FEDERAL SPACE AGENCY OF RUSSIA
Federal State Unitary Enterprise
«Scientific Research Institute
for Precise Instruments Engineering»
Saint-Petersburg branch

Narrowband holographic filter for SLR

- Airborne laser rangefinders
- Lidars
- Spacebased laser communication system
- Satellite laser ranging systems

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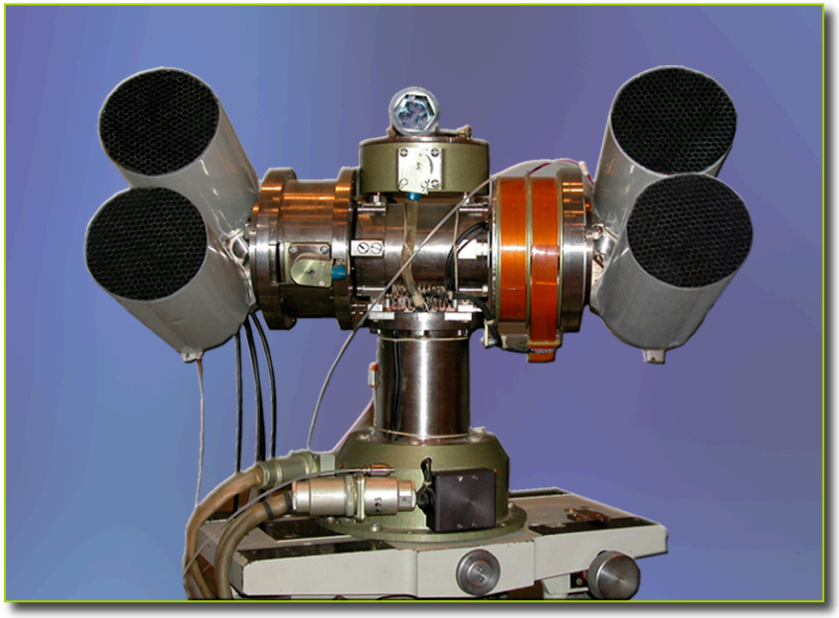

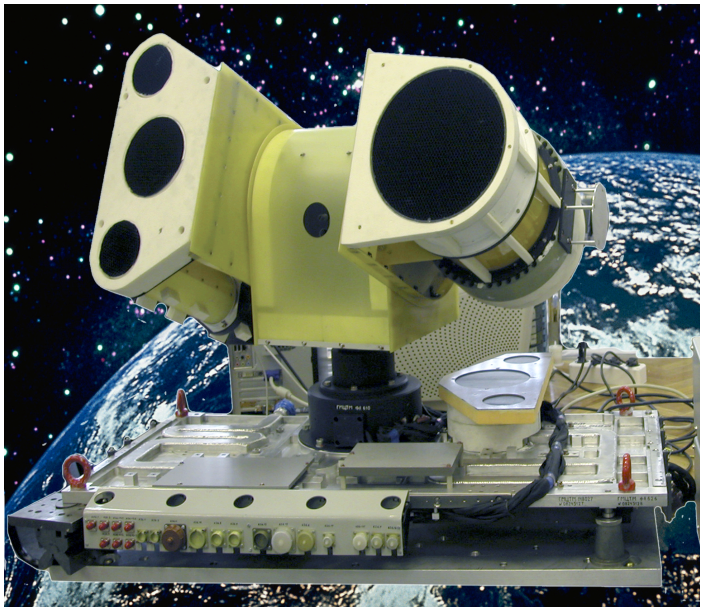

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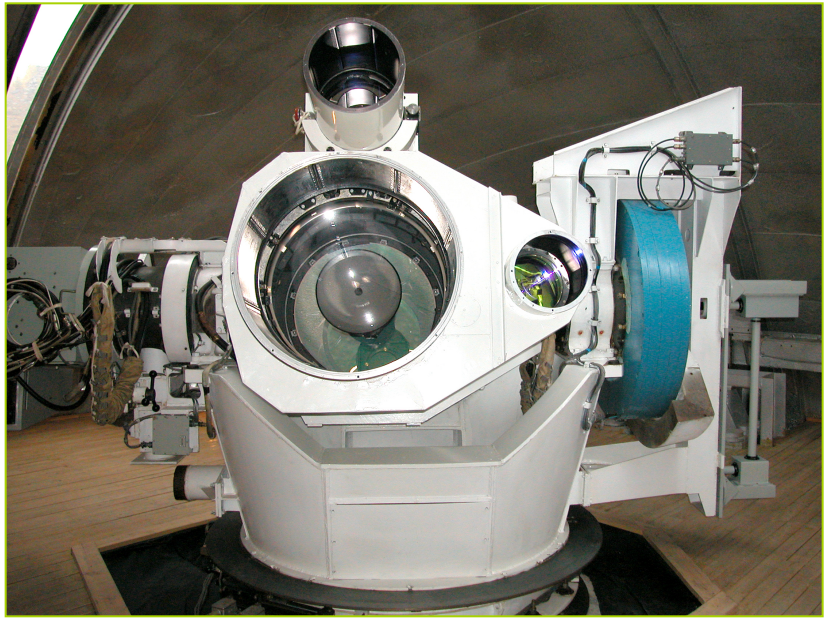


Narrowband optical selector

Requirements

- Bandwidth ~ 100 pm (1 Å)
- Efficiency > 80%
- High temporal stability
- Low temperature drift
- Reasonable cost

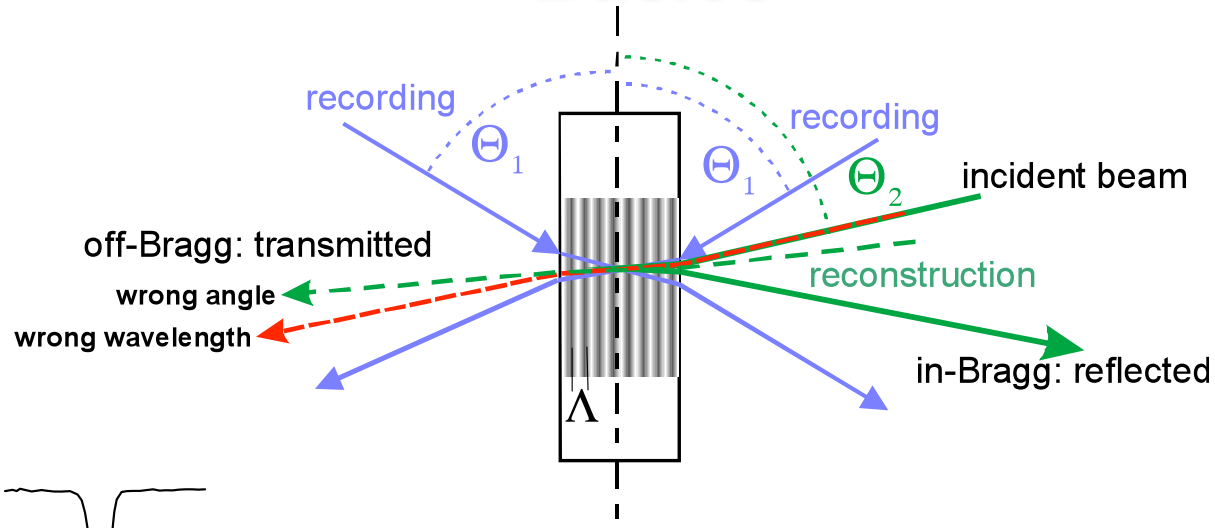
Narrowband optical selector

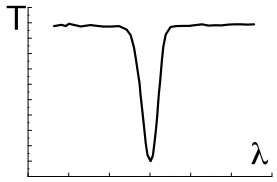
Candidates

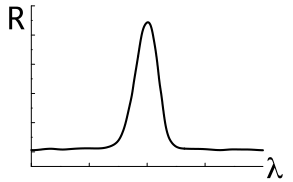
- Interference filter
- Faraday filter
- Atomic line filter
- Acoustic-optical filter
- Holographic filter

Holographic filter

Basics

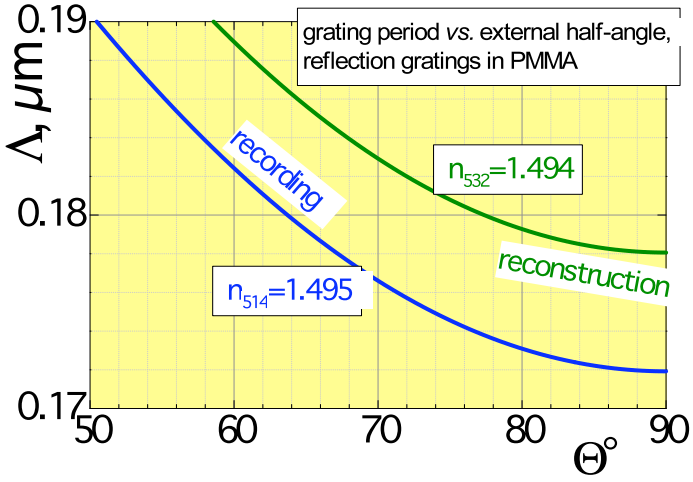






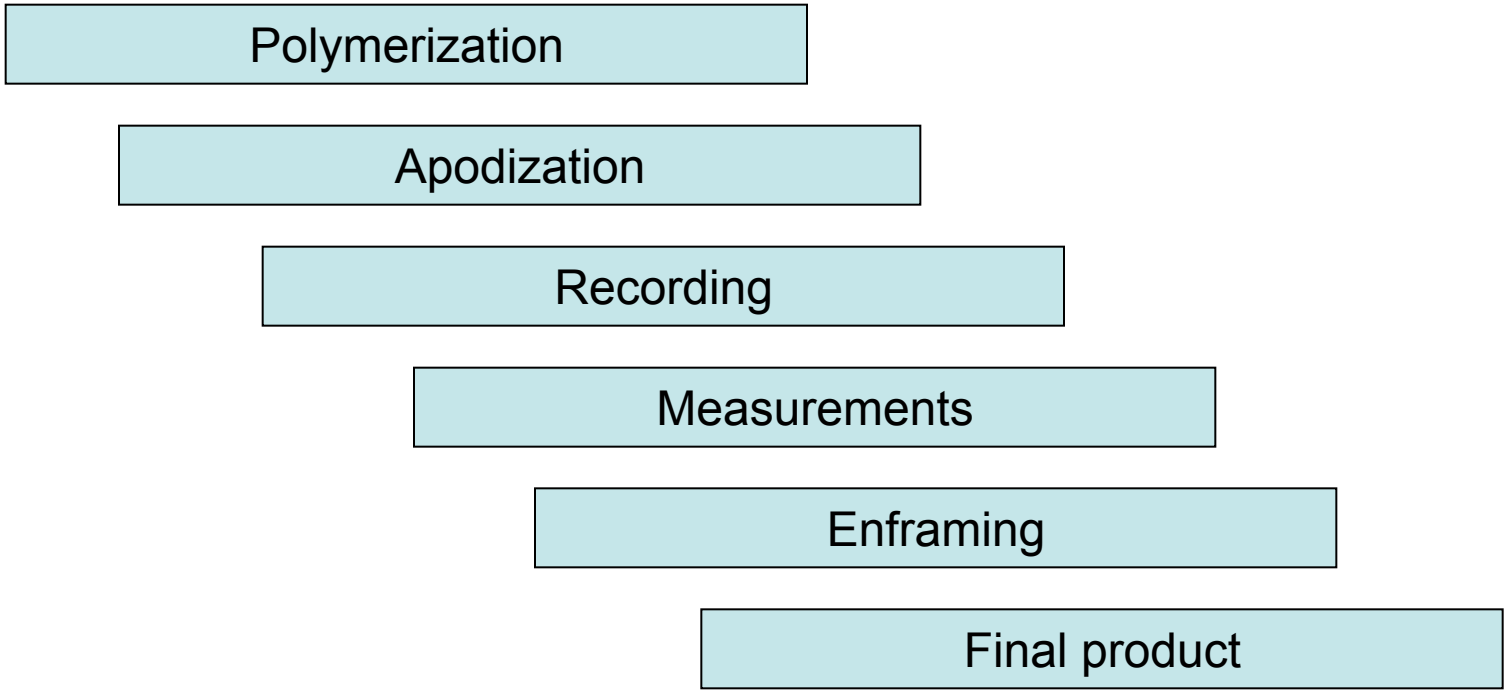
Bragg condition

$$\sqrt{n^2 - \cos^2\Theta} = \frac{\lambda}{2\Lambda}$$



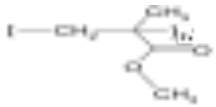
Holographic filter

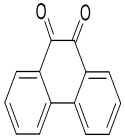
Principal stages of manufacturing



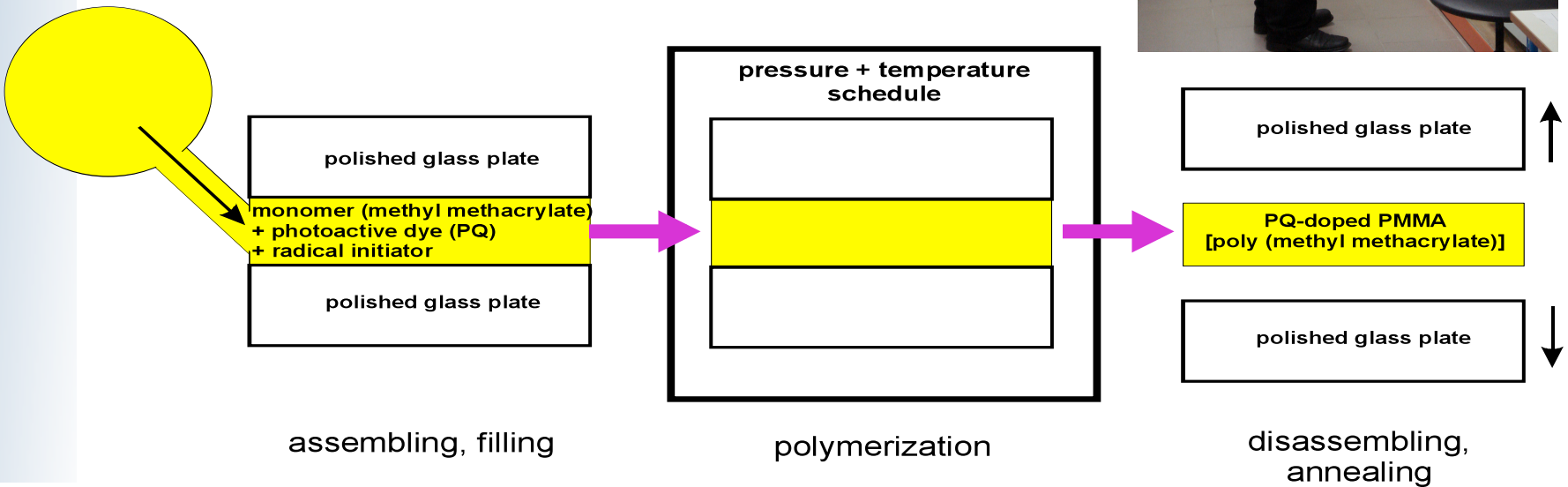
Holographic filter

Polymerization



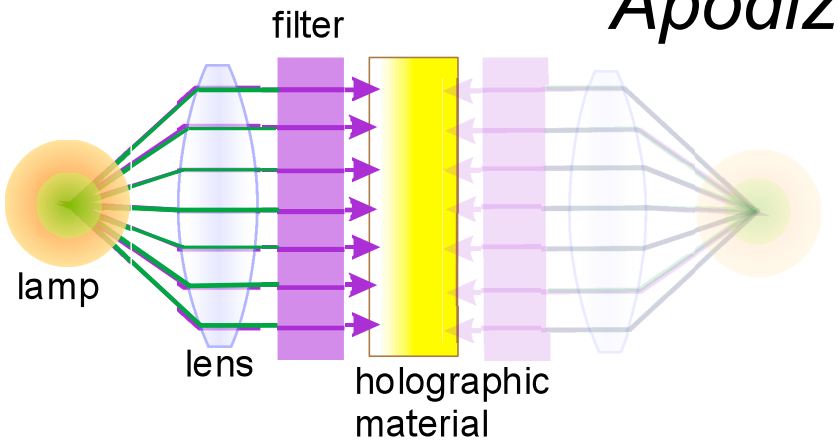


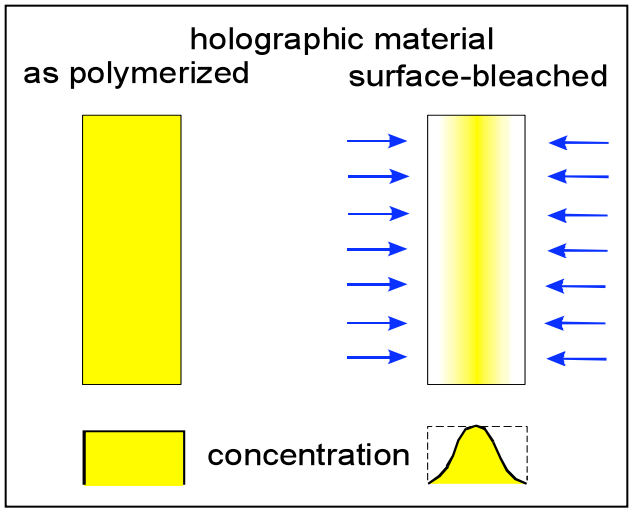
polymethylmethacrylate doped by phenanthrenequinone

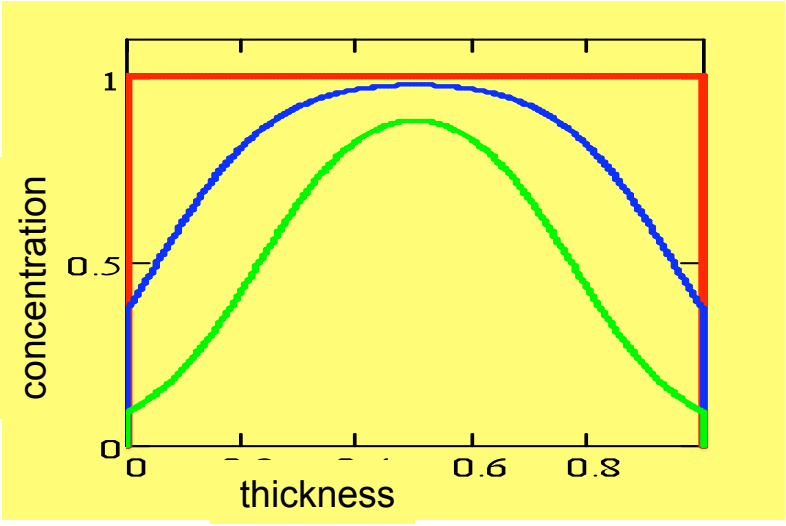


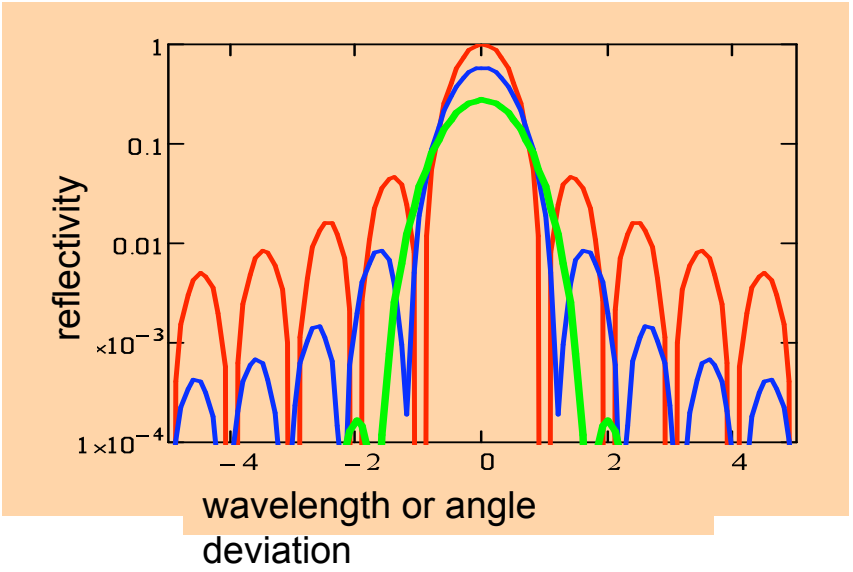
Holographic filter

Apodization



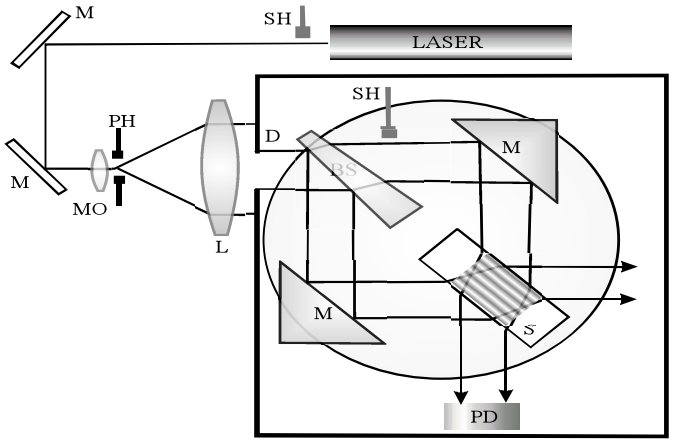


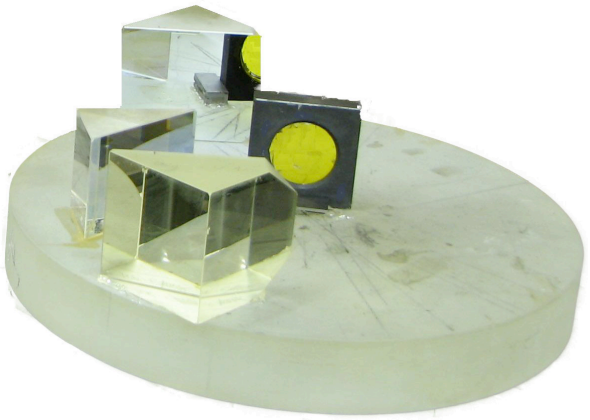


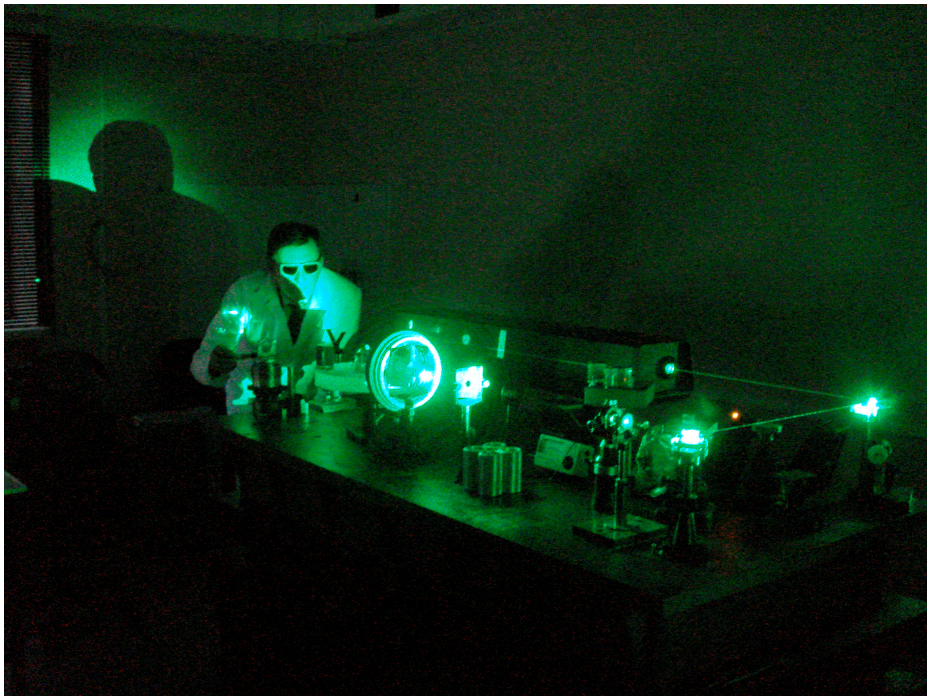


Holographic filter

Recording

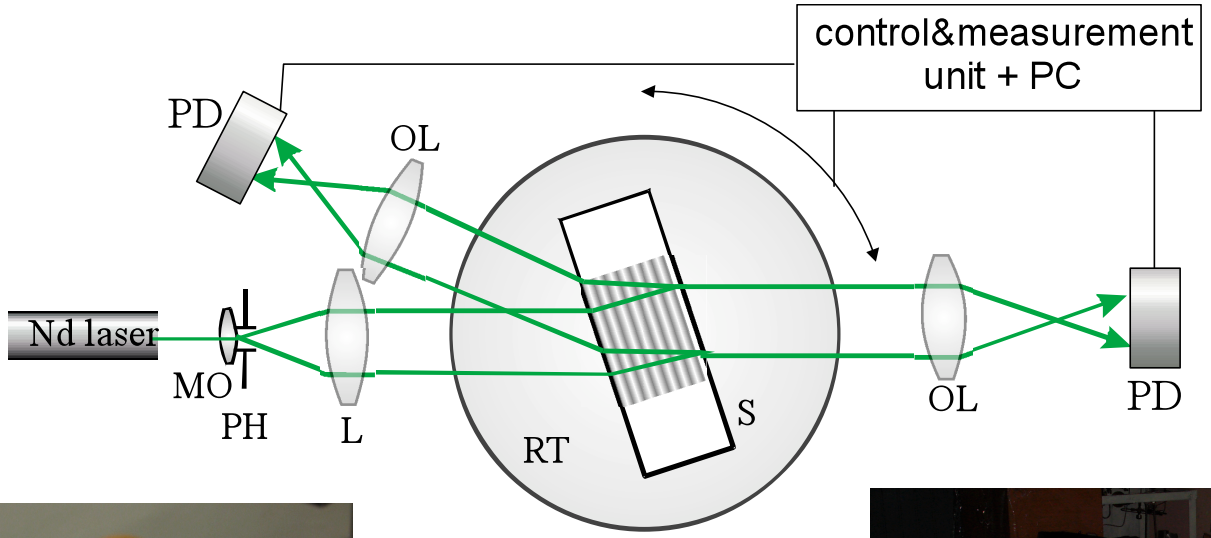


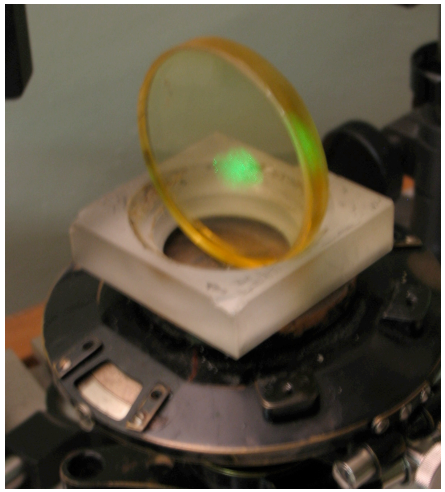




Holographic filter

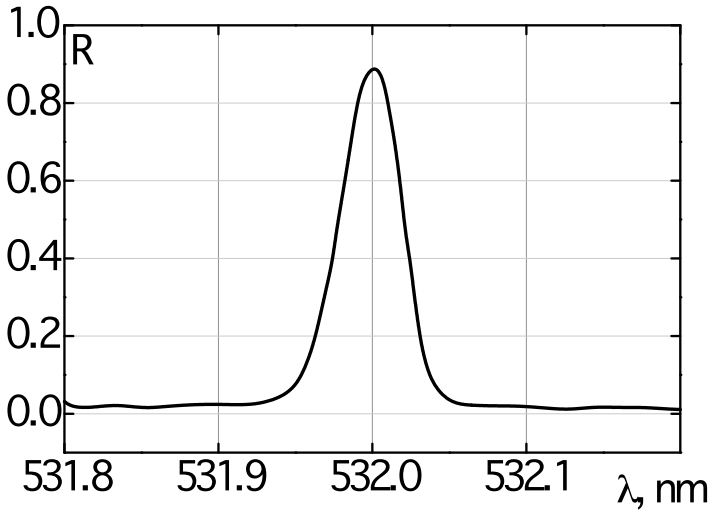
Measurements



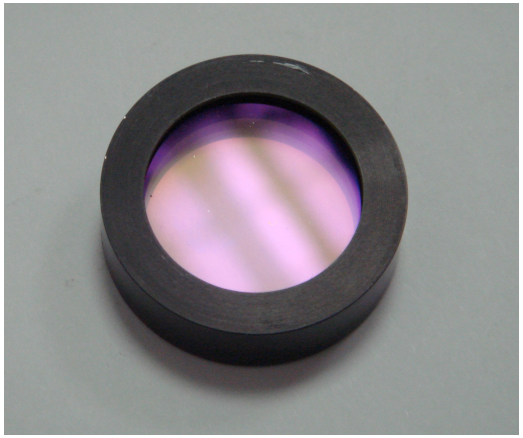


Holographic filter

Final product



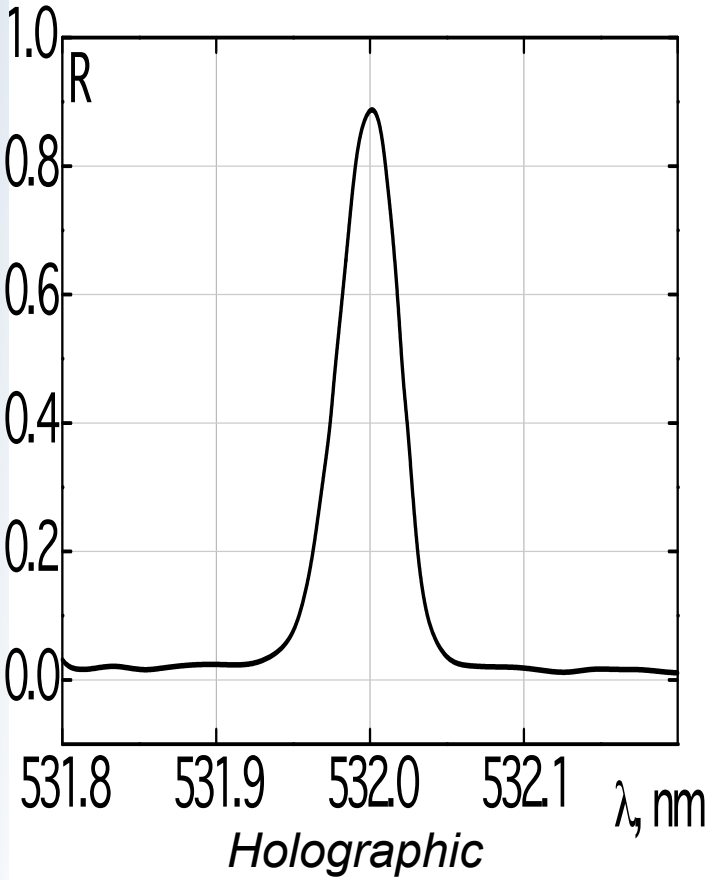
Typical spectrum of selective reflectivity



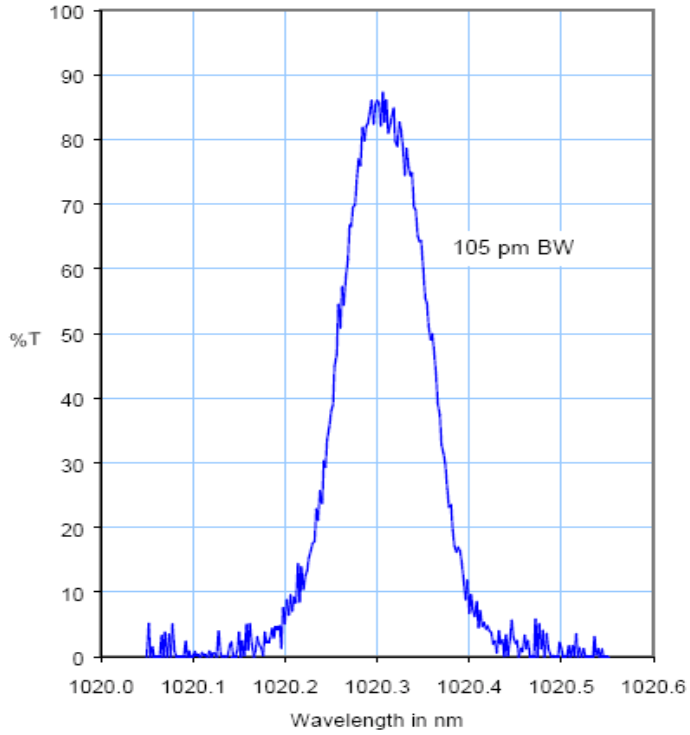
- spectral selectivity $\Delta\lambda$ ~ 1 Å
- maximum selective reflectivity ~ 90%
- wavelengths range: visible and NIR regions (typically λ = 532 nm)
- thermal wavelength shift ~0.05 Å/K.
- lifetime: years (at moderate temperatures < 60 °C)
- selective reflection angle 5 ÷ 7°
- angular selectivity $\Delta\theta$ = 0.5°

Holographic filter

Comparison with interference filter



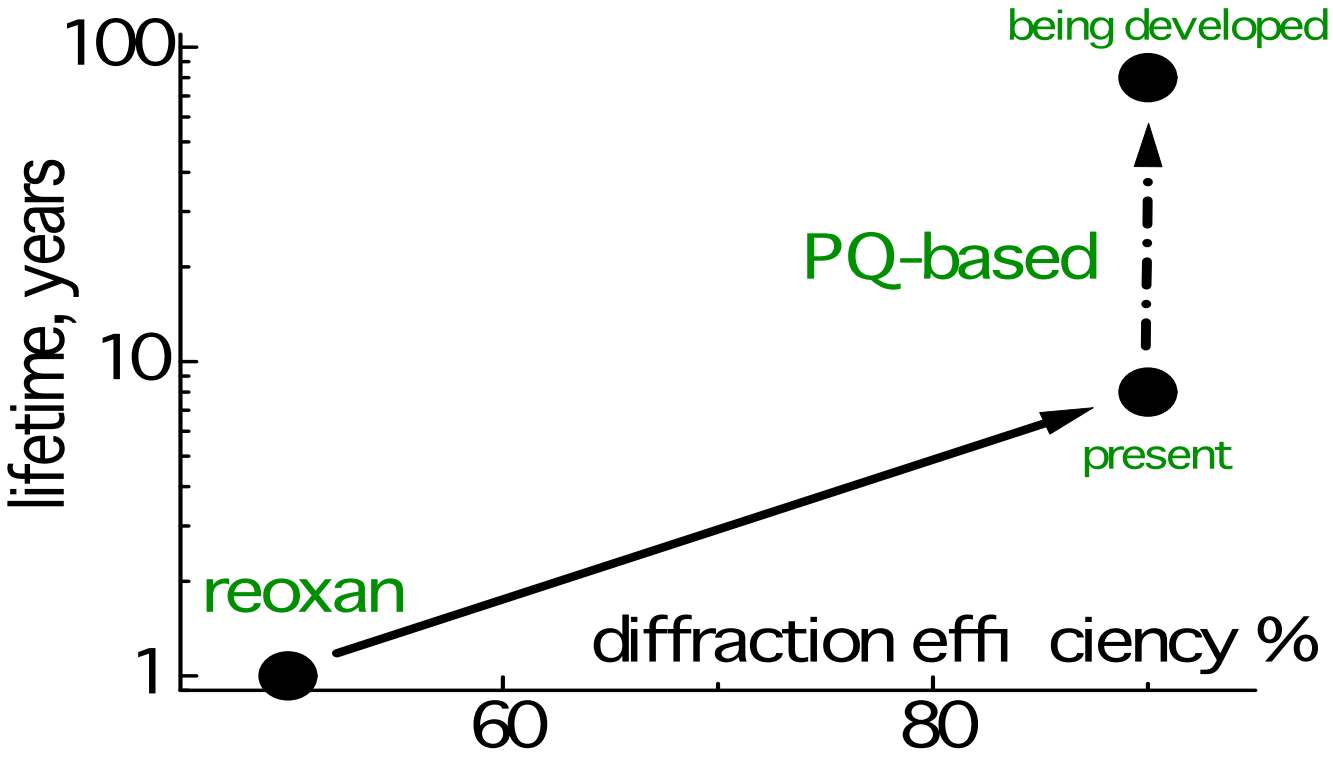
Holographic



Interference (Barr® Ass. # 000 522-1)

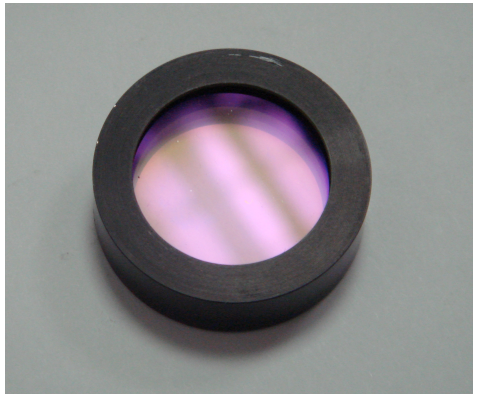
Holographic filter

Current status



Holographic filter

Optical element vs. monochromator



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