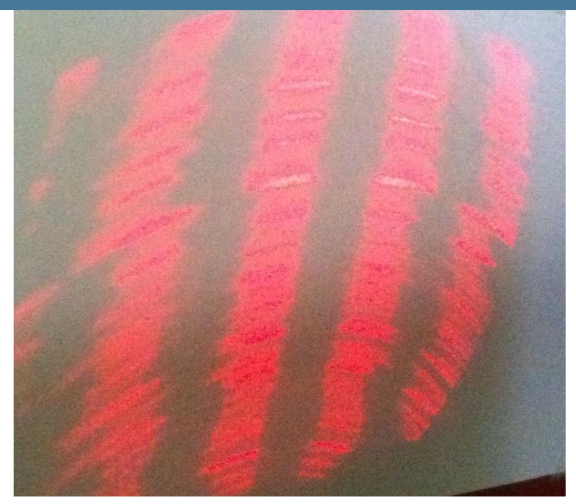
Comparison of High Precision Profilometry to Lateral Shearing Interferometry Collected from High NA Aspheric Surfaces with Materials from SIC, Aluminum, ULE and Zerodur

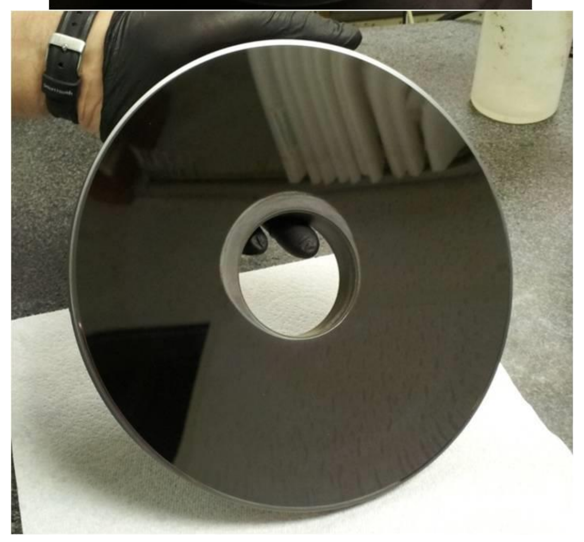
light solutions

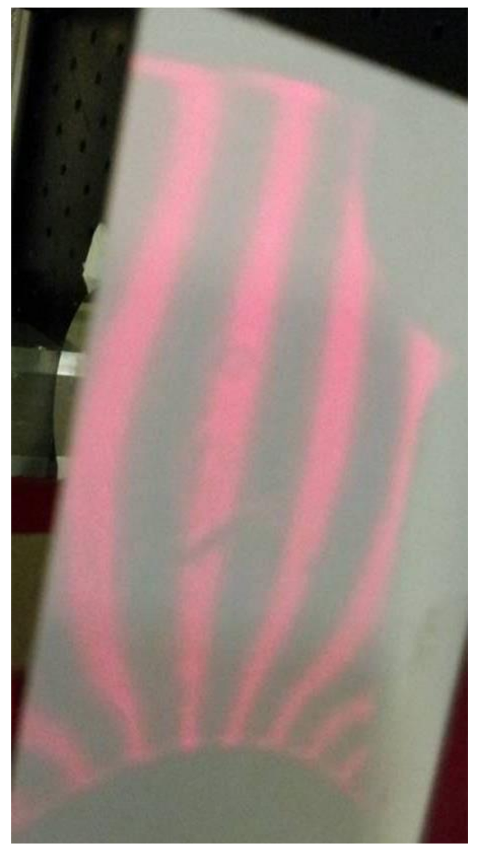
Silicon Carbide F2 Parabolic Primary

Moire Fringes

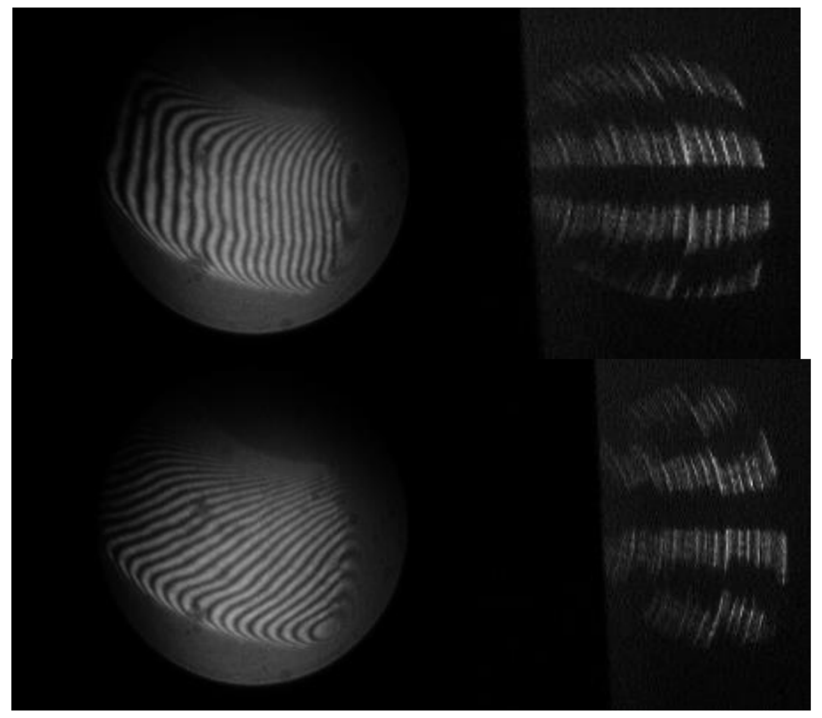


Shear Fringes

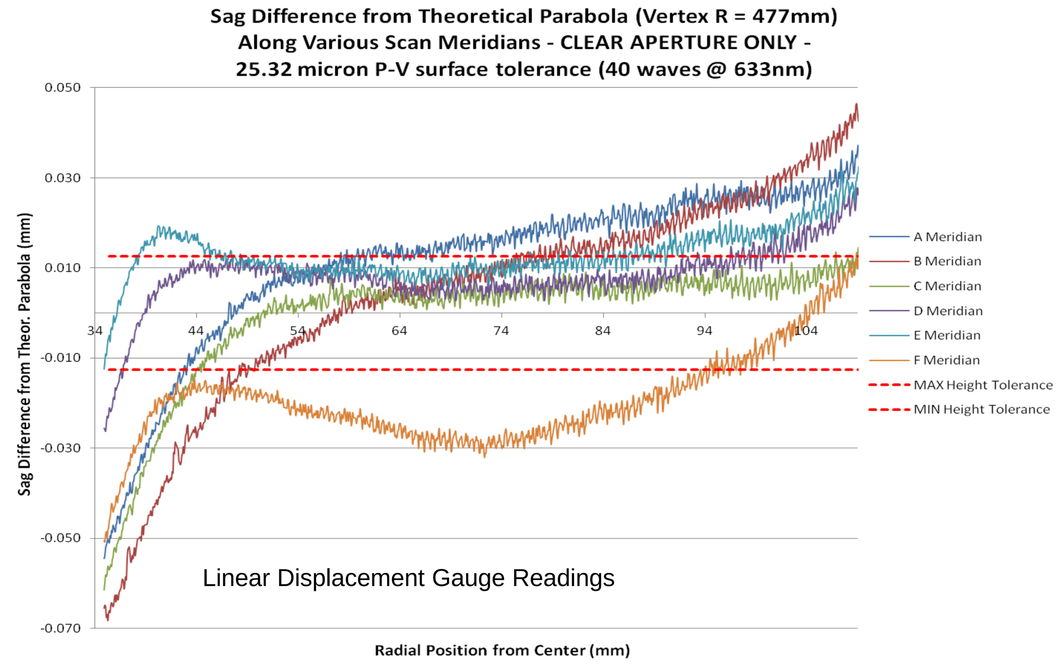




Smoothed shear fringes after polishing

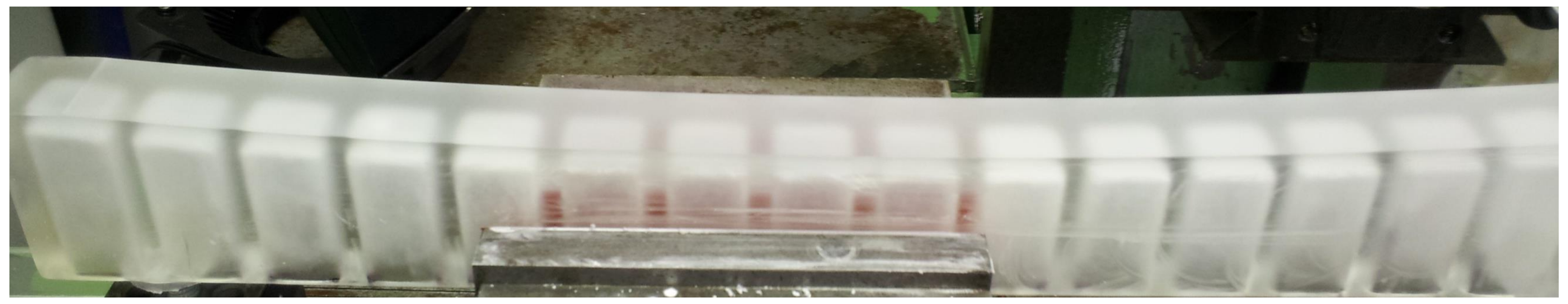


Side by side comparison of Ronchi shearing test and interferometric testing

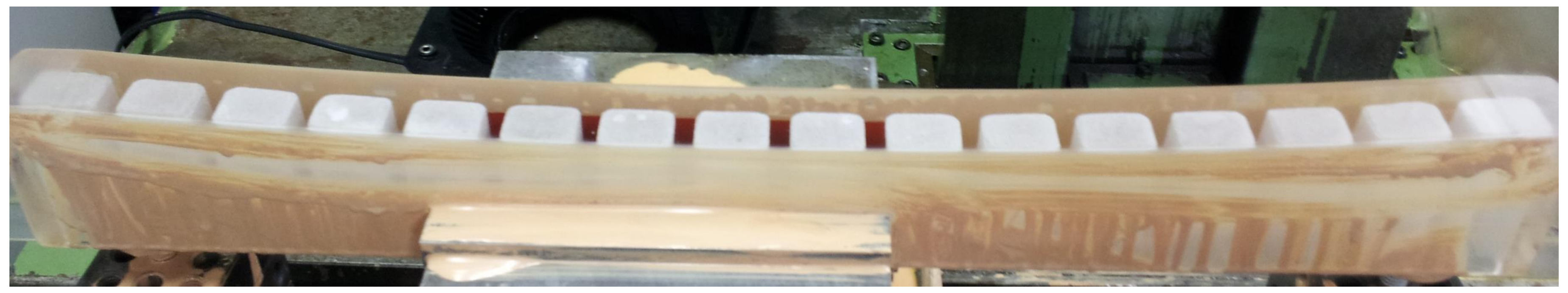


Profilometry for CNC Polishing

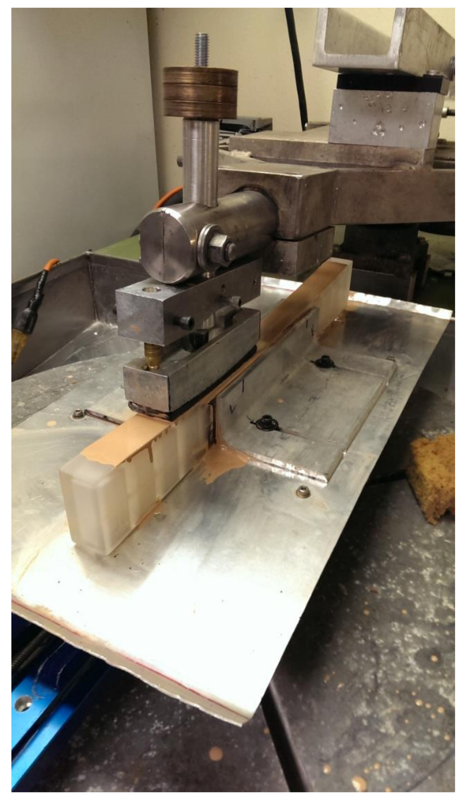
High NA Large Freeform Aspheric Light Weighted Optics



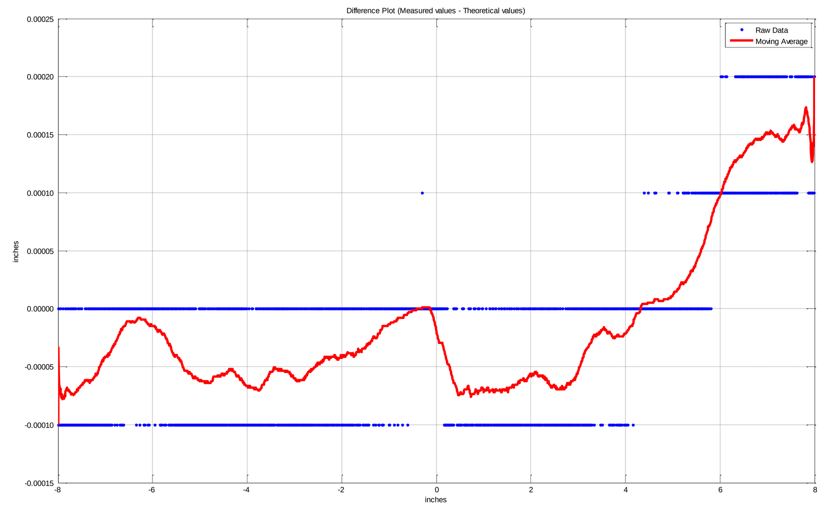
Fine ground surface using CNC milling processes



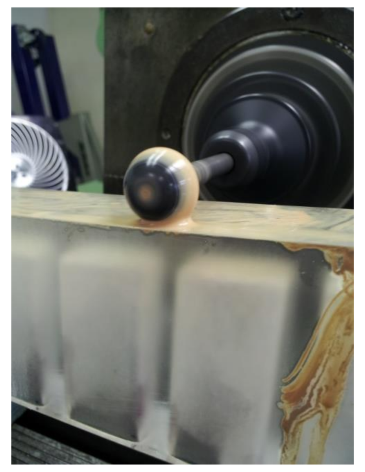
Surface after utilizing CNC polishing processes



Alternate CNC polishing setup using more traditional tooling



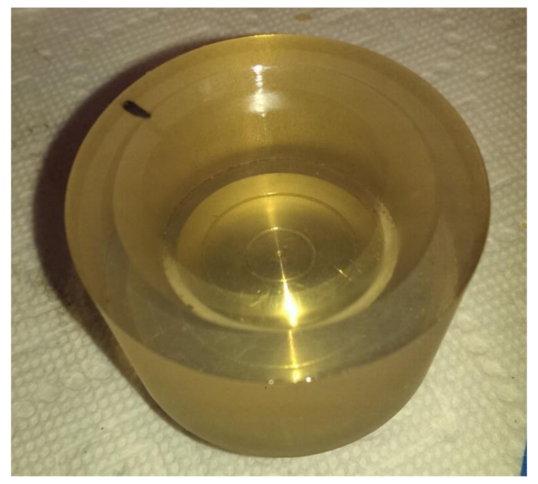
In process profilometry data used to feedback into CNC polishing process



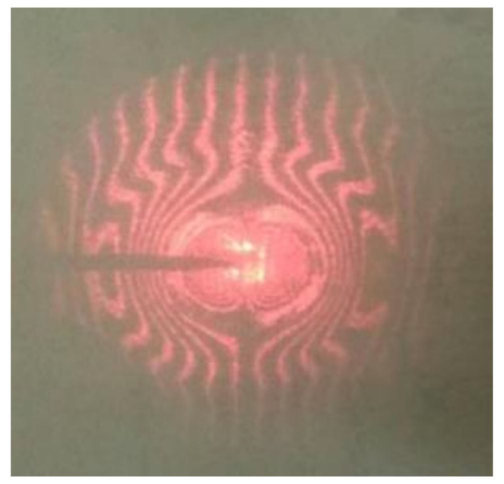
Close up of polishing tool during CNC polishing

Confocal Microscope Objective

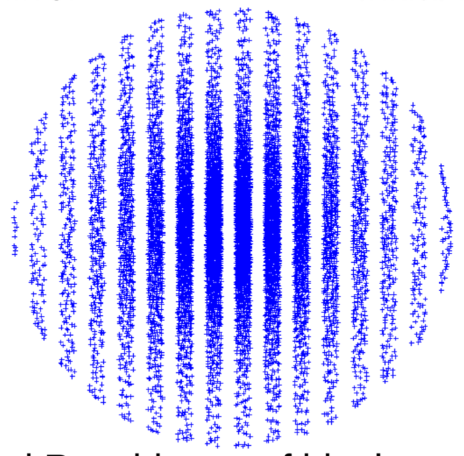
Parabolic mirror with NA = 0.998 used for high resolution confocal microscopy



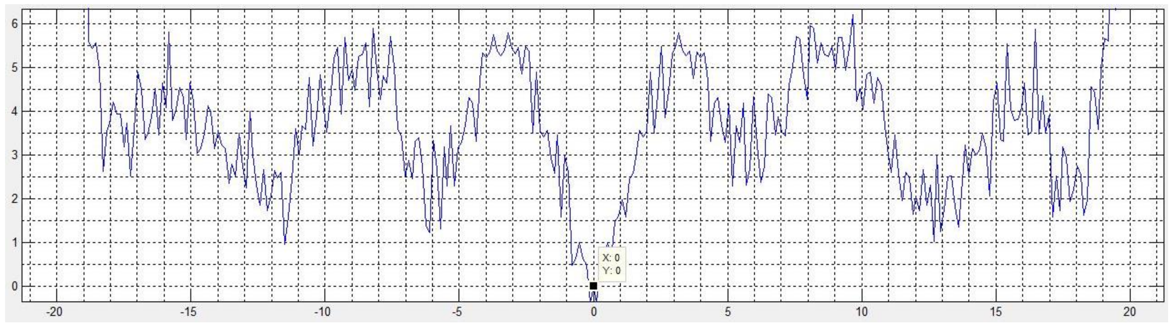
In process mirror



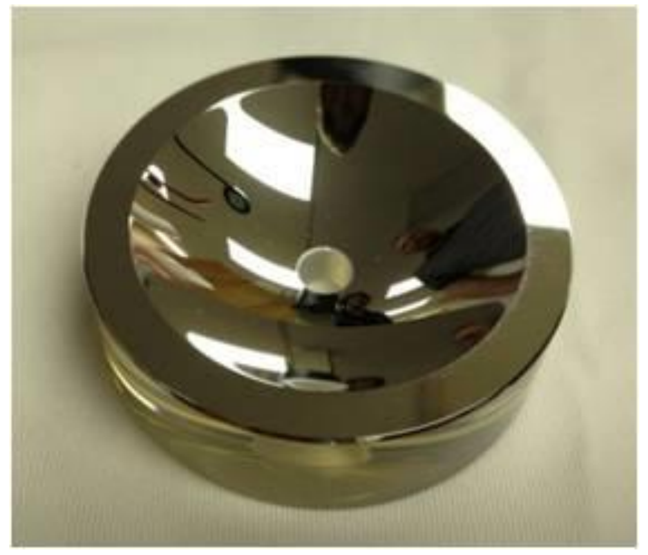
Initial Ronchi test after grinding



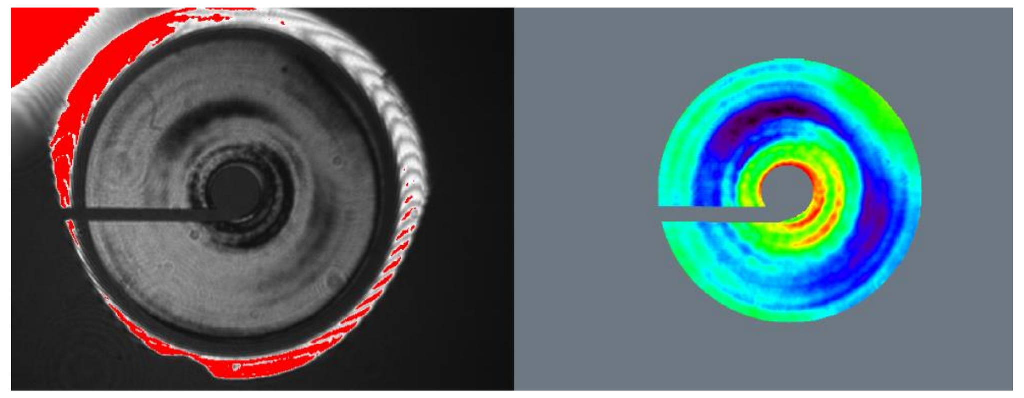
Simulated Ronchigram of ideal parabola



Example of in process profilometry testing. Results correlate well to both Ronchi and interfermetric testing.



Finished and coated CMO mirror



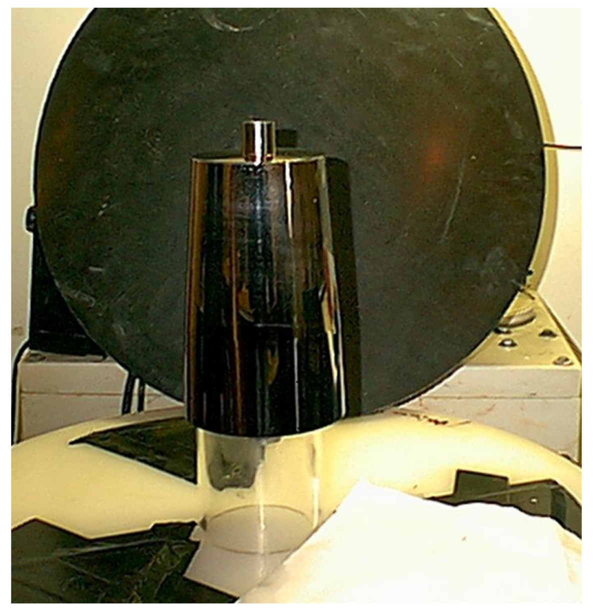
Interferometric test data indicating final PV = 0.3185 waves and RMS = 0.0529 waves at 632.8nm

Abstract

Manufacturing processes to produce high numerical aperture aspheric optics have always been dependent on the use of specialized surface measurement techniques. These techniques can produce high-precision wavefront analysis to provide requisite surface figure control to validate functionality and performance. In this paper we provide data that present the interfacing of these different approaches to produce usable and interpretable information to guide computer controlled precision grinding and final ductile finishing of both free form and centric forms of aspheric surfaces.

Both contact profilometry and rough surface grating interferometry are demonstrated. Interpretation and analysis of the surface topography is presented. The importance of having in-situ measurements to guide surface removal functions is discussed.

Grazing Incidence Optics



Wolter Type II & Type I Large external aspheric Molds finished using waterjet

Large Optics

1 meter Convex hyperboloid aspheric mold used to produce super nano-laminate adaptive optic.

Contact information

www.hnuphotonics.com

Phil Baker, pbaker@hnuphotonics.com
Richard Pultar, rpultar@hnuphotonics.com
Dr. Riley Aumiller, raumiller@hnuphotonics.com

HNu Photonics, LLC, 350 Hoohana St, Kahului HI 96732