

Influence of gas curtain parameters on detected profile

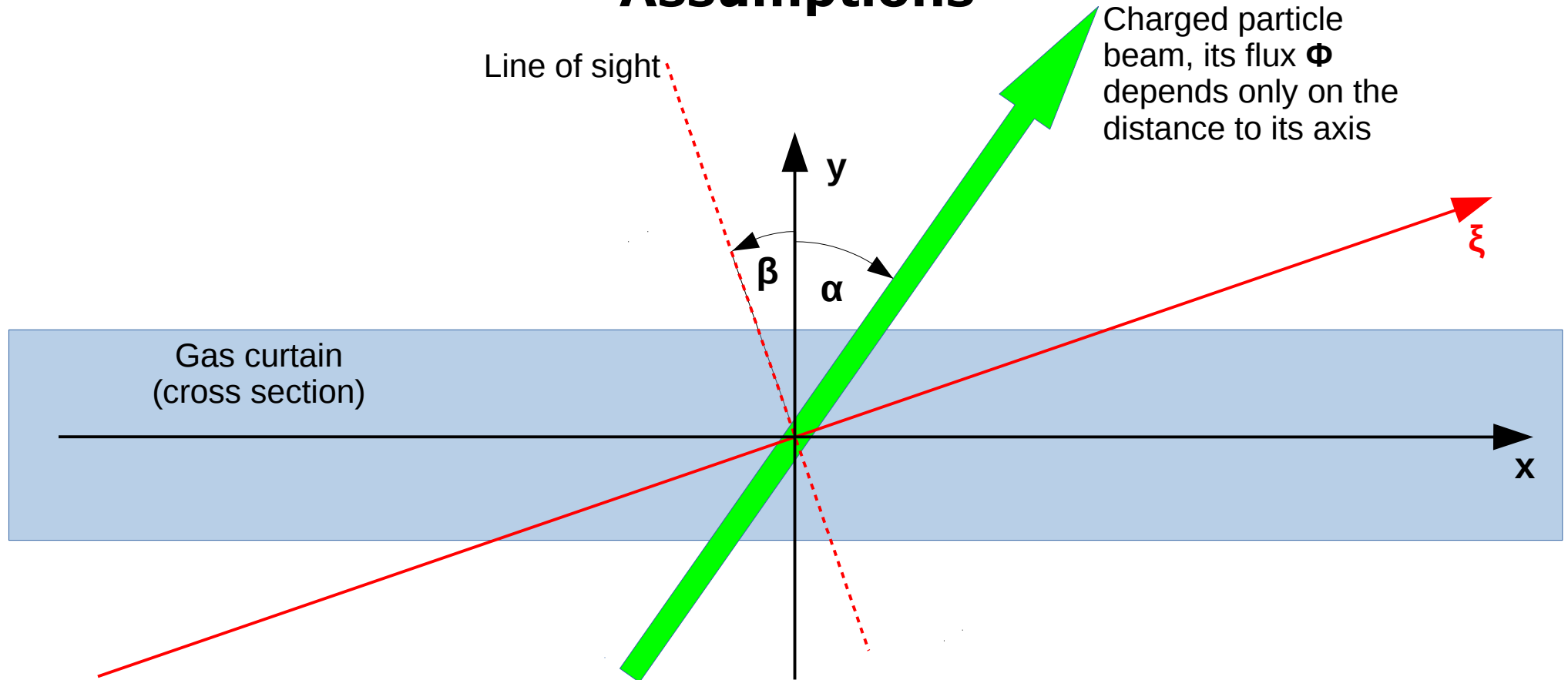
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Motivation

The thickness of the gas curtain and the transverse distribution of the gas density affect the detected beam profiles.

Here a first estimation of the distortions is given using simplifying assumptions.

Assumptions

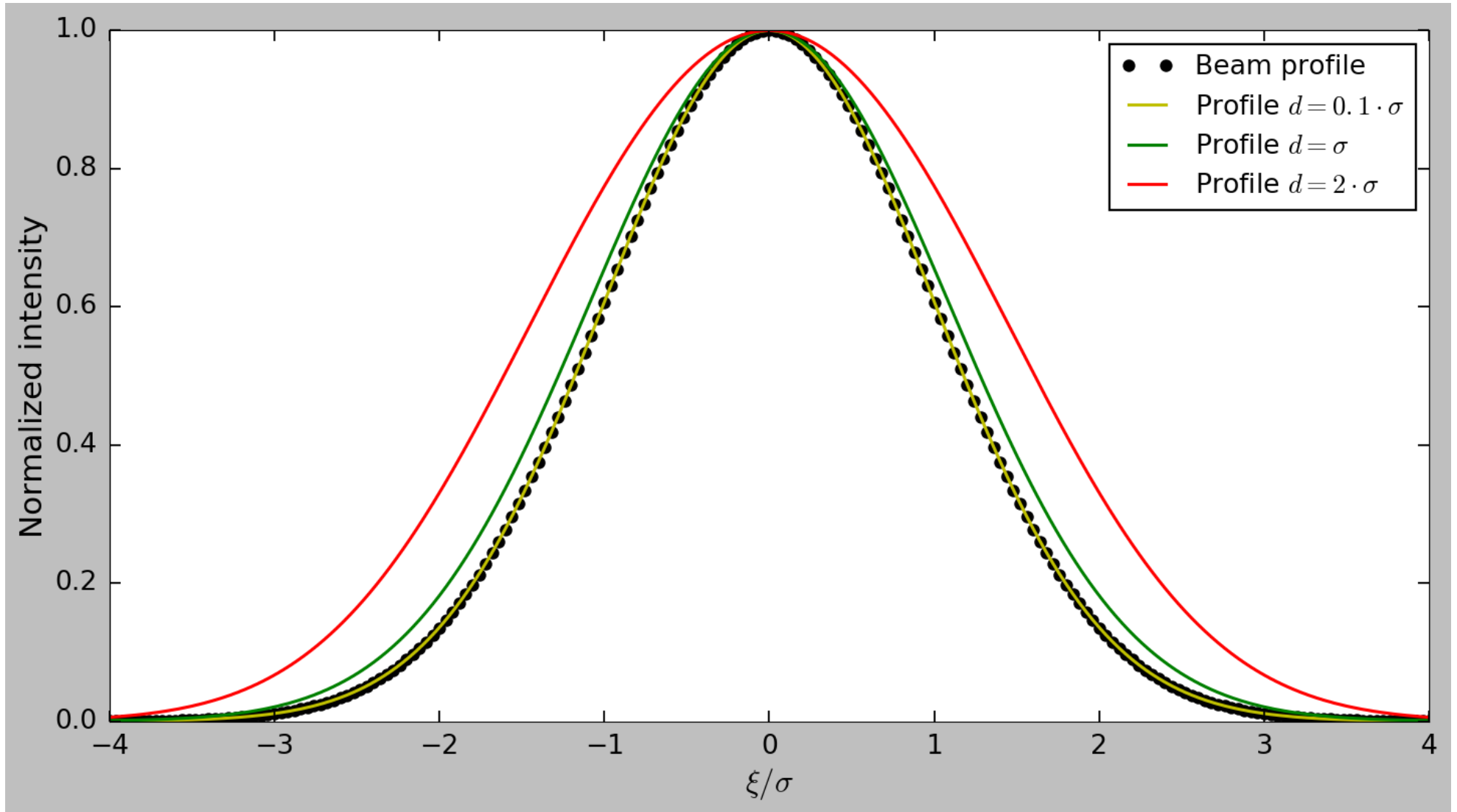


- Gas curtain's density ρ depends only on y
- Gas curtain's refractive index is 1
- Gas curtain extends from $y = -d/2$ to $y = d/2$
- 1D detector parallel to the ξ axis
- Ideal optics placed practically at infinity
- Practically infinite depth of field
- $0 \leq \beta < \pi/2$
- $-\pi/2 < \alpha < \pi/2$

$$I(\xi) \propto \int_{-d/2}^{d/2} \rho(y) \cdot \phi\left(\xi \cdot \frac{\cos(\alpha)}{\cos(\beta)} - \frac{\sin(\alpha + \beta)}{\cos(\beta)} \cdot y\right) dy$$

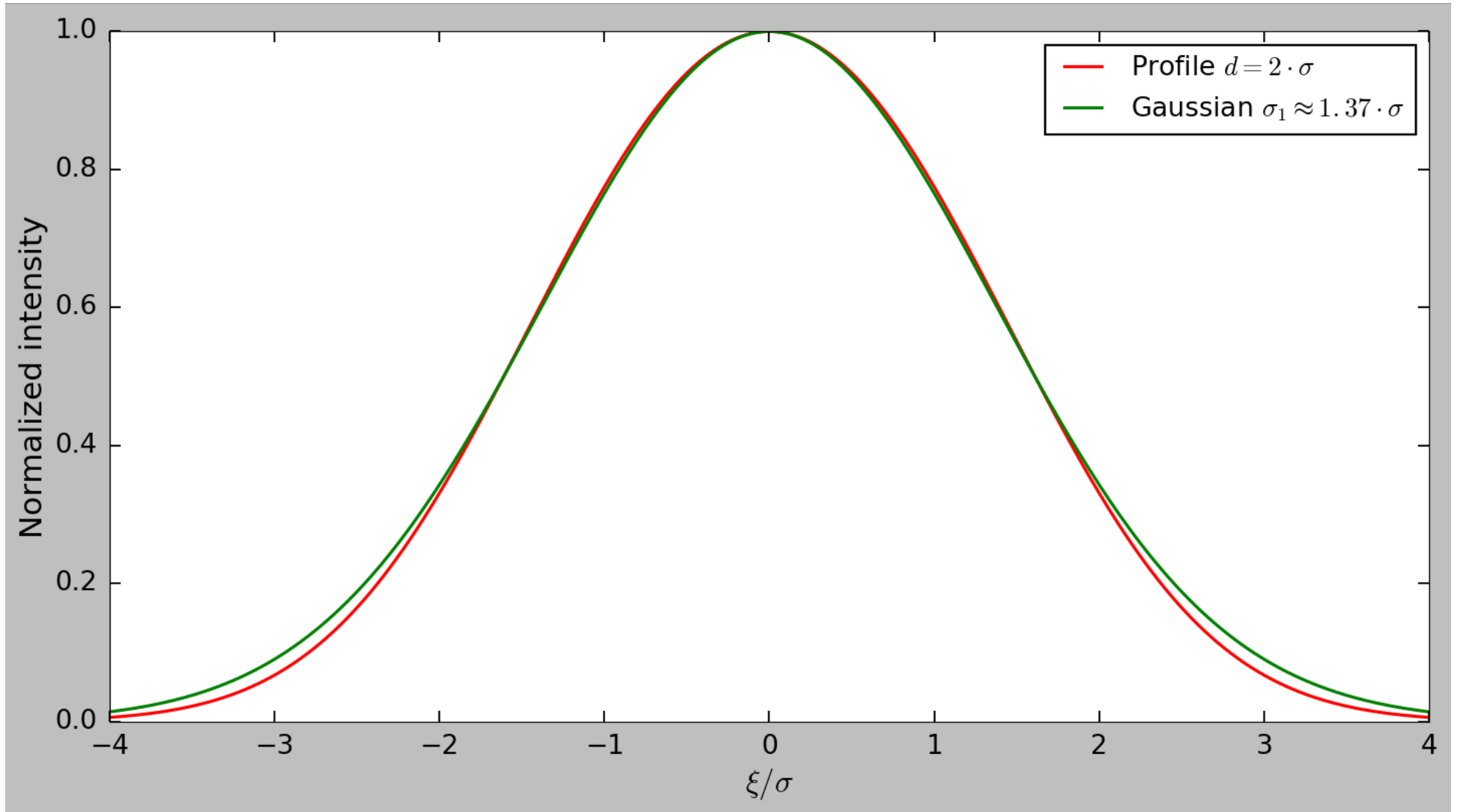
Gaussian Beam Homogeneous Gas Curtain

Line of sight and beam axis are perpendicular to each other, moreover $\alpha = \beta = 45^\circ$



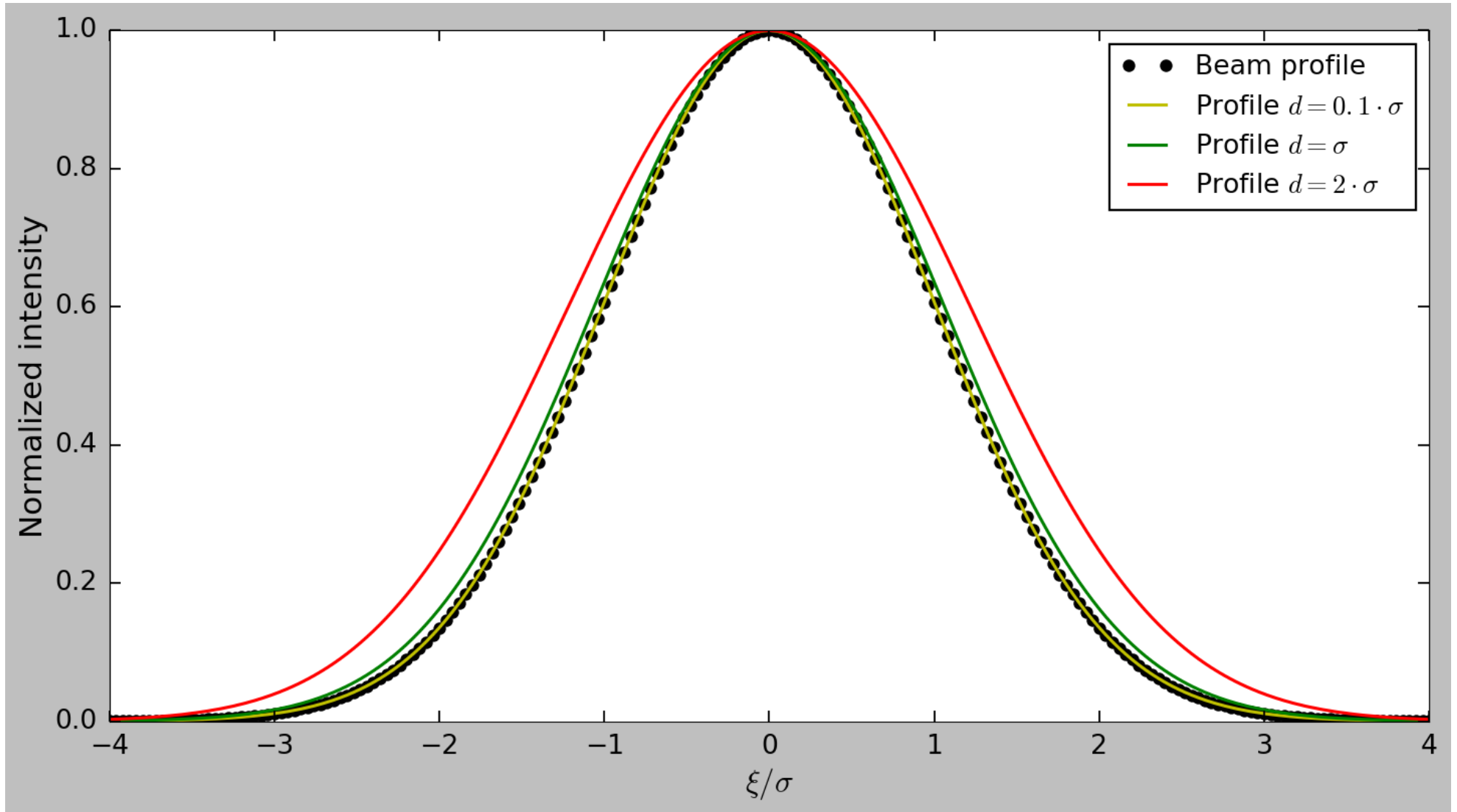
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Gaussian Beam Parabolic Gas Curtain

Line of sight and beam axis are perpendicular to each other, moreover $\alpha = \beta = 45^\circ$



Gaussian Beam Parabolic Gas Curtain

Line of sight and beam axis are perpendicular to each other, moreover $\alpha = \beta = 45^\circ$

