

Mode matching calculator, published 1 Mar 2002 by Shanti Rao,
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Instructions:

Create a new worksheet, and set the cell D2 to the laser wavelength, in millimeters.
Starting with the 'laser source' calculator, copy optical elements from the 'library' worksheet, two rows at a time.
Only change the boxes that are white. Colored backgrounds represent calculations.

The available optical elements are:

Free parameters

Laser source

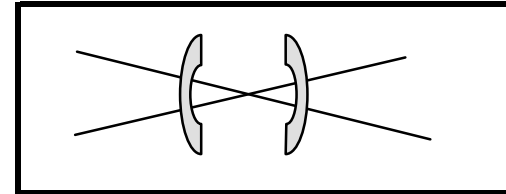
Waist radius, position

This should be the first element in your design. The waist radius is in mm. The position is an arbitrary offset that will be

CC/CC Cavity

Length, radius of curvature

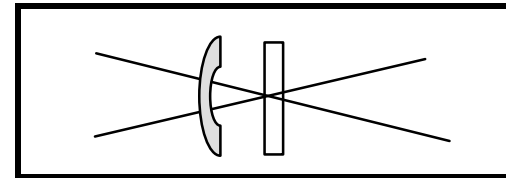
Assumes a symmetric cavity, with the beam waist at the center. Lens position reflects the location of the first mirror. If this is in front of the last optic, the first column will say "Error".



CC/PL Cavity

Length, radius of curvature

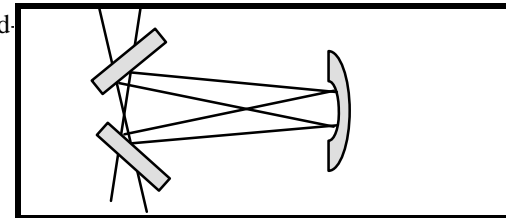
Assumes the input mirror is CC, and the output is PL. The waist will be at the surface of the output mirror. Lens position reflects the location of the first mirror. If this is in front of the last optic, the first column will say "Error".



Ring cavity

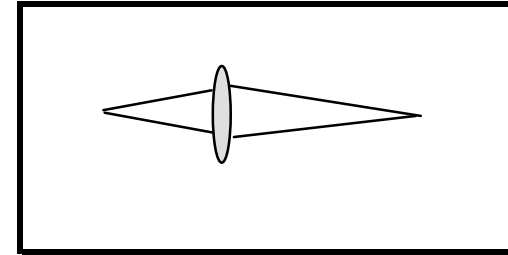
Radius of curvature, waist radius

Assumes a symmetric, triangular ring cavity. The curved mirror, at the far vertex, images the waist onto itself. The round-trip path length is calculated. A ring cavity assumes that the two planar mirrors are very close together, and so the lens and waist positions are not changed.



thin lens
Finds the real solution that images the last waist onto a new waist, of specified size. The lens and waist location are calculated.

focal length, radius of next waist

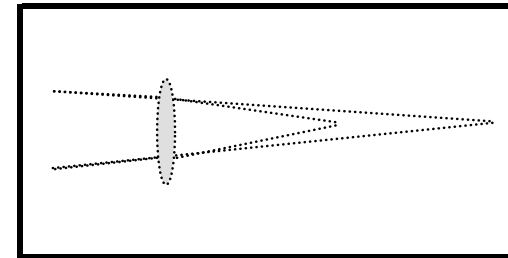


thin lens
Finds the real solution for a new waist, where the lens is at a specific position, and the waist size and position are calculated.

focal length, distance from last optic

thin lens (alt)
Finds the virtual solution that changes the size and position of the next waist. If the lens position is in front of the last optic, the first column will say "Error".

focal length, radius of next waist

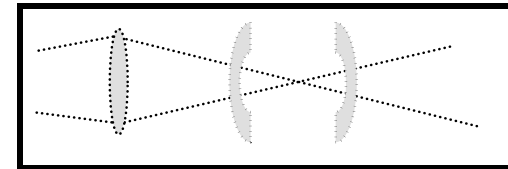


thin lens (alt)
Finds the virtual solution for a new waist, where the lens is at a specific position, and the waist size and position are calculated. If the lens position is in front of the last optic, the first column will say "Error".

focal length, radius of next waist

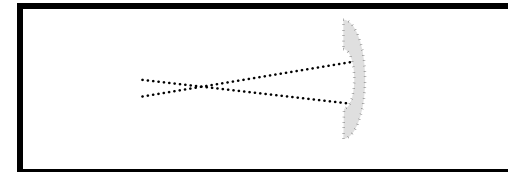
mode match
Calculates the location of a lens that will image the last waist onto the next waist. A mode match element should usually precede a cavity element.

focal length



mirror
Assumes a concave mirror at normal incidence, such as for reflecting a beam back through an AOM.

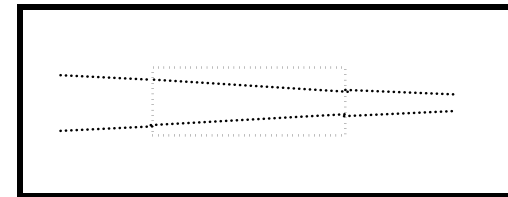
radius of curvature, waist radius



spacer
Acts as a placeholder in the spreadsheet.

propagator
Calculates the spot size after a length of travel. Use this to account for a region in which there can be no lenses (like a window) or a thick piece of high-index material (like a Pockel's Cell).

length, index of refraction



Mode-matching calculator. All units in mm.

Wavelengt 0.001064 mm

Laser source	waist dist		waist radiu f0		waist pos	inches w					
1	0		0.180		0	0.00					
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
2	489.7119	489.7119	254.2	0.180	95.67	979.42	489.71	38.56	19.28	1.289122	19.28
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
3	1060.655	955.7132	508.33	0.200	106.29	2995.79	1935.14	117.94	76.19	1.792311	56.91
thin lens (alt)	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
4	9.202275	9.202275	762.5	0.200	118.10	3014.20	3004.99	118.67	118.31	0.254561	42.12
spacer					waist pos	inches w					
5					0.200	3014.20	118.67				
mirror	waist dist	lens pos	mirror radius	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
6	470.3434	470.3434	500	0.200	118.10	3954.88	3484.54	155.70	137.19	1.143522	137.19
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
7	299.7763	1494.408	250	0.040	23.62	5749.07	5449.29	226.34	214.54	2.01684	77.35
ring cavity	waist dist	path length	mirror radius	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
8	200.0112	400.0223	1000	0.368	400.01	5749.07	5449.29	226.34	214.54	5.191776	0.00
mode match	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
9	499.0641	854.8634	350	0.200	217.35	7102.99	6603.93	279.65	260.00	0.903183	45.46
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
10	782.1665	782.1665	400	0.200	118.10	8667.33	7885.16	341.23	310.44	1.465623	50.44
propagator	index	length				waist pos	inches w				
11	1.4	10			0.200	8663.33	7895.16	341.08	310.83	0.25875	0.39
thin lens (alt)	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
12	-88.0628	100	762.5	0.227	133.82	8675.27	8763.33	341.55	345.01	0.55634	34.18
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
13	2517.892	700	1500	0.154	103.14	11893.16	9375.27	468.23	369.10	1.233215	24.09
mode match (alt)	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
14	66.9168	-69.7776	406	0.130	59.23	11890.30	11823.38	468.12	465.49	0.583396	96.38
CC/CC cavity	waist dist	length	mirror radius	waist radius	waist pos	lens pos	inches w	inches l	inch delta		
15	0	100	100	0.130	11890.30	11840.3	468.1219	466.1534	0.579003	0.67	
thin lens	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
16	329.7297	100	200	0.086	32.88	12320.03	11990.30	485.04	472.06	0.808427	5.91
mode match	waist dist	lens dist	focal length	waist radiu f0	waist pos	lens pos	inches w	inches l	spot size	inch delta	
17	2183.566	484.1526	400	0.394	99.54	14987.74	12804.18	590.07	504.10	2.67113	32.04
CC/PL cavity	waist dist	length	mirror radius	waist radius	waist pos	lens pos	inch w	inch l	inch delta		
18		300	1000	0.394	14987.74	14687.74	590.07	578.26	0.51	74.16	