

# Experimental Nanomechanics

by General Stress Optics, Inc.

Use of advanced optical methods to measure and test  
at the nanoscale level

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# The Need for Testing at the Nano level

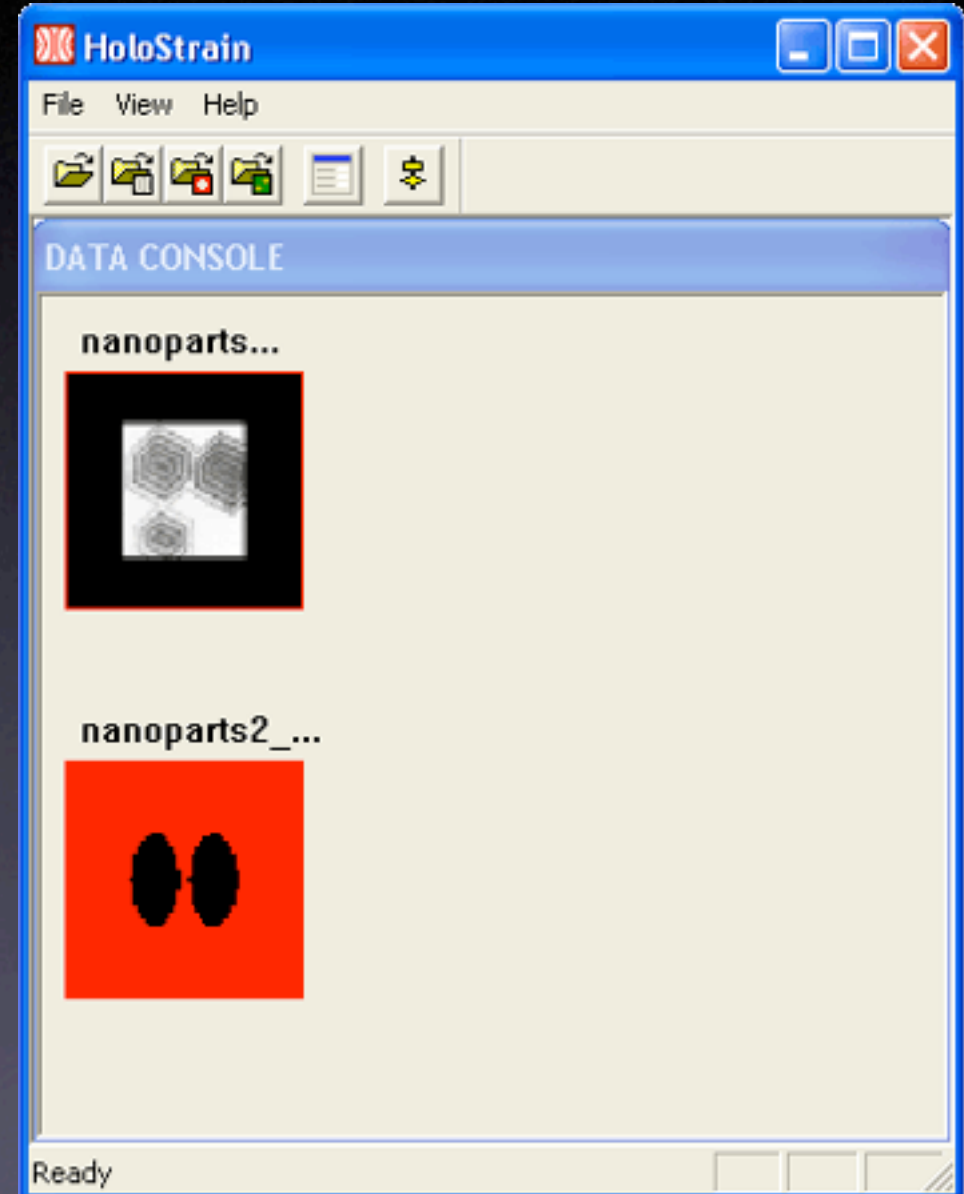
- The rapid advances being made in nanotechnology are creating under-served needs for real **experimental testing at nanoscale levels**
- We at General Stress Optics Inc.(GSO) are making this opportunity **our strategic focus**
- GSO has developed a **software suite** that is ideally suited to the problems posed by experimental nanomechanics

# GSO's software suite- Holostrain<sub>tm</sub> v 2.0

- Holostrain is capable of image analysis from a **wide-range** of optical capturing methods, lighting conditions, and experimental setups
- Holostrain provides **high-speed** image analysis, obtaining the following information
  - displacement
  - stress and strain
  - contouring
- Holostrain can be part of a seamless multi-nanoscale workflow for any kind of **nanosstructure**, **nanomaterial**, or **nanoscale processes**
- Experimental **results visualized in 3D/2D** via Matlab routine, making data presentation effortless

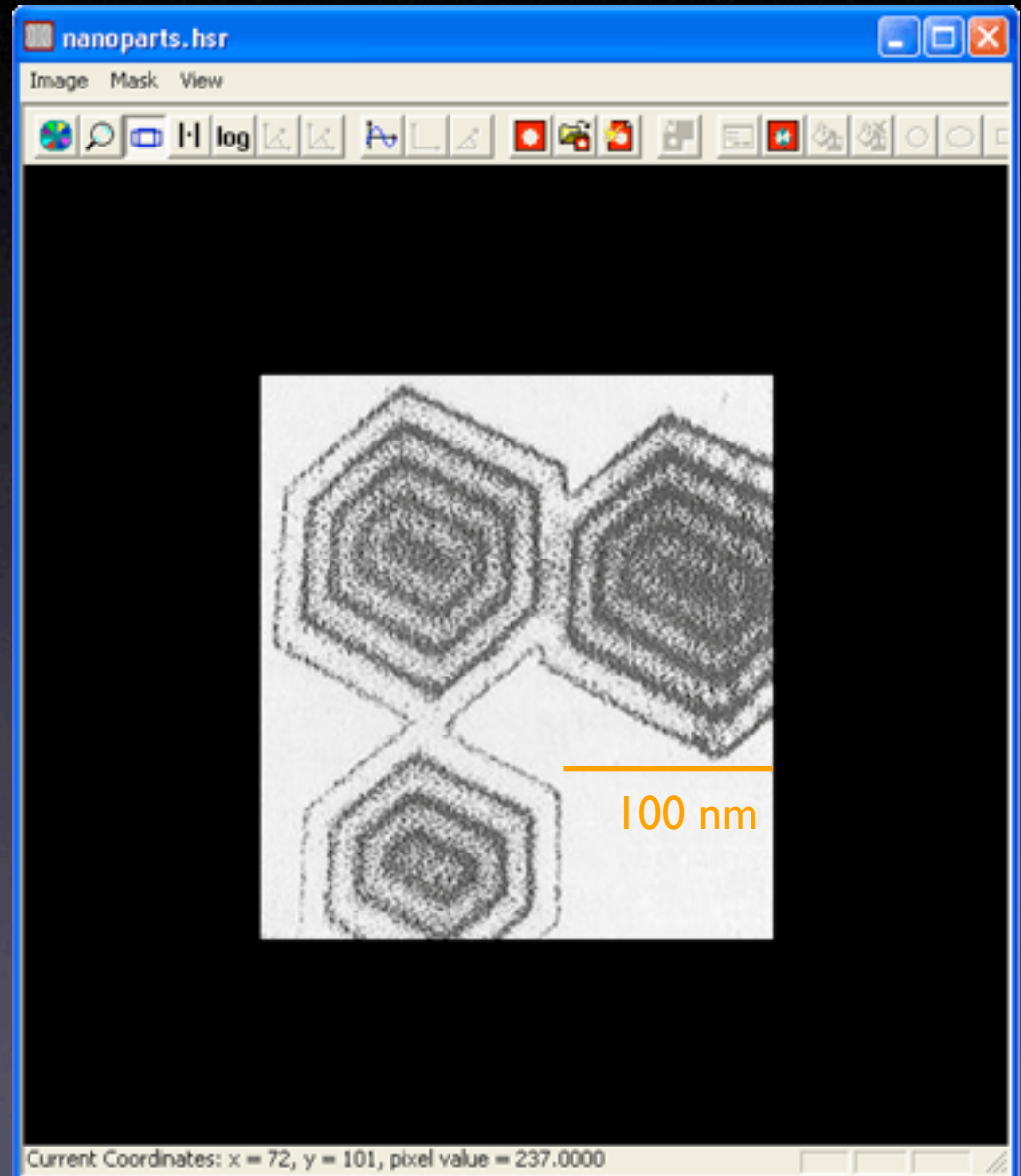
# Walkthrough of Holostrain™ 1 of 8

- 
- **Workspace**
- You can open captured images in the workspace. You can also create masks and filters.
- The workspace environment is flexible and user friendly by letting you view a number of thumbnails at a glance.
- Thumbnail images allow users to easily keep track of the workflow being carried out, and quickly try alternatives.



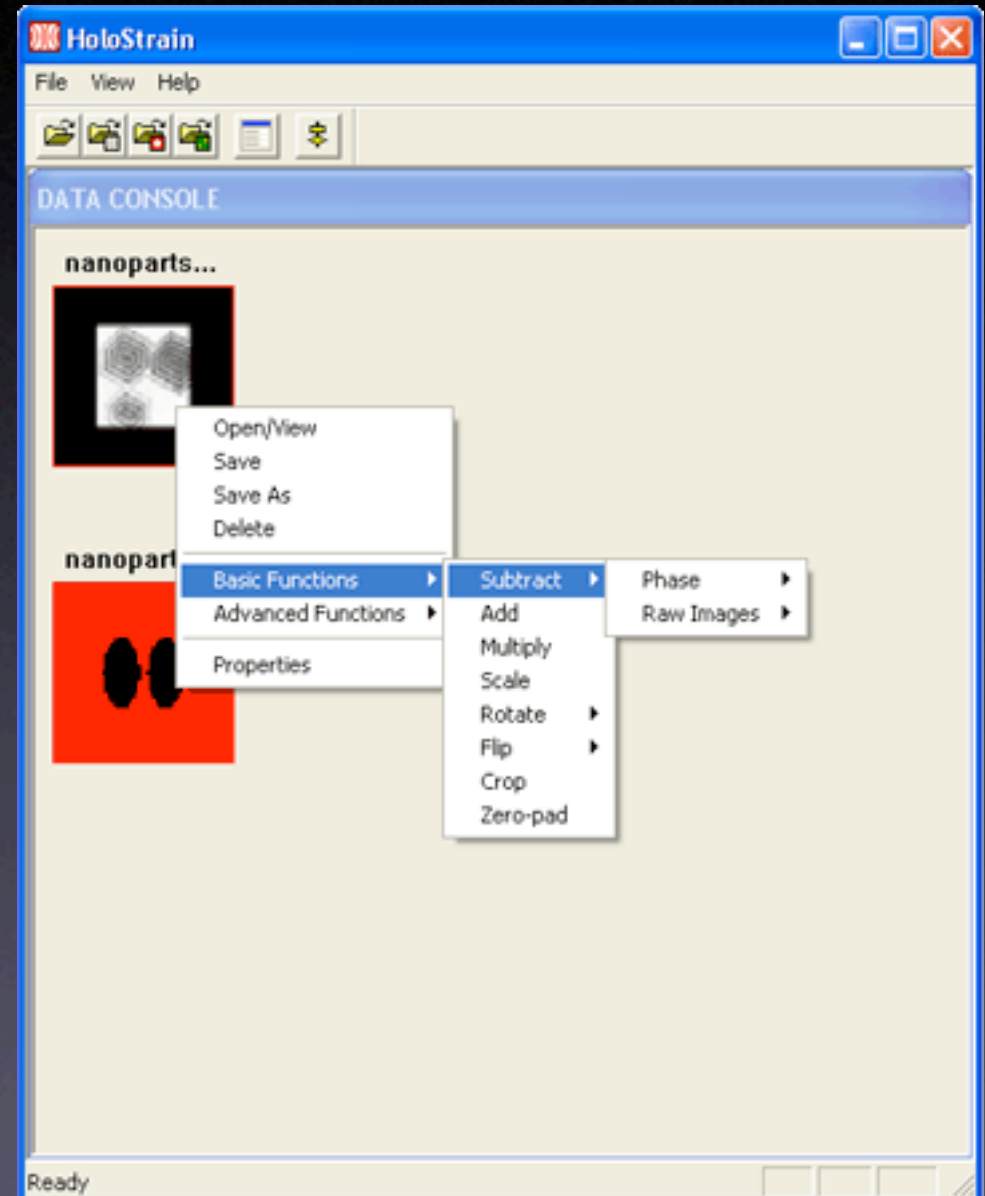
# Walkthrough of Holostrain<sup>tm</sup> 2 of 8

- Image Viewer
- Twice phase-amplified Interference micrograph of magnesium-oxide particles
- The phase-amplified micrographs shows a detailed thickness distribution.
- From this screen you are able to draw image masks and do a number of image enhancement functions that enables you to obtain final contouring results



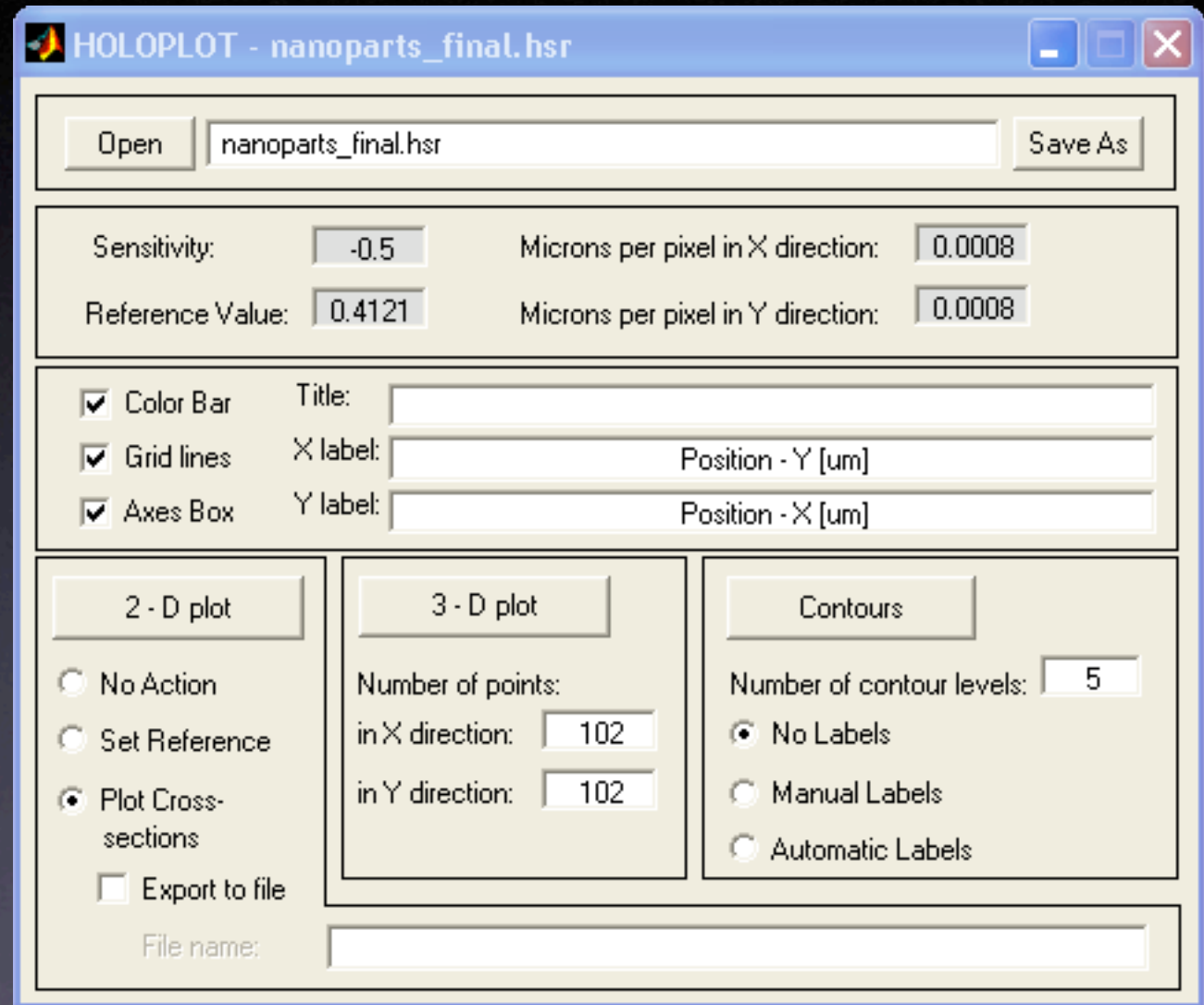
# Walkthrough of Holostrain™ 3 of 8

- **Imaging Functions**
- Simply right click on an image to obtain all the functions available for image analysis
- You are also able to select multiple images and perform functions on them as a group
- The newly generated images appear to the right of the original images in the same workspace



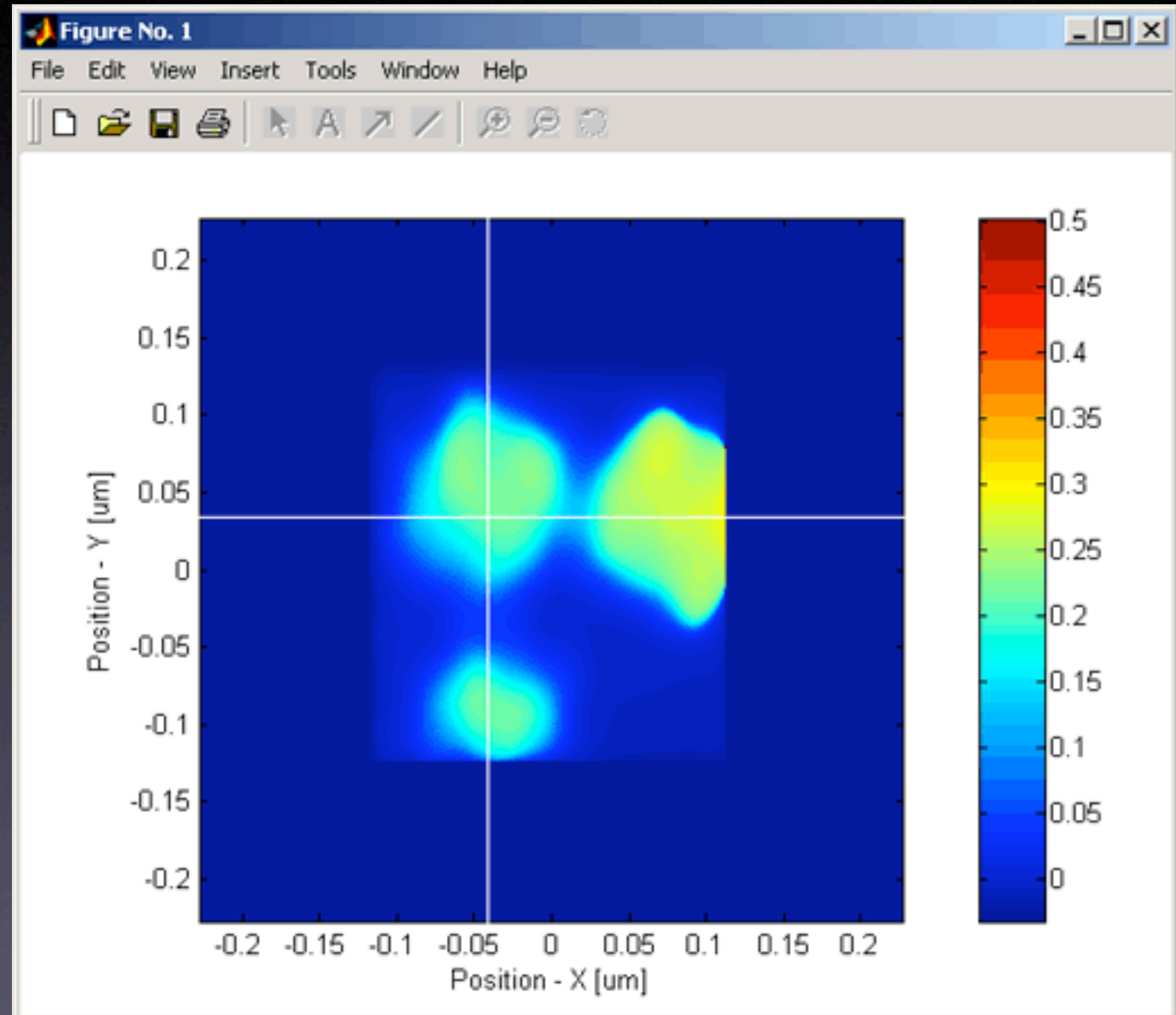
# Walkthrough of Holostrain<sup>tm</sup> 4 of 8

- **Holoplot<sup>tm</sup>**
- Holoplot<sup>tm</sup>, is a subroutine built using matlab as the GUI interface
- Holoplot<sup>tm</sup>, with quick and seamless execution converts image data into 2D/3D visualizations



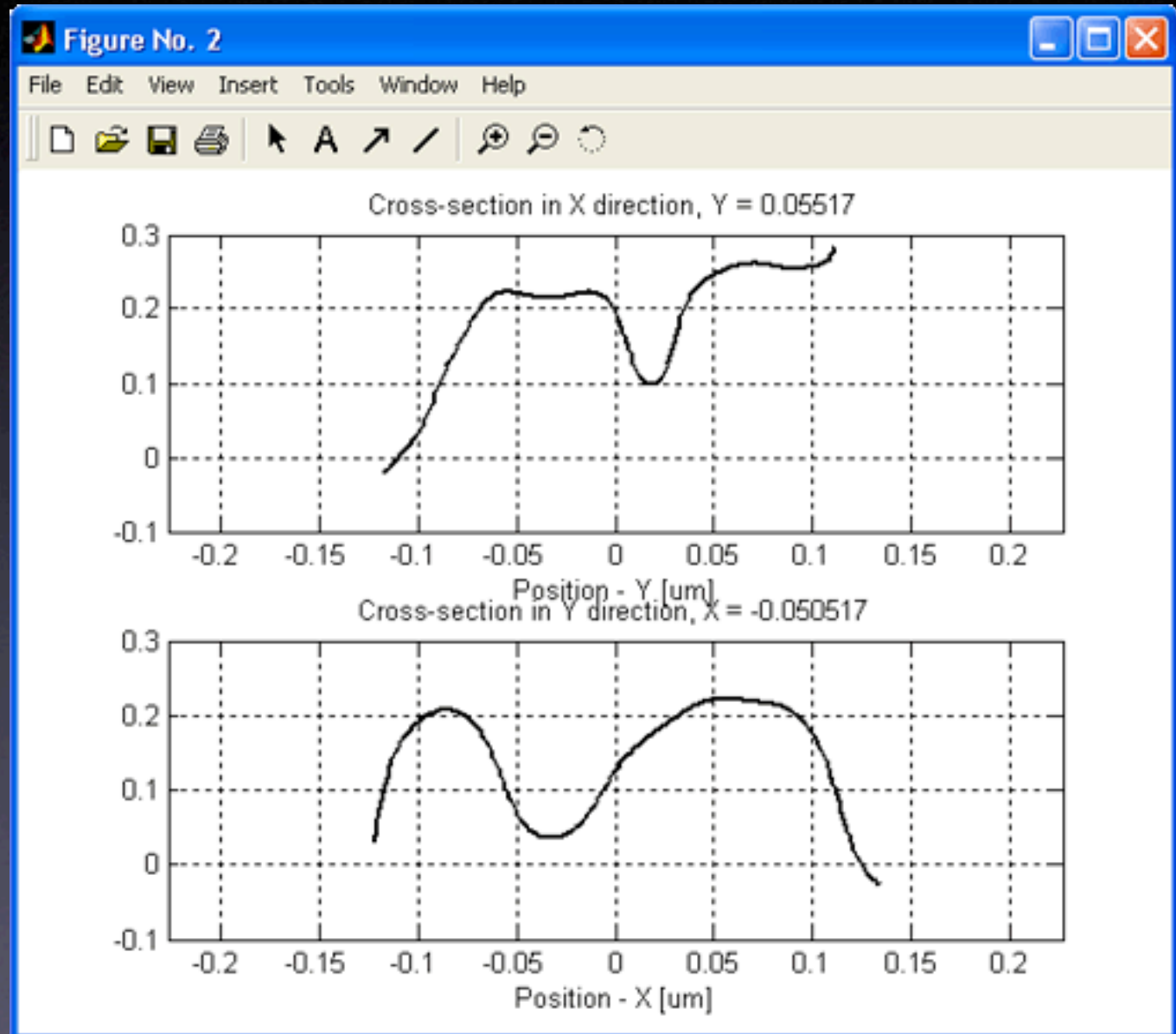
# Walkthrough of Holostrain<sup>tm</sup> 5 of 8

- 2D Visualization
- This is a 2D representation of the previous phase amplified phase image after processing with holostrain (values are in microns - 0.1  $\mu\text{m}$  is 100 nm)
- Holostrain<sup>tm</sup> is able to derive high-precision surface contouring information as well as stress/strain and displacement data



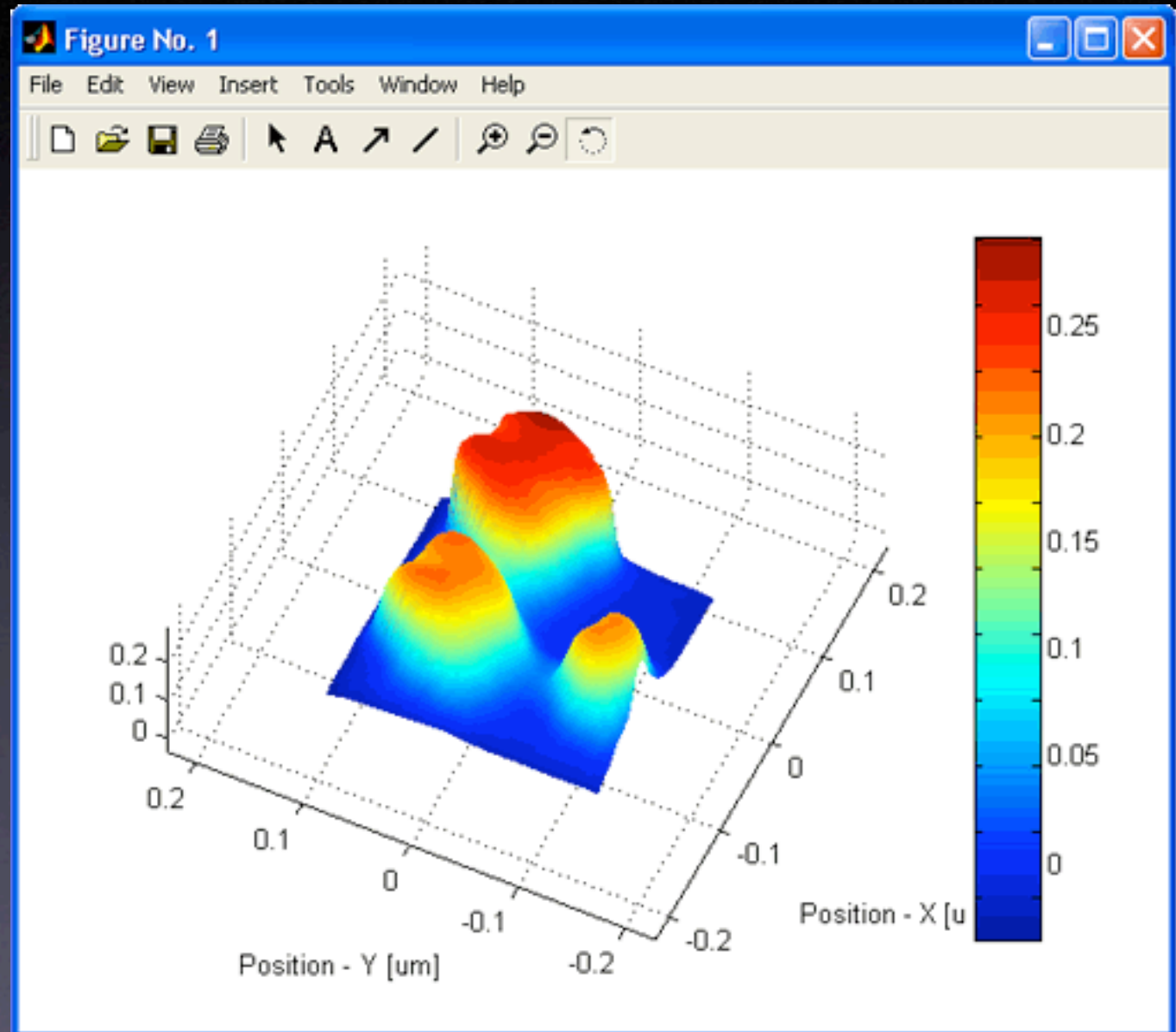
# Walkthrough of Holostrain<sup>tm</sup> 6 of 8

- **2D Visualization**
- These plots represent the cross section that is chosen by positioning crosshairs in the desired location (as seen in the previous slide)
- The data from these plots can be saved for into a file for later use



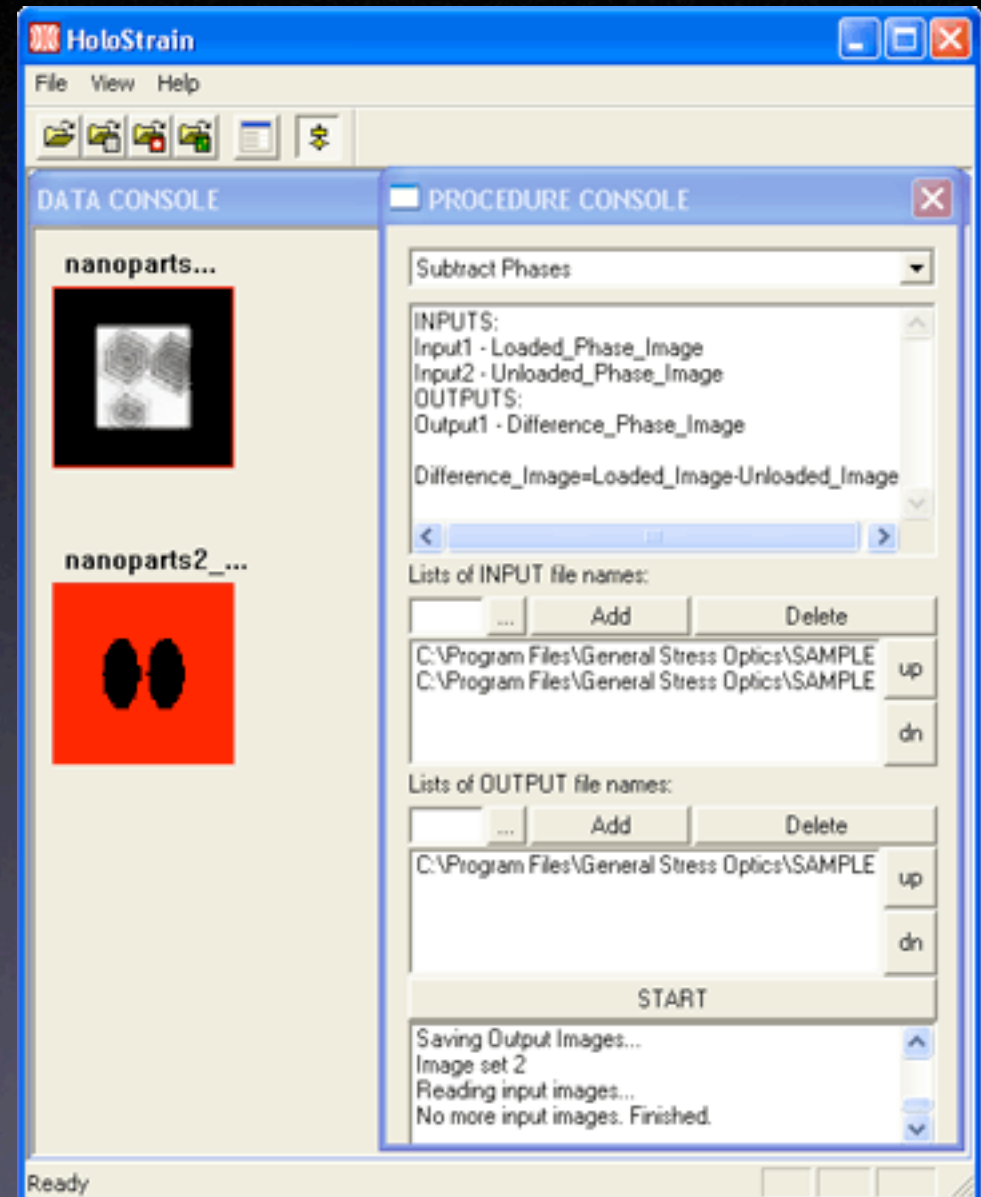
# Walkthrough of Holostrain<sup>tm</sup> 7 of 8

- **3D Visualization**
- This 3D plot shows Holostrain's <sup>tm</sup> capability to derive precise 3D contouring data at the nanoscale level
- Holostrain <sup>tm</sup>, can also derive an equally high-level of stress/strain and displacement data under a wide-range of illumination and experimental set-ups



# Walkthrough of Holostrain<sup>tm</sup> 8 of 8

- Procedure Console
- The 'procedure console' comes with the most common procedures combined into macros
- This allows you to obtain your results even faster
- Using the 'procedure console' you can automate the analysis in many real-world process work flows, not needing to have experts conduct the analysis



# Holostarin<sup>tm</sup> New Features

- We are developing image analysis tools that will allow you to set limits and thresholds or image matching to speed up analysis in a continuous workflow
- We continuously adding new macros for the procedure console to cover the largest variety of imaging problems

# Partner Initiatives & Customers

- GSO is working closely with a number of partners to develop best practice with our set of tools
- Illinois Institute of Technology
- Polytechnic Institute of Bari, Italy
- Alion Science and Technology
- In addition to selling **Holostrain tm software**, General Stress Optics offers two other services for our clients. Our **consulting services** provide companies with immediate results. We also custom build **dedicated applications** for your specific industrial or research needs.

# The Need for Holostarin<sup>tm</sup>

- Nanotechnology-based industry requires the development of **highly capable, low-cost, reliable instrumentation** for the measurement of nanoscale phenomena
- **Holostrain tm**, provides a strong metrological underpinning to better characterize nanoscale structures, materials, and processes.