

NIF

National Ignition Facility & Photon Science  
Bringing Star Power to Earth

## Advanced Optical Components & Technology

### Tools

PS&A has developed and procured a variety of unique tools for the fabrication and metrology of very large diffraction gratings:

#### Meter-scale Reactive Ion Milling

PS&A's reactive ion-beam etcher can transfer etching submicron patterns onto surfaces as large as 1 x 2 meters.

#### Meter-scale Submicron Holographic Exposure Stations

PS&A maintains three holographic-exposure facilities, with 109-, 80, and 30-cm-diameter collimating lenses for writing plane-grating at apertures from 50 to 1000 mm.

#### Modeling and Design

Design codes are employed to evaluate the performance of metal or dielectric gratings in monolithic substrates or multilayer stacks.

Design codes for generating continuous, binary or multilayer, kinoform phase-plates for beam shaping are also available.

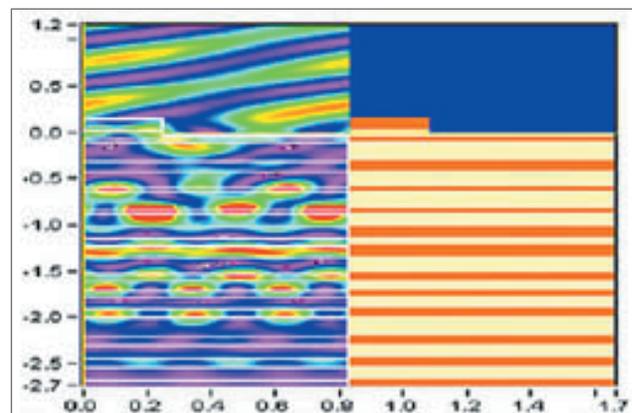


Continuous, 30-mm, square phase-plate design for NIF 500-micron spot.

Designs can be output in Gerber, Zernike, bitmap, or other file formats for maskwork generation.



A Linear RF ion source mounted to a center door provides a collimated beam that is 1.1 meters long and 10 cm wide; patterned optics are rastered back and forth across the beam from left to right.



Electric field distribution in an MLD grating structure.

NIF&amp;PS

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## Advanced Optical Components & Technology – Tools

### Metrology and Characterization

PS&A innovations in beam metrology and characterization include:

- Atomic-force microscopy, capable of submicron CD measurements on meter-diameter parts
- Thin-film and transmission spectrophotometers
- Scanning-electron microscopes
- 18-inch, phase-shifting, 632-nanometer interferometer for wavefront measurement
- 32-inch, polarization-shifting, 1-micron interferometer for wavefront measurement
- Scanning photometry for meter-sized optics at various wavelengths.

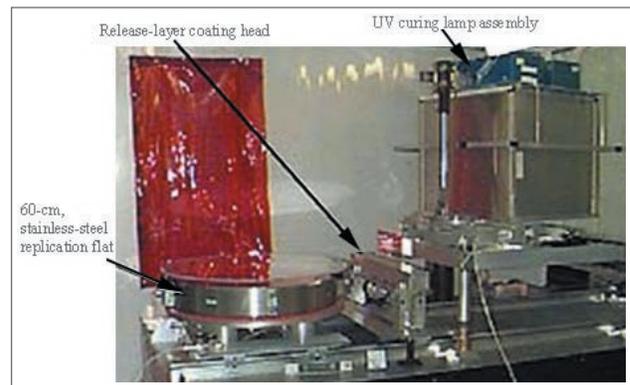


Large-scale, atomic-force microscope capable of nondestructive, critical-dimension measurement of submicron structures on surfaces as large as five hundred by one thousand millimeters.

### Wet-processing Equipment

PS&A's Meniscus coater can apply precision photoresist-films on substrates as large as 1 x 0.8 meters. The coater also:

- Minimizes coating fluid usage
- Results in no edge bead
- Typically produces film uniformity of 3%.



### Replication Facilities

The integrated replication station is used for coating release layers, and can emboss, cure, and release UV-curable, freestanding or attached optical films of up to 50 cm in diameter.