

Mirror Reflectivity Measurements at Small Mirror Test Stand

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2025/11/10

ePIC pfRICH Engineering/Design Meeting

Overview

- Performed direct light measurement first.
- Continued to take small mirror reflectivity measurements.
 - Coating batch 11: mirror 3, aka reference mirror (cross-check)
 - Coating batch 54: 6 mirrors (new)

Had a discussion with mirror coating team

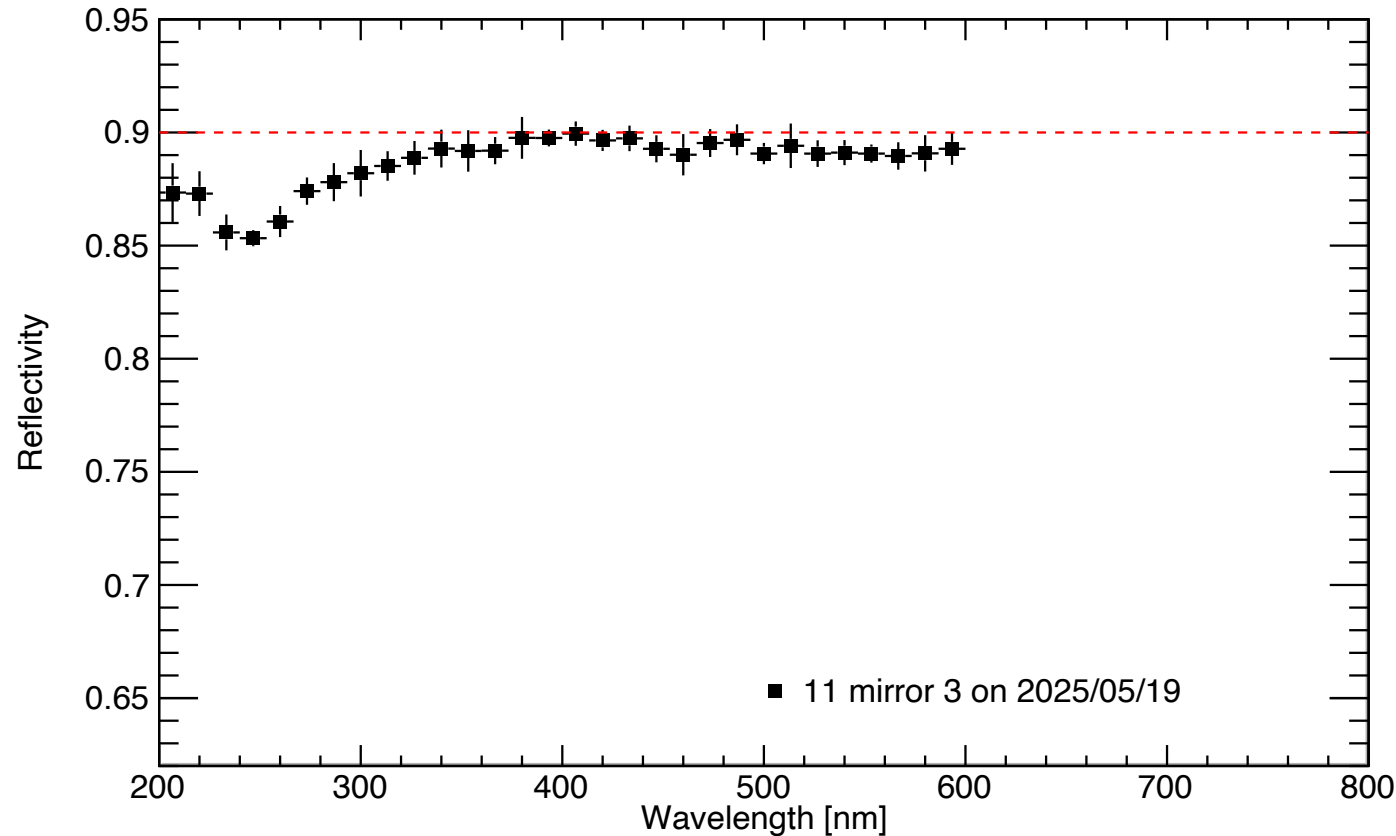
- Revisited Coating batch 53 – purdue and patterned samples
- Double-checked Coating batch 54 – CF and patterned samples

Small Mirror Reflectivity Results – Ref.

Coating Batch 11 mirror 3
with 5.09 kA Cr and 12.36 kA Al

No
image
available

11 3
05/19/2025



The reflectivity of Coating Batch 11, Mirror 3, is used as the reference.

Small Mirror Reflectivity Results – Ref.

Coating Batch 11 mirror 3
with 5.09 kA Cr and 12.36 kA Al

No
image
available

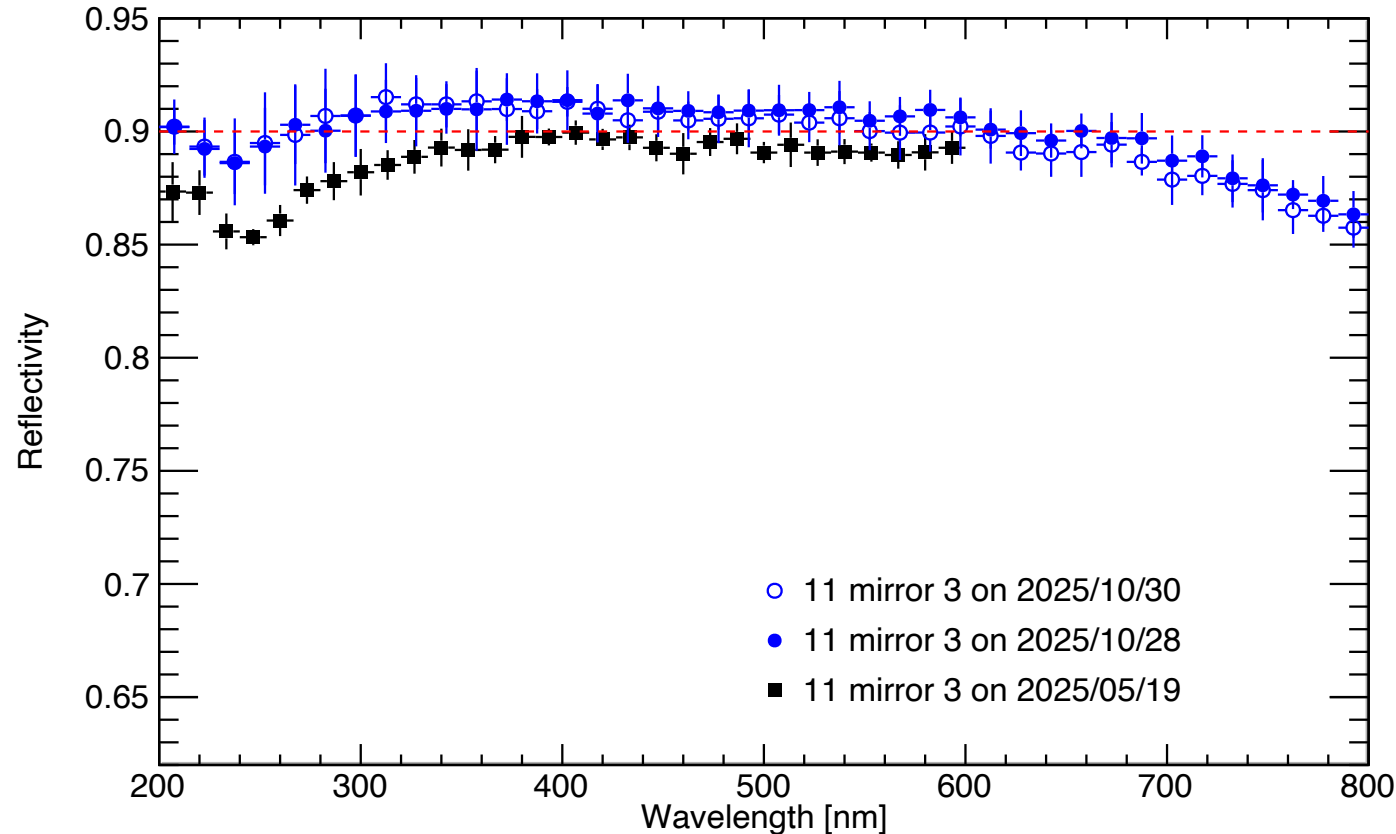
11 3
05/19/2025



11 3
10/28/2025



11 3
10/30/2025



Re-measured the reflectivity of Coating Batch 11, Mirror 3 since new lamp was installed.
Shape is consistent, but magnitude is increased. New measurements are consistent.

Small Mirror Reflectivity Results – Ref.

Coating Batch 11 mirror 3
with 5.09 kA Cr and 12.36 kA Al



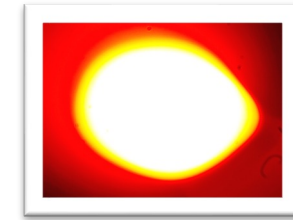
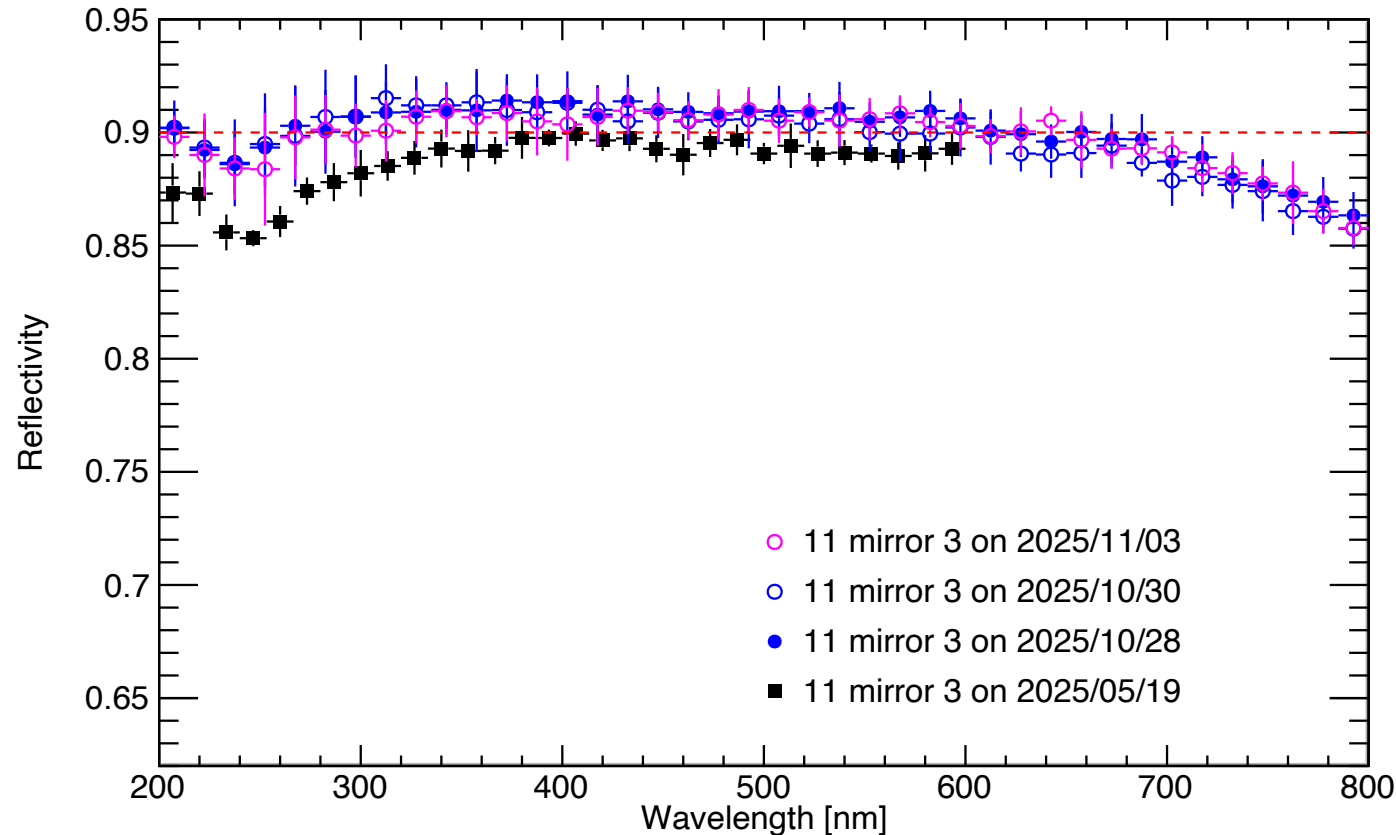
11 3
05/19/2025



11 3
10/28/2025



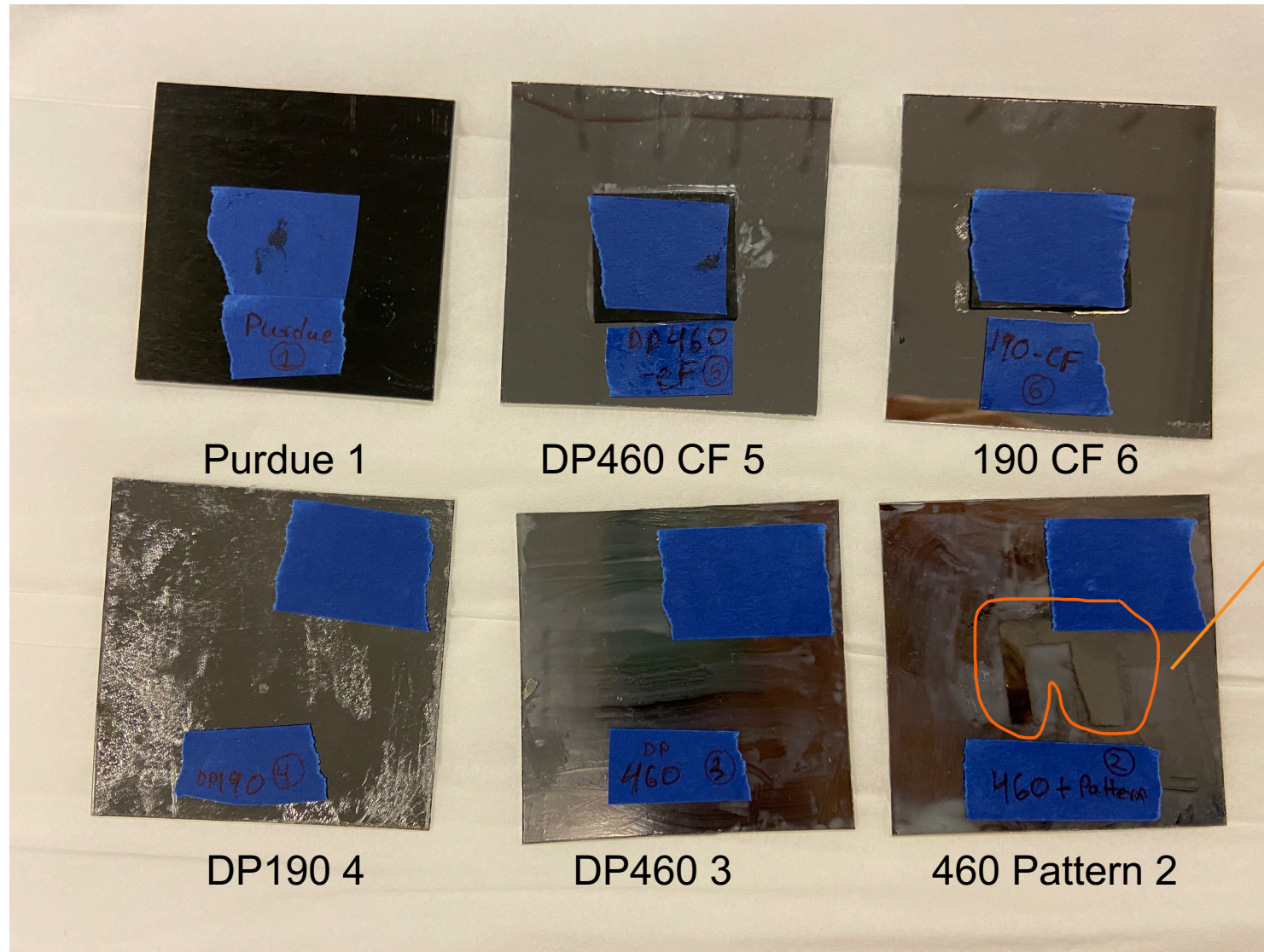
11 3
10/30/2025



11 3
11/03/2025

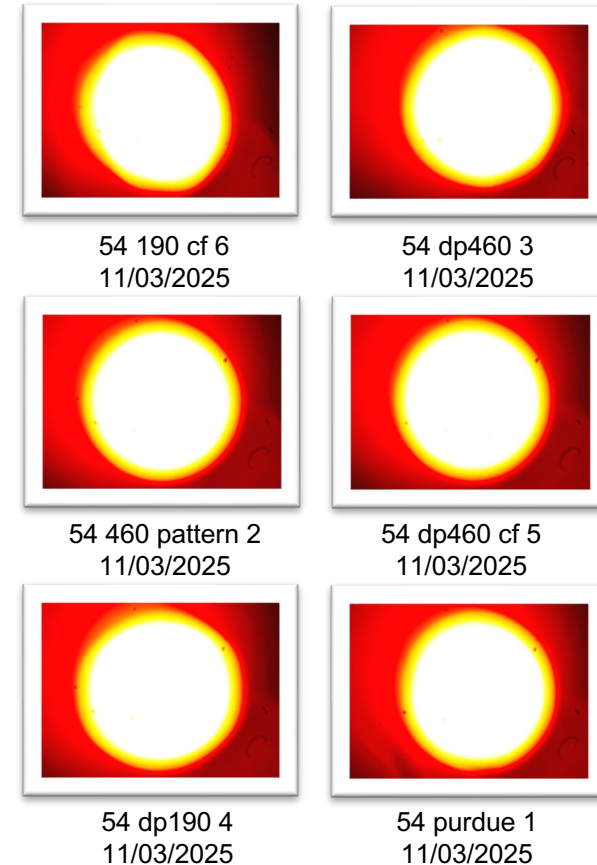
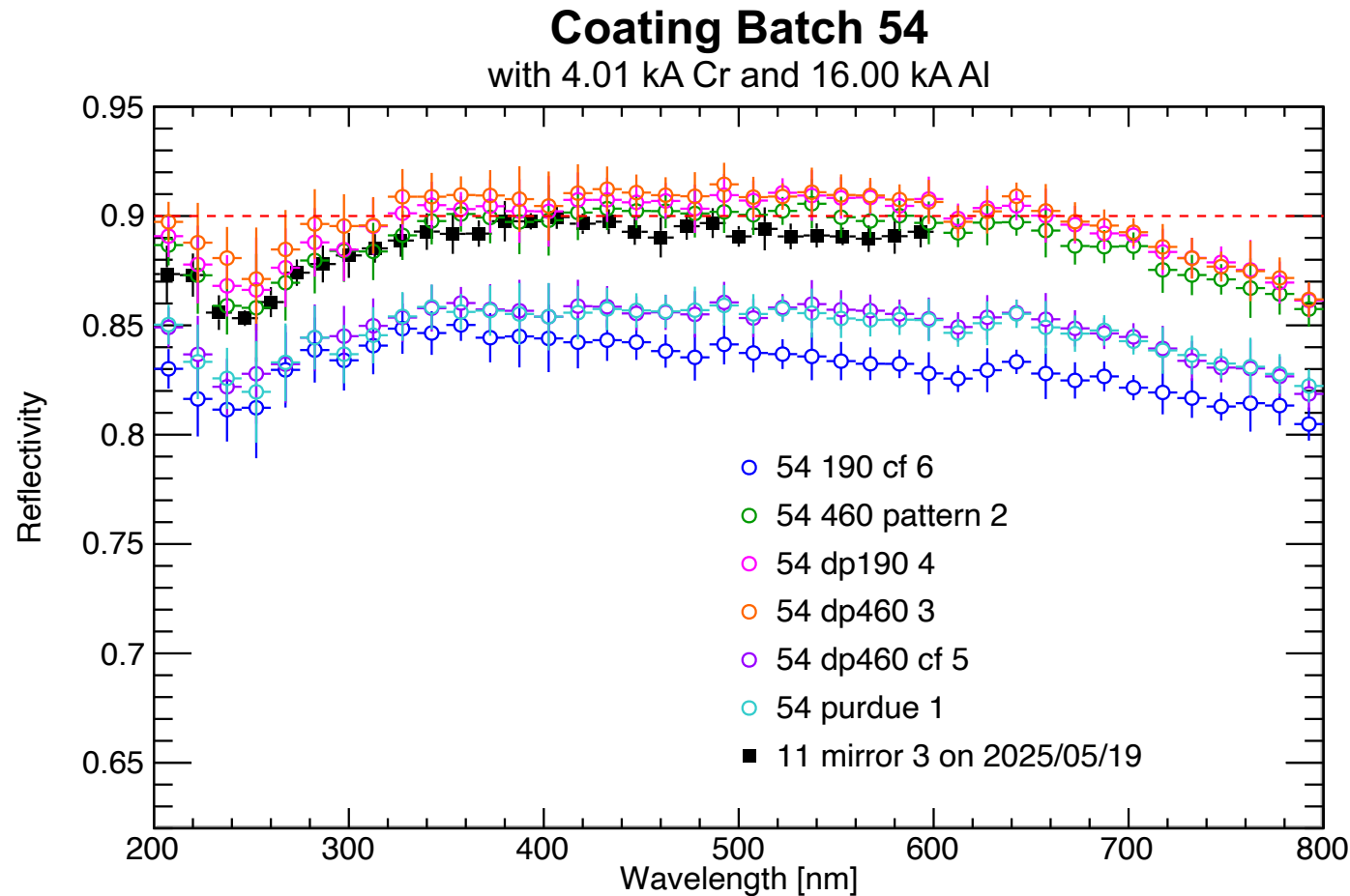
Re-measured the reflectivity of Coating Batch 11, Mirror 3 since new lamp was installed.
Shape is consistent, but magnitude is increased. New measurements are consistent.

Coating Batch #54 Mirror Samples



Patterned sample:
specific pattern w/o epoxy
→ Evaluate impact on
epoxy

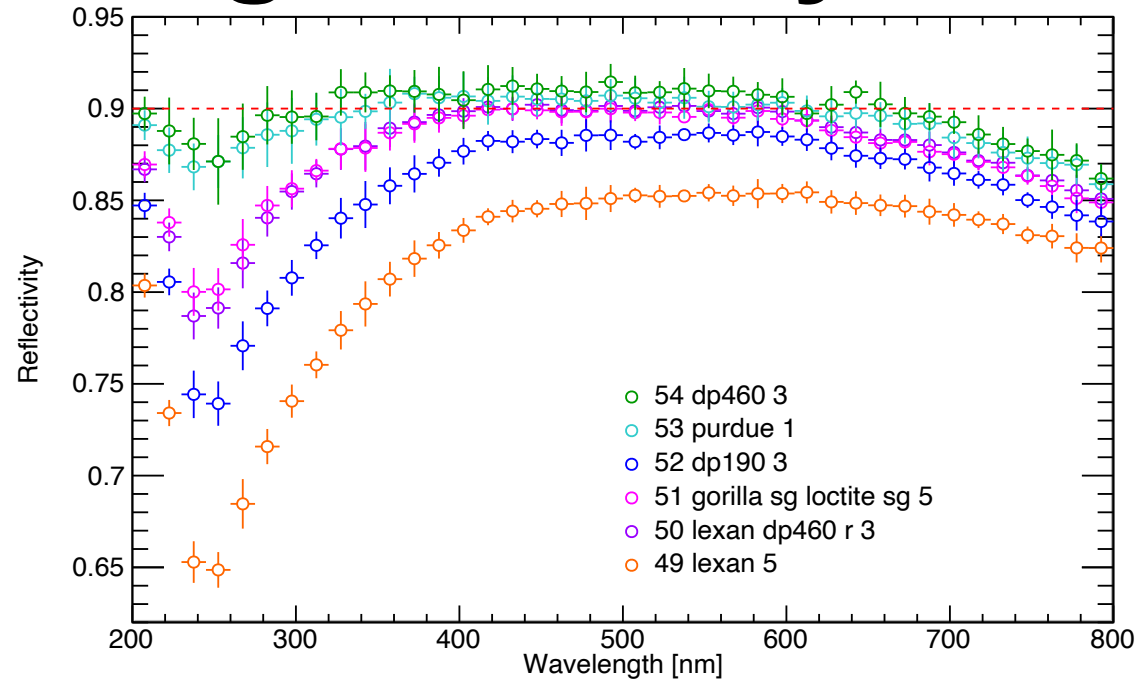
Small Mirror Reflectivity Results – #54



Coating Batch 54 mirrors show mixed reflectivity results — some nearly match Batch 53 or better, while others are lower (Lexan-CF and purdue substrate). Some mirrors were tightly fitted in the holder.

Mirror Coating Summary So Far

Picked the best mirror reflectivity (to me) per coating batch



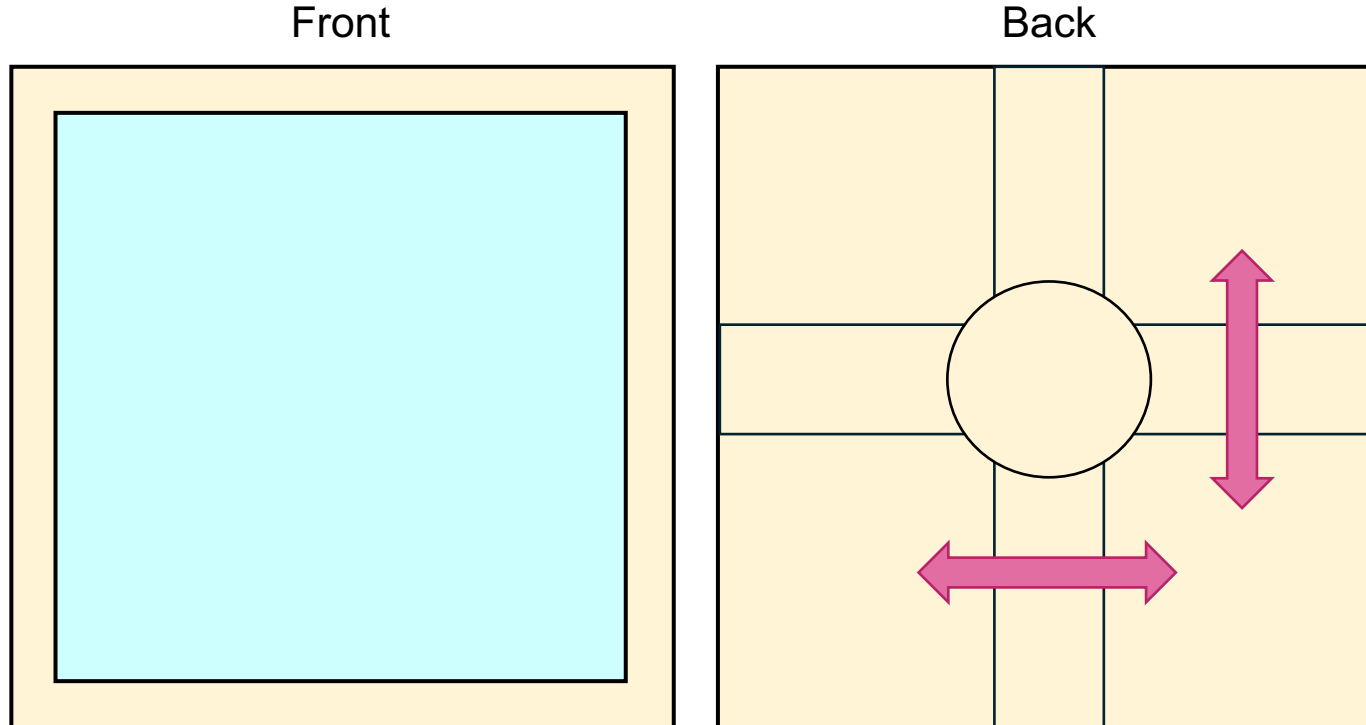
Thanks to Mahmodol

Coating Batch	Coating Total Thickness		Rate of Coating		Substrate
	Cr [kA]	Al [kA]	Cr [A/sec]	Al [A/sec]	
54	4.01	16.00	~8	~15	190 cf 6 (Lexan-CF), 460 pattern 2 (Lexan with pattern), dp190 4 (Lexan), dp460 3 (Lexan), dp460 cf 5 (Lexan-CF), purdue
53	5.04	20.22	-	-	-
52	5.75	23	-	-	-
51	5.29	21	-	-	-
50	5.51	22.02	-	-	-
49	6.01	23.99	-	-	-

Still to be updated

Small Mirror Reflectivity Measurement

White 3D printed mirror holder, made by Yongxin Deng (SULI 2025)

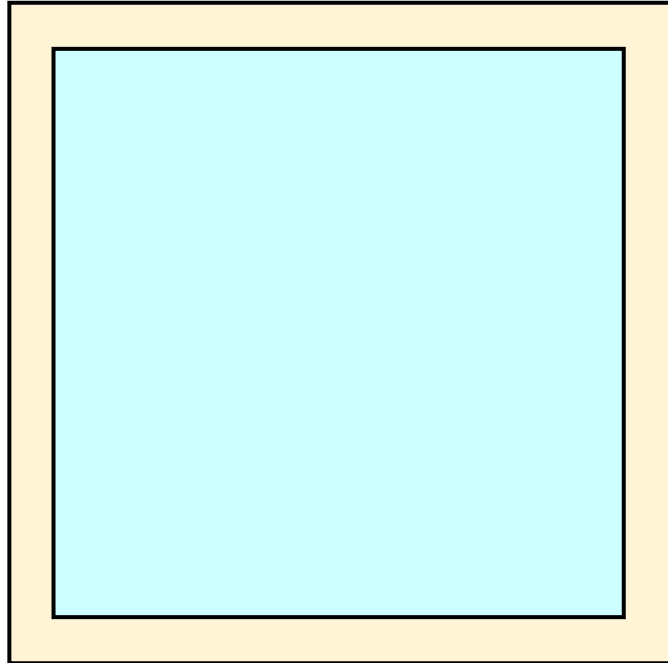


You can move
in X and Y directions,
respectively

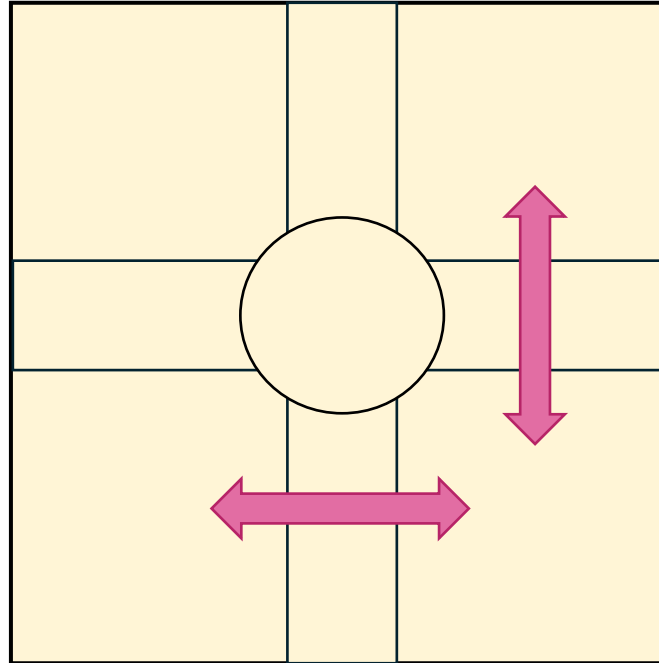
Small Mirror Reflectivity Measurement

White 3D printed mirror holder, made by Yongxin Deng (SULI 2025)

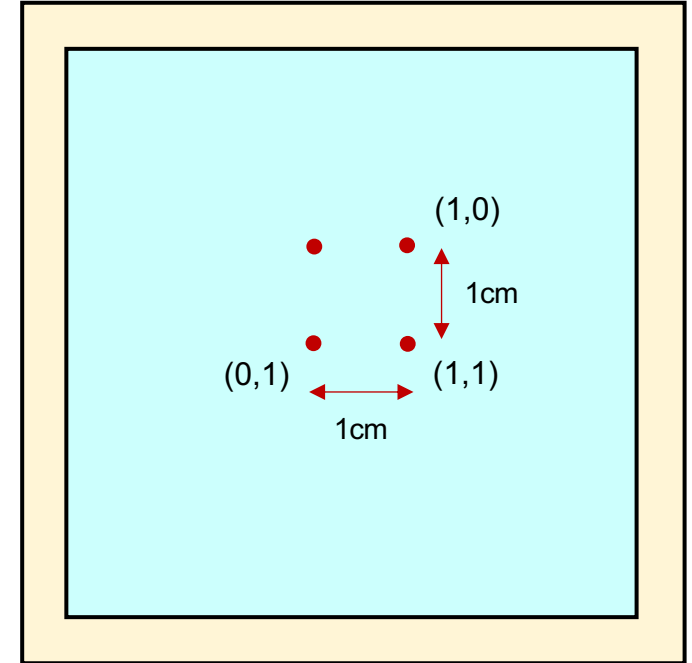
Front



Back

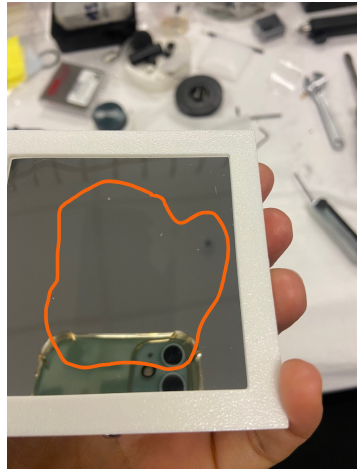


You can move
in X and Y directions,
respectively

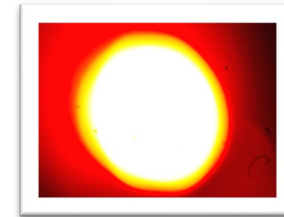
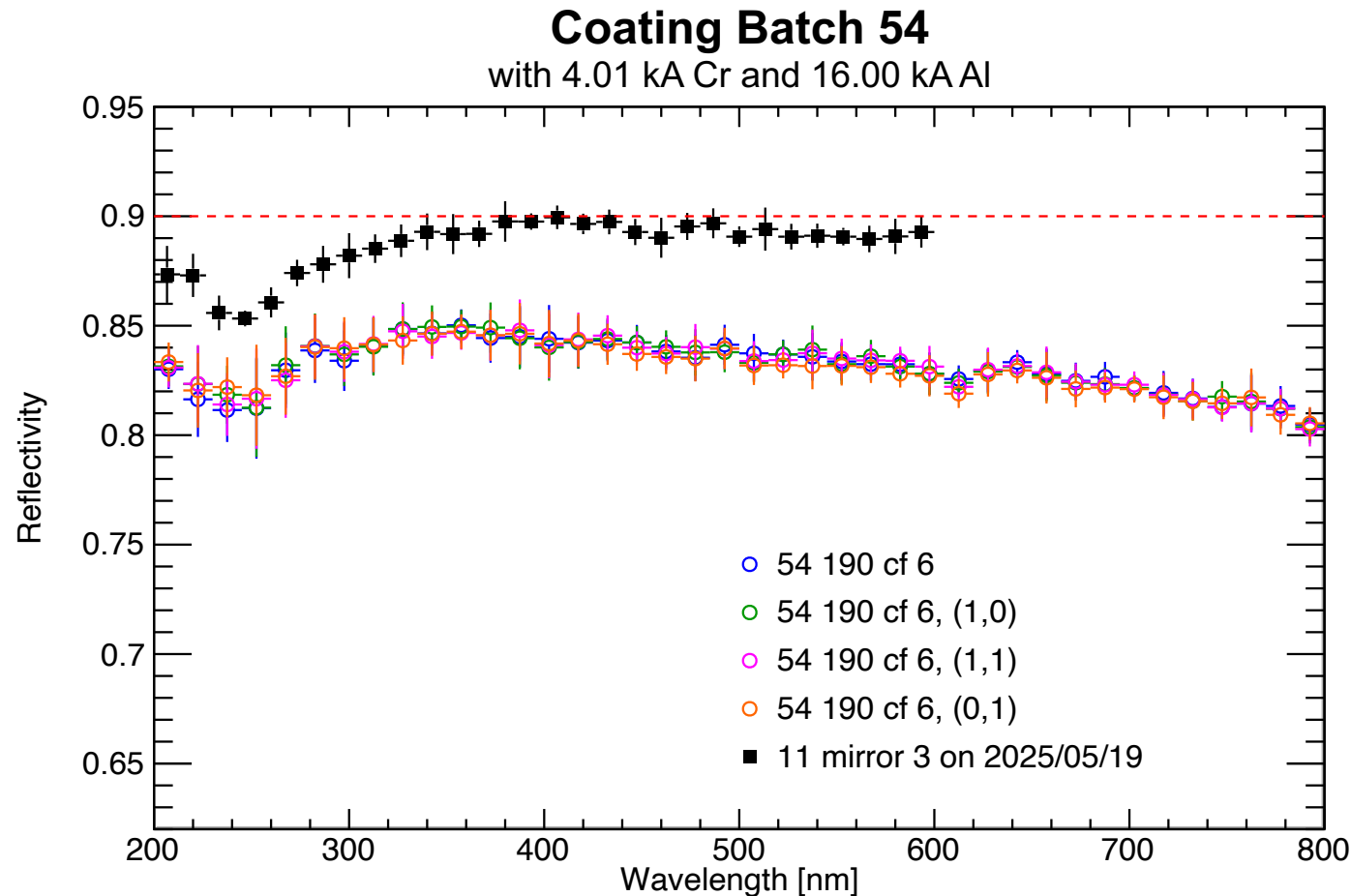


Take the same measurement
on 4 different spots

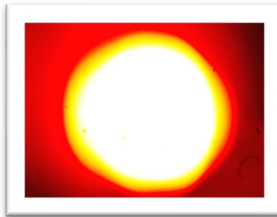
Small Mirror Reflectivity Results – #54



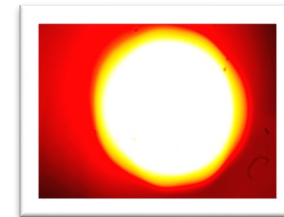
Black spot



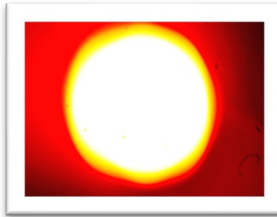
54 190 cf 6
11/03/2025



54 190 cf 6, (1,0)
11/03/2025



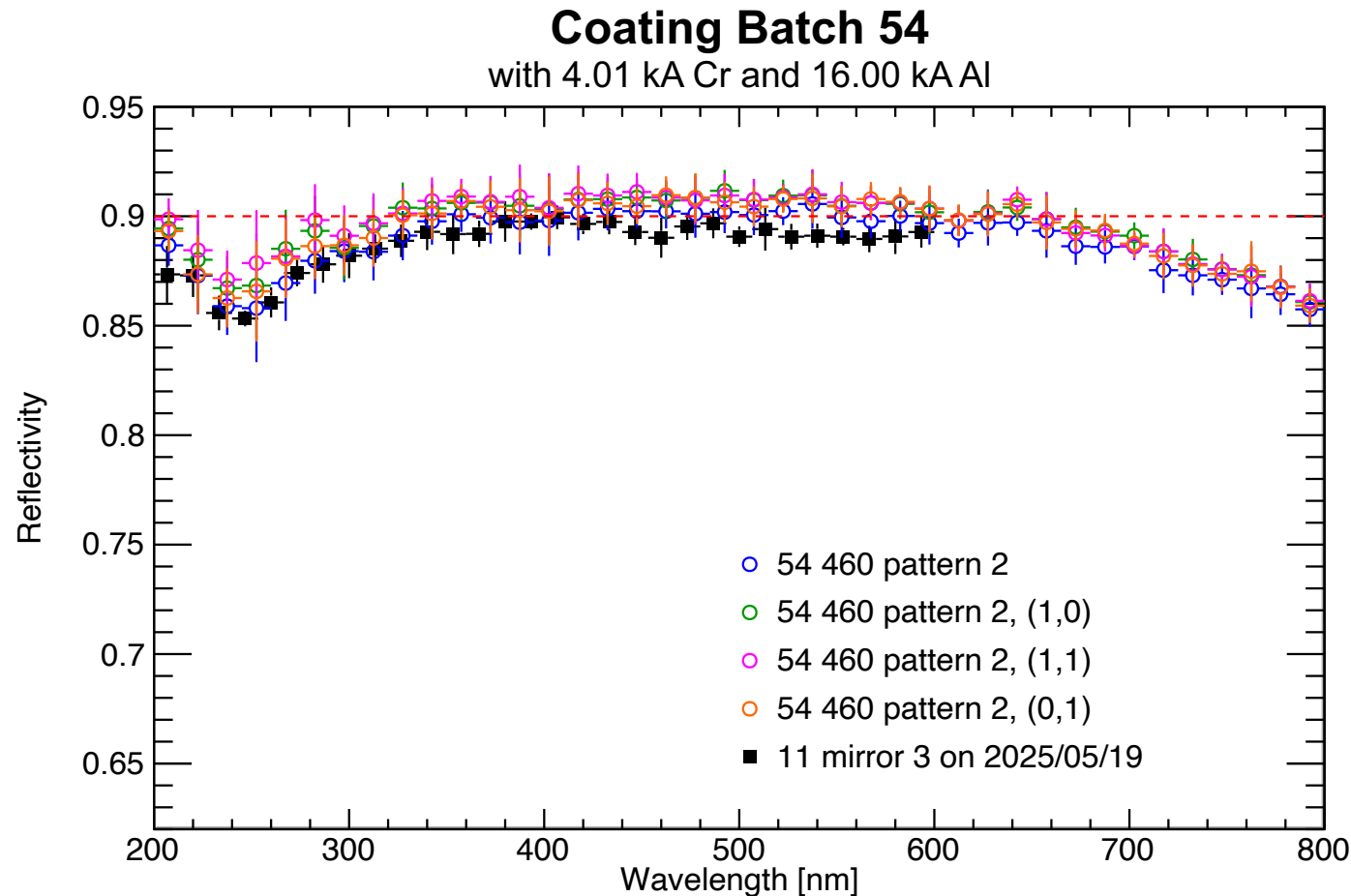
54 190 cf 6, (0,1)
11/03/2025



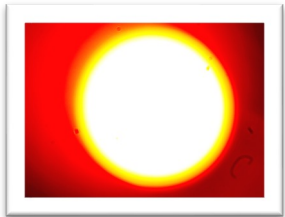
54 190 cf 6, (1,1)
11/03/2025

Overall, lower reflectivity results were shown, but they were consistent. A bit tightly fit into mirror holder. I am afraid that 4 measurements were performed within black spot (Uneven coating? Substrate?).

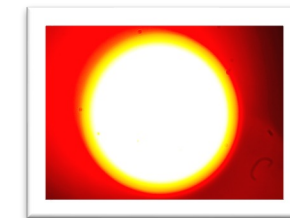
Small Mirror Reflectivity Results – #54



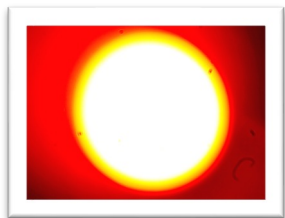
54 460 pattern 2
11/03/2025



54 460 pattern 2, (1,0)
11/03/2025



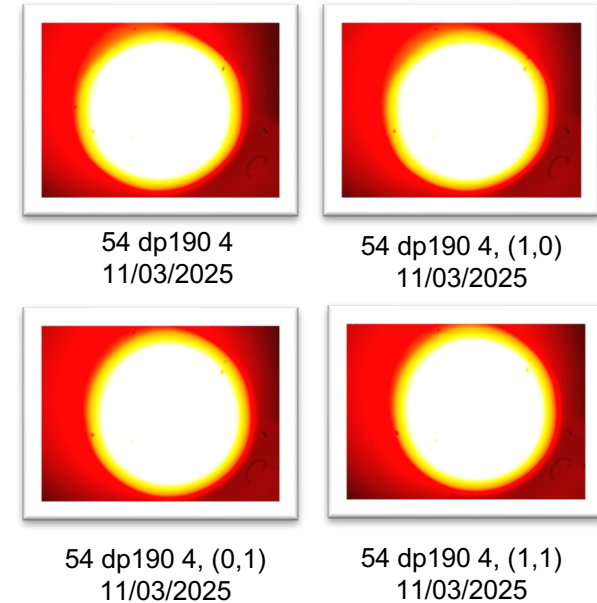
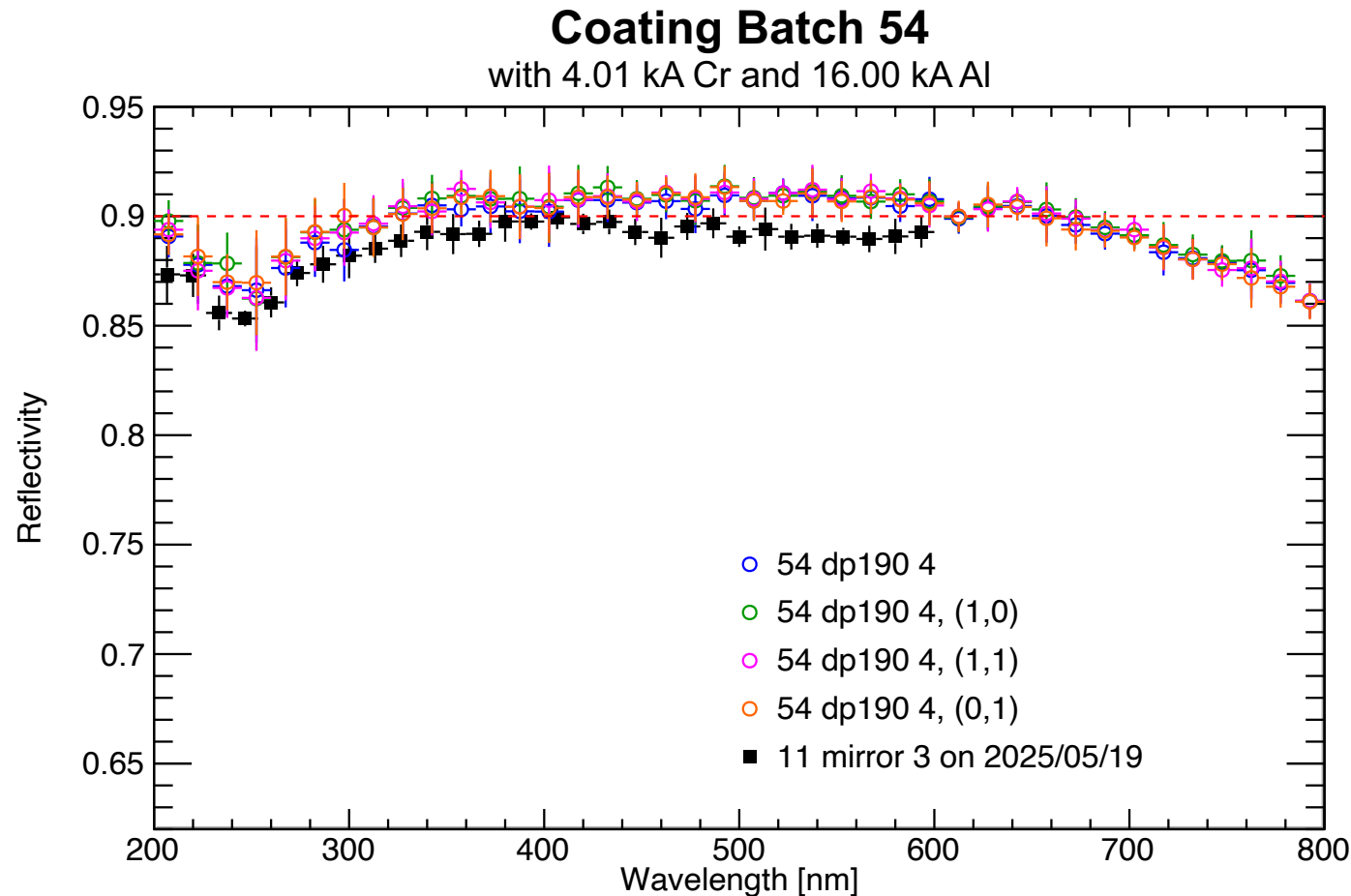
54 460 pattern 2, (0,1)
11/03/2025



54 460 pattern 2, (1,1)
11/03/2025

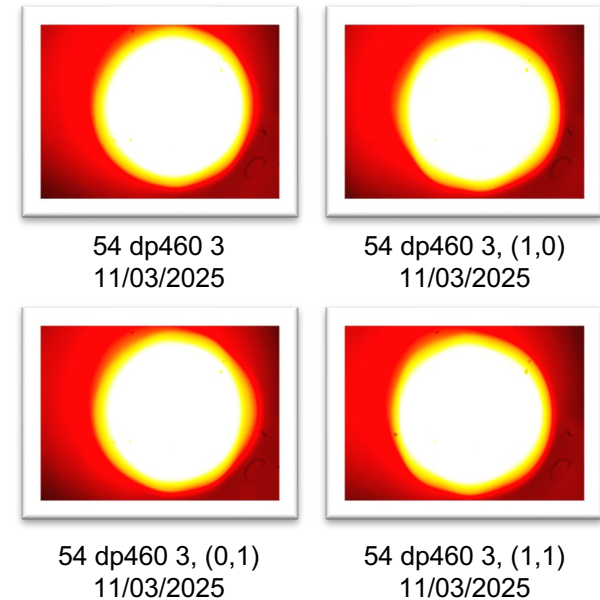
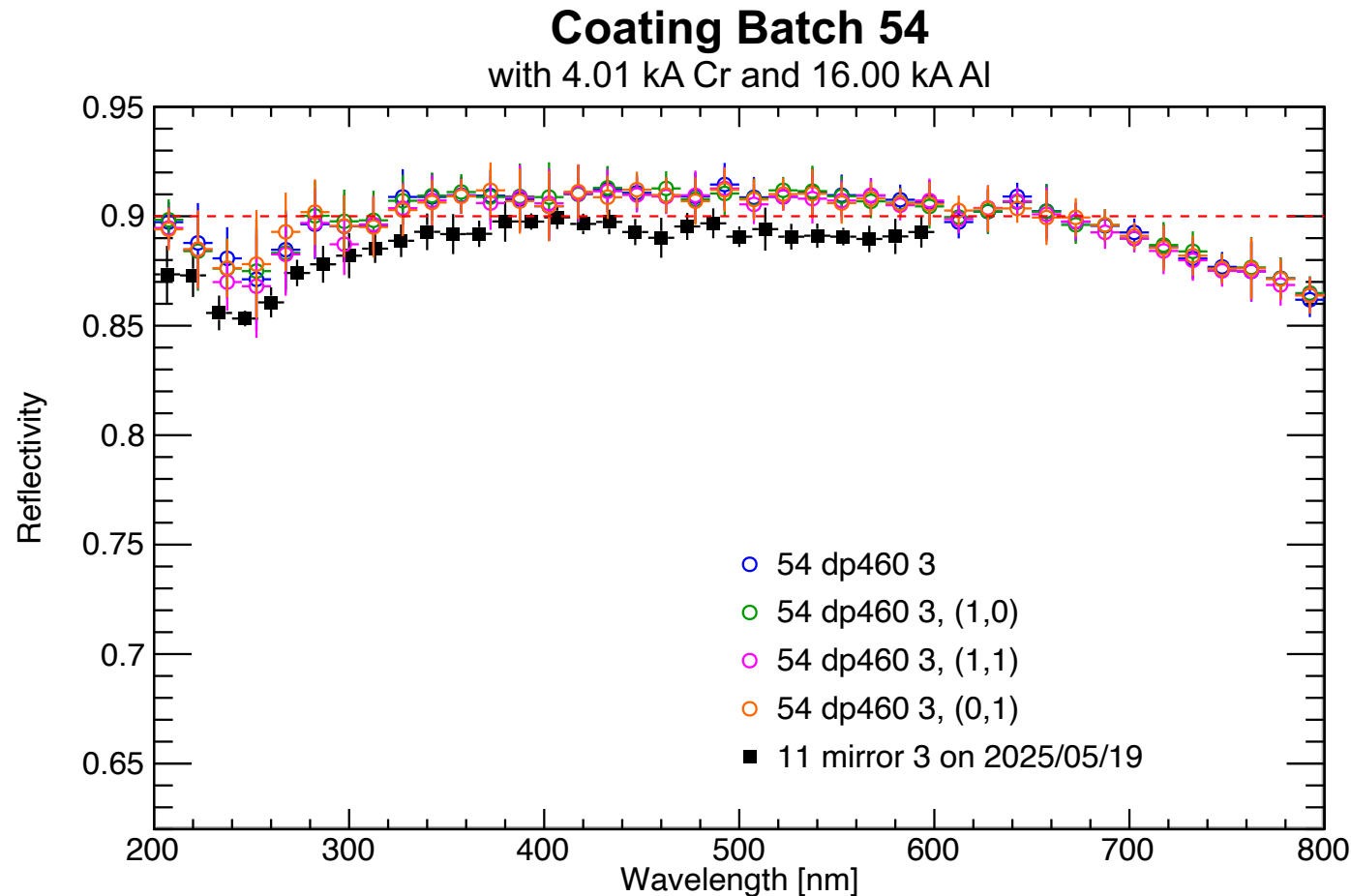
Overall, these mirrors show **similar or improved reflectivity** compared to previous Batch 53.

Small Mirror Reflectivity Results – #54



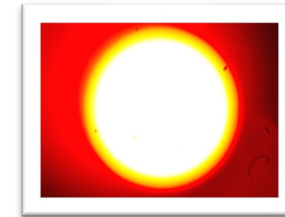
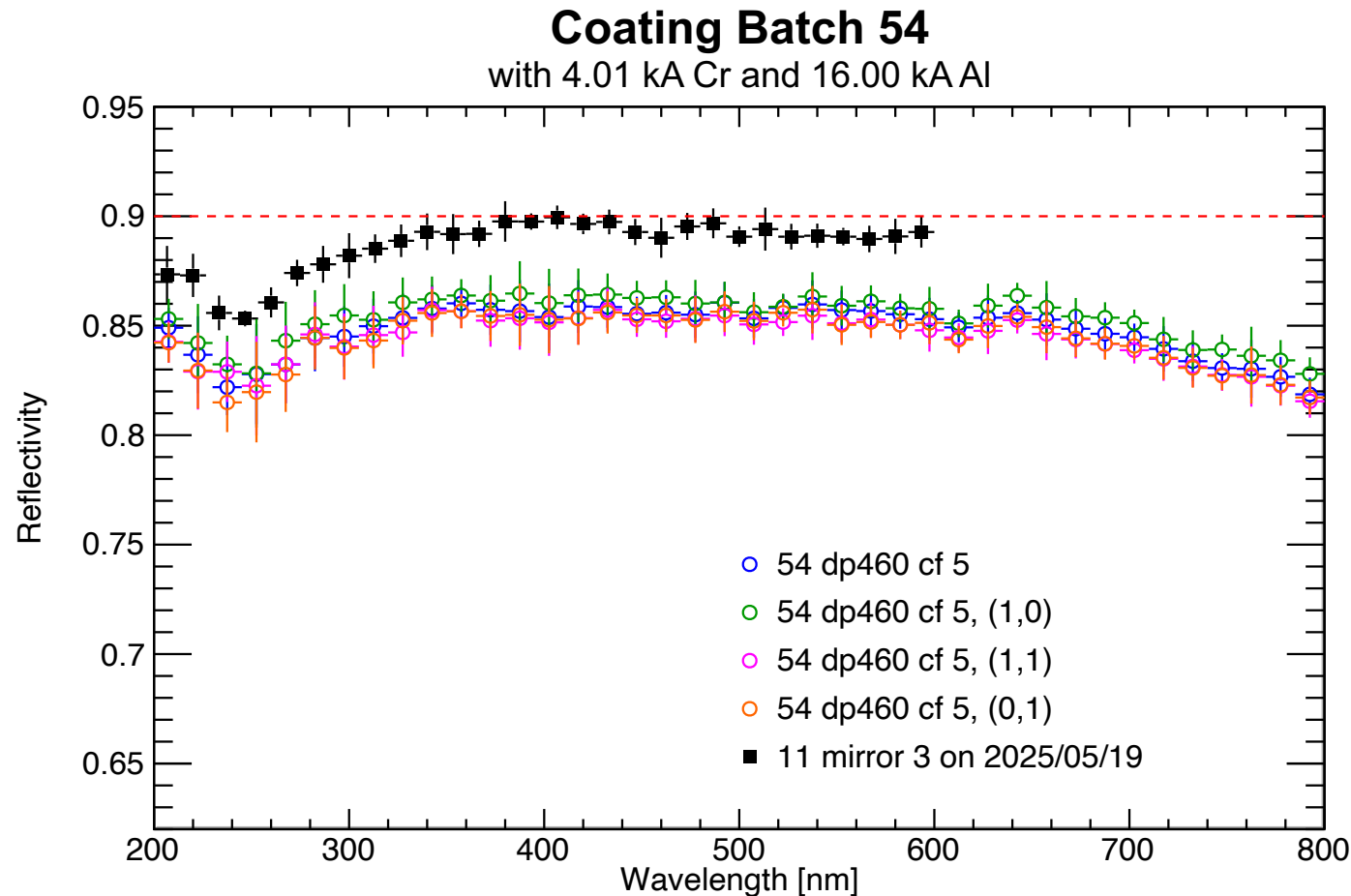
Overall, these mirrors show **similar or improved reflectivity** compared to previous Batch 53.
A bit tightly fit into mirror holder.

Small Mirror Reflectivity Results – #54

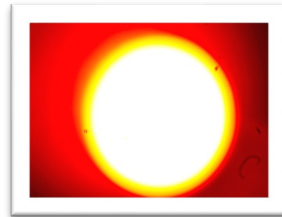


Overall, these mirrors show **similar or improved reflectivity** compared to previous Batch 53.

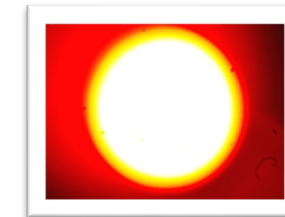
Small Mirror Reflectivity Results – #54



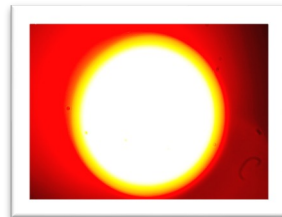
54 dp460 cf 5
11/03/2025



54 dp460 cf 5, (1,0)
11/03/2025



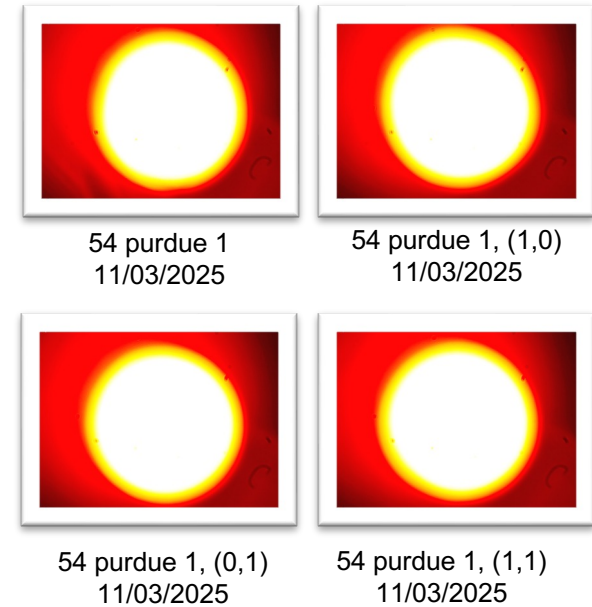
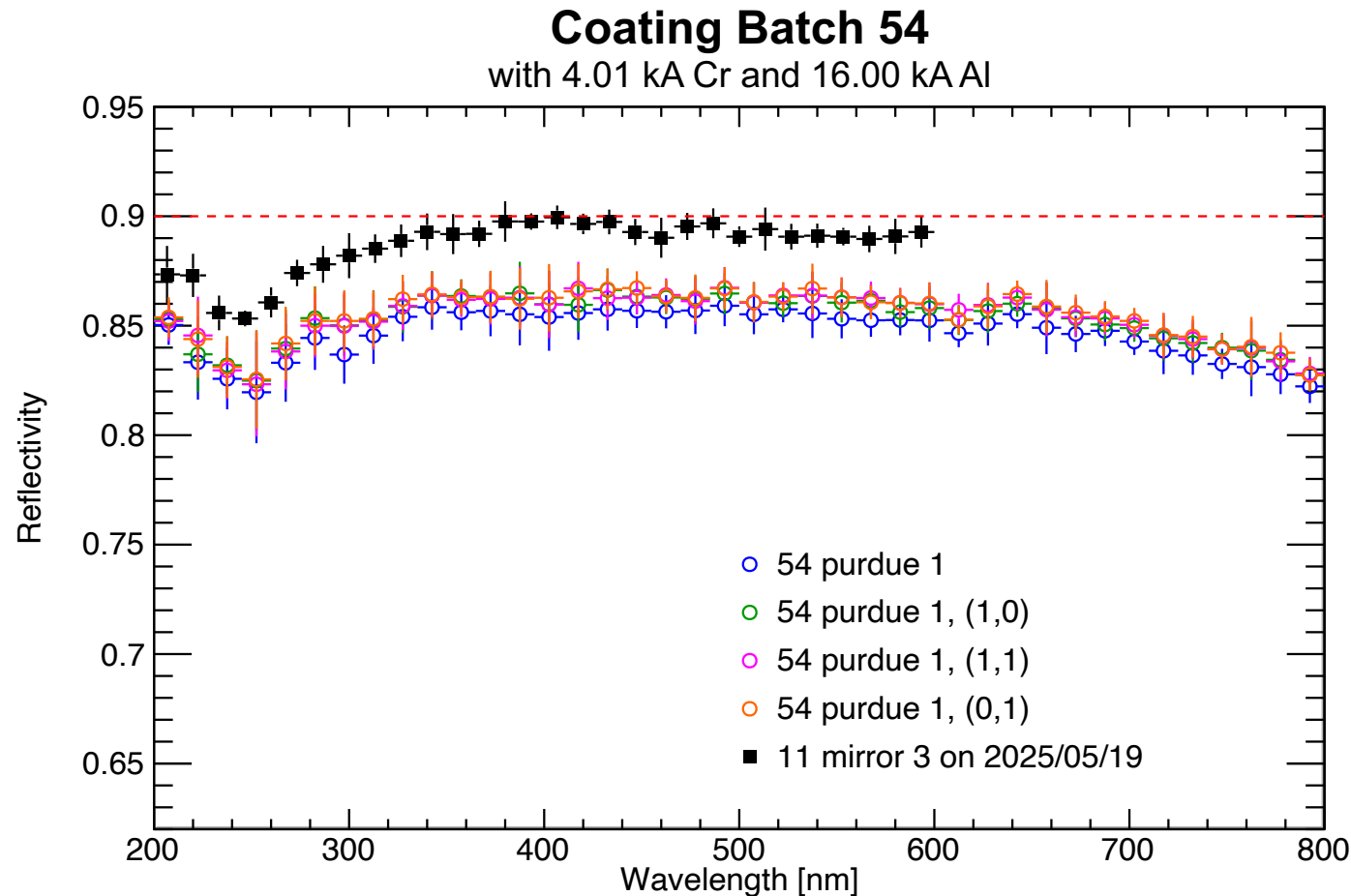
54 dp460 cf 5, (0,1)
11/03/2025



54 dp460 cf 5, (1,1)
11/03/2025

Overall, lower reflectivity results were shown, but they were consistent.
Found similar results with the other Lexan-CF mirror with different epoxy dp190.

Small Mirror Reflectivity Results – #54



Overall, lower reflectivity results were shown compared to other mirrors in Batch 54, but they were consistent.

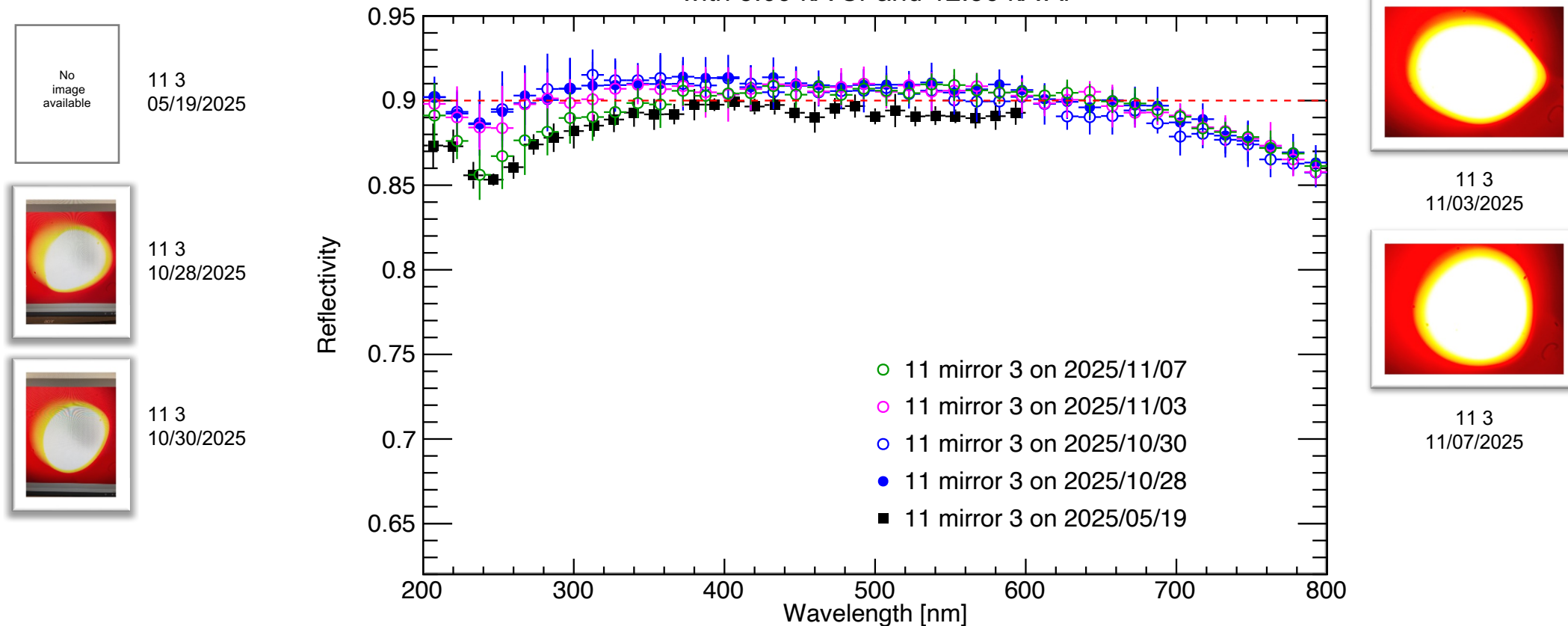
So far, new results for Batch 54 was shown

Next following slides, revisited a couple of samples in Batch 53 and 54

- ✓ Batch 54 – CF and patterned samples
- ✓ Batch 53 – purdue and patterned samples

Small Mirror Reflectivity Results – Ref.

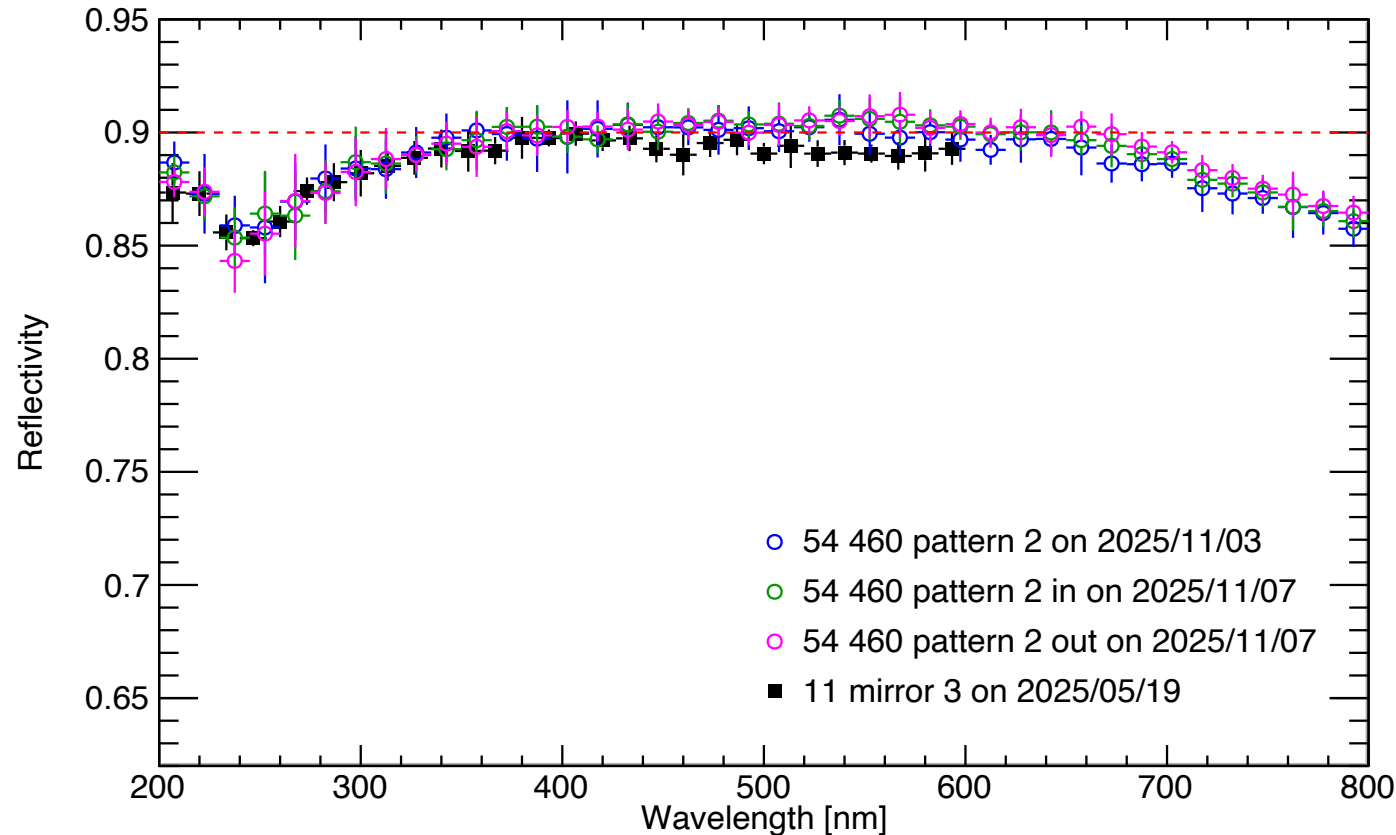
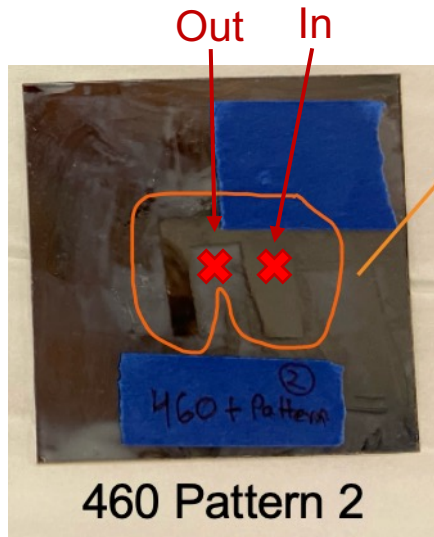
Coating Batch 11 mirror 3
with 5.09 kA Cr and 12.36 kA Al



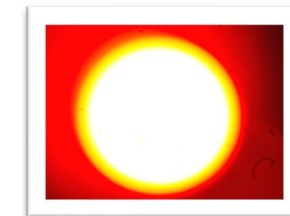
Re-measured the reflectivity of Coating Batch 11, Mirror 3 since new lamp was installed.
Beam spot was different from usual (unintentionally) and image is different accordingly.

Patterned Sample – #54

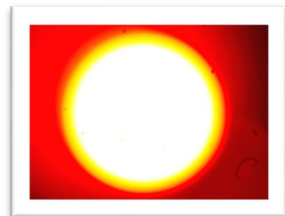
Coating Batch 54
with 4.01 kA Cr and 16.00 kA Al



54 460 pattern 2
11/03/2025



54 460 pattern 2
inside
11/07/2025

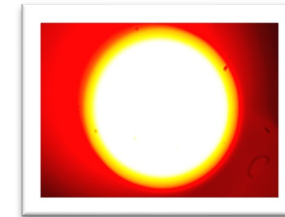
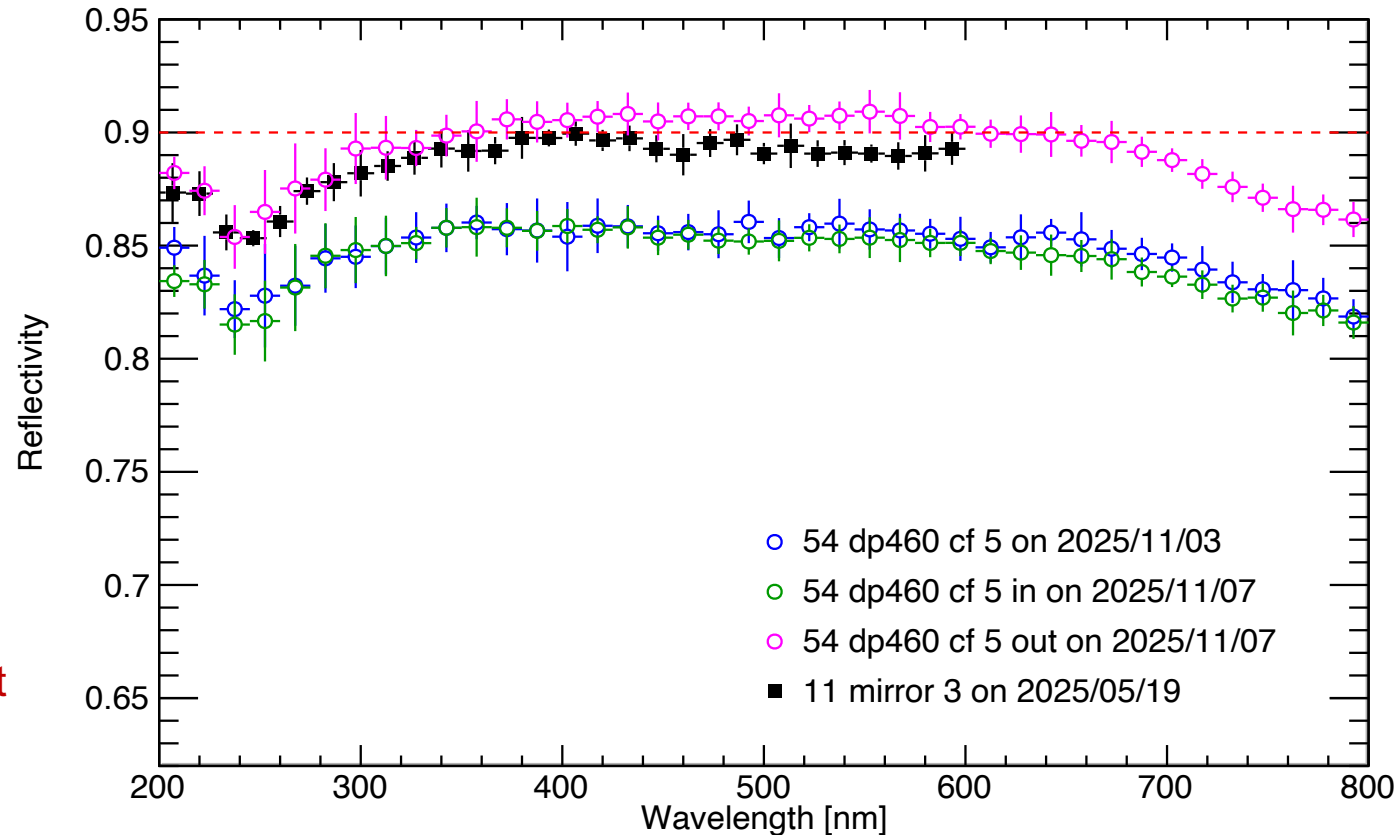
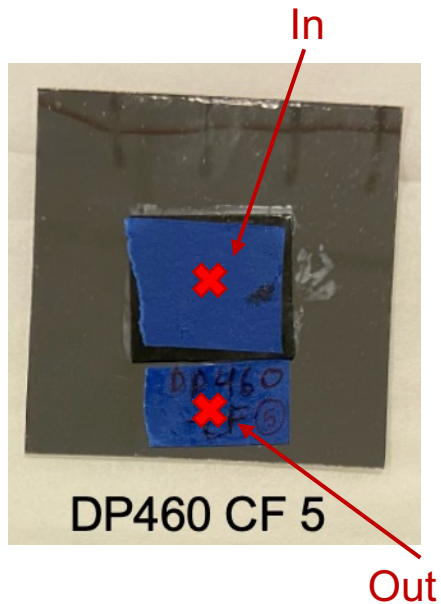


54 460 pattern 2
outside
11/07/2025

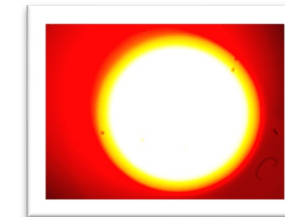
I am afraid that my intended measurements are clearly done inside/outside of patterned area.
A few % different at max. Will suggest clear boundary (right/left) for future coating.

Carbon Fiber Sample – #54

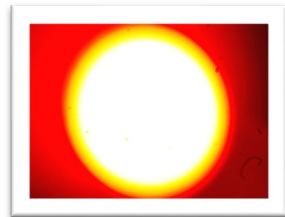
Coating Batch 54
with 4.01 kA Cr and 16.00 kA Al



54 dp460 cf 5
11/03/2025



54 dp460 cf 5
Inside CF
11/03/2025

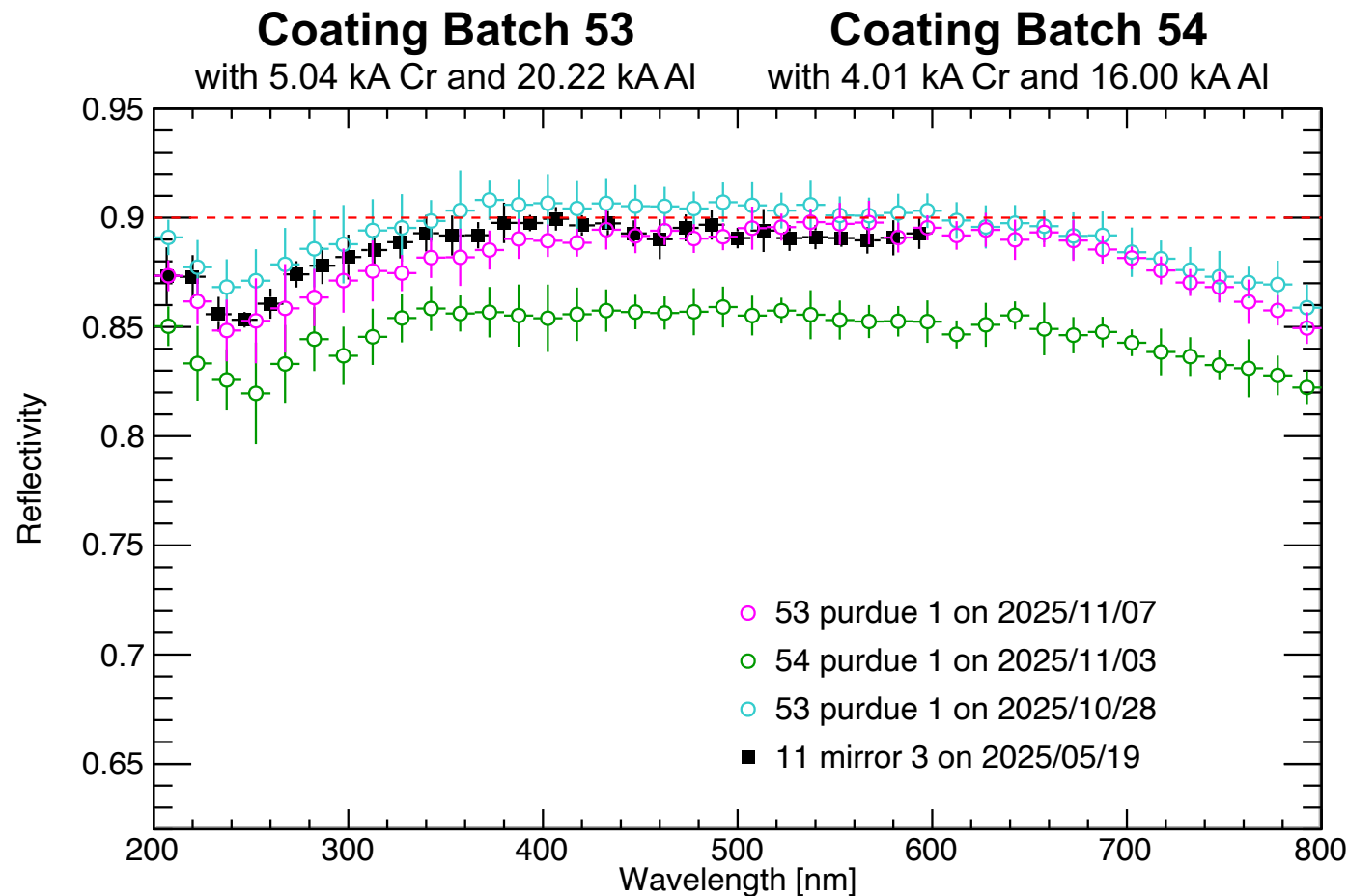


54 dp460 cf 5
Outside CF
11/03/2025

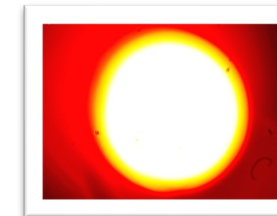
This illustrates the effect of CF on reflectivity.

Blue and Green histograms should agree since measurements are done inside CF.

Purdue Sample – #53 and #54



53 purdue 1
10/28/2025



54 purdue 1
11/03/2025

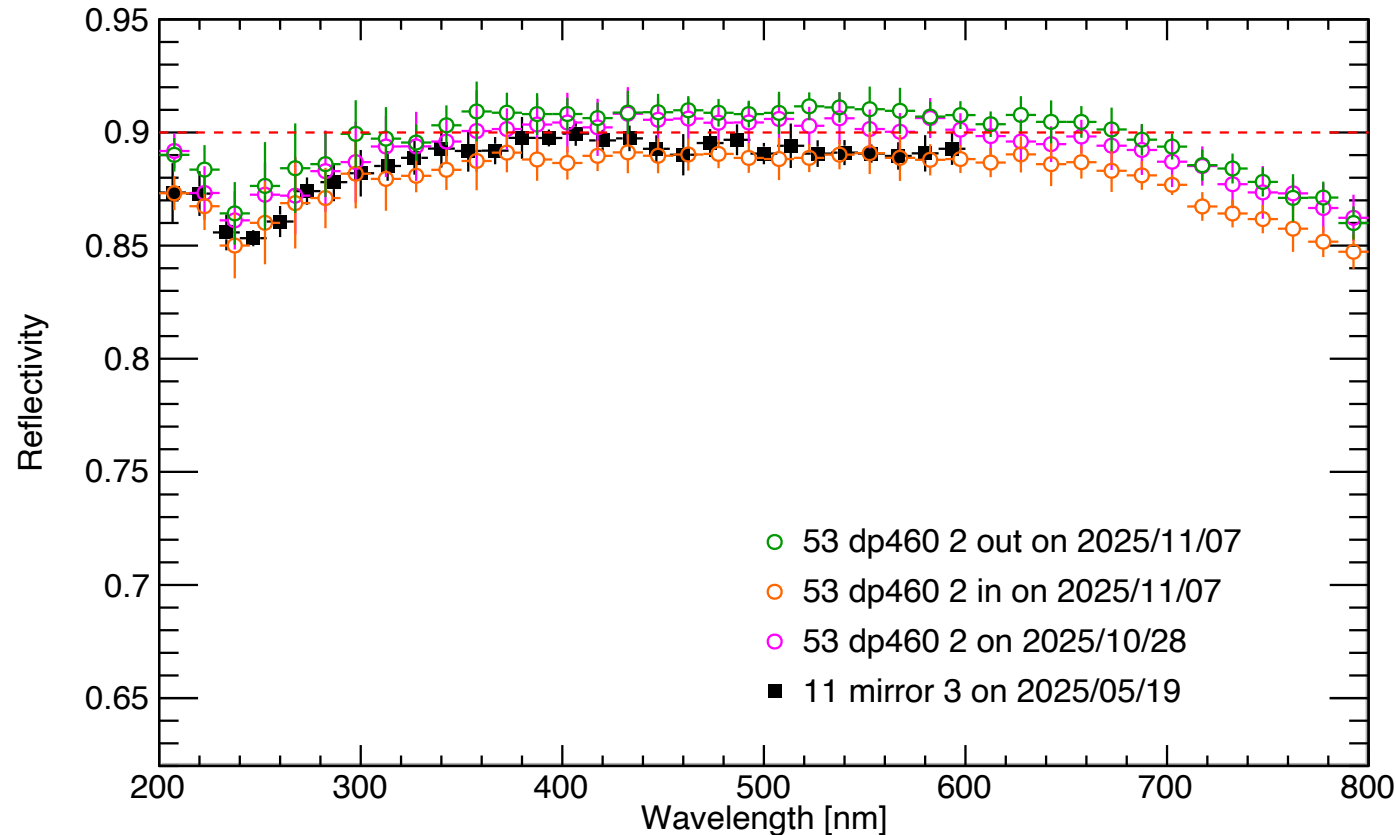
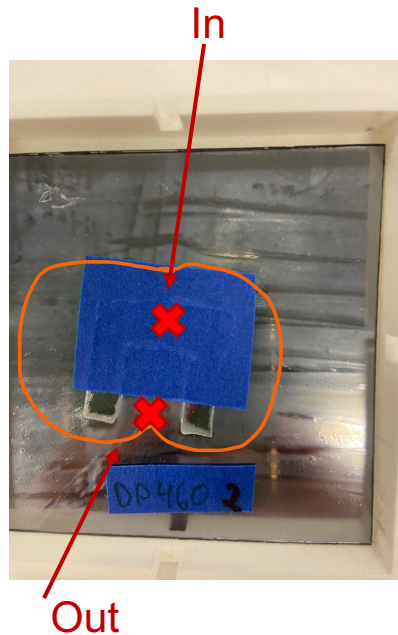


53 purdue 1
11/07/2025

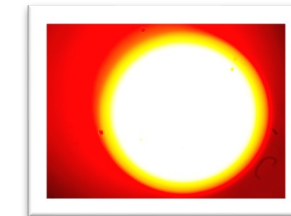
Re-measure Batch 53 purdue sample which shows high reflectivity comparing to usual purdue samples (~85 %; ex Batch 54). Here it indicates coating thickness makes difference on CF?

Patterned Sample – #53

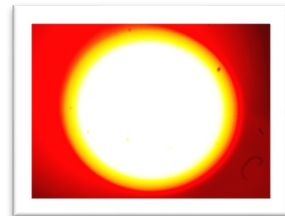
Coating Batch 53
with 5.04 kA Cr and 20.22 kA Al



53 dp460 2
10/28/2025



53 dp460 2
inside
11/07/2025



53 dp460 2
outside
11/07/2025

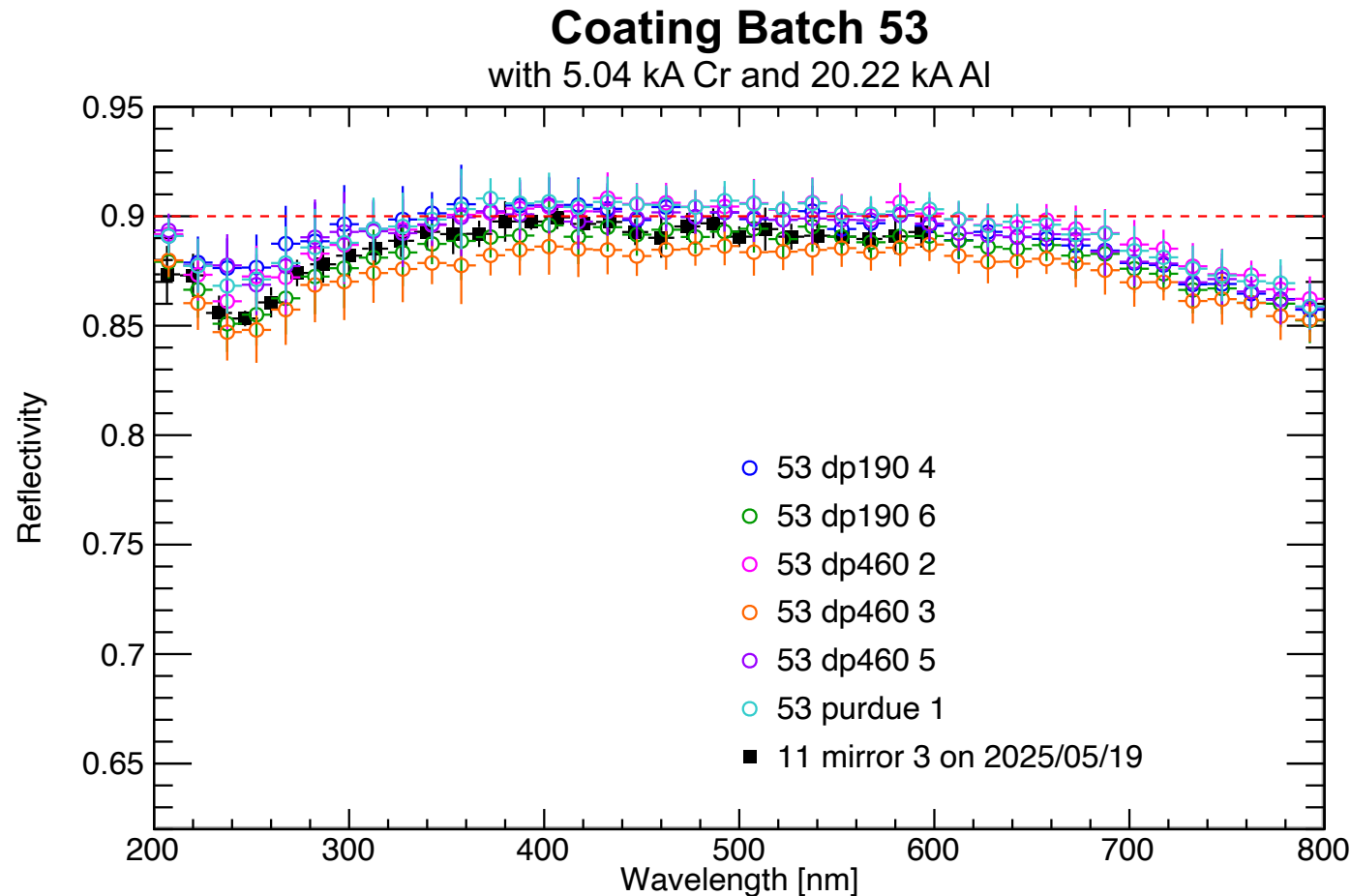
I am afraid that my intended measurements are clearly done inside/outside of patterned area.
Observed more difference between inside and outside patterned area than Batch 54.

Summary

- New Batch 54 mirror reflectivity measurements were performed.
 - Found mixed reflectivity results.
 - Some nearly match Batch 53 or better.
 - Others with Lexan-CF and purdue substrate (CF samples) are lower.
 - Tested 4 different spots on mirrors (scanning mirror surface).
 - All mirrors showed relatively consistent results.
- Patterned samples
 - Due to uncertain beam spot location on mirror, it is hard to conclude for now.
- Carbon Fiber samples
 - Usually ~85 % reflectivity, but between Batch 53 and 54 coating thickness makes different on reflectivity.

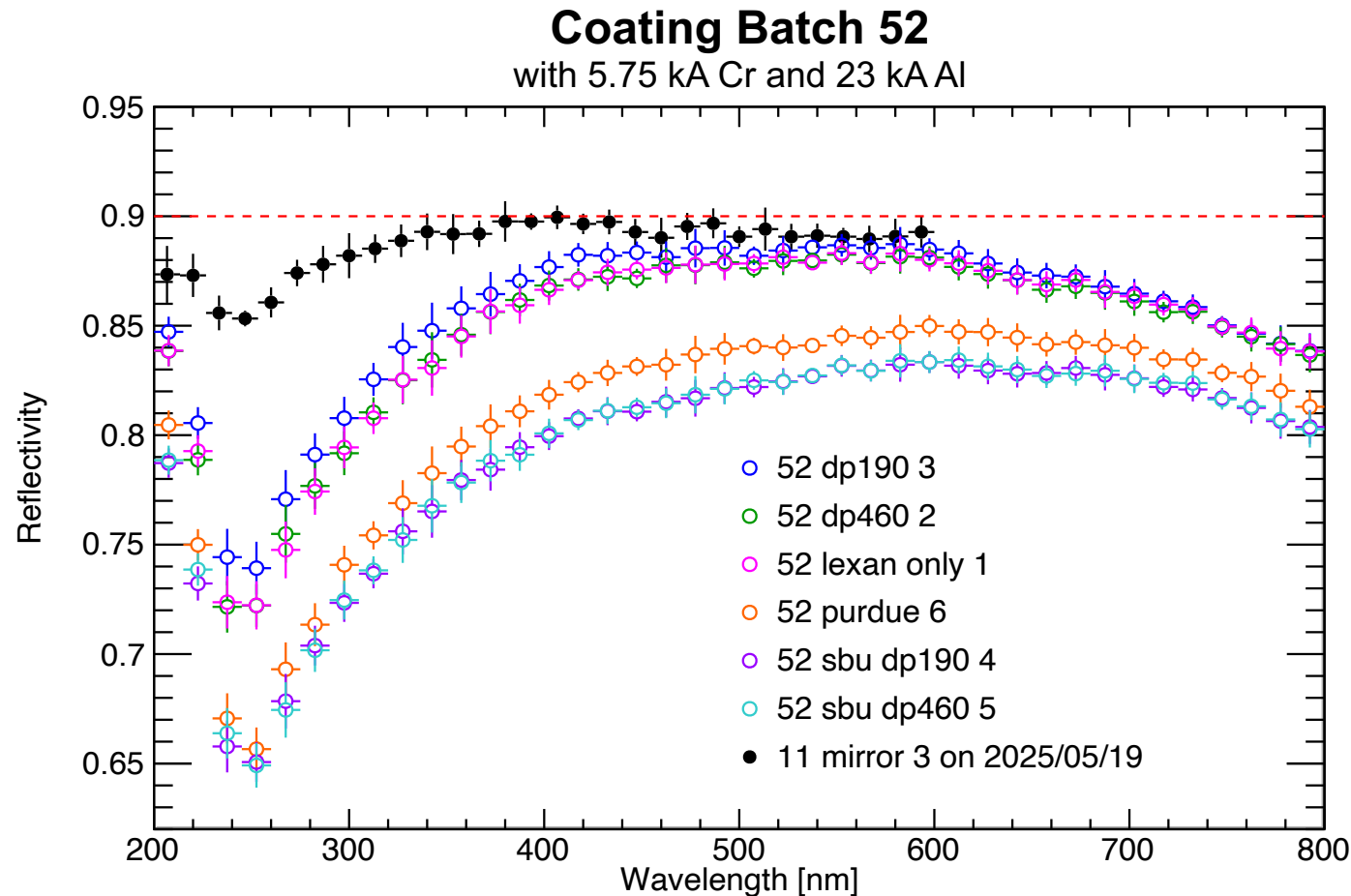
Backup Slides

Small Mirror Reflectivity Results – #53



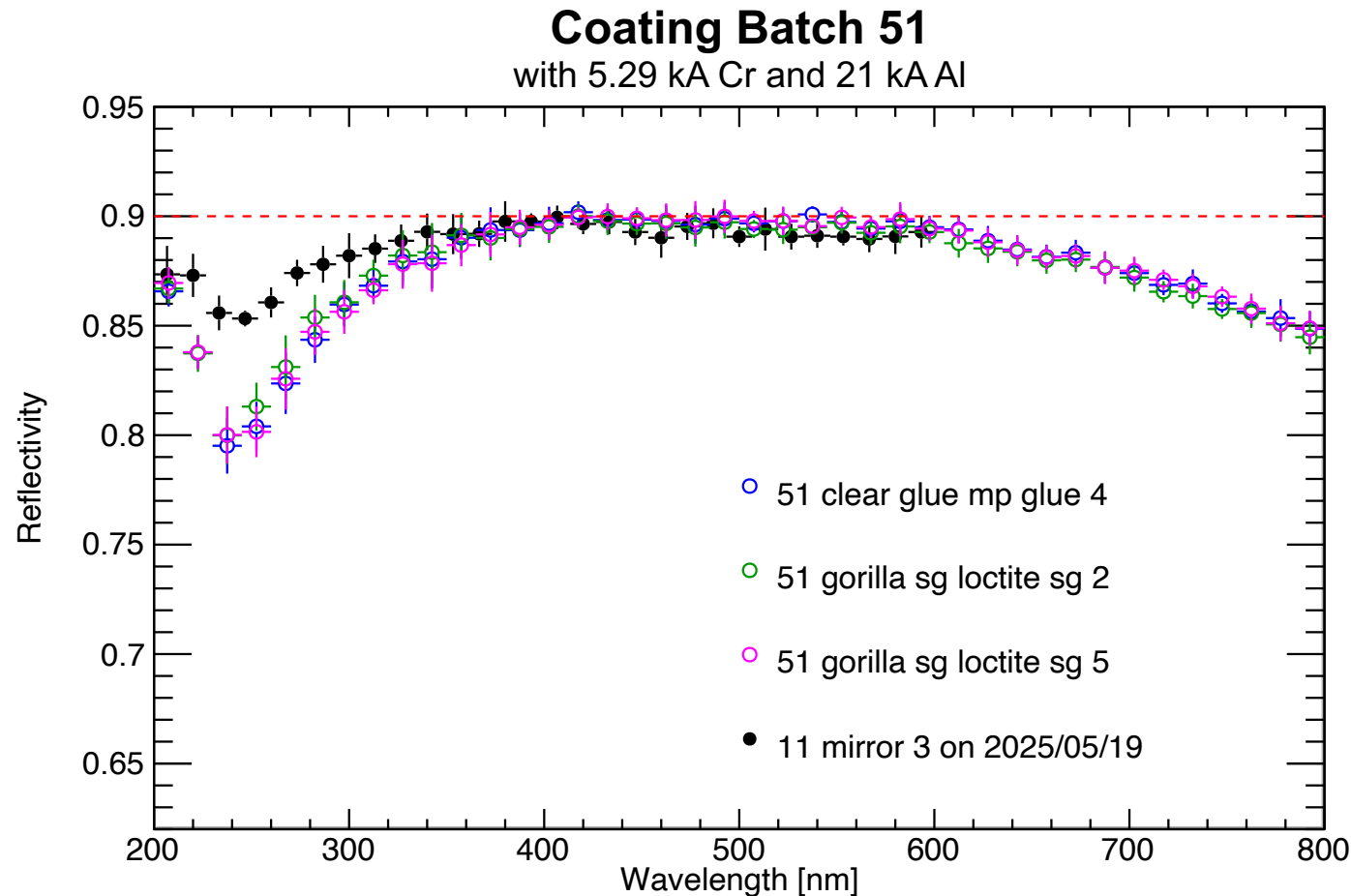
The mirrors from Coating Batch 53 achieved approximately **90% reflectivity** across the 350 – 650 nm range. Overall, these mirrors show **improved reflectivity** compared to previous batches.

Small Mirror Reflectivity Results – #52



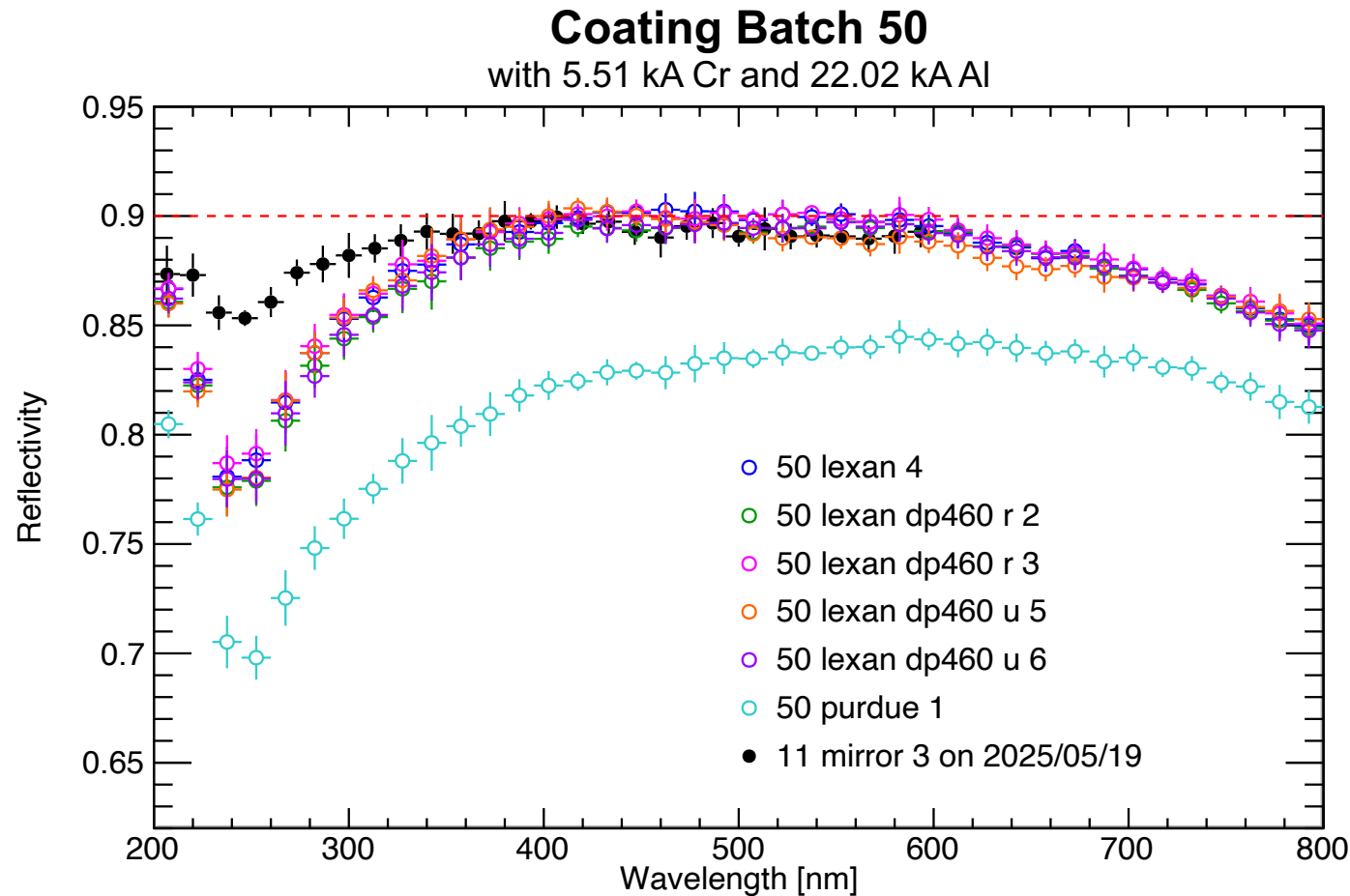
Coating Batch 52 mirrors show mixed reflectivity results — some nearly match the reference (within 1–2%), while others are lower (82–84%). Some mirrors were tightly fitted in the holder.

Small Mirror Reflectivity Results – #51



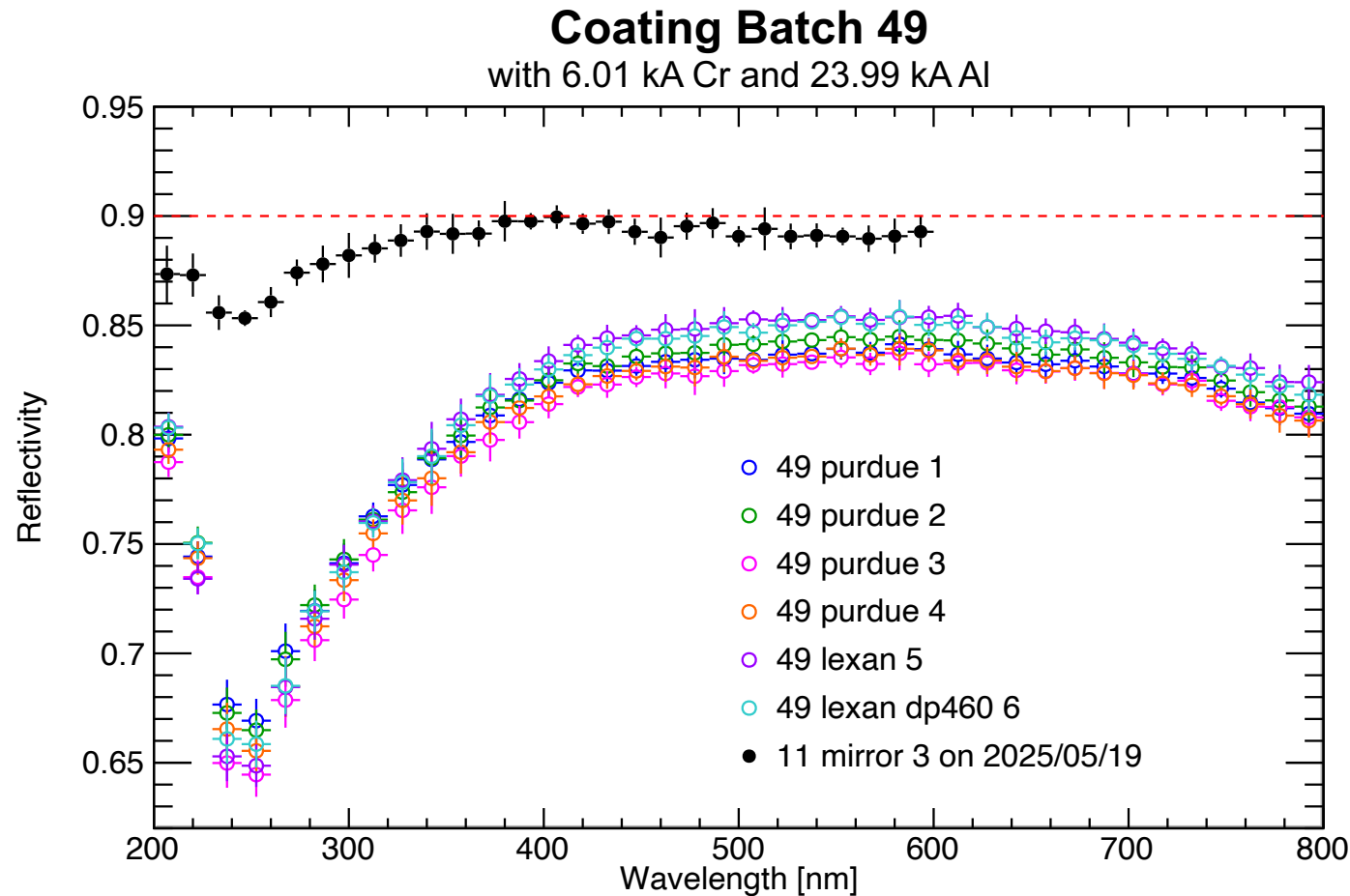
Mirrors from Coating Batch 51 exhibit approximately 90% reflectivity in the 400–600 nm range.

Small Mirror Reflectivity Results – #50



Mirrors from Coating Batch 50 show approximately 90% reflectivity across 400–600 nm, with *Purdue 1* as an exception.

Small Mirror Reflectivity Results – #49



The mirror from Coating Batch 49 reaches a maximum reflectivity of **85%**.