Large mirror test stand

Jan Vanek
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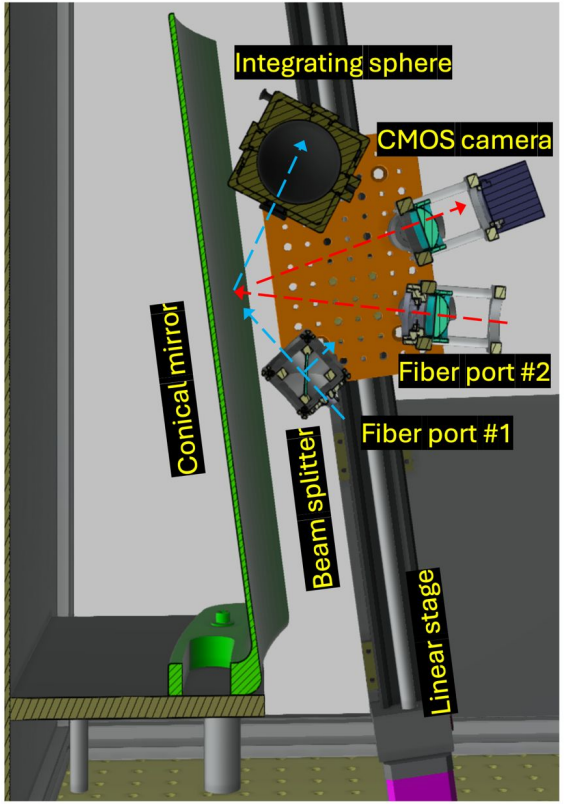
Overview

- Readout testing and commissioning
  - Measurements of various test spectra

- Stage movement
  - Rotating and linear stages

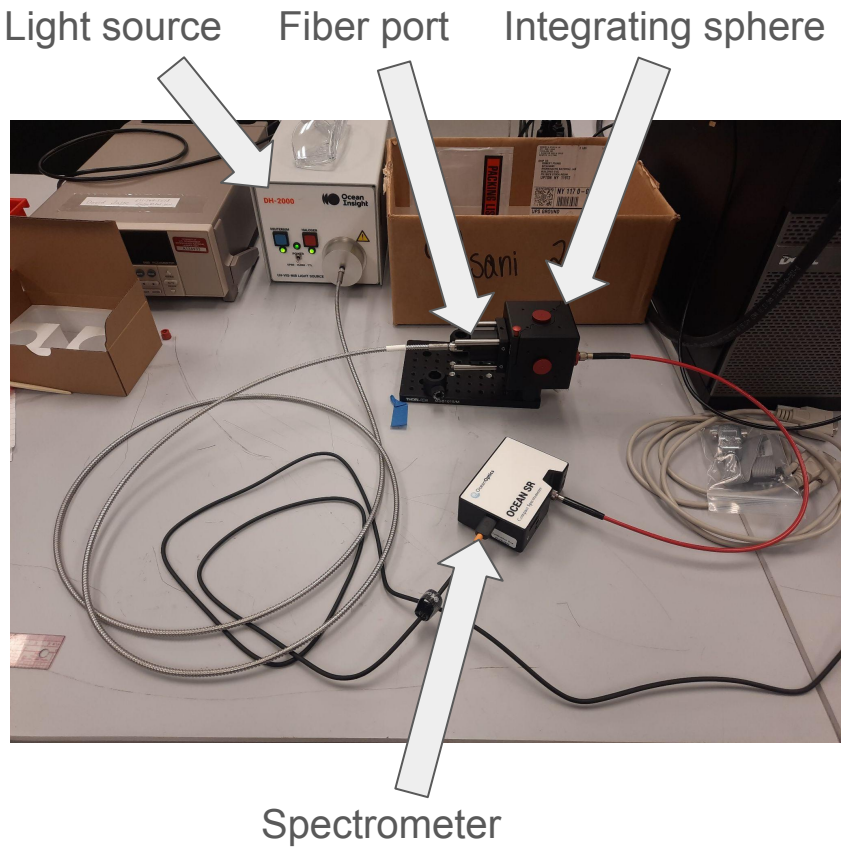
Readout setup – design

- **Light source** connected to **Fiber port #1**
- Light (blue dashed lines) will reflect from the mirror and will be collected by an **Integrating sphere**
- **Integrating sphere** is then connected to **digital spectrometer**
- **Spectrometer** is read out by readout software and analyzed



Readout setup – testing

- Test setup uses 4 posts and ring holder
- Fiber port pointed directly into the integrating sphere allowing little to no external light pollution
- Multicore optical fiber between source and fiber port
- Large (600 nm) fiber between sphere and spectrometer
- This setup is only for testing of readout
- Next step will be to mount everything on the optical table set for the real measurements

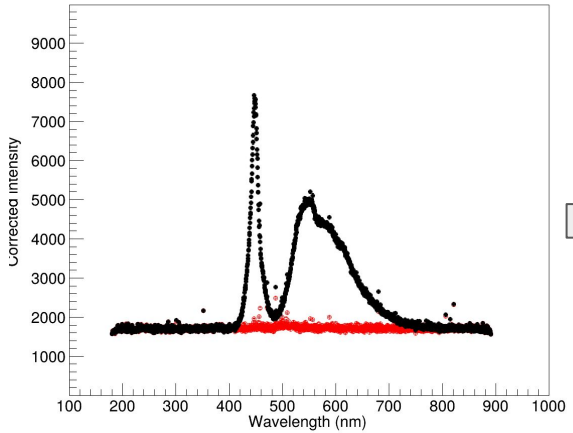


Spectrum measurement

- Each spectrum is extracted by performing 10 measurements
  - Values in plots are mean of the 10 values (μ) with standard deviation (σ)
- Each point represents one spectrometer chanel (pixel)
  - For first tests, can be changed later to have custom bins in wavelength
- Steps in all test measurements:
  - Set appropriate integrating time of spectrometer
    - Avoid saturation of pixels
  - Measure dark current
  - Measure spectrum of source of interest
    - Includes dark current baseline
  - Subtract dark current spectrum from measured spectrum

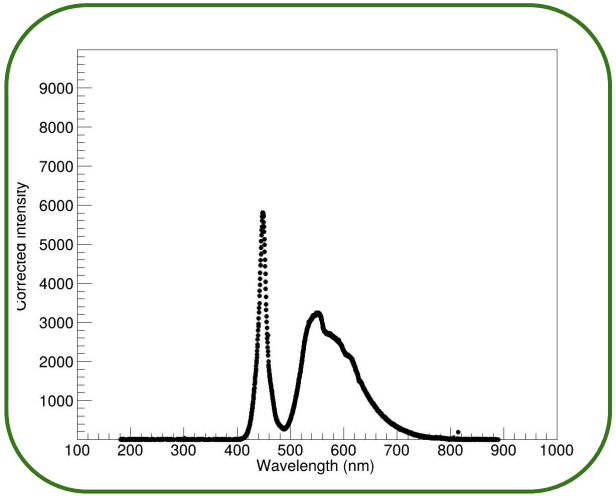
Dark current subtraction example

- (left) Spectrum of phone LED measured by spectrometer with the dark current baseline
- (right) Corrected spectrum, after the dark current subtraction



Measured spectrum

Dark current spectrum

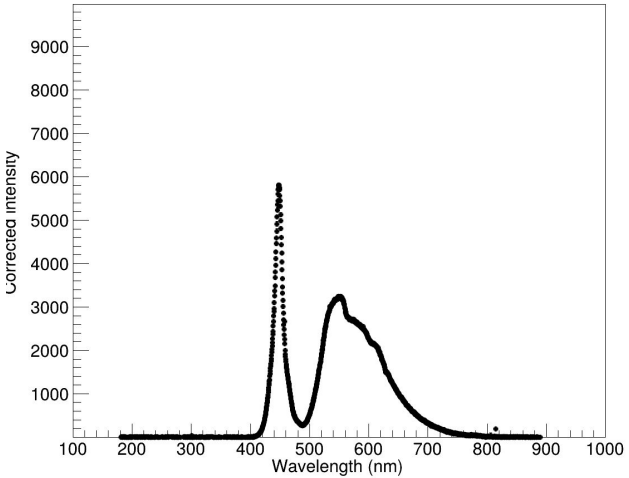


Corrected spectrum

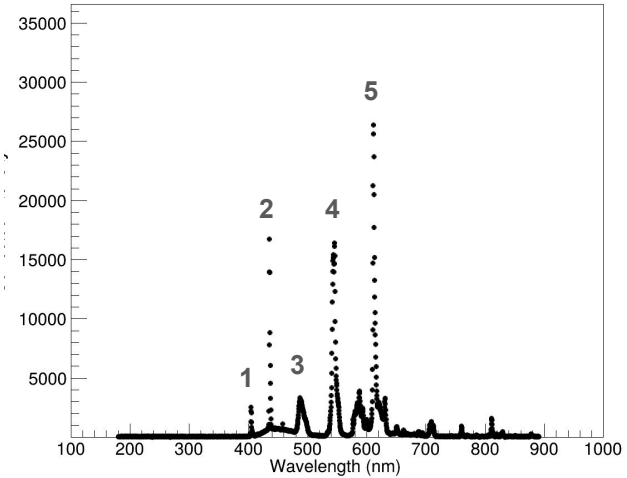
Test spectra – LED and room lights

- Spectra of phone LED (left) and light in the room (right) measured using the new spectrum measurement method
  - After dark background subtraction
  - Spectra look reasonable

Phone LED



Room (fluorescent tubes)

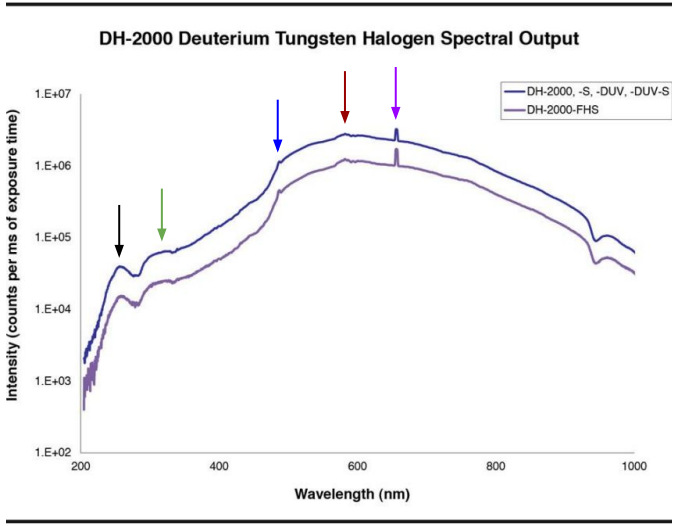


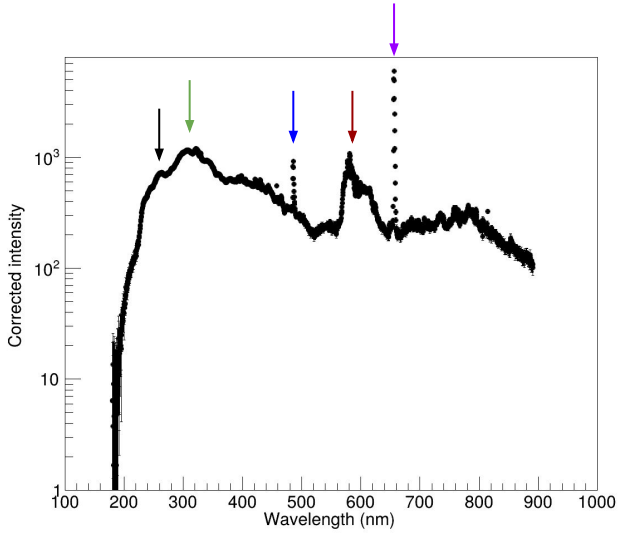
1. Hg (~405 nm)
2. Hg (~436 nm)
3. Tb (~488 nm)
4. Tb (~544 nm) and Hg (~546 nm)
5. Eu (~611 nm)

Values taken from here

Test spectra – Light source

- Spectrum of light source
  - (left) Reference from documentation
  - (right) Measured by spectrometer, after dark current subtraction
  - Main features of measured spectrum seem to be consistent with reference from documentation
  - Magnitude of features is off – will check possible origin



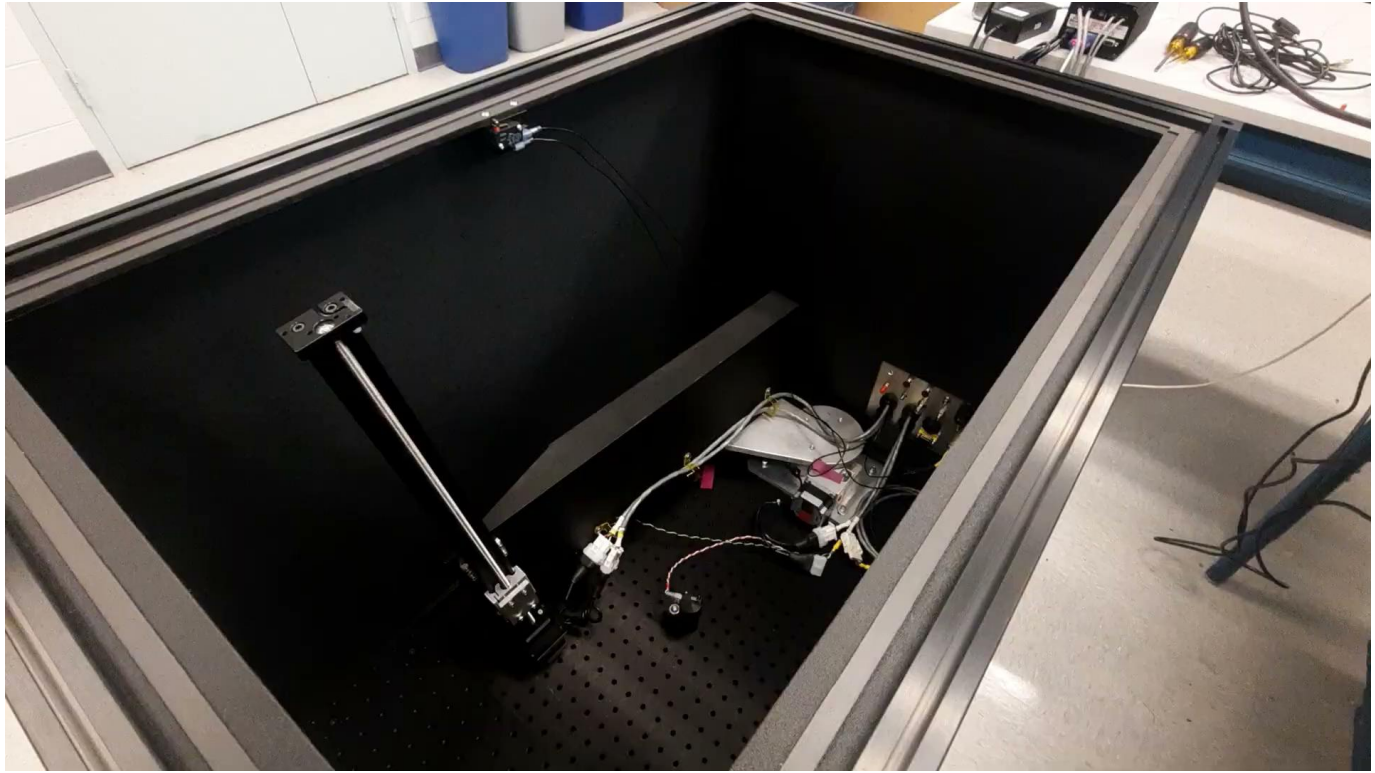


Movement of stages

- Movement of both stages (linear and rotating) implemented
- Two step procedure:
  - First, both stages are sent to home position
    - Home given by end switches
  - Then stages can be moved to any **absolute position** in cm (linear stage) or degrees (rotating stage) **with respect to the set home**
- Linear stage fully functional
- Need to check homing for rotating stage
  - Using custom end switches
  - Need to make sure that they stop the stage in the same spot every time to have reliable home position

Movement of stages – demonstration

- Demonstration video of stage movement



Estimated work timeline

1. May
   a. Readout – finished
      i. Result: Readout software successfully installed and successfully tested
   b. Steering of stages
      i. Both rotational and linear stage operational
      ii. To-do: Cross-check homing precision for rotating stage
   c. Installation of the optical table to the dark box (finish by end of May/early June)
      i. Goal: Optimization of geometry to ensure functionality inside of the box
2. June
   a. Development and optimization of steering and readout software (finish by ca. June 13)
   b. Prepare for scans of small and large mirrors (finish by end of June)
      i. Missing: Curved mirror holders
      ii. Goal: First test scans
3. July
   a. Deploy full reflectivity scanning framework, including documentation (finish by ca. July 11)
      i. Present progress at Collaboration meeting
   b. Start full mirror scans (have ready by end of July)
4. August
   a. Make sure everything is working and properly documented for anyone to take over (by August 15)
   b. Help with any leftover items (by end of my contract at BNL, August 21)