

Commissioning User-Ready Sample Environments at ORNL

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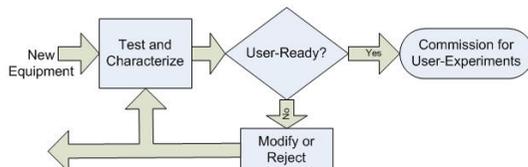
The Spallation Neutron Source (1) and High Flux Isotope Reactor (2) at Oak Ridge National Laboratory, Oak Ridge, Tennessee



Introduction

The demand for sample environment equipment and user-support will explode in the coming years at Oak Ridge National Lab (ORNL). Major facility upgrades are underway at the High Flux Isotope Reactor (HFIR) and the Spallation Neutron Source (SNS) will begin operation in 2006. Scientific and technical teams from both facilities are preparing for the coming onslaught. Here we describe one aspect of this effort: a technical collaboration working to develop efficient procedures for characterizing and preparing new equipment for user operations.

The Path to Commissioning



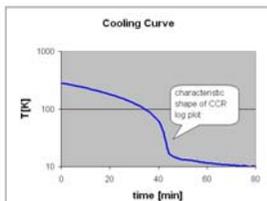
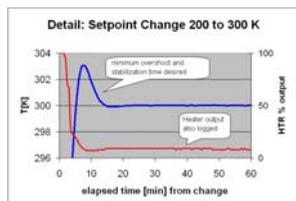
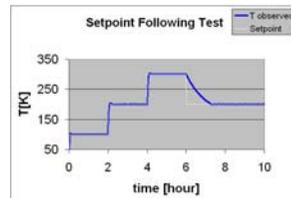
What is "User-Ready"?

- Tough enough to withstand constant cycling, moving & reconfiguration
- Fast, accurate, and intuitive control
- Hassle-free operation (*we're not there yet!*)

Offline Test Methods for Temperature Environments



Using portable data acquisition hardware and rapid software development tools such as LabVIEW™, we have run a variety of tests including the simple examples shown here. We are developing better tests, including multi-sensor tests which give temperature gradient information, and direct-drive heater tests which focus on the fundamental thermal characteristics, instead of temperature controller PID settings. Even more importantly, we are streamlining the testing process to make it simple and automatic.



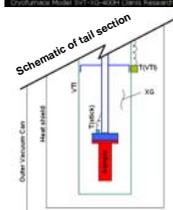
Cryofurnace Example

Users often want to cross the line from cryogenic to high temperatures in a single experiment. With this in mind, one of the first sample environments purchased by the SNS is a cryofurnace which now covers 2 to 600 K. We have put it to the test at the HFIR, working out several bugs along the way. It was recently commissioned for user experiments – with very promising results!



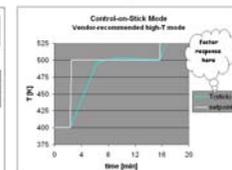
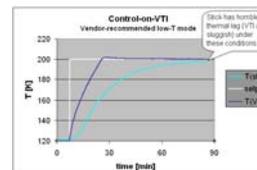
Basic Description:

- Top loading configuration
 - Samples are attached to a stick and inserted into a variable temperature insert (VTI) (*aka* sample well)
- Cooling via liquid helium flow through heat exchanger surrounding VTI
- Heating via resistive elements (~50 Ohm) on stick and VTI
 - Two control modes: control-on-stick or VTI
- VTI charged with static "exchange gas" (XG) or evacuated



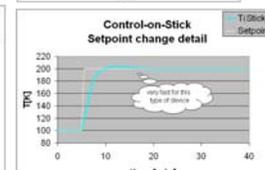
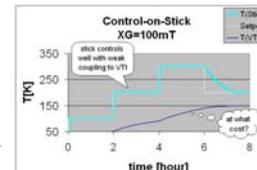
First Round Test Results

Slow thermal response at 300K and below. Let's try varying the XG pressure and/or control-on-stick mode for all temperatures.



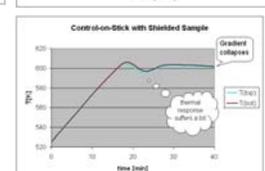
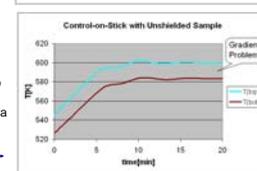
2nd Round

We found conditions for fast and stable control of stick temperature, but became concerned about temperature gradients.



3rd Round

We added extra sensors to the stick for gradient measurements, and made a heat shield for gradient reduction.



This is not a Test!

The cryofurnace was commissioned in March 2004 and used for a challenging experiment requiring very stable and uniform temperature control at dozens of points above and below room temperature. Results are shown at right.



SNS Cryofurnace Commissioning at the HFIR

