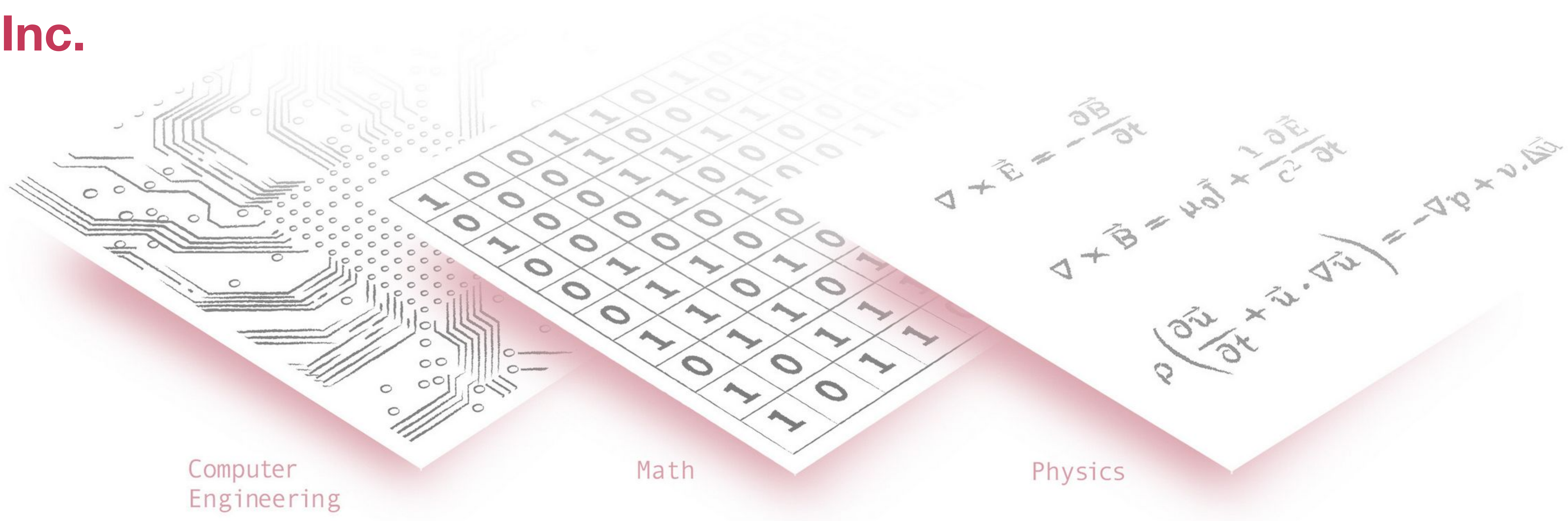
INTRO TO FDTD (3)

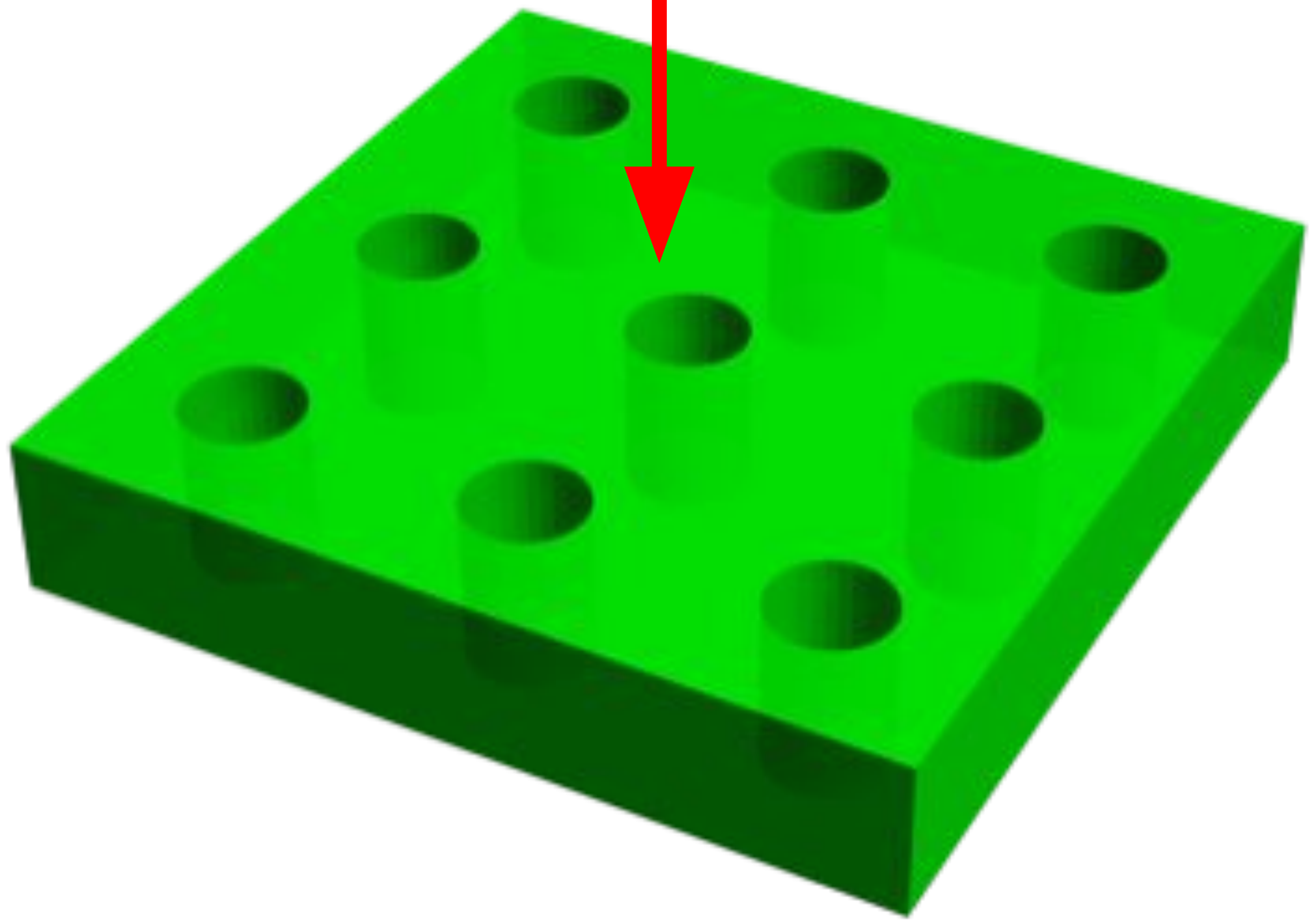
Flexcompute **Inc.**



Tidy3D

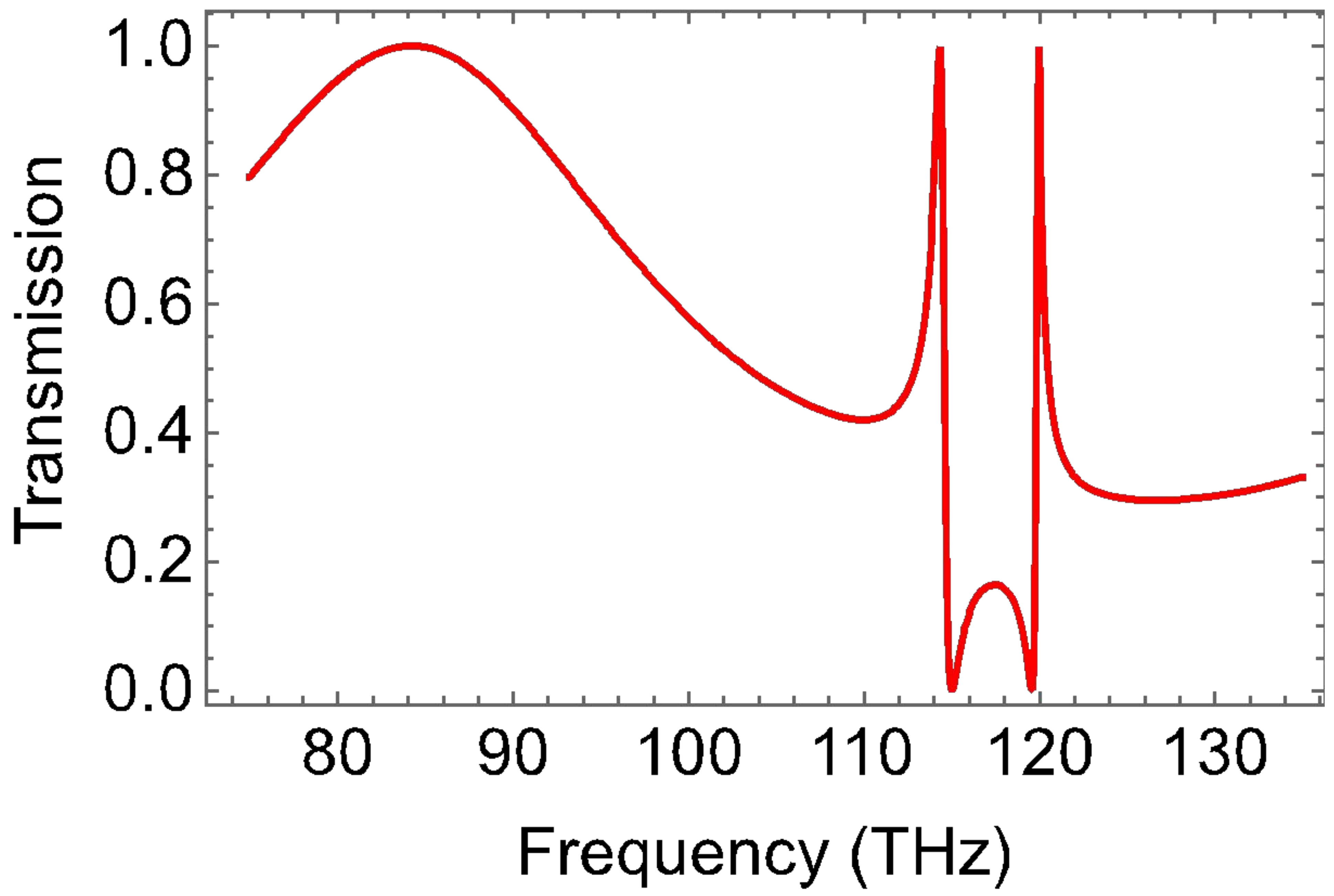
Normally incident plane wave

Photonic Crystal (PhC) Slab

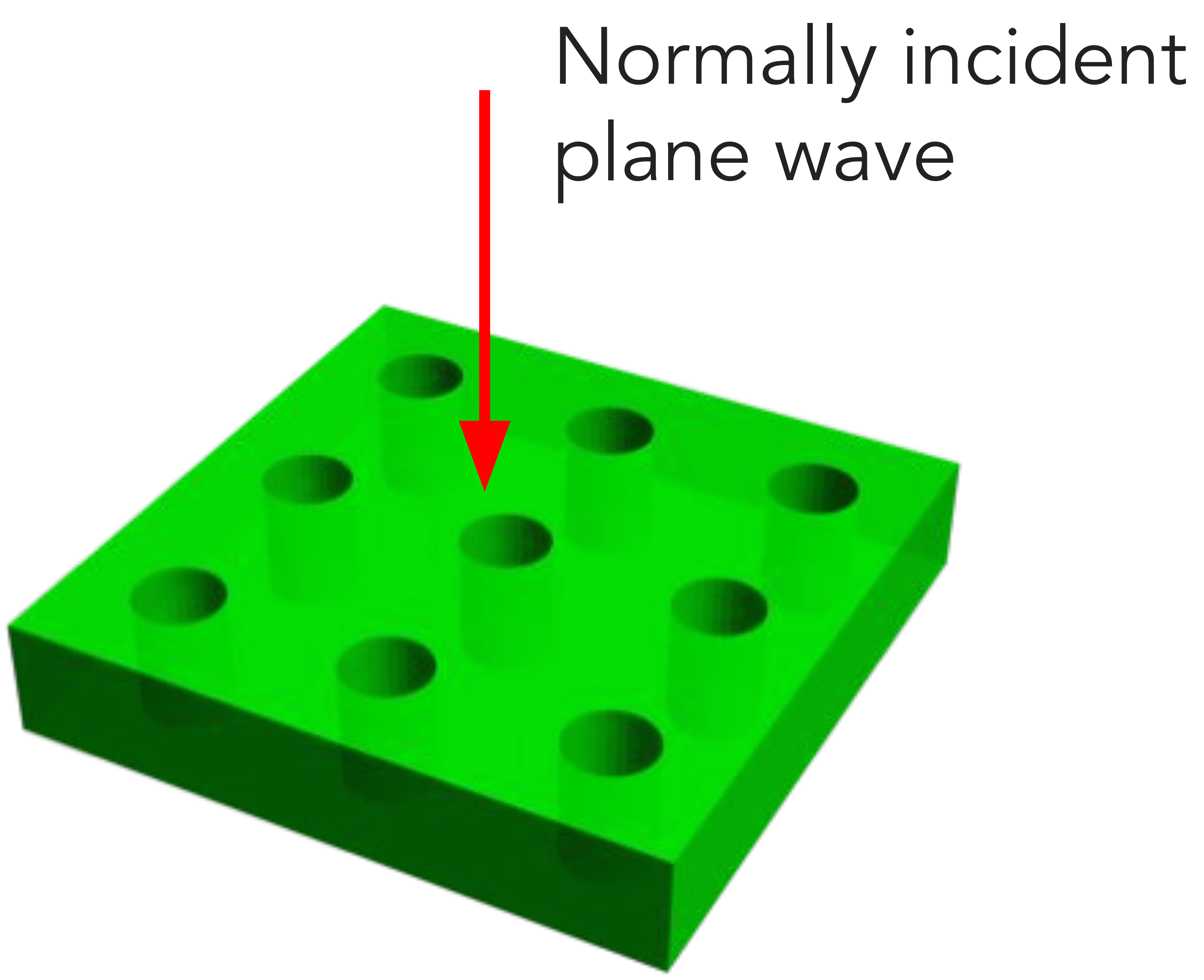


Period: $a = 1\mu m$
Radius: $0.2a$
Thickness: $0.55a$
Permittivity: $\epsilon = 12$

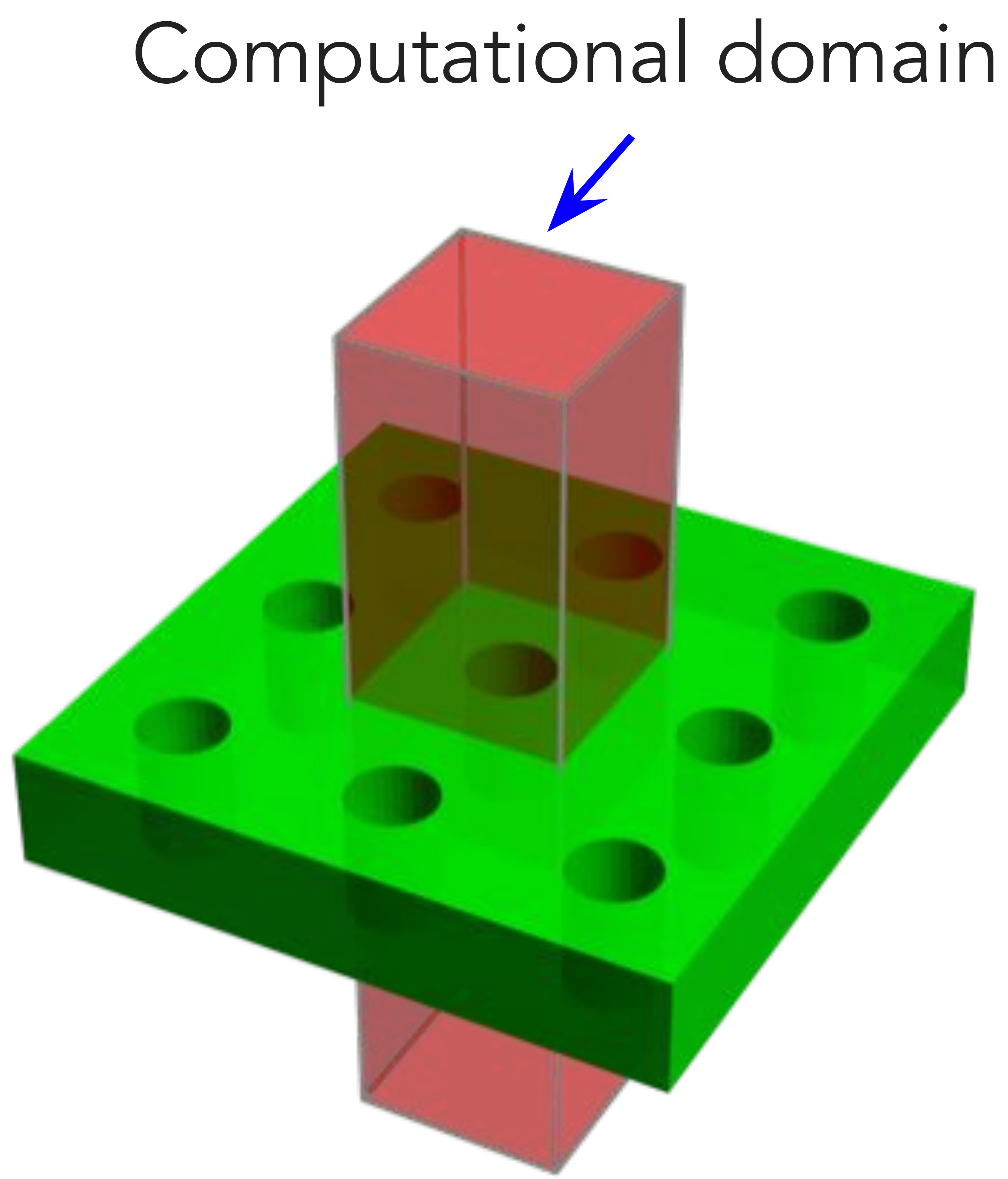
Transmission computed from FDTD

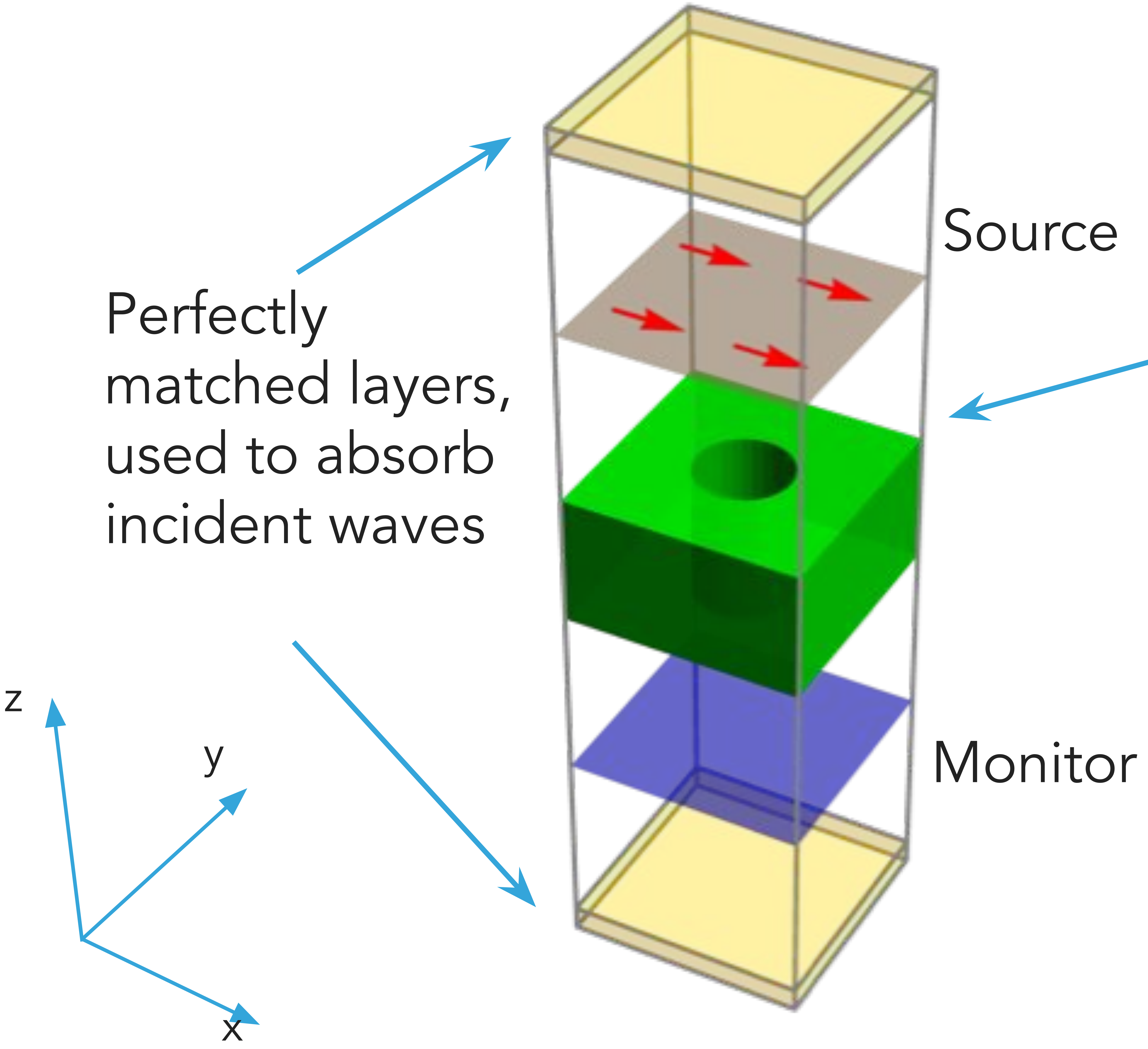


S. Fan, W. Suh and J. D. Joannopoulos, Journal of the Optical Society of America A 20, 569 (2003).



Period: $a = 1\mu m$
Radius: $0.2a$
Thickness: $0.55a$
Permittivity: $\epsilon = 12$



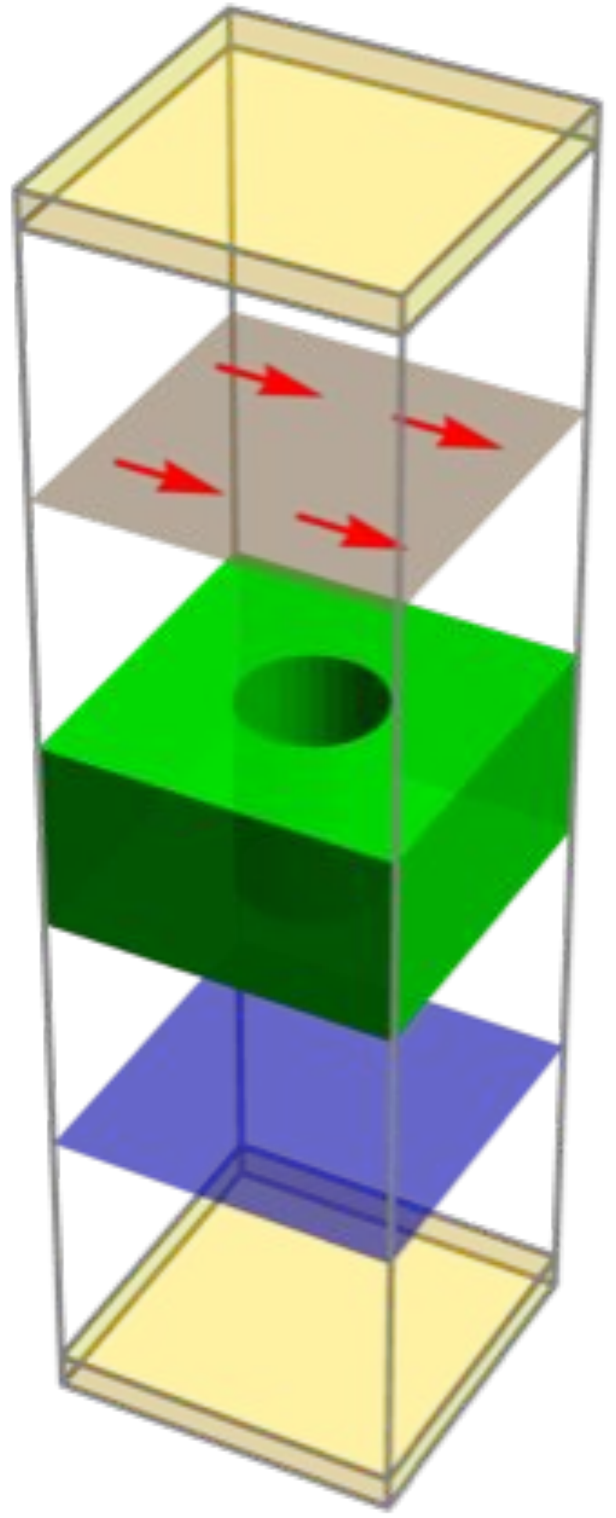


Periodic boundary condition

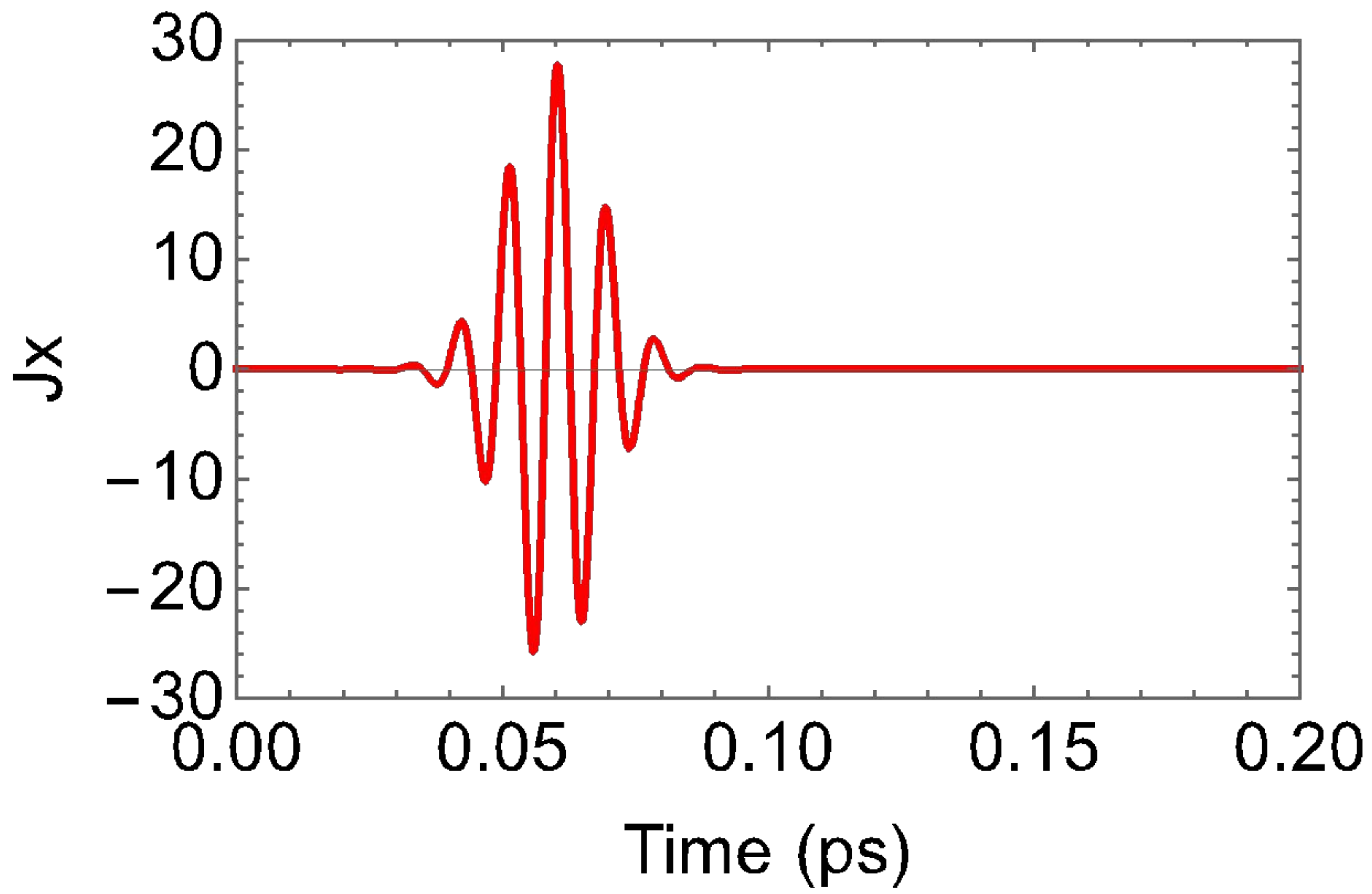
$$E(L_x, y) = E(0, y),$$
$$E(x, 0) = E(x, L_y)$$

Compute the transmission near the frequency of 100THz, corresponding to the free space wavelength of $\lambda \approx 3\mu m$

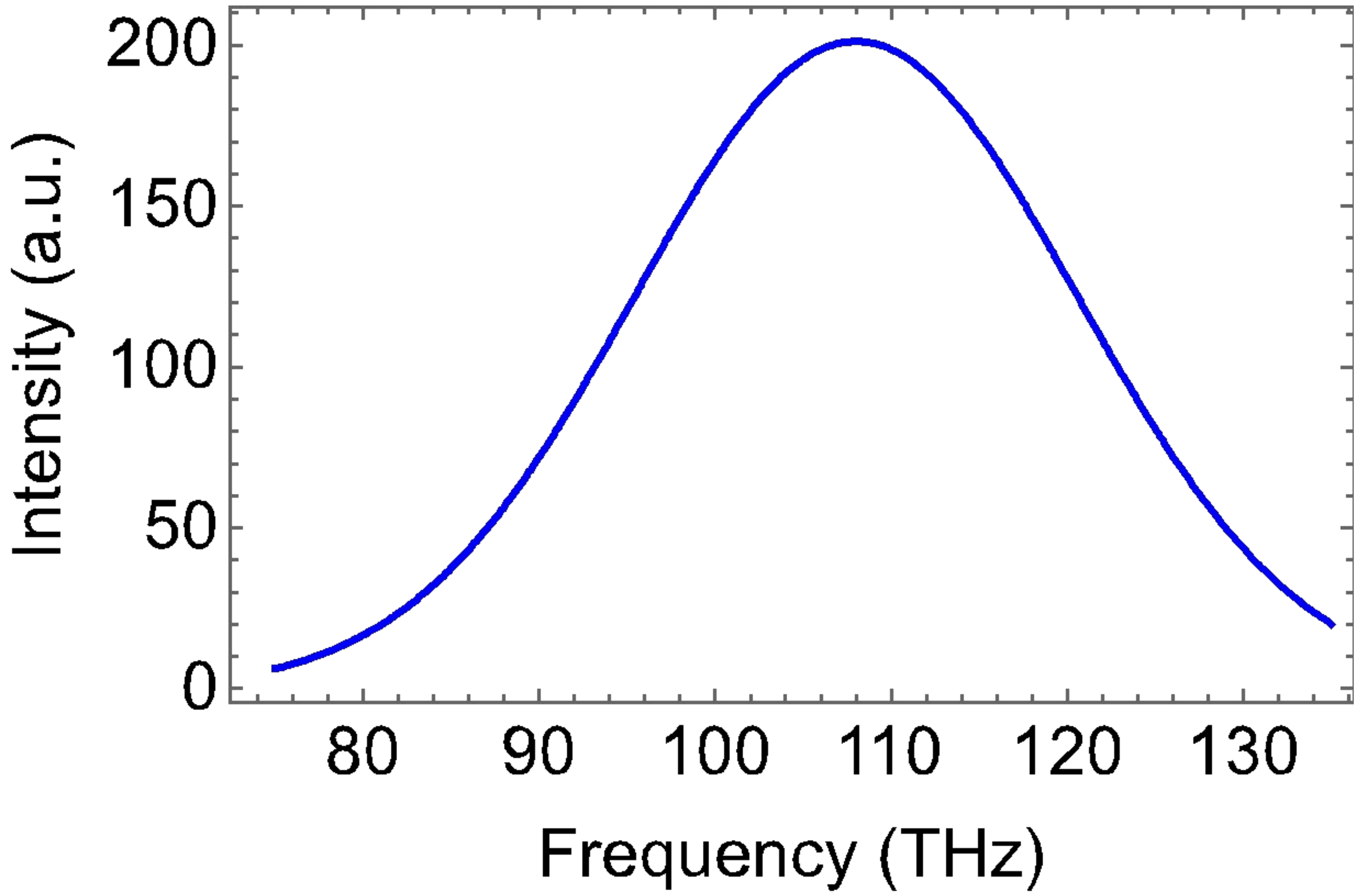
Discretization: $\Delta x = \frac{\lambda_{max}}{n}/30 = 20nm$



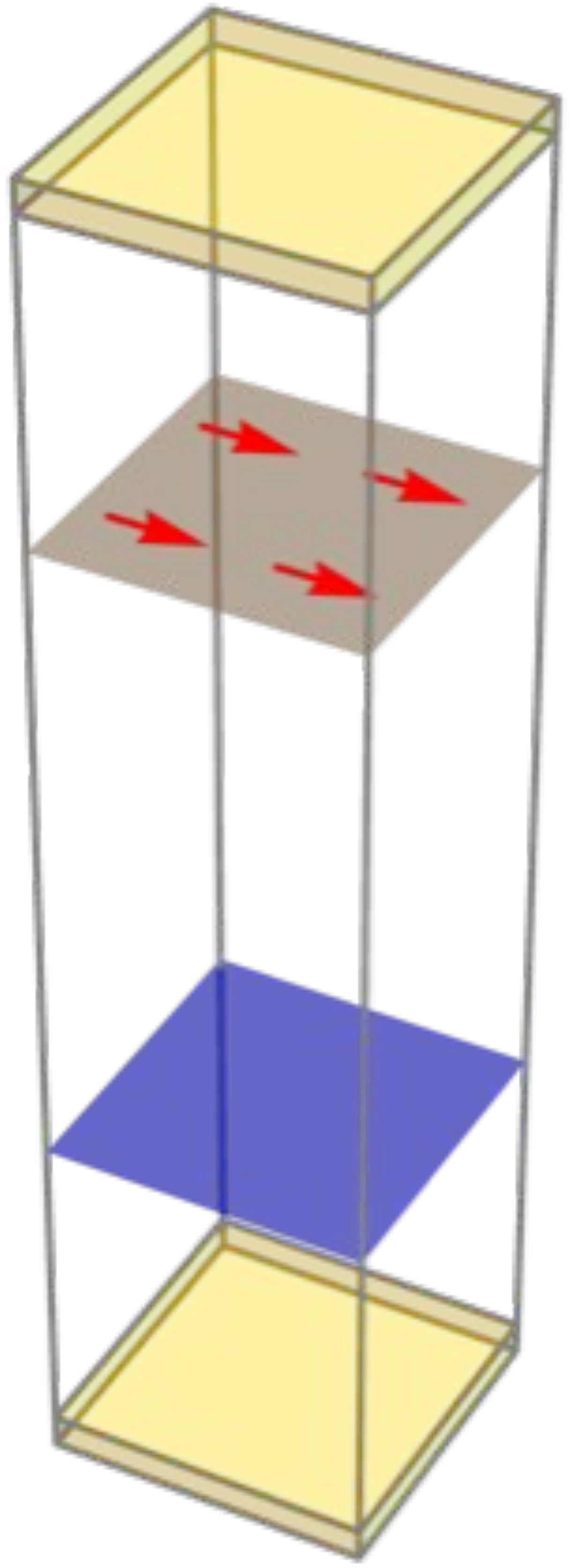
Pulsed source

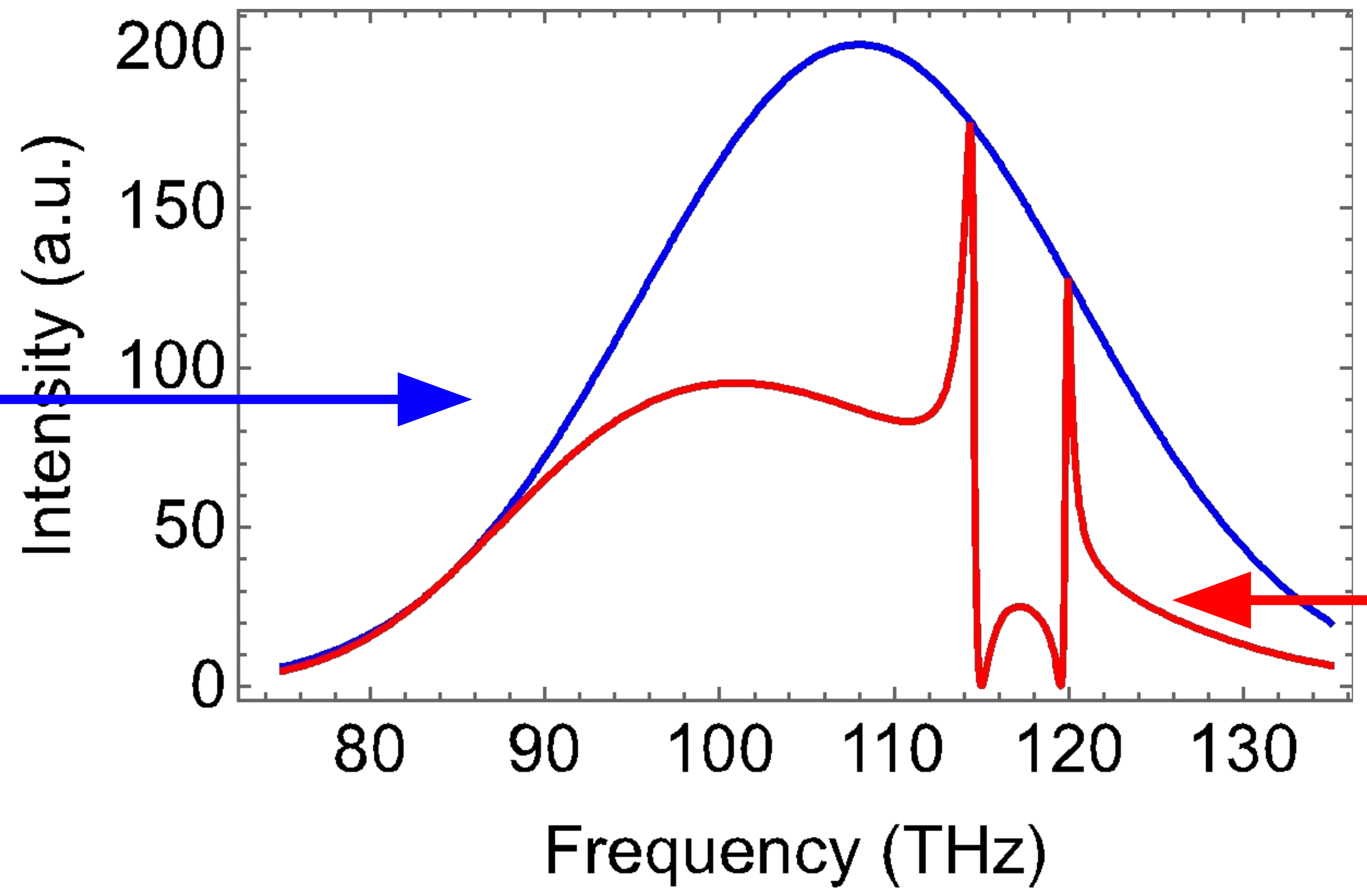


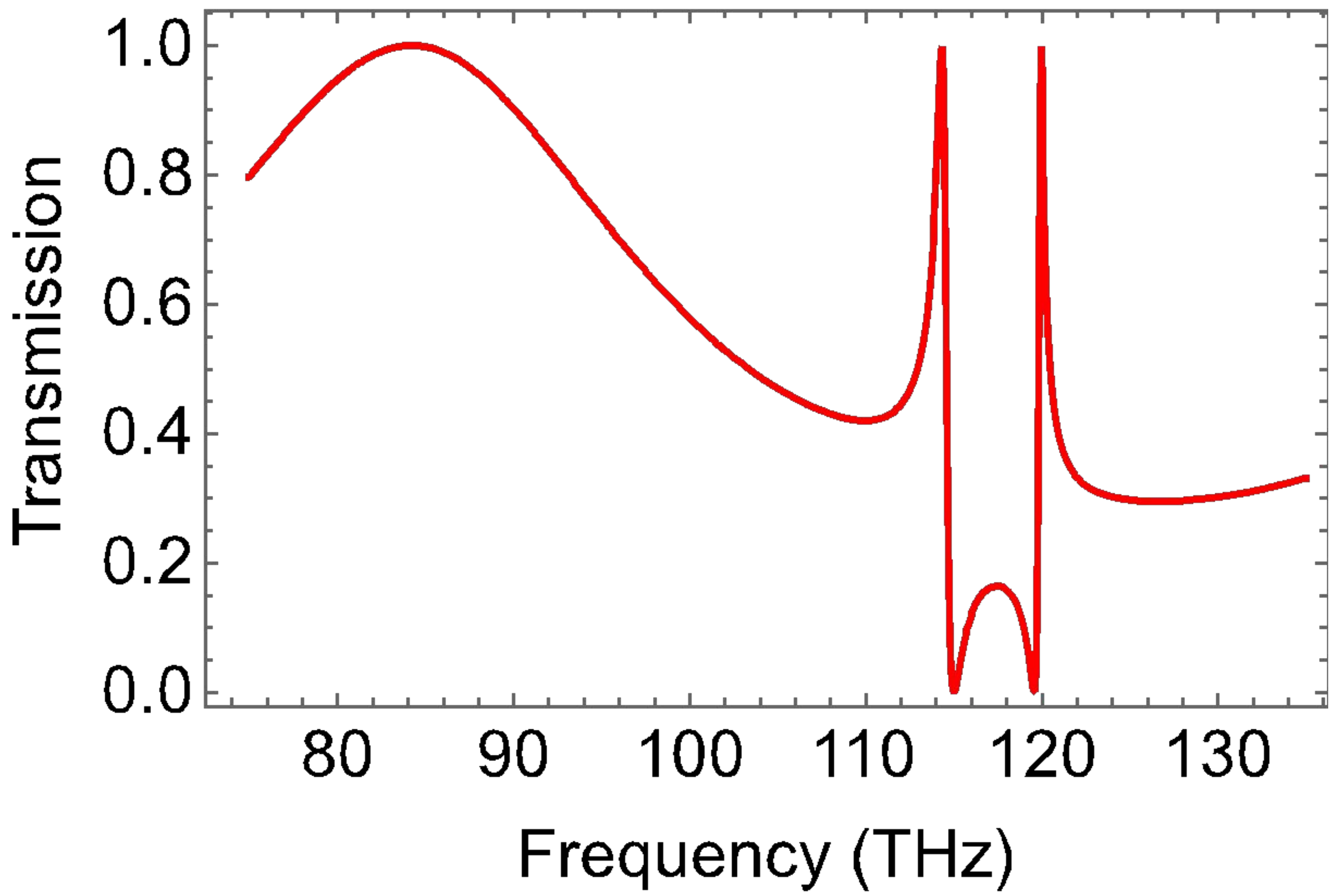
Spectrum of the source



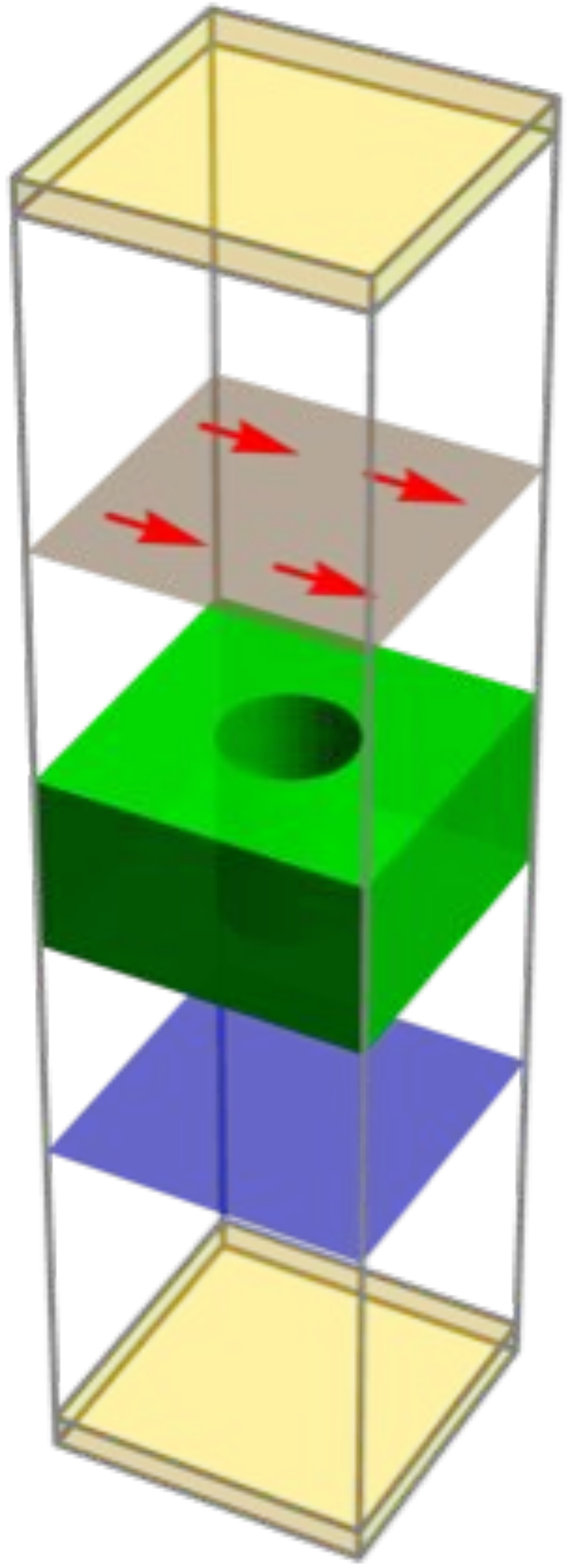
Without PhC slab



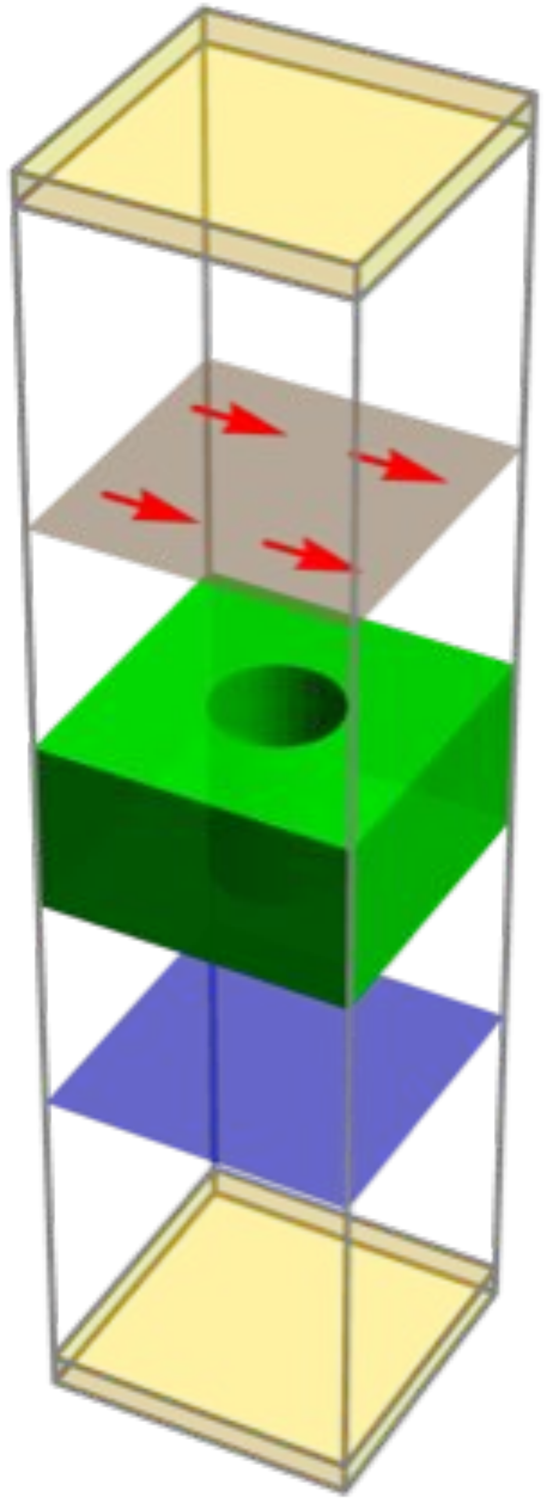


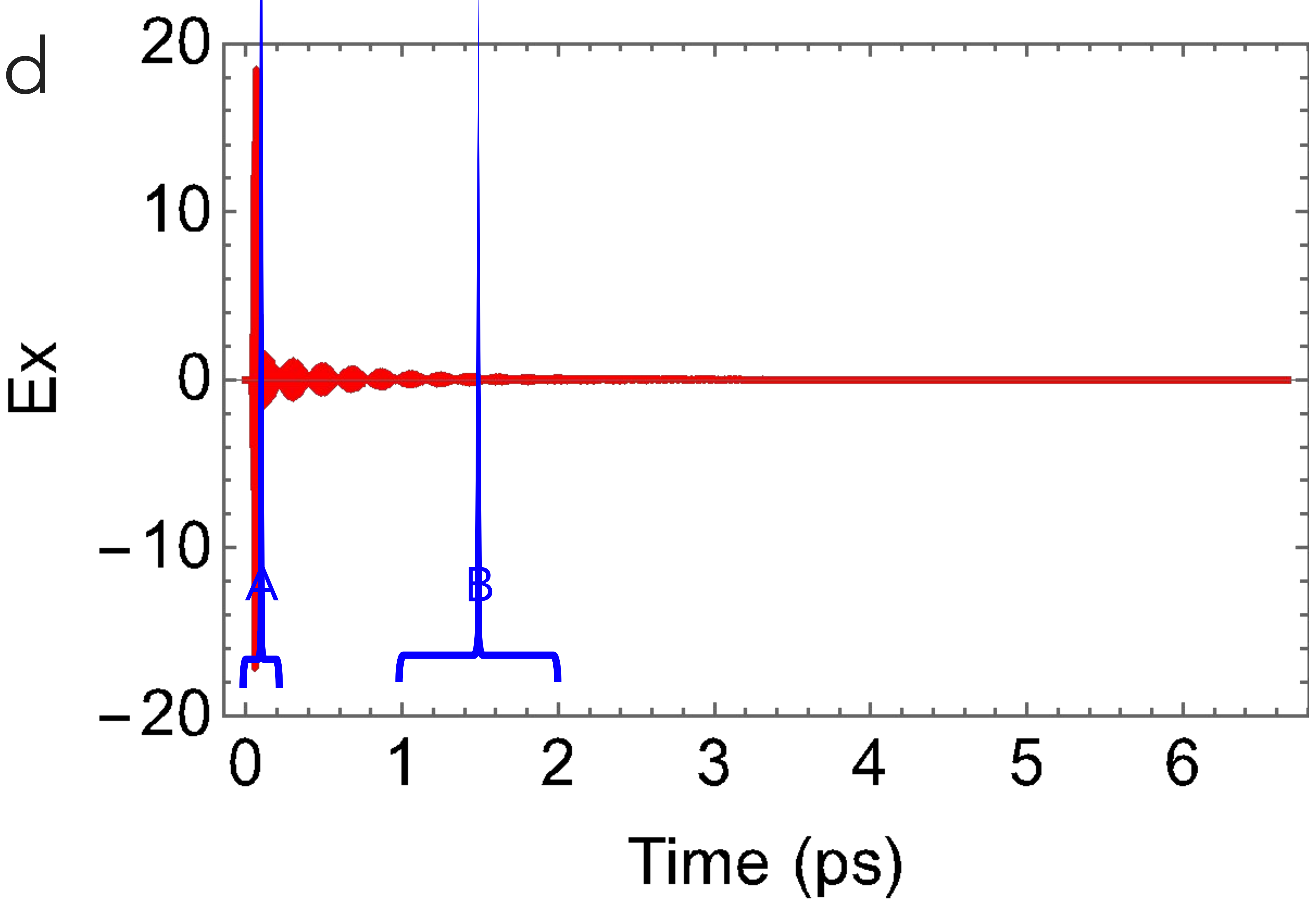


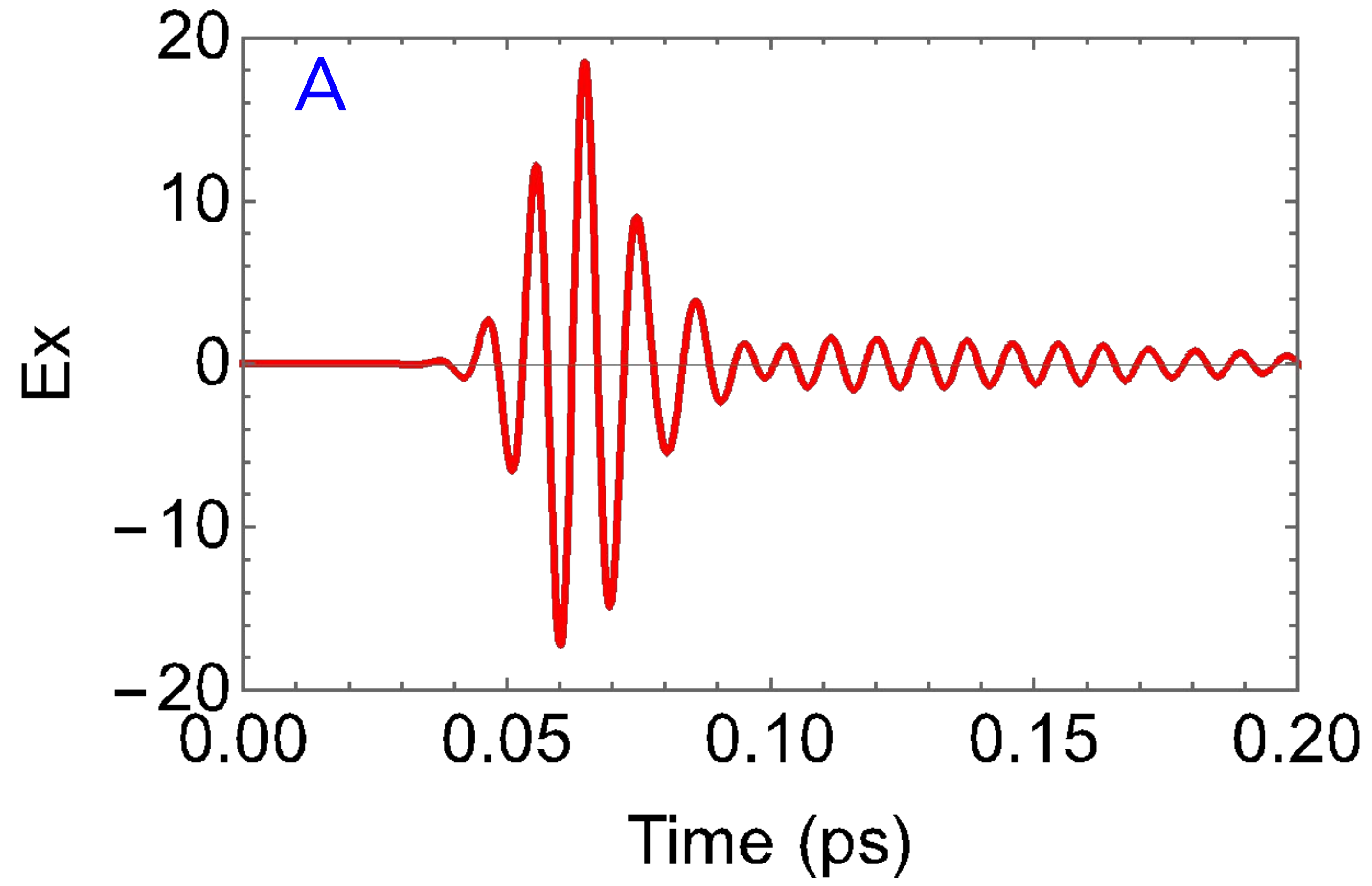
With PhC slab

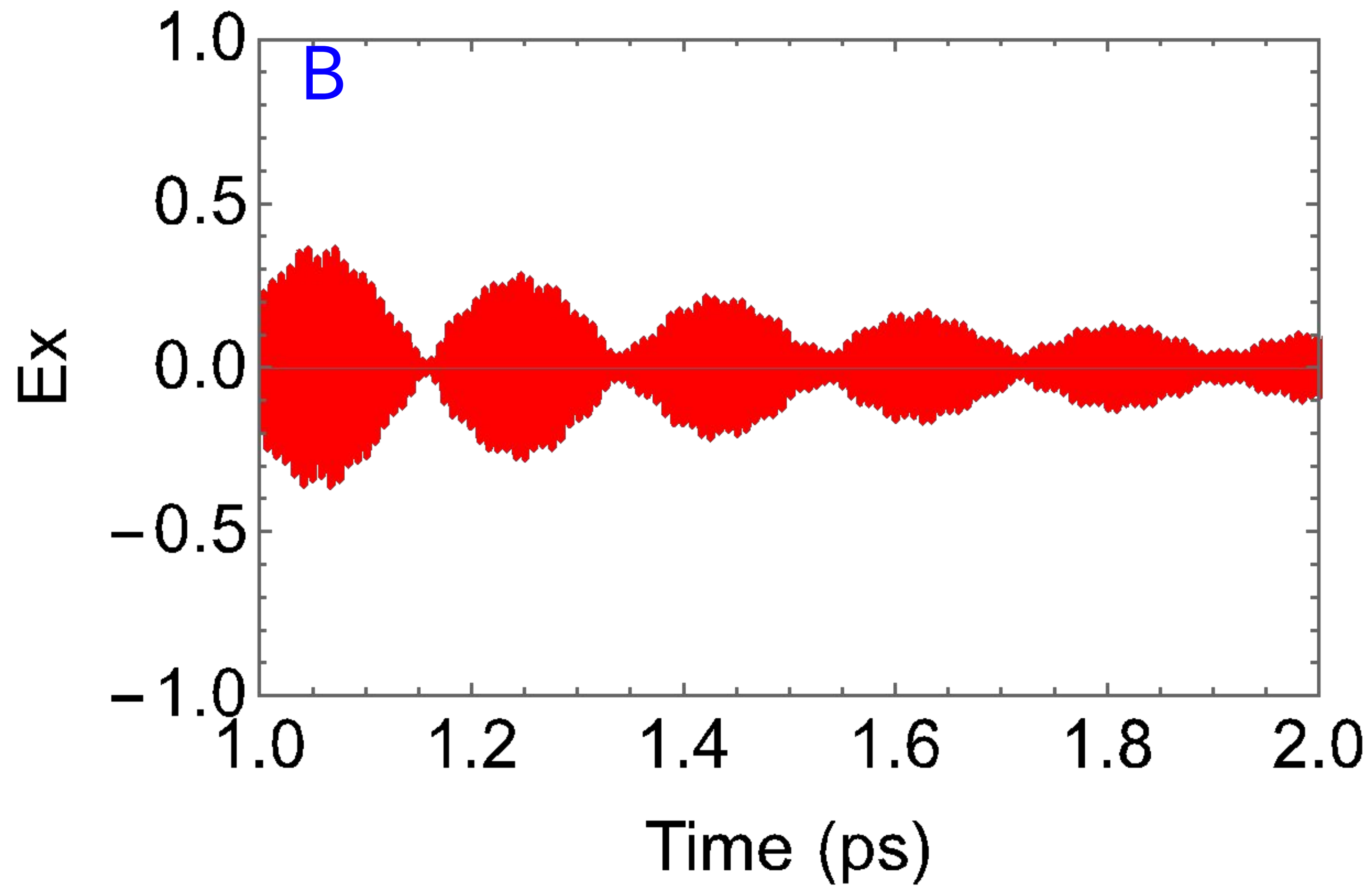


Time evolution of the field on a monitor point

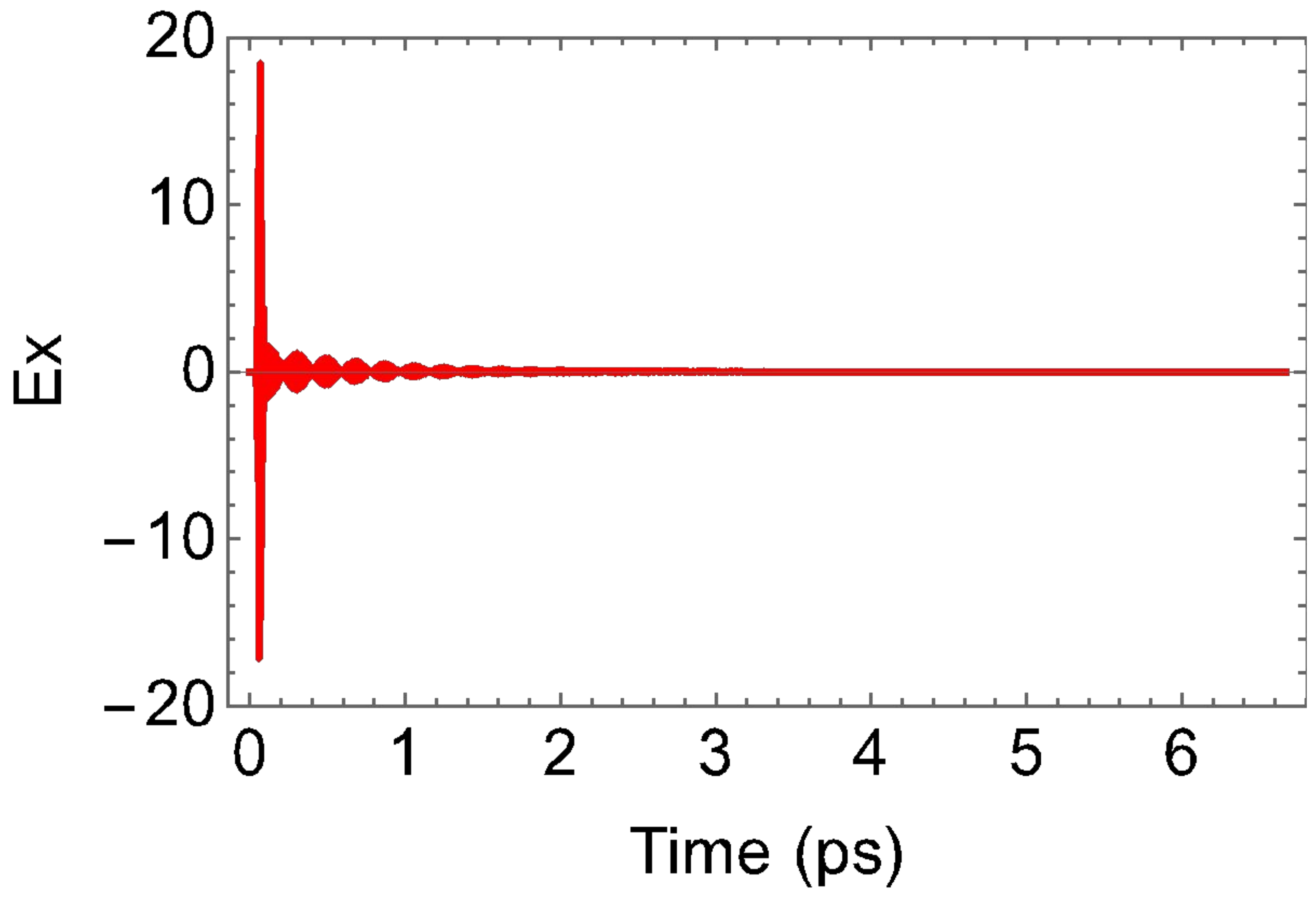


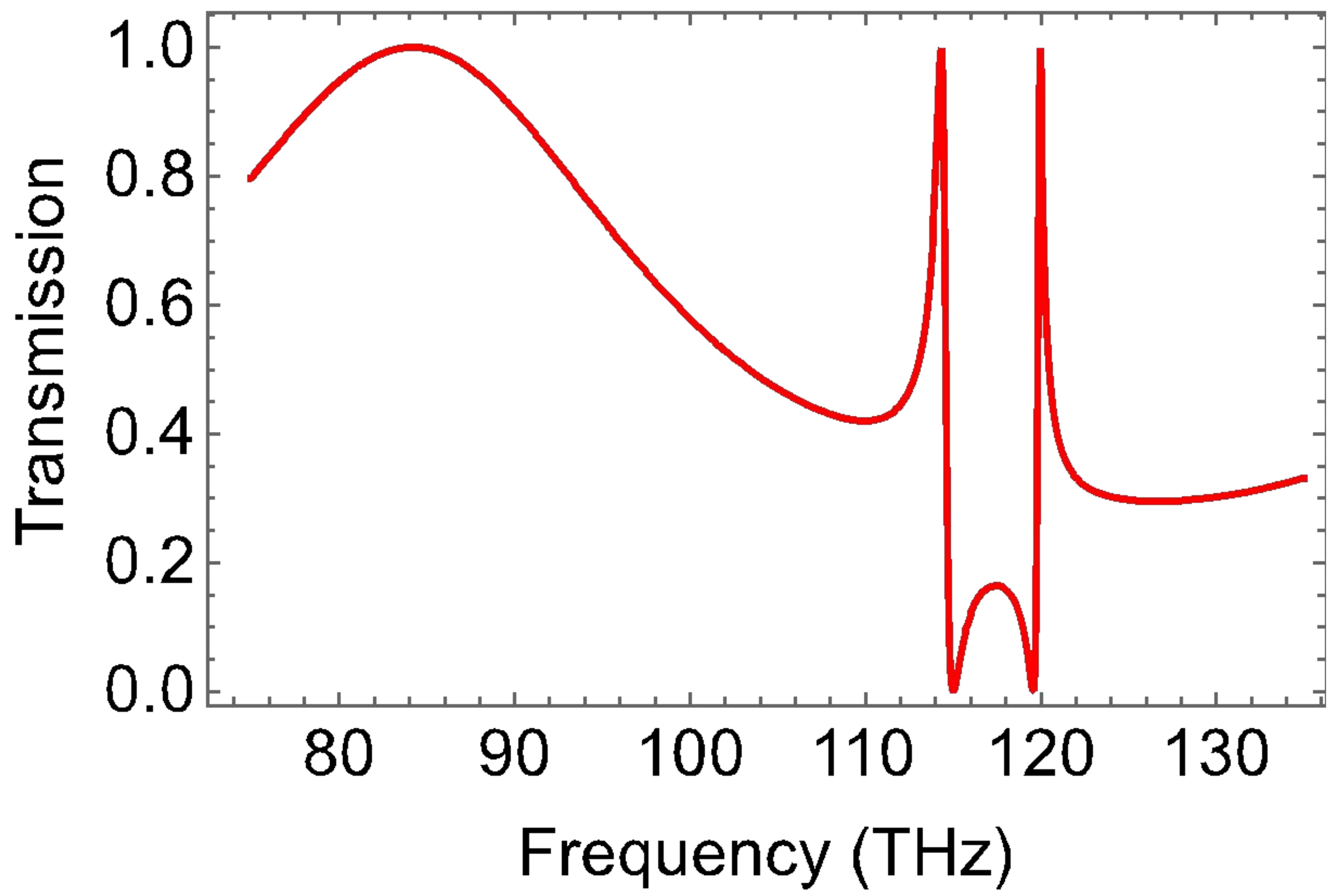




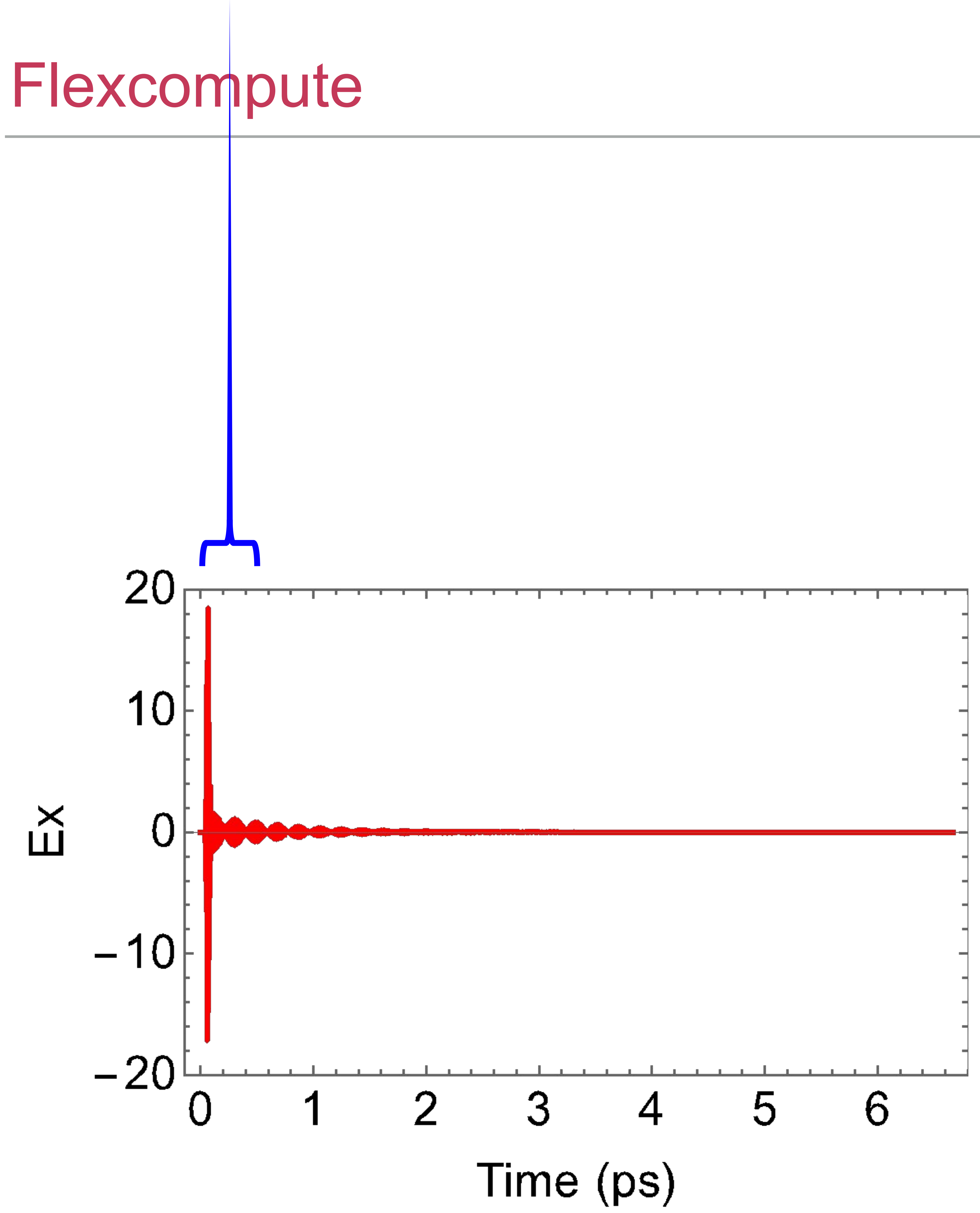


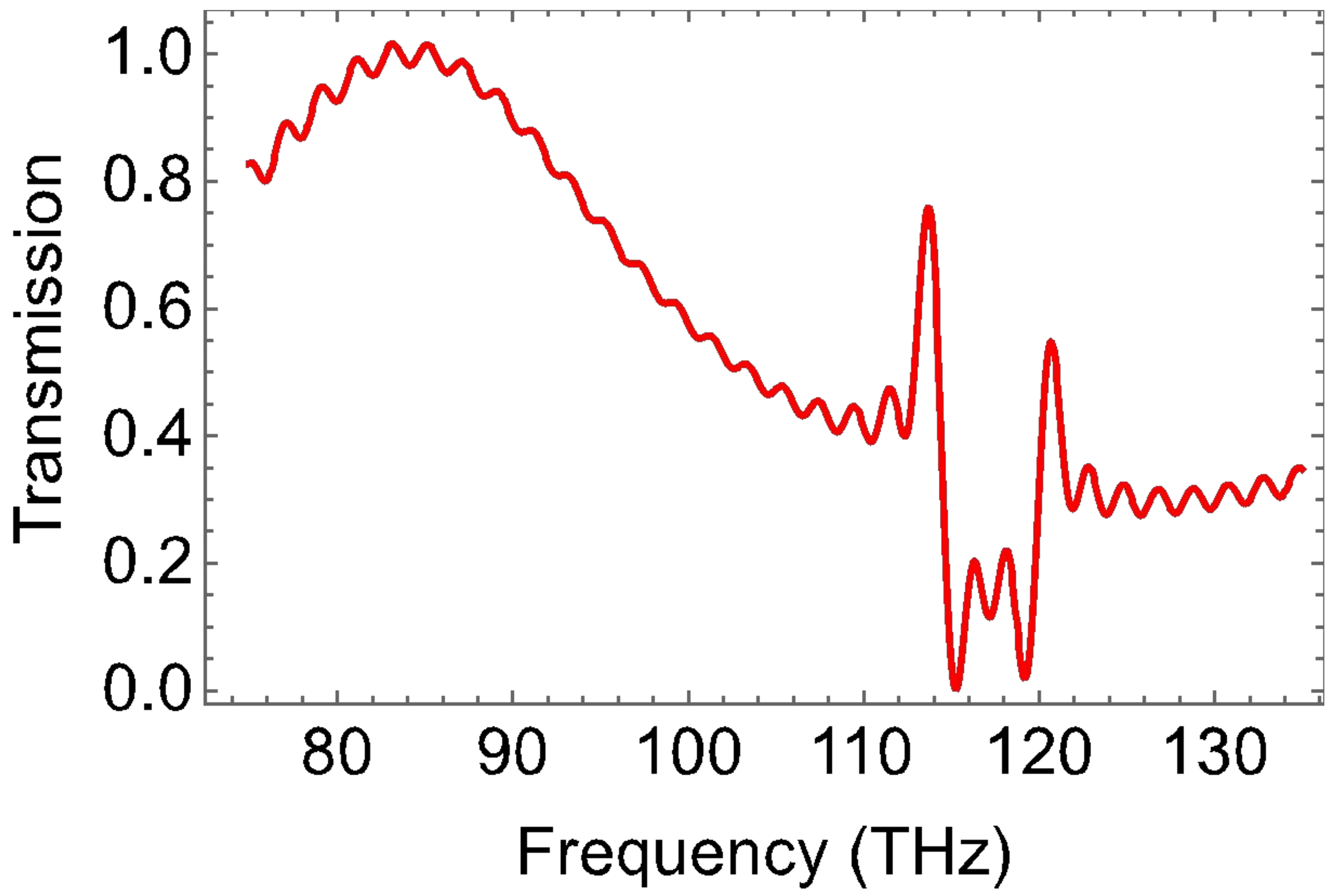
For resonant structures, it is important to choose a sufficiently long run time, such that the resonant field completely decays away.

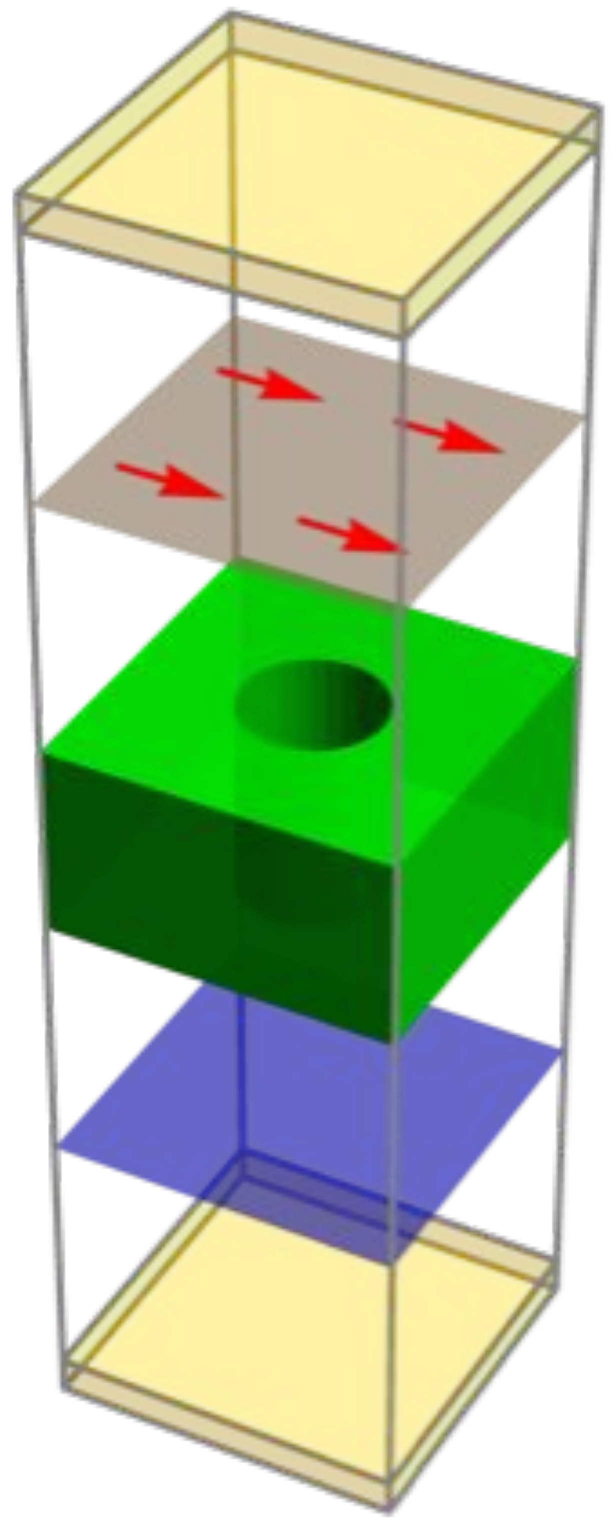




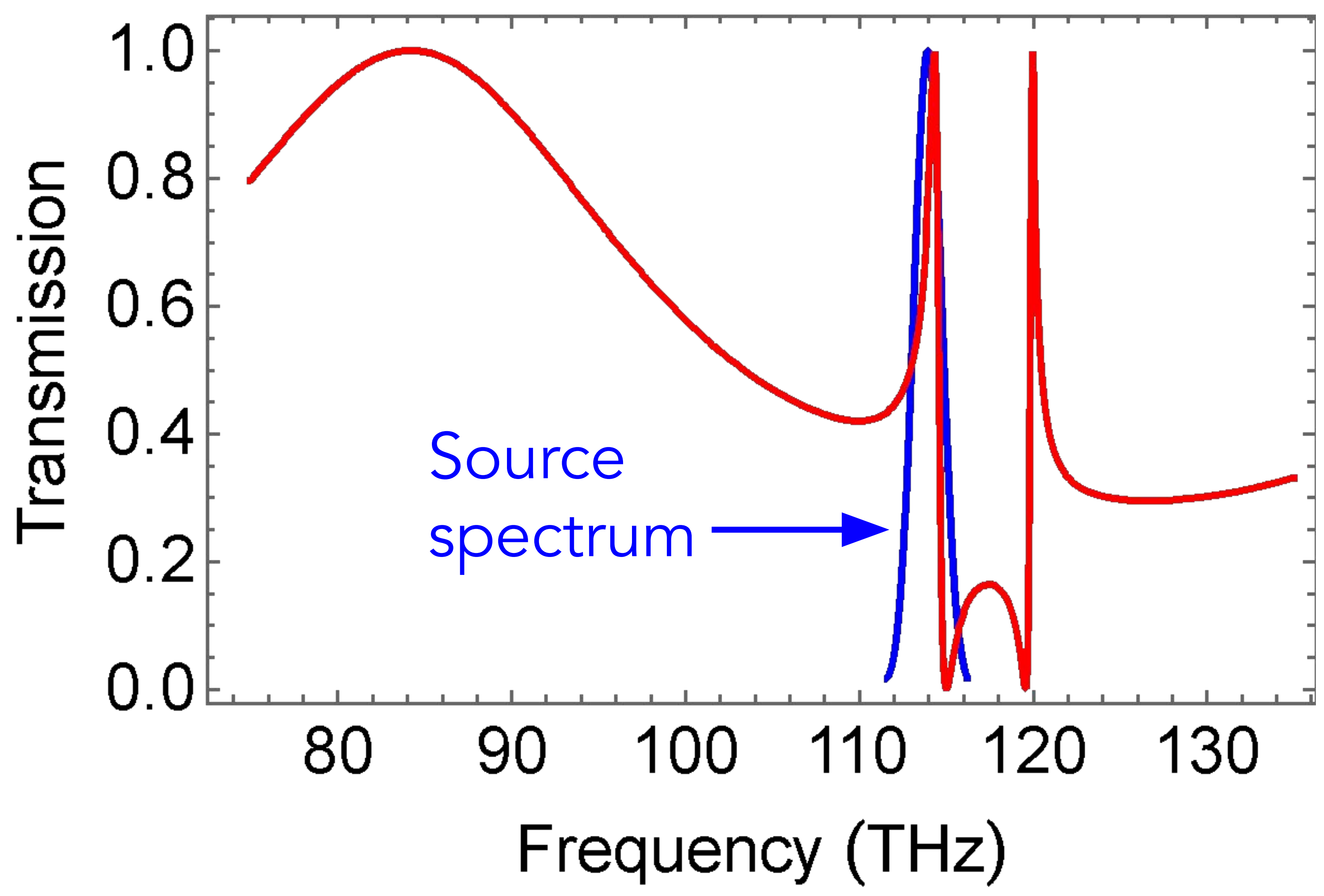
Obtained spectrum for 0.56ps simulation time



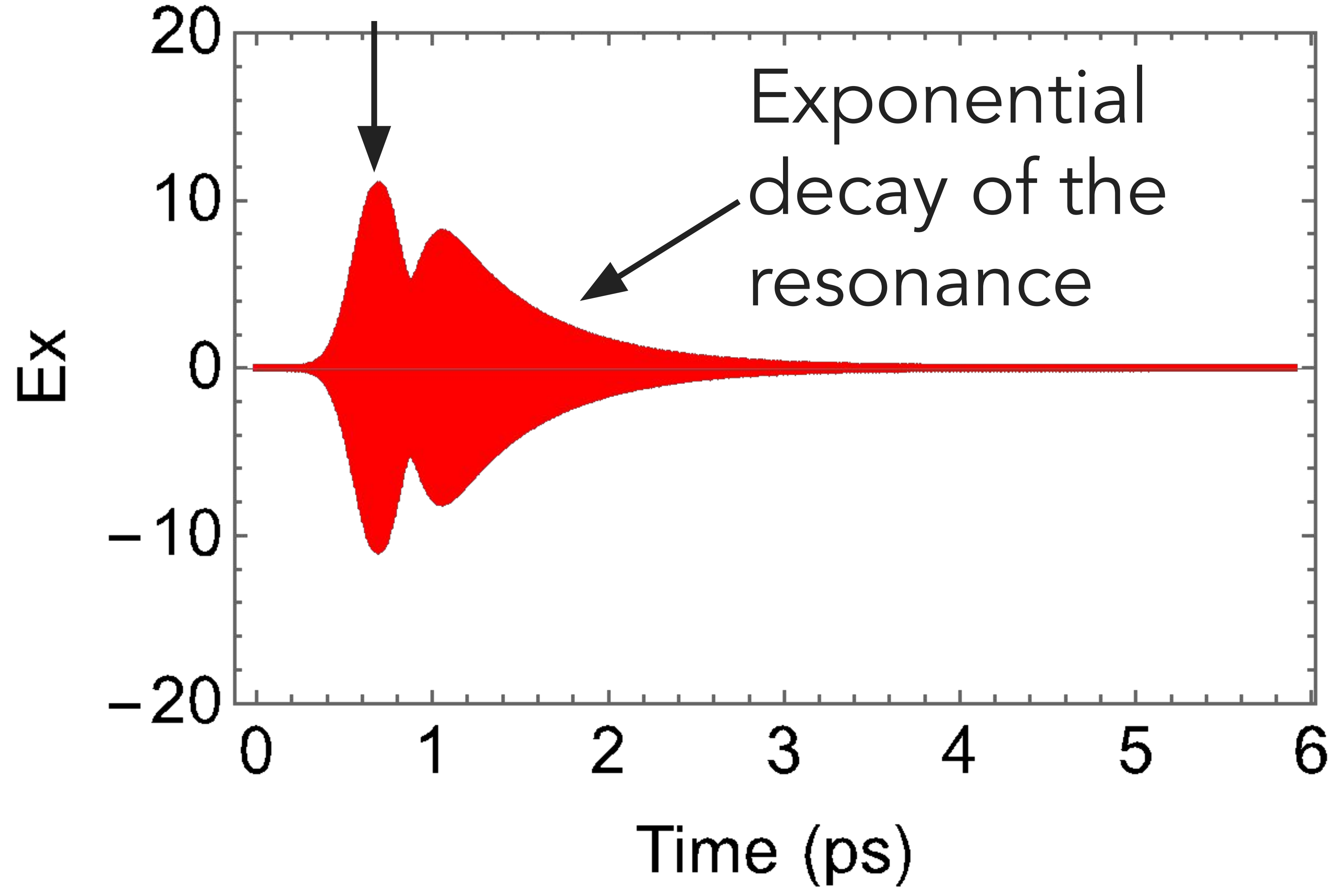




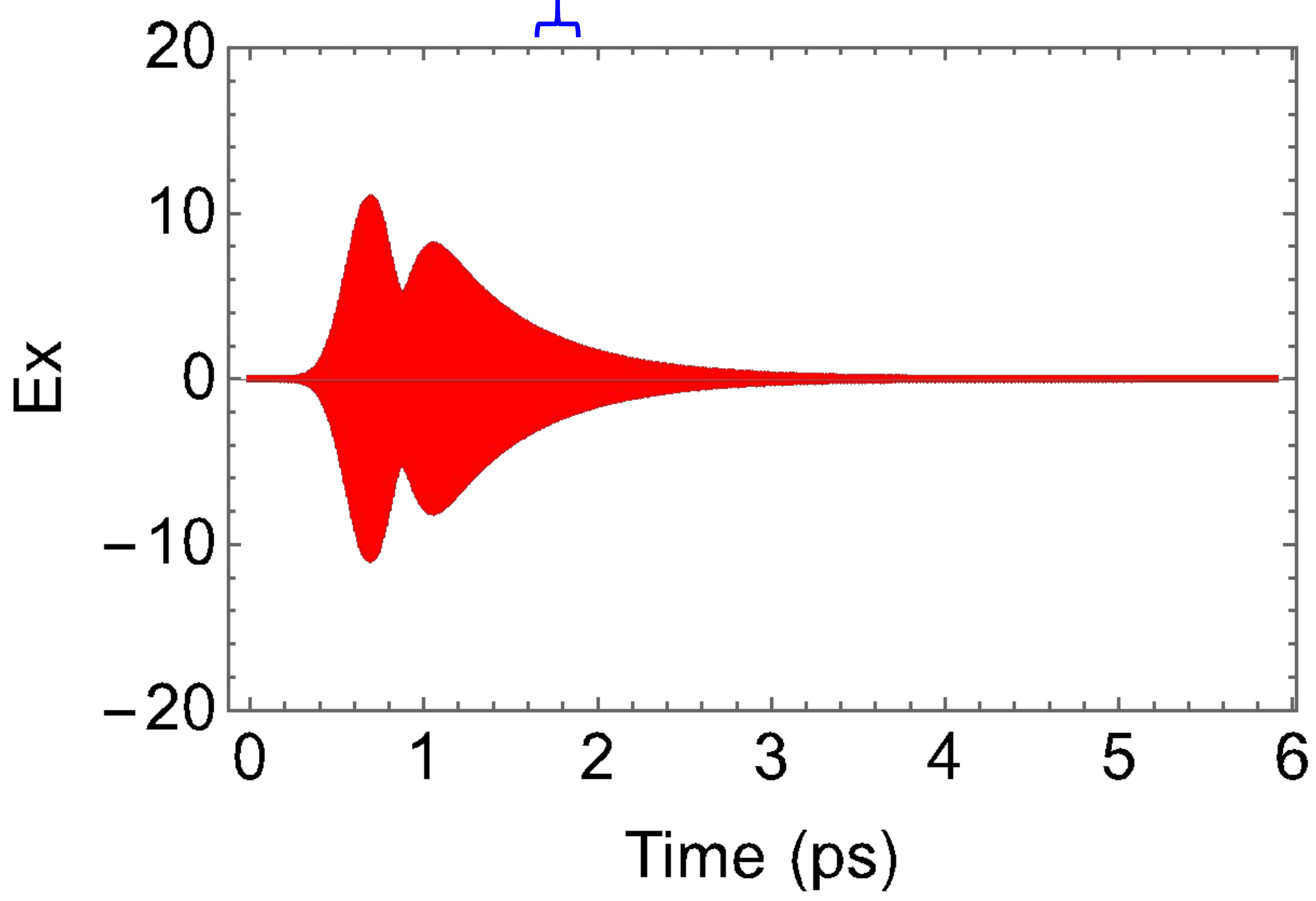
One can selectively excite one resonance with the use of a narrow band source

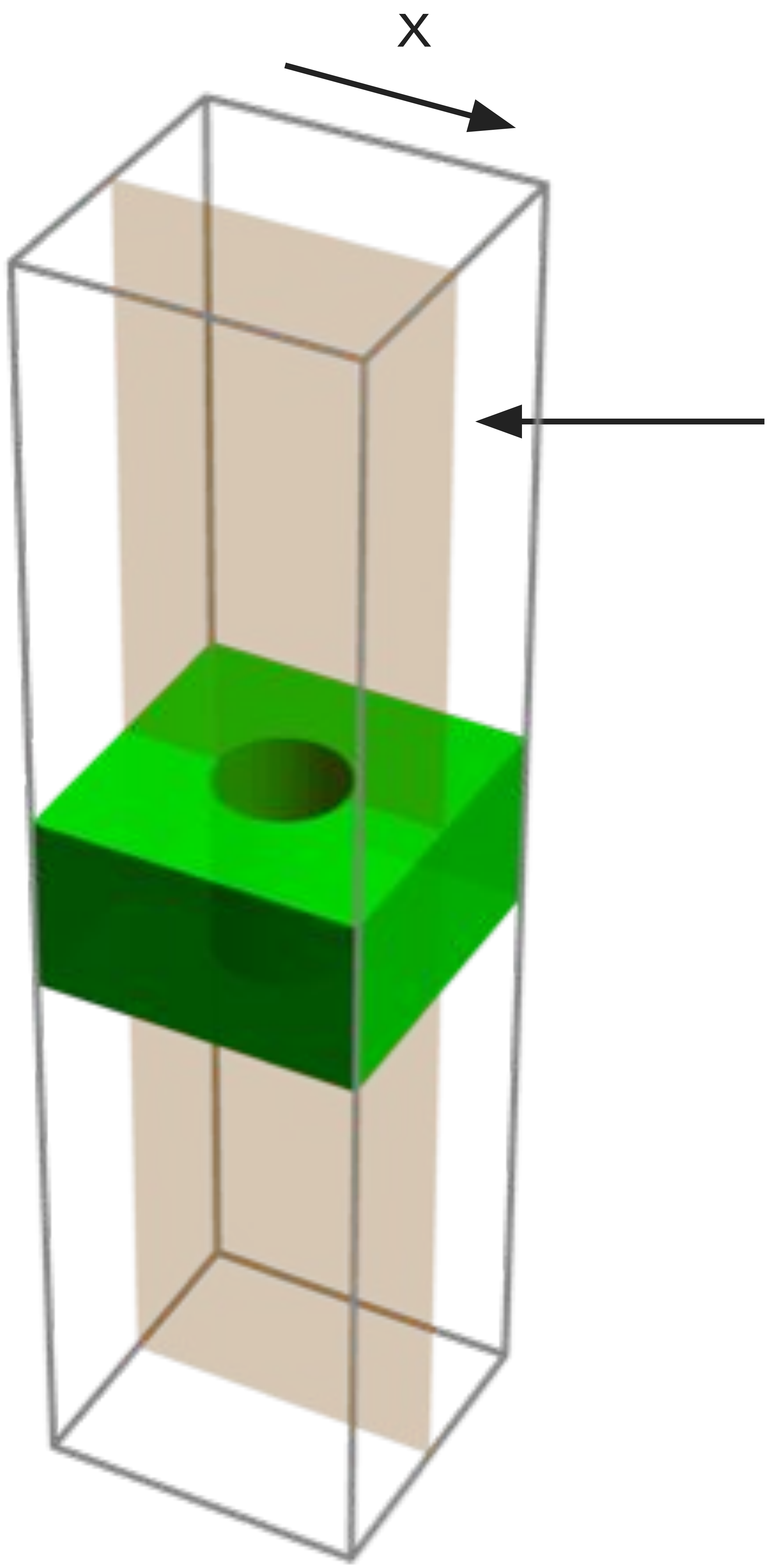


Initial pulse



Movie for the time evolution of the resonance field





Ex-field