

Simulation numérique du fonctionnement des micro-résonateurs optiques par éléments finis

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Troisième rencontre FOTON-IRMAR
Rennes

Simulations numériques

1) L'anneau

- a) Exemple et comparaison
- b) Variations de la longueur d'ondes
- c) Variations des dimensions
- d) Indice non linéaire

2) Le disque

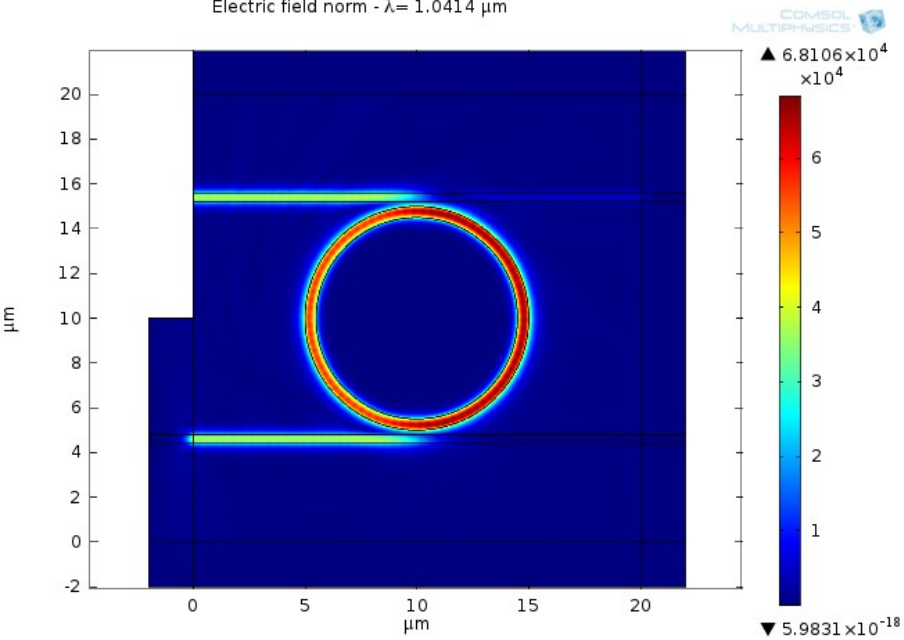
3) L'hippodrome

4) Calcul en 3D

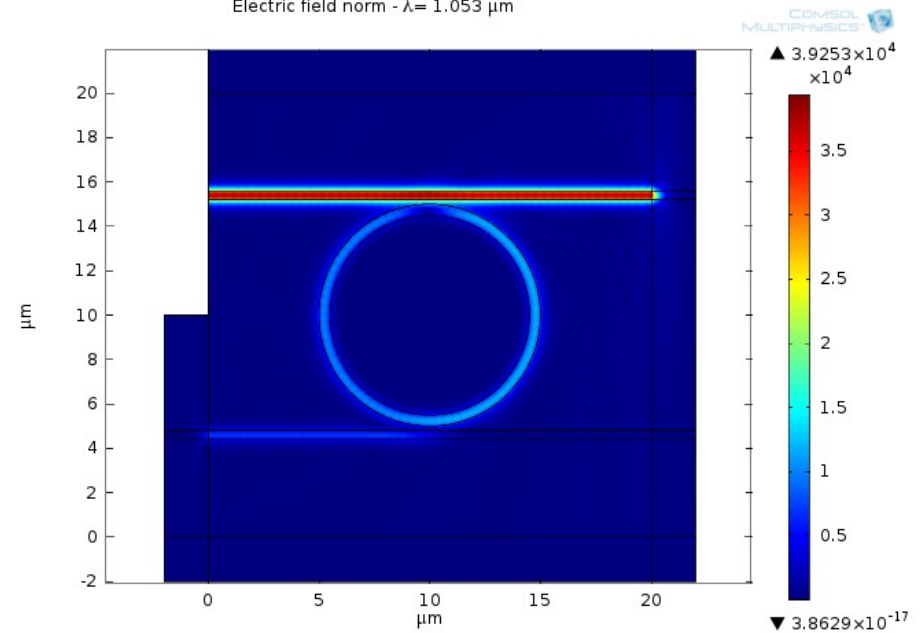
5) Calcul en dynamique / non linéaire

1) L'anneau

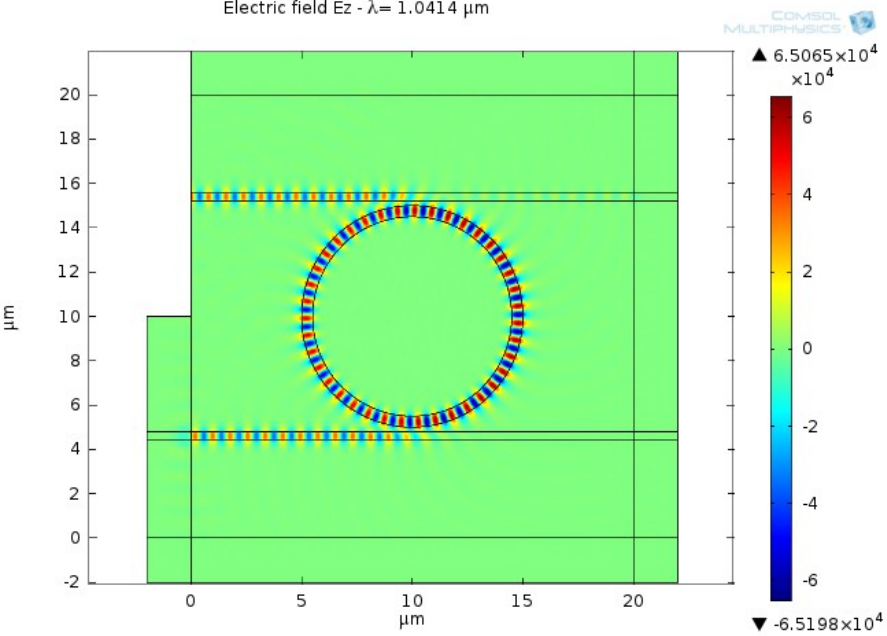
Electric field norm - $\lambda = 1.0414 \mu\text{m}$



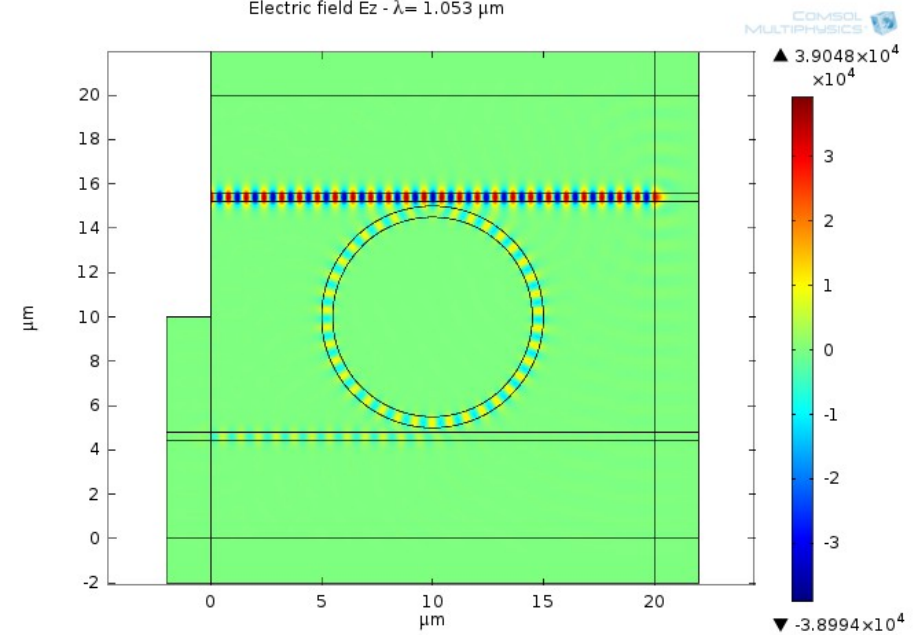
Electric field norm - $\lambda = 1.053 \mu\text{m}$



Electric field Ez - $\lambda = 1.0414 \mu\text{m}$

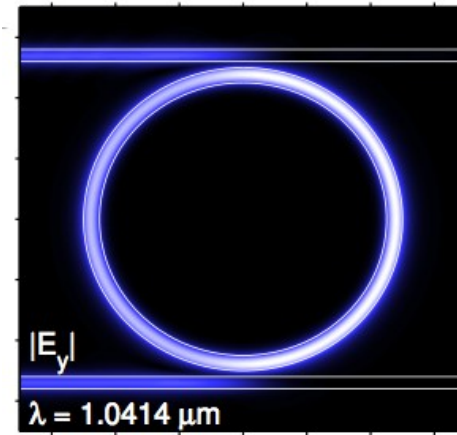
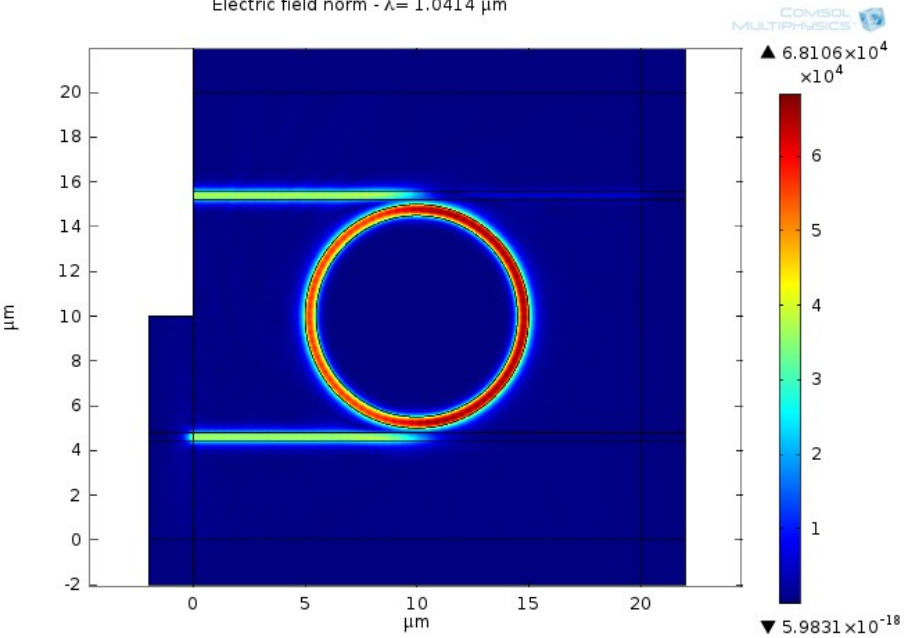


Electric field Ez - $\lambda = 1.053 \mu\text{m}$

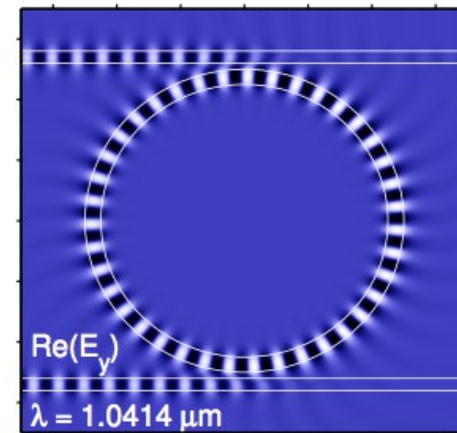
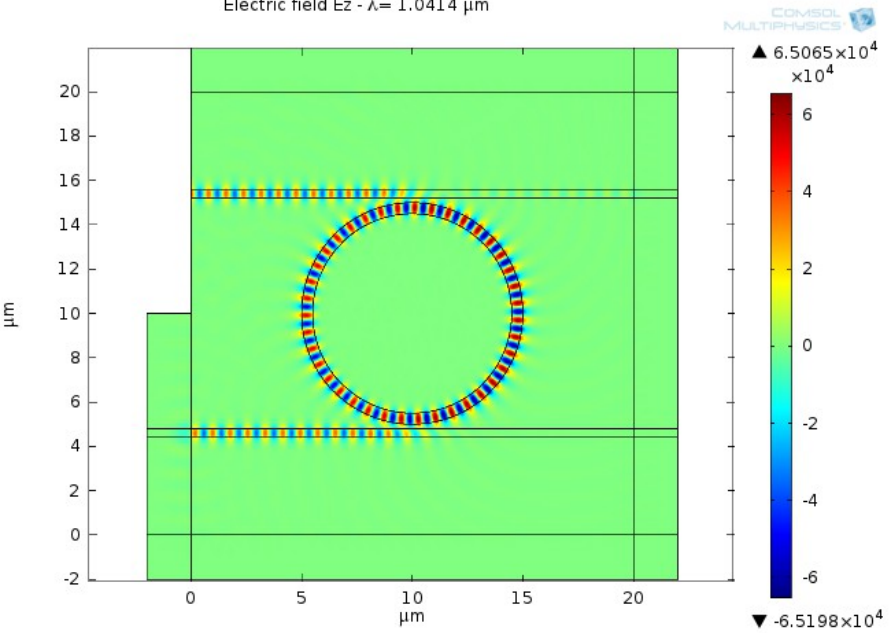


Hiremath, Stoffer, Hammer 2006

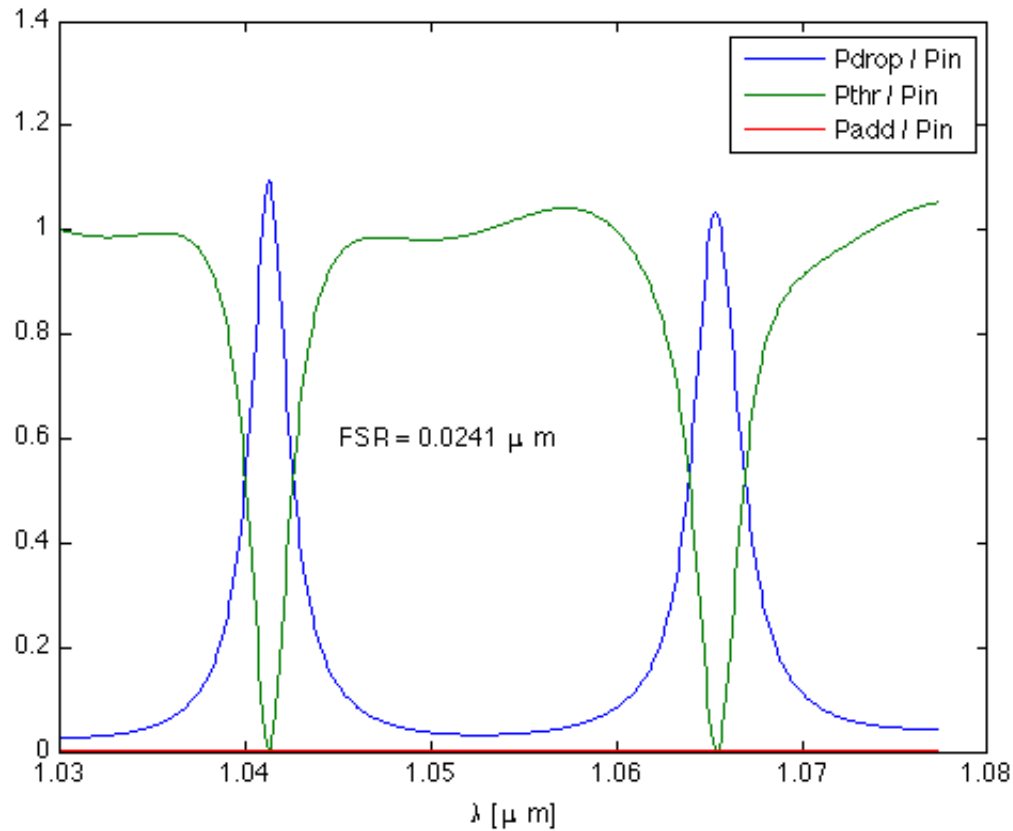
Electric field norm - $\lambda = 1.0414 \mu\text{m}$



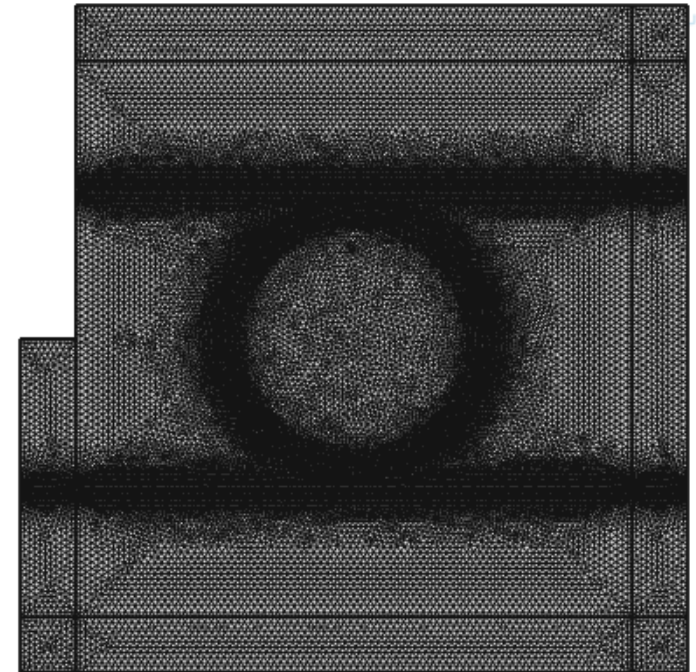
Electric field Ez - $\lambda = 1.0414 \mu\text{m}$



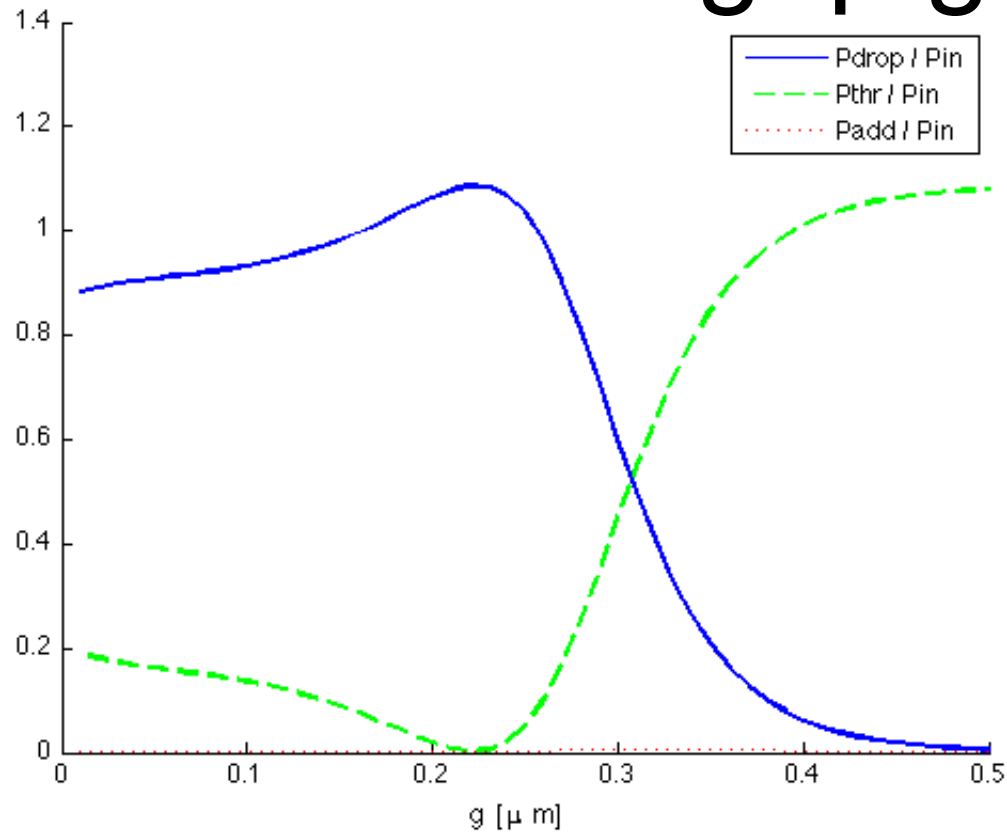
Variations de la longueur d'onde I



Hiremath : FSR = 0.02 mm

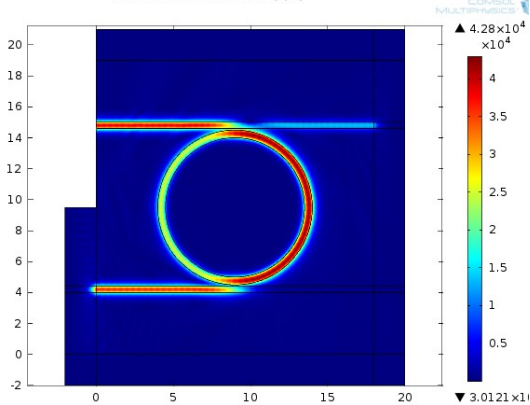


Variations du gap g



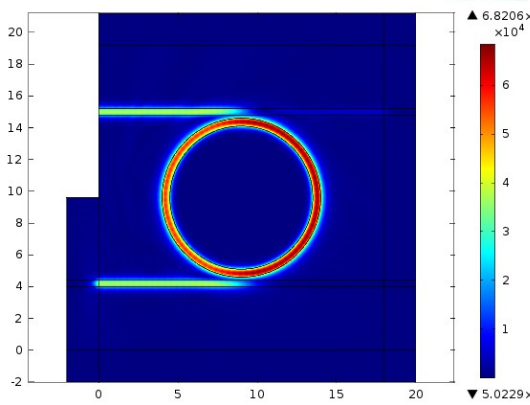
$g = 0.1$ mm

Surface: Electric field norm (V/m)



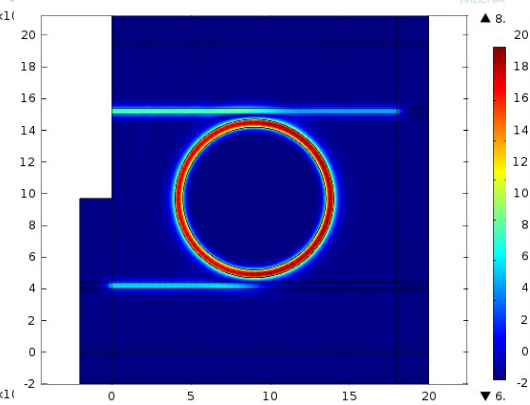
$g = 0.2$ mm

Surface: Electric field norm (V/m)



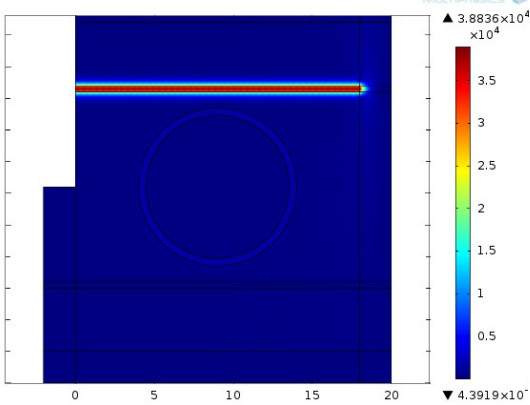
$g = 0.3$ mm

Surface: Electric field norm (V/m)

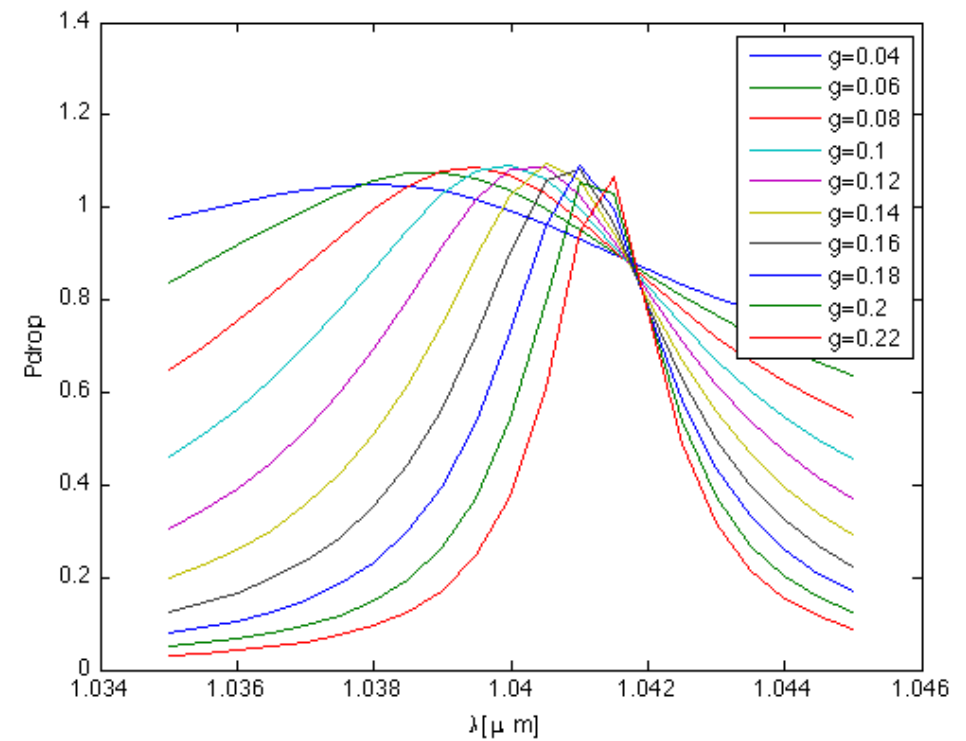
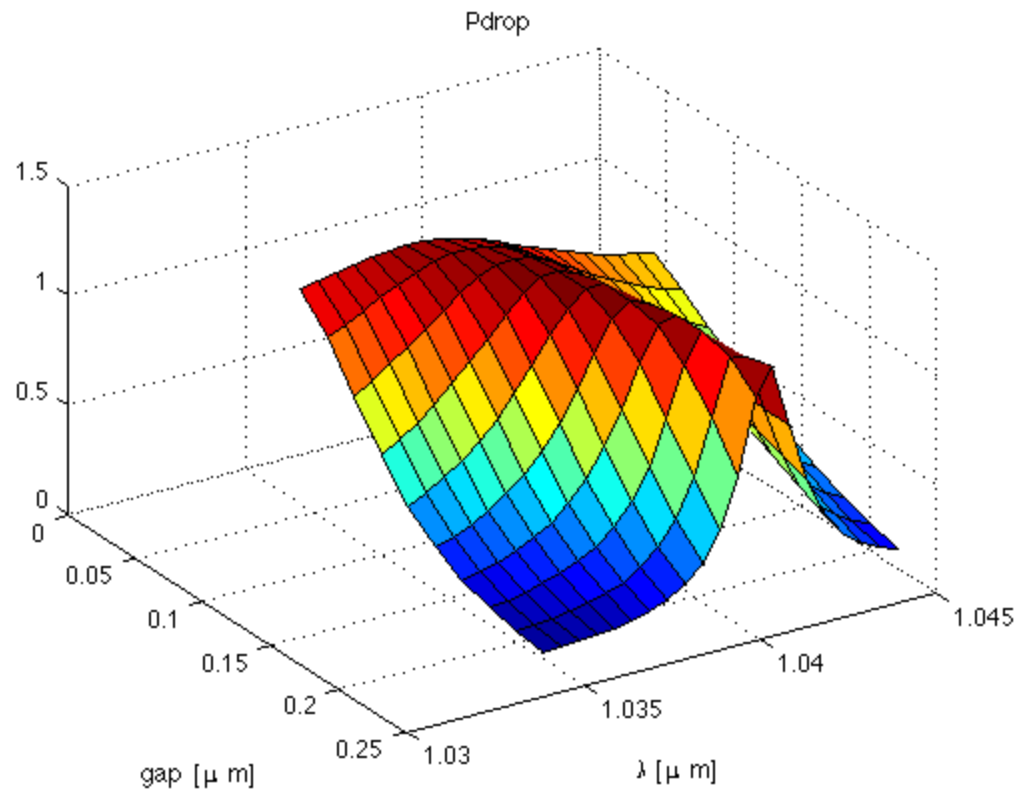


$g = 1$ mm

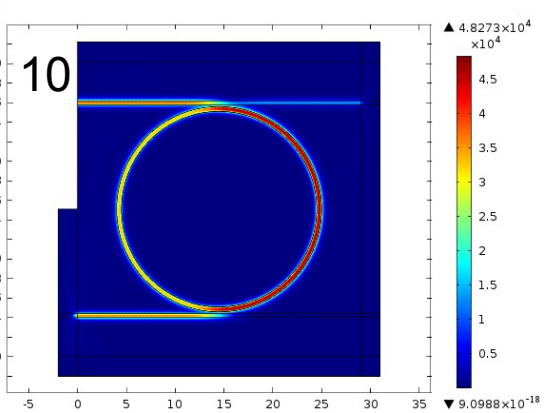
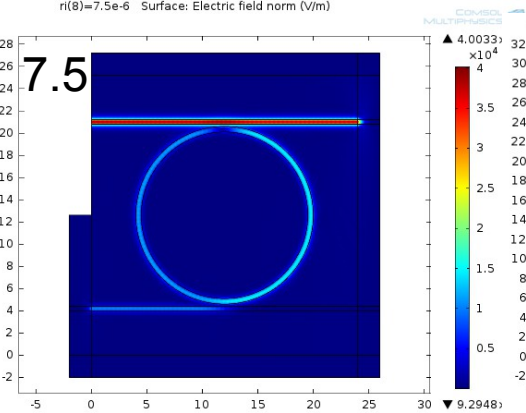
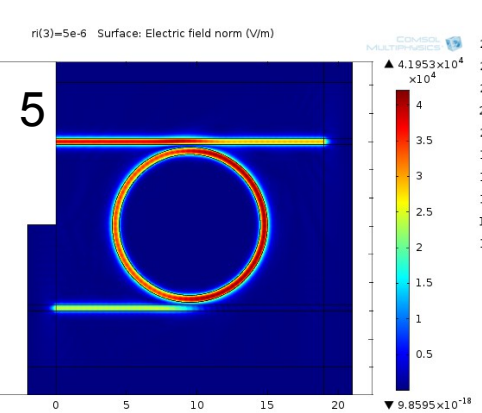
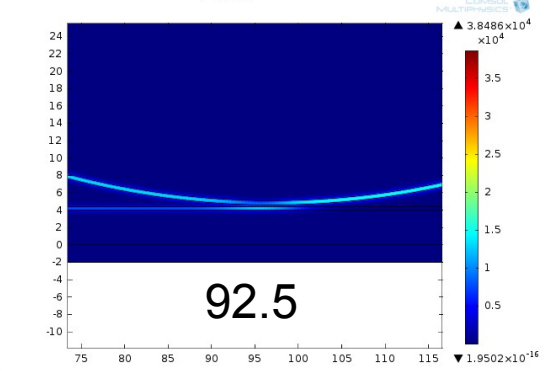
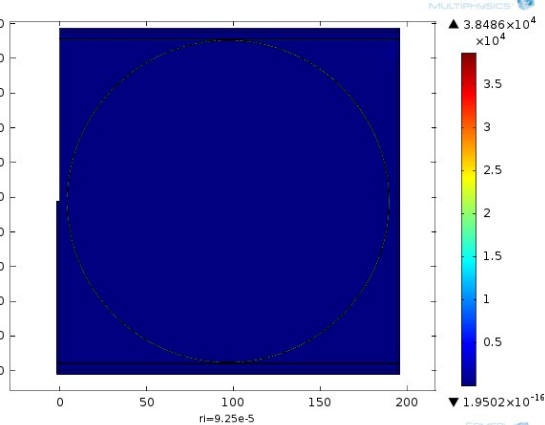
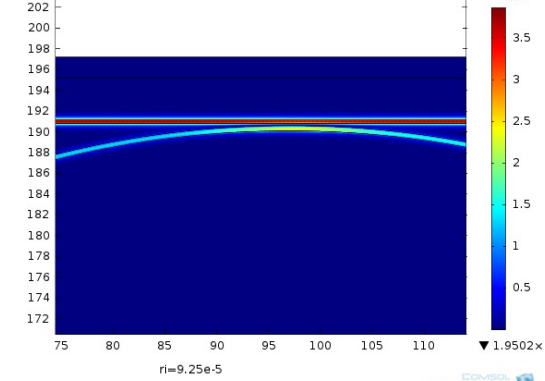
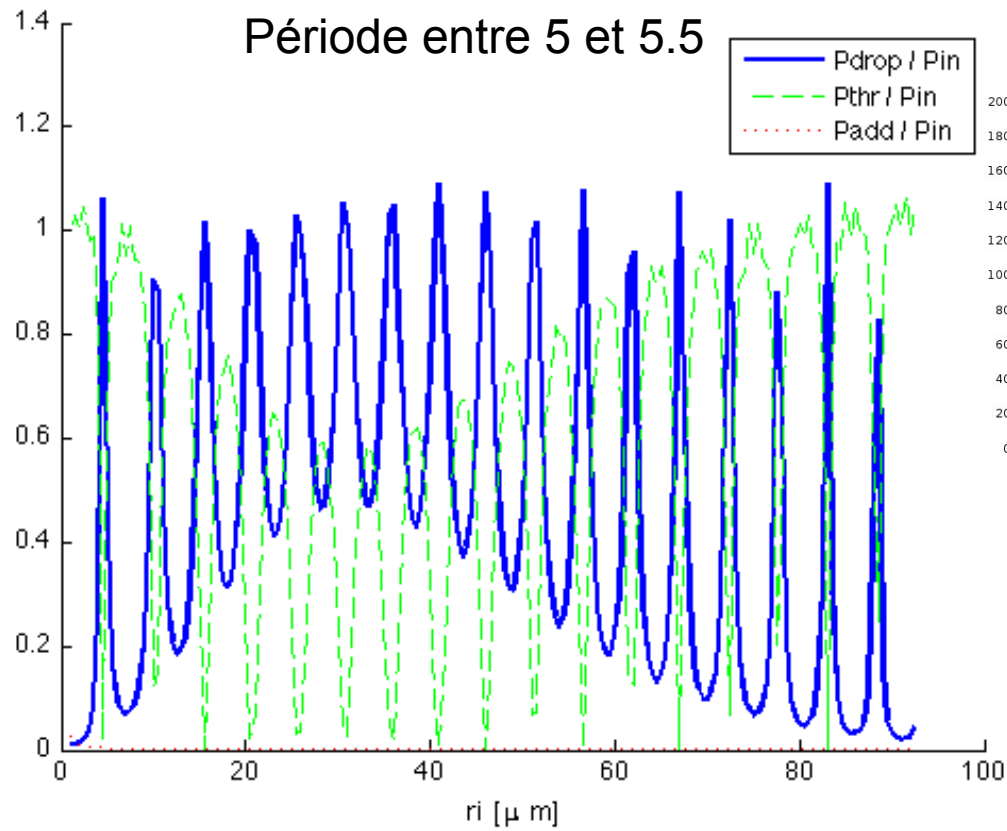
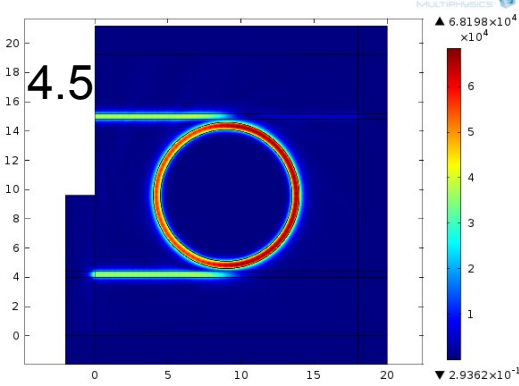
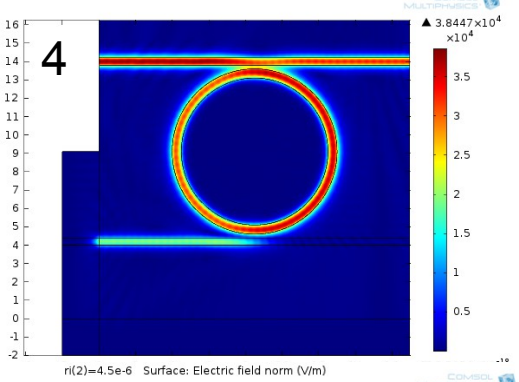
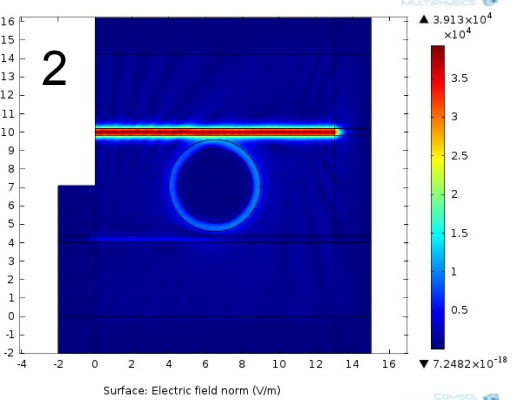
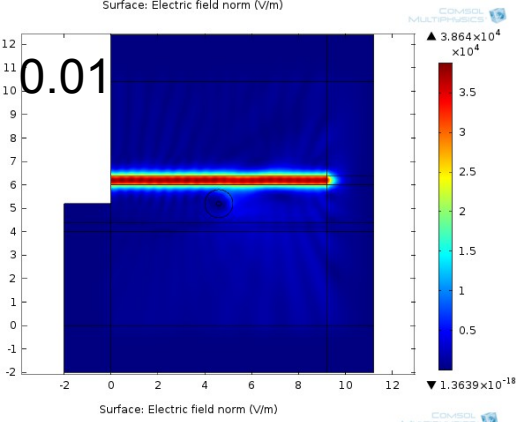
Surface: Electric field norm (V/m)



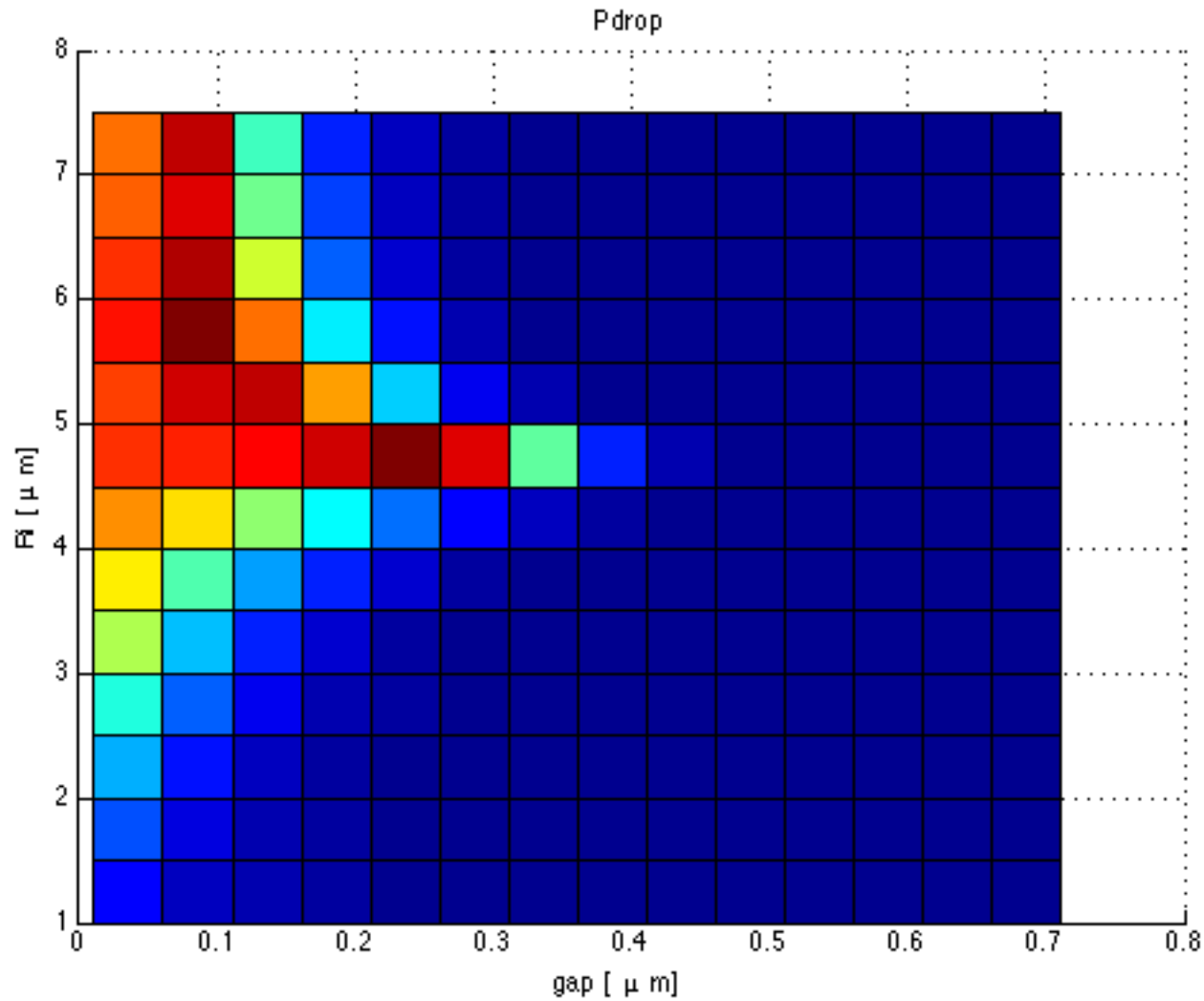
Variations de g et l



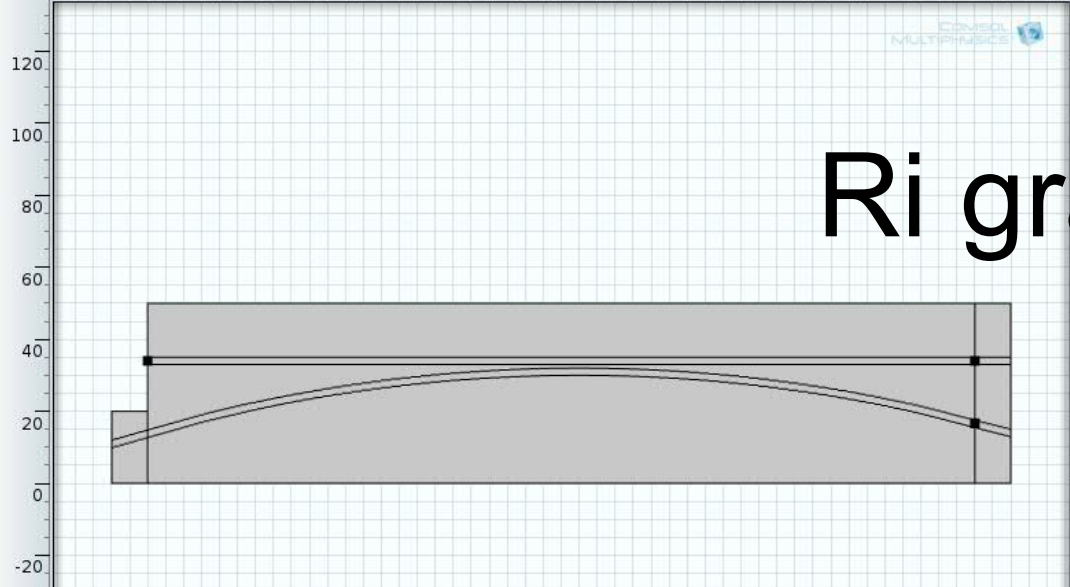
Variations de Ri



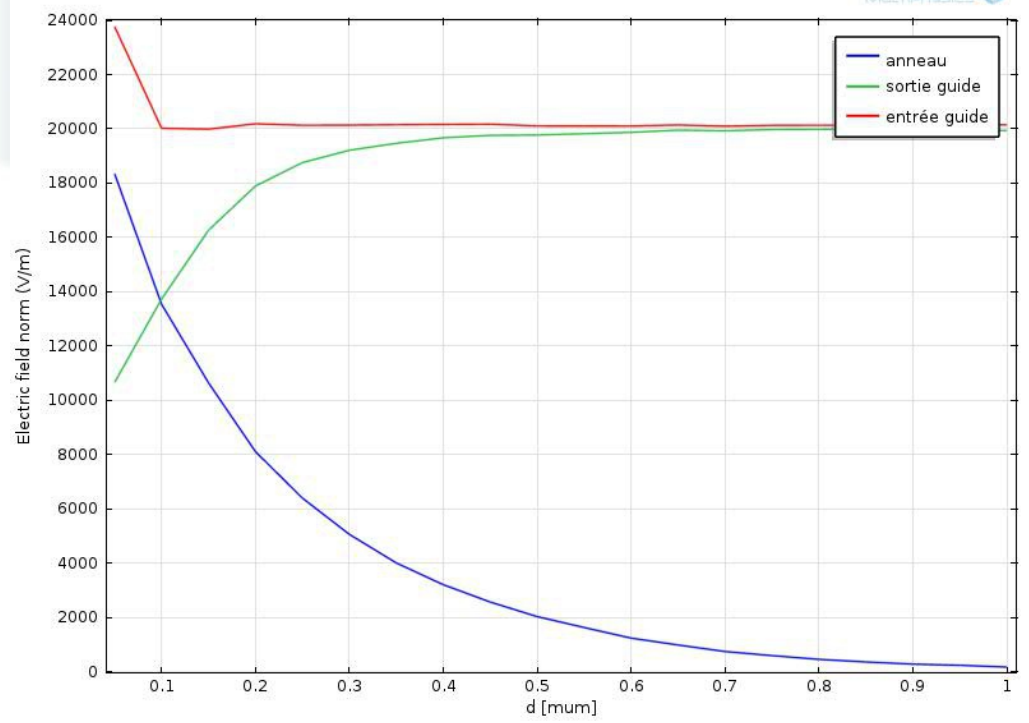
Variations de Ri et g



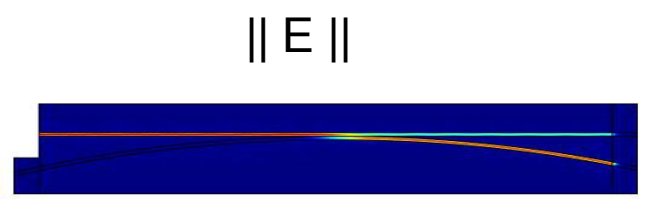
Ri grand



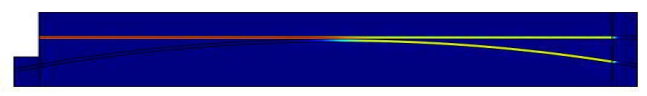
Norme du champs électrique en trois points pour $R=430$ μm ; $w_s=w_c=2$ μm ; $\text{Lamba}_0=1.55$ μm ; $n_g=1.57$; $n_a=1$



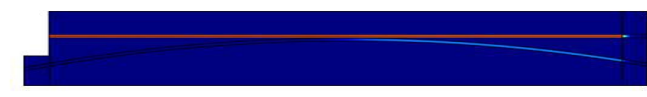
$g=0.05$



$g=0.1$



$g=0.3$



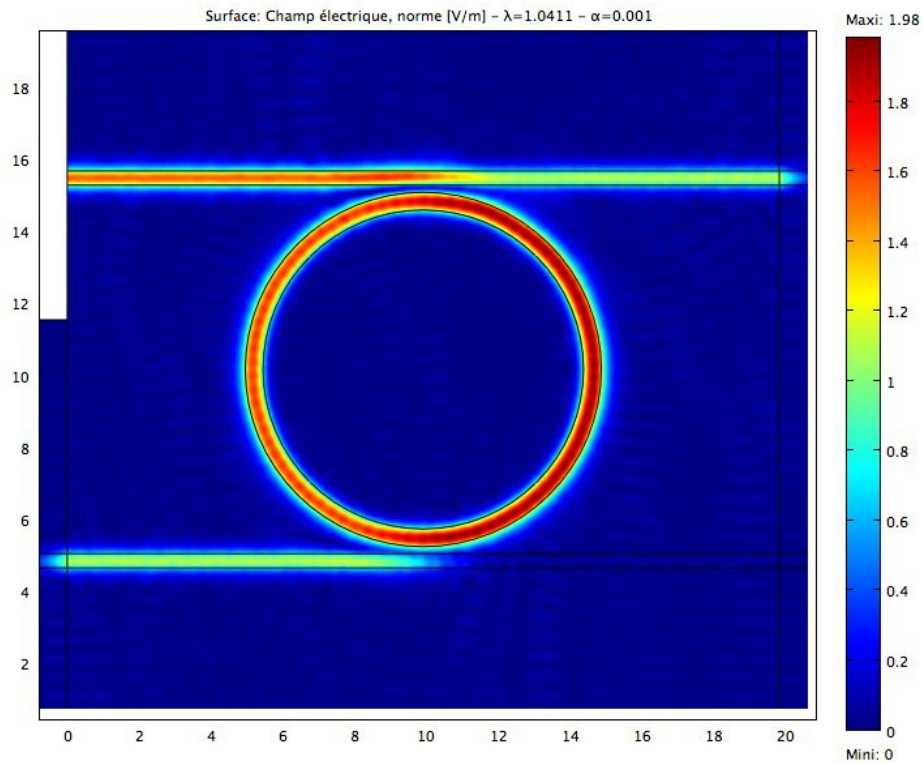
$g=0.5$



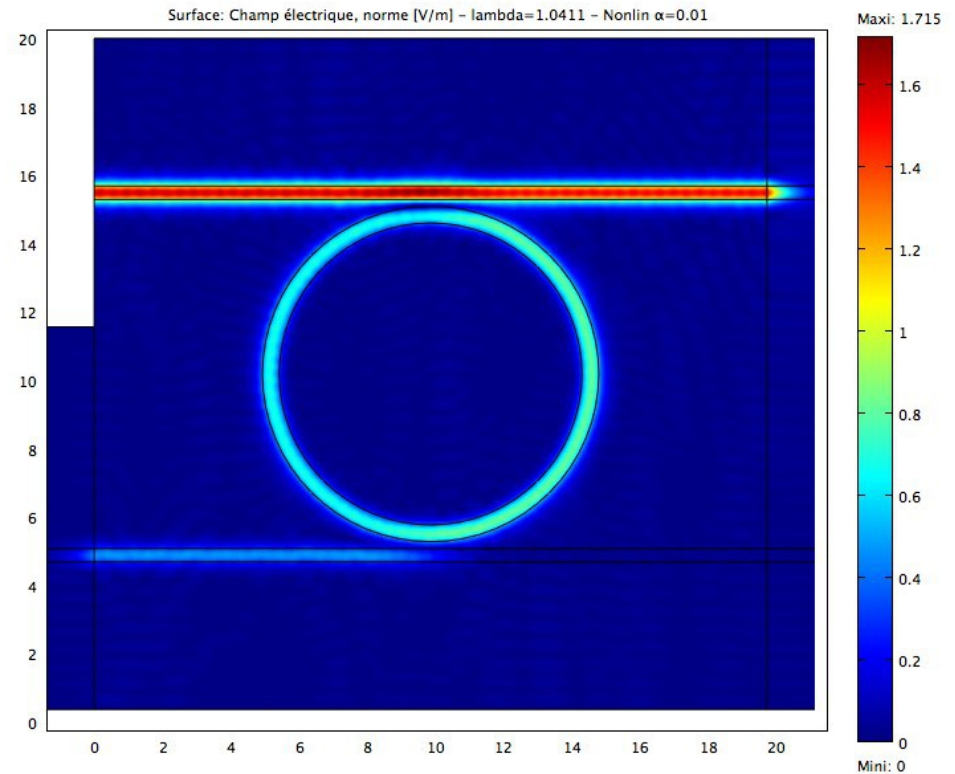
Harmonique non linéaire 2D

- $N = n_0 + a || E ||$

$a = 0.001$

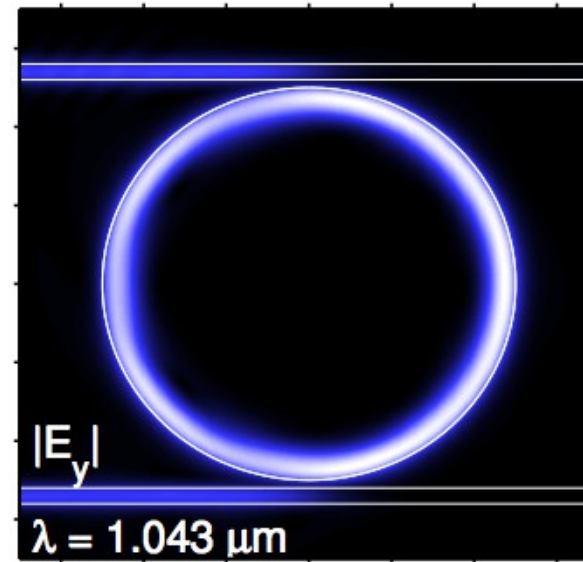
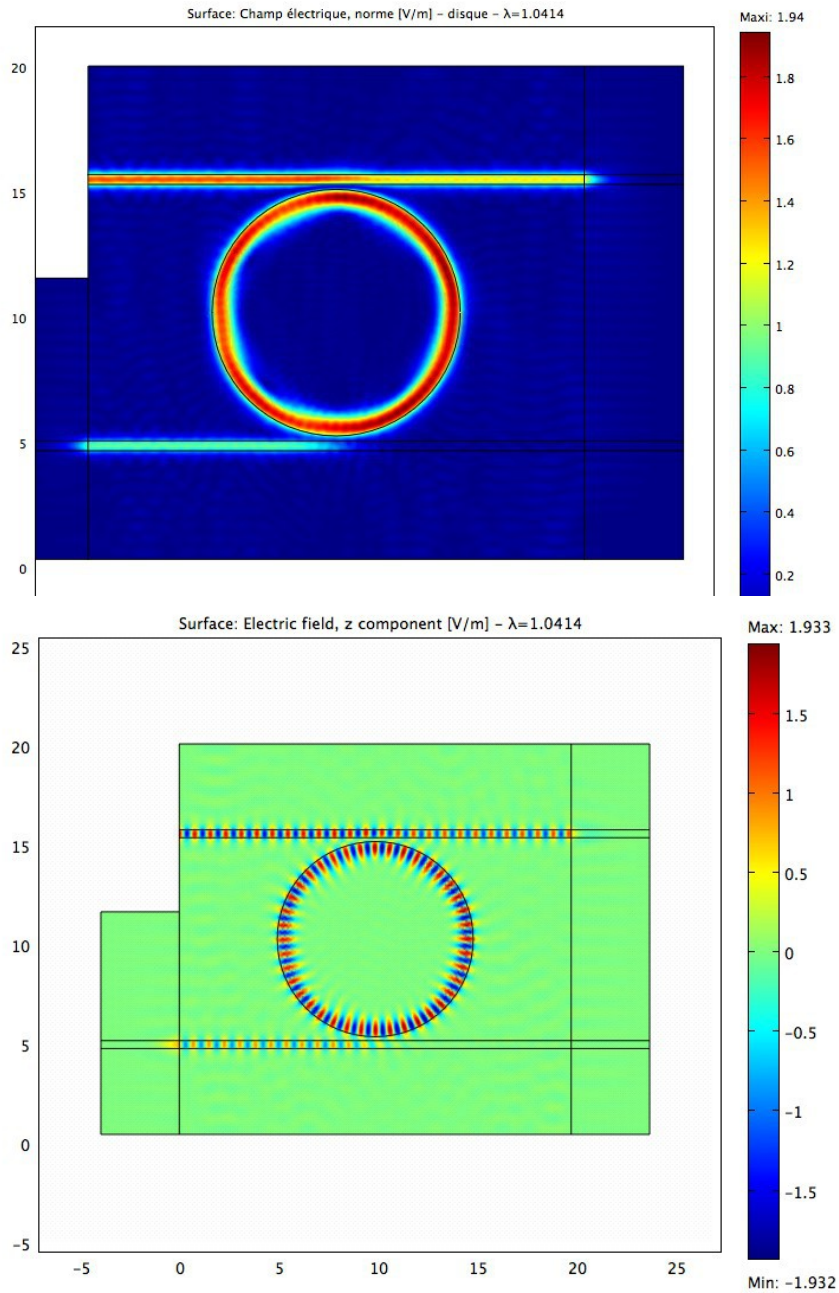


$a = 0.01$



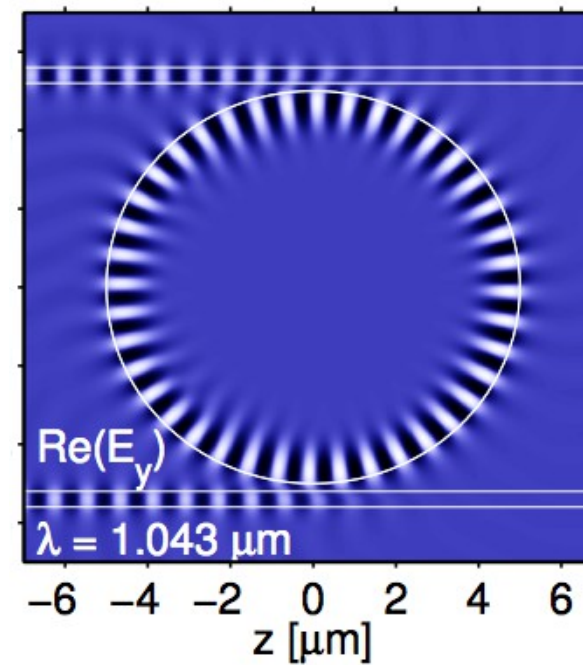
$l = 1.0414$

2) Le disque



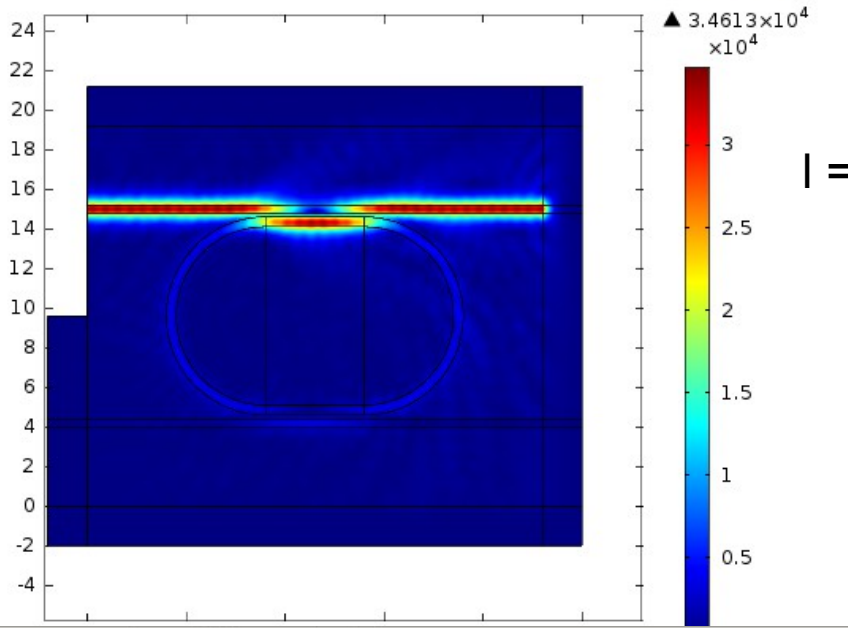
Hiremath 2006

$l = 1.043$

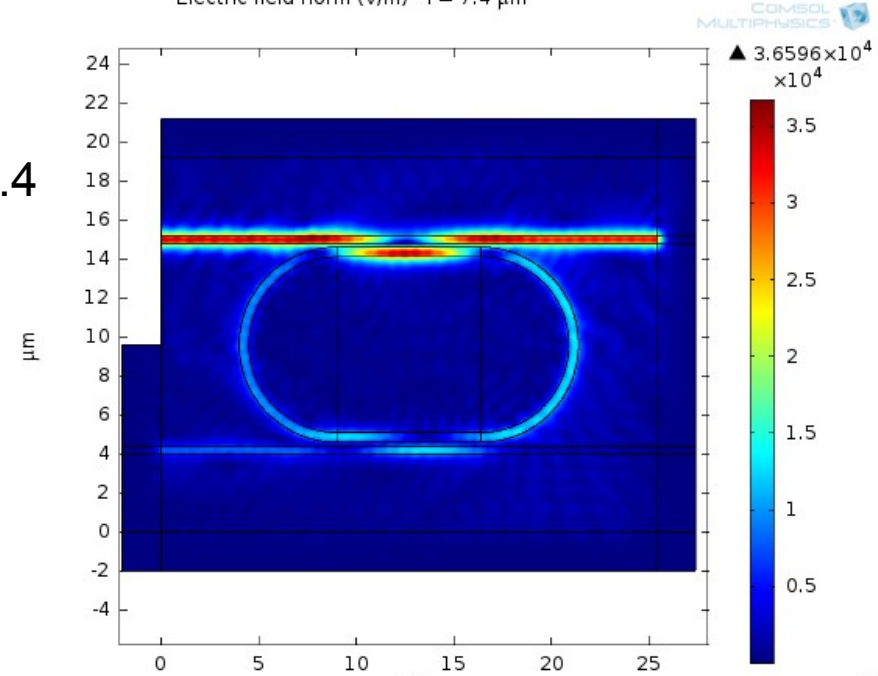


3) L'hippodrome

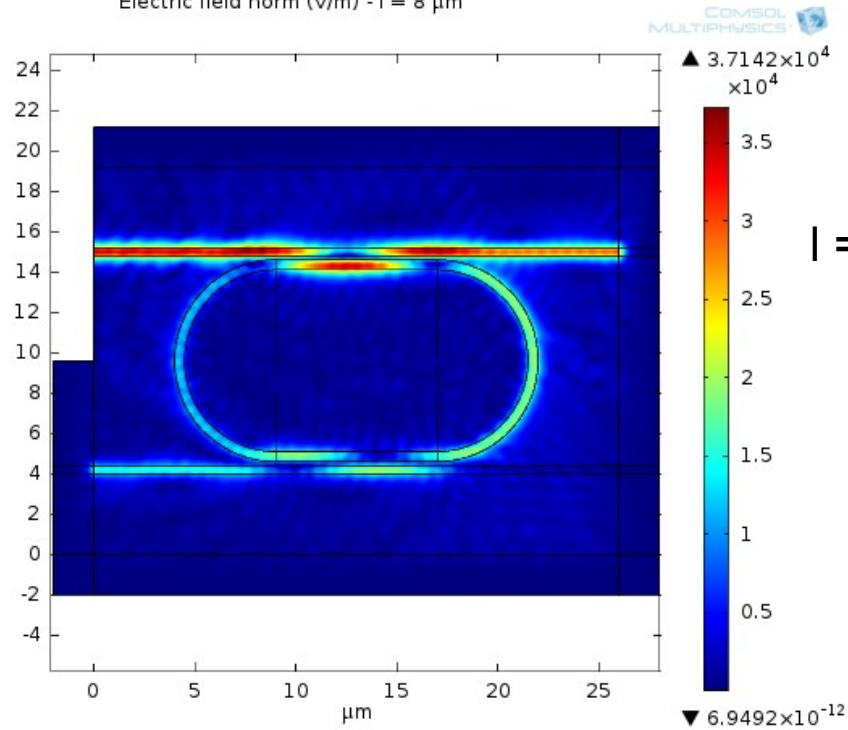
Electric field norm (V/m) - l = 5 μm



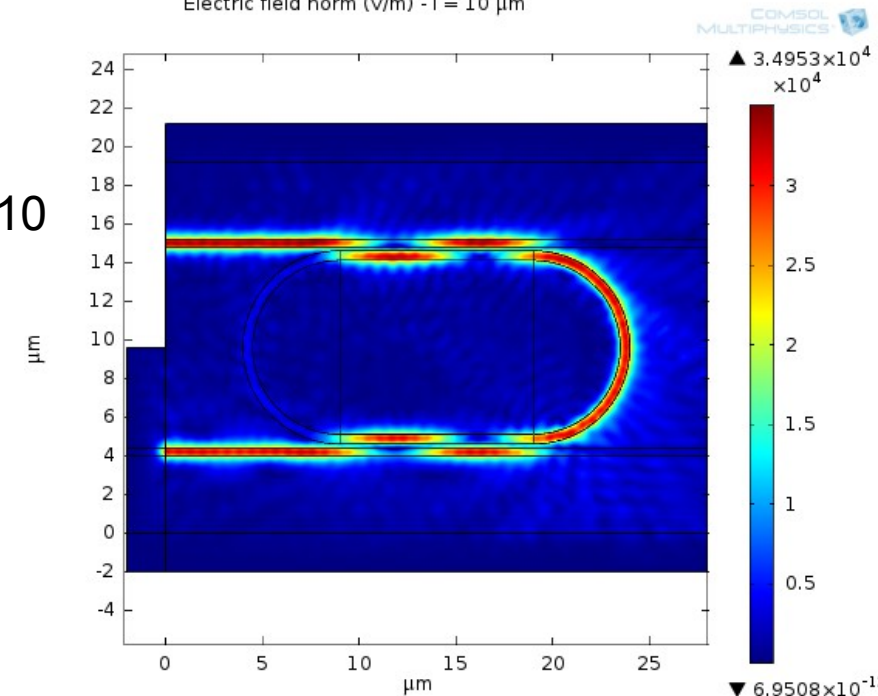
Electric field norm (V/m) - l = 7.4 μm



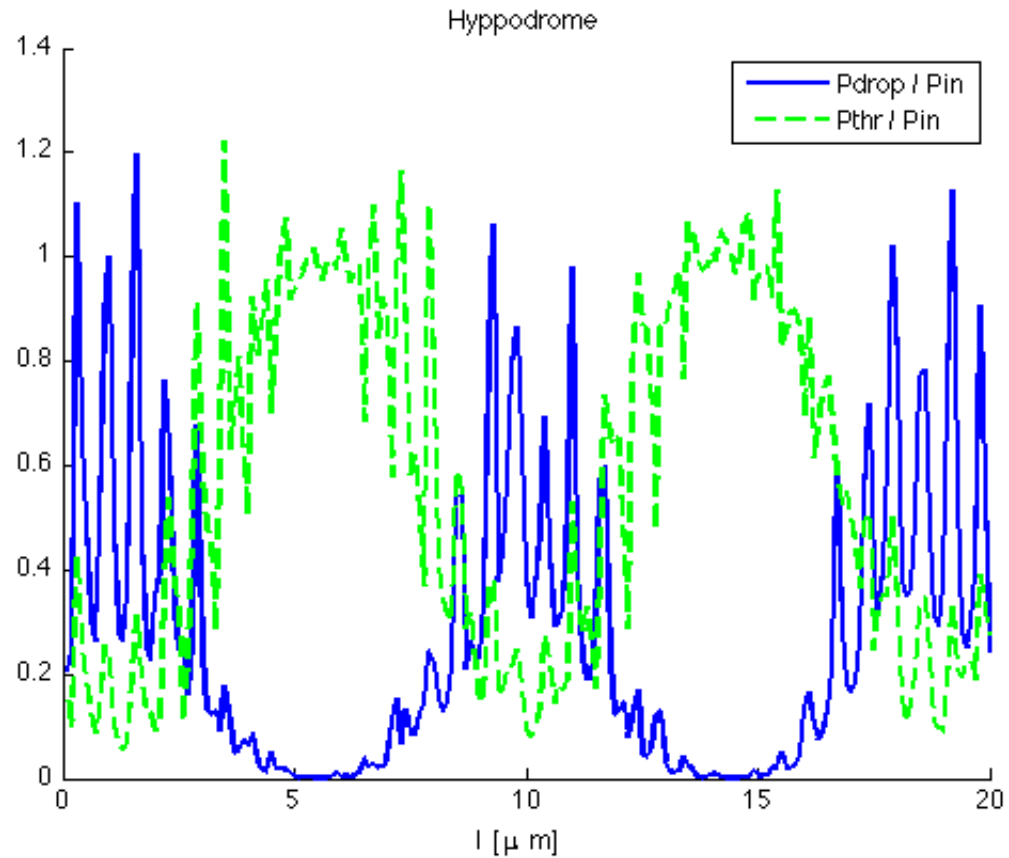
Electric field norm (V/m) - l = 8 μm



Electric field norm (V/m) - l = 10 μm

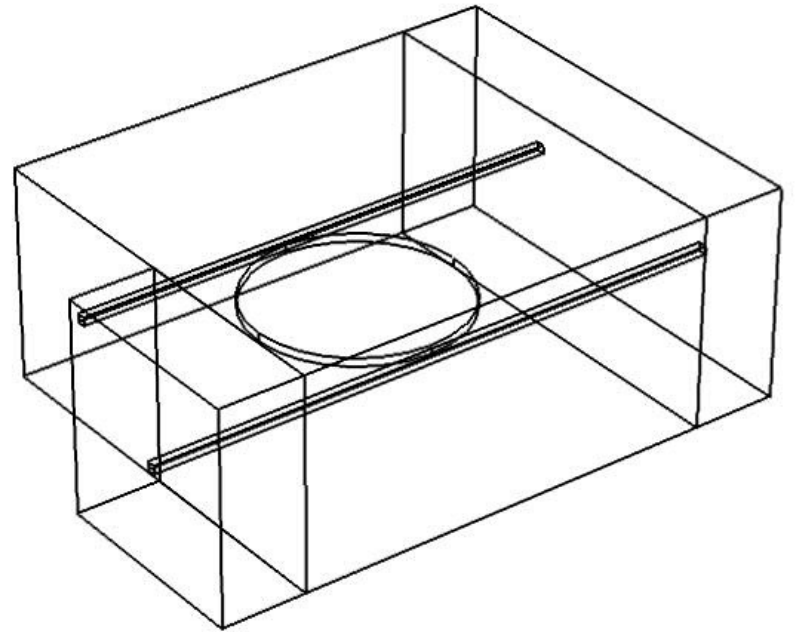
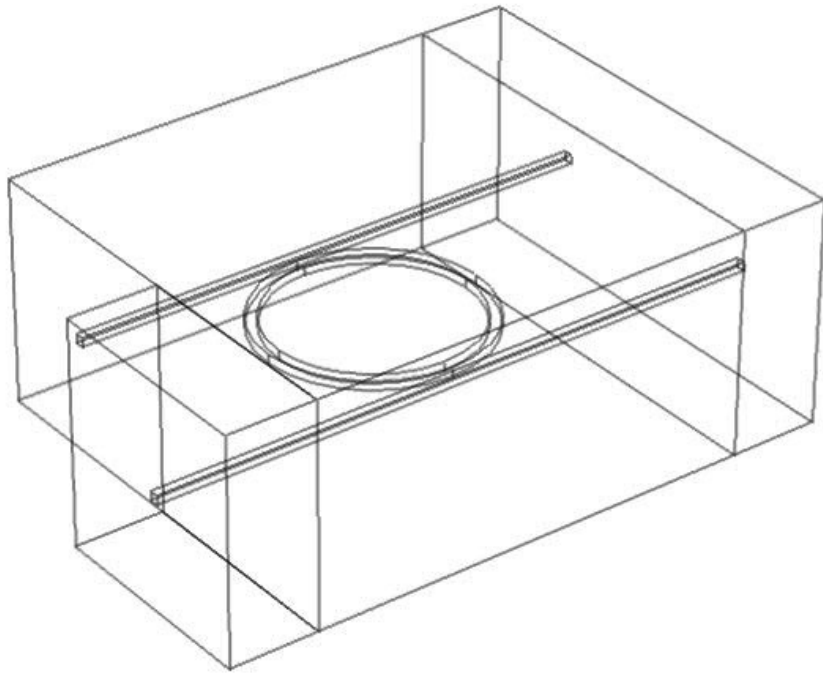


Variations de la longueur l

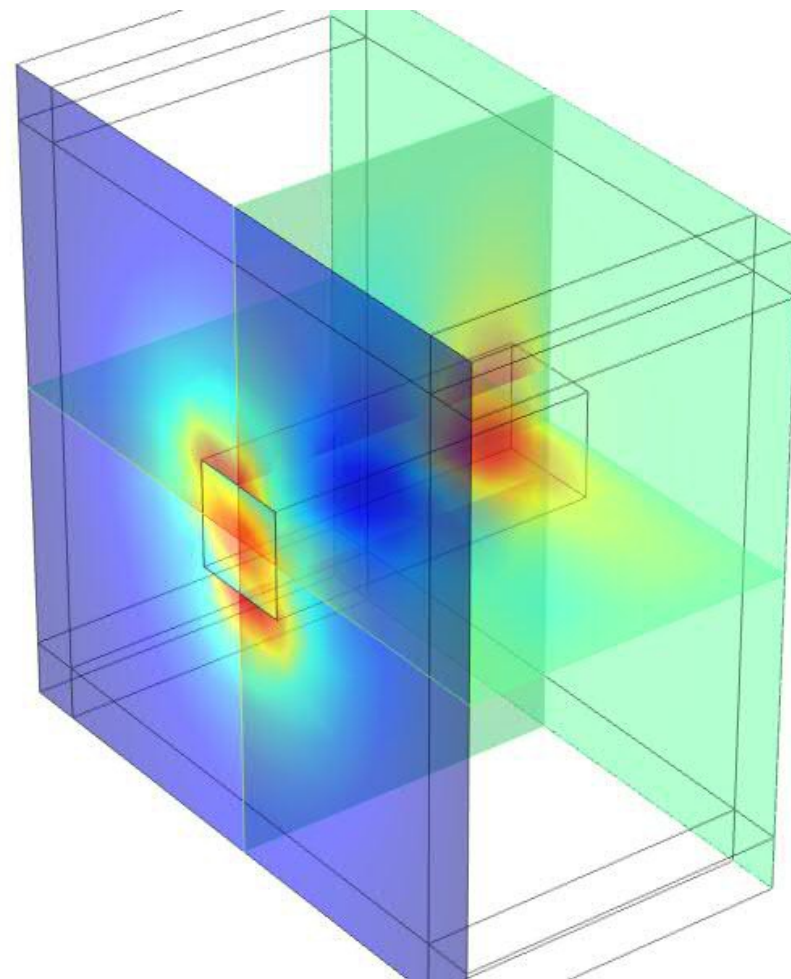
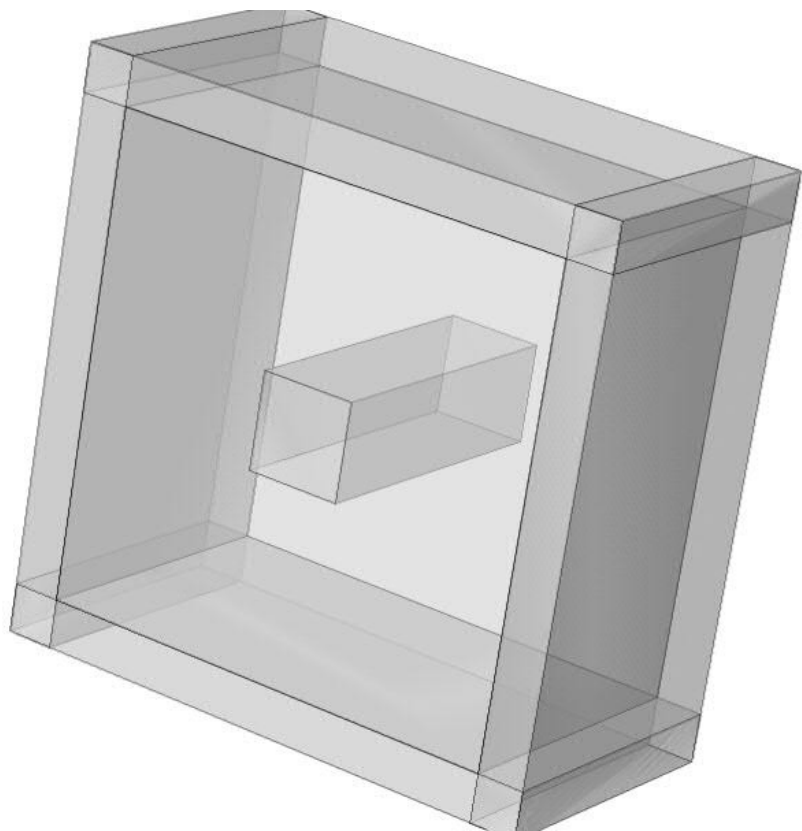


Période d'environ une demi longueur d'onde : $l / 2$

4) Simulation en 3D



Simulation 3D



Harmonique non linéaire 3D

- Mêmes difficultés que pour le linéaire 3D
- et du non linéaire 2D.