Utilizing PI Programming Tools to Support Predictive Model Applications

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Access Computer Solutions

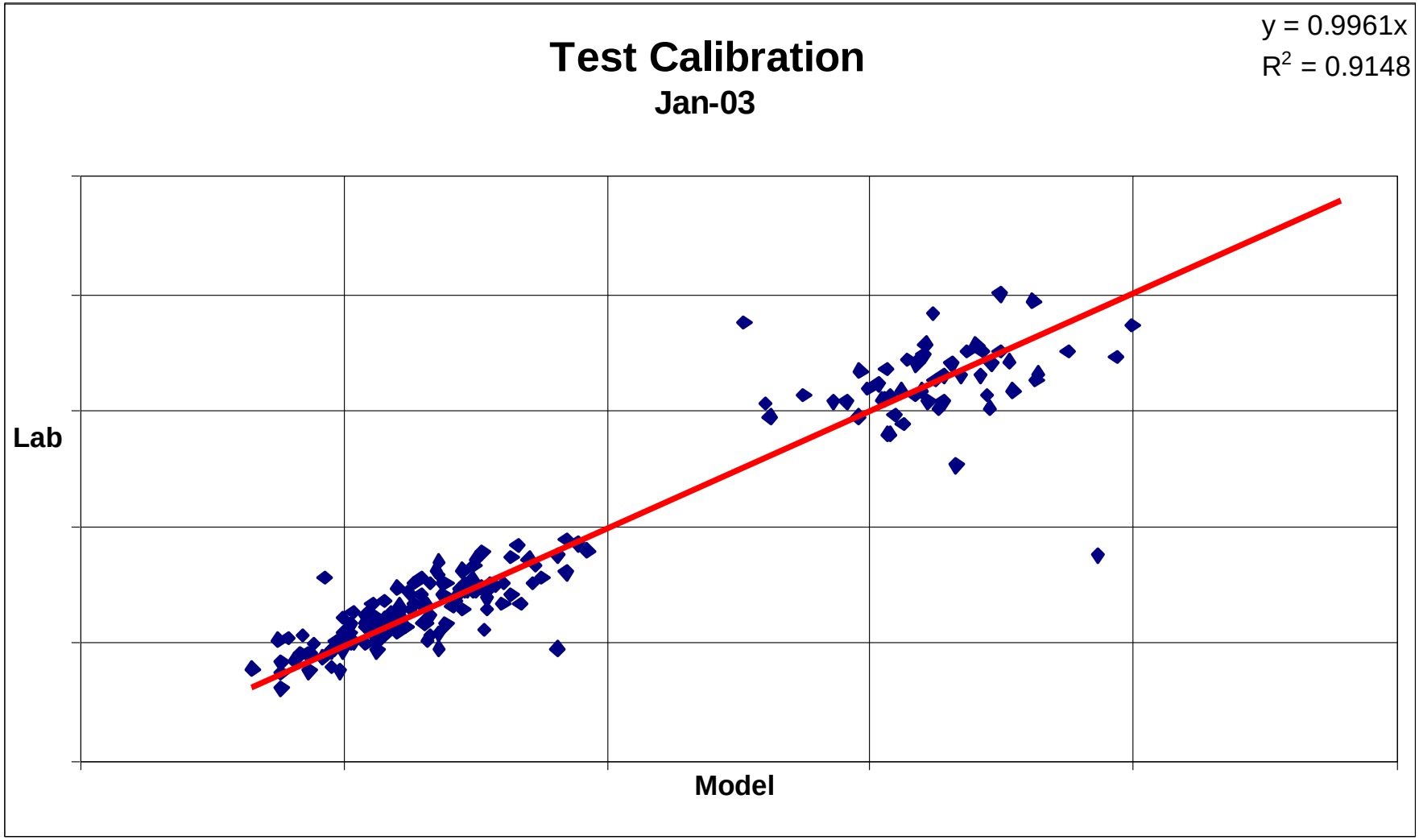
Project Goals

- Utilize technological advances in predictive modeling to optimize product quality.
- Distribute process performance information in real-time to expedite decision making.
- Stabilize the process output by the reduction of initially perceived testing variability.
- Optimize process performance by the reduction of off-standard production.
- Leverage the power of the PI system to automate and execute the system.

Model Development

- Artificial Neural Network (ANN) software used
  1. **Non-linear Process.**
  2. **Variables are highly interacting.**
  3. **Abundance of accessible historical data.**
  4. **Seamless integration with the PI system.**
- Models built with Previous 12 months historical data.
  1. **Over 70 PI tags per model initially**
  2. **Pared down to under 20 per model**
- Calibration adjustment check system developed.
  1. **Run twice per shift**
- Batches for paper reels and sets configured.
  1. **Ability to track concurrent batches**
  2. **Programmatically determine start and end times**

Model Development

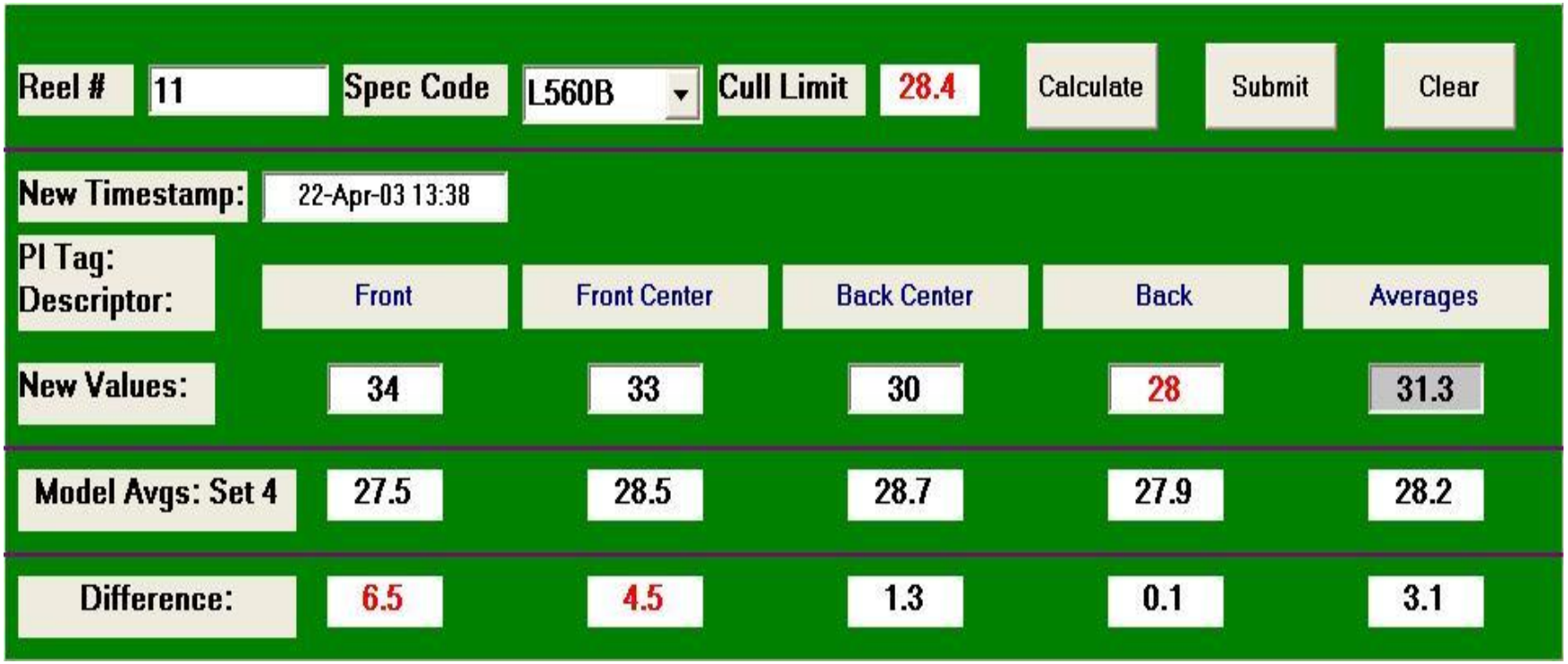


Software Development

- ActiveX technology chosen
  1. **Portability to a wide variety of applications.**
  2. **Easily converted to web-based delivery.**
  3. **Highly scalable and configurable.**
- ProcessBook was chosen for the container
  1. **Designed for real-time data delivery.**
  2. **Additional process information can be displayed**
  3. **No additional licensing required.**
- Two ActiveX controls were written
  1. **Paper Tester Data entry**
  2. **Dynamic Batch Grid**

Software Development

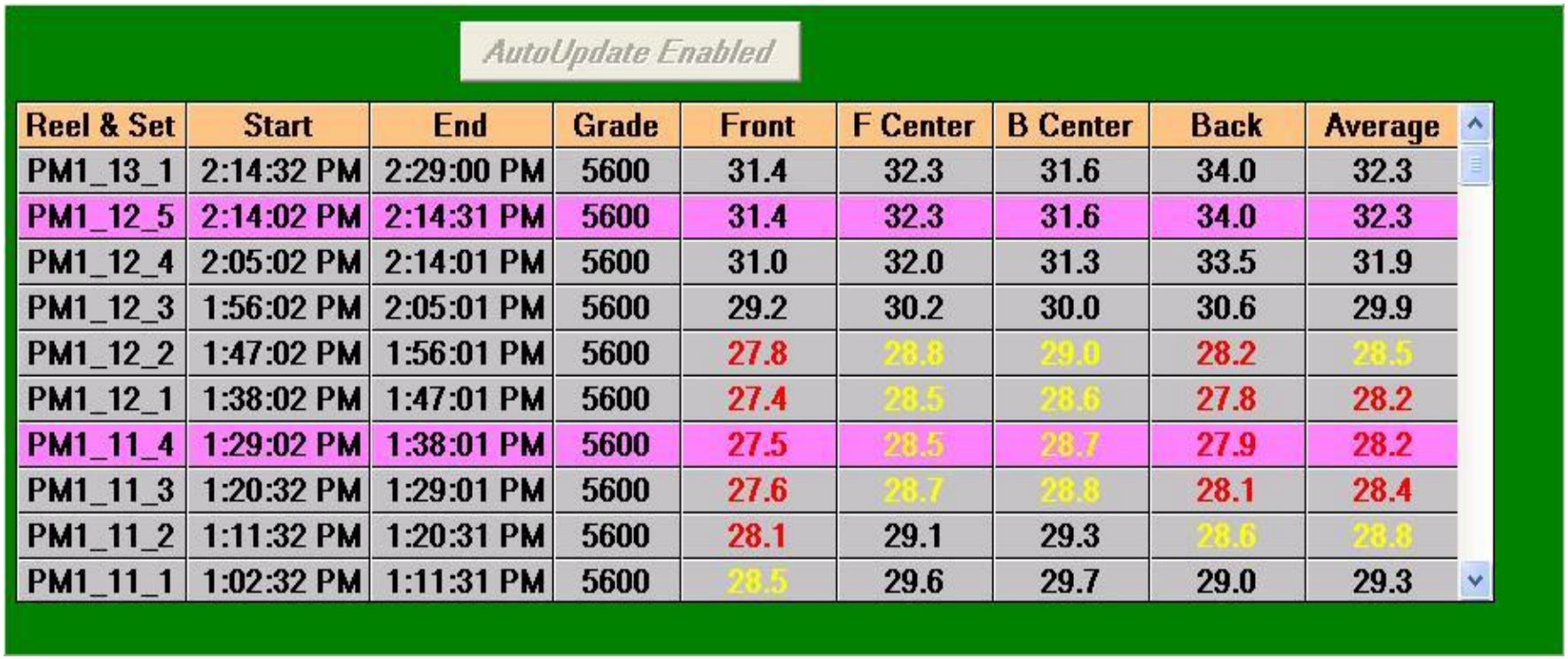
Data Entry Control



All data included herein is purely fictitious and used as sample data only.

Software Development

Dynamic Batch Grid Control



Reel & Set	Start	End	Grade	Front	F Center	B Center	Back	Average
PM1_13_1	2:14:32 PM	2:29:00 PM	5600	31.4	32.3	31.6	34.0	32.3
PM1_12_5	2:14:02 PM	2:14:31 PM	5600	31.4	32.3	31.6	34.0	32.3
PM1_12_4	2:05:02 PM	2:14:01 PM	5600	31.0	32.0	31.3	33.5	31.9
PM1_12_3	1:56:02 PM	2:05:01 PM	5600	29.2	30.2	30.0	30.6	29.9
PM1_12_2	1:47:02 PM	1:56:01 PM	5600	27.8	28.8	29.0	28.2	28.5
PM1_12_1	1:38:02 PM	1:47:01 PM	5600	27.4	28.5	28.6	27.8	28.2
PM1_11_4	1:29:02 PM	1:38:01 PM	5600	27.5	28.5	28.7	27.9	28.2
PM1_11_3	1:20:32 PM	1:29:01 PM	5600	27.6	28.7	28.8	28.1	28.4
PM1_11_2	1:11:32 PM	1:20:31 PM	5600	28.1	29.1	29.3	28.6	28.8
PM1_11_1	1:02:32 PM	1:11:31 PM	5600	28.5	29.6	29.7	29.0	29.3

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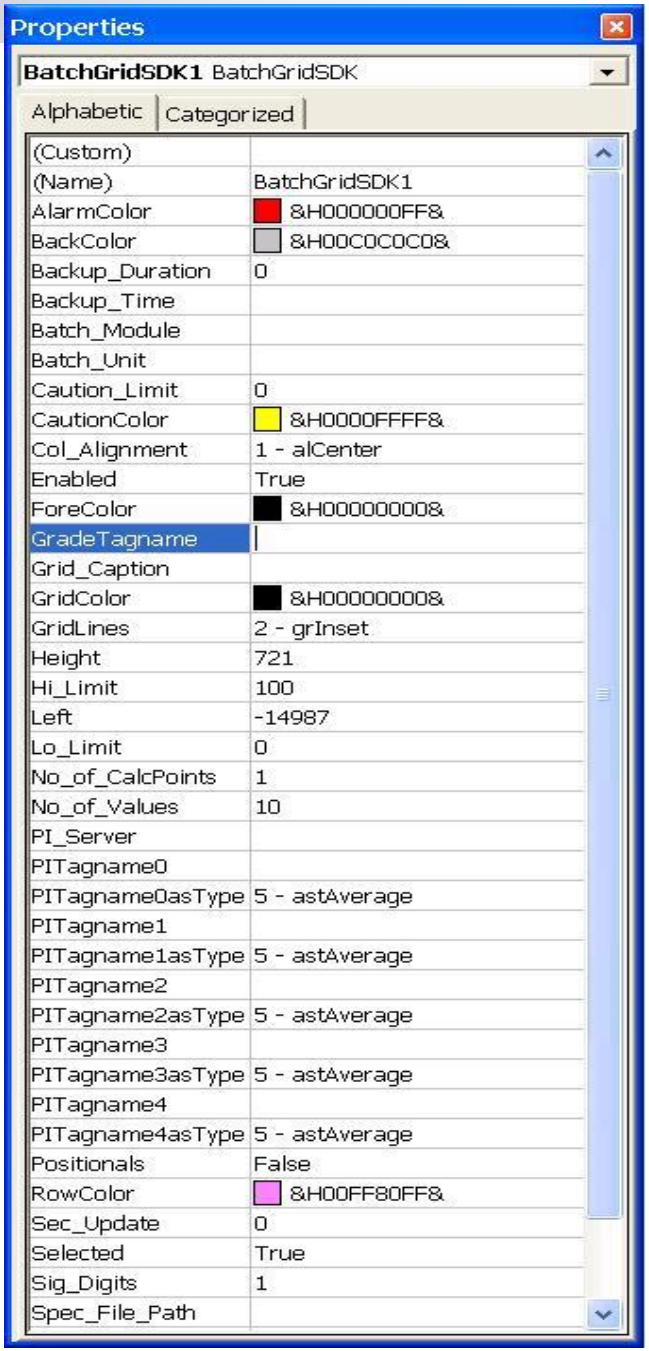
Software Development

Dynamic Batch Grid Control

- **Configurable Properties**
  1. **PI server**
  2. **Batch module and unit**
  3. **Up to five PI Tags**
  4. **Machine positions**
  5. **Timer**
  6. **Significant digits**
  7. **Path to initialization file**
  8. **Column alignment**
  9. **Gridline style**
  10. **All colors**

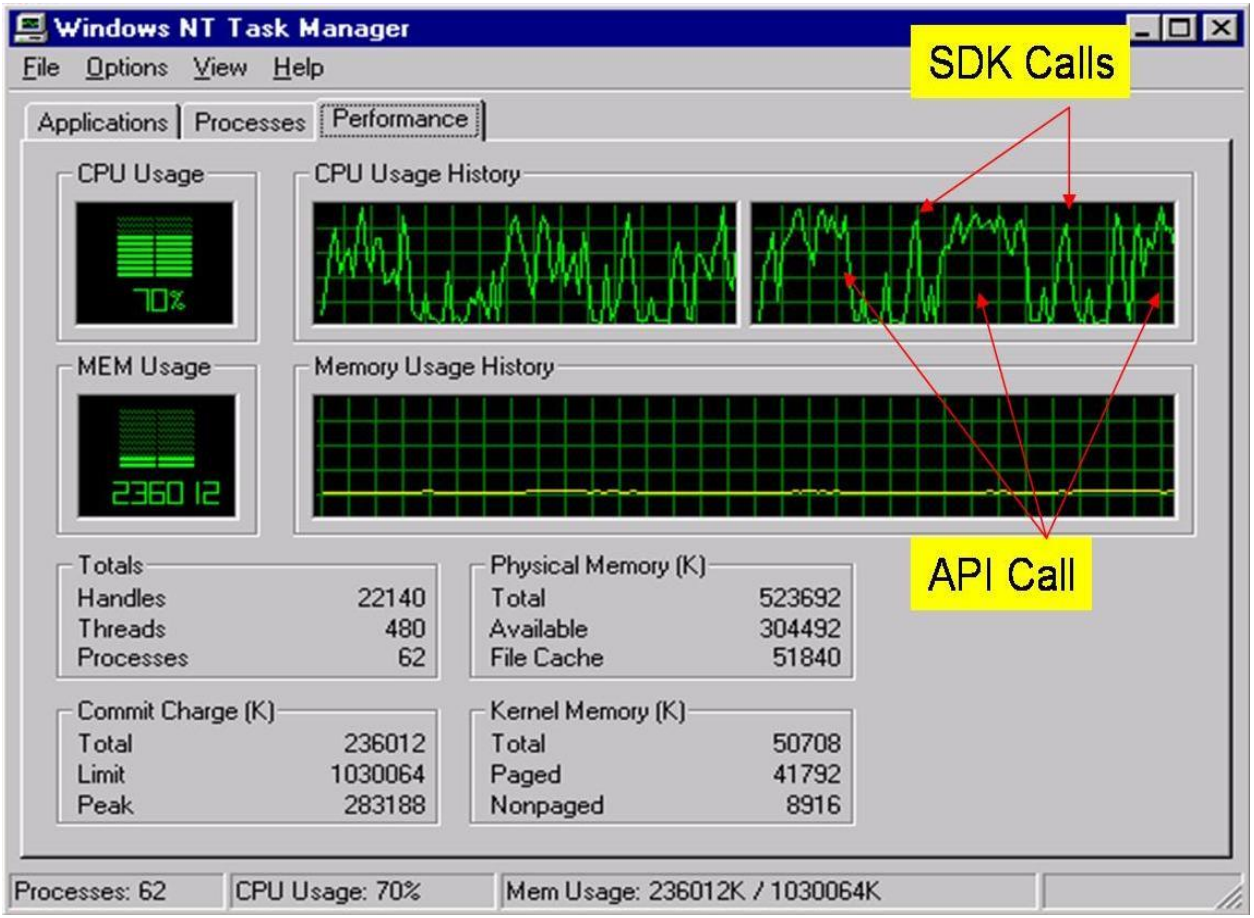


Software Development

- **Learning Experiences**
  1. **Although API calls from the controls while the server is being backed up will cause the control to crash, There is a method in the SDK to check for the server being backed up.**
  2. **Since the batch subsystem is not buffered, it is imperative that the PI server have enough resources to record the batch events.**
  3. **Batch search calls cause a significant strain on processor load**

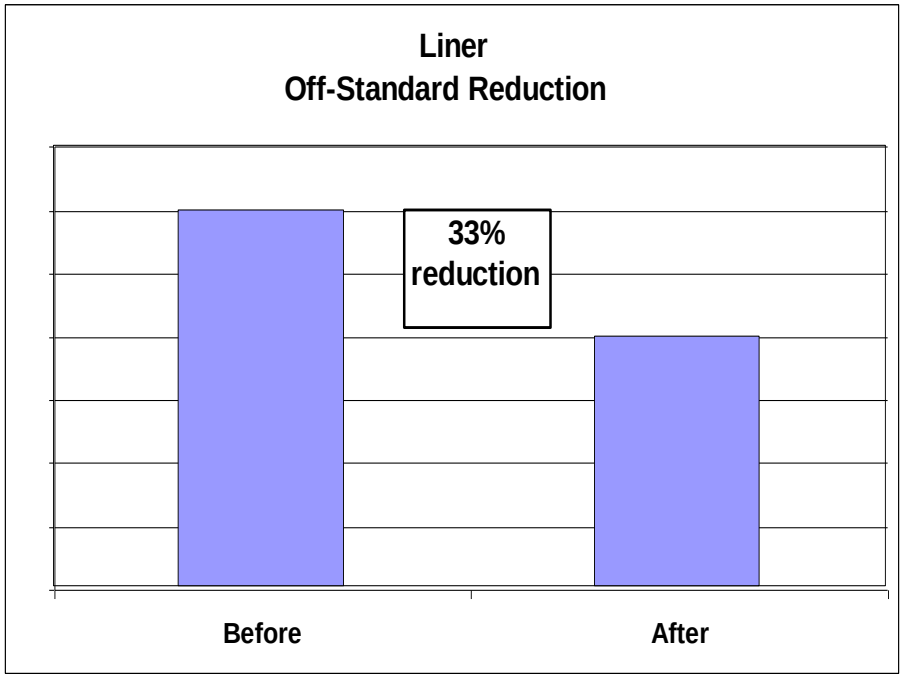
Software Development

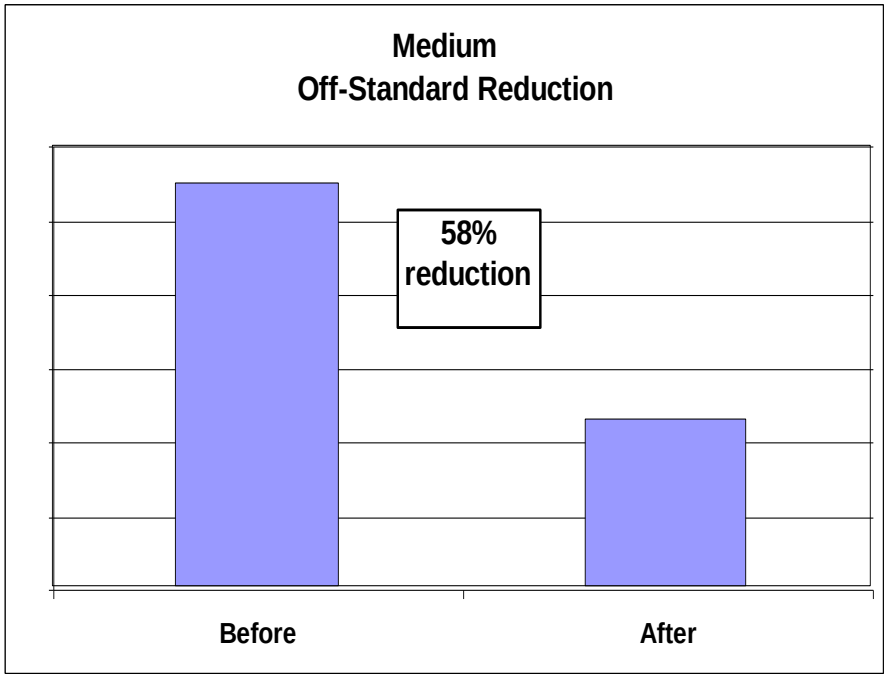
Processor Load



Software Development

System Results





Conclusion

- **The PI system and client applications provided the functionality and versatility to be able to achieve our objectives.**
- **It is imperative to implement a procedure to ensure the model stays in calibration.**
- **It is important to continue periodic testing to provide a feedback to the model for adjusting for long term drifts and subtle changes in the process that were not represented in the original model.**
- **Special attention should be given to make sure that the PI server is operating within it's limitations and that all data is backed up in a timely fashion.**
- **A process model can act as a filter to remove "noise" and allow the machine crew to see the real process variation.**