

# DataRay Inc. Datasheet

## LensPlate™ Specifications & Use

Beam Profiling ... Engineered as a system  
... Delivered as a Solution

### Specifications

Part #	Specify $-\lambda = -850$ for 600 - 1050 nm = $-1550$ for 1050 - 1750 nm	LP-1:1-0.65- $\lambda$	LP-1:4.9-0.68- $\lambda$
<b>Input NA / Total Acceptance Angle</b>		0.65 / 81°	0.68 / 85.6°
<b>WD</b> in mm (Working Distance, lens to focus)		1.56	1.75
<b>Resolution</b> in $\mu\text{m}$ @ 675 /1550 nm = $0.61\lambda/\text{NA}$		0.63 / 1.45	0.61 / 1.4
<b>Magnification</b> Source:(Image in BeamMap)		1:1	1:4.9
<b>Reimaging Applications</b>		Small beams, Fiber ends	Waveguides & Lensed fibers

**Warning #1:** If you received a LensPlate attached to the BeamMap head, then it will have a yellow 'Factory Set' label on it.



You must resist the typical engineer's tendency to 'play' with the LensPlate. The focus position for the nominal magnification is set at the factory. The focus position is held in place by a friction ring on the threaded barrel. The set position is marked by two adjacent white spots.

**LensPlate LP-1:1-0.65-850**  
**Xc = 155  $\mu\text{m}$  Yc = 237  $\mu\text{m}$**   
**Made in the USA by DataRay**

**FACTORY SET**  
**DO NOT REFOCUS**

**Warning #2:** If these small lenses get scratched or dusty, performance will deteriorate, and the results will be in error. Use the packaging and the plastic cap (spare provided) to store the LensPlate when not in use.



LensPlates are attached to the front of a Beam'R or BeamMap. They are factory or user attached, & are demountable by the user.

### Important:

**Understand BeamMap first.** If you do not understand how to use BeamMap, do not bother to proceed. Read the manual and experiment on some simple beams first.

**Numerical Aperture (NA) limitations.** If your beam is high NA, the NA of the lensplate may limit the minimum beam size that you see. The LensPlate NA's are listed in the table above.

**BeamWaist position.** Using a LensPlate requires that you focus the minimum of the reimaged beamwaist on the '0' plane of the BeamMap. The factory established focus is for this condition. The lens is only diffraction limited within a small range of magnifications.

**BeamMap BMS3XYKE or Beam'R?** Both units allow you use either Knife Edge mode with 0.1  $\mu\text{m}$  sampling resolution on the beams or the normal Slit mode. The BeamMap simplifies the task of ensuring that you are reimaging the beamwaist into the zero plane. See the Fit\_BeamMaps.xls spreadsheet available at the website.

**Single mode fiber divergence.** Lensplate is inappropriate. Use an unlensed BMS4XY500/IGA units to simply measure far-field divergence in real-time or the 1:1 unit to reimagine the fiber output.

## A. Mounting a Factory Set LensPlate

- 1) If a **Factory Set** LP is not already mounted, unscrew the four screws that hold the BeamMap/Beam'R front cover plate.
- 2) Replace the cover plate with the LP. To align it correctly, first loosely tighten the screws and then back them off one quarter turn. Invert the head on a very flat surface and align the tops of the head and the LP to the same plane. Tighten the four screws as opposite pairs.
- 3) When ready to use it, remove the plastic cover cap. Proceed to Section C.

## B. Mounting a Separately Delivered LensPlate

- 1) If the LP arrived separately, then you must focus the LP and set the centroid before use. ***If you do not do this, the measurements will be incorrect.*** In this instance, the labels on the LP will be as shown right. The focus position will be approximately correct, but not exactly correct.

LensPlate LP-1:1-0.65-1550  
Working Dist. = 1.56 mm  
Made in the USA by DataRay Inc

Set centroid at:  
Xc[abs] =  μm  
Yc[abs] =  μm

- 2) Unscrew the four screws that hold the BeamMap/Beam'R front cover plate.
- 3) Replace the cover plate with the LP. To align it correctly, first loosely tighten the screws and then back them off one quarter turn. Invert the head on a very flat surface and align the tops of the head and the LP to the same plane. Tighten the four screws as opposite pairs.
- 4) Align a source approximately on the Xc, Yc axis, and move in z until the beam diameter is minimized in the zero plane of the instrument (the #2 plane for BeamMap-C's). Move the source in X or Y by ~100 μm and determine the movement of the centroid.
  - For a 1:1 LP the source and centroid movements should be equal, ±1%.
  - For a 1:4.9 LP the centroid movement should be 4.9 times the source movement.

If the centroid movement is lower than required for the magnification, turn the friction held knurled anticlockwise. If it is too high, turn it clockwise. **IMPORTANT:** *Every time that you adjust the focus, you must move the source in z to reset the minimum diameter on the zero plane of the head.*

Iterate until the in-focus magnification is correct to ±1%.

- 5) You will then need to determine/redetermine the optimum Xc, Yc values. This is done with the tightly focused beam by first minimizing the beam diameter in the **2** plane while viewing the plane **2** profiles, and then maximizing the signal by moving in first X and then Y to maximize the **Peak = %** value and minimize the required **Gain = db** value. Normally there will be a range of Xc and Yc values in which the Gain is ~ flat. Determine the center of this range to ~ ±50 microns. Write down these values and later write them on the LP label.

### C. Using the LensPlate



**Warning #3:** Buy and use a good XYZ stage. Unless the measurement head and/or the source are mounted on a micron capable XYZ you will fail in your attempts to use the LP. Do not waste your time. The instructions also assume good angular alignment between the two stage.

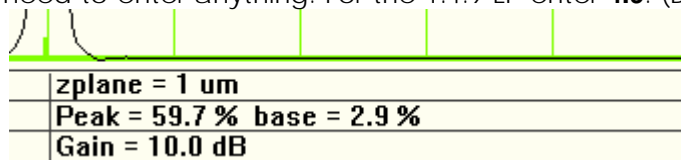
- 1) The XY working range for a 1:1 LP at its working distance is much smaller than the  $\pm 2$  mm for the instrument head without a LP. For 1:4.9 LP it is even less.
- 2) Due to machining and mounting tolerances, when the source is set at the correct zero for the LP, the Xc, Yc absolute position display on the BeamMap head will be different. These values are listed on the label on the head. They are the target centroid values for X2c[abs], Y2c[abs]. If you remount the LP for any reason, follow the procedure in Section B. 5) in order to reestablish the centroid position.

**LensPlate LP-1:1-0.65-850**  
**Xc = 155  $\mu$ m Yc = 237  $\mu$ m**  
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**Warning #4:** If you remount the LP yourself, these optimum Xc, Yc numbers can change by up to  $\pm 250$   $\mu$ m. In the **Setup** pull-down menu, select **Enter Multiplication Factor**. For the 1:1 LP there is no need to enter anything. For the 1:4.9 LP enter **4.9**. (Be warned, if you ever load defaults it will be reset to 1).

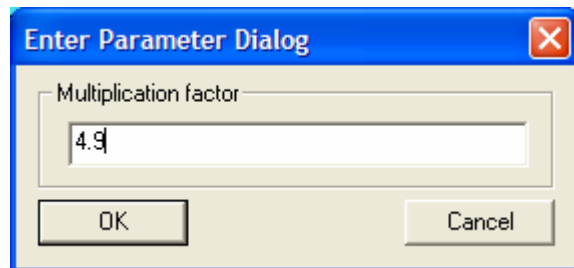
- 3) The source must be positioned at the correct working distance from the lens, but to align it to this position you must start further out and move in.



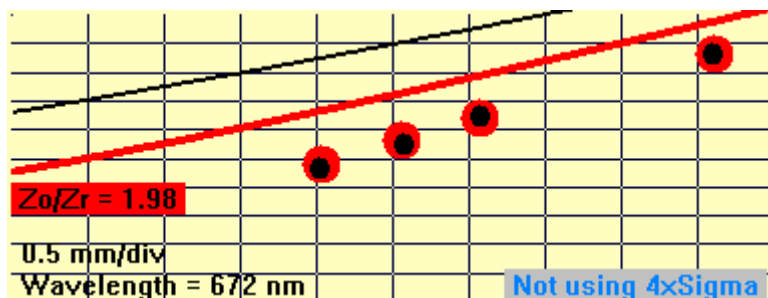
For the 1:1 LP you must start **further out** than 1.56 mm.

For the 1:4.9 LP you must start **further out** than 1.75 mm.

**U V 1 2 3 4** Press the **2** button, or **2** on the keyboard.



**M2** Select the **M<sup>2</sup> Divergence** button. The graph should look something like this, when you are outside the correct focus. The curves may be a poor fit because you are so far from the correct focus.



4) Iterate as follows:

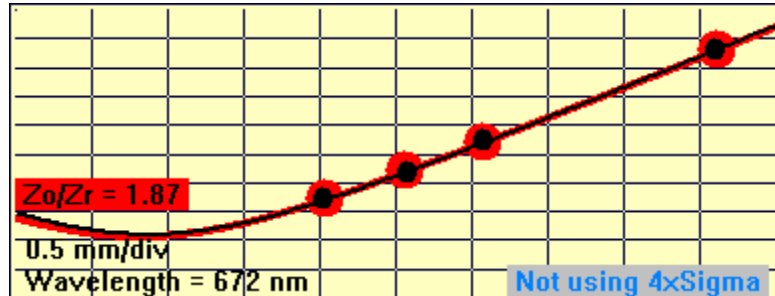
- Approximately adjust the 2 plane centroid **X2c[abs]**, **Y2c[abs]** to the values on the label.

<b>X2c[abs]</b>	<b>144.2 um</b>
<b>Y2c[abs]</b>	<b>5.7 um</b>

- Move the source in z towards the lensplate.

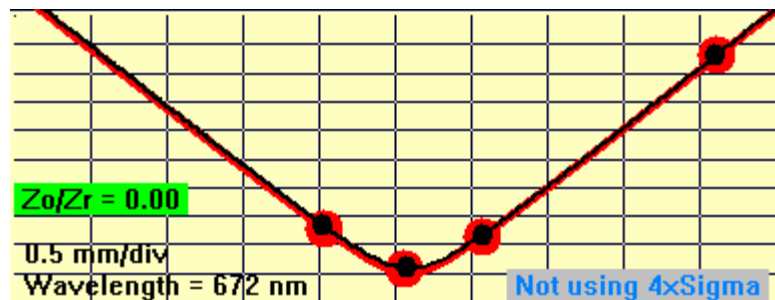
- Approximately adjust the 2 plane centroid **X2c[abs]**, **Y2c[abs]** to the values on the label, within  $\pm 25 \mu\text{m}$ .

- Move the source in z towards the lensplate.



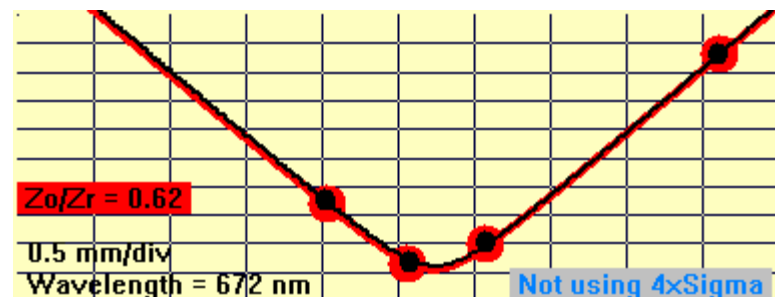
- As you move in in z the fit will improve and the curves will change as shown.

- Repeat as necessary until the  $Z_0/Z_r$  box changes from red, though yellow, to green. Always finish with the iteration to the label centroid values of **X2c[abs]**, **Y2c[abs]**.



- In this position, with the box green, the reimaged waist readings will be correct. Now choose **u** and then **v** to verify that the beams in all planes are showing values that make sense.

- If you go in too far in z, the curve will change to put the bottom of the curve to the right of the second points. **BAD NEWS**. You are in danger of crashing into the lens.



**Problems?** Go **File, Save, Save current data**, and email the file to [support@dataray.com](mailto:support@dataray.com).

1:1 Lensplate shown twice actual size

