PREVENTATIVE MAINTENANCE

for Beamline Common Components

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LINAC COHERENT LIGHT SOURCE (LCLS)

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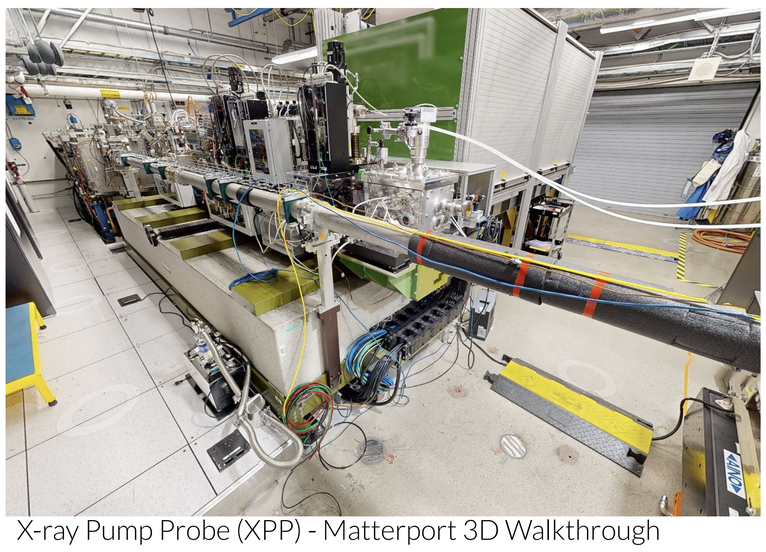
WHAT ARE COMMON COMPONENTS?

Common components are mechanical and motion-controlled assemblies that are used across the beamline, but can be found across all of the hutches at LCLS. Their purpose is to make sure the beamline can run as it should with minimal to no problems



X-ray Pump Probe (XPP) - Matterport 3D Walkthrough

DEVELOPMENT OF THE XPP AND XPP-HE COMMON COMPONENTS

When receiving funding for common components on the beamline, the Experimental Control Systems (ECS) and Mechanical Engineering (ME) teams focus on building common components that might not be put on the beamline for the next couple years. The current common components on the X-Ray Pump Probe (XPP) were built in 2025, and the 15 common components for the XPP-HE (High Energy) beamline have been used and added on the beamline throughout the last 20 years, before LCLS had it's first light in April of 2009, from a small cluster of electrons to producing the first burst of X-rays from an aligned series of magnets. [1]

LEADING CAUSES FOR UNSCHEDULED DOWNTIME

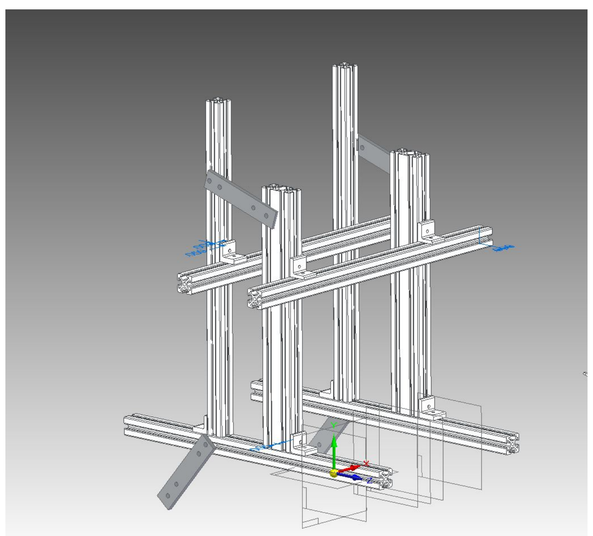
While LCLS does not currently have any logged information on preventative maintenance, data from the Pacific Northwest National Laboratory (PNNL), states in it's maintenance manual that preventative maintenance extends equipment life, improves reliability and quality, saves money by 8-12%, and improves worker and environmental safety. LCLS can use these PNNL, as well as preventative maintenance information from other national labs, as a reference to help avoid similar issues and identify potential risks before they can impact operations. [2]

TEMPORARY SUPPORT STRUCTURE (GBS)

Grating beam splitter with the temporary support structure.

Designed for the purpose of supporting the stem for a stage swap for the grating beam splitter (GBS), but is now redesigned to fit common components with the parker stage. A stage swap is when the stage is removed from the stem (or base) so that it can be replaced with a new stem. Original support structure was built for the one time stage swap, and built with items on hand, making it serviceable, but disproportionate, and not practical in the long run.

REVISED SUPPORT STRUCTURE



Revised CAD model of the parker stage support structure

- Started by measuring the dimensions of the original parker stage support structure
- Adjusted measurements to be equal on identical parts
- Researched different bolts and plate nuts for the design
  - Original fabrication had different size and design of bolts.
  - Had to do research on which would fit best for the support structure.
- Revised entire design with modified dimensions to improve fit and to make the model more uniform.
- Had to research and download the CAD parts away from SLAC's logging system for CAD models because of the difference in dimensions.
  - Some parts would be 1x1, while others would be 1.5x1.5
  - Finished with a support structure with 1x1 parts
- Developed as a reusable solution for future stage swap operations.
- The design was made to securely hold the stem during maintenance of the parker stage
  - Using a standardized tool for stage swaps provides more efficient maintenance procedures.

PREVENTATIVE MAINTENANCE FOR PARKER STAGES

The 406XR parker stages needs regular maintenance to keep it operating smoothly and accurately. For maintenance, start by removing covers and seals to access the internal parts, including the ballscrew, guide rails, and bearings. These components should then be inspected for dirt, debris, wear, or contamination, and then should be lubricated with the appropriate grease:

Item	Clean Room Prep (R1 &R5)	Clean Room Prep (R2 & R6)
Screw/Ball Nut	Shell GADUS S2 V100 2	IKO CGL
Rail/Trucks	Shell GADUS S2 V100 2	IKO CGL
Angular Contact Bearings	Kyodo Yushi Multemp	IKO CGL

This guide is meant to be followed once every 1000 hours of operation, although the time period could change depending on how frequently the stage is being used, as well as the environment. Inspect for contamination, chips, etc. and replenish according to the results of the inspection given, rather than waiting for equipment to fail. Regular inspection and lubrication help reduce and prevent excessive wear, avoid unexpected downtime from unexpected stage failures, and extend the overall life of the stage. [3]

Next Steps

Currently, the CAD model is in its final stages; the assembly needs to be integrated put digitally onto some common component CAD models with the parker stage, and needs to be reviewed to make sure that it meets the goals for the project. Once the model has been approved, it will then be released, fabricated, and used for a stage swap to make sure it will be fully practical for use during future stage swaps.

ACKNOWLEDGEMENTS

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[2] Operations & Maintenance Best Practices Guide, https://www.pnnl.gov/main/publications/external/technical_reports/pnnl-13890.pdf (accessed Aug. 10, 2026).

[3] Manual no. 100-5320-01 rev.V 404/406XR series product manual, https://www.parker.com/content/dam/Parker-com/Literature/Electromechanical-North-America/SERVICE-USER-GUIDES/404-406XR-Series-Linear-Positioners-Manual.pdf (accessed Aug. 10, 2026).