



LCLS Ultrafast Science Instruments

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|--|--|--|
| MEETING REPORT | | Report No. TR-391-003-24 |
| The Design Review Report Shall include at a minimum: <ul style="list-style-type: none"> ▪ The title of the item or system; ▪ A description of the item; ▪ Design Review Report Number; ▪ The type of design review; ▪ The date of the review; ▪ The names of the presenters ▪ The names, institutions and department of the reviewers ▪ The names of all the attendees | | <ul style="list-style-type: none"> ▪ Findings/List of Action Items – these are items that require formal action and closure in writing for the review to be approved. See SLAC Document AP-391-000-59 for LUSI Design Review Guidelines. ▪ Concerns – these are comments that require action by the design/engineering team, but a response is not required to approve the review ▪ Observations – these are general comments and require no response |
| TYPE OF REVIEW: Fabrication Design Review | | |
| WBS: 1.2 X-ray Pump Probe | | |
| Title of the Review | XPP Team Leaders Meeting | |
| Presented By: | David Fritz | |
| Report Prepared By: | David Fritz | Date: 17 October 2008 |
| Attachments: | <input checked="" type="checkbox"/> Meeting Slides <input type="checkbox"/> Design Checklist <input type="checkbox"/> Calculations <input type="checkbox"/> Other | |

Purpose/Goal of the Meeting:

To update the XPP team leaders on the instrument status and to define a prioritized re-scope and de-scope list.

Attendees:

- David Fritz
- Tom Fornek
- John Galayda
- Kelly Gaffney
- David Reis
- Jorgen Larsson



XPP Team Leaders Meeting

October 17, 2008

LUSI

LCLS Ultrafast Science Instruments

David FRITZ
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XPP

Outline

- 6 month LUSI Summary
- XPP Scope
- XPP Status Report
 - XPP Support Tables
 - XPP Sample Goniometer
 - XPP Detector Mover
 - Hutch Facilities Design
- XPP Schedule
- Meeting Action Items
 - Prioritize items to re-scope into XPP
 - Prioritize items to de-scope from XPP

6-month LUSI Summary

- Director's Review (March 4-5)
 - LUSI plan did not fit budget profile
 - Items were de-scoped to fit into profile
- LCLS SAC Meeting (March 18-19)
- LCLS FAC Meeting (June 16-18)
- XPP Proposal Prep Workshop (June 20-21)
- Director's Review (July 15-16)
- LUSI CD2 Lehman Review (Aug. 19-21)
 - Review was successful
 - Baseline scope, cost & schedule defined
 - Determined that a procurement review needs to be held for all long lead items

XPP Scope

| | CD-4A | | CD-4C | |
|------------------|--------------------------------|-----------|------------------------------------|-----------|
| | COMPONENT | WBS | COMPONENT | WBS |
| XPP | TRAVERSING SUPPORTS | 1.2.2.1 | LASER POWER AMP MISC PARTS | 1.2.3.1.2 |
| | FIXED SUPPORTS | 1.2.2.2 | LASER POWER AMP PUMP | 1.2.3.1.2 |
| | LASER COMPRESSOR MISC PARTS | 1.2.3.1.2 | LASER POCKEL CELL | 1.2.3.1.2 |
| | LASER OPTICS AND OPTOMECHANICS | 1.2.3.2.1 | LASER TEMPORAL PULSE SHAPER | 1.2.3.1.3 |
| | LASER FAST OSCILLOSCOPE | 1.2.3.2.2 | LASER OPTICAL PARAMETRIC AMPLIFIER | 1.2.3.1.4 |
| | LASER GRENOUILLE | 1.2.3.2.2 | LASER 3RD ORDER CORRELATOR | 1.2.3.2.2 |
| | LASER SAMPLING SCOPE | 1.2.3.2.2 | LASER OPTICAL EXPERIMENTS | 1.2.3.2.4 |
| | LASER DIAGNOSTIC EQUIPMENT | 1.2.3.2.2 | | |
| | HUTCH OPTICAL TABLE SYSTEM | 1.2.3.2.3 | | |
| | LASER CONTAINMENT | 1.2.3.2.5 | | |
| | BNL DETECTOR SENSOR | 1.2.4.2 | | |
| | BNL DETECTOR ASIC | 1.2.4.3 | | |
| | BNL DETECTOR CONTROLS AND DAQ | 1.2.4.4 | | |
| | DIFFRACTOMETER GONIOMETER | 1.2.5.1 | | |
| | DIFFRACTOMETER DETECTOR MOVER | 1.2.5.1 | | |
| | HUTCH DROP FLOOR | 1.2.6.2 | | |
| | HUTCH BEAMLINE CABLE TRAYS | 1.2.6.2 | | |
| | VACUUM EQUIPMENT | 1.2.7.1 | | |
| | ION PUMPS | | | |
| | GAUGES | | | |
| VALVES | | | | |
| LEAK DETECTOR | | | | |
| SPOOLS & BELLOWS | 1.2.7.2.1 | | | |
| SUPPORTS | 1.2.7.2.2 | | | |
| DCO | POP-IN PROFILE MONITOR | 1.5.XX | HARMONIC REJECTION MIRRORS | 1.5.XX |
| | POP-IN INTENSITY MONITOR | 1.5.XX | X-RAY FOCUSING LENS | 1.5.XX |
| | INTENSITY POSITION MONITOR | 1.5.XX | ATTENUATOR | 1.5.XX |
| | SLIT SYSTEM (COARSE GUARD) | 1.5.XX | | |
| | SLIT SYSTEM (PRECISE PRIMARY) | 1.5.XX | | |
| | SLIT SYSTEM (PRECISE MONO) | 1.5.XX | | |
| | PULSE PICKER | 1.5.XX | | |



















XPP Support Tables

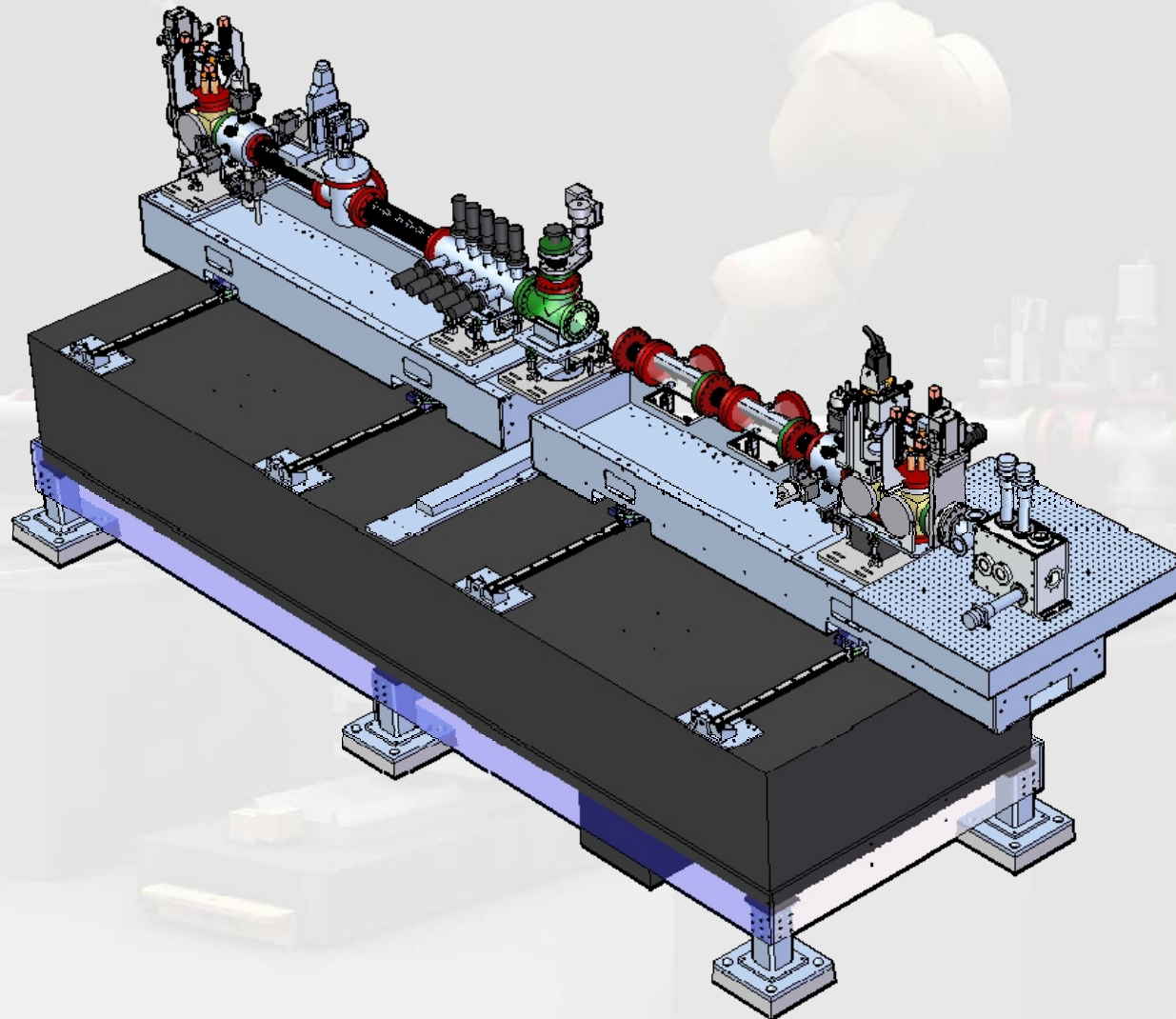
- Physics goals
 - Stabilize components with respect to each other
 - Stabilize components to “world”
- Preliminary design effort was completed in August
- Design review successfully held Aug. 27
 - Review action items have been addressed
- Final design is in progress and nearing completion
 - Excellent progress has been made

XPP Support Tables



















| CONFIGURATION OPTION | LEG | S'BACK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|----------------------|---------|---------|----|---|---|---|----|---|----|---|----|----|----|----|----|----|----|
| | STL | STL | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| | STL | GRANITE | N | N | N | N | Y | N | N | N | N | N | N | N | N | N | N |
| | GRANITE | STL | N | N | Y | Y | N | N | N | N | N | N | YN | N | N | N | N |
| | GRANITE | GRANITE | N | Y | Y | Y | Y | N | N | N | N | N | YN | N | N | N | N |
| | STL | STL | YN | N | N | N | YN | N | YN | N | N | N | N | N | N | N | N |
| | STL | GRANITE | YN | N | N | N | Y | N | YN | N | N | N | N | N | N | N | N |
| | GRANITE | STL | YN | Y | Y | Y | YN | N | YN | N | N | N | YN | N | N | YN | N |
| | GRANITE | GRANITE | YN | Y | Y | Y | Y | N | YN | N | N | N | YN | N | N | N | N |
| | STL | STL | Y | N | N | N | Y | N | Y | N | YN | N | N | N | N | N | N |
| | STL | GRANITE | Y | N | N | N | Y | N | Y | N | YN | N | N | N | N | N | N |
| | GRANITE | STL | Y | Y | Y | Y | Y | N | Y | N | N | N | YN | N | N | YN | N |
| | GRANITE | GRANITE | Y | Y | Y | Y | Y | N | Y | N | N | N | YN | N | N | N | N |
| | GRANITE | STL | YN | N | Y | Y | N | Y | N | Y | Y | Y | Y | Y | Y | Y | Y |
| | GRANITE | GRANITE | YN | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | N | N | N |
| | GRANITE | STL | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | YN |
| | GRANITE | GRANITE | YN | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | N | N | N |

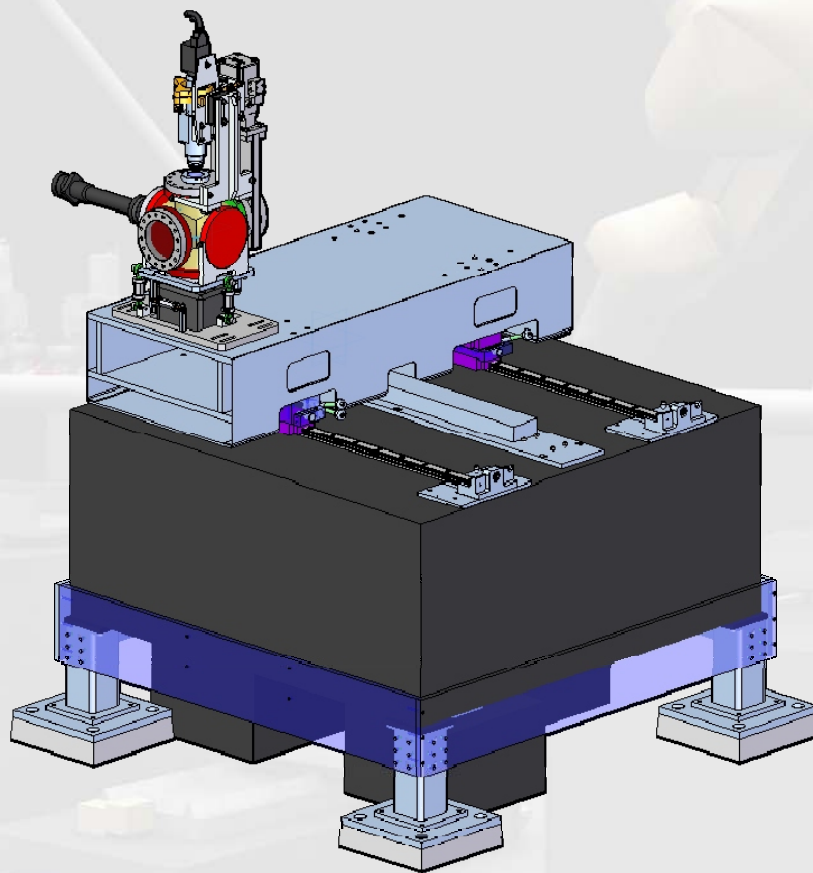
XPP Support Tables

| | |
|---|-------------------|
|  | Photon Shutter |
|  | Intensity Monitor |
|  | Slits |
|  | Profile Monitor |
|  | Intensity Monitor |
|  | Slits |
|  | Focusing Lenses |
|  | Attenuators |
|  | Pulse Picker |
|  | Mirrors |
|  | Slits |
|  | Intensity Monitor |
|  | Profile Monitor |
|  | Sample Goniometer |
|  | Detector Mover |
|  | Profile Monitor |
|  | Intensity Monitor |
|  | Photon Shutter |





















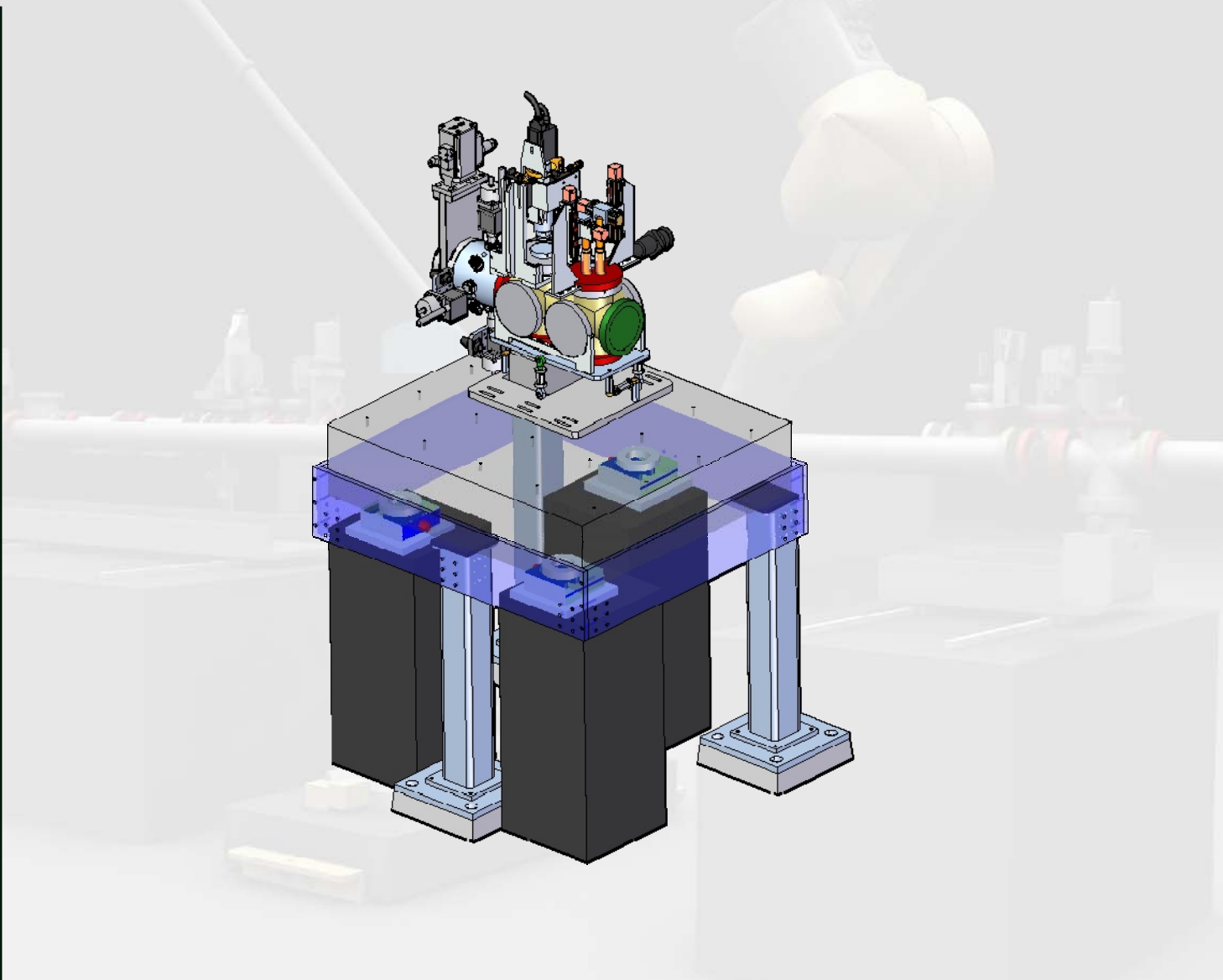
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|  | Detector Mover |
|  | Profile Monitor |
|  | Intensity Monitor |
|  | Photon Shutter |

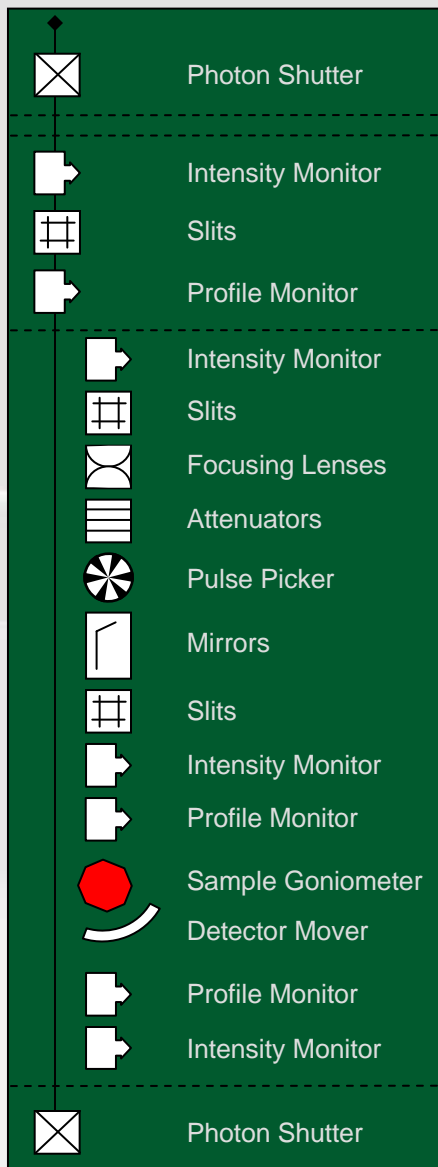


XPP Support Tables

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|  | Intensity Monitor |
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|  | Profile Monitor |
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|  | Intensity Monitor |
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|  | Focusing Lenses |
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|  | Pulse Picker |
|  | Mirrors |
|  | Slits |
|  | Intensity Monitor |
|  | Profile Monitor |
|  | Sample Goniometer |
|  | Detector Mover |
|  | Profile Monitor |
|  | Intensity Monitor |
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|  | Photon Shutter |

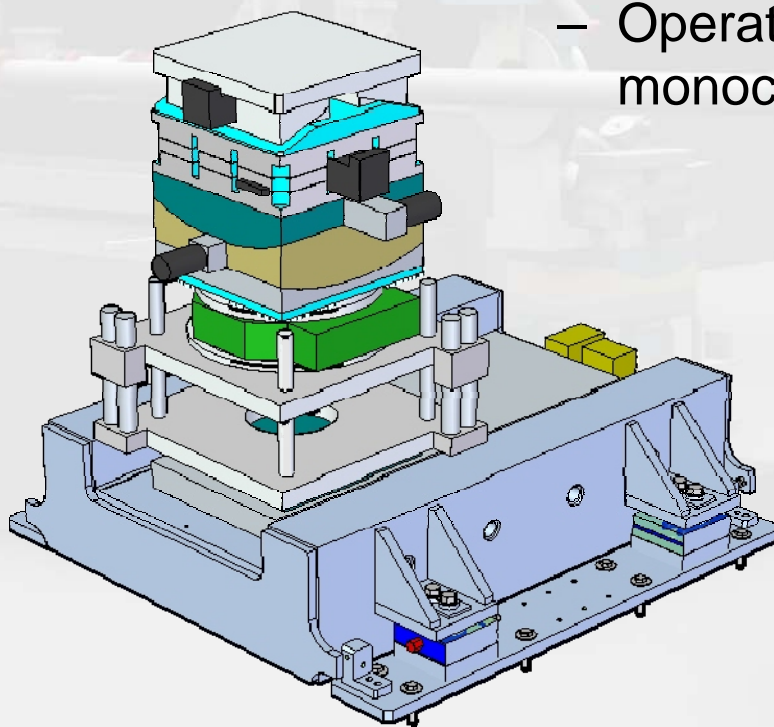


XPP Sample Goniometer



- Tilt Platform

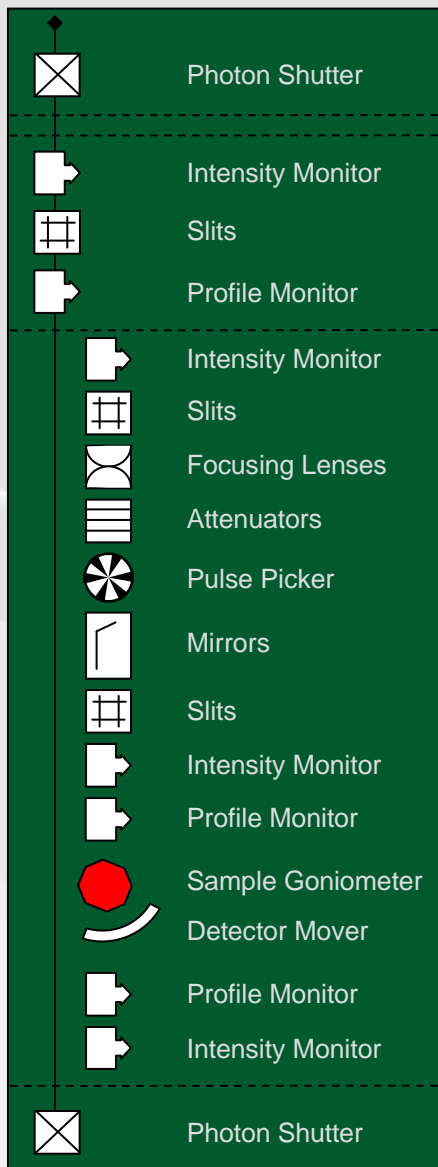
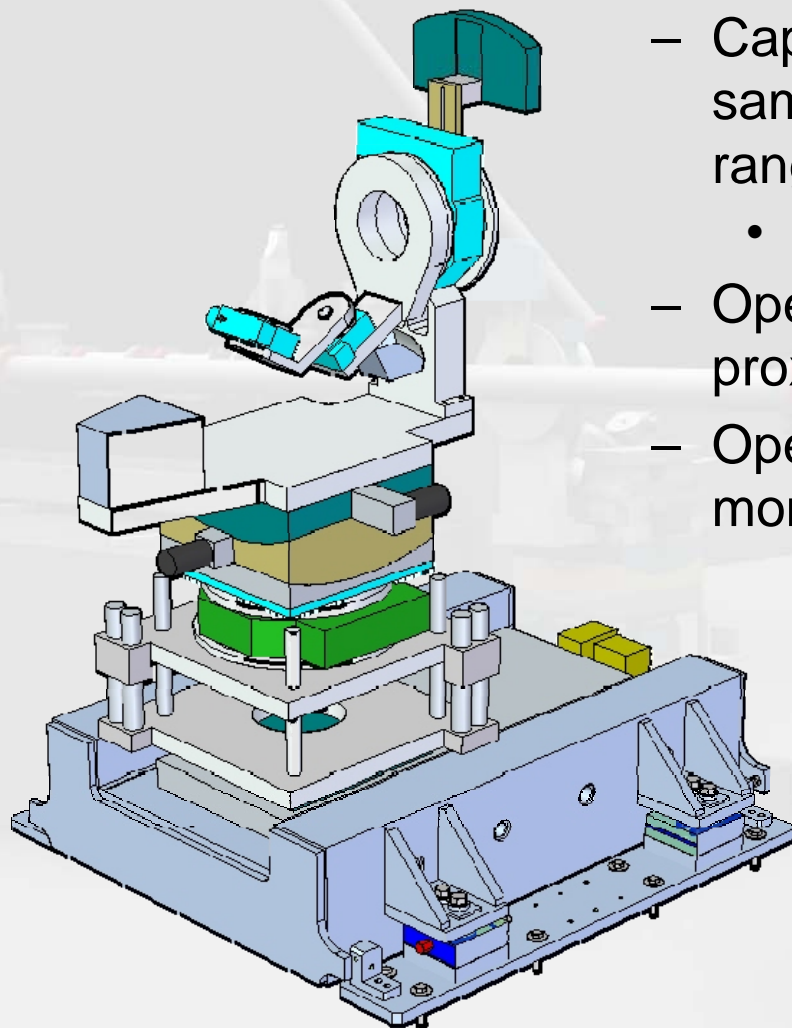
- Capable of orienting large sample environments (50 kg)
- Open access to allow close proximity laser optics
- Operate in direct or future monochromatic beam



XPP Sample Goniometer

- Kappa Goniometer

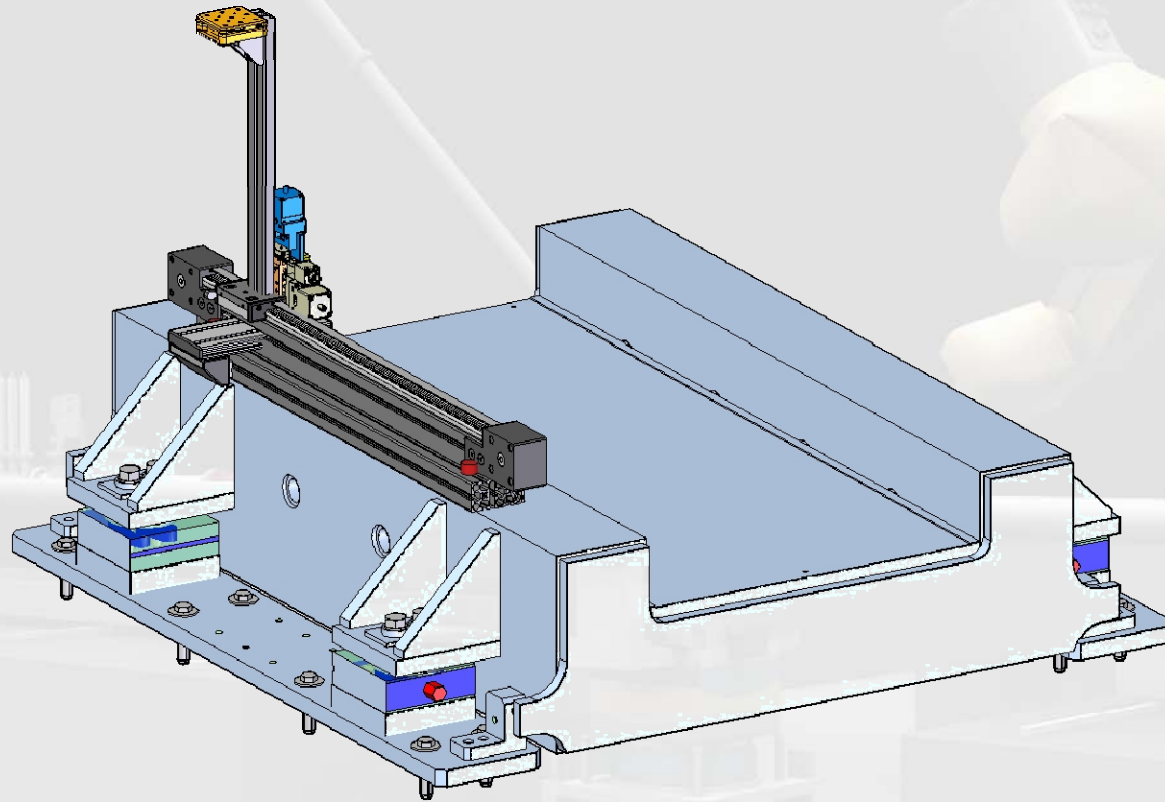
- Capable of orienting small samples ($\sim 50 \mu\text{m}$) over a wide range of reciprocal space
 - Sphere of confusion $< 30 \mu\text{m}$
- Open access to allow close proximity laser optics
- Operate in direct or future monochromatic beam



XPP Sample Goniometer



















- Game Plan
 - LUSI will design and build goniometer support structure and beam stop
 - A vendor will construct the sample goniometer as a design build contract
 - Interface point is the top surface of the support structure
- A sample goniometer procurement review is tentatively scheduled in early November
 - Review procurement plan
 - Review vendor selection criteria
 - Quality assurance plan

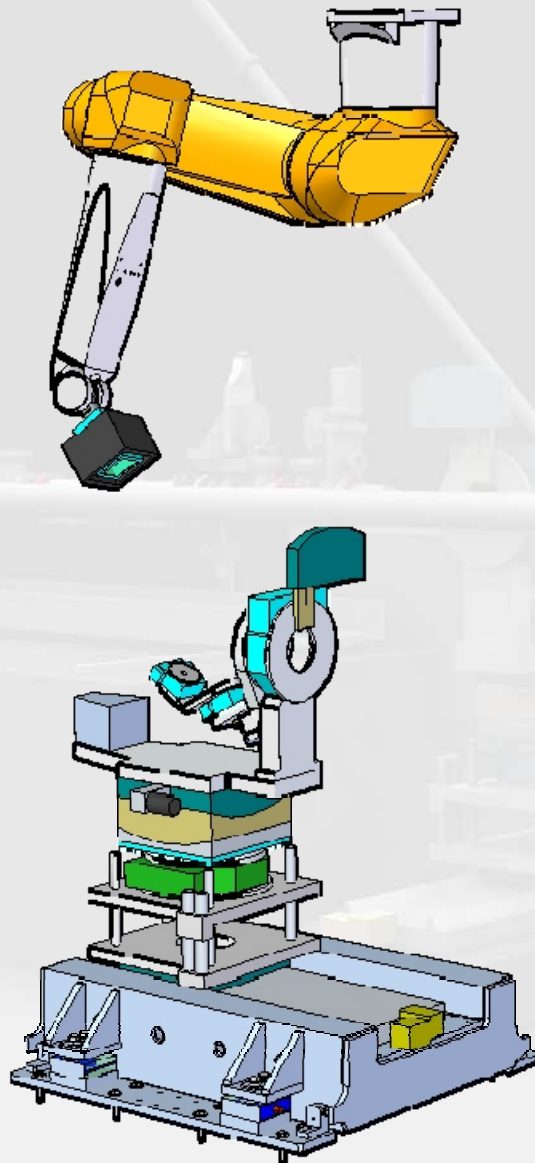
XPP Sample Goniometer



- Preliminary design of goniometer base is complete
 - Large steel weldment
 - Provisions for beamstop and camera mounting

XPP Detector Mover

| | |
|---|-------------------|
|  | Photon Shutter |
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|  | Slits |
|  | Profile Monitor |
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|  | Intensity Monitor |
|  | Slits |
|  | Focusing Lenses |
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|  | Photon Shutter |

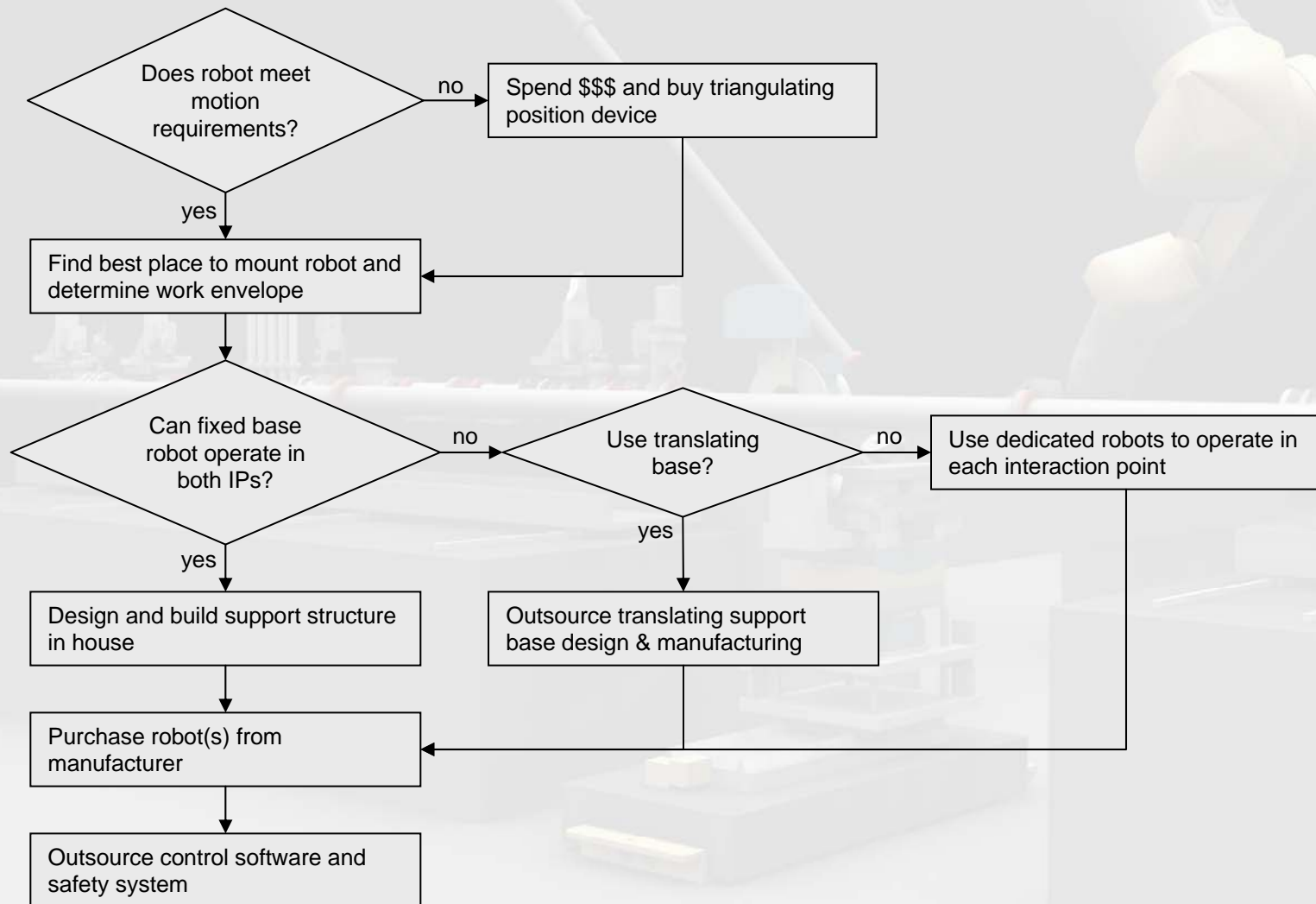


- Detector Mover
 - 10 cm – 100 cm sample to detector distance
 - Repeatable position the XPP detector pixels to a fraction of the pixel size
 - Definitively know the position of all detector pixels to a fraction of the pixel size
 - Operate in both interaction points
 - Remotely variable sample to detector distance

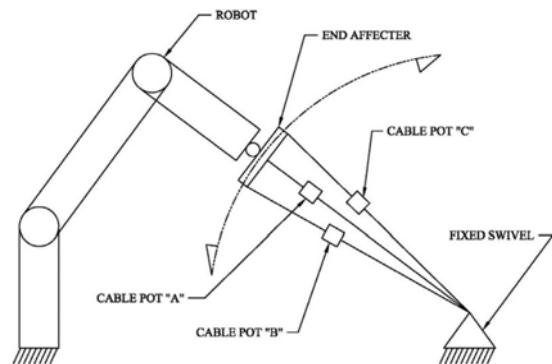
XPP Detector Mover

- Game Plan
 - The detector mover will be split up into various statements of work (SOW) and procurements
 - SOW #1 – Motion tests to verify if an industrial robot, with sufficient payload and reach, can meet XPP requirements
 - SOW #2 – Determine the optimal place to mount the robot arm and the application-specific work envelope
 - Remaining statements of work are dependent on the results of SOW #2

XPP Detector Mover

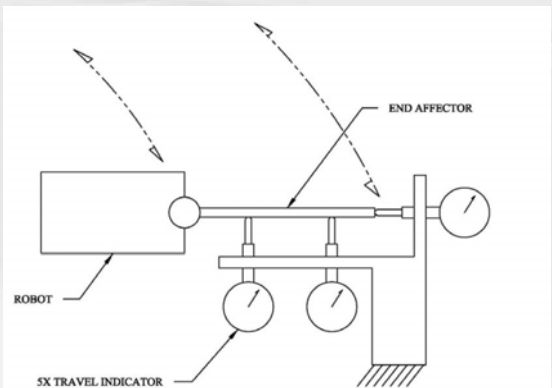


XPP Detector Mover



NOTES:

- 1) Fixed swivel defines spherical surface(s) center.
- 2) Cable pot "A" measures nominal radius as robot translates along circular path.
- 3) Cable pots "B" and "C" measure end affector pointing during translations.



NOTES:

- 1) 5 travel indicators provide position and orientation.
 - a. 2 sets of travel indicators (each set oriented orthogonally) along affector length.
 - b. 1 travel indicator registering on end of affector

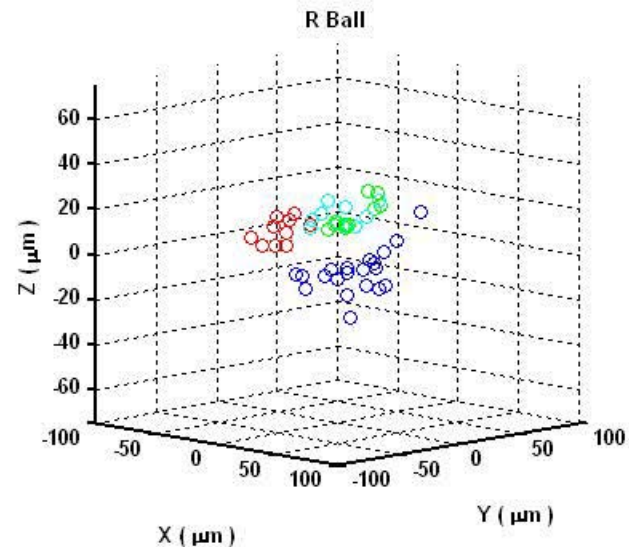
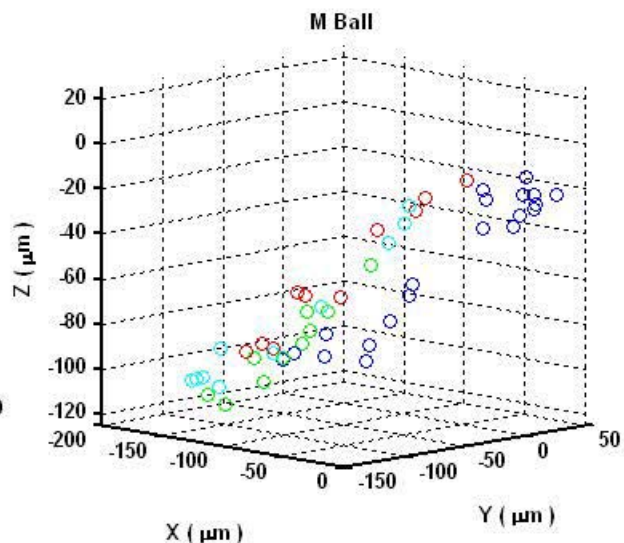
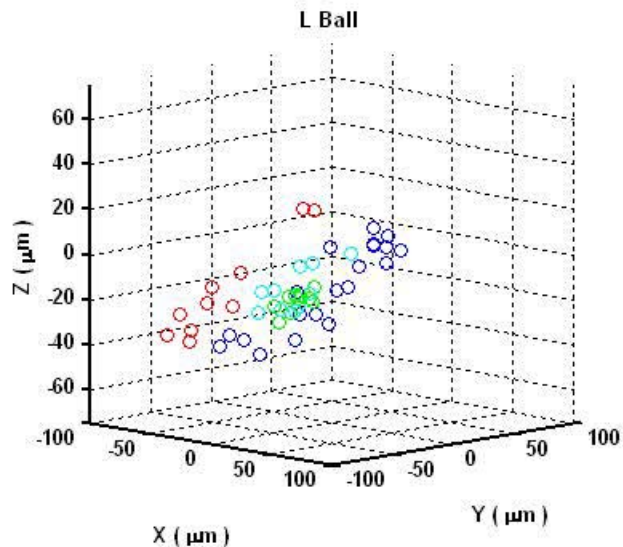
- Test 1 – Spherical motion and pointing
 - System is capable of moving the detector about a spherical surface of a user defined radii while pointing the detector at the interaction region
- Test 2 – Repeatability
 - Measure repeatability and hysteresis of system
- Test 3 – Detector Clocking Angle
 - Measure how well the clocking angle can be controlled
- Test 4 – Stability
 - Measure long term (~ hours) motion drift for various fixed positions

XPP Detector Mover

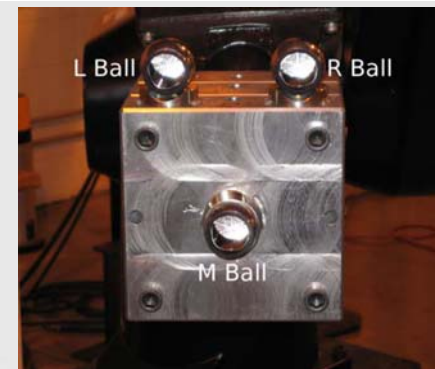


XPP Detector Mover

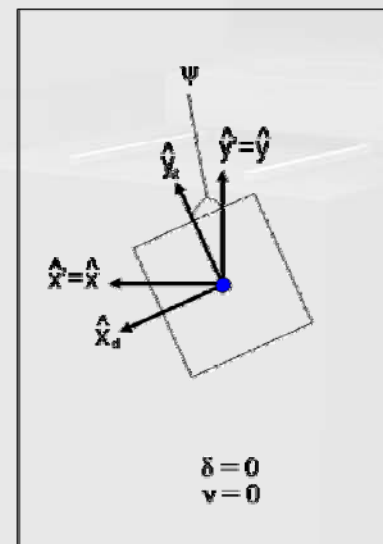
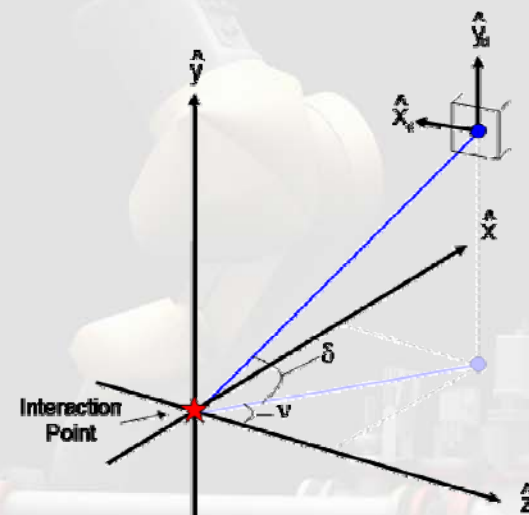
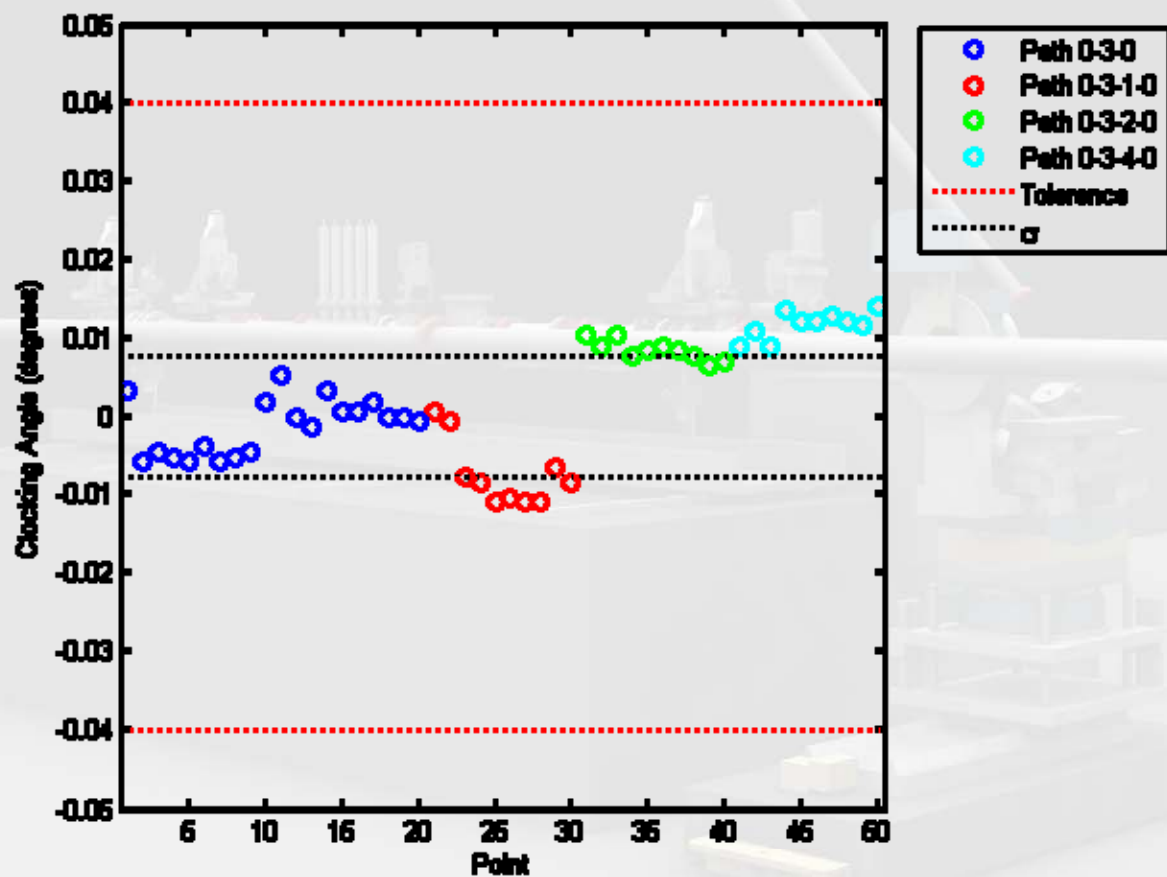
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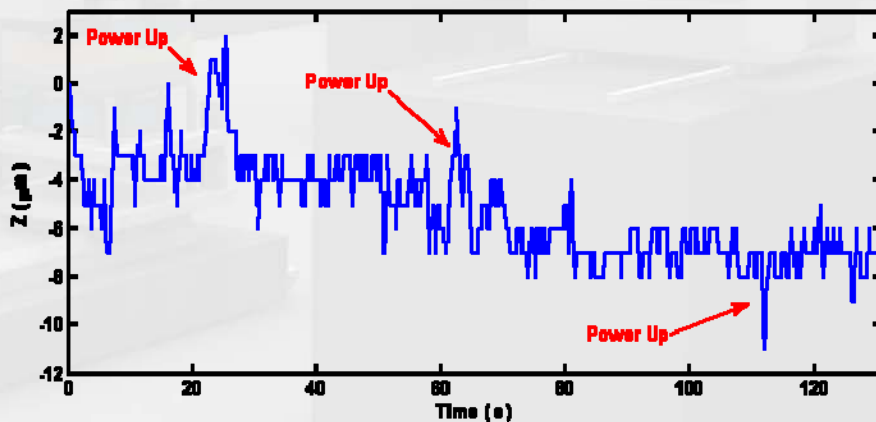
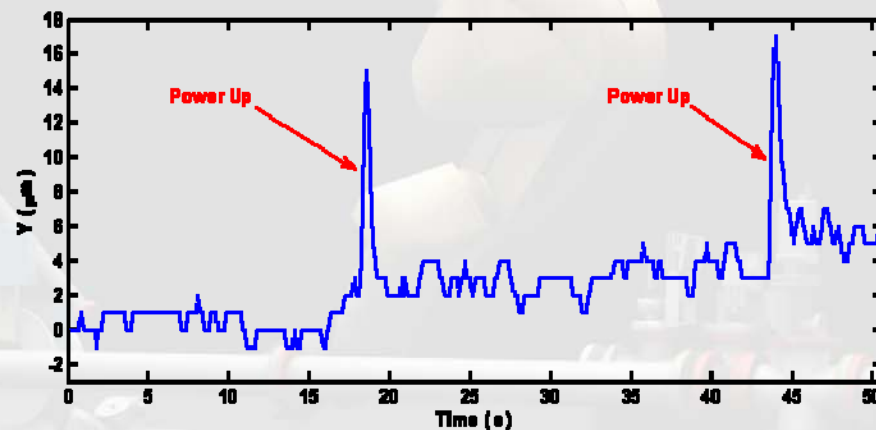
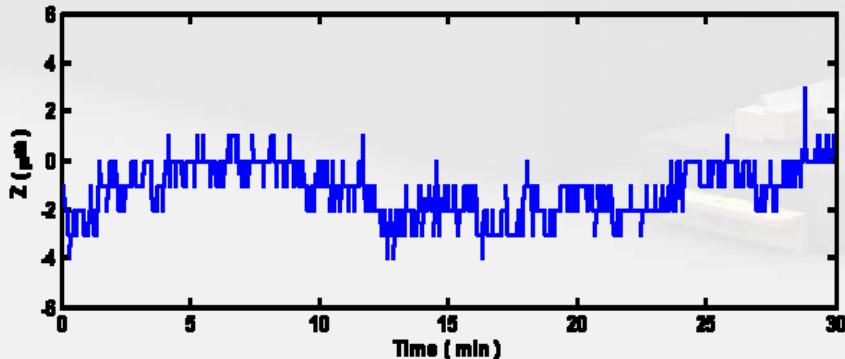
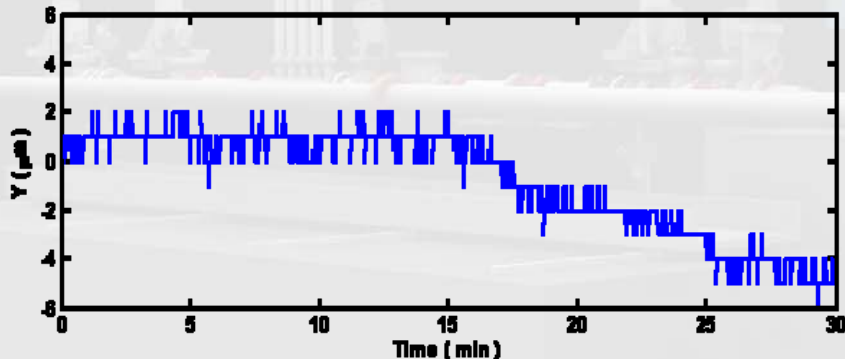
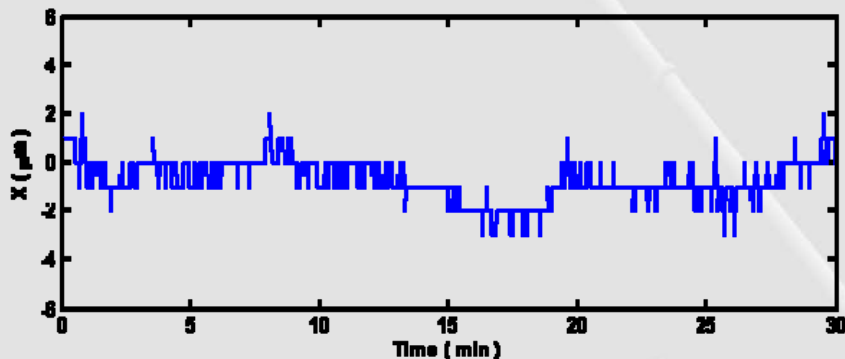
| Datum | σX | σY | σZ | X | Y | Z |
|---------|------------------|------------------|------------------|-------------------|-------------------|-------------------|
| Keyence | 29 μm | 21 μm | 14 μm | -22 μm | -1 μm | -16 μm |
| L Ball | 37 μm | 16 μm | 18 μm | -26 μm | -6 μm | -19 μm |
| M Ball | 66 μm | 27 μm | 36 μm | -92 μm | -45 μm | -66 μm |
| R Ball | 29 μm | 17 μm | 16 μm | 9 μm | -9 μm | 8 μm |



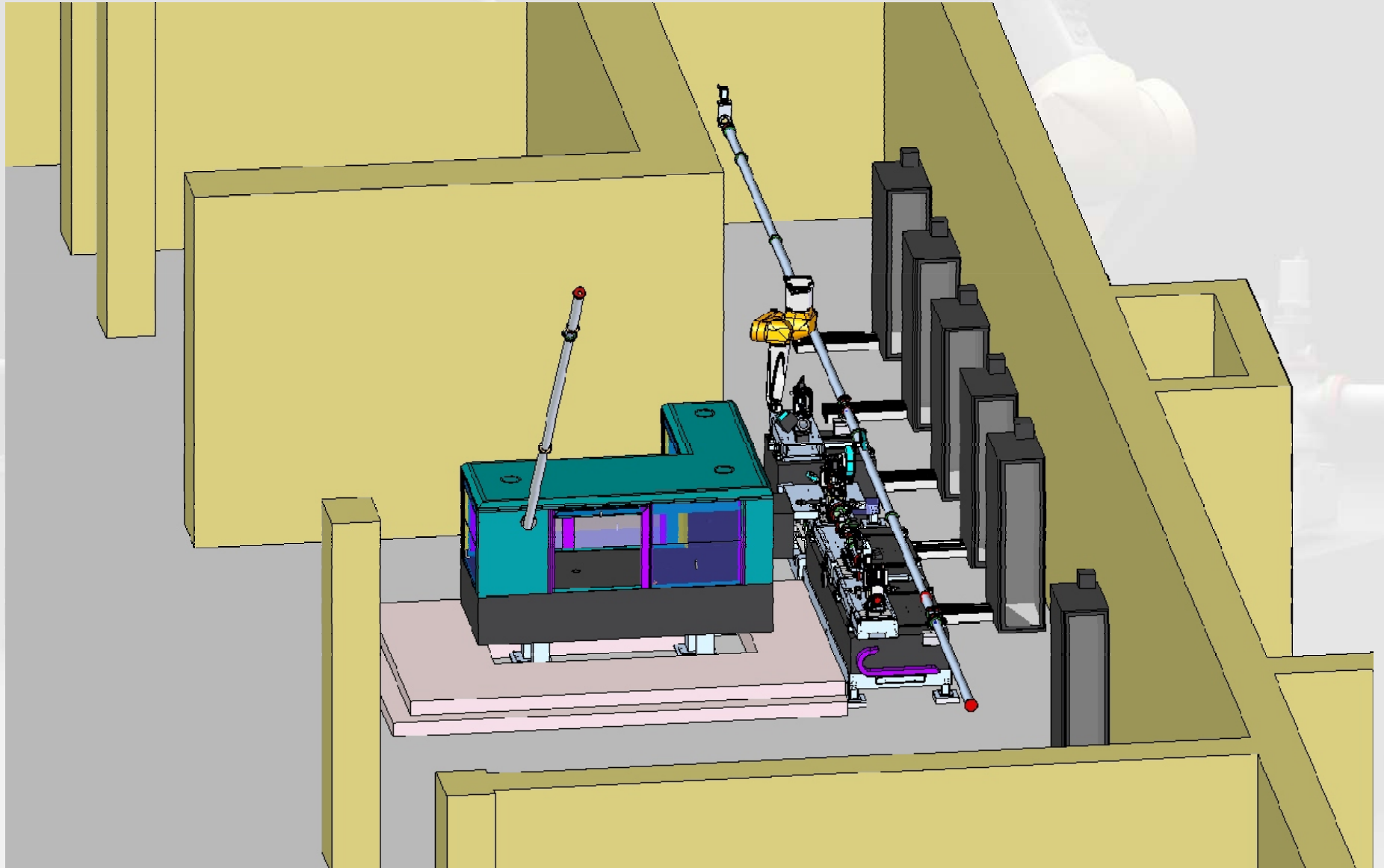
XPP Detector Mover



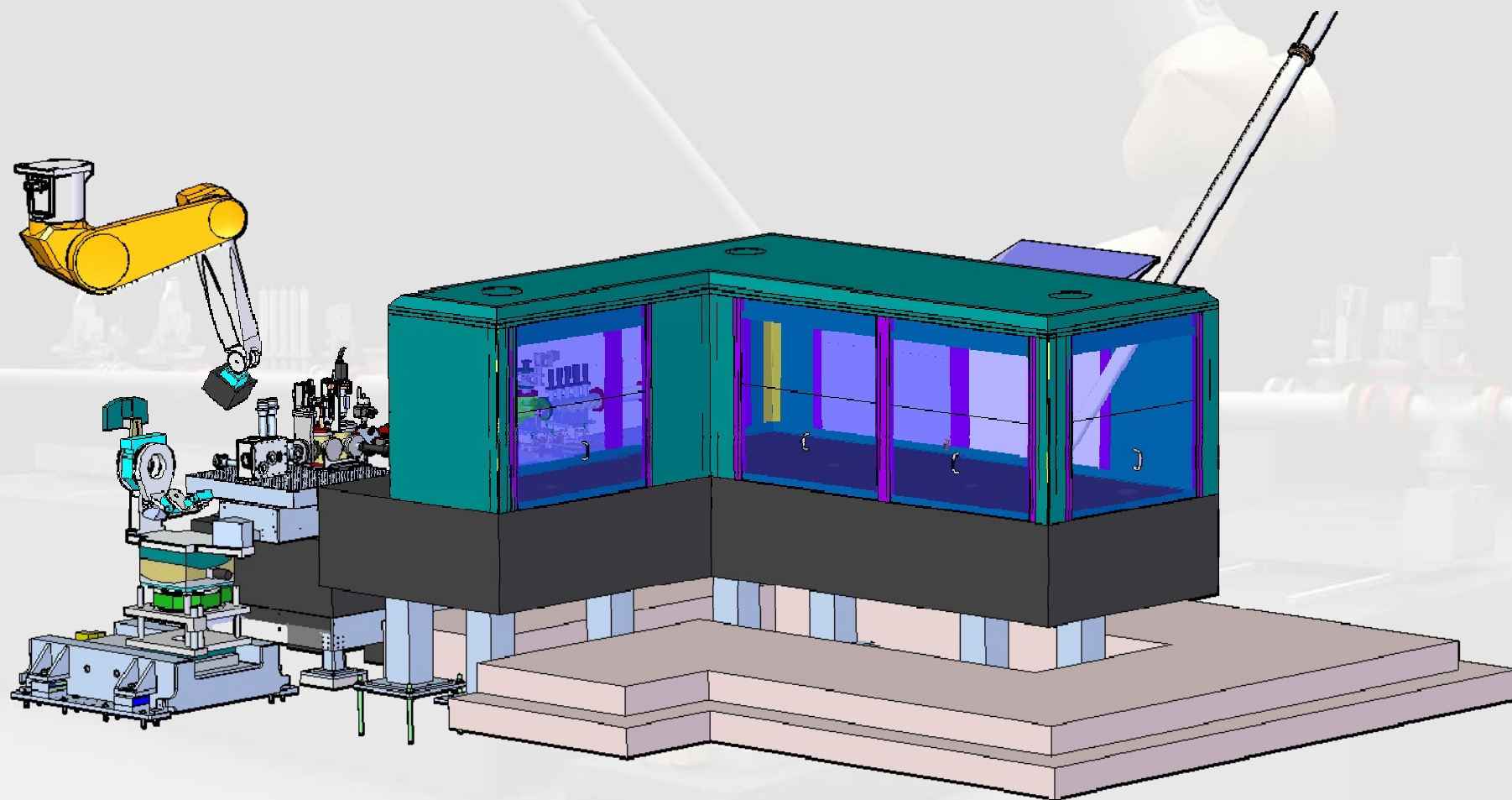
XPP Detector Mover



Hutch Design

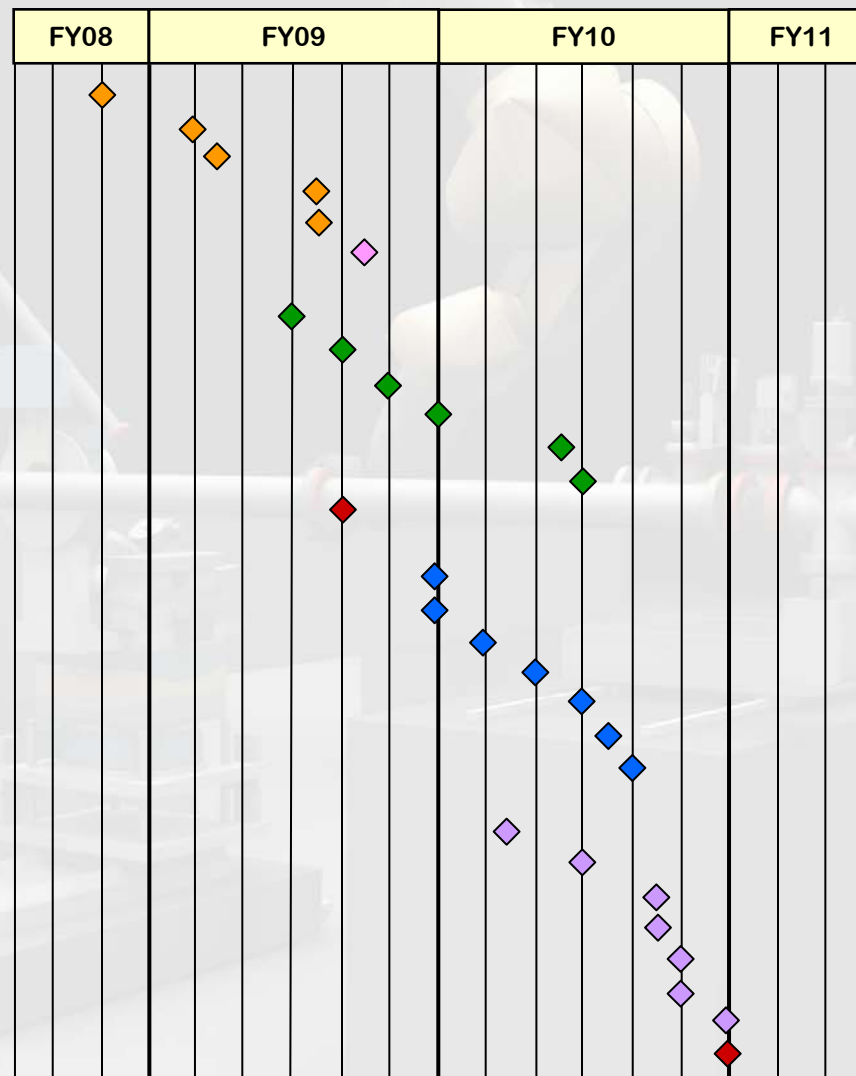


Laser Enclosure and Work Platform



XPP Schedule

- ◆ Preliminary Design Reviews
 - X-ray Optics Support Tables – August 2008
 - Sample Goniometer – December 2008
 - Detector Mover – January 2009
 - Optical Table Layout – May 2009
 - Laser Containment System – May 2009
- ◆ Final Instrument Design Review – July 2009
- ◆ Final Design Reviews
 - Sample Goniometer – April 2009
 - Vacuum Equipment – June 2009
 - Detector Mover – August 2009
 - X-ray Optics Support Tables – October 2009
 - Optical Table Layout – March 2010
 - Laser Containment – April 2010
- ◆ Project Ready for CD-3A - June 2009
- ◆ Award PO
 - Sample Goniometer – October 2009
 - Hutch Facilities – October 2009
 - Detector Mover – December 2009
 - X-ray Optics Support Tables – February 2010
 - Optical Tables – April 2010
 - Laser Optics and Optomechanics - May 2010
 - Laser Containment System – June 2010
- ◆ Receive
 - Hutch Facilities – January 2010
 - X-ray Optics Support Tables – April 2010
 - Sample Goniometer – July 2010
 - Detector Mover – July 2010
 - Optical Tables – August 2010
 - Laser Containment System – August 2010
 - Laser Optics and Optomechanics - October 2010
- ◆ Project Ready for CD-4A – Oct. 2010 (Early Finish July 2010)



XPP Schedule

| Component Available in Mid-2010 | Components Available in 2012 (or before) |
|---|--|
| Sample Goniometer (Kappa & Tilt Platform) | X-ray Focusing Lenses |
| Detector Mover | Harmonic Rejection Mirrors |
| X-ray Detector System | Attenuators |
| Laser System Optics and Diagnostics | Laser Power Amplifier |
| X-ray Slits | Optical Parametric Amplifier |
| X-ray Pulse Picker | |
| X-ray Diagnostics | |
| Controls & DAQ | |

Re-Scope & De-Scope Lists

| Prioritized Re-Scope List | Prioritized De-Scope List |
|---|--|
| 1. Large Offset Monochromator System | 1. Temporal Pulse Shaper |
| 2. Front End Ultrafast Laser System (depends) | 2. 3 rd Order Correlator |
| 3. SAXS Beamline | 3. Replace Jedi Pump with Flashlamp in Multipass |
| 4. Sample Vacuum Chamber | 4. Multipass Amplifier |
| 5. Cryostat | |
| 6. Cryostream | |
| | |
| | |