Mirror coating (SBU) and reflectivity test (BNL)

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SBU & BNL
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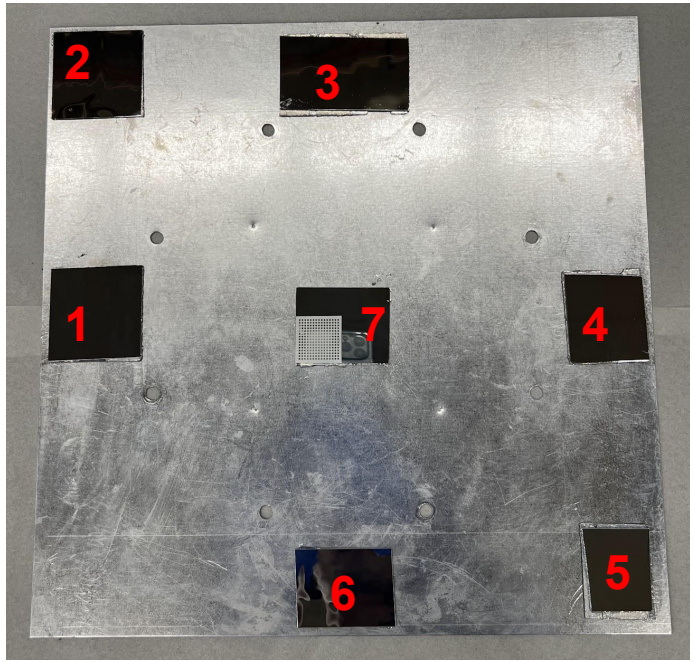
Mirror coating on Jan 30, 2024

This is the 3rd coating test, done by Bill Li, Preet Mann, and Kong Tu.

Goal of the test is to see the combination of Lexan + Carbon fiber

- 1,2,6
  - 10 mil (0.25mm) Lexan + carbon fiber
- 3,4,5
  - 30 mil (0.75mm) Lexan + carbon fiber
- 7
  - Depth measurement with pure Lexan



2 & 5 are used for reflectivity test

Mirror samples at a closer look

2

5

The binding between the Lexan and Carbon fiber is double-sided tape, which is NOT the ultimate method but a quick test to see how it looks.

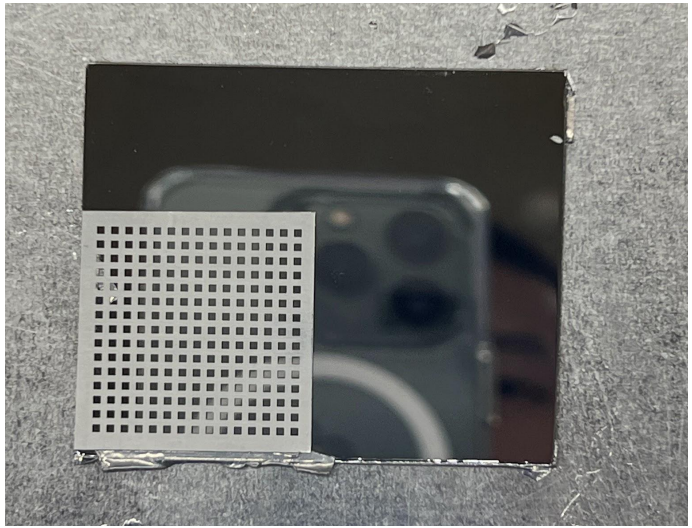
It shows the need to be better binded.

10 mil is thin that the binding makes it wavy, while 30 mil seems to be better.

Mirror coating process

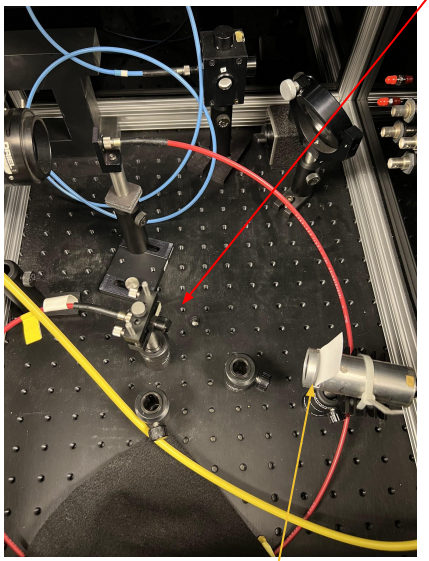
What we coated:

- ~10 kang of **Chromium** (only a few minutes of coating at 64 mA of current of the electron gun)
- ~70 kang of **Aluminium** (used two different crucibles with high current 150-180 mA)
- The actual thickness can be tested/measured from the setup on the right.



** the 3 of us are getting more fluent/efficient performing the coating.*
All coating processes are documented in details in the log book at SBU.

Mirror reflectivity test at BNL

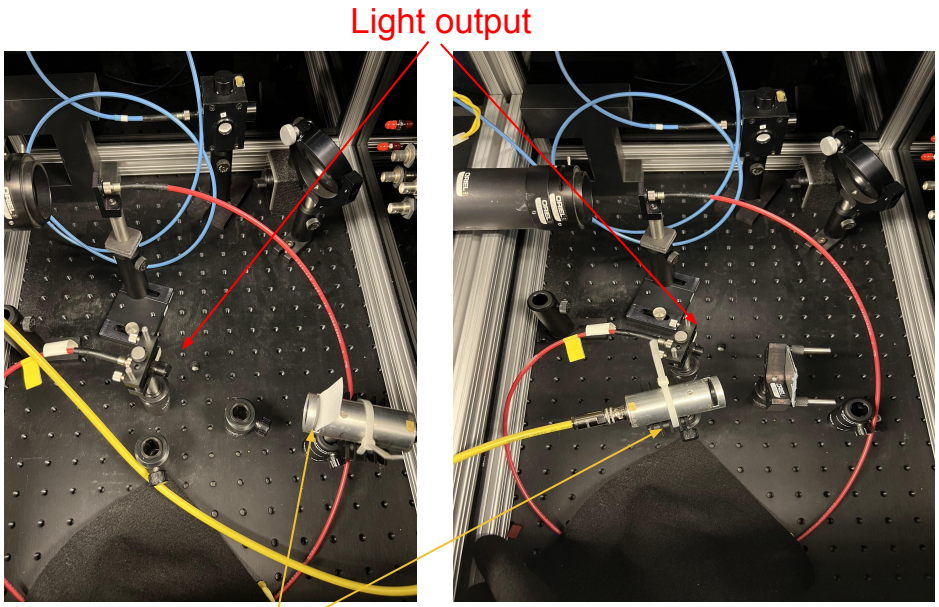


Baseline

Method:

Baseline: 100% reflectivity when the sensor is directly measuring the beam.

Mirror reflectivity test at BNL



Method:

Baseline: 100% reflectivity when the sensor is directly measuring the beam.

Test: Mirror reflectivity is a ratio measurement to the baseline.

QE is cancelled in the ratio.

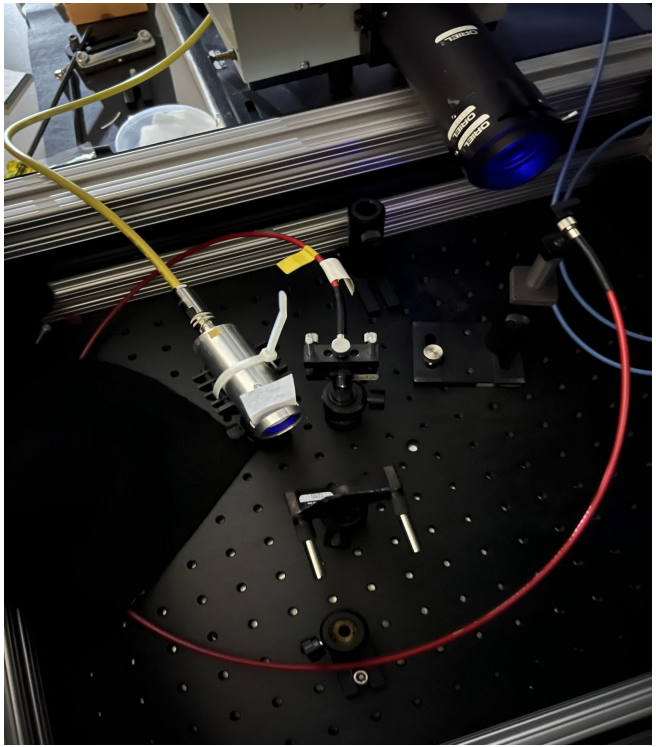
Monochromator

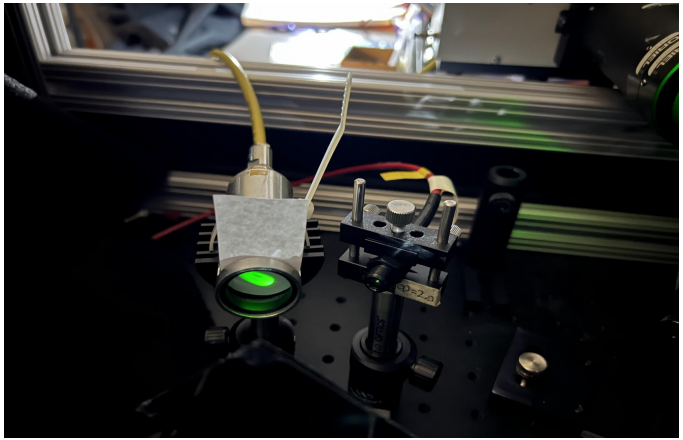
Monochromator w.
hand-cranking* wavelength control

Sean said we can program this to automate the scan, which will speed up the test in the future.

Need to think what to do when HRPPD test needs the monochromator (> March).

Angle setup (~ 71.6 degrees)

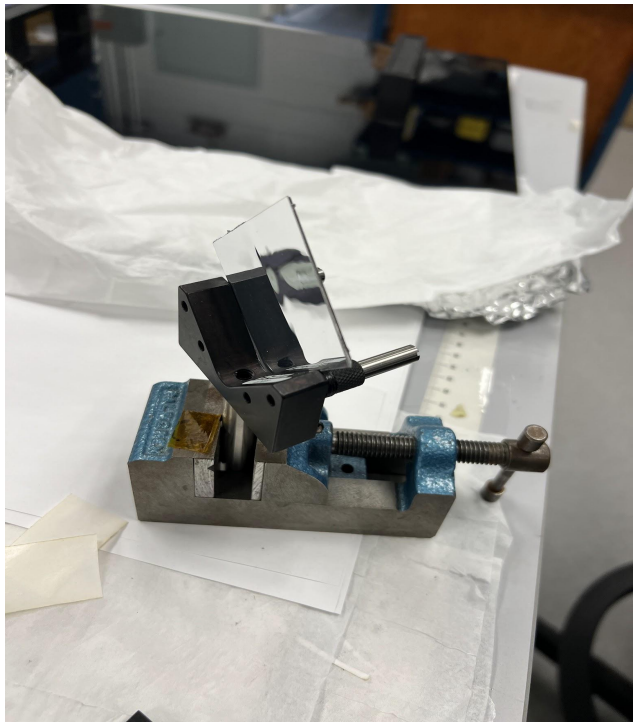




Right now, we just use the angle shown here for the test. In the future testing, the difficult part is to keep a consistent angle and a good beam spot for the sensor.

(This one in picture is with the wavy mirror and the beam spot is very broad.)

Mirror holders

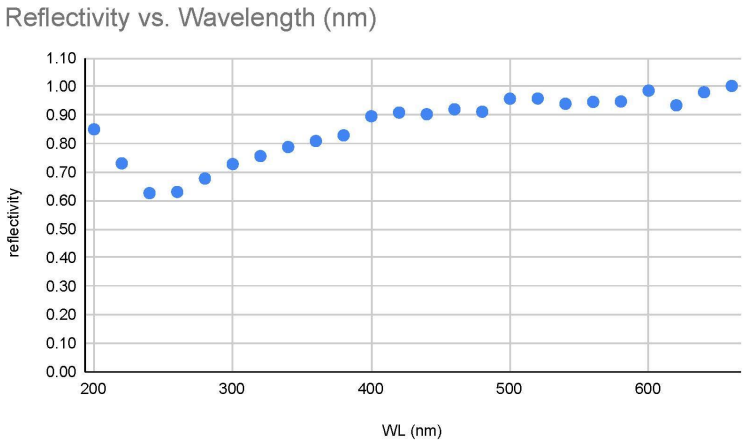


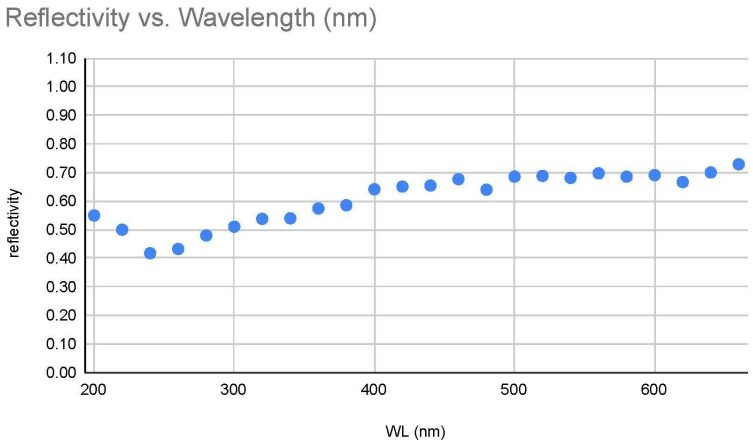
This is a test stand to support the mirror sample.

Need to find a way to *minimize the systematics in terms of angle, position, heights, etc. such that each time we switch sample, we will be consistent.*

We are also ordering some holders along with the CMA mirrors.

Test results @ a fixed angle = 71.6 degrees. Data here.





10 mil Lexan (wavy one)

30 mil Lexan (non wavy one)

- It seems counterintuitive that the wavy one has a better reflectivity
- But we are not that far from the requirement? (300-600 nm @ 90%)

Summary

We established our planned “procedure” of the mirror coating + reflectivity testing, which is overall very successful. **Many experiences gained and lessons learned.**

- **SBU:** Mirror coating becomes more efficient and the crew are more comfortable;
- **BNL:** Reflectivity test made good progress with the first test done, improvements will come in the following weeks.

Plans:

- We will continue to perform more coating tests, e.g., **large mirror sample**, mirror samples that will be ordered soon from SBU (**1 INCH standard mirror blanks**, holder, etc.)
- Perform another reflectivity test based on the sample **Bill has tested at JLab with 45 degree angle** to have a consistency check
- Improve reflectivity tests procedure and efficiency.