

Abstract

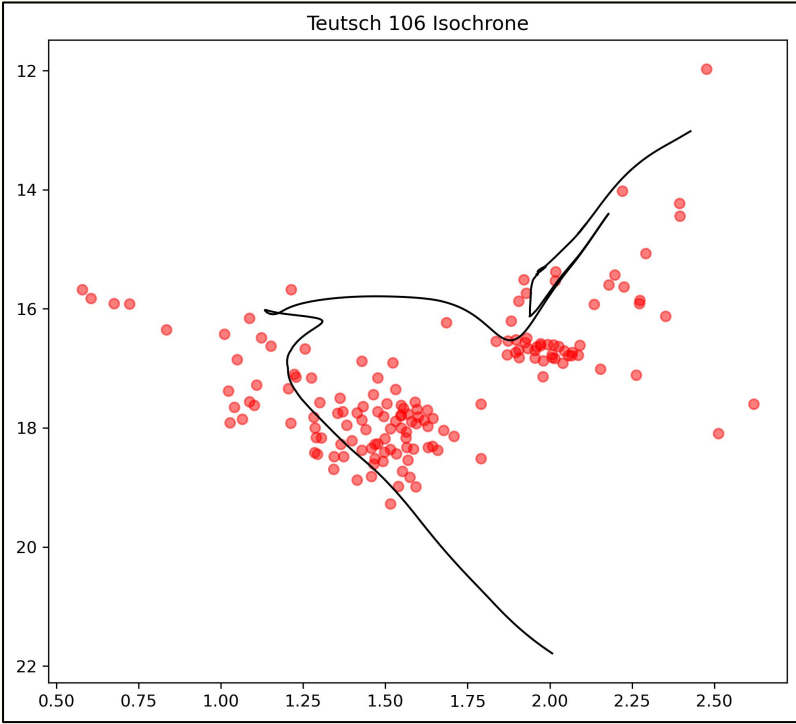
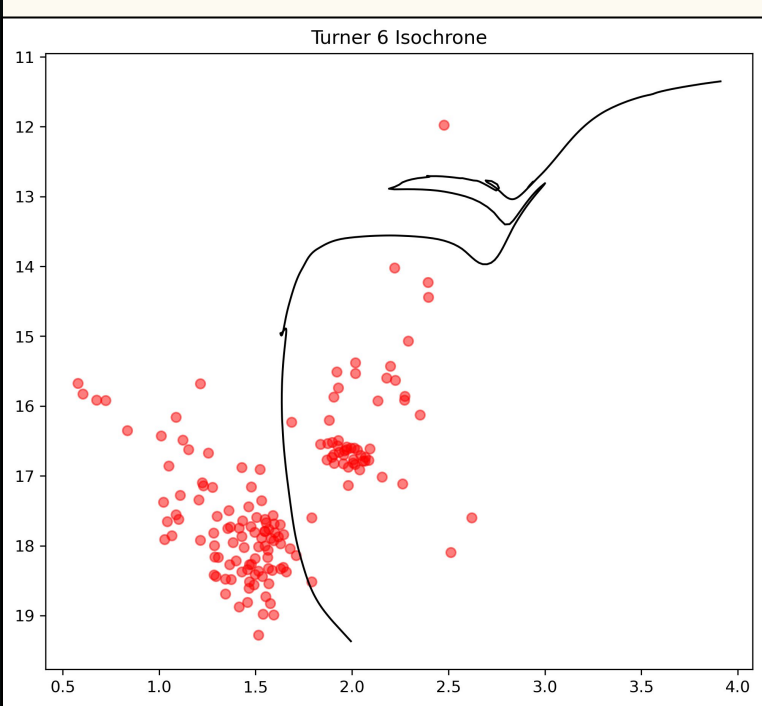
Turner 6 and Teutsch 106 are two star clusters which share high overlap. In order to determine if there are differences between the two clusters or if Teutsch 106 is truly a duplicate analysis is conducted on the high probability members compiled by the Unified Cluster Catalog. This analysis is focused mostly on the two opposing sides of the giants and main sequence stars of both cluster members combined, making use of various statistical tests and plotting methods for the stars. This all leading to the conclusion that the two clusters should be merged at a distance of 6.7 kpc, an age of 603 myr, and extinction value of 2.03. Some stars should be cut due to their parallaxes being significantly outside the range of possibility to belong to the revised distance estimate.

Introduction

More and more open clusters are being discovered and classified, but this classification has been nearly fully automated, with this automation leaving gaps that must be filled with manual review. This study focuses on a manual review of 2 open clusters: Teutsch 106 and Turner 6, that share nearly the same space in the sky. The purpose was to evaluate if these clusters should be merged or stay separated, with data compiled by Perren et al. (2023) given by Kronberger et al.; Kharchenko et al.; R.-D. Scholz et al.; Kharchenko et al.; Luri et al.; Lennart Lindegren et al.; Vallenari et al. (2006; 2013; 2015; 2015; 2018; 2021; 2022), and analyzed with the assistance of Hunter; McKinney; van der Walt et al.; Virtanen et al.; Dotter et al. (2007; 2010; 2011; 2020; 2026).

Methods

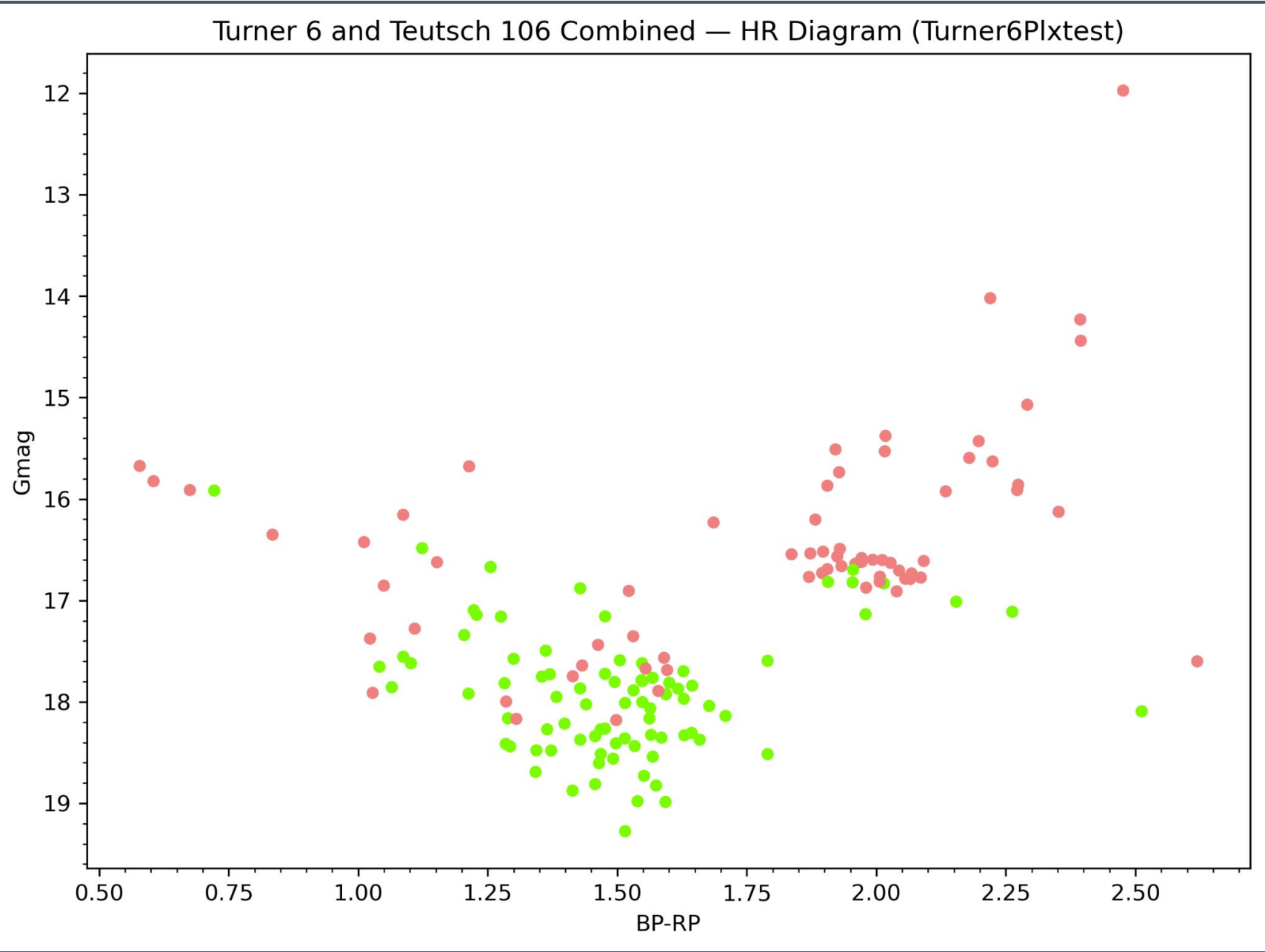
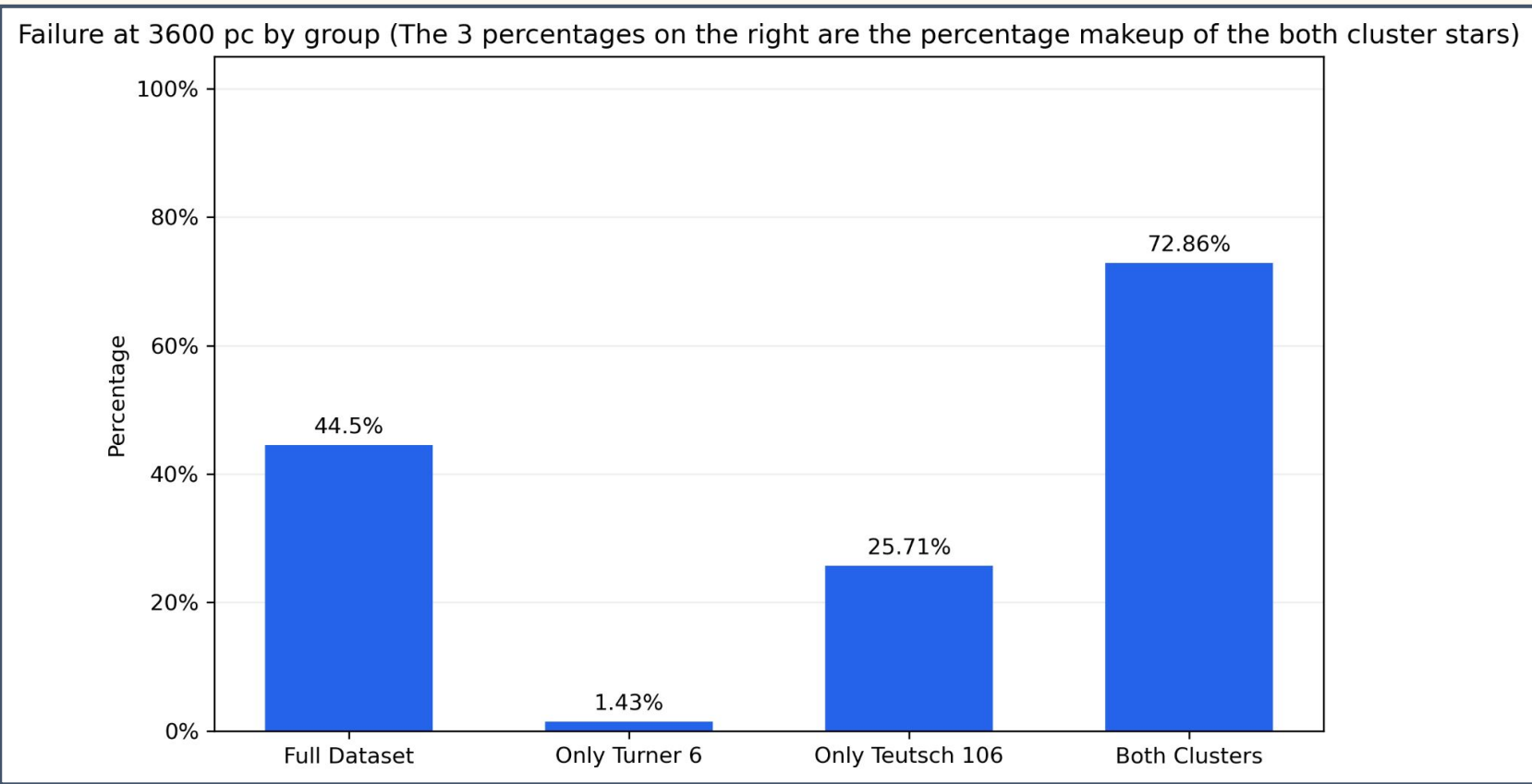
UCC source data from various data releases is downloaded to give the current member stars of Teutsch 106 and Turner 6. These members from both clusters are then combined (with both already having a high overlap with each other) into one table in pandas. This pandas table is then divided into two tables, with the divider being a Gaia satellite color index value of 1.75 in order to create the suspected main sequence and suspected giant stars. A z test with an alpha level of 0.01 was conducted with both cluster’s recorded parallax values (parallax being the value that allows for distance measurements) to find stars unlikely to be in the cluster. Finally multiple color luminosity “HR” diagrams were made, the first two sets serving as visualization for cluster overlap and statistical significance respectively, while the third set using stellar isochrones, which plot cluster evolution on the diagram, in order to check if the recorded age and extinction, the later being a value which measures light absorption, for each cluster are accurate.



Isochrones for recorded values of Turner 6 and Teutsch 106

Results

The tests of statistical significance showed that a cluster containing nearly all of these stars, including stars presently identified at the distance of 3600 pc, would have to be at around the recorded distance for Teutsch 106 which is 6700 pc. Results also show that the evolution of the cluster lines up with the recorded values of 2.03 Av for extinction and 603 million years for age.



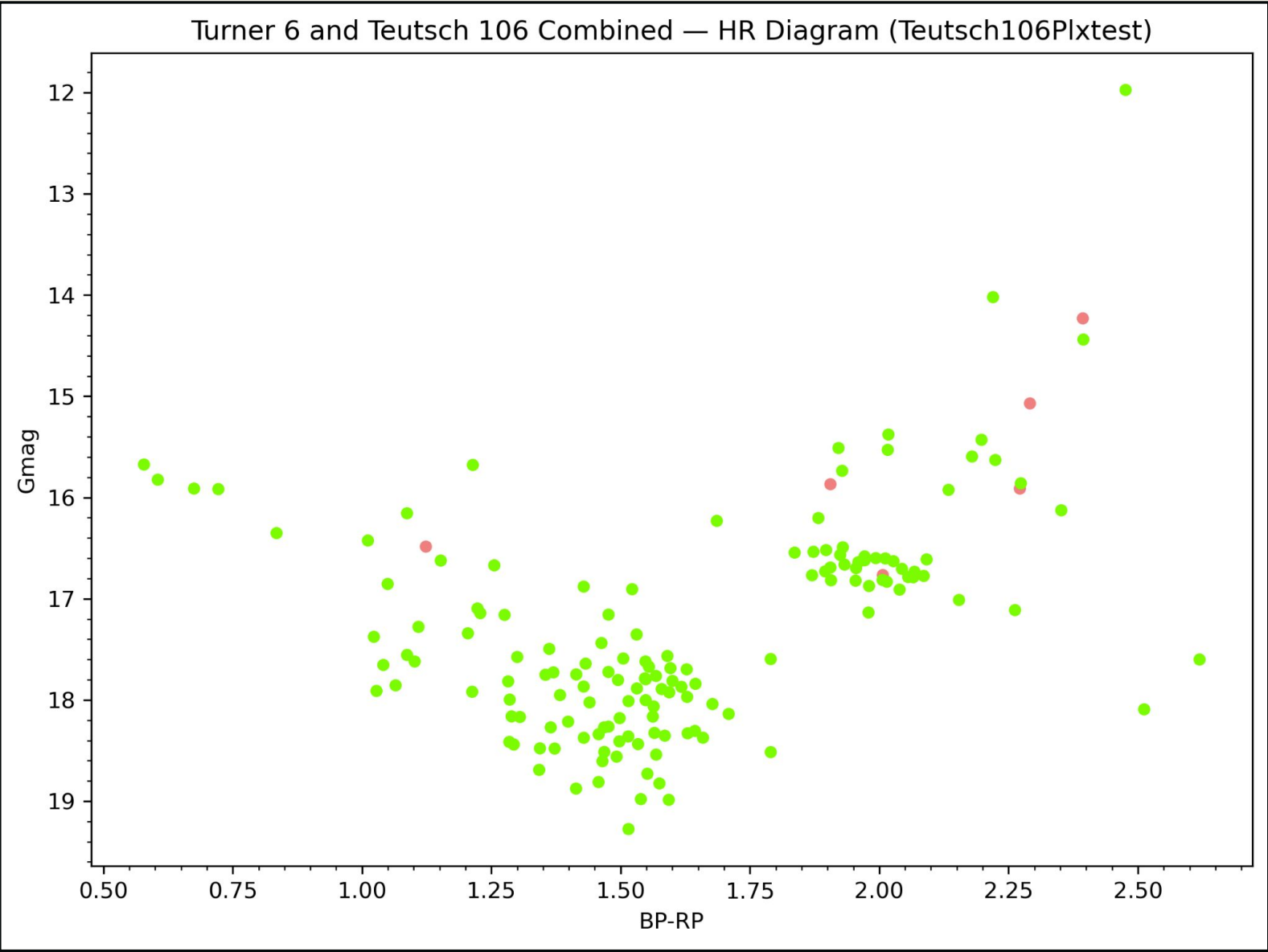
Parallax z test at 3600 parsecs

Discussion

The results show that a cluster located around 3600 pc do not line up with the data currently presented, and that the clusters should likely be merged, given the name of Turner 6 due to order of discovery, and the data values recorded for cluster characteristics should be the mentioned 2.03 Av, 6700 pc, and 603 million years.

Conclusion

The data shows that a combined cluster at a distance of 3600 pc is unreasonable, and shows that a cluster centered at this distance is unlikely to exist even if the cluster stars are uncombined. As such, the preheld notions on these cluster should be disregarded to form a more cohesive cluster. Additionally, this cluster should be given special focus when Gaia DR4 releases to see if this new data shelves the chance of these clusters reasonably existing.



Parallax z test at 6700 parsecs

References

Searle and Zinn; Bergond et al.; Dias et al.; Butkevich et al.; Kronberger et al.; Huff and Stahler; Hunter; McKinney; van der Walt et al.; Kharchenko et al.; Perren et al.; R.-D. Scholz et al.; Kharchenko et al.; Luri et al.; Virtanen et al.; Lennart Lindegren et al.; Vallenari et al.; Perren et al.; Hunt and Reffert; Boucher et al.; Dotter et al. (1978; 2001; 2002; 2005; 2006; 2006; 2007; 2010; 2011; 2013; 2015; 2015; 2015; 2015; 2018; 2020; 2021; 2022; 2023; 2024; 2026; 2026)