USER INTERFACE IN THE DIAGNOSTIC SYSTEM OF THE EXTRACTED BEAMS OF THE U-70 ACCELERATOR

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Abstract

User interface in the diagnostic system of extracted beams is described. It was developed under Linux operating system on the personal computers used as workstations.

The considered program tools provide:

- the representation on operator consoles (workstations) information about beam profiles, intensity, displacement, root-mean-square error etc. in different forms;
- the dynamic adjustment of the diagnostic system;
- web presentation of the current information about the extracted beams;
- data transfer to physical setups;
- special beam characteristics calculation by the profilometer individual units data (for research purposes);
- data archiving and web facilities for data viewing.

INTRODUCTION

The diagnostic system for the beams extracted of U-70 accelerator is intended for beam profiles, intensity and position measurement. It is a three-level hardware-software complex [1]. The structure of the lower and middle levels is described in detail in [2]. The software for the middle and upper levels was developed by EPICS toolkit [2].

This report considers software for the upper level and its important part – the user interface. The users of the diagnostic system are the beam and the accelerator specialists, experimental physicists, hardware designers and operational staff. The user interface developed in the diagnostic system provides the interaction with the system in various forms. Functionality and convenience were the main aspects of the interface design.

UPPER LEVEL OF THE DIAGNOSTIC SYSTEM

The workstations and the server are the upper level computers. The workstations take the beam data from the middle level, which is composed of so called IOCs (Input Output Controller in EPICS terms). Each IOC is connected to the lower level of the system where the data is registered. The scheme of the upper level is shown in Figure 1. The computers are linked via Ethernet by TCP/IP protocol.

One IOC is usually used for a single beam channel. From experience, it is best when single workstation corresponds to one IOC. The workstation accepts the data from this IOC and it is responsible for initial loading and parameters adjustment of this IOC.

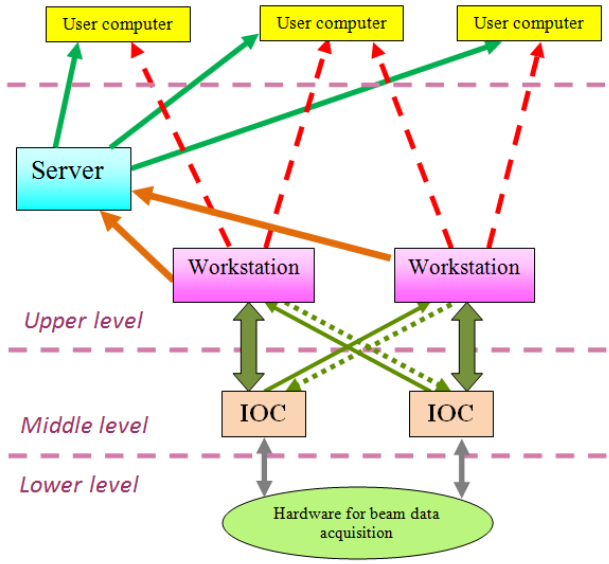

Figure 1: Upper level computers and their links. The dashed lines mean the restricted access.

However, the EPICS tools allow to monitor (and tune with small restrictions) any IOC from any workstation. For the system's reliability, we have supplied some redundancy measures. When one workstation is down another workstation is able to replace it. For this purpose the software for one workstation and "its" IOC is duplicated at another workstation and is in a non-active state. But this software can be activated if necessary and the workstation will work with two IOCs.

The current data from all workstations are transferred to the server which provides the access to information through a web-site. In addition to on-line data server keeps the information about the previous runs.

All computers of the upper level are running under Linux operating system. But user computers may be equipped with another operating system, for example, MS Windows. All one needs is a browser and an access to Internet.

SOFTWARE FOR USER INTERFACE

The upper level software includes the programs which directly realize the user interface, EPICS components needed for diagnostic system work, utilities, etc.

The main parts of the user interface software are shown in Fig. 2. The most important task of interface is to present beam data for on-line control. The appropriate software was developed by EPICS tools. It is shown by red color. This software is located on the workstation. The other part of the interface consists of utilities which are on

the workstation and on the server. They are marked by green color. And a set of programs provides an access to the information by web-sites (blue color).

Also, remote access to workstation by VNC (Virtual Network Computing) is provided. It gives the possibility to retransmit the workstation screen to a user computer. The access is made by Linux tools.

Some programs read data from IOC by Channel Access (CA). CA is the EPICS component which is intended for the communication between the system levels. The other way of data transfer is by our driver-program in IOC. It uses NFS protocol. The driver writes the current data to file located on the workstation in every accelerator cycle. This current data file is open for reading for all programs on the workstation.

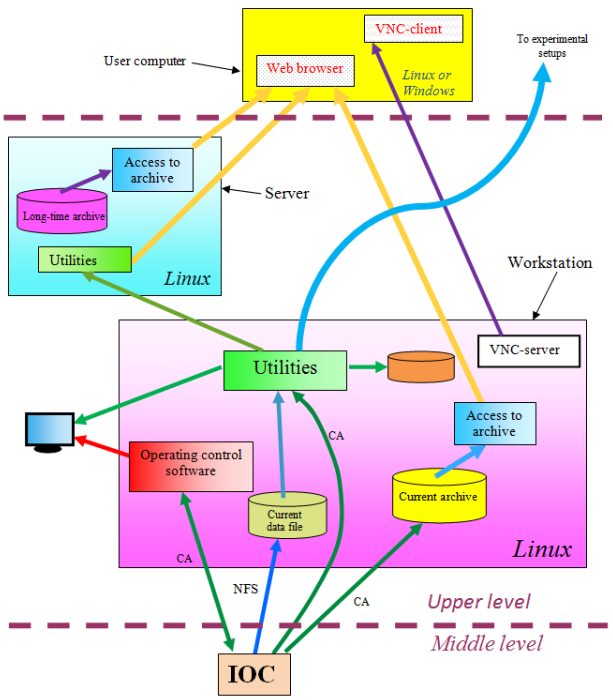

Figure 2: The user interface structure and the information flow.

ON-LINE CONTROL SOFTWARE

The on-line control software is designed for the specialists of the magnetic optics of beam channels and for the operational staff. The software is developed by EPICS and it is a graphic interface. When diagnostic system starts up an operator points out IOC and necessary graphic data presentations, so called displays. These displays contain the information about the current beam state. Two of them are presented in Fig. 3. The first picture depicts the beam profiles in the horizontal and vertical planes and some current beam features. The second display gives the operators opportunity to manage diagnostic system running. There are operator and administrator levels of management. The entry to the administrator level is paroled. It is easy to change any display or to create a new one by means of EPICS graphical editor.

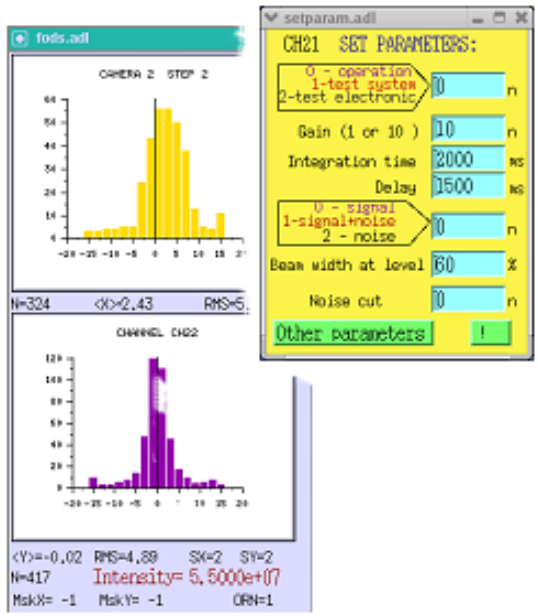

Figure 3: Examples of displays.

UTILITIES

Besides the current data visualization, the users of the diagnostic system do need the digital presentation of information, data transportation, etc. Utility programs are designed for this purpose. Fig. 4 shows the programs and related information flows. The programs are written in C. They take input data by CA or from the current data file. All the programs are running in real time. Below we describe these programs briefly.

INTEN program reads the current intensity value and computes the average and the total value of intensity during the given time period. The results are displayed and written to the file for every accelerator cycle. INTEN is used for the intensimeter calibration [2].

STAB is intended for magnetic optic specialists. It processes data acquired by the profilometer which is near the beamstopper (for OKA setup). STAB calculates the values R, Q, <Y> and RMS, where

$$R = \frac{(Pn_2 + Pn_3)}{(Pn_1 - Pn_4)} \qquad (1)$$

$$Q = \frac{(Pn_1 - Pn_4)}{(Pn_2 + Pn_3)} \qquad (2)$$

<Y> – average beam deviation,
RMS – mean-square deviation from <Y>,
Pn_i – charge of the device channel number n_i.

FRED is used for beam deviation control. It calculates value R:

$$R = \frac{(P_n)}{(Q_m)} \times coeff \qquad (3)$$

where P and Q represent the charges in X- or Y- plane, n and m – profilometers numbers, coeff – user coefficient.

FSEND reads information from the current data file and send it to FODS experimental setup. Among these data are profile measurements, intensity value etc. FSEND is running as program-client that communicates with program-server on experimental setup computer.

NTRIN is similar to FSEND program, but it is for other experimental group.

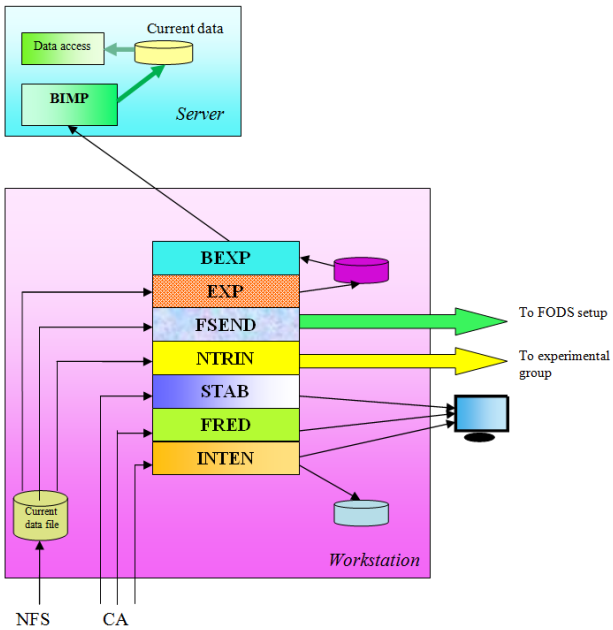

Figure 4: Utility programs.

WEB-SITES IN THE DIAGNOSTIC SYSTEM

The programs described above are for magnetic optics specialists and for physicists of some experimental groups. However, there is information that may be of interest for broader audience. Some web-sites were organized for this purpose.

One of the web-sites is located on the server. It represents the current data about extracted of U-70 beams. EXP program reads the information from the current data file and converts it into graphical form. BEXP program sends it to the server where BIMP receives this information and prepares for the web-site (Fig .4). The data on the site is refreshed in every accelerator cycle.

The acquired in diagnostic system data are archived by means of EPICS tool. The data are moved to archive immediately upon arrival. The archive for the current accelerator run is on every workstation. For access to archive the web-site is organized at every workstation.

CONCLUSION

The developed software provides user interface for different kinds of hardware and software specialists as well as for experimental setup groups. The interface is provided in various ways.

REFERENCES

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[2] N.Ivanova, V.Kovaltsov et al., Profiles and intensities measurements in the diagnostic system of the extracted beams of the U-70 accelerator. This Conference.

[3] http://www.aps.anl.gov/epics, ‘EPICS Home Page’.