



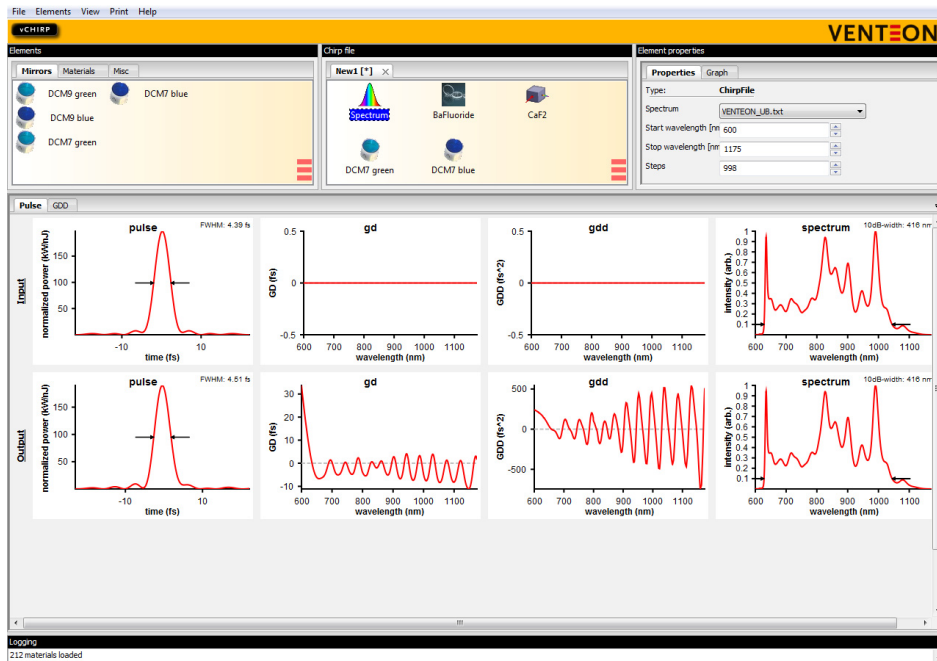
vCHIRP

Dispersion Calculation Software

Quick user guide

Release 1.0

VENTEON | PULSEAPPS



Content

1. Getting started	3
1.1 Basic functions	3
1.2 Input field "Elements"	4
1.4 Input field Element properties:	6
1.5 Context menus and editing	7
2. Example calculations	8

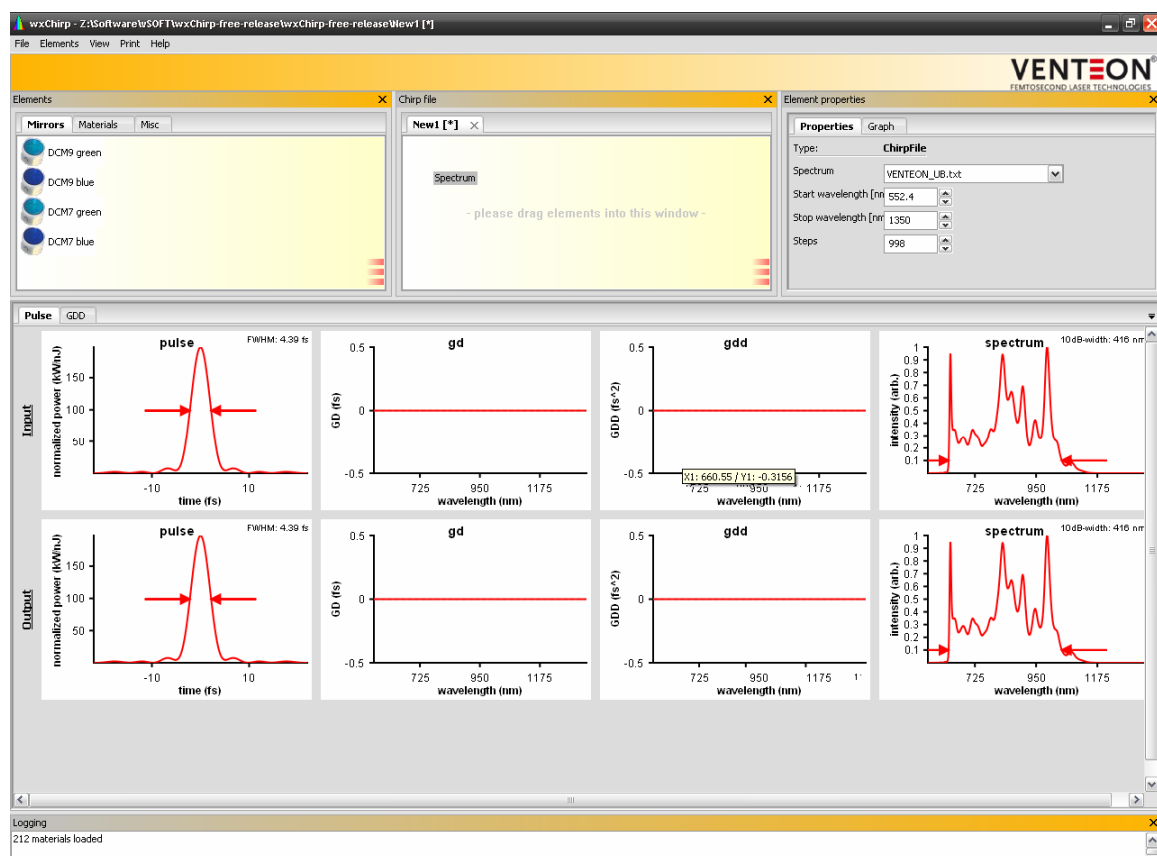
1. Getting started

Please execute the vChirp-Installer to install the program and start the vChirp-program file from the desktop or from the start menu.

This program is delivered as freeware under the conditions as specified by the license agreement included. By installing and using this program, these terms are accepted by the user. Distribution of this program is only allowed by the prior approval of VENTEON Laser Technologies GmbH.

1.1 Basic functions

After starting the vChirp program, the following screen will be shown initially:

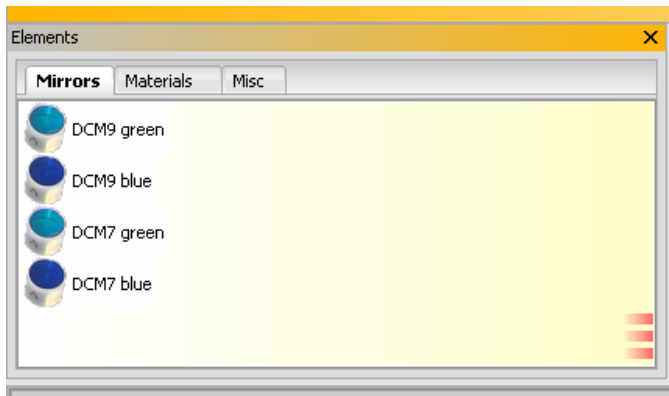


The window is divided into different input fields: **Elements** (top left), **Chirp file** (top, middle) and **Element properties** (top right). Here the dispersive elements can be selected and added to the dispersion calculation in the Chirp file window. Their properties like thickness, angle, etc. can be specified in the Element properties window.

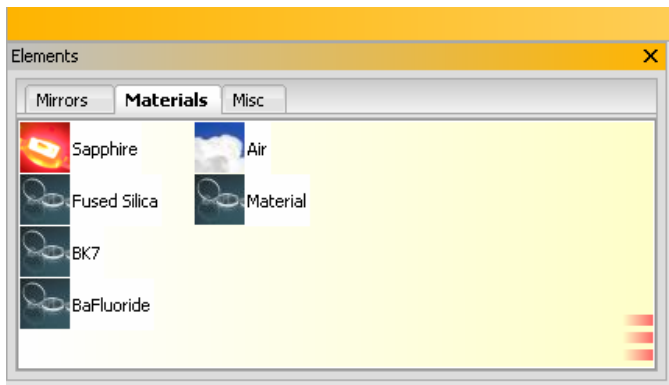
Below these segments, the calculated results are displayed in different columns depicting the instantaneous pulse power in time domain (**Pulse**), the Group Delay (**GD**), the Group Delay Dispersion (**GDD**) and the corresponding power spectrum.

1.2 Input field "**Elements**"

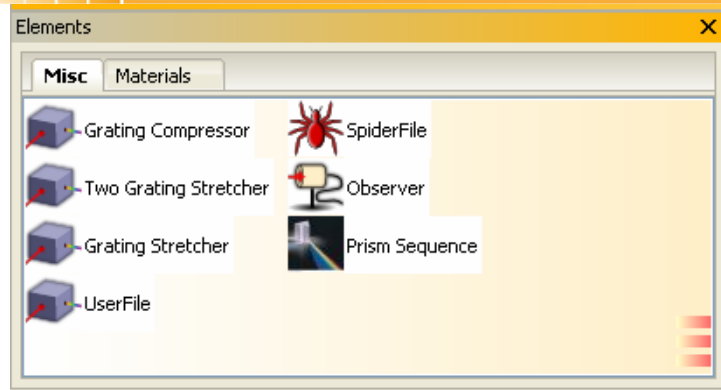
Here the user can choose between three different types of dispersive elements. In the category **mirrors**, the two GVD mirror pairs DCM7 and DCM9 as commercially available from VENTEON can be selected. One pair is formed by one "blue" and one "green" mirror of the same type.



By selecting **Materials** from the tab menu bar, different pre-selected materials can be chosen. The icon **Material** will allow you to select a different glass or crystal type from an included data base which will be shown in the properties window after this element is added to the dispersion calculation.



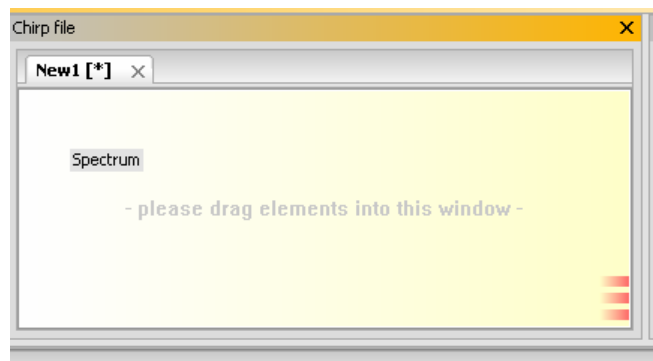
For any type of glass or dispersive element not listed, various options are offered in the **Misc** tab.



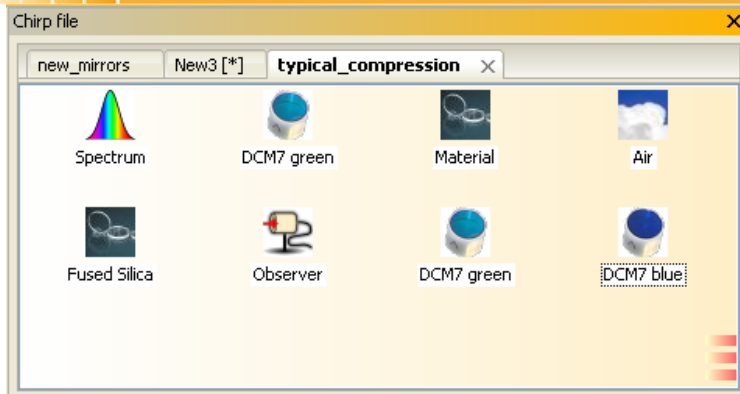
The **SpiderFile** option allows a direct implementation of the VENTEON | PULSE FOUR SPIDER measurements in the dispersion calculation. The **Observer** can be used to get information about the chirp at any intermediate point in the calculated setup. A **Prism Sequence** which properties can be specified in the **Element properties** window can also be chosen.

The selections indicated by the black box icon on the left side are not available in this freeware version of vChirp.

1.3 Input field "Chirp file"

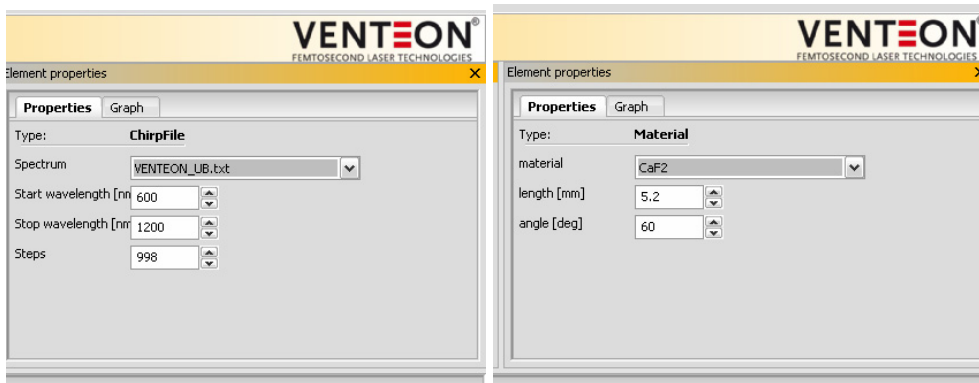


In this window, the dispersion setup to be calculated is assembled. The schematical graphic user interface allows for a very intuitive composition of the dispersive elements which can be selected in the **Elements** window and simply dragged into this window just as they are transversed by the laser pulse in the real lab experiment. For every selected component a context dialog will open up in the **Element properties** window. Each setup can be saved and re-loaded in the "File" menu from the task bar. By toggling the tab bar, several calculations can be done in parallel for easy comparison of the best compression scheme.

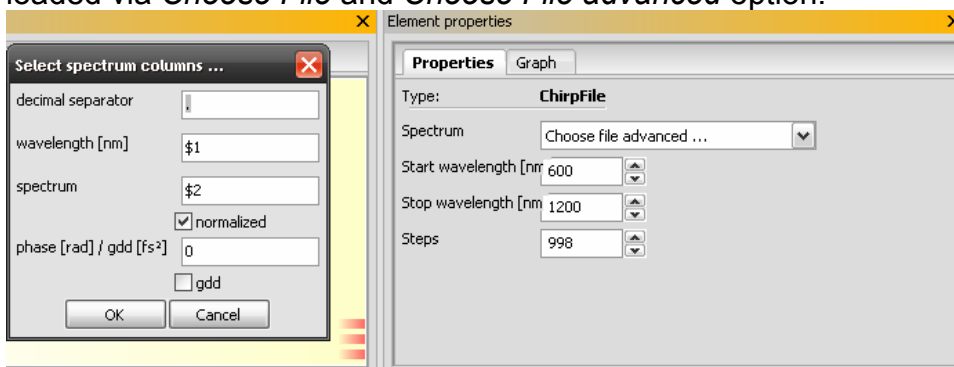


In the example above, the pulse with the specified spectrum travels through air, fused silica (here the chirp is "observed") then CaF2 ("Material") and is finally compressed by dispersive mirrors.

1.4 Input field *Element properties*:



In this dialogue box, the properties of every element in the chirp calculation can be edited (**Properties**) or viewed individually (**Graph**). The spectrum of the laser pulse to be used for the calculations can be selected for VENTEON | PULSE: ONE PE (power edition), UB (ultrabroad edition) and OS (octave-spanning edition). In addition, several Gaussian spectra can be defined or user data can be loaded via *Choose File* and *Choose File advanced* option.



In the latter case, after selecting the file name, the file format can be specified. In this dialogue also simple calculations are possible ($10^{(\$2/10)}$) for logarithmic spectral data [dB/nm] in column 2 e.g.)

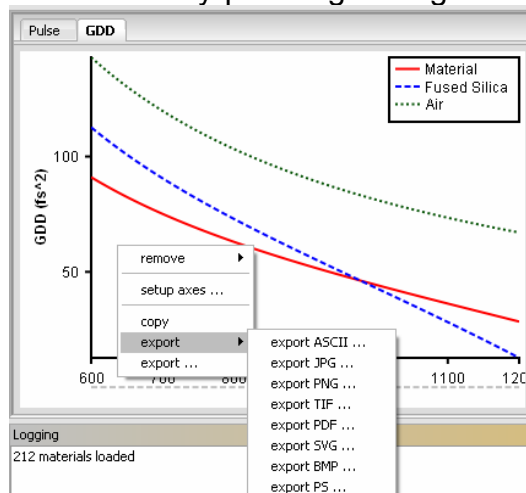
1.5 Context menus and editing

Apart from the controls provided in the Menu bar various context dependent menus are available where only some most helpful ones should be mentioned here briefly.

Within the **Elements** window, the right mouse button can be used for selecting elements and adding them to the dispersion calculation file.

Within the **Chirp file** window, the right mouse button can be used for selecting elements or deleting them from the dispersion calculation file. In addition a “Plot...” menu is available to add the selected component to a designated plot window.

Every plotted figure can be edited in several convenient ways. Axis ranges in any plot and coordinate can be changed by positioning the mouse pointer over the corresponding axis and moving the mouse with the left button pressed down. Also a setup menu for each axis is available, where plotting parameters can be adjusted. This menu can be entered by pressing the right mouse button over the

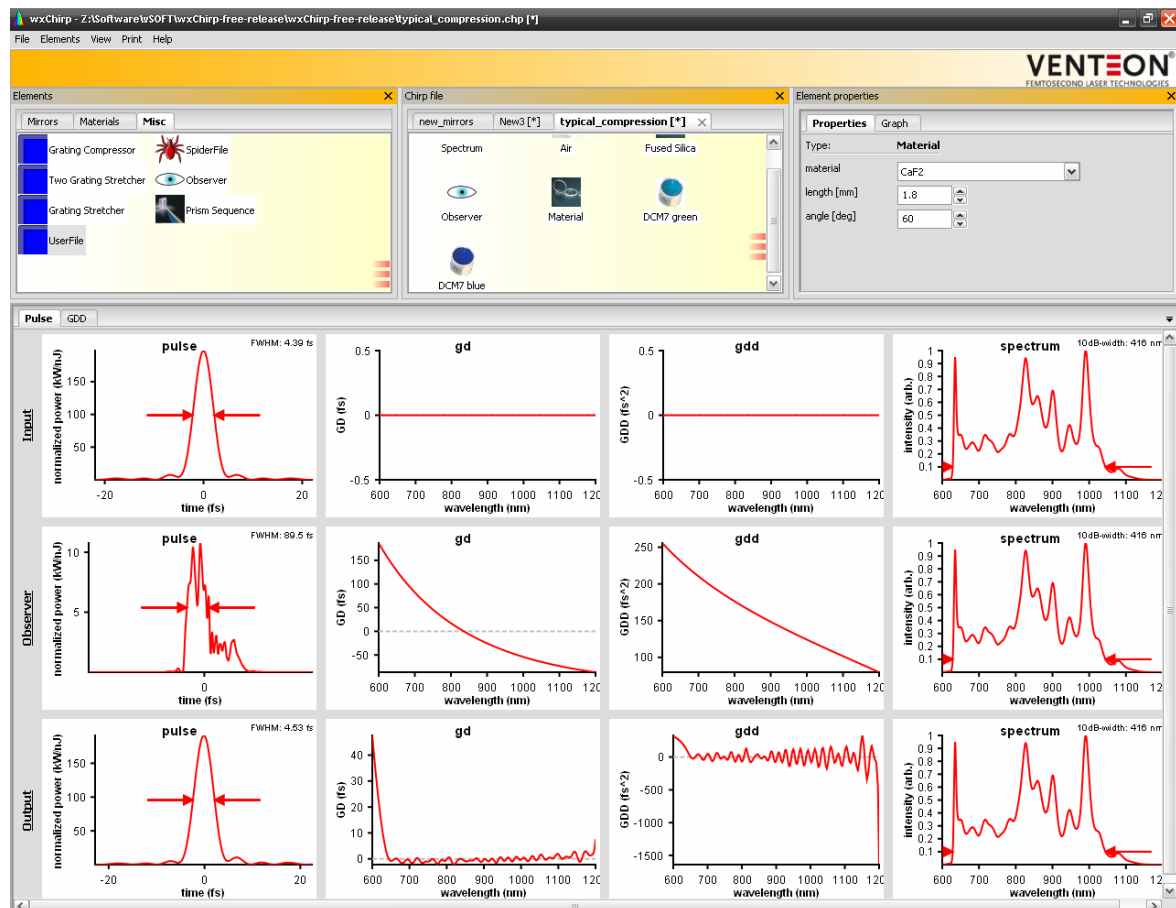


plot window to be edited.

Window elements can be undocked by dragging the window using the left mouse button in the header bar of the element. In order to hide any window from view, please choose the corresponding option from the “View” menu.

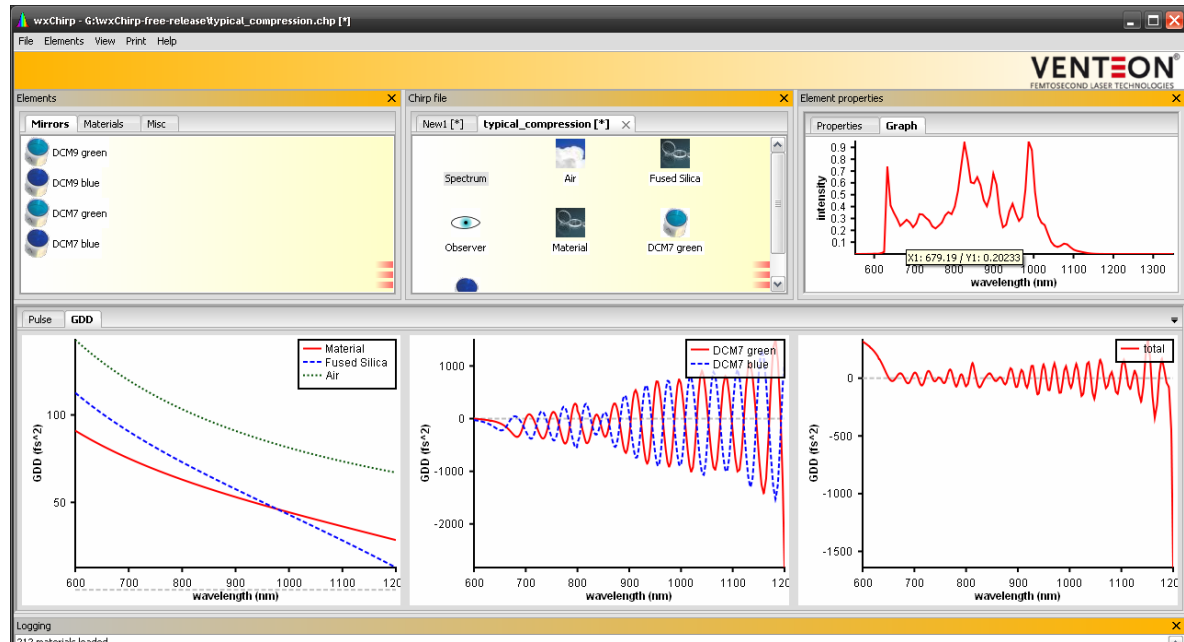
2. Example calculations

The calculation shown below represents a typical compression setup, where the ultrashort laser pulse with a transform limit of 4.4 fs as emitted by the VENTEON | PULSE: ONE UB edition travels through 5 m of ambient air and 2 mm of fused silica. After this, the Observer is used to view, how chirped the pulse is at this point in the experiment. The pulse duration (FWHM) is stretched to about 90 fs and the pulse peak power is reduced by more than one order of magnitude. The compression is done by NANO|CHORD DCM7 mirrors ("blue" and "green") as exclusively sold by VENTEON and CaF2 wedges used in Brewster angle for fine tuning. With 2 bounces on each mirror and 1.8 mm CaF2 (under 55° degrees) the pulse can be ideally recompressed to 4.5 fs and almost identical peak power. The scaling of this axis is done in kW/nJ which allows the direct calculation of the peak power, if the pulse energy is known. So for a VENTEON | PULSE: ONE UB edition with a specified pulse energy of 2 nJ, the recompressed peak power would be close to 400 kW. For a focussing down to 1 μm, this would correspond to an intensity of more than 10^{11} W/cm² (900 kW for a VENTEON | PULSE: ONE PE).



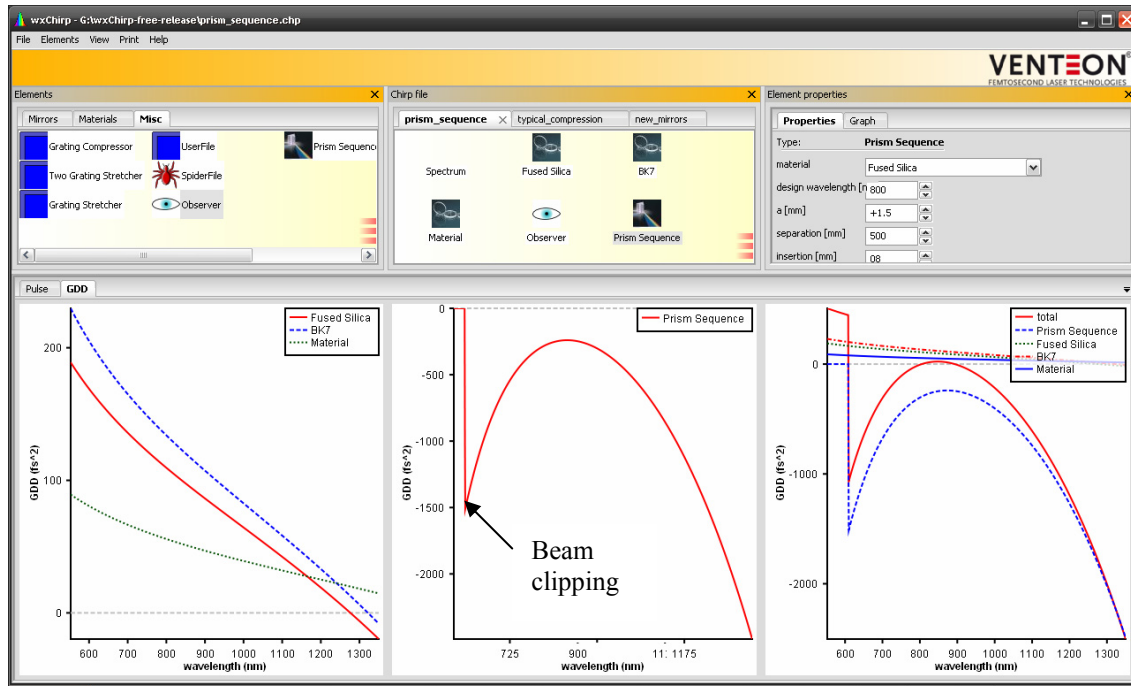
Please note that these calculations are without any warranty for the results achieved in the real experiments and are based on the design data of the implemented components as GVD mirrors and glass types. No liability can be accepted for any deviations from these calculations and the decisions and planning based thereupon.

The individual contribution of each element to the overall dispersion can be seen easily by the GDD tab in the results window. In the Chirp file calculation window, each element can be plotted into the “Positive Dispersion”, “Negative Dispersion” or “Total Dispersion” window by opening the context menu with the right mouse button and choosing the Plot options therein.

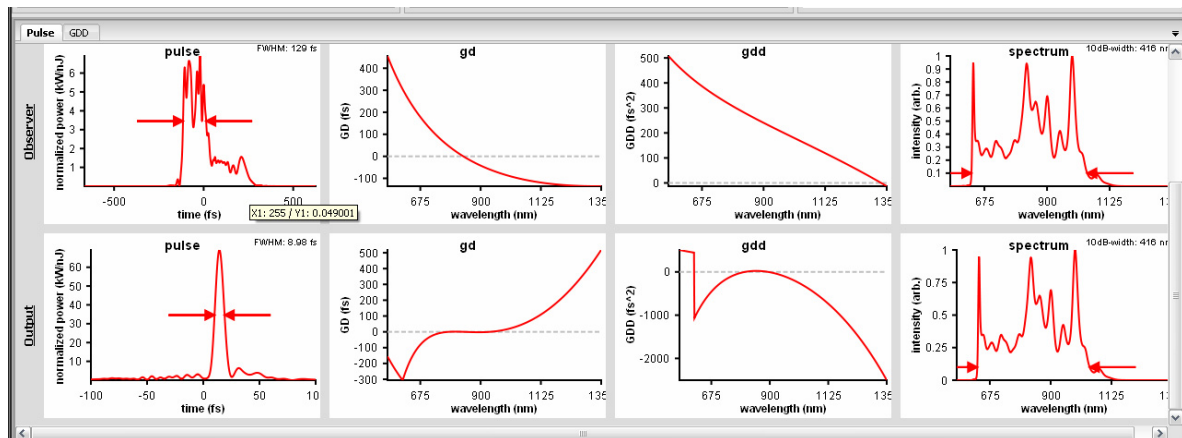


This view is especially helpful in cases of unsatisfying compression results in order to learn which problems in the setup causes the suboptimal recompression.

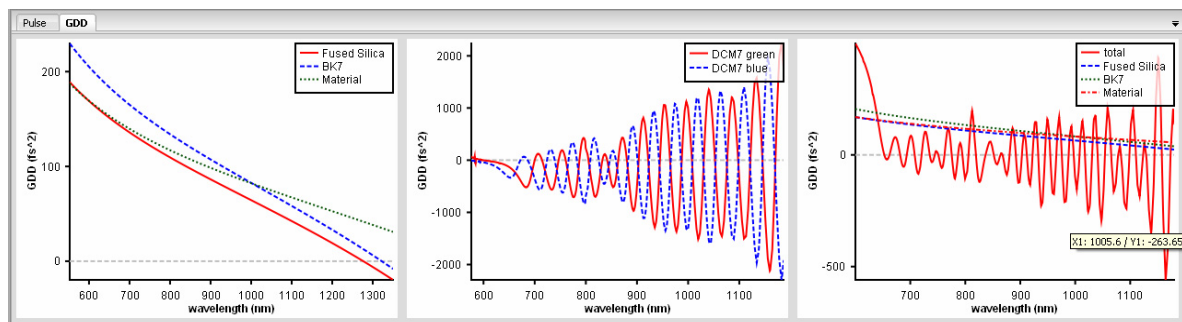
As an example two compression schemes using a fused silica prism sequence (apex separation 500 mm, material insertion 8 mm) and NANEON | CHORD GVD mirrors are compared. The dispersion to be compensated is caused by 3 mm fused silica, 3 mm BK7 glass and 2 mm CaF₂. In the next figure, the dispersion curves are individually depicted.

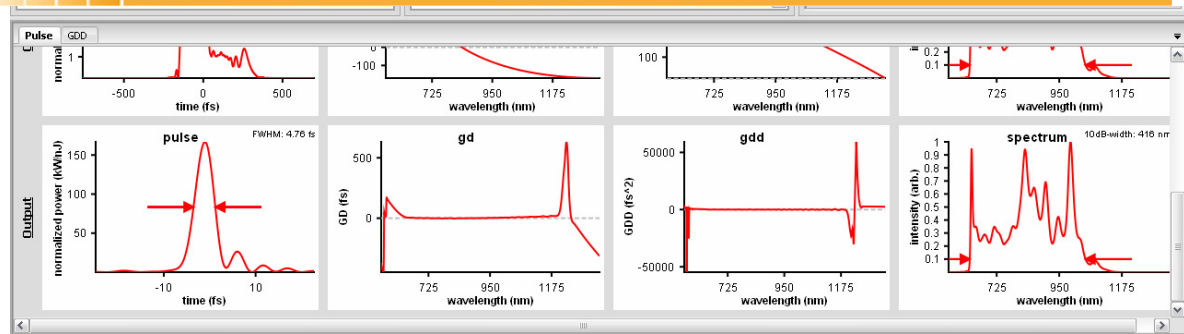


The resulting total group velocity dispersion curve will still be strongly curved indicating the remaining third and fourth order distortions. The resulting pulse duration will therefore be about 9fs (FWHM) (peak power about one third of max. value) and the edges of the spectrum are dispersed into the pulse background.



The alternative compact recompression scheme using GVD mirrors is shown below (an additional 2.2 mm of CaF2 have been added for fine tuning).





Although the used mirrors are designed to compensate ambient air, CaF₂ and BaF₂ and thus the third order dispersion is not optimized for the materials used here, it is possible to recompress the pulse to sub-5fs and to reach almost 90 % of the initial peak power.

VENTEON Laser Technologies hopes that this program will help you in optimizing your ultrafast dispersion management and thereby achieving the shortest pulses available with your system. We would be happy to assist you in your ultrafast application, so if you have any questions, please feel free to contact us any time at info@venteon.com.