Development of EPICS Accelerator Control System for the IAC 44 MeV Linac

Idaho State University

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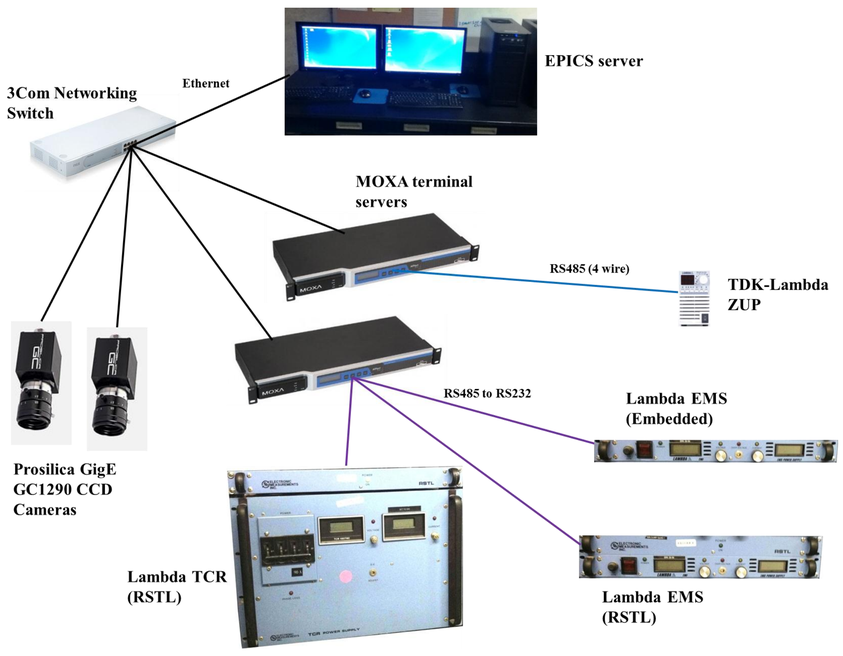
Abstract

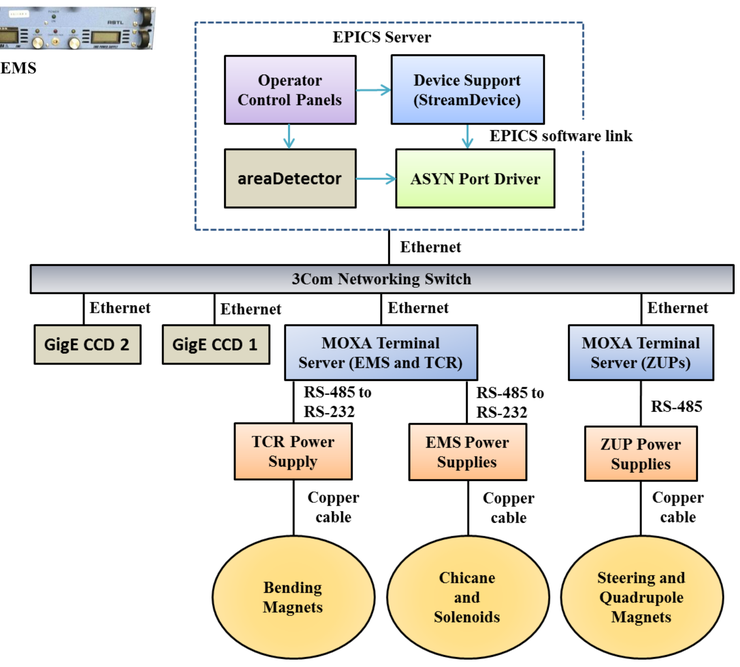
The Idaho Accelerator Center (IAC) of Idaho State University (ISU) has been operating nine low energy accelerators . Since the beginning of the fall semester of 2012, the ISU Advanced Accelerator and Ultrafast Beam Lab (AAUL) group has been working to develop a new EPICS system to control 51 magnet power supplies and 2 GigE CCD cameras for the IAC 44 MeV L-band linac. It's original control system was fully analog, which had several limitations in reproducibility and stability during the accelerator operation. This poster and corresponding paper provide details of the group's team effort and accomplishments in developing a new EPICS system to control GigE CCD cameras, and several magnet power supplies including: Lambda EMS, Lambda TCR, and TDK-Lambda ZUP power supplies . In addition, other useful tools such as the save and restore function used for this linac are described.

Upgrade of 44 MeV Linac Control System



The 44 MeV hardware controlled by EPICS consists of:

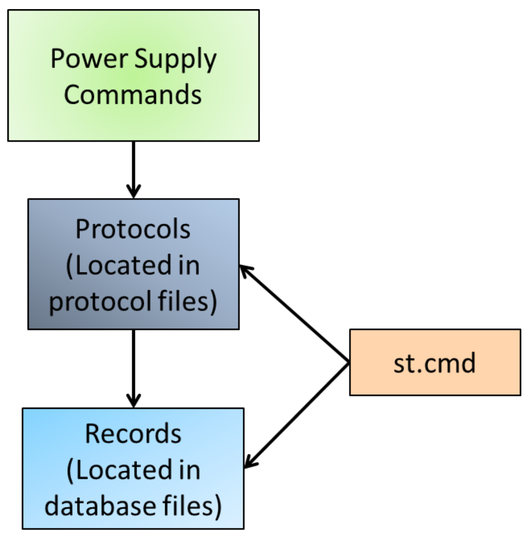
- **32 TDK-Lambda ZUP power supplies**
- **15 Lambda EMS power supplies with embedded IEEE 488 controllers**
- **3 Lambda EMS power supplies with external RSTL controllers**
- **1 Lambda TCR power supply with external RSTL controller**
- **2 Prosilica GC1290 GigE CCD cameras**



To begin communication with the power supplies and cameras, the synApps software package including ASYN, StreamDevice, and areaDetector was installed.

areaDetector is a pre-made device support application that is specific to devices like the CCD camera.

Creating PV's



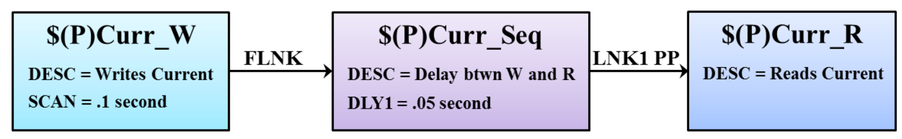
StreamDevice uses protocols to translate simple commands into a format that EPICS records use.

This is the way commands in the users manual are converted to records.

Then the executable st.cmd file loads all of the records, associates them to an IP address and port, and then connects to the device.

This is the basic way commands, for devices which communicate by sending and receiving strings, are transformed into PV's!

Structure of Database



1. **Current write record processes**
2. **Current sequence record processes**
3. **Sequence record causes a delay for 0.05 seconds**
4. **Current is read from the power supply**

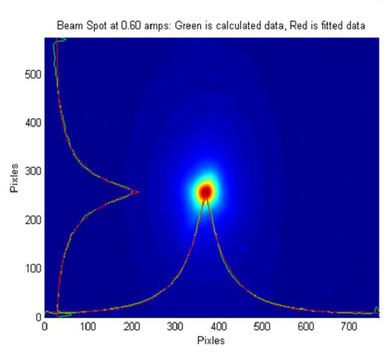
EPICS Control System for Prosilica GC1290 CCD Camera

To control a Prosilica GC1290 GigE CCD camera with EPICS, all that one needs to do is:

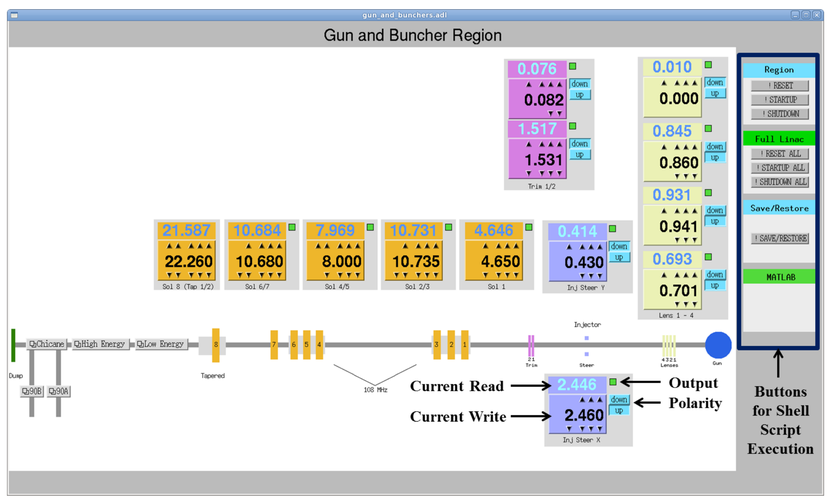
- **Determine camera settings to get an image**
- **Install synApps with areaDetector**
- **Place static IP address of camera in the st.cmd file**

The picture to the right, is a false result from the automatic emittance measurement tool developed by Chris Eckman at Idaho State University.

This emittance measurement tool was developed using the EPICS extension MATLAB Channel Access (MCA) in conjunction with areaDetector.



MEDM Operator Interface



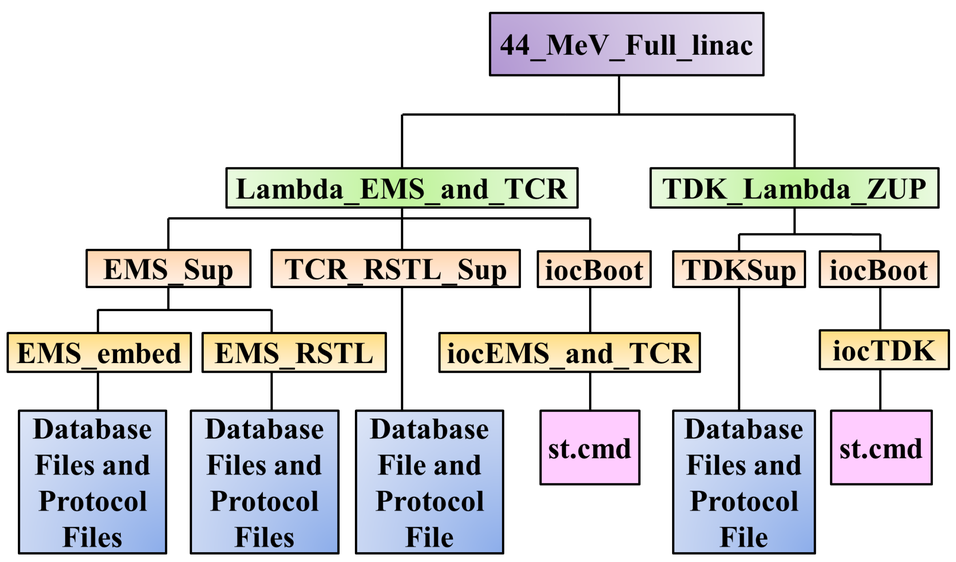
One of the OPIs created to control the power supplies for the 44 MeV is shown above. The current in this figure is controlled with a controller widget which has arrows. This display also runs several scripts to: turn on the output of the power supplies, reset the current value to zero, save and shutdown the power supplies, and launch a save/restore GUI with the program Back Up and Restore Tool (BURT) for manual save/restore.

Application Structure for Power Supplies

The application structure for the 44 MeV linac is shown on the right.

Two separate applications were made to separate the power supplies by the terminal server they are connected to.

In this way all PVs for the 44 MeV linac were associated with power supplies



Summary

The goal of the 44 MeV linac control system upgrade was to create an EPICS control system for a set of TDK-Lambda ZUP, Lambda EMS of mixed control type, a TCR power supply, and Prosilica GigE CCD cameras. Using this upgraded EPICS accelerator control system, the operators have seen improvements in the efficiency of the linac including: stability in magnet power supply current values that don't fluctuate with temperature or humidity, and the ability to save/restore the values of the power supplies reduces the time to tune the 44 MeV magnets.