Section 3.4

Statistical Properties: Catalogue Comparisons

3.4. Statistical Properties: Catalogue Comparisons

In this section results from comparisons of the Hipparcos and Tycho Catalogues with each other, and with certain other catalogues, are presented.

Figures 3.4.1 to 3.4.10 give sky distributions and frequency histograms for the differences in the five astrometric parameters between the Hipparcos stars in the Tycho Catalogue and the same stars in the Hipparcos Catalogue. Excluded from the comparison are the 'Hipparcos only' stars from the Tycho Catalogue (Field T42 = 'H'), and the entries with Field T51 non-blank (in order to avoid situations where one Hipparcos Catalogue entry corresponds to two Tycho Catalogue entries, and vice versa). There is little residual structure, and, for the longitudinal parameters, a slightly higher scatter in the ecliptic region. The widths of the histograms reflect the precision of the Tycho results for the Hipparcos stars, which is better than the overall precision of the Tycho results, because the Hipparcos selection emphasizes the brighter stars (cf. Figure 1.1.1).

Figures 3.4.11 to 3.4.18 illustrate the differences of $\alpha*$, δ, $\mu_{\alpha*}$, and μ_δ between the Hipparcos Input Catalogue and the Hipparcos Catalogue. The dramatic improvement, particularly in the position, is evident. The presence of zonal (especially declination-dependent) structure in the Hipparcos Input Catalogue may also be seen.

Figures 3.4.19 to 3.4.26 compare the results of the Hipparcos Catalogue with those in the Fifth Fundamental Catalogue (FK5) (W. Fricke, H. Schwan, T. Lederle, 1988, *Fifth Fundamental Catalogue*, Veröff. Astron. Rechen-Inst. Heidelberg). A running median over 50 stars has been computed. Again, the large corrections made by Hipparcos, especially in the southern hemisphere, are clearly depicted. Further details of the relationship between ICRS(Hipparcos) and J2000(FK5) are given in Section 1.5.7.

Figures 3.4.27 to 3.4.42 give a similar comparison of the results of the Tycho Catalogue with those from the PPM, the Catalogue of Positions and Proper Motions (S. Röser, U. Bastian, 1991, *PPM Star Catalogue, Vol. I–II*; U. Bastian, S. Röser, 1993, *PPM Star Catalogue, Vol. III–IV*, Astron. Rechen-Inst. Heidelberg). In view of the large number of stars, the results are presented as density plots, and a median over a fixed range is computed (see captions for details). Only Tycho 'recommended stars' (blank in Field T10) have been used, and separate comparisons are presented for brighter and fainter stars, for the reasons explained in Volume 4, Section 18.3. Indeed some of the comparisons differ considerably, especially in the northern hemisphere. The sudden change in scatter at $\delta = -2.5°$ is due to the different statistical properties of the northern and southern parts of the PPM. The northern part is based on older catalogues, so that the present day accuracy is modest (0.27 arcsec and 4 mas/year for the positions and proper motions respectively, according to the authors). The southern part is based on more recent catalogues; the authors quote accuracies of 0.11 arcsec and 3 mas/year for the positions and proper motions respectively.

Figure 3.4.1. *Median difference between $\alpha*$ from the Tycho Catalogue and $\alpha*$ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

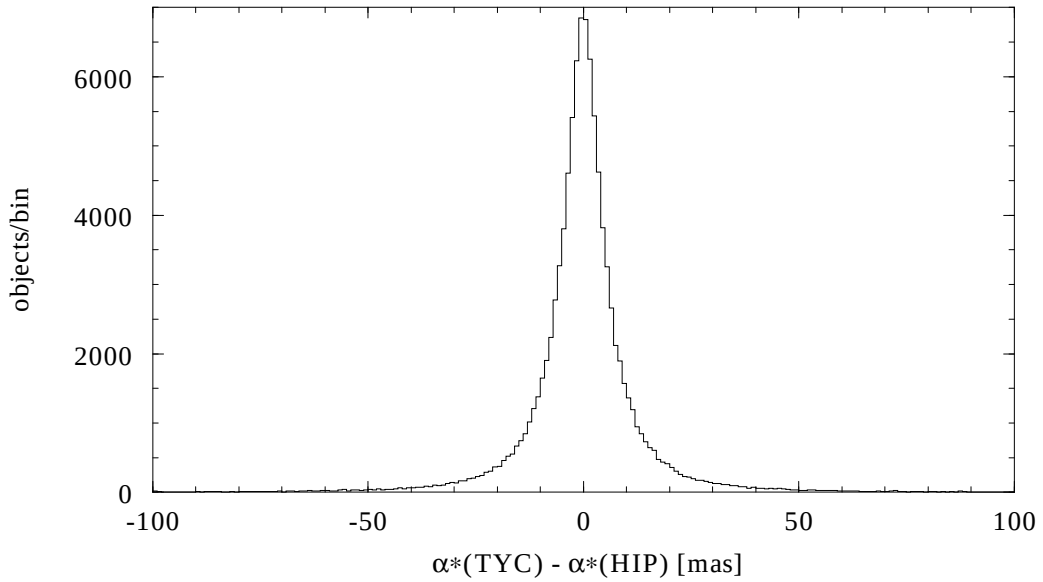

Figure 3.4.2. *Difference between $\alpha*$ from the Tycho Catalogue and $\alpha*$ from the Hipparcos Catalogue.*

Figure 3.4.3. *Median difference between δ from the Tycho Catalogue and δ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2° \times 2°$).*

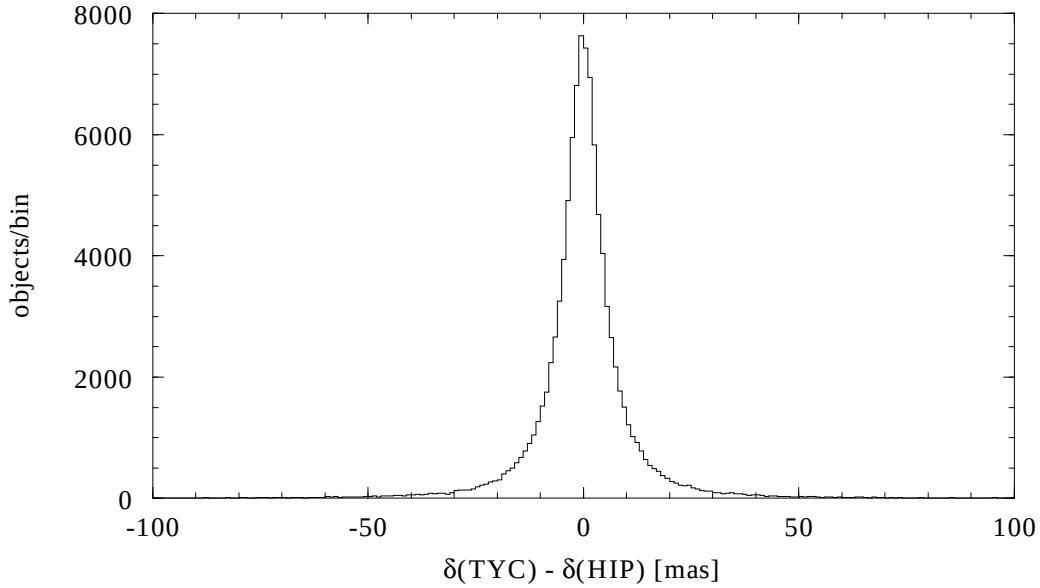

Figure 3.4.4. *Difference between δ from the Tycho Catalogue and δ from the Hipparcos Catalogue.*

Figure 3.4.5. *Median difference between $\mu_{\alpha*}$ from the Tycho Catalogue and $\mu_{\alpha*}$ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

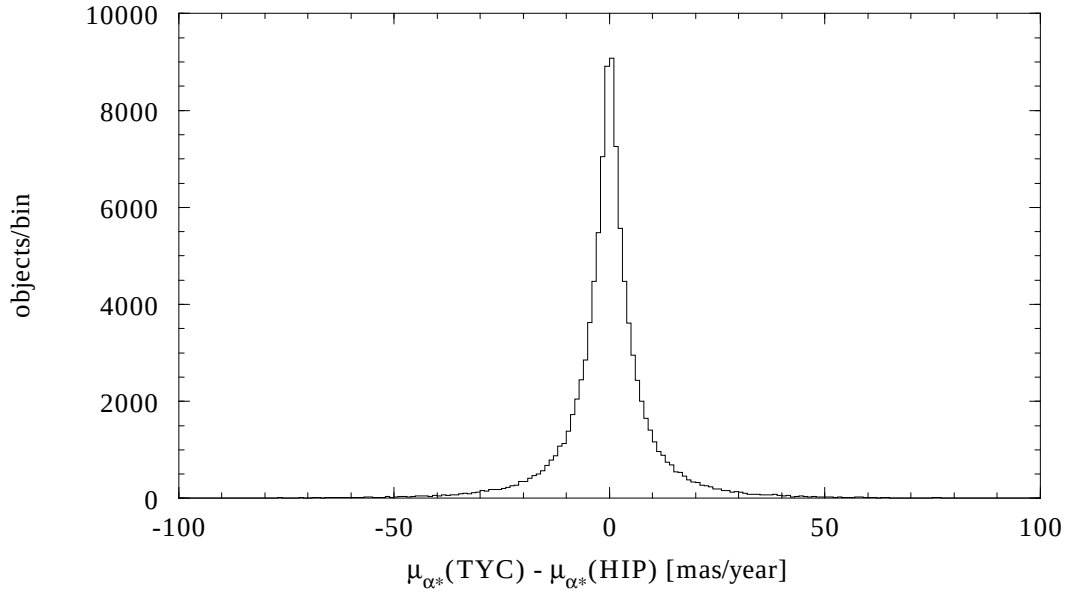

Figure 3.4.6. *Difference between $\mu_{\alpha*}$ from the Tycho Catalogue and $\mu_{\alpha*}$ from the Hipparcos Catalogue.*

Figure 3.4.7. *Median difference between μ_δ from the Tycho Catalogue and μ_δ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

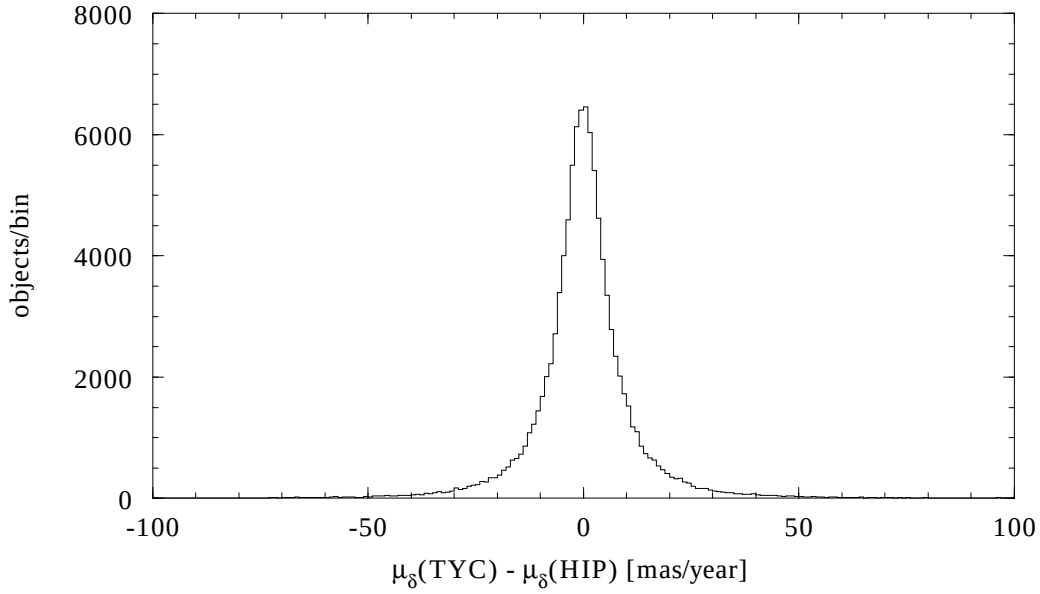

Figure 3.4.8. *Difference between μ_δ from the Tycho Catalogue and μ_δ from the Hipparcos Catalogue.*

Figure 3.4.9. *Median difference between π from the Tycho Catalogue and π from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

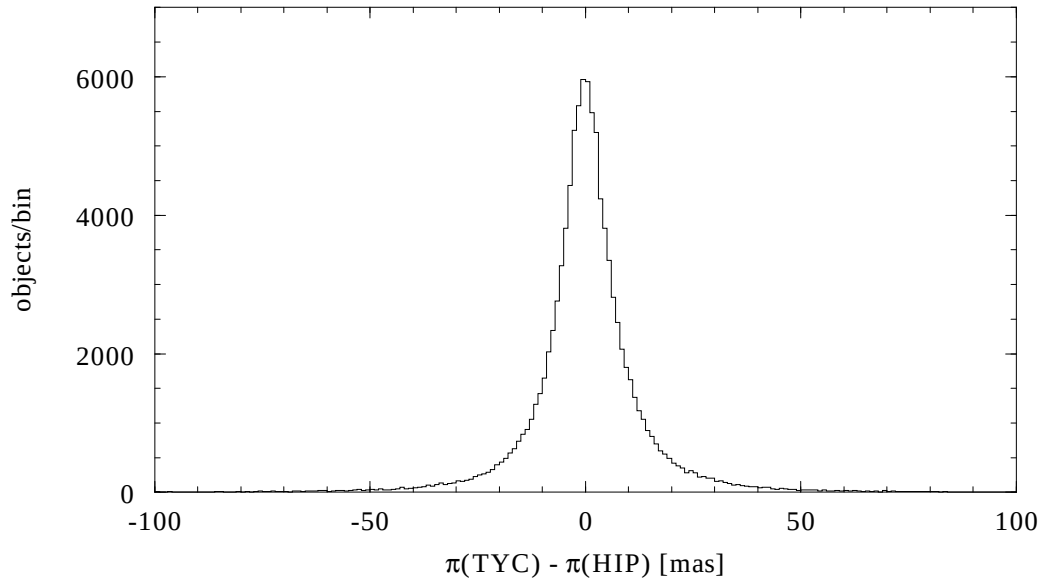

Figure 3.4.10. *Difference between π from the Tycho Catalogue and π from the Hipparcos Catalogue.*

Figure 3.4.11. *Median difference between $\alpha*$ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

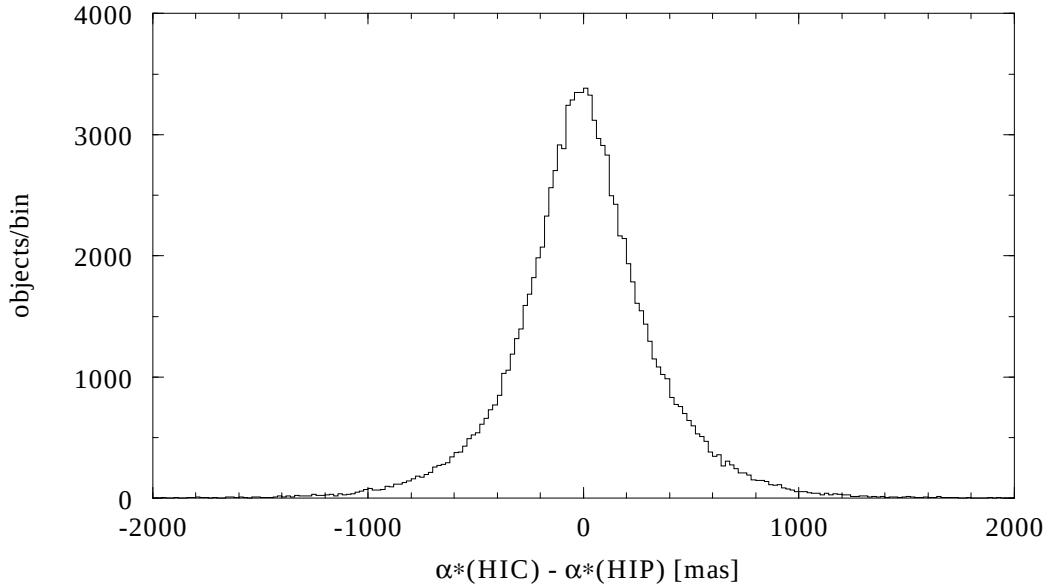

Figure 3.4.12. *Difference between $\alpha*$ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Hipparcos Catalogue.*

Figure 3.4.13. *Median difference between δ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and δ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

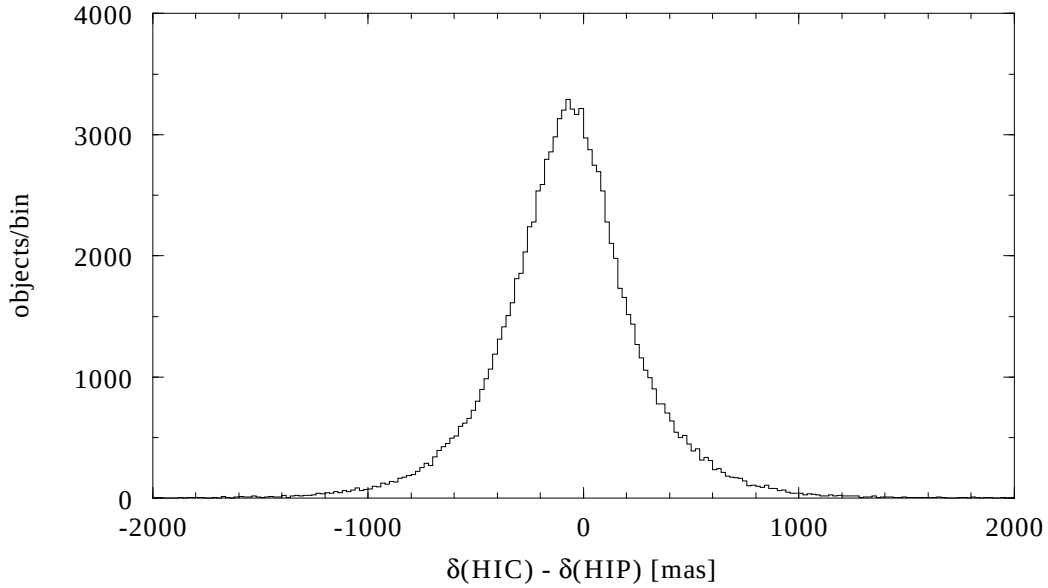

Figure 3.4.14. *Difference between δ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and δ from the Hipparcos Catalogue.*

Figure 3.4.15. *Median difference between $\mu_{\alpha*}$ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and $\mu_{\alpha*}$ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

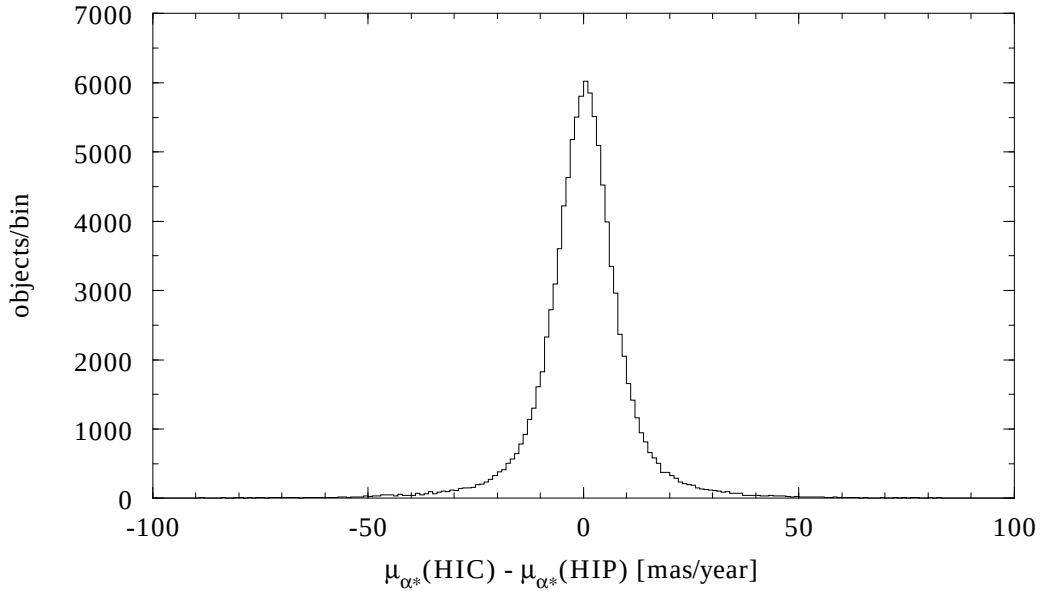

Figure 3.4.16. *Difference between $\mu_{\alpha*}$ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and $\mu_{\alpha*}$ from the Hipparcos Catalogue.*

Figure 3.4.17. *Median difference between μ_δ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and μ_δ from the Hipparcos Catalogue, in equatorial coordinates (cell size $2^\circ \times 2^\circ$).*

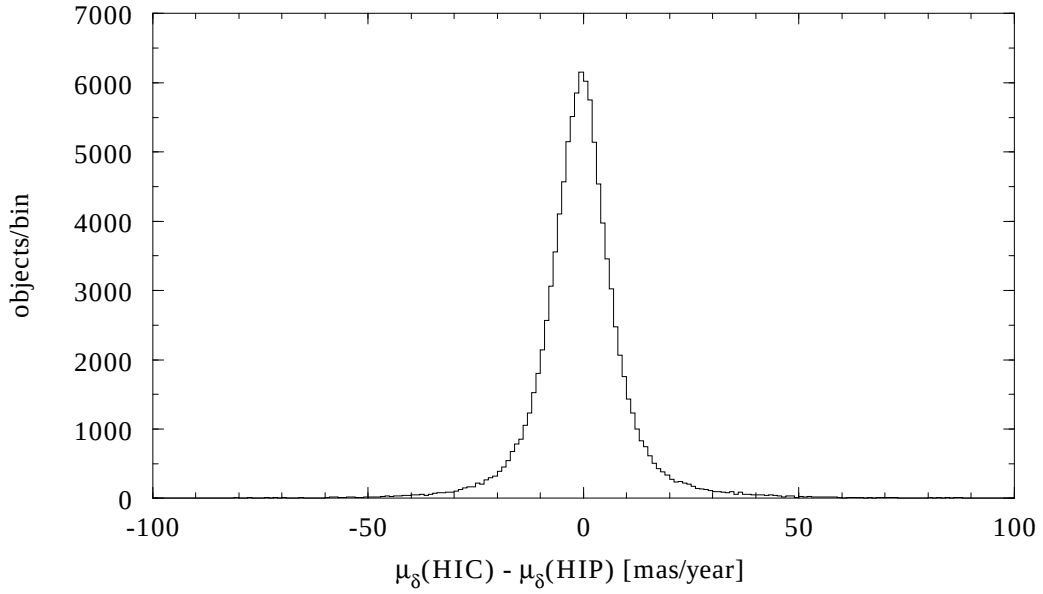

Figure 3.4.18. *Difference between μ_δ from the Hipparcos Input Catalogue (after rotation to the Hipparcos reference frame) and μ_δ from the Hipparcos Catalogue.*

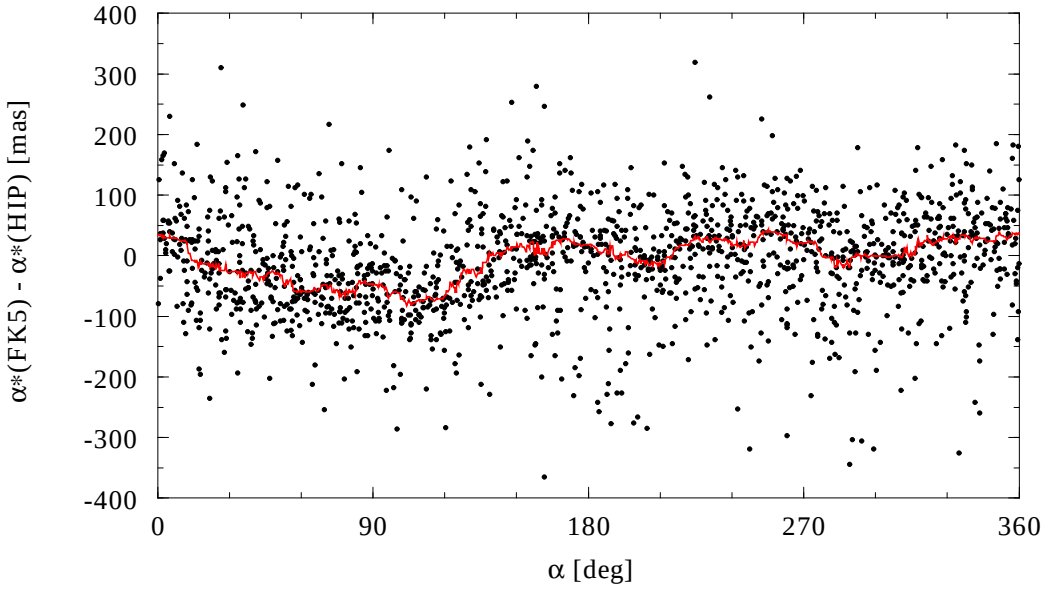

Figure 3.4.19. *Difference between $\alpha*$ from FK5 (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Hipparcos Catalogue, versus α. The red curve is the running median over 50 points.*

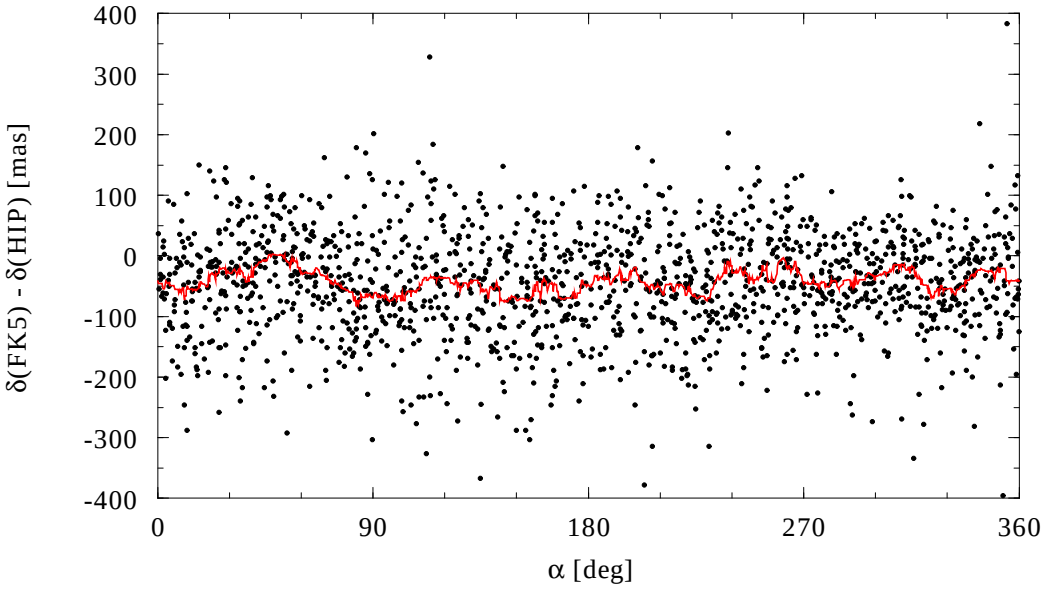

Figure 3.4.20. *Difference between δ from FK5 (after rotation to the Hipparcos reference frame) and δ from the Hipparcos Catalogue, versus α. The red curve is the running median over 50 points.*

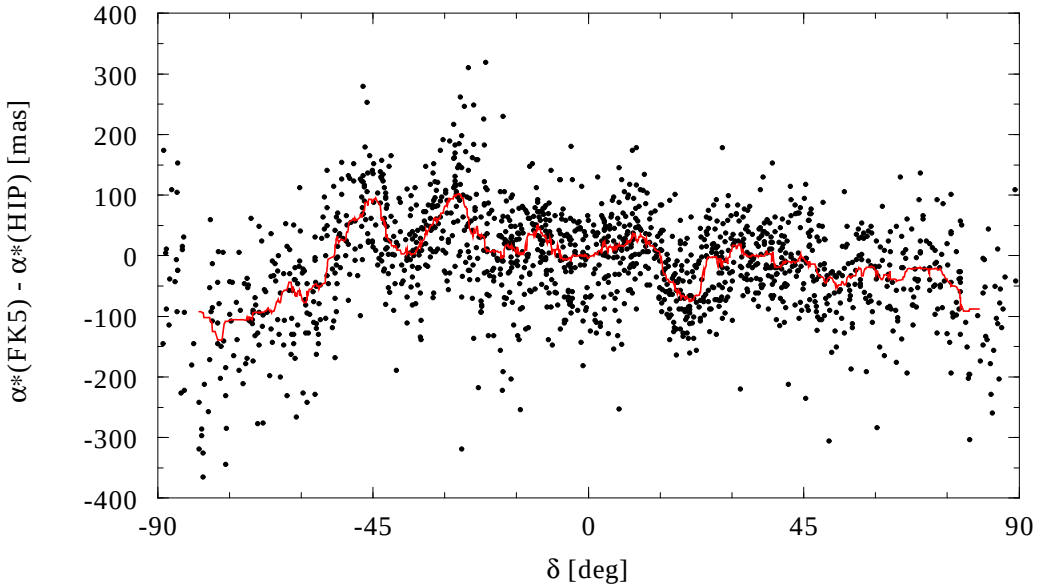

Figure 3.4.21. *Difference between $\alpha*$ from FK5 (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Hipparcos Catalogue, versus δ. The red curve is the running median over 50 points.*

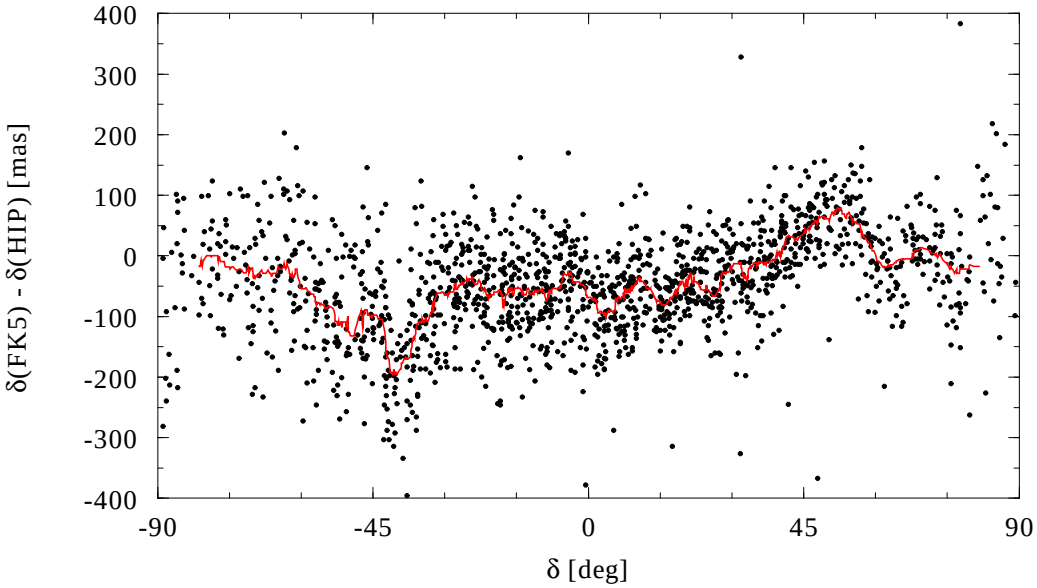

Figure 3.4.22. *Difference between δ from FK5 (after rotation to the Hipparcos reference frame) and δ from the Hipparcos Catalogue, versus δ. The red curve is the running median over 50 points.*

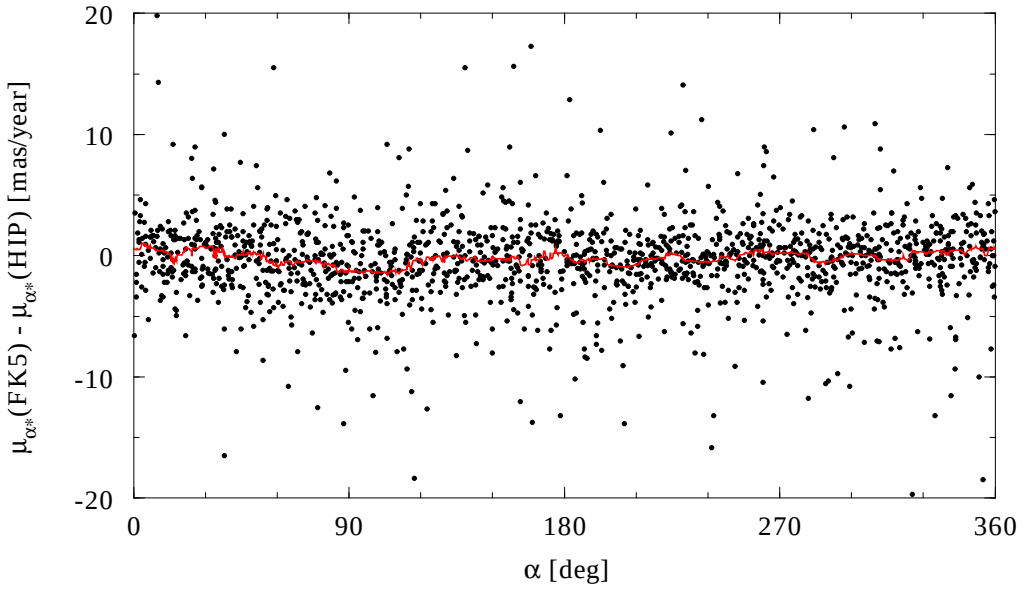

Figure 3.4.23. *Difference between $\mu_{\alpha *}$ from FK5 (after rotation to the Hipparcos reference frame) and $\mu_{\alpha *}$ from the Hipparcos Catalogue, versus α. The red curve is the running median over 50 points.*

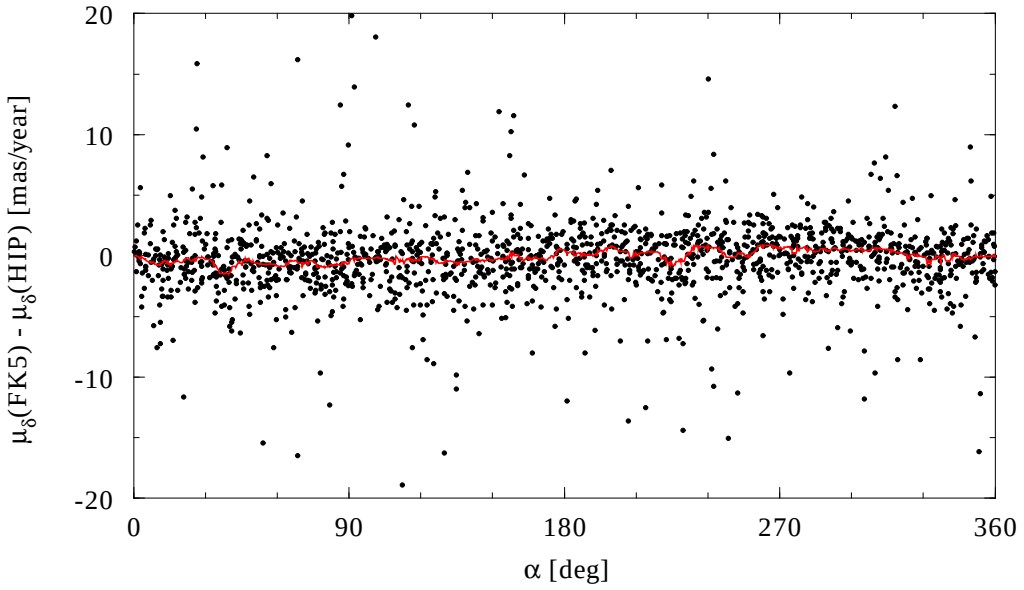

Figure 3.4.24. *Difference between μ_{δ} from FK5 (after rotation to the Hipparcos reference frame) and μ_{δ} from the Hipparcos Catalogue, versus α. The red curve is the running median over 50 points.*

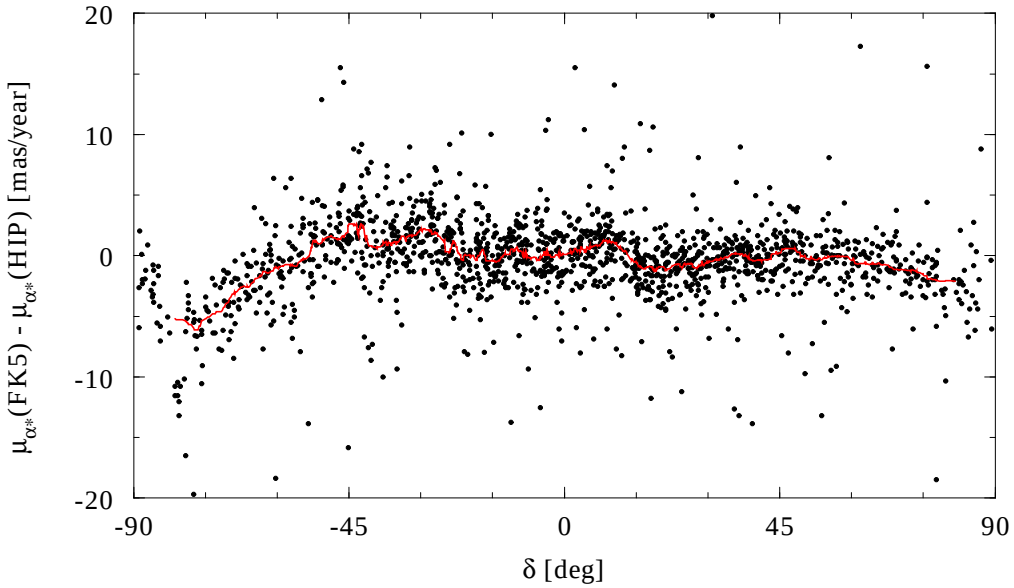

Figure 3.4.25. *Difference between $\mu_{\alpha*}$ from FK5 (after rotation to the Hipparcos reference frame) and $\mu_{\alpha*}$ from the Hipparcos Catalogue, versus δ. The red curve is the running median over 50 points.*

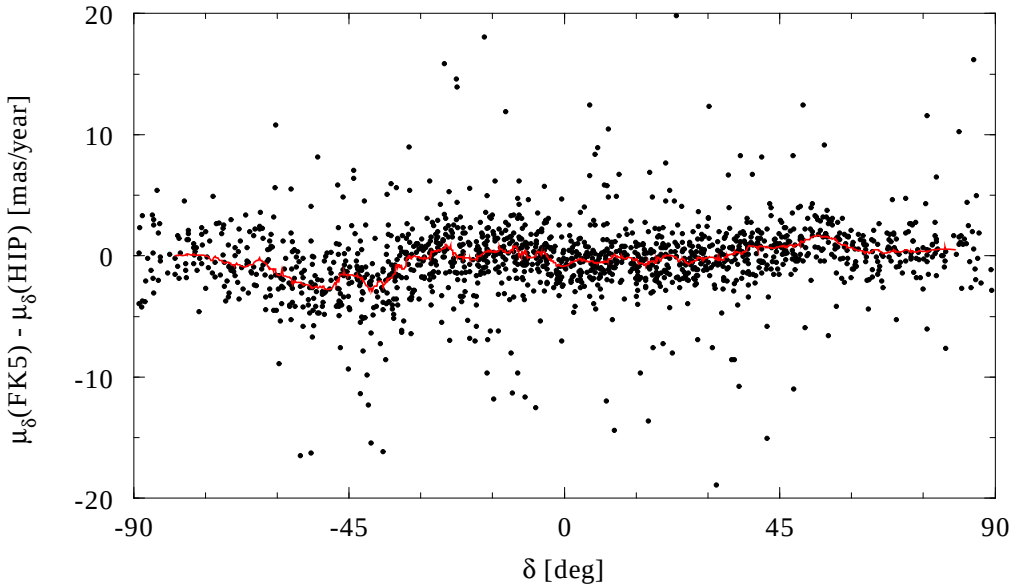

Figure 3.4.26. *Difference between μ_{δ} from FK5 (after rotation to the Hipparcos reference frame) and μ_{δ} from the Hipparcos Catalogue, versus δ. The red curve is the running median over 50 points.*

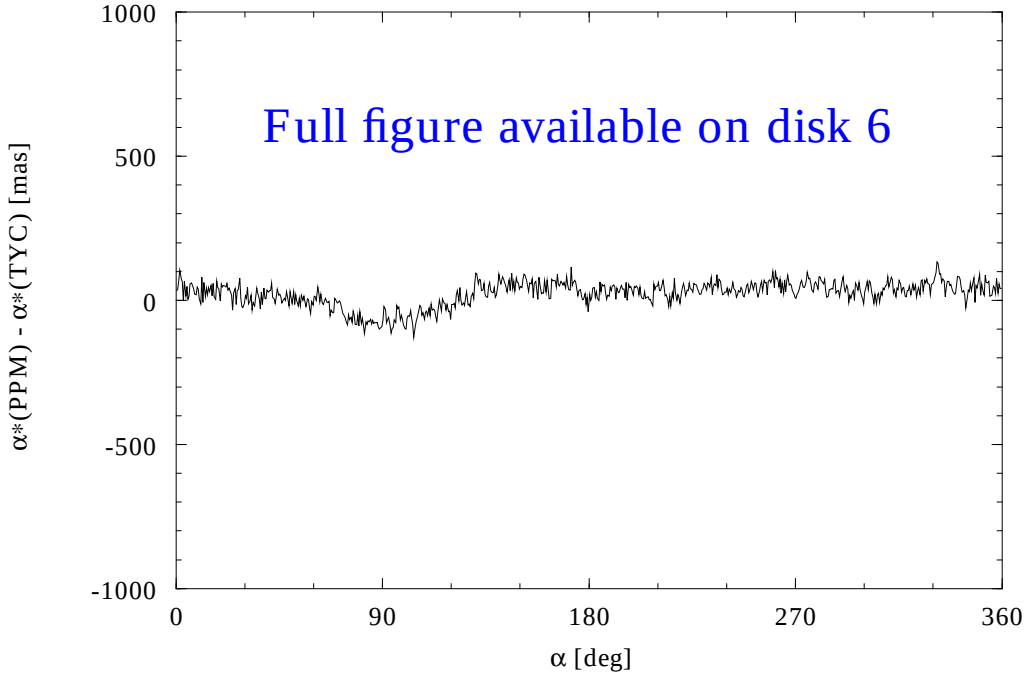

Figure 3.4.27. *Difference between $\alpha*$ from PPM (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

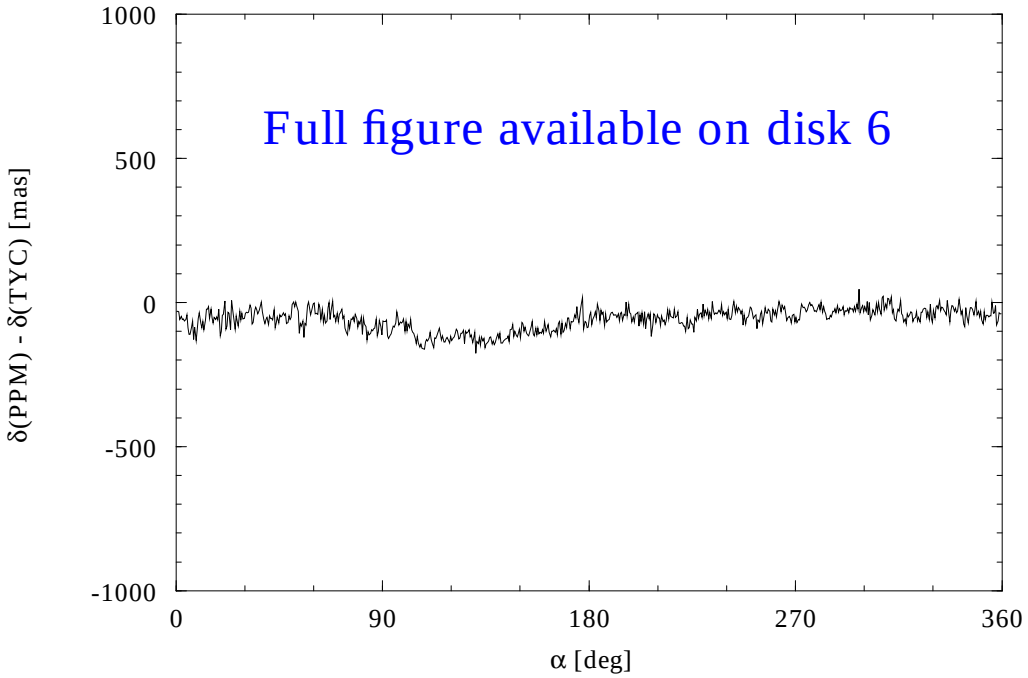

Figure 3.4.28. *Difference between δ from PPM (after rotation to the Hipparcos reference frame) and δ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

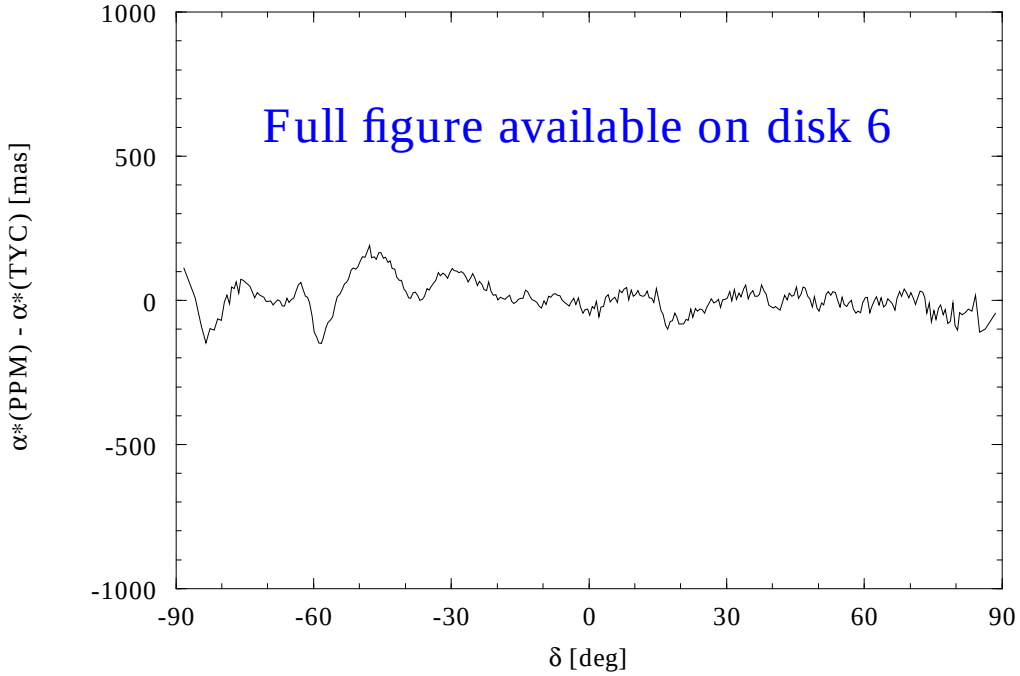

Figure 3.4.29. *Difference between $\alpha*$ from PPM (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

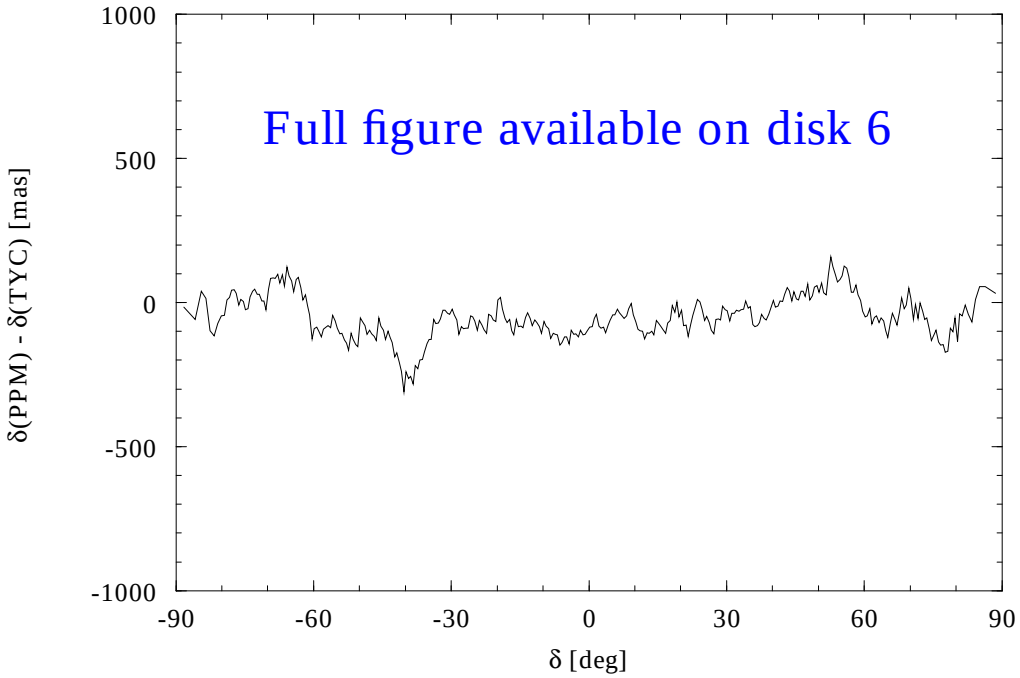

Figure 3.4.30. *Difference between δ from PPM (after rotation to the Hipparcos reference frame) and δ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

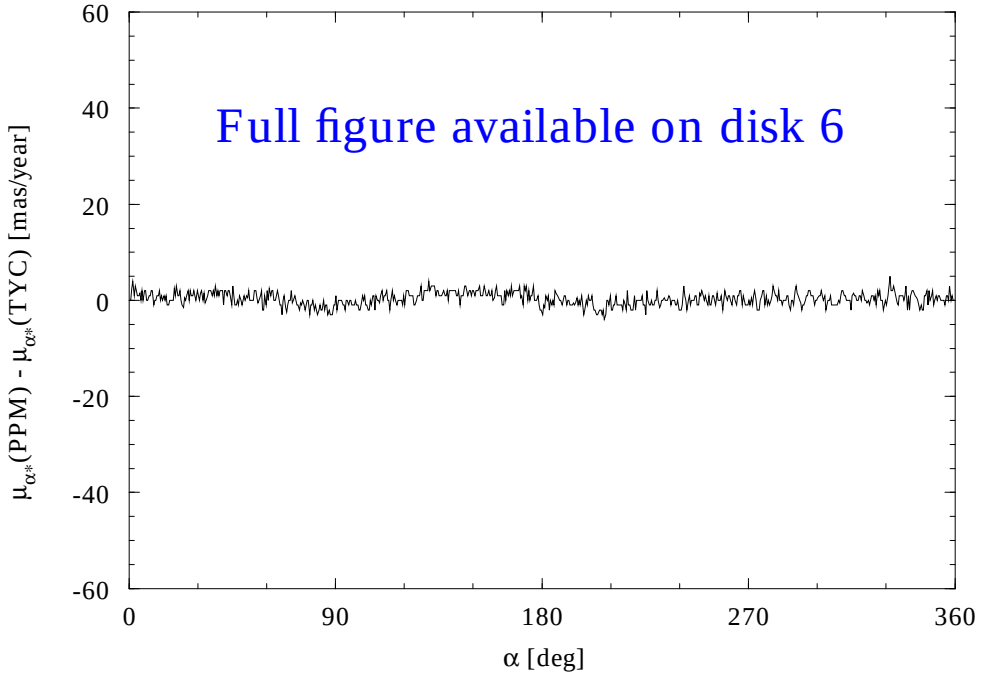

Figure 3.4.31. *Difference between $\mu_{\alpha *}$ from PPM (after rotation to the Hipparcos reference frame) and $\mu_{\alpha *}$ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1^\circ \times 1$ mas/yr. The curve is the median difference over intervals of 0.5°.*

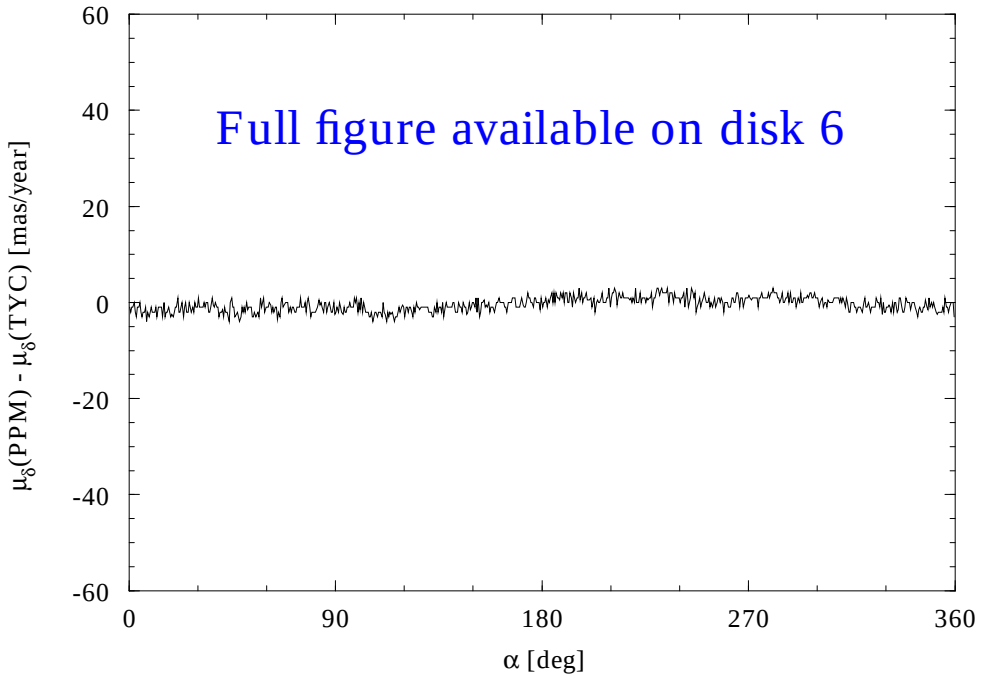

Figure 3.4.32. *Difference between μ_δ from PPM (after rotation to the Hipparcos reference frame) and μ_δ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1^\circ \times 1$ mas/yr. The curve is the median difference over intervals of 0.5°.*

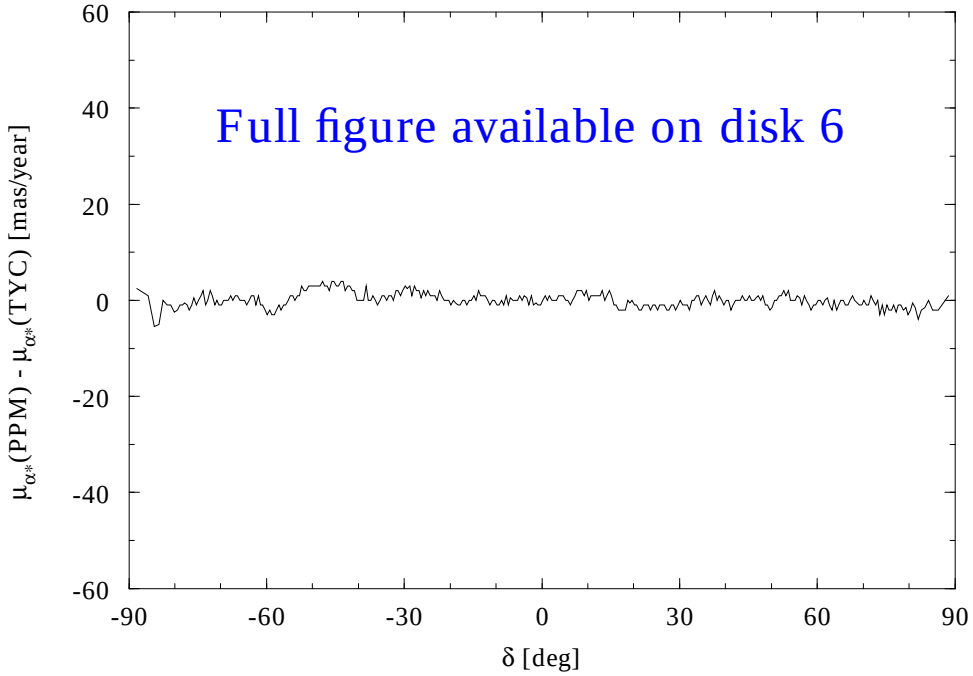

Figure 3.4.33. *Difference between $\mu_{\alpha *}$ from PPM (after rotation to the Hipparcos reference frame) and $\mu_{\alpha *}$ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 1$ mas/yr. The curve is the median difference over intervals of $0.5°$.*

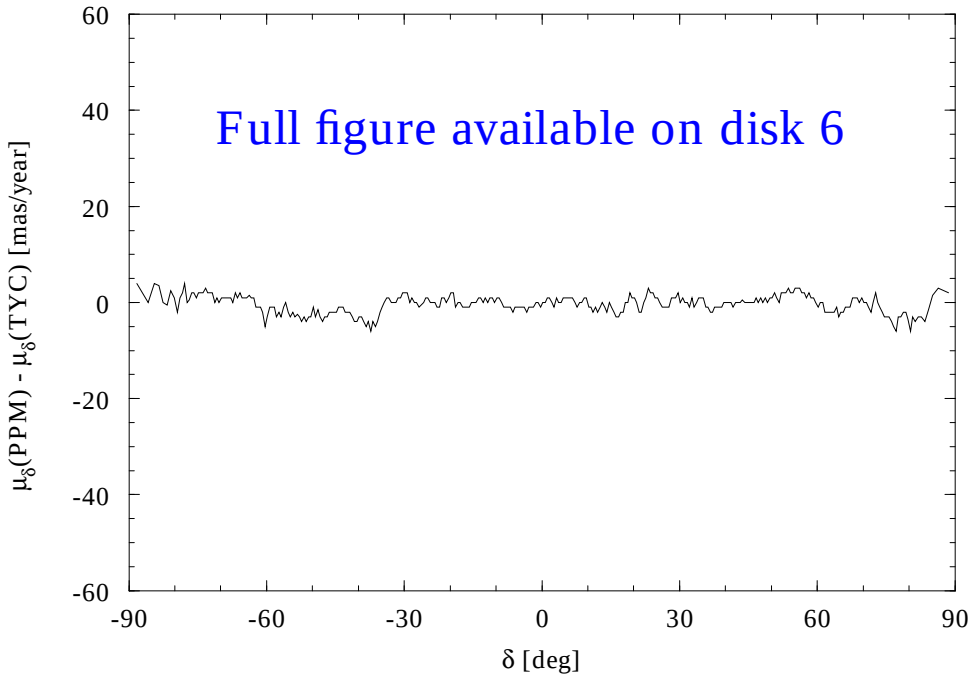

Figure 3.4.34. *Difference between μ_δ from PPM (after rotation to the Hipparcos reference frame) and μ_δ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars brighter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 1$ mas/yr. The curve is the median difference over intervals of $0.5°$.*

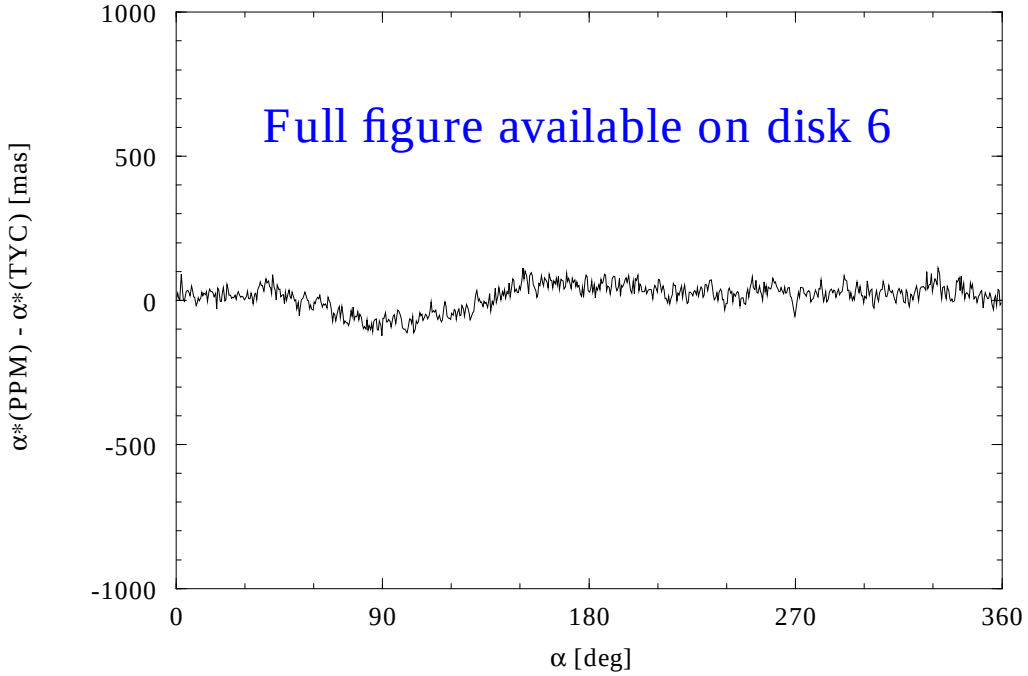

Figure 3.4.35. *Difference between $\alpha*$ from PPM (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

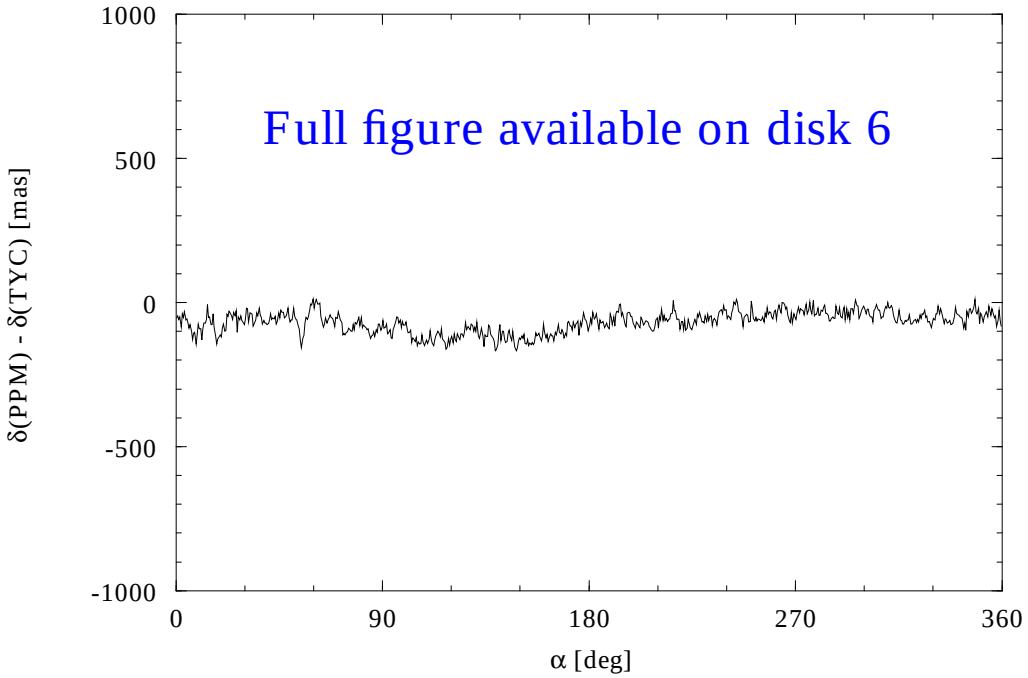

Figure 3.4.36. *Difference between δ from PPM (after rotation to the Hipparcos reference frame) and δ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

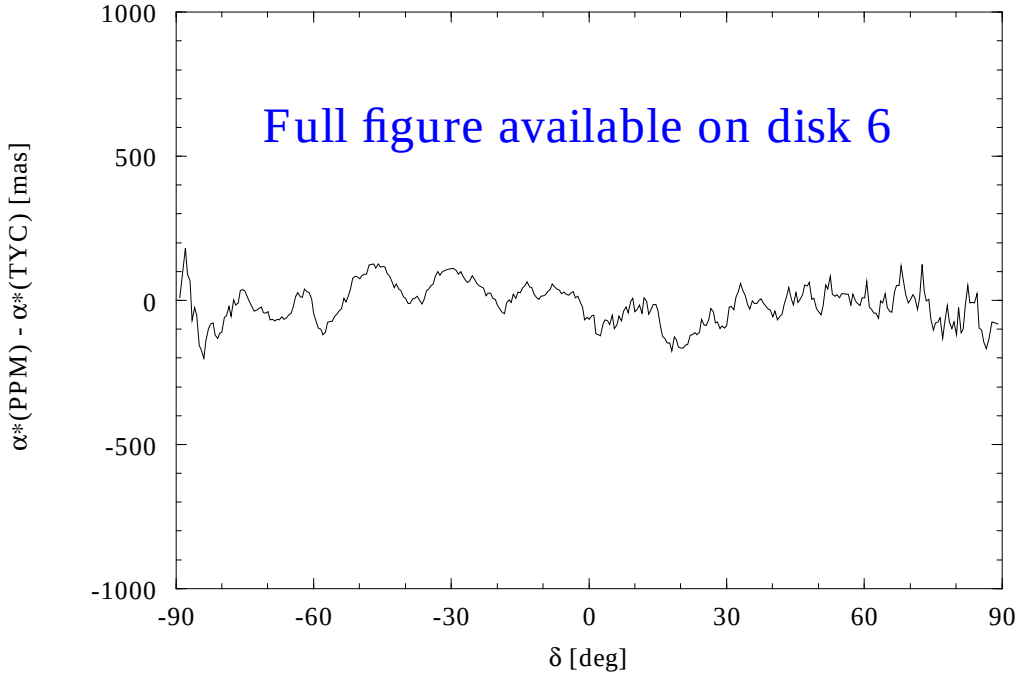

Figure 3.4.37. *Difference between $\alpha*$ from PPM (after rotation to the Hipparcos reference frame) and $\alpha*$ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

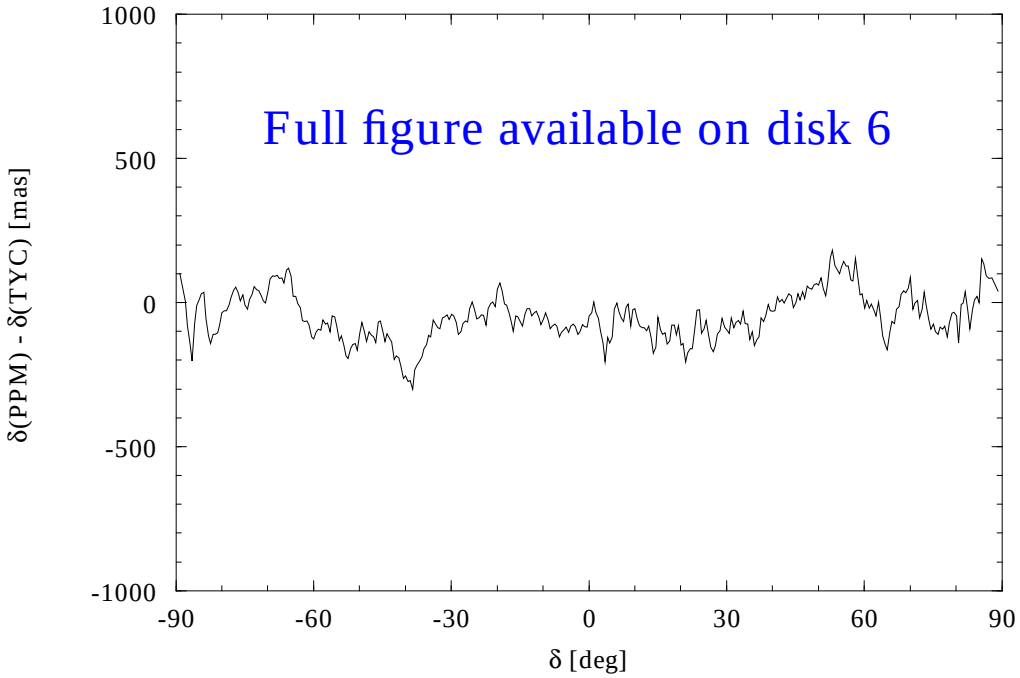

Figure 3.4.38. *Difference between δ from PPM (after rotation to the Hipparcos reference frame) and δ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5° \times 8$ mas. The curve is the median difference over intervals of $0.5°$.*

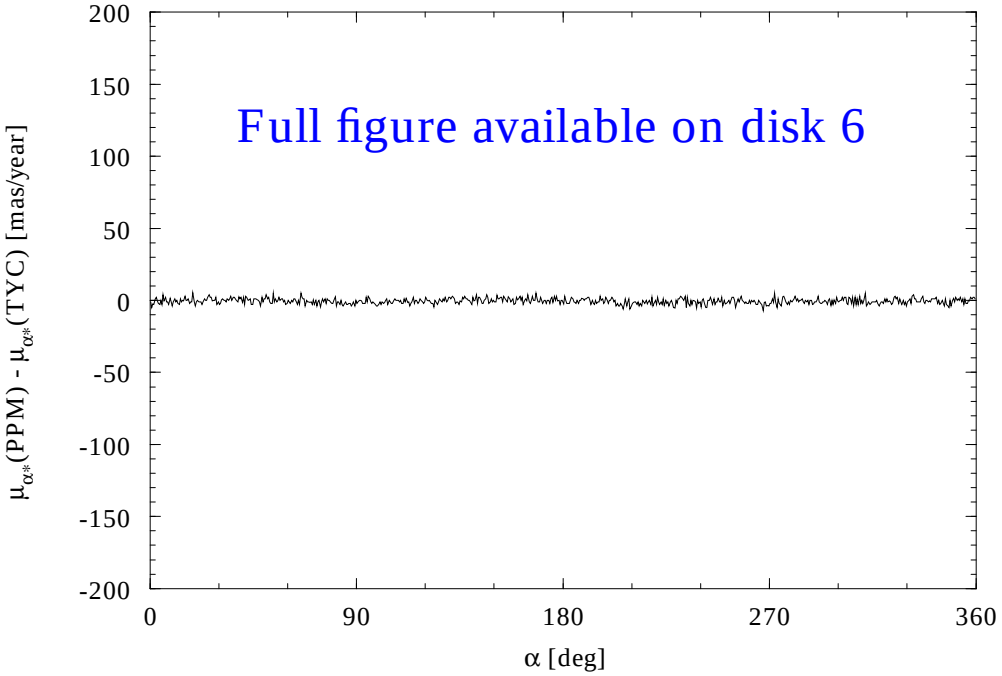

Figure 3.4.39. *Difference between $\mu_{\alpha *}$ from PPM (after rotation to the Hipparcos reference frame) and $\mu_{\alpha *}$ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1^\circ \times 2$ mas/yr. The curve is the median difference over intervals of 0.5°.*

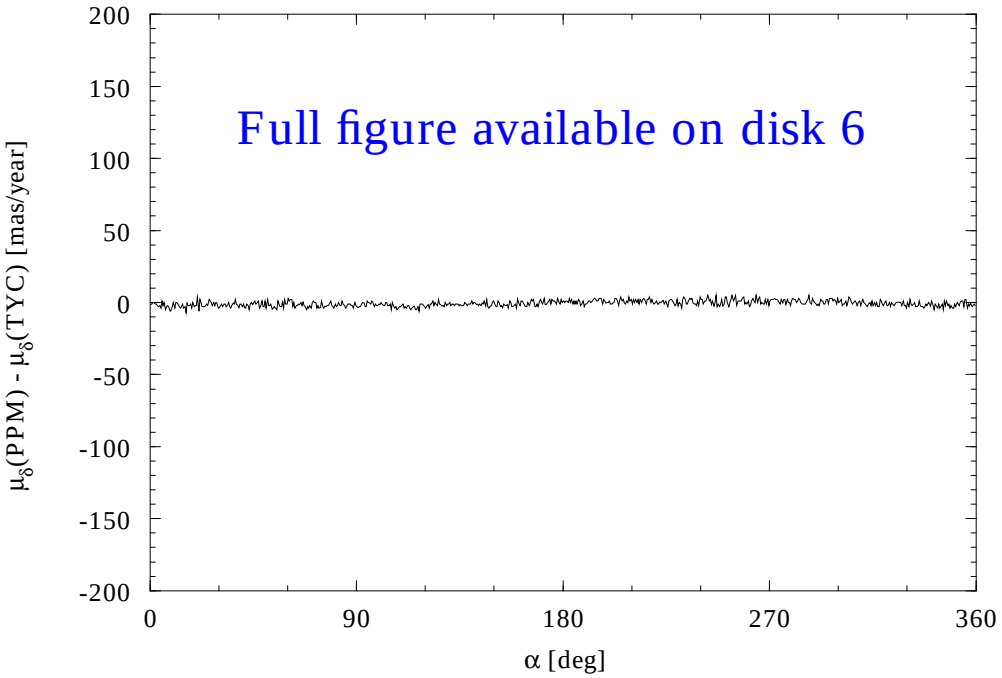

Figure 3.4.40. *Difference between μ_δ from PPM (after rotation to the Hipparcos reference frame) and μ_δ from the Tycho Catalogue, versus α, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $1^\circ \times 2$ mas/yr. The curve is the median difference over intervals of 0.5°.*

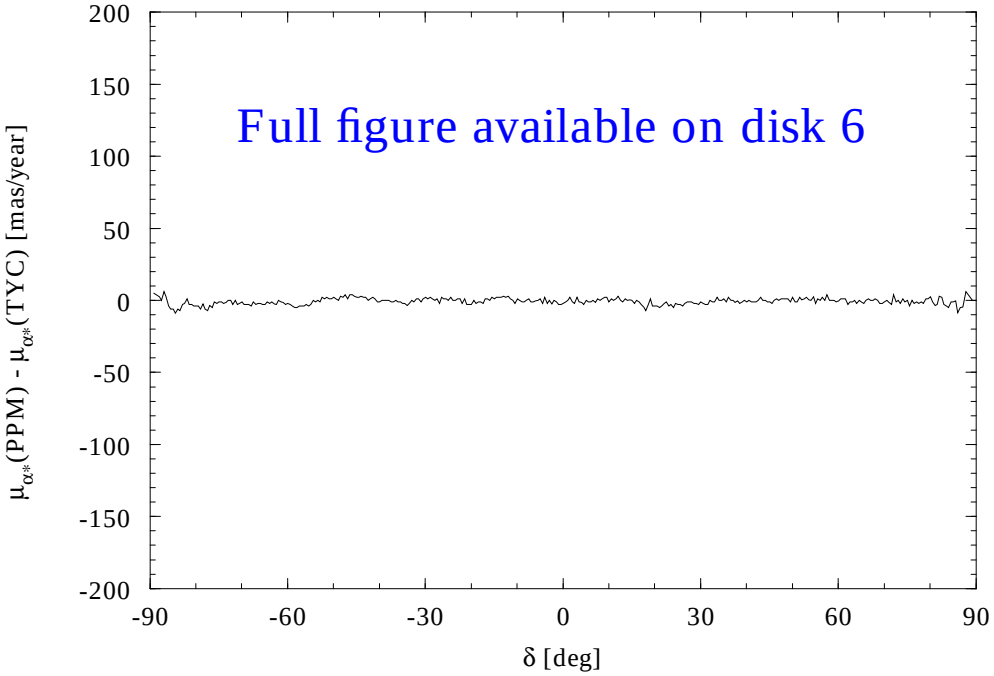

Figure 3.4.41. *Difference between $\mu_{\alpha *}$ from PPM (after rotation to the Hipparcos reference frame) and $\mu_{\alpha *}$ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5^\circ \times 2$ mas/yr. The curve is the median difference over intervals of 0.5°.*

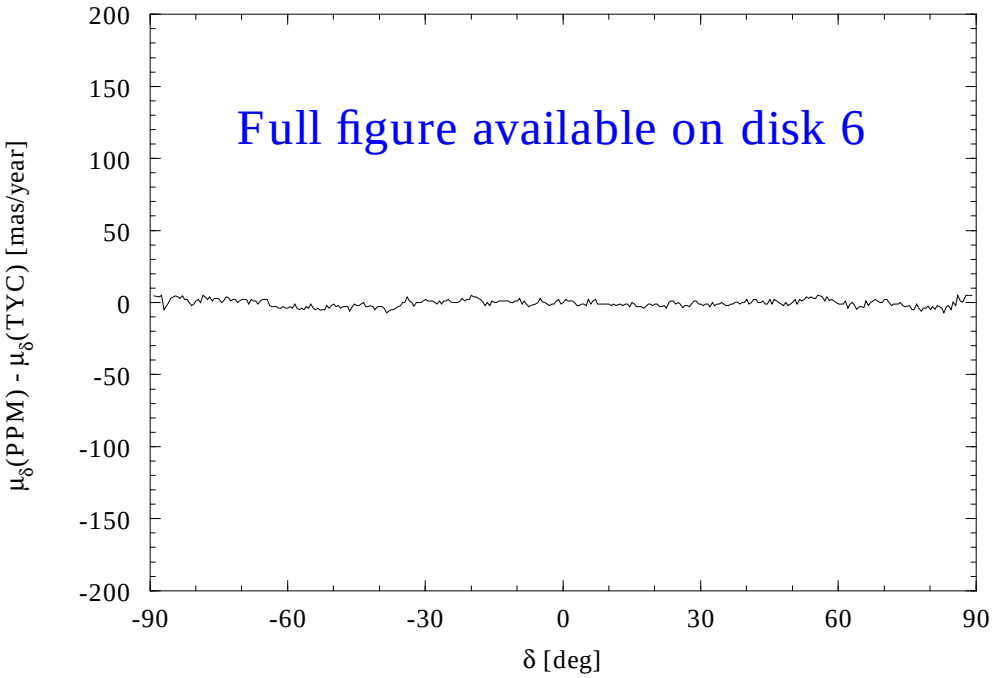

Figure 3.4.42. *Difference between μ_δ from PPM (after rotation to the Hipparcos reference frame) and μ_δ from the Tycho Catalogue, versus δ, as a density plot, for recommended Tycho Catalogue stars fainter than $B_T = 10$ mag. The colour scale indicates the number of stars in a cell of $0.5^\circ \times 2$ mas/yr. The curve is the median difference over intervals of 0.5°.*