Control System Upgrade

F.P. Abegglen, R.H. Burch, and T. Cowden

Introduction

The upgrade of the K500 control system is approximately ninety percent complete for the two ECR sources, vertical, horizonal injection lines and all elements of the K500 cyclotron. Computer control of the beamline elements used to transport the beams to various experimental areas are being worked on at the present time. During the past January shutdown all elements of the cyclotron were tested with the new control system, and a beam was accelerated to the radius of 26" inside the cyclotron. All the subsystems of the control system performed well with only minor problems.

The problems encountered are being addressed, with plans to install the new control system in June.

Main Magnet

The Main Magnet control code was rewritten in the standard language C, for the operating system QNX. In porting the code, we used the same algorithms from the old control system to insure we maintained the same magnetic field reproducibility. Several modifications were made to the ramp algorithm to eliminate well known ramp behavioral problems. The code was written to allow the Main Magnet to be controlled in three modes: (1) stand alone using a VT100 terminal connected to the control computers serial port: (2) console mode through the QNX server using Arcnet: and (3) graphical mode using Labview servers with Ethernet and Arcnet. The Main Magnet graphical user interface display was modified to display all Main Magnet control parameters including the ramp state, dump state and fault states.

Beam Line Interface

The Beam line graphical user interface and server have been designed. There is one program for each cave, several for the vaults and a global beam line tuning and server program.

Reloadable Run Sheets

Reloadable run sheets were added to the database monitor system. This feature will allow the operator to reload an old run sheet and rapidly set various machine elements to the values recorded in the run sheet. The run sheets can be searched by group, ion and date.

Single Point of Failure

The new control system is based on a two level computer network. The user interface level is where the graphical user interface programs exchange data using standard TCP/IP calls over Ethernet. The control level is where the control programs exchange data using two nonstandard, Arcnet application interfaces, and the institute's Arcnet network. The networks are bridged by a single computer running a bridging software. This computer represents a single point of failure. If the bridge software is corrupted or the computer fails, the control programs will be isolated from the user interface programs and the users will be unable to control the machine or related devices. The network system has been redesigned to reduce the risk of losing machine control due to a network switch failure or a bridge computer failure. All user interface programs and the bridge program reside on each user interface computer. The bridge program has been redesigned to mirror the history and run sheet database files on all user interface computers. The user interface servers have been redesigned to automatically search for

the bridge program over ethernet and connect to it. Thus, if the bridge computer ever fails the user can regain the control by terminating the interface programs, and reconnecting the Arcnet cable to a user interface computer and restarting the system.

Conclusion

The new control system has been tested on and off line as time has permitted. The system has performed well with minor problems. Problems encountered have been largely addressed and solved. The new control system is to be installed in two stages; the control for the sources, injection lines, and the K500 machine will be installed in late June, and the control for beam lines will follow at a later date.