

# Characterization of Deformable Mirrors

Angela Haff  
UC Davis  
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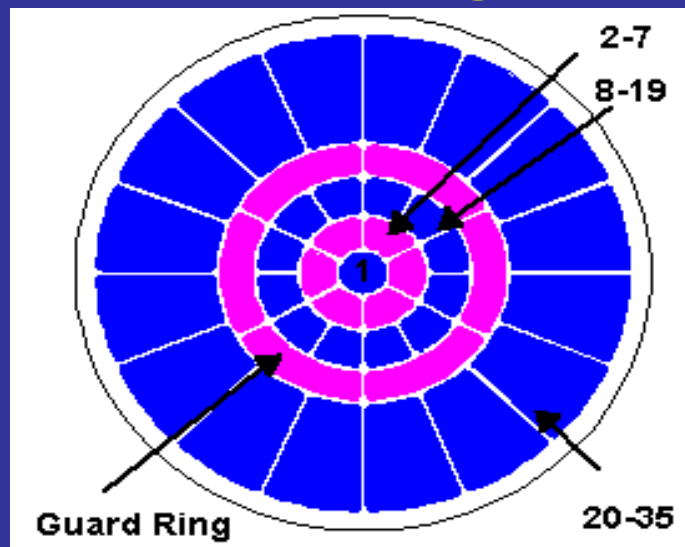
## Partners

- UC Davis Medical Center Ophthalmology group  
Jack Werner
- UC Davis Mechanical Engineering Dept  
Dave Horsley

## Objective

- Characterization of a deformable mirror to determine whether it is suitable for use in adaptive optics systems used by Ophthalmology group in the field of vision science.

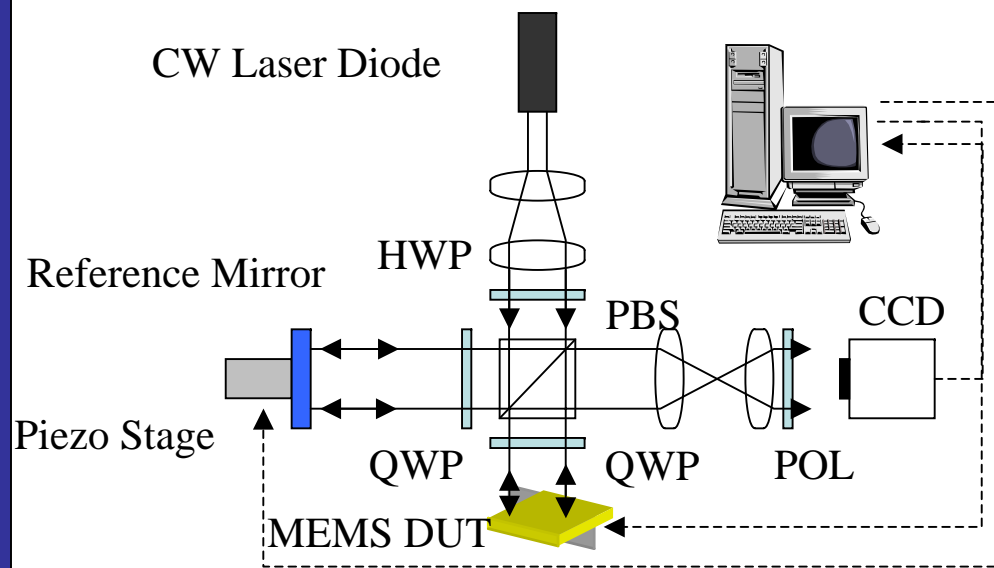
- Aluminum surface with a piezoelectric film coating underneath. 36 actuators distributed through the piezoelectric coating.
- Voltage applied to the actuators causes strain in piezoelectric material, results in deformation of the mirrors surface.
- Characterize the mirror by determining the ability to control mirror deformation through application of voltages.

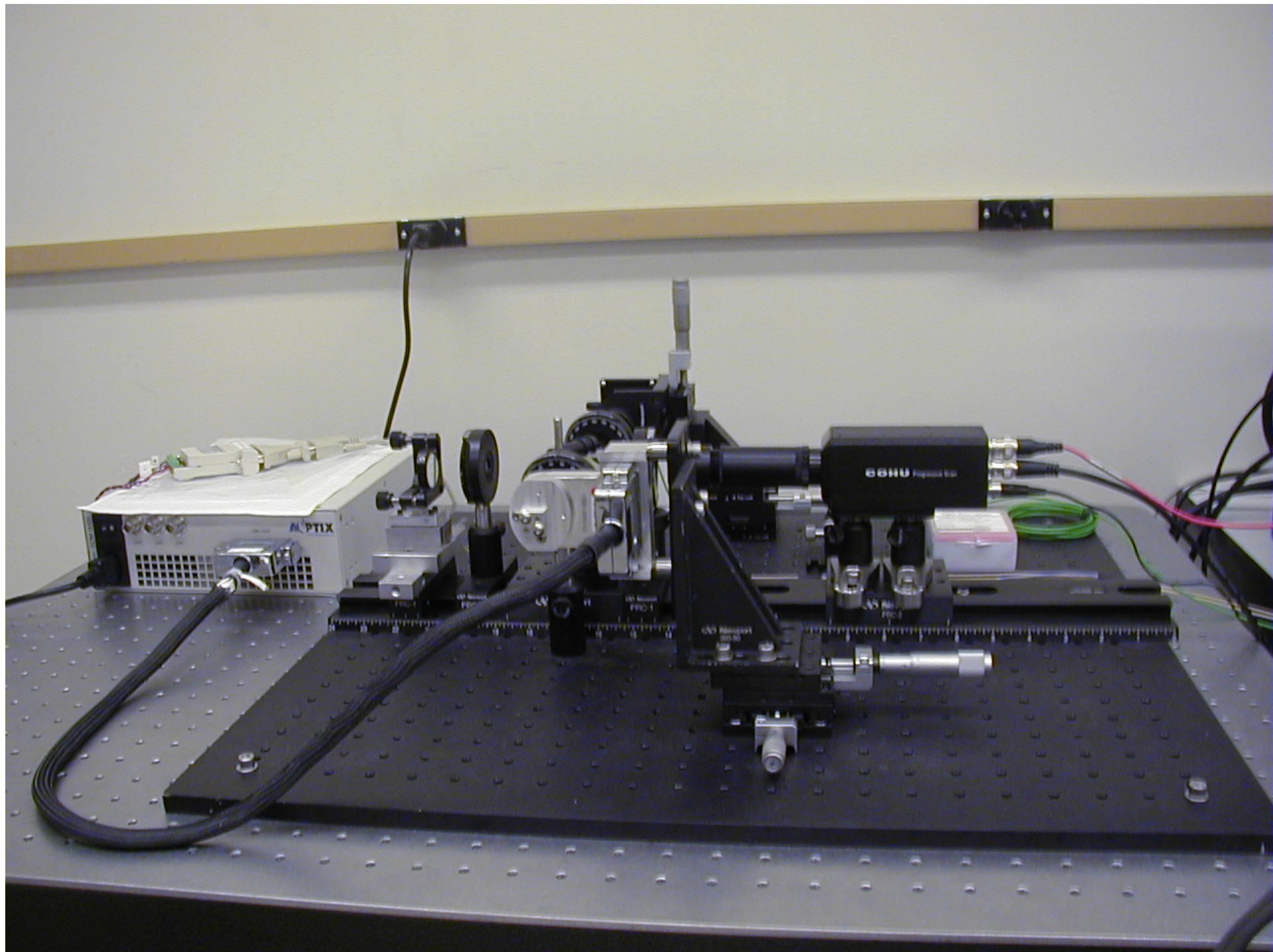


# Zernike modes

- Aberrations of the eye modeled by combinations of Zernike polynomials
- Mirror will be used to correct aberrations of the eye
- Mirror must be able to recreate Zernike modes in order to correct aberrations.

- **Surface deformation is measured through analysis of interference patterns using a Twyman-Green interferometer.**
- **Computer algorithms attempt to convert the interference patterns into surface height maps over the surface of the mirror.**



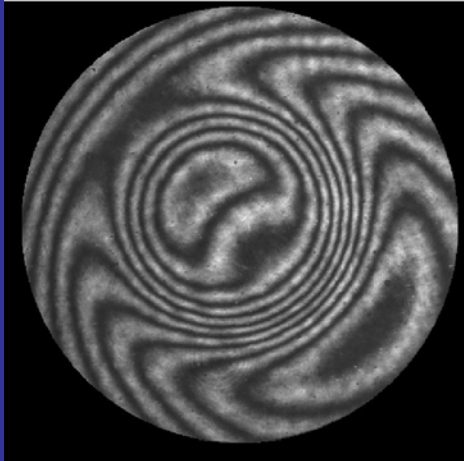


# System Characteristics

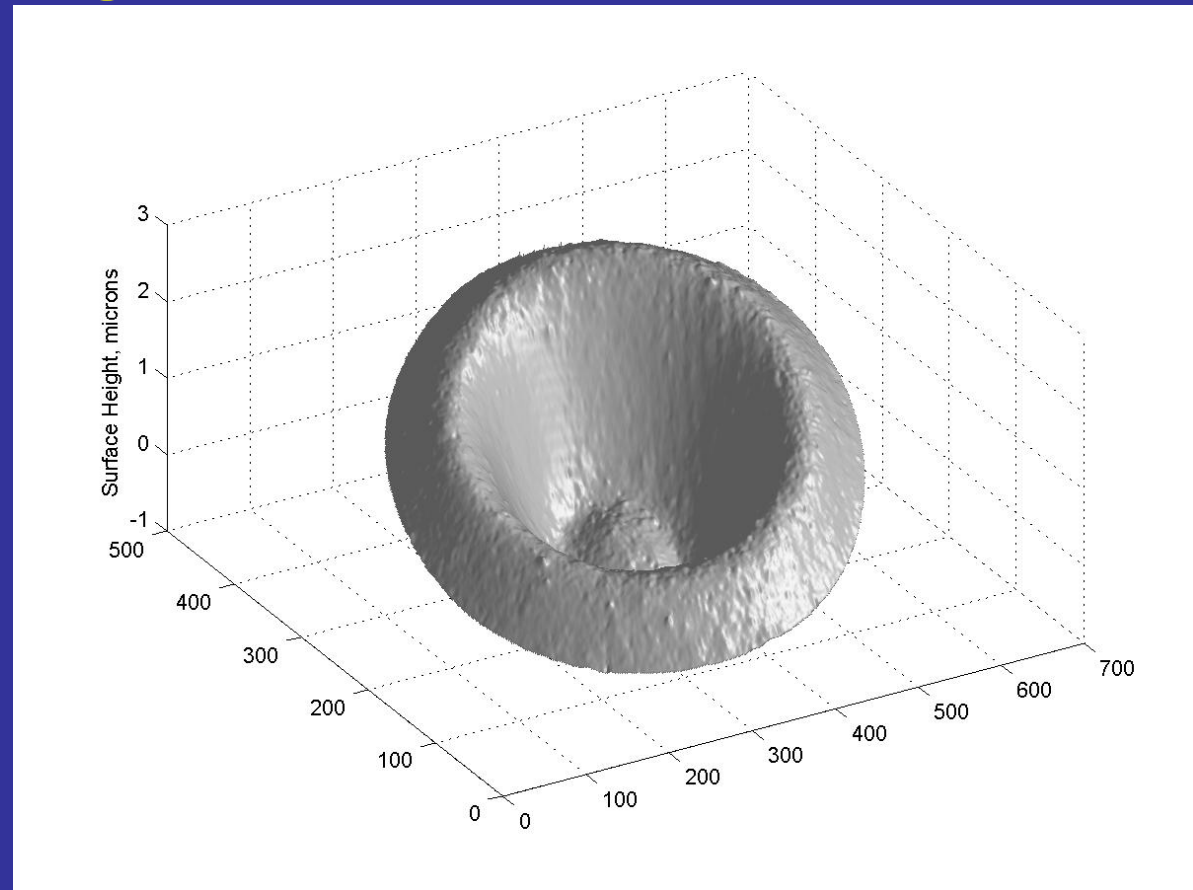
- Before we could characterize the mirror we needed to determine some system characteristics.
- Minimum resolvable fringe spacing corresponds to maximum measurable deformation
- A series of interferograms was created
- We plotted contrast v. pixel spacing.
- Contrast goes to zero at 1 pixel.
- Corresponds to 35 microns ( max deformation)

- Now ready to begin creating surface maps
- Voltages were applied to individual actuators
- surface maps were created by computer programs

# Sample Interferograms & Resulting Surface Shape



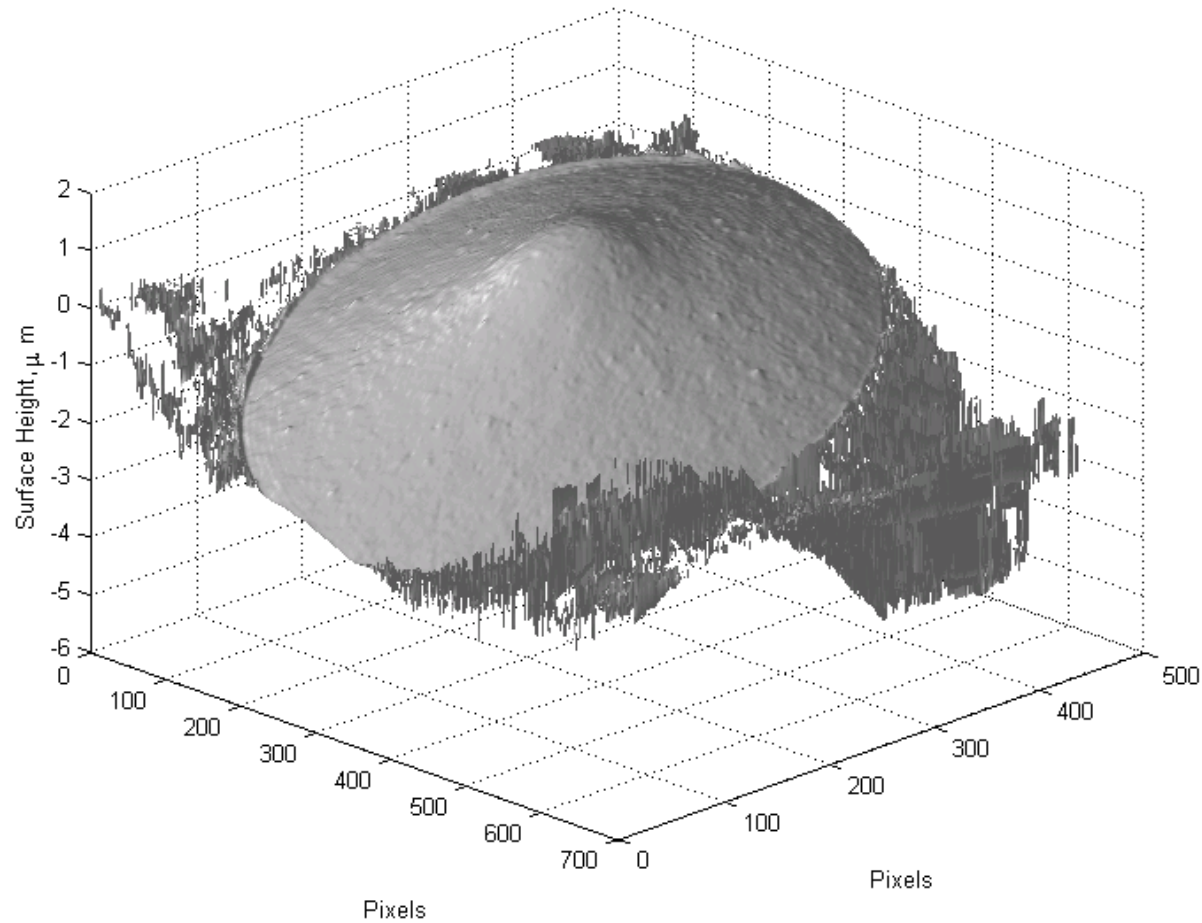
**Interferogram of Deformed Mirror**



**Mirror Surface Reconstructed from Interferograms**

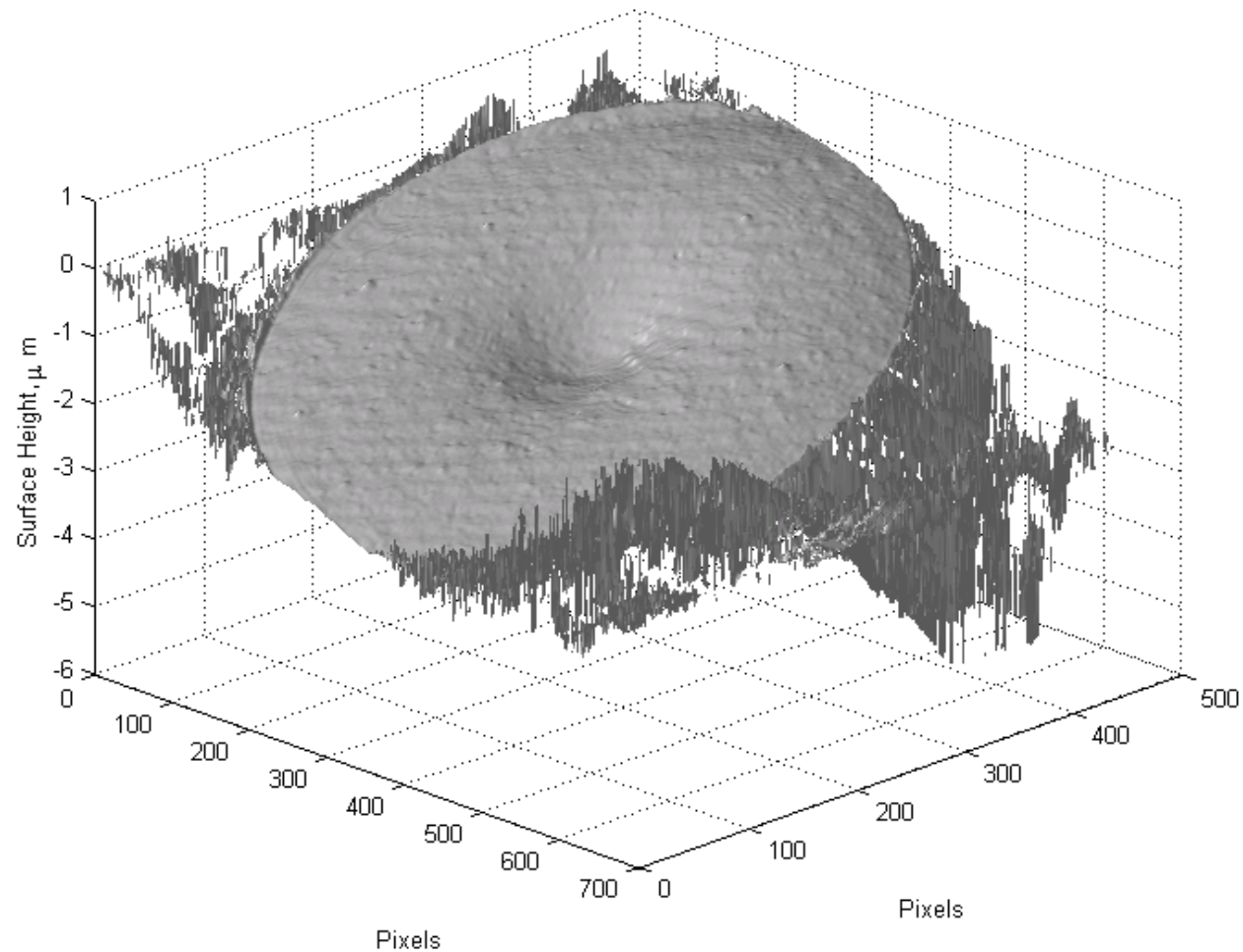
# Surface Map Minimum Voltage

actuator 20  
V = V min



# Surface Map Maximum Voltage

Actuator 20  
 $V = V_{\text{max}}$



# Conclusions

- From surface maps computer programs will generate deformation data for specific applied voltages
- Goal is to determine the voltage configuration required to produce the Zernike modes



# Acknowledgements

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# fring resolution

