

## ARCHIVING AND MONITORING OF STATUS FOR KSRS

Yury Krylov, Yury Yupinov  
 KSRS RRC Kurchatov Institute, Moscow, Russia

### ABSTRACT

Kurchatov Synchrotron Radiation Source (KSRS) - the electron accelerators facility, including the linear accelerator, the booster synchrotron and the main ring [1]. The operational level of control system is based on a local area network of the PC. The software of data acquisition system (DAS) about parameters of a beam and technological systems of facility and creation of the archive database is given. The DAS consists of three layers. The first one is updated data set to supervise parameters of the current session. The second layer is the history of beam parameters and work of the facility. The third one is the set of PC network applications for the beam monitoring and graphic display of technological processes.

### THE DATA ACQUISITION SYSTEM

The KSRS control system [2] is functionally divided into two parts: first, the controllers managing in a real-time mode by the executive equipment; and second one, the PC's network which serves of the user applications, uses a database of control channels and creates archive of facility parameters. The CAMAC-embedded minicomputers are used as the lower level of control system. Upper level of control system consists of MSWin2000/XP PC's which are a segment of local area network (LAN) of KSRS.

The DAS is the integral component of uniform KSRS control system [3]. DAS includes the PC workstation which serves of communication protocol with lower level machines and the file-server which supports the facility parameters archive. DAS solves the following problems:

- visualization of an operating conditions of technological systems, monitoring of vacuum and temperature;
- providing of access to results of measurement of electron beam parameters in storage rings from the local PC network;
- creation of facility archive and statistical reports and processing of the archive data convenient for the external users.

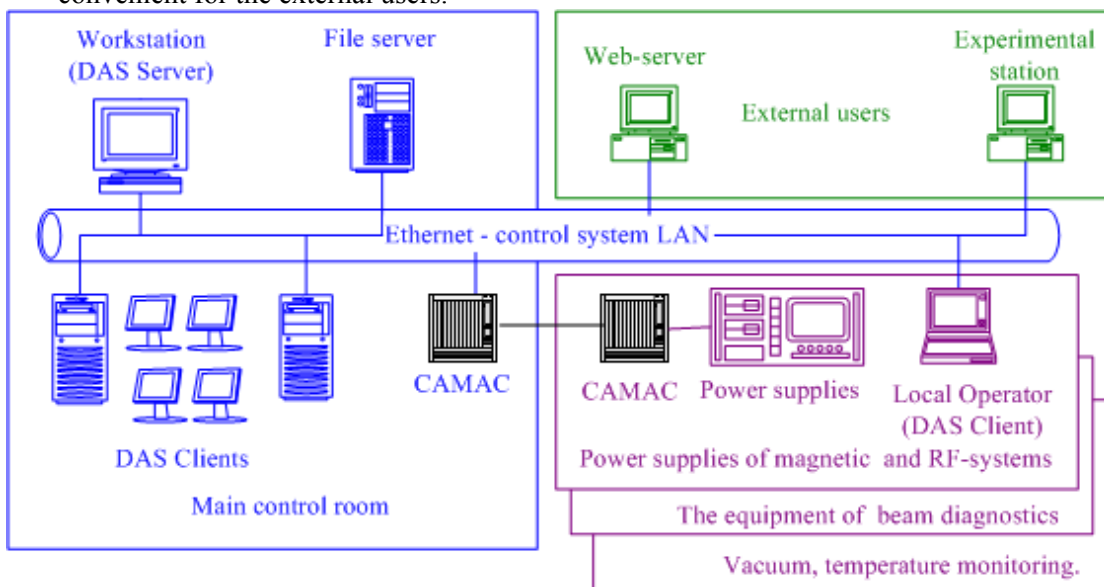


Figure1: DAS block diagram.

A block diagram of DAS is submitted on Figure 1. The crate of CAMAC is complemented by modules: mini-computer, RAM, Ethernet interface, adapters of terminals and monitors, driver peripheral crates. The network of CAMAC embedded mini-computers "Odnok" [4] works under the control of ODOS operating system which provides multitasking, exchange between processes, synchronization of programs written in TRAN language (version of FORTRAN).

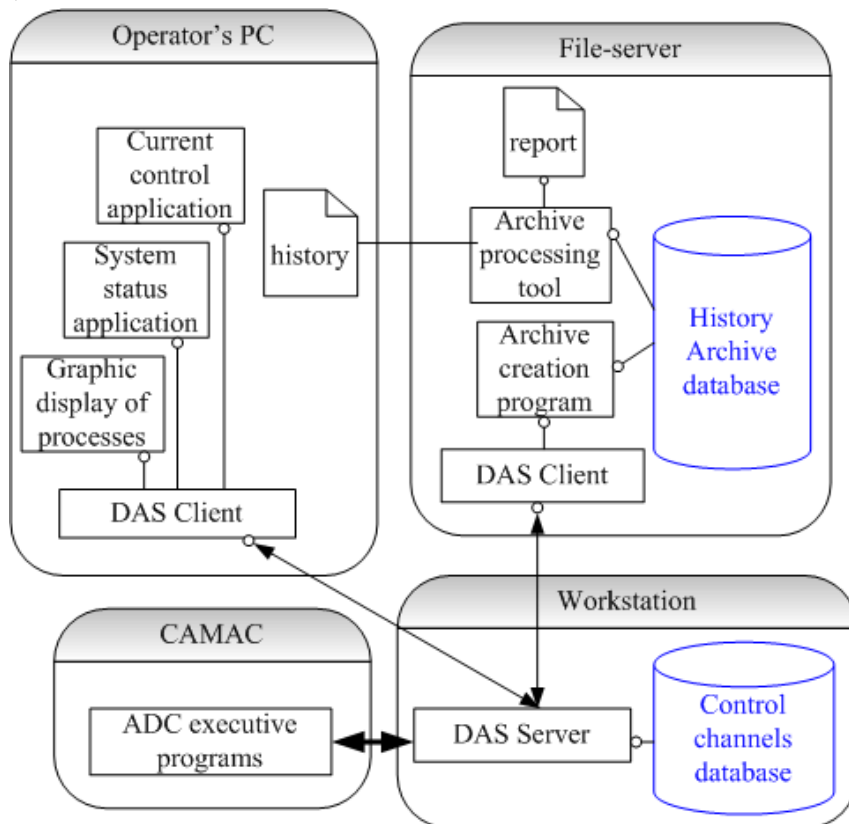


Figure 2: DAS software scheme.

The data acquisition software scheme is presented in Figure 2. The measuring programs send data to workstation DAS server via Ethernet. The DAS server under the control of MSWin98 supports the control channels database. Each record of base determines the logic channel of control. The record includes a unique name of the channel which is a key field, a name of process and the address in a memory of ADC executive program where the code is written down, factor of translation of a code in units of dimension and other service data. The full list of control channels is given in table 1.

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

Table 1: Channels of control and monitoring.

The DAS server expects request from the client, then addresses it to the executive program in a lower level machine, reads the code from ADC, and saves it in the table of a dynamic database. The DAS client program chooses the list of names of control channels and the period of request.

### THE KSRS ARCHIVE CREATION

The database - archive of working parameters of KSRS is stored in the Pentium-IV PC file-server. The file server works under the control of MSWin2000. The database consists of six catalogues: BeamSib1 (beam parameters in the booster ring), BeamSib2 (beam parameters in the main ring), OrbitSib2 (measurements of beam orbit), FacilitySib2 (regimes of magnet and RF systems), Termocontrol (temperature measurements), Vacuum (monitoring of vacuum). Each catalogue is a set of the tables appropriate to one day. For example, the file BeamSib2\Mar05\_05 (beam parameters measured in March, 5 2005) contains a set of beam parameters, such as a current, energy, life time and betatron frequency. Each record corresponds to one measurement; the first field in record is the time of measurement.

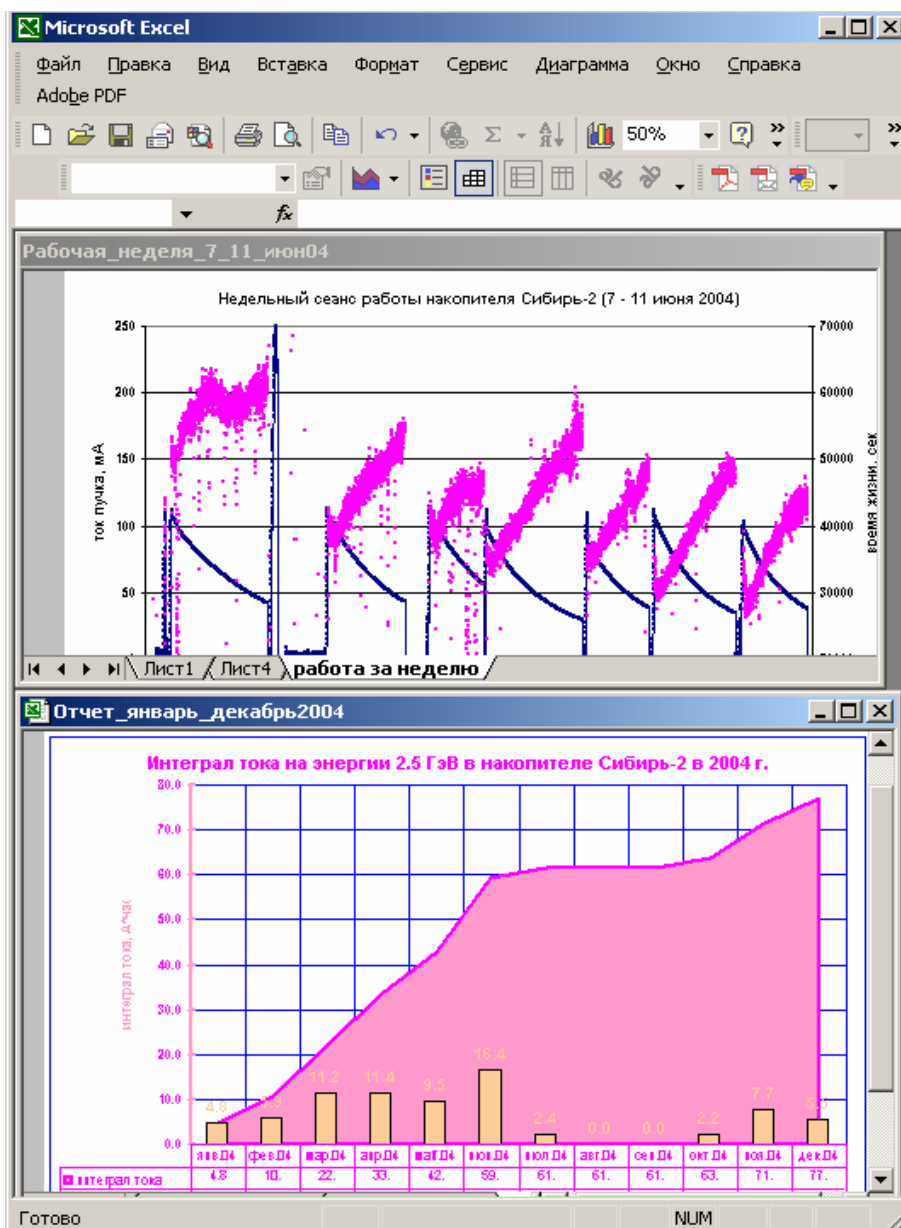


Figure3: The report generated by archive processing tools.

The software developed on VBA [3] provides access to the KSRS archive files. That is the convenient tool for creation of the reports and data processing. By choosing date of record and list of required parameters, the user can generate the block of the necessary parameters on the Excel book.

For example, Figure 3 presents two reports generated by archive processing tools. First report (file Week\_7\_11\_jun\_04) is weekly diagram of beam current and life time during the user session. Second one (file Report\_Jan\_Dec\_2004) is the KSRS annual statistical report, presented diagram shows beam current integral stored during 2004.

### THE SOFTWARE OF MONITORING SYSTEM

The top level of the control network includes 4 PCs (operators consoles), placed in the main control room, and 3 PCs (local consoles) in technological systems rooms and the file-server PC. The consoles are a PCs of class Intel Pentium 1.7GHz, 128Mb SDRAM, 40Gb HDD, working under the control of OS Windows2000/XP.

We have developed on VisualC++ application software to fit the KSRS control framework. This framework presents the status of the main and booster rings, linac, vacuum, temperature monitoring system, magnet power supplies and RF-system. It is developed three types of applications for visualization: the current control application, application of technological status, the graphic display of processes. Their samples are submitted in Figure 4, it is the screen copy of operator’s console during the injection and ramping.

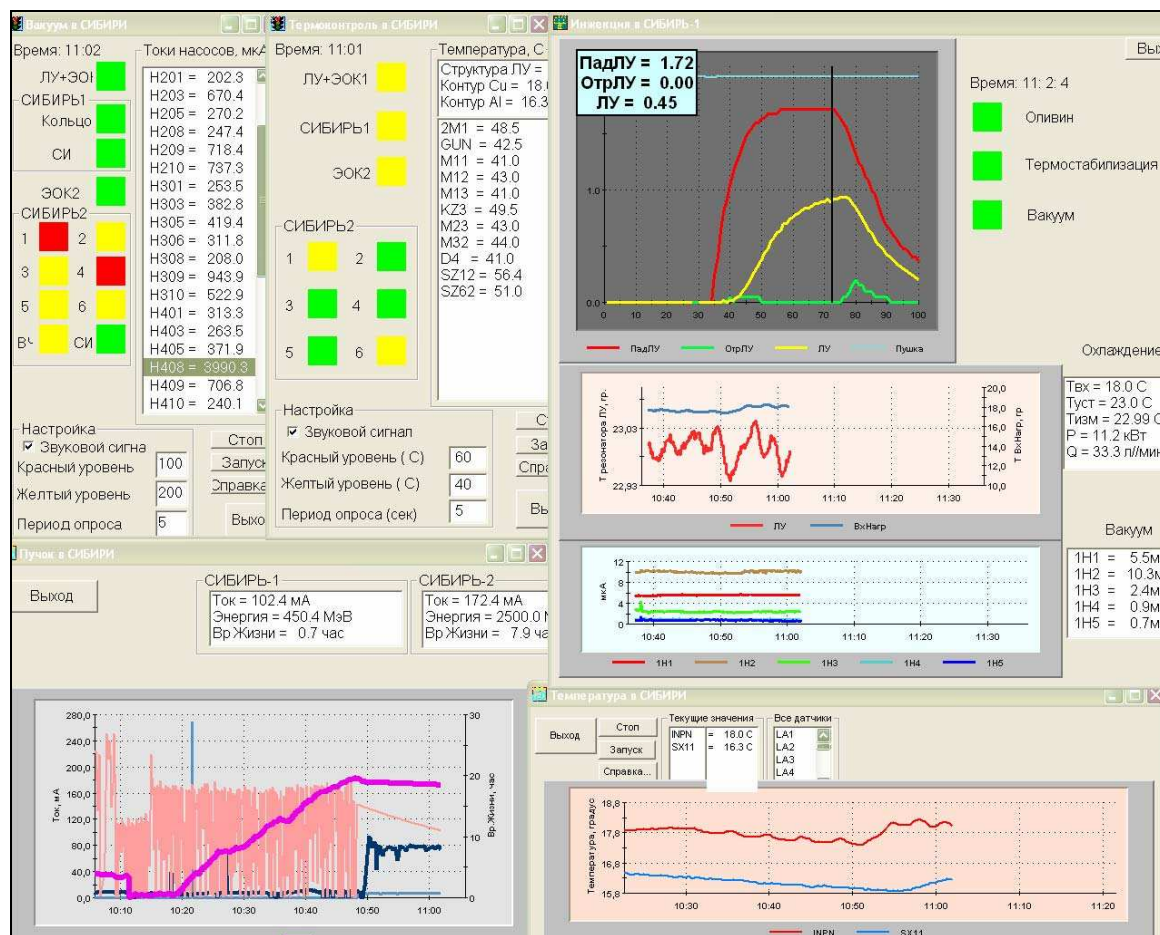


Figure 4: Screen copy of system monitoring during injection and ramping.

The current control application creates and updates once a second the monitor of diagnostic system, an example in the right top corner (see Figure 4) - the screen of the digital oscilloscope measuring RF-signals of falling and reflected wave in the linac wave guide.

The application of technological status presents system parameters on the screen and in addition creates a color warning and a sound alarm in case of a deviation from a normal mode of operation. On an example, in the left top corner of the screen are shown the control of vacuum on a pumps current and the control of temperature.

The graphic interface allows to choose a channels of the control and the form of graphic representation. The diagrams of a beam current and temperature of cooling water are submitted in bottom of the screen.

The application which updates htm-file with period 2 minutes used by KSRS web-server for the current information on the status is given.[5]

## REFERENCES

- [1] V.Korchuganov et al., «The Status-2004 of the Kurchatov Centre of SR» Proc. of 9-th EPAC, 2004, Lucerne, Swiss. <http://www.epac04.ch/head1/index.htm>
- [2] Yu. Krylov, et al., "Upgrading The Control System At KCSR" Proc. of 9-th EPAC, 2004, Lucerne, Swiss. <http://www.epac04.ch/head1/index.html>
- [3] Yu. Krylov, E. Ushkova. "Data Acquisition System for Studying of Beam Parameters and Status of KCSR facility" Proc. of 4-th PCaPAC, 2002, Frascati. <http://www.lnf.infn.it/conference/pcapac2002/>
- [4] S. Kuznetsov et al., "Control system of synchrotron radiation SIBERIA", NIM A352 (1994), p.161-165.
- [5] <http://www.kcsr.kiae.ru>