



**Coastline Optics, Inc.**  
906 Via Alondra  
Camarillo, CA 93012  
Phone (805) 384-0609  
Fax (805) 384-0610

## ***Certificate of Compliance***

*Materials and/or parts furnished in this order have been manufactured in accordance with all applicable instructions and specifications.*

*January 11, 2019*

**Customer:** FiveNine Optics, Inc.

**Purchase Order:** 3290

**Part Number:** None

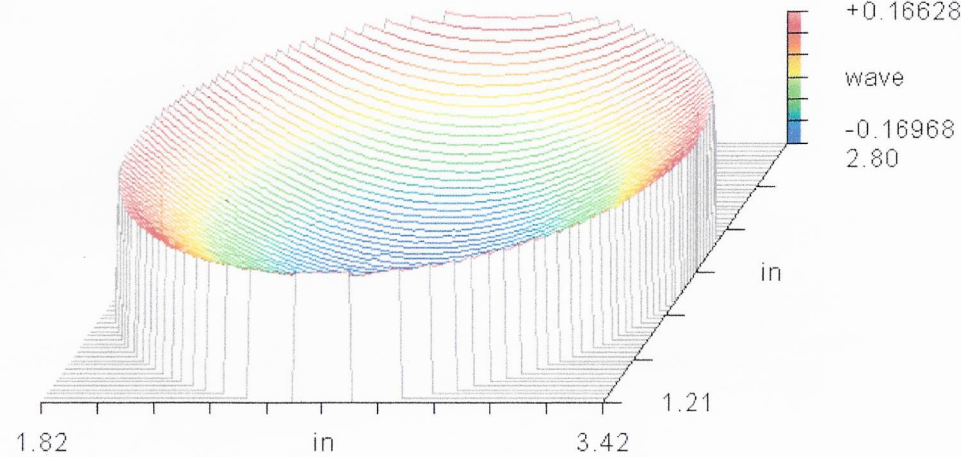
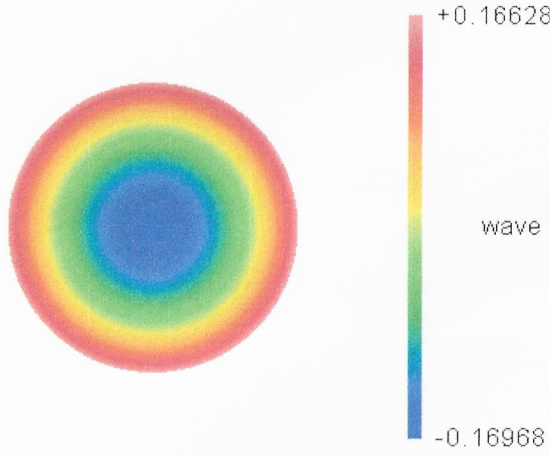
**Quantity:** 5 each

**Description:** LIGO 40M Folding Mirror

Signed: \_\_\_\_\_

*Sally Haist*

Date: 01.11.2019



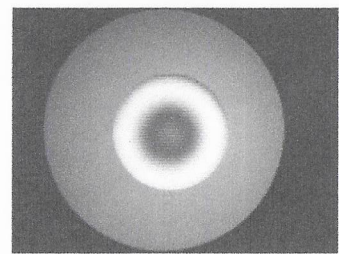
PV 0.3360 wave  
 rms 0.0962 wave  
 Power 0.3347 wave  
 Removed:  
 PST TLT

Data Points 28117  
 Rad -976.7 m

Auto Aperture: Off  
 Aperture OD (%): 0

Trim Filter: Off  
 Trim Mode: Outside  
 Trim Quantity: 0

Filter: Off Filter Window Size: 3  
 Filter Type: Average



Desc: LIGO 40M Folding Mirror AGC: On Light Level: 199  
 S/N: E1800089 REV 7-1 - Side 1 AGC Mode: Normal Reflectivity  
 Inspector: K. Chavez Acquisition Mode: Phase  
 Wavelength-In: 632.8 nm Phase Resolution: High  
 Wavelength-Out: 632.8 nm Phase Avg: 4 Intens Avg: 4  
 Refractive Index of Material: 1.500 Camera Res: 640x480 25 Hz  
 Substrate System Error: Off Discon Action: Filter  
 System Error File: 12InTFlat.dat Discon Filter: 0  
 Interferometer Scale Factor: 0.500  
 Inst: Mark GPI Id 0 SN 004157 Date: Fri Jan 04 14:56:12 2019

# Surface Roughness Profile

E1800089 REV 7-1, Side 1

Processed

RMS 0.69 angstroms

P-V 4.43 angstroms

Points 1024 microns

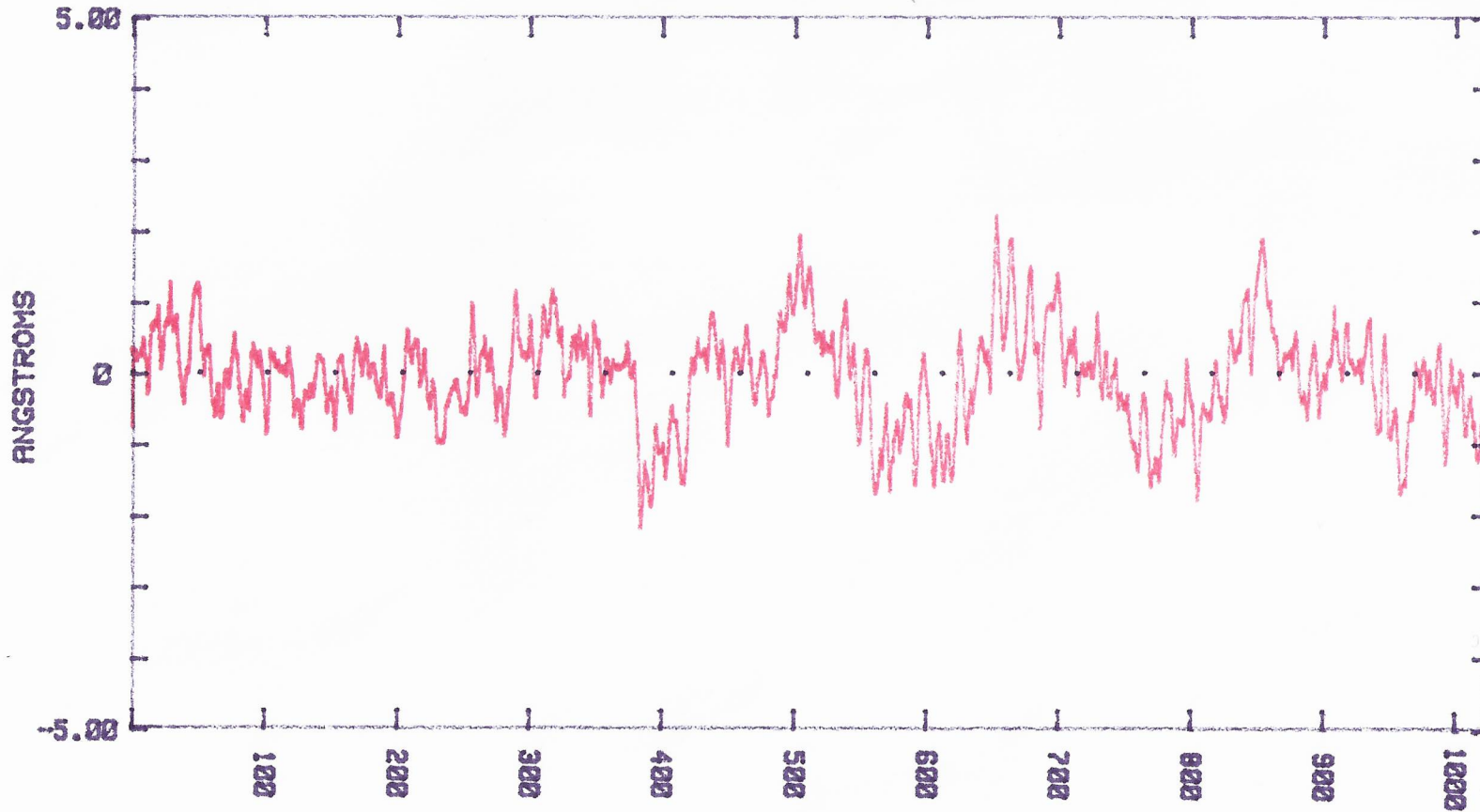
Coastline Optics, LLC

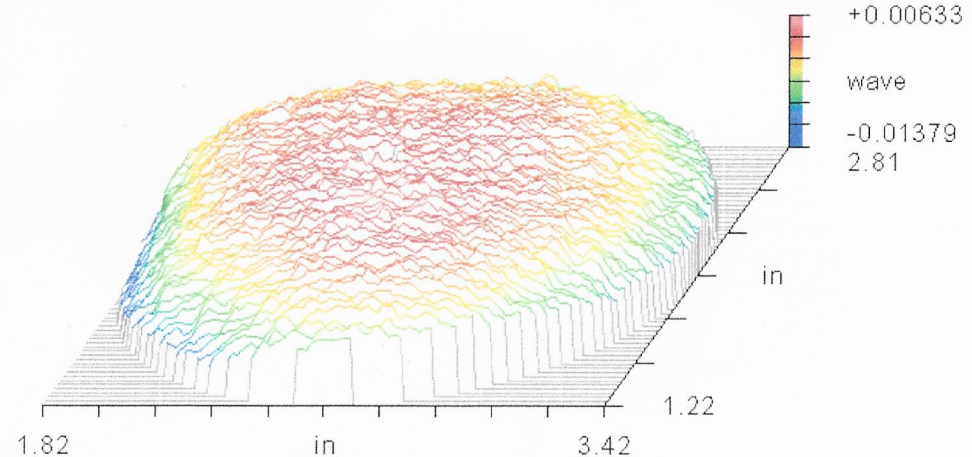
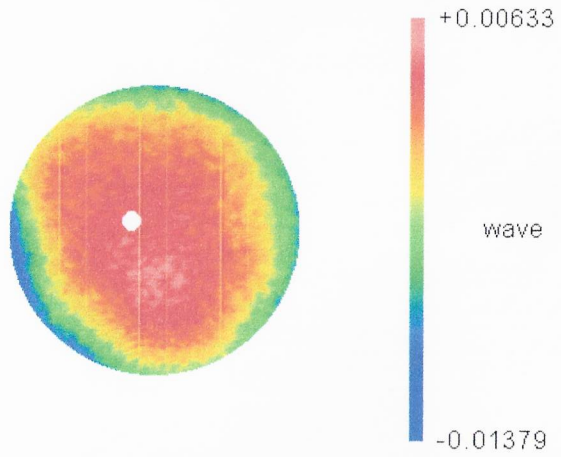
906 Via Alondra

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9 Jan 2019 09:15:11





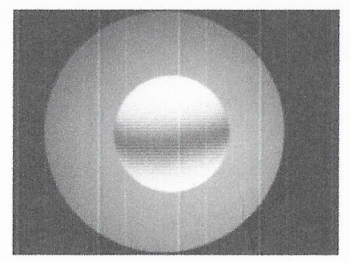
PV 0.0201 wave  
 rms 0.0034 wave  
 Power -0.0105 wave  
 Removed:  
 PST TLT

Data Points 27988  
 Rad 31091.0 m

Auto Aperture: Off  
 Aperture OD (%): 0

Trim Filter: Off  
 Trim Mode: Outside  
 Trim Quantity: 0

Filter: Off Filter Window Size: 3  
 Filter Type: Average



Desc: LIGO 40M Folding Mirror	AGC: On	Light Level: 166
S/N: E1800089 REV 7-1 - Side 2	AGC Mode: Normal Reflectivity	
Inspector: K. Chavez	Acquisition Mode: Phase	
Wavelength-In: 632.8 nm	Phase Resolution: High	
Wavelength-Out: 632.8 nm	Phase Avg: 4	Intens Avg: 4
Refractive Index of Material: 1.500	Camera Res: 640x480 25 Hz	
Substrate System Error: Off	Discon Action: Filter	
System Error File: 12InTFlat.dat	Discon Filter: 0	
	Interferometer Scale Factor: 0.500	
Inst: Mark GPI Id 0 SN 004157	Date: Thu Dec 20 12:05:16 2018	

# Surface Roughness Profile

E1800089 REV 7-1, Side 2

Processed

RMS 0.37 angstroms

P-V 2.34 angstroms

Points 1024 microns

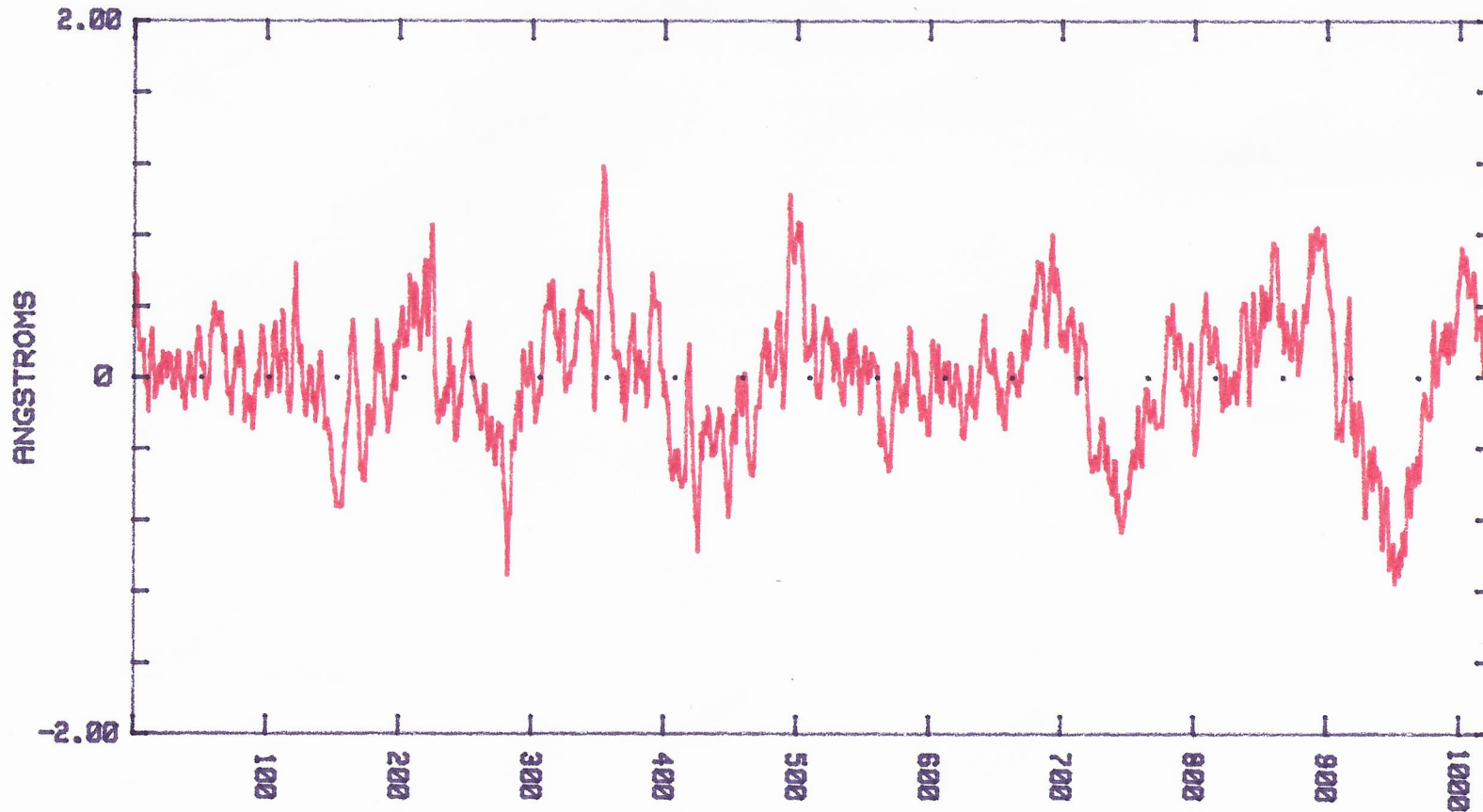
Coastline Optics, Inc.

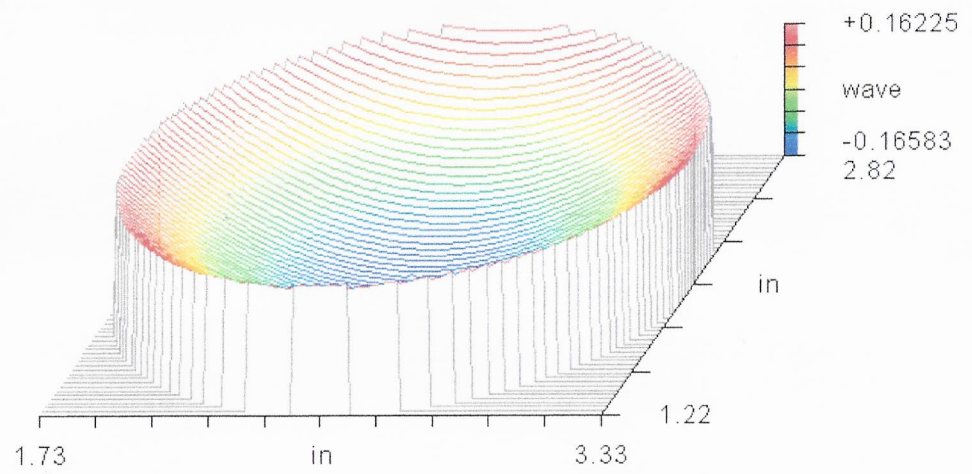
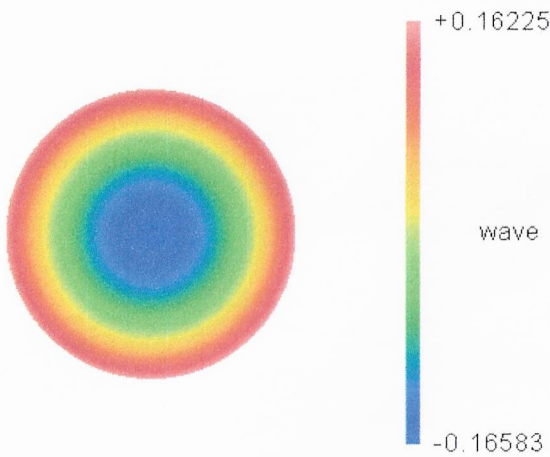
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20 Dec 2018 14:32:16





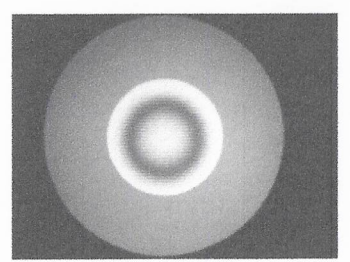
PV	0.3281	wave
rms	0.0938	wave
Power	0.3263	wave
Removed: PST TLT		

Data Points	28117
Rad	-1002.0 m

Auto Aperture:	Off
Aperture OD (%):	0

Trim Filter:	Off
Trim Mode:	Outside
Trim Quantity:	0

Filter:	Off	Filter Window Size:	3
Filter Type:	Average		



Desc: LIGO 40M Folding Mirror	AGC: On	Light Level: 193
S/N: E1800089 REV 7-2 - Side 1	AGC Mode: Normal Reflectivity	
Inspector: K. Chavez	Acquisition Mode: Phase	
Wavelength-In: 632.8 nm	Phase Resolution: High	
Wavelength-Out: 632.8 nm	Phase Avg: 4	Intens Avg: 4
Refractive Index of Material: 1.500	Camera Res: 640x480 25 Hz	
Substrate System Error: Off	Discon Action: Filter	
System Error File: 12InTFlat.dat	Discon Filter: 0	
	Interferometer Scale Factor: 0.500	
Inst: Mark GPI Id 0 SN 004157	Date: Tue Jan 08 10:26:25 2019	

# Surface Roughness Profile

E1800089 REV 7-2, Side 1

Processed

RMS 0.40 angstroms

P-V 2.11 angstroms

Points 1024 microns

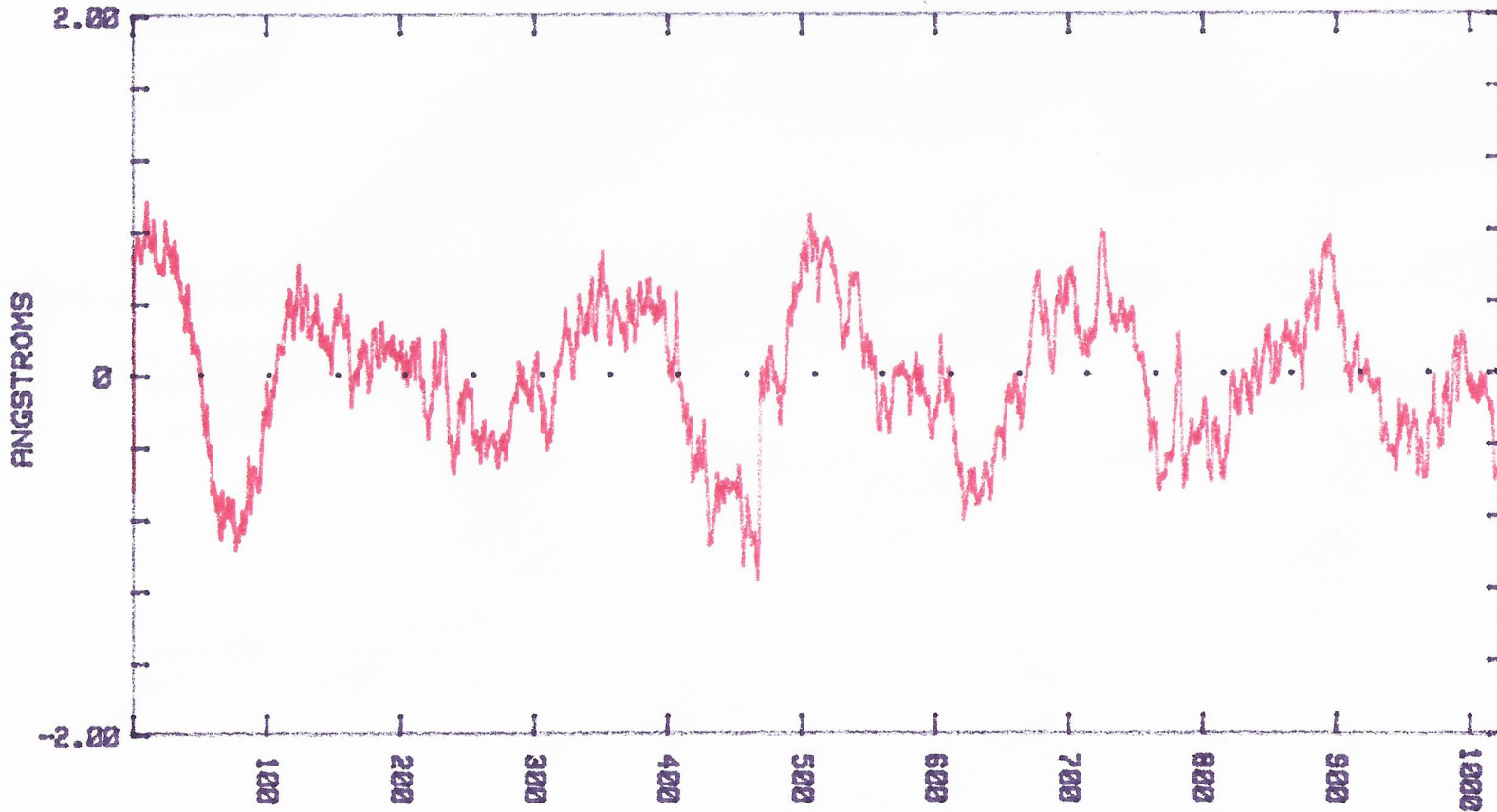
Coastline Optics, LLC

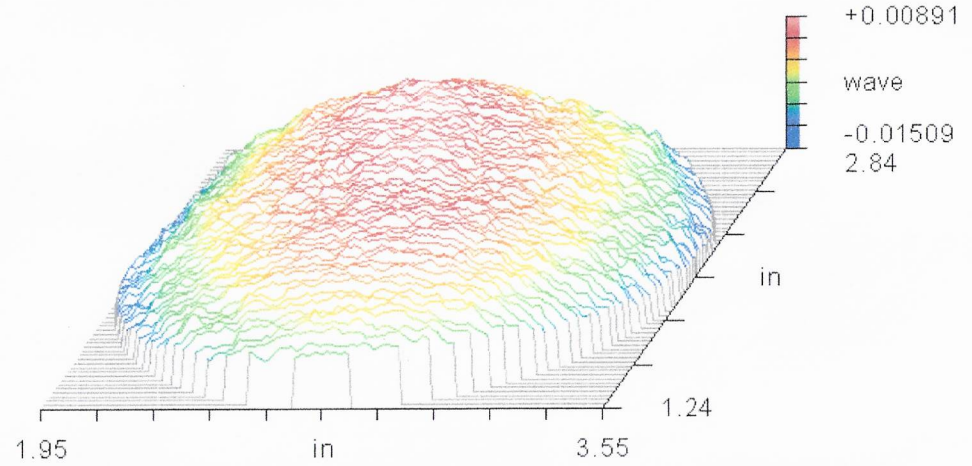
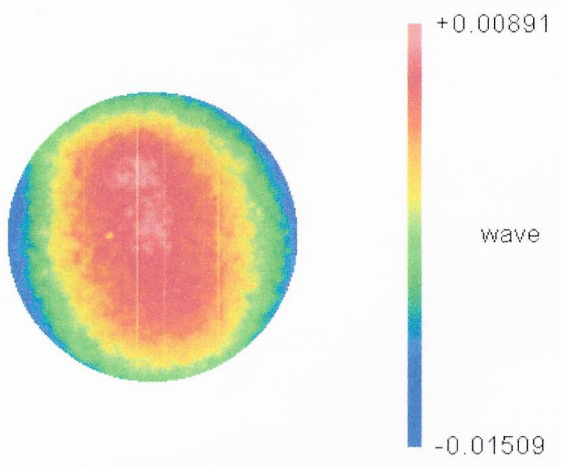
906 Via Alondra

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8 Jan 2019 10:34:35





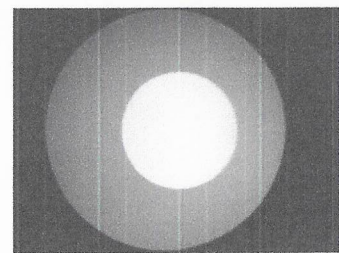
PV	0.0240	wave
rms	0.0049	wave
Power	-0.0155	wave
Removed: PST TLT		

Data Points	28117
Rad	21079.3 m

Auto Aperture:	Off
Aperture OD (%)	0

Trim Filter:	Off
Trim Mode:	Outside
Trim Quantity:	0

Filter:	Off	Filter Window Size:	3
Filter Type:	Average		



Desc: LIGO 40M Folding Mirror	AGC: On	Light Level: 169
S/N: E1800089 REV 7-2 - Side 2	AGC Mode: Normal Reflectivity	
Inspector: K. Chavez	Acquisition Mode: Phase	
Wavelength-In: 632.8 nm	Phase Resolution: High	
Wavelength-Out: 632.8 nm	Phase Avg: 4	Intens Avg: 4
Refractive Index of Material: 1.500	Camera Res: 640x480 25 Hz	
Substrate System Error: Off	Discon Action: Filter	
System Error File: SysErr.dat	Discon Filter: 0	
	Interferometer Scale Factor: 0.500	
Inst: Mark GPI Id 0 SN 004157	Date: Fri Dec 21 10:45:23 2018	

# Surface Roughness Profile

E1800089 REV 7-2, Side 2

Processed

RMS 0.41 angstroms

P-V 2.75 angstroms

Points 1024 microns

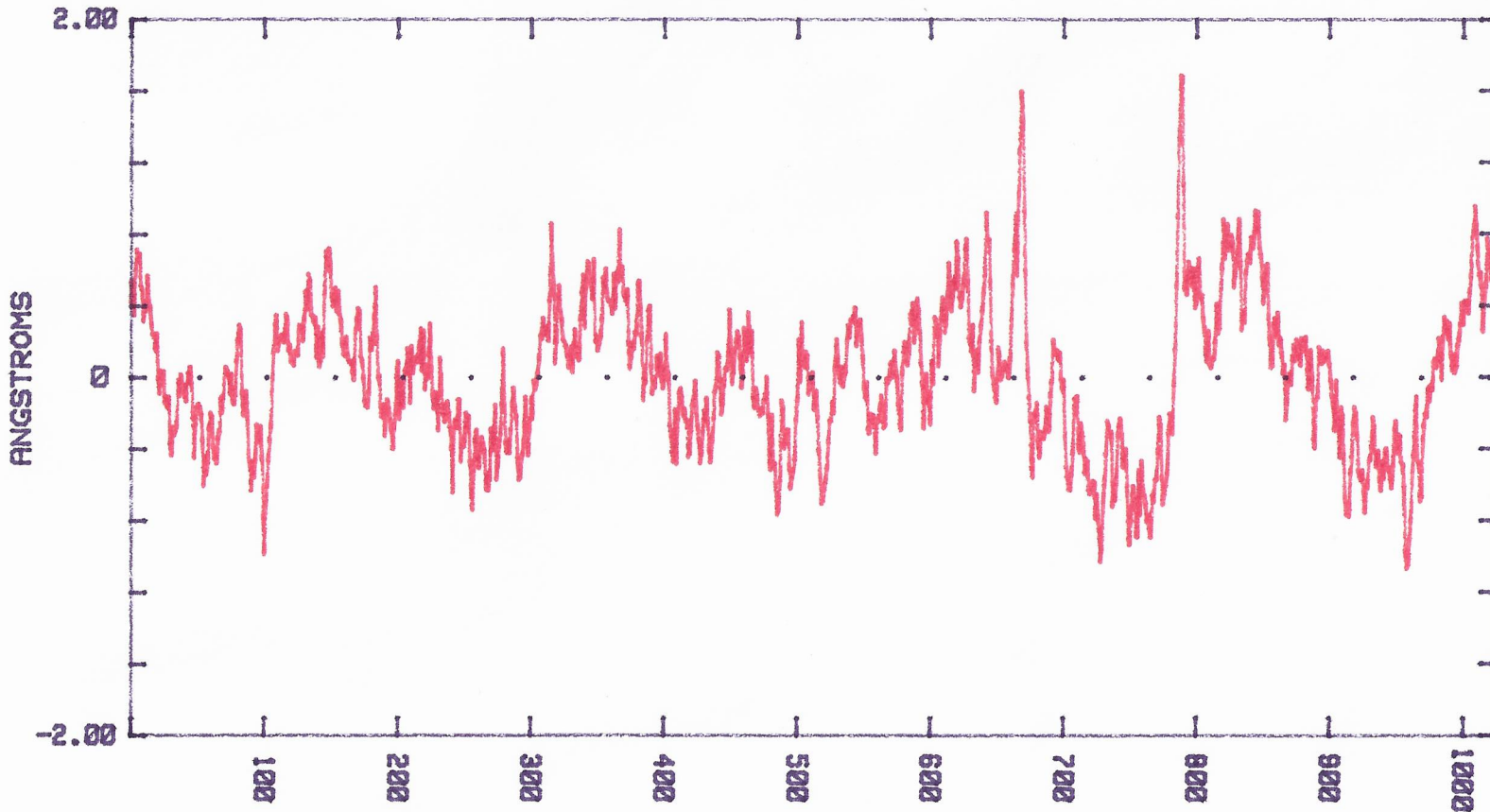
Coastline Optics, Inc.

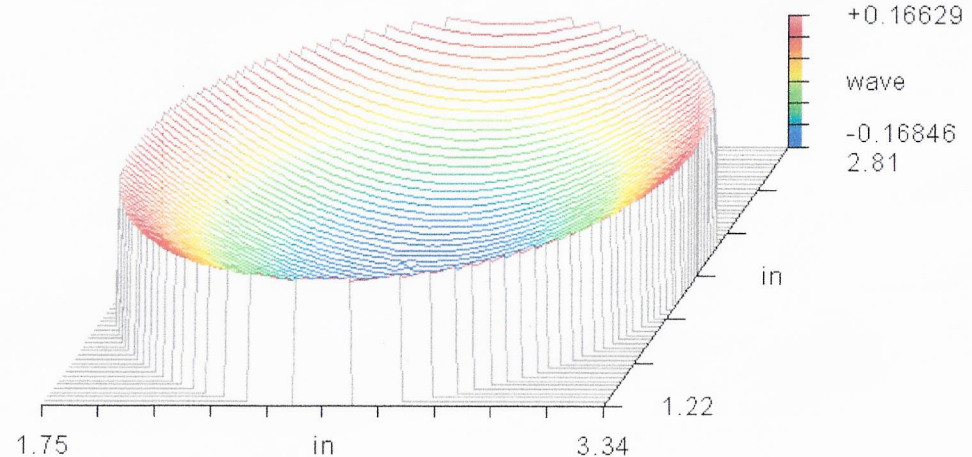
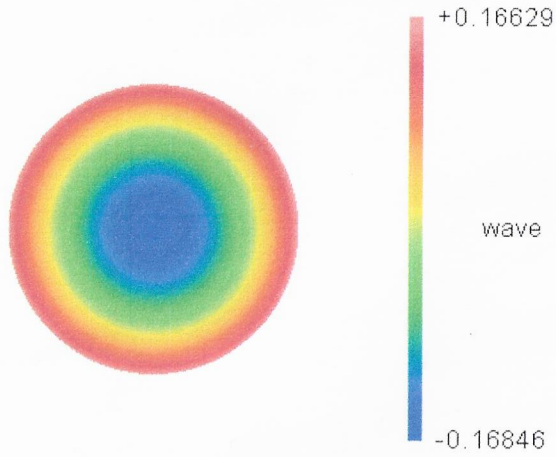
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(805) 384-0609

21 Dec 2018 11:35:05





PV 0.3347 wave

rms 0.0937 wave

Power 0.3261 wave

Removed:  
BST TLT

Data Points 28117

Rad -1002.6 m

Auto Aperture: Off

Aperture OD (%): 0

Trim Filter: Off

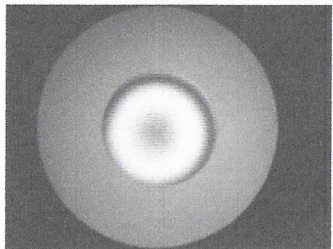
Trim Mode: Outside

Trim Quantity: 0

Filter: Off

Filter Window Size: 3

Filter Type: Average



Desc: LIGO 40M Folding Mirror	AGC: On	Light Level: 199
S/N: E1800089 REV 7-3 - Side 1	AGC Mode: Normal Reflectivity	
Inspector: K. Chavez	Acquisition Mode: Phase	
Wavelength-In: 632.8 nm	Phase Resolution: High	
Wavelength-Out: 632.8 nm	Phase Avg: 4	Intens Avg: 4
Refractive Index of Material: 1.500	Camera Res: 640x480 25 Hz	
Substrate System Error: Off	Discon Action: Filter	
System Error File: 12InTFlat.dat	Discon Filter: 0	
	Interferometer Scale Factor: 0.500	
Inst: Mark GPI Id 0 SN 004157	Date: Fri Jan 04 14:44:30 2019	

# Surface Roughness Profile

E1800089 REV 7-3, Side 1

Processed

RMS 0.83 angstroms

P-V 4.55 angstroms

Points 1024 microns

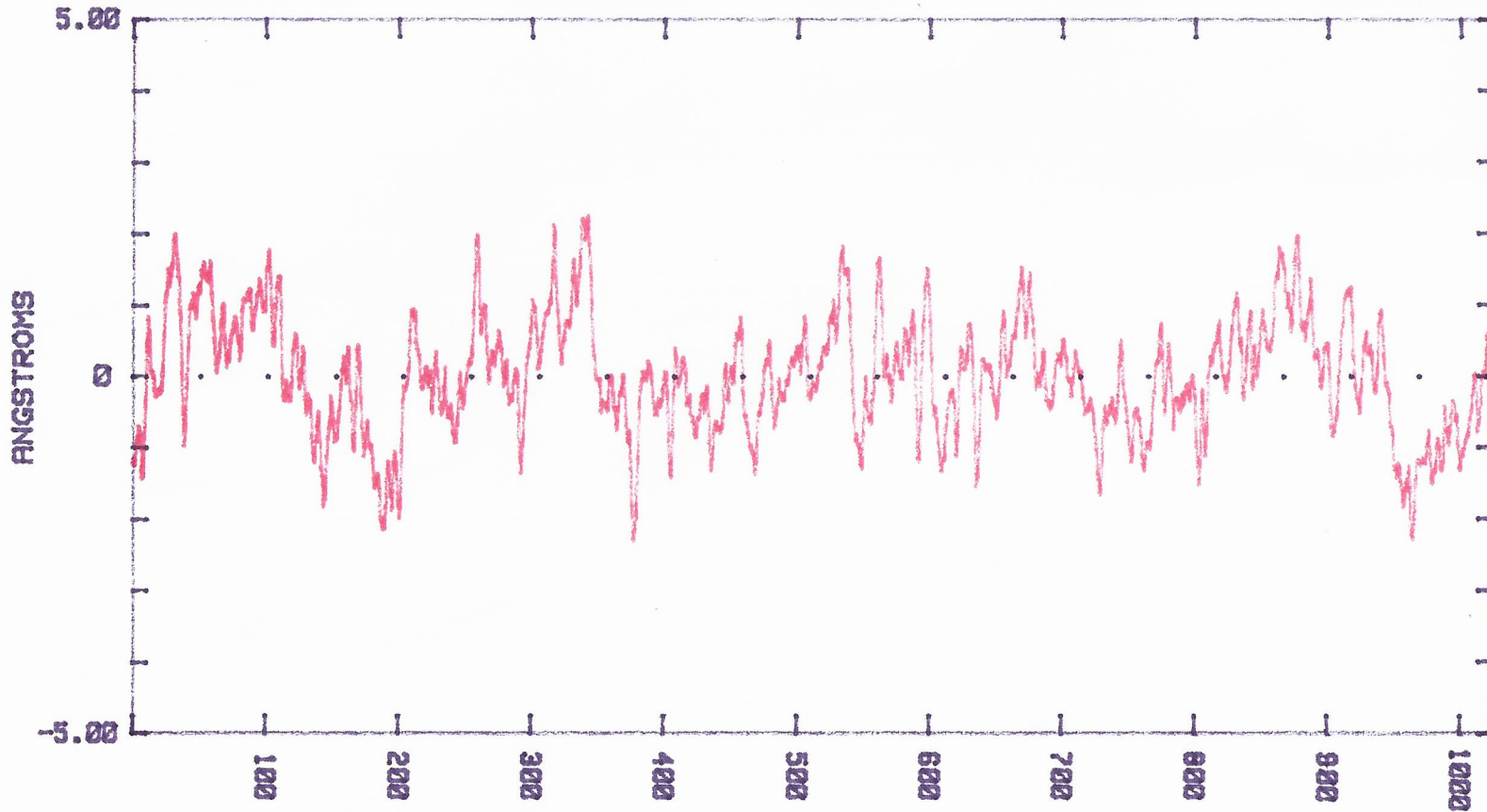
Coastline Optics, LLC

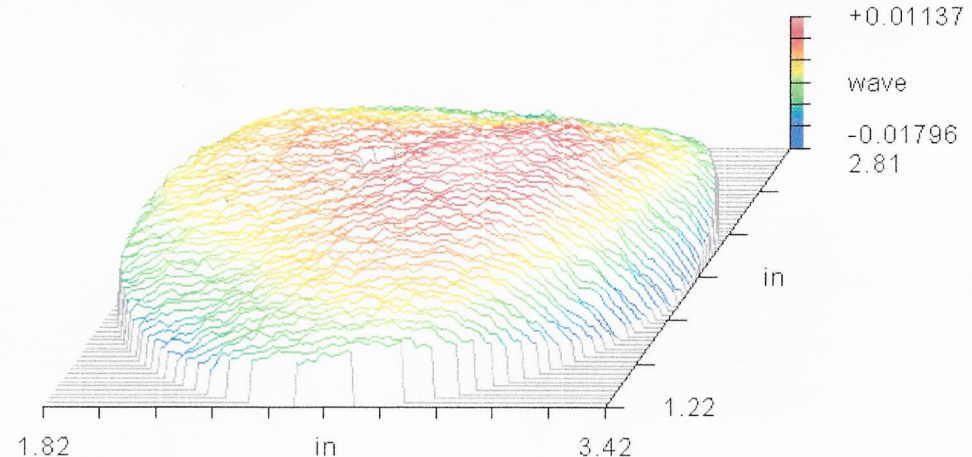
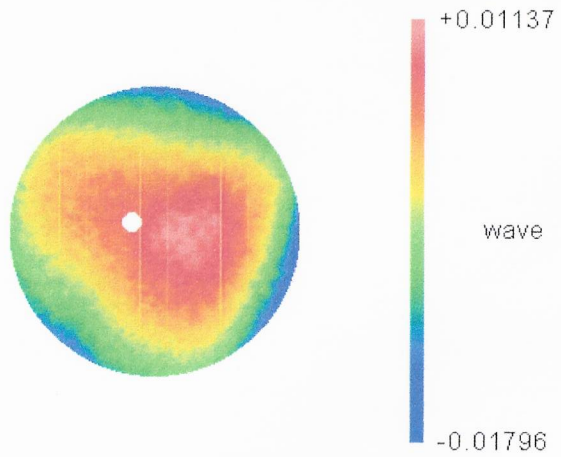
906 Via Alondra

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9 Jan 2019 09:48:19





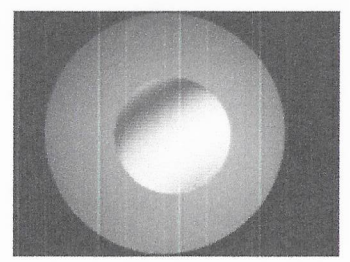
PV 0.0293 wave  
rms 0.0056 wave  
Power -0.0173 wave  
Removed:  
PST TLT

Data Points 27988  
Rad 18876.4 m

Auto Aperture: Off  
Aperture OD (%): 0

Trim Filter: Off  
Trim Mode: Outside  
Trim Quantity: 0

Filter: Off Filter Window Size: 3  
Filter Type: Average



Desc: LIGO 40M Folding Mirror AGC: On Light Level: 166  
S/N: E1800089 REV 7-3 - Side 2 AGC Mode: Normal Reflectivity  
Inspector: K. Chavez Acquisition Mode: Phase  
Wavelength-In: 632.8 nm Phase Resolution: High  
Wavelength-Out: 632.8 nm Phase Avg: 4 Intens Avg: 4  
Refractive Index of Material: 1.500 Camera Res: 640x480 25 Hz  
Substrate System Error: Off Discon Action: Filter  
System Error File: 12InTFlat.dat Discon Filter: 0  
Interferometer Scale Factor: 0.500  
Inst: Mark GPI Id 0 SN 004157 Date: Thu Dec 20 12:07:52 2018

# Surface Roughness Profile

E1800089 REV 7-3, Side 2

Processed

RMS 0.38 angstroms

P-V 2.17 angstroms

Points 1024 microns

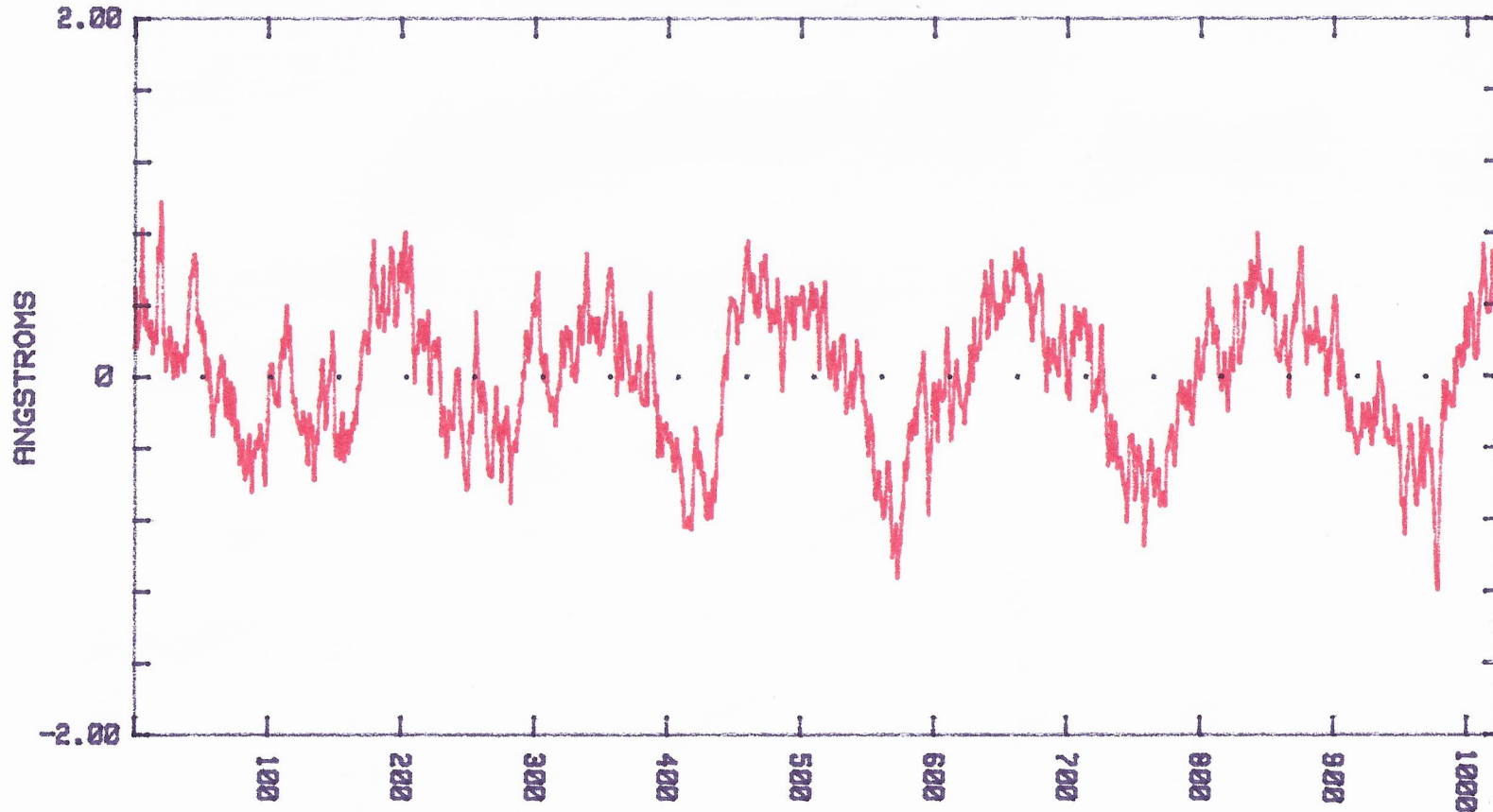
Coastline Optics, Inc.

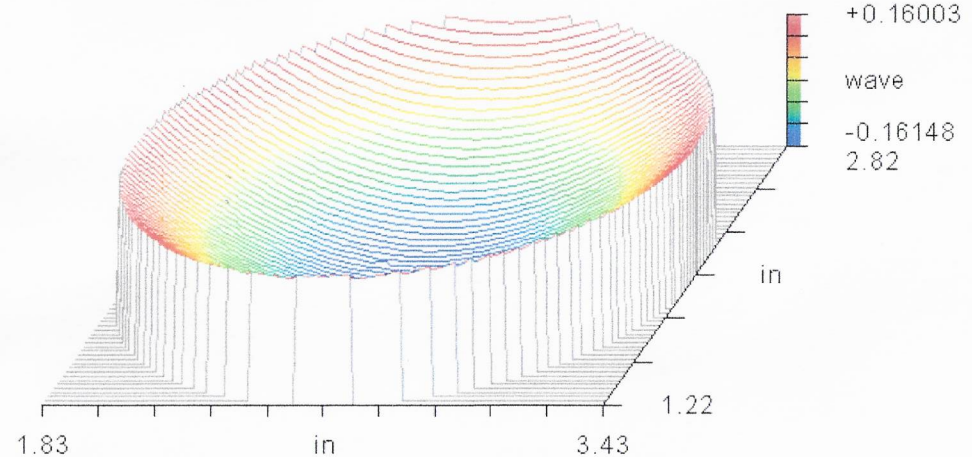
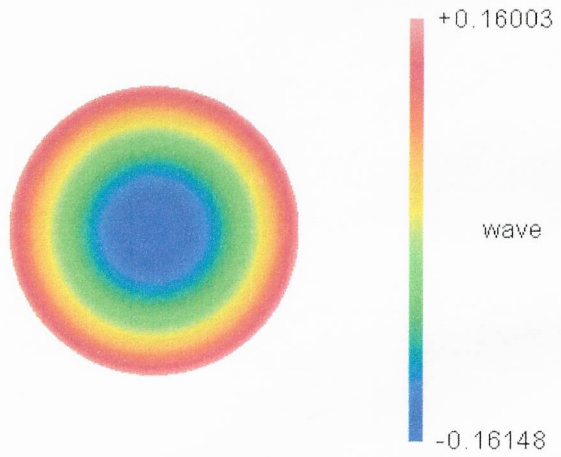
906 Via Alondra

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20 Dec 2018 14:37:16





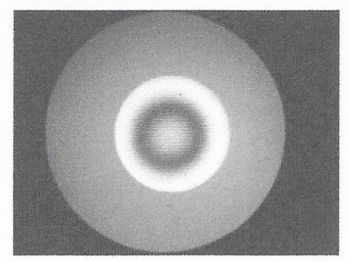
PV 0.3215 wave  
 rms 0.0918 wave  
 Power 0.3193 wave  
 Removed:  
 PST TLT

Data Points 28117  
 Rad -1023.8 m

Auto Aperture: Off  
 Aperture OD (%): 0

Trim Filter: Off  
 Trim Mode: Outside  
 Trim Quantity: 0

Filter: Off Filter Window Size: 3  
 Filter Type: Average



Desc: LIGO 40M Folding Mirror AGC: On Light Level: 192  
 S/N: E1800089 REV 7-4 - Side 1 AGC Mode: Normal Reflectivity  
 Inspector: K. Chavez Acquisition Mode: Phase  
 Wavelength-In: 632.8 nm Phase Resolution: High  
 Wavelength-Out: 632.8 nm Phase Avg: 4 Intens Avg: 4  
 Refractive Index of Material: 1.500 Camera Res: 640x480 25 Hz  
 Substrate System Error: Off Discon Action: Filter  
 System Error File: 12InTFlat.dat Discon Filter: 0  
 Interferometer Scale Factor: 0.500  
 Inst: Mark GPI Id 0 SN 004157 Date: Mon Jan 07 11:39:35 2019

# Surface Roughness Profile

E1800089 REV 7-4, Side 1

Processed

RMS 0.38 angstroms

P-V 2.32 angstroms

Points 1024 microns

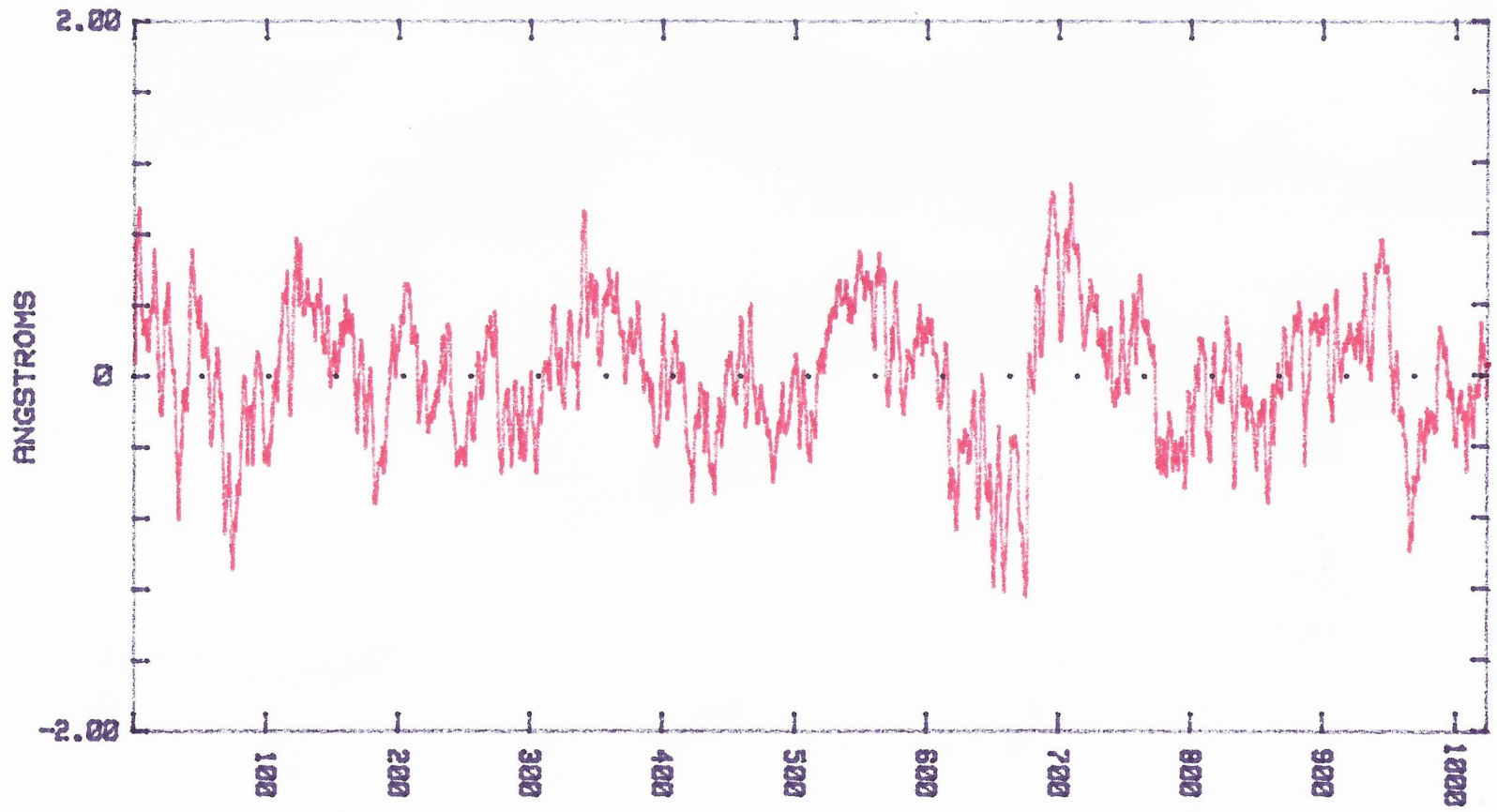
Coastline Optics, LLC

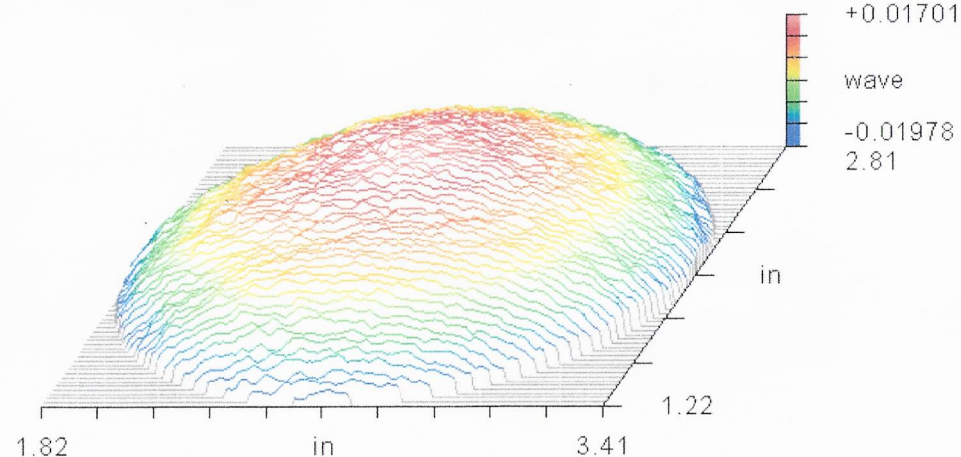
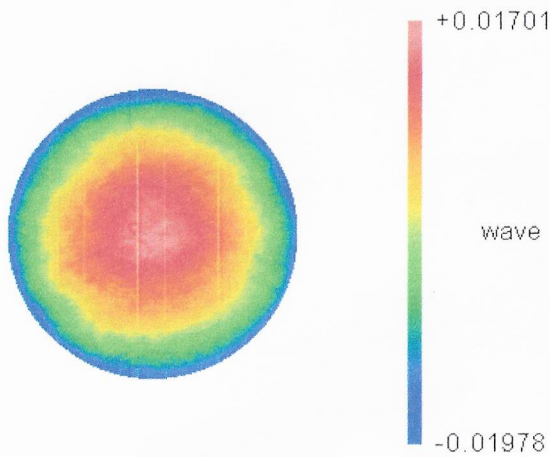
906 Via Alondra

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7 Jan 2019 11:47:17





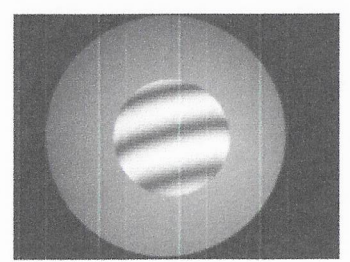
PV 0.0368 wave  
rms 0.0087 wave  
Power -0.0301 wave  
Removed:  
PST TLT

Data Points 28117  
Rad 10855.1 m

Auto Aperture: Off  
Aperture OD (%): 0

Trim Filter: Off  
Trim Mode: Outside  
Trim Quantity: 0

Filter: Off Filter Window Size: 3  
Filter Type: Average



Desc: LIGO 40M Folding Mirror  
S/N: E1800089 REV 7-4 - Side 2  
Inspector: K. Chavez  
Wavelength-In: 632.8 nm  
Wavelength-Out: 632.8 nm  
Refractive Index of Material: 1.500  
Substrate System Error: Off  
System Error File: SysErr.dat  
Inst: Mark GPI Id 0 SN 004157  
AGC: On Light Level: 169  
AGC Mode: Normal Reflectivity  
Acquisition Mode: Phase  
Phase Resolution: High  
Phase Avg: 4 Intens Avg: 4  
Camera Res: 640x480 25 Hz  
Discon Action: Filter  
Discon Filter: 0  
Interferometer Scale Factor: 0.500  
Date: Fri Dec 21 10:49:38 2018

# Surface Roughness Profile

E1800089 REV 7-4, Side 2

Processed

RMS 0.74 angstroms

P-V 4.64 angstroms

Points 1024 microns

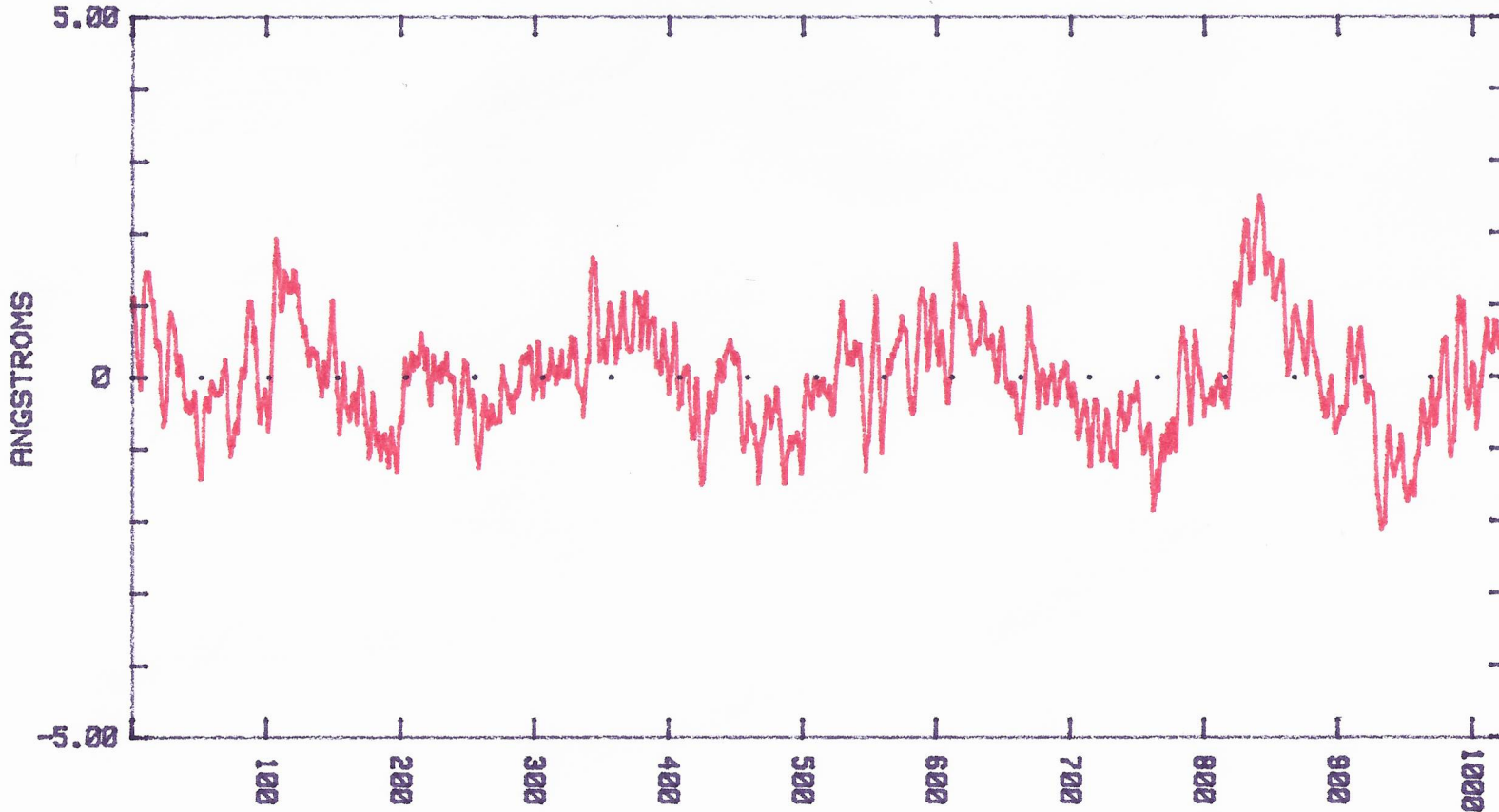
Coastline Optics, Inc.

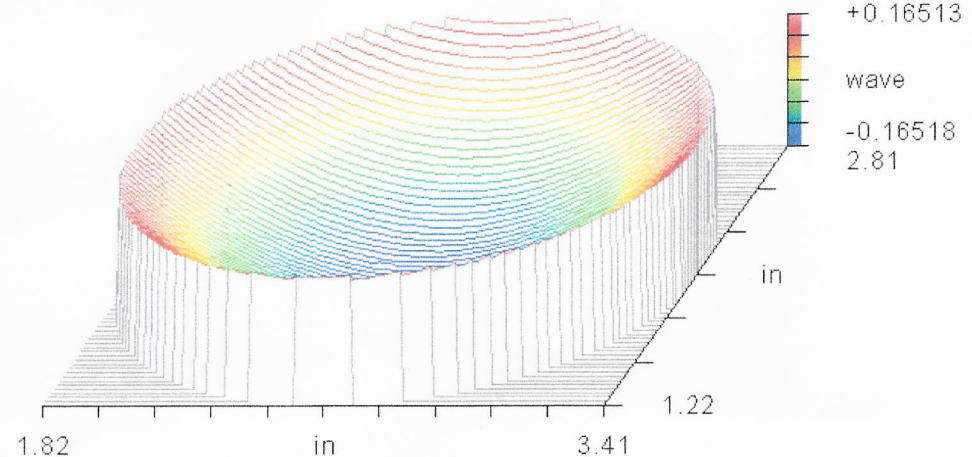
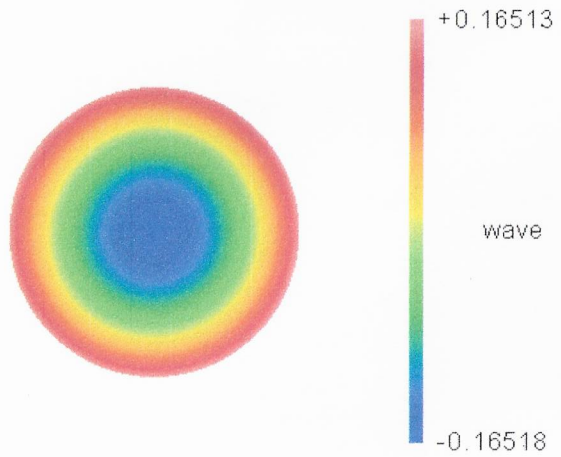
906 Via Alondra

Camarillo, CA 93012

(805) 384-0609

21 Dec 2018 11:40:39





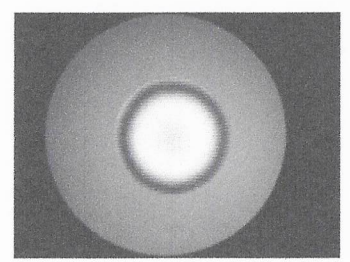
PV	0.3303	wave
rms	0.0935	wave
Power	0.3254	wave
Removed: PST TLT		

Data Points	28117
Rad	-1004.6 m

Auto Aperture:	Off
Aperture OD (%)	0

Trim Filter:	Off
Trim Mode:	Outside
Trim Quantity:	0

Filter:	Off	Filter Window Size:	3
Filter Type:	Average		



Desc:	LIGO 40M Folding Mirror	AGC:	On	Light Level:	195
S/N:	E1800089 REV 7-5 - Side 1	AGC Mode:	Normal Reflectivity		
Inspector:	K. Chavez	Acquisition Mode:	Phase		
Wavelength-In:	632.8 nm	Phase Resolution:	High		
Wavelength-Out:	632.8 nm	Phase Avg:	4	Intens Avg:	4
Refractive Index of Material:	1.500	Camera Res:	640x480 25 Hz		
Substrate System Error:	Off	Discon Action:	Filter		
System Error File:	12InTFlat.dat	Discon Filter:	0		
Interferometer Scale Factor: 0.500					
Inst:	Mark GPI Id 0 SN 004157	Date:	Fri Jan 04 15:36:49 2019		

# Surface Roughness Profile

E1000089 REV 7-5, Side 1

Processed

RMS 0.49 angstroms

P-V 2.98 angstroms

Points 1024 microns

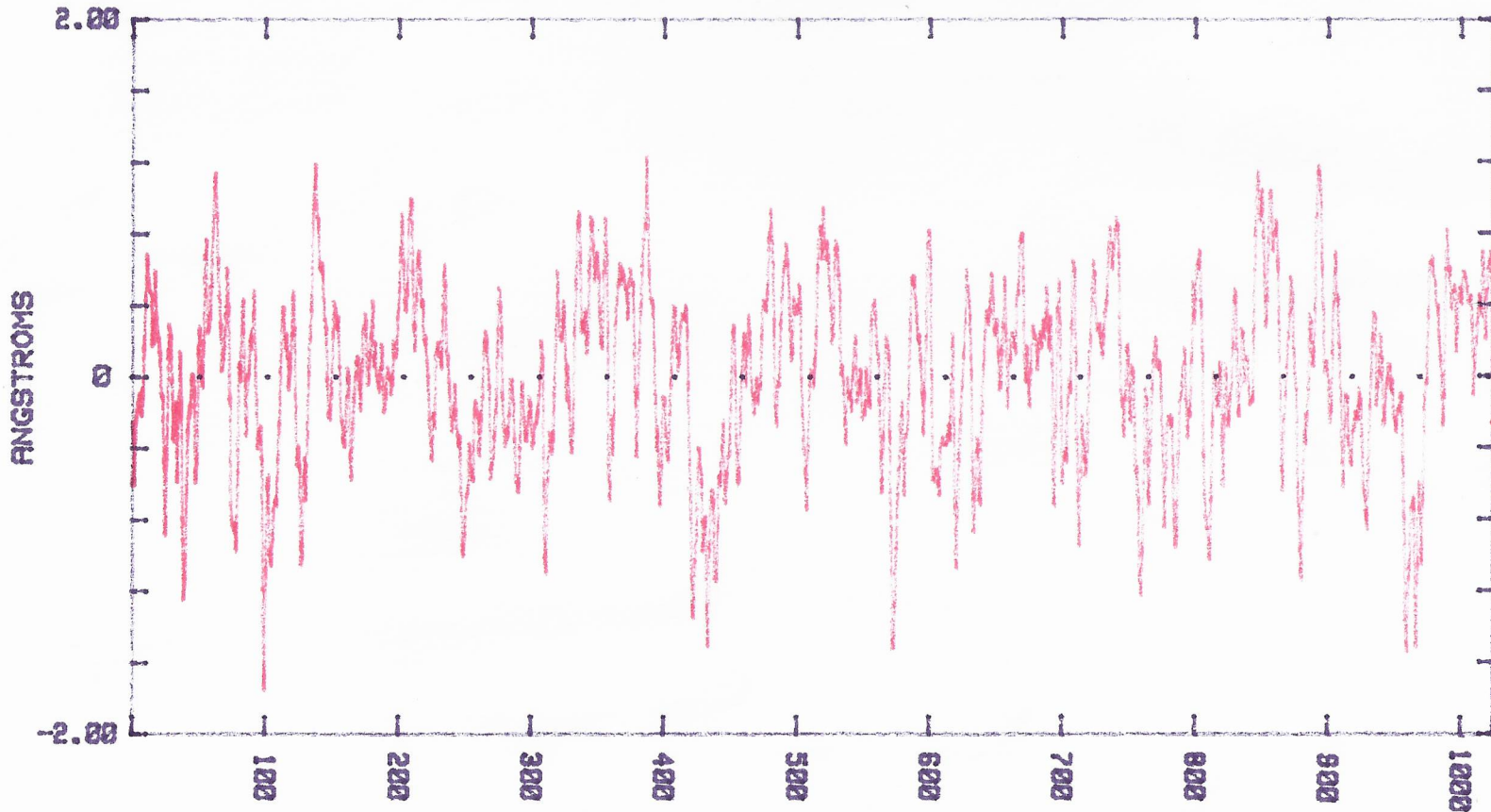
Coastline Optics, LLC

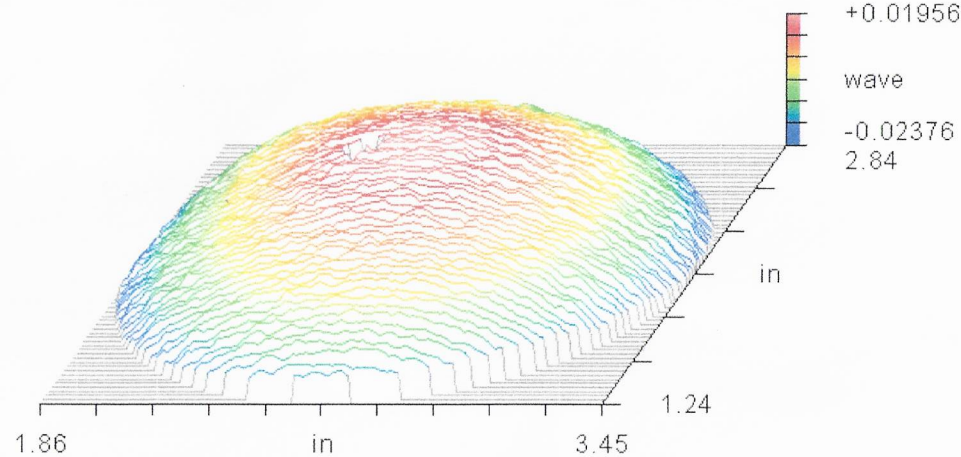
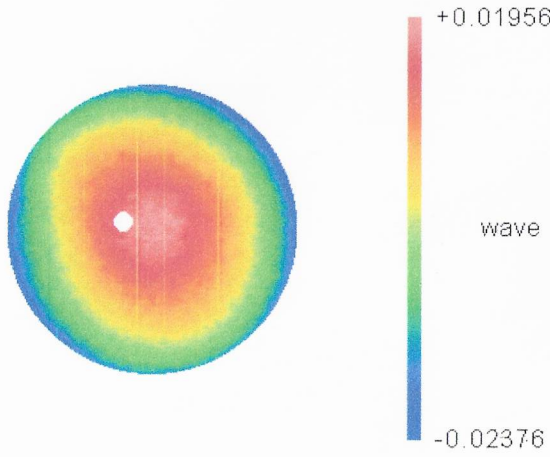
906 Via Alondra

Camarillo, CA 93012

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9 Jan 2019 09:33:39





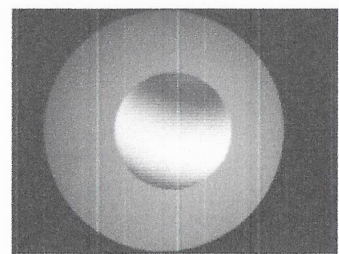
PV 0.0433 wave  
 rms 0.0100 wave  
 Power -0.0342 wave  
 Removed:  
 BST TLT

Data Points 27988  
 Rad 9556.2 m

Auto Aperture: Off  
 Aperture OD (%): 0

Trim Filter: Off  
 Trim Mode: Outside  
 Trim Quantity: 0

Filter: Off Filter Window Size: 3  
 Filter Type: Average



Desc: LIGO 40M Folding Mirror	AGC: On	Light Level: 166
S/N: E1800089 REV 7-5 - Side 2	AGC Mode: Normal Reflectivity	
Inspector: K. Chavez	Acquisition Mode: Phase	
Wavelength-In: 632.8 nm	Phase Resolution: High	
Wavelength-Out: 632.8 nm	Phase Avg: 4	Intens Avg: 4
Refractive Index of Material: 1.500	Camera Res: 640x480 25 Hz	
Substrate System Error: Off	Discon Action: Filter	
System Error File: 12InTFlat.dat	Discon Filter: 0	
	Interferometer Scale Factor: 0.500	
Inst: Mark GPI Id 0 SN 004157	Date: Thu Dec 20 11:50:28 2018	

# Surface Roughness Profile

E1800089 REV 7-5, Side 2

Processed

RMS 0.71 angstroms

P-V 4.54 angstroms

Points 1024 microns

Coastline Optics, Inc.

906 Via Alondra

Camarillo, CA 93012

(805) 384-0609

20 Dec 2018 14:27:11

