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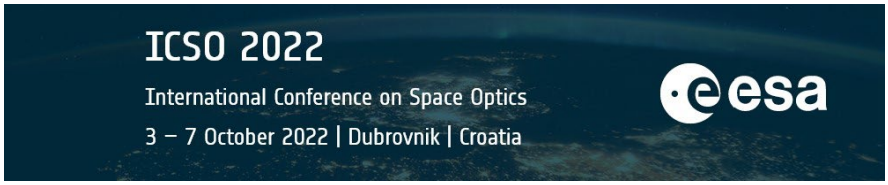

Meter class Optical Coatings

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Meter class Optical Coatings

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ABSTRACT

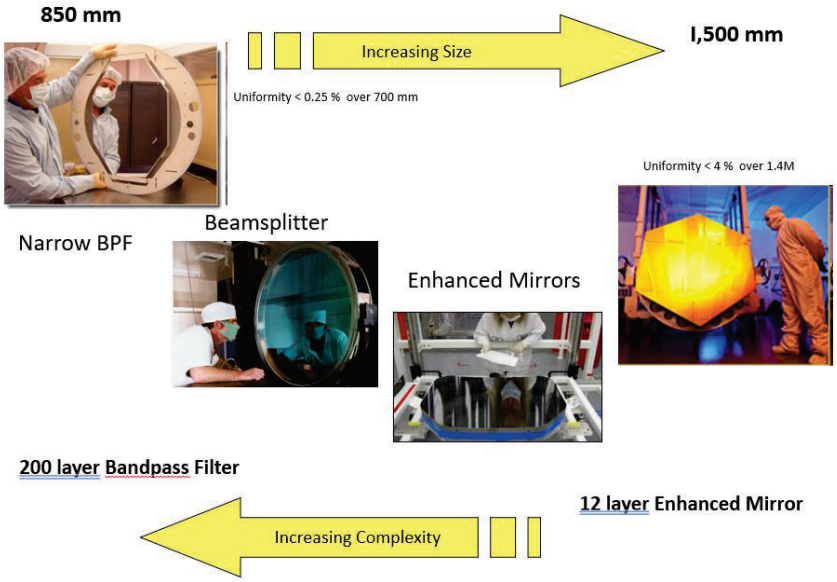
Materion Optics Balzers has been providing optical coatings for space exploration, both ground and space based for over 40 years. MBO's Large Area Optics (LAO) laboratory, designed and brought online in 2012 continues to improve & enhance capabilities in providing bandpass filters (narrow & wide), edge filters, AR coatings, dichroic beamsplitters, enhanced mirrors and notch filters. This paper intends to demonstrate our improvements over the past decade to manufacture precision, high performance optical interference filters up to 1.4M in diameter. MBO's purpose-built LAO laboratory includes a custom spectrophotometer, deposition system and substrate cleaning setup. All self-contained in an ISO 6/7 clean room. Previous and current efforts include items for Large Synoptic Survey telescope (LSST), Very Large telescope (VLT), Hyper Suprime Camera (HSC), Visible Tunable Filter (VTF), SkyMapper Telescope as well as many others.

Keywords: coatings, large optics, dichroic beamsplitters, bandpass filters, large mirrors

1. INTRODUCTION

Materion has a long and proved track record of providing large optical components for astronomical purposes. During that time ground-based telescopes have continued to get larger and larger. In the past a 1M telescope was considered large, now that has expanded to > 20 meters. In 2001 Materion Balzers Optics began offering optics up to 600mm in diameter. As the need for larger optics continued to increase (LSST, VLT, TMT) Materion made an internal decision in 2012 to build a large deposition system fully dedicated to offering meter class optics.

Fig 1. Summary of link between capability & design complexity



In this poster, we present some results as well as some of the current capabilities of our Large Area Optics (LAO) laboratory

2. LAO LABORTORY

MBO's LAO laboratory was designed and built in 2012 with the sole purpose of providing meter class optical components. The lab was fabricated and currently maintained to ISO 6/7 standards. Custom designed test, loading, substrate cleaning and storage equipment was designed for dedicated use in our LAO laboratory. A large custom designed deposition system was contracted out, built to MBO design specifications to ensure strict uniformity control for multiple material sets. A precision monitoring system to allow for tight wavelength control and positioning. Flexibility of design for further improvements and configurations.

Fig 2. Initial placement of deposition system in the LAO laboratory

Fig 3. Installation of deposition system

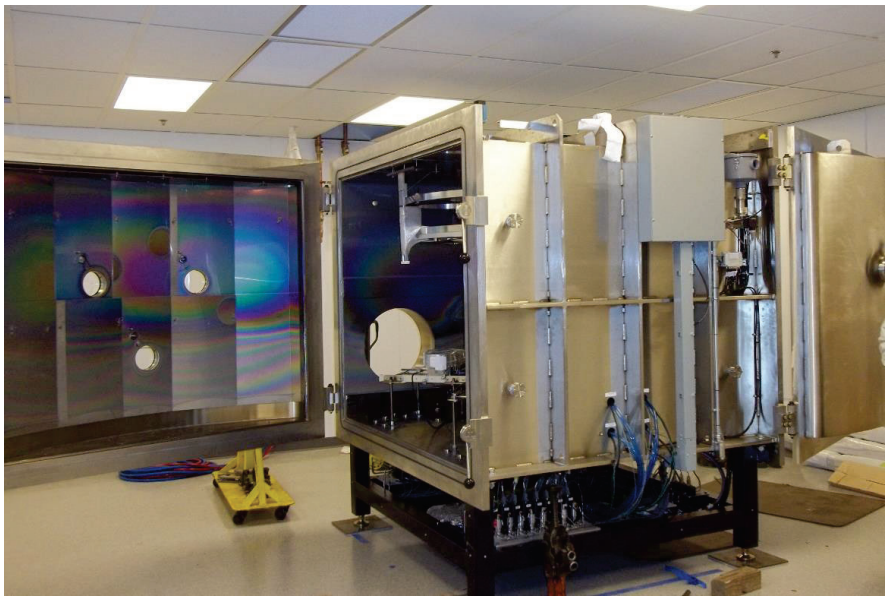
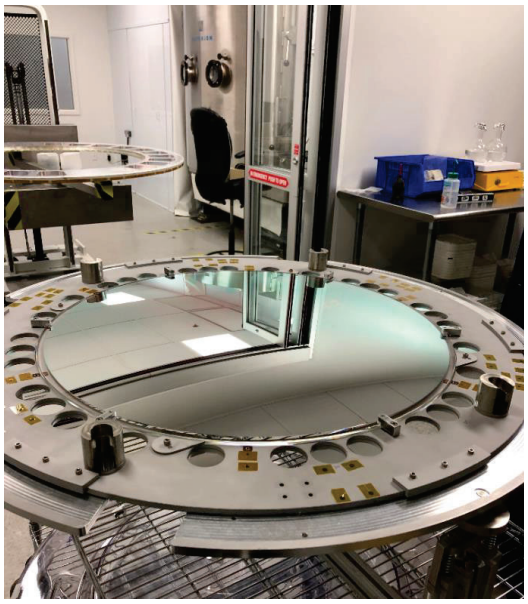


Fig 4. Examples of custom designed loading equipment



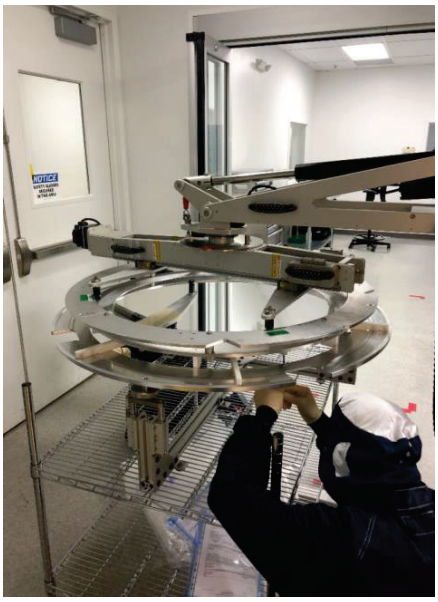
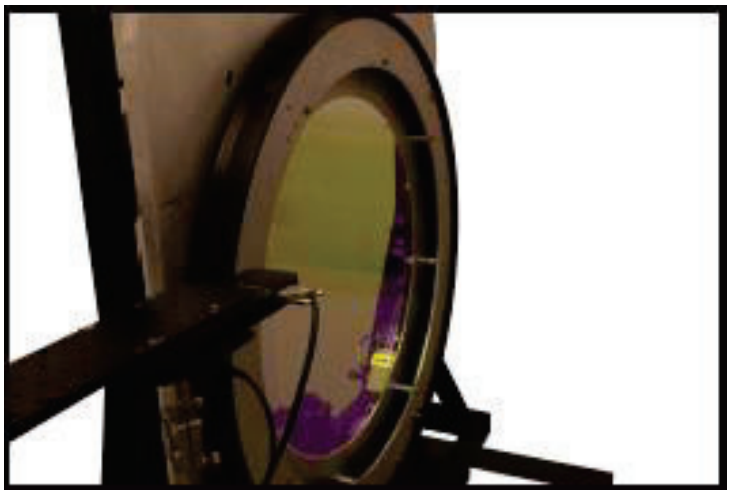


Fig 5. MBO designed automated test setup



3. PERFORMANCE RESULTS

Materion Balzers Optics LAO deposition was designed and manufactured to provide the extremely tight uniformity requirements necessary for high end large form optical components. Typical uniformity is stated in Fig 6. Tighter uniformity can be achieved for specialty items.

Fig 6.

- **Complex Filters (> 200 layers)**:
  - ✓ Coating uniformity:
    - ✓ < .5 % over 700 mm (3-4nm)
    - ✓ < 0.25 % over 600 mm (~2nm)
  - ✓ Physical substrate size: **850 mm**

- **Dichroic beamsplitters and High Performance AR coatings:**
  - ✓ Coating uniformity: < 1.5% over 950 mm (< 15 nm at one micron)
  - ✓ Physical substrate size: **1,000 mm**

- **Enhanced Mirrors**
  - ✓ Coating uniformity: < 4% over 1250 mm (< 60 nm, NIR)
  - ✓ Physical substrate size: **1,500 mm**

Demonstrated measurements results shown in Fig 7 and fig 8.

Fig 7.

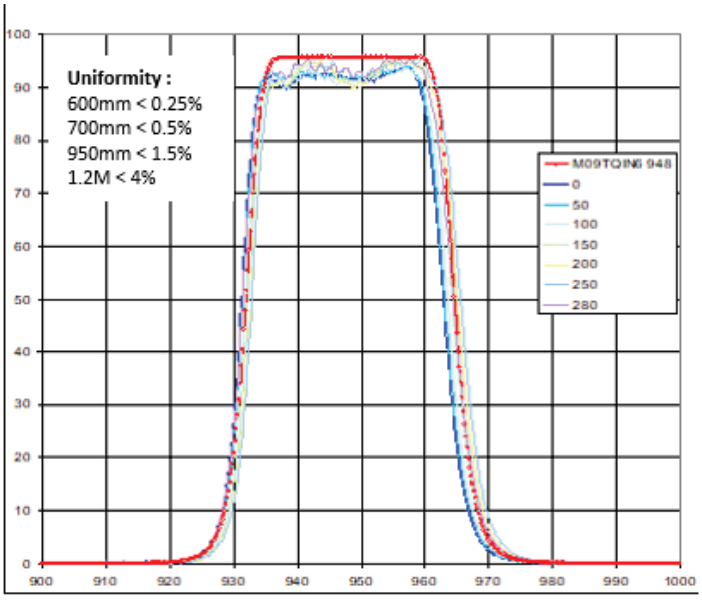
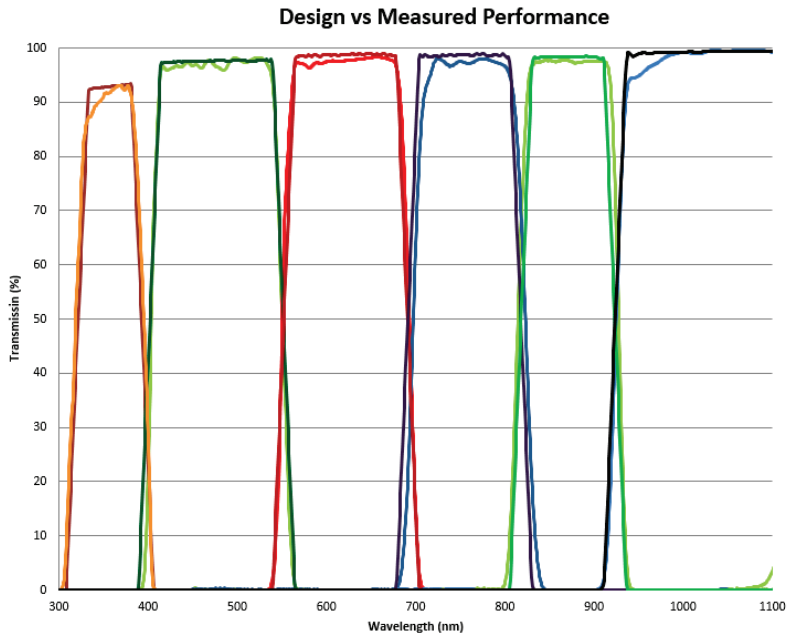

Uniformity :
600mm < 0.25%
700mm < 0.5%
950mm < 1.5%
1.2M < 4%
M09TQIN6 948
0
50
100
150
200
250
280
100
90
80
70
60
50
40
30
20
10
0
900
910
920
930
940
950
960
970
980
990
1000

Fig 8.


Design vs Measured Performance
Transmissin (%)
Wavelength (nm)
100
90
80
70
60
50
40
30
20
10
0
300
400
500
600
700
800
900
1000
1100

4. CONCLUSION

In this poster, Materion Balzers Optics presents our Large Area Optics laboratory set up, custom designed equipment and current capabilities with regards to manufacturing meter class optical components.

ACKNOWLEDGEMENTS

MBO thanks all partners for their support during development and manufacturing of the large form optical components mentioned in this paper.