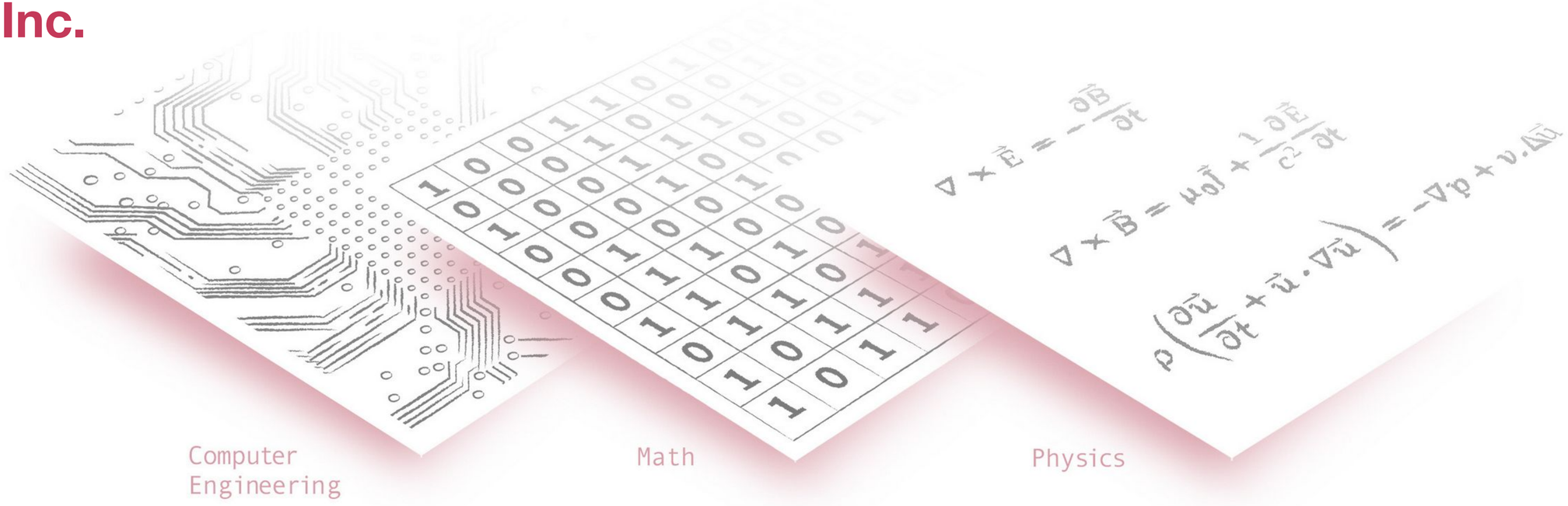
# INTRO TO FDTD (9)

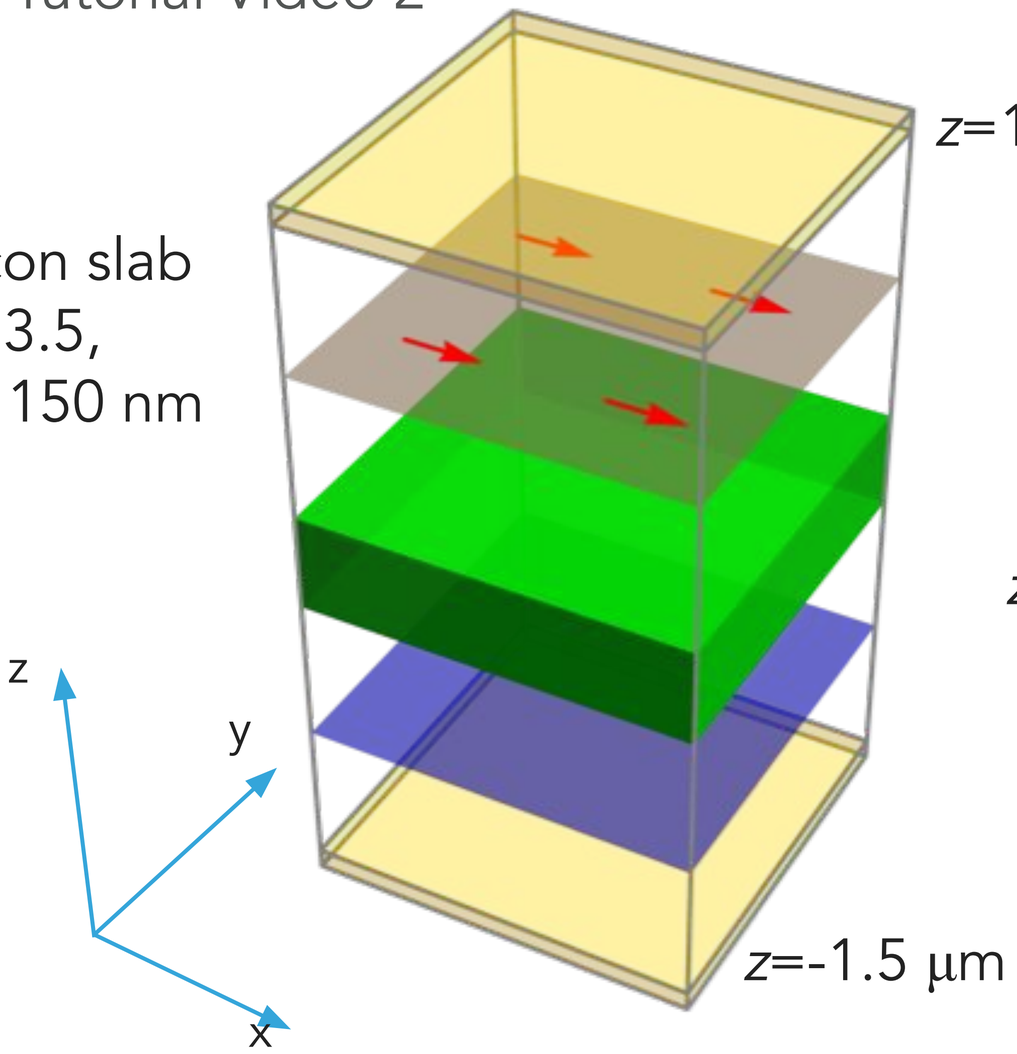
Flexcompute **Inc.**




Tidy3D

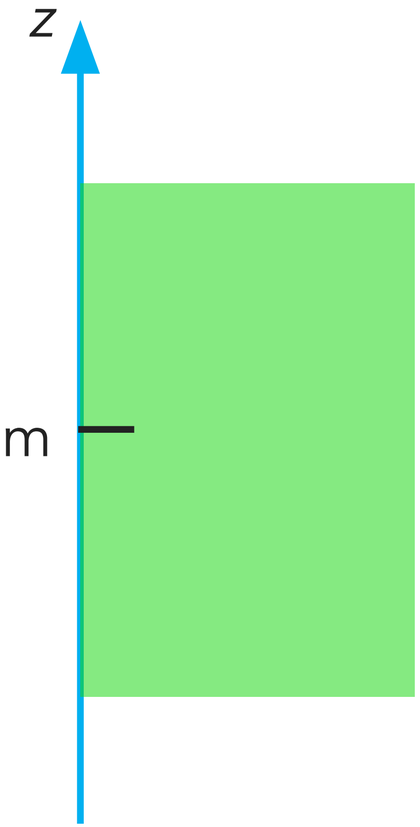
See Tutorial Video 2

Silicon slab
$n$ = 3.5,
$d$ = 150 nm

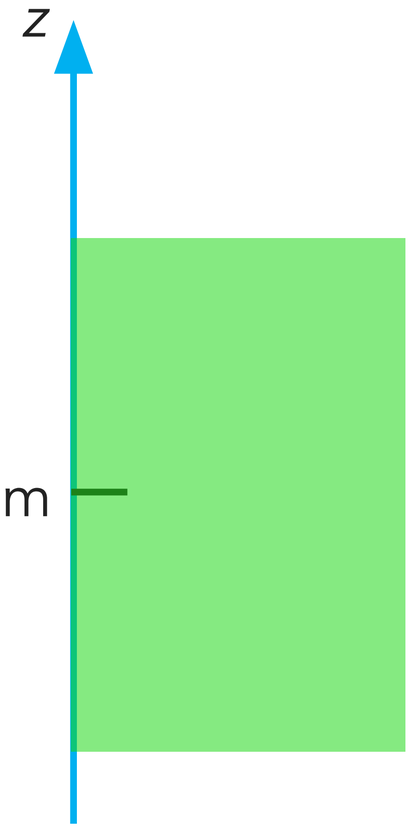



$z$=1.5 μm

$z$=-1.5 μm

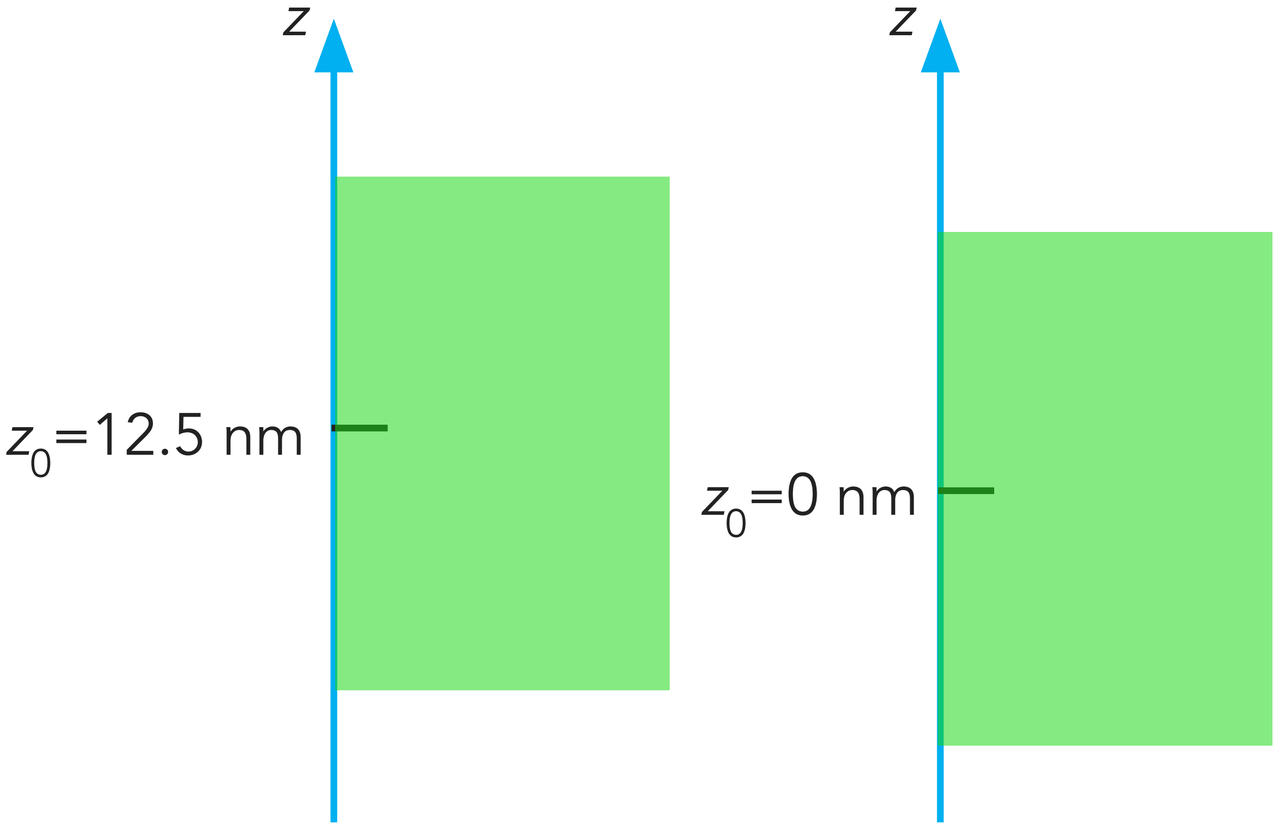


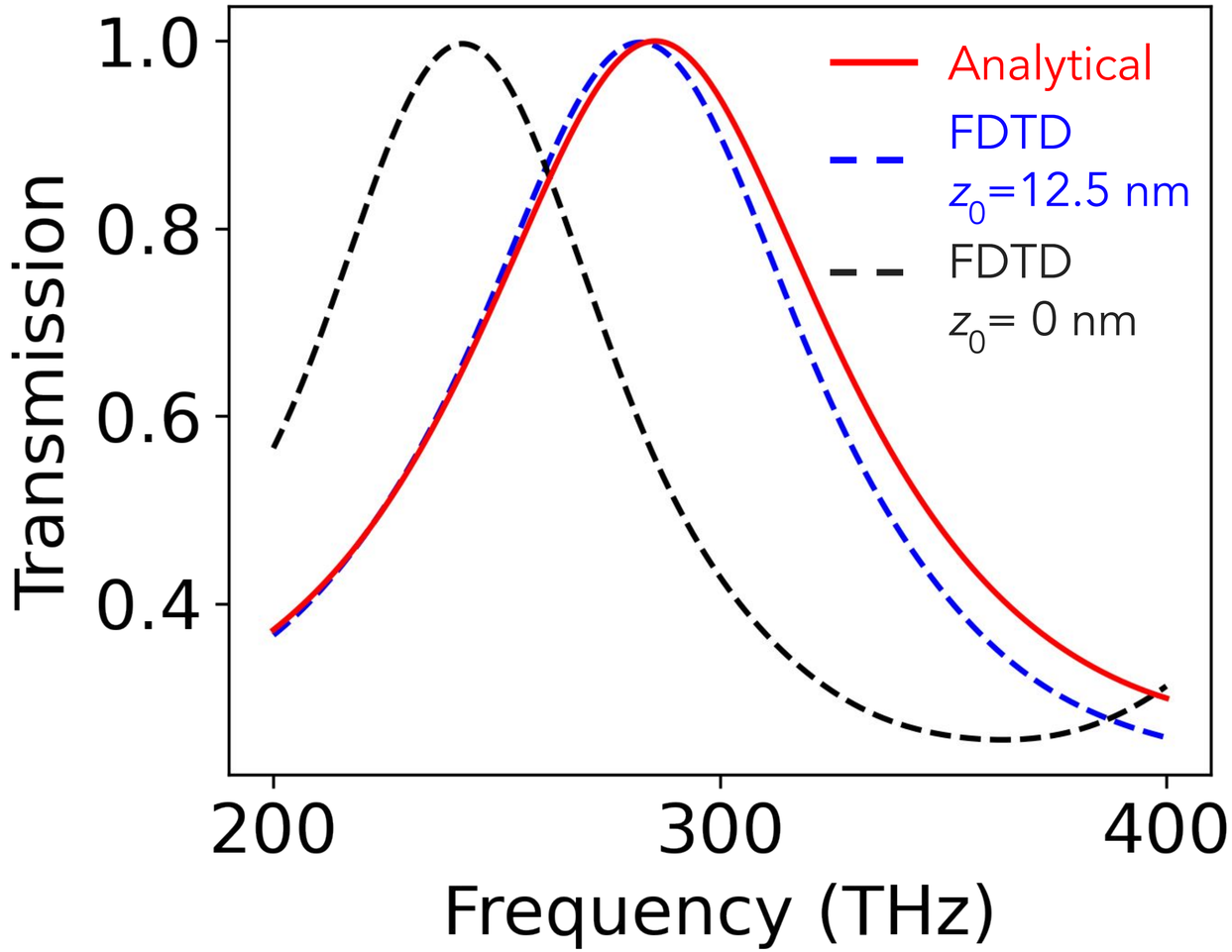

$z_0$=12.5 nm




$z_0$=0 nm

Spatial discretization: 25 nm



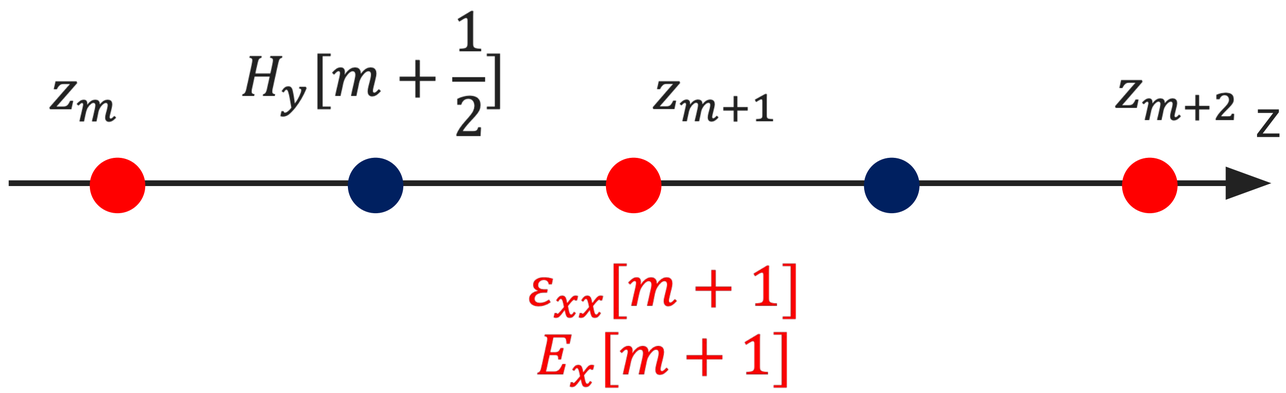

- Basic FDTD simulation: no subpixel averaging; uniform grid
- Spatial discretization: 25 nm

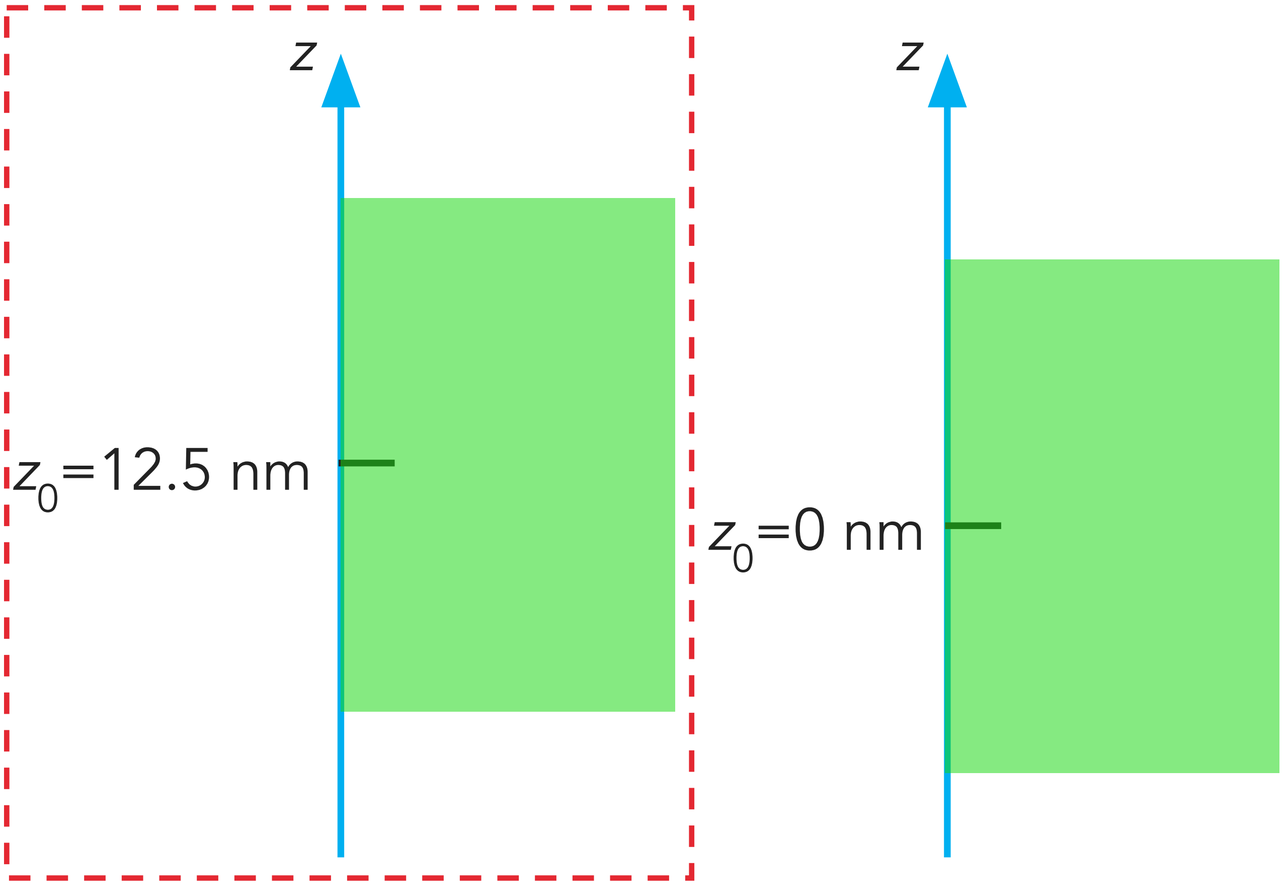
# 1D Yee lattice with spatial dielectric distribution

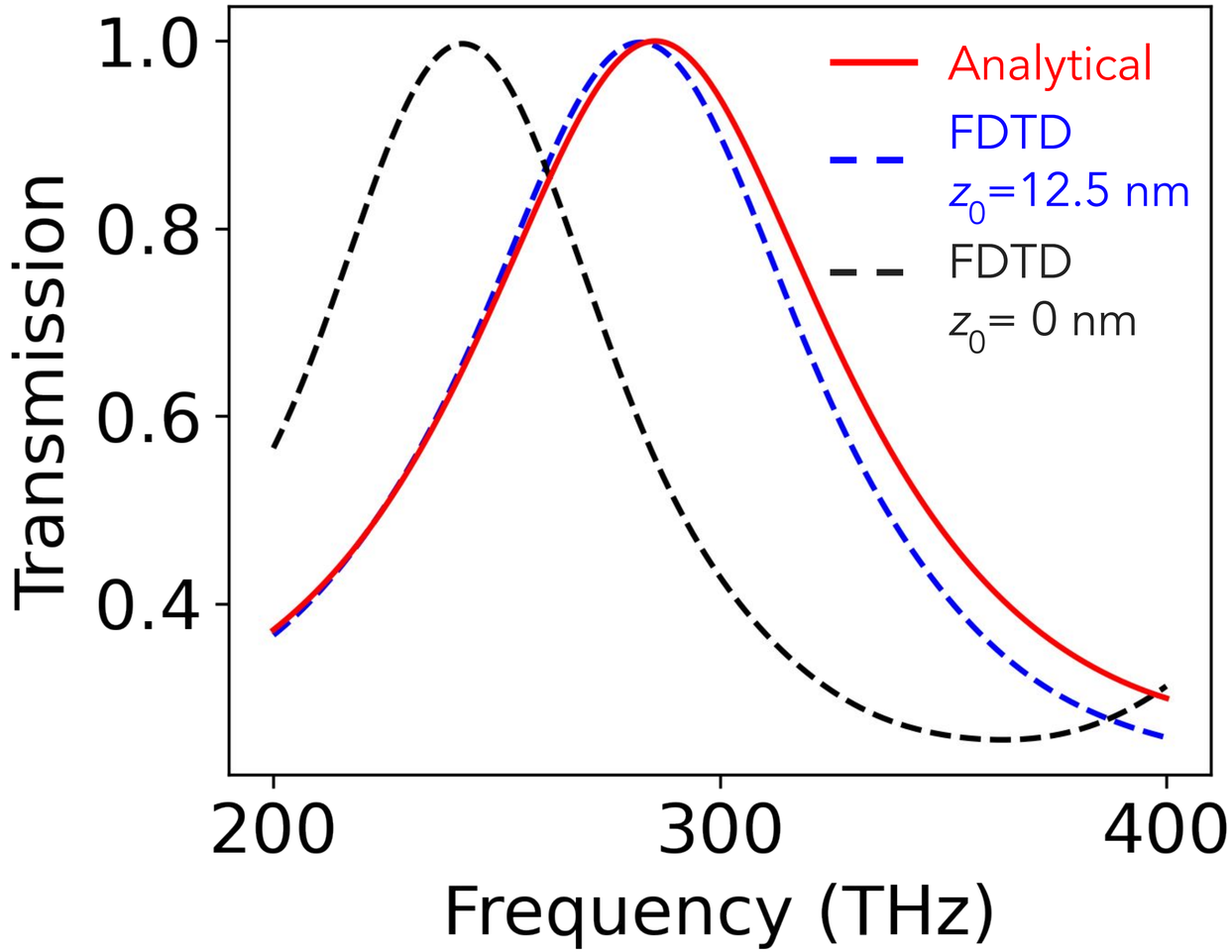
Maxwell's equation in 1D:

$$\frac{\partial(\varepsilon_{xx}E_x)}{\partial t} = -\frac{\partial H_y}{\partial z}$$
$$\mu\frac{\partial H_y}{\partial t} = -\frac{\partial E_x}{\partial z}$$

- Dielectric constant is allocated together with electric field

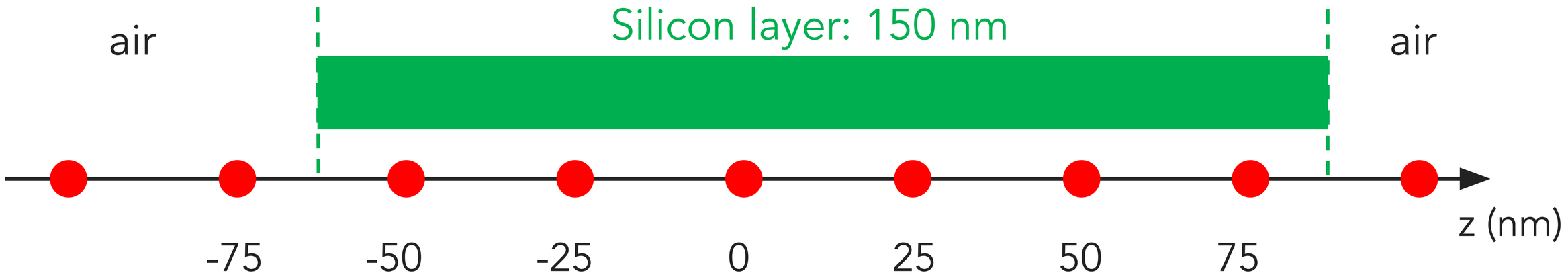





- Basic FDTD simulation: no subpixel averaging; uniform grid
- Spatial discretization: 25 nm

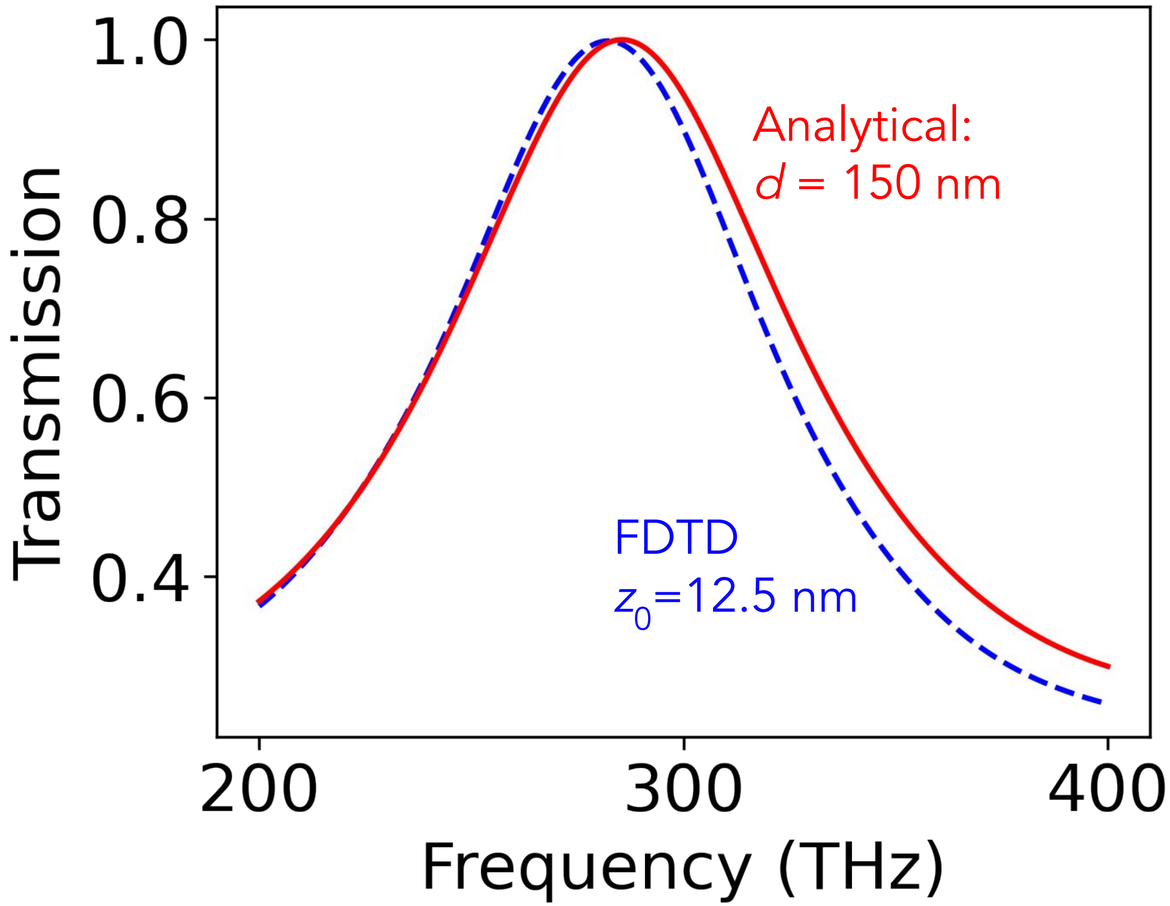
How dielectric constant is assigned to Yee lattice?

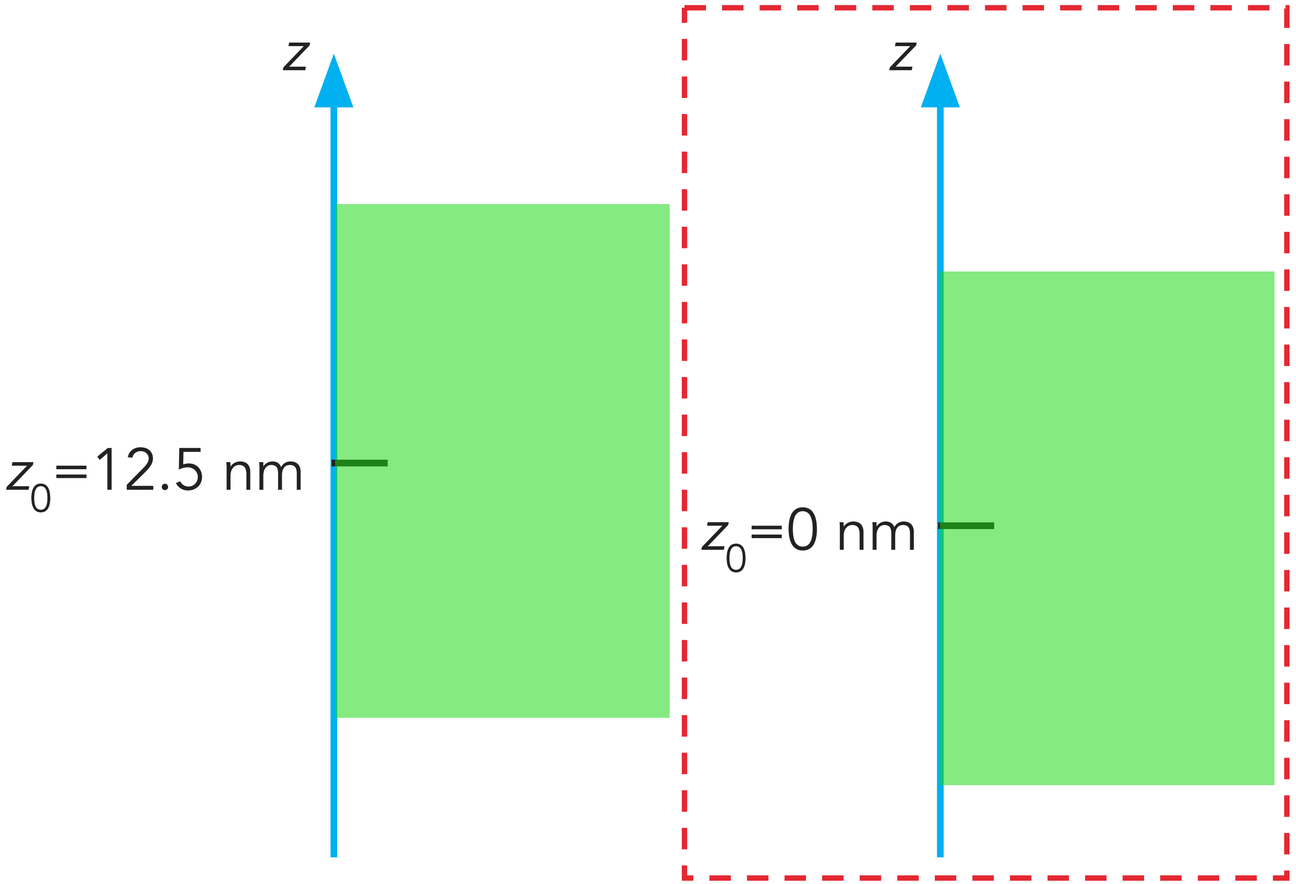


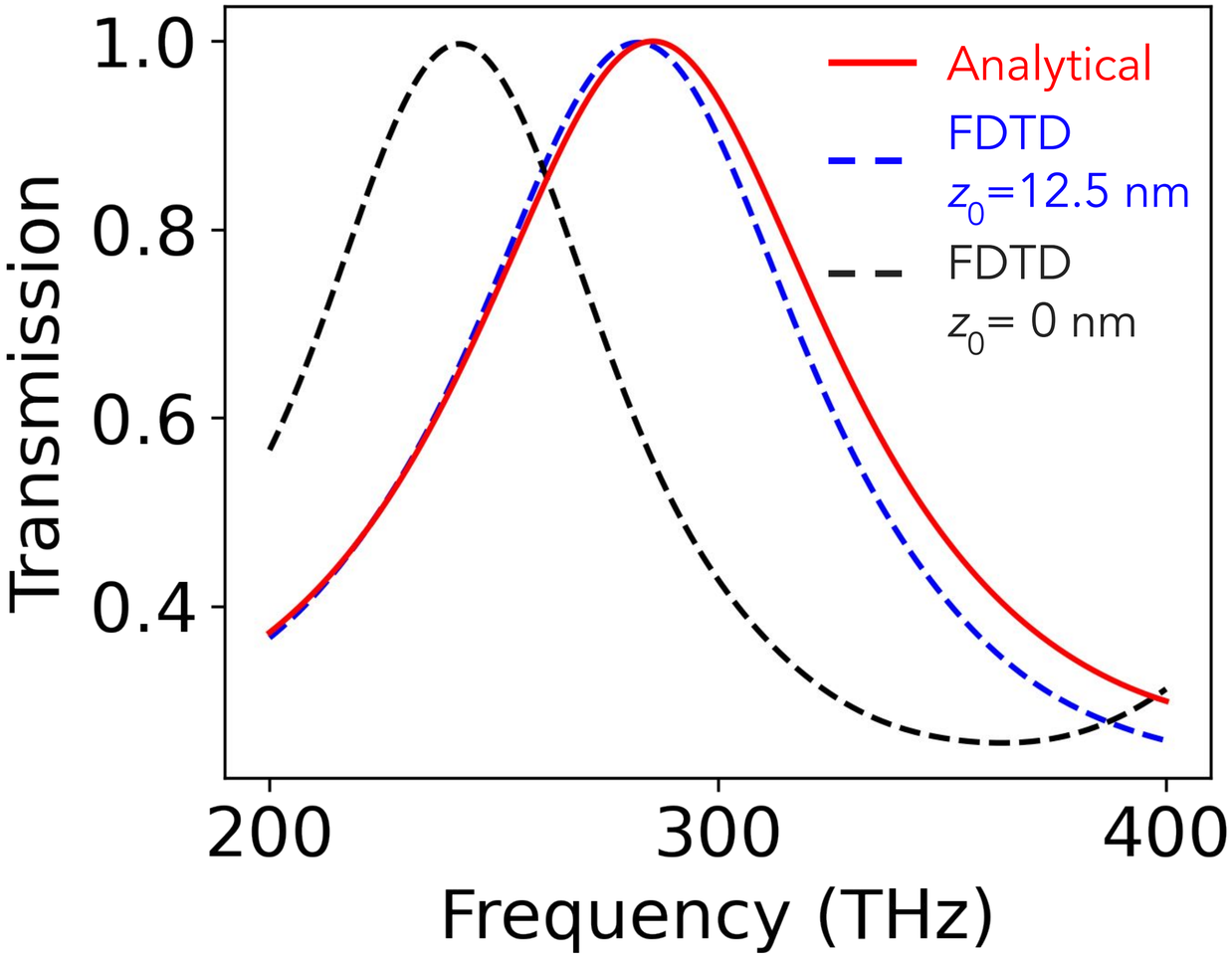

**6 grids assigned to silicon: 6×25 nm = 150 nm**

E-grid

How dielectric constant is assigned to Yee lattice?

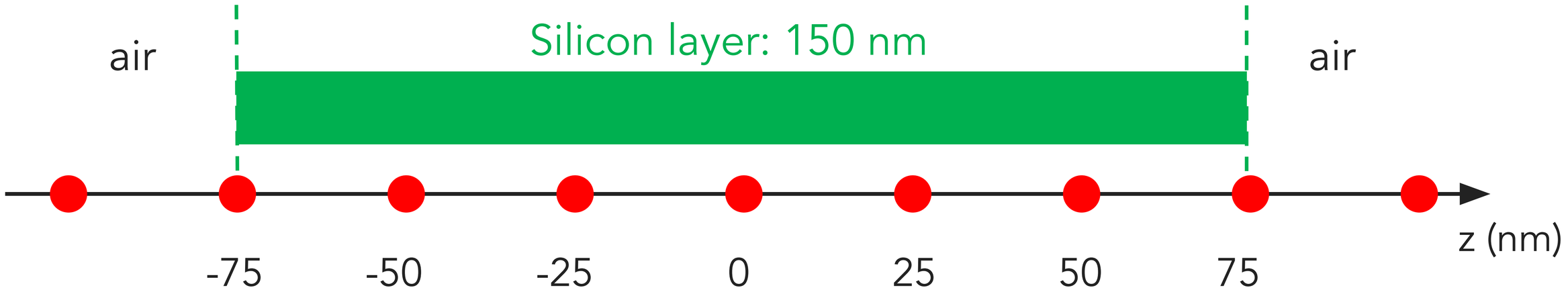





- Basic FDTD simulation: no subpixel averaging; uniform grid
- Spatial discretization: 25 nm

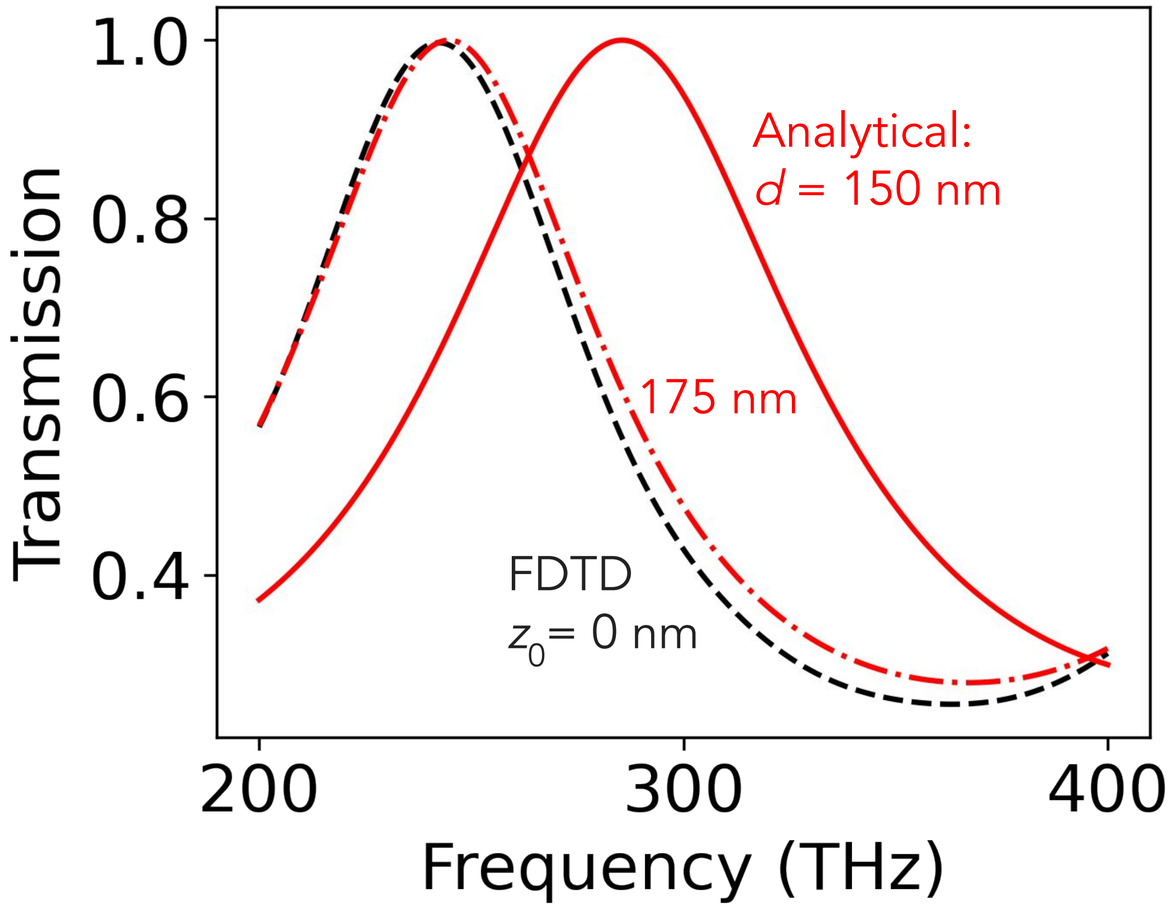
How dielectric constant is assigned to Yee lattice?



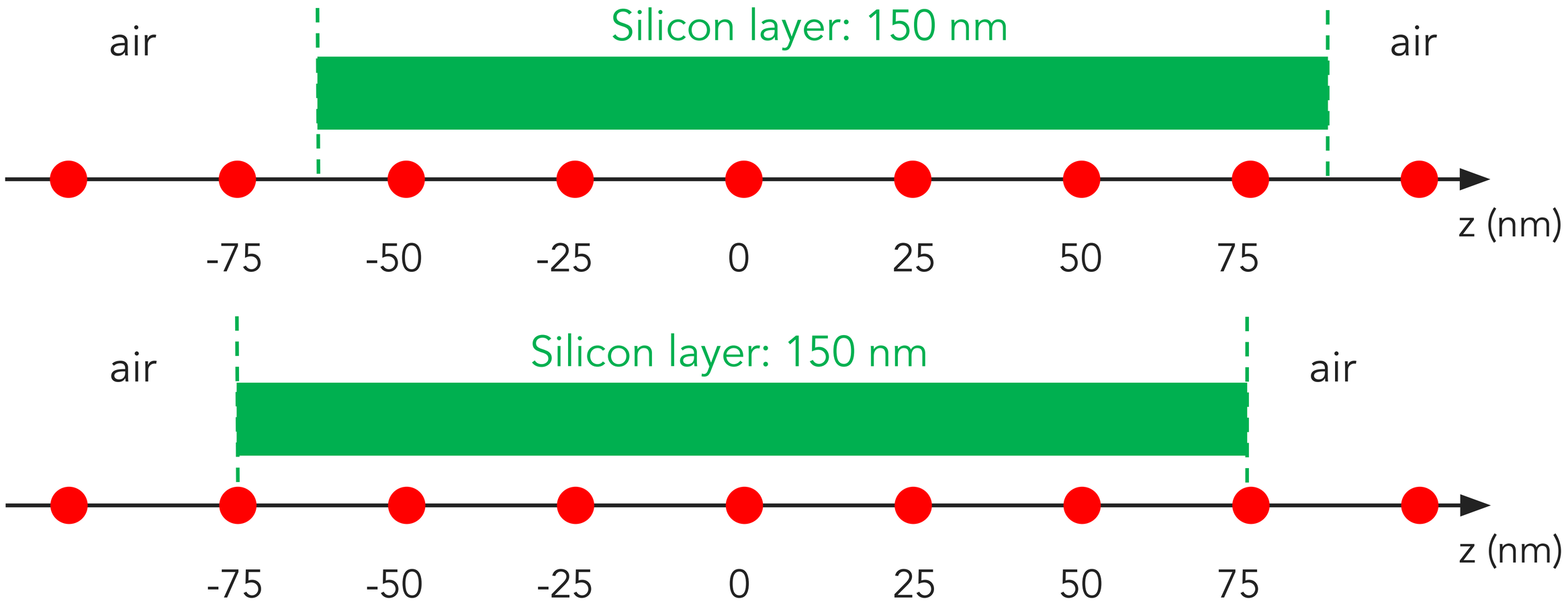

**7 grids assigned to silicon: 7×25 nm = 175 nm**

E-grid

How dielectric constant is assigned to Yee lattice?



Important to understand how dielectric constant is assigned to Yee lattice



Important to understand how dielectric constant is assigned to Yee lattice

- How to automate the assignment for arbitrary slab position and grid size?
- More complicated geometries?

Next lecture: subpixel averaging