Application Note Stable Top

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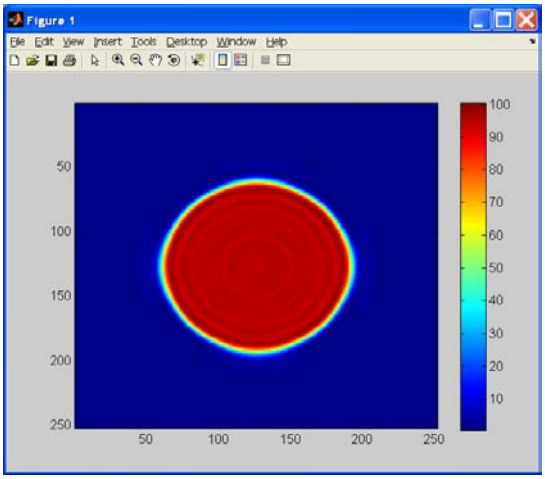

Introduction

In various industries there is a need to create a spot with uniform intensity and sharp transition regions.

Holo-Or supplies for over a decade custom and stock Top-Hat Elements that accept a well-defined Gaussian beam, and transform this into a uniform intensity spot in a specific work plane.

Over the years customers asked for a design that is less sensitive for the position, orientation and beam quality of the input beam. In order to address this need Holo-Or introduced the Stable-Top design family.

In this application note we emphasize the difference between the traditional Top-Hat design and the new Stable-Top version.

For general application information including: Operating Principal, Typical Set-Up, (De) Magnification of the Spot and Design Considerations, we wish to refer to our Top-Hat application note. This article comes only to emphasize the differences between the traditional Top-Hat and the new Stable-Top concept.

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Characteristics

If we compare the Stable Top with the Traditional Top-Hat design we will find the new Stable Top to be:

- Less sensitive to misalignment, (X-Y)
- Less sensitive for elipticity of the input beam
- Less sensitive for the beam quality of the input beam
- Less sensitive to the orientation of the input beam
- To Have a sharper edge

From the negative side one can expect:

- Stronger side lobs
- Larger ripple in center

Comparison of Simulation (Nominal)
For a specific design we found the transfer region to be 2 times smaller for the new design (defined as the length of the region where the intensity of the spot climbs from 14% till 90% of the maximum). Although this value may differ per design, it is expected to be representative for this design family.

Unlike the traditional Top-Hat where in theory a virtual ripple free intensity profile can be obtained, the Stable-Top will even in theory have a minor ripple in its uniformity as displayed in figure 1.

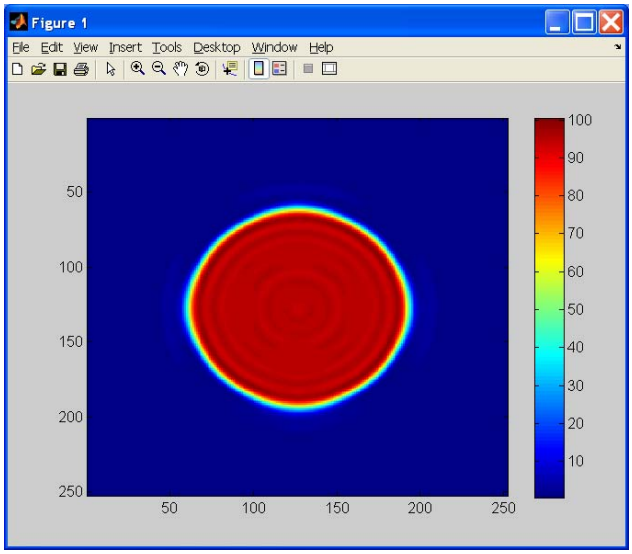

Fig 1. Simulation ripple in center with Stable-Top design

When one takes a cross-section of the intensity profile, (displayed in figure 2) one can see that the ripple for this specific design is very small (~2% in our case), and the shape is rather random. This special shape helps to compensate for all kind of mis-alignments

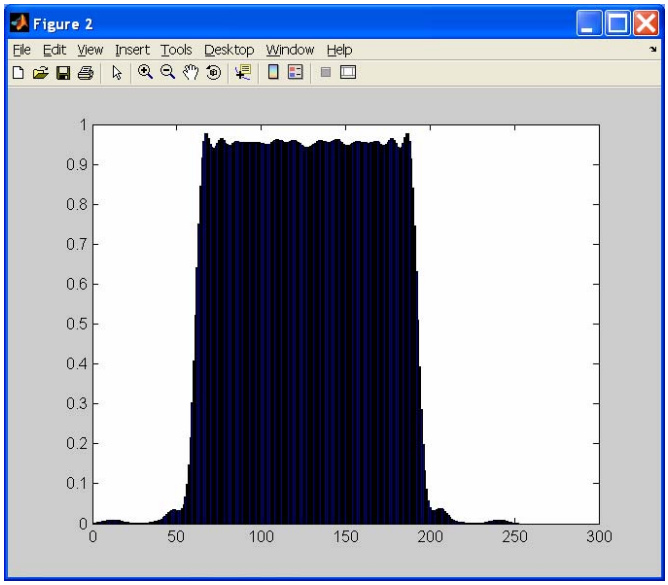

Fig 2. Simulation intensity for Stable-Top.

Comparing the profile with that of the traditional Top-Hat design (displayed in Fig. 3) on sees the uniformity to be about the same. One can also see that the traditional design has virtually no side lobs, but has a larger transfer region.

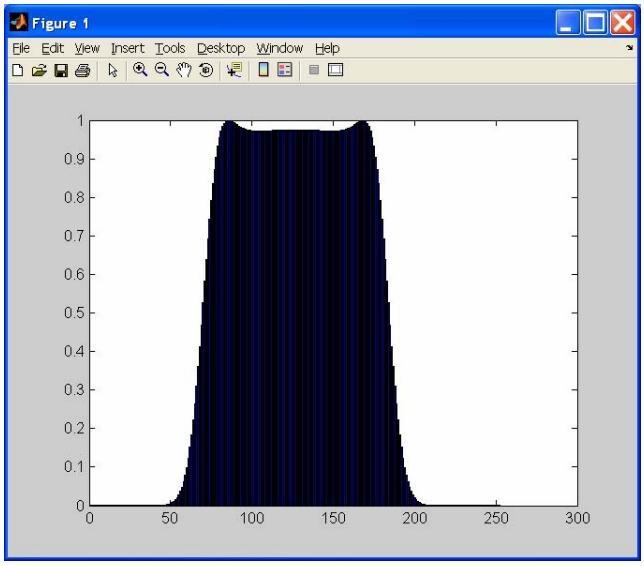

Fig 3. Simulation intensity with Traditional Top-Hat Design

Comparison of Misalignment

For a specific design we compared the effects for a few types of misalignments.

In figure 4 one can see that the new stable top design keeps a well defined and sharp edge even when the element is not well aligned with the beam.

Traditional Top-Hat | **NEW Stable Top**

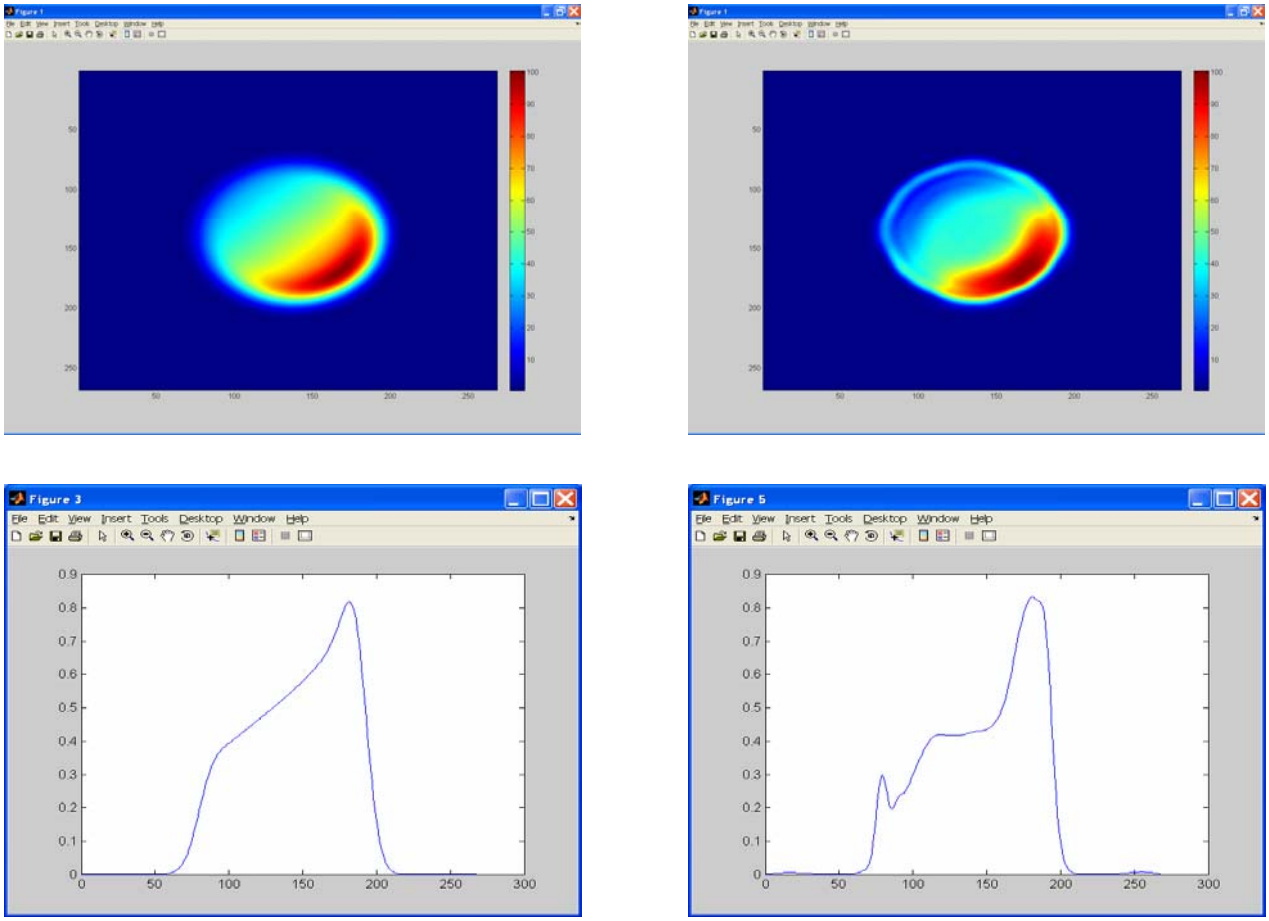

Fig 4. Simulation Sensitivity to misalignments, Traditional Top-Hat versus new Stable-Top Design: Sensitivity for displacement of the beam by 0.5mm in both X and Y direction out of 6mm.

In figure 5 one can see that the new stable top design keeps close to the desired round shape for an elliptical input beam that is orientated 45 degrees from the axis.

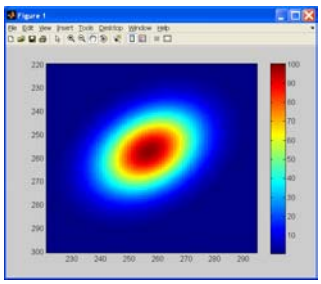

Fig 5a. Input beam used to check sensitivity for ellipticity of input beam (Gaussian of 5x7mm 45 deg:)

Top-Hat **NEW Stable Top**

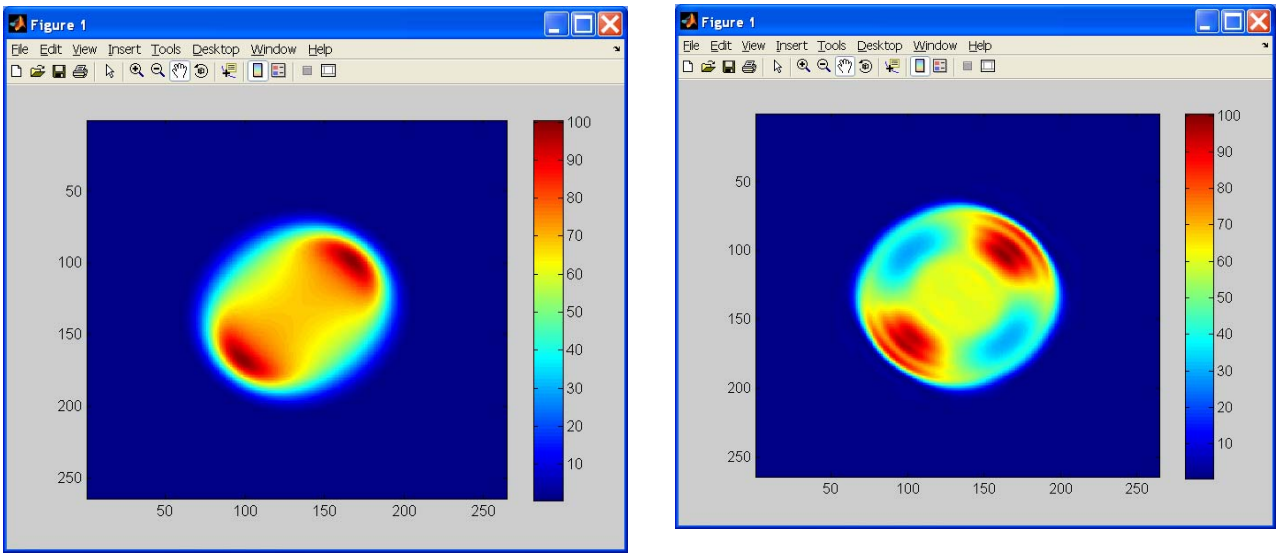

Fig 5b. Comparison Traditional Top-Hat and New Stable-Top design, sensitivity for non ellipticity of input beam

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