1.3_Hawaii-HDFN

March 8, 2018

1 HDF-N master catalogue

1.1 Preparation of Hawaii-HDFN data

The catalogue comes from `dmu0_Hawaii-HDFN`.

It contains UBVRIz data.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The kron magnitude, there doesn't appear to be aperture magnitudes. This may mean the survey is unusable.

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
```

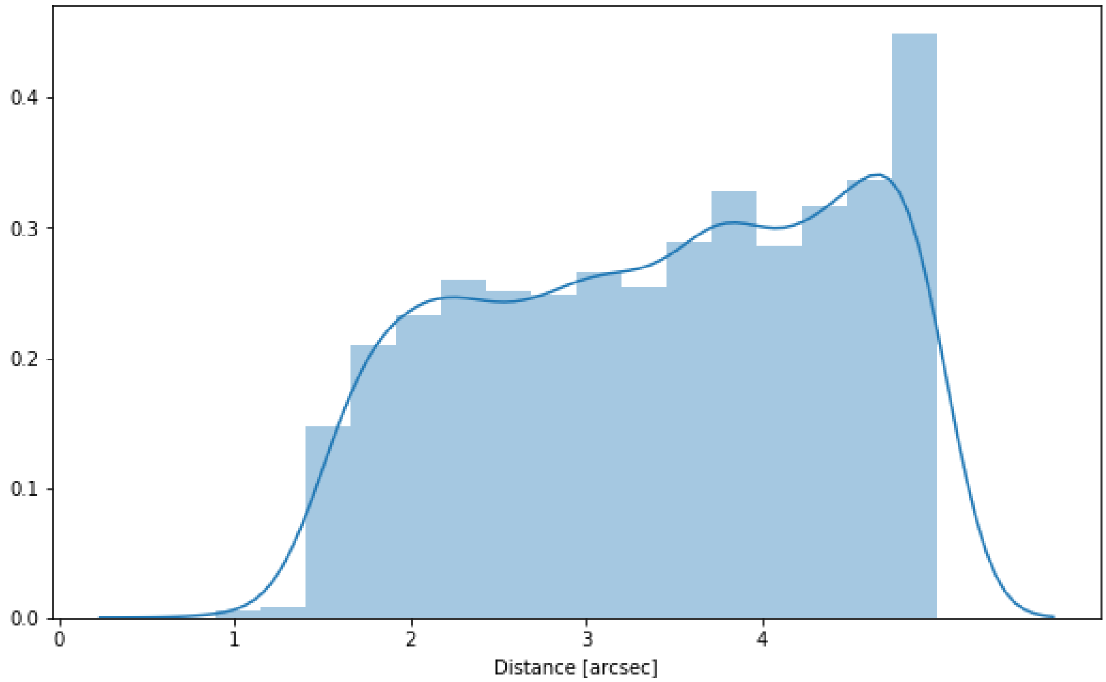
1.2 I - Column selection

```
Out[4]: <IPython.core.display.HTML object>

Out[7]: <IPython.core.display.HTML object>

Out[8]: <IPython.core.display.HTML object>
```

1.3 III - Merging



The catalogues apper to contain no cross matches. We therefore simply stack the catalogues. We need to understand why this is the case. Have cross matches already been removed from the Z selected catalogue?

```
Out[12]: <IPython.core.display.HTML object>
```

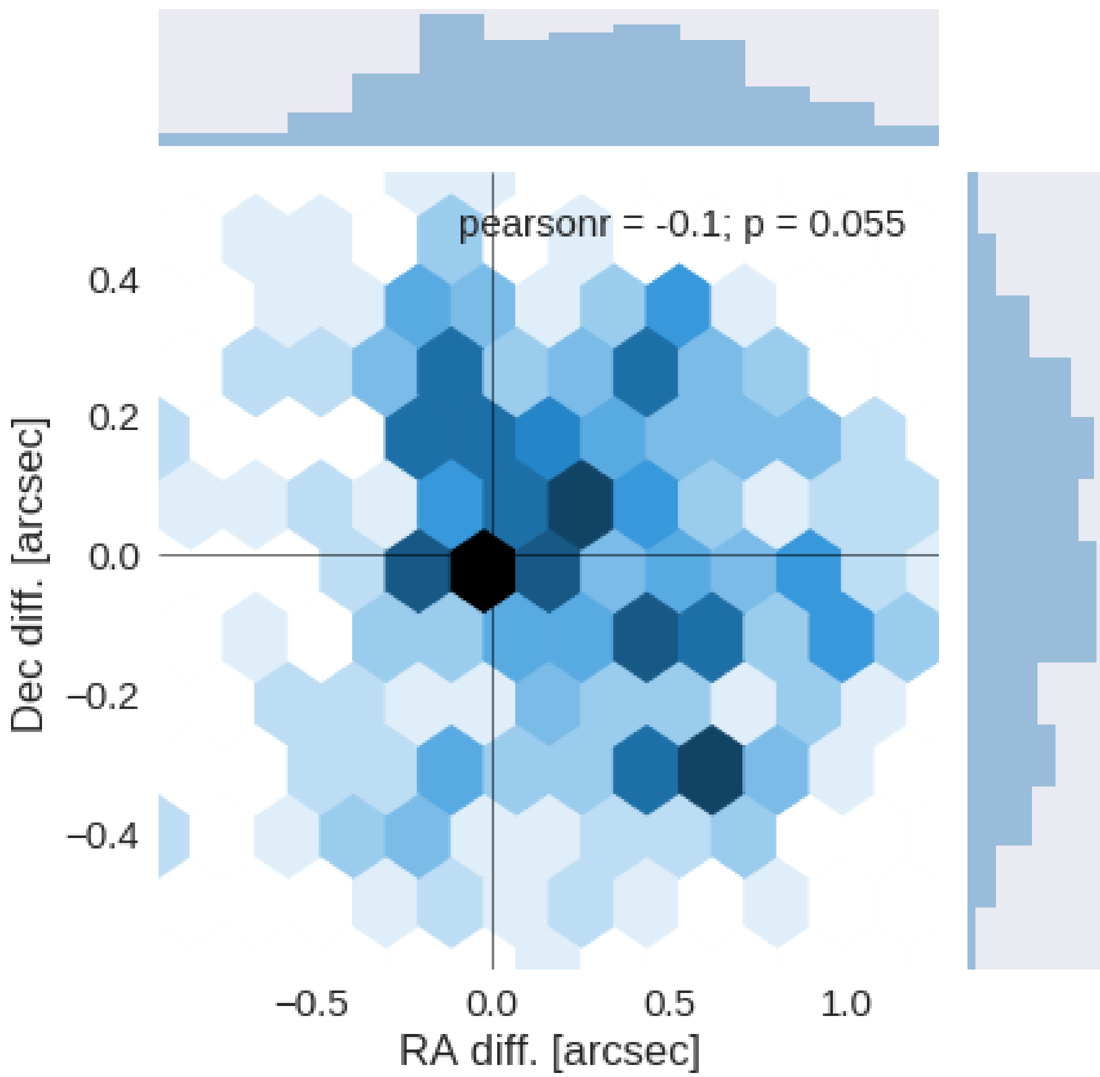
1.4 II - Removal of duplicated sources

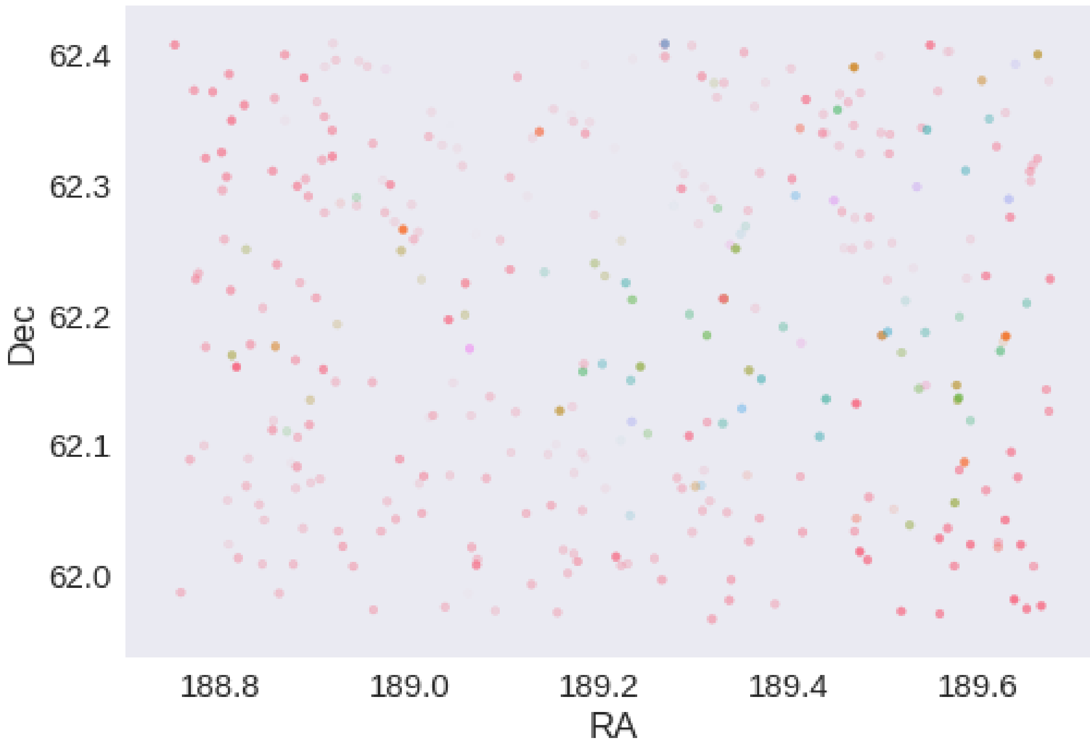
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 48858 sources.
The cleaned catalogue has 48858 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

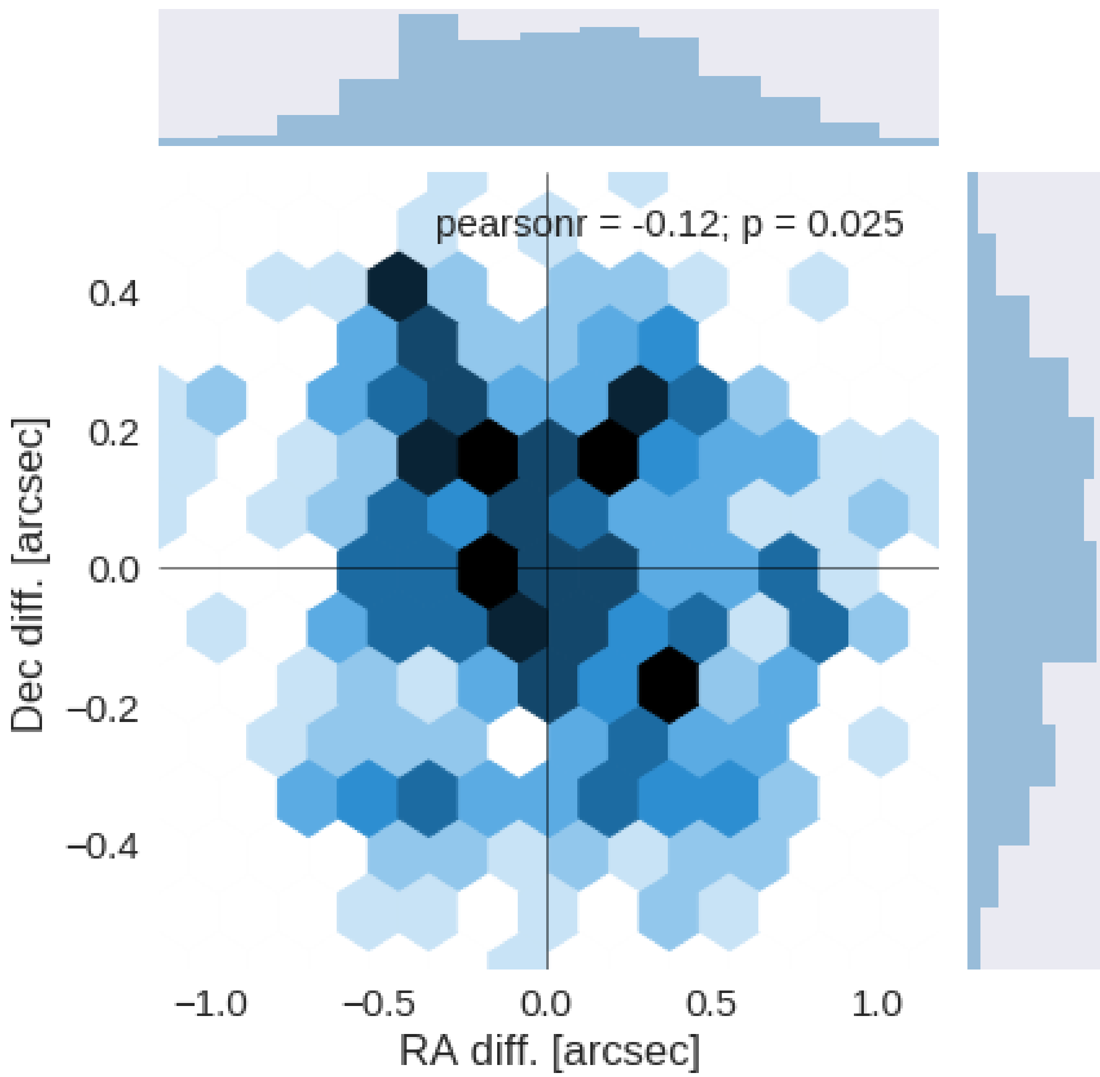
1.5 III - Astrometry correction

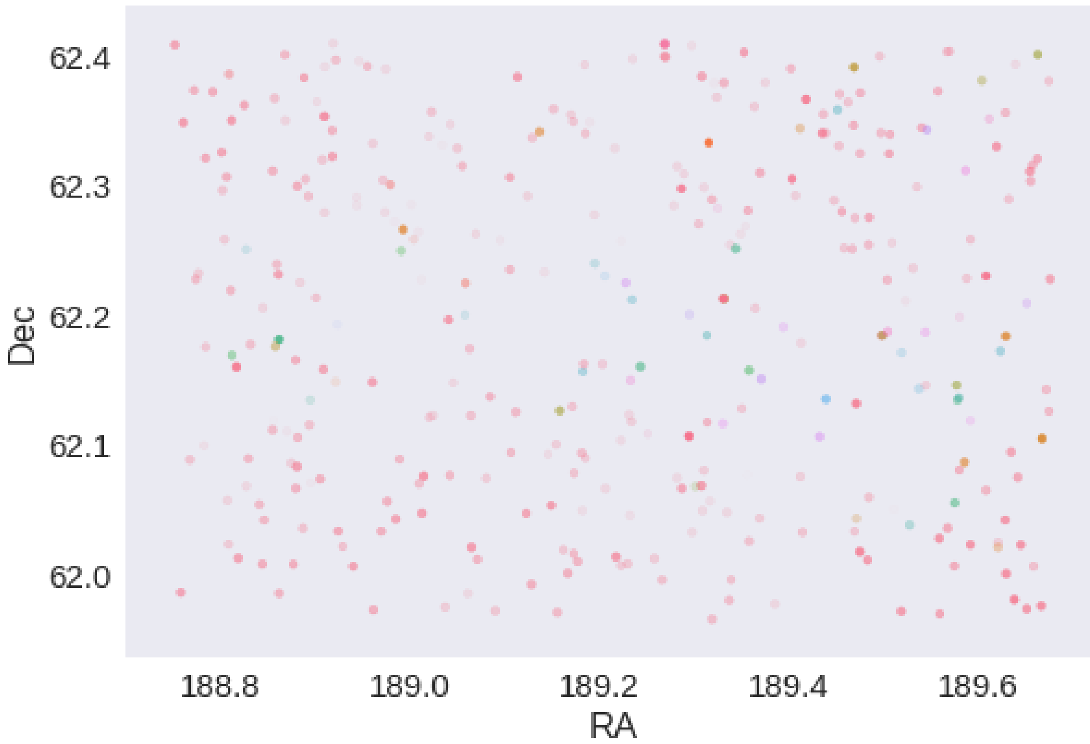
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.1; p = 0.055
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.5
0.0
0.5
1.0
RA diff. [arcsec]




```
RA correction: -0.22843071726015296 arcsec
Dec correction: 0.014955391984017297 arcsec
```


pearsonr = -0.12; p = 0.025
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−1.0
−0.5
0.0
0.5
1.0
RA diff. [arcsec]



1.6 IV - Flagging Gaia objects

```
431 sources flagged.
```

1.7 V - Flagging objects near bright stars

2 VI - Saving to disk

```
Out[21]: 48858
```

```
Out[22]: <IPython.core.display.HTML object>
```

1.4_Ultradeep-Ks-GOODS-N

March 8, 2018

1 HDF-N master catalogue

1.1 Preparation of Ultradeep-Ks-GOODS-N data

The catalogue comes from `dmu0_Ultradeep-Ks-GOODS-N`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The total flux.

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
```

1.2 I - Column selection

```
Out[6]: <IPython.core.display.HTML object>
```

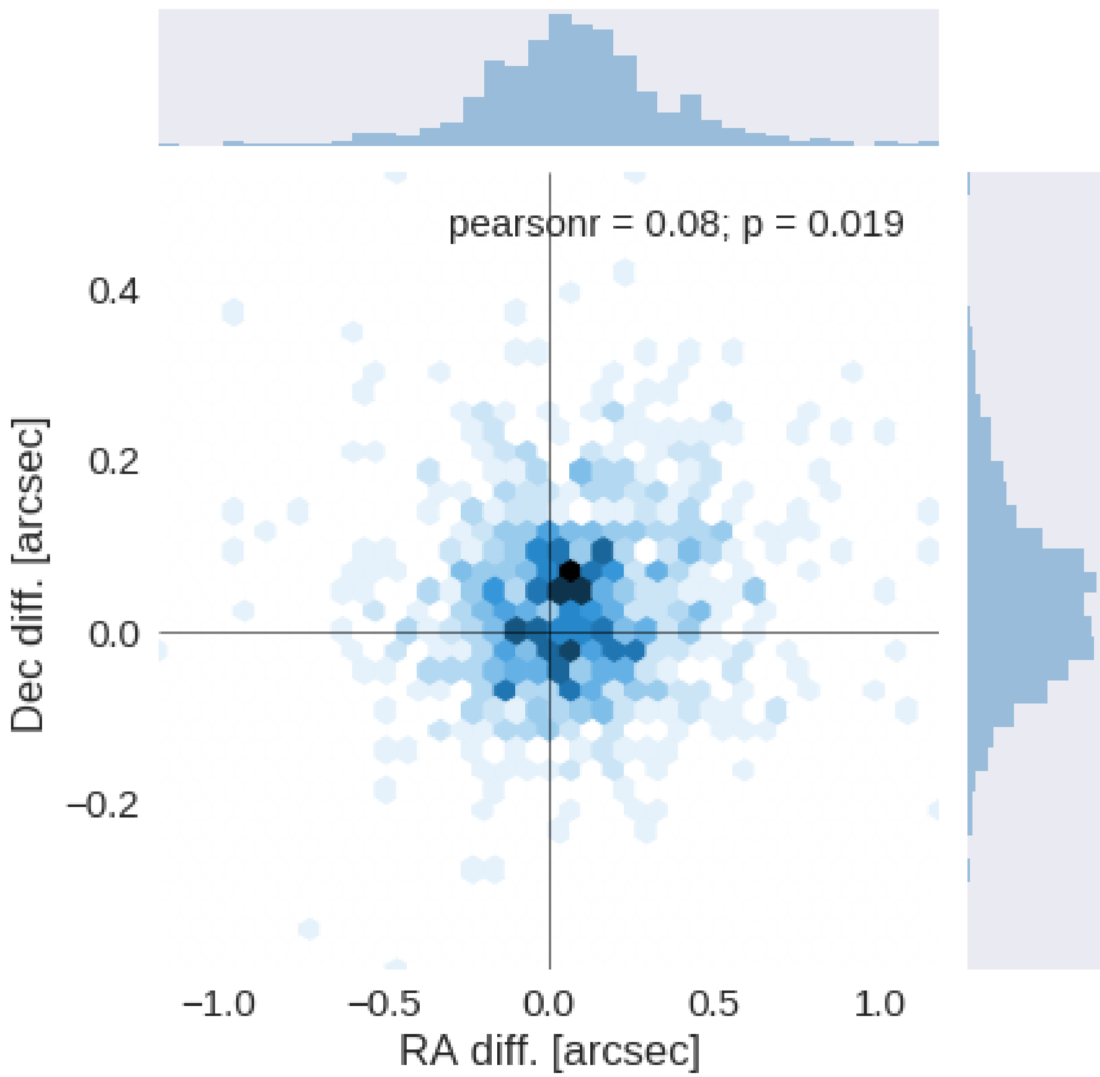
1.3 II - Removal of duplicated sources

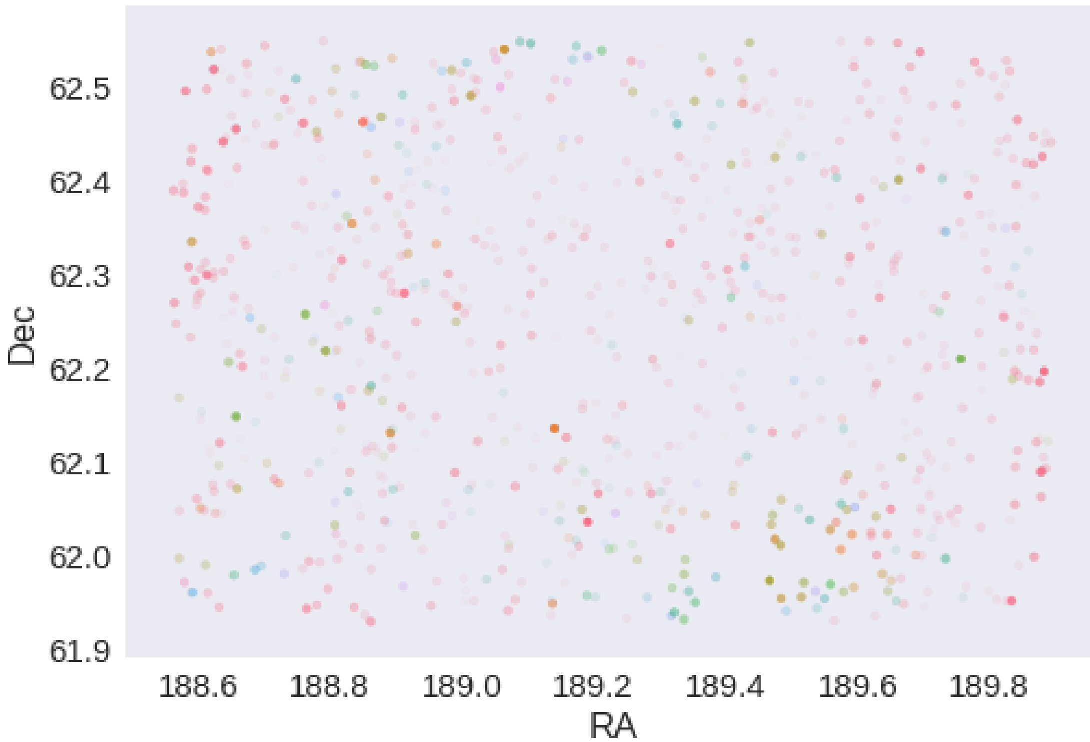
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 94930 sources.
The cleaned catalogue has 94930 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

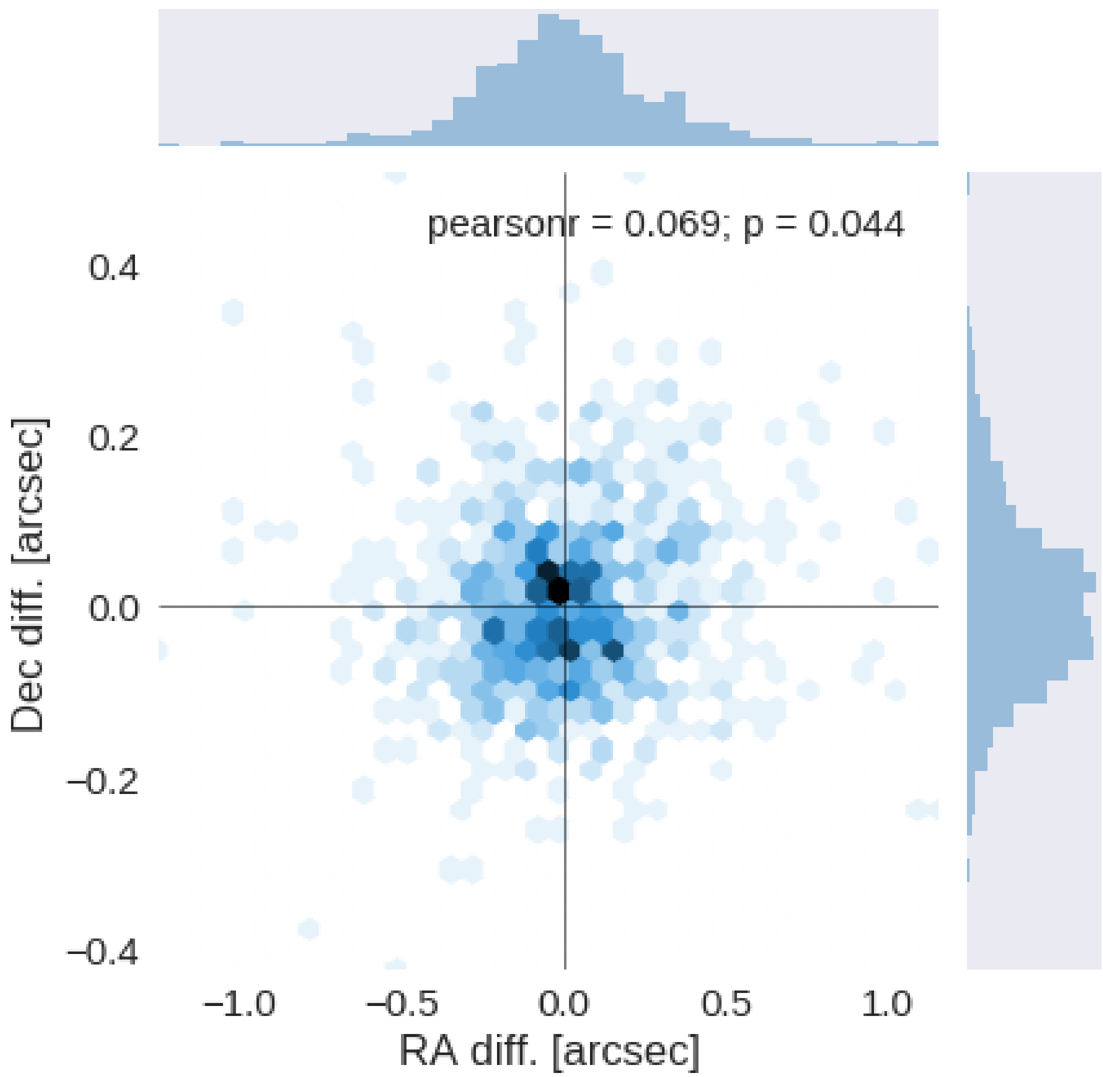
1.4 III - Astrometry correction

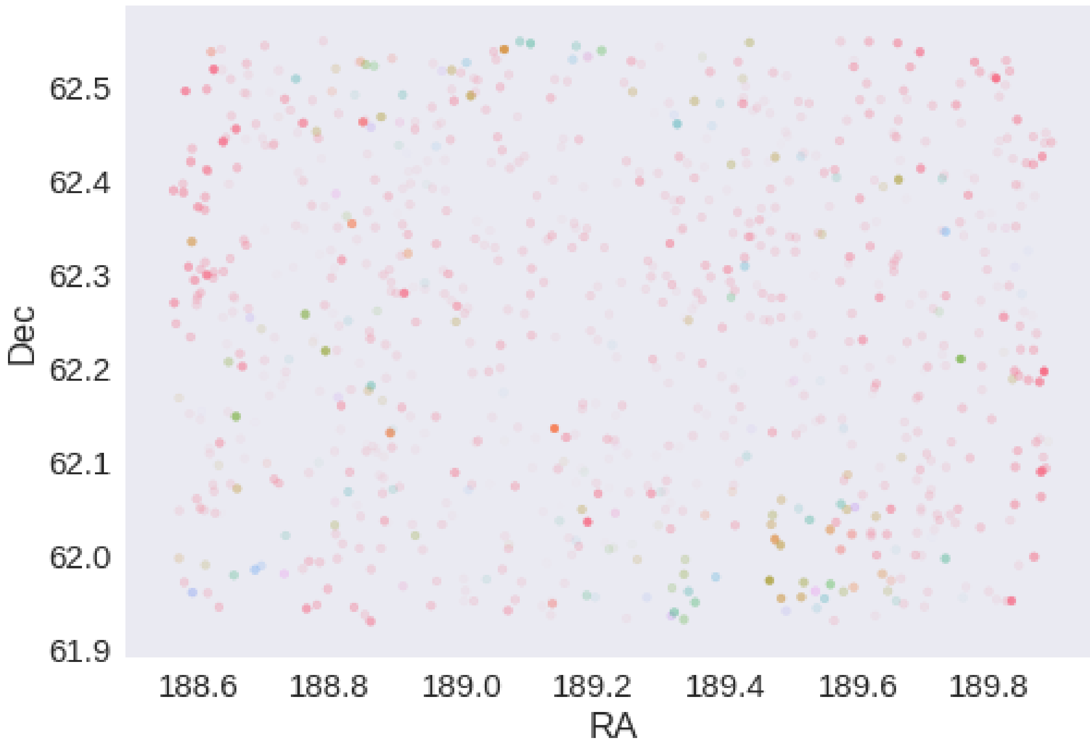
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.08; p = 0.019
0.4
0.2
0.0
−0.2
Dec diff. [arcsec]
−1.0
−0.5
0.0
0.5
1.0
RA diff. [arcsec]




```
RA correction: -0.07018150315616367 arcsec
Dec correction: -0.02818903770247516 arcsec
```


pearsonr = 0.069; p = 0.044
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−1.0
−0.5
0.0
0.5
1.0
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
888 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.5_PanSTARRS1-3SS

March 8, 2018

1 HDF-N master catalogue

1.1 Preparation of Pan-STARRS1 - 3pi Steradian Survey (3SS) data

This catalogue comes from `dmu0_PanSTARRS1-3SS`.

In the catalogue, we keep:

- The `uniquePspsSTid` as unique object identifier;
- The r-band position which is given for all the sources;
- The grizy `<band>FApMag` aperture magnitude (see below);
- The grizy `<band>FKronMag` as total magnitude.

The Pan-STARRS1-3SS catalogue provides for each band an aperture magnitude defined as "In PS1, an 'optimal' aperture radius is determined based on the local PSF. The wings of the same analytic PSF are then used to extrapolate the flux measured inside this aperture to a 'total' flux."

The observations used for the catalogue where done between 2010 and 2015 (ref).

TODO: Check if the detection flag can be used to know in which bands an object was detected to construct the coverage maps.

TODO: Check for stellarity.

```
This notebook was run with herschelhelp_internal version:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

1.2 I - Column selection

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
Out[6]: <IPython.core.display.HTML object>
```

1.3 II - Removal of duplicated sources

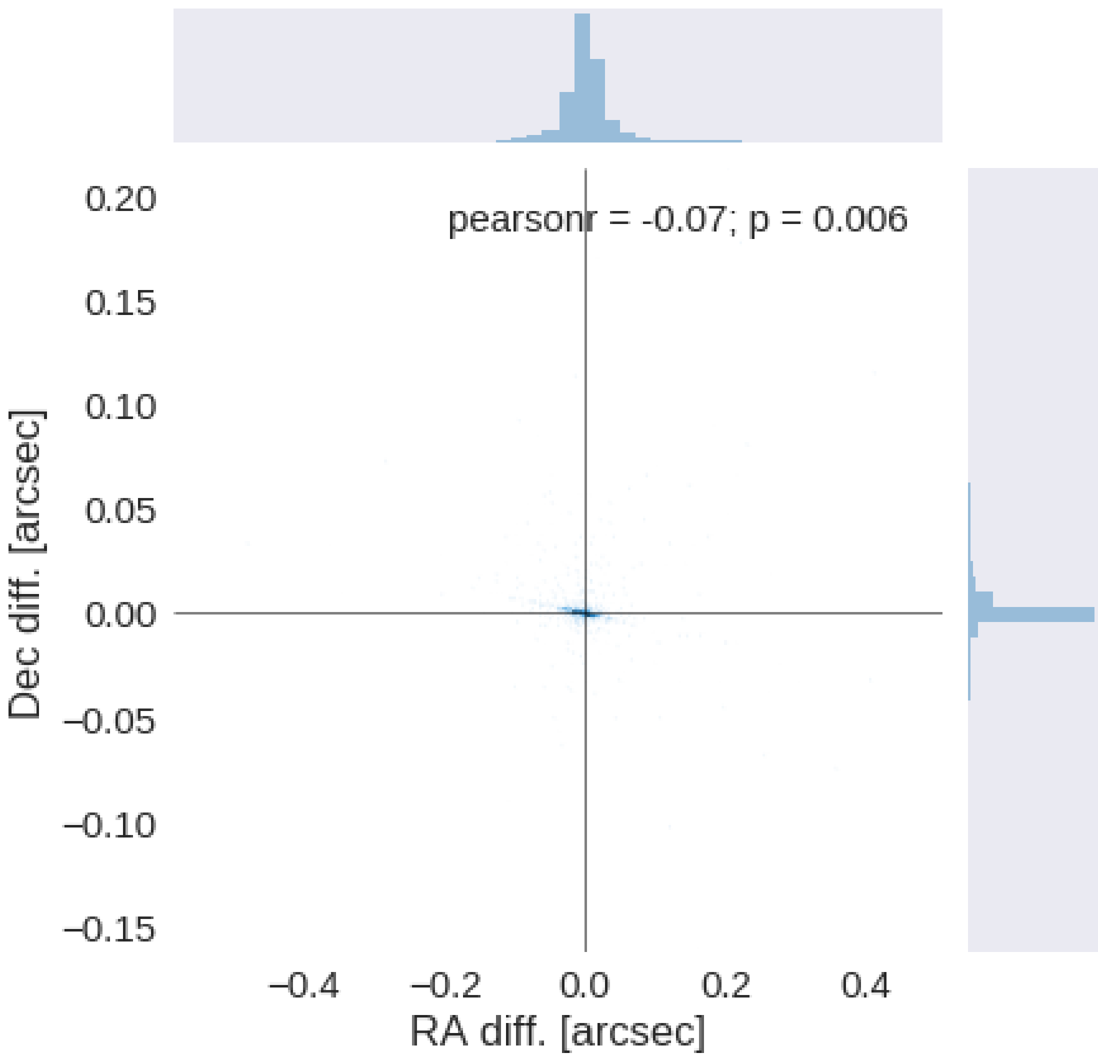
We remove duplicated objects from the input catalogues.

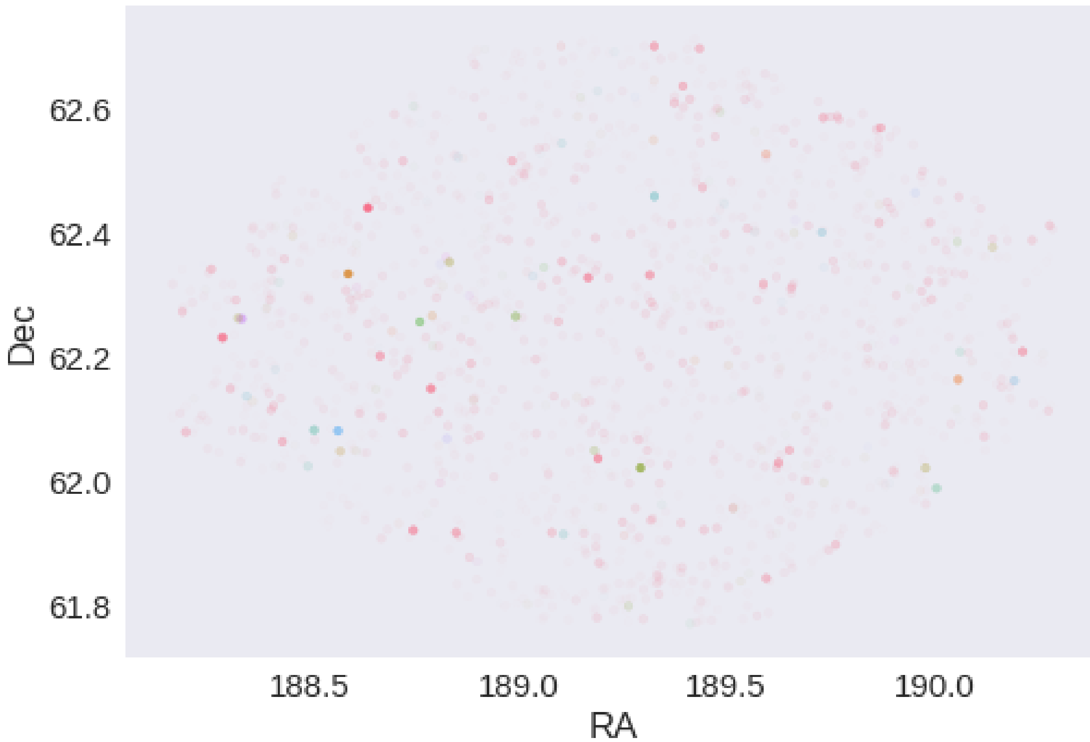
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 10100 sources.
The cleaned catalogue has 10097 sources (3 removed).
The cleaned catalogue has 3 sources flagged as having been cleaned
```

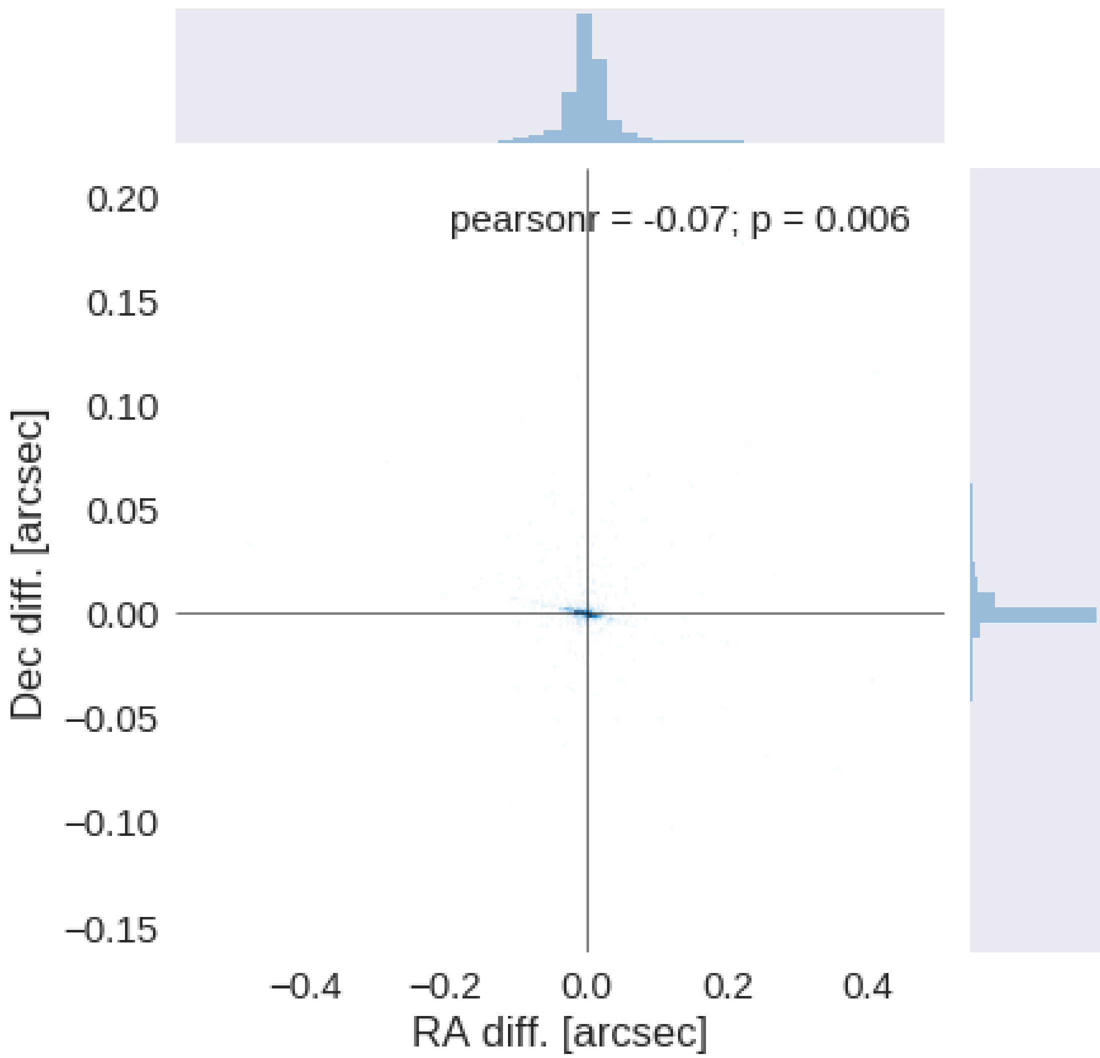
1.4 III - Astrometry correction

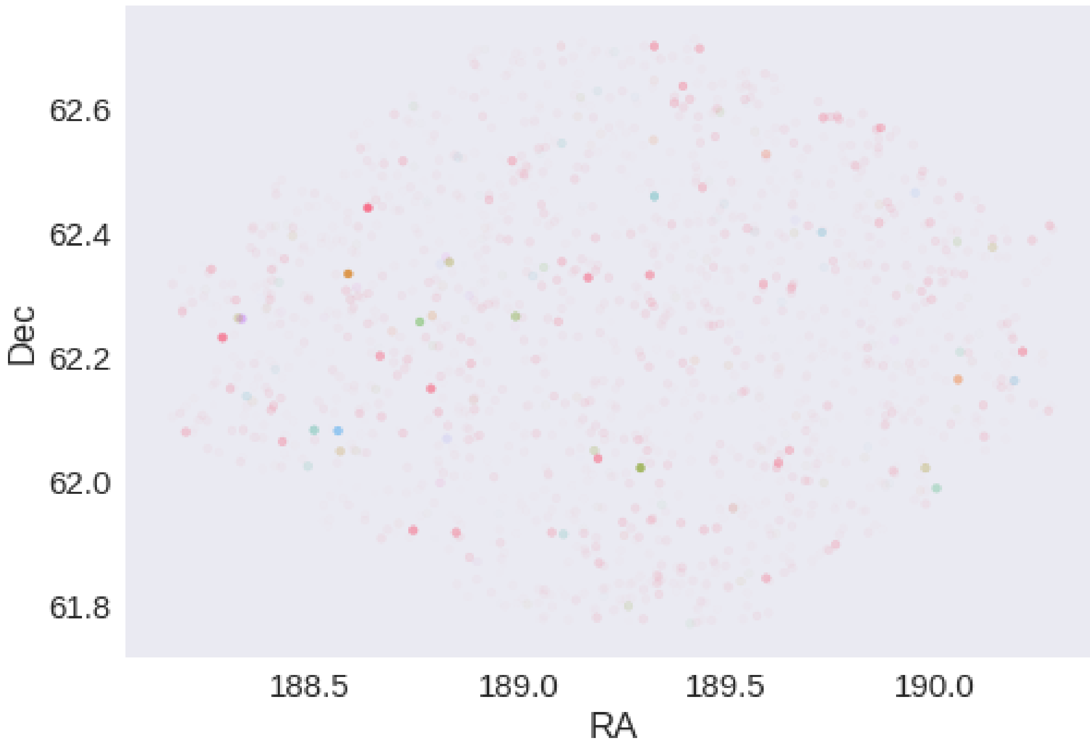
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.0009251711844626698 arcsec
Dec correction: -0.000312677103408987 arcsec
```


pearsonr = -0.07; p = 0.006
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
1548 sources flagged.
```

2 V - Saving to disk

1.6_CANDELS-GOODS-N

March 8, 2018

1 HDF-N master catalogue

1.1 Preparation of CANDELS-GOODS-N data

CANDELS-GOODS-N catalogue: the catalogue comes from `dmu0_CANDELS-GOODS-N`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The total magnitude.

We don't know when the maps have been observed. We will use the year of the reference paper.

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
```

1.2 I - Column selection

```
WARNING: UnitsWarning: '0 use, gt 1 no-use' did not parse as fits unit: At col 2, Unit 'use' not
WARNING: UnitsWarning: '0 galaxy, 1 star' did not parse as fits unit: At col 2, Unit 'galaxy' no
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:76: RuntimeWarning: divide by zero enc
  magnitudes = 2.5 * (23 - np.log10(fluxes)) - 48.6
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:76: RuntimeWarning: invalid value enco
  magnitudes = 2.5 * (23 - np.log10(fluxes)) - 48.6
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:80: RuntimeWarning: divide by zero enc
  errors = 2.5 / np.log(10) * errors_on_fluxes / fluxes
```

```
Out[6]: <IPython.core.display.HTML object>
```

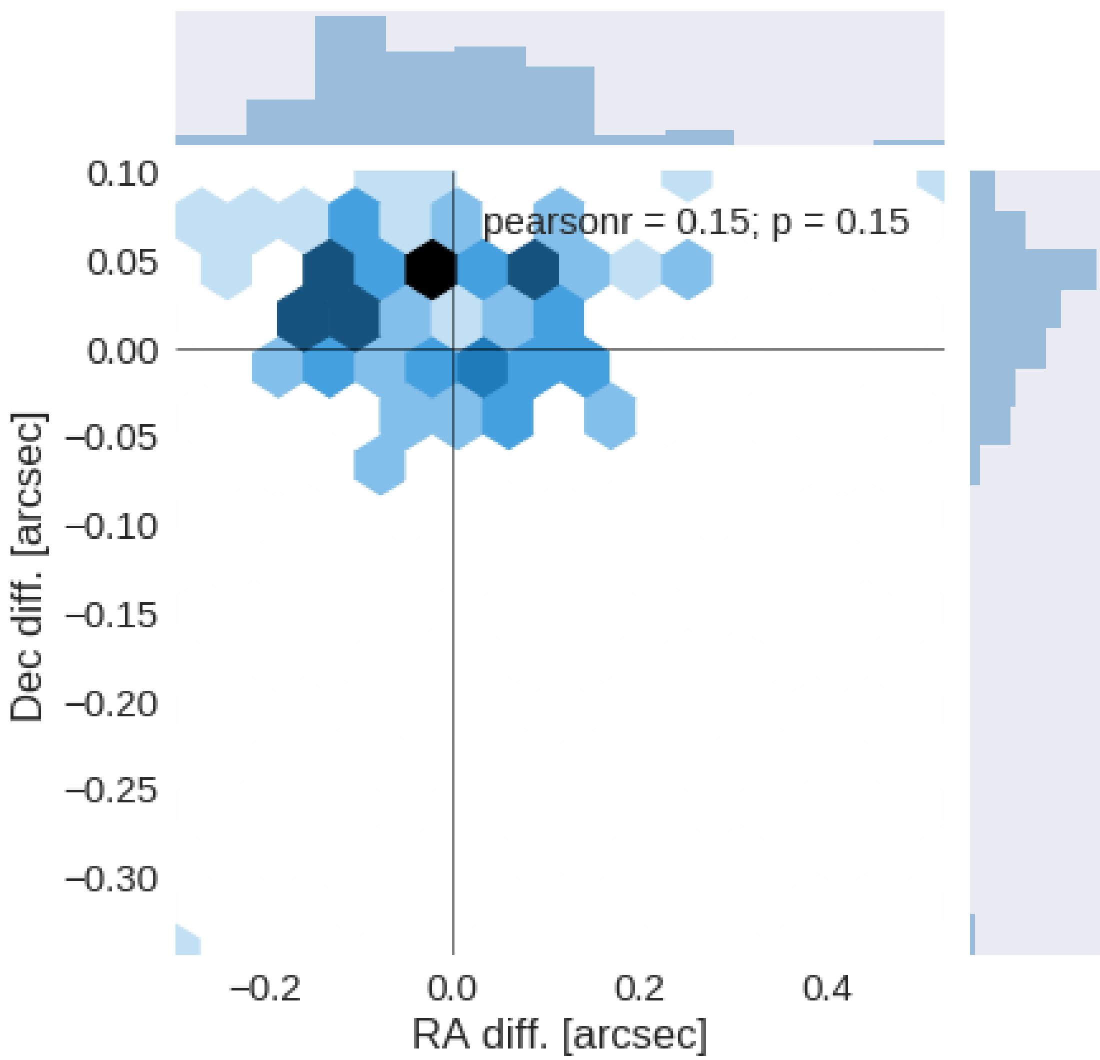
1.3 II - Removal of duplicated sources

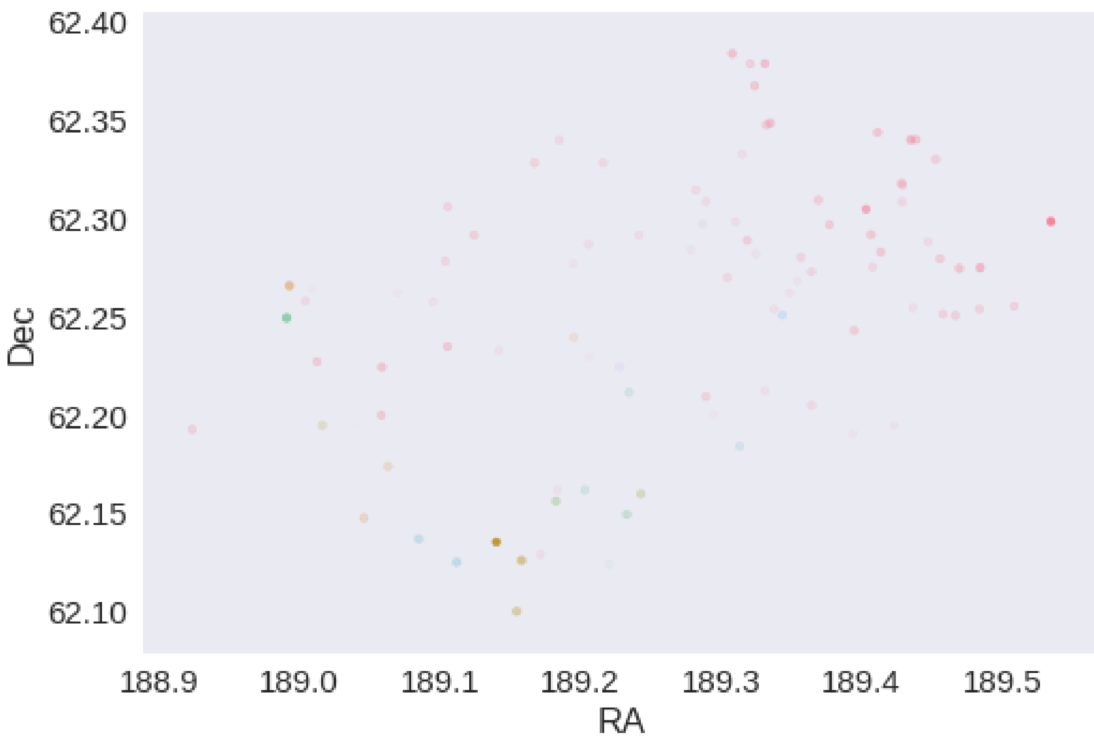
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 35445 sources.
The cleaned catalogue has 35423 sources (22 removed).
The cleaned catalogue has 21 sources flagged as having been cleaned
```

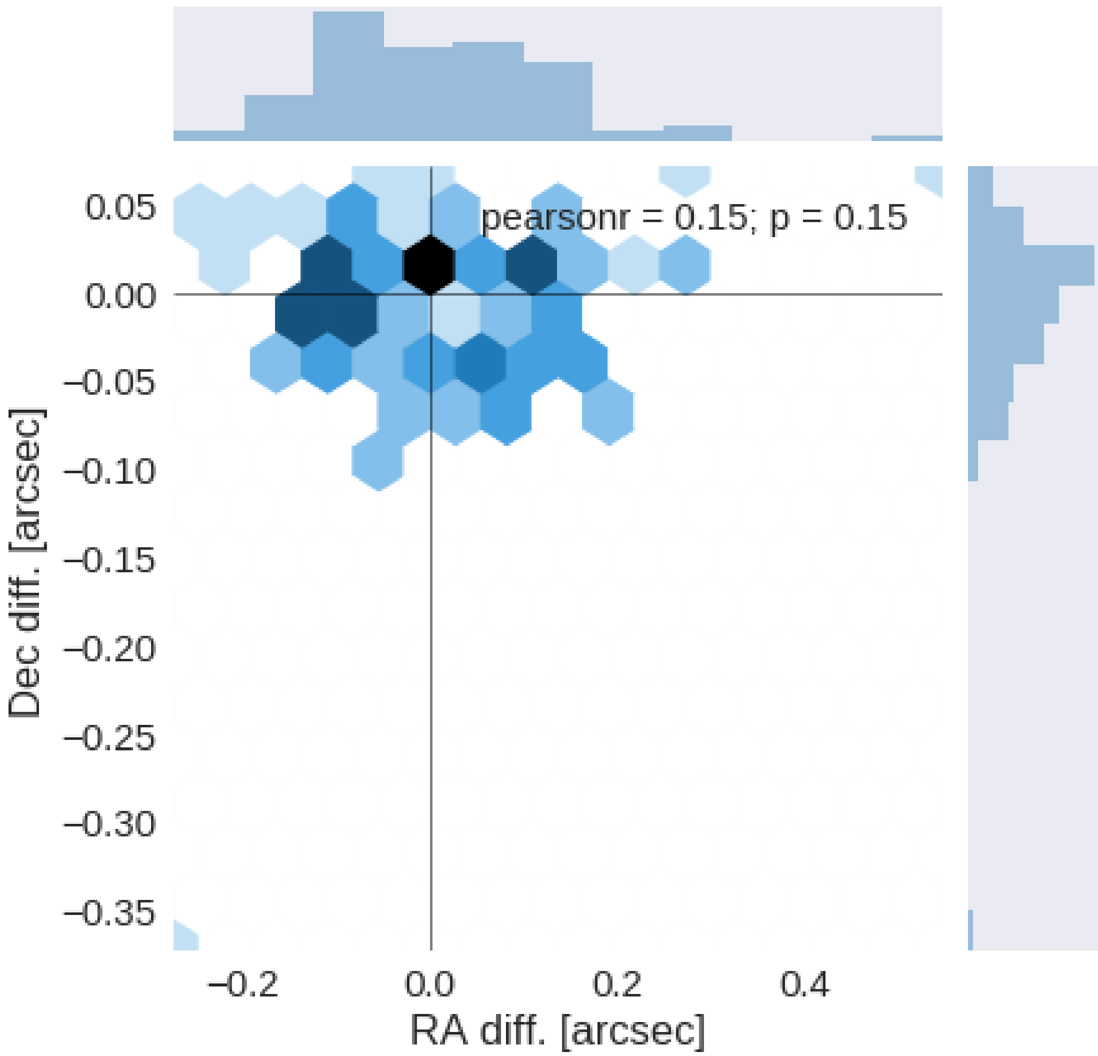
1.4 III - Astrometry correction

We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.

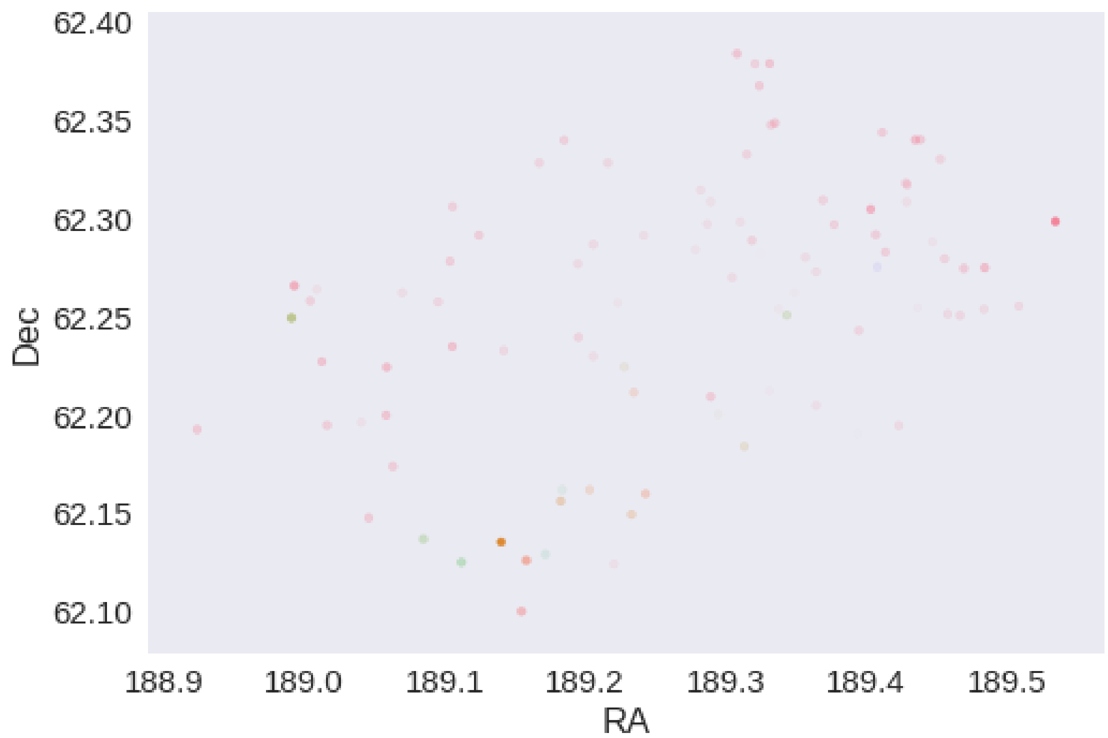





```
RA correction: 0.02082349079728374 arcsec
Dec correction: -0.02865639995377478 arcsec
```



pearsonr = 0.15; p = 0.15
0.05
0.00
−0.05
−0.10
−0.15
−0.20
−0.25
−0.30
−0.35
Dec diff. [arcsec]
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
102 sources flagged.
```

2 V - Saving to disk

2_Merging

March 8, 2018

1 HDF-N master catalogue

This notebook presents the merge of the various pristine catalogues to produce the HELP master catalogue on HDF-N.

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
```

1.1 I - Reading the prepared pristine catalogues

```
WARNING: UnitsWarning: '0 galaxy, 1 star' did not parse as fits unit: At col 2, Unit 'galaxy' no
```

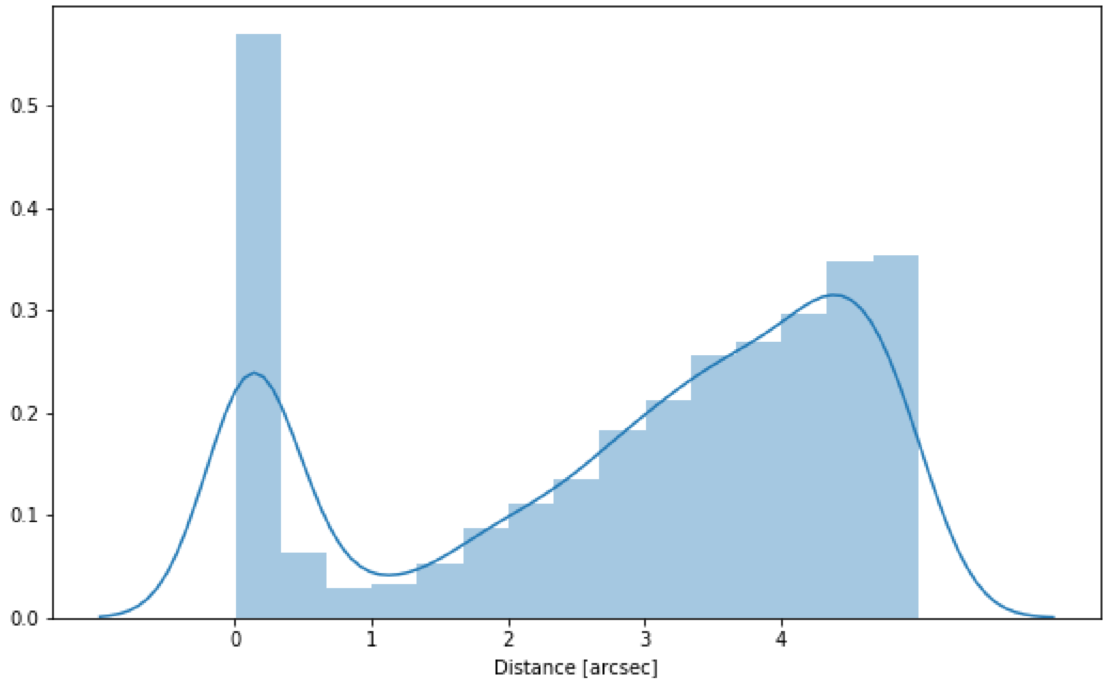
1.2 II - Merging tables

We first merge the optical catalogues and then add the infrared ones. We start with PanSTARRS because it coevrs the whole field.

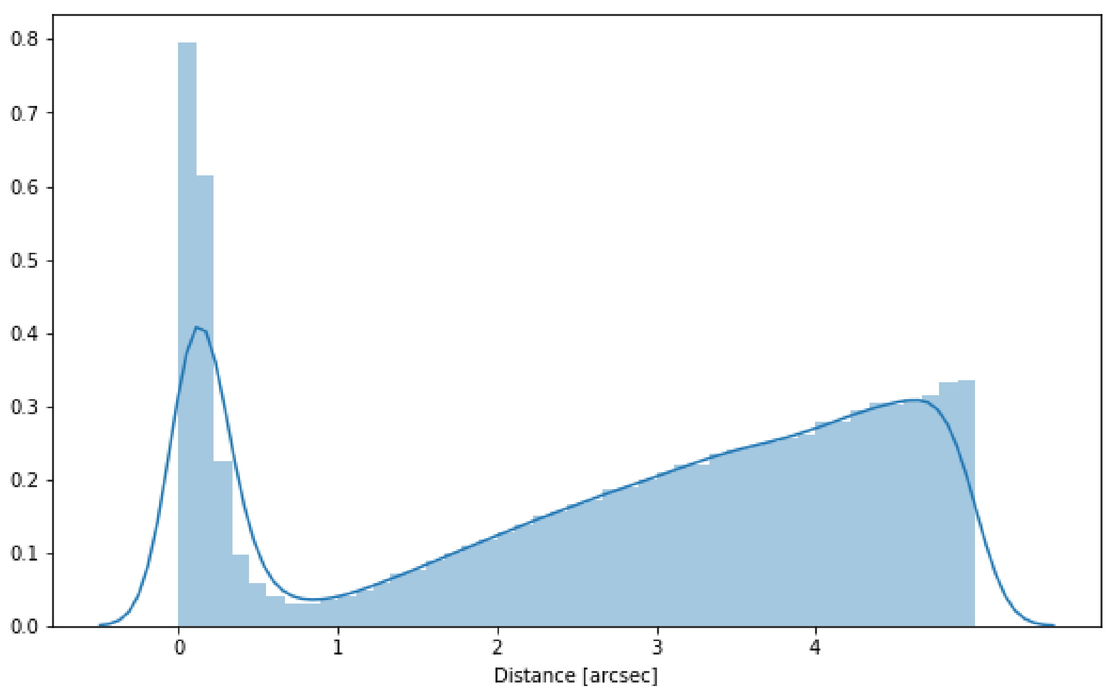
At every step, we look at the distribution of the distances to the nearest source in the merged catalogue to determine the best crossmatching radius.

1.2.1 PanSTARRS

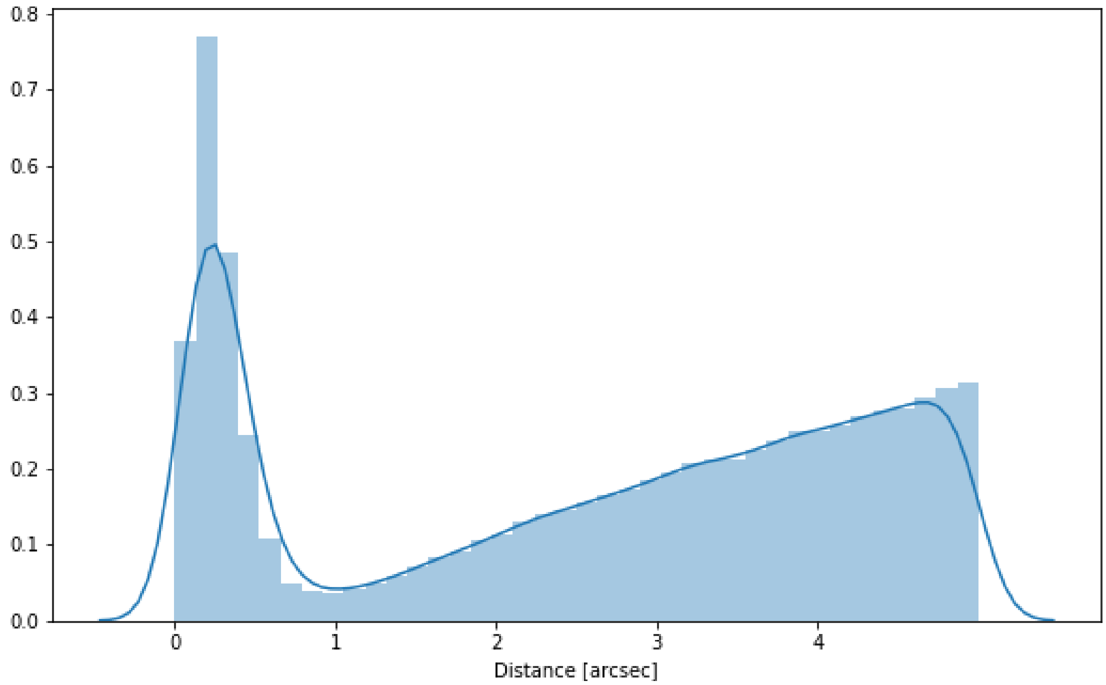
1.2.2 CANDELS-GOODS-N



1.2.3 Ultradeep



1.2.4 Hawaii



1.2.5 Cleaning

When we merge the catalogues, astropy masks the non-existent values (e.g. when a row comes only from a catalogue and has no counterparts in the other, the columns from the latest are masked for that row). We indicate to use NaN for masked values for floats columns, False for flag columns and -1 for ID columns.

```
Out[13]: <IPython.core.display.HTML object>
```

1.3 III - Merging flags and stellarity

Each pristine catalogue contains a flag indicating if the source was associated to a another nearby source that was removed during the cleaning process. We merge these flags in a single one.

combining the flag_merged column which contains information regarding multiple associations

Each pristine catalogue contains a flag indicating the probability of a source being a Gaia object (0: not a Gaia object, 1: possibly, 2: probably, 3: definitely). We merge these flags taking the highest value.

Each prisitine catalogue may contain one or several stellarity columns indicating the probability (0 to 1) of each source being a star. We merge these columns taking the highest value. We keep trace of the origin of the stellarity.

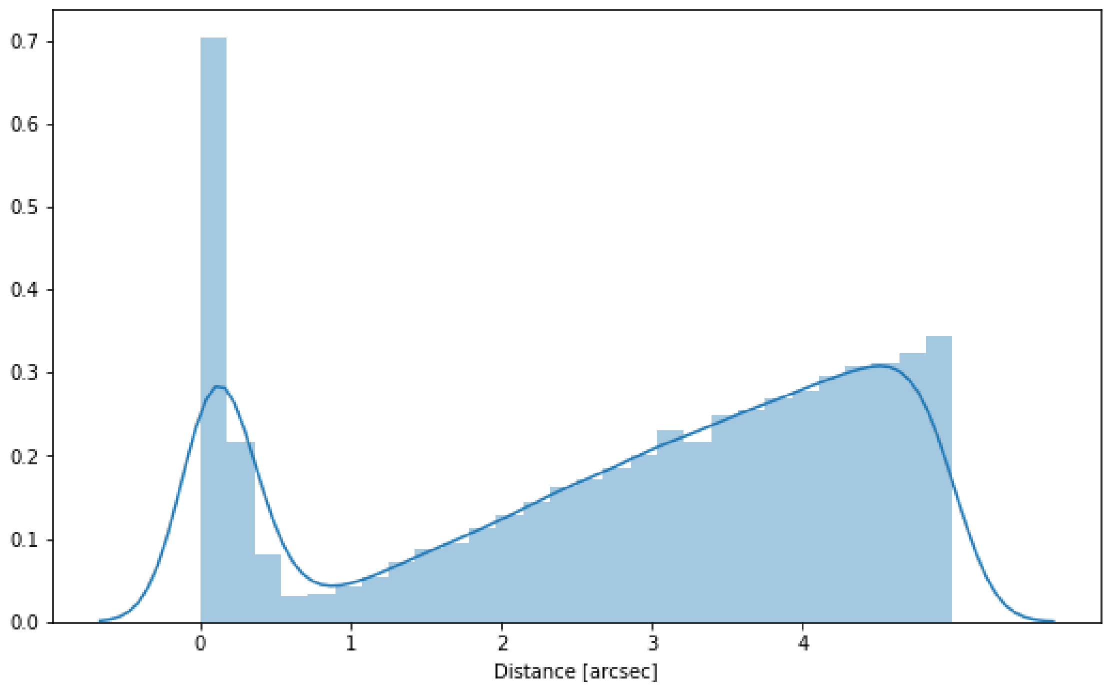
candels-gn_stellarity

1.4 IV - Adding E(B-V) column

1.5 V - Adding HELP unique identifiers and field columns

OK!

1.6 VI - Cross-matching with spec-z catalogue



1.7 VII - Choosing between multiple values for the same filter

We have to choose between the various HST catalogues which may contains different objects depending on the prior catalogue. The CANDELS-GOODS-N catalogue is taken as a base and any missing wircam or IRAC fluxes are taken from the Ultradeep Ks selected catalogues

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype), FutureWarning)
```

```
Out[29]: <IPython.core.display.HTML object>
```

```
Out[31]: <IPython.core.display.HTML object>
```

1.8 VIII.a Wavelength domain coverage

We add a binary `flag_optnir_obs` indicating that a source was observed in a given wavelength domain:

- 1 for observation in optical;
- 2 for observation in near-infrared;
- 4 for observation in mid-infrared (IRAC).

It's an integer binary flag, so a source observed both in optical and near-infrared by not in mid-infrared would have this flag at 1 + 2 = 3.

Note 1: The observation flag is based on the creation of multi-order coverage maps from the catalogues, this may not be accurate, especially on the edges of the coverage.

Note 2: Being on the observation coverage does not mean having fluxes in that wavelength domain. For sources observed in one domain but having no flux in it, one must take into consideration the different depths in the catalogue we are using.

1.9 VIII.b Wavelength domain detection

We add a binary `flag_optnir_det` indicating that a source was detected in a given wavelength domain:

- 1 for detection in optical;
- 2 for detection in near-infrared;
- 4 for detection in mid-infrared (IRAC).

It's an integer binary flag, so a source detected both in optical and near-infrared by not in mid-infrared would have this flag at 1 + 2 = 3.

Note 1: We use the total flux columns to know if the source has flux, in some catalogues, we may have aperture flux and no total flux.

To get rid of artefacts (chip edges, star flares, etc.) we consider that a source is detected in one wavelength domain when it has a flux value in **at least two bands**. That means that good sources will be excluded from this flag when they are on the coverage of only one band.

1.10 IX - Cross-identification table

We are producing a table associating to each HELP identifier, the identifiers of the sources in the pristine catalogues. This can be used to easily get additional information from them.

For convenience, we also cross-match the master list with the SDSS catalogue and add the objID associated with each source, if any. **TODO: should we correct the astrometry with respect to Gaia positions?**

```
8 master list rows had multiple associations.
```

```
['ps1_id', 'candels-gn_id', 'ultradeep_id', 'hawaii_id', 'help_id', 'specz_id', 'sdss_id']
```

1.11 X - Adding HEALPix index

We are adding a column with a HEALPix index at order 13 associated with each source.

1.12 XI - Saving the catalogue

Out[43]: <IPython.core.display.HTML object>

```
Missing columns: {'flag_acs_f606w', 'flag_wfc3_f105w', 'flag_wircam_ks', 'flag_suprime_zp', 'fla
```

3_Checks_and_diagnostics

March 8, 2018

1 HDF-N master catalogue

1.1 Checks and diagnostics

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
```

```
Diagnostics done using: master_catalogue_hdf-n_20180219.fits
```

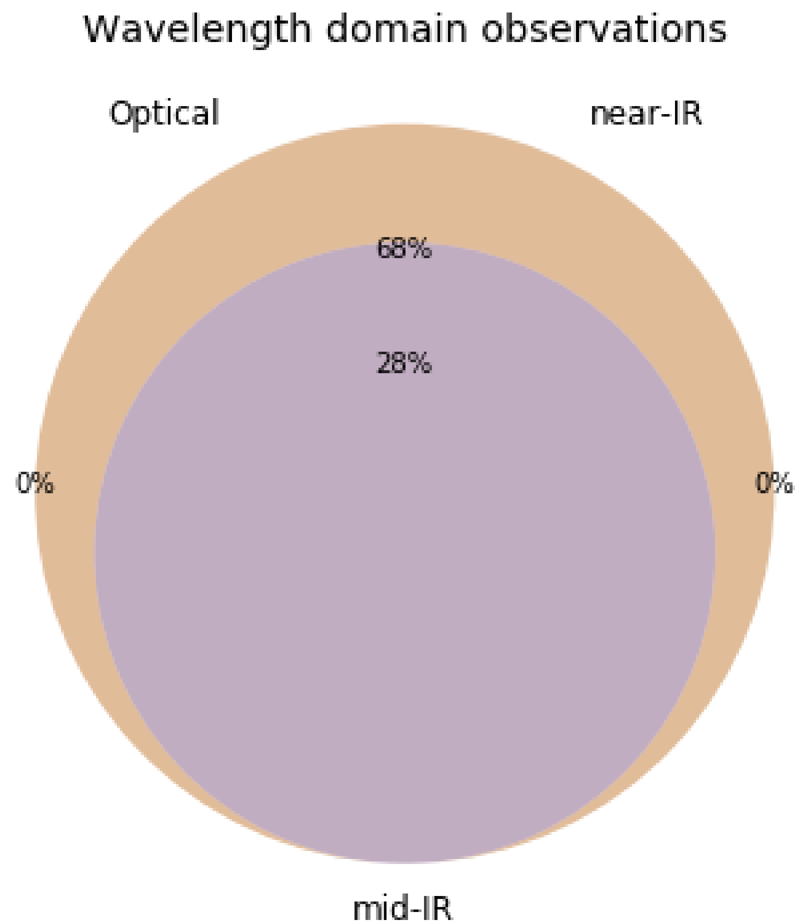
1.2 0 - Quick checks

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype), FutureWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype), FutureWarning)
```

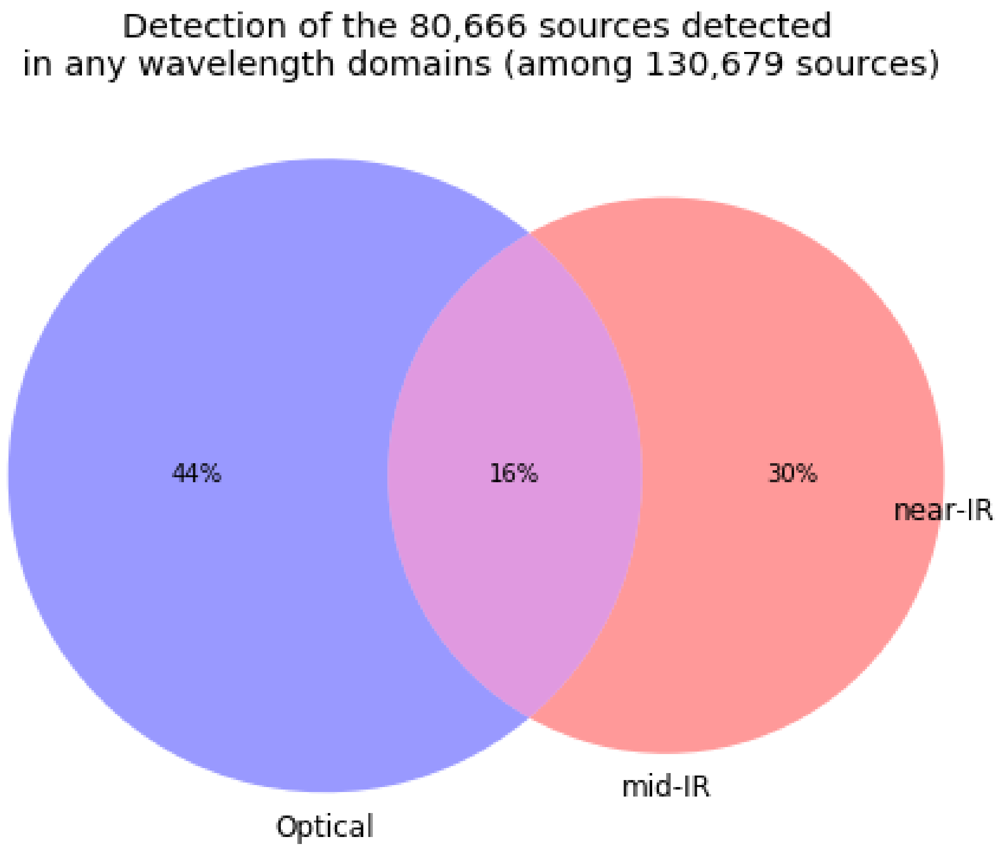
```
Table shows only problematic columns.
```

```
Out[4]: <IPython.core.display.HTML object>
```

1.3 I - Summary of wavelength domains




```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/matplotlib_venn/_venn3.py:
  warnings.warn("Circle B has zero area")
```

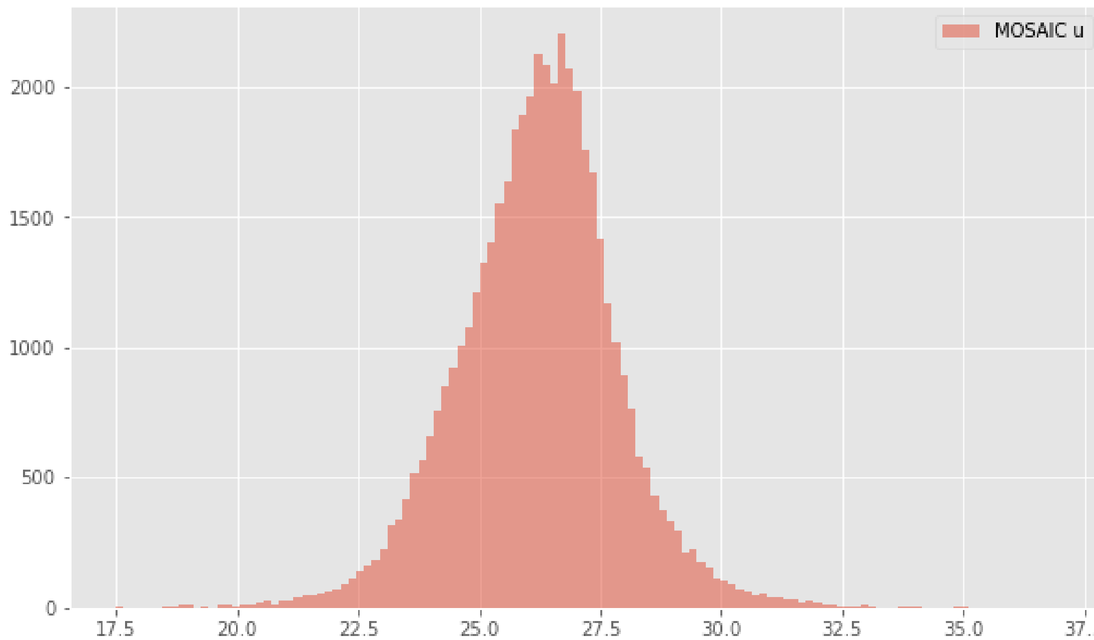


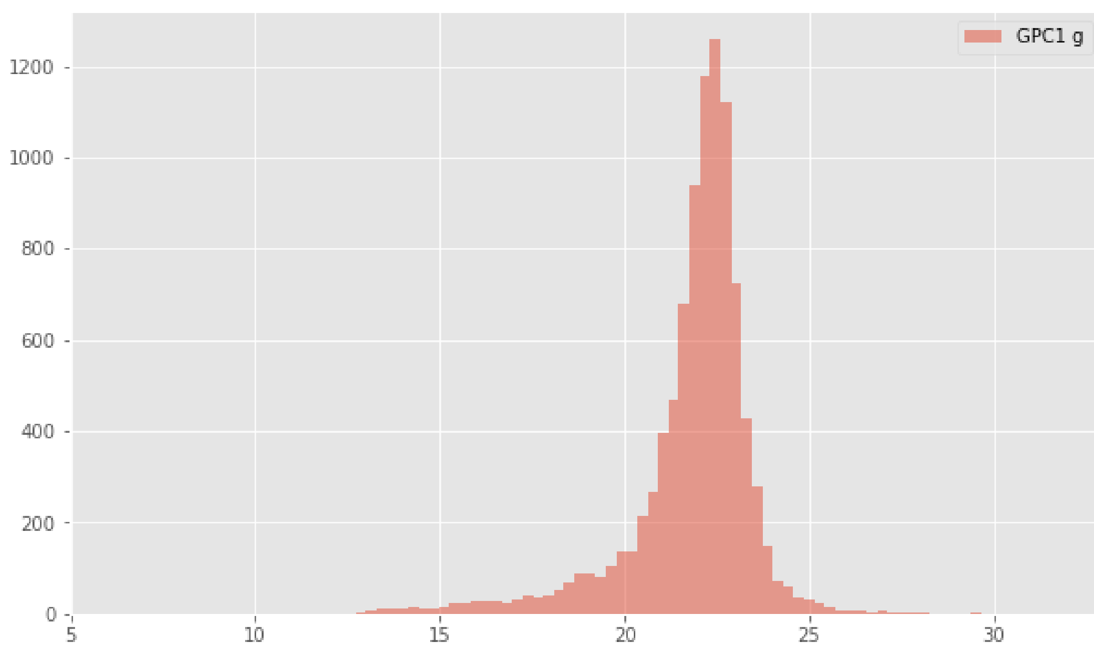
1.4 II - Comparing magnitudes in similar filters

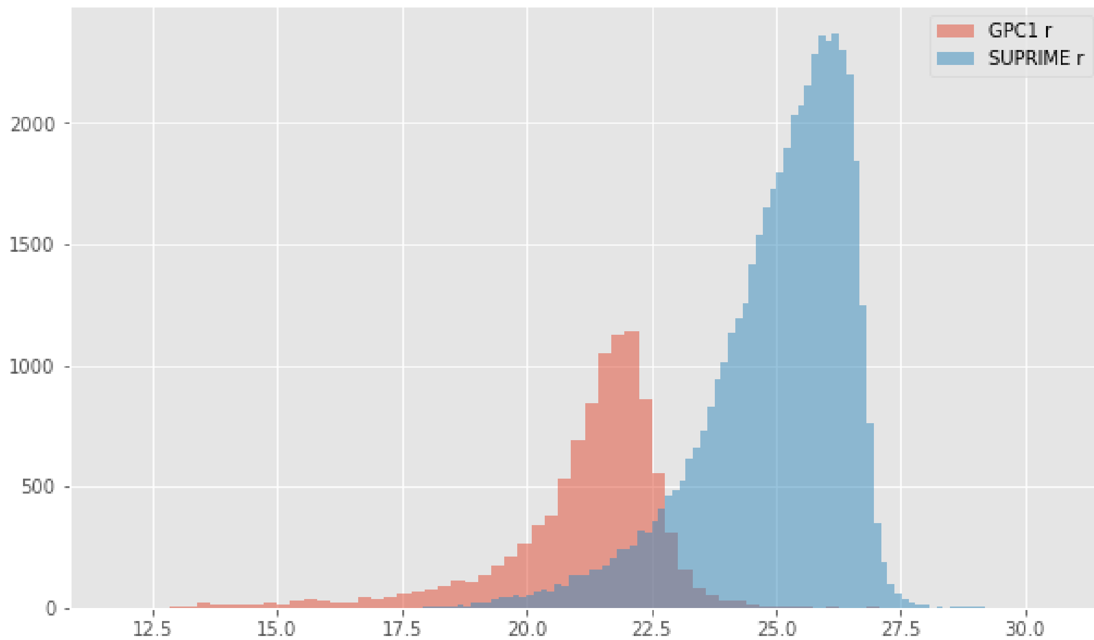
The master list if composed of several catalogues containing magnitudes in similar filters on different instruments. We are comparing the magnitudes in these corresponding filters.

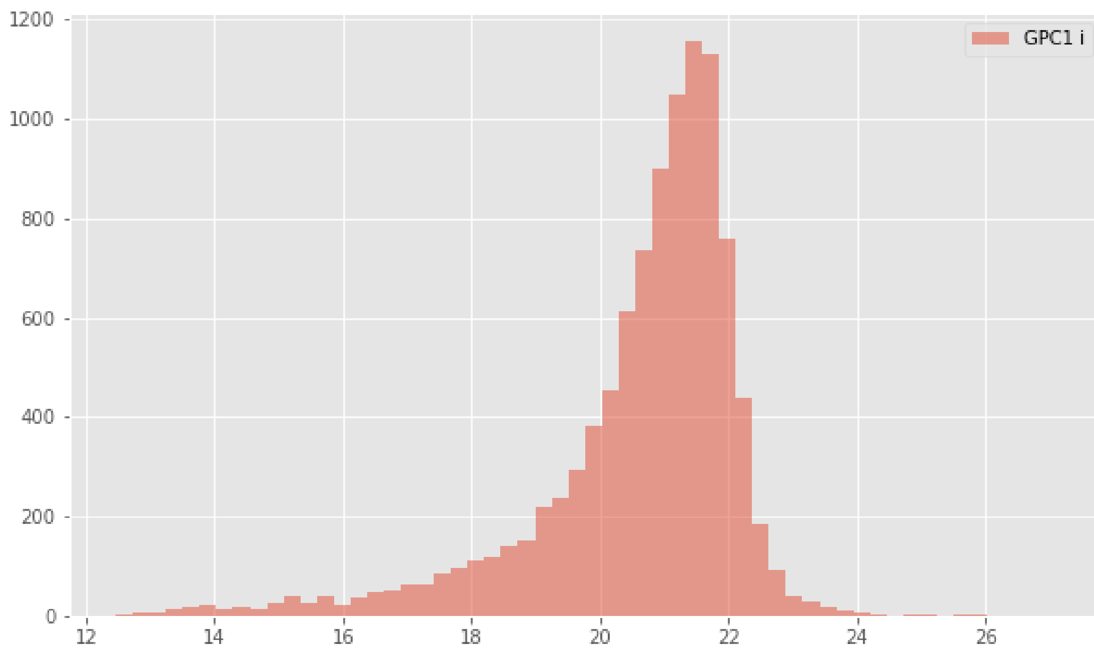
1.4.1 II.a - Comparing depths

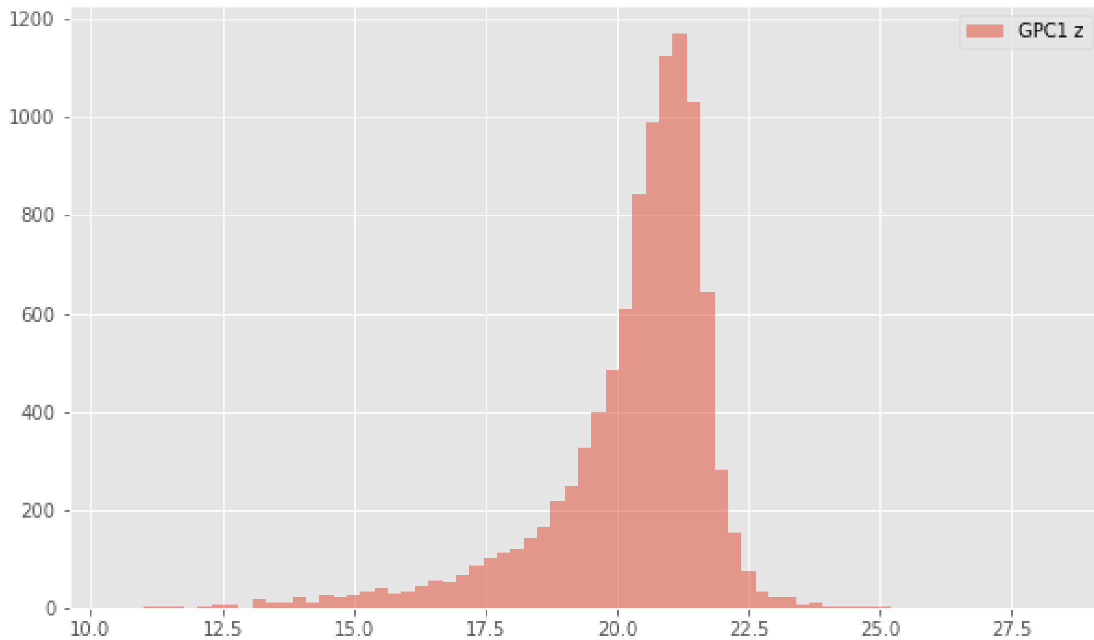
We compare the histograms of the total aperture magnitudes of similar bands.

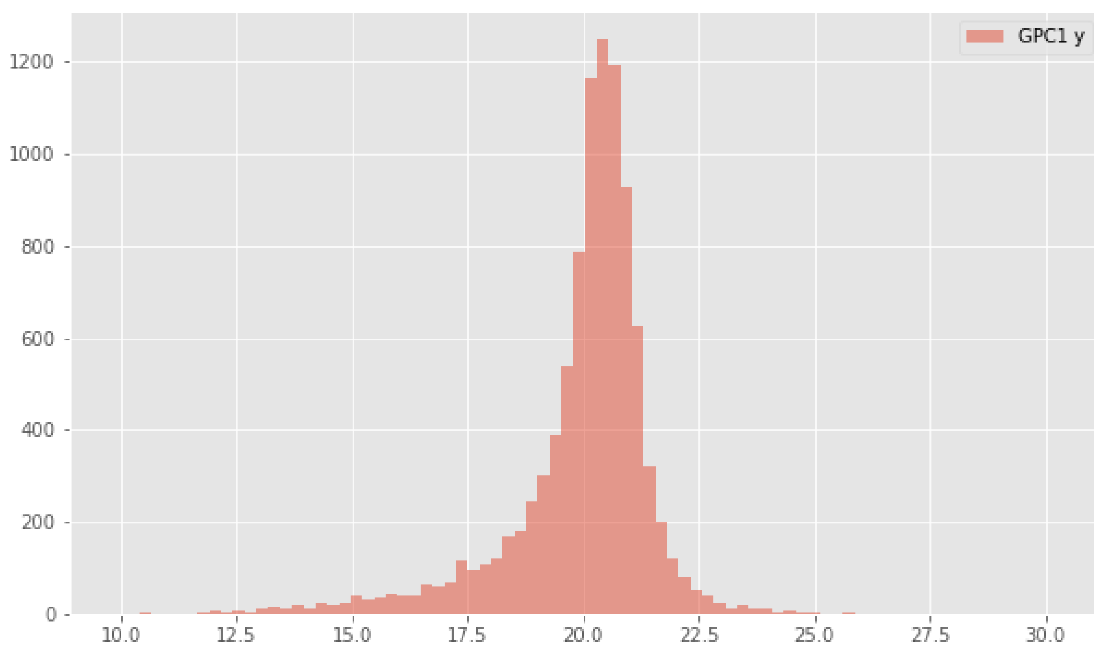

MOSAIC u
0
500
1000
1500
2000
17.5
20.0
22.5
25.0
27.5
30.0
32.5
35.0
37.5


GPC1 g
0
200
400
600
800
1000
1200
5
10
15
20
25
30


GPC1 r
SUPRIME r
2000
1500
1000
500
0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0


GPC1 i
1200
1000
800
600
400
200
0
12
14
16
18
20
22
24
26

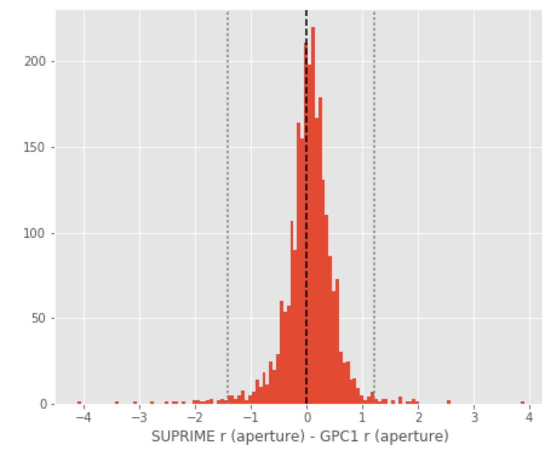


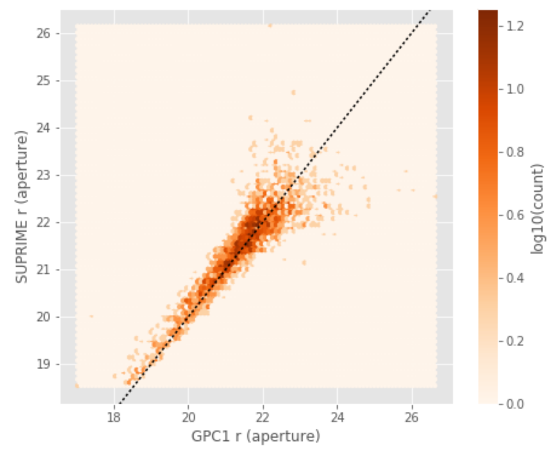


1.4.2 II.b - Comparing magnitudes

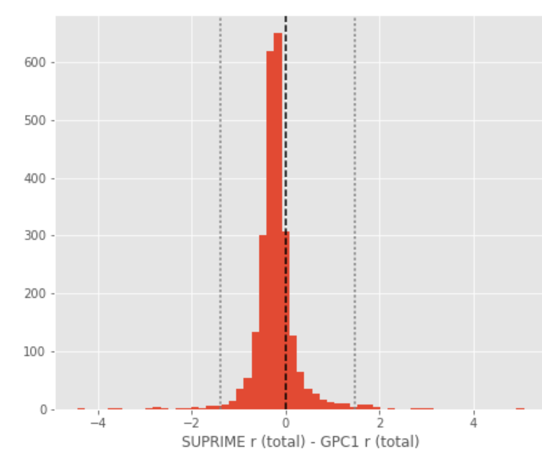
We compare one to one each magnitude in similar bands.

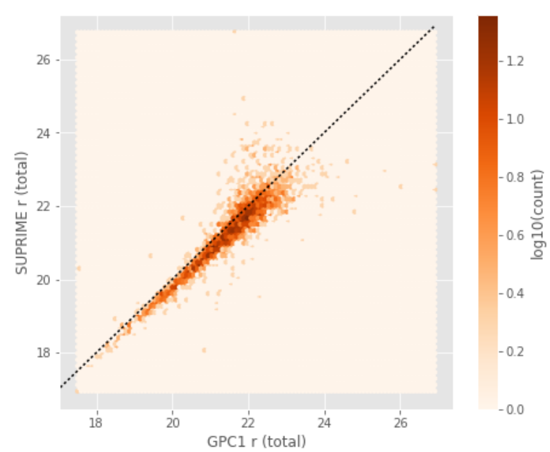
SUPRIME r (aperture) - GPC1 r (aperture):
- Median: 0.07
- Median Absolute Deviation: 0.21
- 1% percentile: -1.424673613403319
- 99% percentile: 1.2040346905273431





SUPRIME r (total) - GPC1 r (total):
- Median: -0.24
- Median Absolute Deviation: 0.16
- 1% percentile: -1.4006093564038085
- 99% percentile: 1.4649504818432544





1.5 III - Comparing magnitudes to reference bands

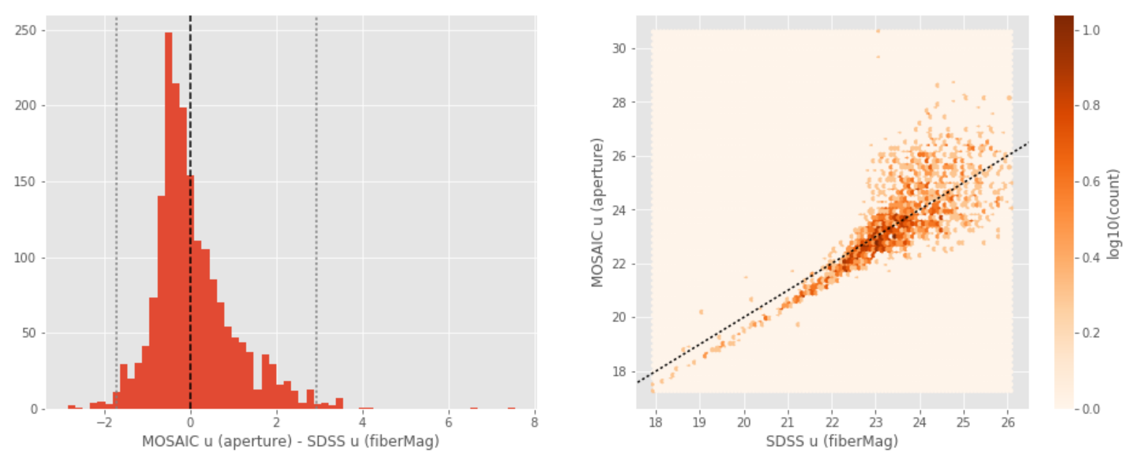
Cross-match the master list to SDSS and 2MASS to compare its magnitudes to SDSS and 2MASS ones.

1.5.1 III.a - Comparing u, g, r, i, and z bands to SDSS

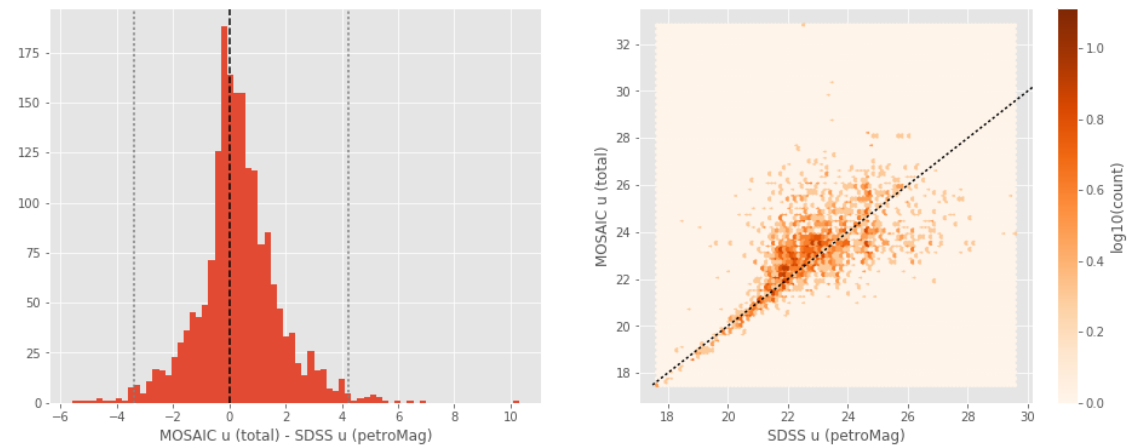
The catalogue is cross-matched to SDSS-DR13 withing 0.2 arcsecond.

We compare the u, g, r, i, and z magnitudes to those from SDSS using `fiberMag` for the aperture magnitude and `petroMag` for the total magnitude.

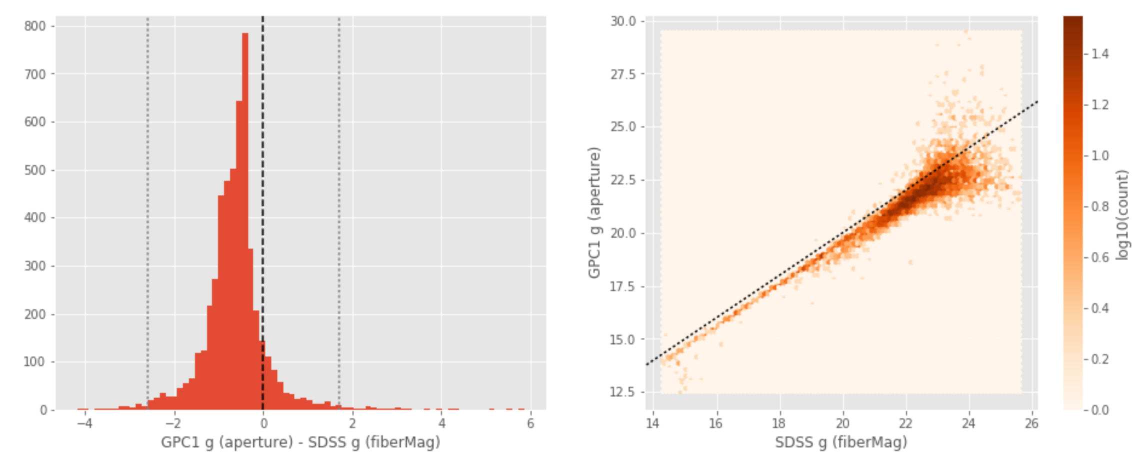
```
MOSAIC u (aperture) - SDSS u (fiberMag):
- Median: -0.15
- Median Absolute Deviation: 0.44
- 1% percentile: -1.7168668045751936
- 99% percentile: 2.942735320161134
```



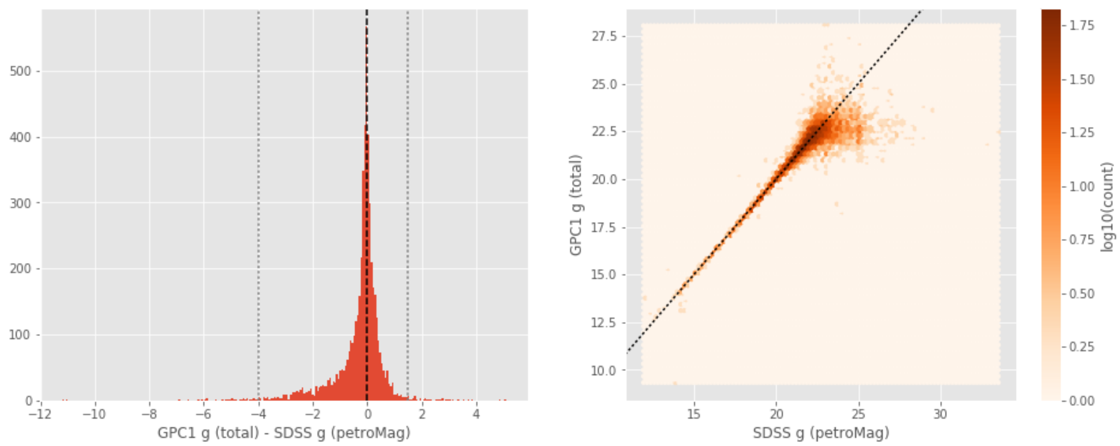

```
MOSAIC u (total) - SDSS u (petroMag):
- Median: 0.26
- Median Absolute Deviation: 0.67
- 1% percentile: -3.3910033163061515
- 99% percentile: 4.251866573155514
```



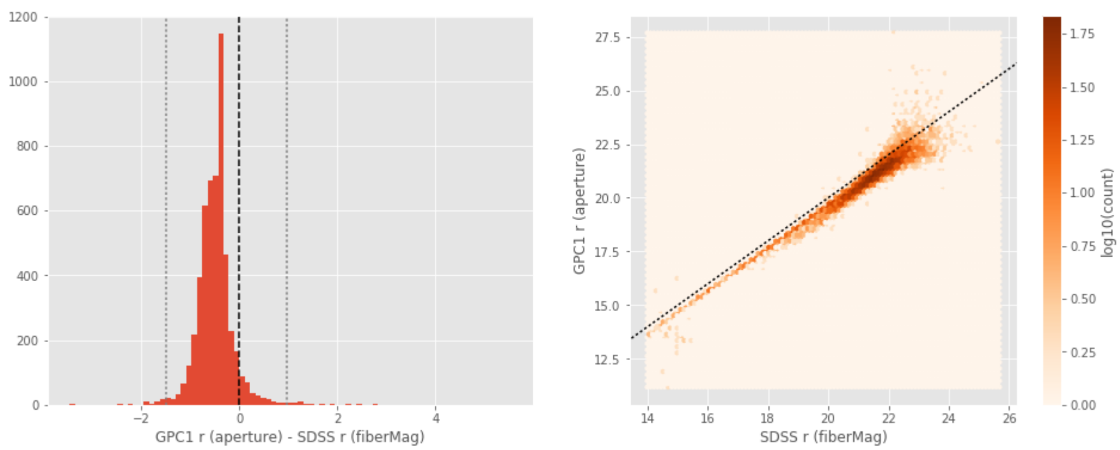
GPC1 g (aperture) - SDSS g (fiberMag):
- Median: -0.60
- Median Absolute Deviation: 0.29
- 1% percentile: -2.5760694885253907
- 99% percentile: 1.7048368072509783



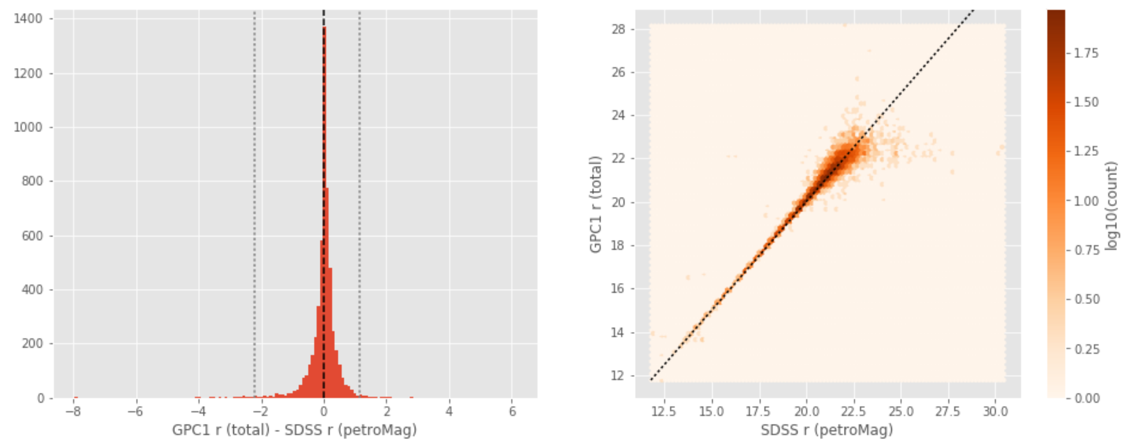
GPC1 g (total) - SDSS g (petroMag):
- Median: -0.08
- Median Absolute Deviation: 0.25
- 1% percentile: -3.9923860931396487
- 99% percentile: 1.4683370971679683



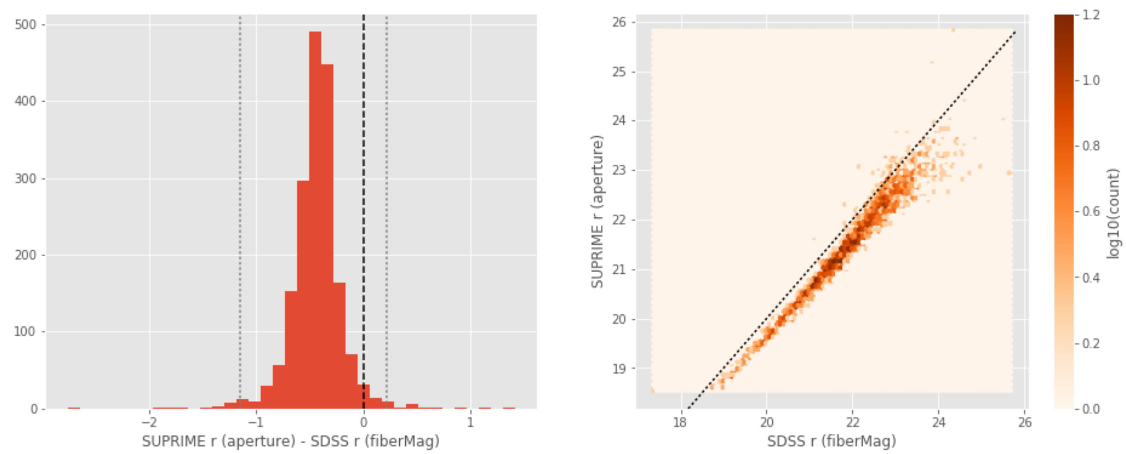
GPC1 r (aperture) - SDSS r (fiberMag):
- Median: -0.47
- Median Absolute Deviation: 0.17
- 1% percentile: -1.4966218566894531
- 99% percentile: 0.9670242309570285



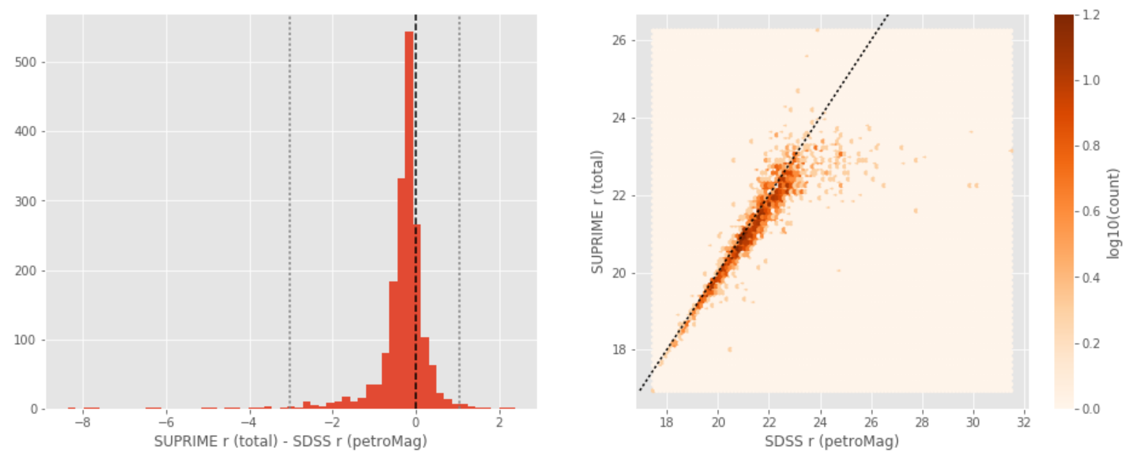
GPC1 r (total) - SDSS r (petroMag):
- Median: 0.03
- Median Absolute Deviation: 0.14
- 1% percentile: -2.213793106079102
- 99% percentile: 1.1340791320800772



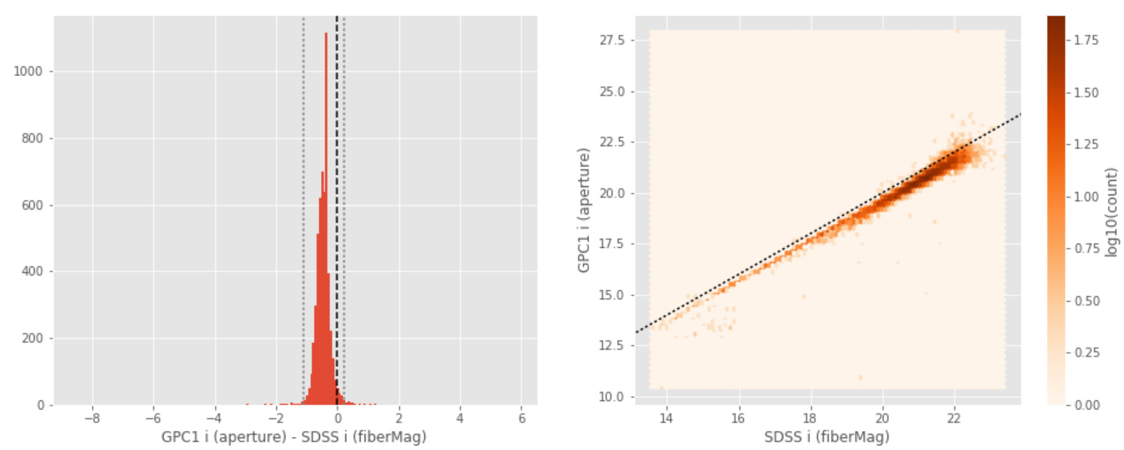
SUPRIME r (aperture) - SDSS r (fiberMag):
- Median: -0.42
- Median Absolute Deviation: 0.11
- 1% percentile: -1.1524517989306626
- 99% percentile: 0.2232965563378855



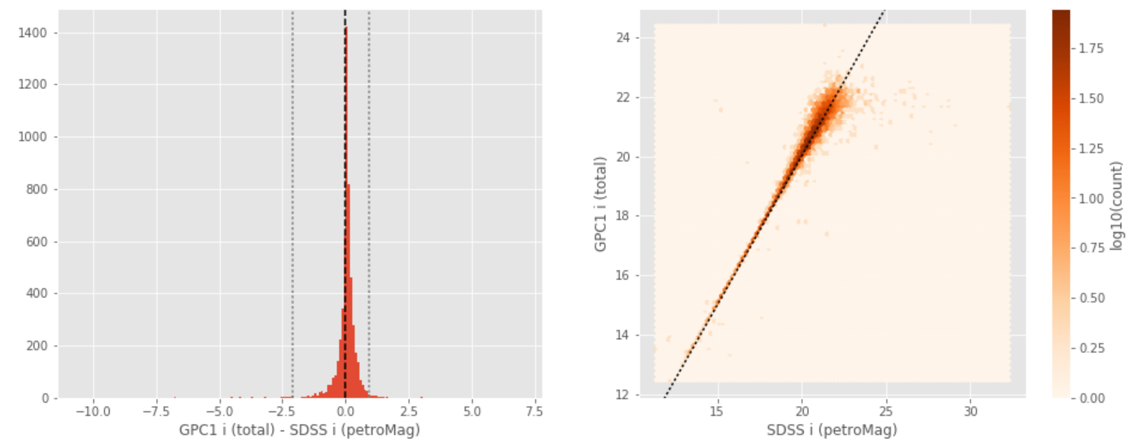
SUPRIME r (total) - SDSS r (petroMag):
- Median: -0.20
- Median Absolute Deviation: 0.19
- 1% percentile: -3.034374487626954
- 99% percentile: 1.0472558652038568



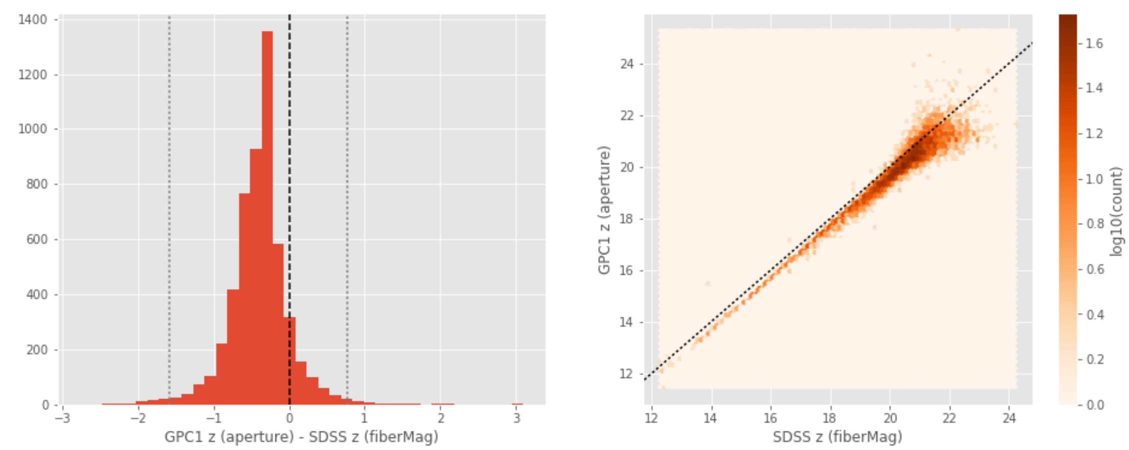
GPC1 i (aperture) - SDSS i (fiberMag):
- Median: -0.44
- Median Absolute Deviation: 0.12
- 1% percentile: -1.1171233367919922
- 99% percentile: 0.2286124420166025



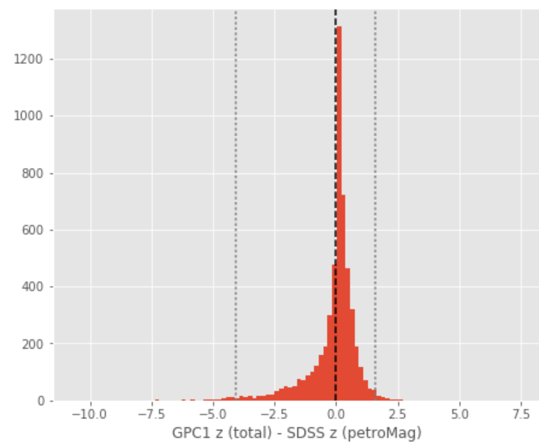
GPC1 i (total) - SDSS i (petroMag):
- Median: 0.06
- Median Absolute Deviation: 0.12
- 1% percentile: -2.0888433837890625
- 99% percentile: 0.9435255050659161

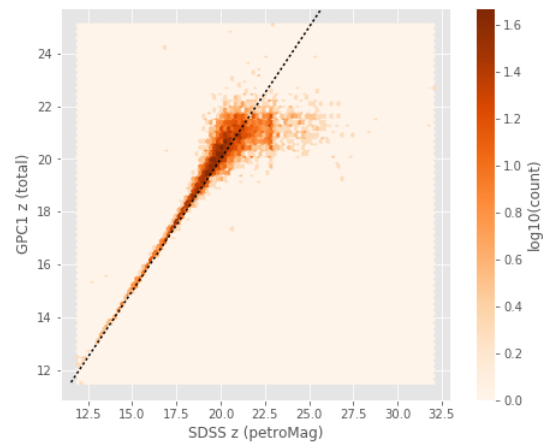


GPC1 z (aperture) - SDSS z (fiberMag):
- Median: -0.36
- Median Absolute Deviation: 0.18
- 1% percentile: -1.5850920677185059
- 99% percentile: 0.7624429321289085



GPC1 z (total) - SDSS z (petroMag):
- Median: 0.10
- Median Absolute Deviation: 0.30
- 1% percentile: -4.0788907623291015
- 99% percentile: 1.606949920654297





1.5.2 III.b - Comparing J and K bands to 2MASS

The catalogue is cross-matched to 2MASS-PSC withing 0.2 arcsecond. We compare the UKIDSS total J and K magnitudes to those from 2MASS.

The 2MASS magnitudes are "*Vega-like*" and we have to convert them to AB magnitudes using the zero points provided on this page:

Band	F - 0 mag (Jy)
J	1594
H	1024
Ks	666.7

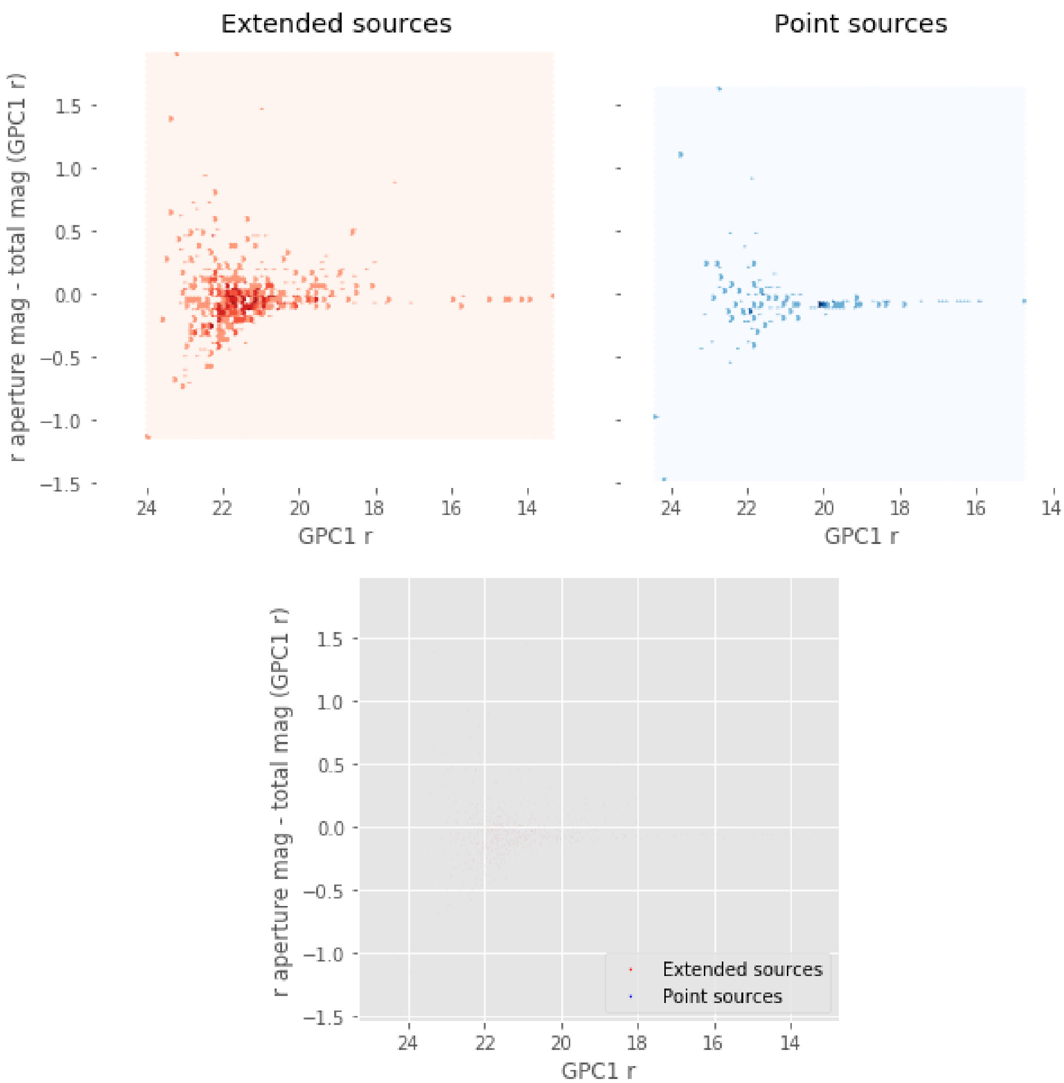
In addition, UKIDSS uses a K band whereas 2MASS uses a Ks ("short") band, this page give a correction to convert the K band in a Ks band with the formula:

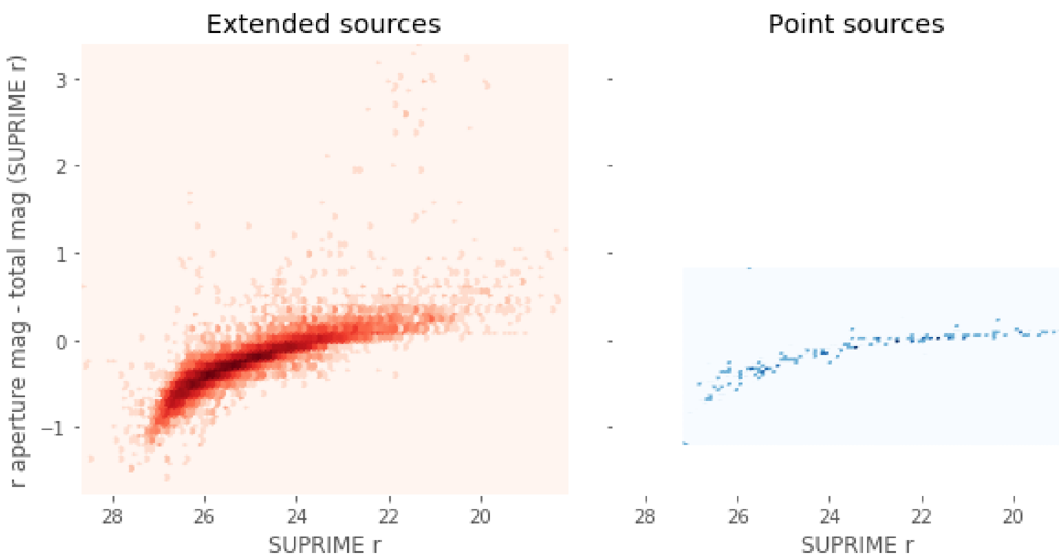
$$K_{s(2MASS)} = K_{UKIRT} + 0.003 + 0.004 * (JK)_{UKIRT}$$

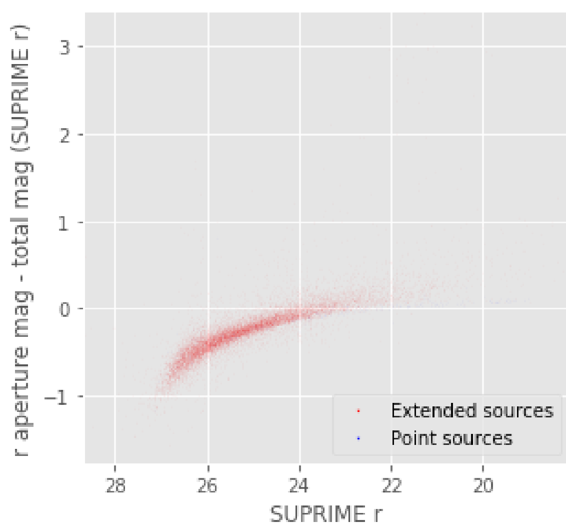
```
No sources have both 2MASS Ks and WIRCAM Ks (total) values.
```

1.6 IV - Comparing aperture magnitudes to total ones.

```
Number of source used: 682 / 130679 (0.52%)
Number of source used: 12017 / 130679 (9.20%)
```

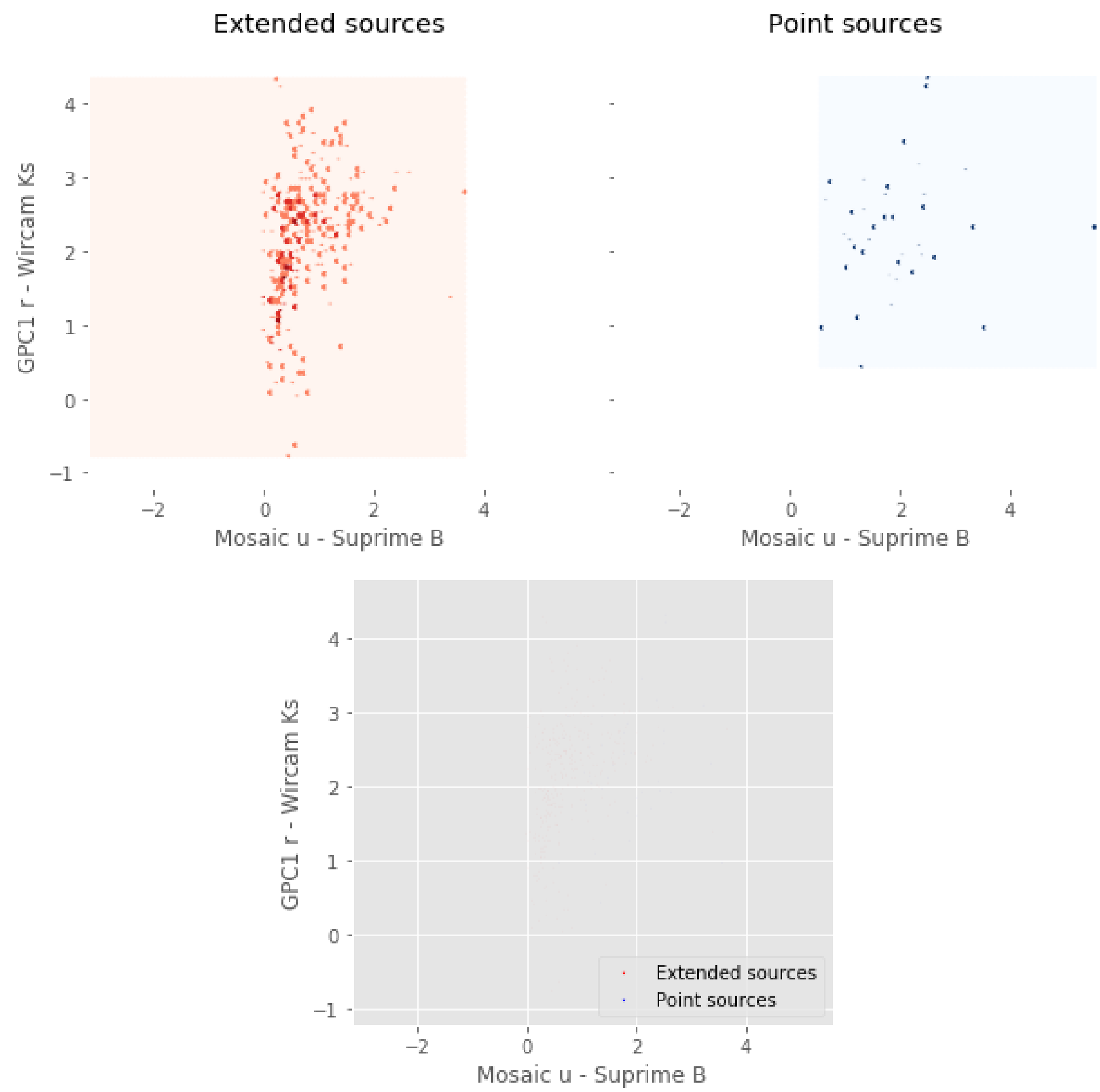

Extended sources
Point sources
r aperture mag - total mag (GPC1 r)
GPC1 r
Extended sources
Point sources



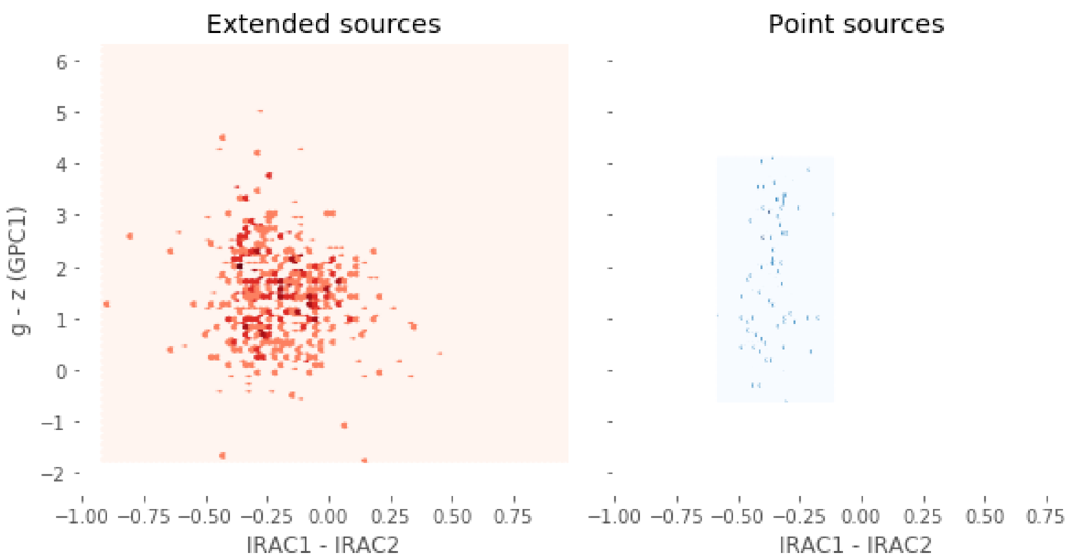


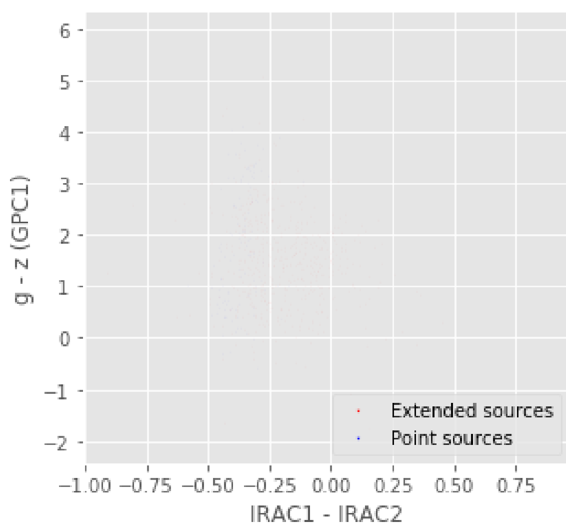
1.7 V - Color-color and magnitude-color plots

```
Number of source used: 374 / 130679 (0.29%)
```



Number of source used: 640 / 130679 (0.49%)


Extended sources
Point sources
g - z (GPC1)
IRAC1 - IRAC2
IRAC1 - IRAC2


g - z (GPC1)
IRAC1 - IRAC2
Extended sources
Point sources

4_Selection_function

March 8, 2018

1 HDF-N Selection Functions

1.1 Depth maps and selection functions

The simplest selection function available is the field MOC which specifies the area for which there is Herschel data. Each pristine catalogue also has a MOC defining the area for which that data is available.

The next stage is to provide mean flux standard deviations which act as a proxy for the catalogue's 5σ depth

```
This notebook was run with herschelhelp_internal version:
0246c5d (Thu Jan 25 17:01:47 2018 +0000) [with local modifications]
This notebook was executed on:
2018-02-27 22:24:03.014619
```

```
Depth maps produced using: master_catalogue_hdf-n_20180219.fits
```

1.2 I - Group masterlist objects by healpix cell and calculate depths

We add a column to the masterlist catalogue for the target order healpix cell per object.

1.3 II Create a table of all Order=13 healpix cells in the field and populate it

We create a table with every order=13 healpix cell in the field MOC. We then calculate the healpix cell at lower order that the order=13 cell is in. We then fill in the depth at every order=13 cell as calculated for the lower order cell that that the order=13 cell is inside.

```
Out[9]: <IPython.core.display.HTML object>
```

```
Out[11]: <IPython.core.display.HTML object>
```

```
Out[12]: <IPython.core.display.HTML object>
```

1.4 III - Save the depth map table

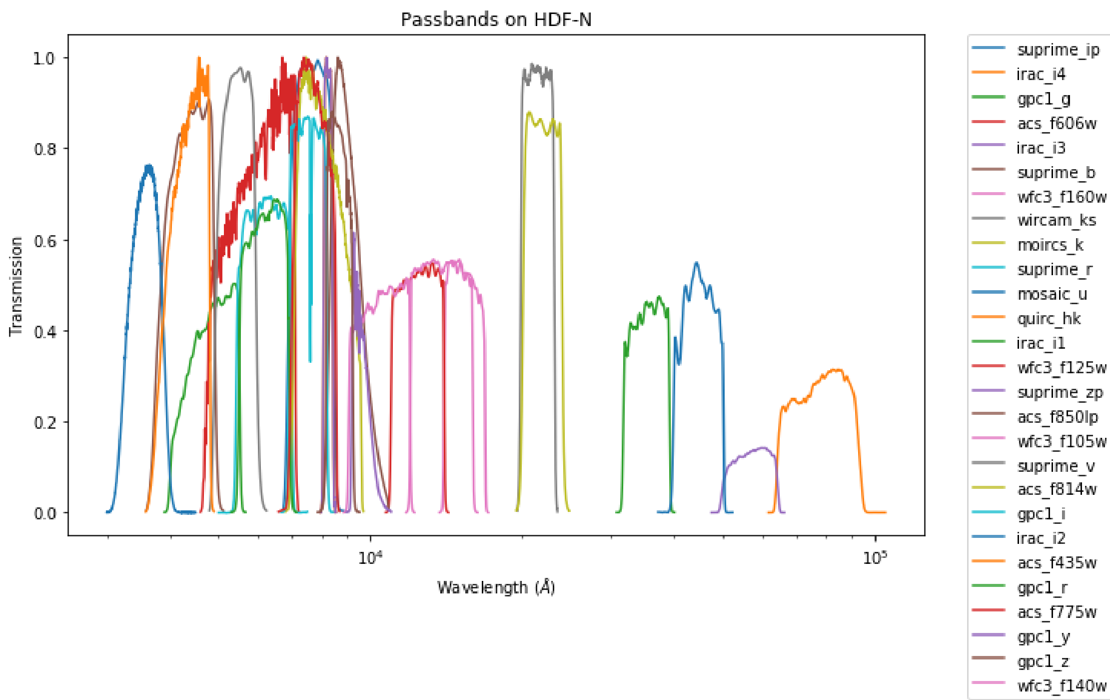
1.5 IV - Overview plots

1.5.1 IV.a - Filters

First we simply plot all the filters available on this field to give an overview of coverage.

```
Out[14]: {'acs_f435w',
          'acs_f606w',
          'acs_f775w',
          'acs_f814w',
          'acs_f850lp',
          'gpc1_g',
          'gpc1_i',
          'gpc1_r',
          'gpc1_y',
          'gpc1_z',
          'irac_i1',
          'irac_i2',
          'irac_i3',
          'irac_i4',
          'moircs_k',
          'mosaic_u',
          'quirc_hk',
          'suprime_b',
          'suprime_ip',
          'suprime_r',
          'suprime_v',
          'suprime_zp',
          'wfc3_f105w',
          'wfc3_f125w',
          'wfc3_f140w',
          'wfc3_f160w',
          'wircam_ks'}
```

```
Out[15]: <matplotlib.text.Text at 0x7f22d0eb4358>
```



1.5.2 IV.a - Depth overview

Then we plot the mean depths available across the area a given band is available

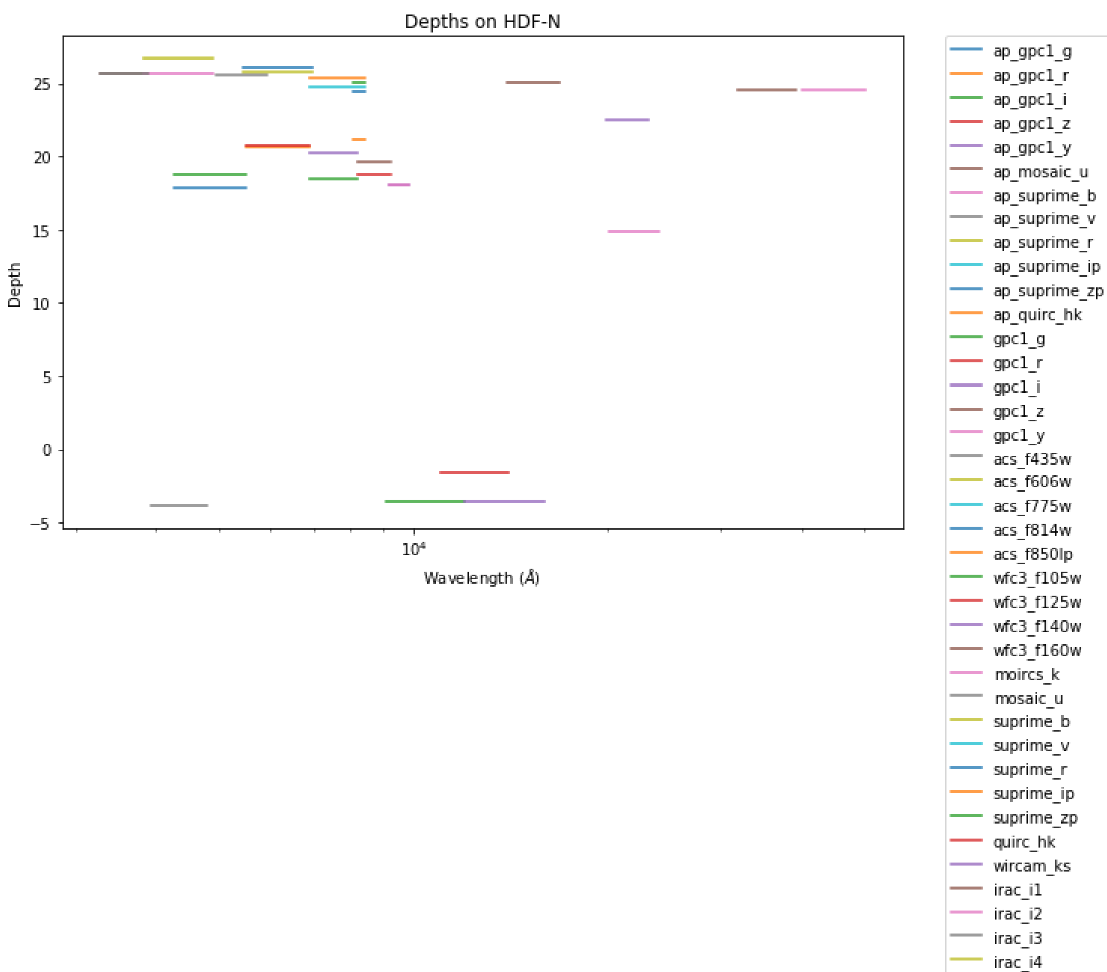
```
gpc1_g: mean flux error: 49.31889105795856, 3sigma in AB mag (Aperture): 18.474663606044878
gpc1_r: mean flux error: 3.9650023892121498, 3sigma in AB mag (Aperture): 21.21158822982887
gpc1_i: mean flux error: 28.839910761999484, 3sigma in AB mag (Aperture): 19.05721208262043
gpc1_z: mean flux error: 21.881597184502564, 3sigma in AB mag (Aperture): 19.356999315950922
gpc1_y: mean flux error: 42.15458136573825, 3sigma in AB mag (Aperture): 18.64508491142542
mosaic_u: mean flux error: 0.037849102429692624, 3sigma in AB mag (Aperture): 26.262057900932525
suprime_b: mean flux error: 0.036868076515944356, 3sigma in AB mag (Aperture): 26.29057066281874
suprime_v: mean flux error: 0.043454611888431194, 3sigma in AB mag (Aperture): 26.11210717467946
suprime_r: mean flux error: 0.034602777768592184, 3sigma in AB mag (Aperture): 26.35941945428616
suprime_ip: mean flux error: 0.09358766967248164, 3sigma in AB mag (Aperture): 25.27915027944185
suprime_zp: mean flux error: 0.12159221232312142, 3sigma in AB mag (Aperture): 24.99493246231879
quirc_hk: mean flux error: 2.6074063198573043, 3sigma in AB mag (Aperture): 21.666675078603895
gpc1_g: mean flux error: 21.940918363220646, 3sigma in AB mag (Total): 19.354059859373486
gpc1_r: mean flux error: 3.539784110499412, 3sigma in AB mag (Total): 21.334754924575584
gpc1_i: mean flux error: 5.930459506566338, 3sigma in AB mag (Total): 20.774476001023437
gpc1_z: mean flux error: 9.88114732694127, 3sigma in AB mag (Total): 20.220178426622915
gpc1_y: mean flux error: 40.950411302280756, 3sigma in AB mag (Total): 18.67655119286733
acs_f435w: mean flux error: 24518589460.49422, 3sigma in AB mag (Total): -3.266541841469696
acs_f606w: mean flux error: -3485900157.9875946, 3sigma in AB mag (Total): nan
acs_f775w: mean flux error: -8150367983.31671, 3sigma in AB mag (Total): nan
acs_f814w: mean flux error: -6035782824.048011, 3sigma in AB mag (Total): nan
```

```
acs_f850lp: mean flux error: -19538527428.49734, 3sigma in AB mag (Total): nan
wfc3_f105w: mean flux error: 17951690756.750423, 3sigma in AB mag (Total): -2.9280665325595123
wfc3_f125w: mean flux error: 3149191470.7425175, 3sigma in AB mag (Total): -1.0383008031245353
wfc3_f140w: mean flux error: 18078406457.130688, 3sigma in AB mag (Total): -2.93570350284228
wfc3_f160w: mean flux error: 0.06776823408194037, 3sigma in AB mag (Total): 25.62963144106113
moircs_k: mean flux error: 832.740080918873, 3sigma in AB mag (Total): 15.405923192329148
mosaic_u: mean flux error: 0.037338022674080984, 3sigma in AB mag (Total): 26.27681857545057
suprime_b: mean flux error: 0.015313337191511709, 3sigma in AB mag (Total): 27.244522249302413
suprime_v: mean flux error: inf, 3sigma in AB mag (Total): -inf
suprime_r: mean flux error: 0.025553774485105058, 3sigma in AB mag (Total): 26.68855921875754
suprime_ip: mean flux error: 0.05139216547444444, 3sigma in AB mag (Total): 25.929954569144165
suprime_zp: mean flux error: 0.07008859890513011, 3sigma in AB mag (Total): 25.593078417260124
quirc_hk: mean flux error: inf, 3sigma in AB mag (Total): -inf
wircam_ks: mean flux error: 0.7207638901599277, 3sigma in AB mag (Total): 23.062714311645685
irac_i1: mean flux error: 0.11422102499281485, 3sigma in AB mag (Total): 25.062831730441992
irac_i2: mean flux error: 0.1062667161755575, 3sigma in AB mag (Total): 25.141203712353082
irac_i3: mean flux error: -94.31939782470842, 3sigma in AB mag (Total): nan
irac_i4: mean flux error: -6.697126659591726, 3sigma in AB mag (Total): nan


ap_gpc1_g (4260.0, 5500.0, 1240.0)
ap_gpc1_r (5500.0, 6900.0, 1400.0)
ap_gpc1_i (6910.0, 8190.0, 1280.0)
ap_gpc1_z (8190.0, 9210.0, 1020.0)
ap_gpc1_y (9200.0, 9820.0, 620.0)
ap_mosaic_u (3276.0, 3890.0, 614.0)
ap_suprime_b (3827.0, 4906.0, 1079.0)
ap_suprime_v (4941.6001, 5925.7998, 984.19971)
ap_suprime_r (5440.0, 6960.0, 1520.0)
ap_suprime_ip (6895.0, 8437.5, 1542.5)
ap_suprime_zp (8073.5, 8416.0, 342.5)
ap_quirc_hk (8073.5, 8416.0, 342.5)
gpc1_g (4260.0, 5500.0, 1240.0)
gpc1_r (5500.0, 6900.0, 1400.0)
gpc1_i (6910.0, 8190.0, 1280.0)
gpc1_z (8190.0, 9210.0, 1020.0)
gpc1_y (9200.0, 9820.0, 620.0)
acs_f435w (3919.51, 4798.7798, 879.26978)
acs_f606w (4835.3999, 7088.4702, 2253.0703)
acs_f775w (7004.5098, 8521.3799, 1516.8701)
acs_f814w (7069.6699, 9138.1104, 2068.4404)
acs_f850lp (8308.9297, 9584.25, 1275.3203)
wfc3_f105w (9072.9238, 11989.37, 2916.4463)
wfc3_f125w (10993.5, 13997.47, 3003.9697)
wfc3_f140w (12005.91, 15946.44, 3940.5303)
wfc3_f160w (13996.34, 16869.92, 2873.5801)
moircs_k (20072.0, 24010.0, 3938.0)
mosaic_u (3276.0, 3890.0, 614.0)
```

```
suprime_b (3827.0, 4906.0, 1079.0)
suprime_v (4941.6001, 5925.7998, 984.19971)
suprime_r (5440.0, 6960.0, 1520.0)
suprime_ip (6895.0, 8437.5, 1542.5)
suprime_zp (8073.5, 8416.0, 342.5)
quirc_hk (8073.5, 8416.0, 342.5)
wircam_ks (19870.0, 23135.0, 3265.0)
irac_i1 (31754.0, 39164.801, 7410.8008)
irac_i2 (39980.102, 50052.301, 10072.199)
irac_i3 (50246.301, 64096.699, 13850.398)
irac_i4 (64415.199, 92596.797, 28181.598)
```

Out[20]: <matplotlib.text.Text at 0x7f22ceb12940>



1.5.3 IV.c - Depth vs coverage comparison

How best to do this? Colour/intensity plot over area? Percentage coverage vs mean depth?

Out[21]: <matplotlib.text.Text at 0x7f22ce93de48>