Abstract Submitted for the MAR10 Meeting of The American Physical Society

Slicing through a bulk vortex matter using neutron reflectometry: observation of a vortex crystal (Bragg glass) with dirty edge states.¹ HELEN HANSON, XI WANG, IVO DIMITROV, Brown University, BRIAN MARANVILLE, C. MAJKRZAK, NIST, JING SHI, Brown University, MARK LAVER, NIST, XINSHENG LING, Brown University — It is now widely accepted that the ground state of the vortex matter in weak-pinning type-II superconductors is a topologically ordered Bragg Glass (BrG) phase. An unresolved issue is how to access the equilibrium state of the BrG phase. For example, in some samples, the ZFC (zero-field-cooled) states are more ordered than that of the FC (field-cooled) states, while in seemingly similar samples, the opposite is true. In this work, we use neutron reflectometry in the diffraction mode to measure thin slices of the bulk vortex state prepared under various thermal-magnetic history. We found that in a sample with disordered ZFC states, but more ordered FC states, the vortex matter is highly inhomogeneous. We found that after repeated thermal annealing, a large domain of the BrG phase exists in the center of the sample, while the edge vortex matter remains disordered. Our results also provide additional insight into the disappearance of the peak effect.

¹This work is supported by a grant from the US Department of Energy.

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Date submitted: 20 Nov 2009 Electronic form version 1.4