

Selected criteria

The stars are considered as non-members of the Gould Belt, they will be removed from database. First of all, the halo stars and the stars which is older than 100 million years are removed because the Gould belt is thought to be a local sub-system of disk (e.g. Tsioumis & Fricke, 1979; Palouš, 1983; Torra *et al.*, 2000) and its age is about 30 to 90 million years (e.g. Blaauw, 1956; Palouš, 1985; Olano, 1982; Westin, 1985; Frogel & Stothers, 1977; Comerón & Torra, 1990; Pöpel *et al.*, 1994; Wichmann *et al.* 1997; Lesh, 1968). Secondary, the selective conditions include the precision of the stellar parallax, proper motion and radial velocity.

(1) The spectral type of the main sequence stars from O – A5

There are two reasons why spectral types later than A5 should be filtered in the work.

First, the region of the Gould Belt is less than 600 pc (e.g. Guillout *et al.*, 1998). Although the observing limit magnitude is 12.4, the faintest magnitude of the Hipparcos is generally 11. For A5V stars, the limit distance d that can be observed is about 660 pc according to the distance modulus without extinction:

$$m - M_v = -5 + 5 \log d$$

where $m = 11$, $M_v = 1.9$ for A5. If the stellar extinction and reddening are considered, the stars with spectral type later than A5 beyond 600 pc should not be observed. The sample for A5 stars should be suitable complete for analysis.

Second, the age of the Gould Belt estimated by different research groups, range from 30 million to 90 million years old (e.g. Blaauw, 1956; Palouš, 1985; Olano, 1982; Westin, 1985; Frogel & Stothers, 1977; Comerón & Torra, 1990; Pöpel *et al.*, 1994; Wichmann *et al.* 1997; Lesh, 1968). Generally speaking, the B5.5V stars live about 80 million years old and the period of A4V stars stayed at the main sequence is about 60 million years (Gomez *et al.*, 1990). That means that OB stars of the Gould Belt can indicate the position and distribution of the Gould Belt, while the giants of A type should be removed.

On the other hand, the Gould Belt could be find out on X-Z plane by eyes for A0 – A5 main sequence stars, but it is not for the stars whose spectral type are later than A5.

(2) Halo stars

The stars with the larger vertical distance from the galactic disk, the high velocity, or the metal poor abundance are considered as halo stars. Because the Hipparcos catalogue lacks of the information of metal abundance, the stars are considered as halo stars are according to the conditions of stellar position and velocity.

The scale height of the disk is about 300 pc as the value is calculated from vertical density profile of stars brighter than $M_v = 3$ (Gilmore & Reid, 1983), and that is 250 ± 100 pc as the value is from the luminosity of the main sequence stars with $M_v = 5$. If the scale height multiple a factor $\ln 0.03$, 97 percent stars will be contained into the galactic disk and barge. Thus, the $|Z|$ should be restricted to 500 pc in the situation. However, the $|Z|$ is restricted to 300 pc conservatively in this research work because there are few stars beyond the $|Z| = 300$ pc.

Stars with space velocity greater than 60 km/ sec are expelled, too. Halo stars faraway the disk will be the high velocity stars, so the velocity of one star greater than $3\sigma_{vs}$ is expelled due to the higher velocity.

(3) The precision of the parallax is less than or equal to 50%

Lutz and Kelker (1973) considered the bias caused by parallax, and provided that the size of the error doesn't result from the parallax but the ratio σ_π / π . The errors of observation will make the absolute magnitude fainter when the magnitude is derived from the distance modulus. Assuming that the errors of measurement of a parallax can be expressed by a Gaussian distribution, the diagram of the σ_π / π and observed parallax will show that σ_π / π lying between 0.15 and 0.20 is the effective limit of a parallax. More recently, a modification derived by Smith (1987) shows that the ratio will limit to 0.25 after adding a completeness factor in the distribution function. Because the data used by Lutz and Kelker are incomplete and base on the uniform space density, Smith has an idea of modification.

Although the Lutz and Kelker bias plays an important role when the data obtained from parallax observation, σ_π / π of the data in this work is not chosen the value 25% or 17.5% but 50%. When the data considered Lutz and Kelker bias, most stars are non-members and the distance between the stars and the sun is less

than 300 pc. The stars considered the Lutz and Kelker bias or Smith bias supply too little information about the Gould Belt, so the data in the research are chosen $\sigma_{\pi} / \pi = 50\%$, which means the distance is less than about 500 pc in the Hipparcos catalogue.

(4) Precision of radial velocity and proper motion

Stars expelled from the conditions described above should be calculated their error in order to choose the precision of the velocity and list on the table 4.

Table 4: The average and errors of radial velocity, parallax, and proper motion

	OBV	A0 – A5 V
$\langle R_V \rangle$	4.02 km/sec	-0.91 km/sec
$\langle R_V \rangle_{\text{rms}}$	4.01 km/sec	2.25 km/sec
$\langle \mu_{\alpha} \cos \delta \rangle$	1.19 mas/year	1.10 mas/year
$\langle \mu_{\delta} \rangle$	6.41 mas/year	11.02 mas/year
$\langle \pi \rangle$	0.75 mas	0.82 mas
$\langle \pi \rangle_{\text{rms}}$	0.79 mas	0.87 mas
$\langle \pi / \mu_{\alpha} \cos \delta \rangle$	0.141	0.099
$\langle \pi / \mu_{\delta} \rangle_{\text{rms}}$	0.15	0.11
$\langle \mu_{\alpha} \cos \delta \rangle_{\text{rms}}$	1.4 mas/year	2.6 mas/year
$\langle \mu_{\alpha} \cos \delta \rangle$	0.72 mas/year	0.80 mas/year
$\langle \mu_{\alpha} \cos \delta \rangle_{\text{rms}}$	0.79 mas/year	0.98 mas/year
$\langle \mu_{\delta} \rangle_{\text{rms}}$	1.0 mas/year	1.7 mas/year
$\langle \mu_{\delta} \rangle$	0.63 mas/year	0.66 mas/year
$\langle \mu_{\delta} \rangle_{\text{rms}}$	0.67 mas/year	0.85 mas/year
Result		
$V_{\alpha \cos \delta}$	0.58 km/sec	0.42 km/sec
V_{δ}	0.50 km/sec	0.37 km/sec

From table 4, the average error of radial velocity is different from parallax and proper motion. In the model discussed by Moreno et al. (1999), the restricted value of σ_{R_V} is chosen as 1.3 km/sec, but the value in this study seems to be not

suitable. To be consistent with the precision of distance, the precision of radial velocity and proper motion in the work are selected 50%.