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DEVELOPMENT OF A MULTIPLATFORM AND MULTI PARAMETER DATA ACQUISITION INTERFACE

André L. Lapolli, Guilherme S. Zahn

Instituto de Pesquisas Energéticas e Nucleares (IPEN / CNEN - SP)
Av. Professor Lineu Prestes 2242
05508-000 São Paulo, SP
alapolli@ipen.br

ABSTRACT

The process of nuclear data acquisition is evolving continuously. Today data could be digitized from the pre-amplifier or be processed electronically until the digitalization. Besides, some labs have more than one spectrometer and different data acquisition. Depending on the form of the data acquisition, the researcher will have access to the results only after this process. In some cases, to follow up the process of data acquisition, the operator needs specific knowledge of the different data types used by each system. Consequently, the researcher have to gather a lot of skills in different areas other than his' own, interfering in the analysis process and possibly taking away the efficacy of the research.

This work consists in the development of an interface for simultaneous data acquisition of high flexibility and ease of use, which can be programmed by an untrained operator. It is a multiplatform interface and it can make data acquisition in real time. Therefore this system has two major tasks: The human machine interface, using the keyboard, mouse, touchscreen or the distance (by internet), with the definition made by user according to the equipment. The other task is related to the connection with acquisition system or other peripherals. So, it's possible to link one or more systems of different data or process of the acquisition. This system has been developed for different operating systems with concept of using the Object-Oriented Programming (OOP) concept, enabling integrations of new interfaces and acquisition systems without the need for user training. The system is under development and the implantation in the Laboratório de Interação Hiperfinas (LIH) in IPEN, with two different acquisition systems, one using an Ortec® MCA (Model 920-16) and the other a ADC Camberra® ADC (Model 8715) with one National Intruments® (Model 6251) interface, besides several modules of temperature control.

1. INTRODUCTION

The technological developments in recent years allows the reduction of the hardware used to acquire nuclear data by changing several analogical modules to primary pulse digitalization, from the pre-amplifiers (or directly from the photomultiplier), synchronized in time to perform subsequent discrimination. In addition, it is possible to integrate these systems into programmable electronic circuits, substituting the electronic modules for a single chip to perform discriminated data acquisition [1-4].

Depending on the system deployed, there is the need to use large memory space (in the order of terabytes), or the development of low-level language that allows for the optimization of the memory space required. Anyway, it all depends on the needs of the experiment and the philosophy of the laboratory work in question

In general the off-the-shelf data acquisition systems do not present technology for specific applications in nuclear physics, as coincidence measurements, directional angular correlation, perturbed angular correlation, etc., requiring that some improvements are made by professionals with specialized laboratory knowledge of the experimental technique and development of software for both acquisition and data analysis. In addition, depending on the system developed [2] the researcher does not have access to data during its acquisition, precluding any evaluation during the implementation of the measurement, making it impossible to implement adjustments during the process, leading to possible loss of the experiment in question.

On the other hand, for simpler techniques, there is possibility to visualize the data acquisition, as there are commercial software for that purpose. However the recording format of the data is not easily accessible to the user, making it difficult or impossible to carry out data analysis systems developed or acquired by the user.

Therefore, the purpose of this work is to develop a human machine interface that allows the access of acquisition or recorded data in several modes, either on-line or off-line.

Although the purpose of this system is the integration of diverse forms of data acquisition and analysis, the concept of deployment is to be a compact and efficient system, satisfying all the requirements for a lab and having wide remote access by various means, while protecting the essential safety requirements.

The objective of this paper is to present the overall design of the project as well as the initial prototype developed at the Hyperfine Interactions Laboratory (LIH) of IPEN for both data acquisition systems installed in the laboratory, as emphasizing some features in relation to the data acquisition process.

2. THE DESIGN

The general structure of the system being implemented is shown in Figure 1. Despite the size of the proposed work, this consists of an initial part that covers the two systems of data acquisition present at LIH as a prototype for the analysis of users.

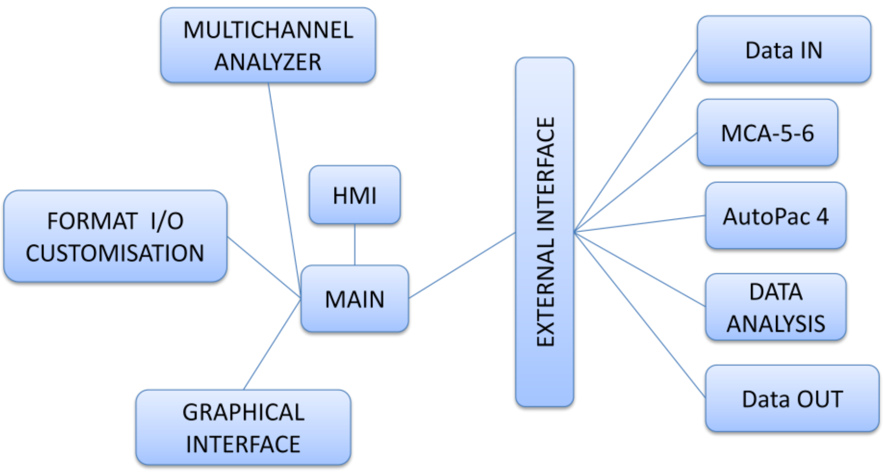

Figure 1: General Structure Design.

The programming languages used for the system is Java, for the main routines and the most general and graphical interface routines, C and Assembly language to access the machine and the various integrated libraries, allowing for further development by the operator of the laboratory in question. The choice of the Java language is due to the fact that it is cross platform and is easily integrated into many operating systems as well as in very different ways.

To satisfy the requirements of operating in different environments, the system consists in a main core, which operates on the server connected directly to the spectrometer and electronic data acquisition, and of secondary interfaces that are connected to browsers, and mobile devices belonging to users. Consequently, during the data acquisition process, the user may access the acquisition system for carrying out various tasks, while restricted by a security requirements hierarchy.

Full integration of the project must meet the following stages of implementation:

I - Development and implementation of the main system (HMI);
II - Integration of acquisition modules;
III - Integration of module for reading data from different formats;
IV - Implementation of interfaces and systems analysis;
V - Integration of various media;
VI - Development of the control system for the users.

As can be seen by the programming languages used, the paradigm of software development is object-oriented programming that allows the integration of different classes as directed by the user.

3. CURRENT STAGE OF DEVELOPMENT

This work constitutes the main core, the Human Machine Interface (which looks as a multichannel), for observation of the acquisition processes online, and of the several interfaces that allow integration of classes as well as the acquisition systems present in LIH. The Interface has been developed to interact with the user via the main menu, some buttons and some shortcut keys to control data acquisition. Some details are shown in Figure 2.

In one of the LIH systems (4 detectors system) the process of data acquisition can be done automatically by AutoPAC-4 (specific in-house developed software). Under these circumstances AutoPac4 can be integrated with this system being customized by the operator. Likewise, the software that operates the 6 detectors system (MCA-5-6.vi) may be included.

In this implementation, according to the user's needs, both systems operating in LIH can be operated, as this interface can operate independently and could be accessed according to user's interest, or can include both systems for managing simultaneous acquisition of two different measurements.

The program allows the generation of base spectra of time or energy, and process or access data stored in ASCII or binary (more compact) formats.

Besides, it is known that the data acquisition of the six detector system performs data recording in queue mode, and the system needs to guarantee that each event is stored properly, even in the event that for some reason the system stops functioning.

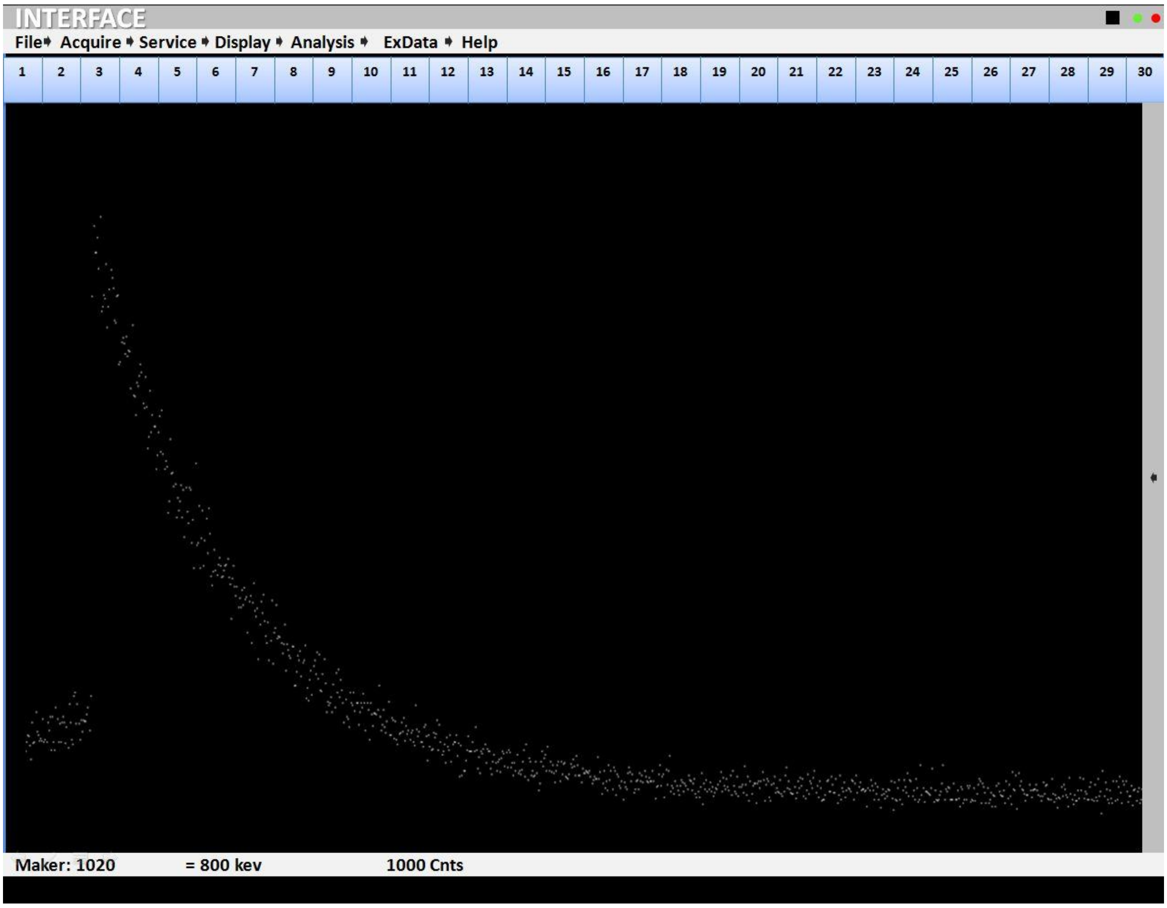

Figure 2: Basic Picture of the Multichannel

4. INTERFACING PROCESSORS

The acquisition interface developed in this work has access to the 4 and 6 detectors systems.

As it is of interest to integrate any acquisition module in the system, various interfaces have been implemented that account for different data acquisition systems.

In addition, the customization interface is also designed for the user to command the integration with the actual data acquisition system.

Also, in caseswhere an implementation performed by the user is not possible, the source program is extensively documented in order to to allow an expert to integrate their own interfaces.

5. CONCLUSIONS

This work is in the initial development phase. The part of the project implemented in LIH is functioning normally.

The next task is the evaluation with systems already deployed in LIH, adaptation to user needs, overhaul of the design and further development.

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