

Introduction

My job at LCLS this summer was helped to design a laser table in a new laser room at Hutch 4 in FEH.

The room was built by separating a small and narrow space from the original Hutch 4. I need to design a laser table that makes the best use of the limited space in the coffin-shaped room, meets all the safety standards, and still makes way for another table and instruments in the room.

I was also in charge of designing the support structures and shelves in the room so that there will be overhead space to hold instruments and supplies.

Keywords: Design, Optics Table, Shelves, Supports

Research

In order to accomplish this goal, I learnt SolidEdge from scratch and gradually became familiar with it.

I first measured the room I'm working with, including the length of each wall and the angles the walls form with each other. The room looks like this:

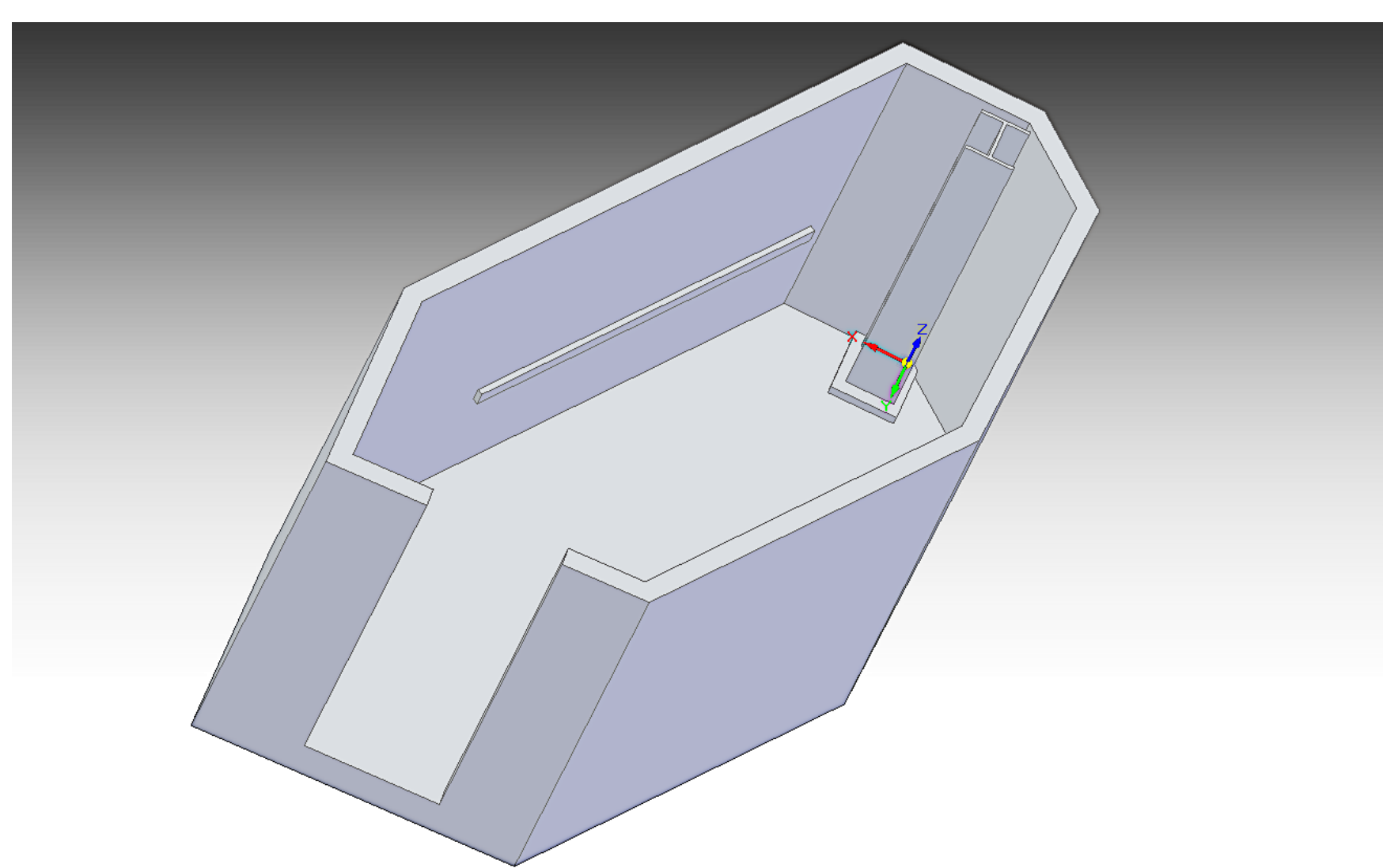


Fig 1. Screenshot of the SolidEdge model of the laser room in Hutch 4

With the shape of the room and the requirements for the table in mind, I modeled the table and its supports. I had the chance to visit some other labs at SLAC to have a better idea of the kinds of supports this kind of table uses. I also learnt about the intriguing way rods and bolts work on the supports and how I can model them precisely.

I also did some research on the websites of the companies that make optics tables to find out what my options are when it comes to the exact model and builds of the table. See below for the table that I assembled:

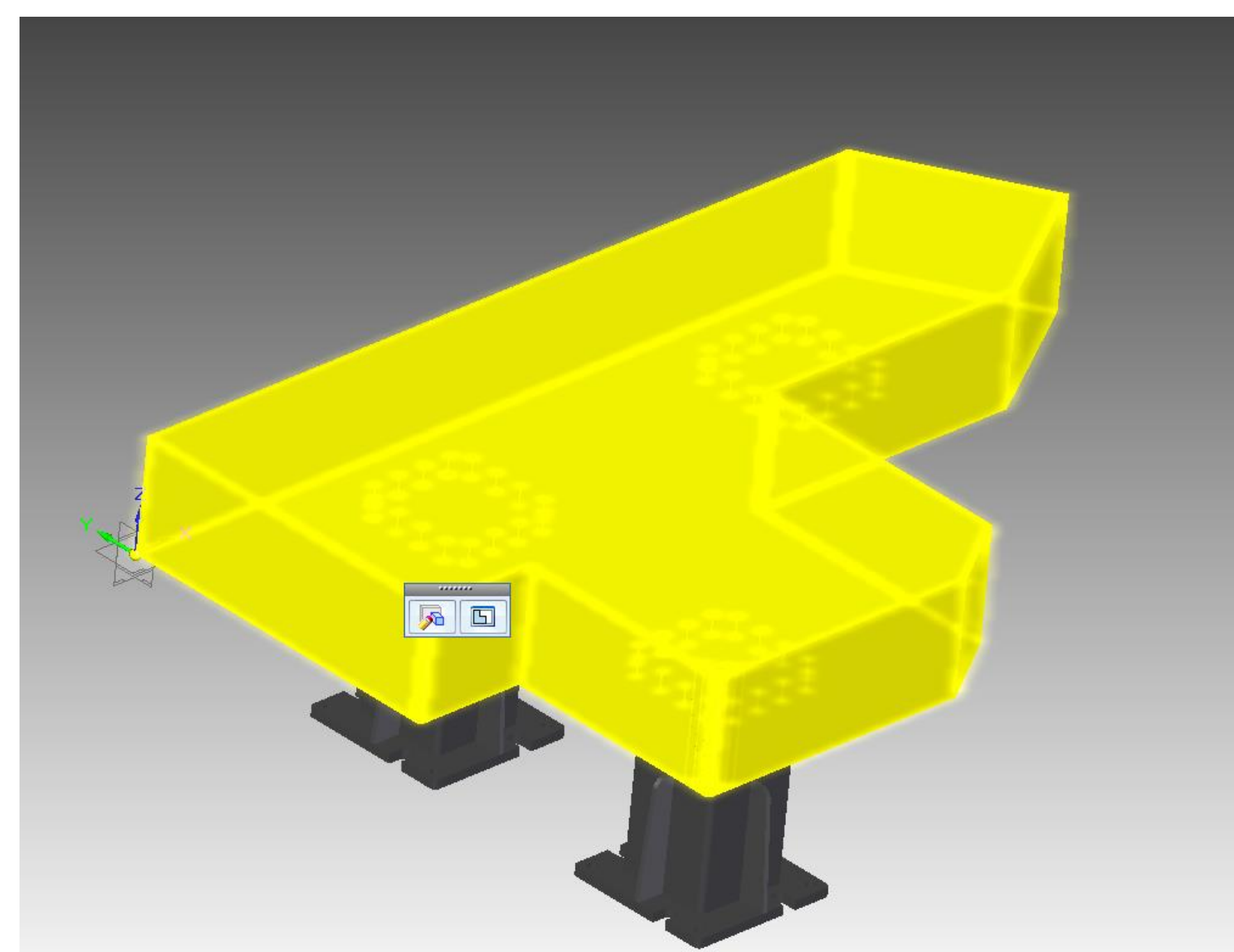


Fig 2. Screenshot of the SolidEdge model of the optics table I designed

Then I drafted the table with its three legs and sent the draft to those companies and asked for quotes.

I sent them something like this:

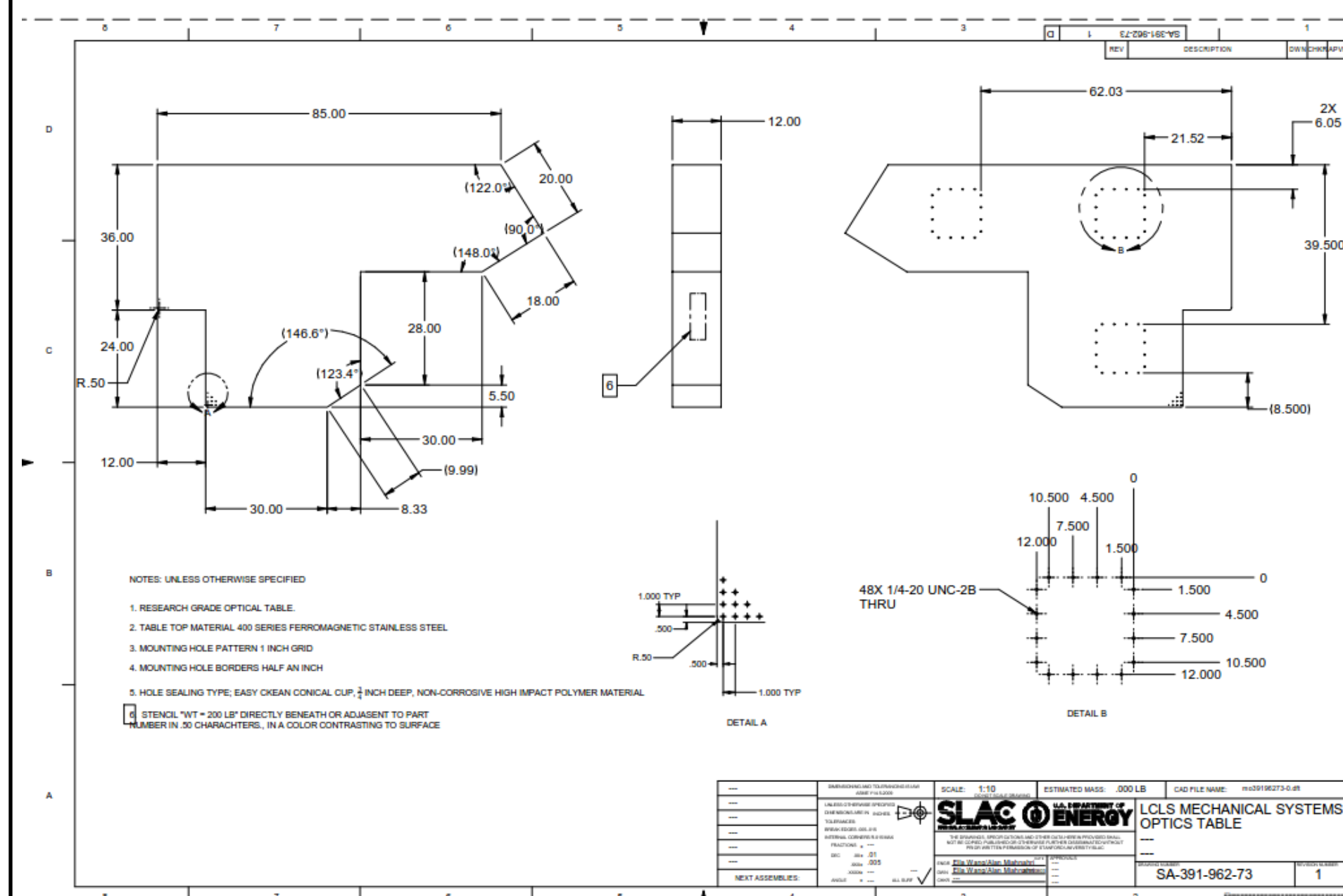


Fig 3. Screenshot of one page of the SolidEdge draft of the optics table I designed

We got two prices and one is two times higher than the other. Then a rep from the company with the higher price came to SLAC and talked with my mentor and me. I learnt that the inside of the table is honeycomb structure to make the table stronger and supports more weights. The table also uses other techs to minimize vibrations so that optics experiments could be performed on it without any unwanted factors.

The meeting was also mind-blowing in how purchases like this was made. The rep promised us to price match. I also got to know how budget works in a huge lab like SLAC.

The final phase of my project was to design support structures in the room for shelves. My mentor and I worked with multiple parties who wanted to store things or used the room in the future.

I chose framing as well as supports structures from 80/20 website and modeled according to what I observed from the other labs I visited and researchers' needs.

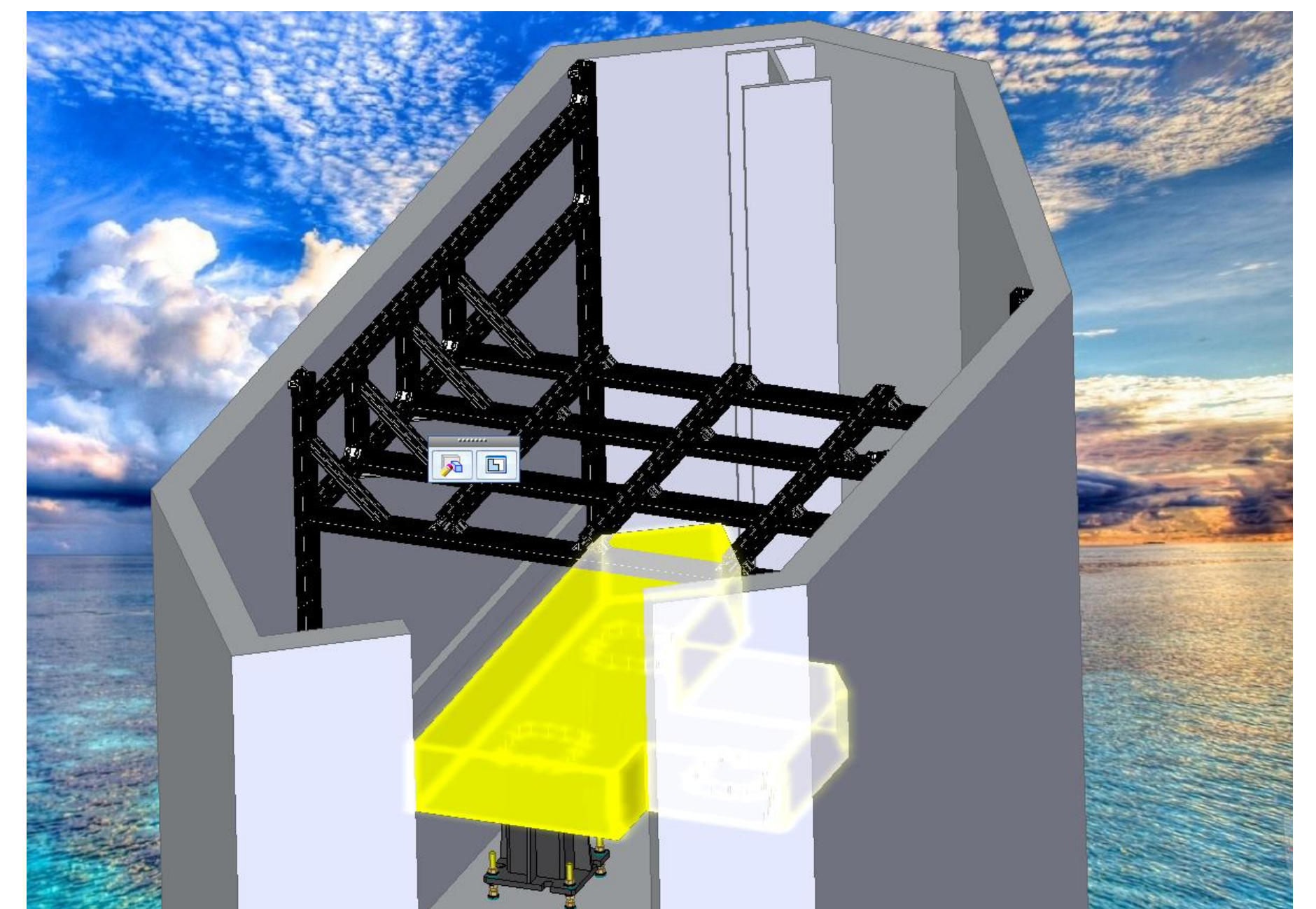


Fig 4. Screenshot of the Solid Edge model of the whole room

I calculated the force on the structures given the loads on them, and designed the supports so that the structure could be as strong as possible.

Conclusions

My experience at LCLS this summer was extremely fruitful and rewarding. I went through the entire process of design at SLAC by modeling structures with CAD, prototyping the product in machine shop, and dealing with optics table company to bring my design to reality.

I wish to give many thanks to my mentor Alan Miahnahri for all the supports, guidance, knowledge and care he gave me. My internship at SLAC granted me confidence and more interest in Mechanical Engineering, especially the design parts of it.

Acknowledgments

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