

# The IPSS 3D Process Nucor Berkeley's Data Analysis System

## Discovery Phase

Process control engineers at Nucor Berkeley's Hot Strip Mill needed a tool to help diagnose mill problems. Specifically, they wanted a system that could:

- Collect and store mill data at the fastest rate possible rate for each piece rolled.
- Collect data from the various control systems that are used in the mill (i.e., Siemens Simadyn D, SMS Stand Controllers, several Alpha computers) and present it in a coherent form.
- Display real-time and historical data in a graphical format.
- Provide mathematical tools for analyzing data (e.g., mean, standard deviation, etc.)

Reviewing our past jobs, we found that the HMI component we had previously used (Vsystem from Vista Controls) would work very well for this project.

After extensive discussions with Nucor's automation personnel and reviewing the prints and code, we proposed two options:

- A Data Analysis System with separate I/O connected in parallel to the existing control system. This was a less costly option but didn't allow values calculated on the control system to be stored. It also added yet another hardware platform to the mill.
- A Data Analysis System integrated into the existing control system. Adding new CPUs to the Stand Controllers and Siemens PLCs was more expensive but allowed access to all the data on the controllers and reduced the hardware required. Adding code to the existing controllers was not possible because either the controllers did not have an Ethernet port for communication or the controller was already at CPU capacity. Further, adding functions to the control CPUs introduced the possibility of negatively impacting control of the mill.

## **Development Phase**

Discussions with Nucor revealed that they had vast experience with the Simadyn D controllers and an interest in being involved in the project. As a result, we formed a team in which Nucor was responsible for modifying the Simadyn D controllers, procuring all the equipment and completing the electrical construction. IPSS designed and developed the basic Data Analysis System and engineering the modifications to the SMS Stand Controllers.

Using Nucor spare parts, we assembled a Stand Controller for testing and development. After training on the iRMX operating system, we developed a prototype that proved we could access the shared memory of the other CPUs to retrieve I/O and calculated data.

We designed the Data Analysis System (DAS) around an AlphaServer 800 computer running OpenVMS and Vsystem from Vista Controls. Our design is modular in that any number of controllers may gather data and send it to the DAS via standard Ethernet. Each Stand Controller has its own Ethernet connection, as do the Simadyn D PLCs and other Alpha computers.

Network (10 Mbps Ethernet), and Alpha system limitations (CPU, disk space) dictated a maximum collection rate of 20Hz.

## **Deployment Phase**

After a detailed acceptance test at IPSS, we installed the DAS at site and then installed the new CPUs in the SMS Stand Controllers. Once this was commissioned, we added links to the other Alpha computers, and finally, Nucor made changes to the Simadyn D PLCs so that they would send I/O data to the DAS.

Because of Nucor's involvement and the simplicity of the system, Nucor has been able to upgrade and enhance the system with minimal outside assistance. The system is used daily to monitor performance of the process and the control system as well as to troubleshoot problems.