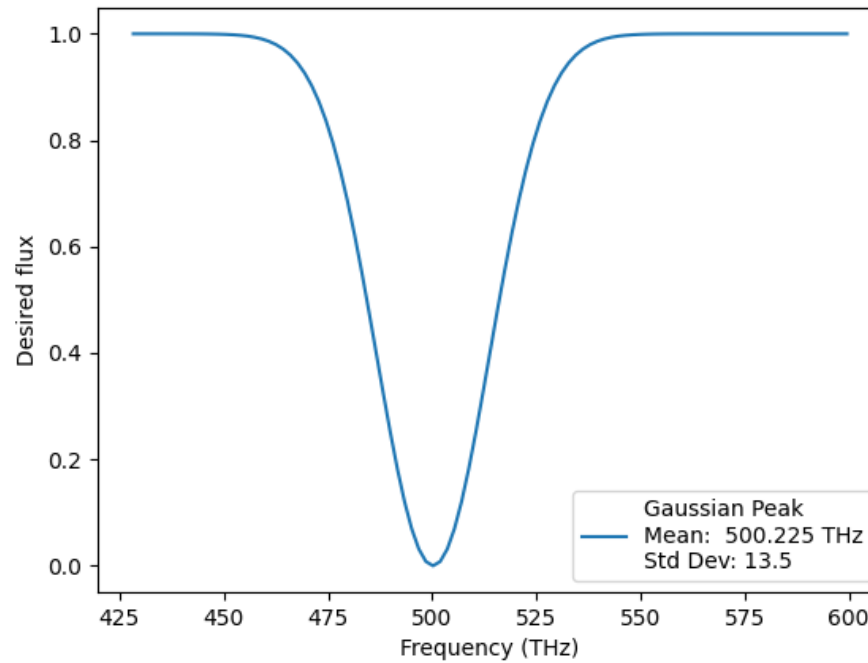
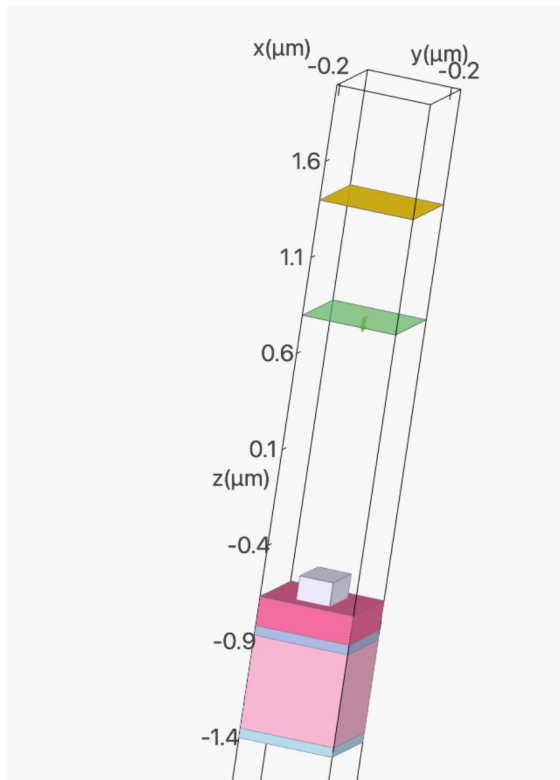


# Week 05 Design Summary

Jax version

# Objective

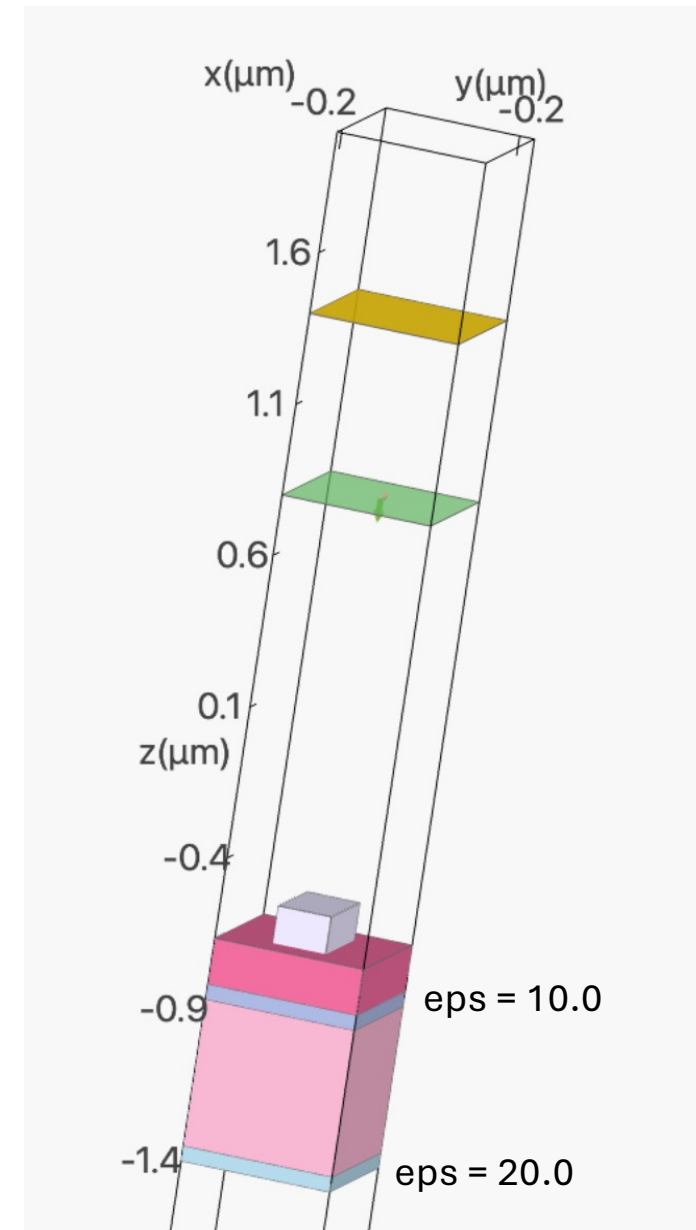


# Methodology

- Simulation parameters
  - Simulated range: [0.5  $\mu\text{m}$ , 0.7  $\mu\text{m}$ ], [428 THz, 600 THz]
  - Center: 0.6  $\mu\text{m}$ , ~500 THz
  - Metals replaced with fixed size ( $t = 50 \text{ nm}$ ) high-k dielectric slabs
  - Shut off:  $1 \text{e-}6$  (by default  $1 \text{e-}5$ )

- Evaluation function

$$e = \sum_{k=0}^{n-1} (D[k] - G[k])^2$$

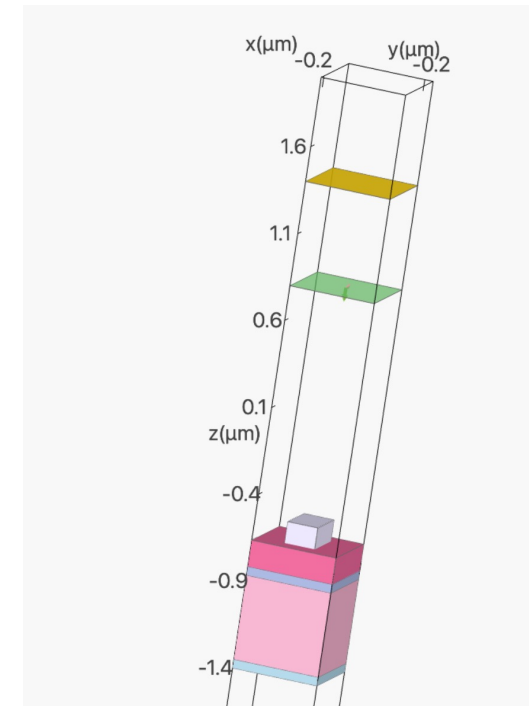


# Methodology

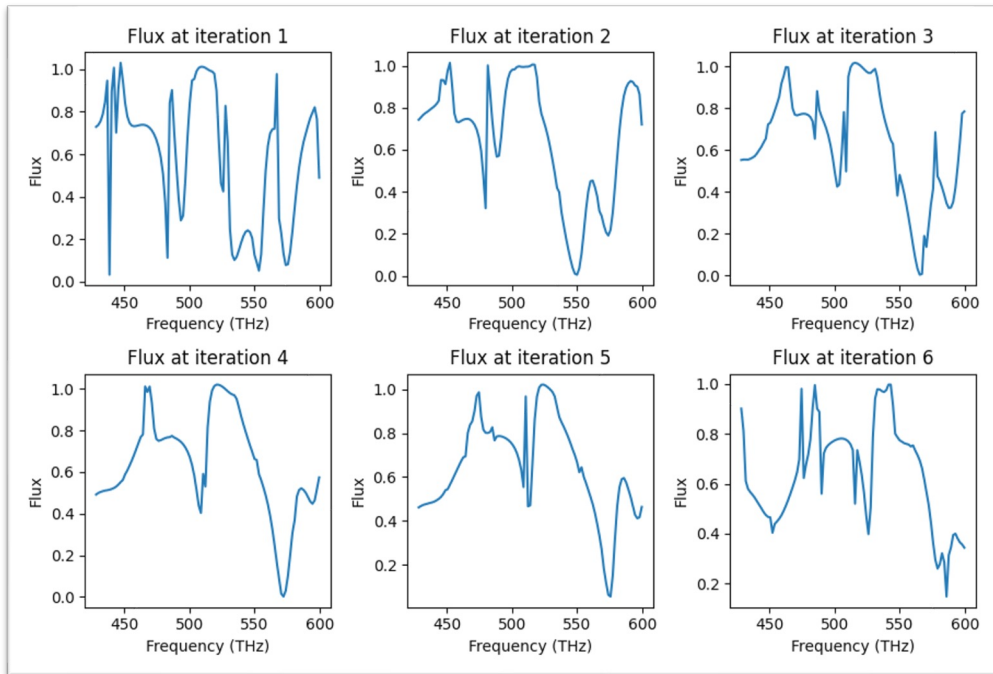
- Optimization range of design parameters

Substrate 1	Substrate 2	Cuboid length	Cuboid width	Cuboid height
[0.05, 0.5] $\mu\text{m}$		[0.1, 0.5] $\mu\text{m}$		

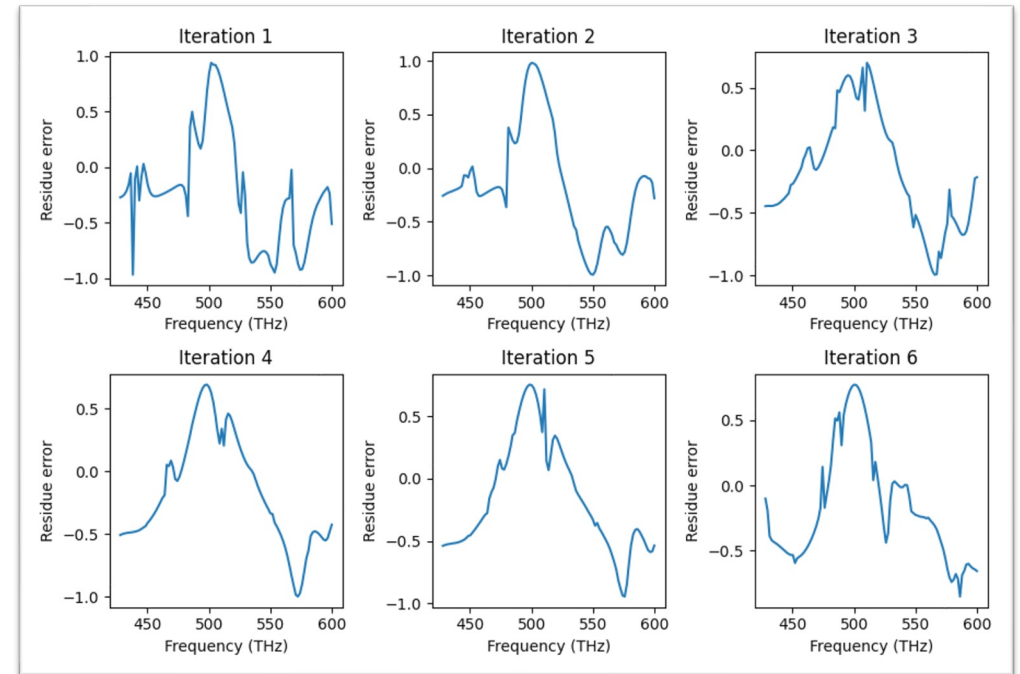
- Optimization loop
  - Number of iterations: 6
  - Step size: 0.1
  - Starting point: slightly below the mid point



# Results: silica (eps = 3.9)

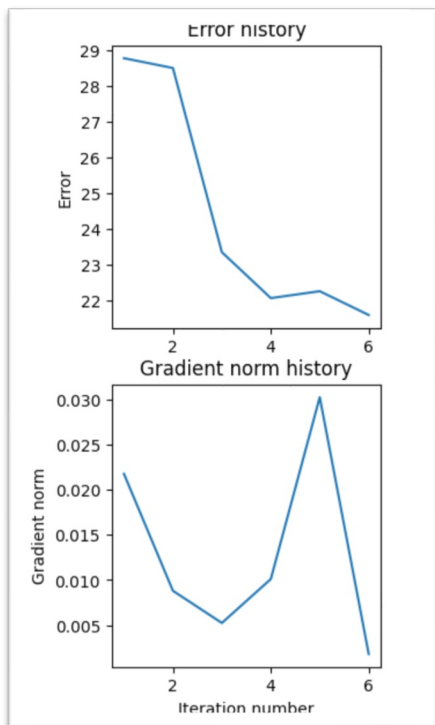


Flux history

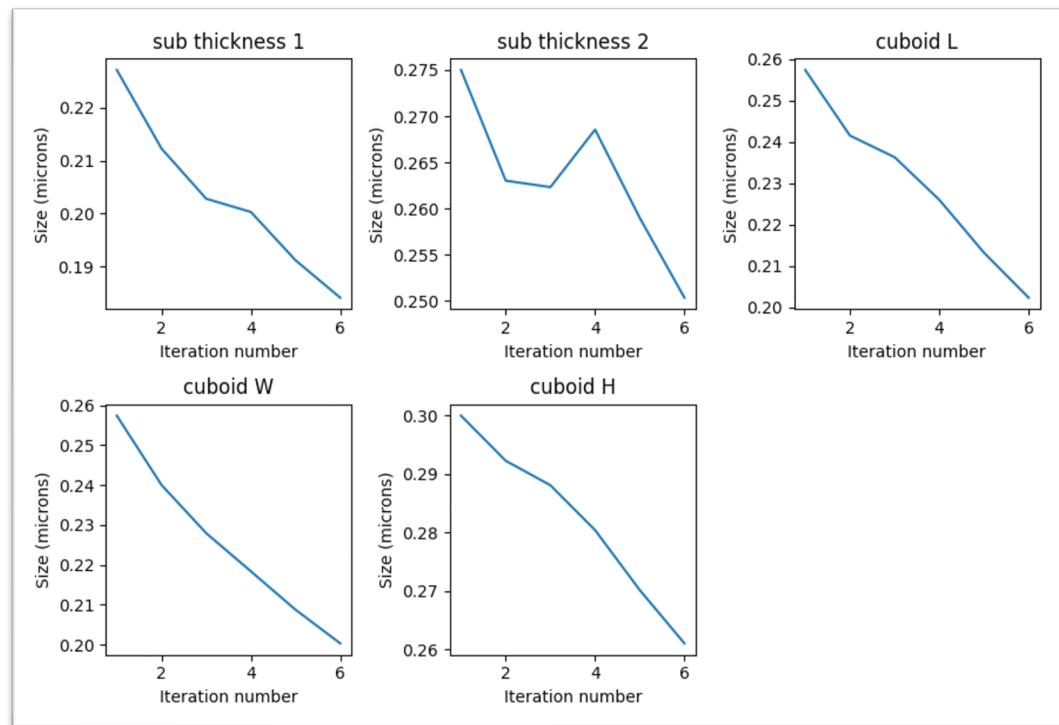


Residue error history

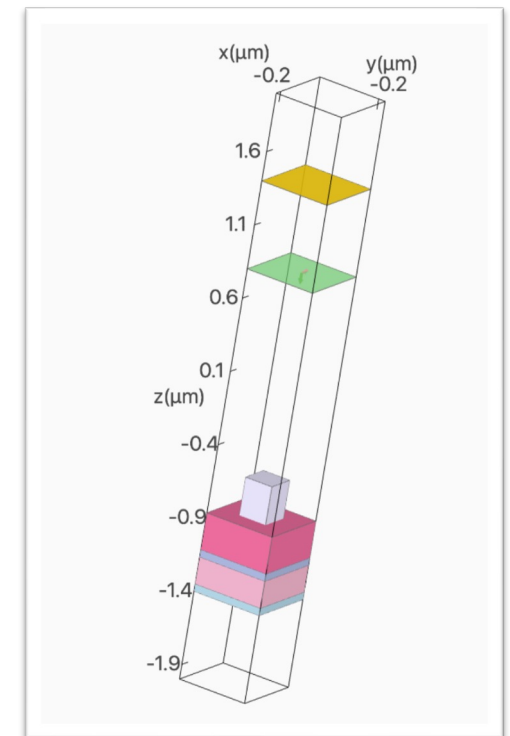
# Results: silica (eps = 3.9)



Error and grad norm history

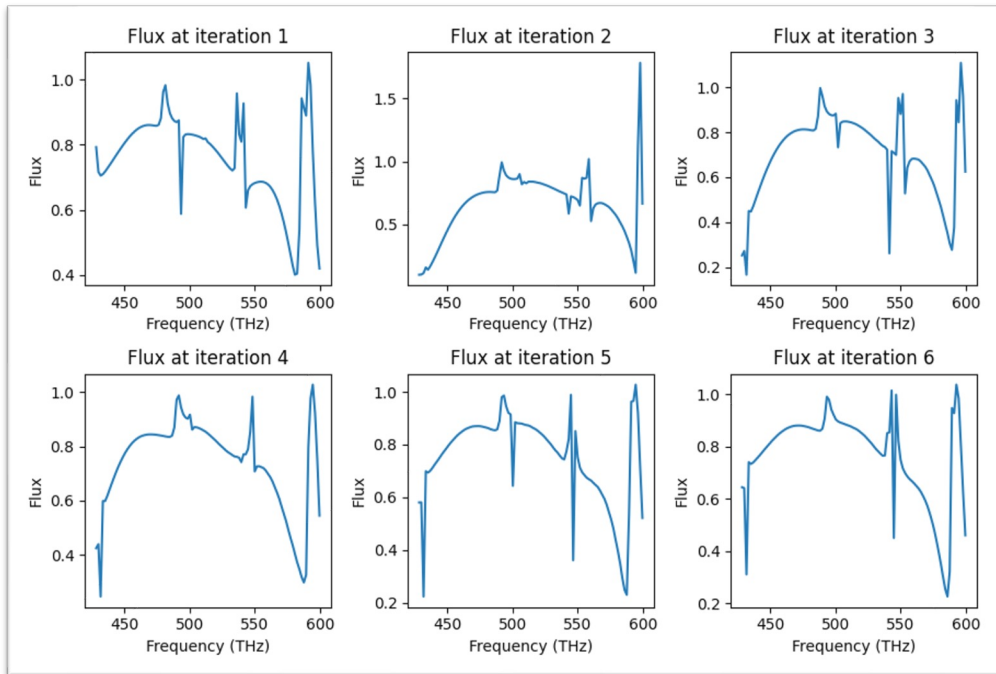


Design history

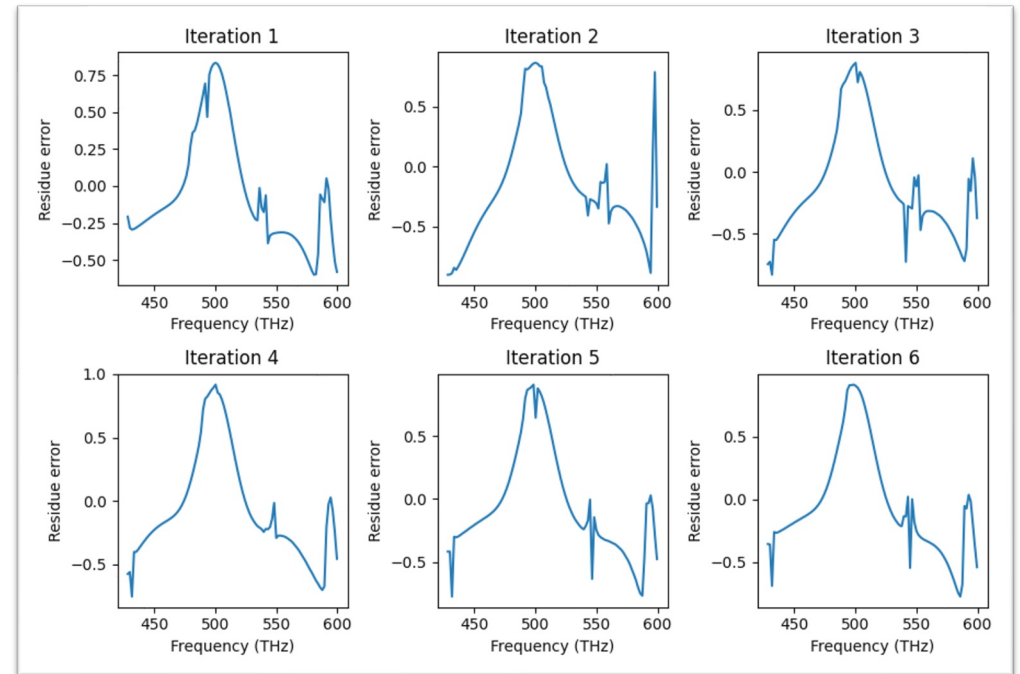


3D plot at iteration 6

# Results: $\text{TiO}_2$ ( $\text{eps} = 2.25$ )

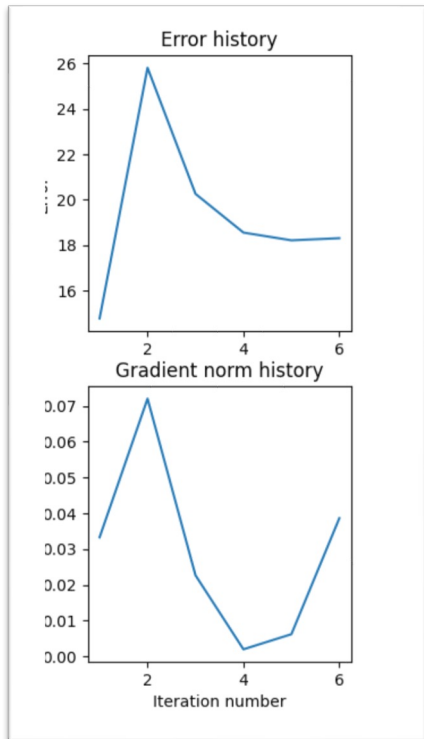


Flux history

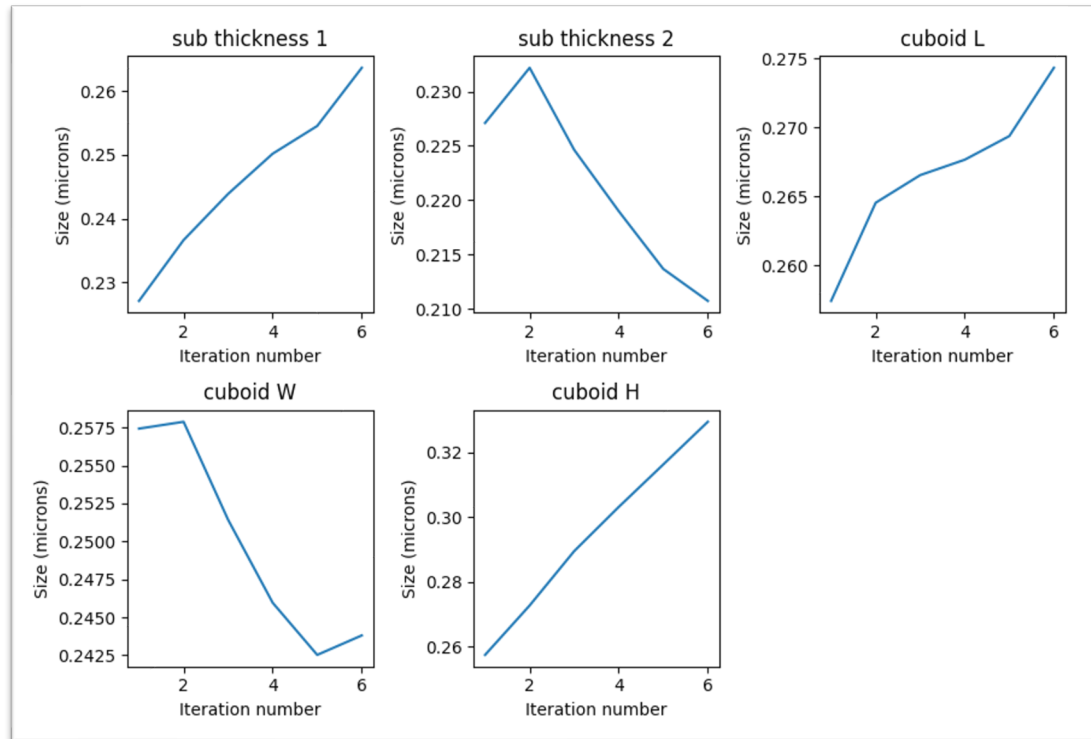


Residue error history

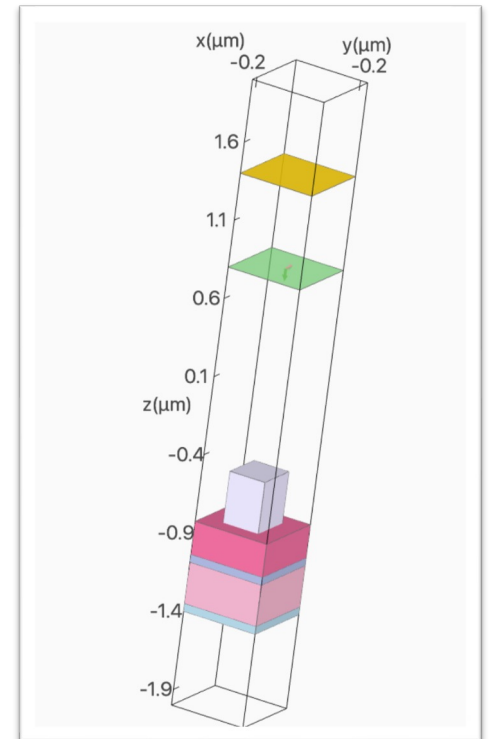
# Results: $\text{TiO}_2$ ( $\text{eps} = 2.25$ )



Error and grad norm history



Design history



3D plot at iteration 6



# Some reflections

- Time consuming
  - Not sure of `autograd`'s speed, but `tidy3d+jax` requires ~15 min per iteration for this application, depending on materials.
- Shut-off value plays an important role
- Off peak?
  - Target at 500 THz but peaked at other frequencies and got stable.