At the end of the evaporation, we have 10^5 atoms per spin state at a normalized temperature $\frac{T}{T_F} = 0.11 \pm 0.02$ where the Fermi temperature corresponds to the Fermi Energy, $E_F = k_b T_F = \hbar\omega(6N)^{1/3}$ where N is the total atom number in one spin state and $\omega = (\omega_r^2\omega_z)^{1/3}$ and k_b is the the Boltzmann constant. After the evaporation we increase the interaction strength adiabatically with a slow magnetic-field ramp to a Fano-Feshbach scattering resonance.

The momentum distribution of the fermions, $n(k)$, is predicted to scale as $1/k^4$ at high k, with the contact being the coefficient of this high momentum tail. Following Tan [2], we define the integrated contact per particle for the trapped gas, which we will refer to simply as the contact, using

$$C = \lim_{k\to\infty} k^4 n(k). \tag{1}$$

Here, k is the wave number in units of the Fermi wave number, $k_F = \frac{2mE_F}{\hbar}$, and $n(k)$ for a 50/50 spin mixture is normalized such that $\int_0^\infty \frac{n(k)}{(2\pi)^3} d^3k = 0.5$. Note that the contact is expected to be the same for both spin states in the interacting Fermi gas, even in the case of an imbalanced spin mixture. Theoretically, the contact is defined in the limit of $1 << k << 1/(k_F r_0)$, where r_0 is the range of the interatomic potential. Using a typical value of $k_F = \frac{1}{2200} a_0^{-1}$ for our trapped ^{40}K gas and the van der Waals length, $r_0 = 60a_0$, we find $1/(k_F r_0) = 37$.

We directly measure $n(k)$ using ballistic expansion of the trapped gas, where we turn off the interactions for the expansion. We accomplish this by rapidly sweeping the magnetic field to 209.2 G where a vanishes, and then immediately turning off the external trapping potential [11]. We let the gas expand for 6 ms before taking an absorption image of the cloud. The probe light for the imaging propagates along the axial direction of the trap and thus we measure the radial momentum distribution. Assuming the momentum distribution is spherically symmetric, we obtain the full momentum distribution with an inverse Abel transform.

Fig. 1a shows an example $n(k)$ for a strongly interacting gas measured with this technique. For this data, the dimensionless interactions strength $(k_F a)^{-1}$, is -0.08 ± 0.10. Empirically, we find that the measured $n(k)$ exhibits a $1/k^4$ tail and we extract the contact C from the average value of $k^4 n(k)$ for $k > k_C$ where we use $k_C = 1.85$ for $(k_F a)^{-1} > -0.5$, and $k_C = 1.55$ for $(k_F a)^{-1} < -0.5$. One issue is whether or not the interactions are switched off sufficiently quickly to accurately measure the high-k part of the $n(k)$. The data in