Bragg Grating

Week 3

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OBJECTIVES

- Verify the gratting results changes with diferent parameters

- Verify how the lenght impact the gratting.

CONSTANT VALUES 0.45NM GUIDE

Using Lambda = 1550nm and 25nm FWHM

Using FDE solver on an straight 0.22um tall, 0.45um thickness waveguide, we can get the constants we need to start projecting the gratting.

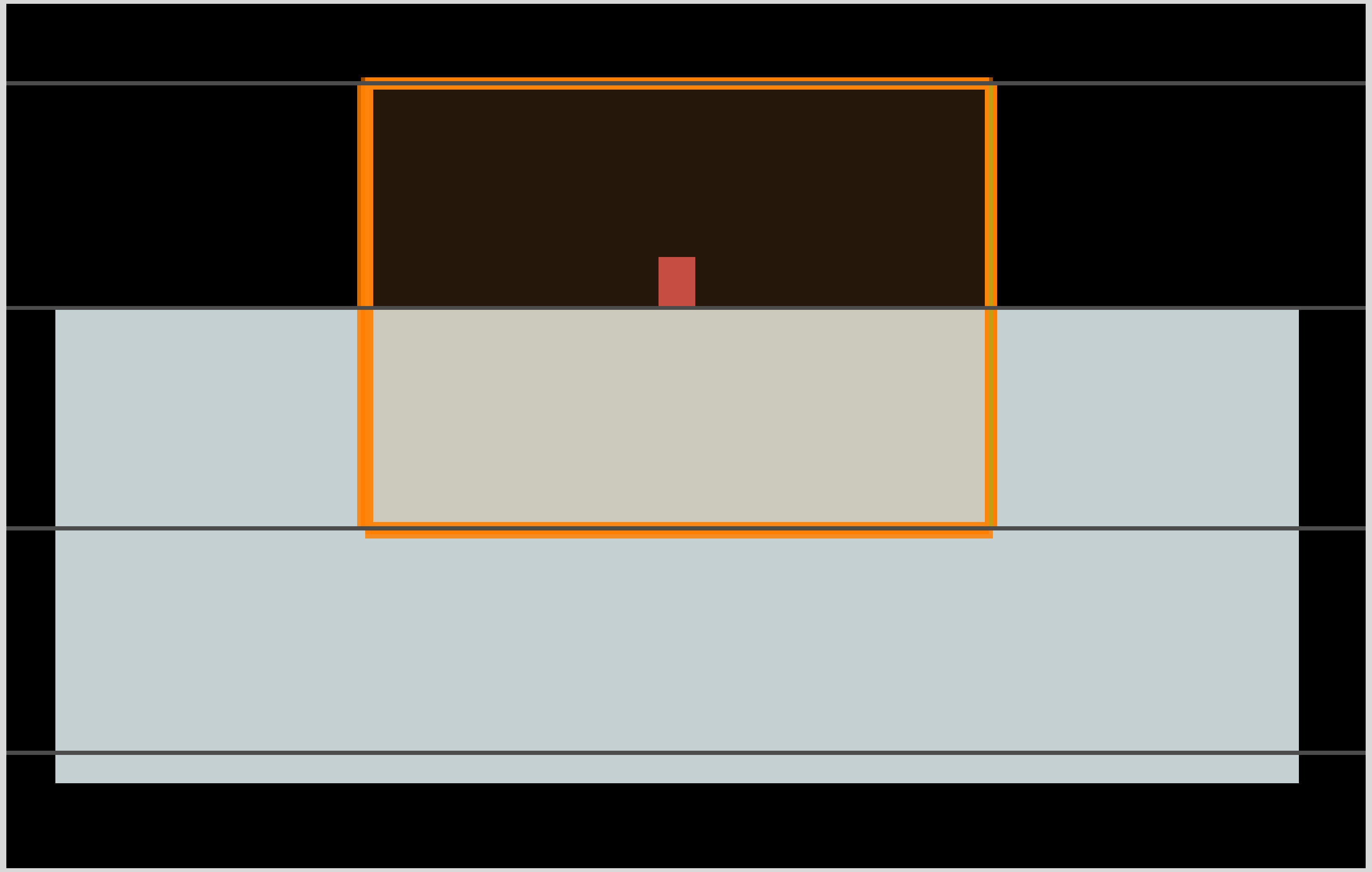
Neff = 2.27;

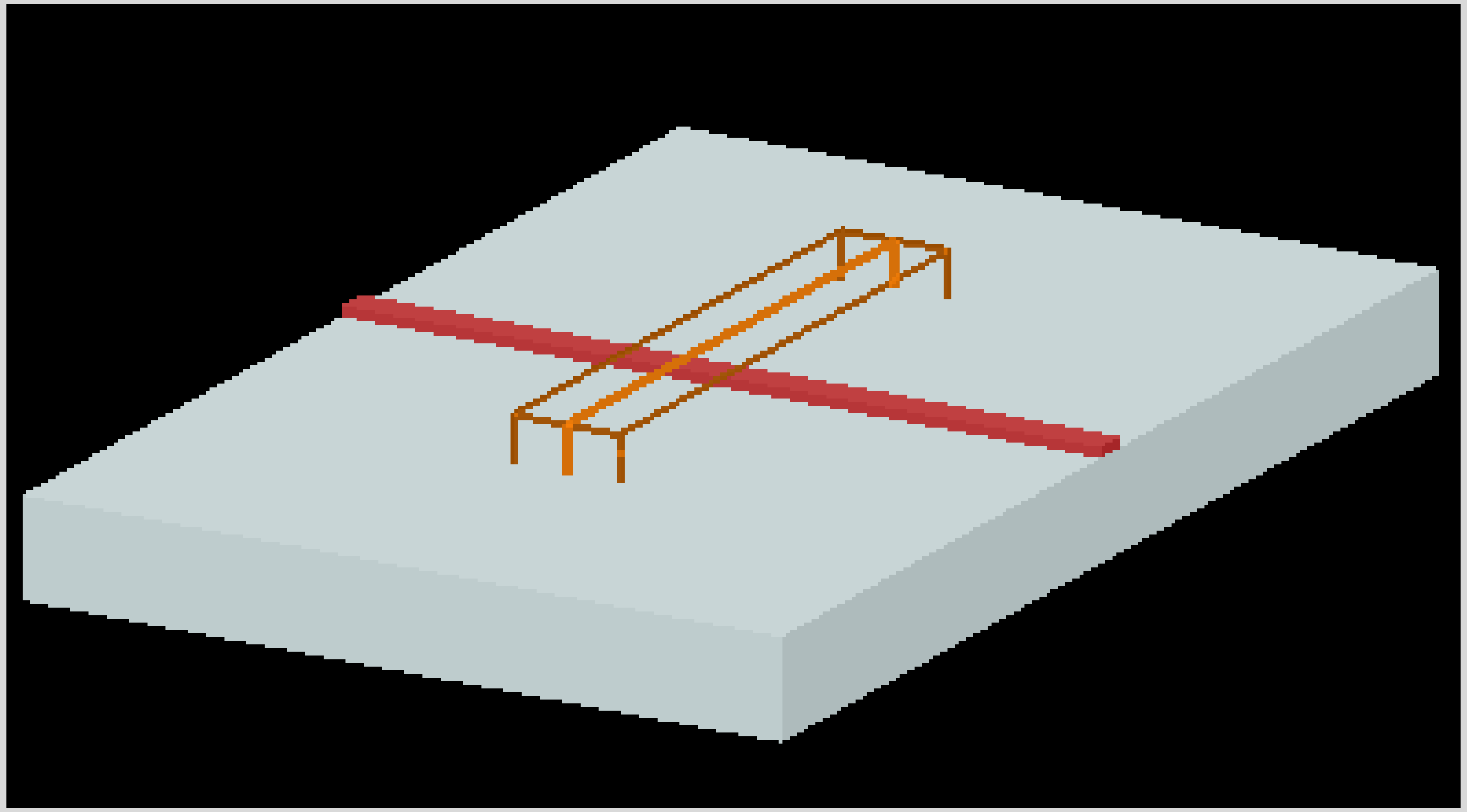
Ng = 4.60;

Grating Period = 341.41nm. (Theoretical Value)

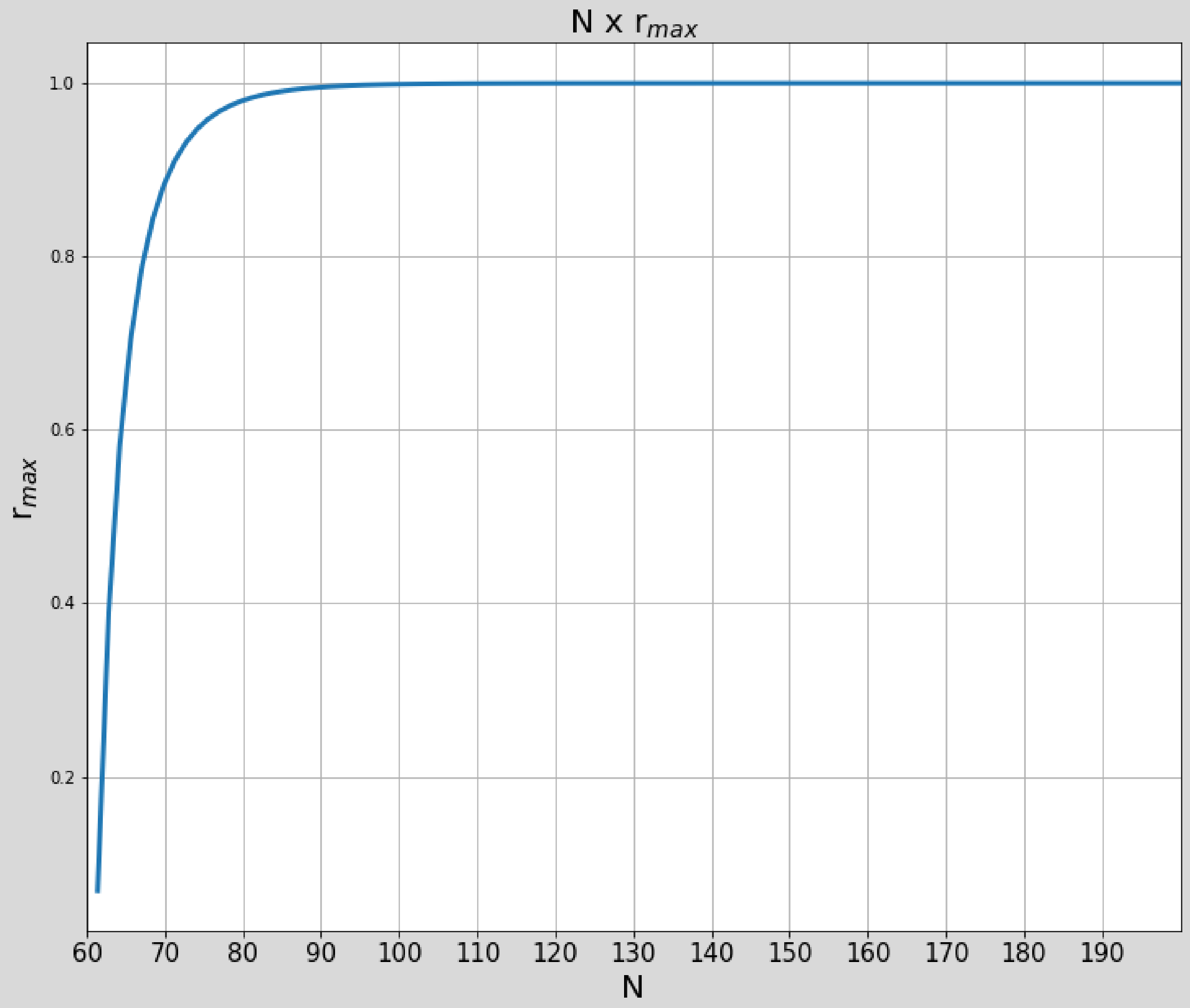
CONSTANT VALUES

Mode





CALCULATING THE NUMBER OF PERIODS



Used value:

N = 82

Theoretical results:

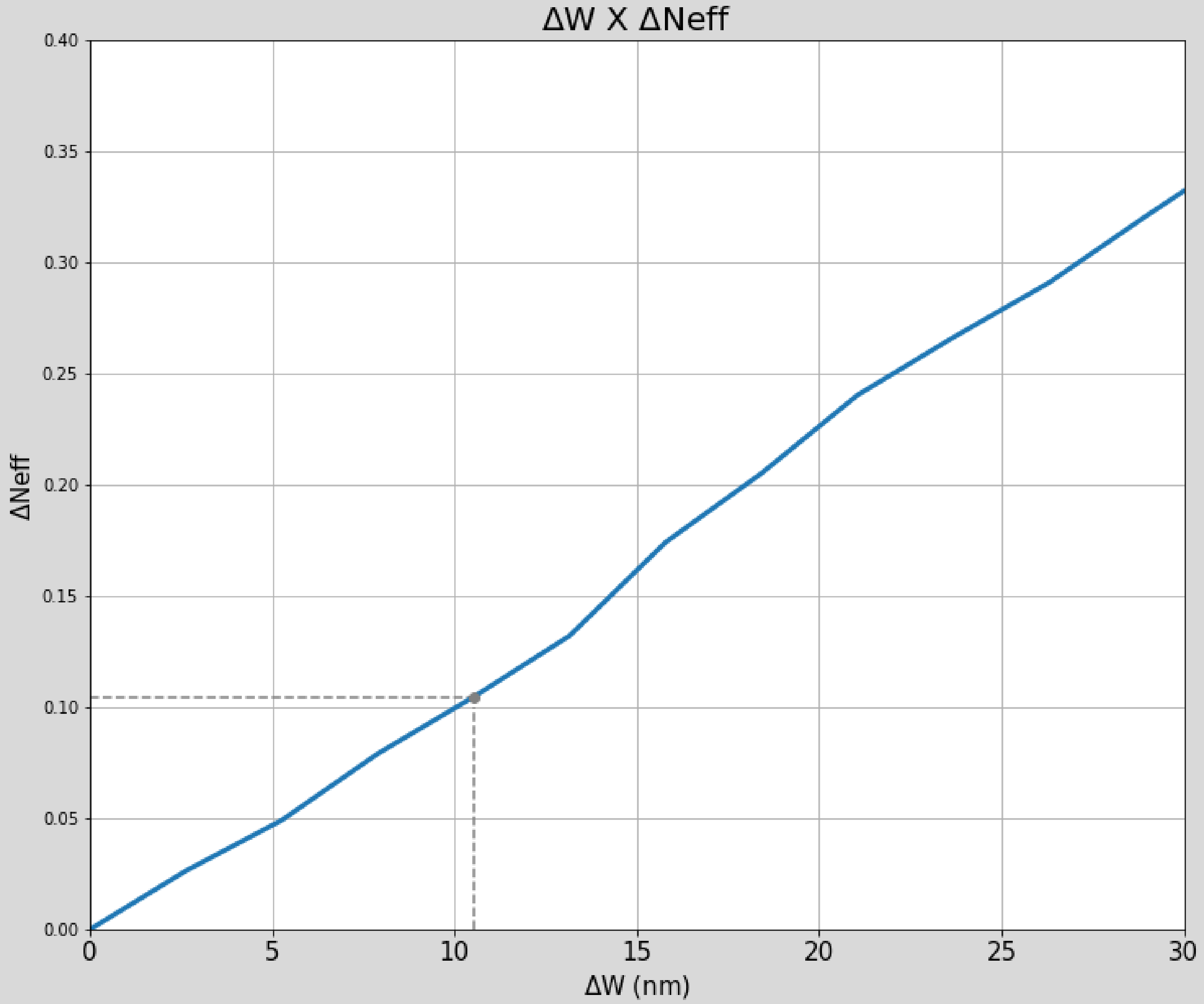
rmax = 1

L = 40.97um

ΔNeff = 0.1

ΔW X ΔNEFF

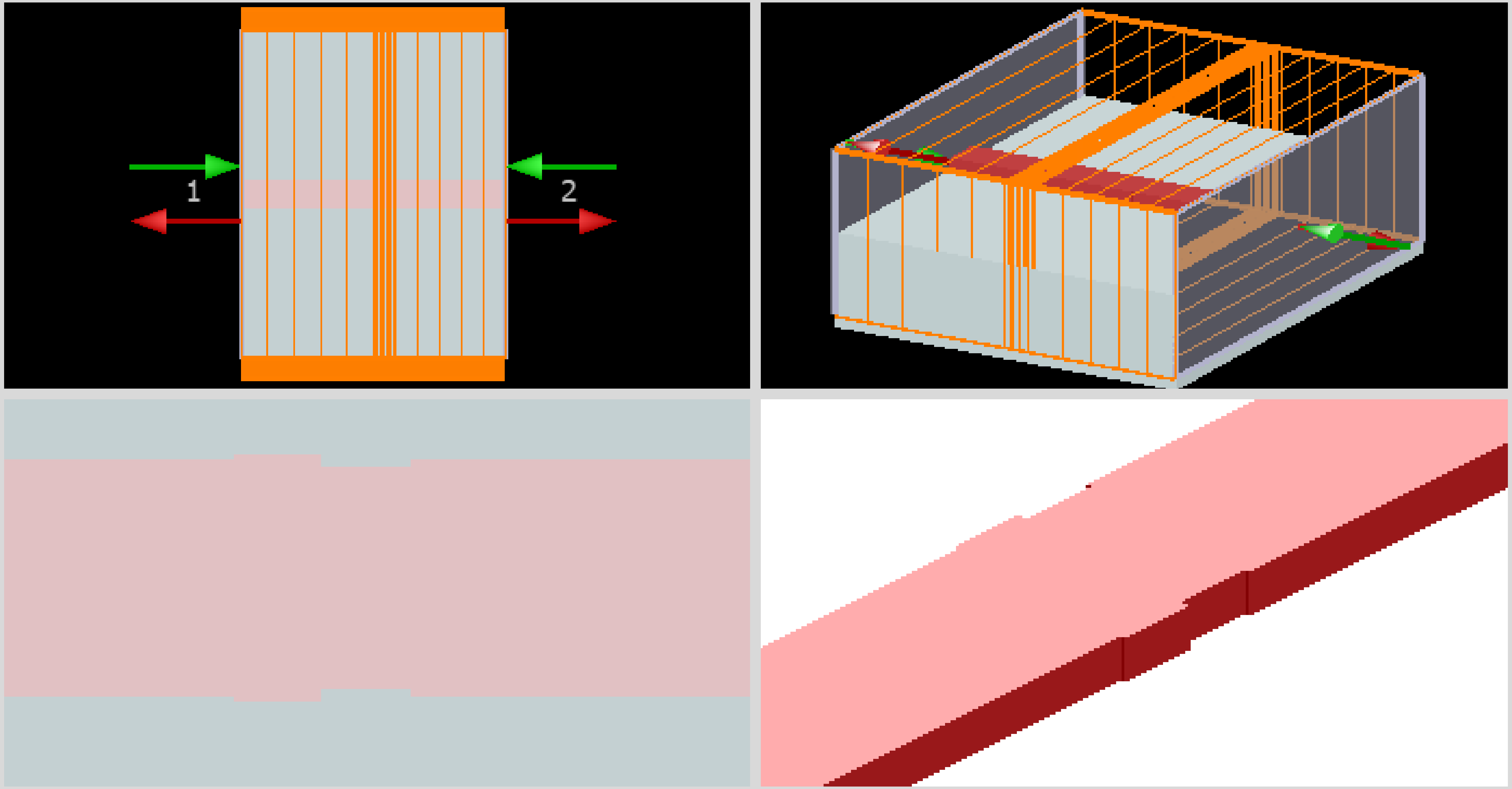
Finding the ΔW to be used on the gratting



With ΔNeff = 0.1 we have:
ΔW = 10.53nm

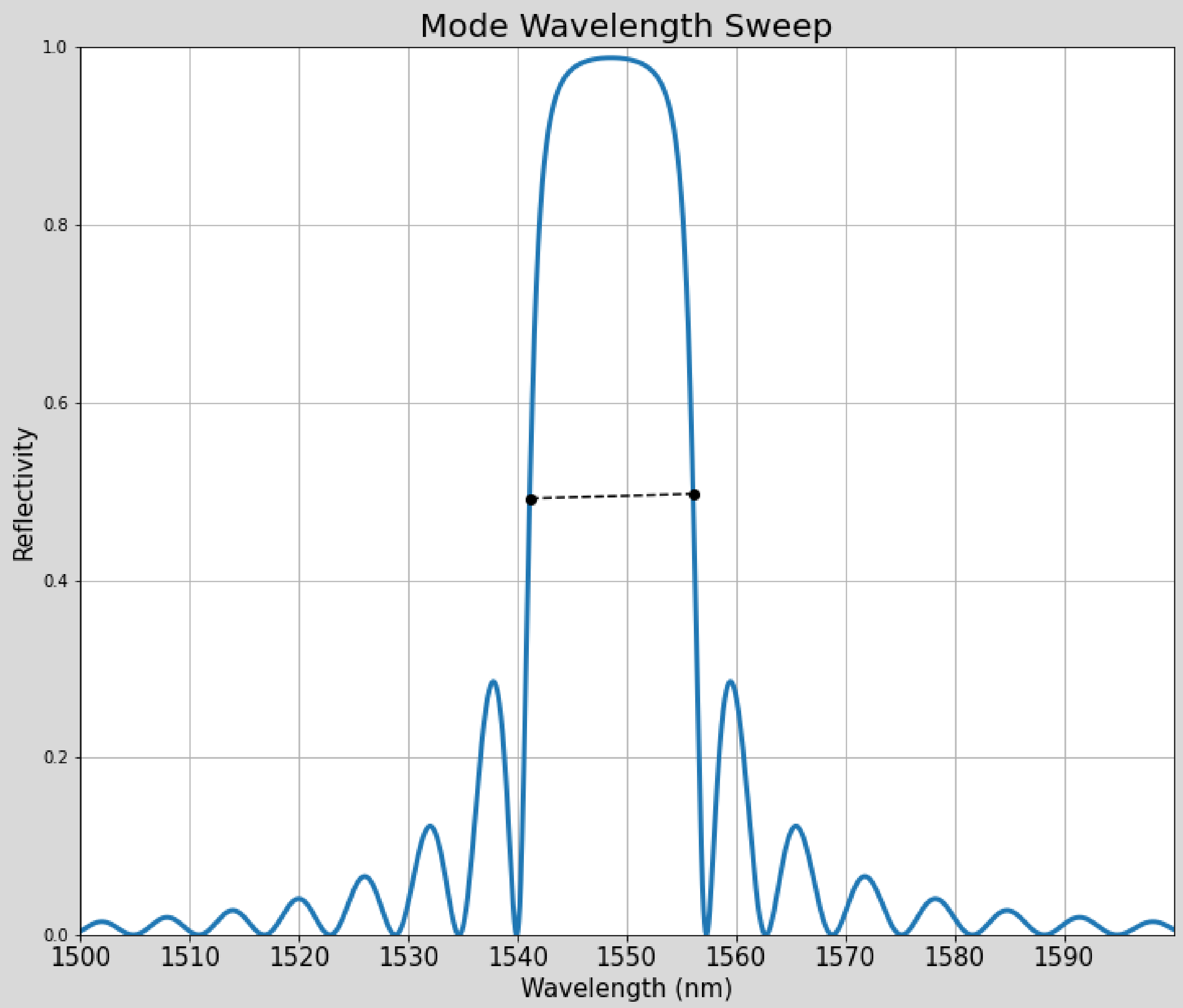
DESIGN

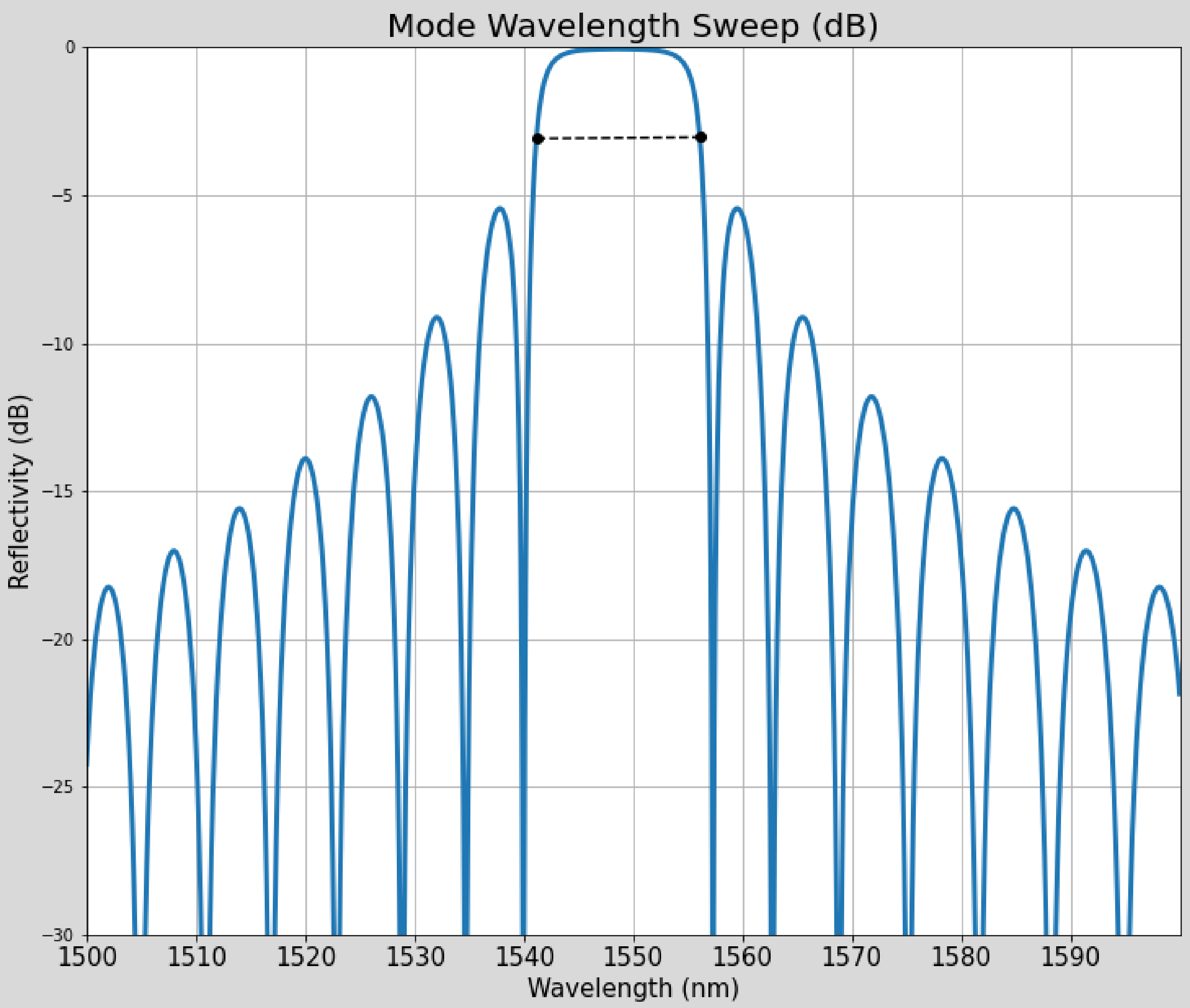
Lumerical mode



THEORETICAL GRAPHICS

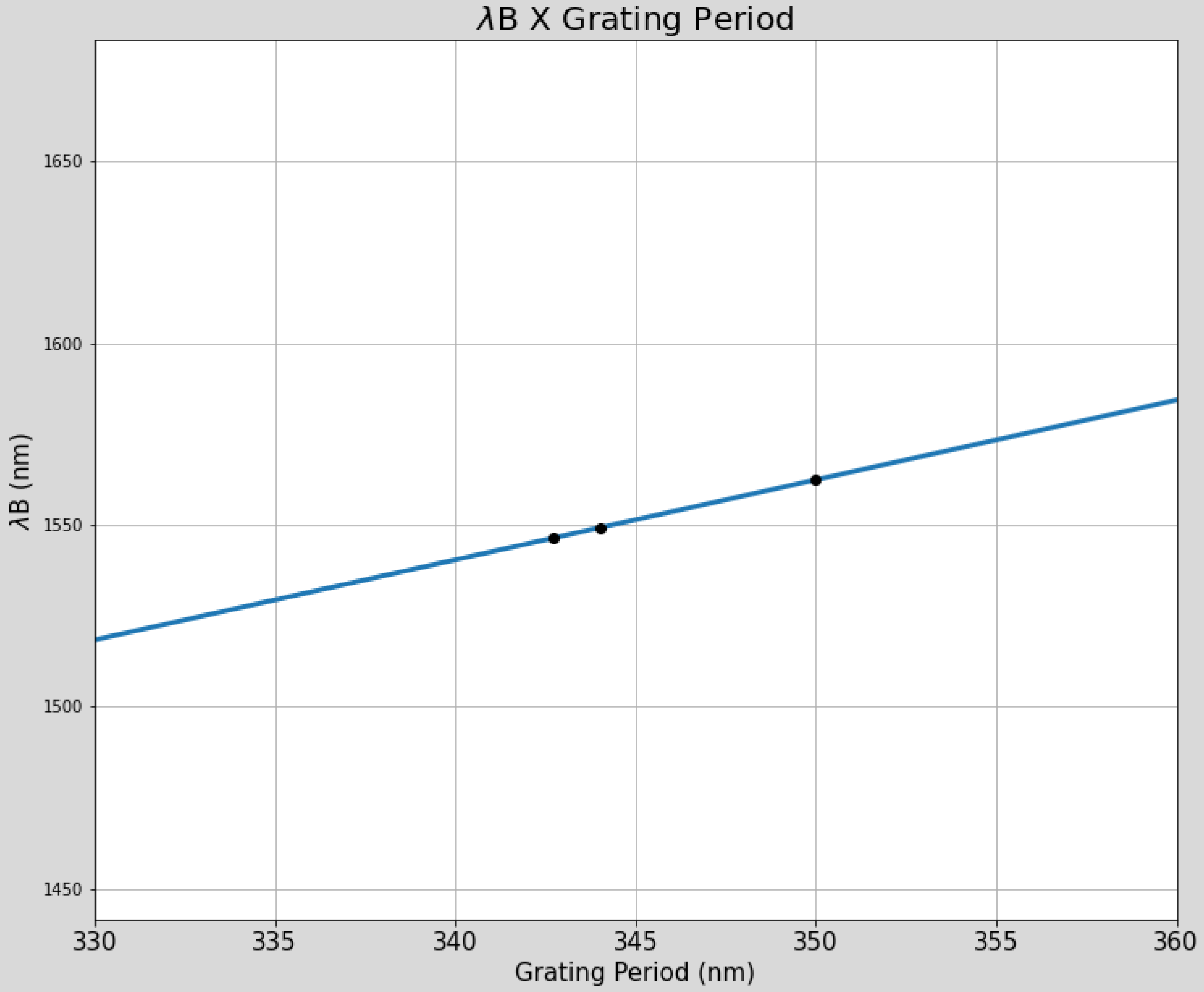
N = 120 (FWHM = 15nm)





OPTIMIZATION

Using ΔW = 24nm (Experimental Value)



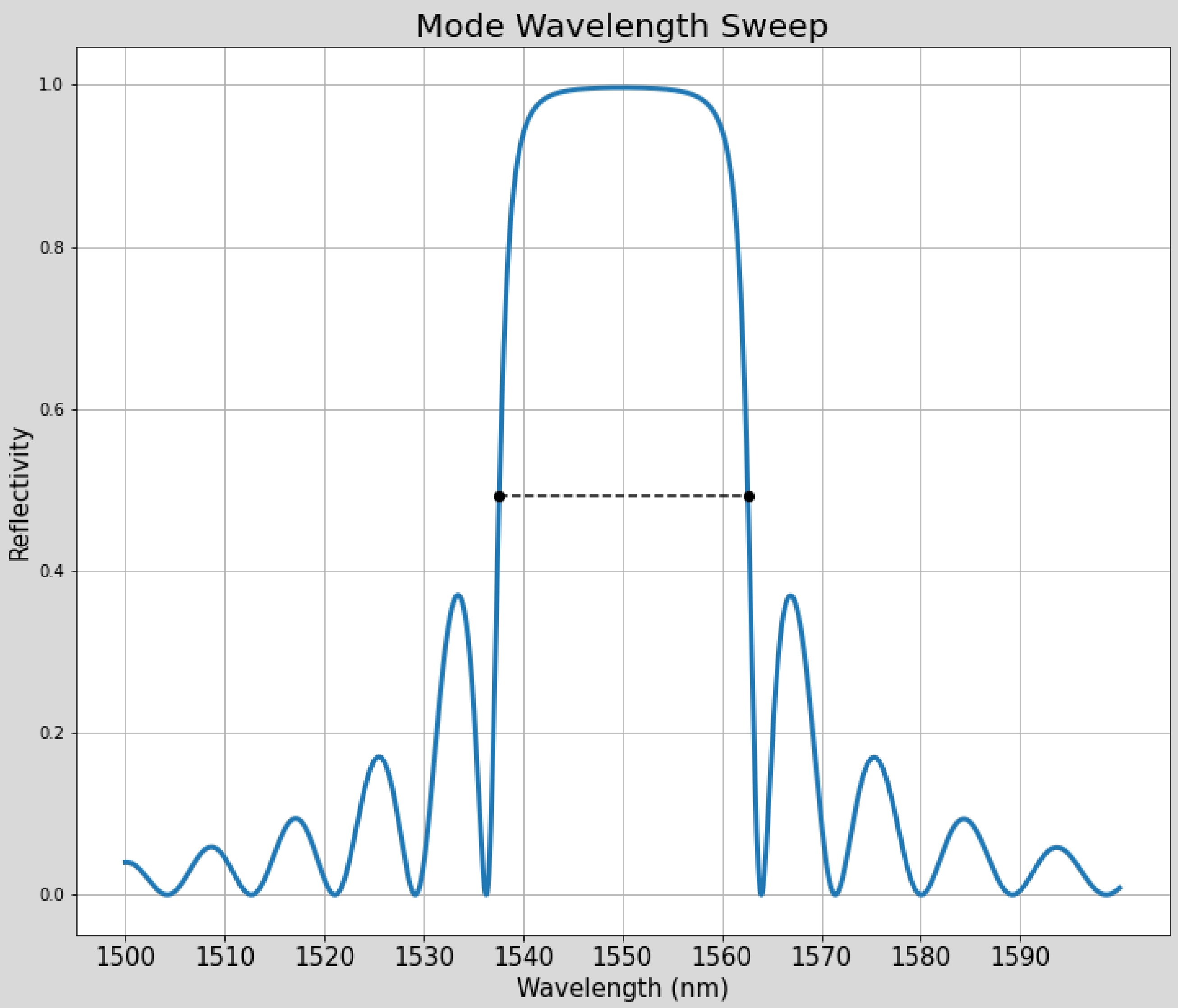
y = 2.197x + 793.392 (nm)

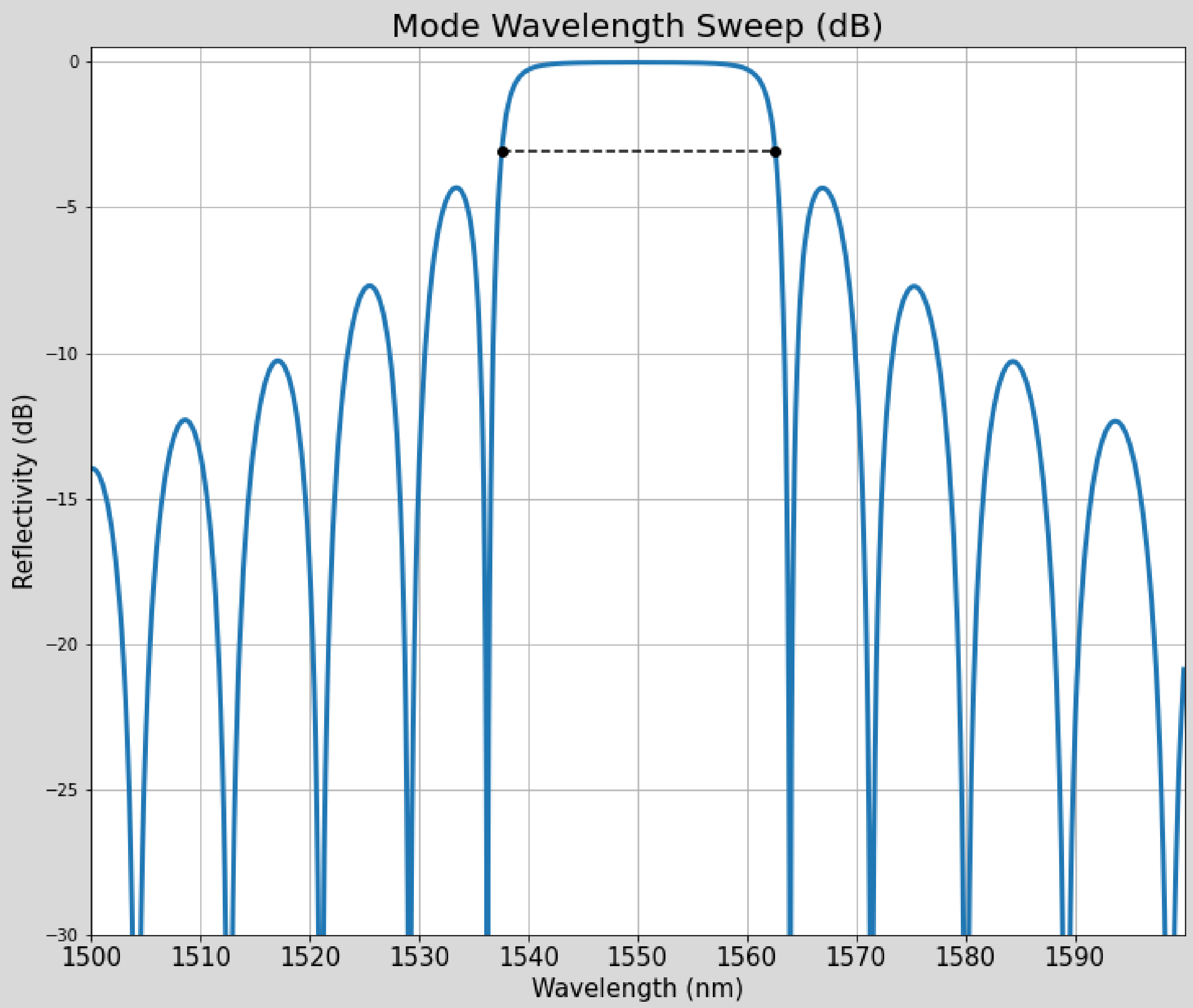
For LambdaB = 1550nm

Grating Period = 344.3777nm

OPTIMIZATION

Final Result 0.45nm Guide (N = 82)



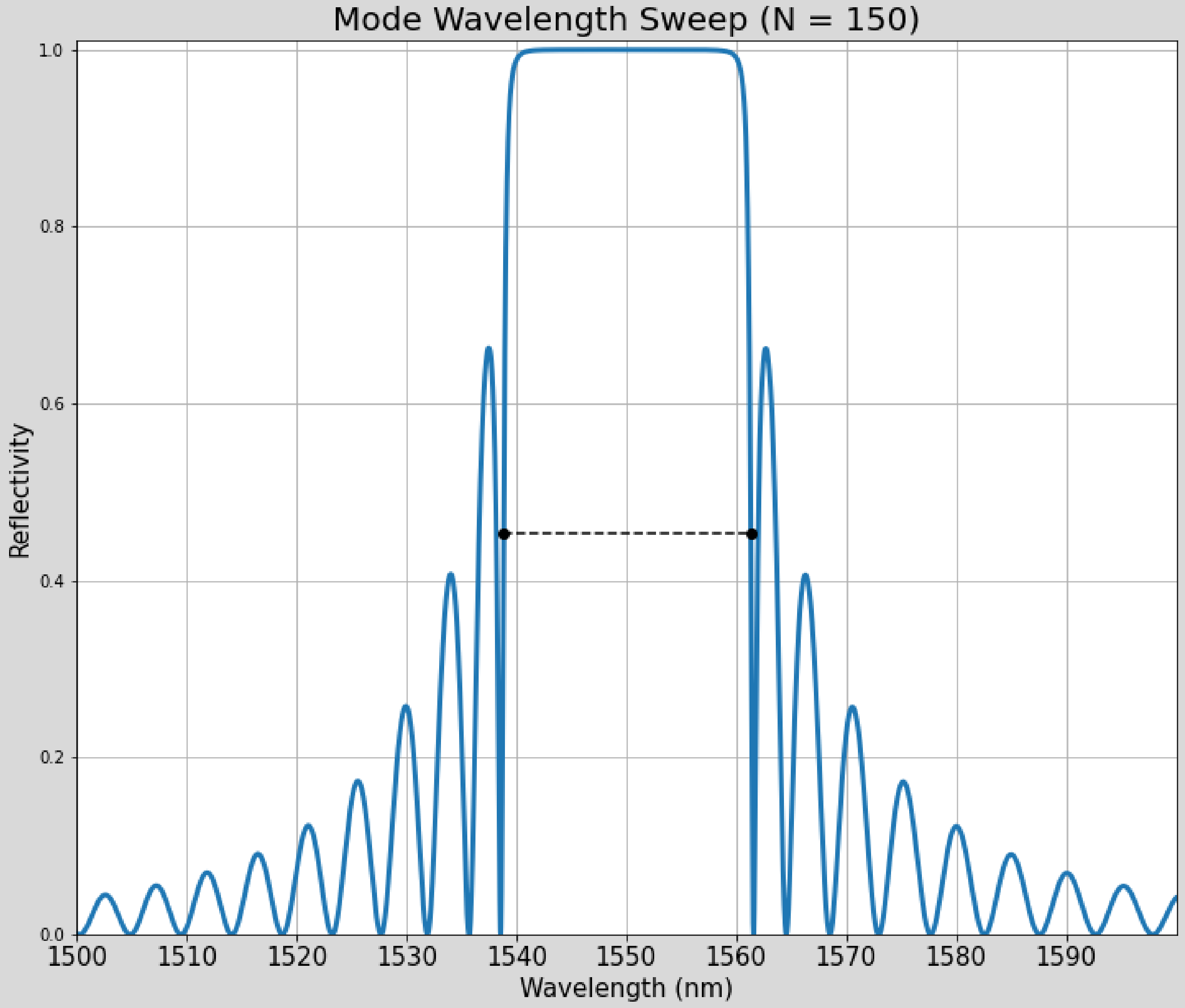


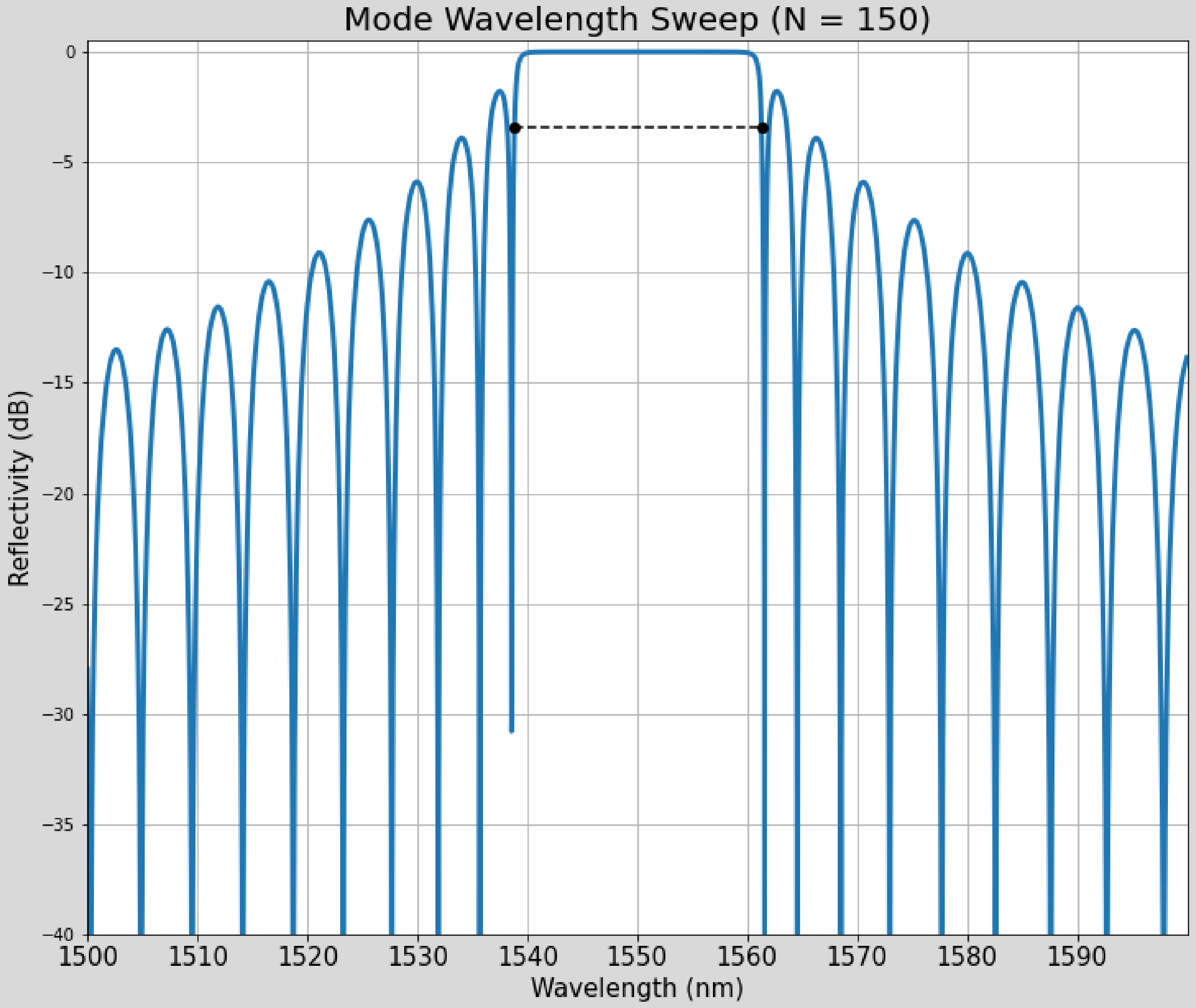
λB = 1550.01nm (0.0006% Error)

FWHM = 25.025nm (0.1% Error)

N VARIATION

Final Result 0.45nm Guide (N = 150)

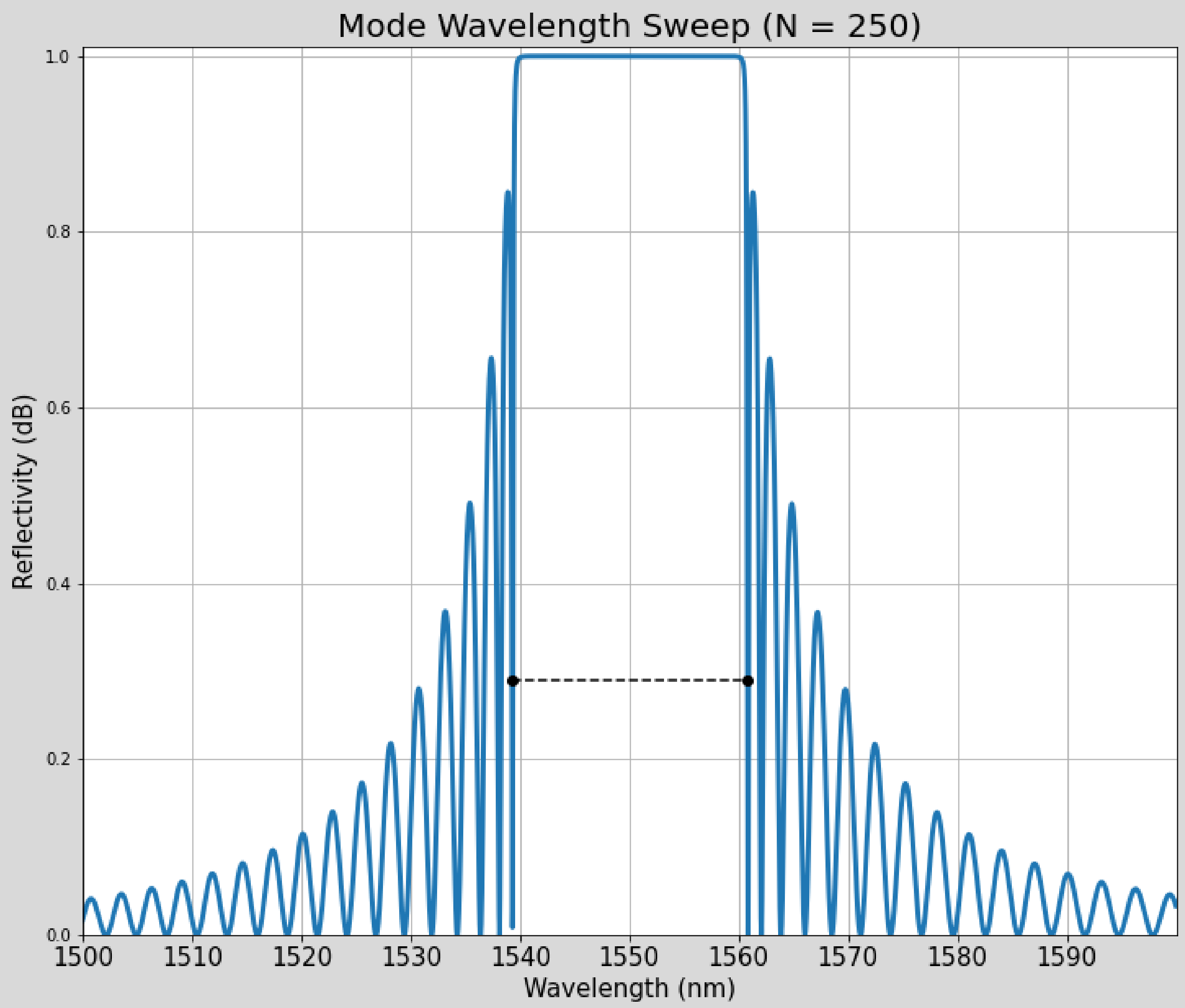


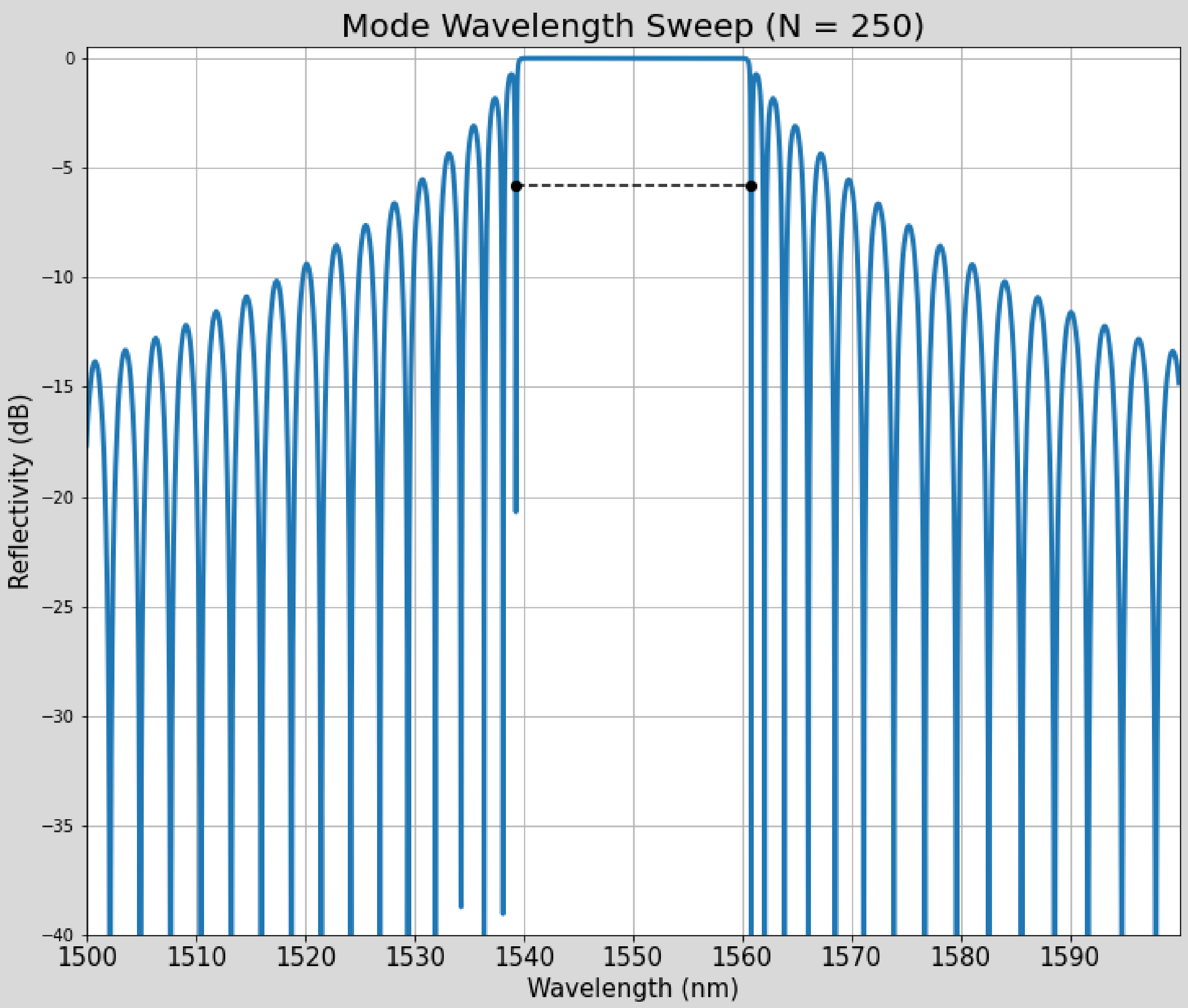


FWHM = 22.4645nm

N VARIATION

Final Result 0.45nm Guide (N = 250)





FWHM = 21.444nm

CONSTANT VALUES 0.6NM GUIDE

Using Lambda = 1550nm and 25nm FWHM

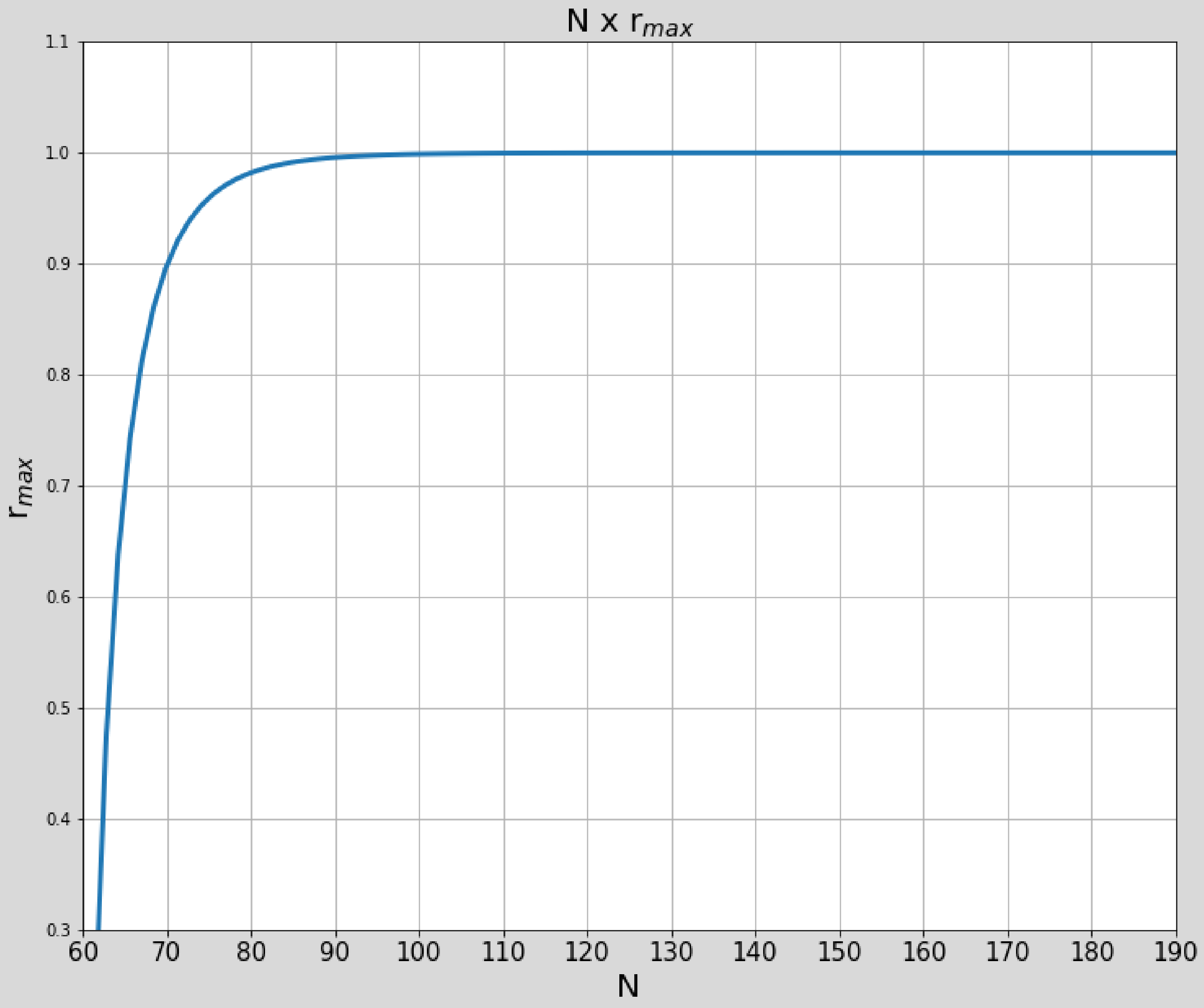
Using FDE solver on an straight 0.22um tall, 0.6um thickness waveguide, we can get the constants we need to start projecting the gratting.

Neff = 2.53;

Ng = 4.20;

Grating Period = 341.41nm. (Theoretical Value)

CALCULATING THE NUMBER OF PERIODS



Used value:

N = 130

Theoretical results:

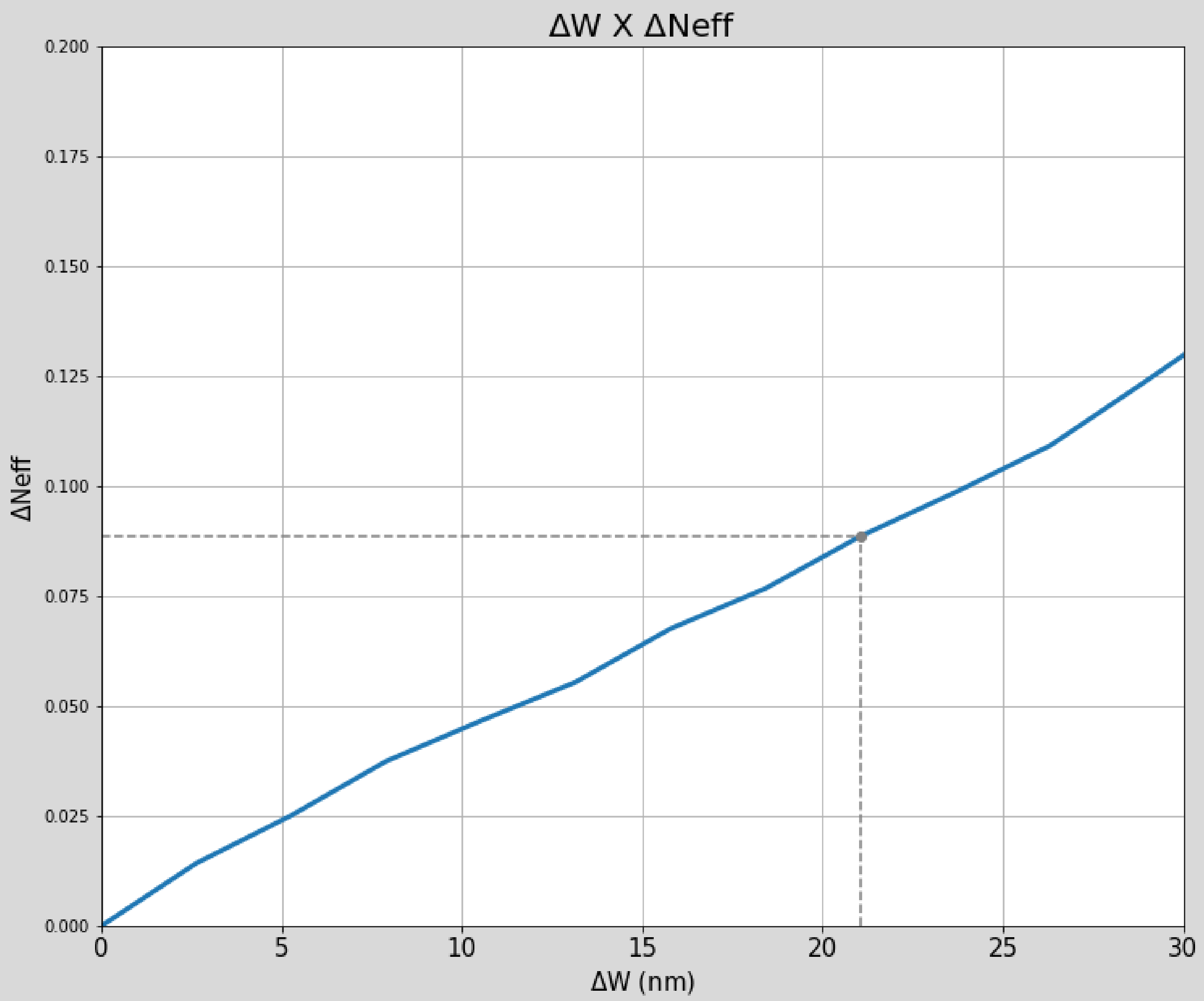
rmax = 1

L = 39.82um

ΔNeff = 0.09

ΔW X ΔNEFF

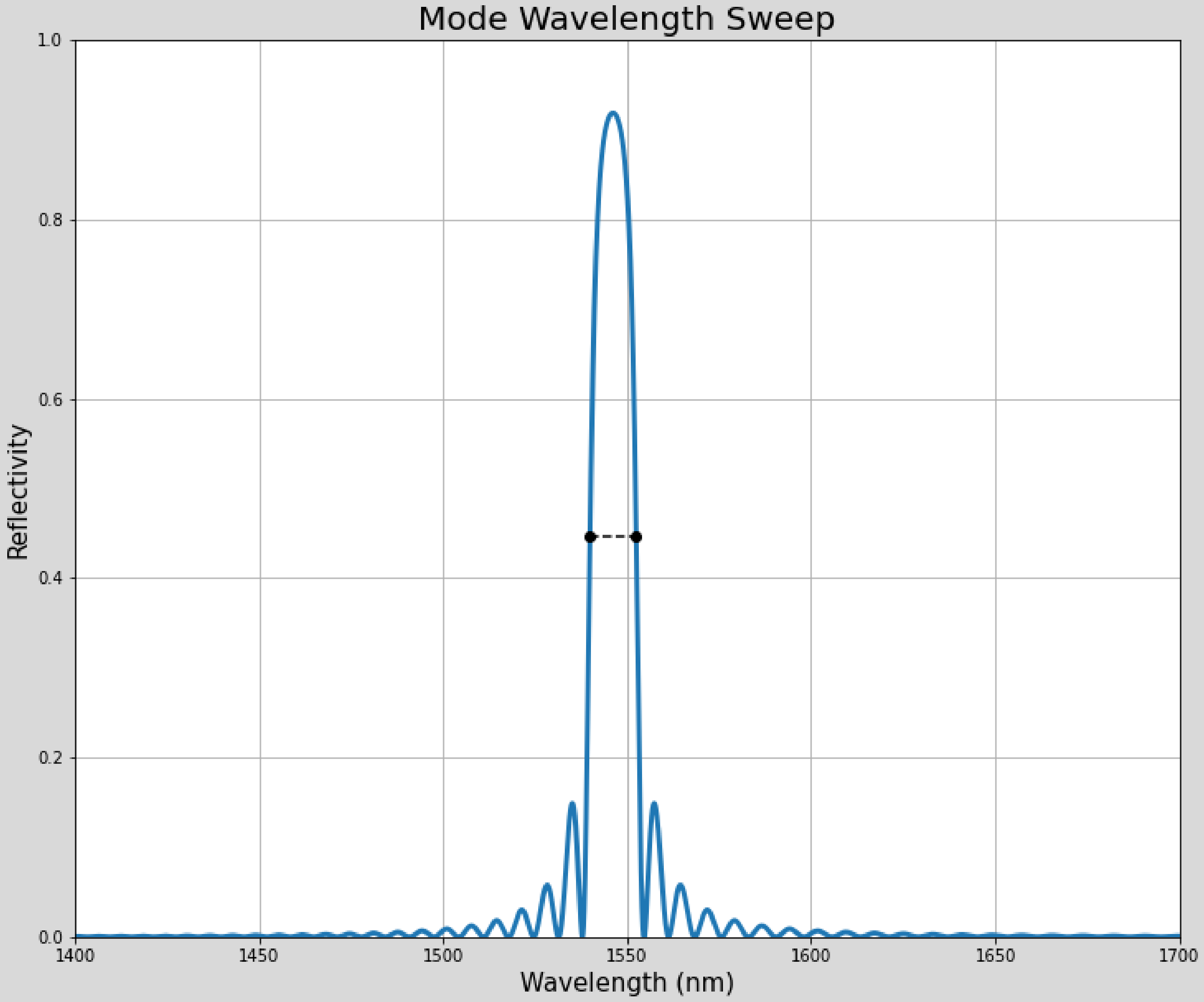
Finding the ΔW to be used on the gratting

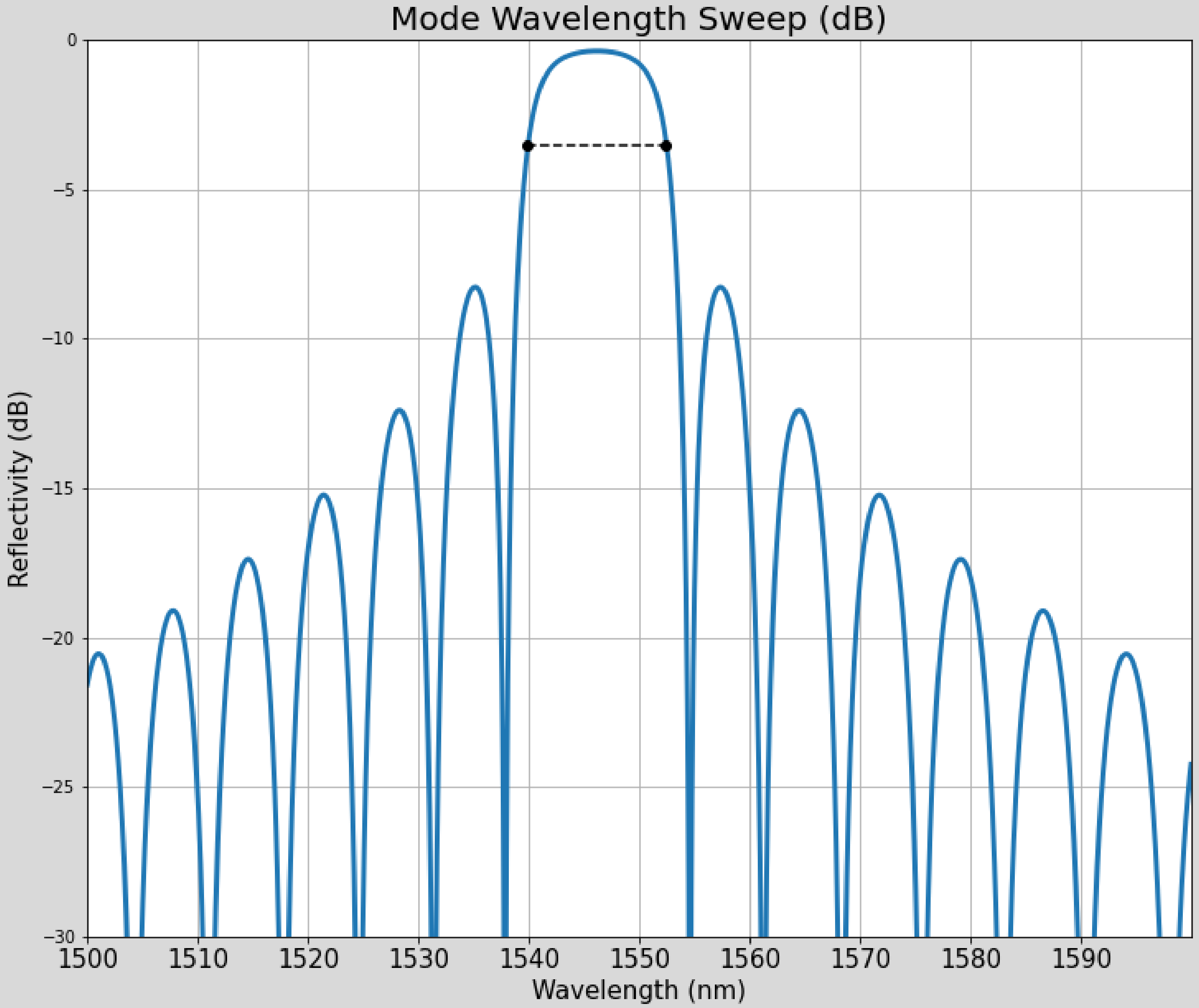


With ΔNeff = 0.09 we have:
ΔW = 21.05nm

THEORETICAL GRAPHICS

N = 130 (FWHM = 15nm)



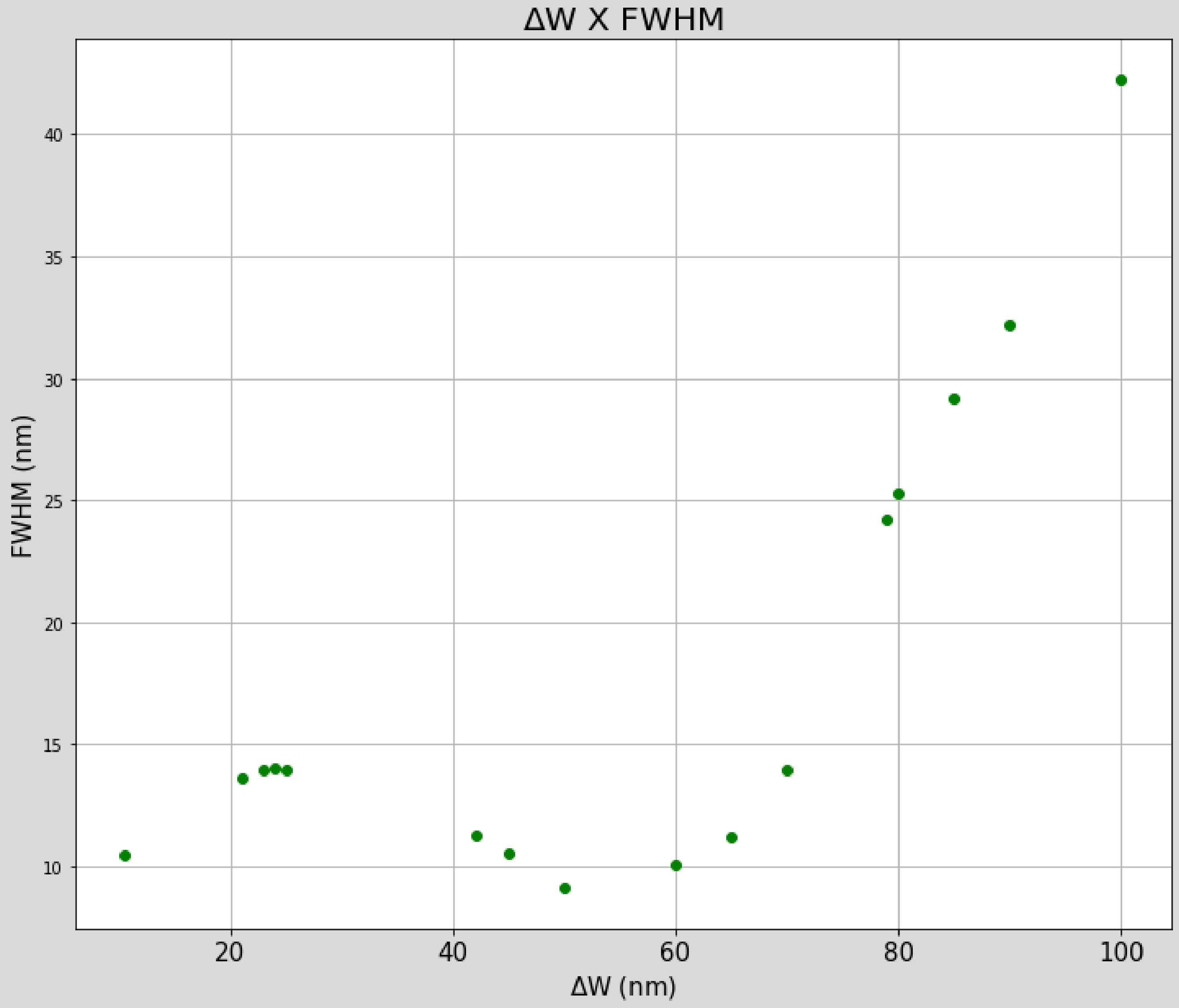


FWHM = 12.5425nm

λB=1546.19nm

DELTAW X FWHM

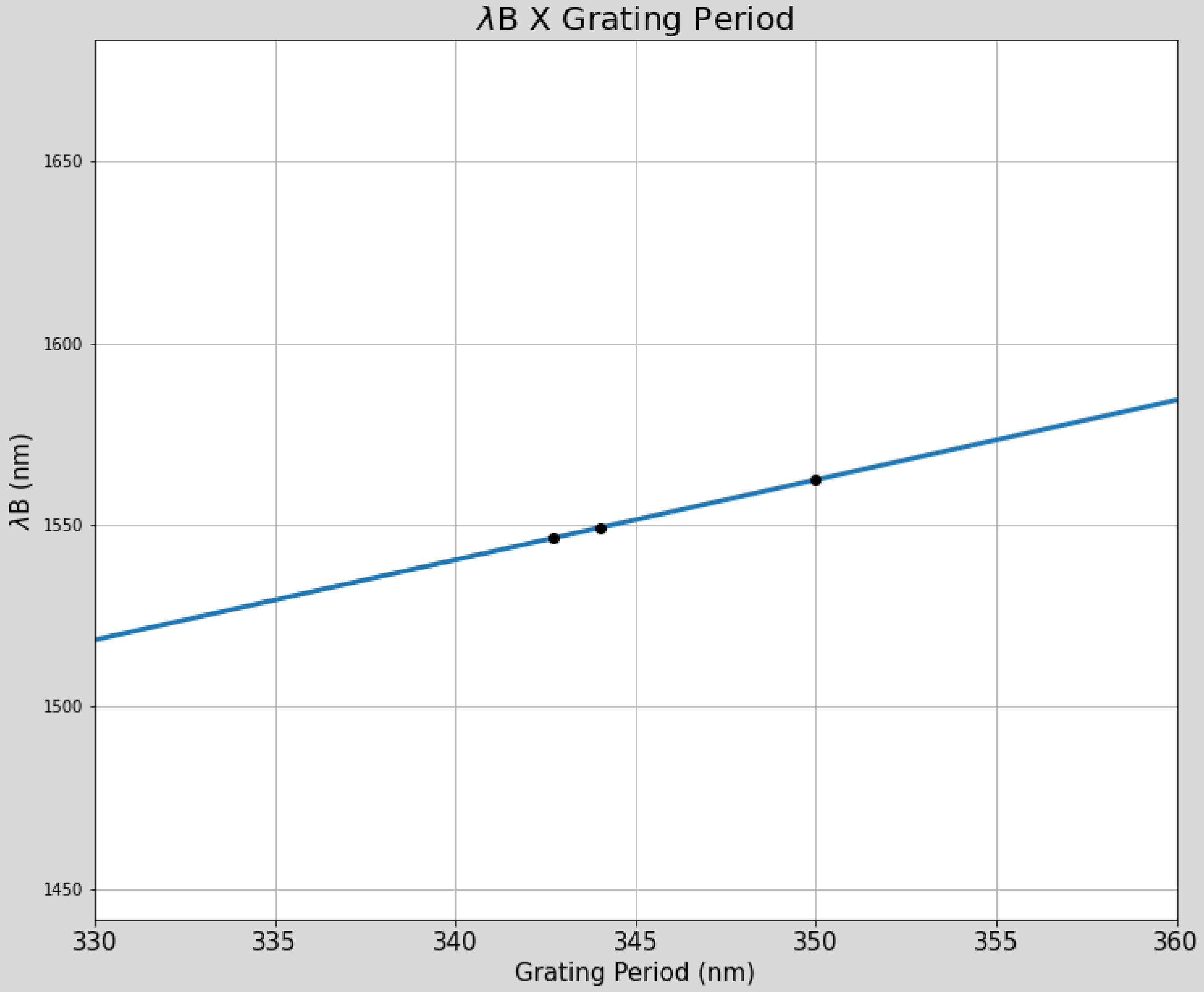
Experimental Points



As we can see the FWHM values are very hard to predict on an 0.6nm and can be only obtained by simulations. Therefore this guide is dificult to be implemented

OPTIMIZATION

Using ΔW = 24nm (Experimental Value)



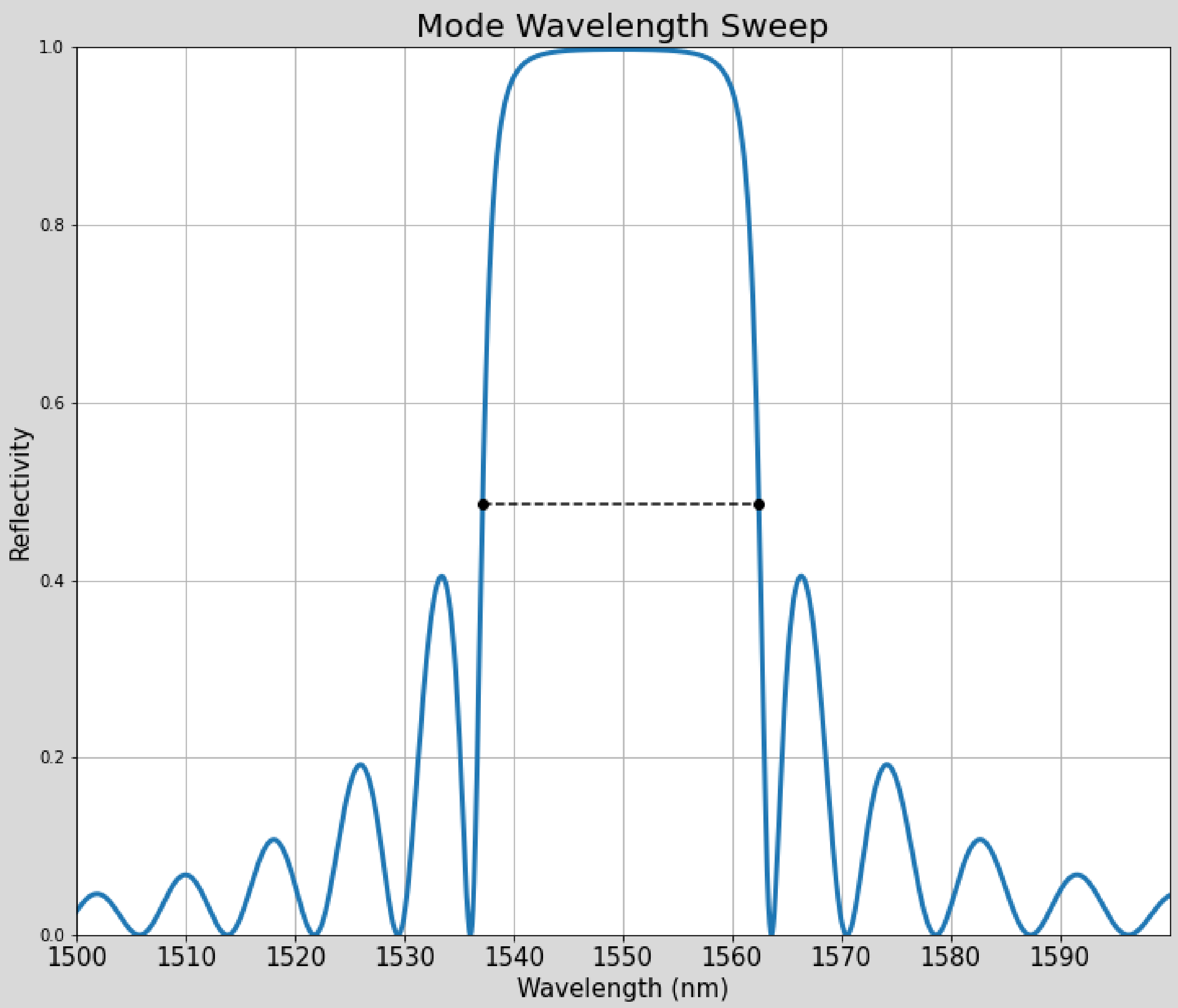
y = 2.818x + 655.810 (nm)

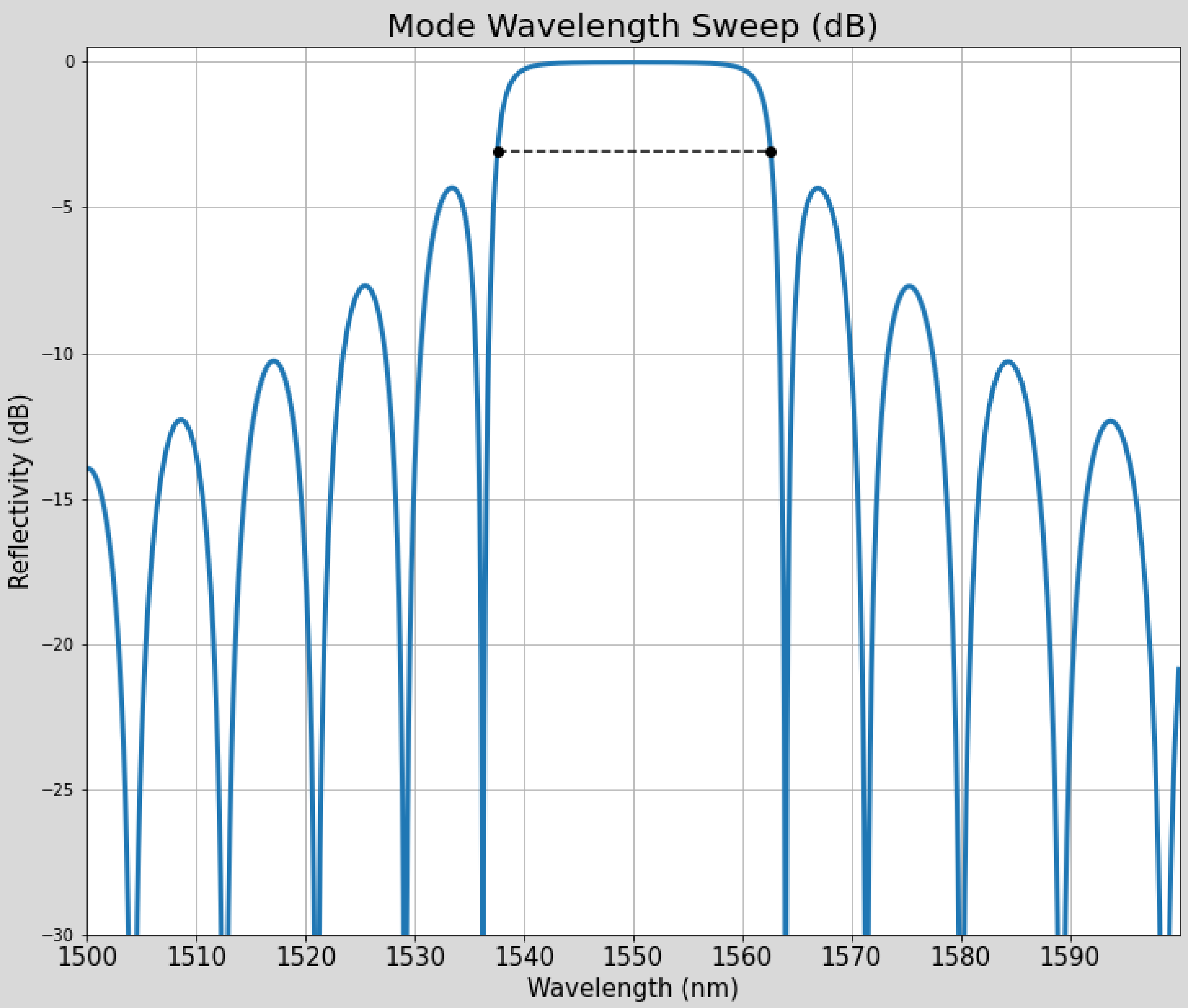
For LambdaB = 1550nm

Grating Period = 317.3210nm

OPTIMIZATION

Final Result 0.6nm Guide (N = 100)





λB = 1549.73nm (0.17% Error)

FWHM = 25.2851nm (1.14% Error)

CONCLUSION

As we can see, when we increase the number of periods the filter noise increase as well.

The 0.45nm grating is more predictble and therefore it may be better than the 0.6nm grating due to an more linear variation of FWHM.