1.1_CANDELS-3D-HST

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of HST CANDELS-3D data

The catalogue comes from `dmu0_CANDELS-3D-HST`.

In the catalogue, we keep:

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

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

1.2 I - Column selection

```
WARNING: UnitsWarning: '0.3631uJy' did not parse as fits unit: Numeric factor not supported by F
WARNING: UnitsWarning: '[Msun]' did not parse as fits unit: Invalid character at col 0 [astropy.


/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>
```

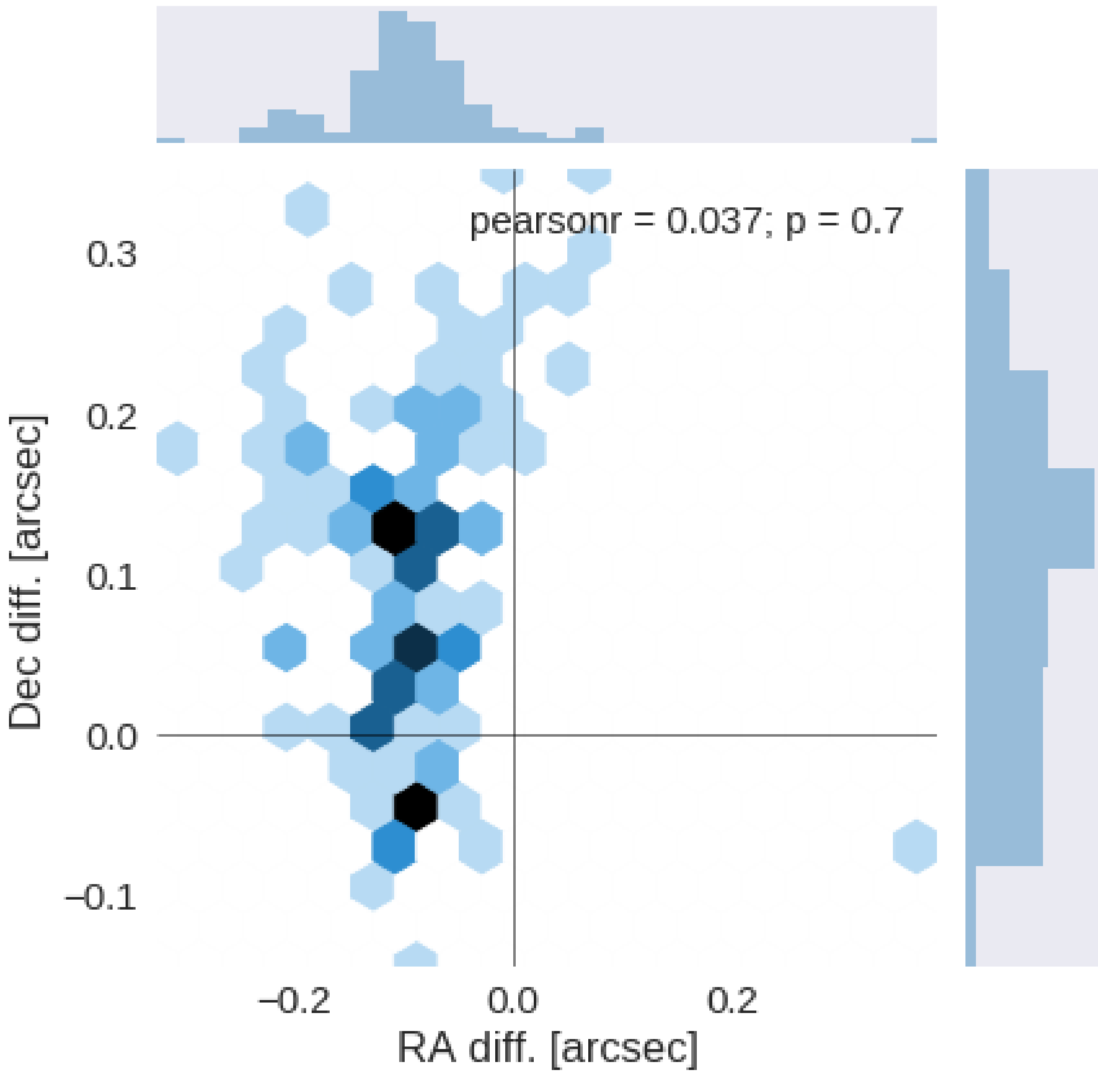
1.3 II - Removal of duplicated sources

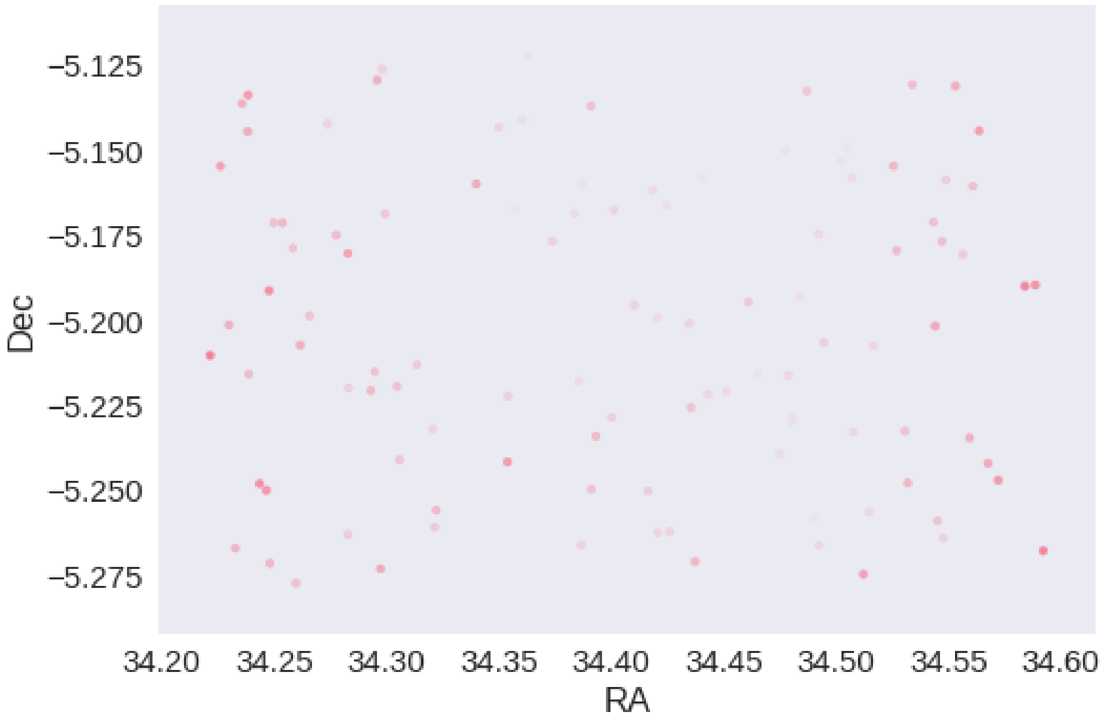
We remove duplicated objects from the input catalogues.

```
/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 44102 sources.
The cleaned catalogue has 43863 sources (239 removed).
The cleaned catalogue has 236 sources flagged as having been cleaned
```

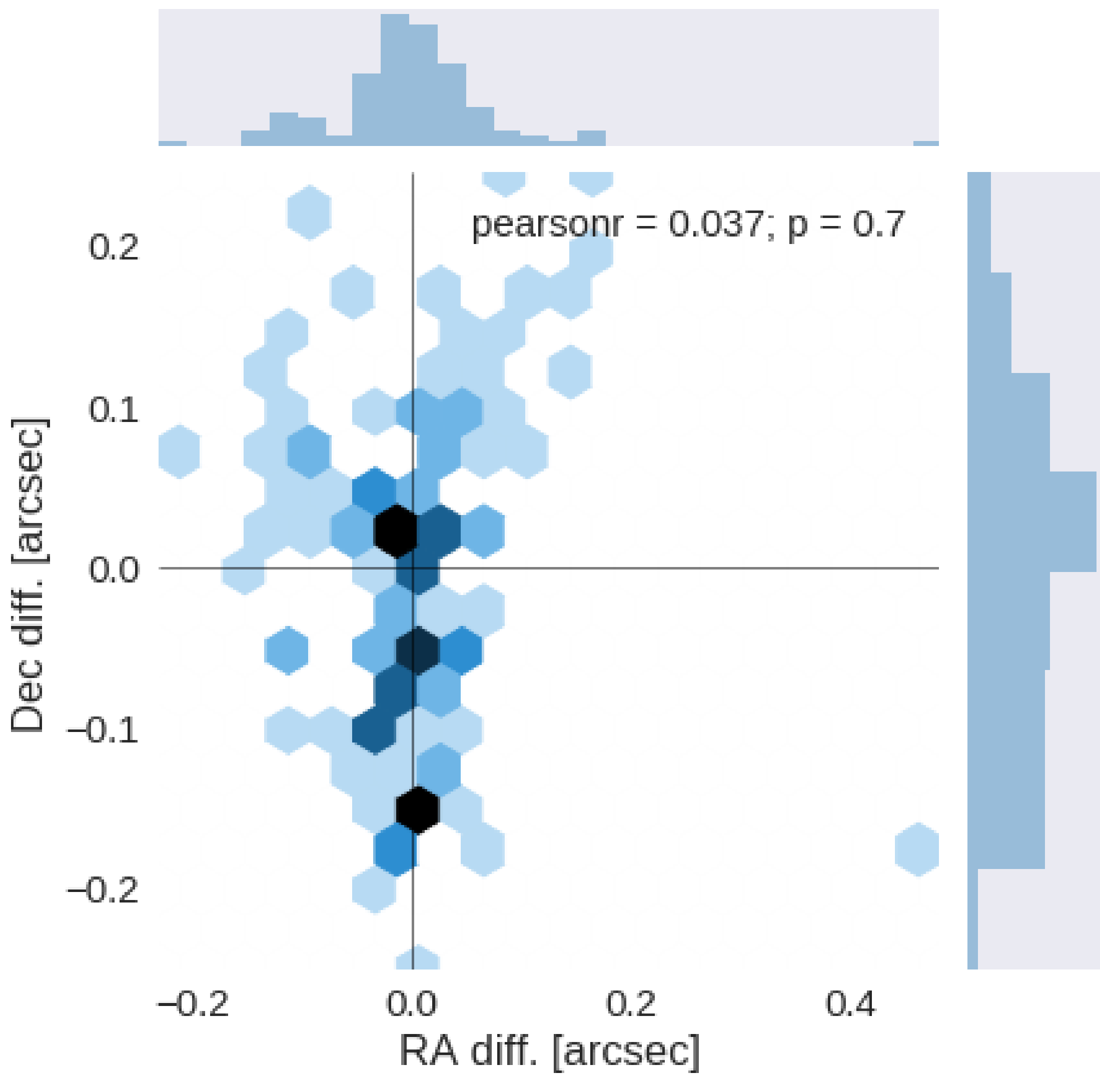
1.4 III - Astrometry correction

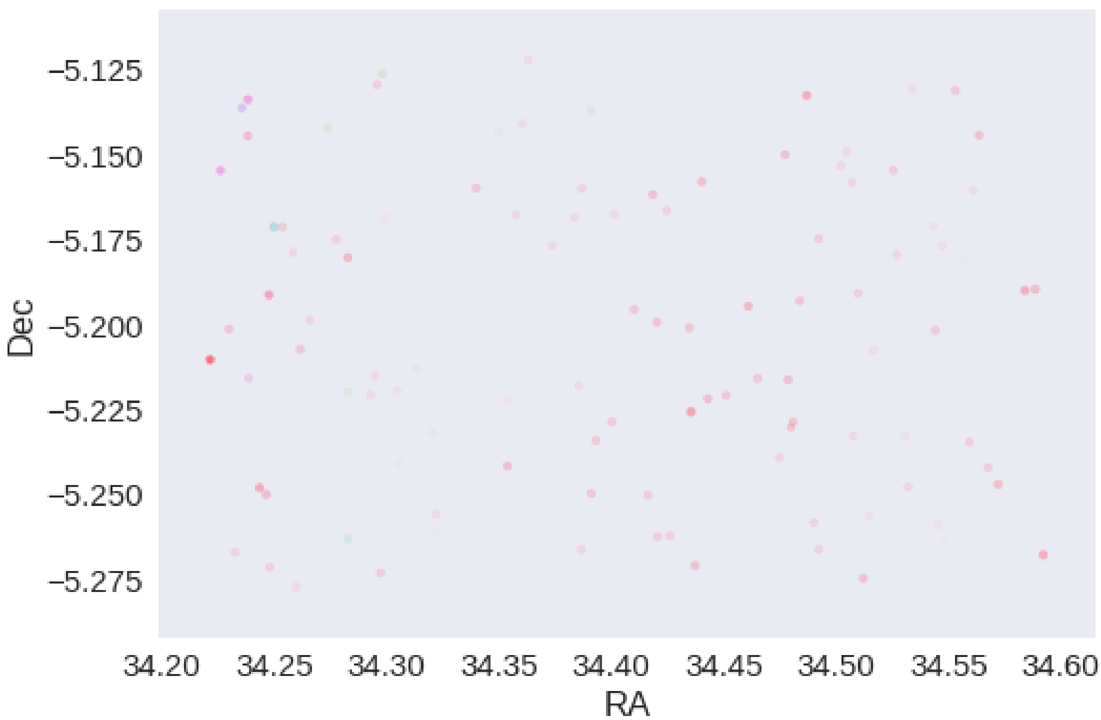
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.09405840634997276 arcsec
Dec correction: -0.10633781055542357 arcsec
```


pearsonr = 0.037; p = 0.7
0.2
0.1
0.0
−0.1
−0.2
Dec diff. [arcsec]
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
127 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.2_CANDELS-UDS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of HST CANDELS-UDS data

The UDS survey appears to be a cross match between CANDELS-3D-HST with various other multiwavelength catalogues that we are already including across XMM-LSS. I therefore choose not to use it here.

1.3_CFHT-WIRDS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Canada France Hawaii Telescope WIRDS Survey (CFHT-WIRDS) data

The catalogue is in `dmu0_CFHT-WIRDS`.

In the catalogue, we keep:

- The position;
- The stellarity;
- The aperture magnitude (3 arcsec).
- The total magnitude (Kron like aperture magnitude).

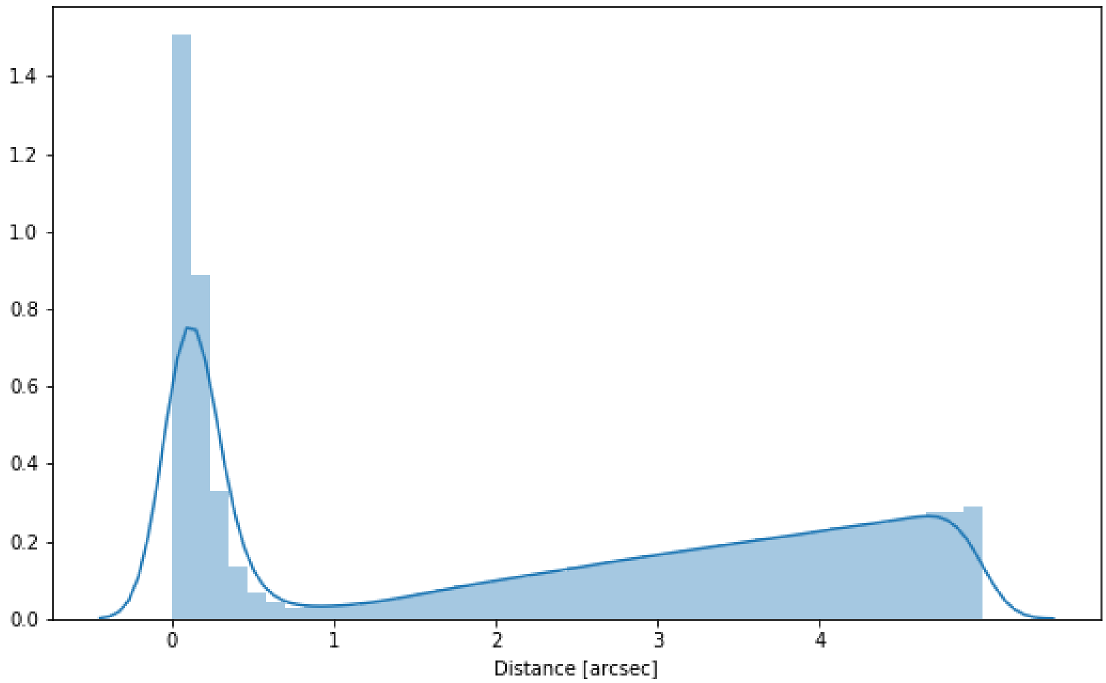
```
This notebook was run with herschelhelp_internal version:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

1.2 I - Column selection

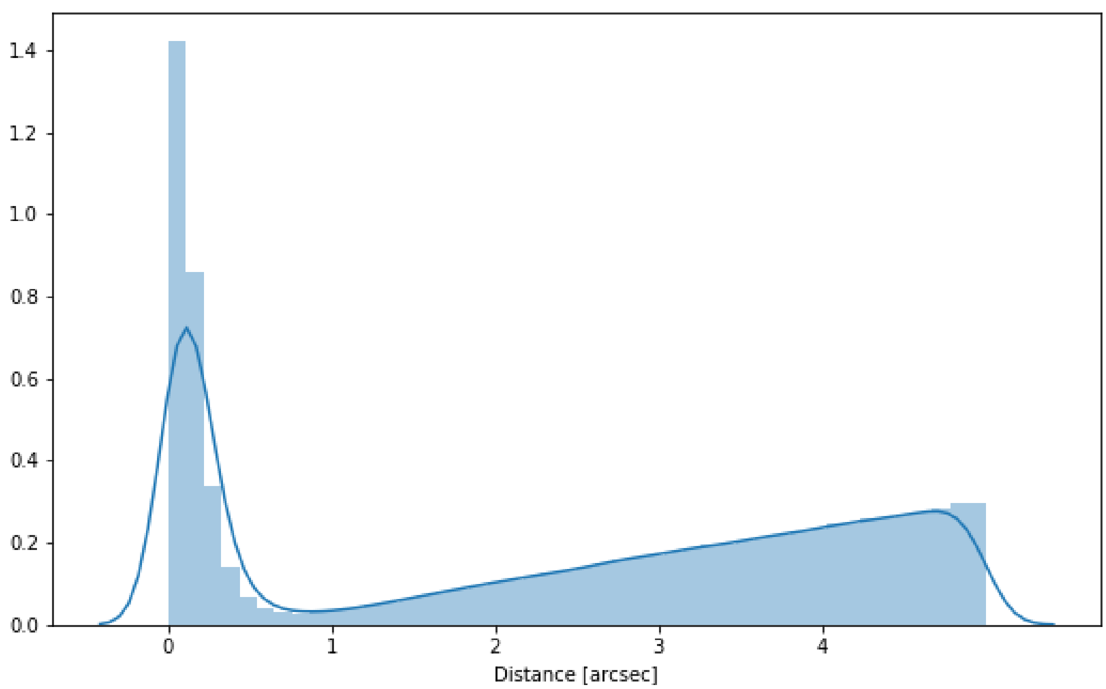
1.3 Merging different bands

CFHT-WIRDS has indivdual extractions from each band. We must therefore merge them as if they were individual catalogues (they have different

```
Out[5]: <IPython.core.display.HTML object>
```



1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
Distance [arcsec]



1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
Distance [arcsec]

1.4 Generate internal id

Since every source has an independent id we combine them in 6 digit groups so that each iondividual id can be retrieved from the final integer

```
wirds_ks_stellarity, wirds_j_stellarity, wirds_h_stellarity
```

```
Out[16]: <IPython.core.display.HTML object>
```

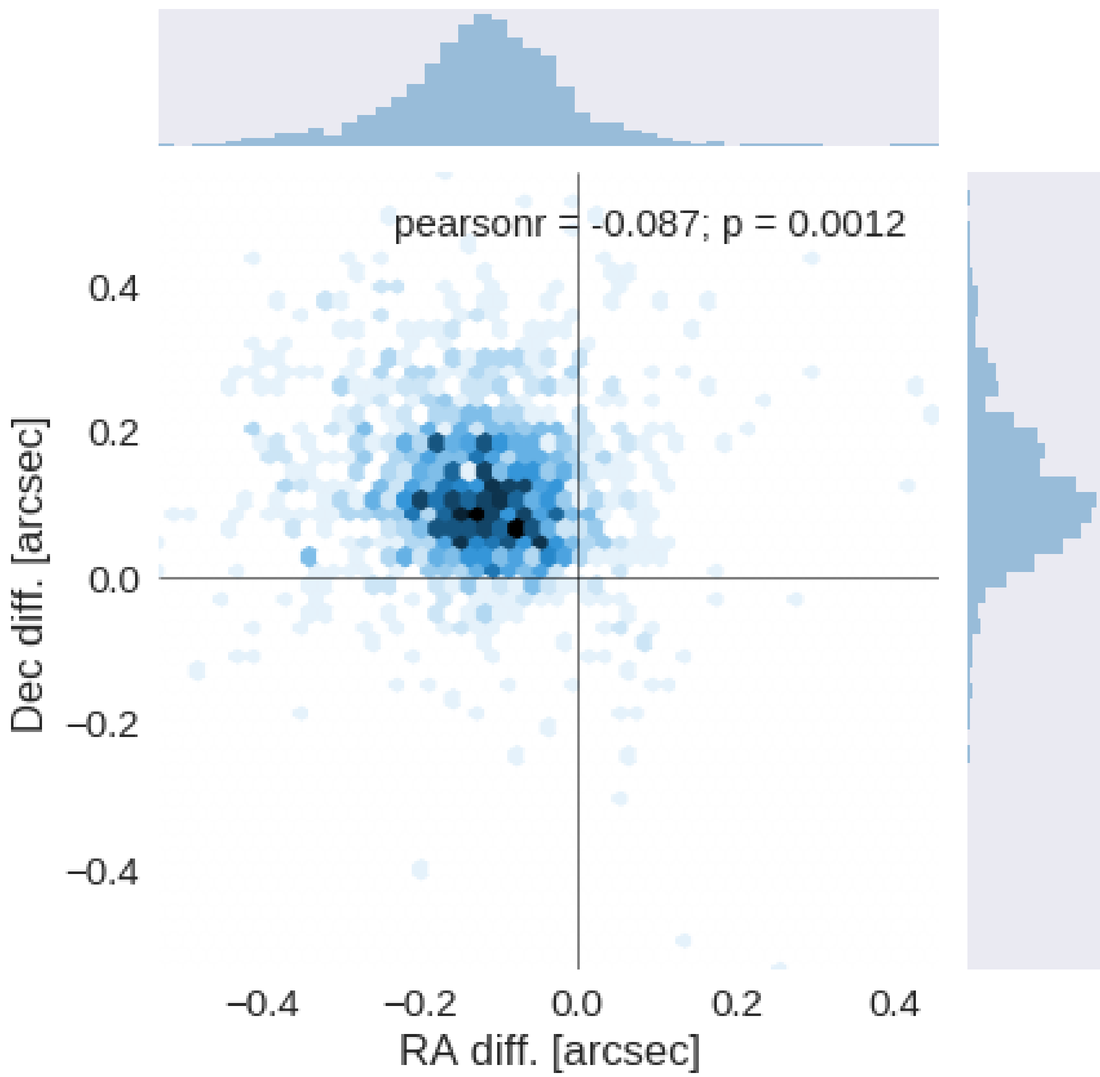
1.5 II - Removal of duplicated sources

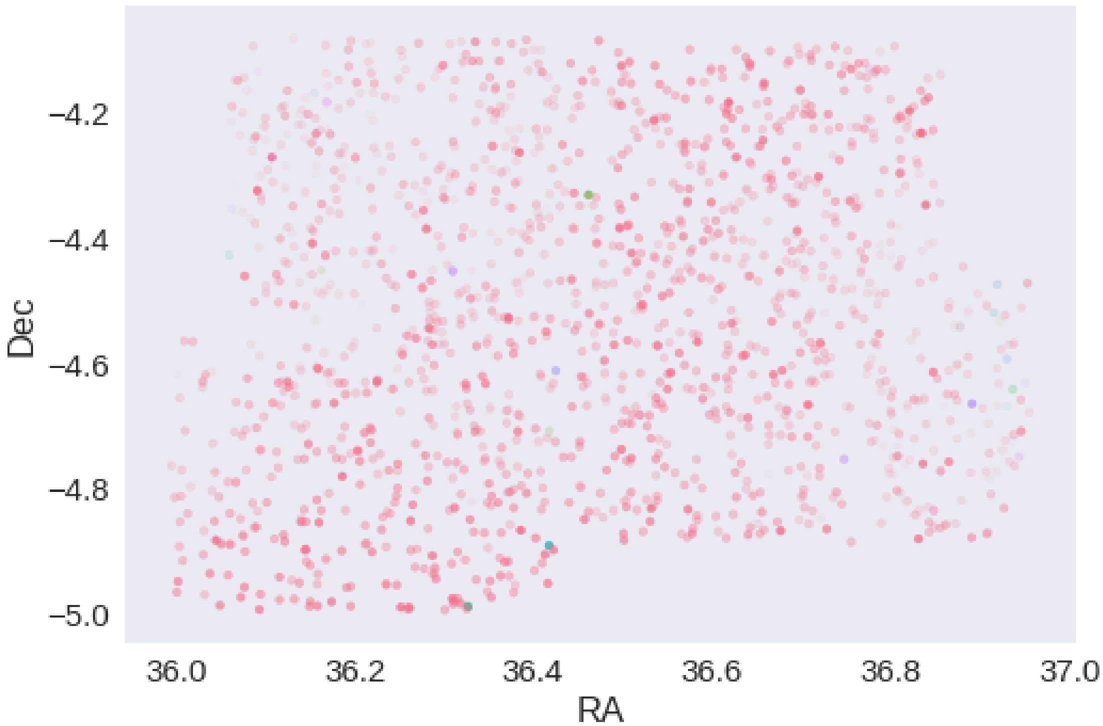
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 245786 sources.
The cleaned catalogue has 245776 sources (10 removed).
The cleaned catalogue has 10 sources flagged as having been cleaned
```

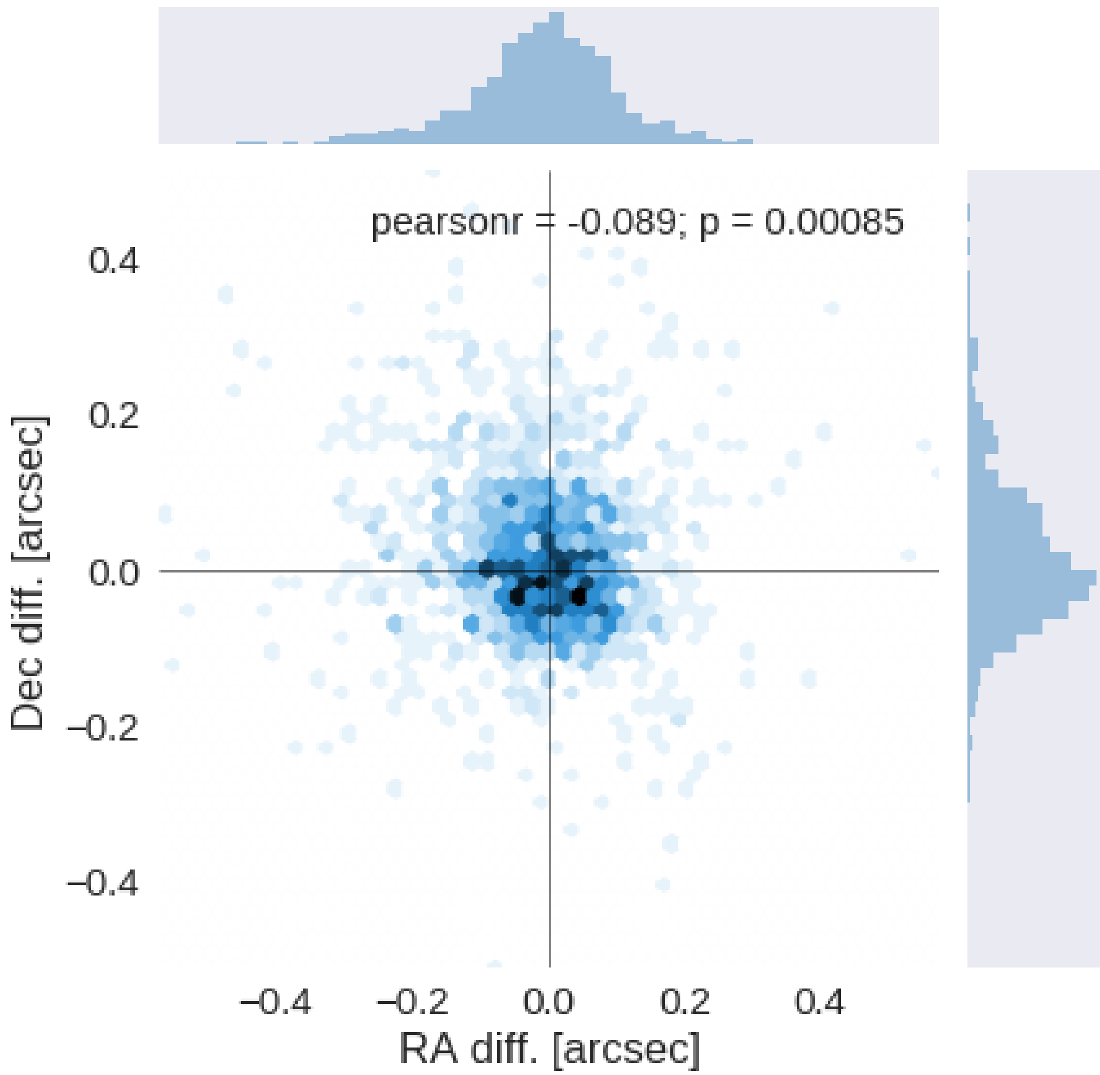
1.6 III - Astrometry correction

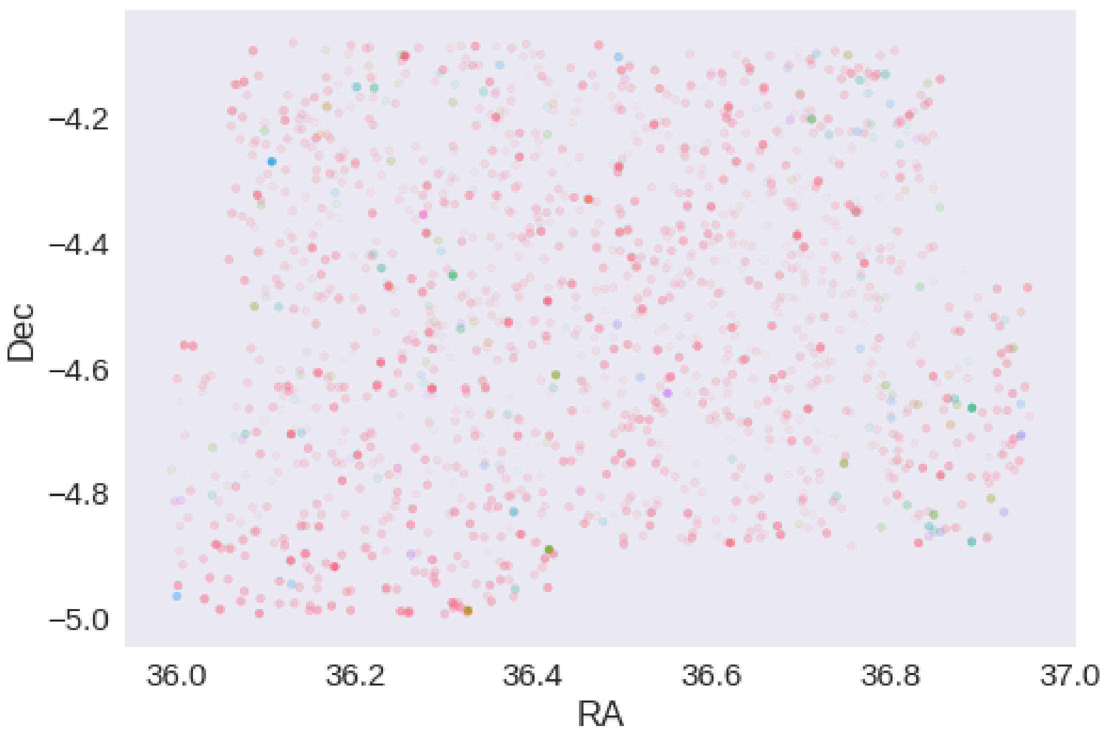
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.087; p = 0.0012
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: 0.11769722784862324 arcsec
Dec correction: -0.10338543637189446 arcsec
```


pearsonr = -0.089; p = 0.00085
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]



1.7 IV - Flagging Gaia objects

```
1667 sources flagged.
```

1.8 V - Flagging objects near bright stars

2 VI - Saving to disk

1.4a_CFHTLS-WIDE

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Canada France Hawaii Telescope Legacy Survey (CFHTLS) wide data

CFHTLS has both a wide area across XMM-LSS and a smaller deep field. We will process each independently and add them both to the master catalogue, taking the deep photometry where both are available.

The catalogue is in `dmu0_CFHTLS`.

In the catalogue, we keep:

- The position;
- The stellarity (g band stellarity);
- The aperture magnitude (3 arcsec).
- The total magnitude (Kron like aperture magnitude).

We use the 2007 release, which we take as the date.

```
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>
```

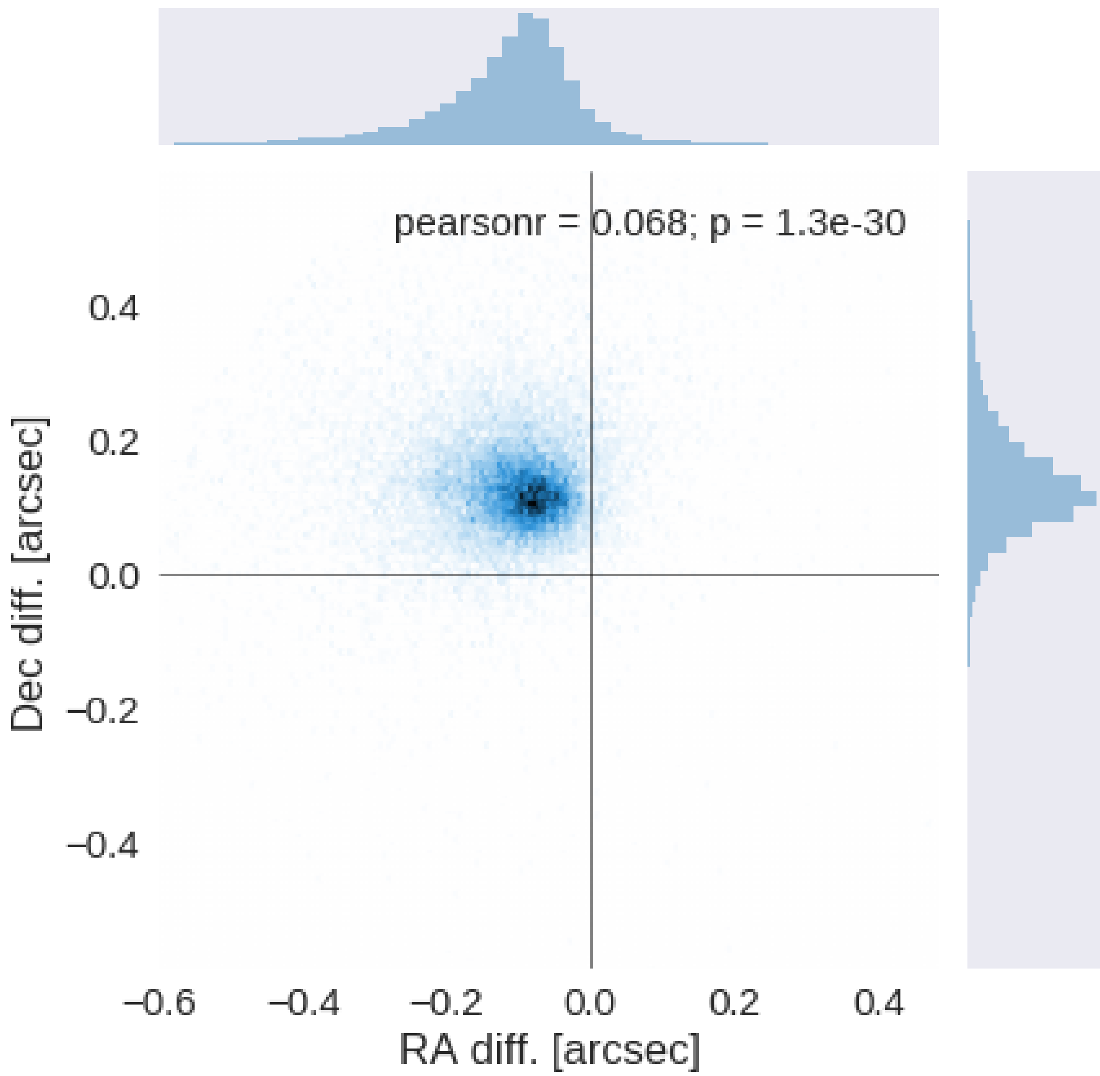
1.3 II - Removal of duplicated sources

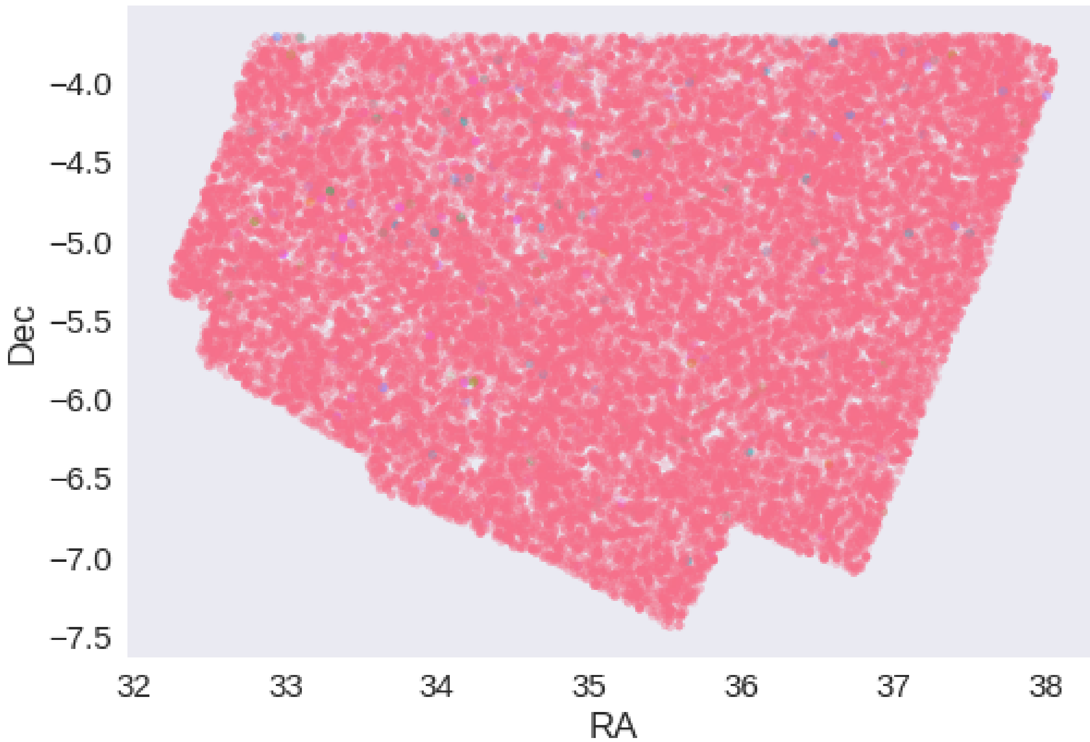
We remove duplicated objects from the input catalogues.

```
/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 3565362 sources.
The cleaned catalogue has 3565219 sources (143 removed).
The cleaned catalogue has 143 sources flagged as having been cleaned
```

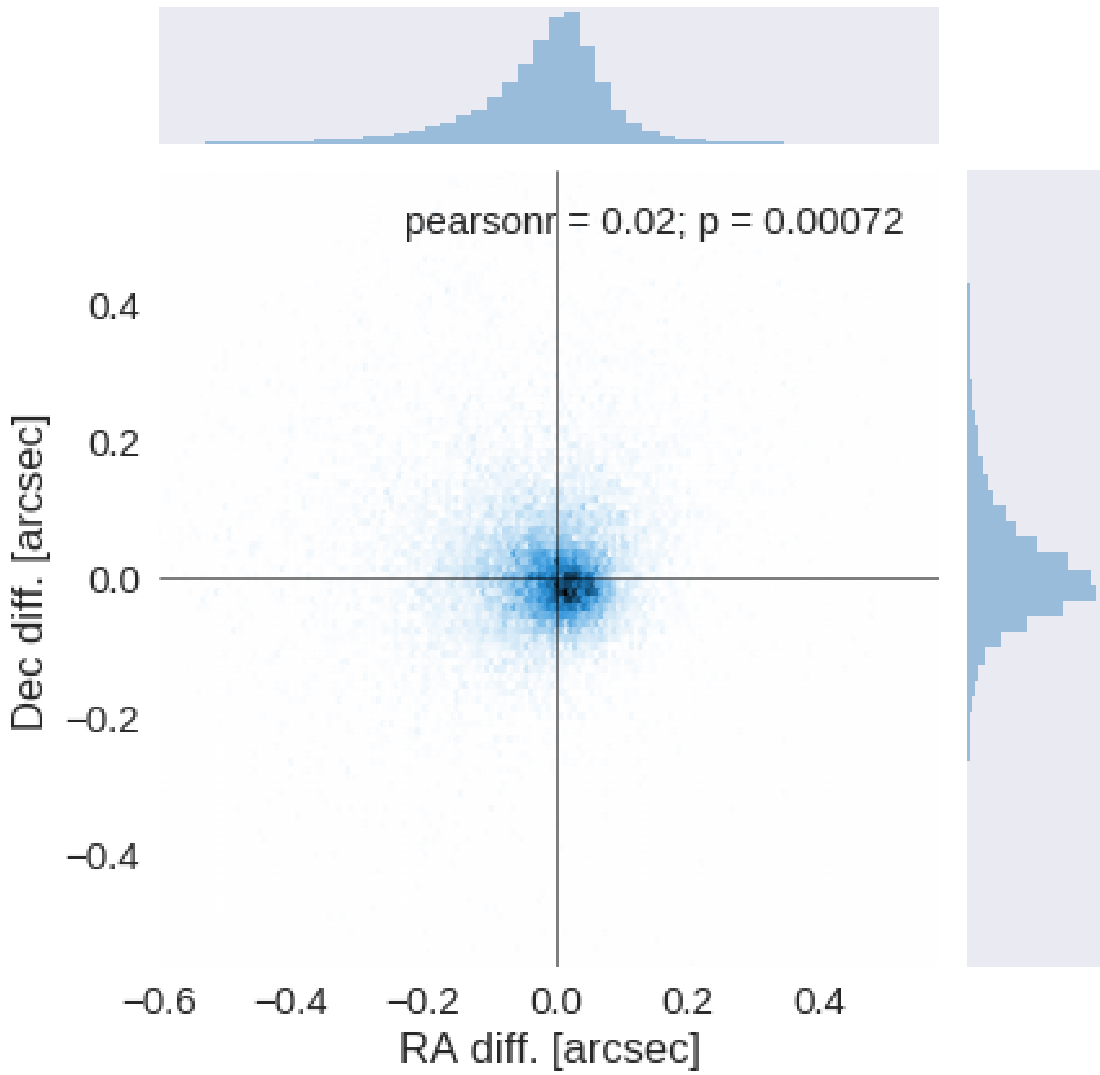
1.4 III - Astrometry correction

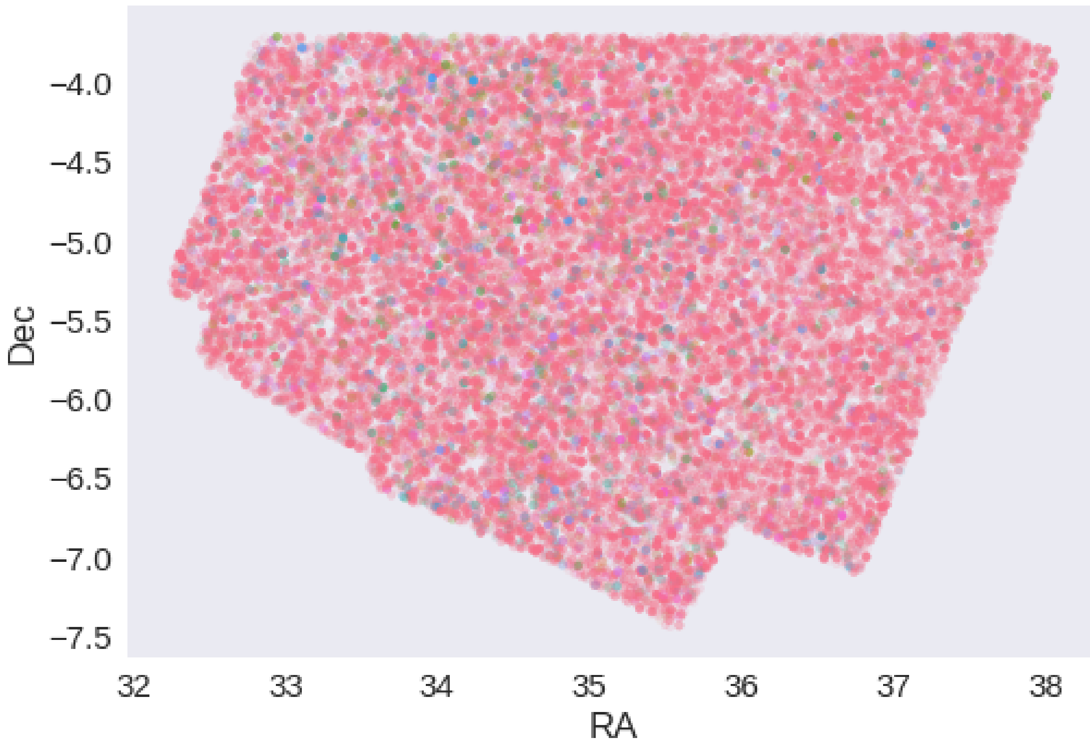
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.09701123327374717 arcsec
Dec correction: -0.12296987141358073 arcsec
```


pearsonr = 0.02; p = 0.00072
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

```
29367 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.4b_CFHTLS-DEEP

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Canada France Hawaii Telescope Legacy Survey (CFHTLS) deep data

CFHTLS has both a wide area across XMM-LSS and a smaller deep field. We will process each independently and add them both to the master catalogue, taking the deep photometry where both are available.

The catalogue is in `dmu0_CFHTLS`.

In the catalogue, we keep:

- The position;
- The stellarity (g band stellarity);
- The aperture magnitude (3 arcsec).
- The total magnitude (Kron like aperture magnitude).

We use the 2007 release, which we take as the date.

```
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>
```

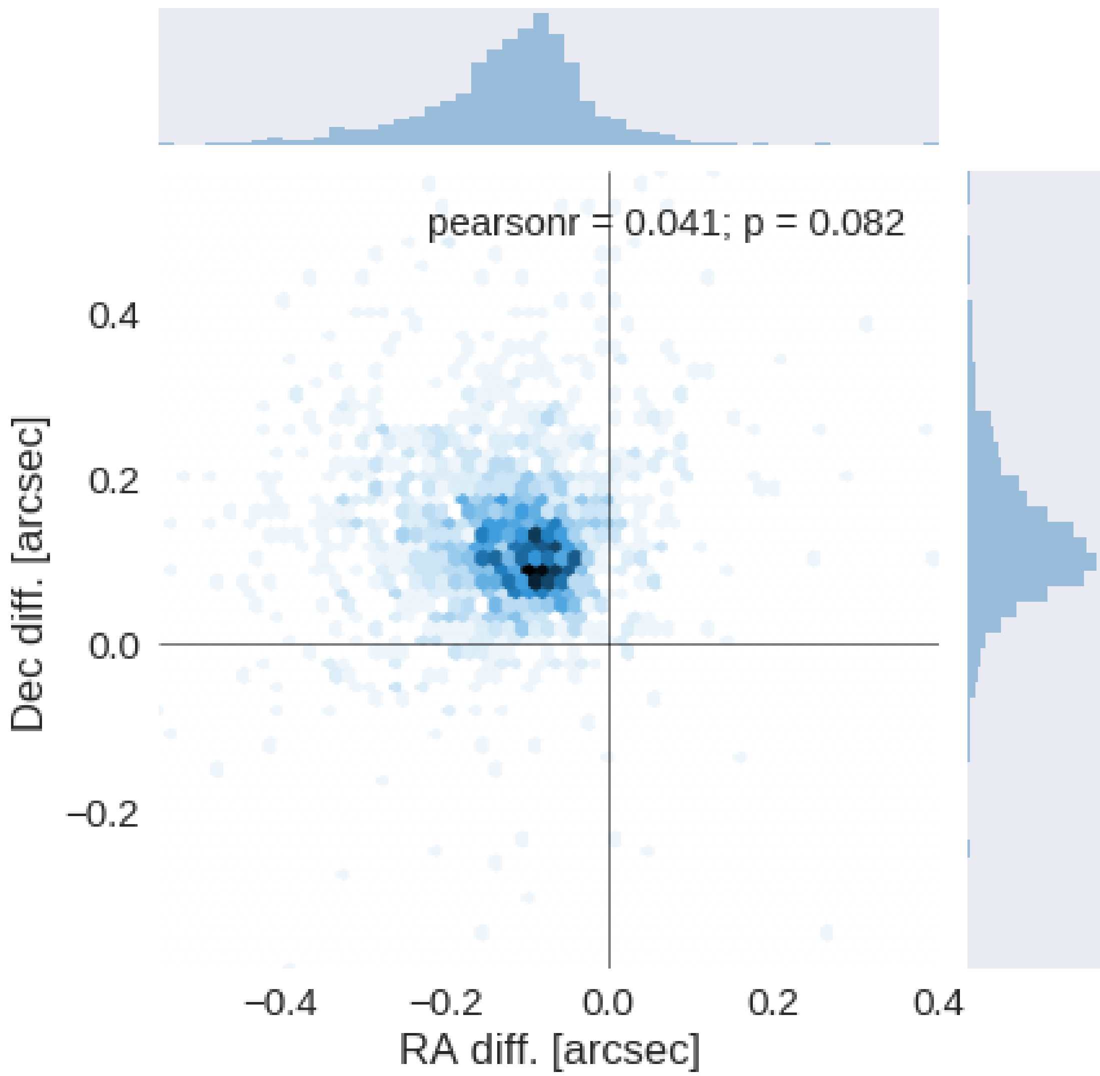
1.3 II - Removal of duplicated sources

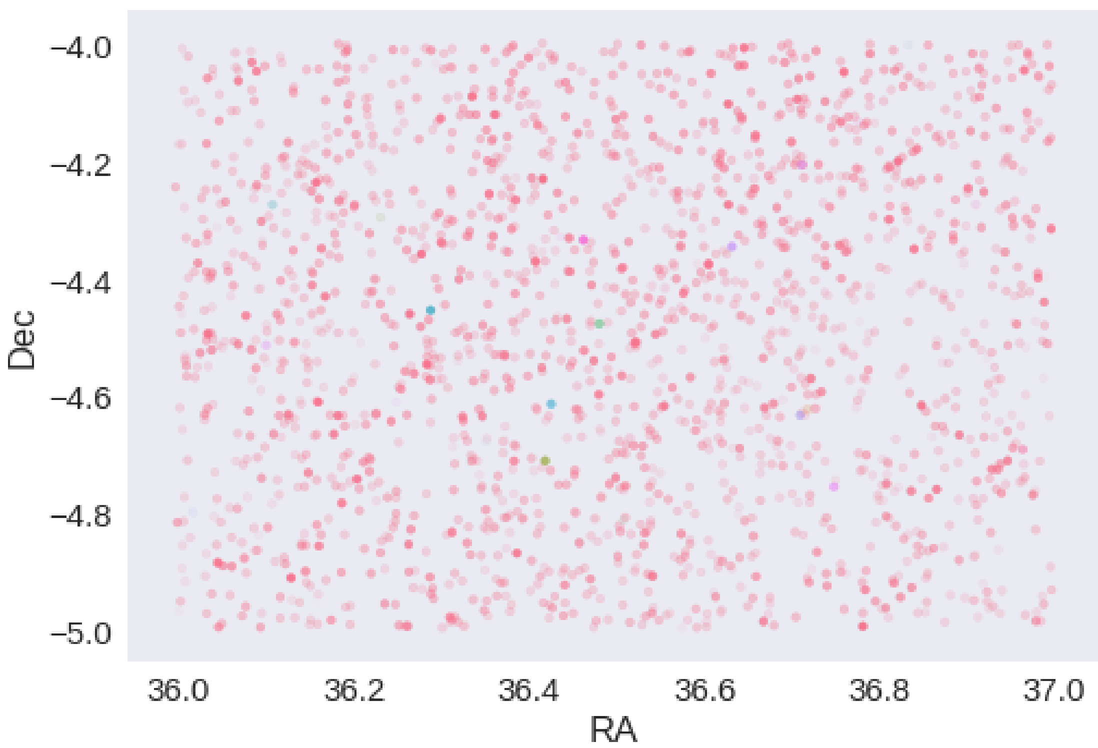
We remove duplicated objects from the input catalogues.

```
/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 592457 sources.
The cleaned catalogue has 592457 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

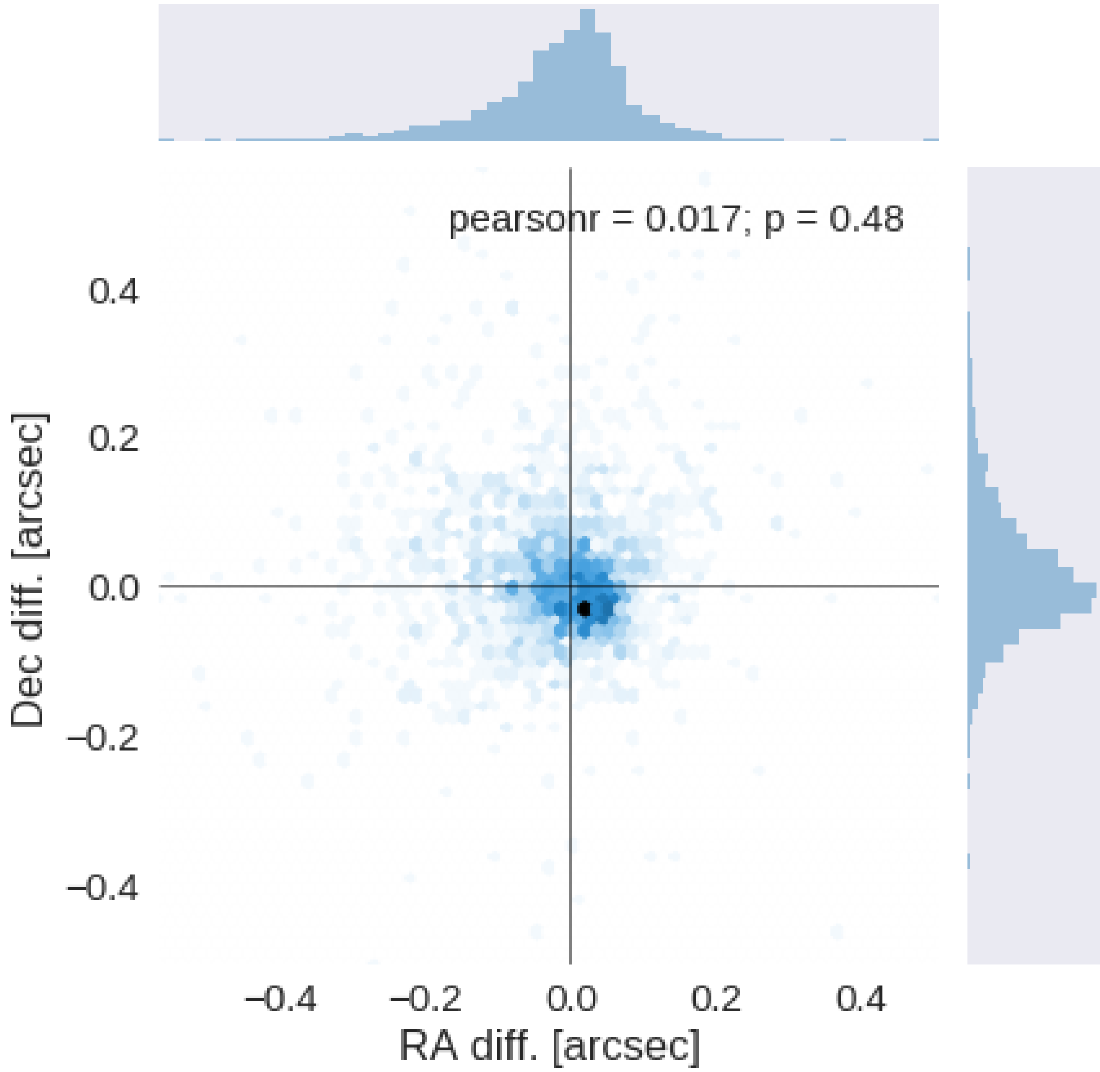
1.4 III - Astrometry correction

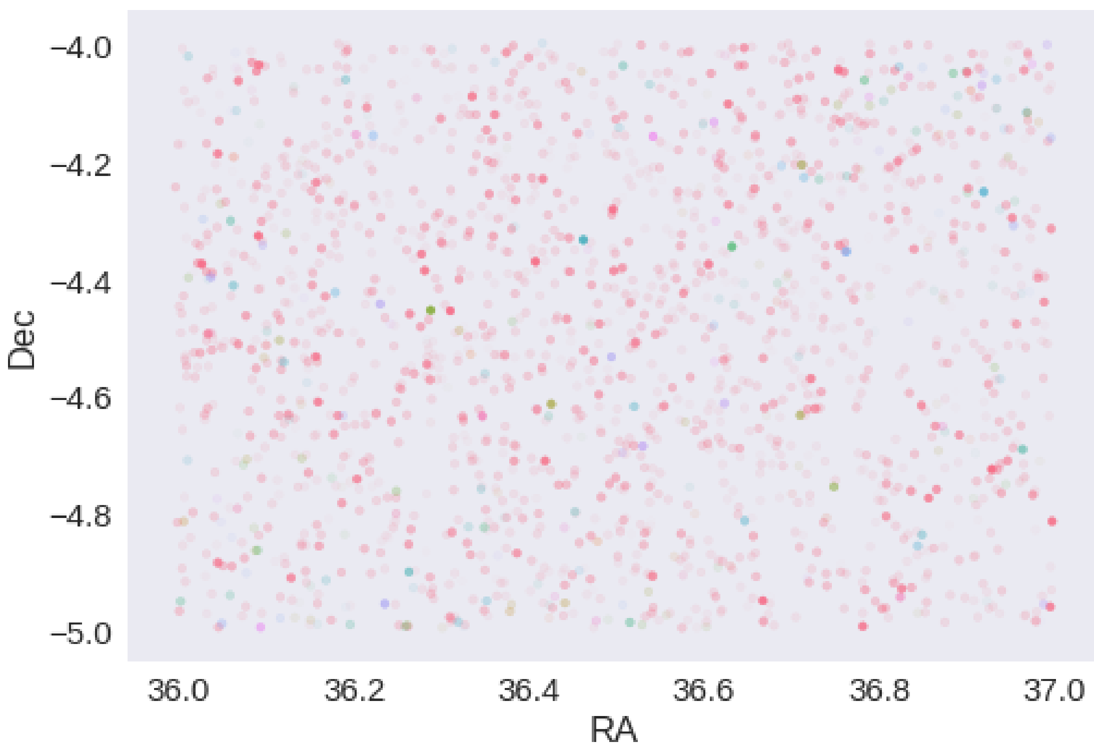
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.10748285569093241 arcsec
Dec correction: -0.11697437952022938 arcsec
```


pearsonr = 0.017; p = 0.48
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

```
1839 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.5_CFHTLenS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Canada France Hawaii Telescope Lensing Survey (CFHTLenS) data

CFHTLenS catalogue: the catalogue comes from `dmu0_CFHTLenS`.

In the catalogue, we keep:

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

We use the publication year 2012 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

```
/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:10:
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:11:
```

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

1.3 II - Removal of duplicated sources

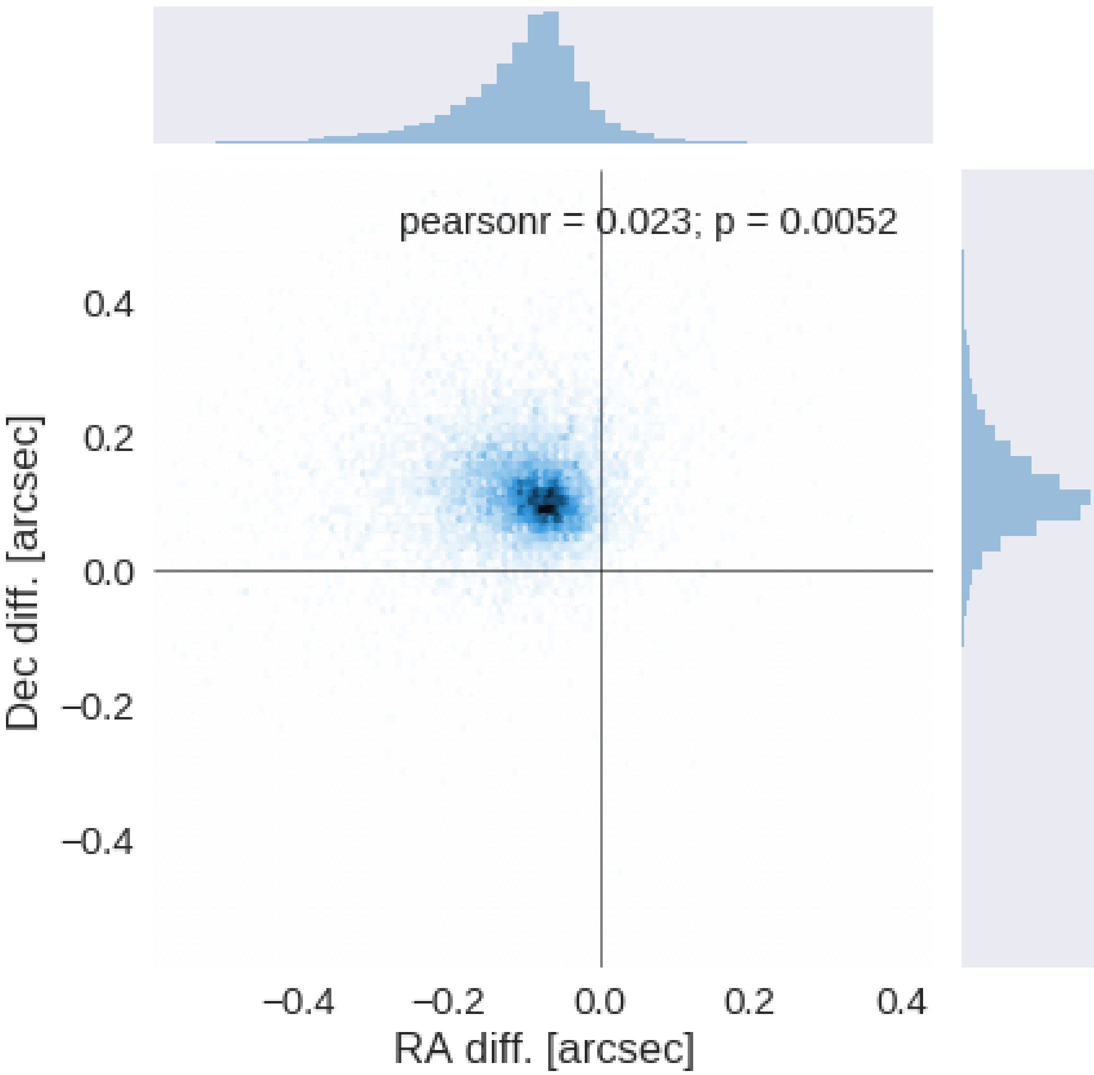
We remove duplicated objects from the input catalogues.

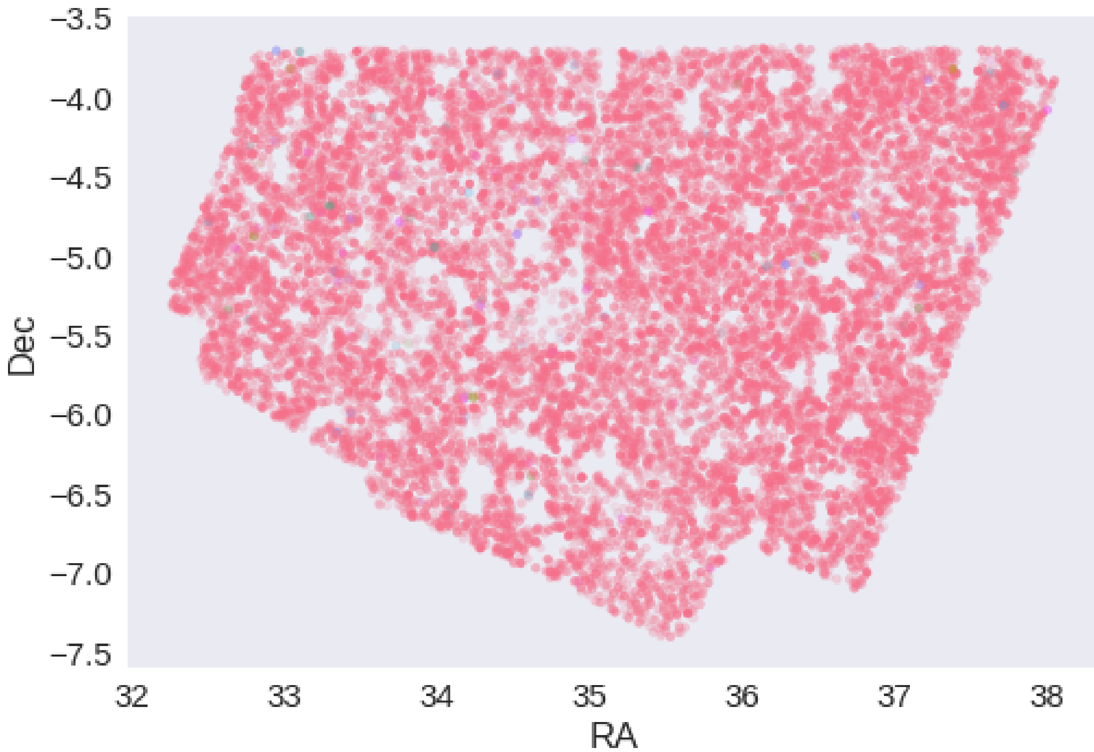
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 2317959 sources.
The cleaned catalogue has 2317937 sources (22 removed).
The cleaned catalogue has 22 sources flagged as having been cleaned
```

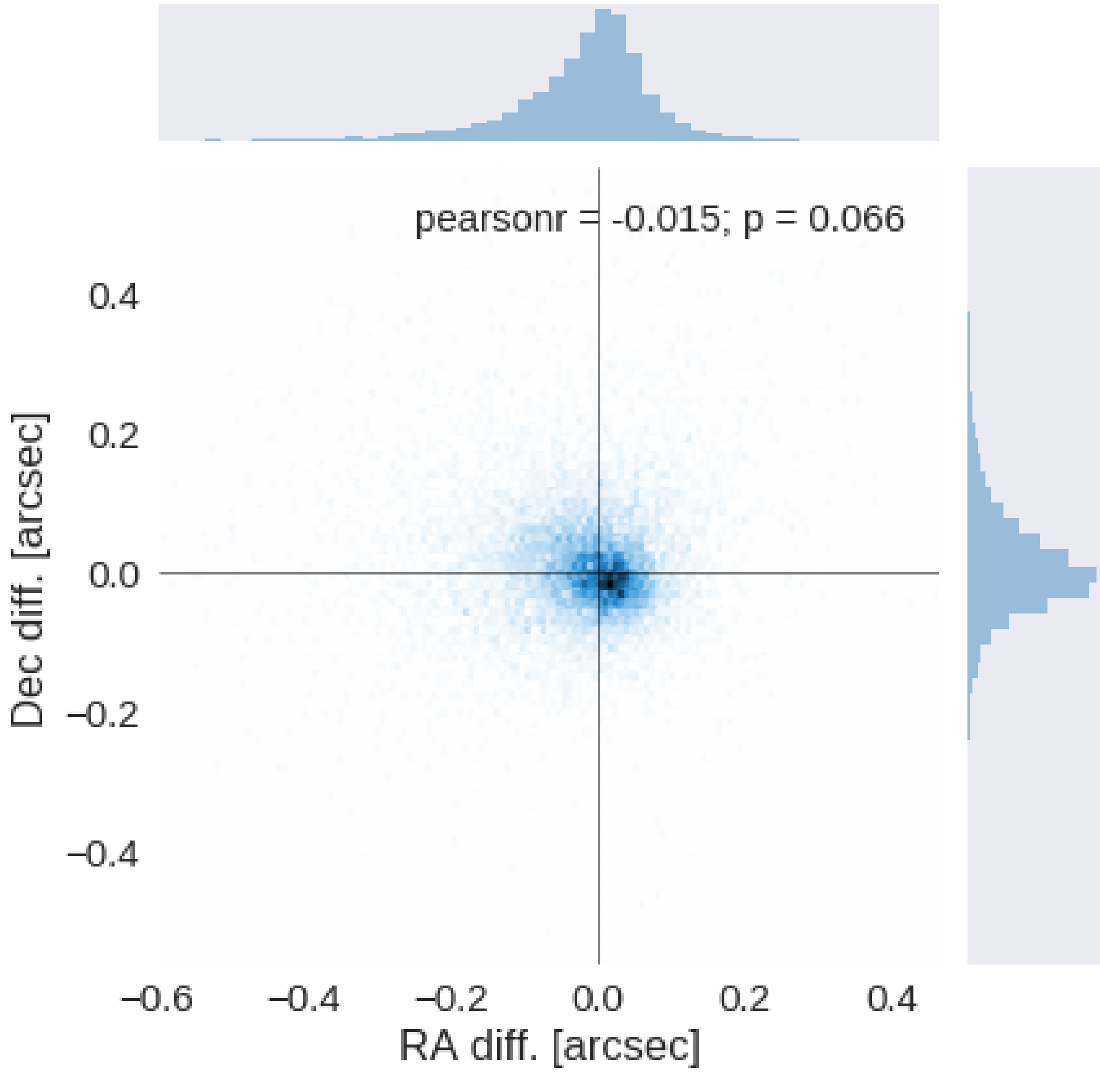
1.4 III - Astrometry correction

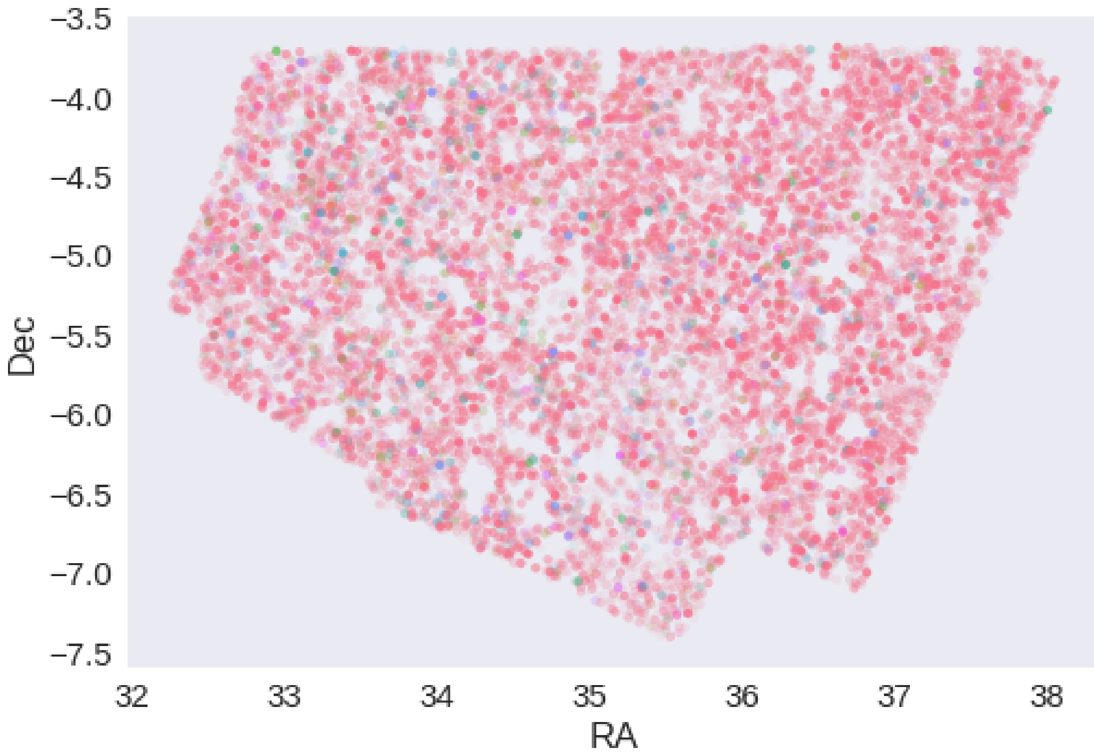
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.08798053969201192 arcsec
Dec correction: -0.11095108088596817 arcsec
```


pearsonr = -0.015; p = 0.066
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

```
15171 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.6.1_DECaLS

January 18, 2018

1 XMM-LSS 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).

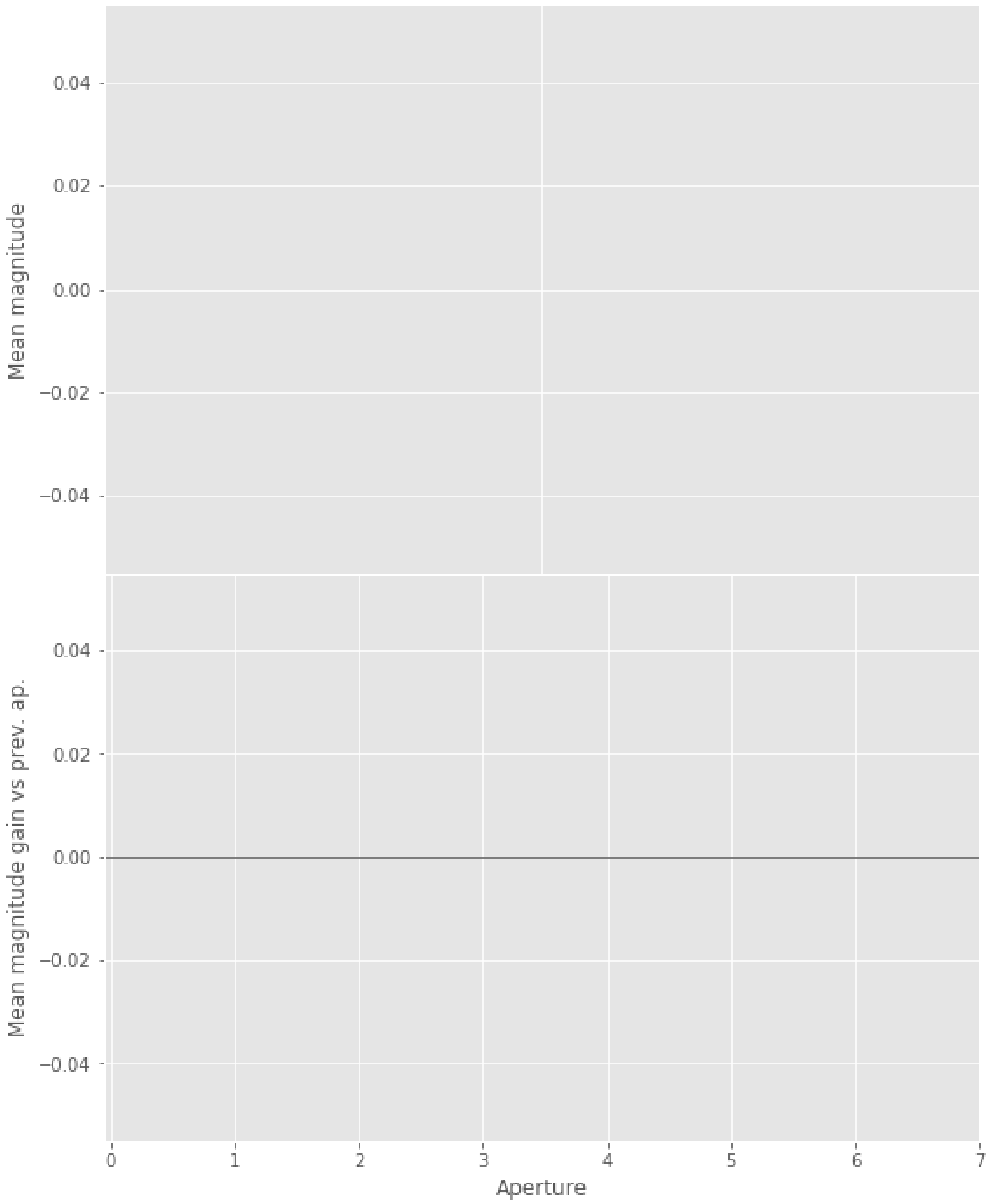
As target aperture, we should use the smallest (i.e. less noisy) aperture for which most of the flux is captures.

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
```

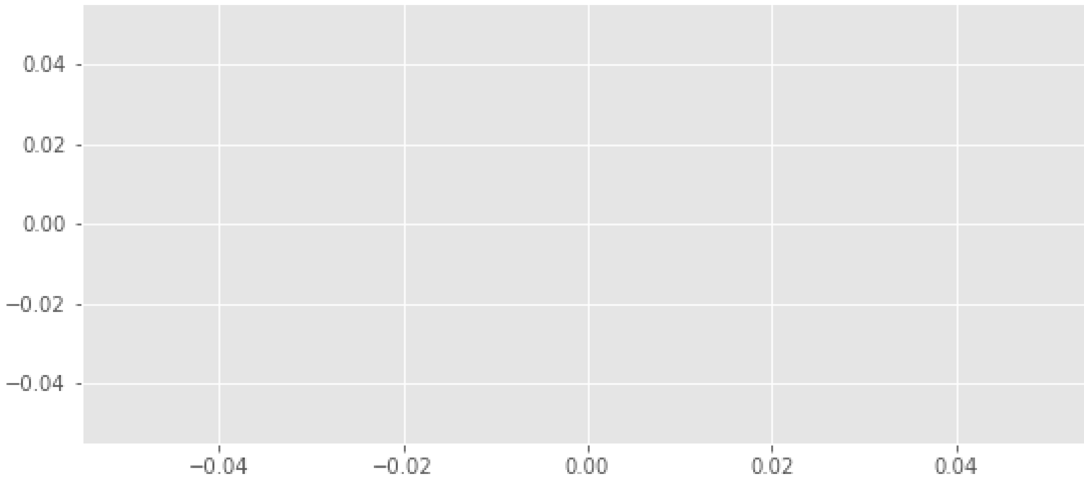
1.2.1 1.a u band

```
/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)
```

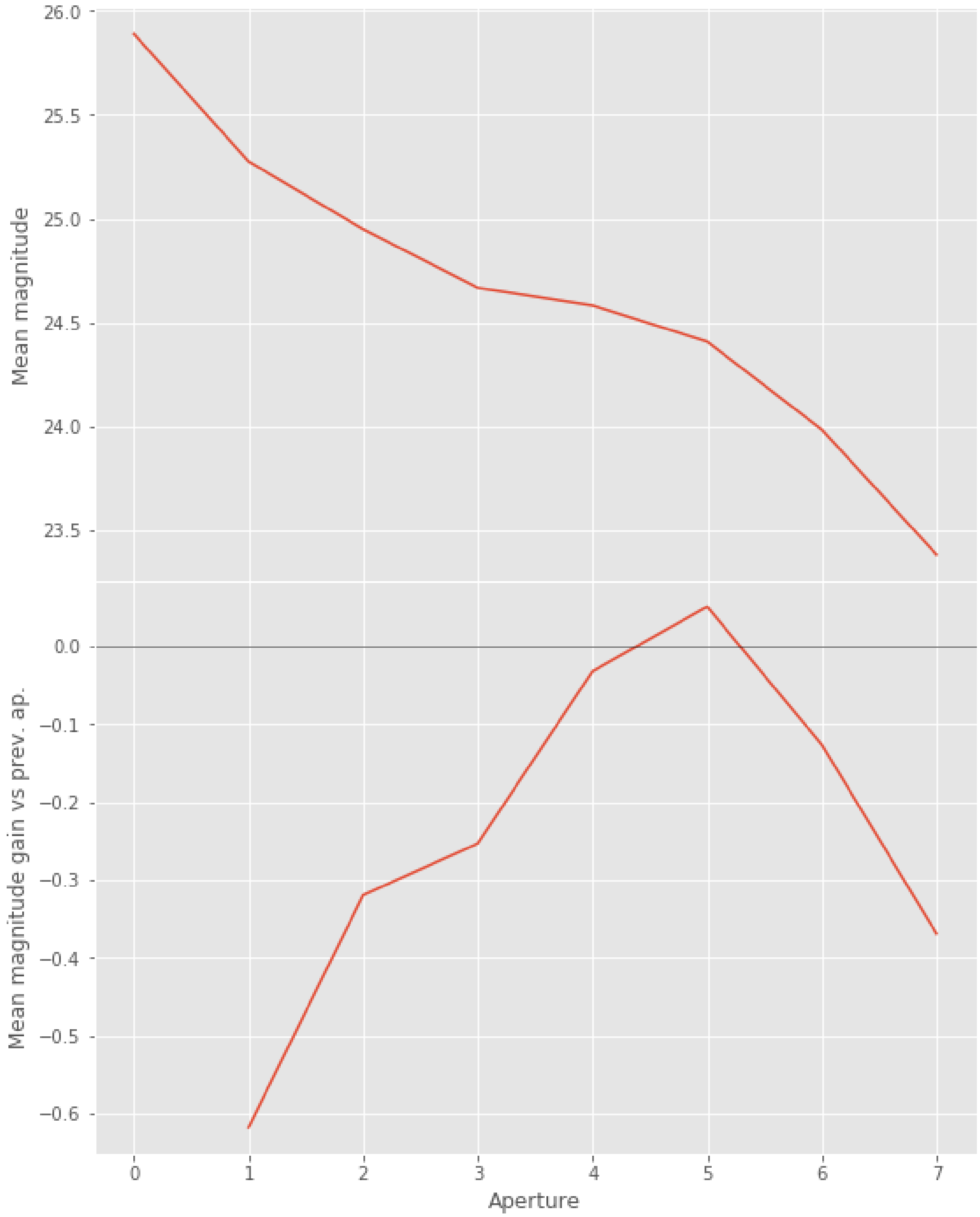


u band is all nan

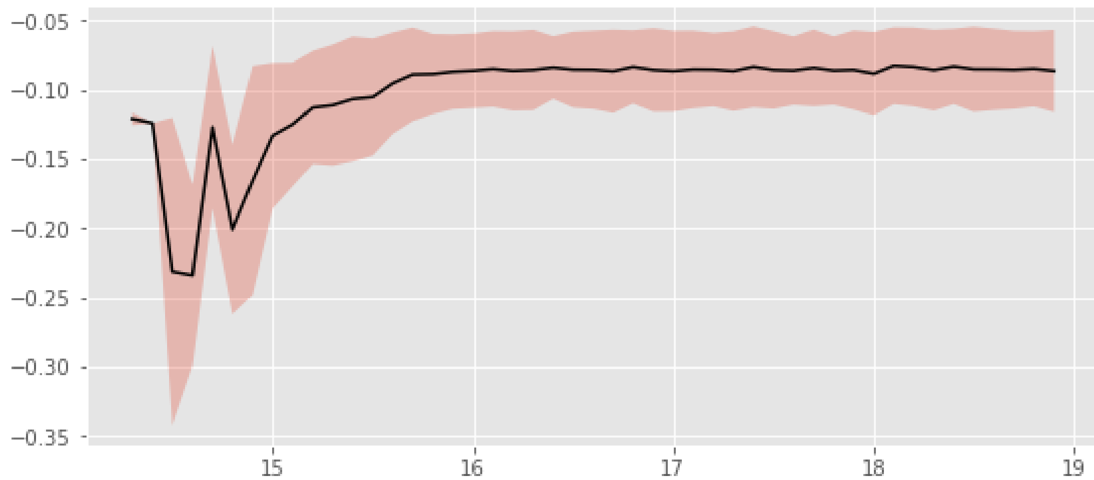
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


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



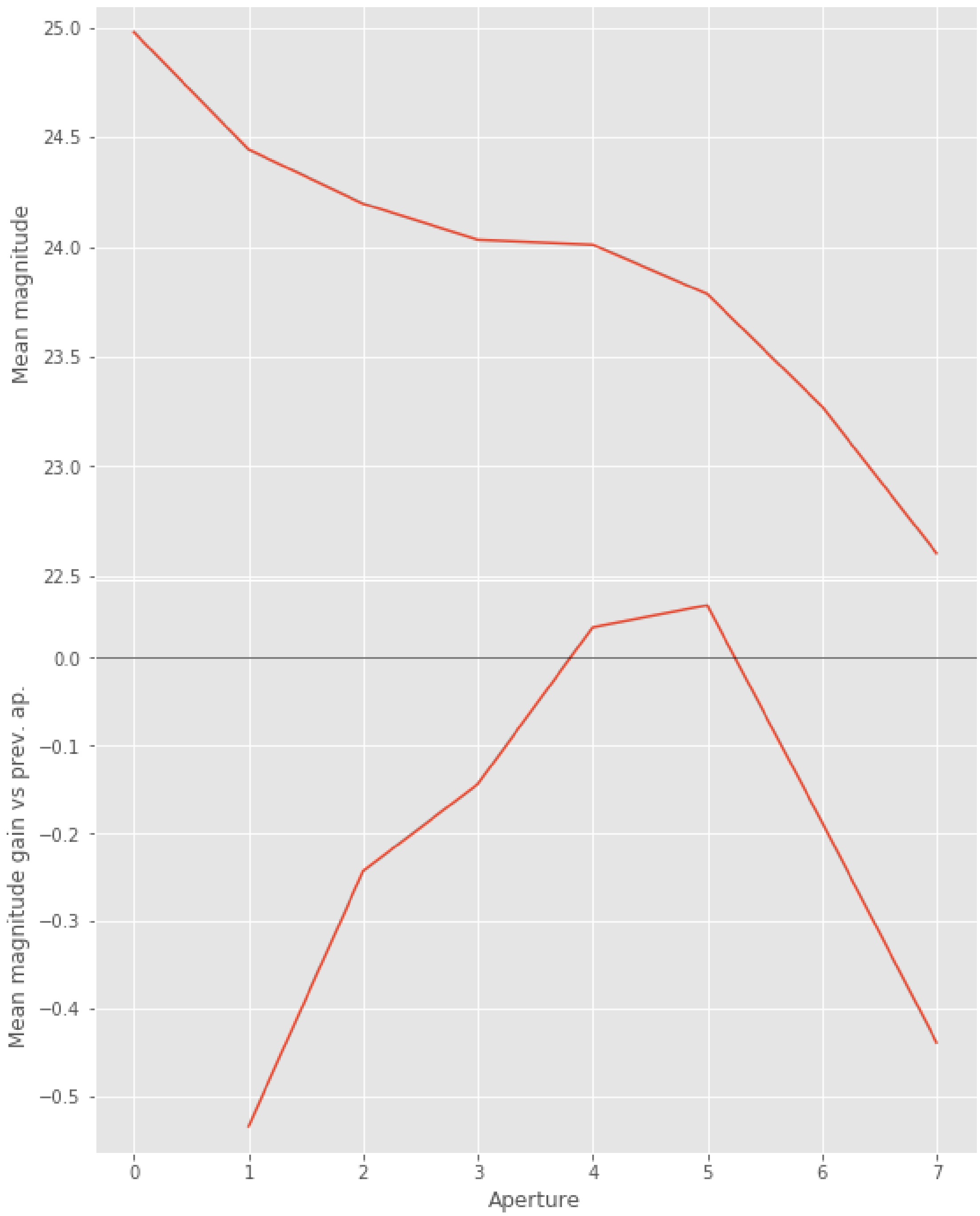
We will use aperture 5 as target.



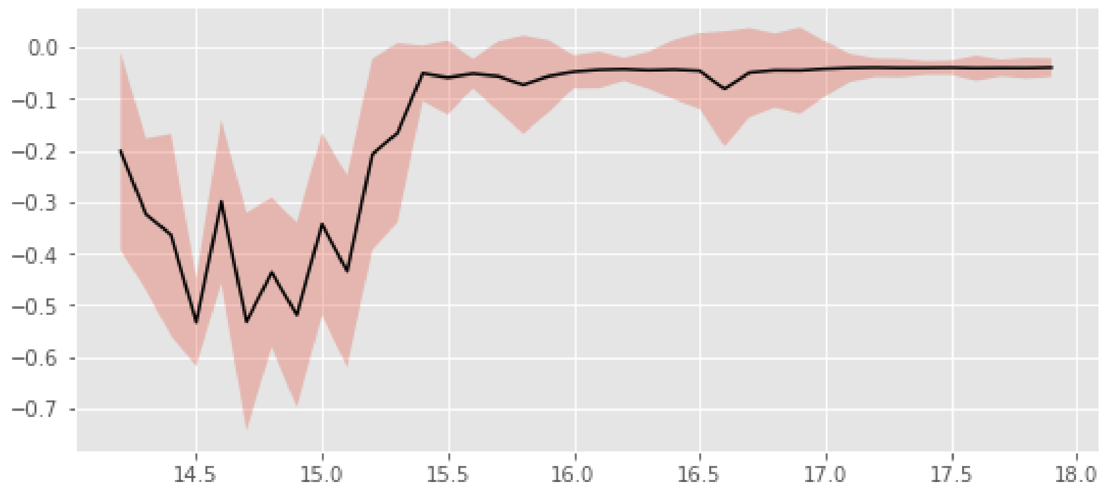
We will use magnitudes between 16.0 and 19.0

```
Aperture correction for g band:
Correction: -0.08519500668633384
Number of source used: 10752
RMS: 0.028076768731770316
```

1.2.3 I.b - r band



We will use aperture 5 as target.

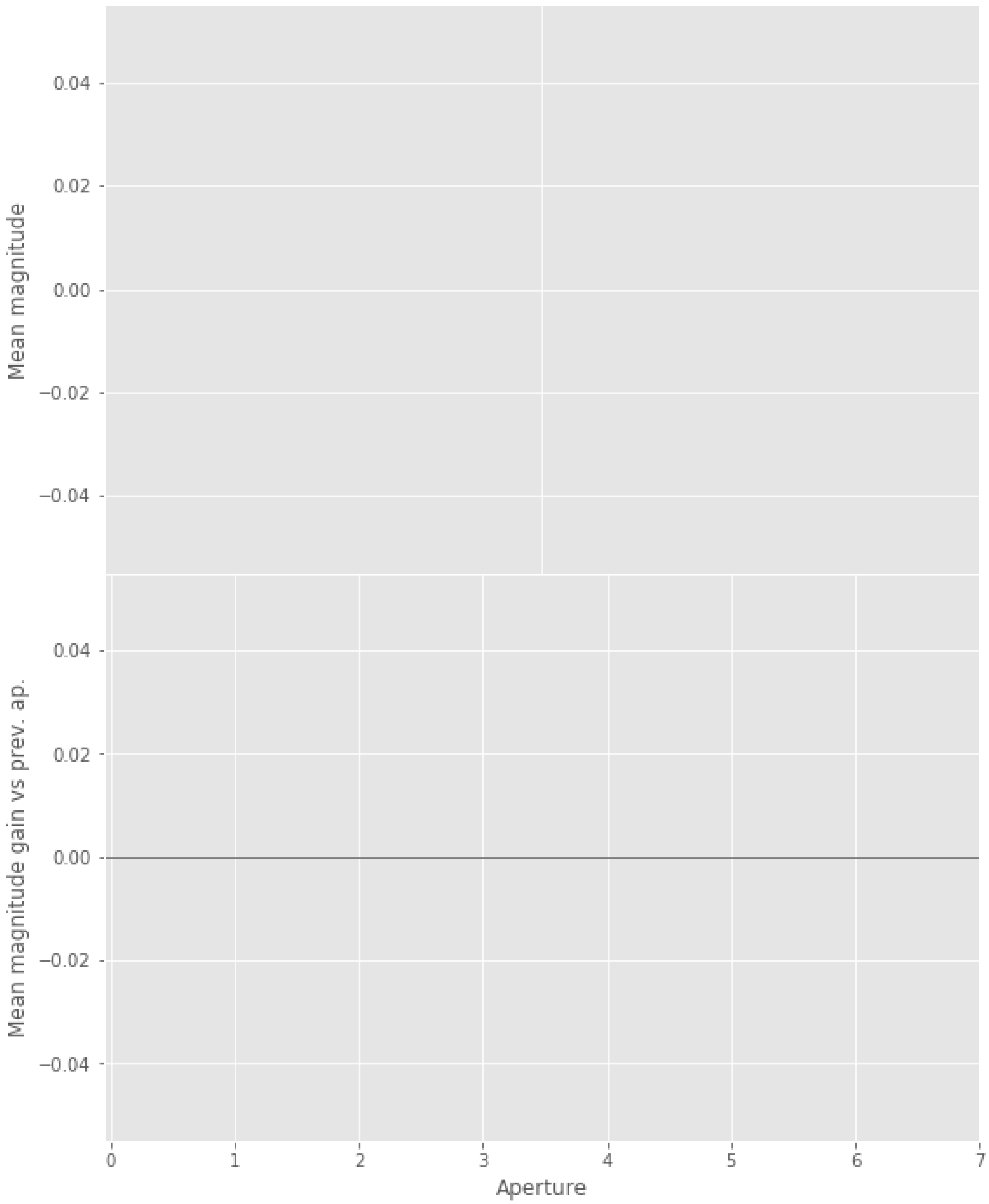


We use magnitudes between 16.0 and 18.0.

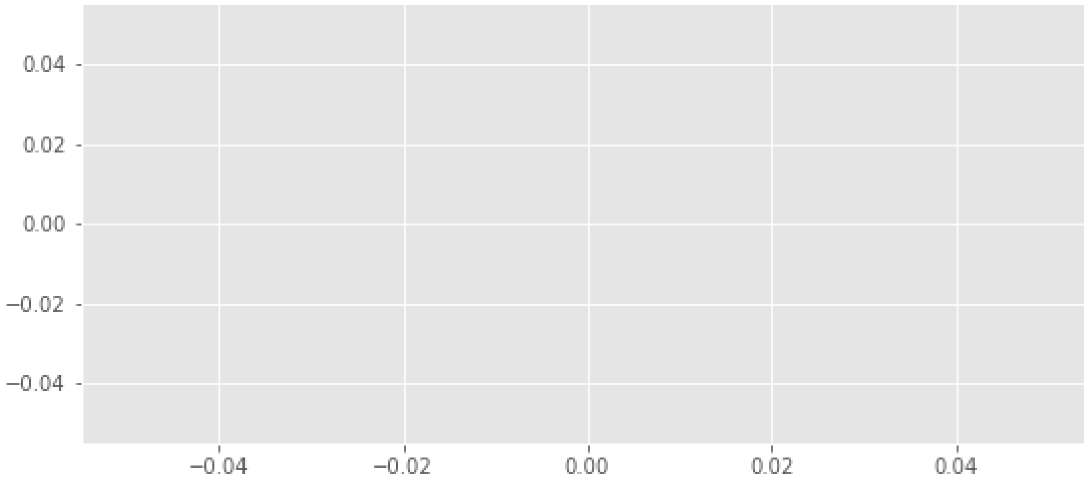
```
Aperture correction for r band:
Correction: -0.04148028156868122
Number of source used: 10646
RMS: 0.034286856718686975
```

1.2.4 I.d - i band

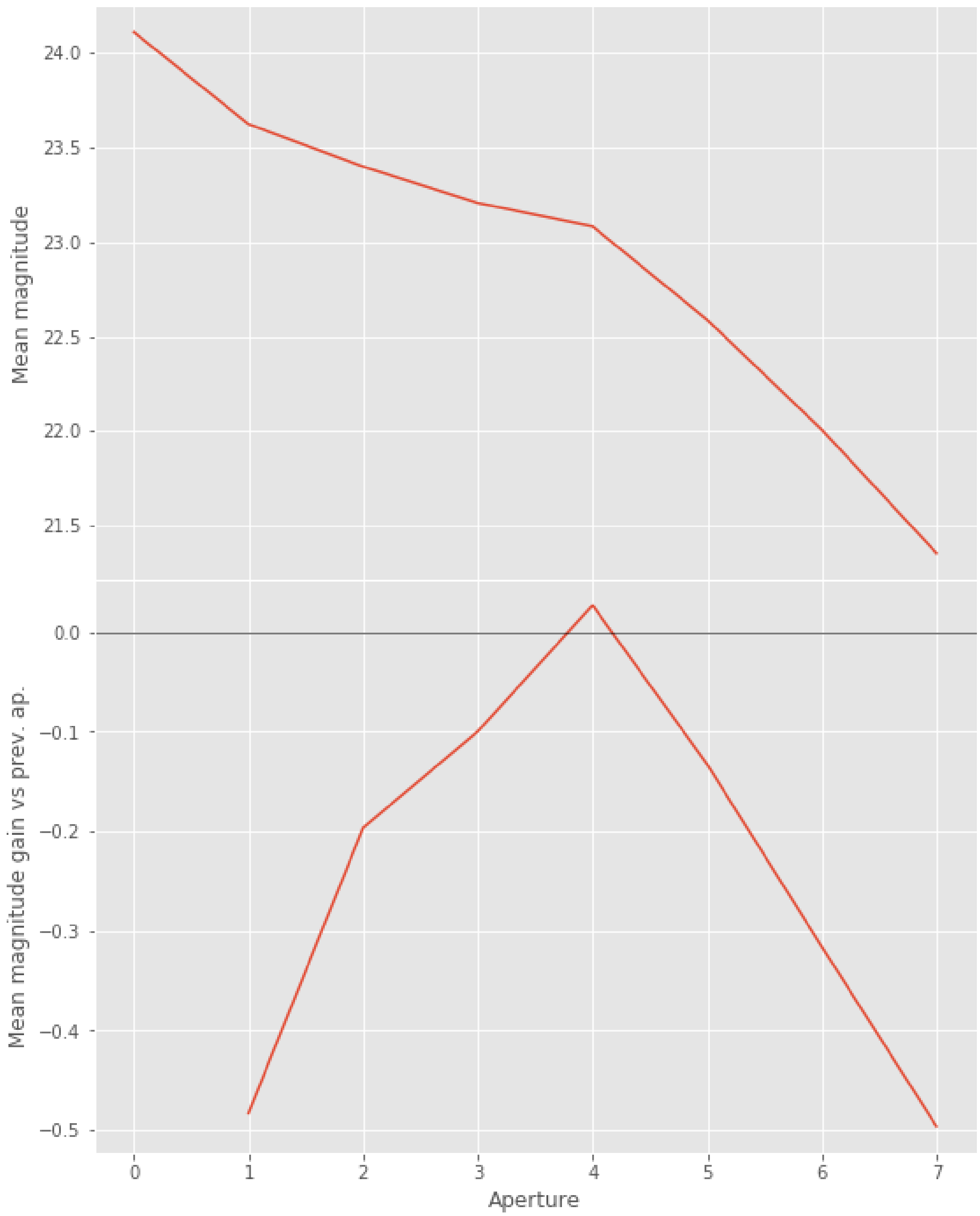
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)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



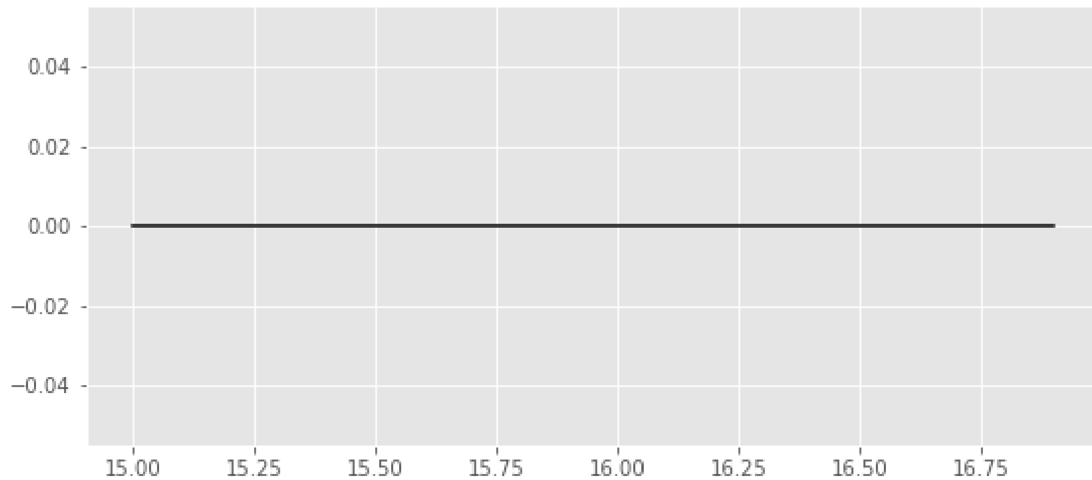

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


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.

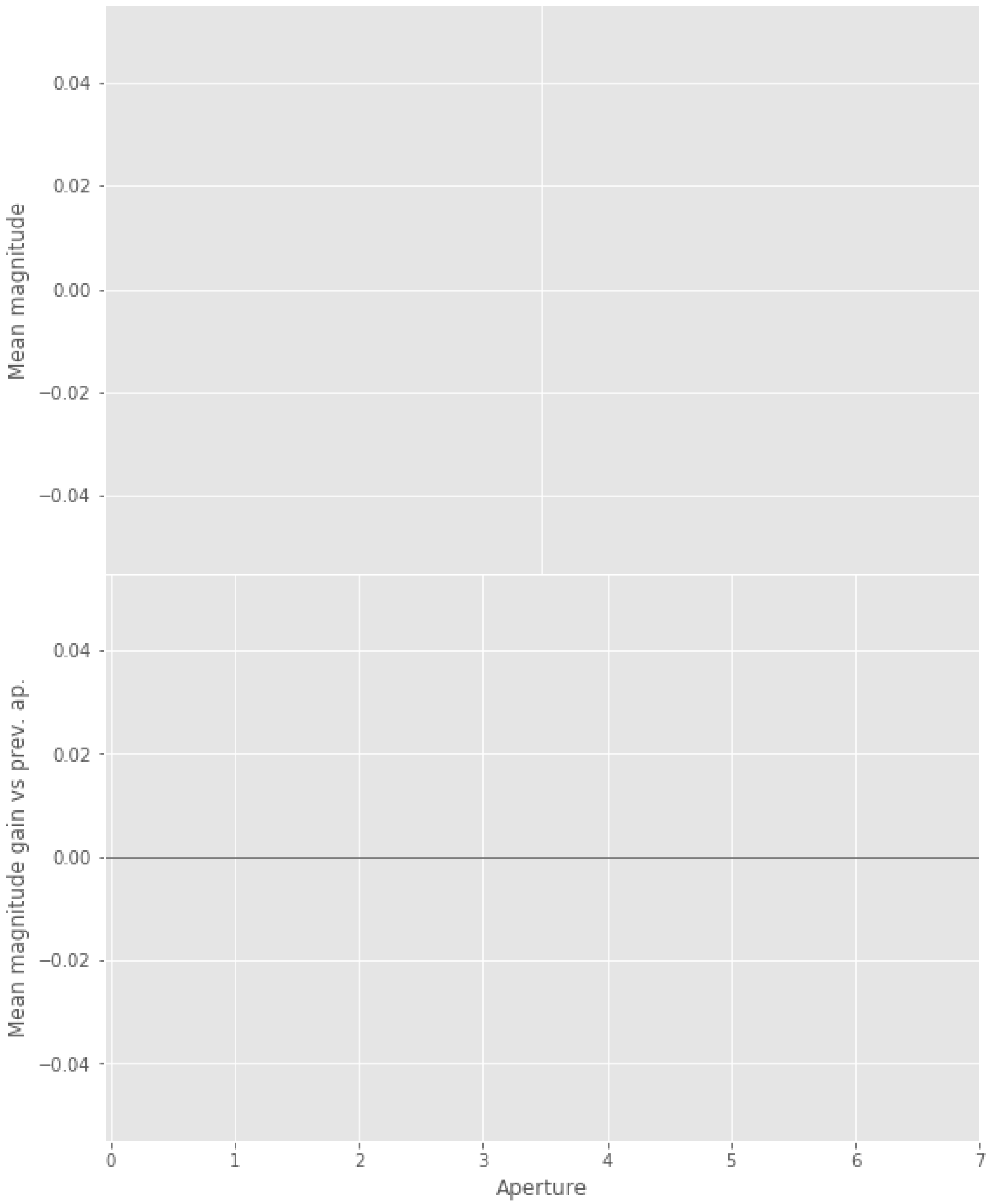


We use magnitudes between 16.0 and 17.5.

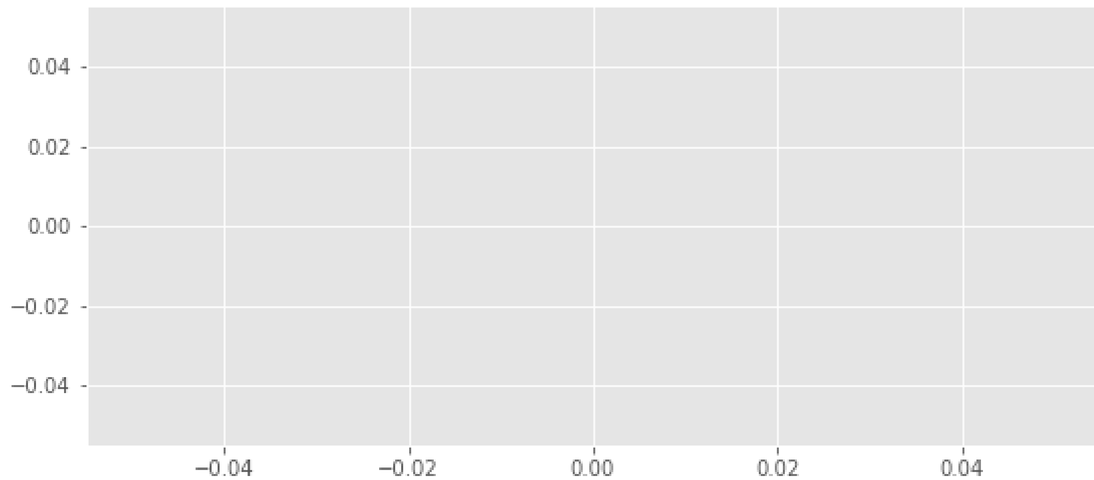
```
Aperture correction for z band:
Correction: -0.047606678474458874
Number of source used: 12624
RMS: 0.04539733727184199
```

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>
```

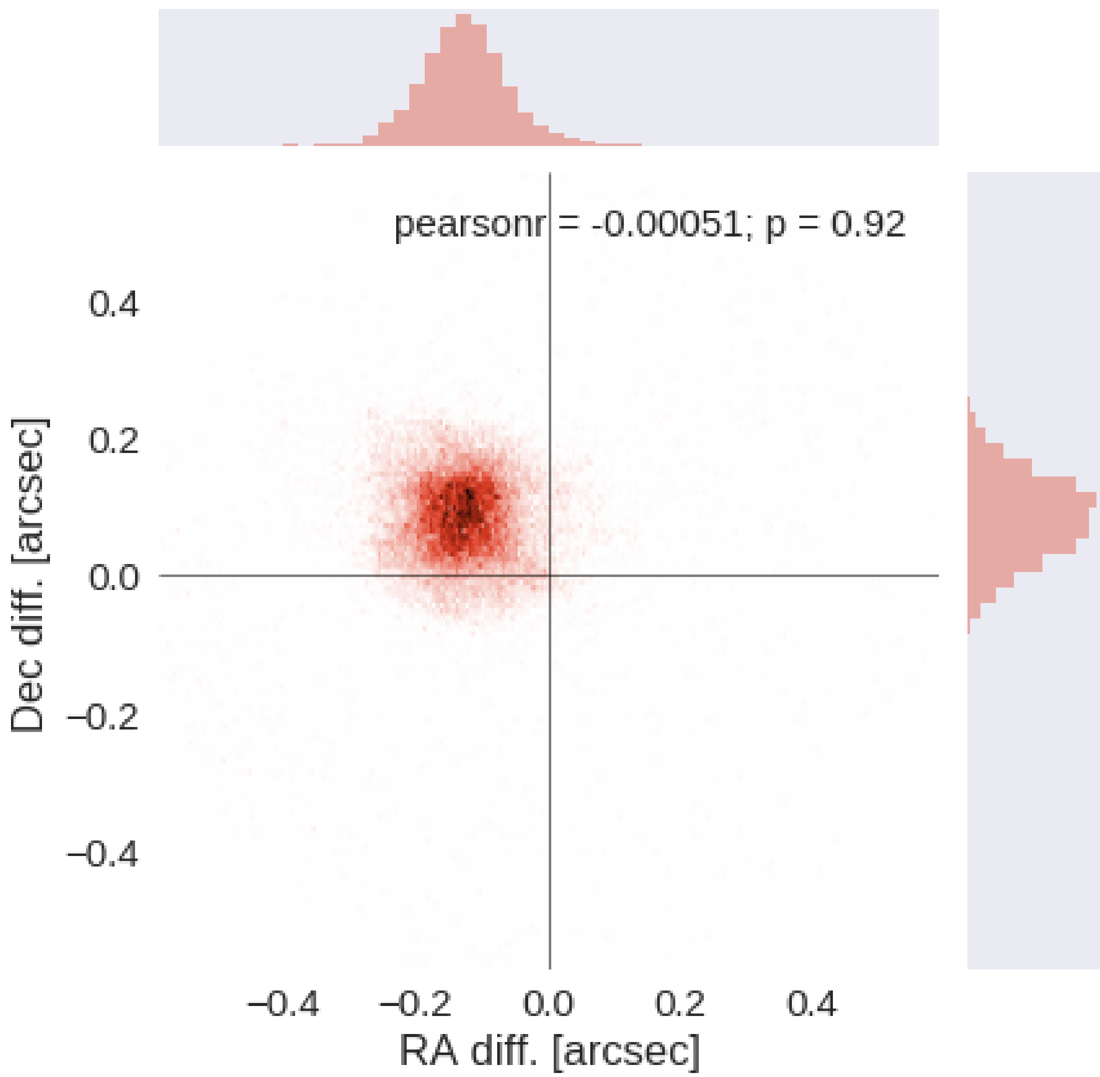
1.5 III - Removal of duplicated sources

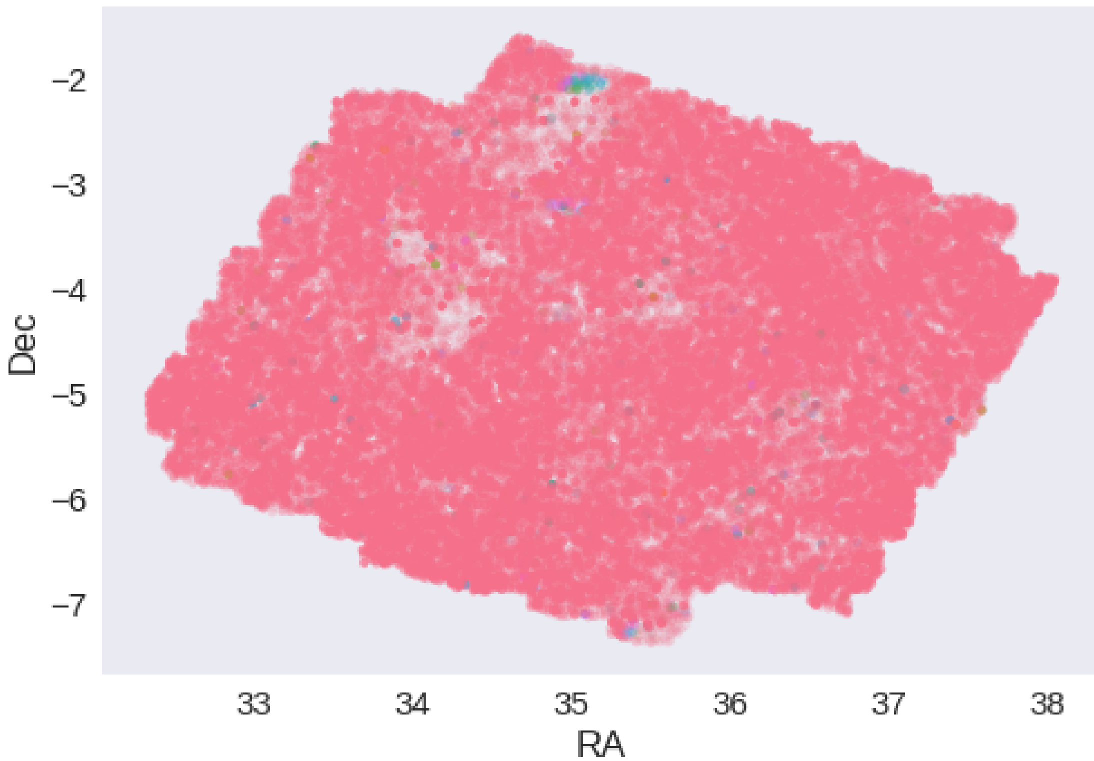
We remove duplicated objects from the input catalogues.

```
/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 1828232 sources.
The cleaned catalogue has 1827824 sources (408 removed).
The cleaned catalogue has 407 sources flagged as having been cleaned
```

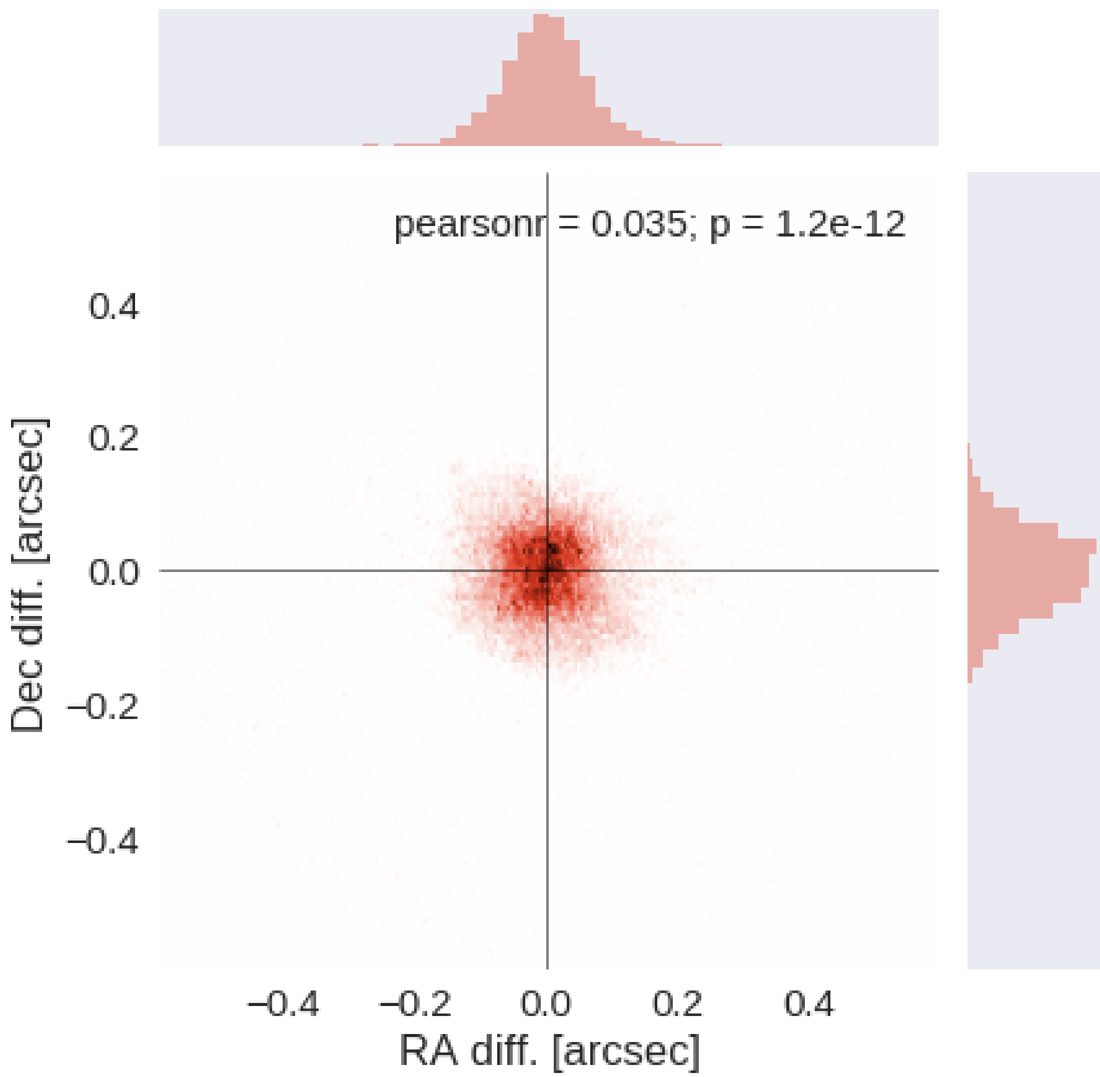
1.6 III - Astrometry correction

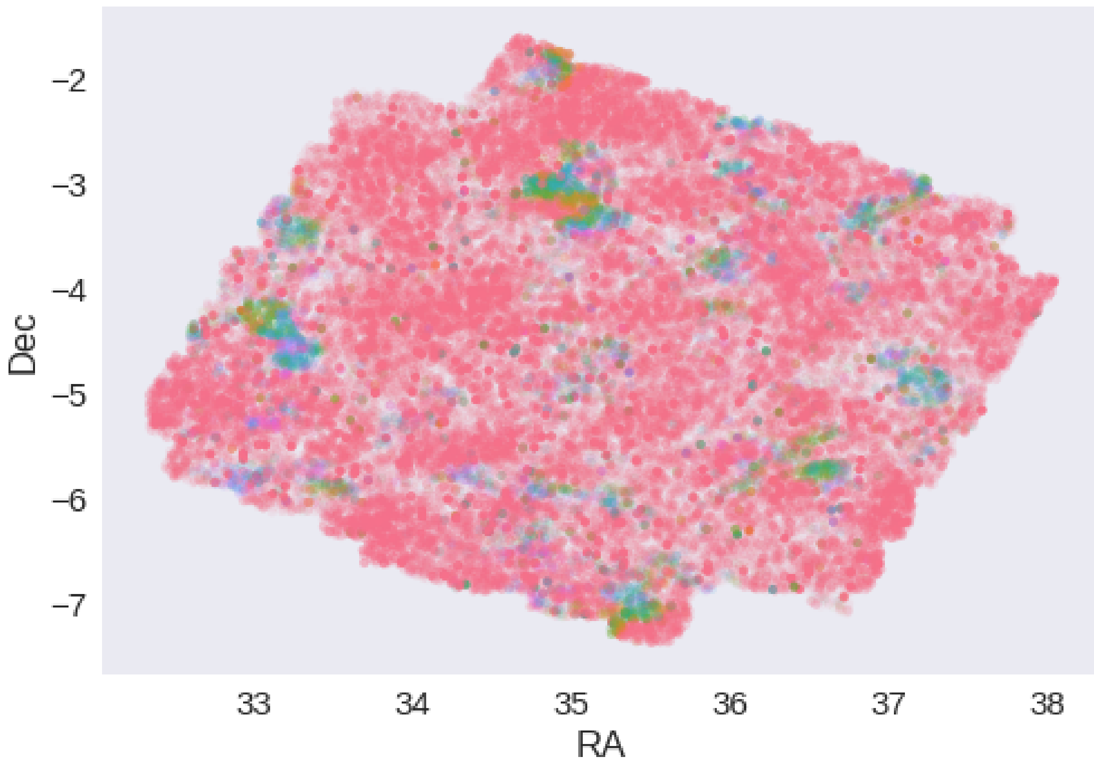
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.00051; p = 0.92
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: 0.12760236888880172 arcsec
Dec correction: -0.08586082651023119 arcsec
```


pearsonr = 0.035; p = 1.2e-12
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]



1.7 IV - Flagging Gaia objects

```
42351 sources flagged.
```

2 V - Saving to disk

1.6.2_DES

January 18, 2018

1 XMM-LSS 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.

1.2 I - Column selection

1.3 II - Removal of duplicated sources

We remove duplicated objects from the input catalogues.

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.

1.5 IV - Flagging Gaia objects

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.7_SWIRE

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Spitzer datafusion SWIRE data

The Spitzer catalogues were produced by the datafusion team are available in `dmu0_DataFusion-Spitzer`. Lucia told that the magnitudes are aperture corrected.

In the catalouge, we keep:

We keep: - The internal identifier (this one is only in HeDaM data); - The position; - The fluxes in aperture 2 (1.9 arcsec) for IRAC bands. - The Kron flux; - The stellarity in each band

A query of the position in the Spitzer heritage archive show that the ELAIS-N1 images were observed in 2004. Let's take this as epoch.

We do not use the MIPS fluxes as they will be extracted on MIPS maps using XID+.

```
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

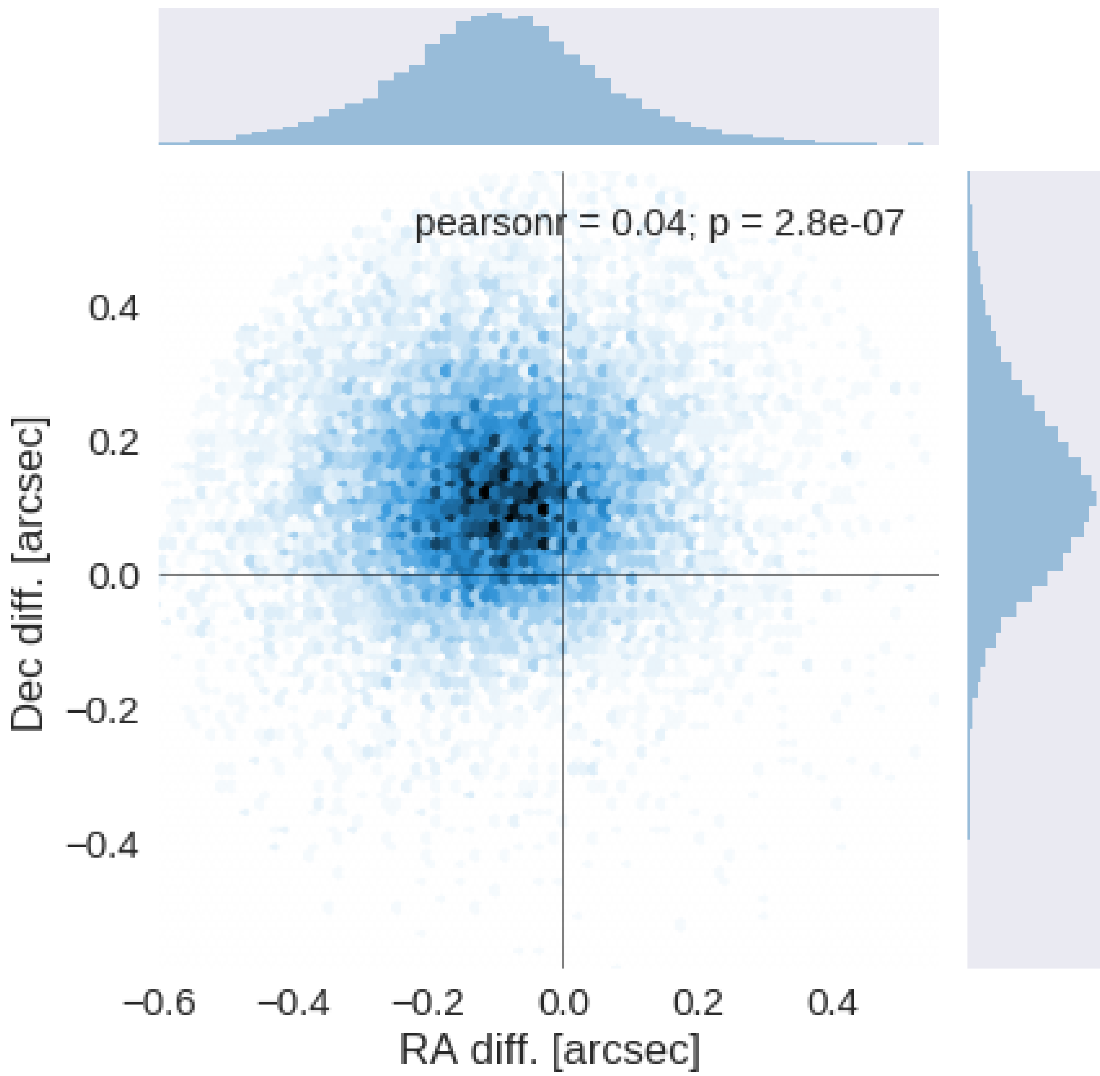
We remove duplicated objects from the input catalogues.

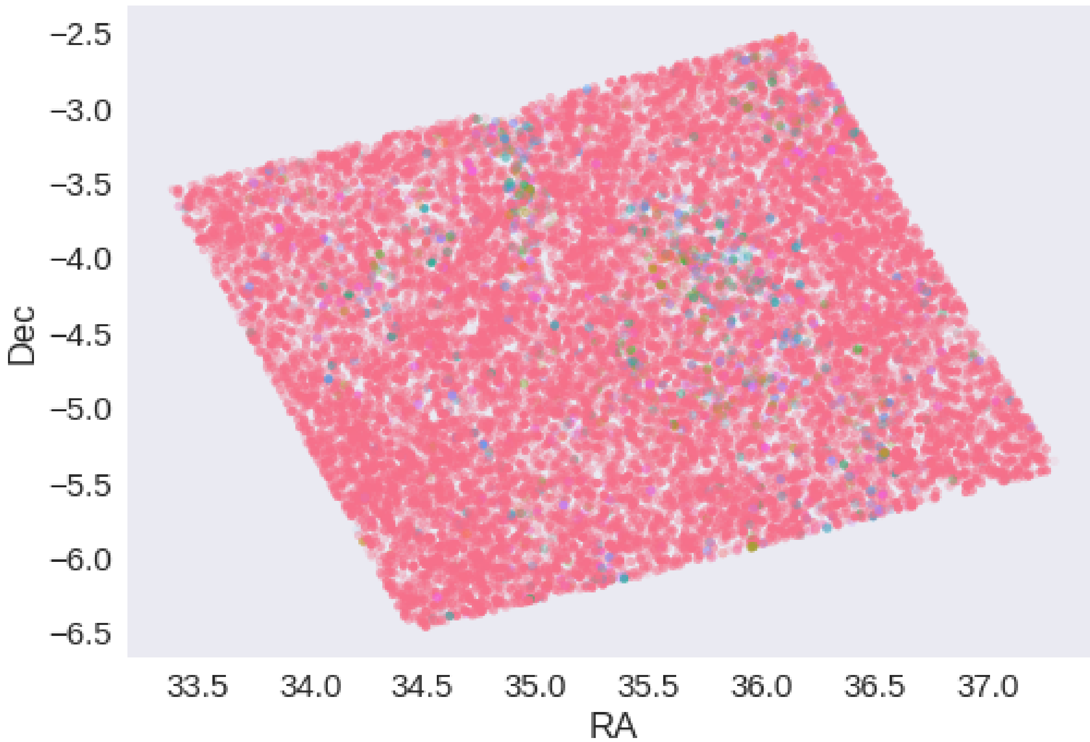
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 497404 sources.
The cleaned catalogue has 497381 sources (23 removed).
The cleaned catalogue has 23 sources flagged as having been cleaned
```

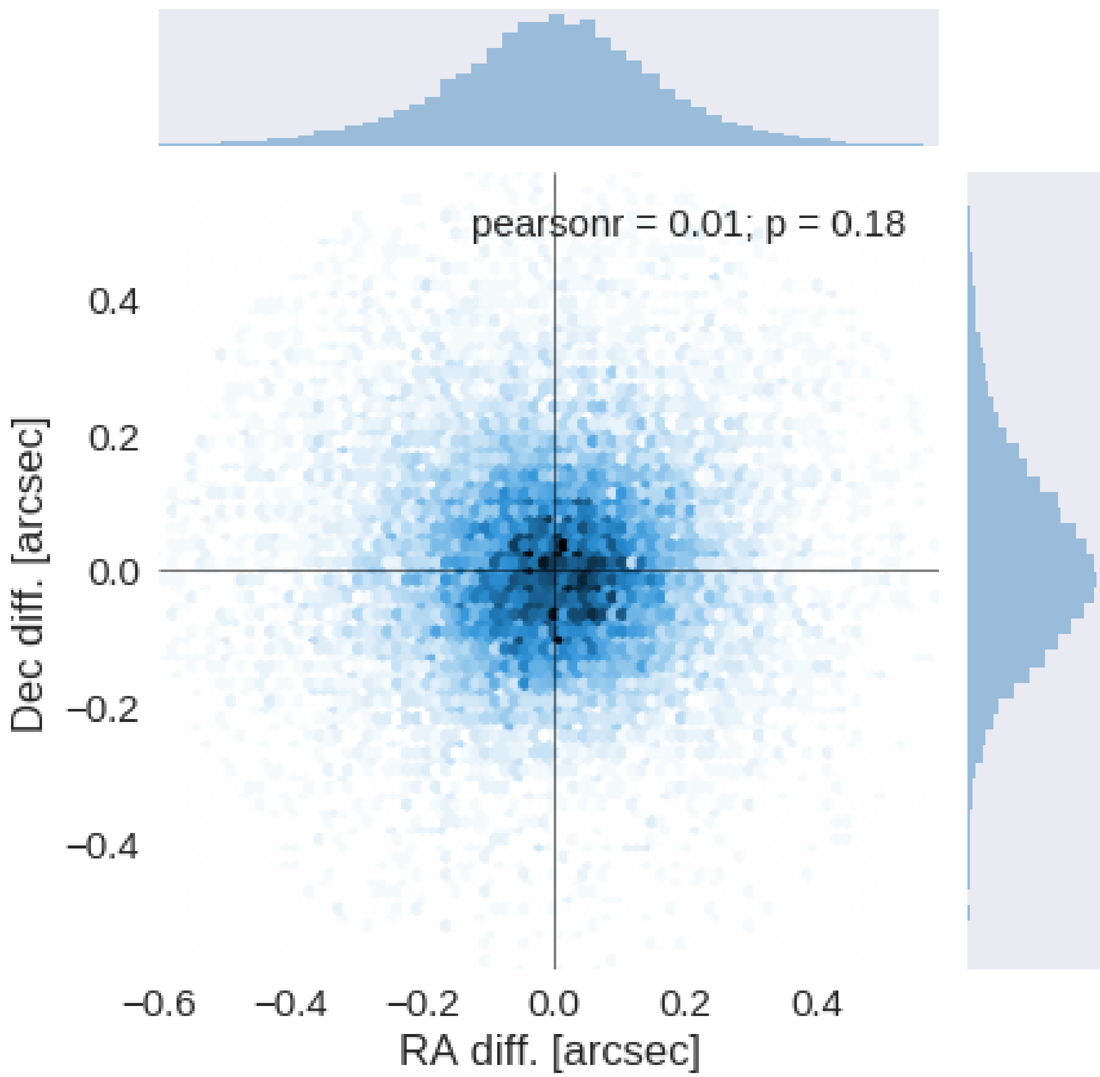
1.4 III - Astrometry correction

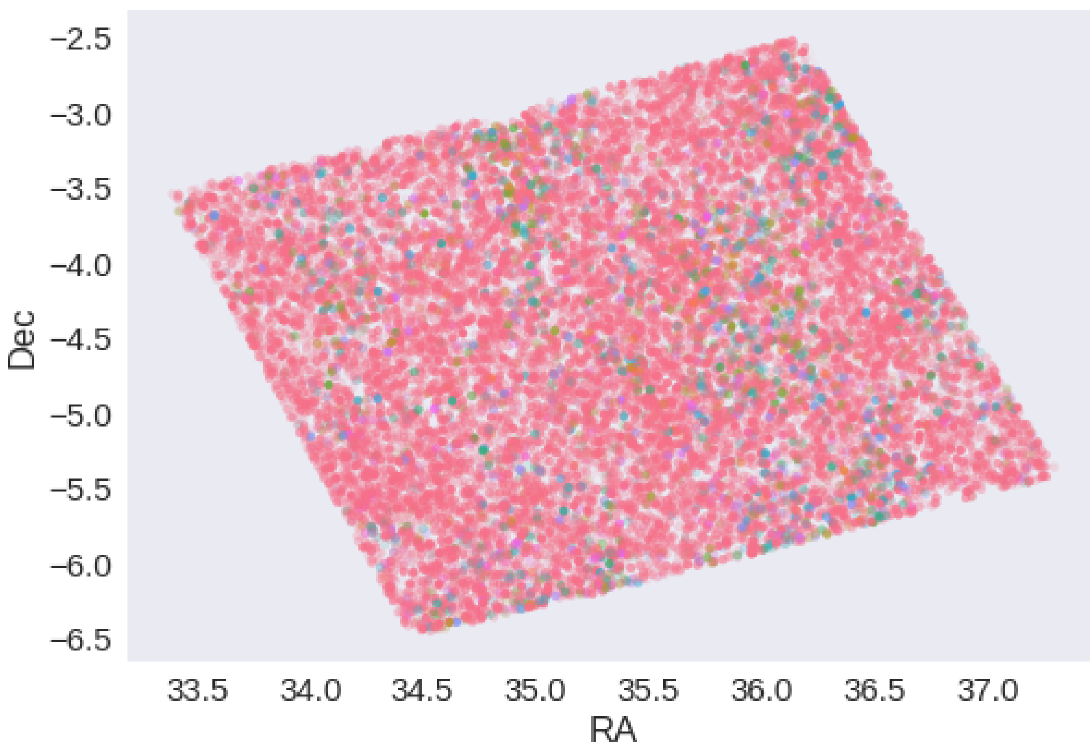
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.09761311656575344 arcsec
Dec correction: -0.11673921999317827 arcsec
```


pearsonr = 0.01; p = 0.18
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

```
17983 sources flagged.
```

2 V - Saving to disk

1.8_SERVS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Spitzer datafusion SERVS data

The Spitzer catalogues were produced by the datafusion team are available in `dmu0_DataFusion-Spitzer`. 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

A query of the position in the Spitzer heritage archive show that the SERVS-ELAIS-N1 images were observed in 2009. Let's take this as 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>
```

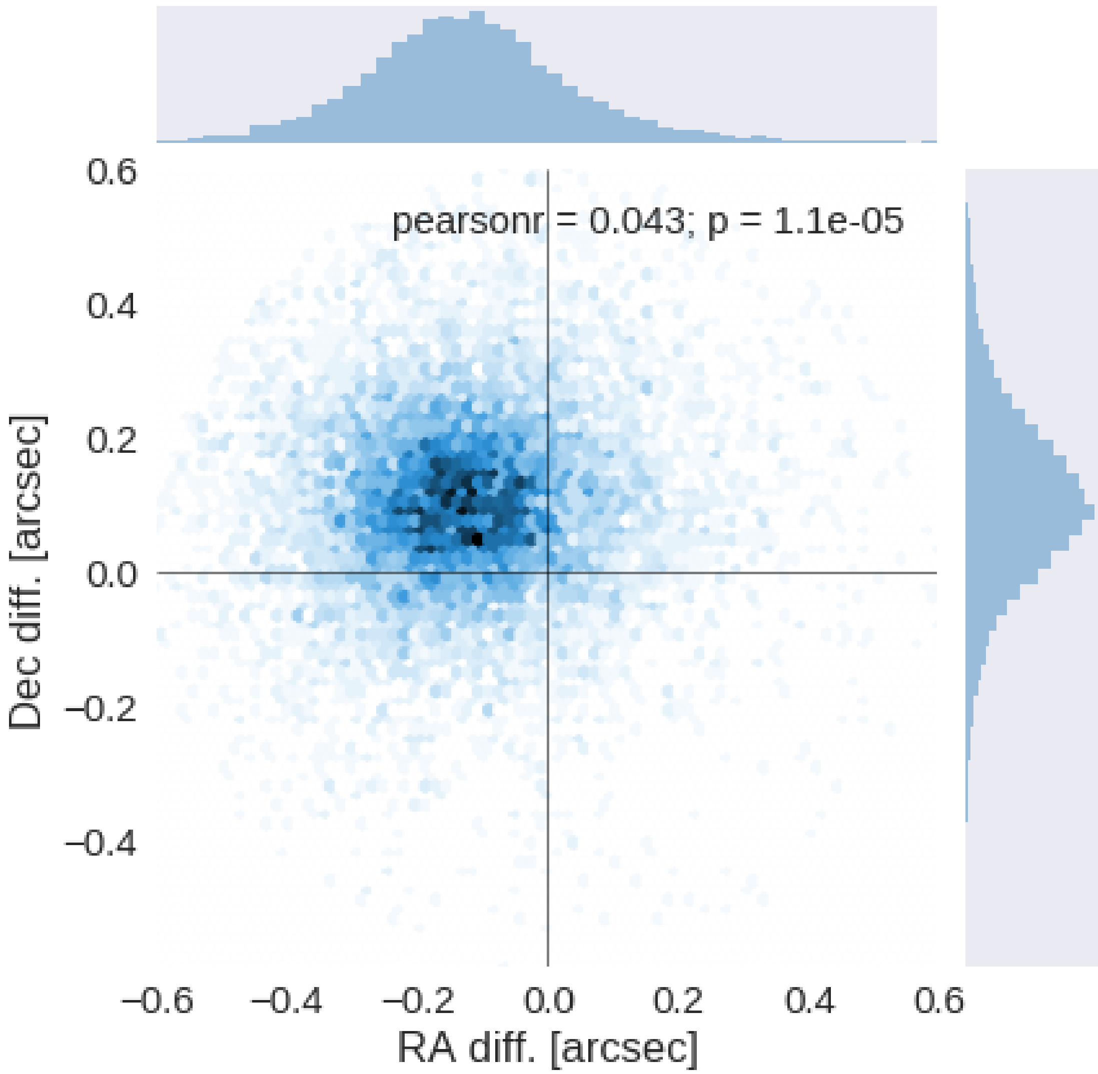
1.3 II - Removal of duplicated sources

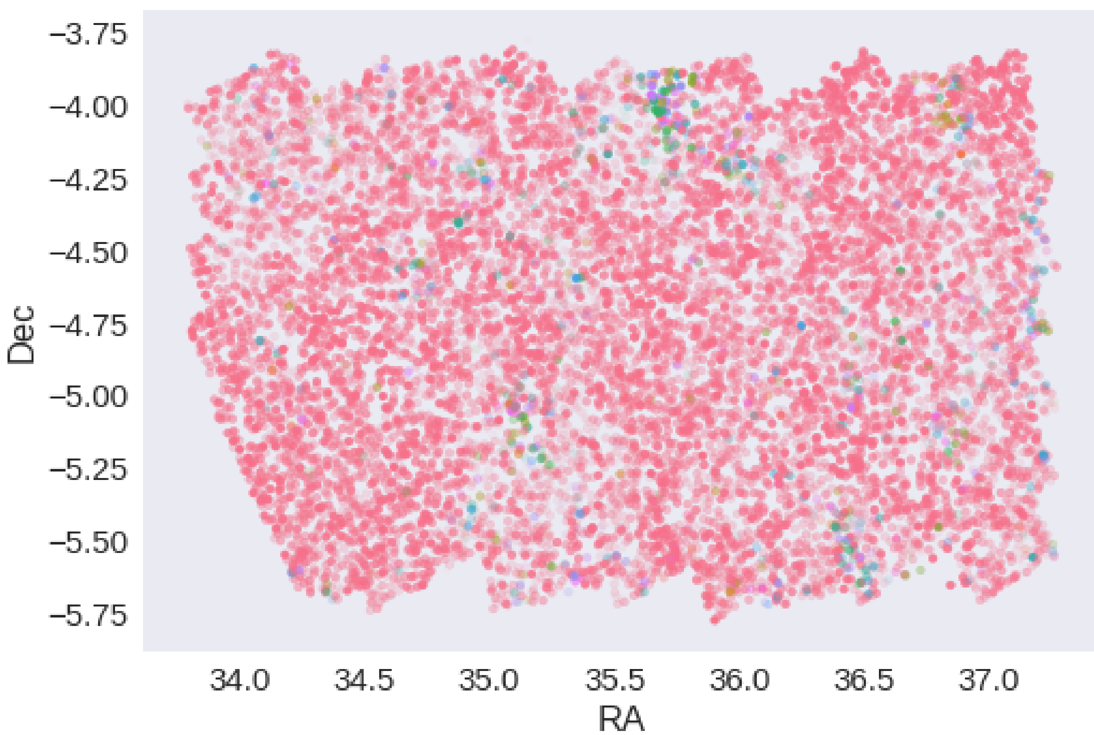
We remove duplicated objects from the input catalogues.

```
/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 958421 sources.
The cleaned catalogue has 958421 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

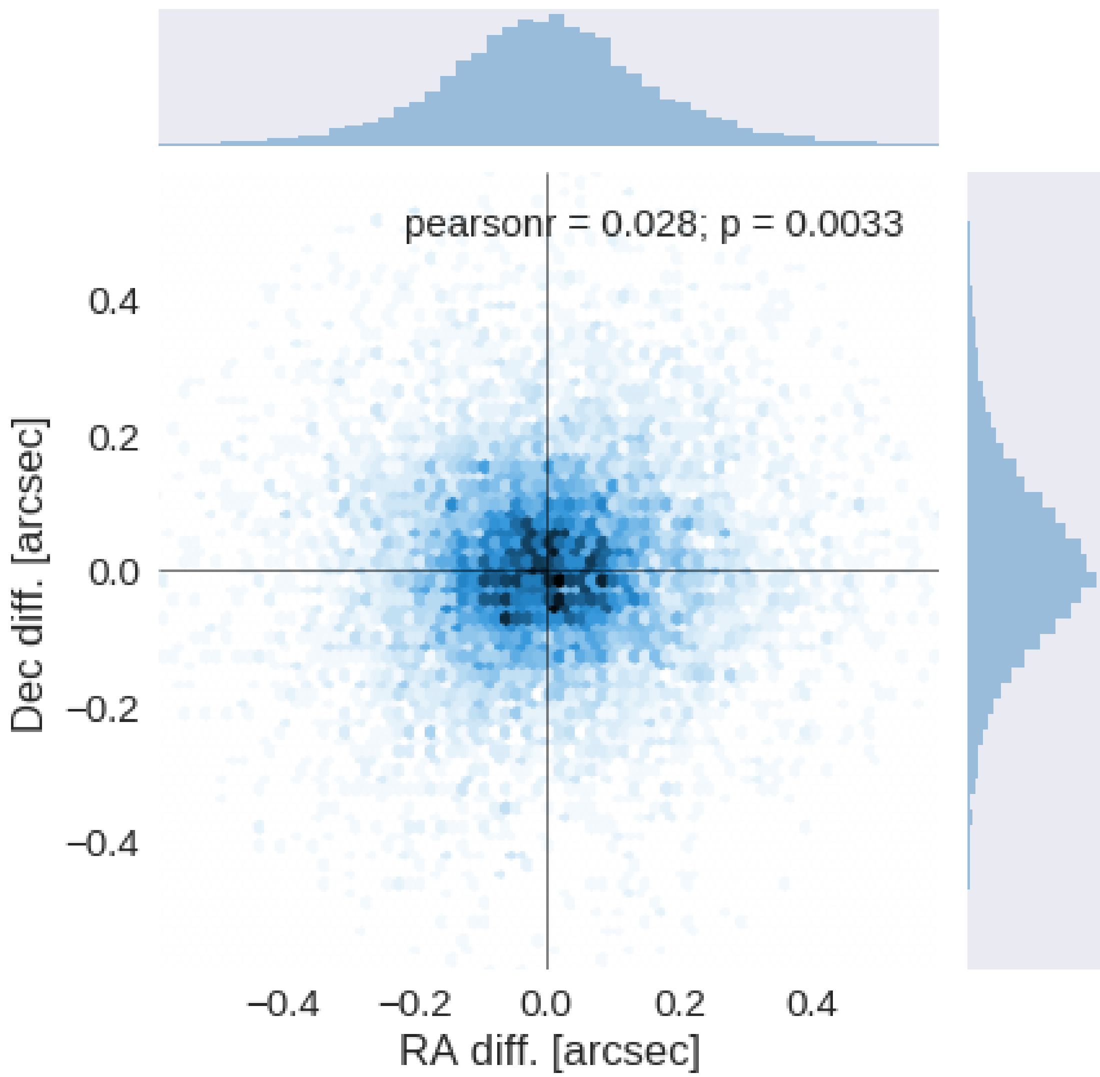
1.4 III - Astrometry correction

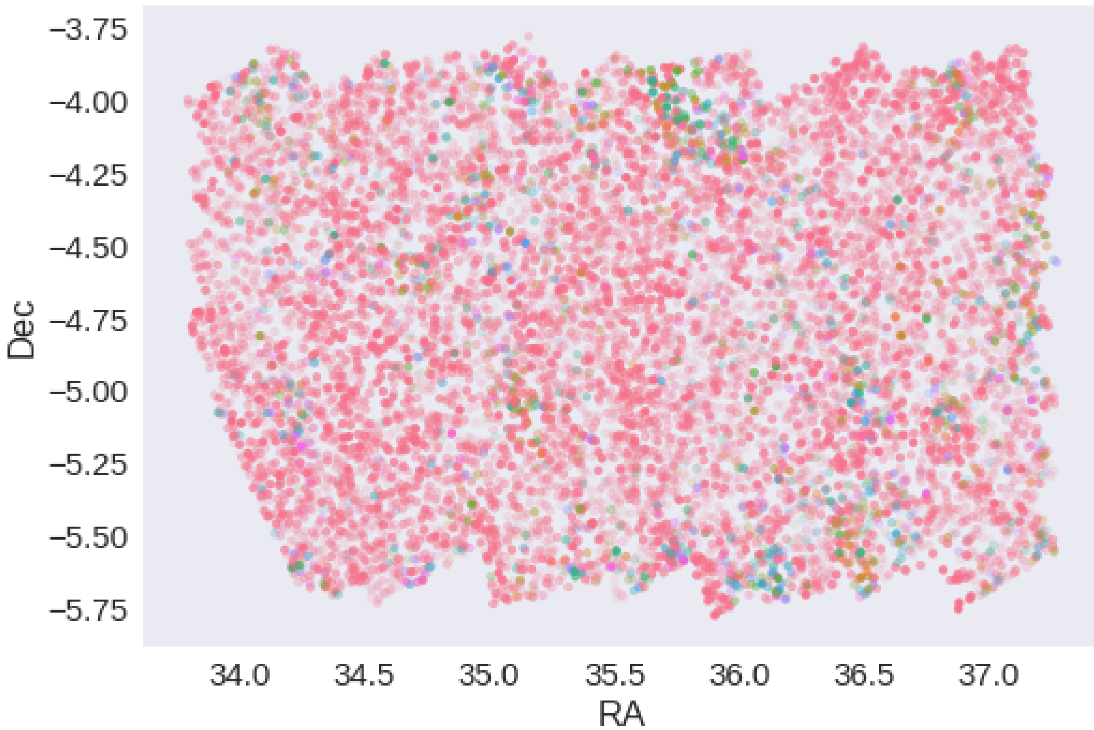
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.12892081194593175 arcsec
Dec correction: -0.10182401164797739 arcsec
```


pearsonr = 0.028; p = 0.0033
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

```
11230 sources flagged.
```

1.6 V - Saving to disk

1.9a_HSC-WIDE

January 18, 2018

1 XMM-LSS master catalogue

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

This catalogue comes from `dmu0_HSC`. We only have n921 and n816 photometry on the ultradeep field.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y aperture magnitude in 2" that we aperture correct;
- The g, r, i, z, y kron fluxes and magnitudes.
- The extended flag that we convert to a stellariy.

TODO: Check that the magnitudes are AB.

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 - 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:

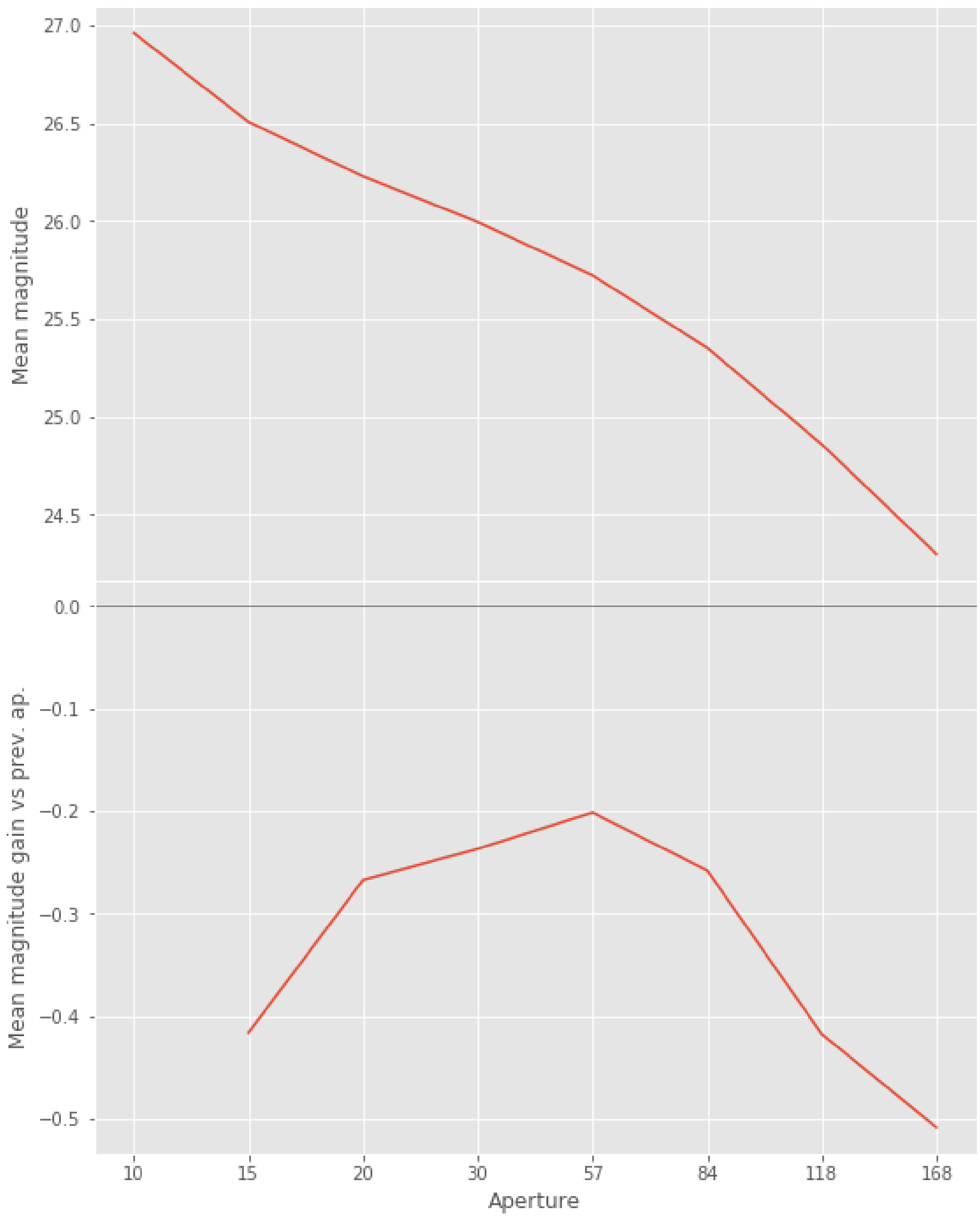
- The evolution of the magnitudes of the objects by plotting on the same plot aperture number vs the mean magnitude.
- The mean gain (loss when negative) of magnitude is each aperture compared to the previous (except for the first of course).

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.

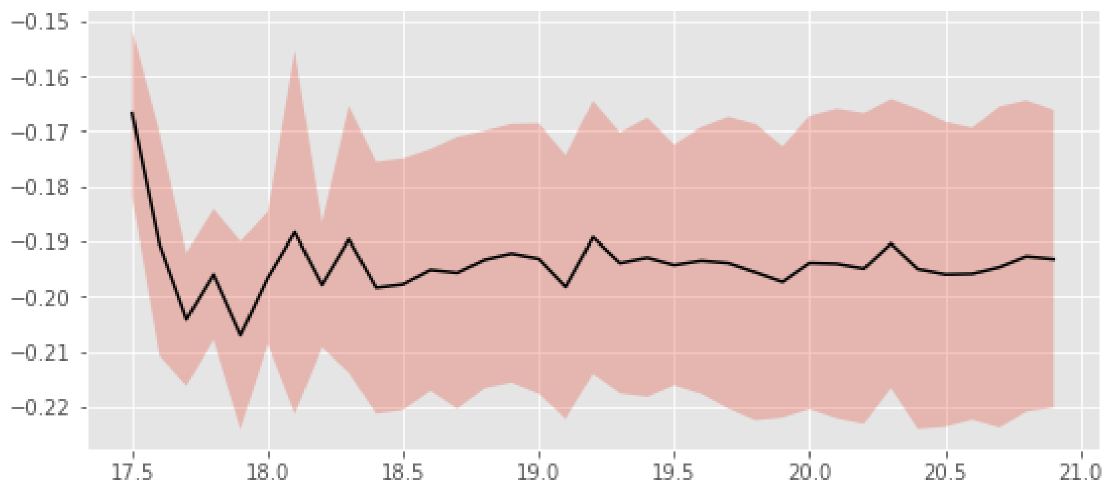
1.2.1 I.a - g band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 57 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We will use magnitudes between 18.5 and 20.8

```
Aperture correction for g band:
Correction: -0.19431591033935547
Number of source used: 5833
RMS: 0.026450276767739297
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

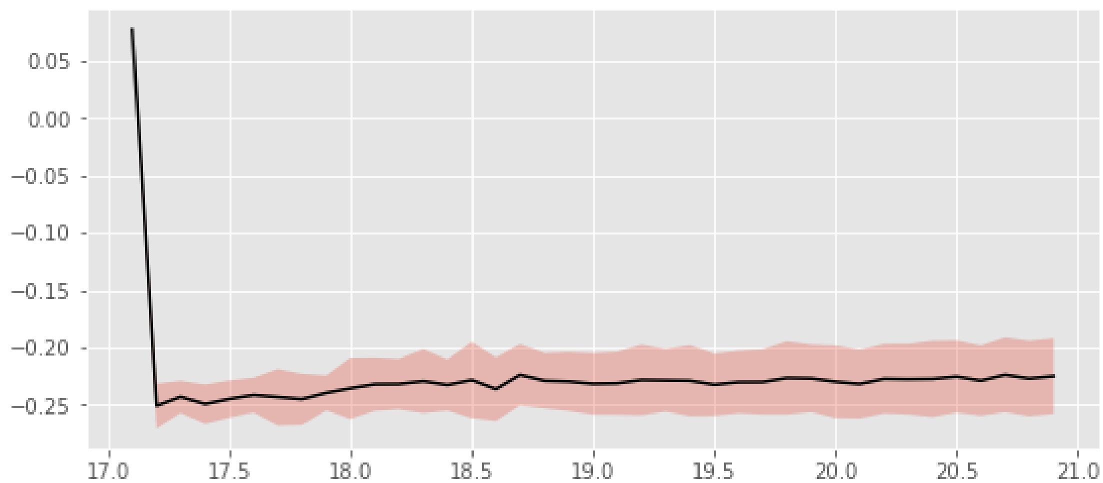
1.2.2 I.b - r band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 57 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



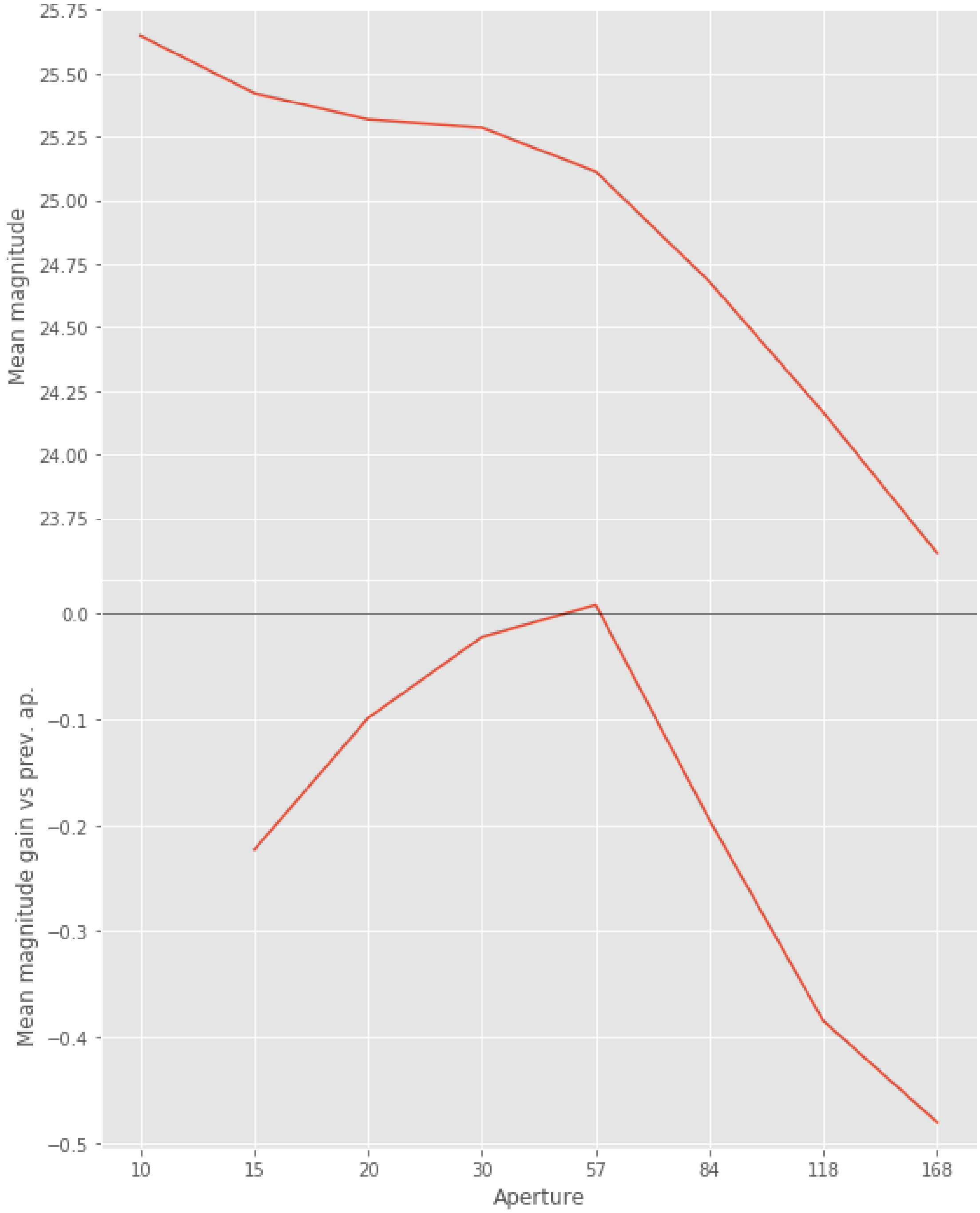
We use magnitudes between 19.5 and 20.5.

```
Aperture correction for r band:
Correction: -0.2287282943725586
Number of source used: 6824
RMS: 0.030347691570742935
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.3 I.c - i band

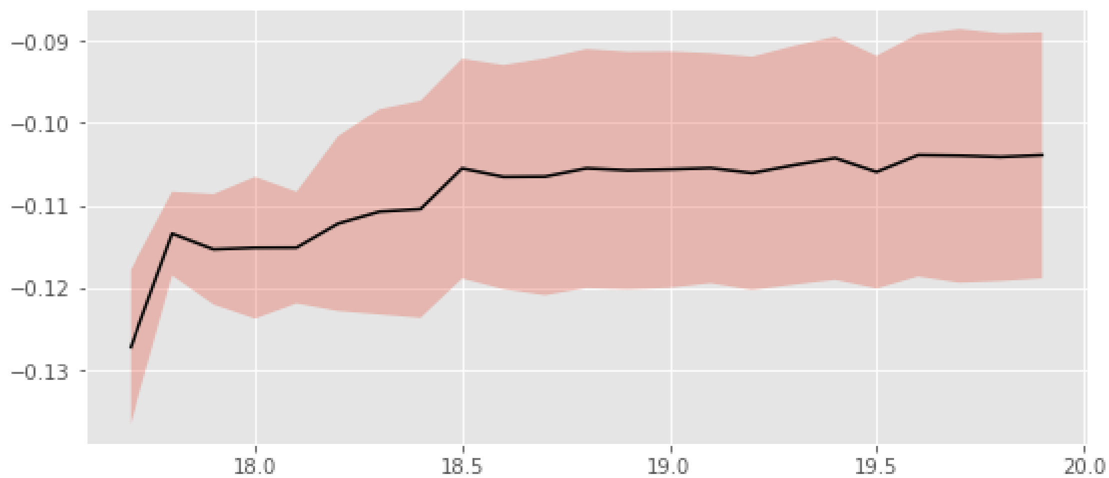
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 57 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



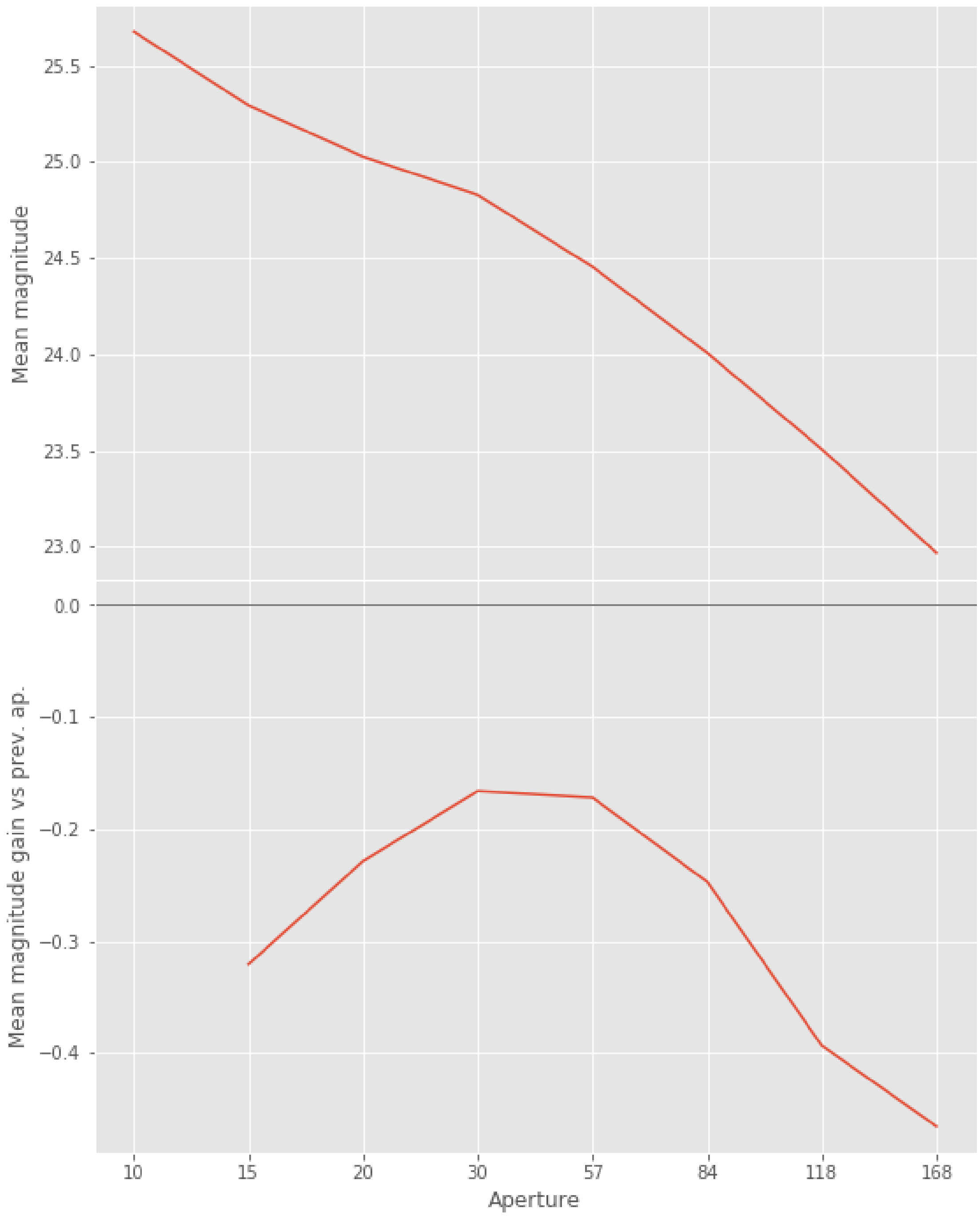
We use magnitudes between 18.5 and 19.8.

```
Aperture correction for i band:
Correction: -0.10515594482421875
Number of source used: 9726
RMS: 0.014409932108072392
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.4 I.d - z band

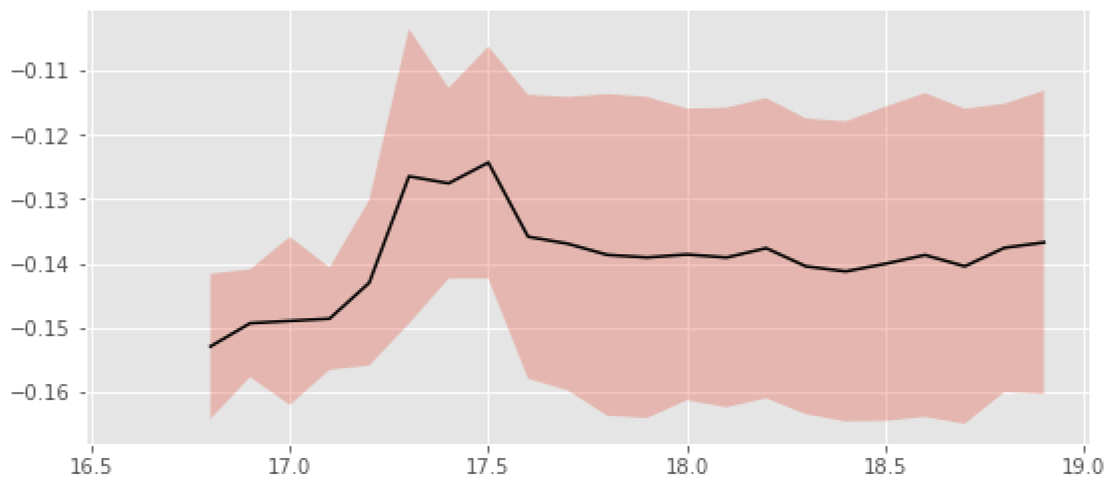
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 57 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



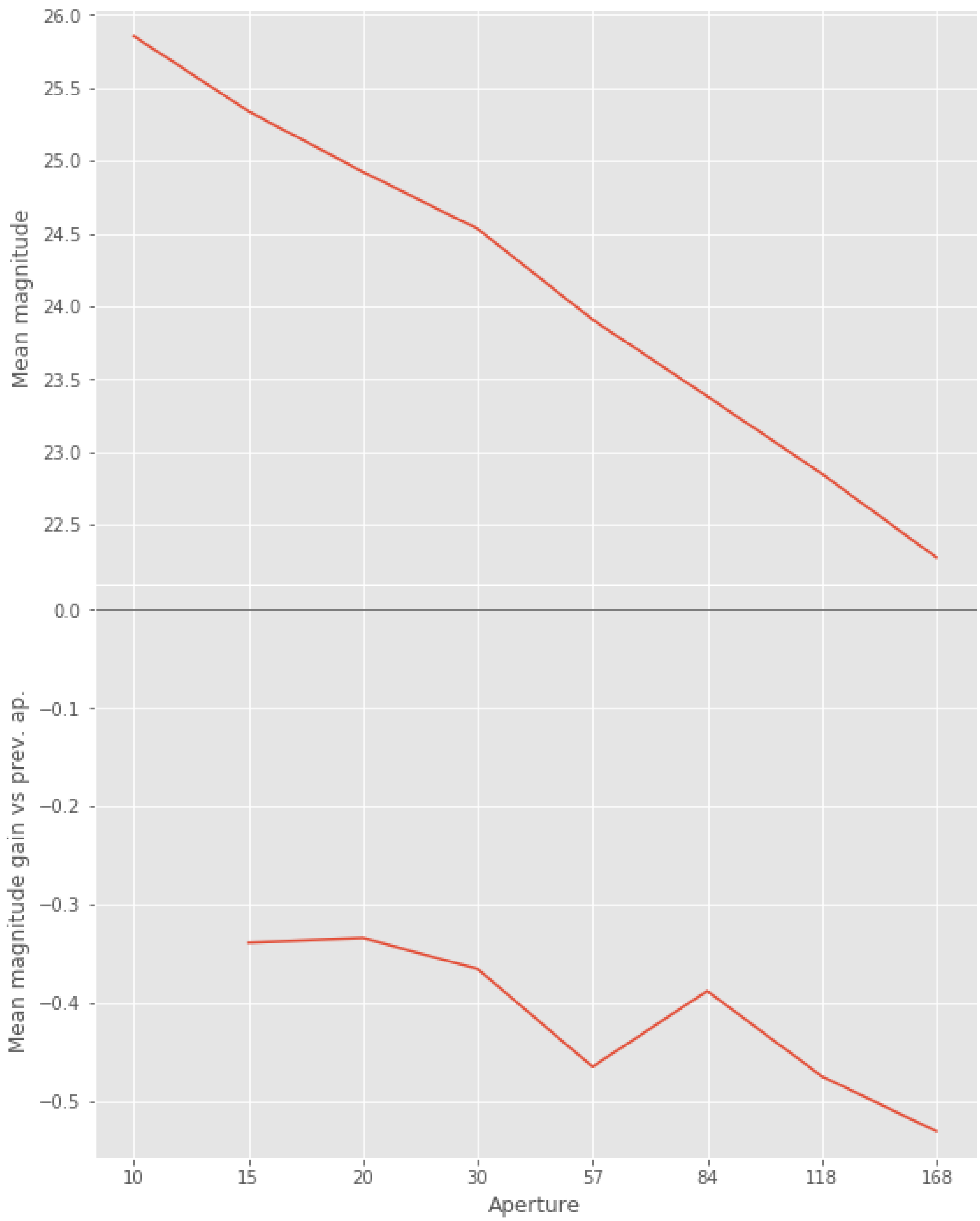
We use magnitudes between 17.5 and 18.8.

```
Aperture correction for z band:
Correction: -0.13919830322265625
Number of source used: 5793
RMS: 0.02398529710992674
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.5 I.e - y band

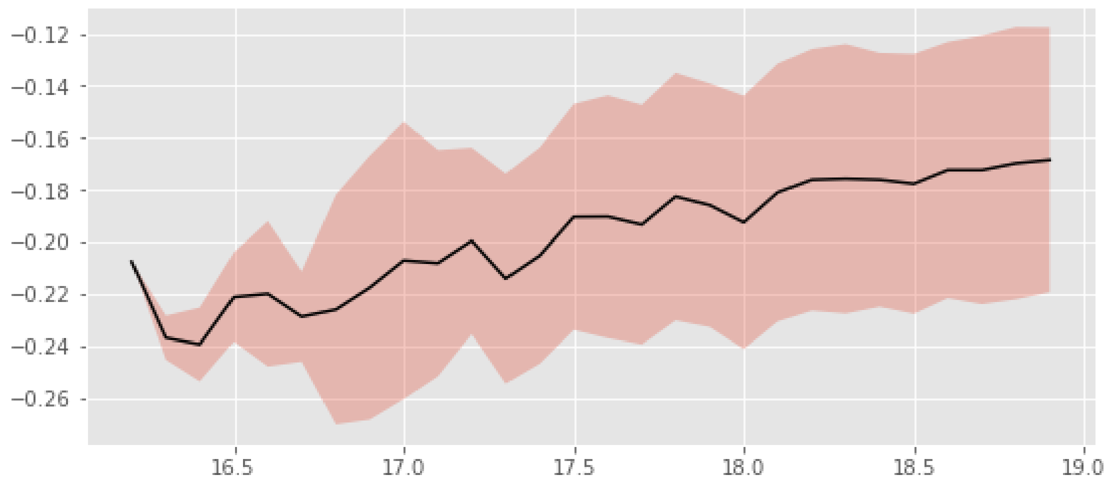
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 57 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 17.6 and 18.7.

```
Aperture correction for y band:
Correction: -0.18083953857421875
Number of source used: 5837
RMS: 0.049393831306902114
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

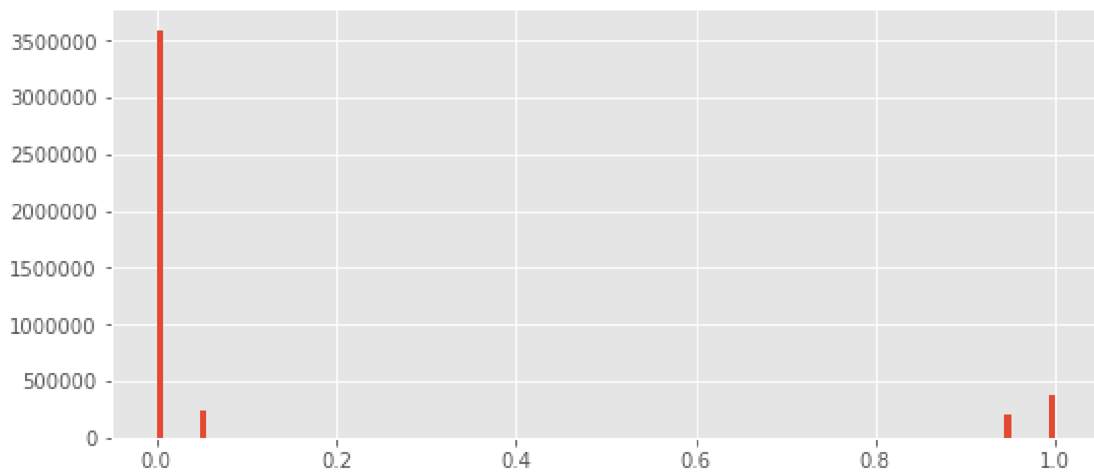
1.3 II - Stellarity

HSC does not provide a 0 to 1 stellarity value but a 0/1 extended flag in each band. We are using the same method as UKIDSS (cf this page) to compute a stellarity based on the class in each band:

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

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

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

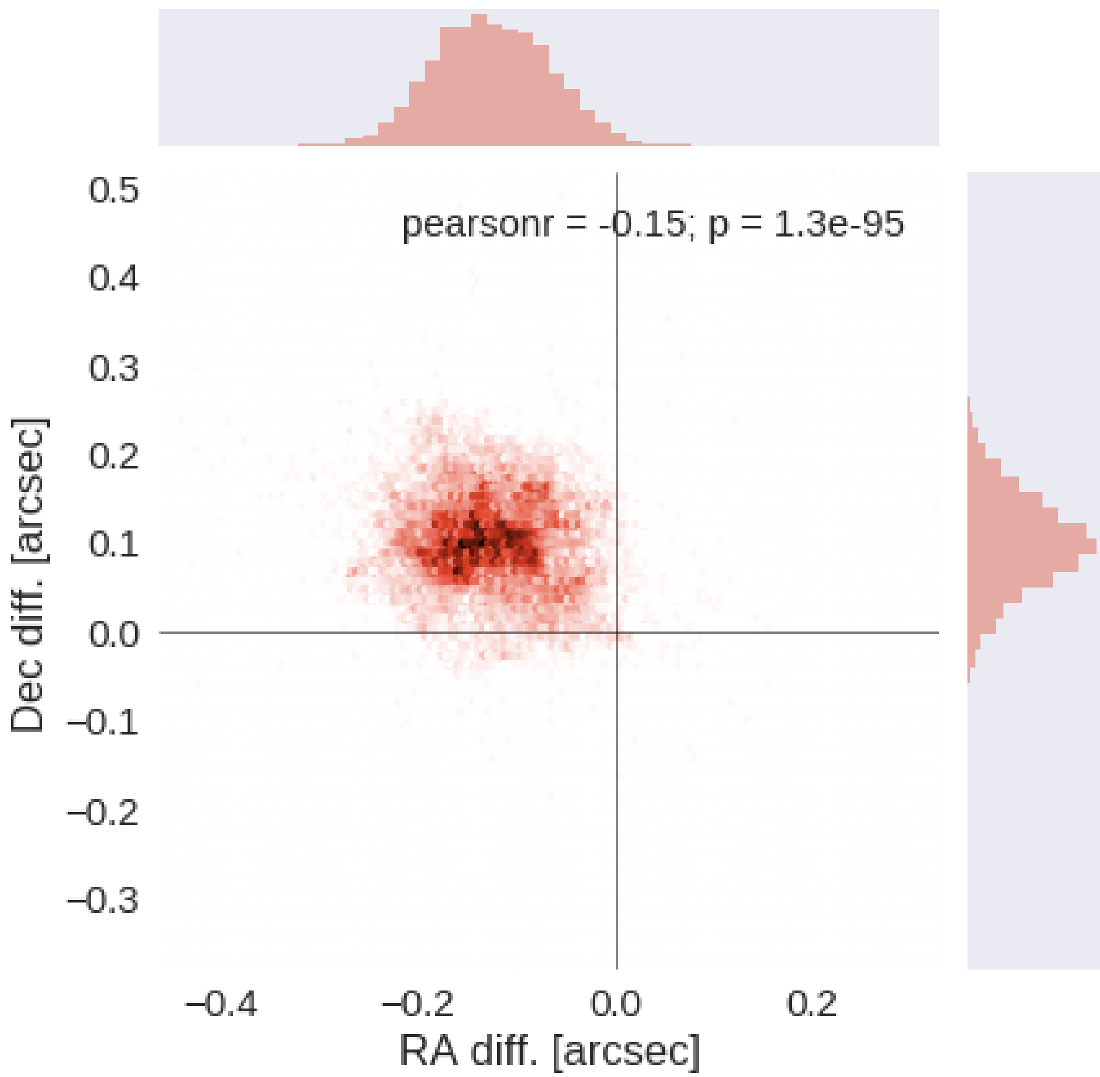
1.5 III - Removal of duplicated sources

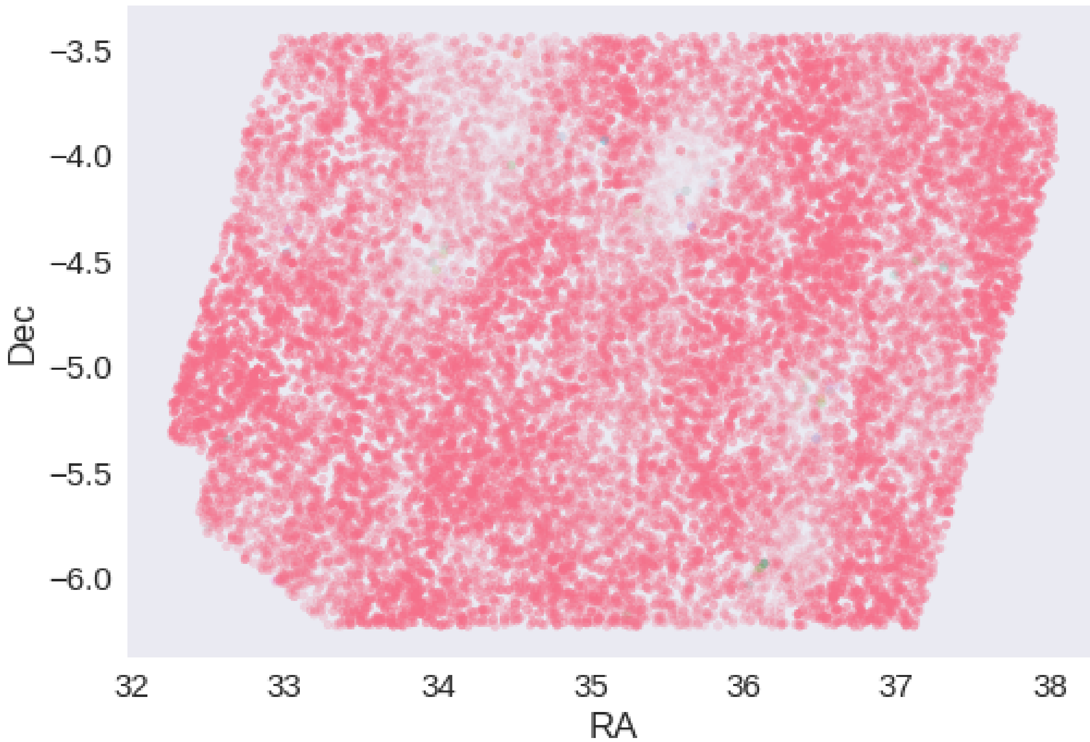
We remove duplicated objects from the input catalogues.

```
/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 4421152 sources.
The cleaned catalogue has 4421020 sources (132 removed).
The cleaned catalogue has 132 sources flagged as having been cleaned
```

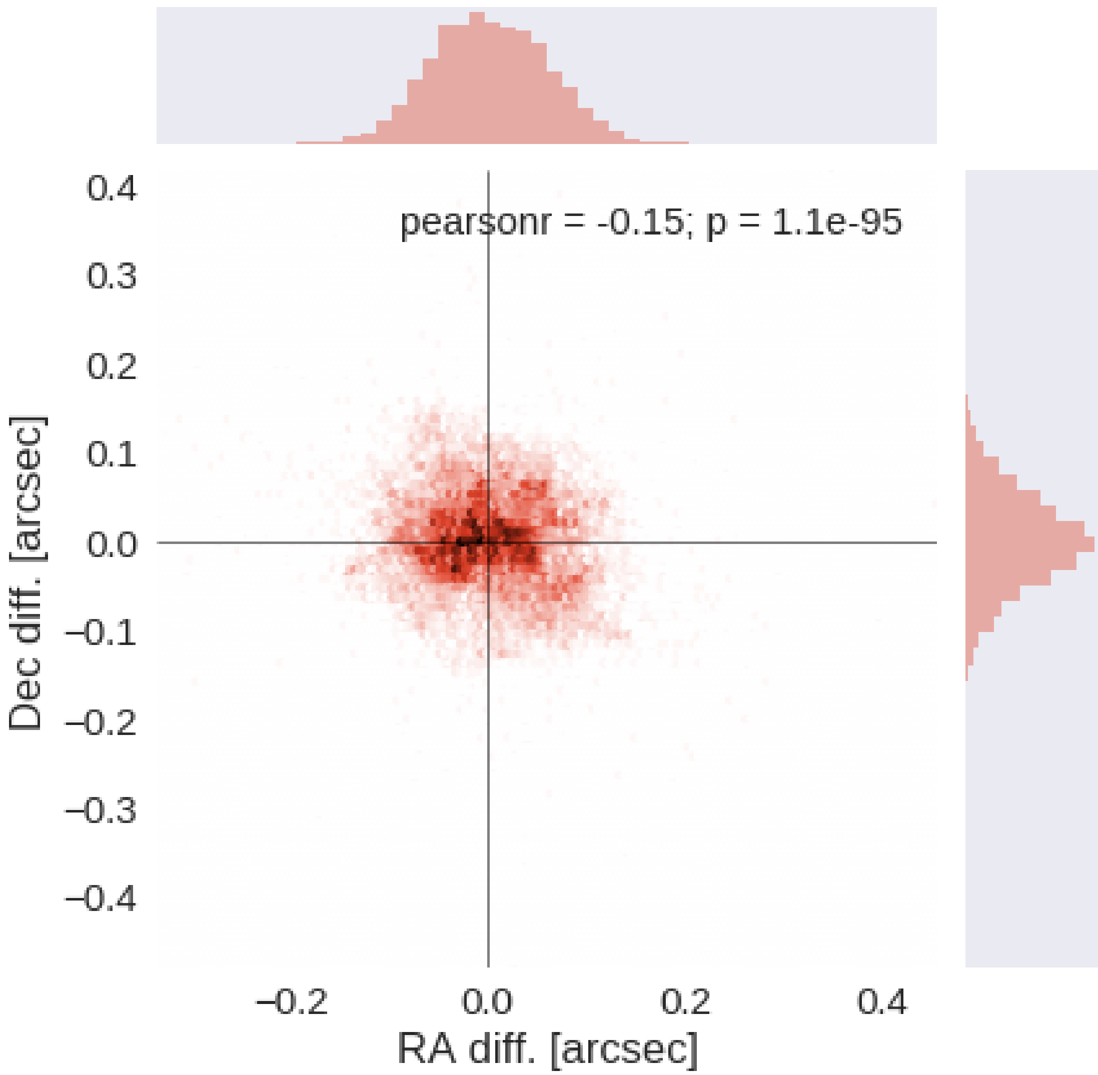
1.6 III - Astrometry correction

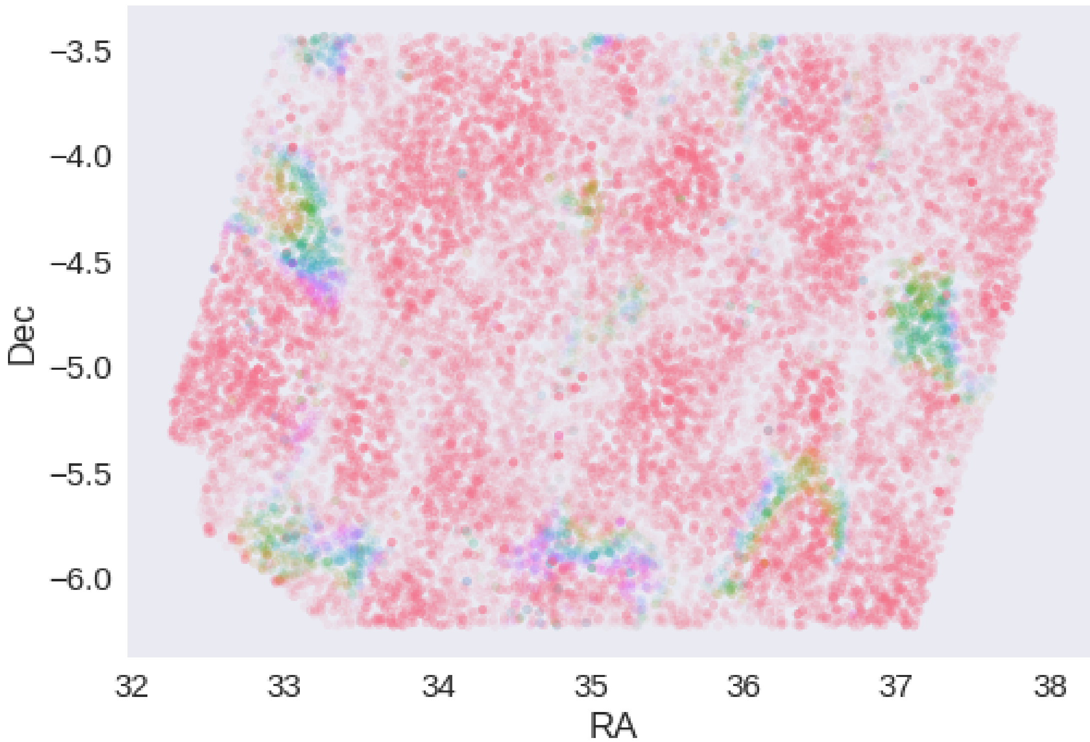
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.15; p = 1.3e-95
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
RA diff. [arcsec]




```
RA correction: 0.1269925983379494 arcsec
Dec correction: -0.09919436644878488 arcsec
```


pearsonr = -0.15; p = 1.1e-95
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
Dec diff. [arcsec]
−0.2
0.0
0.2
0.4
RA diff. [arcsec]



1.7 IV - Flagging Gaia objects

```
18401 sources flagged.
```

2 V - Saving to disk

1.9b_HSC-DEEP

January 18, 2018

1 XMM-LSS master catalogue

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

This catalogue comes from `dmu0_HSC`. We only have n921 and n816 photometry on the ultradeep field.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y aperture magnitude in 2" that we aperture correct;
- The g, r, i, z, y kron fluxes and magnitudes.
- The extended flag that we convert to a stellariy.

TODO: Check that the magnitudes are AB.

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 - 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.

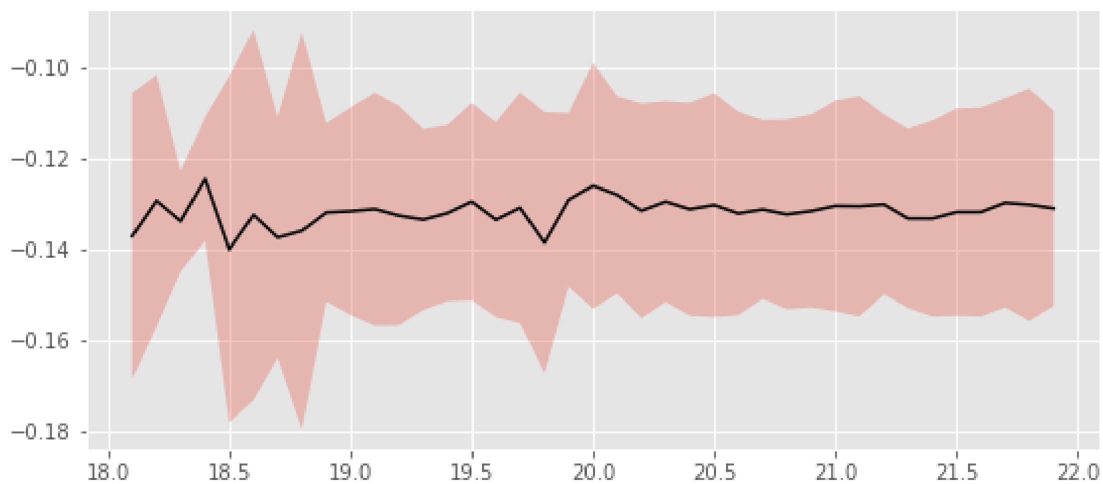
Magnitude range: To know what limits in aperture to use when doing the aperture correction, we plot for each magnitude bin the correction that is computed and its RMS. We should then use the wide limits (to use more stars) where the correction is stable and with few dispersion.

1.2.1 I.a - g band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We will use magnitudes between 18.5 and 20.8

```
Aperture correction for g band:
Correction: -0.13086223602294922
Number of source used: 2519
RMS: 0.022805425014163726
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

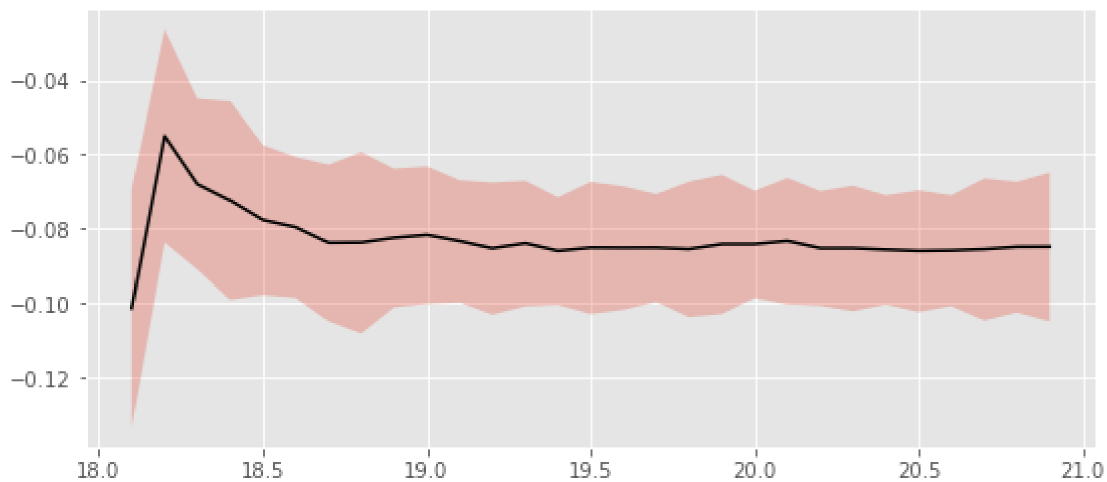
1.2.2 I.b - r band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 18.5 and 19.75.

```
Aperture correction for r band:
Correction: -0.08403396606445312
Number of source used: 1851
RMS: 0.018014916888614004
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

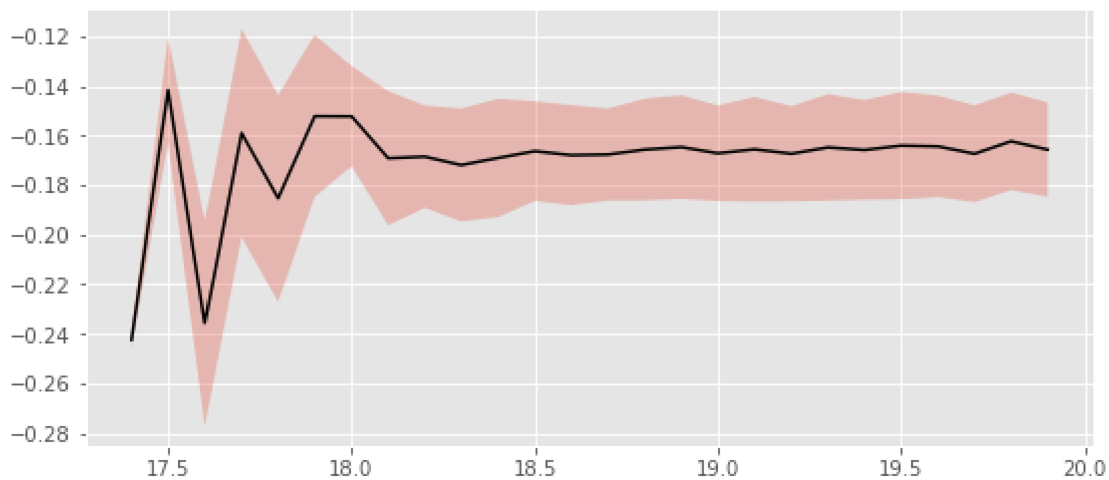
1.2.3 I.c - i band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 18.0 and 19.8.

```
Aperture correction for i band:
Correction: -0.16637039184570312
Number of source used: 4269
RMS: 0.020601125090626168
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

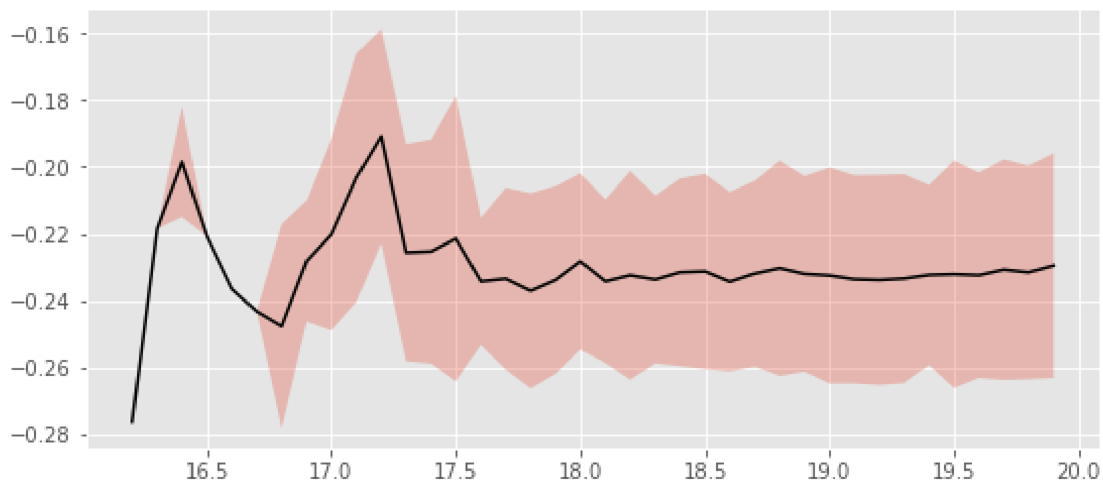
1.2.4 I.d - z band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 17.5 and 19.5.

```
Aperture correction for z band:
Correction: -0.2327556610107422
Number of source used: 4553
RMS: 0.029492398076254384
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

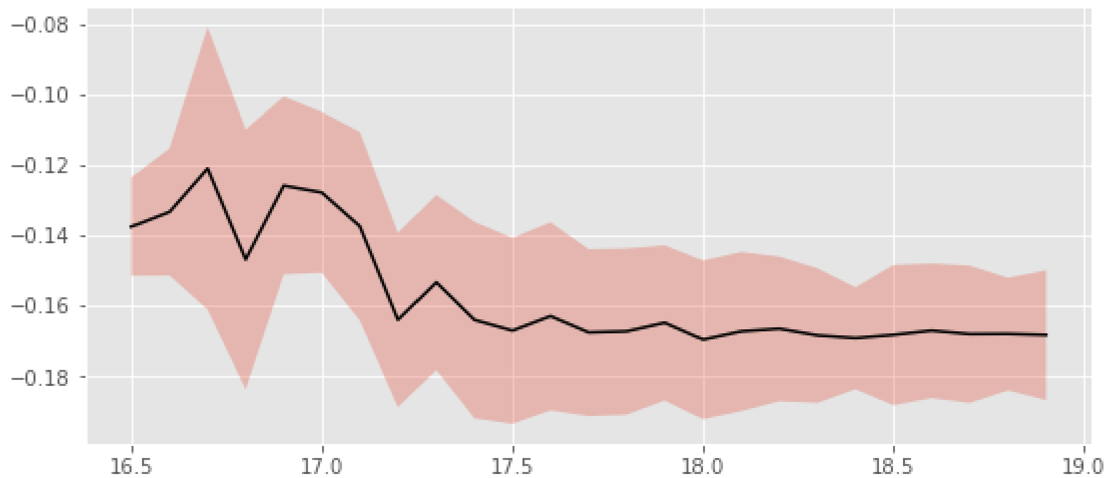
1.2.5 I.e - y band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 17.6 and 18.7.

```
Aperture correction for y band:
Correction: -0.16762733459472656
Number of source used: 2431
RMS: 0.020809063812093947
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

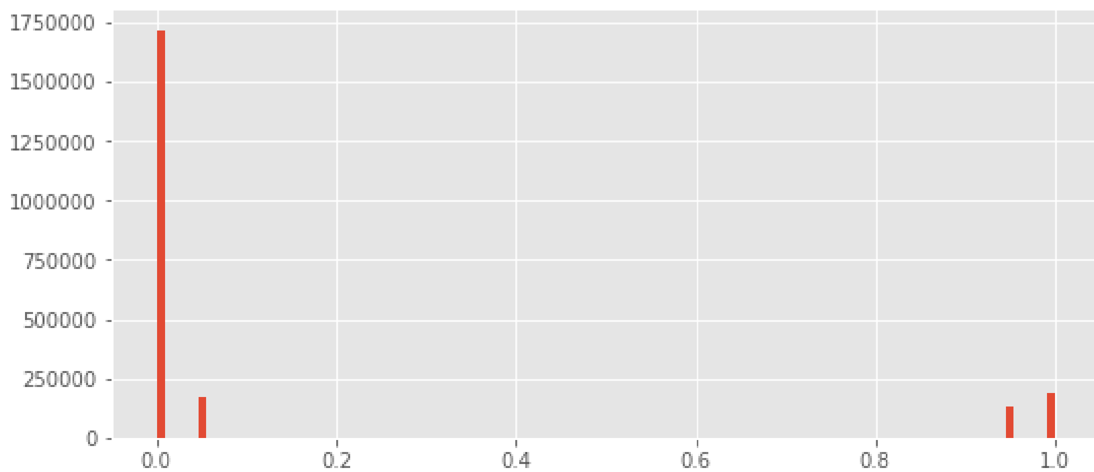
1.3 II - Stellarity

HSC does not provide a 0 to 1 stellarity value but a 0/1 extended flag in each band. We are using the same method as UKIDSS (cf this page) to compute a stellarity based on the class in each band:

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

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

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

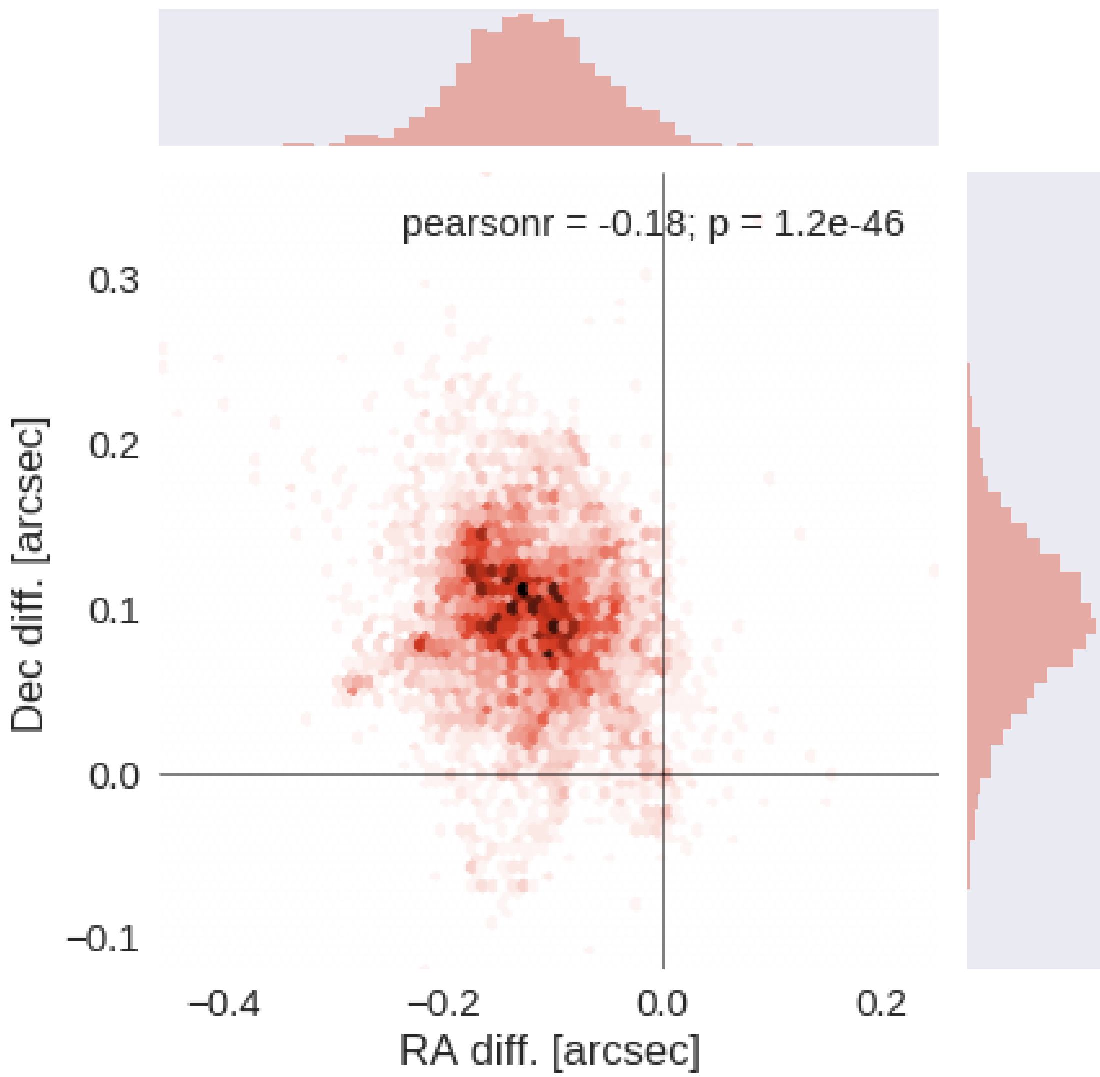
1.5 III - Removal of duplicated sources

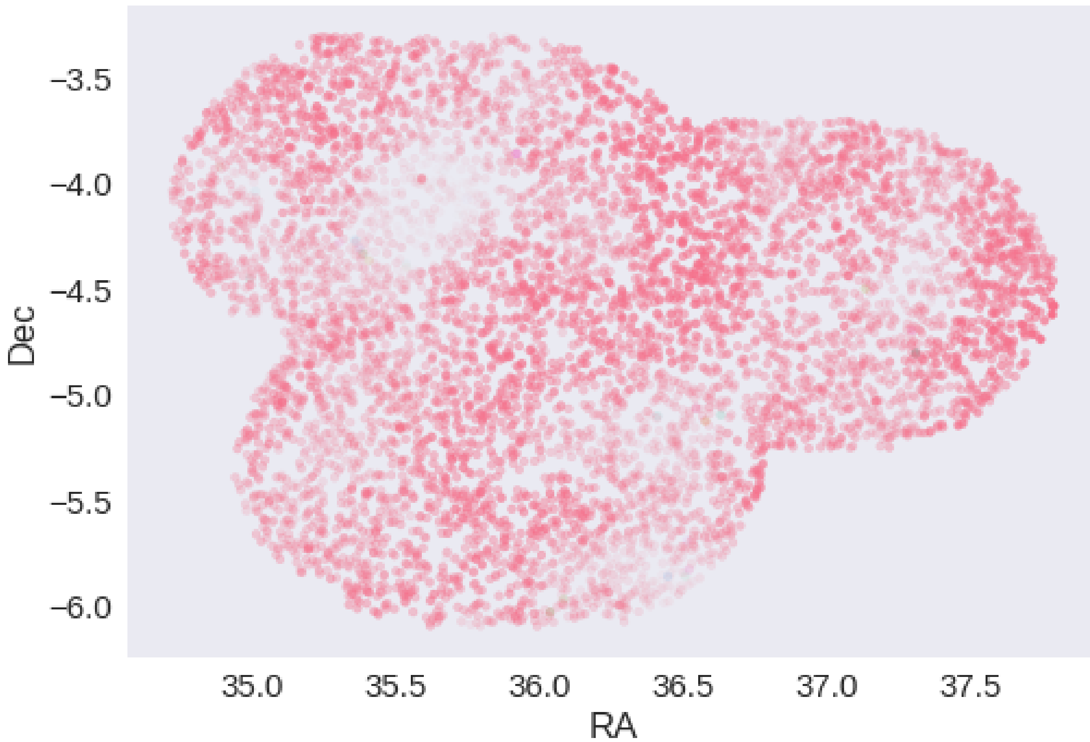
We remove duplicated objects from the input catalogues.

```
/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 2213258 sources.
The cleaned catalogue has 2213165 sources (93 removed).
The cleaned catalogue has 89 sources flagged as having been cleaned
```

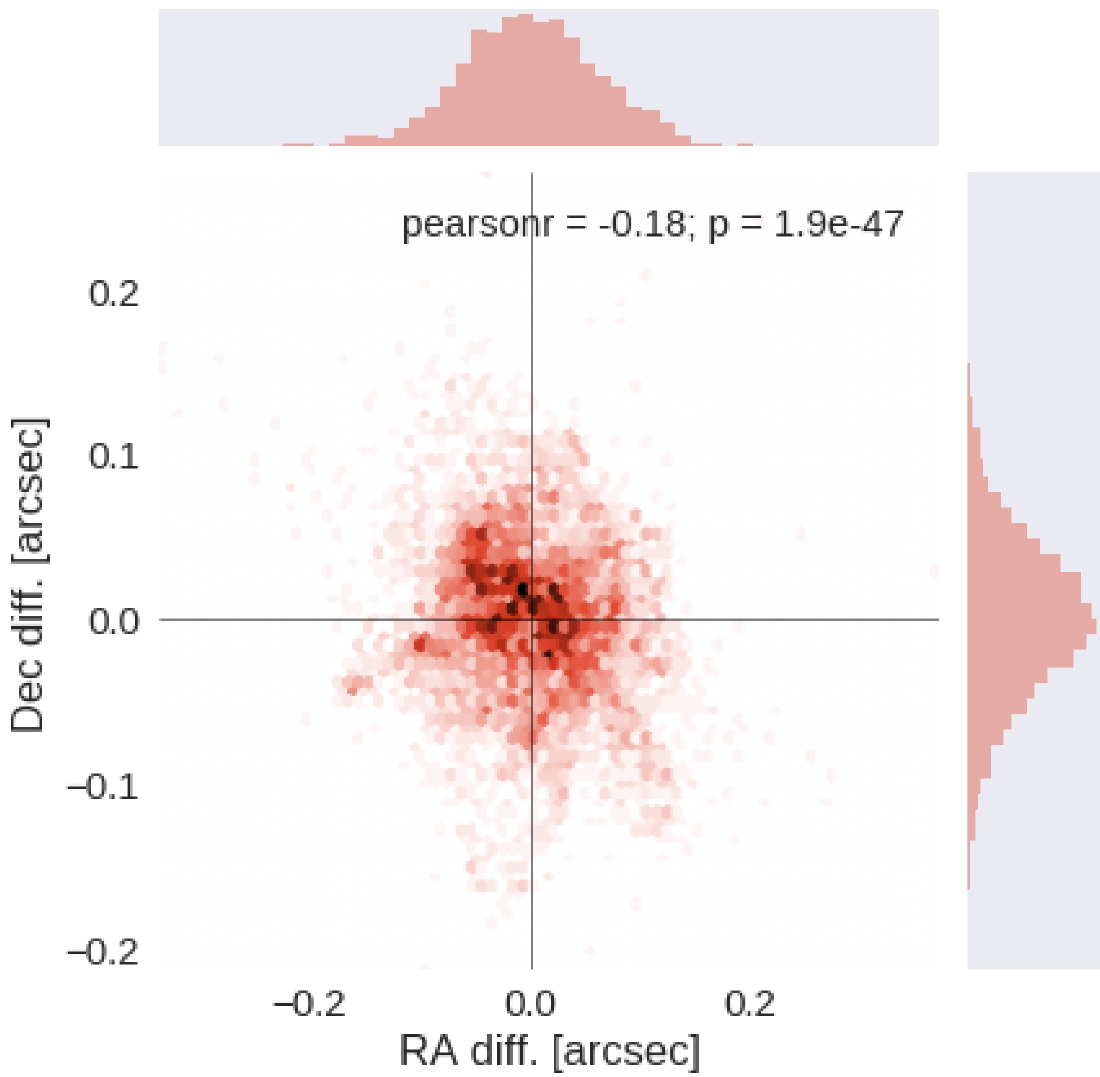
1.6 III - Astrometry correction

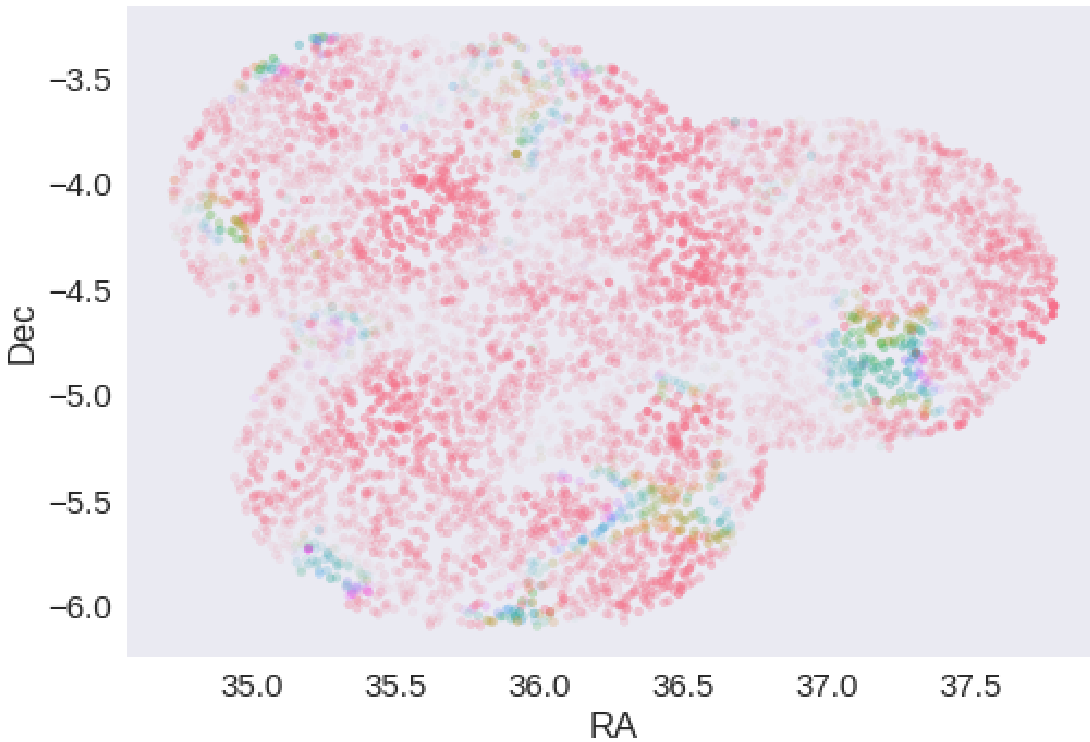
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.18; p = 1.2e-46
0.3
0.2
0.1
0.0
−0.1
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
RA diff. [arcsec]




```
RA correction: 0.12037082196911797 arcsec
Dec correction: -0.09338932542011236 arcsec
```


pearsonr = -0.18; p = 1.9e-47
0.2
0.1
0.0
−0.1
−0.2
Dec diff. [arcsec]
−0.2
0.0
0.2
RA diff. [arcsec]



1.7 IV - Flagging Gaia objects

```
6656 sources flagged.
```

2 V - Saving to disk

1.9c_HSC-UDEEP

January 18, 2018

1 XMM-LSS master catalogue

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

This catalogue comes from `dmu0_HSC`. We only have n921 and n816 photometry on the ultradeep field.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y, n921, n816 aperture magnitude in 2" that we aperture correct;
- The g, r, i, z, y, n921, n816 kron fluxes and magnitudes.
- The extended flag that we convert to a stellariy.

TODO: Check that the magnitudes are AB.

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 - 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.

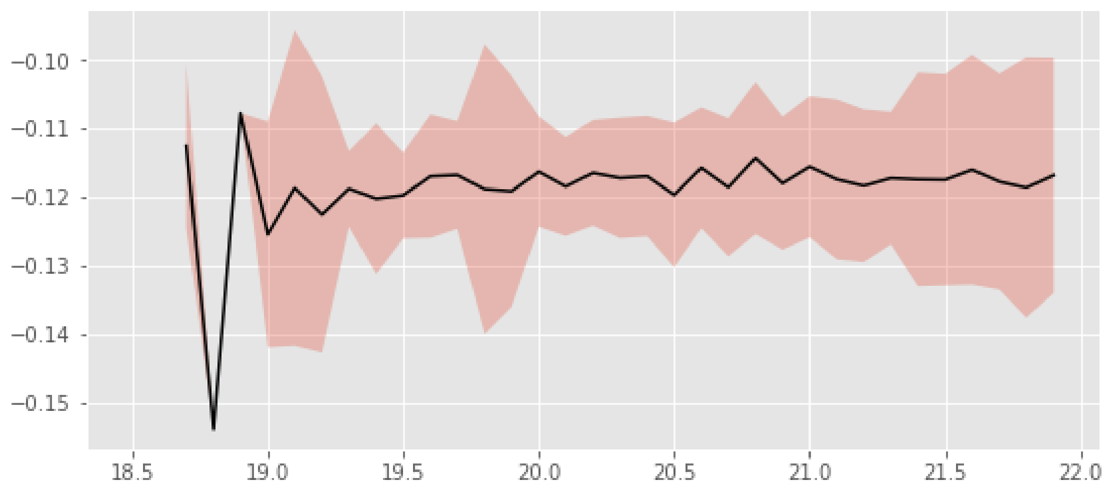
Magnitude range: To know what limits in aperture to use when doing the aperture correction, we plot for each magnitude bin the correction that is computed and its RMS. We should then use the wide limits (to use more stars) where the correction is stable and with few dispersion.

1.2.1 I.a - g band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



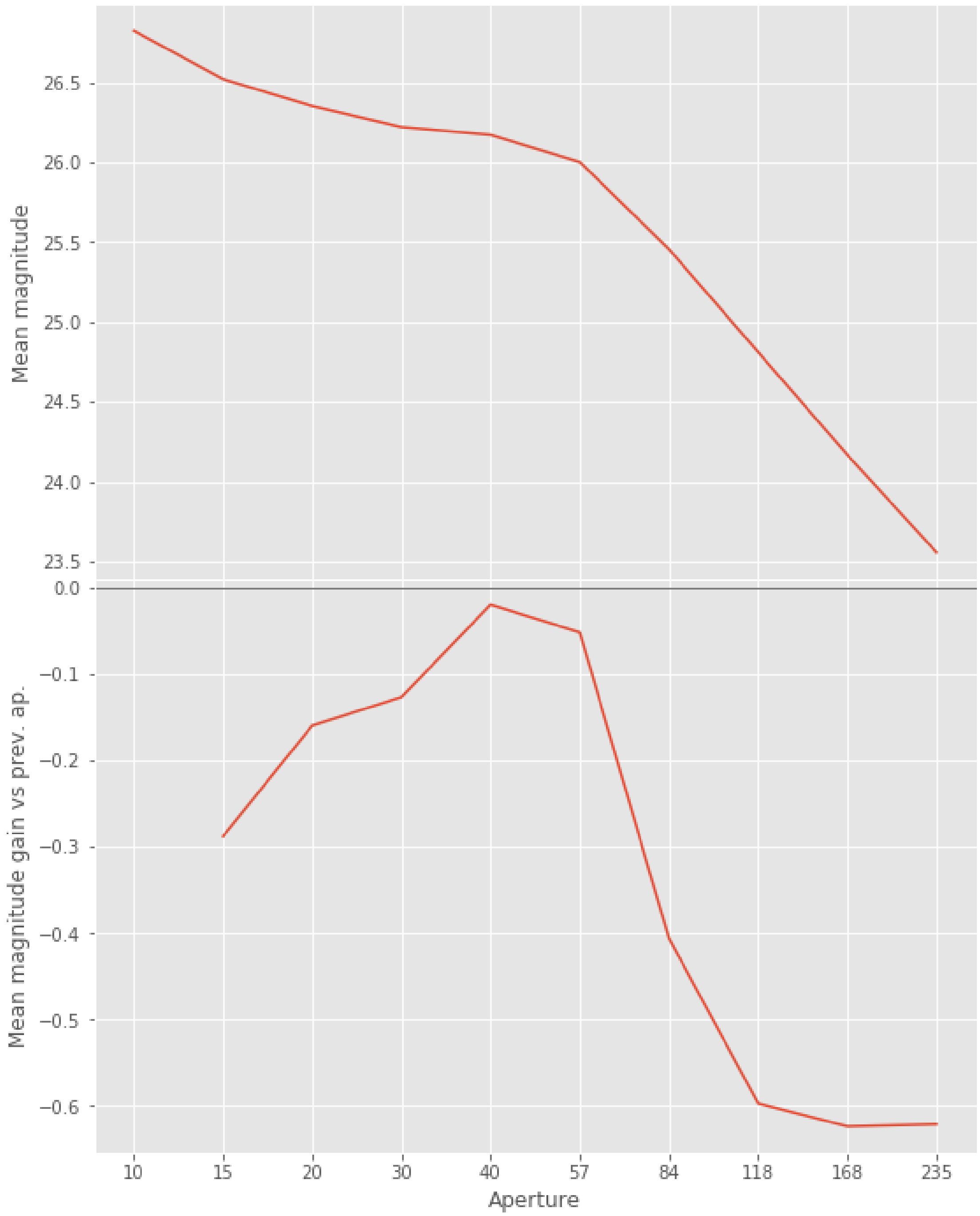
We will use magnitudes between 20.0 and 21.5

```
Aperture correction for g band:
Correction: -0.11709976196289062
Number of source used: 1468
RMS: 0.010006448273662748
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.2 I.b - r band

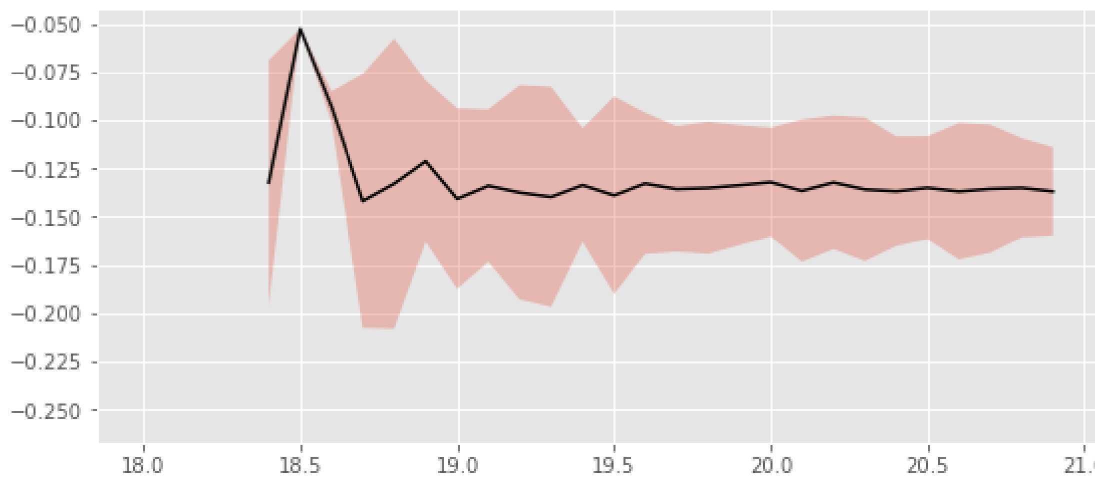
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 19.0 and 20.5.

```
Aperture correction for r band:
Correction: -0.1352062225341797
Number of source used: 1132
RMS: 0.03414906800433681
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

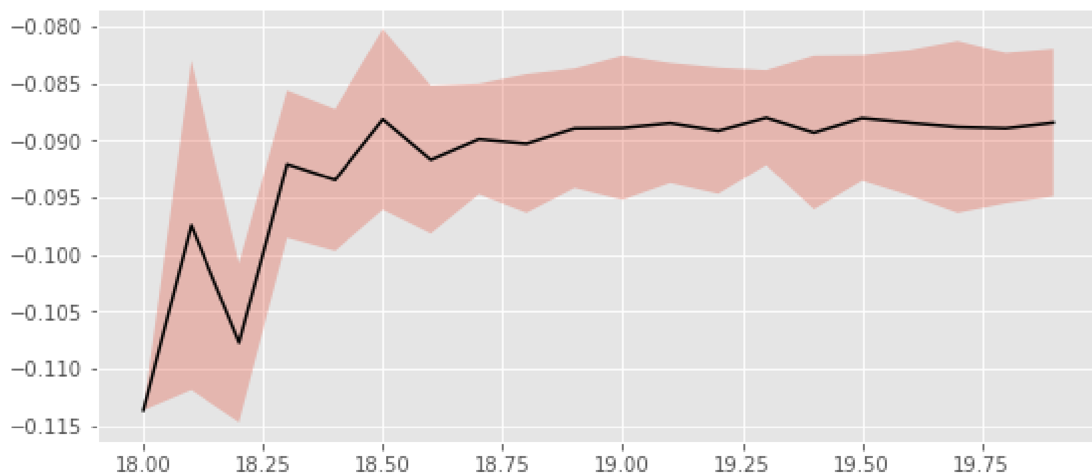
1.2.3 I.c - i band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 18.5 and 19.8.

```
Aperture correction for i band:
Correction: -0.08892059326171875
Number of source used: 1474
RMS: 0.005790887515601094
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

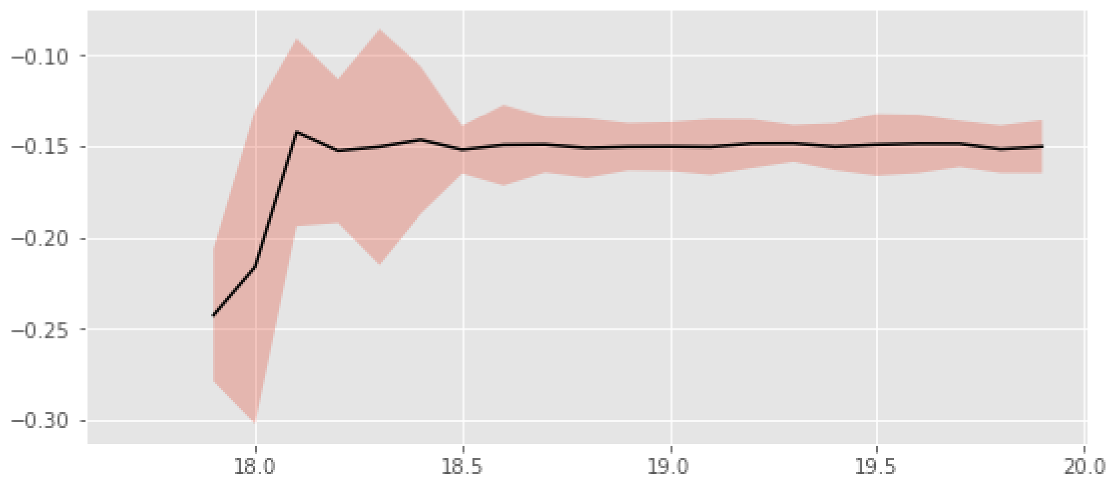
1.2.4 I.d - z band

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```

We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



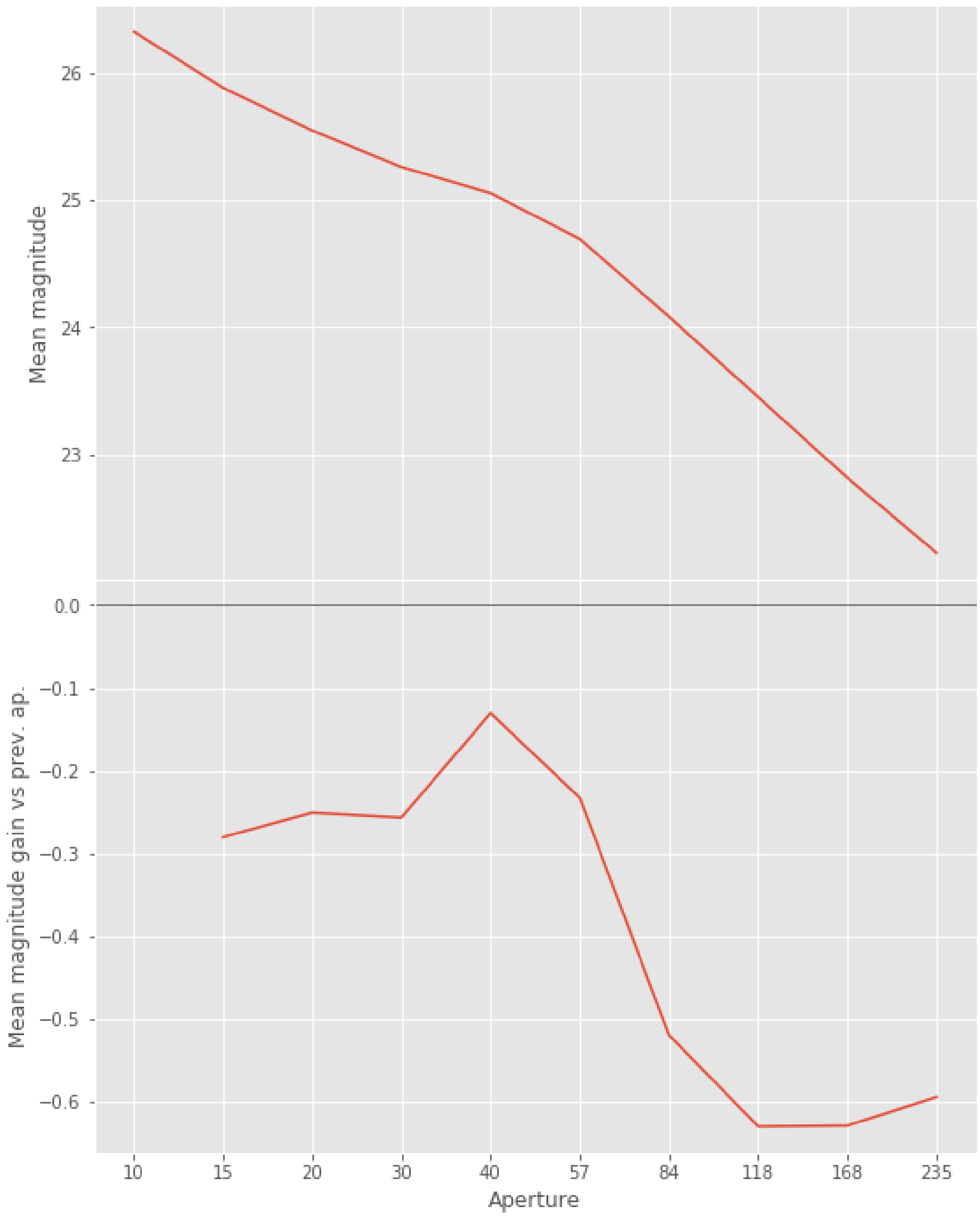
We use magnitudes between 18.5 and 19.8.

```
Aperture correction for z band:
Correction: -0.14960098266601562
Number of source used: 1770
RMS: 0.013925026504311305
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.5 I.e - y band

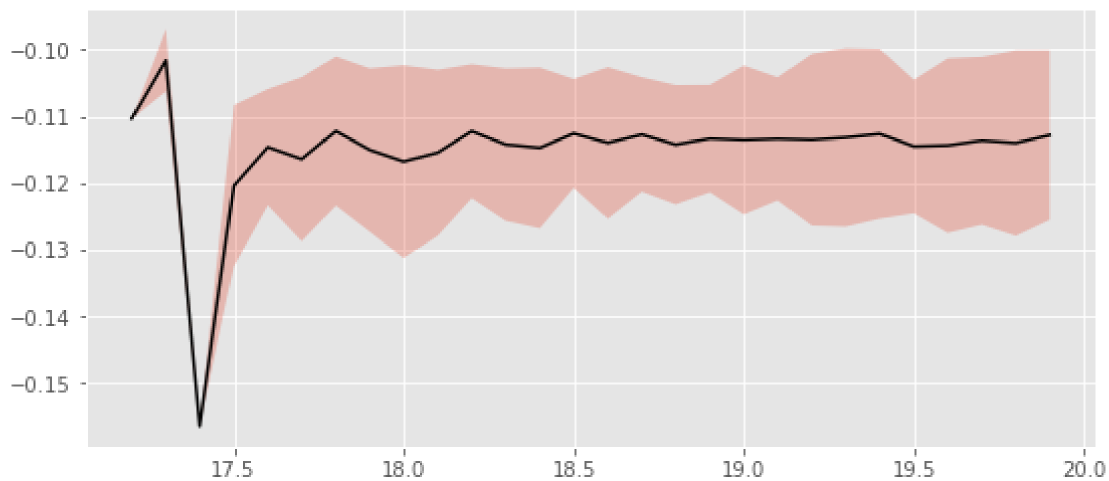
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



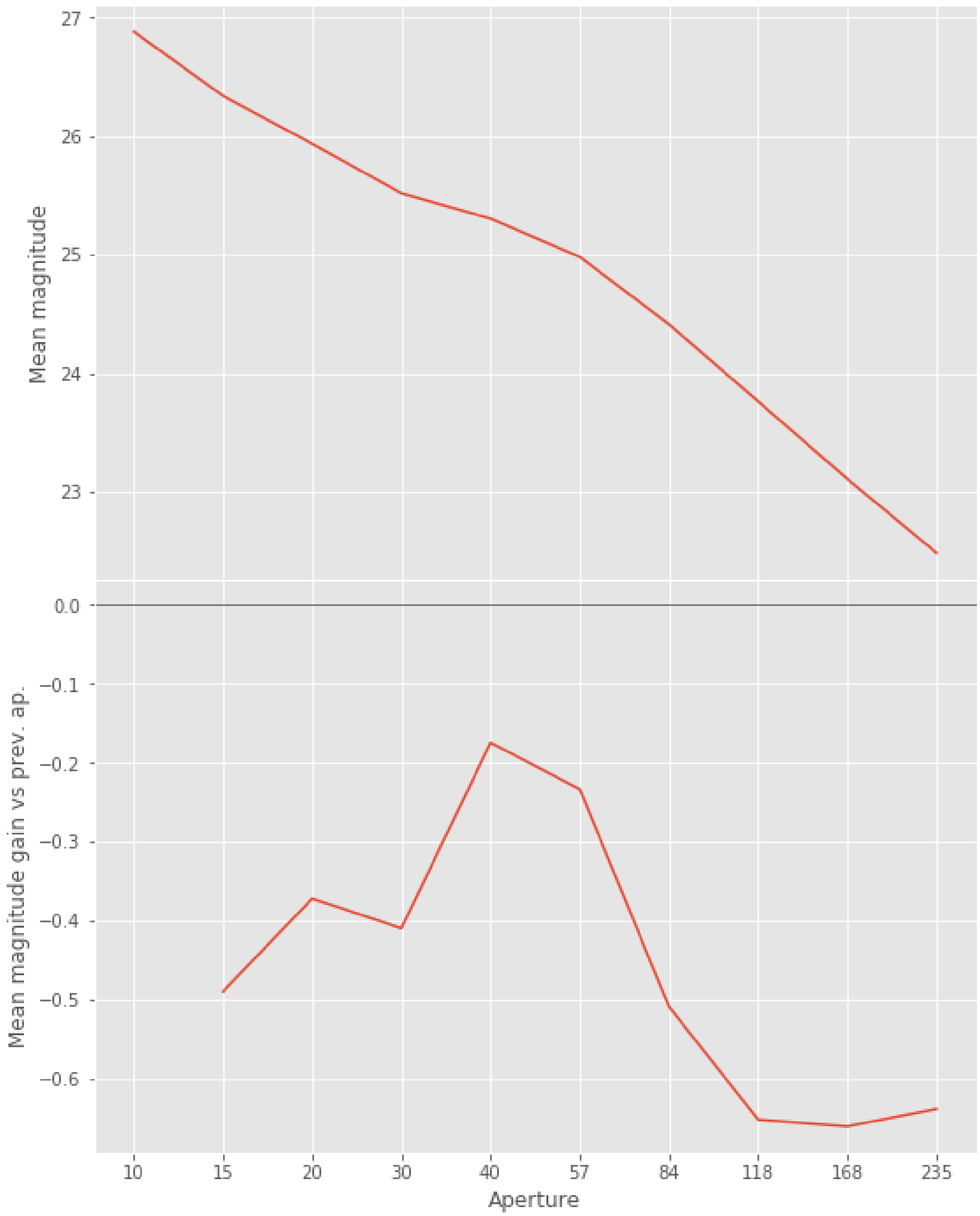
We use magnitudes between 18.0 and 19.5.

```
Aperture correction for y band:
Correction: -0.11351203918457031
Number of source used: 1913
RMS: 0.010453534442076362
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.6 I.f - n921 band

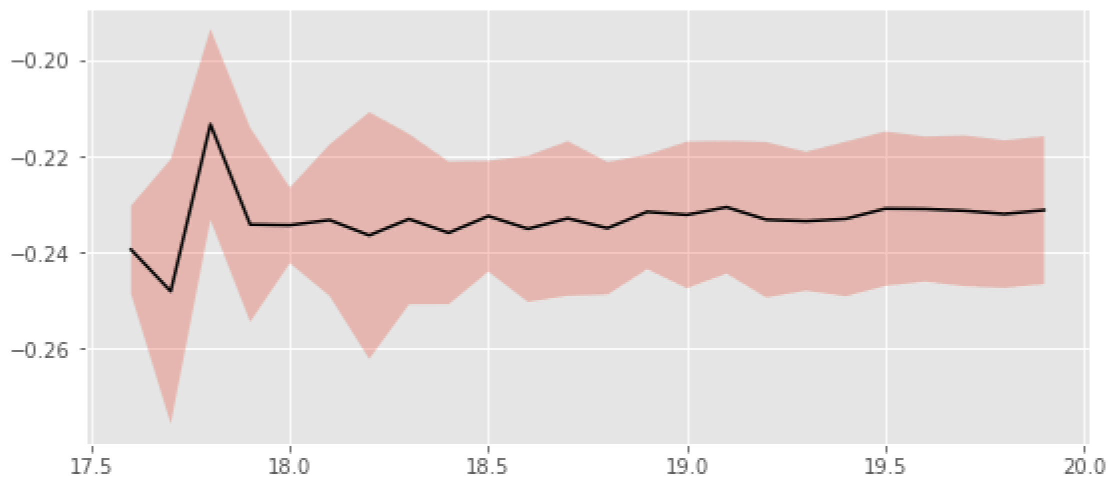
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



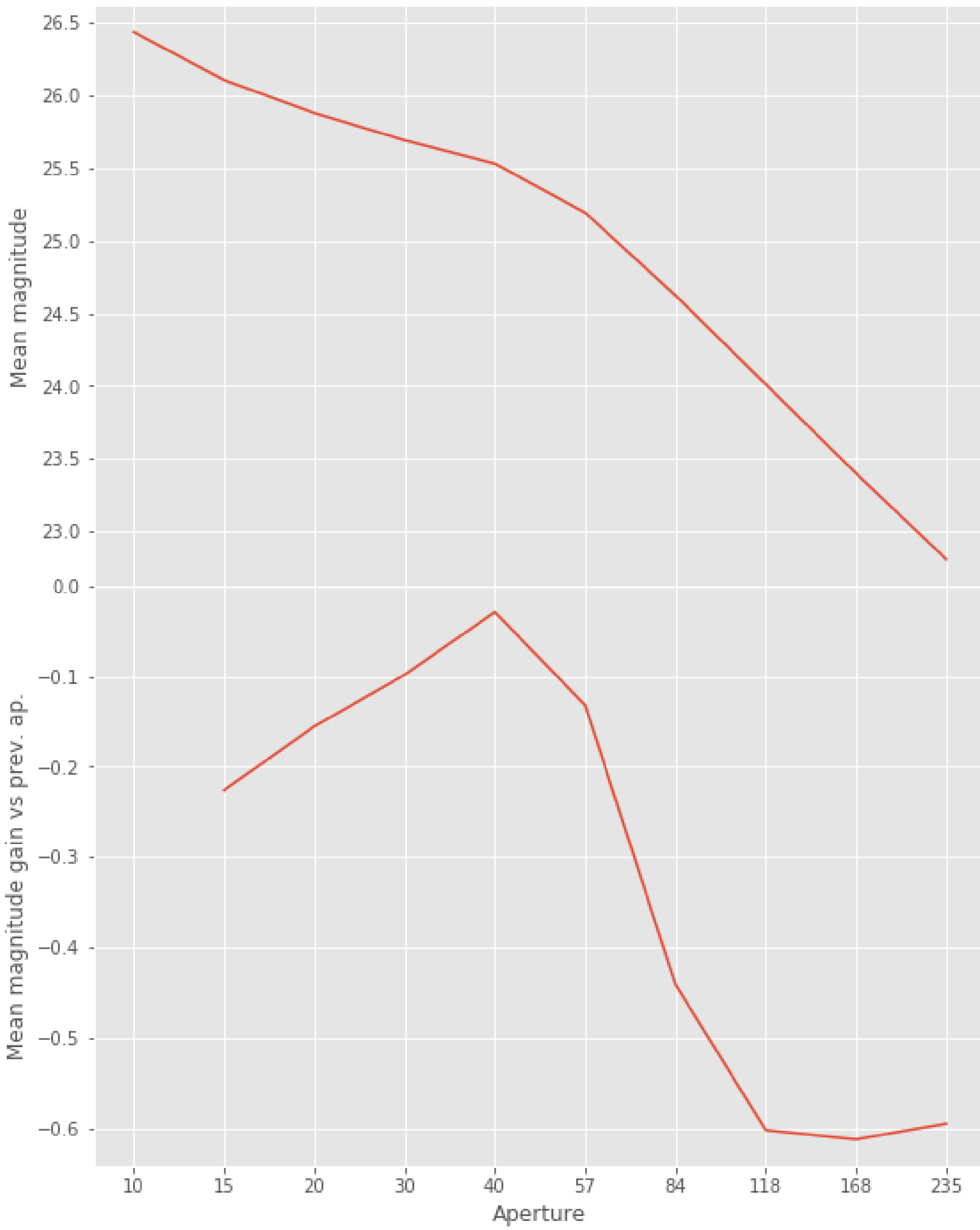
We use magnitudes between 18.0 and 19.5.

```
Aperture correction for n921 band:
Correction: -0.23302078247070312
Number of source used: 1549
RMS: 0.014689342783144942
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

1.2.7 I.g - n816 band

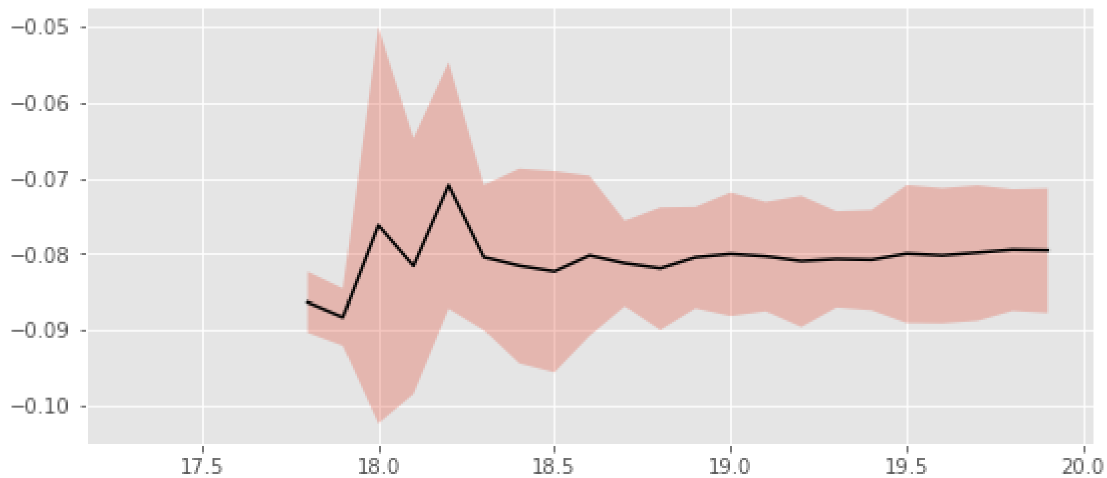
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



We will use aperture 40 as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:903: RuntimeWarning: invalid valu
  mask = stellarity > .9
/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/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 18.0 and 19.5.

```
Aperture correction for n816 band:
Correction: -0.11351203918457031
Number of source used: 1199
RMS: 0.007980501010658921
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:129: RuntimeWarning: invalid value enc
  mask &= (stellarity > 0.9)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```

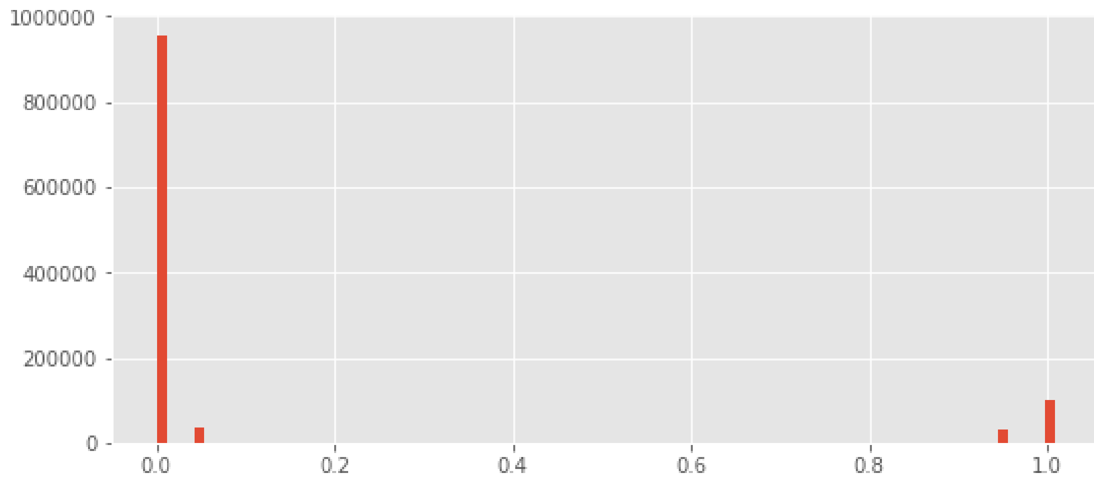
1.3 II - Stellarity

HSC does not provide a 0 to 1 stellarity value but a 0/1 extended flag in each band. We are using the same method as UKIDSS (cf this page) to compute a stellarity based on the class in each band:

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

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

Out[35]: <IPython.core.display.HTML object>

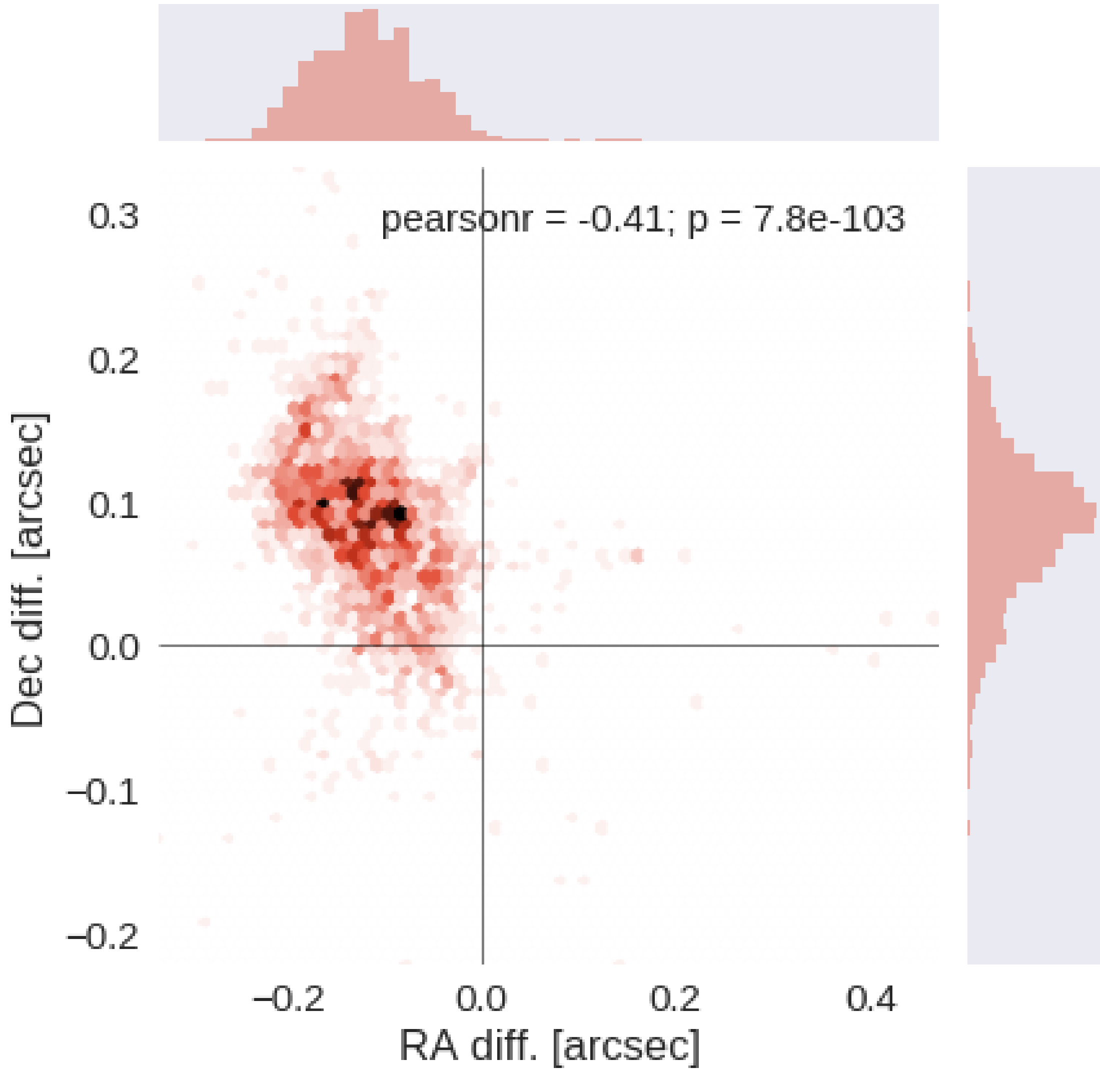
1.5 III - Removal of duplicated sources

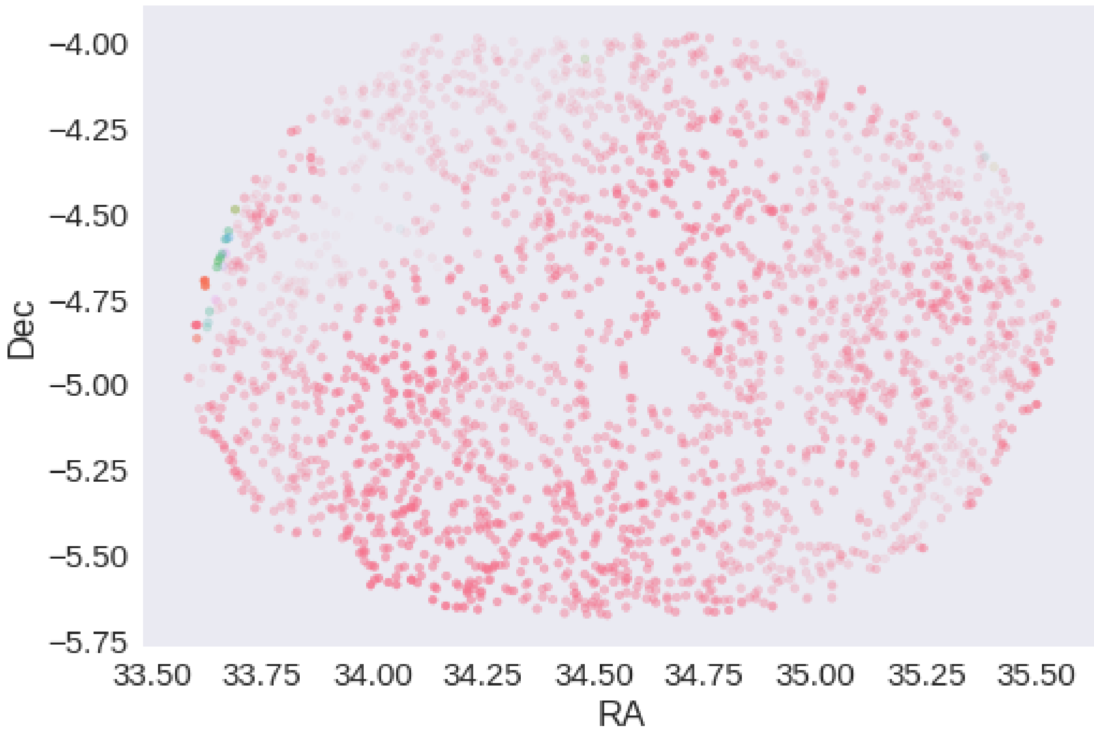
We remove duplicated objects from the input catalogues.

```
/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 1128935 sources.
The cleaned catalogue has 1128841 sources (94 removed).
The cleaned catalogue has 79 sources flagged as having been cleaned
```

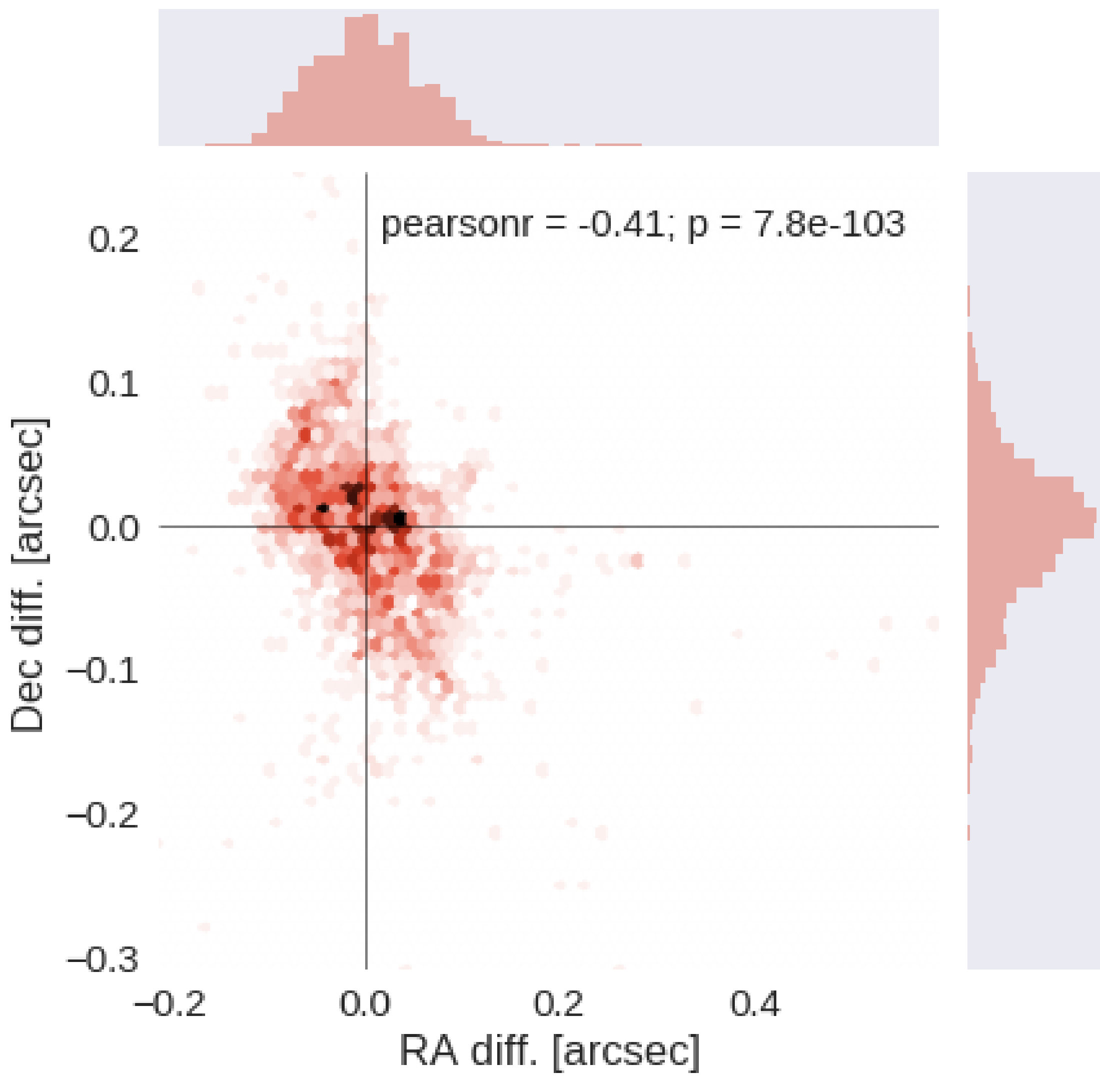
1.6 III - Astrometry correction

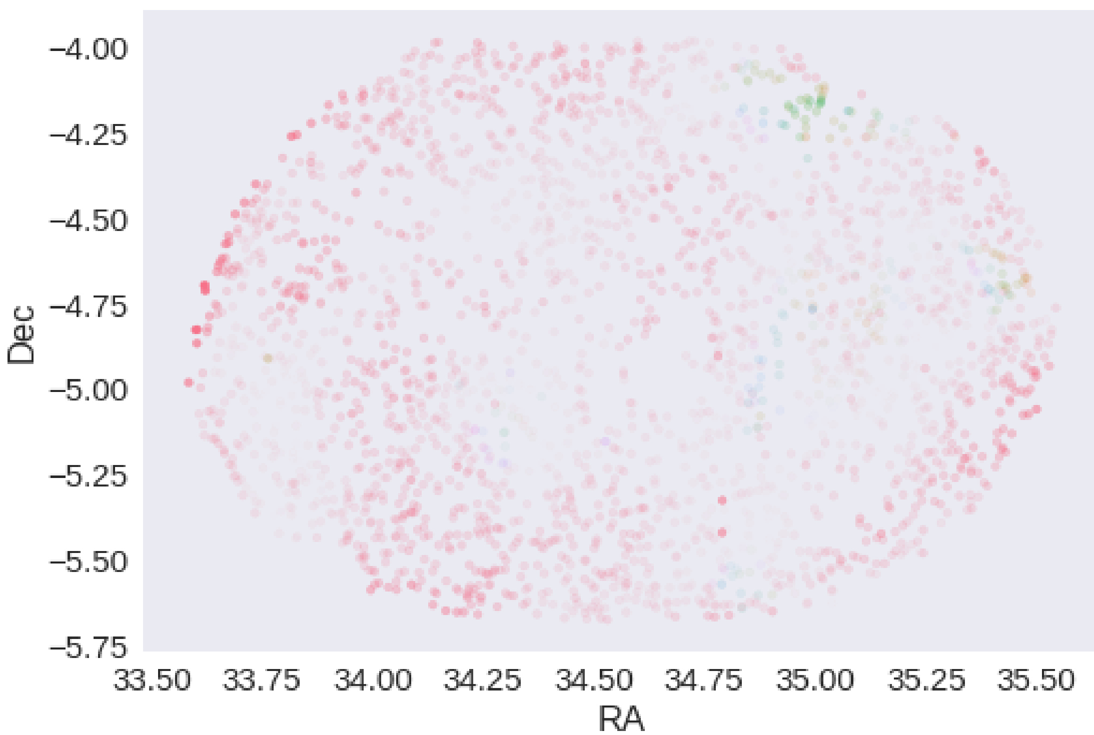
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.41; p = 7.8e-103
0.3
0.2
0.1
0.0
−0.1
−0.2
Dec diff. [arcsec]
−0.2
0.0
0.2
0.4
RA diff. [arcsec]




```
RA correction: 0.11995867840823848 arcsec
Dec correction: -0.08751257112411537 arcsec
```


pearsonr = -0.41; p = 7.8e-103
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]



1.7 IV - Flagging Gaia objects

```
2532 sources flagged.
```

2 V - Saving to disk

1.10_PanSTARRS1-3SS

January 18, 2018

1 XMM-LSS 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

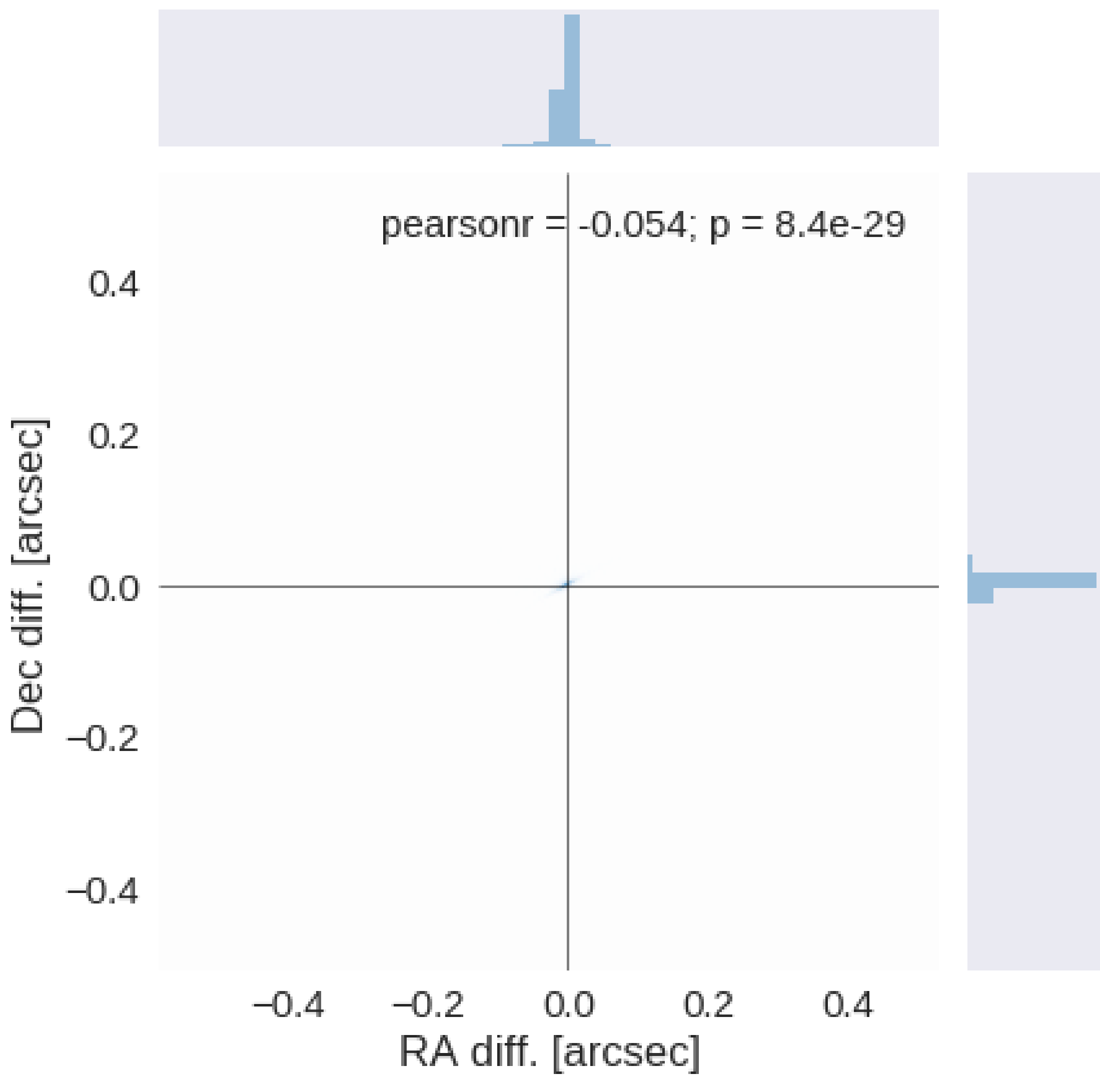
We remove duplicated objects from the input catalogues.

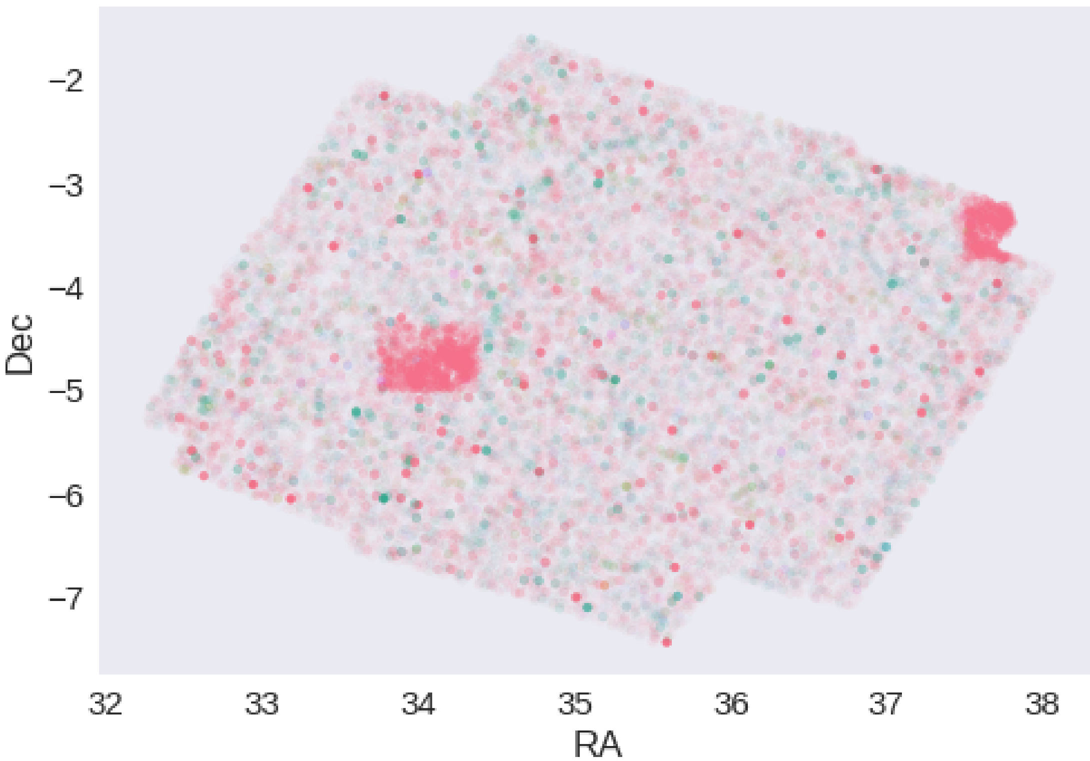
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 384755 sources.
The cleaned catalogue has 384643 sources (112 removed).
The cleaned catalogue has 112 sources flagged as having been cleaned
```

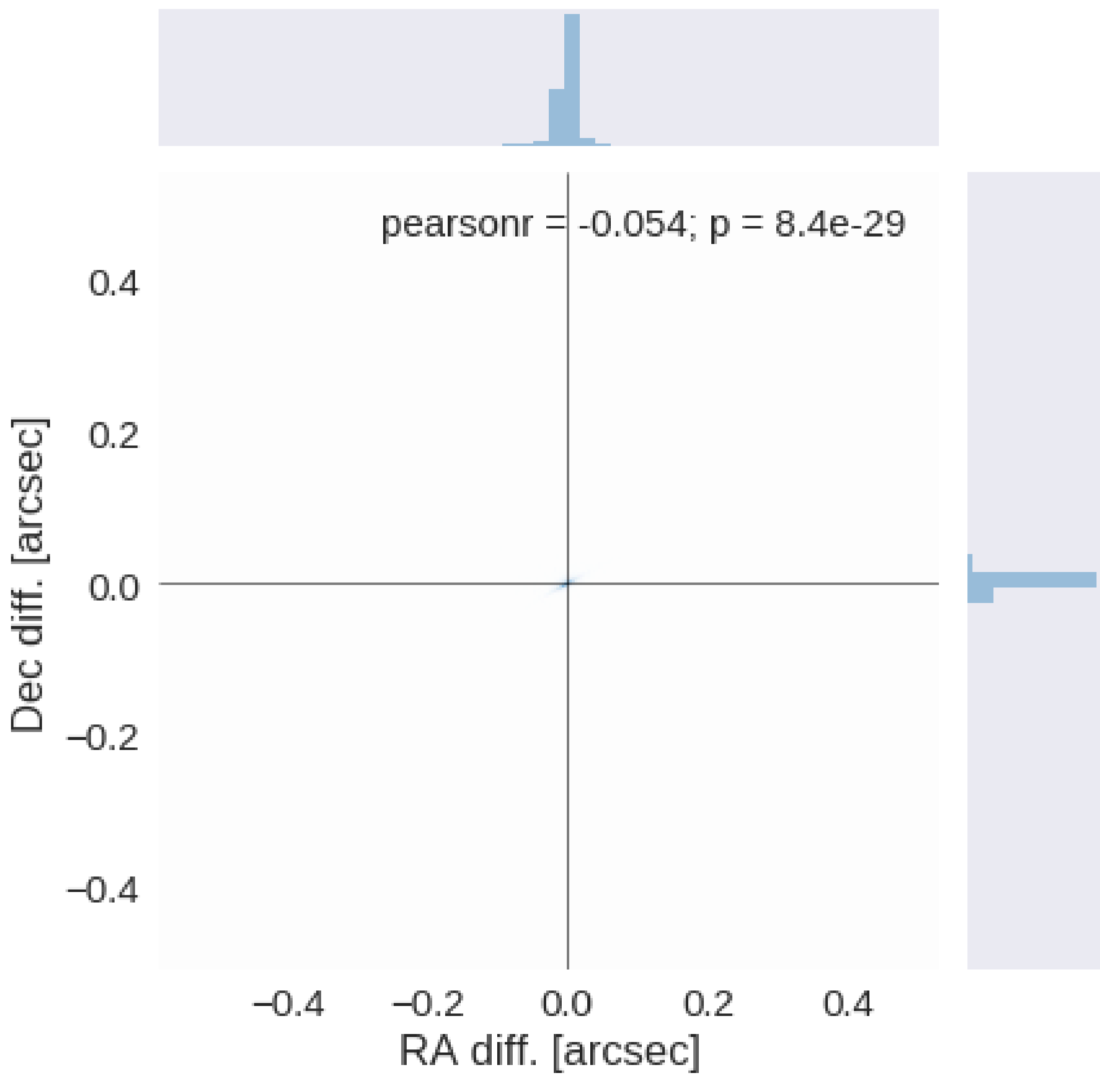
1.4 III - Astrometry correction

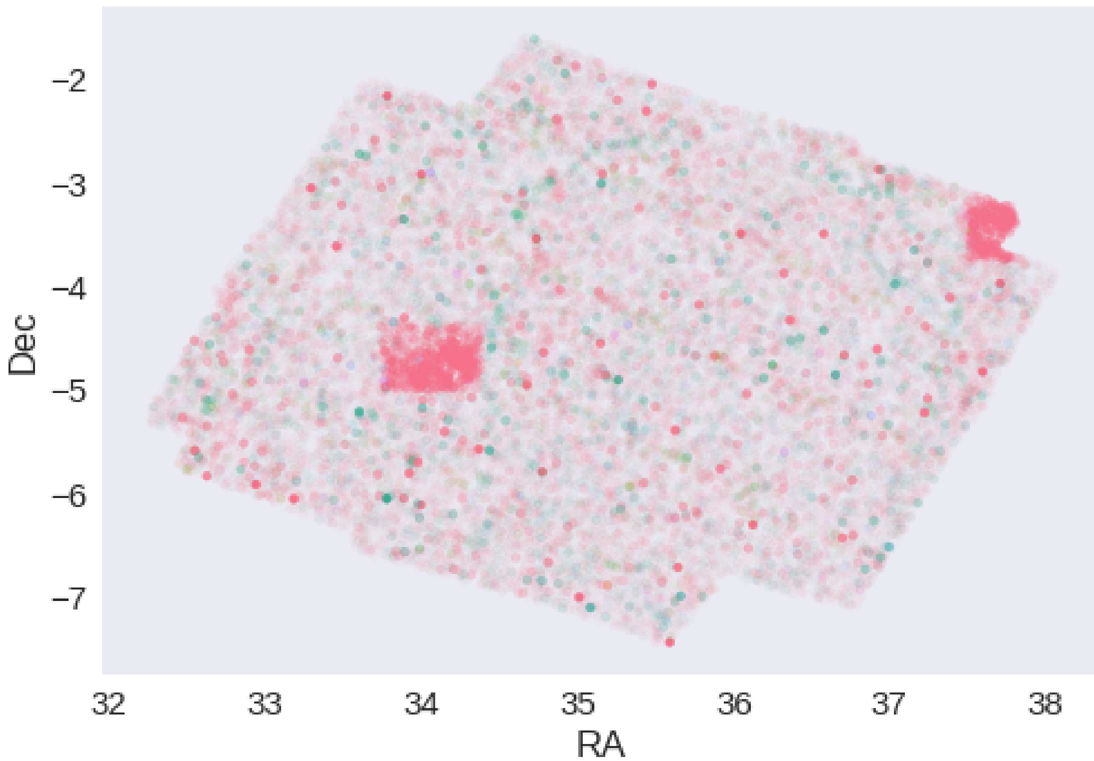
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.00022419935987727513 arcsec
Dec correction: -0.0008451836286837988 arcsec
```


pearsonr = -0.054; p = 8.4e-29
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

```
42278 sources flagged.
```

2 V - Saving to disk

1.11_SXDS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of the Subaru/XMM-Newton Deep Survey (SXDS) data

The catalogue is in `dmu0_SXDS`.

In the catalogue, we keep:

- The position;
- The stellarity;
- The aperture magnitude B, V, R, i, z (2 arcsec).
- The total magnitude B, V, R, i, z (Kron like aperture magnitude).

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

1.2 I - Column selection

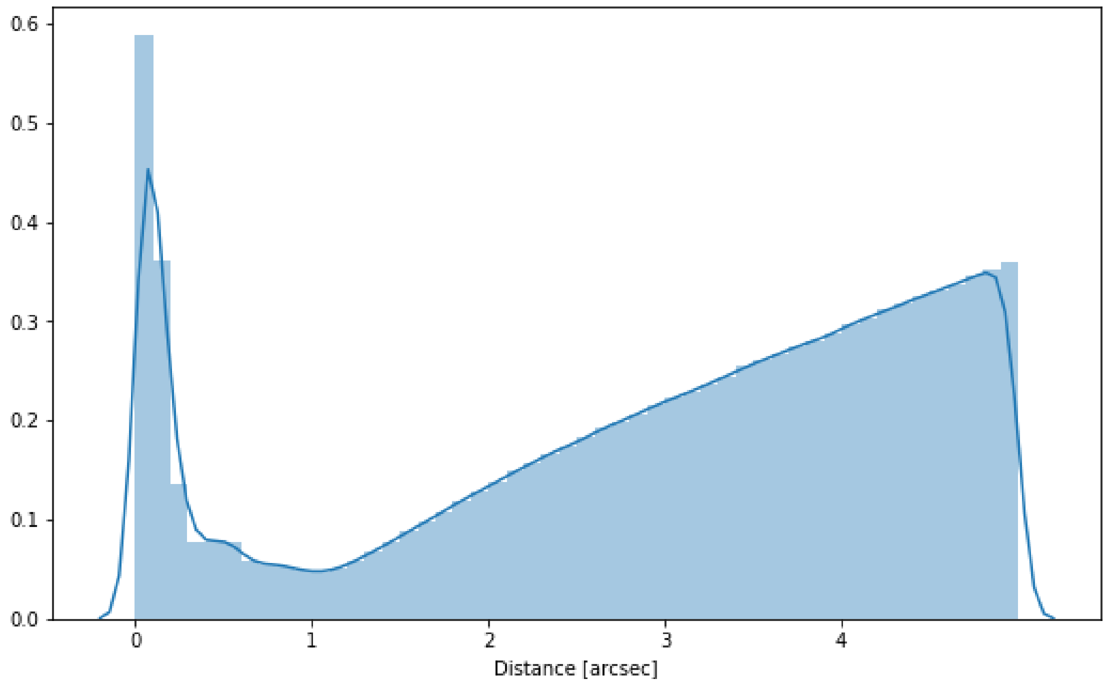
For each band we have 5 independent and overlapping catalogues. We must first stack the catalogues and remove duplicates then merge the bands together.

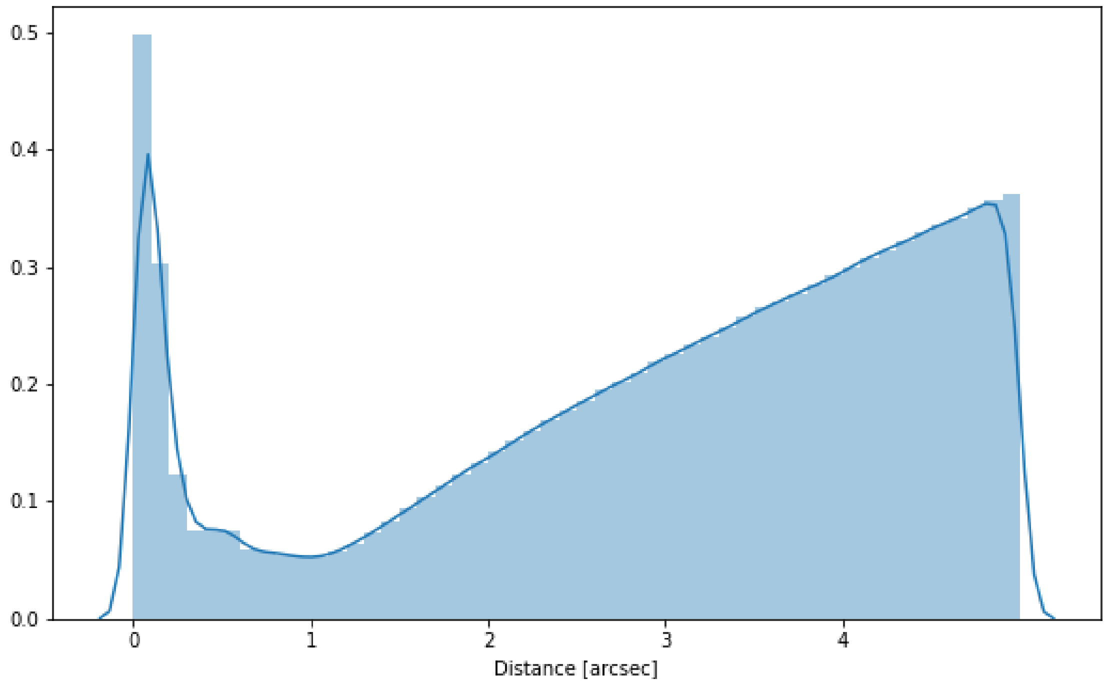
```
The initial catalogue had 940853 sources.
The cleaned catalogue has 908480 sources (32373 removed).
The cleaned catalogue has 32244 sources flagged as having been cleaned


The initial catalogue had 1002561 sources.
The cleaned catalogue has 970203 sources (32358 removed).
The cleaned catalogue has 32252 sources flagged as having been cleaned


The initial catalogue had 901094 sources.
The cleaned catalogue has 873890 sources (27204 removed).
The cleaned catalogue has 27129 sources flagged as having been cleaned


The initial catalogue had 899484 sources.
The cleaned catalogue has 870730 sources (28754 removed).
The cleaned catalogue has 28686 sources flagged as having been cleaned
```

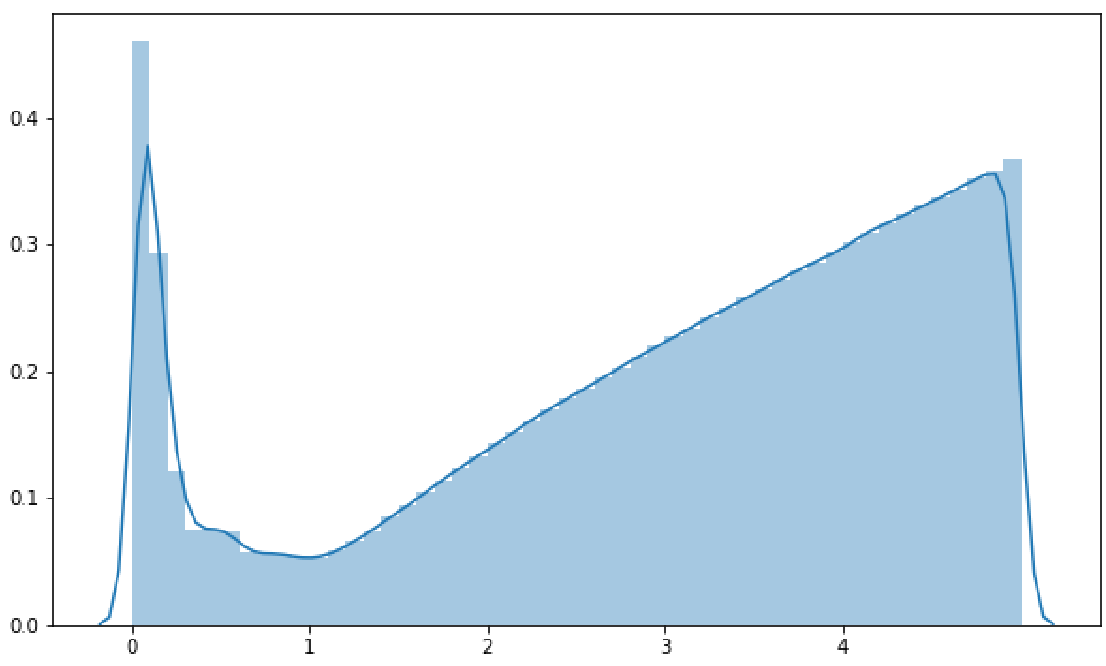
```
The initial catalogue had 842590 sources.
The cleaned catalogue has 818902 sources (23688 removed).
The cleaned catalogue has 23589 sources flagged as having been cleaned
```

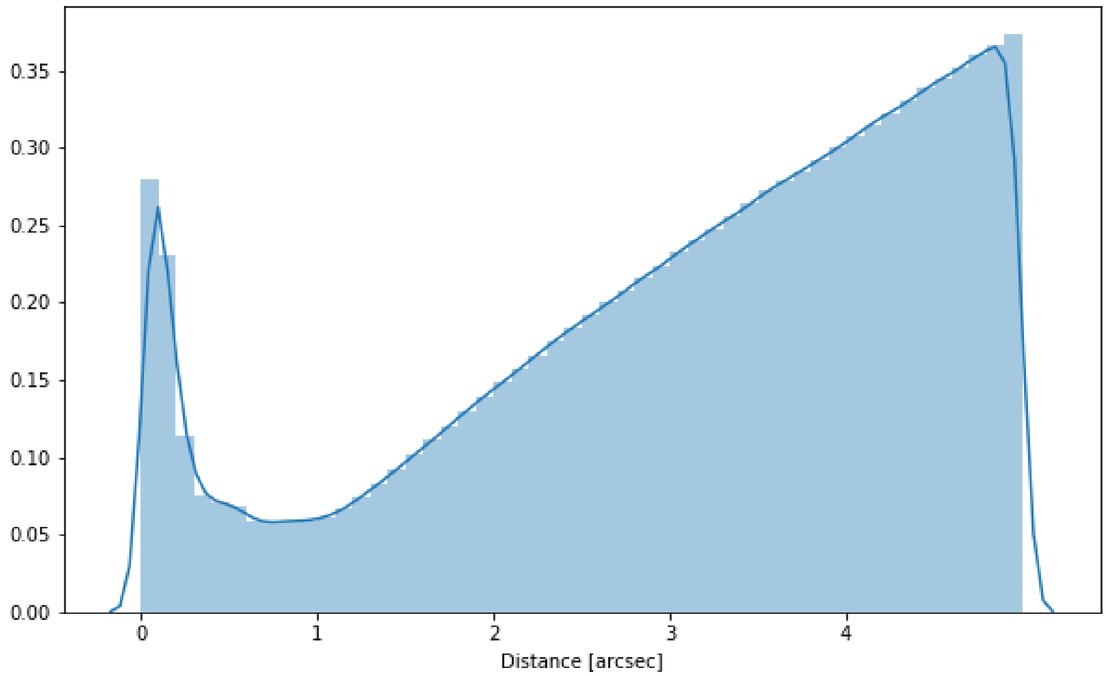
1.3 Merging different bands

SXDS has indivdual extractions from each band. We must therefore merge them as if they were individual catalogues (they have different




0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
Distance [arcsec]


0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
Distance [arcsec]



1.4 Fill masked values and add fluxes and nans

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:9: R
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:10:
```

```
Out[26]: <IPython.core.display.HTML object>
```

1.5 Combine stellarities

```
sxds_b_stellarity, sxds_v_stellarity, sxds_r_stellarity, sxds_i_stellarity, sxds_z_stellarity
```

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

1.6 II - Removal of duplicated sources

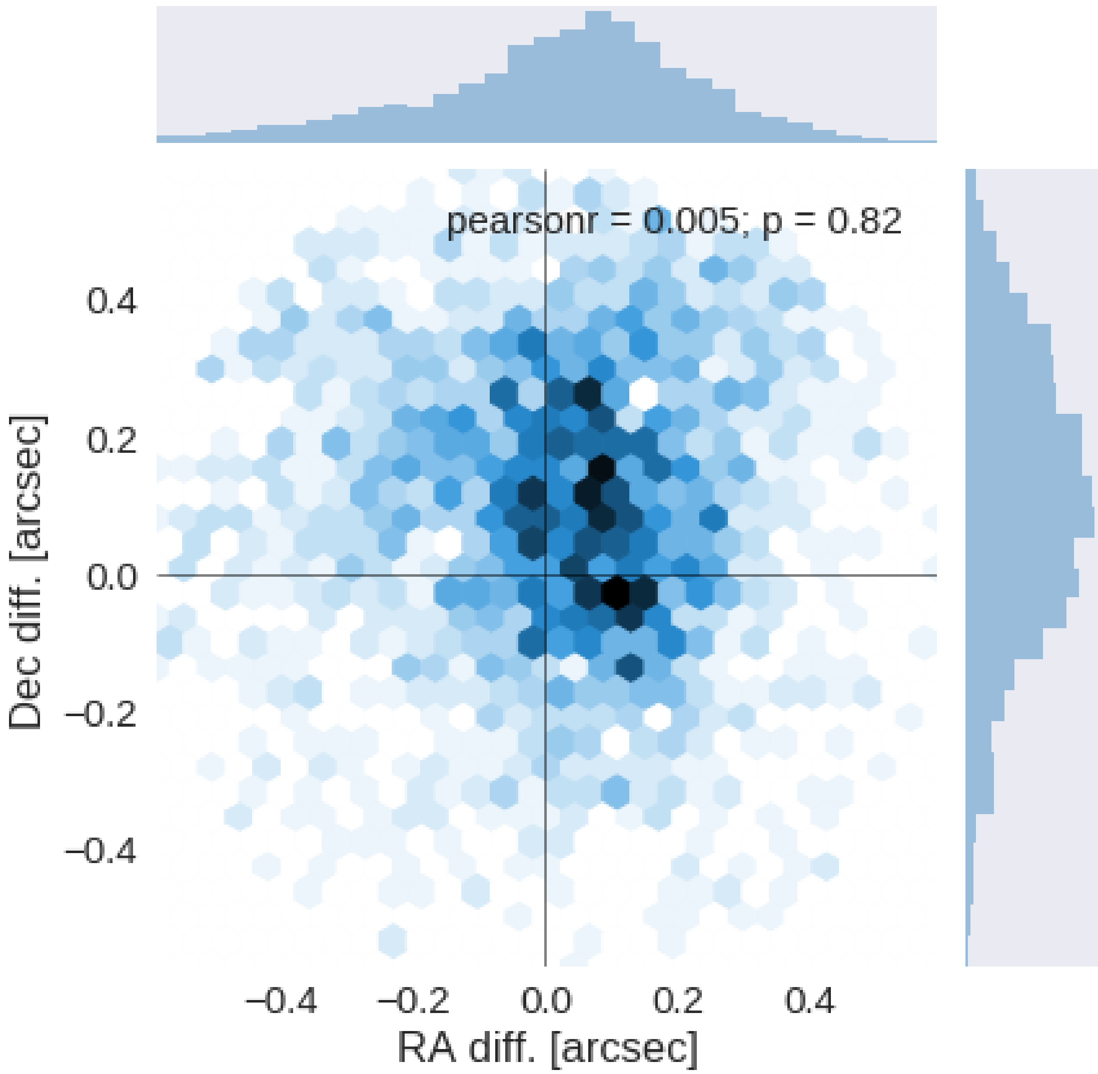
We remove duplicated objects from the input catalogues.

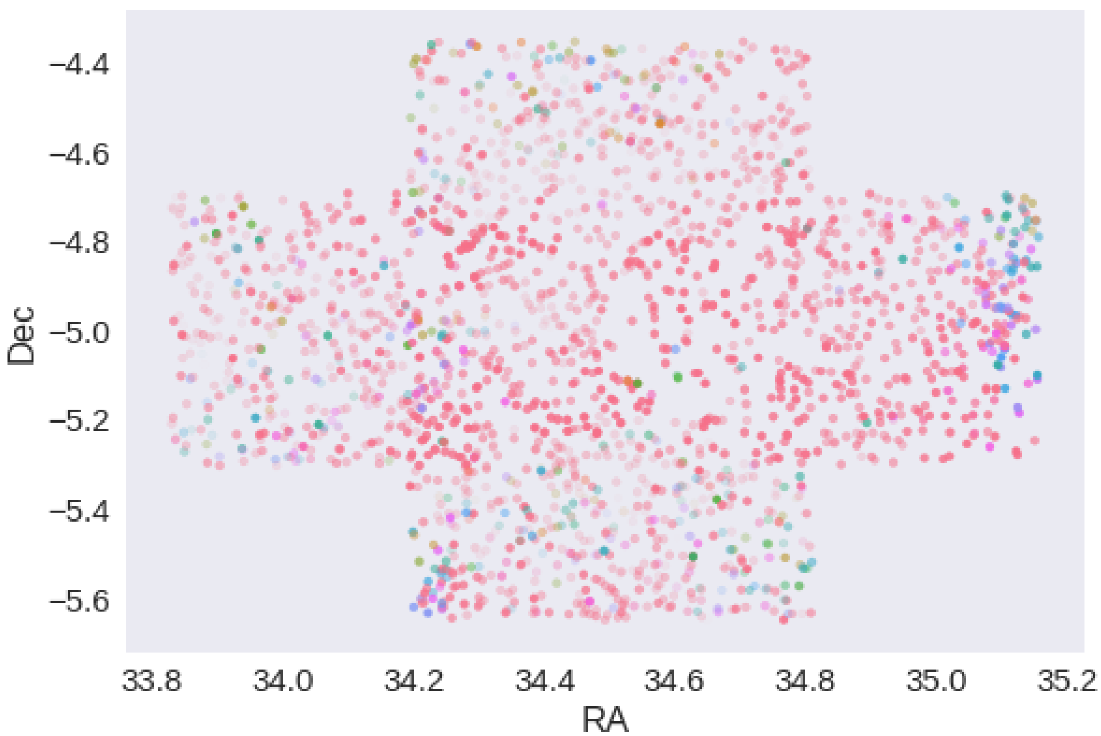
```
The initial catalogue had 1522678 sources.
The cleaned catalogue has 1512687 sources (9991 removed).
The cleaned catalogue has 10007 sources flagged as having been cleaned
```

```
Out[33]: <IPython.core.display.HTML object>
```

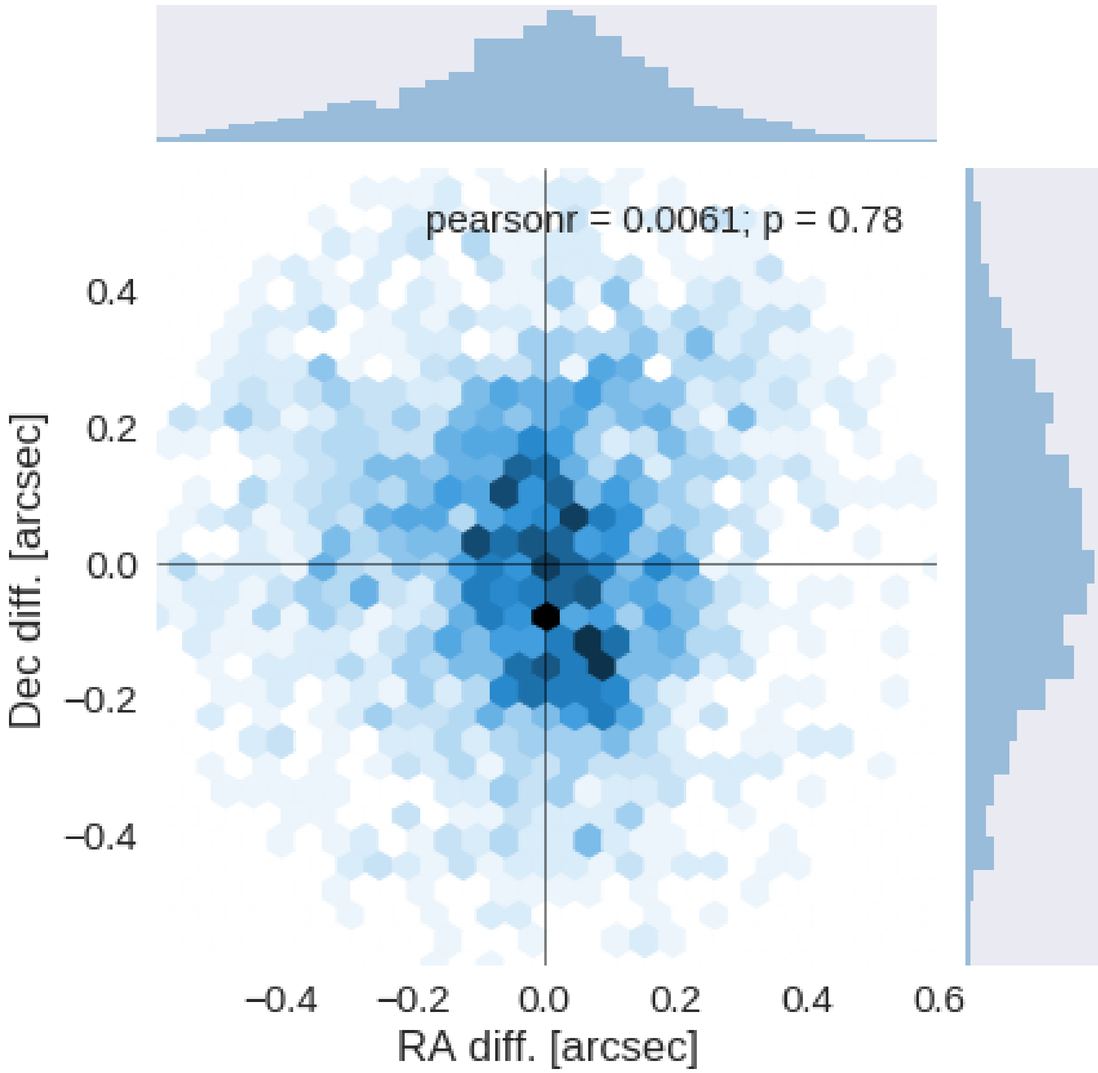
1.7 III - Astrometry correction

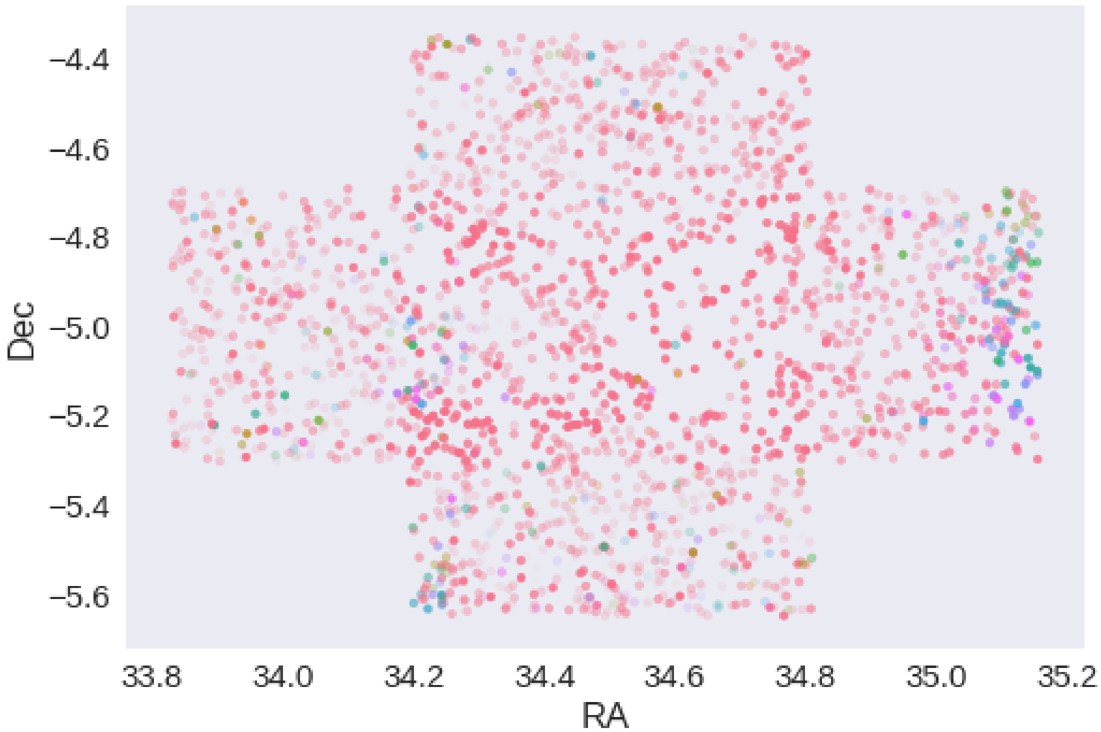
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: -0.050656639996304875 arcsec
Dec correction: -0.1055842856297673 arcsec
```


pearsonr = 0.0061; p = 0.78
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
0.6
RA diff. [arcsec]



1.8 IV - Flagging Gaia objects

```
2954 sources flagged.
```

2 V - Saving to disk

1.12_SpARCS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of Spitzer Adaptation of the Red-sequence Cluster Survey (SpARCS) data

This catalogue comes from `dmu0_SpARCS`. Alexandru Tudorica confirmed that the magnitudes are AB ones and are not aperture corrected.

In the catalogue, we keep:

- The internal identifier (this one is only in HeDaM data);
- The position;
- The ugrzy magnitudes in the 8th aperture (11Œ0.186=2.046 arcsec).
- The "auto" magnitudes.

The maps on the web page indicate they were observed in 2012 (or late 2011). Let's use 2012 as epoch.

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

1.2 I - Parametres for 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.

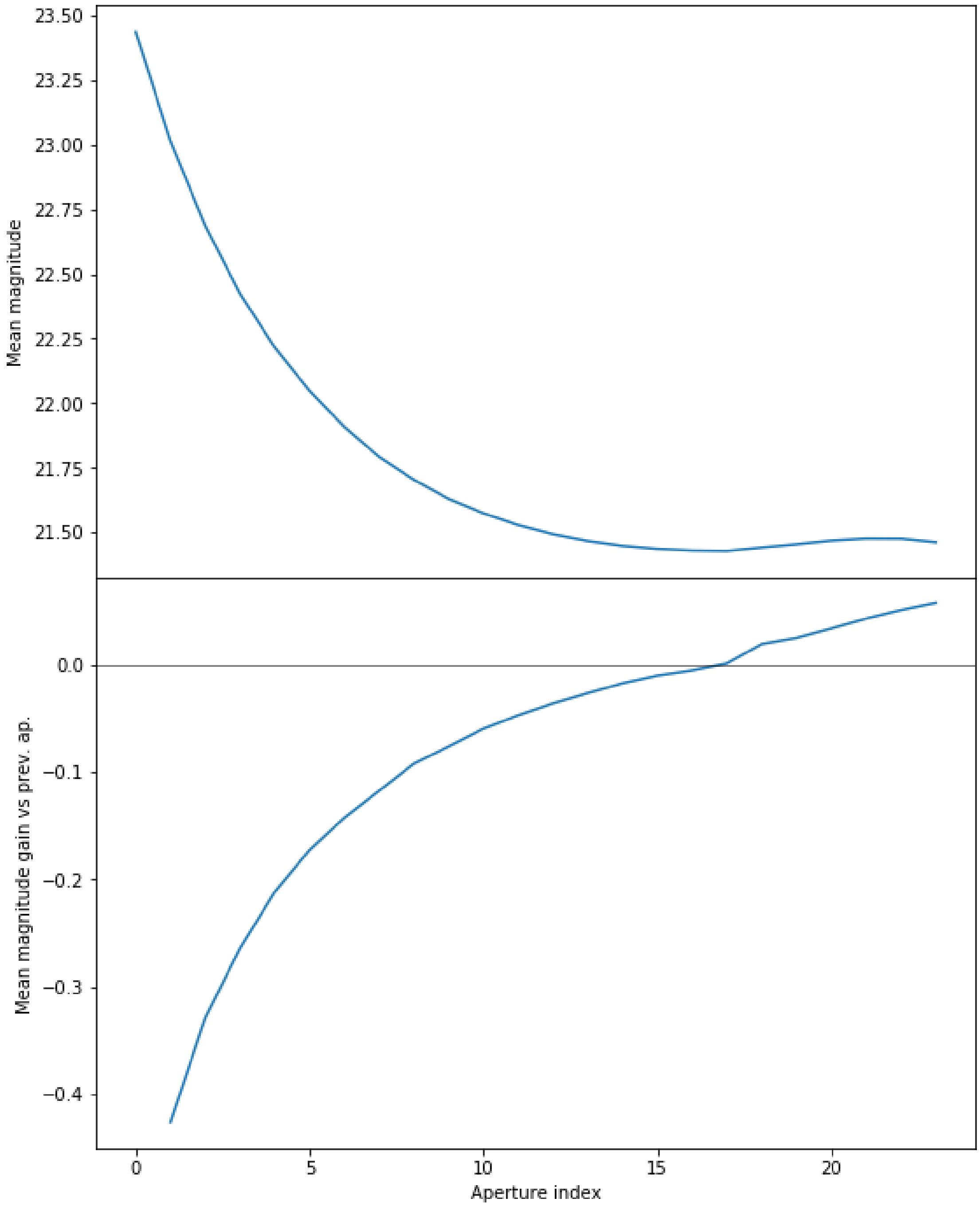
Target aperture: To determine the target aperture, we simulate a curve of growth using the provided apertures and draw two figures: - The evolution of the magnitudes of the objects by plotting on the same plot aperture number vs the mean magnitude. - The mean gain (loss when negative) of magnitude is 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.

```
WARNING: UnitsWarning: '""' did not parse as fits unit: Invalid character at col 0 [astropy.unit
```

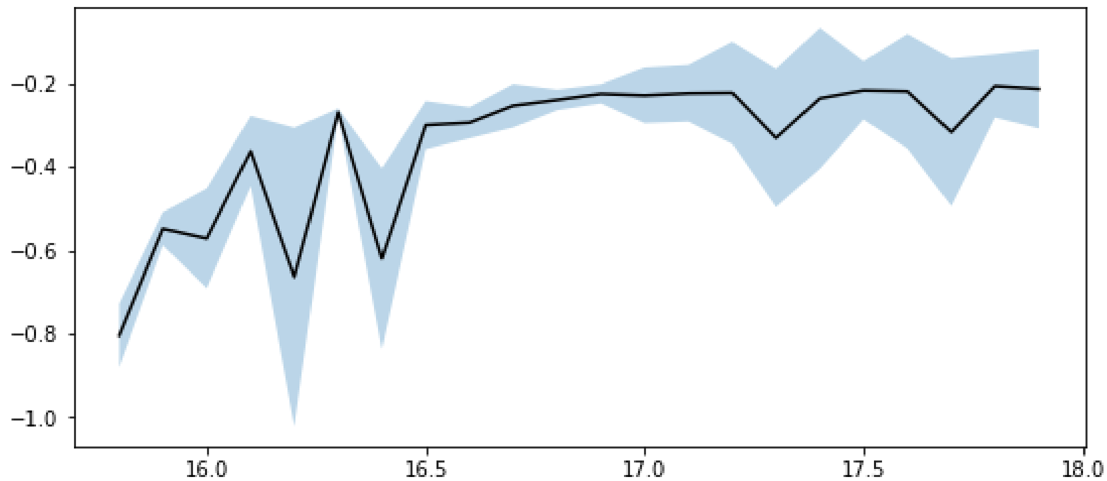
1.2.1 I.a r-band



We will use the 16th (aperture number above begin to 0) aperture as target.

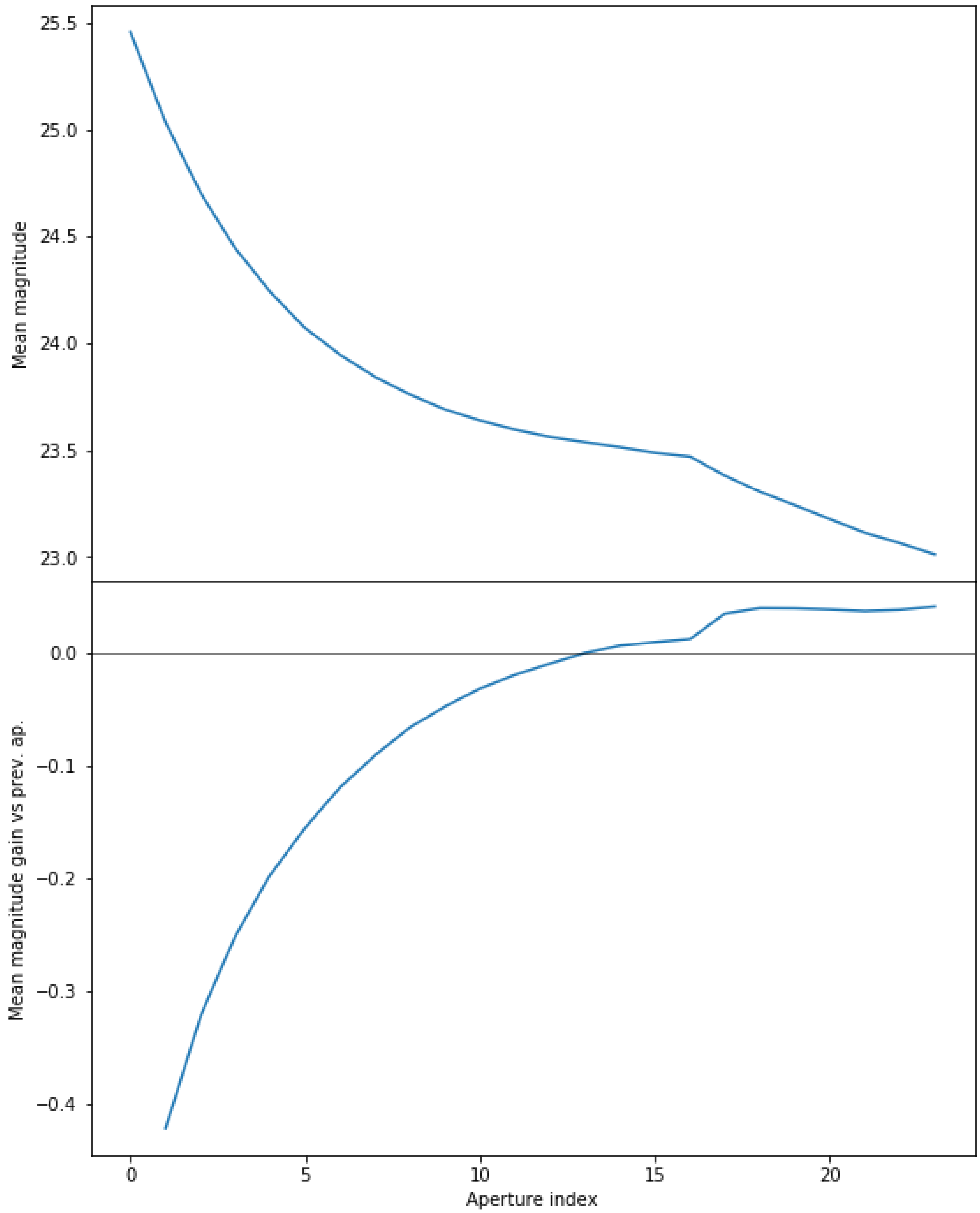
```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
```

```
mask &= (mag <= mag_max)
```



We use magnitudes between 17 and 17.9.

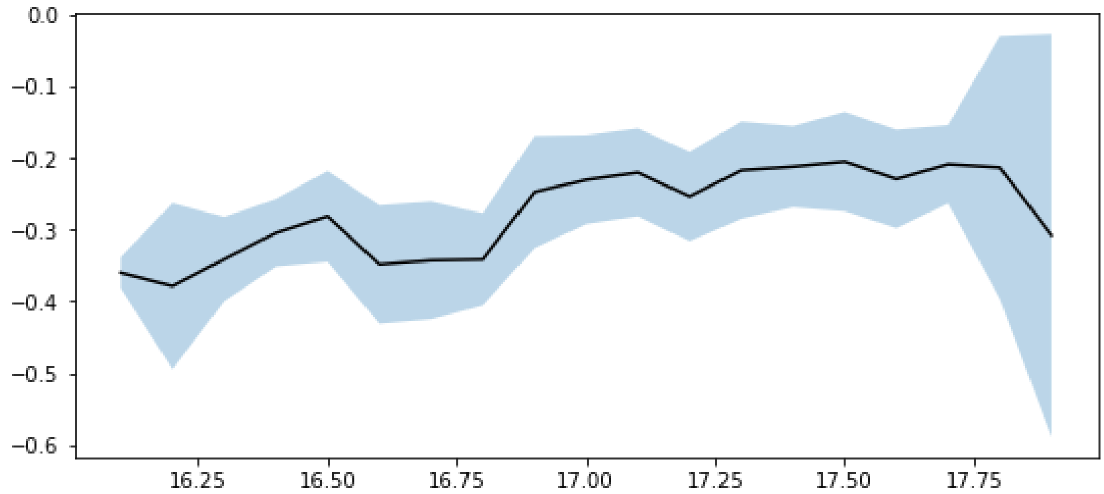
1.2.2 I.b u-band



We will use the 16th (aperture number above begin to 0) aperture as target. Should we use the 12nd because of the increasing magnitude?

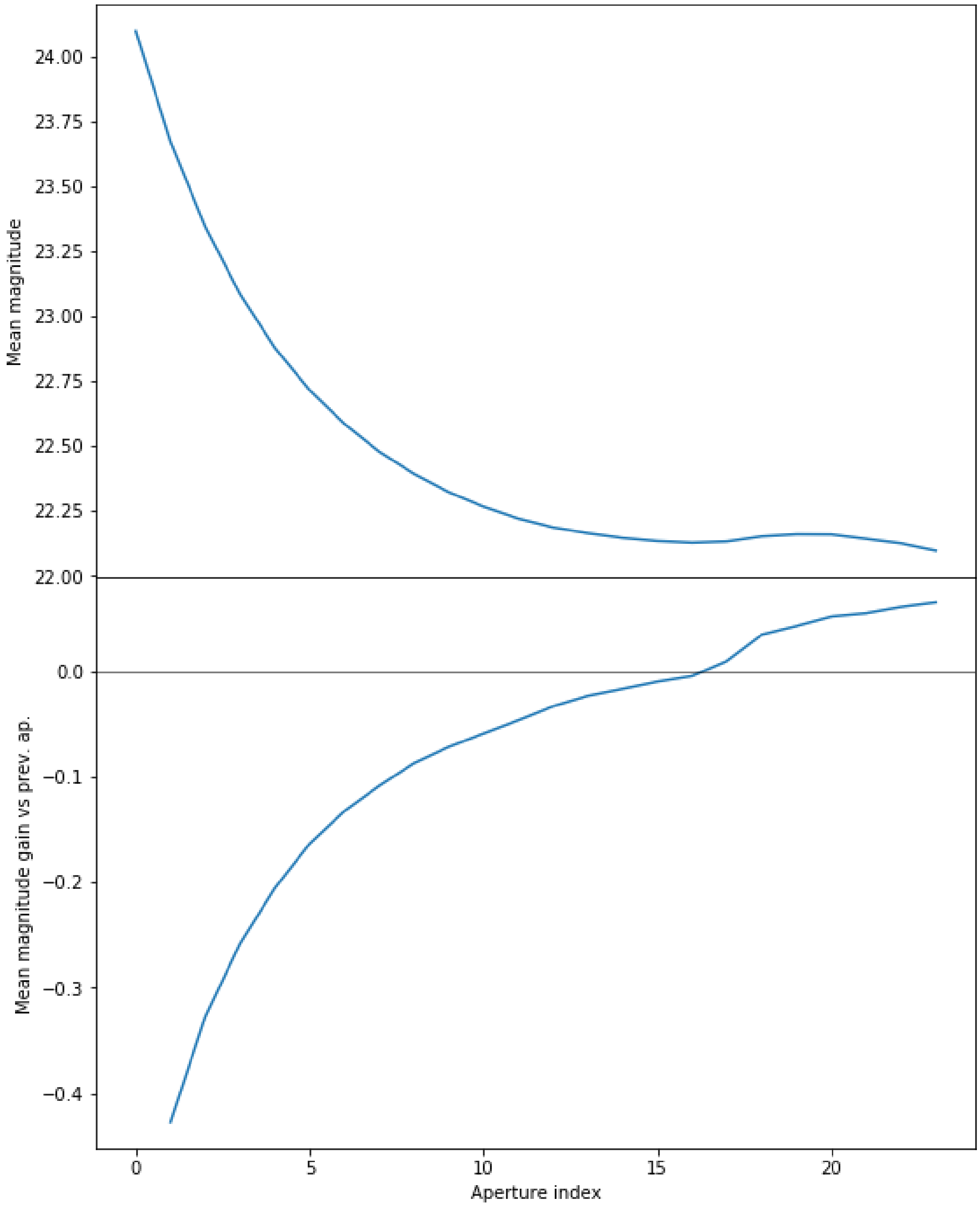
```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
```

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)
```



We use magnitudes between 17 and 17.9.

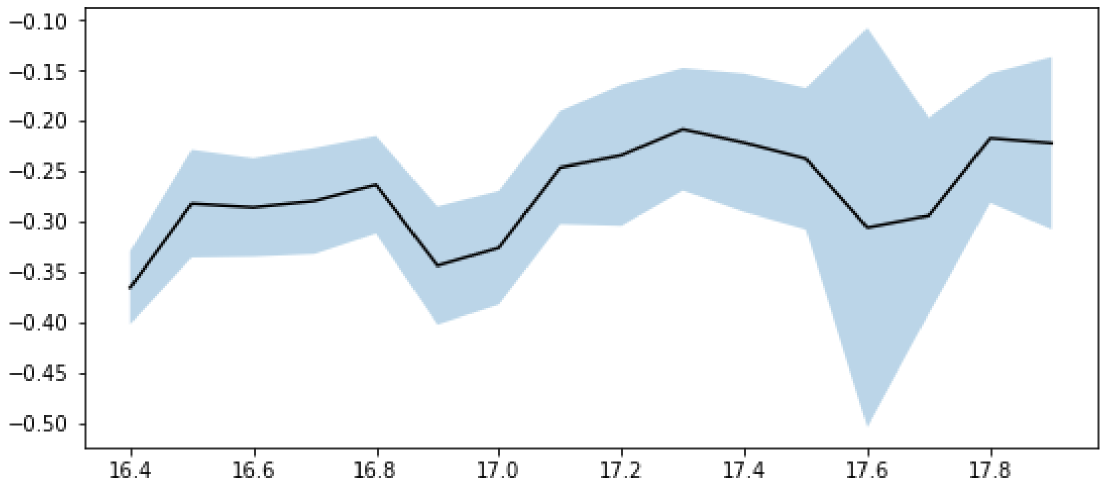
1.2.3 I.c g-band



We will use the 16th (aperture number above begin to 0) aperture as target.

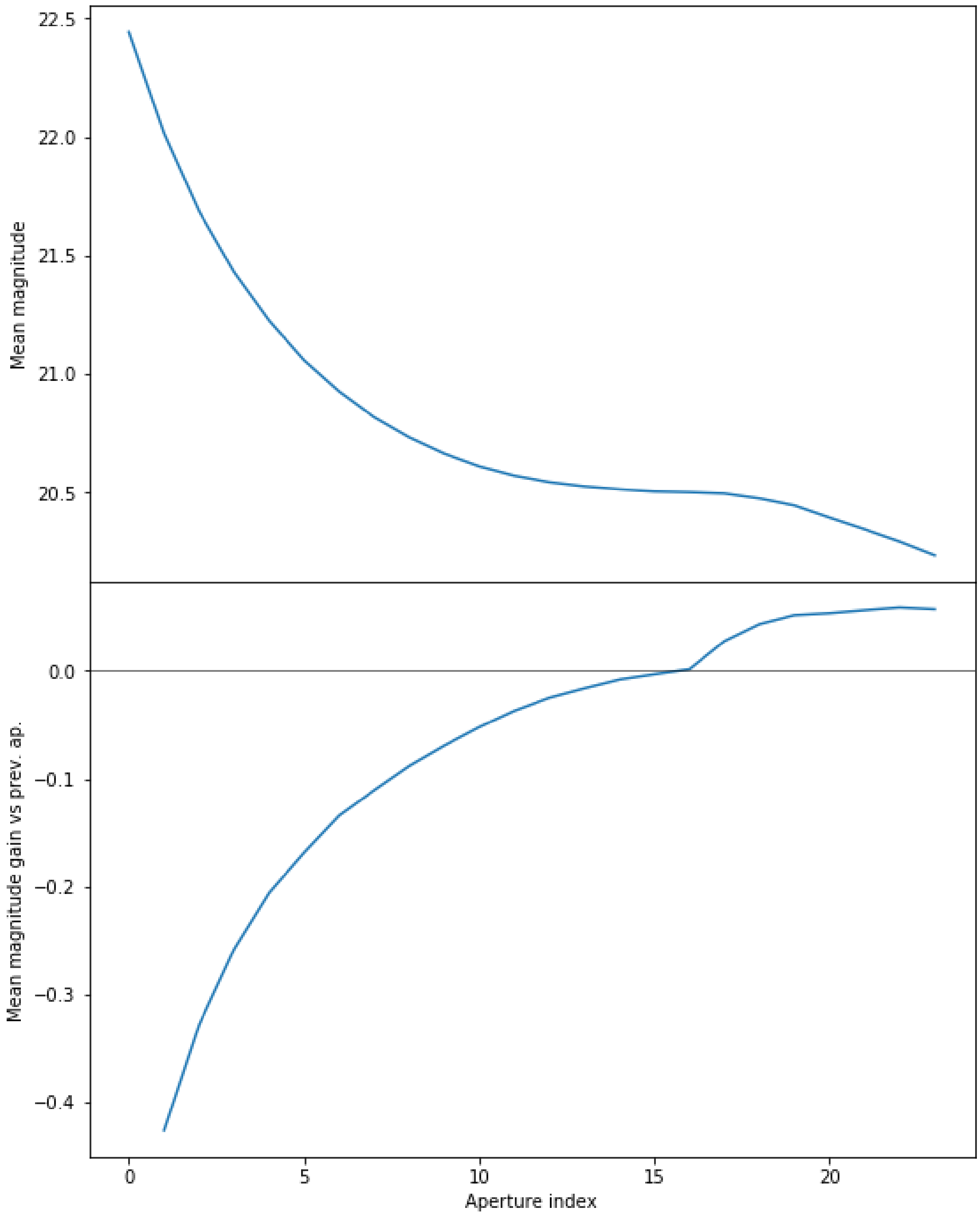
```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
```

```
mask &= (mag <= mag_max)
```



We use magnitudes between 17.2 and 18.

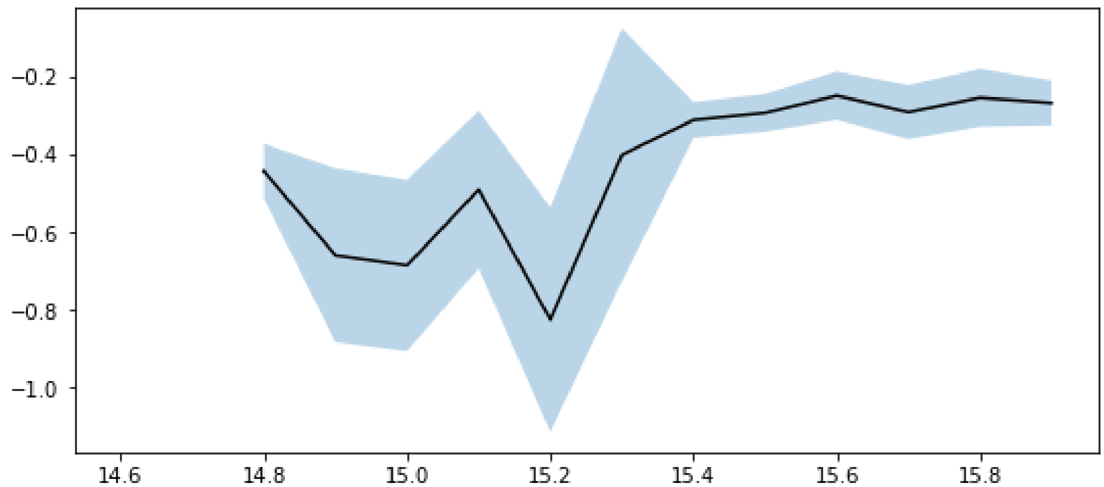
1.2.4 I.d z-band



We will use the 16th (aperture number above begin to 0) aperture as target.

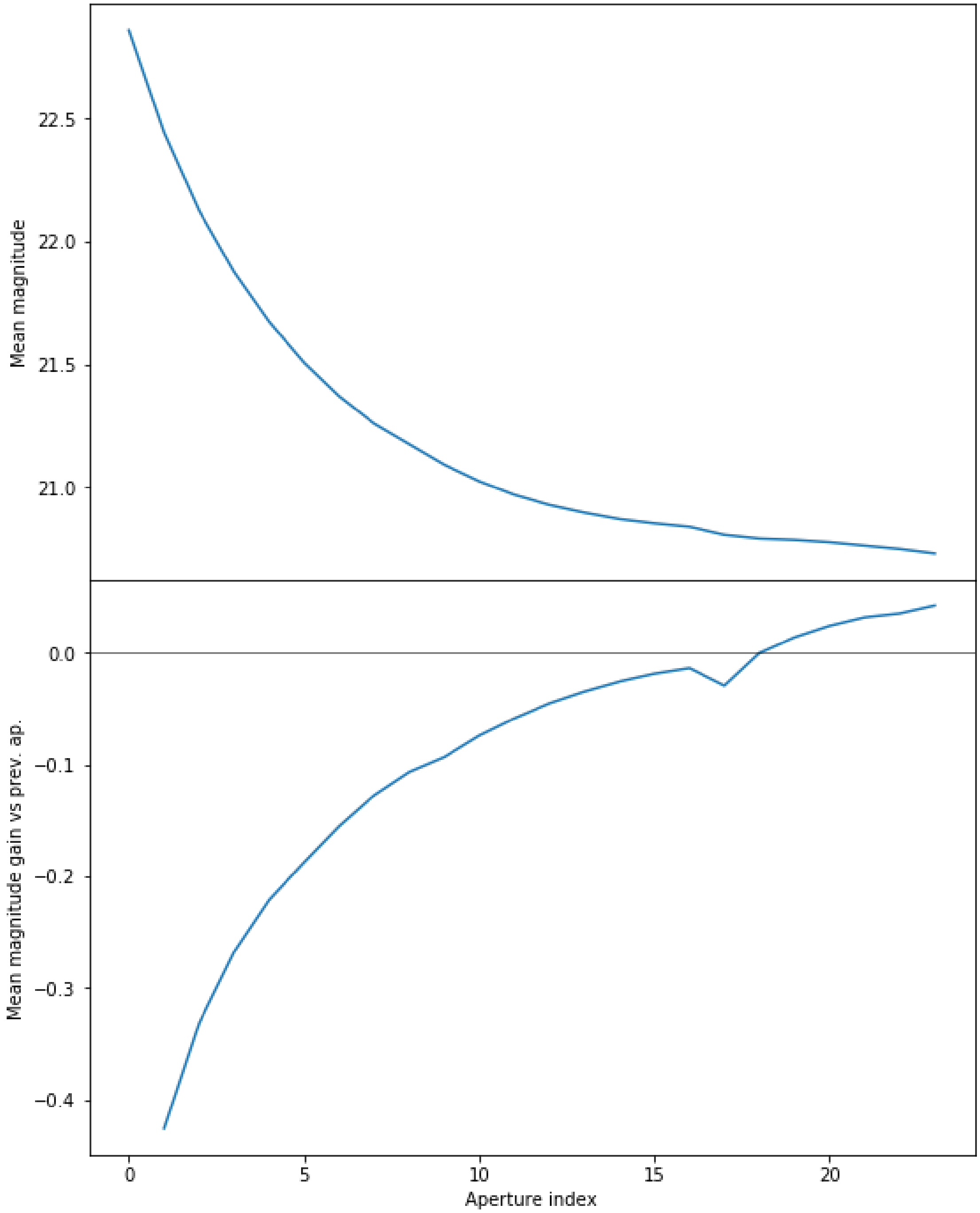
```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
```

```
mask &= (mag <= mag_max)
```



We use magnitudes between 16 and 17.

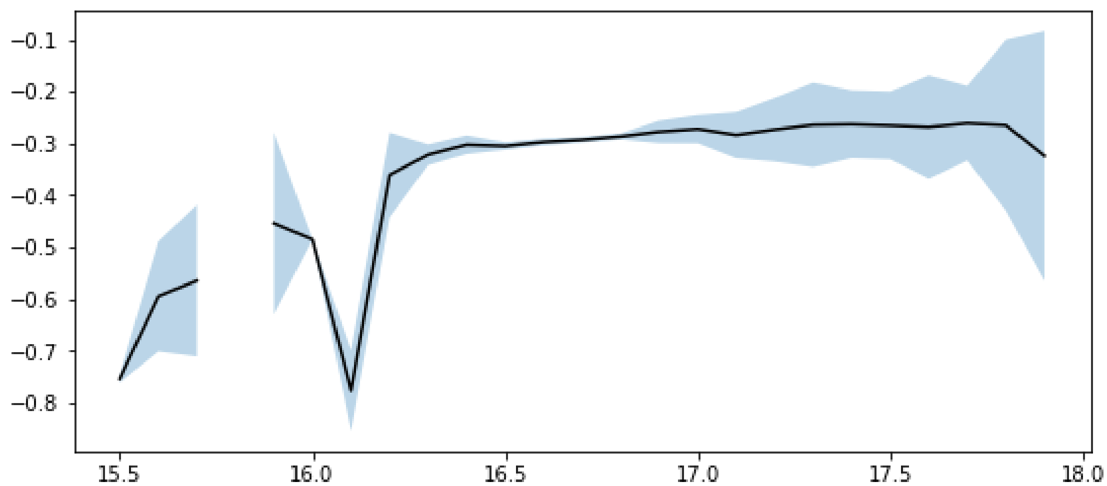
1.2.5 I.e y-band



We will use the 16th (aperture number above begin to 0) aperture as target.

```
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
```

```
  mask &= (mag <= mag_max)
```



We use mags between 16.5 and 17.5

1.3 II - Column selection

```
WARNING: UnitsWarning: '""' did not parse as fits unit: Invalid character at col 0 [astropy.unit
/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/herschelhelp_internal/herschelhelp_internal/utils.py:131: RuntimeWarning: invalid value enc
  mask &= (mag >= mag_min)
/opt/herschelhelp_internal/herschelhelp_internal/utils.py:133: RuntimeWarning: invalid value enc
  mask &= (mag <= mag_max)


Aperture correction for SpARCS band u:
Correction: -0.21997451782226562
Number of source used: 325
RMS: 0.06430433467975358

Aperture correction for SpARCS band g:
Correction: -0.23264789581298828
Number of source used: 487
RMS: 0.06903040173673632

Aperture correction for SpARCS band r:
Correction: -0.2197418212890625
Number of source used: 821
RMS: 0.10640508916122655
```

```
Aperture correction for SpARCS band z:
Correction: -0.2187061309814453
Number of source used: 1058
RMS: 0.06586610521457599

Aperture correction for SpARCS band y:
Correction: -0.2814064025878906
Number of source used: 521
RMS: 0.055379872136121035
```

```
Out[17]: <IPython.core.display.HTML object>
```

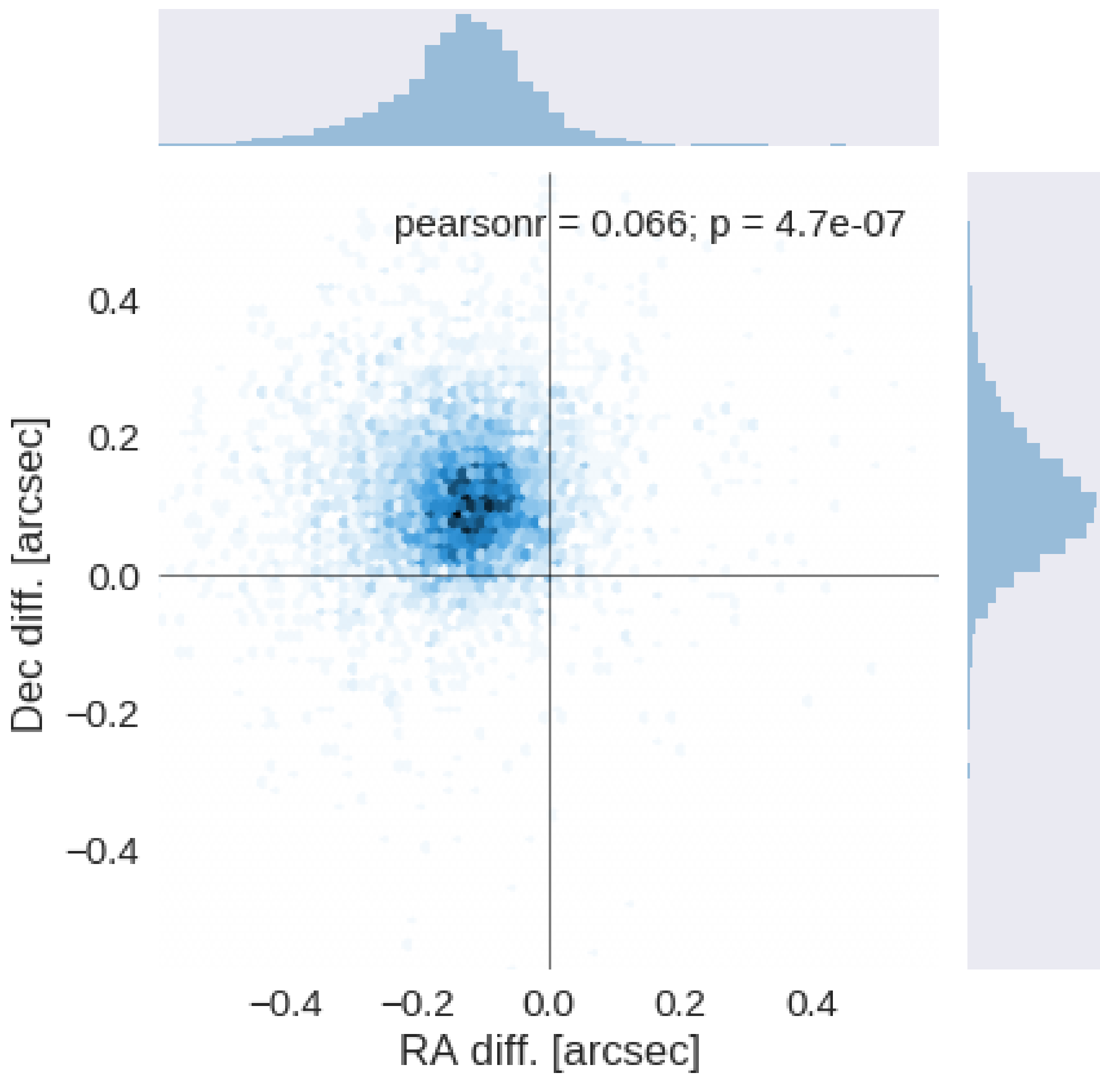
1.4 II - Removal of duplicated sources

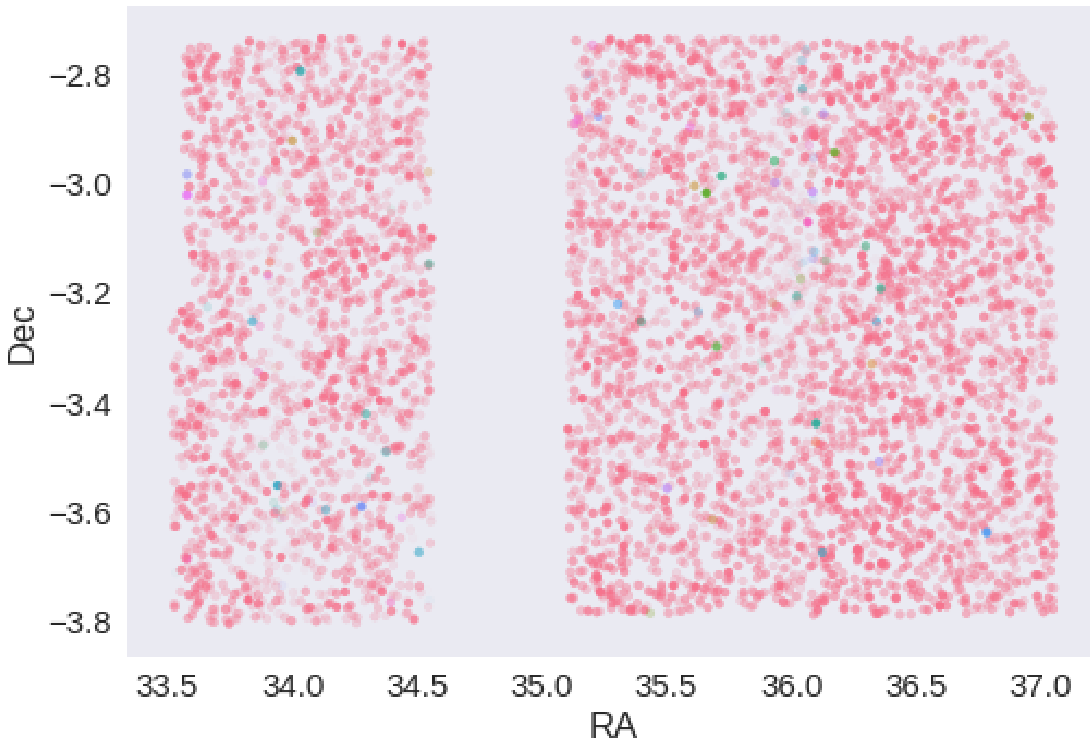
We remove duplicated objects from the input catalogues.

```
/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 447768 sources.
The cleaned catalogue has 447768 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

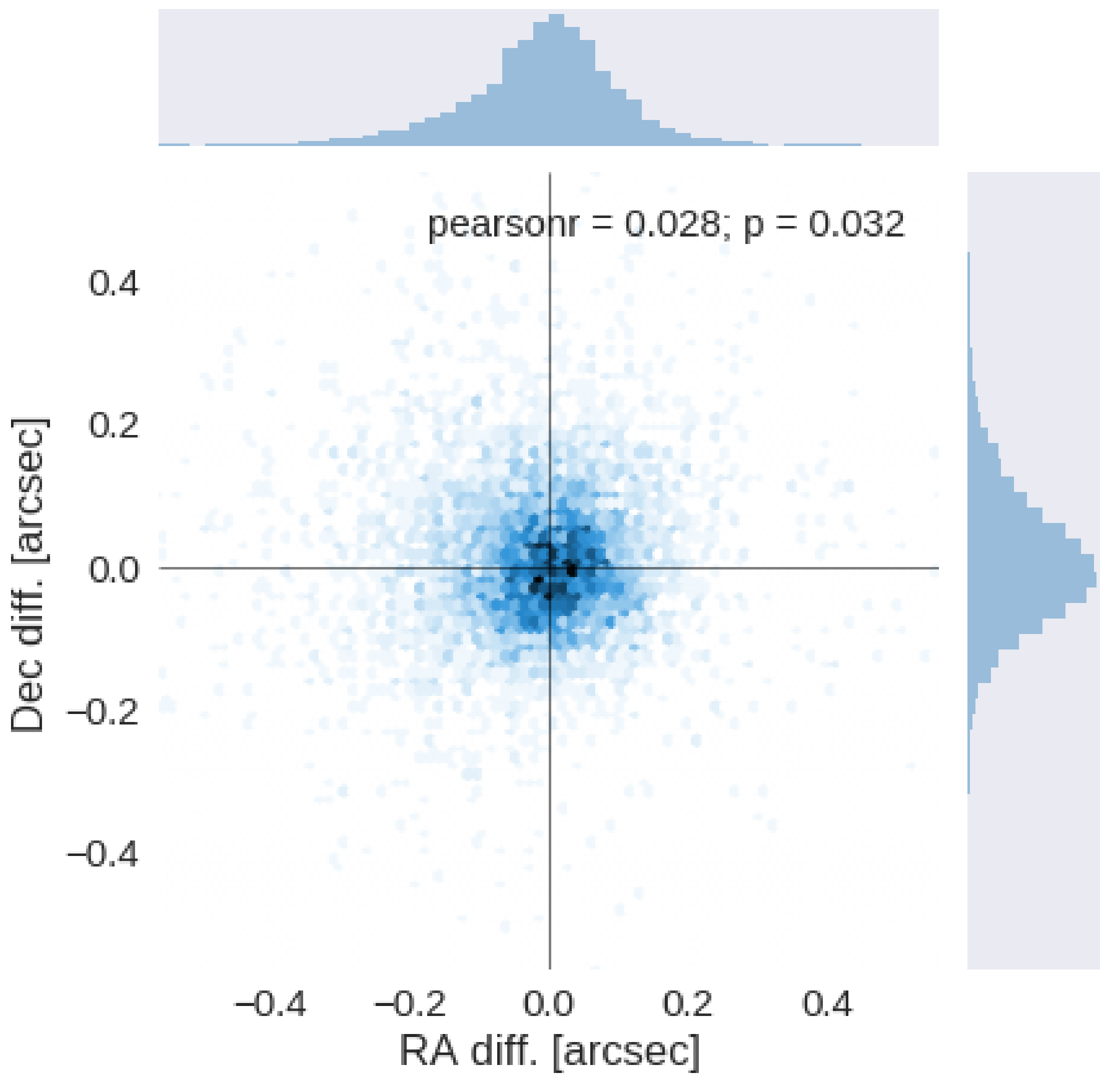
1.5 III - Astrometry correction

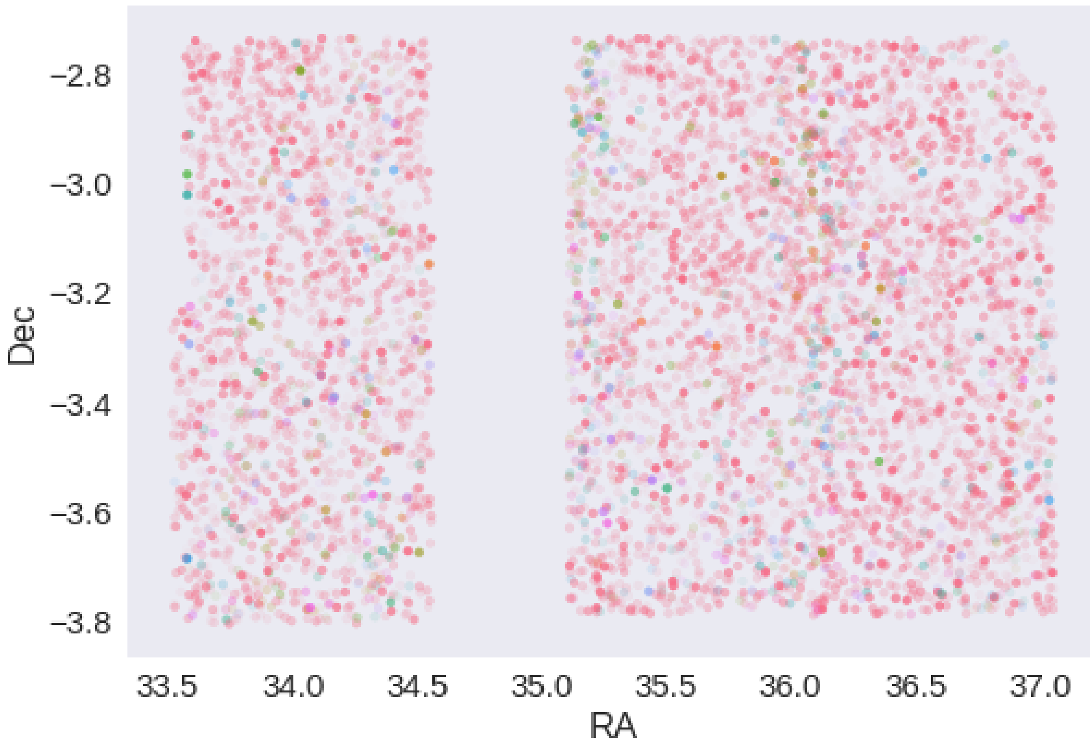
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.066; p = 4.7e-07
Dec diff. [arcsec]
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]




```
RA correction: 0.1243786283438908 arcsec
Dec correction: -0.10356365148096458 arcsec
```


pearsonr = 0.028; p = 0.032
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]



1.6 IV - Flagging Gaia objects

```
6126 sources flagged.
```

1.7 V - Saving to disk

1.13_UKIDSS-DXS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of UKIRT Infrared Deep Sky Survey / Deep Extragalactic Survey (UKIDSS/DXS)

The catalogue comes from `dmu0_UKIDSS-DXS_DR10plus`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The magnitude for each band in apertude 3 (2 arcsec).
- The kron magnitude to be used as total magnitude (no "auto" magnitude is provided).

The magnitudes are "*Vega like*". The AB offsets are given by Hewett *et al.* (2016):

Band	AB offset
J	0.938
H	1.379
K	1.900

A query to the UKIDSS database with 242.9+55.071 position returns a list of images taken between 2007 and 2009. Let's take 2008 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: 'degrees' did not parse as fits unit: At col 0, Unit 'degrees' 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

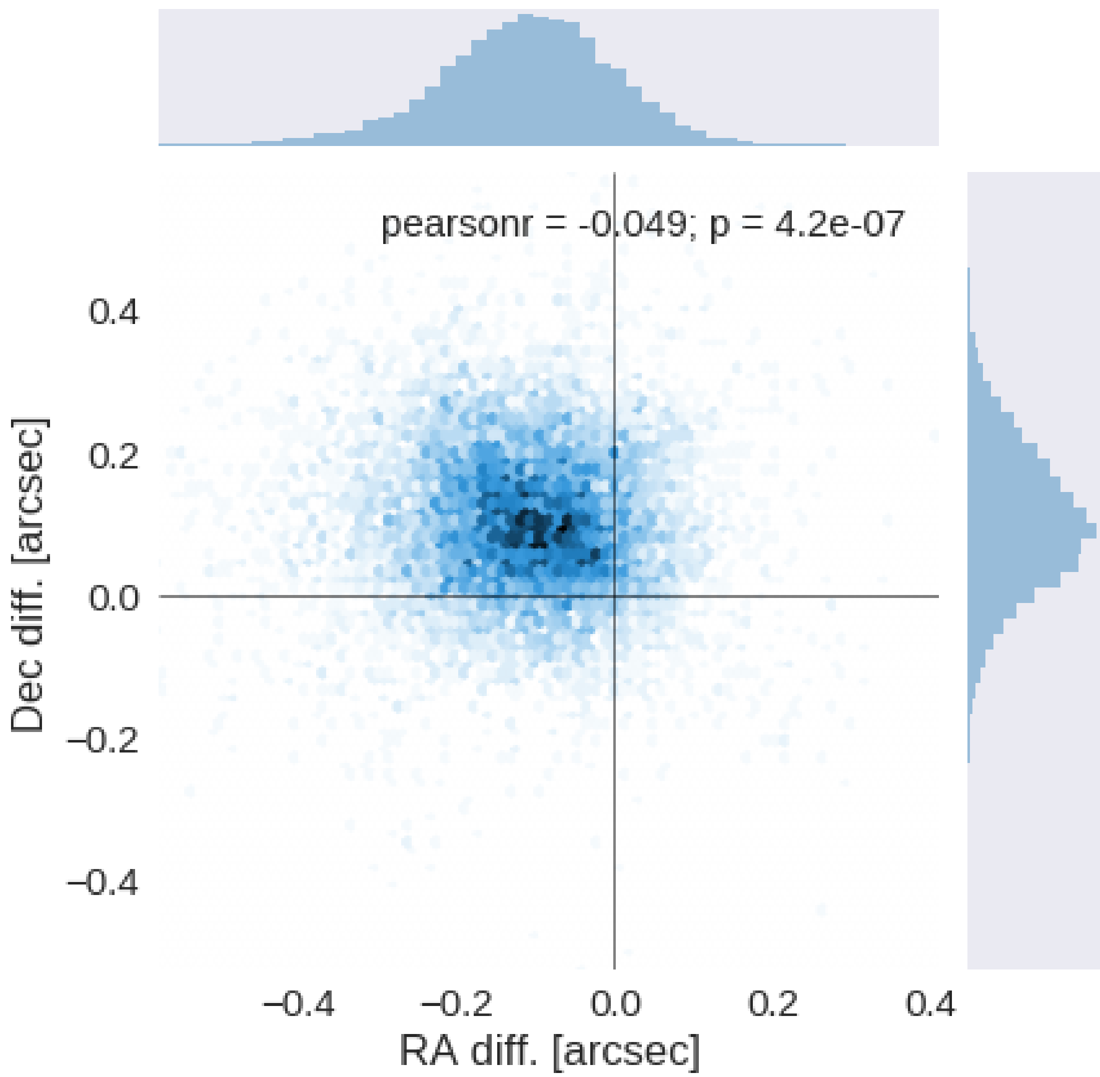
We remove duplicated objects from the input catalogues.

```
/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)
```

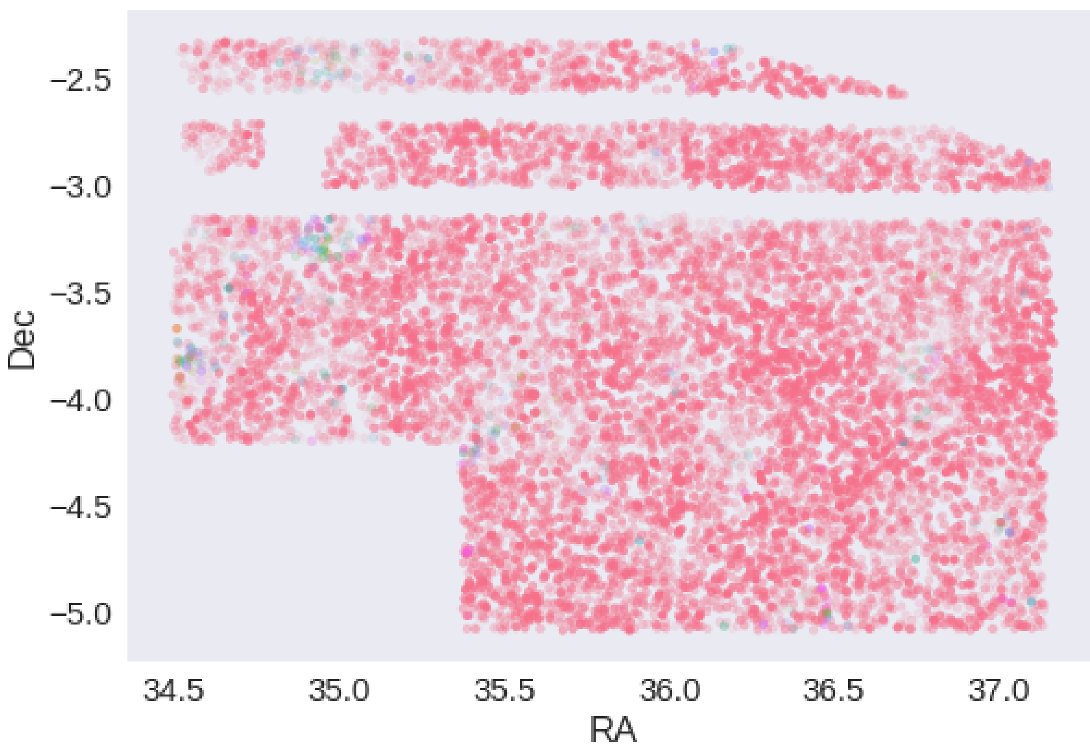
```
The initial catalogue had 428666 sources.
The cleaned catalogue has 428225 sources (441 removed).
The cleaned catalogue has 439 sources flagged as having been cleaned
```

1.4 III - Astrometry correction

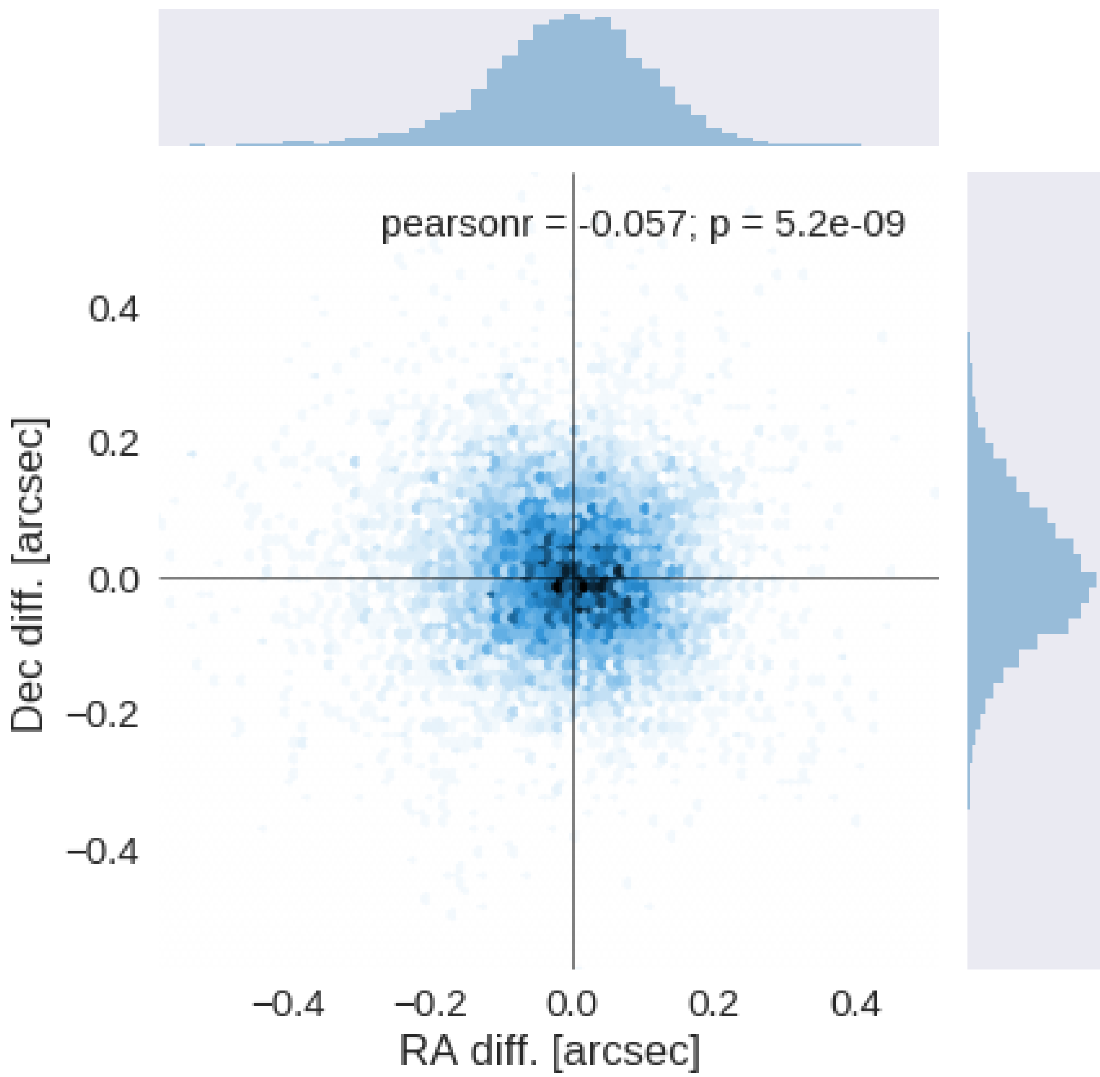
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.

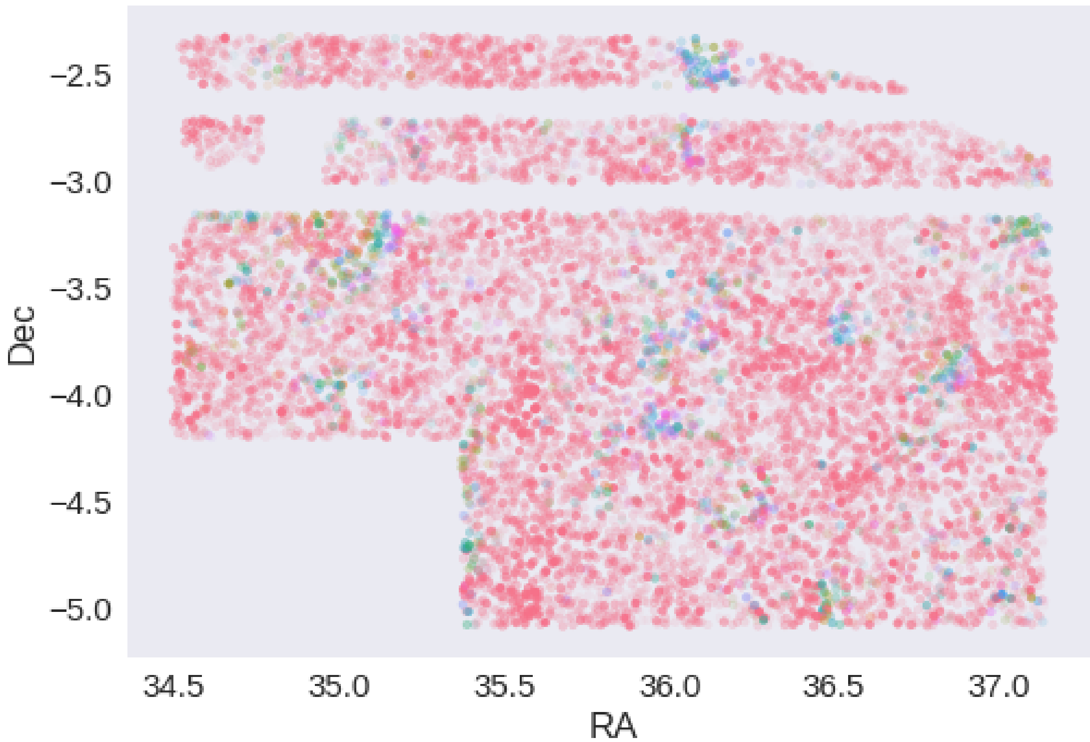


pearsonr = -0.049; p = 4.2e-07
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
0.4
RA diff. [arcsec]




```
RA correction: 0.10588225883907398 arcsec
Dec correction: -0.09947294019285735 arcsec
```


pearsonr = -0.057; p = 5.2e-09
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

```
10794 sources flagged.
```

2 V - Saving to disk

1.14_UKIDSS-UDS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of UKIRT Infrared Deep Sky Survey / Ultra Deep Survey (UKIDSS/DXS)

The catalogue comes from `dmu0_UKIDSS-UDS`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The magnitude for each band in apertude 3 (2 arcsec).
- The kron magnitude to be used as total magnitude (no "auto" magnitude is provided).

The magnitudes are "*Vega like*". The AB offsets are given by Hewett *et al.* (2016):

Band	AB offset
J	0.938
H	1.379
K	1.900

A query to the UKIDSS database with 242.9+55.071 position returns a list of images taken between 2007 and 2009. Let's take 2008 for the epoch. TODO: Update for UDS.

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

1.2 I - Column selection

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

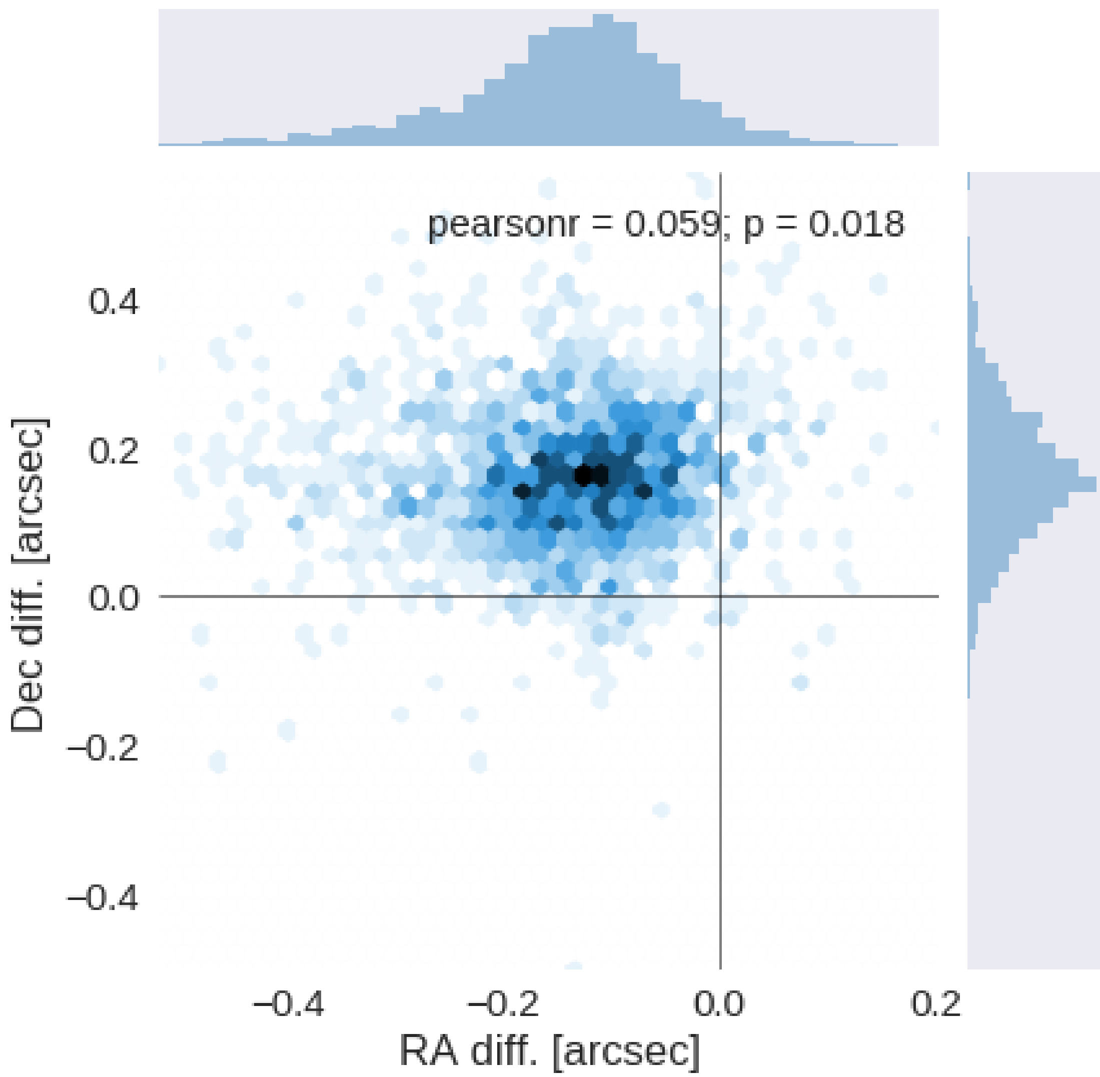
We remove duplicated objects from the input catalogues.

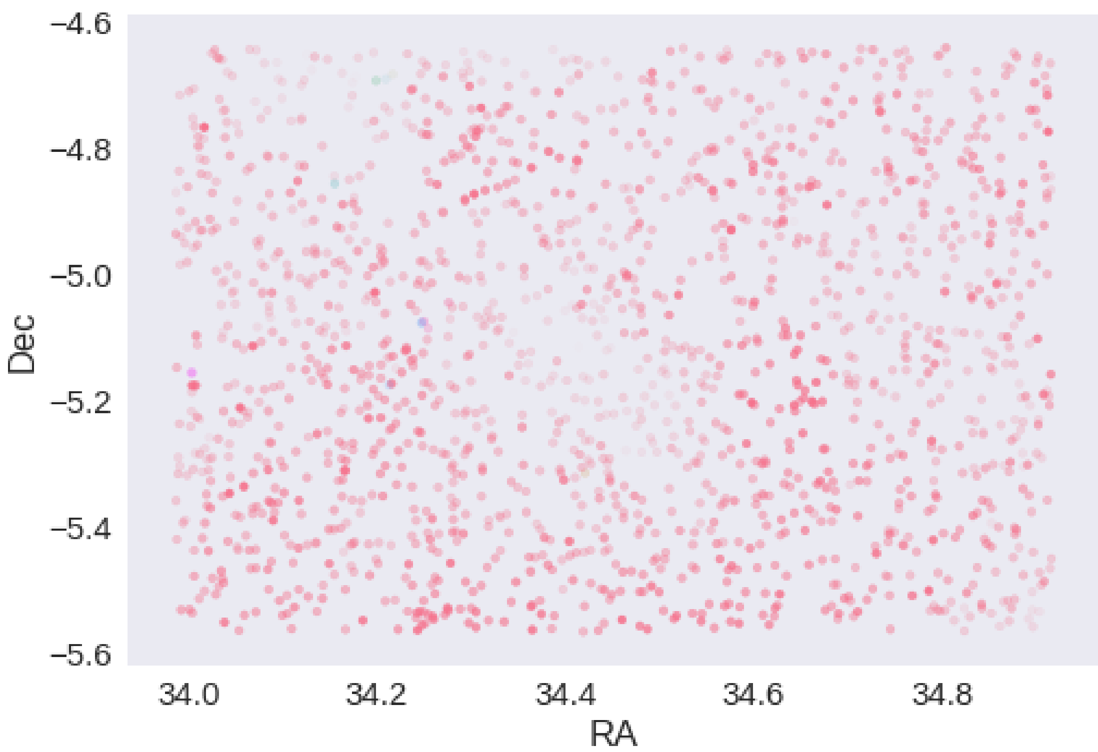
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 296026 sources.
The cleaned catalogue has 296026 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

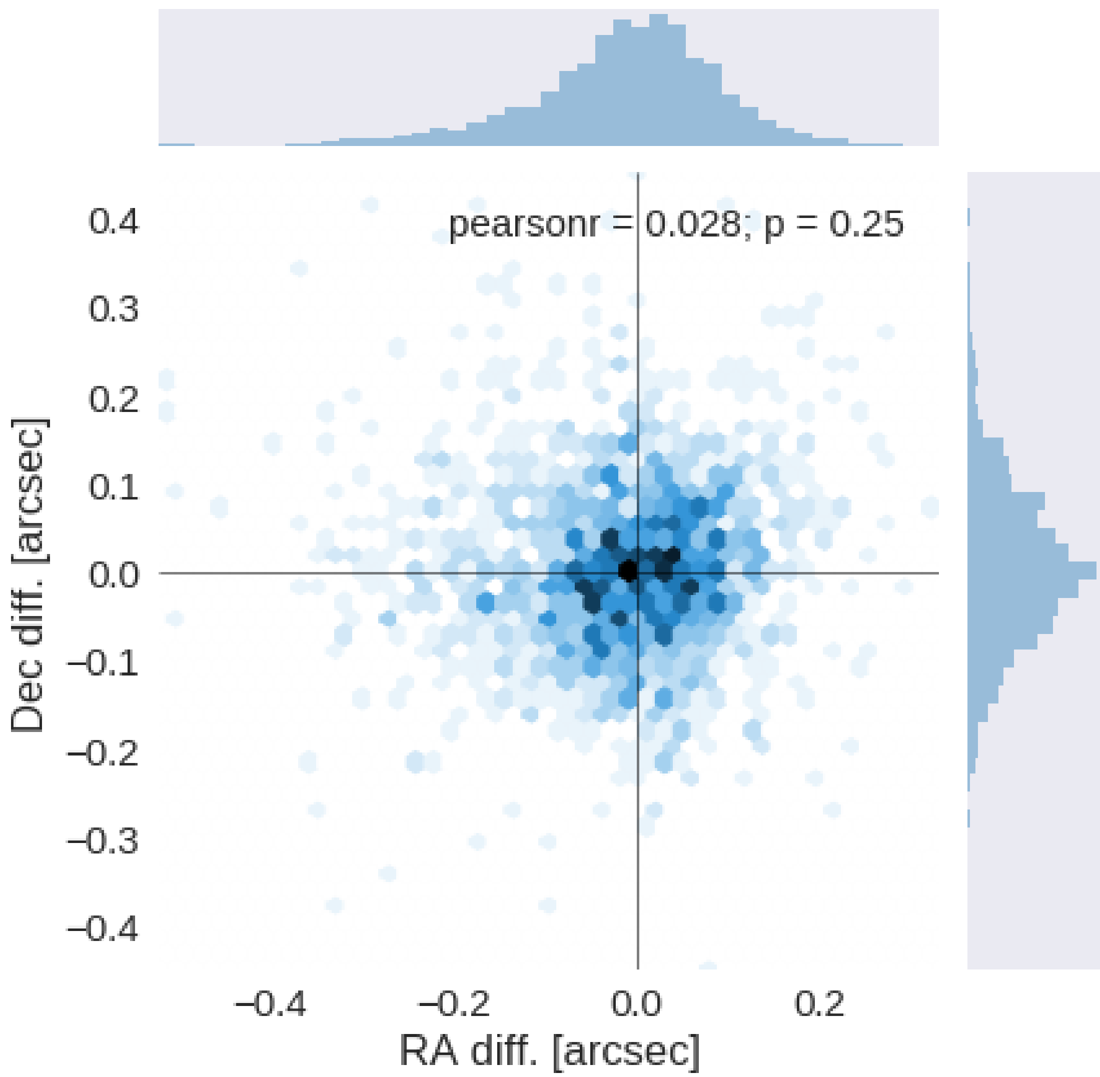
1.4 III - Astrometry correction

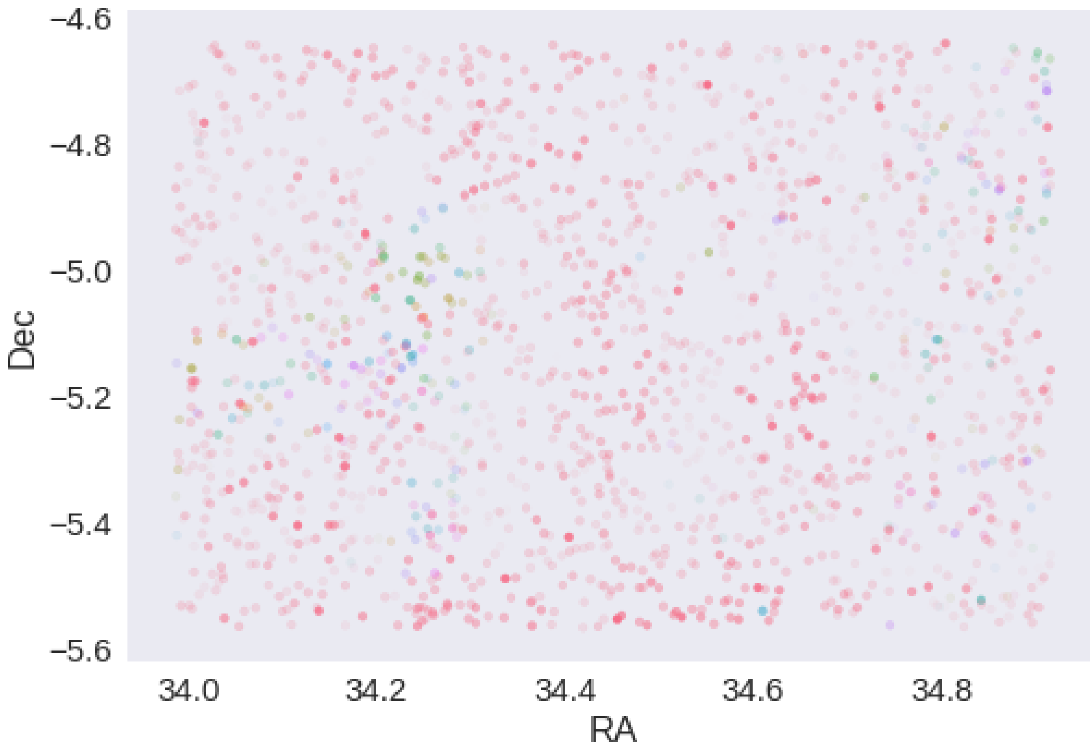
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = 0.059; p = 0.018
0.4
0.2
0.0
−0.2
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
RA diff. [arcsec]




```
RA correction: 0.12895760060445127 arcsec
Dec correction: -0.15744215684776464 arcsec
```


pearsonr = 0.028; p = 0.25
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
Dec diff. [arcsec]
−0.4
−0.2
0.0
0.2
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
1683 sources flagged.
```

2 V - Saving to disk

1.15_VIPERS

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of VIMOS Public Extragalactic Redshift Survey (VIPERS) - Multi Lambda Survey (MLS) data

This catalogue comes from `dmu0_VIPERS`.

In the catalogue, we keep:

- The `ident` as unique object identifier;
- The position which is given for all the sources;
- The ugrizy ks 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)
```

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

1.3 II - Removal of duplicated sources

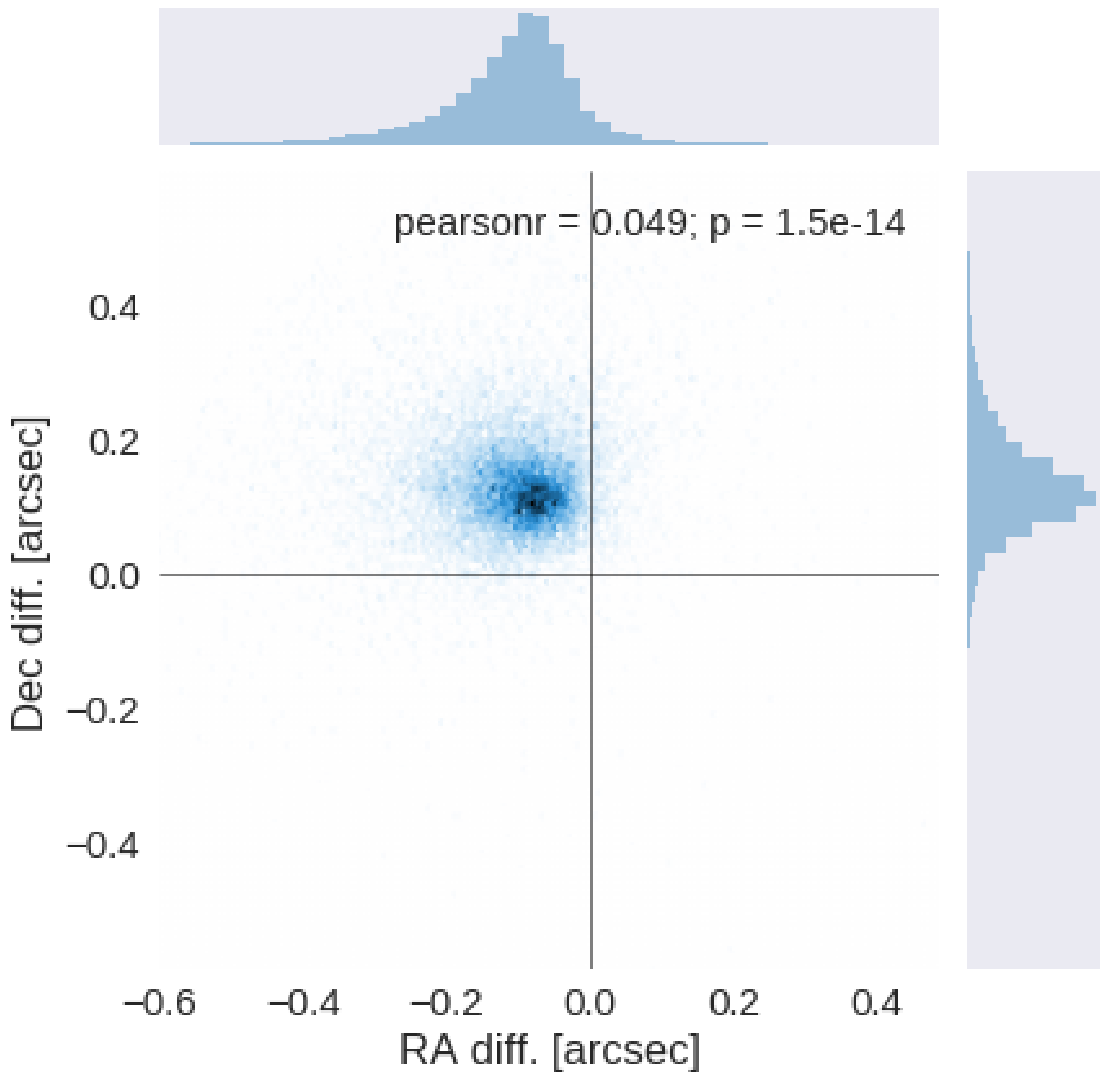
We remove duplicated objects from the input catalogues.

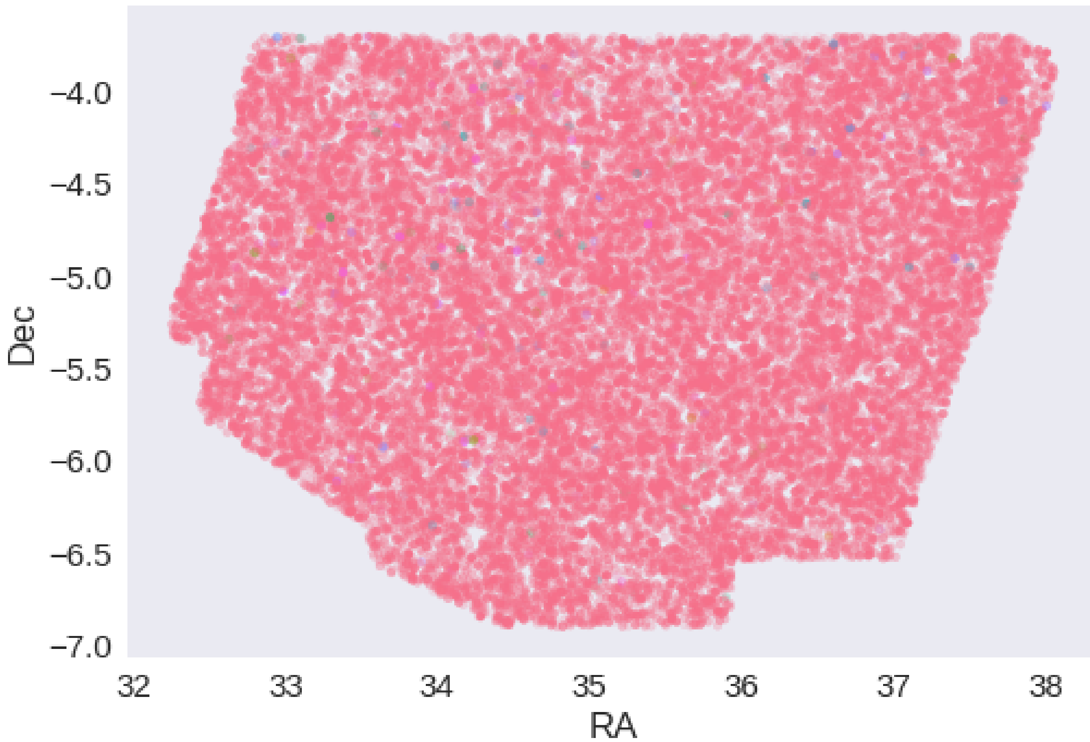
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 956549 sources.
The cleaned catalogue has 956536 sources (13 removed).
The cleaned catalogue has 13 sources flagged as having been cleaned
```

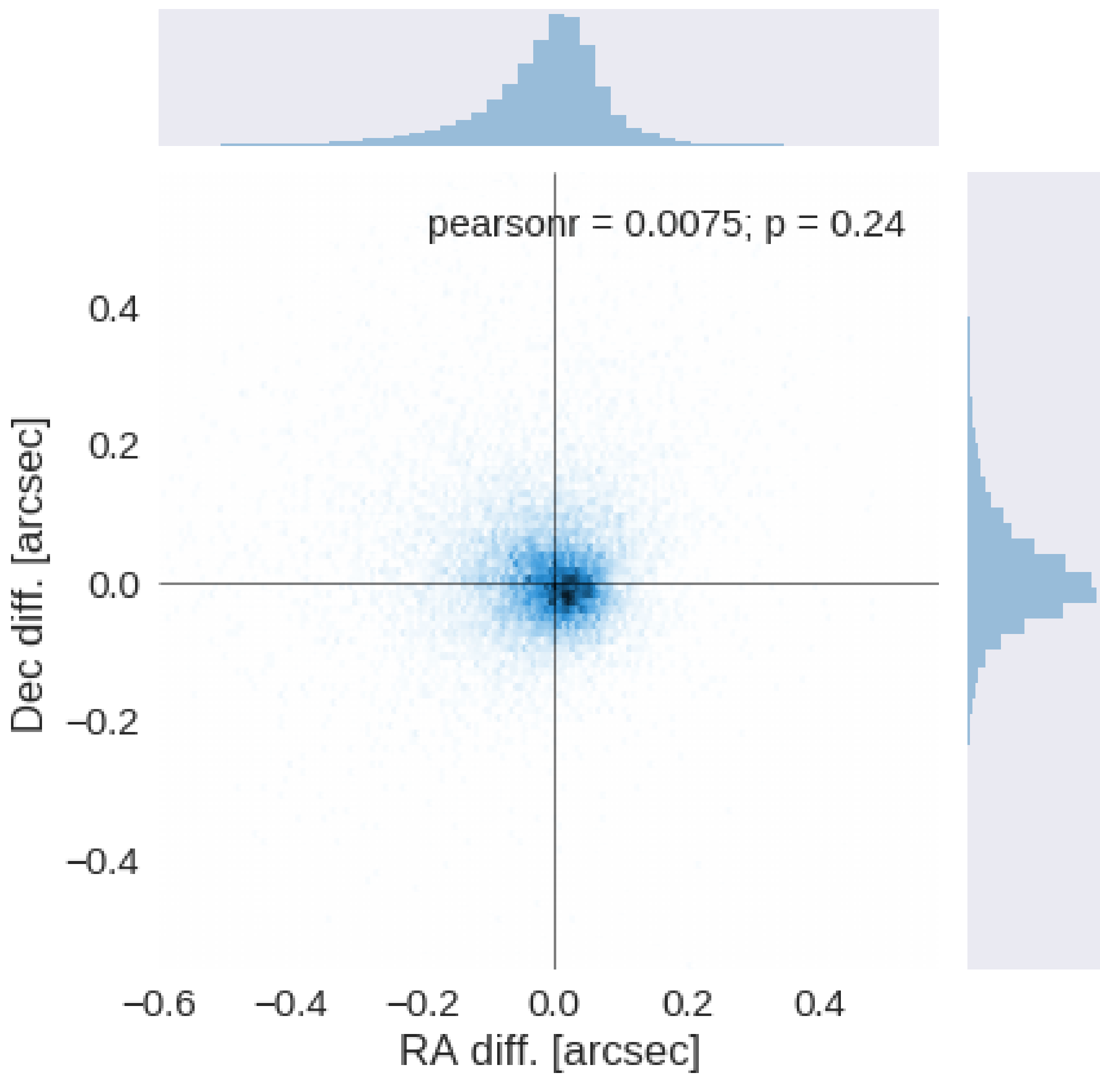
1.4 III - Astrometry correction

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: 0.09501634402795389 arcsec
Dec correction: -0.12179129389160437 arcsec
```


pearsonr = 0.0075; p = 0.24
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

```
25364 sources flagged.
```

2 V - Saving to disk

1.16_VISTA-VHS

January 18, 2018

1 XMM-LSS 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). These are Vega magnitudes and must be corrected to AB.

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

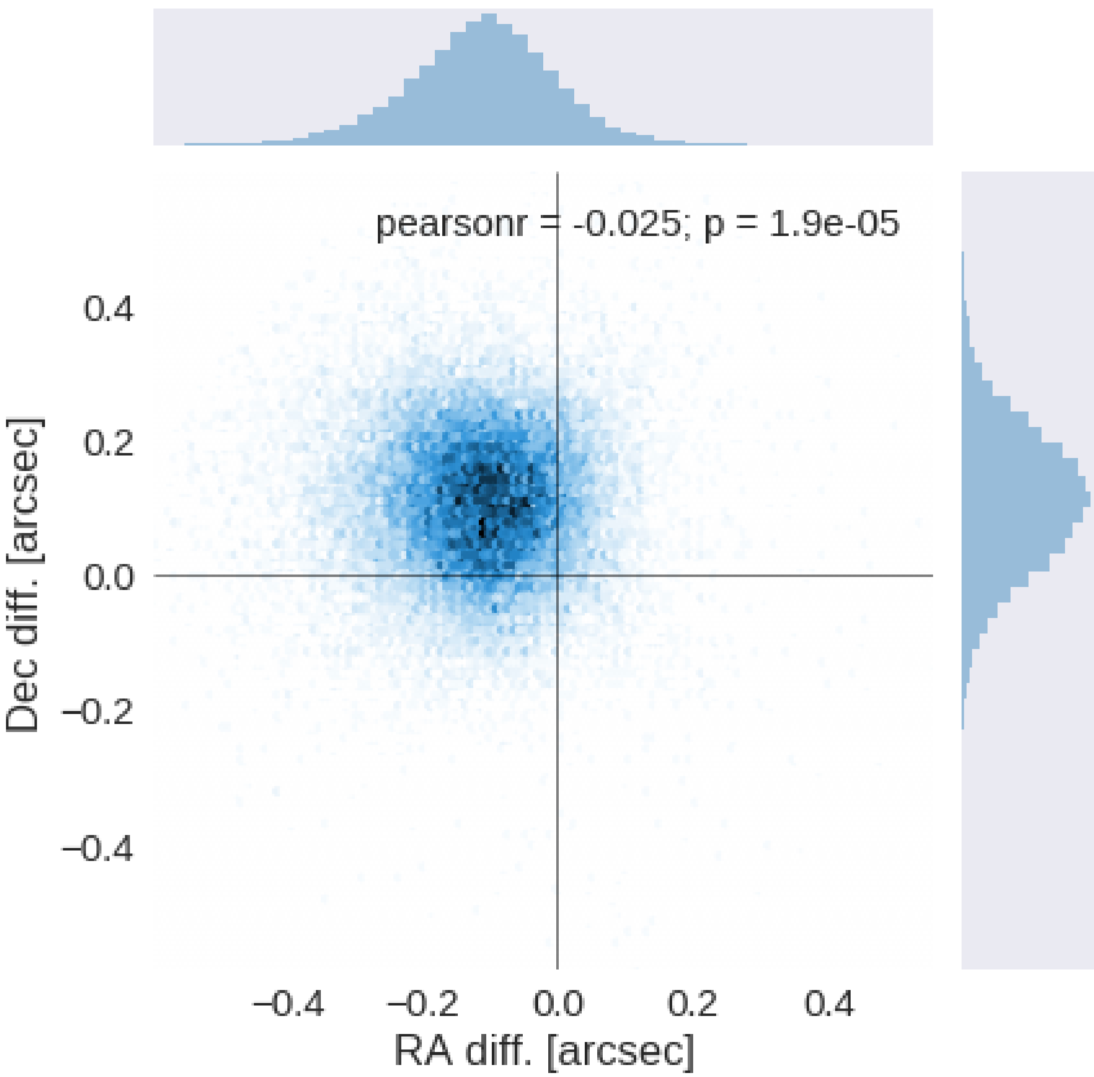
We remove duplicated objects from the input catalogues.

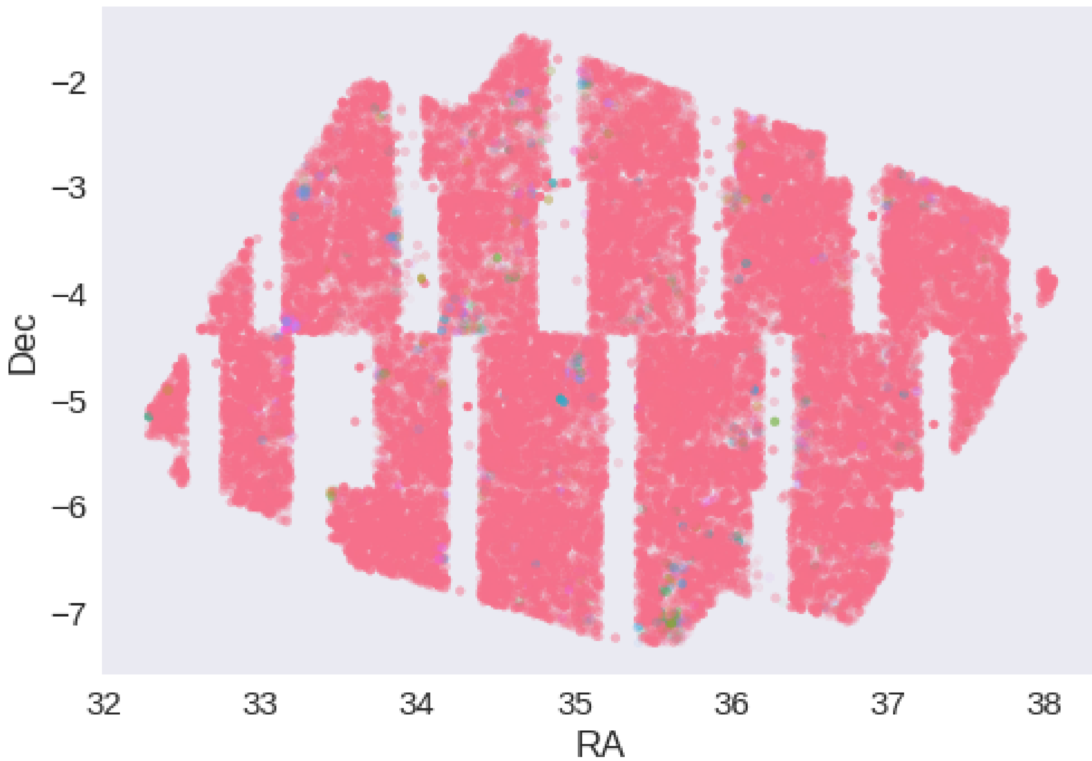
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 437968 sources.
The cleaned catalogue has 428066 sources (9902 removed).
The cleaned catalogue has 9901 sources flagged as having been cleaned
```

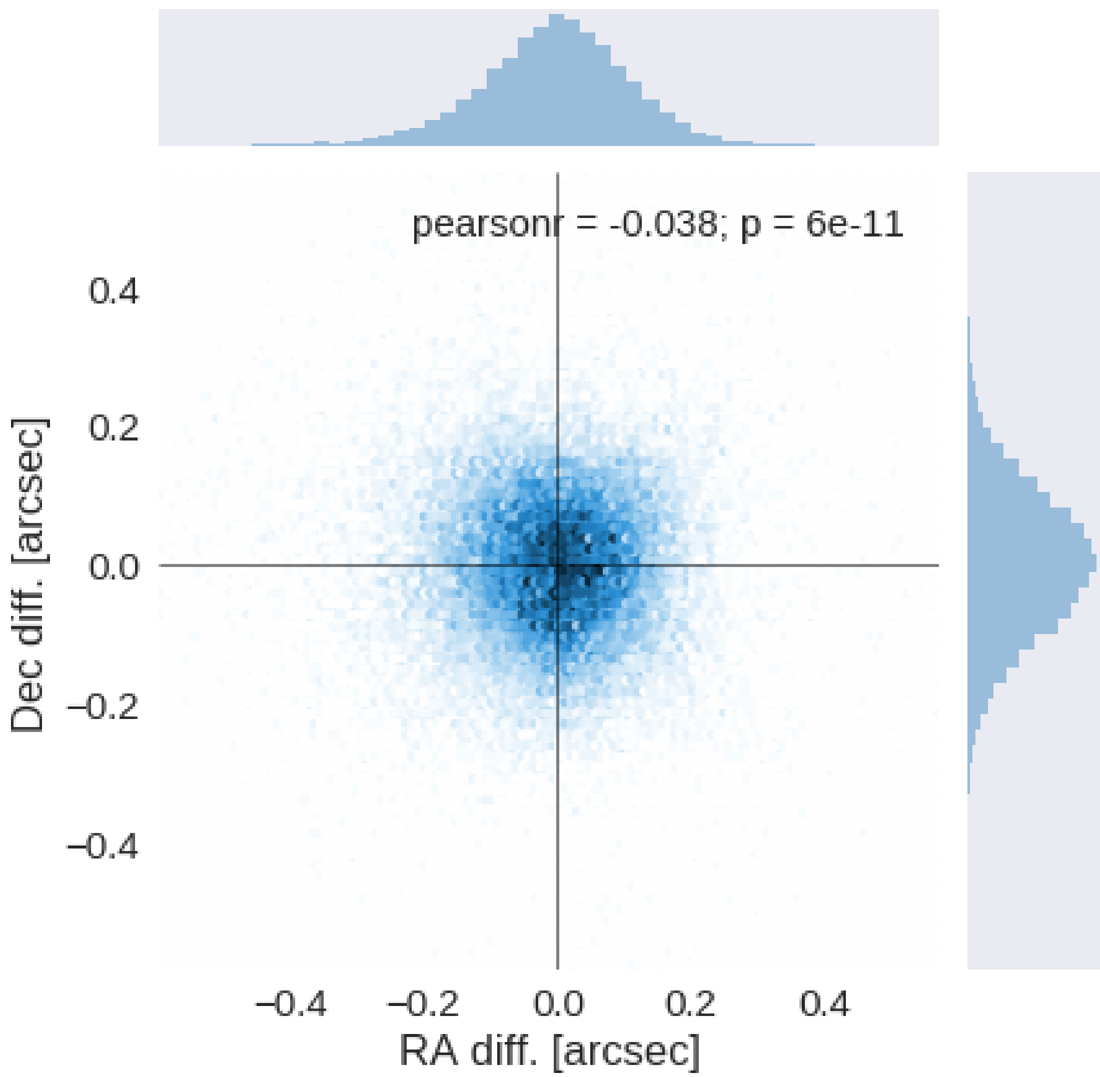
1.4 III - Astrometry correction

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.

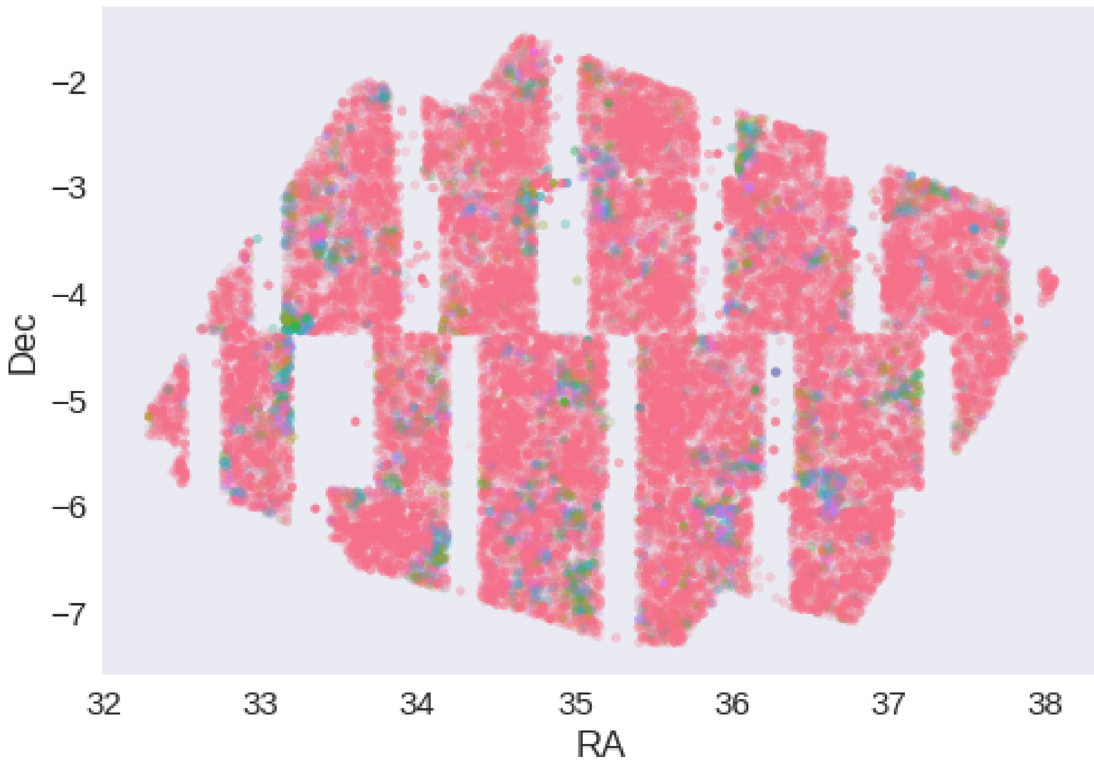





```
RA correction: 0.10875042168549953 arcsec
Dec correction: -0.10968037218450633 arcsec
```



pearsonr = -0.038; p = 6e-11
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

```
30732 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.17_VISTA-VIDEO

January 18, 2018

1 XMM-LSS Master List Creation

1.1 Preparation of VIDEO/VISTA/VIRCAM data

The catalogue comes from `dmu0_VISTA_VIDEO-private`.

There is an old public version of the catalogue but we are using the newer private version in the hope that it will be public by the time we publish the masterlist.

Filters: Z, Y, J, H, Ks

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position (degrees);
- The stellarity;
- The magnitude for each band in apertude 3, which is 2 arcsec (rs548 presumes same for private catalogue).
- The "auto" magnitude is provided, we presume this is standard Sextractor units etc.

Yannick said the dates of observation for VIDEO are from 2009/11 to 2016/12. There is a paper from 2012 (Jarvis et al). So will use 2012.

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

```
Out[3]: 'en_GB'
```

1.2 I - Column selection

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

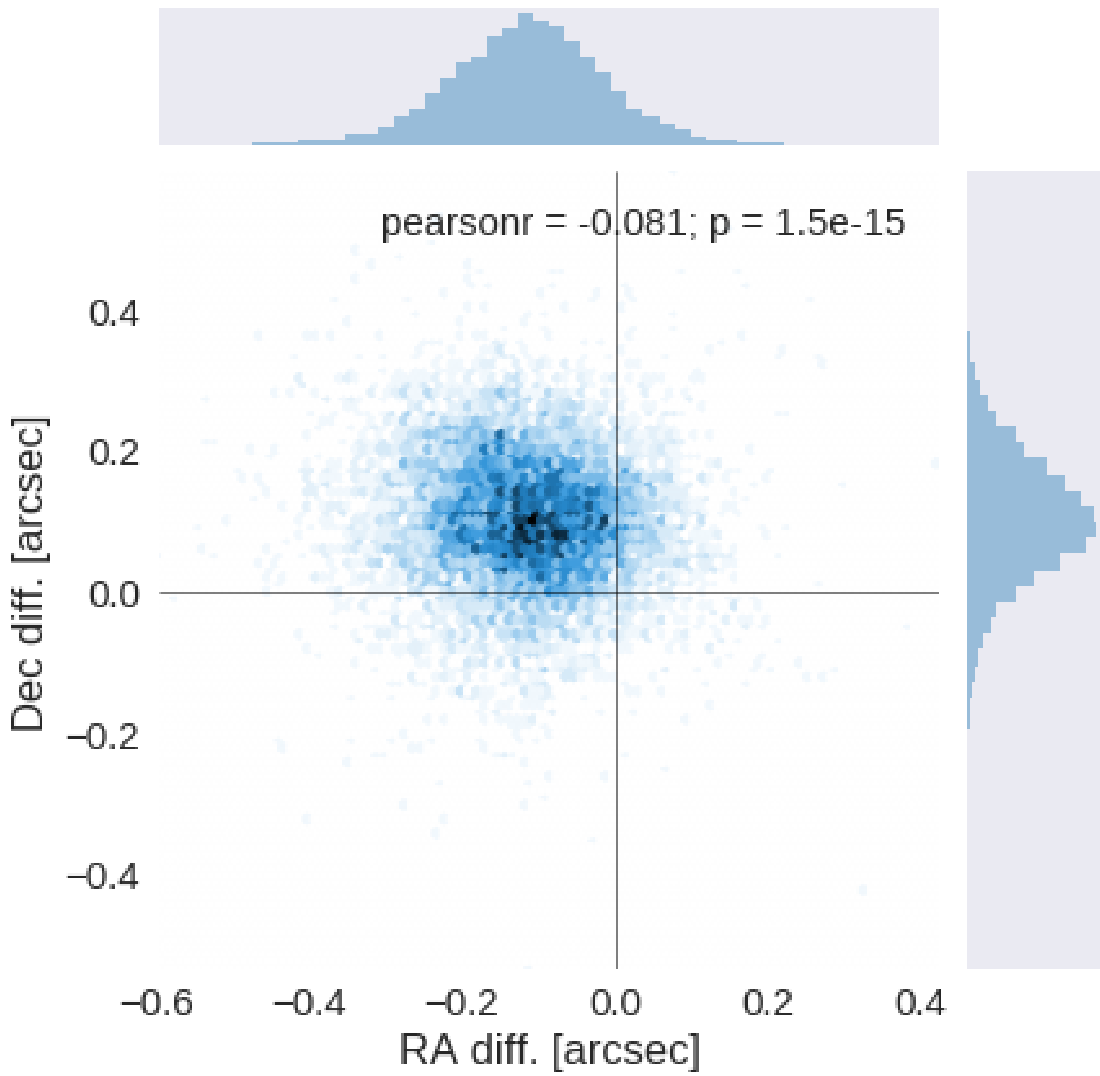
1.3 II - Removal of duplicated sources

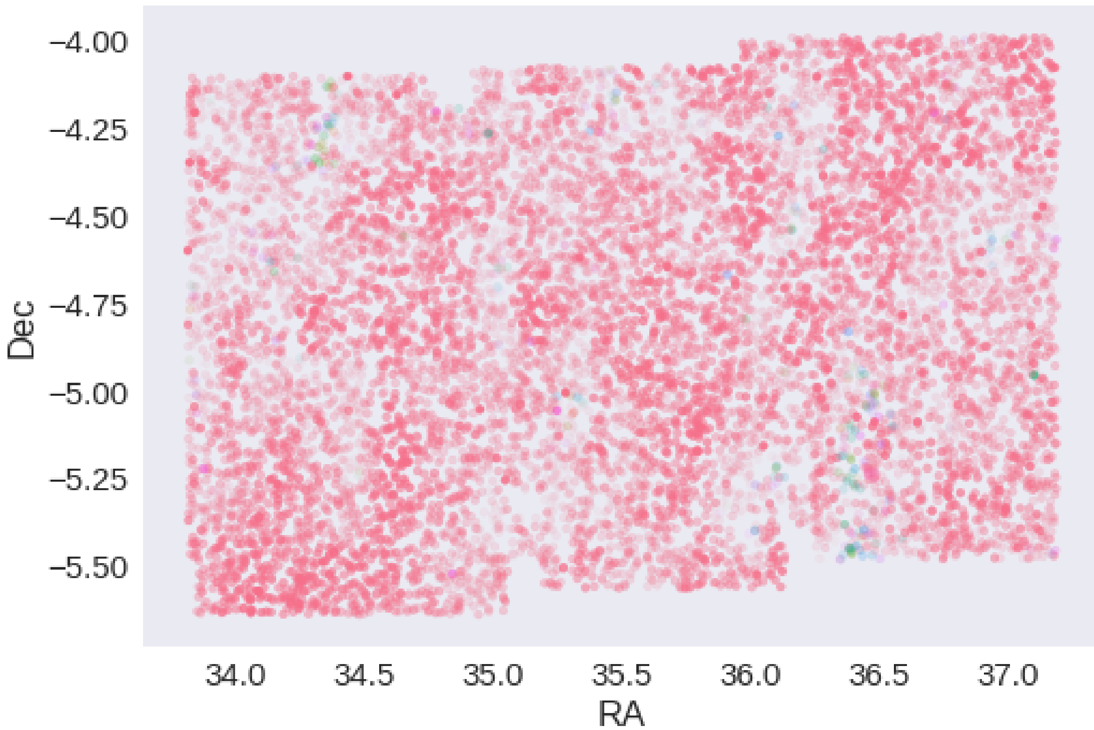
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 1242993 sources.
The cleaned catalogue has 1238657 sources (4336 removed).
The cleaned catalogue has 4293 sources flagged as having been cleaned
```

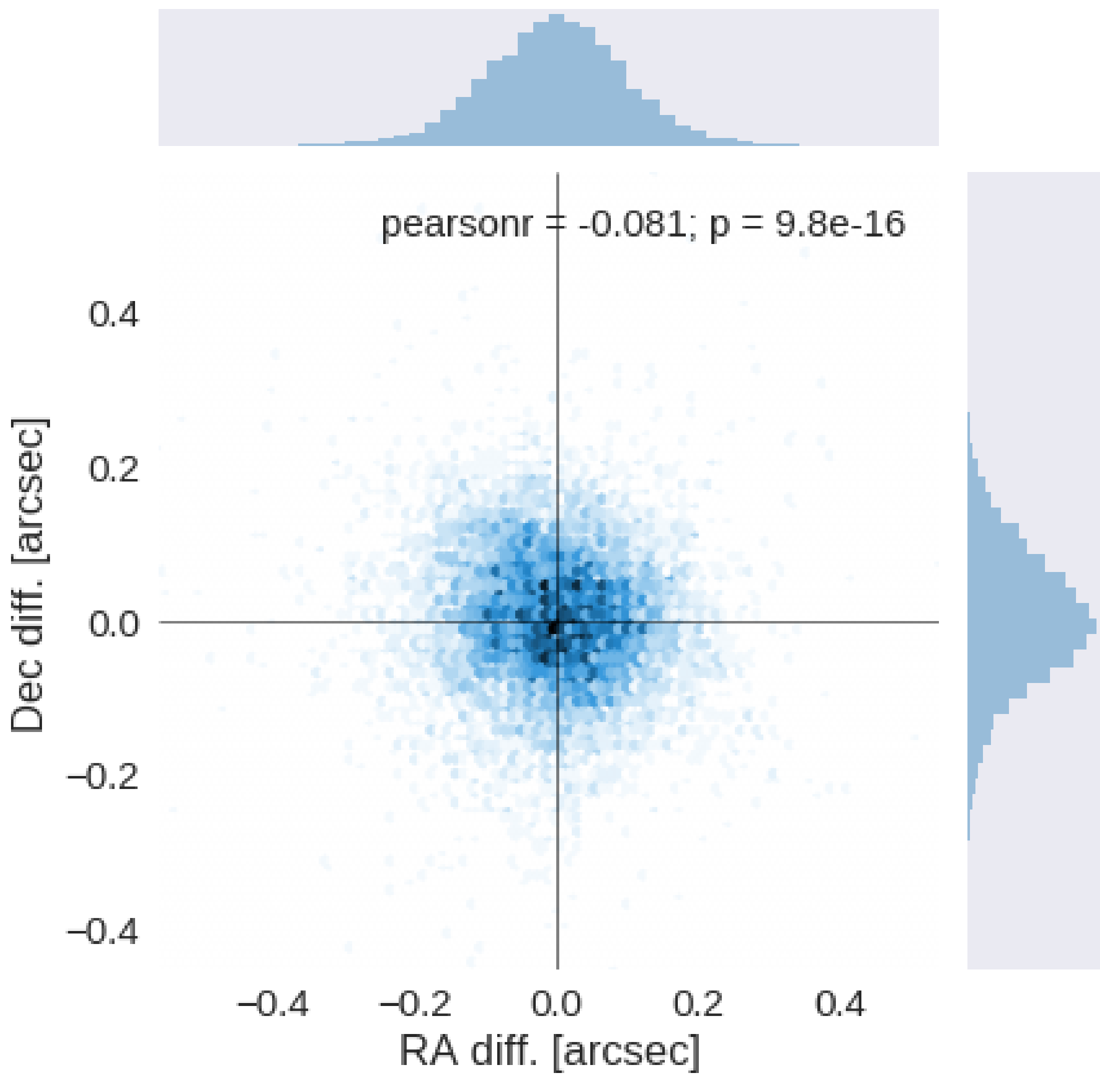
1.4 III - Astrometry correction

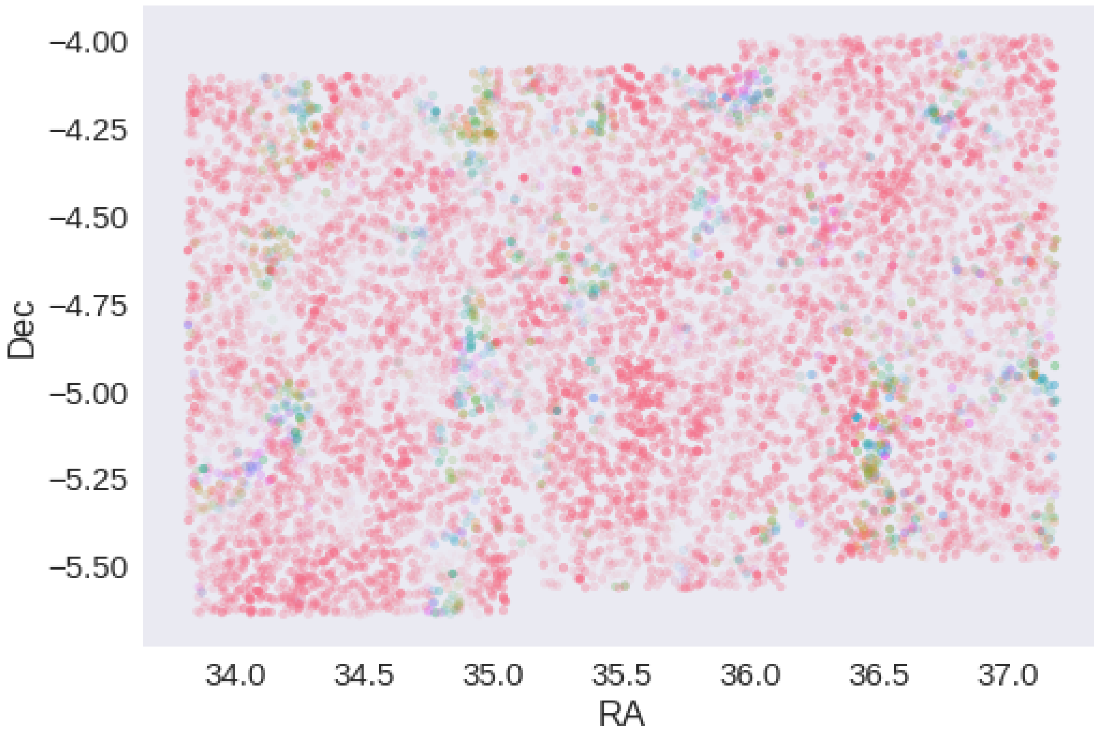
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.11299088805714064 arcsec
Dec correction: -0.10236686479601076 arcsec
```


pearsonr = -0.081; p = 9.8e-16
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

```
9963 sources flagged.
```

1.6 V - Saving to disk

1.18_VISTA-VIKING

January 18, 2018

1 XMM-LSS master catalogue

1.1 Preparation of VIKING data

VISTA telescope/VIKING catalogue: the catalogue comes from `dmu0_VIKING`.
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). These are Vega magnitudes and must be corrected.

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

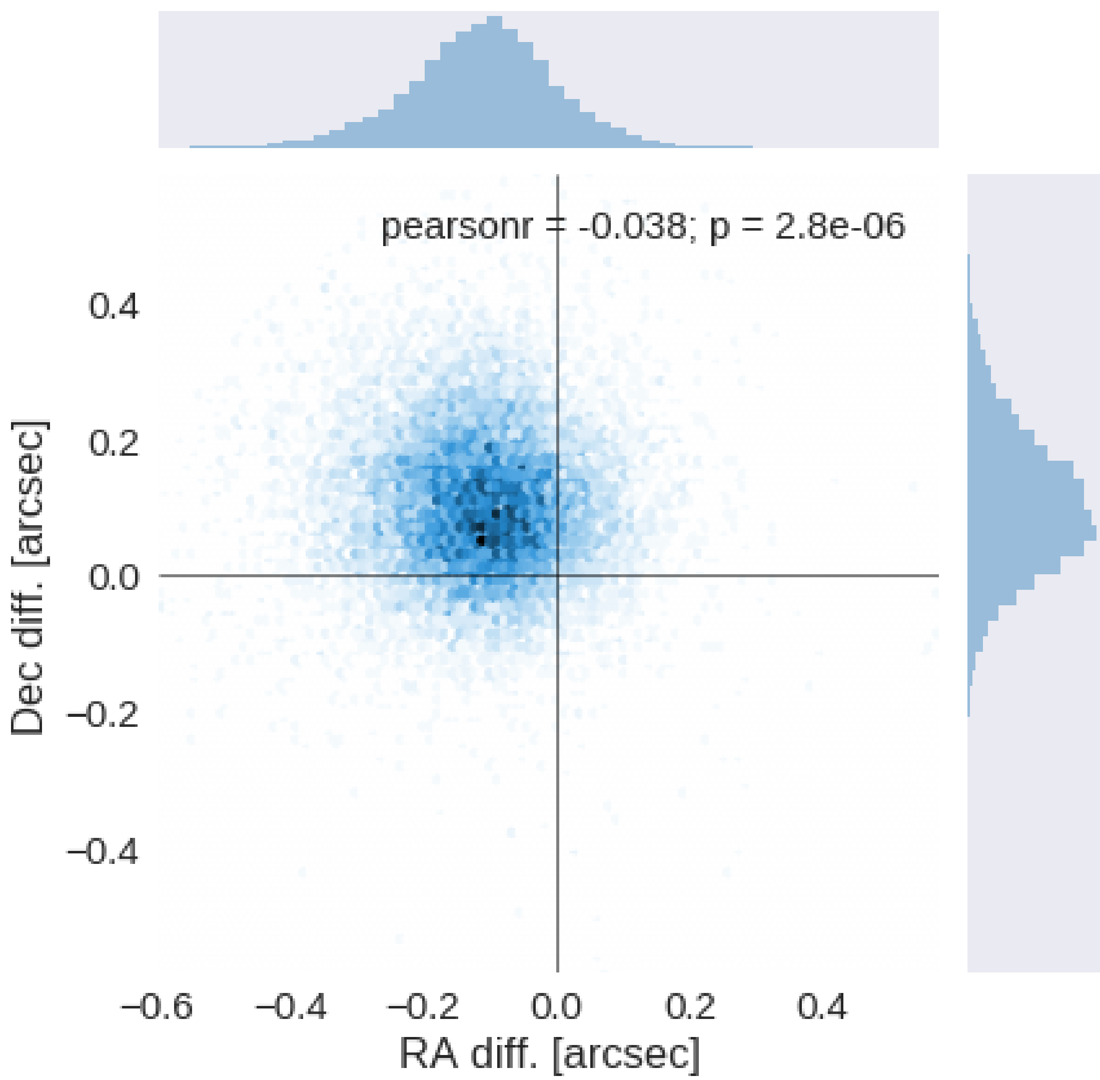
We remove duplicated objects from the input catalogues.

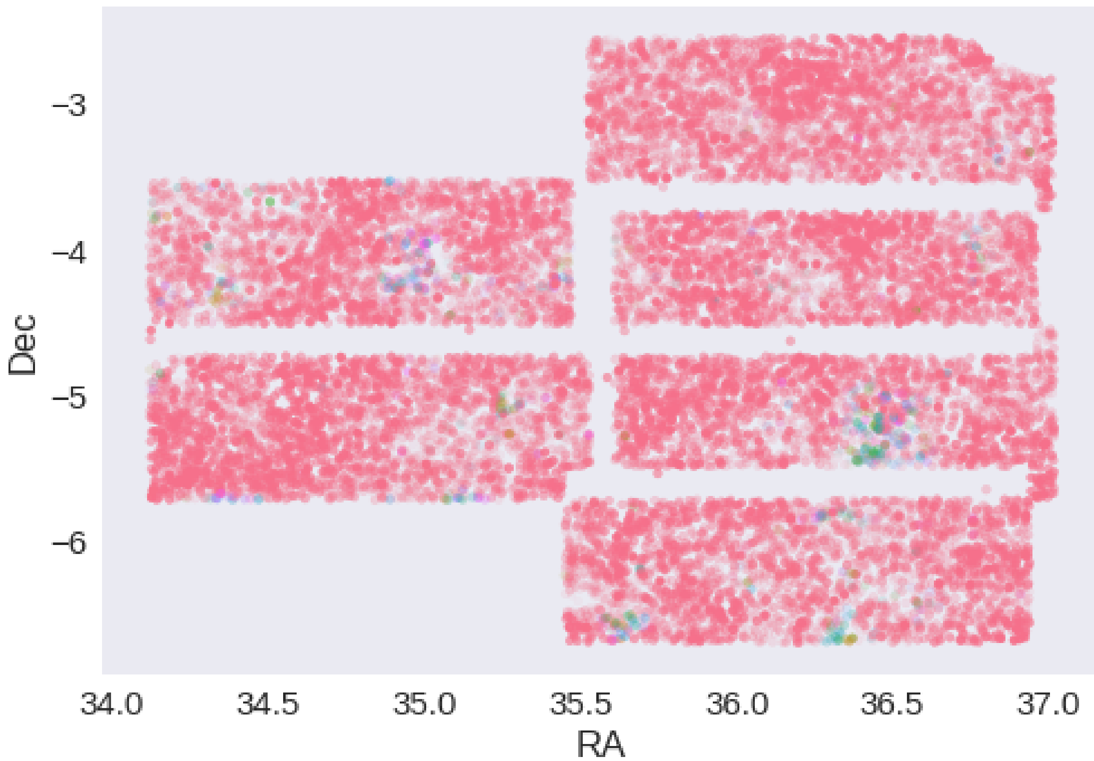
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 325881 sources.
The cleaned catalogue has 325849 sources (32 removed).
The cleaned catalogue has 32 sources flagged as having been cleaned
```

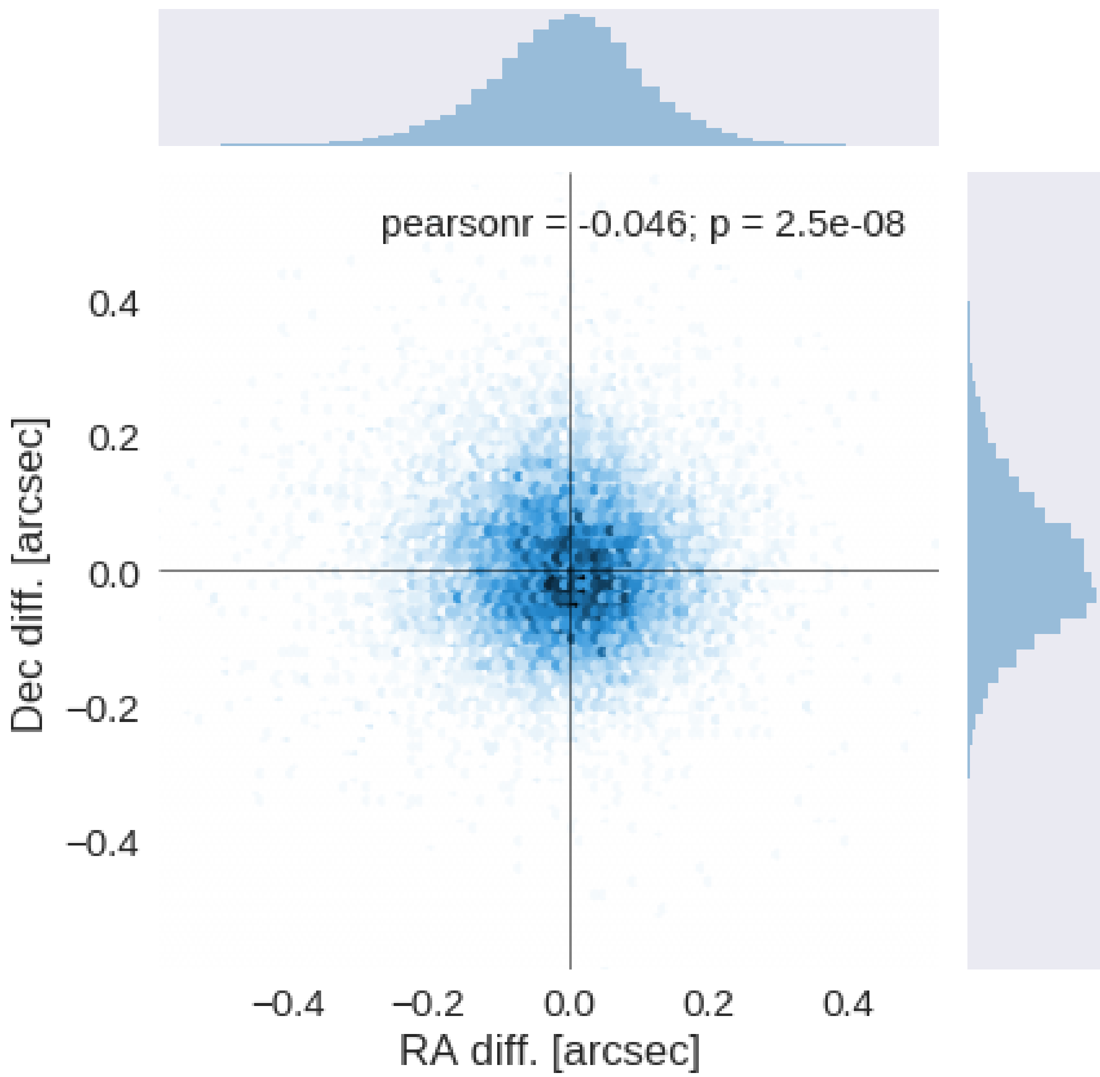
1.4 III - Astrometry correction

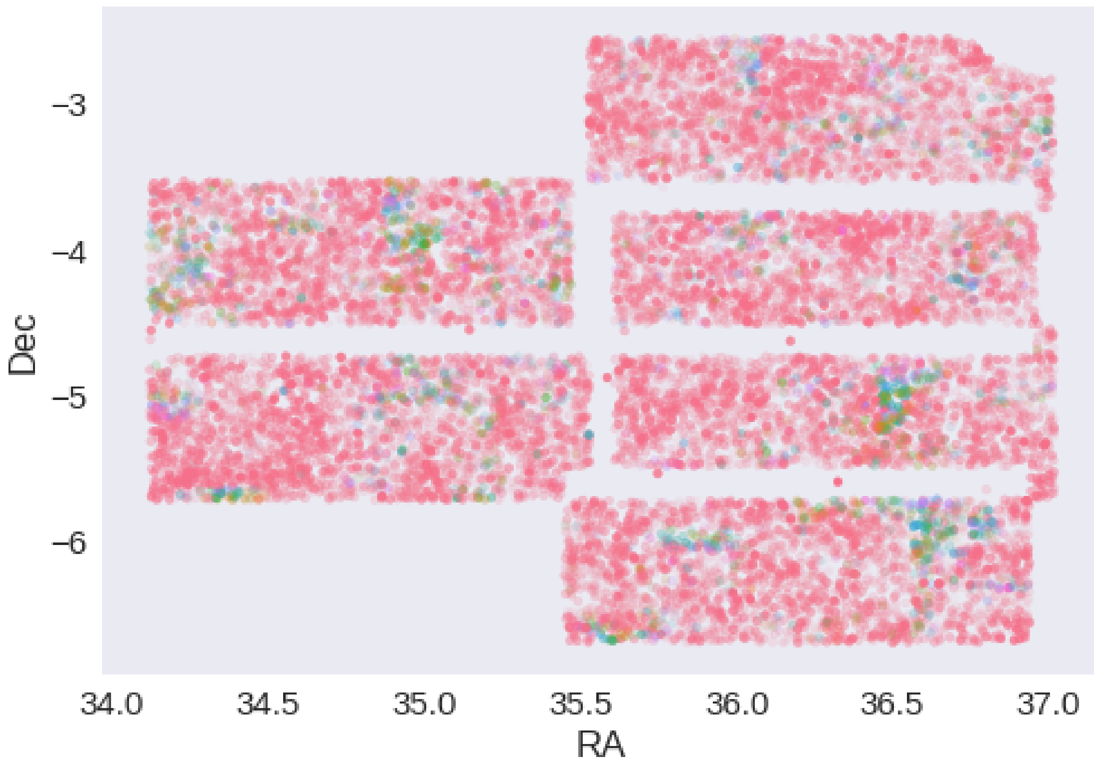
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: 0.10746290045346996 arcsec
Dec correction: -0.0979660293879192 arcsec
```


pearsonr = -0.046; p = 2.5e-08
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]



2 IV - Flagging Gaia objects

```
15270 sources flagged.
```

3 V - Saving to disk

2.1_Megacam_merge

January 18, 2018

1 XMM-LSS master catalogue

This notebook presents the merge of the pristine catalogues from CFHT Megacam. This has to be conducted separately on XMM-LSS due to the large amount of memory required on this field.

```
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

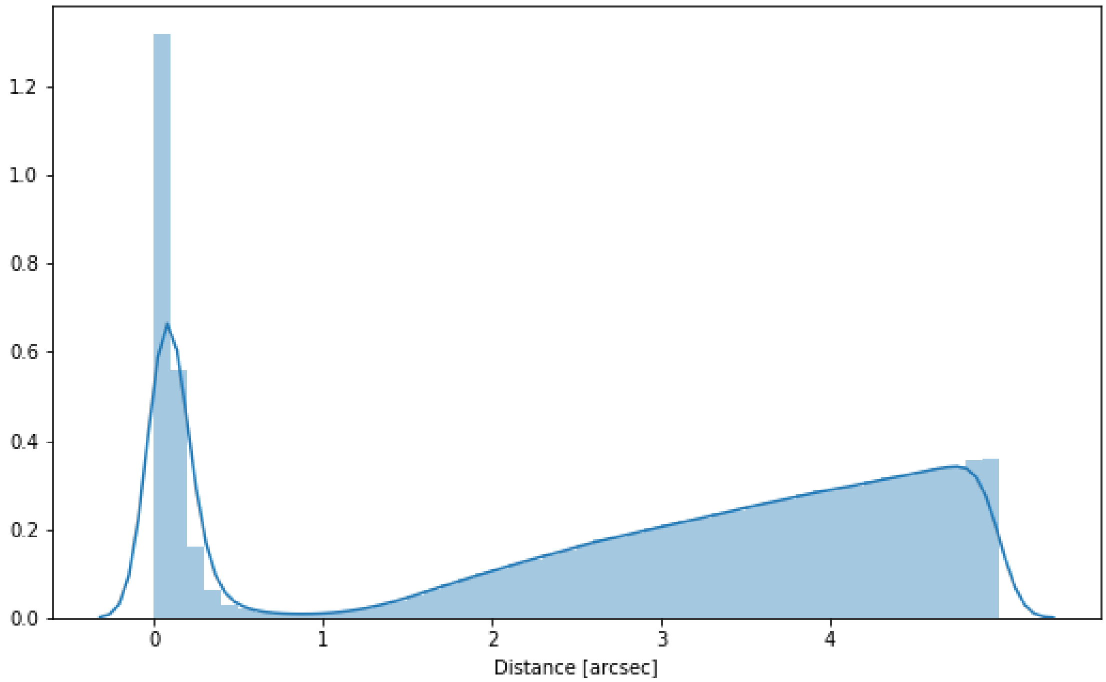
1.2 II - Merging tables

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

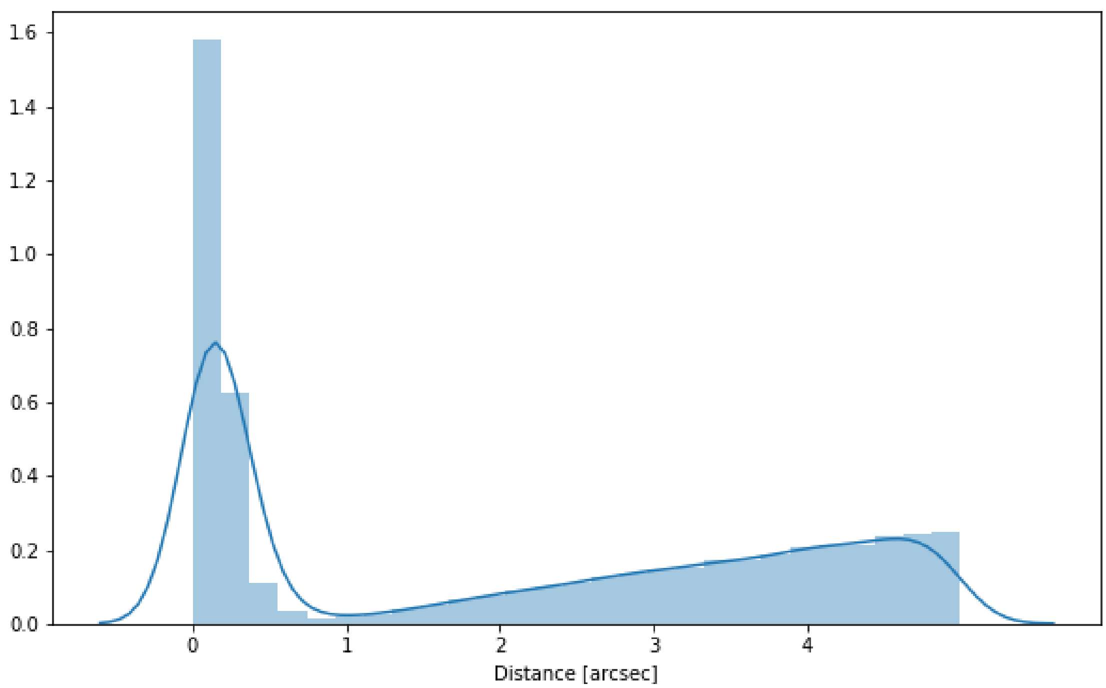
At every step, we look at the distribution of the distances to the nearest source in the merged catalogue to determine the best crossmatching radius.

1.2.1 Start with CFHTLS-WIDE

1.2.2 Add CFHTLS-DEEP



1.2.3 Add SpARCS



1.2.4 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[12]: <IPython.core.display.HTML object>
```

```
['cfhtls-wide_id', 'cfhtls-deep_id', 'sparcs_intid', 'megacam_intid']
```

1.3 VII - Choosing between multiple values for the same filter

VII.b CFHTLS-DEEP, CFHTLS-WIDE and SpARCS: CFHT Megacam fluxes

According to Mattia CFHTLenS is built on the same data as CFHTLS-WIDE and should not be included. I have therefore excluded it from the merge above.

CFHTLS-DEEP is prefferred to CFHTLS-WIDE which is prefferred to SpARCS

CFHTLS-WIDE	u, g, r, i, z
CFHTLS-DEEP	u, g, r, i, z, y
SpARCS	u, g, r, z, y

```
/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[18]: <IPython.core.display.HTML object>
```

1.4 XI - Saving the catalogue

2.2_UKIDSS_merge

January 18, 2018

1 XMM-LSS master catalogue

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

```
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. We start with PanSTARRS because it coevrs the whole field.

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

1.2.1 Start with DXS

1.2.2 Add UDS

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

1.2.3 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>
```

1.3 V - Adding unique identifier

```
['dxs_id', 'uds_id', 'ukidss_intid']
```

1.4 VII - Choosing between multiple values for the same filter

1.4.1 VII. d UKIDSS DXS and UDS

There is no overlap between UDS and DXS so I simply merge the two columns.

1.5 IX - Cross-identification table

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

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

1.6 XI - Saving the catalogue

```
Missing columns: {'uds_flag_gaia', 'ukidss_ra', 'uds_id', 'dxs_stellarity', 'ukidss_dec', 'dxs_f
```

2.3_HSC_merge

January 18, 2018

1 XMM-LSS master catalogue

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

```
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

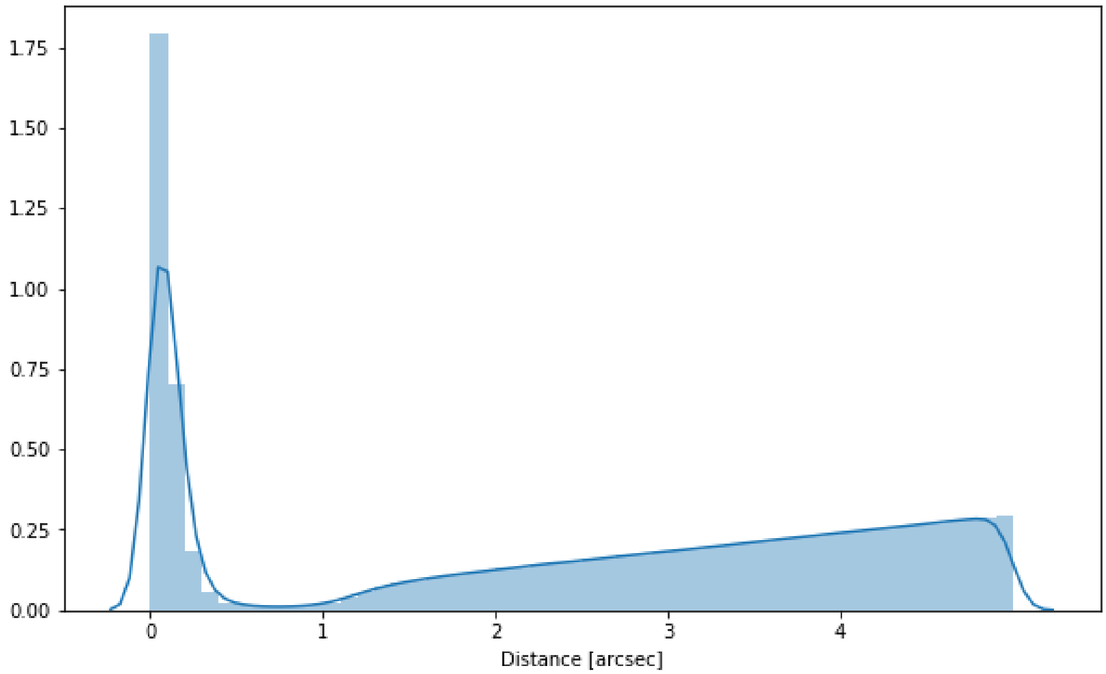
1.2 II - Merging tables

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

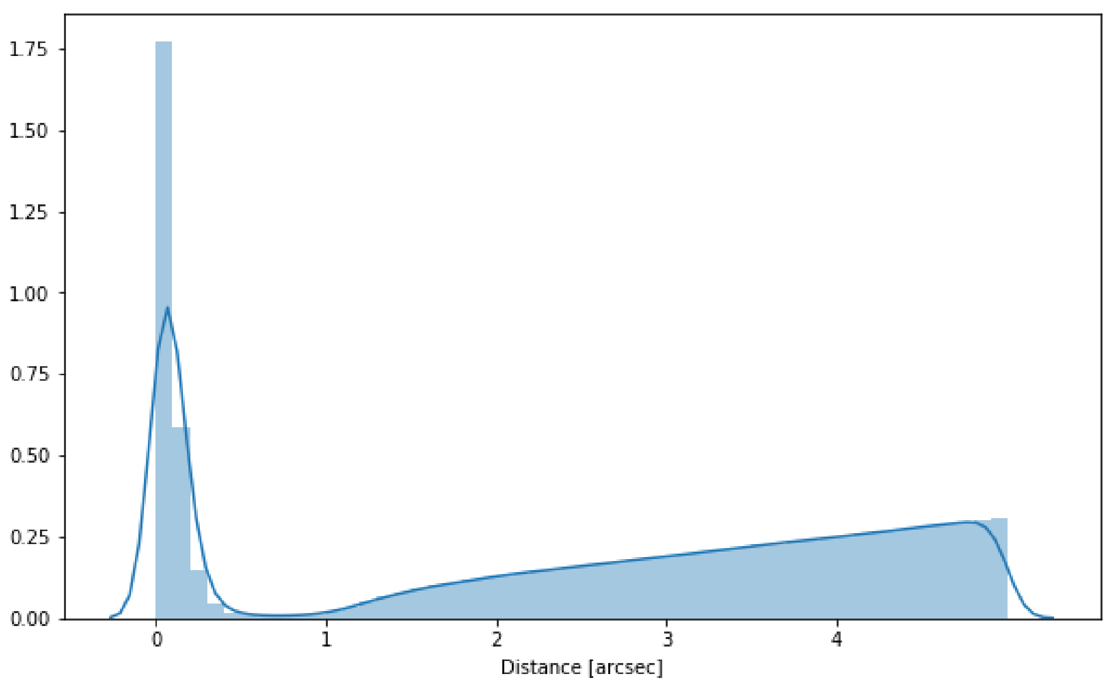
At every step, we look at the distribution of the distances to the nearest source in the merged catalogue to determine the best crossmatching radius.

1.2.1 Start with HSC-WIDE

1.2.2 Add HSC-DEEP



1.2.3 Add HSC-UDEEP



1.2.4 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[12]: <IPython.core.display.HTML object>
```

```
['hsc-wide_id', 'hsc-deep_id', 'hsc-udeep_id', 'hsc_intid']
```

1.3 VII - Choosing between multiple values for the same filter

VII. e HSC wide, deep and udeep Here we straightforwardly take the deepest

Survey	Bands observed
HSC-WIDE	grizy
HSC-DEEP	grizy
HSC-UDEEP	grizy n921 n816

```
/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[18]: <IPython.core.display.HTML object>
```

1.4 XI - Saving the catalogue

```
Missing columns: {'hsc-wide_flag_cleaned', 'hsc-udeep_flag_cleaned', 'hsc-udeep_flag_gaia', 'hsc
```

2.4_VIRCAM_merge

January 18, 2018

1 XMM-LSS master catalogue

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

```
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

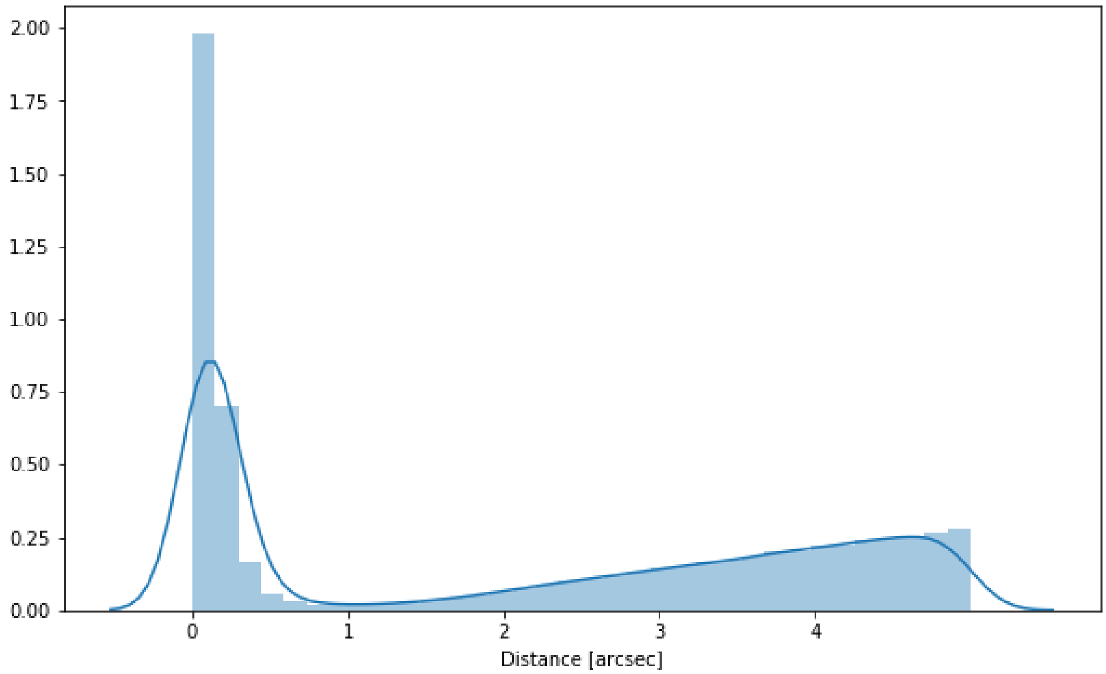
1.2 II - Merging tables

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

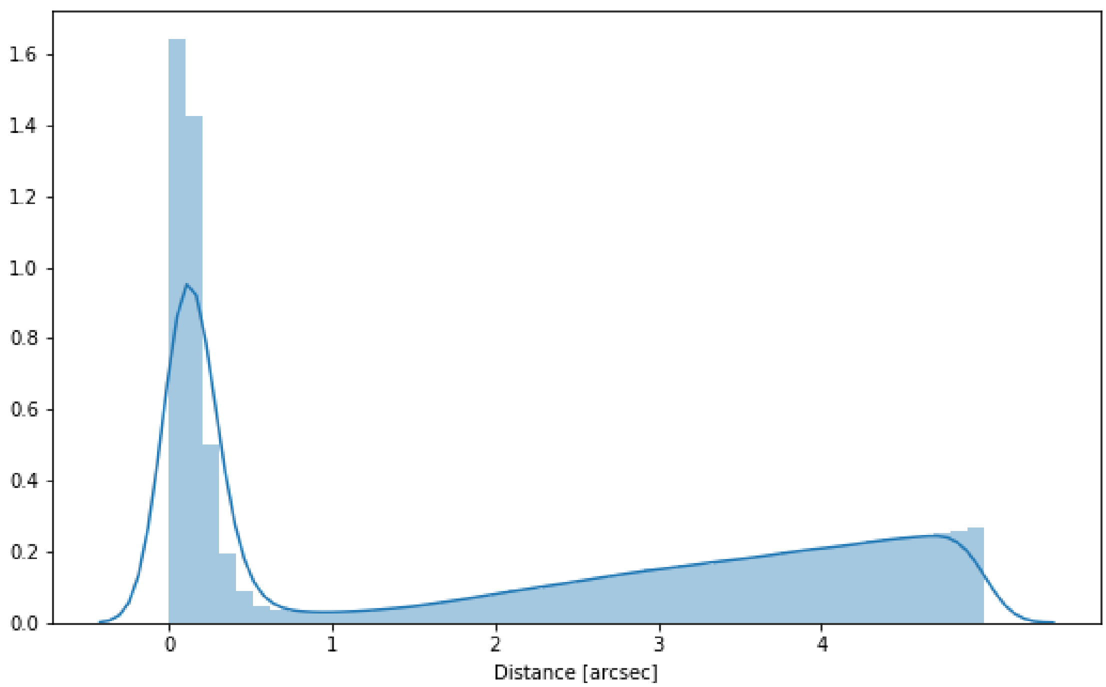
At every step, we look at the distribution of the distances to the nearest source in the merged catalogue to determine the best crossmatching radius.

1.2.1 Start with VHS

1.2.2 Add VIDEO



1.2.3 Add VIKING



1.2.4 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[12]: <IPython.core.display.HTML object>
```

```
['vhs_id', 'video_id', 'viking_id', 'vircam_intid']
```

1.3 VII - Choosing between multiple values for the same filter

1.3.1 VII.c VISTA VIDEO, VHS, and VIKING: VISTA fluxes

According to Mattia Vacari VIDEO is deeper than VIKING which is deeper than VHS

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

1.3.2 Vista origin overview

For each band show how many objects have fluxes from each survey for both total and aperture photometries.

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

1.4 XI - Saving the catalogue

```
Missing columns: {'vircam_intid', 'viking_id', 'video_stellarity', 'vhs_flag_cleaned', 'vhs_stel
```

2.5_IRAC_merge

January 18, 2018

1 XMM-LSS master catalogue - IRAC merging

This notebook presents the merge of the IRAC pristine catalogues to produce the HELP master catalogue on XMM-LSS.

```
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

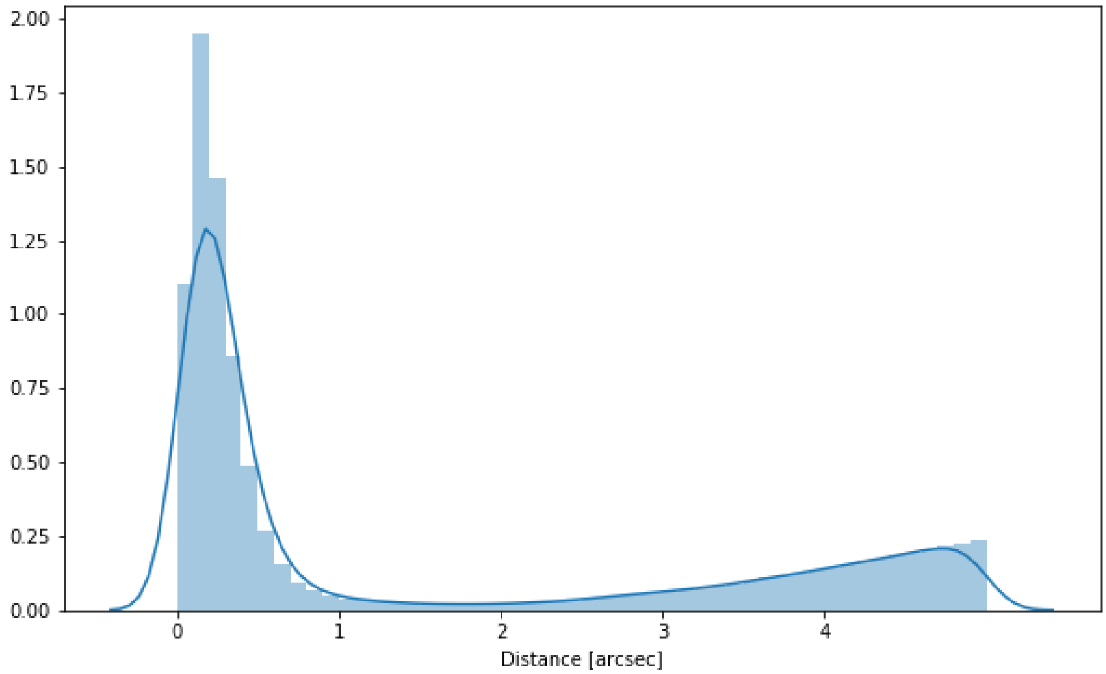
1.2 II - Merging tables

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

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

1.2.1 Start with SERVS

1.2.2 Add SWIRE



1.2.3 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.

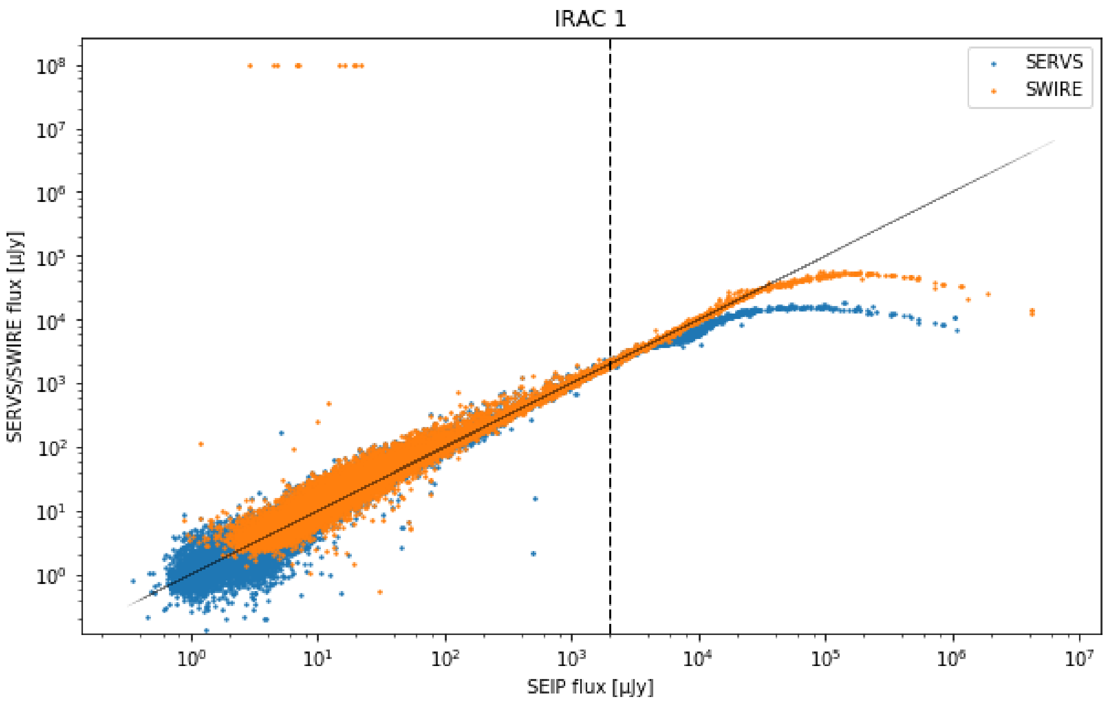
```
Out[10]: <IPython.core.display.HTML object>

['servs_intid', 'swire_intid', 'irac_intid']
```

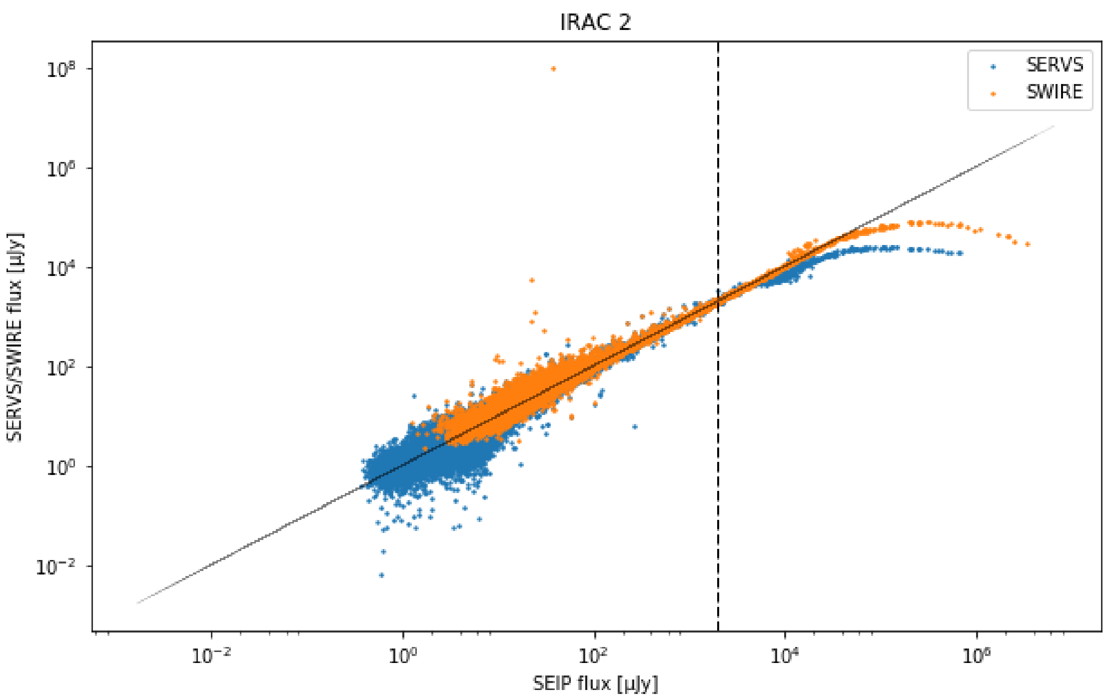
1.3 VII - Choosing between multiple values for the same filter

1.3.1 VII.a SERVS and SWIRE IRAC fluxes

Both SERVS and SWIRE provide IRAC1 and IRAC2 fluxes. SERVS is deeper but tends to underestimate flux of bright sources (Mattia said over 2000 ţJy) as illustrated by this comparison of SWIRE, SERVS, and Spitzer-EIP fluxes.

```
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 SWIRE and SERVS fluxes are provided, we use the SERVS flux below 2000 Jy and the SWIRE flux over.

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

```
710828 sources with SERVS flux
466544 sources with SWIRE flux
239549 sources with SERVS and SWIRE flux
709839 sources for which we use SERVS
227984 sources for which we use SWIRE
```

```
710828 sources with SERVS flux
465906 sources with SWIRE flux
239547 sources with SERVS and SWIRE flux
709760 sources for which we use SERVS
227427 sources for which we use SWIRE
```

```
731919 sources with SERVS flux
324491 sources with SWIRE flux
175800 sources with SERVS and SWIRE flux
731206 sources for which we use SERVS
149404 sources for which we use SWIRE
```

```
731919 sources with SERVS flux
324478 sources with SWIRE flux
175800 sources with SERVS and SWIRE flux
731159 sources for which we use SERVS
149438 sources for which we use SWIRE
```

1.4 XI - Saving the catalogue

```
Missing columns: {'irac_flag_merged', 'servs_stellarity_irac_i2', 'swire_stellarity_irac_i1', 'i
```

2.6_DECAM_merging

January 18, 2018

1 XMM-LSS 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) [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

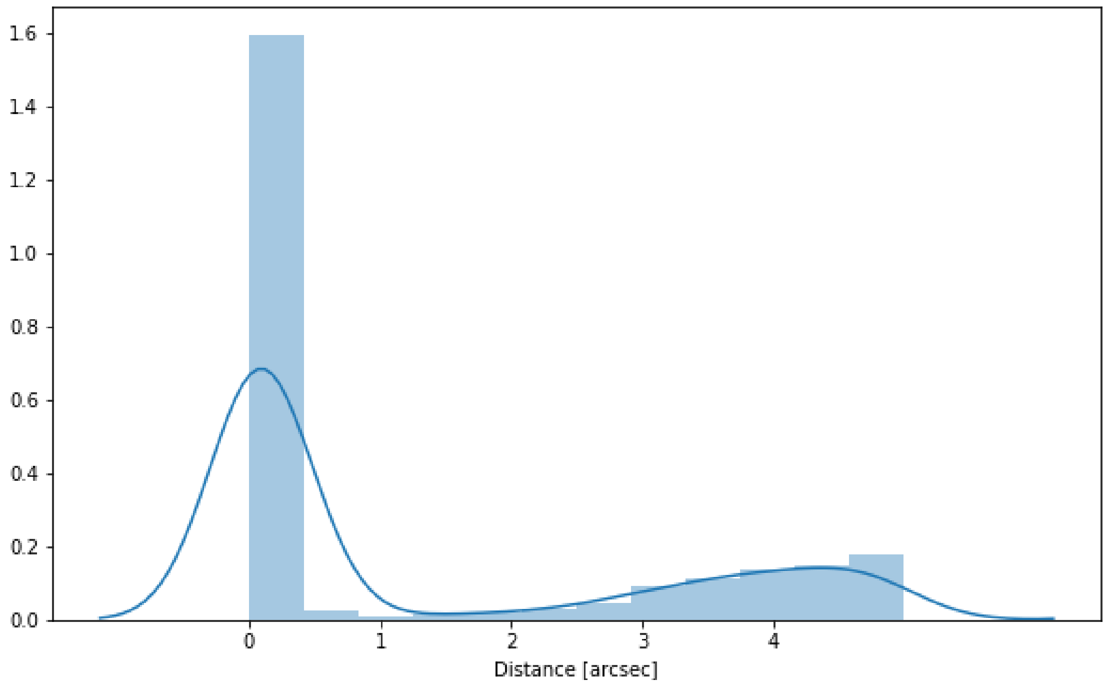
1.2 II - Merging tables

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 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[11]: <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

```
Out[20]: <IPython.core.display.HTML object>
```

1.7 IX - Saving the catalogue

```
Out[22]: ['des_id',
          'ra',
          'dec',
          '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',
          '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',
          'f_decam_i',
          'f_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[26]: <IPython.core.display.HTML object>
```

2.7_Merging

January 18, 2018

1 XMM-LSS master catalogue

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

```
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. We start with PanSTARRS because it coevrs the whole field.

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

1.2.1 Add PanSTARRS

1.2.2 CANDELS

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

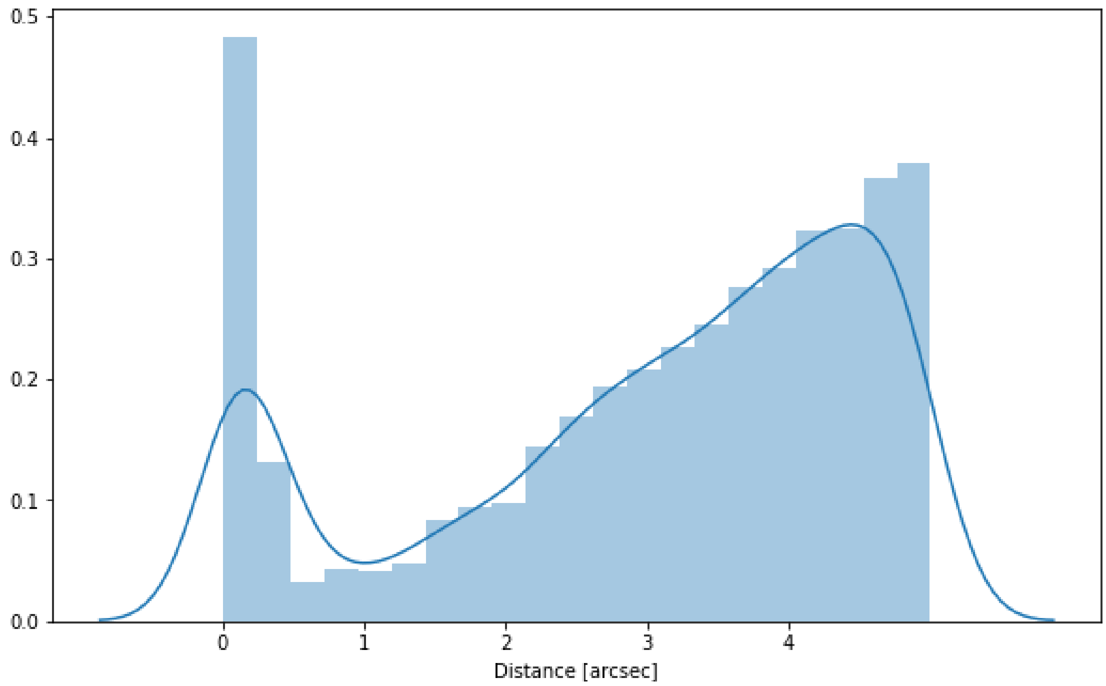
1.2.3 Add CFHT-WIRDS

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

Because CFHT-WIRDS is made by merging the different bands it has a flag_merged columns which must be removed. We throw this information away because one can get back to the original object using the combined id as described in the notebook.

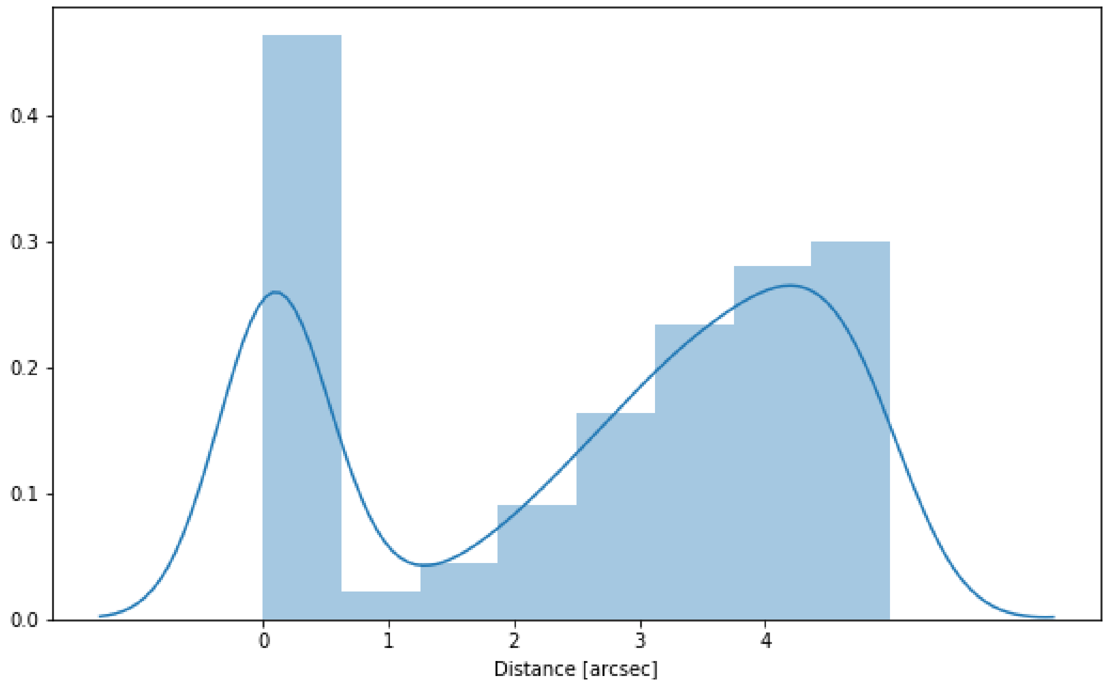
```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.4 Add Megacam



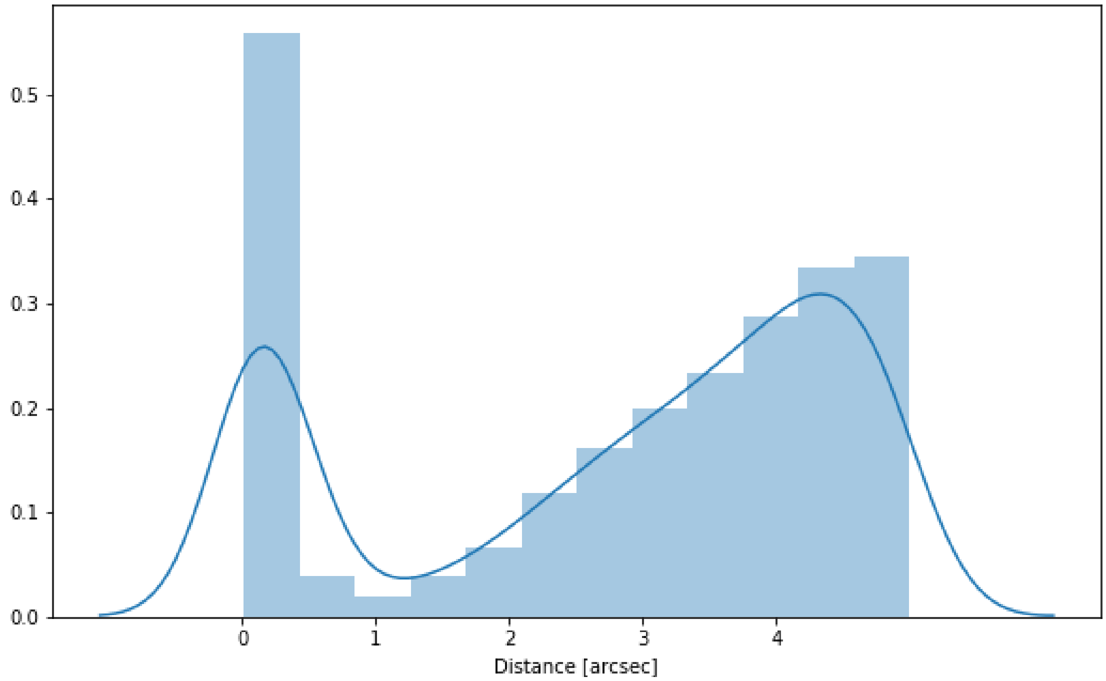

```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.5 Add HSC-PSS




```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.6 Add DECam (DES and DECaLS)




```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

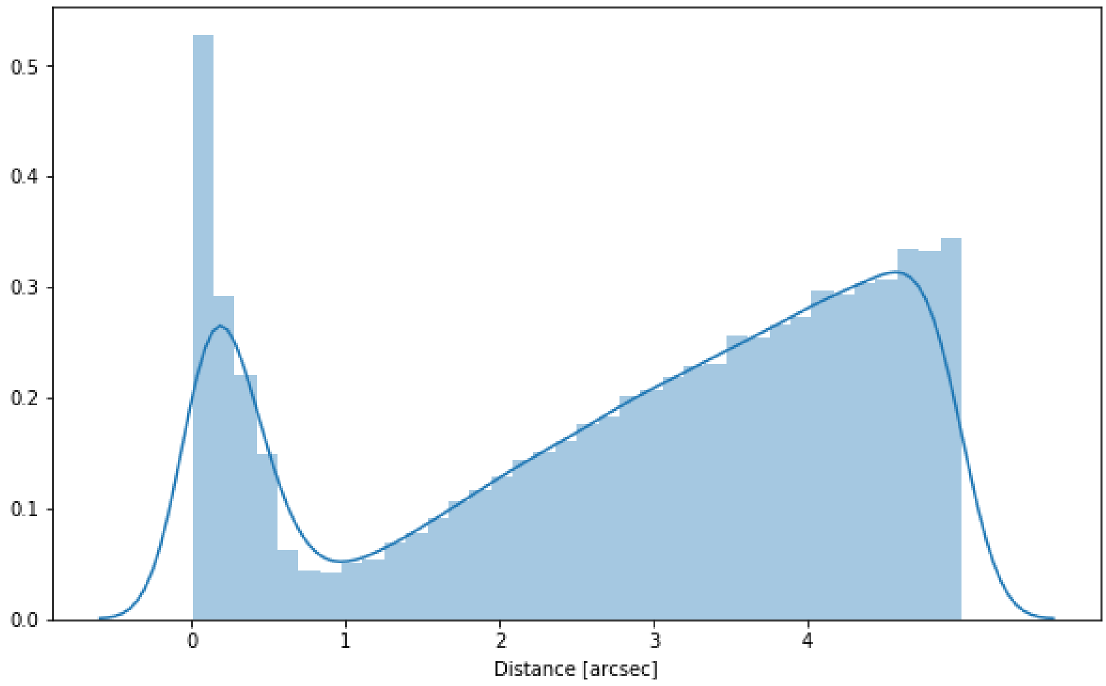
Add SXDS

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

It is strange that this does not peak at zero. This is bservable in the original band cross match. It implies there is a persistent offset. Perhaps each band should be astrometrically corrected before the original merge.

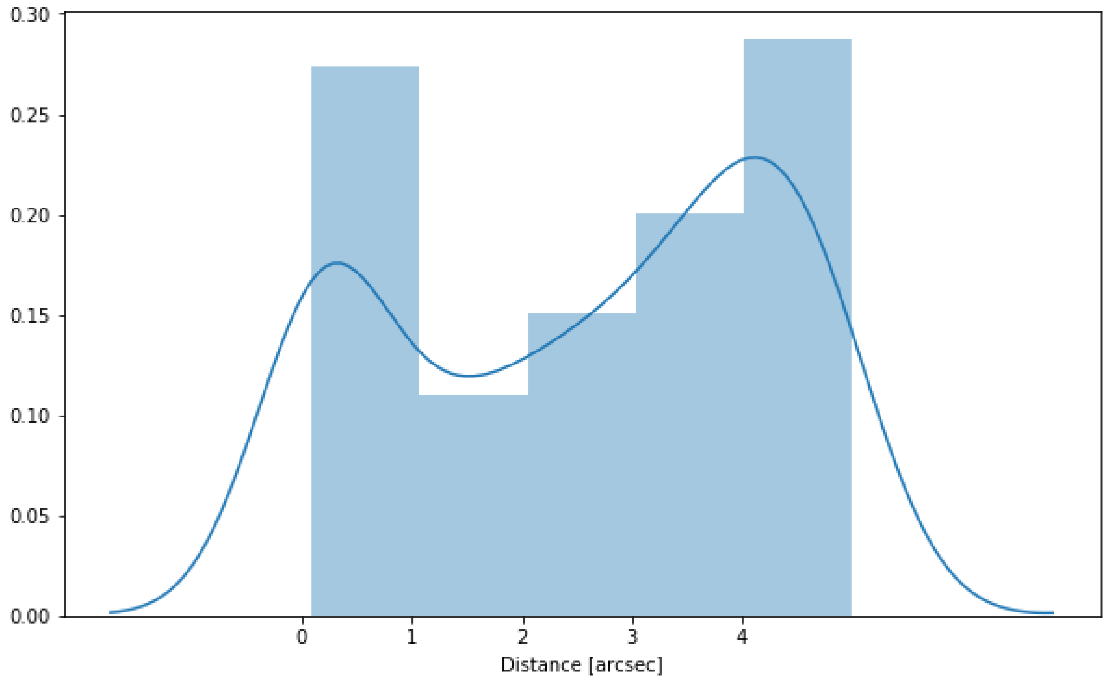
```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.7 Add UKIDSS



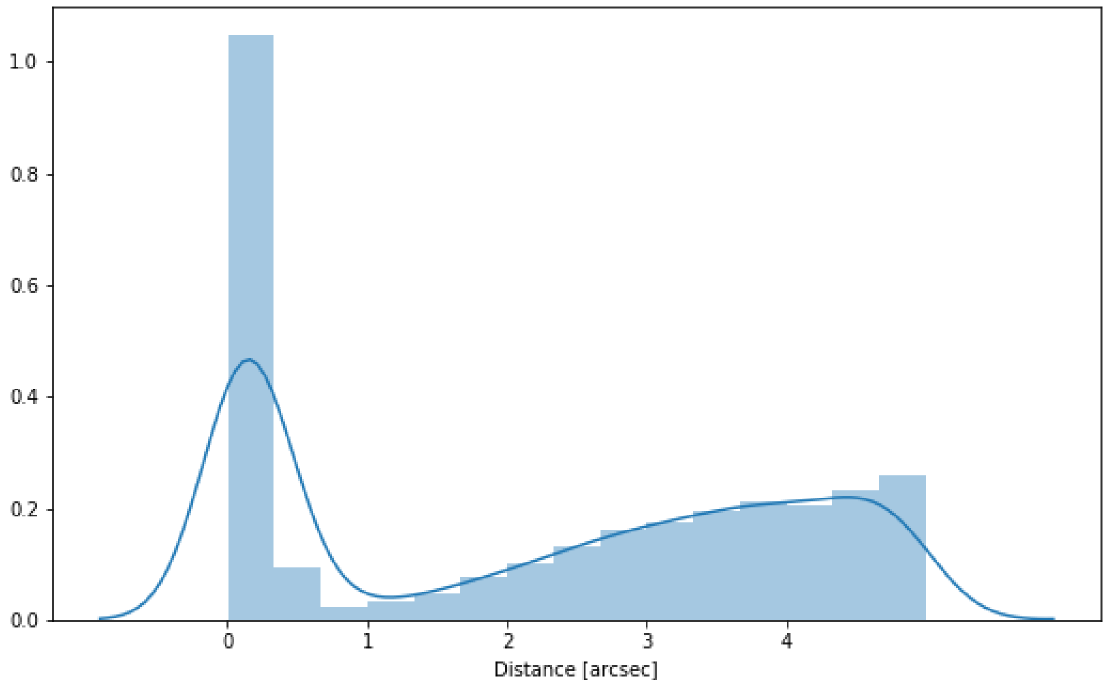

```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.8 Add VIPERS



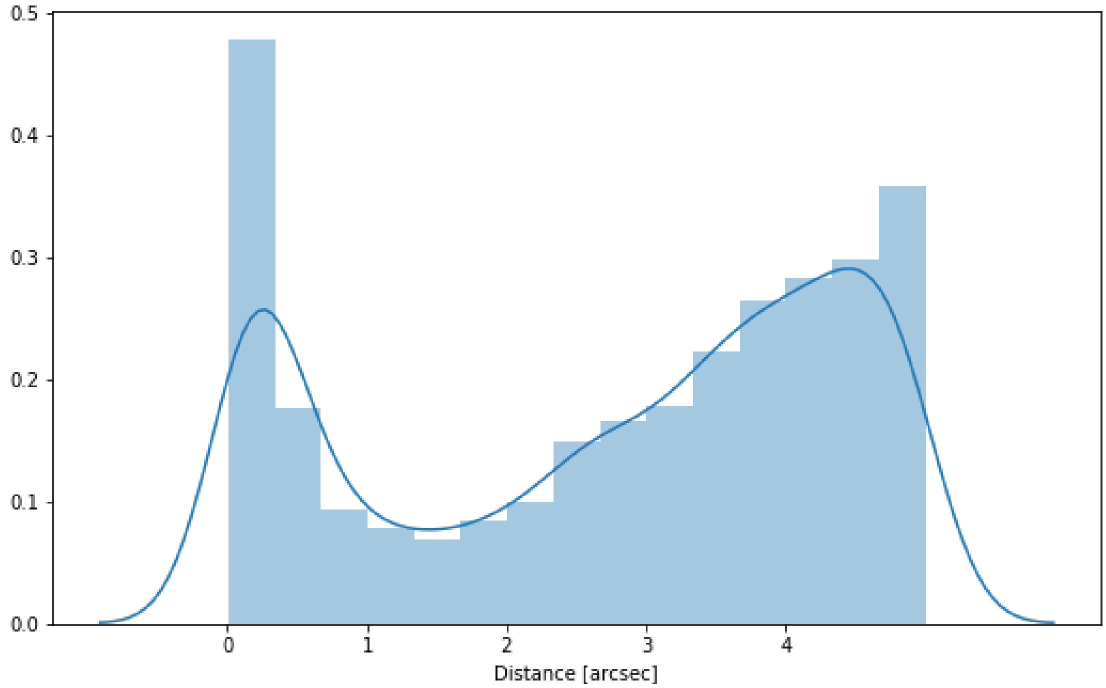

```
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'EXTNAME' types <class 'str'> and <class 's
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.9 Add VIRCAM




```
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
WARNING: MergeConflictWarning: Cannot merge meta key 'DATE-HDU' types <class 'str'> and <class '
```

1.2.10 Add IRAC



1.2.11 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.

```
ps1_id
ra
dec
flag_merged
candels_id
wirds_intid
megacam_intid
cfhtls-wide_id
cfhtls-deep_id
sparcs_intid
hsc_intid
hsc-wide_id
hsc-deep_id
hsc-udeep_id
decam_intid
decals_id
```

```
des_id
sxds_intid
ukidss_intid
dxs_id
uds_id
vipers_id
vircam_intid
vhs_id
video_id
viking_id
irac_intid
servs_intid
swire_intid
```

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

1.3 III - Merging flags and stellarity

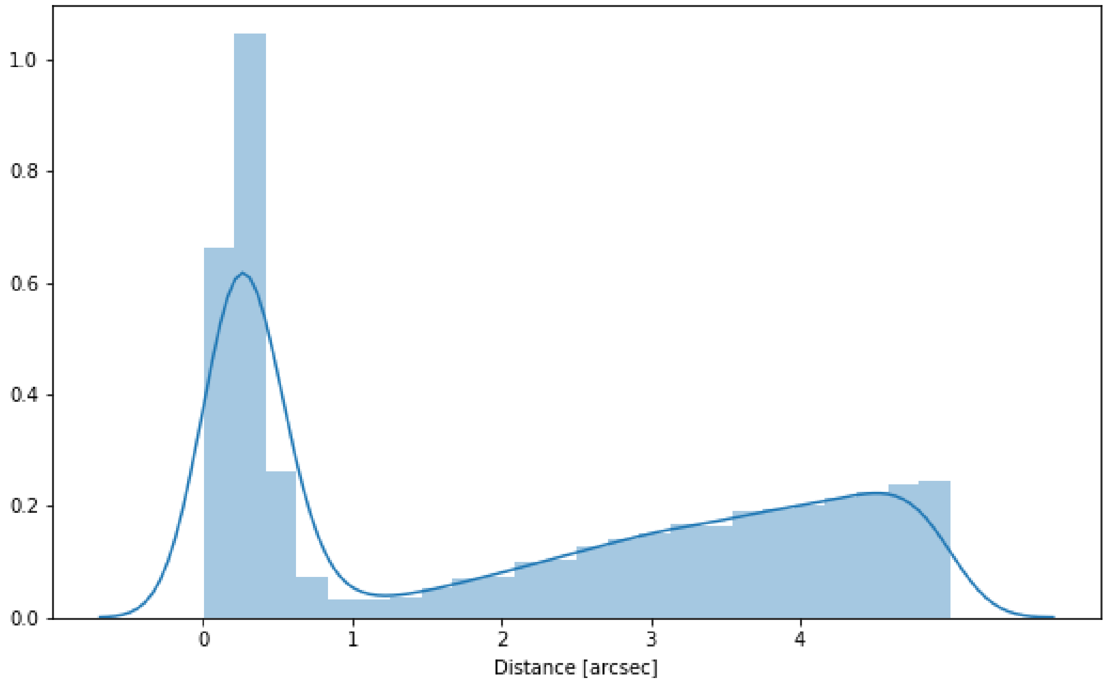
This all happens at the end now after the catalogue has been cut into strips.

1.4 IV - Adding E(B-V) column

1.5 V - Adding HELP unique identifiers and field columns

```
OK!
```

1.6 VI - Cross-matching with spec-z catalogue



1.7 VIII.a Wavelength domain coverage

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

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

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

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

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

1.8 VIII.b Wavelength domain detection

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

- 1 for detection in optical;

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

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

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

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

1.9 IX - Cross-identification table

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

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

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

```
['ps1_id', 'candels_id', 'wirds_intid', 'megacam_intid', 'cfhtls-wide_id', 'cfhtls-deep_id', 'sp
```

1.10 X - Adding HEALPix index

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

1.11 XI - Saving the catalogue

```
Missing columns: {'ukidss_intid', 'decam_intid', 'candels_id', 'ps1_id', 'vhs_id', 'sxds_intid',
```

1.12 XII - folding in the photometry

On XMM-LSS 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.

```
2
```

3_Checks_and_diagnostics

January 18, 2018

1 XMM-LSS 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_xmm-lss_20180111.fits
```

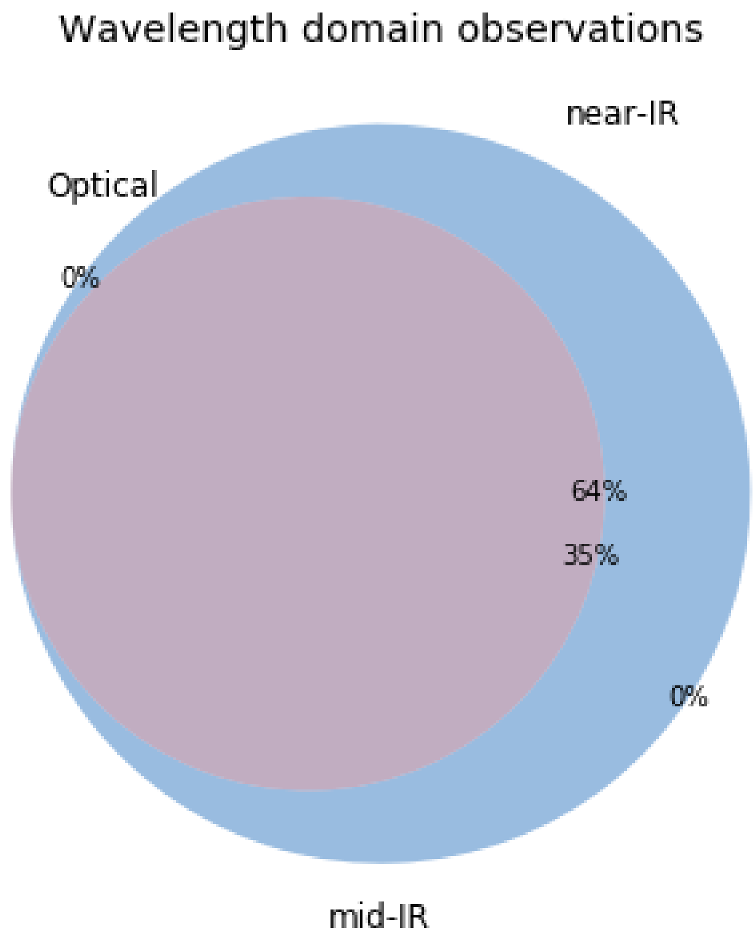
1.2 0 - Quick checks

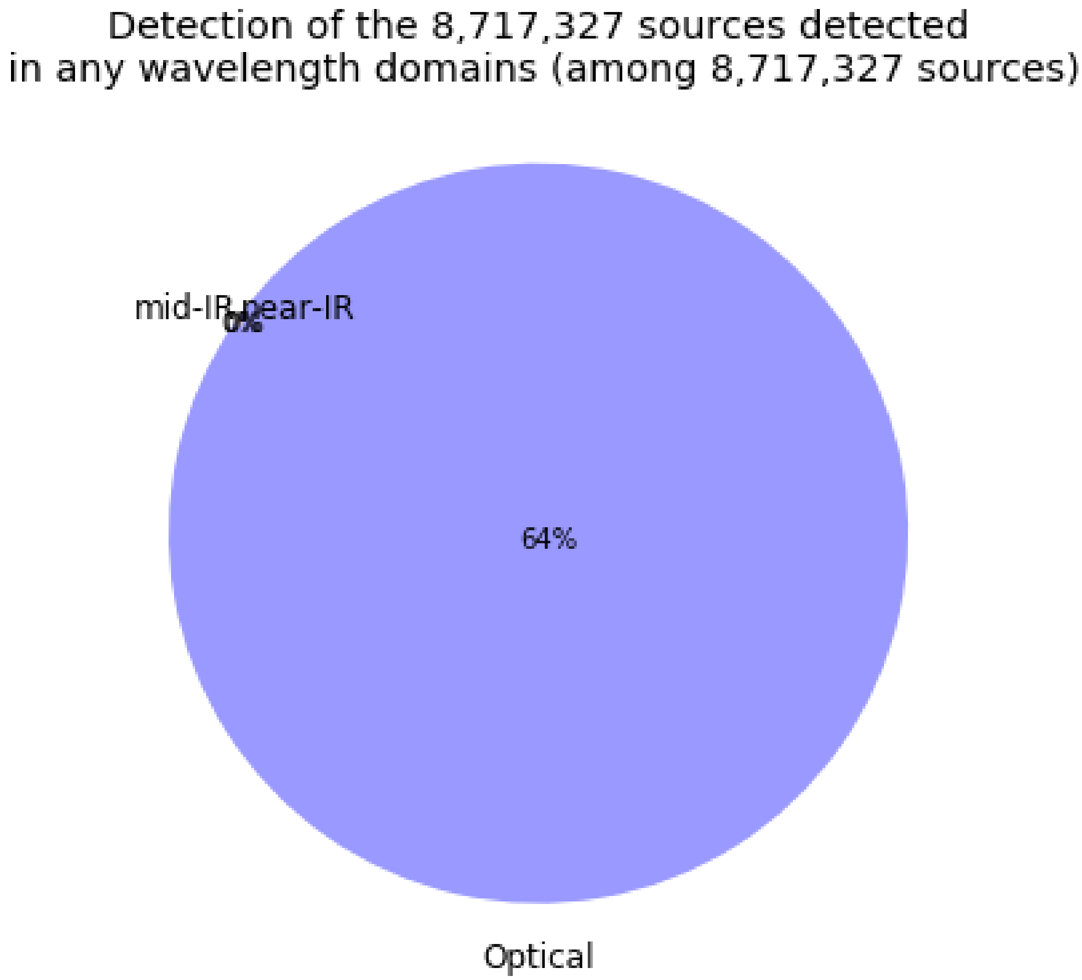
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype), FutureWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype),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

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

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

1.3 I - Summary of wavelength domains



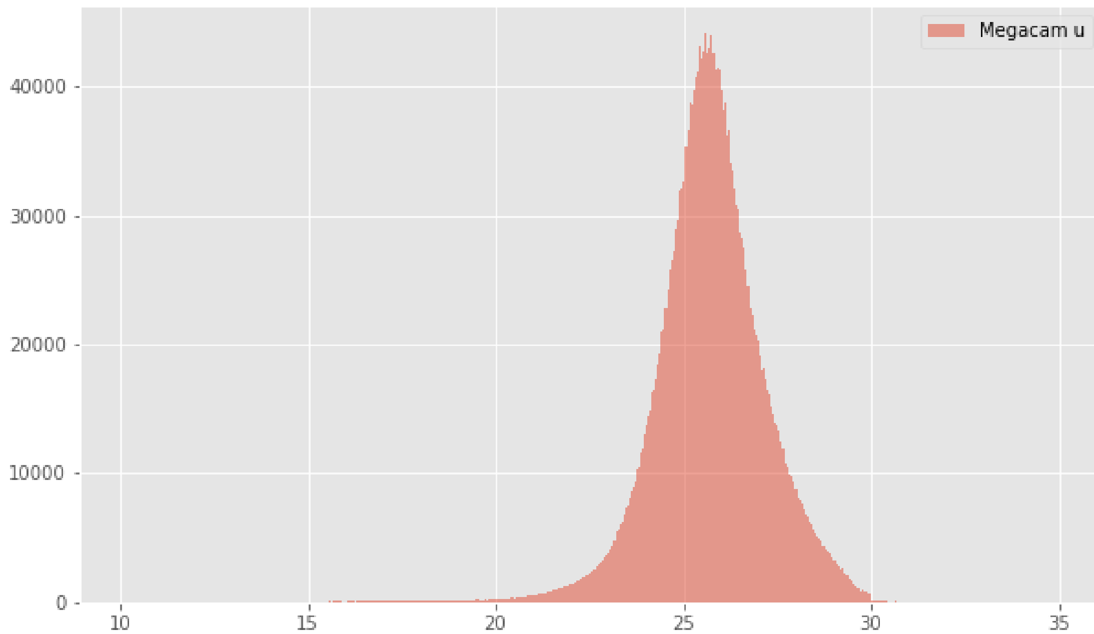


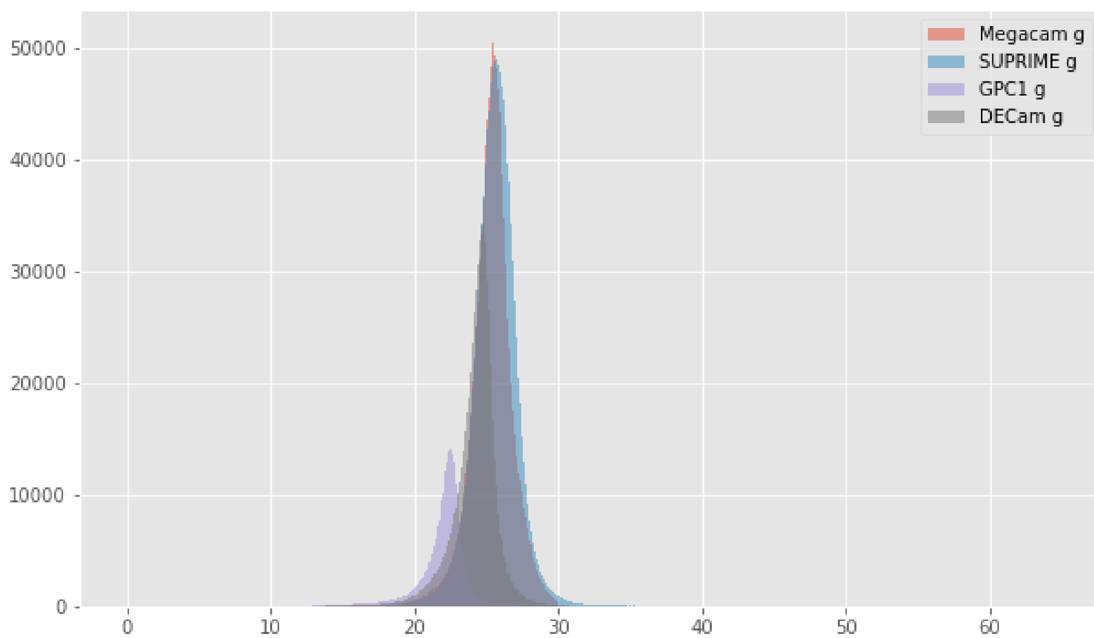
1.4 II - Comparing magnitudes in similar filters

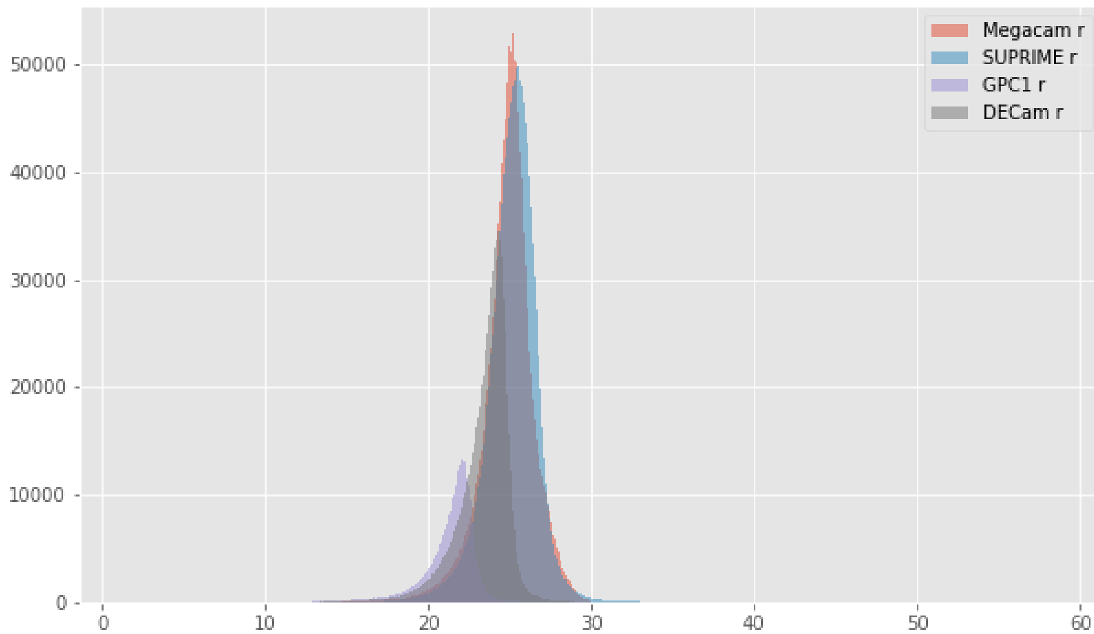
The master list if composed of several catalogues containing magnitudes in similar filters on different instruments. We are comparing the magnitudes in these corresponding filters.

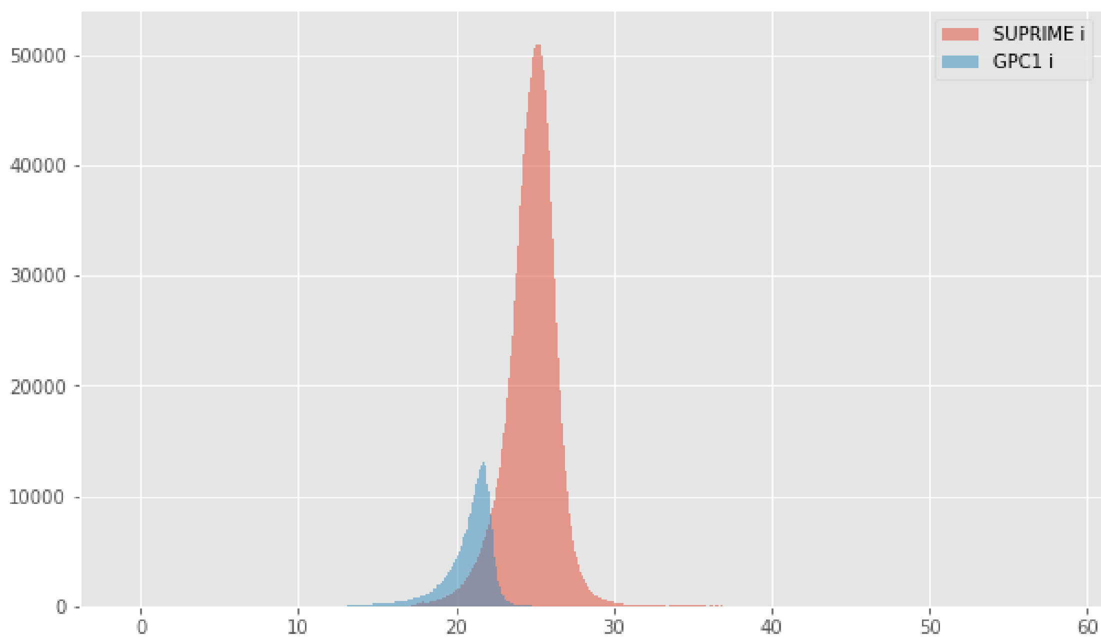
1.4.1 II.a - Comparing depths

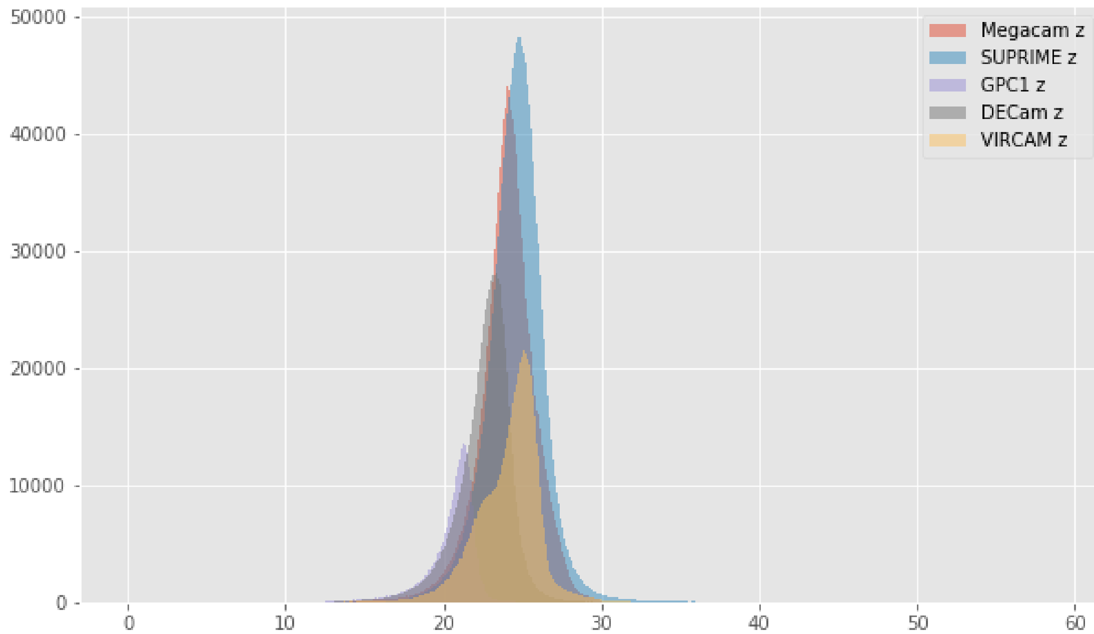
We compare the histograms of the total aperture magnitudes of similar bands.

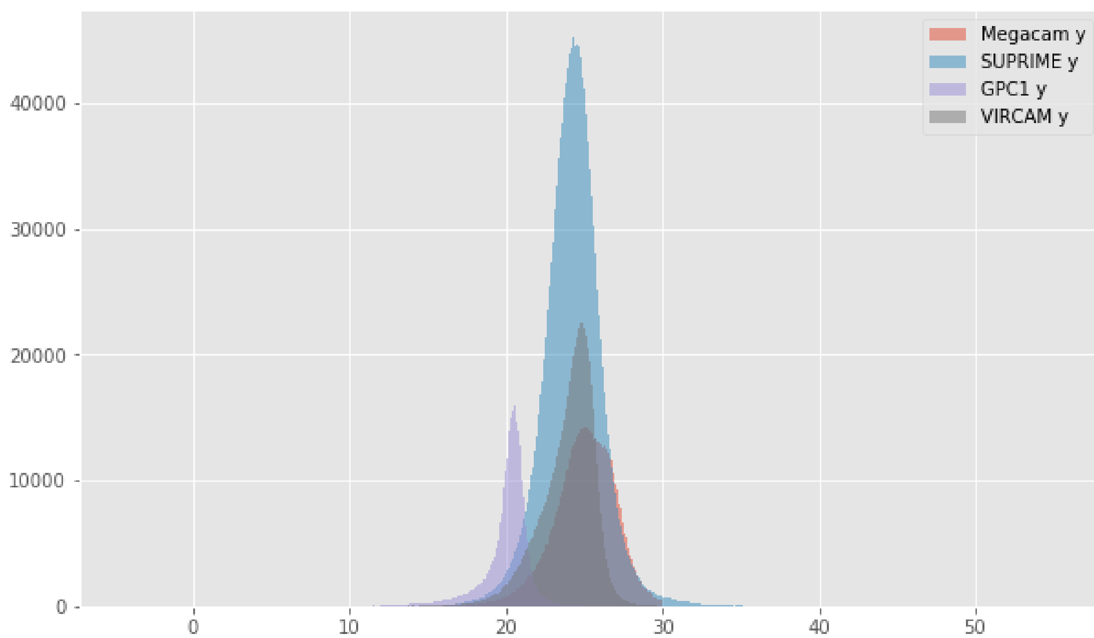

Megacam u
0
10000
20000
30000
40000
10
15
20
25
30
35

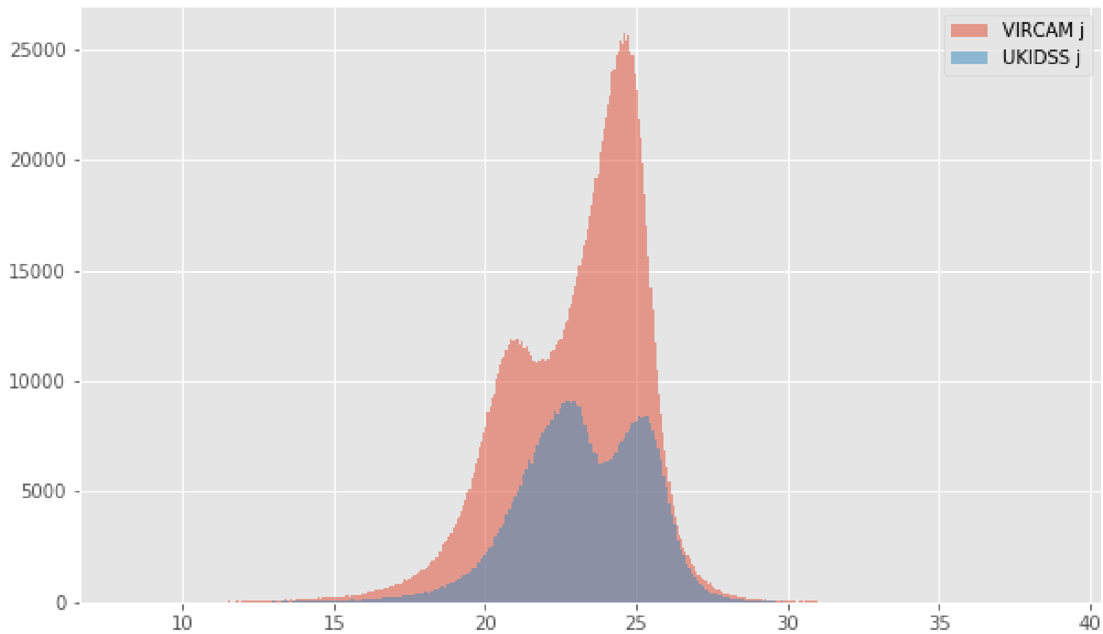

Megacam g
SUPRIME g
GPC1 g
DECam g
0
10000
20000
30000
40000
50000
0
10
20
30
40
50
60

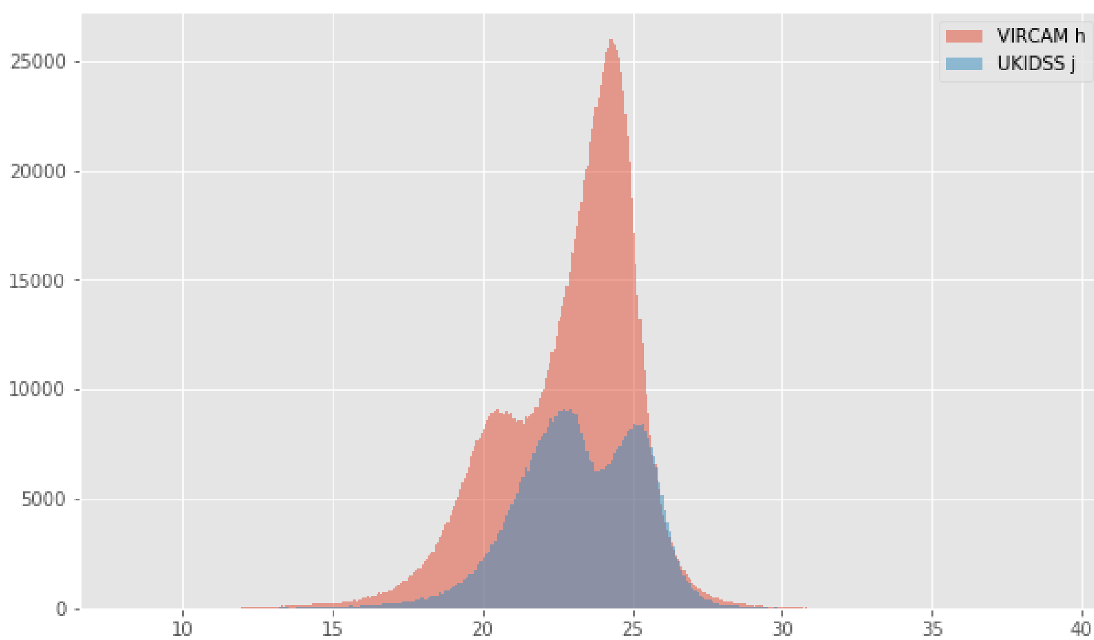

Megacam r
SUPRIME r
GPC1 r
DECam r
50000
40000
30000
20000
10000
0
0
10
20
30
40
50
60

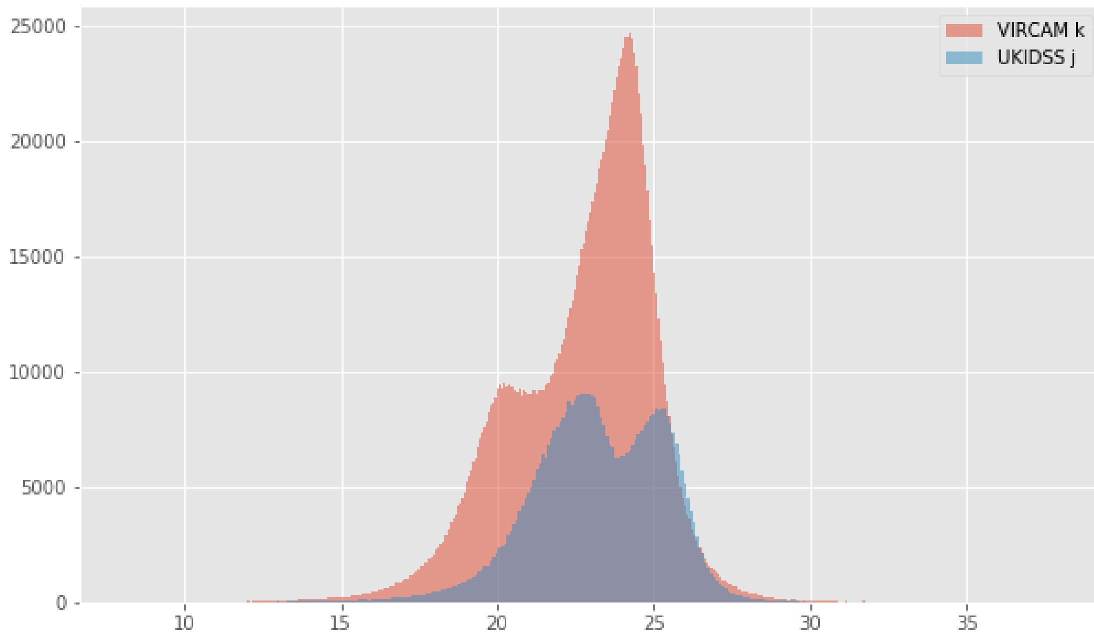

SUPRIME i
GPC1 i
50000
40000
30000
20000
10000
0
0
10
20
30
40
50
60


Megacam z
SUPRIME z
GPC1 z
DECam z
VIRCAM z
50000
40000
30000
20000
10000
0
0
10
20
30
40
50
60


Megacam y
SUPRIME y
GPC1 y
VIRCAM y
40000
30000
20000
10000
0
0
10
20
30
40
50


VIRCAM j
UKIDSS j
0
5000
10000
15000
20000
25000
10
15
20
25
30
35
40

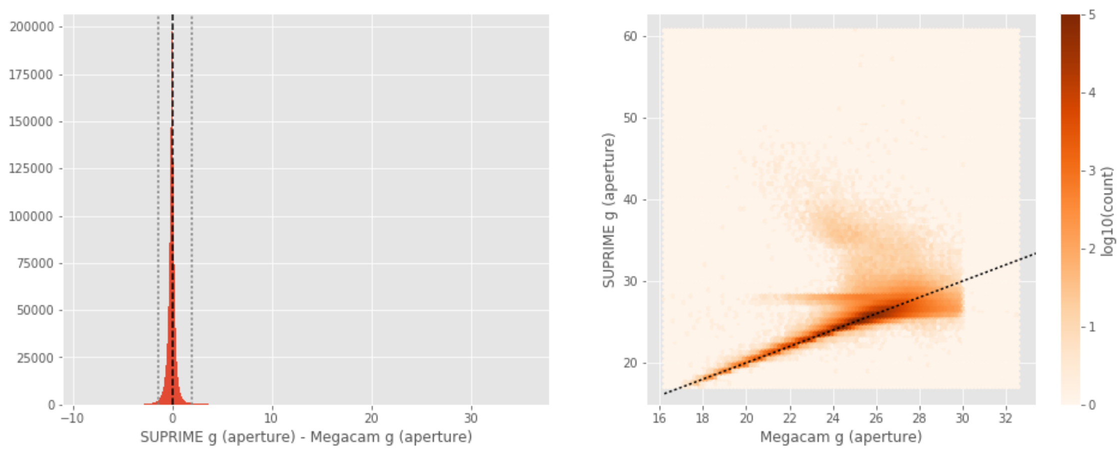

VIRCAM h
UKIDSS j
0
5000
10000
15000
20000
25000
10
15
20
25
30
35
40



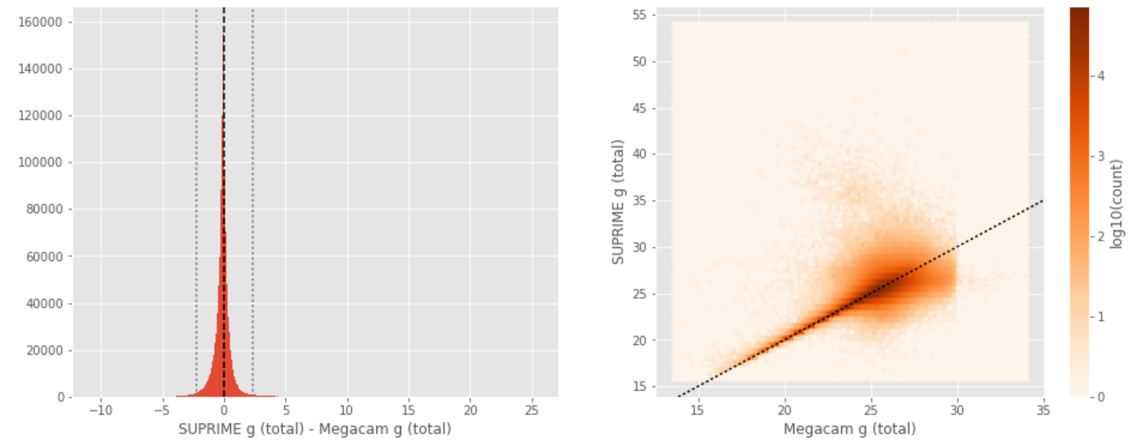
1.4.2 II.b - Comparing magnitudes

We compare one to one each magnitude in similar bands.

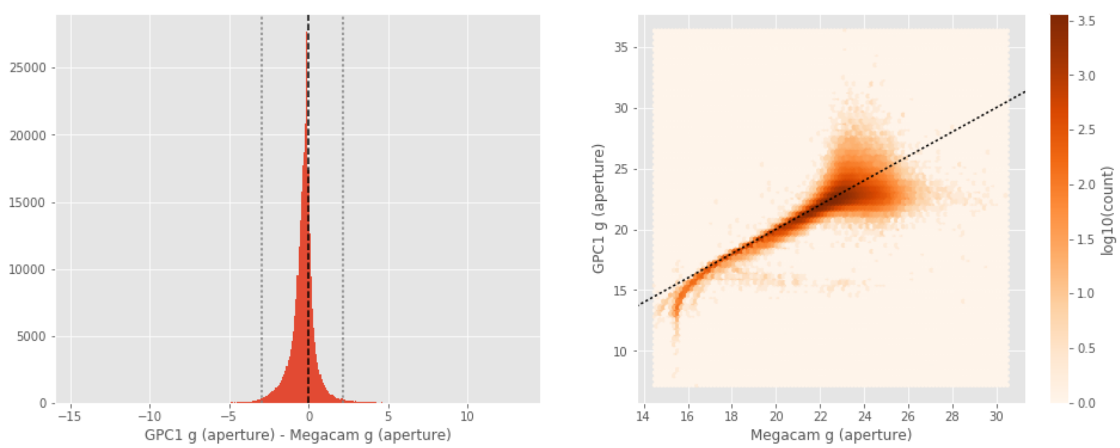
```
SUPRIME g (aperture) - Megacam g (aperture):
- Median: -0.04
- Median Absolute Deviation: 0.17
- 1% percentile: -1.4483098983764648
- 99% percentile: 1.9926118850708008
```



SUPRIME g (total) - Megacam g (total):
- Median: -0.09
- Median Absolute Deviation: 0.24
- 1% percentile: -2.2796373748779297
- 99% percentile: 2.318053646087643

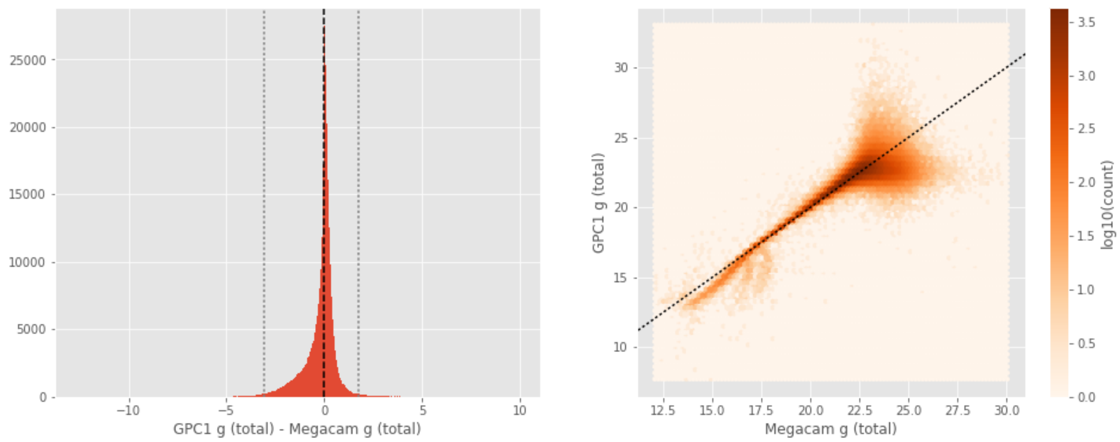


GPC1 g (aperture) - Megacam g (aperture):
- Median: -0.26
- Median Absolute Deviation: 0.32
- 1% percentile: -2.922389602661133
- 99% percentile: 2.15511814117431

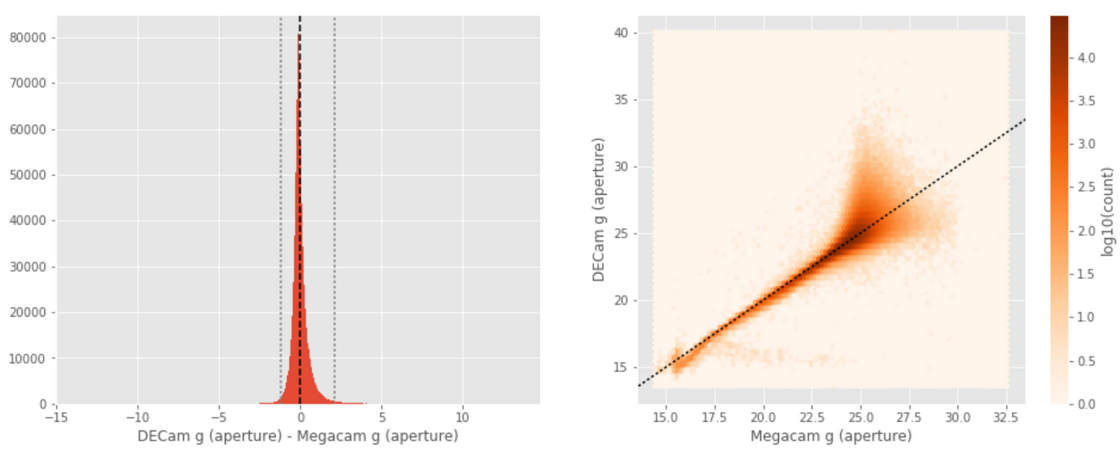


GPC1 g (total) - Megacam g (total):
- Median: 0.01

- Median Absolute Deviation: 0.26
- 1% percentile: -3.0582639503479006
- 99% percentile: 1.7543010711669922

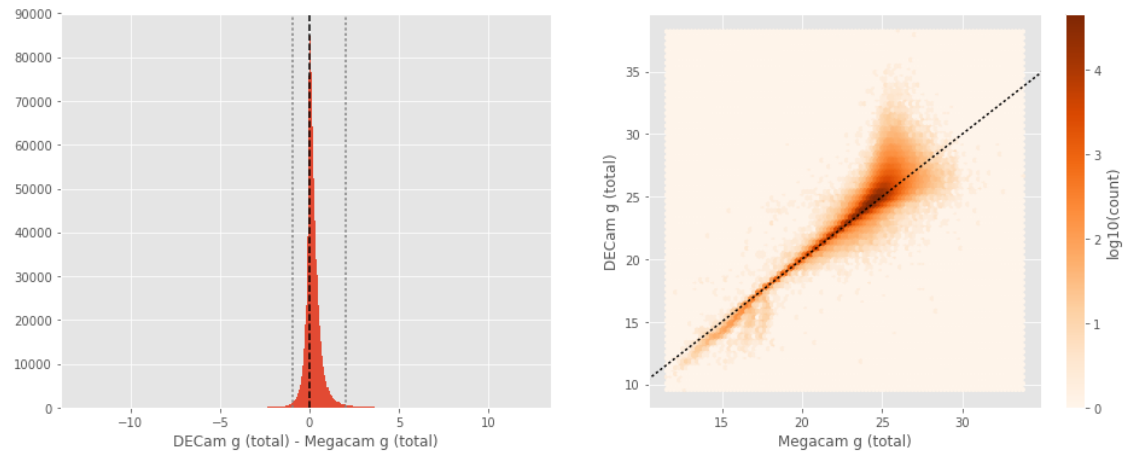


DECam g (aperture) - Megacam g (aperture):
- Median: -0.08
- Median Absolute Deviation: 0.21
- 1% percentile: -1.1811183166503905
- 99% percentile: 2.112486801147454

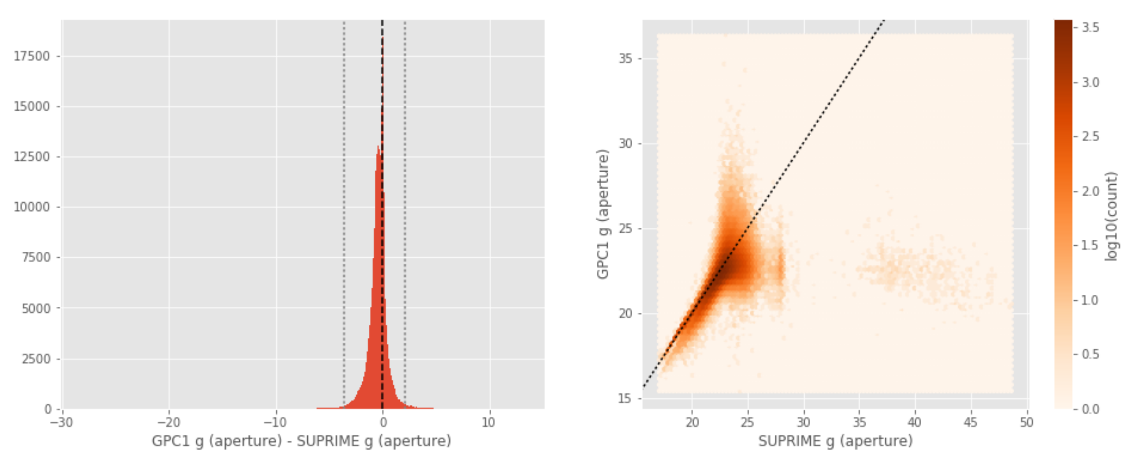


DECam g (total) - Megacam g (total):
- Median: 0.13
- Median Absolute Deviation: 0.18
- 1% percentile: -0.9527052307128906

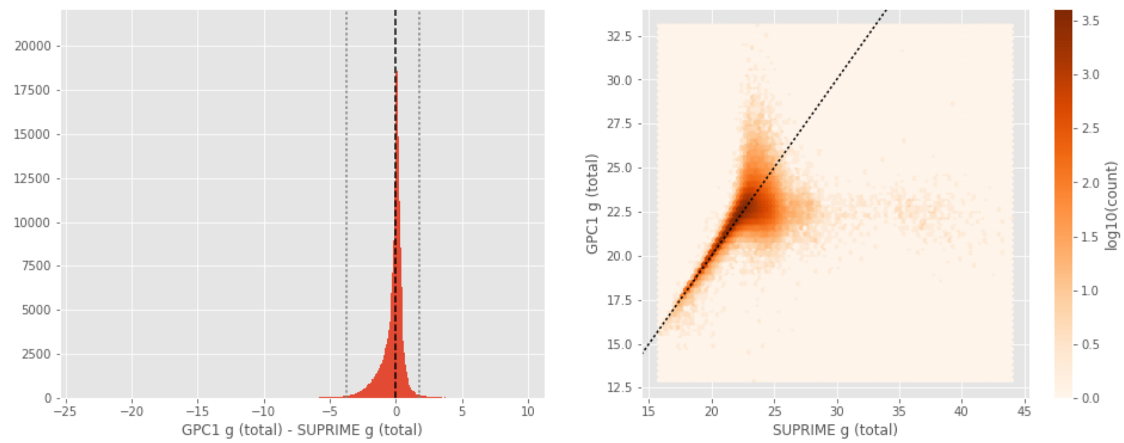
- 99% percentile: 2.0308621215820217



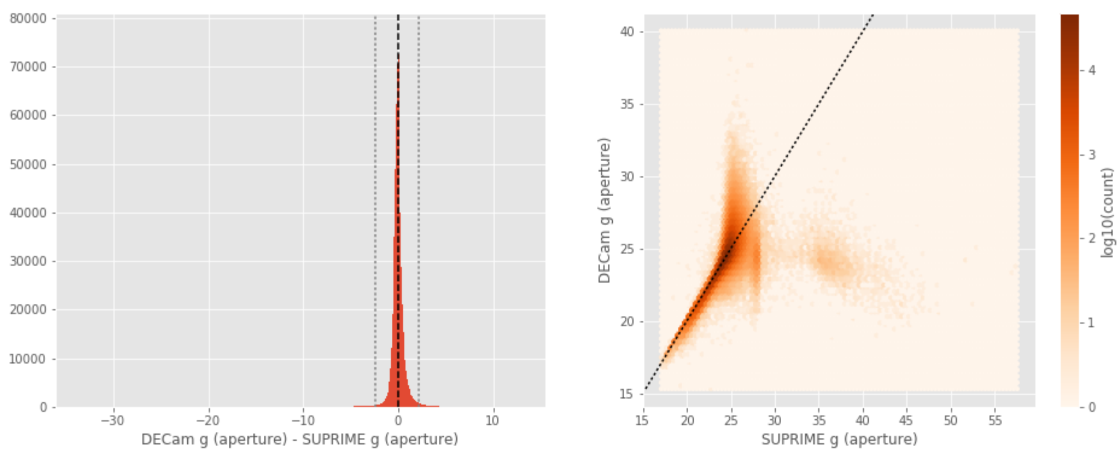
GPC1 g (aperture) - SUPRIME g (aperture):
- Median: -0.34
- Median Absolute Deviation: 0.40
- 1% percentile: -3.638873367309570
- 99% percentile: 2.140432815551756



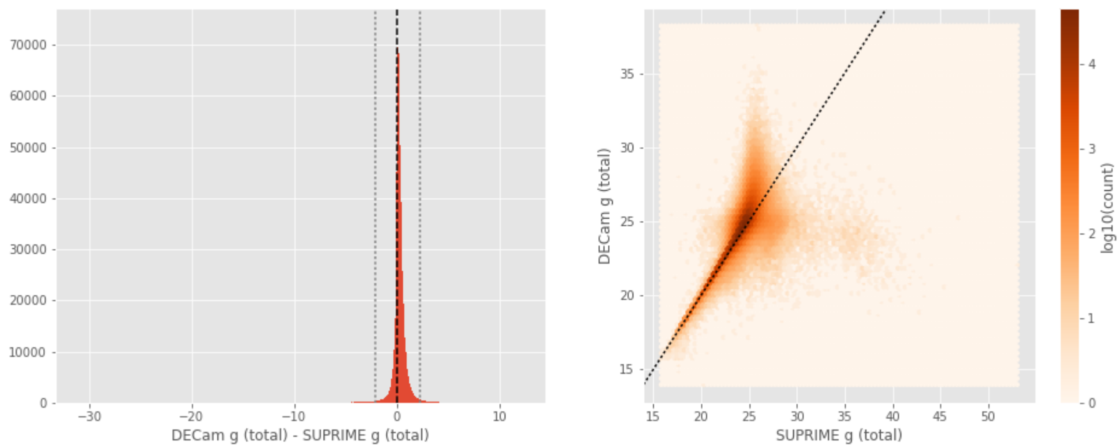
GPC1 g (total) - SUPRIME g (total):
- Median: 0.01
- Median Absolute Deviation: 0.28
- 1% percentile: -3.74440673828125
- 99% percentile: 1.7463184356689447



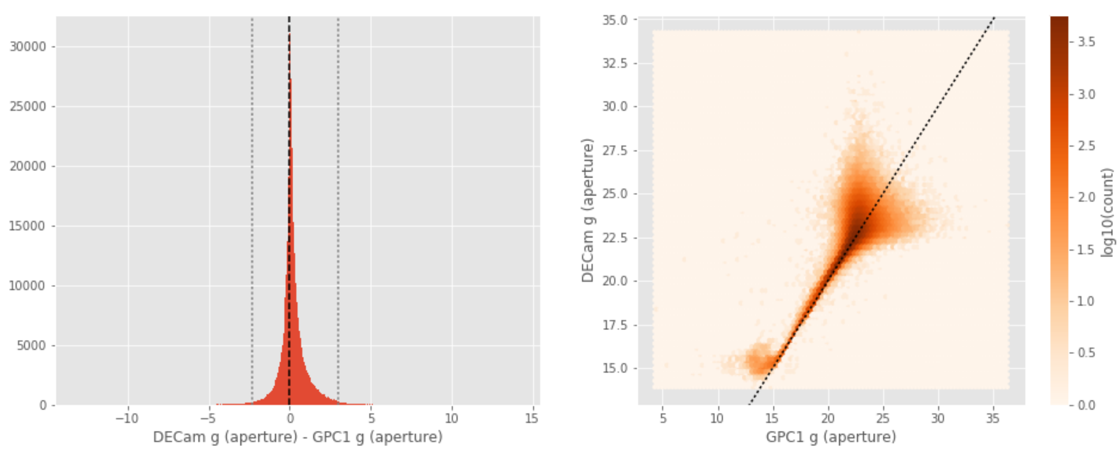
DECam g (aperture) - SUPRIME g (aperture):
- Median: -0.04
- Median Absolute Deviation: 0.25
- 1% percentile: -2.4612117767333985
- 99% percentile: 2.183241653442389



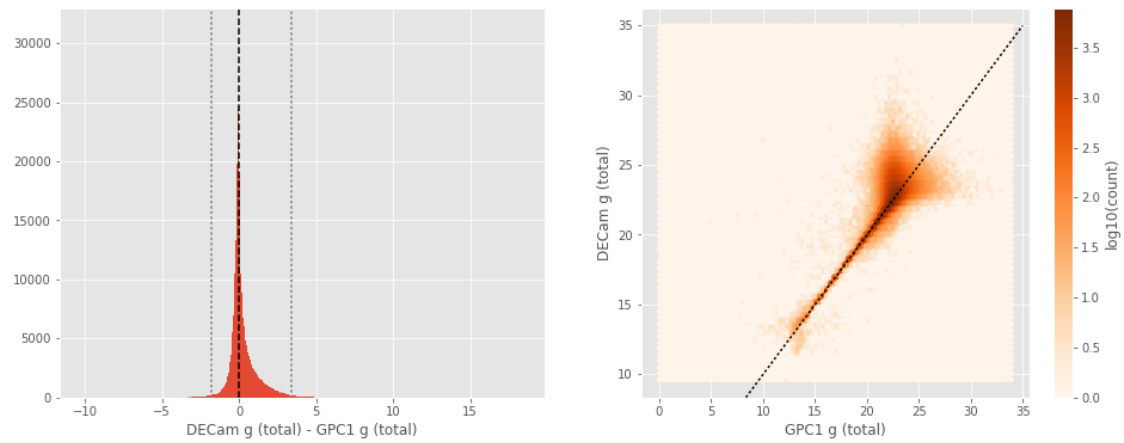
DECam g (total) - SUPRIME g (total):
- Median: 0.21
- Median Absolute Deviation: 0.21
- 1% percentile: -2.076807861328125
- 99% percentile: 2.233863716125488



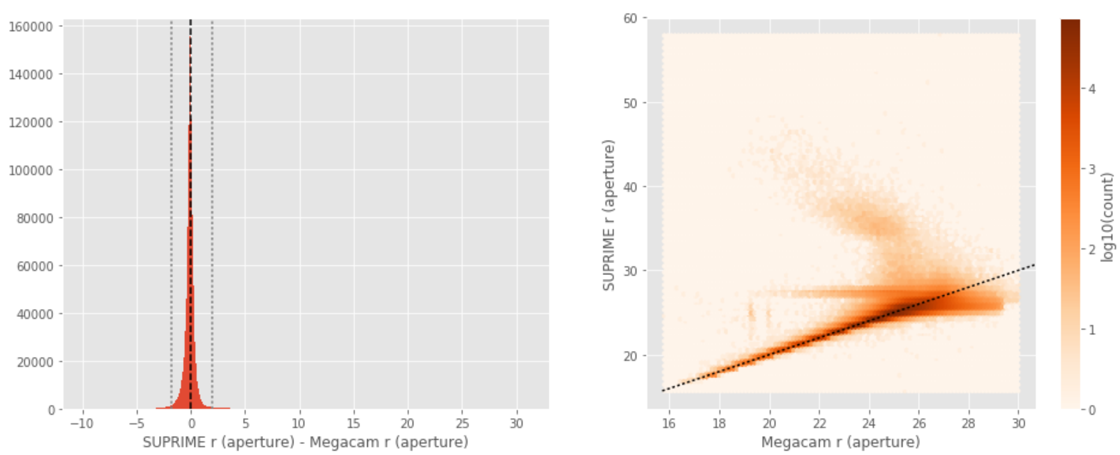
DECam g (aperture) - GPC1 g (aperture):
- Median: 0.10
- Median Absolute Deviation: 0.28
- 1% percentile: -2.302797317504883
- 99% percentile: 3.036126937866211



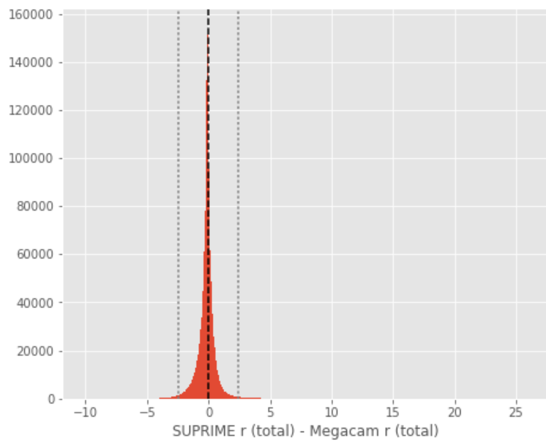
DECam g (total) - GPC1 g (total):
- Median: -0.01
- Median Absolute Deviation: 0.26
- 1% percentile: -1.7767018127441405
- 99% percentile: 3.415311203002934

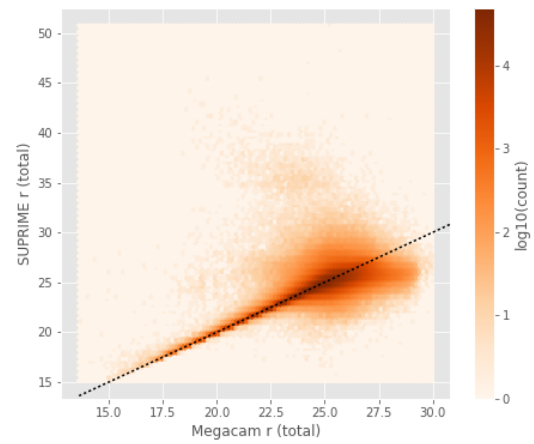


SUPRIME r (aperture) - Megacam r (aperture):
- Median: -0.07
- Median Absolute Deviation: 0.19
- 1% percentile: -1.7427062225341796
- 99% percentile: 1.9742098236084091

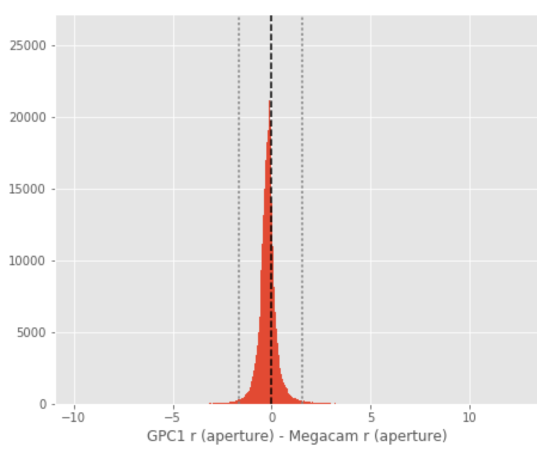


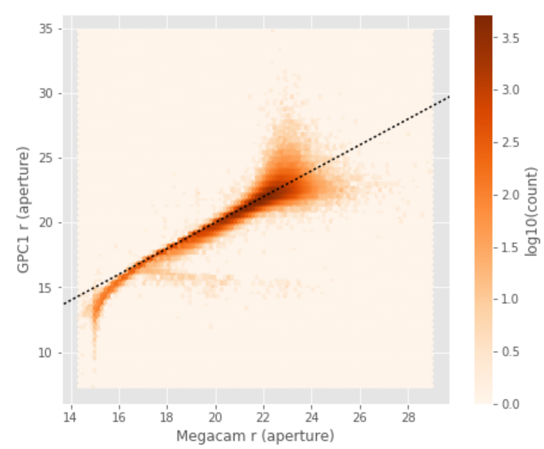
SUPRIME r (total) - Megacam r (total):
- Median: -0.11
- Median Absolute Deviation: 0.25
- 1% percentile: -2.4677522277832034
- 99% percentile: 2.405049591064458



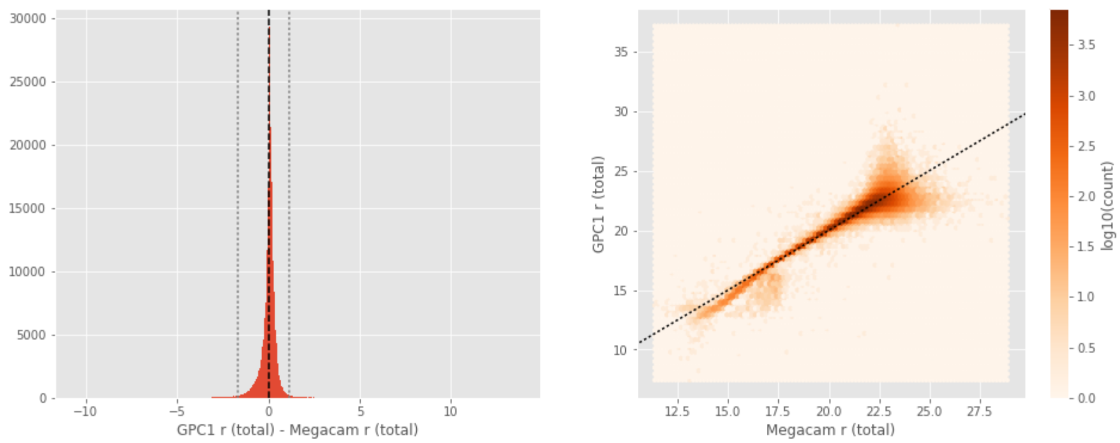


GPC1 r (aperture) - Megacam r (aperture):
- Median: -0.18
- Median Absolute Deviation: 0.20
- 1% percentile: -1.6823997497558594
- 99% percentile: 1.5248133659362808

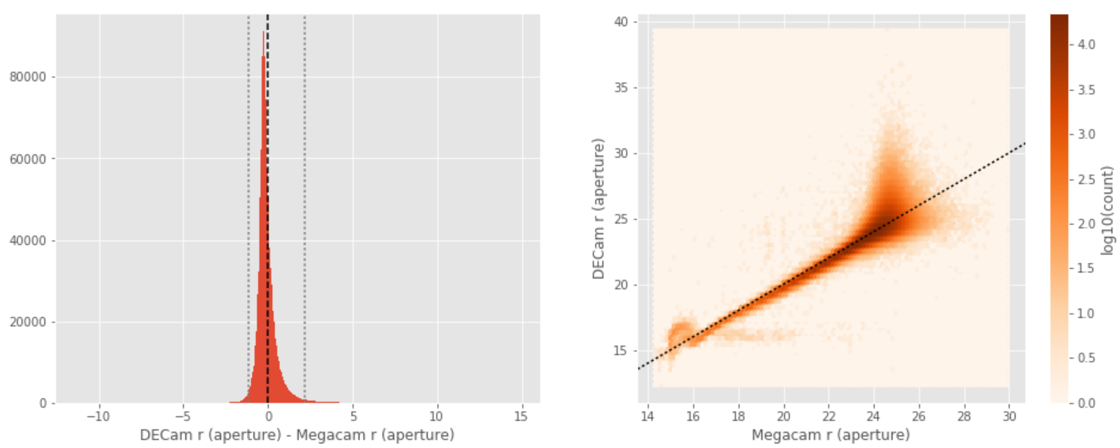




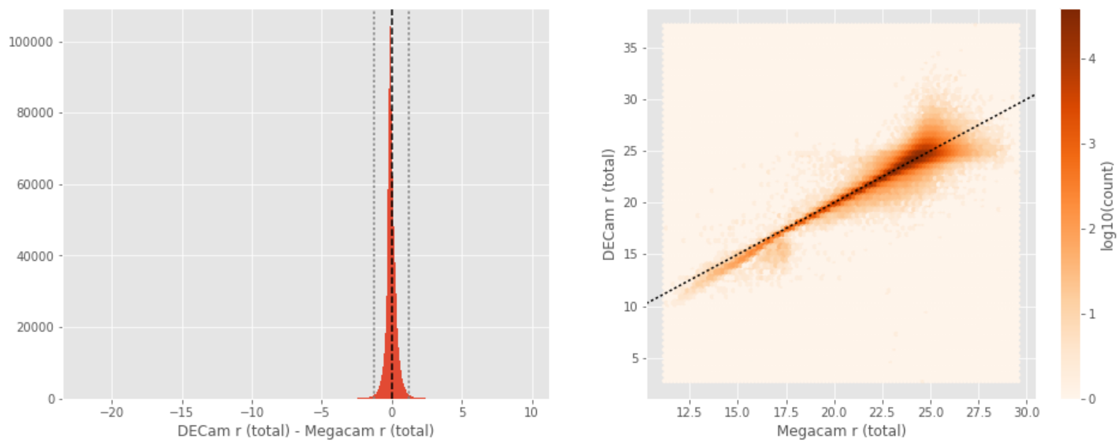
GPC1 r (total) - Megacam r (total):
- Median: 0.06
- Median Absolute Deviation: 0.14
- 1% percentile: -1.696656036376953
- 99% percentile: 1.1219566345214784



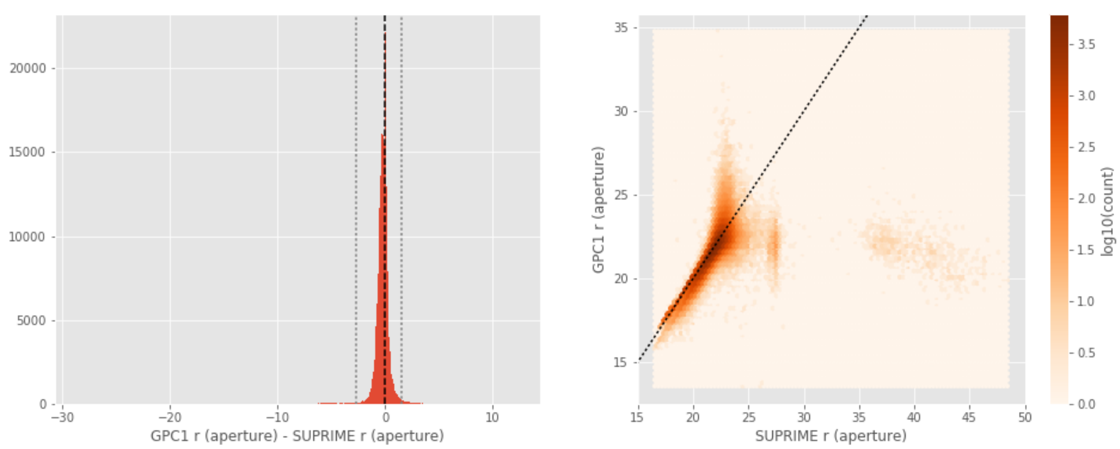
DECam r (aperture) - Megacam r (aperture):
- Median: -0.18
- Median Absolute Deviation: 0.23
- 1% percentile: -1.171355857849121
- 99% percentile: 2.210715560913087



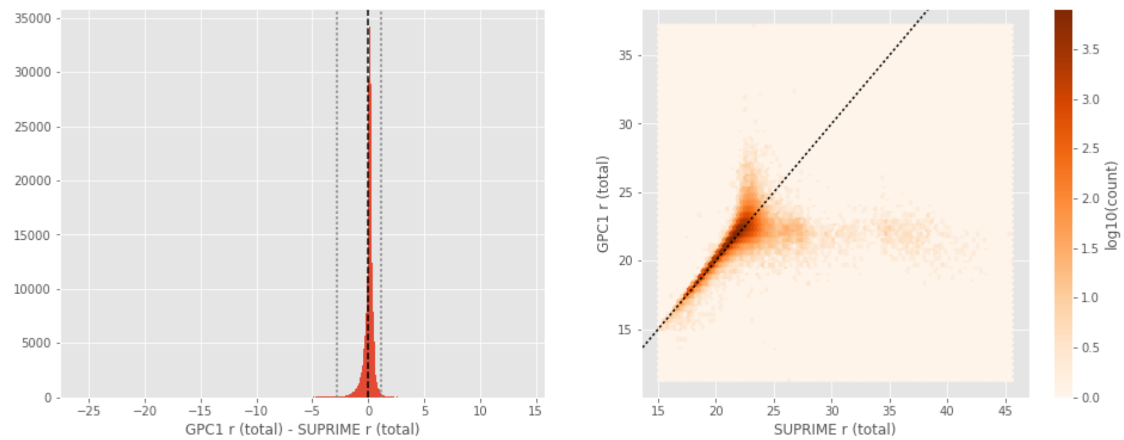
DECam r (total) - Megacam r (total):
- Median: -0.07
- Median Absolute Deviation: 0.18
- 1% percentile: -1.224824752807617
- 99% percentile: 1.1843146514892569



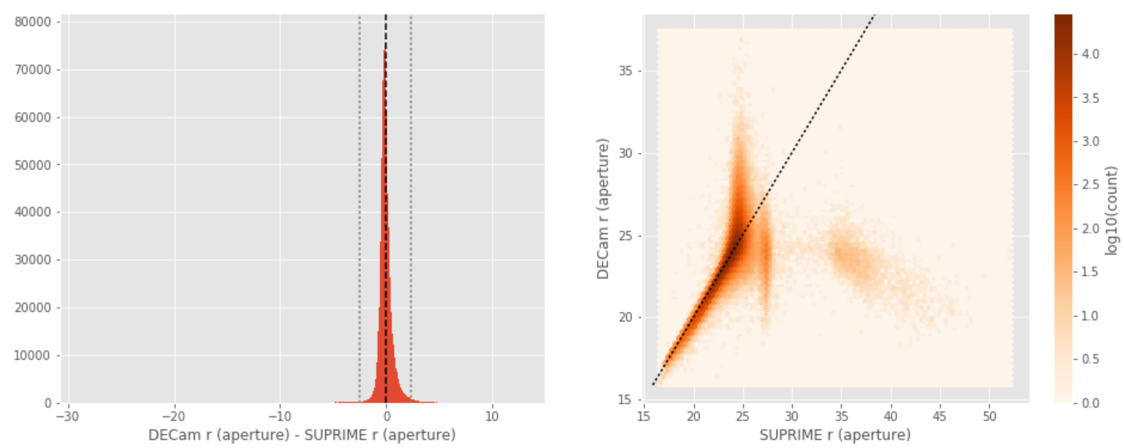
GPC1 r (aperture) - SUPRIME r (aperture):
- Median: -0.18
- Median Absolute Deviation: 0.27
- 1% percentile: -2.692432670593262
- 99% percentile: 1.5765325546264626



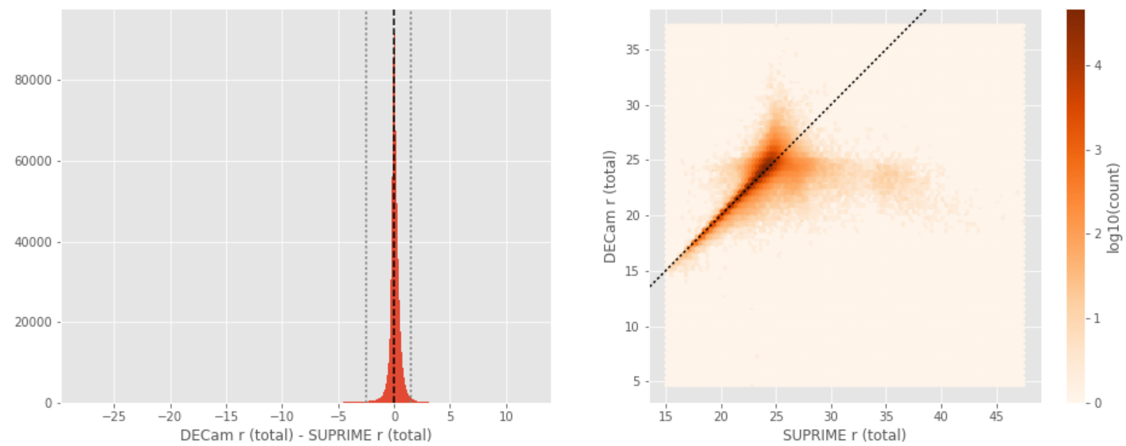
GPC1 r (total) - SUPRIME r (total):
- Median: 0.12
- Median Absolute Deviation: 0.16
- 1% percentile: -2.7956747817993164
- 99% percentile: 1.1564066696166995



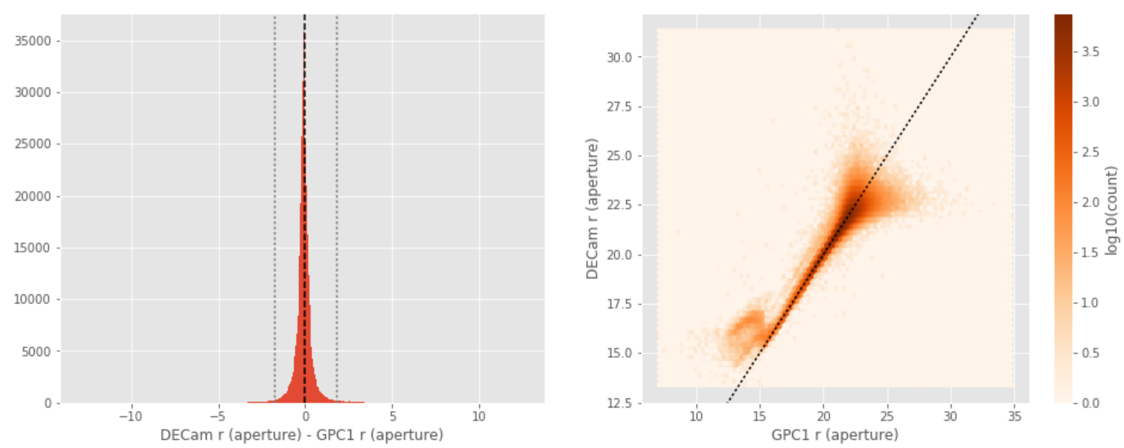
DECam r (aperture) - SUPRIME r (aperture):
- Median: -0.10
- Median Absolute Deviation: 0.27
- 1% percentile: -2.514927597045898
- 99% percentile: 2.380972080230713



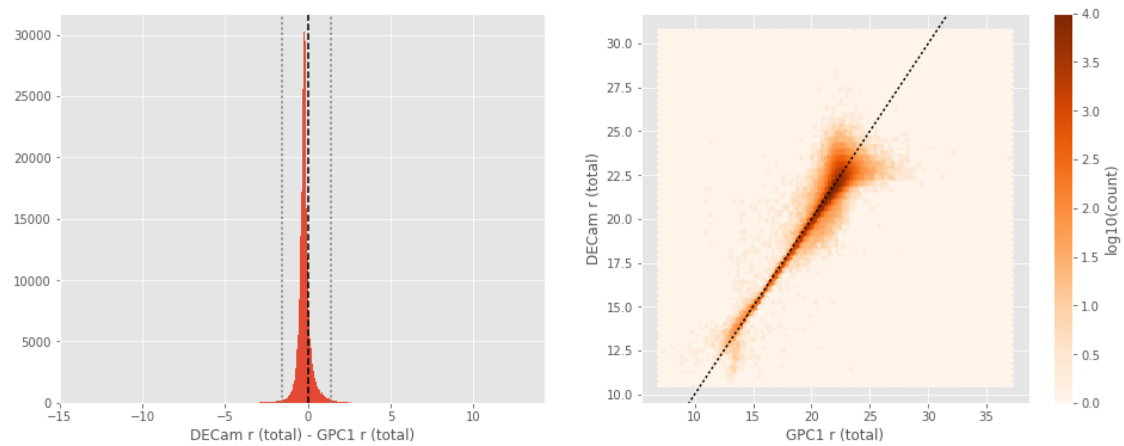
DECam r (total) - SUPRIME r (total):
- Median: 0.03
- Median Absolute Deviation: 0.20
- 1% percentile: -2.541008338928223
- 99% percentile: 1.5030912780761714



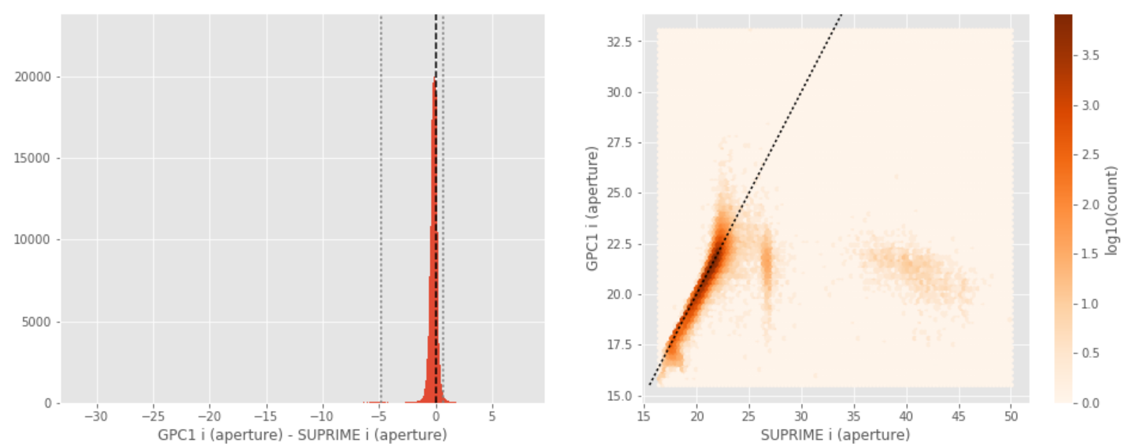
DECam r (aperture) - GPC1 r (aperture):
- Median: -0.08
- Median Absolute Deviation: 0.18
- 1% percentile: -1.7710686492919923
- 99% percentile: 1.831312179565407



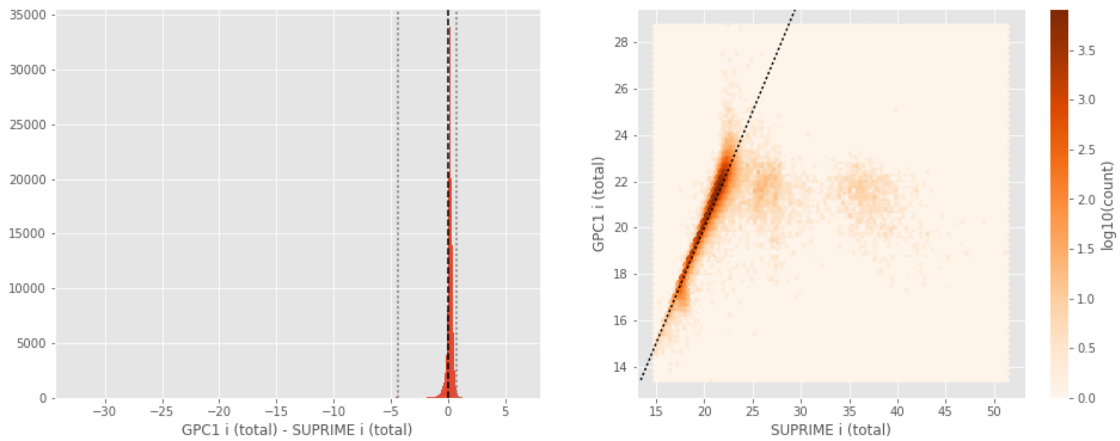
DECam r (total) - GPC1 r (total):
- Median: -0.22
- Median Absolute Deviation: 0.15
- 1% percentile: -1.5473146820068355
- 99% percentile: 1.3859005737304706



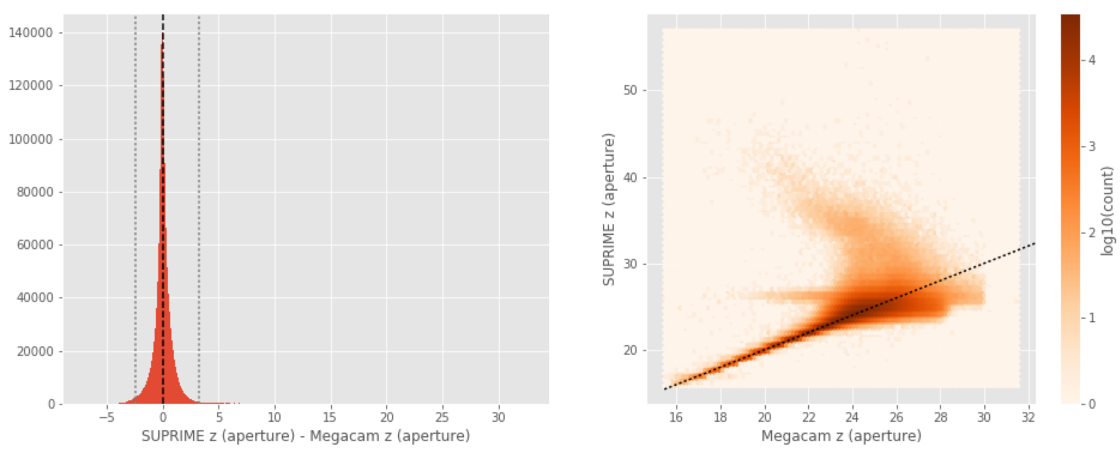
GPC1 i (aperture) - SUPRIME i (aperture):
- Median: -0.13
- Median Absolute Deviation: 0.20
- 1% percentile: -4.781778450012207
- 99% percentile: 0.6964595603942864



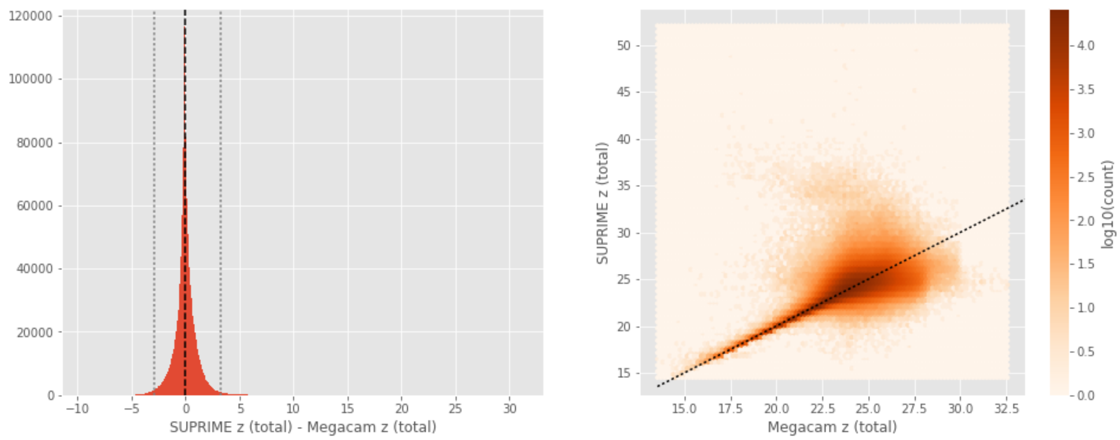
GPC1 i (total) - SUPRIME i (total):
- Median: 0.19
- Median Absolute Deviation: 0.11
- 1% percentile: -4.400829467773438
- 99% percentile: 0.7501198959350581



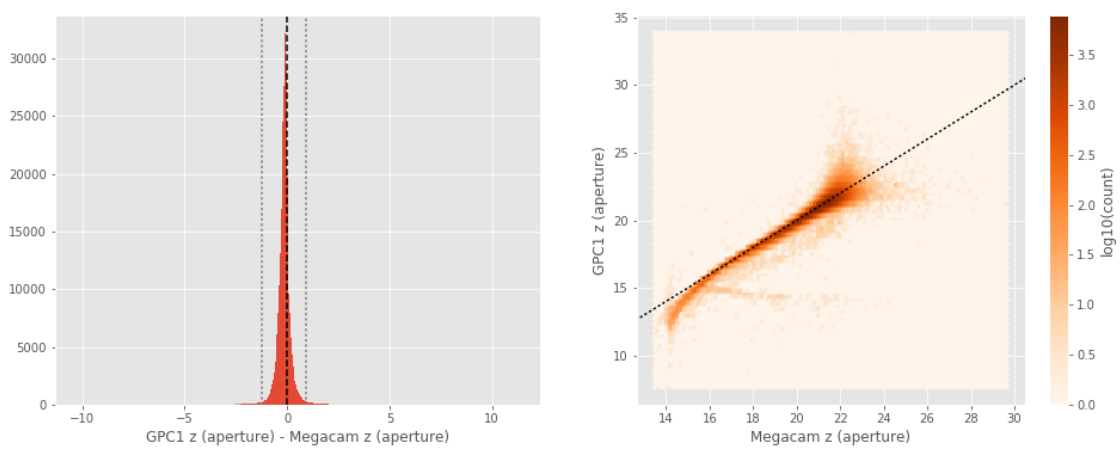
SUPRIME z (aperture) - Megacam z (aperture):
- Median: -0.02
- Median Absolute Deviation: 0.32
- 1% percentile: -2.448016357421875
- 99% percentile: 3.2967525482177784



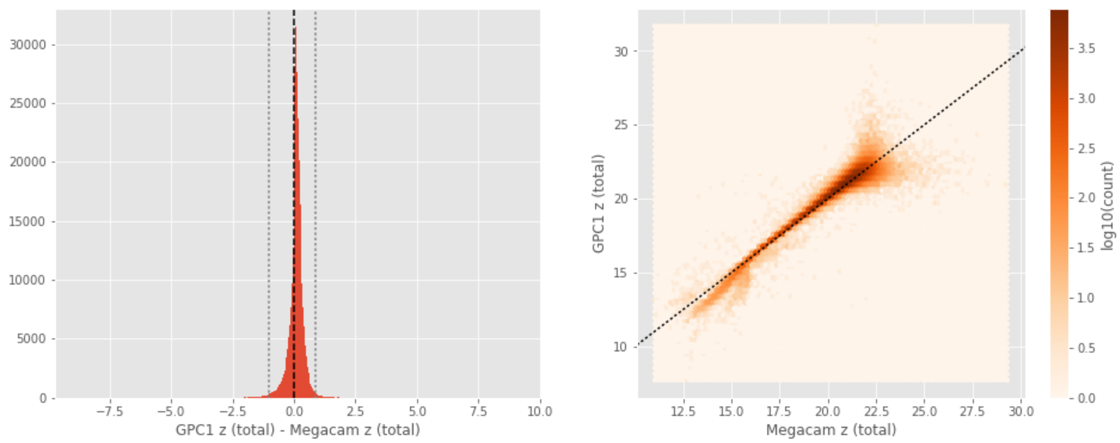
SUPRIME z (total) - Megacam z (total):
- Median: -0.07
- Median Absolute Deviation: 0.42
- 1% percentile: -2.9330552291870116
- 99% percentile: 3.2738224792480537



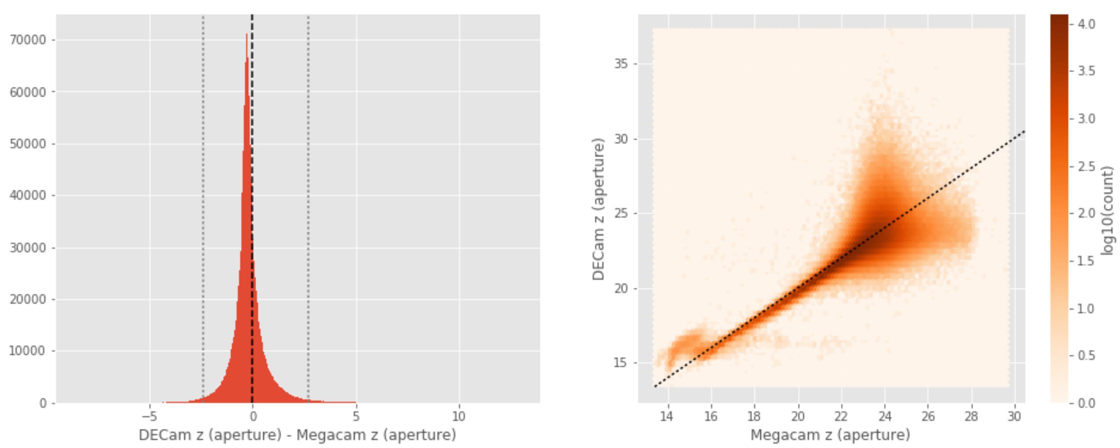
GPC1 z (aperture) - Megacam z (aperture):
- Median: -0.13
- Median Absolute Deviation: 0.14
- 1% percentile: -1.2277031707763673
- 99% percentile: 0.9080109024047944



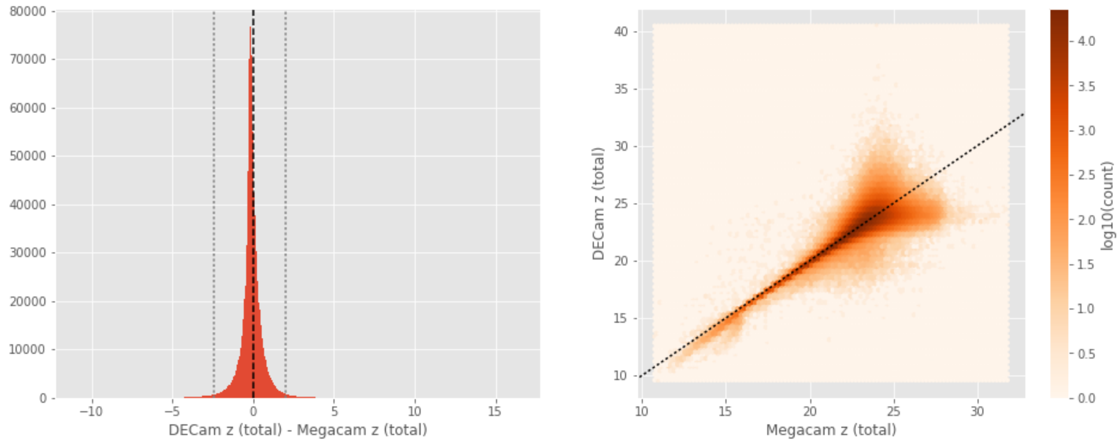
GPC1 z (total) - Megacam z (total):
- Median: 0.10
- Median Absolute Deviation: 0.12
- 1% percentile: -1.0412810516357422
- 99% percentile: 0.8804988861083984



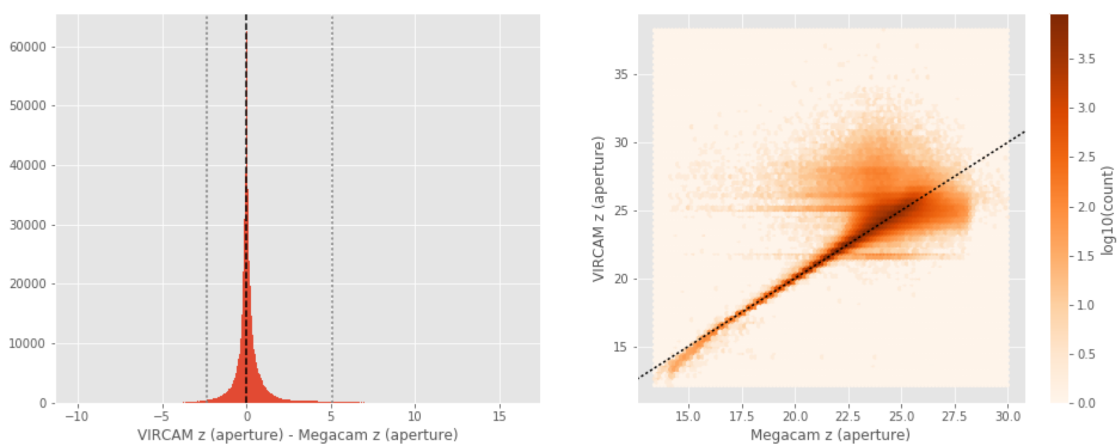
DECam z (aperture) - Megacam z (aperture):
- Median: -0.25
- Median Absolute Deviation: 0.29
- 1% percentile: -2.4187049865722656
- 99% percentile: 2.695146560668933



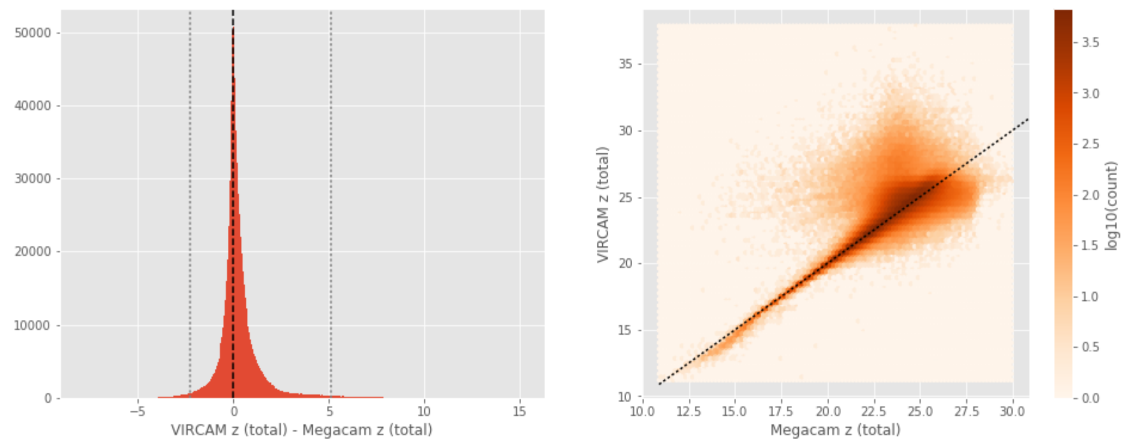
DECam z (total) - Megacam z (total):
- Median: -0.12
- Median Absolute Deviation: 0.26
- 1% percentile: -2.4386180877685546
- 99% percentile: 2.0305015563964846



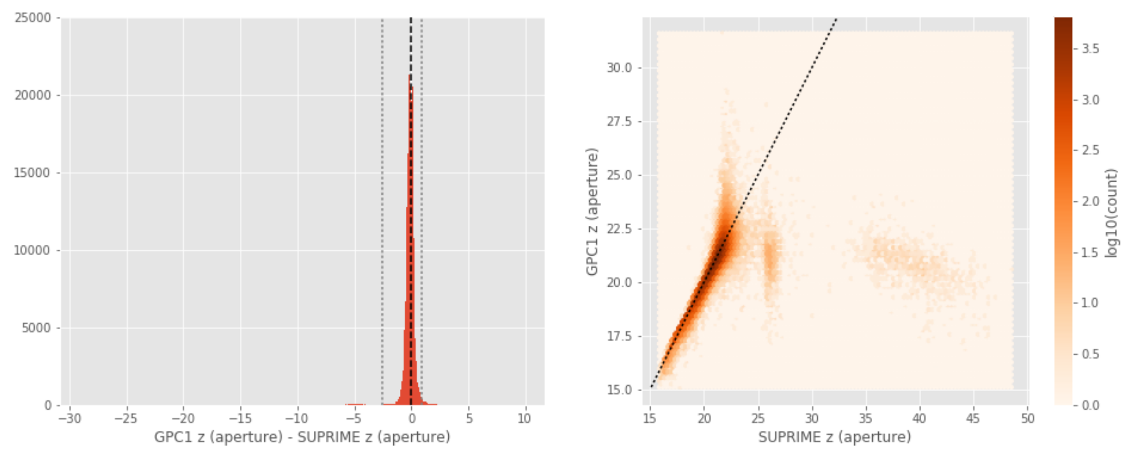

```
VIRCAM z (aperture) - Megacam z (aperture):
- Median: 0.04
- Median Absolute Deviation: 0.23
- 1% percentile: -2.3195960617065428
- 99% percentile: 5.068790473937982
```



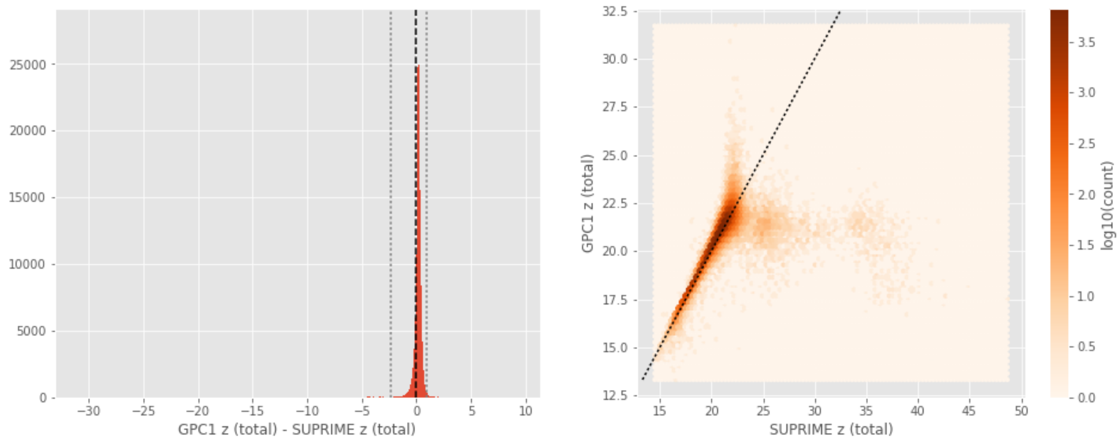

```
VIRCAM z (total) - Megacam z (total):
- Median: 0.10
- Median Absolute Deviation: 0.33
- 1% percentile: -2.2589456176757814
- 99% percentile: 5.133895874023441
```



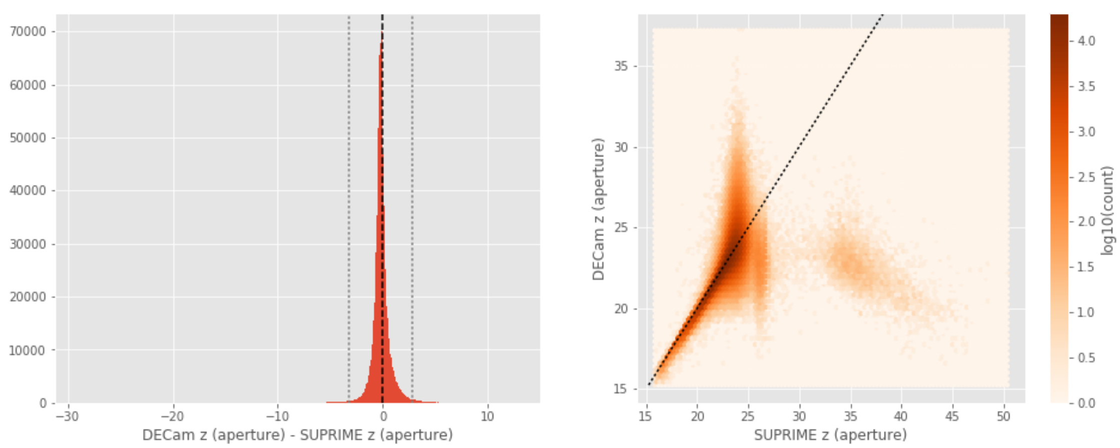
GPC1 z (aperture) - SUPRIME z (aperture):
- Median: -0.09
- Median Absolute Deviation: 0.20
- 1% percentile: -2.555379219055175
- 99% percentile: 0.9683575057983382



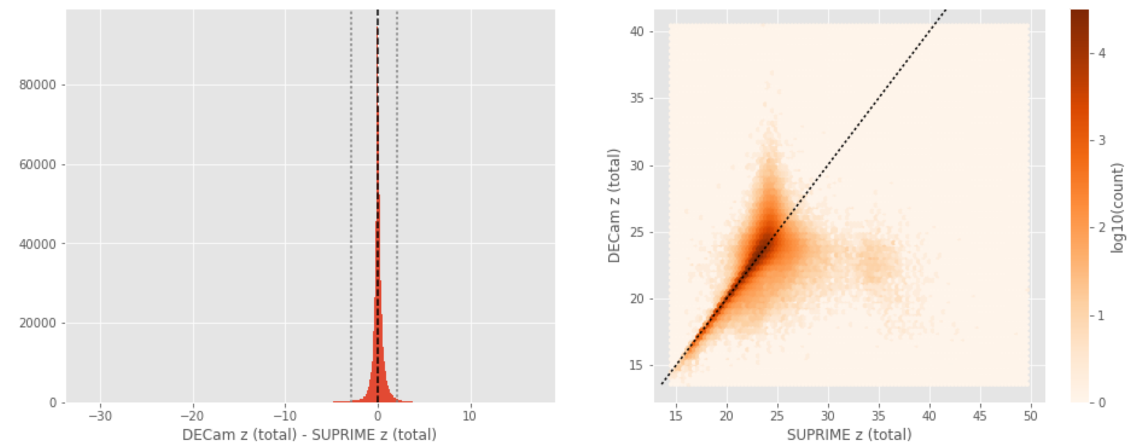
GPC1 z (total) - SUPRIME z (total):
- Median: 0.19
- Median Absolute Deviation: 0.13
- 1% percentile: -2.387874717712403
- 99% percentile: 0.9101642227172849



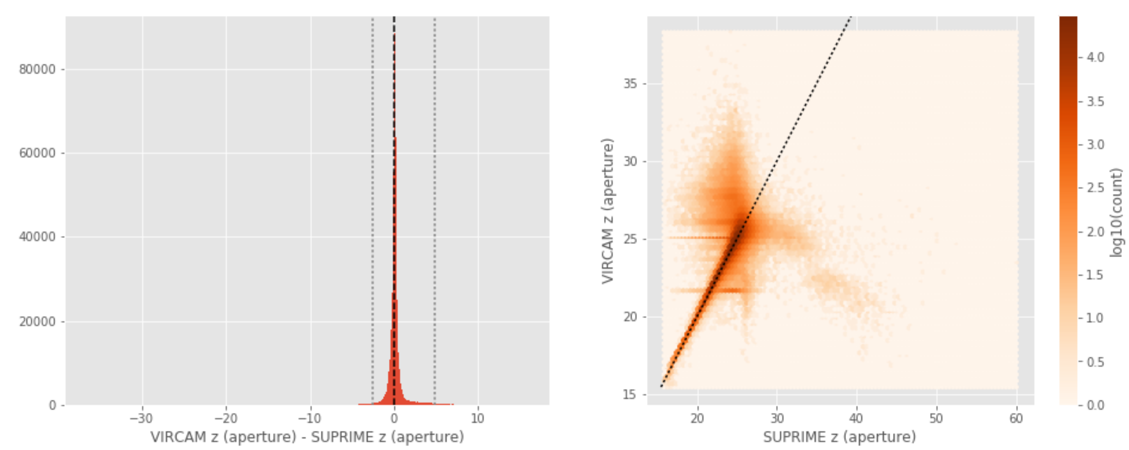
DECam z (aperture) - SUPRIME z (aperture):
- Median: -0.18
- Median Absolute Deviation: 0.31
- 1% percentile: -3.265641212463379
- 99% percentile: 2.778275489807129



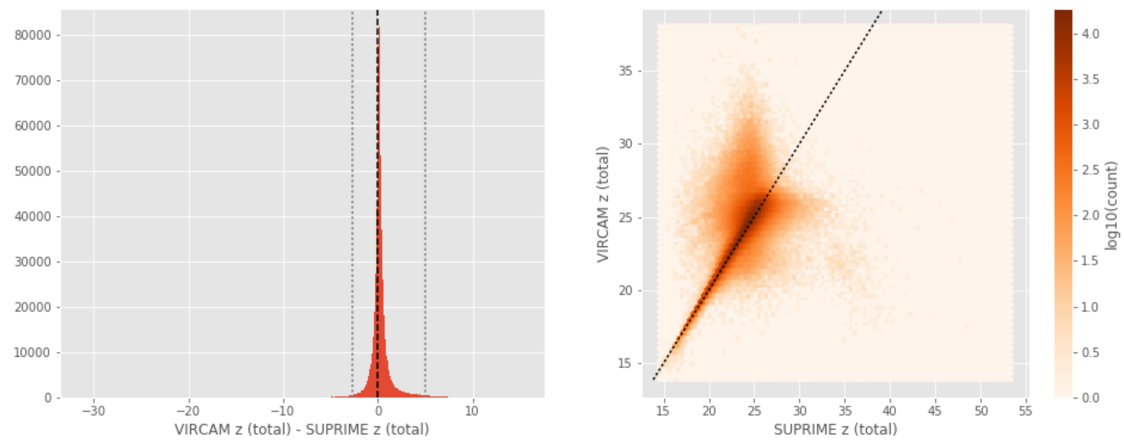
DECam z (total) - SUPRIME z (total):
- Median: 0.00
- Median Absolute Deviation: 0.21
- 1% percentile: -2.932722759246826
- 99% percentile: 2.109028720855707



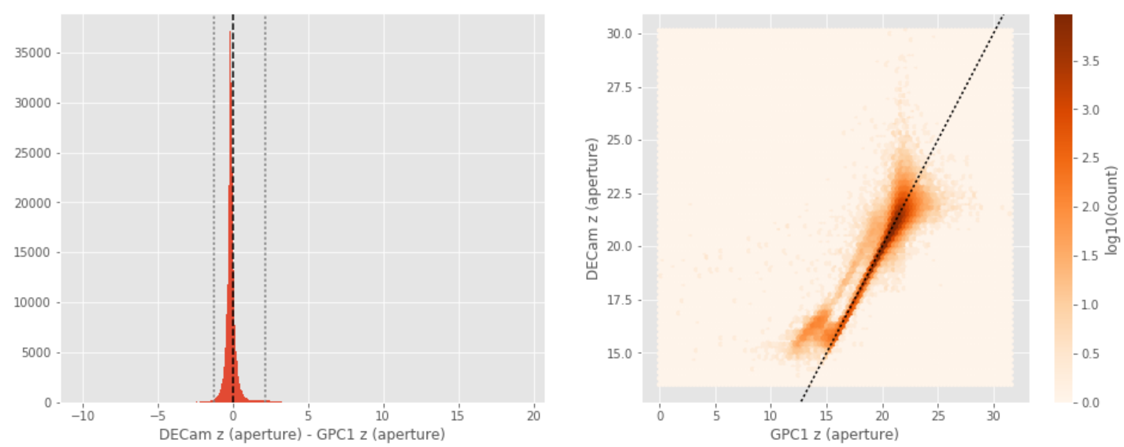
VIRCAM z (aperture) - SUPRIME z (aperture):
- Median: 0.06
- Median Absolute Deviation: 0.18
- 1% percentile: -2.593037872314453
- 99% percentile: 4.799118499755852



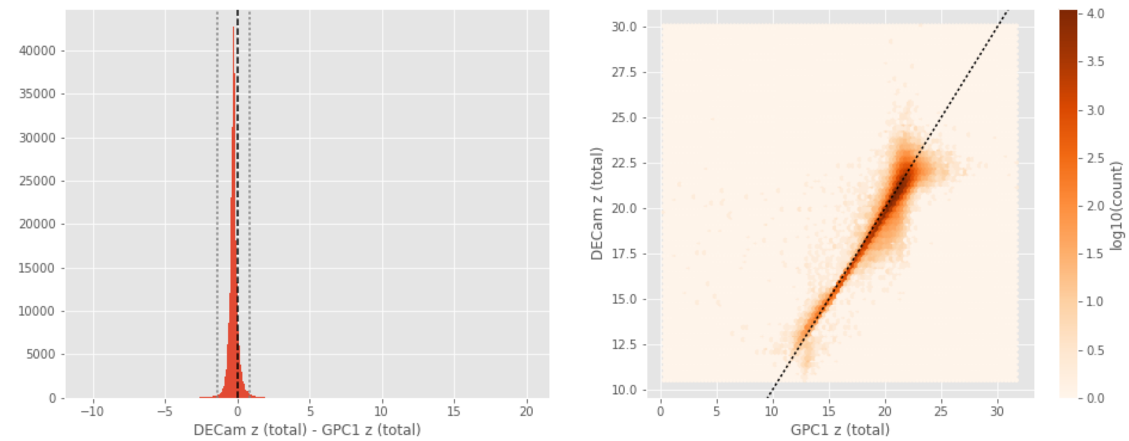
VIRCAM z (total) - SUPRIME z (total):
- Median: 0.15
- Median Absolute Deviation: 0.29
- 1% percentile: -2.66920768737793
- 99% percentile: 5.024603118896463



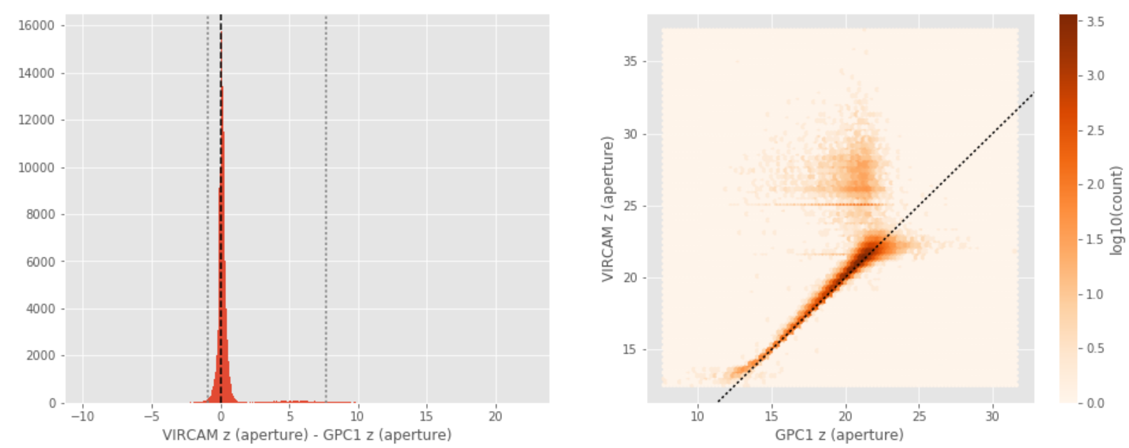
DECam z (aperture) - GPC1 z (aperture):
- Median: -0.15
- Median Absolute Deviation: 0.13
- 1% percentile: -1.2277854347229005
- 99% percentile: 2.150250682830812



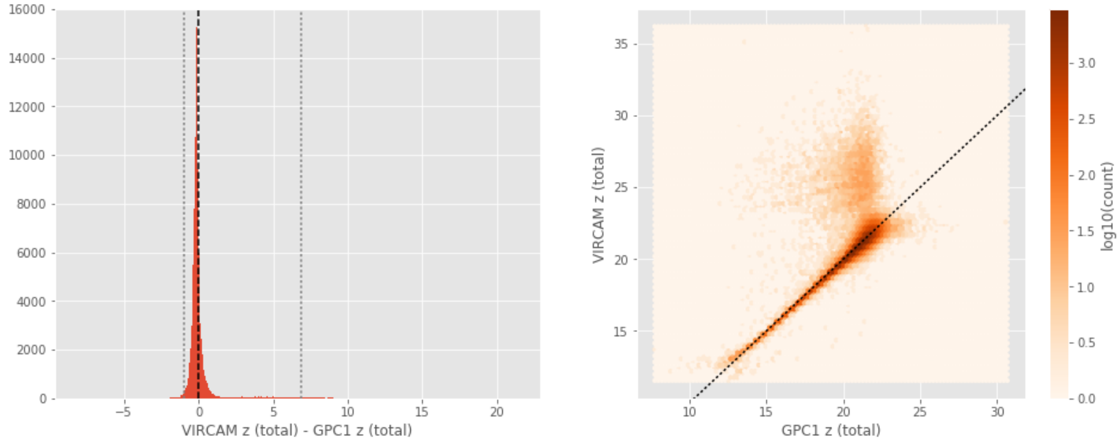
DECam z (total) - GPC1 z (total):
- Median: -0.27
- Median Absolute Deviation: 0.13
- 1% percentile: -1.3960829544067384
- 99% percentile: 0.8739760780334483



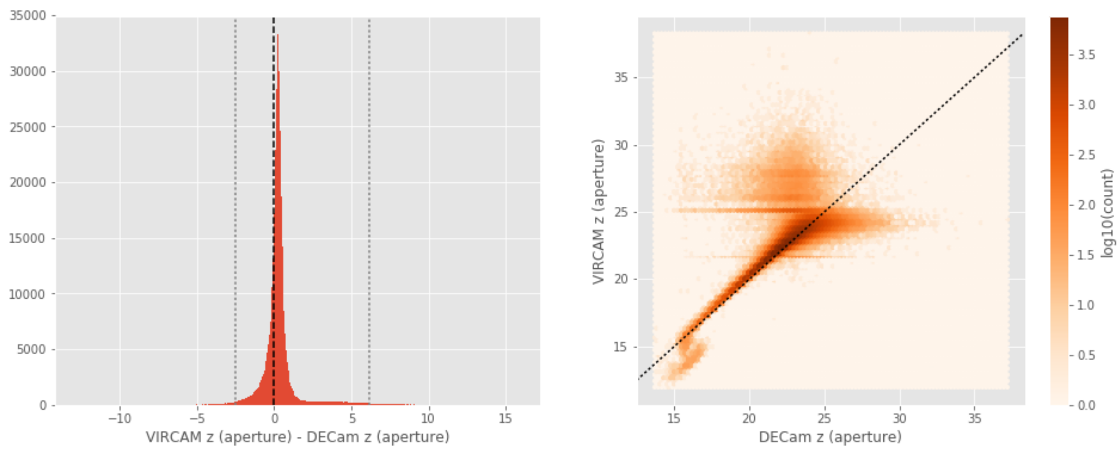
VIRCAM z (aperture) - GPC1 z (aperture):
- Median: 0.14
- Median Absolute Deviation: 0.16
- 1% percentile: -0.8961103057861328
- 99% percentile: 7.704749069213866



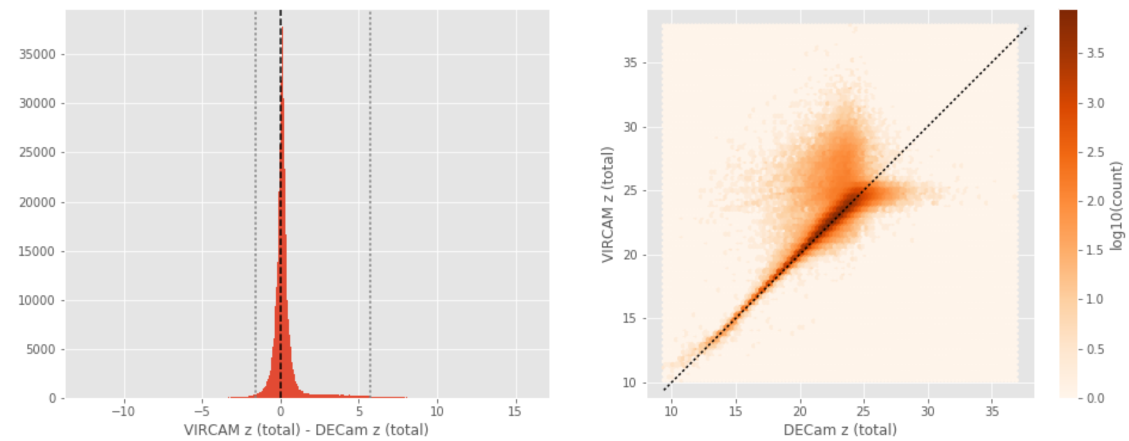
VIRCAM z (total) - GPC1 z (total):
- Median: -0.13
- Median Absolute Deviation: 0.14
- 1% percentile: -0.9847936248779297
- 99% percentile: 6.875855712890623



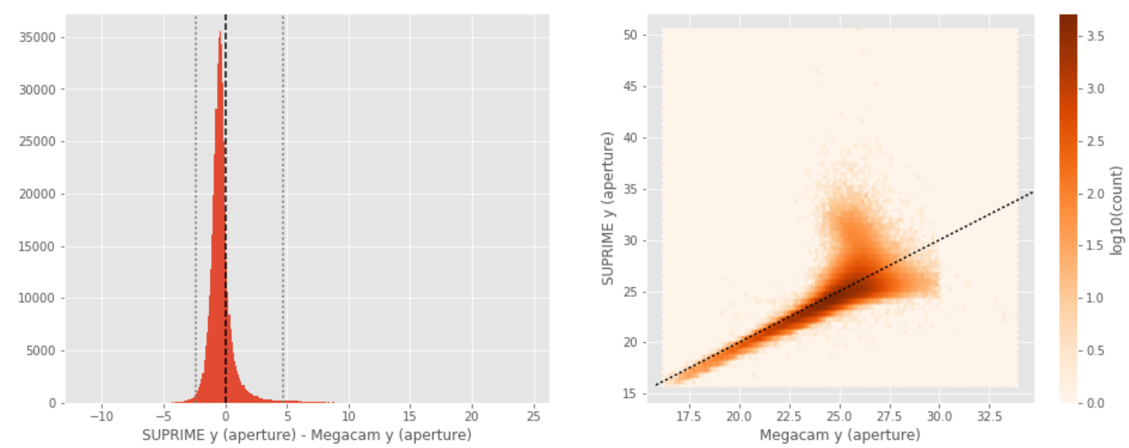
VIRCAM z (aperture) - DECam z (aperture):
- Median: 0.22
- Median Absolute Deviation: 0.24
- 1% percentile: -2.514739685058594
- 99% percentile: 6.131947021484377



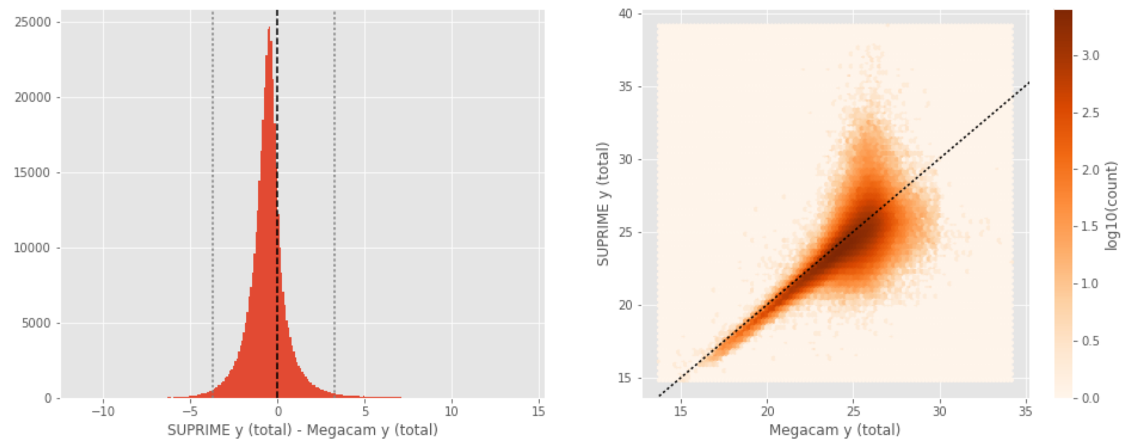
VIRCAM z (total) - DECam z (total):
- Median: 0.12
- Median Absolute Deviation: 0.21
- 1% percentile: -1.5759179687500002
- 99% percentile: 5.729764804840084



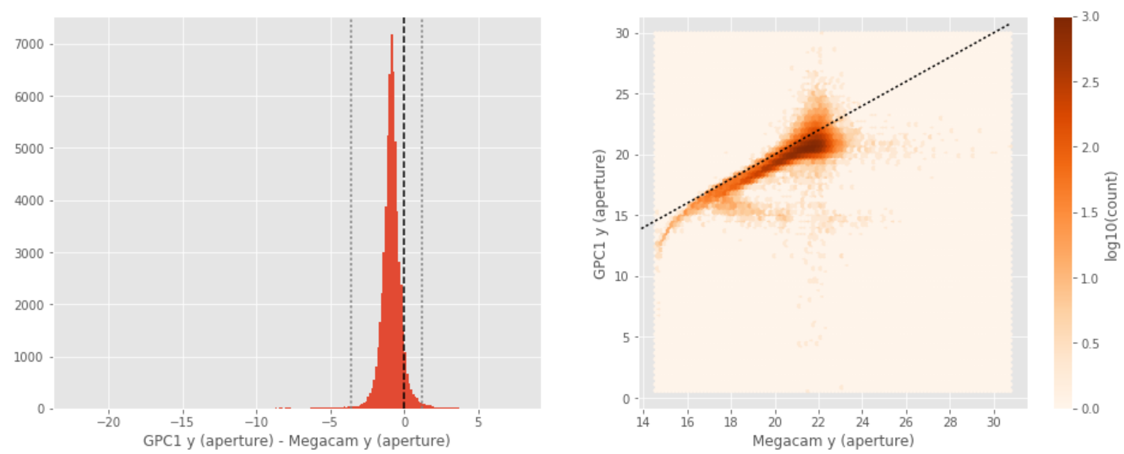
SUPRIME y (aperture) - Megacam y (aperture):
- Median: -0.44
- Median Absolute Deviation: 0.38
- 1% percentile: -2.362299919128418
- 99% percentile: 4.703008651733398



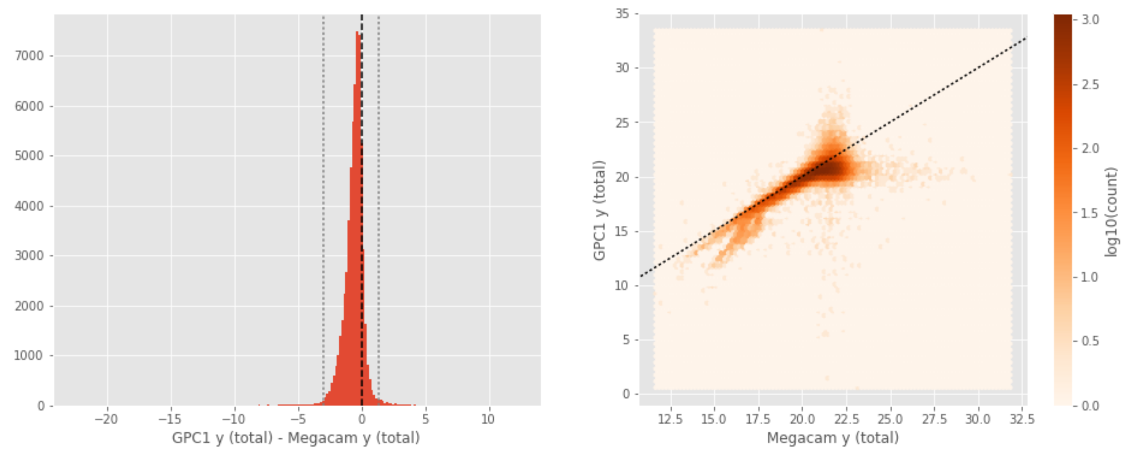
SUPRIME y (total) - Megacam y (total):
- Median: -0.55
- Median Absolute Deviation: 0.50
- 1% percentile: -3.7402098846435545
- 99% percentile: 3.2572619628906354



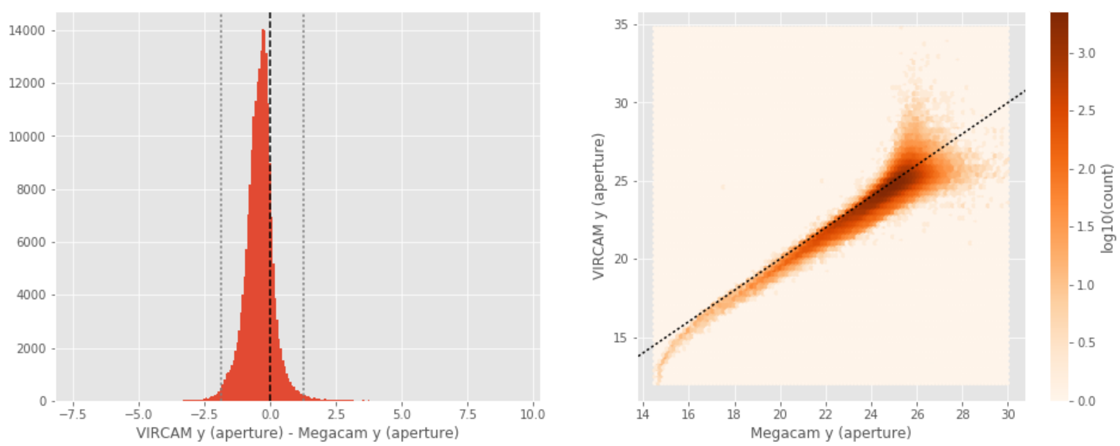
GPC1 y (aperture) - Megacam y (aperture):
- Median: -0.85
- Median Absolute Deviation: 0.33
- 1% percentile: -3.6013498878479004
- 99% percentile: 1.2522003364562988



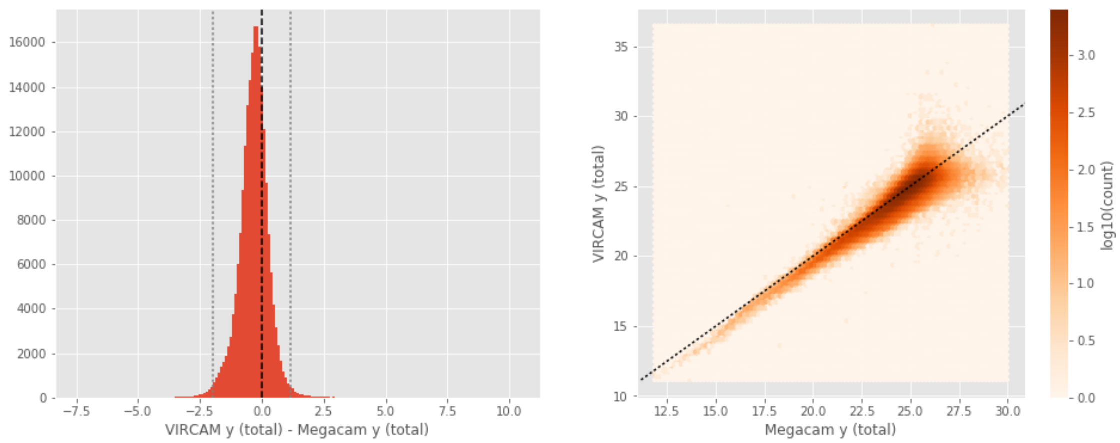
GPC1 y (total) - Megacam y (total):
- Median: -0.49
- Median Absolute Deviation: 0.39
- 1% percentile: -3.0049793243408205
- 99% percentile: 1.352081871032714



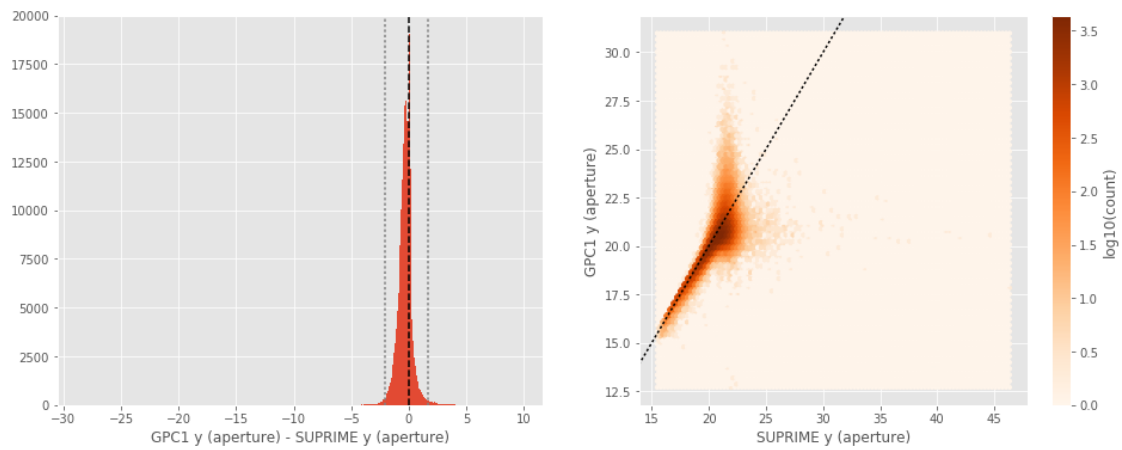
VIRCAM y (aperture) - Megacam y (aperture):
- Median: -0.39
- Median Absolute Deviation: 0.30
- 1% percentile: -1.896066665649414
- 99% percentile: 1.2390281677246078



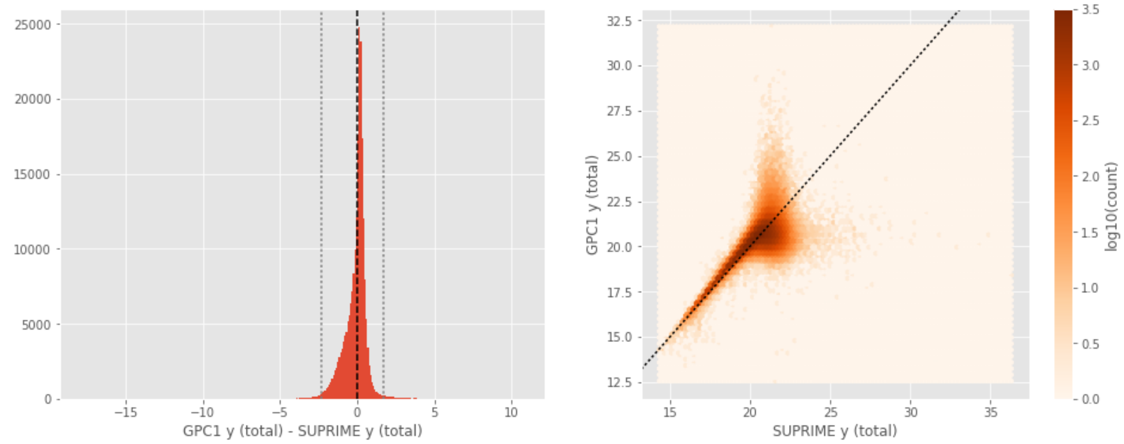
VIRCAM y (total) - Megacam y (total):
- Median: -0.29
- Median Absolute Deviation: 0.34
- 1% percentile: -1.9751595306396483
- 99% percentile: 1.1648015594482426



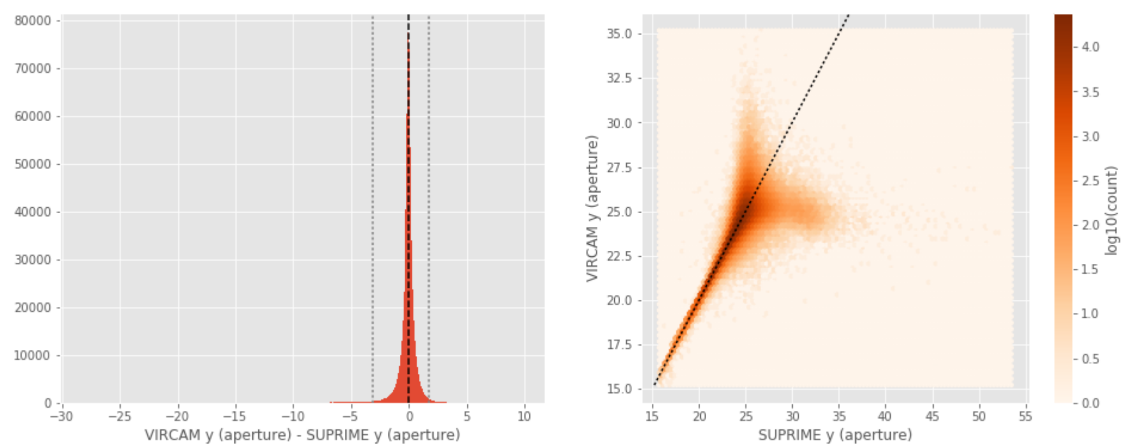
GPC1 y (aperture) - SUPRIME y (aperture):
- Median: -0.29
- Median Absolute Deviation: 0.32
- 1% percentile: -2.0788632011413575
- 99% percentile: 1.671594486236573



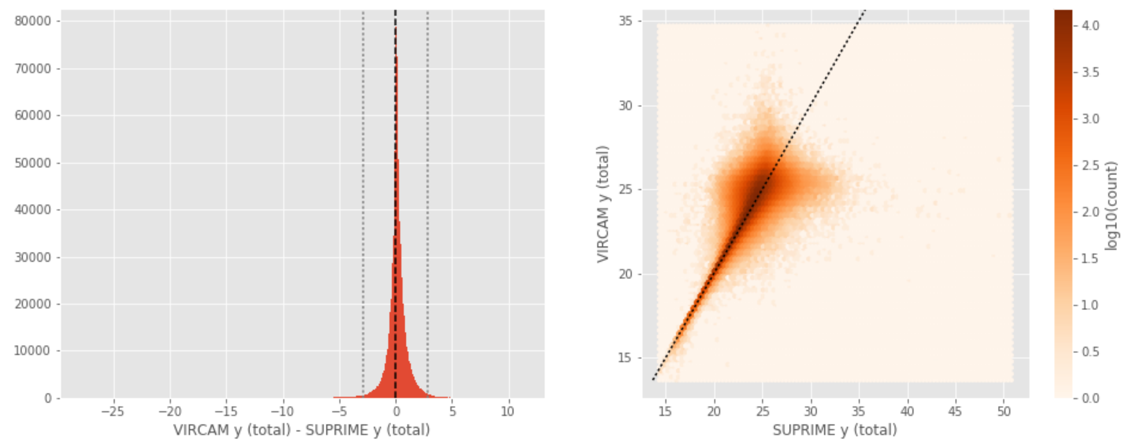
GPC1 y (total) - SUPRIME y (total):
- Median: 0.07
- Median Absolute Deviation: 0.29
- 1% percentile: -2.2870947265625
- 99% percentile: 1.6791526794433507



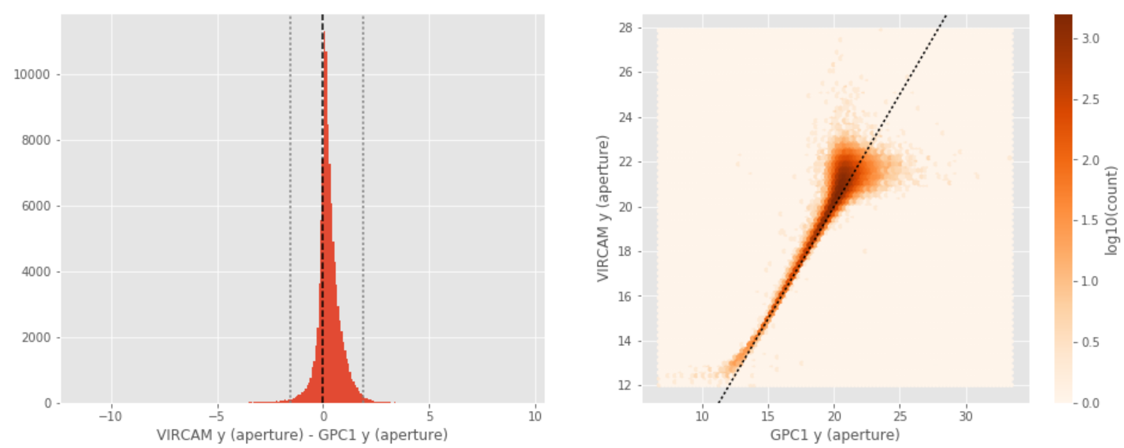
VIRCAM y (aperture) - SUPRIME y (aperture):
- Median: -0.02
- Median Absolute Deviation: 0.23
- 1% percentile: -3.085487289428711
- 99% percentile: 1.6951151275634828



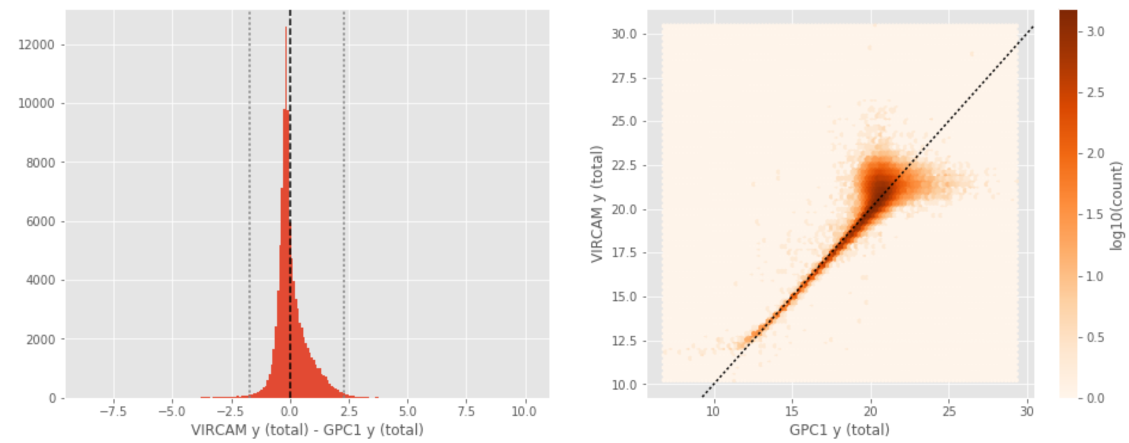
VIRCAM y (total) - SUPRIME y (total):
- Median: 0.10
- Median Absolute Deviation: 0.33
- 1% percentile: -2.8656583404541016
- 99% percentile: 2.7909027099609394



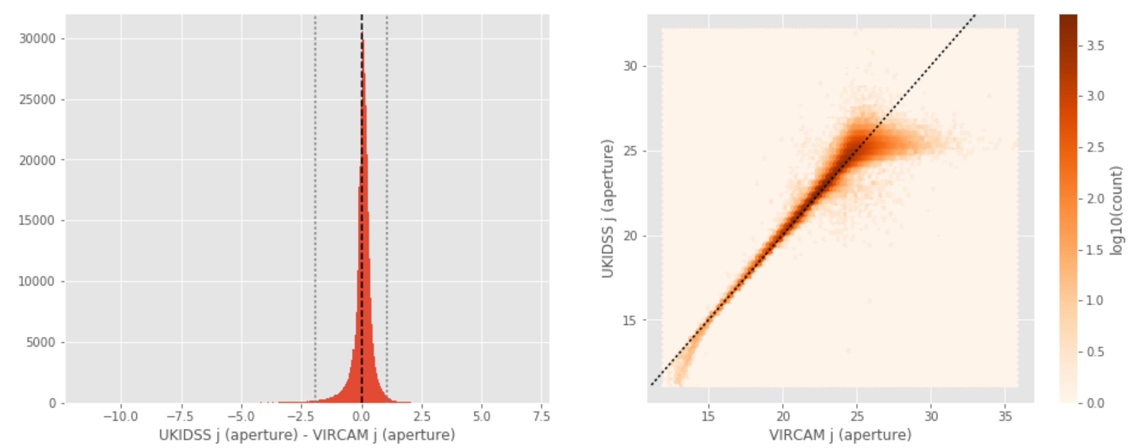
VIRCAM y (aperture) - GPC1 y (aperture):
- Median: 0.20
- Median Absolute Deviation: 0.25
- 1% percentile: -1.571140251159668
- 99% percentile: 1.9104980468749981



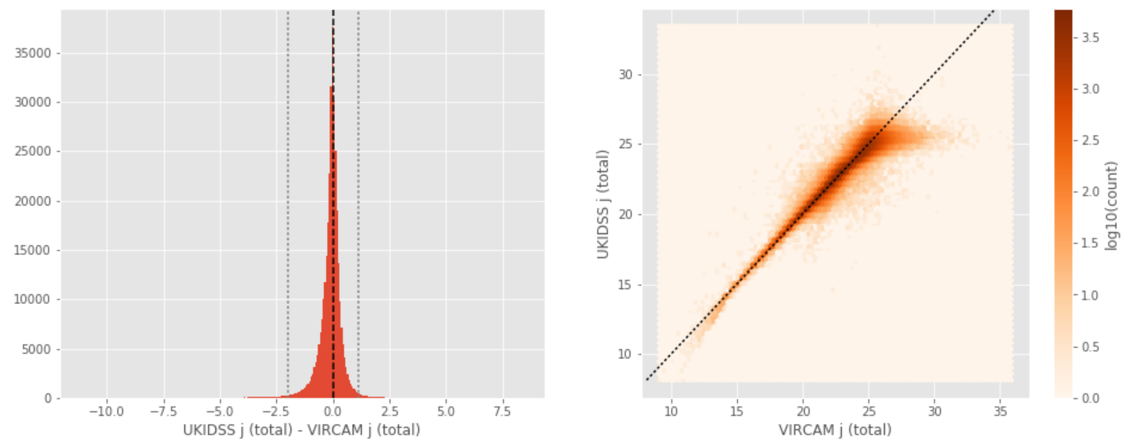
VIRCAM y (total) - GPC1 y (total):
- Median: -0.10
- Median Absolute Deviation: 0.27
- 1% percentile: -1.6898953437805178
- 99% percentile: 2.2788714408874515



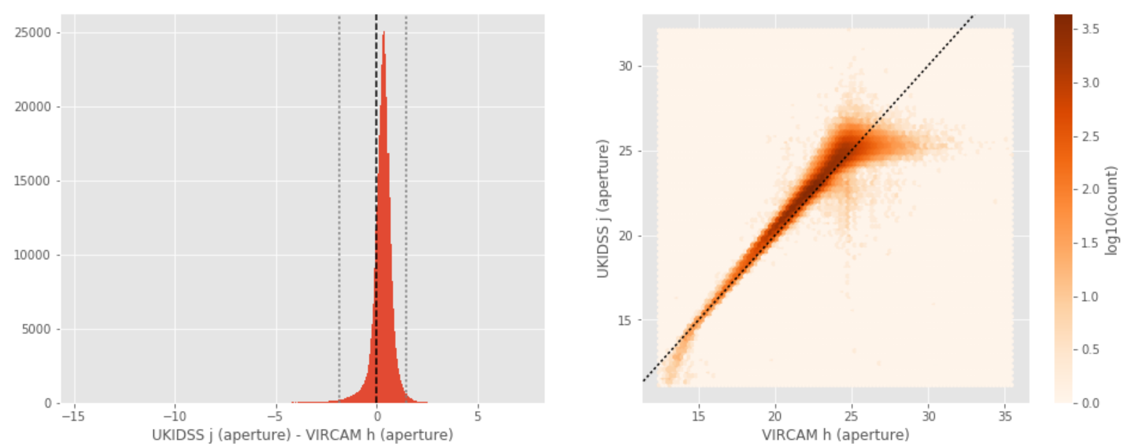
UKIDSS j (aperture) - VIRCAM j (aperture):
- Median: 0.07
- Median Absolute Deviation: 0.16
- 1% percentile: -1.9186085510253905
- 99% percentile: 1.069121322631836



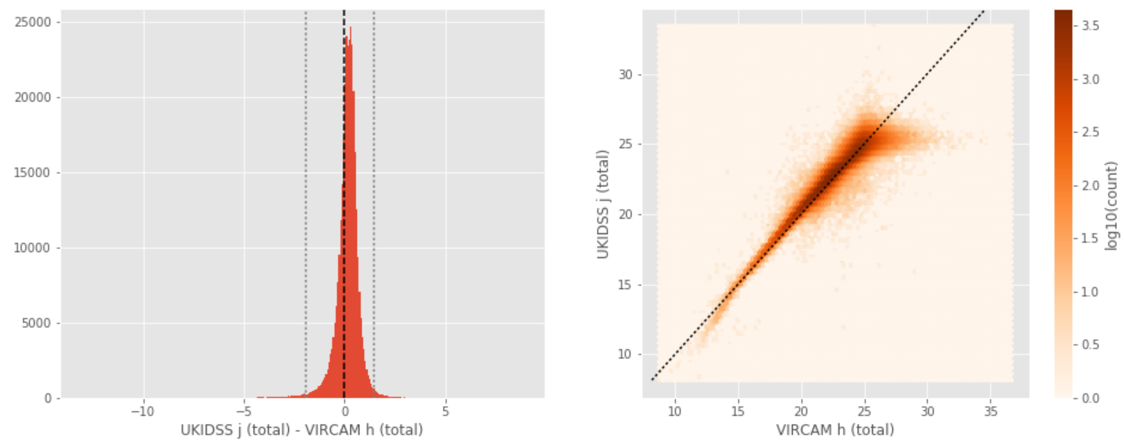
UKIDSS j (total) - VIRCAM j (total):
- Median: -0.04
- Median Absolute Deviation: 0.20
- 1% percentile: -1.9965031242370606
- 99% percentile: 1.1109847259521484



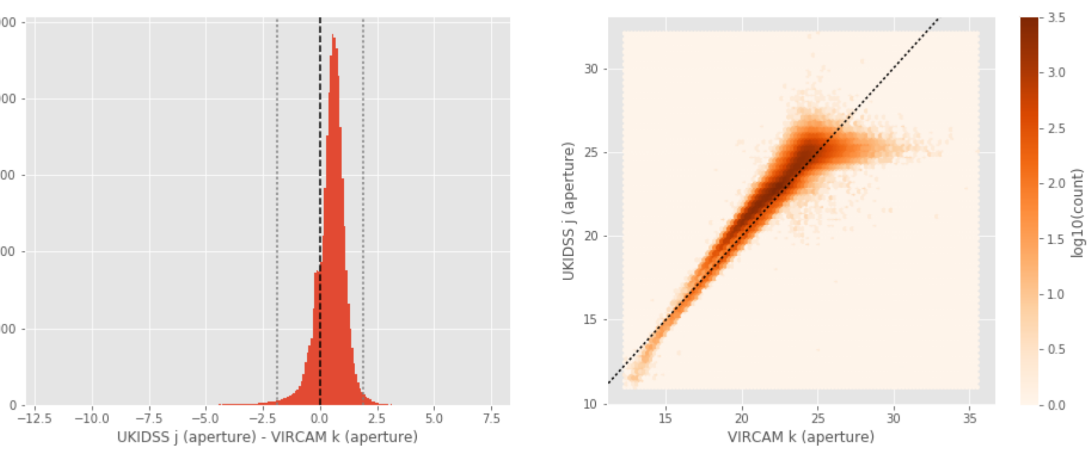
UKIDSS j (aperture) - VIRCAM h (aperture):
- Median: 0.34
- Median Absolute Deviation: 0.23
- 1% percentile: -1.862683277130127
- 99% percentile: 1.4852854537963847



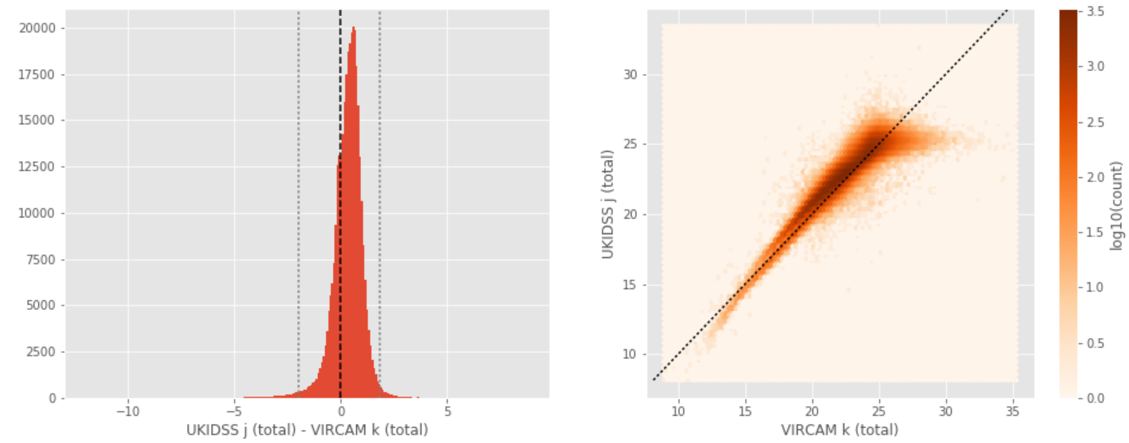
UKIDSS j (total) - VIRCAM h (total):
- Median: 0.20
- Median Absolute Deviation: 0.26
- 1% percentile: -1.939602279663086
- 99% percentile: 1.4660823822021585



UKIDSS j (aperture) - VIRCAM k (aperture):
- Median: 0.55
- Median Absolute Deviation: 0.33
- 1% percentile: -1.8585863494873045
- 99% percentile: 1.8937459564208996



UKIDSS j (total) - VIRCAM k (total):
- Median: 0.40
- Median Absolute Deviation: 0.38
- 1% percentile: -1.9898881912231445
- 99% percentile: 1.8312970161437994



1.5 III - Comparing magnitudes to reference bands

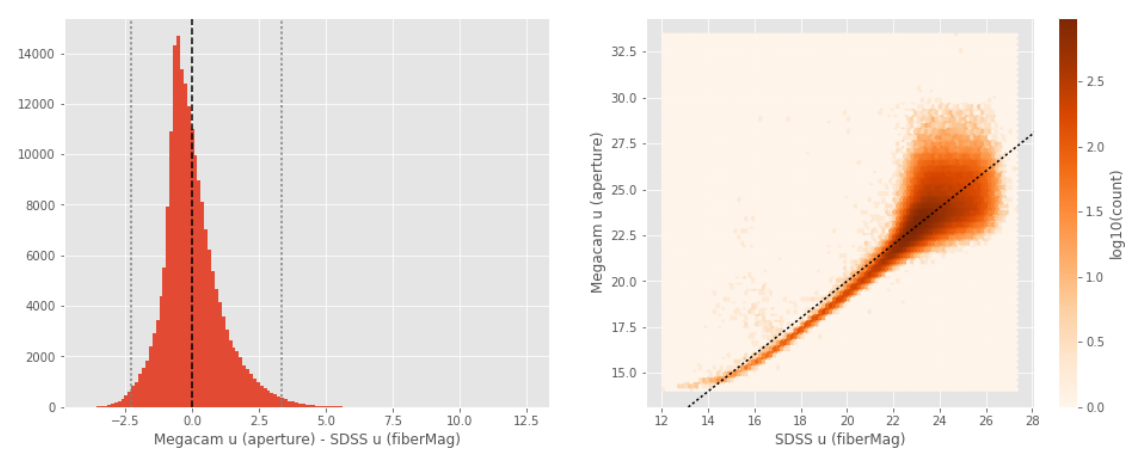
Cross-match the master list to SDSS and 2MASS to compare its magnitudes to SDSS and 2MASS ones.

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

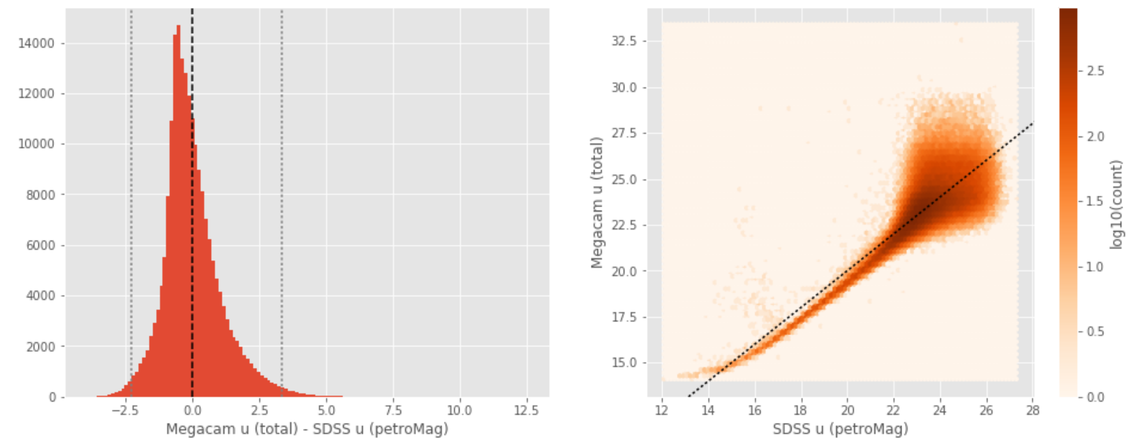
The catalogue is cross-matched to SDSS-DR13 withing 0.2 arcsecond.

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.

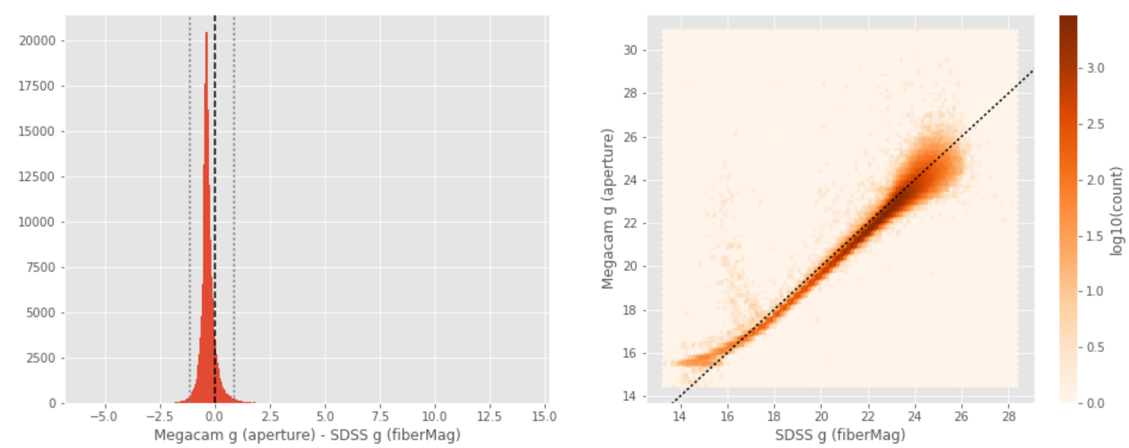
```
Megacam u (aperture) - SDSS u (fiberMag):
- Median: -0.16
- Median Absolute Deviation: 0.56
- 1% percentile: -2.275182304382324
- 99% percentile: 3.3625221252441406
```



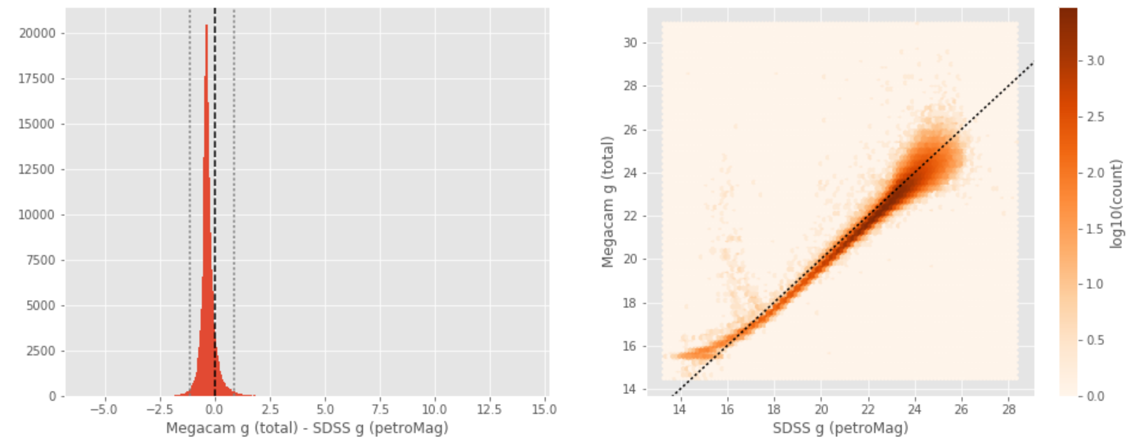
```
Megacam u (total) - SDSS u (petroMag):
- Median: -0.16
- Median Absolute Deviation: 0.56
- 1% percentile: -2.275182304382324
- 99% percentile: 3.3625221252441406
```



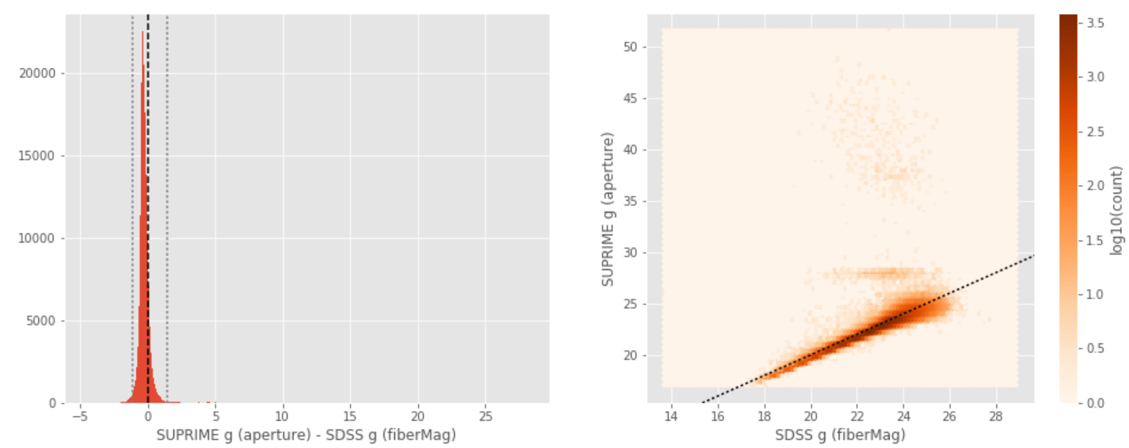

```
Megacam g (aperture) - SDSS g (fiberMag):
- Median: -0.34
- Median Absolute Deviation: 0.13
- 1% percentile: -1.124325294494629
- 99% percentile: 0.9107969665527345
```



Megacam g (total) - SDSS g (petroMag):
- Median: -0.34
- Median Absolute Deviation: 0.13
- 1% percentile: -1.124325294494629
- 99% percentile: 0.9107969665527345

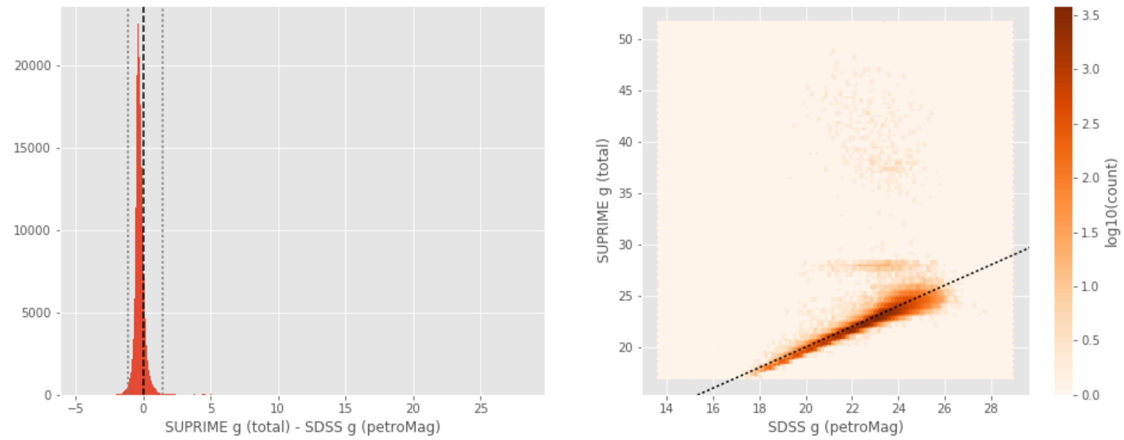


SUPRIME g (aperture) - SDSS g (fiberMag):
- Median: -0.30
- Median Absolute Deviation: 0.17
- 1% percentile: -1.1427298736572264
- 99% percentile: 1.4442640686035149

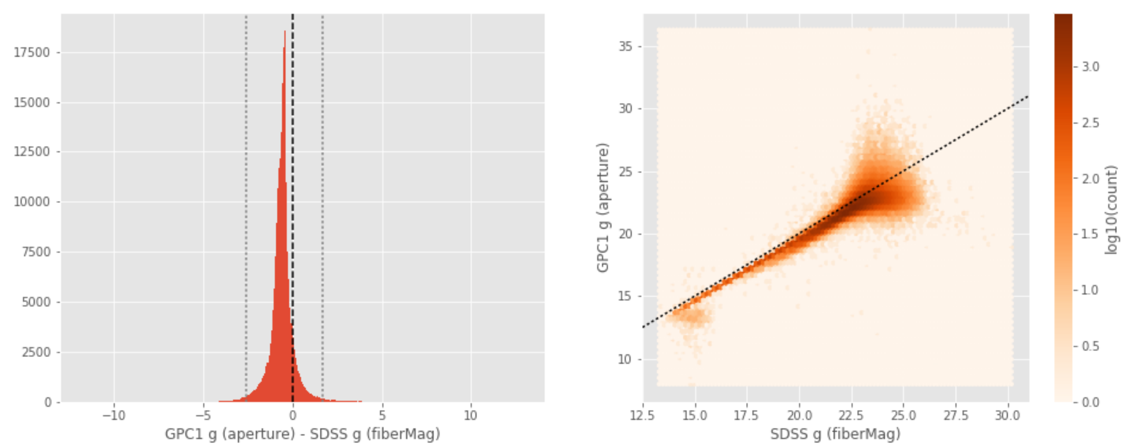


SUPRIME g (total) - SDSS g (petroMag):
- Median: -0.30

- Median Absolute Deviation: 0.17
- 1% percentile: -1.1427298736572264
- 99% percentile: 1.4442640686035149

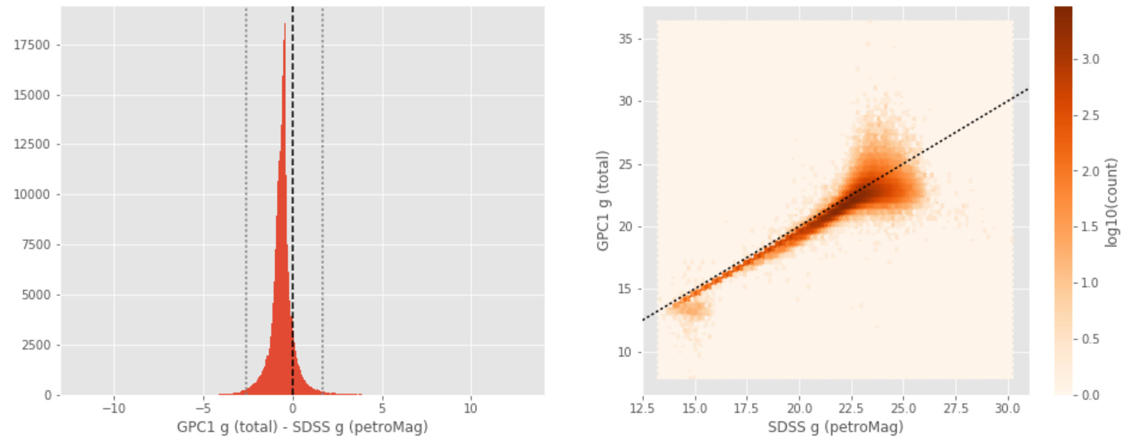


GPC1 g (aperture) - SDSS g (fiberMag):
- Median: -0.56
- Median Absolute Deviation: 0.26
- 1% percentile: -2.621855392456055
- 99% percentile: 1.6956641387939437

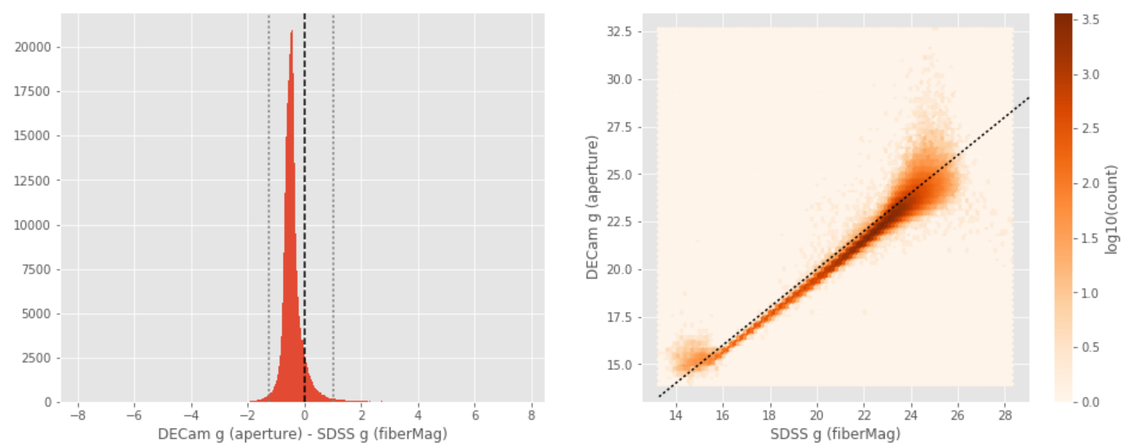


GPC1 g (total) - SDSS g (petroMag):
- Median: -0.56
- Median Absolute Deviation: 0.26
- 1% percentile: -2.621855392456055

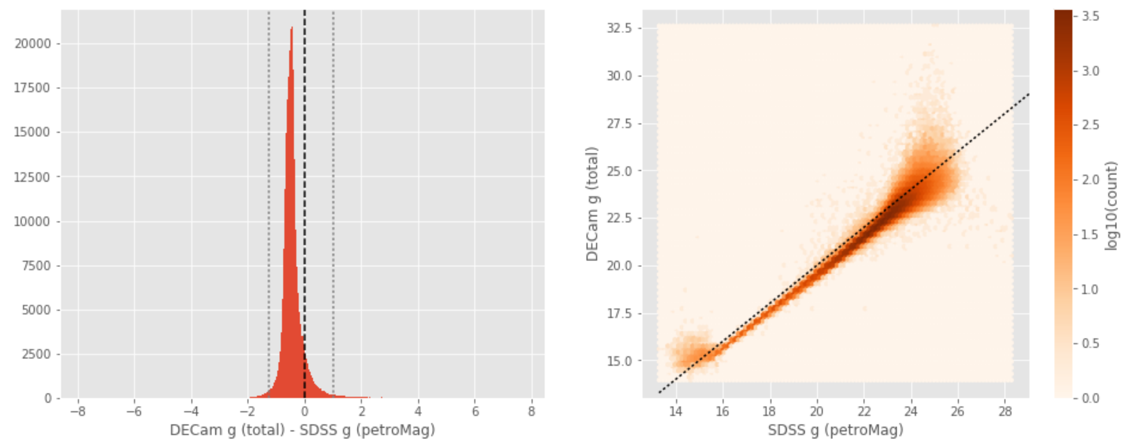
- 99% percentile: 1.6956641387939437



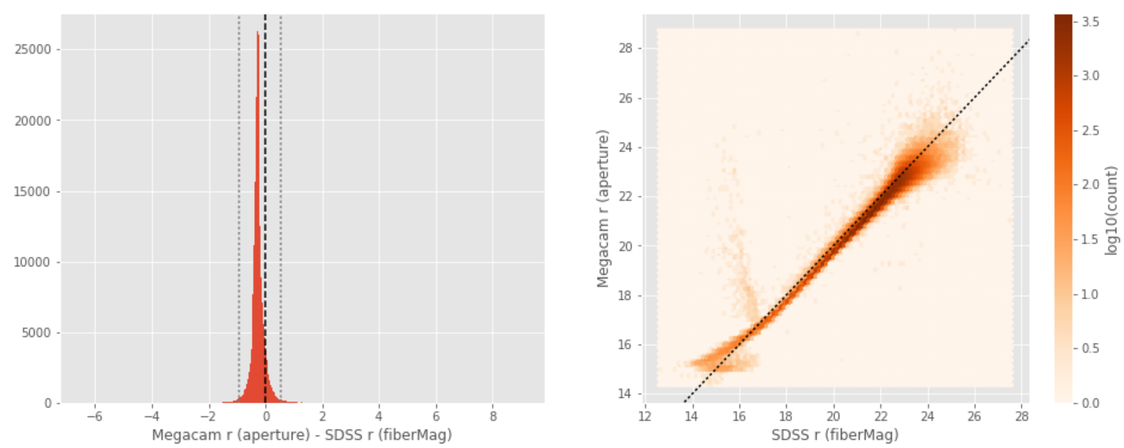
DECam g (aperture) - SDSS g (fiberMag):
- Median: -0.47
- Median Absolute Deviation: 0.15
- 1% percentile: -1.244184684753418
- 99% percentile: 1.0085596084594715



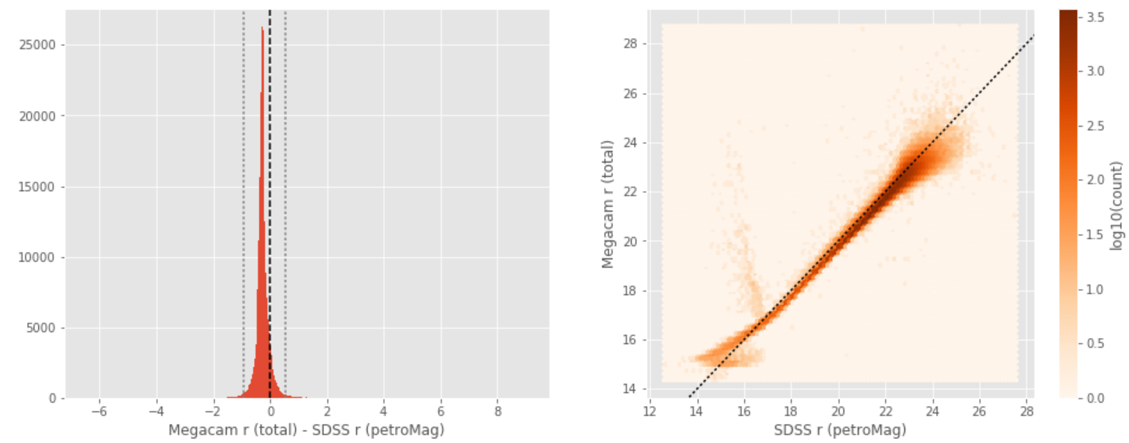
DECam g (total) - SDSS g (petroMag):
- Median: -0.47
- Median Absolute Deviation: 0.15
- 1% percentile: -1.244184684753418
- 99% percentile: 1.0085596084594715



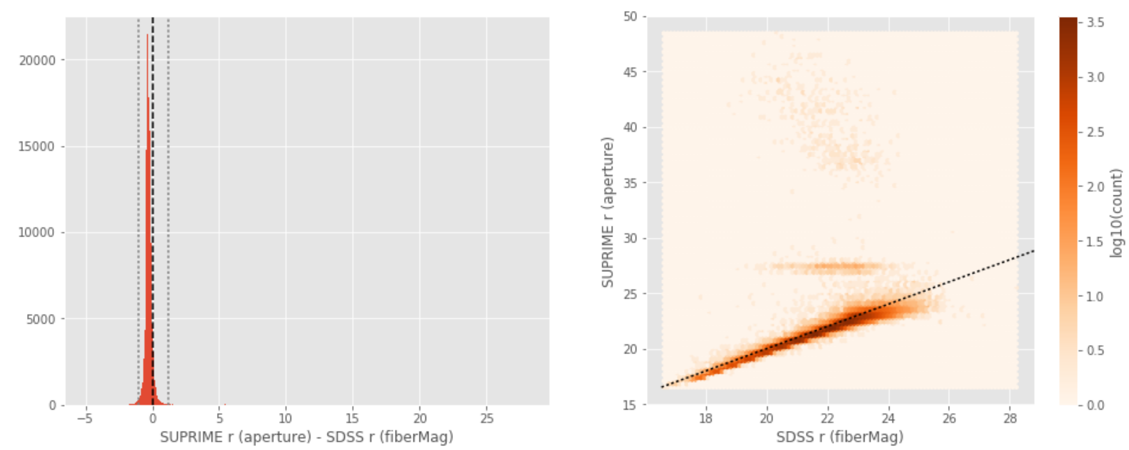

```
Megacam r (aperture) - SDSS r (fiberMag):
- Median: -0.27
- Median Absolute Deviation: 0.09
- 1% percentile: -0.9249799919128417
- 99% percentile: 0.538681001663208
```



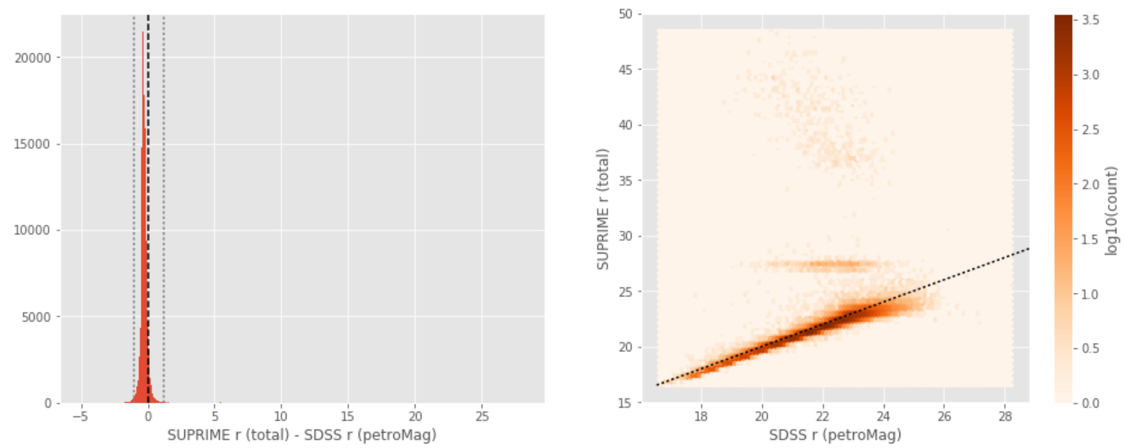

```
Megacam r (total) - SDSS r (petroMag):
- Median: -0.27
- Median Absolute Deviation: 0.09
- 1% percentile: -0.9249799919128417
- 99% percentile: 0.538681001663208
```



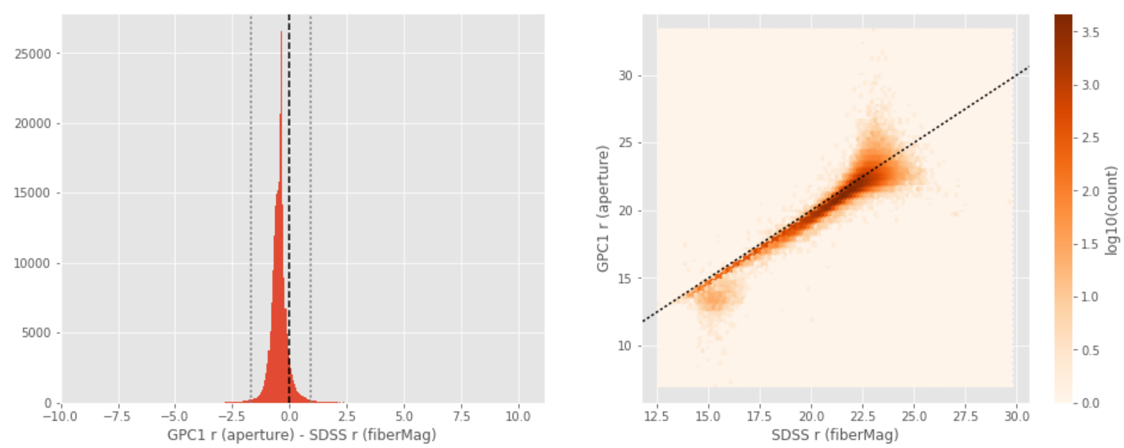

```
SUPRIME r (aperture) - SDSS r (fiberMag):
- Median: -0.29
- Median Absolute Deviation: 0.13
- 1% percentile: -0.9901150512695311
- 99% percentile: 1.1704694557189843
```



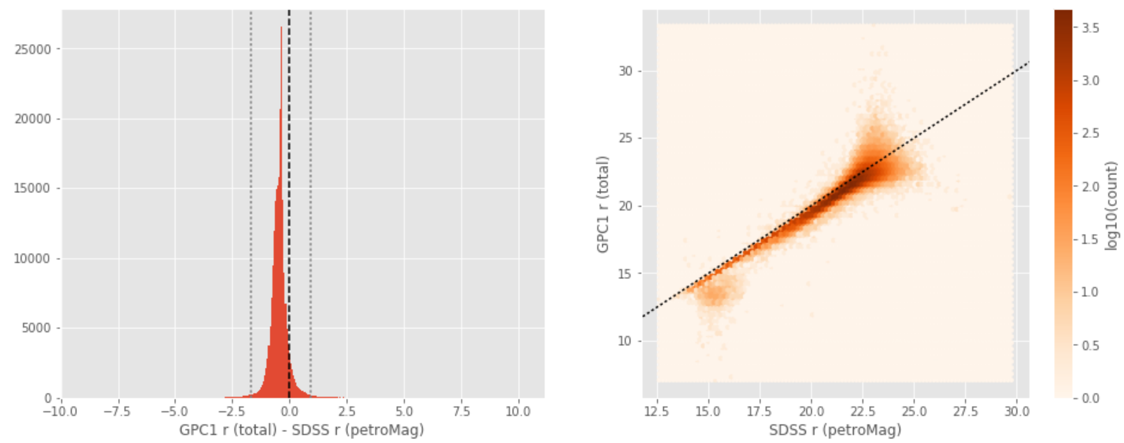

```
SUPRIME r (total) - SDSS r (petroMag):
- Median: -0.29
- Median Absolute Deviation: 0.13
- 1% percentile: -0.9901150512695311
- 99% percentile: 1.1704694557189843
```



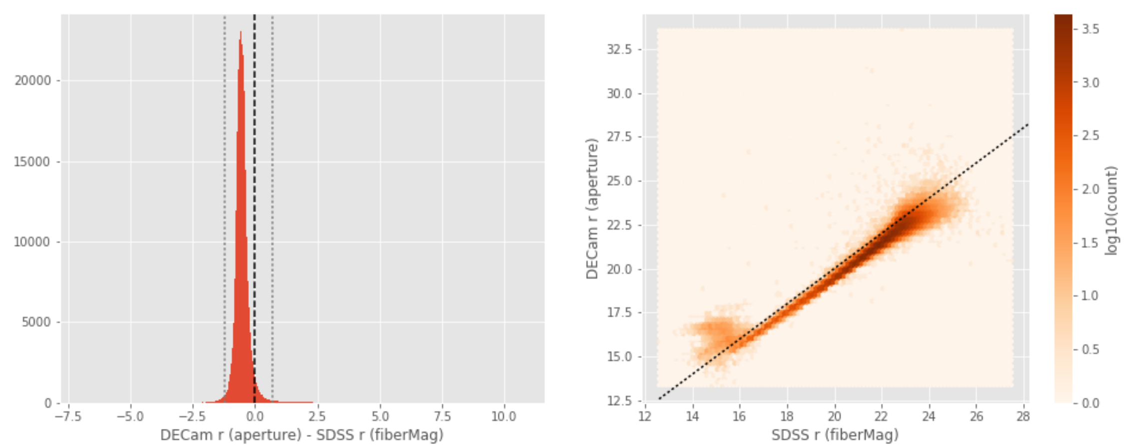
GPC1 r (aperture) - SDSS r (fiberMag):
- Median: -0.43
- Median Absolute Deviation: 0.17
- 1% percentile: -1.6574333953857423
- 99% percentile: 0.9487327003478969



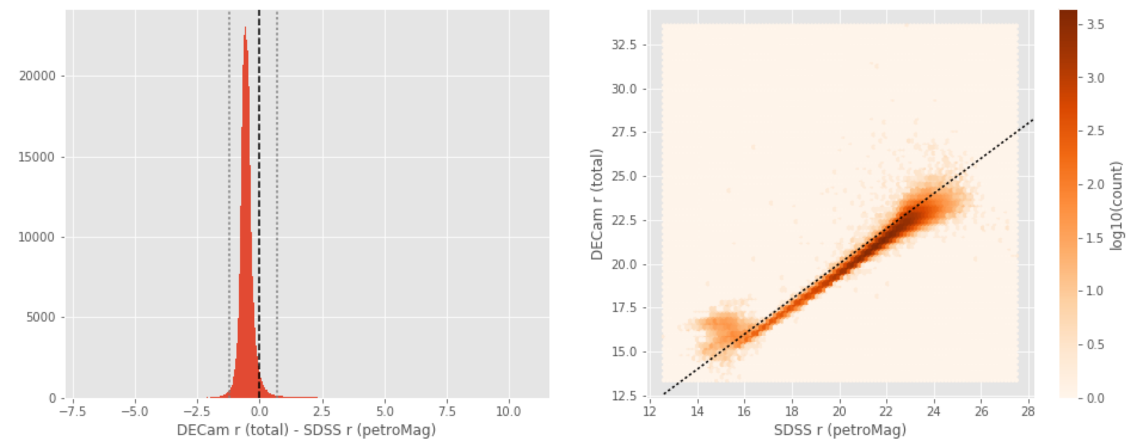
GPC1 r (total) - SDSS r (petroMag):
- Median: -0.43
- Median Absolute Deviation: 0.17
- 1% percentile: -1.6574333953857423
- 99% percentile: 0.9487327003478969



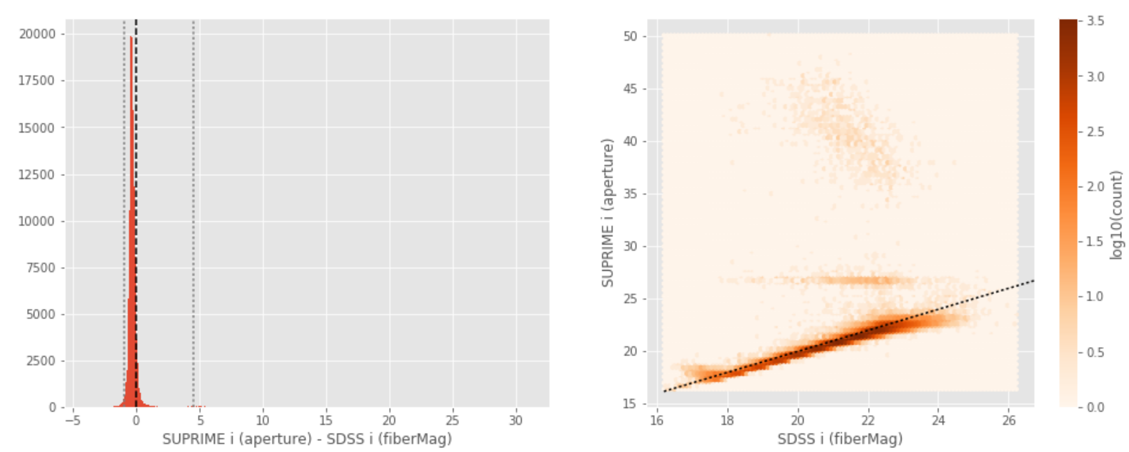
DECam r (aperture) - SDSS r (fiberMag):
- Median: -0.54
- Median Absolute Deviation: 0.13
- 1% percentile: -1.2241885185241699
- 99% percentile: 0.7106982612609866



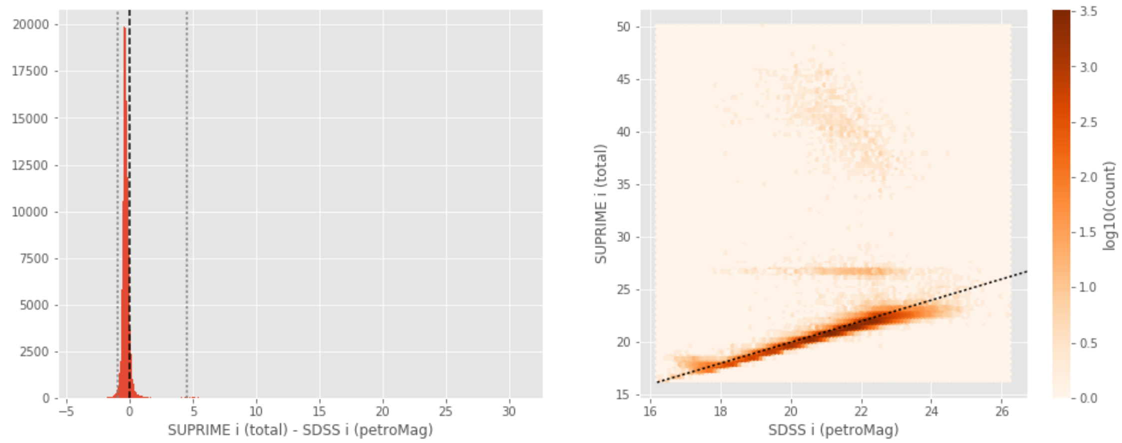
DECam r (total) - SDSS r (petroMag):
- Median: -0.54
- Median Absolute Deviation: 0.13
- 1% percentile: -1.2241885185241699
- 99% percentile: 0.7106982612609866



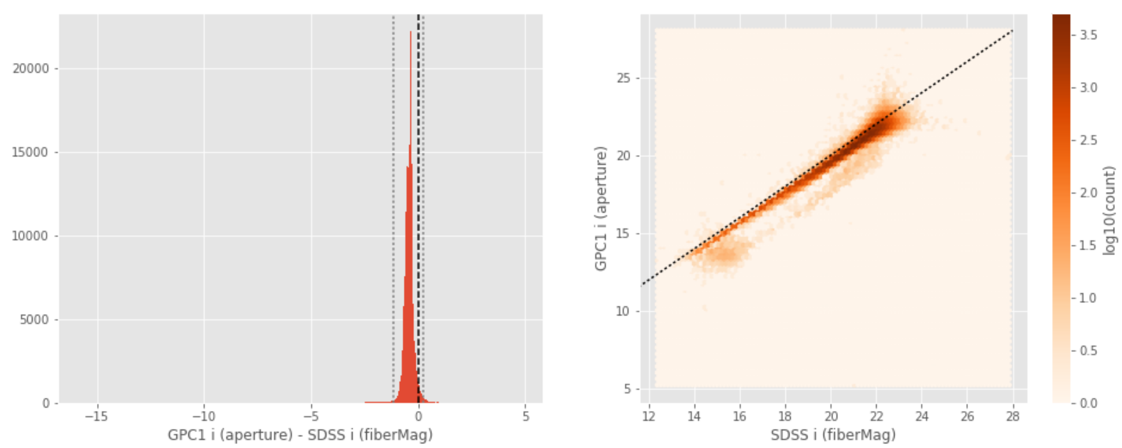
SUPRIME i (aperture) - SDSS i (fiberMag):
- Median: -0.30
- Median Absolute Deviation: 0.13
- 1% percentile: -0.944521141052246
- 99% percentile: 4.506950340271012



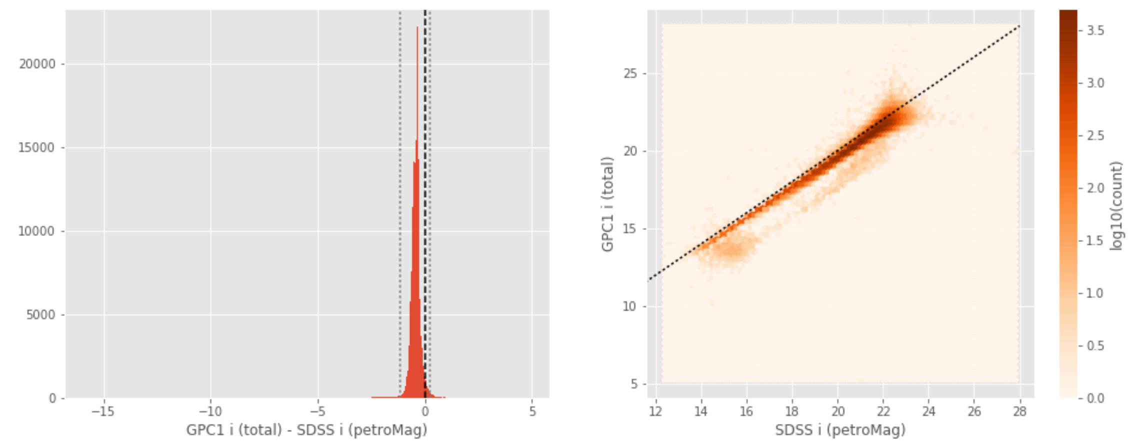
SUPRIME i (total) - SDSS i (petroMag):
- Median: -0.30
- Median Absolute Deviation: 0.13
- 1% percentile: -0.944521141052246
- 99% percentile: 4.506950340271012



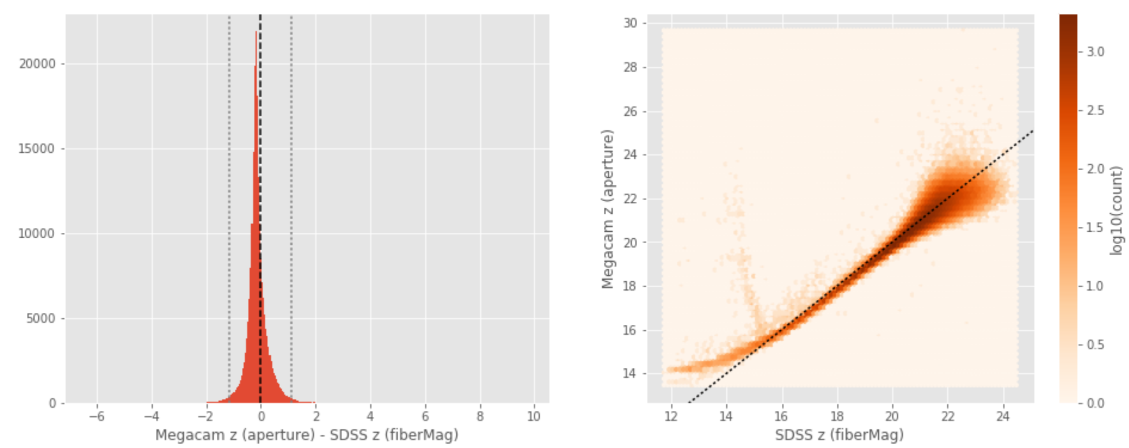
GPC1 i (aperture) - SDSS i (fiberMag):
- Median: -0.41
- Median Absolute Deviation: 0.11
- 1% percentile: -1.1643628311157226
- 99% percentile: 0.2622515487670894



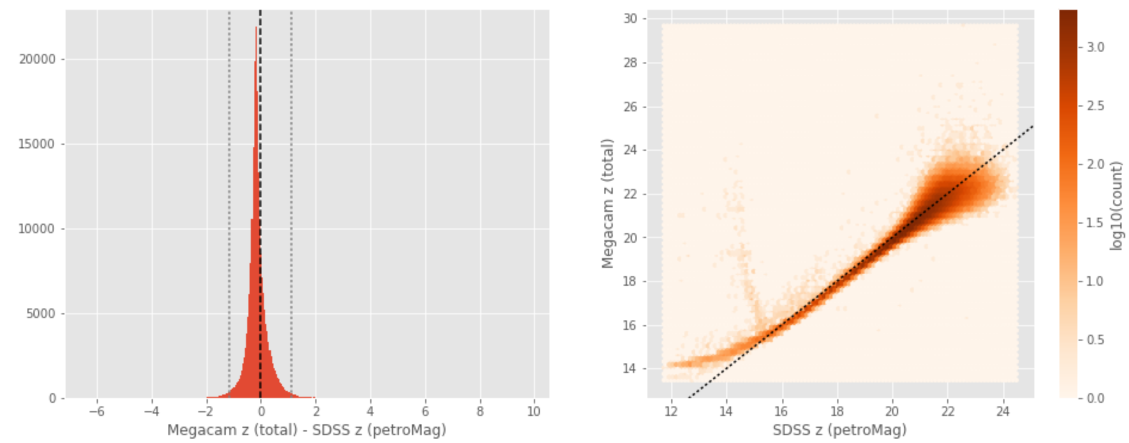
GPC1 i (total) - SDSS i (petroMag):
- Median: -0.41
- Median Absolute Deviation: 0.11
- 1% percentile: -1.1643628311157226
- 99% percentile: 0.2622515487670894



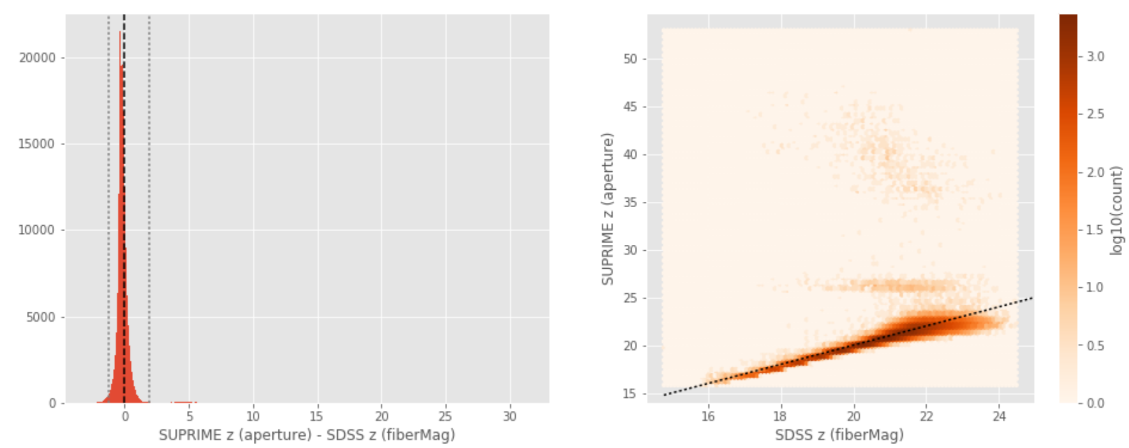
Megacam z (aperture) - SDSS z (fiberMag):
- Median: -0.17
- Median Absolute Deviation: 0.15
- 1% percentile: -1.1768099784851074
- 99% percentile: 1.1184026050567626



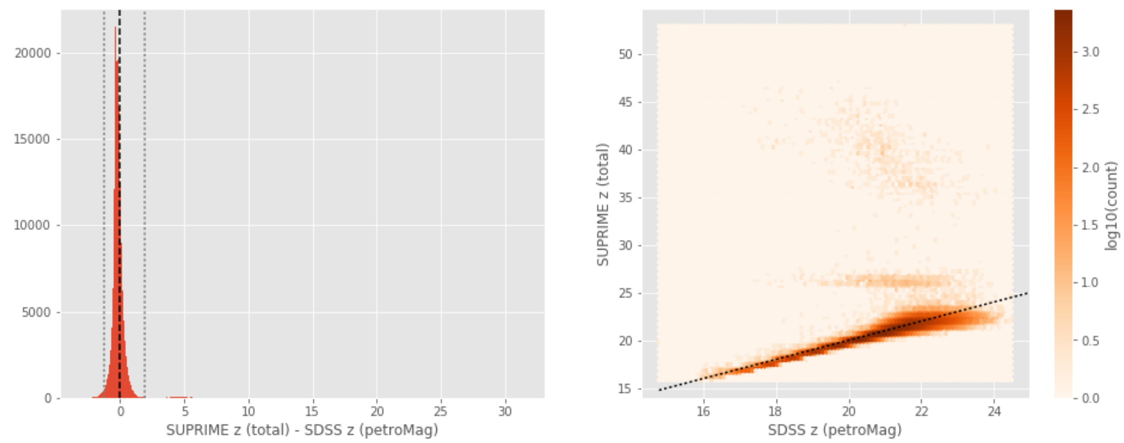
Megacam z (total) - SDSS z (petroMag):
- Median: -0.17
- Median Absolute Deviation: 0.15
- 1% percentile: -1.1768099784851074
- 99% percentile: 1.1184026050567626



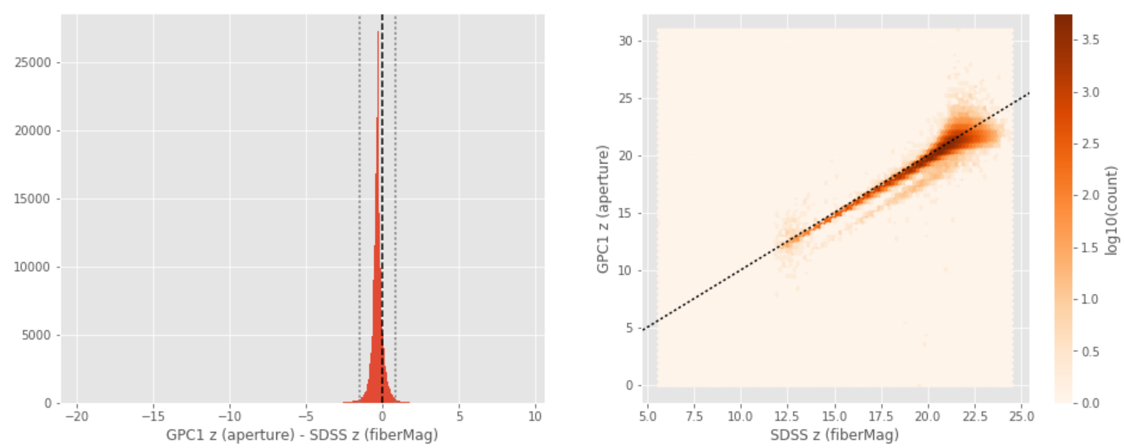
SUPRIME z (aperture) - SDSS z (fiberMag):
- Median: -0.21
- Median Absolute Deviation: 0.19
- 1% percentile: -1.2232777976989746
- 99% percentile: 1.9618323898315522



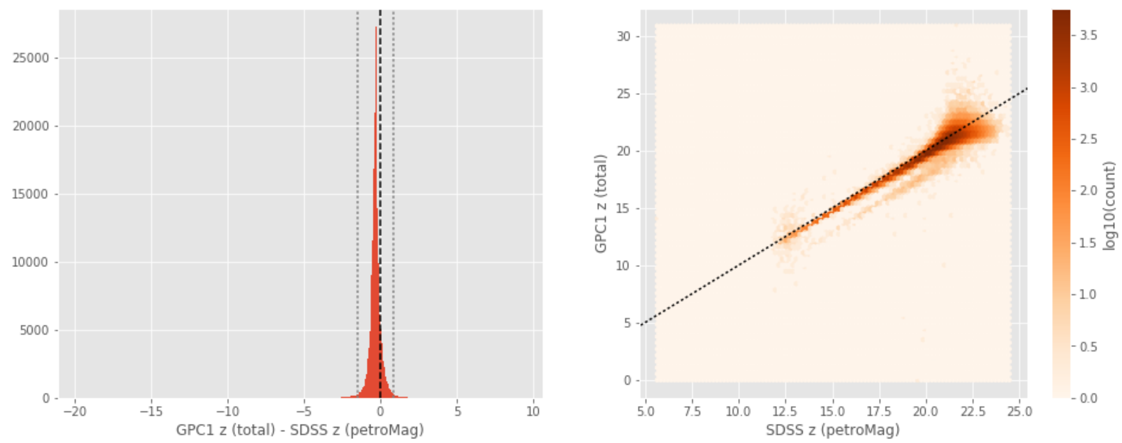
SUPRIME z (total) - SDSS z (petroMag):
- Median: -0.21
- Median Absolute Deviation: 0.19
- 1% percentile: -1.2232777976989746
- 99% percentile: 1.9618323898315522



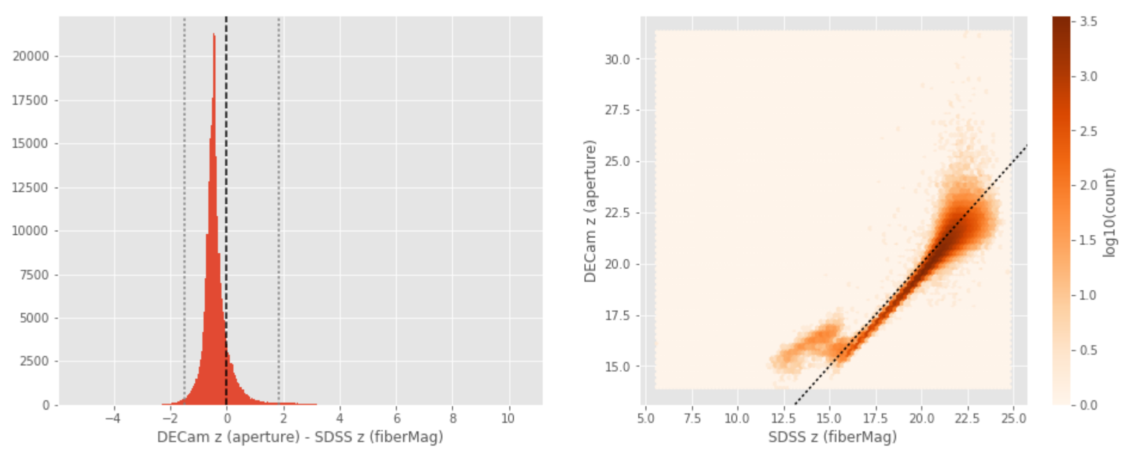

```
GPC1 z (aperture) - SDSS z (fiberMag):
- Median: -0.31
- Median Absolute Deviation: 0.16
- 1% percentile: -1.5094172859191894
- 99% percentile: 0.8233450889587486
```



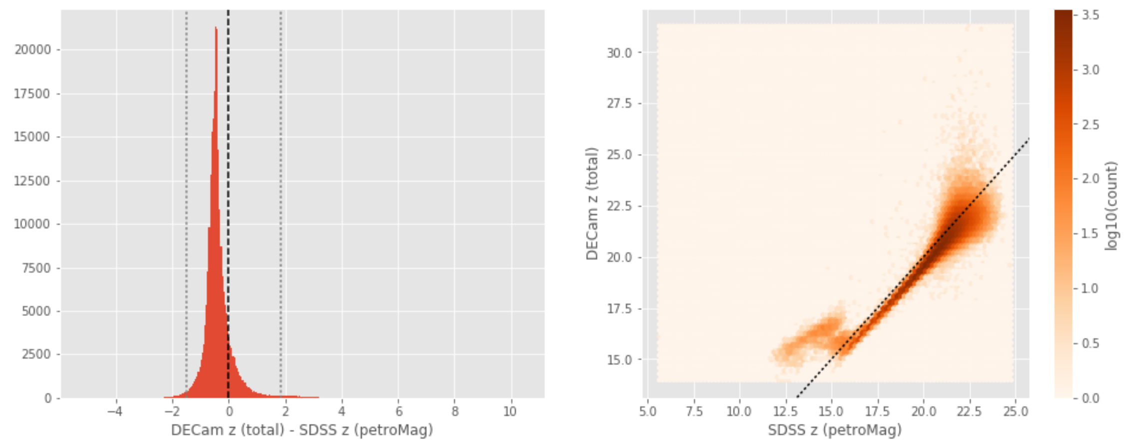

```
GPC1 z (total) - SDSS z (petroMag):
- Median: -0.31
- Median Absolute Deviation: 0.16
- 1% percentile: -1.5094172859191894
- 99% percentile: 0.8233450889587486
```



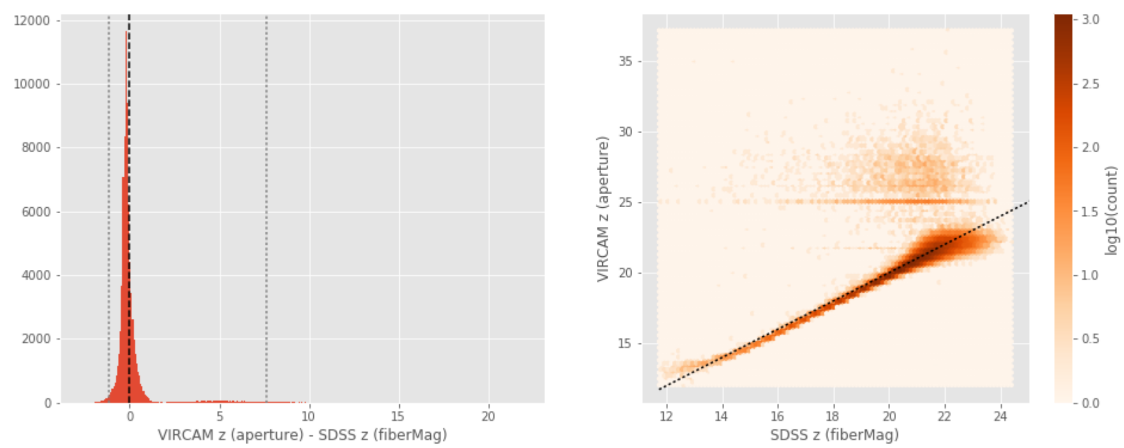
DECam z (aperture) - SDSS z (fiberMag):
- Median: -0.45
- Median Absolute Deviation: 0.18
- 1% percentile: -1.4926085090637207
- 99% percentile: 1.8611146831512486



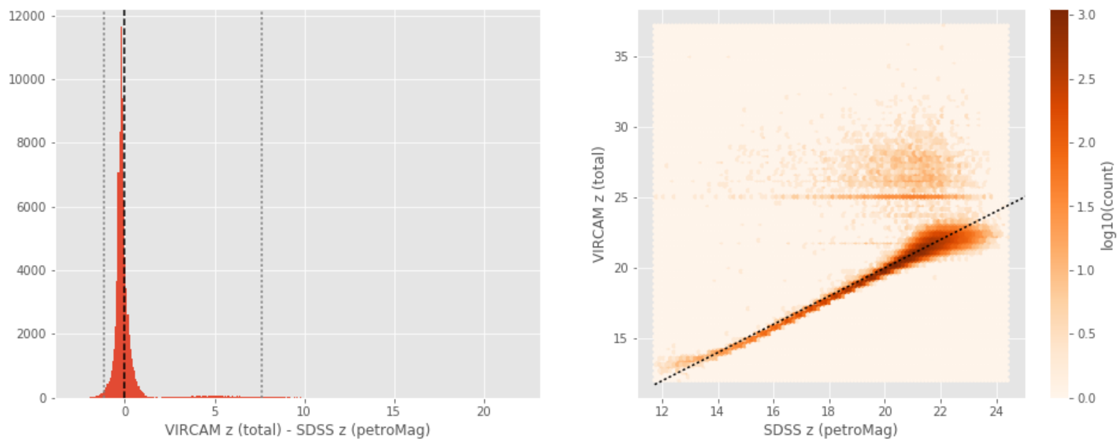
DECam z (total) - SDSS z (petroMag):
- Median: -0.45
- Median Absolute Deviation: 0.18
- 1% percentile: -1.4926085090637207
- 99% percentile: 1.8611146831512486



VIRCAM z (aperture) - SDSS z (fiberMag):
- Median: -0.18
- Median Absolute Deviation: 0.17
- 1% percentile: -1.1820927810668946
- 99% percentile: 7.613719787597657



VIRCAM z (total) - SDSS z (petroMag):
- Median: -0.18
- Median Absolute Deviation: 0.17
- 1% percentile: -1.1820927810668946
- 99% percentile: 7.613719787597657



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

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

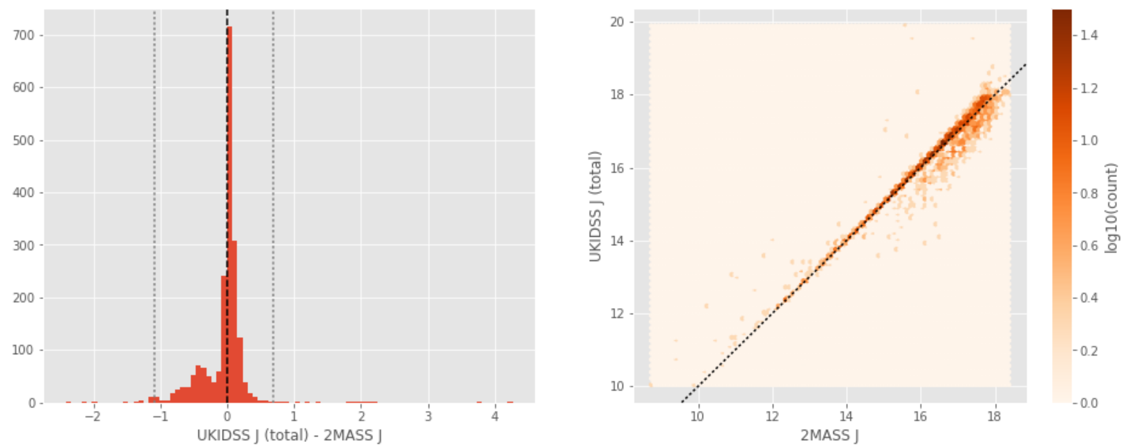
The 2MASS magnitudes are "*Vega-like*" and we have to convert them to AB magnitudes using the zero points provided on this page:

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

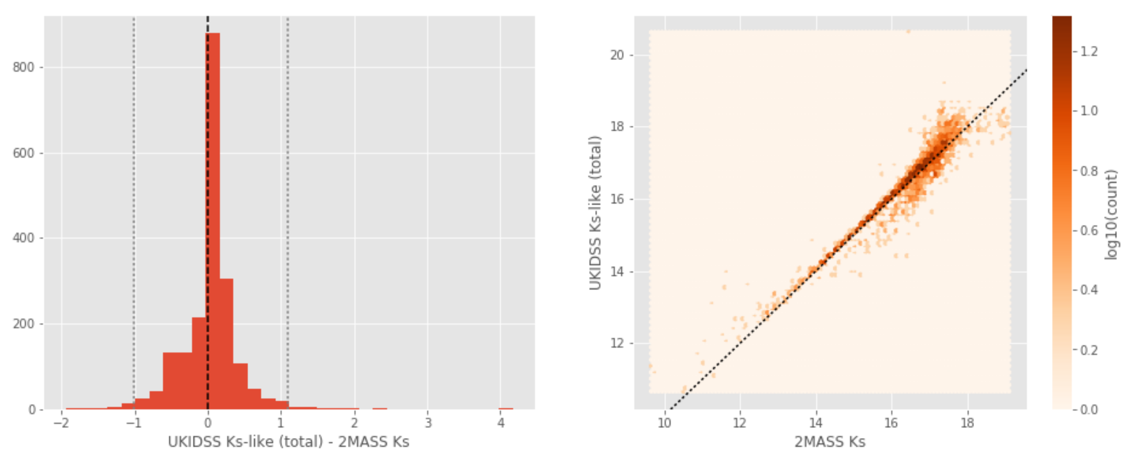
In addition, UKIDSS uses a K band whereas 2MASS uses a Ks ("short") band, this page give a correction to convert the K band in a Ks band with the formula:

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

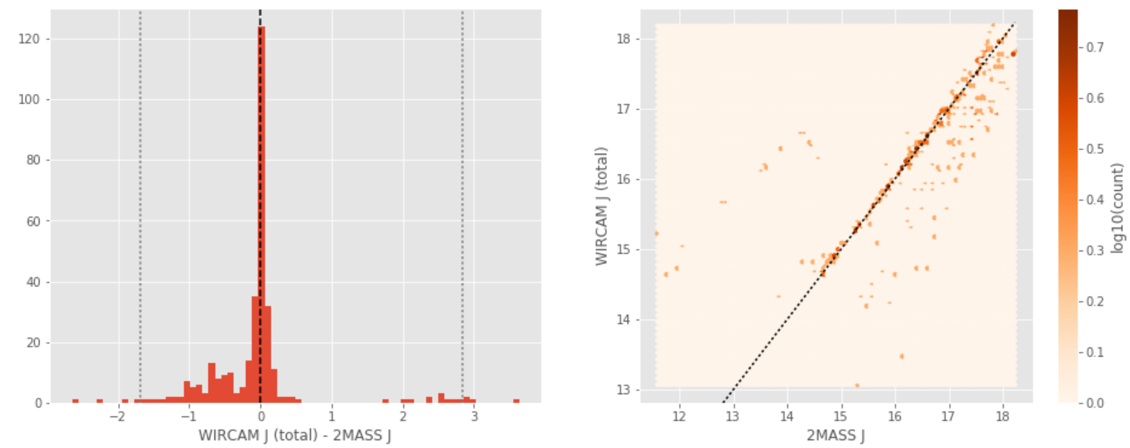
```
UKIDSS J (total) - 2MASS J:
- Median: 0.02
- Median Absolute Deviation: 0.07
- 1% percentile: -1.0929408017637088
- 99% percentile: 0.6913616157625345
```



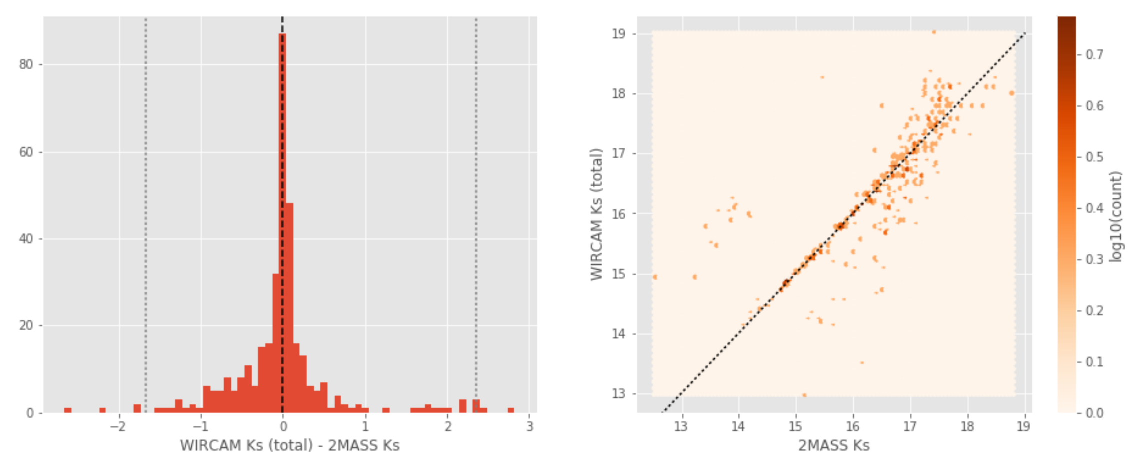
UKIDSS Ks-like (total) - 2MASS Ks:
- Median: 0.07
- Median Absolute Deviation: 0.11
- 1% percentile: -1.0088261194475698
- 99% percentile: 1.0918024134198605



WIRCAM J (total) - 2MASS J:
- Median: -0.01
- Median Absolute Deviation: 0.08
- 1% percentile: -1.6887039037992306
- 99% percentile: 2.8399360962007716

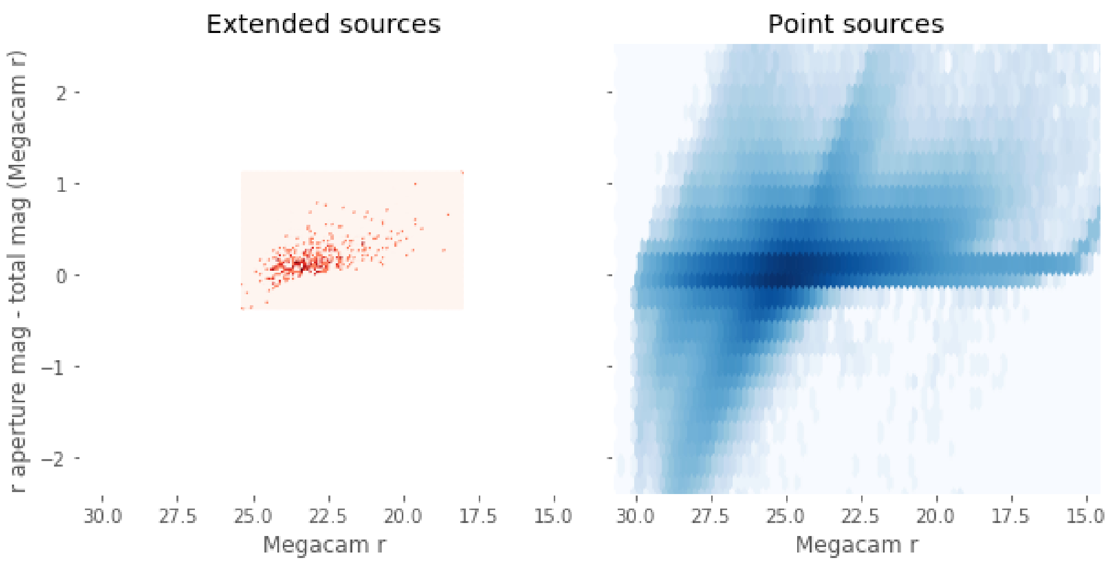


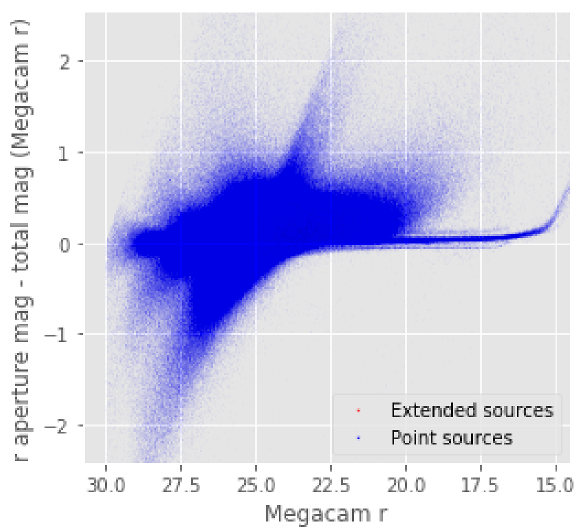

```
WIRCAM Ks (total) - 2MASS Ks:
- Median: -0.01
- Median Absolute Deviation: 0.13
- 1% percentile: -1.671212484468322
- 99% percentile: 2.357890515531679
```

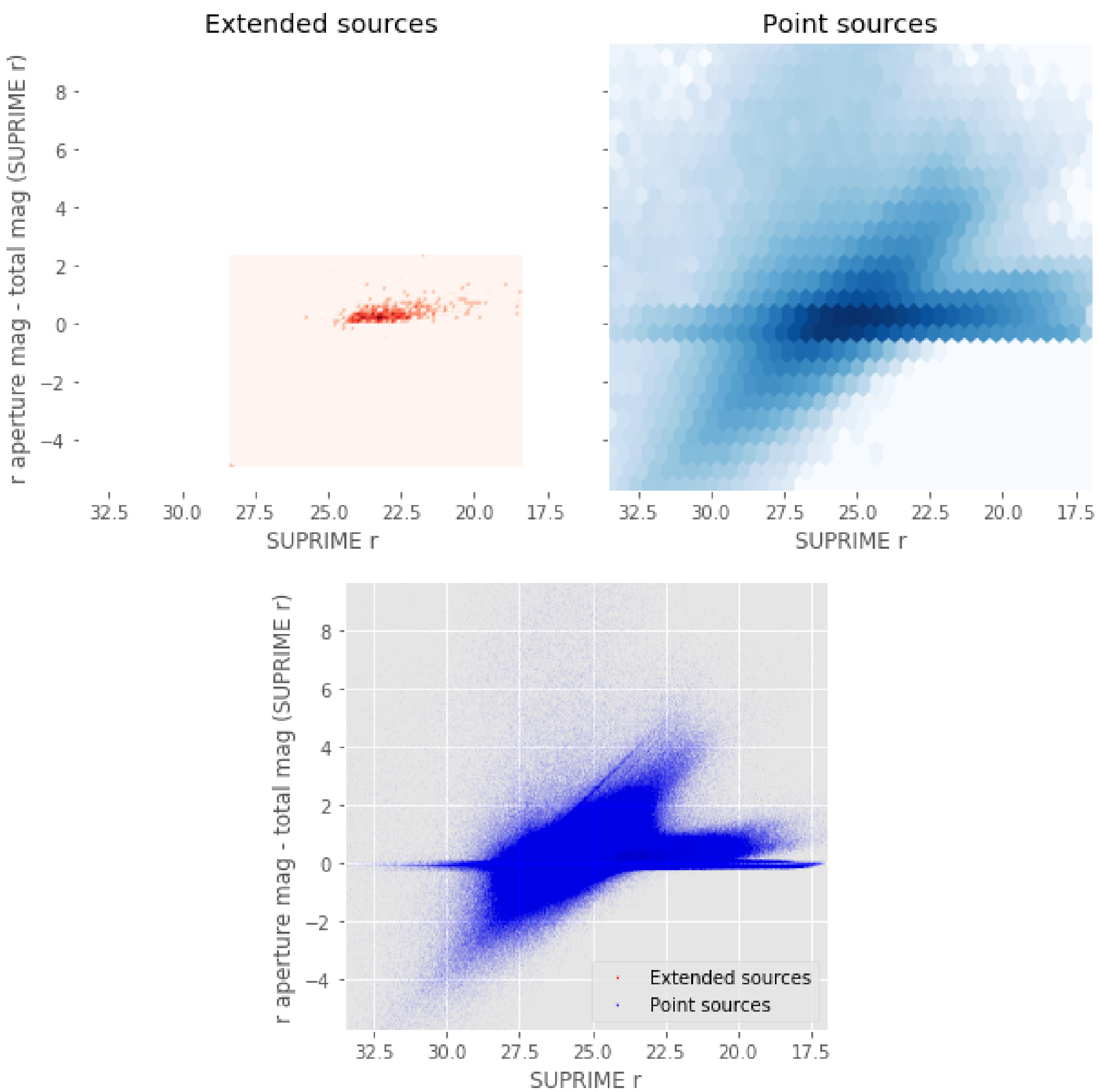


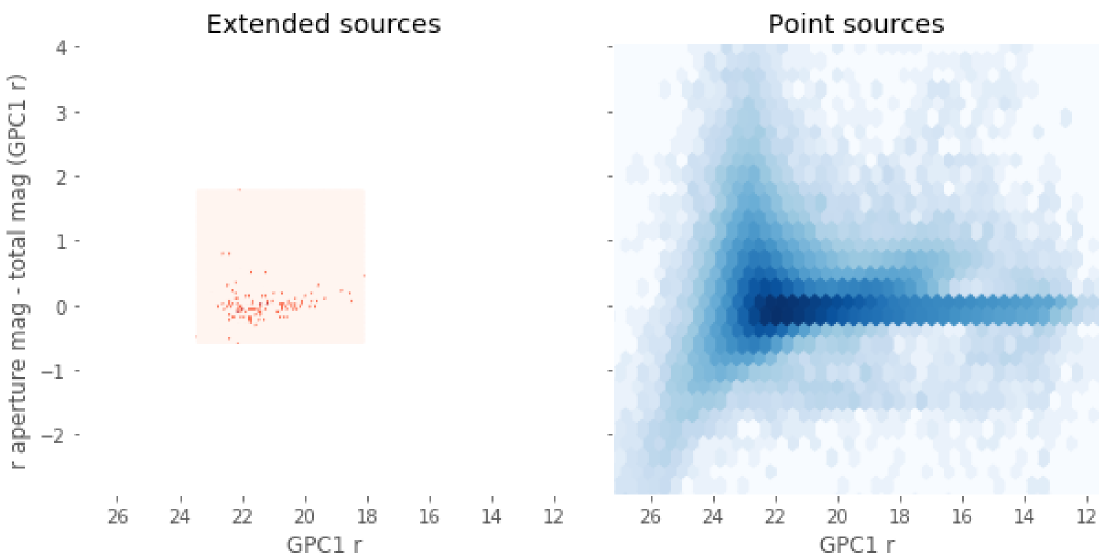
1.6 IV - Comparing aperture magnitudes to total ones.

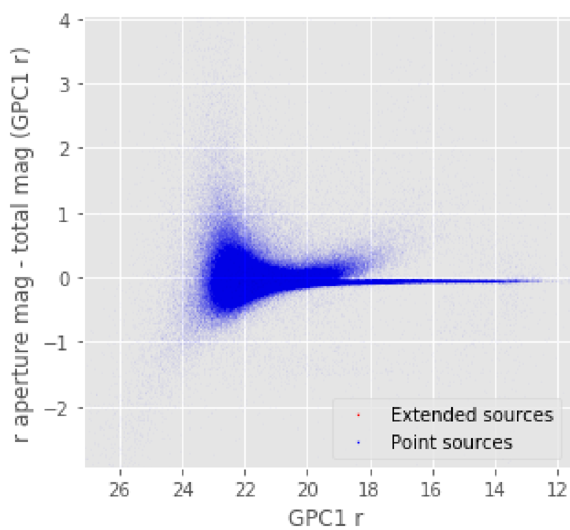
```
Number of source used: 4126581 / 8717327 (47.34%)
Number of source used: 4718862 / 8717327 (54.13%)
Number of source used: 373246 / 8717327 (4.28%)
Number of source used: 1744740 / 8717327 (20.01%)
```

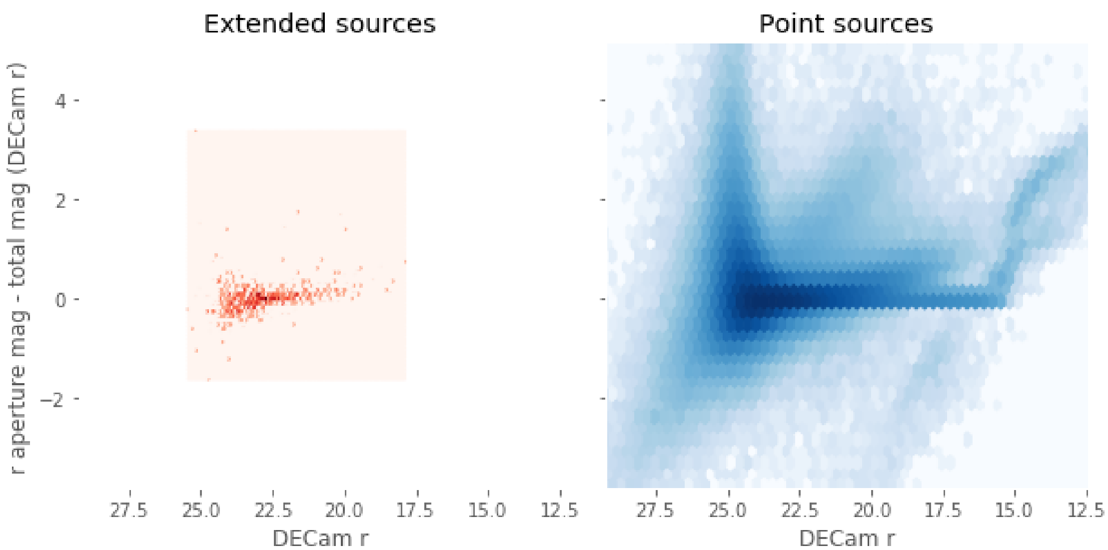

Extended sources
Point sources
r aperture mag - total mag (Megacam r)
Megacam r
2
1
0
−1
−2
30.0
27.5
25.0
22.5
20.0
17.5
15.0

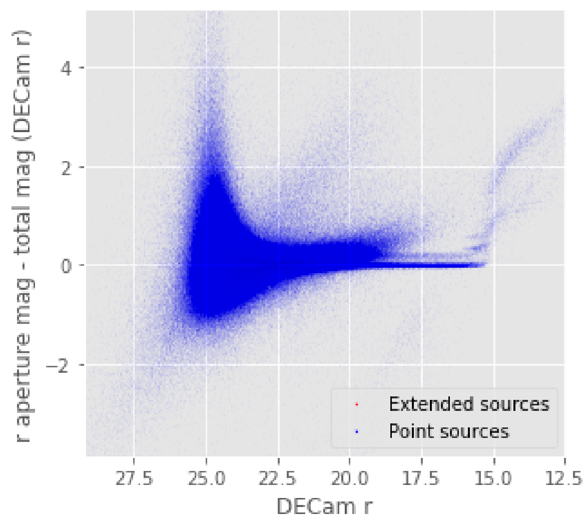

r aperture mag - total mag (Megacam r)
Megacam r
Extended sources
Point sources
2
1
0
−1
−2
30.0
27.5
25.0
22.5
20.0
17.5
15.0


Extended sources
Point sources
r aperture mag - total mag (SUPRIME r)
SUPRIME r
8
6
4
2
0
−2
−4
32.5
30.0
27.5
25.0
22.5
20.0
17.5
Extended sources
Point sources


Extended sources
Point sources
r aperture mag - total mag (GPC1 r)
GPC1 r
4
3
2
1
0
−1
−2
26
24
22
20
18
16
14
12

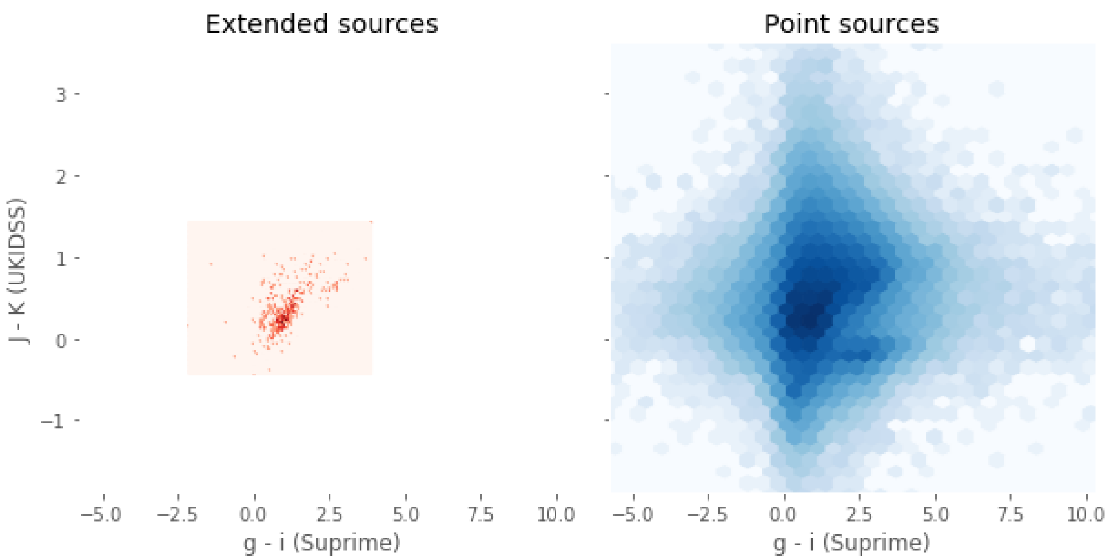

r aperture mag - total mag (GPC1 r)
GPC1 r
Extended sources
Point sources
4
3
2
1
0
−1
−2
26
24
22
20
18
16
14
12

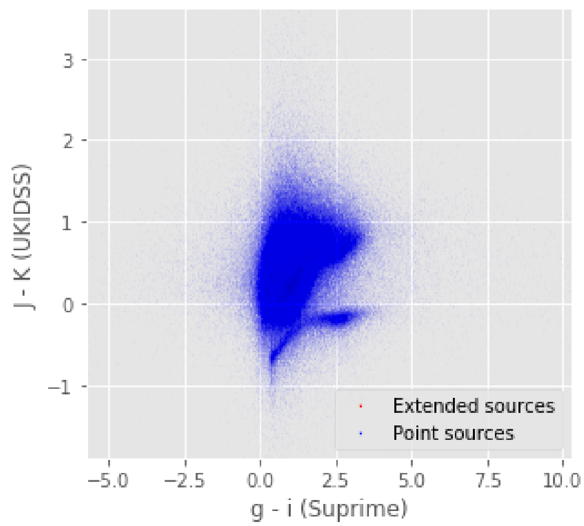




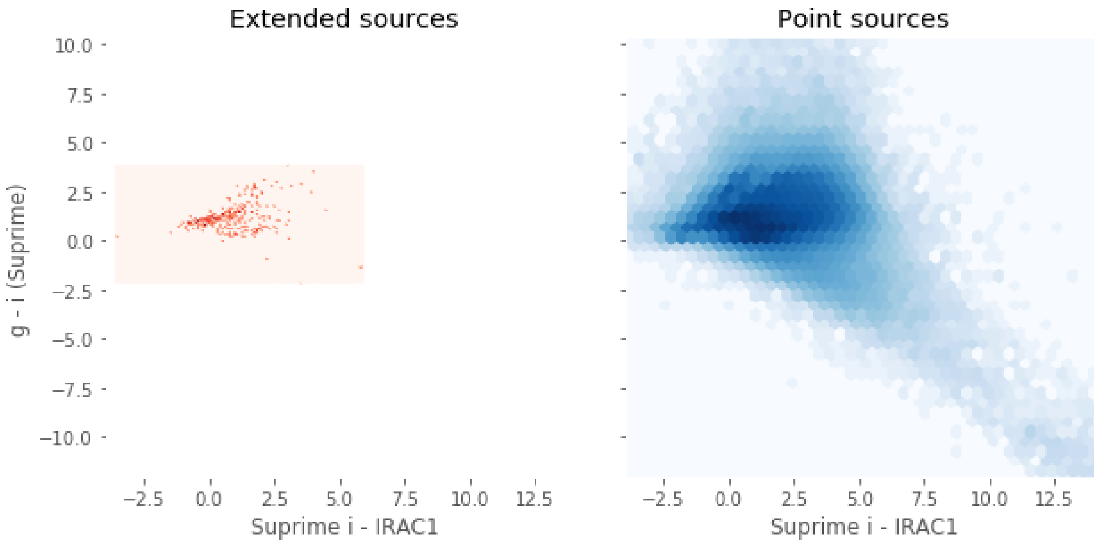
1.7 V - Color-color and magnitude-color plots

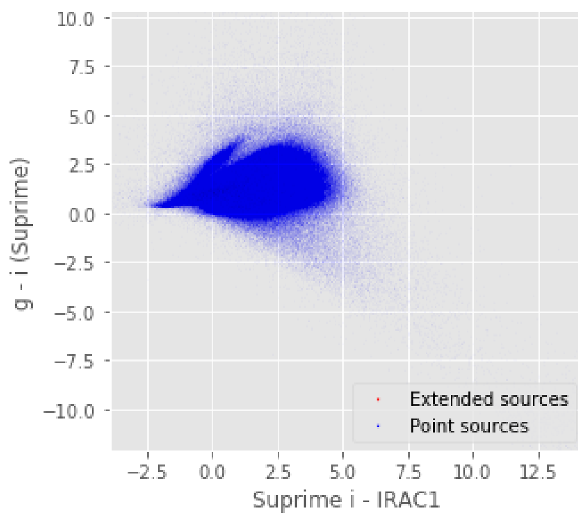
```
Number of source used: 395116 / 8717327 (4.53%)
```



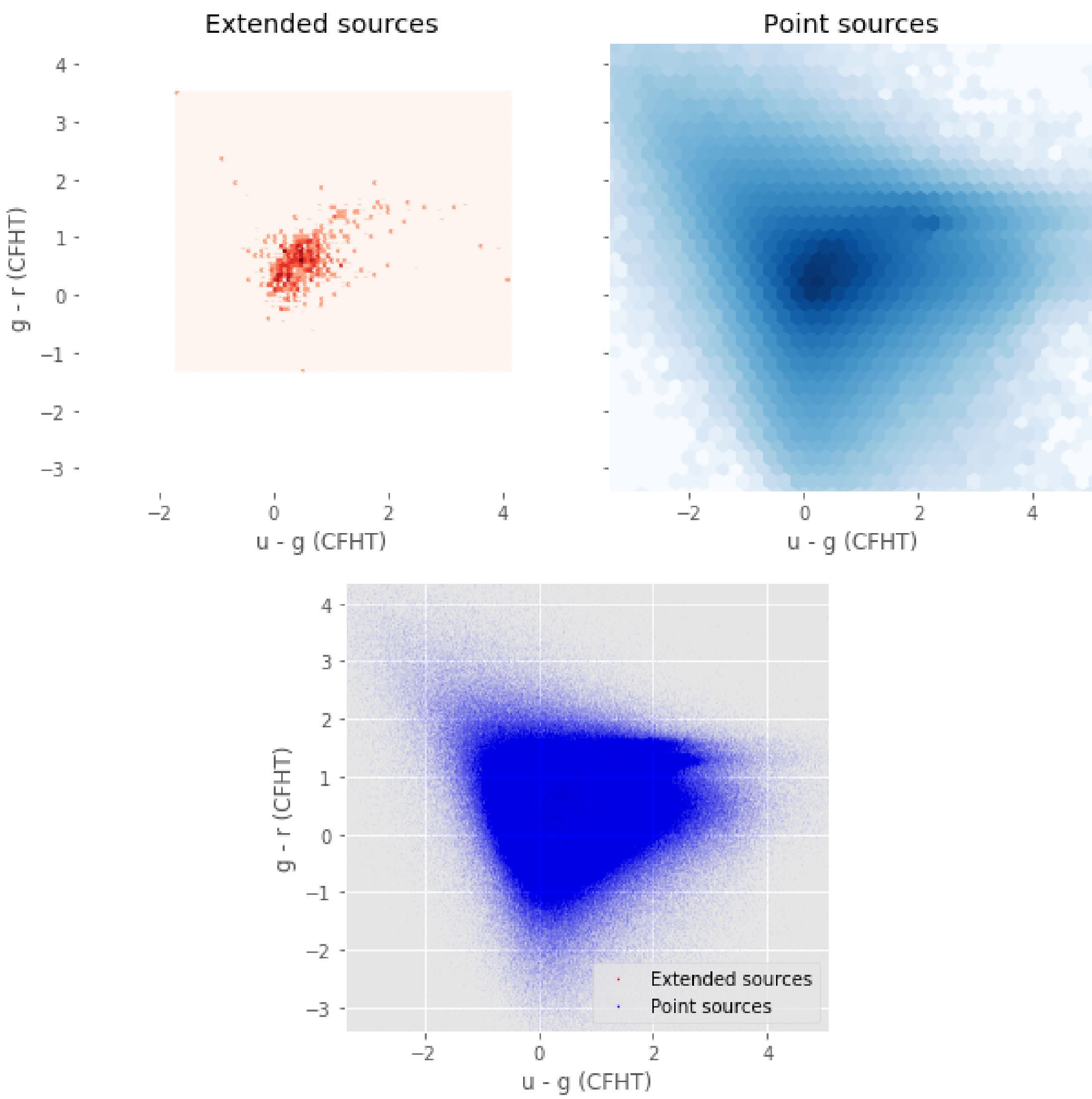


Number of source used: 708406 / 8717327 (8.13%)

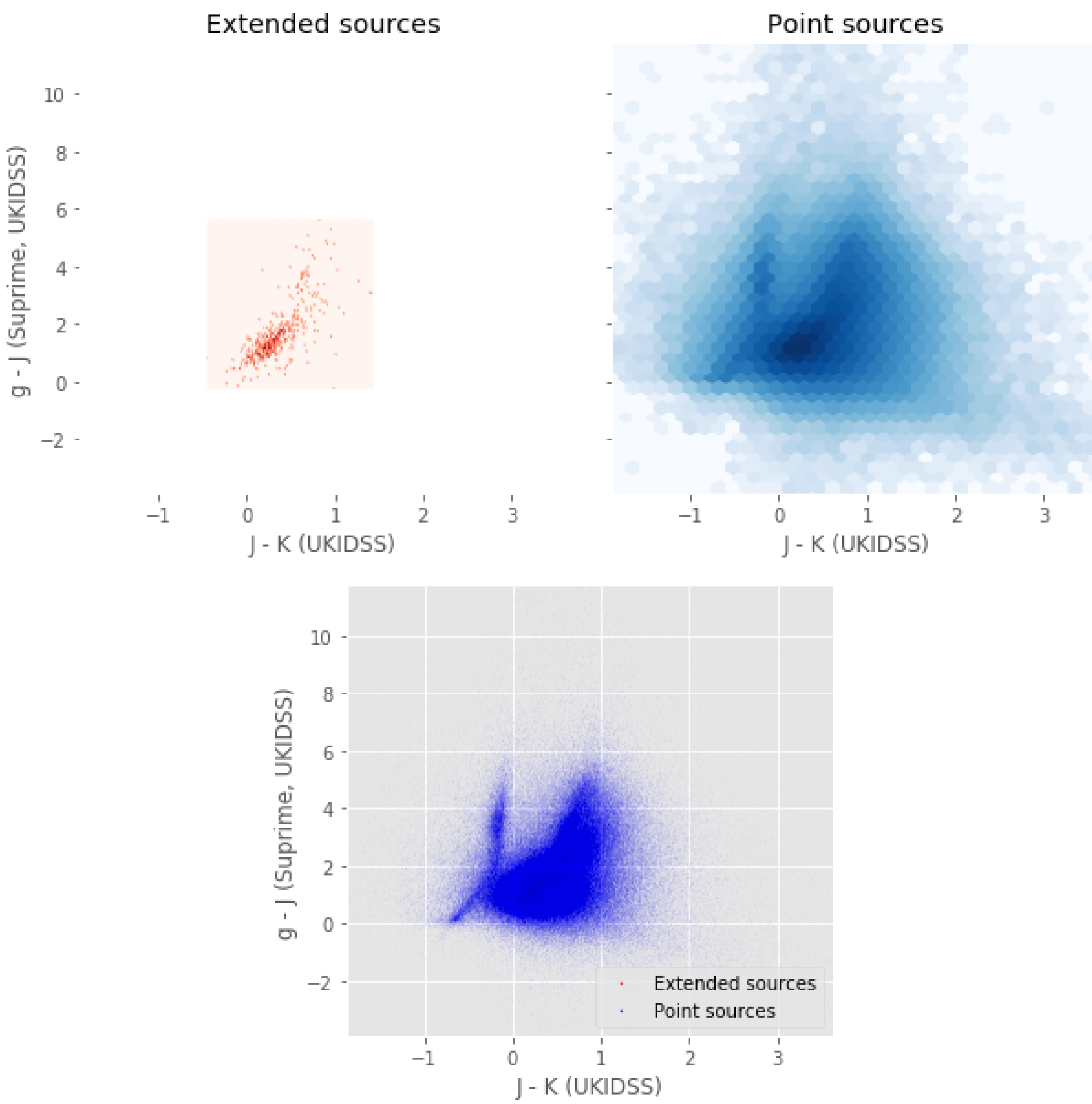




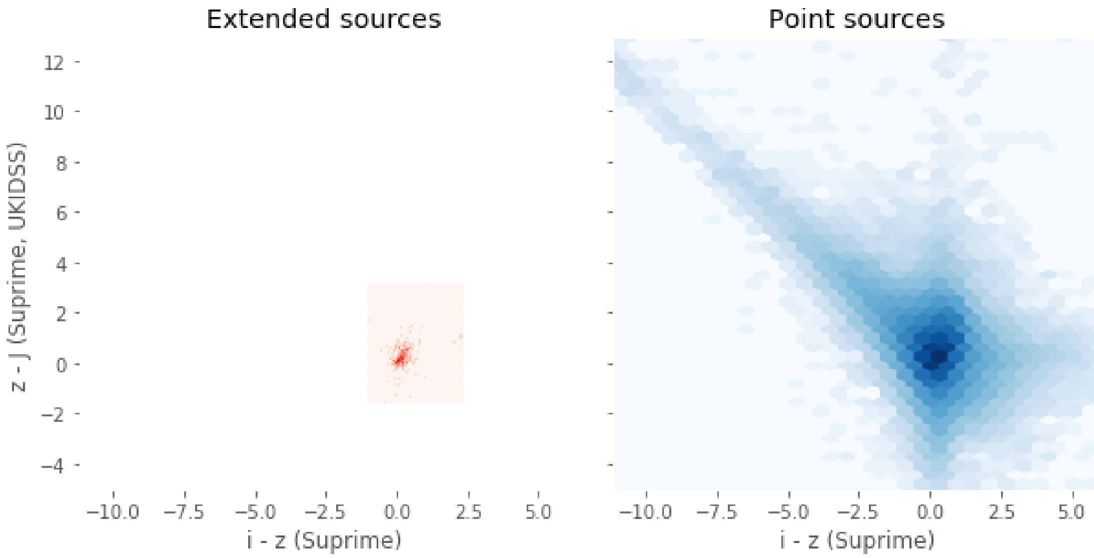

```
Number of source used: 3615206 / 8717327 (41.47%)
```

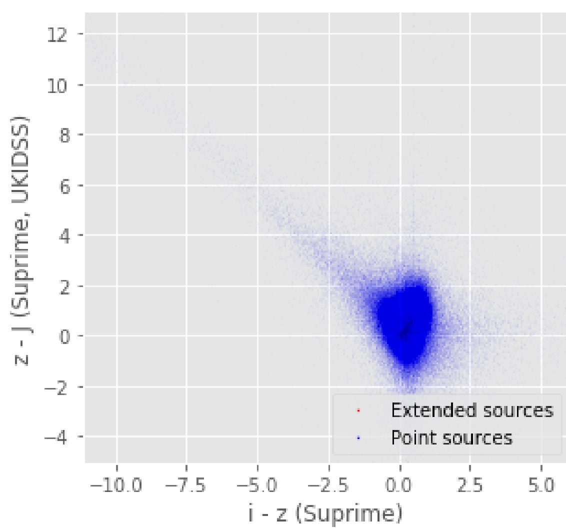


Number of source used: 398239 / 8717327 (4.57%)

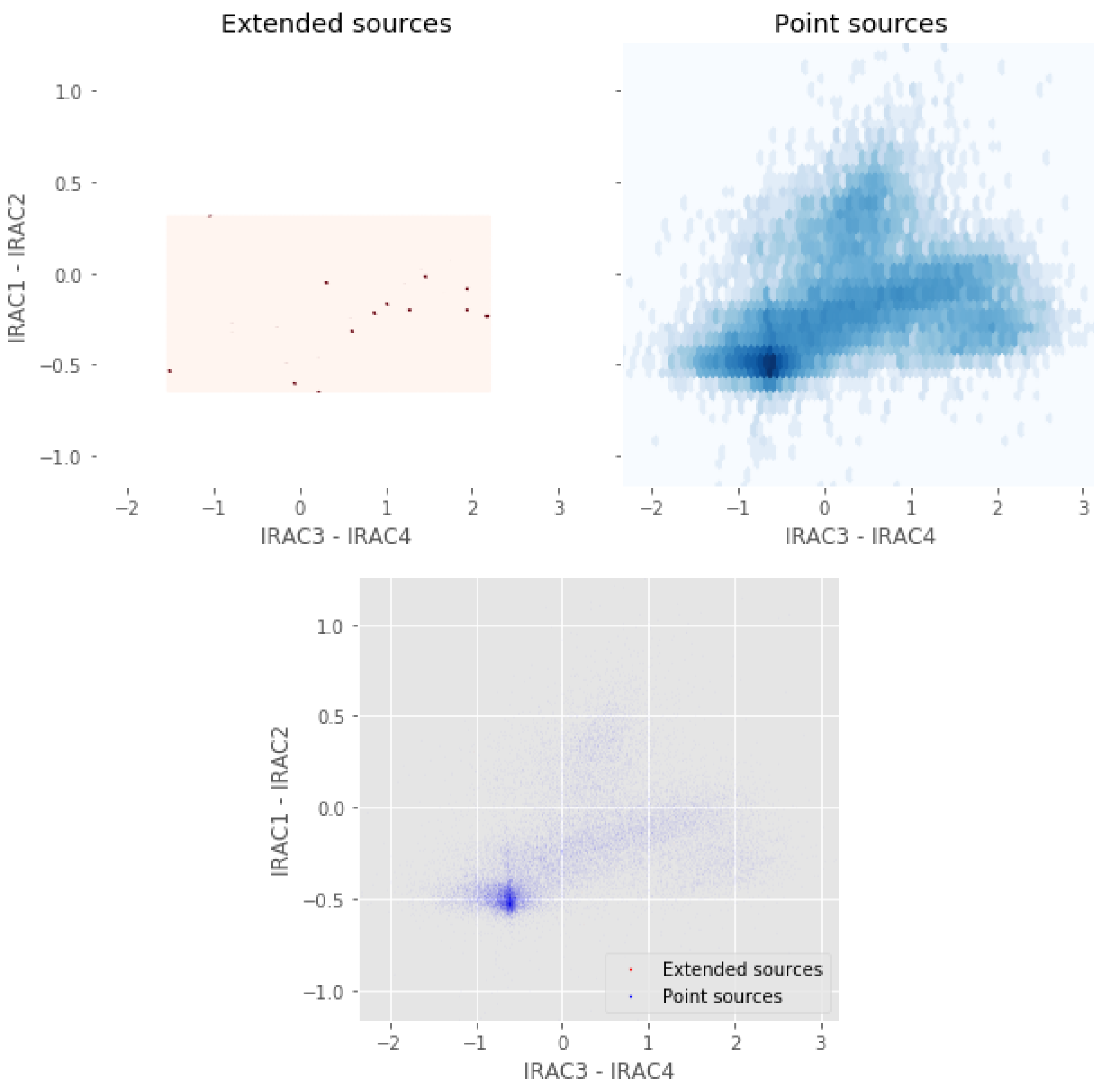


Number of source used: 421209 / 8717327 (4.83%)






```
Number of source used: 23470 / 8717327 (0.27%)
```



Extended sources
Point sources
IRAC1 - IRAC2
IRAC3 - IRAC4
1.0
0.5
0.0
−0.5
−1.0
−2
−1
0
1
2
3
Extended sources
Point sources