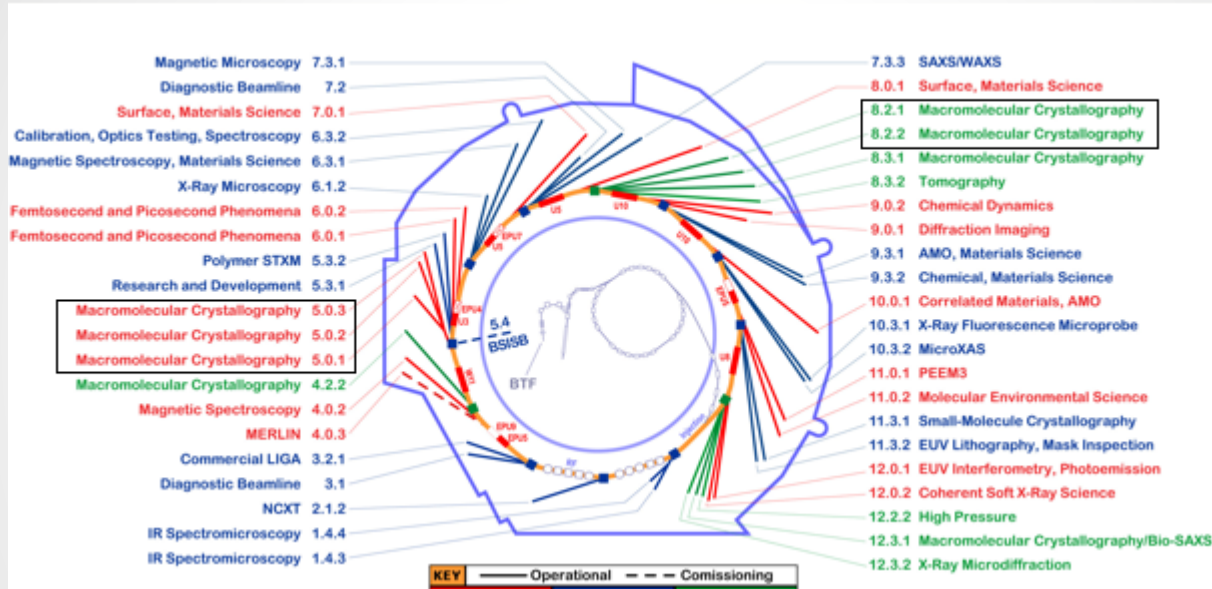


B3 Control System Framework & Applications

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

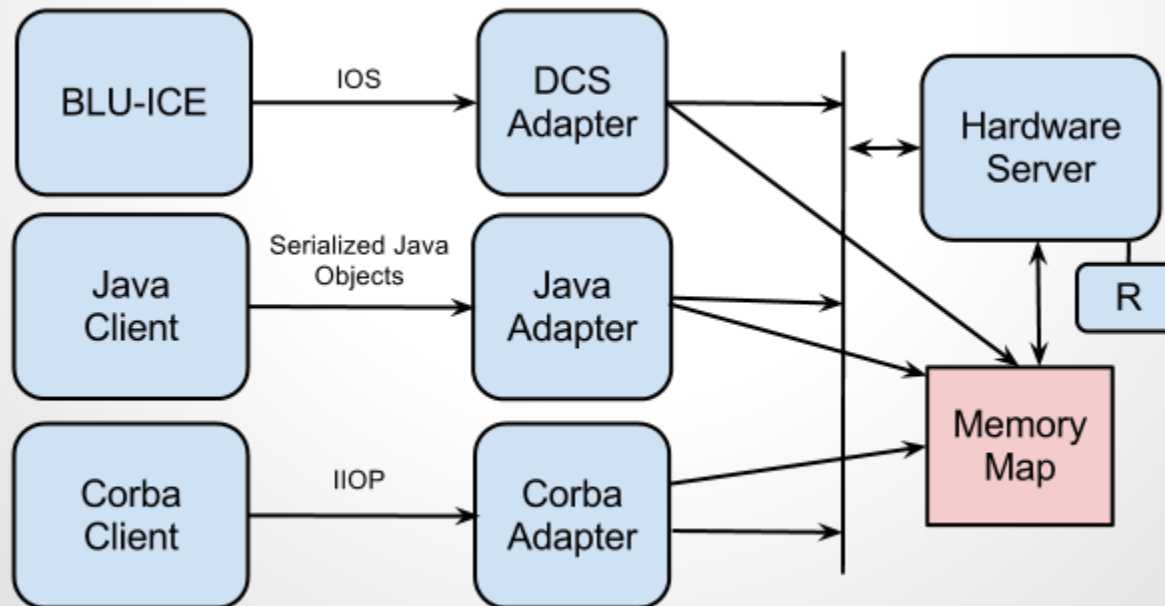
Yun Zhou

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 interprocess 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.

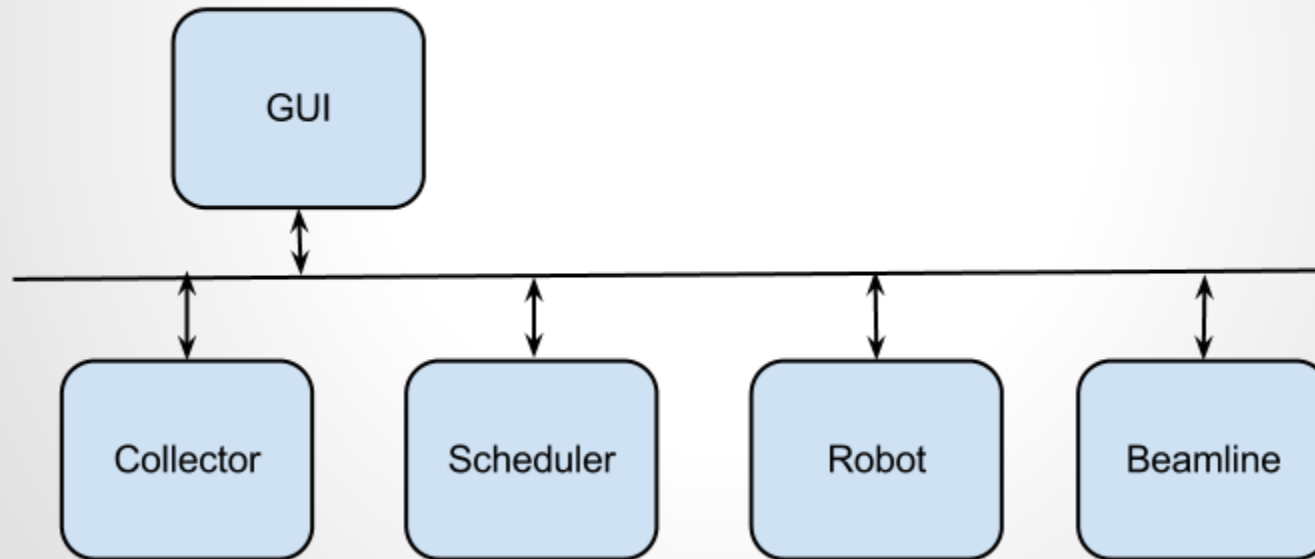
Swing

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.

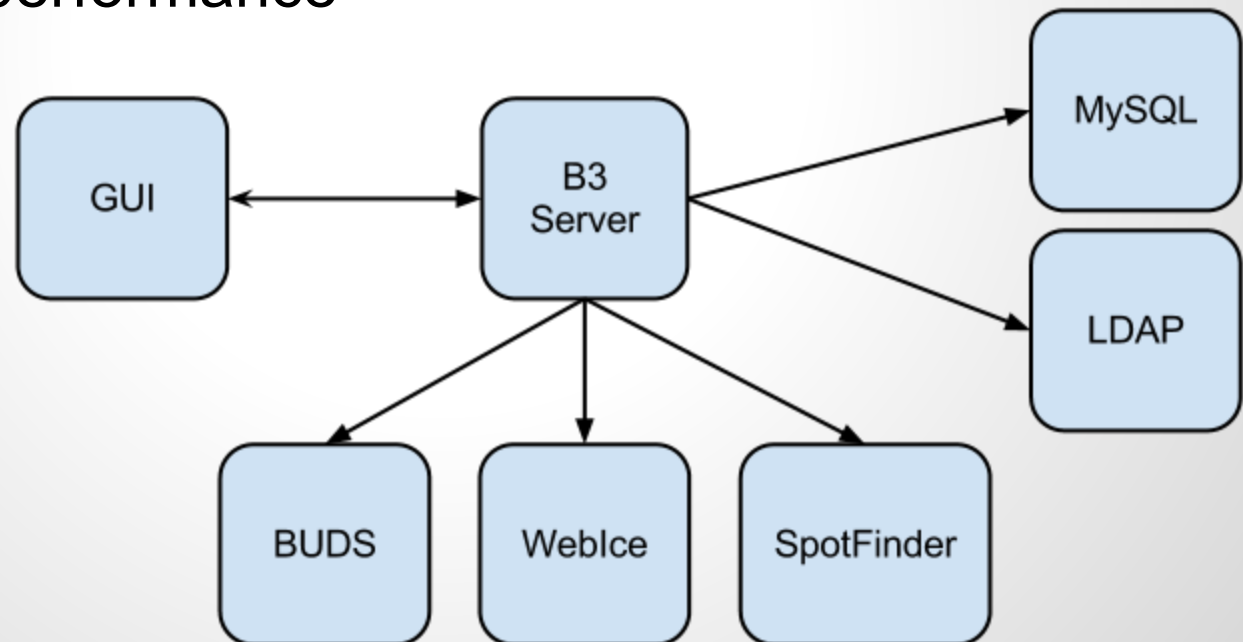
B3 Framework

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

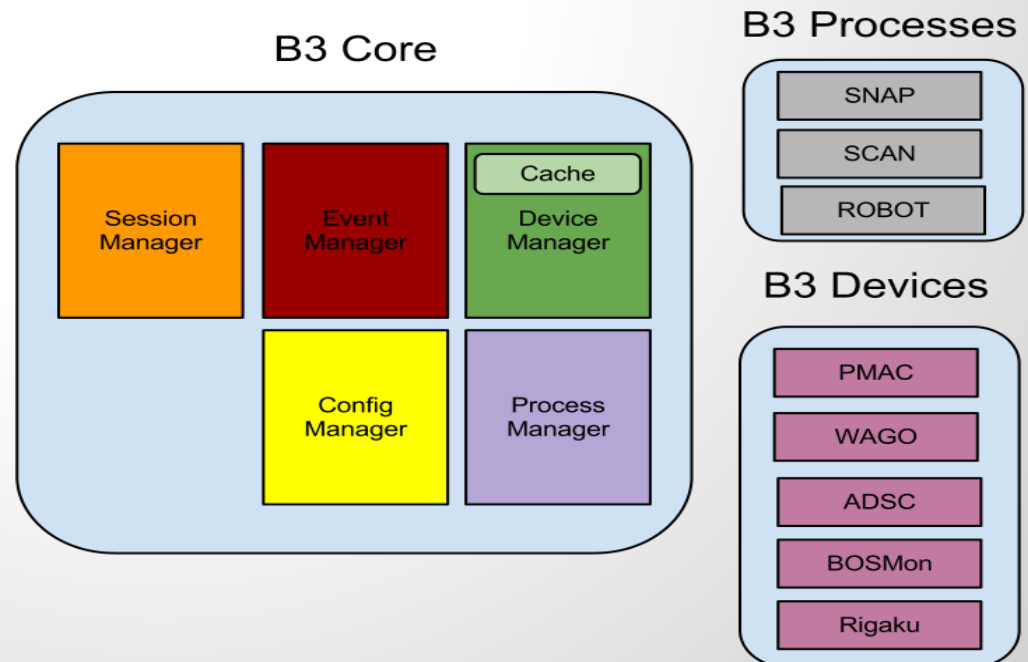
Session - Authorizes

Event - Manages Command Queue.

Device - Manages Devices and Cache.

Process - TaskQ, Robot, Snap and Scan

Configuration - Manages XML config file



B3 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

Calendar Beamtime Dewars User Admin Documents Admin Help

Today Cal Legend Jan 14-Jan 20 2013 Last Change: KMWoo 2013-01-24 10:35:05 On-Call: jmdickert Username:jtaylor Log Out

Date	501	502	503	821	822	
Mon 1-14-2013	<p>9AM-2PM(s) Startup 2PM-11:30PM C 11:30PM-9AM C</p> <p>Beamtime Details for Takeda at Mon Jan 14 14:00 2013 on 503</p> <p><input checked="" type="checkbox"/> Sent Confirmation Letter <input type="button" value="Send Now"/> 2012-11-30</p> <p><input checked="" type="checkbox"/> Sent User Support Letter <input type="button" value="Send Now"/> 2012-12-31</p> <p><input type="checkbox"/> Sent Remote Support Letter</p> <p><input type="checkbox"/> Sent Required Work Description Letter</p> <p><input type="checkbox"/> Remote Data Collection <input type="checkbox"/> Remote And On-Site Data Collection</p> <p><input type="checkbox"/> Pending <input type="checkbox"/> Non-PRT Scheduled on Cancelled or Unused Beamtime</p> <p><input type="checkbox"/> Collaborative Crystallography</p> <p><input checked="" type="checkbox"/> Autounloader <input type="checkbox"/> No Autounloader</p> <p>Puck Types <input type="checkbox"/> Rigaku Pucks <input checked="" type="checkbox"/> ALS Pucks <input type="checkbox"/> Unipucks</p>		<p>9AM-2PM(s) kbroyal Startup 7:30PM-9AM Takeda(s)</p>	<p>10AM-2PM(s) nathan Startup 2PM-11:30PM Brandeis-Miller(ra) 11:30PM-10AM Brandeis-Miller(ra)</p>	<p>10AM-2PM(s) nathan Startup 2PM-11:30PM OHSU-Gouaux(ra) 11:30PM-10AM Available</p>	
Tue 1-15-2013	<p>9AM-10AM(s) Staff-Taylor 10AM-5:30PM C 5:30PM-1:30AM</p> <p><input type="checkbox"/> Pending <input type="checkbox"/> Non-PRT Scheduled on Cancelled or Unused Beamtime</p> <p><input type="checkbox"/> Collaborative Crystallography</p> <p><input checked="" type="checkbox"/> Autounloader <input type="checkbox"/> No Autounloader</p>				<p>Startup Staff-Taylor M Staff-Taylor</p>	
Wed 1-16-2013	<p>1:30AM-9AM BC 9AM-10AM(s) jmc 10AM-5:30PM G 5:30PM-1:30AM</p>				<p>Staff-Taylor j steinhour Startup UT Southwestern-Jiang(ra) M UT Southwestern-Jiang(ra)</p>	
Thur 1-17-2013	<p>1:30AM-9AM BC 9AM-10AM(s) jmc 10AM-5:30PM N 5:30PM-1:30AM</p>				<p>UT Southwestern-Jiang(ra) j steinhour Startup UT Southwestern-Jiang(ra) M UT Southwestern-Jiang(ra)</p>	
Fri 1-18-2013	<p>1:30AM-9AM Novartis Emeryville(a) 9AM-10AM(s) abldoux Startup 10AM-5:30PM CC, TAMU(a) 5:30PM-1:30AM Staff-Sankaran</p>	<p>1:30AM-9AM BCBS 9AM-10AM(s) kbroyal Startup 10AM-5:30PM AMGEN(a) 5:30PM-1:30AM Cancelled</p>			<p>UT Southwestern-Jiang(ra) j kbroyal Startup Columbia University-Zhou(a) M Columbia University-Zhou(ra)</p>	
Sat 1-19-2013	<p>1:30AM-9AM Staff 9AM-10AM(s) Startup 10AM-5:30PM Crystallographic Consulting(a) 5:30PM-1:30AM Available</p>	<p>1:30AM-9AM Cancelled 9AM-10AM(s) Startup 10AM-5:30PM U Colorado-Sousa(ra) 5:30PM-1:30AM U Colorado-Sousa(ra)</p>			<p>Columbia University-Zhou(a) j diane Startup JGJ(a) M JGJ(a)</p>	
Sun 1-20-2013	<p>1:30AM-9AM Available 9AM-10AM(s) nathan Startup 10AM-5PM UCSC-Rubin(ra) 5PM-11PM UCSC-Rubin(ra)</p>	<p>1:30AM-9AM U Colorado-Sousa(a) 9AM-10AM(s) nathan Startup 10AM-5PM UofTaustin-Monzingo(ra) 5PM-11PM UofTaustin-Monzingo(ra)</p>	<p>1:30AM-9AM Available 9AM-10AM(s) nathan Startup 10AM-5PM Available 5PM-11PM Available</p>	<p>2:30AM-10AM Staff-Morton 10AM-11AM(s) nathan Startup 11AM-6PM Staff-Morton 6PM-11PM Staff-Morton</p>	<p>2:30AM-10AM JGJ(a) 10AM-11AM(s) nathan Startup 11AM-6PM Available 4PM-11PM Available</p>	

List Users

Username	First Name	Last Name	Badge	AltID	Email	ALS Expiration	Id
nobody	Anna	Aagaard	008668	16343			1894
lamb	Carnie	Abajan	010508	16995	c-abajan@northwestern.edu		1895
syrrs	Ruben	Abalos	004880	14910			1455
scripps	Dafna	Abelson	015335	15929	dafna@scripps.edu		2149
emerald	Jan	Abendorth	008032	15992	jabendorth@embios.com		1896
nobody	Jonathan	Abraham		0	abraham@crystal.harvard.edu		2727
jabramson	Jeff	Abramson	013972	18438	jabramson@mednet.ucsf.edu		706
ucsd	Edward	Abresch	666159	14785	eabresch@ucsd.edu		707
nobody	Alessio	Accardi	012970	18043			1897
usc	Vadim	Adamovich	008180	16066			1087
pdadams	Paul	Adams	001842	13369	pdadams@bl.gov		1088
stanford	Jarrett	Adams	022145	21317	jadams@stanford.edu		1898
garcia	Erin	Adams	007927	15948	eadams@cimg.stanford.edu		508
addigatta	Anthony	Addigatta	010543	17078	anthony@uxray.uoregon.edu		1507
sprang	Anirban	Adhikari	011177	17116	Anirban.Adhikari@UTSouthwestern.edu		1715
adler	Marc	Adler	916603	12367	dr_marc_adler@yahoo.com		1899
callerton	Kathleen	Aertgeerts	null	0	kaertgeerts@dartheuroscience.com		2782
uwash	Arthor	Aevansson	800215	12497			708
marletta	Theodor	Agapie	020382	20756	marletta@berkeley.edu		1892
agard	David	Agard	005708	11734	agard@msg.ucsf.edu		1332
ucberkeley	Madhav	Agrawal	018906	35313	madhavasamaraya@gmail.com		608
nobody	Alysia	Ahmed	030226	26586	aahmed@caltech.edu		2567
dbushnell	Victoria	Ahn	null	0	vahn@cocrysaliscovery.com		2620
nobody	Shivani	Ahuja	034190	0	shujas@gene.com		2787
ucberkeley	Jun	Aishima	006130	30312			709
nobody	Adriaan	Akerboom	021278	20995	akerboom@janella.hmi.org		1900
stroud	David	Akhavan	004255	14725			1089
harrison	Jawdat	Al-Bassam	013363	18262	jawdat@crystal.harvard.edu		1901
nobody	Maher	Alayyoubi	023911	21888	maher.alayyoubi@gmail.com		710
reesse	Lisa	Alex	800280	12588			711
tsaremonte	Yazan	Ahaddid	019895	20562	ykhadid@hotmail.com		1090
scripps	George	Alendorph	012223	17078			1456

Creates User Refresh Dismiss

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

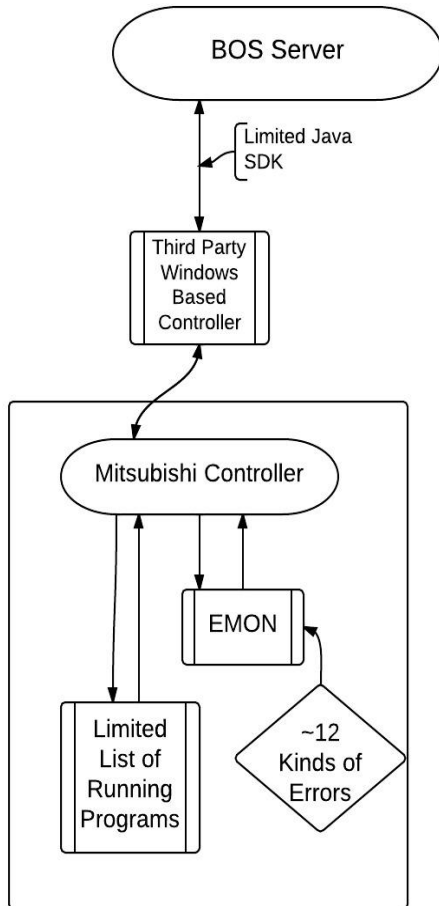
Linear Motors

Sector 5 Gripper Swap

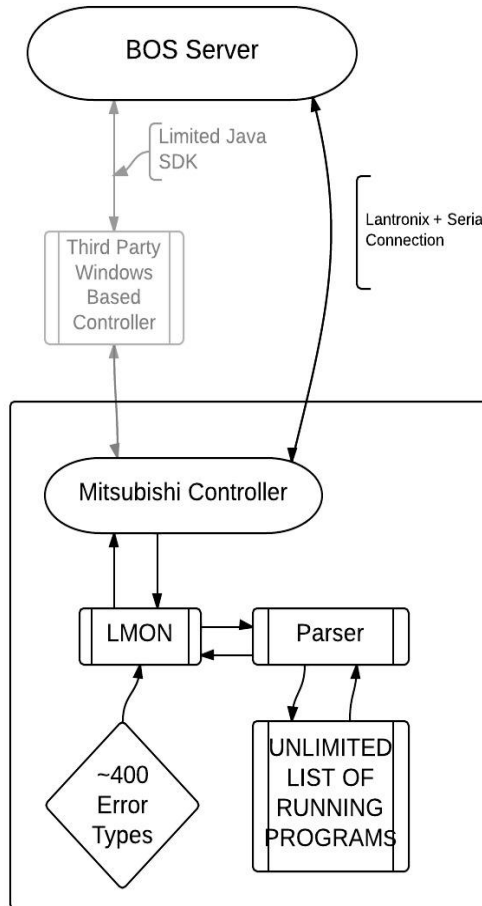
Dry Cold Nitrogen Collets

Motivations for BOSMon

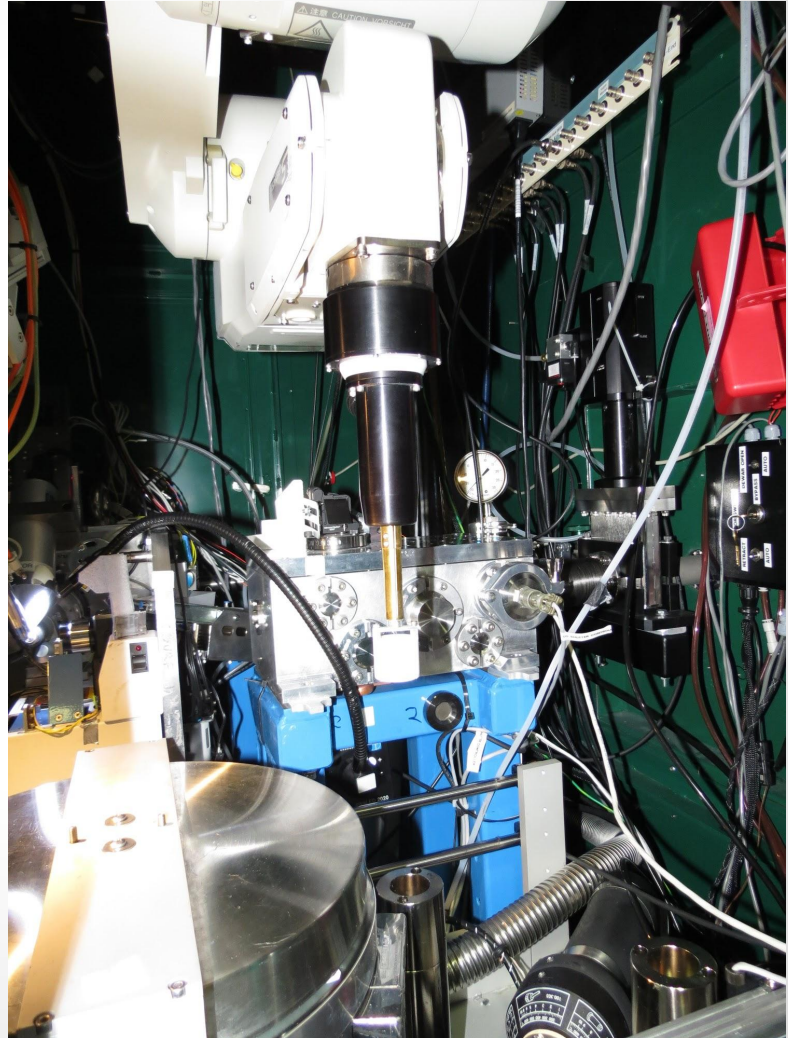
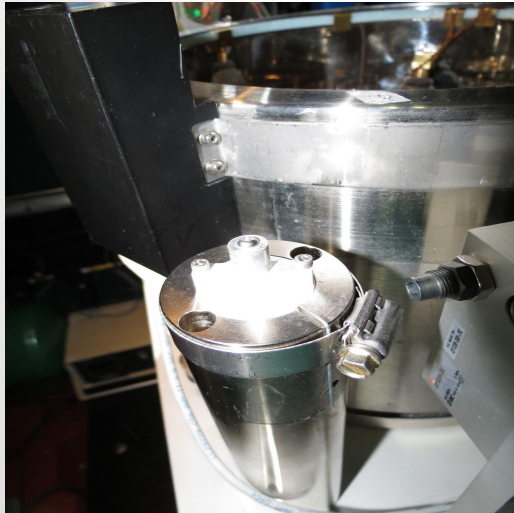
Previous Configuration:



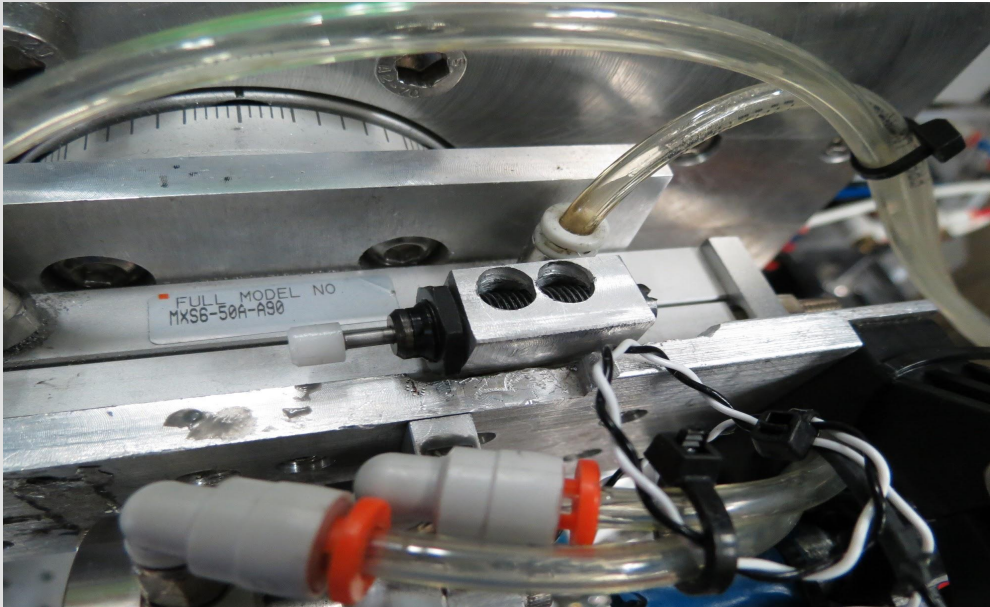
New Setup:



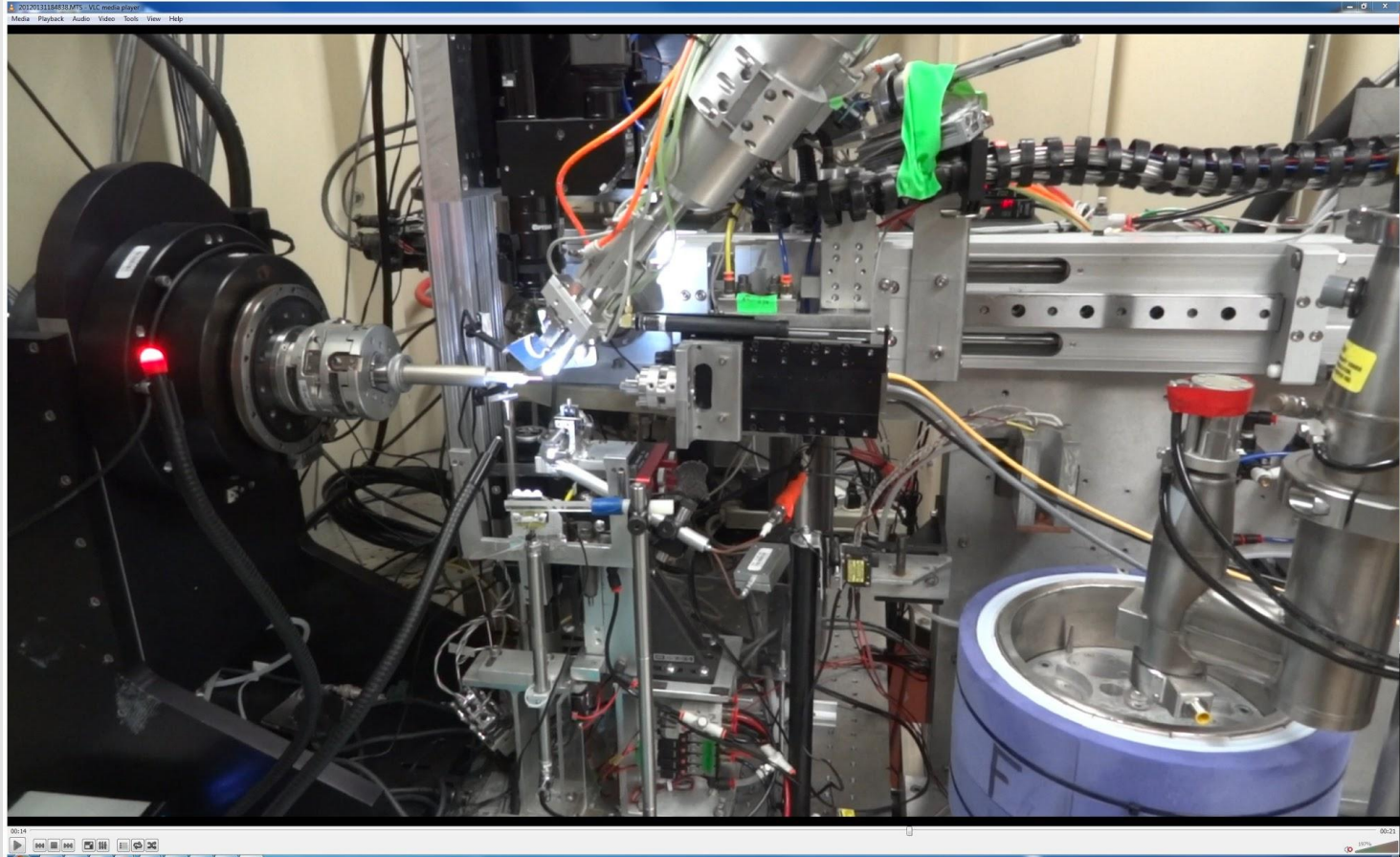
Crystal Washer (developed by Anthony Rozales)



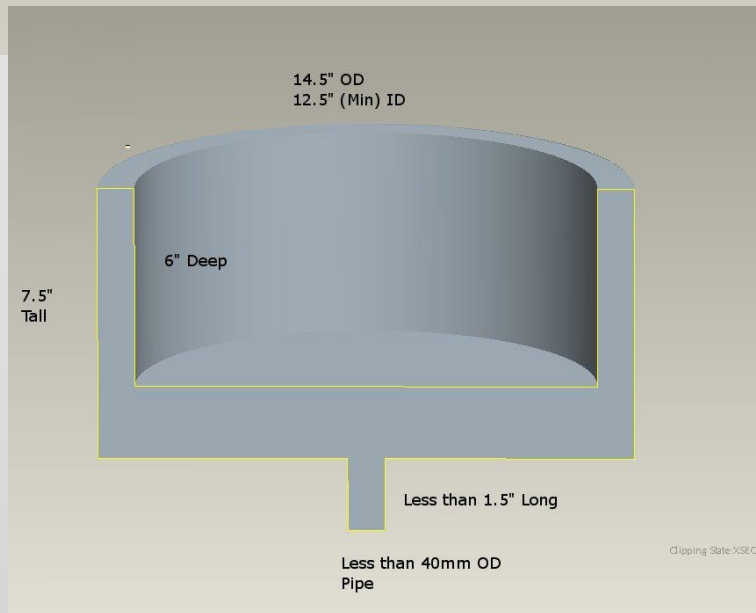
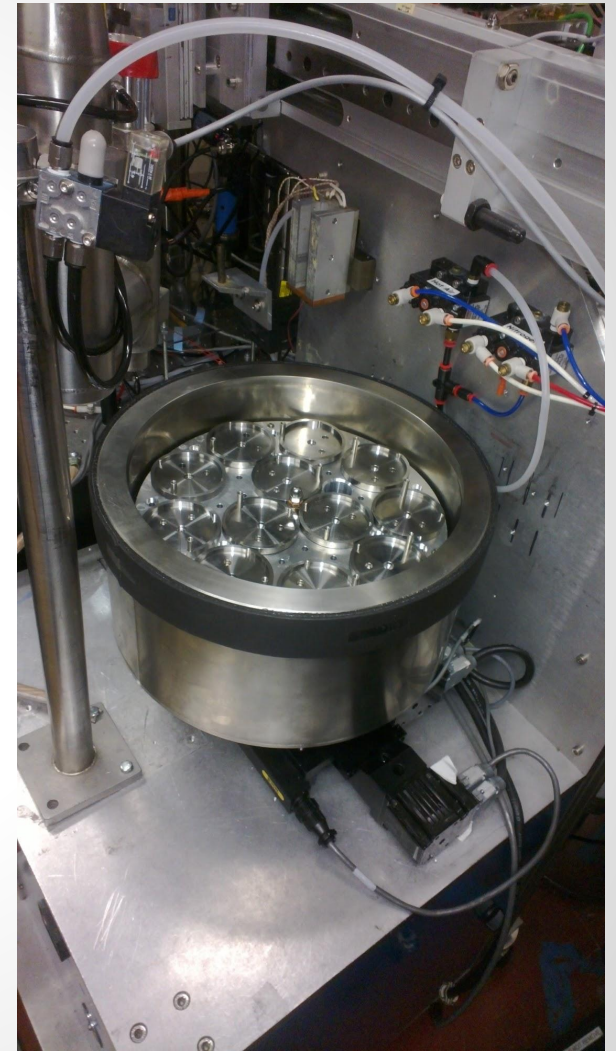
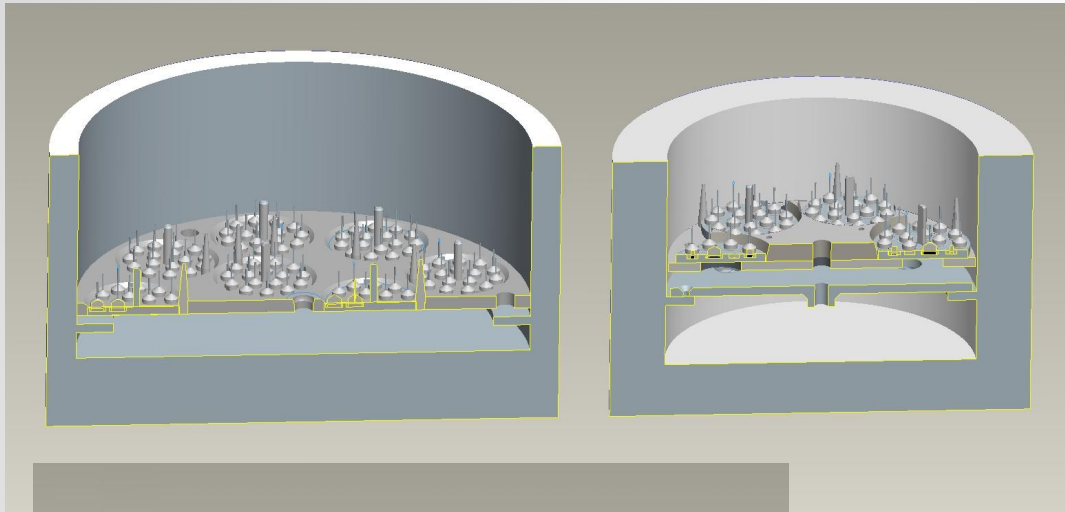
Bumpers



Small Move Linear Motor



Big Dewar



Sector 5 Gripper Swap



Conclusion

Questions?

We are always looking for collaborators.

Thanks for coming!

Website - bcsb.als.lbl.gov

John Taylor - jrtaylor@lbl.gov

Leif Steinhour - LASteinhour@lbl.gov