LensPlate2 for BeamR2/BeamMap2

Applications

- Waveguide reimaging
- Lensed fiber focal spot reimaging
- Fiber end reimaging

LensPlate2 reimages an external beamwaist onto the zero plane of the **BeamMap2** or **BeamR2**. It employs a pair of diffraction-limited aspheric lenses coated for the wavelengths of interest. These lenses are designed for use with the small beams typical of fiber optics and integrated optics, and are diffraction limited when used at their design distances. The resolution (Rayleigh Resolution) of a lens is defined as ~$\frac{0.61\lambda}{NA}$. These values are listed in Table 1. These assemblies are screwed into the 0.535"-40 (SM05) threaded aperture behind the removable crosshair target on the front plate of a BeamR2 or BeamMap2 (Fig. 1). All LensPlate2 options are factory focused and aligned, and are field demountable/mountable by the user. The actual magnification factor **'M'** is determined during factory or user calibration. The magnification **'M'** is marked on the unit. Custom configurations are available. Email support@dataray.com with your application details.

Figure 1: A scanning slit device mounted with a LensPlate2. LensPlate2 reimages the beamwaist onto the zero plane of the detector that lies within the beam profiler's case. The magnification is marked on the unit.

Important Considerations

1. **Beamwaist position**
    - It is necessary to focus the minimum of the reimaged beamwaist on the zero plane of the BeamMap2.
    - The factory established magnification is for this condition, and the lens is only diffraction limited at this setting.

Part #	LP2-1:1-0.55-$\lambda\lambda\lambda$*	LP2-1:3.4-0.55-$\lambda\lambda\lambda$*	LP2-1:4.93-0.68-$\lambda\lambda\lambda$*
Description	0.55 NA 1:1 LensPlate2	0.55 NA 1:3.4 LensPlate2	0.68 NA 1:4.9 LensPlate2
Magnification	1:1	1:3.4	1:4.9
Working Distance	2.5 mm	2.5 mm	1.68 mm
Resolution (= 0.61λ/NA) @ 675 / 1550 nm	0.75/1.7 μm	0.75/1.7 μm	0.6/1.4 μm
Applications	1:1 reimaging	Fiber end/waveguide reimaging	1:4.93 reimaging (shorter working distance)

***$\lambda\lambda\lambda$** = **VIS**, **NIR** or **TEL**

Table 1: Description of the standard LensPlate2 options, sorted by part number. To meet wavelength requirements, each lense is available in **VIS**, **NIR**, or **TEL**. **VIS** applies to the 350-700 nm wavelength range. **NIR** is 650-1050 nm. **TEL** is 1050-1620 nm.

2. **Single mode fiber divergence**
    - The lensed units are **not** appropriate for measuring beam divergence from a single mode fiber.
    - DataRay sells standard BeamMap2 units for fiber divergence applications.

Displayed Data Correction for the LensPlate2

When the user enters the LensPlate2 actual magnification, the software corrects for the following:

- **Diameter**
    - Consider a beam with diameter **2W** in the measurement plane; it will have a diameter $M * 2W$ in the instrument plane side.
    - The on-screen beam diameters are multiplied by the factor $\frac{1}{M}$.
- **Divergence**
    - In the instrument plane, this beam diverges by factor $\frac{1}{M}$ less than in the measurement plane, so if the divergence is Φ mr in the measurement plane, then it will be $\frac{\Phi}{M}$ mr in the instrument plane.
    - Therefore, in the measurement plane, the beam diameter increases by $z * \Phi$ μm for a distance **z** along the propagation axis.
    - In the instrument plane, the beam diameter increases by only $\frac{\Phi * z}{M}$ μm for a distance **z** along the propagation axis.
    - Therefore, the divergence and NA measurements are multiplied by a factor of **M**.
- **Pointing**
    - In the instrument plane, the centroid positions are a factor **M** greater than in the measurement plane.
    - Therefore, the pointing measurements do not require a correction.
- **Zo**
    - The calculated Zo value is multiplied by a factor of $\frac{1}{M}$
- **Zr**
    - The calculated Rayleigh range value is multiplied by a factor of $\frac{1}{M}$
- **M^2**

- Since M^2 is the product of beam diameter and divergence, M^2 in the measurement and instrument planes are nominally identical.
- In practice, even though an excellent lens pair is used, the measured M^2 is always going to be some undefinable small factor worse than the actual M^2 of the beam prior to reimaging.
- To minimize this error, ensure that the beam is well centered in terms of **Xc[abs.]** and **Yc[abs.]**.
- Therefore, the M^2 measurements do not require correction for magnification.

- **Centroid**
  - These numerical and centroid display values are reversed by the lens. The signs of the (X_c,Y_c) values are therefore reversed.
  - E.g. (X_c, Y_c) = (-57, +49) would become (+57, -49).

Summary: If the user enters the magnification value, **M**, marked on the LensPlate2 into the software under the **Setup** pull-down menu:

- **Beam Diameters** are divided by the magnification **M**.
- **Divergence** and **NA** are multiplied by **M**.
- **Pointing** requires no correction.
- **Zo** values are divided by **M**.
- **Zr** values are divided by **M**.
- **M^2** values require no correction.
- **Xc, Yc** centroid values are corrected for.

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