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ELEC 413 REPORT DRAFT 2

CHIP1: Air Cladded MZI 25GHz

Objective: Design both an optical multiplexer that can be used to combine two lasers separated at a 25 GHz channel spacing, into a single optical output, and a demultiplexer that can separate two optical signals from a single waveguide, into separate waveguides.

Wavelength of operation between 1270 and 1330 nm (O Band, centred at 1.31 µm)

A waveguide width of 350nm was chosen to align with waveguide width of the following PDK components being used:

SiEPICfab\_Ebeam\_ZEP.GC\_Air\_te1310\_BB

SiEPICfab\_Ebeam\_ZEP.splitter\_swg\_assist\_te1310

Simulations were done in Lumerical MODE at a waveguide width of 350nm (chosen above), and height of 220nm (defined by the process). A simulation boundary of 2.5um x span by 1.7um y span was used to ensure the field had sufficiently decayed at the simulation span to obtain the most accurate simulation results.

An effective index for the mode of interest (TE1 mode) was shown to be 2.3623 at 1310nm

A screenshot of a computer

Description automatically generated

Next, a wavelength sweep was performed, tracking the mode of interest TE1 from 1270-1330nm to calculate the effective index and group index across the frequency band.

A graph with a line and a line

Description automatically generated with medium confidence

A graph with a line

Description automatically generated

To calculate the required delta L for an FSR of 25GHz and group index of 4.7672, the following calculations were done:

=2.5172 mm

The target will be 2517.2um

In \_v03 of my design there are three copies of the MZI with delta L of 2517.2um to study manufacturing tolerances across the chip.

In \_v04 of my design there are 2 variants that have a delta L of +/- 1% to have 3 shots at hitting the target of 25GHz (accounting for manufacturing tolerance differences).

To both versions a circuit was added consisting of 2 grating couplers connected by a waveguide to calibrate the measurement system insertion loss.