Technology Offer

Enhancement resonator including non-spherical mirrors

Ref.-No.: 1202-4590-WT

An Enhancement Cavity (EC) with at least one toroidal and/or cylindrical mirror is described. This allows for an arbitrary beam ellipticity of the eigenmode. In particular at a stability edge, where the ellipticity diverges with purely spherical optics, a round beam can be obtained.

Principle

By operating an EC at a stability edge, large illuminated areas on all optics can be obtained simultaneously, which circumvents the problem of intensity-related damage. However, the beam ellipticity, i.e. the ratio of beam radius in the tangential to the one in the sagittal plane, diverges due to the non-zero angle of incidence on spherically curved mirrors. In the patent, a purely reflective scheme for compensating the ellipticity is suggested. A typical implementation of the scheme comprises two spherically curved mirrors for focusing and two weakly curved cylindrical mirrors compensating for the astigmatism caused by the spherical mirrors.

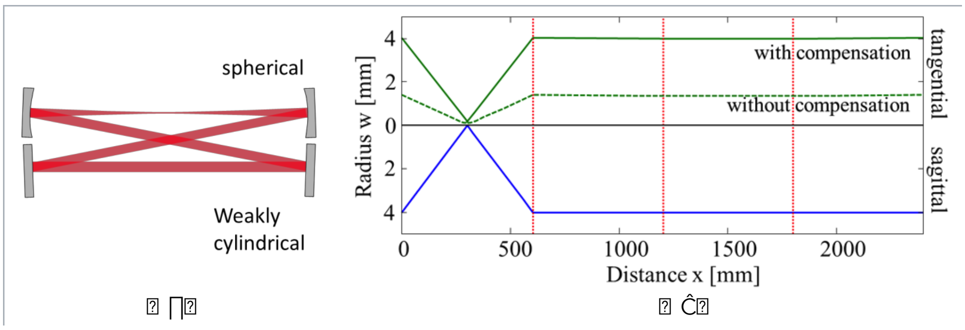

Figure 1: a) Schematic of a large-mode bowtie cavity, b) Beam profile along the optical axis of a 125-MHz bow-tie cavity (2400 mm length, 600 mm radius of curvature mirrors) with (solid line) and without (dotted line) compensation using the technique described above.

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Advantages

- *Only reflective optics* are used, which mitigates intensity and thermal related degradation effects.
- Symmetry with respect to the focal plane can be preserved, i.e. the focus position in the sagittal and tangential planes is the same (*no astigmatism*)
- The smaller beam radius of the elliptical beam can be increased, which *increases the illuminated area* on the optics.
- Typically, a bow-tie resonator at the inner stability edge is used. Here, the beam size is (almost) equal on all optics and the *alignment sensitivity is low*.

Publications

Henning Carstens, Simon Holzberger, Jan Kaster, Johannes Weitenberg, Volodymyr Pervak, Alexander Apolonski, Ernst Fill, Ferenc Krausz, and Ioachim Pupeza, "Large-mode enhancement cavities," Opt. Express **21**, 11606-11617 (2013)
http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-21-9-11606

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