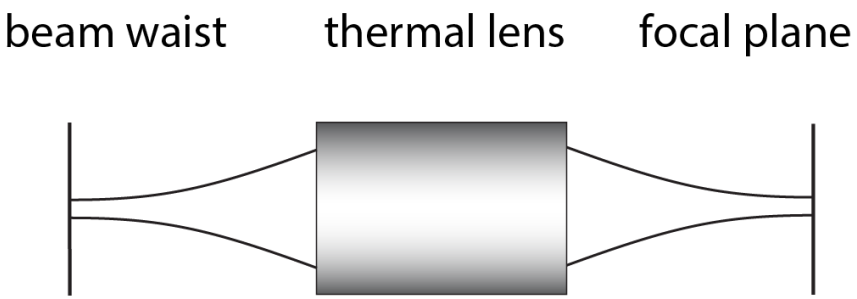
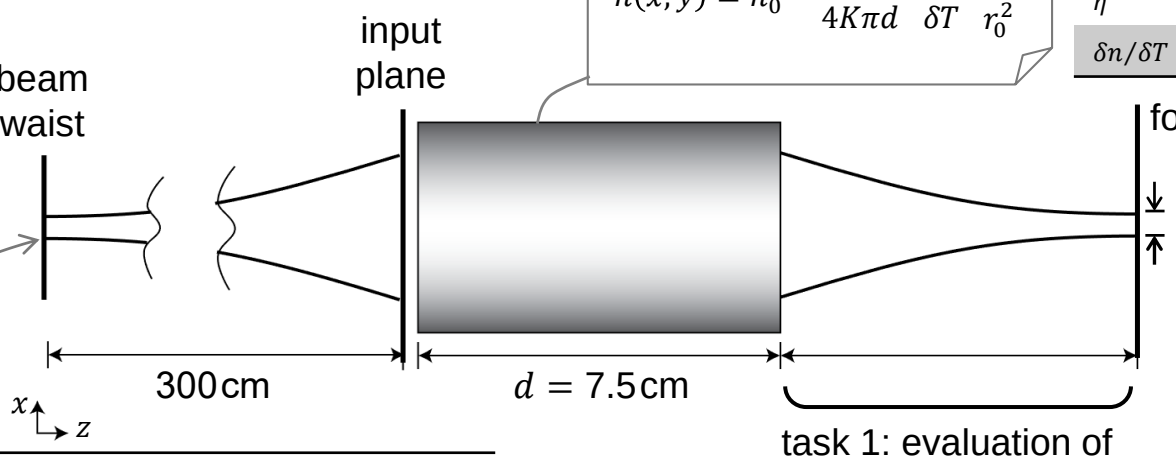
Gaussian Beam Focused by a Thermal Lens

Abstract



Thermal lens effect describes the inhomogeneity of refractive index of medium, which is induced by thermal gradient of a high power incident laser beam. For a Gaussian beam with specified parameters, the refractive index is mathematically represented as a function of temperature and input power [W. Koechner, Appl. Opt. **9**, 2548–2553 (1970)]. This use case shows the variation of the focal length of the thermal lens, as well as the focus beam diameter when the input power changes. This example is published in [H. Zhong, J. Opt. Soc. Am. A **35**].

Modeling Task



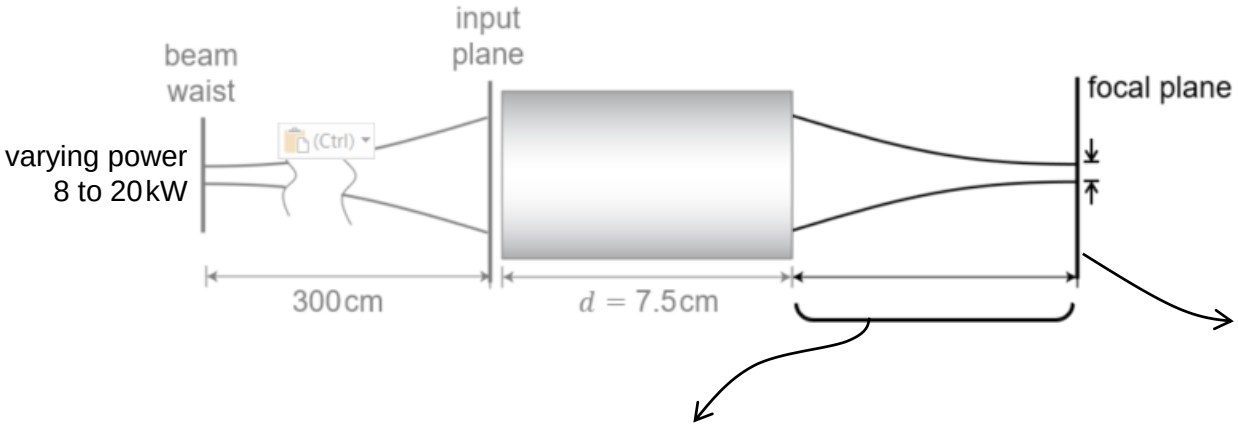
r_0	0.31 cm
K	11.1 W/(cm°C)
η	0.05
$\delta n/\delta T$	7.3×10^{-6} °C^{-1}

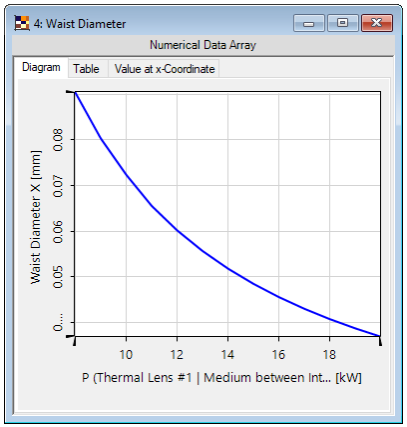
task 2: evaluation of the variation of beam size with varying P_{in}

task 1: evaluation of the variation of focal length with varying P_{in}

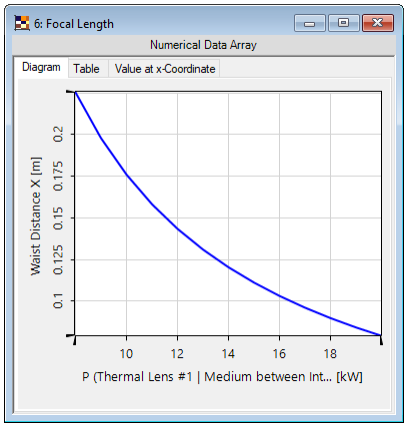
Fundamental Gaussian mode	
wavelength	632.8 nm
polarization	linear in x-direction
waist radius	760 µm
input power P_{in}	**8 to 20 kW**

Results:





beam diameter



focal length

- When P_{in} increases, thermal lens effect becomes stronger and the focal length reduces;
- When NA of thermal lens increases, beam diameter in focal plane reduces.

Document Information

title	Gaussian Beam Focused by a Thermal Lens
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