STATUS OF THE NSCL ACCELERATOR AND BEAM TRANSPORT ELECTRONIC SYSTEMS

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Introduction

The primary focus of the Electronics Department efforts this year has been to complete the construction of the Coupled Cyclotron Project (CCP). At the end of the year, the department focus began switching to CCP commissioning, budgeted reliability upgrades, and support of operations. A brief summary of these activities will be discussed.

General Controls and Instrumentation

The NSCL control system will be described in detail in another paper in this report [1]. In addition, last years annual report also provides a more thorough review of this system [2]. In summary, we use a system of distributed VME crates and PLC s (Programmable Logic Controllers). The significant change to this system as a result of the facility upgrade includes 1) reorientation of the PLC s to functionally versus topologically grouped systems, 2) switching the VME crate processors to PowerPC s running the VxWorks operating system and EPICS, 3) upgrading the PLC system to Modicon Quantum PLC s and associated I/O, and 4) adding a great deal more emphasis on the PLC s for analog process control and monitoring. Generally we are headed in a direction that will make increasing use of off-the-shelf industrial controllers and signal conditioners. In this role, PLC s will likely play an expanding role and the VME systems reduced to functions that are not easily supplied by industrial controllers. In our system, custom software provides gateways between systems and to industrial MMI (Man-Machine-Interface) software such as Labview and Lookout from National Instruments as well as to standard desktop software such as Microsoft Office applications. The versatility of this system provides the operators and others many options for creating their own MMI s for process control and monitoring. A small group consisting of two computer scientists and one electrical engineer are responsible for this system. We are trying to add another member although suitable candidates seem hard to come by due to the strong technical skills necessary and the very strong economy.

Cyclotrons

The upgrades to both cyclotrons are now complete and they are both in routine operation. Problems encountered have been minor and are thought to be due to premature failure of new components, normal failure cycles of existing components, or assembly errors. No fundamental problems with the electronic systems have yet been observed and we believe the existing systems will shake-out into reasonably reliable systems within the next year. The rf systems will be discussed in detail in another paper in this report[3].

Cyclotron Coupling Line

The coupling line is in routine operation. The electronic systems are routinely operated and seem to be reliable and well suited to the task.

A1900 Fragment Separator

The A1900 is complete and is being tested and calibrated. Based on what has been observed to date, no issues with the electronic systems have been discovered or are expected.

Transfer Hall (Beamline Switchyard)

The transfer hall beamline equipment has been reinstalled. The electronics, with the exception of the cryomonitors, are mostly reused from the previous installation, although they will have been serviced, rearranged, and reinstalled. This system is scheduled to be tested and placed back into service the first half of next year. Since its systems are largely copies of systems already in use in the coupling line or A1900, we envision no problems.

Experimental Vaults

In general, the experimental equipment in the vaults was left untouched by the changes to the accelerator and beamline controls. Each vault contains two to four magnets packaged in one or two cryostats on the final leg of the beamline feeding the experimental apparatus. These final magnets are treated as extensions of the transfer hall and have been upgraded with new cryomonitors and reattached to the power supplies and controls. This system is scheduled to be tested and placed back into service the first half of next year.

The S800 vault has been upgraded with the new cryomonitors. This system is scheduled to be tested and placed back into service the second half of next year.

A major upgrade and expansion of the N4 vault is being planned. The cryomonitors were fabricated along with the cryomonitors for the S800 and the power supplies needed are being investigated. We expect to have this system completed the second half of next year.

No problems are envisioned for any of these systems since they are largely copies of systems already in use elsewhere in the laboratory.

New Cryoplant

The controls for the new cryoplant were designed and installed this year. Process monitoring and control is done exclusively with a PLC. The PLC executes approximately 40 PID loops and monitors and controls hundreds of points. The EPICS system is used mainly for MMI and communicates with the PLC via Modbus over a standard Ethernet connection. This system is very reliable and seems very well suited to this task.

Reliability Upgrades

Many reliability upgrades have begun this year. The major project the electronics department is undertaking is the replacement of ~75 20V/20A 4-quadrant power supplies used mainly for our superconducting quadrapole doublets. The existing units are complex and heavy due to the technology available at the time of their construction and have become increasingly unreliable as parts have aged and become obsolete. The N4 vault expansion also needs these supplies so that we need 95 total including spares. We expect the decisions to be made and replacement units to become available early in the second have of next year.

Conclusion

As mentioned in the introduction, the NSCL began implementation of a major upgrade this year. The electronics that are a portion of this upgrade have been installed and test/commissioning shall occur during the first half of next year. Based on our experience with systems that have already begun operations, we expect the work to be finished slightly ahead of schedule and on budget. In addition, a new cryoplant control system is being commissioned and reliability upgrades are being planned. We are pleased with the quality and reliability of the new installations and expect them to be placed into routine operations late next year.

References

1. J. Priller, K. Davidson, L. Foth, J. Vincent, 2000 NSCL Annual Report , “Status of the Cyclotron and Beam Transport Control Systems”
2. J. Vincent, et. al., 1999 NSCL Annual Report, “Status of the NSCL Accelerator and Beam Transport Electronic Systems, Internet. available from: http://www.nscl.msu.edu/research/1999_Annual_Report/Vincent.pdf; accessed 2 July, 2001
3. D. Pedtke, J. Brandon, J. Vincent, 2000 NSCL Annual Report, “Status of the Cyclotron RF Systems”