Mirror Testing Round Robin
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In the summer of 2001 a set of three mirrors was collected for a mirror testing game. The mirrors were to be passed around to different volunteers to test using whatever method they preferred. At the end the results were to be made public. Although it was not designed as a rigorous scientific study, presumably the results would tell us all something about the reproducibility of standard ATM tests in the hands of different workers.

Now, three years later the results are in. Approximately 20 people sent me results of their tests. (Not all the participants shared their results with me. They are welcome to report their results to the list.) I have compiled the results and would be glad to share the data with whomever is interested. Most of the participants used a Foucault test or some variant. A few people used more than one test. Roger Ceragioli did interferometry testing on all three mirrors. James Lerch and I also carried out interferometric testing on some or all of the mirrors. If we assume that Roger has the "correct" answer, then we can judge the results of the other test based on how close they come to his result.

Mirror A
8" F5.4 mirror
Typical numbers from Foucault testers:
1/3 wave peak-to-valley error in correction, ca. 1/20 wave RMS error.
Undercorrected; b ~ -0.83
Strehl ~ 0.75
Surface roughness was mentioned by most testers.
Mirror rated poor to acceptable by most testers.

Interferometry (Roger):
0.0695 (1/14) wave RMS
Rough with a TDE.
Modest trefoil error.
Strehl (James) ~ 0.75

Mirror B
8" F5.0
Typical numbers from Foucault testers:
1/10 wave Peak-to-valley error, ca. 1/30 wave RMS error.
Slightly overcorrected; b ~ -1.06
Strehl ~ 0.90
Smooth, Good edge.
Mirror rated excellent by most reviewers.

Interferometry (Roger):
1/20 wave RMS
high zone at 80%, low center.

Strehl (James) ~ 0.88

Mirror C
6" F5.4
Typical numbers from Foucault testers:
1/14 wave Peak-to-valley, ca. 1/50 – 1/90 wave RMS
Correction about right.
Strehl ~ 0.98
Narrow TDE, could be masked.
Mirror rated excellent to outstanding by most reviewers.

Interferometry (Roger):
1/16 wave RMS
correction P-V ~ 1/13 wave
Astigmatism increases RMS error significantly.
Strehl (James) ~ 0.86

The three mirrors show interesting flaws. Mirror A was undercorrected and rough. Most testers assigned it as such. Interestingly, the Foucault tester's Strehl ratio matches the interferometer Strehl ratio for both mirror A and mirror B. Mirror B had the smoothest surface and a good edge. It suffered from a modest zone at about 80% and a slight overcorrection. The third mirror was the most surprising. Mirror C was rated the highest by the Foucault testers, whereas the interferometry tests put it slightly worse than Mirror B by Strehl ratio and RMS values.

Mirror C showed astigmatism, ca. 0.2 wave P-V, which accounts for roughly half of the surface error. Only one of the Foucault testers (Hanagan) considered the astigmatism of mirror C explicitly, but found no evidence of it in an eyepiece test. He did detect strain in a cross-polarizer test on the blank. I have repeated both test on mirror C. Under some conditions I could detect a modest "cross" of strain similar to the image in Texereau (p. 155, Figure 70, type II). In a ROC eyepiece test I can detect astigmatism when I am looking for it, but it is very faint and I only see it outside of focus as the inside of focus pattern is washed out due to the spherical correction. It is less dramatic than the 0.37 wave astigmatism example in Suiter, p. 260. Modest astigmatism is not easily detected without interferometry analysis.

The raw data for each mirror is included as a separate PDF file. Each section begins with an index and a tabular summary. In addition to these reports, there are two very complete write-ups that I will provide in their entirety. First, Wm. D. Hanagan, Jr. Ph. D. provided a very nice discussion of several test he conducted. I have included it as a separate PDF file. Second, James Lerch prepared web pages with many interesting details of his studies, including Robo-Foucault and interferometry. Both of these discussions are well worth reading.

The reports can be downloaded from the ATM List web site:
http://www.atmlist.net/contrib/srychnov-at-chem-dot-ps-dot-uci-dot-edu/

Mirror A Report

Mirror B Report

Mirror C Report

Hanagan Report

Lerch Web site: http://lerch.no-ip.com/atm/MRR/

       A number of you have your own data and analysis of these mirrors that I encourage you to share with the group. If anyone would like to provide a more in-depth analysis I have provided the data in the reports to support such an analysis and would be willing to help. I would like to end by thanking all of you who participated.

       Scott Rychnovsky

       PS-(I am not able to host the reports on my web site because they are too large. Does anyone have some space I can use for this purpose?)