

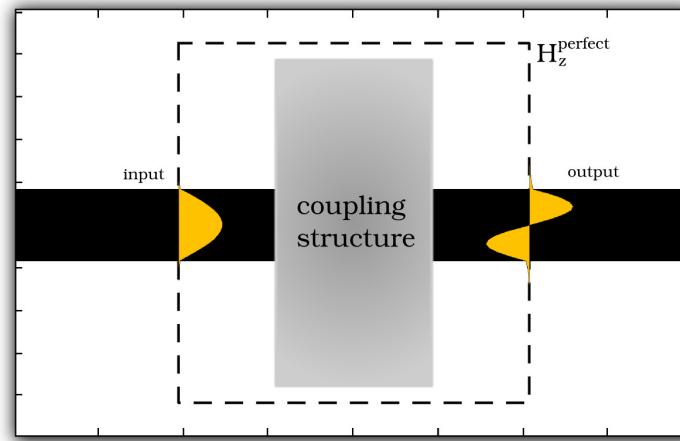
**Jesse Lu, inverse design mini-conf, 2012-07-02**

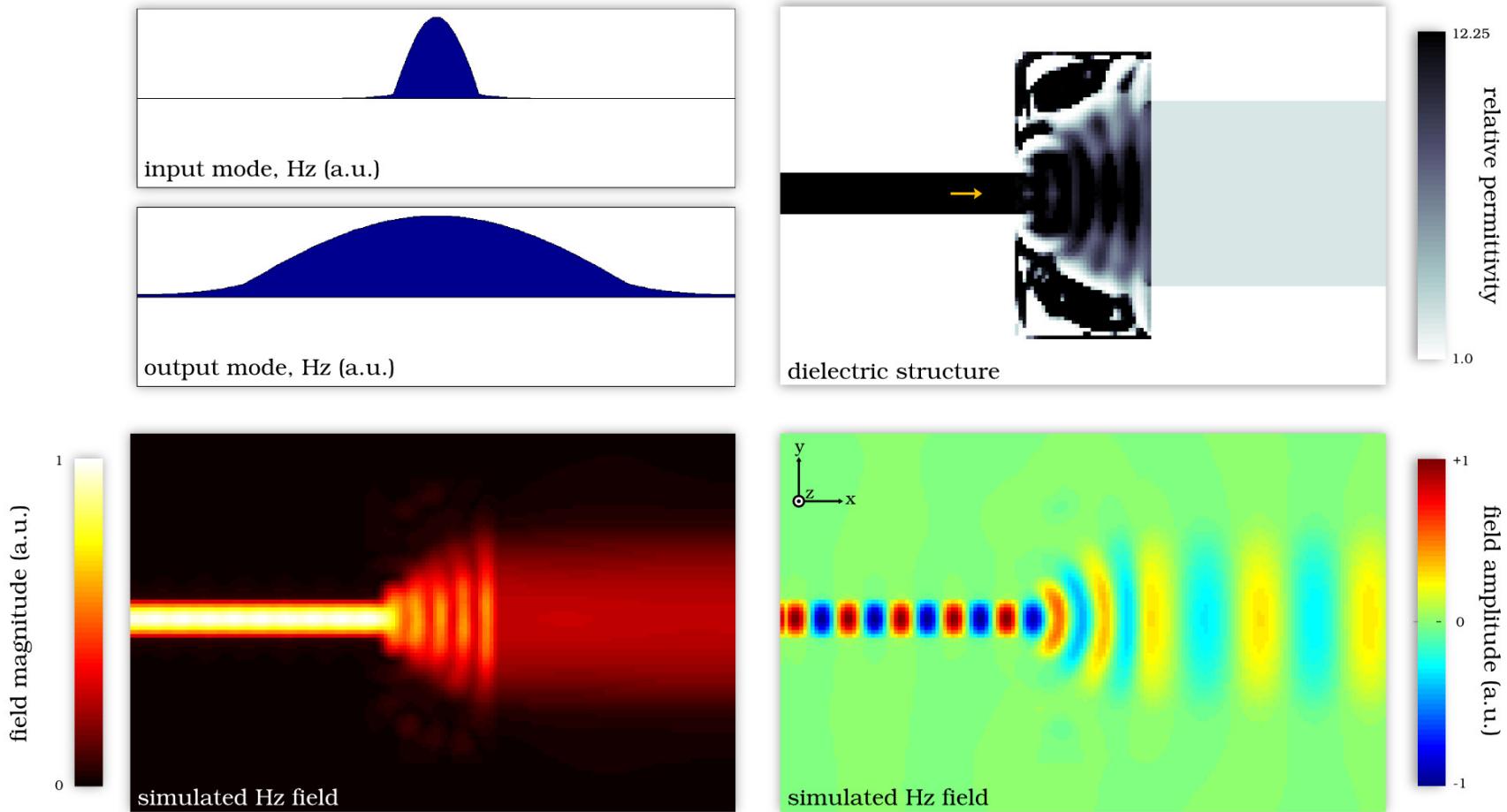
## Ob-1 says...

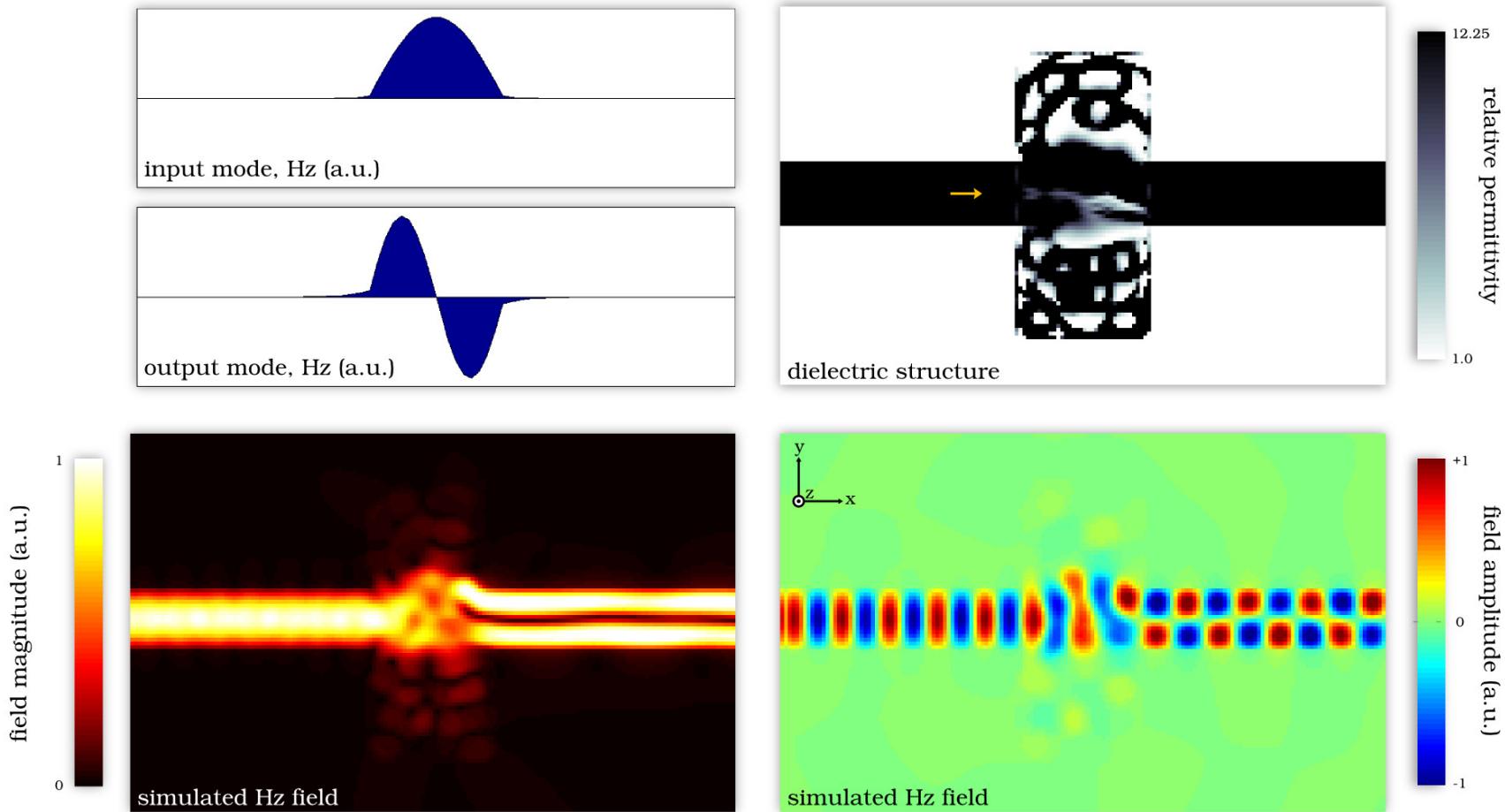
$$\begin{aligned} & \underset{x,p}{\text{minimize}} && \|A(p)x - b(p)\|^2 \\ & \text{subject to} && f(x) = f_{\text{ideal}} \\ & && p_0 \leq p \leq p_1. \end{aligned}$$

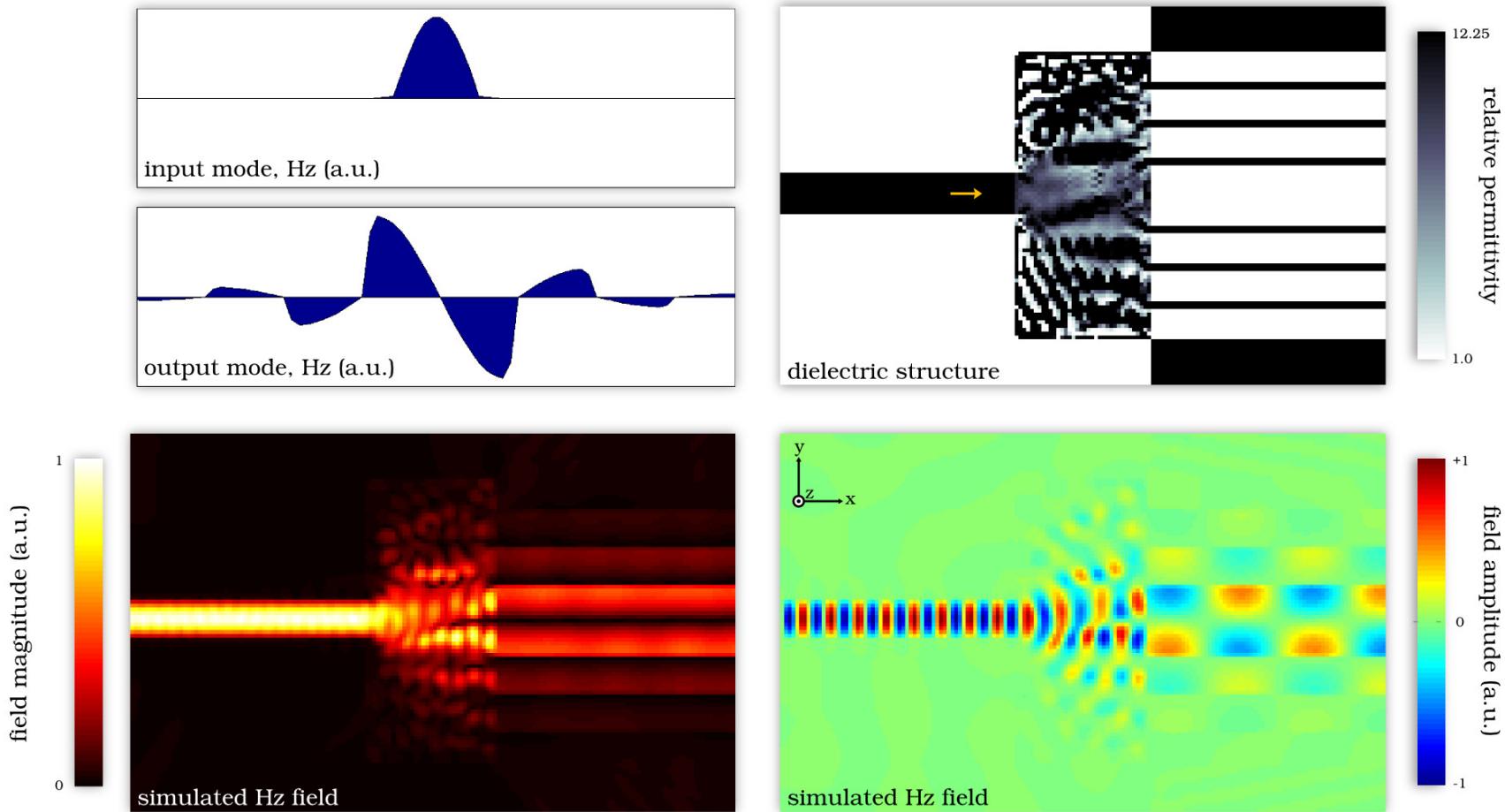
- $x \rightarrow H$
- $p \rightarrow \epsilon^{-1}$
- $A(p)x - b(p) \rightarrow \nabla \times \epsilon^{-1} \nabla \times H - \mu \omega^2 H$
- In general,  $A(p)x - b(p) \neq 0$ , the *physics residual*

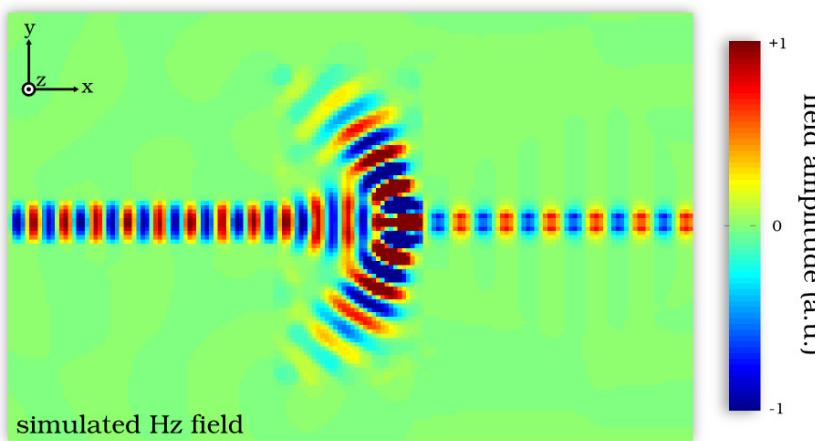
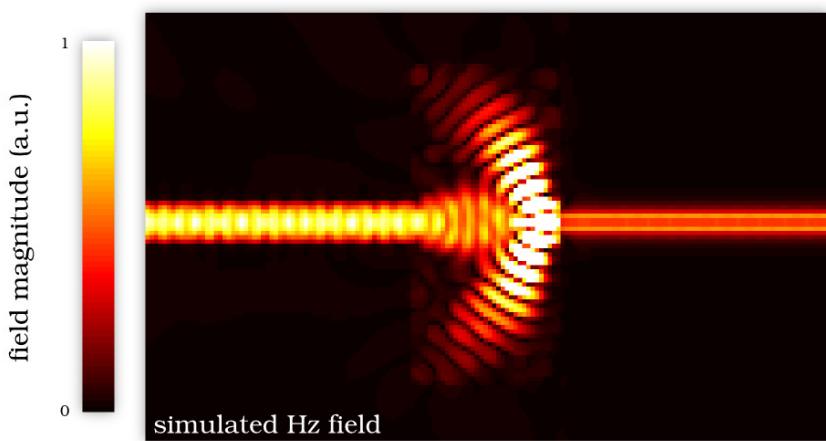
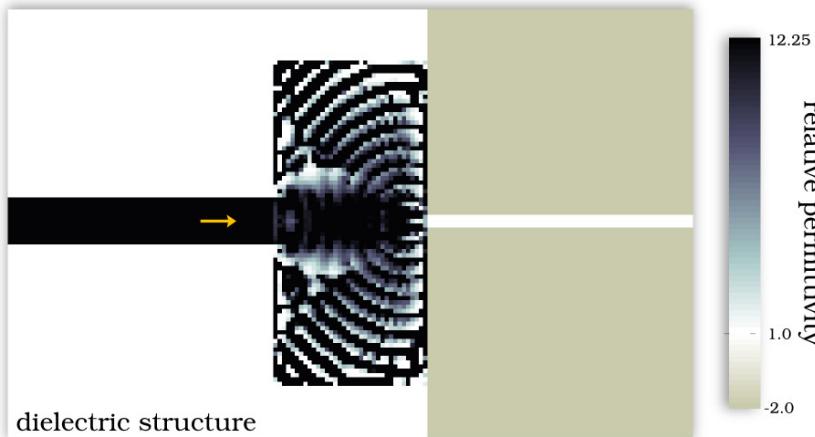
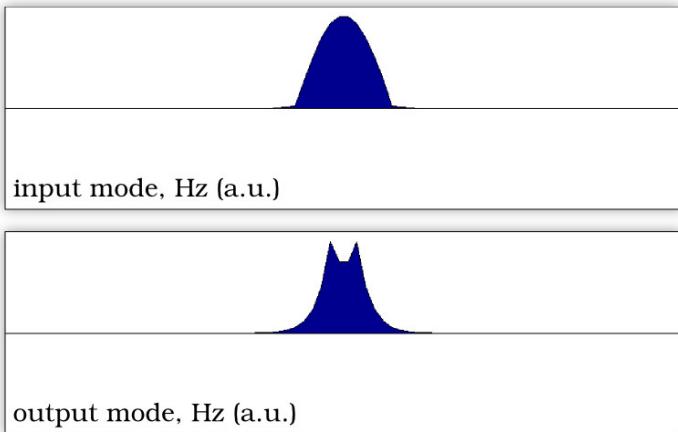
- $f(x)$  is the *design objective*, always met.

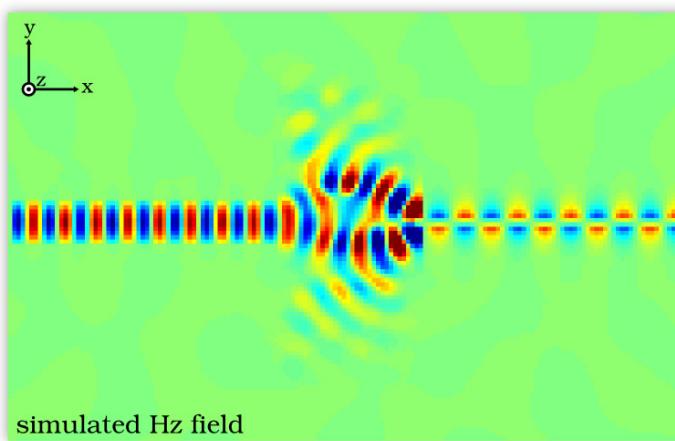
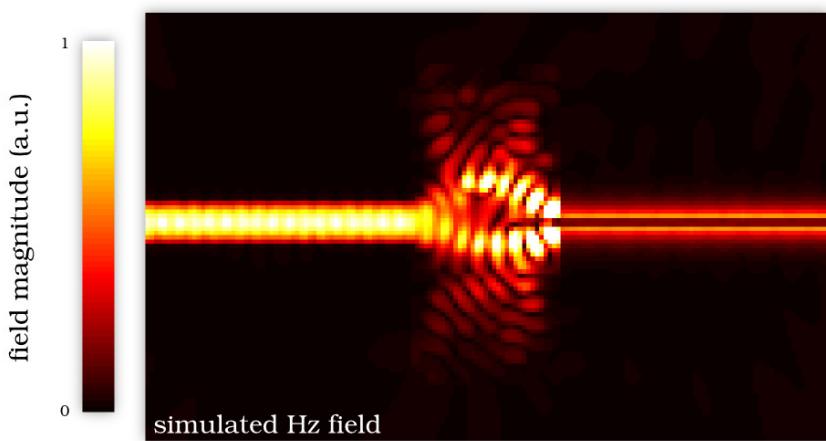
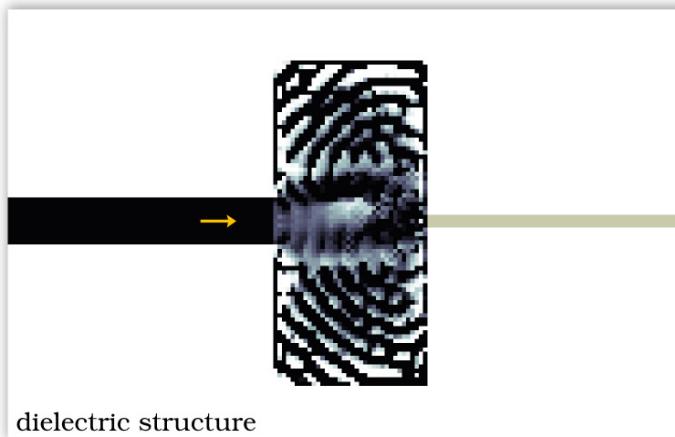
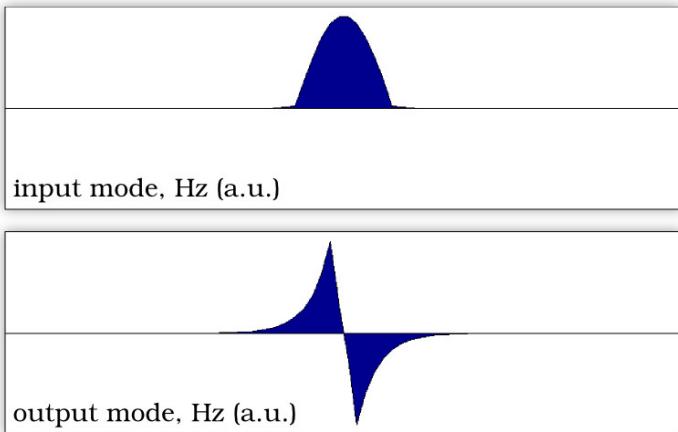






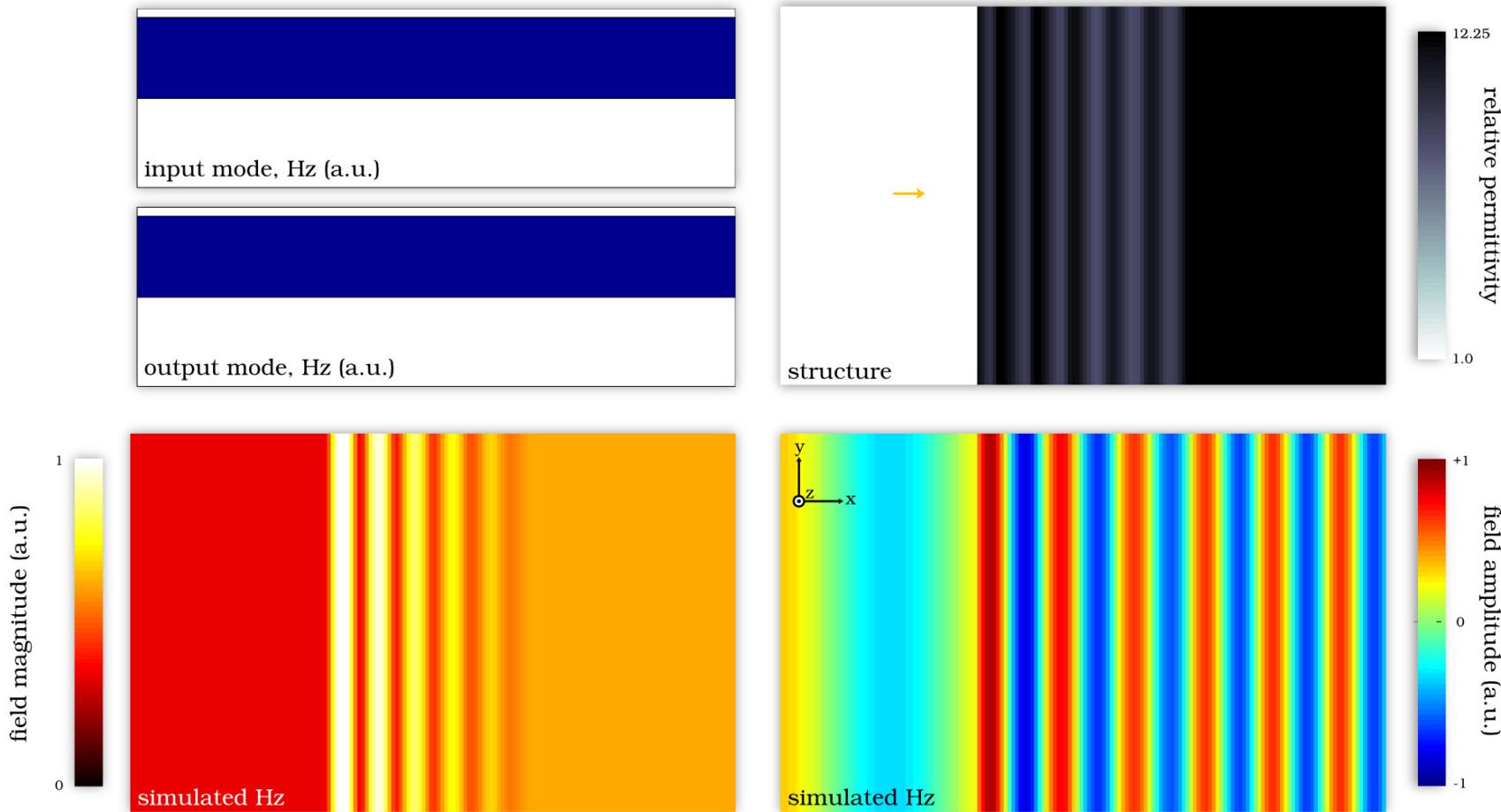


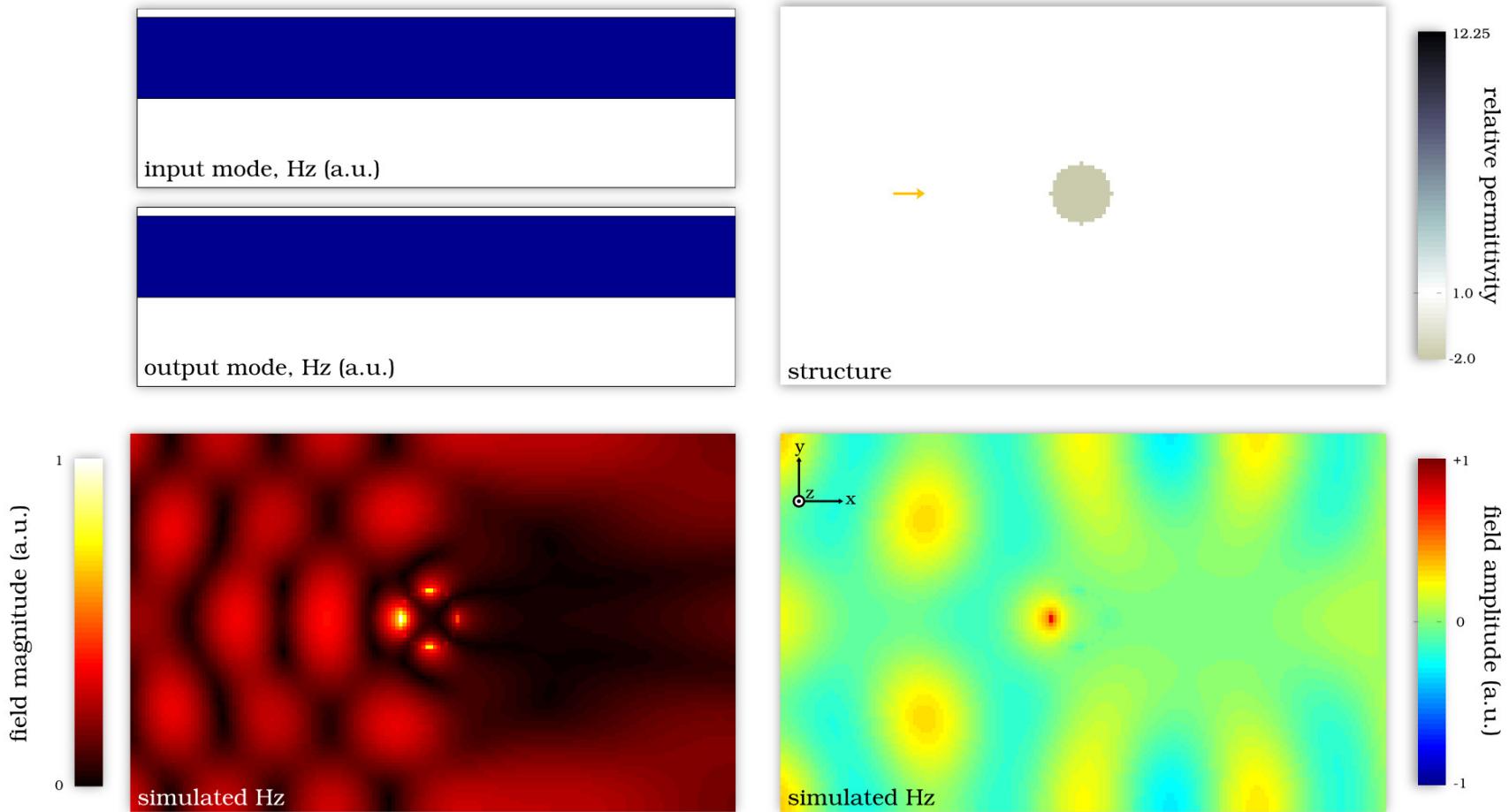


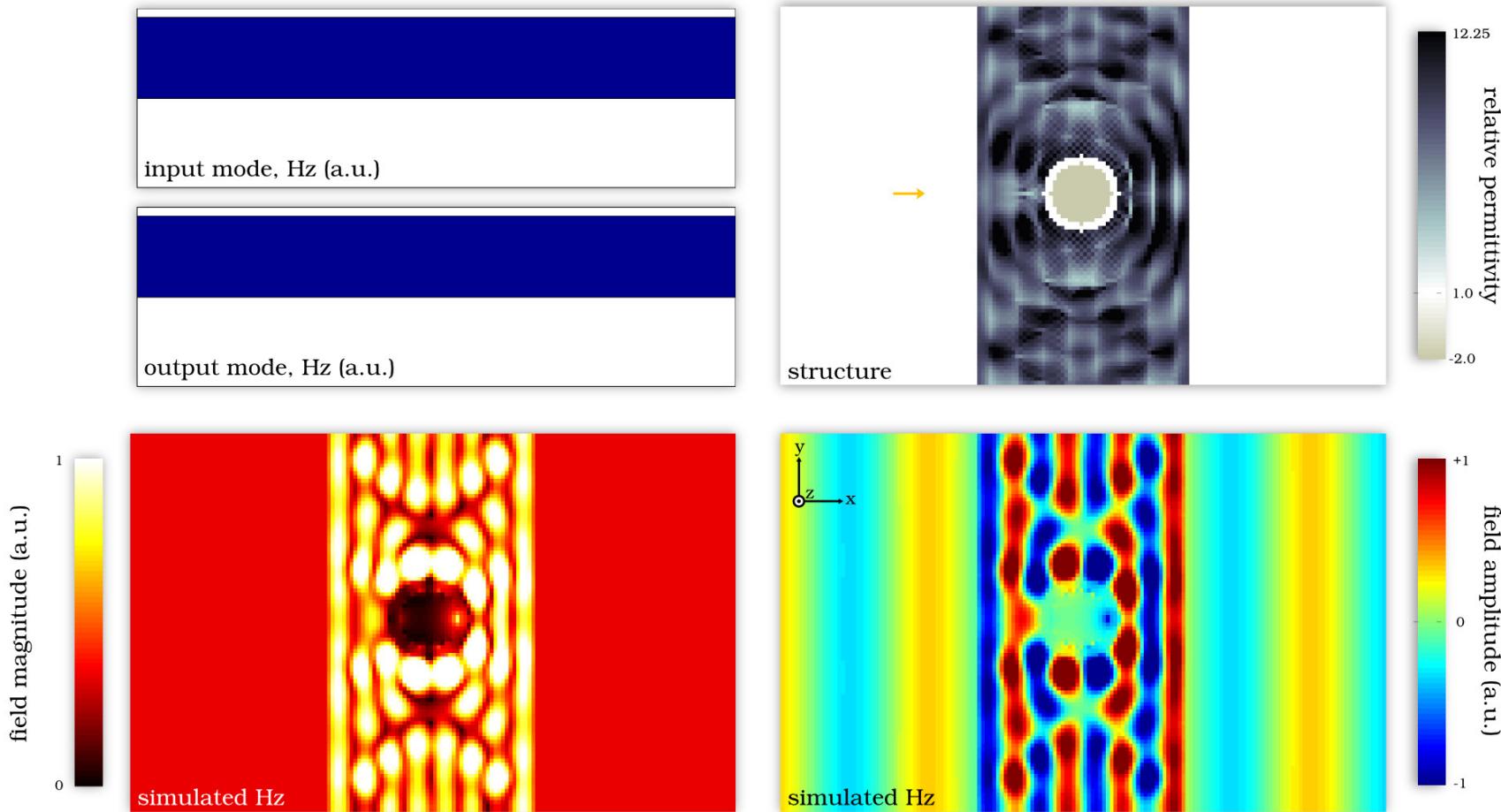


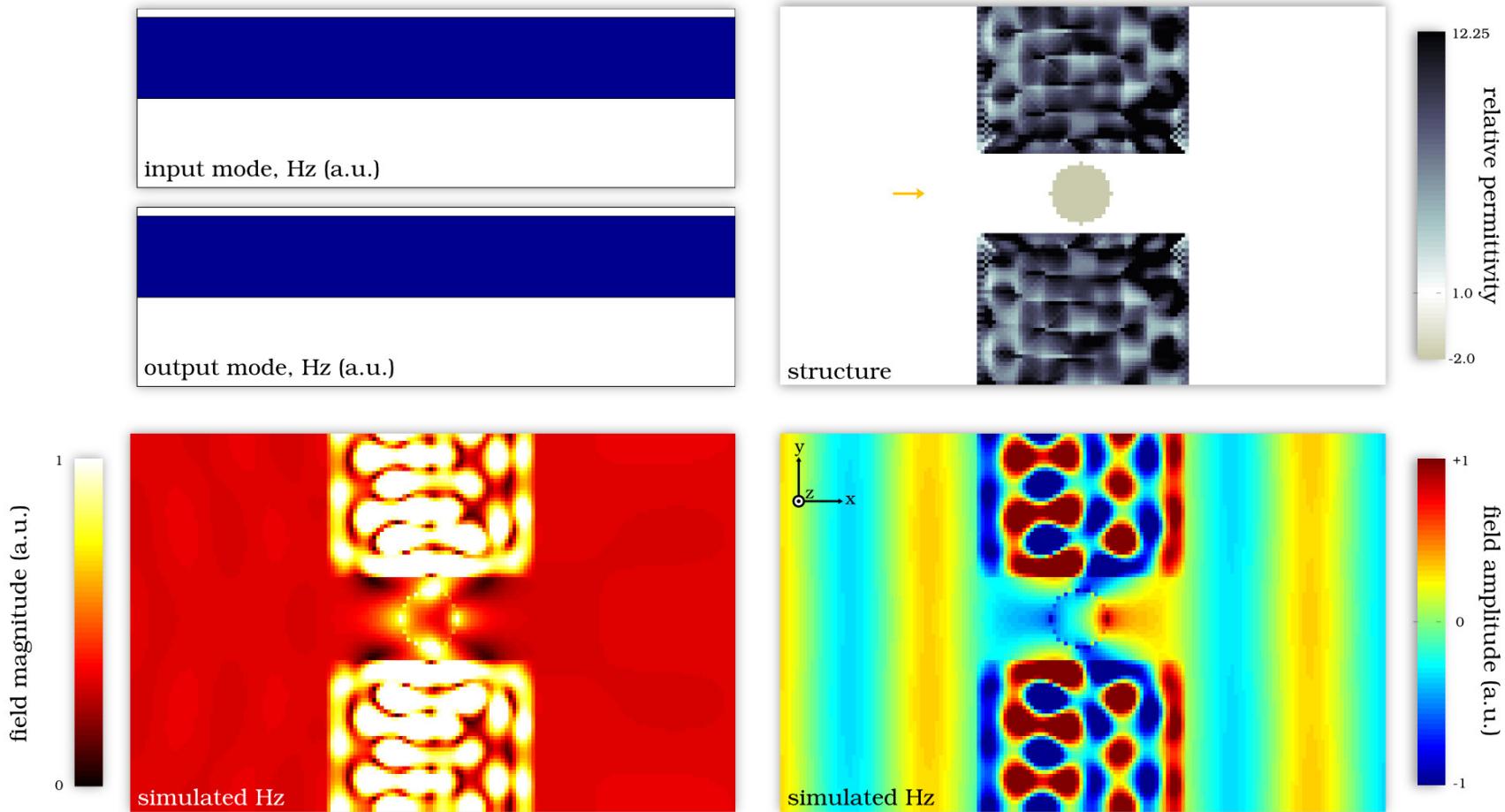
## **Ob-1, metamaterials also do, you must.**

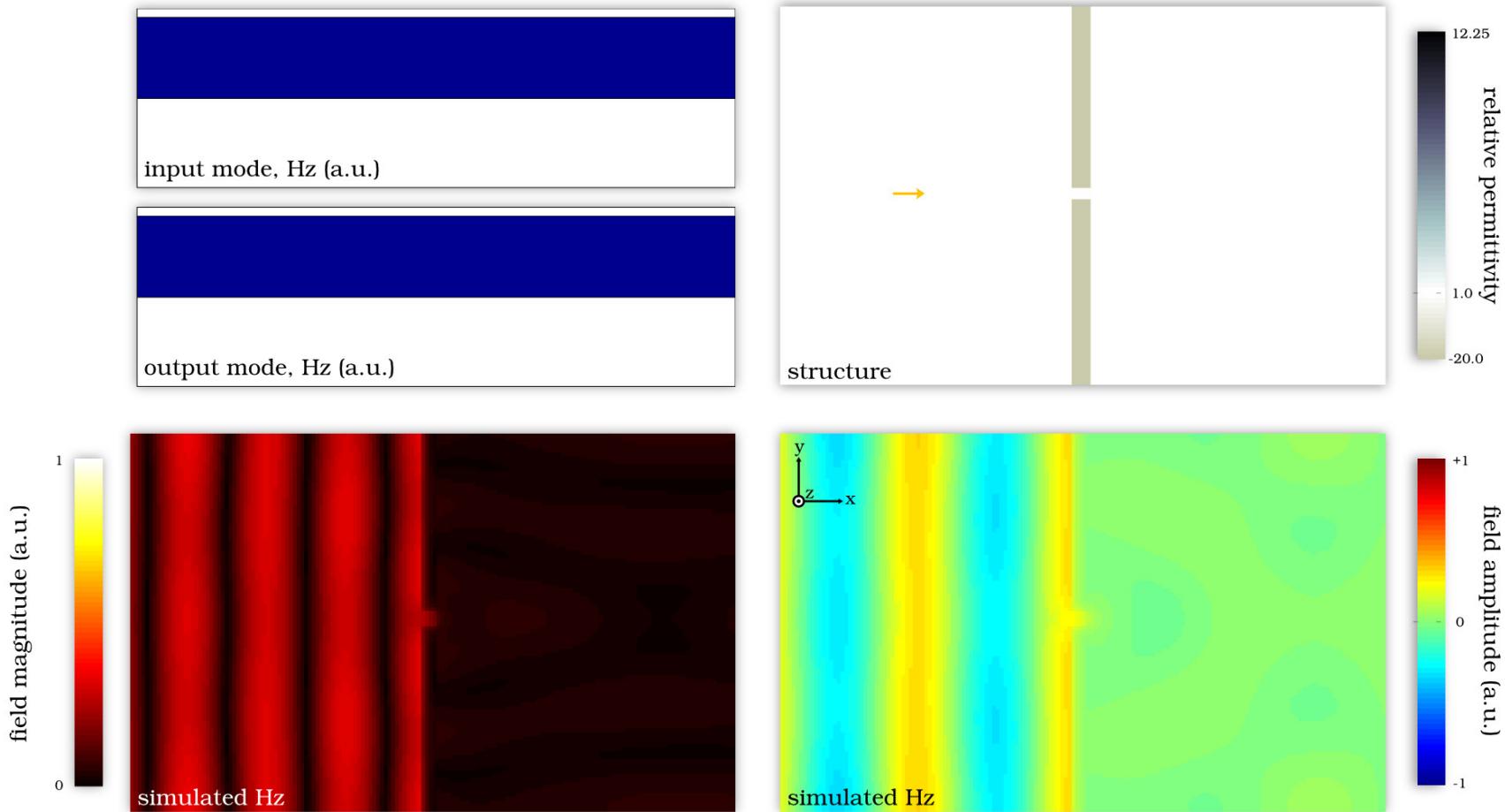
- Try two classes: cloaks and mimics.
- Only modification: periodic boundary conditions on top and bottom.
- Allows for plane waves, and
- consequently only need  $f_{\text{ideal}}$  at left and right (not top and bottom).

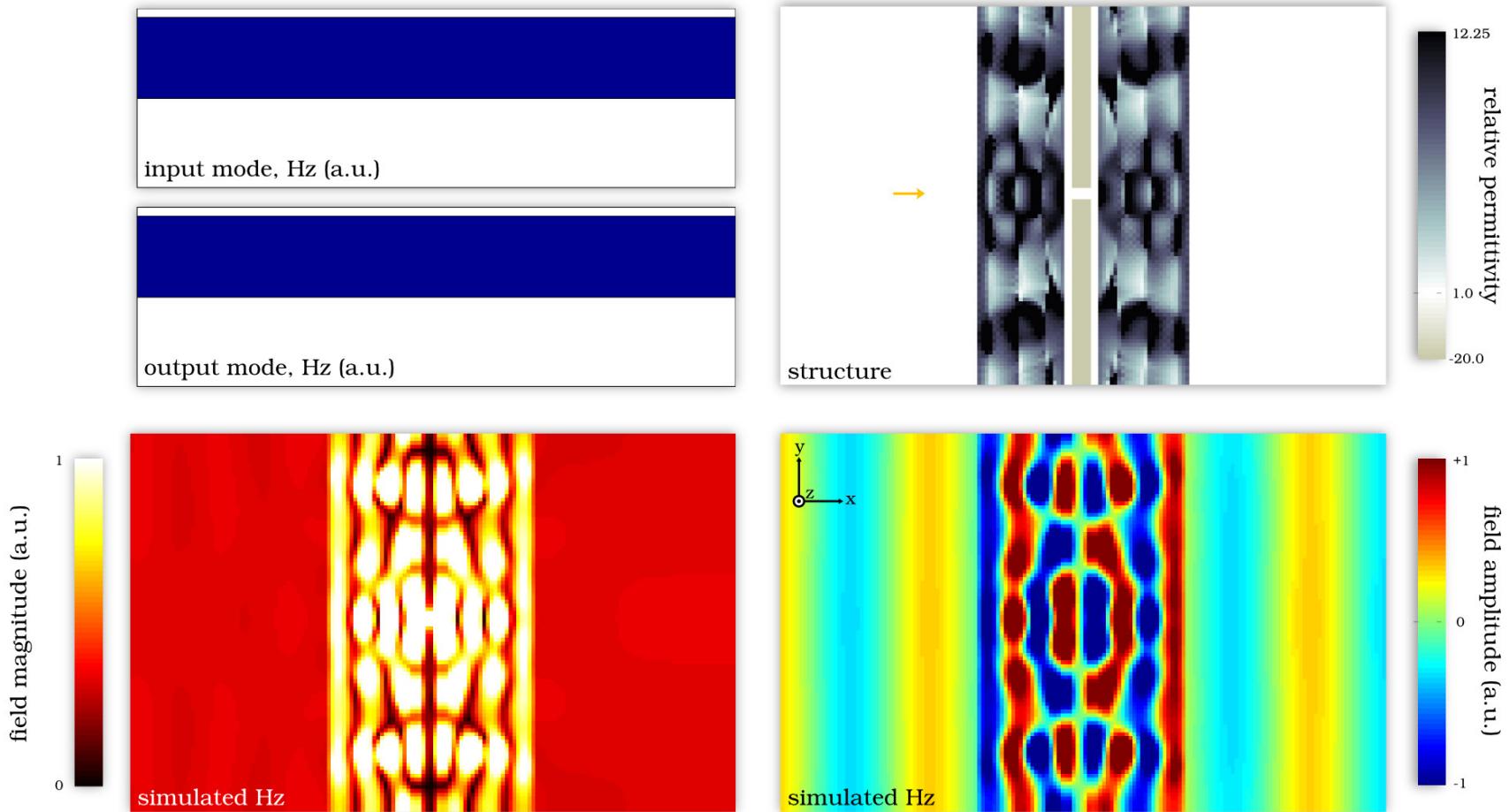


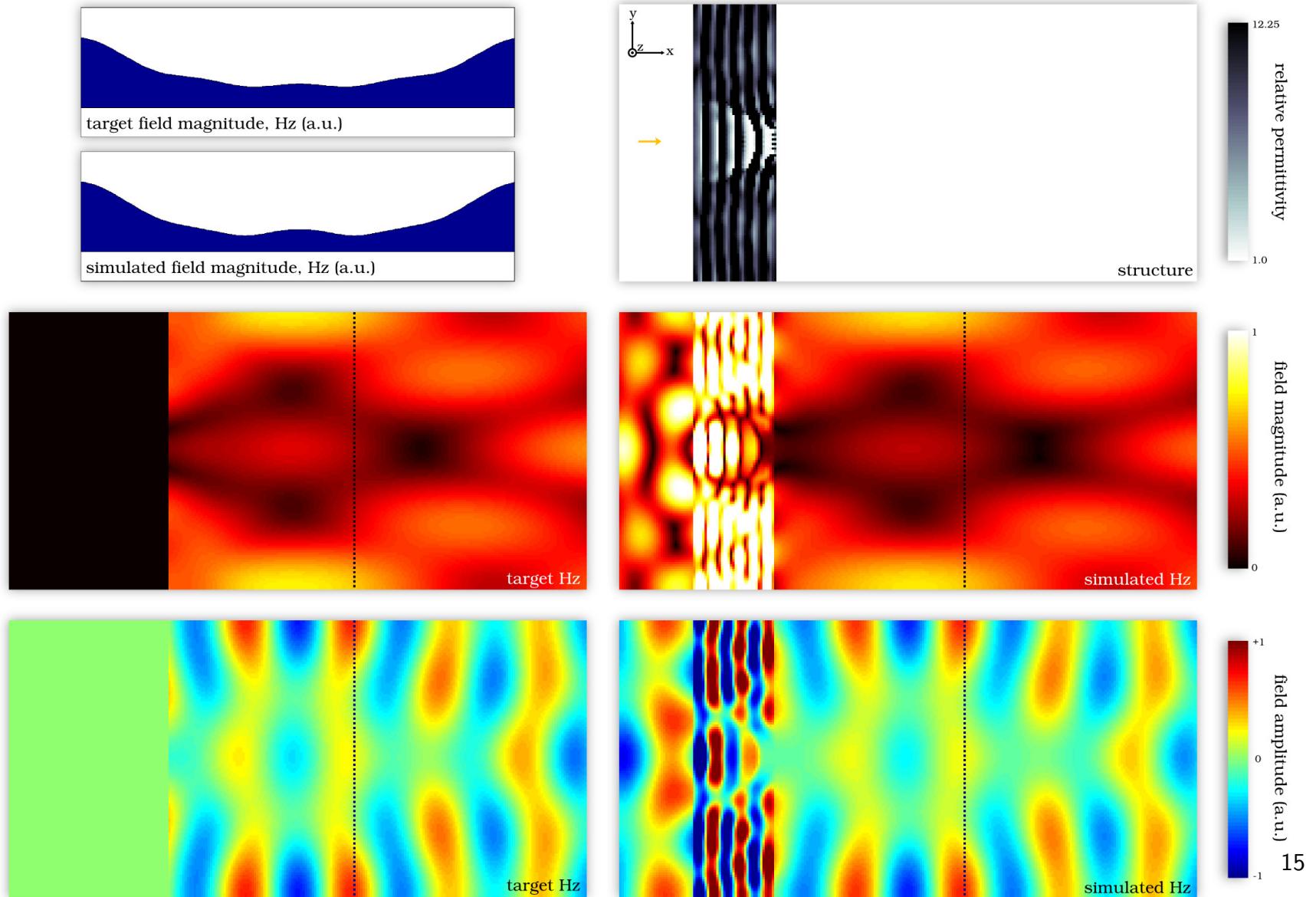


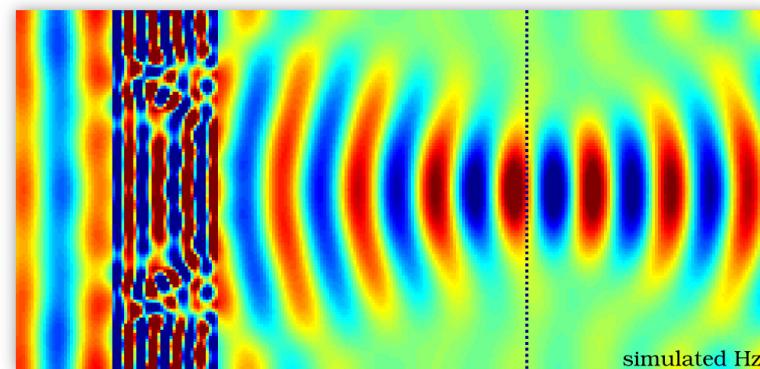
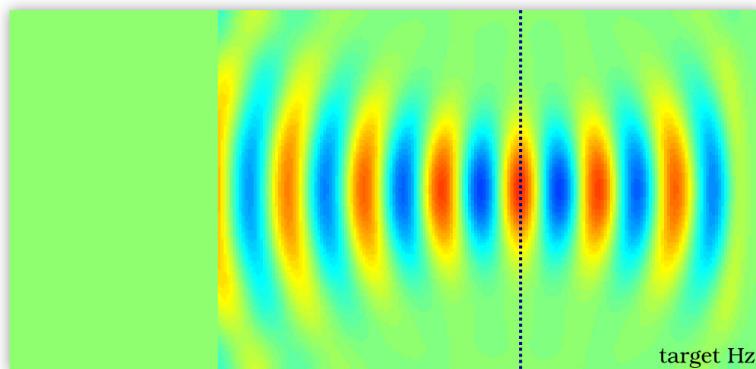
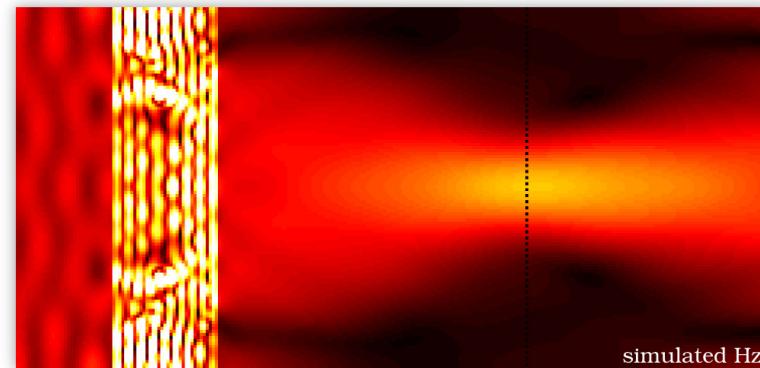
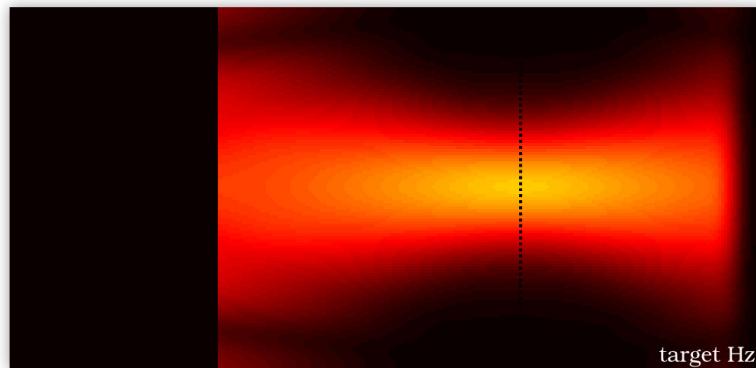
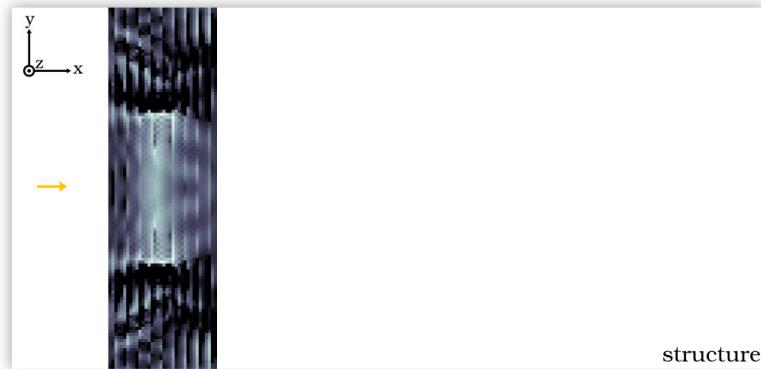
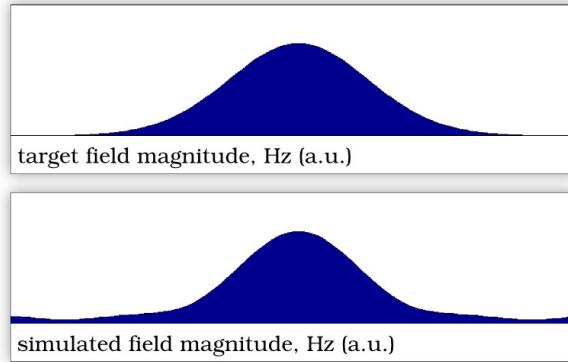


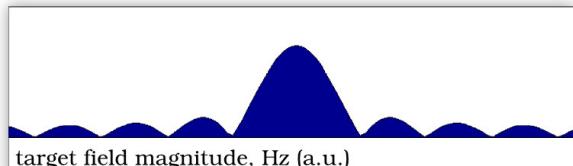




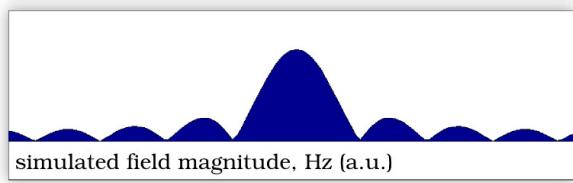




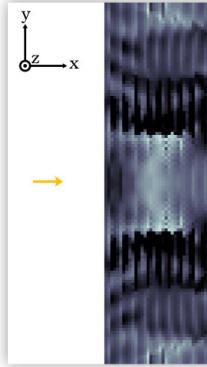




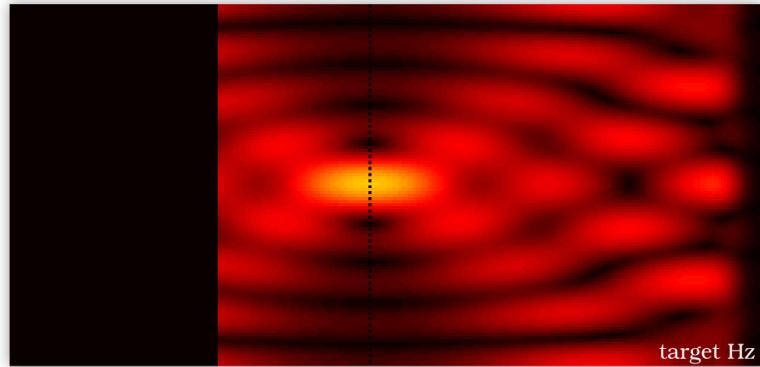
target field magnitude, Hz (a.u.)



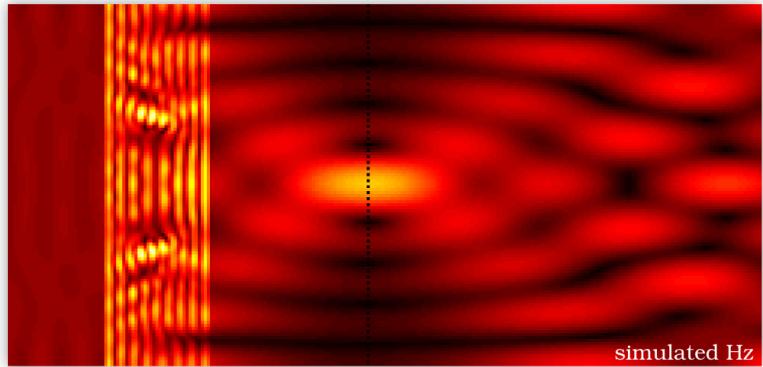
simulated field magnitude, Hz (a.u.)



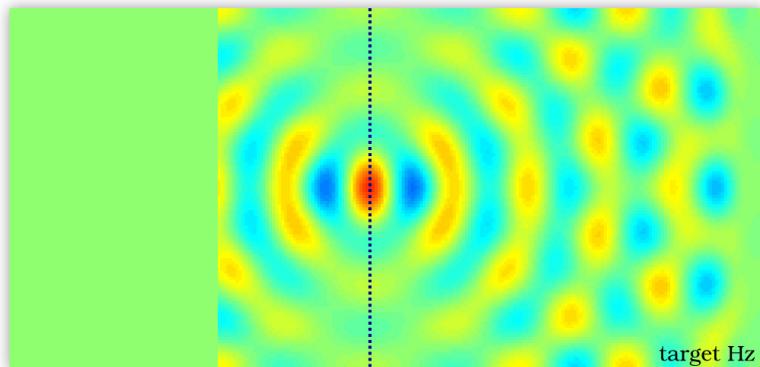
structure



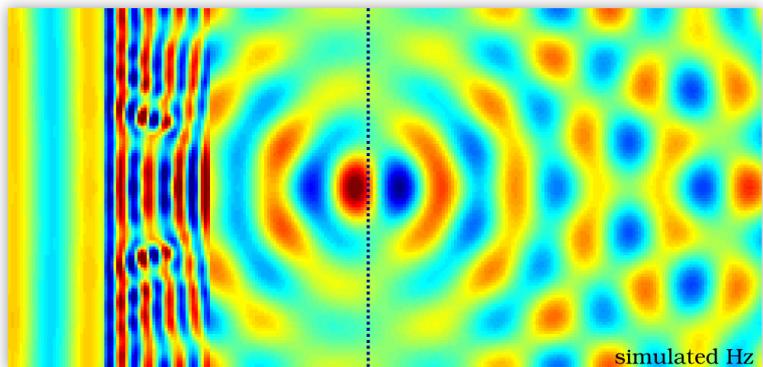
target Hz



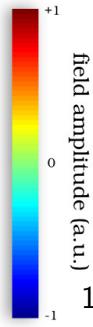
simulated Hz

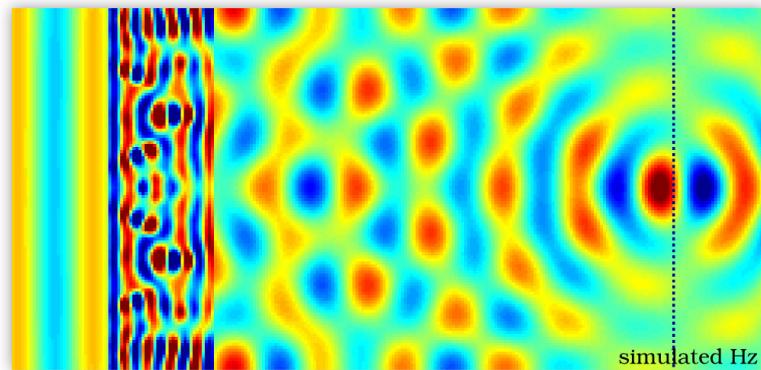
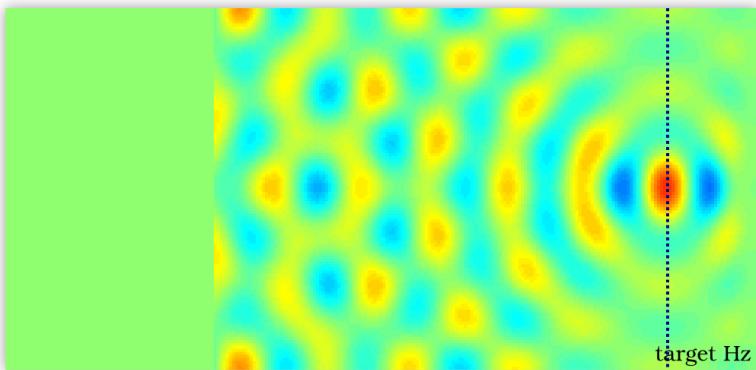
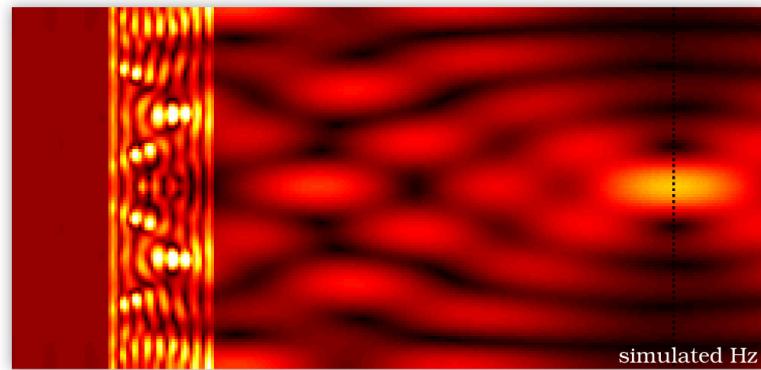
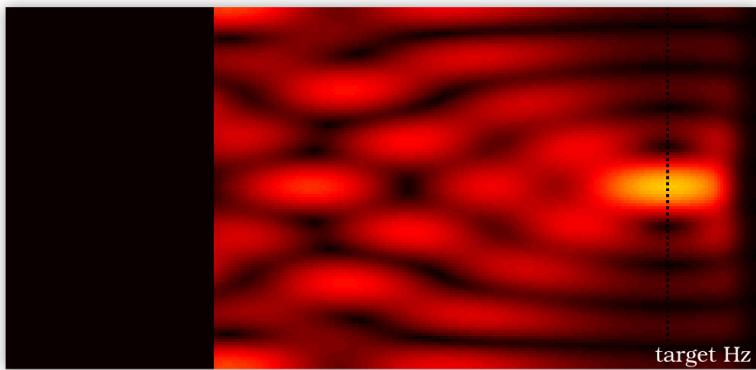
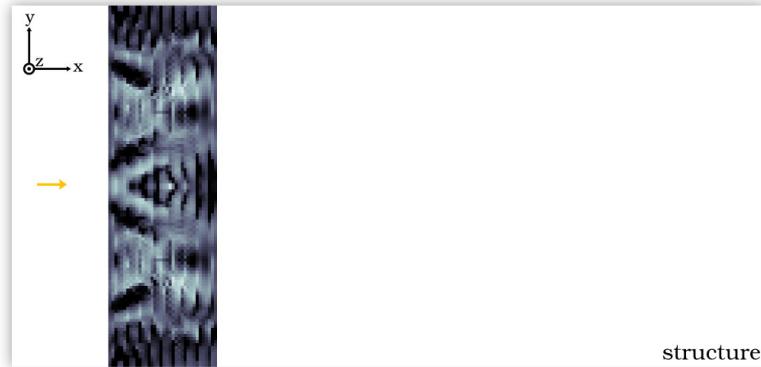
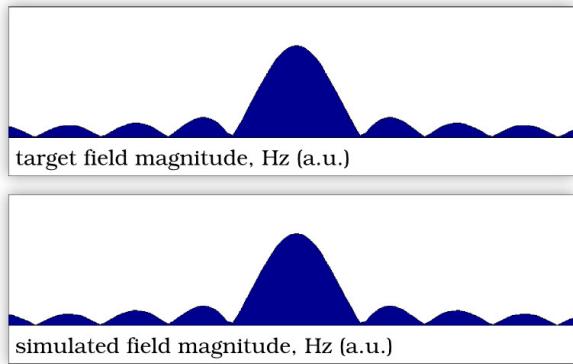


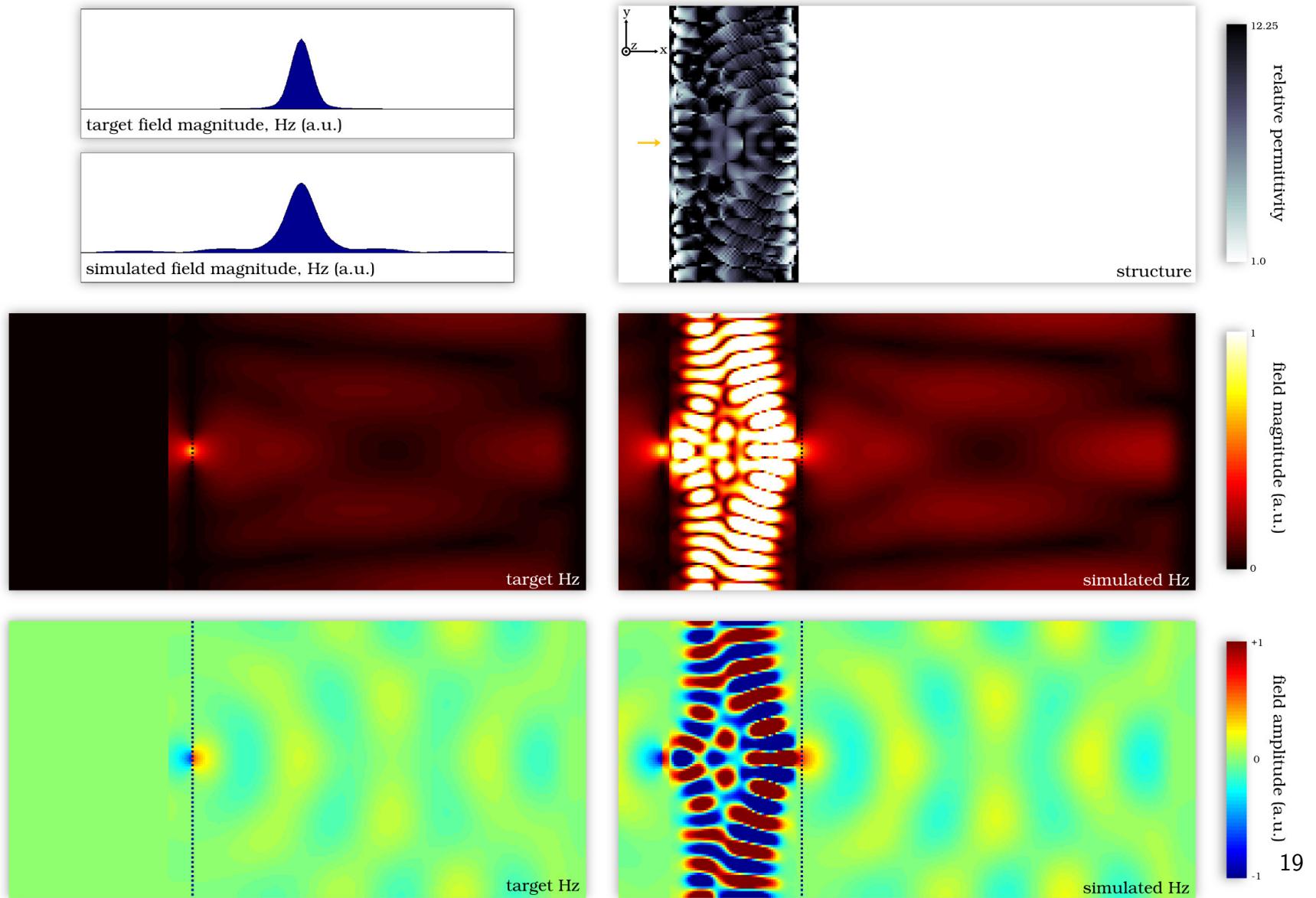
target Hz

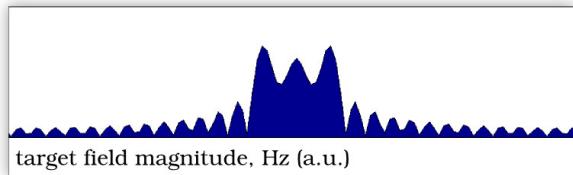


simulated Hz

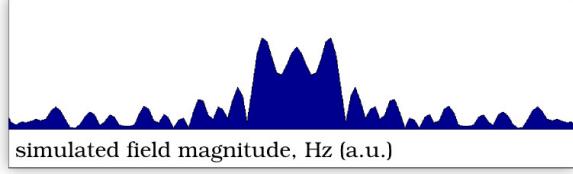




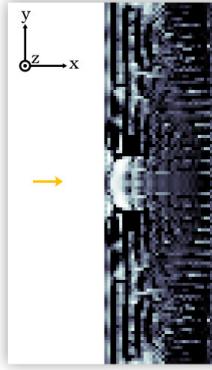




target field magnitude, Hz (a.u.)



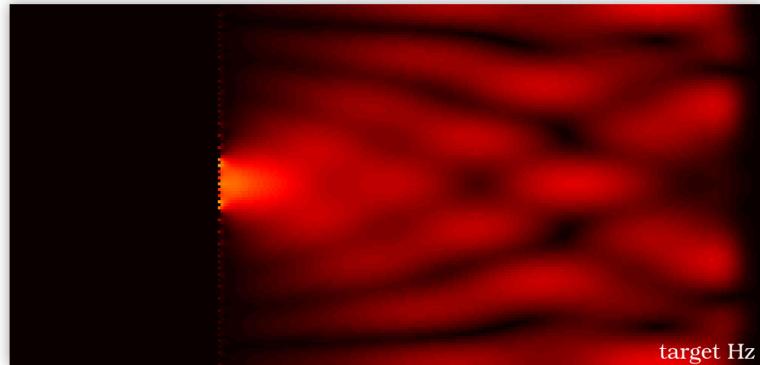
simulated field magnitude, Hz (a.u.)



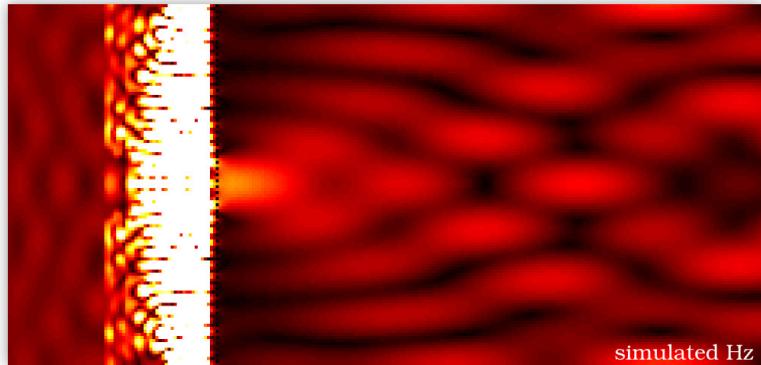
structure



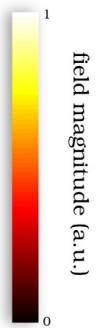
relative permittivity



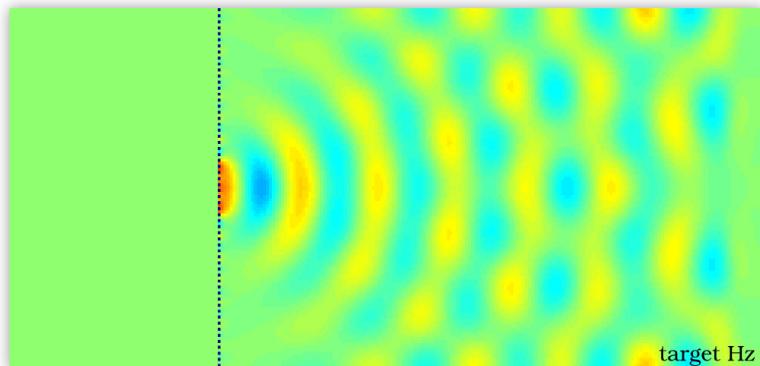
target Hz



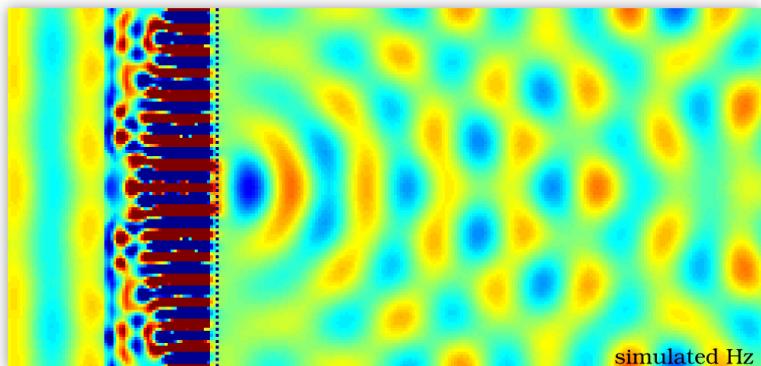
simulated Hz



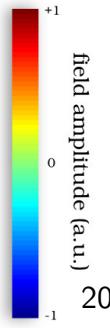
field magnitude (a.u.)



target Hz



simulated Hz



field amplitude (a.u.)