The LANSCE target data collection system

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ABSTRACT: The Los Alamos Neutron Scattering Center (LANSCE) Target Data Collection System is the result of an effort to provide a base of information from which to draw conclusions on the performance and operational condition of the overall LANSCE target system. During the conceptualization of the system, several goals were defined. A survey was made of both custom-made and off-the-shelf hardware and software that were capable of meeting these goals. The first stage of the system was successfully implemented for the LANSCE run cycle 52. From the operational experience gained thus far, it appears that the LANSCE Target Data Collection System will meet all of the previously defined requirements.

The goals of the LANSCE Target Data Collection System are listed in the order in which it was deemed the system was to evolve. Each goal builds upon the data collected and confidence built by the accomplishment of the previous goal.

- Develop a data base of the operational parameters relating to the performance of the target and moderator systems as well as their support systems.

- Extract trend and normal range parameters for the data points of prime interest and then for all data points.

- Implement a means of automatic warning and alarm in cases where a particular data point has exceeded its normal range or has reached a level that poses a threat to the continued safe operation of the system.

- Provide for the intervention of the data collection system in the operation of the target and moderator systems to avert unnecessary system shutdown.

Having defined the capabilities and direction the system was to take, a preliminary survey was made of both custom-made and off-the-shelf hardware and software that were capable of meeting these goals. Additional criteria for the system were then defined as follows.

- All system components were to be standard products offered for sale by established firms.

- All system components would provide a high degree of operational reliability and accuracy while affording the lowest possible cost.

- All system components would provide for easy expansion capability beyond the presently defined number of data points.

A final survey of available system components was then made. Each product was screened in accordance with all the preceding goals and criteria. The union of products from four different vendors seemed to offer a system that would provide the versatility to meet all of our previous requirements. Trade-offs and initial procurements were made.

Contained within the following paragraphs is a brief description of the capabilities of eacʰ system component, followed by a summary of our experience with the system so far, and then a look into the potential of this system for the future.

- The first component is an IBM PC AT compatible computer manufactured by Dell Computer Corporation—the System 200 model, set up with the following:

    - Intel 80286 microprocessor running at 12.5 MHz
    - Intel 80287 math coprocessor
    - 640K Bytes of RAM
    - 40MB 28ms hard disk
    - 1.2MB floppy disk
    - 360MB floppy disk
    - EGA graphics adapter and monitor
    - Real-time clock with battery backup
    - 2400 baud internal modem

- The second component is a hardware data acquisition and control system manufactured by OPTO 22. This system, called Optomux, is a family of digital and analog input and output units. The Optomux system can handle up to 255 different digital or analog module racks, which are all serially connected via one cable of two twisted pairs. Each module rack can support up to 16 input or output modules (any mix). Control of the serial system, which can extend 5000 feet without an additional repeater, is accomplished via an interface card that plugs into the Dell System motherboard.

- The third component in the system is a voice-synthesized warning system built by RACO Manufacturing and Engineering Company. This device, called the Verbatim Automatic Dialing Remote Monitoring System, or "the Verbatim", is capable of monitoring eight different contact-closure channels. Each channel's unique user-recorded message is stored in nonvolatile memory. Upon detecting an alarm condition, the Verbatim unit will dial up to eight different phone numbers up to twenty times to report the channel-specific prerecorded message.

- The last component in the system is the software package that runs on the Dell System 200 PC. Developed by Intec Controls Corporation, the software Paragon Control is a graphics-interface-process-control package optimized for real-time process control and data acquisition. Paragon Control can support up to 800 data points and can display both real-time trend information and store selected data points for archival purposes. The package provides the capability to set operational limits for all signals and respond to alarm conditions by message display on the screen of the computer. It also activates other warning devices thru the OPTO22 hardware output system.

During the LANSCE run cycle 52, the first stage of this system was successfully implemented. Approximately 40 different data points were monitored at a rate of 0.25 s per sample and stored for archival purposes at a rate of 1 to 5 samples per minute. Several liquid-hydrogen-moderator-system shutdowns were averted. The archived data has helped solve several other unexplained system shutdowns that occurred during times when the system was unattended.

For run cycle 53, the LANSCE Target Data Collection System is scheduled to monitor some 100 data points. The Verbatim alarm system will be implemented and operational. Signal trending will be emphasized. The data collection system has been given the prime responsibility to monitor the liquid-hydrogen moderator system and report any out-of-range operating conditions via both the Verbatim automatic voice-synthesized phone-calling system and local warning lights and alarms in the attending technician's work area. From our experience thus far, it appears this system will meet all of our previously defined goals and will provide the versatility needed to meet future requirements.