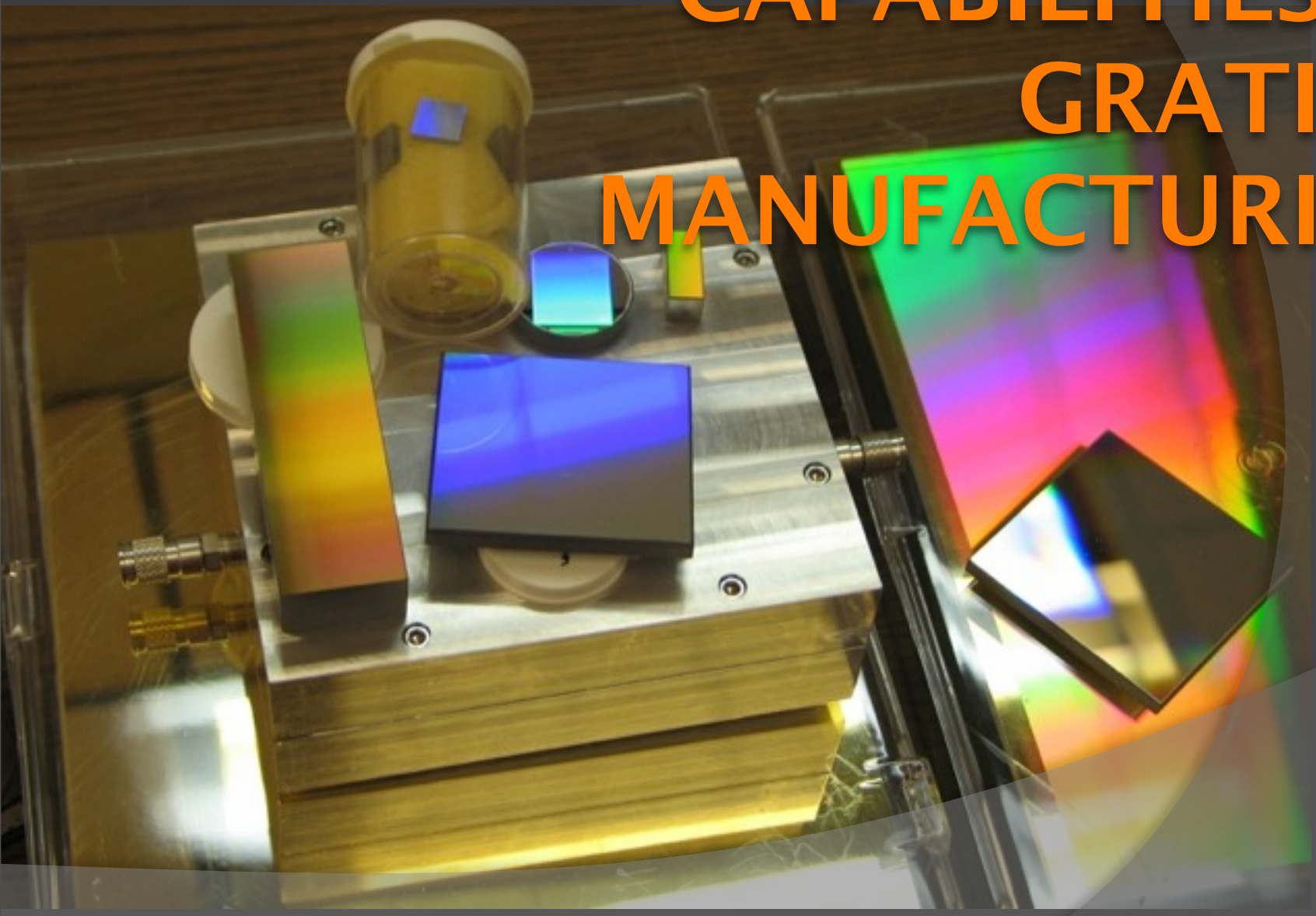
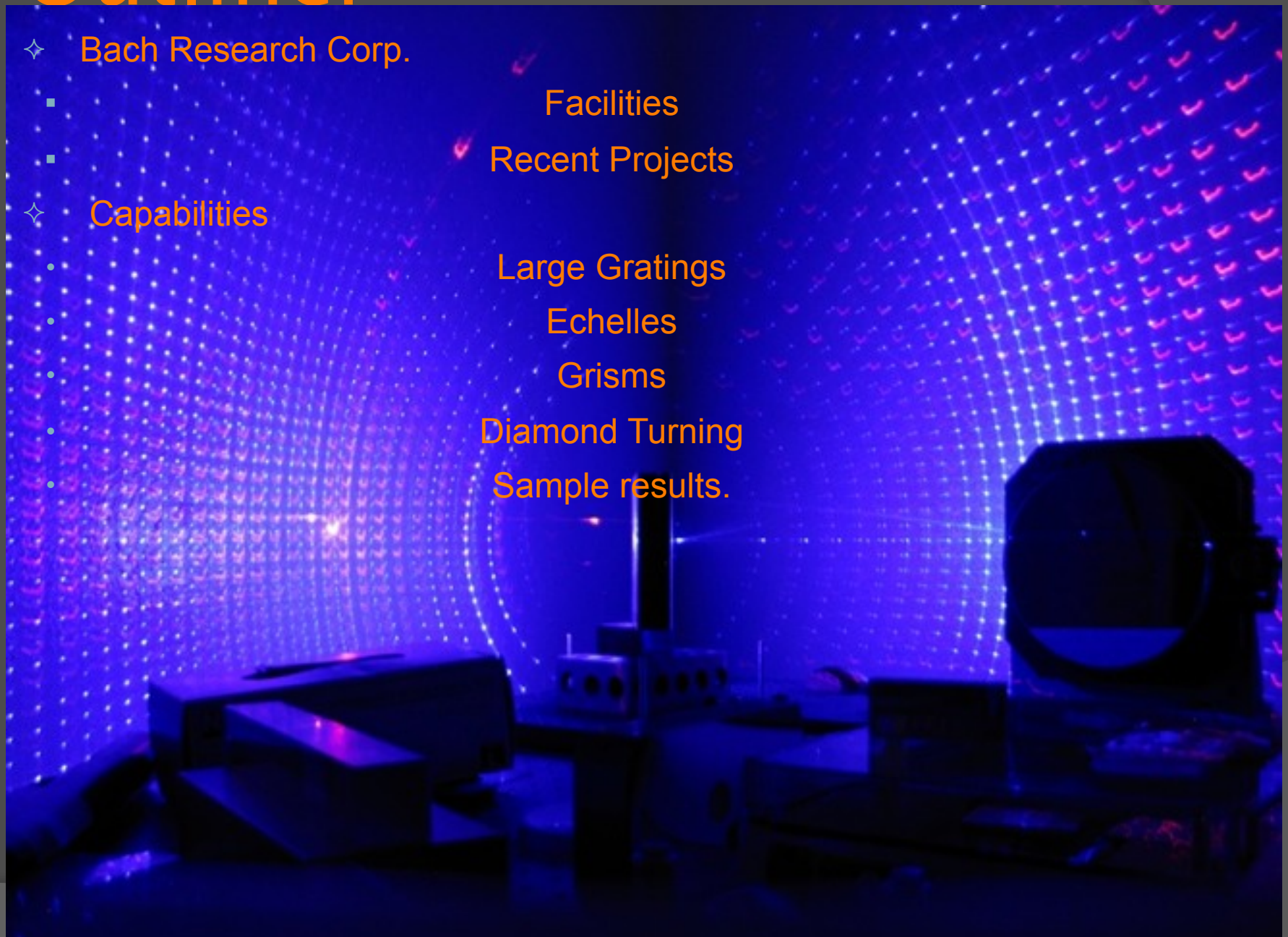
Bach Research Corporation

CURRENT CAPABILITIES IN GRATING MANUFACTURING



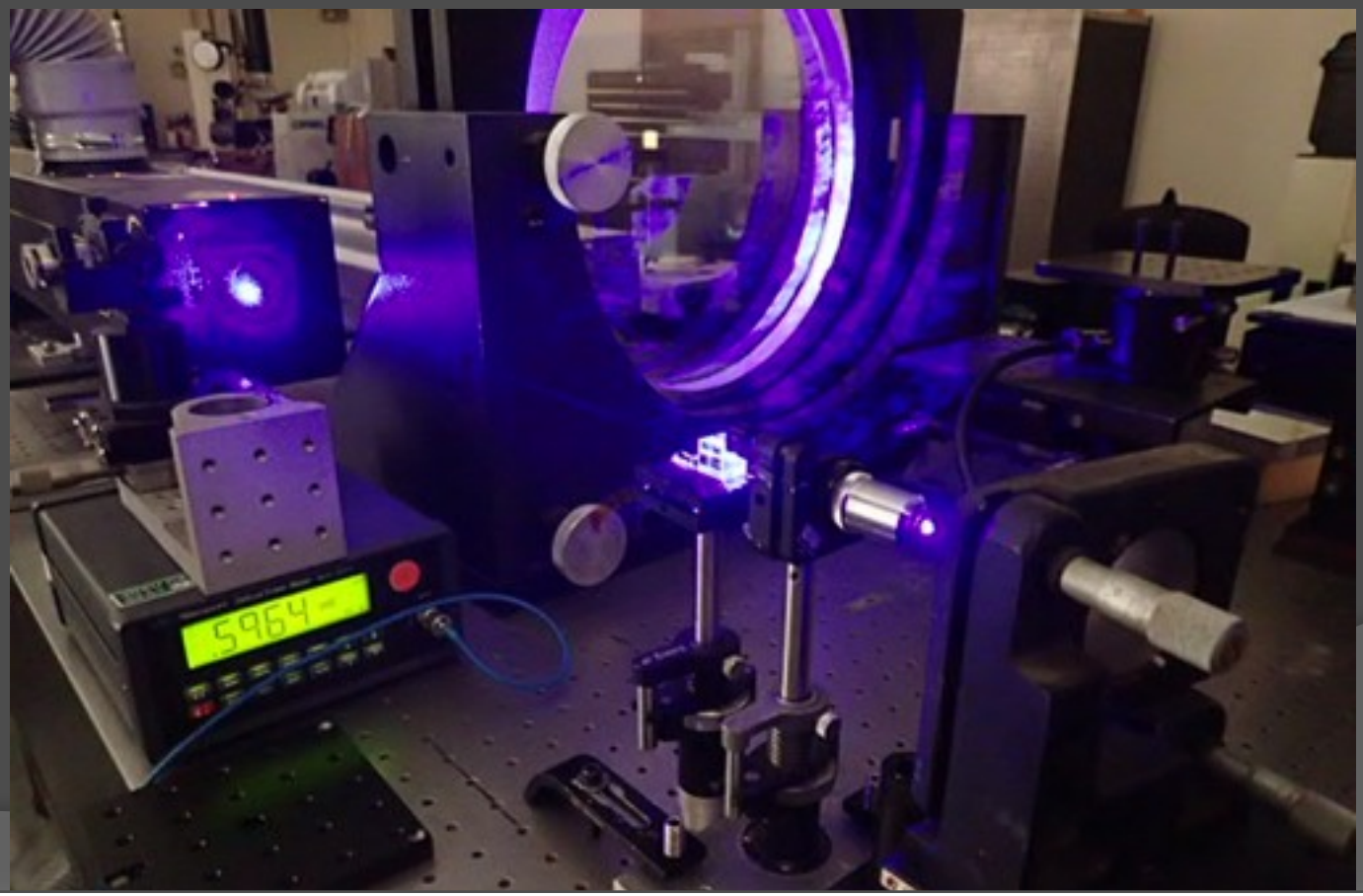
Outline:

- Bach Research Corp.
  - Facilities
  - Recent Projects
- Capabilities
  - Large Gratings
  - Echelles
  - Grisms
  - Diamond Turning
  - Sample results.



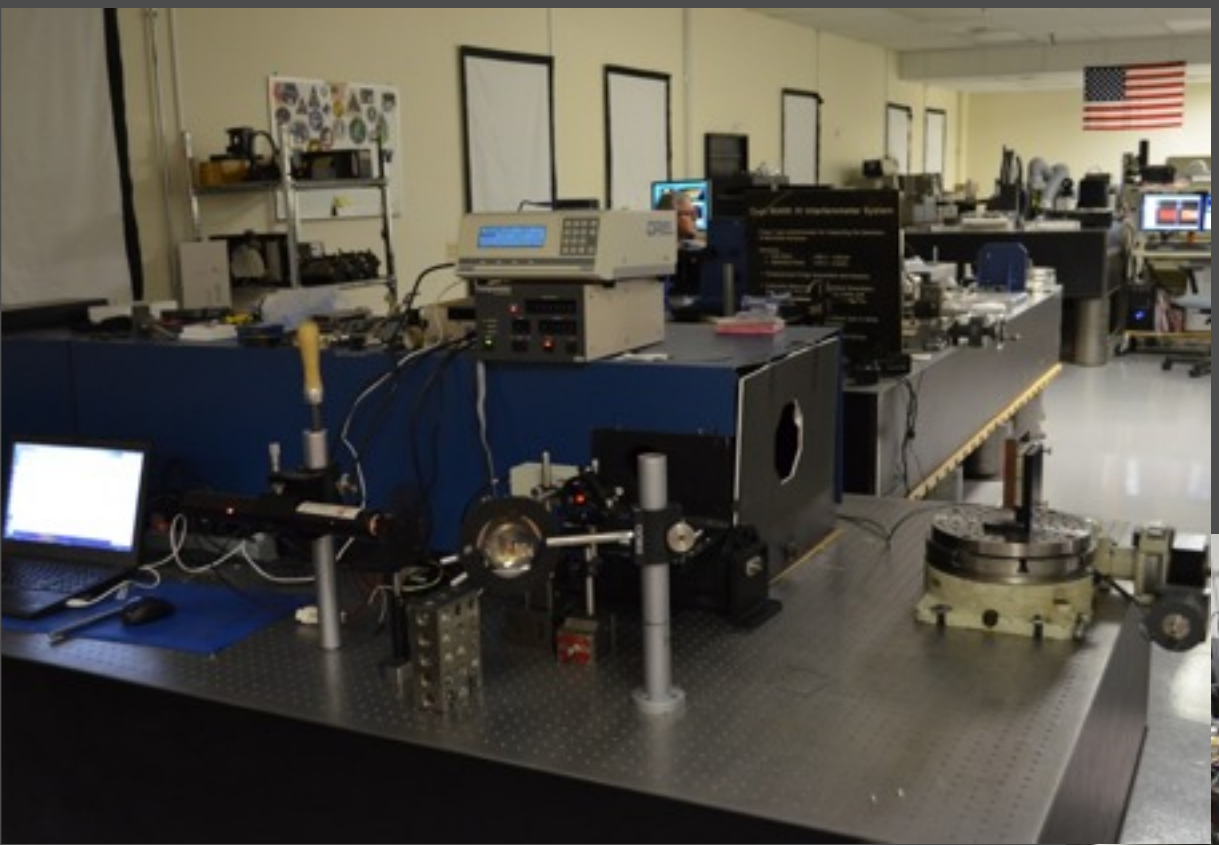
Facilities

- 20,000 sq. ft. facility
- Coating Laboratory: 6 vacuum chambers up to 32” aperture, PVD and electron gun sources
- Diamond Turning: 5 turning lathes up to 36” in diameter
- 6 ruling Engines : Geared for specific types of gratings IR- UV. Curved surfaces (23mm radius to plano.) Variable blazed and VLS gratings

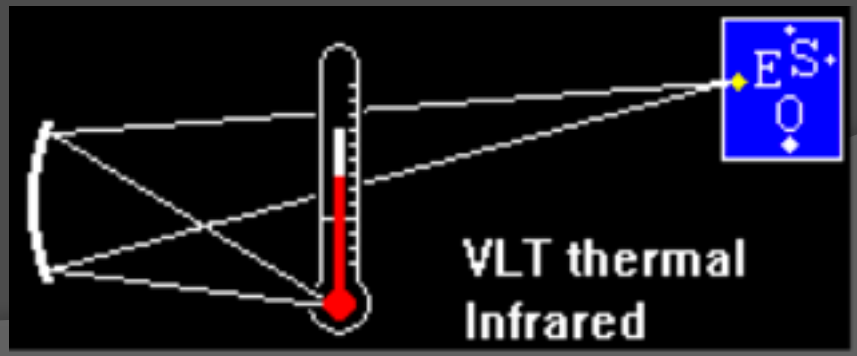


Facilities

- Ruling Laboratory: 6 ruling engines and associated replication facilities
- Metrology Laboratory: AFM, surface roughness, Wavefront testing, efficiency testing (um to nm)



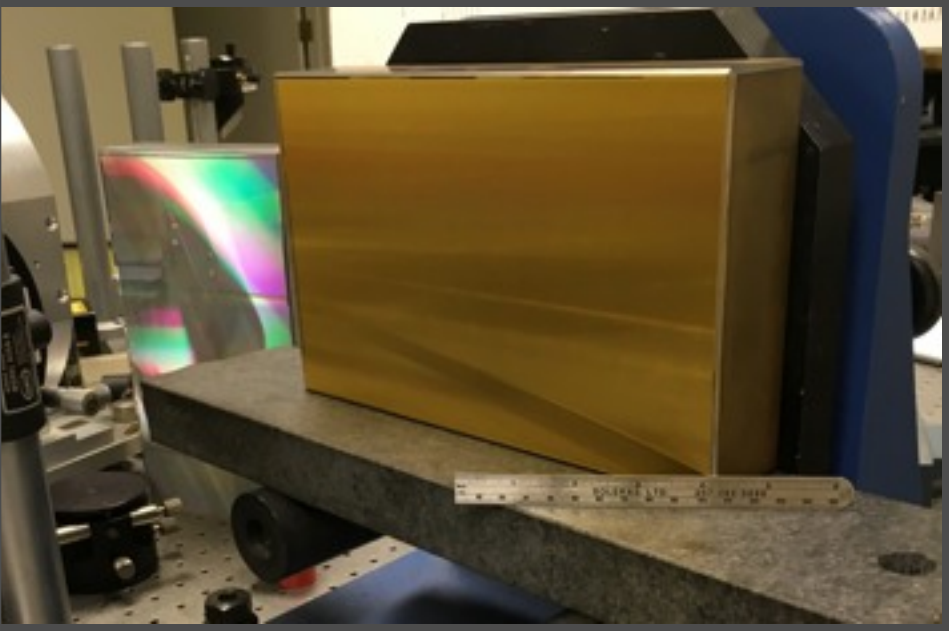
Past Projects

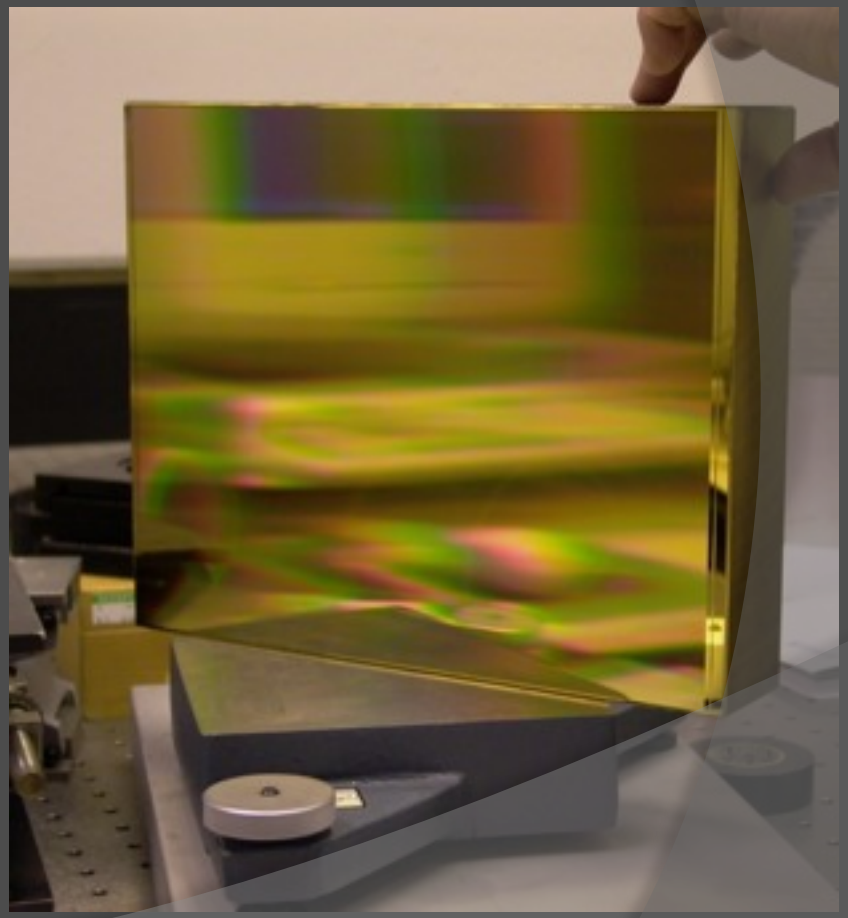


Large Gratings

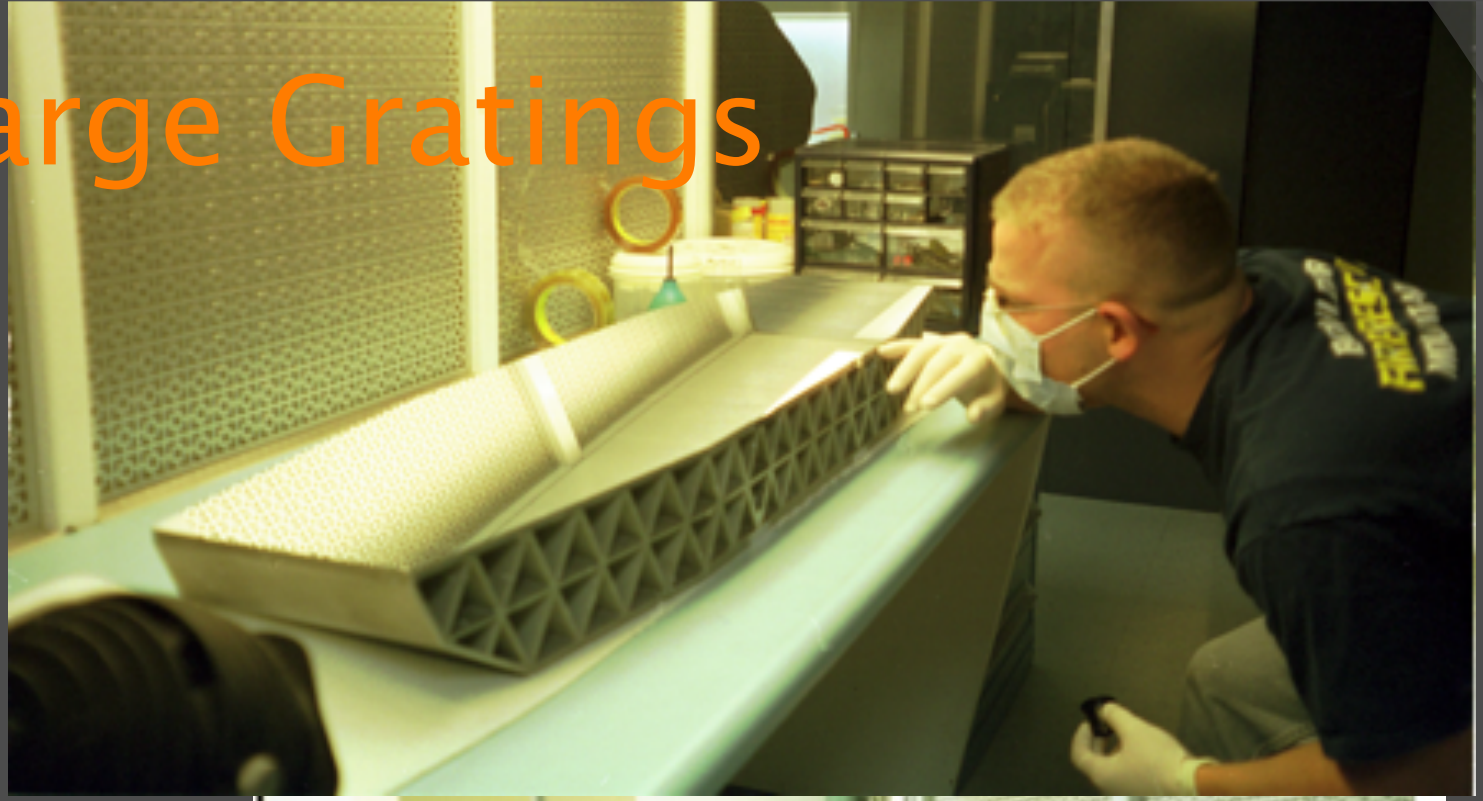
- Typical Dimensions:
  10^2 x 10^2 mm
- Up to 1200mm
- Typical Line Densities:
  10^2 – 10^3 /mm

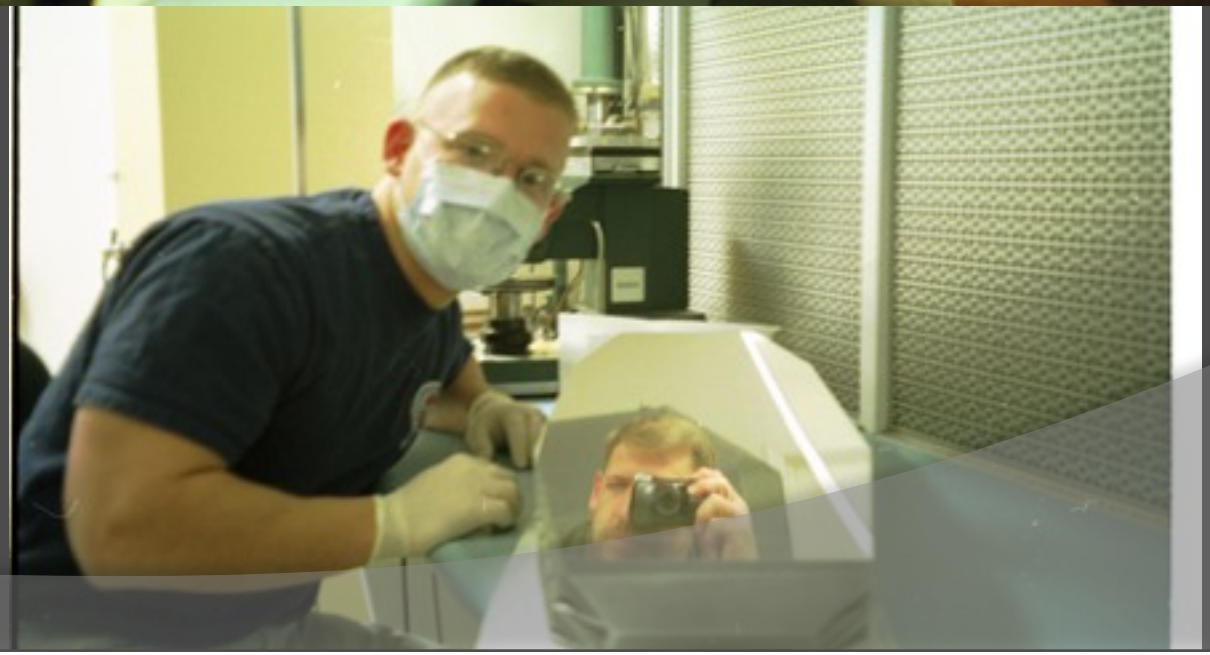
- Efficiency:
  80%< % Eff.
- Wavefront:
  λ/10





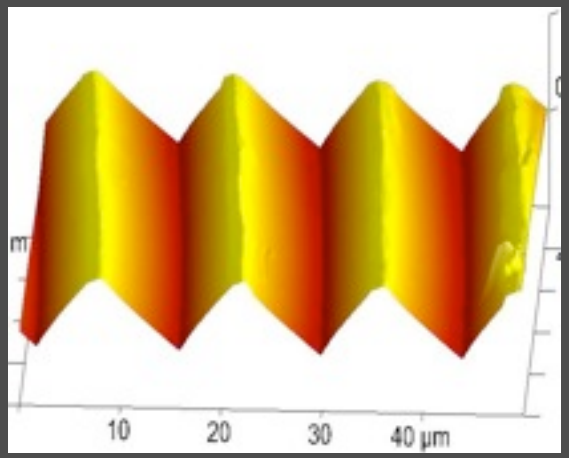
Large Gratings

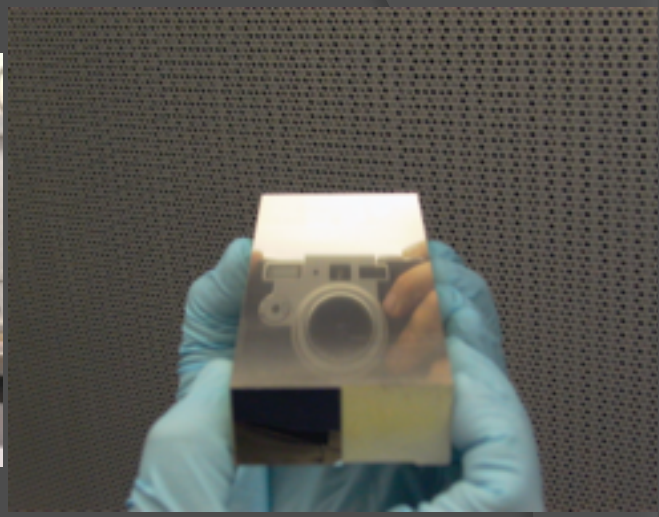


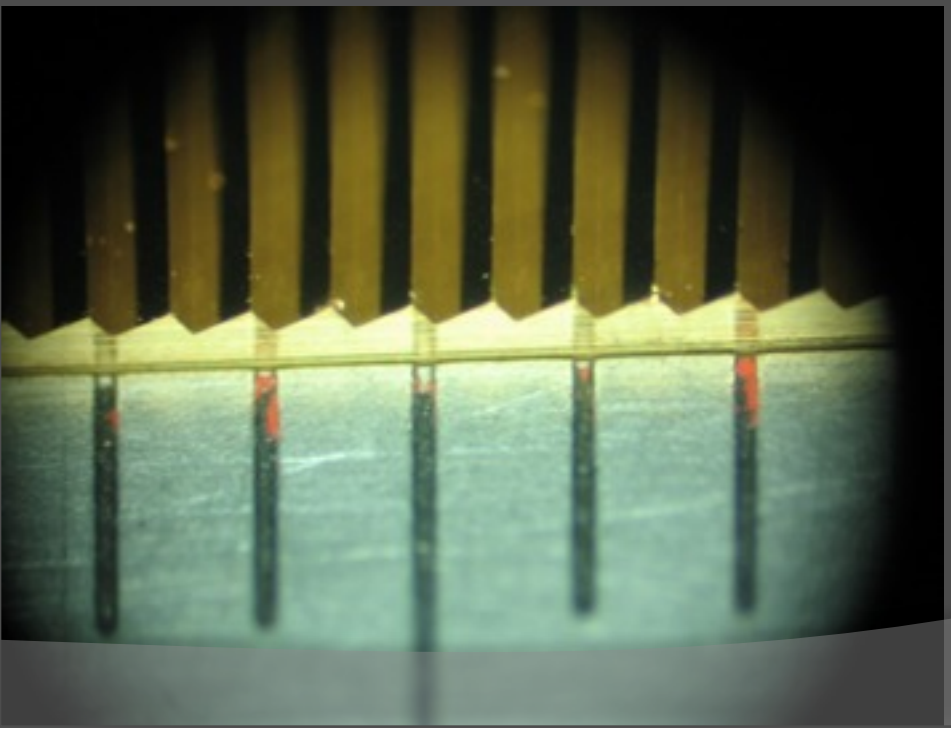


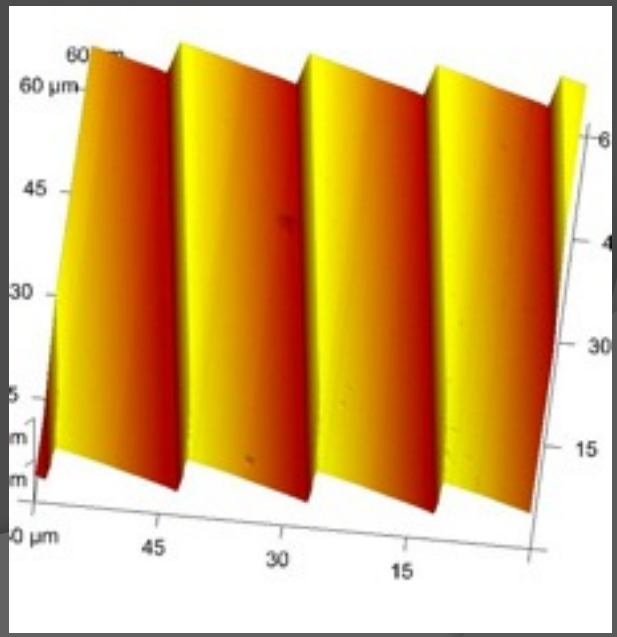
Mechanically rule vs Diamond Machined gratings

- Burnished material vs Removal of Material.

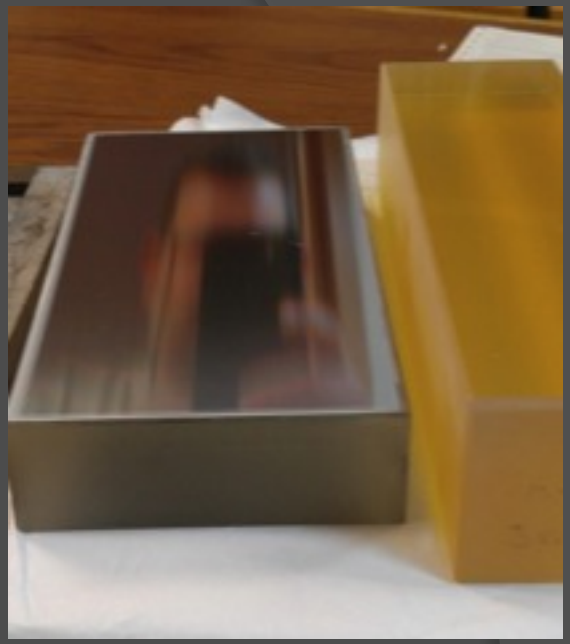


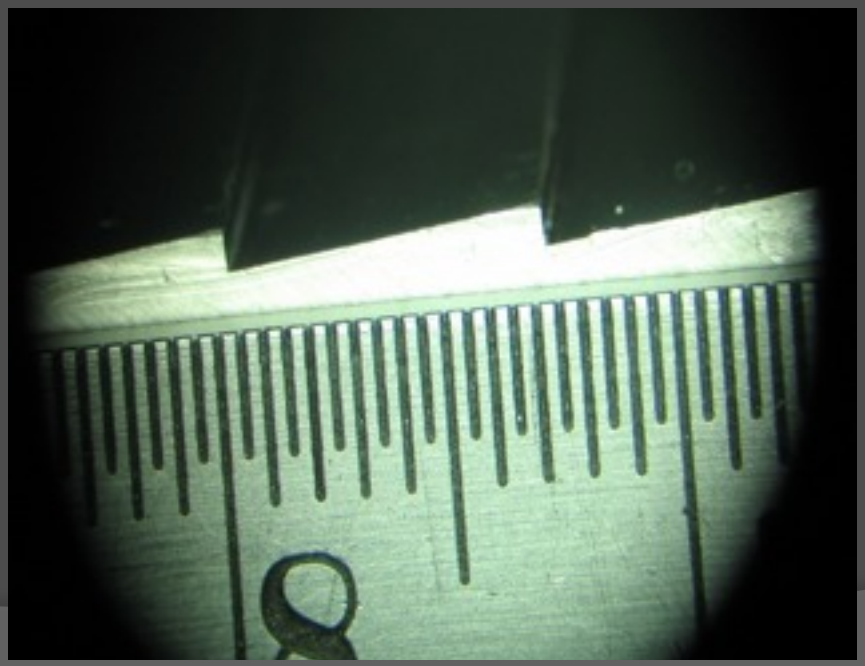


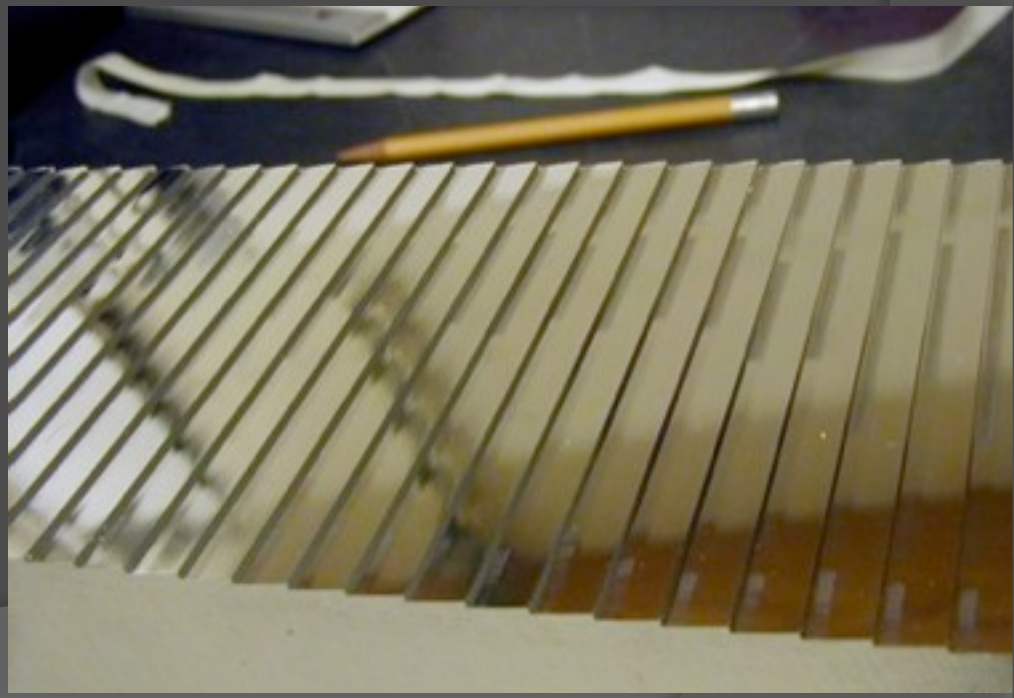




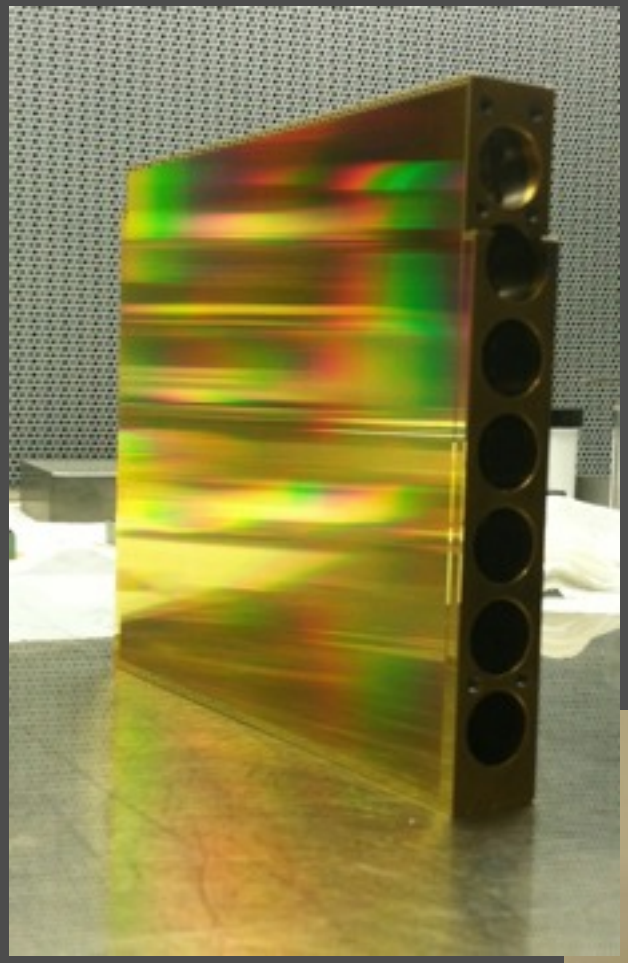
Echelles & Echelons

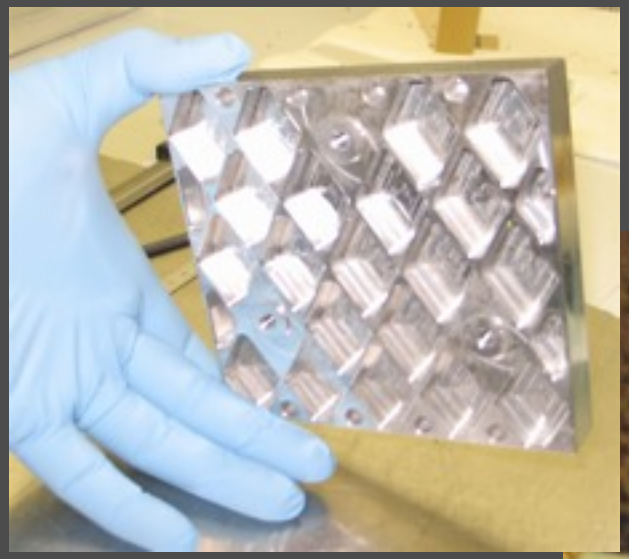


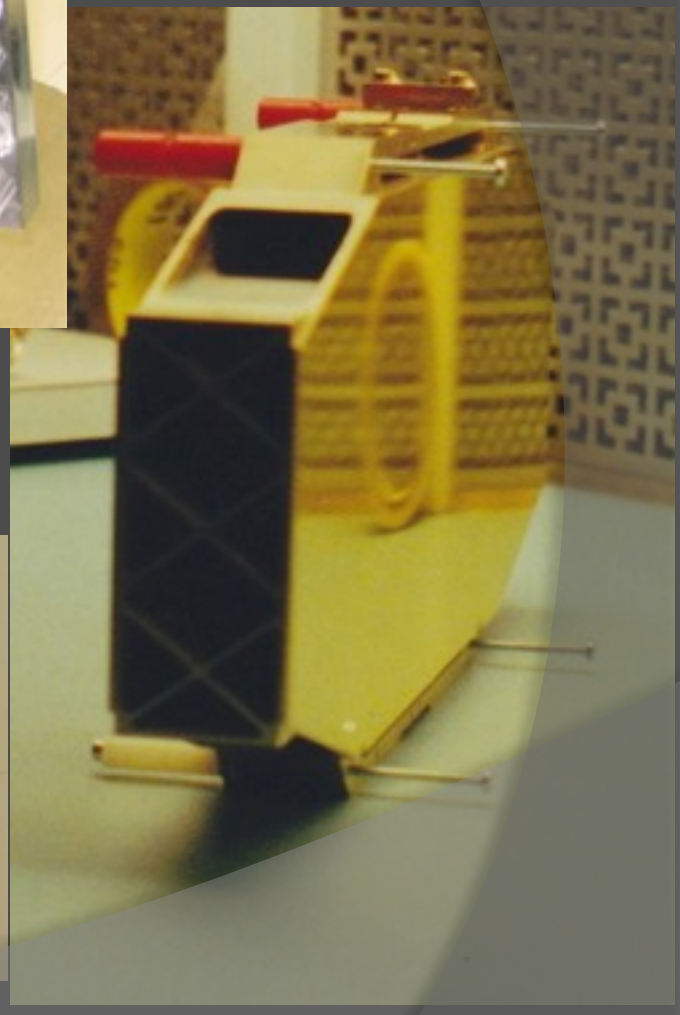




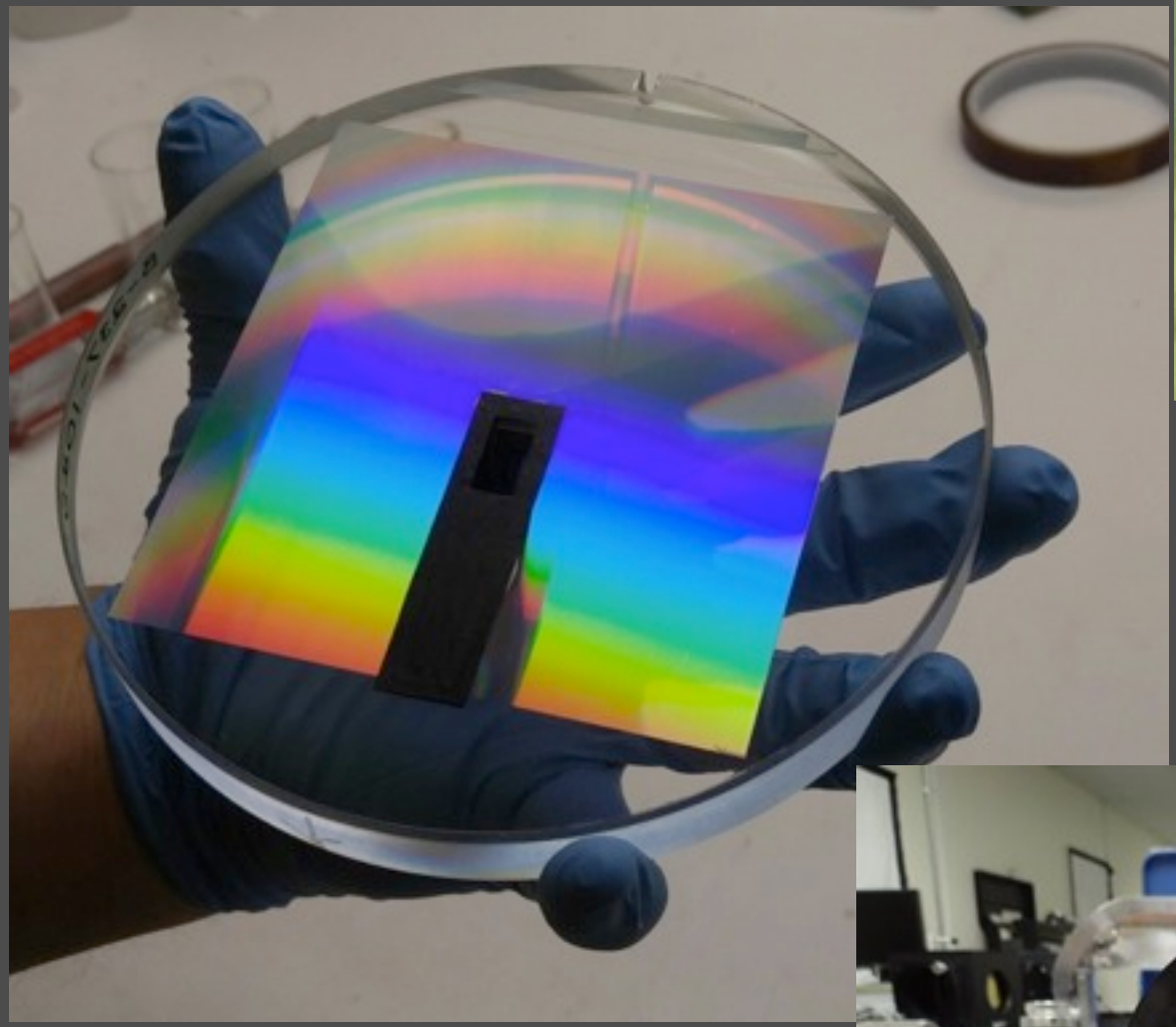
Light weighted substrates & replicas

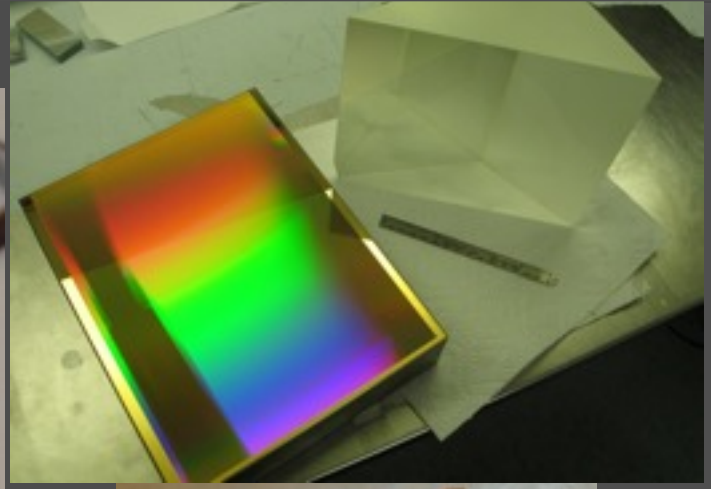


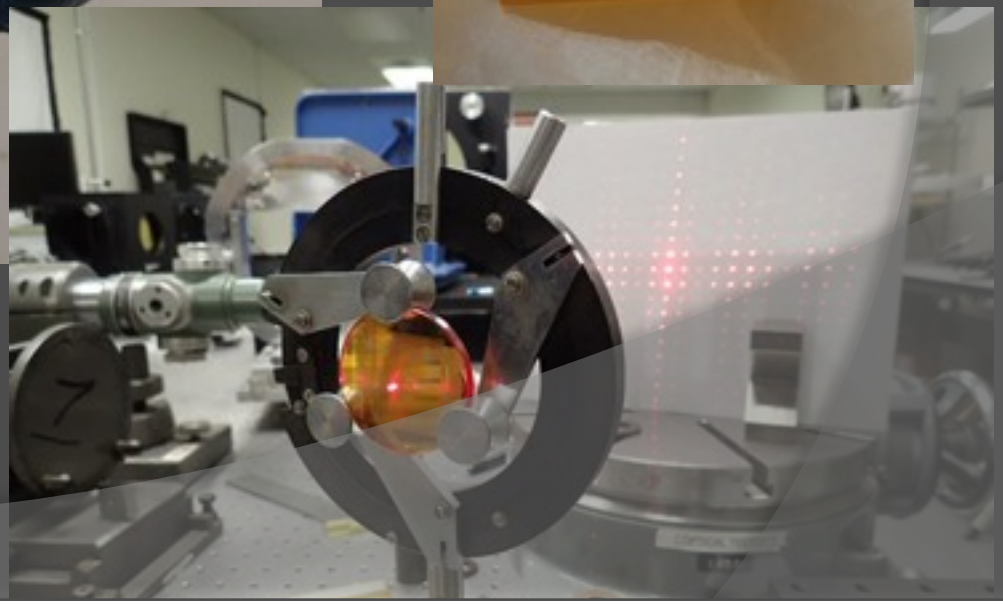




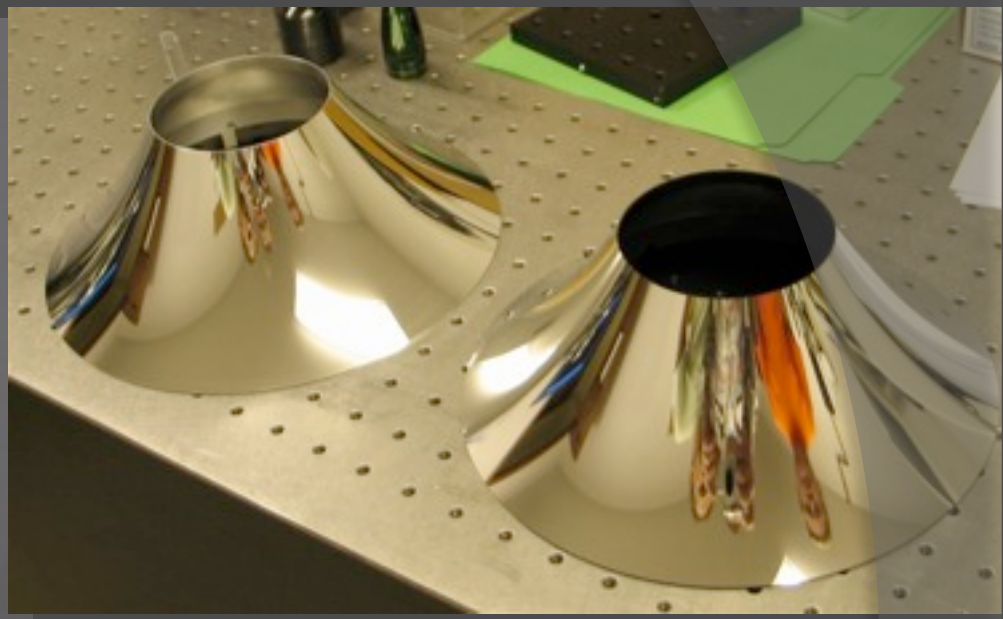
Transmission Gratings & Grisms

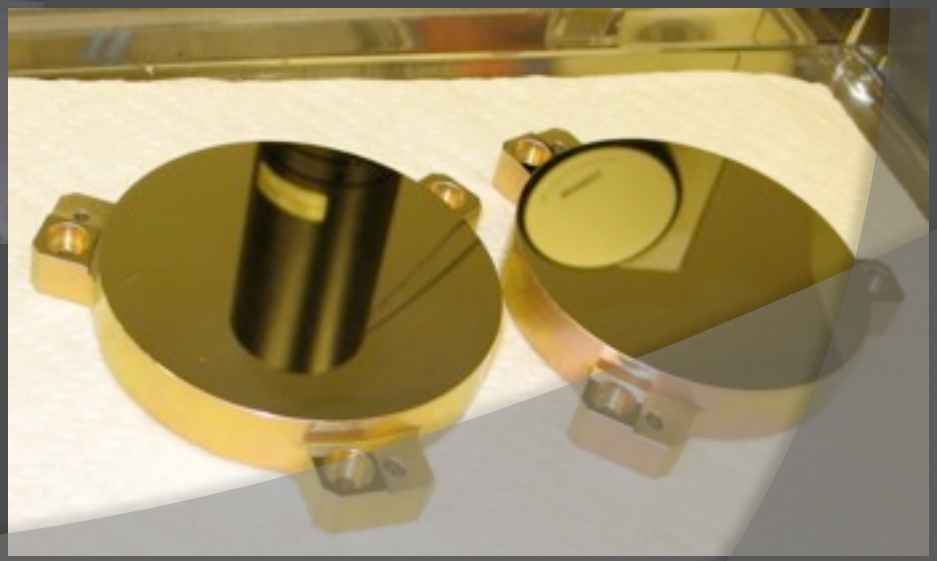






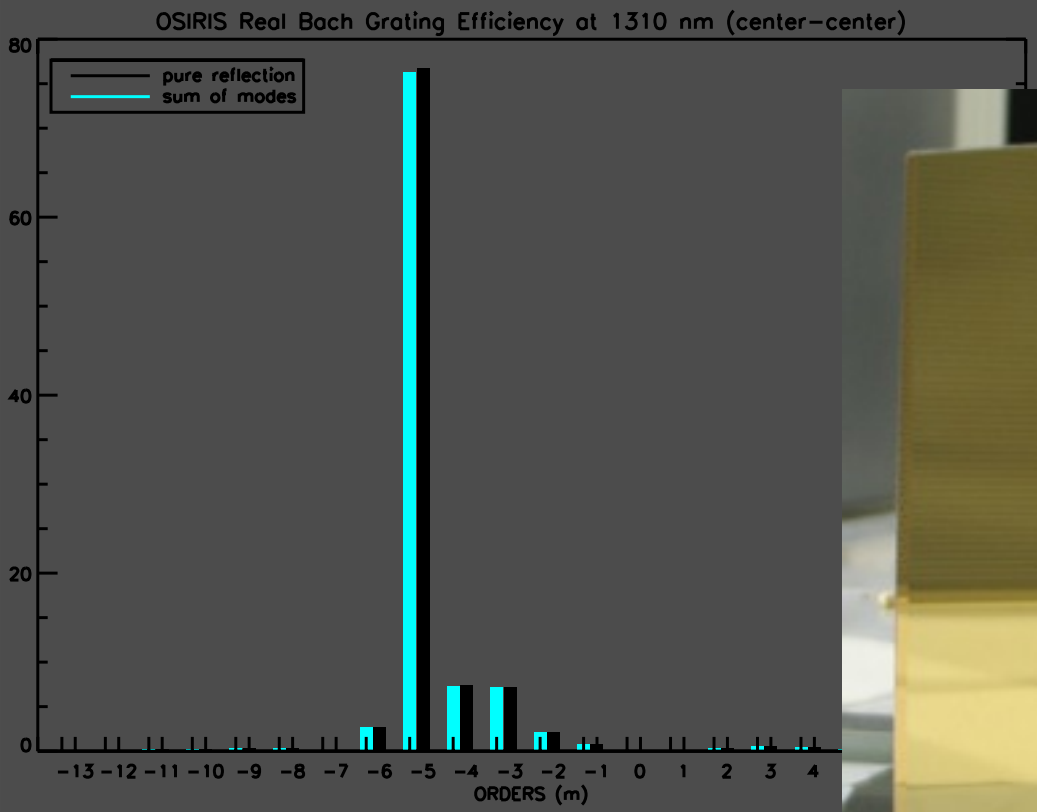
Diamond Turning

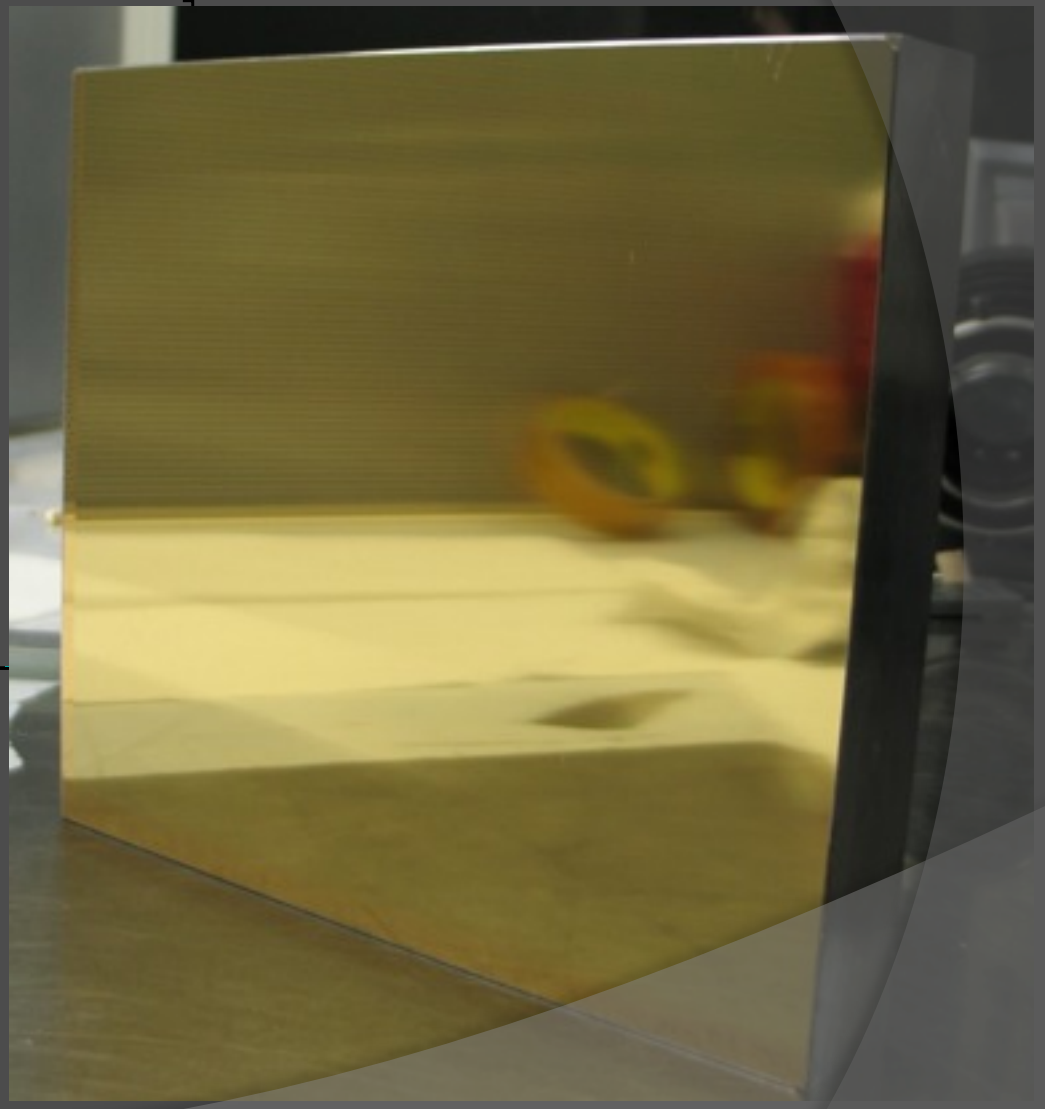




Sample results.

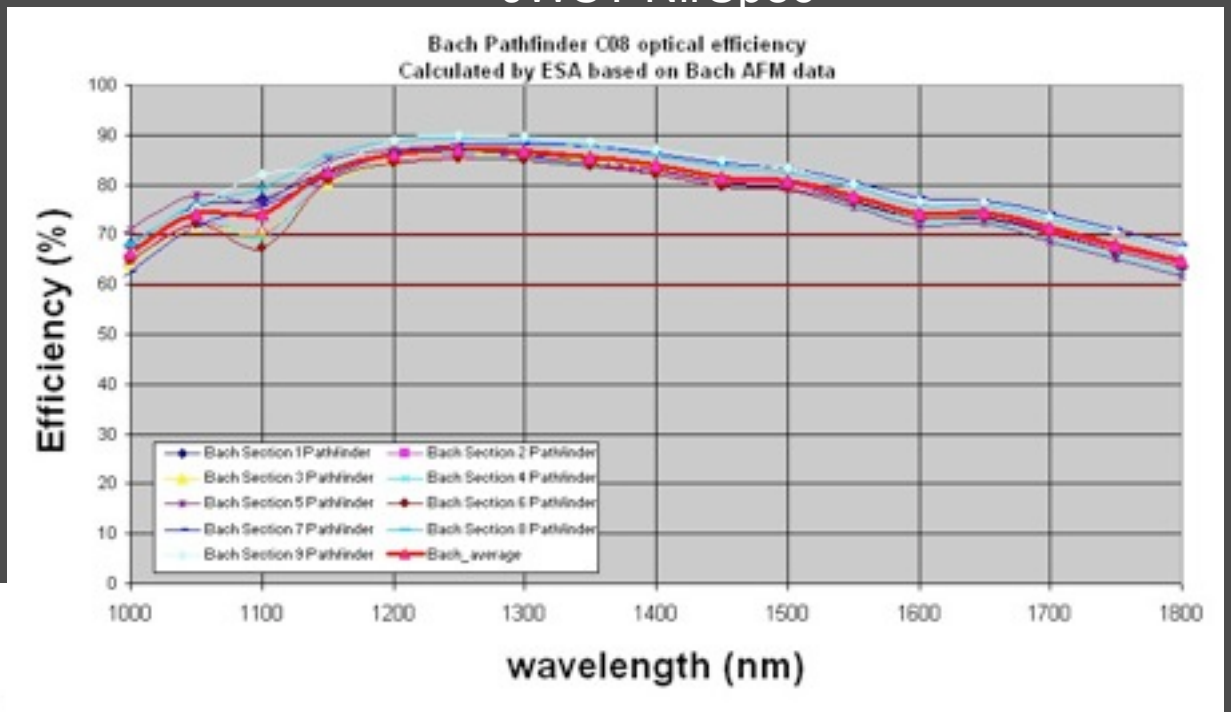
OSIRIS

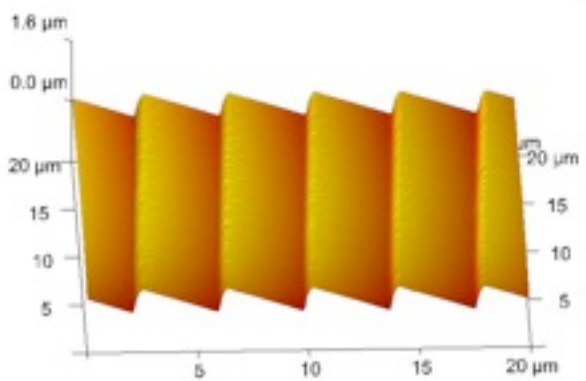


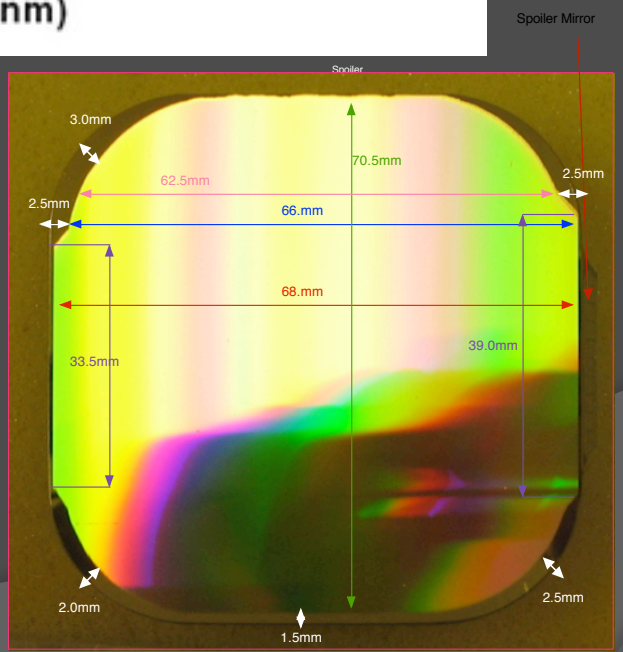


Sample results.

JWST NirSpec







Thank you

Bach Research Facilities:
20,000 sqft; Office, Manufacturing areas; Coating,Ruling and Diamond turning / Testing areas/ Machine shop/ Clean room and storage.

Coating Laboratory: 6 coating chambers (cryo pumped and diffusion pumped)
Material deposited: AU, AL Chromium, Nickel, Rhodium, Platinum, Iridium, Osmium,

Diamond Turning Laboratory: 5 single point diamond turning lathes. 36" plano apertures, curves, spheres. Materials, AL, Cu, ZnSe, Germanium.

Ruling Laboratory: 6 Ruling Engines. Each engine with it's own dedicated temperature controlled room. Ruling engines are geared and sequenced for certain designs of diffraction gratings. Wavelength coverage and groove densities vary; Far IR- Xray. Convex & Concave gratings

Lowest line spacing: 7.2millimeter per line/groove.
Highest Linespacing: 7,200 lines per millimeter.
Blaze angles: 0.1º- 90º
Largest grating manufactured: 10" x 48" AIRs Echelle NASA. Although we do have ruling engines capable of 48"x48" gratings - no customer has approached us with a requirement for that size.
Types of gratings: Type 1 Gratings, Reflection and Transmission.

(1) IR gratings/ High Laser Damage threshold gratings- Course low line density - typically under 600 l/mm and on metal substrates - Invar, Cu etc.
(2) Curved Gratings for Hyperspectral applications - Offner/ Dyson gratings. IR- UV Fastest radius ~23mm convex or concave to Plano. Spheres- toroids

Original Gratings and Replicated Gratings:

Once a Master grating is made- we can make hundreds of replica copies from that Master. (example is XXM Newton spacecraft. We replicated 448 3x6" gratings on to SiC substrates for the RGA engineering model &flight model.)

Replicated Gratings: The grating is replicated from a Master/ Original grating into an epoxy film that is over coated with a metallic coating for reflection or dielectric coating for transmission.

Testing Areas: Multiple Lasers, HeNe, HeCd, C02,Air tables.
Microscopes, Nomarskis, Interference Microscopes
12" Zygo, Wyko, AFM profilers, Spectrometers, Angstrometers.
Some projects require a specific set up to test performance. We negotiate and work with customer if they want to test at Bach or Test at customer.