FAME Pipeline Review
Astrometric Parameters
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- Beginning assumption: Build on Hipparcos history
- Beginning assumption: Model astrometric motion as a set of Calculated positions C. Compare to set of observations O. Calculate $\chi^2 = \Sigma\,(O-C)^2$.
- Model the calculated positions as a set of Parameters P_i. Assume an initial parameter P_0 and try to find corrections for the parameter δP via least squares, maximum likelihood, Baysian, SVD, flavor of the month.
- Astrometric parameters of star I not influence star J, so don't need to worry about huge matrix operation. Data analysis done per star.
- Need the "classic" parameters $\alpha, \delta, \mu_\alpha, \mu_\delta, \pi$.
- "Scourge of the Sky" (Worley). Multiplicity

- Types of Multiple systems.
  1. C Component. Double and multiple stars where the orbital period is much larger than mission lifetime. Hipparcos modeled these with linear relative motions. Suffers from degeneracy with μ_α, μ_δ. 13211H 11%
  2. G Acceleration terms. Apparently single stars needs acceleration (or higher) terms. Some binaries. Some secular accelerations. 2163 7 parameter, 459 9 parameter. 2%
  3. O Orbital solutions. Hipparcos could determine a few hundred orbital solutions of at least one parameter. Used ground based for rest of the 7 parameters. Much less likely for FAME. 235 0.2%
  4. V Variability Induced Moving stars. Apparent motion of the photocenter from one of the components being variable. 288. 0.2%
  5. X Stocastic. Not able to find single or double star solution within statistically uncertainties. Probably short period binaries. 1561.

- High proper motion stars give small changes in parallax.

$$\begin{aligned}\alpha(t) &= \alpha_0 + \mu_\alpha t + \pi P_\alpha + \pi\left[\frac{\partial P_\alpha}{\partial \alpha}\frac{\partial \alpha}{\partial t} + \frac{\partial P_\alpha}{\partial \delta}\frac{\partial \delta}{\partial t}\right] \\ \delta(t) &= \delta_0 + \mu_\delta t + \pi P_\delta + \pi\left[\frac{\partial P_\delta}{\partial \delta}\frac{\partial \delta}{\partial t} + \frac{\partial P_\delta}{\partial \delta}\frac{\partial \delta}{\partial t}\right]\end{aligned}$$

- A check of Hipparcos catalog shows $\approx$ 1500 stars with a parallax change greater than 1 μarcsec over a five year timescale. More than 175 with a 10 μarcsec change parallax. 18 have more than 100μarcsec.

- Fine radial velocities mean change of parallax w.r.t. time. Hipparcos needed radial velocities for 21 stars for 100μarcsec effect. FAME will obviously need more.

- Various accelerations will be difficult to decouple. While the percentage of stars that we need to worry about will not be much larger than Hipparcos, the numbers will make eyeballing these by hand. At 10 seconds per star, Hipparos takes 8 person weeks to inspect. FAME catalog takes 2800 P–W.