



CASE STUDY /

Ansys + MIT

“OpticStudio made it possible for me to achieve meaningful, effective results in my HPLM test bed project by handling all of the simulations and calculations. It gave me shortcuts, so I could focus on managing the scope of the experiments and achieve the best results”

David Griggs

Mechanical Engineer and former MIT Graduate Student Researcher

Using Ansys Zemax OpticStudio, MIT Builds a Better Laser Scanner for Use with Metal Additive Manufacturing.



Laser power bed fusion (L-PBF) is a form of metal additive manufacturing that uses energy from a laser to melt thin layers of powder to facilitate 3D metal printing. The cornerstone of any L-PBF system is the laser scanner itself. At MIT, the existing 70-watt laser system was reaching the end of its useful life due to being underpowered and not having the flexibility needed for customized L-PBF operations.

/ Challenge

The precise use of L-PBF builds on laser welding fundamentals like managing the impact of gas and plume dynamics on weld depth and quality. For this reason, it's important for the designers of L-PBF thermographies to examine and understand the complexities of what happens when a laser interacts with a bed of metal powder.

/ Technology Used

- Ansys Zemax OpticStudio Premium

/ Engineering Solution

Because the laser component itself would be a standard commercial product, the researcher primarily worked on validating the two key pieces that would optimize the laser's capabilities: the collimator and the f-theta refocusing lens. Achieving this optimization without a lot of physical trial and error meant simulating the design in ways that the performance of the components could be analyzed, separately and together. The researcher compared experimental data to an optical model created in OpticStudio comprising the laser collimator and F-theta lens, and tracked the resulting spot sizes from various lens combinations relative to the laser's position. The software also facilitated another critical vector the experimentation: the precise focus profile (slope) of the f-theta lens position in the final design.

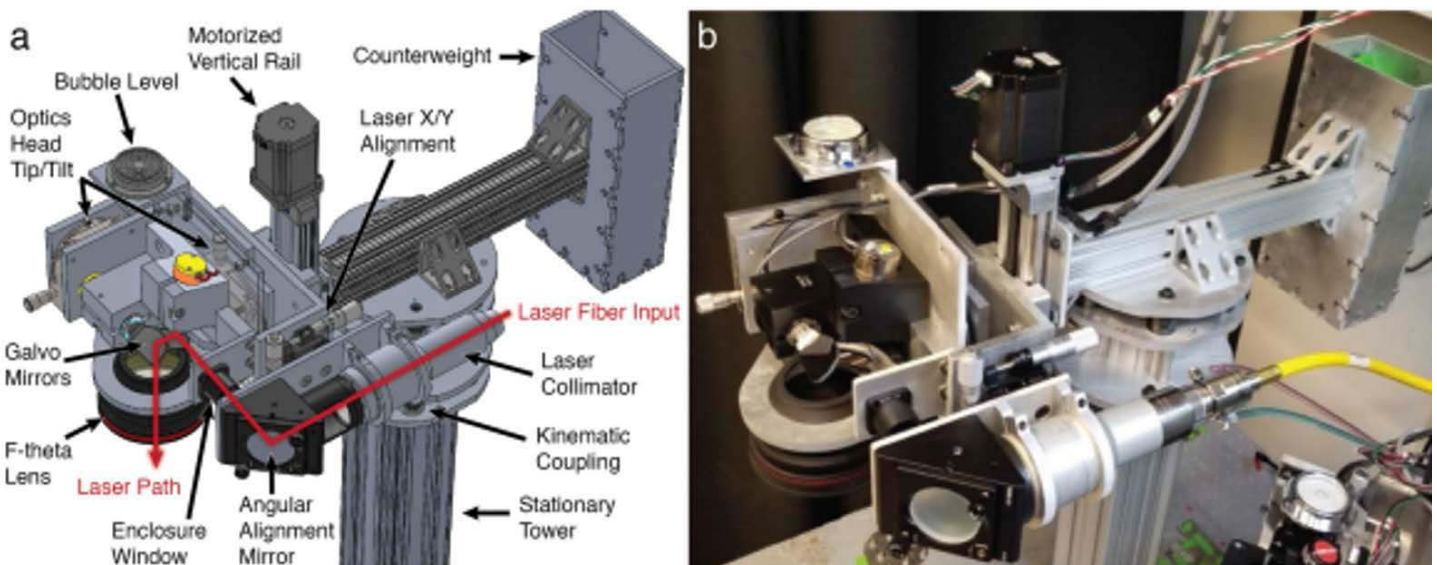


Figure 1. CAD model of the MIT L-PBF laser scanner (a) and finished prototype (b).

/ Benefits

- OpticStudio revealed the exact values to be used in the validation.
- Using OpticStudio, the researcher could see all of the expected spot sizes at every X-and-Y coordinate, which was much more useful than relying on theoretical calculations.
- OpticStudio guided the researcher through the entire process of refining the design, caught a few human errors, and produced a final system that behaved the same way as a manufactured system.
- Not only did the researcher benefit from the extensive materials library built into OpticStudio for the various materials that were tested under HPLM, but he also added data to the catalog based on the properties of materials he observed during his experimentation.

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