Grating Information

Diffraction Gratings:

SpectraPro® monochromators and spectrographs use *diffraction gratings* as the optical element which separates (disperses) polychromatic "white" light into individual wavelengths (colors). When polychromatic light encounters the grating it is dispersed so that each wavelength reflects from the grating at a slightly different angle. Dispersed light is then reimaged by the monochromator or spectrograph so that individual wavelengths (or a desired band of wavelengths) can be directed to a detection system or sample.

SpectraPro Diffraction Gratings

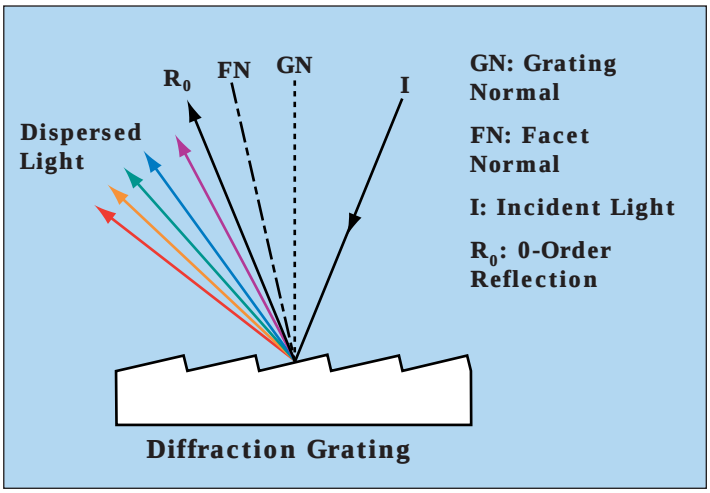
Selecting the Proper Grating:

Groove Density (or Groove Frequency):
The number of grooves contained on a grating surface, expressed in grooves per mm (g/mm) or lines per mm (l/mm). Groove density affects the wavelength region in which an instrument can operate (mechanical scanning range), dispersion properties of a system, and is also a factor in determining the resolution capabilities of a monochromator. Higher groove densities result in greater dispersion and higher resolution capabilities (see page 8 for detailed information on grating performance). *We recommend selecting a grating that delivers the required dispersion when using a CCD or array detector, or the required resolution (with appropriate slit width) when using a monochromator.*

Mechanical Scanning Range:
Refers to the *mechanical rotation capability* (not the "operating" or "optimum range") of a grating drive system with a specific grating installed. *We recommend selecting a grating groove density which allows operation over your required wavelength region.*

Blaze Wavelength:
Diffraction grating efficiency plays an important role in monochromator or spectrograph throughput. Efficiency at a particular wavelength is largely a function of the *blaze wavelength* if the grating is ruled, or *modulation* if the grating is holographic. *Blaze wavelength* relates to the angle in which the grooves are formed with respect to the grating normal, often termed blaze angle. *Modulation* is the depth of the grooves formed by holographic methods, assuming the grooves are sinusoidal. The collection of efficiency curves for typical SpectraPro gratings on page 9 shows the effect that *blaze wavelength* has on the efficiency of a grating, and ultimately on the throughput of the monochromator or spectrograph.

Optimum Wavelength Range:
The wavelength region of highest efficiency for a particular grating, normally determined by the blaze wavelength. *We recommend selecting a grating with maximum efficiency over the required wavelength region for your application.*



Light dispersed from a grating contains a "zero-order" reflection, plus dispersed wavelengths of light.

Selecting the Correct Blaze Wavelength:
To determine the correct blaze wavelength for your application, consider the total wavelength region for your current and future applications. *From a practical standpoint, we recommend selecting a blaze wavelength that favors the short wavelength side of the spectral region to be covered.*

Advantages of Multiple Grating Turrets:
Quite often it becomes necessary to select two or three gratings to achieve efficient light throughput over a broad spectral region. That's why SpectraPro monochromators and spectrographs are equipped with multiple grating turrets as a standard feature. Turrets make grating changes an easy push-button or computer controlled operation, and also reduce the risk of handling the delicate gratings.

Need Help?
ARC's technical staff can assist you in selecting the best gratings for your application.

Grating Selection Guide

Dispersion* and Bandpass Performance:

Grating Groove Density	Mechanical Scanning Range	Dispersion (nm/mm) @ 500nm for SpectraPro Models				Nominal Bandpass (nm) with 100µm Slits, for SpectraPro Models			
		SP-150	SP-300i	SP-500i	SP-750	SP-150	SP-300i	SP-500i	SP-750
150g/mm	0 to 11.2µm	40	21	13	8.8	4	2.1	1.3	.88
300g/mm	0 to 5600nm	19	11	6.5	4.4	1.9	1.1	.65	.44
600g/mm	0 to 2800nm	9	5	3.2	2.2	.9	.5	.32	.22
1200g/mm	0 to 1400nm	4	2.3	1.5	1	.4	.23	.15	.1
1800g/mm	0 to 933nm	2.2	1.4	0.9	.6	.22	.14	.09	.06
2400g/mm	0 to 700nm	1.2	.85	.6	.4	.12	.085	.06	.04
3600g/mm†	0 to 466nm	1.1	.7	.45	.3	.11	.07	.045	.03

* Reciprocal Linear Dispersion. †3600g/mm dispersion and bandpass calculated at 250nm

Grating Part Numbers:

Grating Groove Density	Grating Blaze Wavelength	Optimum Wavelength Range	SP-150 32x32mm	SP-300i 68x68mm**	SP-500i 68x68mm**	SP-750 68x68mm**
50g/mm	600nm	400-1200nm	150-05-600	1-05-600	1-05-600	750-1-05-600
75g/mm	8µm	5-13µm	———	1-075-8	1-075-8	750-1-075-8
150g/mm	300nm	200-500nm	150-015-300	1-015-300	1-015-300	750-1-015-300
150g/mm	500nm	330-950nm	150-015-500	1-015-500	1-015-500	750-1-015-500
150g/mm	800nm	475-1300nm	150-015-800	1-015-800	1-015-800	750-1-015-800
150g/mm	4µm	2.6-6µm	150-015-4	1-015-4	1-015-4	750-1-015-4
300g/mm	300nm	200-500nm	150-030-300	1-030-300	1-030-300	750-1-030-300
300g/mm	500nm	330-900nm	150-030-500	1-030-500	1-030-500	750-1-030-500
300g/mm	1µm	650-1800nm	150-030-1	1-030-1	1-030-1	750-1-030-1
300g/mm	2µm	1.3-3µm	150-030-2	1-030-2	1-030-2	750-1-030-2
600g/mm	300nm	200-500nm	150-060-300	1-060-300	1-060-300	750-1-060-300
600g/mm	500nm	330-900nm	150-060-500	1-060-500	1-060-500	750-1-060-500
600g/mm	1µm	650-1800nm	150-060-1	1-060-1	1-060-1	750-1-060-1
600g/mm	1.6µm	1-2.4µm	150-060-1.6	1-060-1.6	1-060-1.6	750-1-060-1.6
1200g/mm	Holographic	190-400nm	150-120-HUV	1-120-HUV	1-120-HUV	750-1-120-HUV
1200g/mm	300nm	200-500nm	150-120-300	1-120-300	1-120-300	750-1-120-300
1200g/mm	500nm	330-900nm	150-120-500	1-120-500	1-120-500	750-1-120-500
1200g/mm	750nm	500-1400nm	150-120-750	1-120-750	1-120-750	750-1-120-750
1200g/mm	Holographic	450-1400nm	———	1-120-HVIS	1-120-HVIS	———
1800g/mm	250nm	190-450nm	150-180-250	1-180-250	1-180-250	750-1-180-250
1800g/mm	500nm	330-850nm	150-180-500	1-180-500	1-180-500	750-1-180-500
2400g/mm	240nm	190-450nm	150-240-240	1-240-240	1-240-240	750-1-240-240
2400g/mm	Holographic	190-450nm	150-240-HUV	1-240-HUV	1-240-HUV	750-1-240-HUV
2400g/mm	Holographic	450-700nm	150-240-HVIS	1-240-HVIS	1-240-HVIS	750-1-240-HVIS
3600g/mm	240nm	190-450nm	150-360-240	1-360-240	1-360-240	750-1-360-240
3600g/mm	Holographic	190-450nm	150-360-HUV	1-360-HUV	1-360-HUV	750-1-360-HUV

Over 100 Additional Gratings are Available on Request for SpectraPro Monochromators and Spectrographs

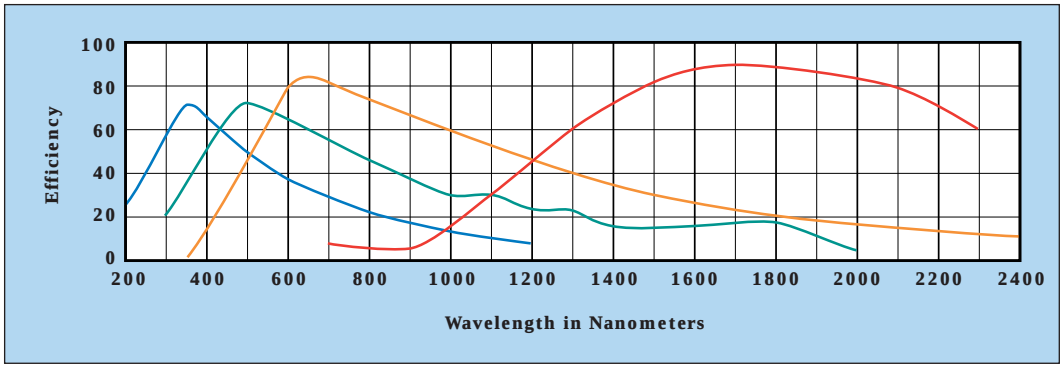
** Standard grating size is 68x68mm with larger 68x84mm gratings available as an option. 68x84mm gratings preserve the light collecting power (aperture ratio) when operating at high wavelengths (high grating angles). 68x84mm gratings benefit operation above 1.2µm with a 1200g/mm grating (≥2.4µm with a 600g/mm, ≥4.8µm with a 300g/mm grating).

Acton Research Corporation • Tel: 978-263-3584 • Fax: 978-263-5086
E-Mail: mail@acton-research.com • Internet: http://www.acton-research.com

Typical Grating Efficiency Curves

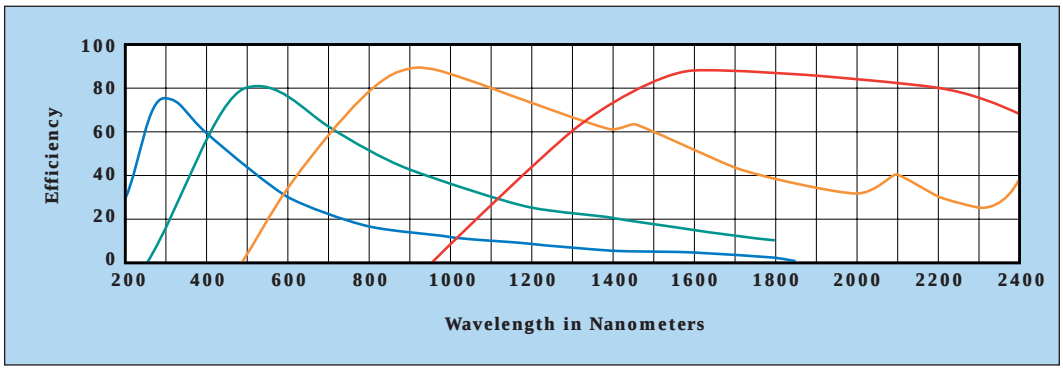
150g/mm Gratings

- 300nm Blaze
- 500nm Blaze
- 800nm Blaze
- 2µm Blaze



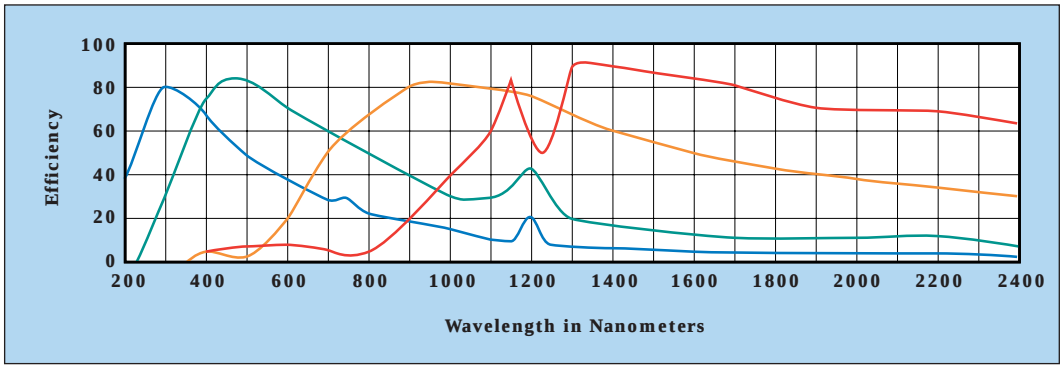
300g/mm Gratings

- 300nm Blaze
- 500nm Blaze
- 1µm Blaze
- 2µm Blaze



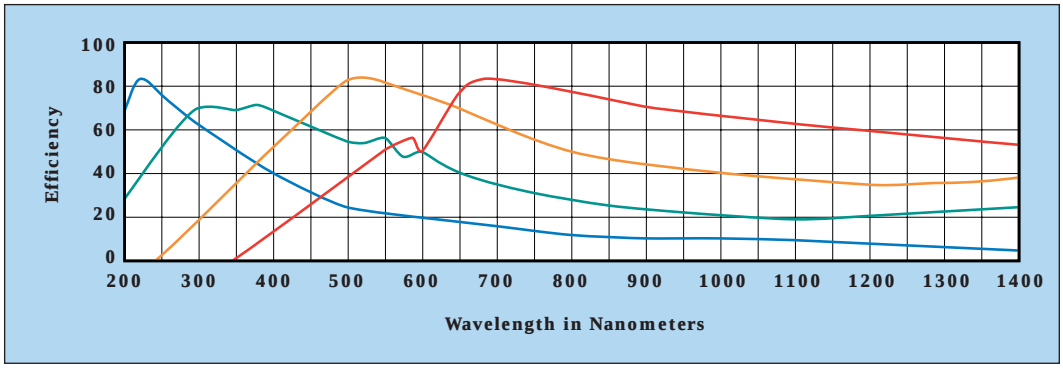
600g/mm Gratings

- 300nm Blaze
- 500nm Blaze
- 1µm Blaze
- 1.6µm Blaze



1200g/mm Gratings

- Holographic
- 300nm Blaze
- 500nm Blaze
- 750nm Blaze



Grating efficiency data from Richardson Grating Laboratory, Rochester, NY.
Grating data is typical and should only be used for relative comparison to other gratings.

Acton Research Corporation Infobase

Product Literature

SpectraPro Monochromator Catalog

General Accessories

Fiber Optic Probes

Optical Filters

Vacuum Monochromators

Double Monochromators

Peak Performance

SpectraSense Software

SpectruMM CCD Detectors

Tech Notes

Guide to System Configuration

Grating Information

Grating Rotation Analysis

Imaging Spectrographs

SP 150 Imaging

Real-time Chemometrics

Source Compensation

Fax-back Literature Request Form