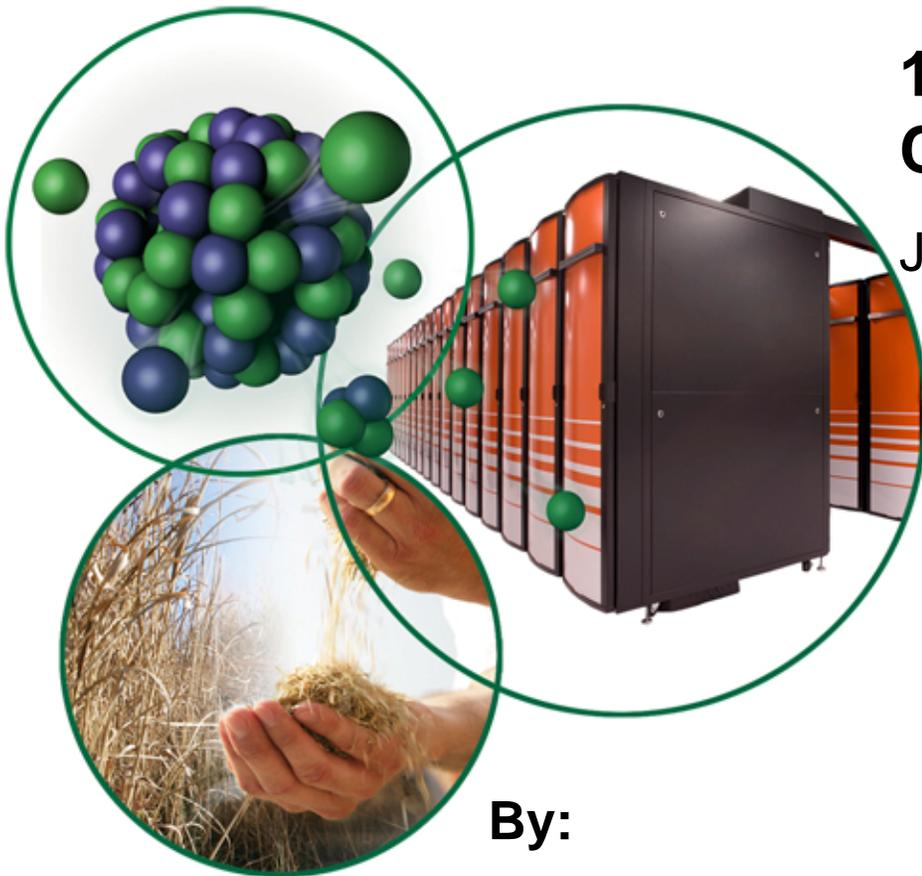


Cryocoolers used in Scientific Research Facility

15th International Cryocooler Conference

June 09 – 12, 2008

Long Beach, CA



By:

Bruce Hill and Lou Santodonato

Sample Environment at SNS

Oak Ridge National Lab

Cryocoolers used in Scientific Research

At scientific user facilities such as the Spallation Neutron Source or HFIR at Oak Ridge National Laboratory in Tennessee, technical support teams are constantly finding ways to adapt and integrate off-the-shelf Cryocoolers into customized measurement systems.

The functional requirements often go far beyond sample cooling. There are needs for remote sample manipulation, exchange and wide ranging set point control,

ORNL Neutron Scattering Facilities

SNS and HFIR

- SNS construction completed May 2006, user ops December 2007
- SNS achieved ~ 500 Kwatt sustained beam power – most powerful pulsed spallation source
- 3 SNS operational instruments
- 3 SNS commissioning instruments
- HFIR cold source operational May 2007 (one of the brightest in the world)
- 6 HFIR operational instruments



Material Scientist often need:

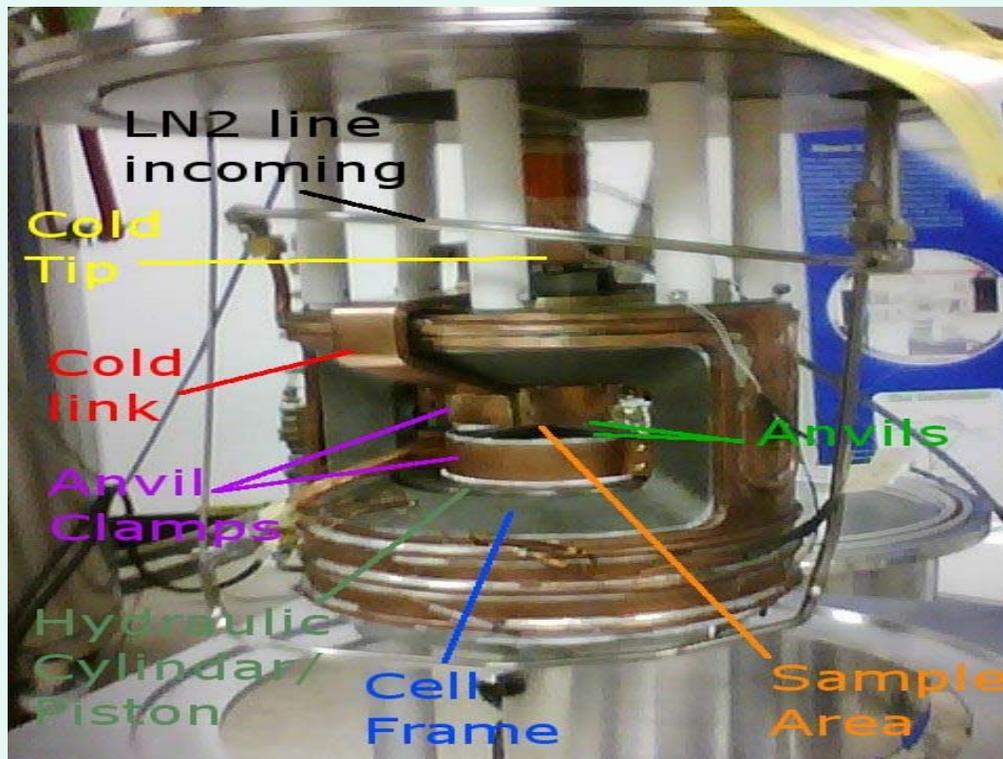
- **Cold specimens**
- **Regulated temperatures**
- **Sample Environment Chambers**
- **Customization**



High Pressure Anvil Cell

- **Pressure up to 20 kBar**
- **Temperatures down to 26K**
- **Weight of cell apprx. 70#**

Paris Edinbrough Pressure Cell



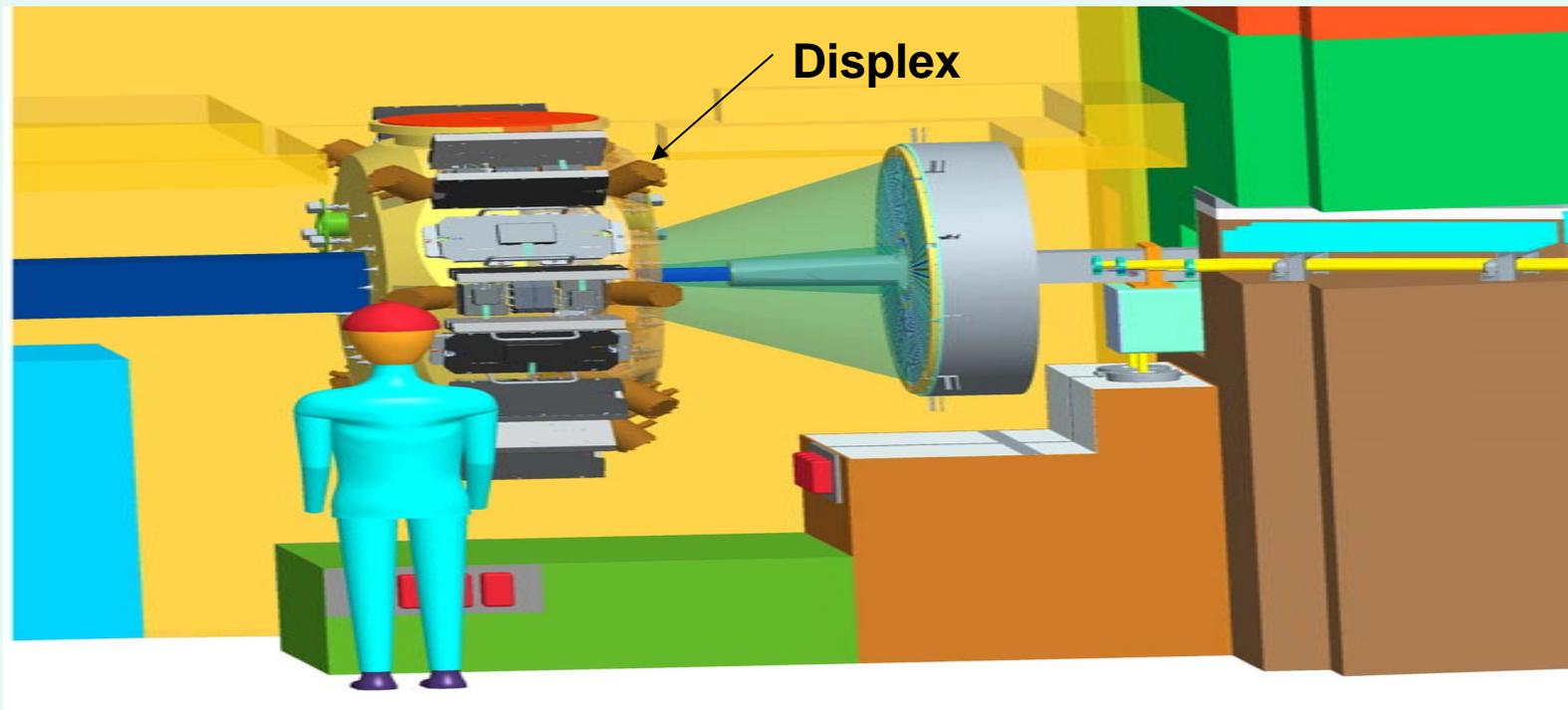
- Pressure cell weight is apprx. 70#
- Second stage temperature apprx. 14K
- Pressure cell temperature apprx. 26K

Neutron Detector Cooling

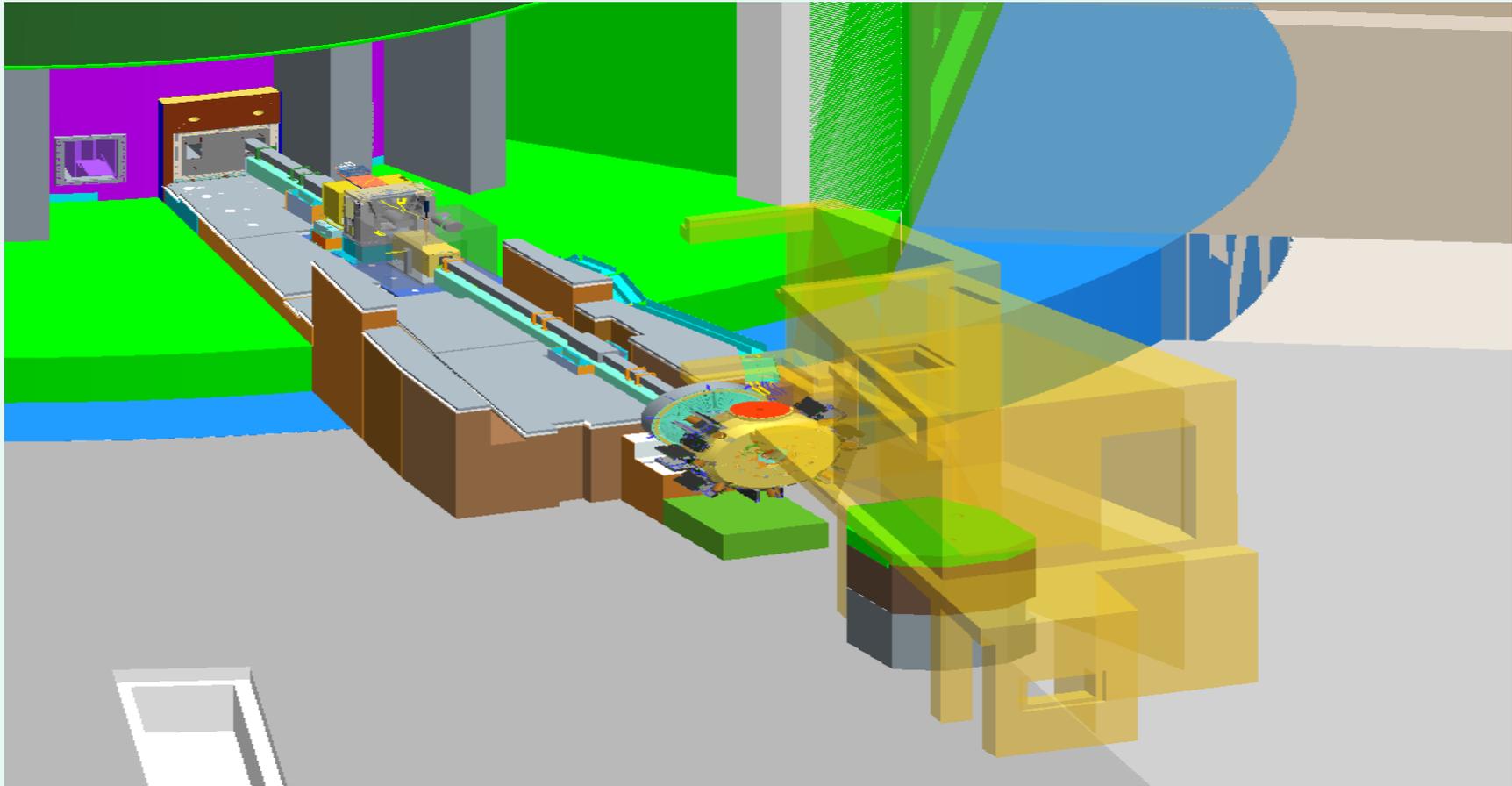
Challenges :

To cool Neutron Detectors that are in a vacuum environment and a high radiation field.

Space, size and configuration.



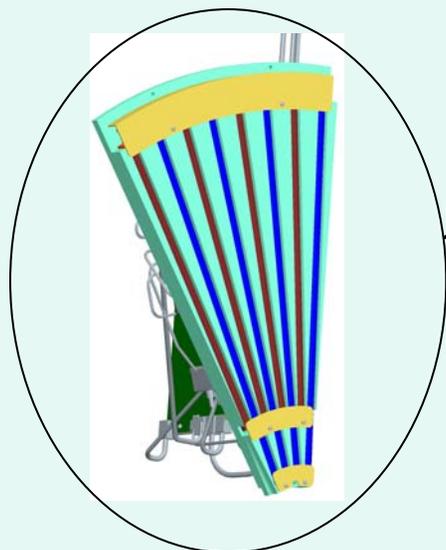
SING Backscattering Detector



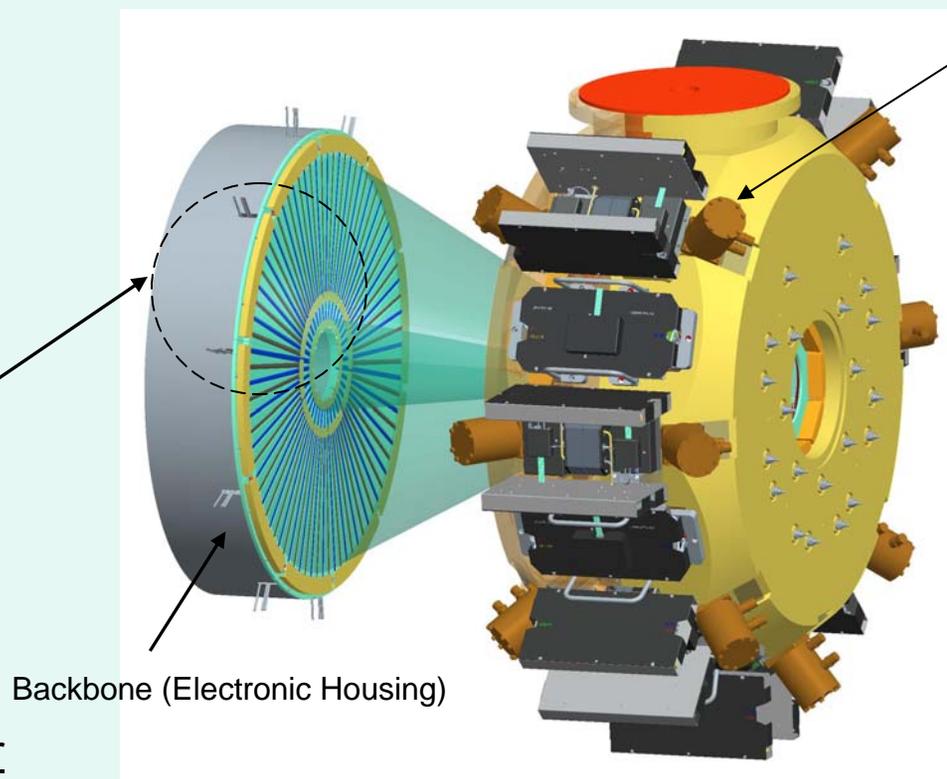
VISION Detector

Backscattering Diffraction Detector
14 Single Stage Displex used for cooling
4 compressors to drive the Displex

Single Stage
displex X14



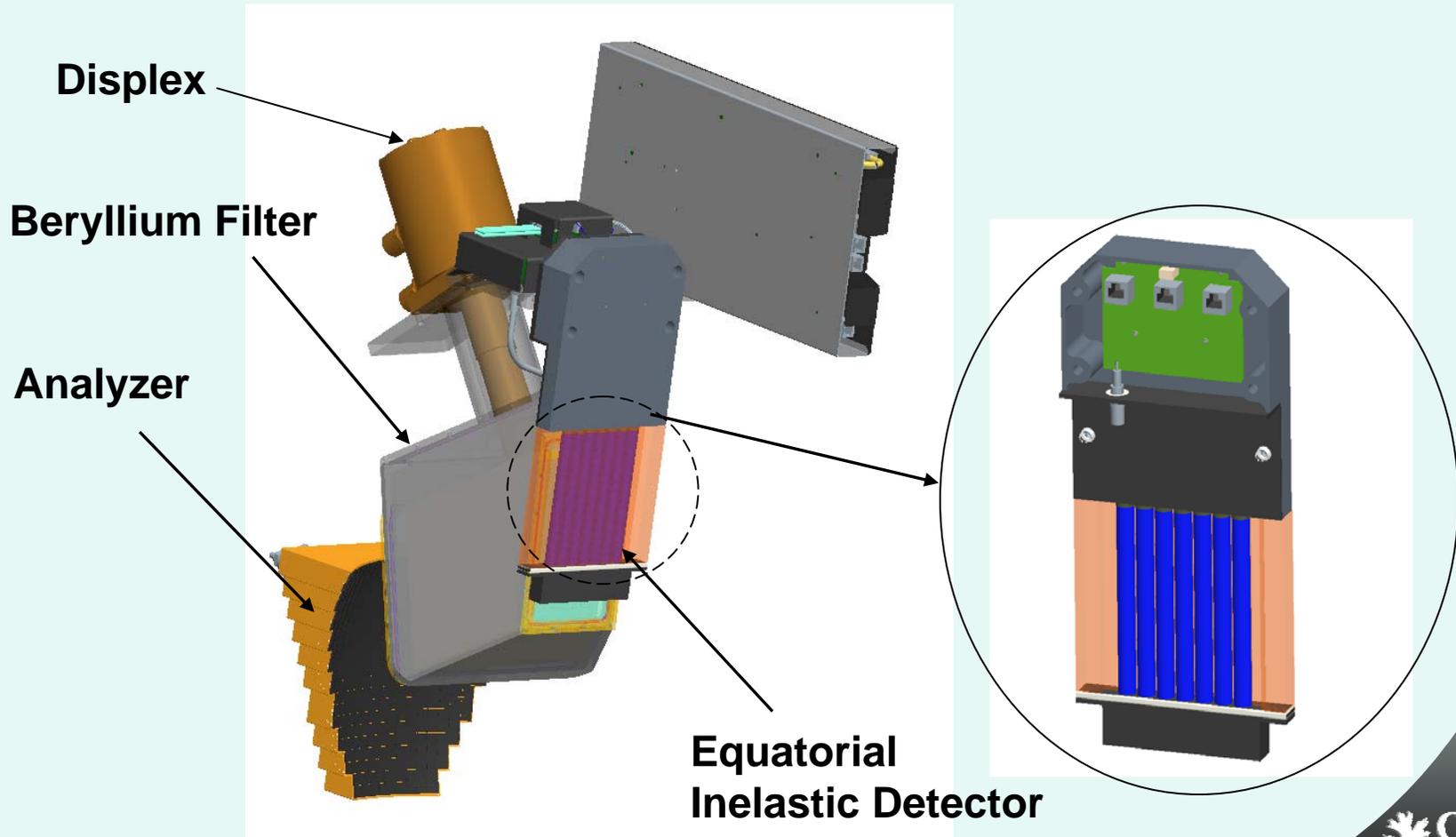
Backscattering Detector
8 Pack Module



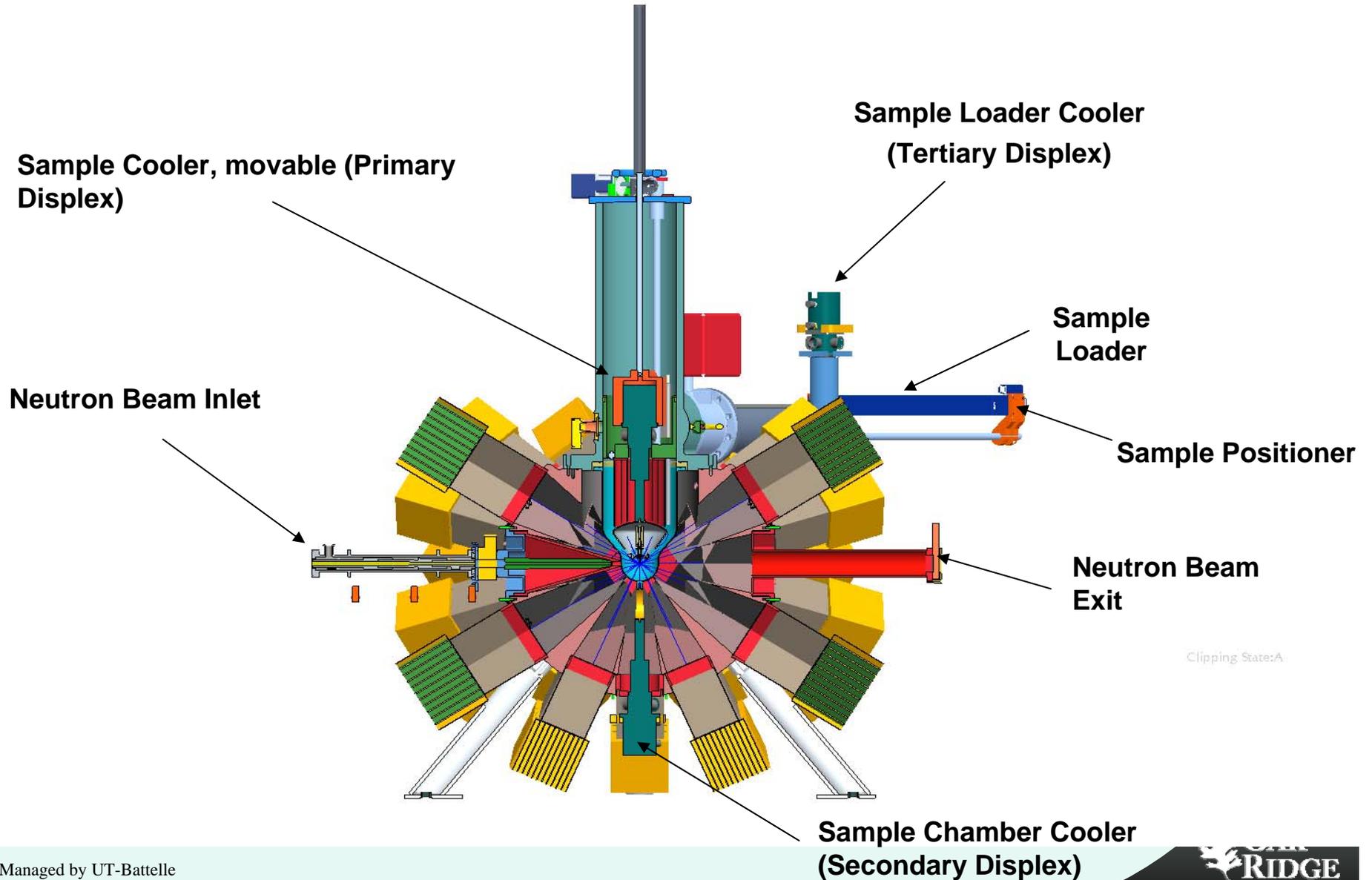
Backbone (Electronic Housing)

VISION Detector Overview

- **Fourteen Equatorial Inelastic Detectors cooled to approx. 80K**



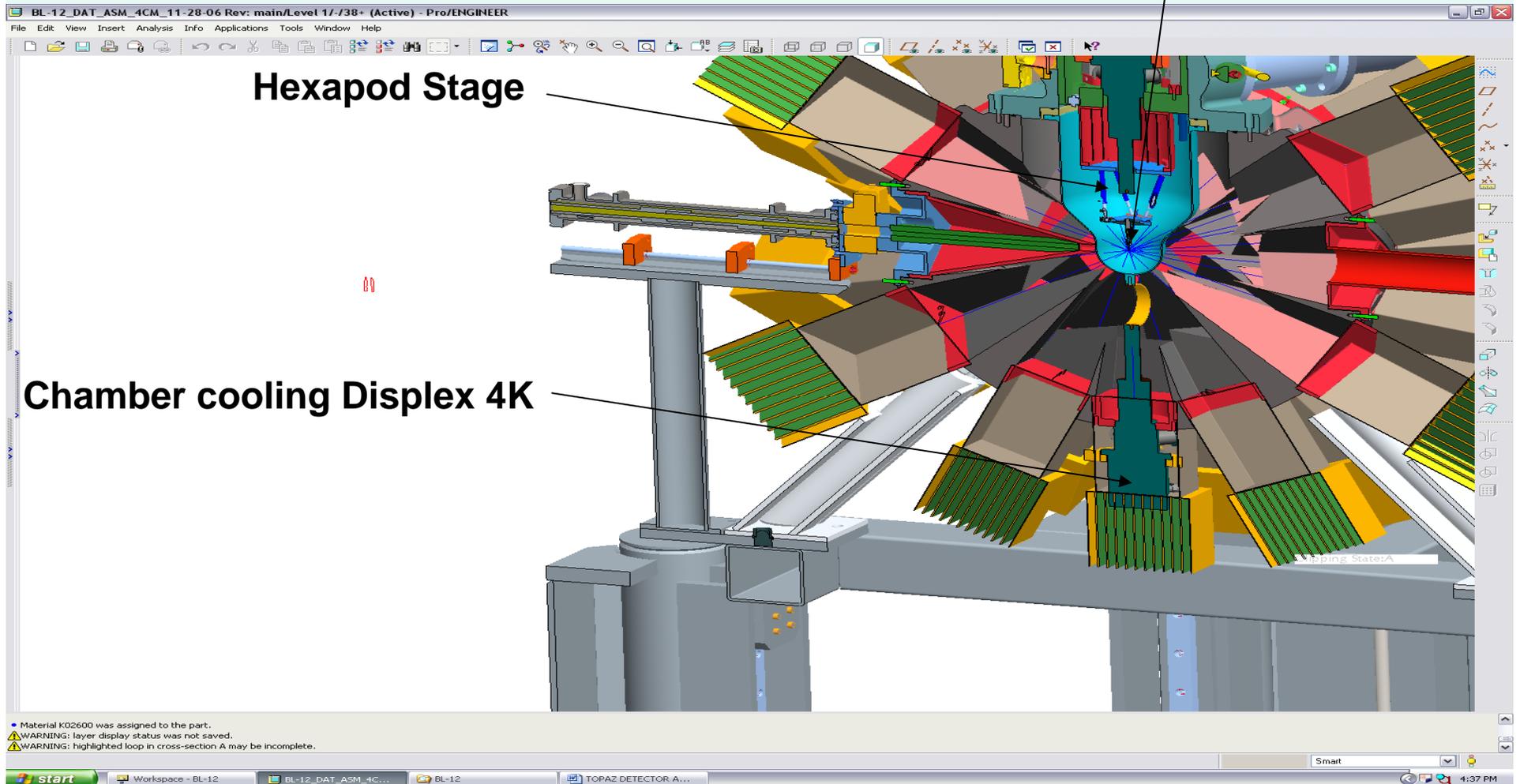
Topaz DAT with Interfacing Sample and Neutron Detection Systems



Clipping State:A

Topaz Lower Sample Environment

Pre-cooled sample insert from sample cartridge (moveable Displex)

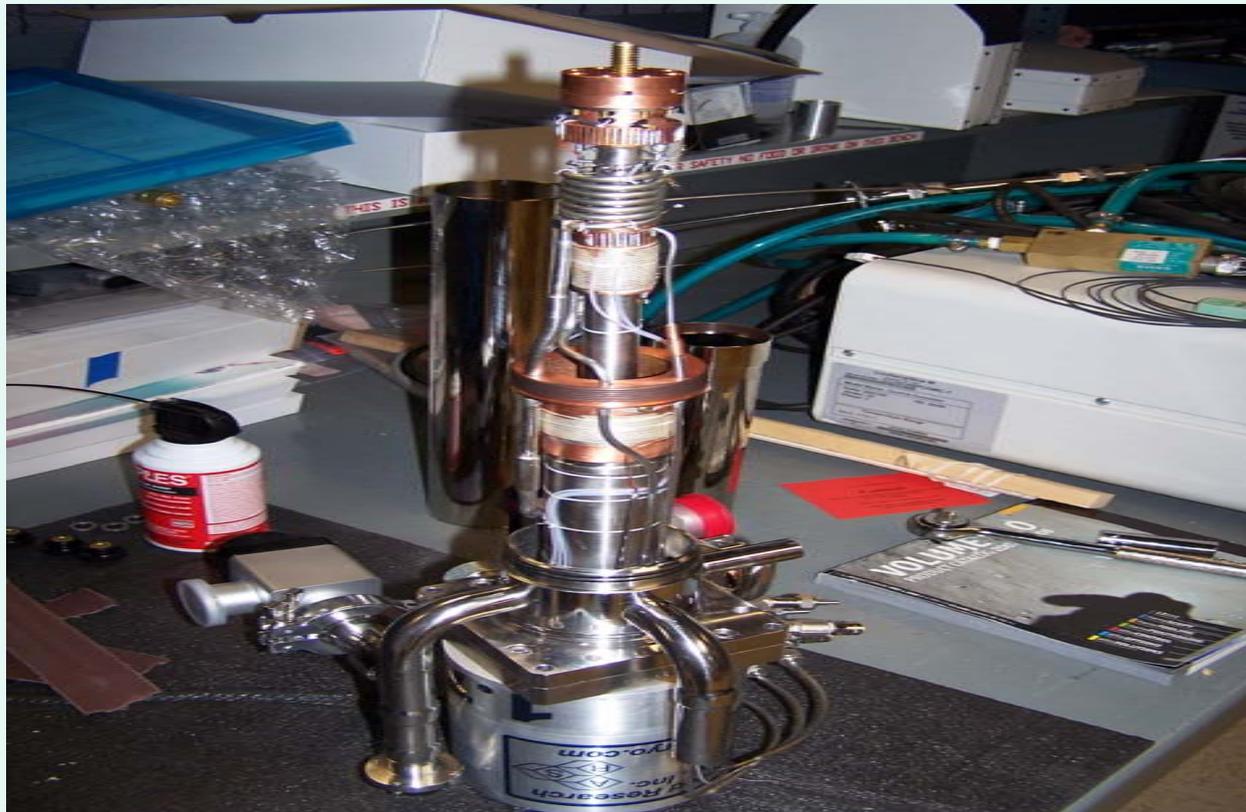


Hexapod Stage

Chamber cooling Displex 4K

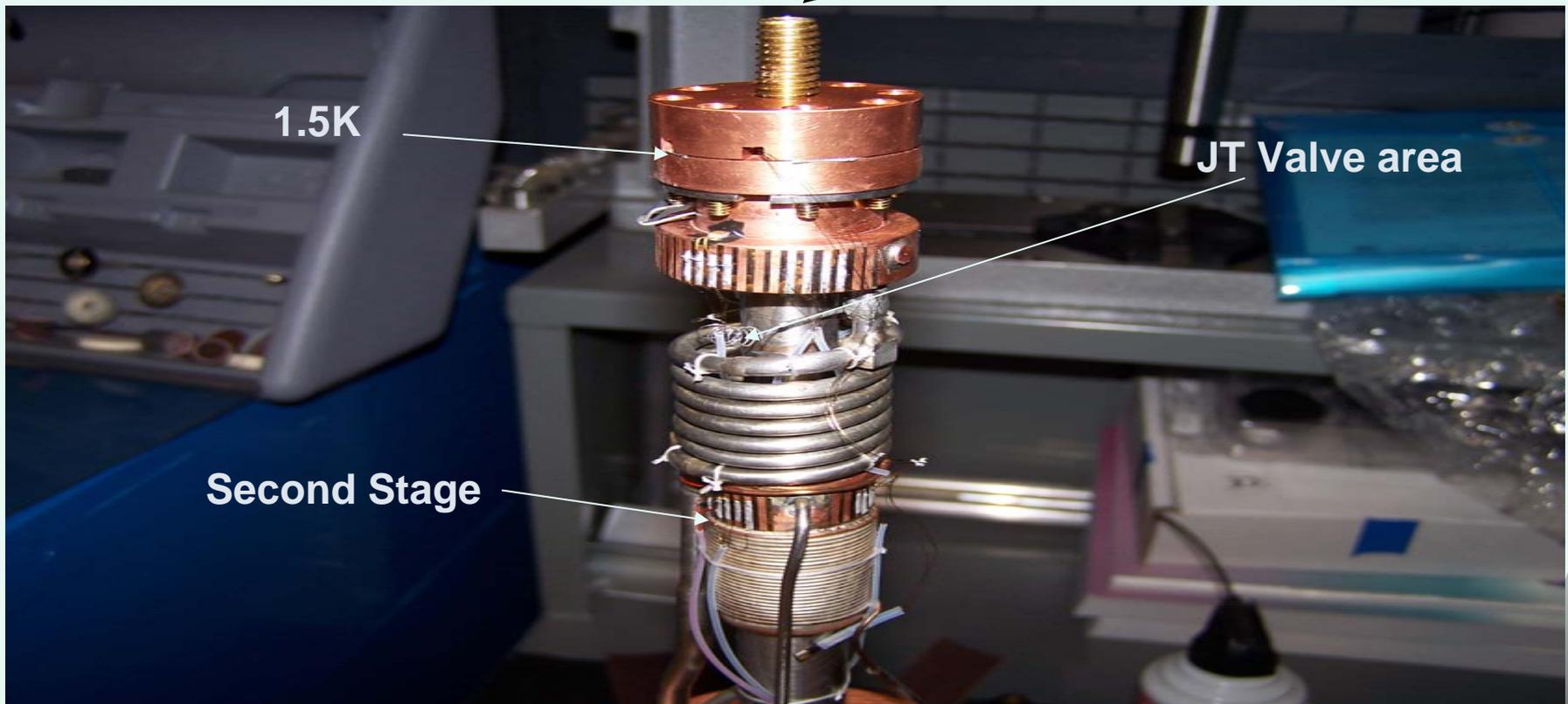
3 Stage Displex System

- **10K Second Stage**
- **1.5K Third Stage**
- **Joule Thompson valve on 3rd stage**



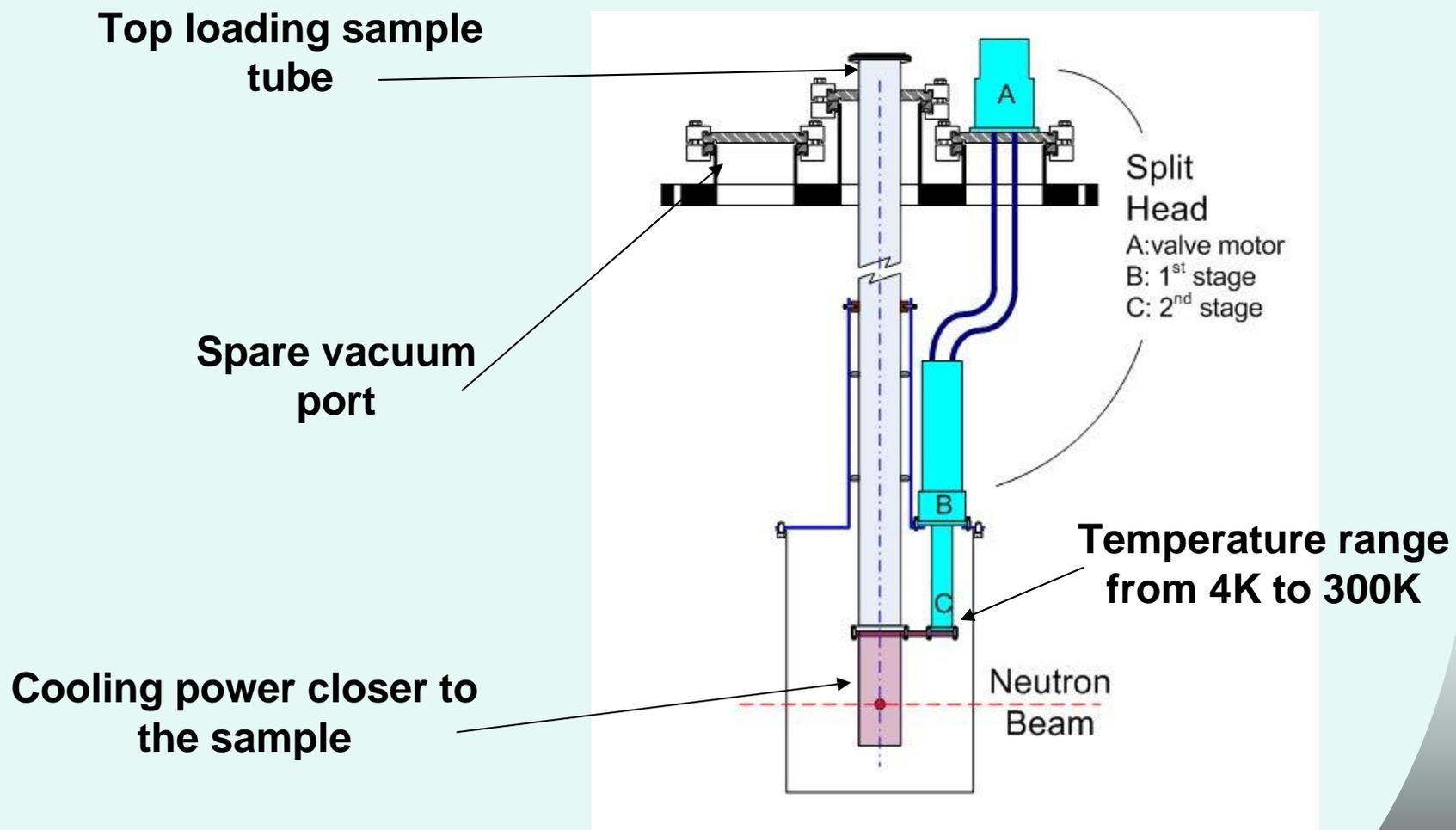
3 Stage Displex System

Sample Attachment area



Developed at a Neutron Scattering Facility
in France

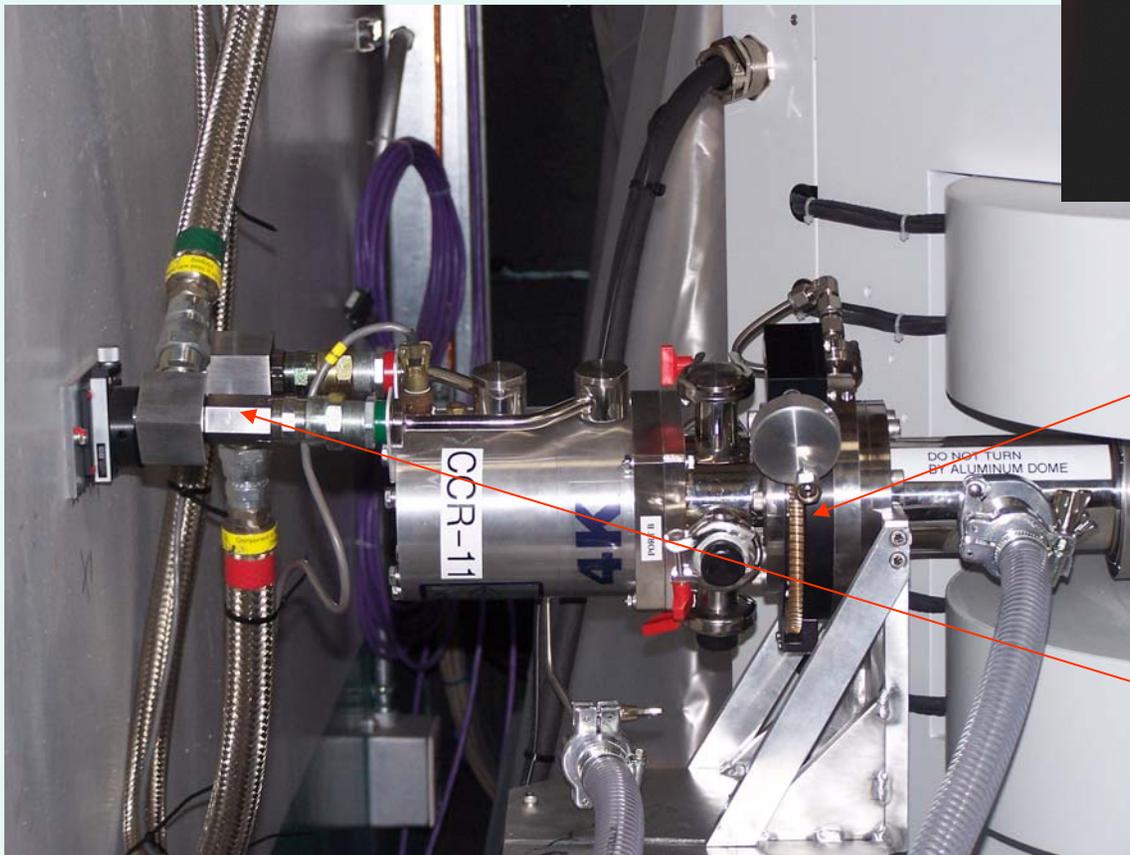
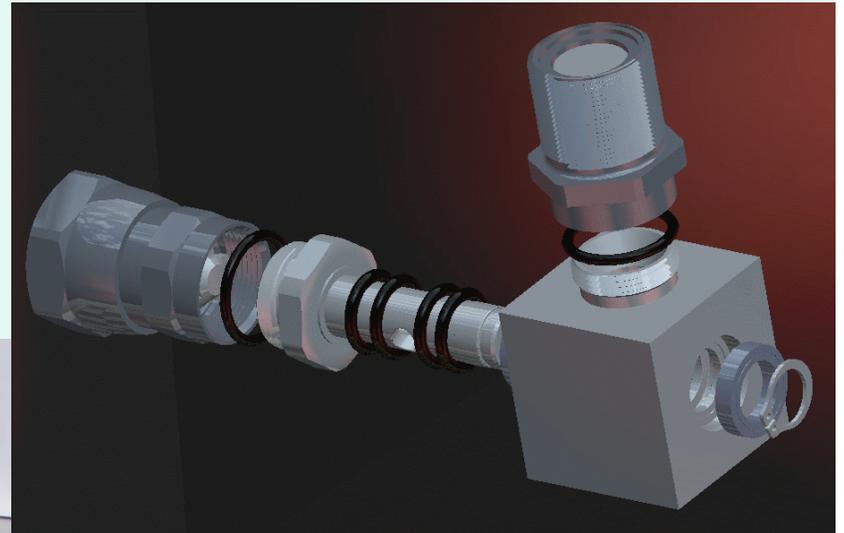
Split Head



High Pressure Cryo Line Swivels

Challenge:

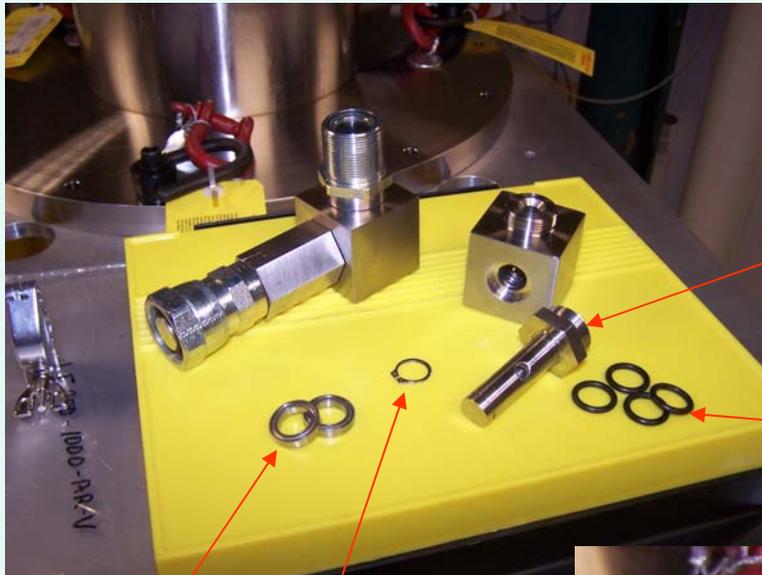
- space limitation
- rotate displax 360°
- maintain high pressure



Gear drive

Swivels

High Pressure Cryo Line Swivels



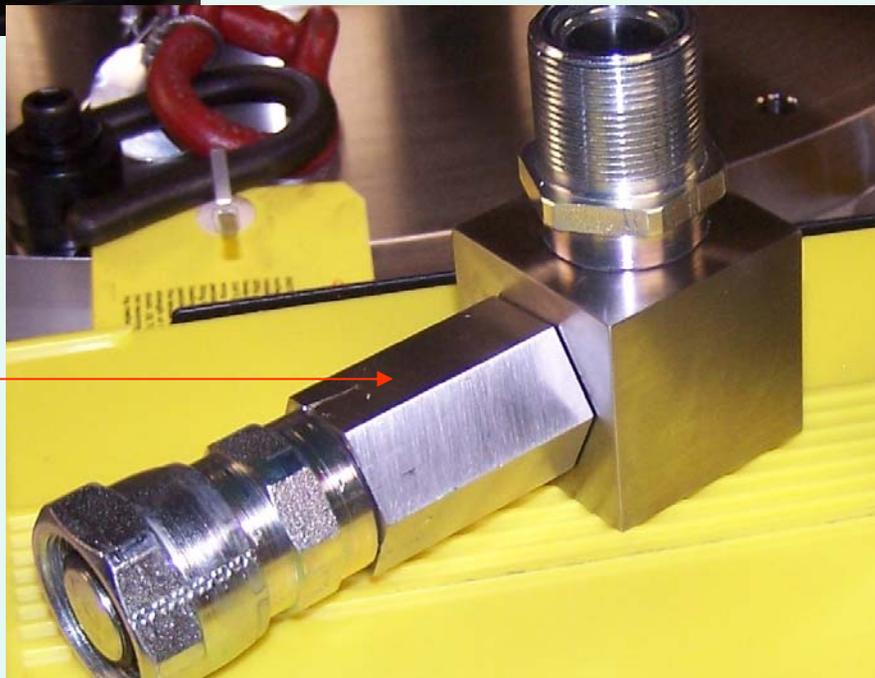
Swivel Shaft

Dual O-Ring Kit

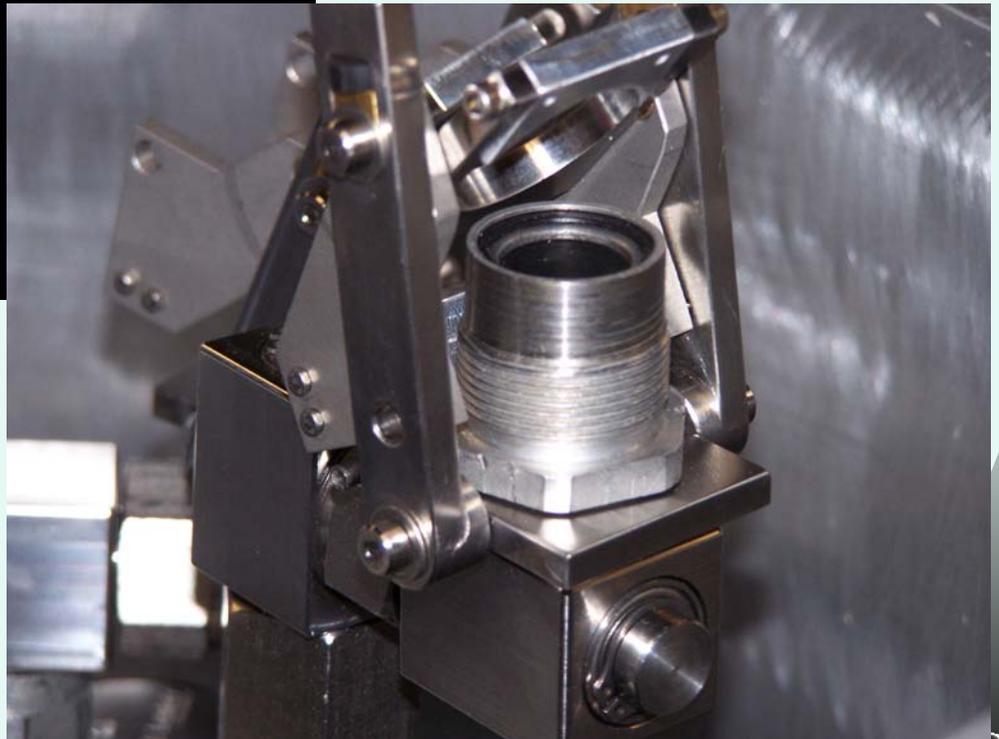
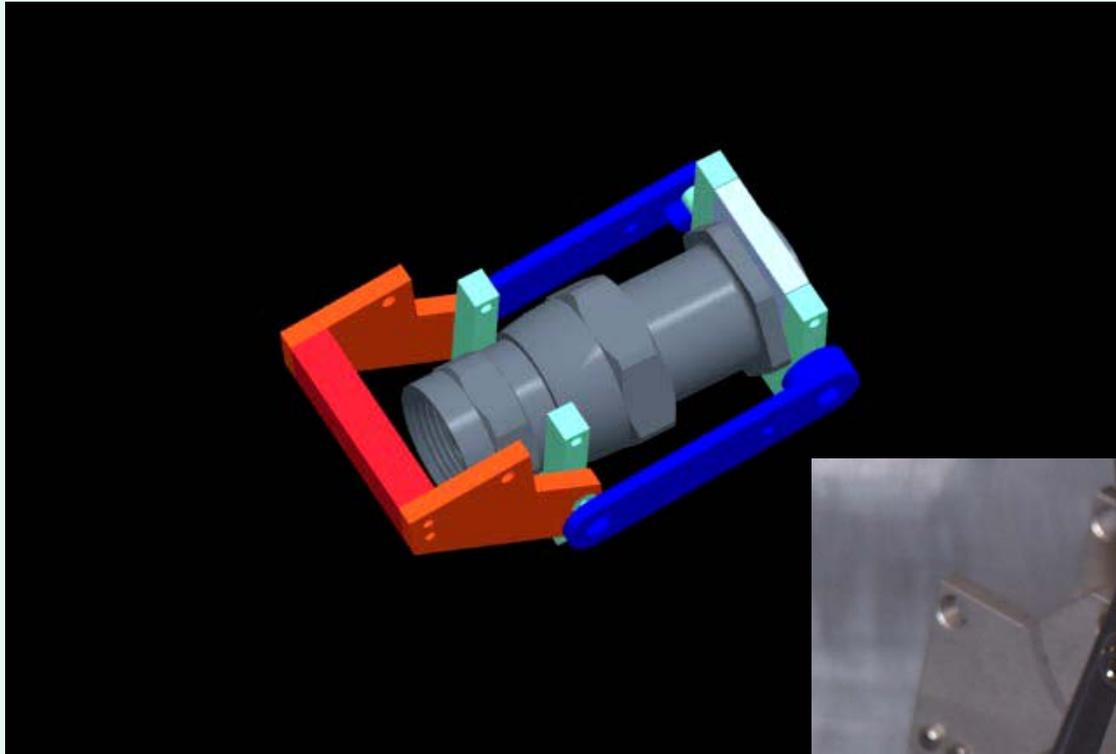
Bearings

Retainer clip

Assembled



Aeroquip Closure Clamp



Spallation Neutron Source Oak Ridge National Lab., TN

Acknowledgement:

Lou Santodonato

Landon Solomon

Tim Chae

Advance Research System

