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Development of femtosecond laser vacuum cryogenic system

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A cooling system is developed for femtosecond laser experiment. The system includes a vacuum tank and a cooling chamber. It uses liquid nitrogen and helium as cold source and resistive heater as power source which heats the cooled crystal. With the controlling strategy of PID, it can make the temperature of the cooled crystal changed continuously from 5 to 300K. In this paper, the structure of the whole system is introduced and the numerical simulation of the heat leakage and temperature field is presented. Finally, the experiment and the analysis of the difference between experiment and numerical simulation are given. From 5 to 80K, we use liquid helium as cold source, and the fluctuation of the temperature is lower than±0.5K; from 80 to 300K the liquid nitrogen as cold source and the fluctuation of the temperature is lower than±0.8K. Besides, for this system, a flexible pipeline transporting cryogenic liquid nitrogen and helium is invented. Using this flexible pipeline and a two-dimension move platform which is used for fixing the cooling chamber, the angle of the crystal can be changed more than±30°and the location can be changed more than±10mm.

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