HORIBA JOBIN YVON

Scientific diffraction gratings / Custom gratings

Ion etched gratings

Explore the future

HORIBA

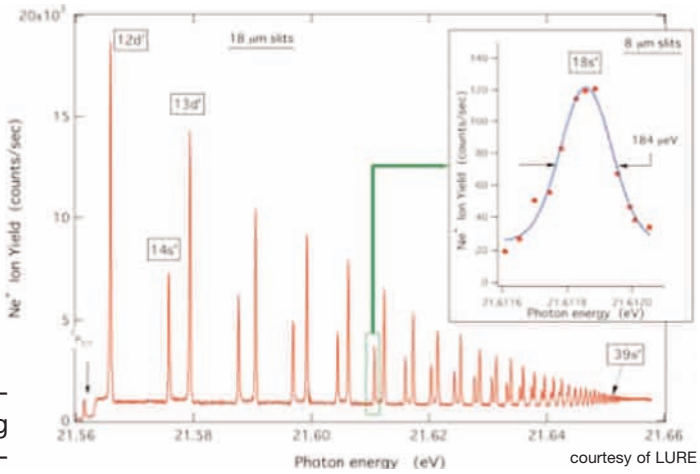
Commitment to quality

HORIBA Jobin Yvon offers complete customer service, including expert technical advice for optimizing system configurations to meet customers' needs.

HORIBA Jobin Yvon is ISO 9001:2000 certified, and our well-staffed departments are committed to customer satisfaction and product quality.

Ion-etched gratings for vacuum UV and soft X-ray applications

Holographic ion-etched lamellar master gratings for synchrotron and soft X-ray applications.



HORIBA Jobin Yvon's holographic ion-etched lamellar gratings exhibit ultra-low stray light levels, making them ideal for synchrotron and soft X-ray applications. These gratings are fully compatible with the latest synchrotron systems, as they are fully engraved in the substrate material and can therefore withstand high thermal loads.

The holographic ion etching manufacturing process is compatible with most high-grade polished substrate materials, including:

- ❑ Silicon,
- ❑ Fused Silica,
- ❑ CVD silicon carbide.

HORIBA Jobin Yvon produces holographic ion-etched gratings on plano, spherical, and toroidal substrates. We can tailor the groove distribution (i.e. constant spacing, aberration correction, or VLS) to optimize gratings for the most demanding applications.

Typical specifications

- ❑ Material: Silicon
- ❑ Slope error: ≤0.7 µrad
- ❑ Roughness: <0.5 nm
- ❑ Roll off: 5 mm
- ❑ Land to groove ratio: 0.5 to 0.6
- ❑ Land to groove ratio tolerance: ±10%
- ❑ Groove depth: 9 to 200 nm
- ❑ Groove depth tolerance: ±10%
- ❑ Coating: Pt or Au or Ni

Constant groove density:

The groove density of the grating is defined by the interference of two plane wavefronts, resulting in a uniform and constant groove spacing along the grating length.

Aberration-corrected groove density:

The groove spacing along the grating length is non-uniform, resulting from the interference of two spherical wavefronts. The non-constant groove density enables the correction of certain aberrations in the optical system.

VLS groove density:

The Variable Line Spacing grating displays a groove-density variation that is defined by a polynomial law. This type of grating is commonly used in synchrotron beamline designs to correct for the defocusing of a grating monochromator. HORIBA Jobin Yvon and the synchrotron community together have developed software tools to define holographic recording geometries for VLS gratings, which allows us to produce gratings according to an arbitrary polynomial VLS law.

Examples of holographic ion-etched lamellar master gratings

Plane constant groove density grating

reference	blank dimension	useful arera	grooves density	blank	spectral range
549 00 xxx	30x100x20	20x90	1200	Si	300-950 eV / 1.3-4.5 nm
553 00 xxx	30x100x20	20x90	600	Si	170-600 eV / 2-7 nm

Spherical constant groove density grating

❑ Radius of curvature: 17 800 mm
❑ Radius of curvature tolerance: ±1 000 mm

reference	blank dimension	useful arera	grooves density	blank	spectral range
549 00 133S	30x100x20	20x90	1200	Si	300-950 eV / 1.3-4.5 nm
549 00 134S	30x100x20	20x90	600	Si	170-600 eV / 2-7 nm
549 00 135S	30x100x20	20x90	300	Si	100-300 eV / 4-12 nm

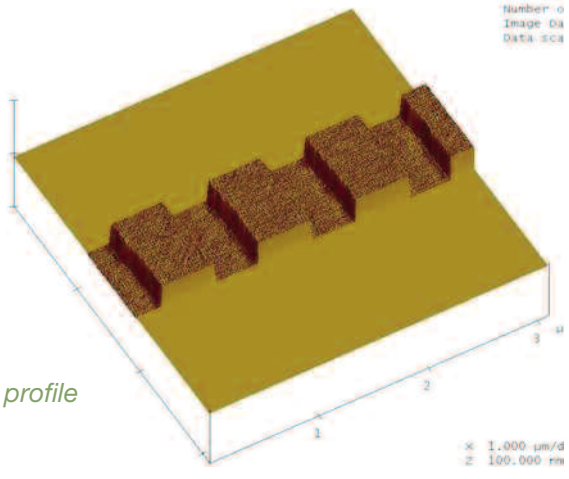
Plane variable line spaced grating

❑ VLS law: $N(x) = N_0 + N_1 x + N_2 x^2$

reference	shape	blank size (mm)	useful arera (mm)	polynomial coefficients	blank	spectral range
549 00 014S	plane	35x155x30	30x150	N_0 = 500 gr/mm N_1 = 0.555 gr/mm^2 N_2 = 4.61 10^{-4} gr/mm^3	Si	180-700 eV / 1.7-7 nm

If you are interested by a specific grating for your application, please contact your HORIBA Jobin Yvon representative.

He will be glad to review your specific requirements.



3D AFM grating profile

Toroidal ion-etched holographic master gratings for VUV applications

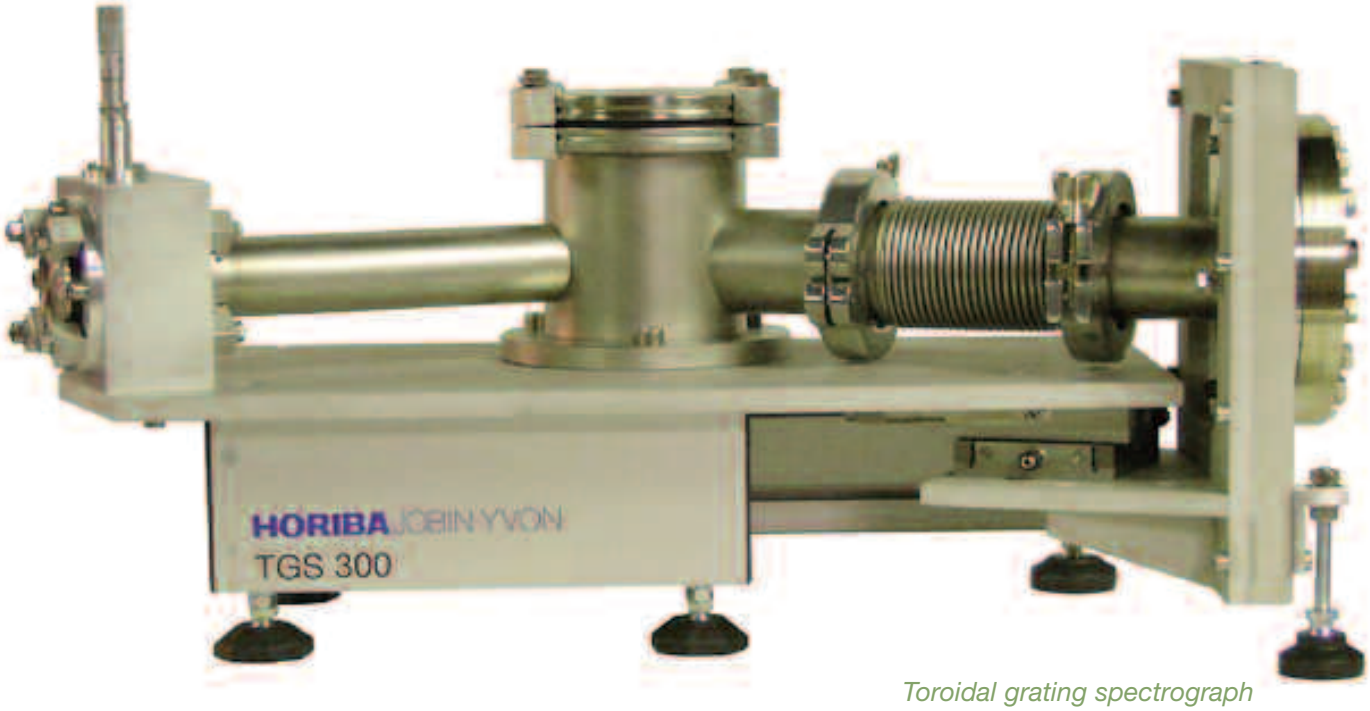
Single focusing/dispersing optic for cost-effective VUV optical systems

The holographic recording process – a non-contact manufacturing technique – allows for the patterning of gratings on aspheric surfaces. HORIBA Jobin Yvon has developed manufacturing methods to define, produce, and test diffraction gratings on toroidal substrates. Toroidal gratings combine the off-axis focusing properties of a toroidal reflector and the dispersive properties of a grating into a single optic, allowing for simplified, high-throughput monochromator and spectrograph designs.

Toroidal diffraction gratings are recorded with a varying groove density along the grating length, which is defined and optimized for correcting aberrations in a particular instrument. This non-uniform groove density is holographically generated by interfering two spherical wavefronts on a photoresist layer deposited on the toroidal surface. The grating pattern is then transferred directly into the substrate bulk using an ion etching process; this technique (used in the semiconductor industry) creates a lamellar groove structure that minimizes unwanted harmonic contamination.

Our toroidal substrates are polished and tested in our own optics fabrication laboratory, allowing us to maintain strict quality control.

HORIBA Jobin Yvon toroidal diffraction gratings are a cost-effective solution for designing high throughput vacuum UV instruments.

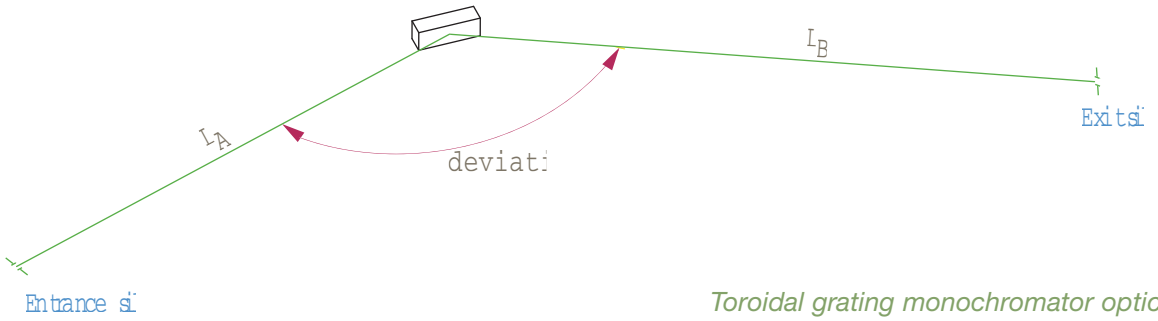


Toroidal grating spectrograph

Toroidal grating monochromator

Ion Etched Gratings

deviation (deg)	spectral range nm	spectral range eV	groove density (l/mm)	blank dim (mm)	useful area (mm)	ℓA (mm)	ℓB (mm)	reference
150	8-32	39-155	1800	45x90x16	40x85	1146	1927	**540 00 600**
150	32-128	10-39	450	45x90x16	40x85	1146	1927	**540 00 610**
146	12.5-52.5	23-100	950	30x110x30	25x105	1000	1168	**540 00 800**
146	50-200	6-25	250	30x110x30	25x105	1000	1168	**540 00 810**
142	10-50	25-124	550	31x31x15	27x27	319.9	319.5	**540 00 900**
142	15-150	8-82	550	31x31x15	27x27	319.9	319.5	**540 00 910**
142	50-300	4-25	275	31x31x15	27x27	319.9	319.5	**540 00 920**

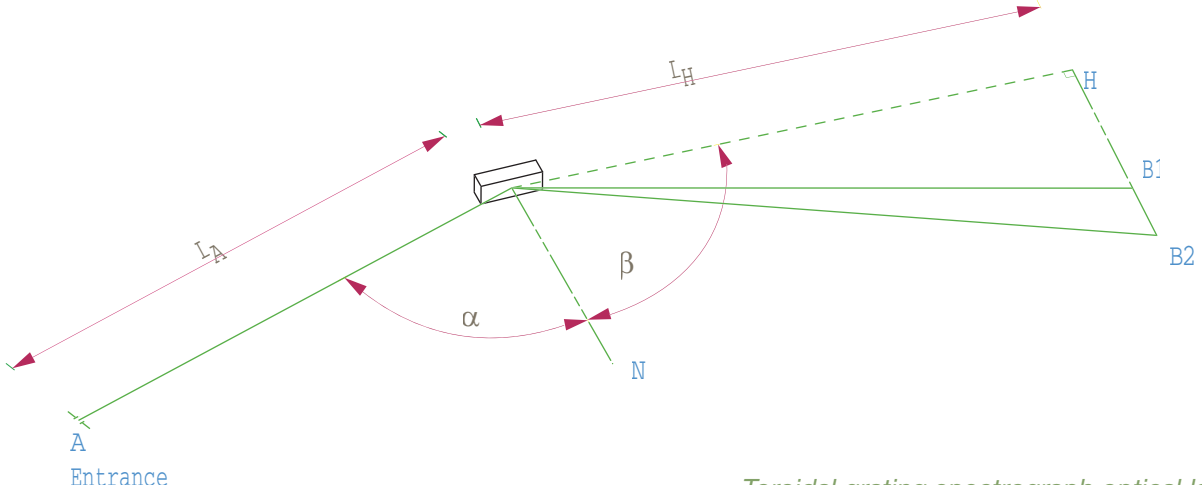


Toroidal grating monochromator optical layout

Toroidal grating spectrograph

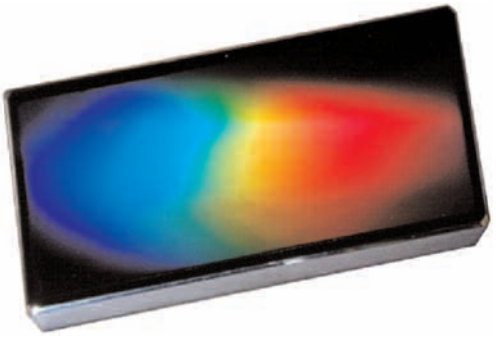
Ion Etched Gratings

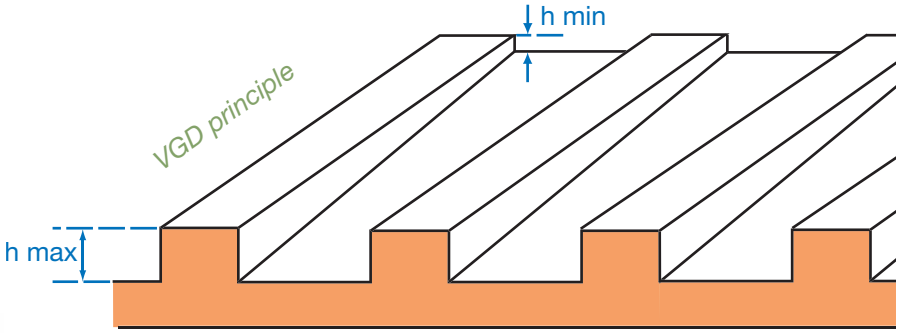
deviation (deg)	spectral range nm	spectral range eV	groove density (l/mm)	blank dim (mm)	useful area (mm)	ℓA (mm)	α deg	ℓH (mm)	βH (deg)	reference
140	9.5-32	39-130	2105	12x34x10	8x22	292.1	-71.78	306.0	86.54	**541 00 220**
140	10-110	11-124	450	12x34x10	8x22	292.1	-70.56	306.0	87.85	**541 00 200**
140	15.5-170	7-80	290	12x34x10	8x22	292.1	-70.56	306.0	87.85	**541 00 210**



Toroidal grating spectrograph optical layout

Variable Groove Depth (VGD) master gratings for XUV application





HORIBA Jobin Yvon VGD grating technology is compatible with:

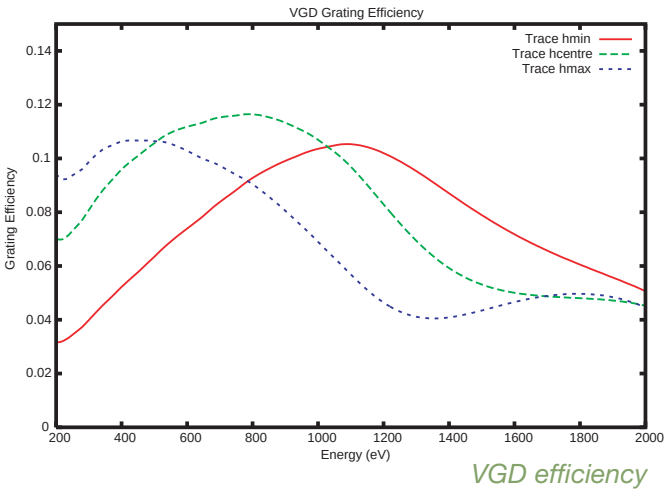
- ❑ Silicon and fused silica grating substrates
- ❑ Holographic recording processes
- ❑ Constant, aberration corrected, and VLS groove distributions
- ❑ Ion etching processes
- ❑ XUV reflective coatings

One VGD grating gives you the efficiency of several classical gratings

Variable Groove Depth (VGD) gratings from HORIBA Jobin Yvon exhibit a continuously-varying groove depth across the grating width, allowing for continuous adjustment of the grating blaze wavelength with a simple lateral translation. When such blaze adjustments are combined with rotational scanning and a narrow beam, our VGD gratings provide a unique opportunity to perform continuous on-blaze scans and to minimize harmonic contamination over a wide spectral range.

Our VGD grating technology is compatible with the most-recent synchrotron beamline designs that provide a mm size synchrotron beam onto the grating. Replacing a classical or multi-track gratings with a HORIBA Jobin Yvon VGD will open new experimental opportunities, with optimized flux performance over the entire beamline spectral range.

material:	non-oriented silicon crystal
micro-roughness:	less than 0.5 nm RMS
slope error:	0.7 µrad RMS
land to groove ratio:	0.55 within ±15%
coatings:	Au, Pt or Ni

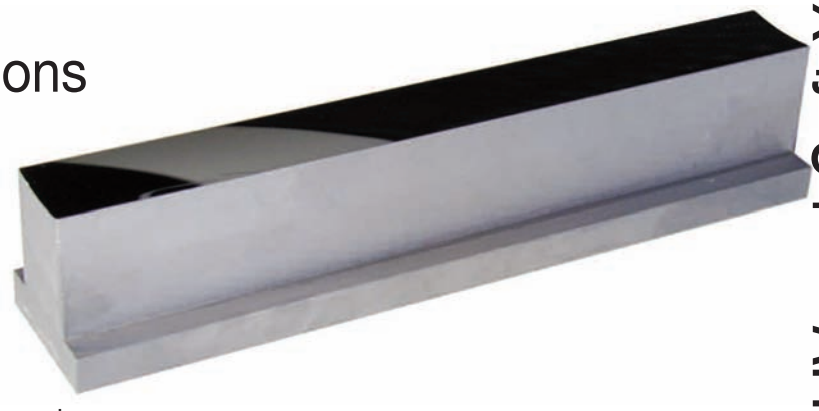


VGD efficiency

Example of VGD gratings

blank size	useful arera	grooves density	Nominal depth variation over 25 mm		
			h min (nm)	h centre (nm)	h max (nm)
40x100x30	35x90	1800	4.5	10	15.5
40x100x30	35x90	600	18	35	52
40x100x30	35x90	300	42.5	80	117.5

High-grade mirrors for VUV and XUV applications



The technical specifications placed on synchrotron radiation diffraction gratings such as excellent shape control, ultra low roughness, etc. are similar to the one placed on the mirrors that are installed on a synchotron beamline.

In order to control the diffraction-grating substrate quality HORIBA Jobin Yvon developed a dedicated polishing facility.

These polishing capabilities are used internally to supply state-of-the-art grating substrates to our recording grating laboratory and also high-quality VUV Soft X-ray mirrors for your applications.

HORIBA Jobin Yvon places considerable emphasis on the testing of components at every stage of the manufacturing process. Thus HORIBA Jobin Yvon can analyze errors and apply appropriate corrective action to the subsequent manufacturing stages. Slope Error is measured using interferometry and is cross-calibrated using long trace profilometry (LTP). Microroughness is measured using a Nomarski microscope during the preliminary polishing. The final quantitative microroughness measurements are made using a MicroMap interferential microscope to ensure compliance with specifications.

HORIBA Jobin Yvon capabilities include:

- ❏ Material: Silicon, SiC CVD, Fused Silica, Zerodur
- ❏ Shape: Plane, Spherical, Cylindrical, Toroidal
- ❏ Surface shape: down to 0.5 µrad (0.1 arcsec)
- ❏ Roughness: down to 0.2 nm
- ❏ XUV reflective coating: Pt, Au, C, Ni

In addition to the below presented standard toroidal and cylindrical mirrors, HORIBA Jobin Yvon can manufacture custom plane, spherical, cylindrical and toroidal mirrors. Please contact your HORIBA Jobin Yvon representative for radius availability, manufacturability, price and delivery.

Example of toroidal mirror:

reference	shape	blank size (mm)	useful area (mm)	radius of curvature (mm)	blank	roughness (nm)	slope error (µrad)
545 70 038S	toroidal	50x250x50	20x230	R_1 = 57 300 R_2 = 93.1	Si	0.5	5
545 70 060S	toroidal	40x280x40	30x270	R_1 = 328 360 R_2 = 261.77	Si	0.5	5

Example of cylindrical mirror:

reference	shape	blank size (mm)	useful area (mm)	radius of curvature (mm)	blank	roughness (nm)	slope error (µrad)
545 70 039S	cylindrical	60x300x60	30x280	R = 698	Si	0.5	5

FAX FORM

For more information or custom grating / mirror quotations, please complete the corresponding request info on our web site: www.jobinyvon.com or send this completed form by fax.

The personal details that we use to provide or promote our products and services (for example your name and telephone number), will NOT be passed to ANY organization beyond the HORIBA Group, its Subsidiary or Associate Companies, Agents or Distributors to be used for marketing purposes.

Your Contact Details:

Last Name: . . . .

First Name: . . . .

Title: . . . .

Organization: . . . .

Dept: . . . .

Address: . . . .
. . . .
. . . .

State/Province: . . . .

Country: . . . .
(USA please include Zip)

Postal Code: . . . .

Telephone: . . . .

Fax: . . . .

E-Mail: . . . .

❑ Please keep me informed with up-to-date information.

Your Interest

My interest is:

❑ Information only ❑ Possible purchase ❑ I have funding ❑ I am applying for funds

I intend to purchase

❑ Now! ❑ Within 3 months ❑ Within 6 months ❑ Within 12 months ❑ More than 12 months

❑ Salesperson please call

Please Send Product Information For:

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❑ Diffraction Gratings
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❑ OEM Spectrometers
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Vacuum UV

❑ Monochromators & Spectrographs
❑ Mirrors
❑ Gratings

My Application is:

We would be interested in learning more about your application. Please give details below:

. . . .
. . . .

Comments

Please include any comments or further information about your requirement below:

. . . .
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COMPANY PROFILE

HORIBA Jobin Yvon is one of the world's largest manufacturers of analytical and spectroscopic systems and components and we are committed to serving our customers with superior products and technical support.

Established in 1819, Jobin Yvon is part of the HORIBA Group which employs more than 4,500 people worldwide, with annual sales in excess of $900,000,000.

HORIBA Jobin Yvon, Sofie, Dilor, Spex and IBH are some of our well known and respected brand names.

HORIBA JOBIN YVON

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(All HORIBA Jobin Yvon companies were formerly known as Jobin Yvon)

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