Cluster 123

March 10, 2025

1 Identifying Genuine cluster members with 3D Monte-Carlo simulation and HDBSCAN

This is an auto generated report for Cluster 123.

It shows methodology for identifying genuine cluster memebers with 3D Monte-Carlo Simulation and HDBSCAN*. Similar reports have been generated for all analyzed clusters.

1.1 Determination of membership cut-off from membership distribution

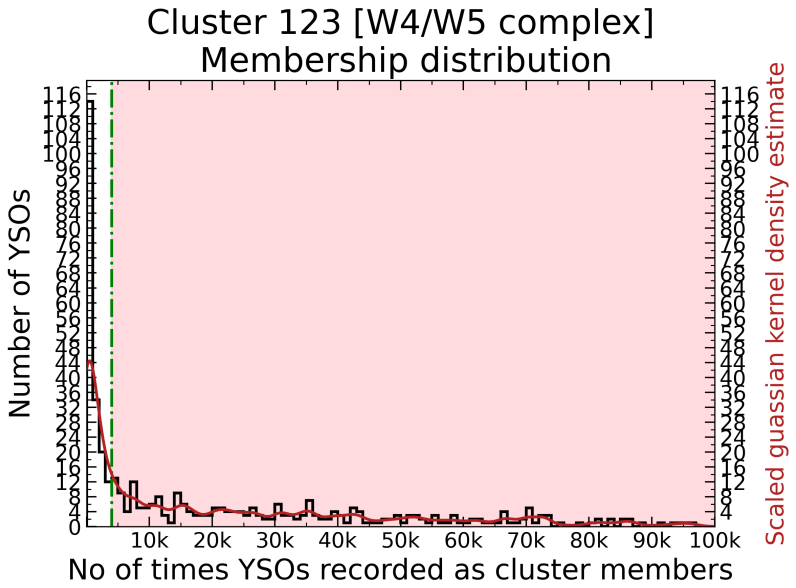

Figure 1: Distribution of YSO membership for 100,000 iterations of HDBSCAN* for 123

Monte-Carlo threshold (green dash-dotted line): 4000
Number of members above threshold in run 6 of HDBSCAN-MC: 253

1.2 Identifying common members across 10 runs HDBSCAN-MC

Figure 2 shows stability of HDBSCAN-MC across 10 runs. The common members across all runs will be considered for further analysis

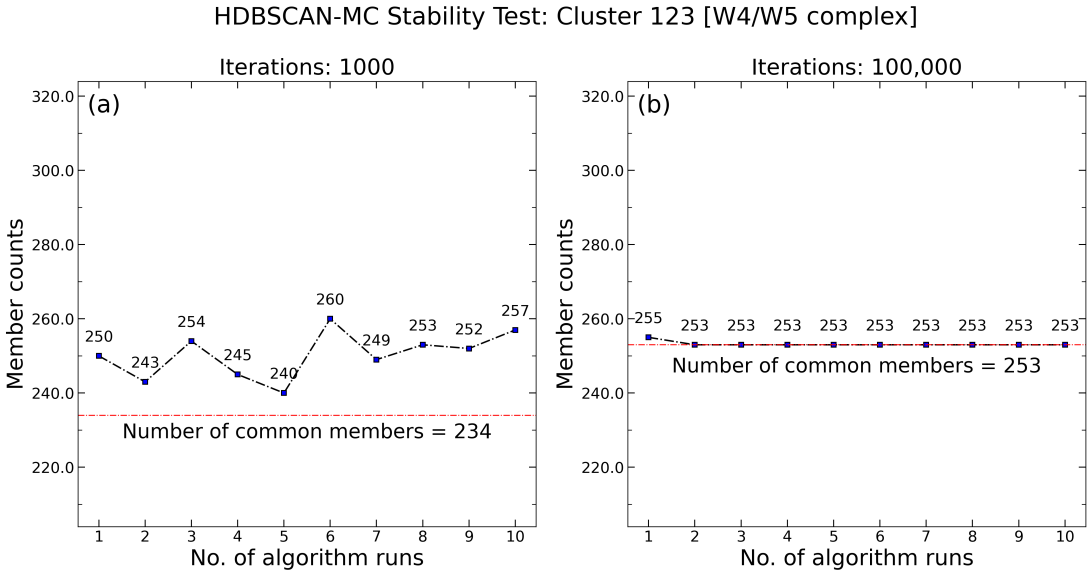

Figure 2: Stability Test for identification of HDBSCAN-MC algorithm across 10 runs. Common members across various runs are taken as final members

1.3 Viewing identified genuine cluster members in astrometric space.

Figure 3 shows final identified members in astrometric space along with Gaia color-color diagram.

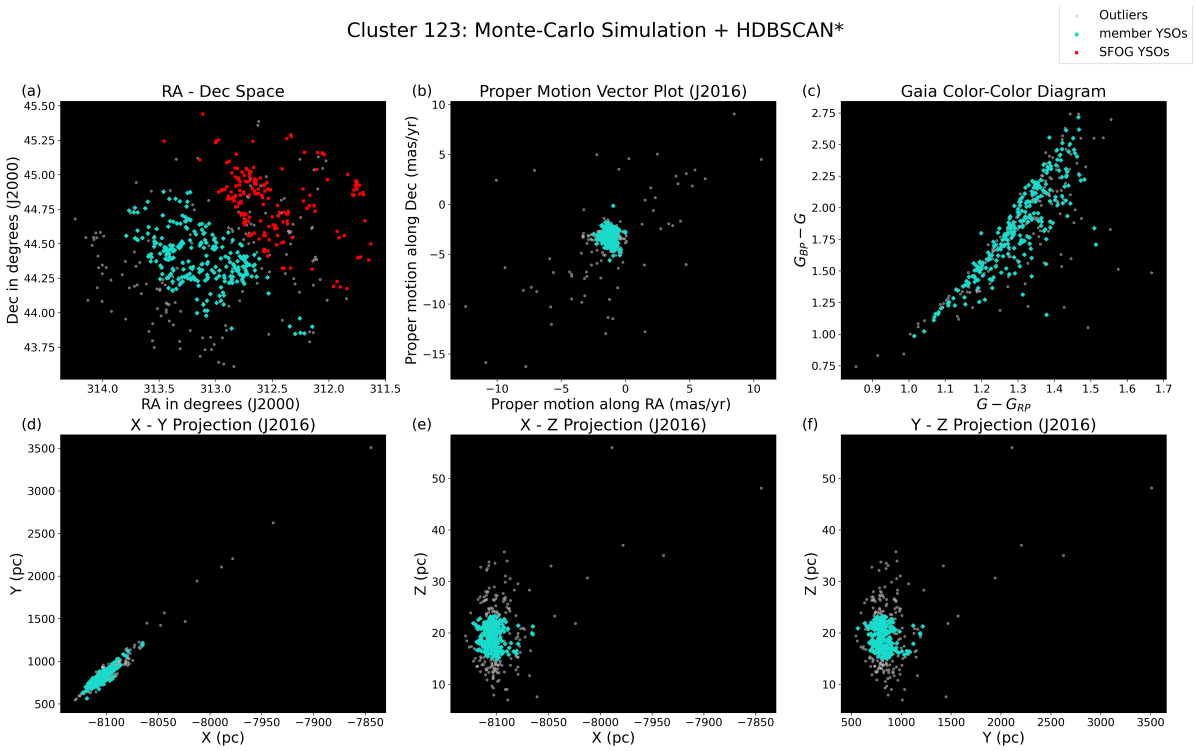

Figure 3: Astrometric analysis by application of HDBSCAN-MC for Cluster 123

1.4 Summarizing Cluster Statistics

Cluster Statistics	
Median Distance	786 pc +/- 75 pc
Mean Distance	802 pc +/- 75 pc
Kinematic Distance (Winston et.al. 2020)	N/A
Simulation predicted distance estimate	740 pc +/- 6 pc
No.of Gaia matched SFOG YSOs	0 out of 33
No.of Gaia only YSOs	196 out of 400
Total cluster members (with Gaia counterparts)	196 out of 433
Predicted false positives	28 out of 196
New Gaia-matches SFOG members	0
SFOG only YSOs in region	194
SFOG cluster members as reported in Winston et.al. (2020)	175
No. of outlier in Winston et.al. (2020) SFOG cluster members	1
Cluster β value	0.9655

1.5 Proper Motion Analysis

Figure 4 shows direction distribution of proper motion vectors for identified cluster members. The angle is measured from positive x-axis. The proper motion magnitude distribution is given by Figure 5.

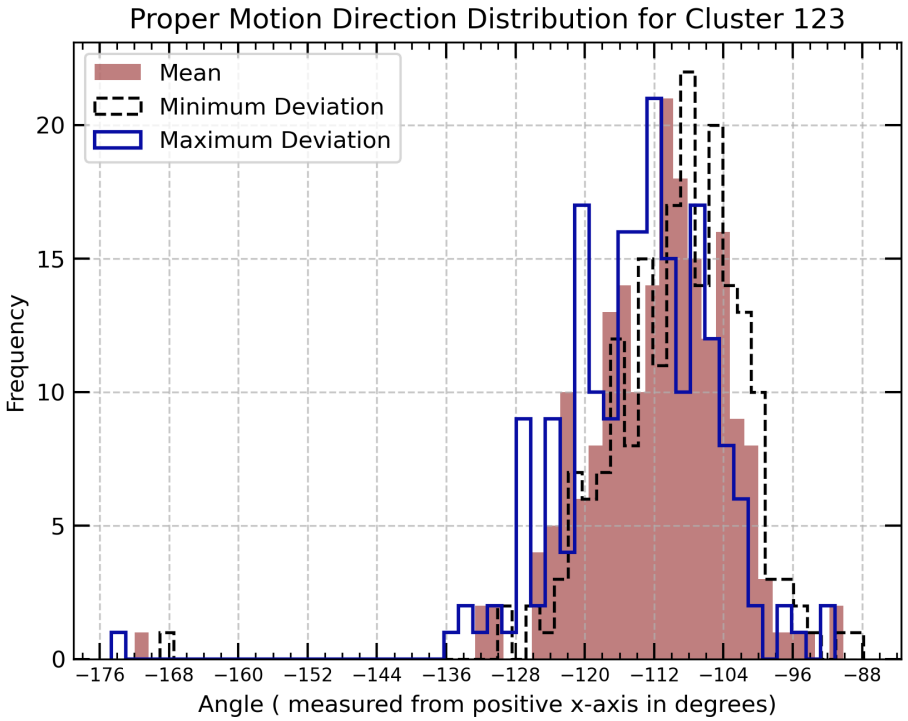

Figure 4: Proper motion direction distribution
for Cluster 123

1.6 Cluster simulation

The table below gives weighted parameters and unbiased weighted standarad deviation obtained from optimization process. The weighted parameters are calculted using optimized parameter sets having MSD less than three times best-fit solution.

Iteration	center_dist	mem_frac	noise_lower	noise_upper	c	pm_scale	MSD
	740 pc +/- 6 pc	59.441 +/- 3.72	558.479 +/- 51.528	1576.504 +/- 77.034	553.604 +/- 151.801	2961.587 +/- 168.483	
27	744.0	61.0	502.0	1615.0	619.0	2881.0	148.9751
6	743.0	61.0	580.0	1492.0	588.0	2877.0	184.5025
9	743.0	61.0	568.0	1643.0	446.0	2888.0	193.2488
24	743.0	61.0	602.0	1628.0	612.0	2887.0	209.5274
4	744.0	61.0	521.0	1503.0	448.0	2903.0	224.4627
15	743.0	61.0	626.0	1527.0	381.0	2876.0	234.801
7	739.0	59.0	630.0	1691.0	828.0	2831.0	249.3234
17	743.0	61.0	500.0	1532.0	441.0	2880.0	267.4478
19	741.0	61.0	552.0	1509.0	579.0	2849.0	309.4428
16	742.0	61.0	502.0	1574.0	431.0	2882.0	318.2935
3	725.0	51.0	568.0	1625.0	763.0	3165.0	326.6169
12	739.0	59.0	595.0	1706.0	813.0	3089.0	334.6318
13	741.0	61.0	644.0	1517.0	434.0	2873.0	339.5871
26	741.0	61.0	496.0	1525.0	400.0	2917.0	361.3682
5	741.0	61.0	518.0	1509.0	435.0	2858.0	370.7015
28	746.0	64.0	545.0	1701.0	860.0	3352.0	378.3035
23	727.0	51.0	492.0	1631.0	535.0	3359.0	410.8756
29	729.0	51.0	525.0	1424.0	461.0	3196.0	412.2438
22	728.0	51.0	641.0	1556.0	386.0	3360.0	444.3433

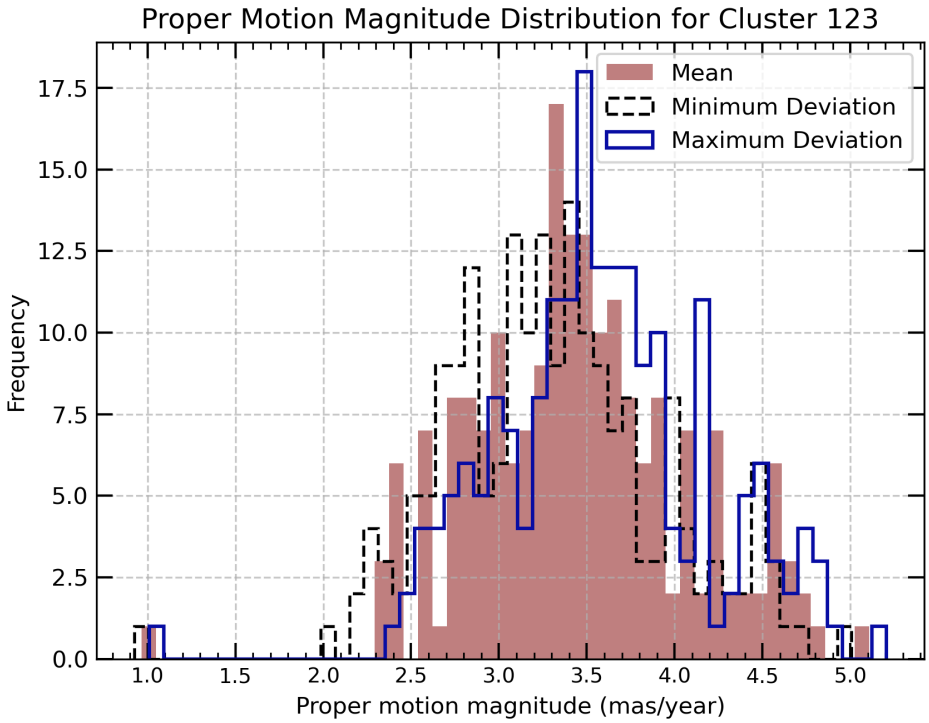

Figure 5: Proper motion magnitude distribution for Cluster 123

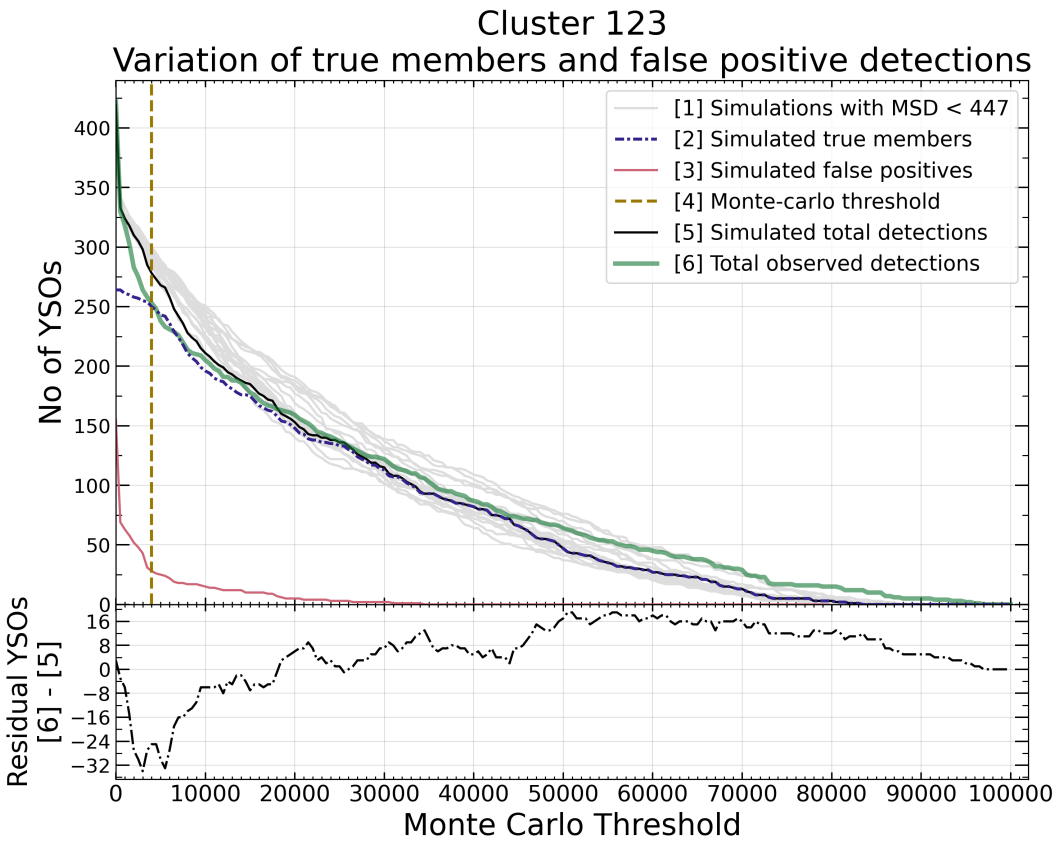

Figure 6: Monte Carlo spectra and simulation result for Cluster 123