Superstructural lattice distortion within electron doped superconductor $\text{Pr}_{0.88}\text{LaCe}_{0.12}\text{CuO}_4$\textsuperscript{1} \textsc{Branton J. Campbell}, Dept. of Physics and Astronomy, Brigham Young University, \textsc{Stephan Rosenkranz}, \textsc{Peter J. Chupas}, Materials Science Division, Argonne National Laboratory, \textsc{Hye Jung Kang}, \textsc{Pengcheng Dai}, Dept. of Physics and Astronomy, University of Tennessee, Knoxville, \textsc{Yasuaki Kurita}, \textsc{Seiki Komiya}, \textsc{Yoichi Ando}, Central Research Institute of the Electric Power Industry, Japan — It is well-known that electron-doped Nd$_{0.85}$Ce$_{0.15}$CuO$_4$ can be reversibly converted between the superconductor and non-superconductor by appropriate high-temperature treatments in reducing or oxidizing environments, respectively. Samples that exhibit superconductivity also present a crystalline Nd$_2$O$_3$ (bixbyite structure) impurity phase as well as diffuse $\langle 0, 0, L \rangle$ rods of scattering at superlattice positions in the $(H, K, 0)$ plane that coincide with the reciprocal lattice of the larger $2\sqrt{2} \times 2\sqrt{2}$ impurity cell. We present a diffuse scattering analysis of the rod scattering in related compound $\text{Pr}_{0.88}\text{LaCe}_{0.12}\text{CuO}_4$ (PLCCO) and demonstrate that they are evidence of a superstructural distortion of the CuO$_2$ sheets, rather than an impurity effect. This in-plane superstructure may prove to be a necessary condition for superconductivity in the electron-doped cuprates.

\textsuperscript{1}This work was supported by U.S. NSF DMR-0139882 and by U.S. DOE under Contract Nos. DE-AC05-00OR22725 and BES-DMS W-31-109-ENG-38.