

Design and Installation of Foldable Work Platform for MFX Detector Stage v.3

Russell Edmonds¹, Matt Hayes²⁺

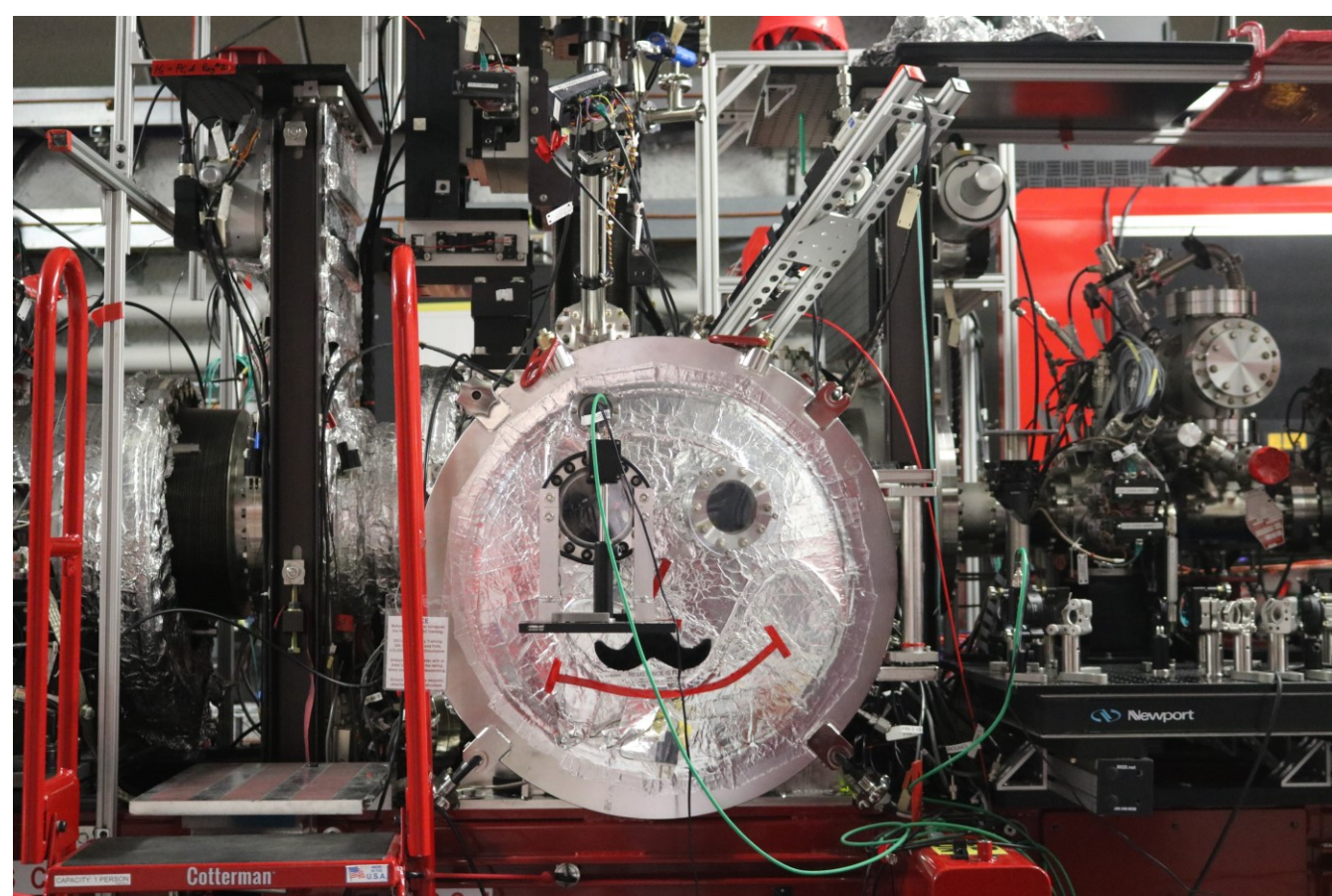
¹LCLS Summer Research Intern

²Linac Coherent Light Source, SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, CA 94025, USA.

+Contact: Hayes@slac.stanford.edu

Internship Overview

My experience through this internship has exposed me to a variety of things, such as vacuum design, the machining process, as well as linac physics. The focus of this poster will be on my experience designing and installing the third iteration of a work platform for the MFX detector stage as well as some of what I learned about vacuum systems. This project exposed me to the



CXI Sample Chamber

important roles engineers and technicians play in enabling cutting edge science to be conducted in a seamless fashion.

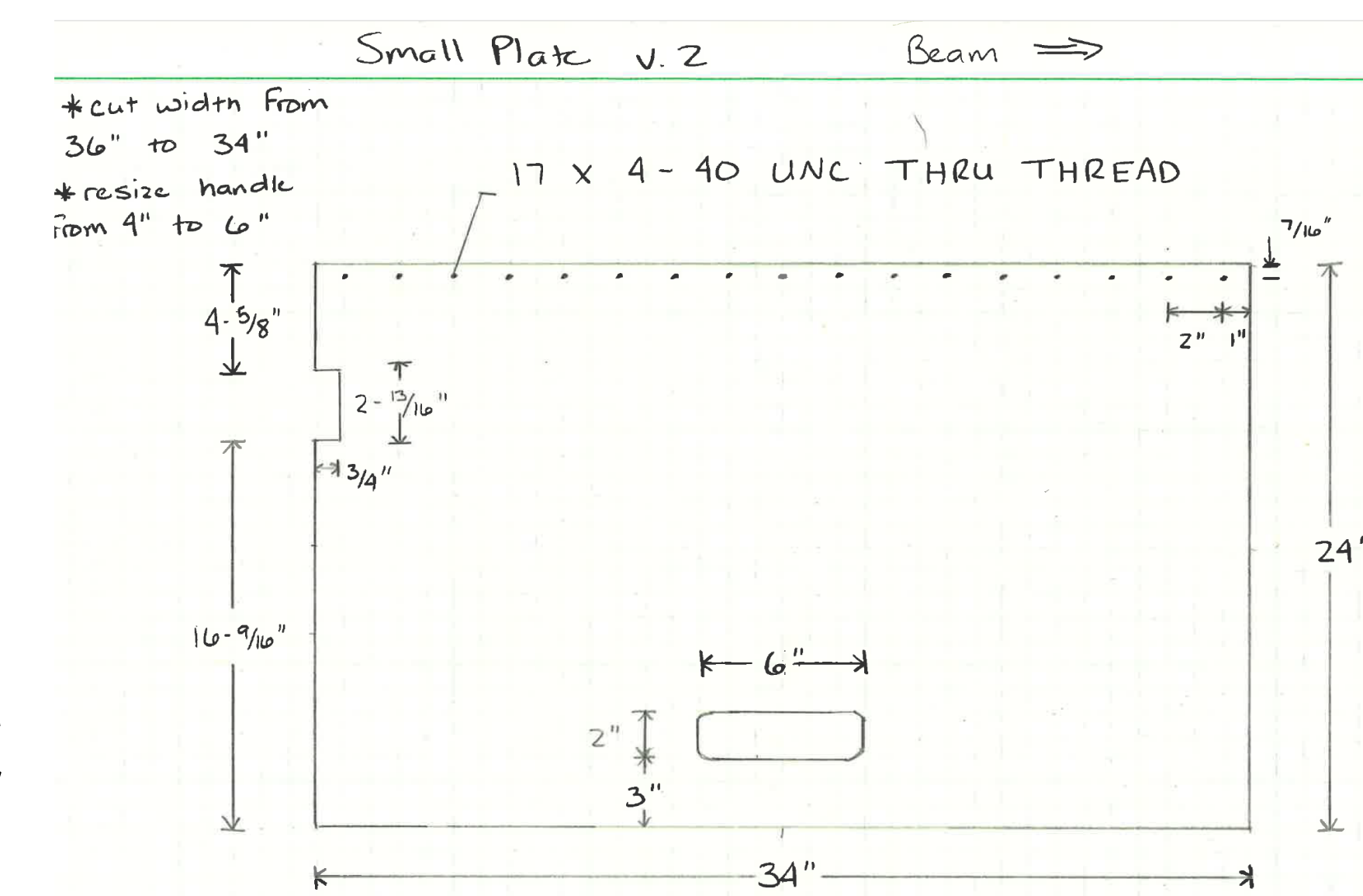
Initial Challenge

Platform Design Constraints:

- Provide a surface for scientists to stand on when the detector is not in use
- Cover the 60 inch horizontal span while staying within the 44 inches of vertical clearance

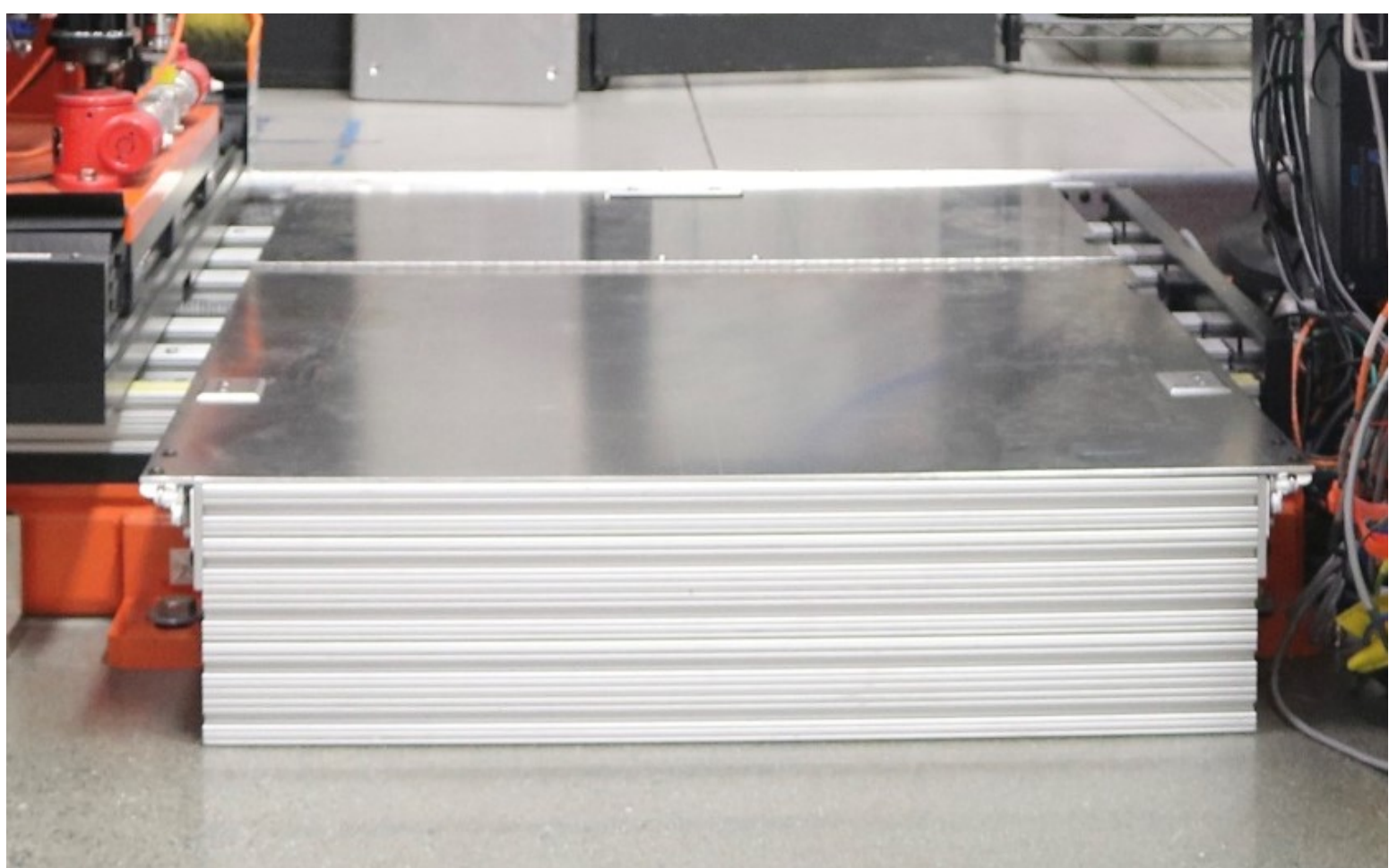
Version 2 of the work platform featured three sheets of aluminum hinged together to fold along the Z-axis. This design proved difficult as it required two users and was not intuitive to operate. Also, due to so many moving parts, the platform was showing signs of wear and needed to be replaced. The solution proposed in version 3 requires two sheets of aluminum that once hinged together fold along the Y-axis. The new design consists of fewer moving parts and, since there is more clearance, has room for spring loaded hinges which will make the lift less taxing on a user. To the right is a hand-drawn sketch of the smaller of two aluminum sheets machined to create the platform.

- Cover and protect the detector stage
- Avoid obstructing the path of the detector when it is to be used



Platform Design Sketch

Engineering Considerations



Platform in Horizontal and Vertical Orientation

Space Optimization:

The key aspect of this design is to maximize horizontal space while minimizing vertical space. To accomplish this two sheets of aluminum of roughly equal length are used. Their being roughly the same size is crucial as the vertical height can only be as small as the largest sheet is long once folded together. The two figures on the left make apparent how by folding the two sheets there is plenty of clearance below the beam while still spanning the requisite distance when flat.

Ease of Use:

To make the lift as easy as possible for users, a combination of spring loaded hinges are used. The system of 4 hinges is shown in the figure to the right. The 2 white hinges seen are both rated for 5 pounds and are primarily used to provide the structure for the platform. The two silver hinges are rated for 40 pounds and aid the user when they lift the platform from horizontal to vertical. Because of the new spring loaded hinge system used, what once required two users to operate in version 2 can now be done with one hand in version 3 of the platform.



Hinge Design

Conclusions

The improvements made on the platform design will both drastically improve the longevity and usability of the platform. Since fewer parts are exposed to users it can be expected that the platform should not require much maintenance. One improvement that could be made is to cover the gaps on either side of the platform. Due to objects in the arc of the platform while it is being raised, the platform had to be narrowed. An additional solution that would fill in those gaps while also maintaining the ease of use would be the next step. The biggest takeaway I have from completing this project is that it is important to plan, and it is especially important to plan for things to not work out on the first try.

Acknowledgments

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Additional Activity: Minimizing Vacuum Outgassing

This Summer I also cleaned out the sample chambers in CXI. Regular cleaning is imperative to reach the ultra-high vacuum levels needed for experiments. When pumping down the chambers a phenomenon called outgassing occurs, where individual molecules in the surface of the chamber are released. When trying to produce 6 to 9 scale vacuums in the chamber, even individual molecules can create an issue. By cleaning, some molecules that absorbed or adsorbed into the surface will be removed. Included to the right is a diagram detailing how molecules can interact with the surface of the chamber.

