

BEAMLINE FRONT ENDS AT THE 2.5-GeV PHOTON FACTORY STORAGE RING

H. Miyauchi[†], S. Asaoka, T. Tahara, Accelerator Laboratory, High Energy Accelerator Research Organization (KEK), Tsukuba, Ibaraki, Japan

INTRODUCTION

Since the first commissioning in 1982, the 2.5-GeV Photon Factory (PF) storage ring has been upgraded three times in 1986, 1997 and 2005, in order to reduce the beam emittance and to produce new short-straight sections for in-vacuum short period undulators.

In order to adopt the PF storage ring upgrades, the beamline front ends were necessary to be modified. We look back the old and new components of the PF beamline front ends.

MANUAL GATE VALVES

Manual gate valves separate the beamline front ends from the storage ring. We used to use the Viton O-ring seal manual gate valves, but the Viton O-ring seal could not bear the radiation damage. So we replaced the Viton O-ring seal manual gate valves into the all metal manual gate valves (Figs.1 and 2).

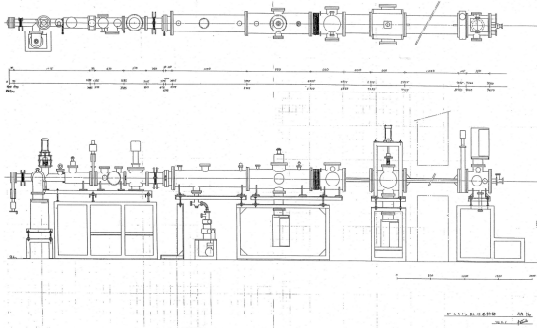


Figure 1: Old BL-15 Front End Layout.

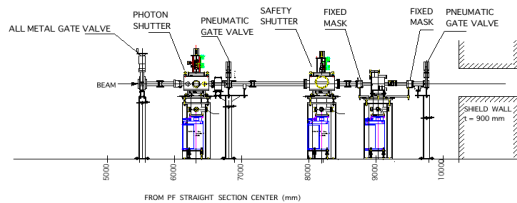


Figure 2: New BL-15 Front End Layout.

PHOTON SHUTTERS

At the first commissioning in 1982, the PF storage ring had only 4 bending beamlines and no insertion devices,

the structure of the water cooling Cu absorber inside the photon shutter was very simple (Fig. 3). After installing undulators, we developed the rod type of photon shutter (Fig. 4). And after installing multi-pole wigglers, in order to reduce the loading power density on the surface of shutter, the water cooling Cu absorber inside the photon shutter was made triangle-shaped at the multi-pole wiggler beamline front ends (Fig. 5).



Figure 3: Photon Shutter for Bending BL Front End (Old Type).

[†] hiroshi.miyauchi@kek.jp

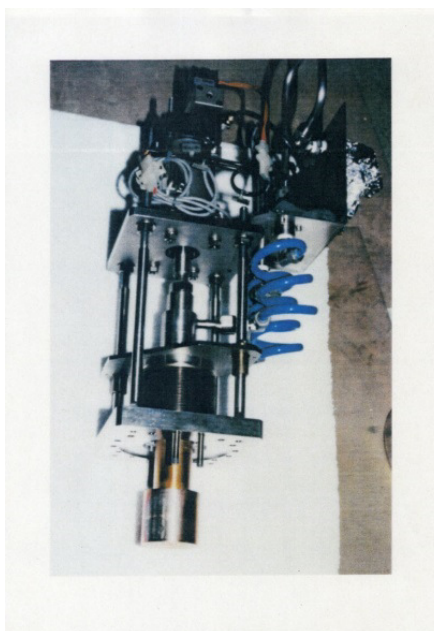


Figure 4: Photon Shutter for Undulator BL Front End (Old Type).

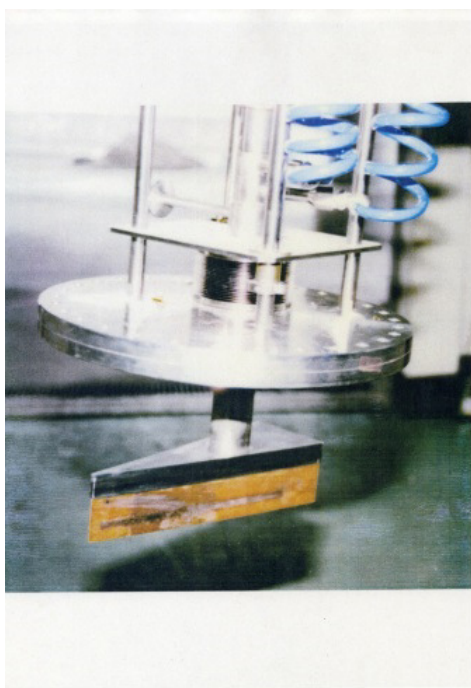


Figure 5: Photon Shutter for Multi-Pole Wiggler BL Front End (Old Type).

At the time of the upgrade in 1997, we designed the photon shutter with 86 degrees-inclination-angle for the insertion-device sources, that was able to adopt the plan of the PF high current operation (2.5-GeV, 1000 mA) (Fig. 6). We have to take measure of the multi-reflection between the shutter block surface and the water cooling Cu cover, because the grazing angle incidence promotes the photon reflectivity. At the time of upgrade in 2005, we

developed the compact design “V” shaped water cooling Cu absorber (V-absorber) inside the photon shutter for in-vacuum short period undulator (Fig. 7). The V-absorber is designed for universal use of photon shutters for compact SR facilities.

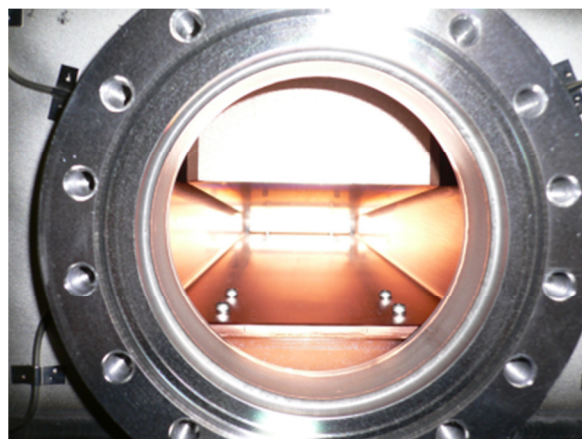


Figure 6: Photon Shutter for Multi-Pole Wiggler and Long Undulator BL Front End (New Type).

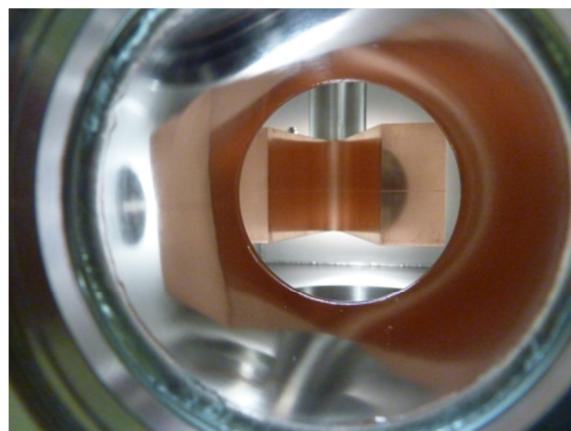


Figure 7: Photon Shutter for Multi-Pole Wiggler and Long Undulator BL Front End (New Type).

SAFETY SHUTTERS

The material of the safety shutter block was replaced from 400-mm thick stainless steel with oil-hydraulic cylinder (Figs. 8 and 9) by 250-mm thick tungsten with pneumatic cylinder (Figs.10 and 11).

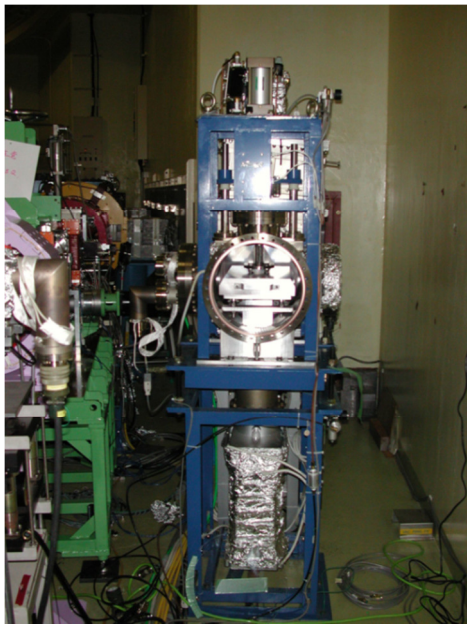


Figure 8: Old Safety Shutter: 400-mm Thick Stainless Steel Block.

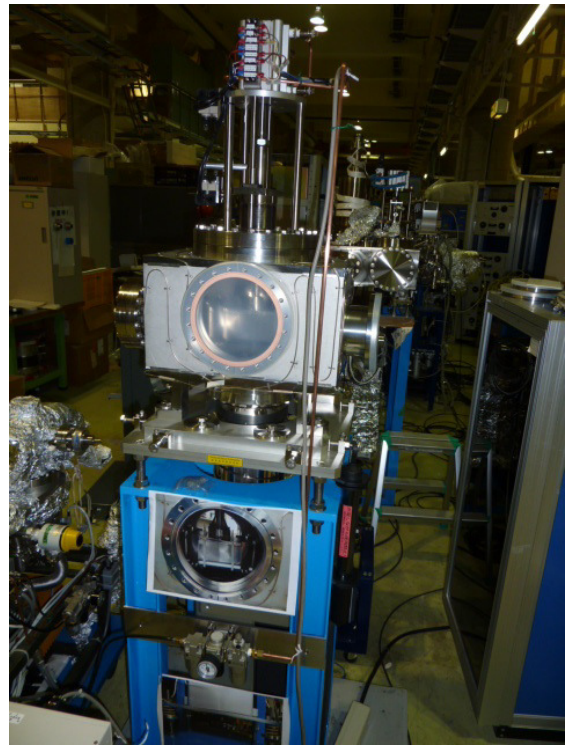


Figure 10: New Safety Shutter: 250-mm Thick Tungsten Block with Pneumatic Cylinder.



Figure 9: Old Safety Shutter: Oil-Hydraulic Cylinder.

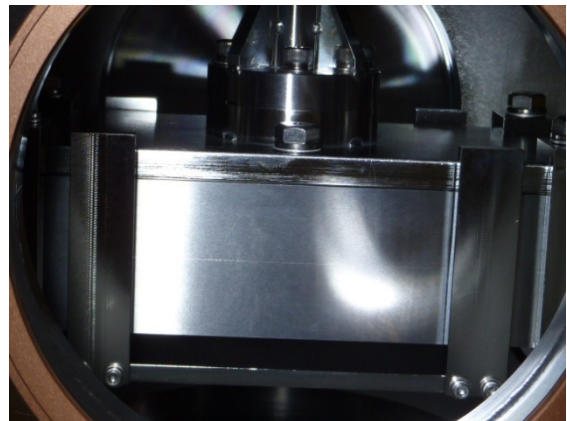


Figure 11: New Safety Shutter: 250-mm Thick Tungsten Block.