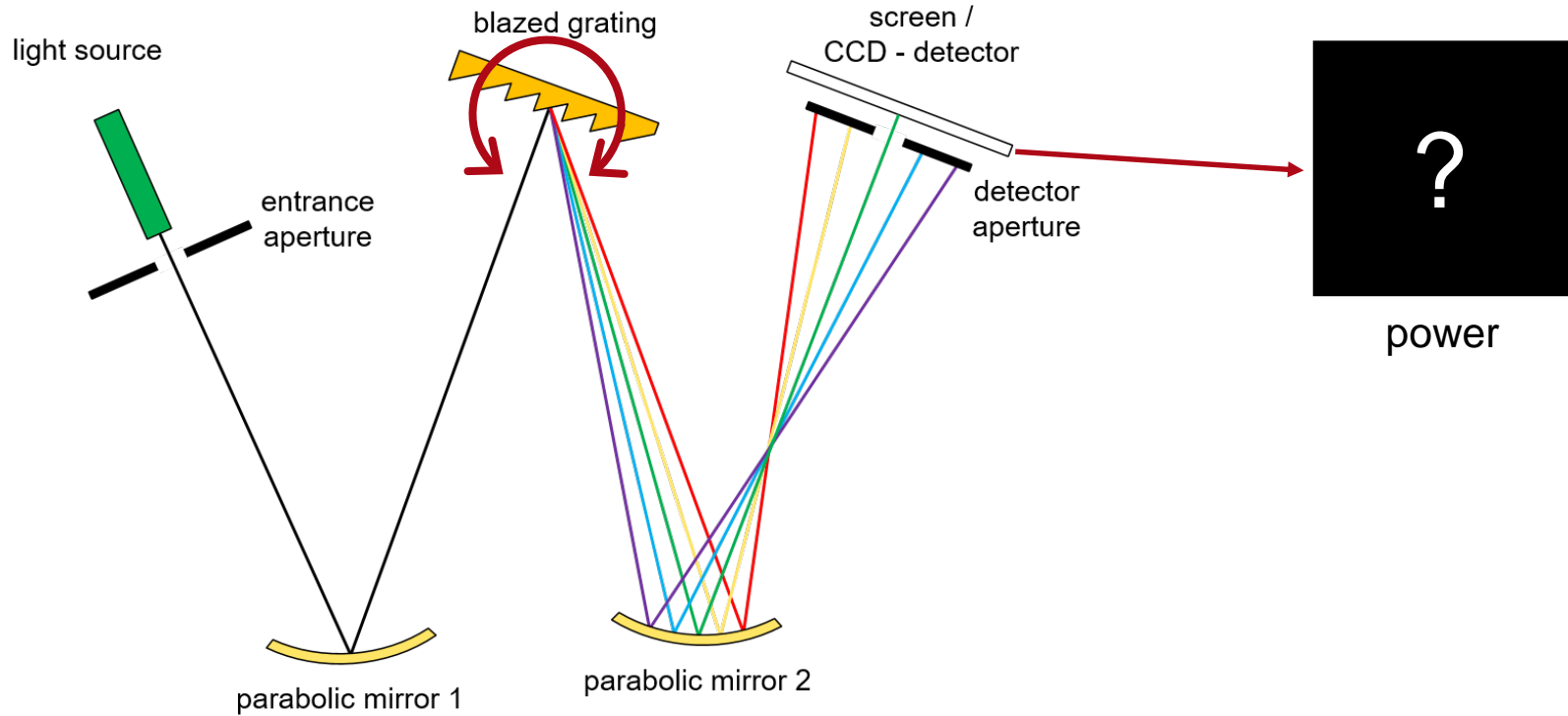


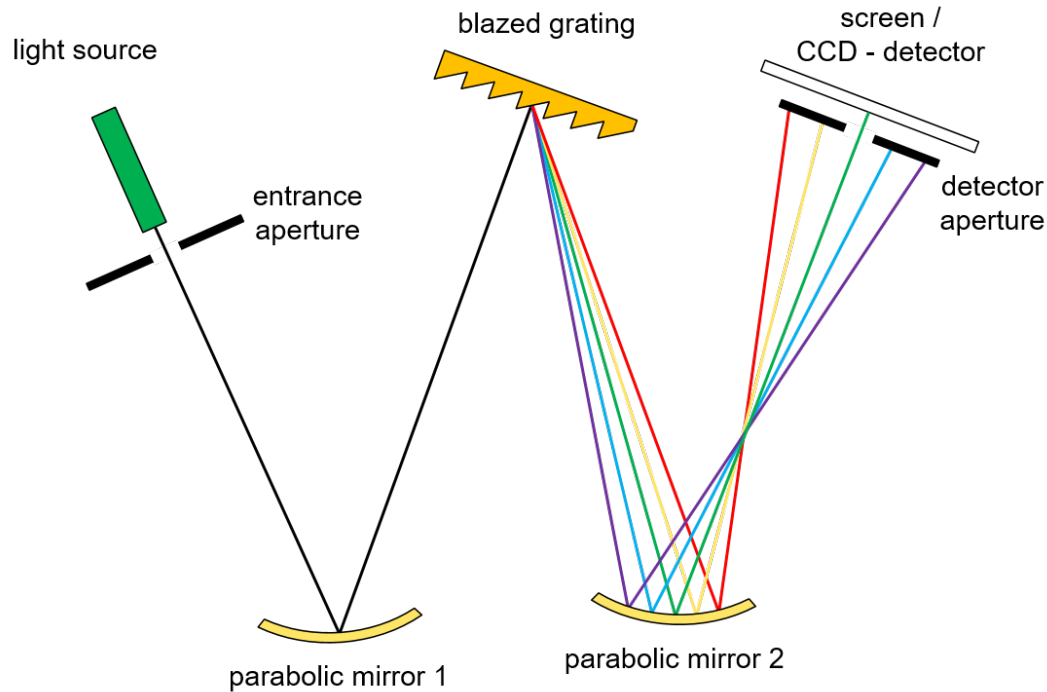
Optical Metrology > Spectrometer

# **Czerny-Turner Spectrometer – Resolving the Sodium Doublet**

# Task/System Illustration

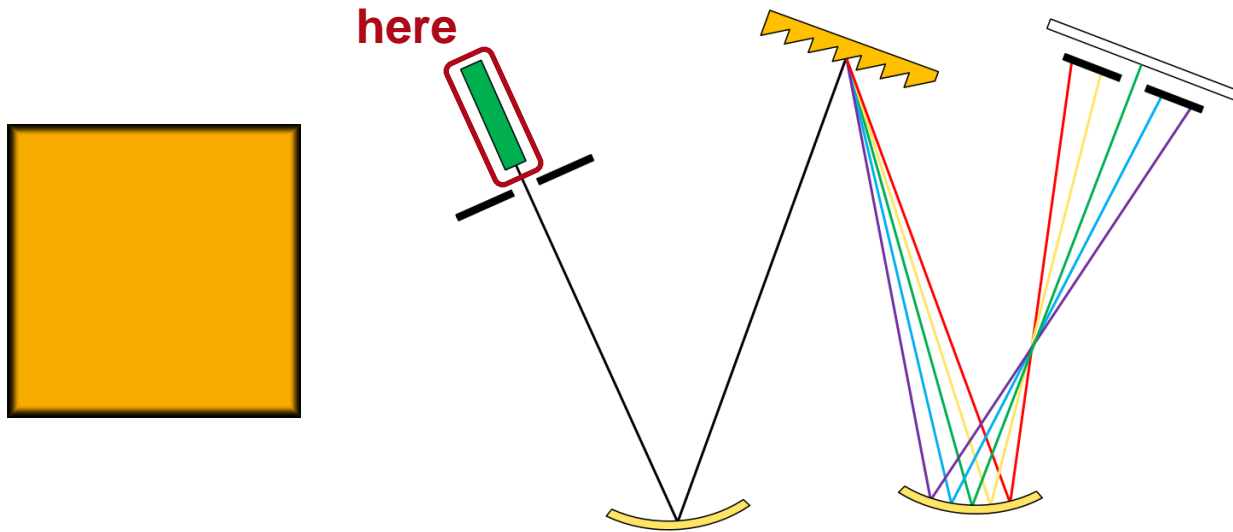


# Highlights



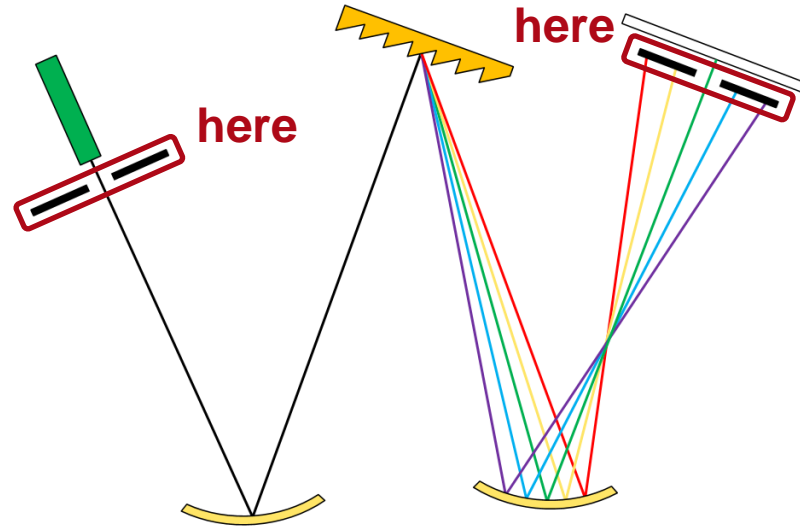
- high-performance analysis of complex optical systems
- full vectorial analysis of gratings by using rigorous algorithm (FMM)

# Specification: Light Source



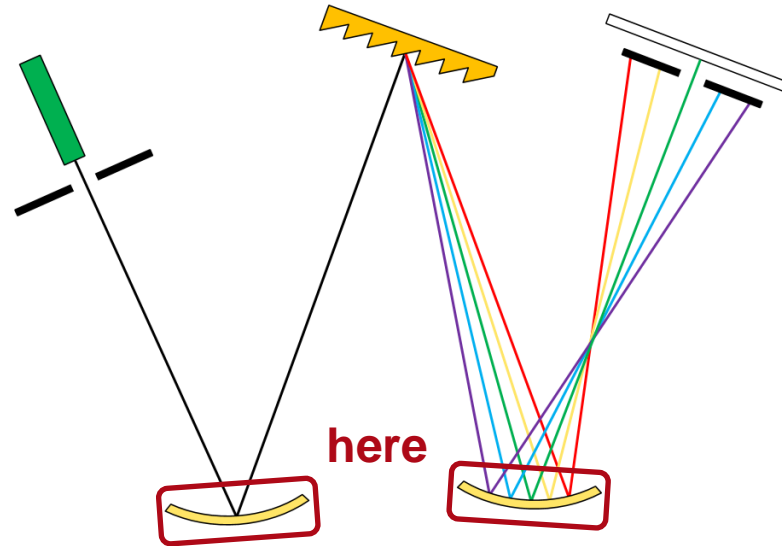
Parameter	Description / Value & Unit
type	sodium lamp
model	plane wave
wavelengths	characteristic doublet: 588.995 nm & 589.592 nm
polarization	linear in x-direction (0°)

# Specification: Apertures



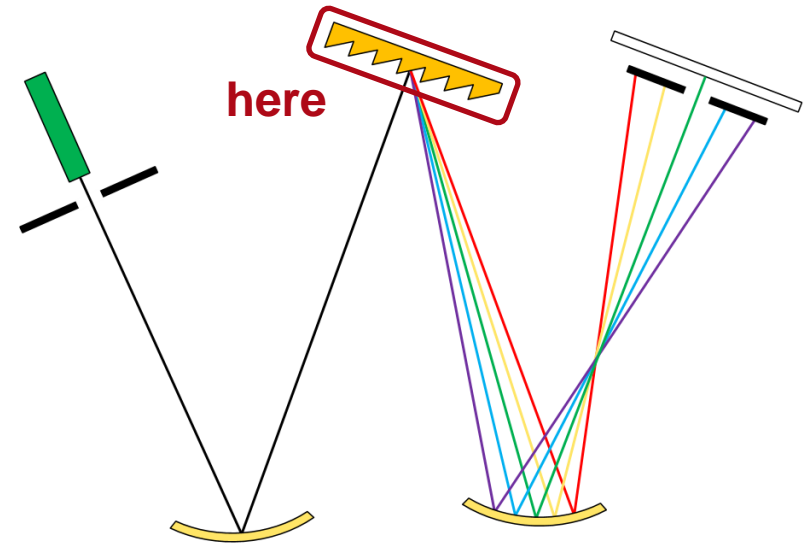
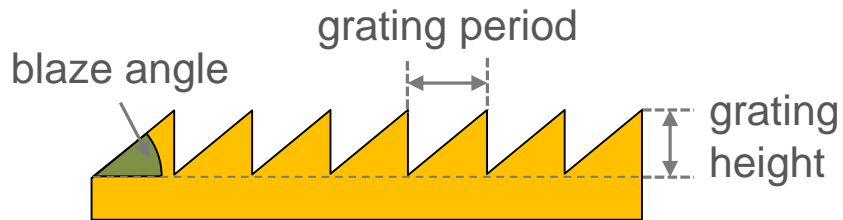
Parameter	Description / Value & Unit
width of entrance aperture	500 $\mu\text{m}$
width of detector aperture	649 $\mu\text{m}$

# Specification: Parabolic Mirrors



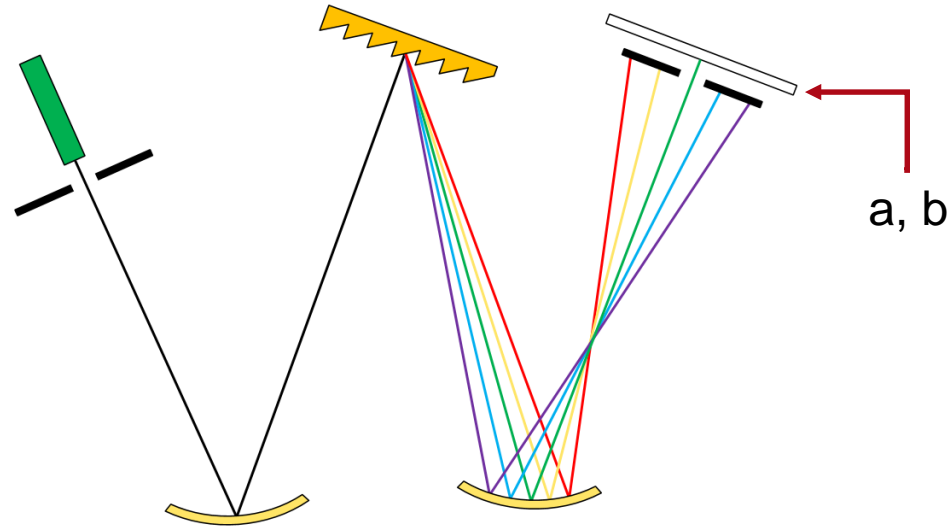
Parameter	Description / Value & Unit
type	parabolic mirror
material	ideal high-reflective material
focal length	1 m
diameter	20mm
tilt angle	5°
reflectance	100%

# 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)
tilt angle	variable

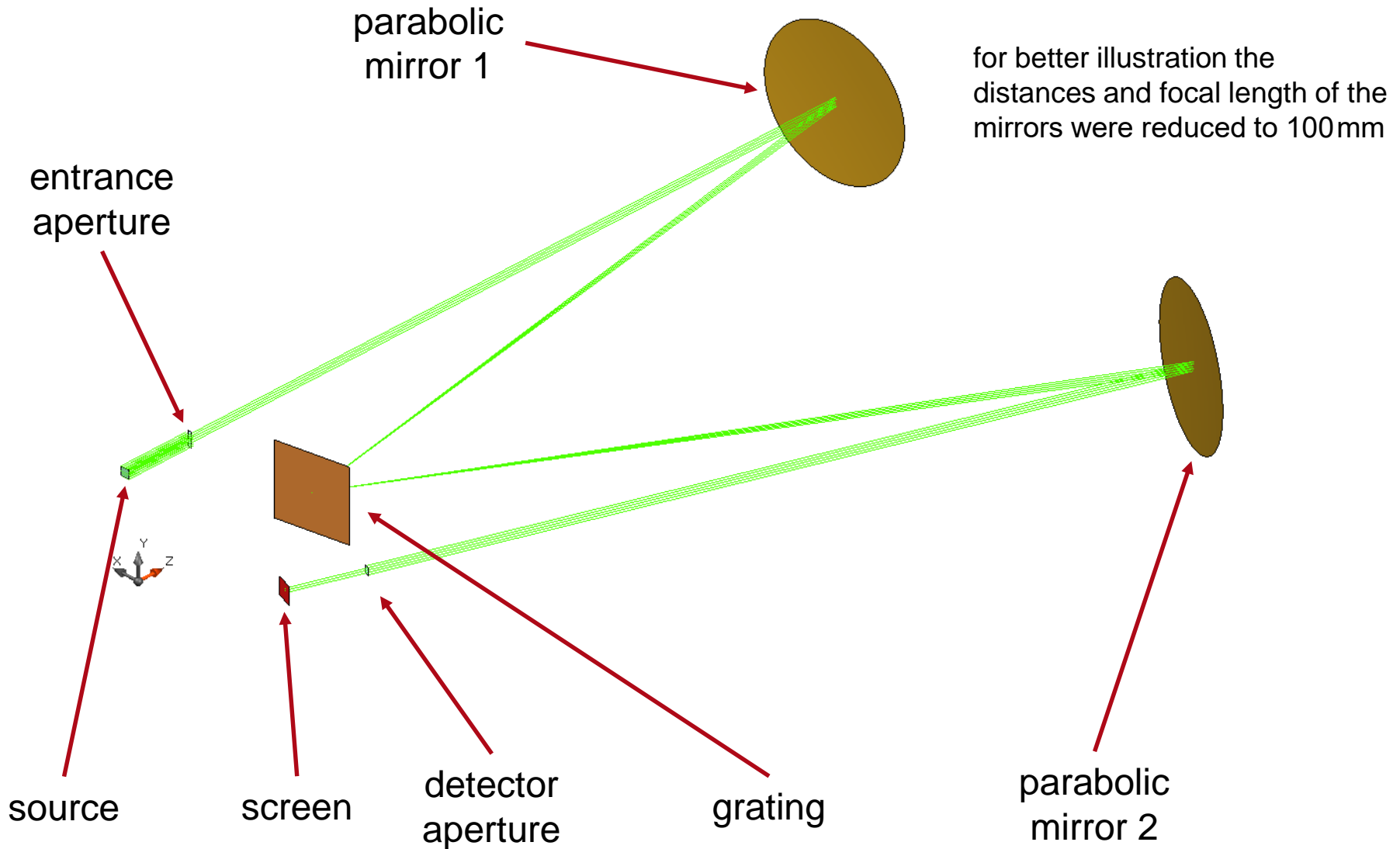
# Specification: Detectors



Position	Modeling Technique	Detector/Analyzer
full system	3D ray tracing	3D ray tracing system visualization
a	field tracing	2D intensity (real color view)
b	field tracing	power detection



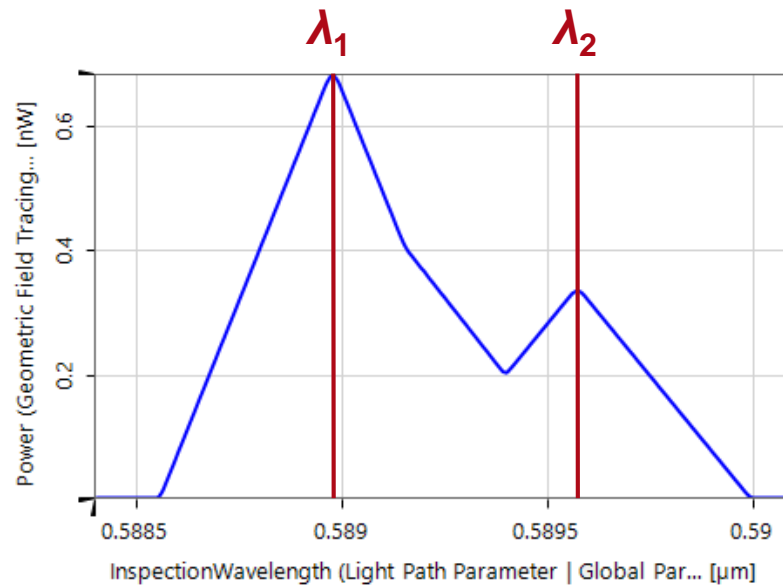
# Result: 3D Ray Tracing



# Result: Field Tracing

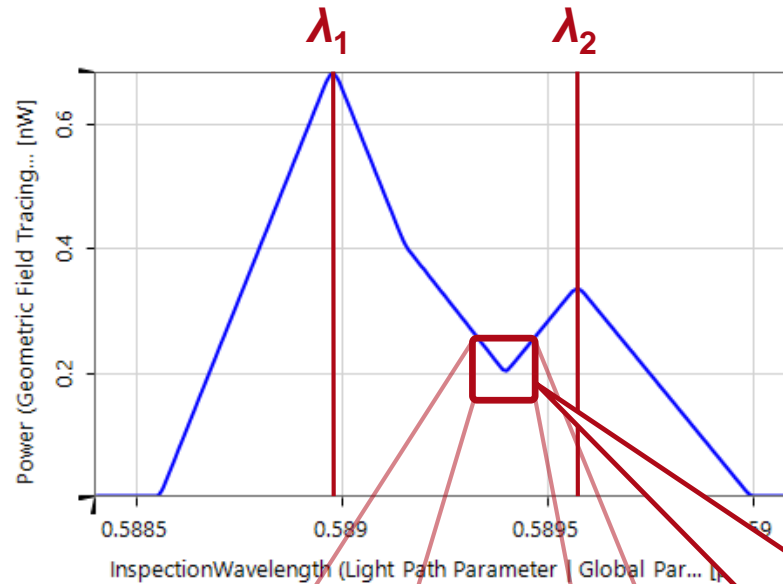
analysis of sodium spectrum by tilting the spectrometer grating

detected power:



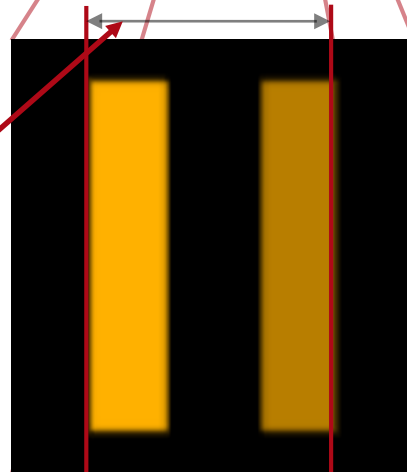
# Result: Field Tracing

detected power:



2D intensity:

width of detector aperture  $d_2$



The used spectrometer setup is able to resolve the two wavelengths of the characteristic sodium doublet.

# Document & Technical Info

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code	SPE.0002
version of document	1.0
title	Czerny-Turner Spectrometer – Resolving the Sodium Doublet
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