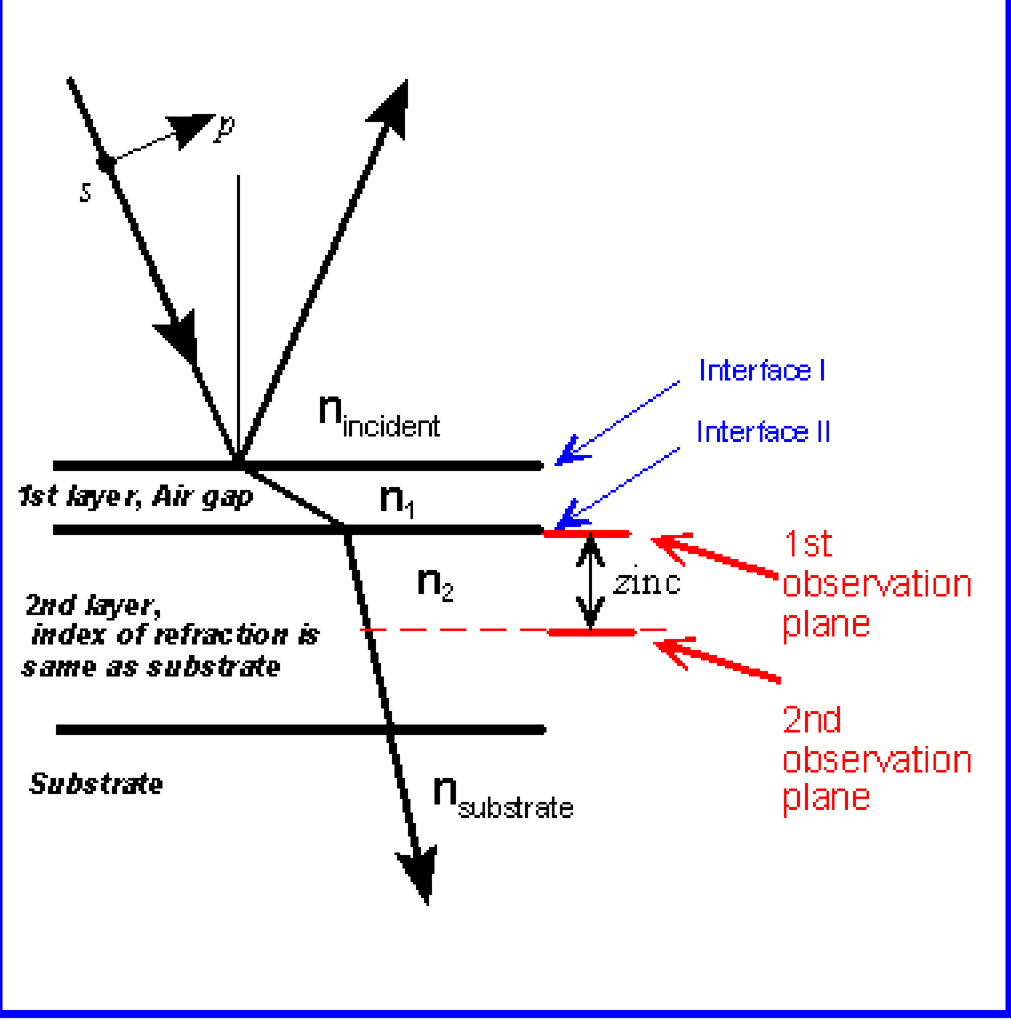
TFT Tutorial Contents

This tutorial provides several tutorials which discuss how to use the TFT model in OPTISCAN

- TFT Tutorial System using a solid immersion lens
- Reflected TFT Tutorial System
- Phase Change TFT Tutorial System
- Appendix A - fancy plotting tips
- Appendix B - journal references
- Appendix C - conference paper references

System I: Thin Film Target(TFT) Tutorial System Using a Solid Immersion Lens



Goal (system I)

Simulate, with OPTISCAN, the Thin Film Target.

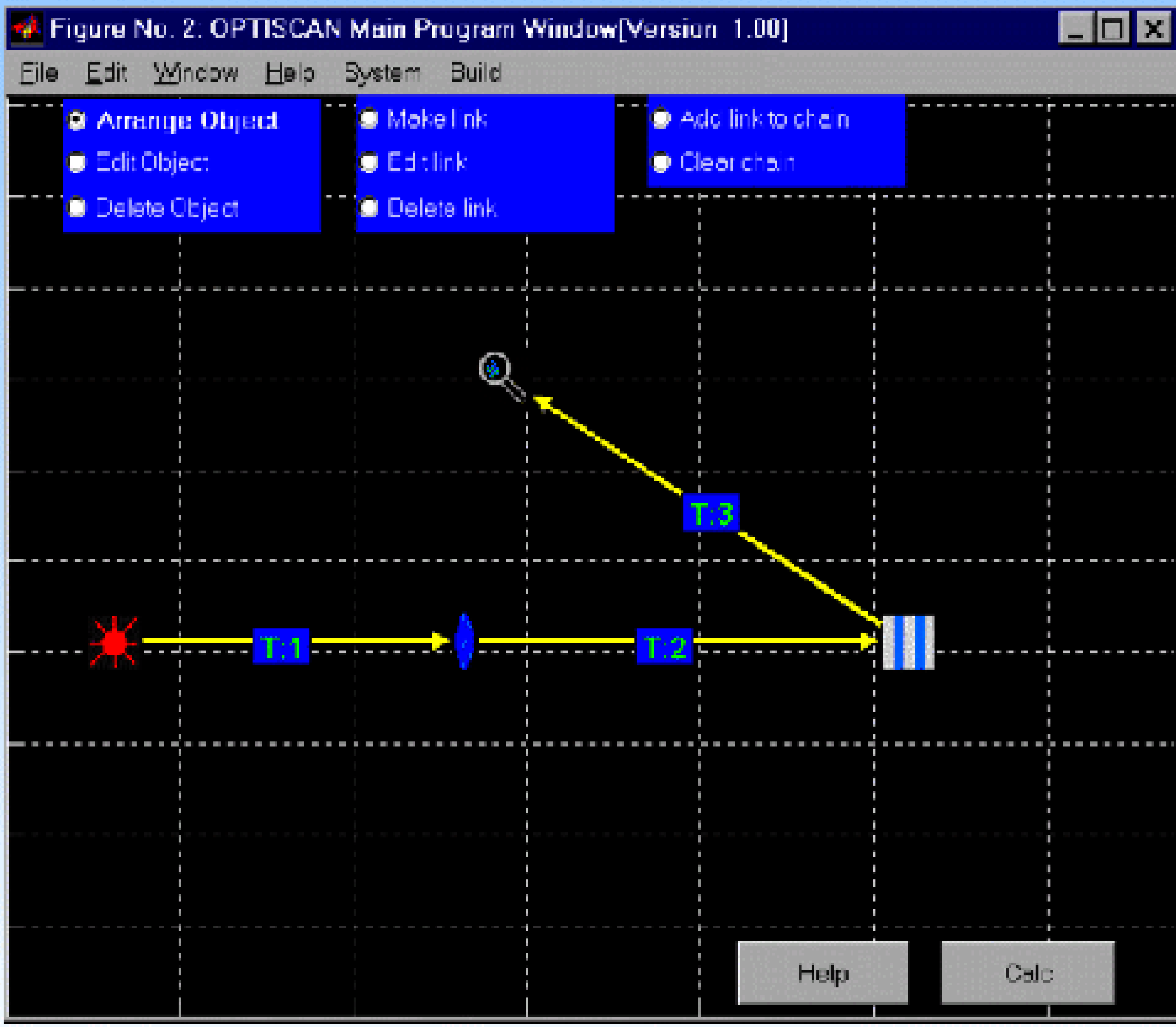
Model Description

We would like to calculate the electric field at two positions inside the substrate.

	Refractive index	Thickness
Incident	1.816	
layer #1	1.000	100 nm
layer #2	1.816	200 nm
Substrate	1.816	

Two observation planes are 0 and 10nm inside the substrate respectively.

Optiscan System Main Window for Thin Film Target

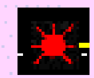


Step #1 (system I)

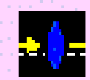
Build the OPTISCAN System on the Left.

System Description

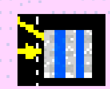
The incident electric field



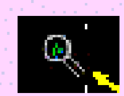
is focused onto the *Thin Film Target* by a Lens :



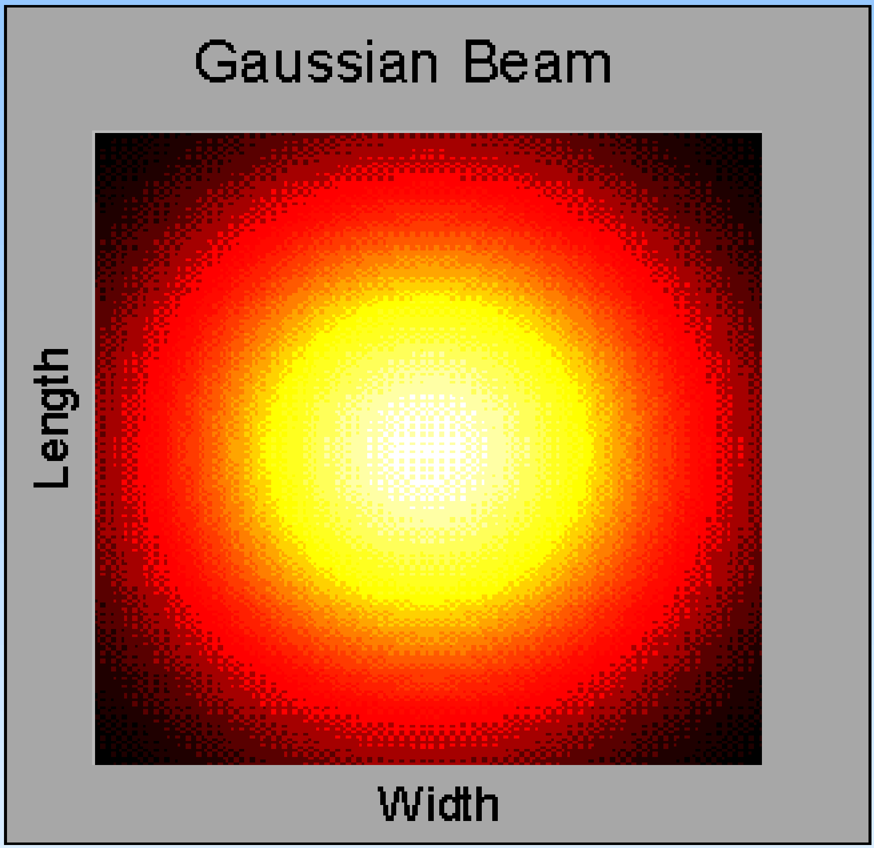
The Thin Film Target is represented in Optiscan by



The resulting electric field at the last observation plane can be displayed on the screen by using a Look object :



The Incident Field



Step #2 (system I)

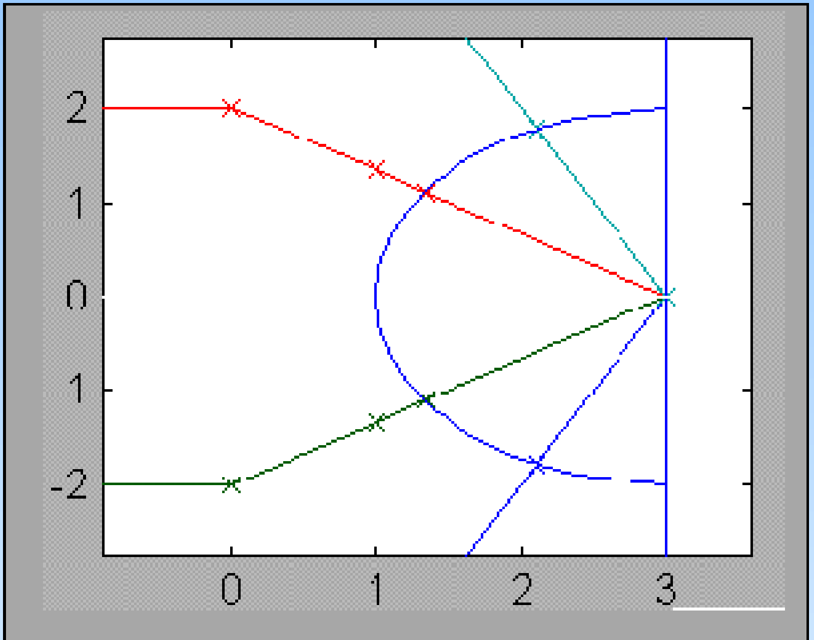
Set the source's properties to:

Dimensions

Width	0.014
Length	0.014
X-Sampling	-0.007
Y-Sampling	0
X-Offset	0.014/256
Y-Offset	0.014/256

** The Dimensions are in meters

The Optics Lens -Importing the Lens



SIL LENS

SIL lens has the refractive index, 1.816.
The LaSFN9 is used for a SIL lens.
The NA in the image side is 1.3

NA = (sinθ x refractive index)
1.3 = (0 .715 x 1.816)

θ is the marginal ray angle
The beam focused down to the bottom of SIL

Step #3 (system I)

Go to the Len's property editor and select the "Settings" tab:

Click the "**BROWSE**" button and select the following lens from the OPTISCAN demos folder:

folder	**OPTISCAN\demos\tft**
filename	**SILlens.mat**

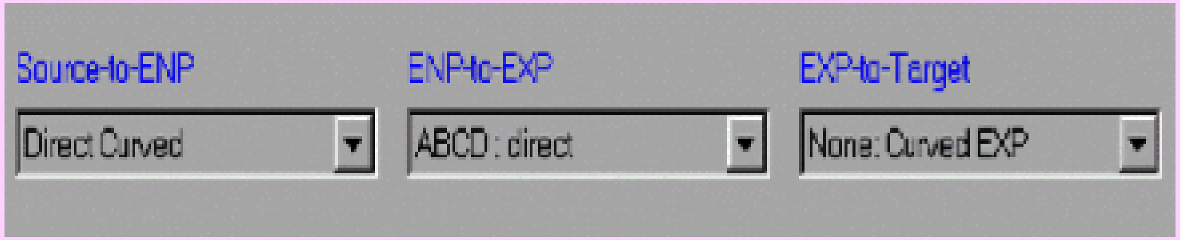
give the imported lens any filename you wish.

Note:

"OPTISCAN" is where OPTISCAN is installed.

The Optics Lens -Propagation Options

Step #5 (system I)



For our calculation, we use the direct-curved option for calculation from the source to entrance pupil, ABCD-direct for entrance to exit pupil, and None:curved EXP option for exit pupil to target.

Click Help for more information of these options.

The Editing Lens

Step #6 (system I)

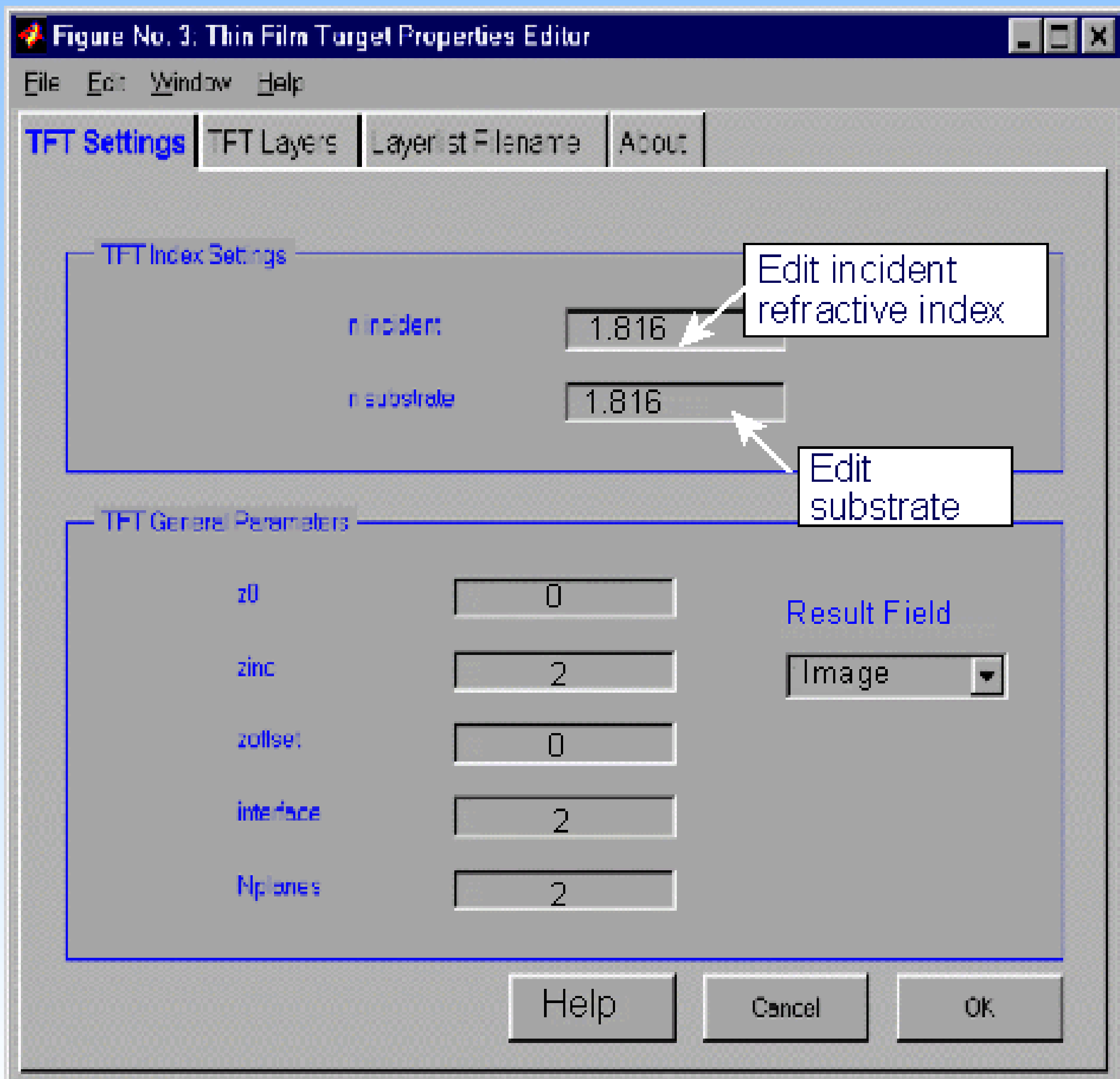
General Lens Parameters

Stop Surface #	2
Stop Diameter	6.1514
NA Object	3.0757e-020
NA Image	1.3
LAMBDA	0.00065

Click and edit the Lens object.
Click the Lens Editor in the menu items.

We use the NA Image = 1.3

Configuring the TFT's Settings



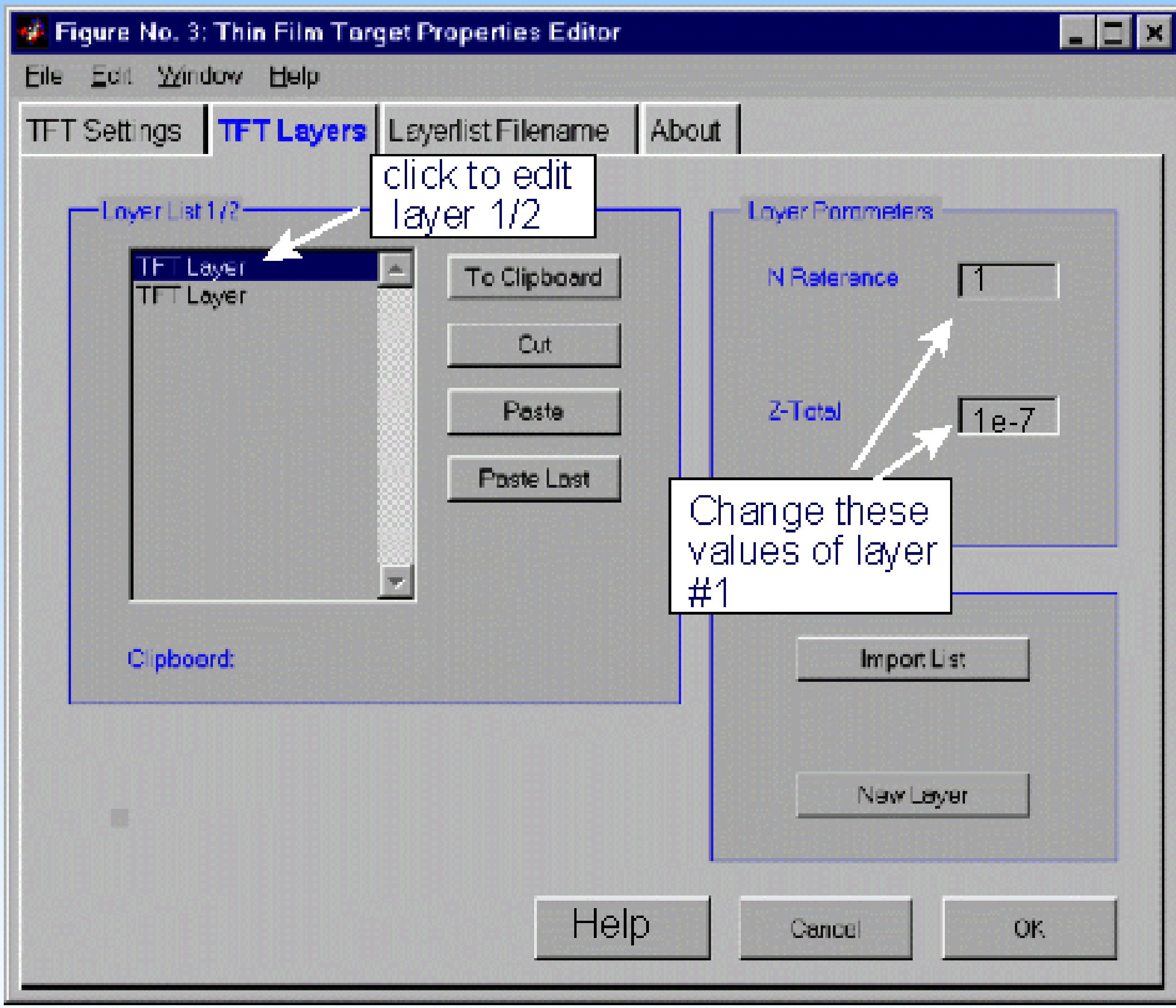
Step #7 (system I)

Edit refractive index of the incident material and substrate. Change the ***TFT index settings*** values to:

TFT index settings	
n incident	1.816
n substrate	1.816

CLICK [Help] for information about z0, zinc, zoffset, interface, Nplanes, and Result field, etc.

Configuring the TFT's Layers



Step #8 (system I)

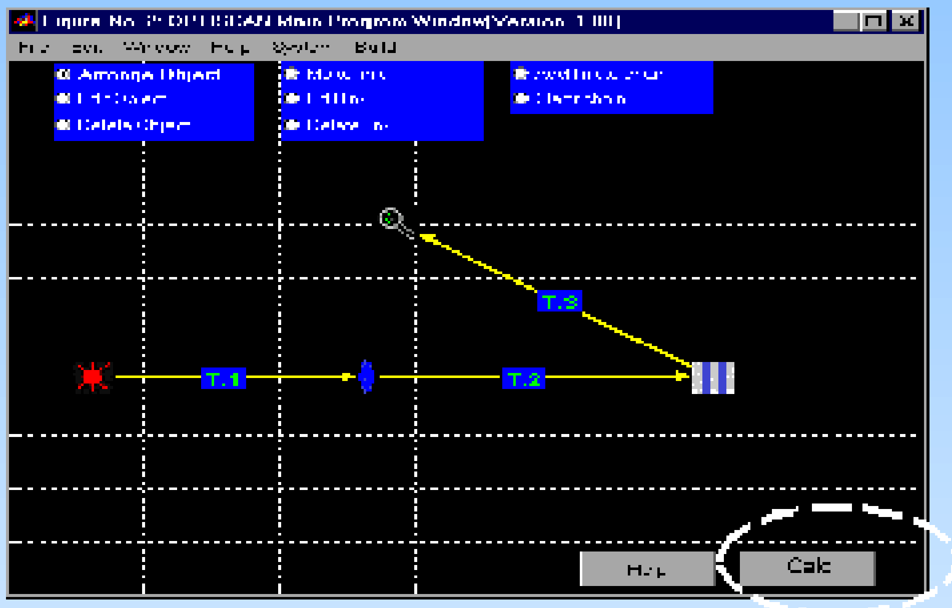
Click and edit layer's one and two. Change the ***Layer Parameter*** values to:

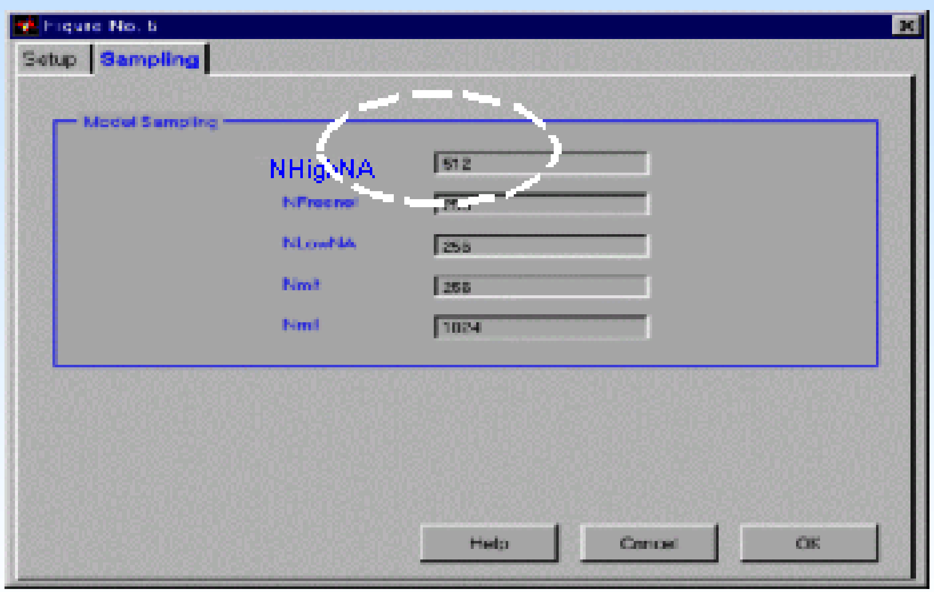
layer#	n-reference	z-total
1/2	1.0	1e-7
2/2	1.816	2e-7

If you have more than two layers, than you need to ***Cut*** some layers. If you have less than two layers, than you need some ***New Layers***.

CLICK Help for information on how to do this if you need to.

Simulate the System





Step #9 (system 1)

1. Click the **Calc** Button to start the simulation.

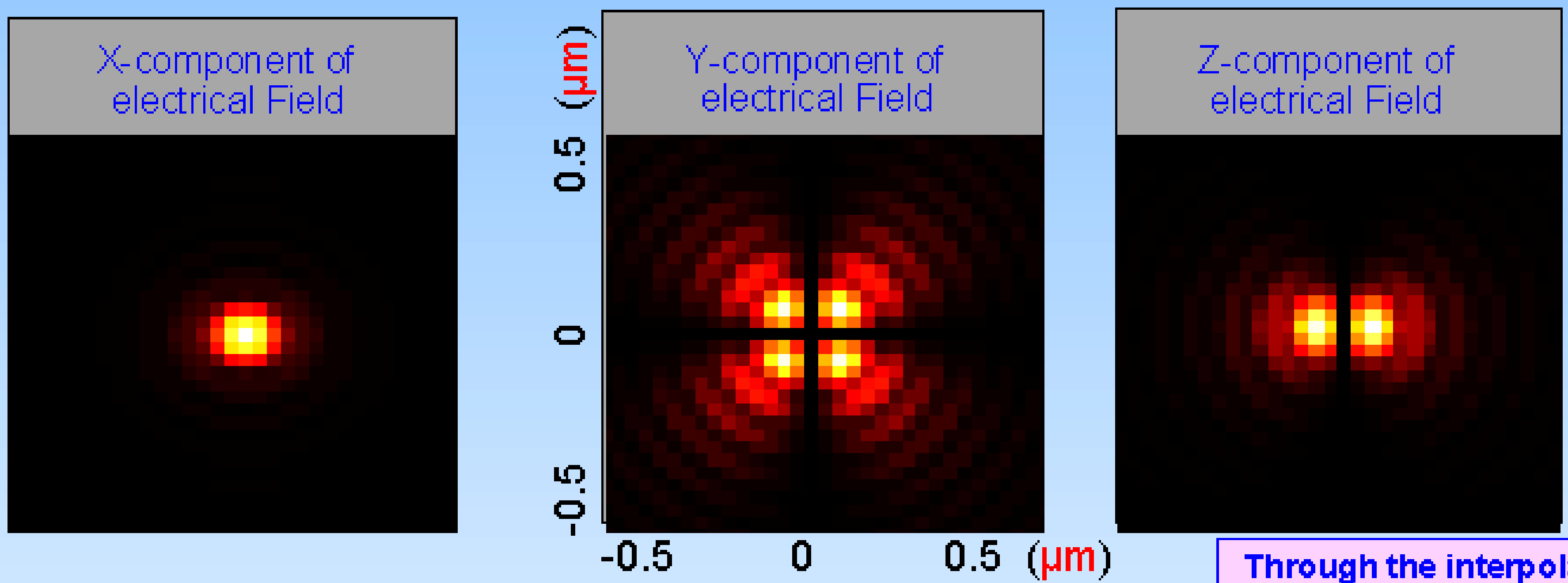
2. Set **NHighNA** to the value :

   Sampling

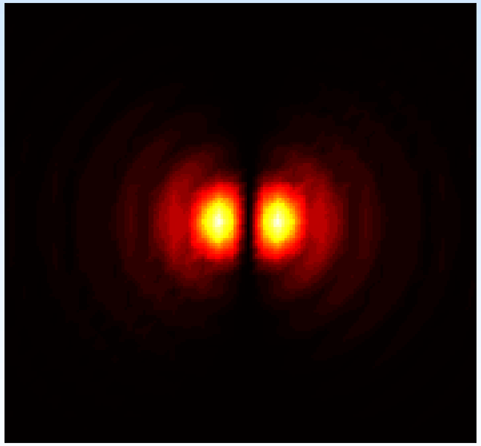
   NHighNA 512

3. Click on the **OK** Button to initiate the simulation.

Output at 2nd Observation Plane



Through the interpolation, image can be seen much better

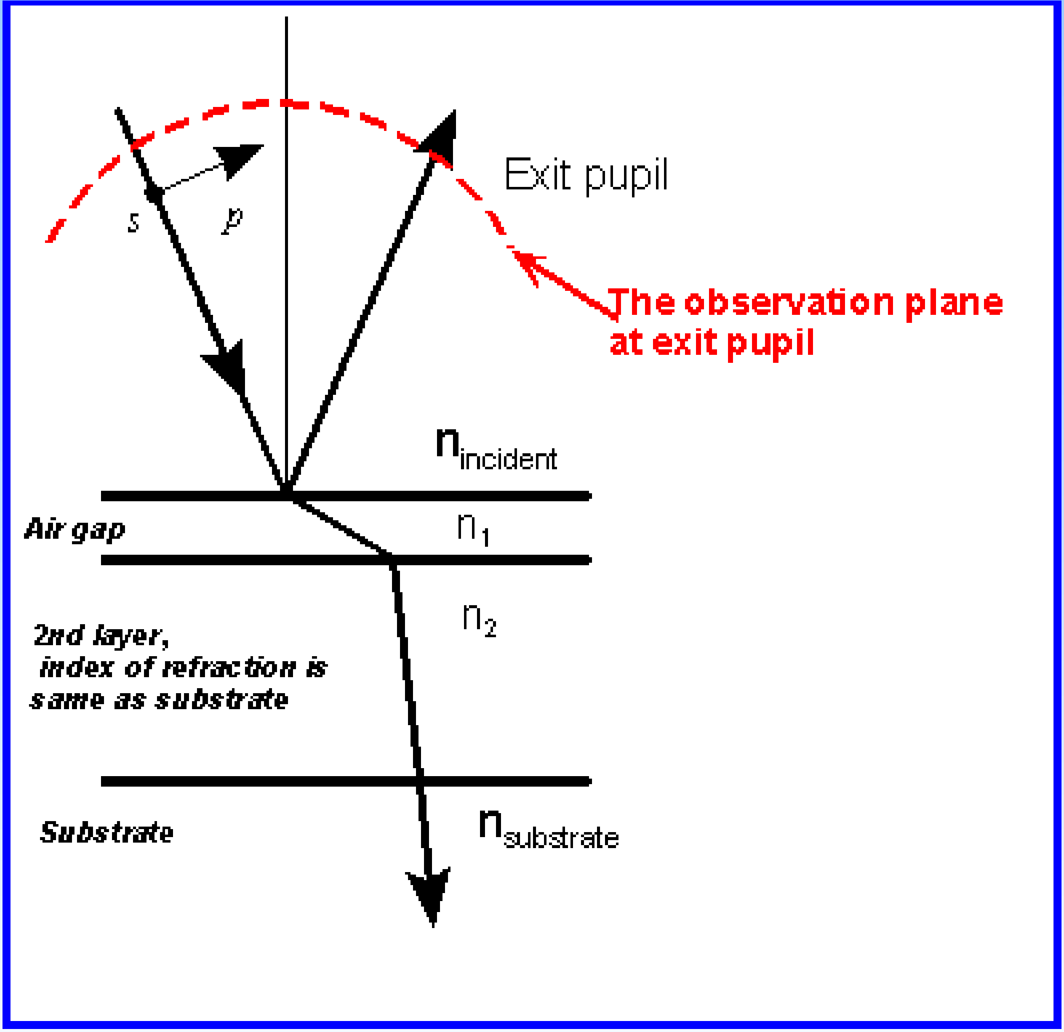


Final (system I)

Simulate the System and then Look at the x, y, and z-component of electric field. Each component shows the vector effects very well inside the substrate.

We can get better figure through the interpolation method (Appendix A)

System II: Reflected TFT Tutorial System



Goal (system II)

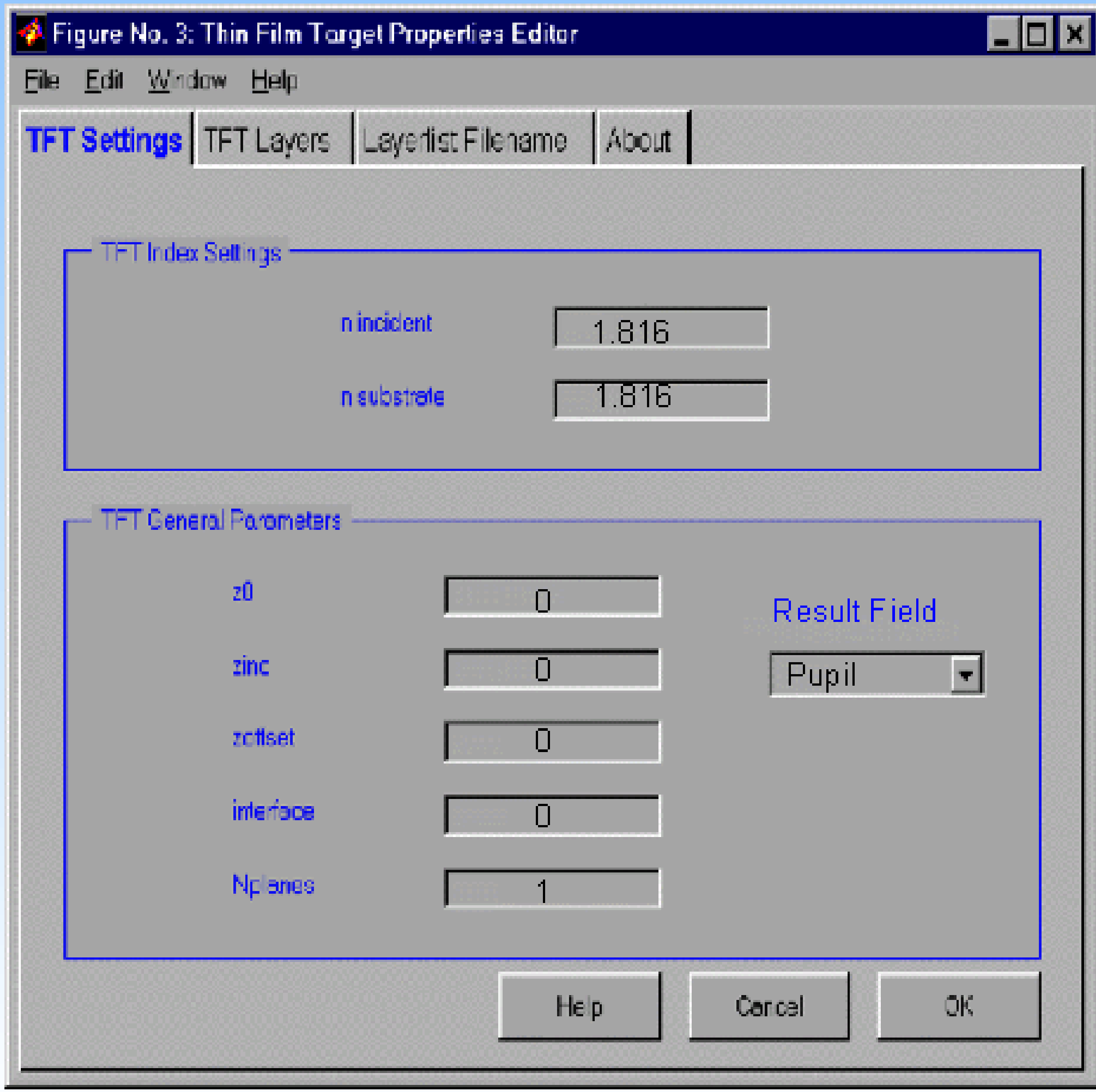
Simulate, the reflected field for the Thin Film Target

Model Description (System II)

The observation plane of system I is modified so that the reflected electric field can be calculated.

The observation plane is at the exit pupil.

Configuring the TFT's Parameters



Step #1 (system II)

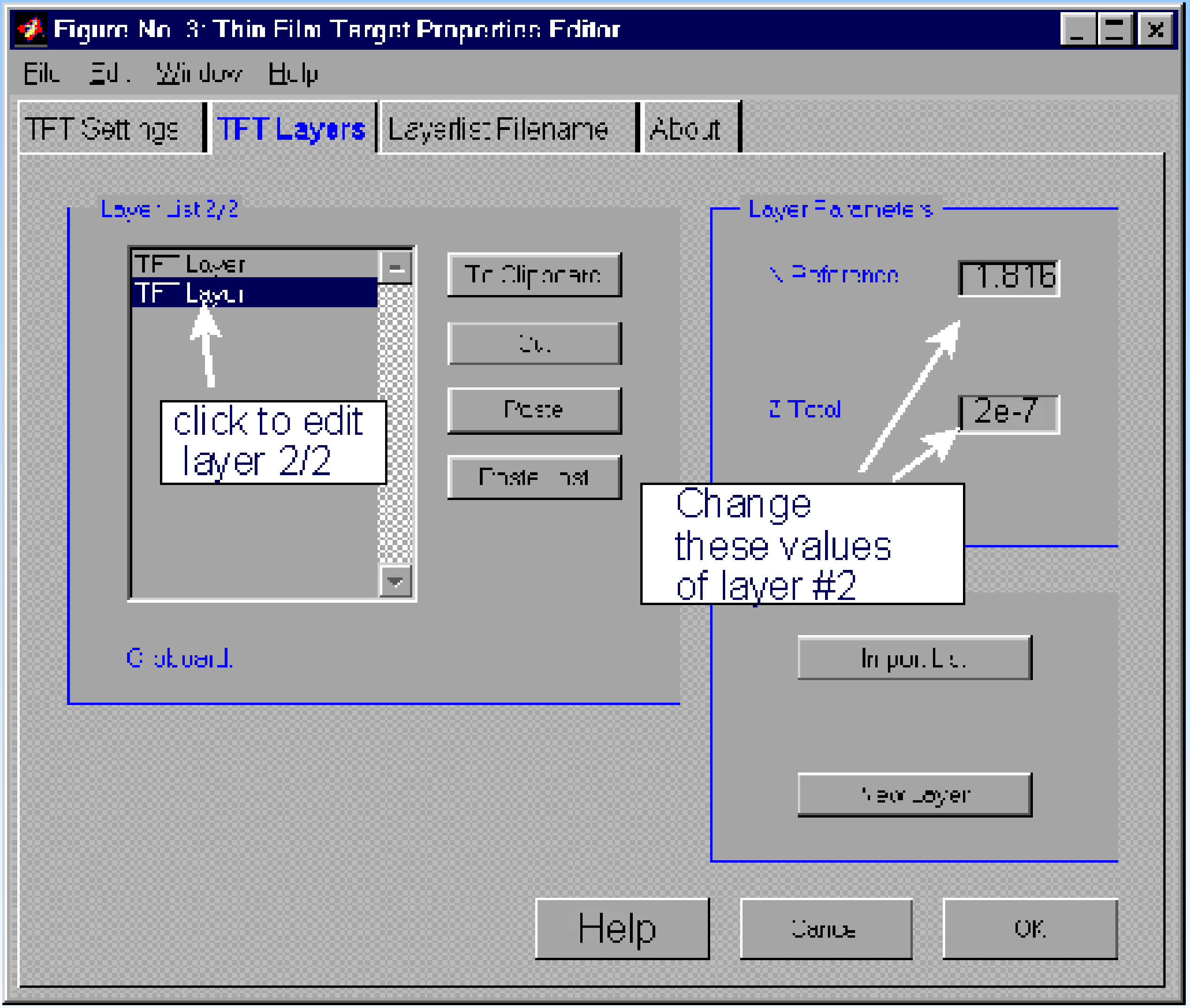
Set the *TFT Index Settings* to :

TFT index settings	
n incident	1.816
n substrate	1.816

Set the *TFT General Parameters* to:

z0	0
zinc	0
zoffset	0
Interface	0
Nplanes	1
Result field	**Pupil**

Configuring the TFT's Layers

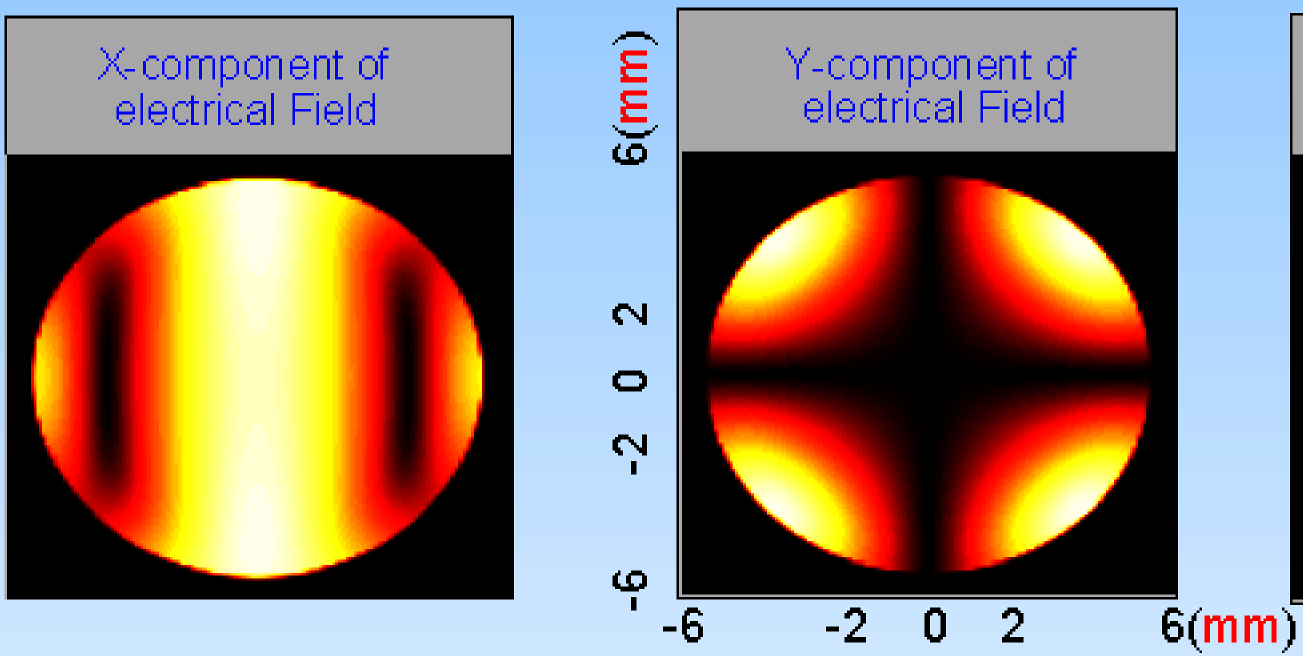


Step #2 (system II)

Click and edit layer's one and two. Change the ***Layer Parameter*** values to:

layer#	n-reference	z-total
1/2	1.0	1e-7
2/2	1.816	2e-7

Output of reflected field at the Exit Pupil

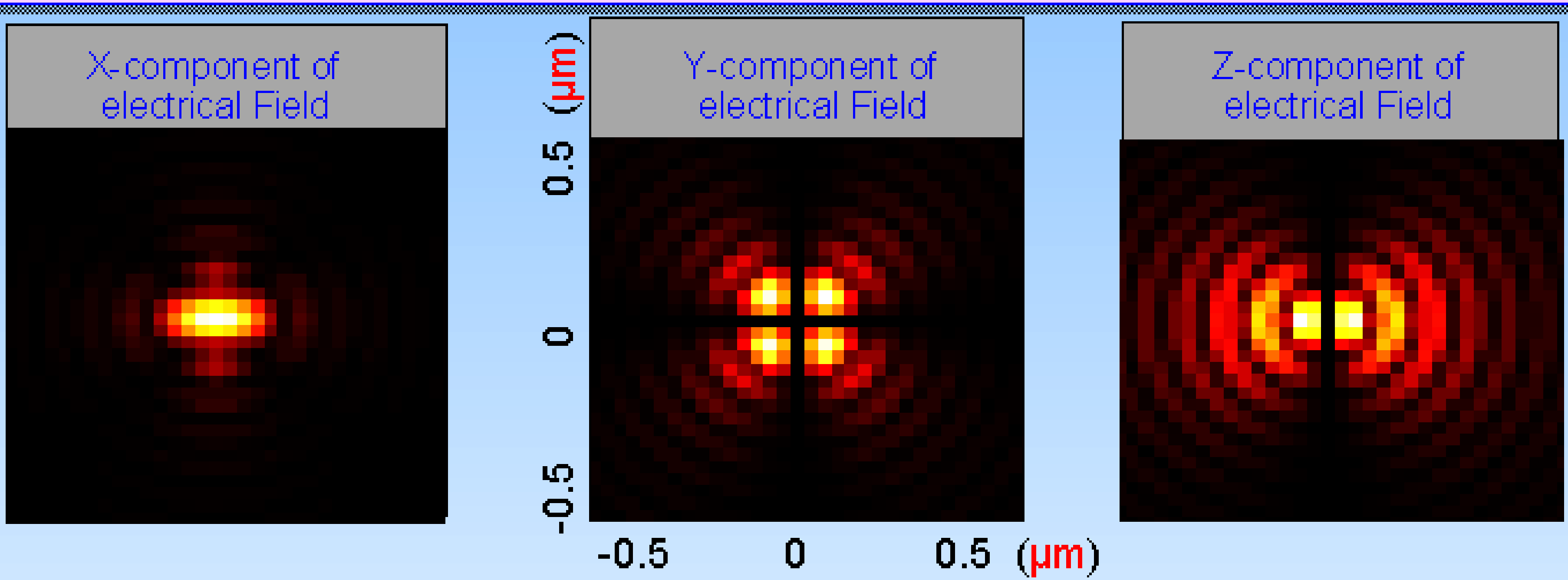


Final I(system II)

Simulate the system and then Look at the x, y, and z-compoenent of the reflected electric field. Note that this is the electric field at the exit pupil.

Output of reflected field at the Optical Disk

In Step 1(System II), if the result field type is changed to **Image**, then these results can be obtained:



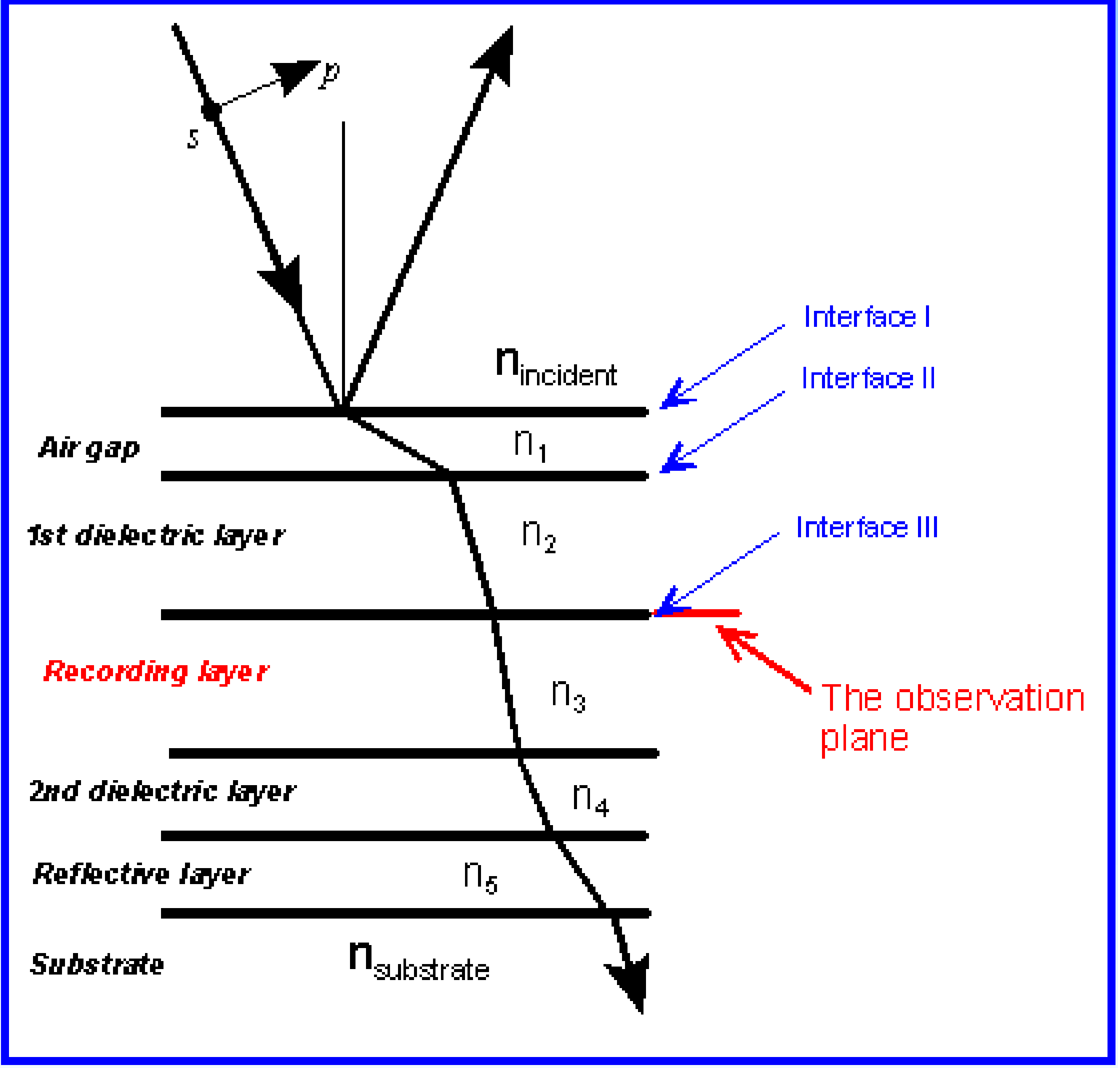
Final II (system II)

Simulate the system and then Look at the x, y, and z-compoenent of the reflected electric field at the image. Note that the difference from the system I due to the vector diffraction.

The x-component gives more elongated in x-direction. The z-component gets more side lobes than the system I.

Also we can get the phase information of each component.

System III: Phase Change TFT Tutorial System



Goal

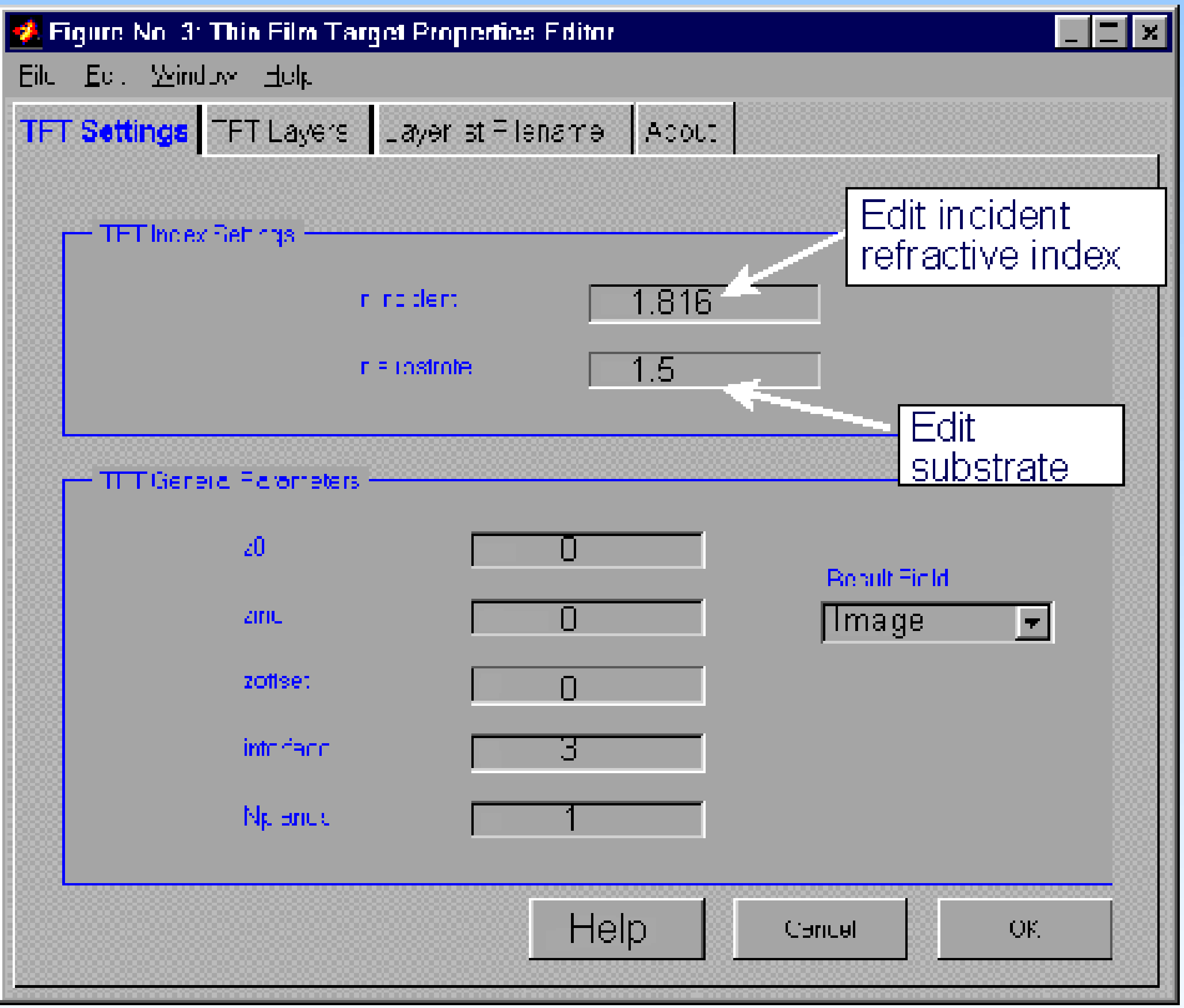
Simulate Phase Change Media by introducing a recording layer in between two dialetric layers.

Model Description

	Refractive index	Thickness
Incident	1.816	
Air gap	1.000	100 nm
1st Dielectric	2.150	90 nm
Recording Layer**	4.4 + 2.1i	19 nm
2nd Dielectric	2.150	16 nm
Reflective Layer	1.2 + 5.8i	150 nm
Substrate	1.500	

**Amorphous

Configuring the TFT's Settings



Step #1 (system III)

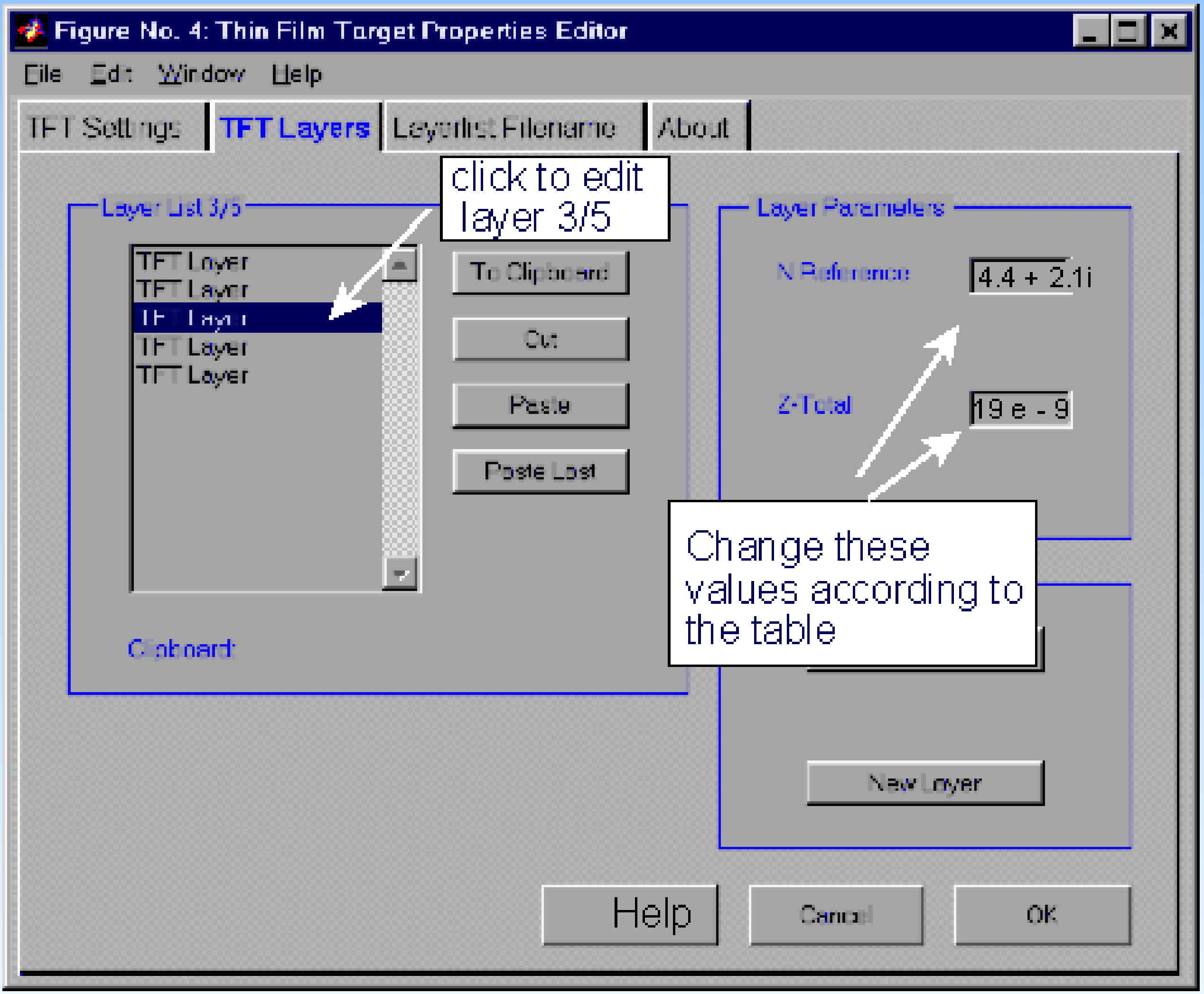
Change the ***TFT index settings*** values to:

TFT index settings	
n incident	**1.816**
n substrate	**1.500**

Change te TFT General Parameters to:

z0	0
zinc	0
zoffset	0
Interface	3
Nplanes	1

Configuring the TFT's Layers



Step #2 (system III)

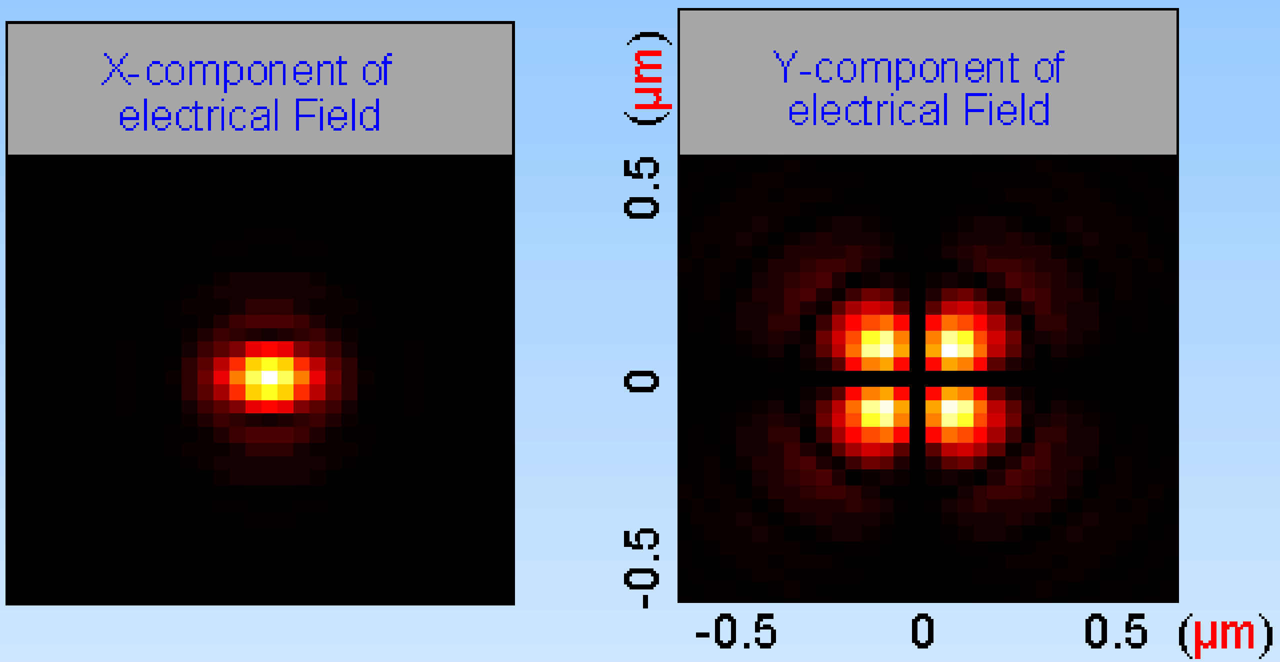
Click and edit layer's one and two. Change the ***Layer Parameter*** values to:

layer#	N-reference	Z-total
Incident	1.816	
1/5	1.000	100 nm
2/5	2.150	90 nm
3/5	4.4 + 2.1i**	19 nm
4/5	2.150	16 nm
5/5	1.2 + 5.8i	150 nm
Substrate	1.500	

Use "**New Layers**" to add TFT layers as needed.

**amorphous

Output of Phase Change Media Simulation



Final (system III)

Simulate the System and then Look at the X, Y, and Z electric fields.

Note that the diffrence of y- component of electric field from system I.

The y-component electric field spreads out due to diffraction and aberration of phase change recording media.

Appendix A - Interpolated Shading with Look Object

- click on ***Look Plot***
- han = get(gca,'children');
- cdata = get(han,'cdata');
- figure;
- p=256-25:256+25;
- pcolor(cdata(p,p));
- colorbar; colormap(hot);
- shading interp;
- As easier method is to use the 'save field' data rather that 'cdata.'

Appendix B
Journal Papers Using Optiscan's TFT Model

Tom D. Mister, Joshua S. Jo, Kusato Hirota, Kei Shimura and Yan Zhang, "The nature of the coupling field in optical data storage using solid immersion lens," accepted to J. Jpn. Appl. Phys., 1998

Tom D. Mister, Joshua S. Jo, Kusato Hirota, "The Roles of Propagating and Evanescent Waves in Solid Immersion Lens Systems ", Applied optics, 1999.

Tom D. Mister, Kei Shimura, Joshua S. Jo and Kusato Hirota, "Pupil plane filtering for improved signal detection in an optical data storage system incorporating a solid immersion lens," Vol.24, No. 9, Opt. Lett. 1999.

"Gap-induced aberrations in solid immersion lens system", (in progress) 1999.

"Vector calculation affects aberrations in a solid immersion lens system", (in progress) 1999.

"Spot distribution and aberration inside a recording layer in a solid immersion lens system", (in progress) 1999.

Appendix C
Conference Papers Using Optiscan's TFT Model

Joshua S. Jo, Tom D. Mister, Kei Shimura, and Kusato Hirota, "Gap-induced aberrations in a solid immersion lens system", (in progress) to ISOM. 1999 at Kauai, Hawaii.

Tom D. Mister, Kei Shimura, Joshua S. Jo and Kusato Hirota, "Pupil plane filtering for improved signal detection in an optical data storage system incorporating a solid immersion lens," submitted to ISOM '99 at Kauai, Hawaii.

Kusato Hirota, Tom D. Mister, Kei Shimura, Yan Zhang, and Joshua S. Jo, "Near field phase change optical recording using a GaP hemispherical lens," submitted to ISOM '99 at Kauai, Hawaii.

Tom D. Mister, Joshua S. Jo, Kusato Hirota, and Kei Shimura, "The nature of the coupling field in optical data storage using solid immersion lens," ISOM '98 digest, Pd-15, Japan.

Kusato Hirota, Joshua S. Jo, Tom D. Mister, "High Density Phase Change Optical Recording Using a Solid Immersion Lens," p. 34 Vol. 3401 SPIE (1998), at Aspen, USA.