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6.18 Engineering design for Wolter imaging diagnostic on Z

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Wolter optics are a mature imaging technology, although they are new to Sandia's Z machine pulsed-power accelerator. Wolter optics have a number of physics performance advantages over more traditional imaging technologies like pinholes and slits; however they require careful design and precise alignment to reduce data analysis uncertainties. This paper discusses the mechanical engineering and design of the Z Wolter optic system. Meeting the 500 µm source-to-optic distance tolerance requirement was a significant challenge since this relationship can only be measured indirectly, under vacuum, and is approaching the accuracy limit of available commercial off-the-shelf rangefinders. The devised solution locates a precision switch with tightly toleranced mechanical components. A Monte Carlo simulation was performed to quantify the system level contributions of the Wolter optic alignment stage motion control uncertainties, which demonstrated 1σ requirements compliance. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525.

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