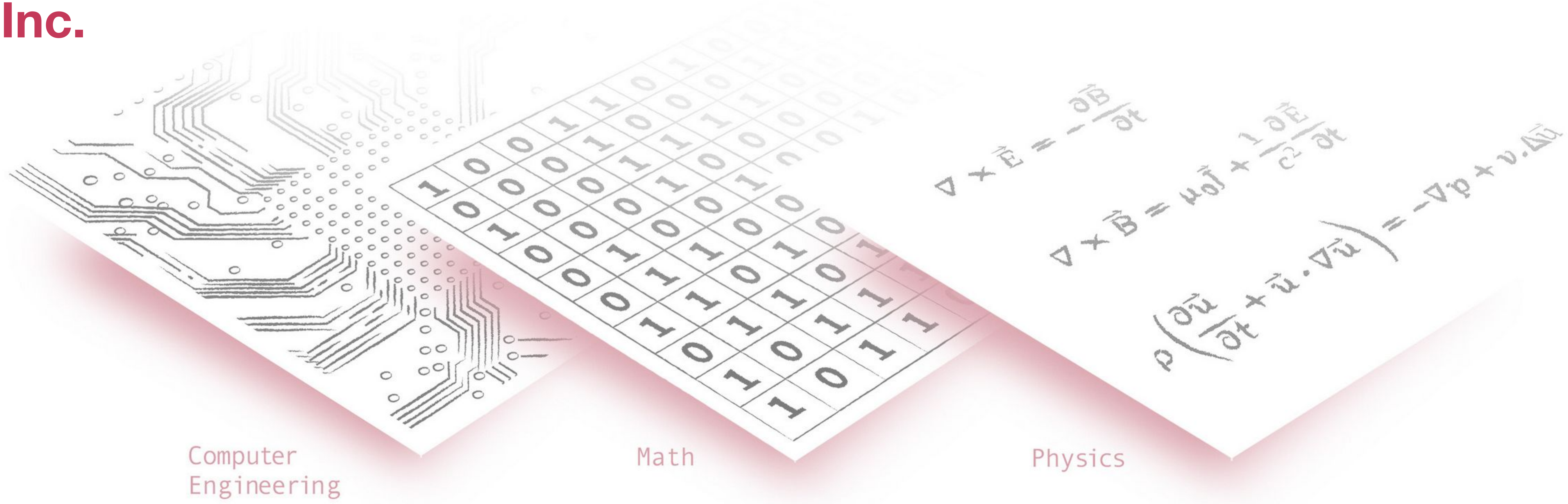
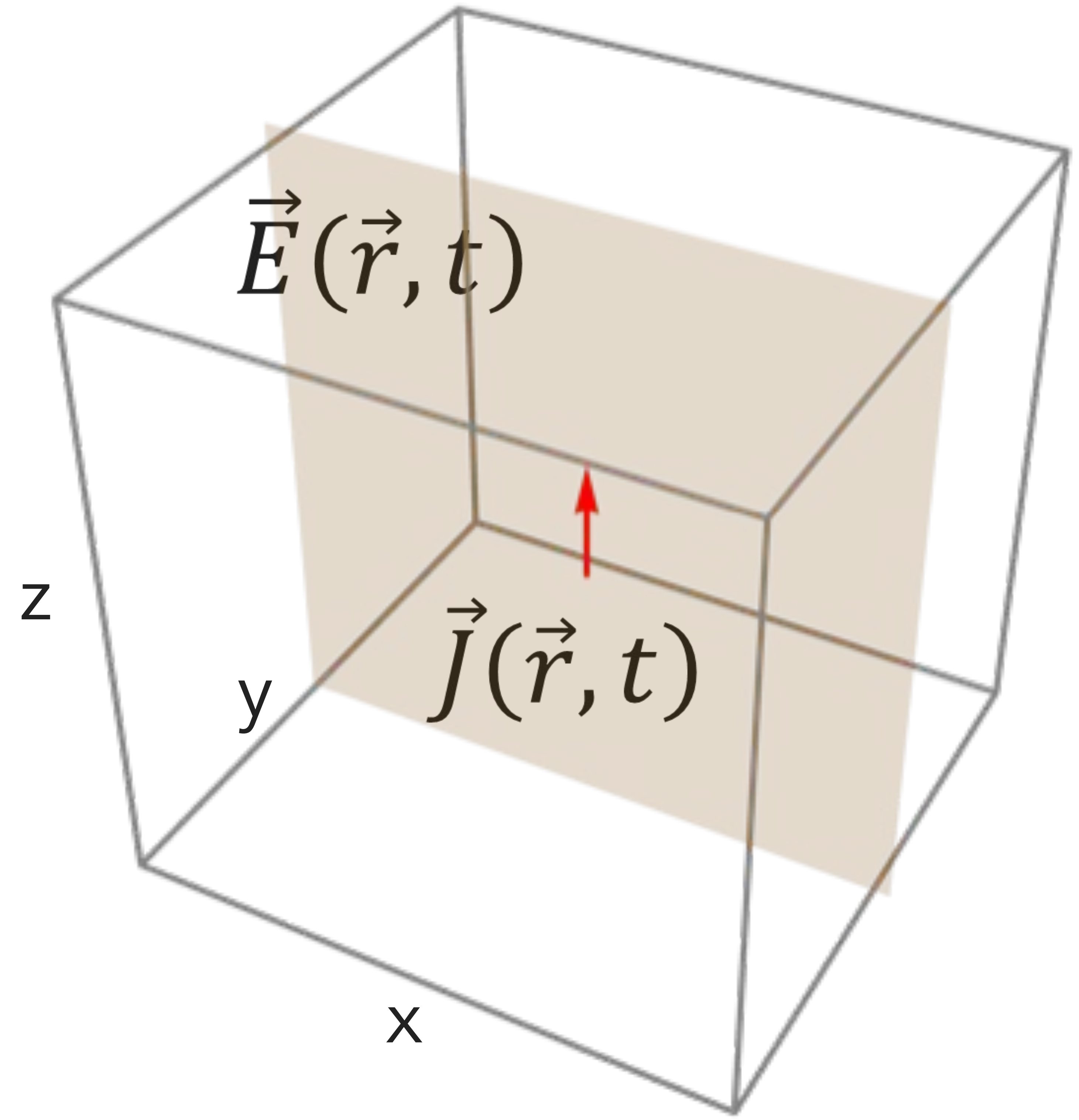
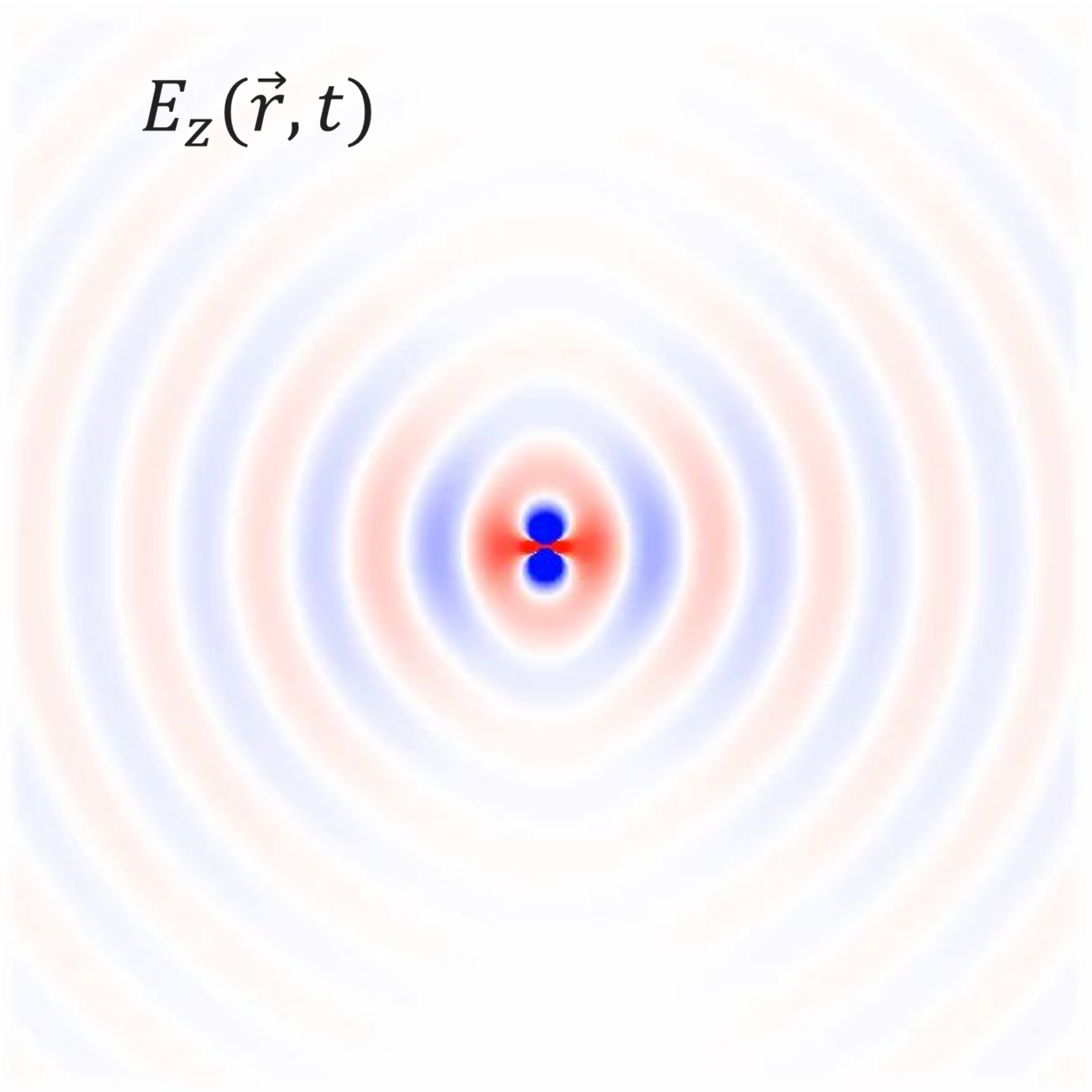
INTRO TO FDTD (2)

Flexcompute **Inc.**

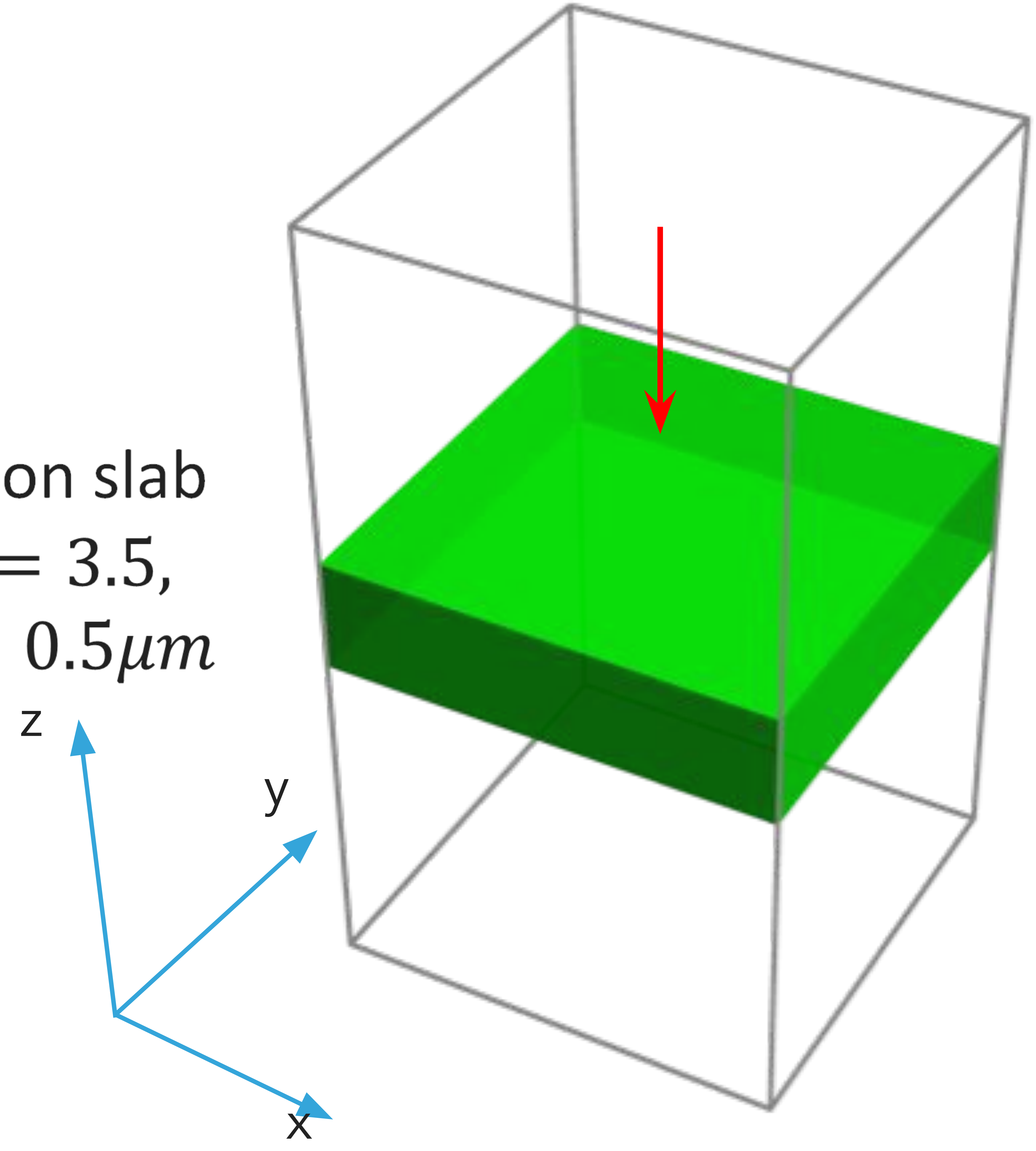


VACUUM

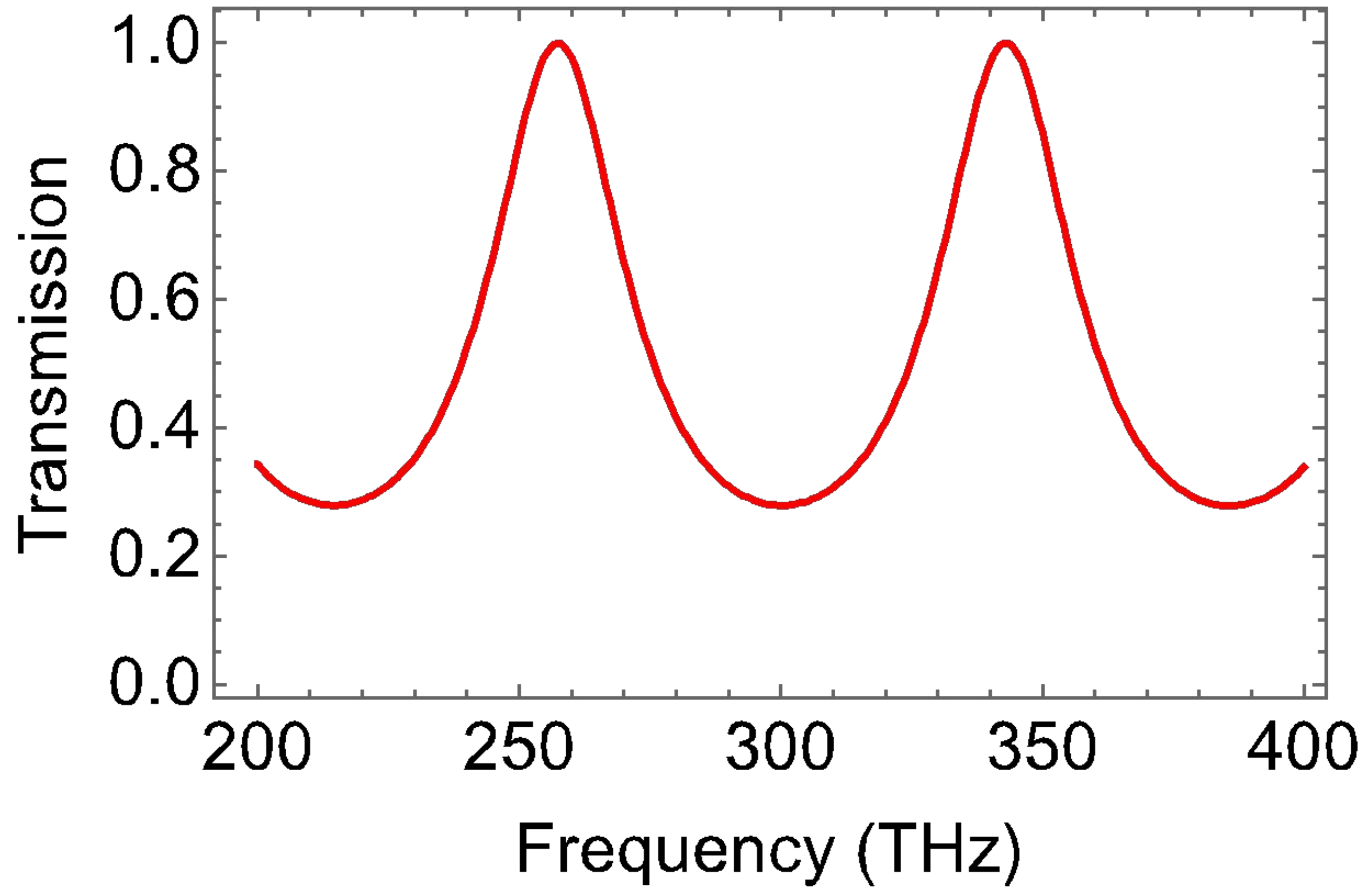


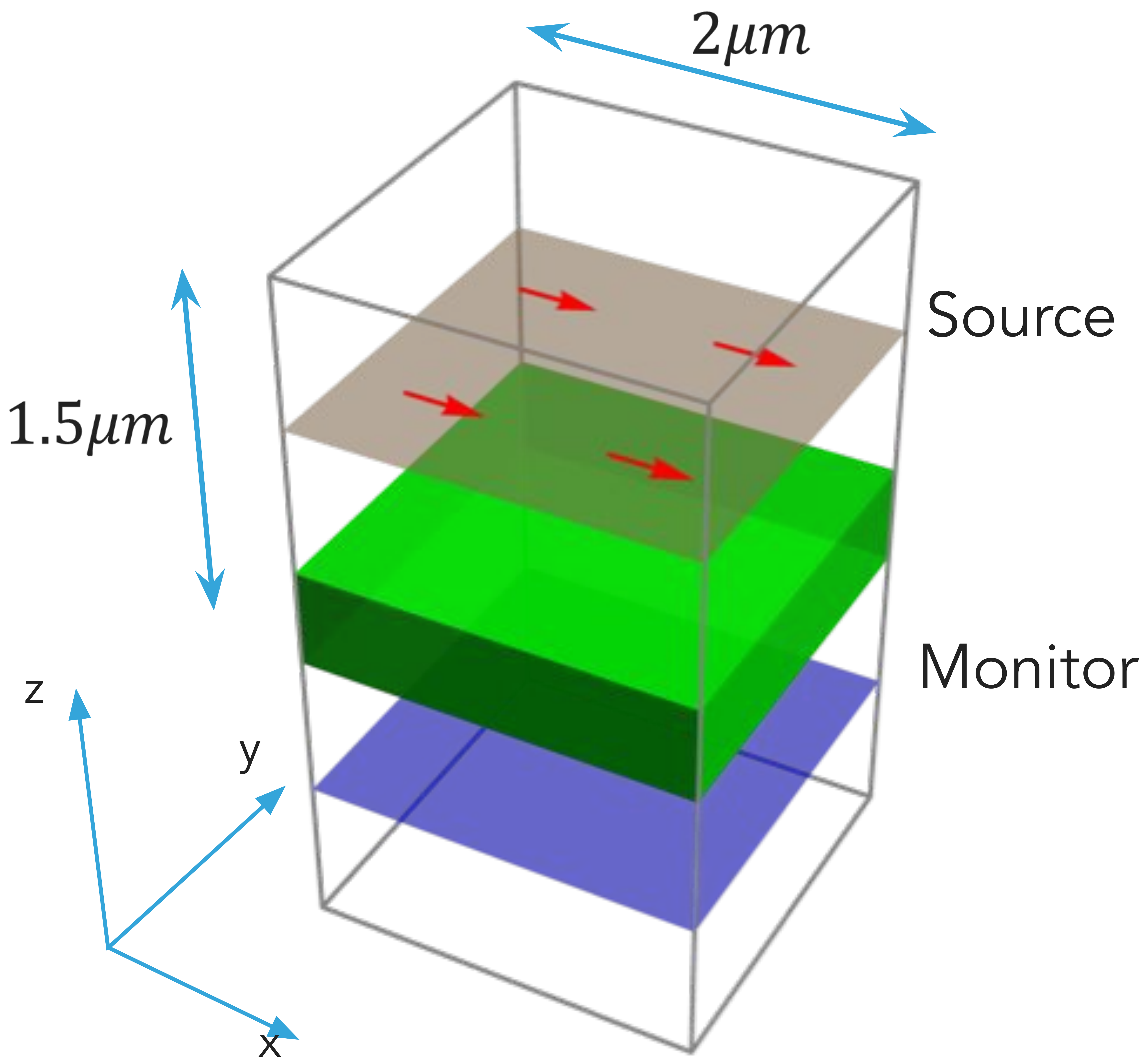


silicon slab
$n = 3.5,$
$d = 0.5\mu m$



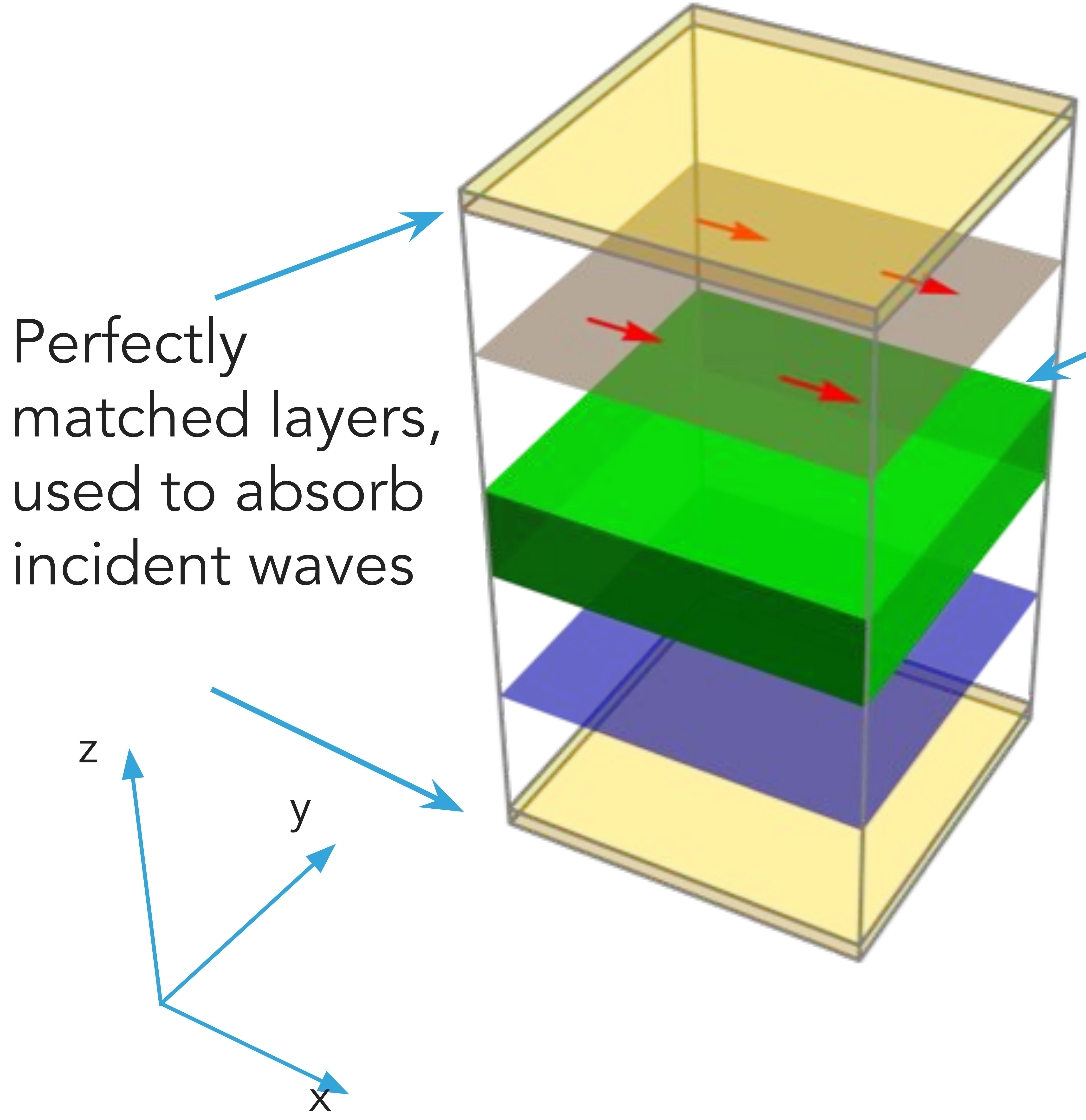
Analytic Results





Compute the transmission near the frequency of 300THz, corresponding to the free space wavelength of $\lambda = 1\mu m$

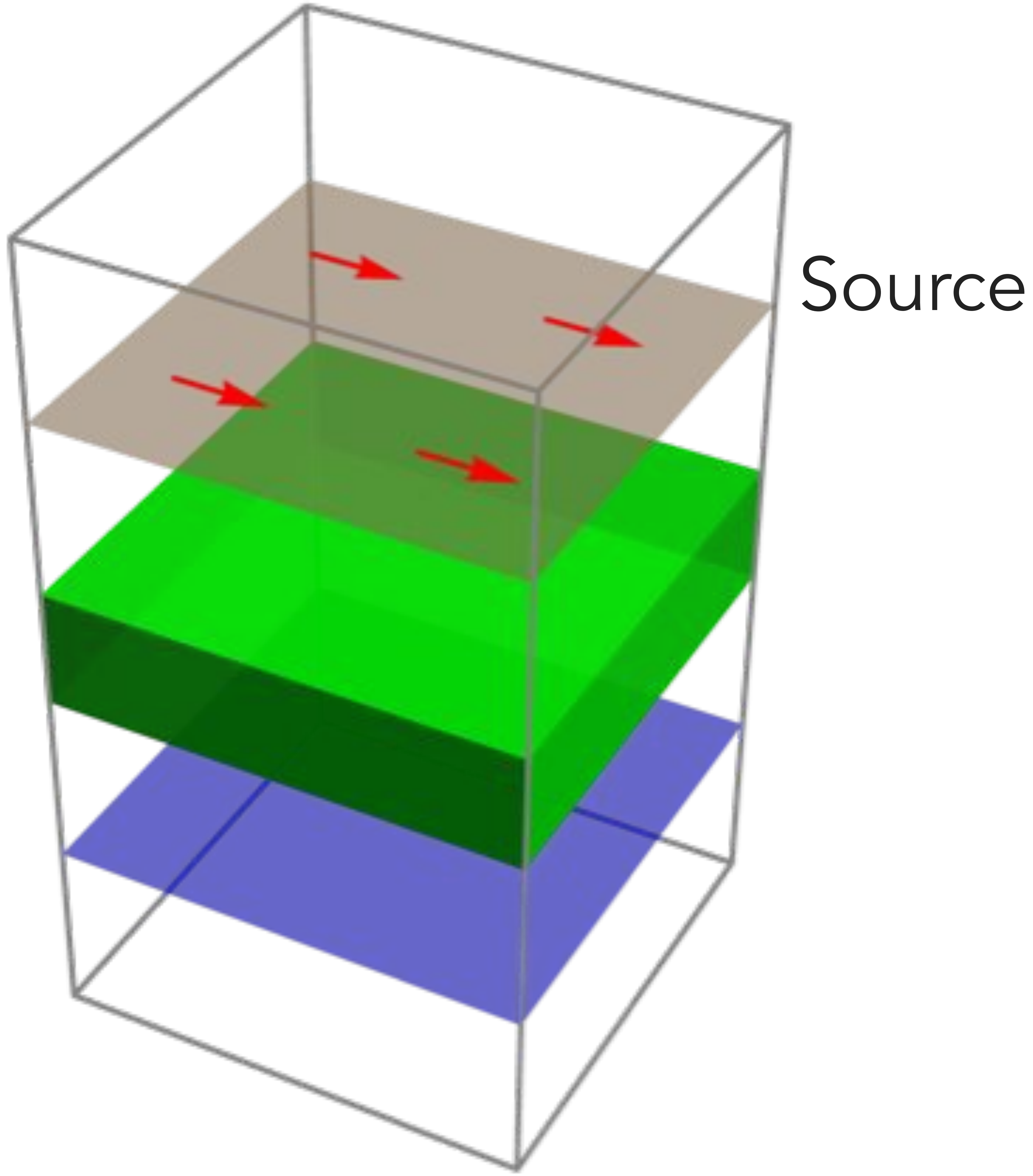
Discretization: $\Delta x = \frac{\lambda}{n}/30 = 9.5nm$



Periodic boundary condition

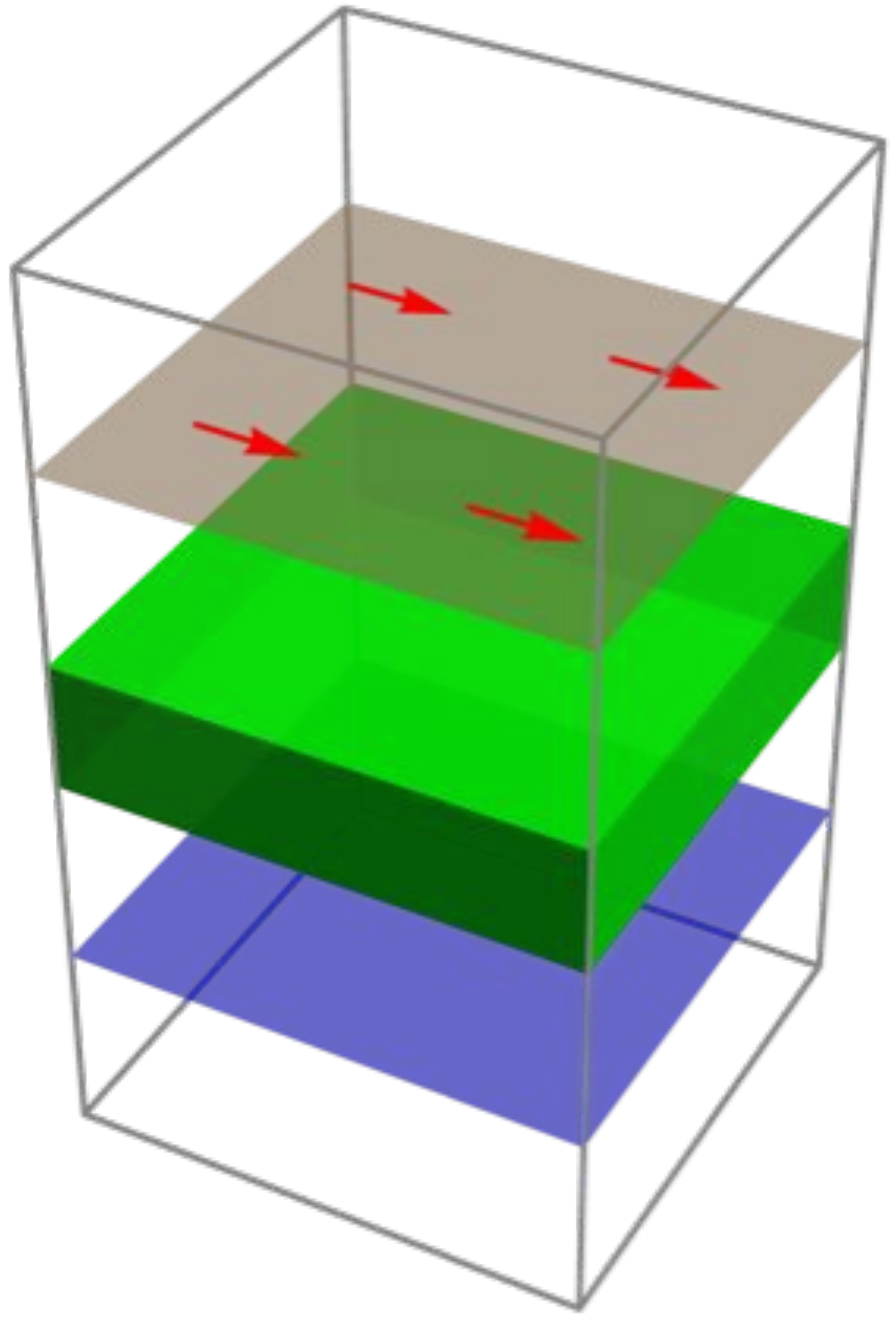
$$E(L_x, y) = E(0, y),$$
$$E(x, 0) = E(x, L_y)$$

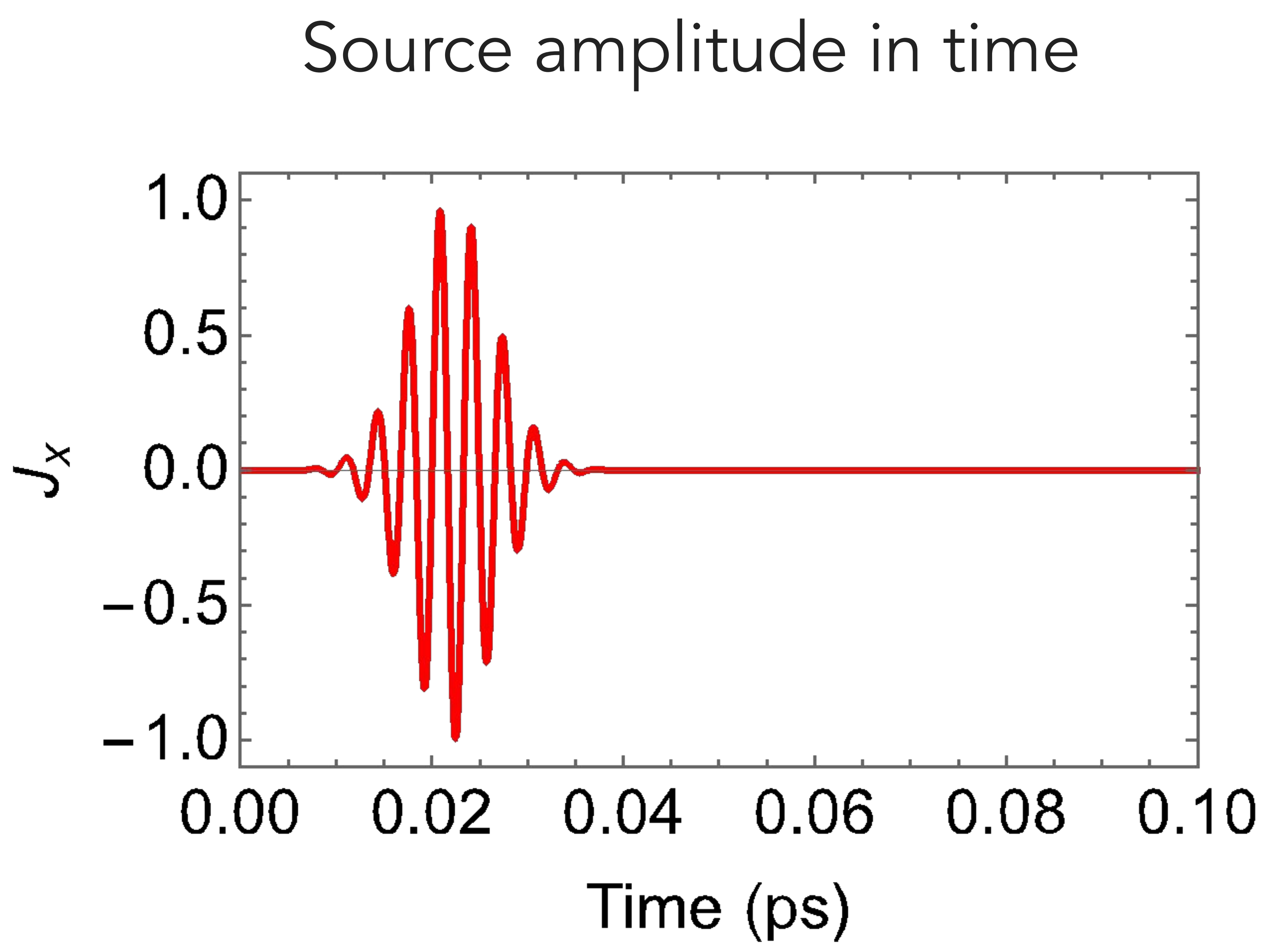
Periodic boundary condition is useful for simulating structures with infinite extent, interacting with an incident plane wave

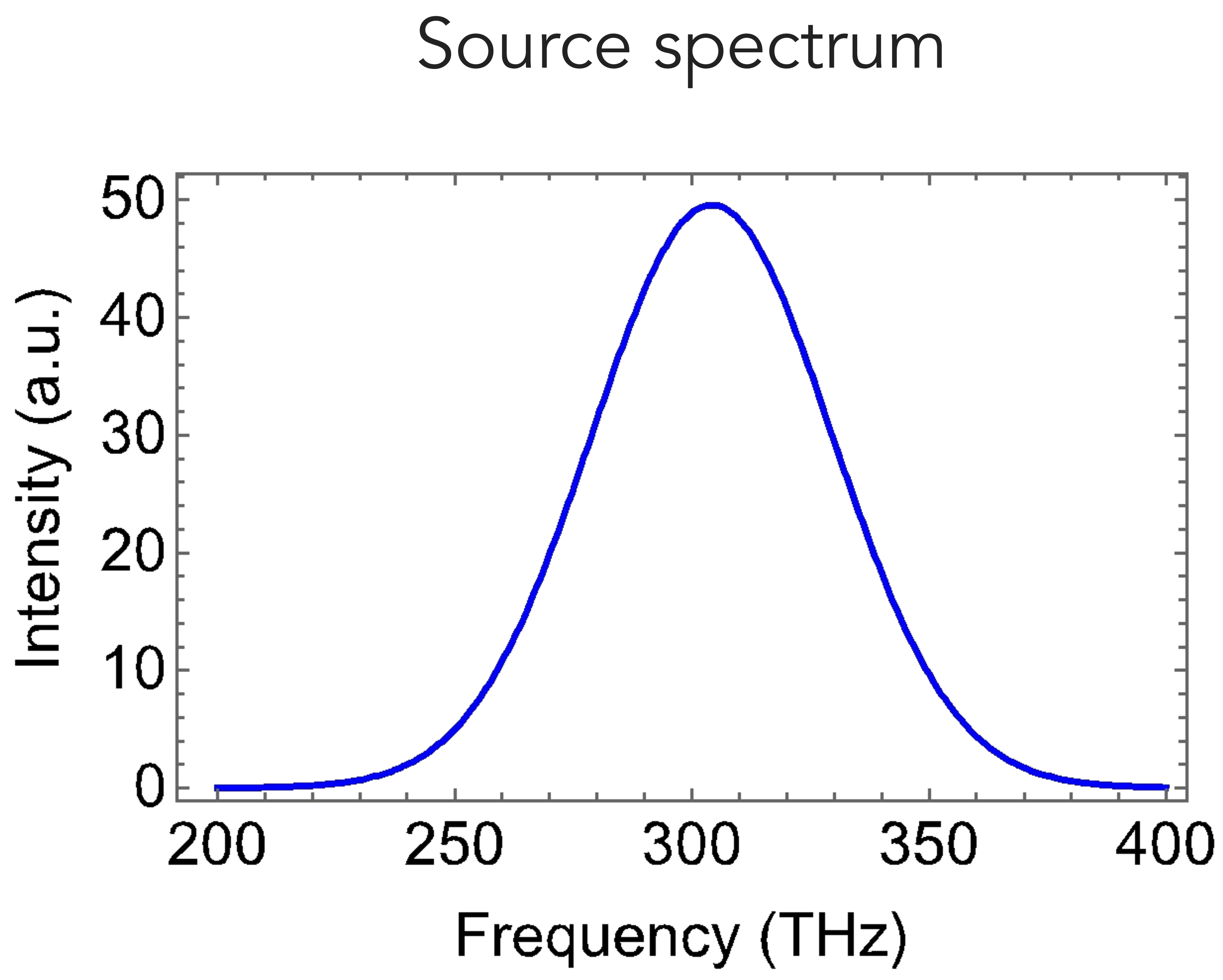


Source consists of distribution of oscillating dipoles on a plane.

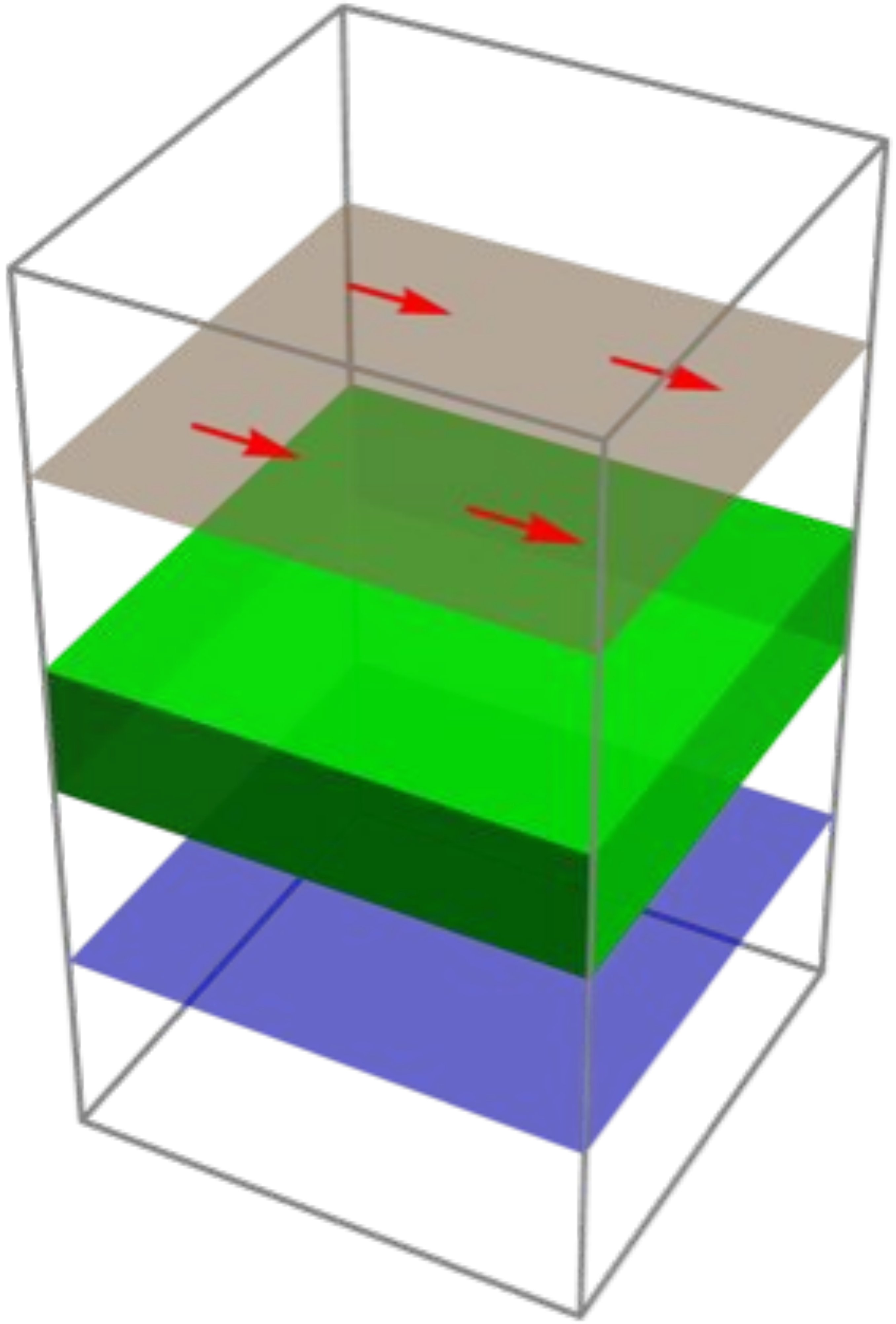
All dipoles have the same magnitude, and oscillate in phase to set up an incident plane wave



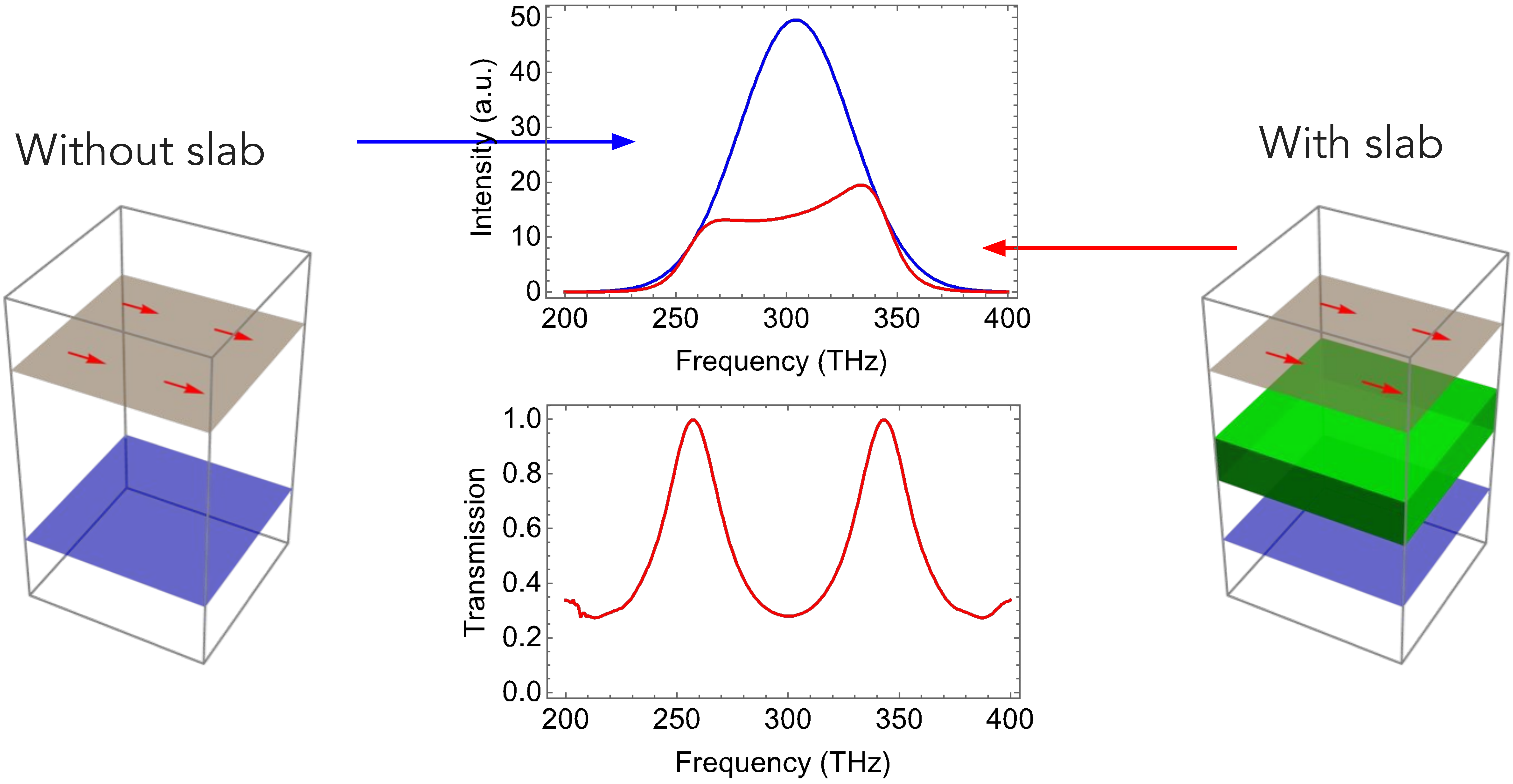




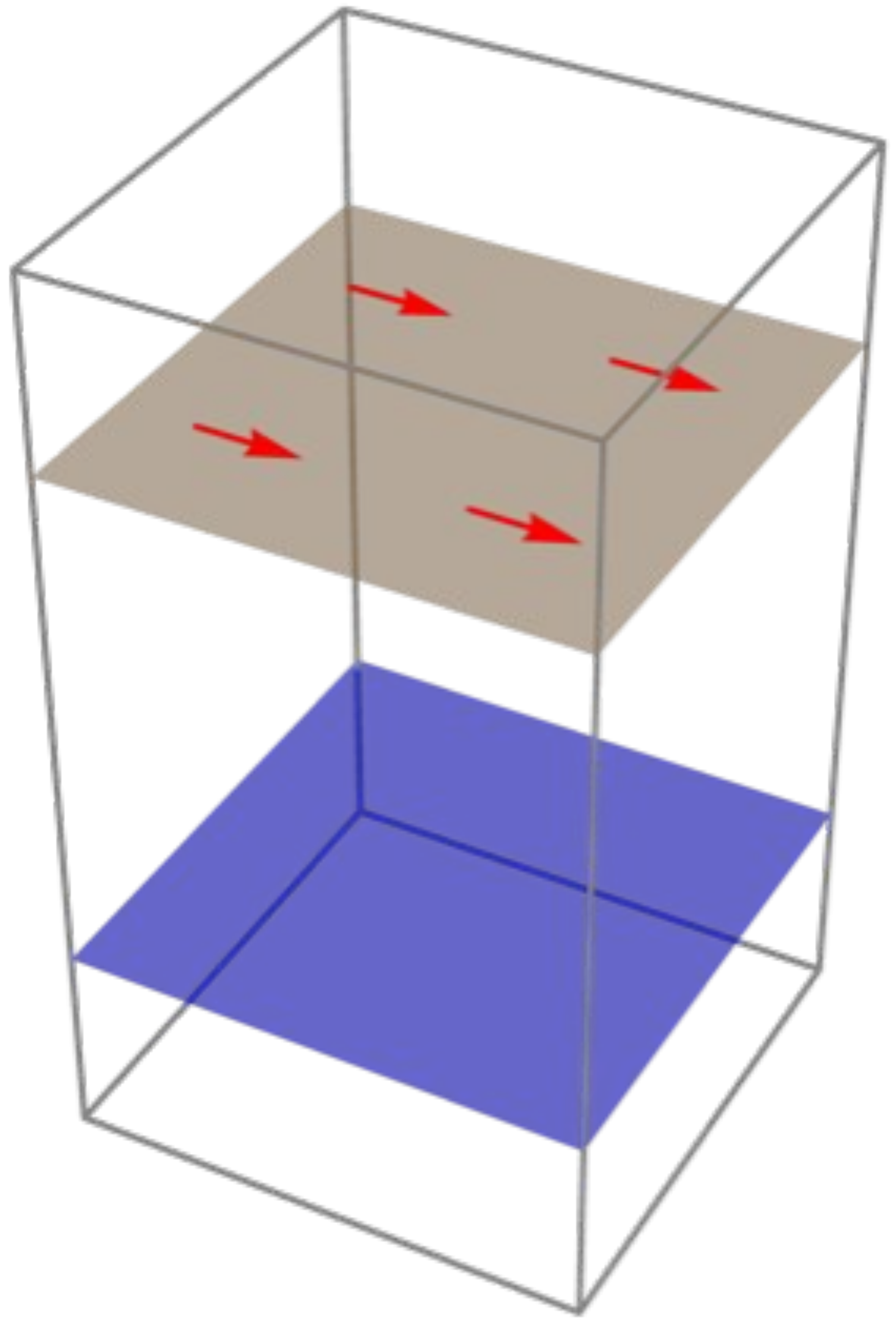
A pulsed source to generate a broad-band input. A single simulation then allows us to determine the response of the structure over broad bandwidth.

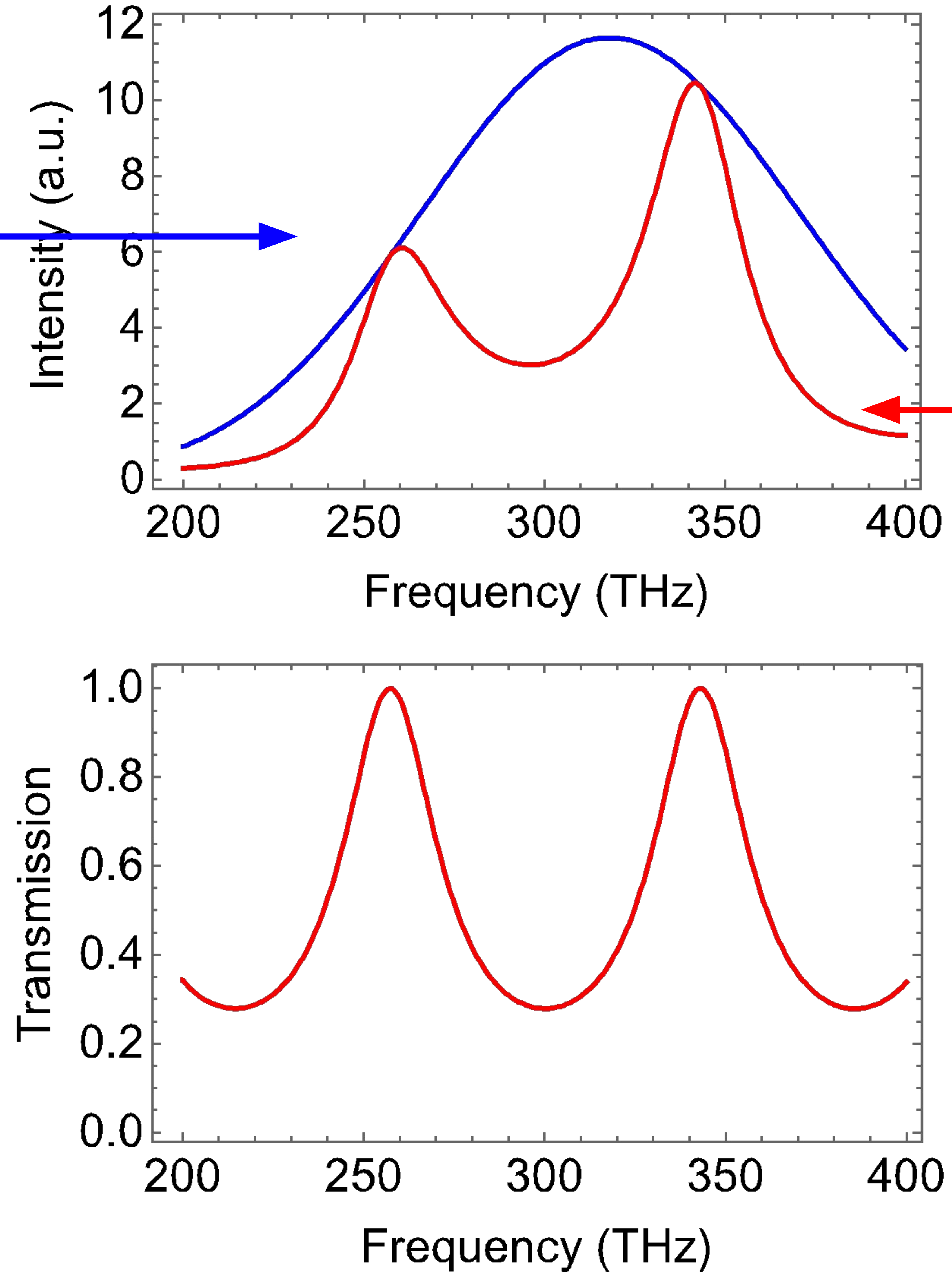


Compute the Poynting vector flux that passes through the monitor plane, as a function of frequency

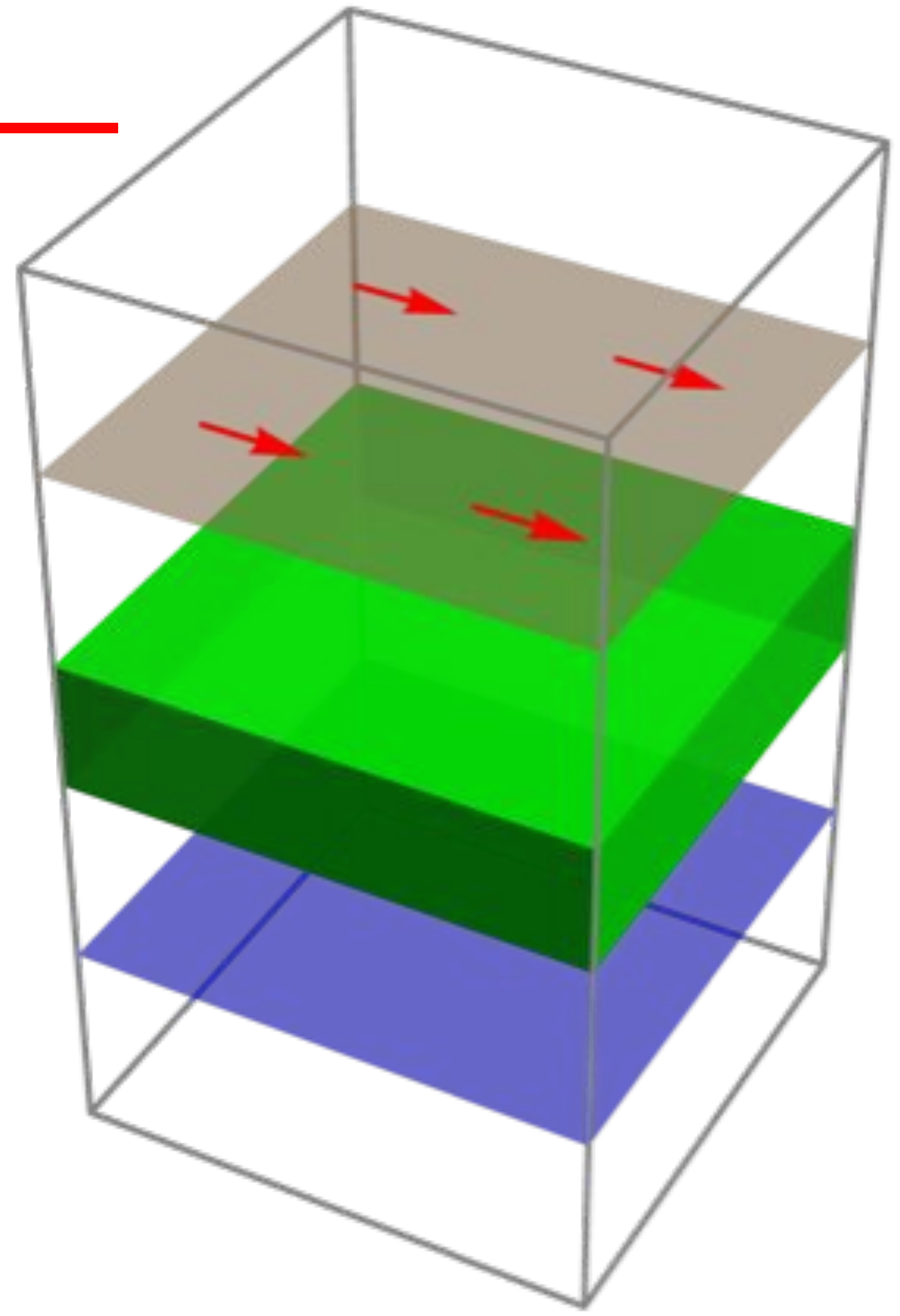

Without slab
With slab
Intensity (a.u.)
50
40
30
20
10
0
200
250
300
350
400
Frequency (THz)
Transmission
1.0
0.8
0.6
0.4
0.2
0.0
200
250
300
350
400
Frequency (THz)

Without slab





With slab



Comparison of FDTD with analytic results