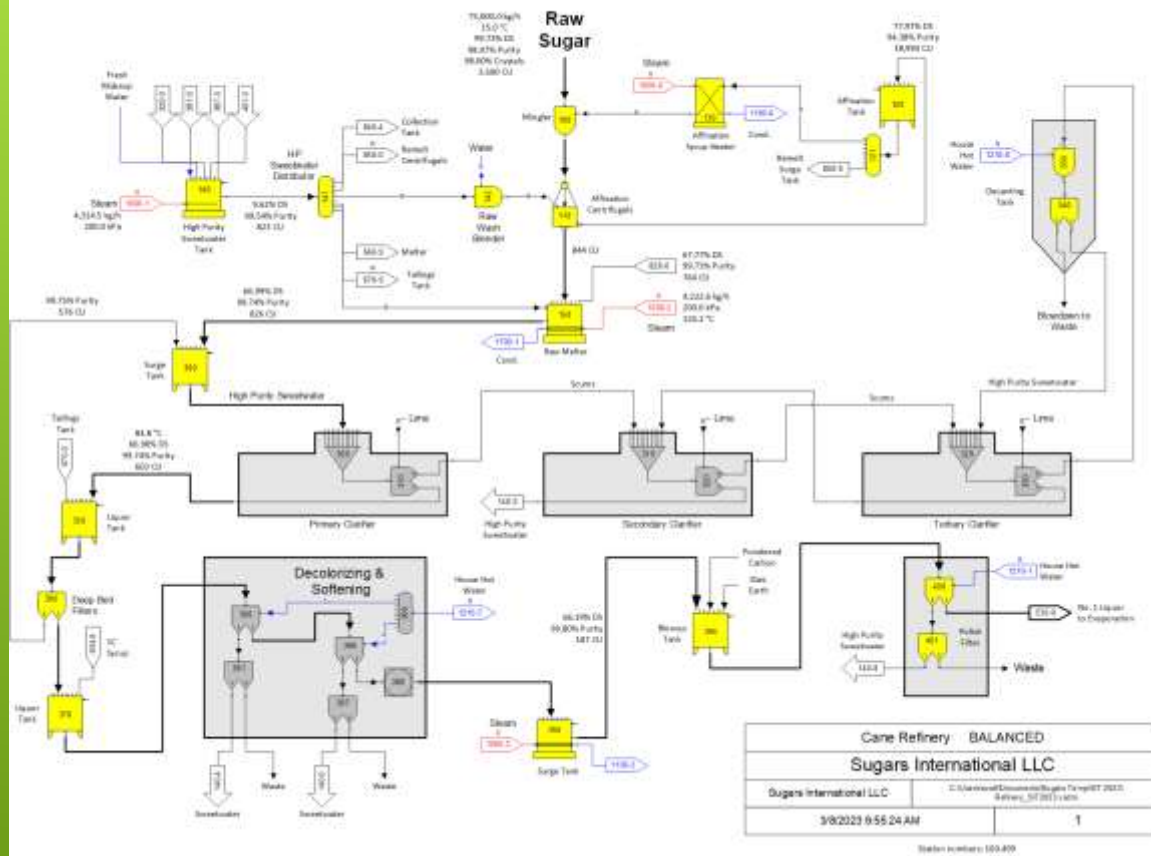
Chief Engineer of Applications and Customer Support

Sugars International LLC



HOW DO WE PREDICT THE REFINERY'S
RESPONSE TO CHANGES IN RAW SUGAR
QUALITY?

Affination and Purification



“DIGITAL TWIN” – MASS AND ENERGY BALANCE SUCH AS SUGARS™

Affination and Purification

External Flow Properties

External Flow Properties dialog box showing flow stream name "Raw Sugar" and various parameters.

Flow Stream Name: **Raw Sugar**

Flow Stream Summary:

Pressure	101.4 kPa	Temperature	15.0 °C	Flow	75,000.00 kg/h
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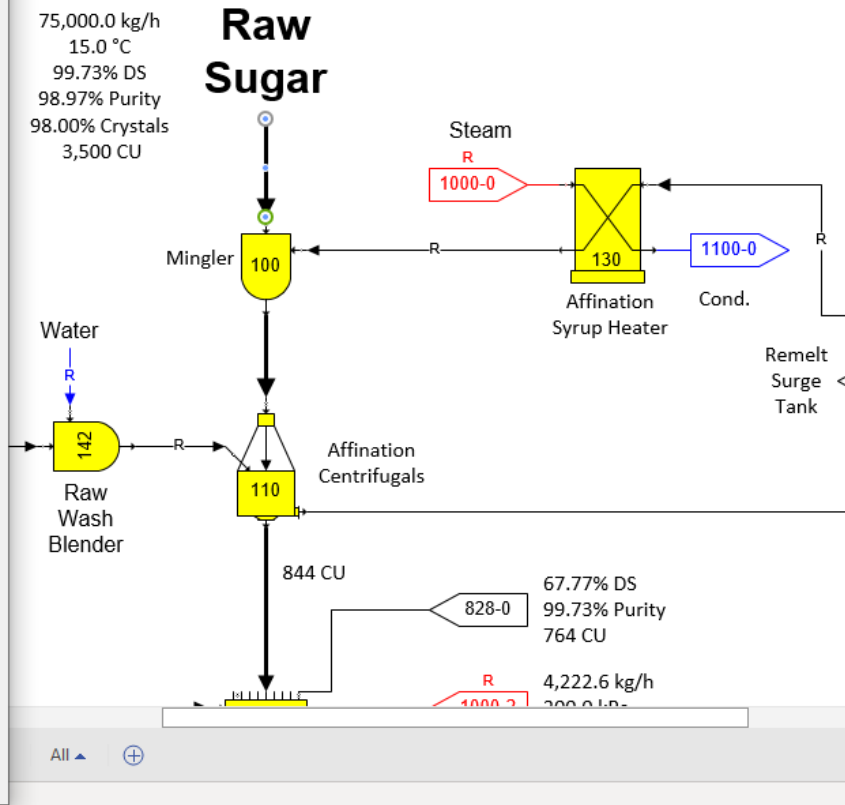
Flow Stream Components:

Liquid		Solid		Gas	
DS and Purity					
Water	0.27000 %	Sucrose Crystals	98.00000 %	Steam/Vapor	0.00000 %
Ethanol	0.00000 %	Lime Rock (CaCO ₃)	0.00000 %	Ethanol	0.00000 %
Sucrose	0.70000 %	Lime (CaO)	0.00000 %	Carbon Dioxide	0.00000 %
Invert	0.00000 %	Fiber	0.00000 %	Ammonia	0.00000 %
Ash	0.00000 %				
Non-sucrose #1	0.72000 %				
Non-sucrose #2	0.31000 %				

Color: 3.500

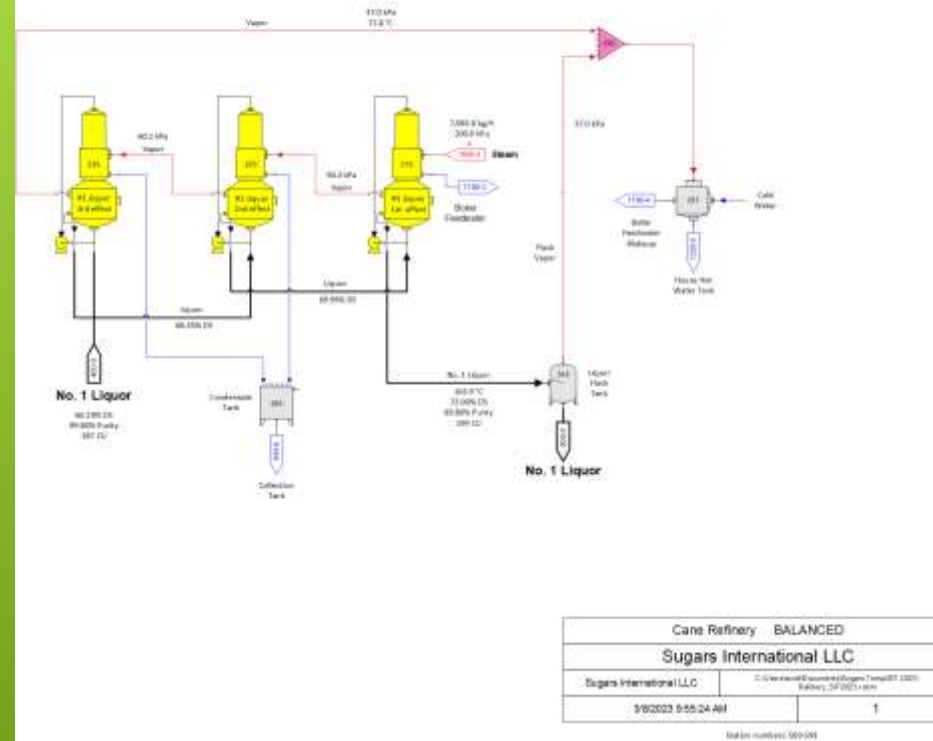
Solubility Coefficients:

a =	0.0375	b =	0.7070	c =	-2.050	Value	0.42770 per kg
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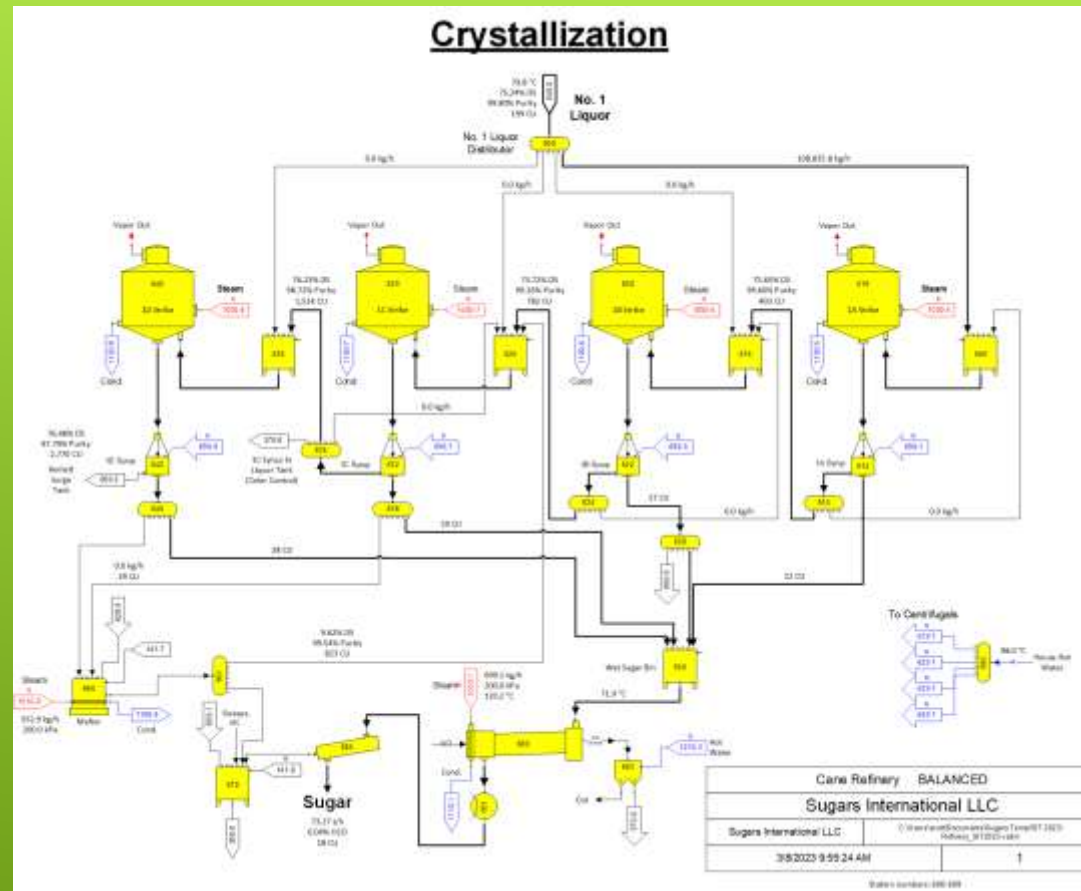
INCOMING RAW SUGAR PARAMETERS

Evaporation



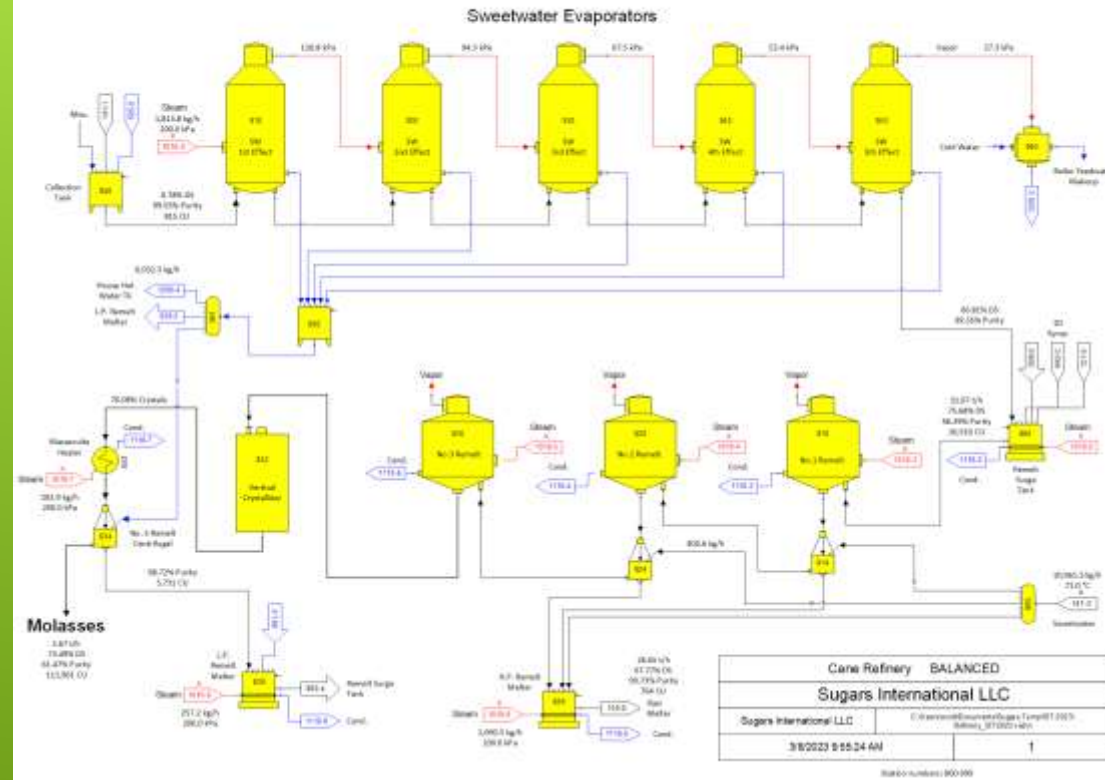
REFINERY-WIDE BALANCE - EVAPORATION

Crystallization



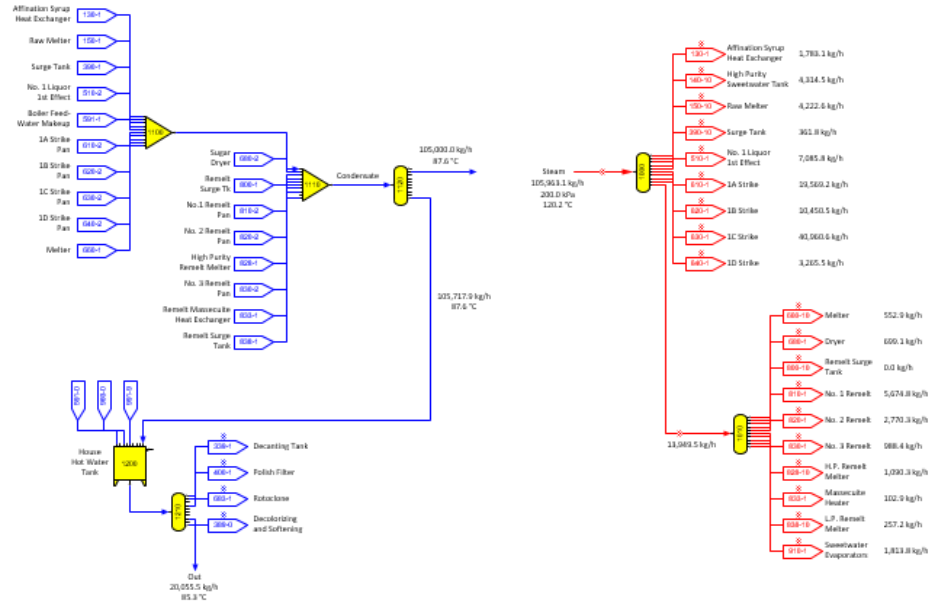
REFINERY-WIDE BALANCE -
CRYSTALLIZATION

Remelt



REFINERY-WIDE BALANCE - REMELT

Steam and Water Distribution



Cane Refinery BALANCED	
Sugars International LLC	
Sugars International LLC	C:\Users\m\Documents\Sugars\TSP\2023\Refinery_20230210.xlsx
3/8/2023 9:55:24 AM	5

Station numbers: 1000-1100

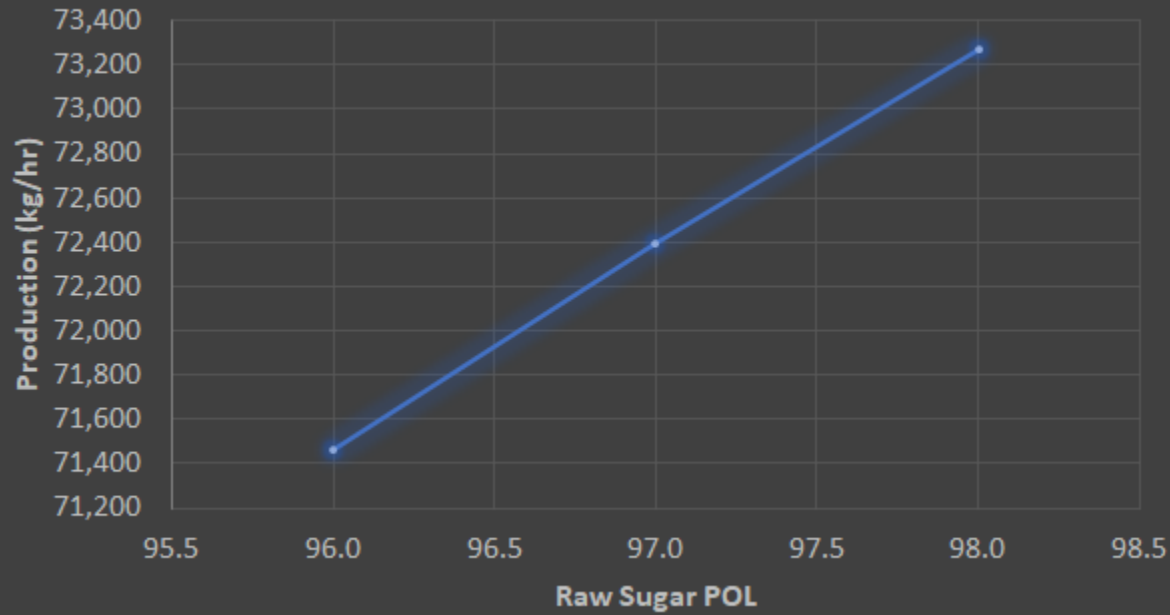
REFINERY-WIDE BALANCE – STEAM/WATER

Refinery Balance Results - Raw Sugar Quality Scenarios

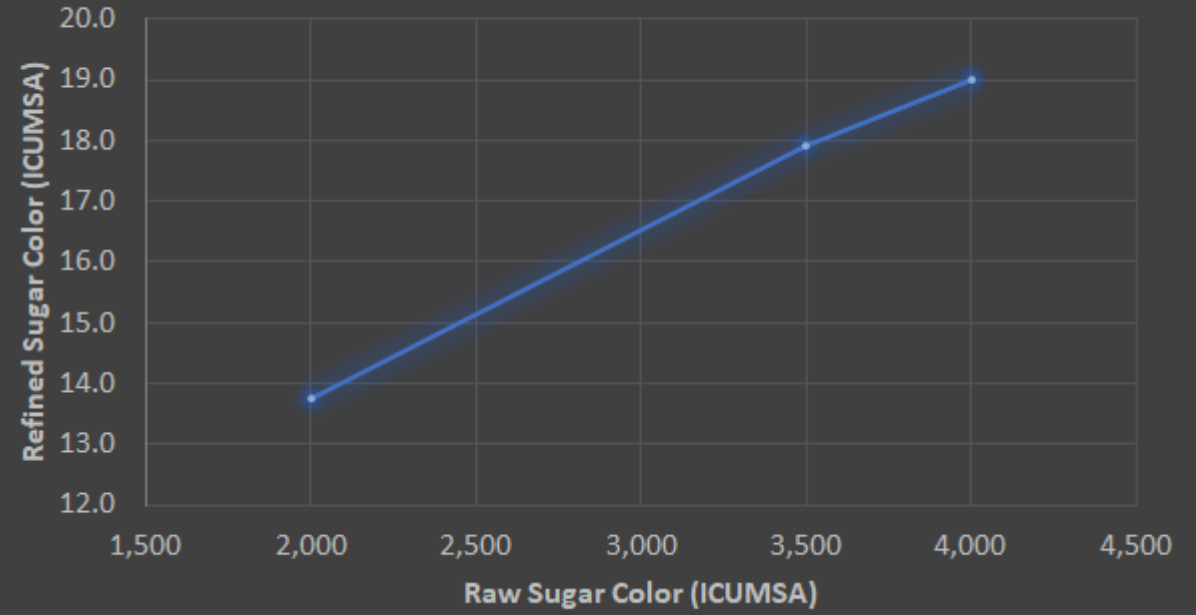
	Linked Model		Scenario	Scenario	Scenario
	Data:	Baseline	#1	#2	#3
Raw Sugar % Sucrose Crystals:	98.0	98.0	98.0	97.0	96.0
Raw Sugar % Dissolved Sucrose:	0.7	0.7	0.7	0.7	0.7
Raw Sugar Color (ICUMSA):	3,500	3,500	2,000	3,500	4,000
Refined Sugar Production (kg/hr):	73,269	73,269	73,269	72,395	71,463
Refined Sugar Color (ICUMSA):	18.0	18.0	13.7	17.9	19.0
Sweetwater Purity (%):	99.5	99.5	99.5	99.3	99.2
Sweetwater Color (%):	822.8	822.8	473.0	773.9	831.1
Steam Flow (kg/hr):	105,963	105,963	105,963	105,569	105,247
Clarifier Lime Feed 1 (kg/hr):	49.8	49.8	49.8	108.6	157.4
Clarifier Lime Feed 2 (kg/hr):	21.5	21.5	21.5	47.0	68.1
Clarifier Lime Feed 3 (kg/hr):	9.1	9.1	9.1	19.9	28.8

COMPILE RESULTS OF RAW SUGAR QUALITY BALANCE SCENARIOS USING EXCEL ADD-IN

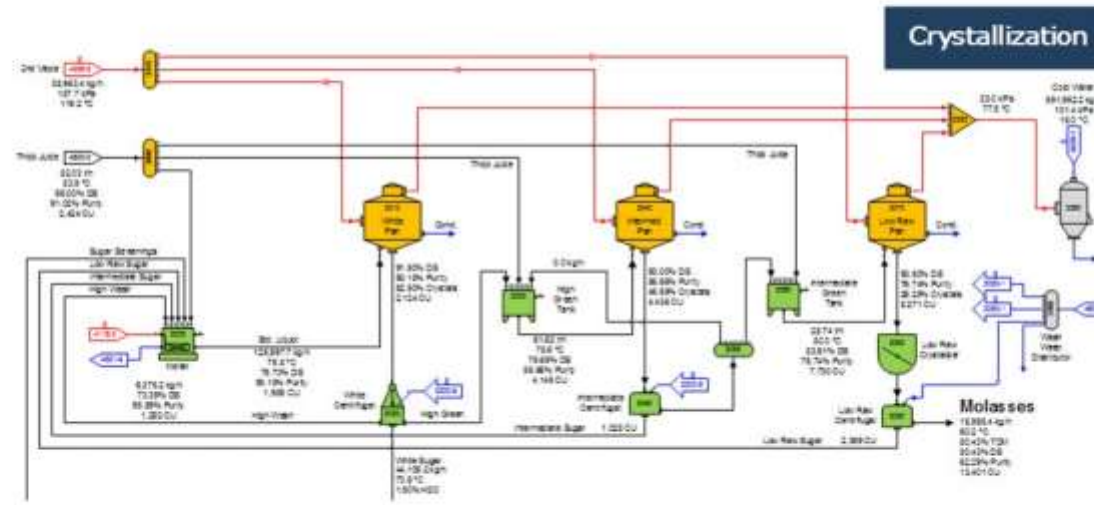
Refined Sugar Production vs. Raw Sugar POL



Refined Sugar Color vs. Raw Sugar Color



CHARACTERIZE REFINERY RESPONSE
TO RAW SUGAR QUALITY



Process Modeling and Simulation Software Used by Major Sugar Companies Around the World

THANK YOU FOR YOUR ATTENTION!