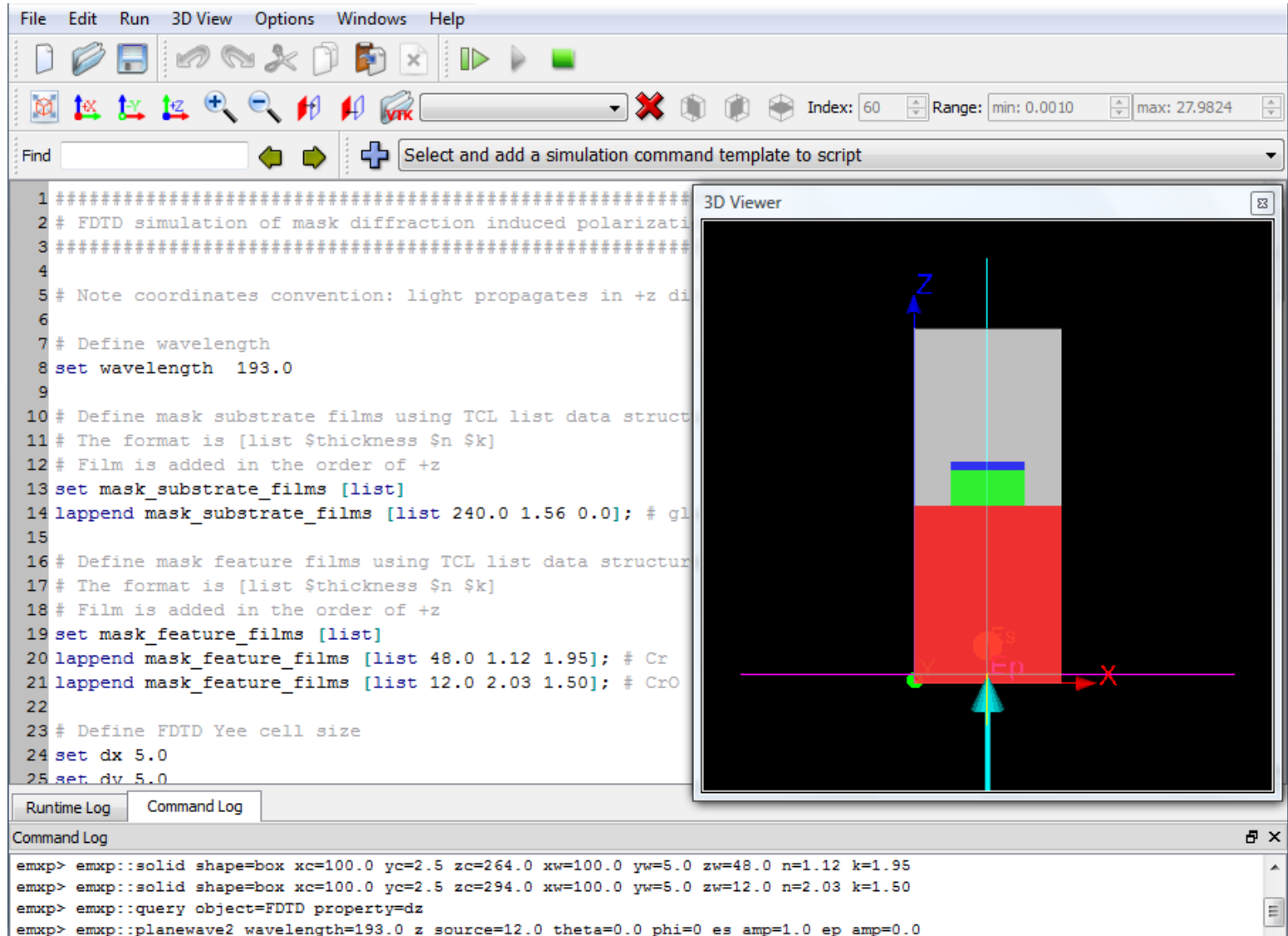


# 3D Mask Scattering Induced Polarization

# Simulation Setup

(Based on Karsten Bubke et al., "Investigation of Polarization Effects on new Mask Materials," Optical Microlithography XVIII, Proceedings of SPIE Vol.5754, 2005)



The screenshot displays the EM Explorer software interface. The main window is divided into several sections:

- Menu Bar:** File, Edit, Run, 3D View, Options, Windows, Help.
- Toolbar:** Contains icons for file operations (open, save, print), editing (undo, redo, delete), and simulation (run, stop).
- Find:** A search bar with navigation arrows.
- Script Editor:** Contains the following TCL script:

```
1 #####
2 # FDTD simulation of mask diffraction induced polarizati
3 #####
4
5 # Note coordinates convention: light propagates in +z di
6
7 # Define wavelength
8 set wavelength 193.0
9
10 # Define mask substrate films using TCL list data struct
11 # The format is [list $thickness $n $k]
12 # Film is added in the order of +z
13 set mask_substrate_films [list]
14 lappend mask_substrate_films [list 240.0 1.56 0.0]; # gl
15
16 # Define mask feature films using TCL list data structur
17 # The format is [list $thickness $n $k]
18 # Film is added in the order of +z
19 set mask_feature_films [list]
20 lappend mask_feature_films [list 48.0 1.12 1.95]; # Cr
21 lappend mask_feature_films [list 12.0 2.03 1.50]; # CrO
22
23 # Define FDTD Yee cell size
24 set dx 5.0
25 set dy 5.0
```
- 3D Viewer:** Shows a cross-sectional view of the mask structure. A red block represents the substrate, with a green layer on top. A blue layer is on top of the green layer. A cyan arrow points upwards from the bottom, indicating the direction of light propagation. The Z-axis is vertical, and the X-axis is horizontal.
- Command Log:** Shows the execution of commands:

```
emxp> emxp::solid shape=box xc=100.0 yc=2.5 zc=264.0 xw=100.0 yw=5.0 zw=48.0 n=1.12 k=1.95
emxp> emxp::solid shape=box xc=100.0 yc=2.5 zc=294.0 xw=100.0 yw=5.0 zw=12.0 n=2.03 k=1.50
emxp> emxp::query object=FDTD property=dz
emxp> emxp::planewave2 wavelength=193.0 z_source=12.0 theta=0.0 phi=0 es_amp=1.0 ep_amp=0.0
```

# Degree of Polarization

$$DOP = \frac{\eta_{TE} - \eta_{TM}}{\eta_{TE} + \eta_{TM}}$$

where  $\eta$  = diffraction efficiency

