

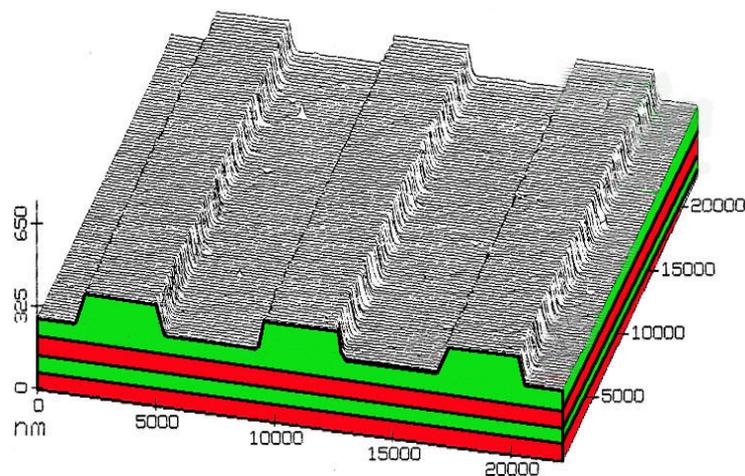
## Multi-Layer Dielectric gratings For Laser Chirped Pulsed Compression

The rapid development of intense sources for picosecond and femtosecond light pulses and in particular pulse compression techniques has prompted the need for new ultra-high performance, high damage threshold, diffraction gratings. HORIBA Jobin Yvon has been a leading supplier of gold coated pulse compression gratings since the development of the technique, and is now pleased to be able to provide unique Multi-Layer Dielectric gratings<sup>1</sup> for laser chirped pulse compression.

Traditional diffraction gratings for pulse compression applications are often holographically mastered and coated with a thin metallic film. Metalised gratings have many useful features including diffraction efficiencies that can exceed 92% over a broad range of wavelengths. The groove profile as well as the optical properties of the metal coating determine the properties of the grating. Typically, Gold, Silver, or Aluminium is used as a coating. However metalised gratings have an inherently low damage threshold, often about 400 mJ/cm<sup>2</sup> for nanosecond pulses in the near infrared and at lower fluences for shorter pulses or shorter wavelengths.

For many years multi-layer dielectric (MLD) structures composed of alternating high and low index layers have been well known to be highly reflecting. At each interface between a low and high index pair about 4% of the light is reflected. By summing all of the light from the many layers gives an optic that can approach close to complete reflection. Since MLD structures are insulators they lack the conduction electrons that make metals good reflectors and thus can have intrinsically higher damage thresholds.

The manufacture of MLD gratings requires control of the stack of dielectric films, each of a predefined thickness, uniform coating of photoresist and very precise generation of the holographic pattern that



Multi-Layer Dielectric Gratings are the leading edge diffraction grating technology for ultra-high-energy laser systems around 1 µm wavelength (1740g/mm).

defines the groove shape and distribution. The latent image in the photoresist is transferred permanently into the dielectric stack by ion etching.

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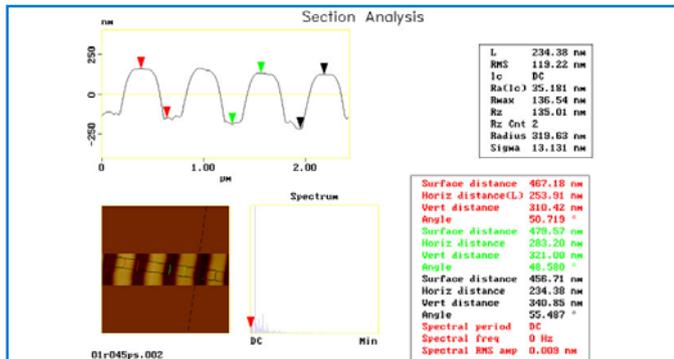
### Key Features:

- Diffraction Efficiency : to 98%
- Damage threshold ~ 2.5 x Gold for ps pulses
- 1740 g/mm - 1.053 µm

<sup>1</sup>Sold in the US under license of Patent # 5,907,436

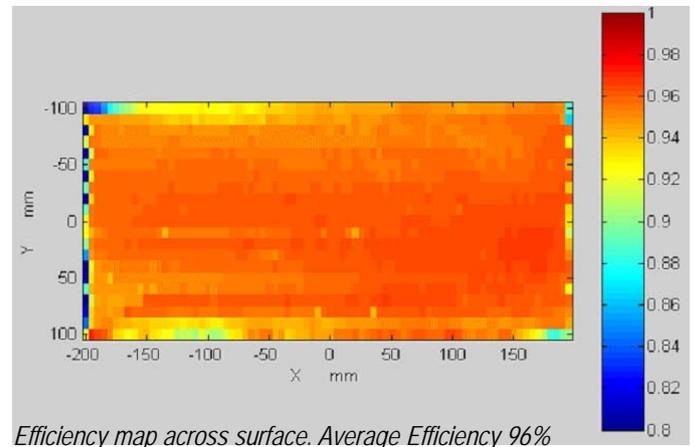
## Examples of MLD Grating Performances

### MLD Grating: 1740 g/mm, 1053 nm

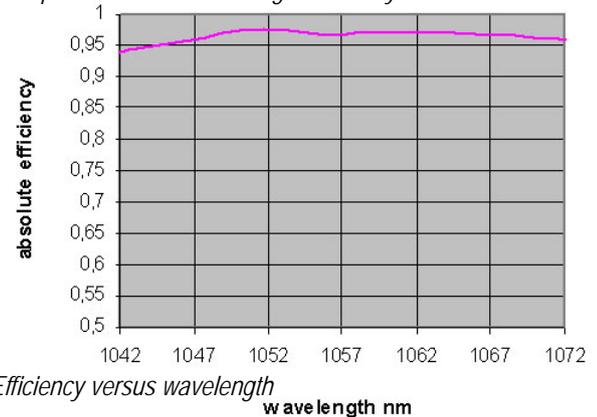


MLD Grating Groove Profile

Design wavelength	1053 nm
Groove density	1740 g:mm
Standard sizes	50 mm dia, 120x140 mm <sup>2</sup> 210x420 mm <sup>2</sup>
Custom sizes	to 335x485 mm <sup>2</sup>
Absolute efficiency	to 98%
Damage threshold	~2.5 x Gold PCG (ps pulse)
Test conditions	10 ps pulse at 1053 nm



Efficiency map across surface. Average Efficiency 96%



Grating Efficiency versus wavelength

### HORIBA Jobin Yvon your partner in Pulse Compression Gratings

Since our formation in 1819 by JB Soleil, Jobin Yvon has been at the forefront of optical and spectroscopic instrumentation. The company is committed to the design and manufacture of high quality optics and diffraction gratings for high-energy laser systems.

These include: gold coated master and replica pulse compression gratings for 800 nm and ca. 1  $\mu$ m lasers with

groove densities of 1200, 1480, 1740, 1800 and 2000 g/mm, transmission gratings and phase plates as well as ultra-high performance multi-layer dielectric gratings with 1740 g/mm optimised for 1053 nm operation.

Please contact one of the HORIBA Jobin Yvon offices for further information on our products and/or for a consultation with our optical engineers.

**We are pleased to work with you to find a suitable solution to your requirements.**

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