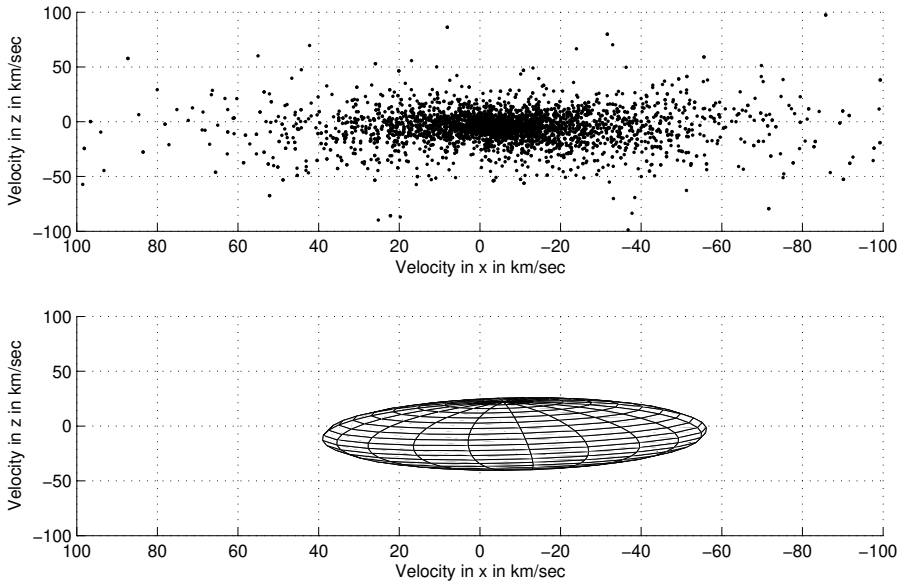

Fig. 7. Ellipsoid in $x - z$ plane.

trim. I have used this elimination criterion in the past, generally with good results, but a further reason exists to justify its use. For the G giants there is a 19.0% chance that the original residuals are random, as calculated by a runs test, but a 78.7% chance that the trimmed residuals are random. Eliminating some of the residuals, therefore, increases the randomness of the sample.

Table 1 shows the solution for the kinematical unknowns and Table 2 for the coefficients and orientation of the velocity ellipsoid for the G stars. For convenience the components for the displacement tensor are converted to the more familiar form of the solar motion, Oort constants, the deviation l_1 between the longitude of the geometric center and the kinematic center of the Galaxy, and K term. Also shown is the circular velocity V_0, found from the relation $V_0 = (A - B)R_0$, where R_0 is the distance to the centre of the Galaxy. Kerr & Lynden-Bell (1986) determine a value of 8.5 ± 1.1 kpc for R_0. Perryman (2008, App. A), however, after a survey of recent determinations feels that 8.2 kpc is a better determination. The mean error for V_0 comes from the procedure given in Branham (2008) and uses 8.2 kpc for R_0 with the same mean error as given by Kerr & Lynden-Bell (1986).

The orientation of the velocity ellipsoid in space and in the $x - y$, $x - z$, and $y - z$ planes is shown in Figures 5–8 for the G giants. (Because of the density of data points, it proved impossible to plot both the stars and the velocity ellipsoid on one graph because the stars blotted out the ellipsoid; therefore a subgraph was used for the stars and another for the ellipsoid.)

7. DISCUSSION

The distribution of the residuals from the kinematical solution, after eliminating discordant residuals, is seen in the histogram of Figure 9. As mentioned in the previous section, 168 of the residuals were eliminated, a 2.5% trim. The distribution is somewhat skewed, coefficient of skewness 0.09, more platykurtic, kurtosis of 1.42, than the normal distribution, kurtosis of 3, and more lighter tailed, Hogg's Q factor of 0.36, than a normal distribution, Q=2.58. The Q factor is defined as

$$Q = \frac{(U_{0.05} - L_{0.05})}{(U_{0.5} - L_{0.5})}, \tag{5}$$

where U_α and L_α are averages of the respective upper and lower 100α of the data (Stigler 1977). A runs test, however, reveals 3,350 runs out of an expected 3,404. The residuals, therefore, can be considered random. To be specific, there is a 19.0% chance that the residuals are taken randomly from a normal distribution.