By inelastic neutron scattering, we observed a new superconductivity-induced phonon anomaly of the buckling phonon mode in the system $YBa_2Cu_3O_{6+x}$. Therefore we decided to investigate this effect on $YBa_2Cu_4O_8$ with inelastic x-rays at ID 28, as for this material no samples for neutron scattering are available. Now we have concluded our first measurements (6 days) on the buckling mode with inelastic x-rays and improved our data on the buckling mode.
ID28 is a multi-analyzer very high-resolution backscattering spectrometer, which scans the energy of the excitation by variation of the monochromator temperature. The energy resolution is that high, that one obtains for incident x-rays with the energy in the keV range an energy resolution in the meV range. For the (9 9 9) reflection with 17.8 keV we obtain an energy resolution between 3.3 and 4.75meV depending on the analyzer. We used this monochromator reflection because of the higher flux compared to reflections with higher energy resolution. We made our measurements at temperatures above (93.5K) and below (11.5K) the superconducting transition temperature. We made our measurements in transmission geometry around the reciprocal lattice vector Q = (0, 1, 9). For this geometry we ensured to maximize the intensity of the buckling mode and minimizing the intensities of neighboring phonon modes.

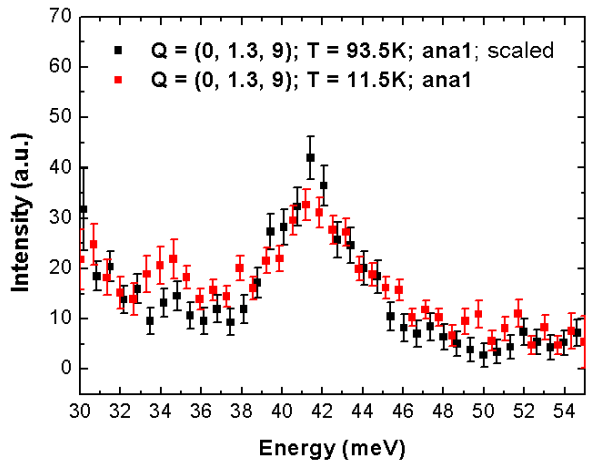

Figure 1: Buckling mode above and below the superconducting transition temperature. The nominal reciprocal lattice vector was Q = (1, 1.3, 9) meaning that analyzer 1 was at the effect Q-value (0, 1.182, 8.395). The high temperature data is Bose corrected, moreover a temperature dependend background was subtracted. Explanation see text.

Figure 1 shows the buckling mode above (93.5K) and below (11.5K) the superconducting transition temperature. The measurements have been performed with analyzer 1 meaning the effective Q position was Q = (0, 1.182, 8.395). That means the measurements were performed along the b* direction. The data show clearly the buckling mode at the energy around 41.5meV. It seems that there is no (clear) superconductivity-induced energy renormalization. However, due to the resolution of around 3meV it is probable that the apical oxygen mode is also observed in our data. **Therefore the statistics need to be improved in order to make a conclusive statement, whether there is some superconductivity-induced effect or not.** In addition we need to make similar measurements along the a* direction in order to make a statement about the anisotropy of the effect.
In summary we have shown, that one can indeed measure the buckling mode with inelastic x-rays by measuring in an appropriate Brillouin zone. This is an important first step in measuring the superconductivity-induced transfer of spectral weight in $YBa_2Cu_4O_8$. The next step is to improve statistics further for our data and to measure the a* direction in order to investigate the anisotropy of the effect.