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Microcrystallography at MacCHESS. R.E. Gillilan, M.J. Cook, S. Cornaby, T.A. Szebenyi, D.H. Bilderback, Cornell High-Energy Synchrotron Source, Ithaca NY 14853 USA.

Small crystals seem to be a frequent occurrence in protein crystallography. Refinement of crystallization conditions to produce larger, better quality crystals is a time-consuming activity that is not always successful. Protein crystals, that are 30 μm or smaller in their largest dimension, present special challenges in both handling and data collection. Typical 100 micron diameter beams produce unnecessary scattering from solvent surrounding the crystal and the result is degraded signal-to-noise ratios. While apertures and slits can reduce beam size, the number of photons reaching the sample remains the same. To meet the needs of an increasing number of researchers with smaller crystals, beamline F1 at CHESS now offers microbeam capabilities based on single-bounce high-gain capillary optics. Beams, 18 microns in diameter with a flux of 1.4×10^{10} photons/second, are now routinely available to regular users. In this poster we will discuss the details of our implementation, limitations due to source characteristics, and our latest results using new 5 micron capillary optics. This poster will also demonstrate the improvement that can be achieved using a helium atmosphere to further reduce unwanted scattering and absorption. We have integrated a helium-enclosed microbeam environment with ALS-style sample automounting for convenient screening of microcrystals. We will also discuss our use of fluorescence microscopy to center crystals smaller than the resolving power of our visible light optics. The poster will conclude with a discussion of how Cornell's proposed Energy Recovery Linac, with its diffraction-limited, high spectral brightness source, is ideally suited to advance microcrystallography.

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