

## Beam Displacers

### Product Description:

A Beam Displacer splits an unpolarized light beam into two orthogonally polarized beams which are parallel to each other. The most widely used materials for beam displacers are Yttrium Vanadate (YVO4) crystal, Alpha Barium Borate ( $\alpha$ -BBO) crystal, Calcite crystal and Rutile crystal. Among the four materials, YVO4 crystal is the most popular material due to the thermal and mechanical properties, and large birefringence.

You may refer to this page (<http://www.pmoptics.com/crystals.html>) for material properties



### Specifications:

Dimensional Tolerance	$\pm 0.05\text{mm}$
Optical Axis Orientation	$\pm 0.5^\circ$
Parallelism	$<15$ arc sec
Perpendicularity	$<10$ arc min
Flatness	$\lambda/4$ @ 632.8nm
Surface Quality	20~10
Wavefront Distortion	$\lambda/4$ @ 632.8nm
AR Coating	Specified by customer

### Beam Separation Calculation:

Figure 2 shows a schematic drawing for the beam separation calculation. Optical axis is in the plane ABFE. When an incident beam is perpendicular to the surface ABCD, then the beam separation between o-ray and e-ray is given by:

$$\tan(\alpha) = \left(1 - \frac{n_o^2}{n_e^2}\right) \cdot \frac{\tan(\theta)}{1 + \frac{n_o^2}{n_e^2} \cdot \tan^2(\theta)} \quad (1)$$

$$d = L \cdot \tan(\alpha) \quad (2)$$

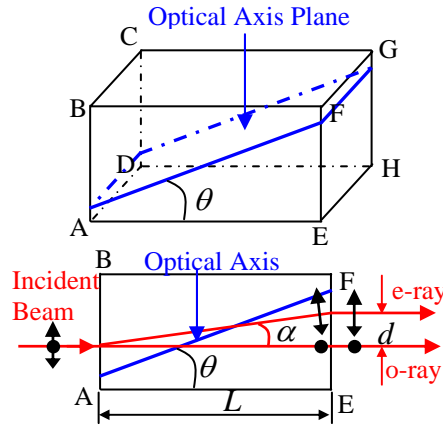


Figure 2: A drawing for beam separation calculation

where

$L$  : Crystal length

$d$  : Beam separation between two rays

$\alpha$  : Angle between two rays inside the crystal

$\theta$  : Angle between optical axis and wavevector

Figure 3 shows the beam separation verse angle  $\theta$  and the beam separation verse wavelength for a 10mm long crystal. At a fixed wavelength, the beam separation reaches maximum when the angle  $\theta$  is around 45 degrees. At a short wavelength, the separation is larger due to a large birefringence.

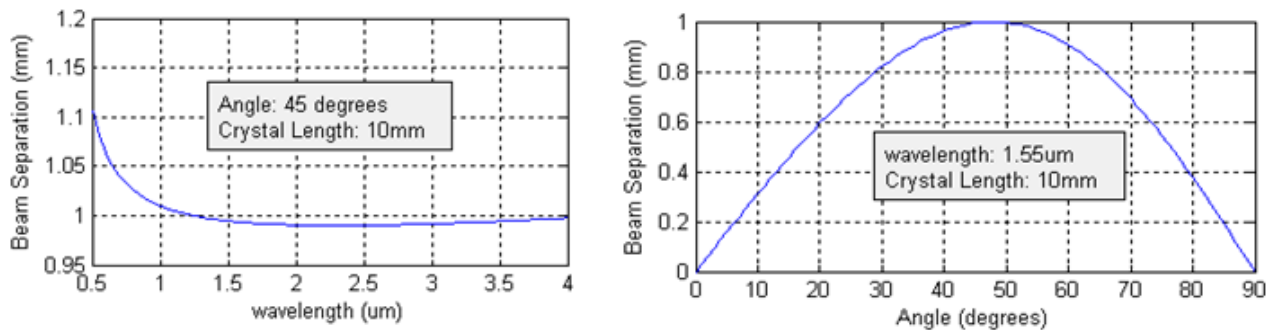


Figure 3: Beam separation verse angle and beam separation verse wavelength

One adverse effect for many applications is the beam separation at both horizontal and vertical directions when an incident light beam is not perpendicular to the line BC.

### Mount Dimensions:

The mount outer diameter is 5.5mm and the length is the crystal length plus 0.5mm for standard size crystals. Custom dimensions and shape are available upon request.

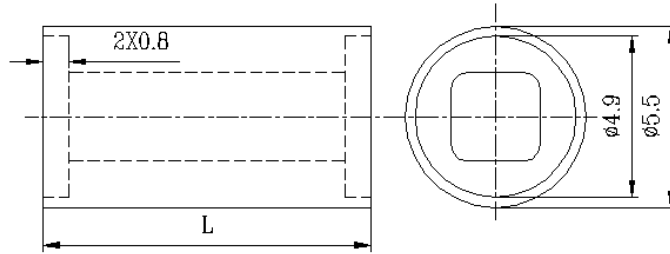
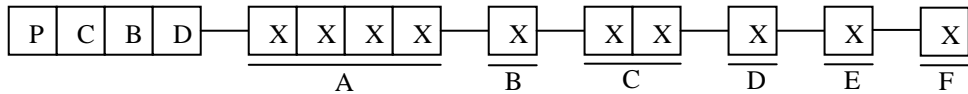


Figure 4: Beam displacer mount dimensions

### Ordering Information:



<b>A</b>	<b>Wavelength</b>	<b>1550 = 1550nm</b>
		<b>0980 = 980nm</b>
		<b>XXXX = Your Application Wavelength</b>
<b>B</b>	<b>Material</b>	<b>1 = YVO4</b>
		<b>2 = Calcite</b>
		<b>3 = Alpha-BBO</b>
		<b>4 = Rutile</b>
		<b>0 = Special</b>
<b>C</b>	<b>Dimensions</b>	<b>01 = 7mm(L)X2.6mm(W)X2.6mm(H)</b>
		<b>Check Standard Size Table Below</b>
		<b>00 = Customized Size</b>
<b>D</b>	<b>Optical Axis Angle (<math>\theta^*</math>):</b>	<b>1 = 45°</b>
		<b>0 = Special</b>
<b>E</b>	<b>Polishing Angle (<math>\phi</math>):</b>	<b>1 = 0°</b>
		<b>2 = 5.8°</b>
		<b>0 = Special</b>
<b>F</b>	<b>AR Coating</b>	<b>1=Yes</b>
		<b>0=No</b>

\*: See the drawing below.

### Standard Size Table:

Dimensions P/N	Length L (mm)	Width W (mm)	Height H (mm)
01	7.0	2.6	2.6
02	10.0	2.6	2.6
03	12.0	2.6	2.6
04	15.0	2.6	2.6
05	14.2	2.6	3.6

