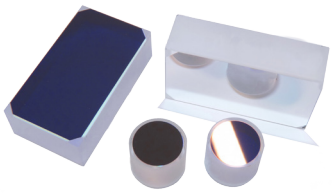
venteon optics

Optics designed for ultra-short pulses

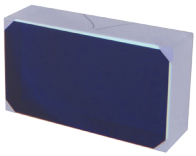
- Group delay dispersion compensation mirrors
- Enhanced silver mirrors
- CaF_2 and fused silica glass wedge pairs
- 50:50 ratio beam splitter
- Designed specifically for few cycle pulse management



Overview

Laser Quantum's **venteon optics** range of mirrors, wedges and splitters are designed specifically for beam path control and Group Velocity Dispersion (GVD) compensation of few-cycle laser pulses.

DCM mirror pairs



The DCM products are dispersion compensating mirror pairs used for the compensation of positive dispersion affecting femtosecond laser pulses (Fig. 1 to 10). The unique design enables reflectivity greater than 99% over the whole supported spectral bandwidth next to a defined negative dispersion. Using these mirrors in a pulse compressor in combination with CaF_2 wedges pair/glass material it is possible to compress the pulses nearly to the supported transform limit according to the lasers spectral bandwidth.

Compared to other methods used for GVD compensation, the use of high damage-threshold DCM mirrors results in a compact and robust designs for ultra-short pulse laser oscillators or compressor setups with octave-spanning spectral bandwidth. This can be achieved with a minimum of optical components and without complex and often narrow-band and inefficient prism or grating sequences.

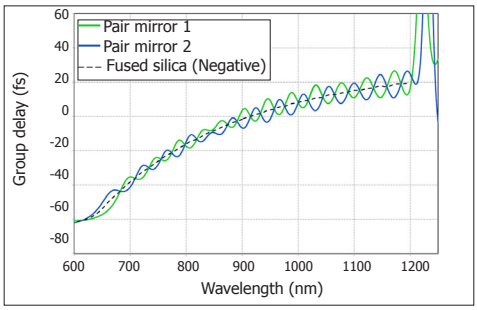


Fig. 1 DCM7 group delay dispersion measurement of mirror pair (blue) in comparison to the compensation target (fused silica glass, black dashed).

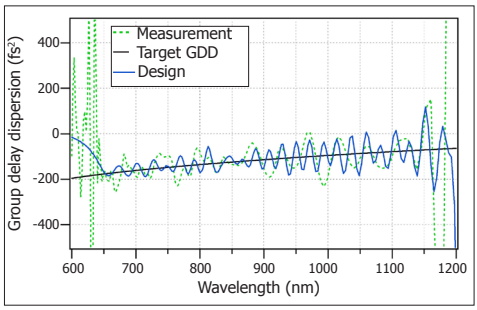


Fig. 2 DCM7 reflected group delay dispersion measurement of mirror pair (green dotted) in comparison to the design data (blue solid) and the compensation target (black solid).

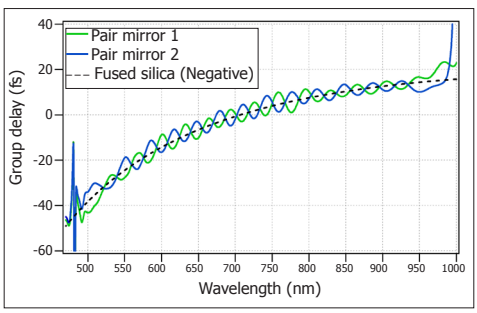


Fig. 3 DCM9 group delay of individual mirror types (green/blue) in comparison to compensation target (1.2mm fused silica glass, black).

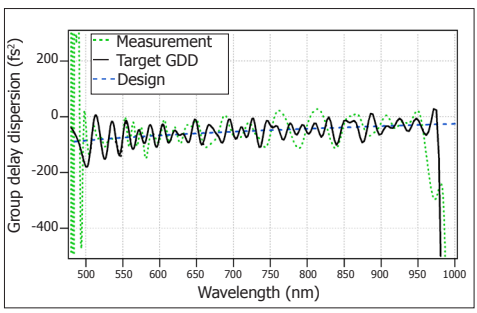


Fig. 4 DCM9 reflected group velocity dispersion measurement of mirror pair (black) in comparison to design data (blue) and compensation target (1.2mm FS, red).

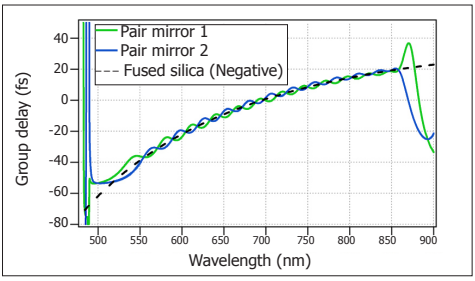


Fig. 5 DCM10 reflected group velocity dispersion measurement of mirror pair (green) in comparison to design data (blue) and compensation target (dotted).

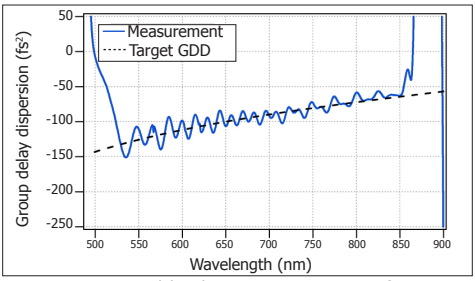


Fig. 6 DCM10 group delay dispersion measurement of mirror pair (blue) in comparison to the compensation target (fused silica glass, black dashed).

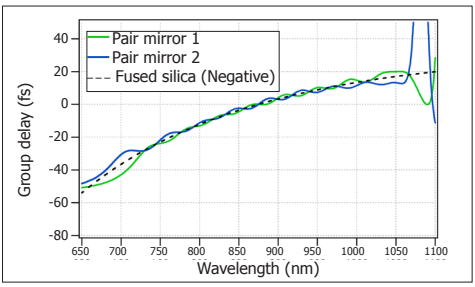


Fig. 7 DCM11 reflected group velocity dispersion measurement of mirror pair (green) in comparison to design data (blue) and compensation target (dotted).

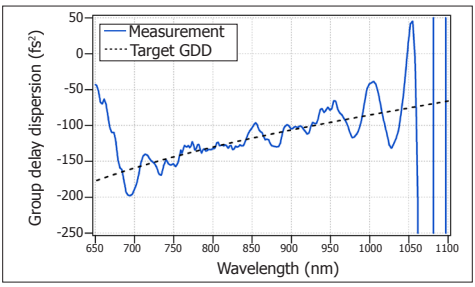


Fig. 8 DCM11 group delay dispersion measurement of mirror pair (blue) in comparison to the compensation target (fused silica glass, black dashed).

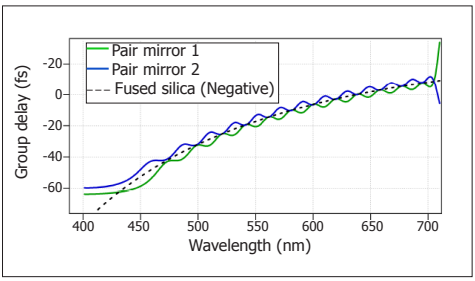


Fig. 9 DCM12 reflected group velocity dispersion measurement of mirror pair (green) in comparison to design data (blue) and compensation target (dotted).

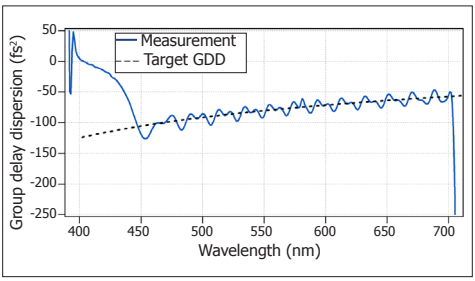


Fig. 10 DCM12 group delay dispersion measurement of mirror pair (blue) in comparison to the compensation target (fused silica glass, black dashed).

Enhanced silver mirrors

This protected silver mirror is enhanced for femtosecond applications and tested for sub-5fs pulses. It features an average reflectivity of more than 99% between 600nm and 1200nm (0-45°) (Fig. 11) and a tailored flat dispersion characteristic in this range. Using this type of mirror for steering few cycle pulses, the applicable pulse energy will no longer be significantly reduced by using several bounces giving you more freedom in designing your experimental setup.

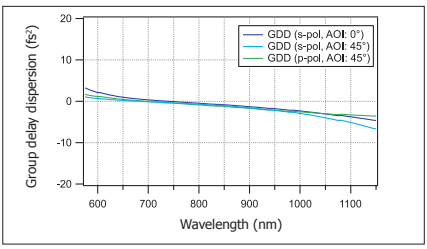


Fig. 11 Flat tailored GDD of the enhanced silver mirrors which is designed for femtosecond applications in a wavelength range between 600 and 1200nm.

Specification of DCM and silver mirrors

	DCM7	DCM9	DCM10	DCM11	DCM12	Enhanced silver
Wavelength range (nm)	600-1200	450-950	500-850	650-1050	400-700	585-1500
Reflectivity (%) HR	>99.6 @600-1200nm	>99.6 @700nm	>99.6 @480-870nm	>99.8 @650-1050nm	>99.7 @400-700nm	>99 @600-1200nm
Reflectivity (Side 2) AR	515-532nm					
GDD/pair	-120fs² @800nm	-60fs² @700nm	-100fs² @650nm	-130fs² @800nm	-80fs² @550nm	
Substrate	Fused Silica					
Dimensions	35 x 20mm : 10mm thickness					1/2" or 25mm diameter 6.35mm thick
ROC	Flat					
AOI	0-10°					0-45°

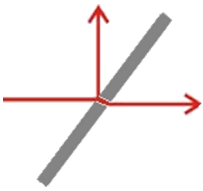
Glass wedges for dispersion fine tuning

The glass wedge pairs allow for dispersion fine tuning and optimal pulse compression in combination with dispersion compensating mirrors. The dispersion characteristics of the DCM mirrors are especially designed to work together with specific glass materials and thus such a wedge pair can be used to fine-tune the dispersion and compress pulses for the desired application.

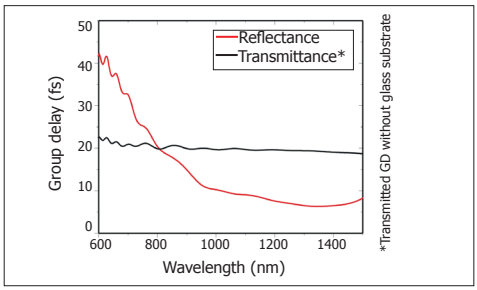
Specification of glass wedges

	Calcium fluoride	Fused silica		
Centre thickness	1.4mm	1.4mm		2.0mm
Dimensions	35x20mm	35 x 20mm		50 x 25mm
Wedge angle	4°	4°		
Surface Quality	S/D <60-40, surface < λ/6	<lambda	<lambda/10	<lambda/4
For use with	DCM7	DCM9		
	Uncoated for use under Brewster angle			

Beam splitter with balanced dispersion



The Laser Quantum all-dielectric beam splitters feature a constant splitting ratio for an ultra-broadband wavelength range and a balanced dispersion in transmission and reflection. Therefore these components are ideally suited for femtosecond applications where a precise control of reflectivity and dispersion is required over a wide spectral range. Transmission and reflection properties of this beam splitter are designed to be identical and thus perfect for dispersion-balanced interferometers or autocorrelators (Fig. 12 & Fig. 13).



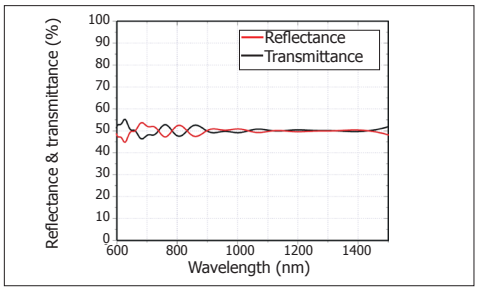


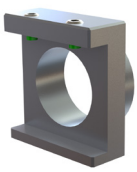
Fig. 12 & Fig. 13 The reflectance, transmission and group delay of the broadband beam splitter with 50% splitting ratio and identical group delay after transmission and reflection. The dispersion in reflection upon the dielectric coating is designed to be identical to 0.7mm of fused silica thus the dispersion in transmission is the same as in reflection.

Specification of beam splitter

Wavelength range:	600nm to 1500nm	Fused silica substrate
Split ratio:	50% ± 5%	Diameter 1”; 0.7mm thickness

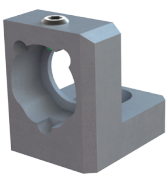
Specialised mirror/optics mounts

Rectangular optics mount



This special optics mount accept rectangular optics/mirrors with a height of either 20mm or 25mm (depending on the chosen version) and can be directly mounted into standard 1” round mirror mounts. The slim design without sideframe is ideally suited to build up compressor beam lines using rectangular mirrors with multi-bounces.

Fixed mirror mount



This mirror mount is designed to accept 1/2” (12.7mm) optics where no adjustment but an increased stability is required. The dimensions of this mount are similar to 1/2” adjustable mirror mounts and can be directly used to exchange those if more stability is needed. Recess’ are engineered into the mount for more permanent positioning of mirrors using glue.

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Wedge mounting adapter pair

This pair of wedge mounting adapters is designed to accept up to 4mm thick glass wedges, as provided by Laser Quantum, to allow dispersion fine tuning in a pulse compression setup. One of the adapters can be directly screwed onto M4 threaded pedestal posts whereas the other features a 20mm grid for M2 screws to allow for a direct mounting onto standard compact translation stages that can be ordered optionally. The design of these adapters allows for a minimal gap between the wedges to minimise dispersive effects.

Specification of specialised mirror/optics mounts

Rectangular optics mount	Fixed mirror mount	Wedge mounting adapter pair
Accepts rectangular optics with a height of 20mm or 25mm	Accepts round optics with a diameter of 1/2" (12.7mm)	Accepts glass wedges and optics up to 4mm thickness
No width limitation of the optics	Not adjustable for increased stability	No width limitations (open frame design)
Directly compatible to standard 1" mirror mounts	Dimensions similar to standard adjustable 1/2" mirror mounts	Optimised design for mounting two wedges with minimal gap between each other and gentle glass clamping due to rubber sheets
Aperture in backplane for leakage or transmitted radiation	Cut-outs for optics gluing	M4 thread for direct pedestal mounting (one adapter). Mounting holes (M2-grid) for direct translation stage mounting (one adapter)
High quality aluminium alloy, anodised or with vibration-grounded finish	High quality aluminium alloy, anodised or with vibration-grounded finish	Translation stage with 6.5mm travel can be ordered optional with an additional adapter for pedestal mounting below the translation stage

Monolithic periscope

The monolithic periscope is designed to realise a broadband polarisation rotation or beam offset within a minimal space and highest stability due to the use of non-adjustable mirror mounts. It is ideally suited to rotate from p-polarisation to s-polarisation, e.g. for use with venteon SPIDER or for parametric phase matching. The design allows for easy height adjustments of the mirror mounts/sliders for quick adaptation to the optical beam path.

Specification of monolithic periscope

Monolithic periscope
Three different mirror mounts (sliders) included to realise different periscope and beam steering options
Polarisation rotating (90°) or non-rotating (0°) beam offset possible
Mirror mounts accept 0.5°" optics
Adapters for 1" optics available (optional)
M4 threaded for direct pedestal post mounting
Minimal beam height: 1.5" (using 0.5" pedestal post mounting)
Minimal beam offset (input - output): 15mm
Maximal beam offset (input - output: 55mm
Monolithic stainless steel body
Choice of mirrors (sold separately) available

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