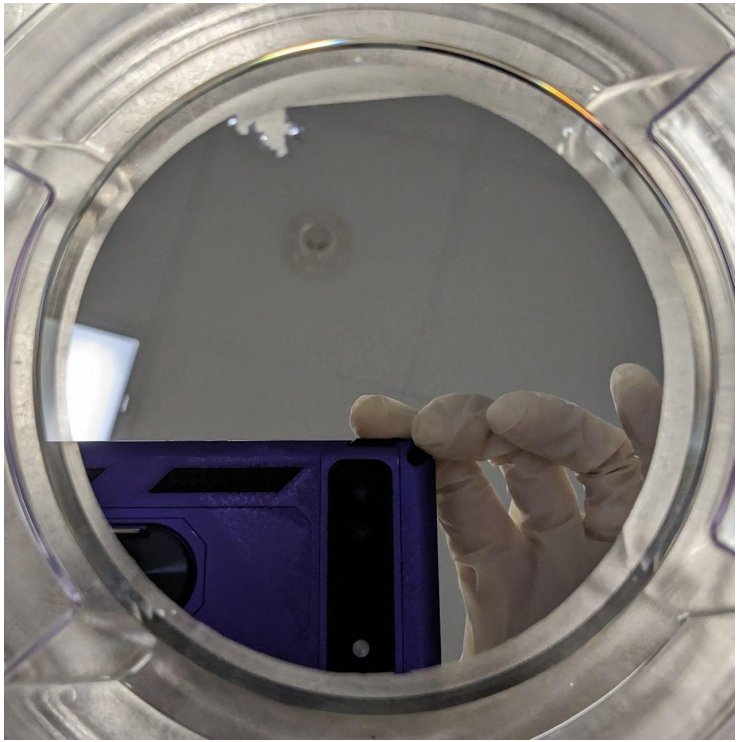
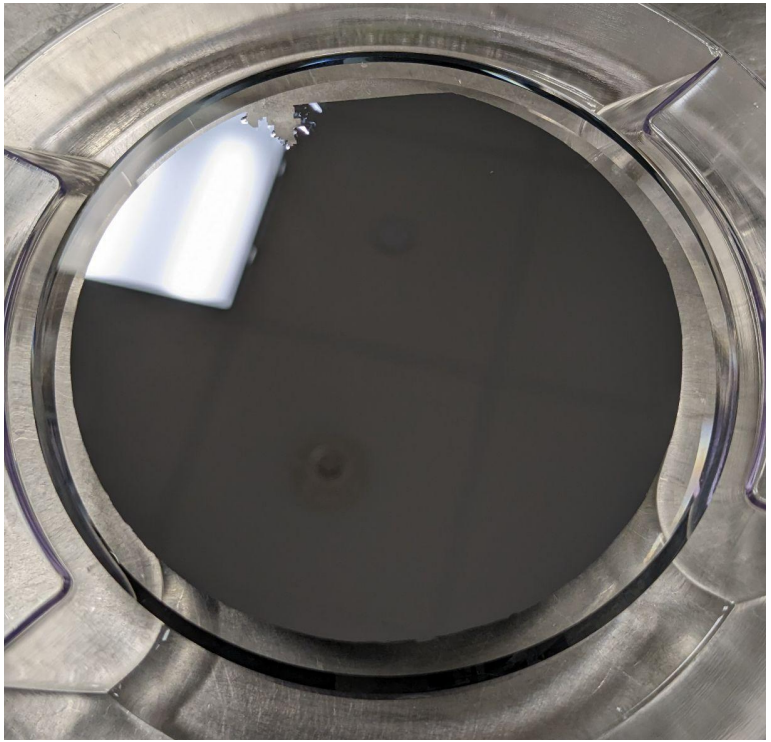
E2300026: AlGaAs Coating of 100mm Substrates

CMS-100-03
(coated with AlGaAs)





Note: Photos are flipped in horizontal direction to be comparable to Zygo images.

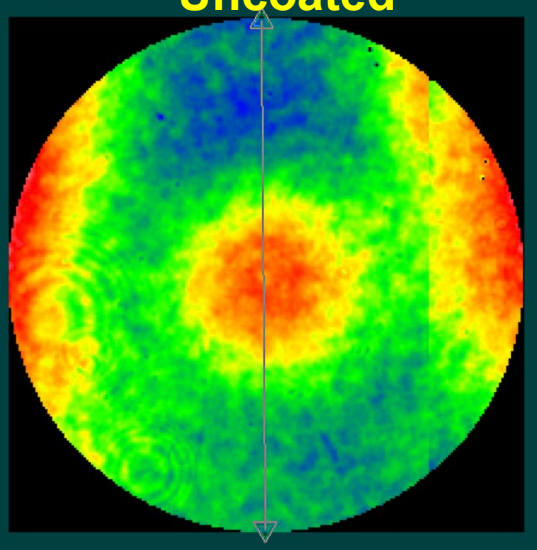
CMS-100-03

zygo — Measurement Attributes

Data File: O:\aLIGOmet\CMS\CMS-100-03\Uncoated\Uncoated_Avg

LIGO

Uncoated



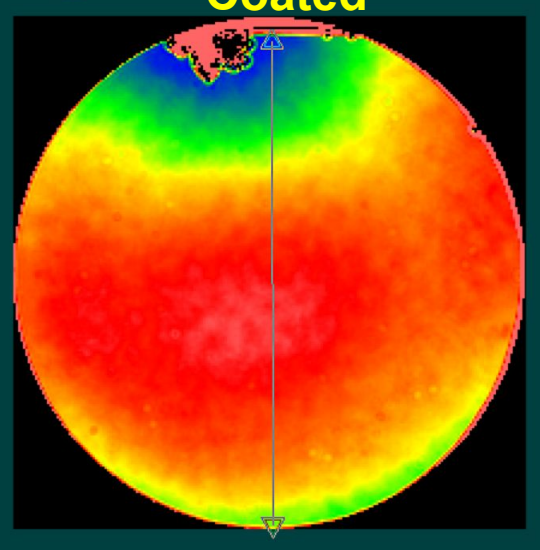
Dots and rings are interferometer artifacts

PV	8.442	nm	Removed: PST TLT PWR		
rms	1.526	nm	Trimmed: 0		
Power	-0.324	nm	Filter: Off		
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	-11.666	nm	Tref.X	0.080	nm
Tilty	-0.378	nm	Tref.Y	0.980	nm
Ast.X	2.651	nm	2Ast.X	0.087	nm
Ast.Y	0.685	nm	2Ast.Y	-0.247	nm
ComaX	-0.395	nm	2ComaX	-0.053	nm
ComaY	0.676	nm	2ComaY	-0.202	nm
Sph Ab	1.605	nm	2Sph Ab	-1.195	nm

zygo — Measurement Attributes

LIGO

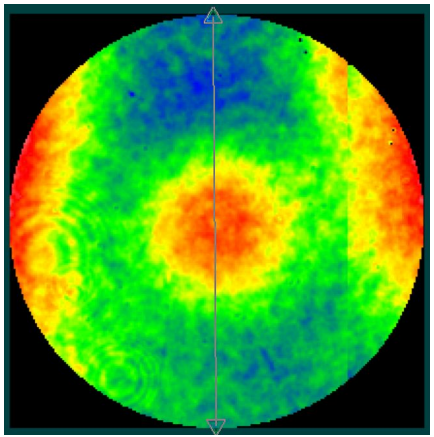
Coated

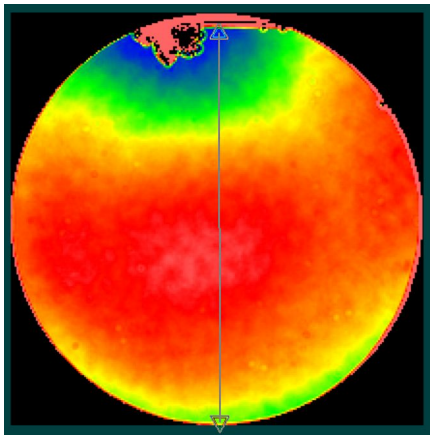


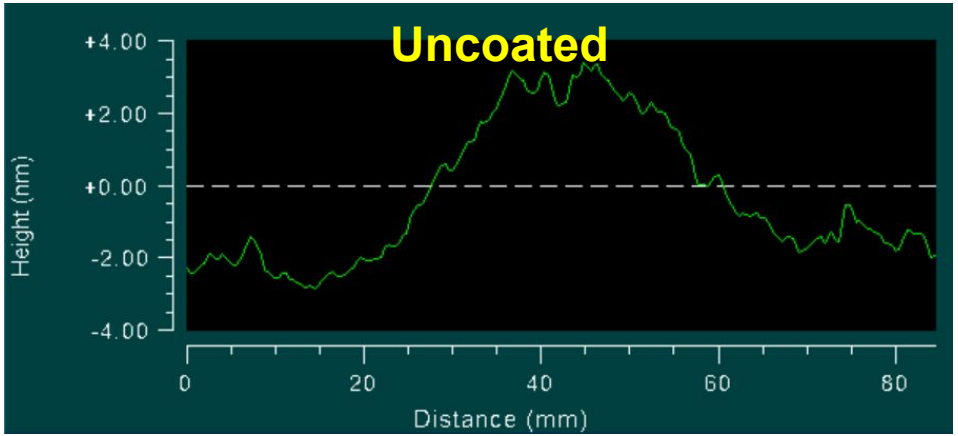
Dots and rings are interferometer artifacts

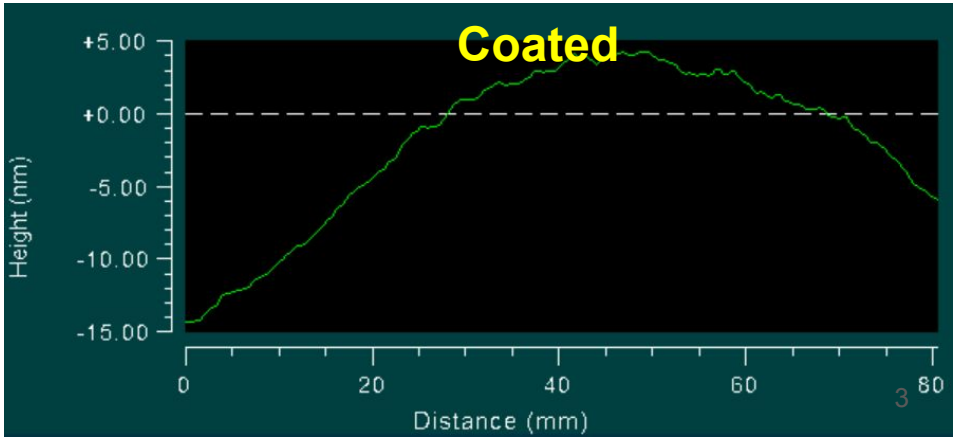
PV	156.683	nm	Removed: PST TLT PWR		
rms	9.001	nm	Trimmed: 0		
Power	-254.707	nm	Filter: Off		
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	6.698	nm	Tref.X	2.209	nm
Tilty	0.996	nm	Tref.Y	-3.696	nm
Ast.X	0.434	nm	2Ast.X	-6.872	nm
Ast.Y	1.326	nm	2Ast.Y	-1.302	nm
ComaX	0.813	nm	2ComaX	0.968	nm
ComaY	9.373	nm	2ComaY	6.255	nm
Sph Ab	5.162	nm	2Sph Ab	3.105	nm

CMS-100-03
Surface Profile

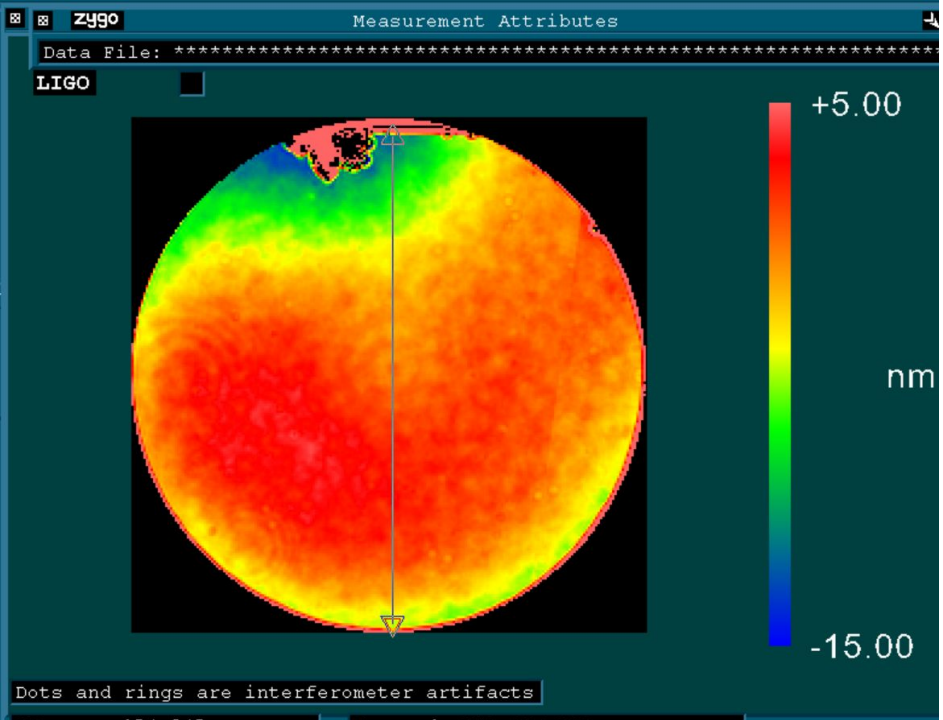


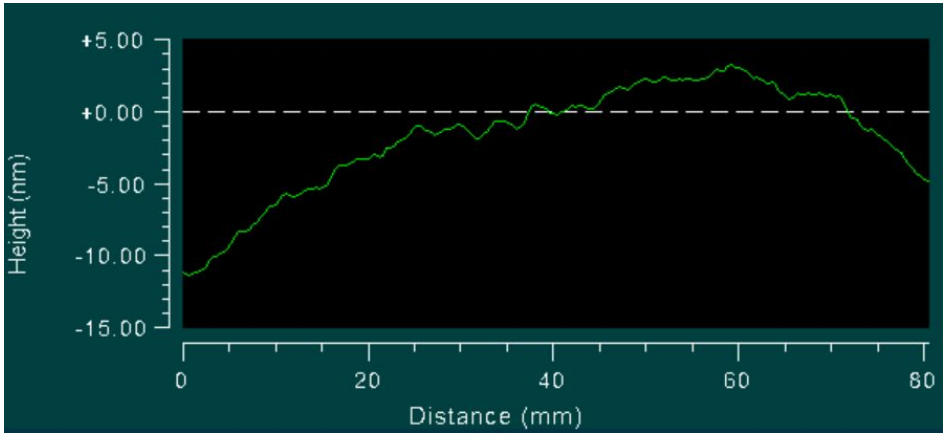




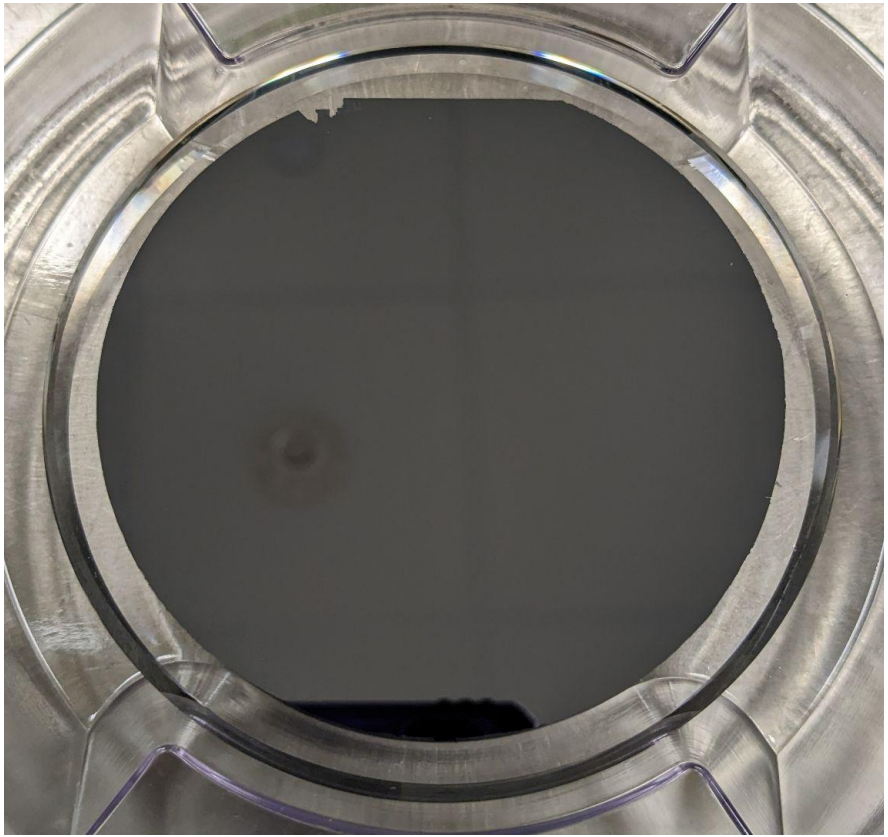


Subtracted Data
(shows coating only)





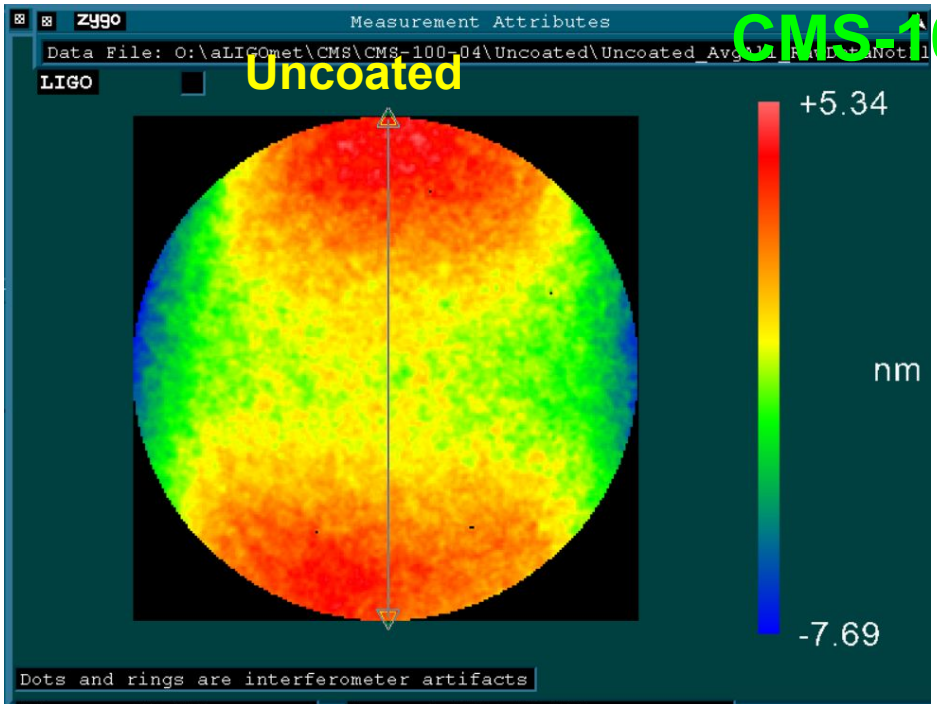
CMS-100-04
(coated with AlGaAs)



Note: Photos are flipped in horizontal direction to be comparable to Zygo images.

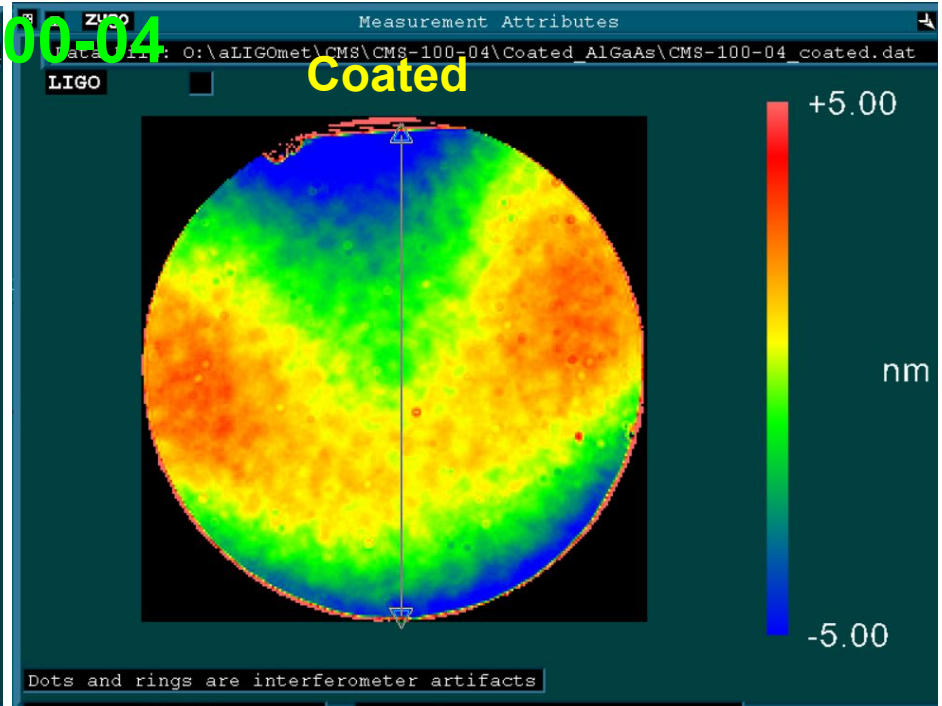
CMS-100-04

Uncoated



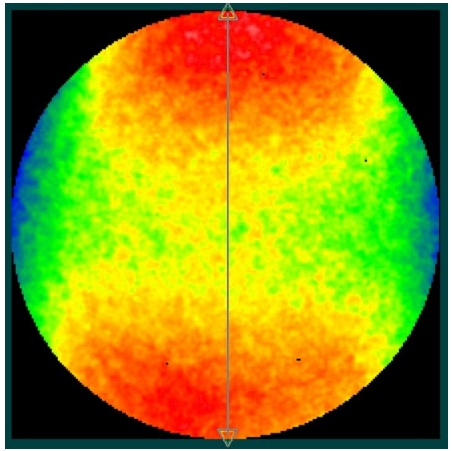
PV	13.033	nm	Removed: PST TLT PWR		
rms	2.156	nm	Trimmed:	0	
Power	34.974	nm	Filter:	Off	
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	-15.348	nm	Tref.X	0.088	nm
Tilty	-5.326	nm	Tref.Y	-1.014	nm
Ast.X	-4.875	nm	2Ast.X	0.002	nm
Ast.Y	0.748	nm	2Ast.Y	0.166	nm
ComaX	0.334	nm	2ComaX	0.043	nm
ComaY	-0.410	nm	2ComaY	0.059	nm
Sph Ab	-1.035	nm	2Sph Ab	-0.345	nm

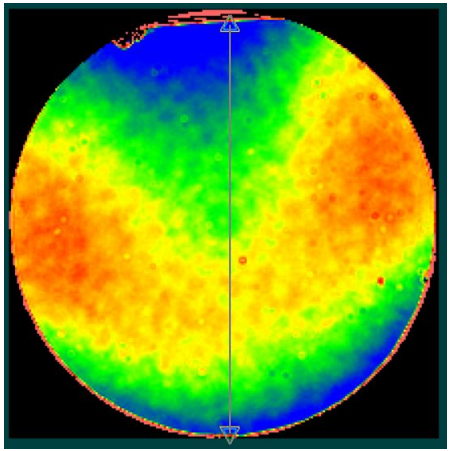
Coated

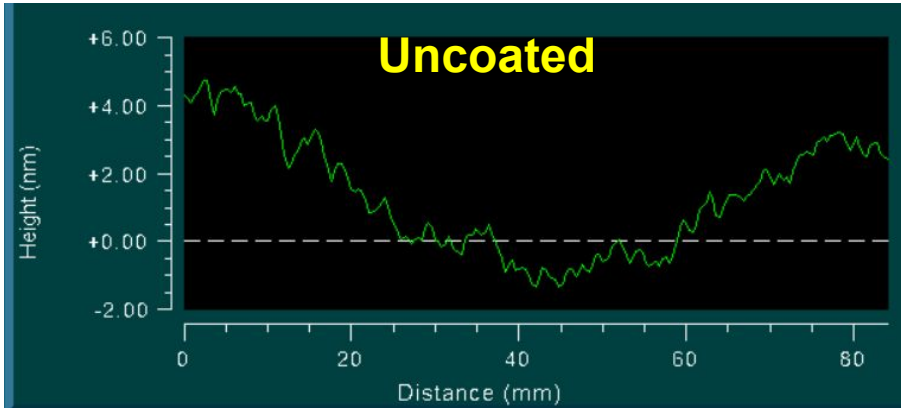


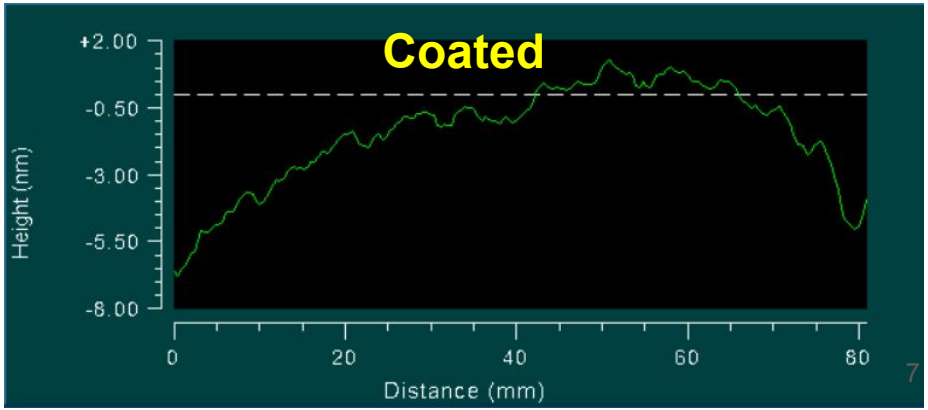
PV	82.614	nm	Removed: PST TLT PWR		
rms	4.224	nm	Trimmed:	0	
Power	-221.839	nm	Filter:	Off	
Size X	84.800	mm	Size Y	85.2	mm
Tiltx	5.858	nm	Tref.X	0.575	nm
Tilty	-1.017	nm	Tref.Y	-1.862	nm
Ast.X	0.872	nm	2Ast.X	-4.688	nm
Ast.Y	1.426	nm	2Ast.Y	-0.933	nm
ComaX	-0.980	nm	2ComaX	-0.696	nm
ComaY	4.779	nm	2ComaY	3.848	nm
Sph Ab	2.872	nm	2Sph Ab	4.298	nm

CMS-100-04
Surface Profiles

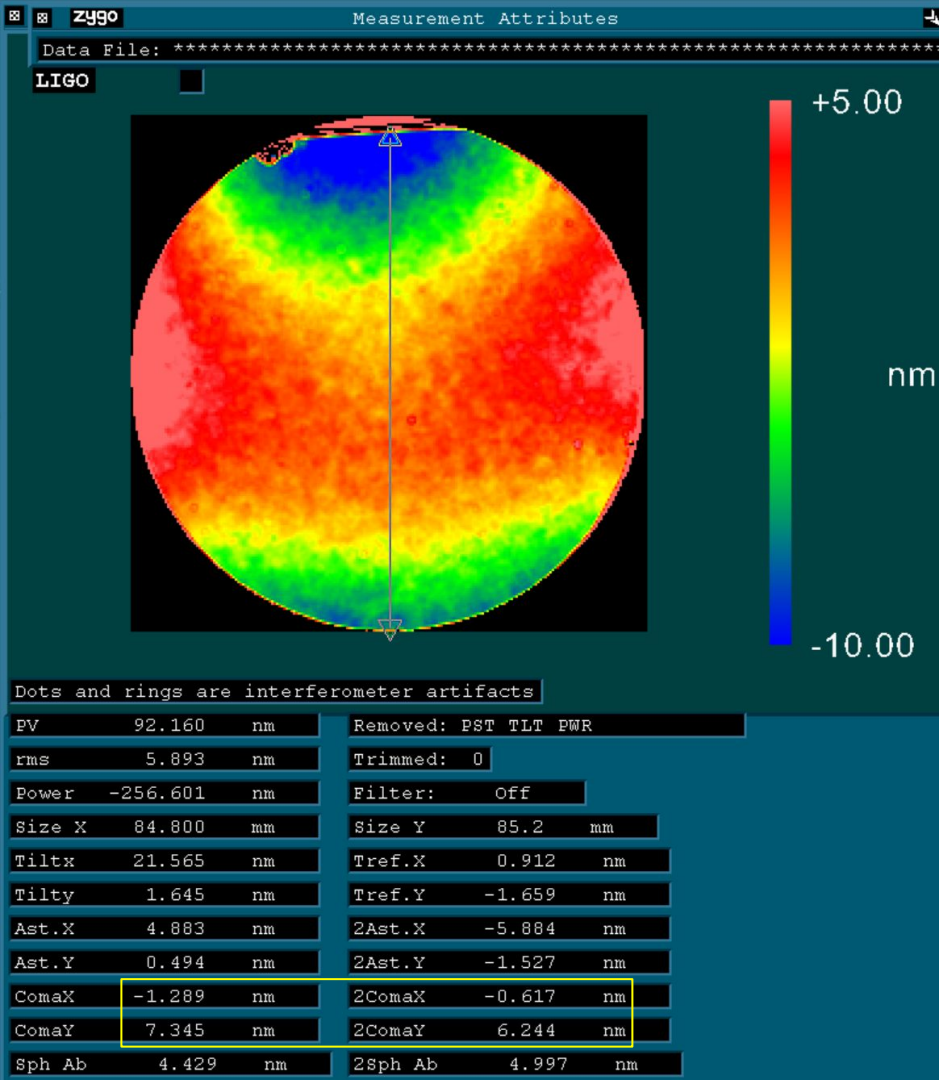


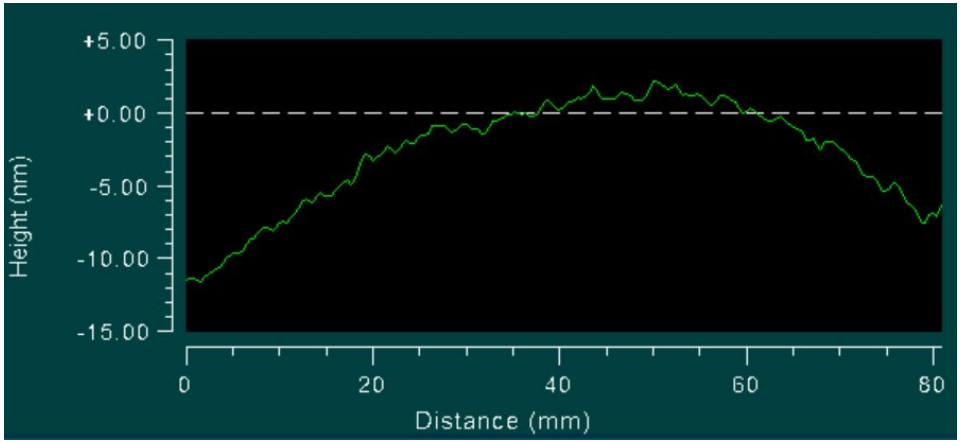






Subtracted Data
(shows coating only)





Summary

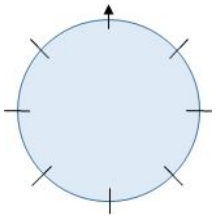
- Surface of the substrate does not influence the coated surface profile
- Both coatings are very similar in their surface profiles and Zernike coefficient values
- Zernike coefficients
  - Biggest change is power
  - Astigmatism and Coma → Second order Zernike coefficients range from ~4-7 nm
- Correlation with crystalline axis? Which direction?

Back-Of-Coating Measurements

AlGaAs Back-of-Coating Measurements

Summary of previous measurements:

- Substrate was rotated through different angles and averaged
- Measured surface of coated & uncoated substrate
- Both coated samples had similar surfaces after coating



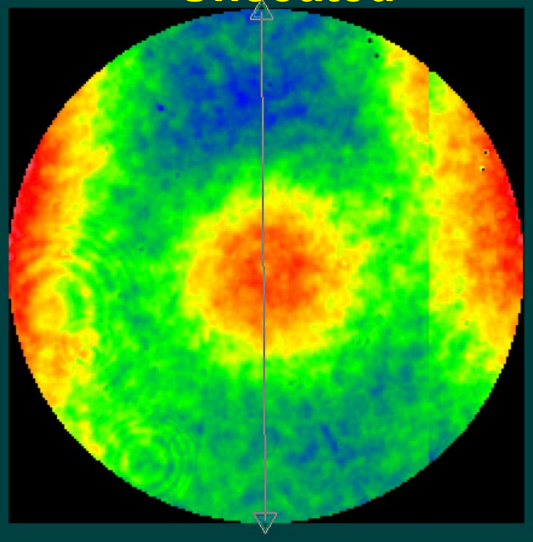
Coating Uniformity measurements:

- Measure back side of coating
  →Data from back of coating is scaled and flipped in X
  →Take difference between front and back to see uniformity

Data as collected by Zygo.

CMS-100-03

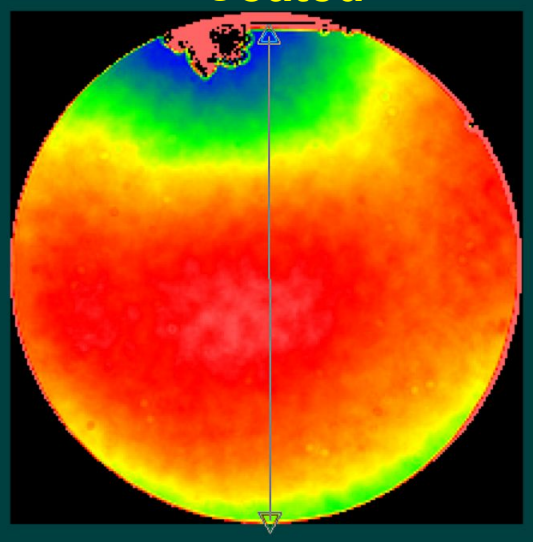
Uncoated



ts and rings are interferometer artifacts

	8.442	nm	Removed: PST TLT PWR		
s	1.526	nm	Trimmed: 0		
wer	-0.324	nm	Filter: Off		
ze X	85.200	mm	Size Y	85.2	mm
ltx	-11.666	nm	Tref.X	0.080	nm
lty	-0.378	nm	Tref.Y	0.980	nm
t.X	2.651	nm	2Ast.X	0.087	nm
t.Y	0.685	nm	2Ast.Y	-0.247	nm
maX	-0.395	nm	2ComaX	-0.053	nm
maY	0.676	nm	2ComaY	-0.202	nm
h Ab	1.605	nm	2Sph Ab	-1.195	nm

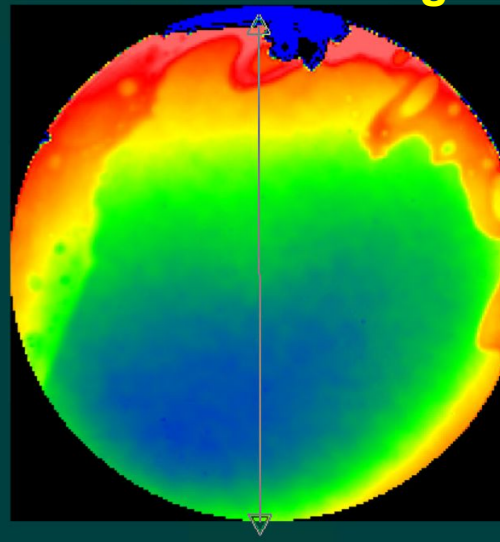
Coated



Dots and rings are interferometer artifacts

PV	156.683	nm	Removed: PST TLT PWR		
rms	9.001	nm	Trimmed: 0		
Power	-254.707	nm	Filter: Off		
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	6.698	nm	Tref.X	2.209	nm
Tilty	0.996	nm	Tref.Y	-3.696	nm
Ast.X	0.434	nm	2Ast.X	-6.872	nm
Ast.Y	1.326	nm	2Ast.Y	-1.302	nm
ComaX	0.813	nm	2ComaX	0.968	nm
ComaY	9.373	nm	2ComaY	6.255	nm
Sph Ab	5.162	nm	2Sph Ab	3.105	nm

Back of Coating



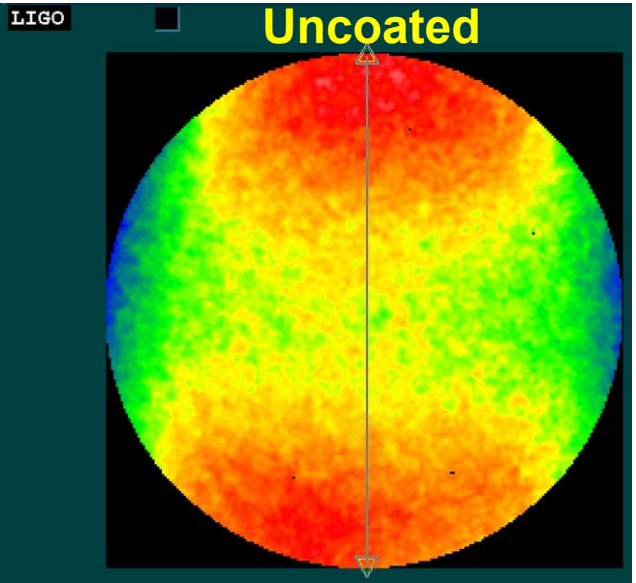
Dots and rings are interferometer artifacts

PV	336.827	nm	Removed: PST TLT PWR		
rms	29.014	nm	Trimmed: 0		
Power	217.345	nm	Filter: Off		
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	0.483	nm	Tref.X	0.291	nm
Tilty	-2.908	nm	Tref.Y	26.110	nm
Ast.X	23.460	nm	2Ast.X	25.805	nm
Ast.Y	-6.857	nm	2Ast.Y	-1.337	nm
ComaX	0.743	nm	2ComaX	0.145	nm
ComaY	-27.781	nm	2ComaY	-20.069	nm
Sph Ab	-9.008	nm	2Sph Ab	-6.918	nm

Data as collected by Zygo.

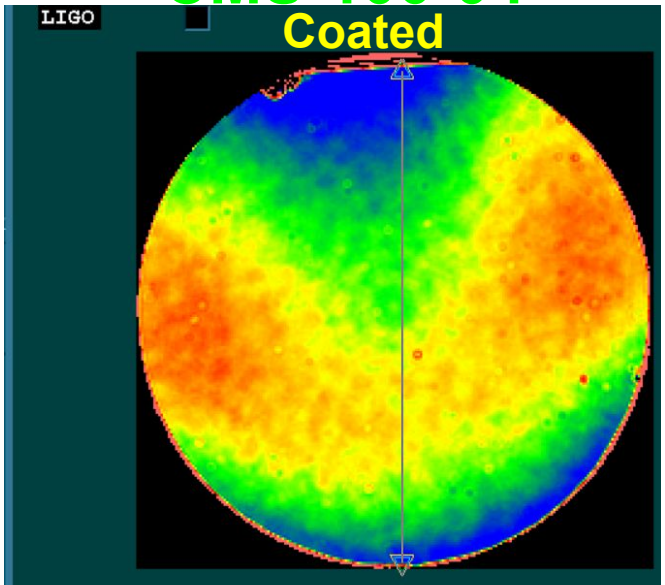
CMS-100-04

Uncoated



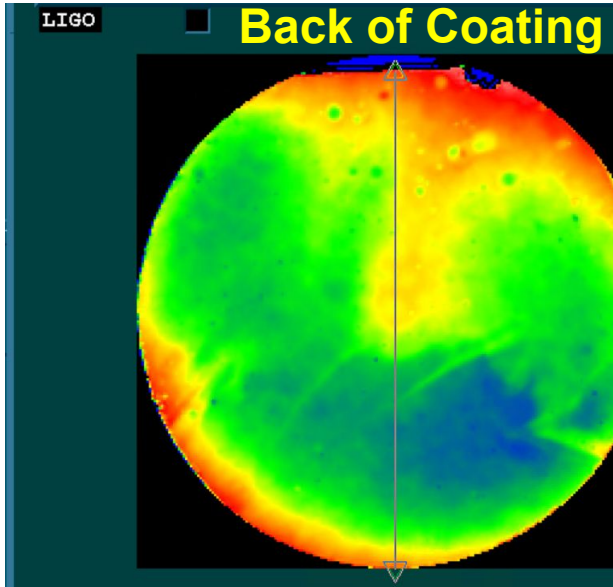
ots and rings are interferometer artifacts					
V	13.033	nm	Removed: PST TLT PWR		
ms	2.156	nm	Trimmed: 0		
ower	34.974	nm	Filter: Off		
ize X	85.200	mm	Size Y	85.2	mm
iltx	-15.348	nm	Tref.X	0.088	nm
ilty	-5.326	nm	Tref.Y	-1.014	nm
st.X	-4.875	nm	2Ast.X	0.002	nm
st.Y	0.748	nm	2Ast.Y	0.166	nm
omaX	0.334	nm	2ComaX	0.043	nm
omaY	-0.410	nm	2ComaY	0.059	nm
ph Ab	-1.035	nm	2Sph Ab	-0.345	nm

Coated



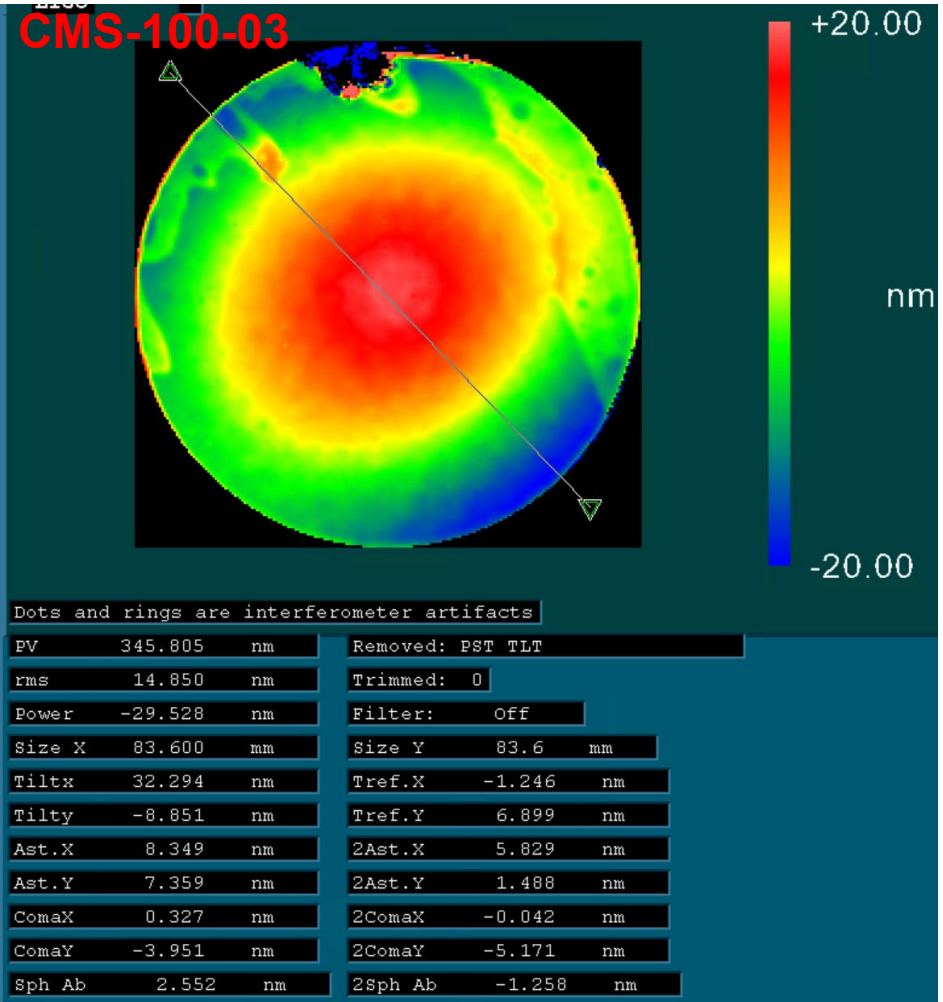
Dots and rings are interferometer artifacts					
PV	82.614	nm	Removed: PST TLT PWR		
rms	4.224	nm	Trimmed: 0		
Power	-221.839	nm	Filter: Off		
Size X	84.800	mm	Size Y	85.2	mm
Tiltx	5.858	nm	Tref.X	0.575	nm
Tilty	-1.017	nm	Tref.Y	-1.862	nm
Ast.X	0.872	nm	2Ast.X	-4.688	nm
Ast.Y	1.426	nm	2Ast.Y	-0.933	nm
ComaX	-0.980	nm	2ComaX	-0.696	nm
ComaY	4.779	nm	2ComaY	3.848	nm
Sph Ab	2.872	nm	2Sph Ab	4.298	nm

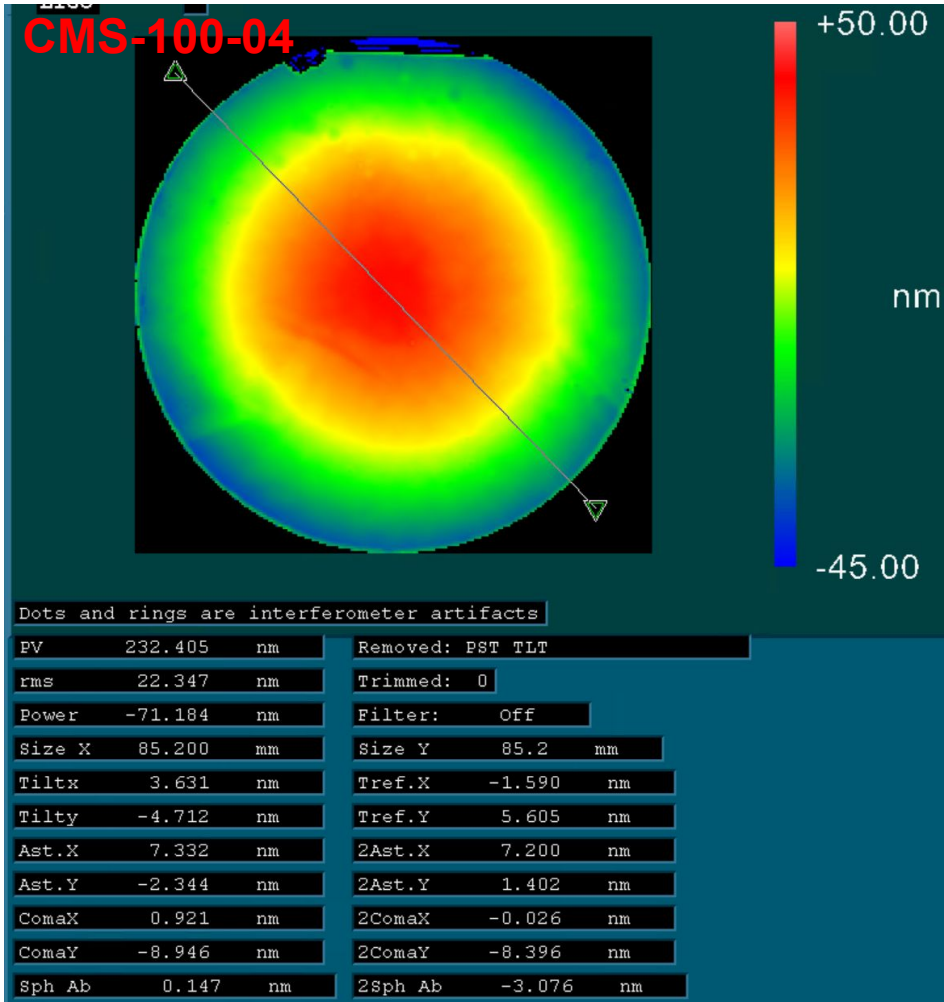
Back of Coating



Dots and rings are interferometer artifacts					
PV	258.069	nm	Removed: PST TLT PWR		
rms	14.338	nm	Trimmed: 0		
Power	149.705	nm	Filter: Off		
Size X	85.200	mm	Size Y	85.2	mm
Tiltx	-3.353	nm	Tref.X	1.887	nm
Tilty	-1.036	nm	Tref.Y	7.071	nm
Ast.X	5.431	nm	2Ast.X	10.879	nm
Ast.Y	3.486	nm	2Ast.Y	-1.902	nm
ComaX	-1.127	nm	2ComaX	0.498	nm
ComaY	-13.835	nm	2ComaY	-12.531	nm
Sph Ab	-2.881	nm	2Sph Ab	-7.804	nm

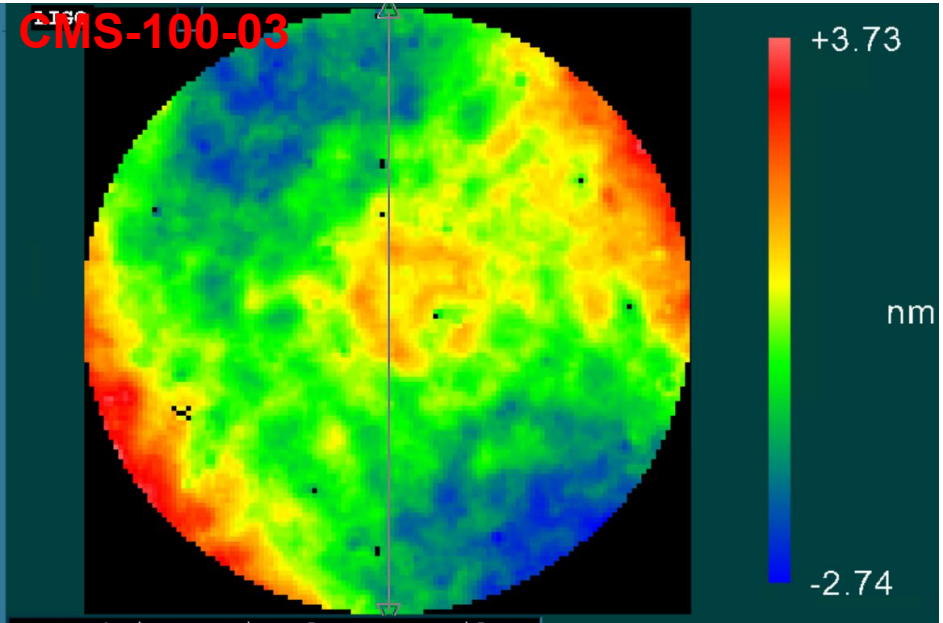
COATING UNIFORMITY: Difference between front & back





COATING UNIFORMITY: 50mm aperture (power removed)

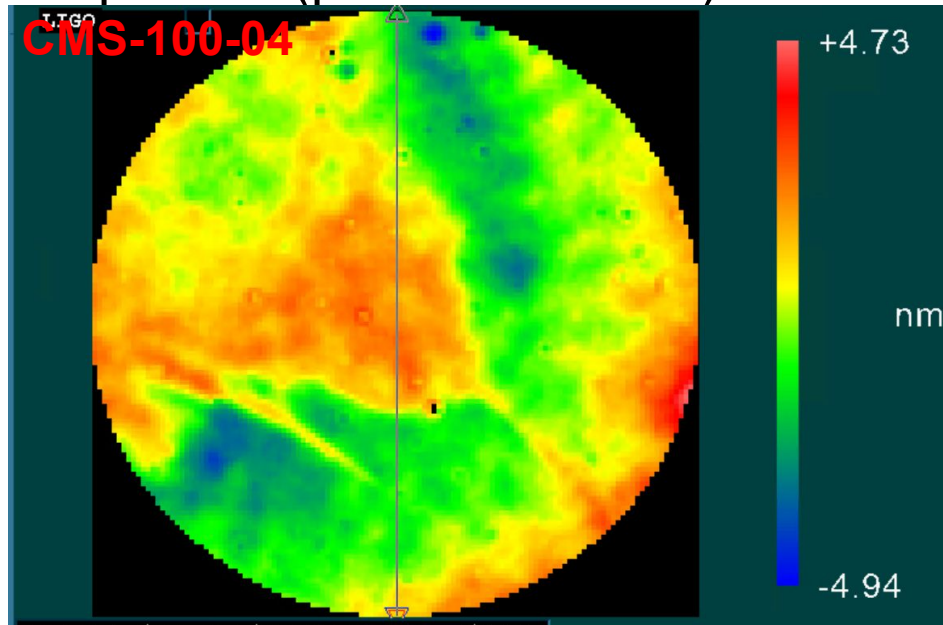
CMS-100-03



Dots and rings are interferometer artifacts

PV	6.474	nm	Removed:	PST TLT PWR	
rms	1.138	nm	Trimmed:	0	
Power	-16.100	nm	Filter:	Off	
Size X	50.000	mm	Size Y	50.0	mm
Tiltx	19.327	nm	Tref.X	0.268	nm
Tilty	-4.470	nm	Tref.Y	0.201	nm
Ast.X	1.268	nm	2Ast.X	0.166	nm
Ast.Y	2.142	nm	2Ast.Y	-0.015	nm
ComaX	-0.578	nm	2ComaX	0.006	nm
ComaY	-0.113	nm	2ComaY	0.252	nm
Sph Ab	0.824	nm	2Sph Ab	-0.146	nm

CMS-100-04



Dots and rings are interferometer artifacts

PV	9.676	nm	Removed:	PST TLT PWR	
rms	1.348	nm	Trimmed:	0	
Power	-28.490	nm	Filter:	Off	
Size X	50.000	mm	Size Y	50.0	mm
Tiltx	1.428	nm	Tref.X	-0.375	nm
Tilty	1.097	nm	Tref.Y	0.151	nm
Ast.X	1.303	nm	2Ast.X	-0.358	nm
Ast.Y	-1.307	nm	2Ast.Y	0.397	nm
ComaX	1.042	nm	2ComaX	-0.779	nm
ComaY	-0.705	nm	2ComaY	0.036	nm
Sph Ab	1.224	nm	2Sph Ab	-0.592	nm

Notes

- Coating is thicker at edges
  →Uncoated substrate is flat
  →Stress on substrate

- Zernike Coefficients
  → Power is dominant
  → Other Zernike values are very low; most are <1nm, astigmatism ~1-3nm