

EPICS-QT BASED GRAPHICAL USER INTERFACE FOR ACCELERATOR CONTROL

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Introduction

Particle accelerators and many industrial complex systems, require a robust and efficient control for its proper operation to achieve required beam quality, safety of its sub component and all working personnel. This control is executed via a graphical user interface through which an operator interacts with the accelerator to achieve the desired state of the machine and its output. Experimental Physics and Industrial Control System (EPICS) is a widely used control system framework in the field of accelerator control. It acts as a middle layer between field devices and graphic user interface used by the

operator. Field devices can also be made EPICS compliant by using EPICS based software in that. On the other hand Qt is a C++ framework which is widely used for creating very professional looking and user friendly graphical component. In Low Energy High Intensity Proton Accelerator (LEHIPA), which is the first stage of the three stage Accelerator Driven System(ADS) program taken by Bhabha Atomic Research Centre (BARC)[1], it is decided that EPICS will be used for controlling the accelerator and Qt will be used for developing the various Graphic User Interface (GUI) for operation and diagnostics.

This paper discuss the work carried out to achieve this goal in LEHIPA.



Fig. 1. Screen shot of the main control window.

EPICS

EPICS is a control system framework , developed mainly to cater the control system needs of the particle accelerator . It is open source SCADA system and very well supported by the community. Its open source nature helps to customize the EPICS for any system by changing the already existing source code[1]. EPICS is networked in architecture. When used as middleware , it acts as the client for field device and server for the GUI or Human Machine Interface(HMI). If a field device is EPICS compliant then , GUI or HMI can directly communicate with the field device. GUI client can get data by accessing the Process Variable(PV) name. EPICS ensure no single point of failure due to a nameserver and fixed addresses[3]. Another very nice feature of EPICS is that it scales very easily with the growth of the plant or system. More details on EPICS can be obtained here[3].

In LEHIPA , separate EPICS IO controllers are in operation for ion source control , low energy beam tube components, vacuum system and timing system. Total number of process variables(PV) handled by these IOC controllers are nearly hundred.

Qt and EPICS Qt

Qt is a cross platform C++ framework mainly used to develop professional quality graphics[5]. Its cross platform nature ensure that a well tested program on one platform just need to be recompiled in other platform to make it up and running. Qt can be obtained under the open source licence. Qt is capable to achieve everything what C++ can achieve , often with much more convenience .

Main focus of the EPICS development was to achieve networked control operation. Traditional Graphical User Interface(GUI) support for EPICS was somewhat unsatisfactory. EPICS Qt filled that space by integrating EPICS with the Qt. It is developed by the Anthony Owen, Andrew Rhyder, Glenn Jackson and team from Australian Synchrotron Facility. More details on EPICS Qt is available here [4].

EPICS Qt widgets (a graphical entity) are just like Qt widgets which can be dragged

and dropped. But EPICS Qt widgets are EPICS aware , that is , if a process variable name is supplied to the widget , then it communicates command and readbacks with the EPICS. Combining the GUI power of Qt , many graphical needs for operator interface is achieved natively in the EPICS Qt widget which reduce the GUI developers responsibility hugely, thereby make the design, prototype development and testing fast and efficient.

Conclusion

EPICS is the control system framework of the LEHIPA. EPICS Qt is used to make operator interface of the LEHIPA(Fig-1).

In LEHIPA, EPICS Qt is not always used directly. In many cases widgets developed specifically for LEHIPA used the underlying feature of the EPICS Qt to communicate with the the EPICS. In figure-1 , meters and sliders are EPICS Qt widgets but they acted as the sub component of the GUI design requirement in LEHIPA operator interface which is carried out in Qt. In DO columns in figure-1 , EPICS Qt widget is wrapped by the the custom widgets developed for the LEHIPA operator interface. Here functionality of EPICS Qt widget is kept intact but look, feel and addition graphics feature is added .

The LEHIPA operator interface is working very satisfactorily for last six months and played important role in recent beam trials through two segment RFQ of the LEHIPA[1]. Improvements on various front in operator interface is continuing taking feedbacks from the various operators.

Apart from LEHIPA , EPICS Qt is also used in BARC Pelletron LINAC control system.

References

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