**Introduction:** The Focus of this summer’s project is to create an automated Bake-Out Assembly for Cornell’s High Energy Synchrotron Source (CHESS).

A Bake-Out is a process in which an object that will be placed under Ultra High Vacuum is “cooked” up to very high temperatures (ranging from 140-400 degrees Celsius) for an extended period of time.

This process is necessary to remove chemicals and particles on the molecular level. If excess particles are present in a part, it will not pump down to a sufficient pressure. Therefore, a Bake-Out is necessary for all ultra high vacuum parts in a particle accelerator.

**Bake-Out Process:**

1. **Part is pumped down to Ultra High Vacuum** using roughing and turbo pumps and an RGA (Residual Gas Analysis) is performed along with a leak check.
2. **Thermocouples are placed on each different heat zone and part is then wrapped in aluminum foil, heat tapes (which coincide with each thermocouple), and then wrapped in more aluminum foil.**
3. Heat tapes and heated nitrogen gas heat part up to desired temperature, after which a “soaking period” commences.
4. **Part is cooled down to room temperature and another RGA scan is performed to compared to the first. A “leak check” is also performed with Helium gas.**

**Conclusion:**

This process is necessary to remove chemicals and particles on the molecular level. If excess particles are present in a part, it will not pump down to a sufficient pressure. Therefore, a Bake-Out is necessary for all ultra high vacuum parts in a particle accelerator.

**Desired Test Results:**

- Original Prototype Test Results
- Basic Control Schematic
- Prototype testing is periodically performed on assembly and iTools logic program
- Desired Test Results
- Inventor Prototype
- Serial Converter converts Ethernet communication to Serial and vice versa.
- Ethernet Box used to connect ABOA and other devices to local servers, internet, and one another via Ethernet cables
- Logic Control mounted to Din-Rail/Panel used to compare signals from thermocouples and switches power to Solid State Relays
- Cooling Fan used to vent heat from Solid State Relays and other components
- 10 Amp Fuse used to protect Logic Control from circuit shorts
- 16 Thermocouple Ports allow for multiple thermocouples to switch power to Logic Control
- 10 Power-outs 120V to heat tapes to heat specimen
- 10 GFCI Breakers safely stop shorts in circuit and allow for a quick shut-down of ABOA.
- 3 Power-ins receive 120V power from wall source
- Gauge Controller measures pressure and sends signal to temperature controller