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An intelligent filter control system for APS insertion device beamlines using fuzzy logic

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A modular filter has been designed for the white-beam undulator/wiggler beamlines at the Advanced Photon Source. For a typical hard x-ray application, the filter assembly consists of four filter banks and each bank has five beam apertures. Therefore, a maximum of 625 filter combinations is mechanically possible. To prevent any mistaken setup, which could damage the filter itself or downstream optical components, a programmable logic controller (PLC) based protection system has been designed. Fuzzy logic was used in this system to reduce the memory size and improve the system performance. Ten different storage-ring beam currents and ten insertion-device gap setups have been chosen to cover a large operating dynamic range.

Aspects of the system's fuzzy logic design, as well as the special program modification for large amount of the power absorption and transmission calculations, are presented.