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Lessons learned in commissioning the new beam-loss monitors for the superconducting upgrade to LCLS

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The superconducting upgrade to the LCLS x-ray free-electron laser at SLAC is now in commissioning, as we gradually raise the repetition rate of the 4-GeV beam toward 1 MHz and the beam power toward 120 kW. A further upgrade next year will double the energy and power. Machine protection at this extremely high power required a novel system of fast beam-loss monitors (BLMs). Points of concern, such as collimators or kickers, are covered by diamond detectors (PBLMs). Long optical fibres (LBLMs) of up to 200 m span the entire 4-km facility, generating and capturing Cherenkov emission from beam-loss showers. Previous papers have reported on the design and early commissioning of this safety system, and on plans to use the loss signals for wire scanners and loss localisation. Subsequent experience in commissioning and operating the full system has demonstrated that the concept is sound and sensitive, but several aspects of the implementation have proven troublesome. Extensive testing and debugging uncovered issues with both hardware and firmware. We will detail these problems, their remedies, and the improvements in performance.

Footnotes

Funding Agency

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