

# Development of Fiber-based Radiation Protection Beam Loss Monitor for PAL-XFEL

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A PAL-XFEL is a free electron laser using 10 GeV, 0.2 nC electron beams. The beam loss monitoring and interlock system of PAL-XFEL is required to secure the personal safety against the occurrence of the accidental beam loss. A beam loss monitor for radiation protection (RP BLM) using a long optical fiber has been developed and operated because the overall length of the linac and undulator section of the PAL-XFEL is 1 km. The detector part of RP BLM, i.e., optical fiber and PMT, was tested well at the Injector Test Facility. From the test, we successfully obtained important detector characteristics such as the relation of signal arrival time to PMT and the beam loss position, the attenuation and the dispersion of Cherenkov light. The fiber length applied to PAL-XFEL did not exceed 150 m, and two strands were installed independently along the accelerator from the viewpoint of redundancy. By using a VME-based digitizer with a high bandwidth and fast sampling rate, the beam loss signal could be monitored in real-time at the operation room. In addition, by setting the LED heartbeat signal to follow immediately after the beam loss signal, the malfunction of the RP BLM system could be noticed. Through the analysis of the RP BLM response for typical beam loss situation, the advantage of the system and issues to be solved from the viewpoint of radiation protection will be described.