

DATA ACQUISITION SYSTEM FOR “URAGAN-2M”

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The work is focused on the data acquisition system for collecting of basic parameters of plasma in thermonuclear installation “Uragan-2M” in real time experiment. The “Uragan-2M” thermonuclear installation is electro-technical device used for studies of high-temperature plasma. Data acquisition system provides monitoring, collecting and storing of the incoming information from the diagnostic equipment. Such diagnostic equipment operates in increased electrical, magnetic and high frequency fields. The system also provides remote controlling of diagnostic equipment.
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INTRODUCTION

In order to improve the quality of measuring system and data collection algorithms, the presented data acquisition system was specially designed for “Uragan-2M” installation. The system hardware is based on L-783 and E 20-10 multifunctional cards with Lgraph2 program providing the conversion of input analog signals. The system software was based on object-oriented programming C++Builder 6 which allowed collection of experimental data and their storing on a server. As it was mentioned above, hard operational conditions make some difficulties for data collection. This problem was partly resolved by using a special VOLS-1 optical-fiber line. Such a line provided high accuracy level and noiseproof factor that is very important during operating on long-range distances.

DATA ACQUISITION SYSTEM

Data acquisition system, presented in Fig.1, consists of a server and six client stations, each of which includes universal cards L-Card L-783 (3 MHz, 32 channels, PCI bus) and E20-10 (10 MHz, 4 channels, USB) used for transformation of input-analog signals, their storing and analysis on local operator workplace [1-3].

The CSP on board realizes synchronizing of ADC and DAC in staff mode serves as a buffer and organizes data exchange with PC through dual-port RAM. The channel switching under multi-channel mode of data collection takes place automatically with free channel choosing. The input channel resistance is not less than 1 mOhm.

For measuring the parameters of plasma, the following methods of diagnostics and devices have been used: radiometry, 1mm interferometer, 8-16 mm interferometer, reflectometer, analyzer of the neutral particles of recharge, bolometer, grid analyzer, Langmuir probes, diamagnetic diagnostics, HF and capacitive probes. The sensor of the proper diagnostics to the individual workplace server for strengthening, normalization and protecting from increased electrical, magnetic and high frequency fields of initial signals. The distance between the diagnostic sensors and the control room comprises 100 meters. The signals, coming from sensors, after being reinforced and normalized are sent in a measuring room via optical-fiber communication link VOLS -1.

Such an automatized system allows creating such

functioning under which the users can work independently. Realization of multi-user mode is carried out using the parallel processes with full synchronizing of all client station and server. Parallel processing of several information flows allows to conduct real time controlling of the equipment, viewing data at the sensors with the following storage on a hard disk.

With this automatic system, it is possible to extend the local-area network up to N-go numbers of client stations, and as a result to increase the number of diagnosticians. Each researcher has its own password, after checking the password; server manager gives client a permission to start a desired program.

The structural scheme of the data acquisition system is presented in Fig. 1.

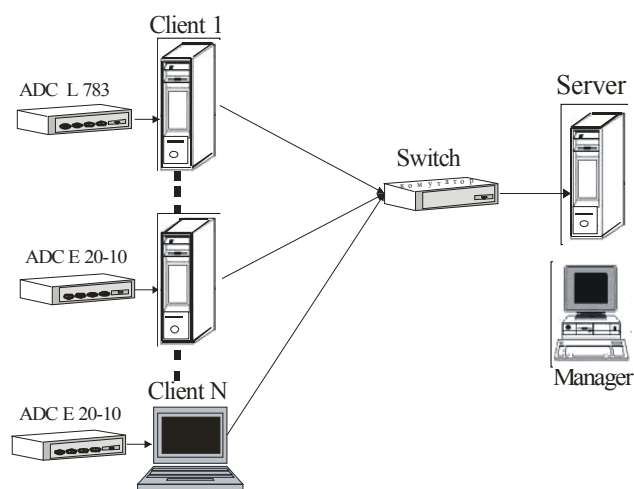


Fig.1. Data acquisition system

Program Client_Prj (Fig.2) with subprograms are used to collect information on users computers with further copying into clients archive directory and then sending the information to server for storage. From one workplace, it is possible to send of up to 2048 MB depending on number of connected channels.

The software modules operated on the base of C++Builder 6 language for IBM RS-compatible personal computers under Windows XP system. Specialized software Windows Server 2003 provides the whole system controlling.

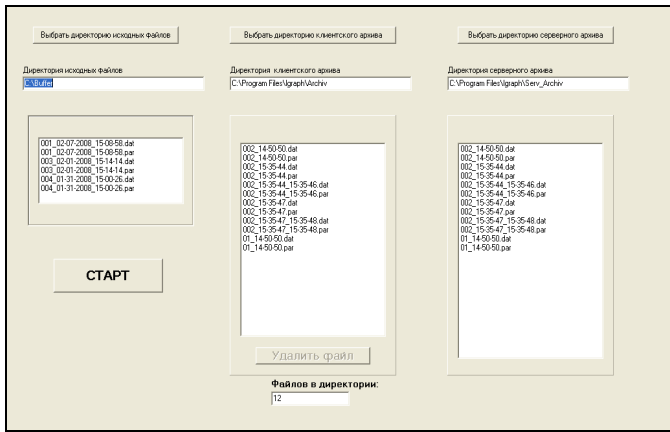


Fig.2. Window of the program Client_Prj

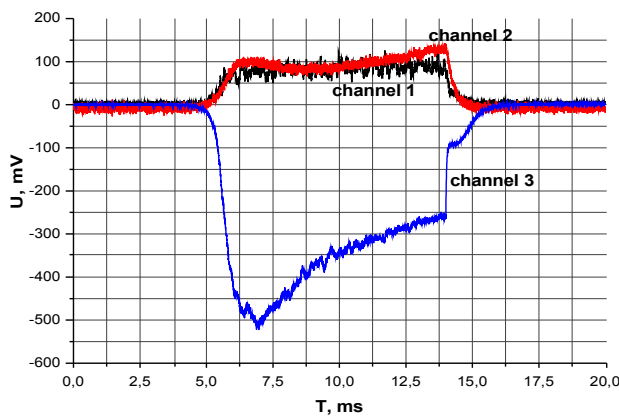


Fig.3. Spectroscopic original signal

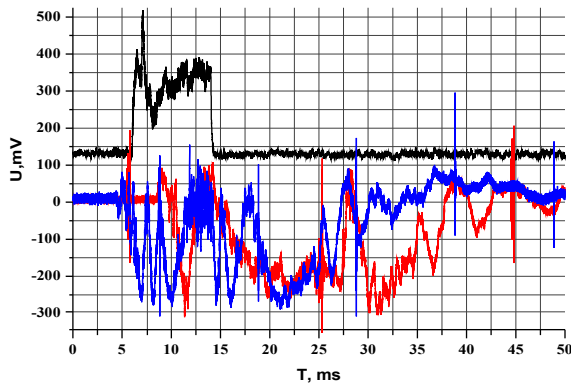


Fig.4. Interferometer original signal (8mm)

CONCLUSIONS

The usage of data acquisition system for "URAGAN-2M" installation has allowed to improve the accuracy of the experimental data collection and also to use parallel processes with full synchronizing of all clients reducing the time necessary for data collection and analysis, provided objectivity and validity of the conducted measurements.

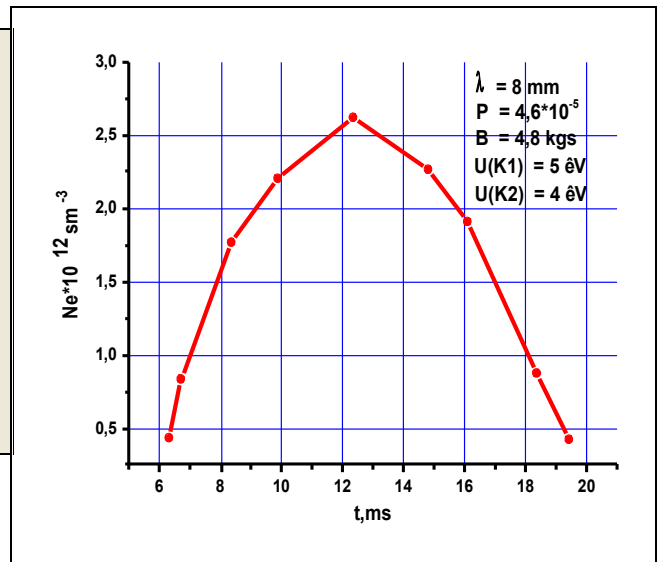


Fig.5. Interferometer signal after processing (8mm)

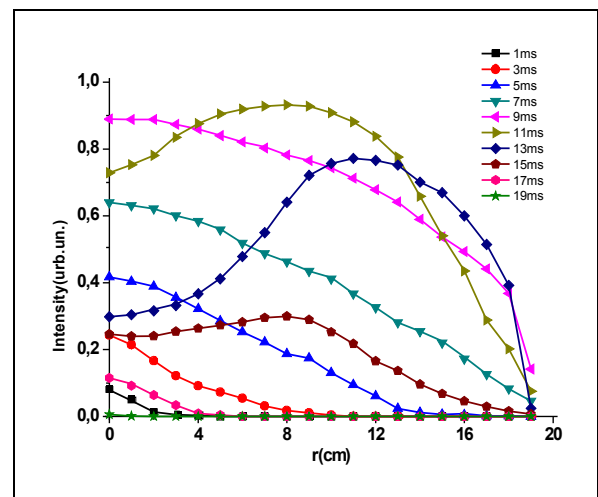


Fig.6. Radial distribution of glow plasma on "U-2M"

The presented system has also allowed to unite various diagnostics in one local-area network by means of TCP/IP protocol, has provided the simultaneous access for 6 users (with possible extension) to diagnostic equipment, data exchange and their protection.

The output system data include collecting and storing, archiving of the information on a server (original signals Fig. 3, Fig. 4); possibility of each diagnostician to build the graphs using various mathematical packages (for instance, OriginPro and Matlab package (processed signals Fig. 5, Fig. 6).

The use of automatic system for data collection on installation "URAGAN-2M" has allowed to gain access to equipment, which is located on determined distance from a researcher providing remote controlling.

The presented software has a module structure based on C++ Builder 6. It presents itself a set of autonomous modules, united by program-traffic manager and general file data. Such a structure of the package provides full division of functions between the modules which is quite

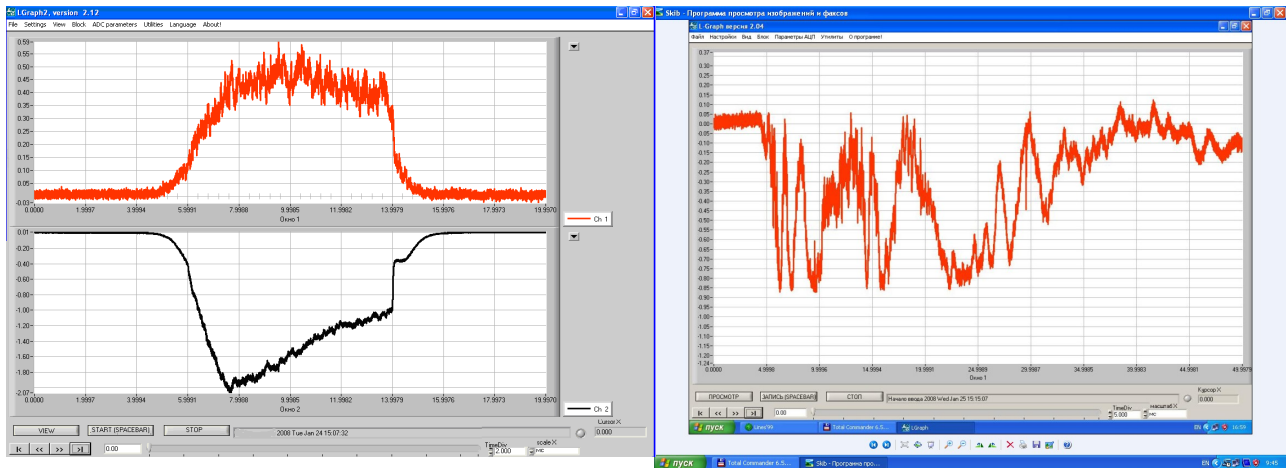


Fig.7. Lgraph2

The program (delivered with equipment Lgraph2) (Fig. 7) registers (views and saves in digital type) analog signals of pre-data onto various inputs.

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АВТОМАТИЗИРОВАННАЯ СИСТЕМА СБОРА ДИАГНОСТИЧЕСКОЙ ИНФОРМАЦИИ НА УСТАНОВКЕ “УРАГАН – 2М”

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Рассмотрена созданная система сбора информации о различных параметрах плазмы в реальном масштабе времени с термоядерной установки “Ураган-2М”. Эта система обеспечивает управление экспериментом, сбор, отображение информации с различных диагностик, архивирование ее на сервере, а также предоставляет пользователям доступ к файлам и физическому оборудованию, которое работает в условиях повышенных электрических, магнитных (≤ 2 Т) и высокочастотных полей (частоты ~ 10 МГц). С помощью данной системы появилась техническая возможность получить доступ к оборудованию, которое расположено на определенном расстоянии от исследователя.

АВТОМАТИЗОВАНА СИСТЕМА ЗБОРУ ДІАГНОСТИЧНОЇ ІНФОРМАЦІЇ НА УСТАНОВЦІ “УРАГАН – 2М”

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Розглянуто створену систему збору інформації про різні параметри плазми в реальному масштабі часу з термоядерної установки “Ураган-2М”. Ця система забезпечує управління експериментом, збір, відображення інформації з різних діагностик, архівація її на сервері, а також надає користувачам доступ до файлів і фізичного устаткування, яке працює в умовах підвищених електричних, магнітних (≤ 2 Т) і високочастотних полів (частоти ~ 10 МГц). За допомогою даної системи з'явилася технічна можливість отримати доступ до устаткування, яке розташоване на певній відстані від дослідника.