Engineering Research Center for

Reconfigurable Manufacturing Systems

Reducing Unscheduled Downtime Through Automated Event-based Control
- Updates for May 2009 -

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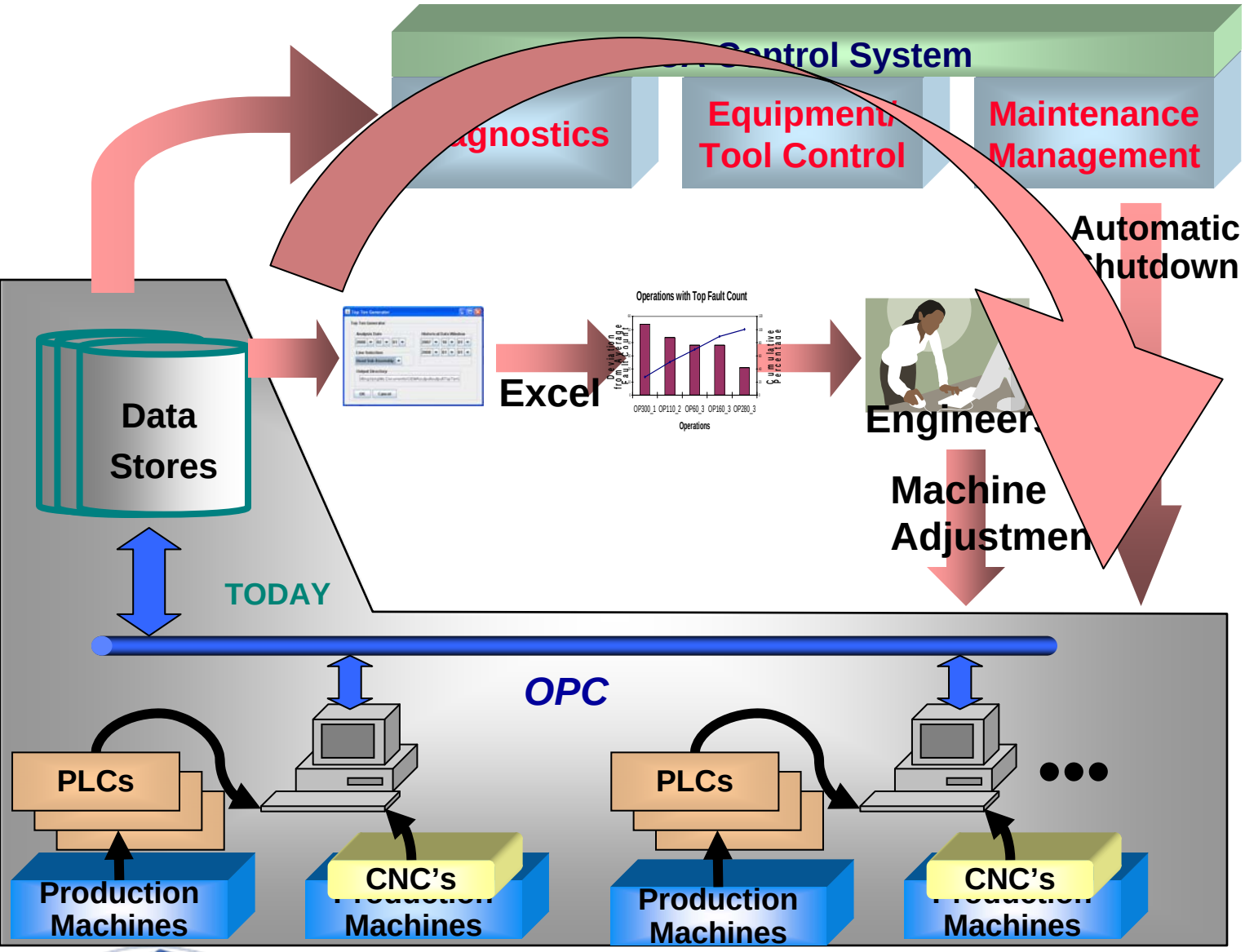
Closing the Loop



BENEFITS

- Reduced Unscheduled Downtime
- Reduced Scrap
- Reduced MTTR
- Improved Productivity

Previous Work and Results

- **Top Ten Software:** **Generate Pareto Chart, of machines experiencing abnormal behavior.**

- **Downtime Prediction Software:** **Usi ents can be made in dealing with low factory loads and r wntime.**

- **Improving Standard Best Practices** **improvements can be made in dealing with low factory loads and reducing the costs of downtime.**

Delivered softwares are portable to other plants and manufacturing systems, on going discussions with GM to implement software

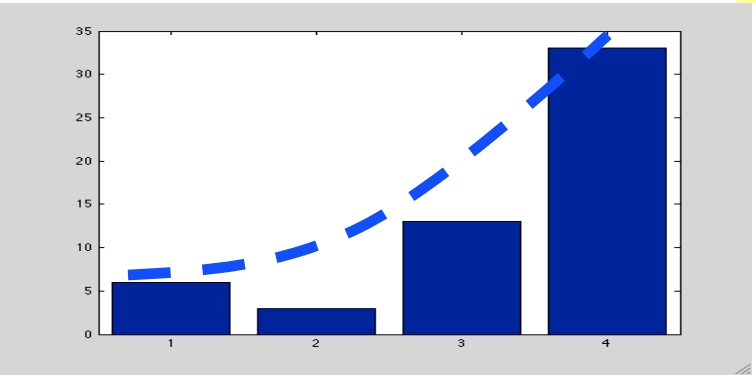
Moving Forward: Tools for Improving Control

- **Software for Optimized PM scheduling**
- **Software for Low Load Maintenance Scheduling**
  - **Representative of today's economic climate**
- **Software for Reducing Redundancy in Maintenance Scheduling**
- **Best Practices for Improving Data Quality**

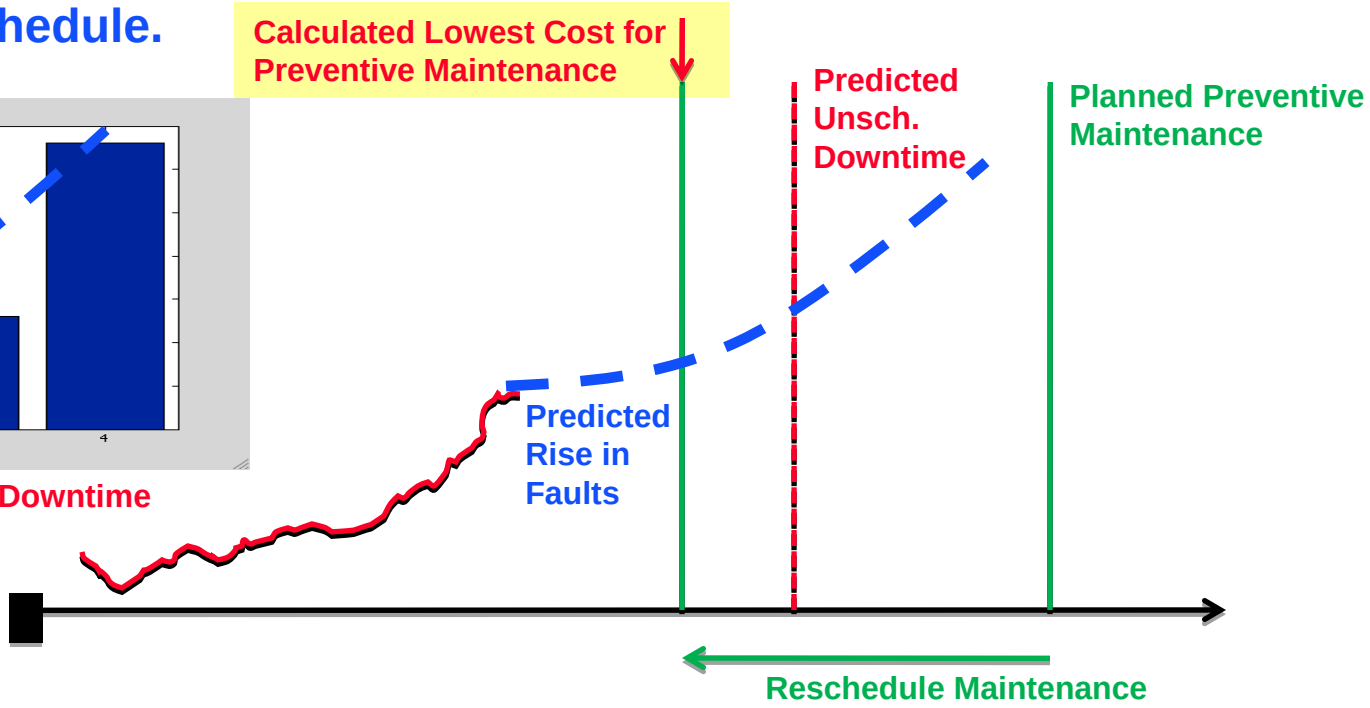
The project will focus on delivering tools that can help a factory improve fault prediction and data quality.

Software For Optimizing Maintenance Scheduling

Profiling the rise in faults can be used to optimize the preventive maintenance schedule.

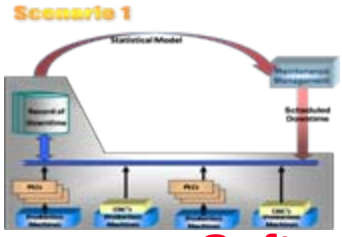


Observed Rise in Faults before Downtime



Tool will compare the cost of rescheduling a preventive maintenance relative to the cost generated to the rise in faults and the costs of the expected unscheduled downtime.

Evolution of Software Tools as Data Quality Improves

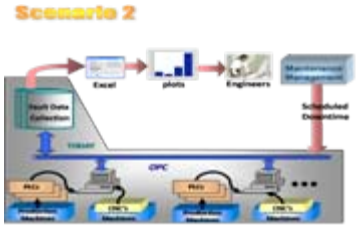


Stage 1: Only data involving maintenances and unscheduled downtime is available.

Software Tools: statistical methods

Stage 2: Fault and event data are available to the managers, no discernable relationship can be established between the two.

Software Tools: Anomaly Detection



Stage 3: Enough data exists to establish a straightforward linear trend in the event data and machine failures.

Software Tools: normalized regression

Stage 4: Enough knowledge exists to filter out bad data and enough data exists to train and use a pattern recognition algorithm.

Software Tools: Pattern Recognition

Low Data Quality

High Data Quality

The process by which factory data quality can be im ou id nu

Deliverable is a best practices document that references software solutions developed for analysis.

Milestones and Future Plans