1.1_HSC-SSP

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of Hyper Suprime-Cam Subaru Strategic Program Catalogues (HSC-SSP) data

This catalogue comes from `dmu0_HSC`.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y, N816, N921 aperture magnitude (for now in 3″);
- The g, r, i, z, y, N816, N921 kron fluxes and magnitudes.

TODO: Check that the aperture magnitudes are aperture corrected and that all the magnitudes are AB.

TODO: Check for stellarity.

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:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

1.2 I - Column selection

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

1.3 II - Removal of duplicated sources

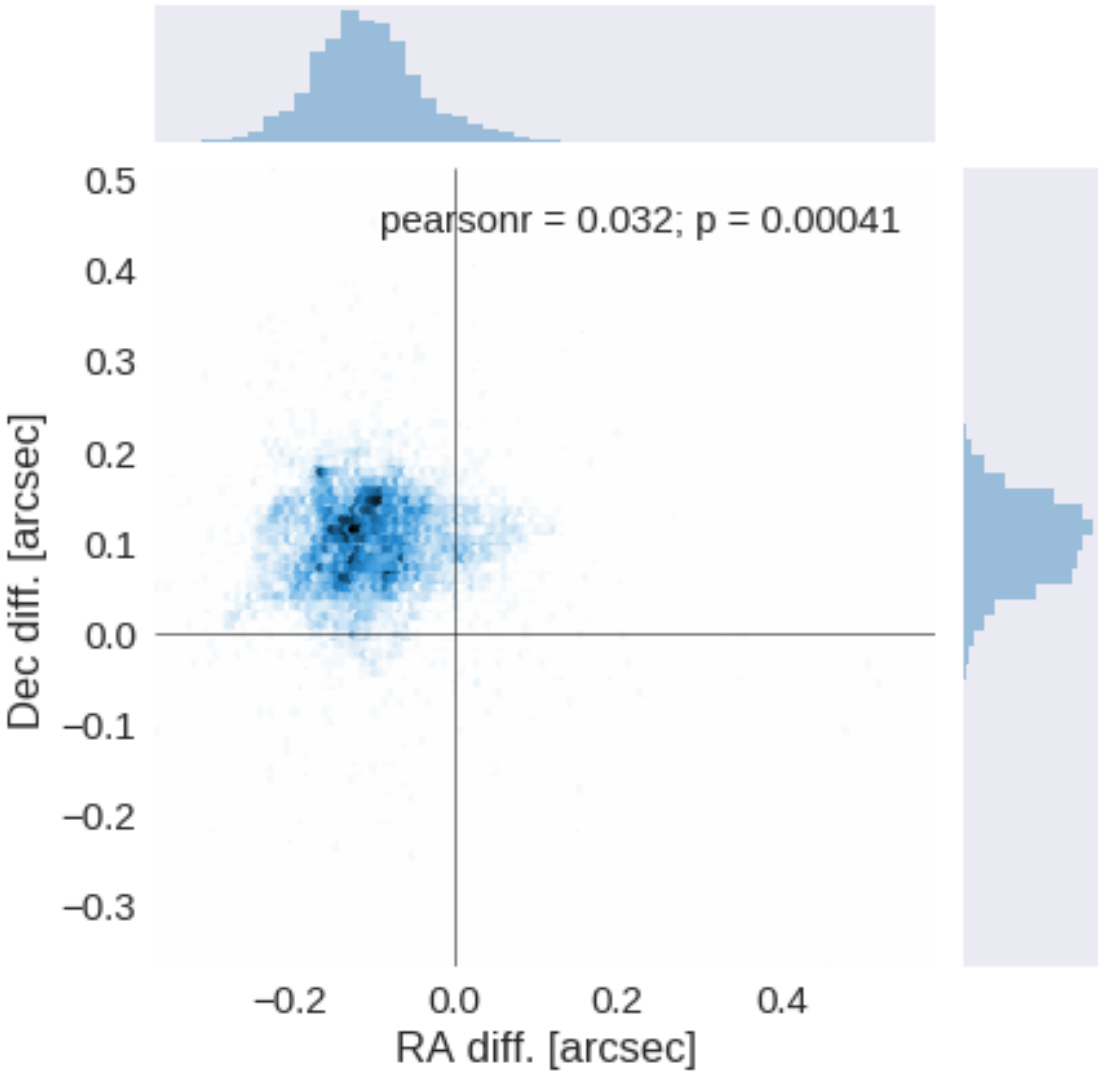
We remove duplicated objects from the input catalogues.

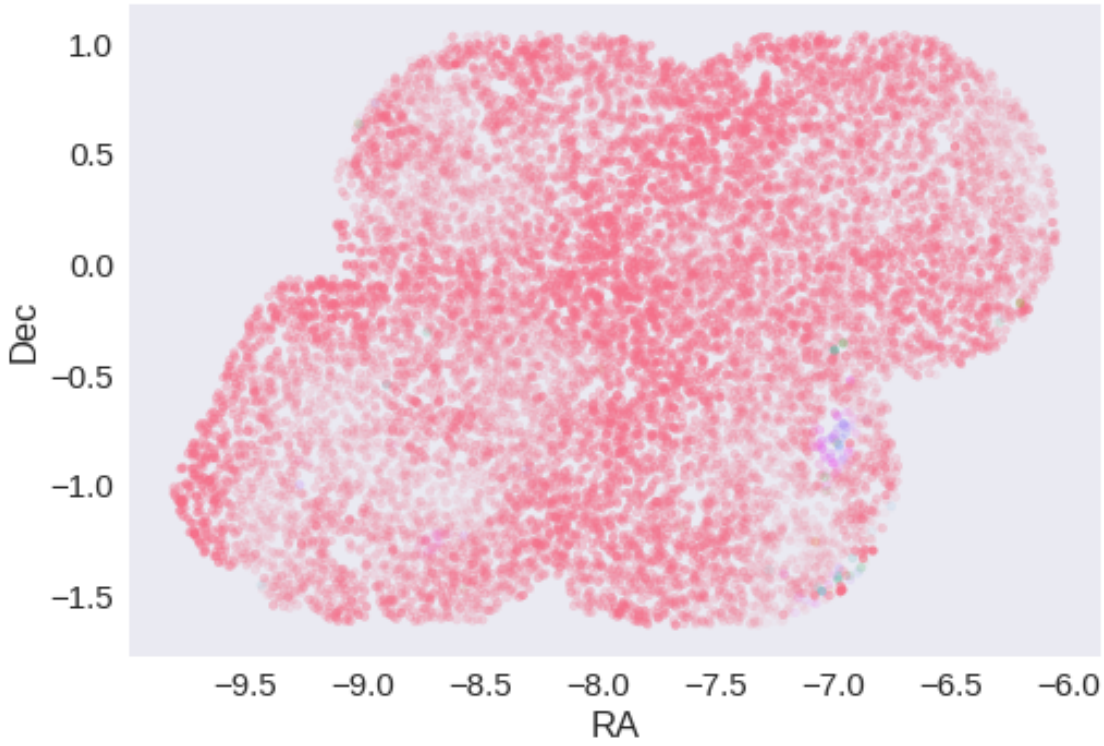
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 2868474 sources.
The cleaned catalogue has 2868272 sources (202 removed).
The cleaned catalogue has 168 sources flagged as having been cleaned
```

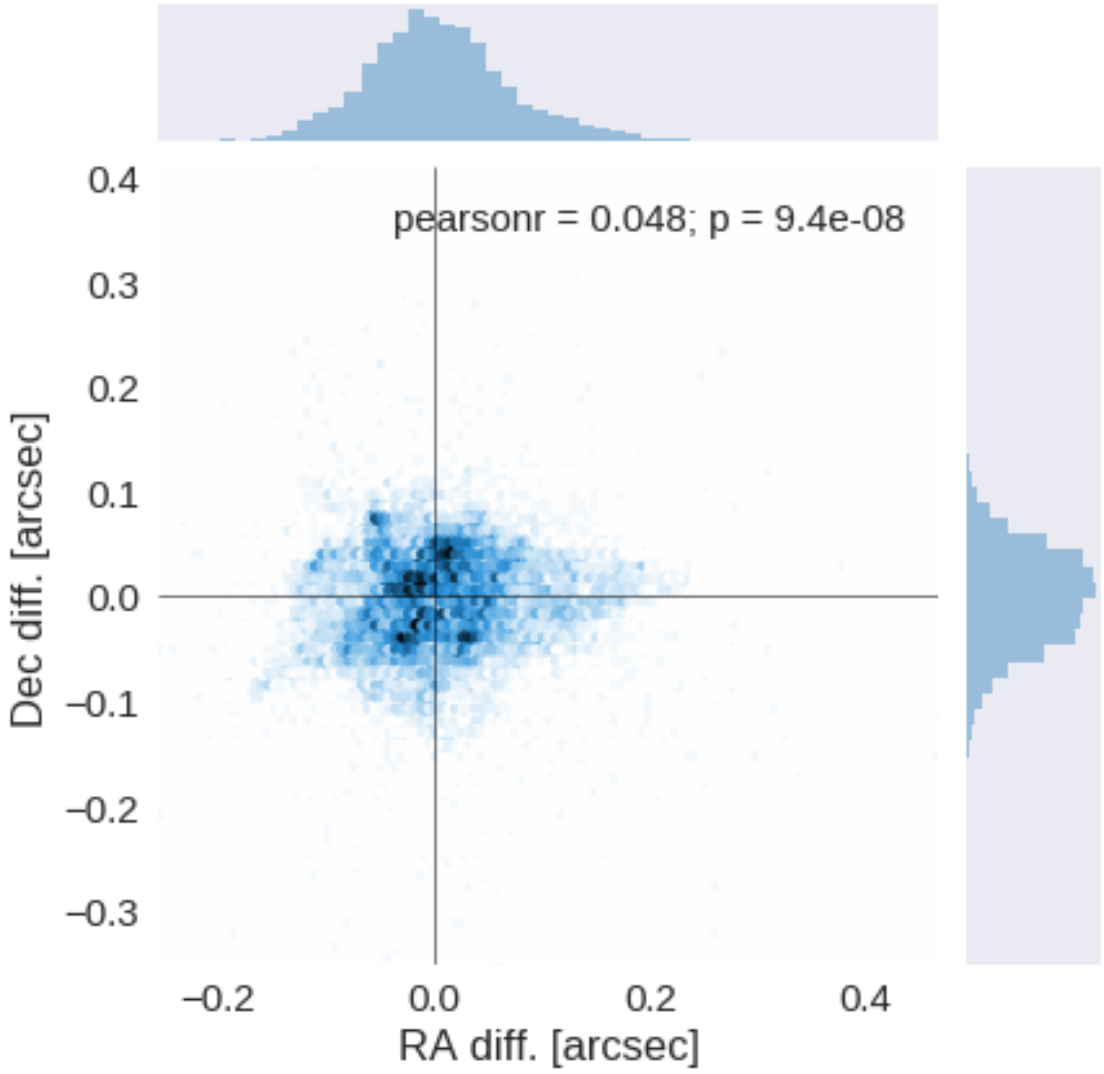
1.4 III - Astrometry correction

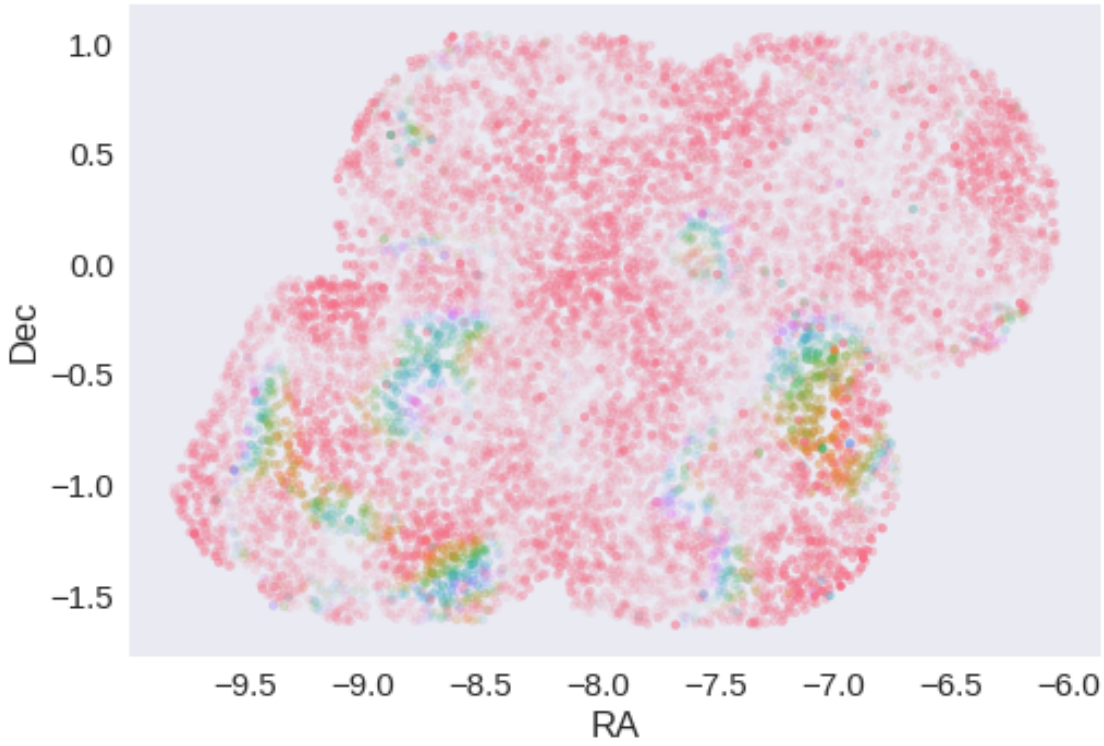
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.109708158538524 arcsec
Dec correction: -0.10202967583285982 arcsec
```


pearsonr = 0.048; p = 9.4e-08
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
12702 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.2_VISTA-VHS

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of VHS data

VISTA telescope/VHS catalogue: the catalogue comes from `dmu0_VHS`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The magnitude for each band.
- The kron magnitude to be used as total magnitude (no "auto" magnitude is provided).

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

1.3 II - Removal of duplicated sources

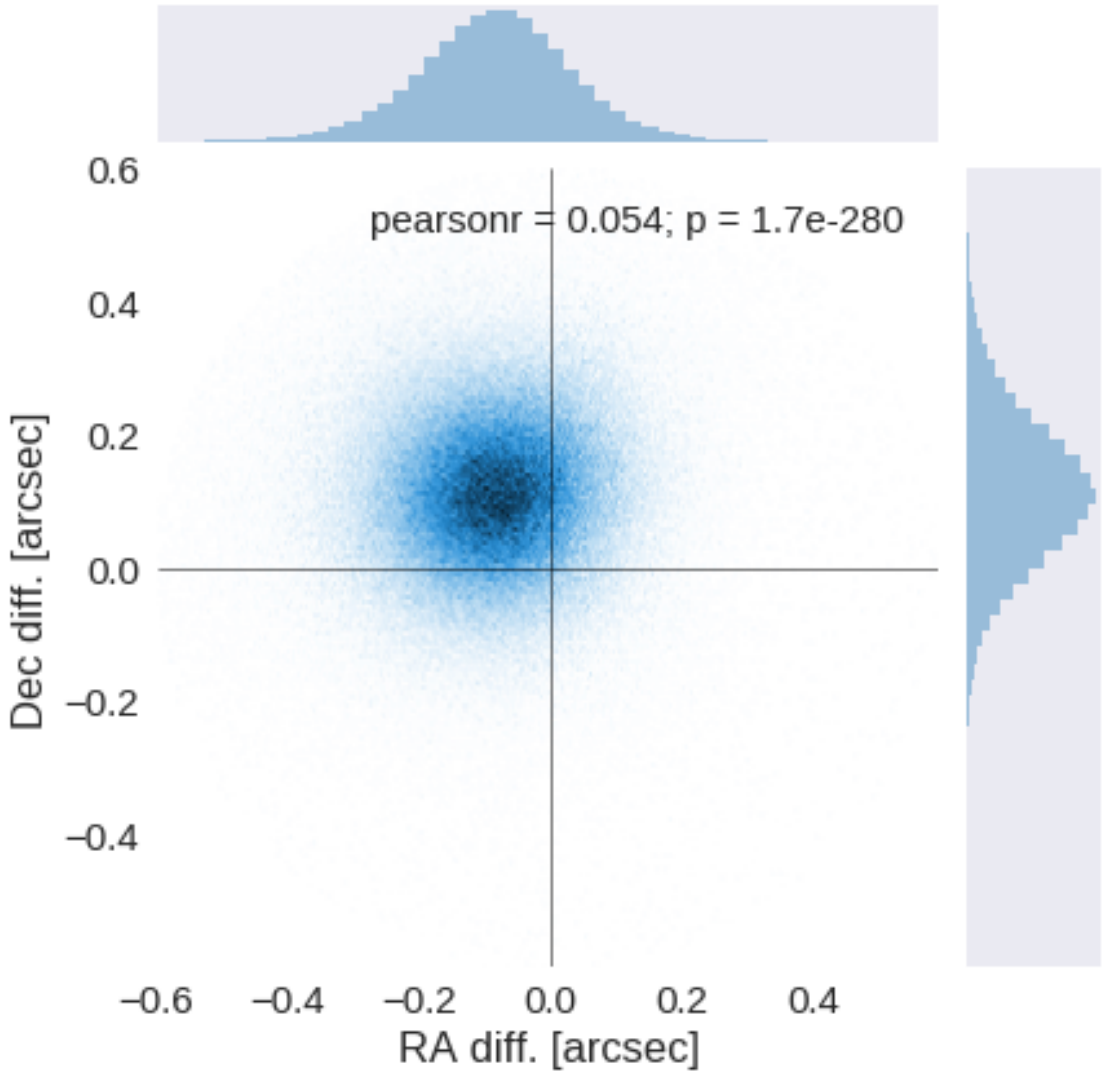
We remove duplicated objects from the input catalogues.

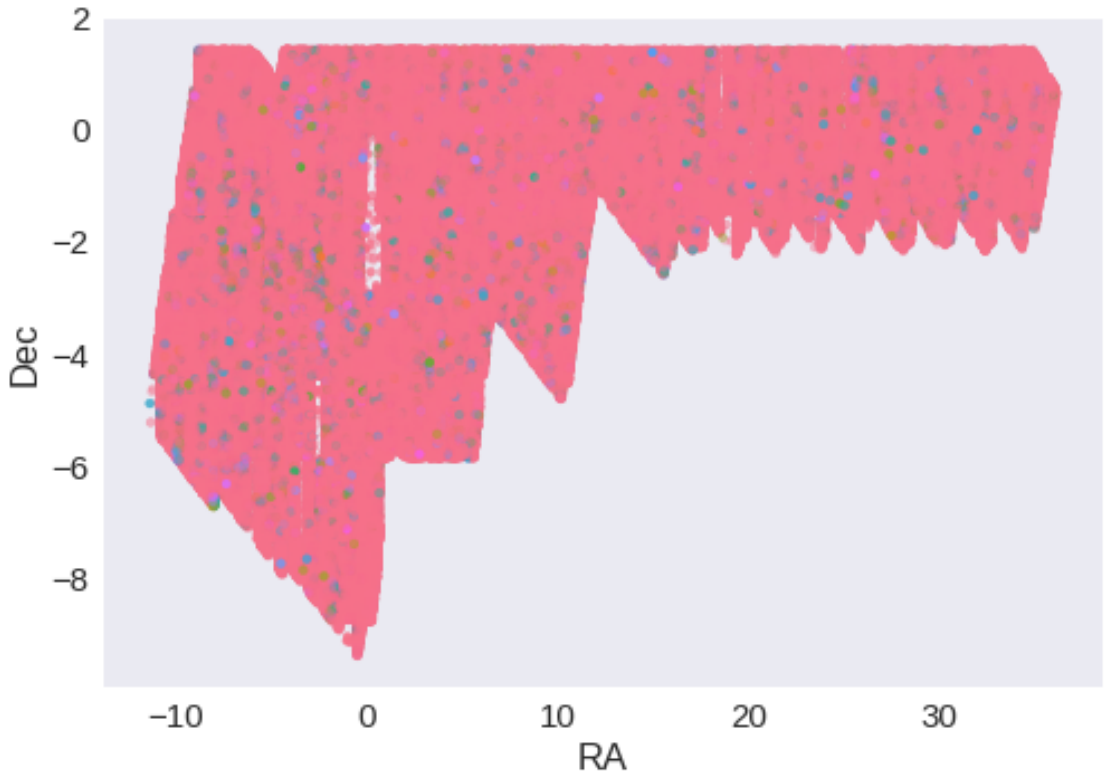
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 4723782 sources.
The cleaned catalogue has 4708094 sources (15688 removed).
The cleaned catalogue has 15670 sources flagged as having been cleaned
```

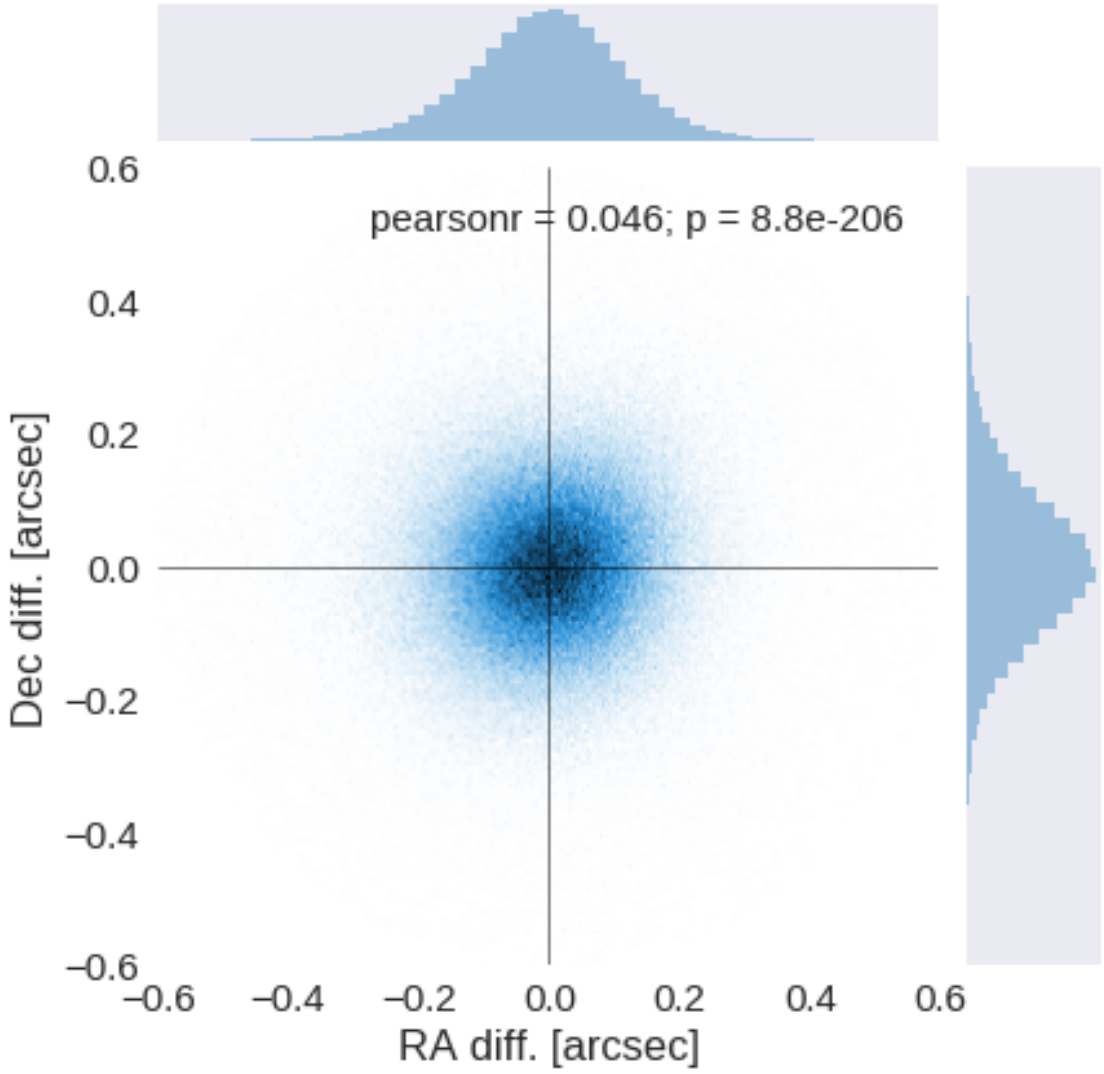
1.4 III - Astrometry correction

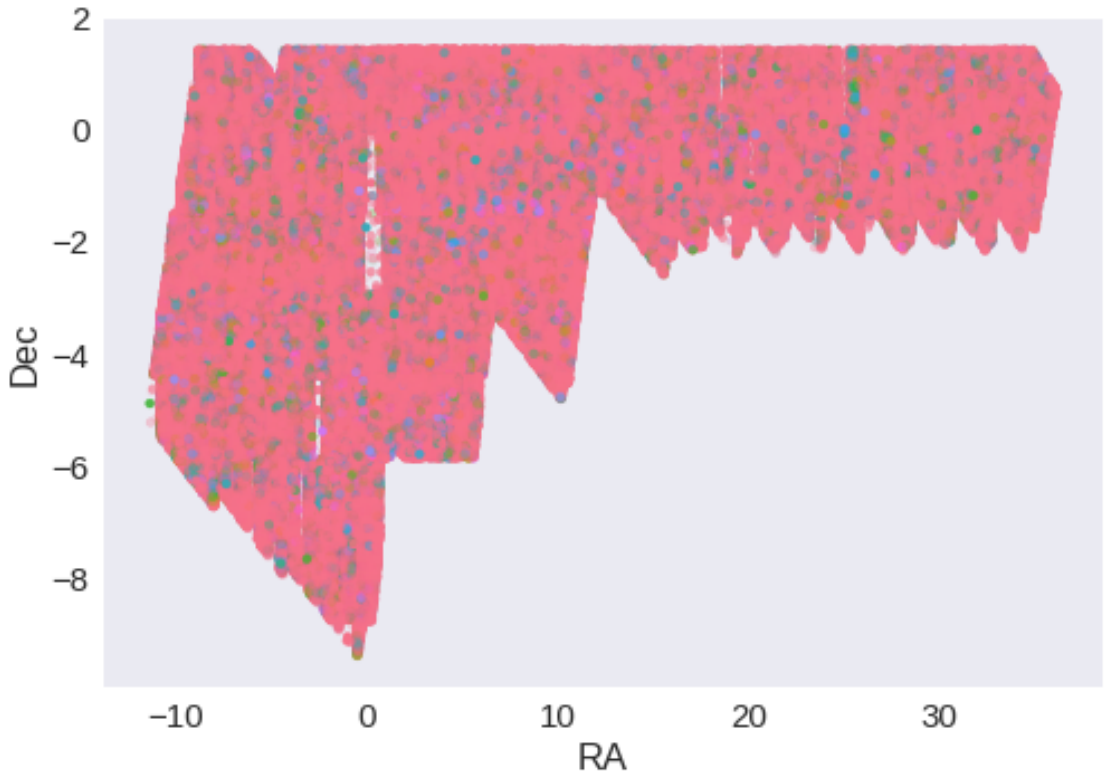
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.08399760600354966 arcsec
Dec correction: -0.11251507613907474 arcsec
```


pearsonr = 0.046; p = 8.8e-206
Dec diff. [arcsec]
RA diff. [arcsec]
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6



1.5 IV - Flagging Gaia objects

```
443115 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.3_VICS82

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of VISTA/CFHT Telescope / VIRCAM/WIRCAM Camera data

VISTA/CFHT Telescope / VIRCAM/WIRCAM Camera VICS82 catalogue: the catalogue comes from `dmu0_VICS82`.

The catalogue is described here: https://arxiv.org/pdf/1705.05451.pdf

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The magnitude for each band.
- The auto magnitude to be used as total magnitude .

```
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)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:13:
```

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

1.3 II - Removal of duplicated sources

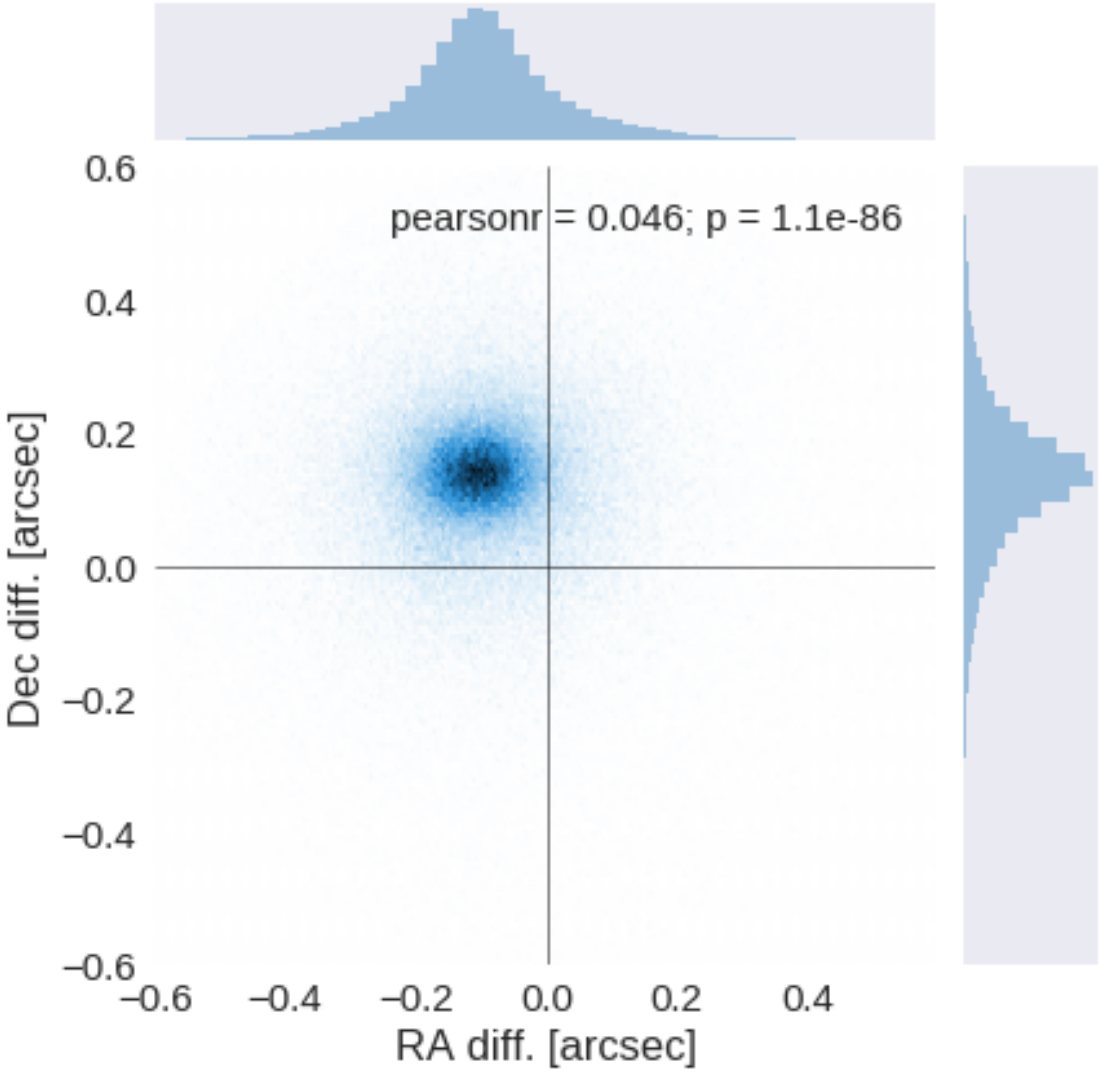
We remove duplicated objects from the input catalogues.

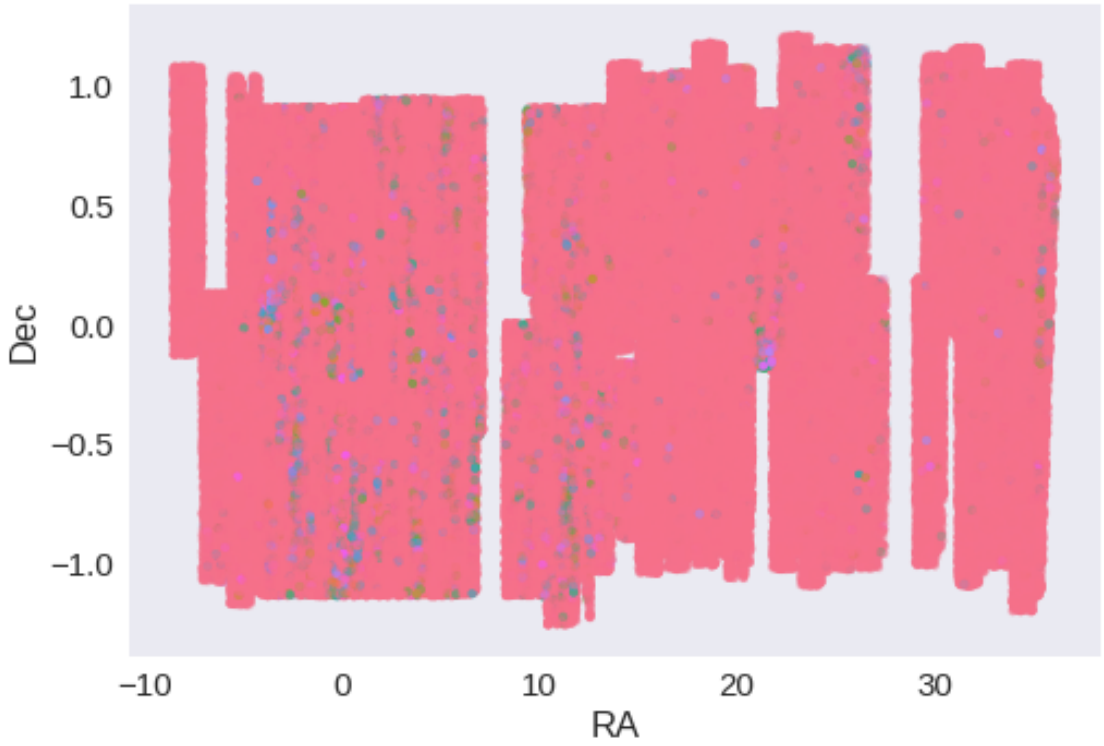
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 15318703 sources.
The cleaned catalogue has 13914785 sources (1403918 removed).
The cleaned catalogue has 1239758 sources flagged as having been cleaned
```

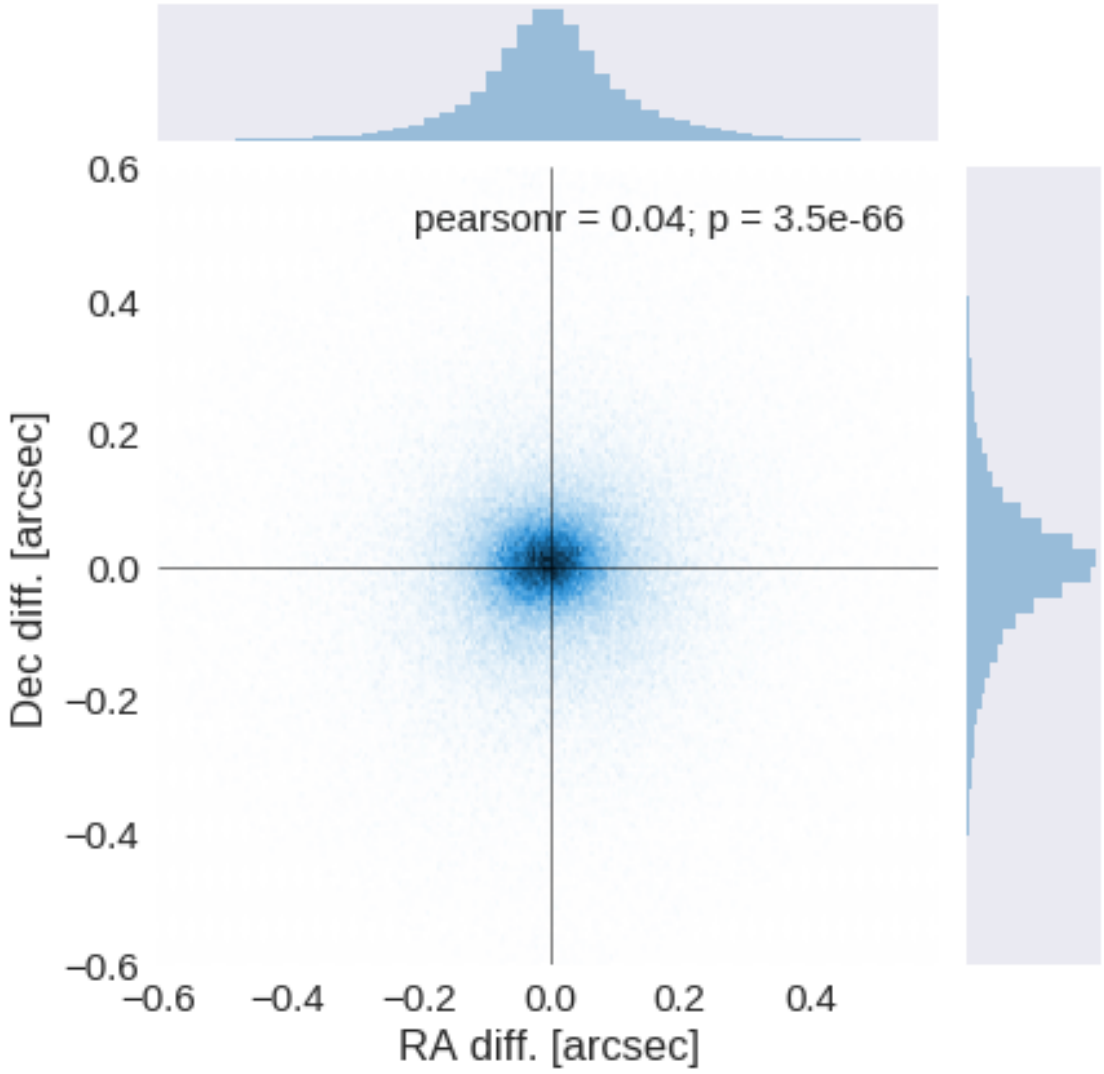
1.4 III - Astrometry correction

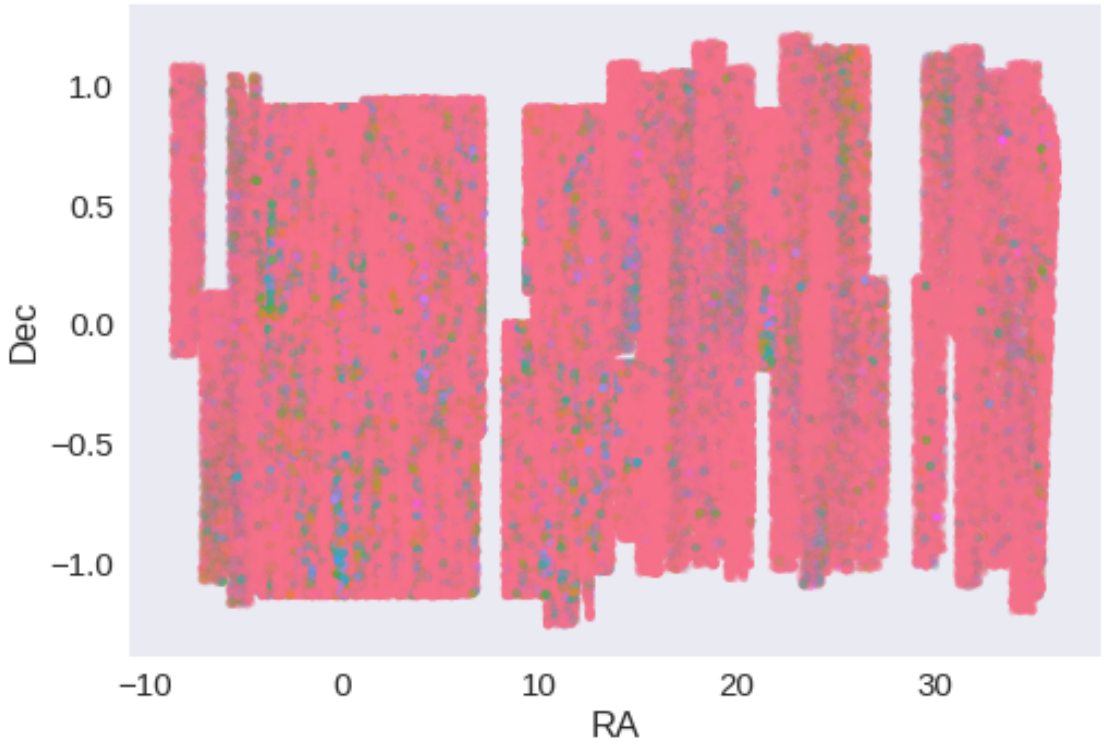
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.09985838245256673 arcsec
Dec correction: -0.13517424260163224 arcsec
```


pearsonr = 0.04; p = 3.5e-66
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
194610 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.4_UKIDSS-LAS

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of UKIRT Infrared Deep Sky Survey / Large Area Survey (UKIDSS/LAS)

Information about UKIDSS can be found at http://www.ukidss.org/surveys/surveys.html
The catalogue comes from `dmu0_UKIDSS-LAS`.
In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The magnitude for each band in aperture 3 (2 arcsec).
- The hall magnitude is described as the total magnitude.

J band magnitudes are available in two eopchs. We take the first arbitrarily.
The magnitudes are "*Vega like*". The AB offsets are given by Hewett *et al.* (2016):

Band	AB offset
Y	0.634
J	0.938
H	1.379
K	1.900

Each source is associated with an epoch. These range between 2005 and 2007. We take 2006 for the epoch.

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

1.2 I - Column selection

```
WARNING: UnitsWarning: 'RADIANS' did not parse as fits unit: At col 0, Unit 'RADIANS' not suppor


/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

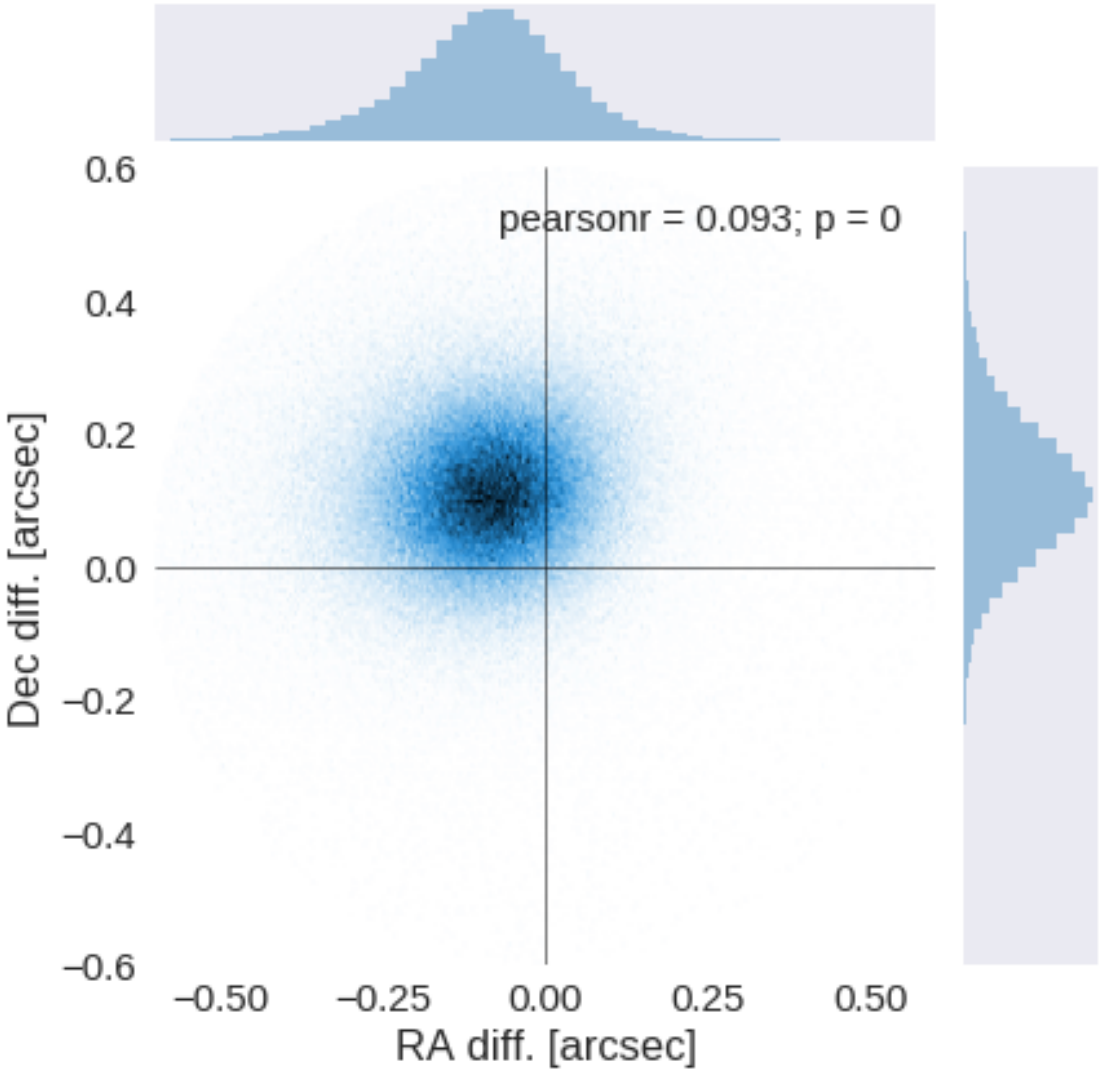
We remove duplicated objects from the input catalogues.

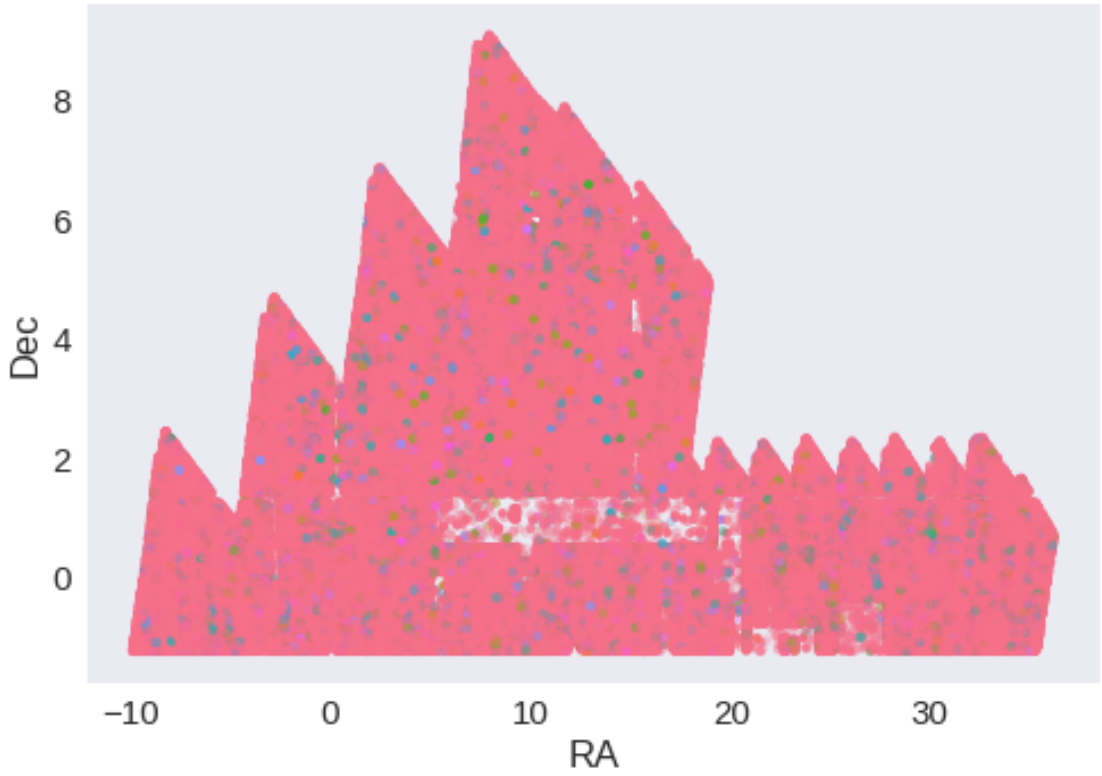
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 3298592 sources.
The cleaned catalogue has 3296181 sources (2411 removed).
The cleaned catalogue has 2394 sources flagged as having been cleaned
```

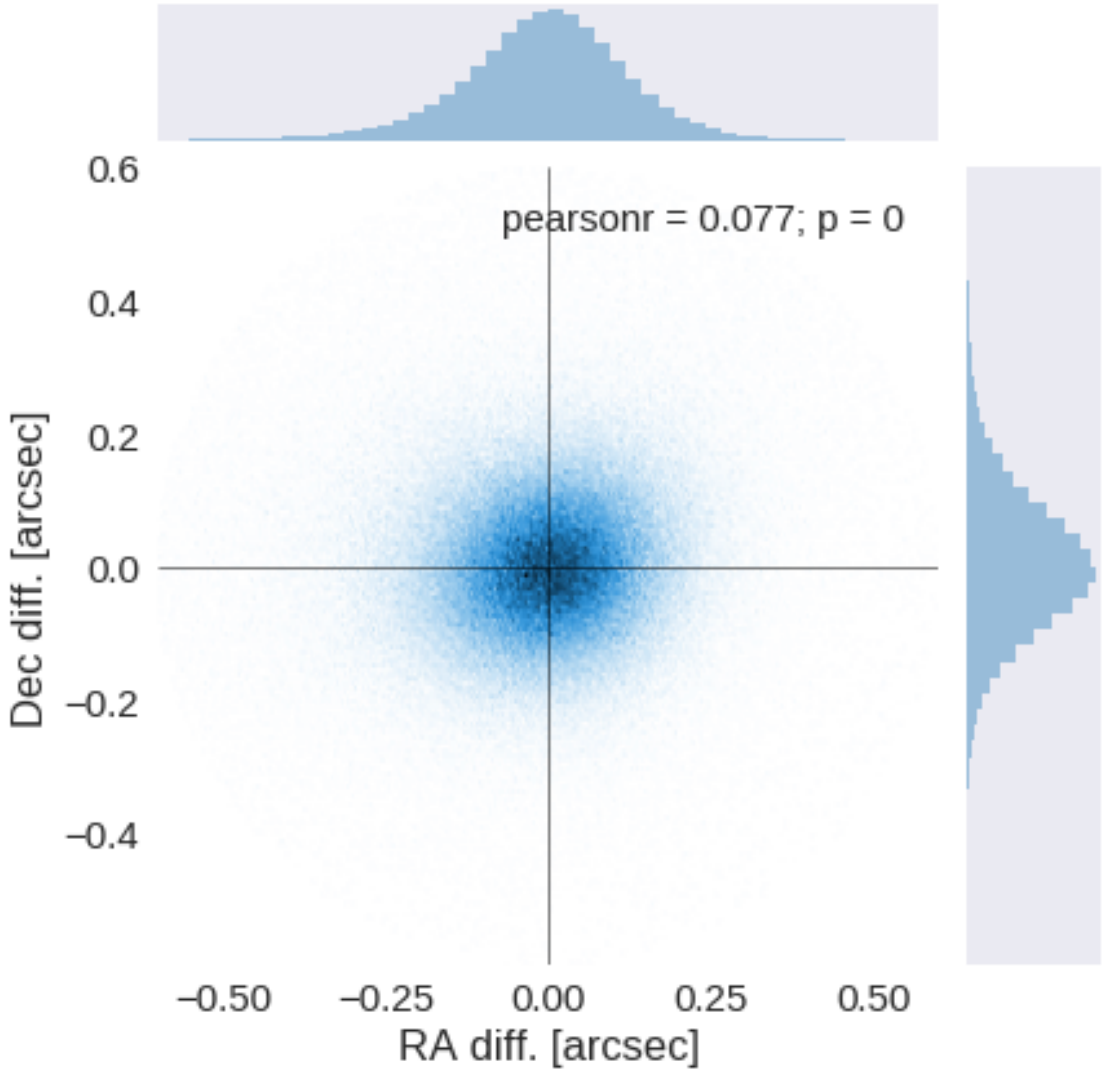
1.4 III - Astrometry correction

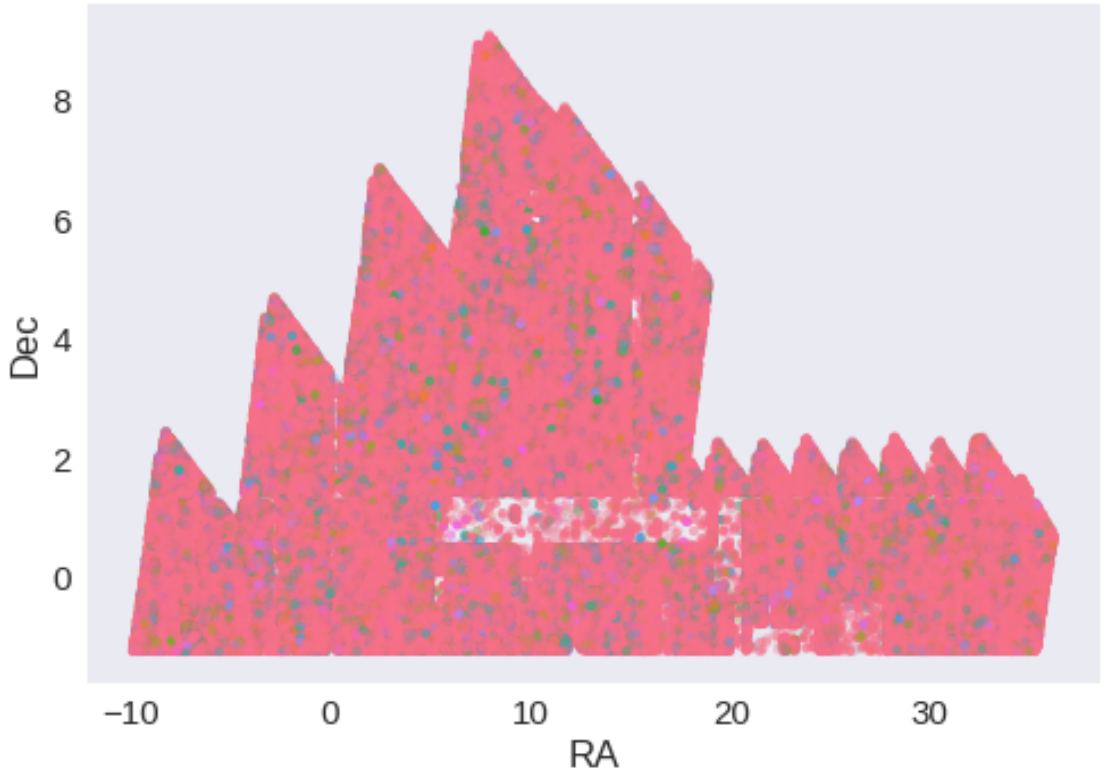
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.093; p = 0
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.50
−0.25
0.00
0.25
0.50
RA diff. [arcsec]




```
RA correction: 0.08633676337694851 arcsec
Dec correction: -0.1104300686126436 arcsec
```


pearsonr = 0.077; p = 0
0.6
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.50
−0.25
0.00
0.25
0.50
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
438850 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.5_PanSTARRS-3SS

January 18, 2018

1 Herschel Stripe 82 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

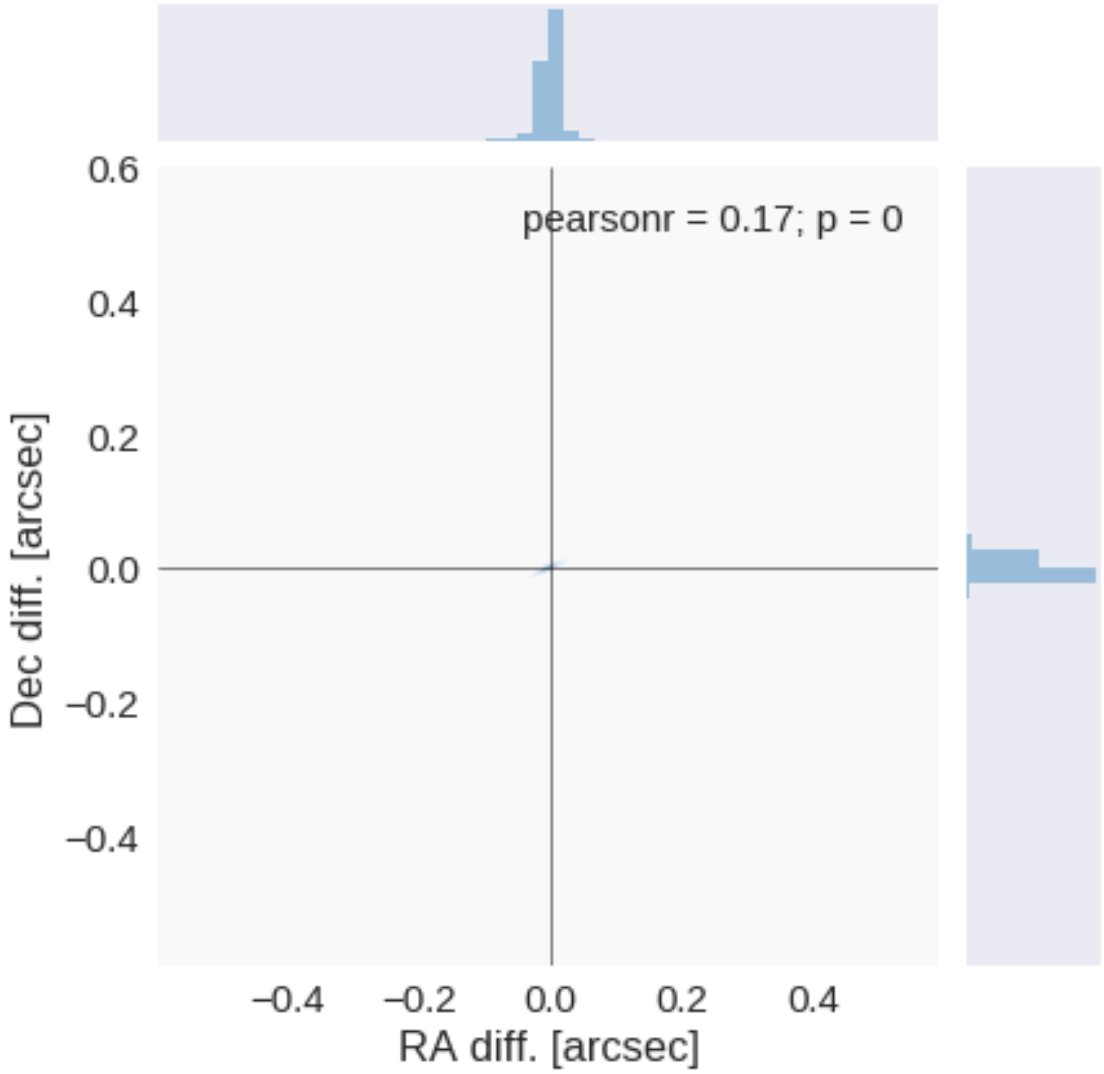
We remove duplicated objects from the input catalogues.

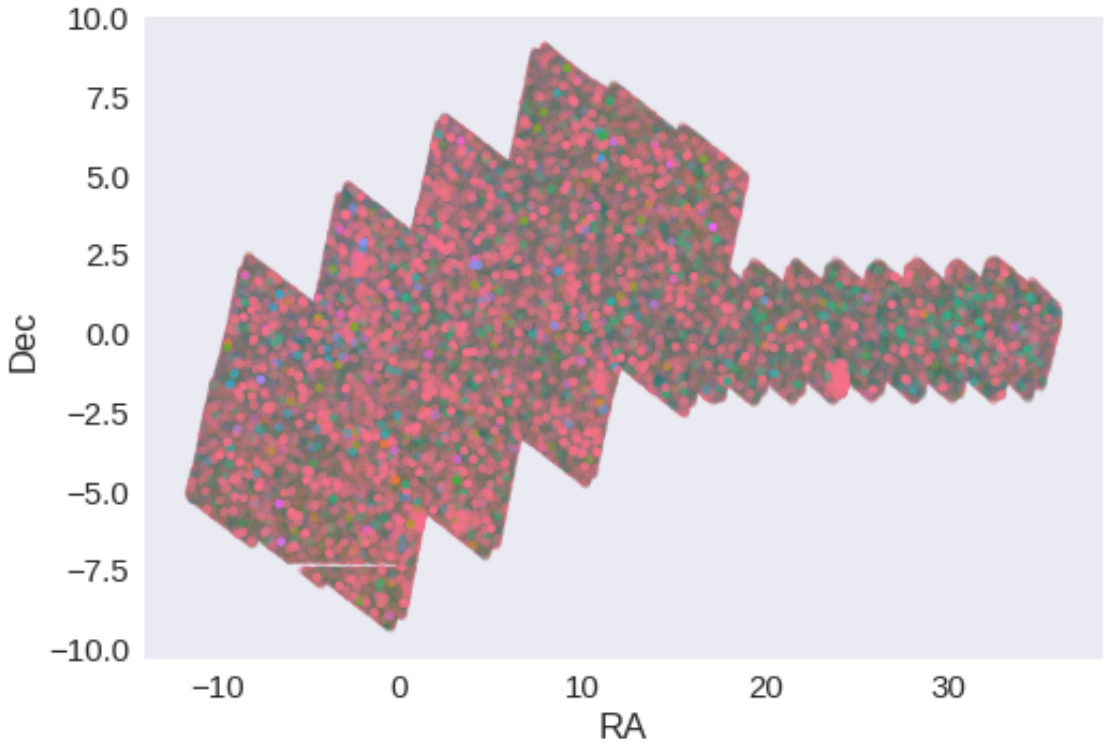
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 6797876 sources.
The cleaned catalogue has 6795065 sources (2811 removed).
The cleaned catalogue has 2810 sources flagged as having been cleaned
```

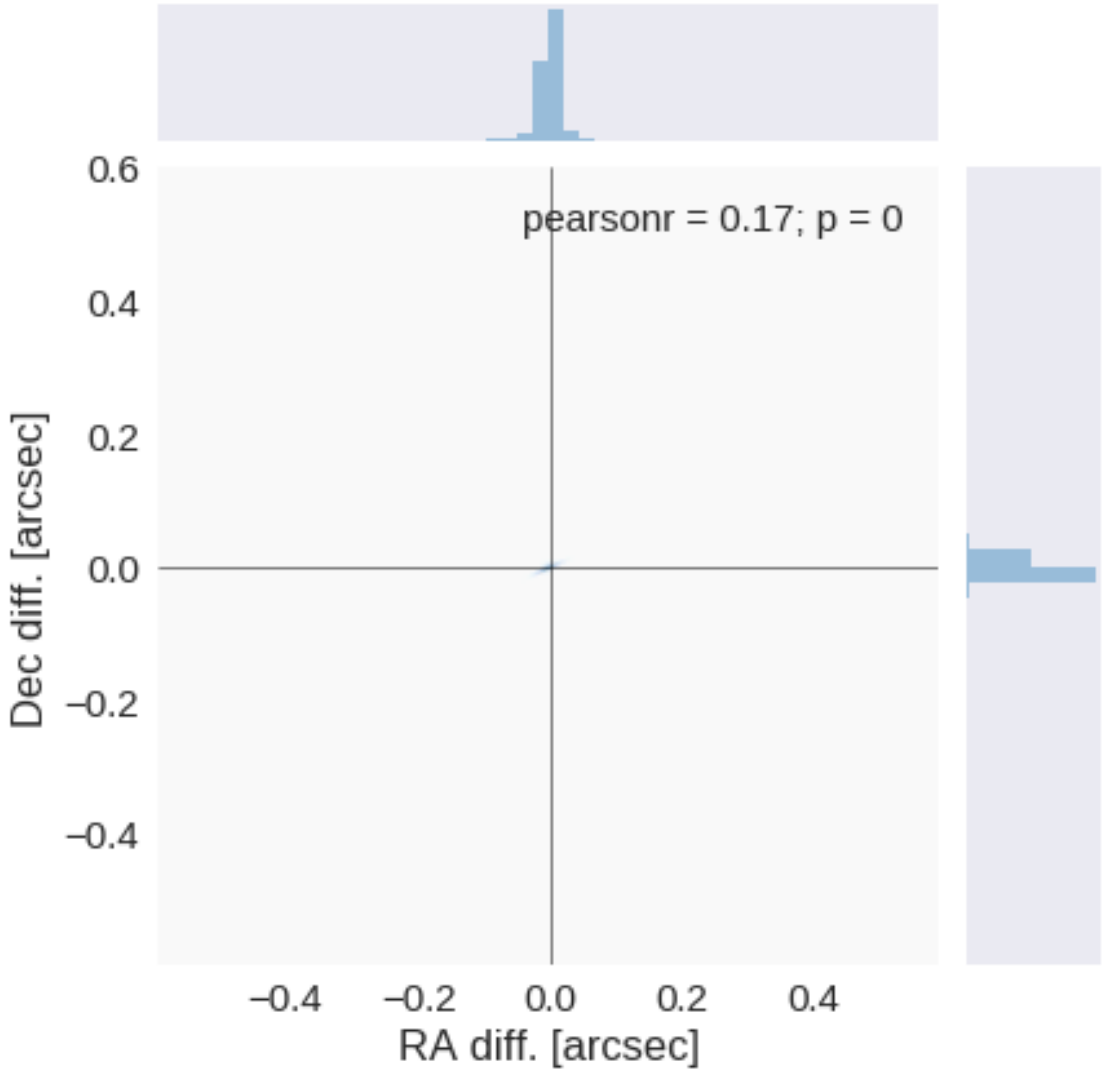
1.4 III - Astrometry correction

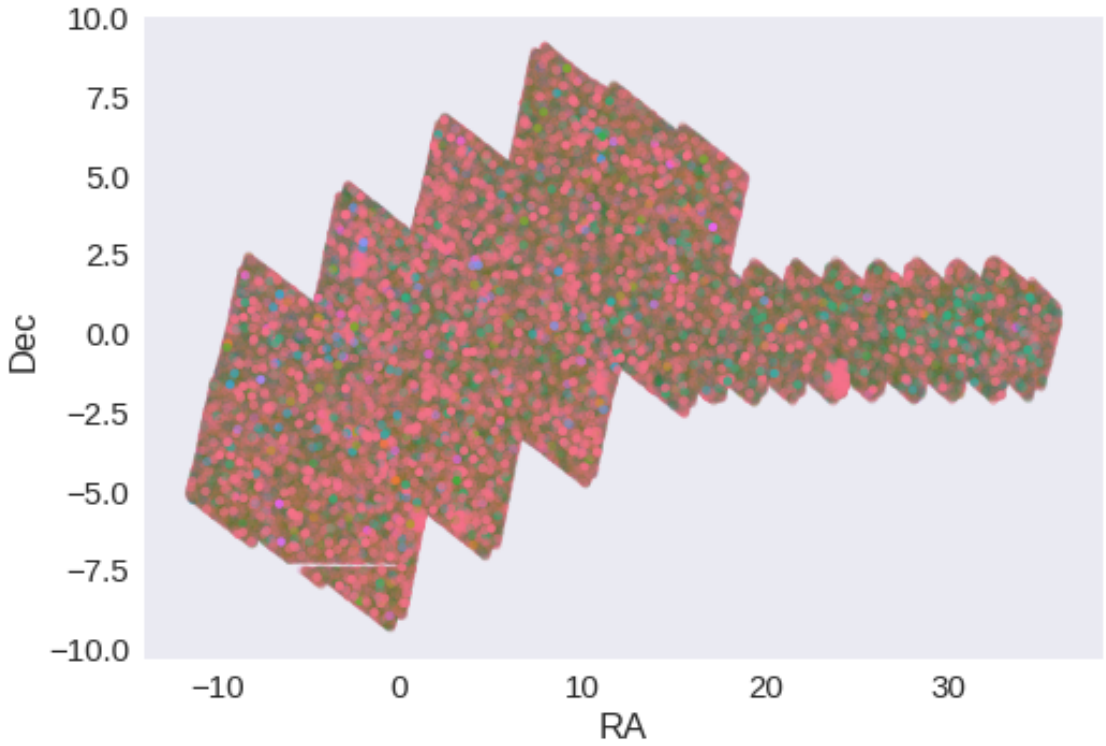
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.0001763459522408084 arcsec
Dec correction: -0.0009540056027157462 arcsec
```


pearsonr = 0.17; p = 0
0.6
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
881634 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.6_SHELA

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of Spitzer SHELA data

The Spitzer/HETDEX Exploratory Large-Area (SHELA) survey covers ~24 sq. deg at 3.6 and 4.5 microns. The Spitzer/SHELA catalogues are available in `dmu0_SHELA`.

In the catalouge, we keep:

- The internal identifier;
- The position;
- The fluxes in 4 arcsecond apertures;
- The "auto" flux;

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

1.2 I - Column selection

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:76: RuntimeWarning: invalid value enco
  magnitudes = 2.5 * (23 - np.log10(fluxes)) - 48.6
```

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

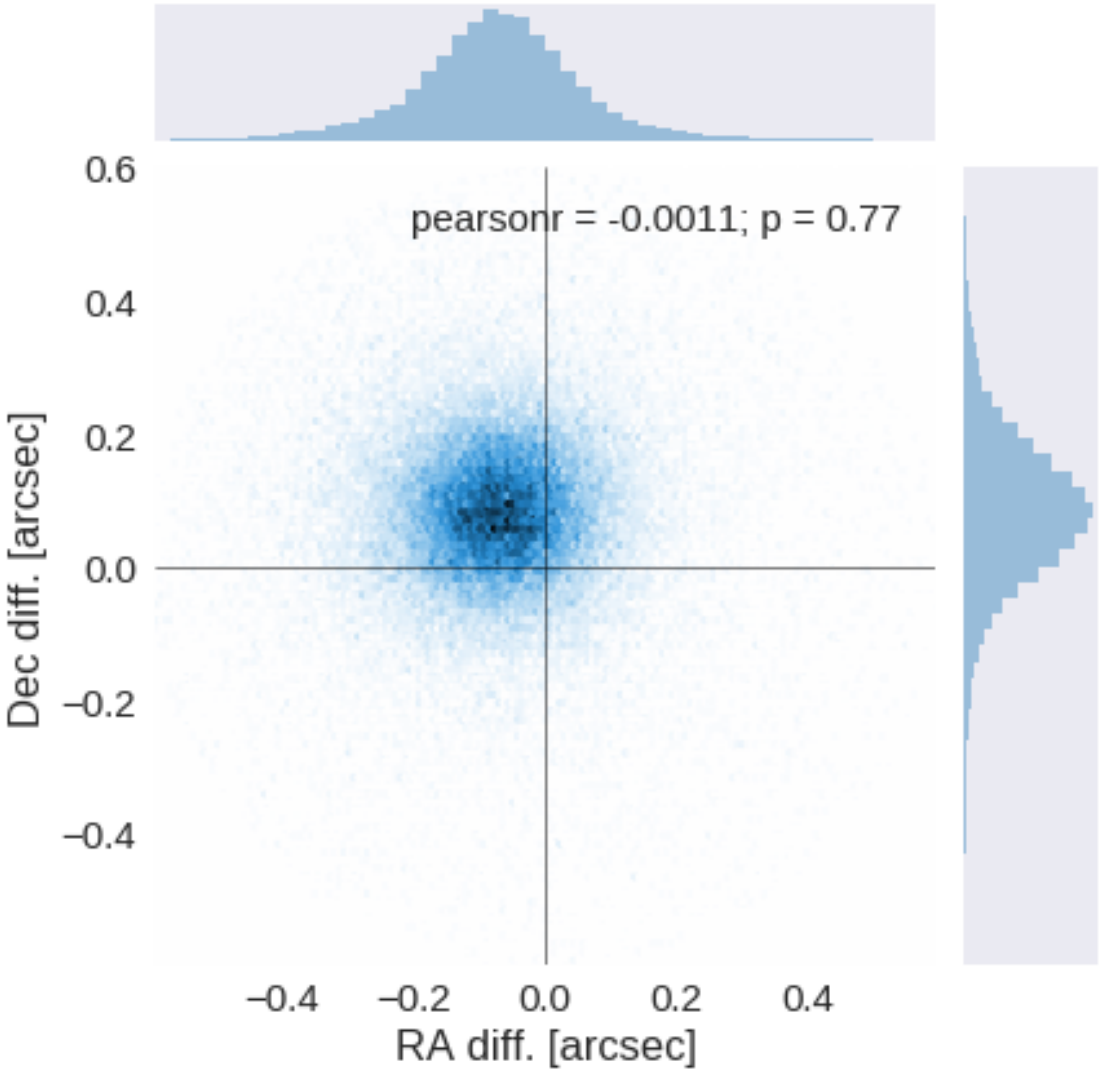
1.3 II - Removal of duplicated sources

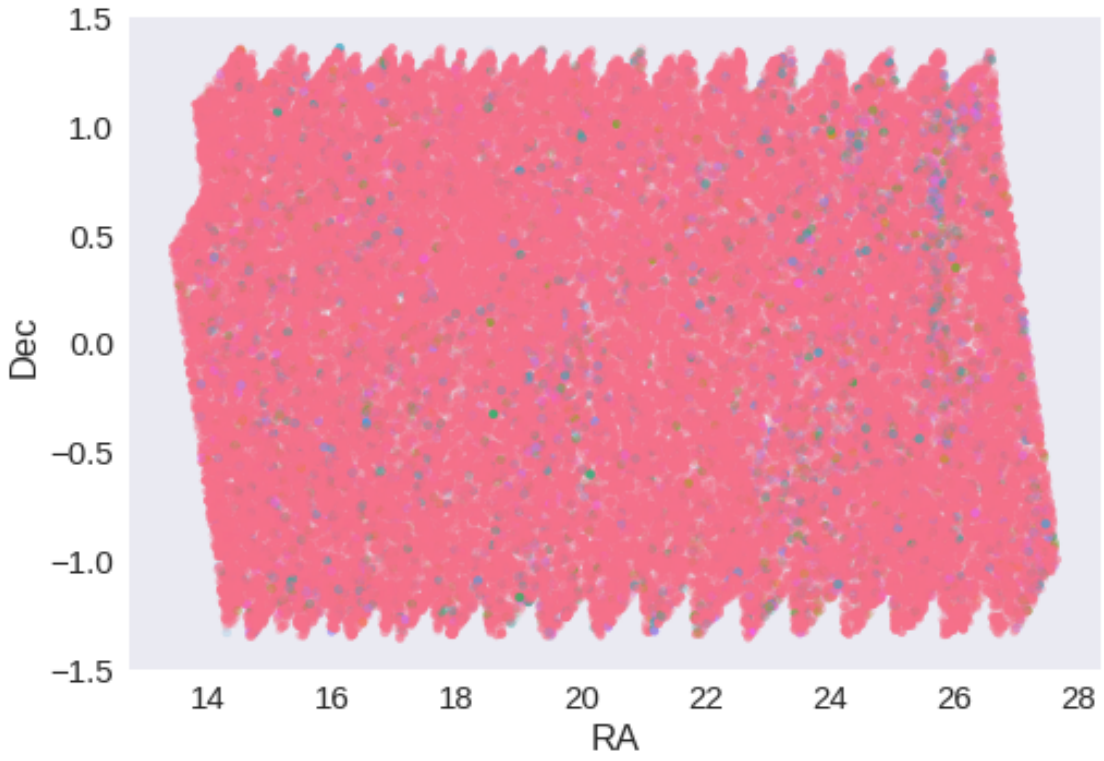
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 2294786 sources.
The cleaned catalogue has 2294786 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

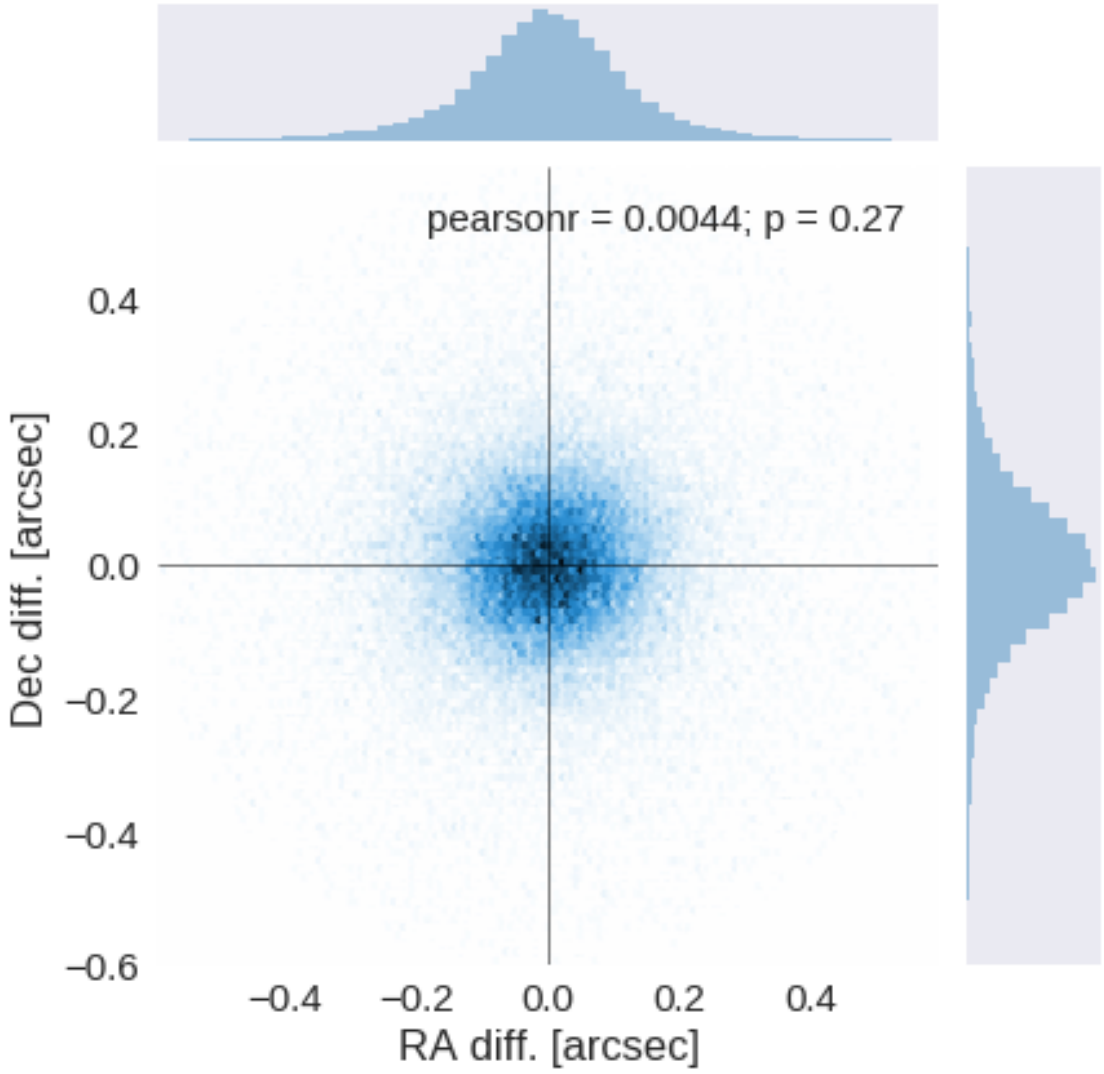
1.4 III - Astrometry correction

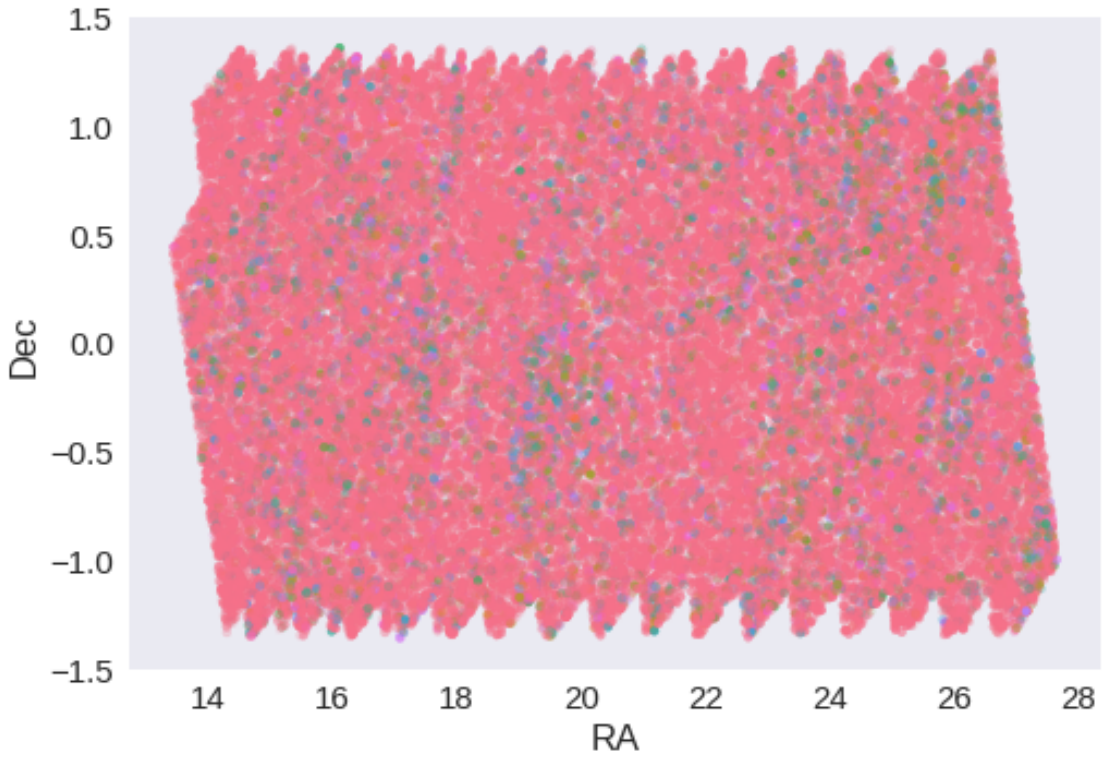
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.0011; p = 0.77
0.6
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]




```
RA correction: 0.07131256496677452 arcsec
Dec correction: -0.08313942358052495 arcsec
```


pearsonr = 0.0044; p = 0.27
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
68747 sources flagged.
```

1.6 V - Flagging objects near bright stars

1.7 VI - Saving to disk

1.7_SpIES

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of Spitzer SpIES data

The Spitzer catalogues are available in `dmu0_SpIES`. Lucia told that the magnitudes are aperture corrected.

In the catalouge, we keep:

- The internal identifier (this one is only in HeDaM data);
- The position;
- The fluxes in aperture 2 (1.9 arcsec);
- The "auto" flux (which seems to be the Kron flux);
- The stellarity in each band

TODO: Epoch?

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

1.2 I - Column selection

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:76: RuntimeWarning: invalid value enco
  magnitudes = 2.5 * (23 - np.log10(fluxes)) - 48.6
```

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

1.3 II - Removal of duplicated sources

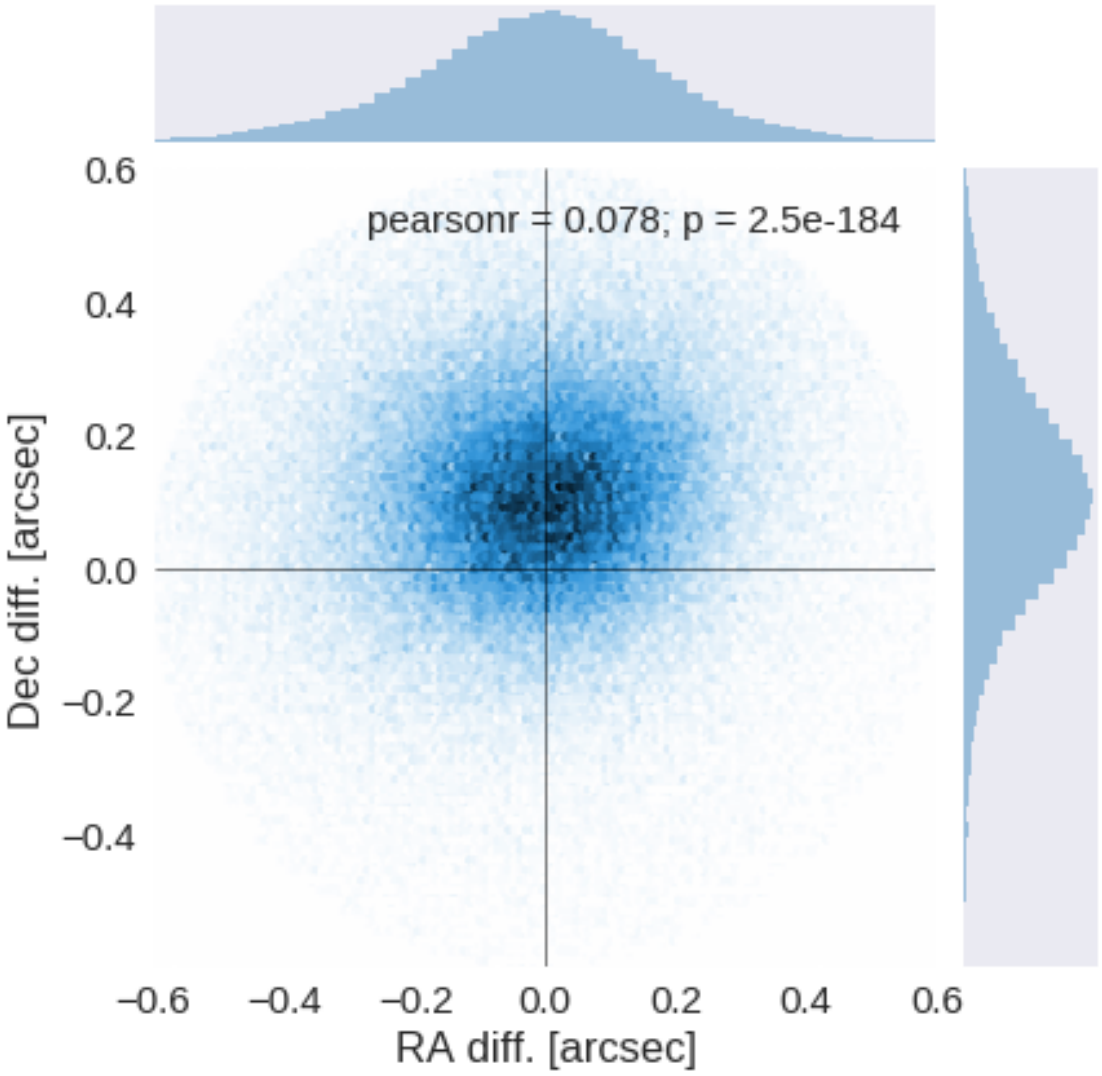
We remove duplicated objects from the input catalogues.

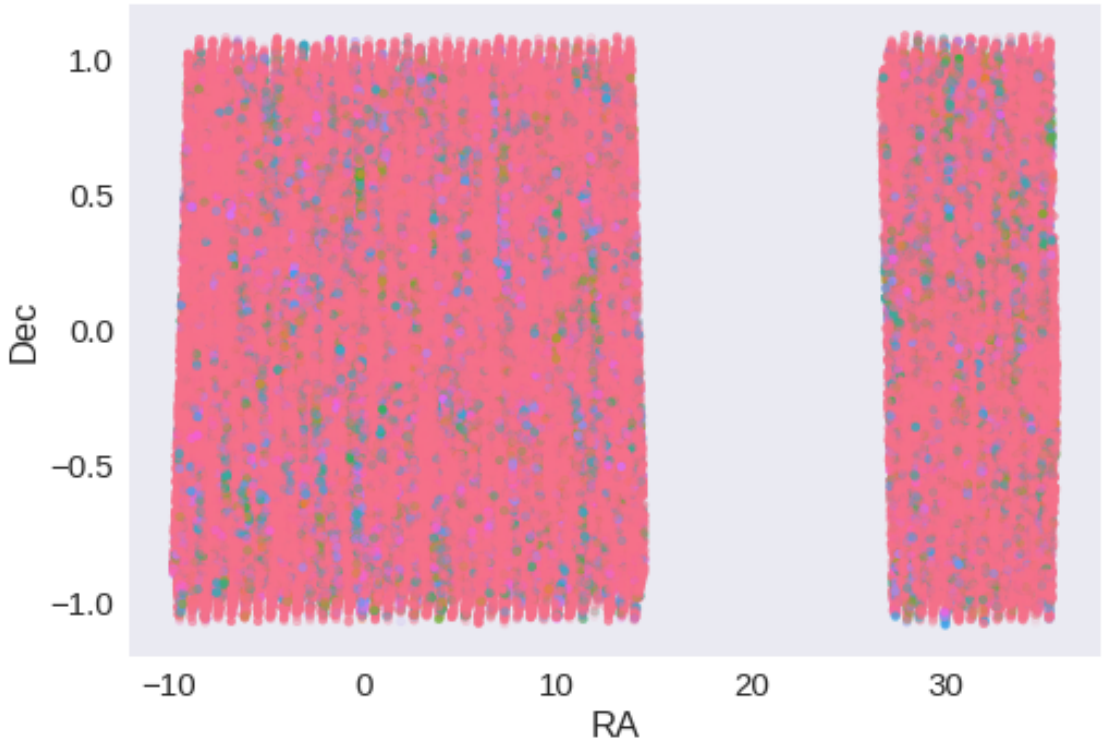
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 3365594 sources.
The cleaned catalogue has 3365594 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

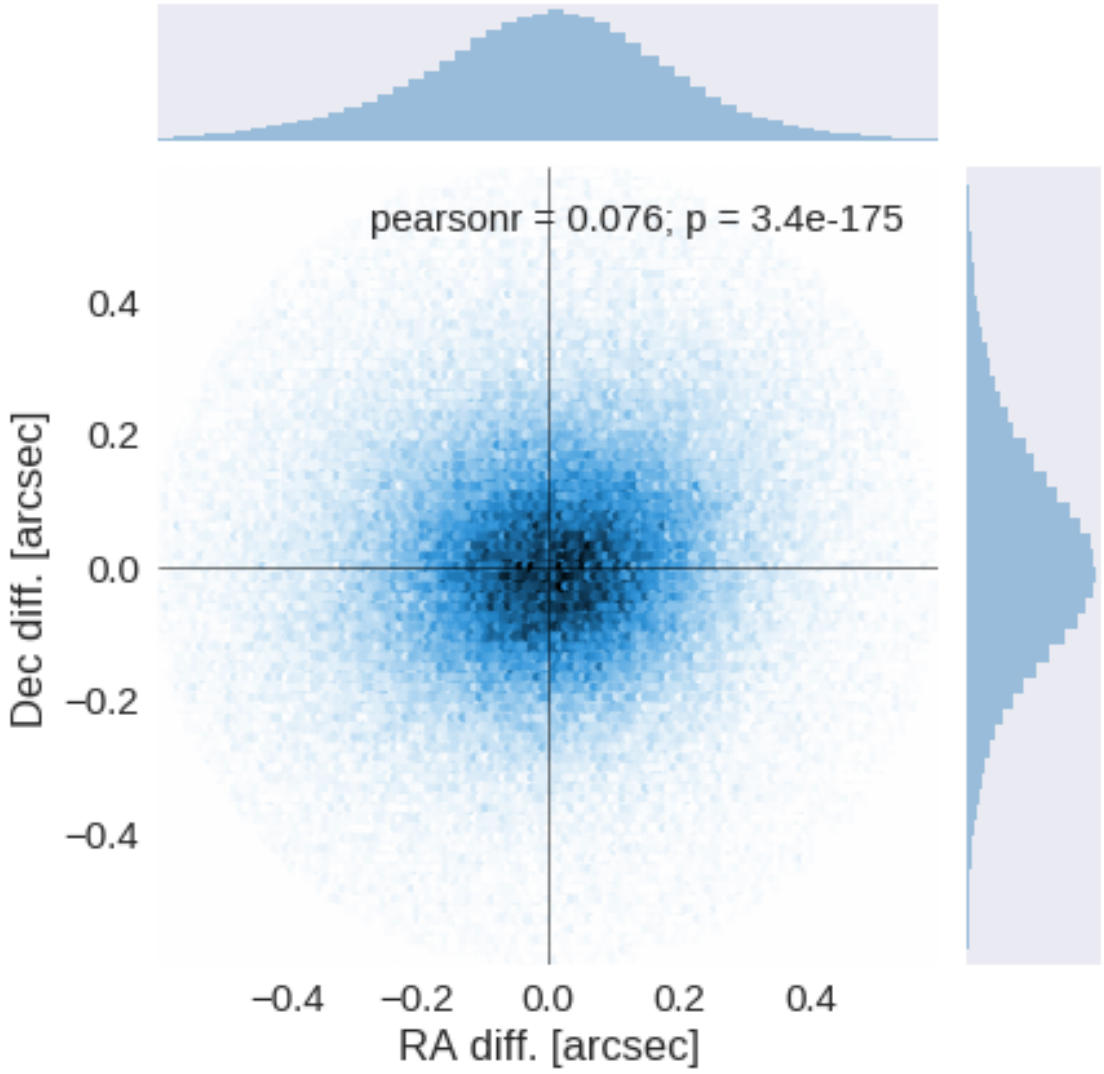
1.4 III - Astrometry correction

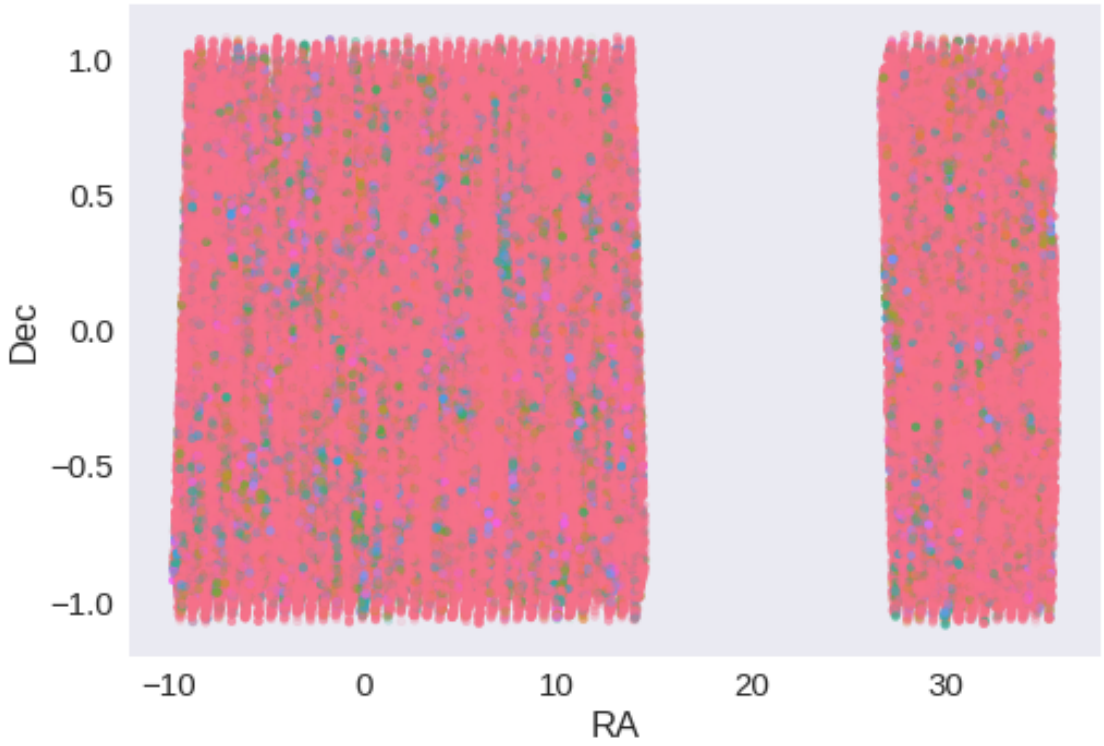
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.007062192162266001 arcsec
Dec correction: -0.10853834623070213 arcsec
```


pearsonr = 0.076; p = 3.4e-175
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
148366 sources flagged.
```

1.6 V - Flagging objects near bright stars

1.7 VI - Saving to disk

1.8.1_DECaLS

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of DECam Legacy Survey data

This catalogue comes from `dmu0_DECaLS`.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The u, g, r, i, z, Y aperture magnitude (2″);
- The u, g, r, i, z, Y kron fluxes and magnitudes.

We check for all ugrizY then only take bands for which there are measurements

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


WARNING: UnitsWarning: '1/deg^2' did not parse as fits unit: Numeric factor not supported by FIT
WARNING: UnitsWarning: 'nanomaggy' did not parse as fits unit: At col 0, Unit 'nanomaggy' not su
WARNING: UnitsWarning: '1/nanomaggy^2' did not parse as fits unit: Numeric factor not supported
WARNING: UnitsWarning: '1/arcsec^2' did not parse as fits unit: Numeric factor not supported by
```

1.2 I - Aperture correction

To compute aperture correction we need to dertermine two parametres: the target aperture and the range of magnitudes for the stars that will be used to compute the correction.

Target aperture: To determine the target aperture, we simulate a curve of growth using the provided apertures and draw two figures:

- The evolution of the magnitudes of the objects by plotting on the same plot aperture number vs the mean magnitude.
- The mean gain (loss when negative) of magnitude is each aperture compared to the previous (except for the first of course).

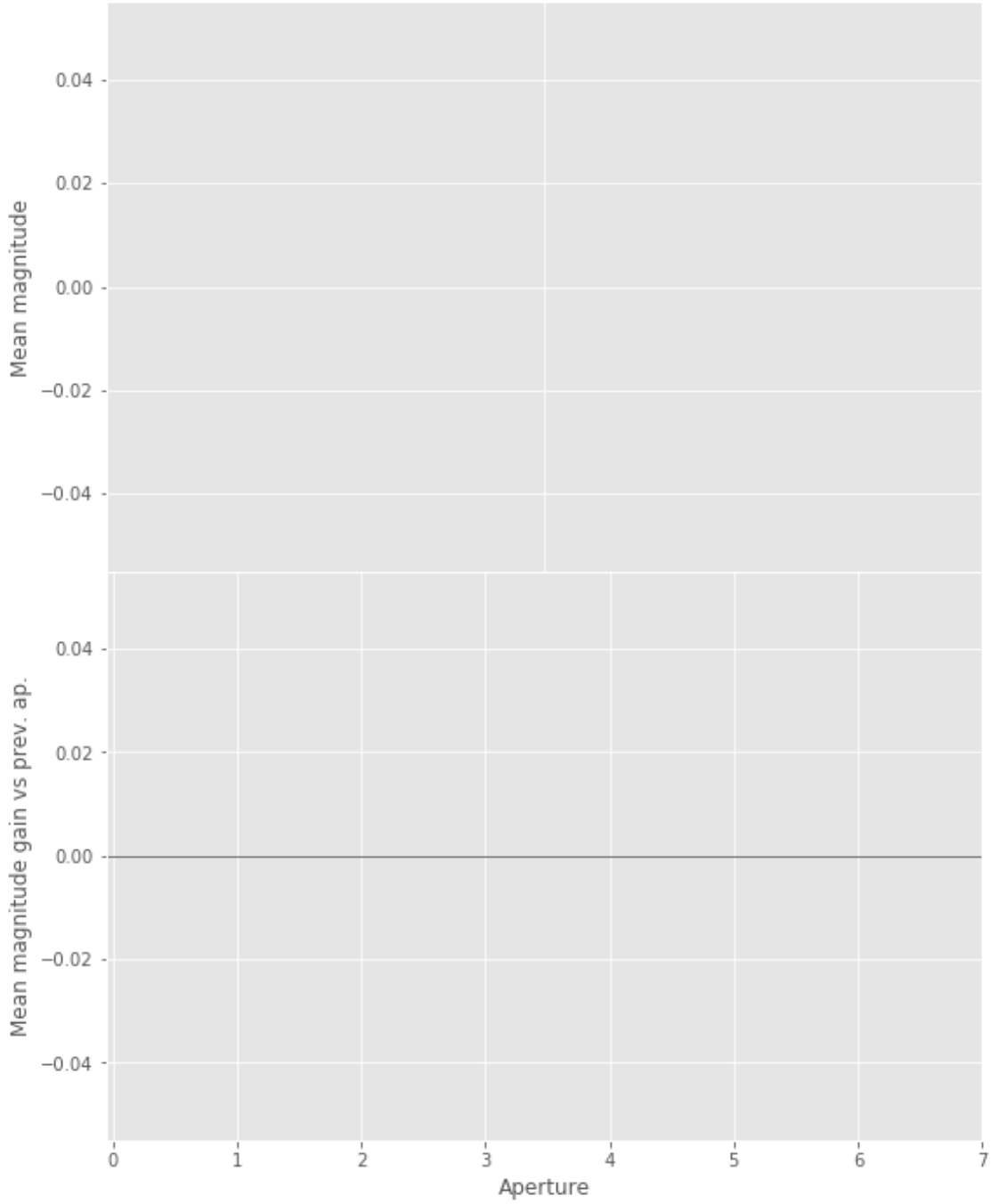
As target aperture, we should use the smallest (i.e. less noisy) aperture for which most of the flux is captures.

Magnitude range: To know what limits in aperture to use when doing the aperture correction, we plot for each magnitude bin the correction that is computed and its RMS. We should then use the wide limits (to use more stars) where the correction is stable and with few dispersion.

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

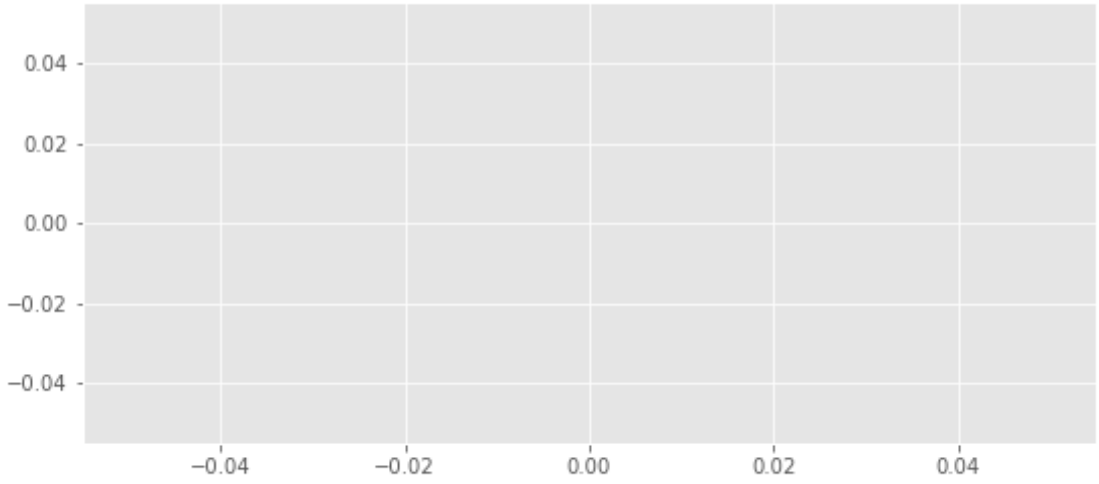
1.2.1 1.a u band

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
```

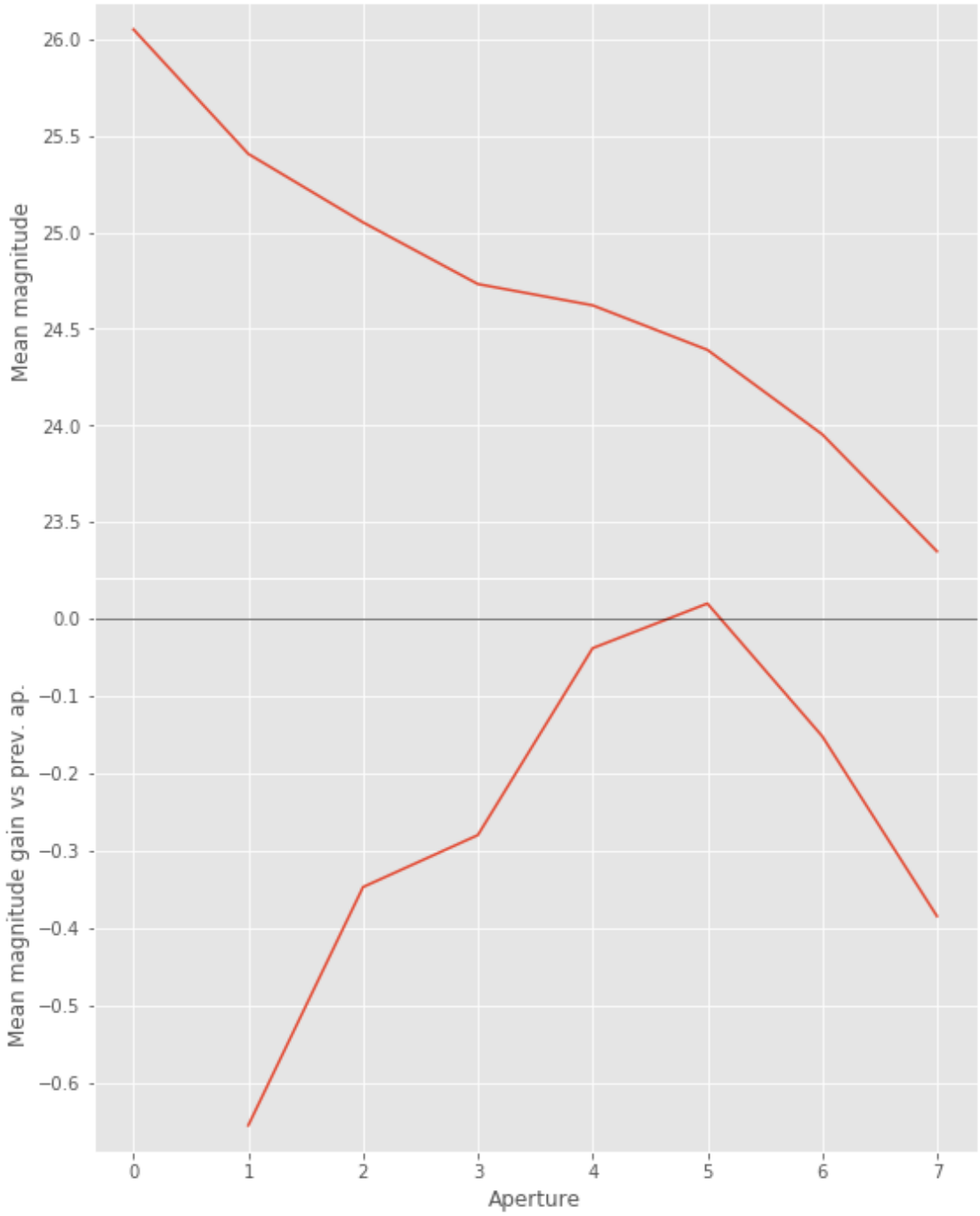


u band is all nan

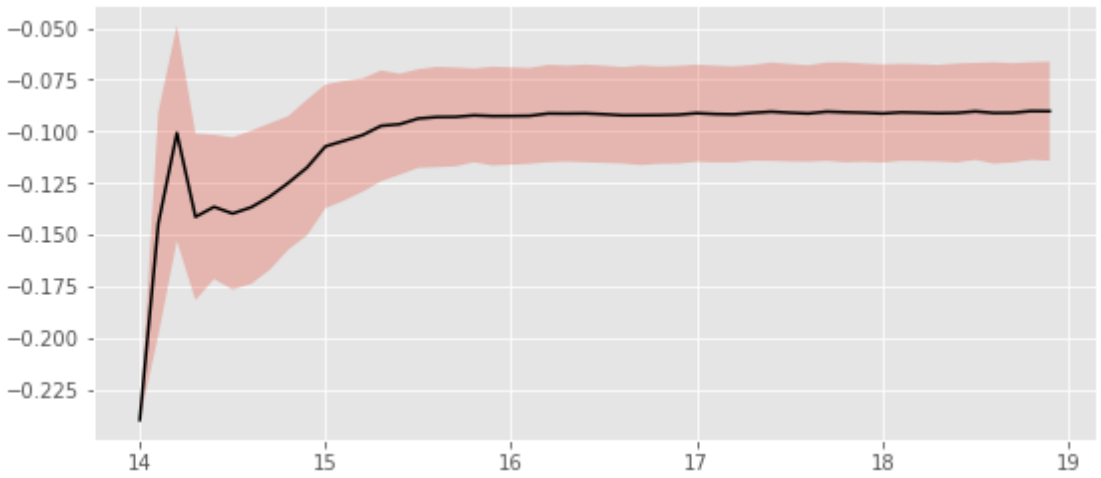
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


0.04
0.02
0.00
−0.02
−0.04
−0.04
−0.02
0.00
0.02
0.04

1.2.2 I.a - g band



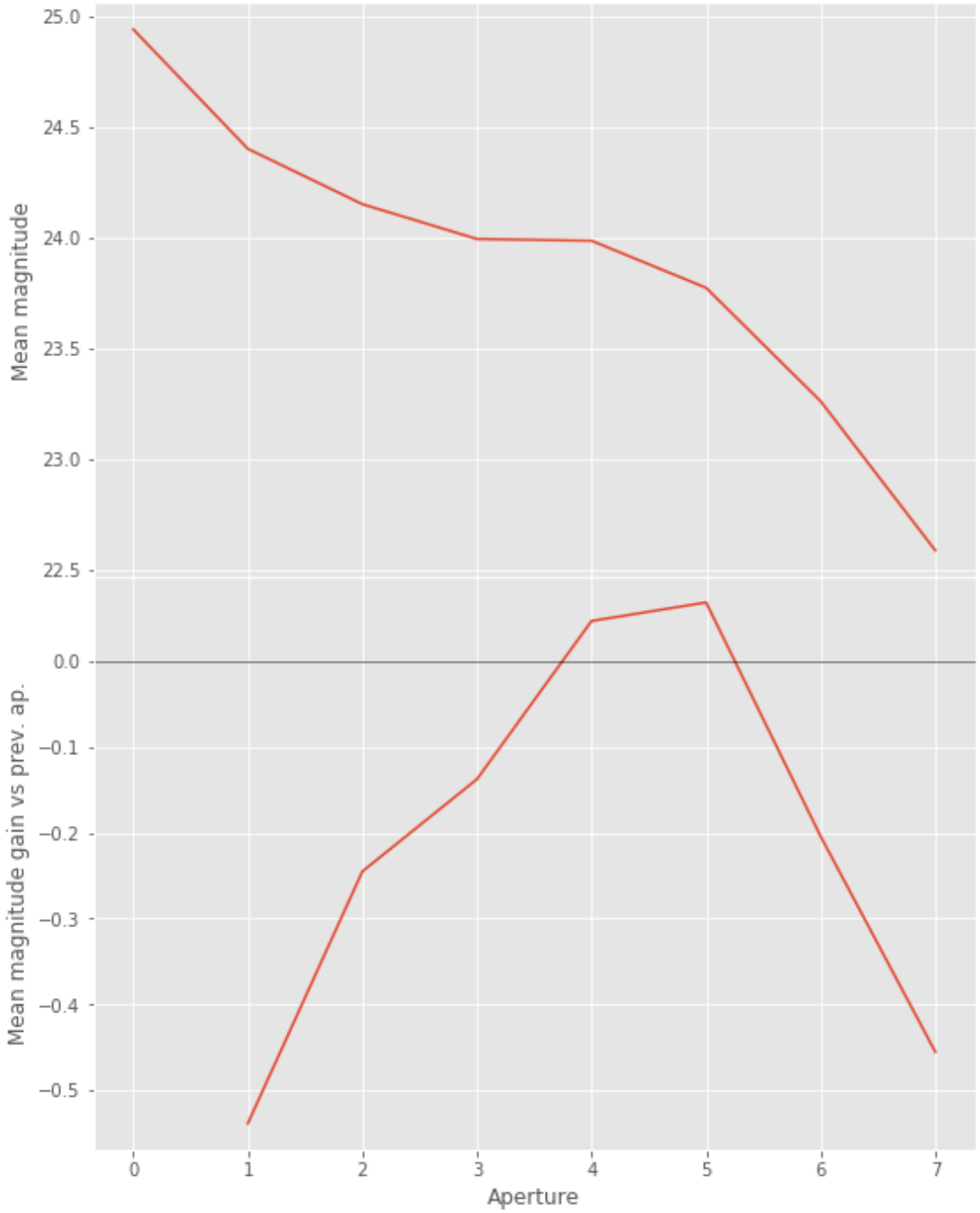
We will use aperture 5 as target.



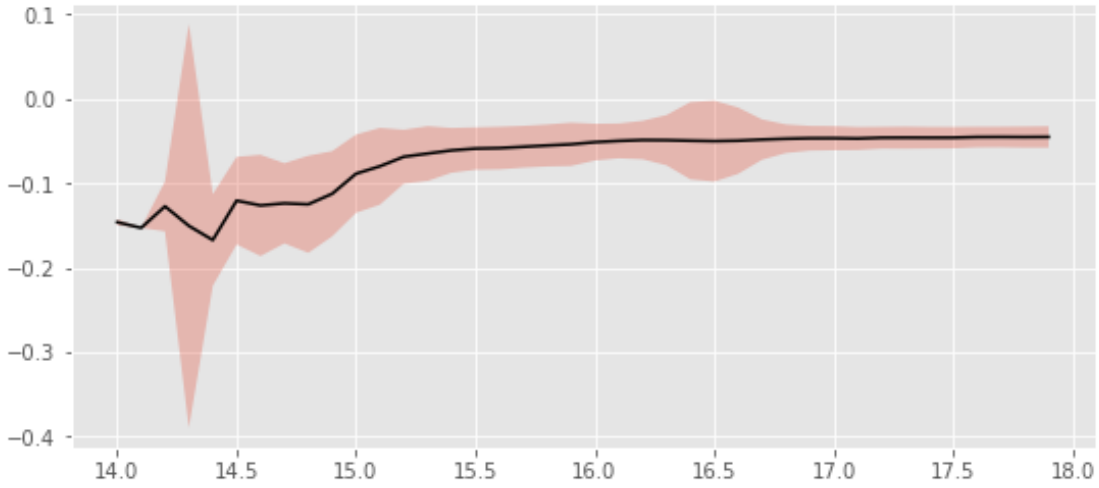
We will use magnitudes between 16.0 and 19.0

```
Aperture correction for g band:
Correction: -0.0911514235846056
Number of source used: 151015
RMS: 0.02364389650630337
```

1.2.3 I.b - r band



We will use aperture 5 as target.

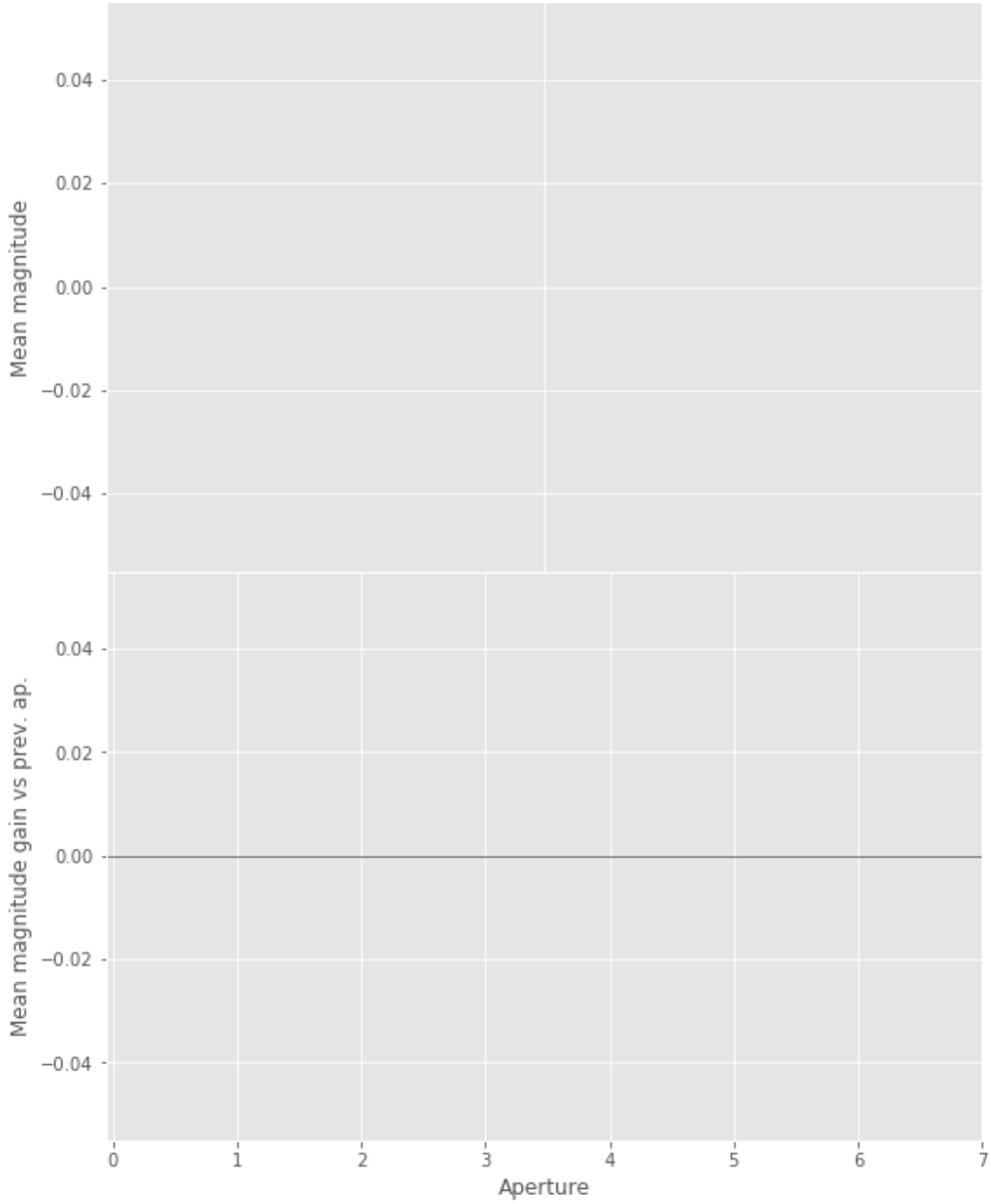


We use magnitudes between 16.0 and 18.0.

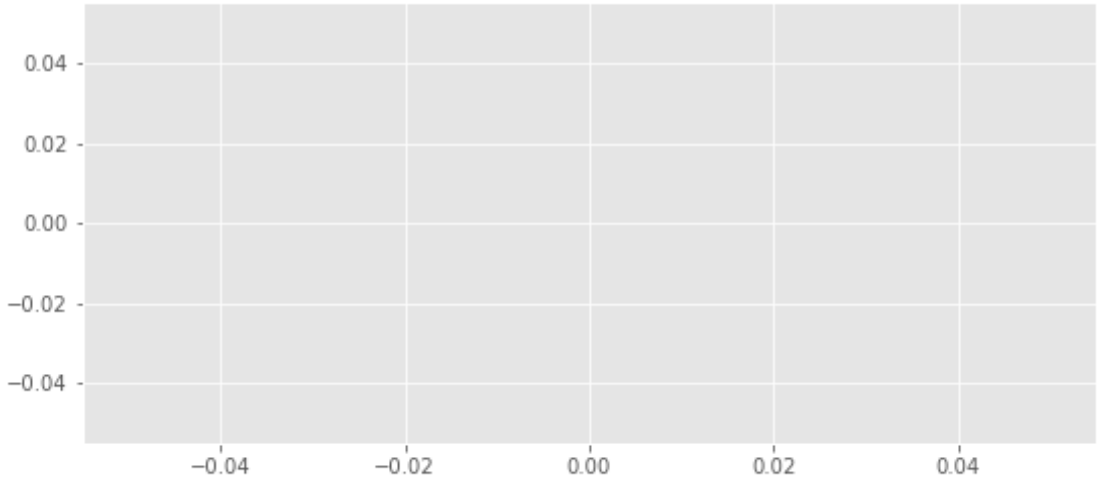
```
Aperture correction for r band:
Correction: -0.0465021447682048
Number of source used: 149159
RMS: 0.013977600173198289
```

1.2.4 I.d - i band

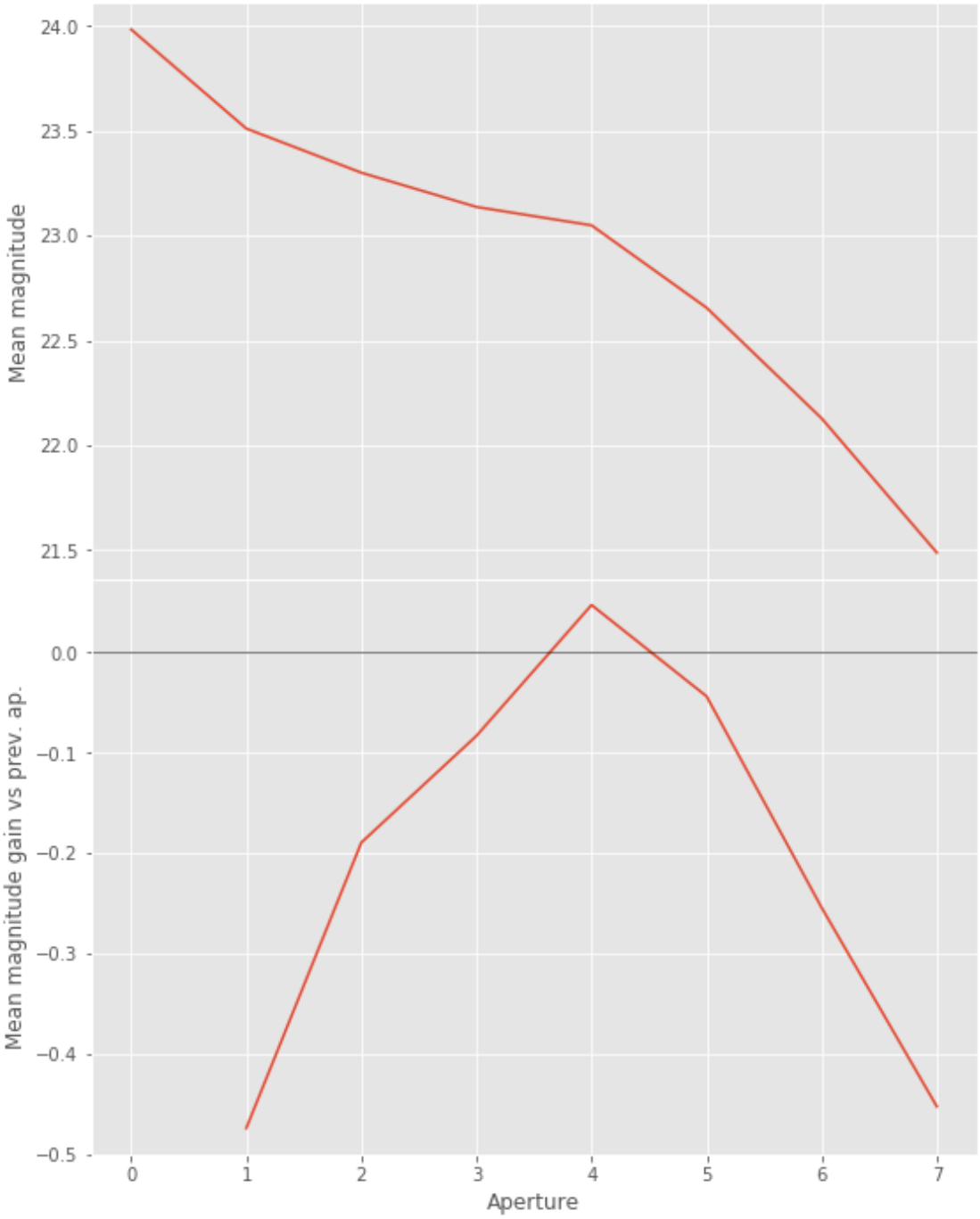
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
```



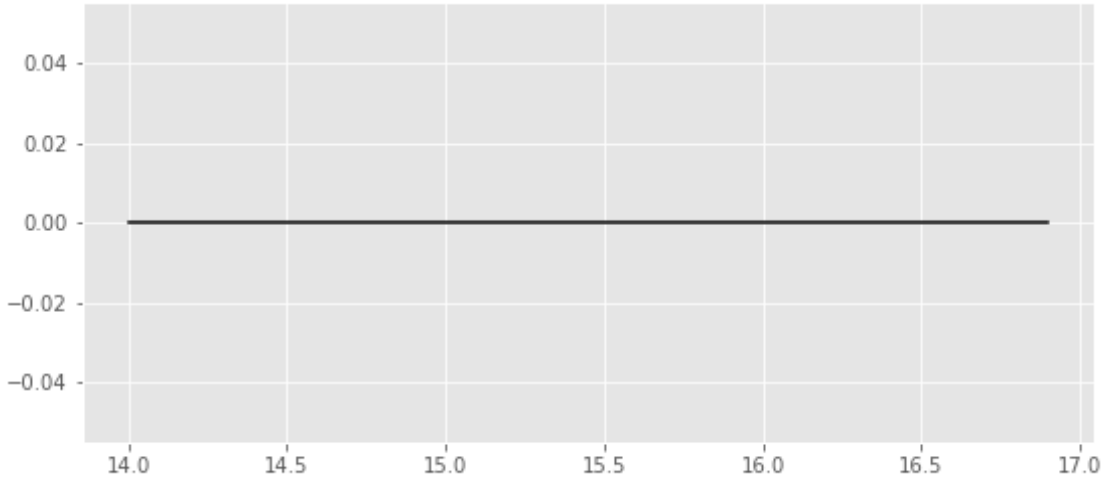

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


0.04
0.02
0.00
−0.02
−0.04
−0.04
−0.02
0.00
0.02
0.04

1.2.5 I.e - z band



We will use aperture 4 as target.

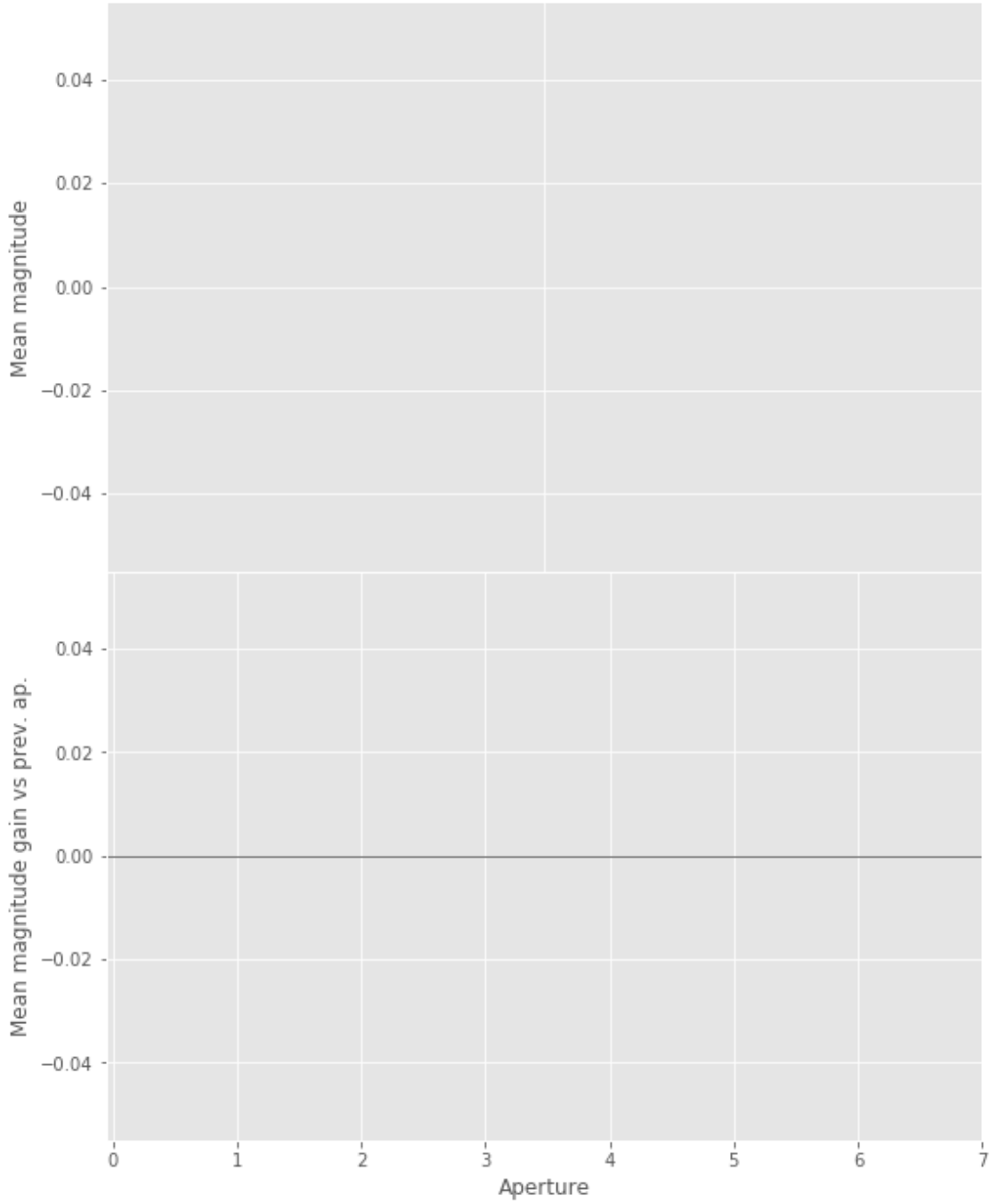


We use magnitudes between 16.0 and 17.5.

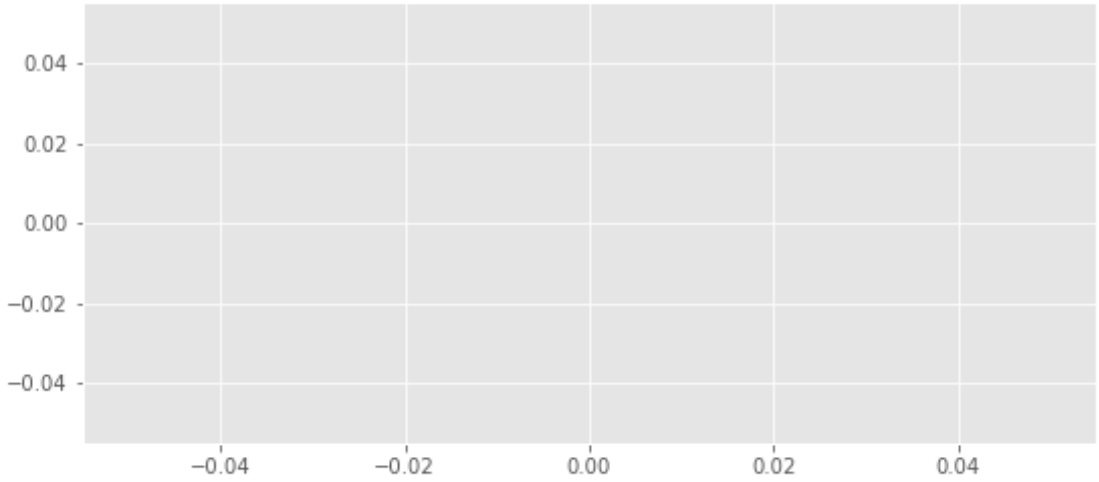
```
Aperture correction for z band:
Correction: 0.0
Number of source used: 176285
RMS: 0.0
```

1.2.6 I.f - Y band

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
```




```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```



1.3 II - Stellarity

Legacy Survey does not provide a 0 to 1 stellarity so we replace items flagged as PSF accpording to the following table:

$$P(star) = \frac{\prod_i P(star)_i}{\prod_i P(star)_i + \prod_i P(galaxy)_i}$$

where i is the band, and with using the same probabilities as UKDISS:

HSC flag	UKIDSS flag	Meaning	P(star)	P(galaxy)	P(noise)	P(saturated)
	-9	Saturated	0.0	0.0	5.0	95.0
	-3	Probable galaxy	25.0	70.0	5.0	0.0
	-2	Probable star	70.0	25.0	5.0	0.0
0	-1	Star	90.0	5.0	5.0	0.0
	0	Noise	5.0	5.0	90.0	0.0
1	+1	Galaxy	5.0	90.0	5.0	0.0

1.4 II - Column selection

```
WARNING: UnitsWarning: '1/deg^2' did not parse as fits unit: Numeric factor not supported by FIT
WARNING: UnitsWarning: 'nanomaggy' did not parse as fits unit: At col 0, Unit 'nanomaggy' not su
WARNING: UnitsWarning: '1/nanomaggy^2' did not parse as fits unit: Numeric factor not supported
WARNING: UnitsWarning: '1/arcsec^2' did not parse as fits unit: Numeric factor not supported by
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:76: RuntimeWarning: invalid value enco
  magnitudes = 2.5 * (23 - np.log10(fluxes)) - 48.6
```

```
Out[27]: <IPython.core.display.HTML object>
```

1.5 III - Removal of duplicated sources

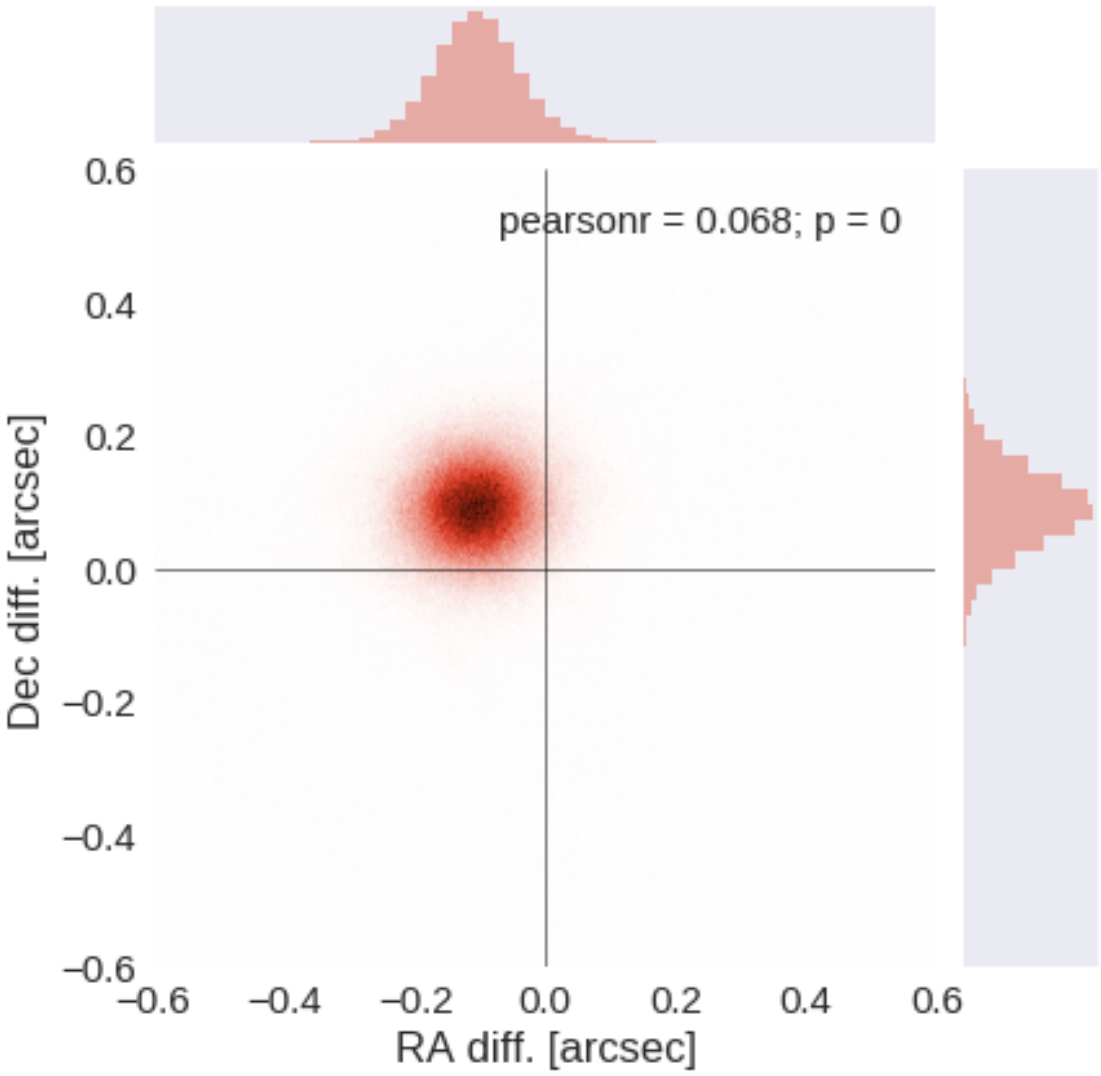
We remove duplicated objects from the input catalogues.

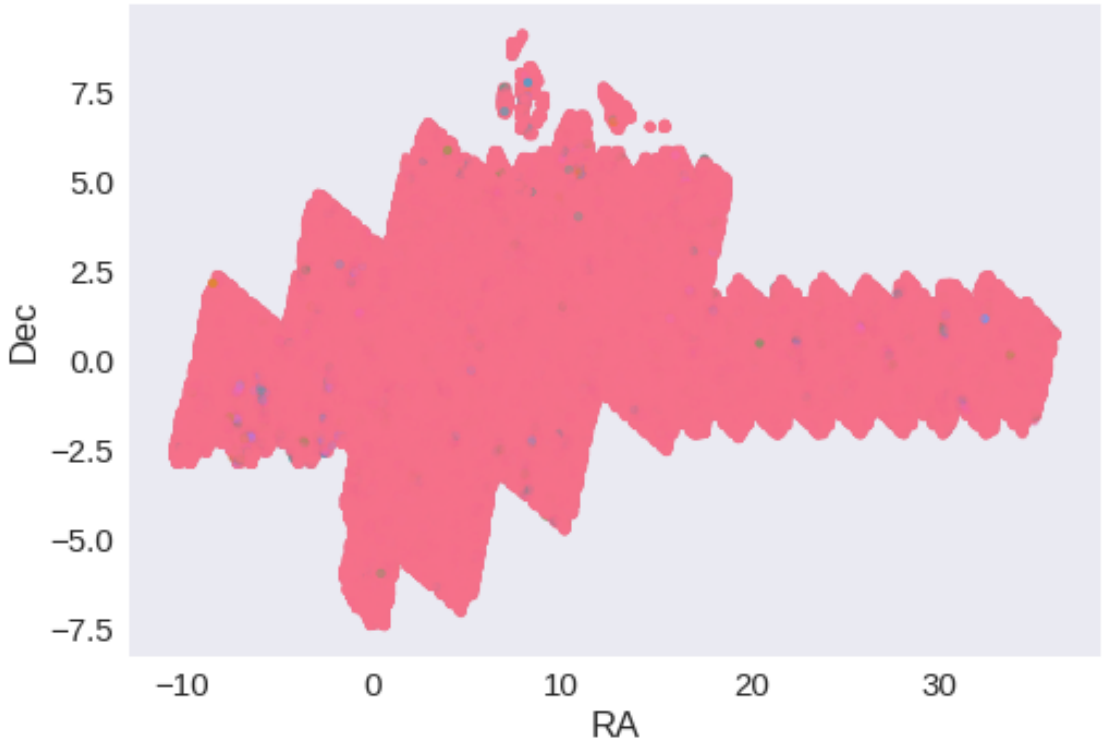
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 24089956 sources.
The cleaned catalogue has 24084781 sources (5175 removed).
The cleaned catalogue has 5169 sources flagged as having been cleaned
```

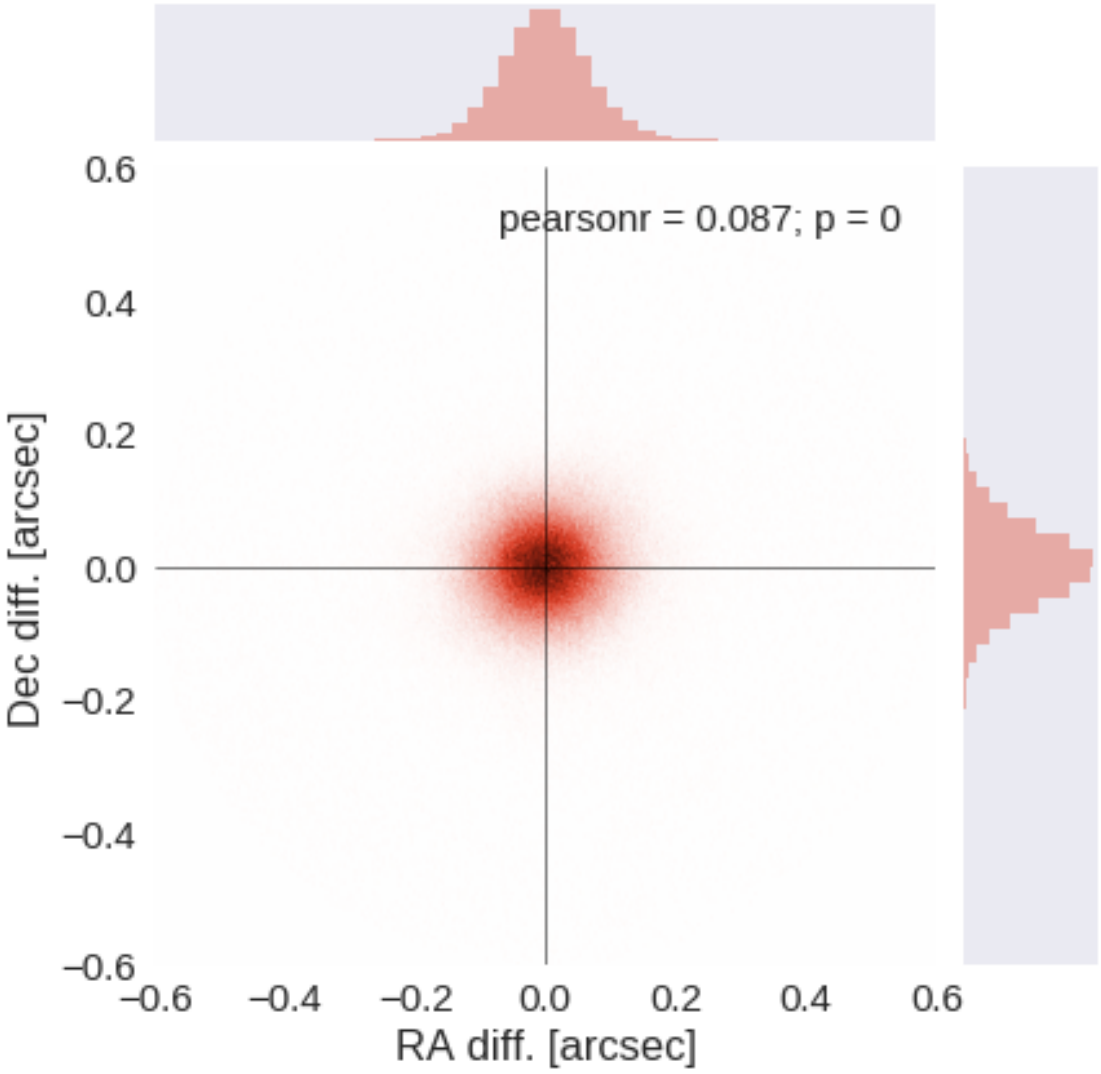
1.6 III - Astrometry correction

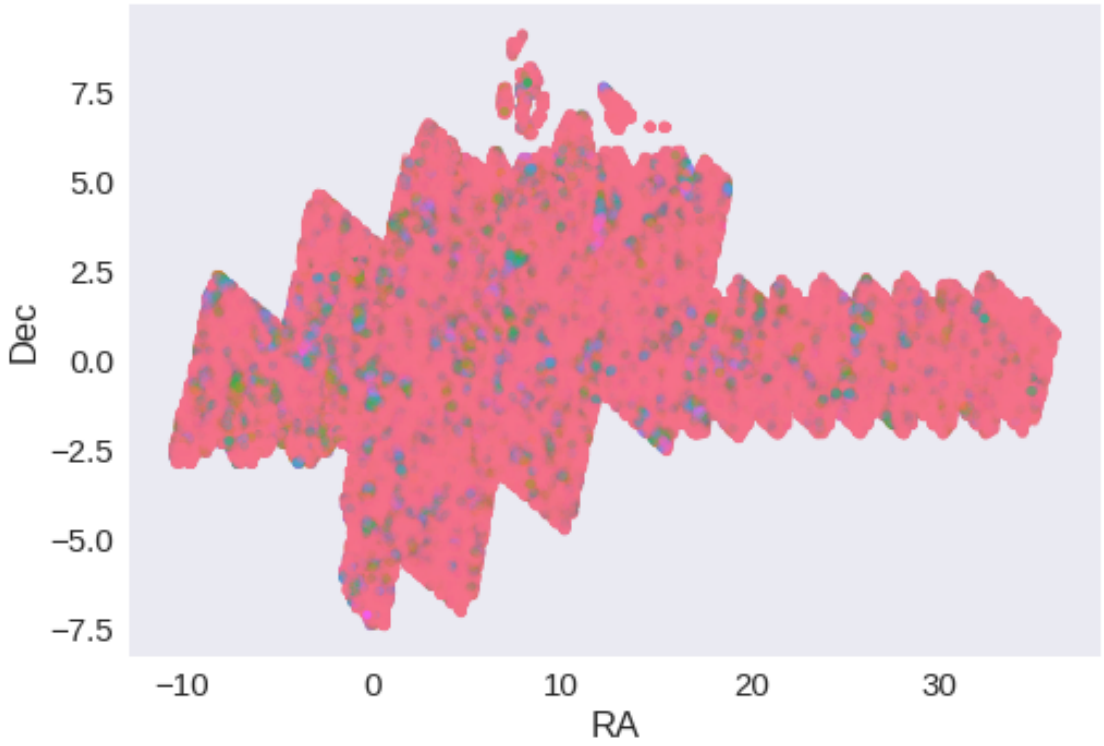
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.068; p = 0
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
RA diff. [arcsec]




```
RA correction: 0.10549986955084023 arcsec
Dec correction: -0.0907548244944989 arcsec
```


pearsonr = 0.087; p = 0
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
RA diff. [arcsec]



1.7 IV - Flagging Gaia objects

```
717665 sources flagged.
```

2 V - Saving to disk

1.8.2_DES

January 18, 2018

1 Herschel-Stripe-82 master catalogue

1.1 Preparation of DES data

Blanco DES catalogue: the catalogue comes from `dmu0_DES`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The G band stellarity;
- The magnitude for each band.
- The auto/kron magnitudes/fluxes to be used as total magnitude.
- The PSF fitted madnitudes/fluxes are used as aperture magnitudes.

We don't know when the maps have been observed. We will take the final observation date as 2017.

```
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

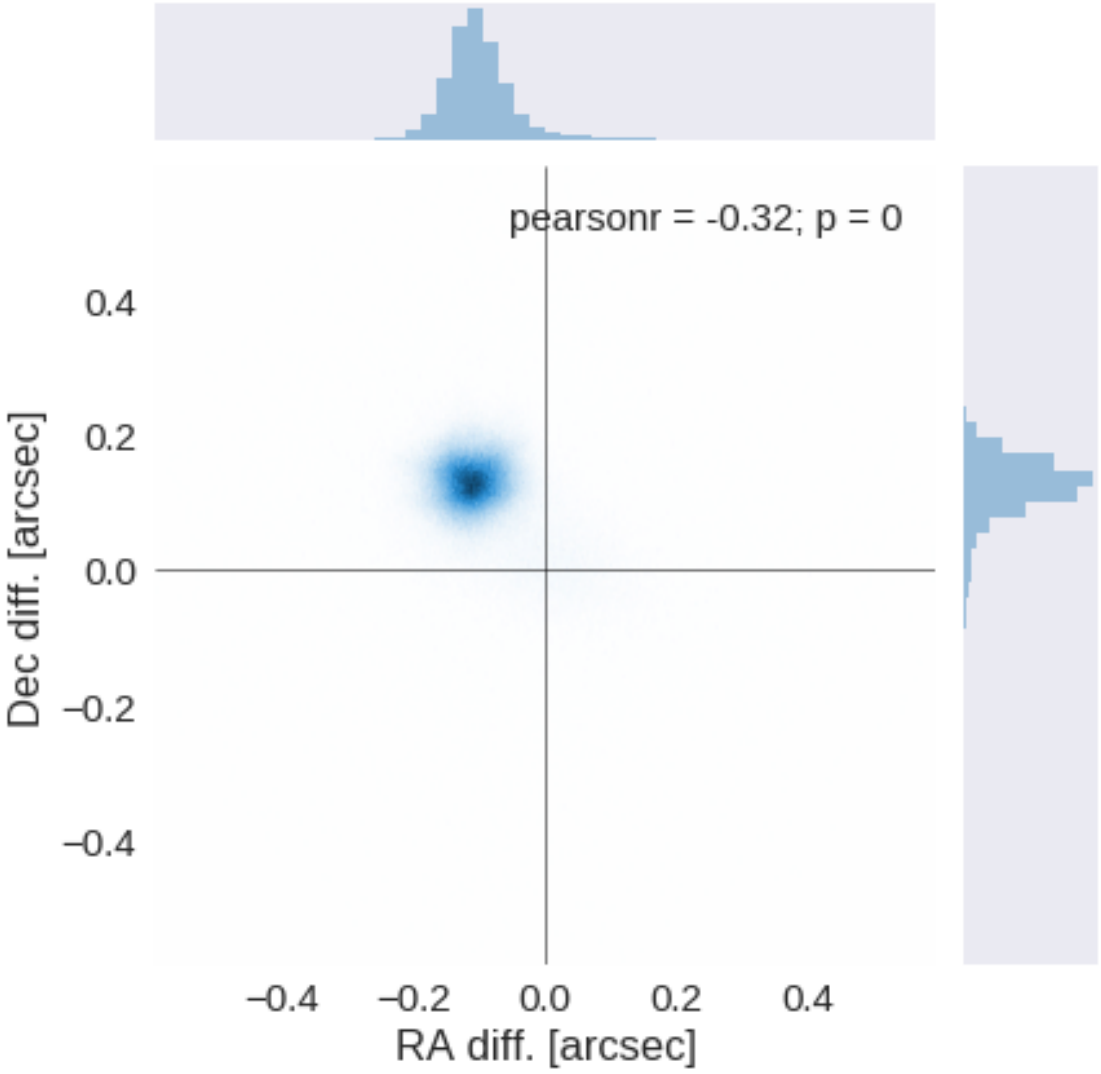
We remove duplicated objects from the input catalogues.

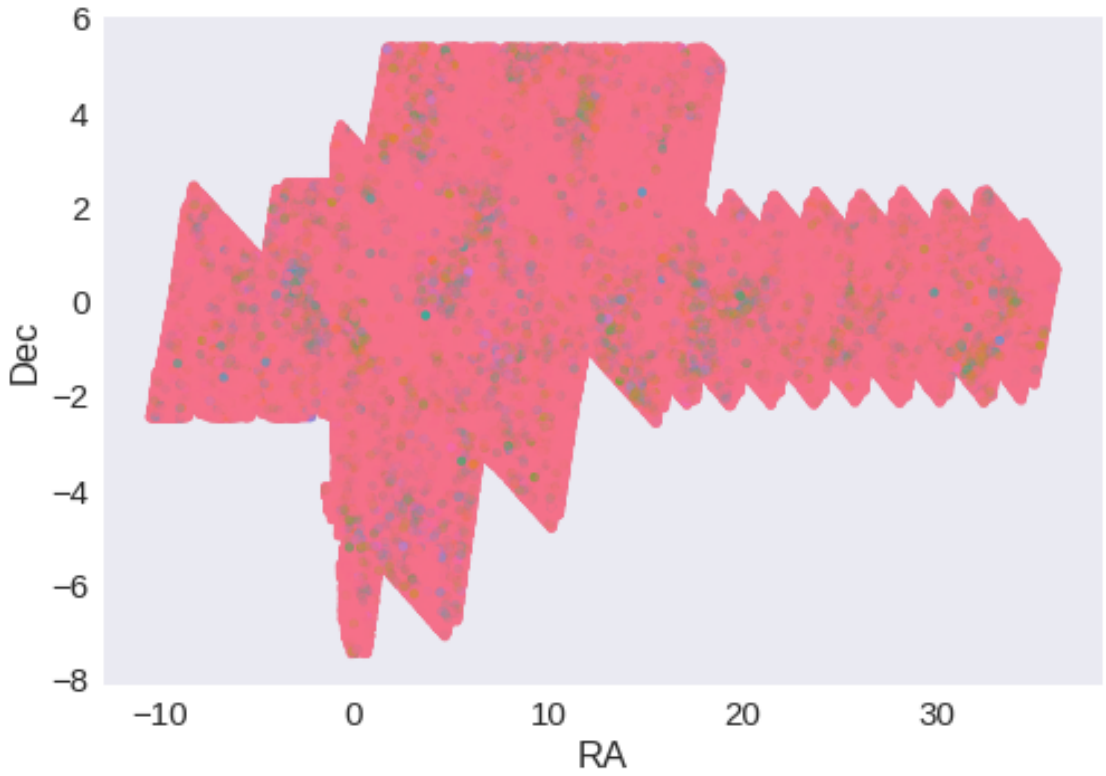
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 18518766 sources.
The cleaned catalogue has 18518555 sources (211 removed).
The cleaned catalogue has 211 sources flagged as having been cleaned
```

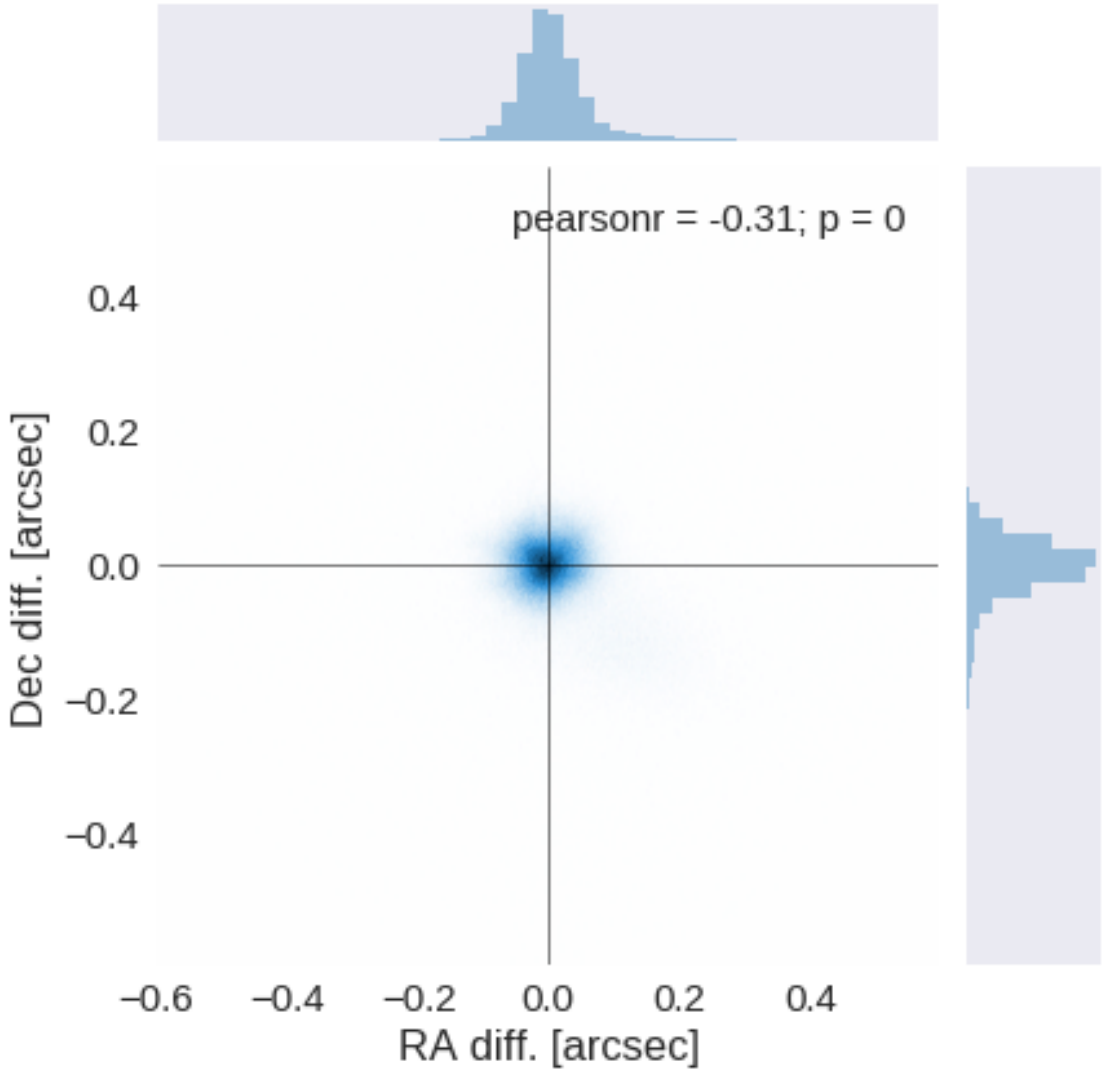
1.4 III - Astrometry correction

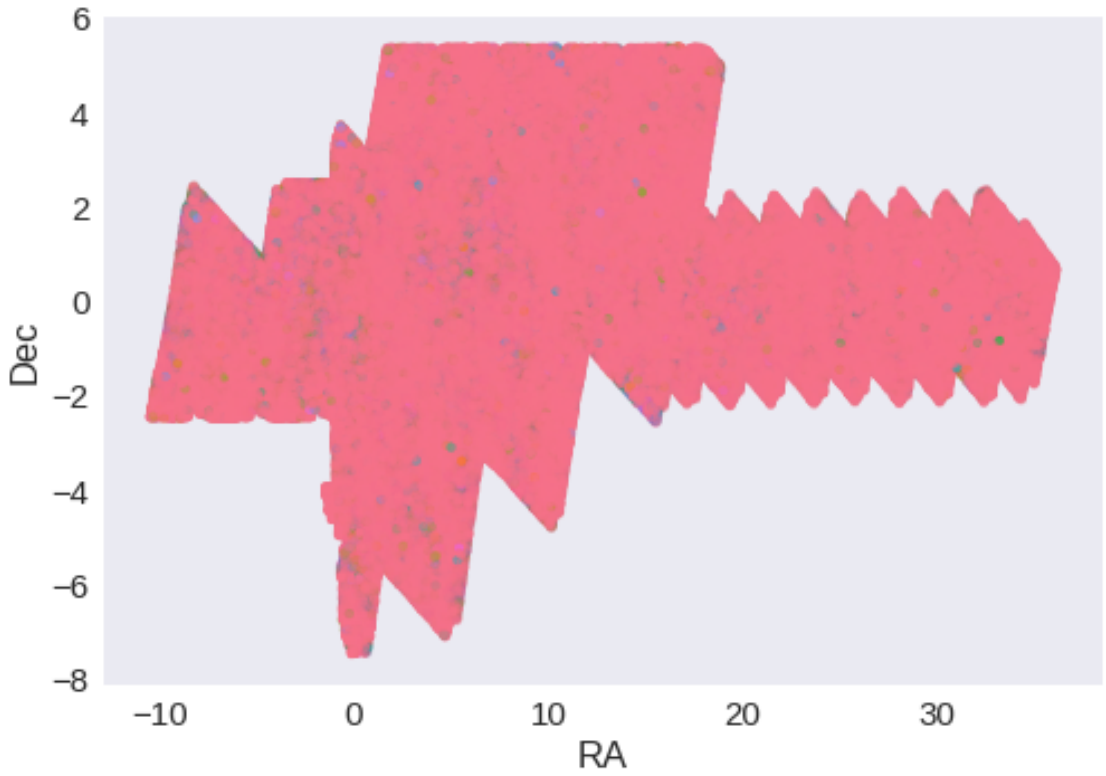
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.10772843384074804 arcsec
Dec correction: -0.12958926648645175 arcsec
```


pearsonr = -0.31; p = 0
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
668327 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.9_RCSLenS

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of Red Cluster Sequence Lensing Survey (RCSLenS) data

This catalogue comes from `dmu0_RCSLenS`.

In the catalogue, we keep:

- The `id` as unique object identifier;
- The position;
- The g, r, i, z, y auto magnitudes.

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

1.2 I - Column selection

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:39: RuntimeWarning: overflow encounter
  fluxes = 10 ** ((8.9 - magnitudes)/2.5)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:43: RuntimeWarning: invalid value enco
  errors = np.log(10)/2.5 * fluxes * errors_on_magnitudes
/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

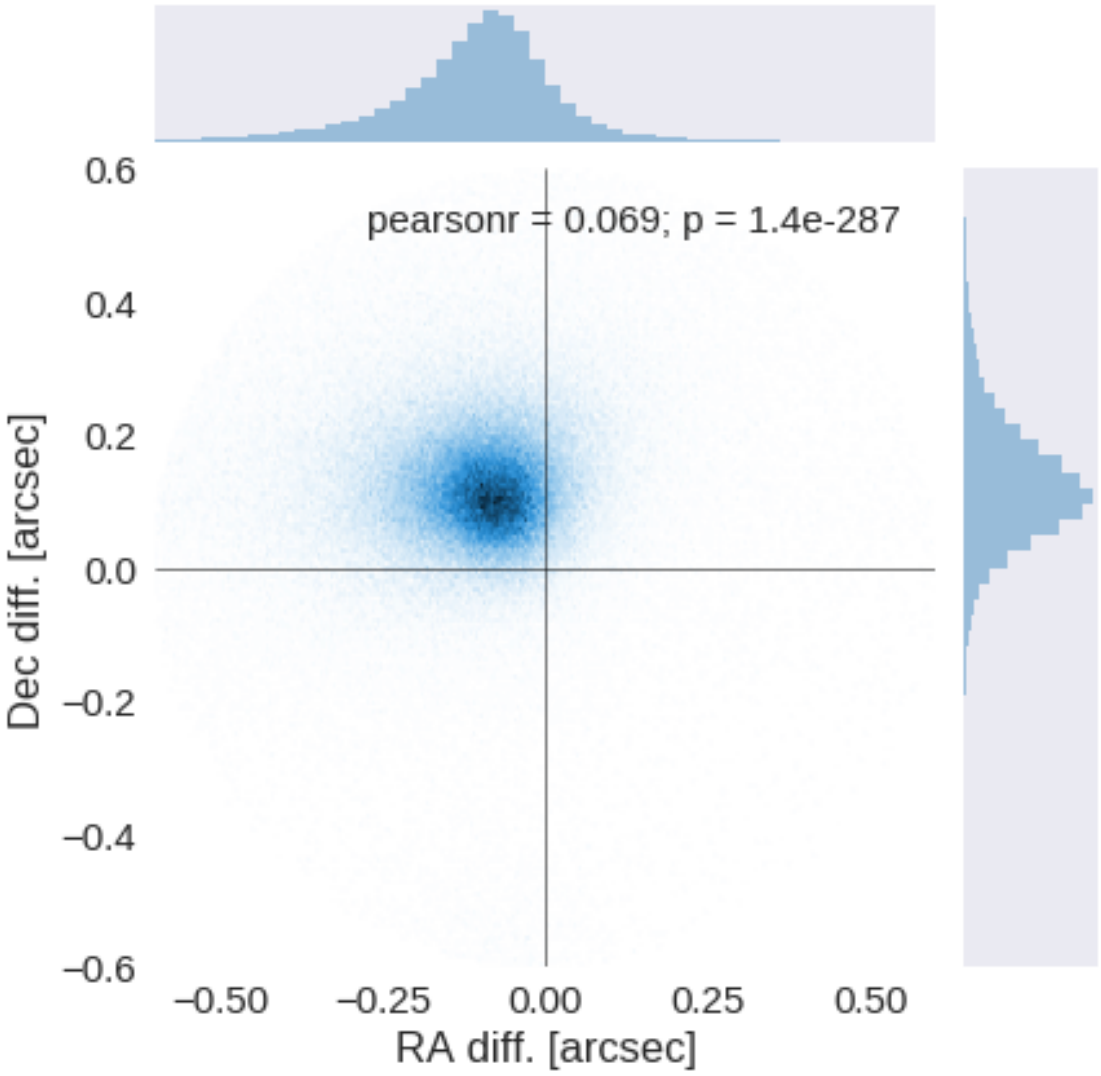
We remove duplicated objects from the input catalogues.

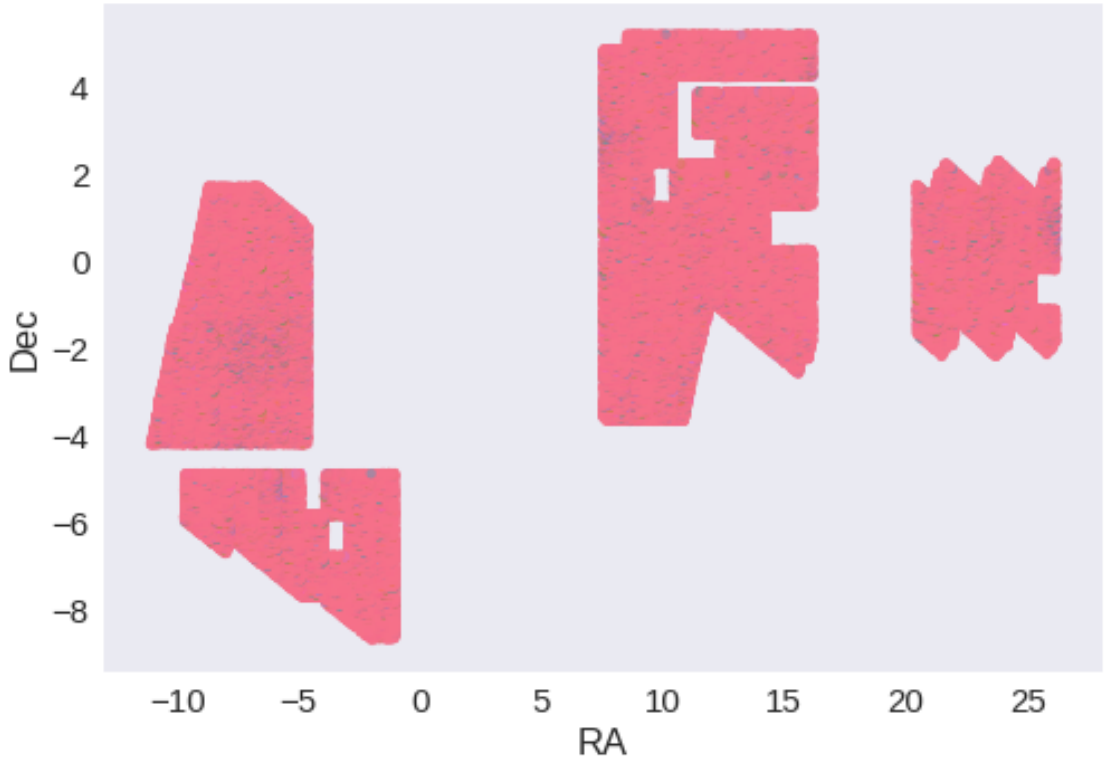
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 13515631 sources.
The cleaned catalogue has 13138199 sources (377432 removed).
The cleaned catalogue has 372333 sources flagged as having been cleaned
```

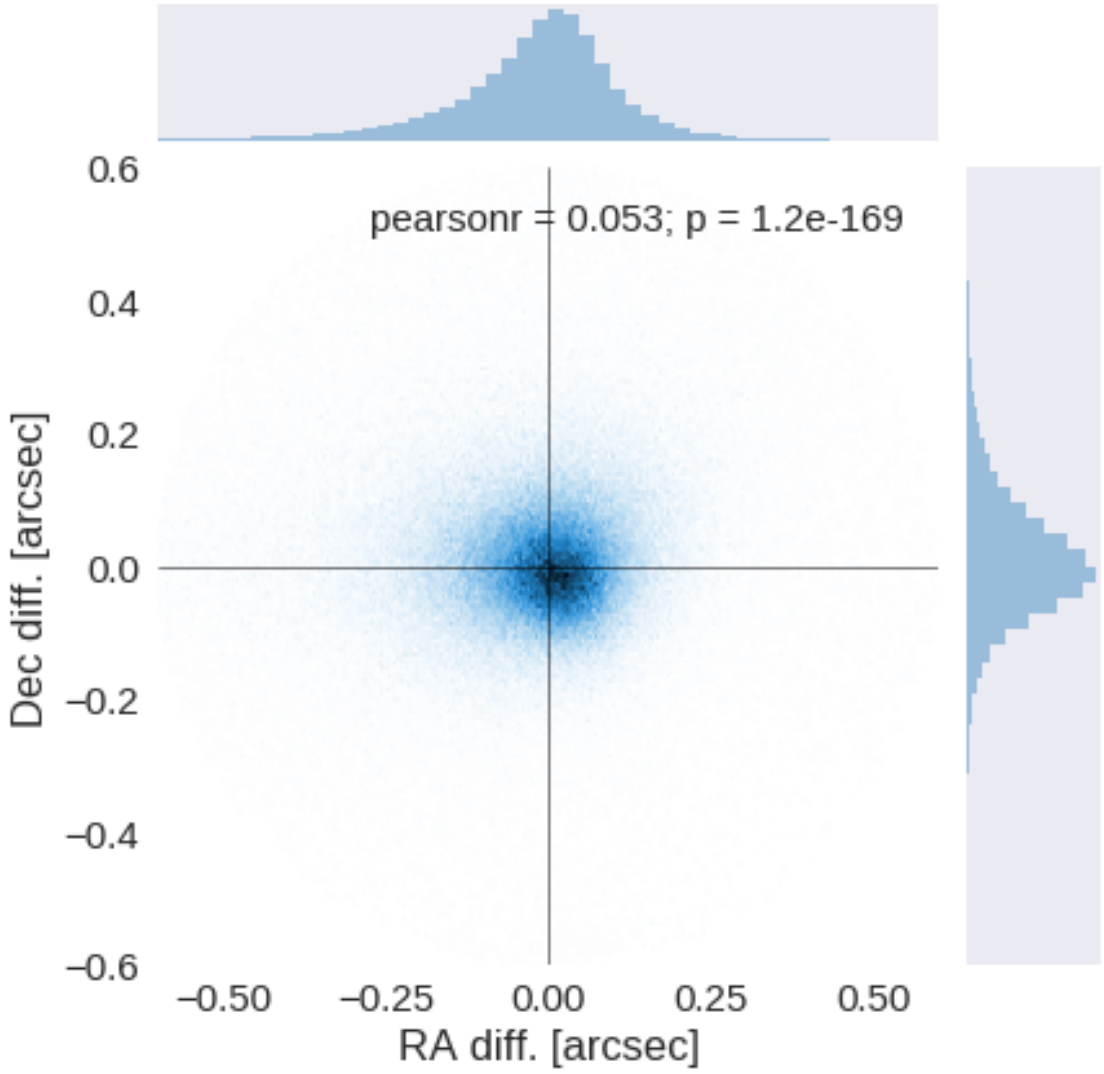
1.4 III - Astrometry correction

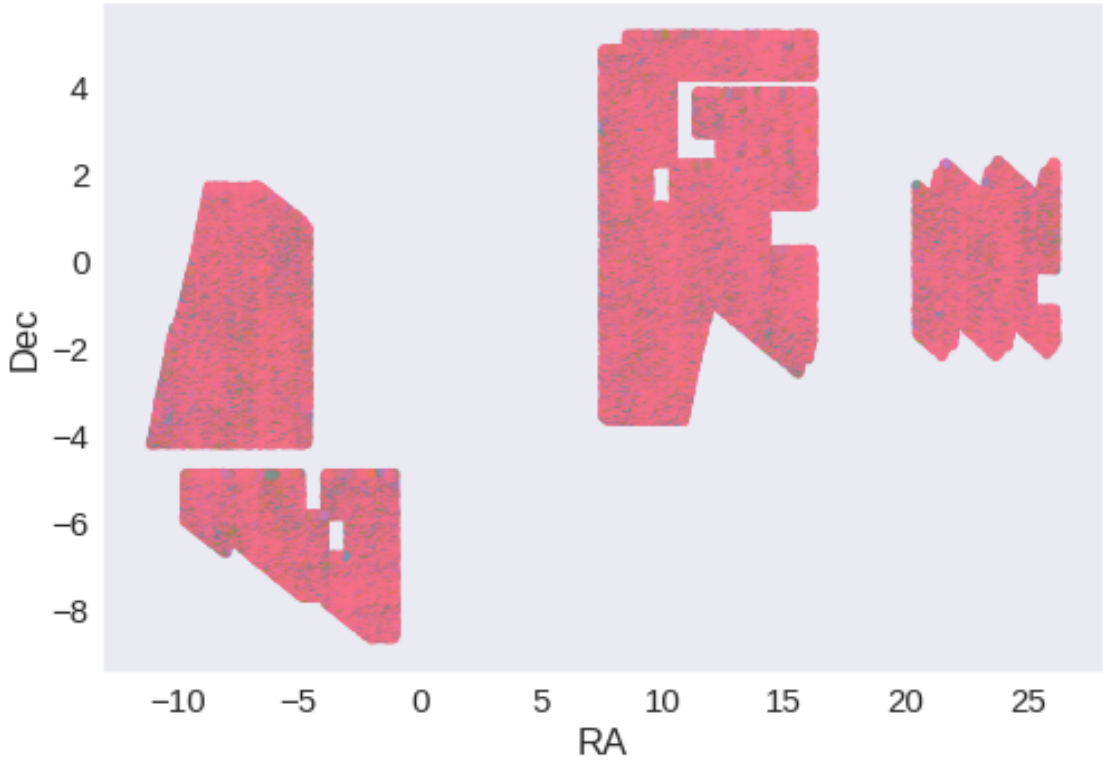
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.09379497242889556 arcsec
Dec correction: -0.11609776623586754 arcsec
```


pearsonr = 0.053; p = 1.2e-169
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Dec diff. [arcsec]
−0.50
−0.25
0.00
0.25
0.50
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
307429 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.10.1_SDSS-S82-IAC

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of SDSS Stripe 82 - IAC Legacy Survey data

This catalogue comes from `dmu0_IAC_Stripe82_Legacy_Project`.

One must choose between this catalogue and the official SDSS catalogue in 'dmu0_SDSS-S82'. Currently we choose this one.

In the catalogue, we keep:

- We generate a unique object identifier;
- The position;
- The u, g, r, i, z, aperture magnitude (for now in 3″);
- The u, g, r, i, z, auto fluxes and magnitudes.

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:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

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.

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INFO:herschelhelp_internal.masterlist:The catalogue is divided in 37 x 3 (RA, Dec) tiles
INFO:herschelhelp_internal.masterlist:Processing RA between -0.000355 and 0.999645, and Dec betw
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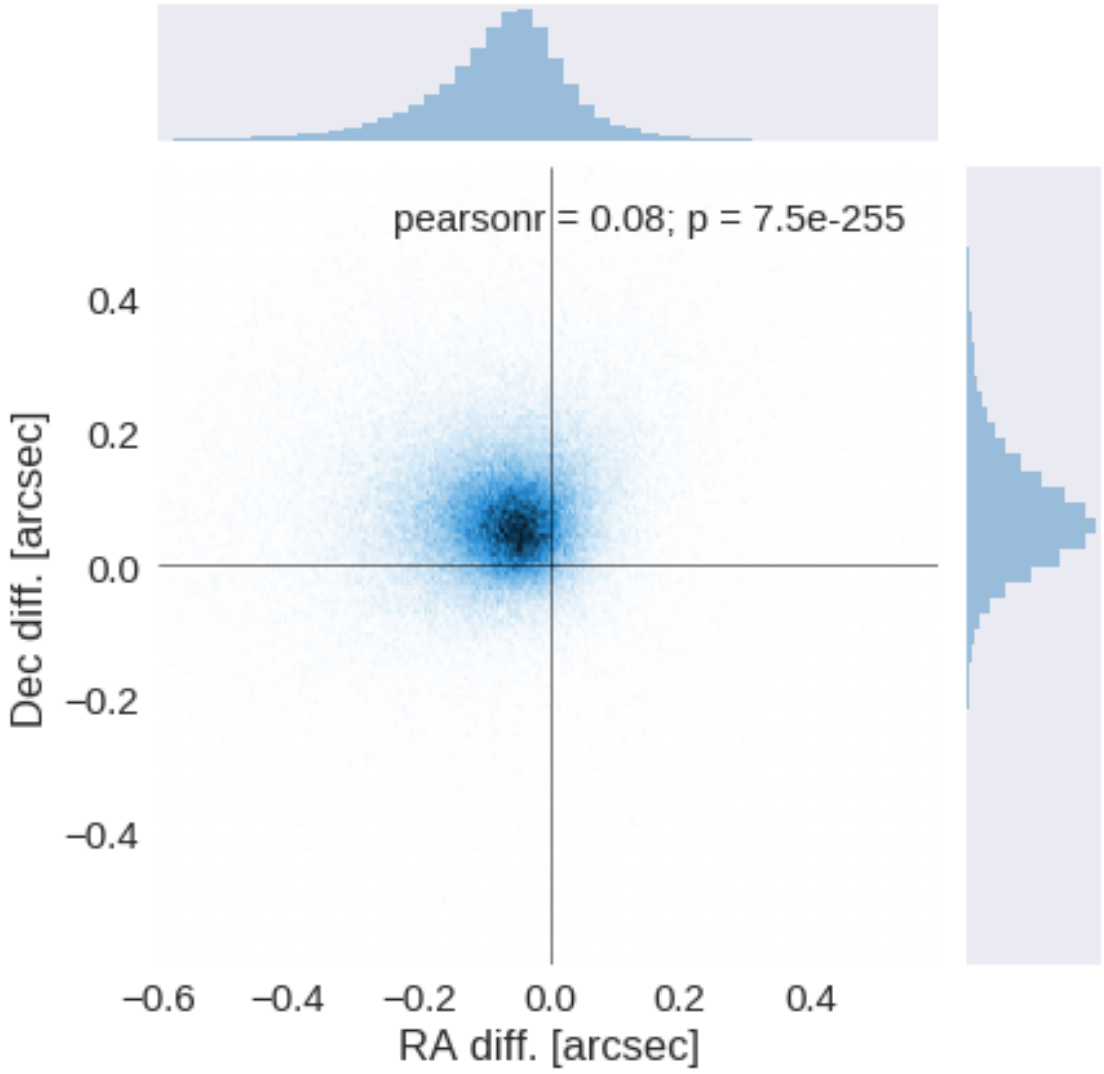
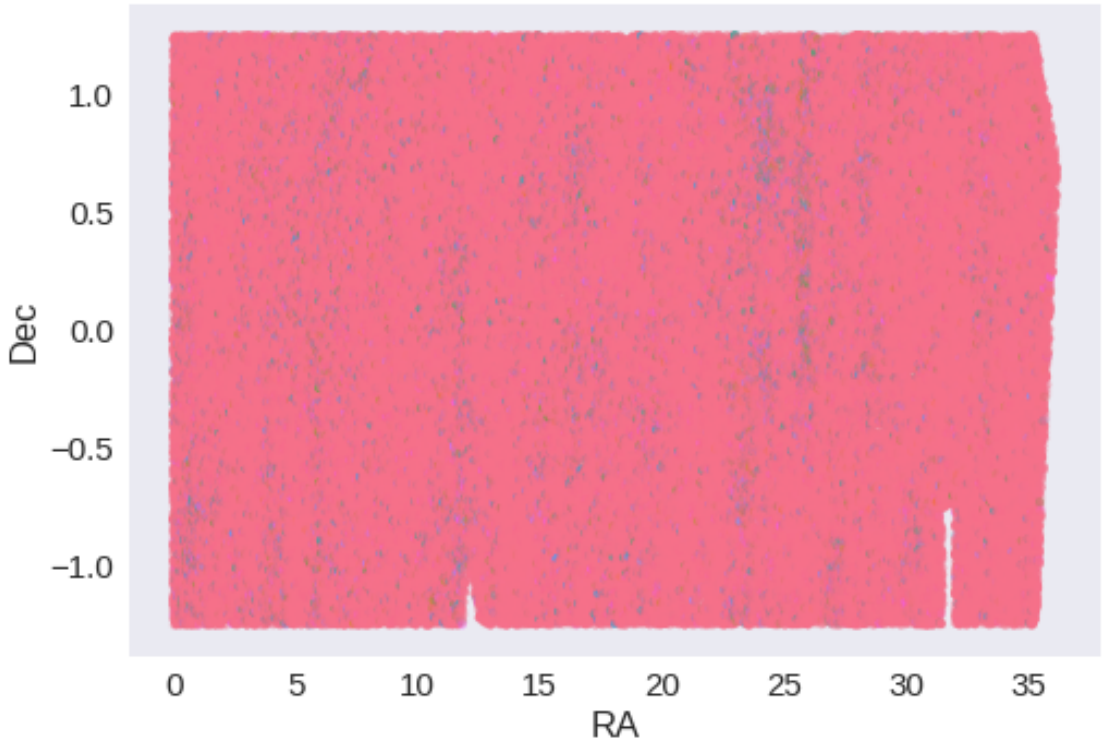
INFO:herschelhelp_internal.masterlist:Processing RA between 35.999645 and 36.999645, and Dec bet
```

```
The initial catalogue had 5290888 sources.
The cleaned catalogue has 5279317 sources (11571 removed).
The cleaned catalogue has 11560 sources flagged as having been cleaned
```

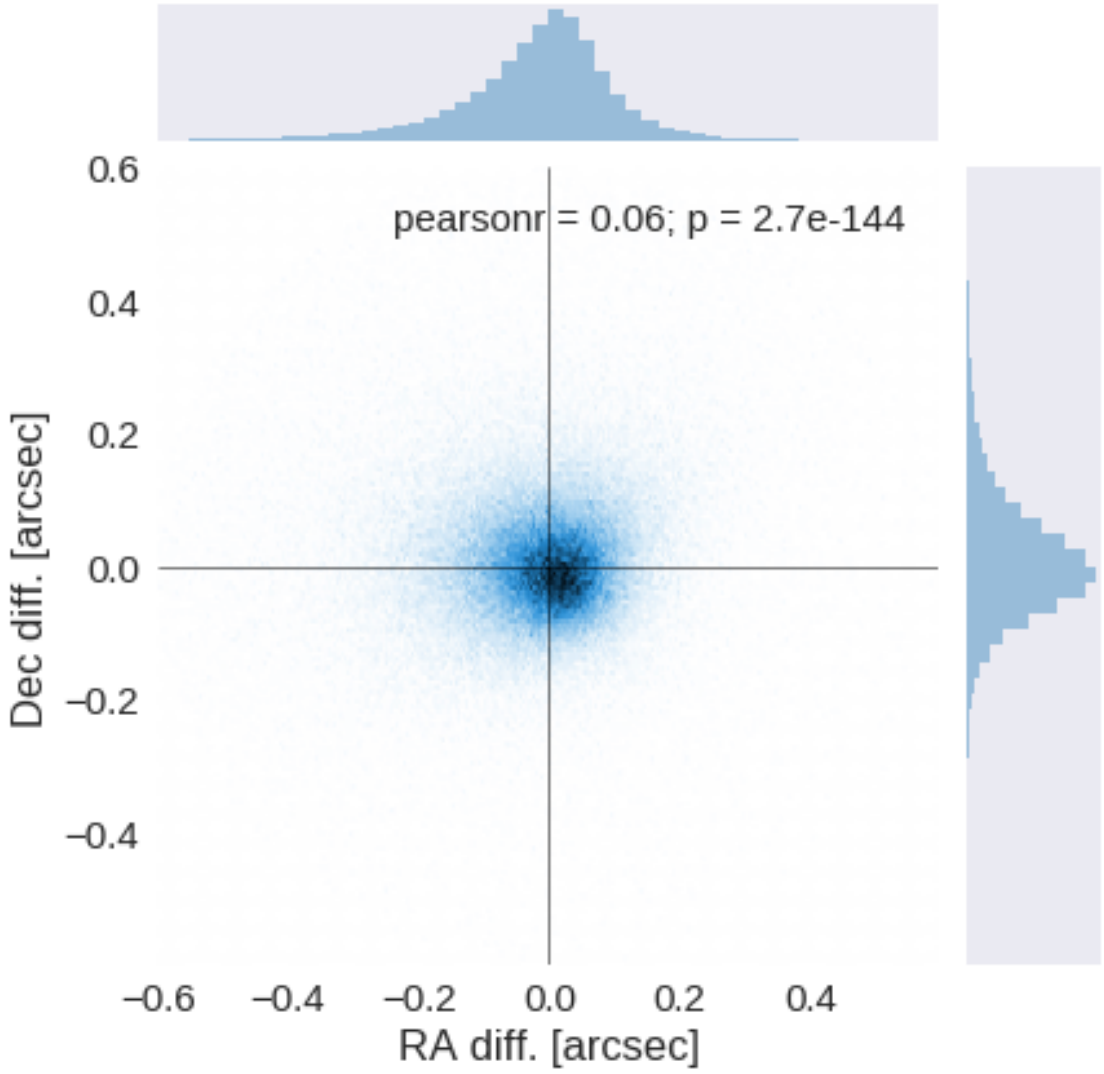
1.4 III - Astrometry correction

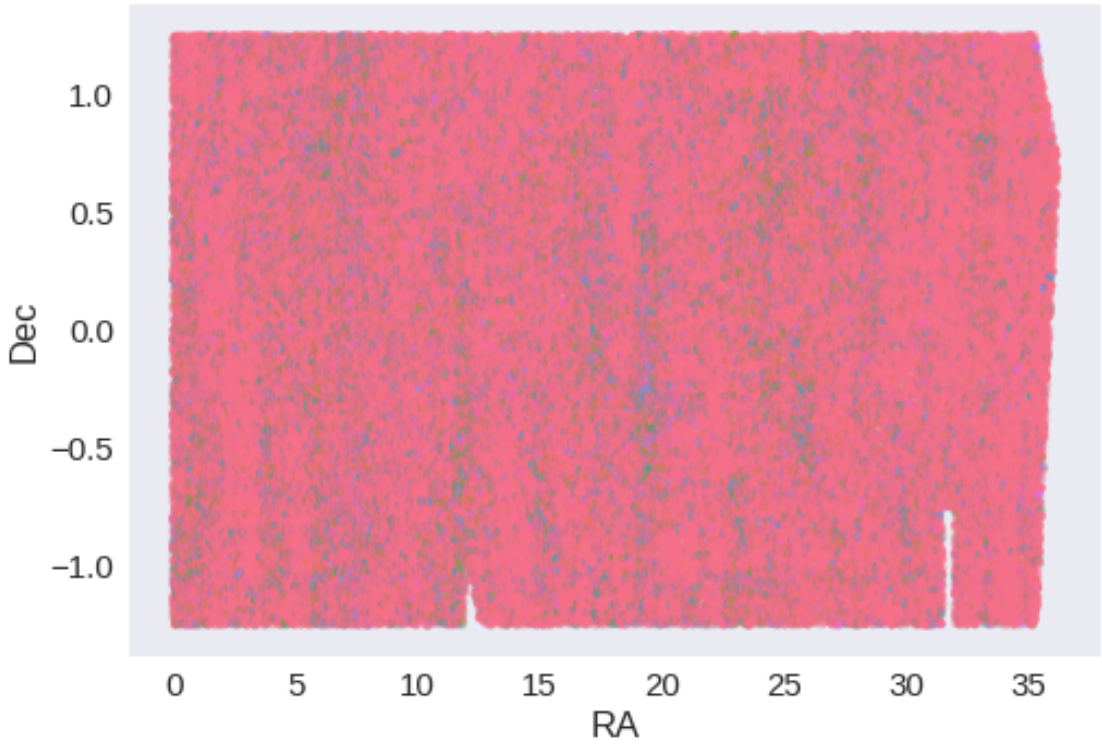
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.08; p = 7.5e-255
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]




```
RA correction: 0.06390892208401056 arcsec
Dec correction: -0.0685382447484173 arcsec
```


pearsonr = 0.06; p = 2.7e-144
0.6
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
184058 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.10.2_SDSS-S82

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Preparation of SDSS Stripe 82 data

This catalogue comes from `dmu0_SDSS-S82`.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The u, g, r, i, z, aperture magnitude (for now in 3″);
- The u, g, r, i, z, auto fluxes and magnitudes.

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:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

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.

```
INFO:herschelhelp_internal.masterlist:The catalogue is divided in 47 x 3 (RA, Dec) tiles
INFO:herschelhelp_internal.masterlist:Processing RA between -9.924922 and -8.924922, and Dec bet
/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)
INFO:herschelhelp_internal.masterlist:Processing RA between -9.924922 and -8.924922, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between -9.924922 and -8.924922, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between -8.924922 and -7.924922, and Dec bet
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INFO:herschelhelp_internal.masterlist:Processing RA between -7.924922 and -6.924922, and Dec bet
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INFO:herschelhelp_internal.masterlist:Processing RA between -7.924922 and -6.924922, and Dec bet
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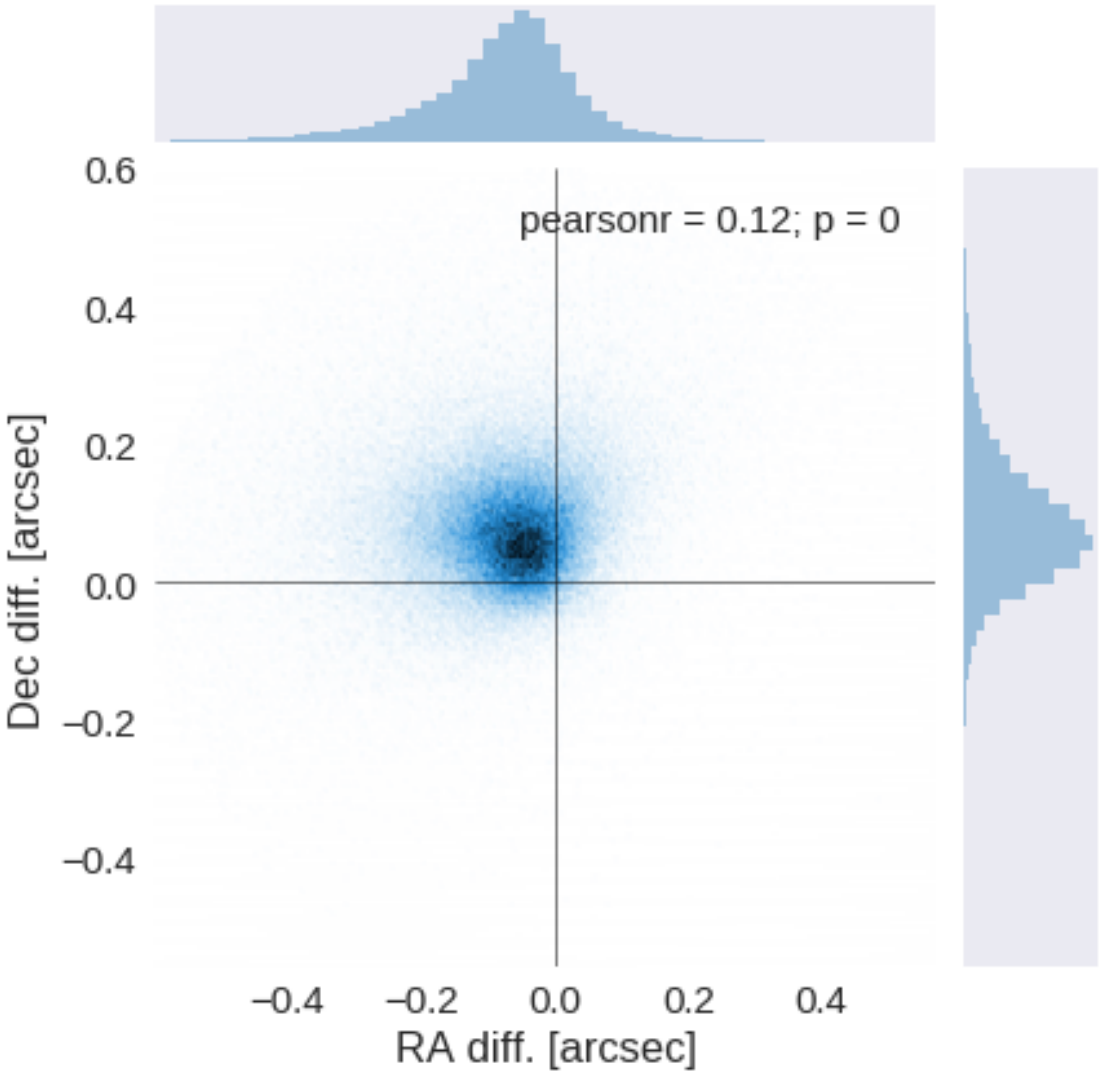
```

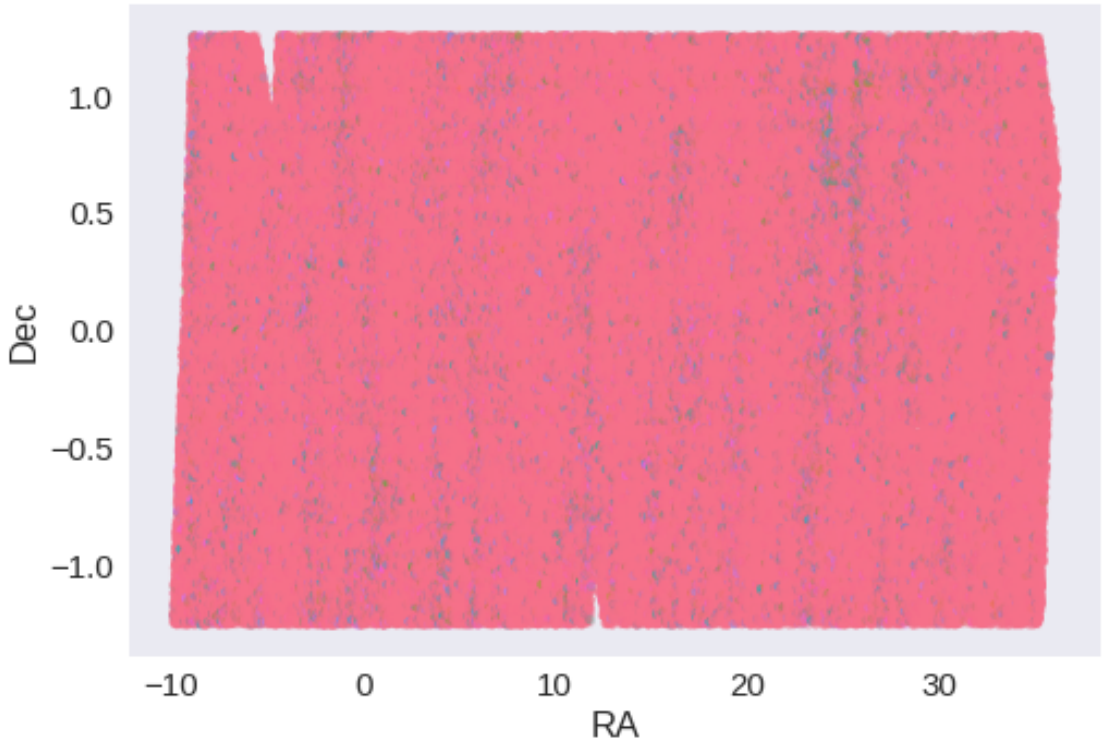
```
INFO:herschelhelp_internal.masterlist:Processing RA between 24.075078 and 25.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 24.075078 and 25.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 25.075078 and 26.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 25.075078 and 26.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 25.075078 and 26.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 26.075078 and 27.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 26.075078 and 27.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 26.075078 and 27.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 27.075078 and 28.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 27.075078 and 28.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 27.075078 and 28.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 28.075078 and 29.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 28.075078 and 29.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 28.075078 and 29.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 29.075078 and 30.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 29.075078 and 30.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 29.075078 and 30.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 30.075078 and 31.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 30.075078 and 31.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 30.075078 and 31.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 31.075078 and 32.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 31.075078 and 32.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 31.075078 and 32.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 32.075078 and 33.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 32.075078 and 33.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 32.075078 and 33.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 33.075078 and 34.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 33.075078 and 34.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 33.075078 and 34.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 34.075078 and 35.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 34.075078 and 35.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 34.075078 and 35.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 35.075078 and 36.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 35.075078 and 36.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 35.075078 and 36.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 36.075078 and 37.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 36.075078 and 37.075078, and Dec bet
INFO:herschelhelp_internal.masterlist:Processing RA between 36.075078 and 37.075078, and Dec bet


The initial catalogue had 6377638 sources.
The cleaned catalogue has 6376812 sources (826 removed).
The cleaned catalogue has 826 sources flagged as having been cleaned
```

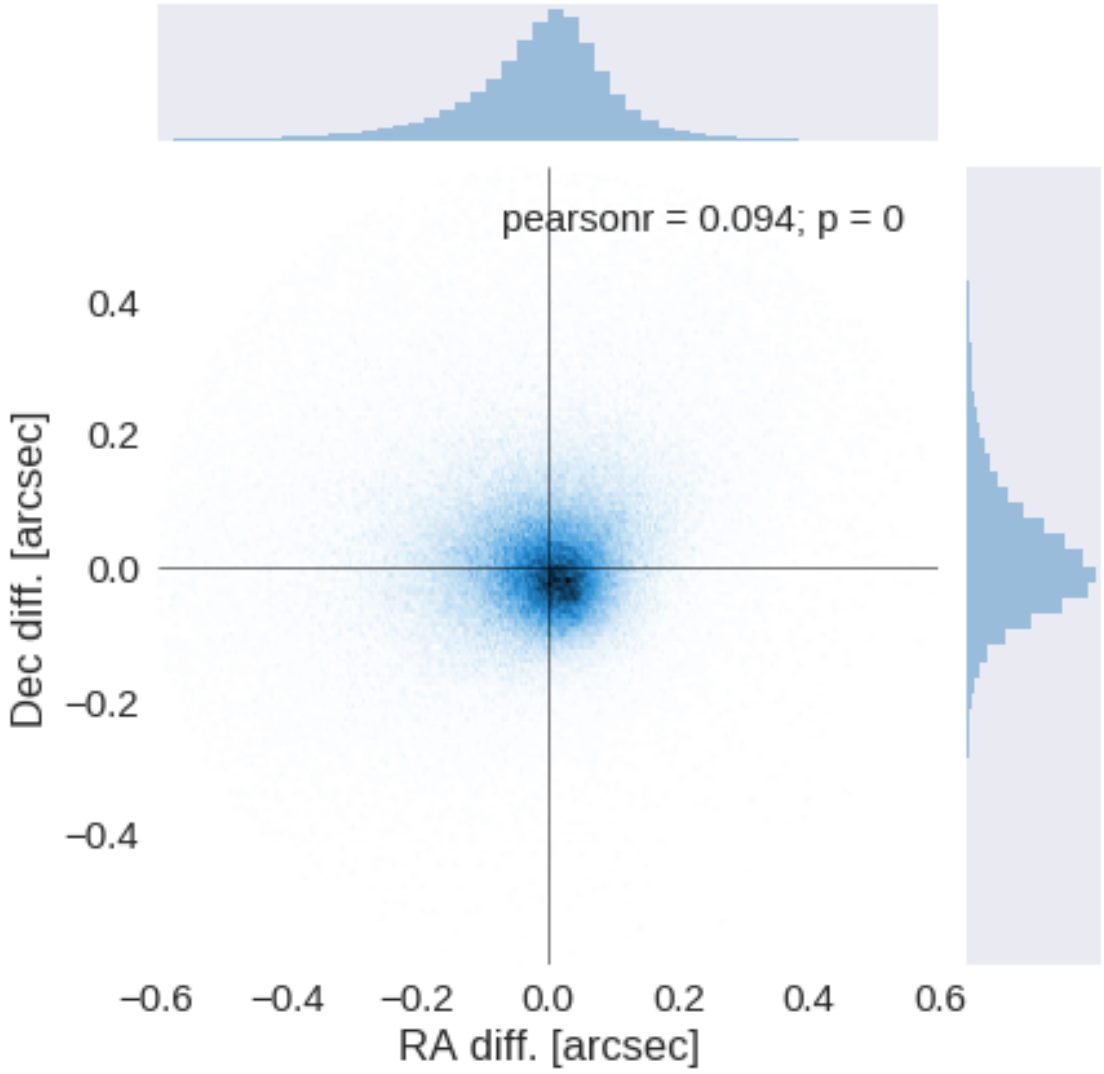
1.4 III - Astrometry correction

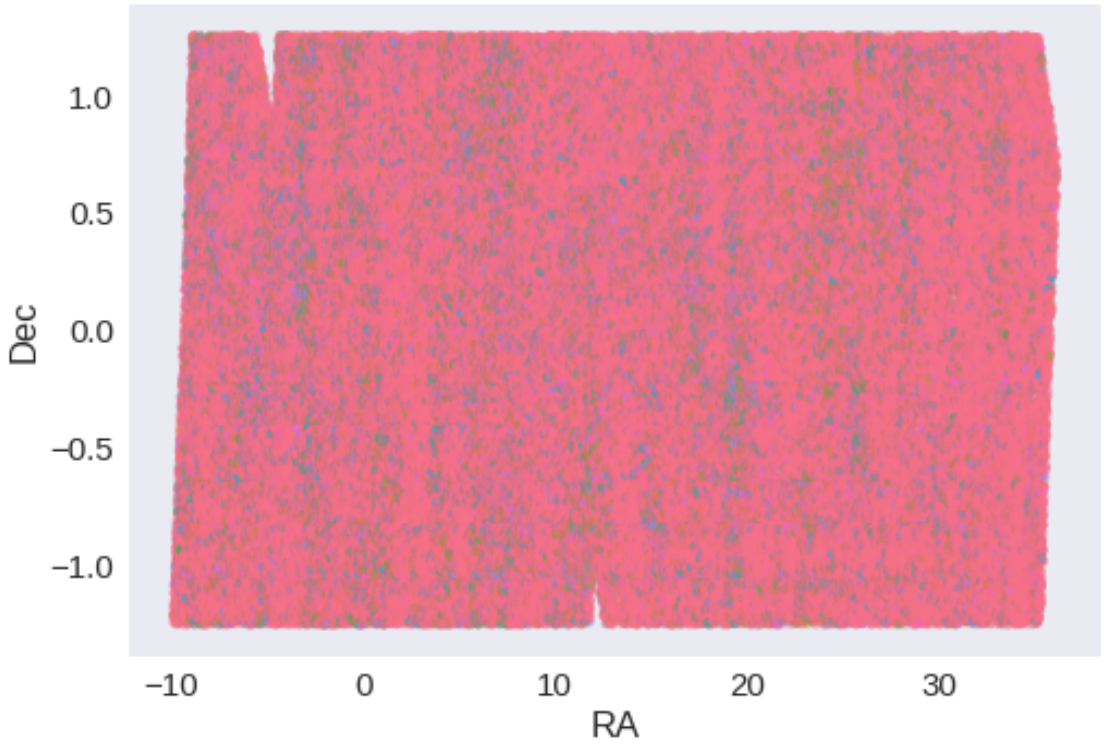
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.06227235712685797 arcsec
Dec correction: -0.0734814464327993 arcsec
```


pearsonr = 0.094; p = 0
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
232639 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

2.1_IRAC_merging

January 18, 2018

1 Herschel Stripe 82 IRAC merging

Both SHELA and SpIES provide IRAC fluxes which have marginally overlapping coverage. We chose which to use here since in order to run in low memory mode we must have one catalogue per band before merging

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

1.1 I - Reading the prepared pristine catalogues

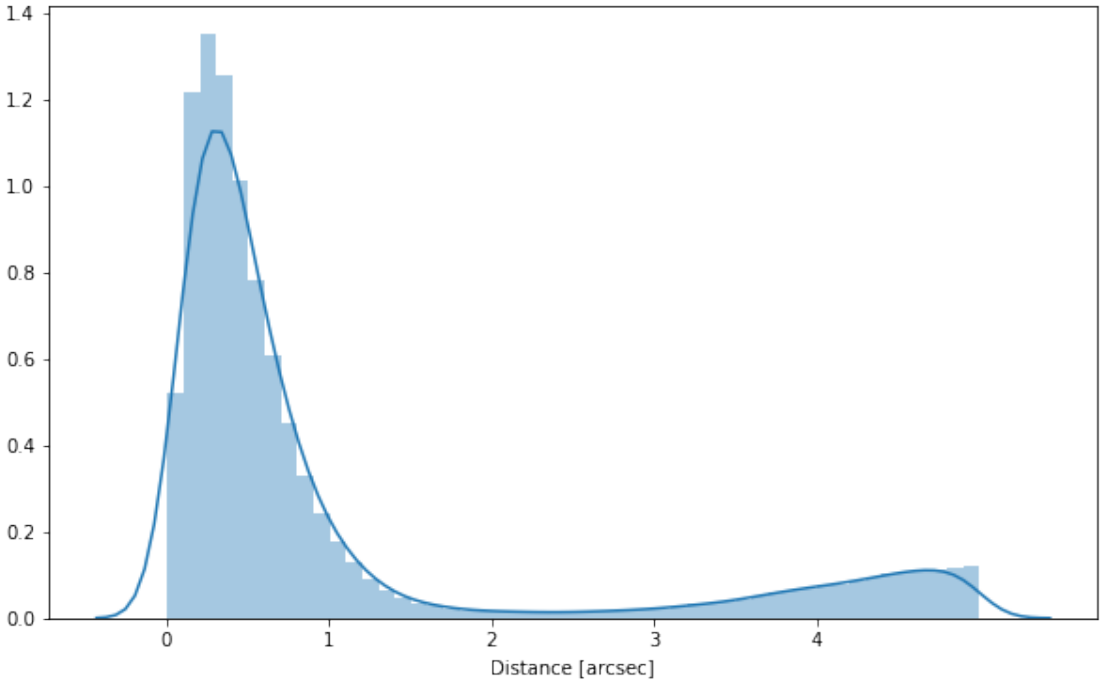
1.2 II - Merging tables

We first merge the optical catalogues and then add the infrared ones: HSC, VHS, VICS82, UKIDSS-LAS, PanSTARRS, SHELA, SpIES.

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 SHELA

1.3 Add SpIES



1.3.1 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[9]: <IPython.core.display.HTML object>
```

1.4 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.

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.

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```

1.5 VIII - Cross-identification table

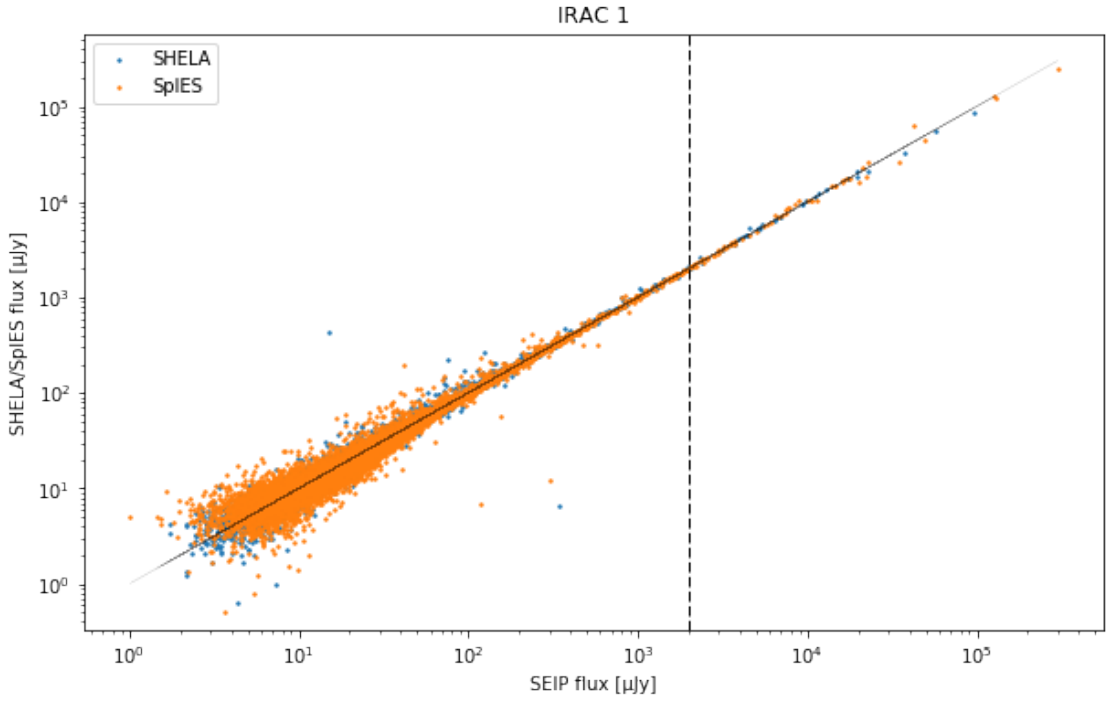
We are producing a table associating to each HELP identifier, the identifiers of the sources in the pristine catalogue. This can be used to easily get additional information from them.

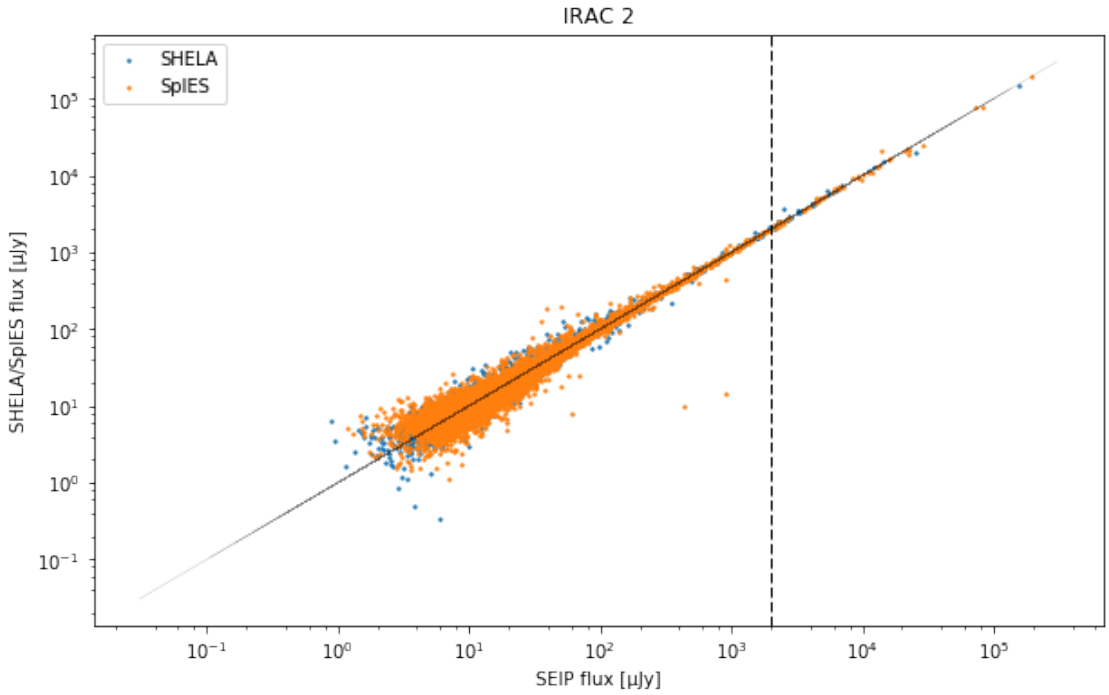
```
['shela_intid', 'spies_intid', 'irac_intid']
```

1.6 VI - Choosing between multiple values for the same filter

Both SHELA and SpIES provide IRAC1 and IRAC2 fluxes. SpIES seems to go deeper and neither apear to suffer from the bright drop off that affects both SERVS and SWIRE.

```
WARNING: UnitsWarning: 'e/count' did not parse as fits unit: At col 0, Unit 'e' not supported by
WARNING: UnitsWarning: 'image' did not parse as fits unit: At col 0, Unit 'image' not supported
```





When both SHELA and SpIES fluxes are provided, we use the SpIES flux.

We create a table indicating for each source the origin on the IRAC1 and IRAC2 fluxes that will be saved separately.

```
2240390 sources with SHELA flux
3365594 sources with SpIES flux
64802 sources with SHELA and SpIES flux
2240390 sources for which we use SHELA
3300792 sources for which we use SpIES


2240390 sources with SHELA total flux
3365594 sources with SpIES total flux
64802 sources with SHELA and SpIES total flux
2240390 sources for which we use SHELA
3300792 sources for which we use SpIES


2244367 sources with SHELA flux
3365594 sources with SpIES flux
66244 sources with SHELA and SpIES flux
2244367 sources for which we use SHELA
3299350 sources for which we use SpIES


2244367 sources with SHELA total flux
3365594 sources with SpIES total flux
```

```
66244 sources with SHELA and SpIES total flux
2244367 sources for which we use SHELA
3299350 sources for which we use SpIES
```

1.7 IX - Saving the catalogue

```
Out[25]: ['shela_intid',
          'ra',
          'dec',
          'flag_merged',
          'spies_intid',
          'irac_flag_cleaned',
          'irac_flag_gaia',
          'irac_stellarity',
          'irac_intid',
          'f_ap_irac_i1',
          'ferr_ap_irac_i1',
          'm_ap_irac_i1',
          'merr_ap_irac_i1',
          'f_irac_i1',
          'ferr_irac_i1',
          'm_irac_i1',
          'merr_irac_i1',
          'flag_irac_i1',
          'f_ap_irac_i2',
          'ferr_ap_irac_i2',
          'm_ap_irac_i2',
          'merr_ap_irac_i2',
          'f_irac_i2',
          'ferr_irac_i2',
          'm_irac_i2',
          'merr_irac_i2',
          'flag_irac_i2']

Missing columns: set()


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

2.2_DECAM_merging

January 18, 2018

1 Herschel Stripe 82 DECAM merging

Both DES and DECaLS provide DECam fluxes which have overlapping coverage. We chose which to use DES preferentially. In this notebook we cross match both catalogues and take the DES fluxes where available, using DECaLS otherwise

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

1.1 I - Reading the prepared pristine catalogues

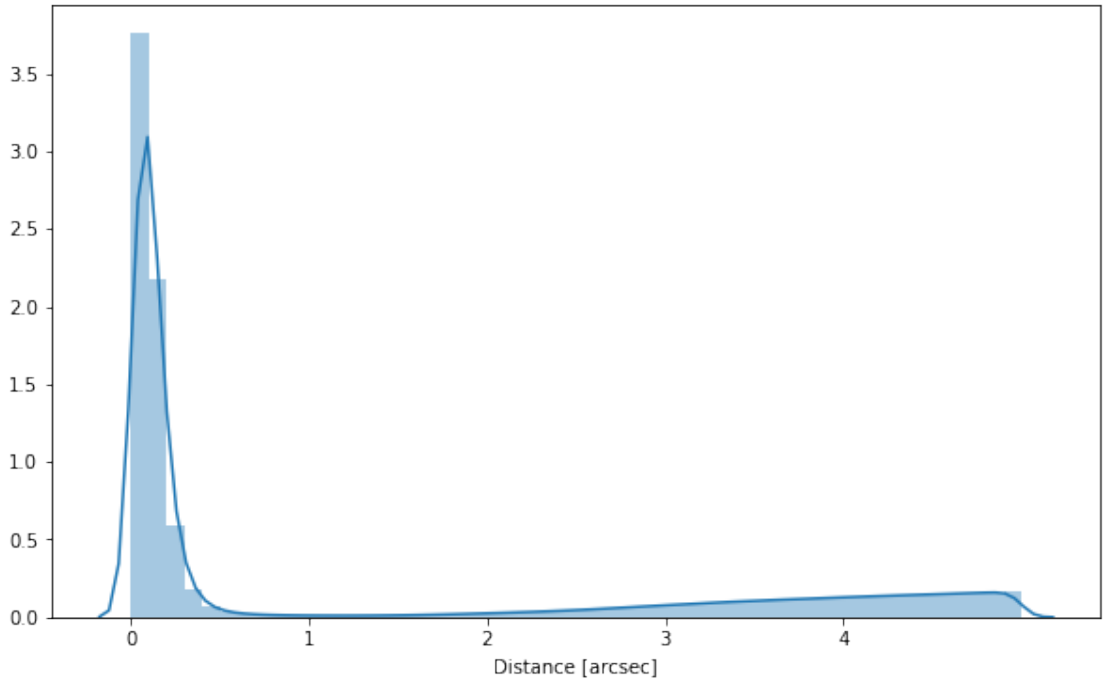
1.2 II - Merging tables

We first merge the optical catalogues and then add the infrared ones: HSC, VHS, VICS82, UKIDSS-LAS, PanSTARRS, SHELA, SpIES.

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 DES

1.3 Add DECaLS



1.3.1 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[10]: <IPython.core.display.HTML object>
```

1.4 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.

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.

1.5 VIII - Cross-identification table

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

```
['des_id', 'decals_id', 'decam_intid']
```

1.6 VI - Choosing between multiple values for the same filter

```
/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[19]: <IPython.core.display.HTML object>

1.7 IX - Saving the catalogue

Out[21]:
```
['des_id',
 'ra',
 'dec',
 'f_decam_i',
 'ferr_decam_i',
 'f_ap_decam_i',
 'ferr_ap_decam_i',
 'm_decam_i',
 'merr_decam_i',
 'm_ap_decam_i',
 'merr_ap_decam_i',
 'f_decam_y',
 'ferr_decam_y',
 'f_ap_decam_y',
 'ferr_ap_decam_y',
 'm_decam_y',
 'merr_decam_y',
 'm_ap_decam_y',
 'merr_ap_decam_y',
 'flag_decam_i',
 'flag_decam_y',
 'flag_merged',
 'decals_id',
 'decam_flag_cleaned',
 'decam_flag_gaia',
 'decam_stellarity',
 'decam_intid',
 'f_decam_g',
 'ferr_decam_g',
 'm_decam_g',
 'merr_decam_g',
 'flag_decam_g',
 'f_ap_decam_g',
 'ferr_ap_decam_g',
 'm_ap_decam_g',
```

```
            'merr_ap_decam_g',
            'f_decam_r',
            'ferr_decam_r',
            'm_decam_r',
            'merr_decam_r',
            'flag_decam_r',
            'f_ap_decam_r',
            'ferr_ap_decam_r',
            'm_ap_decam_r',
            'merr_ap_decam_r',
            'f_decam_z',
            'ferr_decam_z',
            'm_decam_z',
            'merr_decam_z',
            'flag_decam_z',
            'f_ap_decam_z',
            'ferr_ap_decam_z',
            'm_ap_decam_z',
            'merr_ap_decam_z']

Missing columns: set()


Out[25]: <IPython.core.display.HTML object>
```

2.3_Merging

January 18, 2018

1 Herschel Stripe 82 master catalogue

This notebook presents the merge of the various pristine catalogues to produce HELP mater catalogue on Herschel Stripe 82.

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

```
/Users/rs548/anaconda/envs/herschelhelp_internal/lib/python3.6/site-packages/seaborn/apionly.py:
  warnings.warn(msg, UserWarning)
```

1.1 I - Reading the prepared pristine catalogues

1.2 II - Merging tables

We first merge the optical catalogues and then add the infrared ones: HSC, VHS, VICS82, UKIDSS-LAS, PanSTARRS, SHELA, SpIES.

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 HSC

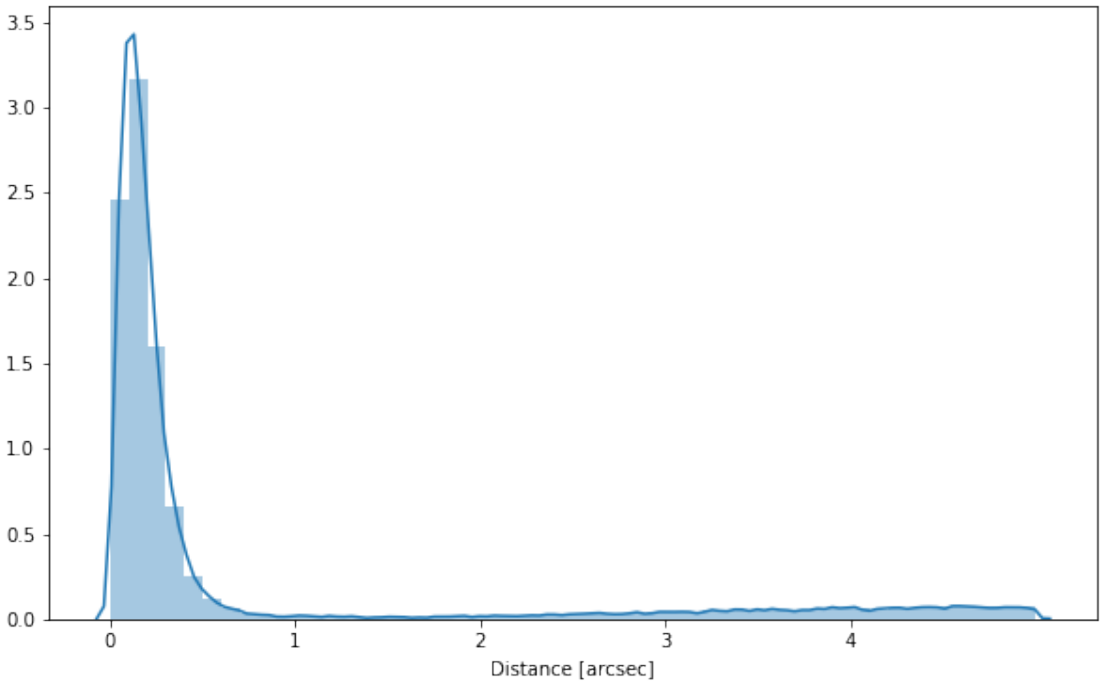
1.2.2 Add VHS

```
HELP Warning: There weren't any cross matches. The two surveys probably don't overlap.
```

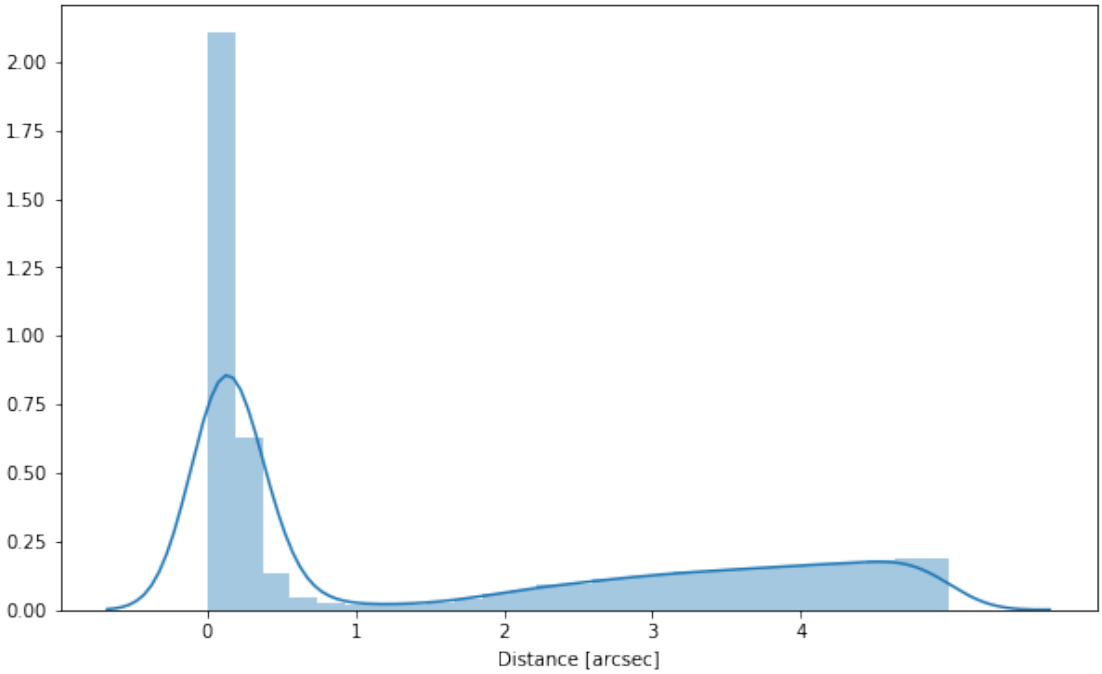
1.2.3 Add VICS82

```
HELP Warning: There weren't any cross matches. The two surveys probably don't overlap.
```

1.2.4 Add LAS

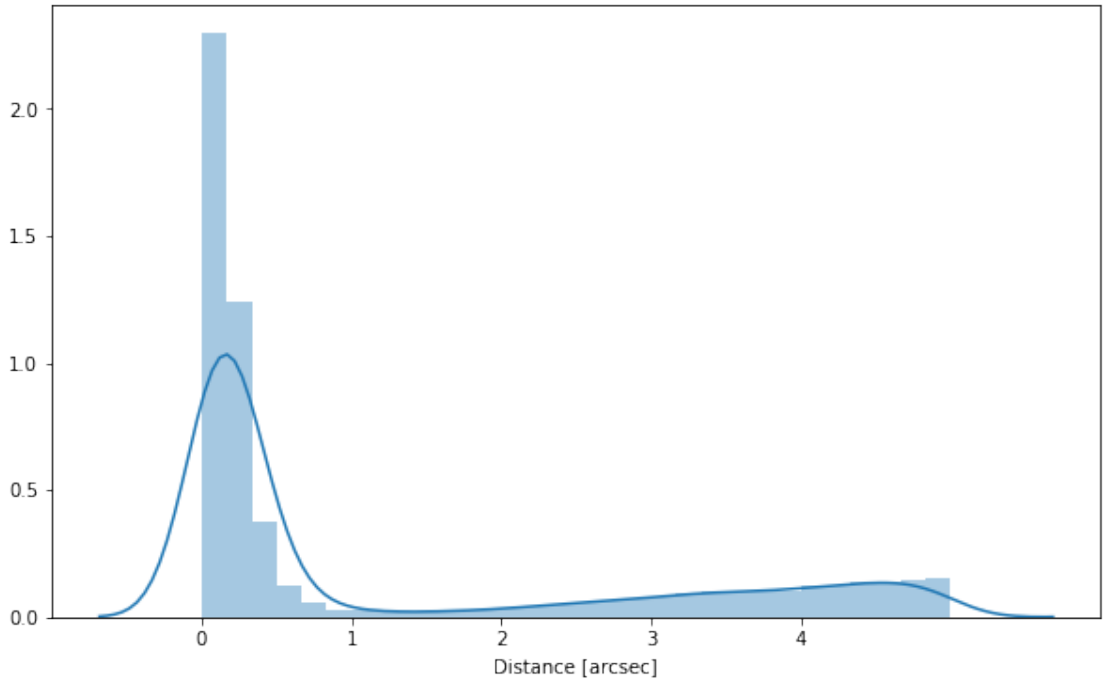


1.2.5 Add PanSTARRS

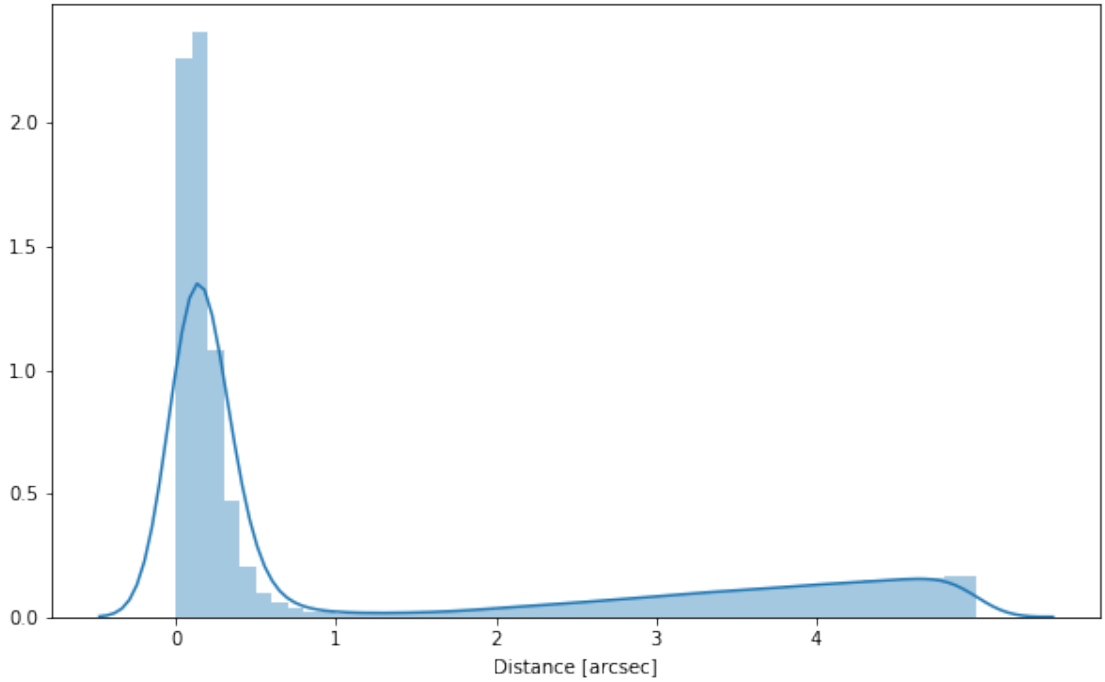


1.3 Add SDSS

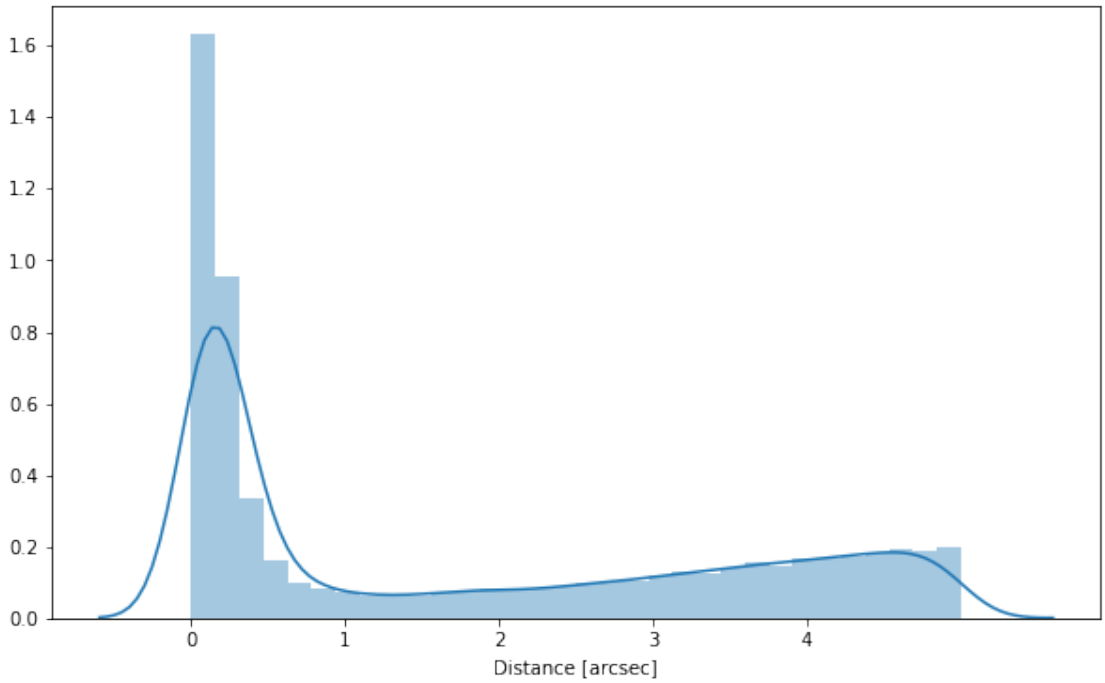
We are waiting for a new SDSS-82 catalogue, which does not suffer from the issue of multiple sources per object due to including all exposure extractions.



1.4 Add DECam (DECaLS and DES)



1.5 Add RCSLenS



1.6 Add IRAC (SHELA and SpIES)

```
HELP Warning: There weren't any cross matches. The two surveys probably don't overlap.
```

1.6.1 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[25]: <IPython.core.display.HTML object>
```

1.7 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.

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.

```
/Users/rs548/anaconda/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.
```

1.8 IV - Adding E(B-V) column

1.9 V - Adding HELP unique identifiers and field columns

```
OK!
```

1.10 VI - Choosing between multiple measurements

If running in low memory mode this happens in a seperate notebook.

1.11 VII.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 de different depths in the catalogue we are using.

1.12 VII.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.

This now takes place at the end of the notebook when teh photometry is folded in.

1.13 VIII - Cross-identification table

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

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

```
['hsc_id', 'vhs_id', 'vics82_id', 'las_id', 'ps1_id', 'sdss_id', 'decam_intid', 'des_id', 'decal
```

1.14 IX - Adding HEALPix index

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

1.15 X - Saving the catalogue

```
Missing columns: {'ps1_id', 'vhs_id', 'irac_intid', 'flag_gaia', 'des_id', 'sdss_id', 'las_id',
```

1.16 XI - folding in the photometry

On HS82 there is too much data to load all in to memory at once so we perform the cross matching without photometry columns. Only now do we fold in the photometry data by first cutting the catalogue up in to manageable sizes.

```
120
```

3_Checks_and_diagnostics

January 18, 2018

1 Herschel Stripe 82 master catalogue

1.1 Checks and diagnostics

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


Diagnostics done using: master_catalogue_herschel-stripe-82_RANDOM10PCSAMPLE_20180113.fits
```

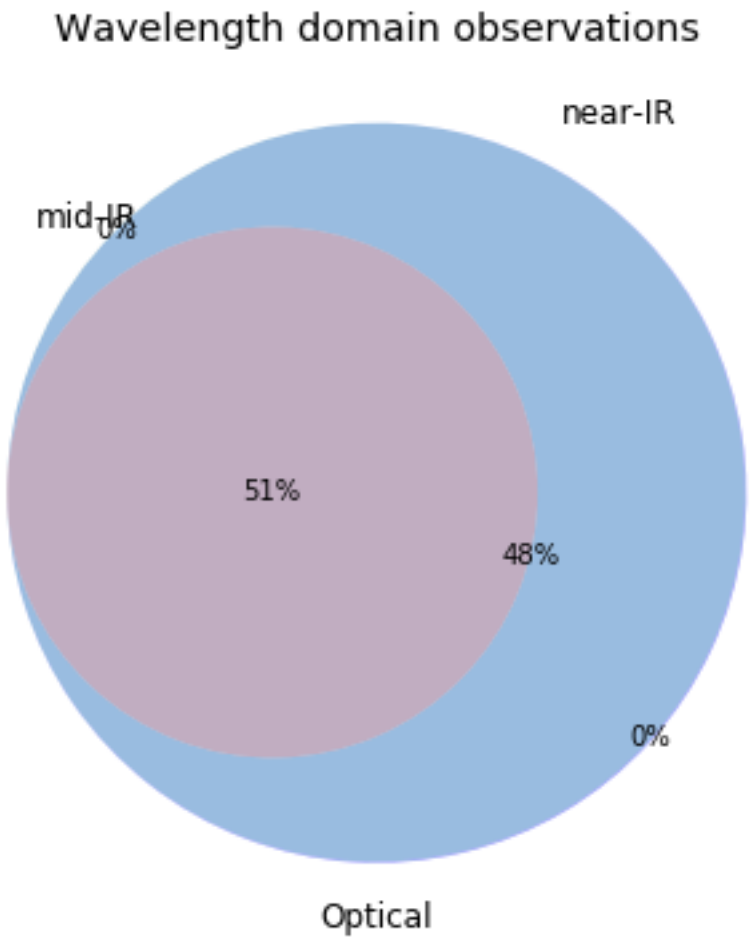
1.2 0 - Quick checks

```
/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)

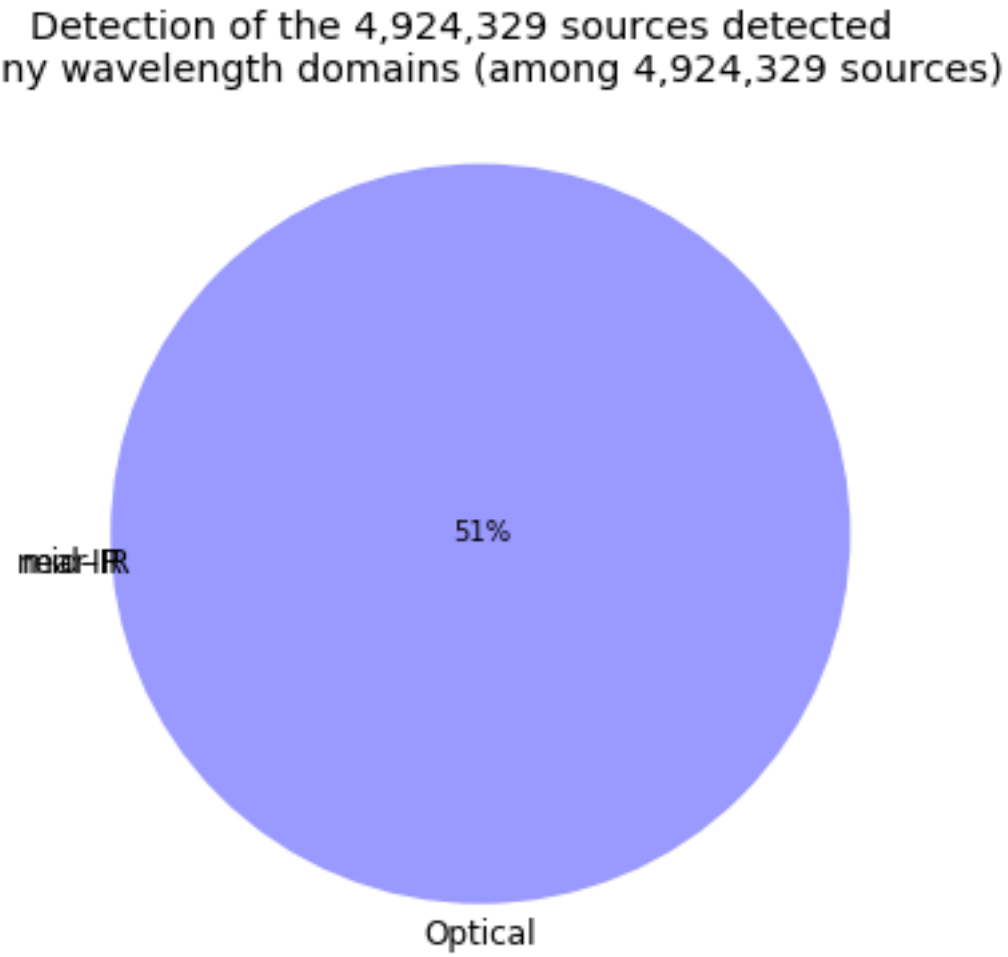

Table shows only problematic columns.


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

1.3 I - Summary of wavelength domains



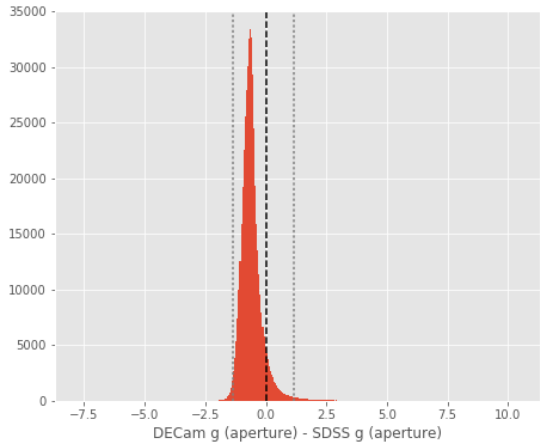

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/matplotlib_venn/_venn3.py:
  warnings.warn("Circle A has zero area")
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/matplotlib_venn/_venn3.py:
  warnings.warn("Circle B has zero area")
```

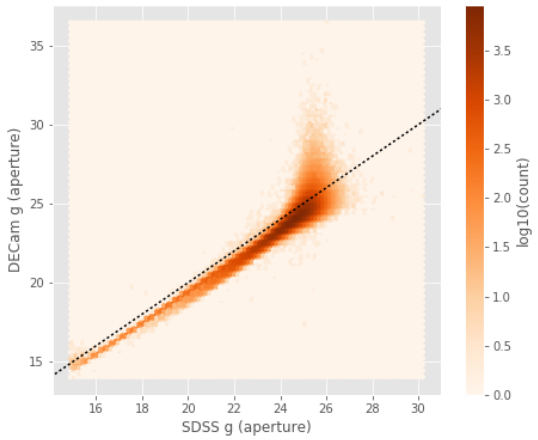


1.4 II - Comparing magnitudes in similar filters

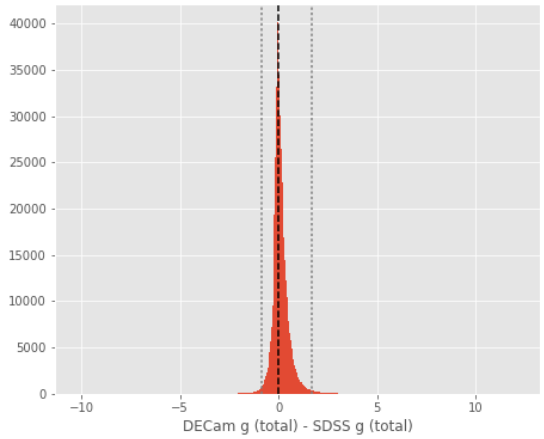
The master list if composed of several catalogues containing magnitudes in similar filters on different instruments. We are comparing the magnitudes in these corresponding filters.

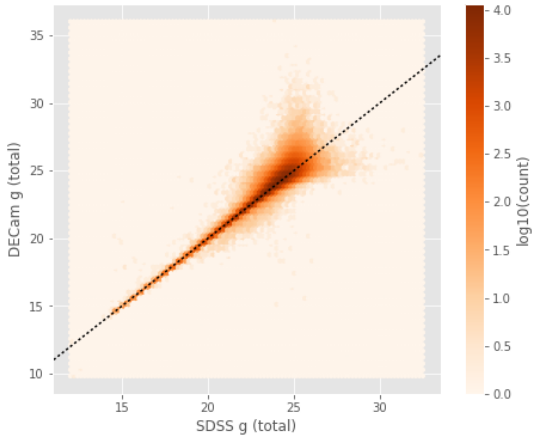
```
DECam g (aperture) - SDSS g (aperture):
- Median: -0.65
- Median Absolute Deviation: 0.21
- 1% percentile: -1.369743415771485
- 99% percentile: 1.1470082854003918
```



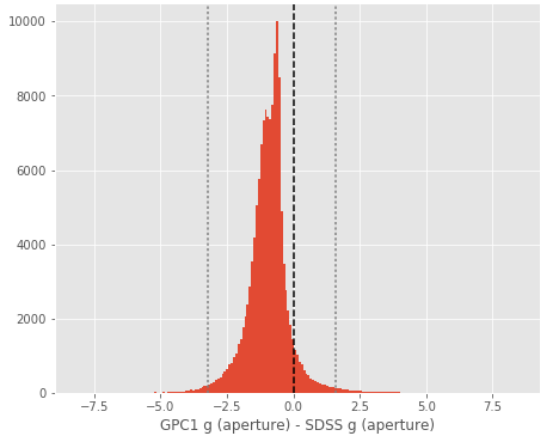


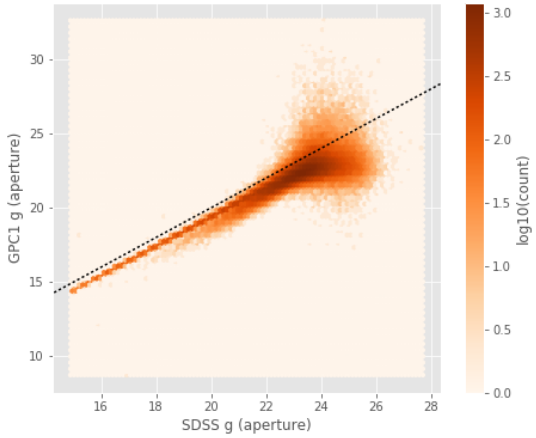
DECam g (total) - SDSS g (total):
- Median: 0.03
- Median Absolute Deviation: 0.18
- 1% percentile: -0.8870277509765617
- 99% percentile: 1.6710442353515624



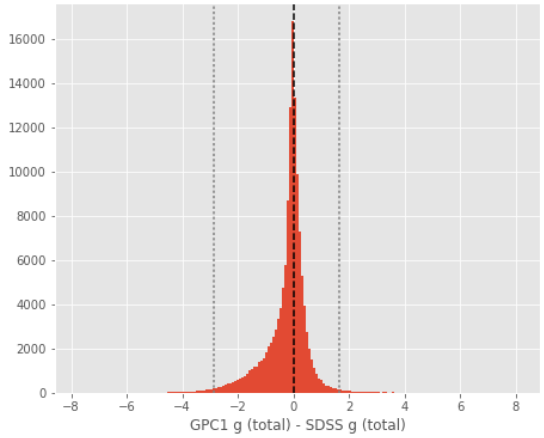


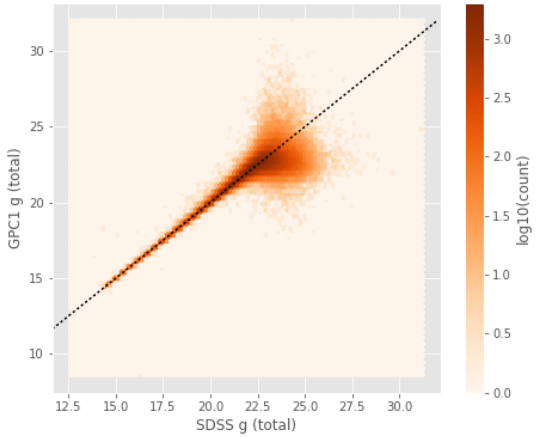
GPC1 g (aperture) - SDSS g (aperture):
- Median: -0.91
- Median Absolute Deviation: 0.37
- 1% percentile: -3.206002183227539
- 99% percentile: 1.5728337866821276



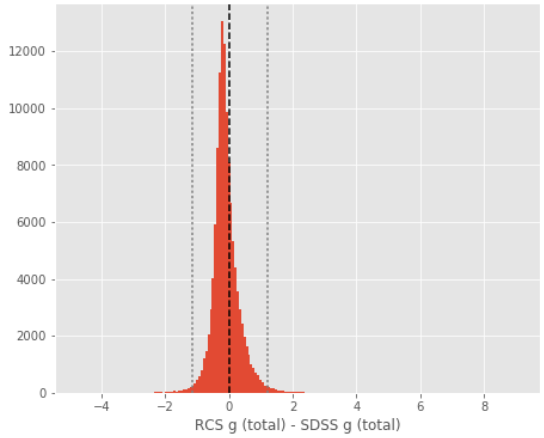


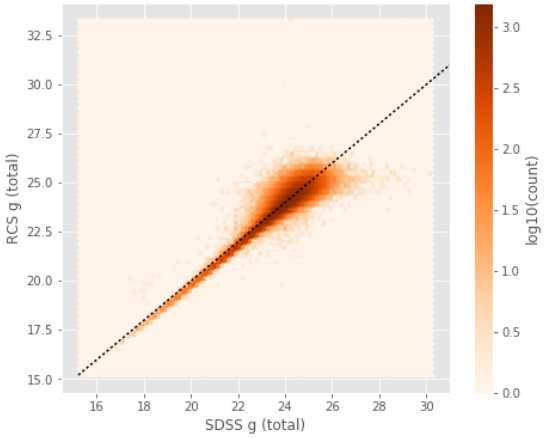
GPC1 g (total) - SDSS g (total):
- Median: -0.07
- Median Absolute Deviation: 0.26
- 1% percentile: -2.8801525574951183
- 99% percentile: 1.6551279635009788



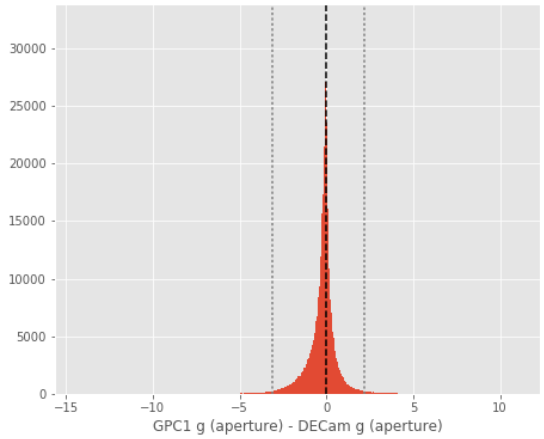


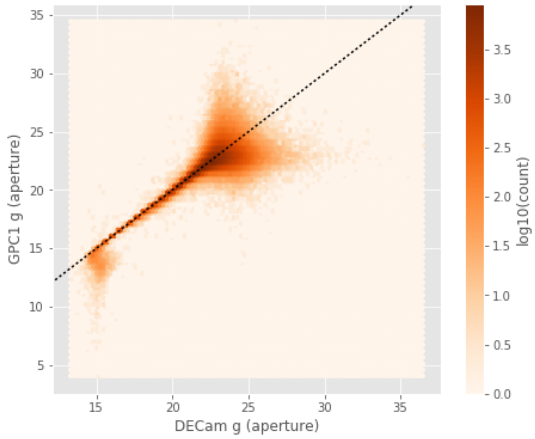
No sources have both SDSS g (aperture) and Suprime g (aperture) values.
No sources have both SDSS g (total) and Suprime g (total) values.
No sources have both SDSS g (aperture) and RCS g (aperture) values.
RCS g (total) - SDSS g (total):
- Median: -0.15
- Median Absolute Deviation: 0.20
- 1% percentile: -1.1508145864868167
- 99% percentile: 1.2041443676757795



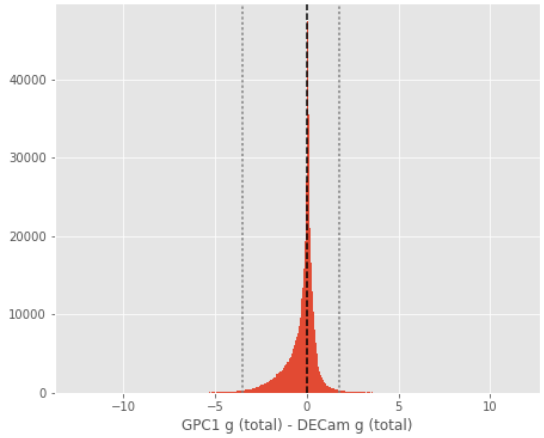


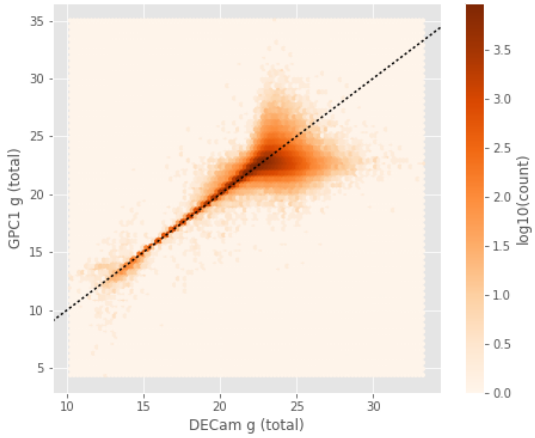
GPC1 g (aperture) - DECam g (aperture):
- Median: -0.12
- Median Absolute Deviation: 0.28
- 1% percentile: -3.1324508666992186
- 99% percentile: 2.209981250762938



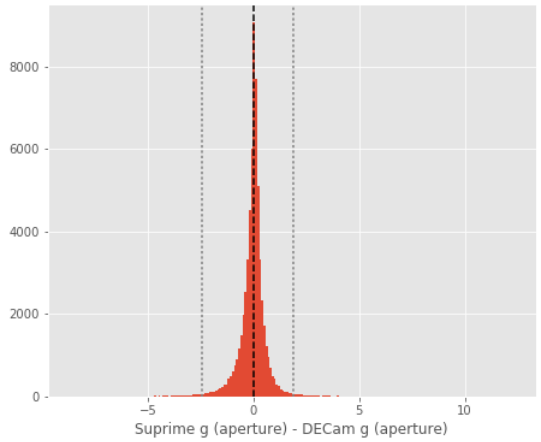


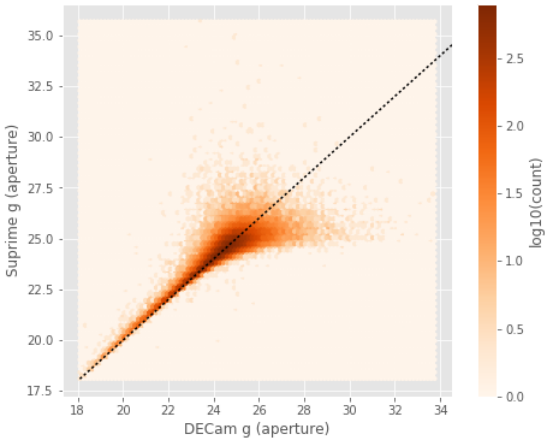
GPC1 g (total) - DECam g (total):
- Median: -0.02
- Median Absolute Deviation: 0.28
- 1% percentile: -3.503301296234131
- 99% percentile: 1.7441903114318813



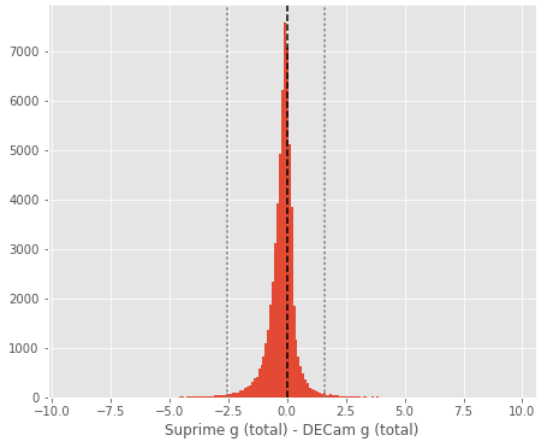


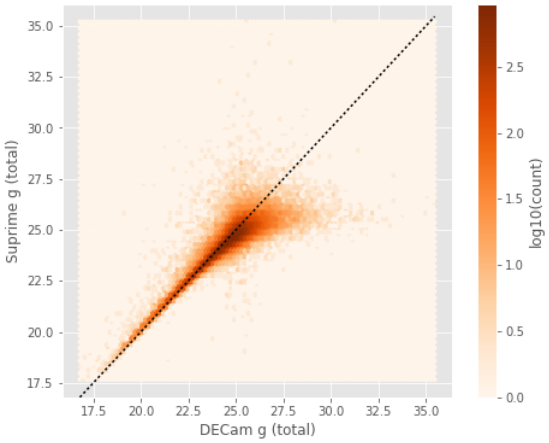
Suprime g (aperture) - DECam g (aperture):
- Median: 0.02
- Median Absolute Deviation: 0.23
- 1% percentile: -2.4182591247558594
- 99% percentile: 1.8705764389038144



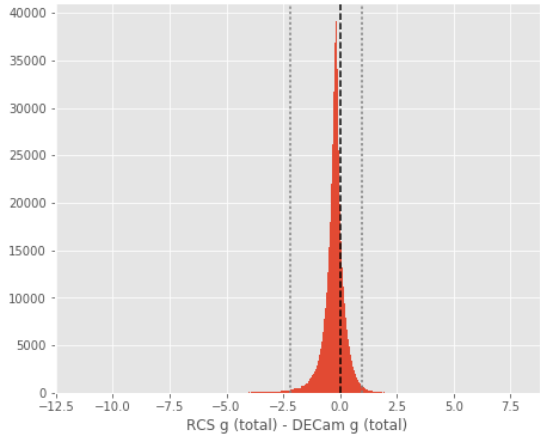


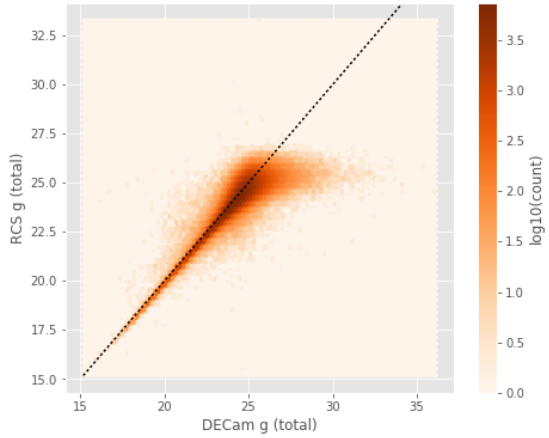
Suprime g (total) - DECam g (total):
- Median: -0.15
- Median Absolute Deviation: 0.24
- 1% percentile: -2.5489704895019534
- 99% percentile: 1.5885691070556645



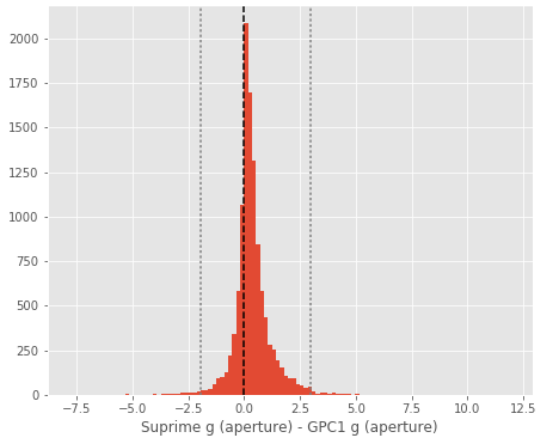


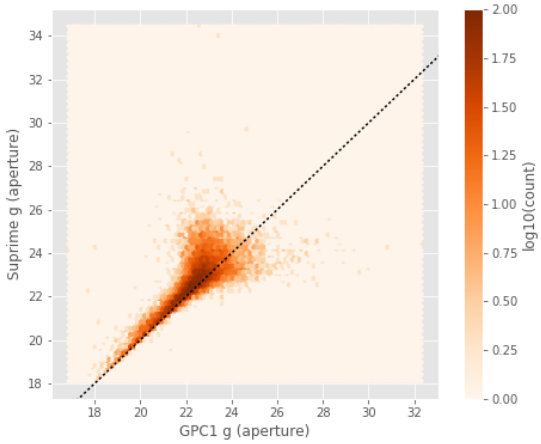
No sources have both DECam g (aperture) and RCS g (aperture) values.
RCS g (total) - DECam g (total):
- Median: -0.22
- Median Absolute Deviation: 0.21
- 1% percentile: -2.1725115966796875
- 99% percentile: 0.9619197845458984



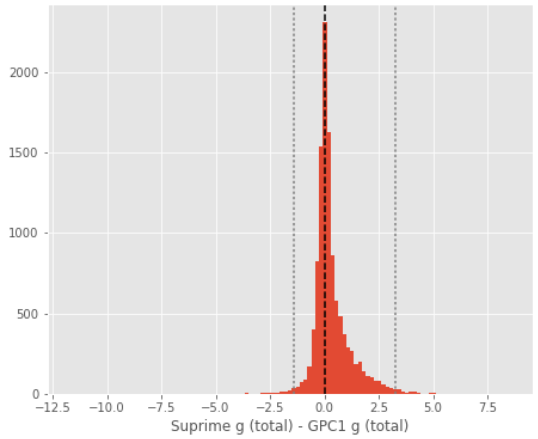


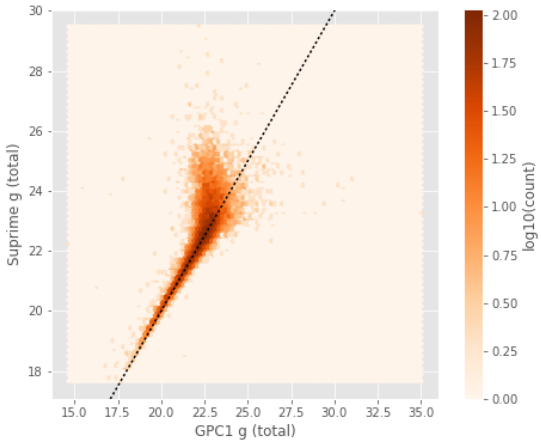
Suprime g (aperture) - GPC1 g (aperture):
- Median: 0.25
- Median Absolute Deviation: 0.30
- 1% percentile: -1.9736169052124022
- 99% percentile: 2.9869889640808087



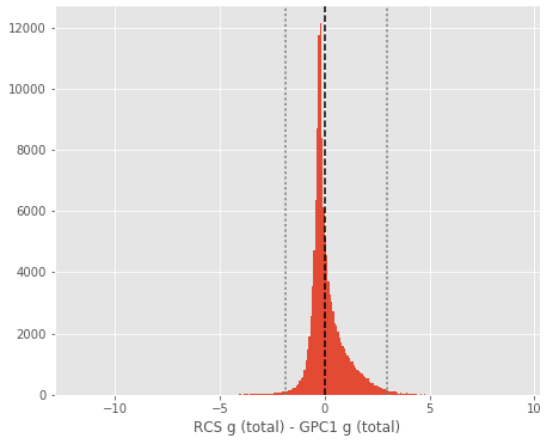


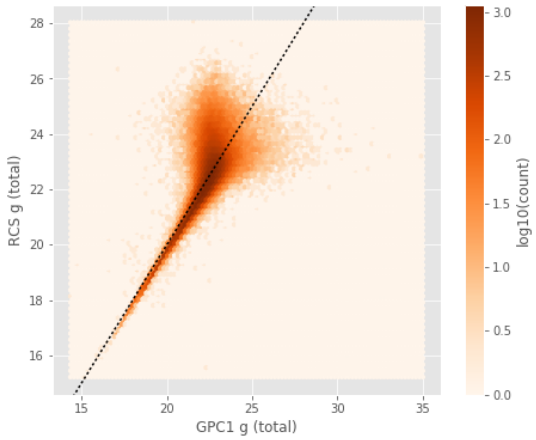
Suprime g (total) - GPC1 g (total):
- Median: 0.12
- Median Absolute Deviation: 0.29
- 1% percentile: -1.4026131439208984
- 99% percentile: 3.274006023406982



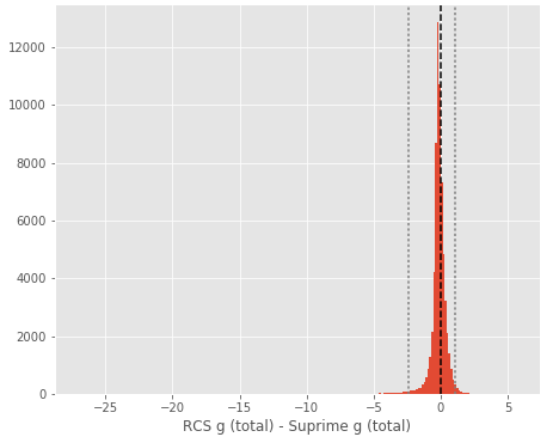


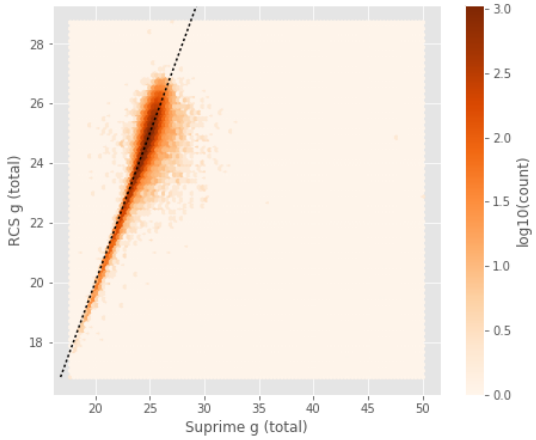
No sources have both GPC1 g (aperture) and RCS g (aperture) values.
RCS g (total) - GPC1 g (total):
- Median: -0.13
- Median Absolute Deviation: 0.32
- 1% percentile: -1.882863235473633
- 99% percentile: 2.9682432556152345



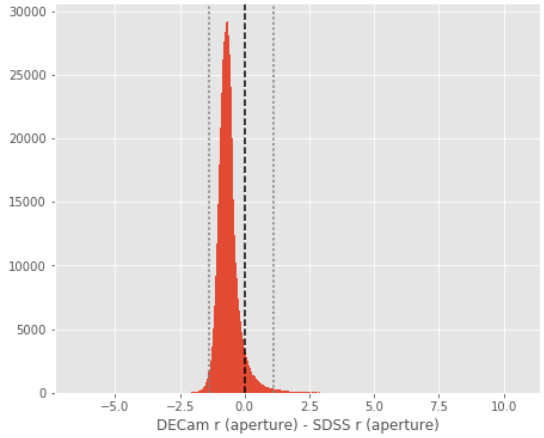


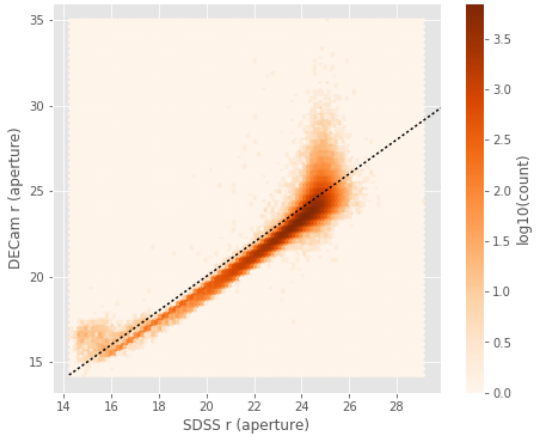
No sources have both Suprime g (aperture) and RCS g (aperture) values.
RCS g (total) - Suprime g (total):
- Median: -0.15
- Median Absolute Deviation: 0.21
- 1% percentile: -2.40746826171875
- 99% percentile: 1.0876546478271485



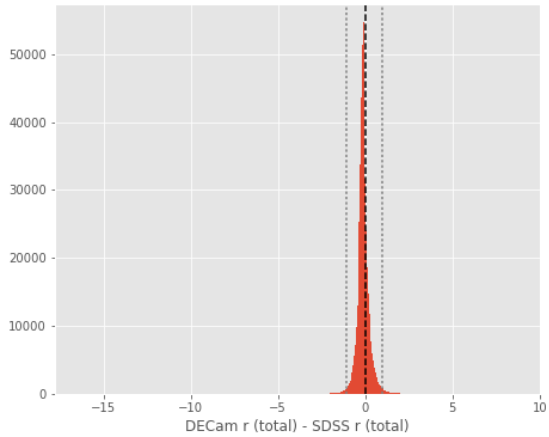


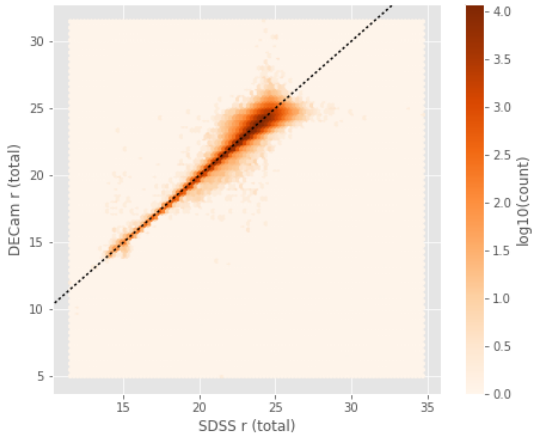
DECam r (aperture) - SDSS r (aperture):
- Median: -0.68
- Median Absolute Deviation: 0.21
- 1% percentile: -1.3852449727783214
- 99% percentile: 1.1101013143310563



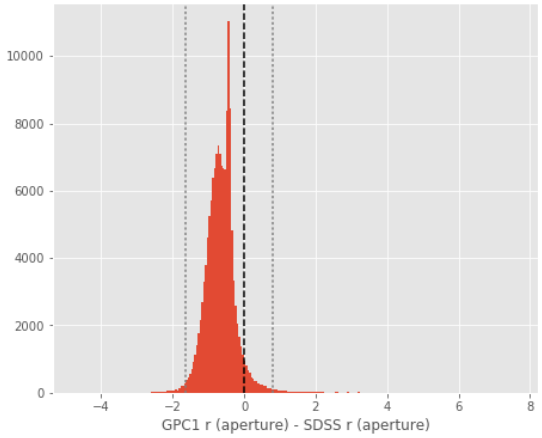


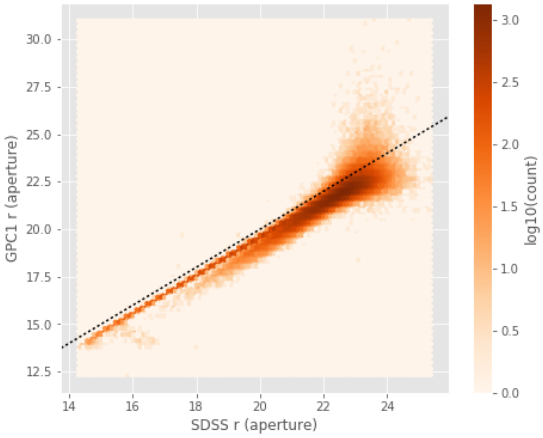
DECam r (total) - SDSS r (total):
- Median: -0.13
- Median Absolute Deviation: 0.15
- 1% percentile: -1.0457528029785144
- 99% percentile: 0.9778500347900343



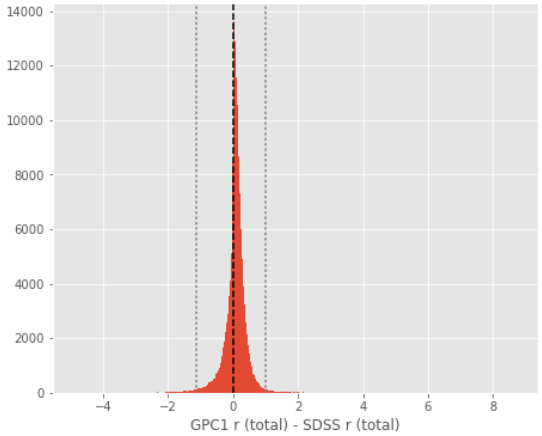


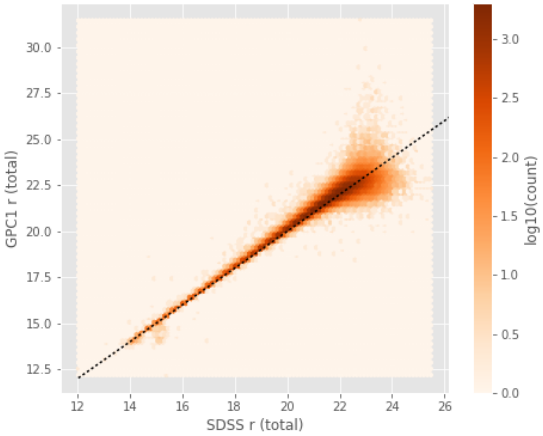
GPC1 r (aperture) - SDSS r (aperture):
- Median: -0.65
- Median Absolute Deviation: 0.24
- 1% percentile: -1.6492644418945306
- 99% percentile: 0.7977198767089918



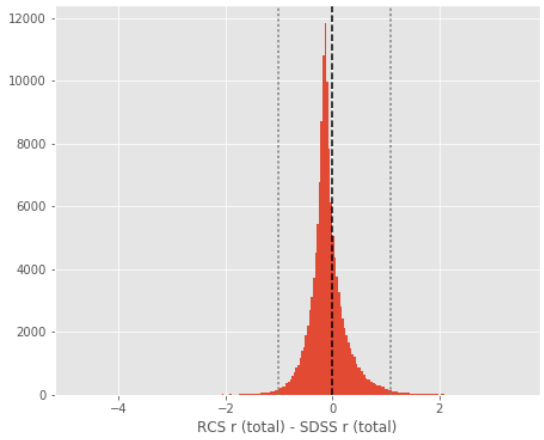


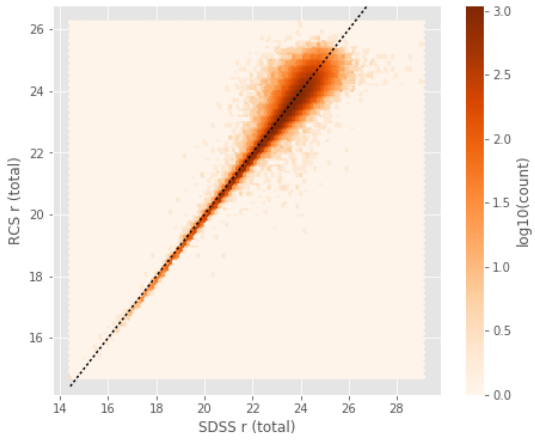
GPC1 r (total) - SDSS r (total):
- Median: 0.09
- Median Absolute Deviation: 0.12
- 1% percentile: -1.150610781066894
- 99% percentile: 1.0046281422119154



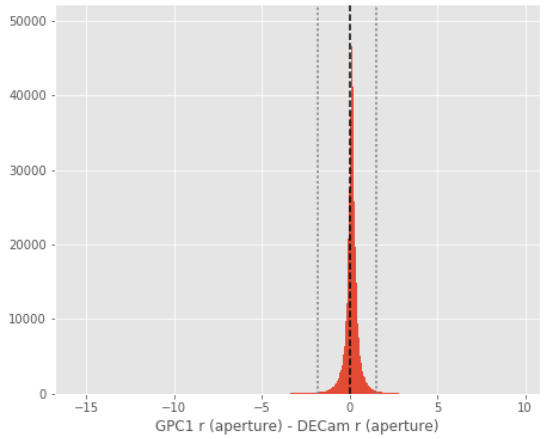


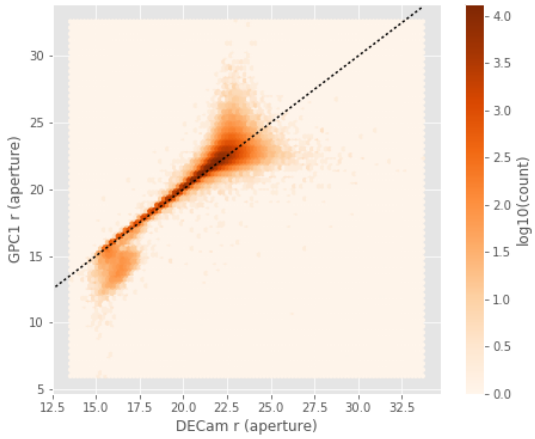
No sources have both SDSS r (aperture) and Suprime r (aperture) values.
No sources have both SDSS r (total) and Suprime r (total) values.
No sources have both SDSS r (aperture) and RCS r (aperture) values.
RCS r (total) - SDSS r (total):
- Median: -0.12
- Median Absolute Deviation: 0.15
- 1% percentile: -1.019848545166015
- 99% percentile: 1.0965001182861318



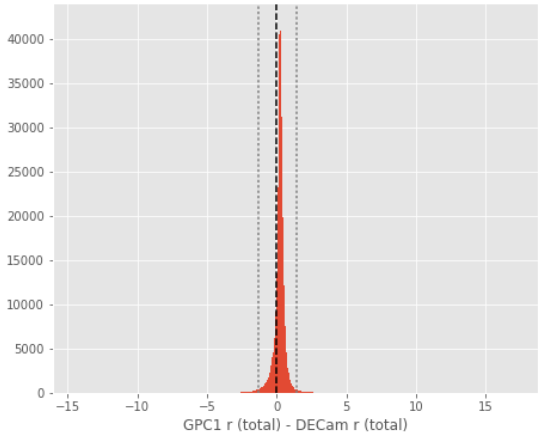


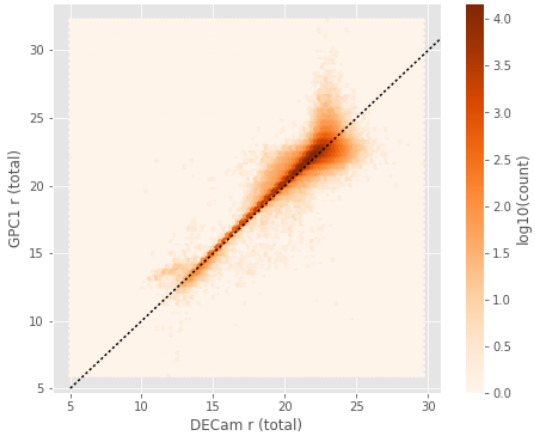
GPC1 r (aperture) - DECam r (aperture):
- Median: 0.12
- Median Absolute Deviation: 0.15
- 1% percentile: -1.838051061630249
- 99% percentile: 1.5183926773071295



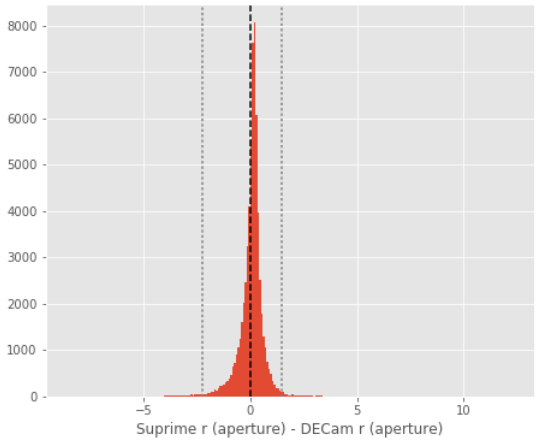


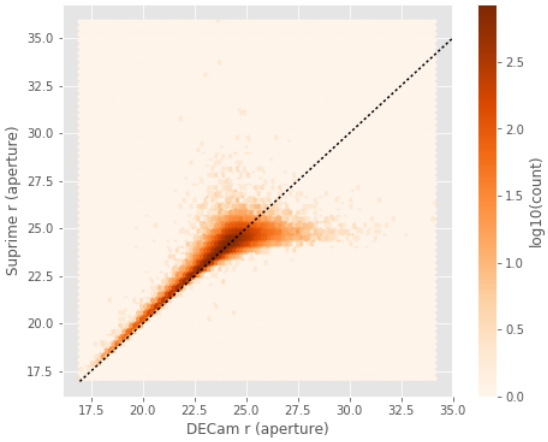
GPC1 r (total) - DECam r (total):
- Median: 0.23
- Median Absolute Deviation: 0.15
- 1% percentile: -1.316351318359375
- 99% percentile: 1.4407266616821286



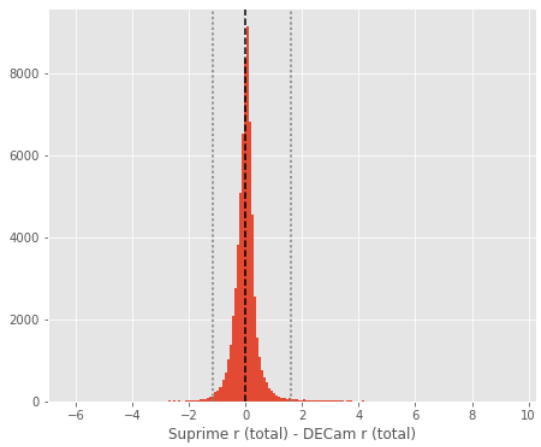


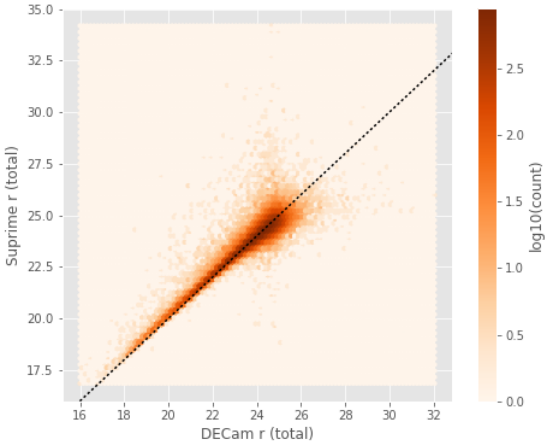
Suprime r (aperture) - DECam r (aperture):
- Median: 0.11
- Median Absolute Deviation: 0.21
- 1% percentile: -2.228728008270264
- 99% percentile: 1.4809819793701173



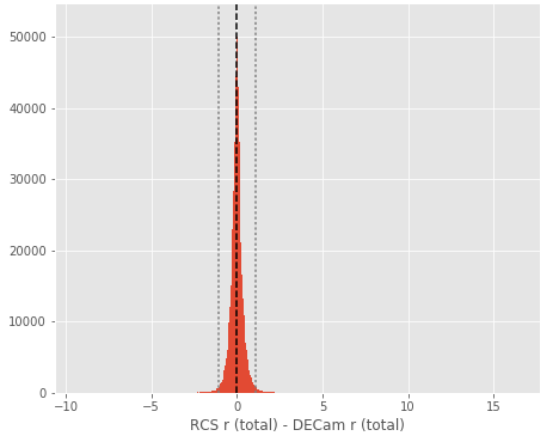


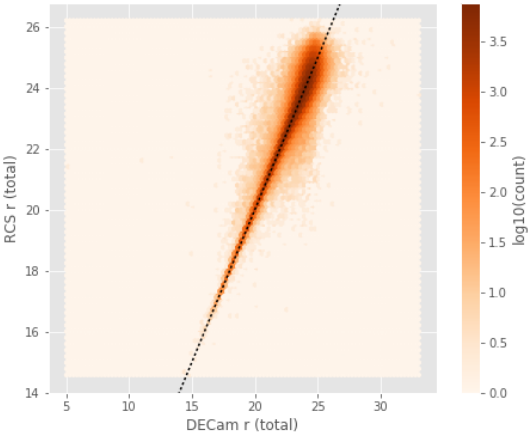
Suprime r (total) - DECam r (total):
- Median: 0.01
- Median Absolute Deviation: 0.18
- 1% percentile: -1.1619326782226564
- 99% percentile: 1.5908895874023425



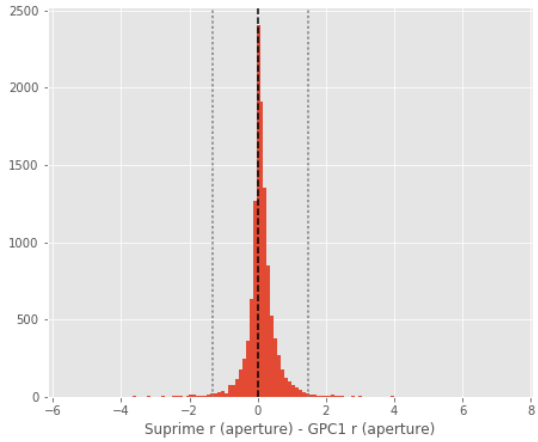


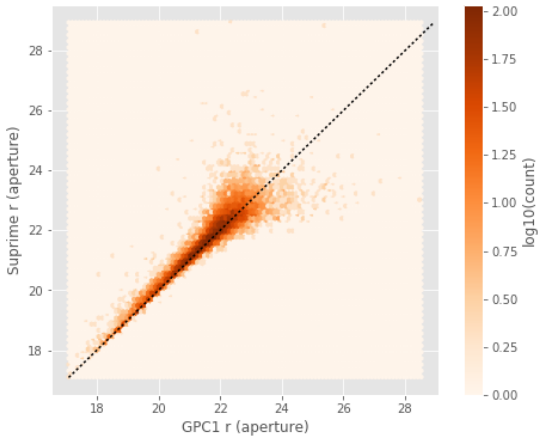
No sources have both DECam r (aperture) and RCS r (aperture) values.
RCS r (total) - DECam r (total):
- Median: -0.01
- Median Absolute Deviation: 0.17
- 1% percentile: -1.0698253631591799
- 99% percentile: 1.1014166641235348



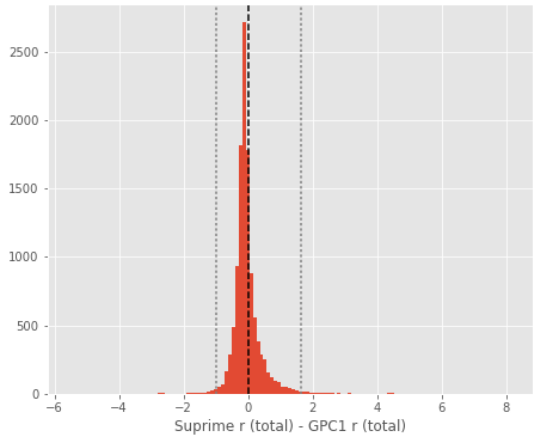


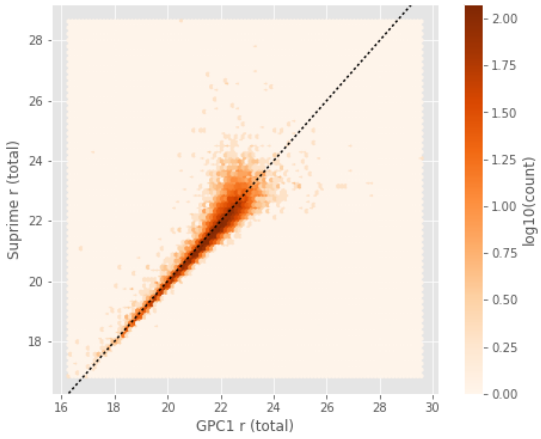
Suprime r (aperture) - GPC1 r (aperture):
- Median: 0.07
- Median Absolute Deviation: 0.15
- 1% percentile: -1.3094873237609863
- 99% percentile: 1.4882897758483766



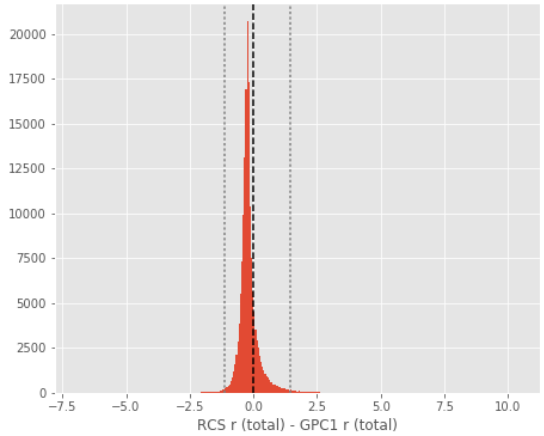


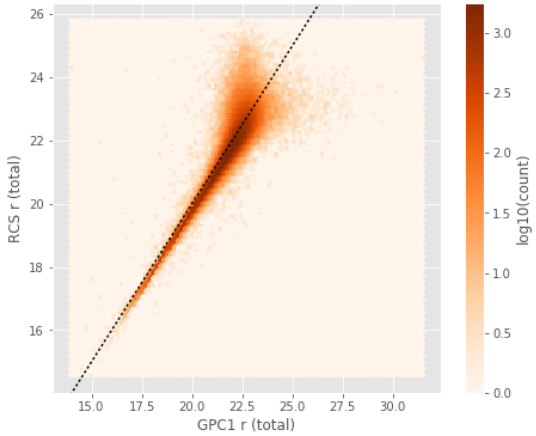
Suprime r (total) - GPC1 r (total):
- Median: -0.11
- Median Absolute Deviation: 0.14
- 1% percentile: -0.9736609268188476
- 99% percentile: 1.6416873550415039



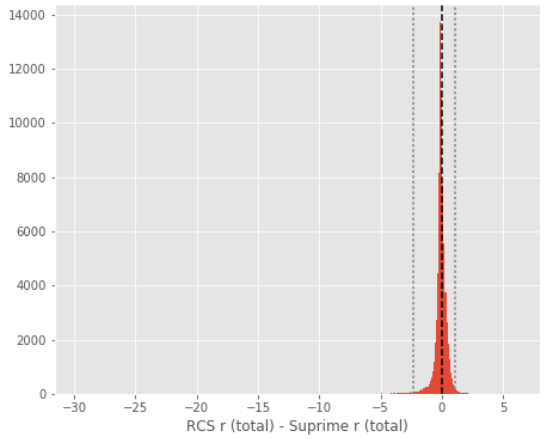


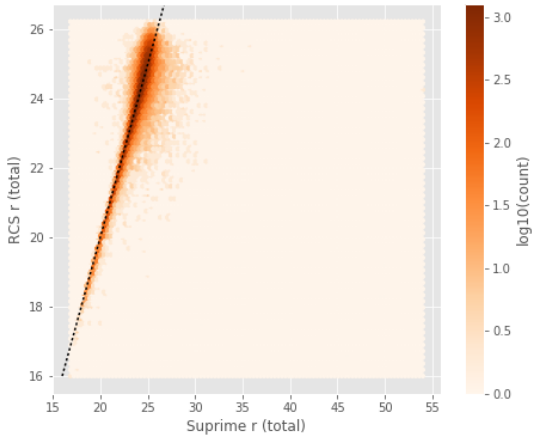
No sources have both GPC1 r (aperture) and RCS r (aperture) values.
RCS r (total) - GPC1 r (total):
- Median: -0.23
- Median Absolute Deviation: 0.14
- 1% percentile: -1.1326136779785156
- 99% percentile: 1.4416136932373051



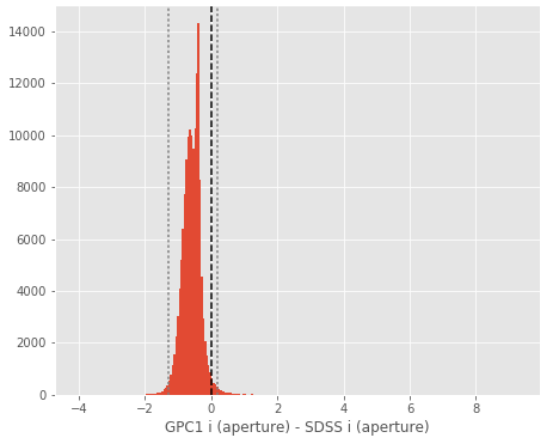


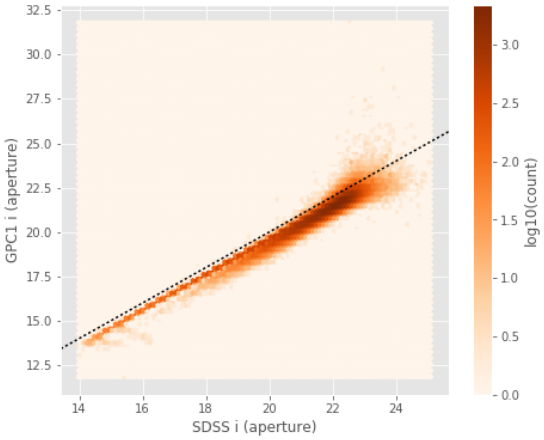
No sources have both Suprime r (aperture) and RCS r (aperture) values.
RCS r (total) - Suprime r (total):
- Median: -0.07
- Median Absolute Deviation: 0.18
- 1% percentile: -2.3652862548828124
- 99% percentile: 1.0521179199218729



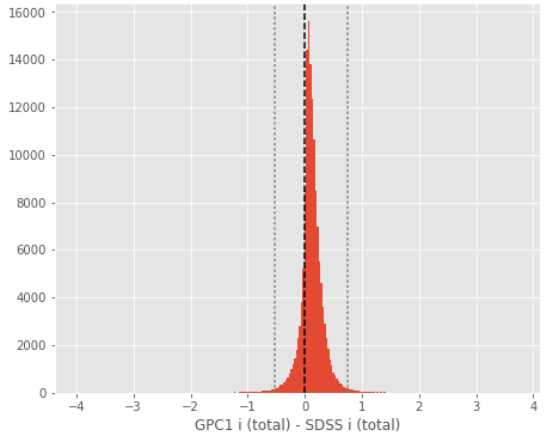


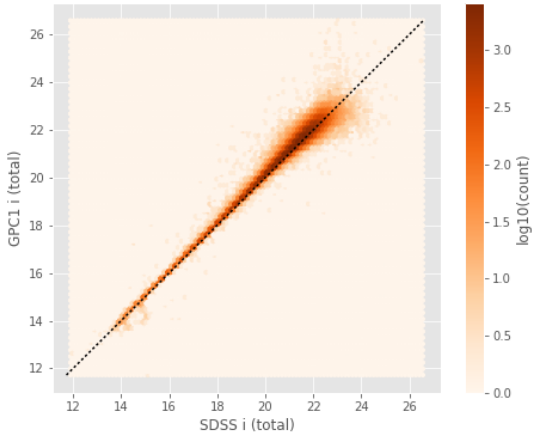
GPC1 i (aperture) - SDSS i (aperture):
- Median: -0.57
- Median Absolute Deviation: 0.18
- 1% percentile: -1.290400276611329
- 99% percentile: 0.20386654101562612



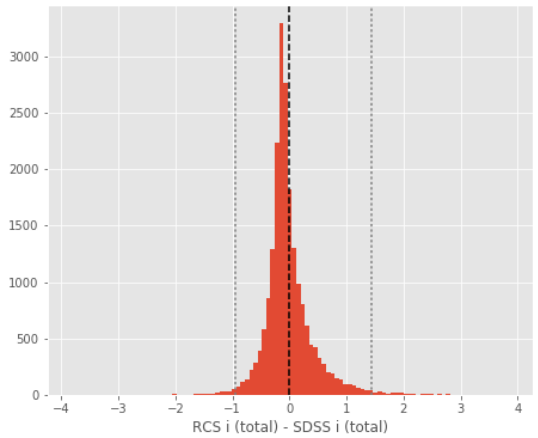


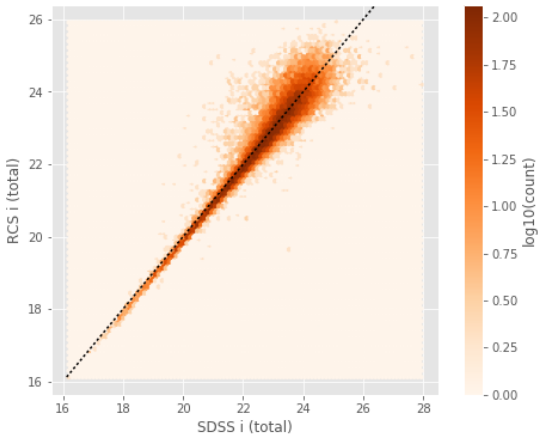
GPC1 i (total) - SDSS i (total):
- Median: 0.11
- Median Absolute Deviation: 0.09
- 1% percentile: -0.5160627268371595
- 99% percentile: 0.7460765848388664



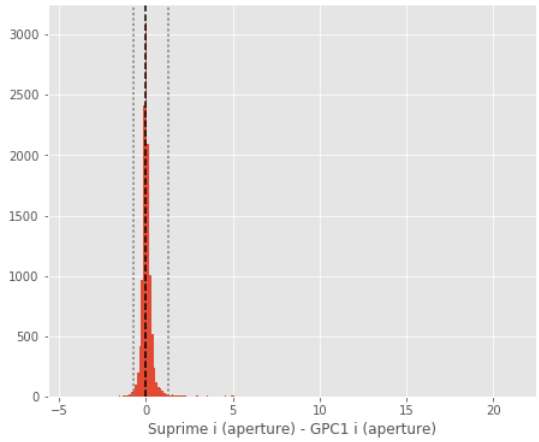


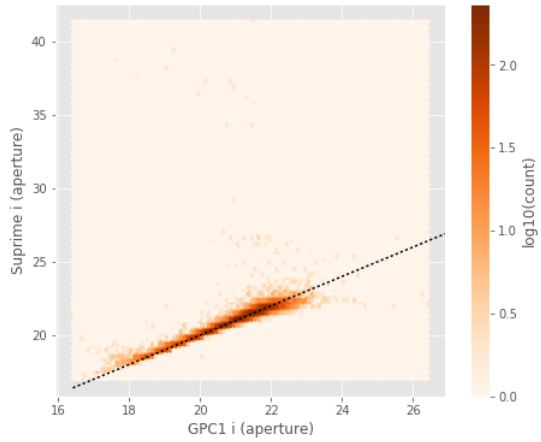
No sources have both SDSS i (aperture) and Suprime i (aperture) values.
No sources have both SDSS i (total) and Suprime i (total) values.
No sources have both SDSS i (aperture) and RCS i (aperture) values.
RCS i (total) - SDSS i (total):
- Median: -0.09
- Median Absolute Deviation: 0.16
- 1% percentile: -0.9390832550659163
- 99% percentile: 1.4268233815002451



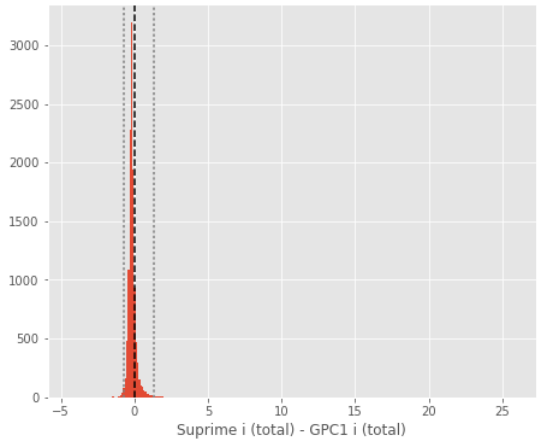


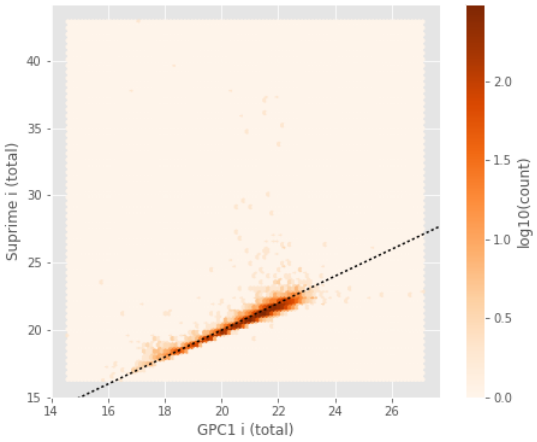
Suprime i (aperture) - GPC1 i (aperture):
- Median: 0.01
- Median Absolute Deviation: 0.12
- 1% percentile: -0.7142147827148437
- 99% percentile: 1.2686882781982451



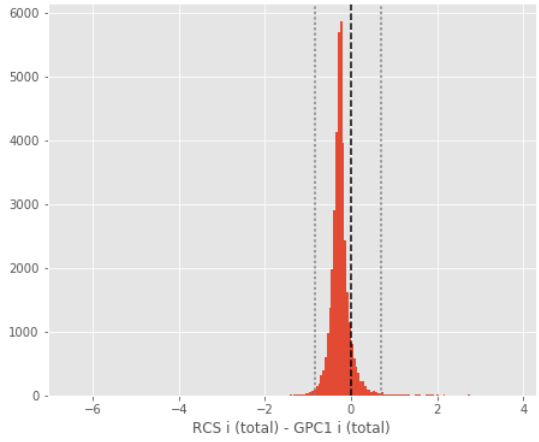


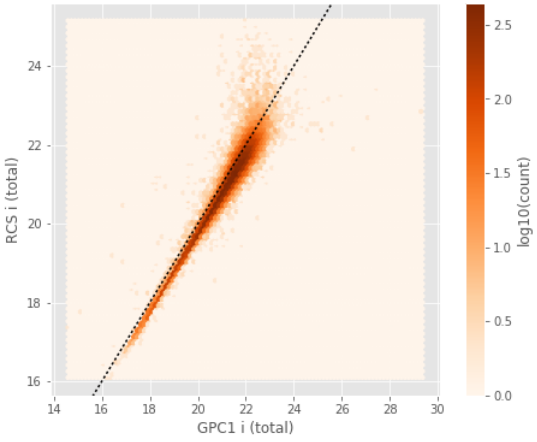
Suprime i (total) - GPC1 i (total):
- Median: -0.19
- Median Absolute Deviation: 0.11
- 1% percentile: -0.7223954772949219
- 99% percentile: 1.327408523559564



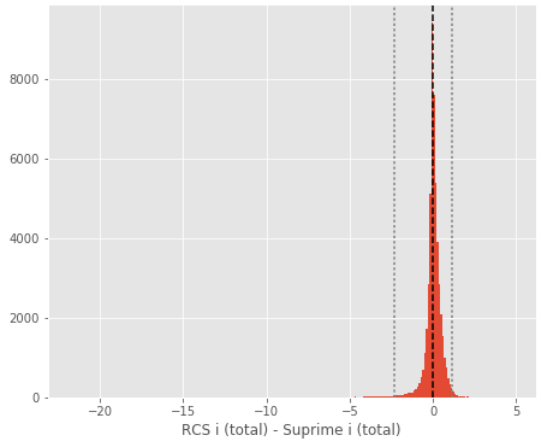


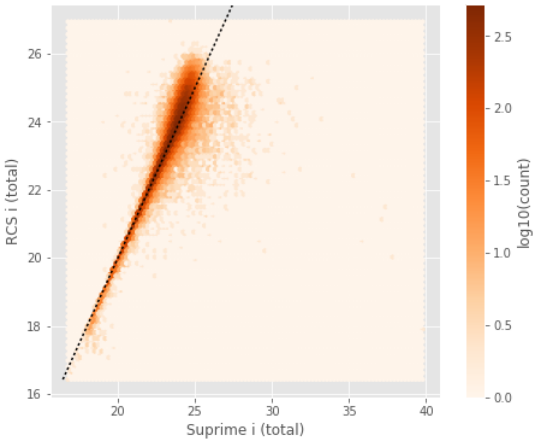
No sources have both GPC1 i (aperture) and RCS i (aperture) values.
RCS i (total) - GPC1 i (total):
- Median: -0.26
- Median Absolute Deviation: 0.10
- 1% percentile: -0.825885009765625
- 99% percentile: 0.6832805633544881



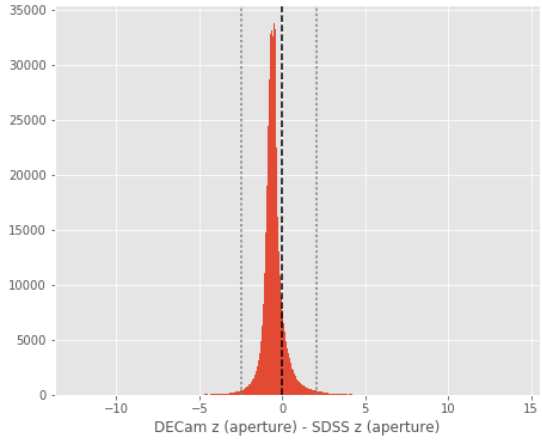


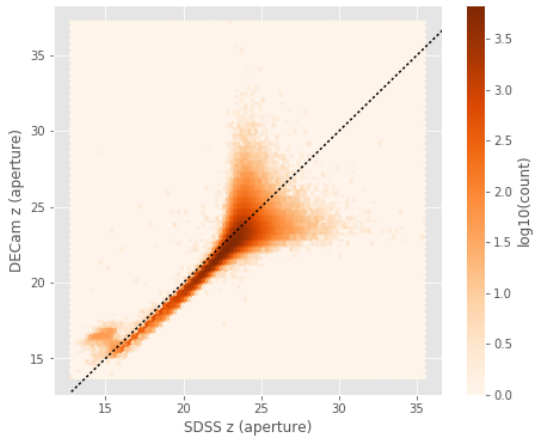
No sources have both Suprime i (aperture) and RCS i (aperture) values.
RCS i (total) - Suprime i (total):
- Median: 0.01
- Median Absolute Deviation: 0.19
- 1% percentile: -2.2906301116943357
- 99% percentile: 1.1509046173095727



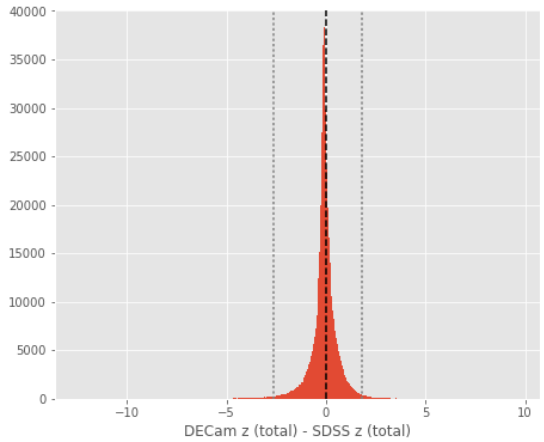


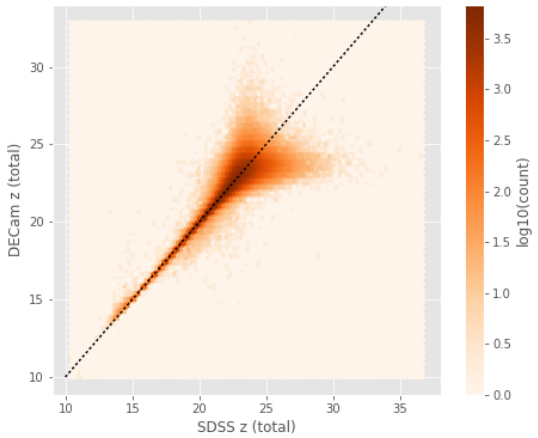
DECam z (aperture) - SDSS z (aperture):
- Median: -0.59
- Median Absolute Deviation: 0.26
- 1% percentile: -2.4457099262695317
- 99% percentile: 2.0554444185790963



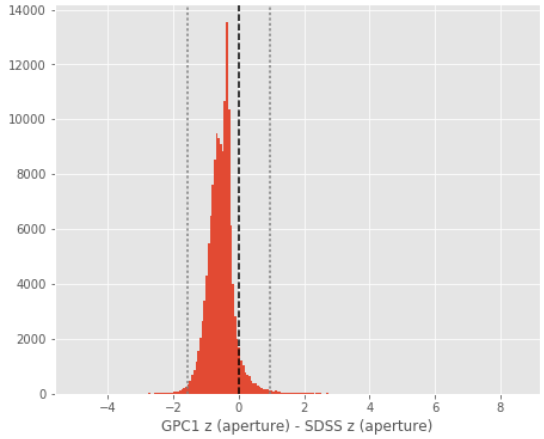


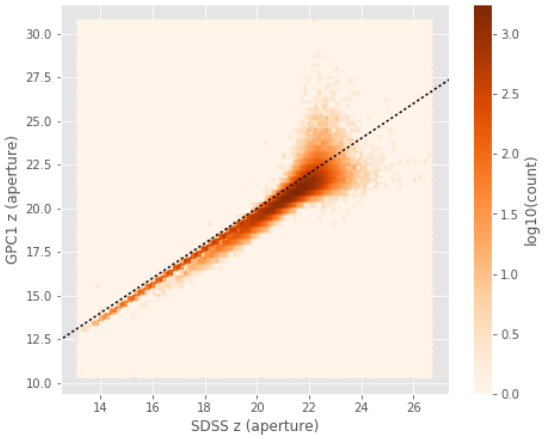
DECam z (total) - SDSS z (total):
- Median: -0.09
- Median Absolute Deviation: 0.24
- 1% percentile: -2.6325343649902337
- 99% percentile: 1.8004996293945332



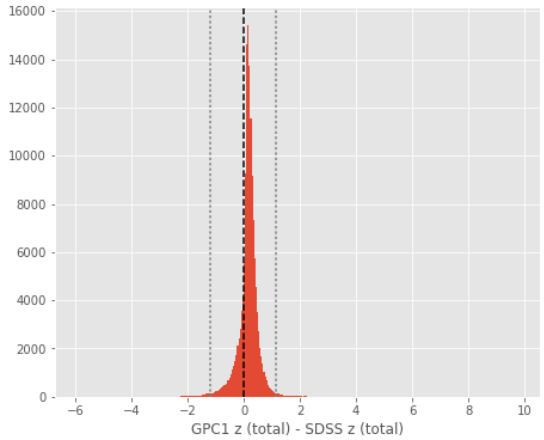


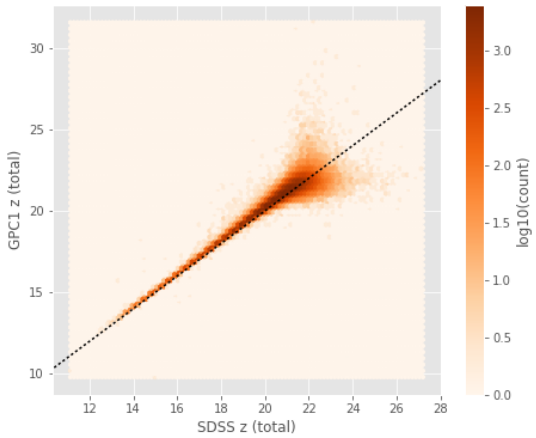
GPC1 z (aperture) - SDSS z (aperture):
- Median: -0.54
- Median Absolute Deviation: 0.22
- 1% percentile: -1.564947363952636
- 99% percentile: 0.9453999288330075



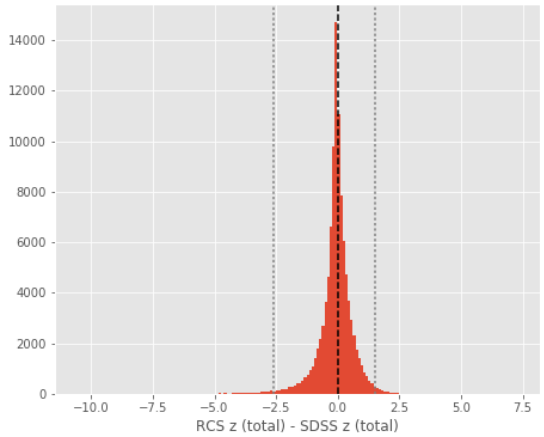


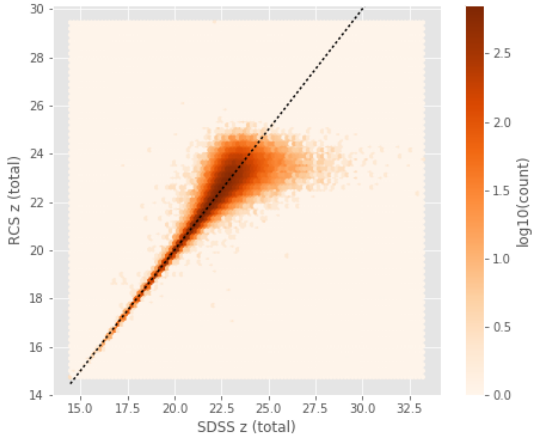
GPC1 z (total) - SDSS z (total):
- Median: 0.17
- Median Absolute Deviation: 0.13
- 1% percentile: -1.1928884832763664
- 99% percentile: 1.1529006408691411



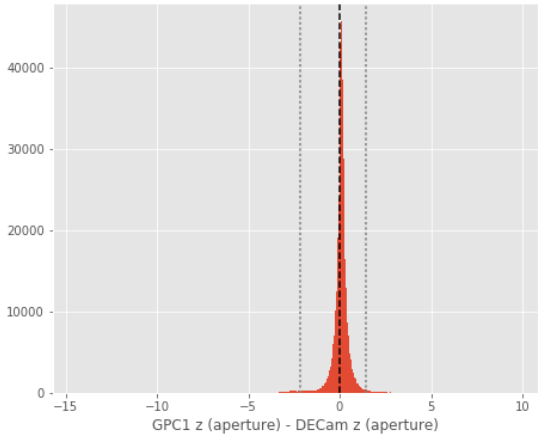


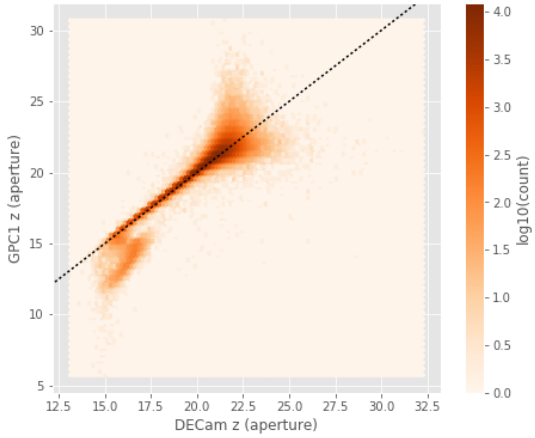
No sources have both SDSS z (aperture) and Suprime z (aperture) values.
No sources have both SDSS z (total) and Suprime z (total) values.
No sources have both SDSS z (aperture) and RCS z (aperture) values.
RCS z (total) - SDSS z (total):
- Median: -0.05
- Median Absolute Deviation: 0.27
- 1% percentile: -2.5915972451171867
- 99% percentile: 1.4944283287963875



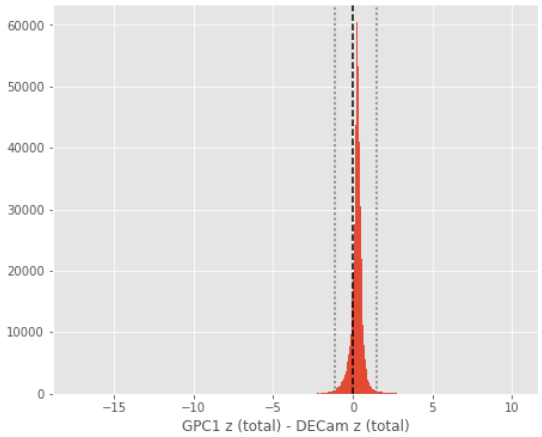


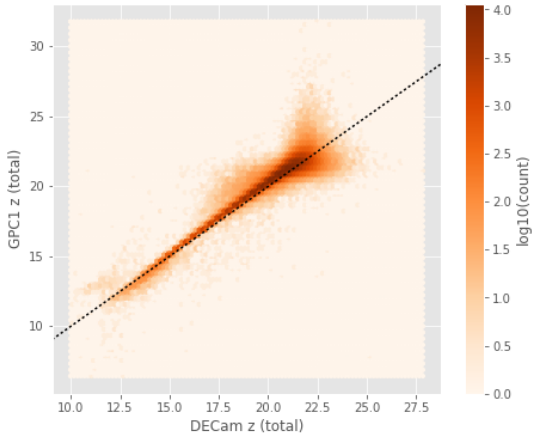
GPC1 z (aperture) - DECam z (aperture):
- Median: 0.09
- Median Absolute Deviation: 0.14
- 1% percentile: -2.1351356887817383
- 99% percentile: 1.4540224456787108



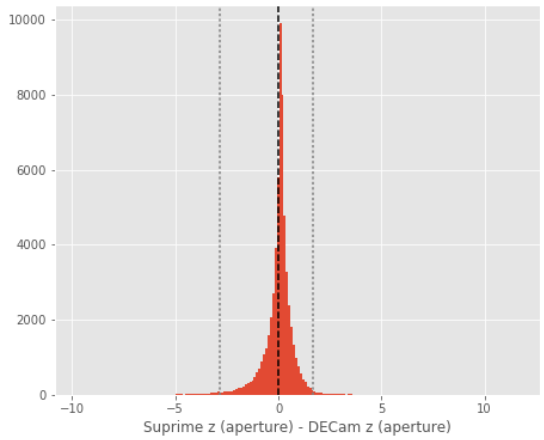


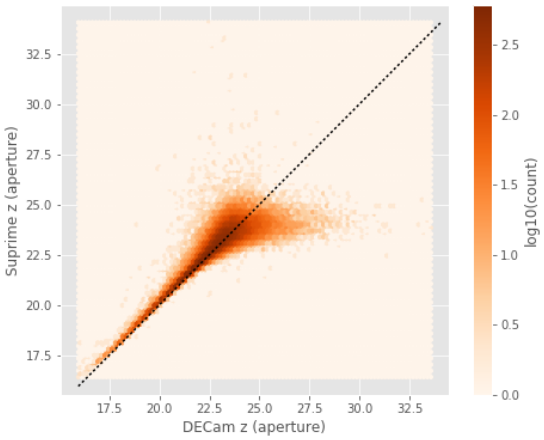
GPC1 z (total) - DECam z (total):
- Median: 0.27
- Median Absolute Deviation: 0.15
- 1% percentile: -1.1103314208984376
- 99% percentile: 1.454379558563233



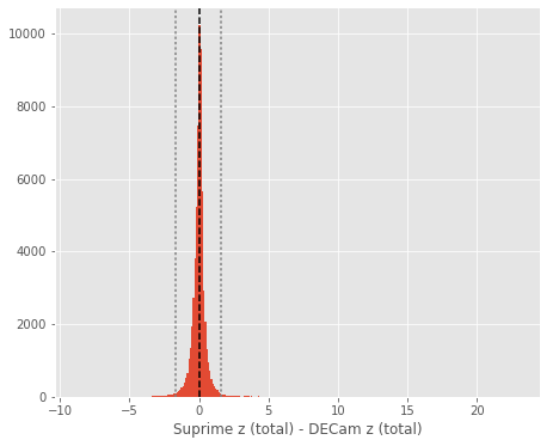


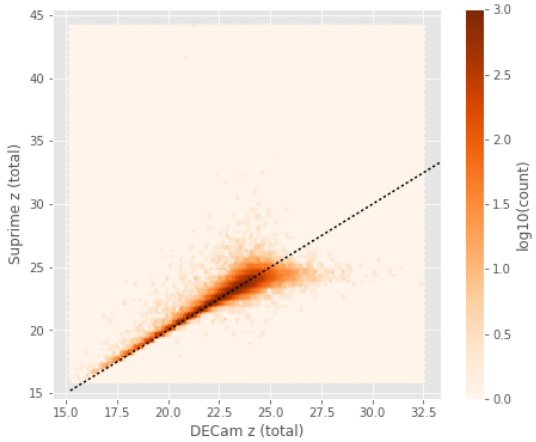
Suprime z (aperture) - DECam z (aperture):
- Median: 0.10
- Median Absolute Deviation: 0.24
- 1% percentile: -2.8512701416015624
- 99% percentile: 1.6853060150146484



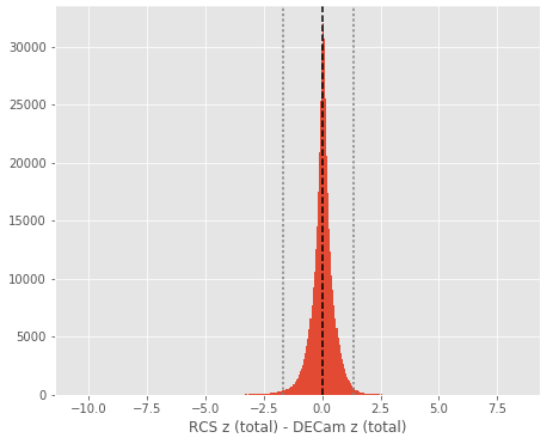


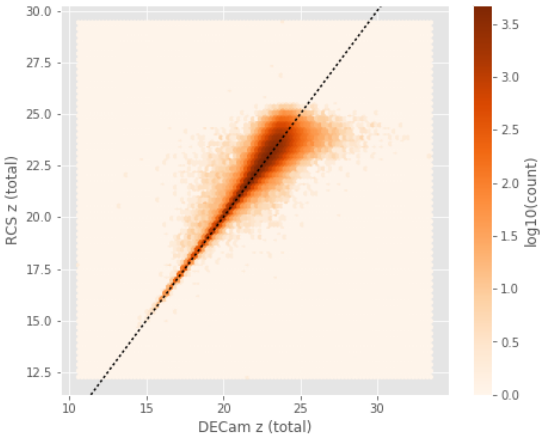
Suprime z (total) - DECam z (total):
- Median: 0.02
- Median Absolute Deviation: 0.19
- 1% percentile: -1.7147566223144532
- 99% percentile: 1.6015958404540975



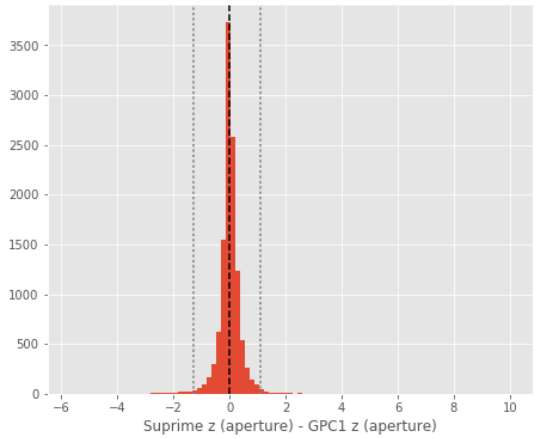


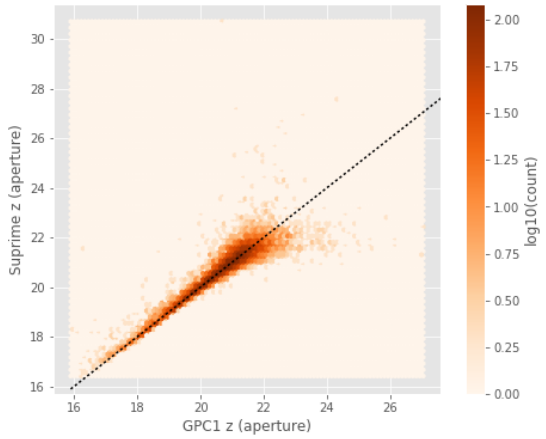
No sources have both DECam z (aperture) and RCS z (aperture) values.
RCS z (total) - DECam z (total):
- Median: 0.03
- Median Absolute Deviation: 0.23
- 1% percentile: -1.6561821365356446
- 99% percentile: 1.3318465232849168



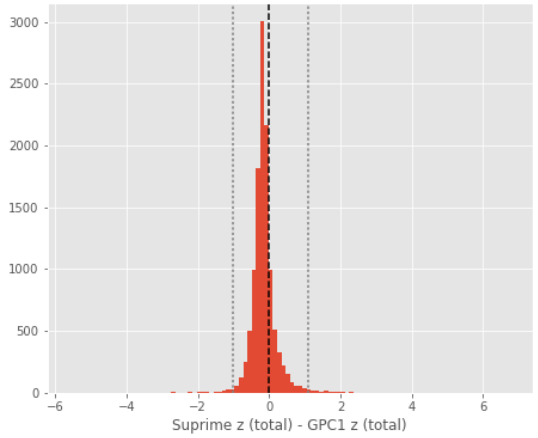


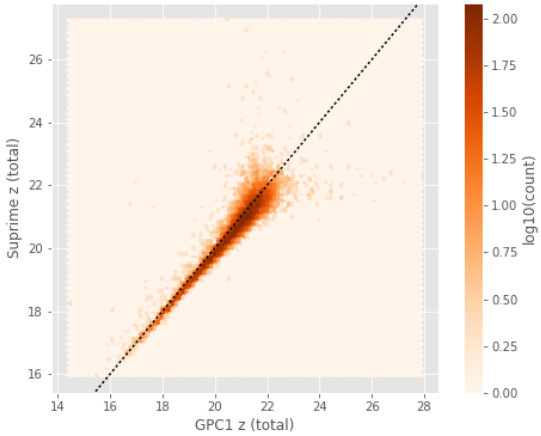
Suprime z (aperture) - GPC1 z (aperture):
- Median: -0.00
- Median Absolute Deviation: 0.15
- 1% percentile: -1.2945173072814942
- 99% percentile: 1.120867881774903



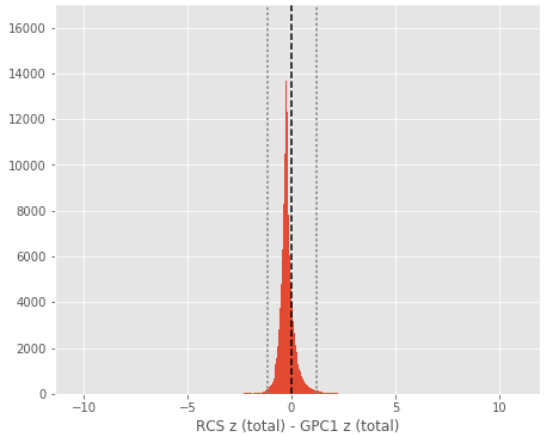


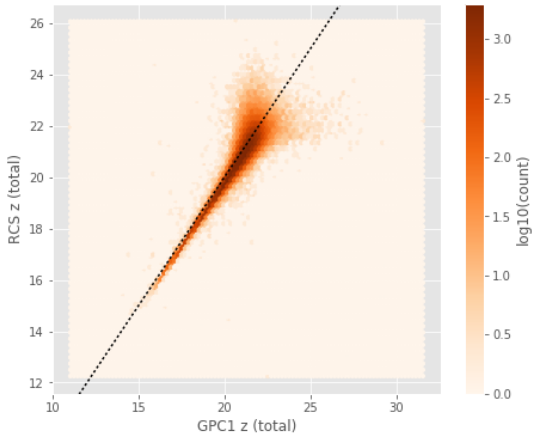
Suprime z (total) - GPC1 z (total):
- Median: -0.17
- Median Absolute Deviation: 0.13
- 1% percentile: -1.0127337074279785
- 99% percentile: 1.1070509338378889



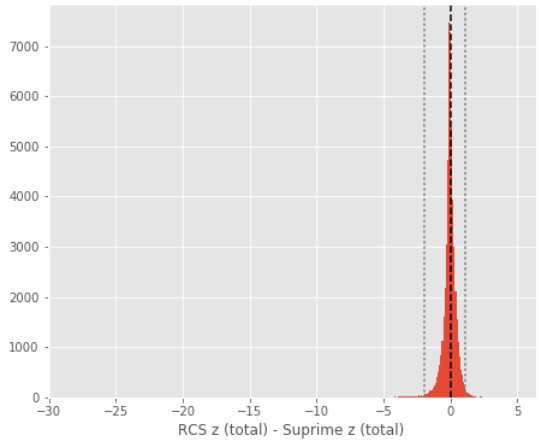


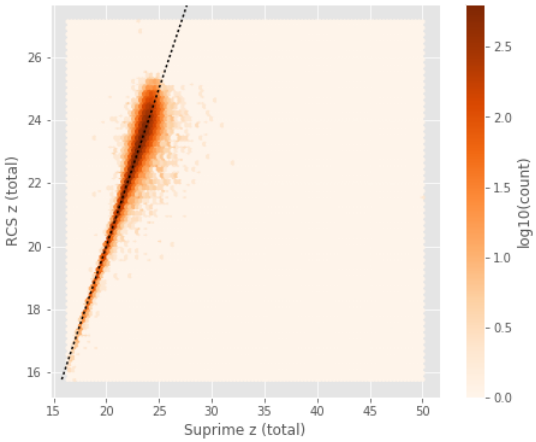
No sources have both GPC1 z (aperture) and RCS z (aperture) values.
RCS z (total) - GPC1 z (total):
- Median: -0.24
- Median Absolute Deviation: 0.15
- 1% percentile: -1.1760531616210939
- 99% percentile: 1.1817067146301268



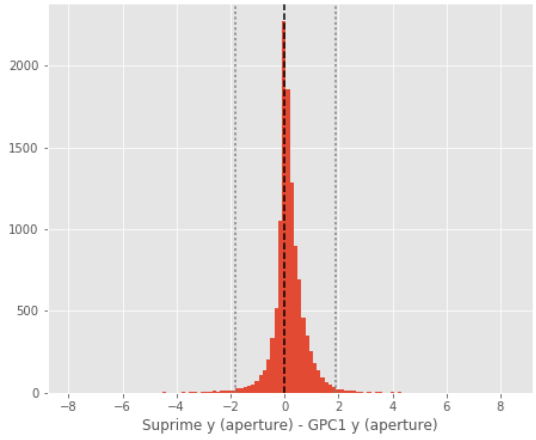


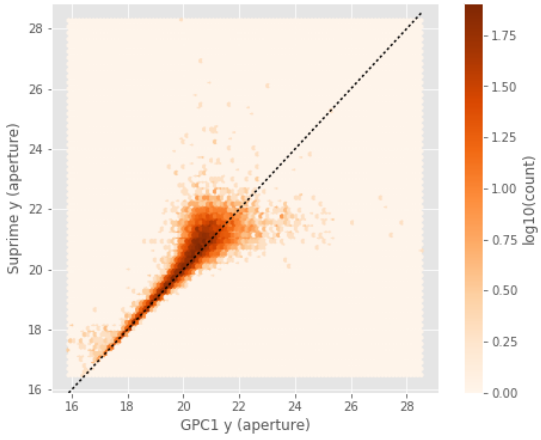
No sources have both Suprime z (aperture) and RCS z (aperture) values.
RCS z (total) - Suprime z (total):
- Median: -0.04
- Median Absolute Deviation: 0.21
- 1% percentile: -1.9193576049804686
- 99% percentile: 1.0926615142822262



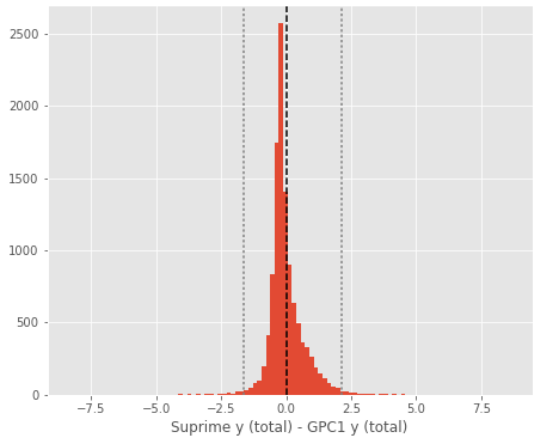


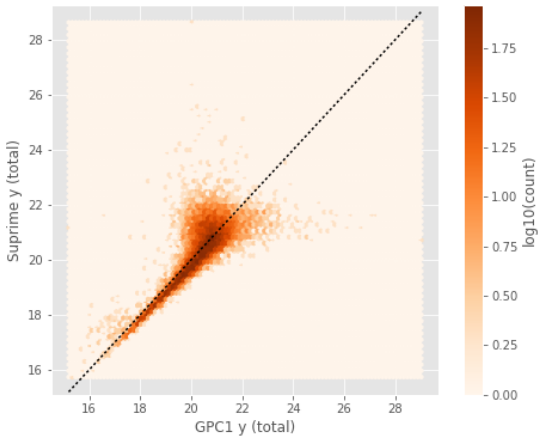
Suprime y (aperture) - GPC1 y (aperture):
- Median: 0.11
- Median Absolute Deviation: 0.23
- 1% percentile: -1.7991735839843748
- 99% percentile: 1.8983014678955072



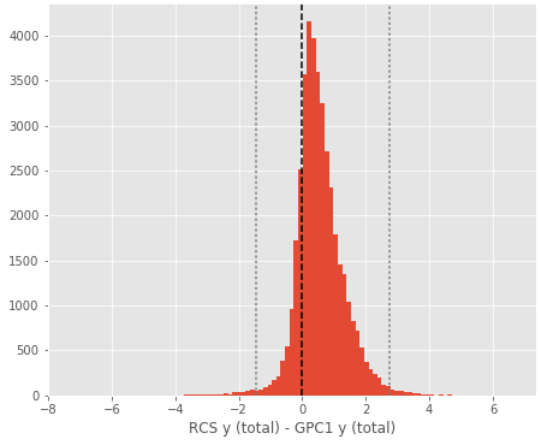


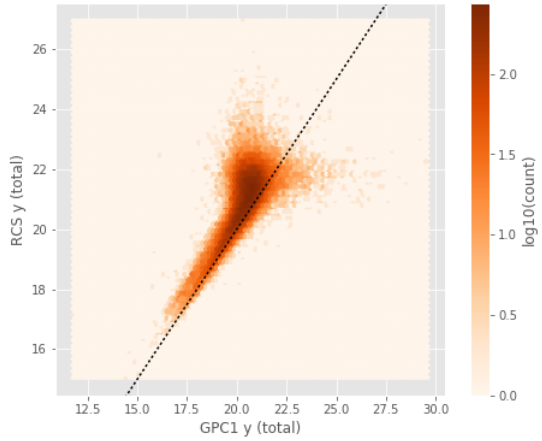
Suprime y (total) - GPC1 y (total):
- Median: -0.15
- Median Absolute Deviation: 0.25
- 1% percentile: -1.6497690963745117
- 99% percentile: 2.1316806030273425



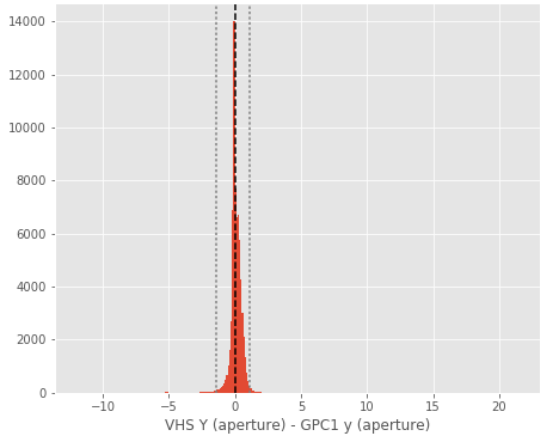


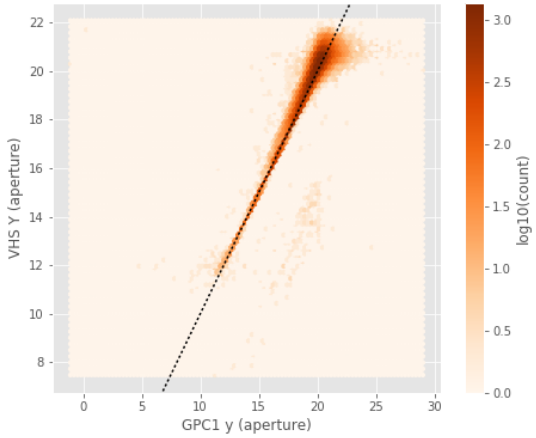
No sources have both GPC1 y (aperture) and RCS y (aperture) values.
RCS y (total) - GPC1 y (total):
- Median: 0.47
- Median Absolute Deviation: 0.39
- 1% percentile: -1.4632400512695314
- 99% percentile: 2.727959060668946



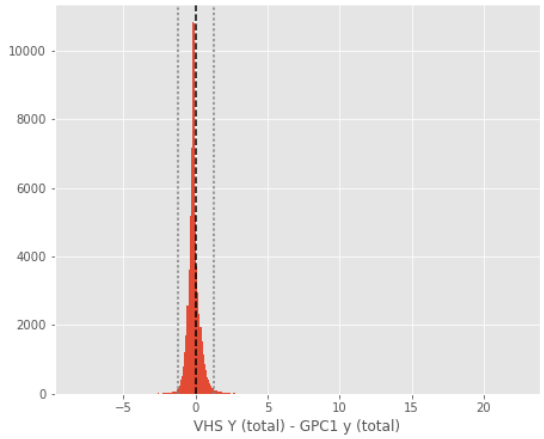


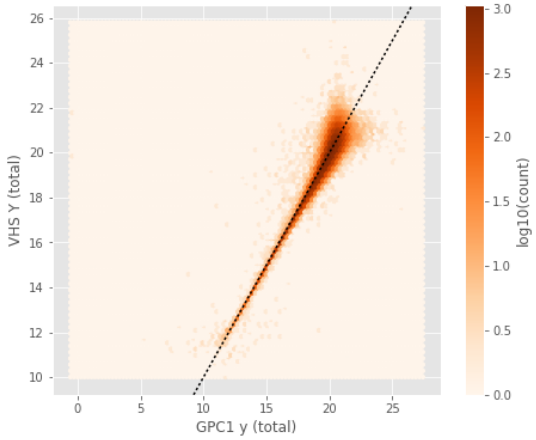
VHS Y (aperture) - GPC1 y (aperture):
- Median: 0.05
- Median Absolute Deviation: 0.20
- 1% percentile: -1.4580602073669433
- 99% percentile: 1.079011898040772



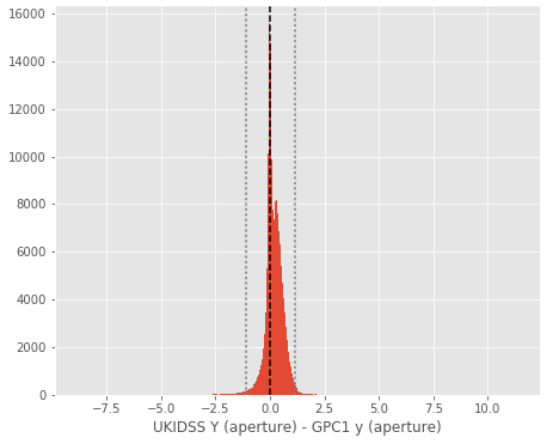


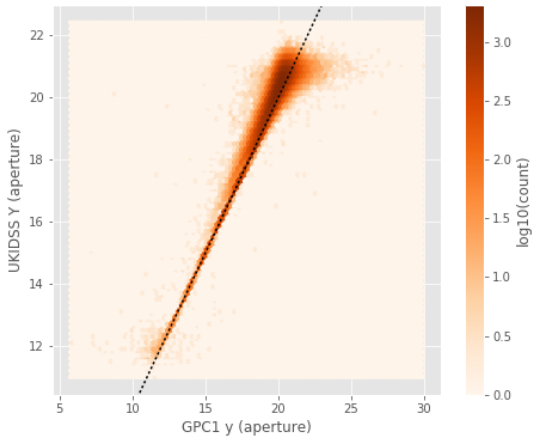
VHS Y (total) - GPC1 y (total):
- Median: -0.15
- Median Absolute Deviation: 0.18
- 1% percentile: -1.2063194274902345
- 99% percentile: 1.3054595184326165



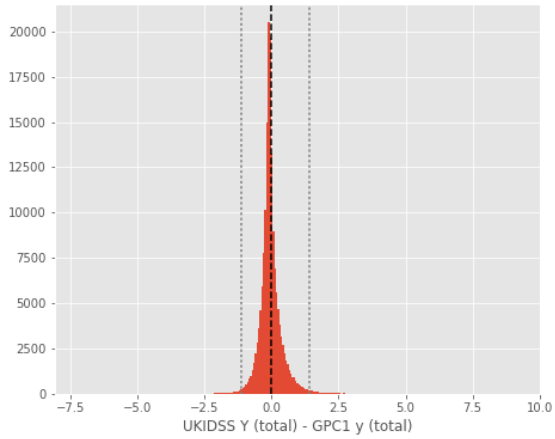


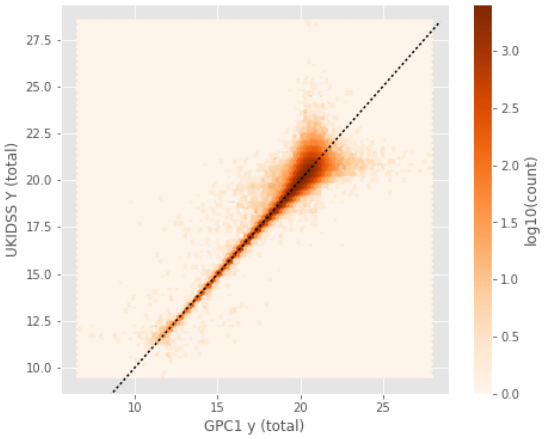
UKIDSS Y (aperture) - GPC1 y (aperture):
- Median: 0.15
- Median Absolute Deviation: 0.22
- 1% percentile: -1.1051537322998046
- 99% percentile: 1.1605104827880872



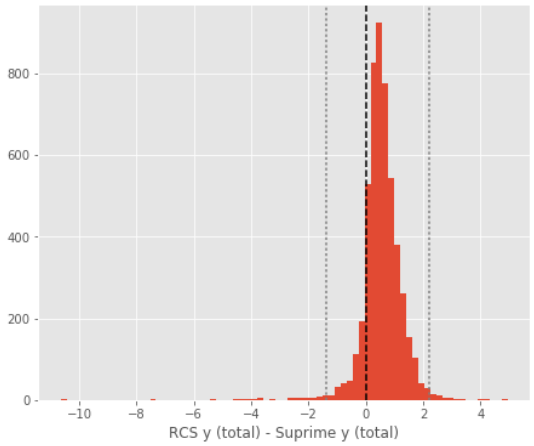


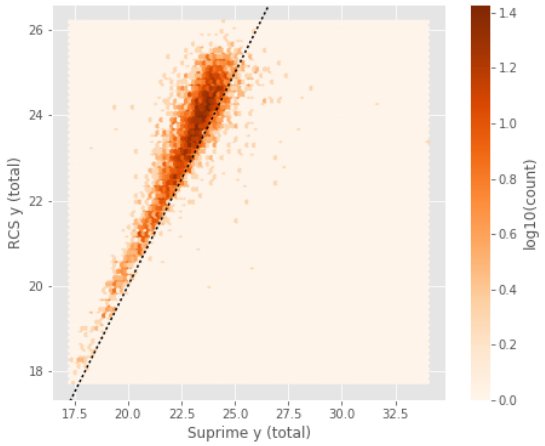
UKIDSS Y (total) - GPC1 y (total):
- Median: -0.08
- Median Absolute Deviation: 0.16
- 1% percentile: -1.1228889083862303
- 99% percentile: 1.4015650177001957



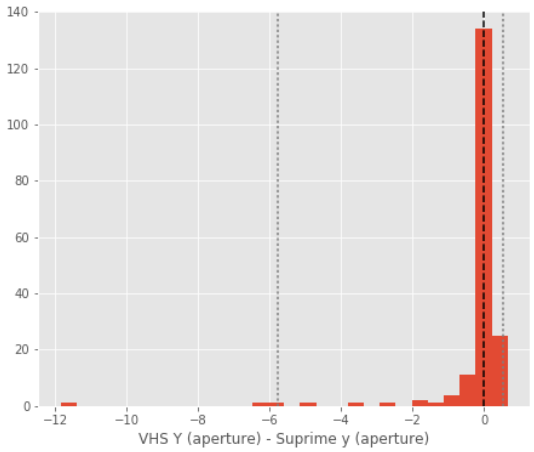


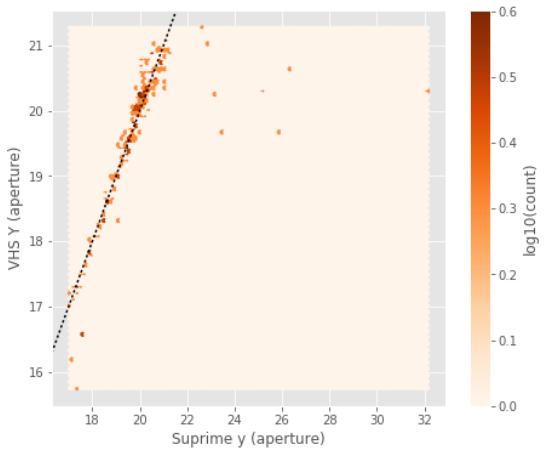
No sources have both Suprime y (aperture) and RCS y (aperture) values.
RCS y (total) - Suprime y (total):
- Median: 0.53
- Median Absolute Deviation: 0.32
- 1% percentile: -1.3908543395996094
- 99% percentile: 2.1912711334228554



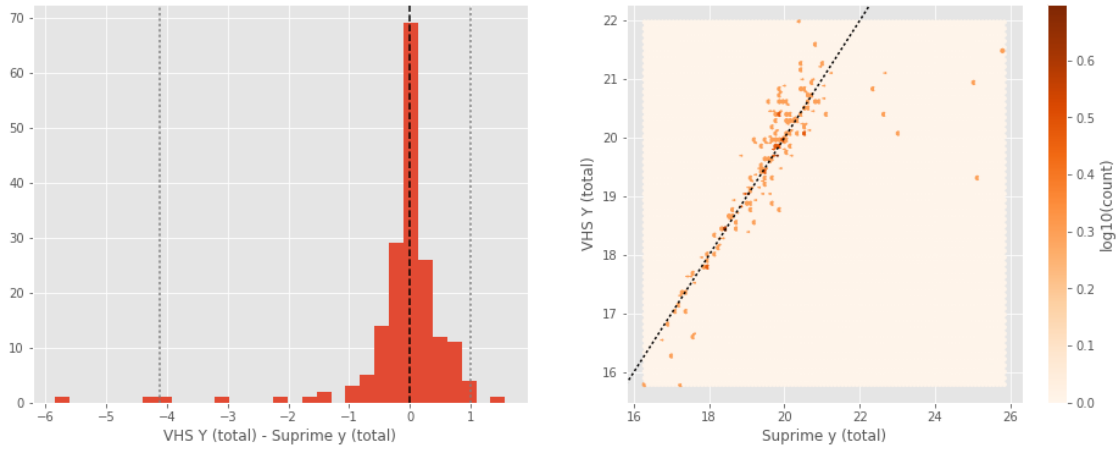


VHS Y (aperture) - Suprime y (aperture):
- Median: -0.04
- Median Absolute Deviation: 0.13
- 1% percentile: -5.783206024169922
- 99% percentile: 0.5436531829833986

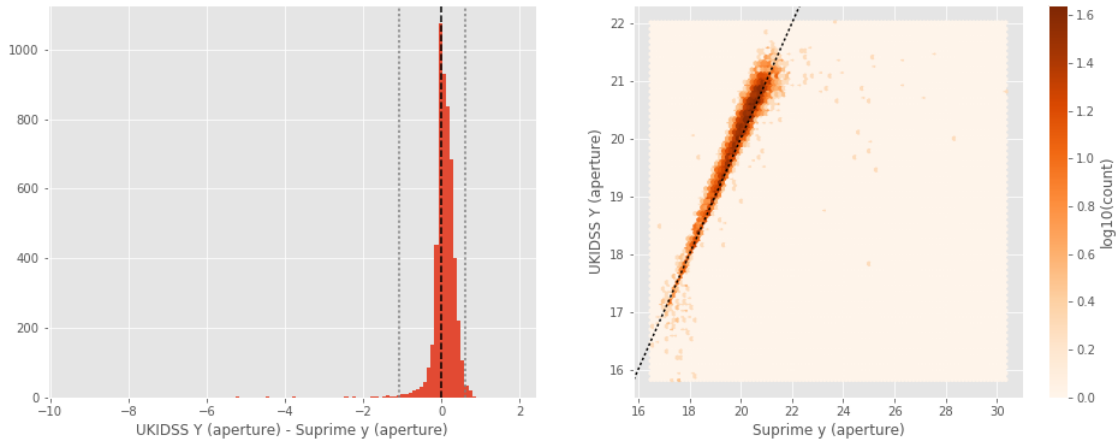




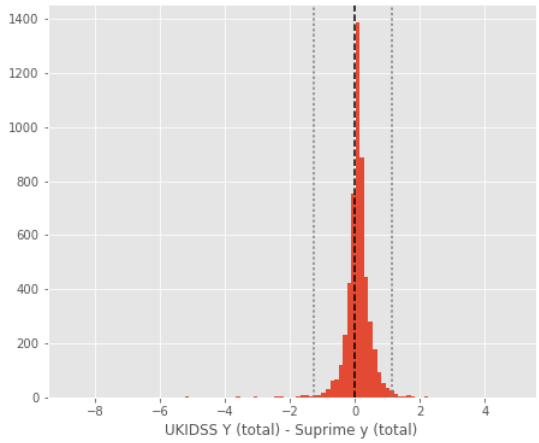
VHS Y (total) - Suprime y (total):
- Median: -0.01
- Median Absolute Deviation: 0.18
- 1% percentile: -4.1186545753479
- 99% percentile: 1.0063447952270506

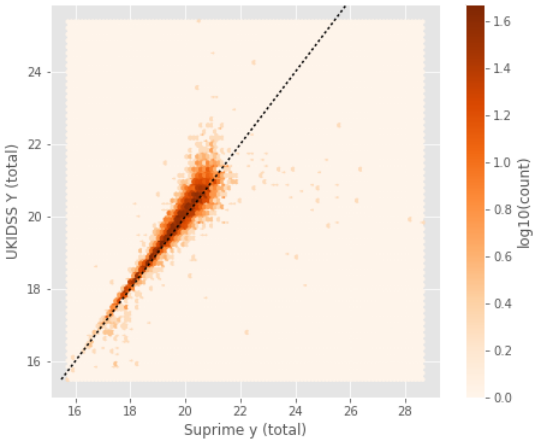


UKIDSS Y (aperture) - Suprime y (aperture):
- Median: 0.08
- Median Absolute Deviation: 0.13
- 1% percentile: -1.0824210357666015
- 99% percentile: 0.6076422119140625

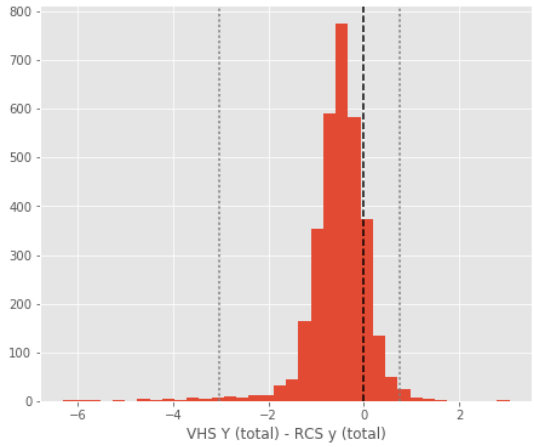


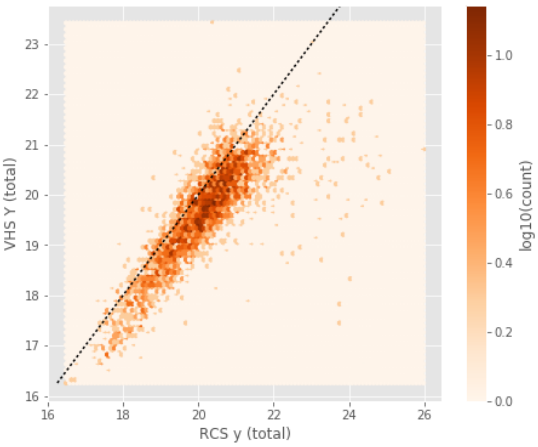
UKIDSS Y (total) - Suprime y (total):
- Median: 0.10
- Median Absolute Deviation: 0.15
- 1% percentile: -1.2867385101318358
- 99% percentile: 1.1423934173583983



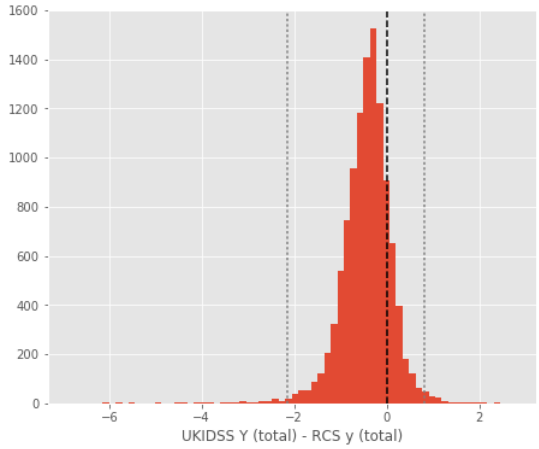


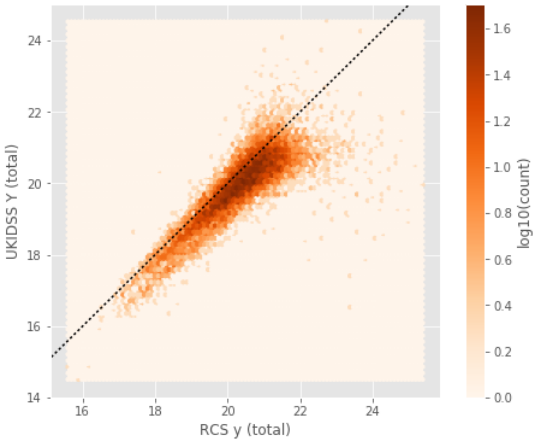
No sources have both RCS y (aperture) and VHS Y (aperture) values.
VHS Y (total) - RCS y (total):
- Median: -0.47
- Median Absolute Deviation: 0.31
- 1% percentile: -3.0394248962402344
- 99% percentile: 0.746319580078125



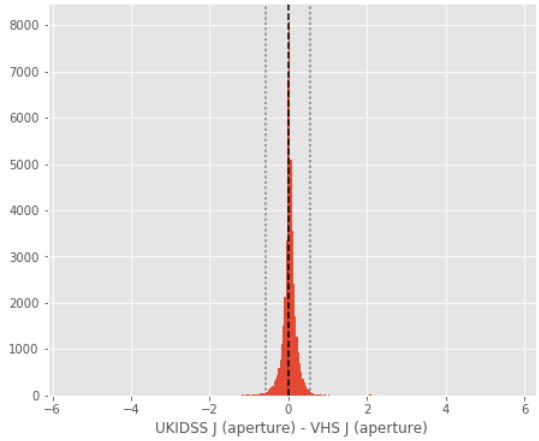


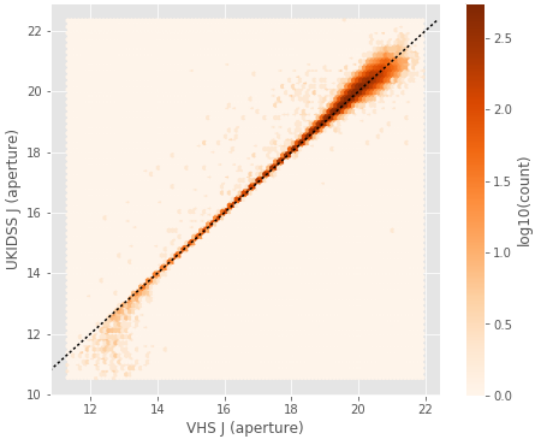
No sources have both RCS y (aperture) and UKIDSS Y (aperture) values.
UKIDSS Y (total) - RCS y (total):
- Median: -0.39
- Median Absolute Deviation: 0.29
- 1% percentile: -2.155640106201172
- 99% percentile: 0.8123551559448239



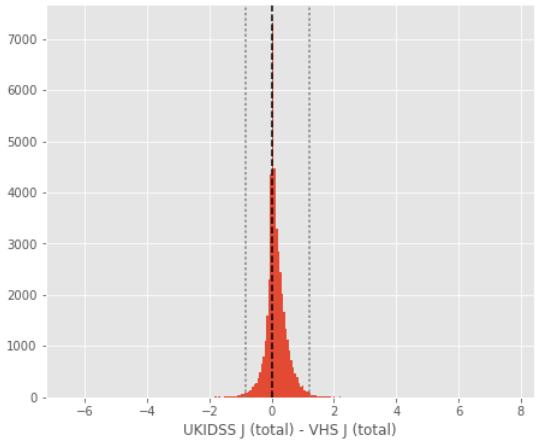


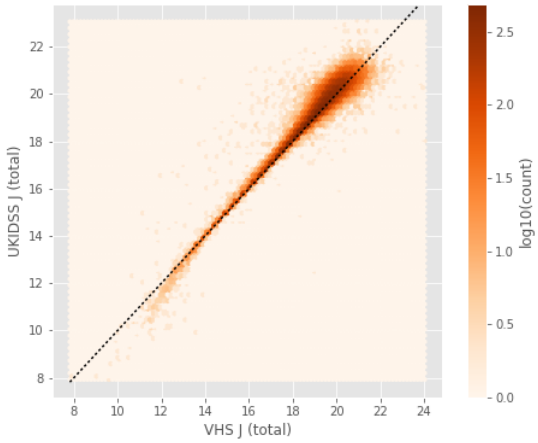
No sources have both VHS Y (aperture) and UKIDSS Y (aperture) values.
No sources have both VHS Y (total) and UKIDSS Y (total) values.
UKIDSS J (aperture) - VHS J (aperture):
- Median: 0.03
- Median Absolute Deviation: 0.07
- 1% percentile: -0.5630474090576172
- 99% percentile: 0.544174575805664



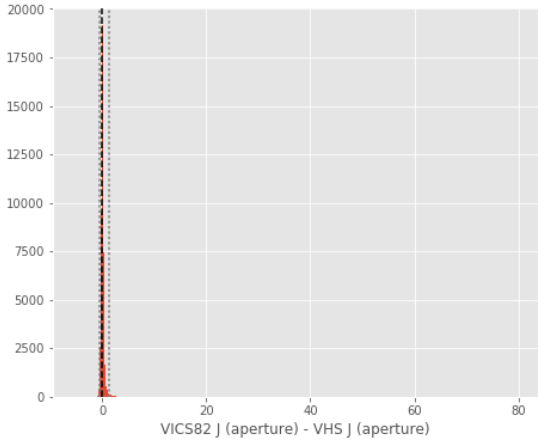


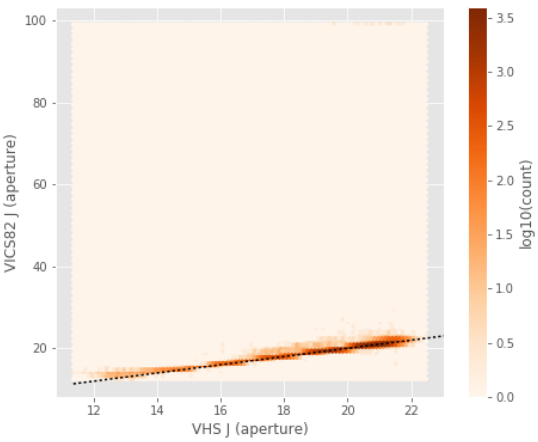
UKIDSS J (total) - VHS J (total):
- Median: 0.09
- Median Absolute Deviation: 0.15
- 1% percentile: -0.8497722434997559
- 99% percentile: 1.2258838081359853



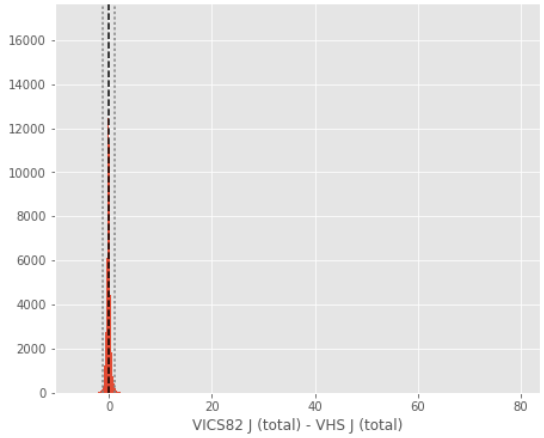


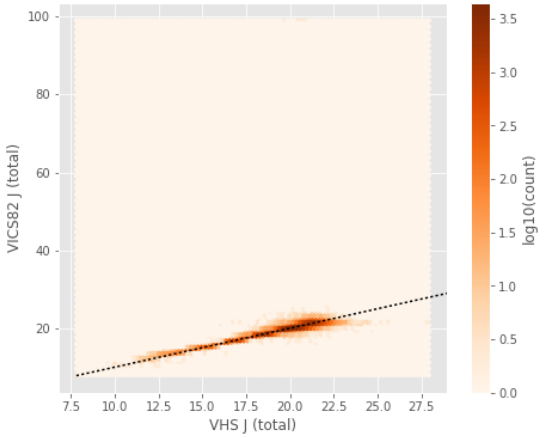
VICS82 J (aperture) - VHS J (aperture):
- Median: 0.11
- Median Absolute Deviation: 0.14
- 1% percentile: -0.514088249206543
- 99% percentile: 1.2630663871765173



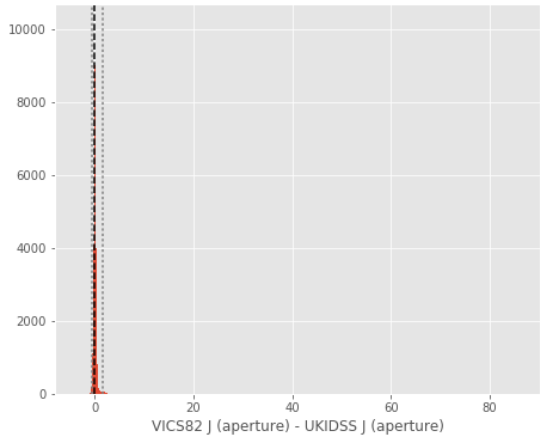


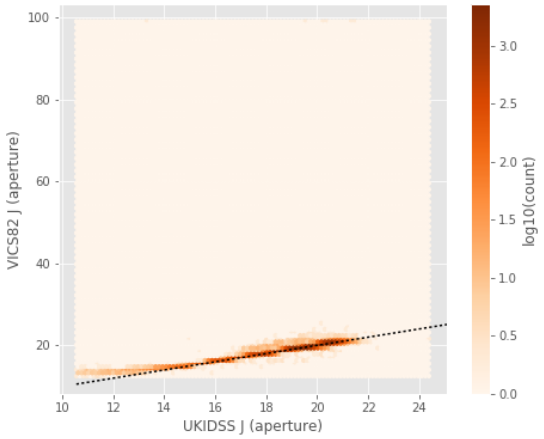
VICS82 J (total) - VHS J (total):
- Median: -0.07
- Median Absolute Deviation: 0.19
- 1% percentile: -1.1885685729980469
- 99% percentile: 1.122412071228025



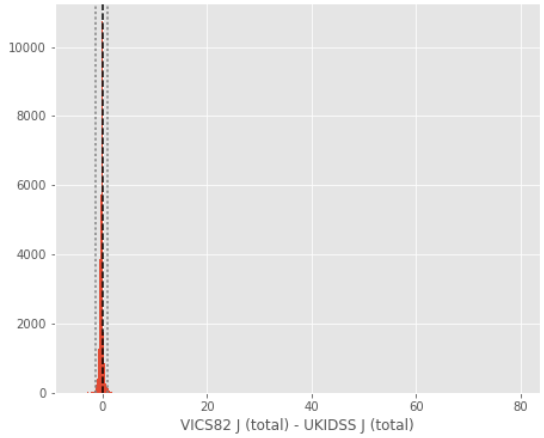


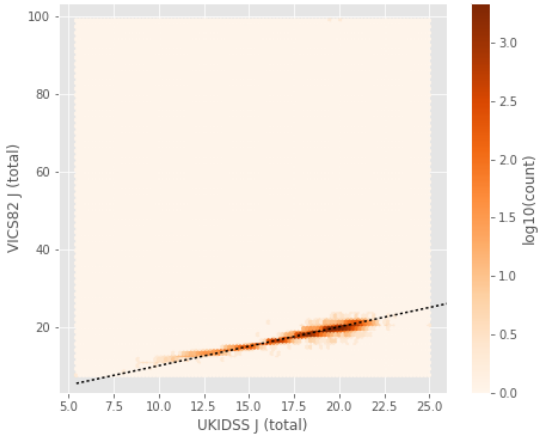
VICS82 J (aperture) - UKIDSS J (aperture):
- Median: 0.10
- Median Absolute Deviation: 0.13
- 1% percentile: -0.5394633865356445
- 99% percentile: 1.7428174400329572



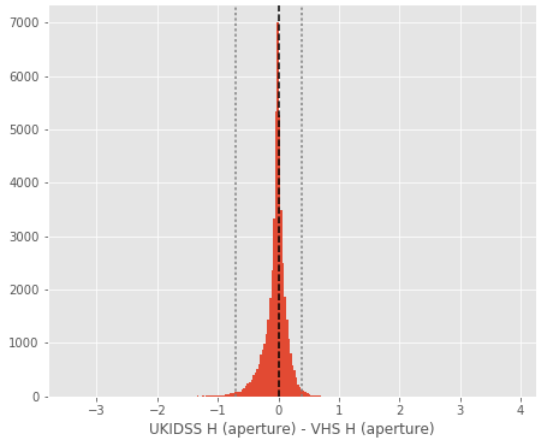


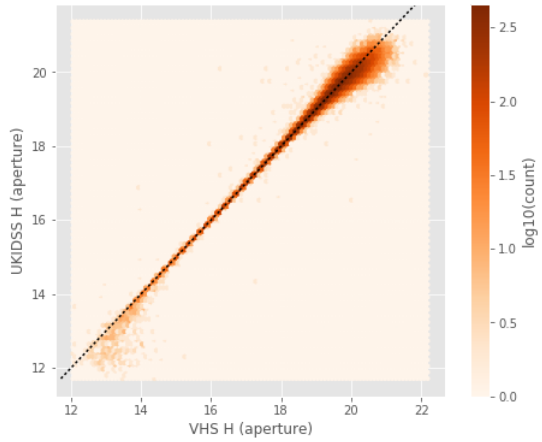
VICS82 J (total) - UKIDSS J (total):
- Median: -0.18
- Median Absolute Deviation: 0.17
- 1% percentile: -1.2610341644287109
- 99% percentile: 1.0374440765380846



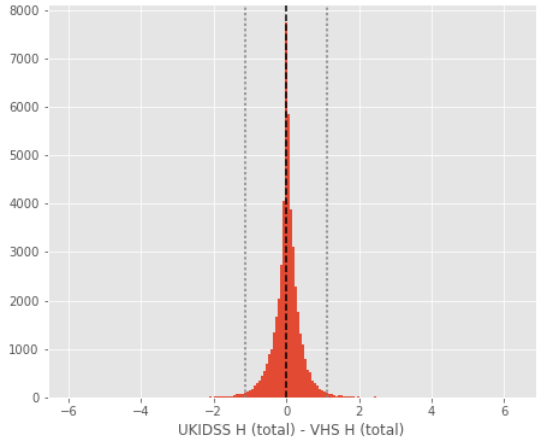


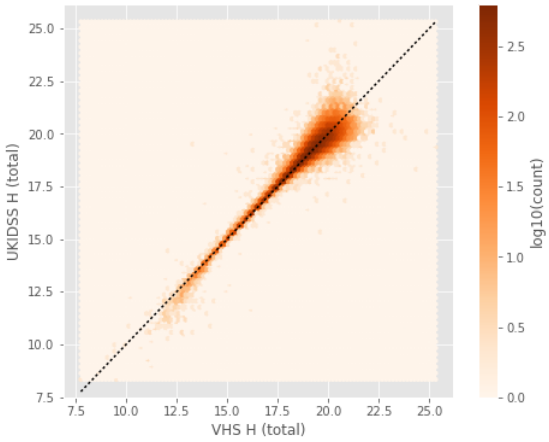
UKIDSS H (aperture) - VHS H (aperture):
- Median: -0.02
- Median Absolute Deviation: 0.07
- 1% percentile: -0.7017165756225586
- 99% percentile: 0.3929036521911624



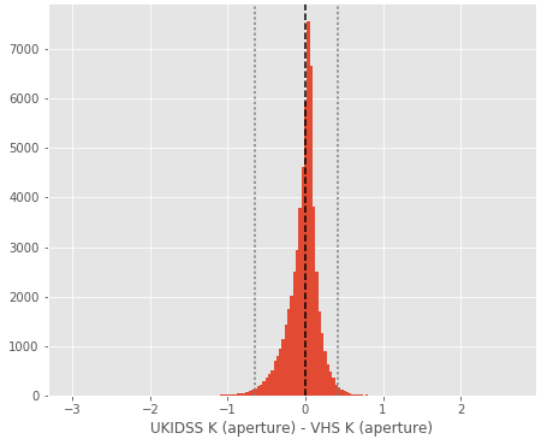


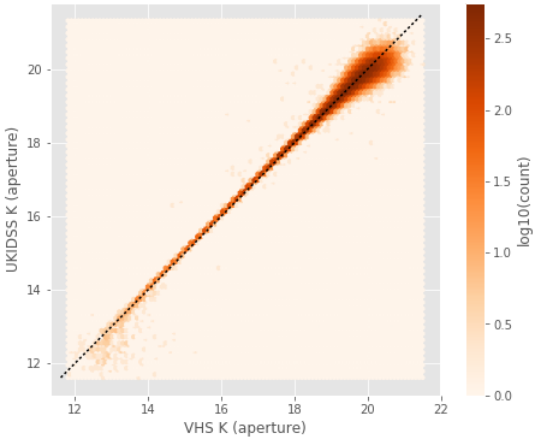
UKIDSS H (total) - VHS H (total):
- Median: 0.01
- Median Absolute Deviation: 0.16
- 1% percentile: -1.1395844078063966
- 99% percentile: 1.1315725898742681



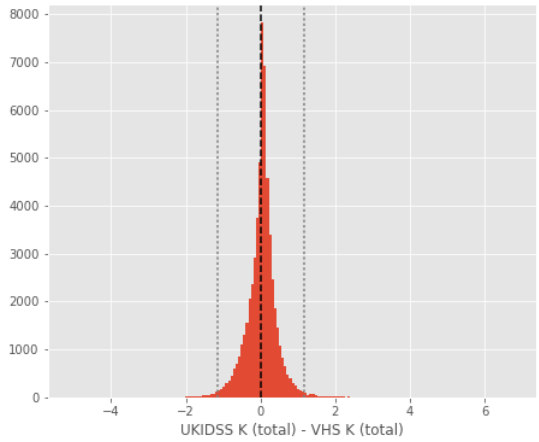


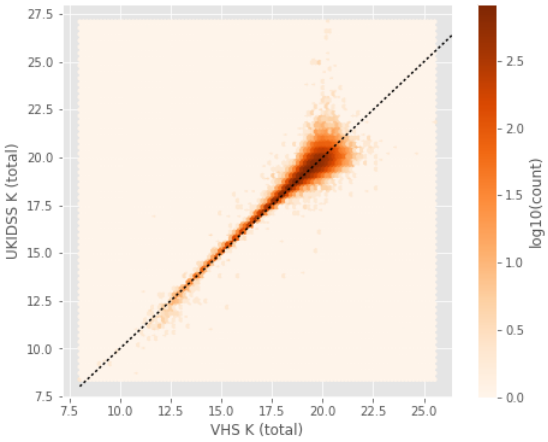
UKIDSS K (aperture) - VHS K (aperture):
- Median: 0.01
- Median Absolute Deviation: 0.09
- 1% percentile: -0.6475127029418946
- 99% percentile: 0.4219000053405762



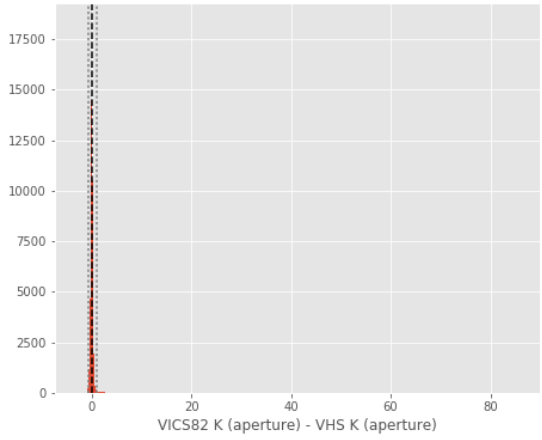


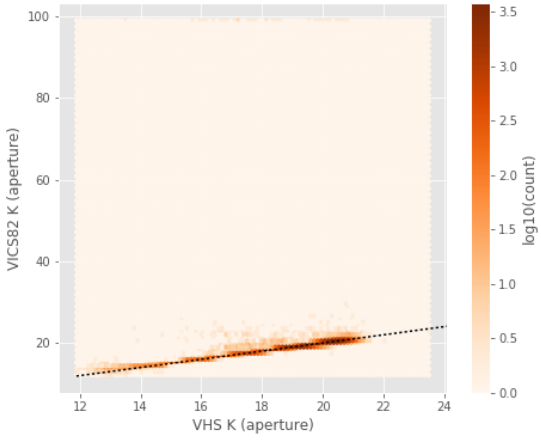
UKIDSS K (total) - VHS K (total):
- Median: 0.06
- Median Absolute Deviation: 0.18
- 1% percentile: -1.1438078880310059
- 99% percentile: 1.1813421249389648



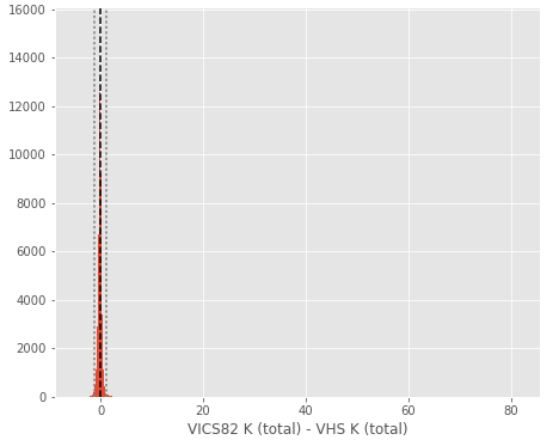


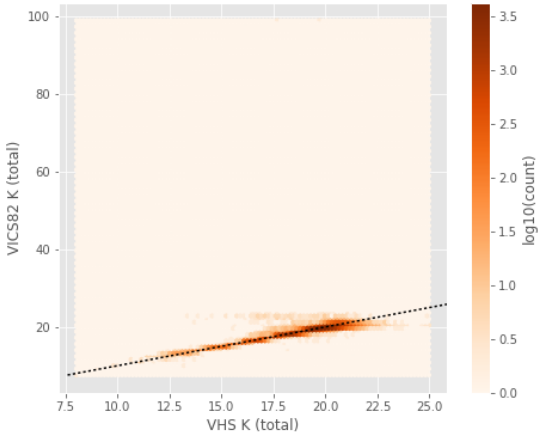
VICS82 K (aperture) - VHS K (aperture):
- Median: -0.00
- Median Absolute Deviation: 0.13
- 1% percentile: -0.6133130645751953
- 99% percentile: 0.9901255798339845



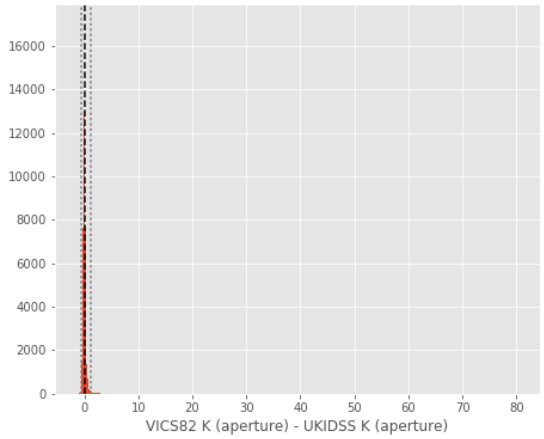


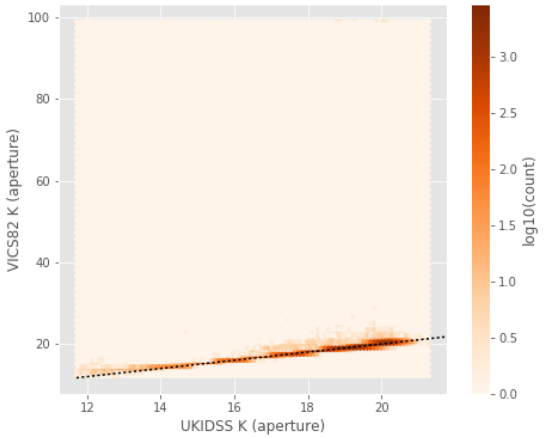
VICS82 K (total) - VHS K (total):
- Median: -0.12
- Median Absolute Deviation: 0.18
- 1% percentile: -1.1994578552246093
- 99% percentile: 1.008749771118168



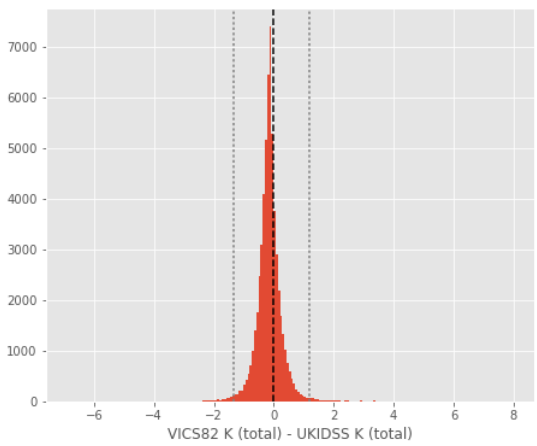


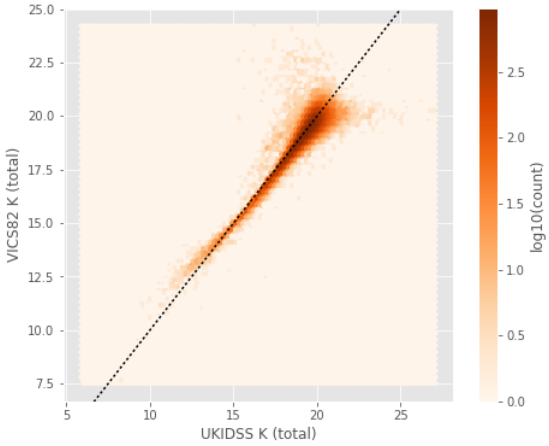
VICS82 K (aperture) - UKIDSS K (aperture):
- Median: 0.02
- Median Absolute Deviation: 0.13
- 1% percentile: -0.5552535057067871
- 99% percentile: 1.2199306488037163





VICS82 K (total) - UKIDSS K (total):
- Median: -0.16
- Median Absolute Deviation: 0.19
- 1% percentile: -1.3577183532714843
- 99% percentile: 1.186549072265621





1.5 III - Comparing magnitudes to reference bands

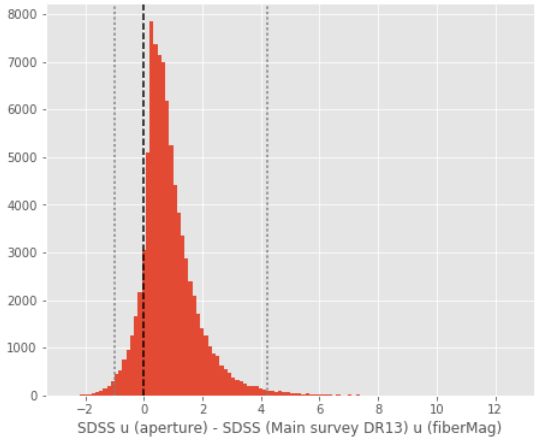
Cross-match the master list to SDSS and 2MASS to compare its magnitudes to SDSS and 2MASS ones.

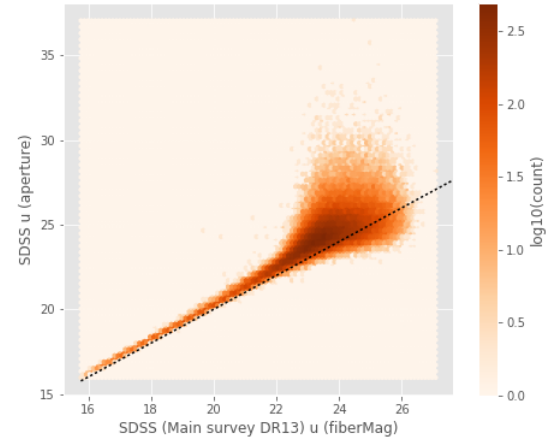
1.5.1 III.a - Comparing u, g, r, i, and z bands to SDSS

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

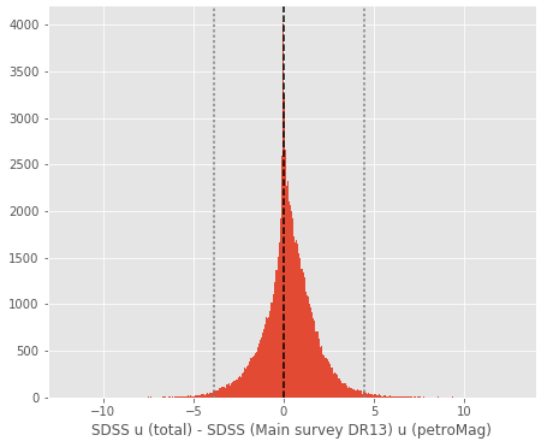
We compare the u, g, r, i, and z magnitudes to those from SDSS using `fiberMag` for the aperture magnitude and `petroMag` for the total magnitude.

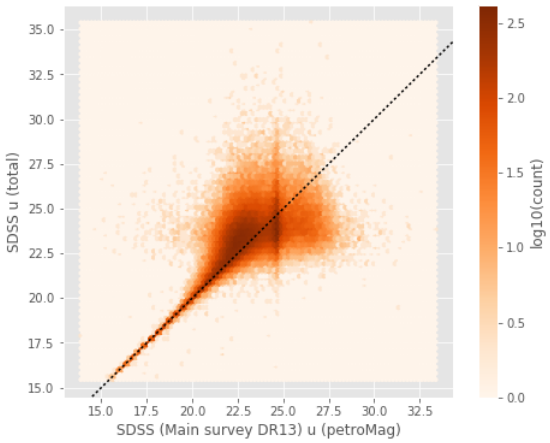
```
SDSS u (aperture) - SDSS (Main survey DR13) u (fiberMag):
- Median: 0.69
- Median Absolute Deviation: 0.46
- 1% percentile: -0.9915702382812488
- 99% percentile: 4.199792940368658
```



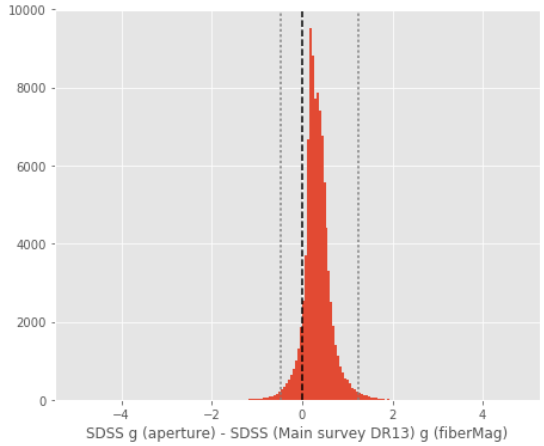


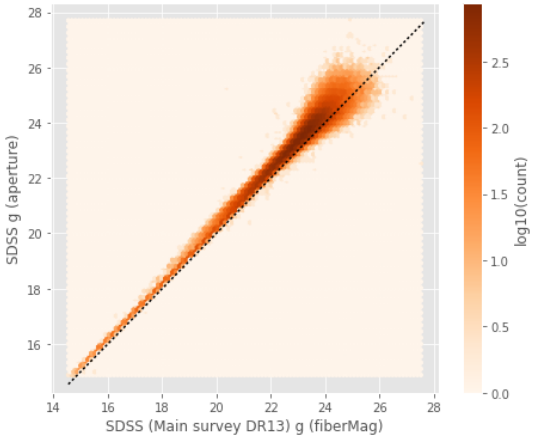
SDSS u (total) - SDSS (Main survey DR13) u (petroMag):
- Median: 0.21
- Median Absolute Deviation: 0.74
- 1% percentile: -3.8369227404785153
- 99% percentile: 4.479896454772954



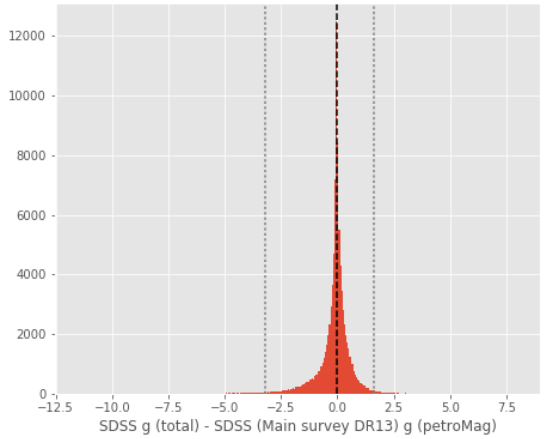


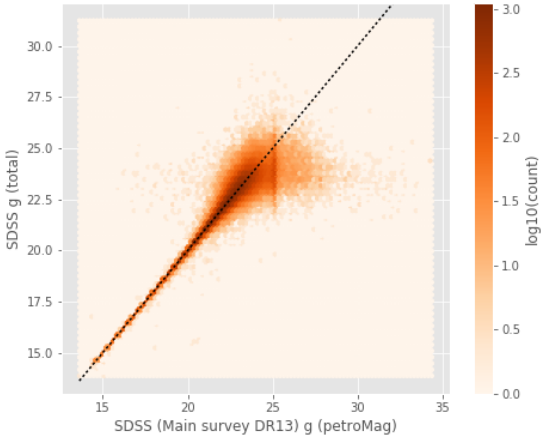
SDSS g (aperture) - SDSS (Main survey DR13) g (fiberMag):
- Median: 0.31
- Median Absolute Deviation: 0.15
- 1% percentile: -0.47871348526000956
- 99% percentile: 1.2509398686218285





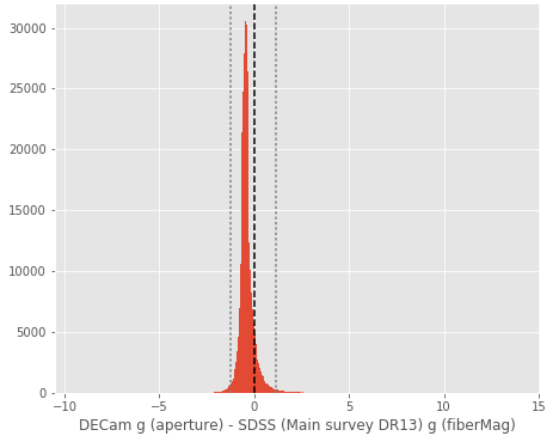
SDSS g (total) - SDSS (Main survey DR13) g (petroMag):
- Median: -0.04
- Median Absolute Deviation: 0.22
- 1% percentile: -3.2007564193725573
- 99% percentile: 1.5934776985168446

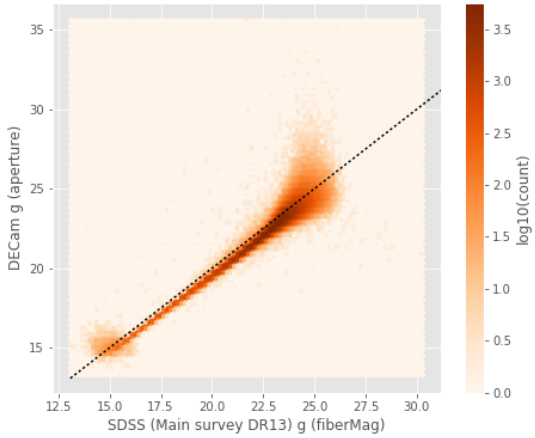




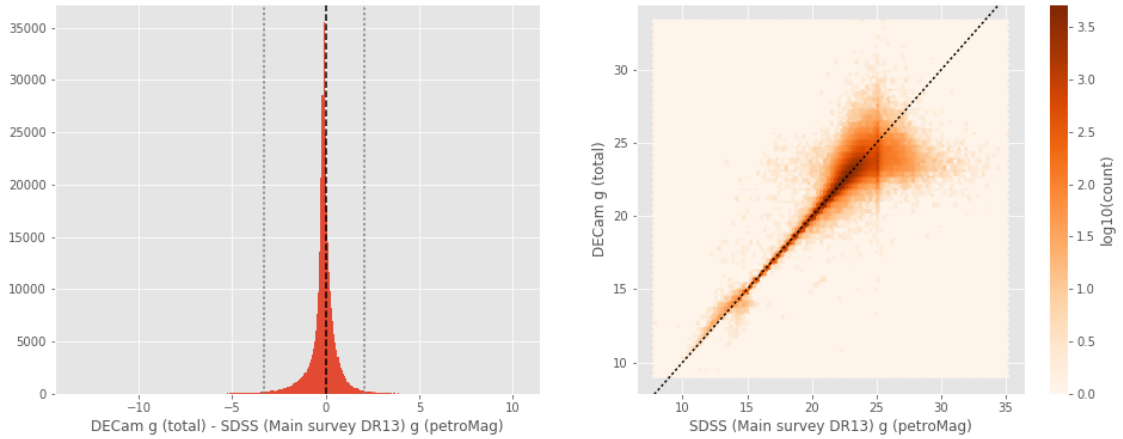
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:12:
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:13:

DECam g (aperture) - SDSS (Main survey DR13) g (fiberMag):
- Median: -0.45
- Median Absolute Deviation: 0.16
- 1% percentile: -1.2813874244689942
- 99% percentile: 1.168358058929444

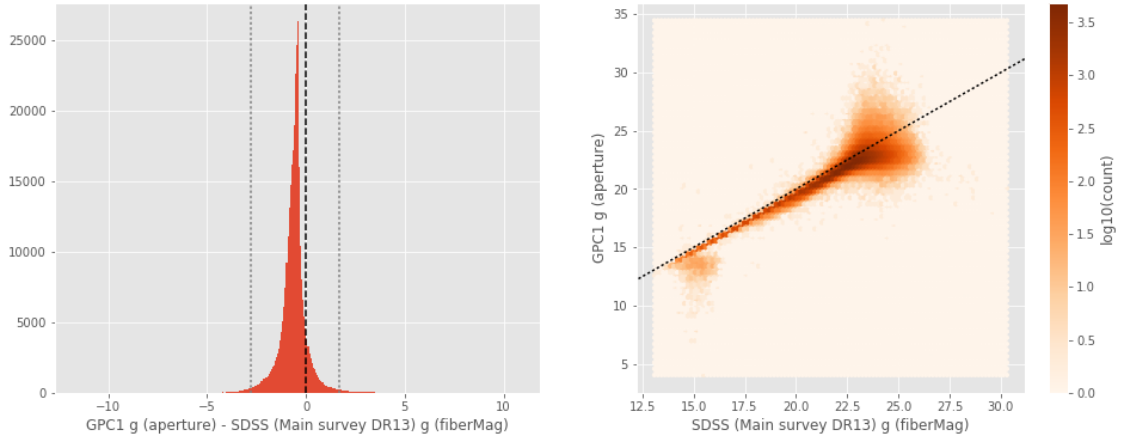




DECam g (total) - SDSS (Main survey DR13) g (petroMag):
- Median: -0.10
- Median Absolute Deviation: 0.24
- 1% percentile: -3.305940704345703
- 99% percentile: 2.042019958496093

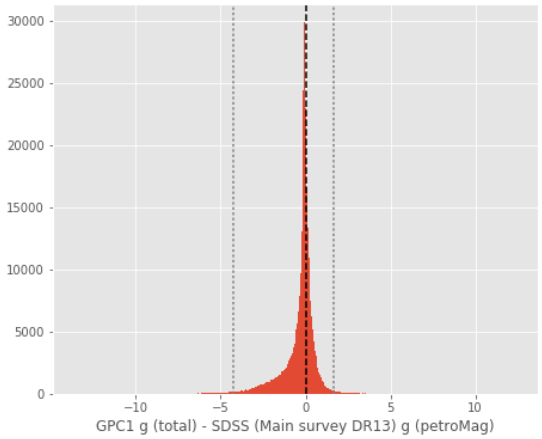


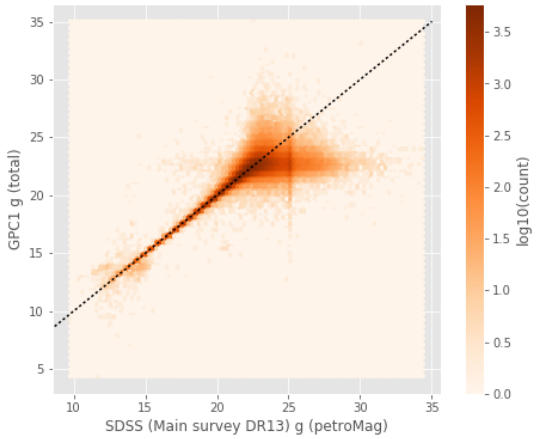
GPC1 g (aperture) - SDSS (Main survey DR13) g (fiberMag):
- Median: -0.56
- Median Absolute Deviation: 0.26
- 1% percentile: -2.765476360321045
- 99% percentile: 1.6859664916992188



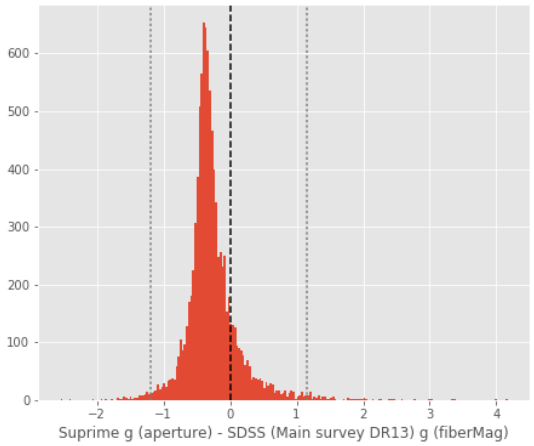
GPC1 g (total) - SDSS (Main survey DR13) g (petroMag):
- Median: -0.11

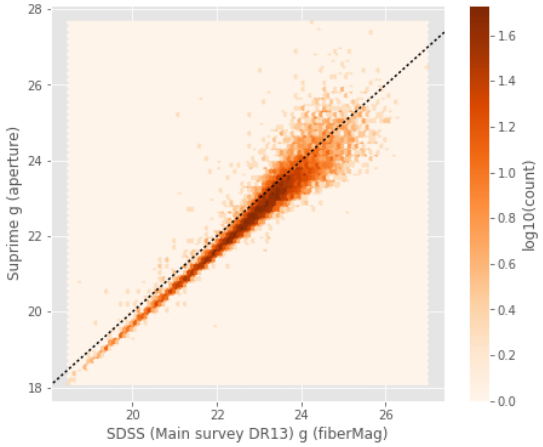
- Median Absolute Deviation: 0.27
- 1% percentile: -4.2331067657470705
- 99% percentile: 1.6772725105285626





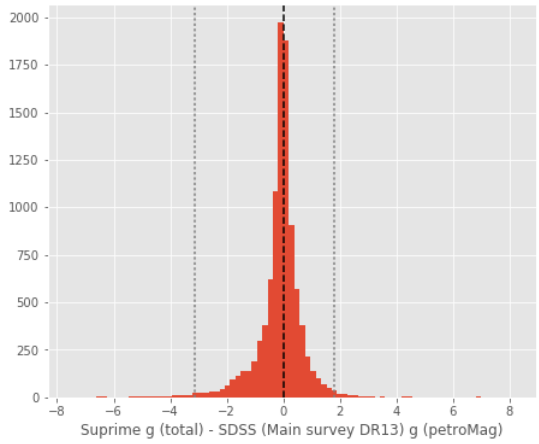
Suprime g (aperture) - SDSS (Main survey DR13) g (fiberMag):
- Median: -0.33
- Median Absolute Deviation: 0.15
- 1% percentile: -1.1898948669433593
- 99% percentile: 1.161732482910156

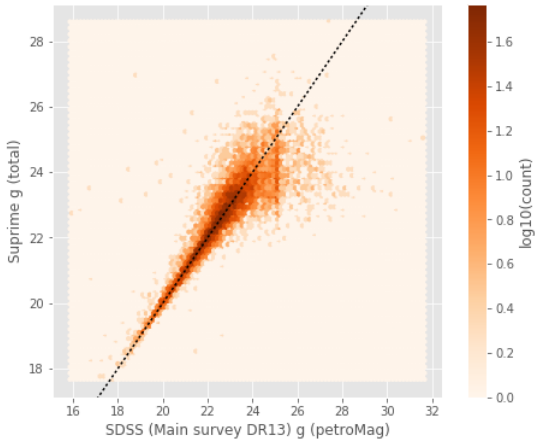




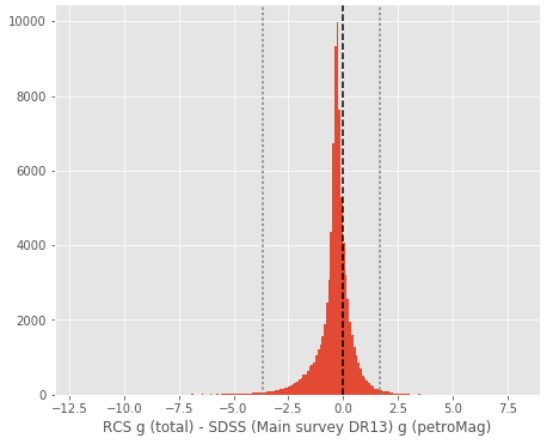
Suprime g (total) - SDSS (Main survey DR13) g (petroMag):
- Median: -0.03
- Median Absolute Deviation: 0.27
- 1% percentile: -3.135676040649414

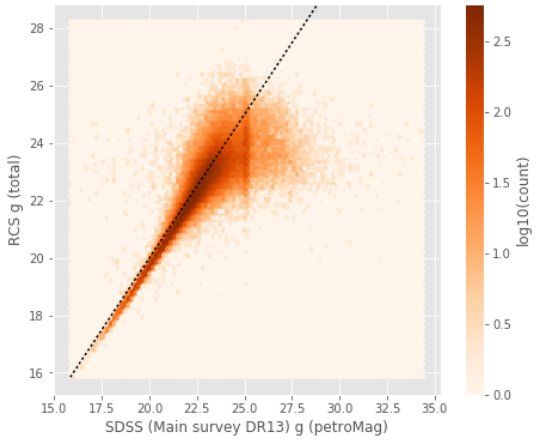
- 99% percentile: 1.8215815734863274



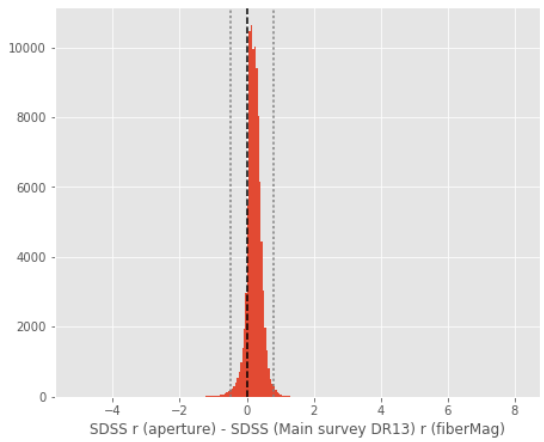


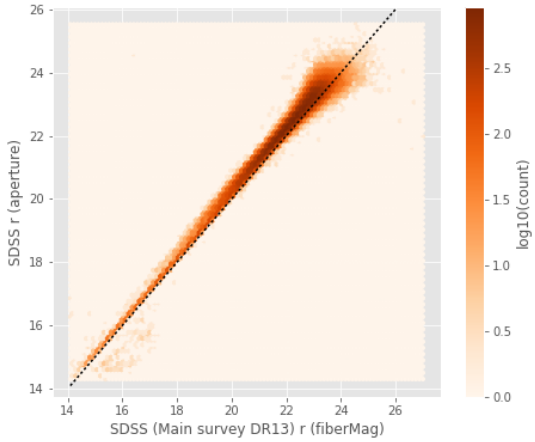
No sources have both SDSS (Main survey DR13) g (fiberMag) and RCS g (aperture) values.
RCS g (total) - SDSS (Main survey DR13) g (petroMag):
- Median: -0.29
- Median Absolute Deviation: 0.28
- 1% percentile: -3.6734525299072267
- 99% percentile: 1.660163574218752



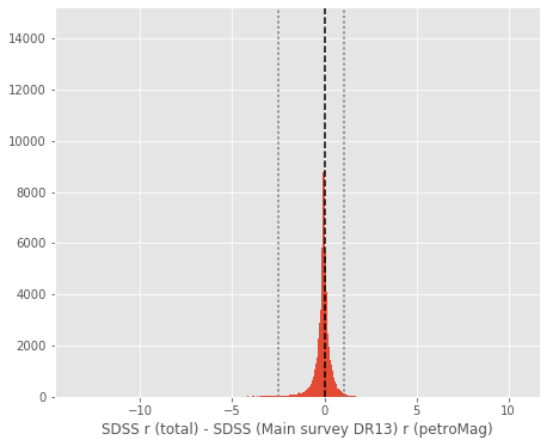


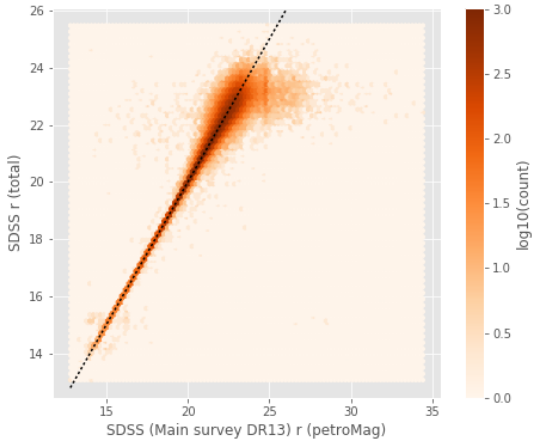
SDSS r (aperture) - SDSS (Main survey DR13) r (fiberMag):
- Median: 0.22
- Median Absolute Deviation: 0.12
- 1% percentile: -0.4703202220153814
- 99% percentile: 0.7856137927246094



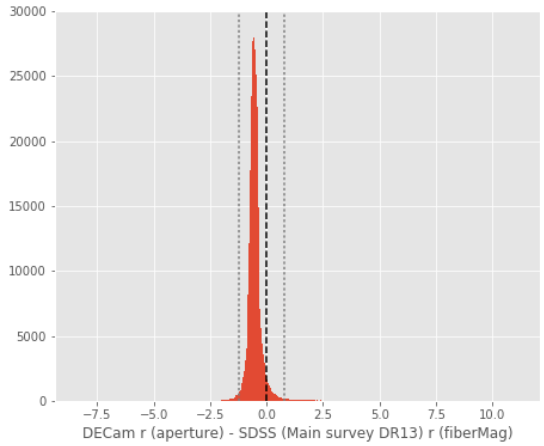


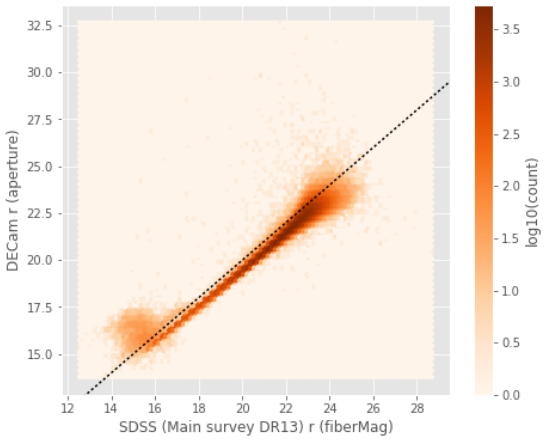
SDSS r (total) - SDSS (Main survey DR13) r (petroMag):
- Median: -0.04
- Median Absolute Deviation: 0.14
- 1% percentile: -2.531239594879151
- 99% percentile: 1.0697426069641118



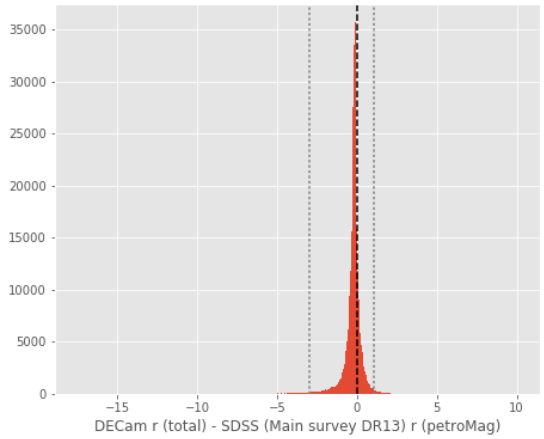


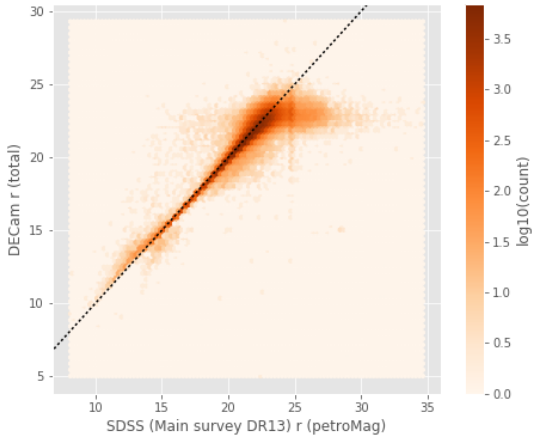
DECam r (aperture) - SDSS (Main survey DR13) r (fiberMag):
- Median: -0.55
- Median Absolute Deviation: 0.13
- 1% percentile: -1.2494139862060547
- 99% percentile: 0.7610930252075252



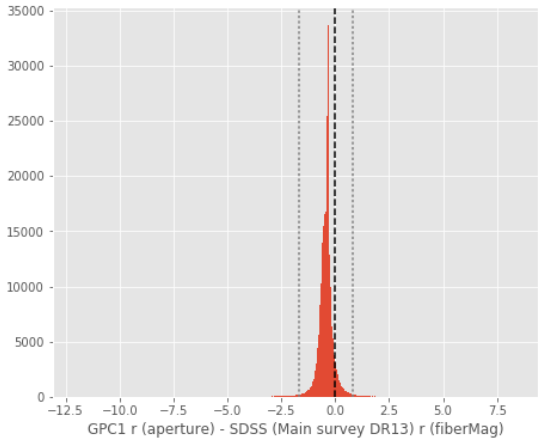


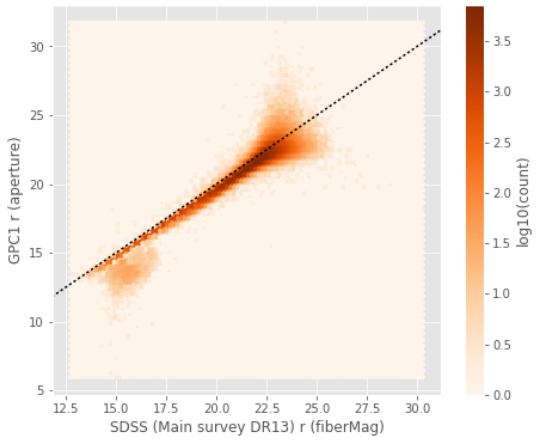
DECam r (total) - SDSS (Main survey DR13) r (petroMag):
- Median: -0.19
- Median Absolute Deviation: 0.17
- 1% percentile: -2.980473175048828
- 99% percentile: 1.074421691894531



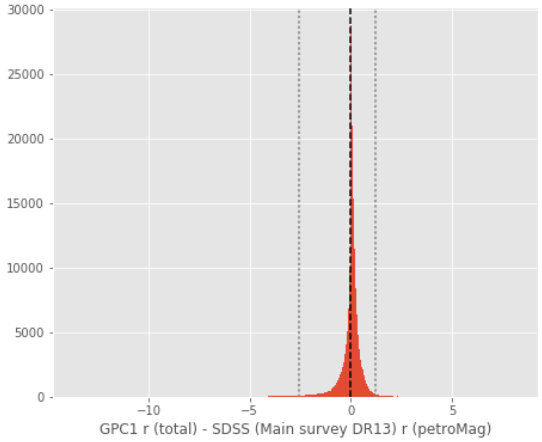


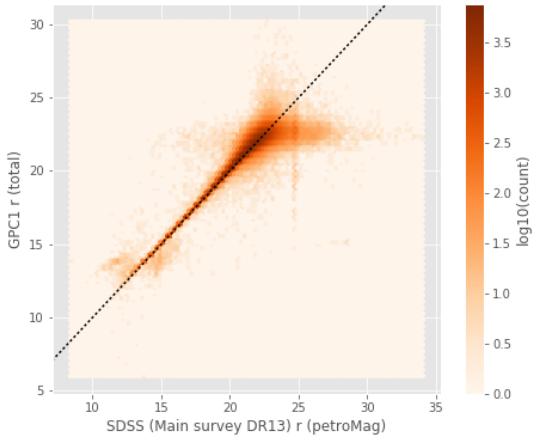
GPC1 r (aperture) - SDSS (Main survey DR13) r (fiberMag):
- Median: -0.40
- Median Absolute Deviation: 0.15
- 1% percentile: -1.664783935546875
- 99% percentile: 0.7864620971679673



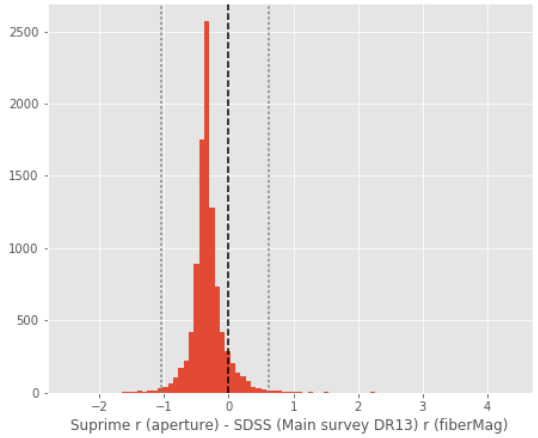


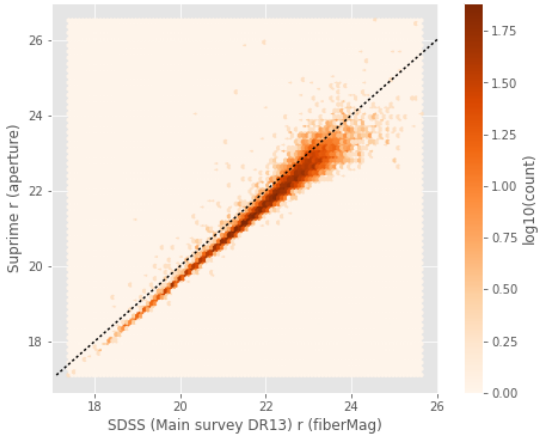
GPC1 r (total) - SDSS (Main survey DR13) r (petroMag):
- Median: 0.05
- Median Absolute Deviation: 0.15
- 1% percentile: -2.5348509216308592
- 99% percentile: 1.213526039123535



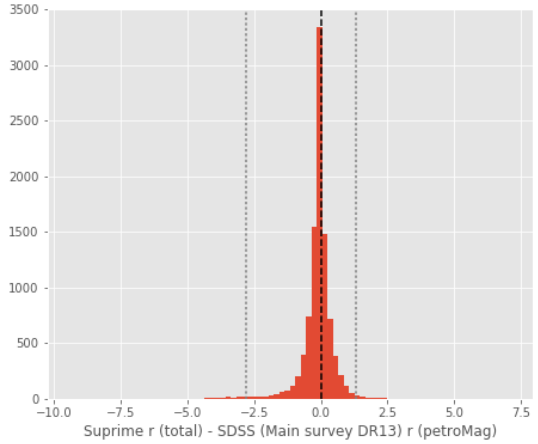


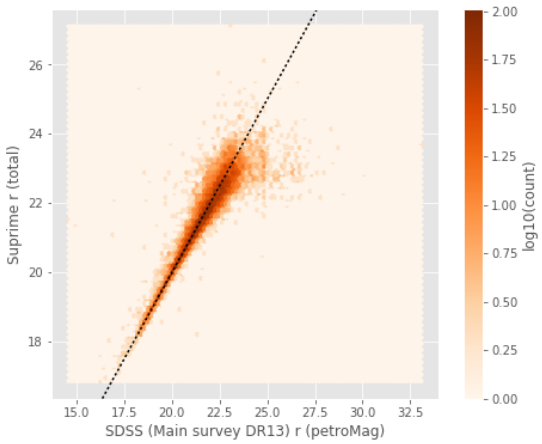
Suprime r (aperture) - SDSS (Main survey DR13) r (fiberMag):
- Median: -0.34
- Median Absolute Deviation: 0.10
- 1% percentile: -1.040871810913086
- 99% percentile: 0.6163643646240211



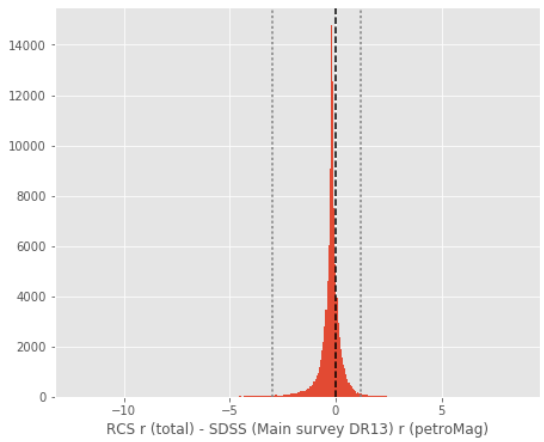


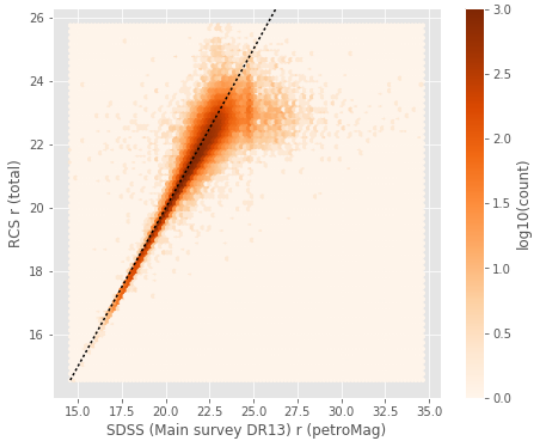
Suprime r (total) - SDSS (Main survey DR13) r (petroMag):
- Median: -0.06
- Median Absolute Deviation: 0.19
- 1% percentile: -2.7978500366210937
- 99% percentile: 1.2967376708984382



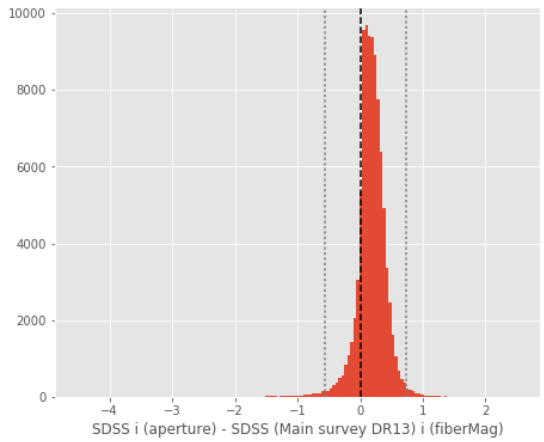


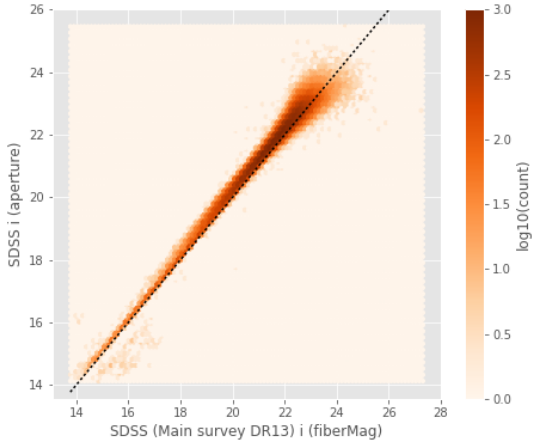
No sources have both SDSS (Main survey DR13) r (fiberMag) and RCS r (aperture) values.
RCS r (total) - SDSS (Main survey DR13) r (petroMag):
- Median: -0.18
- Median Absolute Deviation: 0.16
- 1% percentile: -2.9737467193603515
- 99% percentile: 1.1879370880126947



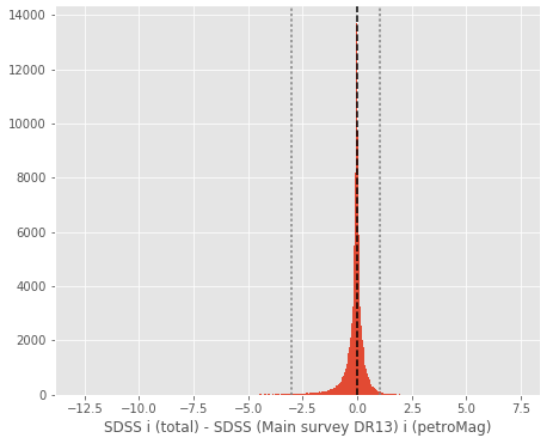


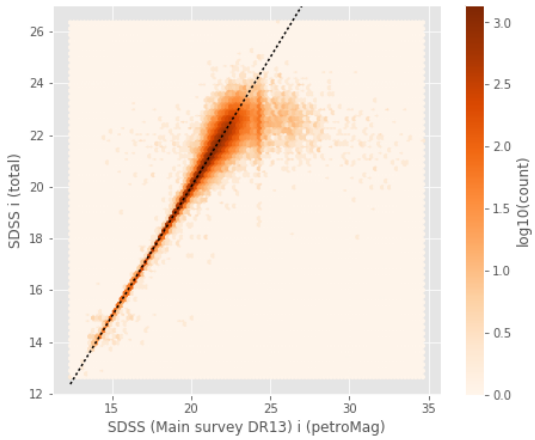
SDSS i (aperture) - SDSS (Main survey DR13) i (fiberMag):
- Median: 0.18
- Median Absolute Deviation: 0.12
- 1% percentile: -0.5666089828491205
- 99% percentile: 0.7385578533935562



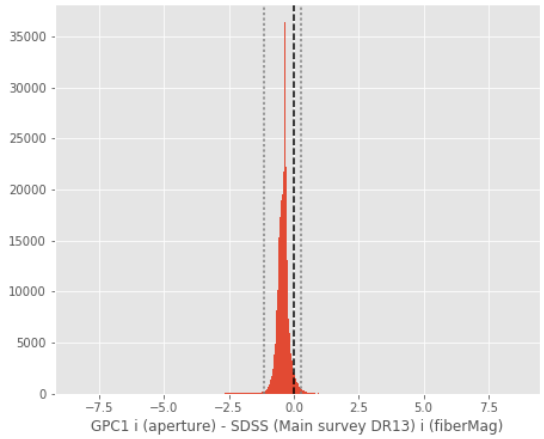


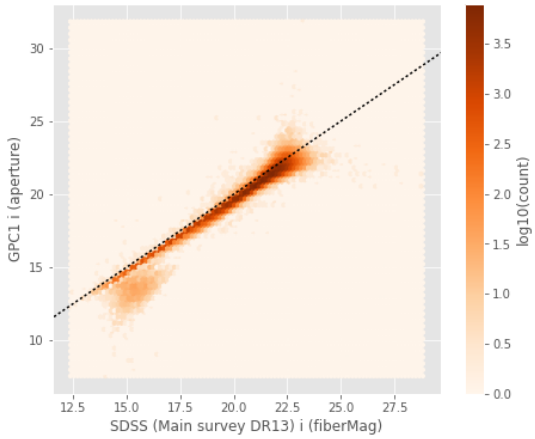
SDSS i (total) - SDSS (Main survey DR13) i (petroMag):
- Median: -0.04
- Median Absolute Deviation: 0.13
- 1% percentile: -2.995337109832765
- 99% percentile: 1.0213562768554678



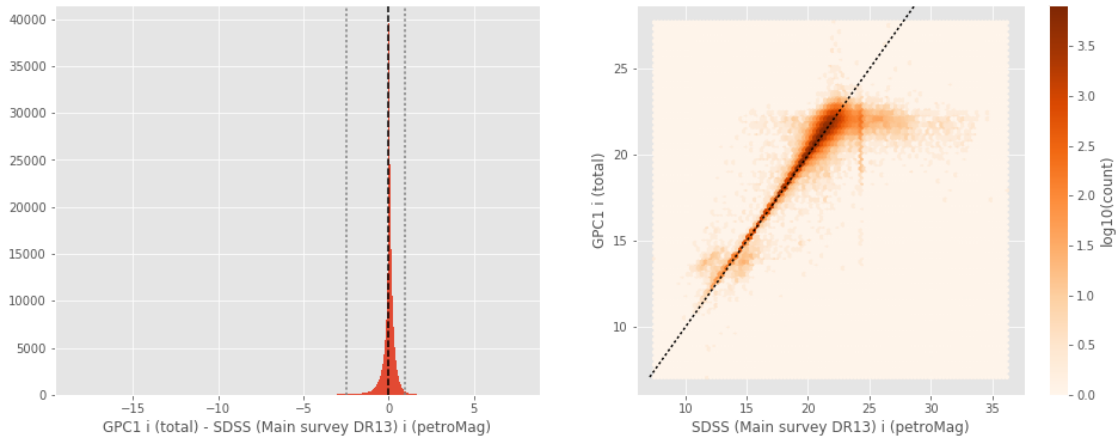


GPC1 i (aperture) - SDSS (Main survey DR13) i (fiberMag):
- Median: -0.39
- Median Absolute Deviation: 0.11
- 1% percentile: -1.1544958877563476
- 99% percentile: 0.2978730392456064

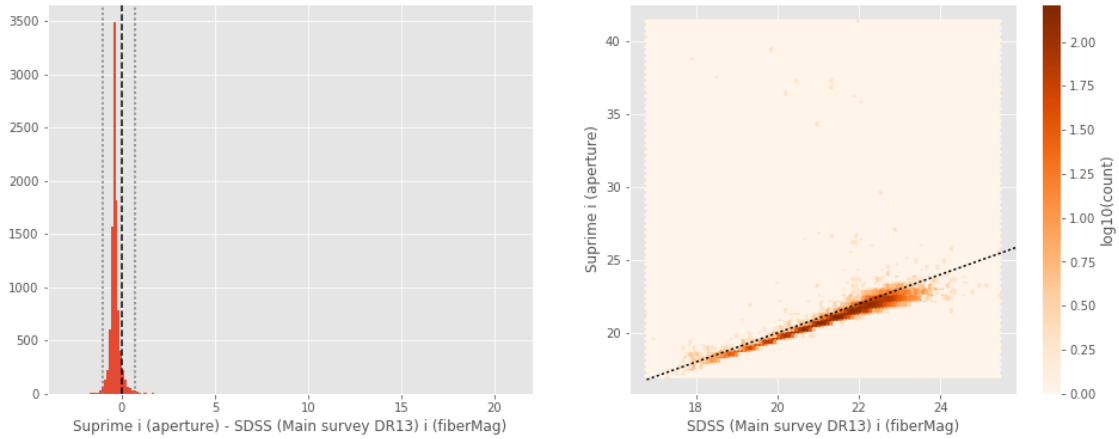




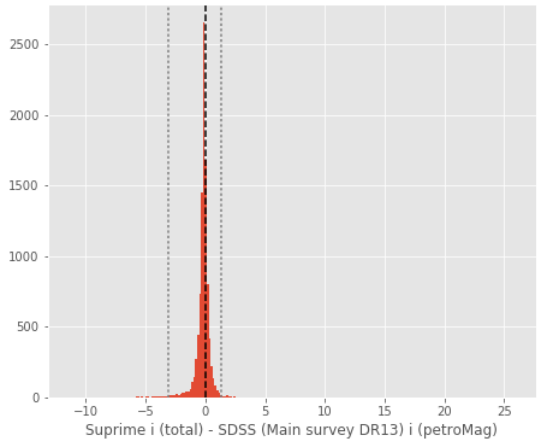
GPC1 i (total) - SDSS (Main survey DR13) i (petroMag):
- Median: 0.05
- Median Absolute Deviation: 0.12
- 1% percentile: -2.4359721183776855
- 99% percentile: 0.9707852172851563

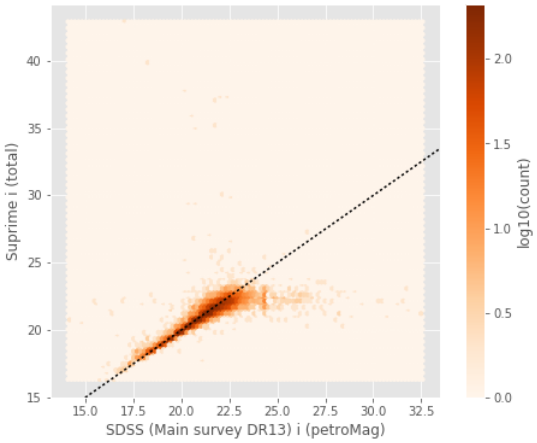


Suprime i (aperture) - SDSS (Main survey DR13) i (fiberMag):
- Median: -0.38
- Median Absolute Deviation: 0.10
- 1% percentile: -1.0213645935058593
- 99% percentile: 0.7098453521728619

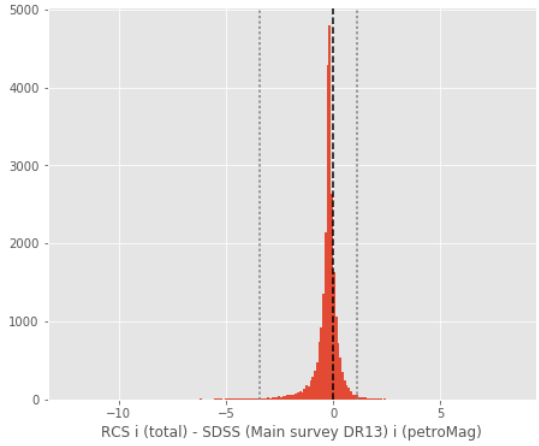


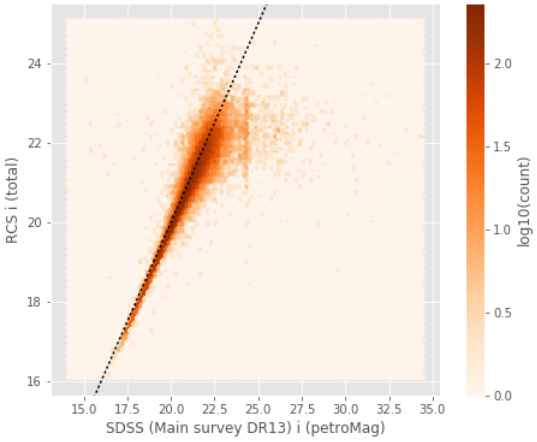
Suprime i (total) - SDSS (Main survey DR13) i (petroMag):
- Median: -0.12
- Median Absolute Deviation: 0.18
- 1% percentile: -3.1270497322082518
- 99% percentile: 1.3416518783569336



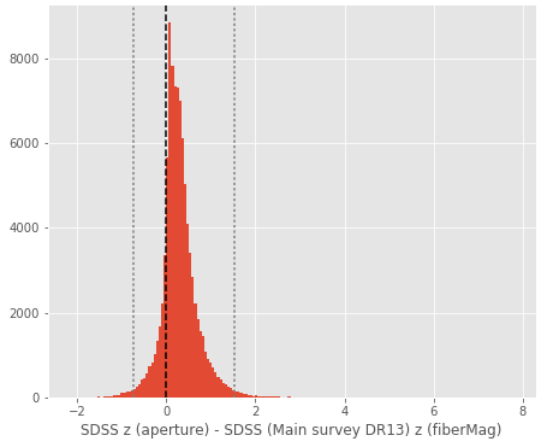


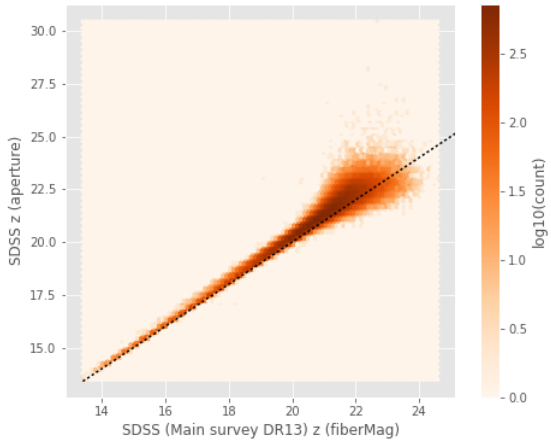
No sources have both SDSS (Main survey DR13) i (fiberMag) and RCS i (aperture) values.
RCS i (total) - SDSS (Main survey DR13) i (petroMag):
- Median: -0.20
- Median Absolute Deviation: 0.17
- 1% percentile: -3.412097816467285
- 99% percentile: 1.129906044006348



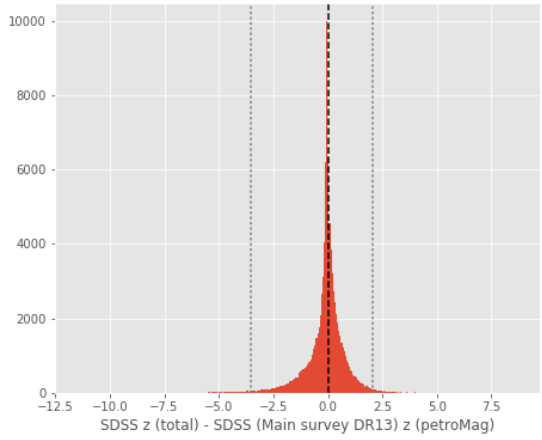


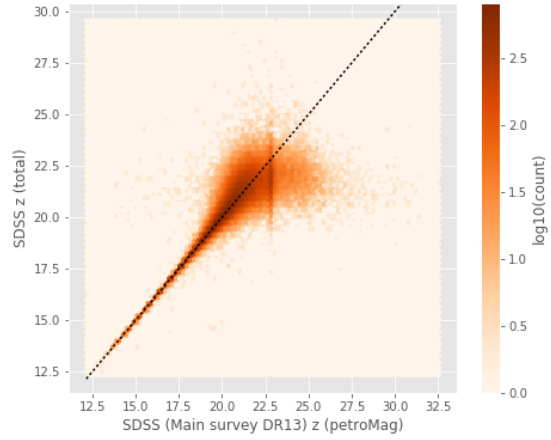
SDSS z (aperture) - SDSS (Main survey DR13) z (fiberMag):
- Median: 0.25
- Median Absolute Deviation: 0.19
- 1% percentile: -0.7316756486816389
- 99% percentile: 1.5328369016113332



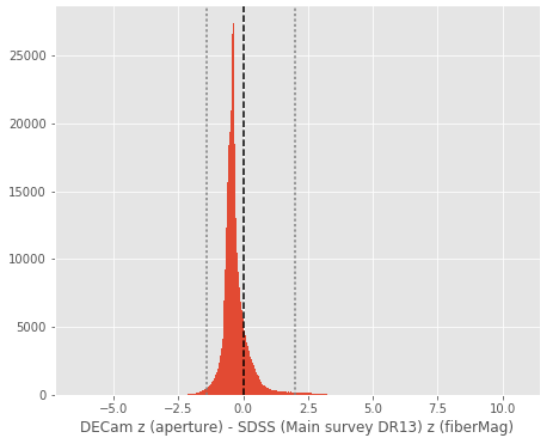


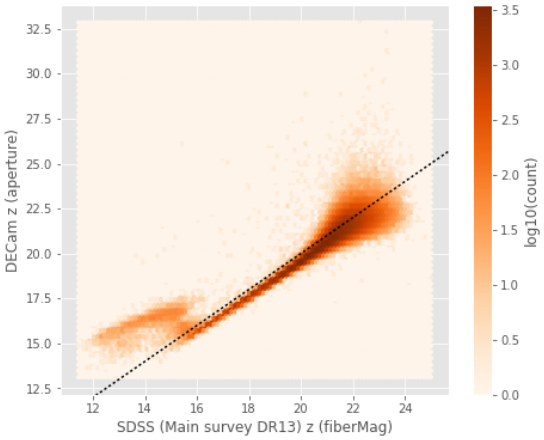
SDSS z (total) - SDSS (Main survey DR13) z (petroMag):
- Median: -0.03
- Median Absolute Deviation: 0.31
- 1% percentile: -3.515508124420166
- 99% percentile: 2.0787191370544447



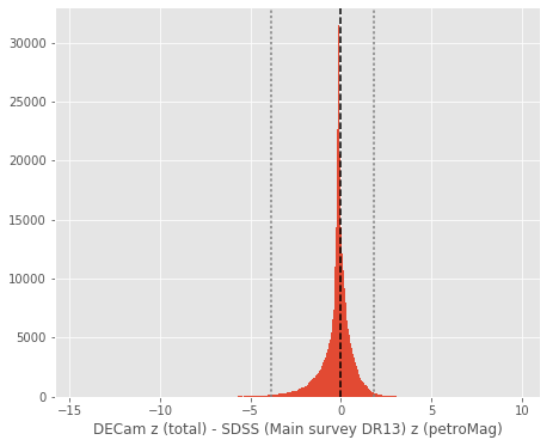


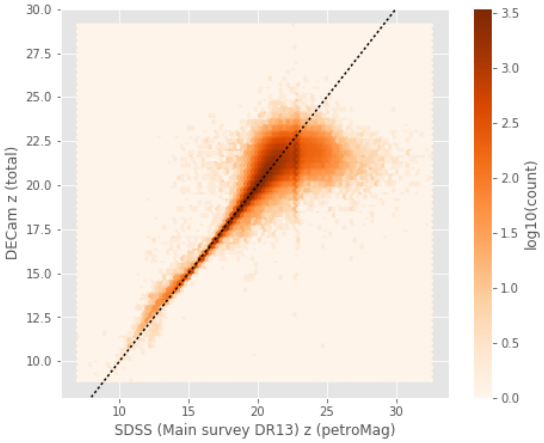
DECam z (aperture) - SDSS (Main survey DR13) z (fiberMag):
- Median: -0.38
- Median Absolute Deviation: 0.19
- 1% percentile: -1.392816925048828
- 99% percentile: 1.9866805076599126



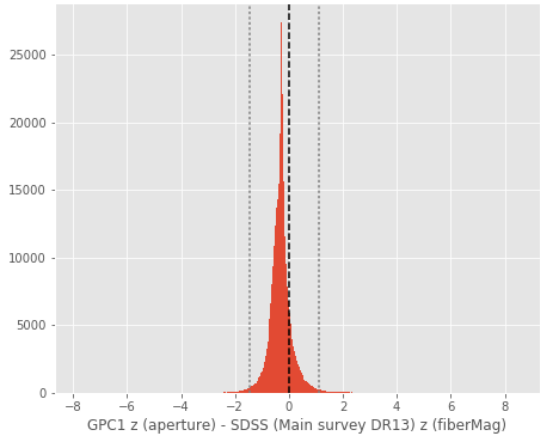


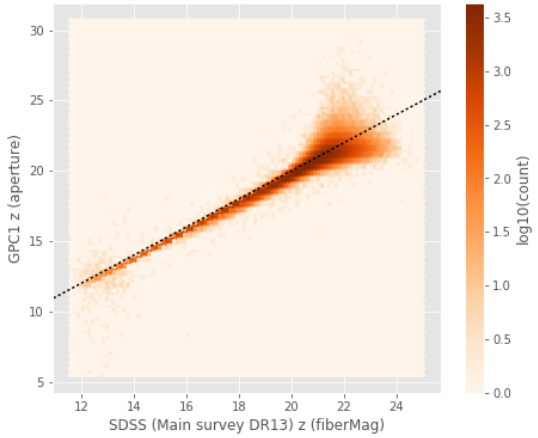
DECam z (total) - SDSS (Main survey DR13) z (petroMag):
- Median: -0.13
- Median Absolute Deviation: 0.32
- 1% percentile: -3.8523220825195312
- 99% percentile: 1.8408506774902273



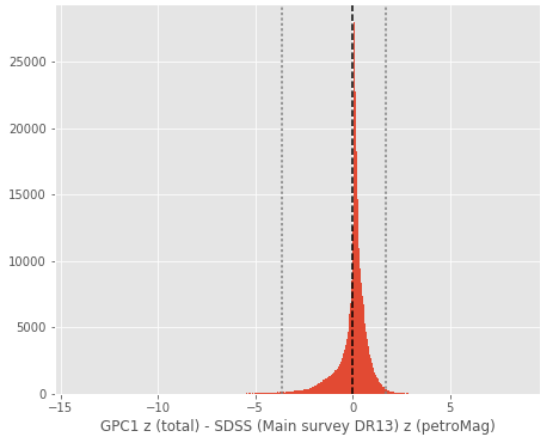


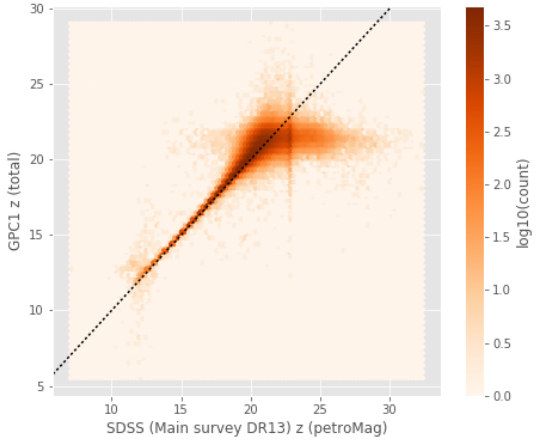
GPC1 z (aperture) - SDSS (Main survey DR13) z (fiberMag):
- Median: -0.30
- Median Absolute Deviation: 0.18
- 1% percentile: -1.4519528579711913
- 99% percentile: 1.1004284858703666



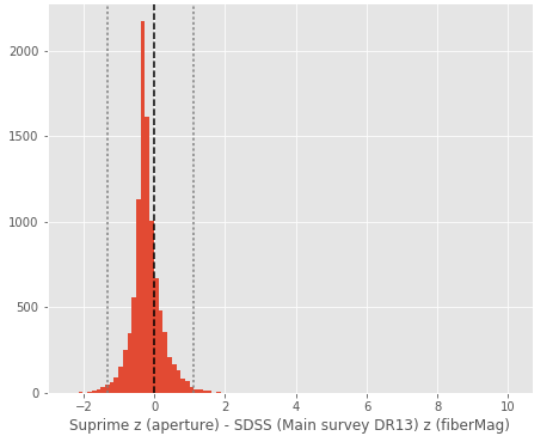


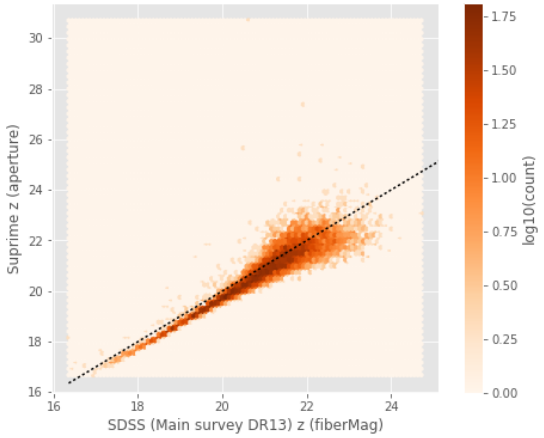
GPC1 z (total) - SDSS (Main survey DR13) z (petroMag):
- Median: 0.12
- Median Absolute Deviation: 0.26
- 1% percentile: -3.6426555824279783
- 99% percentile: 1.6995499610900824



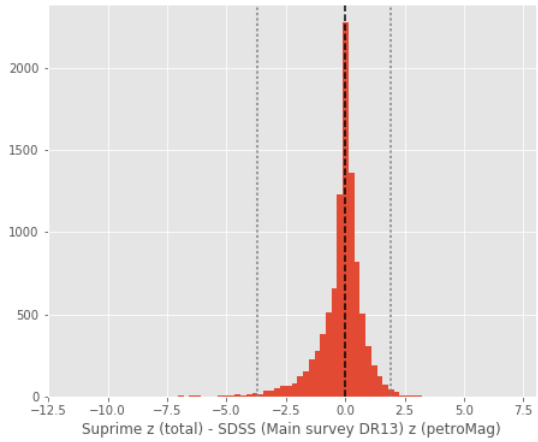


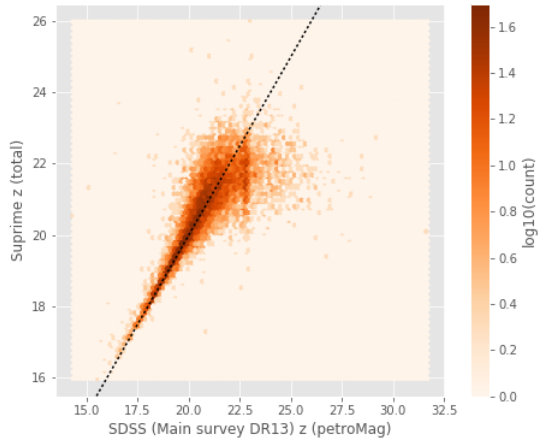
Suprime z (aperture) - SDSS (Main survey DR13) z (fiberMag):
- Median: -0.26
- Median Absolute Deviation: 0.18
- 1% percentile: -1.3362243652343748
- 99% percentile: 1.096382350921631



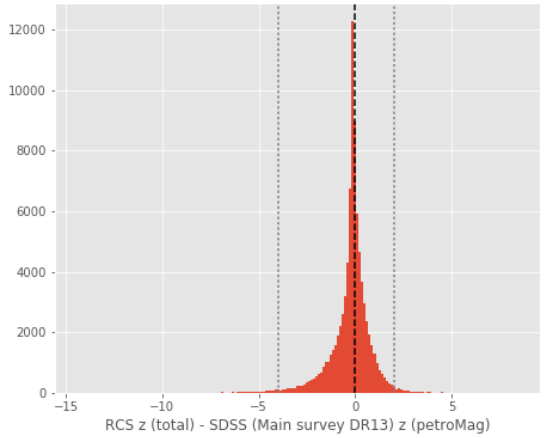


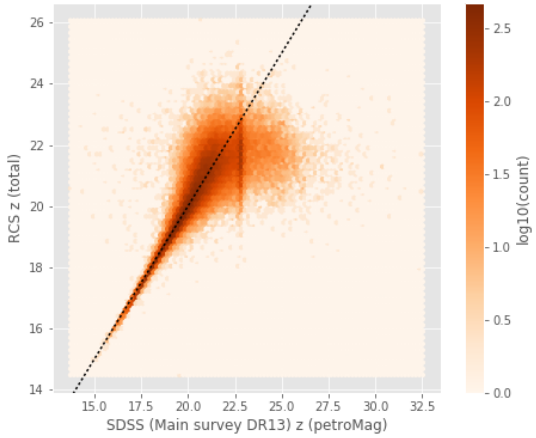
Suprime z (total) - SDSS (Main survey DR13) z (petroMag):
- Median: -0.01
- Median Absolute Deviation: 0.37
- 1% percentile: -3.7131628036499023
- 99% percentile: 1.8880386352539036





No sources have both SDSS (Main survey DR13) z (fiberMag) and RCS z (aperture) values.
RCS z (total) - SDSS (Main survey DR13) z (petroMag):
- Median: -0.10
- Median Absolute Deviation: 0.37
- 1% percentile: -3.960337562561035
- 99% percentile: 2.035121383666991



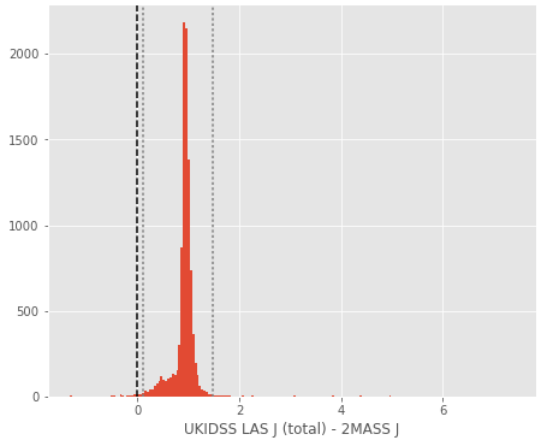


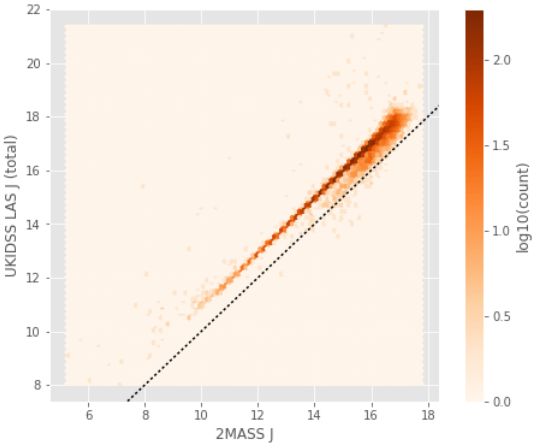
1.5.2 III.b - Comparing J and K bands to 2MASS

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.

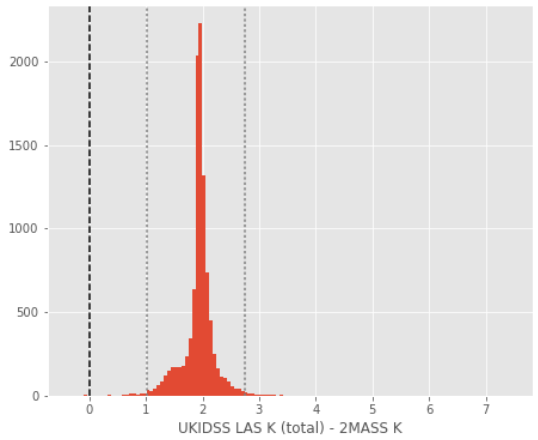
```
UKIDSS LAS J (total) - 2MASS J:
- Median: 0.94
- Median Absolute Deviation: 0.05
- 1% percentile: 0.11236026573181146
- 99% percentile: 1.4694202251434318
```

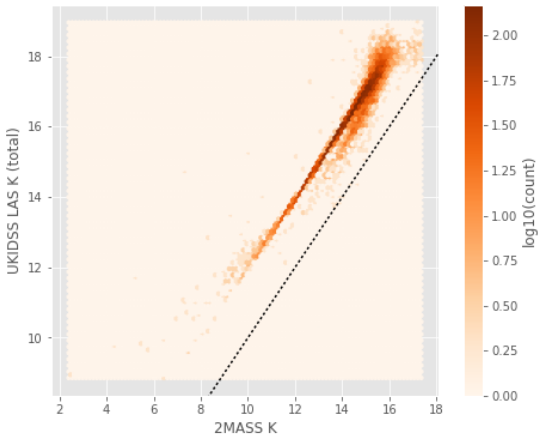





```
UKIDSS LAS K (total) - 2MASS K:
- Median: 1.95
- Median Absolute Deviation: 0.08
- 1% percentile: 1.0191856248474123
```

- 99% percentile: 2.7435803141784705



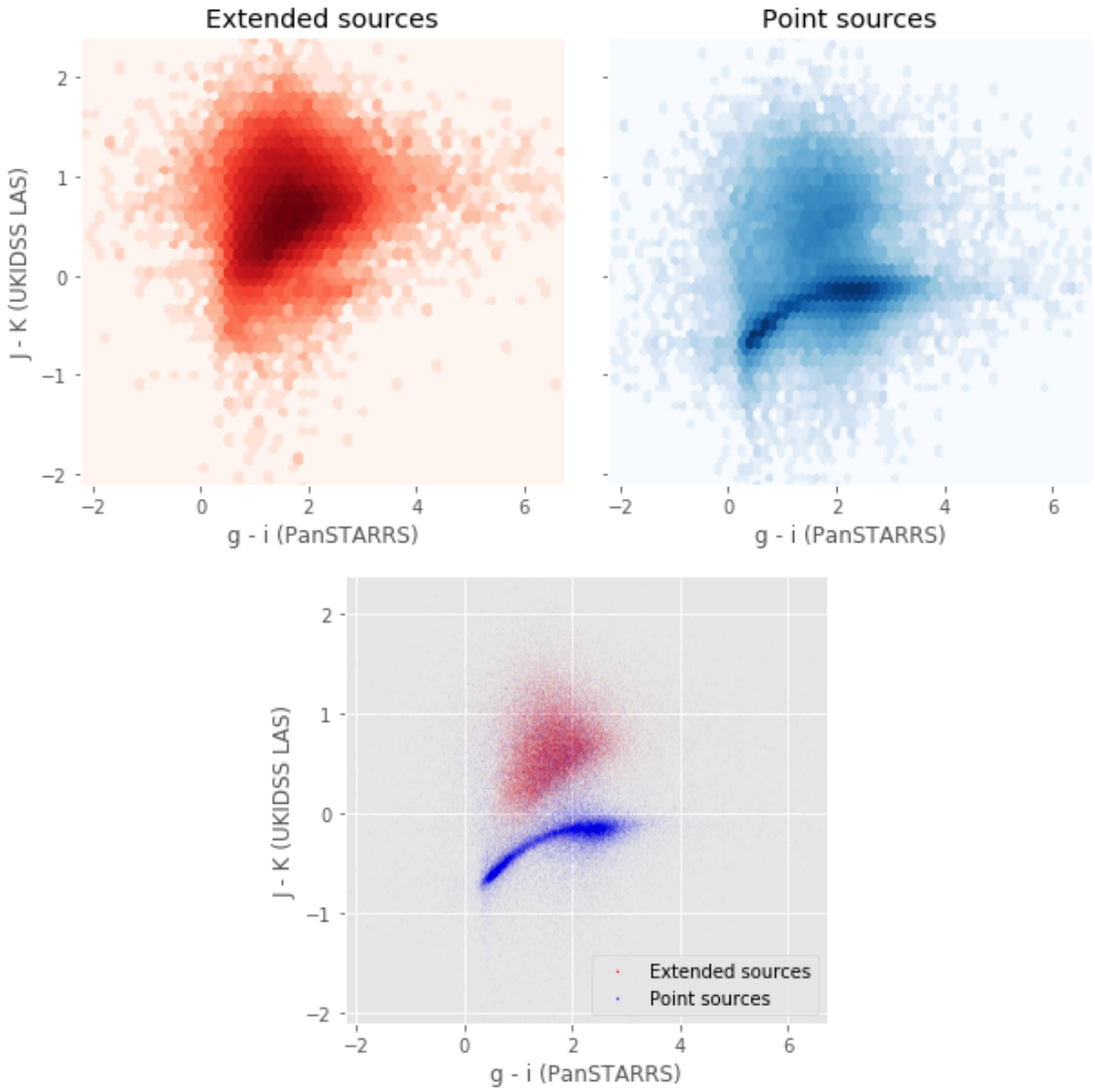


1.6 IV - Comparing aperture magnitudes to total ones.

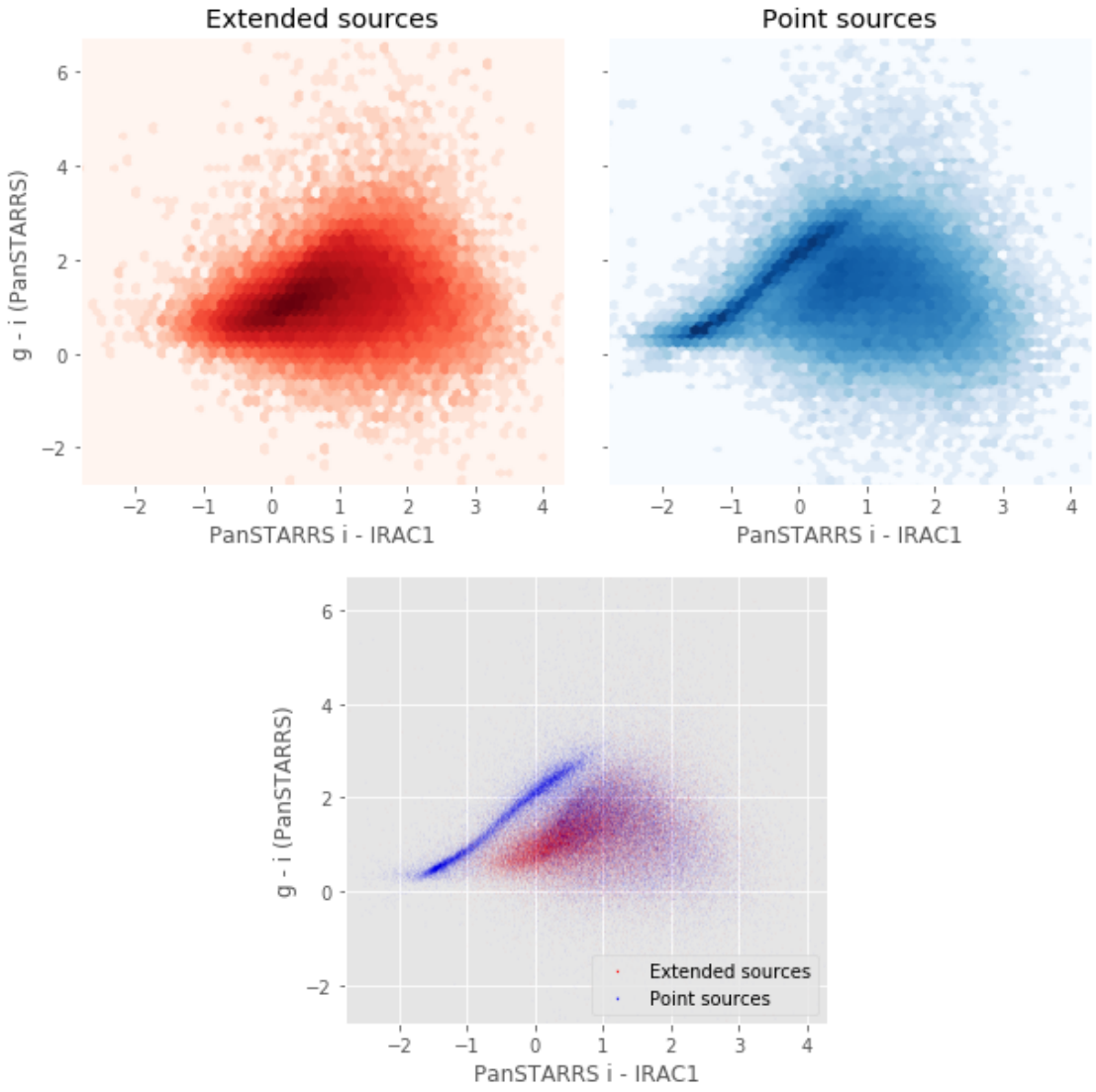
Number of source used: 0 / 4924329 (0.00%)
HELP warning: no sources with observations in both bands

1.7 V - Color-color and magnitude-color plots

Number of source used: 112069 / 4924329 (2.28%)

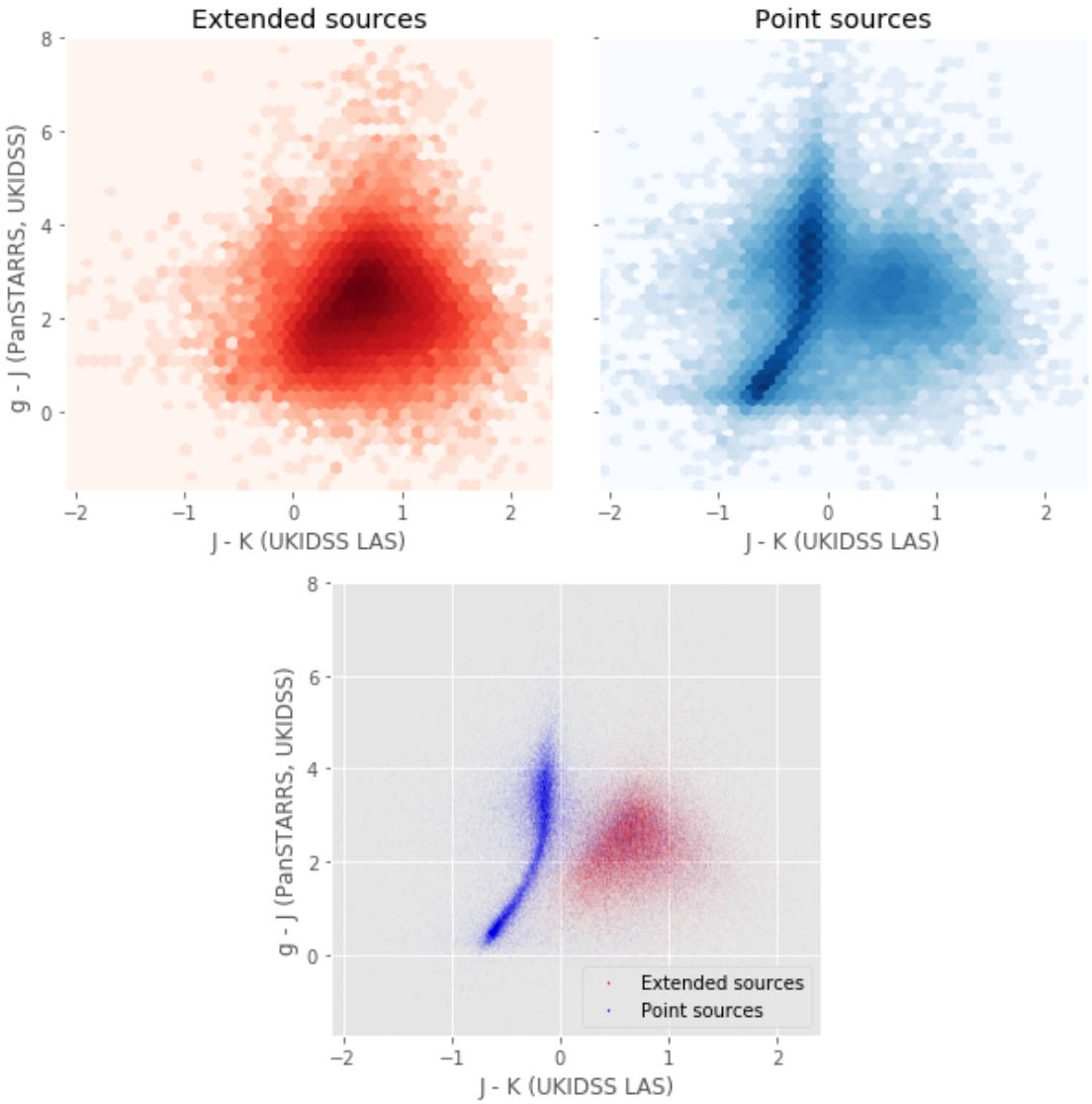



```
Number of source used: 132885 / 4924329 (2.70%)
```

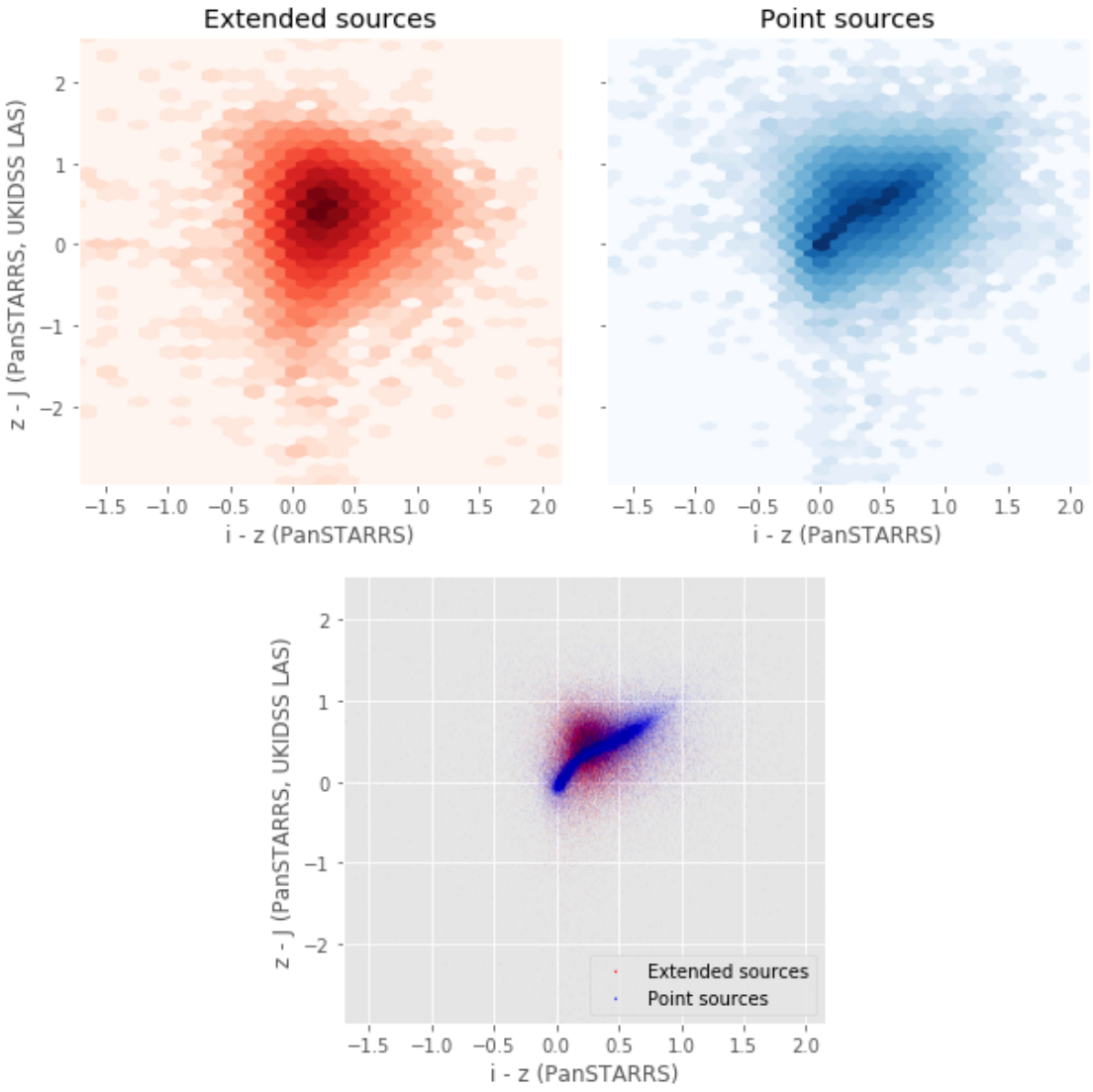



```
Number of source used: 0 / 4924329 (0.00%)
HELP warning: no sources with observations in both bands
```

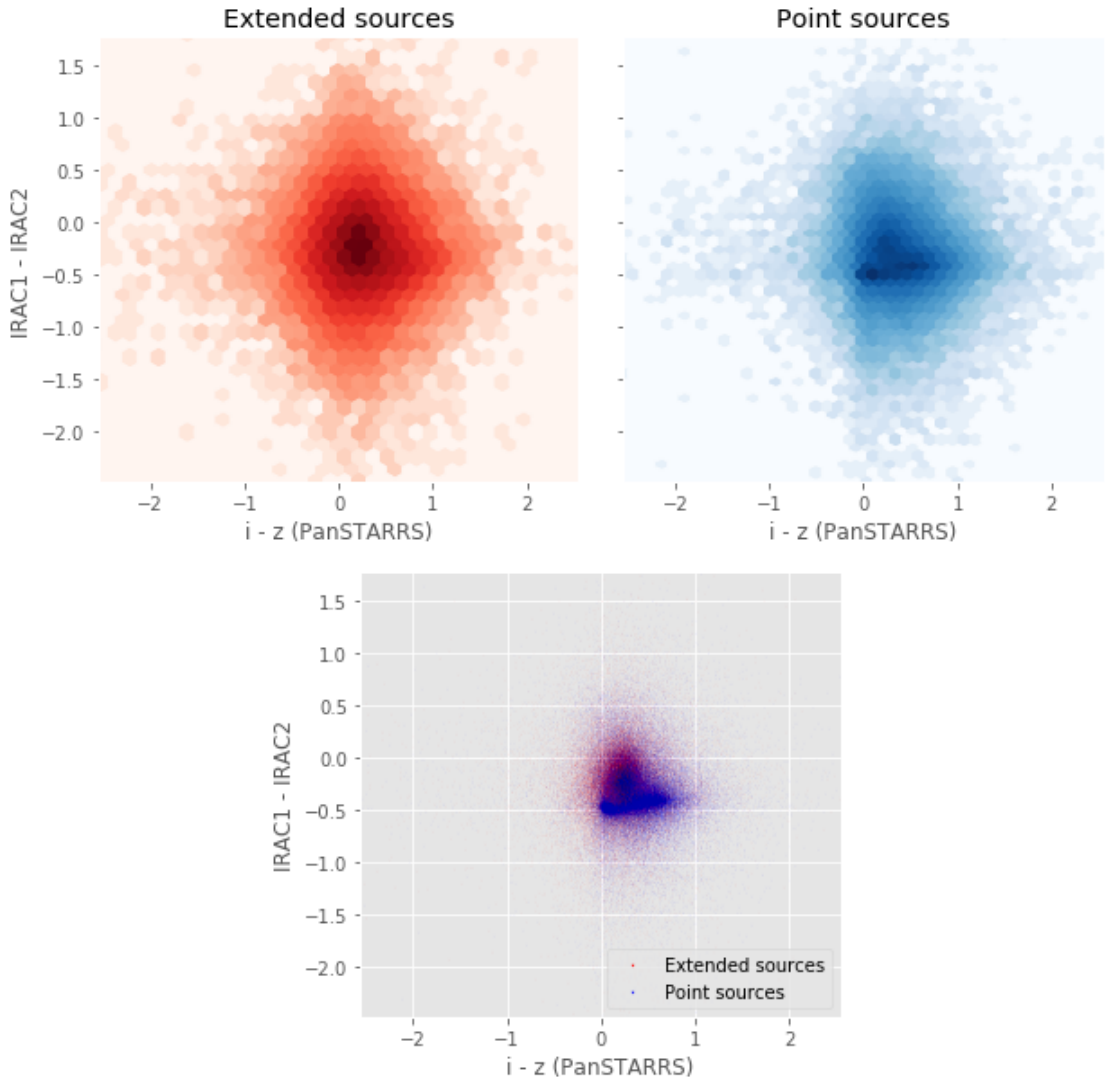
```
Number of source used: 112253 / 4924329 (2.28%)
```




```
Number of source used: 133599 / 4924329 (2.71%)
```




```
Number of source used: 138070 / 4924329 (2.80%)
```


Extended sources
Point sources
IRAC1 - IRAC2
i - z (PanSTARRS)
Extended sources
Point sources