Structure design and precision analysis on rotary feed-in mechanism of toroidal surface mirror in beamline

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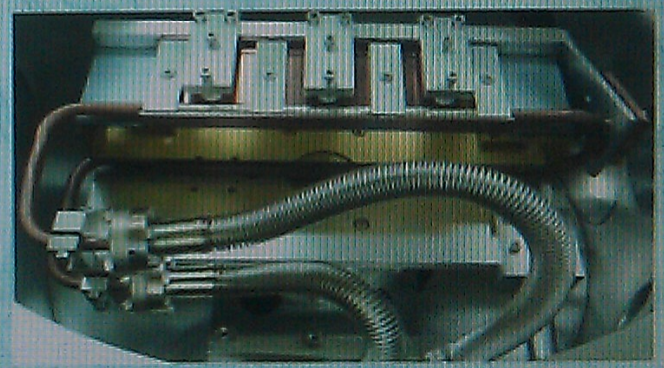
In order to make parallel beam which is chromatic dispersion along vertical direction focused through toroidal surface mirror which is installed vertically behind monochromator and 34m aparting from the light source, and whose grazing incidence angle is 1.5, deflection direction is 3° along horizontal direction, and make the image of light source focused on slit horizontally at the same time, the the full use of limited coherent photons must be guaranteed.

Analysis shows that light spot excursion caused by translation error along vertial direction of beam path is 2δZ. The translation error along beam path has little influence on horizontal position of light spot, so the maximum position deviation along vertical direction should be less than 10μm. When Roll angle and Pitch angle of toroidal surface mirror have angle error, the exit angle will generate deviation, and induce the deviation of light spot on the position of second slit. According to the precision requirement of spatial position of toroidal surface mirror, translation error along X, Y, Z direction should be that X < 0.1 mm, Y < 0.01 mm, Z < 0.01 mm, rotary error along X, Y, Z direction should be that Roll < 5 ", Yaw< 0.2 ", Pitch< 5 ". According to spatial position and angle precision requirement of toroidal surface mirror, step motor, small pitch precision screw and precision linear guide are assembled as angle feed-in mechanism. The mirror support on the turntable is turned by the vacuum feed-in push rod which is drived along sliding guide. Rotary mechanism, rotation of mirror support, deviation of mirror support and spatial position precision of toroidal surface mirror must satisfy the design demand. The mechanism has been used in beamline, and its performance is stable and reliable.

Driving mechanism



Rotary feed-in mechanism