BeamCheck Quick Start Guide

What is BeamCheck?

BeamCheck™ is a camera-based laser beam profiling system (Figure 1) for SLS/SLM 3-D Additive Manufacturing systems. BeamCheck measures and produces a beam profile of the laser beam focused at the plane of the SLS/SLM work surface. It uses the BeamGage™ Laser Beam Analyzer software to display, log, and produce reports on beam data (Figure 2). For complete specifications see the BeamCheck Specifications table on page 4 of this document.
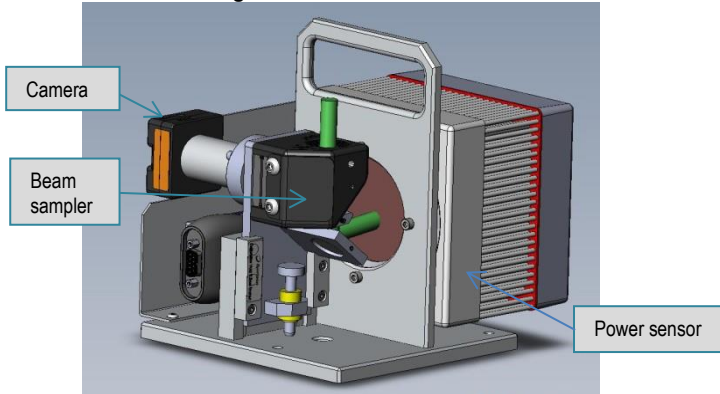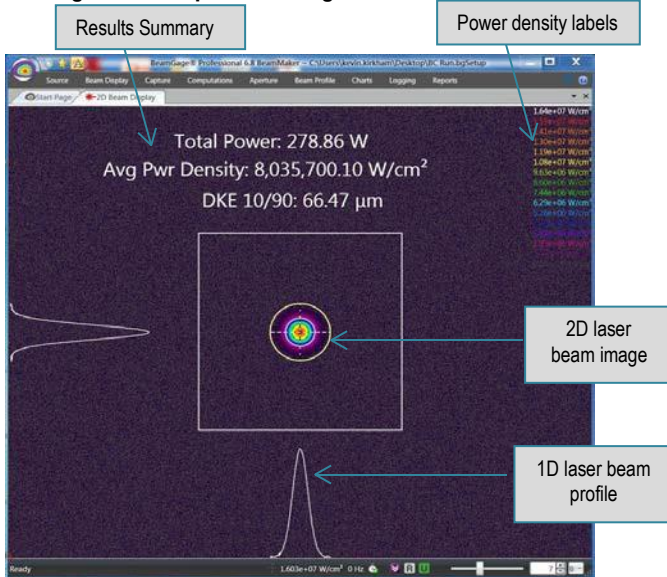
Figure 1. BeamCheck Unit

Figure 2. Sample BeamGage Laser Beam Profile

Install the BeamCheck System

Prerequisite Items

- A laptop or desktop computer with Windows 7 or Windows 10 and 3-4 GB RAM and 50-100 GB hard drive space

- BeamGage Professional Software on shipped disc or from the Ophir/Spiricon website at www.ophiropt.com/laser—
  http://www.ophiropt.com/laser/register.php?item=BeamGage Pro Edition

Unpack the BeamCheck System

1. Remove all items from shipping case. Items include BeamCheck system, power supply for power sensor fan, USB cable, USB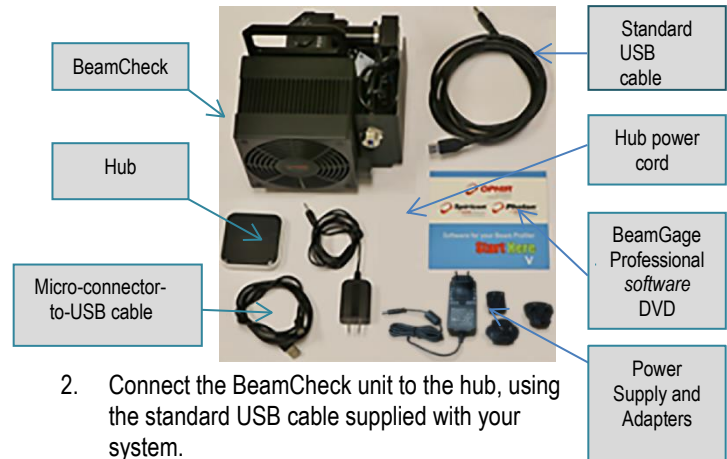 hub, BeamGage DVD, calibration certificate for Power Sensor, JUNO and BeamCheck, and Certificate of Compliance for camera.
2. Save packaging materials for possible future use.

Set Up the BeamCheck System

1. Connect the BeamCheck components shown in Figure 3.

Figure 3. BeamCheck System Components

2. Connect the BeamCheck unit to the hub, using the standard USB cable supplied with your system.
3. Plug the cable with the micro-connector on one end into the hub and connect the hub to your computer's USB port.
4. Connect the power cord to the hub and plug it into a power outlet.
5. Place the BeamCheck unit in your SLS system's build space. BeamCheck is designed for beams that are normal incidence to the build plane, which is usually in the middle.
   CAUTION: The BeamCheck is designed to measure the focused laser beam as it is presented directly to the work plane.
   Be careful to place BeamCheck on the SLS/SLM build plane surface. Placing the unit above or below the work surface may damage BeamCheck components.
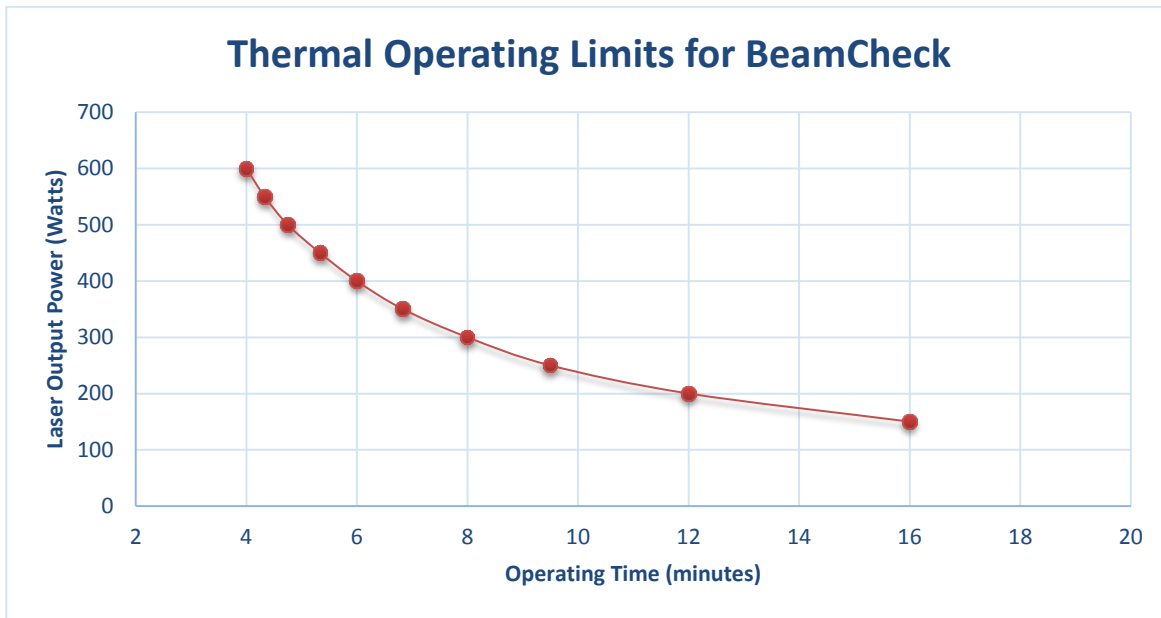
Install the BeamGage Professional Software

1. Using a DVD, on your laptop or desktop computer, run **Setup.exe**. If you don't have a DVD, you can find this file at:
   http://www.ophiropt.com/laser/register.php?item=BeamGage Pro Edition
2. On the Welcome screen, click **Next**.
3. On the Destination screen, click **Next** to use the default destination folder, or use the **Change** button to choose a different destination.
4. Read the License Agreement. Click the **I Agree** box on the License Agreement screen. Then click **Install**.
5. On the Ready to Install the Program screen, review your settings, use the Back button to make any necessary changes, then click **Install** when you are ready.
6. When the InstallShield Wizard Completed screen displays, click **Finish**.

Operating limits

BeamCheck directs the majority of the laser's energy to the power sensor disc and power sensor heat sink/heat exchanger. Heat rise will occur within these structures relative to the amount of laser energy directed into the device.

The chart below shows BeamCheck cooling requirements as a function of its exposure to different laser power levels.


Thermal Operating Limits for BeamCheck

Important: At any power level the BeamCheck will eventually require cooling. To cool the device remove the device from the SLS system to cool with the fan power supply connected.

Use the BeamCheck System

1. Start the **BeamGage Professional** software. A screen similar to the one shown in Figure 4 will display.

Figure 4. BeamGage Software Sample Screen
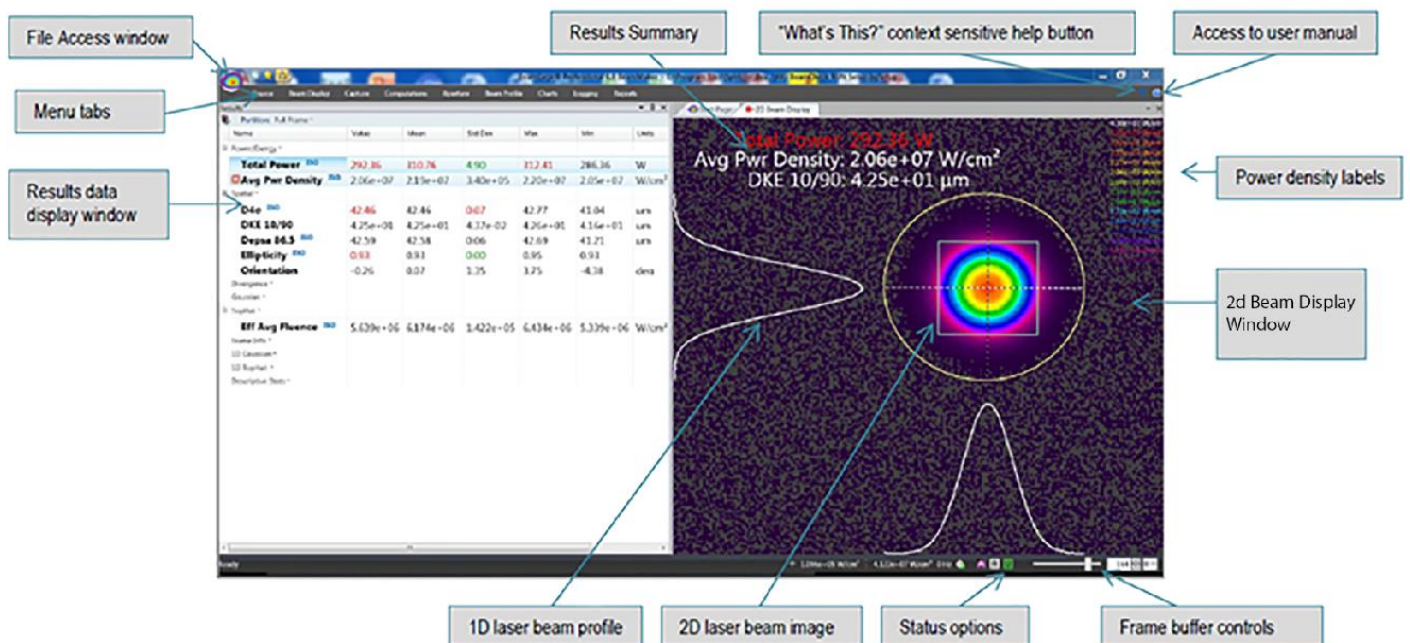
2. On the **Source** tab, select **Local Detector**. The light on the BeamCheck camera will turn green once the camera is selected in the BeamGage software.

3. On the **Source** tab, select **JUNO** and then select the **FL600 Laser Power Sensor**.

4. Select the **Menu** icon in the top left portion of the screen then **Load Setup**. Select the setup file named **BC Setup.bgSetup**. This arrangement of the software is intended to help you select the JUNO power sensor interface and power sensor. The setup file named **BC Run.bgSetup** is provided to show how the display can be simplified.

5. On the **Source** tab, click the **Data** start icon and verify that new images are being collected. The frame buffer indicator at the bottom of the screen should be advancing. Use the machine's alignment laser to place the BeamCheck in the center of the build space.

6. Set the laser power to process levels. Turn on the working laser and adjust the Camera Exposure control until the most intense portions of the beam are in the orange to red color range. The uncalibrated Peak value should be in the range of ~3,000 to 4,000 counts. White indicates camera saturation and should be avoided.

7. Use the ROI (region of interest) control found in the Frame Format section of the Source tab. Set the Width and Height of the control to 3 to 4 times the 1/e^2 beam diameter or 100 x 100. Center the area of interest, using the Horizontal and Vertical Centering features. These setting will provide the fastest measurement update rates.

8. With the alignment beam and the fiber laser turned off or blocked, select the **UltraCal** icon on the **Source** tab, and wait for the calibration cycle to be completed.

9. Once the calibration cycle has completed, the system is ready to analyze the working beam.

   WARNING! Optical radiation and electrical hazards are possible with the use of this system. Use standard laser safety precautions.

10. Drag results onto the 2D display, if desired. The **BC Run.bgSetup** setup file configures the 2D display to include the power and spot size results.

11. If BeamGage does not communicate with the camera and the power meter, use the **Spiricon Driver Manager** to install the **SP928 camera** and **Ophir Power Meter drivers**.

BeamGage Professional Software Quick Reference

If you want to…	Do this in BeamGage:	Then:
1) Select a camera	Select the **Source** tab.	Select **Local Detector**. A list of all the available cameras will be produced. Select the camera you wish to connect to.
2) Connect the power/energy sensor and interface to BeamGage	Select the **Source** tab.	Select **Power Meter** and select the **JUNO** option .The power sensor will be connected automatically.
3) Enable the display of Results	Select the **Computations** tab.	Select the **Tools**. Select the **Results** section.
4) Modify the Results to be calculated	Enable the display of Results (#3).	Select the **Power/Energy** section. Select the **Spatial** section. Modify the enabled Spatial Results.
5) Customize the 2D display	Stop data acquisition. Then select the **Beam Display** tab.	Use the **2D Pan	Zoom** control to change the magnification of the display. Use the **Cursor** controls to enable and place the linear cursors manually, at the beam profile Peak or Centroid.
6) Enable Pass/Fail analysis	**Right Select** the result Pass/Fail to be modified.	**Left click** to select to modify the Max and/or Min boxes as needed.
7) Modify Pass/Fail criteria	**Right Select** the result Pass/Fail to be modified.	**Use keyboard or up/down controls** to modify the selected (Max and/or Min) values.
8) Print a report	Select the **Menu** icon .	Select **Print Preview** and select the printout feature you want. Then Select the printer icon.
9) Save data	Select the **Menu** icon .	Select **Save Data As.** Then select the path and file name.
10) Retrieve data	Select the **Menu** icon .	Select **Load Data.** Then select the path and file name.
11) Enable apertures	Select the **Aperture** tab.	Select the aperture type: **Manual, Auto or Beam Width**. Then specify the aperture shape and X and Y dimensions.
12) Learn more	Select Help in the top right corner.	Study the BeamGage User Guide.

Troubleshooting Quick Reference

Problem	Possible Solution
1) Camera does not connect. The camera LED stays yellow.	Use the Spiricon driver manager to install the SP928 camera driver. The driver manager can be found in the installed BeamGage folder.
2) JUNO does not connect.	Use the Spiricon driver manager to install the power meter driver. The driver manager can be found in the installed BeamGage folder.
3) FL600 laser power sensor does not connect.	Check to see if the JUNO and FL600 sensor will connect through the **StarLab** application. Download StarLab http://www.ophiropt.com/en/laser-measurement-instruments/laser-power-energy-meters/software/starlab
4) BeamGage software does not start up.	Uninstall BeamGage, using the Programs and Feature folder in the Windows Control Panel. Re-install BeamGage from the supplied DVD or directly from the Spiricon website at: http://www.ophiropt.com/laser/register.php?item=BeamGage%20Pro%20Edition
5) Cannot find alignment beam once the BeamCheck unit is place in the center of the SLS/SLM build space.	Make sure the camera is producing images by watching the Frame Buffer scrolling indicator at the bottom of the BeamGage screen. Increase the Exposure setting until the beam can be seen. Decrease Exposure to avoid saturating the camera.
6) Camera appears to be collecting frames there is no alignment beam.	Make sure the dust cap has been removed. The beam must be at normal incidence to the BeamCheck input aperture.
7) Fiber laser beam is too bright.	Decrease the camera's exposure control in the **Source** tab of the BeamGage software until there is no white in the rainbow 2D image.
8) Fiber laser beam is too dim.	Increase the camera's exposure control in the **Source** tab of the BeamGage software until there is orange to red in the rainbow 2D image at the top of the beam.
9) Beam widths are not being calculated correctly.	The Beam Width Aperture in the **Aperture** tab should circle around the blue colors of the 2D display. If the Beam Width Aperture is outside of or inside of this region, it may mean the UltraCal is incorrect or has not been performed. Recalibrate the system by turning off the laser beams and selecting **UltraCal** from the **Source** tab.

Set Up Context-Sensitive Help

Context-sensitive ("What's This?") help is built into the BeamGage Professional software so that the help system will go to the appropriate topic. This reduces the need to search through the manual. But a security feature in Adobe Reader XI may keep the BeamGage context-sensitive help feature from working properly. Use the steps below to make sure Adobe Reader XI properties are set up to allow online help access.

1. Go to **Adobe Reader XI**.
2. On the menu bar, click **Edit**.
3. Click **Preferences…**.
4. In the Categories list Select **Security (Enhanced)**.
5. **Uncheck Enable Protected Mode** at Startup and answer **Yes** when prompted.
6. Click **OK**.

BeamCheck Specifications

Component	Specification
SP928 high resolution CCD camera	CCD located within +/- 50 um from work surface
LBS-300-NIR laser beam splitter/attenuator	Up to 9 orders of magnitude optical attenuation plus electronic attenuation as needed.
FL600A-LP2-65 laser power sensor	NIST traceable, 5W-600W, fan-cooled; Sensor can be cooled by connecting the power supply to the fan when the BeamCheck is not in use
Sensor to USB adaptor	Juno Smart Head
Frames per second	26 (2x binning mode with USB 3.0)
Wavelength	1060-1080nm
Maximum power	400 Watts
Spot sizes	37 um to 3.5mm
AM system focal length	>200mm
Weight	9.2 lbs.
Calibration certificates included	Power sensor, JUNO, camera certificate of compliance for SP928 CCD camera
Software included	BeamGage Professional; Saves data in ASCII and HDF5 formats

For More Information

Use the following resources for help and additional information:

- The BeamGage User Manual and online help system
- Email service at service@us.ophiropt.com
- Call the hotline at 866-755-5499
- Check FAQ's in the Knowledge Center at www.ophiropt.com