SLAC Klystron Test Lab Bake Station Upgrade

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How the Bake Station Oven Works:

1. *Klystron (or other large vacuum vessel) is installed on the oven stand. In the case of a klystron, the internal filament is connected to an external power supply.*
2. *Object to be baked is covered by the oven lid, sealed, and vacuum pumps turned on to evacuate chamber.*
3. *Once the internal pressure of the oven is low enough, heaters wrapped around the chamber are turned on.*
4. *Heat causes the oils and other undesirable substances to evaporate off of the object being baked after which the vacuum pumps remove it from the chamber.*
   - *For klystrons, the filament is also energized to excite contaminants inside the cavities.*
5. *A feedback looks at vacuum pressure and temperature to maintain heater voltages such that contaminants are thoroughly cleaned without damaging the oven or the object being baked.*

Bake Station 5 Oven with lid removed. Object mounted in center is a klystron preparing to be baked out.

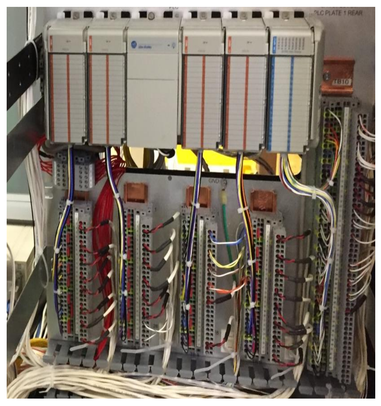
Abstract

The Klystron Bake Station at SLAC is a facility for baking out klystrons (high power RF amplifiers) among other equipment in preparation for installation in the linac. The scope of this project was to upgrade the 30 year old controls (based on VMS and CAMAC) to utilize PLC automation and an EPICS user interface.

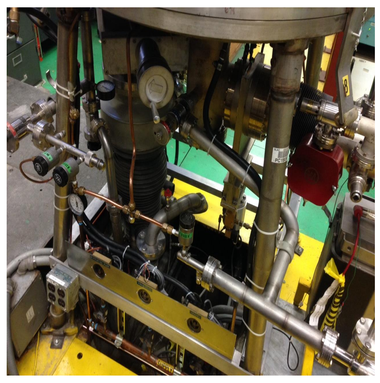
The new system allows for flexible configuration of the bake out schedule which can be saved to files or edited real time both through an EPICS soft IOC as well as a local touch panel HMI. Other improvements include active long term archiving of all data, COTS hardware (replacing custom-built CAMAC cards), email notification of fault states, and graphical user interfaces (old system was command line only). This poster discusses the improvements made and problems encountered in performing the upgrade.

The Hardware

- Allen-Bradley CompactLogix PLC
  - 1769-L33ER Processor
  - 15” PanelView touch panel
- Granville Phillips GP-307 Gauge Controller
- Gamma MPCe Ion Pump Controller
- Eurotherm Epower power controller



CompactLogix PLC configuration and terminal wiring.

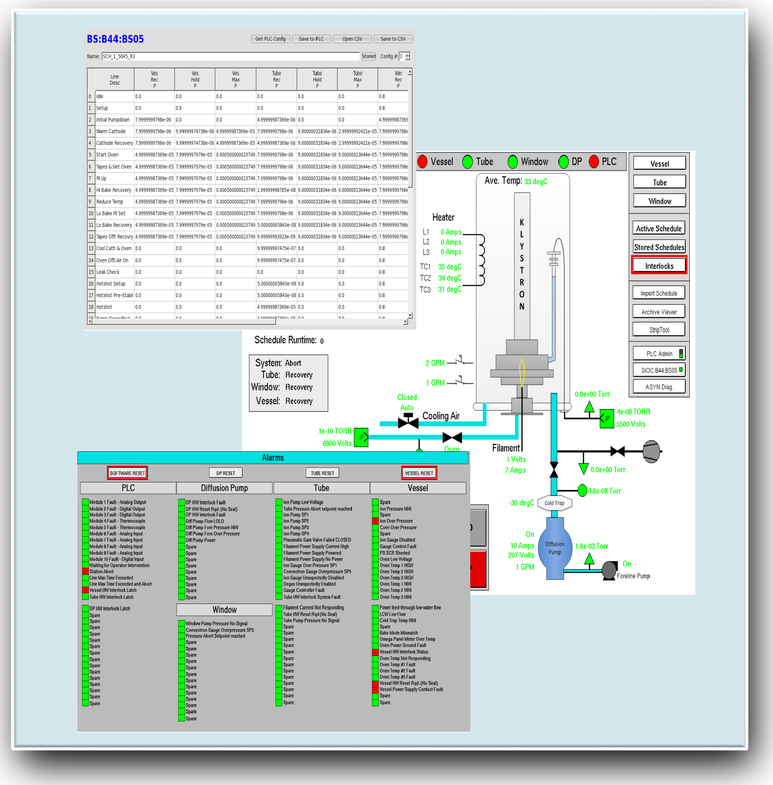


Eurotherm EPower controller for controlling power to oven heater.

Ion Pumps and gauges used to pump out and monitor the vacuum in the oven vessel.

The Software

- Integrated with SLAC’s EPICS based distributed control and data archiving system
- Standard EPICS modules:
  - EtherIP to connect to PLC via Ethernet
  - Asyn and StreamDevice for RS232 connection to gauge and pump controllers
- Developed PyQt4 GUI for easy configuration management

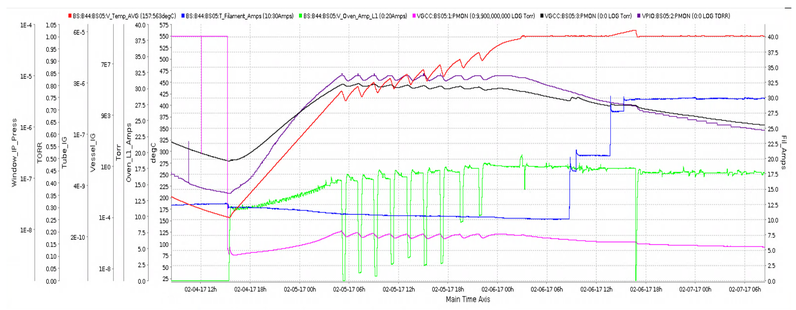


Results

The first station (Station 5) upgraded came online in November 2016 and two more stations are planned to follow this year. Station 5 has been used to successfully bake out several klystrons under feedback control to date.

Before upgrade

After upgrade



Data showing successful feedback control of oven heater during klystron bake out.

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