

ULTRAMAX[®] Application Profile

Food Processing -- Pierre Foods: Continuous Cooking Ovens

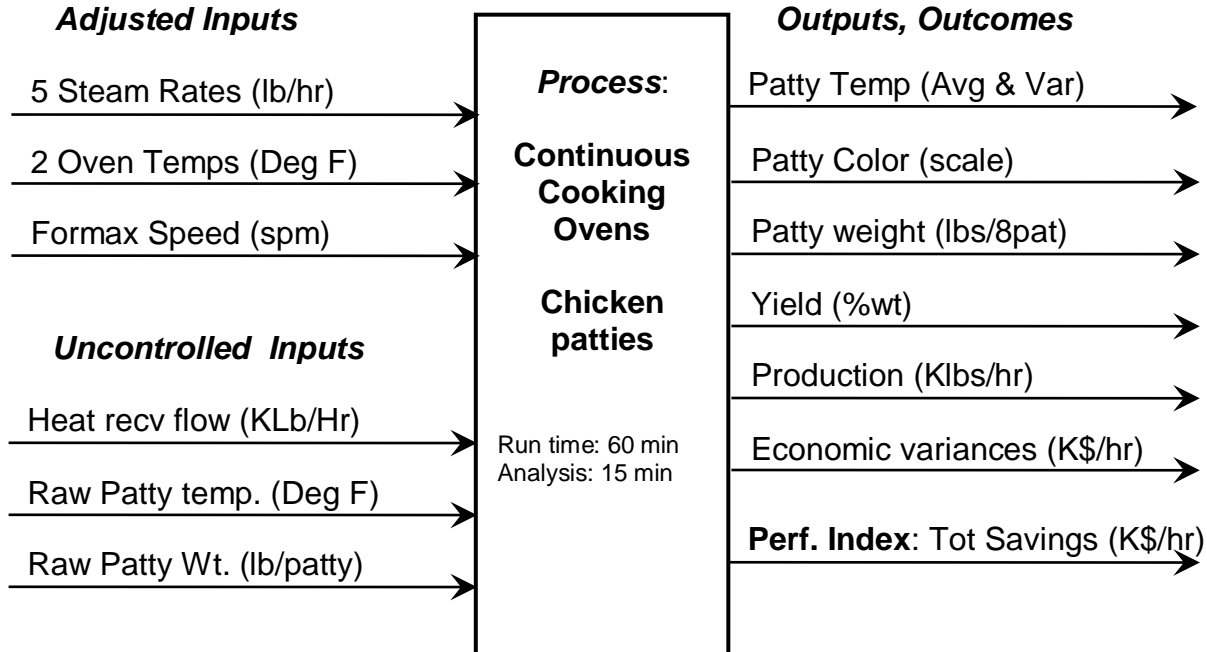
Description of Process: The process uses a series of steam and gas fired stages in a continuous oven to cook unbreaded chicken patties. Critical Control Points (CCP) and Quality are measured by internal cooked temperature and weight, as well as color of the patty (against a scale represented by pictures).

Situation: Capacity constrained production – can sell more if it is produced. USDA has regulatory specifications.

Objectives: Maximize profitability rate with reliability fulfilling all requirements. Also, instill in plant personnel a quantitative awareness of production.

Results Summary: Economic gains (Tot Sav) were about \$1,010 per hour of production (with conclusive statistical confidence at 3.5 sigmas), mostly through Production Rate (and Sales) increasing 40% (while satisfying all requirement constraints, such as for CCP and product quality). Yield increased by 0.4% but with no statistical confidence yet. See details in table in third page.

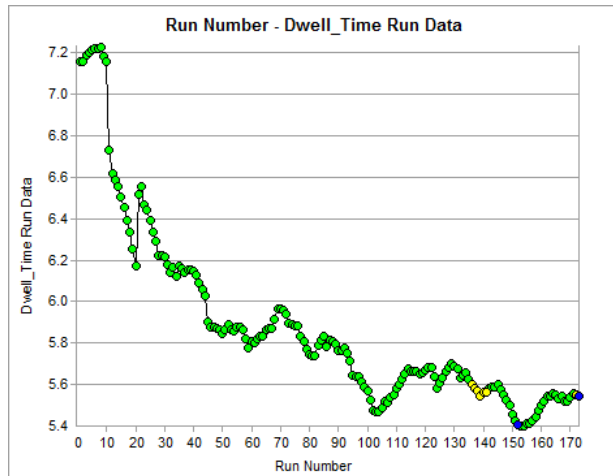
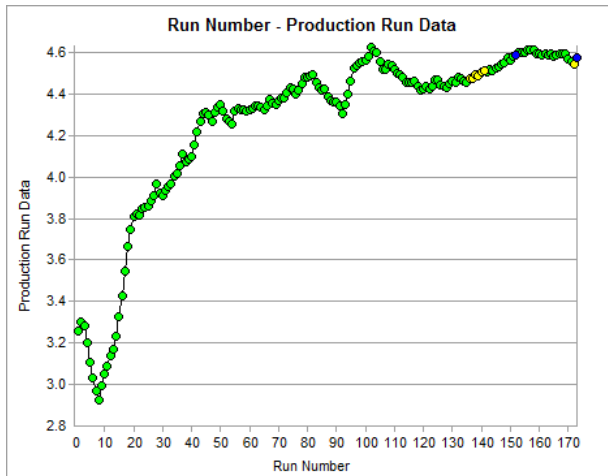
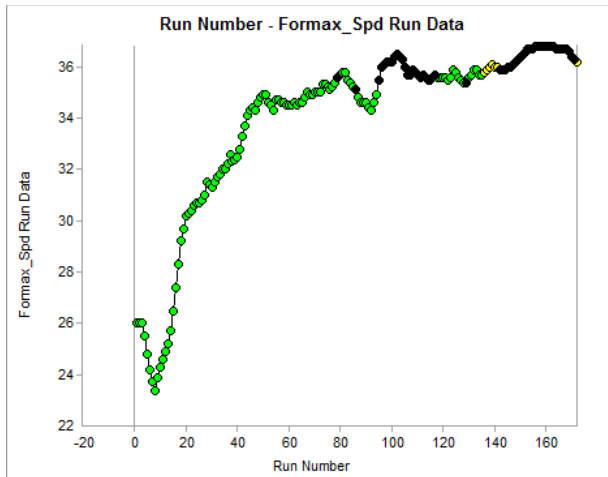
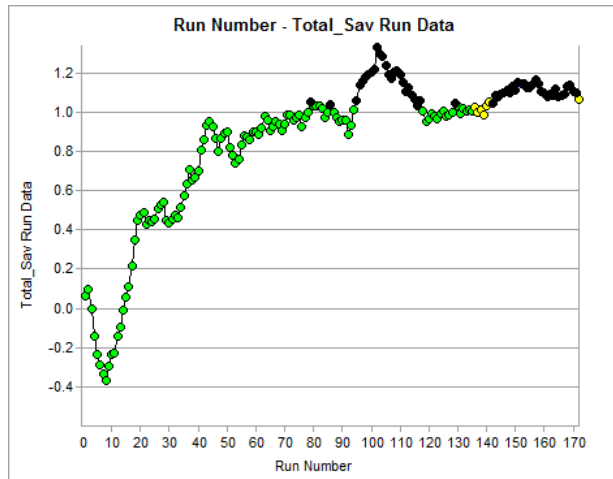
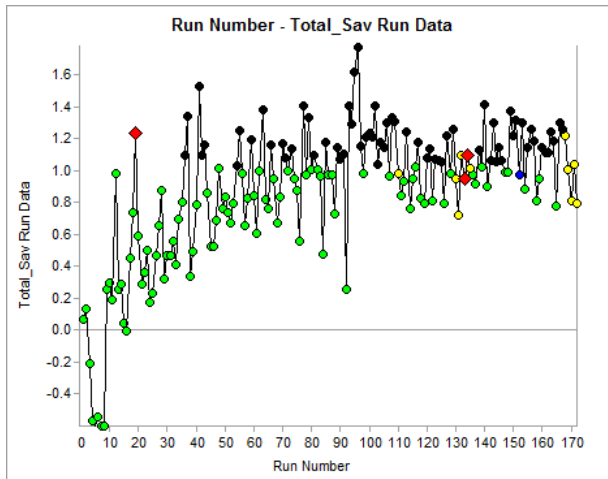
DECISION INPUT/OUTPUT DIAGRAM



Essence: *The user defines metrics, and collects operating data during production. Ultramax[®] learns from the data and modulates re-adjustments to improve the balance of those operating metrics, including reliability satisfying constraints (e.g., for safety and quality). If operations move to certain undesirable results, include those metrics. There is an easy transition to largely autonomous closed-loop optimization.*

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Except for the first plot, all others are 10-moving-average, to perceive changes more readily.



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Quantitative Changes in operating parameters: Last 20 runs vs. First (Baseline)

COMPARISON Report / CHANGE Analysis

APPLICATION: C:\UMC\...\9903_07.umax||9903 Line 7
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Filters for FIRST (REFERENCE) SET : Run range: 1 1
 Filters for SECOND SET : Run range: 153 172

	First Set	Second Set	D I F F E R E N C E	
	AVG n	AVG n	Delta	% Stat. Signific
				(# Sigmas)

CONSTRAINT VIOLATIONS:

% runs w/some INPUT viol ! All input constraints satisfied.
 % runs w/some OUTPUT viol ! All output constraints satisfied.

VARIABLE VALUES (averages):

#	NAME	UNITS	ROLE	First	Second	Delta	%	Sigmas
Adjusted (decision) inputs ...								
1	Formax_Spd	spm	1	26.0	36.5	10.5	40.0%	4.4
2	JSO_1_Stm	Klb/hr	1	1.100	1.247	0.146	13.0%	2.3
3	JSO_2_Stm	Klb/hr	1	1.025	1.220	0.195	19.0%	2.5
4	JSO_1_TMP	dF	1	470.0	500.0	30.0	6.4%	4.6
5	JNO_1_Stm	Lb/hr	1	600.0	542.5	-57.5	-9.6%	-0.8
6	JNO_2_Stm	Lb/hr	1	0	437.0	437.0	--%	3.0
7	Equil_Stm	Lb/hr	1	0	0	0	--%	0
23	JSO_2_Temp	dF	1	445.0	489.6	44.6	10.0%	4.1
Performance Index (Maximize) ...								
21	Total_Sav	K\$/hr	6	0.07	1.08	1.01	1000.0%	3.5
Other consequences, outputs ...								
10	Dwell_Time	min	5	7.16	5.55	-1.61	-23.0%	-4.3
11	Cook_Tmp_Avg	dF	5	170.00	171.45	1.45	0.85%	0.7
12	Cook_Tmp_SD	dF	5	2.990	3.298	0.308	10.0%	0.4
13	Cook_Tmp_CPK	DF	5	0.557	0.661	0.104	19.0%	0.6
14	Cook_Wt_Avg	Lb/8 pat	5	2.0900	2.0860	-0.0040	-0.19%	-0.2
15	Color	scale	5	3.250	3.084	-0.166	-5.1%	-2.7
16	Yield	percent	5	94.144	94.542	0.398	0.42%	0.4
17	Production	Klb/hr	5	3.26	4.57	1.31	40.0%	4.3
18	Labor_Sav	K\$/hr	5	-0.002	0.108	0.109	1000.0%	4.3
19	Overhead_Sav	K\$/hr	5	-0.013	0.811	0.824	1000.0%	4.3
20	Matl_Sav	K\$/hr	5	0.0801	0.1606	0.0806	101.0%	0.6
22	Labor_Amt	Operator	5	25.00	28.55	3.55	14.0%	2.3
Ignored values in SEO analysis...								
8	Raw_Pat_Wt	Lb/8 pat	0	2.2200	2.2065	-0.0135	-0.61%	-0.8