Coupled orthorhombic distortion, antiferromagnetism, and superconductivity in a single twin domain of $\text{Ba(Fe}_{1-x}\text{Co}_x\text{)}_2\text{As}_2$ ($x=0.047$)\footnote{Supported by DOE Basic Energy Sciences contract no. DE-AC02-07CH11358.}  

Qiang Zhang, Wenjie Wang, B. Hansen, N. Ni, S.L. Bud'ko, P.C. Canfield, R.L. McQueeny, D. Vaknin, Ames Laboratory, and Department of Physics and Astronomy, Iowa State University, J.W. Kim, Argonne National Laboratory — The interplay between structure, magnetism, and superconductivity in single crystal $\text{Ba(Fe}_{1-x}\text{Co}_x\text{)}_2\text{As}_2$ ($x=0.047$) has been studied using high-resolution X-ray diffraction by monitoring charge Bragg peaks in each twin domain separately. The emergence of superconducting state is correlated with the suppression of orthorhombic distortion around $T_C$, exhibiting the competition between orthorhombicity and superconductivity. Above $T_S$, the Bragg peak widths gradually broaden, possibly induced by orthorhombic (nematic) fluctuations in the paramagnetic tetragonal phase. Upon cooling, anomalies in the peak width are observed at $T_S$ and also $T_N$ indicative of strong magnetoelastic coupling. Using the capability to study individual twin domains, the peak widths in the $ab$-plane are found to exhibit anisotropic behavior along and perpendicular to the stripe-type AFM wave vector. In contrast, the temperature dependencies of the out-of-plane peak width show an anomaly at $T_N$, reflecting the connection between Fe As distance and Fe local moment.