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Mechanical design of a missteered beam safety monitor at the Advanced Photon Source

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A missteered beam safety monitor is designed to protect the accelerator ring of the Advanced Photon Source against the excessive incursions of the bending magnet radiation. When, somehow, the orbit of the particle beam in the accelerator shifts out of its safety limits, the photon beam from the bending magnet will pass through the square apertures on the cooled mask of the beam missteering safety monitor and will heat up the very thin tungsten wire (0.025 mm in diameter) behind the mask. Acting as a resistance thermometer, the electrical resistance of the tungsten wire increases proportionally with temperature rise. As soon as the electrical resistance of the tungsten wire reaches a preset point, a signal is triggered immediately to dump the particle beam in the accelerator. The tungsten wire is inclined to the photon beam at 4.5 degrees in the vertical direction to prevent it from being overheated by the high-power photon beam. Detailed mechanical design and thermal analysis are presented.

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