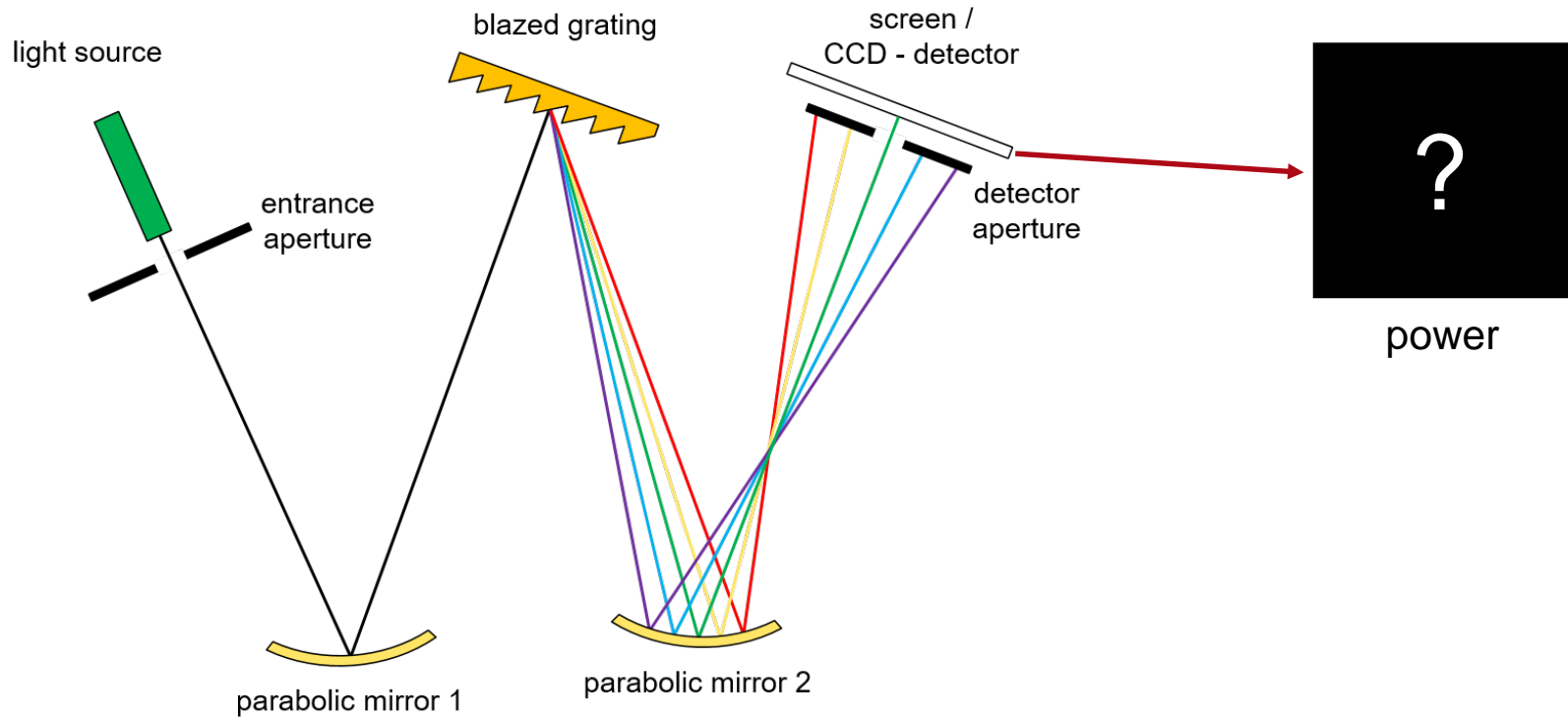


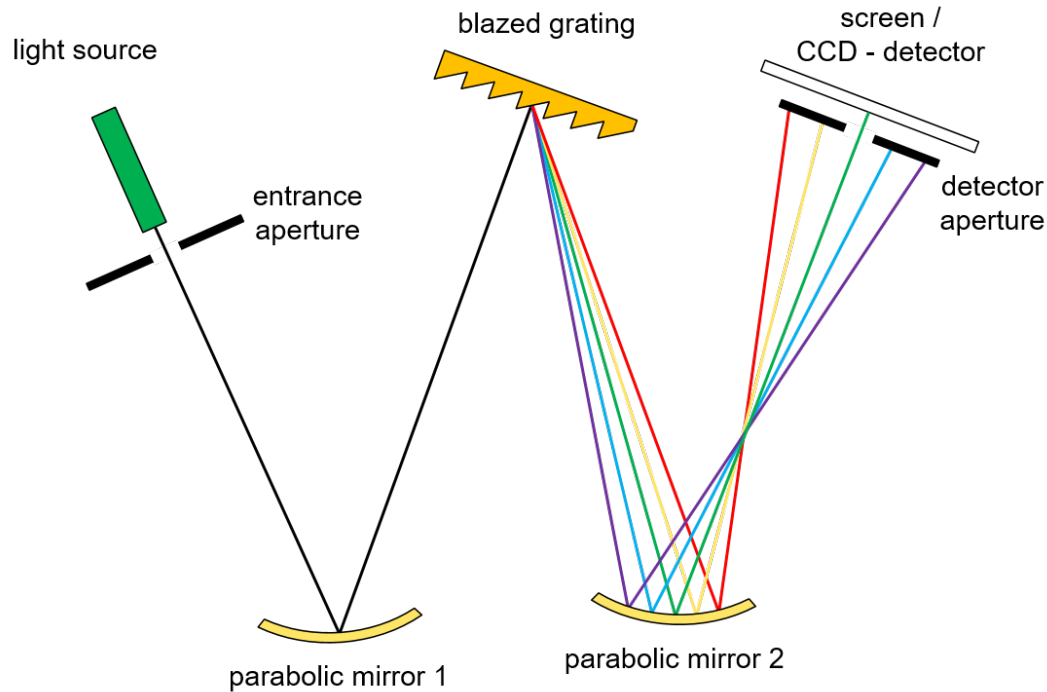
Optical Metrology > Spectrometer

# **Czerny-Turner Spectrometer – Analysis of Spectral Resolution**

# Task/System Illustration

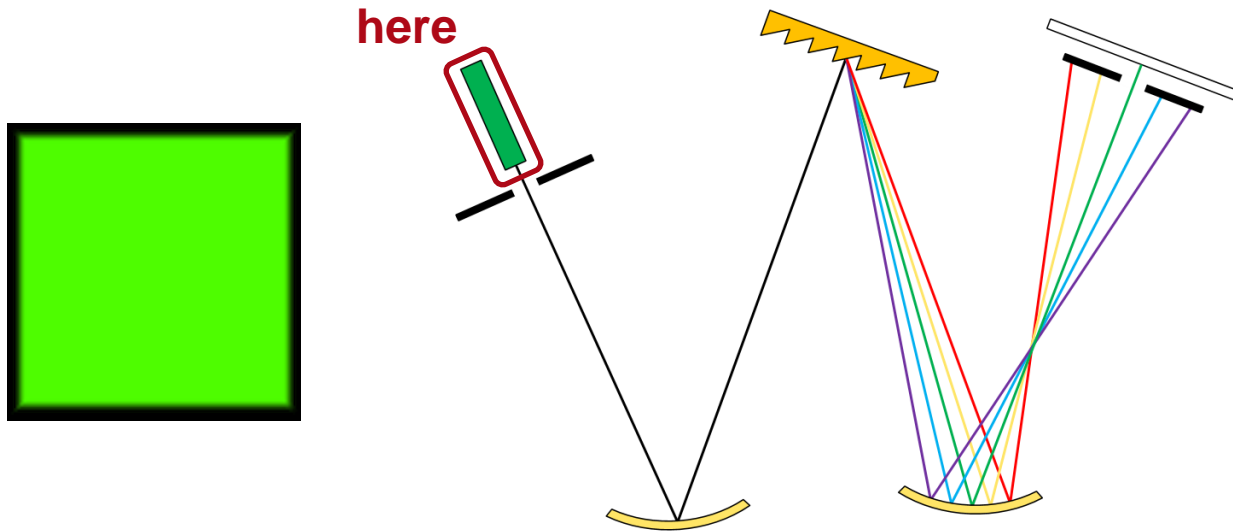


# Highlights



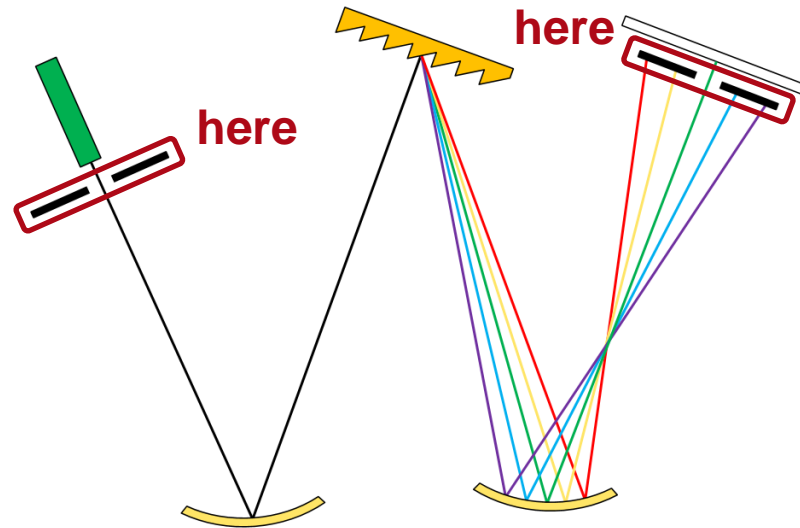
- high-performance analysis of complex optical systems
- full vectorial analysis of gratings by using rigorous algorithm (FMM)

# Specification: Light Source



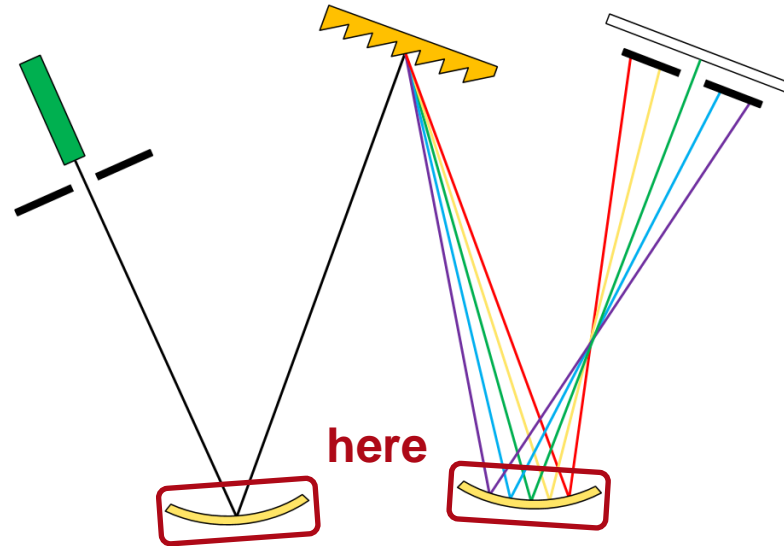
Parameter	Description / Value & Unit
type	plane wave
wavelengths	534.5nm – 535.5nm in steps of 10pm
polarization	linear in x-direction (0°)

# Specification: Apertures



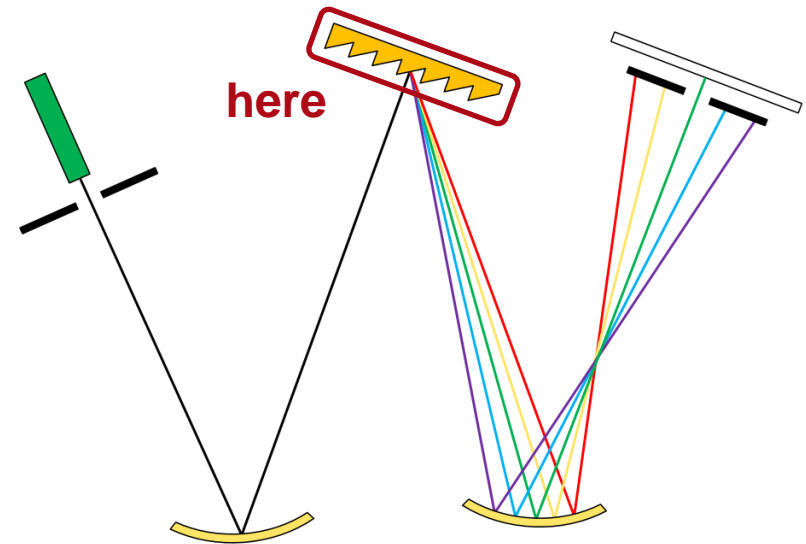
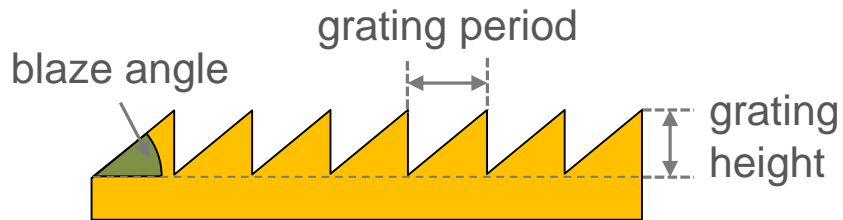
Parameter	Description / Value & Unit
width of entrance aperture	500 $\mu\text{m}$
width of detector aperture	649 $\mu\text{m}$

# Specification: Parabolic Mirrors



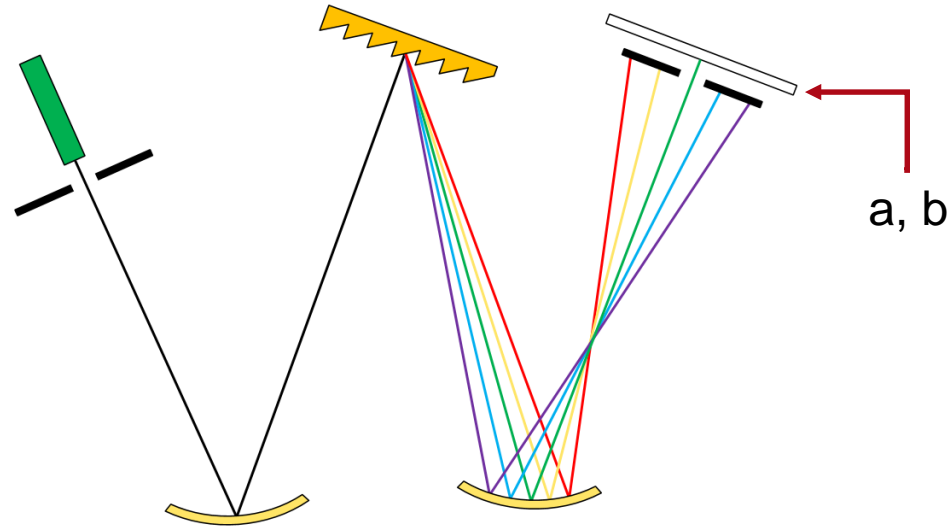
Parameter	Description / Value & Unit
type	parabolic mirror
material	ideal high-reflective material
focal length	1 m
diameter	20mm
tilt angle	5°
reflectance	100%

# Specification: Grating



Parameter	Description / Value & Unit
grating period	833 nm
grating height	282.4 nm (optimized for -1 <sup>st</sup> order efficiency)
blaze angle	18.7°
grating material	silver (Ag)
substrate material	silver (Ag)

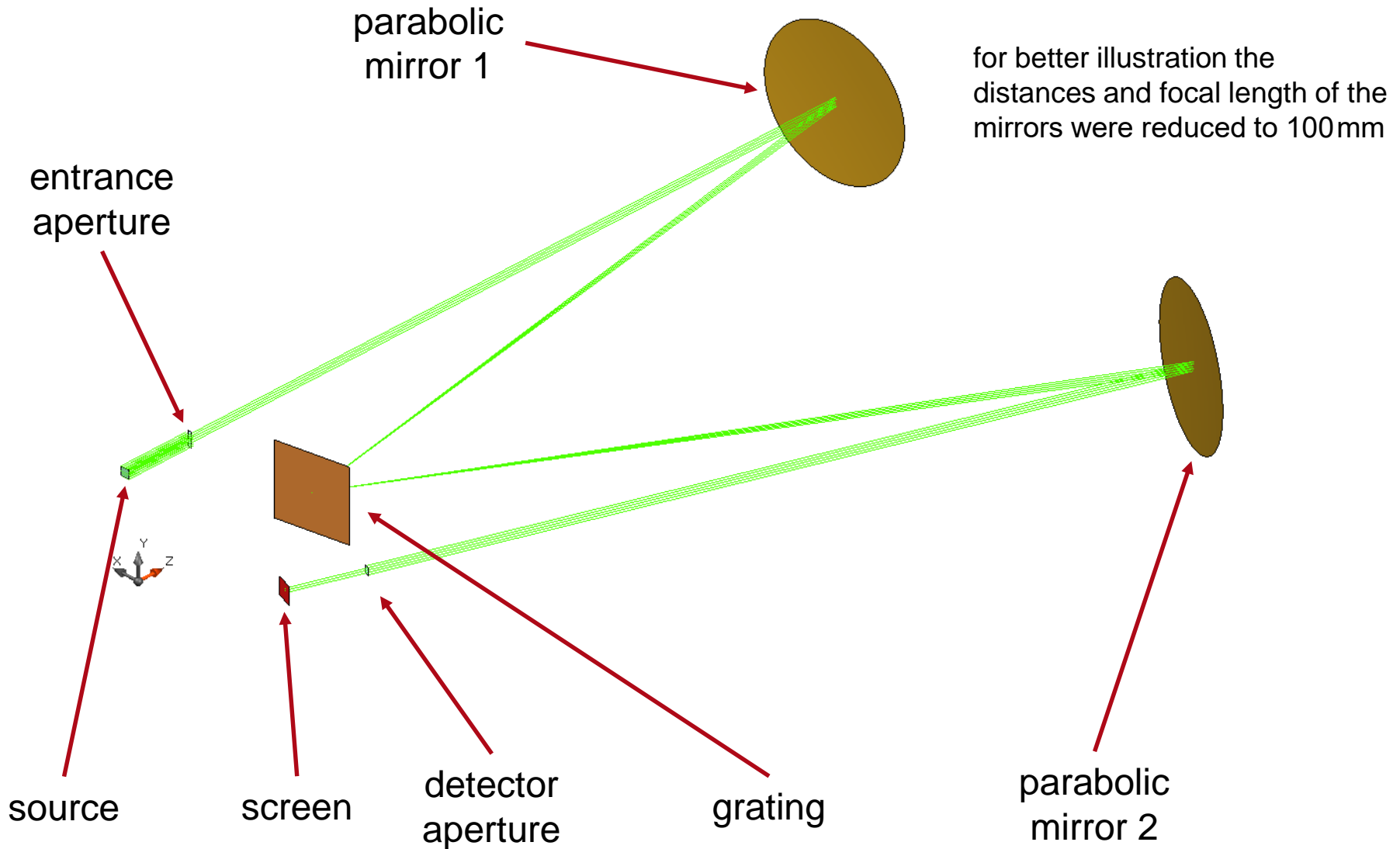
# Specification: Detectors



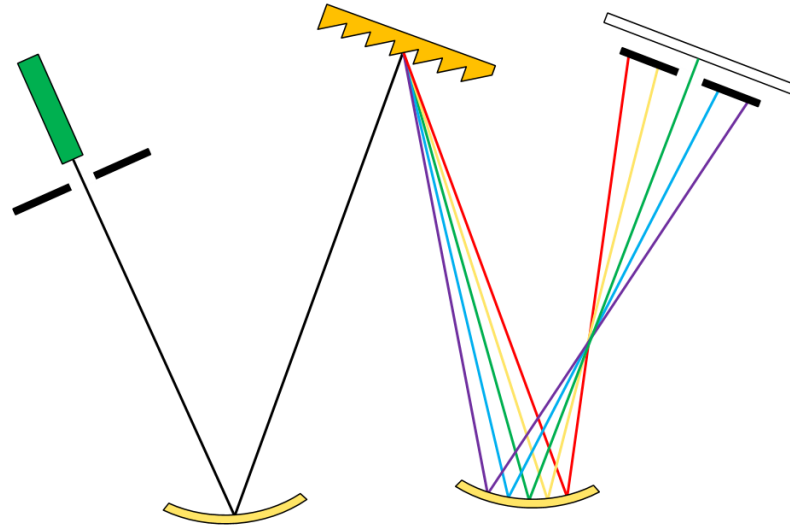
Position	Modeling Technique	Detector/Analyzer
full system	3D ray tracing	3D ray tracing system visualization
a	field tracing	power detection



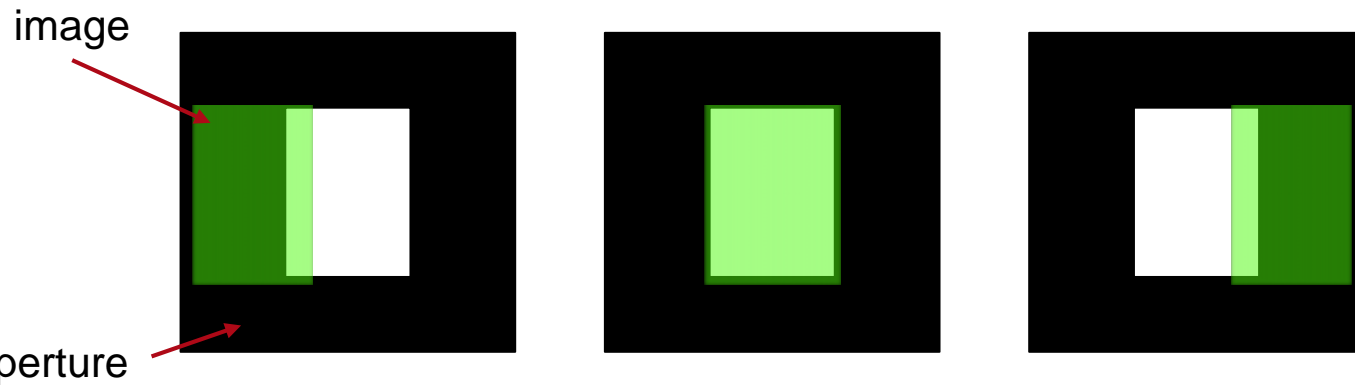
# Result: 3D Ray Tracing



# Result: Variation of Wavelength

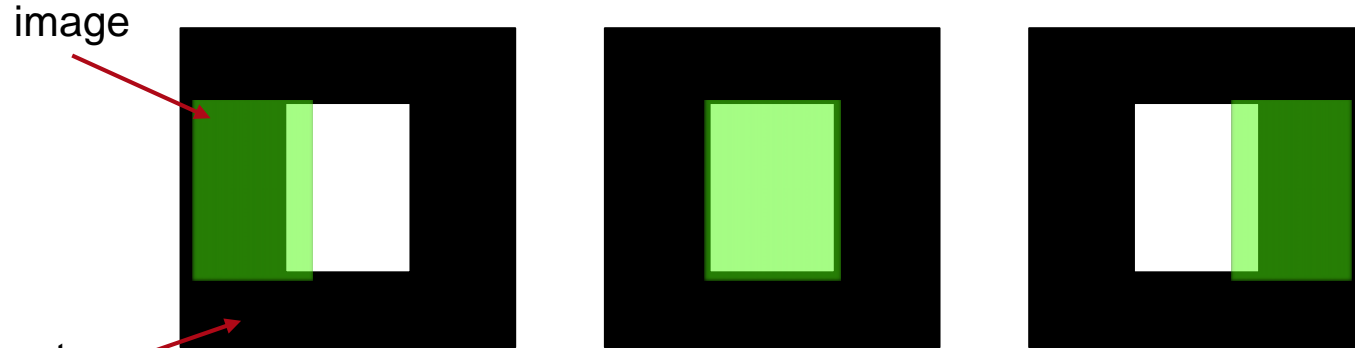


by varying the wavelength, the image of the entrance aperture is scanned over the detector aperture:

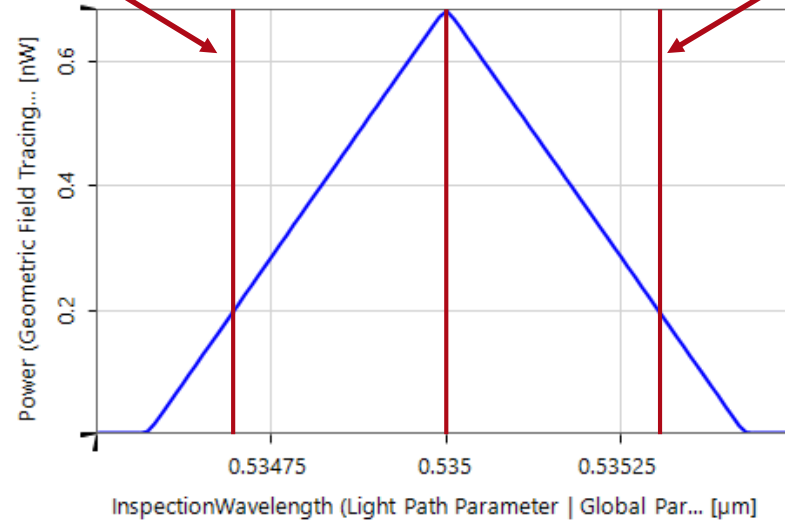


# Result: Variation of Wavelength

by varying the wavelength, the image of the entrance aperture is scanned over the detector aperture:

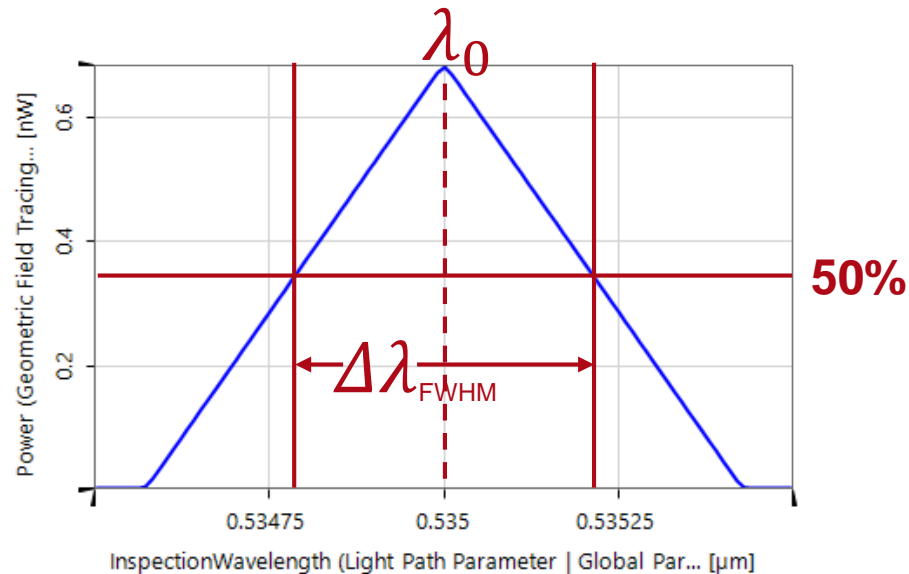


detected power:



# Result: Resolution of Monochromator

detected power:



definition of spectral resolution:

$$A = \frac{\lambda_0}{\Delta\lambda}$$

- $\lambda_0 = 535 \text{ nm}$
- $\Delta\lambda_{FWHM} = 0.43 \text{ nm}$

spectral resolution:  $A = 1244$

# Document & Technical Info

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code	SPE.0001
version of document	1.0
title	Czerny-Turner Spectrometer – Analysis of Spectral Resolution
category	Optical Metrology > Spectrometer
author	Rui Shi (LightTrans)
used VL version	7.0.0.29

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## Specifications of PC Used for Simulation

Processor	i7-4700MQ (1 CPU cores)
RAM	16 GB
Operating System	Windows 8