Abstract

The RAON [1] is a new heavy ion accelerator under construction in South Korea, which is to produce a variety of stable ion and rare isotope beams to support various researches for the basic science and applied research applications. To produce the isotopes to fulfill the requirements we have planned the several modes of operation scheme which require fine-tuned synchronous controls, asynchronous controls, or both among the accelerator complexes. The basic idea and development progress of the control system as well as the future plan are presented.

The RAON

The RAON consists of both the 400 kW In-flight Fragmentation (IF) facility and the 70 kW Isootope Separator On-Line (ISOL) facility. The IF accelerator system is designed to produce stable ion beams with maximum energy up to 200 MeV/u for uranium (600 MeV for proton). The ISOL accelerator system delivers rare isotope beams with maximum energy of 18.5 MeV/u. The two different systems should be operated both independently and concurrently with the user requirements, which is the unique feature of RAON accelerator system.

Requirements

- Integration of different subsystems: RF system, beam diagnostics, power supply, vacuum control, beam line control, and machine protection
- An exclusive operation two and more accelerator systems for two facilities: In-flight Fragmentations (IF) and Isotope Separator On-Line (ISOL)
- C.W. and pulsed beam operation
- Beam off latency < 50 usec
- Automation of most of subsystems and manual control of beam line elements
- EPICS integration

Architecture

- Tightly integrated with the EPICS
- Using two network grid: Timing event network and EPICS channel access (CA) network
- The main building block is the control unit -> for simplified and fast integration
- CA network is linked to the database, HLA and EPICS control interface for users

System Standards

- EPICS, All and Sundry systems :)
- Debian Linux for OS, VxWorks for RTOS
- PostgreSQL for accelerator configuration
- SVN or Git for sources & documents version control
- International / market standard hardwares
- 10 GB Ethernet backbone (1 GB for Usernet)

The Control Unit

The control unit for timing system

- Timing system requires:
  - low latency, jitter in ns level
  - deterministic operation
  - high speed signal processing
  - identifying a bunch.
- We will use:
  - MRF EVG/EVR hardwares [3]
  - Libera BPM products [4]
- We are considering to:
  - use White Rabbit for timing system [5].
  - develop homemade BPM with domestic company.

Timing system & Machine protection

- Interlock controller : use PLC (ST, AB, LSIS [2])
- Integrated with timing system using FPGA based controller.
- Still need idea for more complicated system.

Database

- Data Archiving : PV, HW/SW configuration, A/D signals, Logging,
- Documentation and version control,
- DAQ and pre-processing : BPM and RF related data.
- Use open-source based programs : Channel Archiver with PostgreSQL.
- Develop an archiving framework dedicated to RAON.

User Interface / High Level Application

- Intuitive, Comprehensive.
- Applying existing EPICS CA Clients : EDM, MEDM, StripTool, CSS.
- Developing an UUI environment dedicated to RAON using existing tools :
  - C/C++ : EPICS Qt 
  - JAVA : JCA
  - Python : Cotthead
  - LabView : CalLab
- SNS, CSNS, ESS, GANIL, TRIUMF, and FRIB use plan to use the XAL [6].
- Consider to use XAL and join OpenXAL [7] project.

Status

The vacuum control system

- A testbed for the vacuum control system is being developed with a domestic company.
- The vacuum system controlled by PLC will be integrated with EPICS and be used for the test facilities.

Naming convention

- Important for the system integration
- Should be comprehensive to user and maintain.
A primitive naming convention study is done and shown as following: DODDIII-SSSS TTTT XXXX.
where DODDIII is a device identifier, SSSSS is a system name, TTTT is the signal name followed by the EPICS DB convention, and XXXX is the signal suffix. This naming convention is not fixed but being improved upon the user's request.

Summary & Outlook

The goal of RAON control system is to provide good environment to operate the IF and ISOL accelerator systems. The notion of system architecture and the control unit are being developed. The development of a testbed for vacuum control system and a prototype of timing system together with MPS are also proceeding. Since a test facility for injector and linear accelerator is planned to be finished in next year, the two prototyping of control and timing system will be tested and evaluated. In addition the engineering design of central control system will start soon.

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References