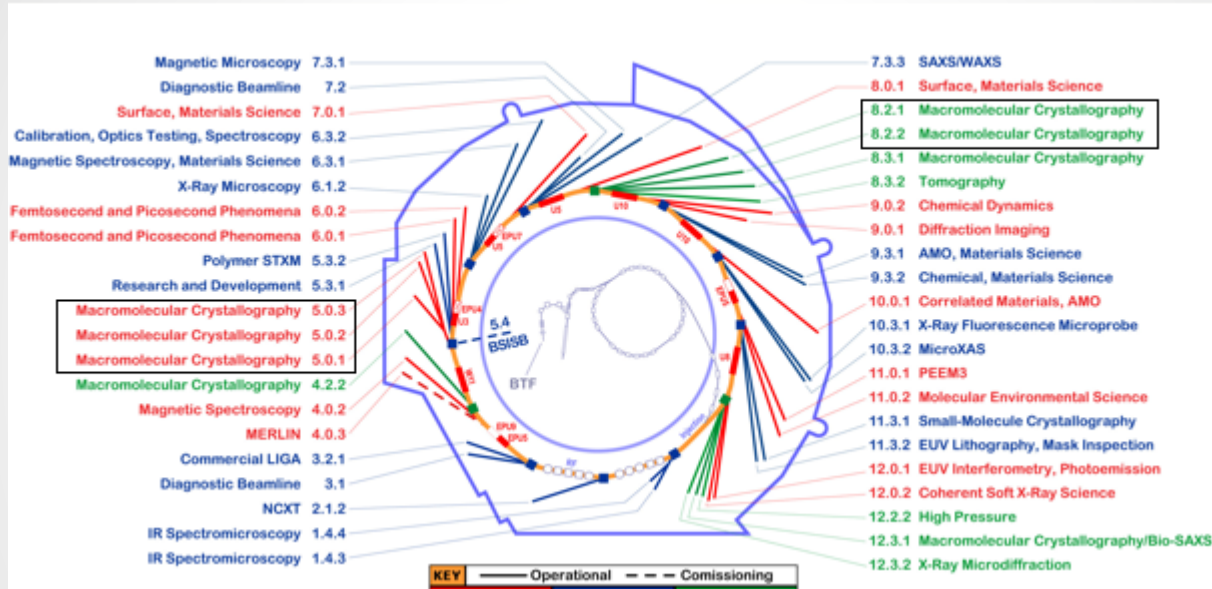# B3 Control System Framework & Applications

John Taylor, Leif Steinhour & Yun Zhou

Advanced Light Source

Outline

Control System Development @ BCSB

Design and Implementation of B3

Related Software Projects

Hardware Development

Evolution of BCSB Control Software

2001 Distributed Control System - DCS
   Carl Cork, Earl Cornell & Arthur Jones.

2006 Beamline Operation System - BOS
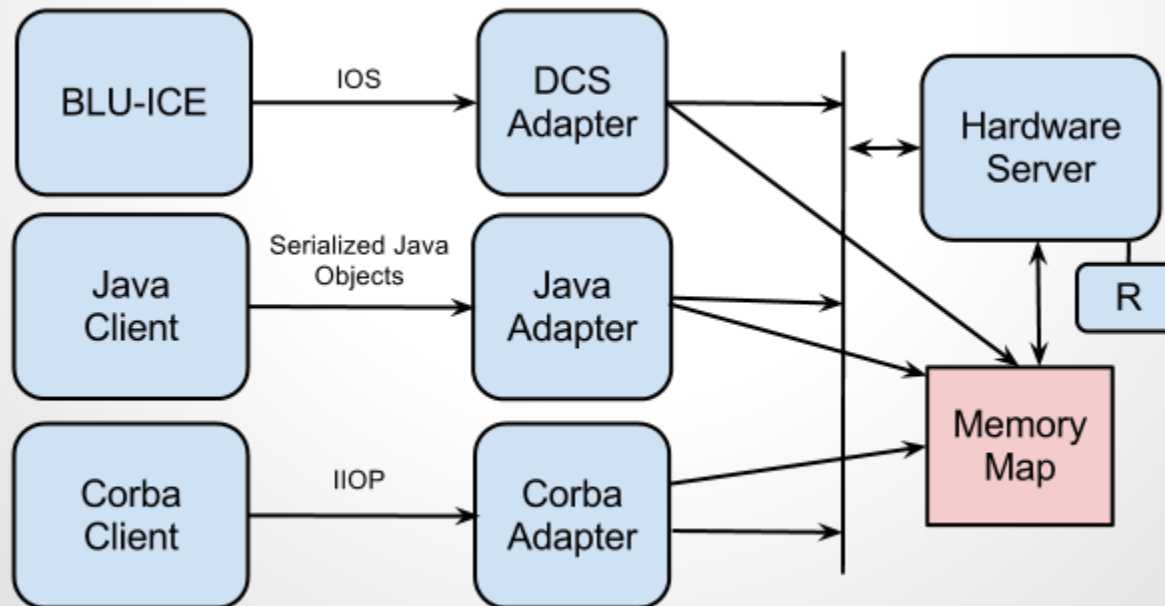
2011 B3 Server & Modified BOS Gui
   Yun Zhou

2013 B3 Client

DCS

Wanted SSRL BLU-ICE

Utilized "protocol adapters" to allow different clients to communicate

DCS - The good and the bad

Design

- Users can "edit" robot protocols

Implementation

- Single Threaded

- Multiple languages C/C++/Java/R?

- Many forms of Unix interprocss Communication

- Non standard network protocols

Configuration

- Generic database that you can put any name value pair

BOS Application

Complete redesign but client looks similar to BLU-ICE

Emphasis on reliability and ease of development.
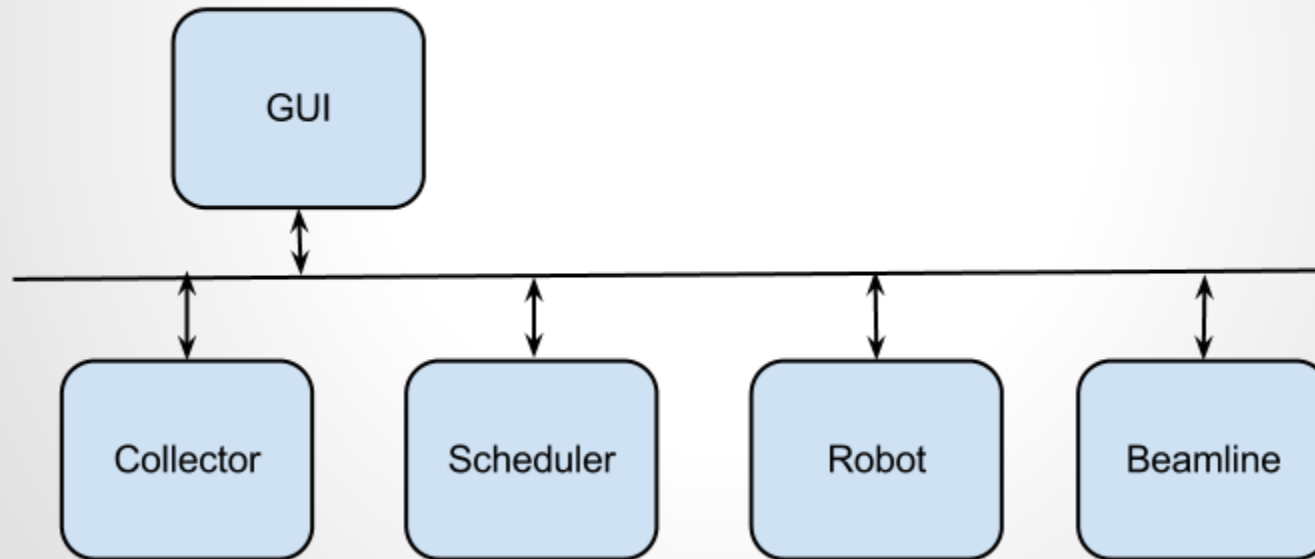
All Java.
    RMI - Big API. Lots of functions calls.
    Swing

Jython interface for scripting.

LDAP integration.

BOS Architecture

Simple SSL/RMI Service-based

B3 Framework

Emphasis on tighter integration with hardware and performance. C++

Another redesign.
    Framework vs Application
    "Thin" communication api. Parameterized Set/Get
    Internal device cache for high speed state reads.
    Monolithic Server

Internal Python script processing.
Easy XML Configuration.

B3 Framework

Middleware helps simplify network programming.

Internet Communication Engine - ICE - www.zeroc.com

It has bindings for many languages

Very high performance
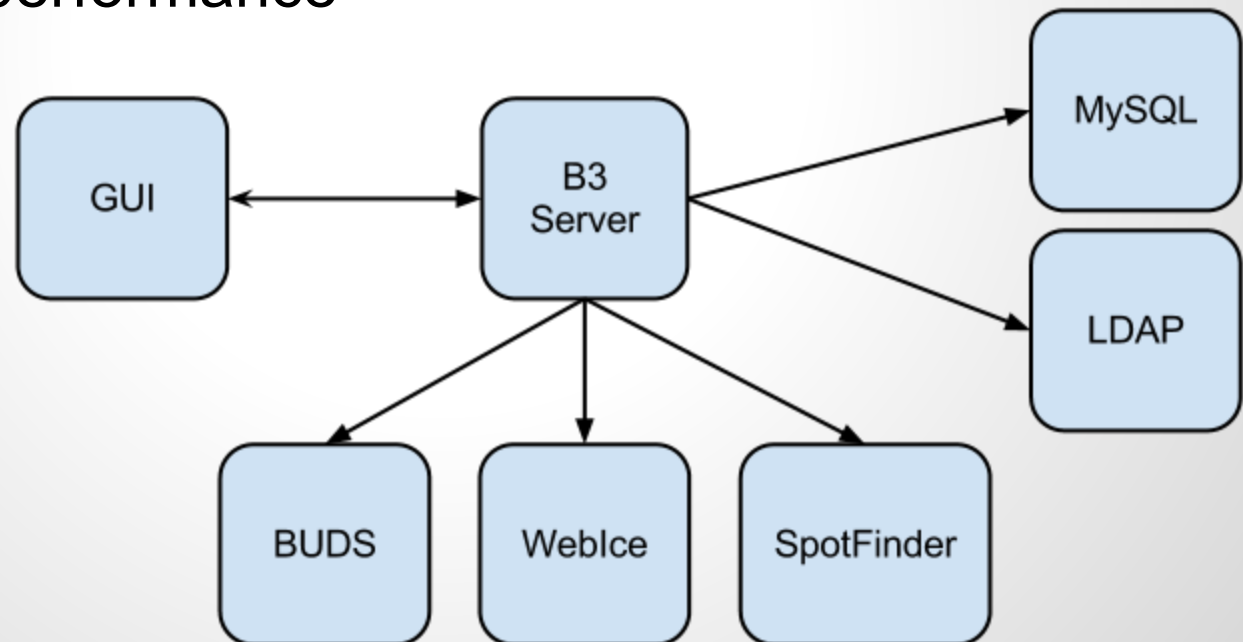
B3 Framework

Server utilizes "manager" objects. Including

Session - Authorizes

Event - Manages Command Queue.

Device - Manages Devices and Cache.

Process - TaskQ, Robot, Snap and Scan

Configuration - Manages XML config file

B3 Core

Session Manager	Event Manager	Cache
		Device Manager
	Config Manager	Process Manager

B3 Processes

- SNAP
- SCAN
- ROBOT

B3 Devices

- PMAC
- WAGO
- ADSC
- BOSMon
- Rigaku
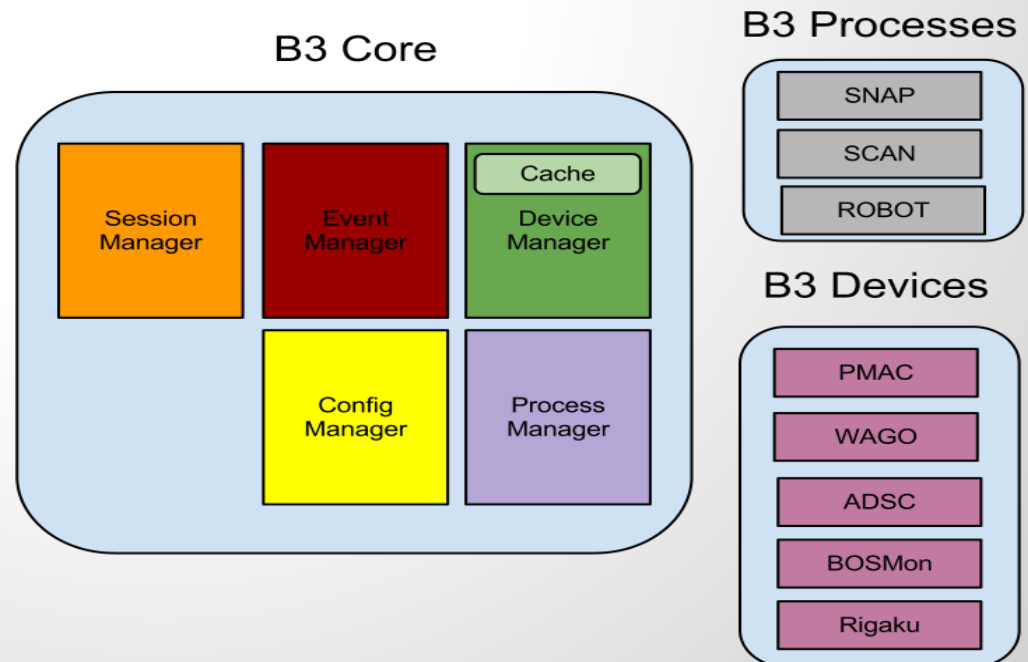
B3 Configuration

```
<ccdSnap>
        <gonioXDevice>gonioX</gonioXDevice>
        <gonioYDevice>gonioY</gonioYDevice>
        <gonioZDevice>gonioZ</gonioZDevice>
        <collectionProgram>phiScan</collectionProgram>
        <phiDevice>gonioPhi</phiDevice>
</ccdSnap>
<ccdSnap>
        <gonioXDevice>MD2gonioX</gonioXDevice>
        <gonioYDevice>MD2gonioY</gonioYDevice>
        <gonioZDevice>MD2gonioStageY</gonioZDevice>
        <collectionProgram>MD2phiScan</collectionProgram>
        <phiDevice>MD2gonioPhi</phiDevice>
 </ccdSnap>
```

Philosophy

Simplify whenever possible.

Move realtime functions onto dedicated hardware that can be managed and monitored.

Utilize any hardware optimizations.

  DPRAM (X100)

Robust error handling.

Provide feedback to user.

Leverage standards.

  ICE, LDAP & SQL

Additional Software

BDXV
  ADXV rewrite. Open Source. Modern widgets.

SIL Server
  Modification to Web-Ice SIL server to use MySQL

BUDS - BCSB User Database System.
  Web-based. LAMPJ.
  Provides access point for user and beamtime info.
  Interacts with other services. Google Calendar, HRIS.

BUDS GUI

New B3 Development

Gigabit Ethernet Cameras

- Developing standalone server.

New B3 Gui

- Simplify interface to service multiple collection modes.
- Separate video windows to utilize desktop.

Refactored Task Queue

- Make taskQ more transparent and generalized.

Hardware Development:

BOSMon
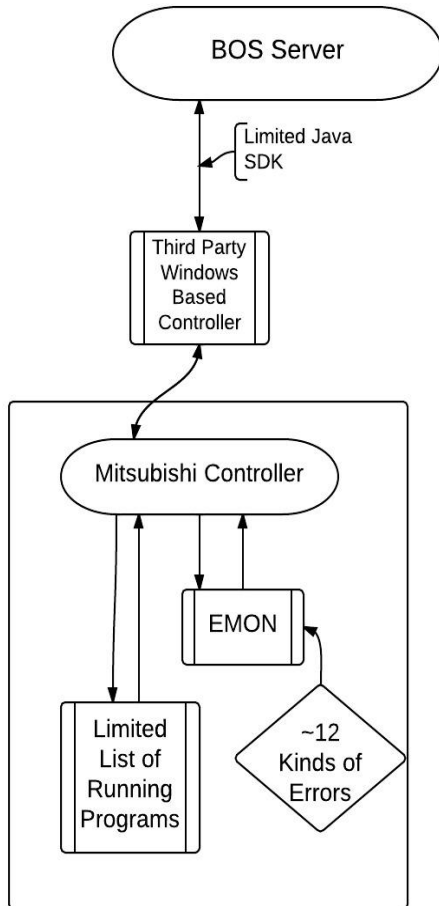
Crystal Washer

Universal Pucks & Plate

Big Dewar

Bumpers
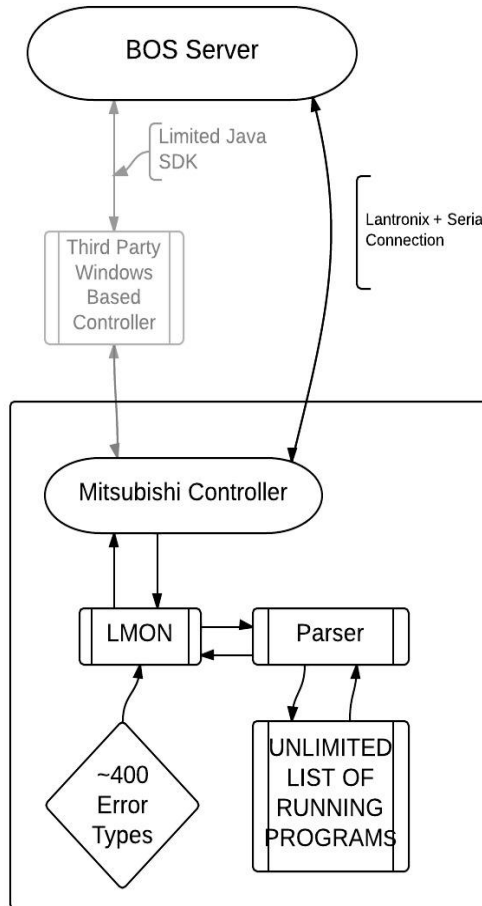
Linear Motors

Sector 5 Gripper Swap

Dry Cold Nitrogen Collets
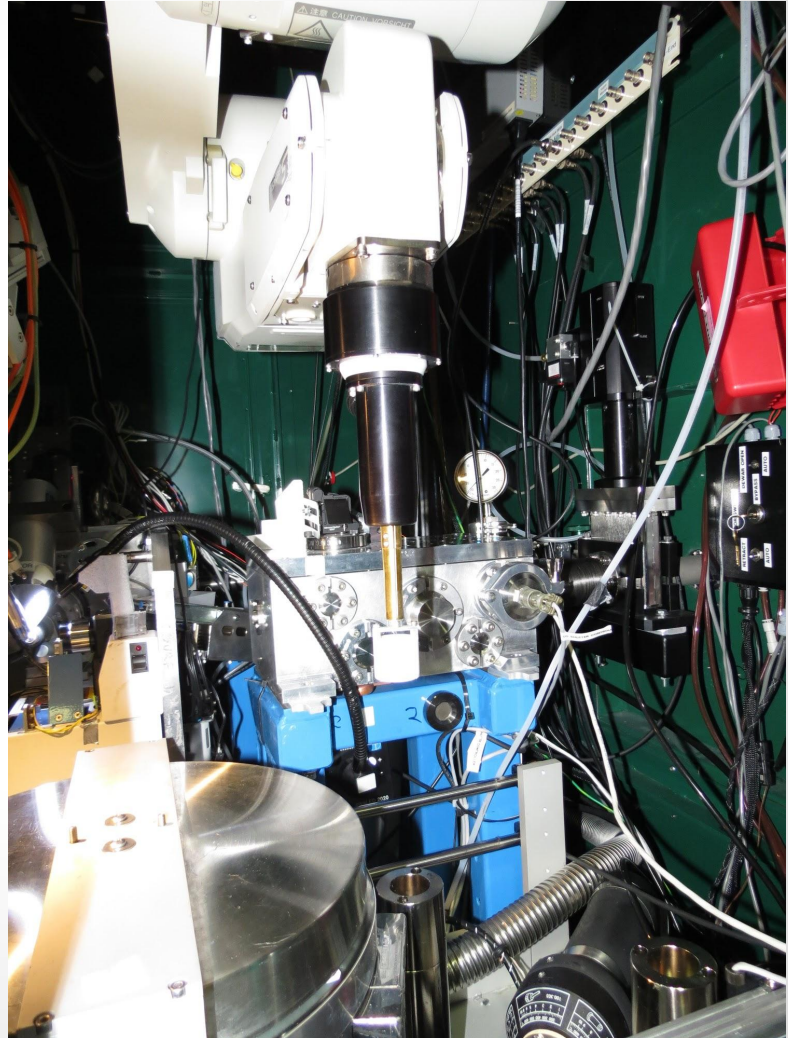
Motivations for BOSMon

Previous Configuration:

New Setup:

BOS Server

Limited Java SDK

Third Party Windows Based Controller

Mitsubishi Controller

EMON

Limited List of Running Programs

~12 Kinds of Errors

BOS Server

Limited Java SDK

Third Party Windows Based Controller

Lantronix + Serial Connection

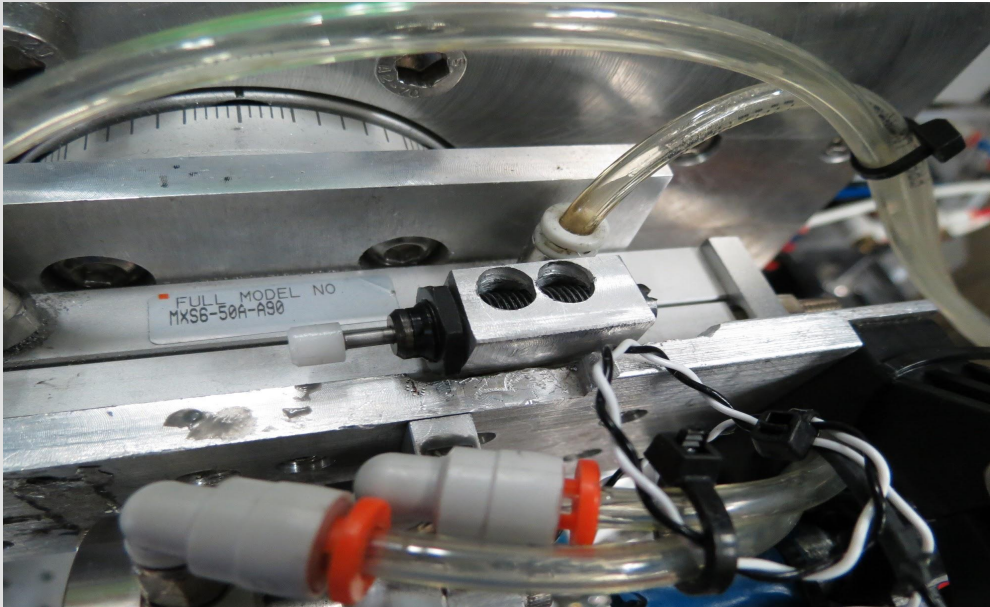Mitsubishi Controller
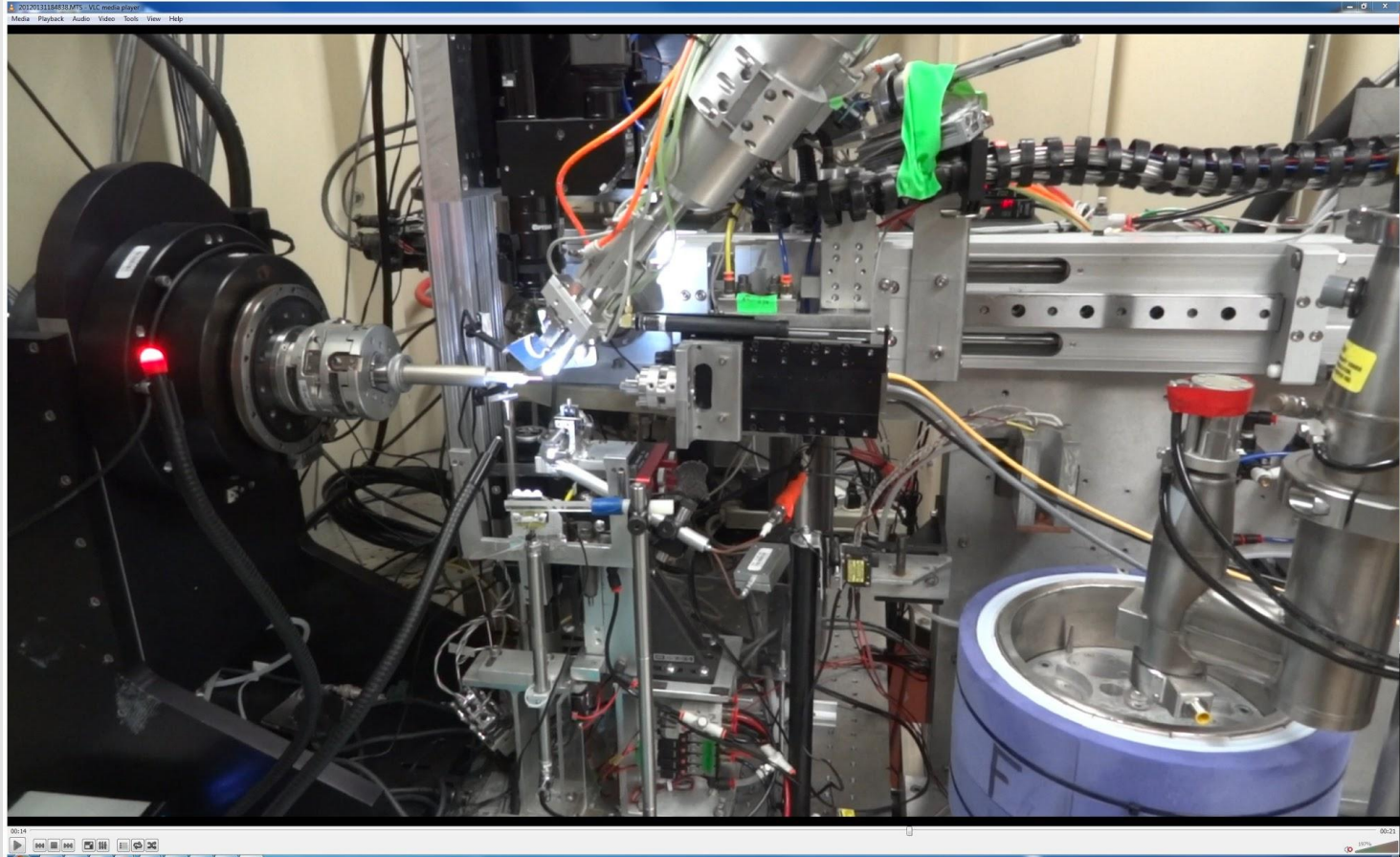
LMON

Parser

~400 Error Types

UNLIMITED LIST OF RUNNING PROGRAMS

Crystal Washer
(developed by Anthony Rozales)
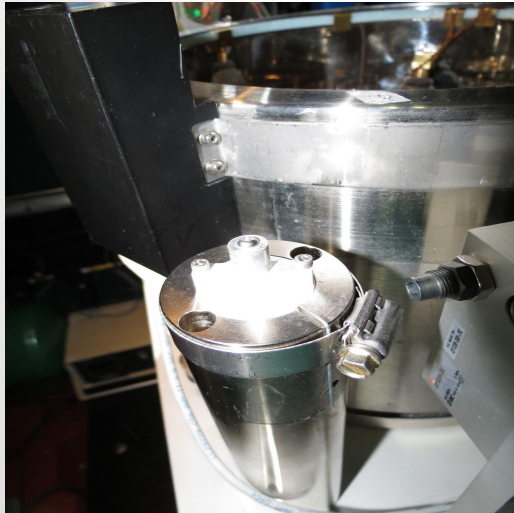
Bumpers

Small Move Linear Motor

Big Dewar

14.5" OD
12.5" (Min) ID

6" Deep

7.5"
Tall

Less than 1.5" Long

Less than 40mm OD
Pipe

Clipping Slate:XSEC0
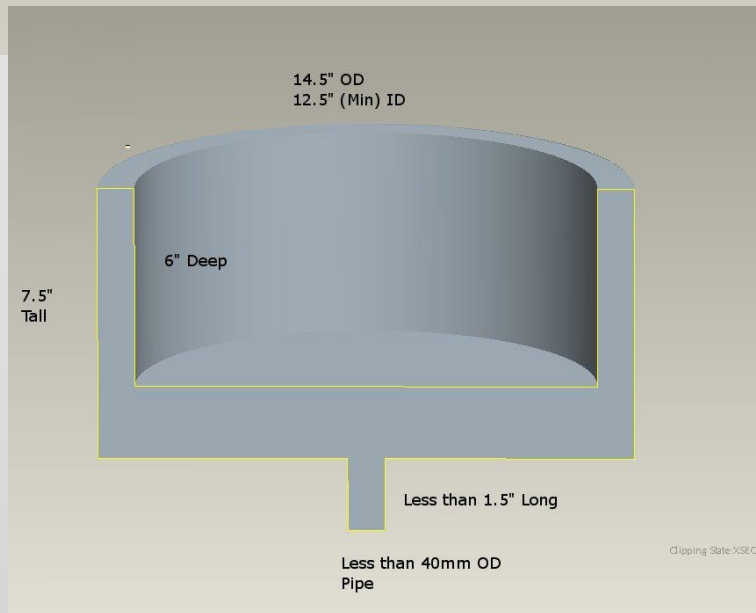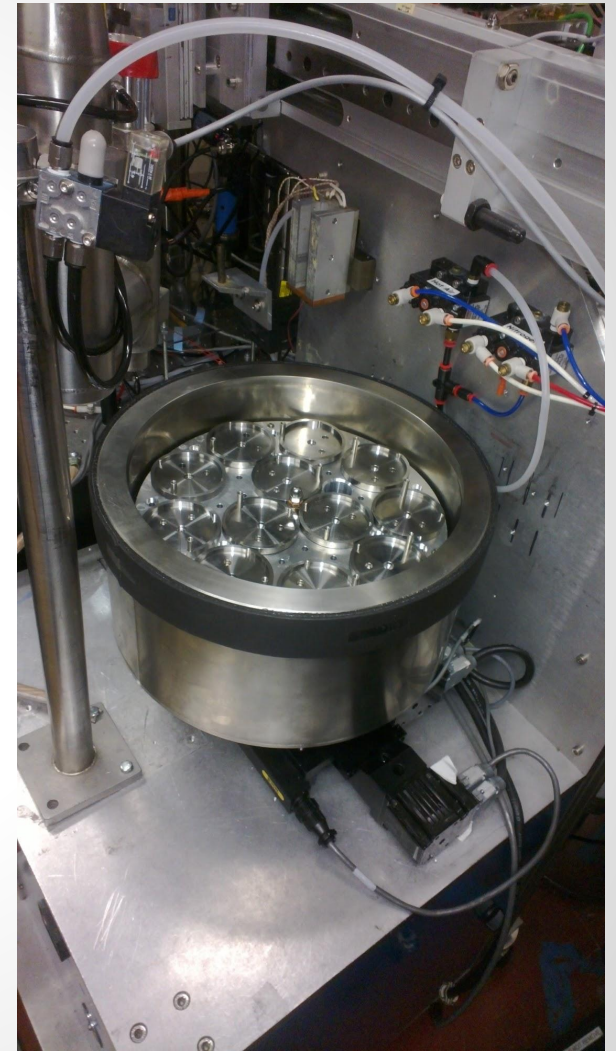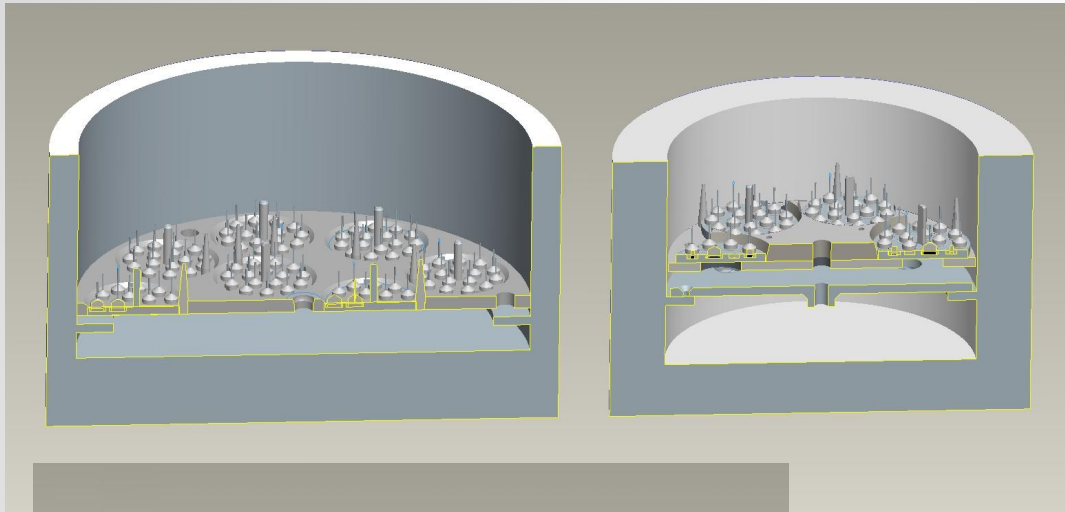
Sector 5 Gripper Swap

Conclusion

Questions?

We are always looking for collaborators.

Thanks for coming!

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