OVERVIEW OF LASER DELIVERY SYSTEM

PANDA™ is designed to be a truly open-architecture LPBF platform, and as such, can accommodate a range of laser delivery options. This handout provides a brief summary of options available. Note that the Open Additive team can also configure a custom system with other lasers/optics for research or application-specific needs. We are also working with or seeking opportunities to work with leading suppliers of lasers/optics, using PANDA as a demonstration platform for emerging technologies and products with goal to rapidly transition these new capabilities as future PANDA options.

STANDARD CONFIGURATION

The standard setup provides a versatile, high-performance capability to process a wide range of materials. The system features a 500W air-cooled Yb-fiber (nominal 1070 nm) laser and collimator from IPG Photonics, SCANLAB hurrySCAN galvo, f-theta lens, and Z-stage driven by a motor to raise and lower the scan head to focus/defocus the laser on the build plate to provide spot size control. Depending on the PANDA build configuration, spot sizes as small as 40 µm are achievable. The 500W laser power provides a significant performance jump from lower-power LPBF systems on the market, which have a relatively limited materials process development range to achieve optimum build quality.

The standard optical configuration is shown in Figure 1 (note right image showing the motor and Z-stage). The laser requires a 200-240V/20A single-phase circuit.

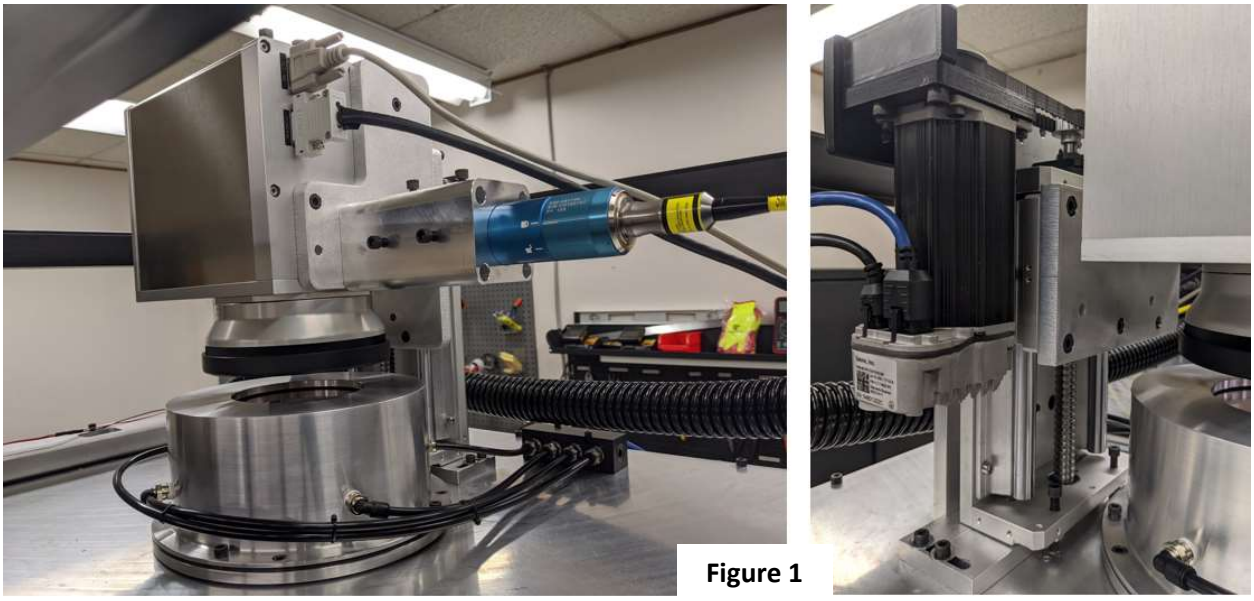

Figure 1

DYNAMIC FOCUS CONTROL

While the motorized stage provides ability to set the spot size before the build and alter between layers as desired, it is not intended for fast-response adjustment within a processing layer. For such dynamic control, Open Additive offers the option to upgrade the optical setup from the standard configuration

(SCANLAB hurrySCAN with f-theta and Z-stage) to a SCANLAB intelliSCAN + varioSCAN combination. This combination effectively converts the 2D scanning system designed to provide a flat field in the *x-y* build plane into a 3D scanning system capable of changing the focus point in *x-y-z* space. PANDA's standard control software (Open Machine Control™) is perfectly capable of controlling this configuration. Upgrading to dynamic focus after installation is possible, with minor added integration costs.

HIGHER POWER

For some research and applications, more laser energy may be desired. As such, Open Additive offers the option to upgrade from the 500W IPG laser to a 1000W IPG laser (nominal 1070 nm). The additional laser power can be of particular benefit for conducting beam optics experiments (e.g., advanced techniques involving different beam shapes, overlap regions, etc.) as well as widening the process development window for standard and exotic materials. The 1000W laser can be configured with or without the optional dynamic focus control. Upgrading to 1000W laser after installation is possible, with minor added integration costs. Note that the 1000W laser upgrade includes an external water-cooled chiller which requires an additional 200-240V/20A single-phase circuit.

DUAL LASER

PANDA can also be configured with a second processing laser and associated optics for multi-laser research and applications development. The second laser has the same range of options as the first laser in terms of standard configuration, dynamic focus control, and upgrade to 1000W power. The dual-laser configuration is intended as an R&D platform, and thus multi-laser scan strategies and processing parameters for parts production are not included. Users are thus responsible for developing their own production scan strategies and parameters, or may acquire support from Open Additive's applications team or project partners. Reconfiguring a system from single laser to dual laser after installation would involve significant costs and would typically not be attempted outside Open Additive facilities, as adding a second lasers/optics requires changing many machined parts and recalibrations.

SPECIALTY LASERS

PANDA can also be outfitted with specialty lasers for research needs. One example is a Spectra-Physics pulsed laser offered as a second-laser option, featuring 75W average power, 3-250 ns programmable pulse width, and 20 kW peak power. This laser has been successfully integrated and used on multiple research projects involving "Selective Laser Ablation and Melting (SLAM)" by Open Additive partners. SLAM uses the pulsed laser to provide in situ ablation/micromachining capability. In addition to configuring a system with this or other pulsed laser for hybrid research, Open Additive can connect prospective researchers with leaders in this field if relevant to customer areas of interest.

Open Additive also has the technical expertise to explore and integrate other lasers for customer needs. These include green and blue lasers for processing copper, gold, and other materials which would benefit from processing at visible wavelengths. CO2 lasers in the 10,000-μm range are also feasible for selective laser sintering of high-performance polymers. Please inquire for collaboration opportunities.