SOFTWARE SERVICE FOR CRYOGENIC DATA REPRESENTATION AND ANALYSIS

I.Lobov, A.Lutchev, M.Stolyarov, S.Sukhov
Institute for High Energy Physics, Protvino, Moscow Region, 142281, Russia

Introduction

The Cryogenic and Vacuum System (CVS) for OKA experimental complex requires reliable, fast and convenient program facilities for cryogenic data analysis – temperatures of cryogenic components, liquid helium levels, helium mass flow rates. In order to achieve that goal the software complex was developed for remote analysis and supervision of the CVS parameters with data storing ability. MS SQL-server 2008 was used for data storage and archiving. For displaying the stored data in graphic and table forms, NI Developer Suit Core software package was used. For on-line displaying current CVS parameters the dedicated web-server with xml mimic panel engine was used. The engine was developed on the base of original software created in IHEP.

THE SOFTWARE COMPLEX STRUCTURE

CVS control system has three local control rooms, which corresponds to tree main CVS machinery subsystems: pump machine (PM), bubble cell (BC) and deflector (RF). Data is transferred from control rooms to local CVS server with 2 seconds periodicity, using Data Socket protocol (National Instruments DS technology). The local CVS server supplies DS-clients with current data and then put it into its own local temporary archive.

The main task of the local CVS server is to collect the data from all CVS subsystems, build full package and transfer it to the Central Database using Open Database Connectivity (ODBC) standard. The Central Database locates on the archive server machine (Zeus) and runs MS SQL-server.

Archive server sends the data to mimic panel server (Zerver) as well. The mimic panel server put incoming data into Microsoft Access DB table and the old data is replaced by new one. This DB is used as main data source for mimic panels.

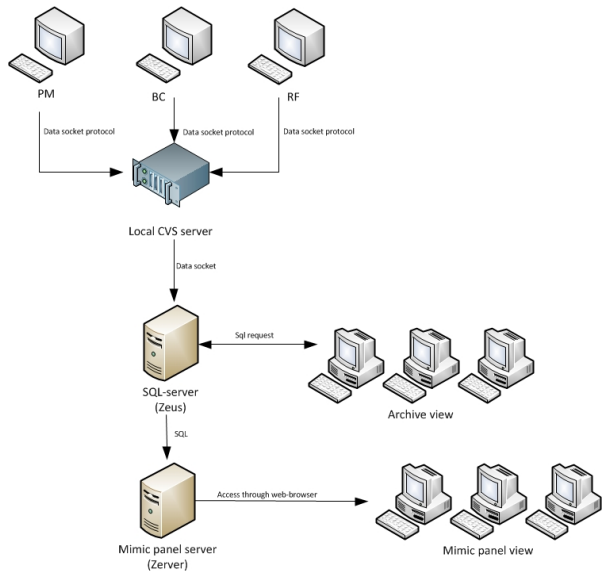

Figure 1: CVS data flow scheme.

SOFTWARE FOR CVS MIMIC PANELS

The CVS mimic panel is a web-page with graphical elements. All this web-pages are located on the mimic panel server (Zerver), and are available to users with any web-browser. The CVS operator has opportunity for supervising any parameter not only at CVS site but using any computer at IHEP site. There is no CVS control ability for mimic panels currently but it is a matter of future development.

The data for mimic panel comes from local CVS server to SQL-server as a string like:

'current data',T1,T2,T3,...Tn

where T - measured value. These original data array is represented on Figure 2.

Parameter	Unit	data	date	time
P1a	Bar	0	09.09.2010	15:31:24
S1	krpm	0	09.09.2010	15:31:24
S2	krpm	0	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
Krusl	mA	0	09.09.2010	15:31:24
DD F1	Bar	0	09.09.2010	15:31:24
P2a	Bar	0	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
P3a	Bar	NaN	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
	-	NaN	09.09.2010	15:31:24
T32	K	287,047	09.09.2010	15:31:24
P31	Bar	0	09.09.2010	15:31:24
P34	Bar	0	09.09.2010	15:31:24
CV2	%	0	09.09.2010	15:31:24
CV3	%	0	09.09.2010	15:31:24
CV4	%	0	09.09.2010	15:31:24
HeUr	%	0	09.09.2010	15:31:24
V VPO	n	10	09.09.2010	15:31:24
v VPO	n/ч	0	09.09.2010	15:31:24
T34	K	287,983	09.09.2010	15:31:24
P32a	Bar	0	09.09.2010	15:31:24
P33	Bar	0	09.09.2010	15:31:24
-	-	0	09.09.2010	15:31:24
P51	Bar	0	09.09.2010	15:31:24
T48	K	223,15	09.09.2010	15:31:24
T41	K	23,2	09.09.2010	15:31:24
P41	Bar	0	09.09.2010	15:31:24
T45	K	23,2	09.09.2010	15:31:24
T44	K	287,047	09.09.2010	15:31:24
T42	K	288,047	09.09.2010	15:31:24
T43	K	287,047	09.09.2010	15:31:24
T46	K	23,2	09.09.2010	15:31:24
4	Om	0	09.09.2010	15:31:24
3	Om	0	09.09.2010	15:31:24
2	Om	0	09.09.2010	15:31:24
1	Om	0	09.09.2010	15:31:24
0	Om	0	09.09.2010	15:31:24
P42	Bar	0	09.09.2010	15:31:24
G1	g/s	0	09.09.2010	15:31:24
G2	g/s	0	09.09.2010	15:31:24
TRF1	K	293	09.09.2010	15:31:24
TRF2	K	0	09.09.2010	15:31:24
HV6		0	09.09.2010	15:31:24

Figure 2: Data from SQL server.

When the data comes onto interactive mimic panel window, it is placed opposite to schematic images of devices in accordance to corresponding CVS parameters. Every 5 seconds the data is renewed and new values are displayed on mimic panel.

The mimic panel for PK subsystem is represented at Figure 3.

SOFTWARE FOR CVS ARCHIVE

To deal with archive data the two types of software was developed. User can choose any of them at his own wish. These are web-pages and LabVIEW programs. Both types of applications give an opportunity to supervising (viewing) data in tabular and graphical styles with data query possibility using different criteria.

Figure 4 represents the appearance of «DB reader» program window, this application designed on the base of LabVIEW. At first the user chooses subsystem, i.e. one of databases (MOE, KVU, U70, ORI), then chooses the "run" by date. Program reads data from DB on the per day basis. Calendar applet will help to choose required date. Using drop-down menu, user can display required parameters in tabular or graphical styles. There is an opportunity to analyze a fragment of data more carefully using loupe facility.

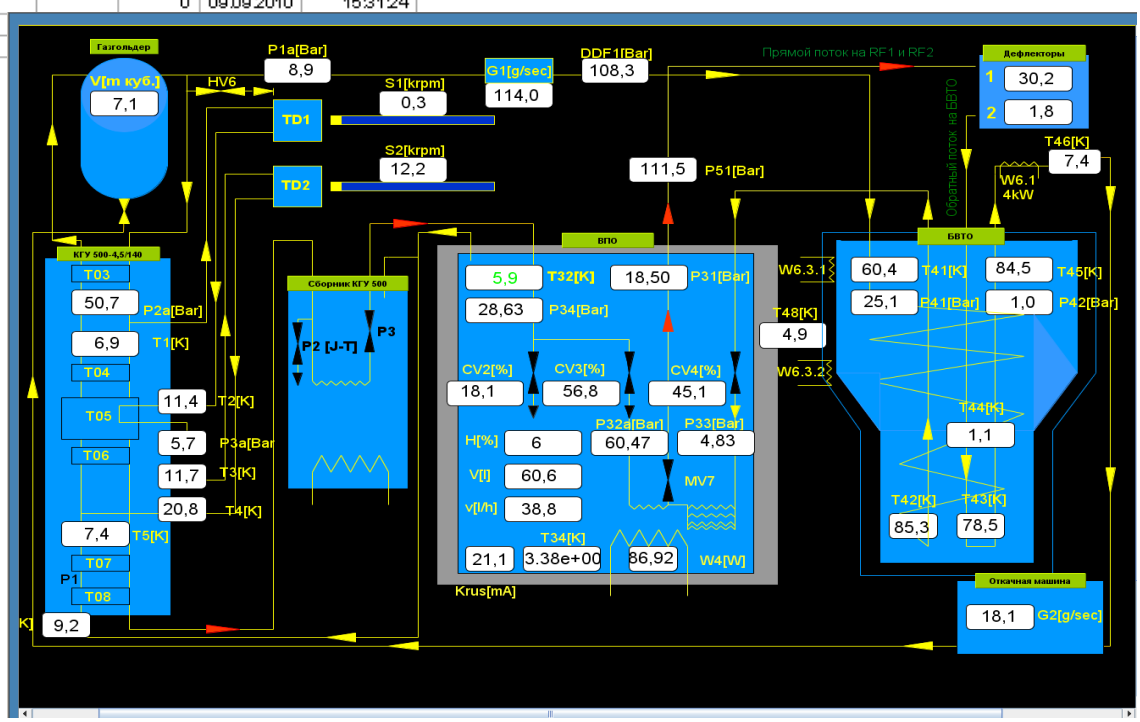

Figure 3: The PK subsystem mimic panel.

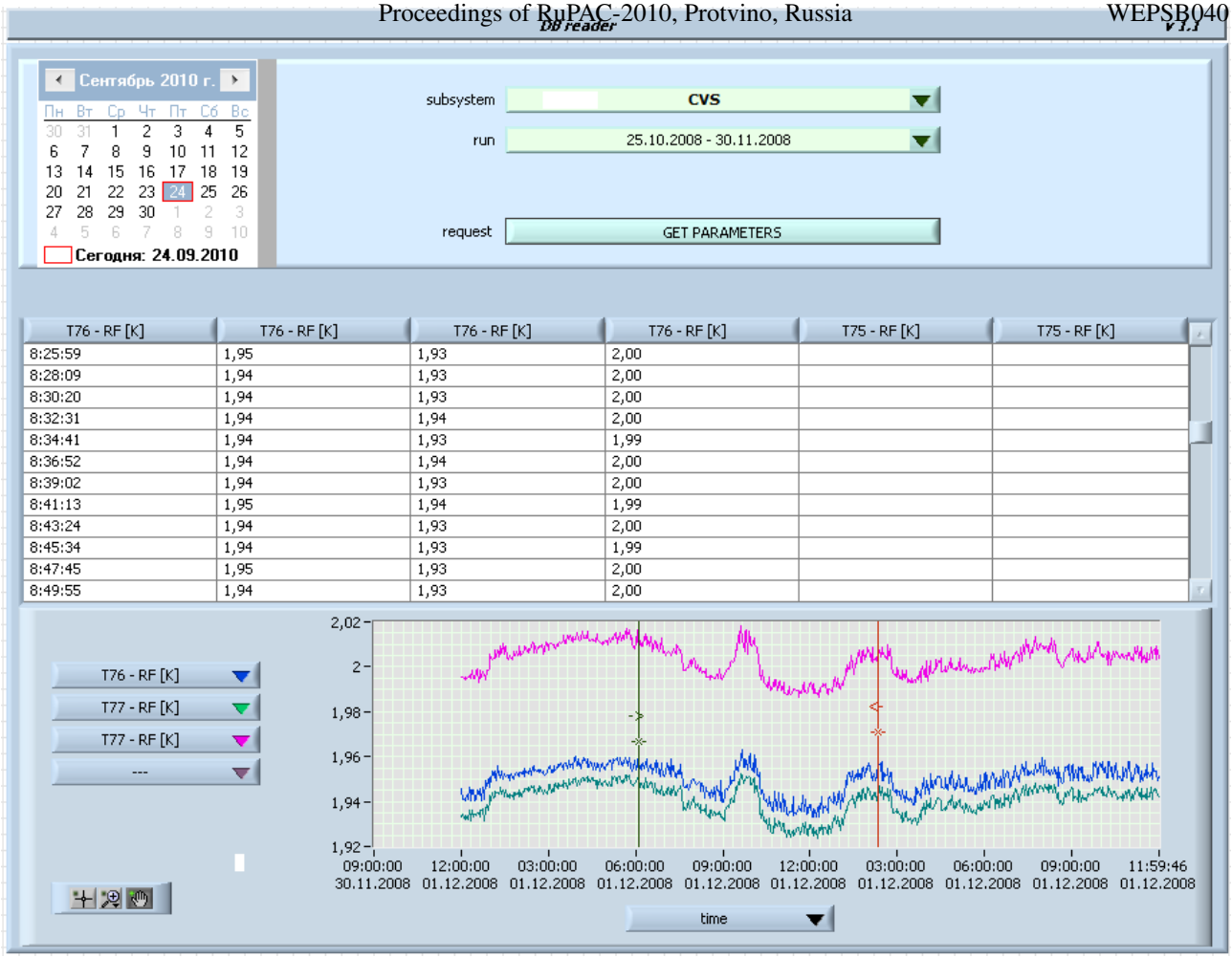

Figure 4: Archive DB reader window (screen copy).

CONCLUSIONS

The software was developed which provides a set of services for data representation and analysis for Cryogenic and Vacuum System personnel:

– viewing current CVS state using web-interface with an extendable mimic panels kit;

– viewing changes in CVS parameters during the required period of time with possibility of statistic analysis.

The software service doesn't depend on CVS parameters assignment, that's why it can be easily extended with new parameters. The service provides an access to archive data from every console inside IHEP local area network.

As a result of work the developing of united IHEP information system has been started.

REFERENCES

[1] V. Alferov, A. Bakay, V. Fedorchenko, N. Ivanova, A. Kholkin, A. Khvorostyanov, S. Klimov, S. Kozub, V. Krendelev, S. Kuznetsov, A. Lukyantsev, V. Milutkin, D. Vasiliev. A Cryo Complex Control System. Proceed of the 2005 Intern. Conf. on Accelerator and Large Experiment Control. Systems. – Geneva, 2005.

[2] Ageev A.I. et al, "Commissioning of Superconducting Radio-frequency Separator Cryogenic System", RUPAC-2006, September 10-14, 2006, Novosibirsk, Russia, http://rupac2006.inp.nsk.su/ready/tufo04.pdf