Upgrade to the EPICS Control System at the Argonne Wakefield Accelerator Test Facility

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Argonne Wakefield Accelerator Facility

AWA

The Argonne Wakefield Accelerator (AWA) is a premier electron accelerator with the world's highest bunch charge to carry out fundamental accelerator research with an emphasis on wakefield acceleration.

AWA Facility

About AWA

Capabilities

AWA Research Area of Focus

- **Advanced Structure Development**
- **Beam Driven Radiation Source**
- **RF Breakdown Studies**
- **Collinear Wakefield Acceleration**
- **Dielectric and Metallic Two-Beam Acceleration**
- **Electron Sources Research**
- **Phase Space Manipulation**
- **Diagnostics**

AWA Control and Data Acquisition System

- **Operating System: Windows 10**
- **IDE: Microsoft Visual Studio**
- **Language: C++**
- **GUI are programmed using MFC (Microsoft Foundation Class)**
- **Control hardware are mainly interfaced with PXI, USB and RS232**
- **Web based user interfaces are added in for recently added hardware**

AWA Control and DA System EPICS Upgrade Motivations

- **The current system is becoming an obstacle for collaborations and future facility growing.**
- **Upgrade into EPICS will make it easier for AWA to collaborate with other facilities.**
- **Upgrade into EPICS will allow AWA to carry out AI/ML project at higher efficiency and thus be more productive**

Plan for the Upgrade

- **For phase 1 of the upgrade, we will focus on provide EPICS support on top of existing AWA control system. The goal is to allow both EPICS based control system and the existing control system to function simultaneously so that we can minimize the impact to the operation of AWA facility while operators can get themselves familiarized with the EPICS based control system.**
- **For phase 2 of the upgrade, we will be phasing out of the non-EPICS control system and transform AWA control and Data acquisition system into EPICS only control and DA system.**

Current status on the EPICS upgrade

- **EPICS IOCs have been integrated into most of our programs:**
  - AWAHWI (A program directly controls PXI DACs, PXI ADCs, USB DIOs and PXI DIOs.), hardware controlled by this program are exposed to EPICS CA/PV clients.
  - AWASMC, a program which controls PXI stepper controllers and few Si5580 stepper drivers. With an EPICS IOC integrated in, phase shifters and motorized actuator on AWA beamline is now exposed to EPICS system.
  - Bira power supply control programs. An EPICS IOC has been integrated into the Bira power supply control program running inside Bira controller modules.
  - AWA Modulator#5 interlock monitor. This program is running in raspberry pi installed inside modulator#5 cabinet to monitor the interlock signals.
  - AWA LLRF Monitor program. With an EPICS IOC integrated into this program, AI/ML projects can now use take advantage of EPICS to gain control and readings of AWA LLRF settings without the need to program a special interface.
  - AWA ICT Monitor. An EPICS IOC has been integrated to allow AI/ML projects to gain access to beam charge information without programming special interface.
  - AWA Laser Position Monitor. A recently added program to monitor the position of laser and profile on virtual target. An EPICS IOC is built in to expose the results to EPICS clients.
  - AWABPPM program. An EPICS IOC has been built into this program to expose the measurement results on the beam phase and position information at the end of linac.
- **Currently, all magnet controls, RF controls and air actuators on AWA beamlines are exposed to EPICS client.**
- **There are still some programs that we haven't touch and will be taking care of when needed**
- **The upgrade won't be complete until all hardware are exposed to EPICS clients, an archiver has been setup, an alarm server has been setup and EPICS operator interface GUI has been configured.**


Thank You