MTW Grating Compression Chamber

The grating compression chamber (GCC) is built in a two-pass scheme with a roof mirror between passes. Both gratings are dielectric with 1740 lines/mm. The first grating (220 × 165 mm) is called G1/G4 to follow the traditional terminology of four gratings compressors and identify each hit of the beam on the grating. The second grating, G2/G3, is 350 × 190 mm. The G1/G4 grating is mounted on a rotation stage, while G2/G3 has both rotation and translation stages. The compressor is located inside the vacuum chamber and shown in Fig. 1. The input beam (red path) of 70 × 70 mm^2 (FWHM) arrives through the port P1 and after the turning mirror M1 hits the upper G1 area of the grating G1/G4.

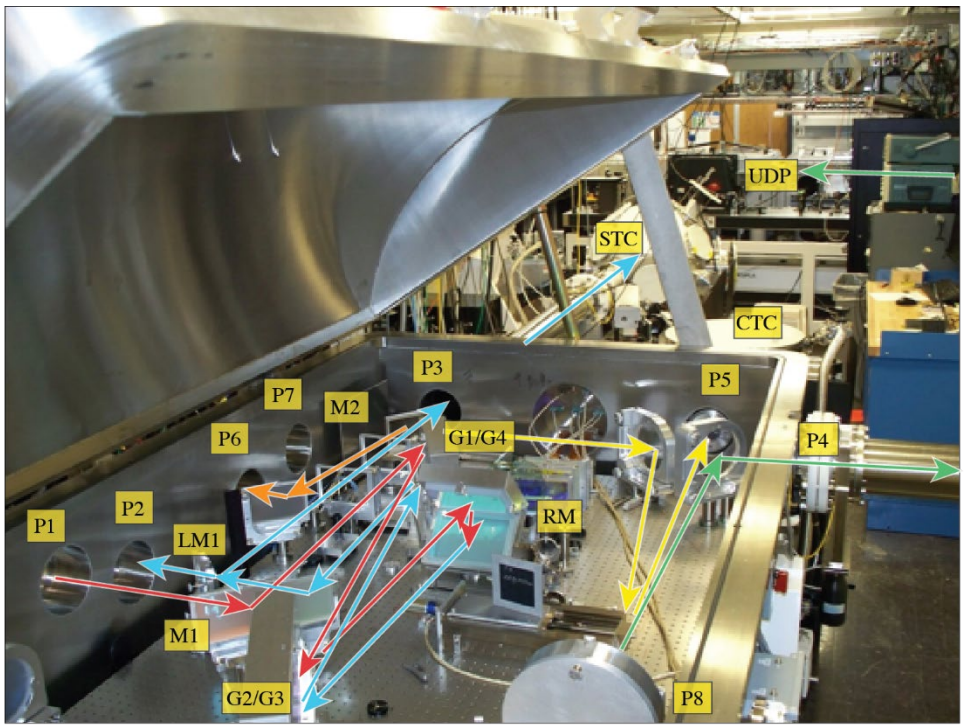

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Fig. 1. Picosecond grating compressor chamber (ps-GCC). P: port; M: mirror; LM: leaky mirror; RM: roof mirror; G1/G4: the first grating; G2/G3: the second grating; STC: spherical target chamber; CTC: cylindrical target chamber; UDP: underdense plasma chamber.

The diffracting beam goes to the G2 area of the grating G2/G3 and then after the roof mirror RM comes back to G1/G4. The leaky mirror LM1 transmits about 1.5% of the output beam to the compressor diagnostics package (CDP) through the port P2.

The output beam can be directed into different applications. Through the vacuum port P3 the output beam (blue path) goes to the STC. The turning mirror M2 on a translation stage directs the beam into the UDP chamber (green path) through the vacuum port P4 or into the CTC through the window port P5

(yellow path). The CTC chamber is separated from the GCC by a lens or a window to enable target experiments at other vacuum levels. The window port P6 passes the main output beam (orange path) on the CDP table for low-intensity experiments and/or diagnostics. The ports P7 and P8 are used for visual inspection of the gratings. All optical ports P use standard NW160 flanges. The chamber also has four facility NW250 ports for vacuum pumps, controls, and electrical feedthroughs.

The ps-GCC optics are mounted on a honeycomb breadboard (8 ft $\times$ 4 ft) that has six support legs that are mechanically decoupled from the compressor chamber body using vacuum bellows. The stainless-steel compressor chamber, weighing ~6 tons, is supported by four separate legs. The NW250 vacuum port is located beneath the chamber. The compressor chamber is not specified for ultrahigh vacuum and therefore has Viton O rings for sealing and does not have baking equipment. The best vacuum with a turbo pump is 2×10^{-6} Torr. Better vacuum levels have been possible with the cryogenic pump (3×10^{-7} Torr), but some experiments and measurements are sensitive to its additional vibration.