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Conceptual studies of a high-energy X-ray detector system for MaRIE/DMMSC YANCEY SECHREST, JOHN L. BARBER, CHRIS W. BARNES, JEN BOHON, Los Alamos National Laboratory, CHEN HU, California Institute of Technology, XUAN LI, Los Alamos National Laboratory, QUINN LOOKER, J. L. PORTER, Sandia National Laboratories, LIYUAN ZHANG, RENYUAN ZHU, California Institute of Technology, ZHEHUI WANG, Los Alamos National Laboratory — Current X-ray imaging cameras used in synchrotrons, such as the Advanced Photon Source (APS), and X-ray free-electron lasers, such as the Linac Coherent Light Source (LCLS), are limited to $\leq$ 10 MHz frame-rate. Higher frame-rate, $\geq$100 MHz, X-ray cameras are recognized as an enabling technology for science applications at next-generation X-ray sources such as APS-U, LCLS-II, and Dynamic Mesoscale Material Science Capability (DMMSC, formerly MaRIE). In addition to an order of magnitude higher frame-rate, other requirements include: high-efficiency detection of high-energy (>20 keV) photons, and sufficiently high spatial resolution. The necessary camera performance also depends on the scattering object/target under dynamic compression. Here, we summarize detector system requirements for DMMSC as a function of scattering angle, detector-target distance and other parameters. We conclude that a combination of different detector systems will allow the optimal capture of scattered X-rays over nearly the entire 4-pi solid angle. Possible alternative detector designs are presented, and community input is sought on best approaches to optimize the data yield from dynamic material experiments using high energy X-rays.

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