

```
In [141]: import astropy.units as u
import numpy as np
from astroquery.gaia import Gaia
from joblib import Memory
```

```
In [158]: def get_gaia_query_results(ra=66.75, dec=15.86, radius=2, conds="", limit=50000):
    add = ""
    if conds != "":
        add = f"AND {conds}"
    query = f"""
SELECT TOP {limit} *
FROM gaiaedr3.gaia_source
WHERE
    CONTAINS(
        POINT('ICRS',gaiaedr3.gaia_source.ra,gaiaedr3.gaia_source.
dec),
        CIRCLE('ICRS',{ra},{dec},{radius})
    )=1
""" + add
    job = Gaia.launch_job_async(query)
    return job.get_results()
```

```
In [159]: location = "./cachedir"
memory = Memory(location, verbose=0)
get_gaia_query_results_cached = memory.cache(get_gaia_query_results)
```

```
In [160]: stringent_conds = '''
    parallax_over_error > 10
    AND phot_g_mean_flux_over_error>50
    AND phot_rp_mean_flux_over_error>20
    AND phot_bp_mean_flux_over_error>20
    AND pmra_error < 0.1
    AND pmdec_error < 0.1
    AND phot_bp_rp_excess_factor < 1.3+0.06*power(phot_bp_mean_mag-pho
t_rp_mean_mag,2)
    AND phot_bp_rp_excess_factor > 1.0+0.015*power(phot_bp_mean_mag-ph
ot_rp_mean_mag,2)
    AND astrometric_excess_noise < 1
    '''
res_stringent = get_gaia_query_results_cached(conds = stringent_conds)
res_condless = get_gaia_query_results_cached()
```

```
INFO:astropy:Query finished.
```

```
INFO: Query finished. [astroquery.utils.tap.core]
```

```
INFO:astropy:Query finished.
```

INFO: Query finished. [astroquery.utils.tap.core]

solution_id	designation	...	ecl_lat
		...	deg
-----	-----	...	
1636042515805110273	Gaia EDR3 3310910234592413184	...	-7.0964214031
8053			
1636042515805110273	Gaia EDR3 3310910303311887360	...	-7.09939015513
4367			
1636042515805110273	Gaia EDR3 3310910676972829696	...	-7.06723761834
5579			
1636042515805110273	Gaia EDR3 3310910681269000448	...	-7.06640649129
1075			
1636042515805110273	Gaia EDR3 3310910951850745984	...	-7.04162845408
9132			
1636042515805110273	Gaia EDR3 3310911093585979776	...	-7.18760824566
6195			
1636042515805110273	Gaia EDR3 3310911127945715968	...	-7.18859557340
8486			
1636042515805110273	Gaia EDR3 3310911127945717248	...	-7.18767752926
7409			
1636042515805110273	Gaia EDR3 3310911265384672384	...	-7.173381778551
1516			
1636042515805110273	Gaia EDR3 3310911368463886464	...	-7.16468546908
6312			
	...	...	...
...			
1636042515805110273	Gaia EDR3 3307892418771847424	...	-7.35249321113
9833			
1636042515805110273	Gaia EDR3 3307892453131585024	...	-7.35554509582
9161			
1636042515805110273	Gaia EDR3 3307892899808159104	...	-7.35616851533
2091			
1636042515805110273	Gaia EDR3 3307893105966589568	...	-7.34490814389
9604			
1636042515805110273	Gaia EDR3 3307893209045804160	...	-7.32254365131
6396			
1636042515805110273	Gaia EDR3 3307893552643212672	...	-7.3047096030
1765			
1636042515805110273	Gaia EDR3 3307893621362688512	...	-7.29324348784
5204			
1636042515805110273	Gaia EDR3 3307893621362689664	...	-7.29603833314
7856			
1636042515805110273	Gaia EDR3 3307893758801617792	...	-7.29697171202
4125			

```
In [206]: import matplotlib.pyplot as plt
          from matplotlib import colors
```

## Stringent Conditions

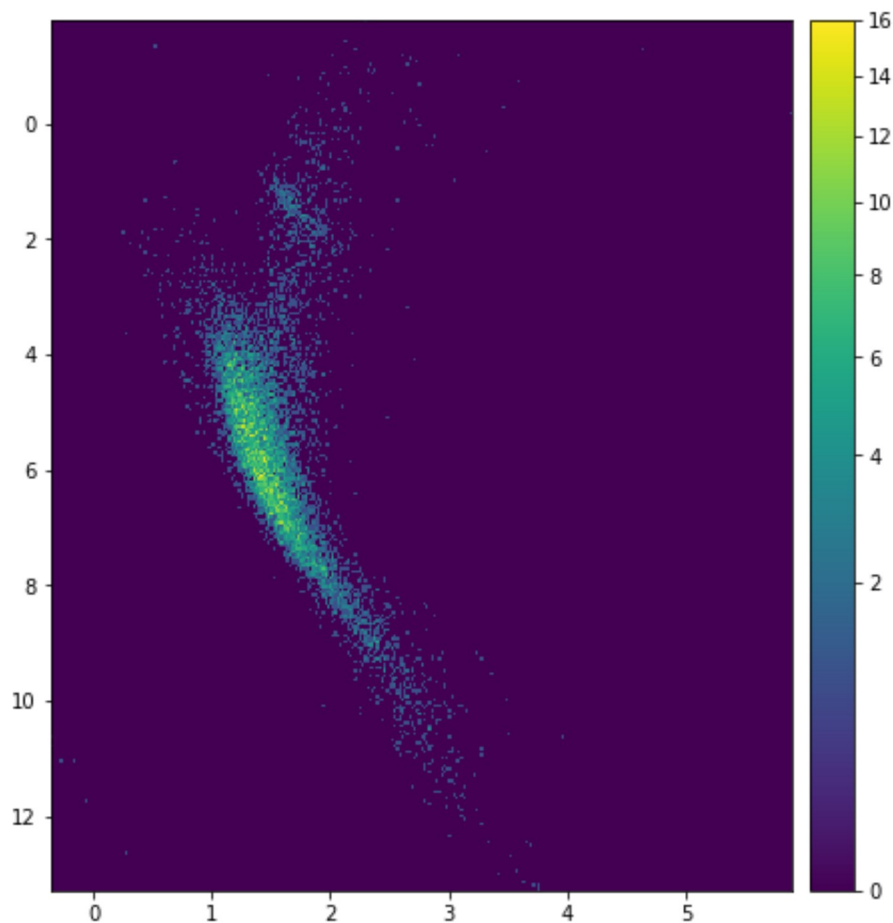
In [169]: `res_stringent`

Out[169]: *Table length=10353*

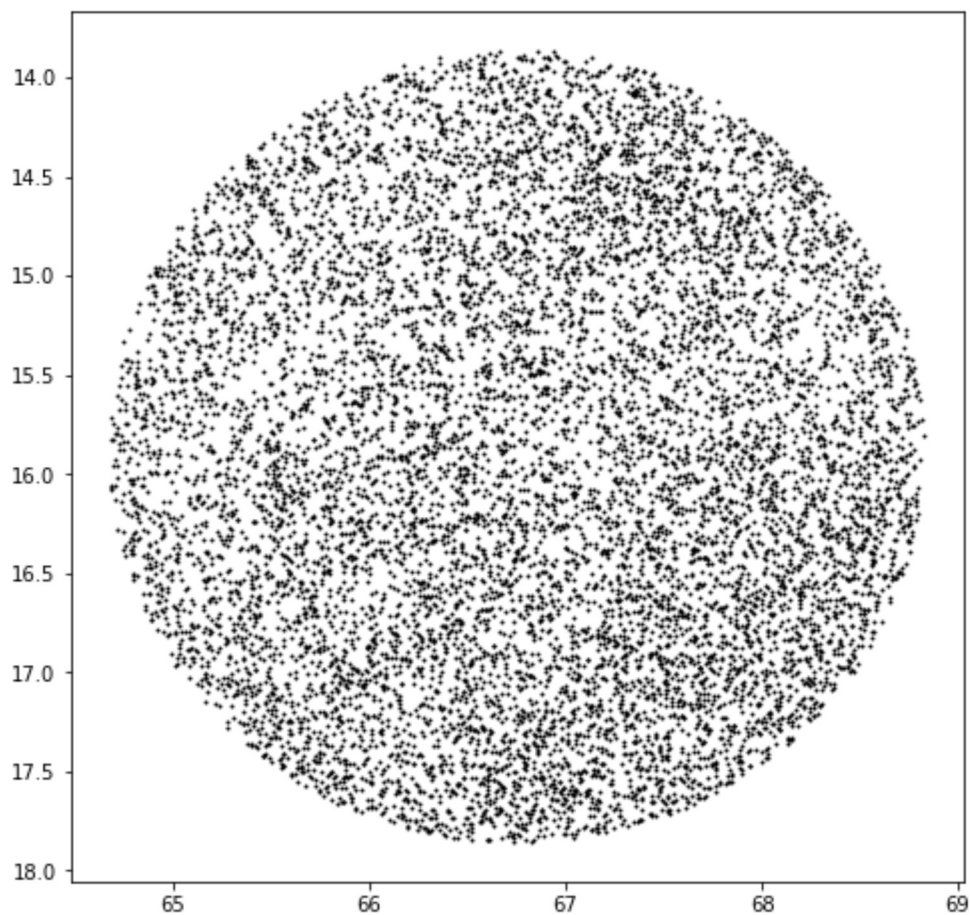
<b>solution_id</b>	<b>designation</b>	<b>source_id</b>	<b>random_index</b>	<b>ref_epoch</b>	
				<b>yr</b>	
<b>int64</b>	<b>object</b>	<b>int64</b>	<b>int64</b>	<b>float64</b>	
1636042515805110273	Gaia EDR3 3310910234592413184	3310910234592413184	521429206	2016.0	6
1636042515805110273	Gaia EDR3 3310910303311887360	3310910303311887360	1182667148	2016.0	6
1636042515805110273	Gaia EDR3 3310910676972829696	3310910676972829696	45383471	2016.0	6
1636042515805110273	Gaia EDR3 3310910681269000448	3310910681269000448	123349059	2016.0	6
1636042515805110273	Gaia EDR3 3310910951850745984	3310910951850745984	1783197016	2016.0	
1636042515805110273	Gaia EDR3 3310911093585979776	3310911093585979776	233179058	2016.0	
1636042515805110273	Gaia EDR3 3310911127945715968	3310911127945715968	1801733269	2016.0	6
1636042515805110273	Gaia EDR3 3310911127945717248	3310911127945717248	1371871890	2016.0	6
1636042515805110273	Gaia EDR3 3310911265384672384	3310911265384672384	809848697	2016.0	6
...	...	...	...	...	
1636042515805110273	Gaia EDR3 3307892418771847424	3307892418771847424	1339237579	2016.0	6
1636042515805110273	Gaia EDR3 3307892453131585024	3307892453131585024	1376820438	2016.0	6
1636042515805110273	Gaia EDR3 3307892899808159104	3307892899808159104	314269291	2016.0	6
1636042515805110273	Gaia EDR3 3307893105966589568	3307893105966589568	925831674	2016.0	6
1636042515805110273	Gaia EDR3 3307893209045804160	3307893209045804160	160118738	2016.0	6
1636042515805110273	Gaia EDR3 3307893552643212672	3307893552643212672	56891181	2016.0	6
1636042515805110273	Gaia EDR3 3307893621362688512	3307893621362688512	75685410	2016.0	6
1636042515805110273	Gaia EDR3 3307893621362689664	3307893621362689664	1688581011	2016.0	6
1636042515805110273	Gaia EDR3 3307893758801617792	3307893758801617792	613682821	2016.0	6
1636042515805110273	Gaia EDR3 3307893793161381632	3307893793161381632	489172446	2016.0	6

```
In [211]: bp_rp = res_stringent['bp_rp'].data
phot_g_mean_mag = res_stringent['phot_g_mean_mag'].data
parallax = res_stringent['parallax'].data
ra = res_stringent['ra'].data
dec = res_stringent['dec'].data
mg = phot_g_mean_mag+5*np.log10(parallax)-10
```

```
In [163]: fig, ax = plt.subplots(figsize=(8,8))
h = ax.hist2d(bp_rp,mg,bins=300, norm=colors.PowerNorm(0.5), zorder=0.5)
ax.scatter(bp_rp, mg, alpha=0.05, s=1, color='k', zorder=0)
ax.invert_yaxis()
cb = plt.colorbar(h[3], ax=ax, pad=0.02)
plt.show()
```



```
In [215]: fig, ax = plt.subplots(figsize=(8,8))
ax.scatter(ra, dec, s=1, color='k', zorder=0)
ax.invert_yaxis()
plt.show()
```



**Conditionless (Limit 50,000)**

In [170]: `res_condless`

Out[170]: *Table length=50000*

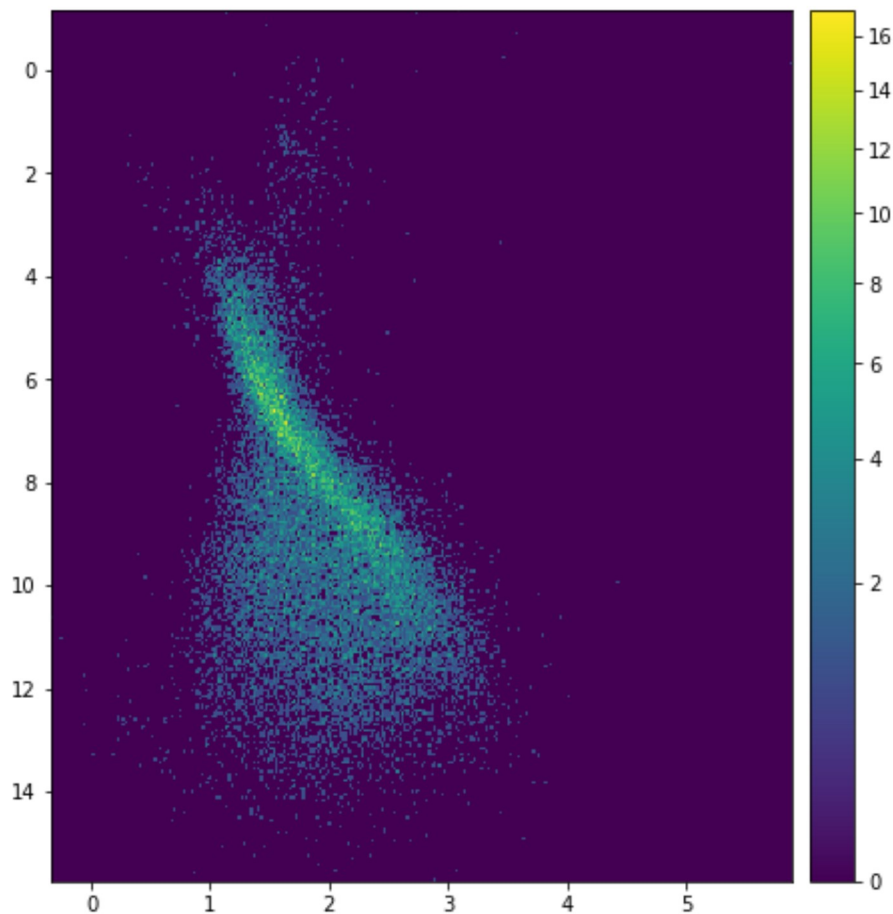
<b>solution_id</b>	<b>designation</b>	<b>source_id</b>	<b>random_index</b>	<b>ref_epoch</b>	
				<b>yr</b>	
<b>int64</b>	<b>object</b>	<b>int64</b>	<b>int64</b>	<b>float64</b>	
1636042515805110273	Gaia EDR3 3310910234591649920	3310910234591649920	1681027601	2016.0	
1636042515805110273	Gaia EDR3 3310910234592413184	3310910234592413184	521429206	2016.0	6
1636042515805110273	Gaia EDR3 3310910264655954048	3310910264655954048	985909722	2016.0	6
1636042515805110273	Gaia EDR3 3310910299015690496	3310910299015690496	1226986992	2016.0	6
1636042515805110273	Gaia EDR3 3310910303311886336	3310910303311886336	1045703154	2016.0	6
1636042515805110273	Gaia EDR3 3310910303311887360	3310910303311887360	1182667148	2016.0	6
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1636042515805110273	Gaia EDR3 3310910402094915072	3310910402094915072	717462831	2016.0	6
...	...	...	...	...	
1636042515805110273	Gaia EDR3 3313930623098788480	3313930623098788480	522181115	2016.0	6
1636042515805110273	Gaia EDR3 3313930627393608832	3313930627393608832	1123797017	2016.0	6
1636042515805110273	Gaia EDR3 3313930627393609984	3313930627393609984	826640637	2016.0	6
1636042515805110273	Gaia EDR3 3313930657457068032	3313930657457068032	600162425	2016.0	6
1636042515805110273	Gaia EDR3 3313930657457069056	3313930657457069056	1239212499	2016.0	6
1636042515805110273	Gaia EDR3 3313930696113080832	3313930696113080832	499047925	2016.0	6
1636042515805110273	Gaia EDR3 3313930730473015808	3313930730473015808	345209945	2016.0	6
1636042515805110273	Gaia EDR3 3313930764832558592	3313930764832558592	136630133	2016.0	6
1636042515805110273	Gaia EDR3 3313930794896020992	3313930794896020992	551192556	2016.0	6
1636042515805110273	Gaia EDR3 3313930794896021120	3313930794896021120	1549139312	2016.0	6



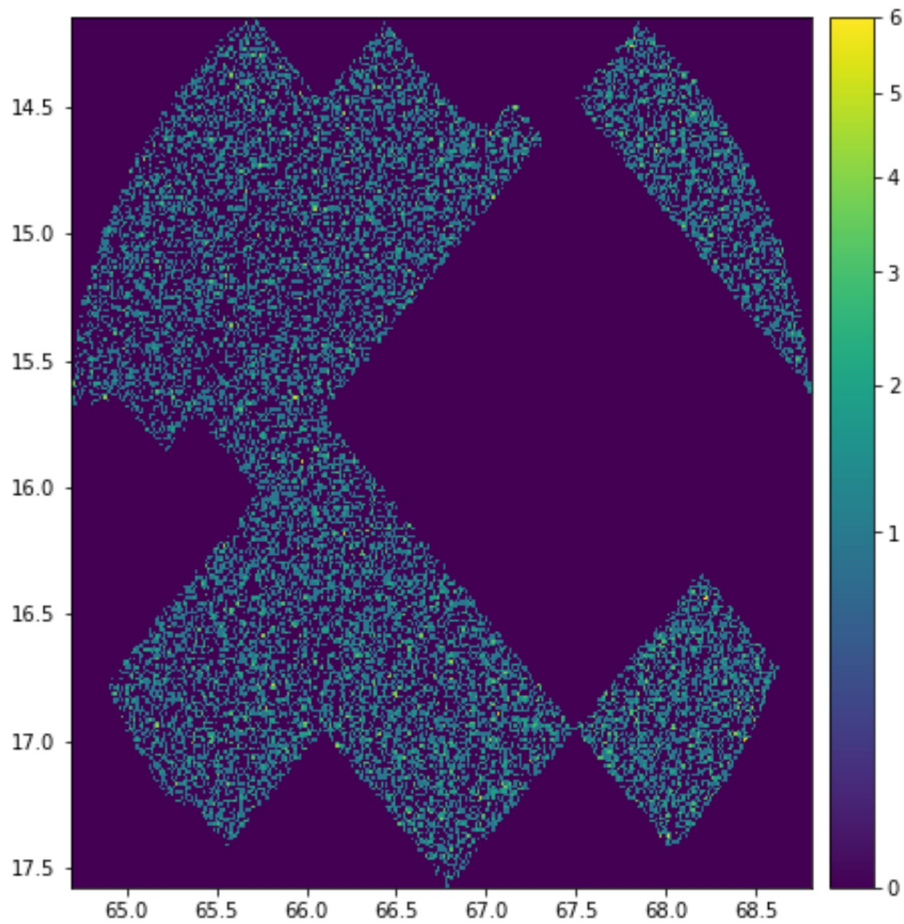
```
In [201]: res_condless_pd = res_condless.to_pandas()
res_condless_pd = res_condless_pd[res_condless_pd['parallax'].notna()]
res_condless_pd = res_condless_pd[res_condless_pd['parallax'] > 0.5]
res_condless_pd = res_condless_pd[res_condless_pd['bp_rp'].notna()]
```

```
In [208]: bp_rp = res_condless_pd['bp_rp']
phot_g_mean_mag = res_condless_pd['phot_g_mean_mag']
parallax = res_condless_pd['parallax']
ra = res_condless_pd['ra']
dec = res_condless_pd['dec']
mg = phot_g_mean_mag+5*np.log10(parallax)-10
```

```
In [204]: fig, ax = plt.subplots(figsize=(8,8))
h = ax.hist2d(bp_rp,mg,bins=300, norm=colors.PowerNorm(0.5), zorder=0.5)
ax.scatter(bp_rp, mg, alpha=0.05, s=1, color='k', zorder=0)
ax.invert_yaxis()
cb = plt.colorbar(h[3], ax=ax, pad=0.02)
plt.show()
```



```
In [209]: fig, ax = plt.subplots(figsize=(8,8))
ax.scatter(ra, dec, alpha=0.05, s=1, color='k', zorder=0)
ax.invert_yaxis()
cb = plt.colorbar(h[3], ax=ax, pad=0.02)
plt.show()
```



```
In [ ]:
```