

UPGRADING THE CONTROL SYSTEM AT KCSR

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Abstract

Till now Kurchatov Centre of Synchrotron Radiation facility control system is based on a CAMAC-oriented computers network. In this paper the project of upgrading and results of prototyping of the new equipment is submitted. Upgrading includes two levels. First, it is possible to create the modern CAMAC crate-controller, connected with standard network. More advanced variant will consist in replacement of CAMAC modules with the embedded controllers of equipment. Second level is a creation of a local managing network of personal computers, as consoles of the control system. The control system is functionally divided into four levels: 1) the controllers managing in a real-time mode by the executive equipment; 2) the workstations which are supporting the link with controllers by CAN-network; 3) the server of applications containing a dynamic database; 4) the PCs network for users applications. Examples of realisation of the software are presented.

INTRODUCTION

Kurchatov Centre of Synchrotron Radiation - the electron accelerators facility, including the linear accelerator, the storage ring - booster at energy 450 MeV and the main storage ring at 2.5 GeV, is a dedicated synchrotron radiation source [1]. The CAMAC-embedded minicomputers are used in the KCSR as the lower level of control system [2]. The PC connected to central machine crate, is used as a file server of control system, it is connected to a local network, that allows to start the network applications from anyone PC of a local network [3].

THE PROJECT OF CONTROL SYSTEM UPGRADING

The control system solves the following tasks:

- control in a mode real time of accelerator equipment during storage and rumping processes in booster and main ring;
- saving of an operating conditions of technological systems, testing of magnets power supplies and RF-systems;
- measurement of electron beam current and orbit parameters in storage rings,
- monitoring of vacuum and temperature;
- support of facility archive and providing of access on a local PC network;
- creation of statistical reports and support of resources of processing of the archive data convenient for the external users.

Table 1: Channels of control and monitoring

Accelerators equipment	Number of channel
Magnet systems of booster and main ring	600
Linac, RF systems, synchronisation	300
Vacuum monitoring	150
Temperature monitoring	450
Radiation safety monitoring and interlock system	50
Beam diagnostic	200
Total	1750

The purposes of upgrade:

- creation of the equipment which uses standards of modular systems of automation and software for connection to a local computer network,
- creation of the system of data acquisition and visualisation with application of the modern languages of programming (for example, VisualC++, Delfi),
- step-by-step replacement morally and physically out-of-date equipment that will allow to reduce expenses for repair of CAMAC and quantity of system refusals during work,
- inclusion of the new subsystems intended for management by experimental stations and for improvement of stability of an electron beam.

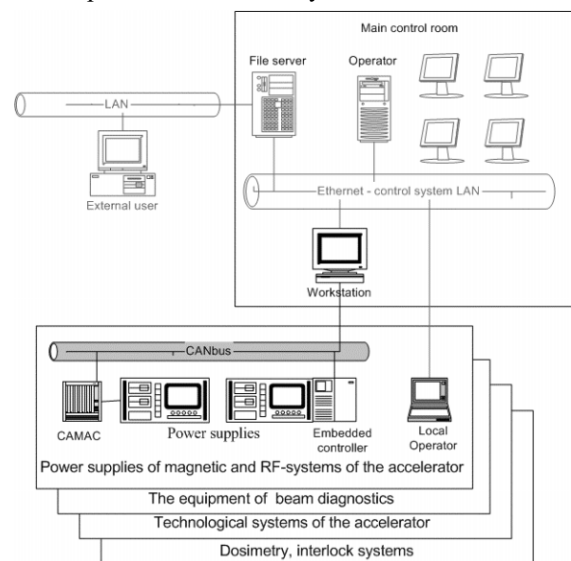


Figure 1: The control system block diagram.

Block diagram of control system is submitted on Fig. 1. It is supposed to organise the top level of control through local the computer network as the allocated segment of KCSR local area network (LAN). The LAN includes workplaces of operators on the basis of the PC in the control room, the file server providing access to a database through Ethernet.

At the second stage installation of a communication facility of the LAN and CAMAC blocks is supposed. CAMAC equipment (mini computer, RAM, adapters of terminals and monitors) will be replaced on new crate controller connected by CANbus to PCs a workstation connected to the LAN.

Further it is supposed to replace executive devices of the accelerating equipment (power supplies of magnetic and RF-systems, beam diagnostics, vacuum and temperature monitoring etc.) on new one, controlled by the embedded controllers connected by CANbus.

Upper level of the software of control system consists of MSWin98/NT/2000 PC's which are connected via Ethernet, intermediate one – processing of inquiries and low level - work with the executive devices.

The process of management by a complex consists of follows:

- loading of working programs in RAM of controlling computers from the centre;

- reading a database of control channels, test of blocks and compilation of the list of channels accessible to handle;
- start of the program of manual management which accepts commands to CAMAC (DAC controls and ADC readers with general synchronisation frequency is 10 Hz);
- start of the program for realisation of standard scripts of work.

File server works under the control of MSWin98/NT/2000 operating system. It provides channel and database access for users applications.

RESULTS OF PROTOTYPING

CAMAC crate controller

The prototype of a new CAMAC crate-controller is developed and made (see Fig. 2). Crate controller K167 [4] based on the miniMODUL-167 single-board computers and the FastFlash XC 95288XL. SBC miniMODUL167CS based on populated Infinion 167CS, which have powerful microcontroller, advanced periphery (ADC, Pulse Width Modulation Module, counters etc.) and effective programming system including RTX166 operating system.

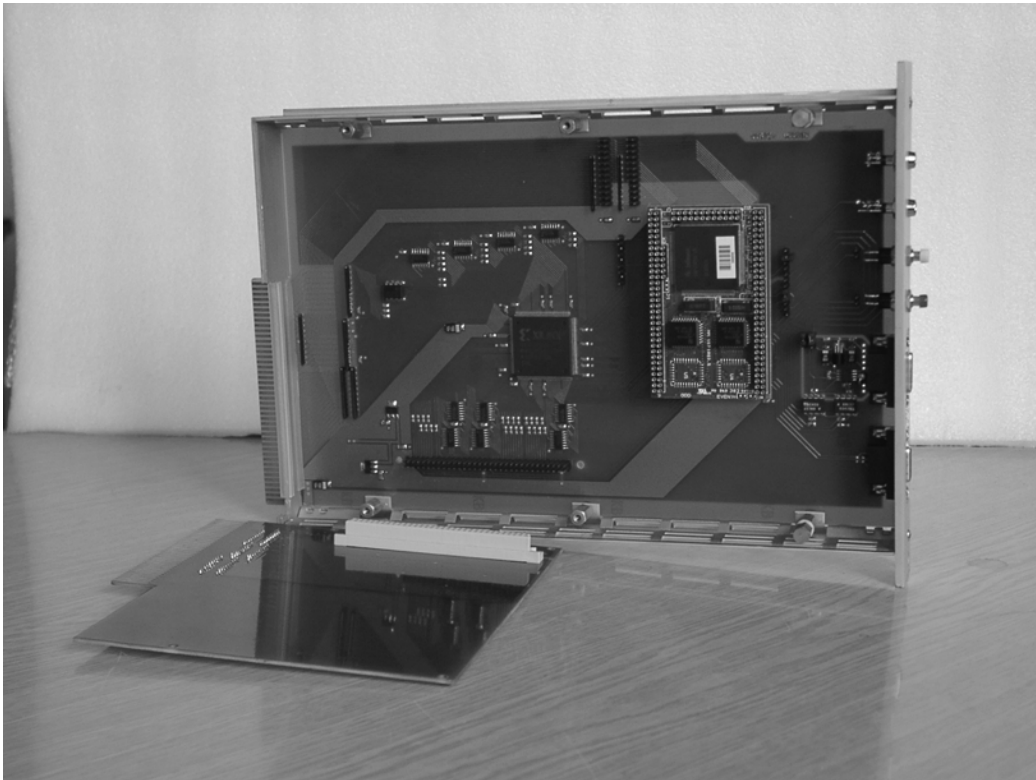


Figure 2: CAMAC crate-controller, developed and made in KCSR.

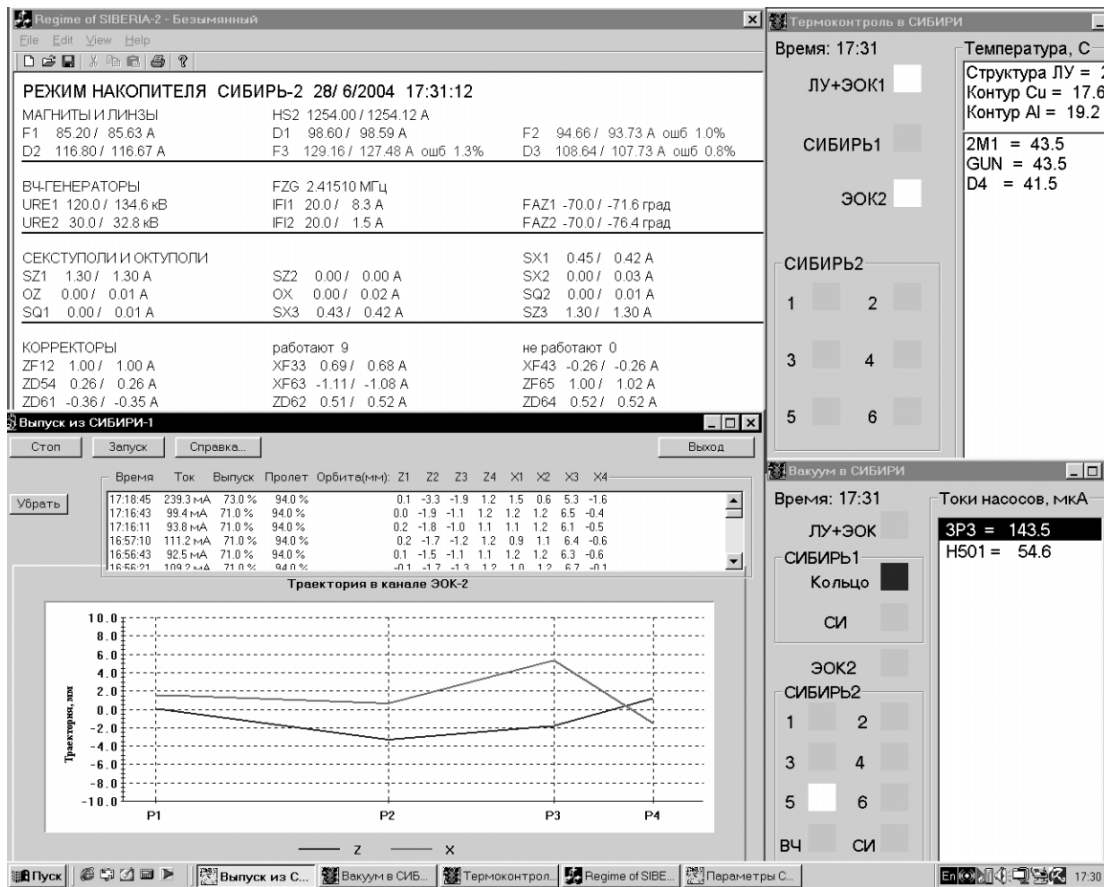


Figure 3: Screen copy of system monitoring and orbit beam measurement during injection.

The XC95288XL is a high-performance CPLD providing advanced in-system programming and test capabilities for general logic integration. It is comprised of 288 macrocells, providing 6,400 usable gates with propagation delays of 15 ns. Device supports in-system programming (ISP) and the full IEEE 1149.1 (JTAG) boundary-scan.

K167 crate-controller, working together with computers Pentium IV will control the accelerating equipment, using all control and measuring modules. Standard CAN-network will be used for connection between controllers and workstation.

The program is developed, allowing to work on a CAN-network under the control of OS real time RTX166 for miniMODUL167 which allows to process up to 256 tasks and contains drivers for work on a CAN-network.

The users applications

We have developed on VisualC++ application software to fit the KCSR control framework. Using this framework, it is possible to control the following measurement system remotely:

- status of a complex (current mode and basic parameters of a beam),
- vacuum monitoring (on a current of pumps),
- temperature monitoring,

- test of magnet power supplies and RF-system.

In Fig. 3 the typical screen copy of the operator PC in a mode of injection in the main ring is given. Windows of the applications parameters of power supplies, orbit beam measurement and the data of vacuum and temperature monitoring are opened.

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