Abstract

Brief overview of the project and the results

Introduction

Add some background to the project

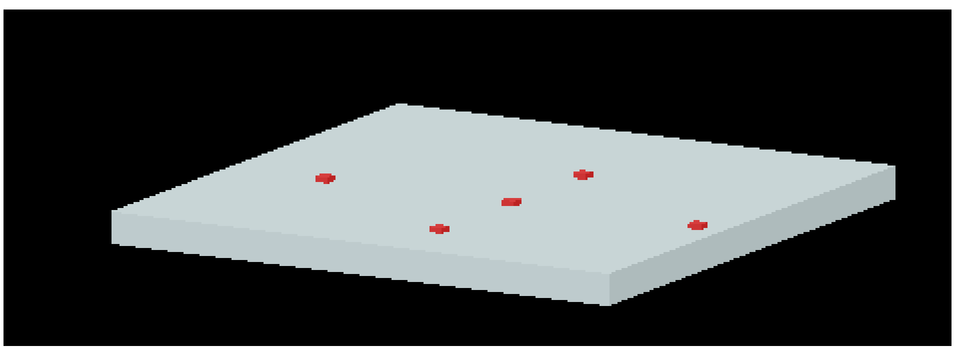
Method

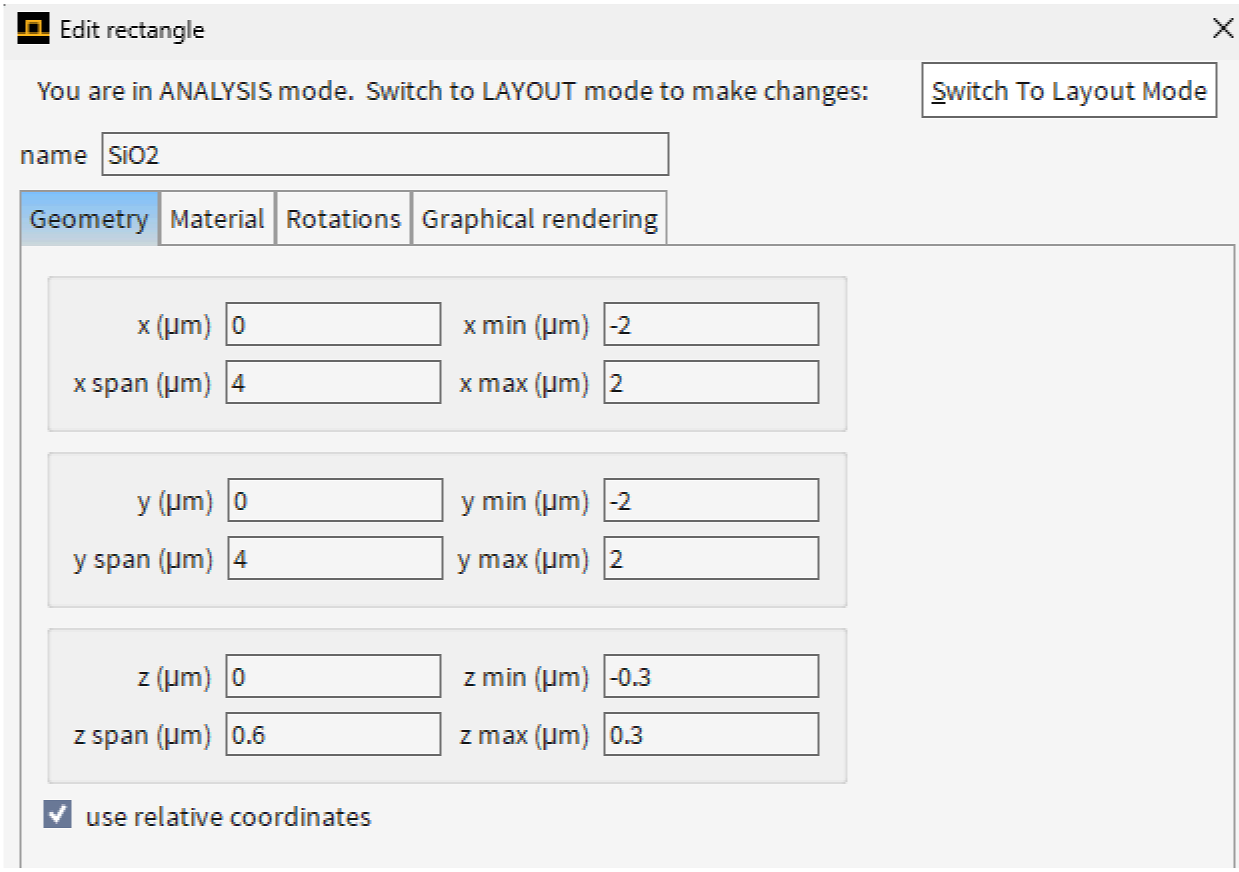
I began by first calculating what ΔL I would require for the interferometer. My first steps were to run a simulation in Lumerical MODE for the given physical size. This was based on the idealised specified dimension. That is 350 nm width, 220 nm height and a wavelength of 1310nm. I then used (eq. 1)

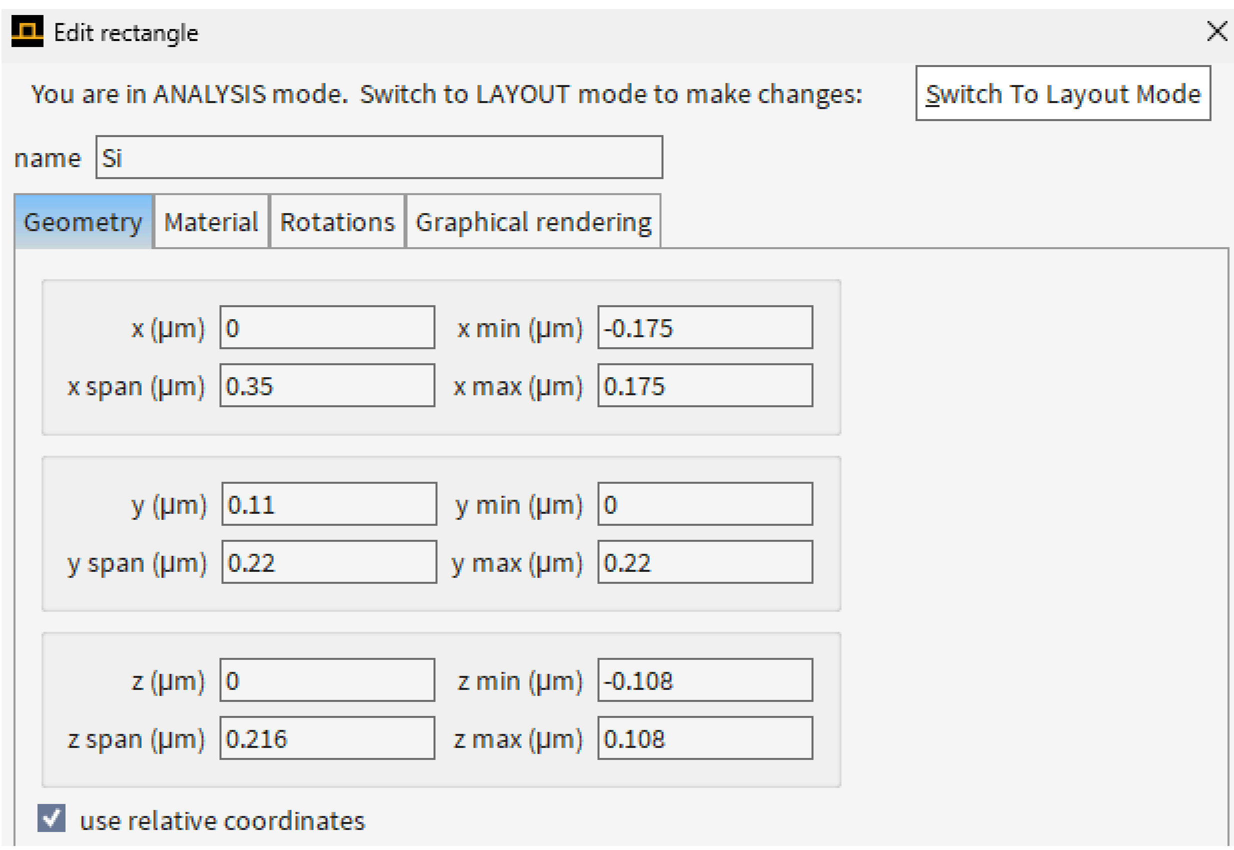
$$\Delta L = c / (FSR * n\_g)$$

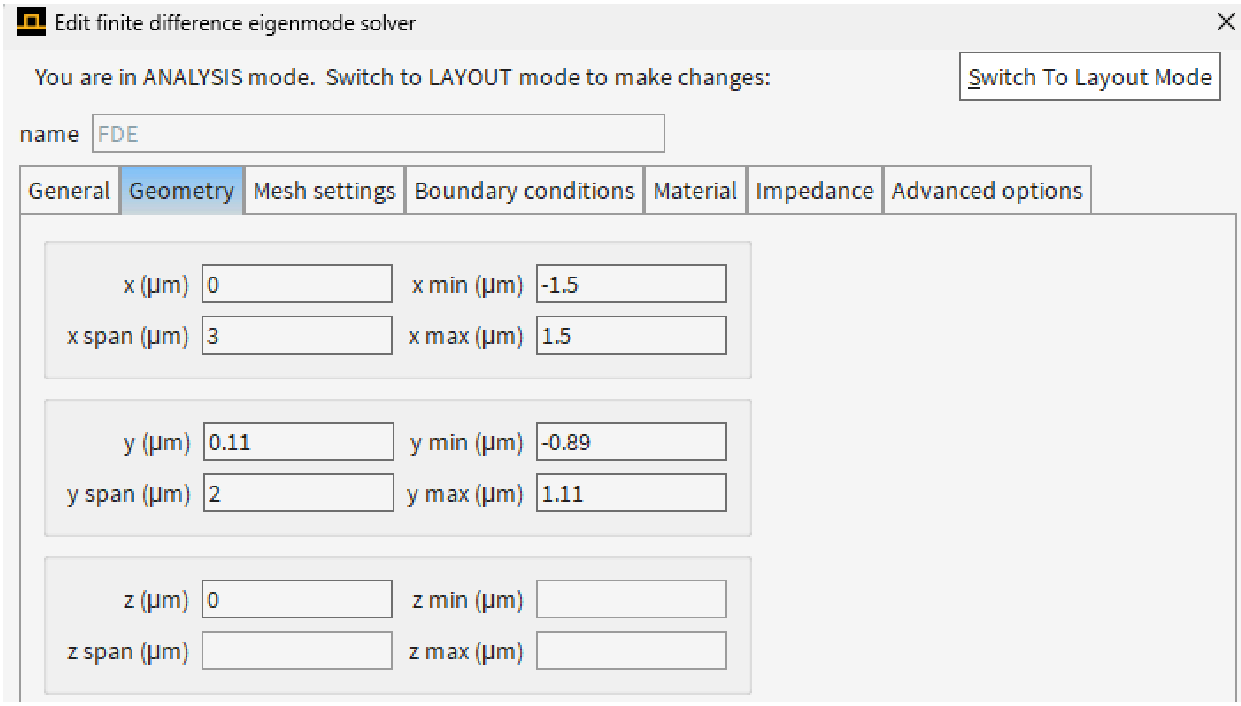
The FSR we are targeting is 25GHz spacing, therefore it remained only to find the group index n_g. This was done in numerical MODE.

Images



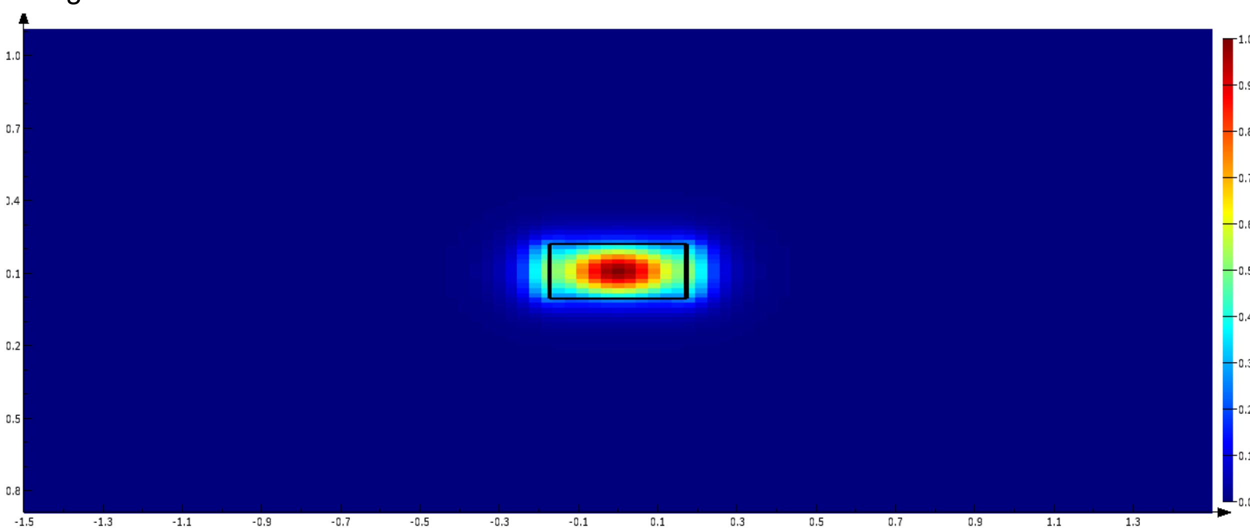

Edit rectangle
You are in ANALYSIS mode. Switch to LAYOUT mode to make changes:
Switch To Layout Mode
name SiO2
Geometry
Material
Rotations
Graphical rendering
x (μm) 0
x min (μm) -2
x span (μm) 4
x max (μm) 2
y (μm) 0
y min (μm) -2
y span (μm) 4
y max (μm) 2
z (μm) 0
z min (μm) -0.3
z span (μm) 0.6
z max (μm) 0.3
use relative coordinates


Edit rectangle
You are in ANALYSIS mode. Switch to LAYOUT mode to make changes:
Switch To Layout Mode
name Si
Geometry
Material
Rotations
Graphical rendering
x (μm) 0
x min (μm) -0.175
x span (μm) 0.35
x max (μm) 0.175
y (μm) 0.11
y min (μm) 0
y span (μm) 0.22
y max (μm) 0.22
z (μm) 0
z min (μm) -0.108
z span (μm) 0.216
z max (μm) 0.108
use relative coordinates



TODO: Update the images to be more explained an integrate

This gave the result seen here



mode #	effective index	wavelength (µm)	loss (dB/cm)	group index	TE polarization fraction (Ex)	waveguide TE/TM fraction (%)	effective area (µm^2)
1	2.429790+1.579253e-09i	1.31	0.00065792	4.499098+3.719344e-09i	98	70.31 / 84.25	0.141679
2	2.008308+1.396056e-09i	1.31	0.00058160	4.625932+5.814175e-09i	5	62.07 / 88.07	0.204789

TODO: Check validity of results

With this group index, from (eq.1) we get **ΔL = 2666.667µm**

The next step was to run a similar simulation, but this time taking into account the “shrinking” that occurs during manufacturing. Per the slides, this was -15nm, so 350 nm *designed* width

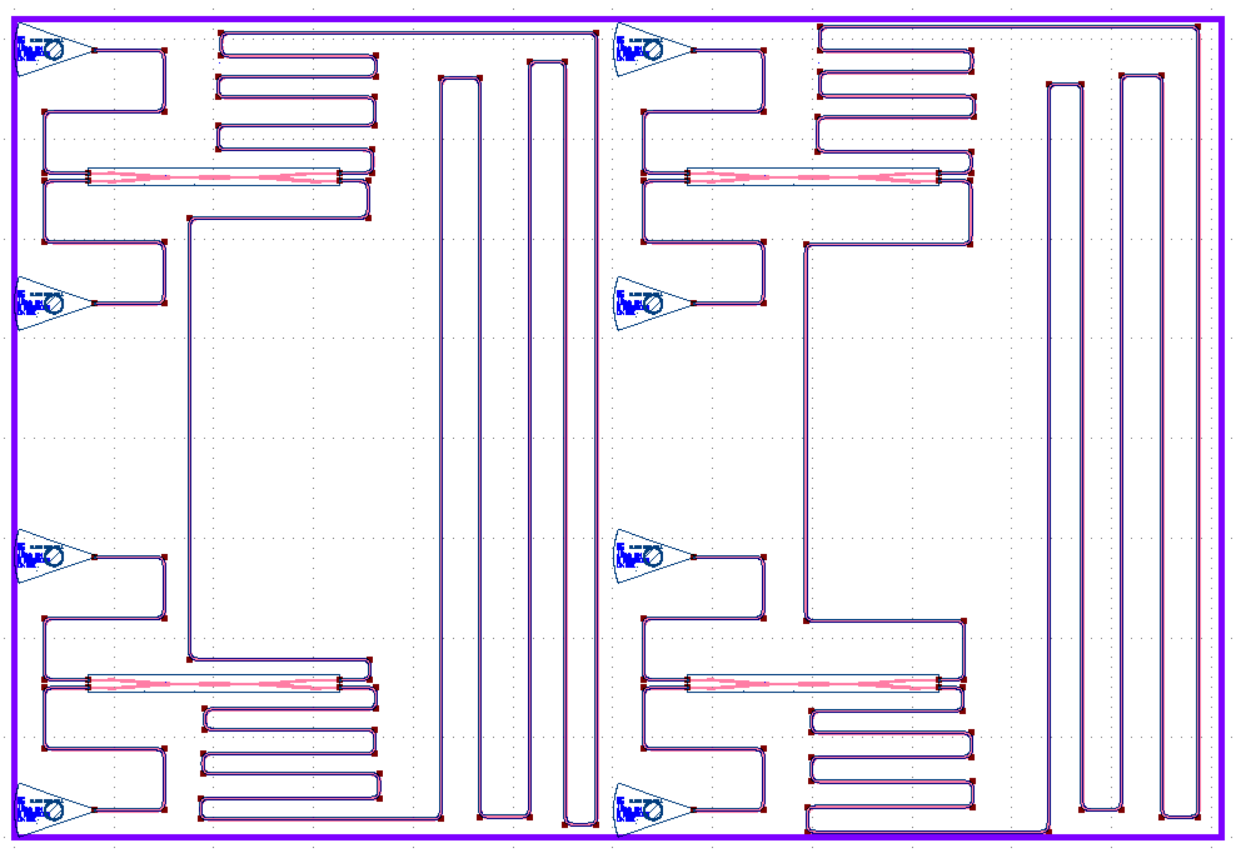
would become 335 nm *real* width. Therefore, I would simulate the results for a width of 335 nm to get my ΔL. Therefore, the ΔL would be the actual ΔL required given the width was 350nm. Doing so gave results:
TODO: Reference shrinking and explain it better

mode #	effective index	wavelength (µm)	loss (dB/cm)	group index	TE polarization fraction (Ex)	waveguide TE/TM fraction (%)	effective area (µm^2)
1	2.382327+1.587773e-09i	1.31	0.00066147	4.554303+3.827430e-09i	98	68.85 / 84.32	0.144132
2	1.988786+1.383029e-09i	1.31	0.00057617	4.612089+5.956273e-09i	5	62.4 / 87.75	0.202808

We see the group index has increased, therefore, using (eq. 1) we get a new **ΔL = 2634.871µm**

Design

Knowing the ΔL we needed for our two design iteration, we could then proceed to creating them in KLayout



TODO: Clean up design…
I fit the two designs onto the layout, with correct ΔL for each, with the left having the idealised ΔL of 2666.6, and the right having the realistic ΔL of 2634.

Next Steps

Now that I have a layout, with a theoretical response the next step will be to simulate this in Lumerical INTERCONNECT, to see how the FSR will look like. THis will require importing the layout and then testing each port to see if I can get the destructive/ constructive interference pattern.