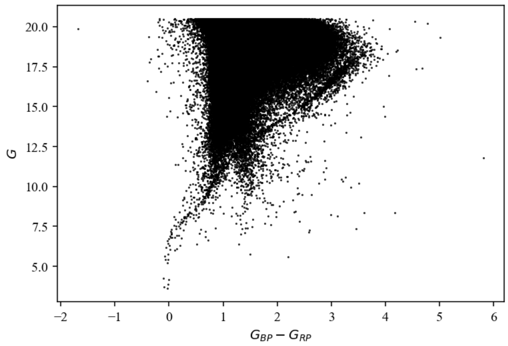
1 Intro

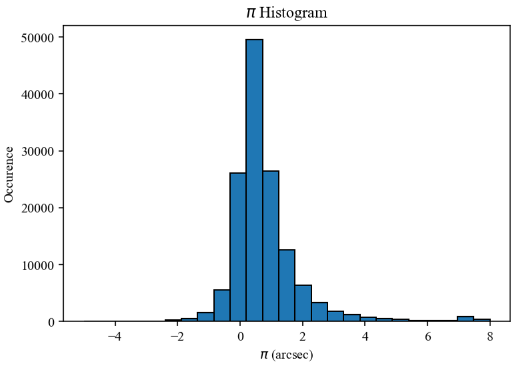
We experiment with making 'cuts' in different parameter spaces to determine actual members of the Pleiades cluster. We conducted the search and found upwards 130,000 targets within the solid angle. Firstly, a total CMD was created.

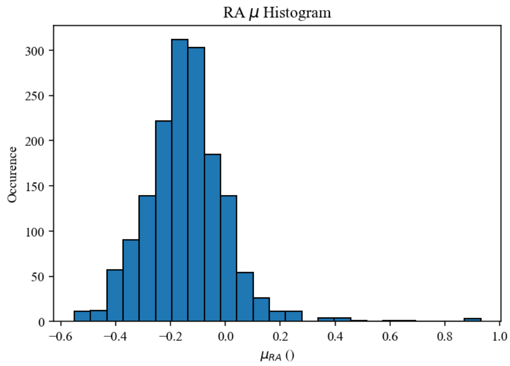


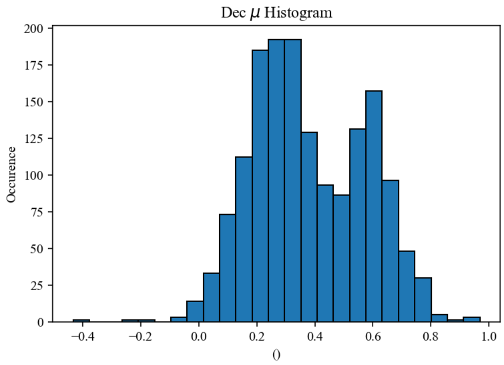
The Pleiades appears to be the narrow thread of stars, underneath the blob that appears in the upper central region.

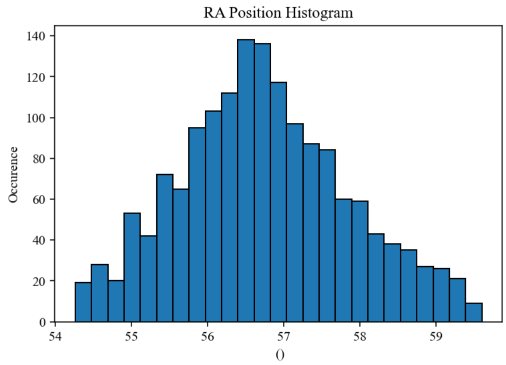
2 Histogram

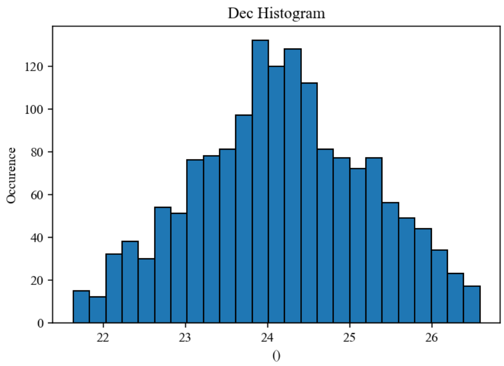
We begin to make cuts in parameter space. Here are the histograms generated.











Note, on the parallax histogram, we have extreme pollution from stars ranging from -2 ot 4 arcseconds. The Pleiades, according to current NASA estimates, its distance of about 130 parsecs should mean it has parallax values of about 7 arcseconds.

3 Cuts and Code

```
# -*- coding: utf-8 -*-
"""
Created on Fri Feb  7 11:43:44 2025

@author: cmark
"""
```

```python
## data import

import pandas as pd
import os
import matplotlib.pyplot as plt
import numpy as np

os.chdir("C:/Users/cmark/Spyder/PHSCS 428")

data = pd.read_csv('Pleiades-result.csv')

#%% plotting
plt.rcParams['font.family'] = 'Times New Roman'

plt.figure()
plt.scatter(data['phot_bp_mean_mag'] - data['phot_rp_mean_mag'], data['phot_g_mean_mag'], s=.2, color='black')
plt.xlabel("$G_{BP} - G_{RP}$")
plt.ylabel("$G$")
plt.show()

#%% startng cuts

## from NASA, distance is 445 ly = 136.43 pc, which is about 7.4 arcsec

plt.hist(data['parallax'], bins=25, range= (-5, 8), edgecolor='black')
plt.title('$\pi$ Histogram')
plt.xlabel('$\pi$ (arcsec)')
plt.ylabel('Occurence')

data_parallax = data[(data['parallax'] >= 6) & (data['parallax'] <= 8)]

#%% RA Proper Motion

plt.hist(data_parallax['ra_pmra_corr'], bins =25, edgecolor='black')
plt.title('RA $\mu$ Histogram')
plt.xlabel('$\mu_{RA}$ ()')
plt.ylabel('Occurence')

data_rapm= data_parallax[(data_parallax['ra_pmra_corr']>=-0.5) & (data_parallax['ra_pmra_corr'] <=.3)]
#%% Dec Proper Motion

plt.hist(data_parallax['dec_pmdec_corr'], bins =25, edgecolor='black')
plt.title('Dec $\mu$ Histogram')
plt.xlabel('()')
plt.ylabel('Occurence')

data_decpm = data_rapm[(data_rapm['dec_pmdec_corr'] >= -0.1) & (data_rapm['dec_pmdec_corr'] <= 0.9)]
#%% Position

plt.figure()
plt.hist(data_parallax['ra'], bins =25, edgecolor='black')
plt.title('RA Position Histogram')
plt.xlabel(' ()')
plt.ylabel('Occurence')
plt.show()
```

```
plt.figure()
plt.hist(data_parallax['dec'], bins =25, edgecolor='black')
plt.title('Dec Histogram')
plt.xlabel('()')
plt.ylabel('Occurence')
plt.show()

data_pra = data_decpm[(data_decpm['ra'] >= 54.5) & (data_decpm['ra'] <= 58.5)]
data_pdec = data_pra[(data_pra['dec'] >= 22) & (data_pra['dec'] <= 27)]

#%% final CMD

datafinal = data_pdec

plt.figure()
plt.title('Color Magnitude Diagram Final')
plt.scatter(datafinal['phot_bp_mean_mag'] - datafinal['phot_rp_mean_mag'],
                                          datafinal['phot_g_mean_mag'], s=.2,
                                          color='black')
plt.xlabel("$G_{BP} - G_{RP}$")
plt.ylabel("$G$")
plt.show()

plt.figure()
plt.title('Color Magnitude Diagram Combined')
plt.scatter(data['phot_bp_mean_mag'] - data['phot_rp_mean_mag'], data['
                                          phot_g_mean_mag'], s=.2, color='black'
                                          )
plt.scatter(datafinal['phot_bp_mean_mag'] - datafinal['phot_rp_mean_mag'],
                                          datafinal['phot_g_mean_mag'], s=.2,
                                          color='red')
plt.xlabel("$G_{BP} - G_{RP}$")
plt.ylabel("$G$")
plt.show()


#%% vector plot

plt.figure()
plt.title('VPD')
plt.scatter(data['ra_pmra_corr']*np.cos(data['dec_pmdec_corr']), data['
                                          dec_pmdec_corr'], s=.04)
plt.xlabel('RA')
plt.ylabel('Dec')
plt.show()

plt.figure()
plt.title('VPD Final')
plt.scatter(datafinal['ra_pmra_corr']*np.cos(datafinal['dec_pmdec_corr']),
                                          datafinal['dec_pmdec_corr'], s=.8)
plt.xlabel('RA')
plt.ylabel('Dec')
plt.show()

plt.figure()
plt.title('VPD Combined')
plt.scatter(data['ra_pmra_corr']*np.cos(data['dec_pmdec_corr']), data['
                                          dec_pmdec_corr'], s=.04)
```

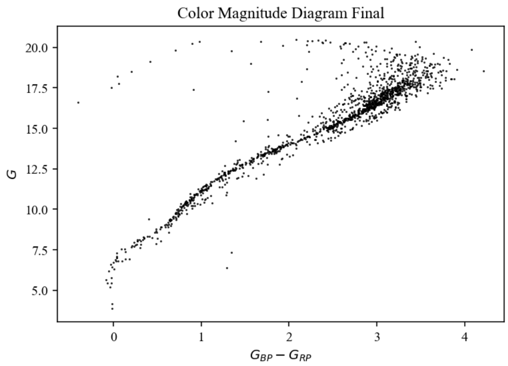
```
plt.scatter(datafinal['ra_pmra_corr']*np.cos(datafinal['dec_pmdec_corr']),
                                                datafinal['dec_pmdec_corr'], s=.8,
                                                color='red')
plt.xlabel('RA')
plt.ylabel('Dec')
plt.show()
```

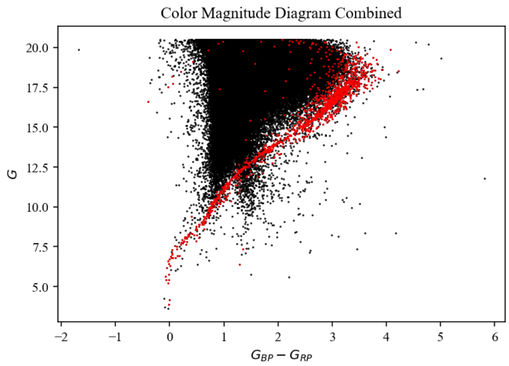
The cuts made are as follows:

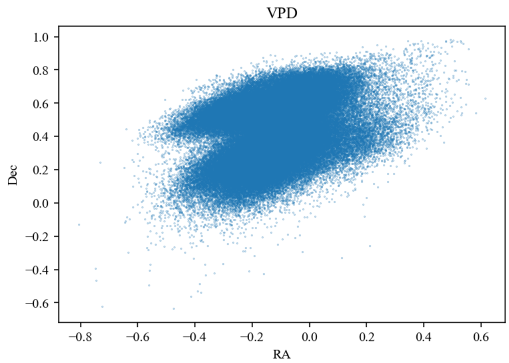
Parameter	Minimum Value	Maximum Value
Parallax	-5	8
Proper Motion (RA)	-0.5	0.3
Proper Motion (Dec)	-0.1	0.9
RA	54.5	58.5
Declination	22	27

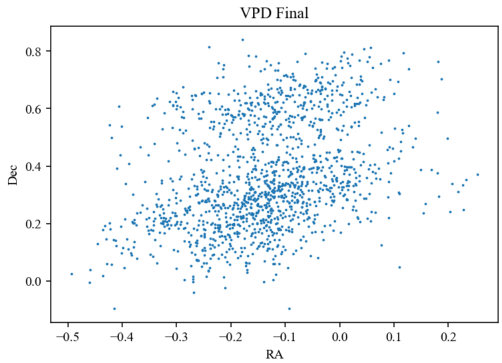
4 Combined Plots

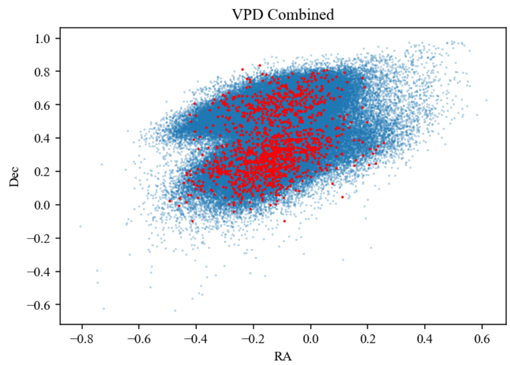
The final data frame contained 1397 objects, which is 97 more than Heyl et al. The final CMDs and VPDs are below.











After rejection, we obtain an average distance value of: 7.217 mas. This corresponds to a distance of about 138 parsec.

```python
#%%

average = datafinal['parallax'].mean()
print(f"Average value: {average}")
distance = 1/average
print(f"Calculated Distance: {distance}")
```