

ULTRAMAX[®] Application Profile

Food Processing: Continuous Cooking Ovens

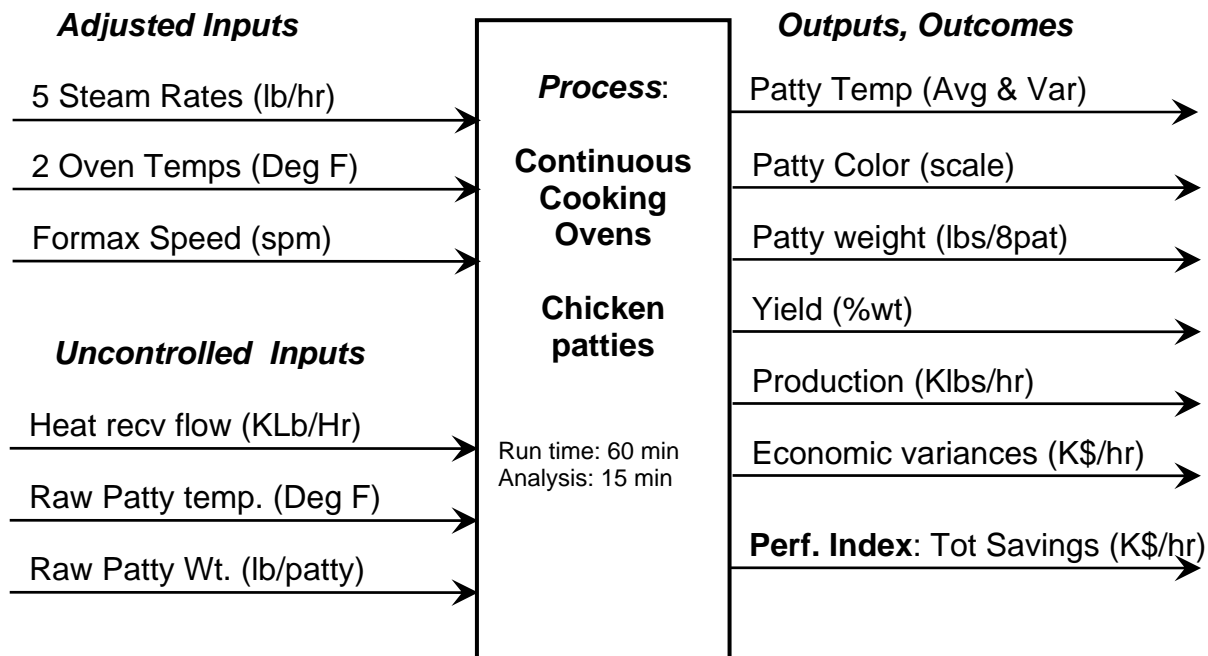
Description of Process: The process uses a series of steam and gas fired stages in a continuous oven to cook unbreaded chicken patties. Quality is measured by internal cooked temperature and weight, and color of the patty (against a scale represented by pictures).

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

Objectives: Maximize profitability rate. Also, instill in plant personnel a quantitative awareness of production.

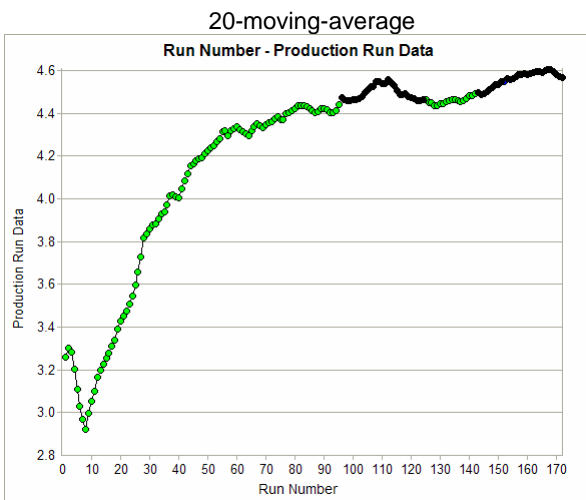
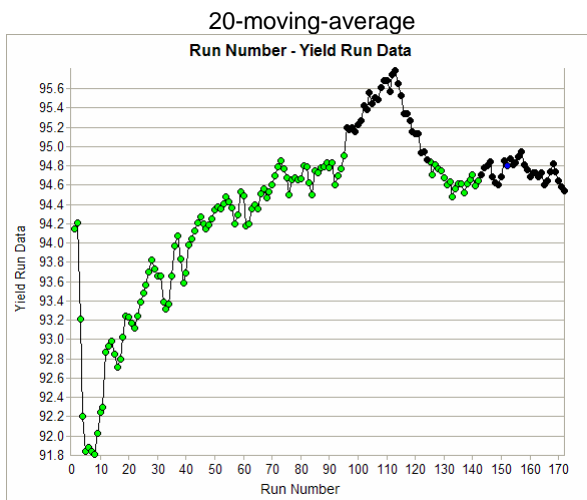
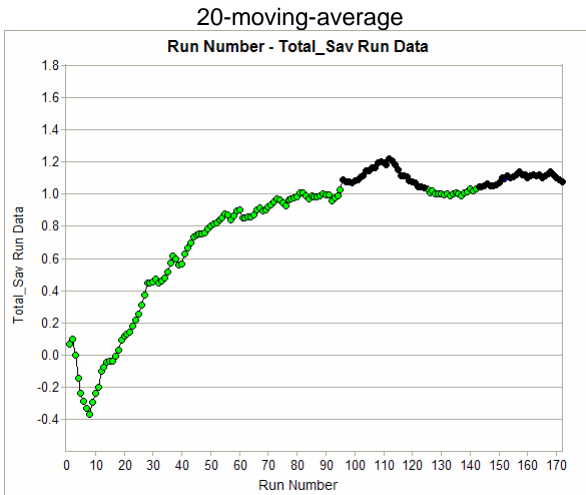
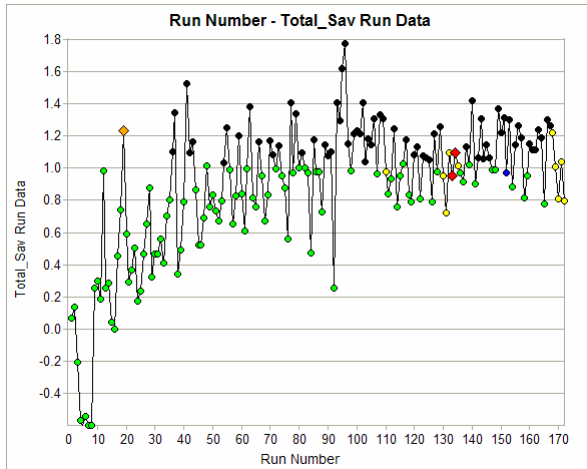
Results Summary: Economic gains were about \$1,000/hr. of production, mostly through Production Rate and sales increasing 39% (while satisfying all constraints). Around run #100 Yield increased statistically by 1.9%. See details in second page.

DECISION INPUT/OUTPUT DIAGRAM



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

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Major changes in operating parameters:

VARIABLE VALUES: First run at Baseline to last 50 runs

#	NAME	UNITS	ROLE	First	Second	Diff	%	Sigmas
1	Formax_Spd	spm	1	26.000	36.280	10.280	40.0%	10.0
2	JSO_1_Stm	Klb/hr	1	1.1000	1.2707	0.1707	16.0%	10.0
3	JSO_2_Stm	Klb/hr	1	1.0250	1.2486	0.2236	22.0%	10.0
4	JSO_1_TMP	dF	1	470.00	504.33	34.33	7.3%	10.0
5	JNO_1_Stm	Lb/hr	1	600.0	535.5	-64.5	-11.0%	-7.7
6	JNO_2_Stm	Lb/hr	1	0.	327.	327.	1000.0%	10.0
8	Raw_Pat_Wt	Lb/8 pat	2	2.2200	2.2044	-0.0156	-0.70%	-6.2
10	Dwell_Time	min	4	7.160	5.543	-1.617	-23.0%	-10.0
15	Color	scale	5	3.2500	3.1224	-0.1276	-3.9%	-10.0
16	Yield	percent	4	94.14	94.67	0.52	0.55%	3.6
17	Production	Klb/hr	4	3.2604	4.5423	1.2819	39.0%	10.0
18	Labor_Sav	K\$/hr	4	-0.00173	0.10556	0.10729	1000.0%	10.0
19	Overhead_Sav	K\$/hr	4	-0.0130	0.7945	0.8076	1000.0%	10.0
20	Matl_Sav	K\$/hr	4	0.080	0.174	0.094	118.0%	5.3
21	Total_Sav	K\$/hr	6	0.065	1.074	1.009	1000.0%	10.0
22	Labor_Amt	Operator	4	25.00	28.56	3.56	14.0%	10.0
23	JSO_2_Temp	dF	1	445.00	482.82	37.82	8.5%	10.0

There are 6 variables not included because the discrimination of the difference between the two sets is less than 3.0 sigmas..