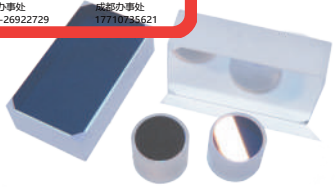
venteon optics

Optics designed for ultra-short pulses

- Group Delay Dispersion (GDD) compens
- Enhanced silver mirrors
- CaF_2 and fused silica glass wedge pairs
- Designed specifically for few-cycle pulse management



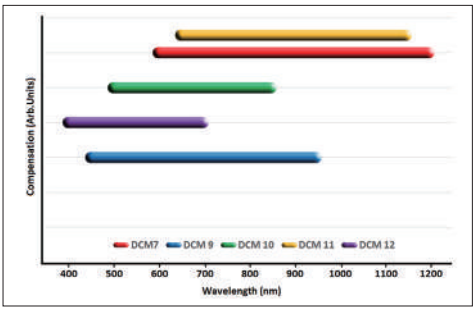
Overview

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

DCM mirror pairs

Choosing the right mirrors

The DCM mirrors are all manufactured to the same high quality specifications, however, each mirror is suited to a different application dependent on compensation vs. wavelength. See Fig. 1 to choose the correct mirrors for your research.



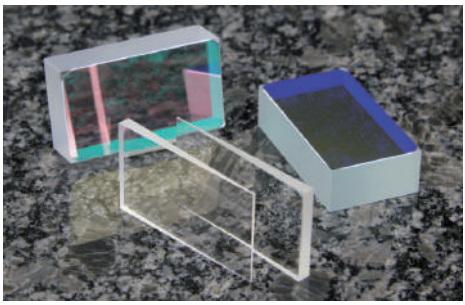


Fig. 1 DCM mirror wavelength and compression performance and image of DCM mirrors

The DCM products are dispersion compensating mirror pairs used for the compensation of positive dispersion affecting femtosecond laser pulses (Fig. 2 to 13). 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 GDD 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.

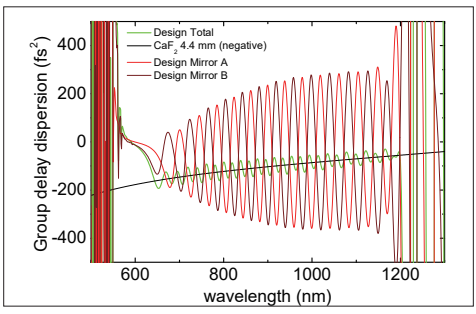


Fig. 2 DCM7 Group delay dispersion: DCM7 reflected group delay dispersion for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green, sum of mirror A (red) and mirror B (dark red)) and compensation target (black, 4.4 mm CaF2).

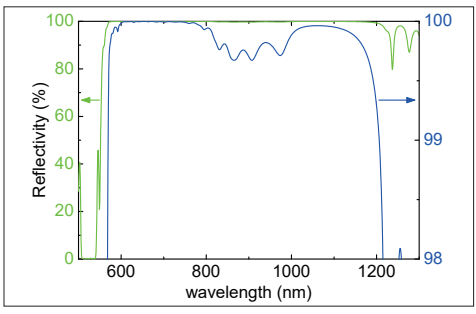


Fig. 3 DCM7 Reflectivity: DCM7 reflectivity for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green/left full range, blue/right zoom-in to 98 to 100%).

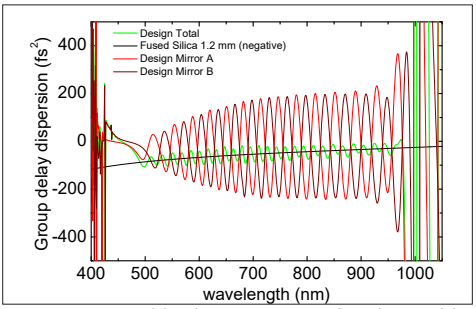


Fig. 4 DCM9 Group delay dispersion: DCM9 reflected group delay dispersion for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green, sum of mirror A (red) and mirror B (dark red)) and compensation target (black, 1.2 mm fused silica).

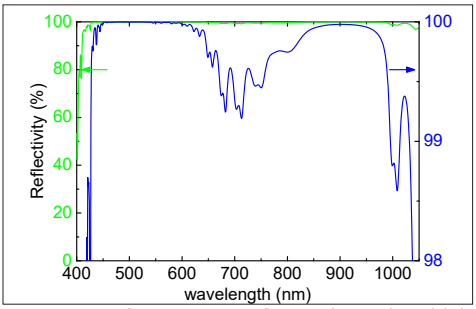


Fig. 5 DCM9 Reflectivity: DCM9 reflectivity for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green/left full range, blue/right zoom-in to 98 to 100%).

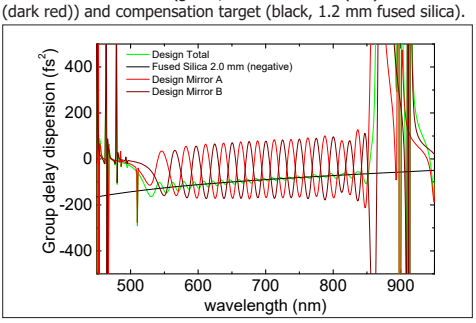


Fig. 6 DCM10 Group delay dispersion: DCM10 reflected group delay dispersion for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green, sum of mirror A (red) and mirror B (dark red) and compensation target (black, 2.0 mm fused silica).

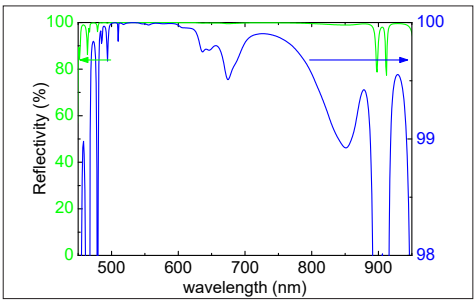


Fig. 7 DCM10 Reflectivity: DCM10 reflectivity for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green/left full range, blue/right zoom-in to 98 to 100%).

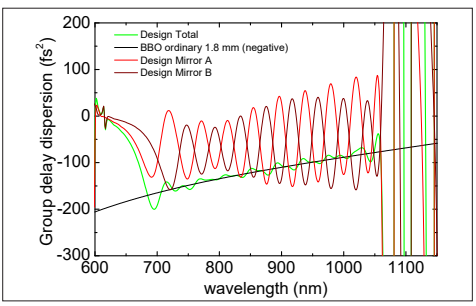


Fig. 8 DCM11 Group delay dispersion: DCM11 reflected group delay dispersion for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green, sum of mirror A (red) and mirror B (dark red)) and compensation target (black, 1.8 mm BBO).

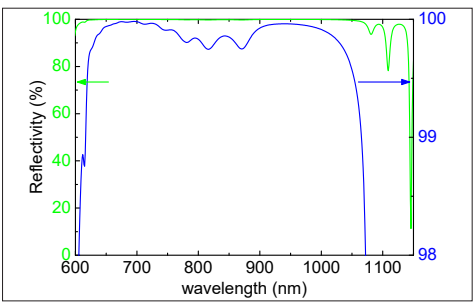


Fig. 9 DCM11 Reflectivity: DCM11 reflectivity for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green/left full range, blue/right zoom-in to 98 to 100%).

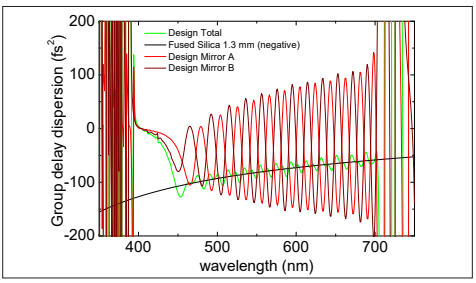


Fig. 10 DCM12 Group delay dispersion: DCM12 reflected group delay dispersion for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green, sum of mirror A (red) and mirror B (dark red)) and compensation target (black, 1.3 mm fused silica).

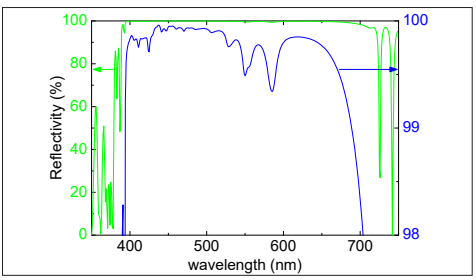


Fig. 11 DCM12 Reflectivity: DCM12 reflectivity for p-polarized light under 7° angle of incidence for one bounce on both mirrors (green/left full range, blue/right zoom-in to 98 to 100%).

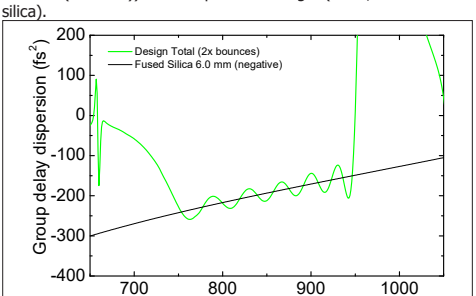


Fig. 12 CM-2 Group delay dispersion: CM-2 reflected group delay dispersion for p-polarized light under 7° angle of incidence for two bounces (green, sum of two mirrors) and compensation target (black, 6.0 mm fused silica).

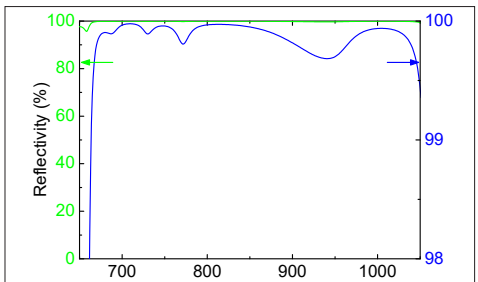


Fig. 13 CM-2 Reflectivity: CM-2 reflectivity for p-polarized light under 7° angle of incidence for two bounces (green/left full range, blue/right zoom-in to 98 to 100%).

Enhanced silver mirrors

This protected silver mirror is enhanced for femtosecond applications and tested for sub-5 fs pulses. It features an average reflectivity of more than 99% between 620 nm and 1110 nm (0-45°) (Fig. 15) and a tailored flat dispersion characteristic in this range (Fig. 14). The enhanced silver mirror "blue" is optimized for shorter wavelengths and offers a reflectivity of more than 97% between 450 nm and 950 nm. Both mirror types will give you more freedom in designing your experimental setup.

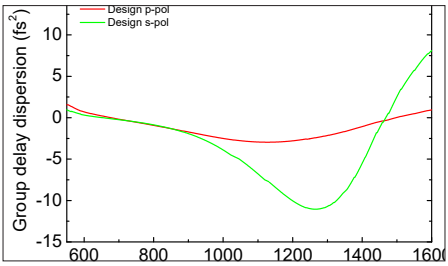


Fig. 14 Enhanced silver mirror Group delay dispersion: Reflected (flat) group delay dispersion of the enhanced silver mirrors for p- and s-polarized (red and green) light under 45° angle of incidence.

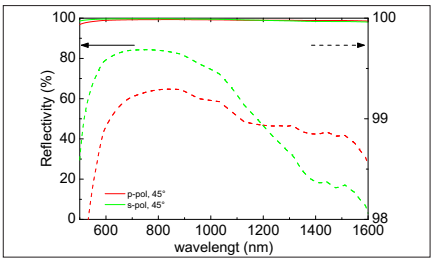


Fig. 15 Enhanced silver mirror Reflectivity: Reflectivity of the enhanced silver mirrors for p- and s-polarized (red and green) light under 45° angle of incidence (solid/right full range, dashed/right zoom-in to 98 to 100%).

	DCM7 GDD-mirror pair	DCM9 GDD-mirror pair	DCM10 GDD-mirror pair	DCM11 GDD-mirror pair	DCM12 GDD-mirror pair	CM-2 GDD-mirror (set of 2)	Enhanced silver mirror (single)	Enhanced silver mirror "blue" (single)
Wavelength range (nm)	600-1200	450-950	500-825	650-1050	400-680	740-940	550-1500	450-1300
Reflectivity/pair (%) HR within wavelength range	>99.2	>99.2	>99.2	>99.5	>99.2	>99.6	>99 @620-1110 nm	>97 @450-950 nm
Reflectivity (Side 2) AR	515-532 nm	n/a	n/a	n/a	n/a	n/a	n/a	n/a
GDD/pair	-120 fs² @800nm	-55 fs² @700 nm	-100 fs² @650 nm	-120 fs² @850 nm	-80 fs² @550 nm	-220 fs² @800 nm	< ±12 fs²	< ±12 fs²
Target design	4.4 mm CaF_2	1.2 mm FS	2.0 mm FS	1.8 mm BBO	1.3 mm FS	6 mm FS	n/a	n/a
Dimensions	35 x 20 mm : 10 mm thickness						1/2" or 25 mm diameter 6.35 mm thick	25 mm diameter 6.35 mm thick
Damage threshold	0.05 J/cm²						0.15 J/cm²	
ROC	Flat, residual ROC of > 250 m possible							
AOI	0-10°						0-45°	
Substrate	Fused Silica							
Surface quality[1]	3/0.2 (all Ø10 within 28x16); 5/3x0.063 (Øe 33x16)							

[1] According to ISO 10110

Beam splitter with balanced dispersion

Wavelength range:	600 - 1500 nm	Substrate:	Fused silica substrate
Split ratio:	50%±5%	Dimensions:	Diameter 1"; 0.7 mm thickness

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.

	Calcium fluoride	Fused silica	
Centre thickness	1.4 mm	1.4 mm	2.0 mm
Dimensions	35 x 20 mm	35 x 20 mm	50 x 25 mm
Wedge angle	4°	4°	
Surface Quality	<lambda/6, S/D<60-40	<lambda/10	<lambda/4
For use with	DCM7	DCM9, DCM10, DCM12	
Bandwidth	300 - 1500 nm, uncoated for use under Brewster angle		

venteon optics

Laser Quantum
A Novanta Company

Specialised mirror/optics mounts

Rectangular optics mount

This special optics mount accepts rectangular optics/mirrors with a height of 20 mm 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.

Wedge mounting adapter pair

This pair of wedge mounting adapters is designed to accept up to 4 mm 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 20 mm 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.

Rectangular optics mount	Wedge mounting adapter pair
Accepts rectangular optics with a height of 20 mm	Accepts glass wedges and optics up to 4 mm thickness
No width limitation of the optics	No width limitations (open frame design)
Directly compatible to standard 1" 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	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	Translation stage with 6.5 mm 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 parametric phase matching. The design allows for easy height adjustments of the mirror mounts/sliders for quick adaptation to the optical beam path.

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
M4 threaded for direct pedestal post mounting
Minimal beam height: 1.5" (using 0.5" pedestal post mounting)
Minimal beam offset (input - output): 15 mm
Maximal beam offset (input - output: 55 mm
Monolithic stainless steel body
Choice of mirrors (sold separately) available

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