Fast Focussing Module

Setup and Applications

Preliminary software description

Version 1.0

rofin
LASER MARKING

CONTENTS

1   The FFM

The FFM (Fast Focussing Module) is an optical module to change the focal length of a galvo head.
With the FFM module the laser focus can be moved fast and accurately along the optical axis of the laser beam. The change of the laser focus is limited to a change of some cm, depending on the used module.
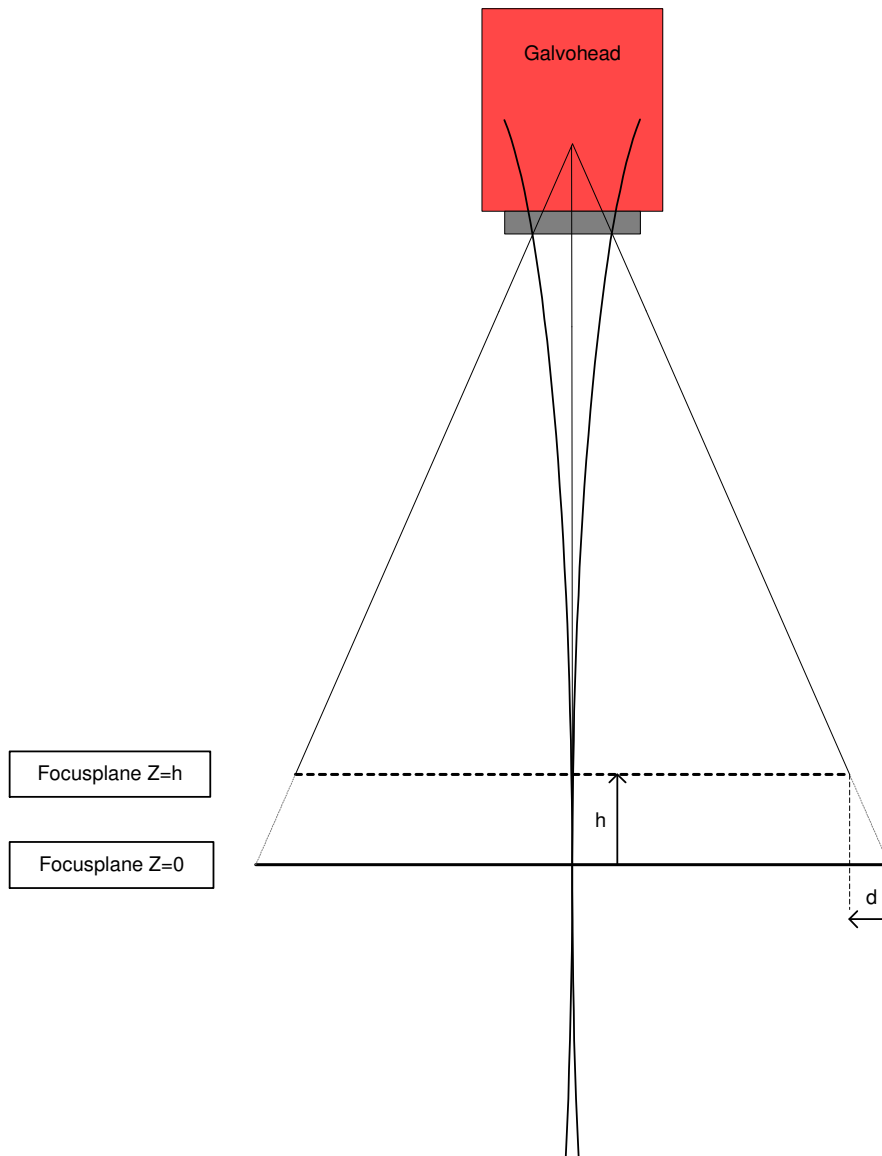
Figure 1 Moving marking plane up, decreases marking field

The use of the FFM module is very similar to the use of a linear Z-axis moving the galvo head up or down

1.1　Requirements

➮ Please note that the FFM requires the use of the ALI3 version 1-n interface board.

➮ Please note the FFM module is only supported with VLM version 4.1 or higher.

2　Configuring the FFM

In the machine configuration the FFM has to be configured before use. For each galvo head used with a FFM the configurations has to be done separately. The configuration dialog for the FFM is shown after pressing the "Advanced" button in the galvo tab in machine configuration.
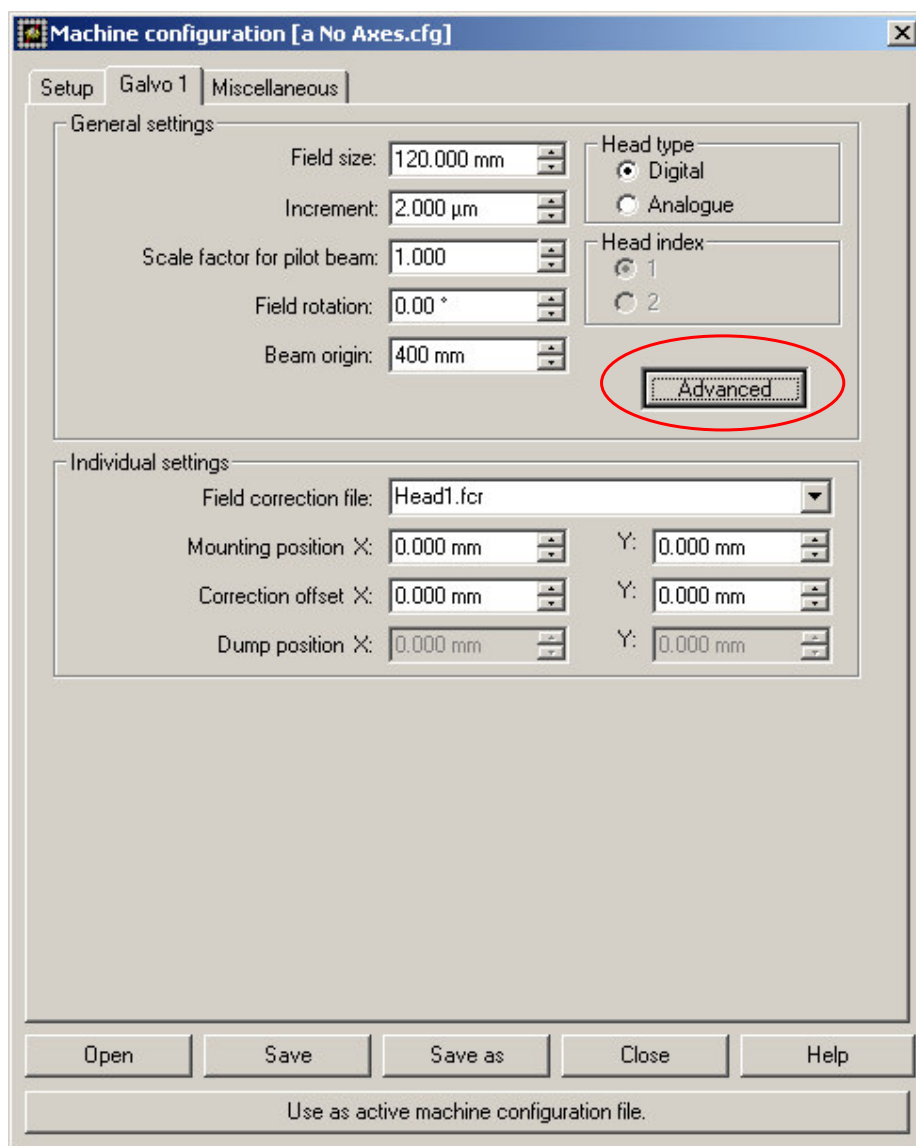

Figure 2 Activating the FFM configuration dialog

After pressing „Advanced" button the „Advanced galvo head settings" dialog appears.

There are three different focus shift modes:

1) none
2) Enable focus correction
3) Enable FFM module

To use the FFM the "Enable FFM module" radio button has to be selected, independent of the use of the FFM within layers, VLM script or laser parameters. If "Enable focus correction" is selected, the FFM can't be used. In this case there is a virtual Z-Height appearing in the layers of VLM. The name for this virtual Z-Height in the layer configuration dialog is Z-corr (Figure 1), this is the same column header as for the use with FFM. The virtual Z-Height is treated mathematically only, to transform the scaling and position of the marking objects, depending on this virtual Z-Height. For the focus correction mode the measurement and configuration of the apex angles have to be done the same way as for the FFM module mode (see 2.1).
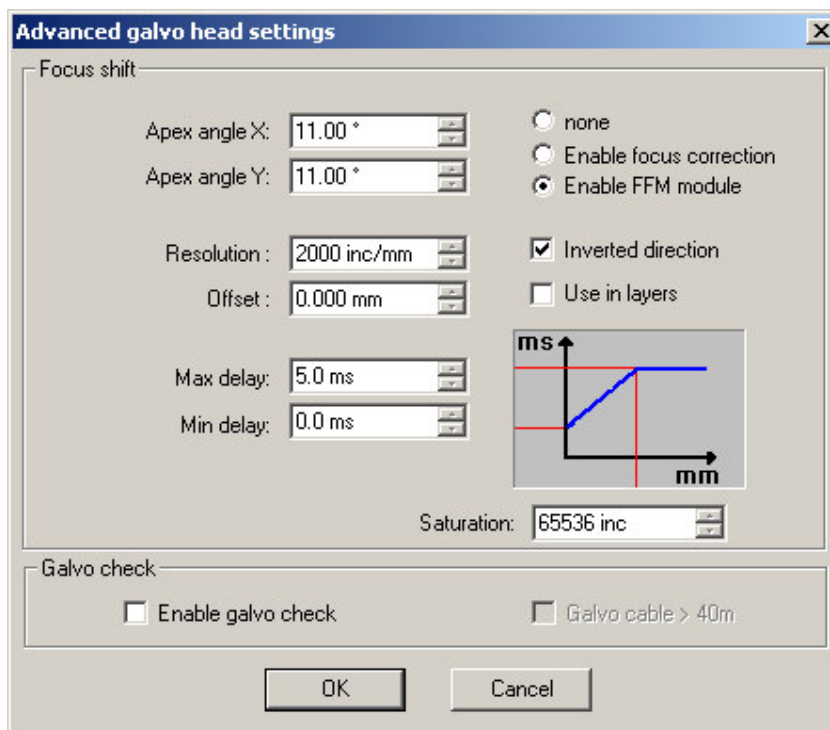

Figure 3 FFM and focus correction configuration dialog

Section focus shift

In this section the FFM is configured:

Apex angle X	Angle of the deflection at the X border of the marking field.
Apex angle Y	Angle of the deflection at the Y border of the marking field.
Resolution	Number of increments per mm. This constant is FFM model dependent. Ask Rofin for this value.
Offset	Offset added to each FFM move.
Max delay	Maximum time to wait after a FFM move.

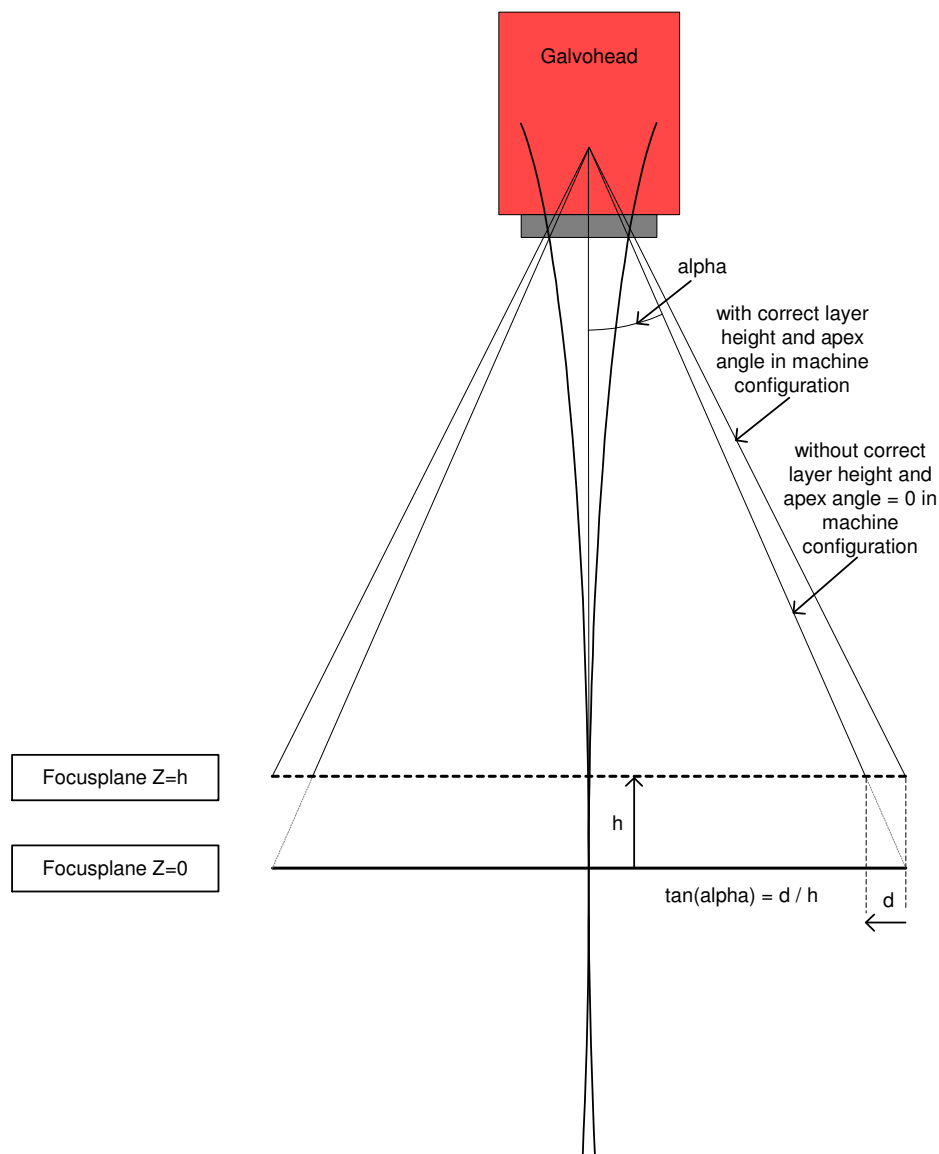| Min delay	Minimum time to wait after a FFM move.
Saturation	Limit of increments when the delay is constant.
Inverted direction	Invert up and down direction.
Use in layers	Decision to use FFM with laser parameters or with Z-Height in layers.

2.1   Adjusting the apex angle

Figure 4 Calculation of apex angles for X and Y

The apex angles for X and Y have to be configured. These two angle have the same size for use of FFM module or for the use with focus correction (radio button in machine configuration FFM dialog Figure 3). These angles have to be measured first and calculated with the following steps:

1) Set apex X + Y- angle to 0° in machine configuration.
2) Activate use in layers in machine configuration. Save configuration.
3) Restart VisualLaserMarker.
4) Make sure marking plane is in focus distance.
5) Laser a square on the border of the marking field with VLM layer Z-corr = 0mm.
6) Move manually the marking plane up with the maximum possible Z-Height in up direction of the FFM. This max Z-Height corresponds to h = 30000 increments / resolution.
7) Laser again a square on the border of the marking field with VLM layer Z-corr = 0mm.
8) The second square should be smaller than the first marked square. Measure X- and Y- size of the squares. Figure 1
9) Calculate the difference of the second square from 7) to the first lasered square from 5). This has to be done for X and Y.
10) Divide the difference from 9) by two -> = d. This has to be done for X and Y.
11) Calculate the apex angle for X and Y with alpha = arc tan (d/h). The value d is the result from 10), the value h is the height from 6). See Figure 4. This has to be done for X and Y.
12) Set apex X + Y- angle to calculated values from 11) in machine configuration. The angles should be normally between 9° and 16°. Save configuration.
13) Restart VisualLaserMarker.
14) Move back marking plane to focus distance manually.
15) Laser a square on the border of the marking field with VLM layer Z-corr = 0mm.
16) See 6).
17) Laser a square on the border of the marking field with VLM layer Z-corr = h = 30000 increments / resolution.
18) Compare 15) and 17), both squares should be of the same size now.

3 Using the FFM with VLM

The FFM can be used in VLM in three different ways:

1) In layers as a Z-Height.
2) In laser parameters as a defocusing value.
3) In VLM script with VB script commands.

It is not possible to use two of the above listed possibilities at the same time. Each of these three use cases can only be used separately.

3.1 FFM use with Z-height in layer
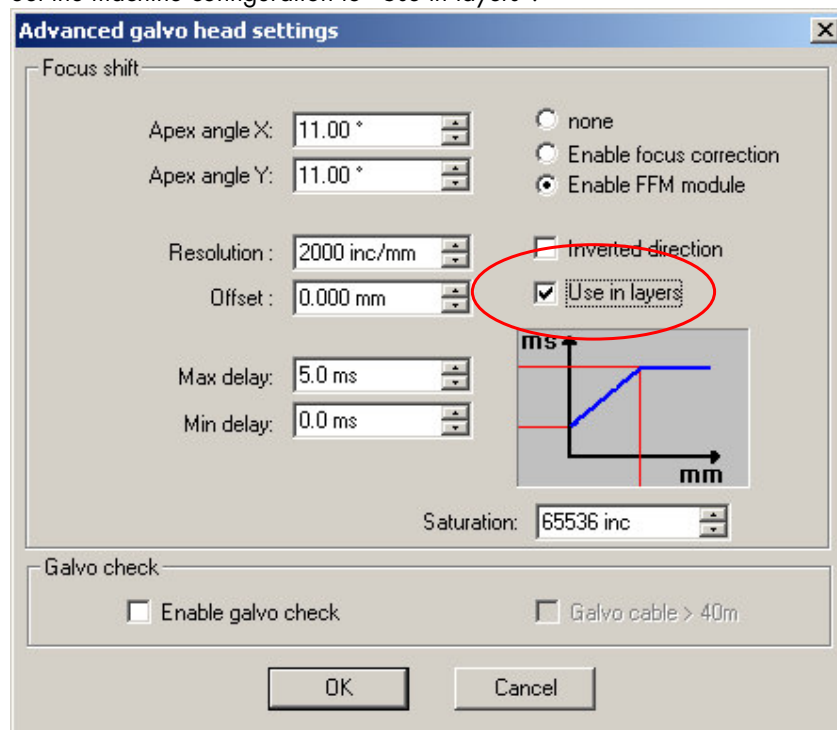
Set the machine configuration to "Use in layers".

Figure 5 activating use in layer

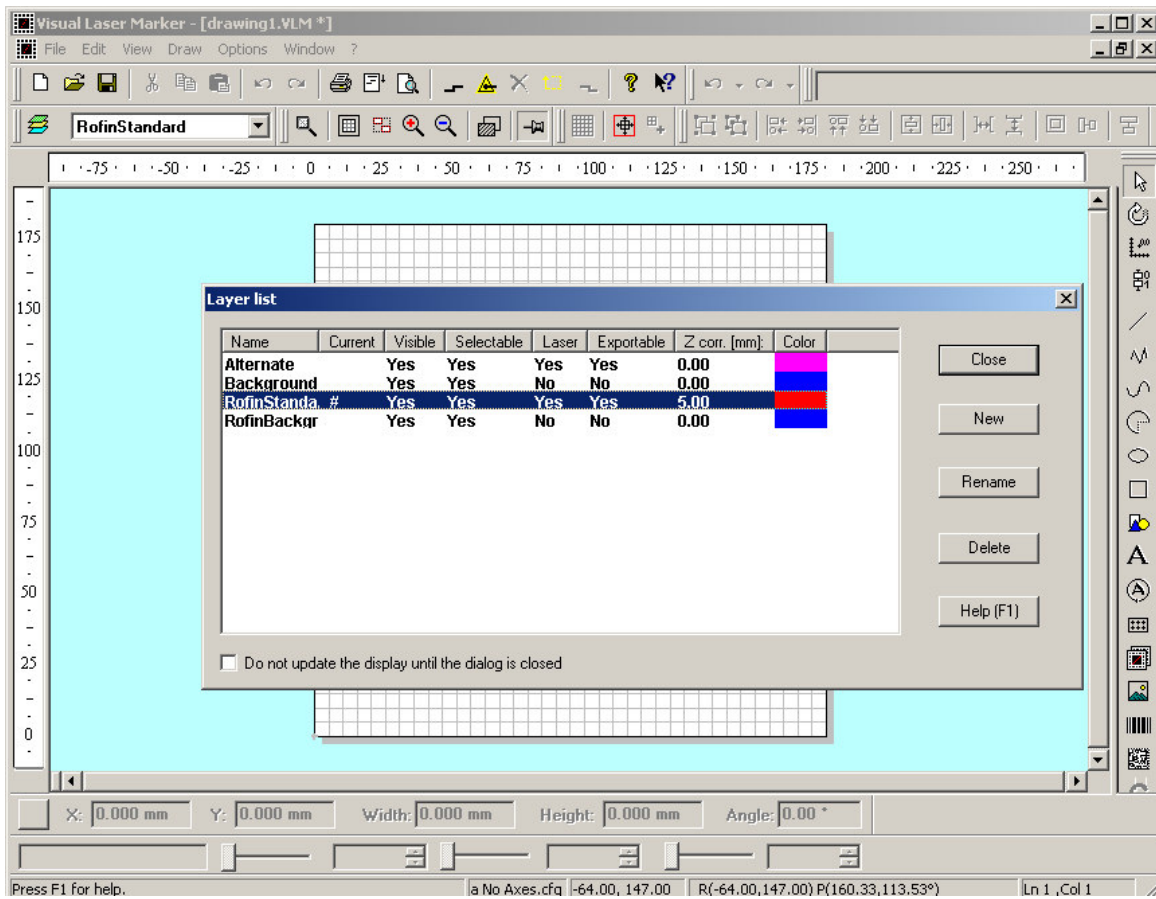set the Z-height in column "Z corr" to the required height.

Figure 6 setting Z-height in layer

3.2   FFM use by defocusing with laser parameter

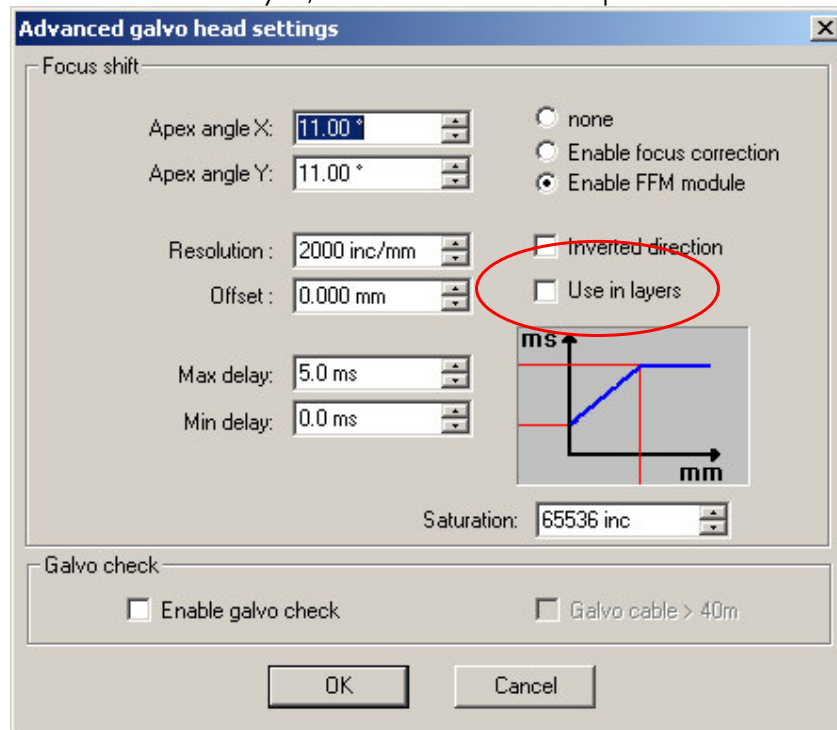Deactivate the use in layers, to enable the use in laser parameters.

Figure 7 Deactivating use in layers

Setting required defocusing value. Value can be between –100% and 100%. –100% is a defocusing distance of 30000 inc / resolution.
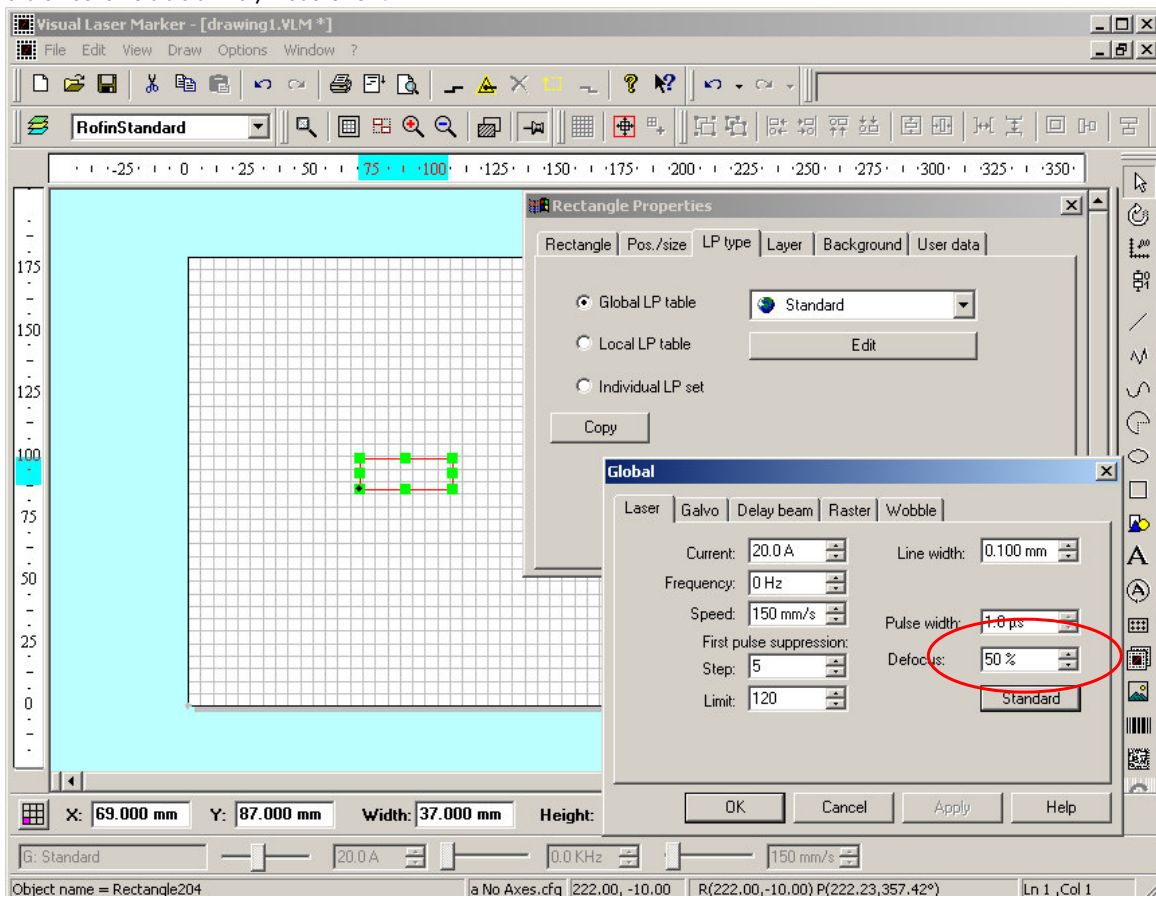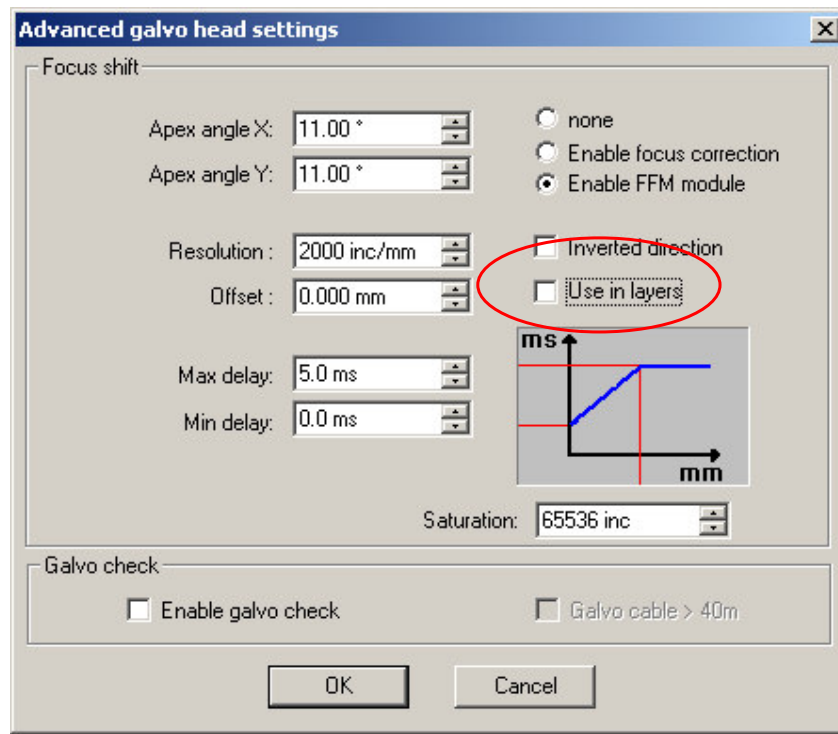

Figure 8 Setting a defocusing value in laser parameter

3.3   FFM use with VLM script

To use the FFM with VLM script, the use in layers has to be deactivated.

In VisualLaserMarker a script is used for the FFM use with a cylinder.

```
'
'Parameters:
' Cylinder.Angle
'     in degrees
' Cylinder.Location
'     1 cylinder axis is parallel to X axis
'     2 cylinder axis is parallel to Y-axis
' Cylinder.HeadIndex
'     0 use HEAD1
'     1 use HEAD2
'


Sub LaserMarker_ScriptBegin()

Dim head
Dim cyl
Set cyl = LaserMarker.Cylinder

head = 0

cyl.Radius = 52.5
cyl.RefX = 0.0
cyl.RefY = 0.0
cyl.RefZ = 49.0
cyl.Angle = 15.0
cyl.Location = 2
cyl.SetConcave
cyl.HeadIndex = head

cyl.ZTable
cyl.CorrectionTable

LaserMarker.EnableCorrection head
LaserMarker.EnableFocusExpansion head

LaserMarker.Drawing.GetMO(100).Mark

LaserMarker.DisableCorrection head
LaserMarker.DisableFocusExpansion head

End Sub
```