Abstract for a General Audience: X-ray Detector Simulations

In recent years, free-electron lasers, or FELs, have become available, enabling advances in all areas of scientific research. The U.S. Department of Energy sponsors several research labs nationwide, one of which is the SLAC National Accelerator Laboratory, where I completed my research this summer as a member of the Science Undergraduate Laboratory Internship (SULI) program. SLAC houses the Linac Coherent Light Source (LCLS), which contains several user facilities that take advantage of the X-rays produced by an FEL.

An important instrument in the radiation detection process is the detector. This device absorbs the X-ray beams and processes the collected data to form images. Due to the high repetition rate, short pulses, and extreme peak brightness of the X-ray beams at LCLS, there is a need for new compatible X-ray detectors to be calibrated and characterized before deployment.

An effective characterization method is a computer simulation. I devised a program that acts much like an X-ray detector. The particular detectors I simulated were the CSPAD, ePix10k, and Rayonix MX170-HS. I focused on understanding the behavior of these detectors so to generate a "map" to which researchers can refer when choosing which detector best suits their experiments. My nine weeks at SLAC were spent working on and optimizing the computer simulation program, under the guidance of the LCLS Detector Department employees, Gabriella Carini and Philip Hart. Plots produced from the program demonstrated the behavioral patterns of the different detectors for comparison. I learned the difference in radiation processing by indirect and direct detectors, the geometries, costs and benefits of the three detectors, as well as new

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programming techniques. Personally I was able to develop my skills at working in a professional and technical environment, presenting my findings, and communicating my knowledge to a wide range of audiences.