

Design Consideration for Mechanically Stable Support, and Concrete Floor Grinding Machine “Yuka-to-Kensaku”

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In the XFEL project, supporting beam line instruments in micron-meter stability is required. Specially, in the undulator section, the electron beam has to be controlled along a straight line within error of 5 μm for 80 m long distance. This is extremely hard task. To perform this requirement, first of all, we need very stable support system.

How can we realize?

- (1) Design beam line level as low as possible. Bring every thing close to concrete floor. >>> In our XFEL, we made it 800 mm.
- (2) Design support structure mechanically rigid. >>>We use ceramic cylinder.
- (3) Use low thermal expansion material for support structure, or control its temperature. >>> We use cordierite ceramic cylinder, whose thermal expansion coefficient is $1\sim 2 \times 10^{-6}$, which is about ten times lower than the steel.
- (4) Make support structure massive and heat capacity bigger, as the granite table. Larger mass makes vibration lower, and big heat capacity reduces temperature change inside the structure. >>>We filled sand inside the ceramic cylinder, thus total weight became 200 kg.
- (5) Eliminate position adjusting screws, since it is most unstable structure against external static force, or vibration of cooling water. If adjusting necessary, use sliding plate, and need to be tightly fixed after adjustment complete.
- (6) Make the interface between the support stand and concrete floor tight link. >>> We developed concrete floor grinding machine, which provides very flat concrete surface, with specified height, with minimum tilt.

Figure 1 shows the support stand for beam monitoring devices in XFEL, Fig. 2 is the concrete floor grinding machine. When we adjust stand position, we feed pressurized air into the base flange, thus air lifts the support about 10 μm high, and we can easily move. When alignment is done, simply stop the air supply, the support stand touch down to the concrete floor. (for detail refer Otake's paper)

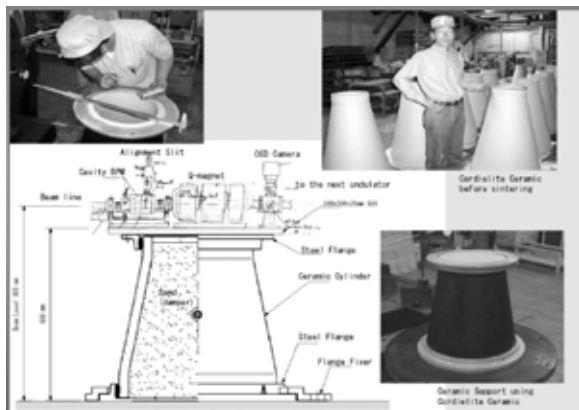


Fig.1 Ceramic support stand.



Fig.2 Concrete floor grinding machine.