

Integration of Sugars™ Process Simulation Data into dataPARC Visualization and Analytics

Presenters:

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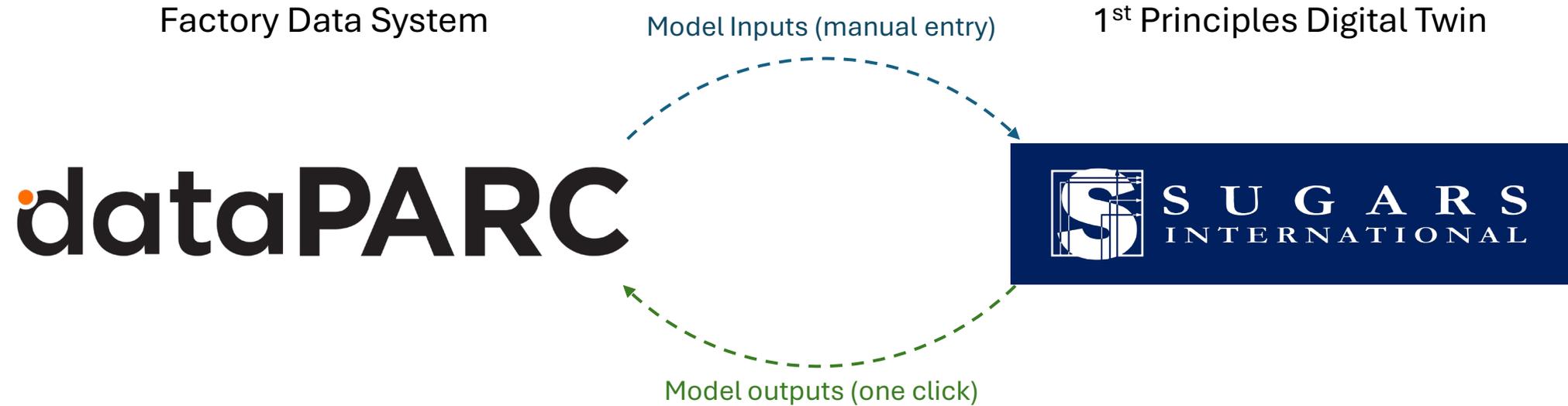
Sigrid Baeth – The Amalgamated Sugar Company LLC

dataPARC

 **Amalgamated
Sugar**



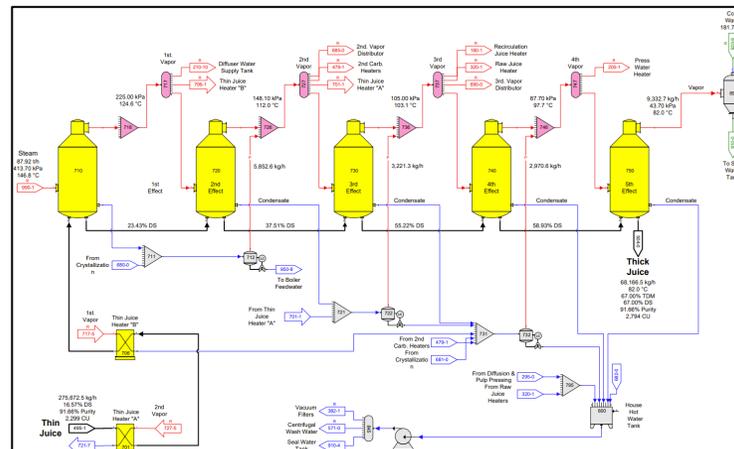
Proof of Concept at Amalgamated Sugar:



1st Principles Digital Twin:

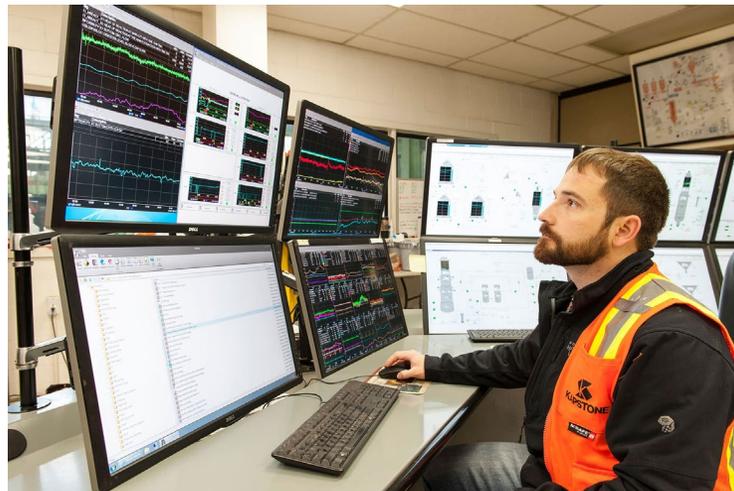


- Leading Mass and Energy balance simulation for the global sugar industry.
- Model was already developed for Amalgamated's Nampa factory.
- Juice Run model chosen for initial POC scope.
- Previous external integration via XML Import/Export required programming skills/resources
- POC utilizes direct Sugars database connection via SQL



Factory Data System: dataPARC

- Data historian, visualization, and analytics tools for manufacturing industries
- Now installed at five North American beet sugar cooperatives (over 11 locations)
- Laboratory and automation data available on single platform
- Graphics include manual data entry and custom scripting tools (SQL)



Proof of Concept:

Create new or select existing Record.

BO-Capstone

Sugars Model Data Interface

Step 1: Add Record Record Selector: 07/20/24 08:00 - 07/21/24 08:00 -

Step 2, set times: Aggregate Start: 07/20/24 08:00 Aggregate End: 07/21/24 08:00

Step 3: Calc. Averages

Step 4: Balance and Save Sugars Model

Step 5: Import Sugars Model Results

Step 6: Save Record

Model Inputs

	Raw from dataPARC	Inputs in Sugars Units	Outputs in Sugars Units	Values to be Saved
Juice from Stor.:	gpm	lb/hr		gpm
Juice RDS:	%DS	%DS		%DS
Juice Purity:	%Pur	%Pur		%Pur
Juice Color:	ICUMSA/100	ICUMSA		ICUMSA/100
Mol. to Sep.:	ton/hr 80 RDS	lb/hr @ 80 RDS		ton/hr 80 RDS
Mol. to Sep. RDS:	%DS dilute	%DS		%DS
Mol. to Sep. Purity:	%Pur	%Pur		%Pur
Mol. to Sep. Color:	ICUMSA/100	ICUMSA		ICUMSA/100

Model Outputs

Sugar Production:	cwt/hr	lb/hr	cwt/hr
Sugar Color:	ICUMSA	ICUMSA	ICUMSA
Virgin Molasses Prod.:	lb/hr	lb/hr	lb/hr
Virgin Molasses RDS:	%DS	%DS	%DS
Virgin Molasses Purity:	%Pur	%Pur	%Pur
Extract Mol. Prod.:	lb/hr	lb/hr	lb/hr
Extract Mol. RDS:	%DS	%DS	%DS
Extract Mol. Purity:	%Pur	%Pur	%Pur
Tot. Steam Flow:	lb/hr	lb/hr	lb/hr

Proof of Concept:

Set time period for model comparison.

The screenshot displays the 'Sugars Model Data Interface' with a workflow of six steps:

- Step 1: Add Record
- Step 2: set times: Aggregate Start: 07/20/24 08:00, Aggregate End: 07/21/24 08:00 (highlighted with a red box)
- Step 3: Calc. Averages
- Step 4: Balance and Save Sugars Model
- Step 5: Import Sugars Model Results
- Step 6: Save Record

The interface includes sections for Model Inputs and Model Outputs, each with a table of parameters and their units. Each parameter has a corresponding input field and a 'Save' button.

	Raw from dataPARC	Inputs in Sugars Units	Outputs in Sugars Units	Values to be Saved
Juice from Stor.:	gpm	lb/hr		gpm
Juice RDS:	%DS	%DS		%DS
Juice Purity:	%Pur	%Pur		%Pur
Juice Color:	ICUMSA/100	ICUMSA		ICUMSA/100
Mol. to Sep.:	ton/hr 80 RDS	lb/hr @ 80 RDS		ton/hr 80 RDS
Mol. to Sep. RDS:	%DS dilute	%DS		%DS
Mol. to Sep. Purity	%Pur	%Pur		%Pur
Mol. to Sep. Color	ICUMSA/100	ICUMSA		ICUMSA/100

Sugar Production:	cwt/hr	lb/hr	lb/hr	cwt/hr
Sugar Color:	ICUMSA	ICUMSA	ICUMSA	ICUMSA
Virgin Molasses Prod.:	lb/hr	lb/hr	lb/hr	lb/hr
Virgin Molasses RDS:	%DS	%DS	%DS	%DS
Virgin Molasses Purity:	%Pur	%Pur	%Pur	%Pur
Extract Mol. Prod.:	lb/hr	lb/hr	lb/hr	lb/hr
Extract Mol. RDS:	%DS	%DS	%DS	%DS
Extract Mol. Purity:	%Pur	%Pur	%Pur	%Pur
Tot. Steam Flow:	lb/hr	lb/hr	lb/hr	lb/hr

Proof of Concept:

Calculate averages for time period.

Sugars Model Data Interface

Step 1: Add Record Record Selector: 07/20/24 08:00 - 07/21/24 08:00 Step 3: **Calc. Averages**

Step 2, set times: Aggregate Start: 07/20/24 08:00 Aggregate End: 07/21/24 08:00 Step 4: Balance and Save Sugars Model

Step 5: Import Sugars Model Results Step 6: Save Record

Model Inputs

	Raw from dataPARC	Inputs in Sugars Units	Outputs in Sugars Units	Values to be Saved
Juice from Stor.:	gpm	lb/hr		gpm
Juice RDS:	%DS	%DS		%DS
Juice Purity:	%Pur	%Pur		%Pur
Juice Color:	ICUMSA/100	ICUMSA		ICUMSA/100
Mol. to Sep.:	ton/hr 80 RDS	lb/hr @ 80 RDS		ton/hr 80 RDS
Mol. to Sep. RDS:	%DS dilute	%DS		%DS
Mol. to Sep. Purity	%Pur	%Pur		%Pur
Mol. to Sep. Color	ICUMSA/100	ICUMSA		ICUMSA/100

Model Outputs

Sugar Production:	cwt/hr	lb/hr	cwt/hr
Sugar Color:	ICUMSA	ICUMSA	ICUMSA
Virgin Molasses Prod.:	lb/hr	lb/hr	lb/hr
Virgin Molasses RDS:	%DS	%DS	%DS
Virgin Molasses Purity:	%Pur	%Pur	%Pur
Extract Mol. Prod.:	lb/hr	lb/hr	lb/hr
Extract Mol. RDS:	%DS	%DS	%DS
Extract Mol. Purity:	%Pur	%Pur	%Pur
Tot. Steam Flow:	lb/hr	lb/hr	lb/hr

Proof of Concept:

Enter input averages to Sugars and balance model. Must be done manually for POC.

The screenshot displays the 'Sugars Model Data Interface' software. At the top, there is a navigation bar with 'Help' and 'BO-Capstone'. The main interface features a workflow of six steps: Step 1: Add Record; Step 2: set times (Aggregate Start: 07/20/24 08:00, Aggregate End: 07/21/24 08:00); Step 3: Calc. Averages; Step 4: Balance and Save Sugars Model (highlighted with a red box); Step 5: Import Sugars Model Results; Step 6: Save Record. Below the workflow, there are two main sections: 'Model Inputs' and 'Model Outputs'. Each section contains a table of parameters with their respective units and input fields.

	Raw from dataPARC	Inputs in Sugars Units	Outputs in Sugars Units	Values to be Saved
Juice from Stor.:	gpm	lb/hr		gpm
Juice RDS:	%DS	%DS		%DS
Juice Purity:	%Pur	%Pur		%Pur
Juice Color:	ICUMSA/100	ICUMSA		ICUMSA/100
Mol. to Sep.:	ton/hr 80 RDS	lb/hr @ 80 RDS		ton/hr 80 RDS
Mol. to Sep. RDS:	%DS dilute	%DS		%DS
Mol. to Sep. Purity	%Pur	%Pur		%Pur
Mol. to Sep. Color	ICUMSA/100	ICUMSA		ICUMSA/100

Sugar Production:	cwt/hr	lb/hr	cwt/hr
Sugar Color:	ICUMSA	ICUMSA	ICUMSA
Virgin Molasses Prod.:	lb/hr	lb/hr	lb/hr
Virgin Molasses RDS:	%DS	%DS	%DS
Virgin Molasses Purity:	%Pur	%Pur	%Pur
Extract Mol. Prod.:	lb/hr	lb/hr	lb/hr
Extract Mol. RDS:	%DS	%DS	%DS
Extract Mol. Purity:	%Pur	%Pur	%Pur
Tot. Steam Flow:	lb/hr	lb/hr	lb/hr

Proof of Concept:

Call PARCgraphic script to read Sugars model results.

Save results if acceptable.

The screenshot displays the 'Sugars Model Data Interface' software. At the top, there is a title bar with 'BO-Capstone' and standard window controls. Below the title bar, the interface is organized into several sections:

- Workflow Steps:** A sequence of steps is shown at the top. Step 1 is 'Add Record'. Step 2 is 'set times' with 'Aggregate Start' and 'Aggregate End' dropdowns set to '07/20/24 08:00'. Step 3 is 'Calc. Averages'. Step 4 is 'Balance and Save Sugars Model'. Step 5 is 'Import Sugars Model Results', which is highlighted with a red box. Step 6 is 'Save Record', also highlighted with a red box.
- Record Selector:** A dropdown menu showing the date range '07/20/24 08:00 - 07/21/24 08:00'.
- Model Inputs:** A table listing various input parameters and their units.
- Model Outputs:** A table listing various output parameters and their units.

	Raw from dataPARC	Inputs in Sugars Units	Outputs in Sugars Units	Values to be Saved
Juice from Stor.:	gpm	lb/hr		gpm
Juice RDS:	%DS	%DS		%DS
Juice Purity:	%Pur	%Pur		%Pur
Juice Color:	ICUMSA/100	ICUMSA		ICUMSA/100
Mol. to Sep.:	ton/hr 80 RDS	lb/hr @ 80 RDS		ton/hr 80 RDS
Mol. to Sep. RDS:	%DS dilute	%DS		%DS
Mol. to Sep. Purity	%Pur	%Pur		%Pur
Mol. to Sep. Color	ICUMSA/100	ICUMSA		ICUMSA/100
Model Outputs				
Sugar Production:	cwt/hr	lb/hr		cwt/hr
Sugar Color:	ICUMSA	ICUMSA		ICUMSA
Virgin Molasses Prod.:	lb/hr	lb/hr		lb/hr
Virgin Molasses RDS:	%DS	%DS		%DS
Virgin Molasses Purity:	%Pur	%Pur		%Pur
Extract Mol. Prod.:	lb/hr	lb/hr		lb/hr
Extract Mol. RDS:	%DS	%DS		%DS
Extract Mol. Purity:	%Pur	%Pur		%Pur
Tot. Steam Flow:	lb/hr	lb/hr		lb/hr

Proof of Concept:

Model results can be trended alongside actual data.



Further Development:

- Native Sugars™ data source in dataPARC (no graphics scripting needed)
- Sugars™ “linked” inputs to dataPARC directly in model – automatic update
- Automation of model runs.
- ***Development efforts based on customer feedback!***

Practical Application

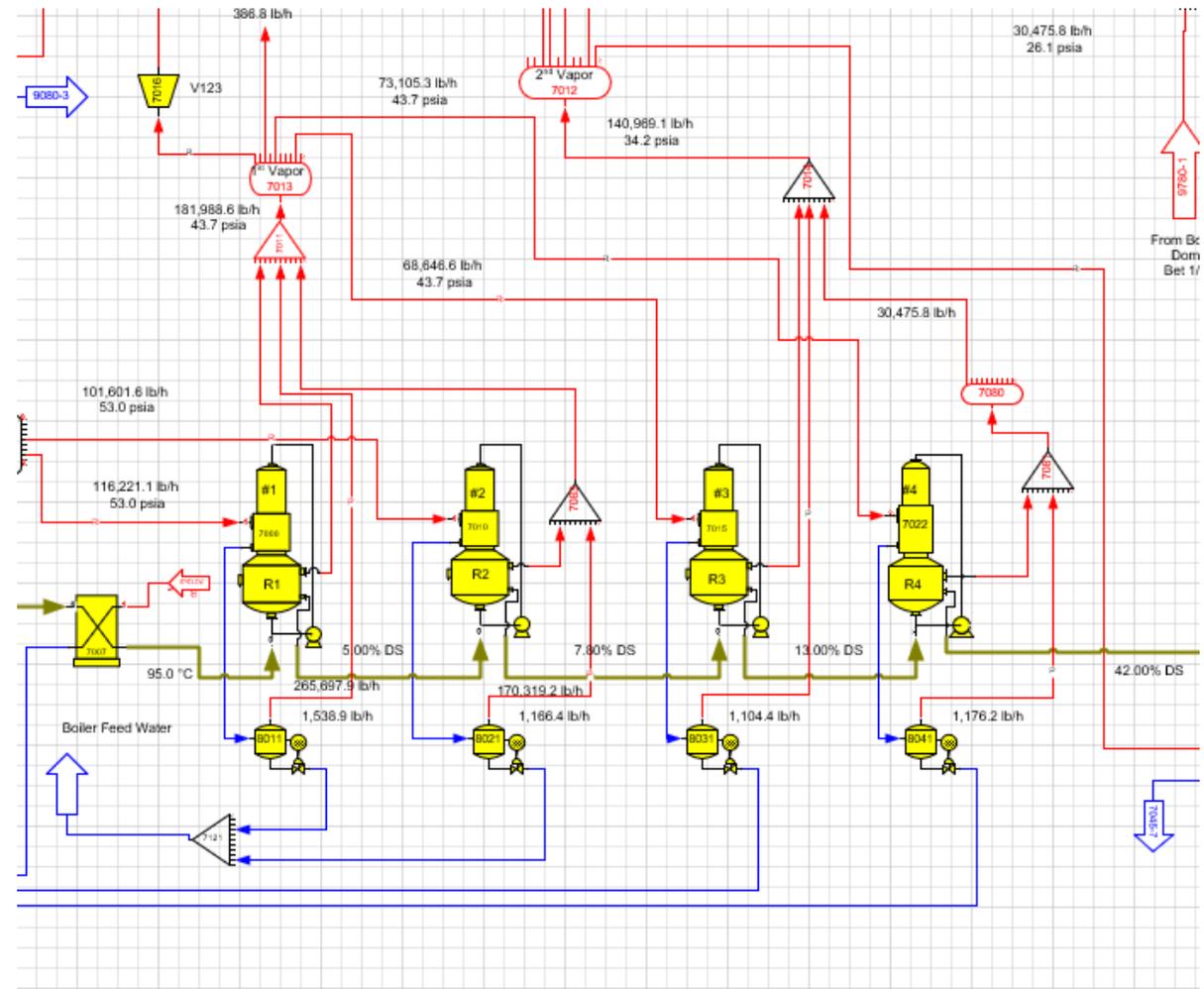
Using Sugars as a Tool for Optimization

Optimization Tool

- Identify gaps in leading indicators
 - Juice/Color Management
 - Steam availability
 - Pan boiling and yield
 - Centrifuge operations
- Identify true root causes in lost time reporting
- Keep asking WHY

Practical Application: Model Validation

- Compare model results to actual data for multiple periods over time
- Focus model refinement efforts for maximum accuracy
Ex: Check heat transfer coefficients
- Identify consistent gaps between model and process



Practical Application: Loss Prevention

- Note differences between mass input/output vs. model
- Locate and repair pipe ruptures or valve leaks
- Check valves!
- Prevent lost revenue or environmental excursions

Import averaged raw
ParcView values

Interface converts these
input values to sugars
compatible units

Enter Sugars compatible units
and Sugars creates an MDE
tag that is trendable with the
actual output

Done in the Sugars Data Model Interface

Identify gaps in Sugars
outputs and actual
outputs.

Helps focus on area of
optimization. Create
action items with team.

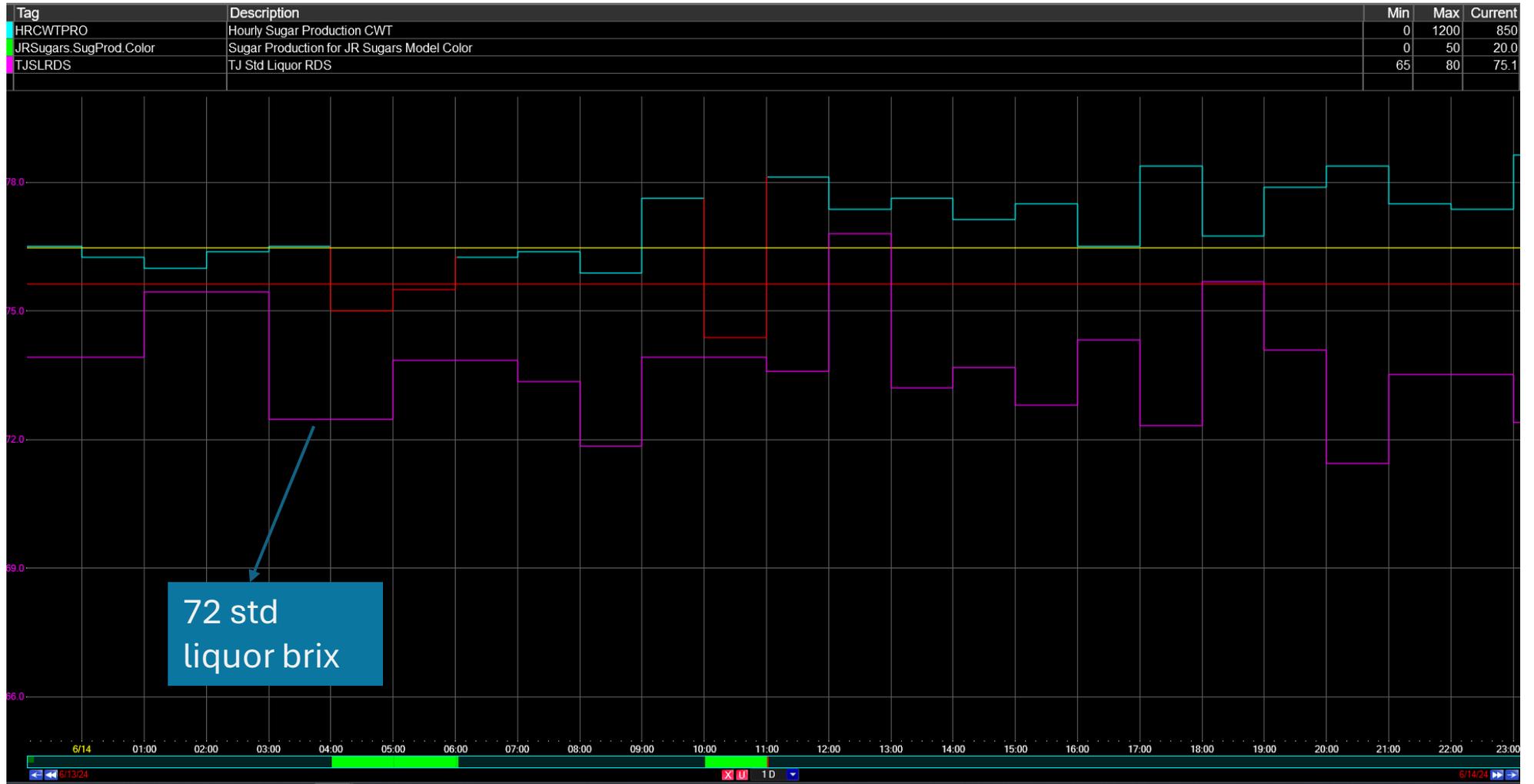
Trend against Sugars
outputs daily as inputs
change (i.e. thick juice
quality). Track results as
improvements are
implemented.

Example: Sugar Production

“We only made more sugar because thick juice color is 5 points lower than yesterday”

- While this may be true, there may have been improvements made to boiling scheme.
 - More consistent amp drops, quicker pan turnarounds, etc.
 - While these factors are harder to track consistently, the sugars model MDE tag will show the gap between the actual and predicted value. The gap will start to decrease overtime as improvements are made. **This gap represented is independent of inputs like thick juice quality.**
 - Gives credit to operators and gives them confidence their changes to process have a direct impact on production rates, not just the “luck of the draw”.

Lost Time Logs



Conclusion

- Use as loss prevention & daily optimization tool
- Proof of Concept that can be built upon
 - More tags can be added as inputs to help clue into deeper into process (i.e. std liquor brix, white pan purity drop)
- Keep driving *consistency* and asking WHY