

CCR-03 Fact Sheet



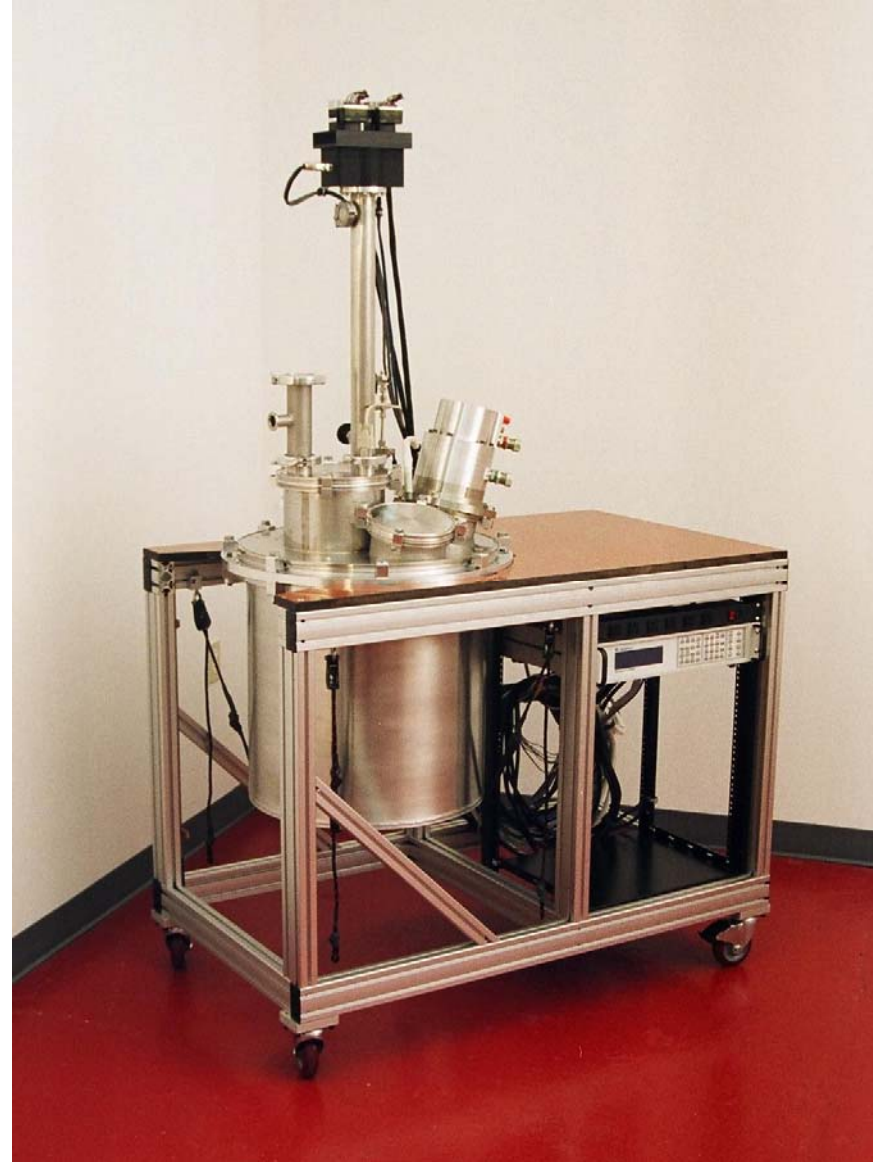
**“Fast Exchange Refrigerator for
Neutron Science”**

FERNS

**ORNL Neutron Sciences
Sample Environment Group**

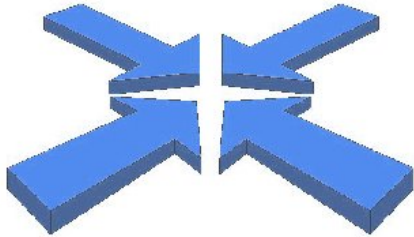
Overview

- **Sample exchange, cooling, and control from 6 K to 300 K**
- **Closed cycle refrigerator cooling engine**
- **24-samples per run**
 - **Modular design can be extended**
- **Quick-seal sample cans and “canning station”**



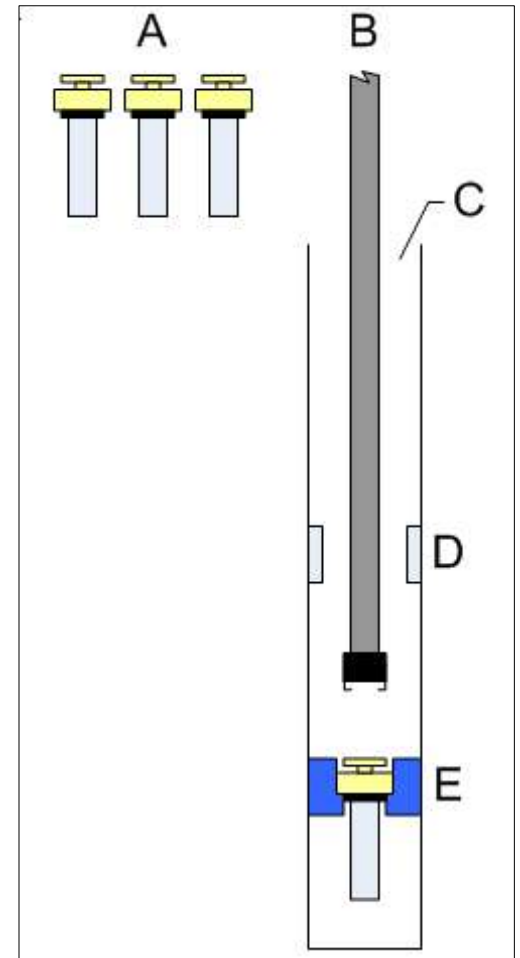
Background

- Developed through a U.S. Department of Energy grant
 - Small Business Innovation Research
 - Application No. 72699B03-II
- Now a commercial product
 - www.matsdev.com



Materials Development, Inc. MDI

Rix *et. al.*, Review of Scientific Instruments,
vol. 78 (2007)



Design Schematic

- A. Sample Carousel
- B. Motorized stick
- C. Sample Well
- D. 1st Stage / pre-cool zone
- E. Landing pad

Development Teams

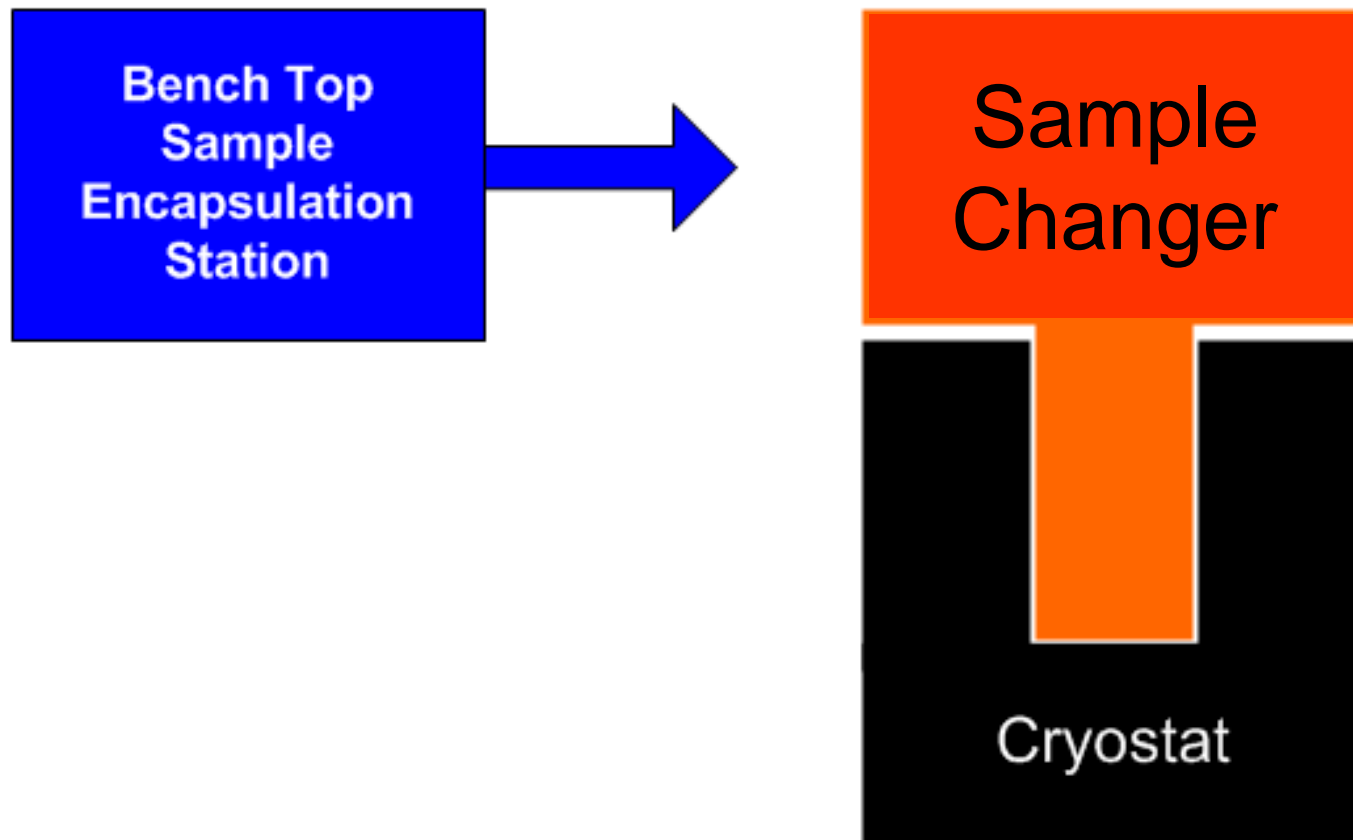
SNS Sample Environment



- Small Business
 - R. Weber and J. Rix
 - CRI, MDI (www.matsdev.com)
- National Labs
 - **L. Santodonato, J. Wenzel, L. Solomon, L. Walker, B. Hill, M. Norris, R. McPherson, Ken Volin, J. Hodges**



Design Concept: Modular System



Sample Cell and "Canning Station"

- **Thin-walled (0.15 mm) vanadium can**

- 6, 8, or 10 mm diameter
- 64 mm length

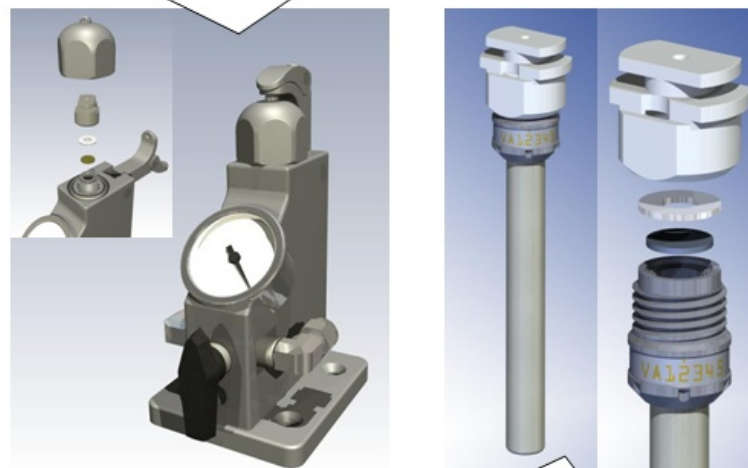
- **Anodized aluminum screw cap**

- Etched with tracking number
- "Wings" for twist lock pick and place operations

- **Soft metal gasket sealing groove**



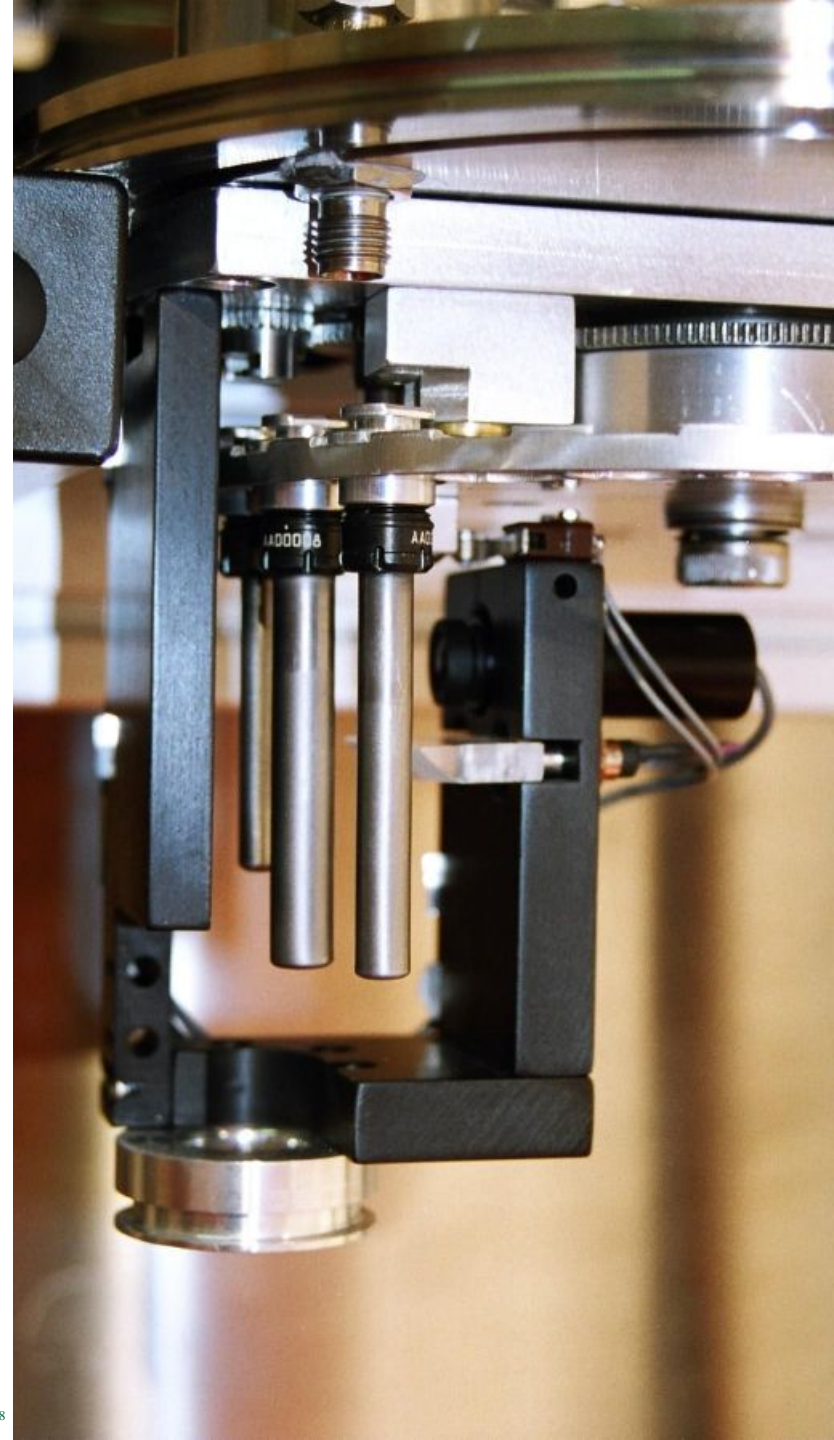
FERNS Sample Preparation
Bench top Purge, Backfill and Seal



FERNS Sample Can

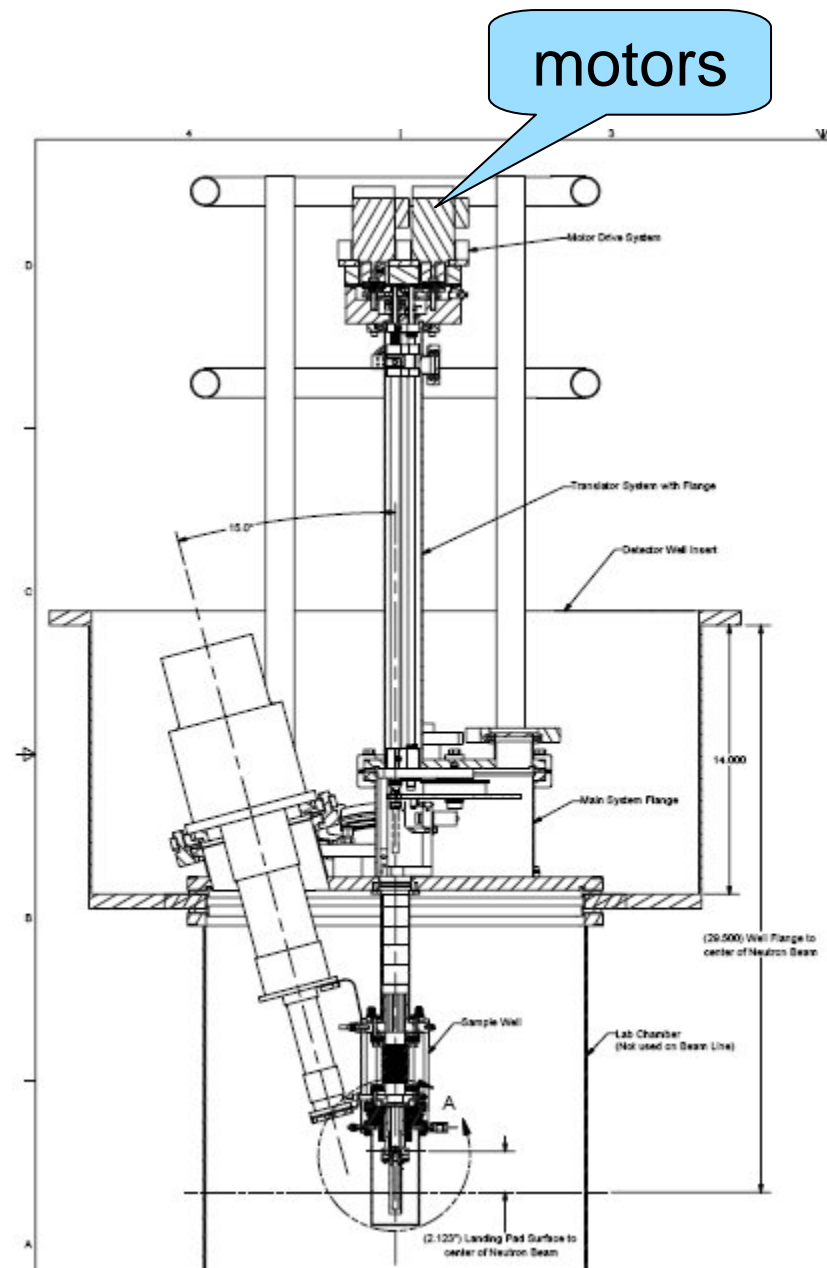
Sample Storage Carousel

- **24 sample capacity**
- **Samples revolve into loading position, co-linear with tube**
- **Passive design**
 - Turned by motorized stick
- **Mounted within housing on top of CCR rig**
- **Miniature camera resides in same housing for sample identification**



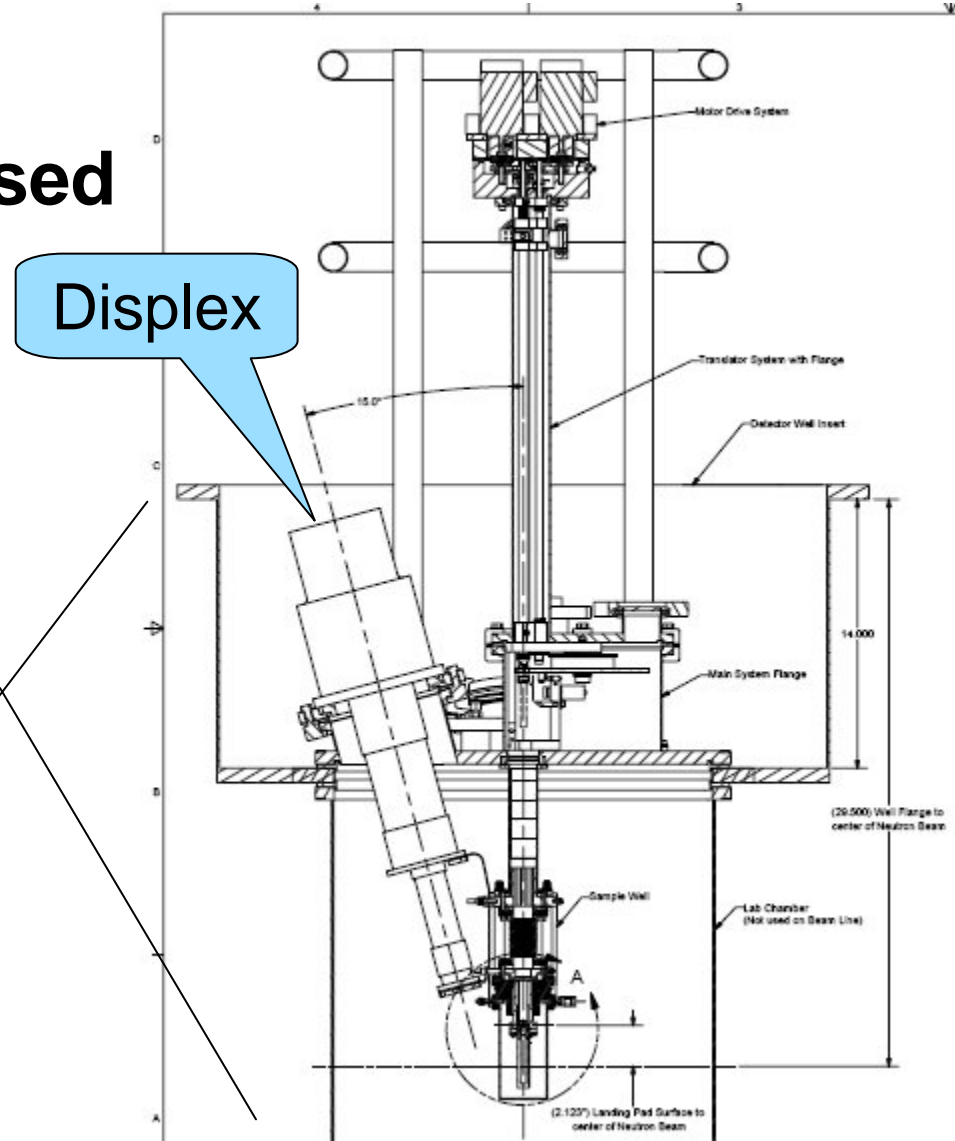
Changer Module

- **Driven by two stepper motors**
 - Reside in ambient atmosphere
 - Coupled to interior via magnetic clutch
- **Motorized stick**
 - Within sealed tube
 - Vertical translation
 - Rotation



Cryogenic Module

- Driven by Displex™ closed cycle refrigerator
- Custom top-loading rig



Early Results

- **Sample exchange and cooling to 10K within 10 minutes!**
- **Assembly and initial testing conducted at CRI in Chicago**
- **Working system delivered to SNS in August 2006**
- **As-delivered system deemed FERNS-1.0**

Upgrades Since 2006 Delivery

- **Better temperature control and computer interface**
- **Performed by SNS Sample Environment Team in consultation with Materials Dev. Inc.**
 - **FERNS-1.1**
 - Heater modification
 - **FERNS-1.2**
 - Sample tube & heater reconfigured
 - **FERNS-1.3**
 - Integrated heater/sensor assembly
 - Software bug fixes
 - Alignment fixtures modified

Temperature Control Data

