Computer Integrated Manufacturing System – Advantages of connected factory floor assets

by

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Digital Tools for Manufacturing

CIMS – Computer Integrated Manufacturing Systems

aka Manufacturing Execution Systems - MES

Computer-integrated manufacturing (CIM) is the manufacturing approach of using computers to control entire production process in REAL TIME. This integration allows individual processes to exchange information with other performance measuring systems to drive consistency and stability in the production of products.

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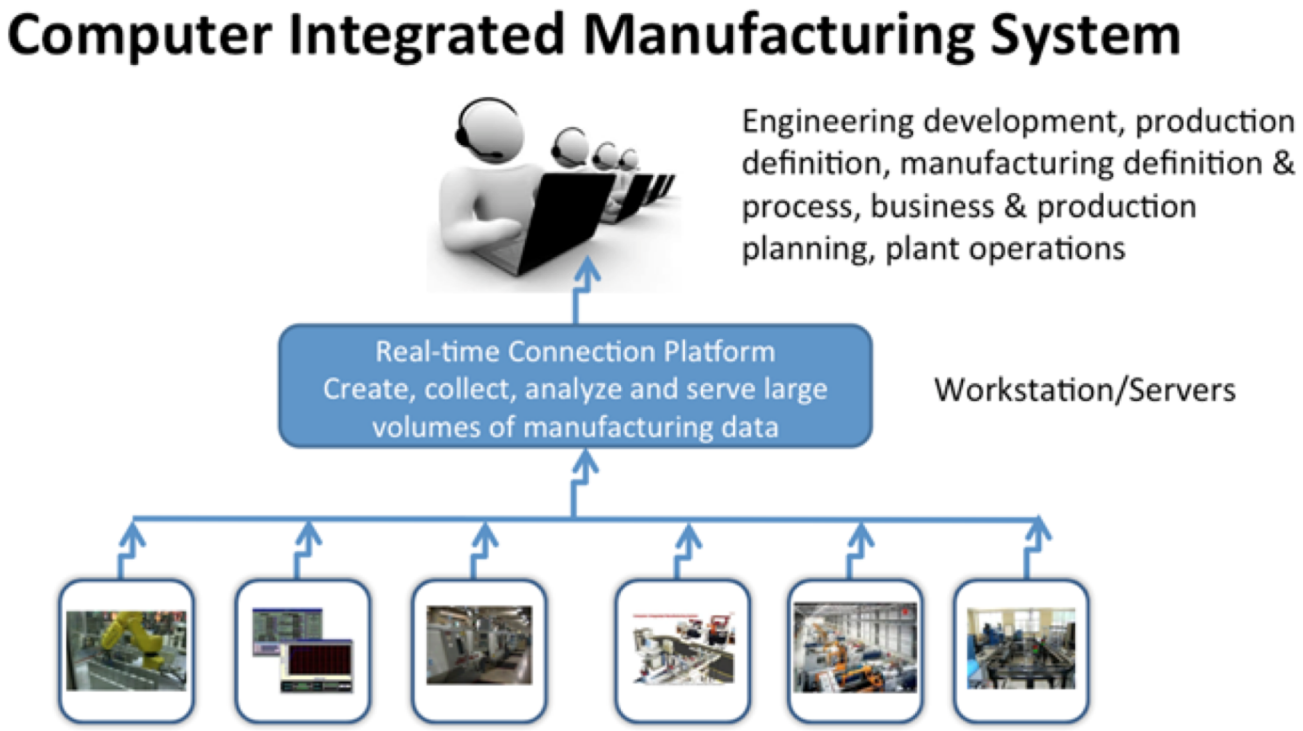

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- CIM or MES systems
  - Syscon International – Plant Star
  - Epicor - Mattec
  - Cai Software – ShopVue
  - Shoptech Corporation – E2 Shop Floor
- Platforms for production and process to assist in
  - Enterprise Resource Planning or Materials Resource Planning
  - Preventive Maintenance Systems
  - Quality Management Systems

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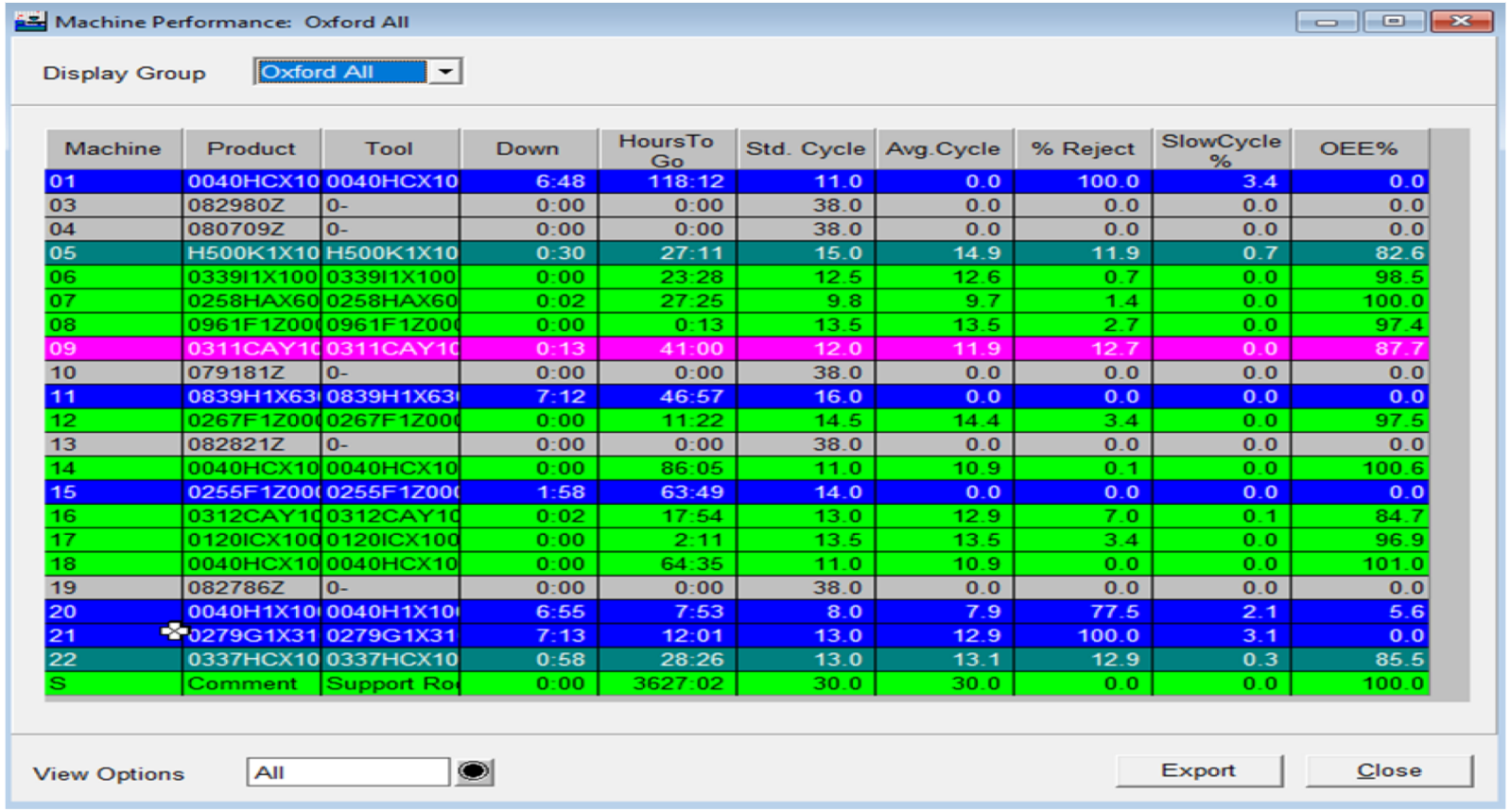
The Big Picture – A Snap Shot of the Operation



Machine	Product	Tool	Down	HoursTo Go	Std. Cycle	Avg.Cycle	% Reject	SlowCycle %	OEE%
01	0040HCX10	0040HCX10	6:48	118:12	11.0	0.0	100.0	3.4	0.0
03	082980Z	0-	0:00	0:00	38.0	0.0	0.0	0.0	0.0
04	080709Z	0-	0:00	0:00	38.0	0.0	0.0	0.0	0.0
05	H500K1X10	H500K1X10	0:30	27:11	15.0	14.9	11.9	0.7	82.6
06	0339I1X100	0339I1X100	0:00	23:28	12.5	12.6	0.7	0.0	98.5
07	0258HAX60	0258HAX60	0:02	27:25	9.8	9.7	1.4	0.0	100.0
08	0961F1Z00(	0961F1Z00(	0:00	0:13	13.5	13.5	2.7	0.0	97.4
09	0311CAY1(	0311CAY1(	0:13	41:00	12.0	11.9	12.7	0.0	87.7
10	079181Z	0-	0:00	0:00	38.0	0.0	0.0	0.0	0.0
11	0839H1X63(	0839H1X63(	7:12	46:57	16.0	0.0	0.0	0.0	0.0
12	0267F1Z00(	0267F1Z00(	0:00	11:22	14.5	14.4	3.4	0.0	97.5
13	082821Z	0-	0:00	0:00	38.0	0.0	0.0	0.0	0.0
14	0040HCX10	0040HCX10	0:00	86:05	11.0	10.9	0.1	0.0	100.6
15	0255F1Z00(	0255F1Z00(	1:58	63:49	14.0	0.0	0.0	0.0	0.0
16	0312CAY10	0312CAY10	0:02	17:54	13.0	12.9	7.0	0.1	84.7
17	0120ICX100	0120ICX100	0:00	2:11	13.5	13.5	3.4	0.0	96.9
18	0040HCX10	0040HCX10	0:00	64:35	11.0	10.9	0.0	0.0	101.0
19	082786Z	0-	0:00	0:00	38.0	0.0	0.0	0.0	0.0
20	0040H1X10(	0040H1X10(	6:55	7:53	8.0	7.9	77.5	2.1	5.6
21	0279G1X31	0279G1X31	7:13	12:01	13.0	12.9	100.0	3.1	0.0
22	0337HCX10	0337HCX10	0:58	28:26	13.0	13.1	12.9	0.3	85.5
S	Comment	Support Ro(	0:00	3627:02	30.0	30.0	0.0	0.0	100.0

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Communications to the Operation Staff via Big Screen

State	Color
Off-line	Black on white
Idle	Black on gray
Down	White on blue
Process Exception	White on magenta
Production Exception	White on dark cyan
Assist	Red on yellow
Slow	White on red
Fast	Black on yellow
Running	Black on green

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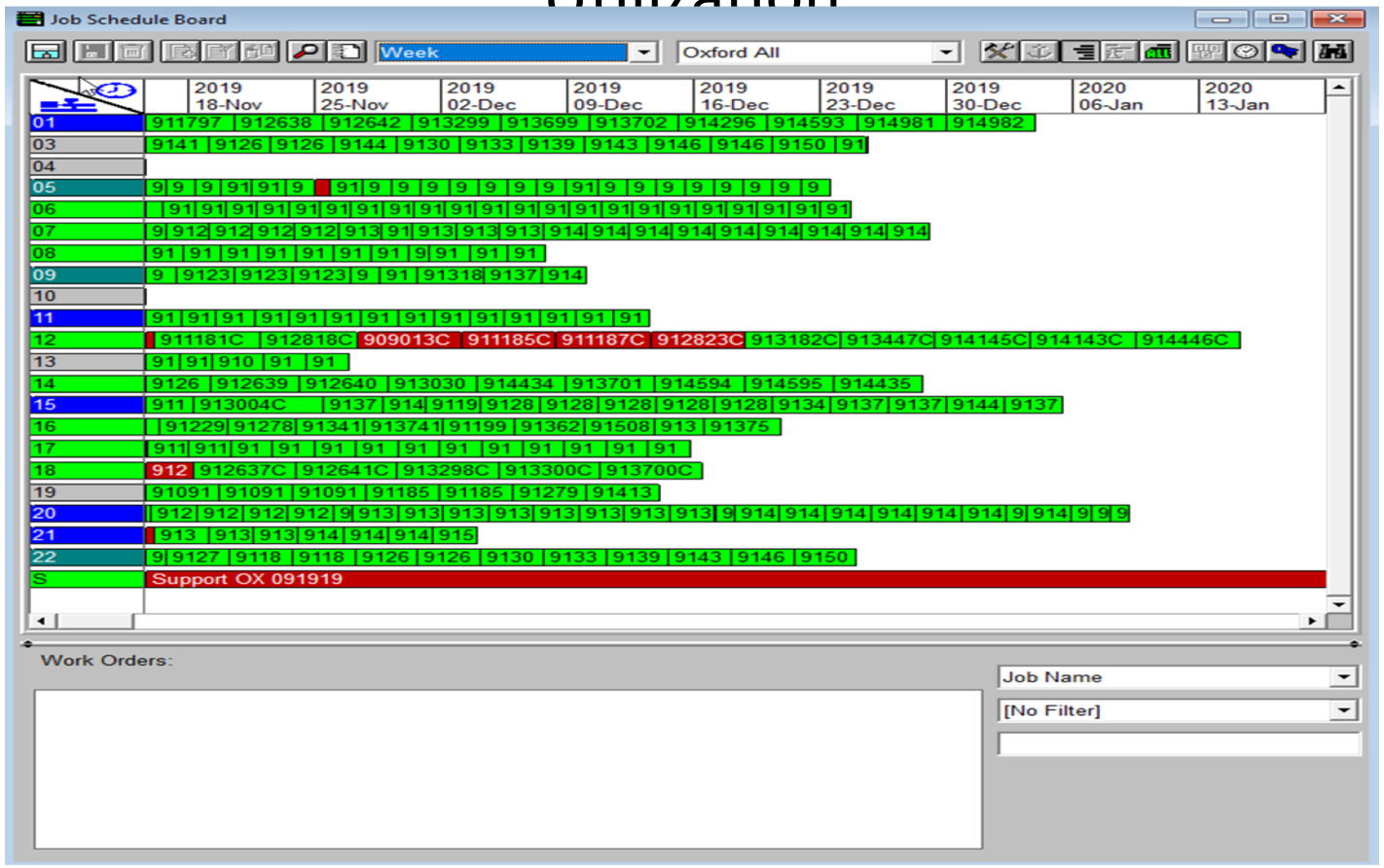
Utilization



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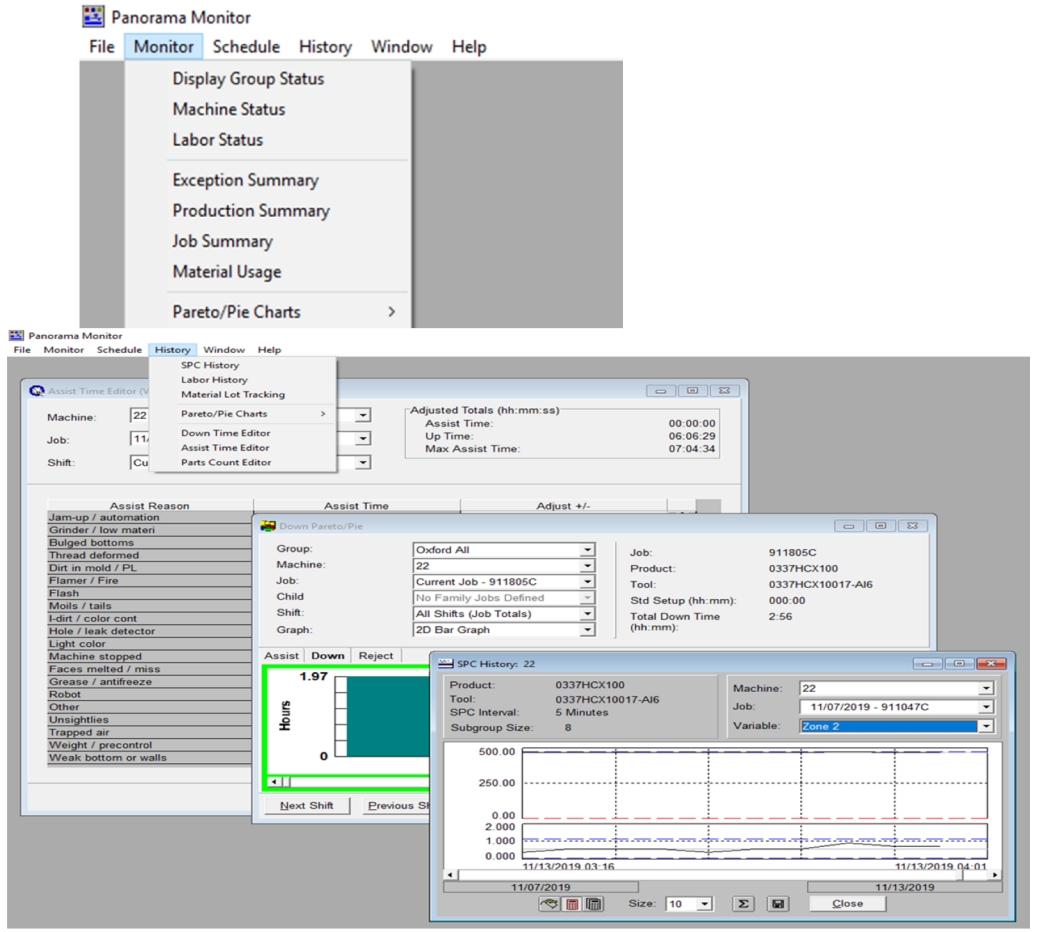
- Production Platform Benefits
  - Labor Costs
  - Material Usage
  - Machine Utilization
  - Machine Efficiency
  - Productivity aka Labor Absorption



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- Production Data Capture for:
  - Scheduling management
  - Manage/change jobs on the fly
  - Capture production data down to the minute
    - Efficiency & utilization
  - Import to and from ERP/MRP

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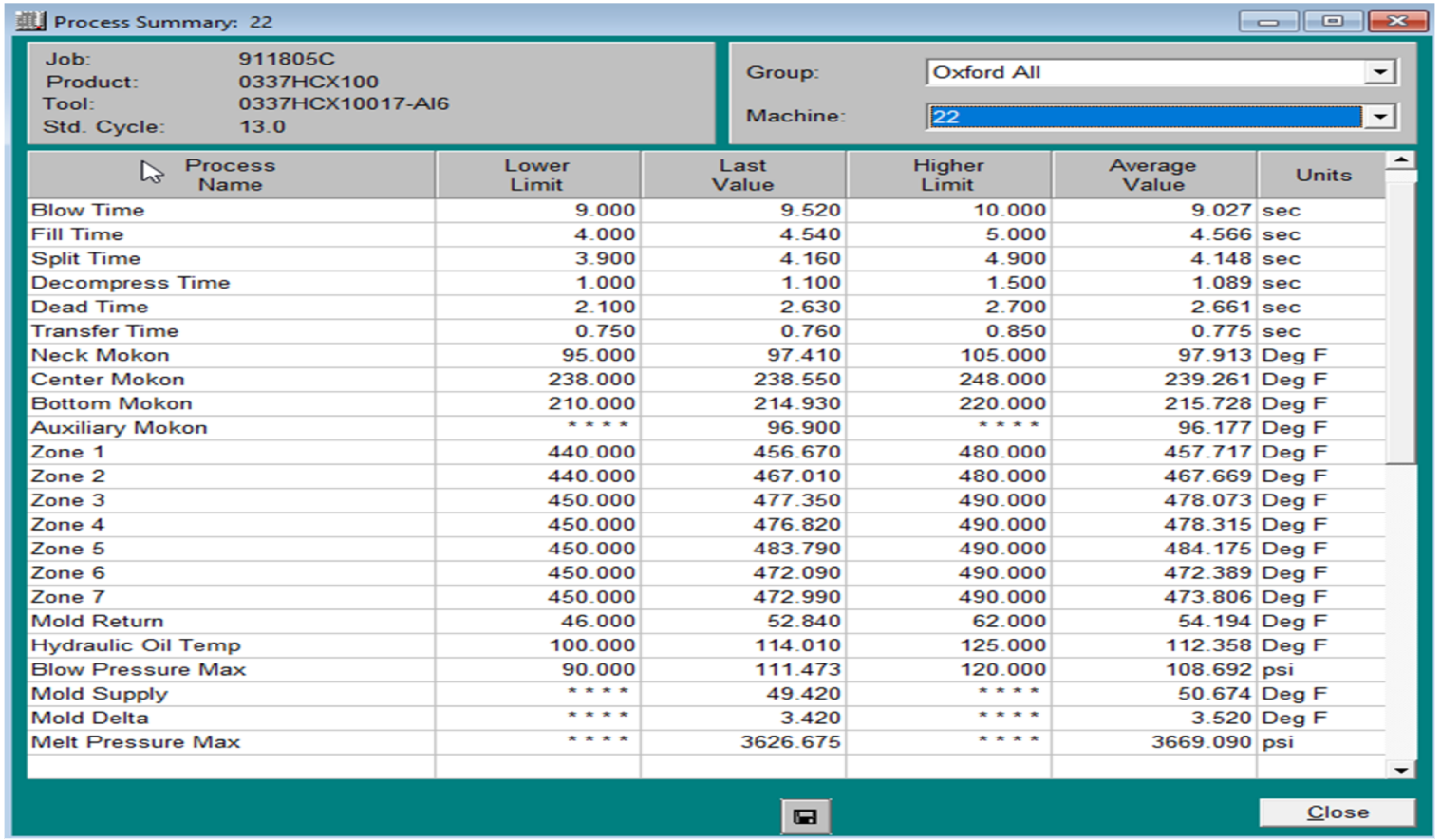
Process Monitoring Platform



Process Name	Lower Limit	Last Value	Higher Limit	Average Value	Units
Blow Time	9.000	9.520	10.000	9.027	sec
Fill Time	4.000	4.540	5.000	4.566	sec
Split Time	3.900	4.160	4.900	4.148	sec
Decompress Time	1.000	1.100	1.500	1.089	sec
Dead Time	2.100	2.630	2.700	2.661	sec
Transfer Time	0.750	0.760	0.850	0.775	sec
Neck Mokon	95.000	97.410	105.000	97.913	Deg F
Center Mokon	238.000	238.550	248.000	239.261	Deg F
Bottom Mokon	210.000	214.930	220.000	215.728	Deg F
Auxiliary Mokon	****	96.900	****	96.177	Deg F
Zone 1	440.000	456.670	480.000	457.717	Deg F
Zone 2	440.000	467.010	480.000	467.669	Deg F
Zone 3	450.000	477.350	490.000	478.073	Deg F
Zone 4	450.000	476.820	490.000	478.315	Deg F
Zone 5	450.000	483.790	490.000	484.175	Deg F
Zone 6	450.000	472.090	490.000	472.389	Deg F
Zone 7	450.000	472.990	490.000	473.806	Deg F
Mold Return	46.000	52.840	62.000	54.194	Deg F
Hydraulic Oil Temp	100.000	114.010	125.000	112.358	Deg F
Blow Pressure Max	90.000	111.473	120.000	108.692	psi
Mold Supply	****	49.420	****	50.674	Deg F
Mold Delta	****	3.420	****	3.520	Deg F
Melt Pressure Max	****	3626.675	****	3669.090	psi

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- Process Monitoring Platform Benefits
  - Time
    - PPM (parts per minute)
    - CPM (cycles per minute)
  - Temperature
  - Pressure
  - Energy

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- Process Control Monitoring
  - Helps control products with very stringent quality specification
  - Predictive process issues that affect quality
    - Time
    - Temperature
    - Pressure
  - Historical data for future reference
  - Process can be monitored from any location

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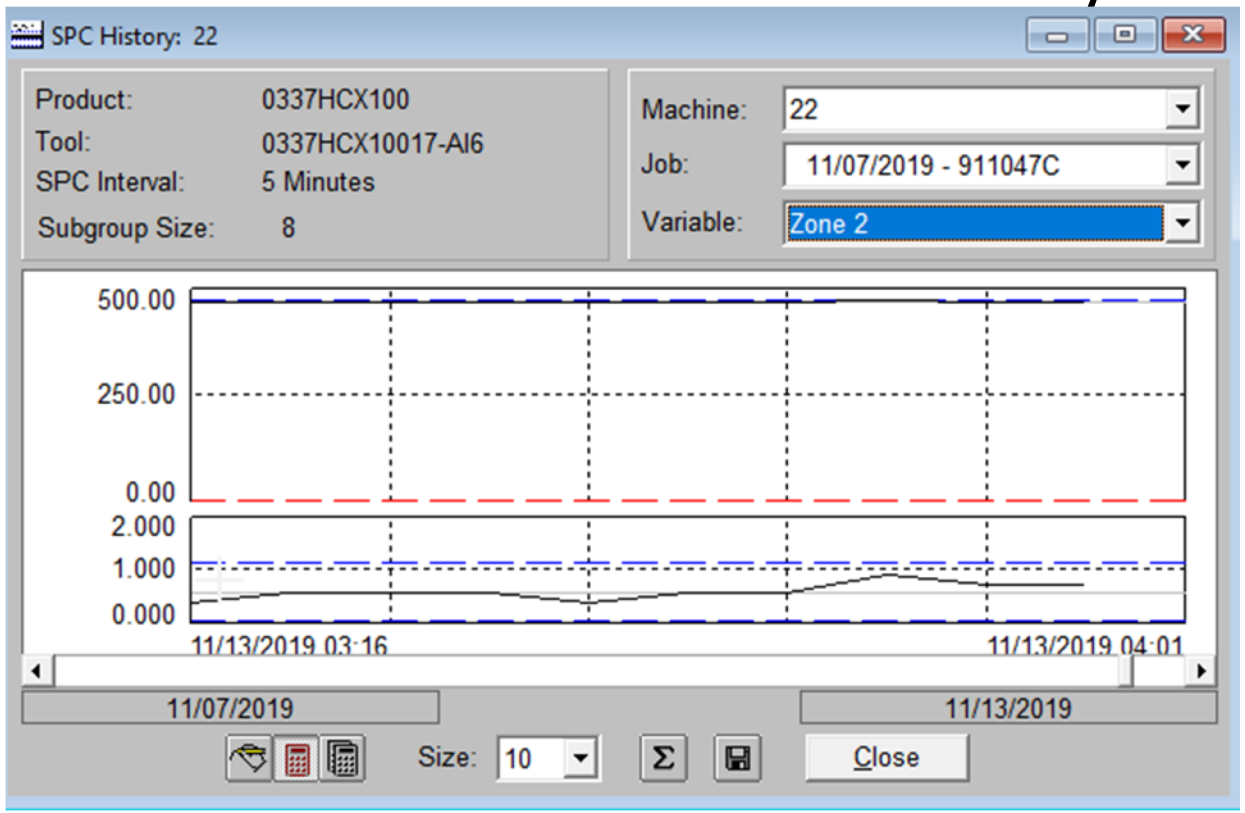
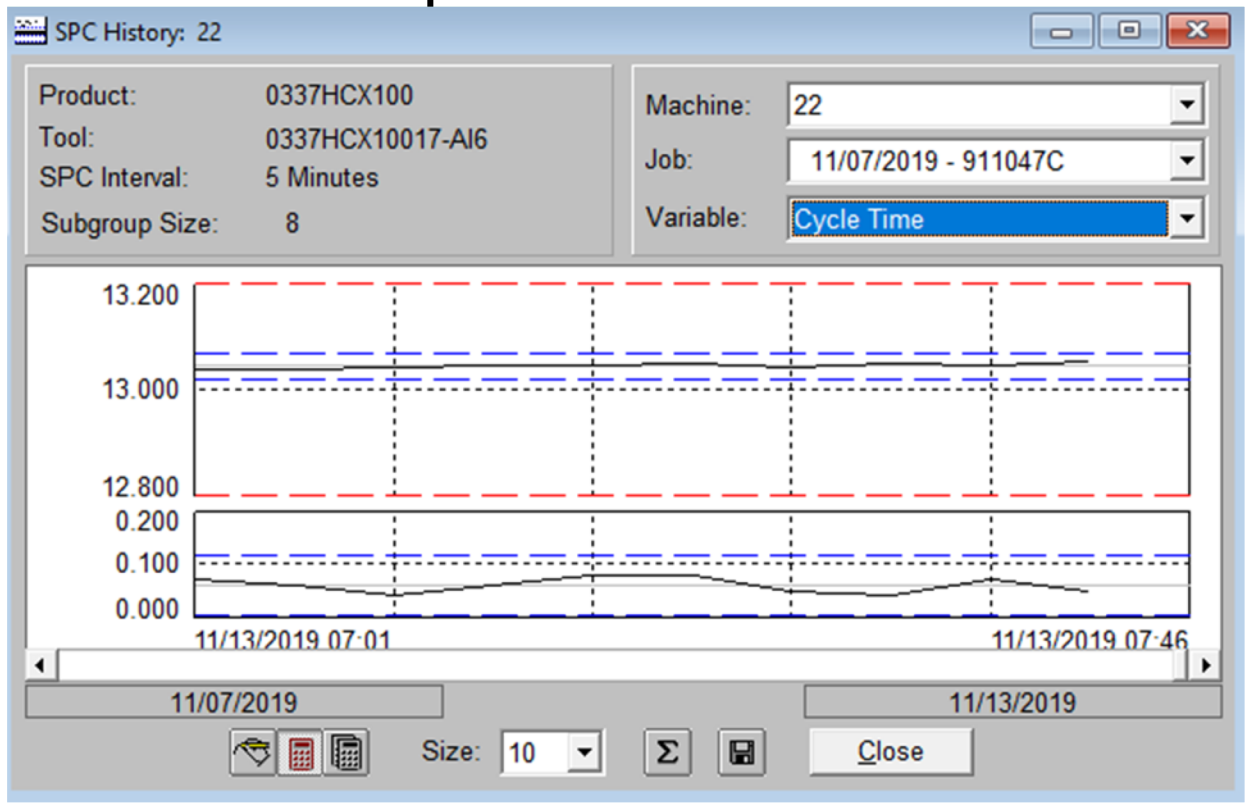
SPC Data – Allows you to drill into the problems





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Process Data Capture of Changes

Process Journal Report

Page 1 of 11 — Creation Date: 11/15/2019 4:50 PM EST

Date	Mach	Lot #	Tool	Shift	Main Reason	Sub Reason	Case	Act/Std	Employee Id
11/15/2019 12:05 AM	05	913166C	H500K1X10019-A03	3	General	Automation	406	8/8	Ryland Pearson
Detailed Reason: Jam-ups									
Problem: Robot jamup.									
Corrective Action: Cleared the case, reset and restarted.									
11/15/2019 12:30 AM	08	911866C	0961F1Z00034-B15	3	General	Automation	319	16/16	David Bolen
Detailed Reason: Other									
Problem: box alarm									
Corrective Action: reset alarm continued packing									
11/15/2019 1:03 AM	05	913166C	H500K1X10019-A03	3	General	Automation	416	8/8	Ryland Pearson
Detailed Reason: Jam-ups									
Problem: Robot jamup.									
Corrective Action: Cleared case, reset and restarted.									
11/15/2019 1:38 AM	16	911846C	0312CAY1021-C01	3	Rejects	Wall Thickness	317	9/10	Cory Hollingsworth
Detailed Reason: Distribution									
Problem: Wall distribution B 1 C 2 caused by dmg to core rod (missing chrome)Reinspection 317 down									
Corrective Action: Stopped machine, plugged cav 2, removed core rods (sent b 1 to P.e.) reinspeciton called, restarted- 3 **bank** chk w/packer, took samples to lab, resumed packing.									

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- Electronic Process Journal
  - Each machine is connected
  - A digital record of changes
  - Easy traceability to changes
  - Who did what, when & why
  - Historical reference for internal & external audits
  - Used in researching quality opportunities (problems)

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- CIM's & Quality Management Systems
  - Product quality and stability dependent on process
  - Process management from CIM
    - Allows process control to be responsive instead of reactive (after the fact)
  - Allows quick containment and isolation of product
    - Reduce cost of rework
      - Rework if needed can be narrowed down to time of production

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- CIM's & Preventative Maintenance
  - Capability to monitor support equipment
    - Water Systems like Chillers and Towers
    - Air Compressors
  - Monitor the Machine (Product manufacturing)
    - Elements of cooling, heating that are critical to the machine performance
      - Including tooling that makes product
  - Data capture for review by maintenance
    - Gives you some element of predictive maintenance

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- Summary of Overall Benefits of CIM's (Real Time)
  - Digital data capture and reduction of paperwork
  - Easy access to historical process and production data
  - Respond to real time events
  - Corrective action and preventive action formulations
    - Product, Process & Support
  - Real time productivity allows real time changes
  - Real time = ability to maximize profitability and efficiency of the organization

Thank You