QUBIG Phase Modulator

What is maximum intensity that can be put in QUBIG phase modulator?

What is the relationship between beam diameter, power and peak intensity,

Gaussian Beam

$$E(r,z) = E_0\hat{x}\frac{\omega_0}{\omega(z)}\exp\left(\frac{-r^2}{\omega(z)^2}\right)\exp\left(-i\left(kz + k\frac{r^2}{2R(z)} - \psi(z)\right)\right)$$

$$I(r,z) = I_0\left(\frac{\omega_0}{\omega(z)}\right)^2 \exp\left(\frac{-r^2}{\omega(z)^2}\right)$$

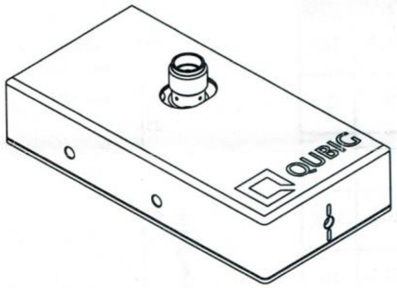
QUBIG

Empowering Laser Technologies

Test Data Sheet

PM-Rb_6.8
S/N: M31621

Resonant electro-optic phase modulator
with
- temperature control option



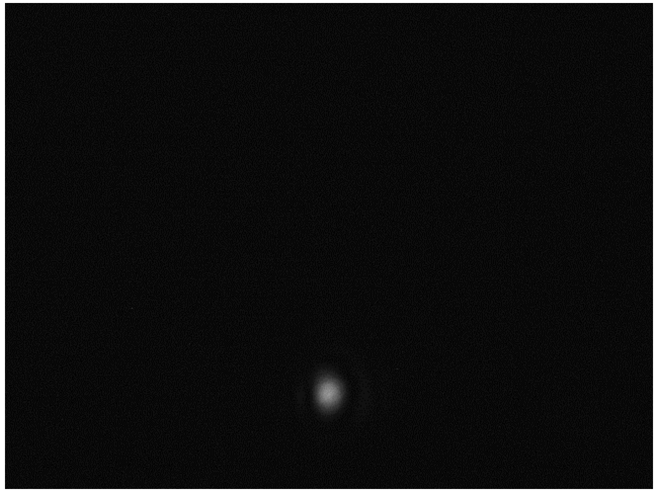
RF properties	Value	Unit
Resonance frequency: f_0 1)	6779 - 6895	MHz
Preset frequency: f_{set} 1)	6835	MHz
Bandwidth: $\Delta\nu$	24.5	MHz
Quality factor Q	279	
Required RF power for 1 rad @ 780 nm	31.6	dBm
max. RF power: RF_{max} 2)	4	W

Optical properties		
Aperture	⌀ 2	mm
Wavefront distortion (@ 633 nm)	λ/4	nm
recommended max. optical intensity (@ 780nm)	5	W/mm^2
AR coating (R< 1%)	780	nm

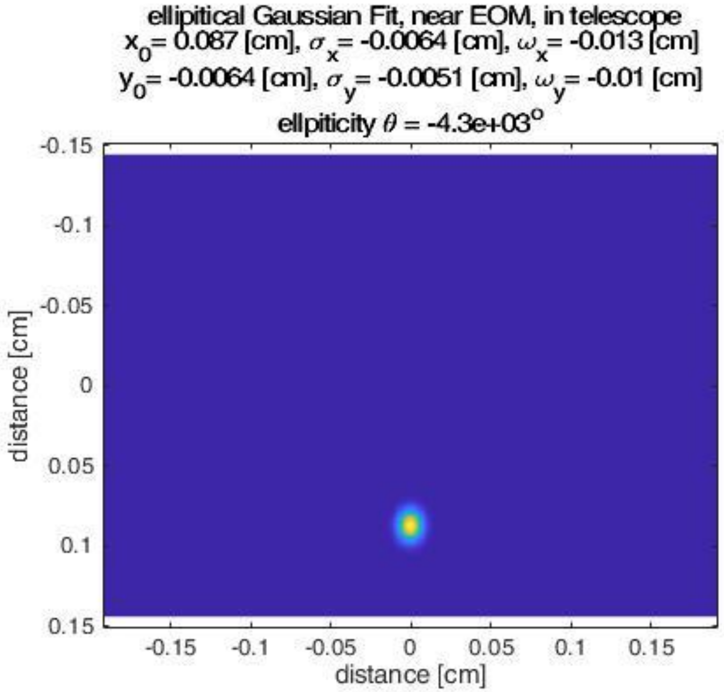
1) at 21.0 °C 2) no damage with RF_{in} < 10W, but use of a proper heatsink is strongly recommended at high powers

The maximum allowed intensity is 5W/mm^2

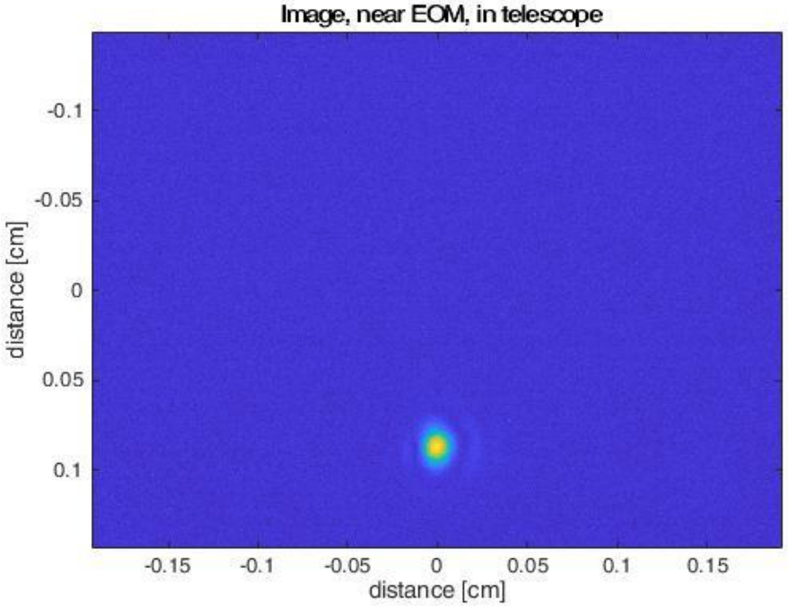
Source Image



Fit in MATLAB



Source Image in MATLAB



The waist dimensions are

$\omega_x = 0.13mm$

$\omega_y = 0.1mm$

Peak Intensity

$$I(0,z) = \frac{2P_0}{\pi\omega(z)^2}$$

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$$P_0 = \frac{\pi}{2} \times 5 \times 0.1 \times 0.13$$

$$P_0 = 0.1W = 100mW$$

OLD

Given that the maximum peak intensity, I_0 ,allowed is 1W/mm2 ($100W/cm^2$)

So for P_0 = 100mW, the waist will be

$$I(0,0) = \frac{2P_0}{\pi\omega(0)^2}$$

$$\omega(0)^2 = \frac{2 \times 100}{\pi \times 200} = \frac{1}{\pi}$$

$$\omega(0) = 0.564cm$$

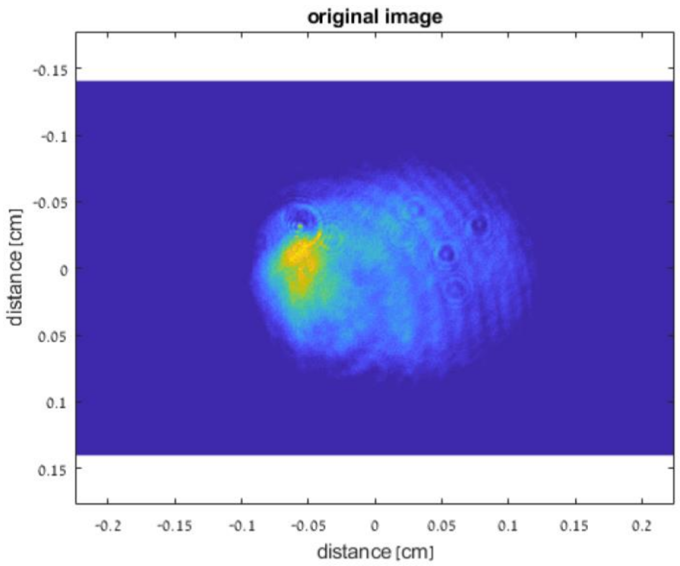
$$\omega(0) = 0.00564cm$$

Connection between waist and sigma?

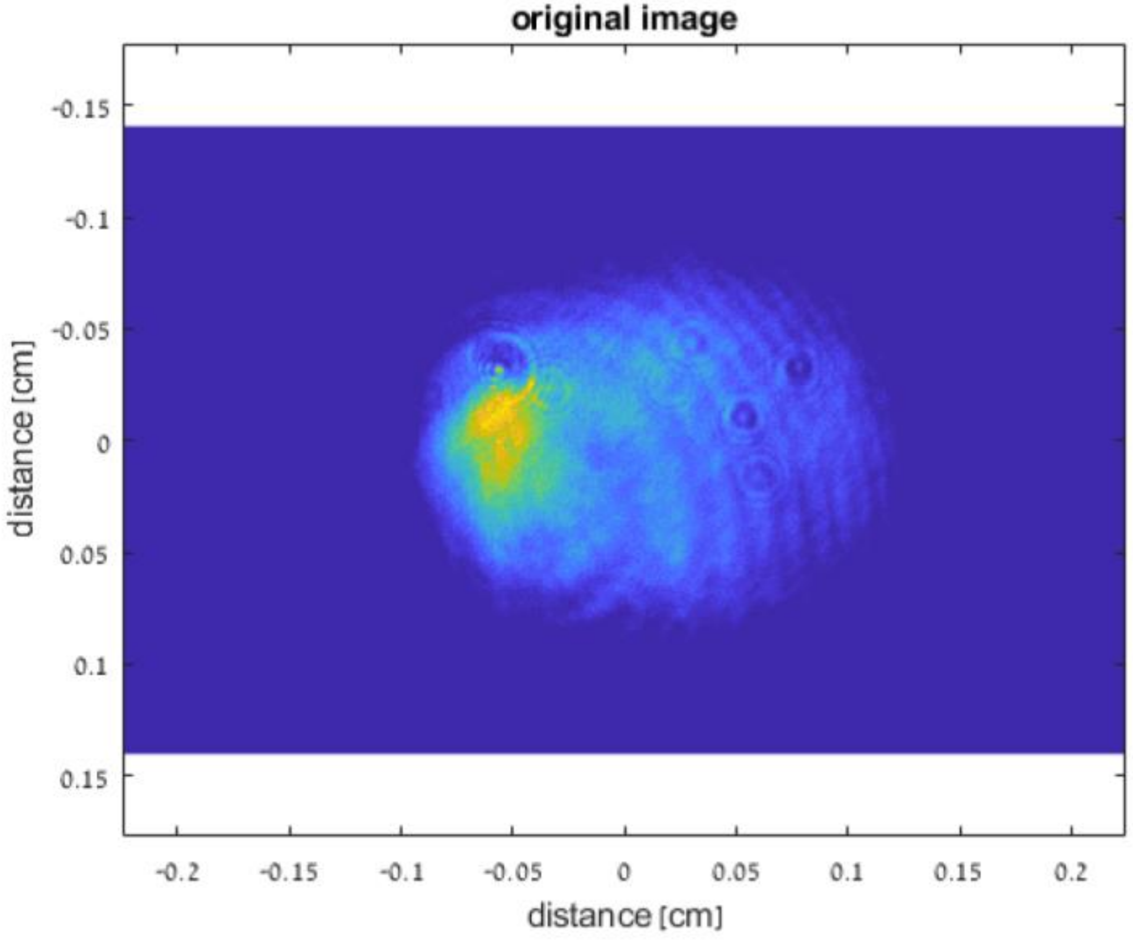
$$I(r) = I_0 e^{-2r^2/\omega^2} = I_0 e^{-r^2/2\sigma^2}$$

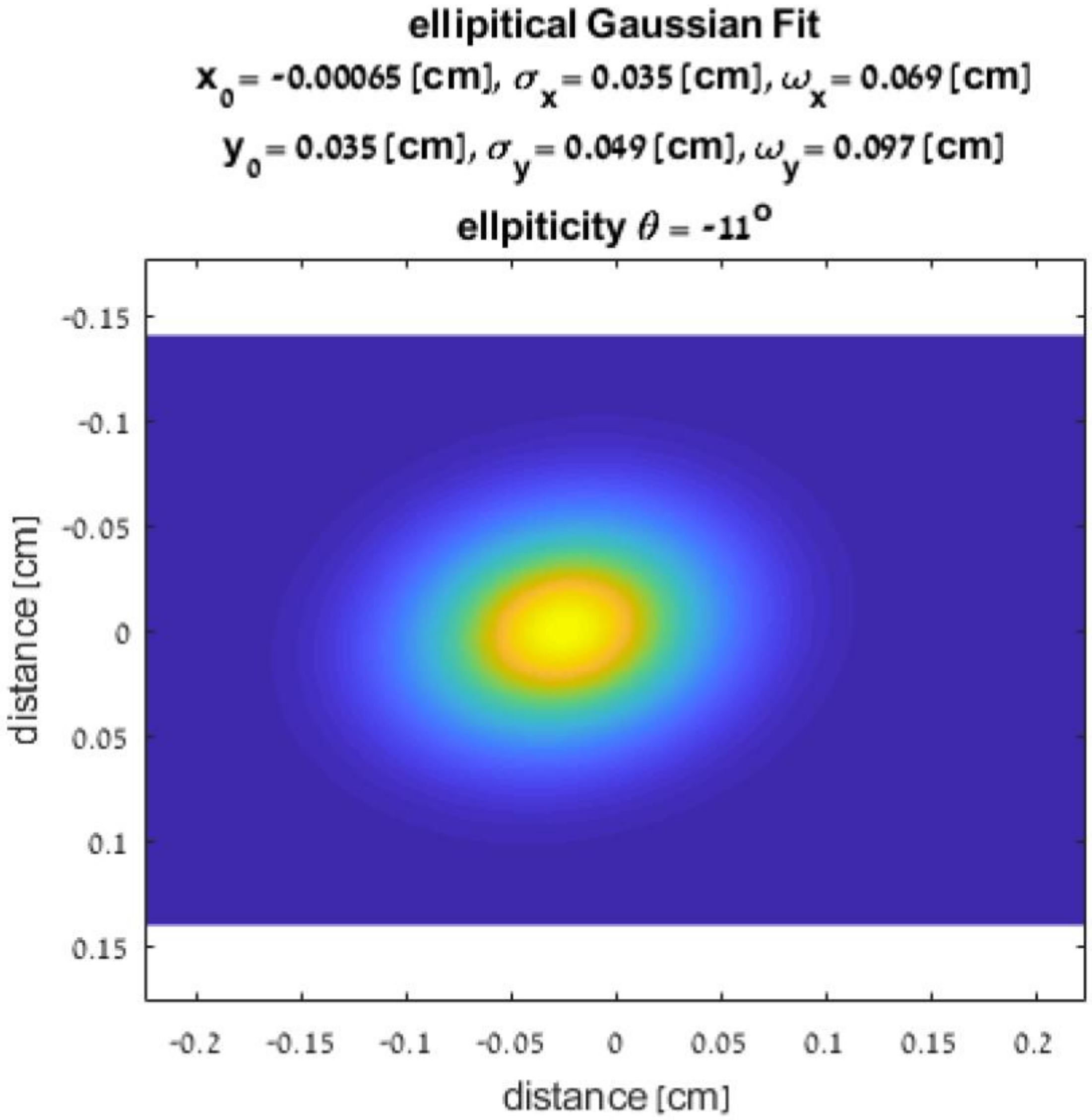
$$\omega = 2\sigma$$

What waist do you have?



OLD


original image
distance [cm]
distance [cm]
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2


ellipitical Gaussian Fit
x_0 = -0.00065 [cm], σ_x = 0.035 [cm], ω_x = 0.069 [cm]
y_0 = 0.035 [cm], σ_y = 0.049 [cm], ω_y = 0.097 [cm]
ellpiticity θ = -11°
distance [cm]
distance [cm]
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2

Focusing

OLD

For a lens: $\omega_1 = \frac{\lambda f}{\pi \omega_0}$ → $\frac{\pi \omega_1 \omega_0}{\lambda} < f$

Switch for larger number 0.097

$\frac{\pi \times 0.564 \times 0.069}{795 \times 10^{-7}} < f$

Working in **cm**

$1540\ cm < f$ → $21.60\ cm < f$

Corrected

Conclusion – OOPS – I need to expand the beam – check calculation.

With 20cm telescope what will waist be?.

$$\omega_1 = \frac{795 \times 10^{-7} \times 30}{\pi \times 0.0069}$$