

# Monochromator

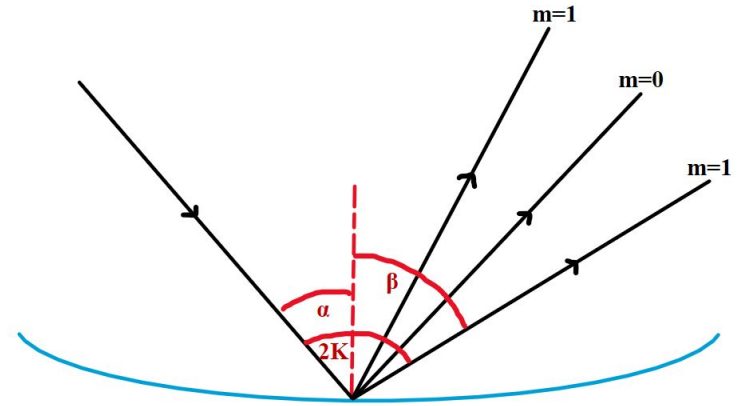
M&M

# Contents

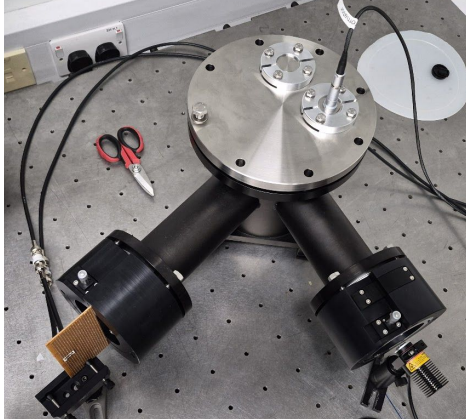
- Repeatability Testing with Red Light
- Monochromator Control Code
- Automated Data Taking
- Investigated Change in Output with Filters, varying slit sizes
- Used 265nm LED and mercury lamp to calculate dispersion and wavelength offset
- Solved reflections (artefacts) issue

# The Monochromator

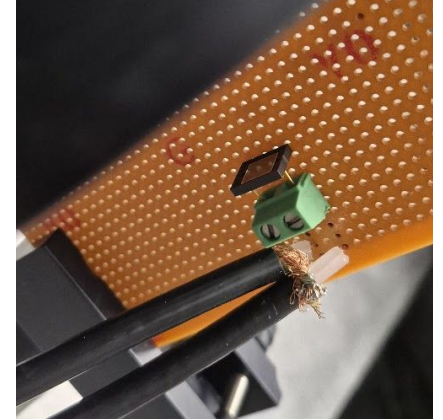
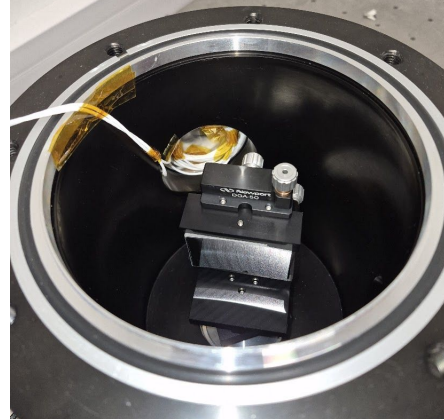
- Adjustable input and output slits
- Adjustable central grating
- SiPM on exit slit for signal readout



SiPM on exit slit  
connected to  
picoammeter

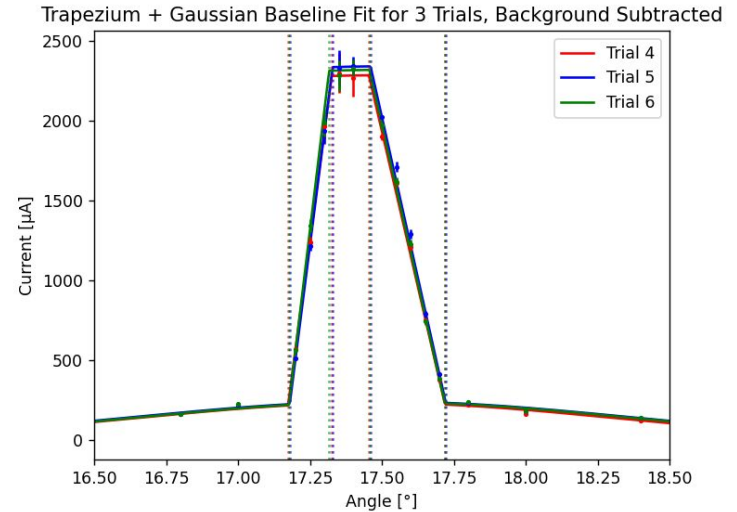
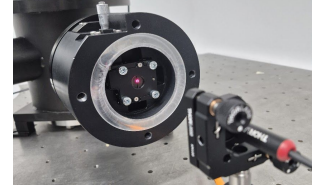


Light  
source on  
input slit



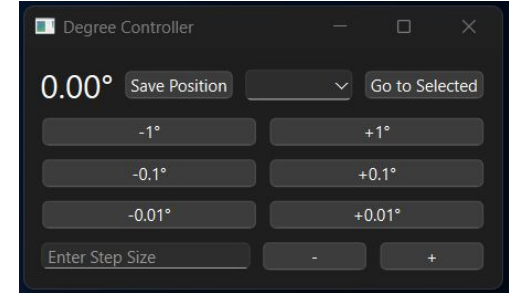
# Repeatability

- Placed Mirror in central chamber and measured output current against grating angle
- Fitted Trapezium function on a gaussian baseline
- Centre of plateau  $17.391 \pm 0.003^\circ$
- Confirmed repeatability of grating positioner



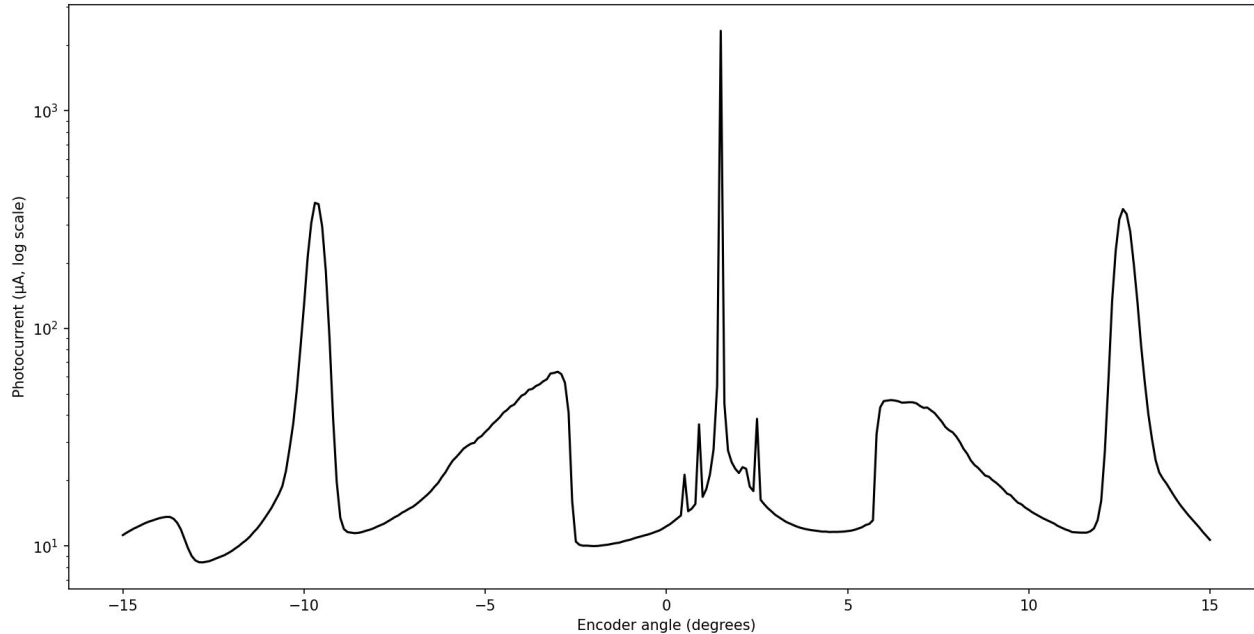
# Control Software

- Simple UI using base protocols to manually set grating angle
- Program interfacing monochromator control and Keithley current readout
- Automated data acquisition
- Lots of redundancy, needs cleanup



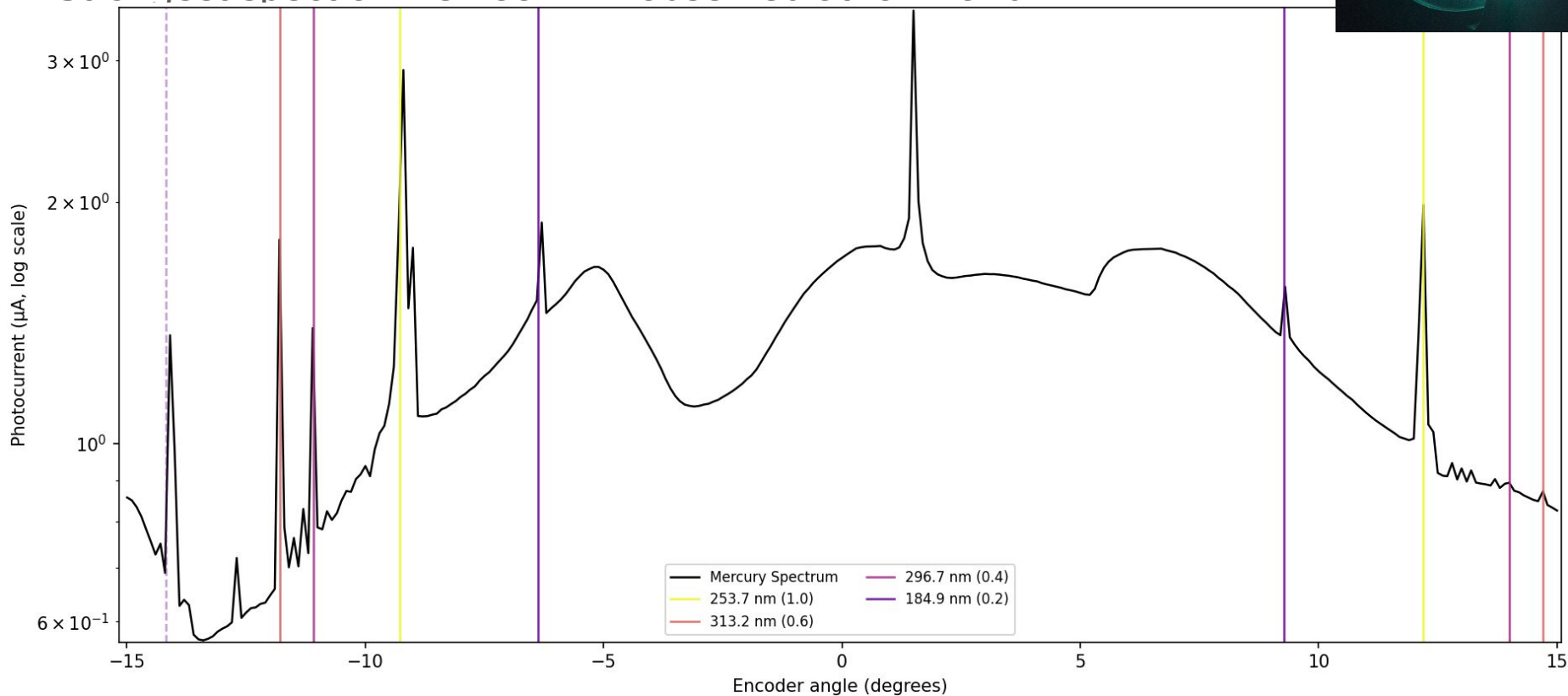
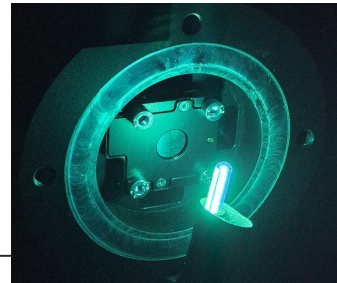
# UV LED

First diffraction orders observed at  $-9.7^\circ$  and  $12.6^\circ$   
Reflection  $\sim 1.4^\circ$  ( $m = 0$ )



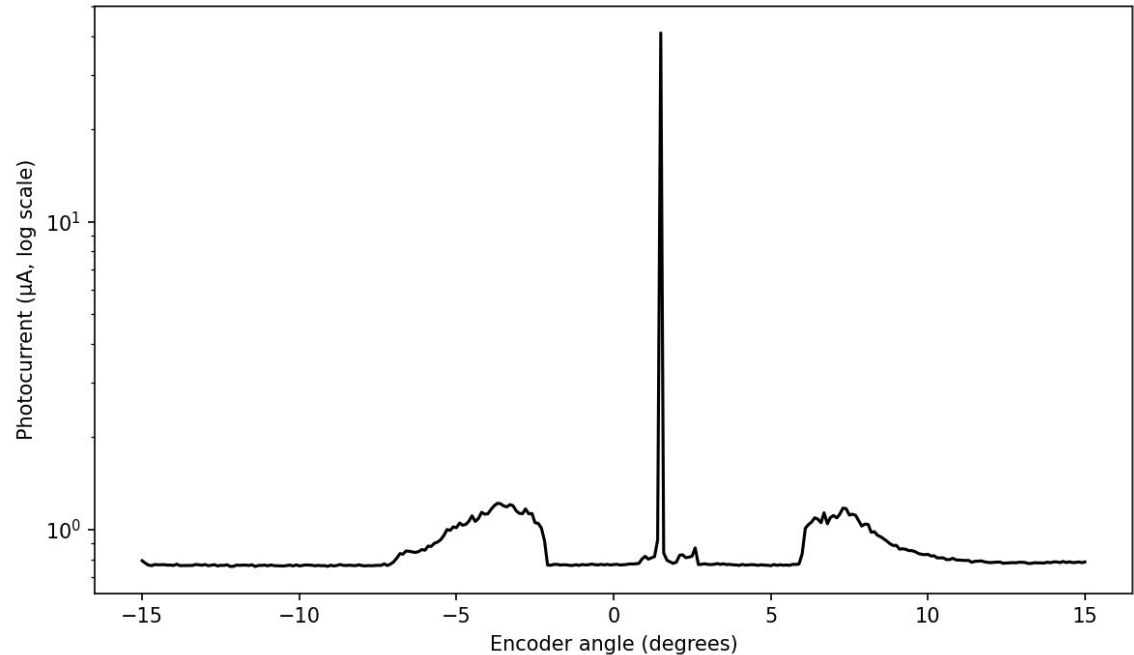
# Mercury lamp

Strongest spectral line 253.7nm observed at  $-9.2^\circ$  and  $12.1^\circ$



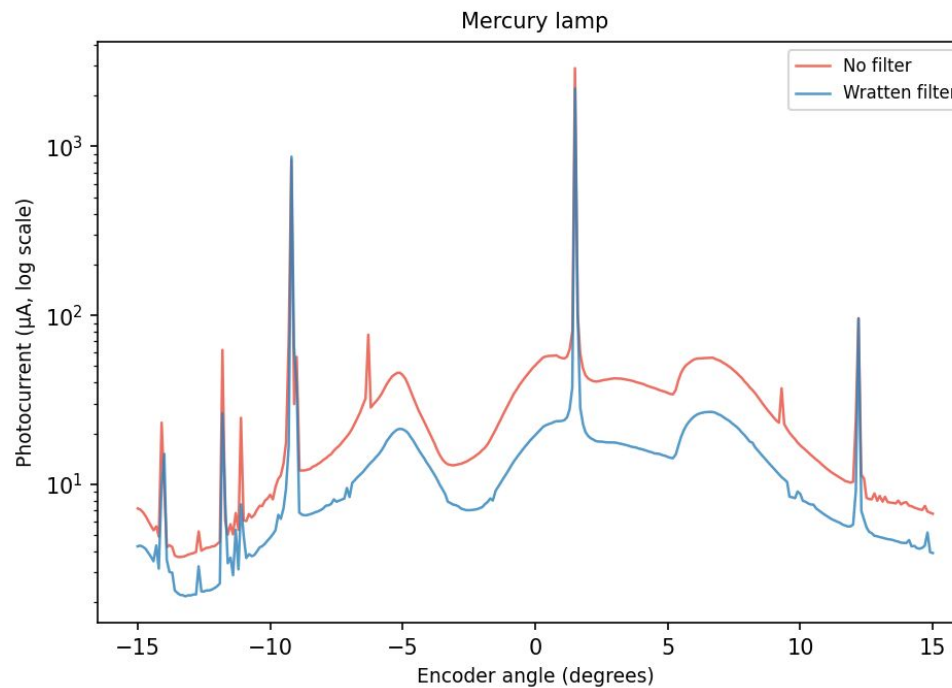
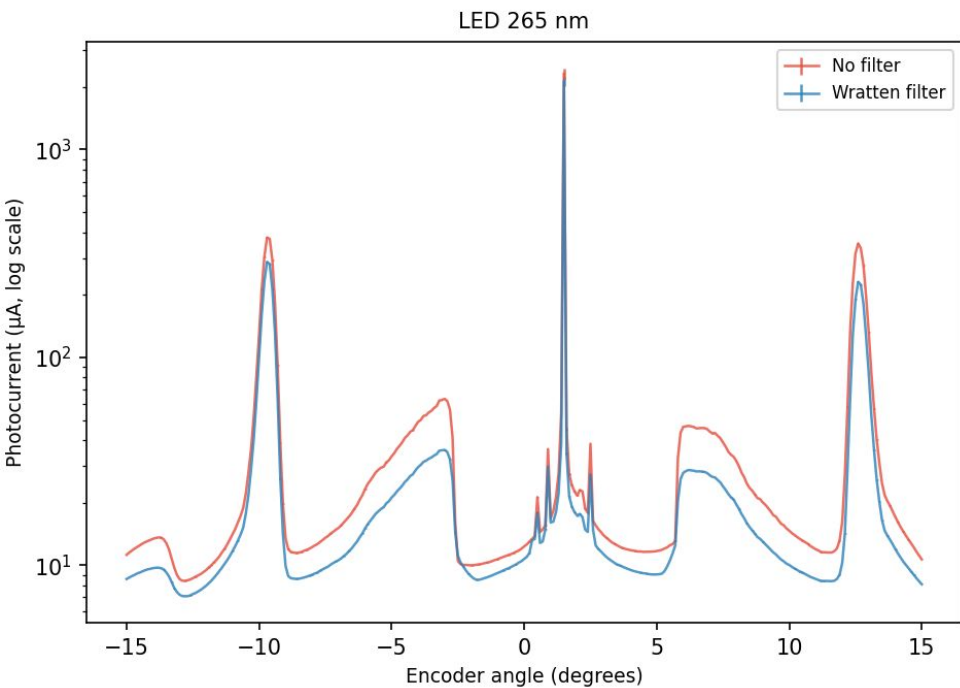
# Blue LED

- Wavelength 450 nm
- first diffraction order expected at  $\sim 20^\circ$
- Confirms artefacts are not diffraction orders



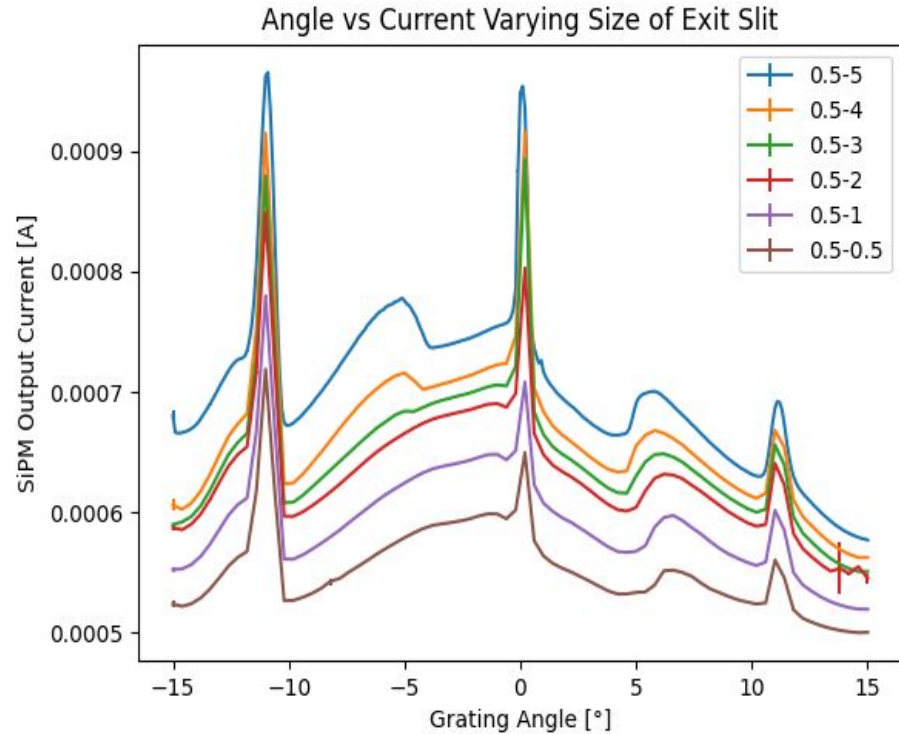
# Wratten Filter

- Data gathered with and without 18B wratten filter for UV LED and mercury lamp
- Transmits 250-380 nm strongly attenuates above  $\sim 400$  nm



# Varying Exit Slit Size

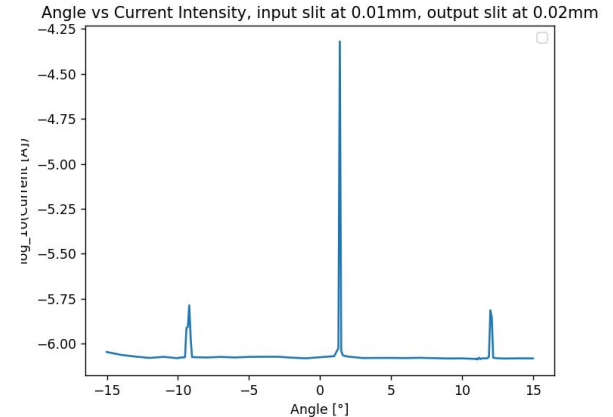
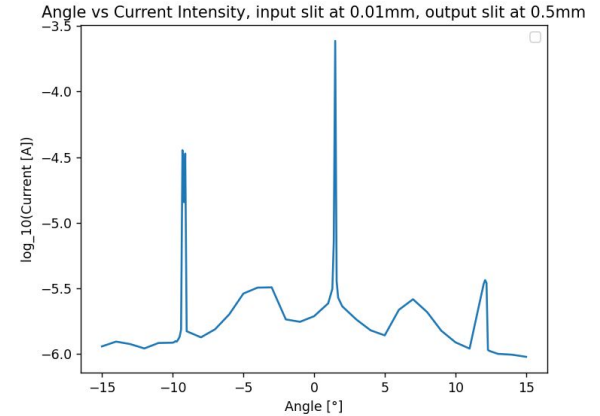
- Artefacts diminish with decreased exit slit size
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- Peak intensities vary significantly based on alignment of optics



Angle vs current with varying exit slit size. 0.5-5 indicates input slit at 0.5mm, exit slit at 5mm

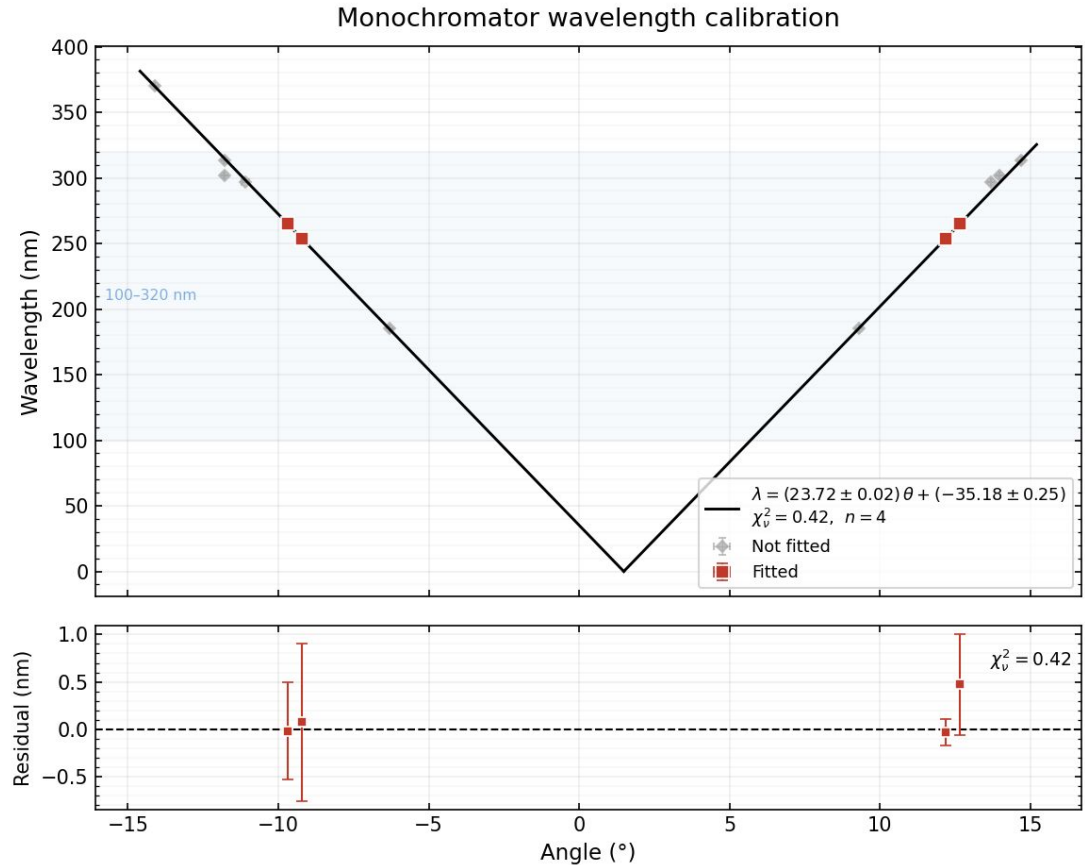
# Further reduction of slit sizes

- Mercury lamp tested with slits narrowed further
- Reducing input slit to 0.01mm, keeping exit at 0.5mm, artefacts still present
- Reducing exit slit down to 0.02mm, artefacts not present!
- Intensity reduced by 1 order of magnitude



# Calibration

- Found angular position of LED (265 nm) and Hg (254 nm) first diffraction orders
- Linear mapping of wavelength and encoder angle
- Uncertainty  $\sim 0.8$  nm



# Future Steps

- Verify output with xenon or argon lamp, with spectral lines in artefact region
- Get more calibration points with cadmium lamp (strong 214.4 nm line)
- Streamline data acquisition software
- Change offset with knob on grating mount