1.1_CANDELS-3D-HST

January 18, 2018

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

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

1.3 II - Removal of duplicated sources

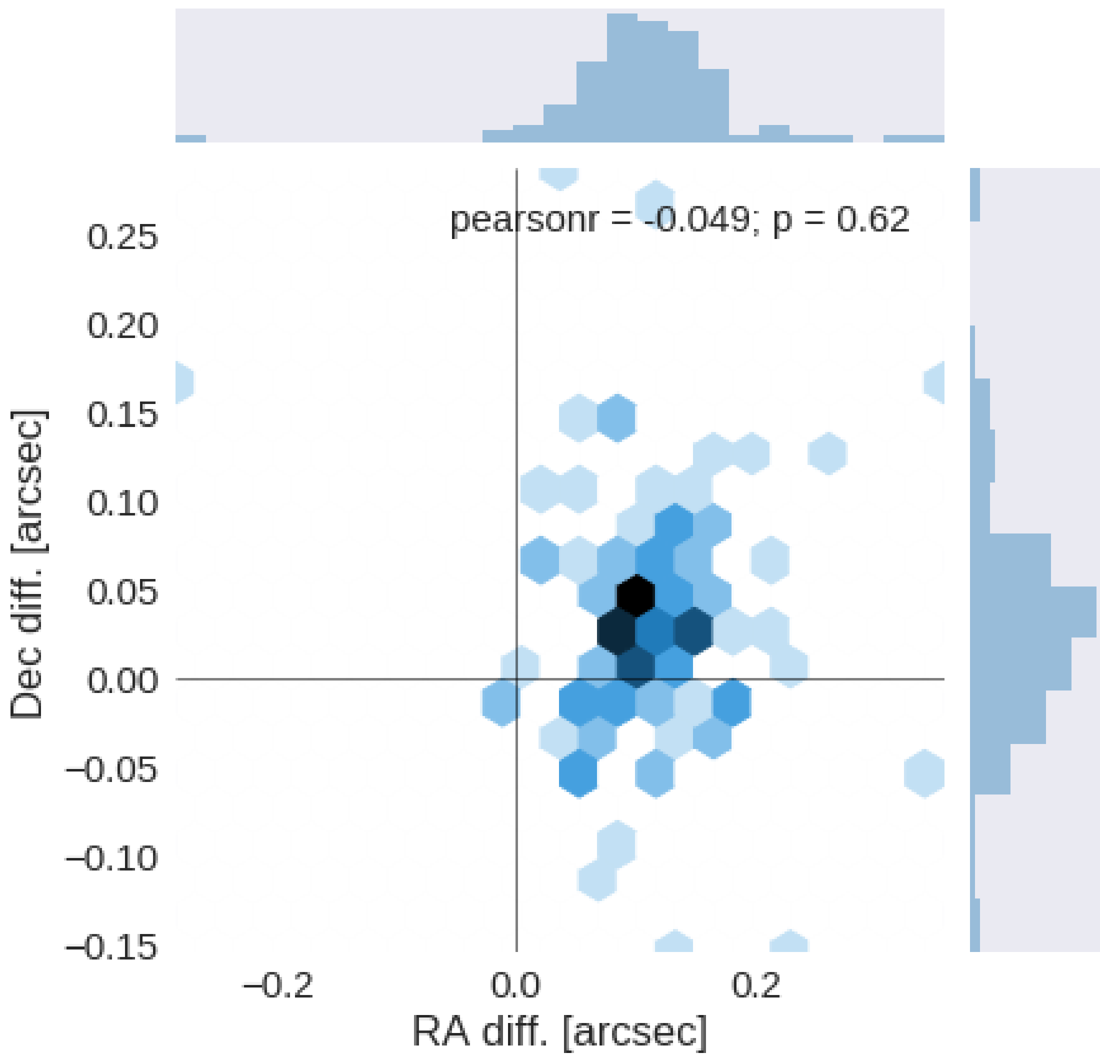
We remove duplicated objects from the input catalogues.

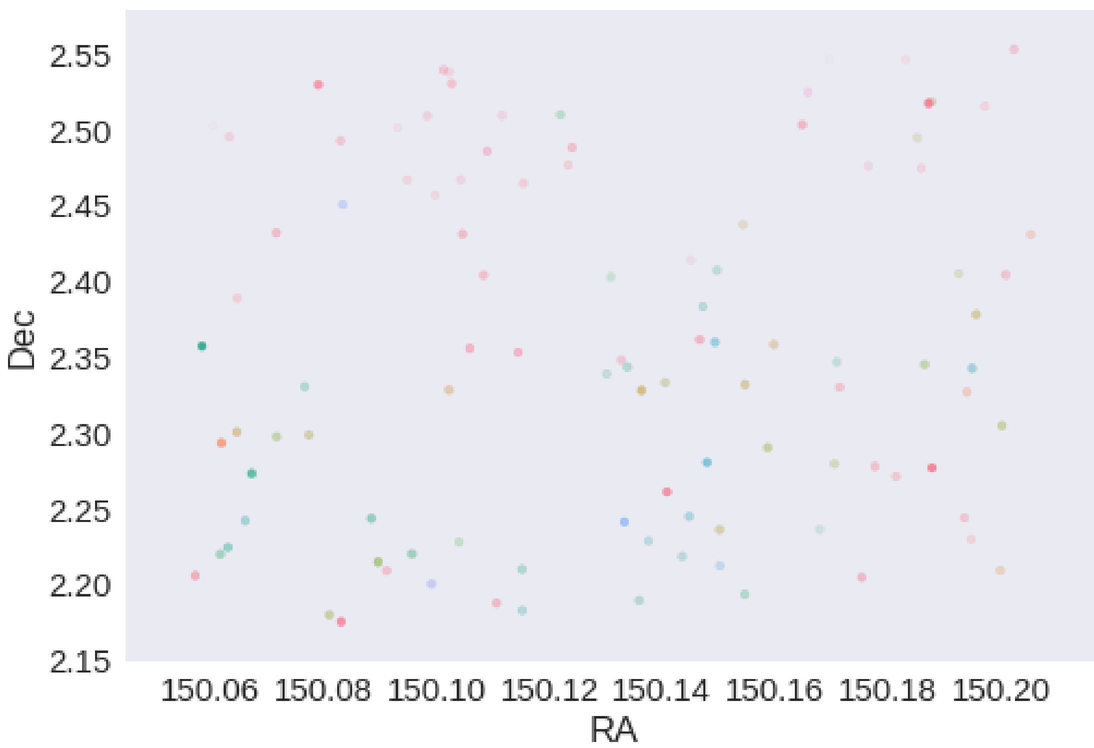
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 33879 sources.
The cleaned catalogue has 33869 sources (10 removed).
The cleaned catalogue has 10 sources flagged as having been cleaned
```

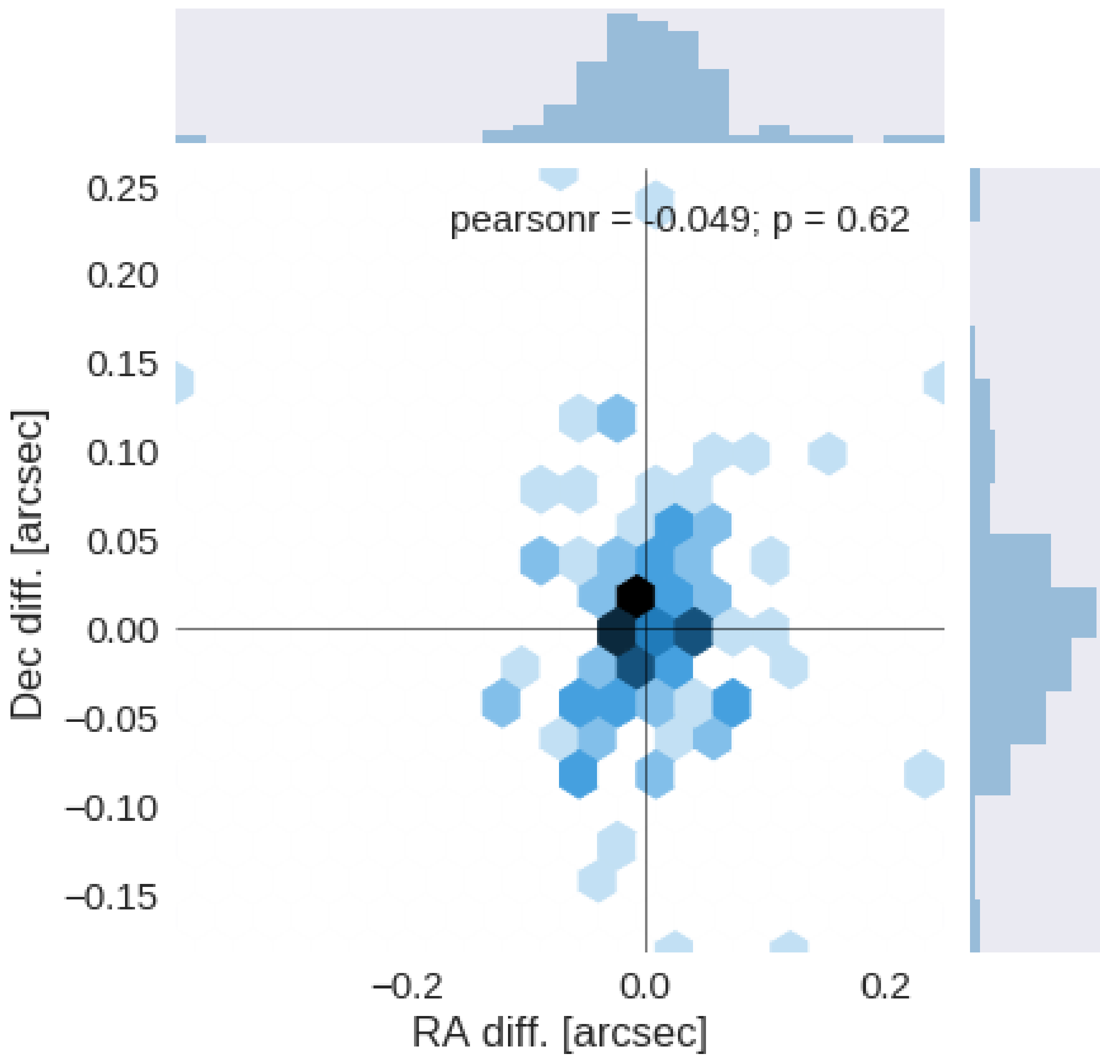
1.4 III - Astrometry correction

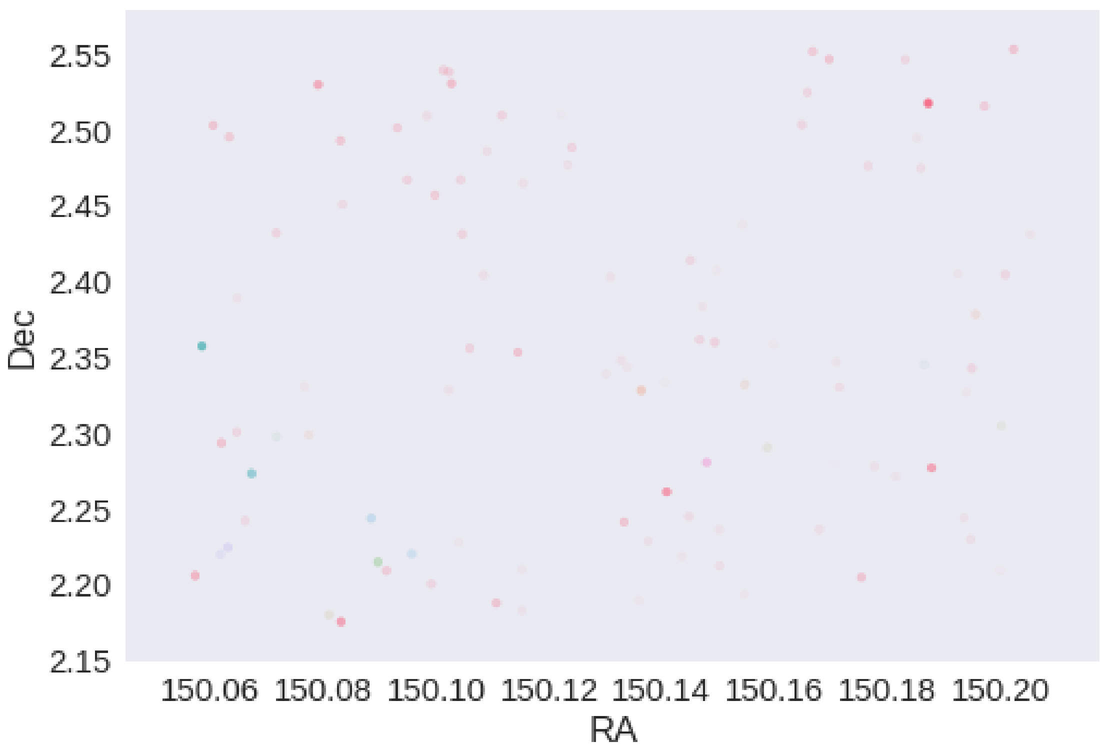
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: -0.10791846540882943 arcsec
Dec correction: -0.028431532331651965 arcsec
```


pearsonr = -0.049; p = 0.62
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
Dec diff. [arcsec]
−0.2
0.0
0.2
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
110 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.2_CFHTLS

January 18, 2018

1 COSMOS master catalogue

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

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

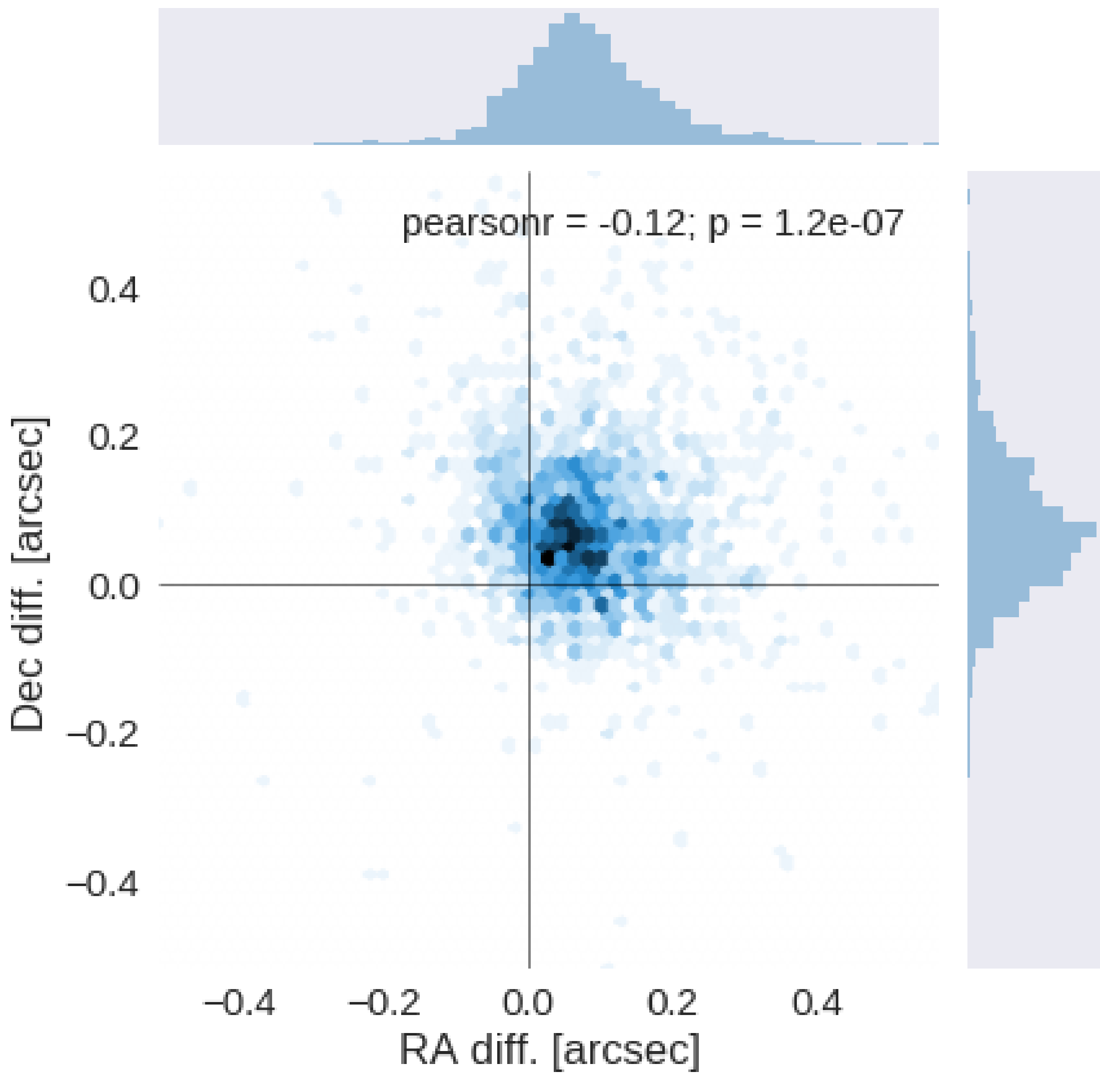
We remove duplicated objects from the input catalogues.

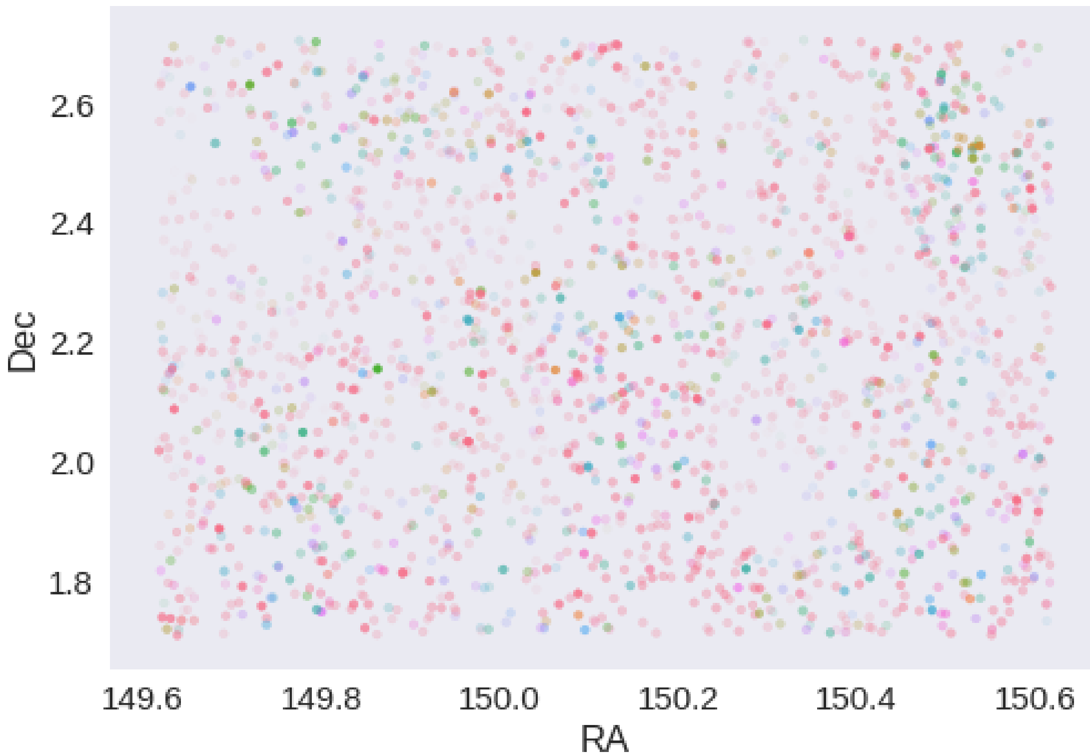
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 554830 sources.
The cleaned catalogue has 554830 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

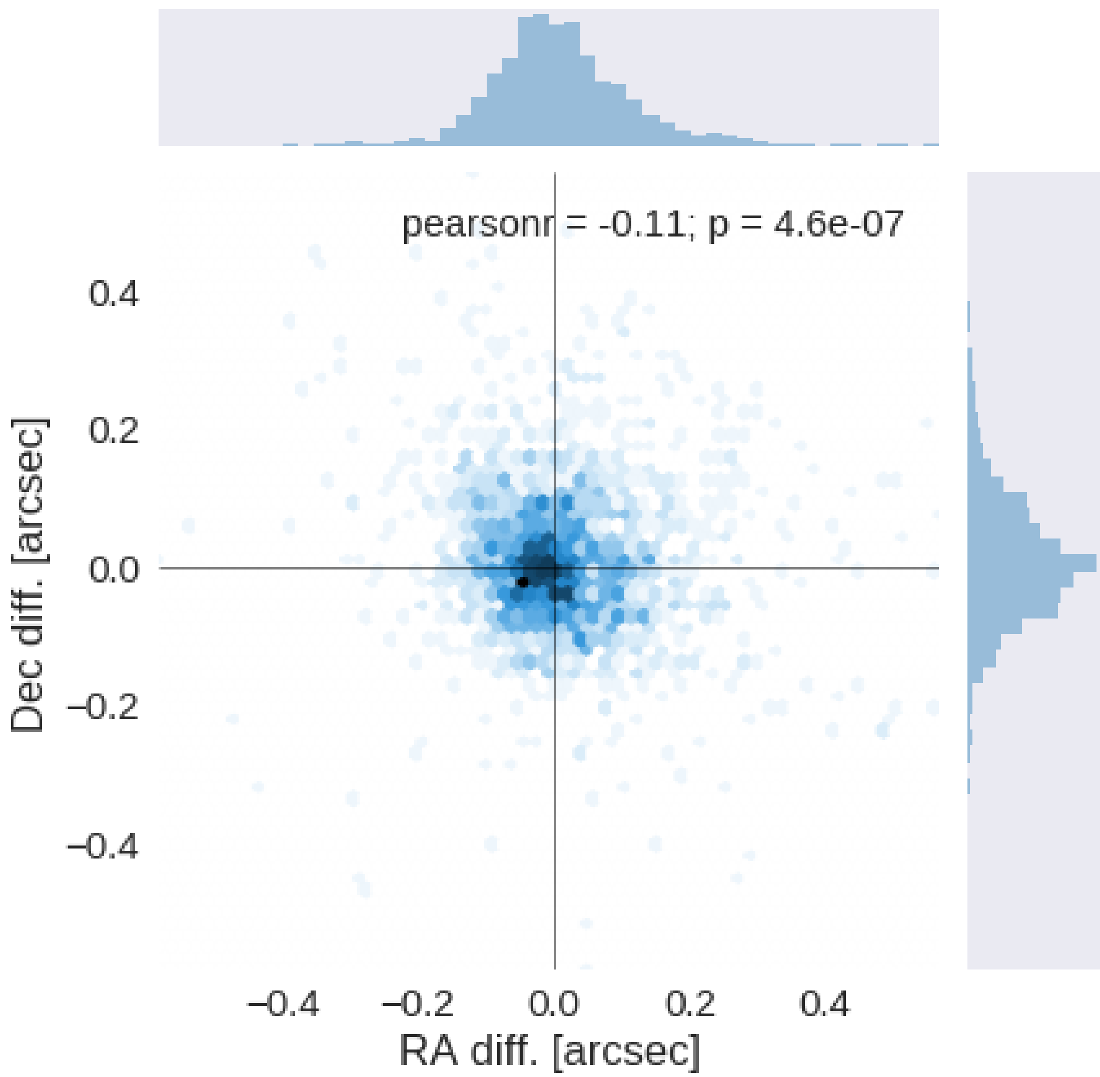
1.4 III - Astrometry correction

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.

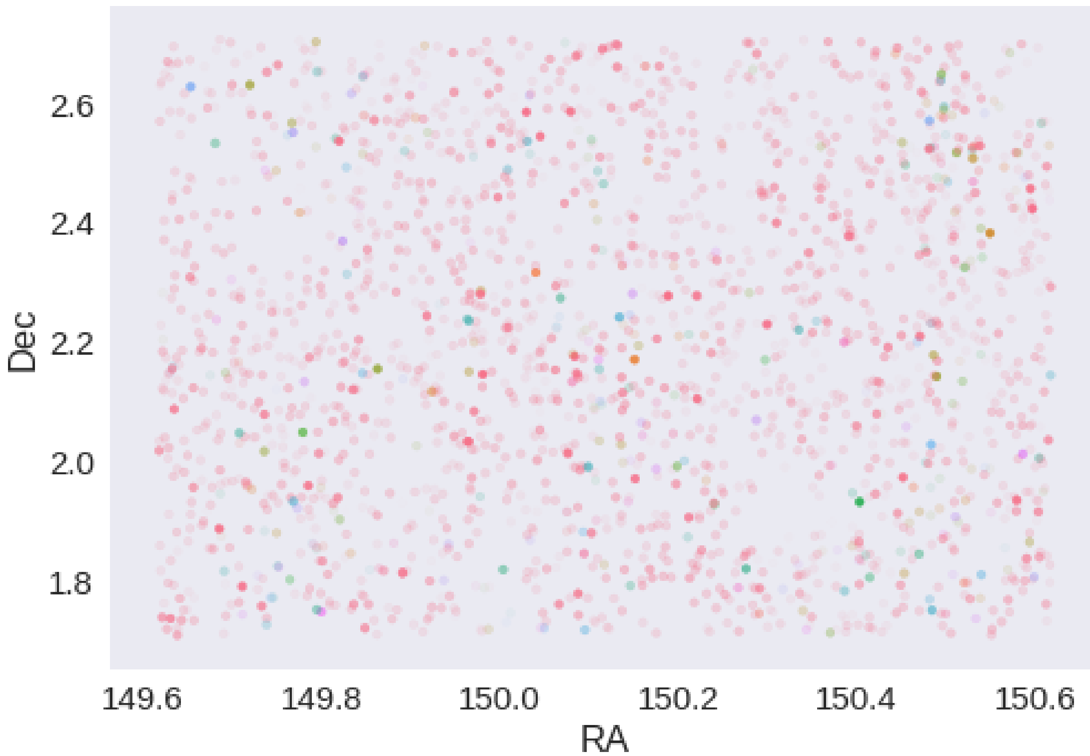





```
RA correction: -0.07301163240072128 arcsec
Dec correction: -0.06591029994105213 arcsec
```



pearsonr = -0.11; p = 4.6e-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]



1.5 IV - Flagging Gaia objects

```
2052 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.3_DECaLS

January 18, 2018

1 COSMOS 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).

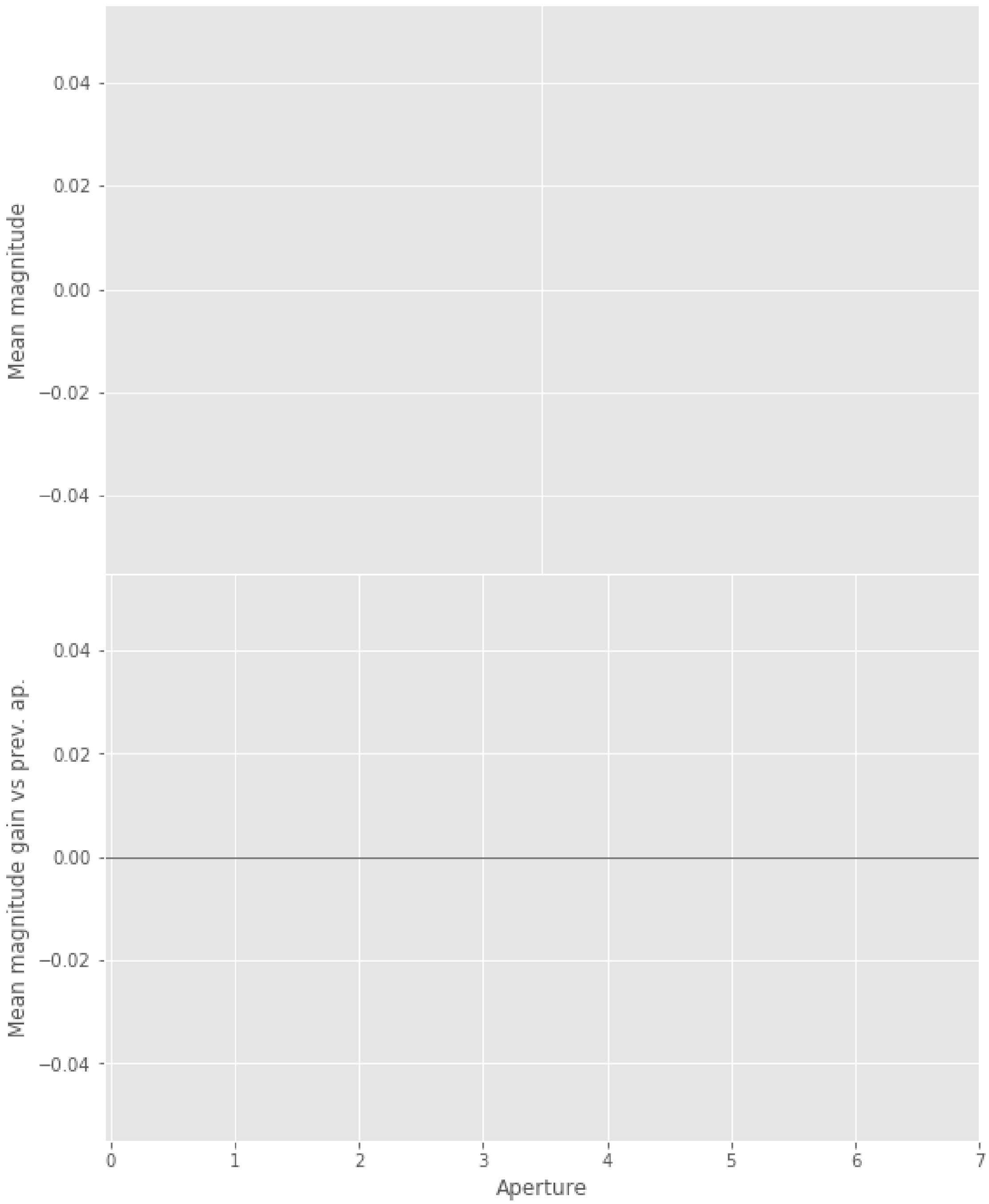
As target aperture, we should use the smallest (i.e. less noisy) aperture for which most of the flux is captures.

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
```

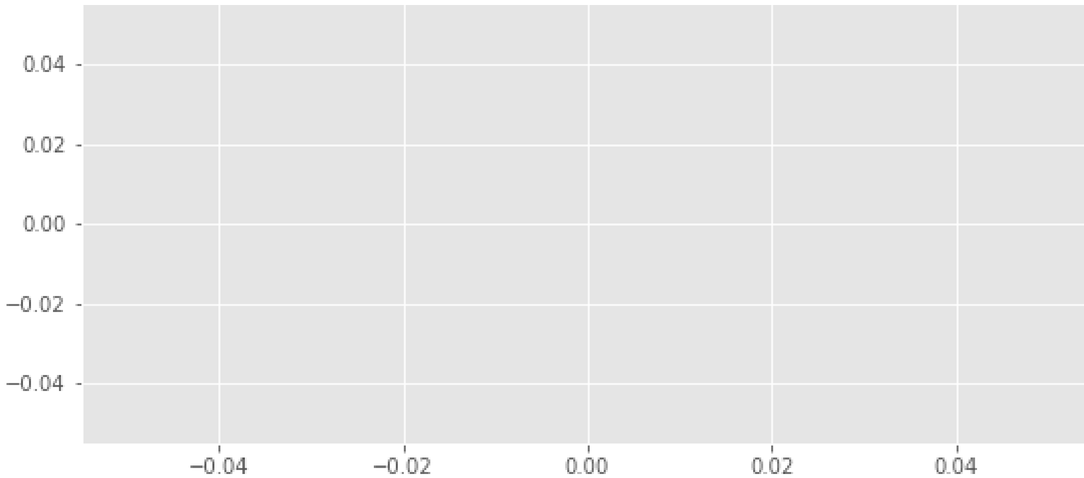
1.2.1 1.a u band

```
/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)
```

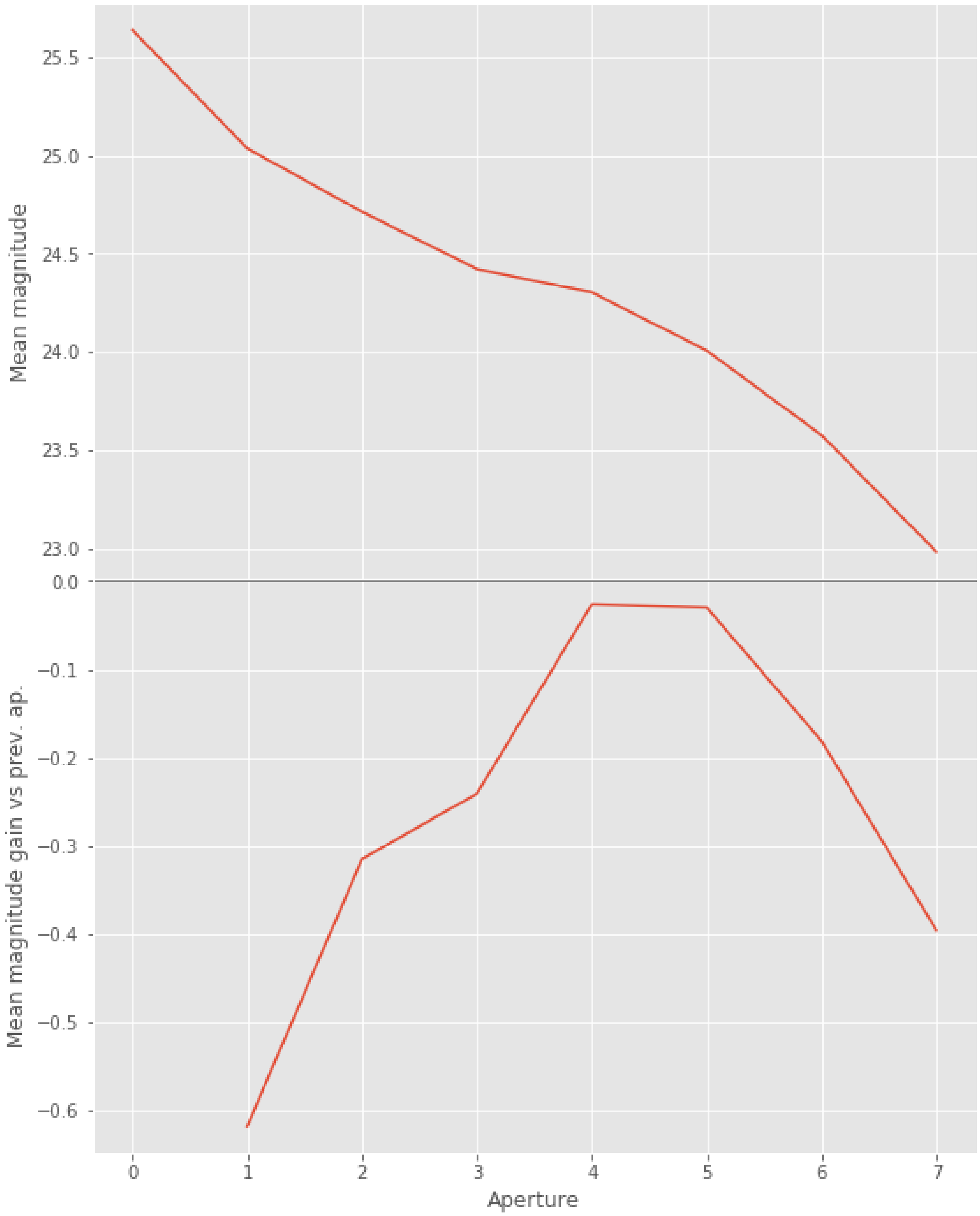


u band is all nan

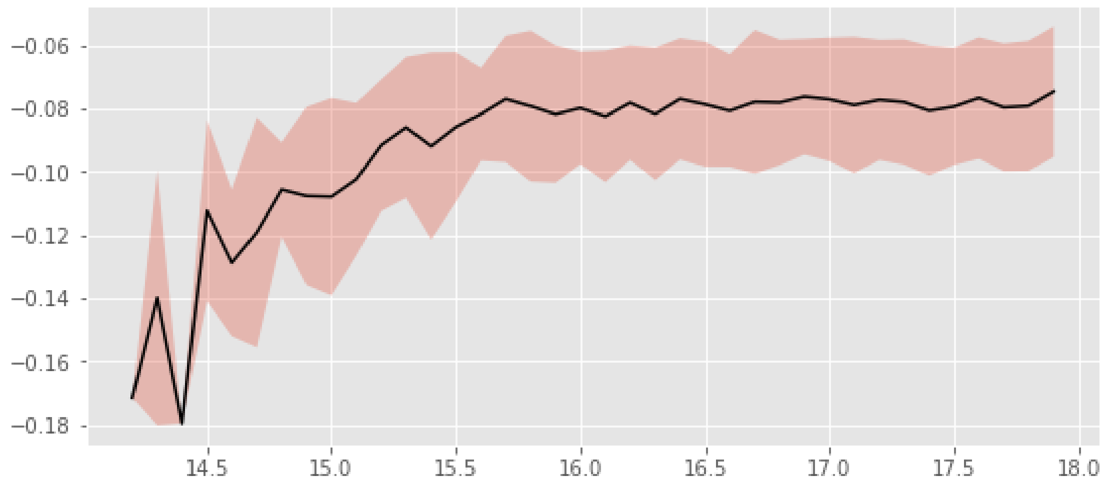
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


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



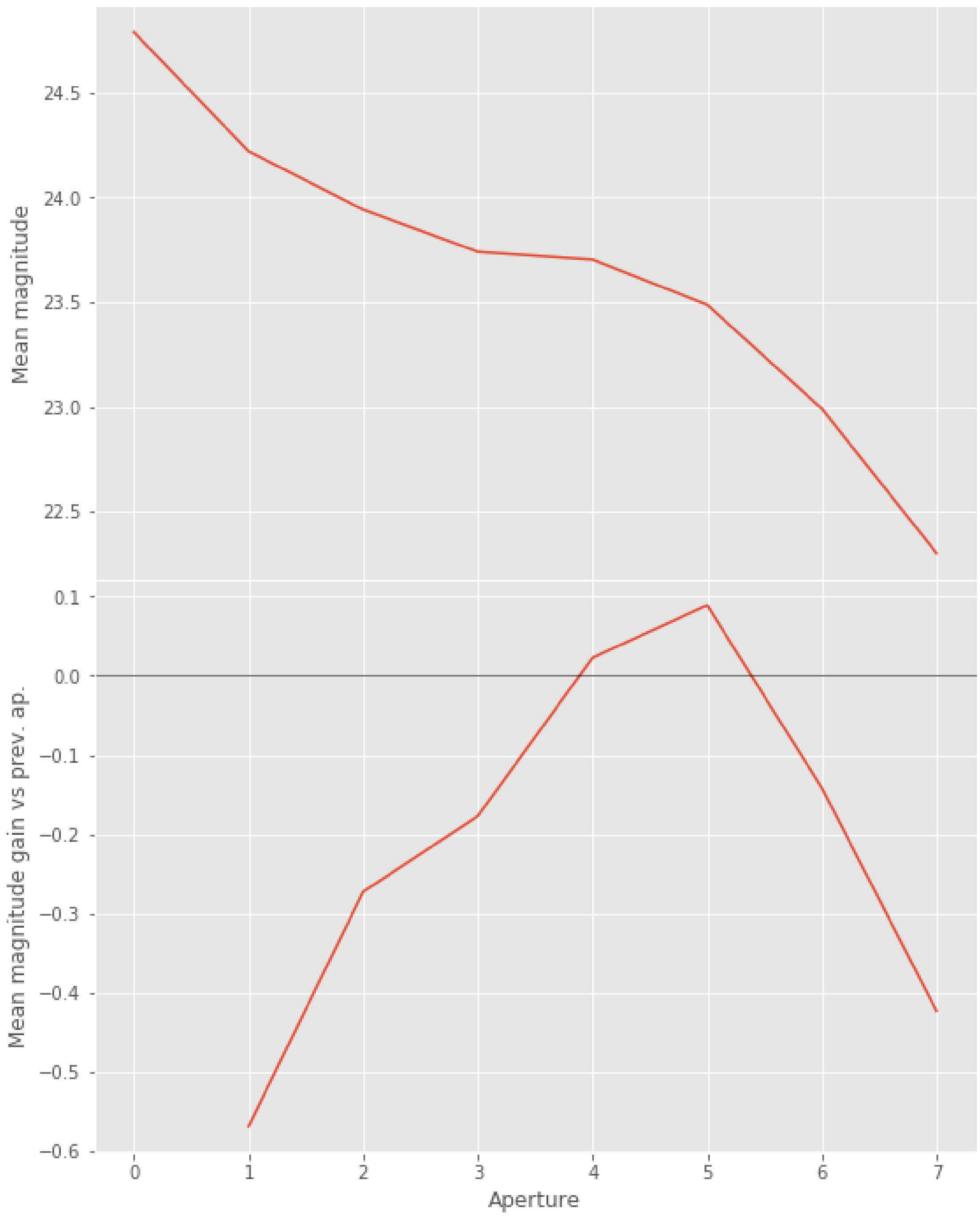
We will use aperture 5 as target.



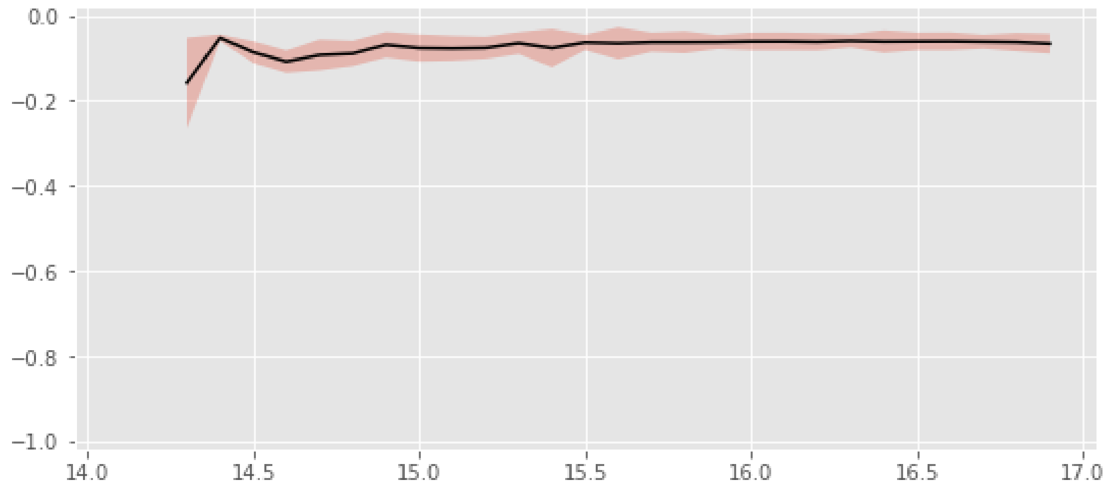
We will use magnitudes between 16.0 and 19.0

```
Aperture correction for g band:
Correction: -0.07828878191013189
Number of source used: 3747
RMS: 0.020050373380106051
```

1.2.3 I.b - r band



We will use aperture 5 as target.

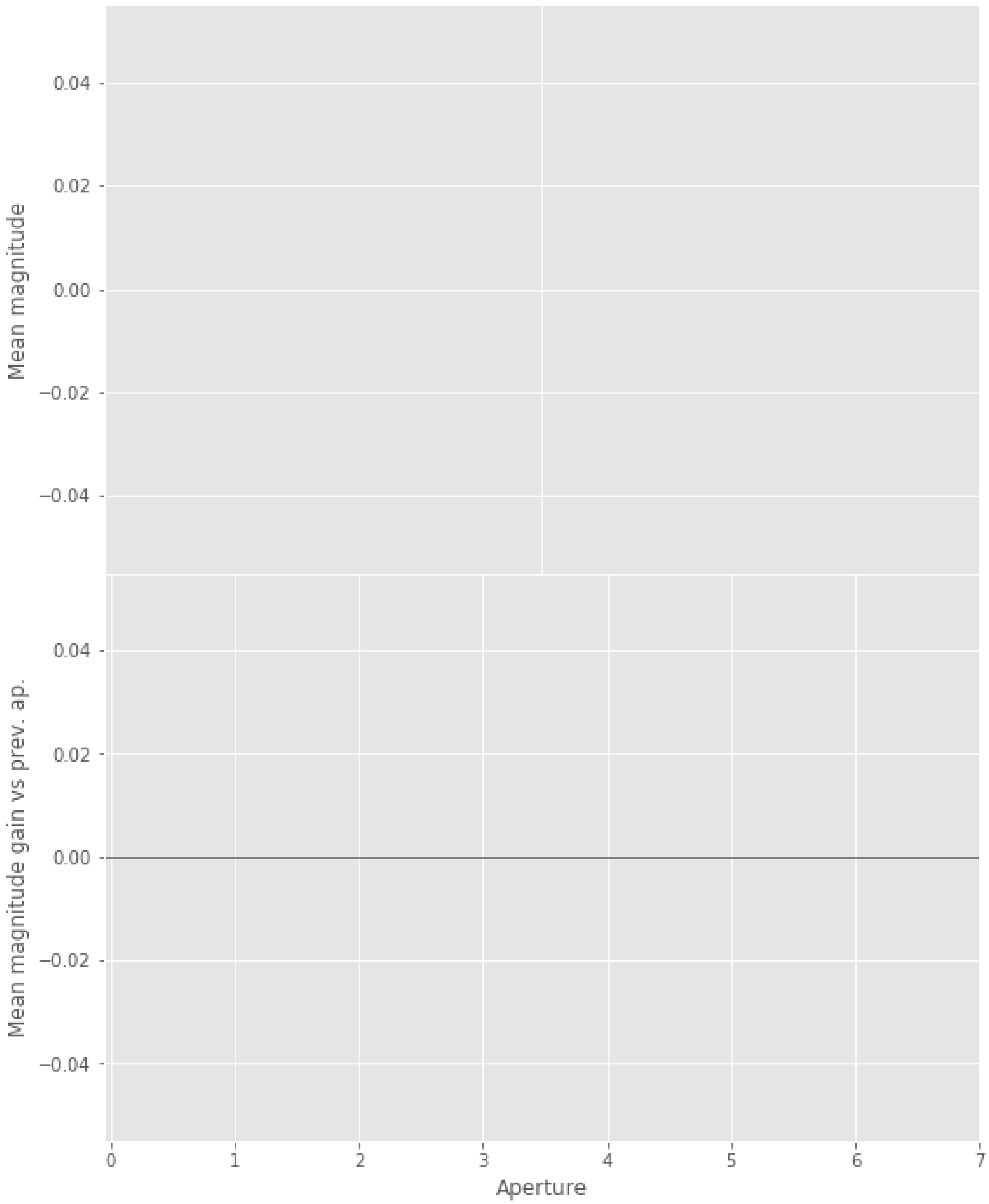


We use magnitudes between 16.0 and 18.0.

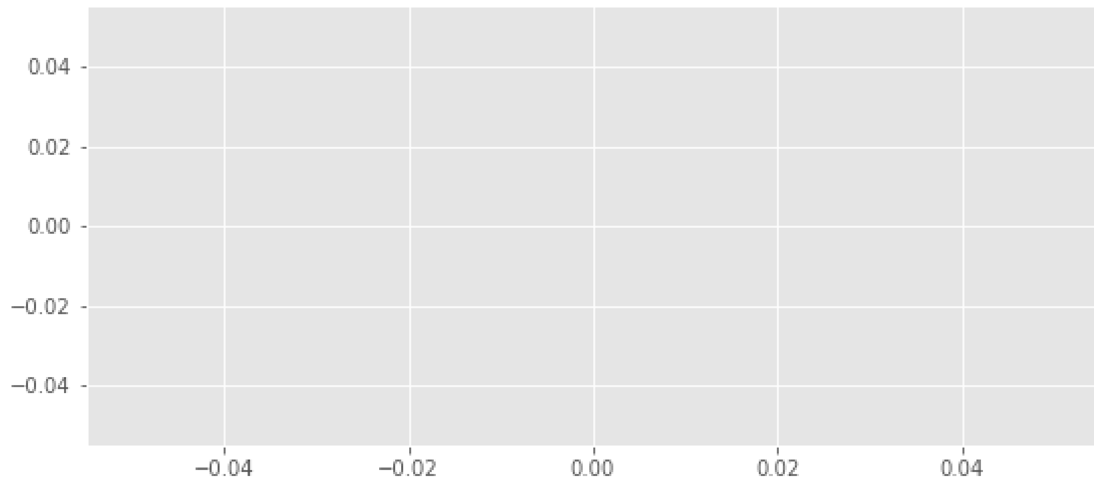
```
Aperture correction for r band:
Correction: -0.0609926935865559
Number of source used: 2998
RMS: 0.02000000736251746
```

1.2.4 I.d - i band

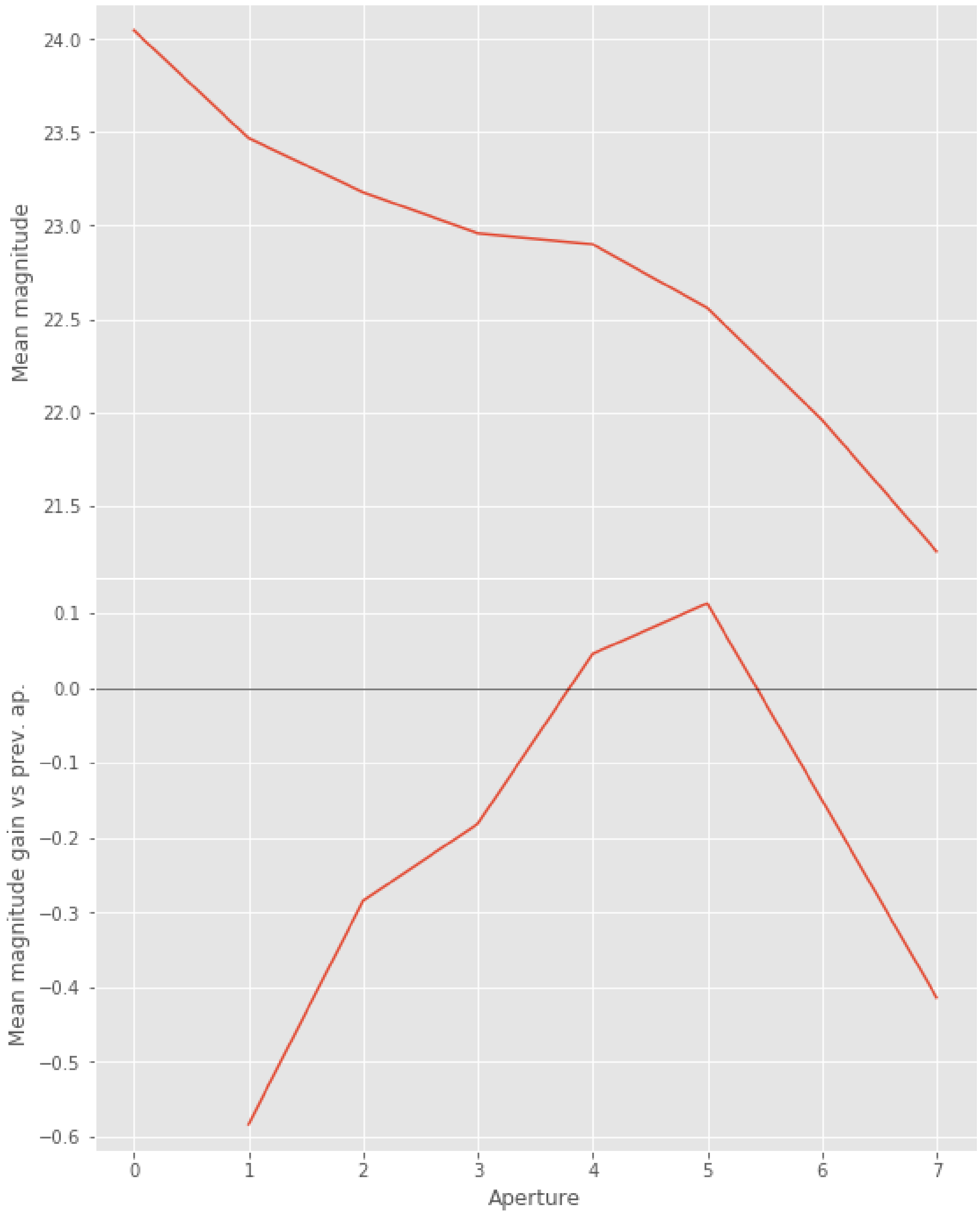
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("Mean of empty slice", RuntimeWarning)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



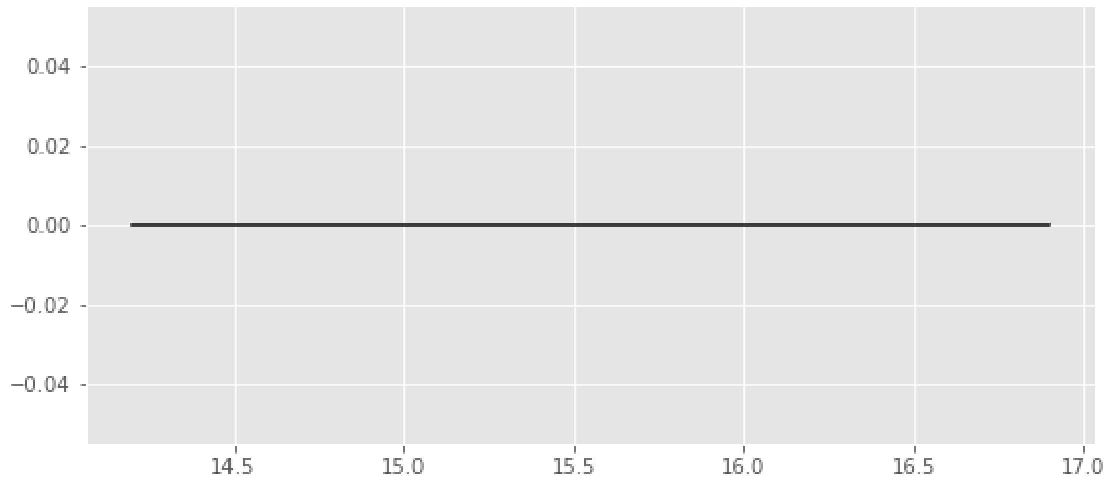

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/lib/nanfunctions.py:
  warnings.warn("All-NaN slice encountered", RuntimeWarning)
```


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



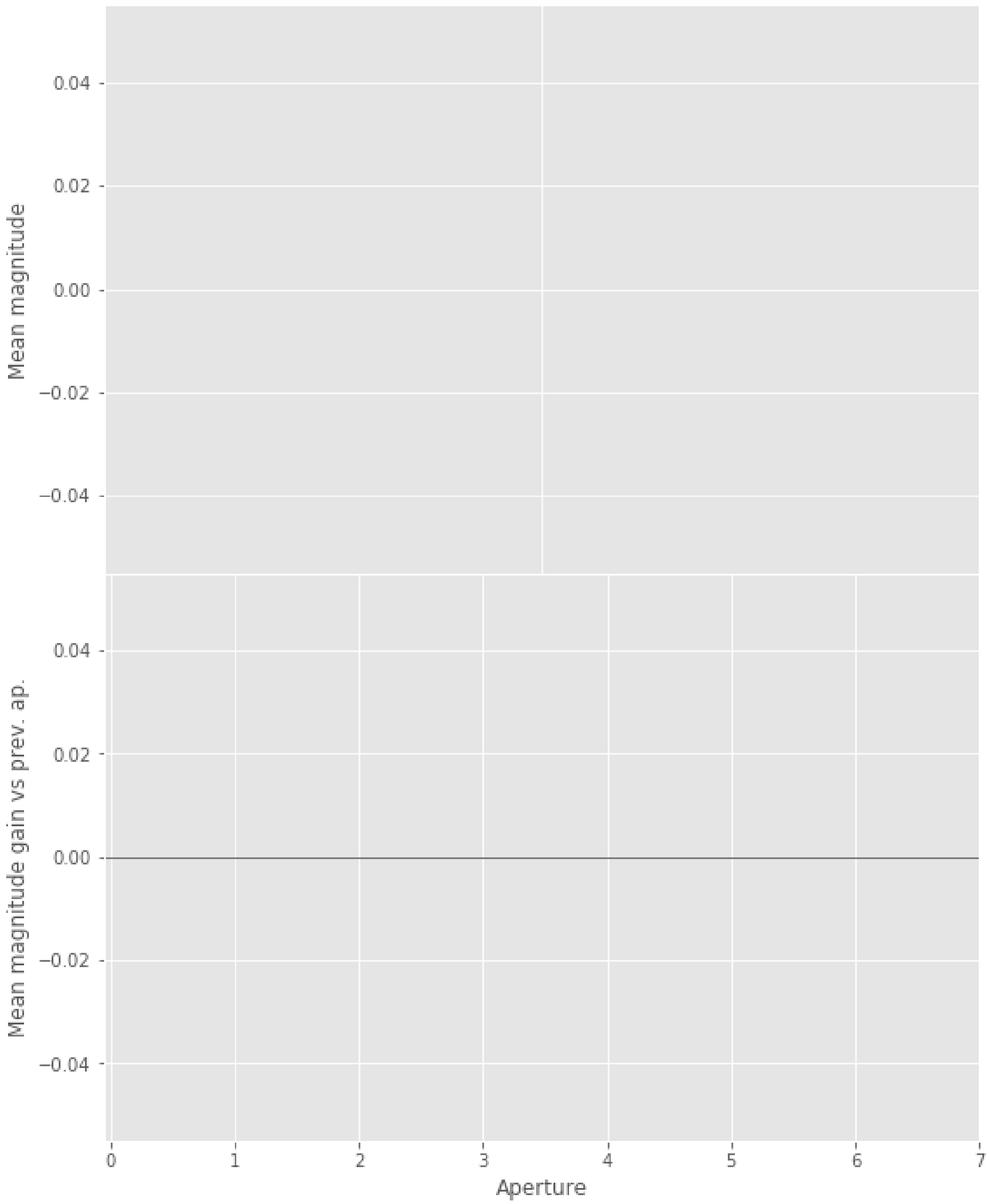
We will use aperture 4 as target.



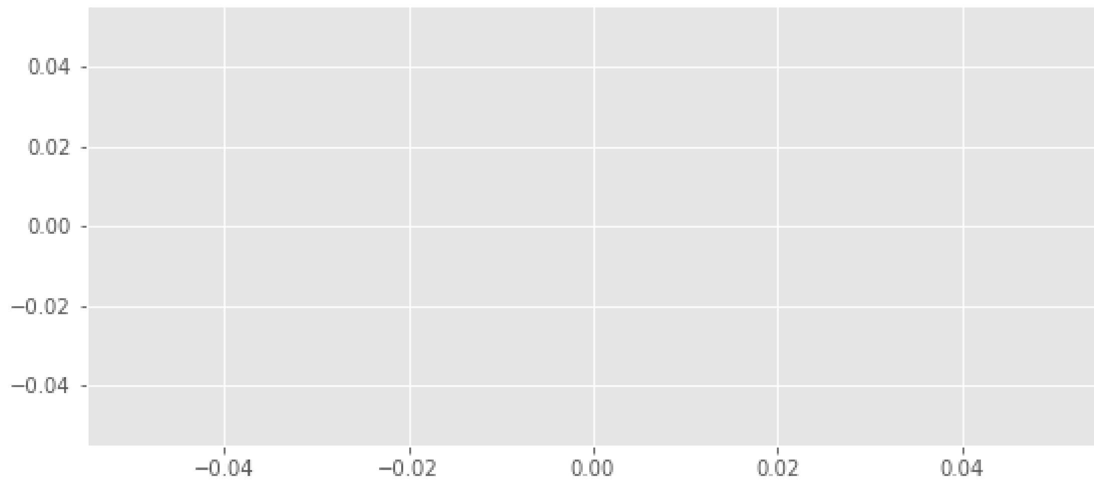
We use magnitudes between 16.0 and 17.5.

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

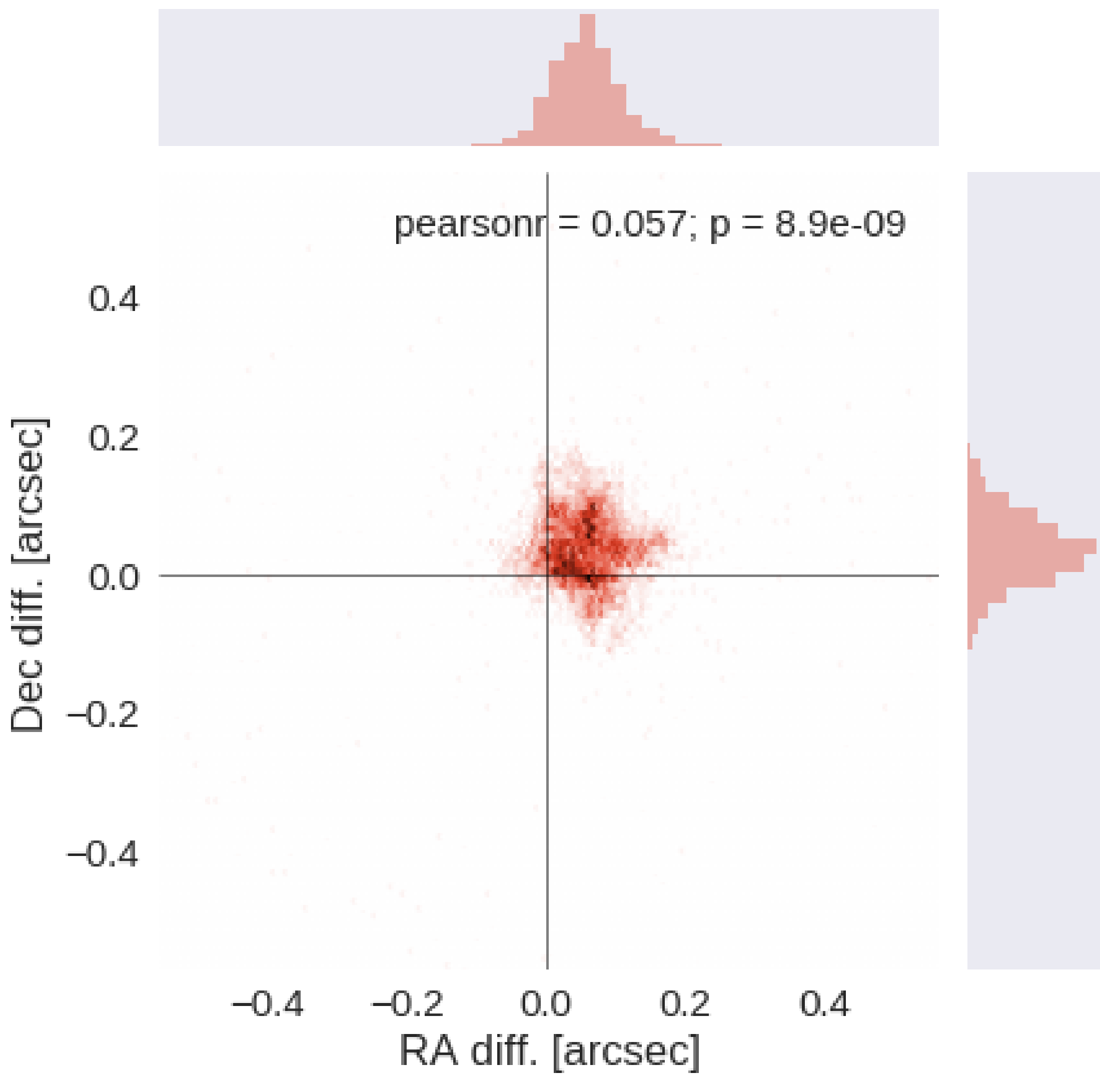
We remove duplicated objects from the input catalogues.

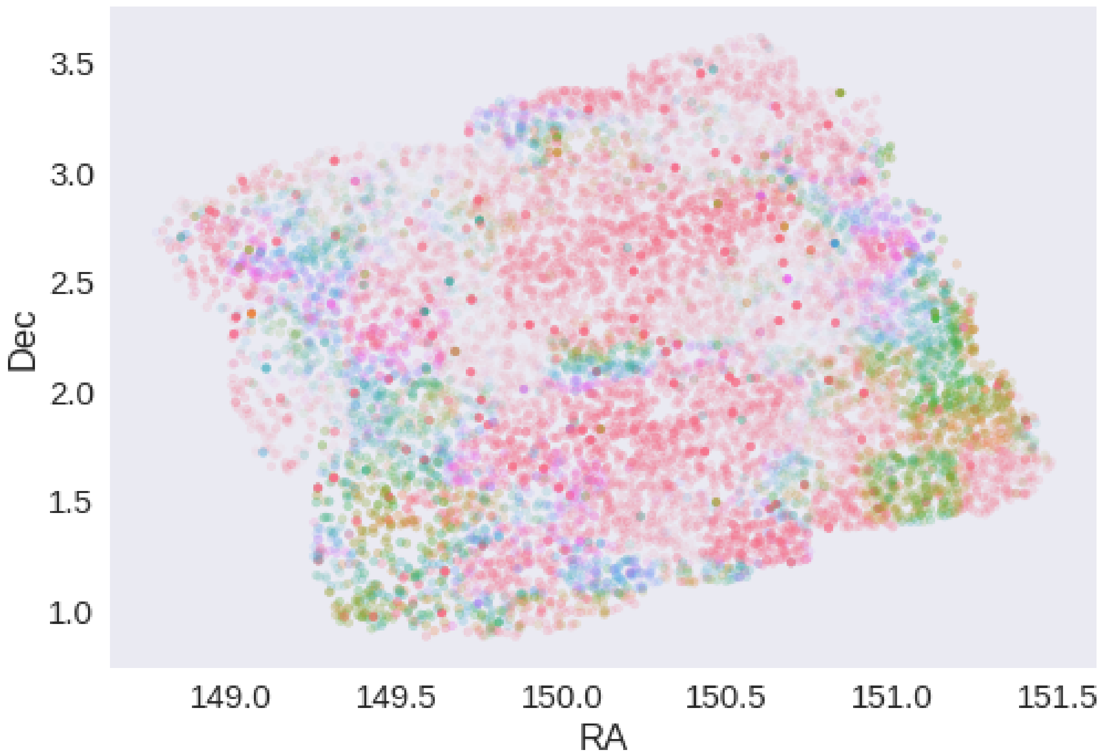
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 376709 sources.
The cleaned catalogue has 376653 sources (56 removed).
The cleaned catalogue has 56 sources flagged as having been cleaned
```

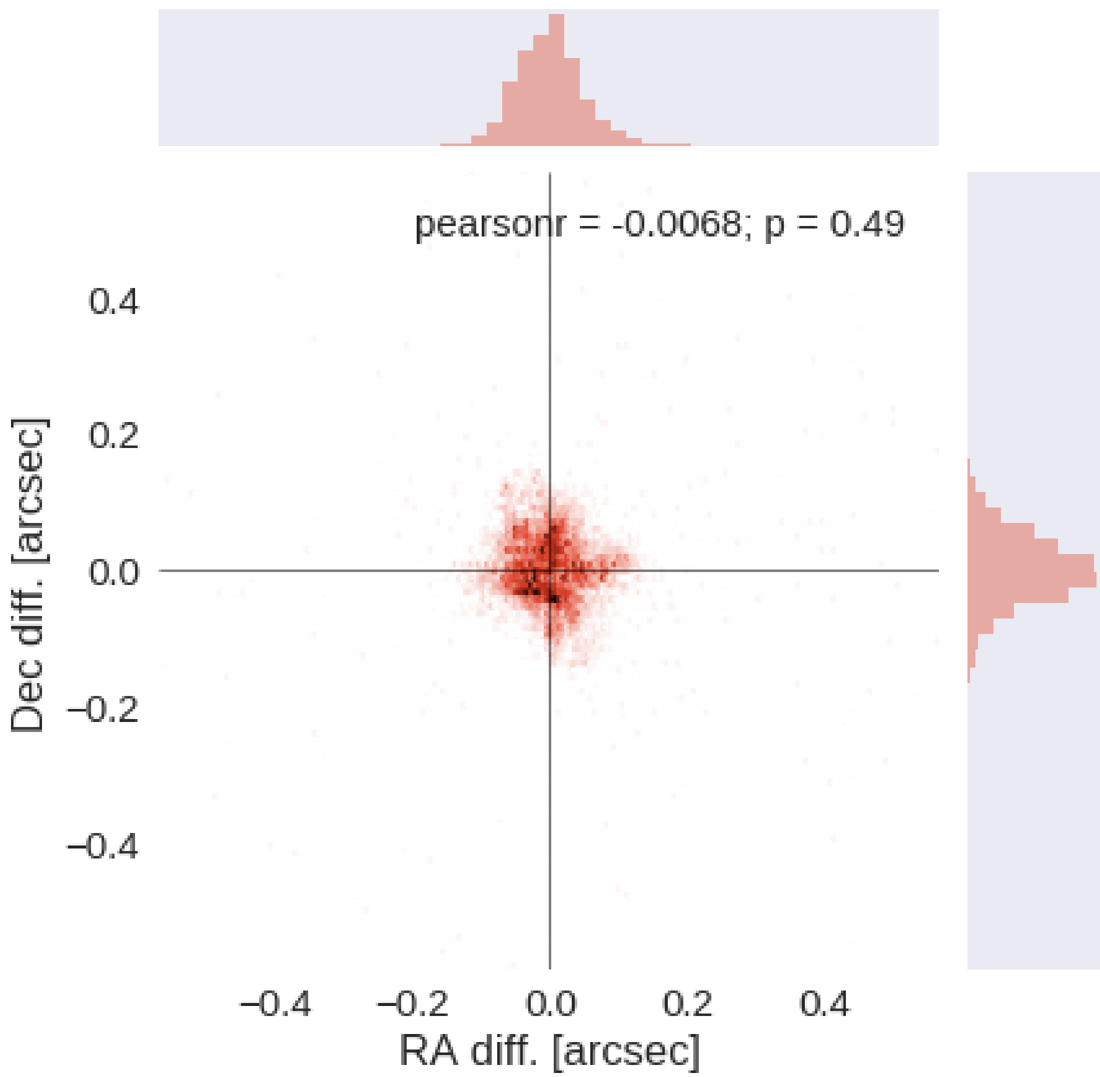
1.6 III - Astrometry correction

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 = 0.057; p = 8.9e-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]




```
RA correction: -0.0579814082698249 arcsec
Dec correction: -0.03379117265440712 arcsec
```



pearsonr = -0.0068; p = 0.49
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

```
10677 sources flagged.
```

2 V - Saving to disk

1.4.1_HSC-DEEP

January 18, 2018

1 COSMOS master catalogue

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

This catalogue comes from `dmu0_HSC`.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y (no N921) aperture magnitude in 2" that we aperture correct;
- The g, r, i, z, y (no N921) kron fluxes and magnitudes.
- The extended flag that we convert to a stellariy.

Note: On ELAIS-N1 the HSC-SSP catalogue does not contain any N816 magnitudes.

We use 2016 as the epoch.

```
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:

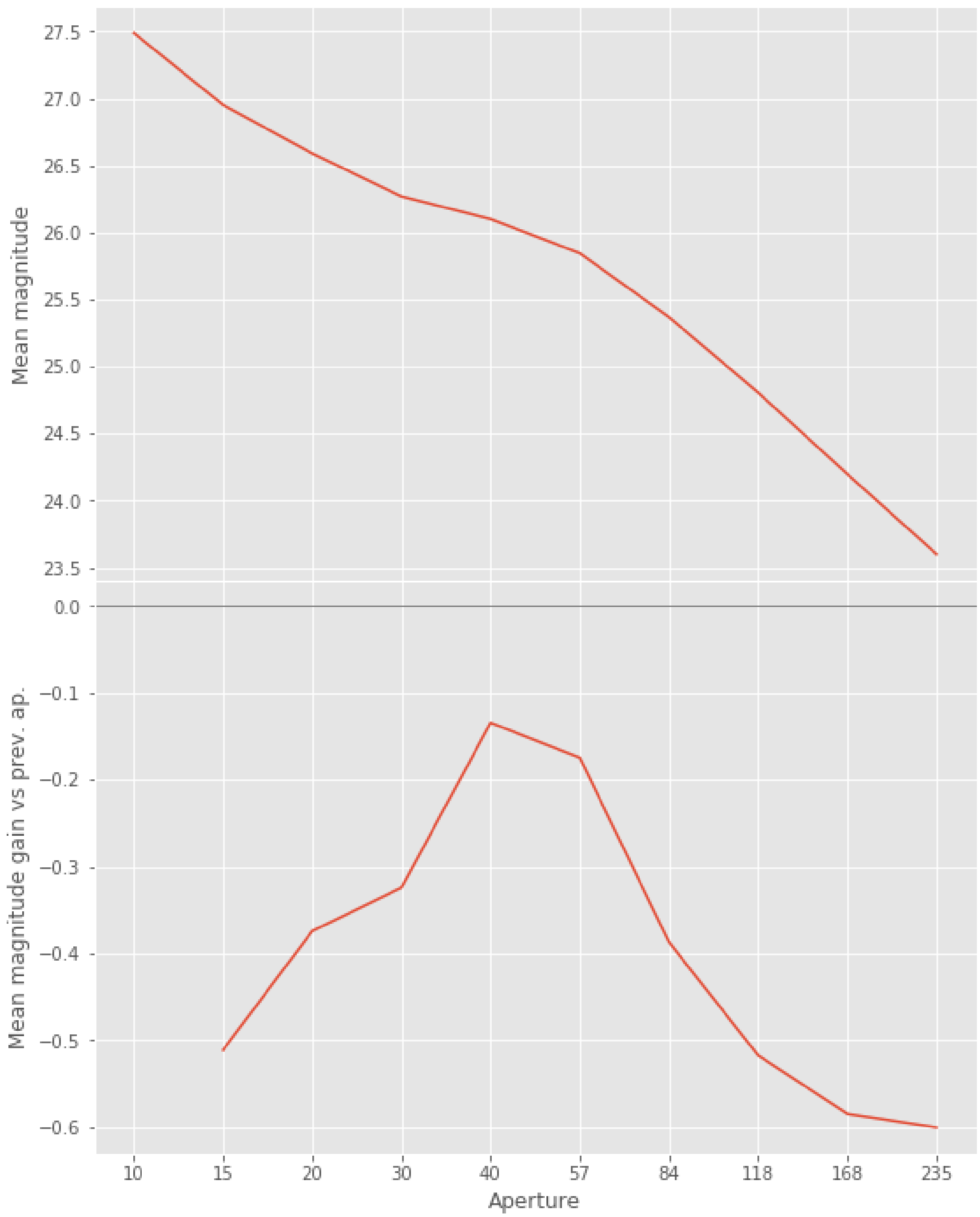
- The evolution of the magnitudes of the objects by plotting on the same plot aperture number vs the mean magnitude.
- The mean gain (loss when negative) of magnitude is each aperture compared to the previous (except for the first of course).

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.

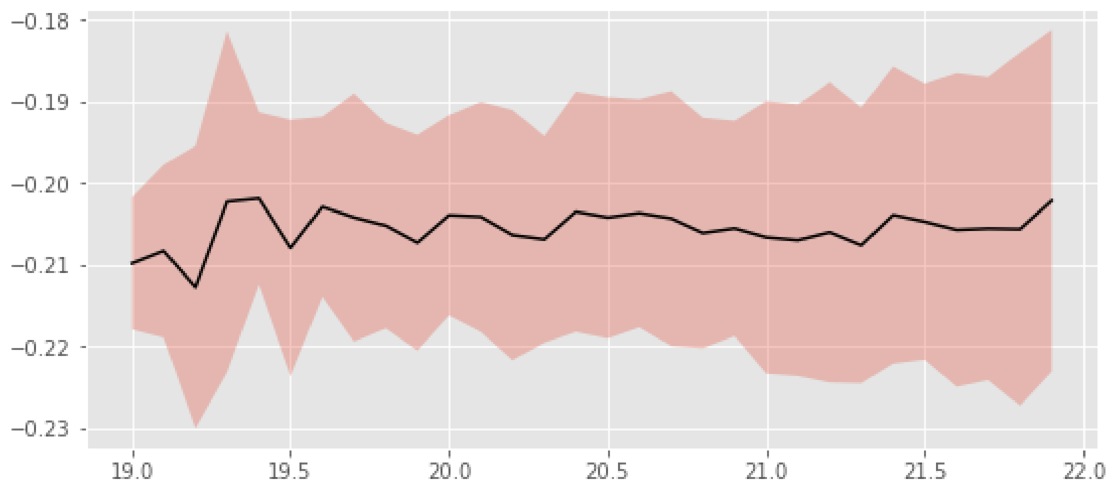
1.2.1 I.a - g band

```
/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)
```



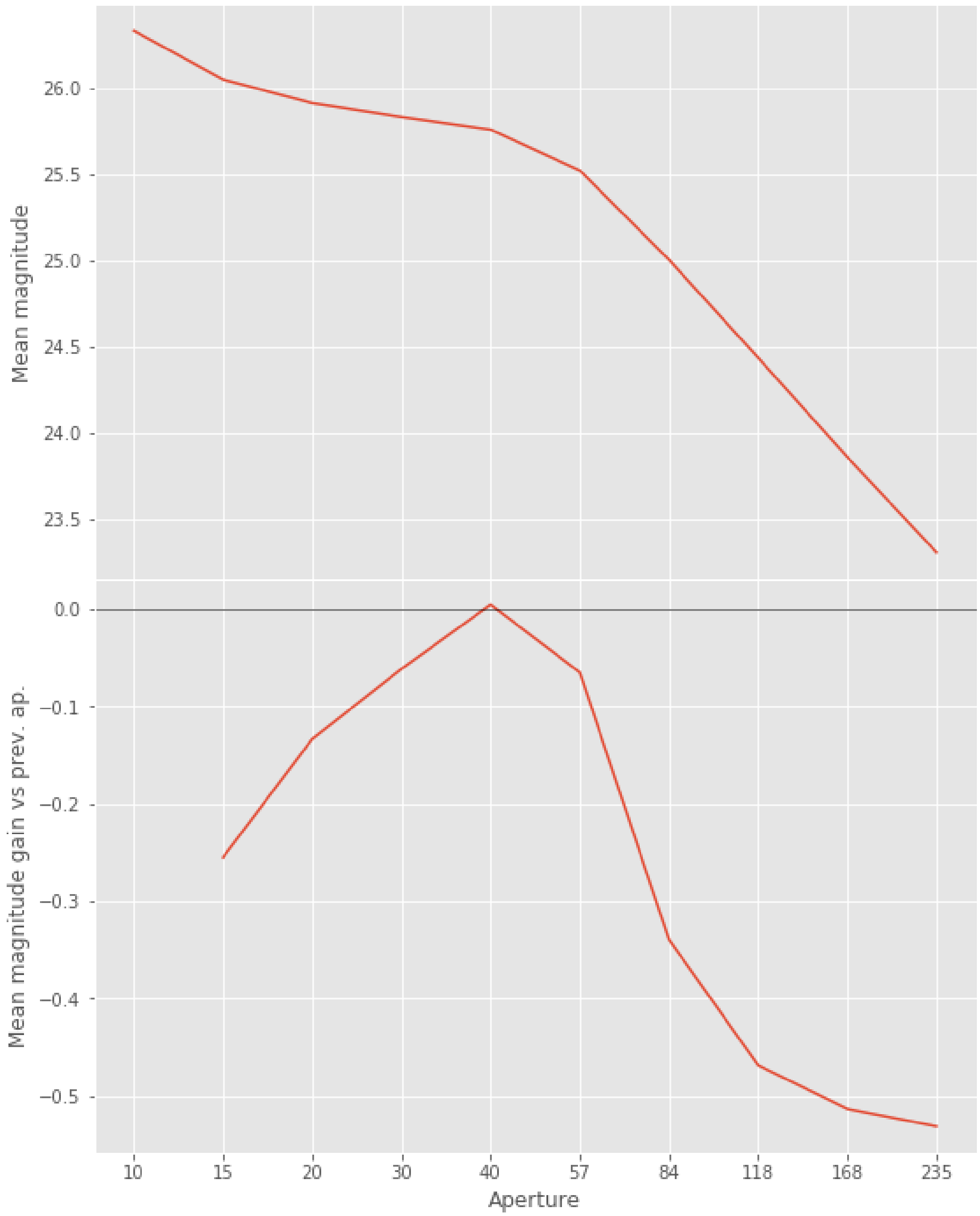
We will use magnitudes between 18.5 and 20.8

```
Aperture correction for g band:
Correction: -0.20549774169921875
Number of source used: 3768
RMS: 0.017911572957685837
```

```
/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

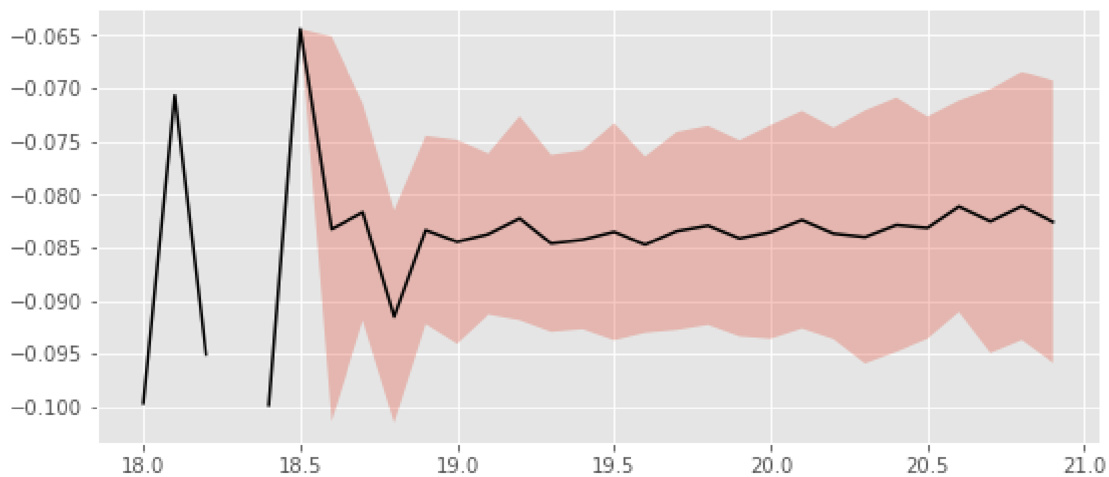
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



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 17.6 and 19.7.

```
Aperture correction for r band:
Correction: -0.08256912231445312
Number of source used: 3891
RMS: 0.011581382492618938
```

```
/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)
```

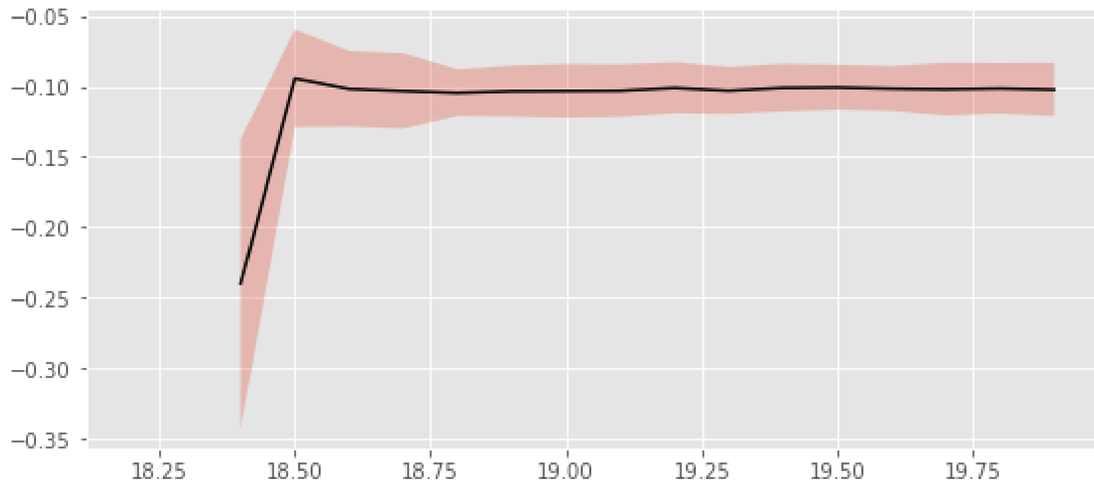
1.2.3 I.c - i band

```
/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: -0.10167789459228516
Number of source used: 3474
RMS: 0.017594865067756222
```

```
/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)
```

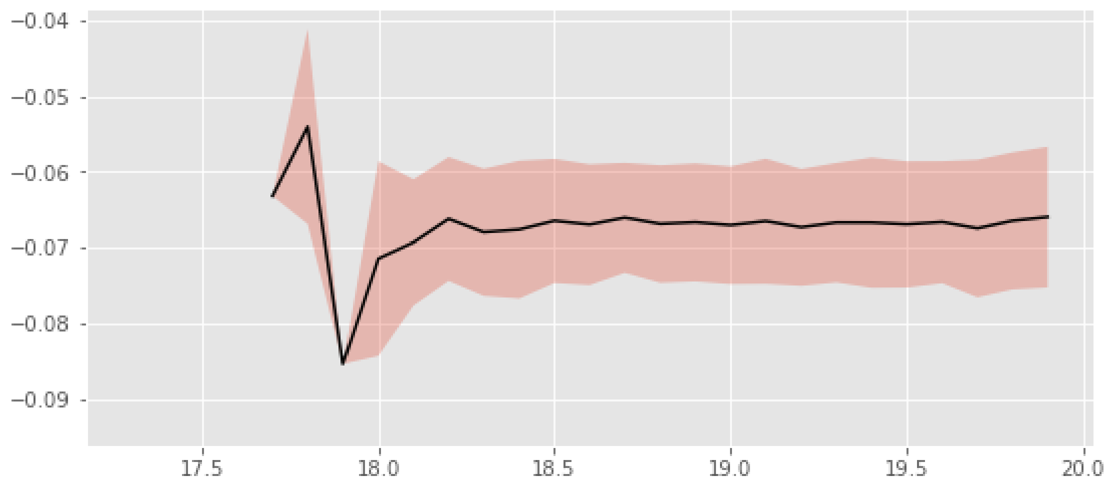
1.2.4 I.d - z band

```
/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)
```



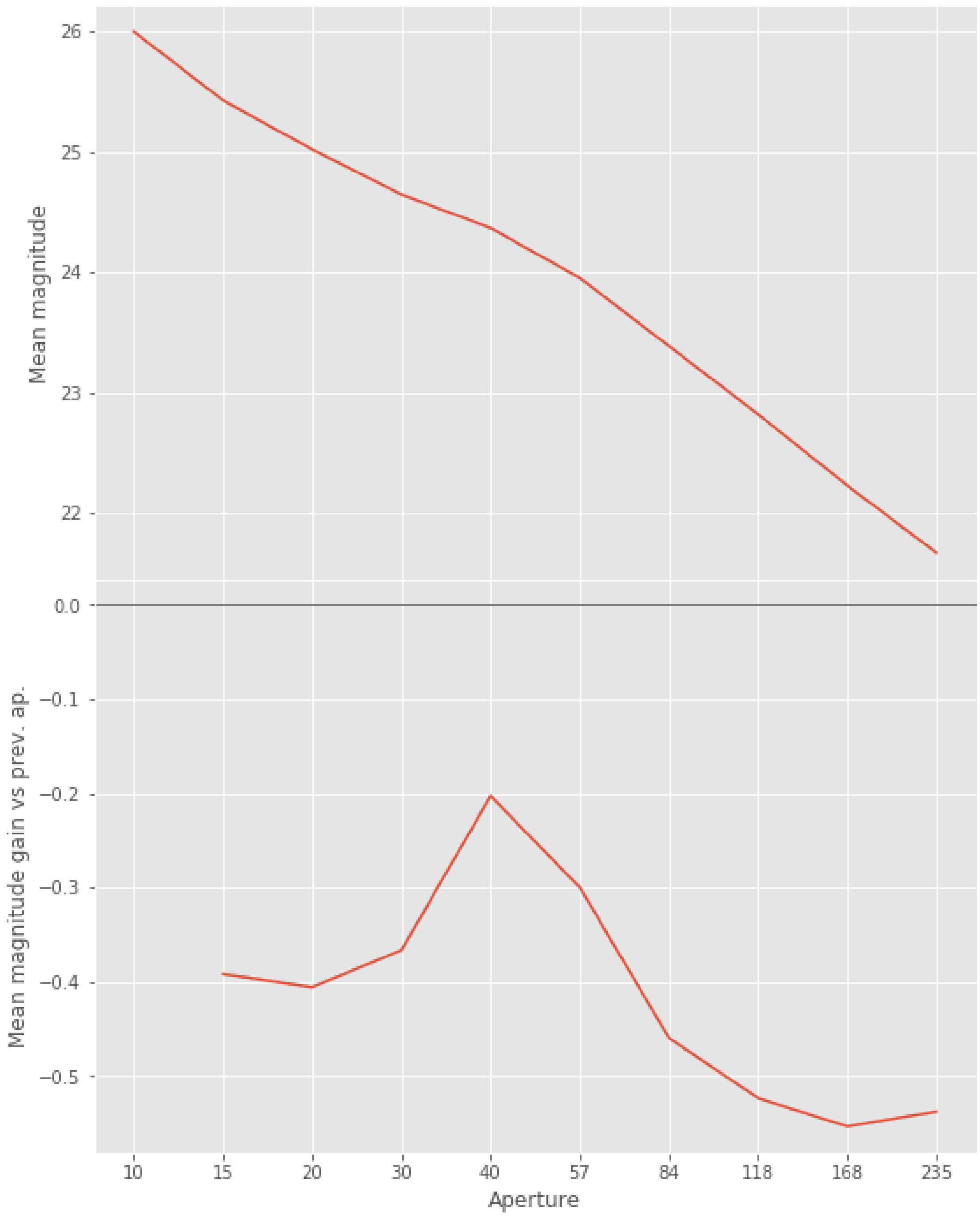
We use magnitudes between 17.5 and 19.8.

```
Aperture correction for z band:
Correction: -0.06690597534179688
Number of source used: 5966
RMS: 0.008133258602144438
```

```
/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

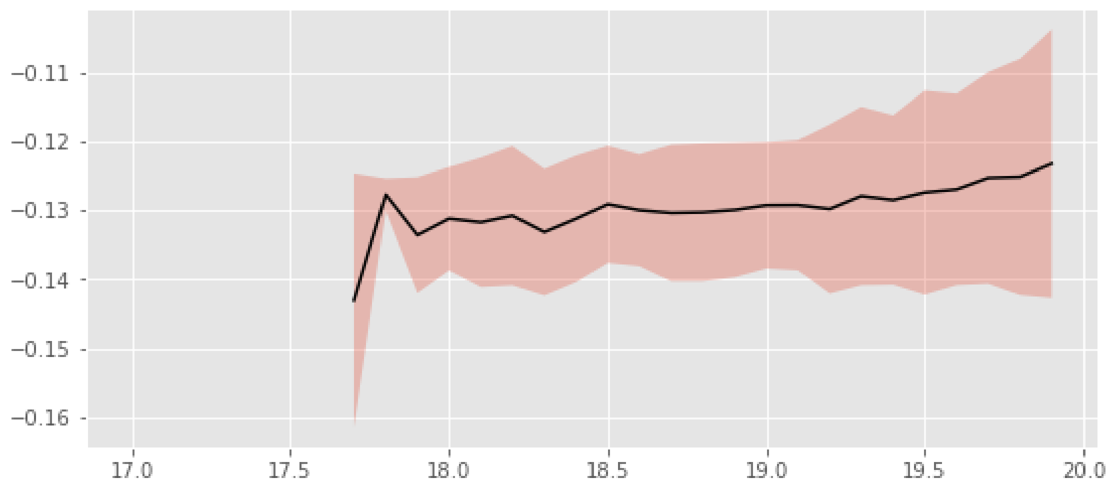
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



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)
```



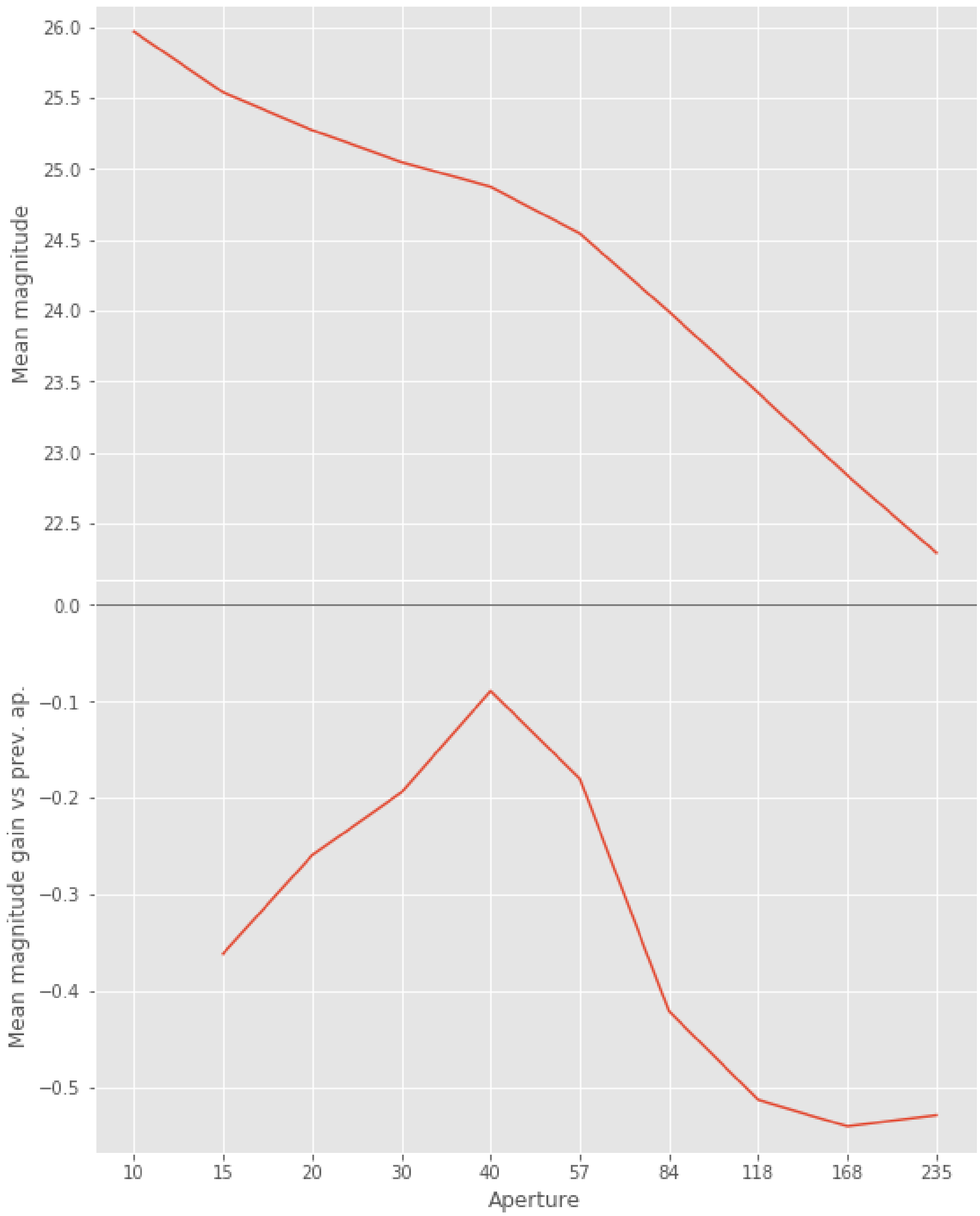
We use magnitudes between 17 and 18.7.

```
Aperture correction for y band:
Correction: -0.13036632537841797
Number of source used: 1008
RMS: 0.008730060428994603
```

```
/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

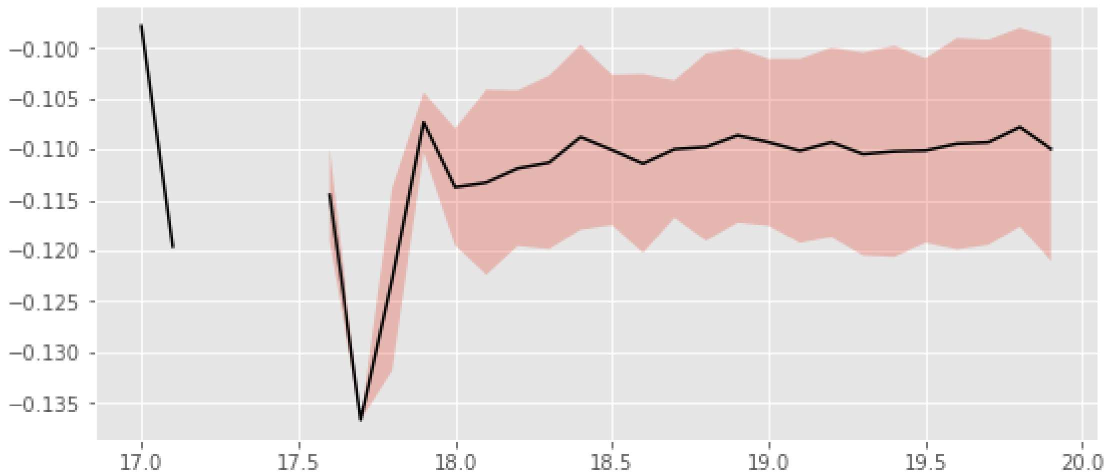
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



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 17 and 18.7.

```
Aperture correction for n921 band:
Correction: -0.11112499237060547
Number of source used: 419
RMS: 0.0083674661823173
```

```
/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)
```

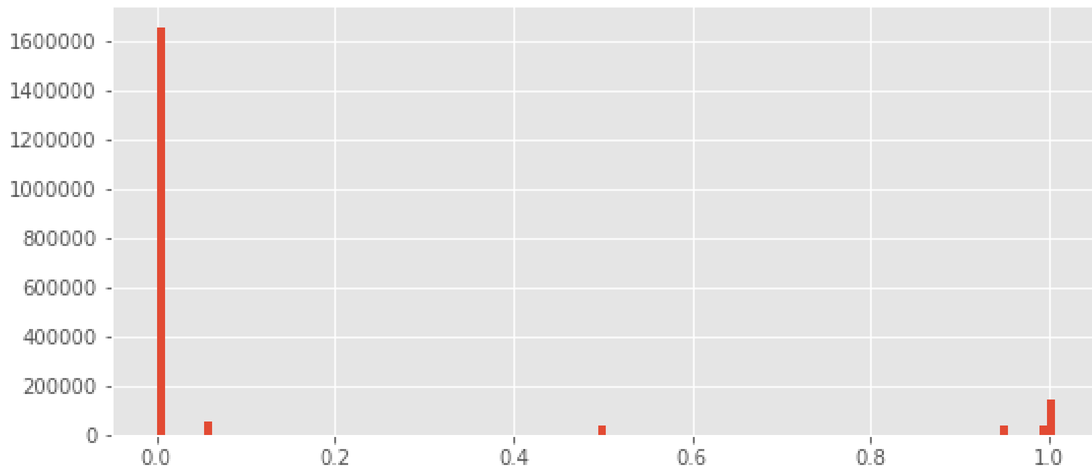
1.3 II - Stellarity

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[32]: <IPython.core.display.HTML object>

1.5 III - Removal of duplicated sources

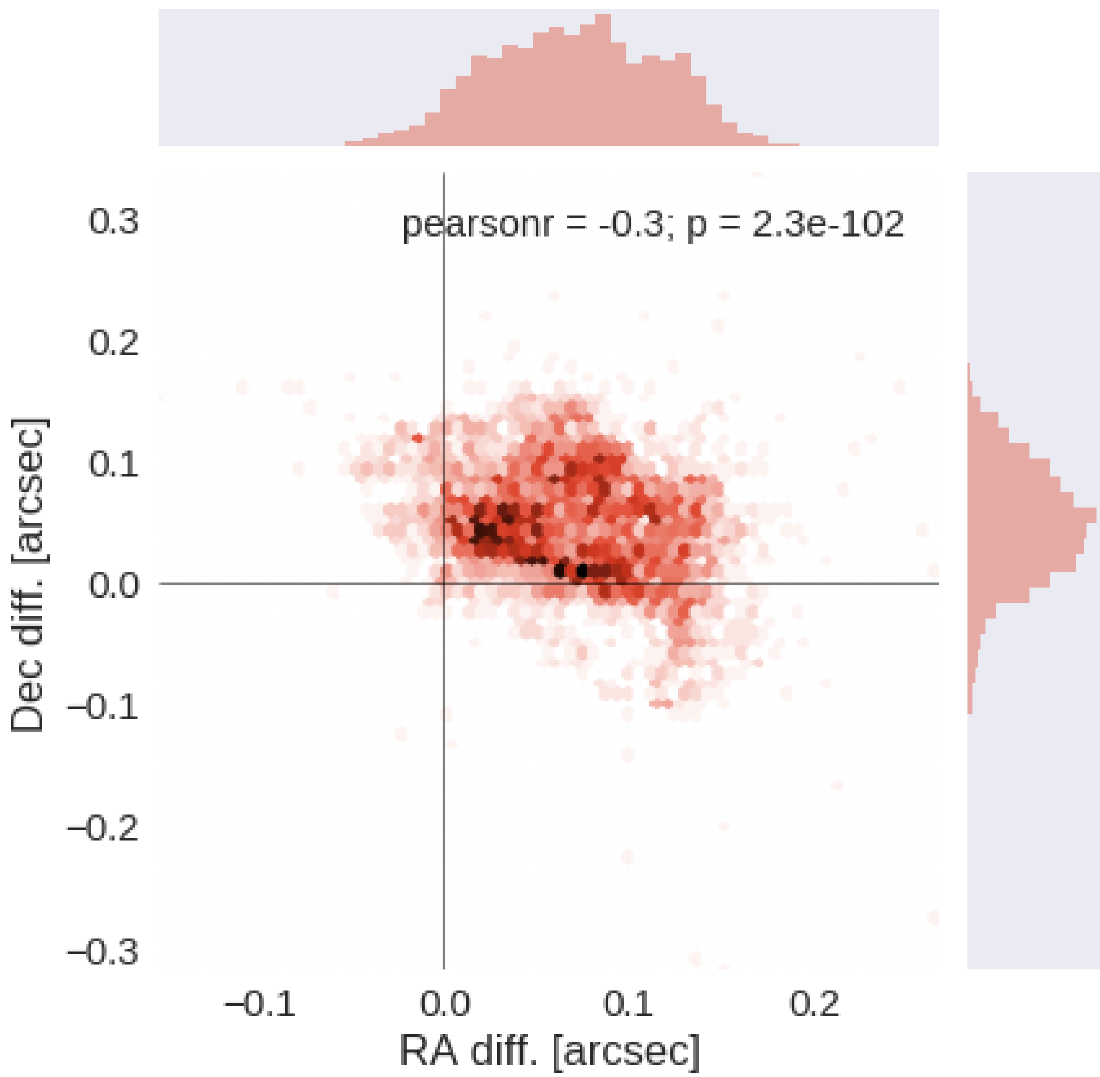
We remove duplicated objects from the input catalogues.

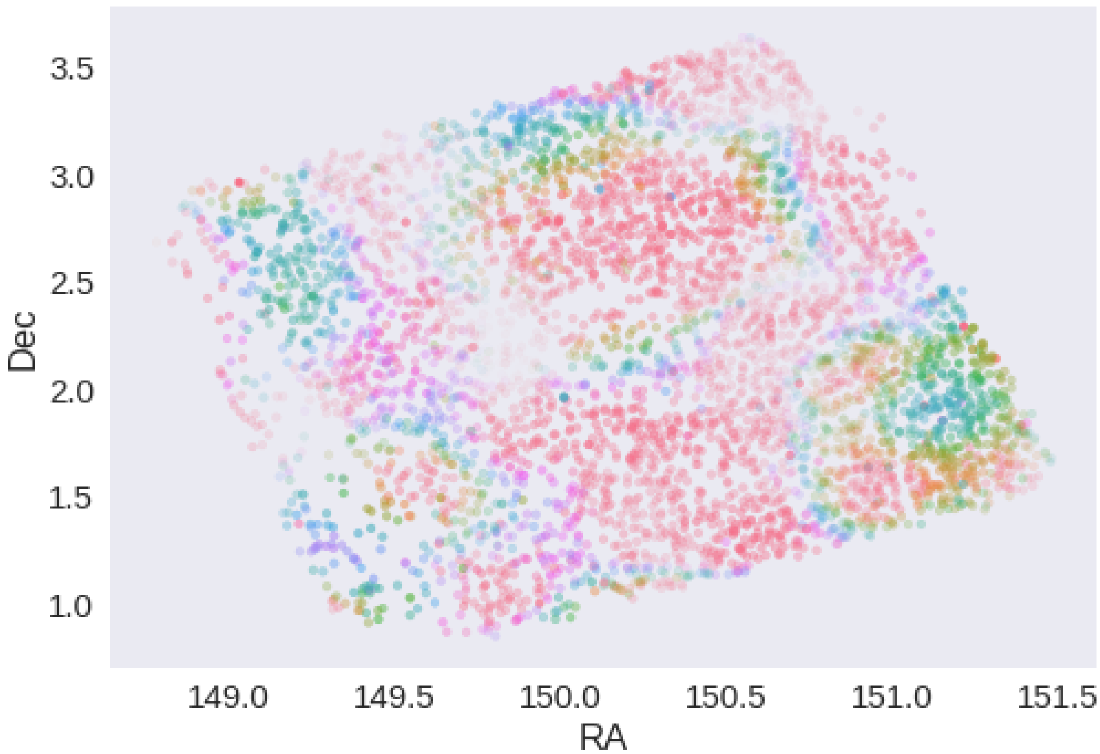
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 1966391 sources.
The cleaned catalogue has 1966275 sources (116 removed).
The cleaned catalogue has 99 sources flagged as having been cleaned
```

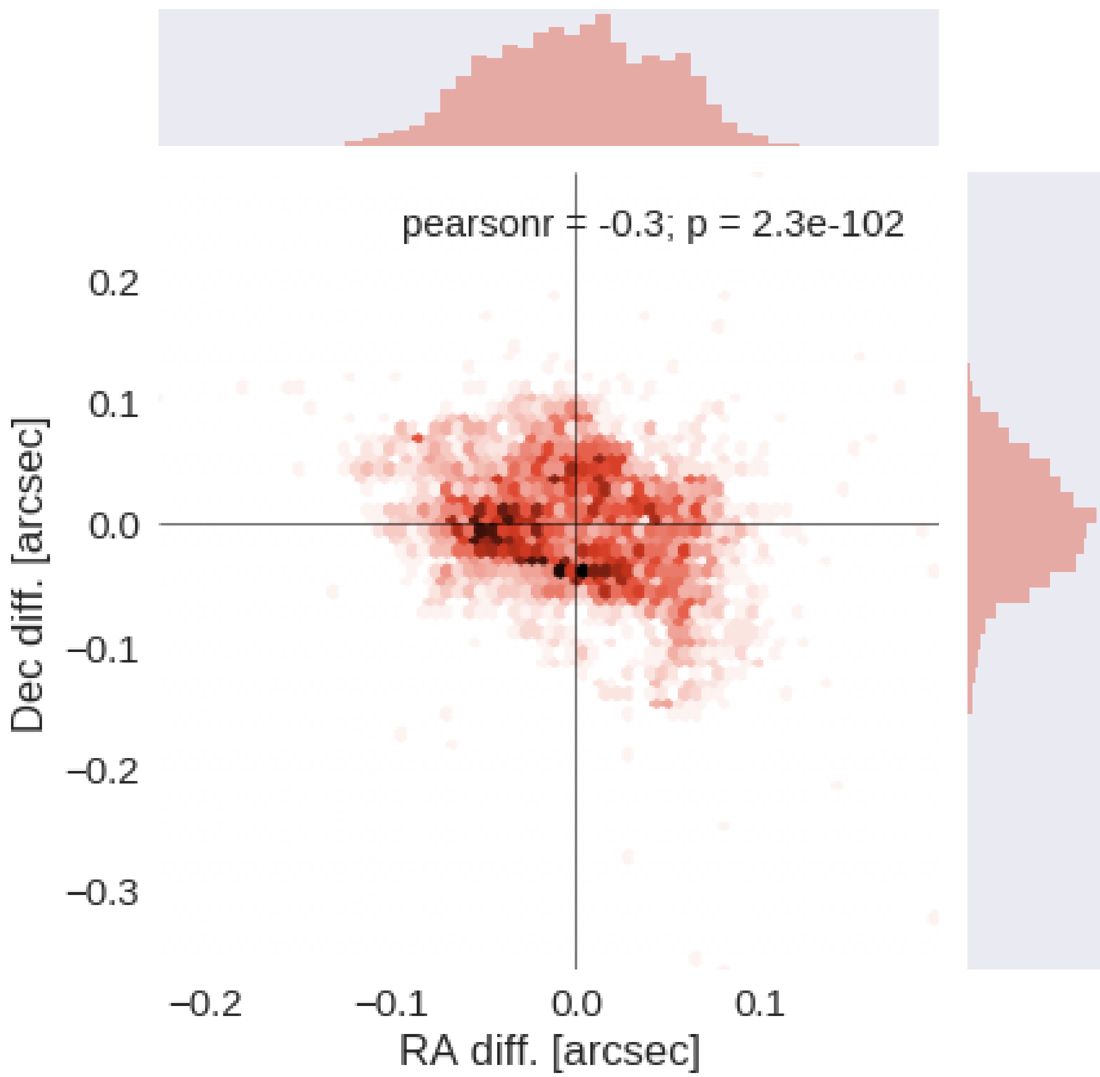
1.6 III - Astrometry correction

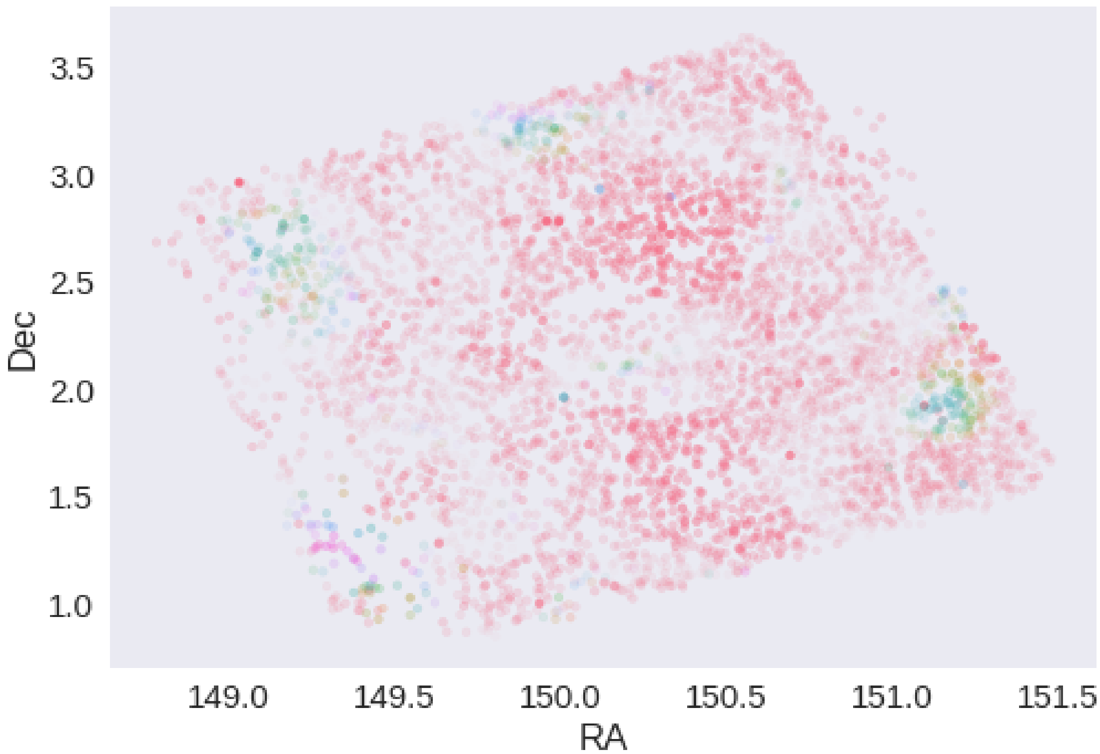
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.3; p = 2.3e-102
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.1
0.0
0.1
0.2
RA diff. [arcsec]




```
RA correction: -0.071356699493208 arcsec
Dec correction: -0.048603063064600605 arcsec
```


pearsonr = -0.3; p = 2.3e-102
0.2
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.2
−0.1
0.0
0.1
RA diff. [arcsec]



1.7 IV - Flagging Gaia objects

```
5103 sources flagged.
```

1.8 V - Flagging objects near bright stars

2 VI - Saving to disk

1.4.2_HSC-UDEEP

January 18, 2018

1 COSMOS master catalogue

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

This catalogue comes from `dmu0_HSC`.

In the catalogue, we keep:

- The `object_id` as unique object identifier;
- The position;
- The g, r, i, z, y (no N921) aperture magnitude in 2" that we aperture correct;
- The g, r, i, z, y (no N921) kron fluxes and magnitudes.
- The extended flag that we convert to a stellariy.

Note: On ELAIS-N1 the HSC-SSP catalogue does not contain any N816 magnitudes.

We use 2016 as the epoch.

```
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.

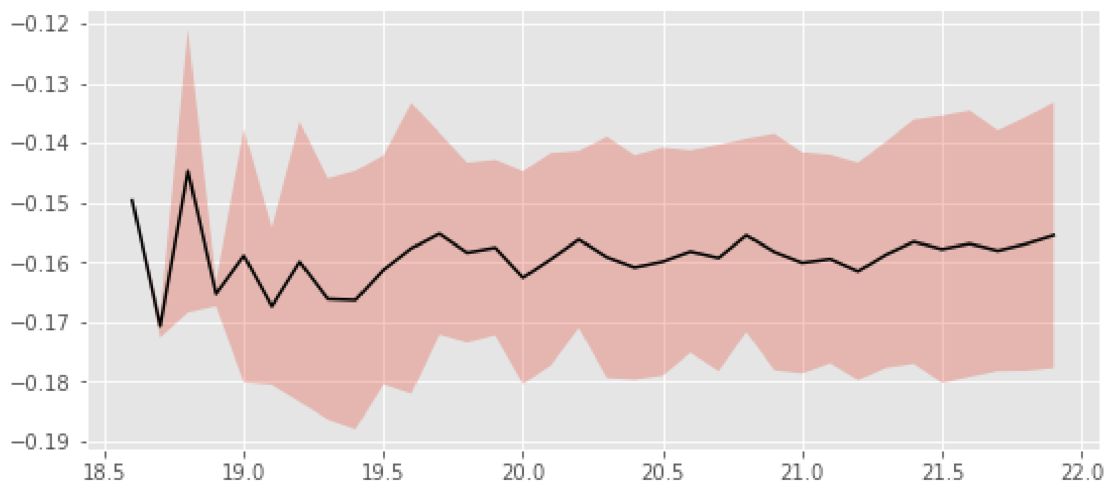
Magnitude range: To know what limits in aperture to use when doing the aperture correction, we plot for each magnitude bin the correction that is computed and its RMS. We should then use the wide limits (to use more stars) where the correction is stable and with few dispersion.

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: -0.15904808044433594
Number of source used: 969
RMS: 0.018600222036784176
```

```
/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)
```

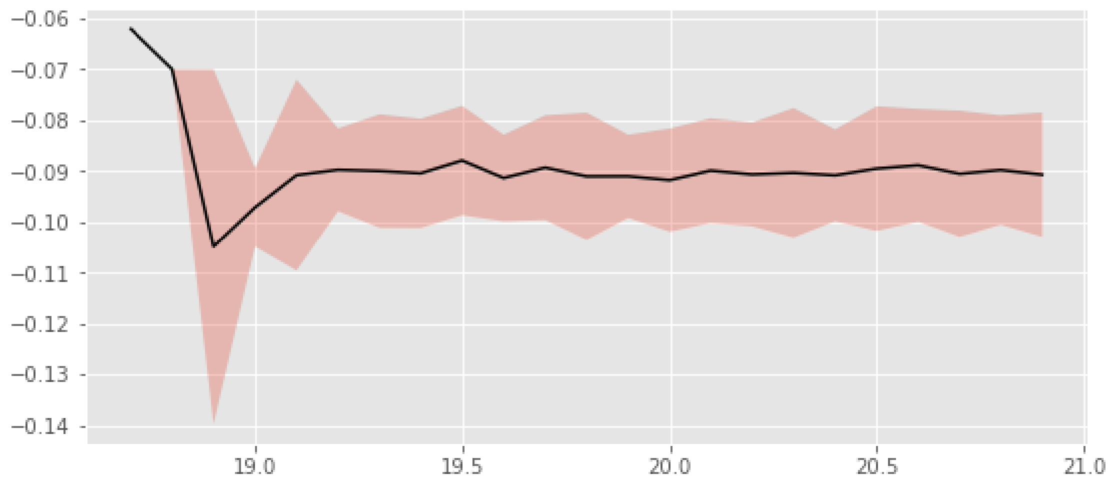
1.2.2 I.b - r band

```
/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 17.6 and 19.7.

```
Aperture correction for r band:
Correction: -0.09056663513183594
Number of source used: 349
RMS: 0.009587196674422224
```

```
/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)
```

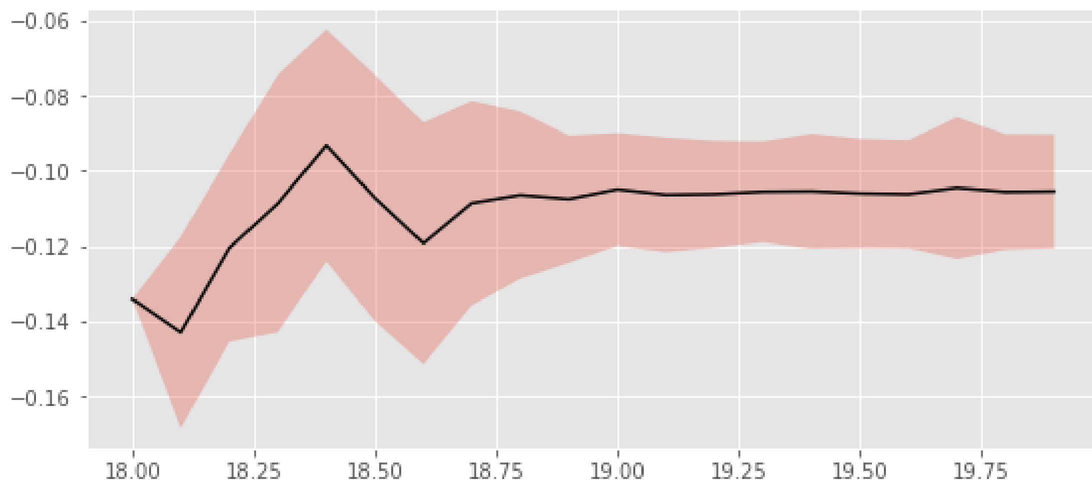
1.2.3 I.c - i band

```
/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: -0.10589122772216797
Number of source used: 2146
RMS: 0.016738303023859657
```

```
/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)
```

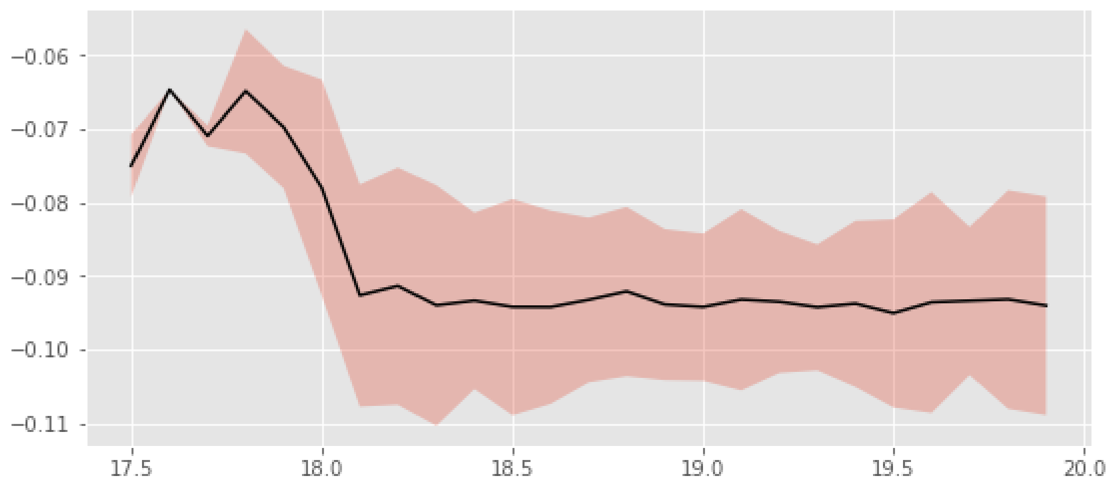
1.2.4 I.d - z band

```
/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)
```



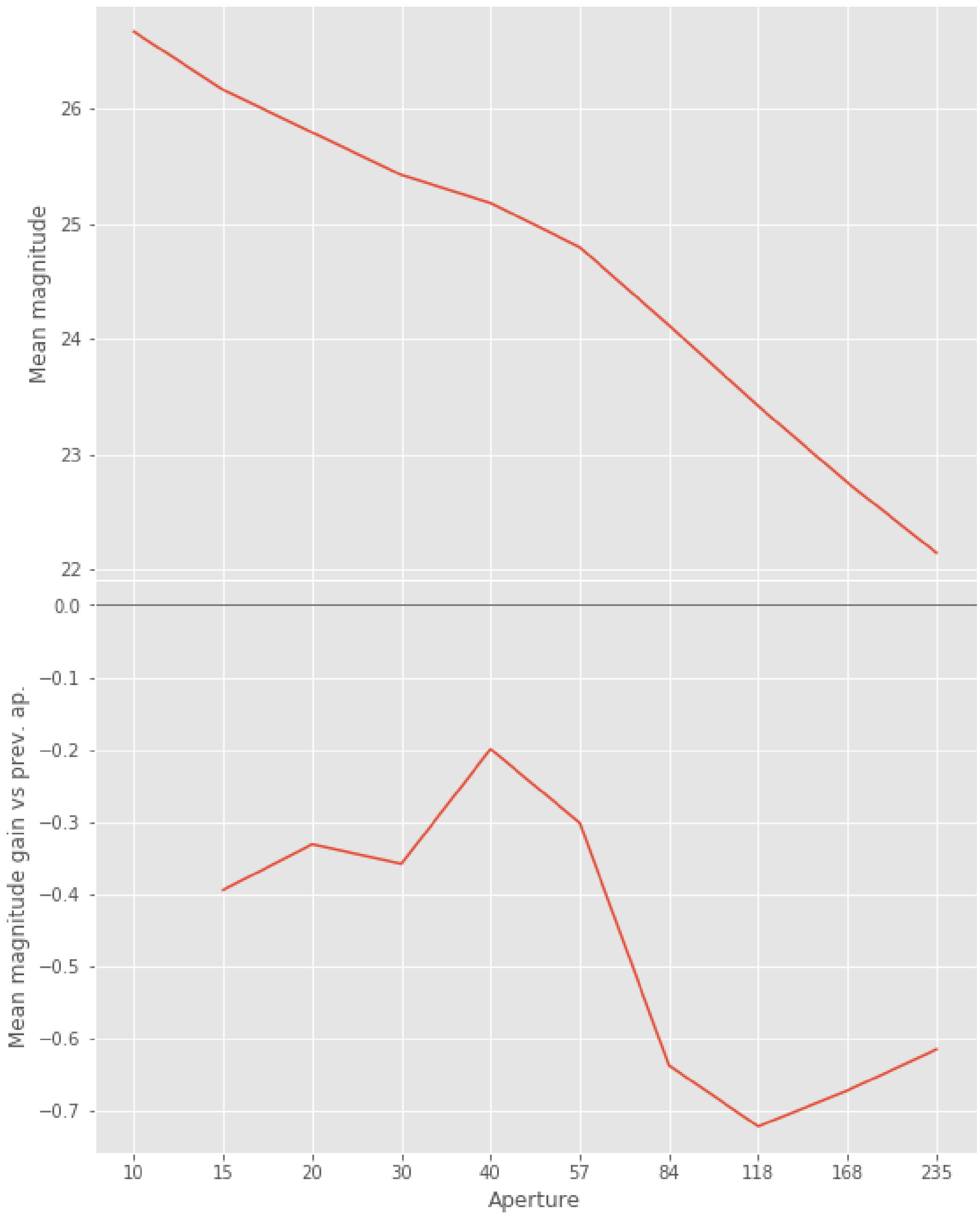
We use magnitudes between 17.5 and 19.8.

```
Aperture correction for z band:
Correction: -0.09363174438476562
Number of source used: 3208
RMS: 0.011914830630386885
```

```
/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

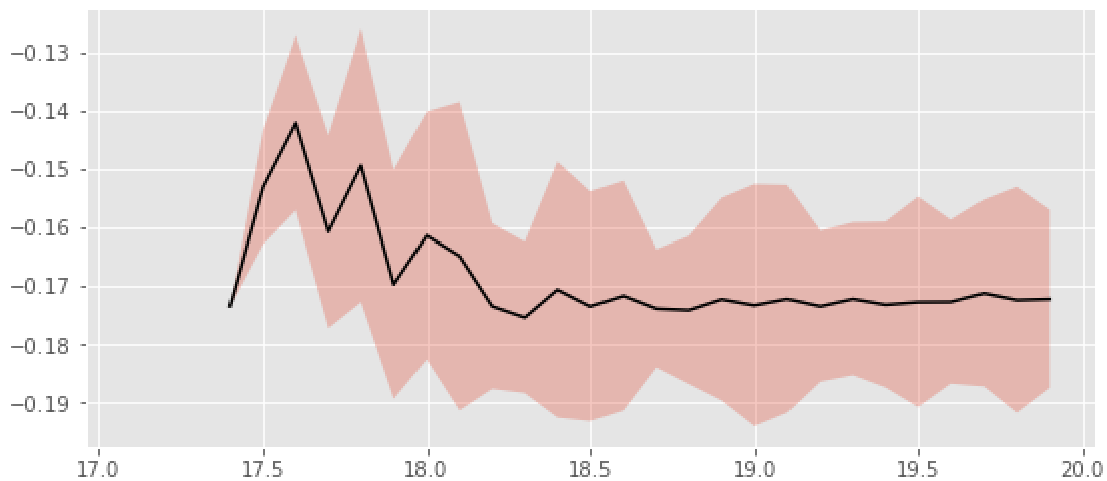
```
/opt/herschelhelp_internal/herschelhelp_internal/masterlist.py:850: RuntimeWarning: invalid valu
  mags = magnitudes[:, stellarity > stel_threshold].copy()
```



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 and 18.7.

```
Aperture correction for y band:
Correction: -0.17114639282226562
Number of source used: 764
RMS: 0.020499810124057233
```

```
/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)
```

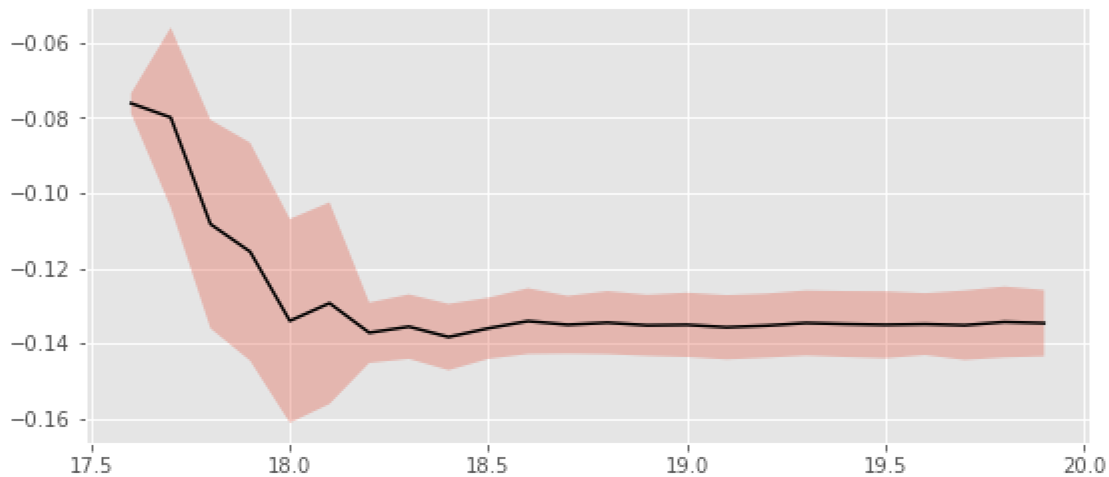
1.2.6 I.f - n921 band

```
/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 17 and 18.7.

```
Aperture correction for n921 band:
Correction: -0.1354379653930664
Number of source used: 533
RMS: 0.008487969070401766
```

```
/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)
```

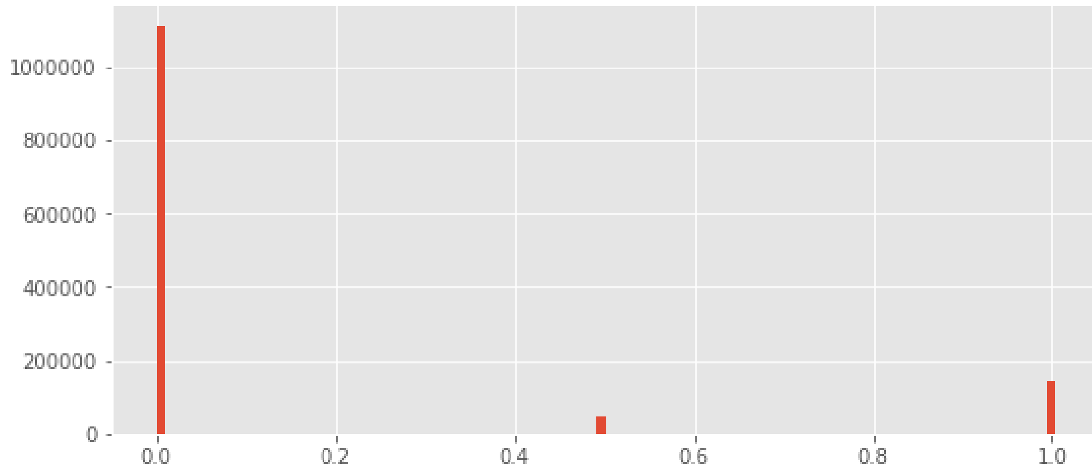
1.3 II - Stellarity

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

1.5 III - Removal of duplicated sources

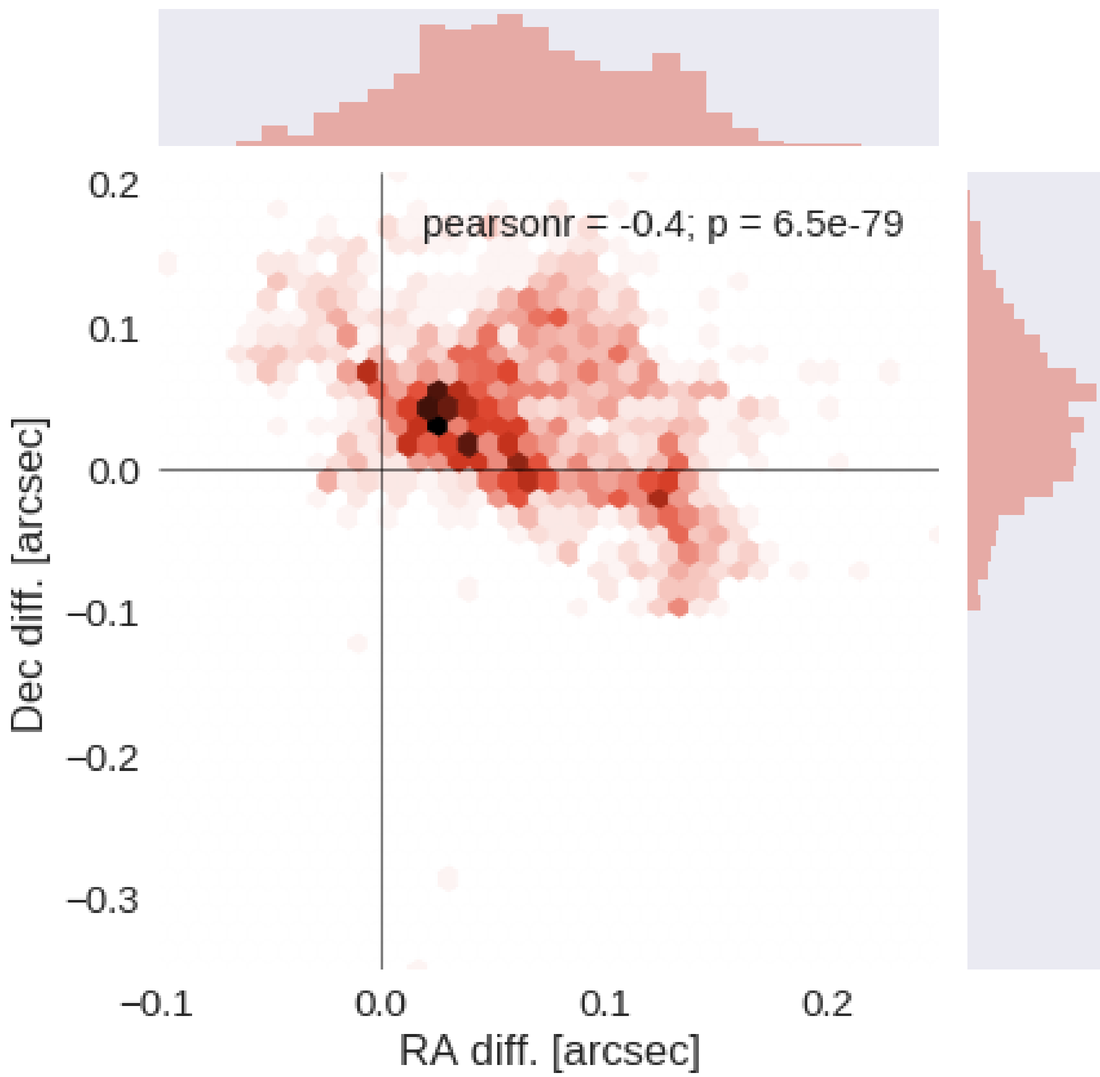
We remove duplicated objects from the input catalogues.

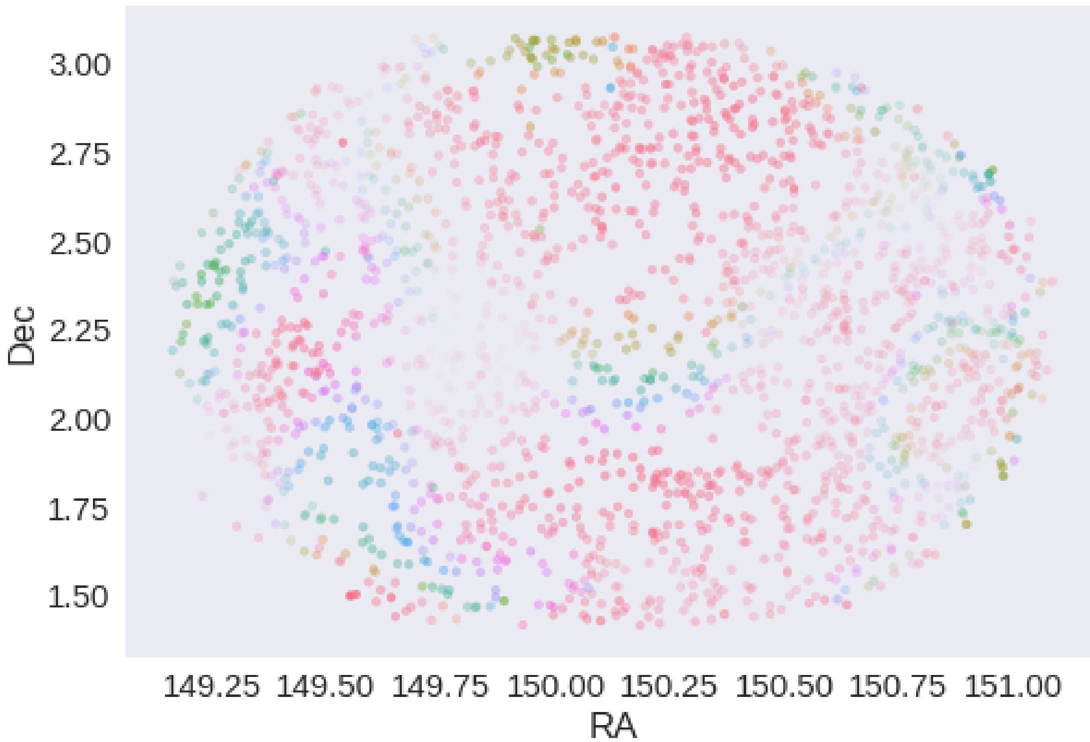
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 1307594 sources.
The cleaned catalogue has 1307525 sources (69 removed).
The cleaned catalogue has 67 sources flagged as having been cleaned
```

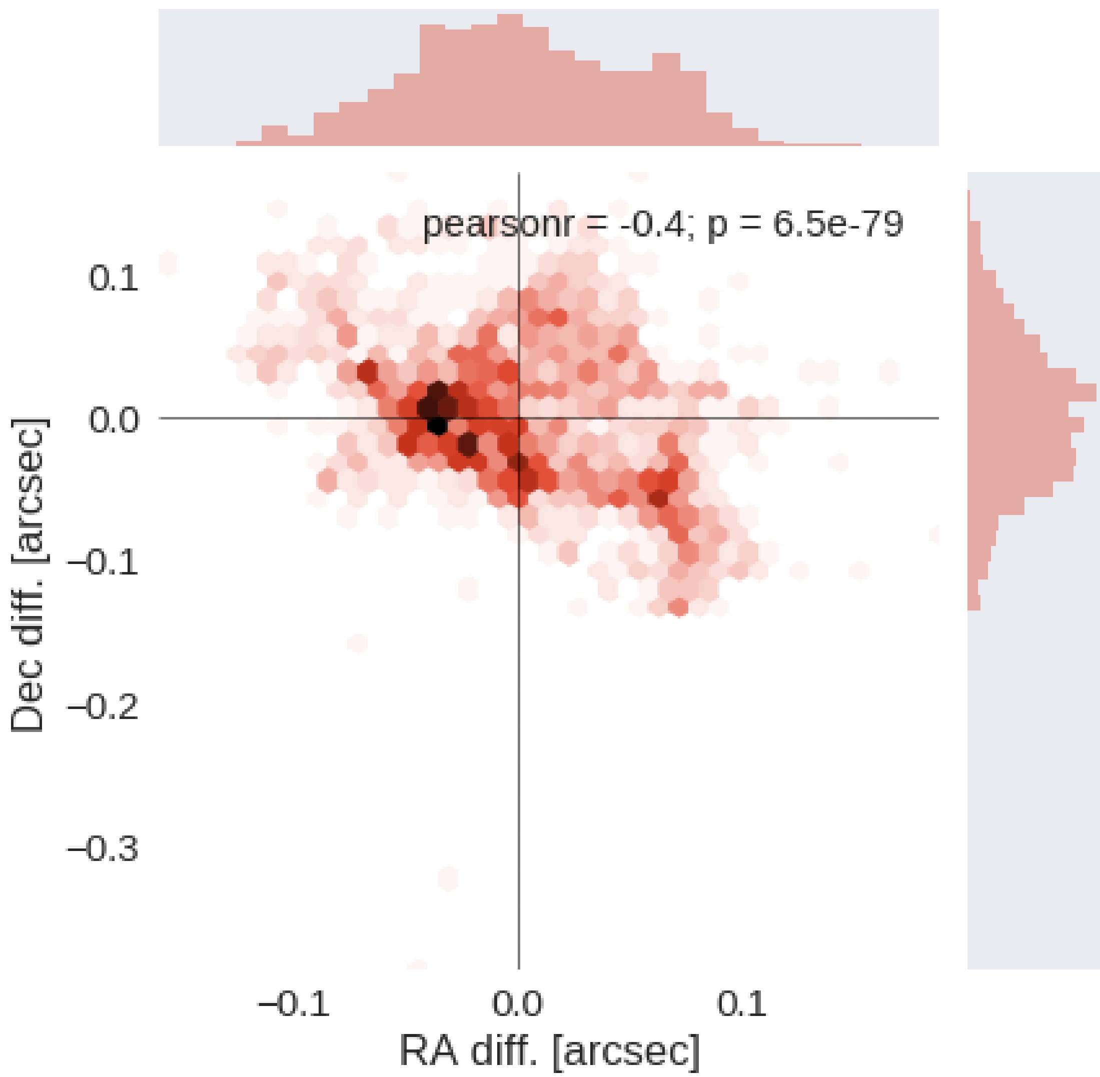
1.6 III - Astrometry correction

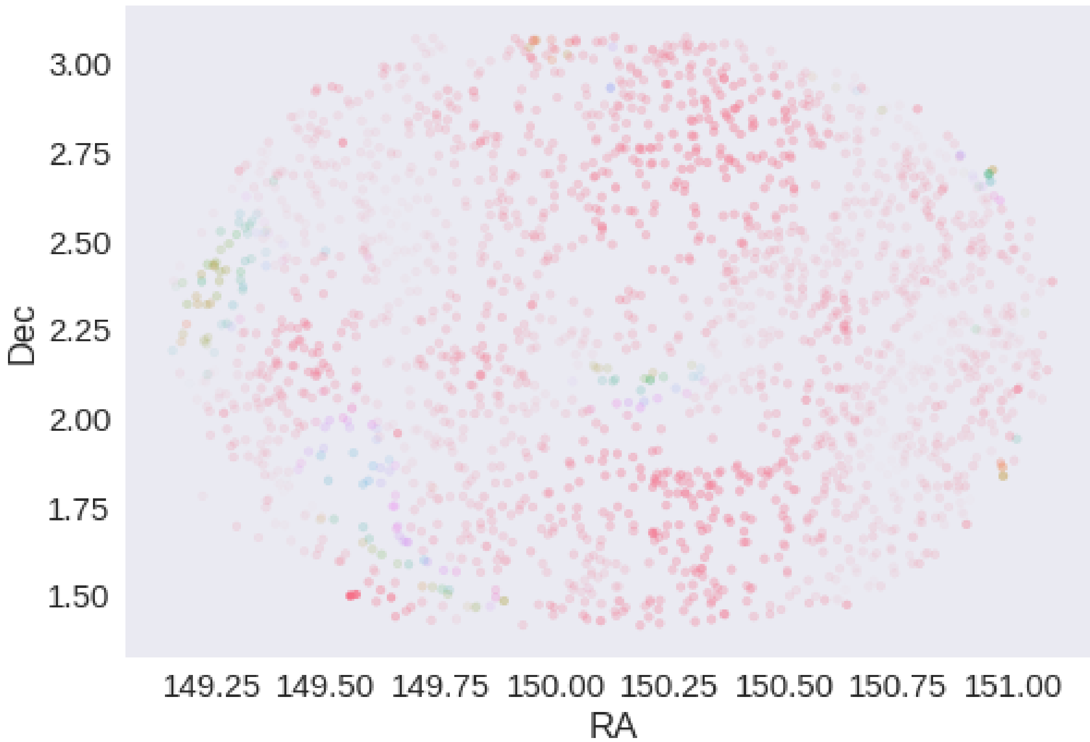
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.4; p = 6.5e-79
0.2
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.1
0.0
0.1
0.2
RA diff. [arcsec]




```
RA correction: -0.061218833292286945 arcsec
Dec correction: -0.03624856686692546 arcsec
```


pearsonr = -0.4; p = 6.5e-79
0.1
0.0
−0.1
−0.2
−0.3
Dec diff. [arcsec]
−0.1
0.0
0.1
RA diff. [arcsec]



1.7 IV - Flagging Gaia objects

```
2142 sources flagged.
```

1.8 V - Flagging objects near bright stars

2 VI - Saving to disk

1.5_KIDS

January 18, 2018

1 COSMOS master catalogue

1.1 Preparation of KIDS/VST data

Kilo Degree Survey/VLT Survey Telescope catalogue: the catalogue comes from `dmu0_KIDS`.

In the catalogue, we keep:

- The identifier (it's unique in the catalogue);
- The position;
- The stellarity;
- The aperture corrected aperture magnitude in each band (10 pixels = 2")
- The Petrosian magnitude to be used as total magnitude (no "auto" magnitude is provided).

We take 2014 as the observation year from a typical image header.

```
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

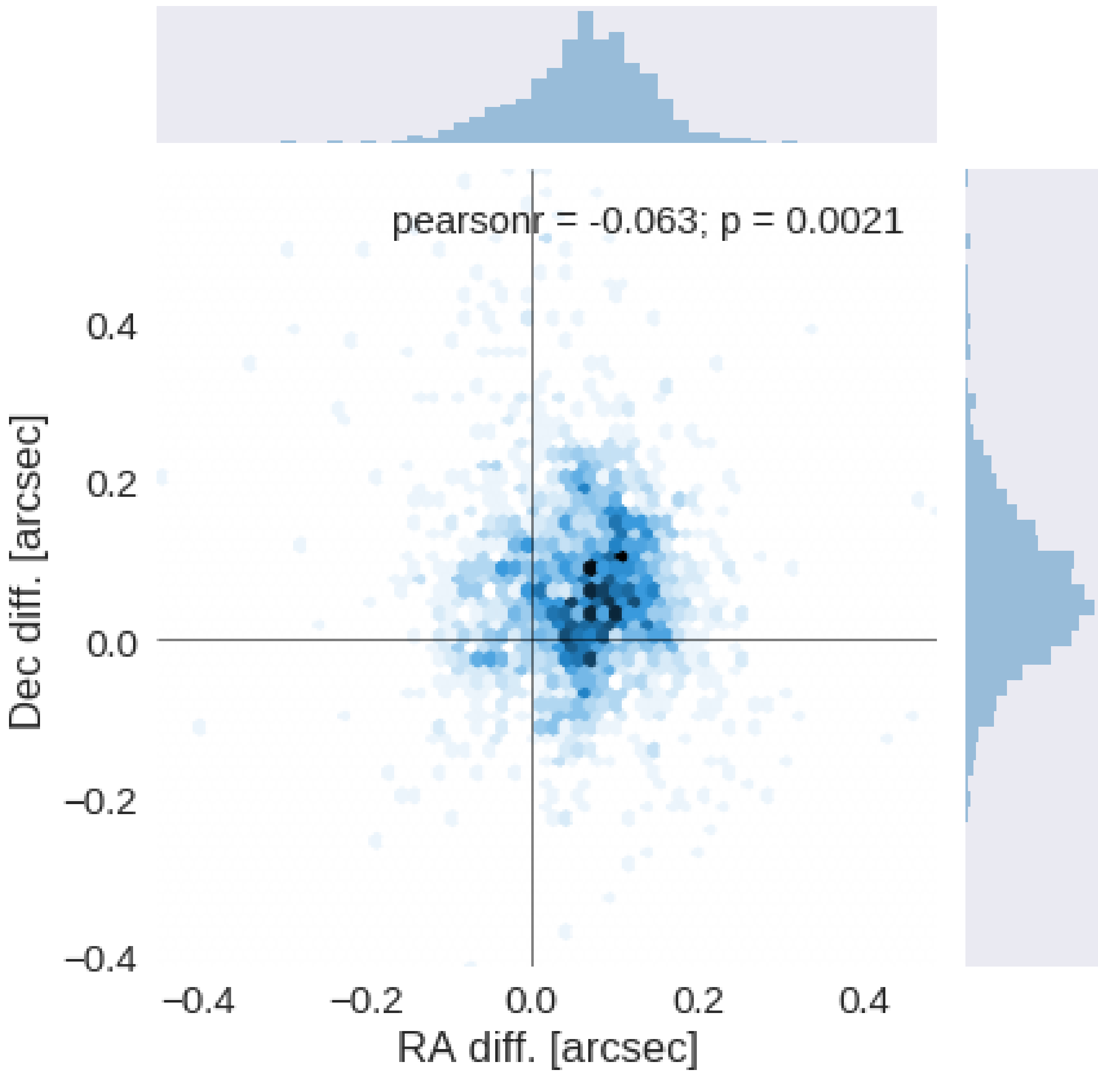
We remove duplicated objects from the input catalogues.

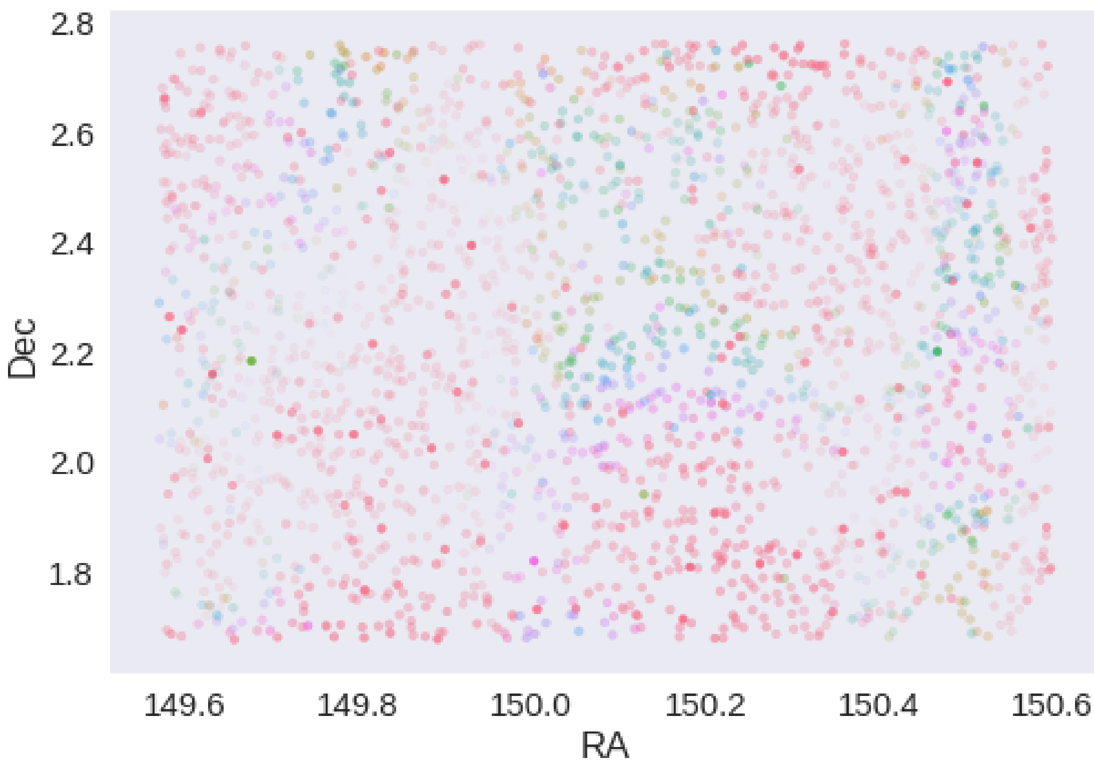
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 152946 sources.
The cleaned catalogue has 152946 sources (0 removed).
The cleaned catalogue has 0 sources flagged as having been cleaned
```

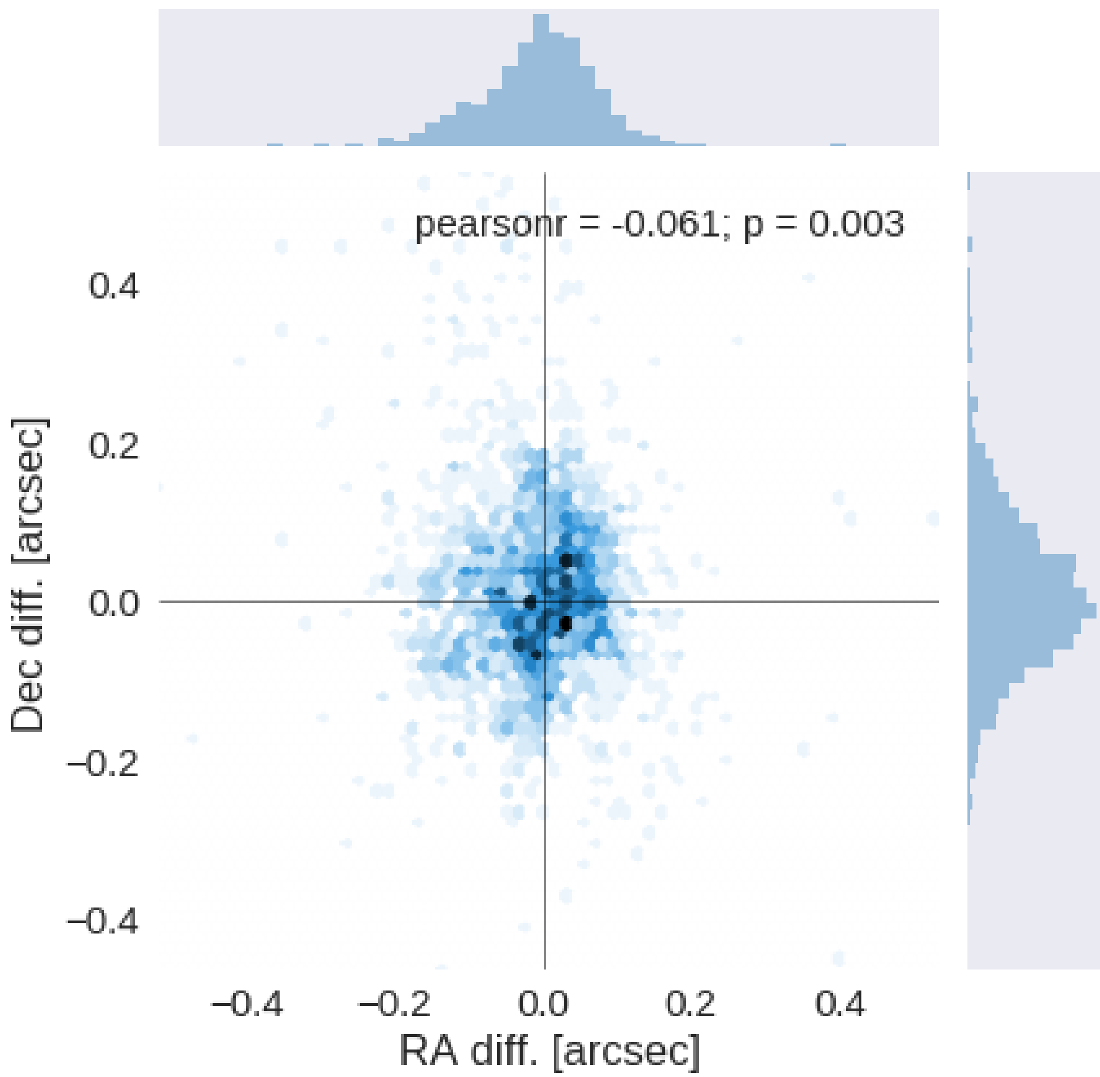
1.4 III - Astrometry correction

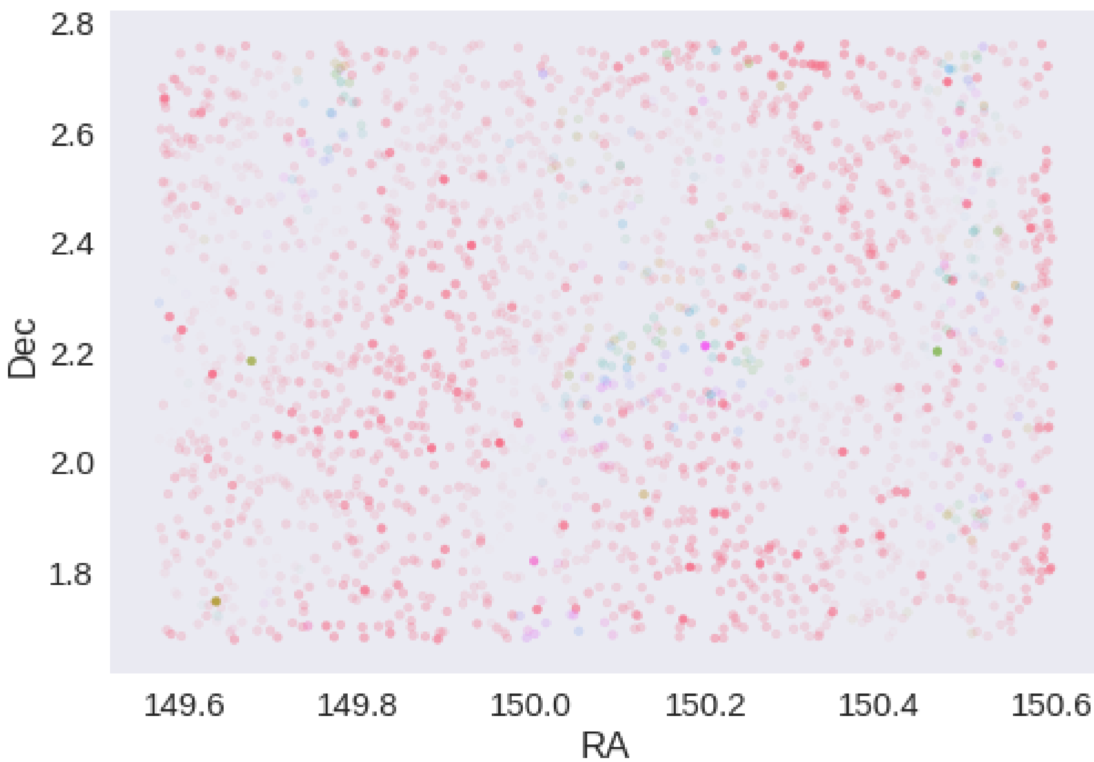
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.






```
RA correction: -0.06793673346123796 arcsec
Dec correction: -0.05321466159404764 arcsec
```


pearsonr = -0.061; p = 0.003
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

```
2633 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.6_PanSTARRS-3SS

January 18, 2018

1 COSMOS 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>ApMag` aperture magnitude (see below);
- The grizy `<band>KronMag` 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).

```
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

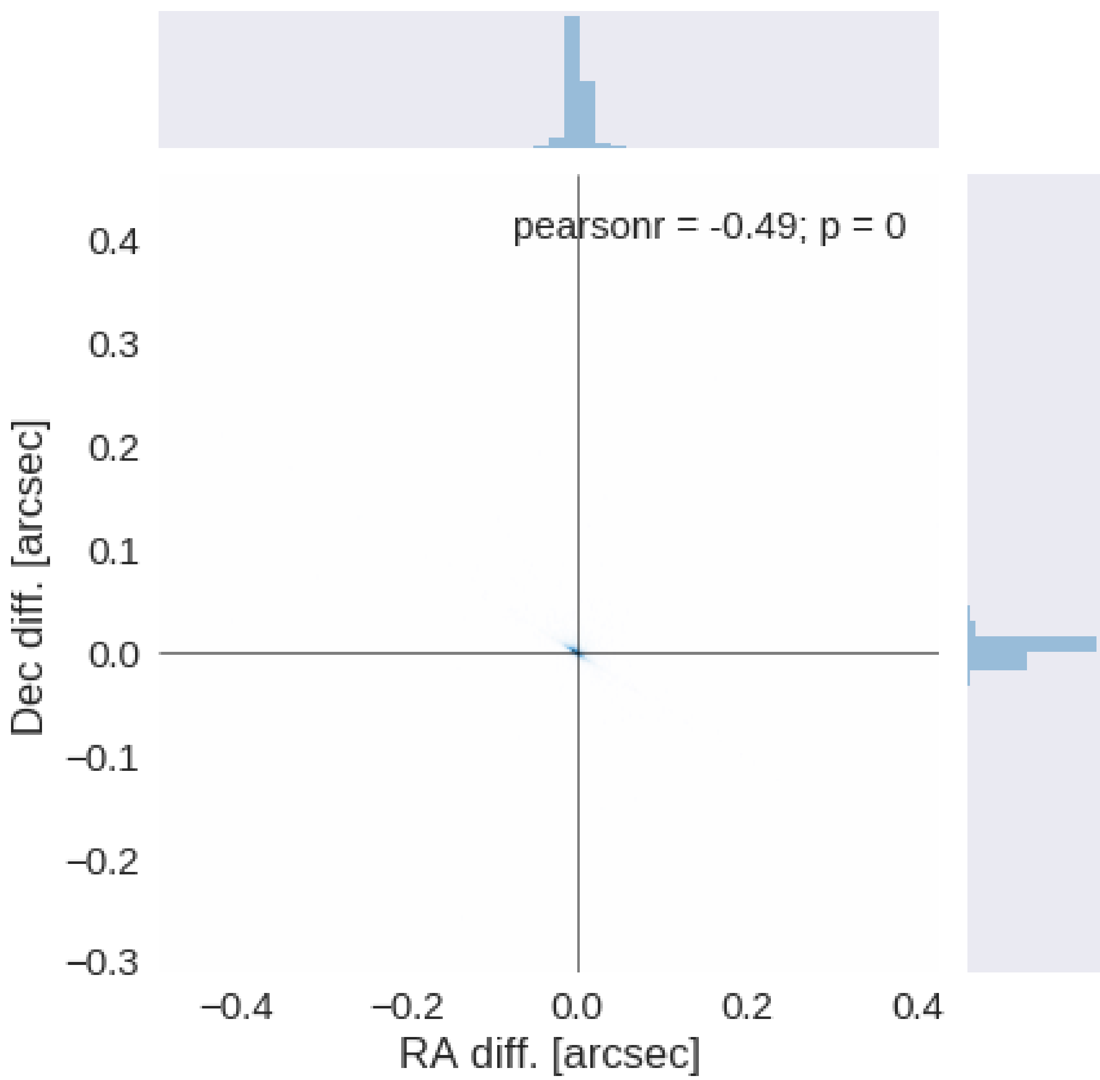
We remove duplicated objects from the input catalogues.

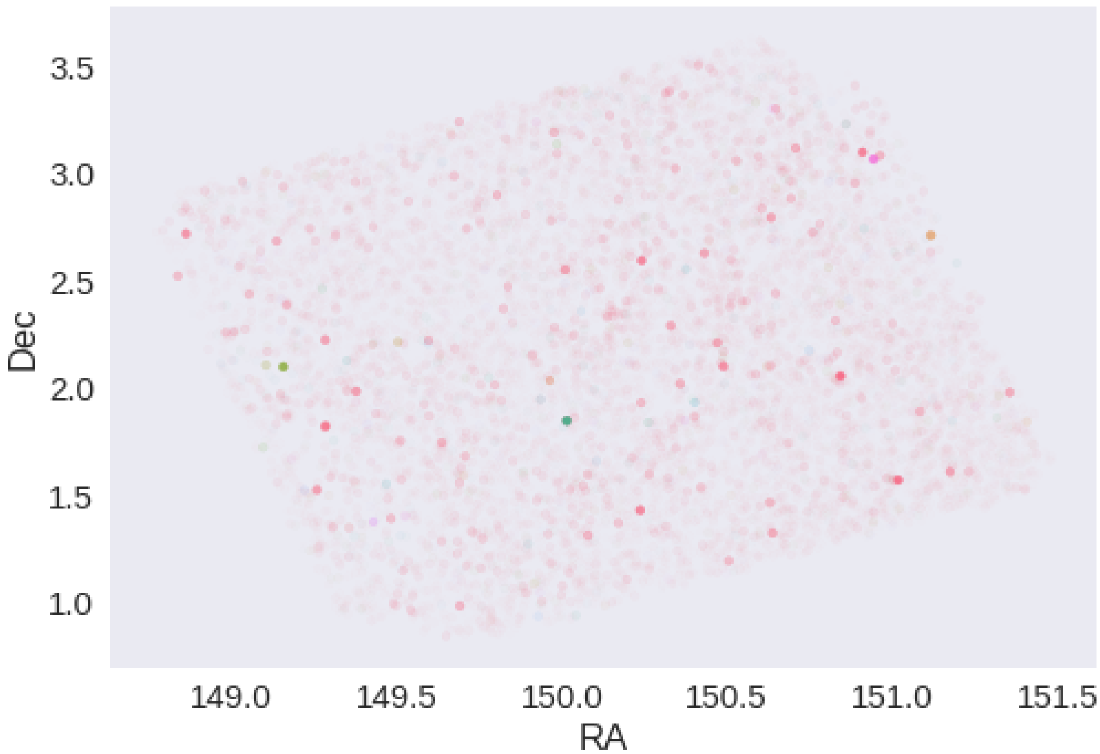
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)
```

```
The initial catalogue had 134257 sources.
The cleaned catalogue has 134209 sources (48 removed).
The cleaned catalogue has 48 sources flagged as having been cleaned
```

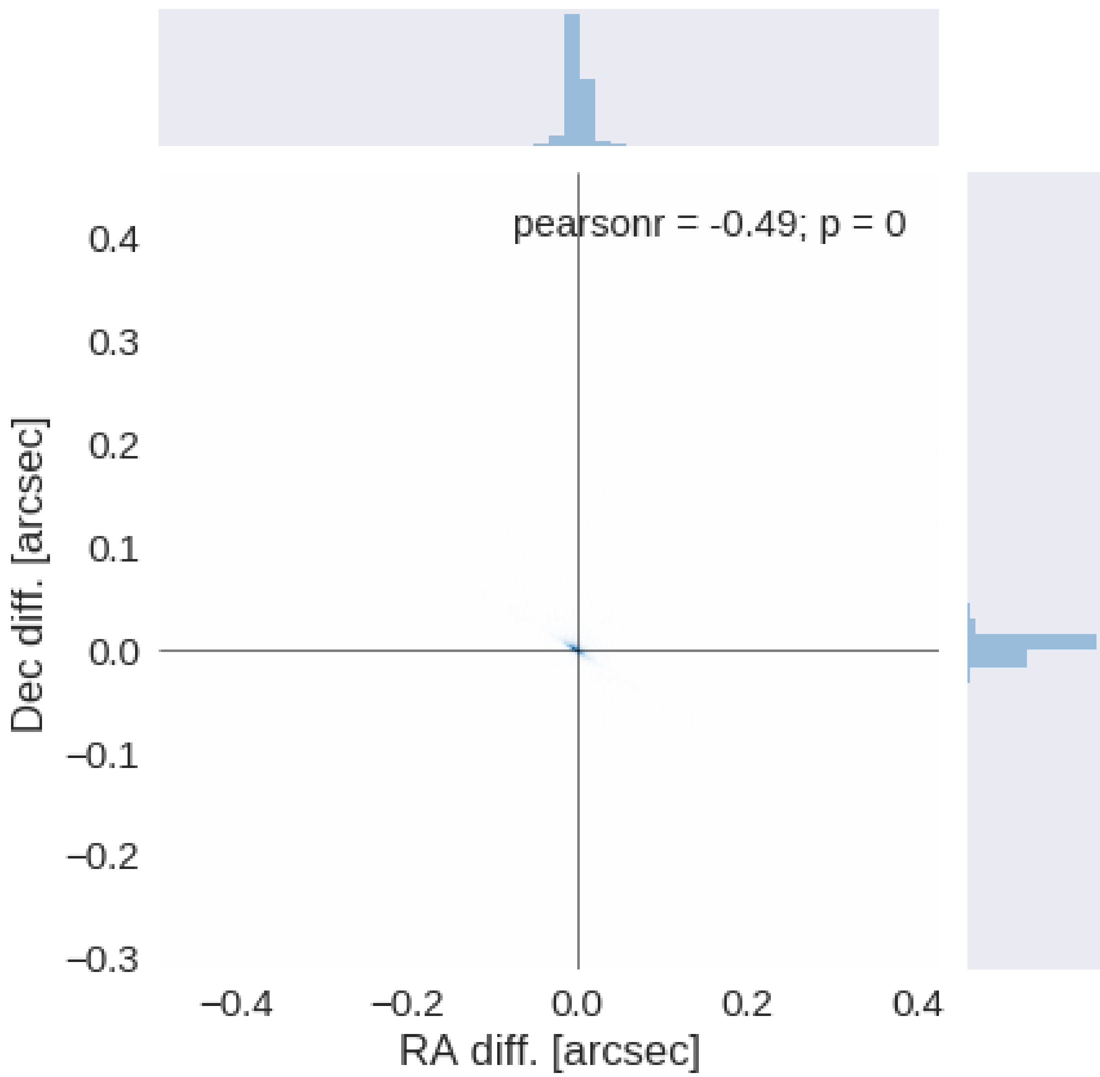
1.4 III - Astrometry correction

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.

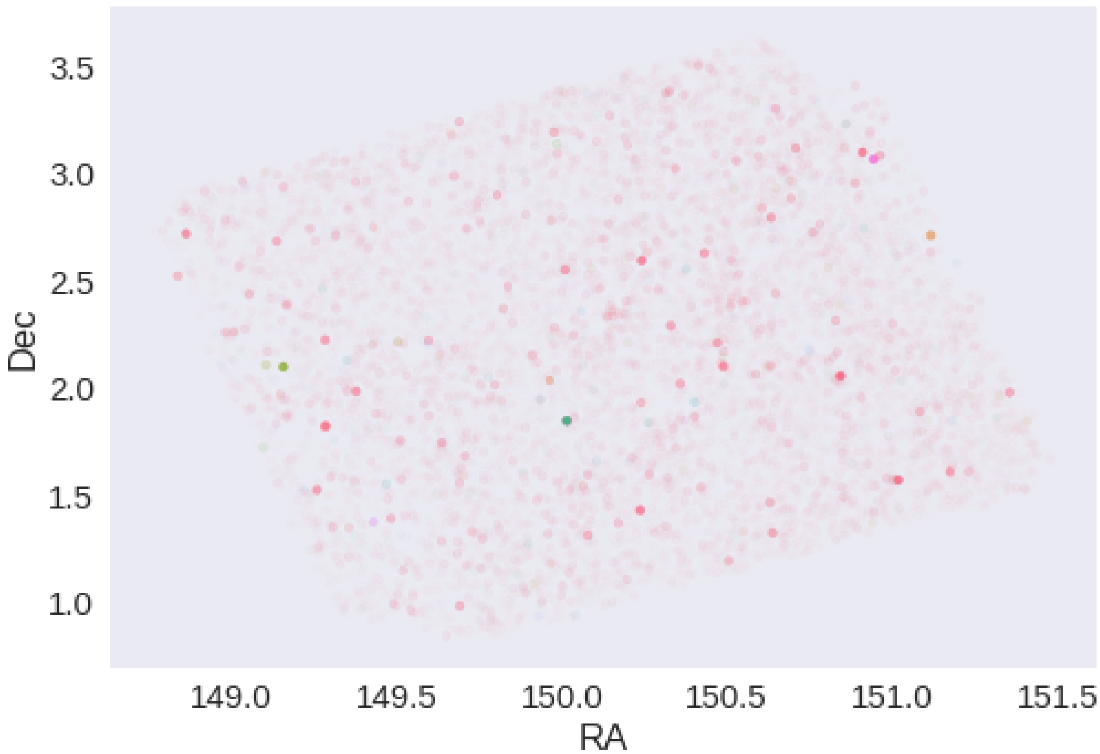





```
RA correction: -0.001830837663874263 arcsec
Dec correction: -0.00030203157574959505 arcsec
```



pearsonr = -0.49; p = 0
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
0.4
RA diff. [arcsec]



1.5 IV - Flagging Gaia objects

```
10748 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.7_UKIDSS-LAS

January 18, 2018

1 COSMOS master catalogue

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

Information about UKIDSS can be found at http://www.ukidss.org/surveys/surveys.html

The catalogue comes from `dmu0_UKIDSS-LAS`.

In the catalogue, we keep:

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

J band magnitudes are available in two eopchs. We take the first arbitrarily.

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

Band	AB offset
Y	0.634
J	0.938
H	1.379
K	1.900

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

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

1.2 I - Column selection

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

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
```

```
  ma.MaskedArray.__setitem__(self, index, value)
```

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

1.3 II - Removal of duplicated sources

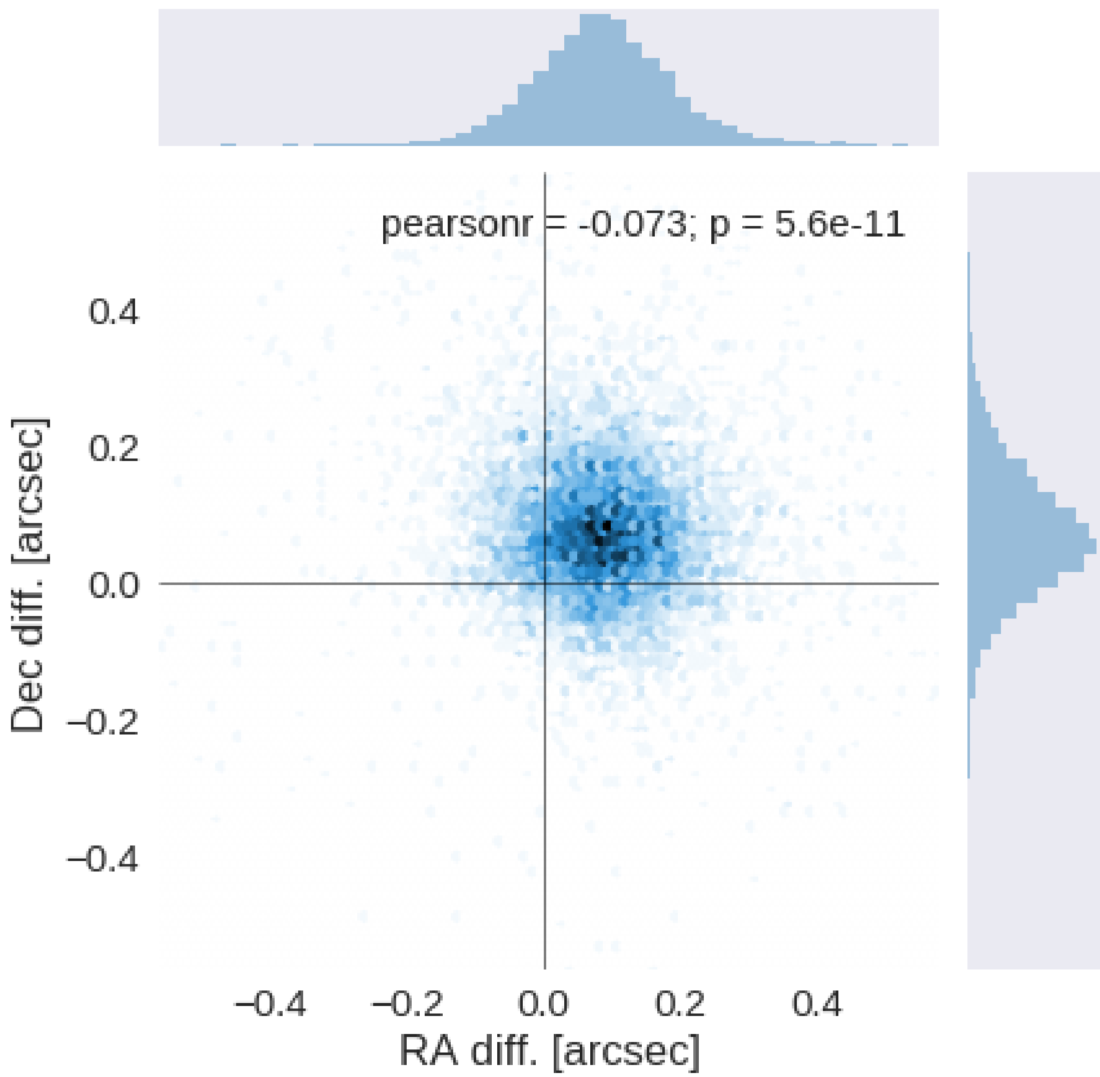
We remove duplicated objects from the input catalogues.

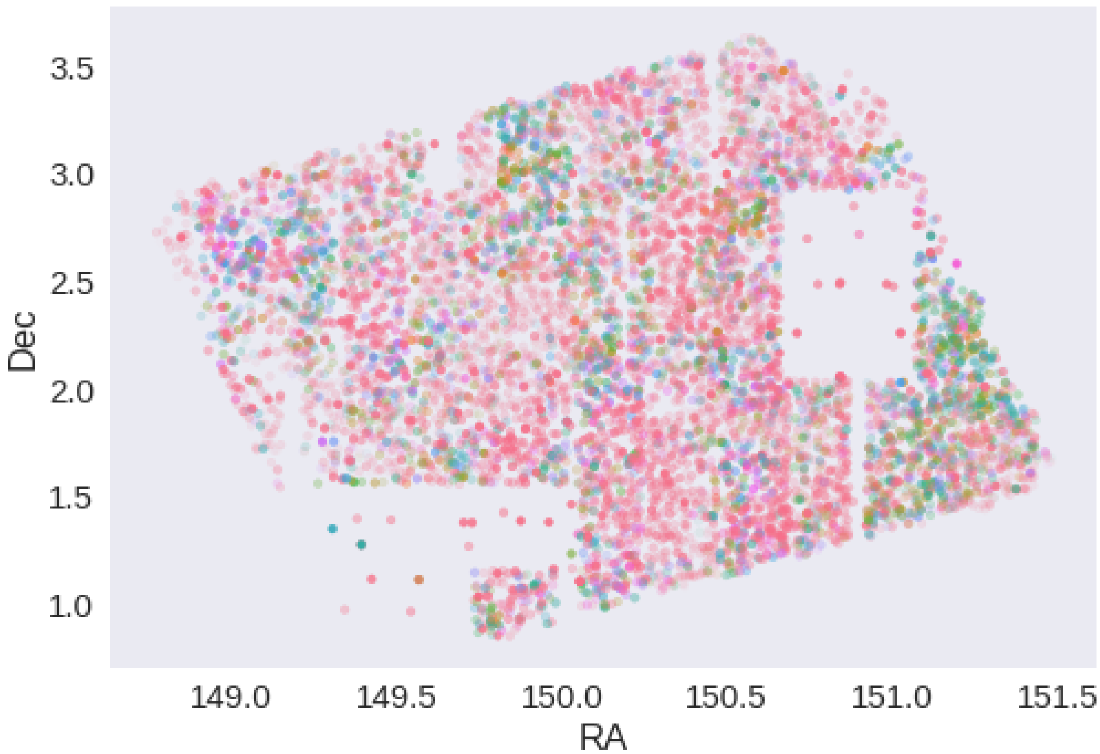
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/astropy/table/column.py:10
Check the NumPy 1.11 release notes for more information.
  ma.MaskedArray.__setitem__(self, index, value)


The initial catalogue had 78235 sources.
The cleaned catalogue has 78114 sources (121 removed).
The cleaned catalogue has 118 sources flagged as having been cleaned
```

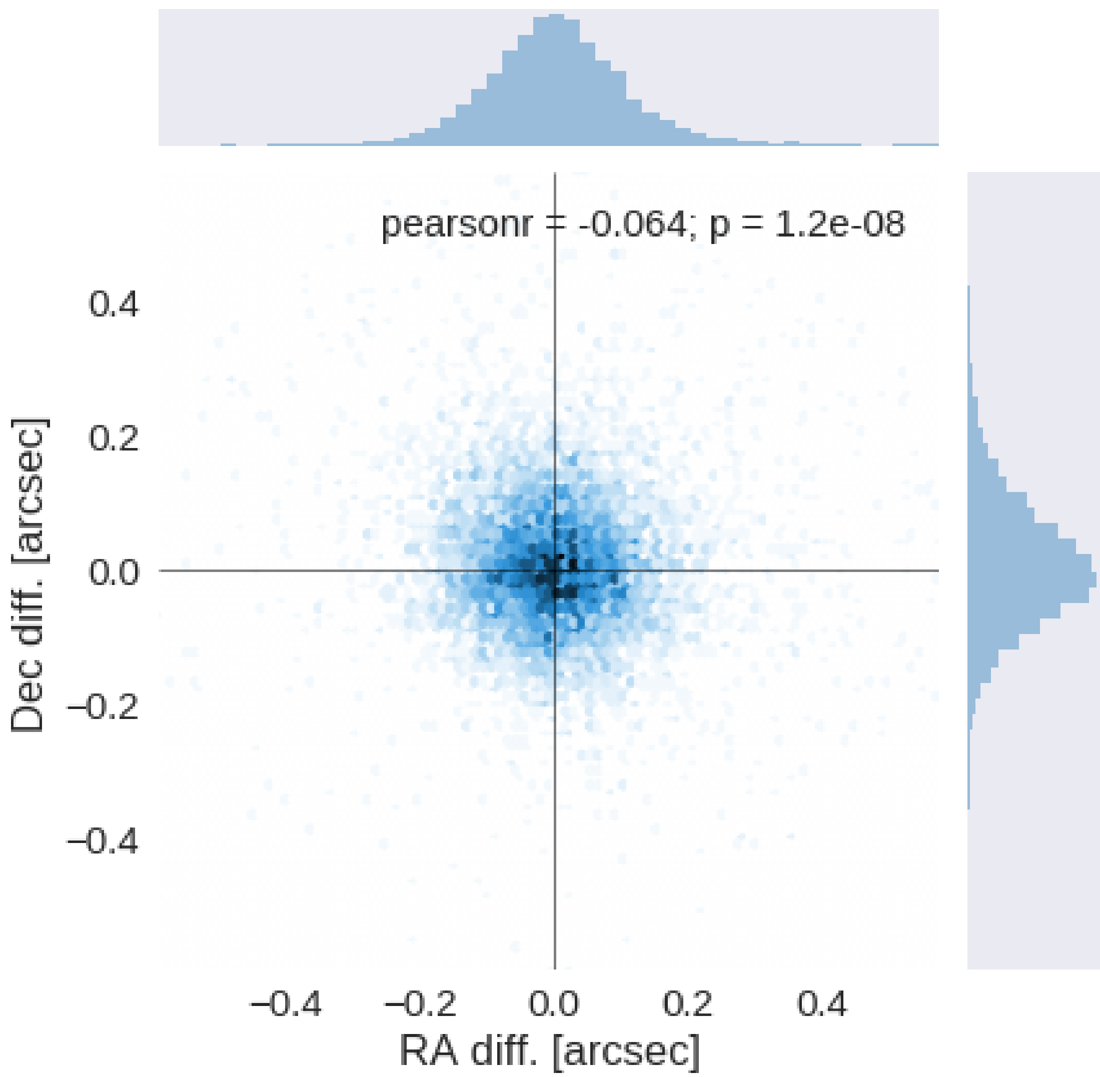
1.4 III - Astrometry correction

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 = -0.073; p = 5.6e-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]




```
RA correction: -0.084222478335505 arcsec
Dec correction: -0.06767946427048699 arcsec
```



pearsonr = -0.064; p = 1.2e-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]

1.5 IV - Flagging Gaia objects

```
8625 sources flagged.
```

1.6 V - Flagging objects near bright stars

2 VI - Saving to disk

1.8_CFHT-WIRDS

January 18, 2018

1 COSMOS 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).

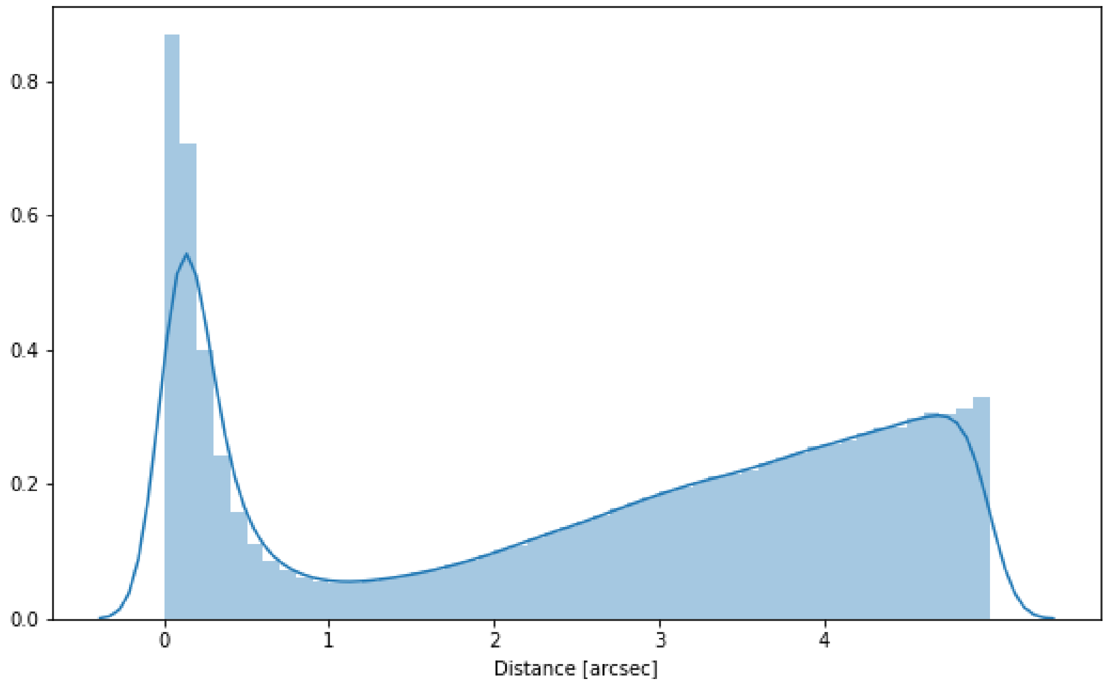
```
This notebook was run with herschelhelp_internal version:
33f5ec7 (Wed Dec 6 16:56:17 2017 +0000)
```

1.2 I - Column selection

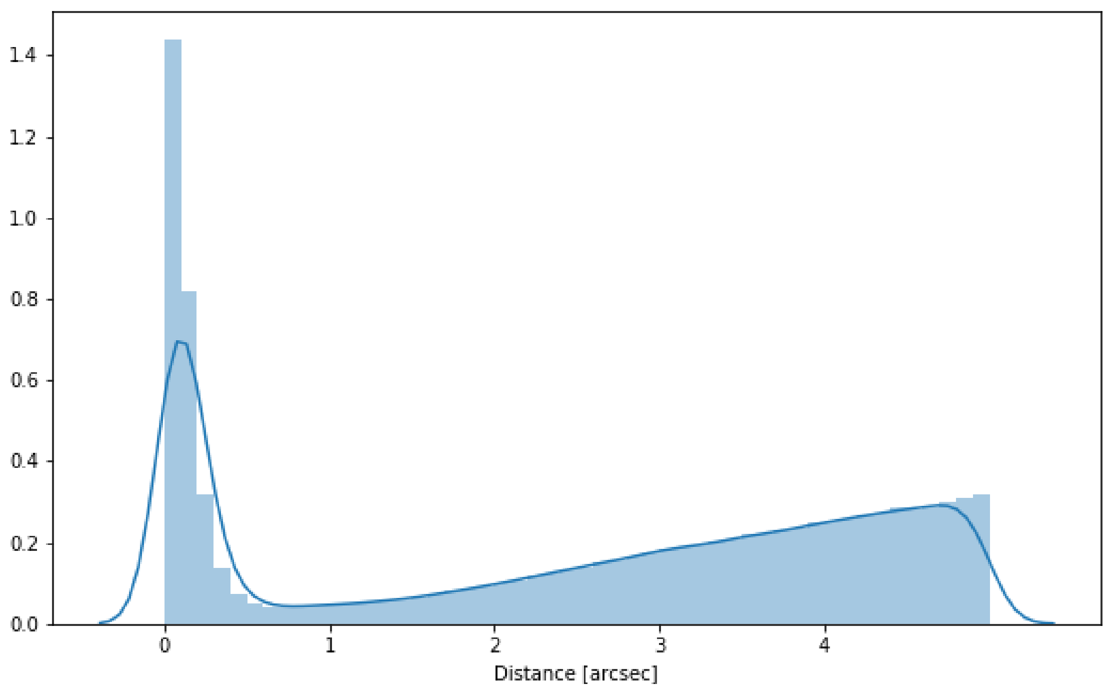
1.3 Merging different bands

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>
```



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>
```

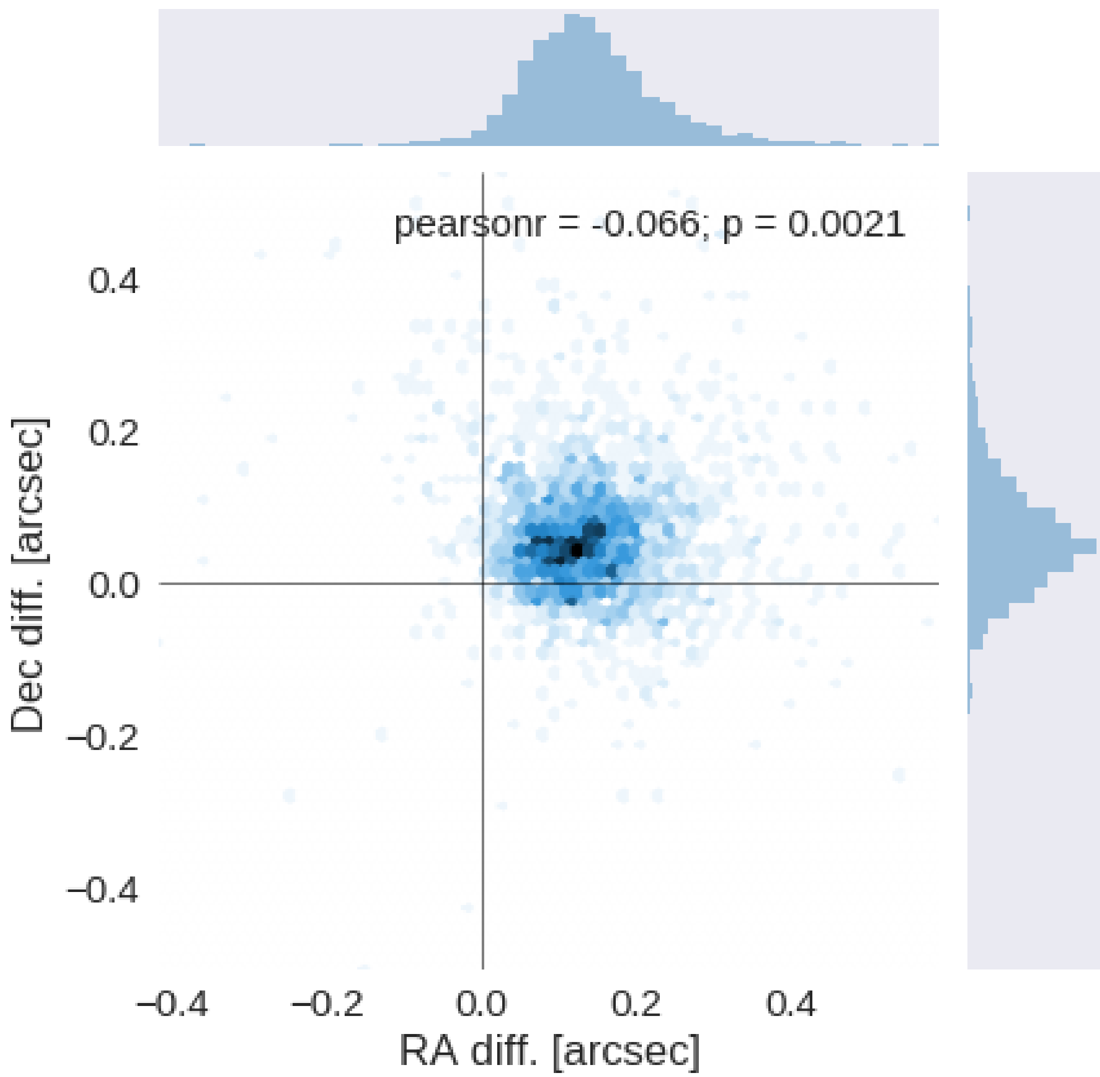
1.5 II - Removal of duplicated sources

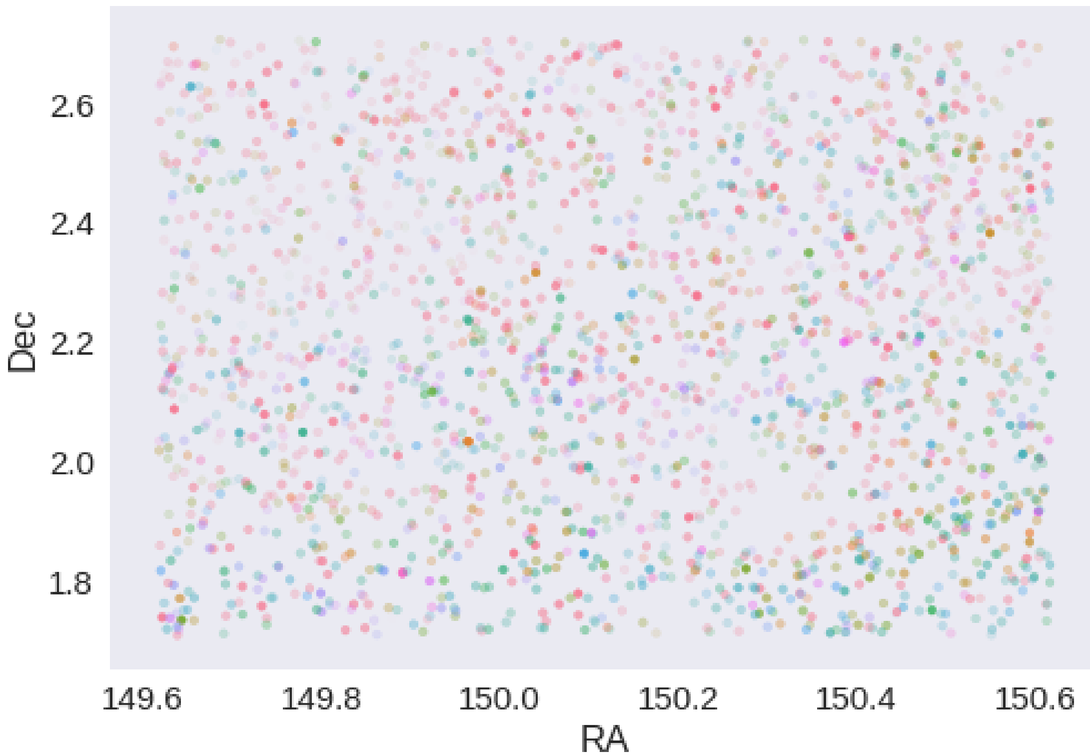
We remove duplicated objects from the input catalogues.

```
The initial catalogue had 447687 sources.
The cleaned catalogue has 447668 sources (19 removed).
The cleaned catalogue has 19 sources flagged as having been cleaned
```

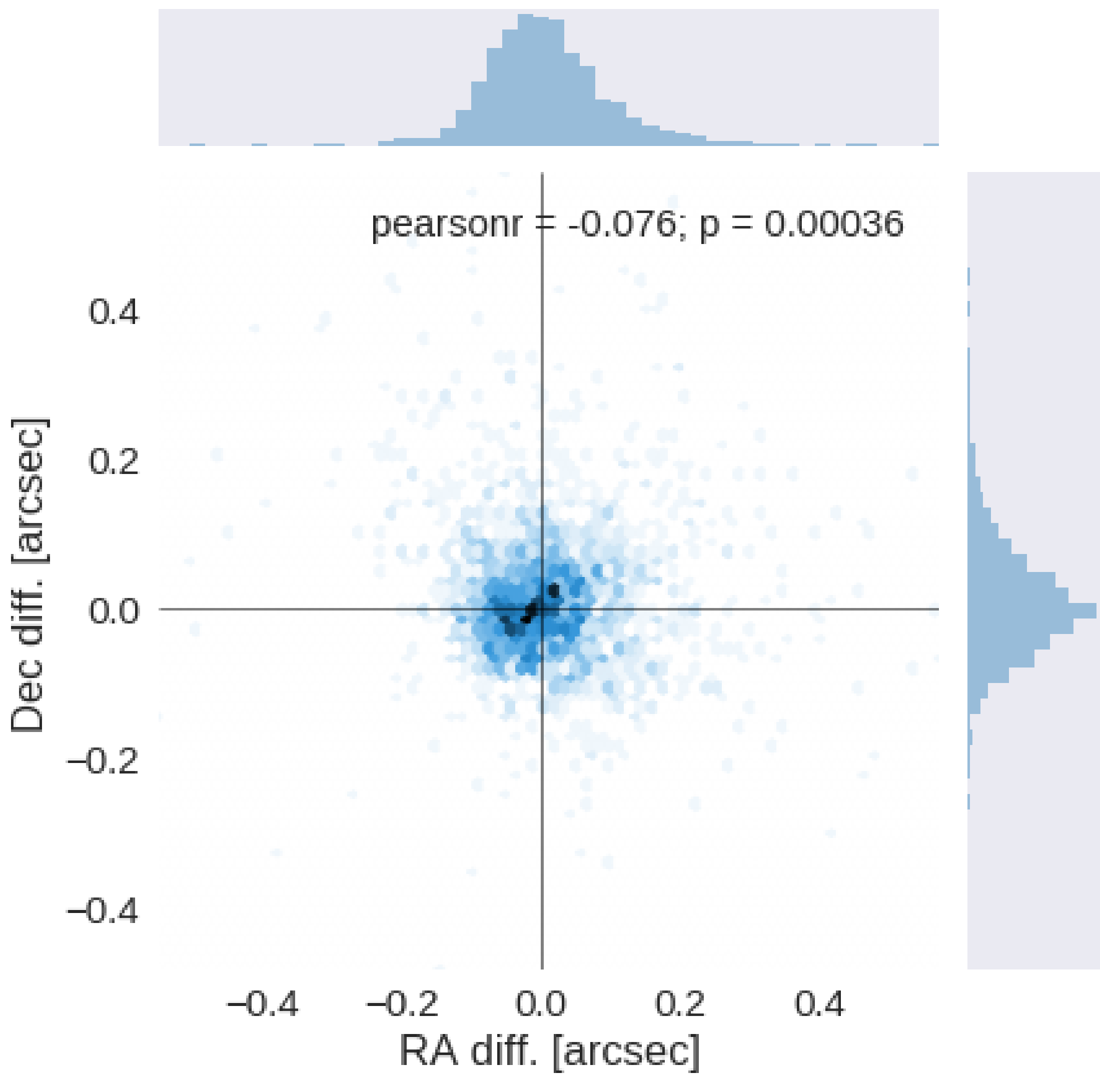
1.6 III - Astrometry correction

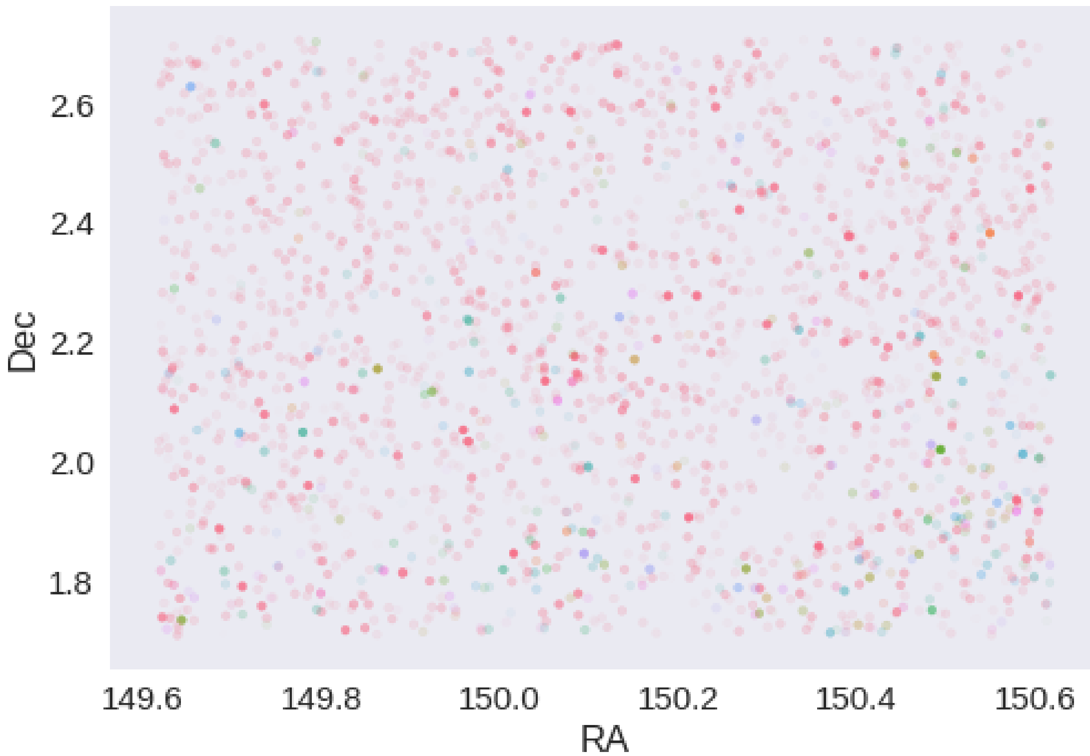
We match the astrometry to the Gaia one. We limit the Gaia catalogue to sources with a g band flux between the 30th and the 70th percentile. Some quick tests show that this give the lower dispersion in the results.


pearsonr = -0.066; p = 0.0021
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: -0.13158172980638483 arcsec
Dec correction: -0.05163567519641532 arcsec
```


pearsonr = -0.076; p = 0.00036
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

```
2256 sources flagged.
```

1.8 V - Flagging objects near bright stars

2 VI - Saving to disk

1.9_COSMOS2015

January 18, 2018

1 COSMOS master catalogue

1.1 Convert COSMOS2016 to help format for comparison and homogeniety

This catalogue comes from `dmu1_COSMOS`.

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

2_Merging

January 18, 2018

1 COSMOS master catalogue

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

```
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

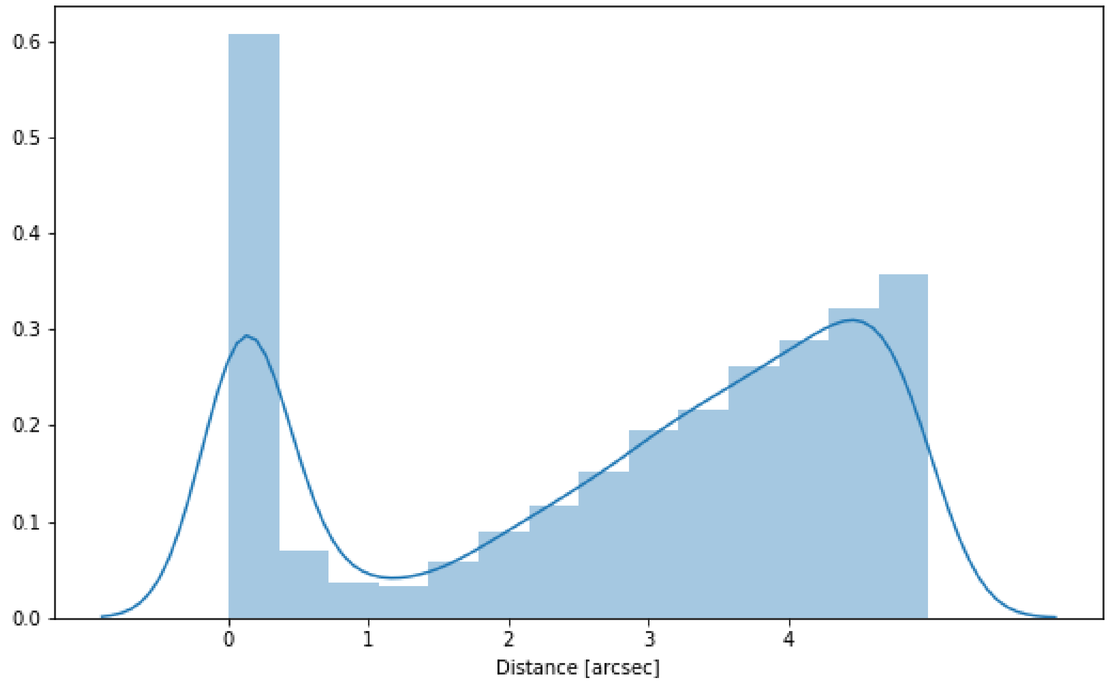
1.2 II - Merging tables

We first merge the optical catalogues and then add the infrared ones: CANDELS, CFHTLS, DECaLS, HSC, KIDS, PanSTARRS, UKIDSS-LAS, and CFHT-WIRDS.

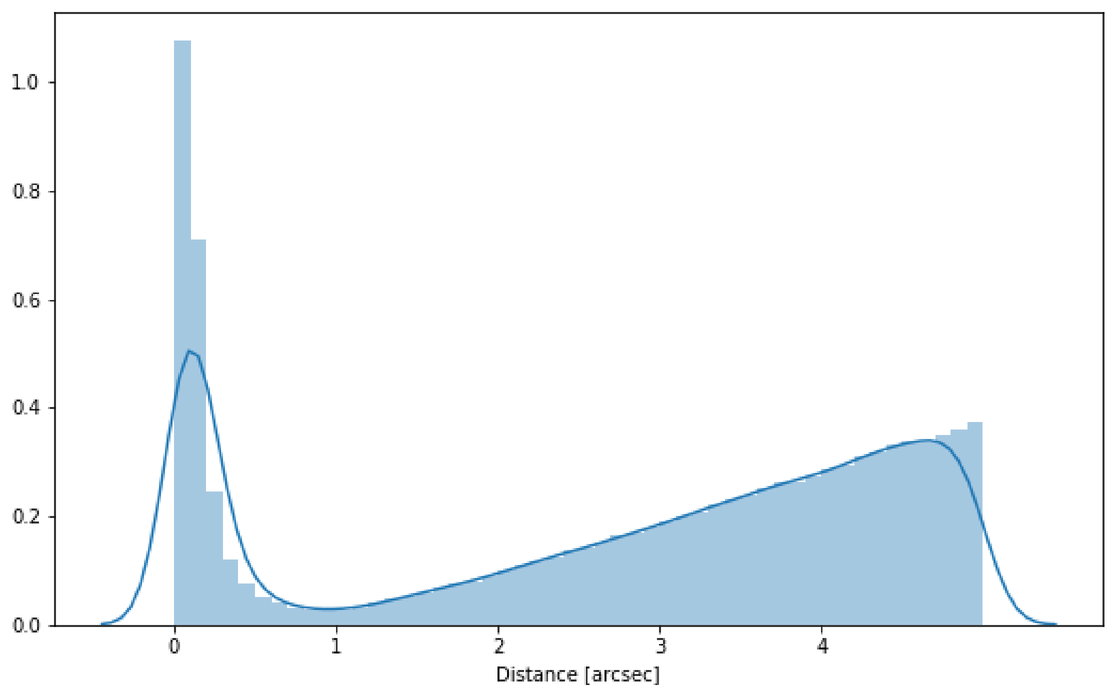
At every step, we look at the distribution of the distances to the nearest source in the merged catalogue to determine the best crossmatching radius.

1.2.1 PanSTARRS

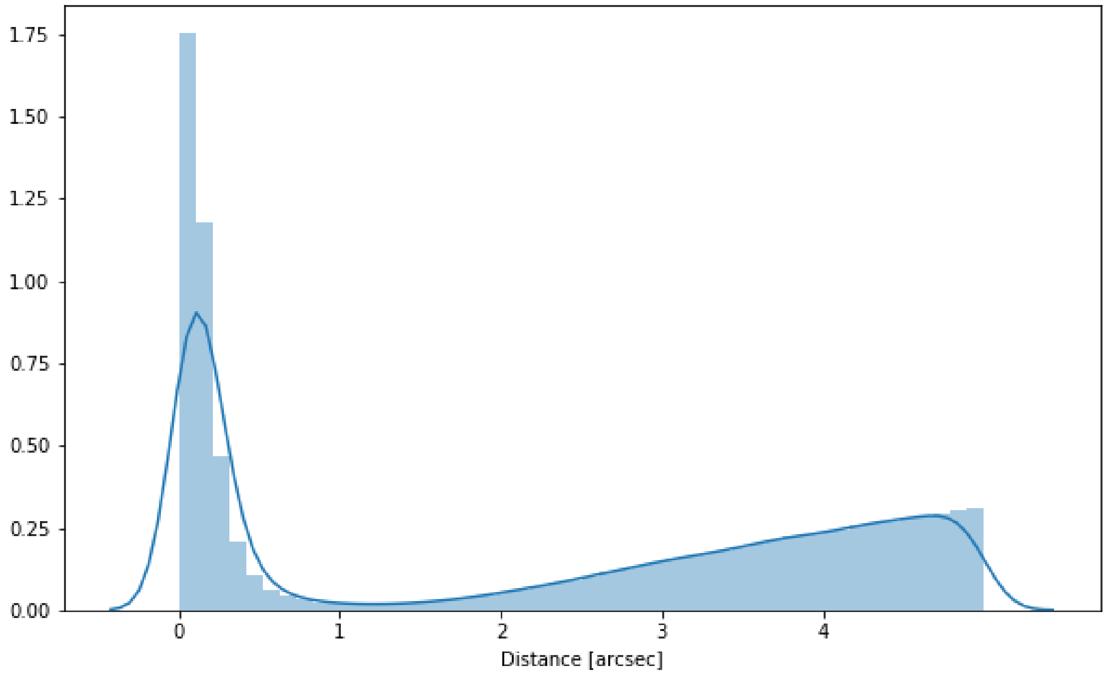
1.2.2 Add CANDELS



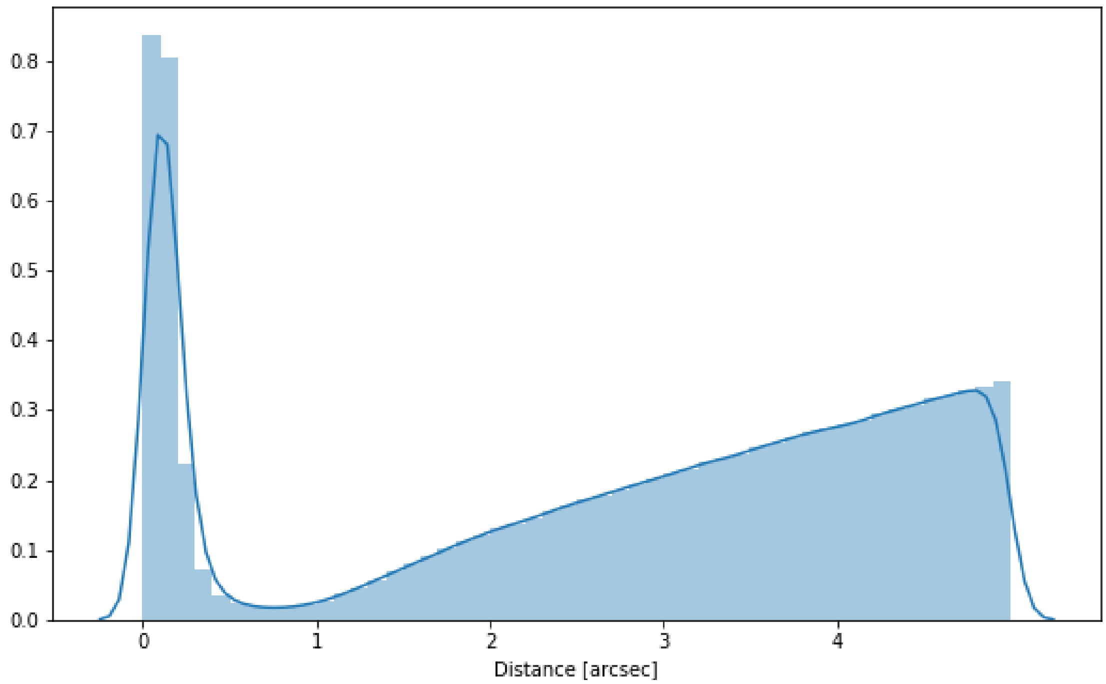
1.2.3 Add CFHTLS



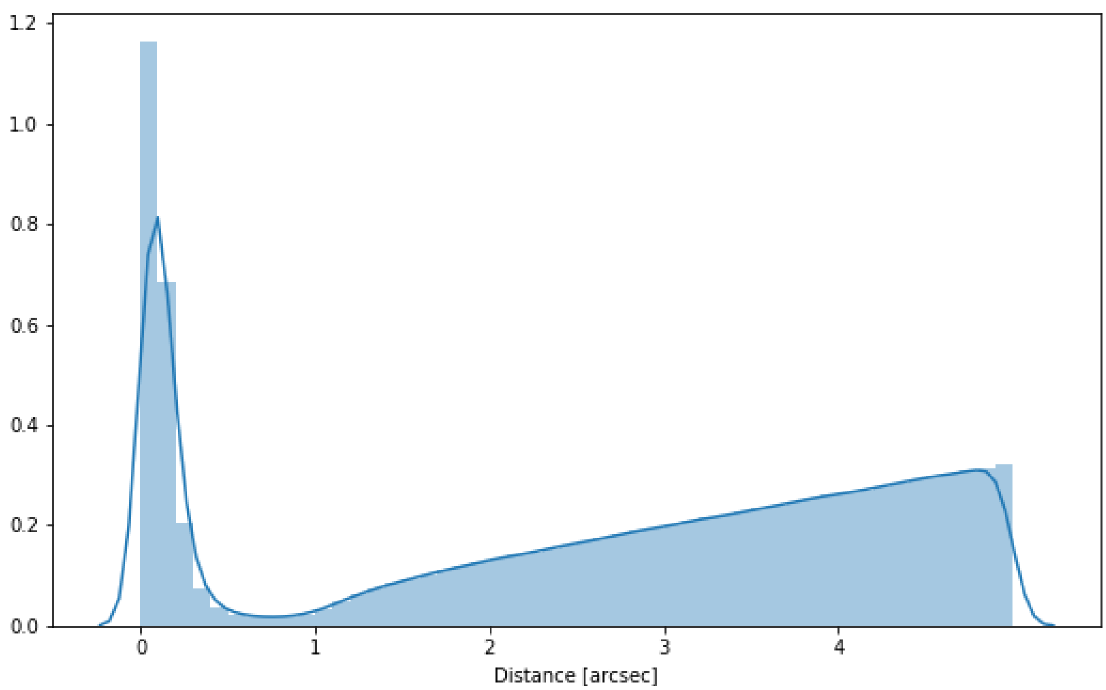
1.2.4 Add DECaLS



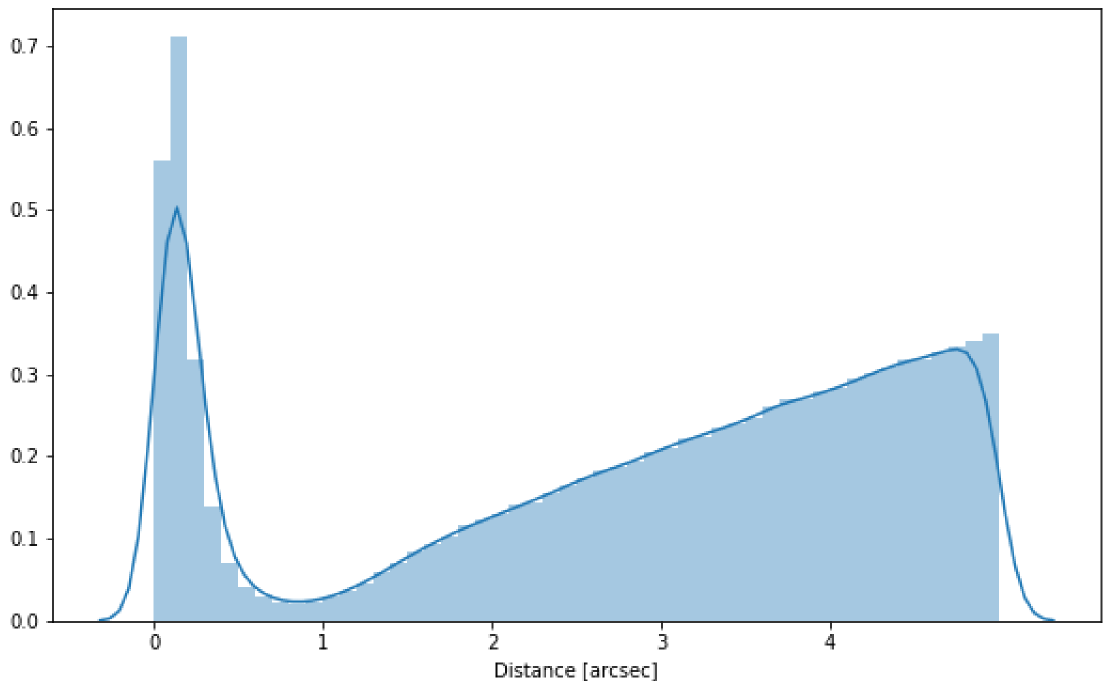
1.2.5 Add HSC-UDEEP



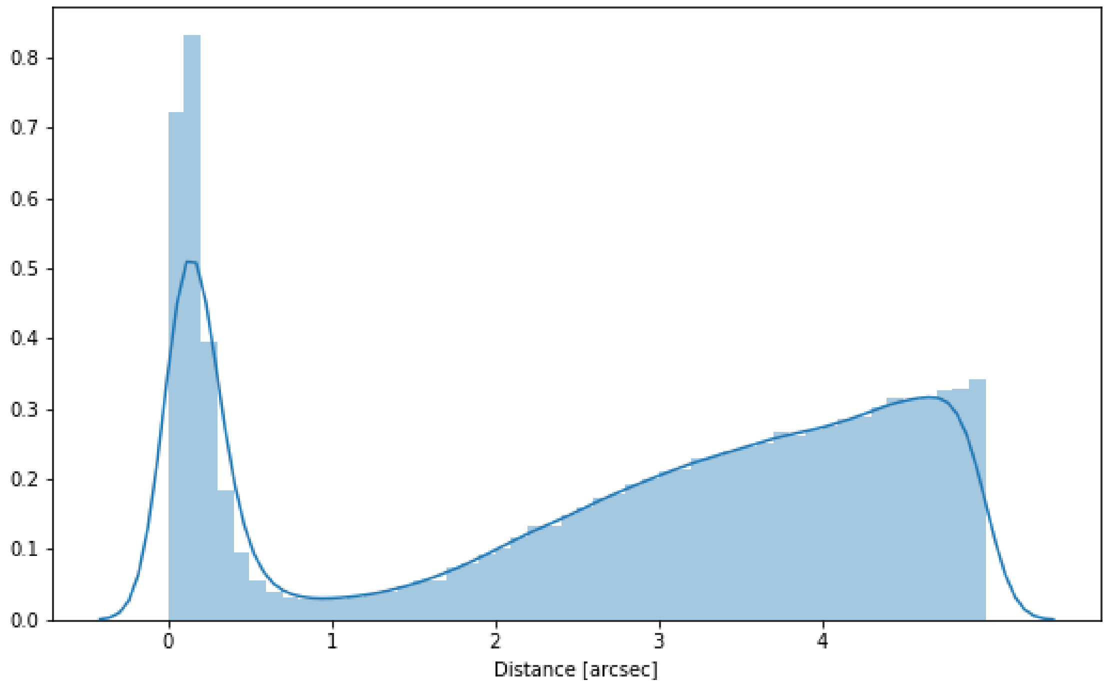
1.2.6 Add HSC-DEEP



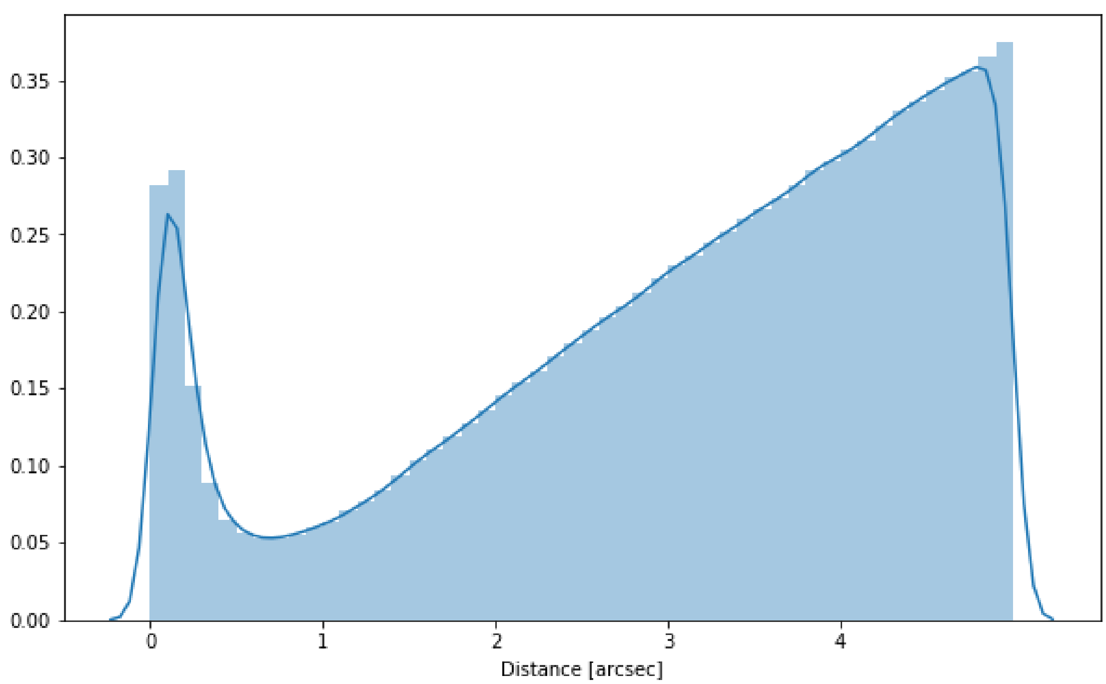
1.2.7 Add KIDS



1.2.8 Add UKIDSS LAS



1.2.9 Add CFHT-WIRDS



1.2.10 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[23]: <IPython.core.display.HTML object>
```

1.3 III - Merging flags and stellarity

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

Wirds was created with a merge so contains a flag to be merged with the merg flag produced here

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

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

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

1.4 IV - Adding E(B-V) column

1.5 V - Adding HELP unique identifiers and field columns

```
OK!
```

1.6 VI - Choosing between multiple values for the same filter

There are currently no overlapping surveys here.

```
/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[36]: <IPython.core.display.HTML object>
```

1.7 VII.a Wavelength domain coverage

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

- 1 for observation in optical;

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

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

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

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

1.8 VII.b Wavelength domain detection

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

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

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

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

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

1.9 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.

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

```
['ps1_id', 'candels_id', 'cfhtls_id', 'decals_id', 'hsc-udeep_id', 'hsc-deep_id', 'kids_id', 'la
```

1.10 IX - Adding HEALPix index

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

1.11 IX - Saving the catalogue

```
Missing columns: set()
```

3_Checks_and_diagnostics

January 18, 2018

1 COSMOS master catalogue

1.1 Checks and diagnostics

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

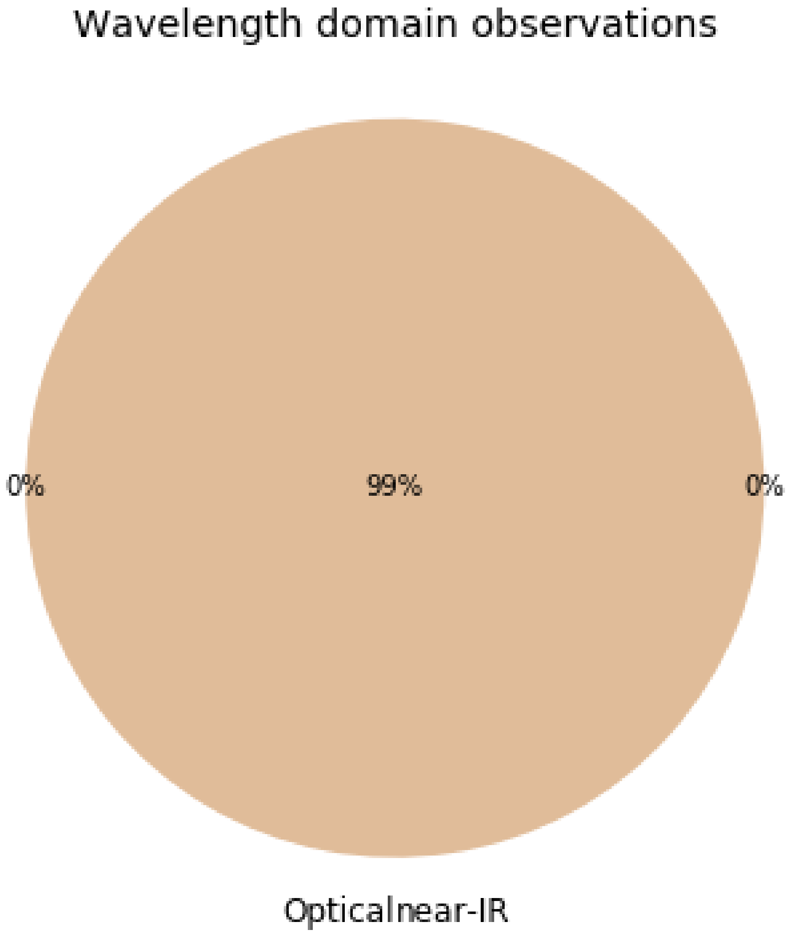
1.2 0 - Quick checks

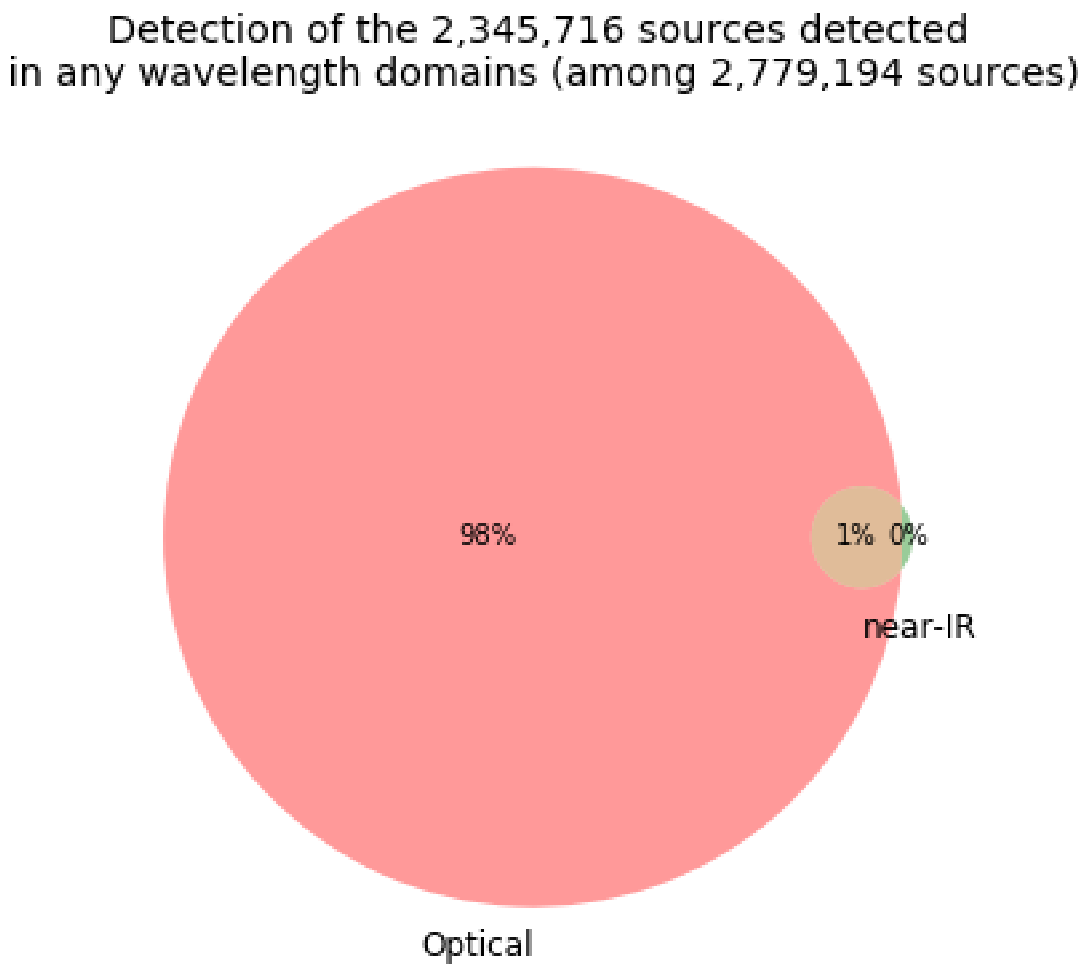
```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype), FutureWarning)
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/numpy/core/numeric.py:301:
  format(shape, fill_value, array(fill_value).dtype),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

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

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

1.3 I - Summary of wavelength domains



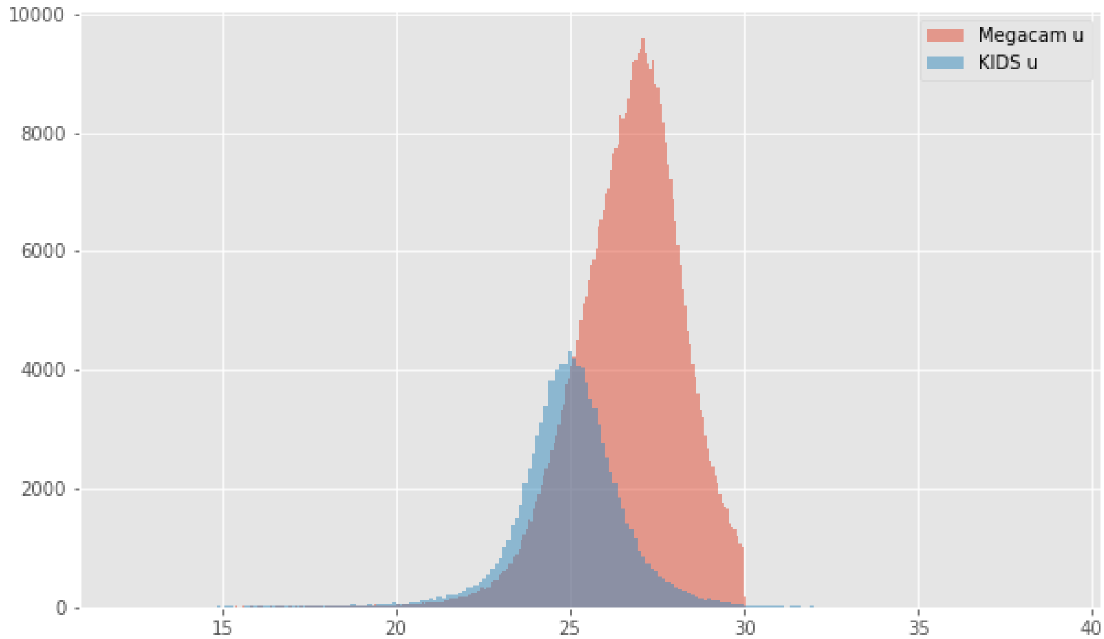


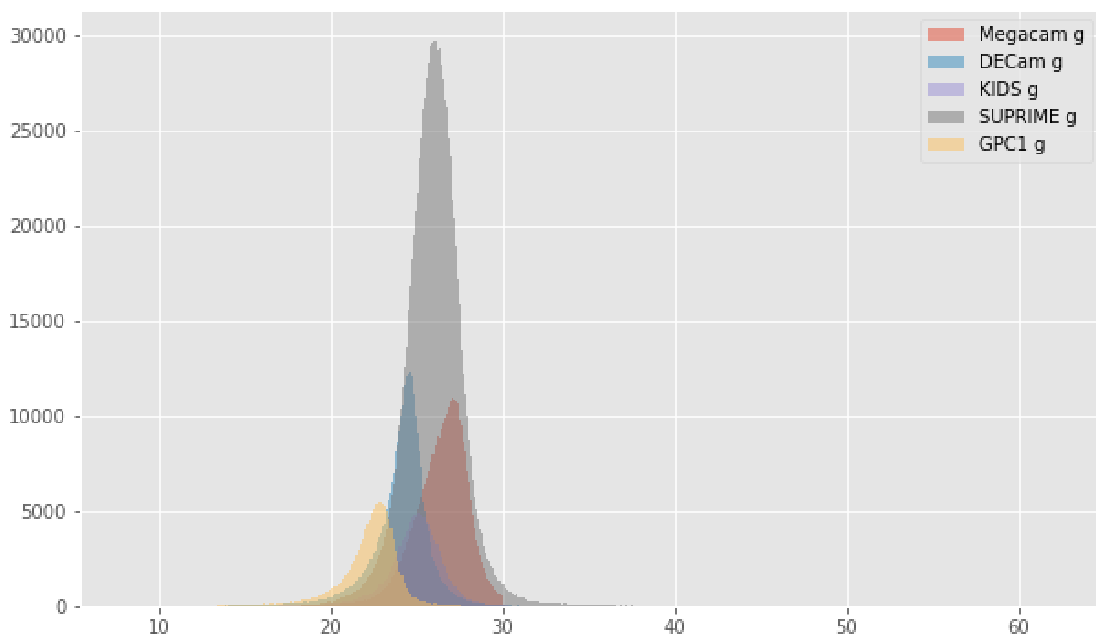
1.4 II - Comparing magnitudes in similar filters

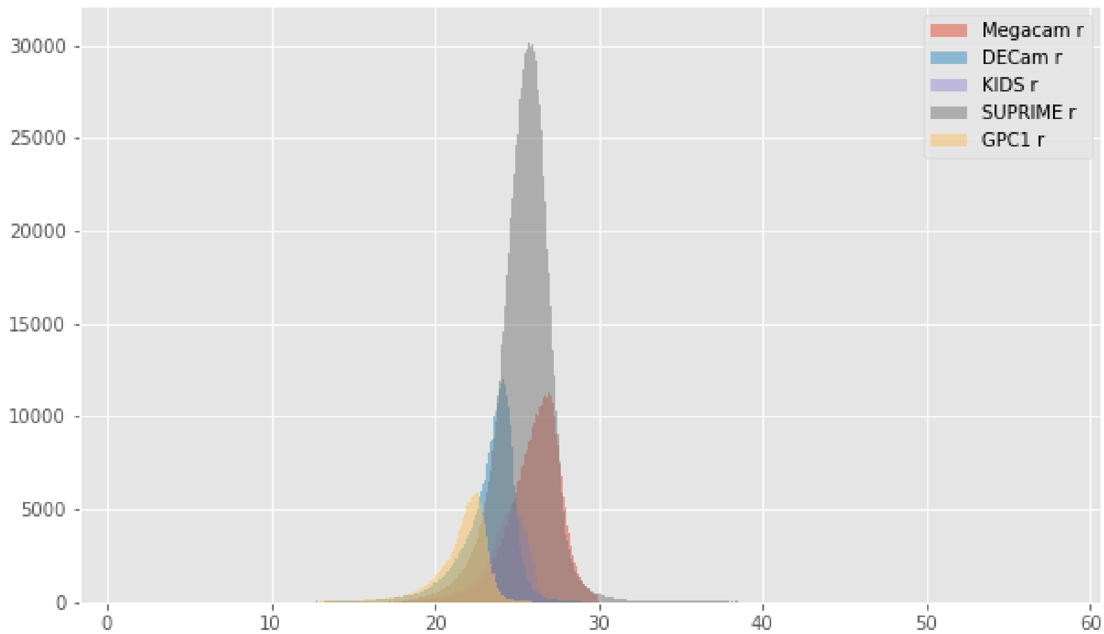
The master list if composed of several catalogues containing magnitudes in similar filters on different instruments. We are comparing the magnitudes in these corresponding filters.

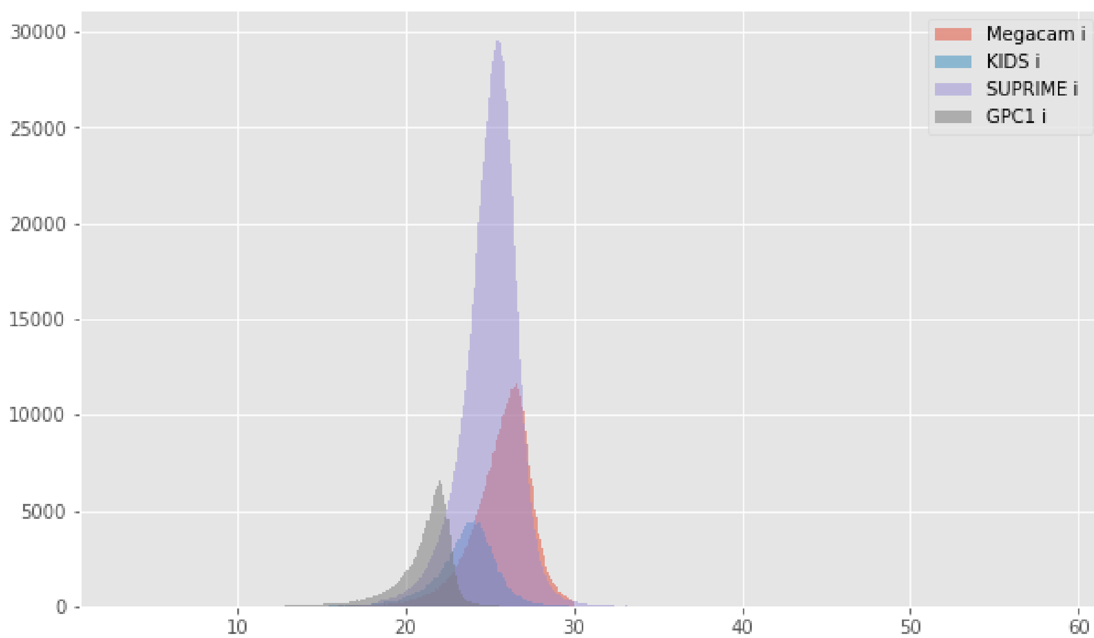
1.4.1 II.a - Comparing depths

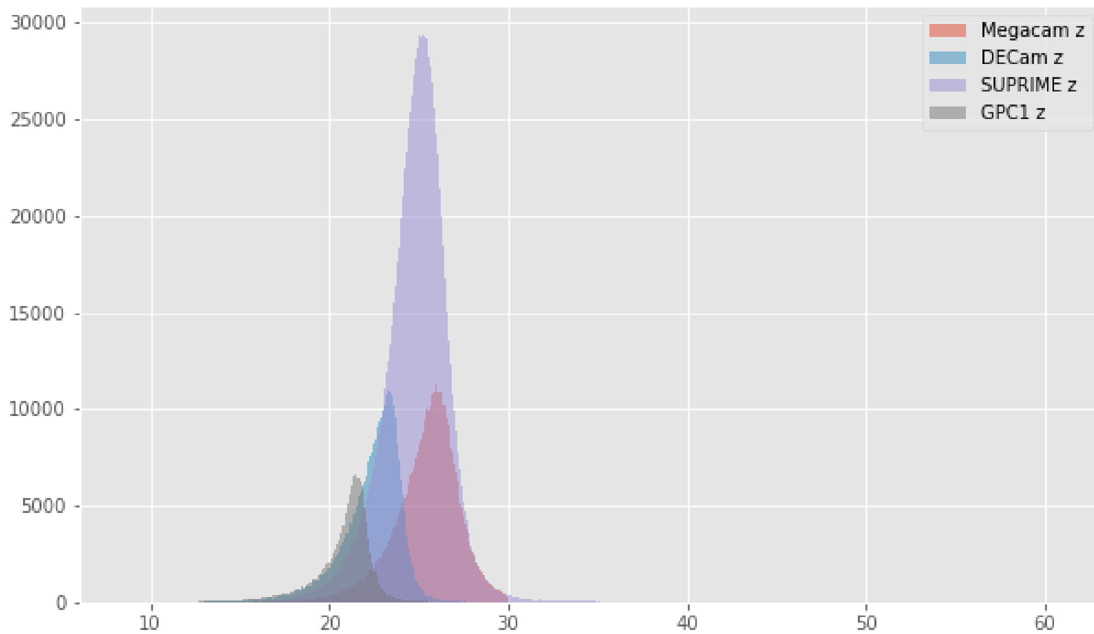
We compare the histograms of the total aperture magnitudes of similar bands.

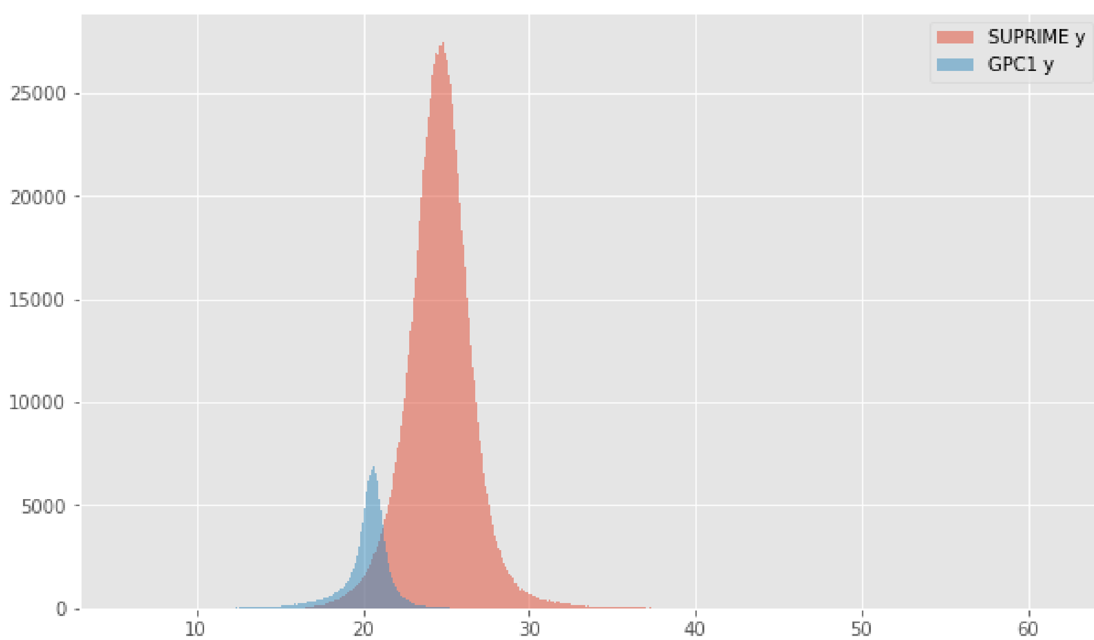

Megacam u
KIDS u
10000
8000
6000
4000
2000
0
15
20
25
30
35
40


Megacam g
DECam g
KIDS g
SUPRIME g
GPC1 g
30000
25000
20000
15000
10000
5000
0
10
20
30
40
50
60


Megacam r
DECam r
KIDS r
SUPRIME r
GPC1 r
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60


Megacam i
KIDS i
SUPRIME i
GPC1 i
30000
25000
20000
15000
10000
5000
0
10
20
30
40
50
60

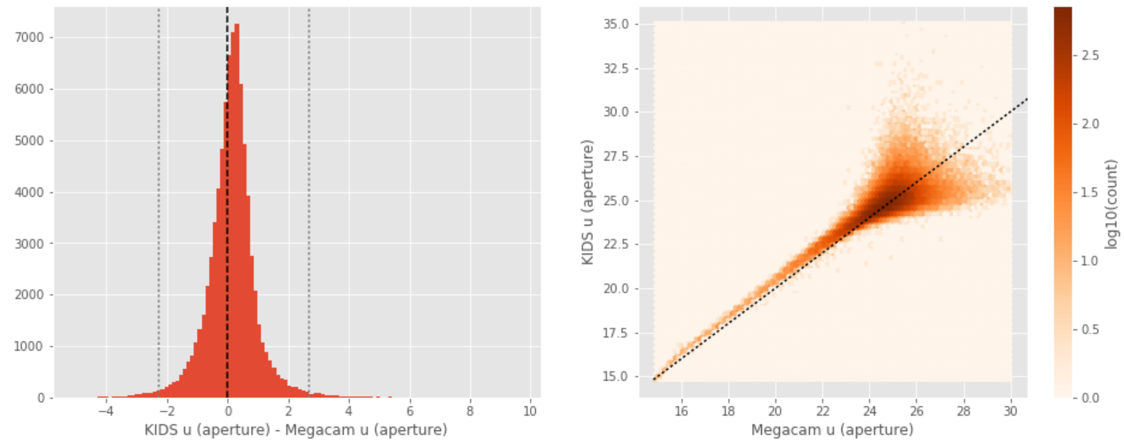




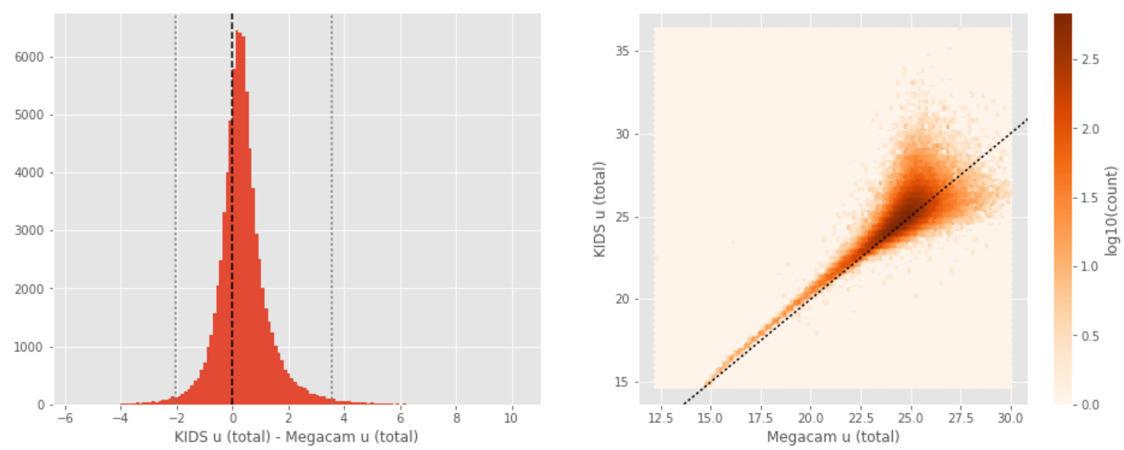
1.4.2 II.b - Comparing magnitudes

We compare one to one each magnitude in similar bands.

KIDS u (aperture) - Megacam u (aperture):
- Median: 0.15
- Median Absolute Deviation: 0.40
- 1% percentile: -2.289331703186035
- 99% percentile: 2.664651012420655

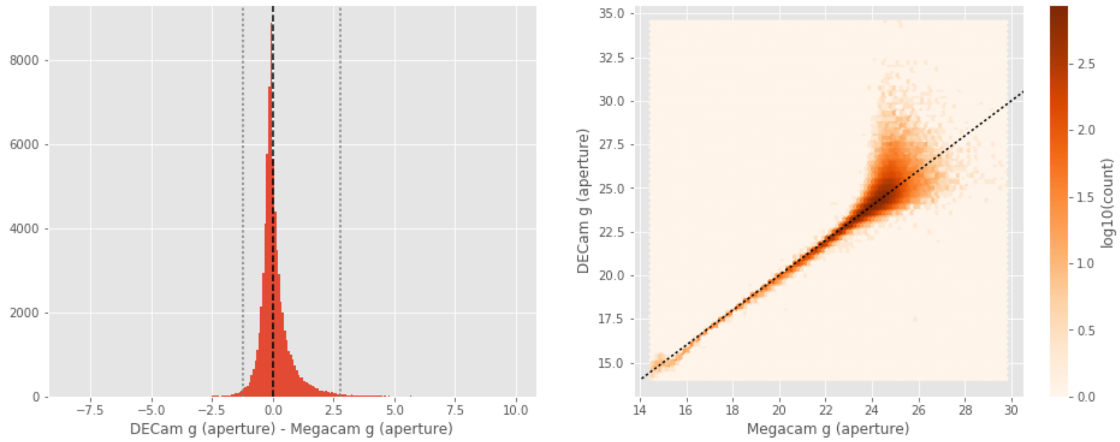


KIDS u (total) - Megacam u (total):
- Median: 0.30
- Median Absolute Deviation: 0.43
- 1% percentile: -2.038863296508789
- 99% percentile: 3.542579879760737

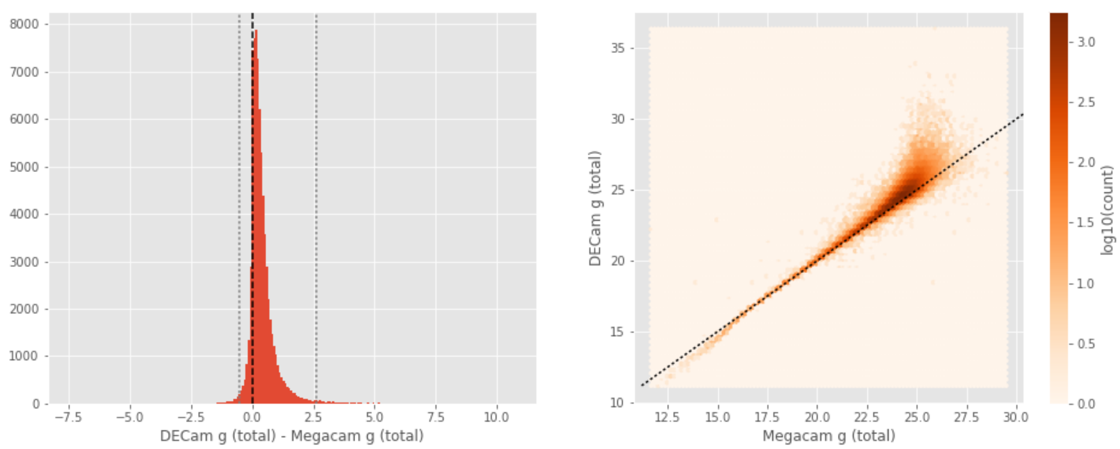


DECam g (aperture) - Megacam g (aperture):
- Median: -0.05

- Median Absolute Deviation: 0.24
- 1% percentile: -1.2481439590454102
- 99% percentile: 2.7848606109619167

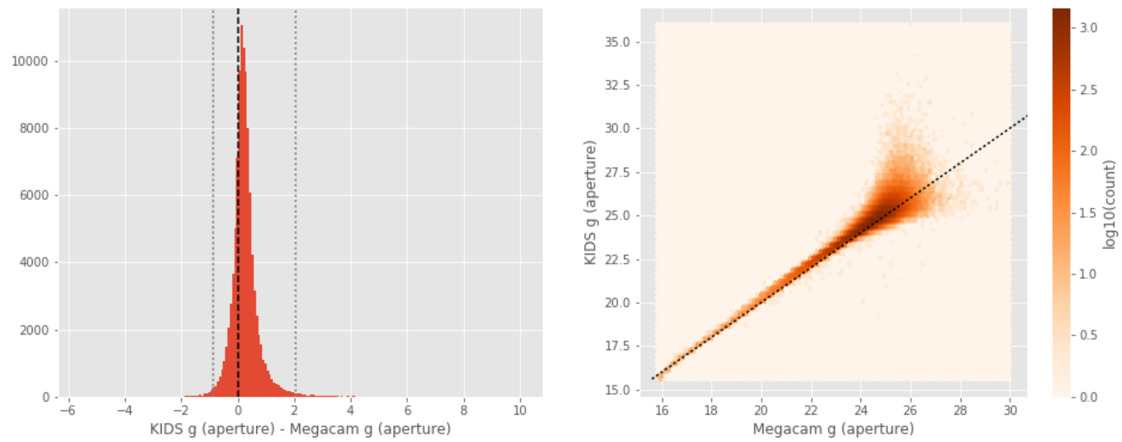


DECam g (total) - Megacam g (total):
- Median: 0.26
- Median Absolute Deviation: 0.21
- 1% percentile: -0.5215093994140625
- 99% percentile: 2.622013511657716

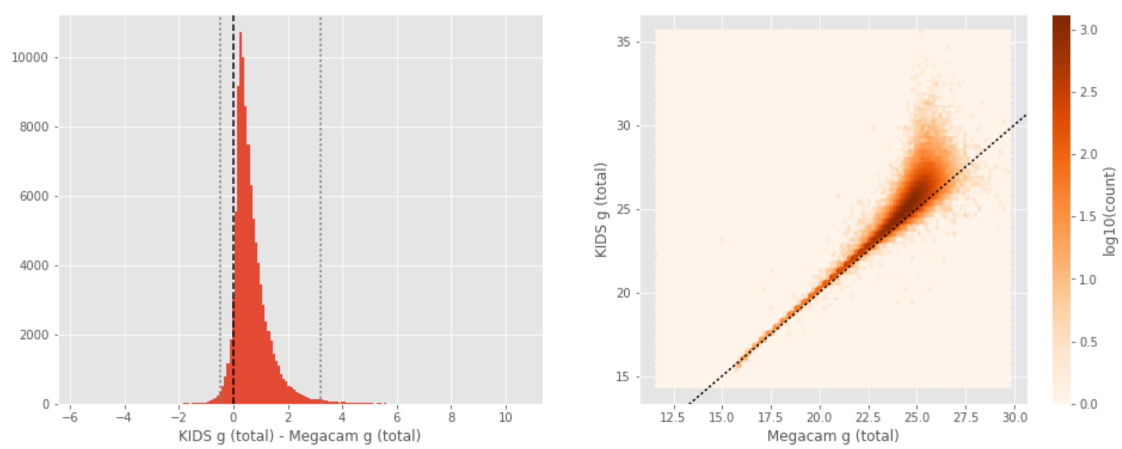


KIDS g (aperture) - Megacam g (aperture):
- Median: 0.21
- Median Absolute Deviation: 0.20
- 1% percentile: -0.8616609191894531

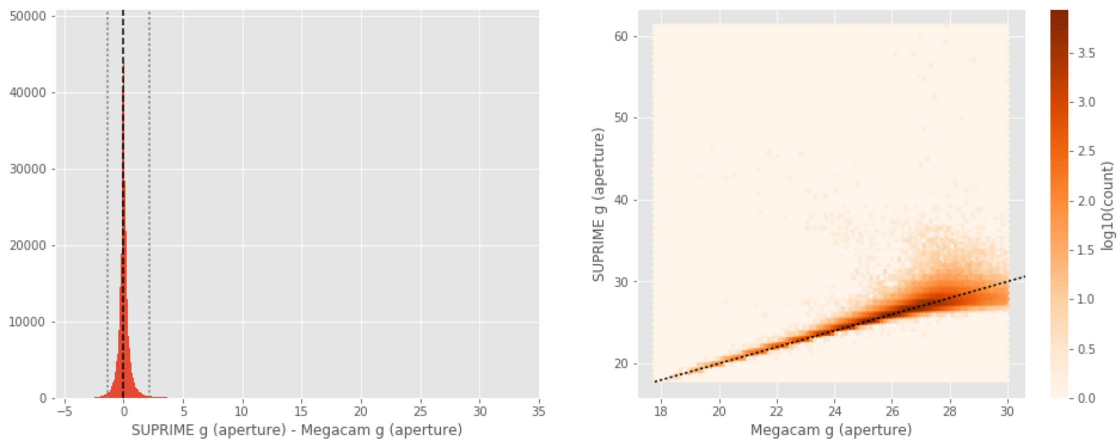
- 99% percentile: 2.0629606628417836



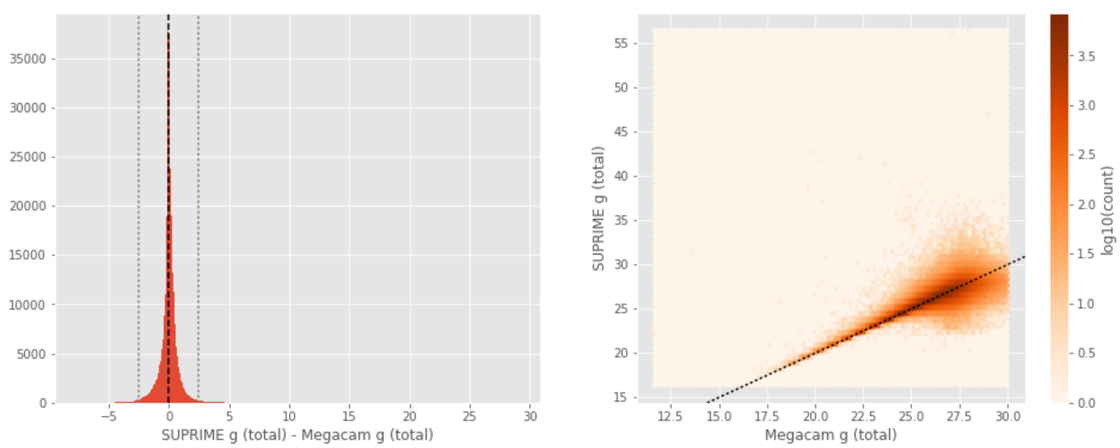
KIDS g (total) - Megacam g (total):
- Median: 0.49
- Median Absolute Deviation: 0.30
- 1% percentile: -0.48593807220458984
- 99% percentile: 3.219382667541507



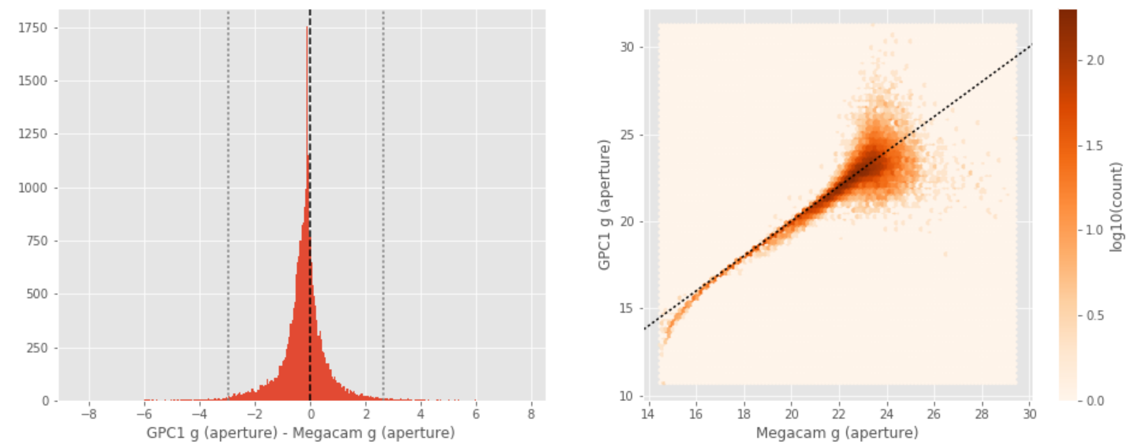
SUPRIME g (aperture) - Megacam g (aperture):
- Median: -0.00
- Median Absolute Deviation: 0.17
- 1% percentile: -1.3727685356140138
- 99% percentile: 2.1900751876831044



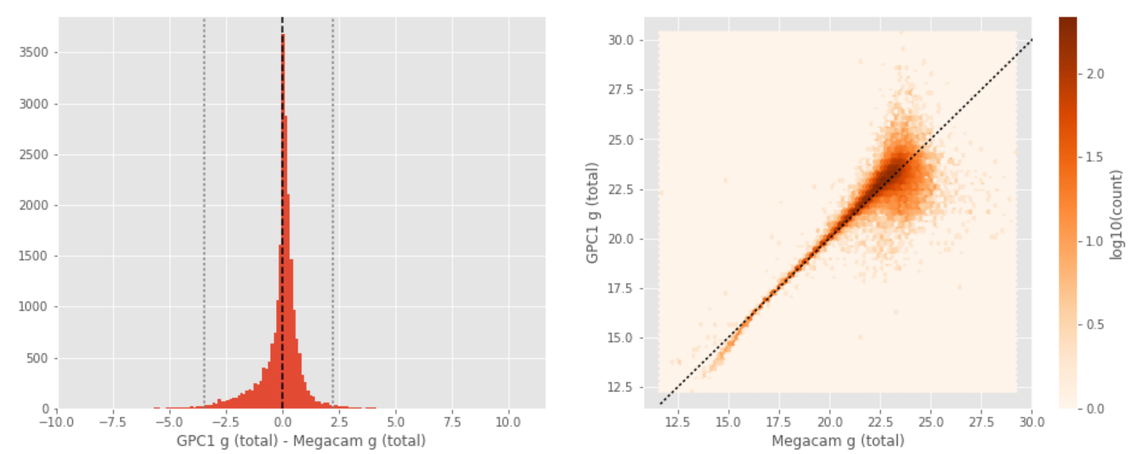
SUPRIME g (total) - Megacam g (total):
- Median: -0.01
- Median Absolute Deviation: 0.24
- 1% percentile: -2.487872428894043
- 99% percentile: 2.44462388992309



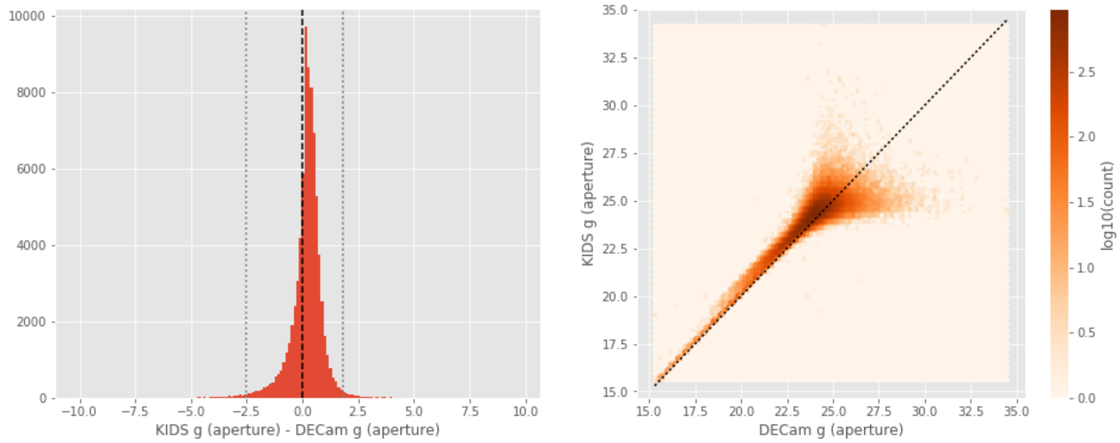
GPC1 g (aperture) - Megacam g (aperture):
- Median: -0.17
- Median Absolute Deviation: 0.32
- 1% percentile: -2.971248092651367
- 99% percentile: 2.6563667678833



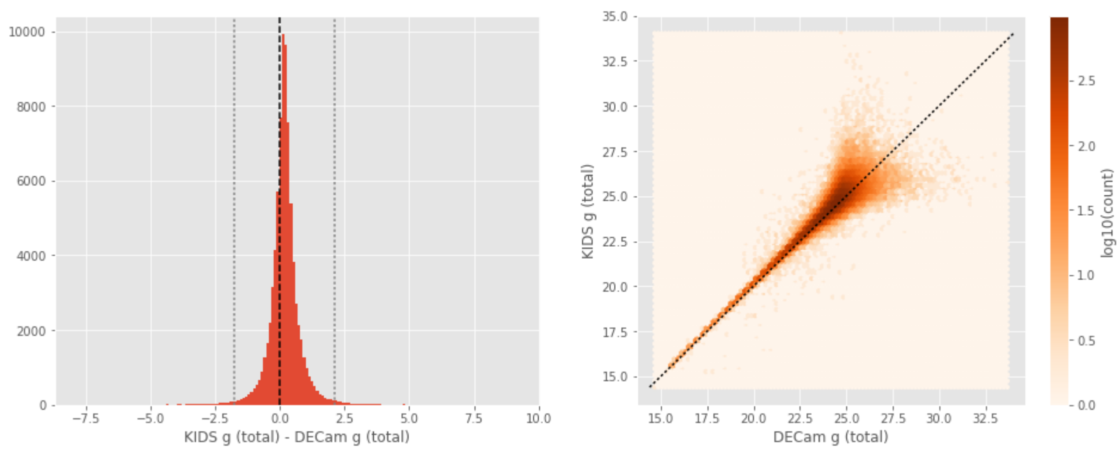
GPC1 g (total) - Megacam g (total):
- Median: 0.07
- Median Absolute Deviation: 0.28
- 1% percentile: -3.4746436309814452
- 99% percentile: 2.239927902221698



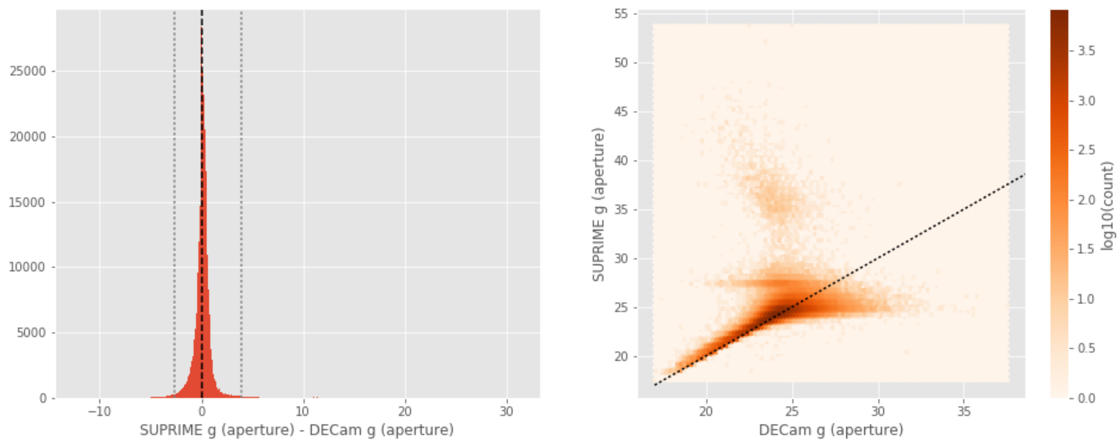
KIDS g (aperture) - DECam g (aperture):
- Median: 0.24
- Median Absolute Deviation: 0.30
- 1% percentile: -2.502174530029297
- 99% percentile: 1.829255371093745



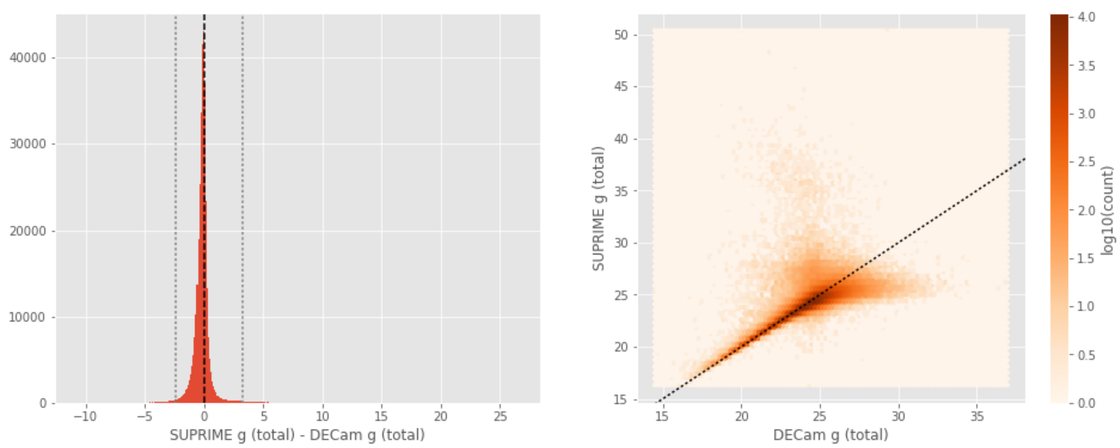
KIDS g (total) - DECam g (total):
- Median: 0.17
- Median Absolute Deviation: 0.25
- 1% percentile: -1.753904094696045
- 99% percentile: 2.109712429046628



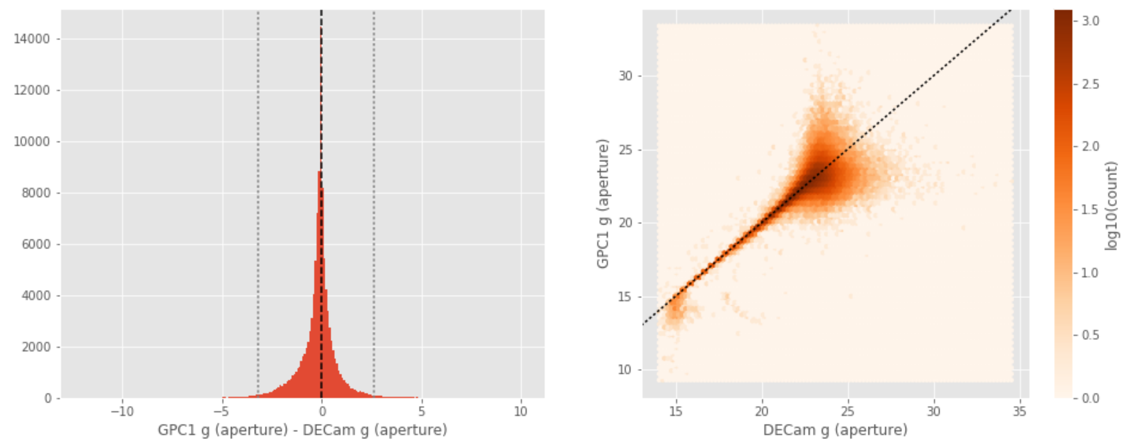
SUPRIME g (aperture) - DECam g (aperture):
- Median: 0.12
- Median Absolute Deviation: 0.31
- 1% percentile: -2.6941718292236327
- 99% percentile: 3.988408126831078



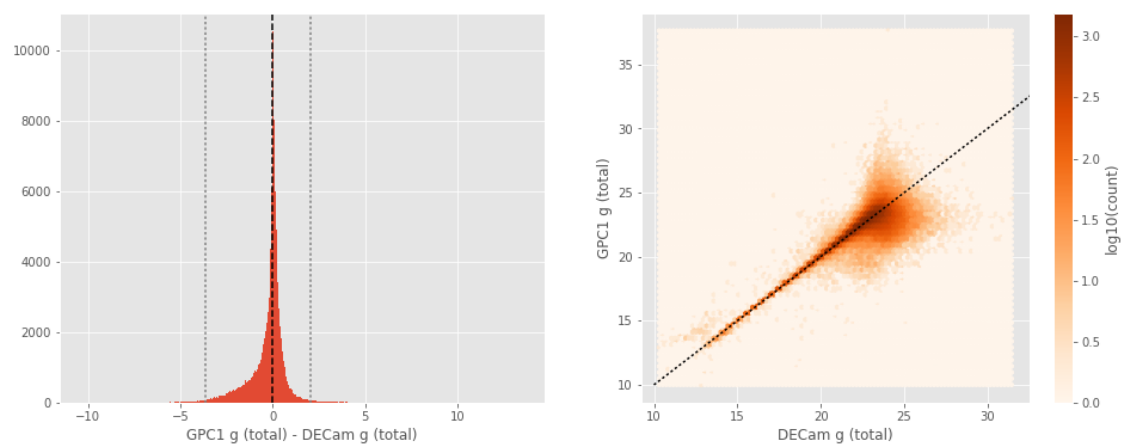
SUPRIME g (total) - DECam g (total):
- Median: -0.16
- Median Absolute Deviation: 0.23
- 1% percentile: -2.432461643218994
- 99% percentile: 3.2051278495788473



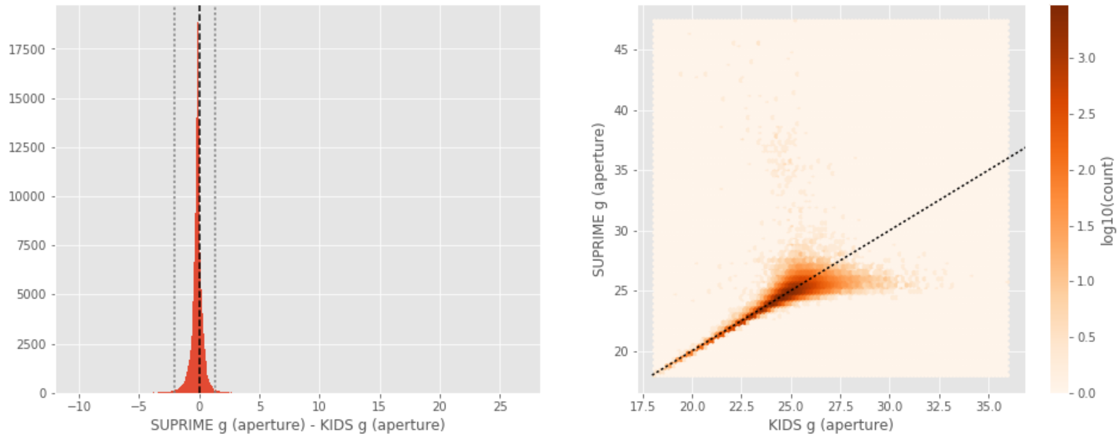
GPC1 g (aperture) - DECam g (aperture):
- Median: -0.07
- Median Absolute Deviation: 0.31
- 1% percentile: -3.1713577270507813
- 99% percentile: 2.64323902130127



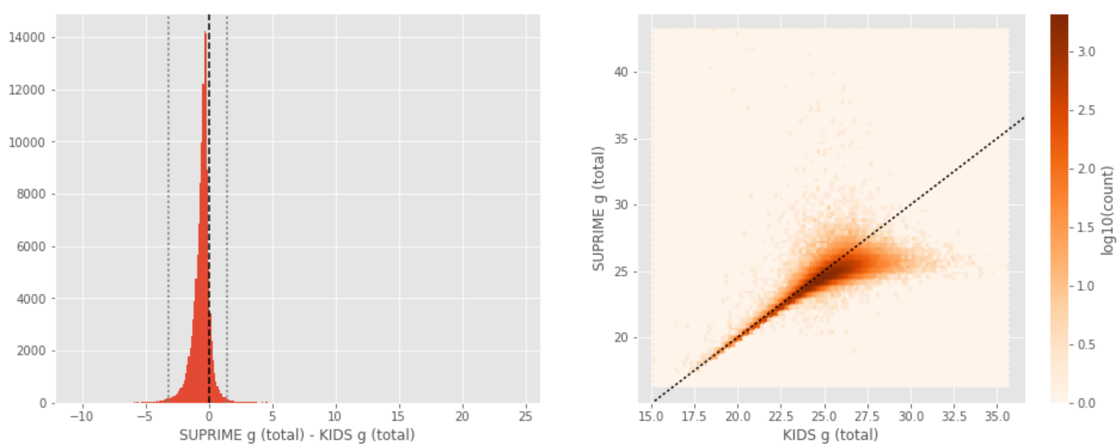
GPC1 g (total) - DECam g (total):
- Median: -0.00
- Median Absolute Deviation: 0.29
- 1% percentile: -3.62840633392334
- 99% percentile: 2.0448080062866225



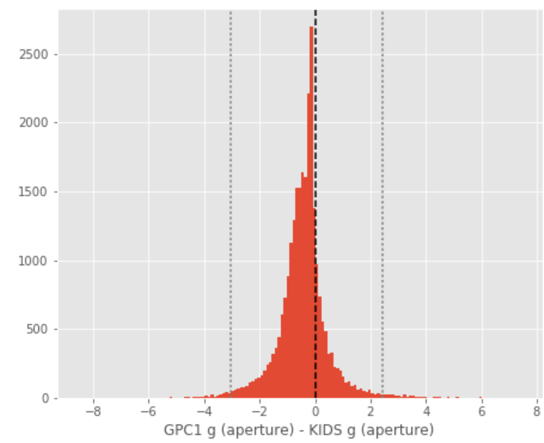
SUPRIME g (aperture) - KIDS g (aperture):
- Median: -0.13
- Median Absolute Deviation: 0.20
- 1% percentile: -2.0132504081726075
- 99% percentile: 1.312053031921387

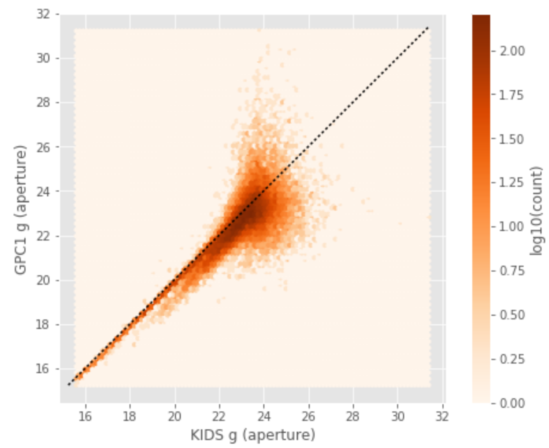


SUPRIME g (total) - KIDS g (total):
- Median: -0.44
- Median Absolute Deviation: 0.31
- 1% percentile: -3.1919830322265628
- 99% percentile: 1.440004119873048

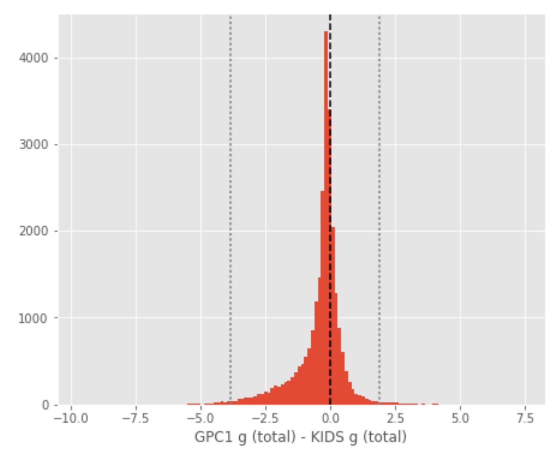


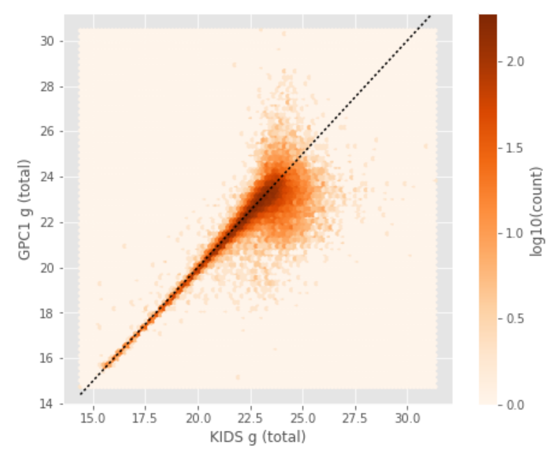
GPC1 g (aperture) - KIDS g (aperture):
- Median: -0.38
- Median Absolute Deviation: 0.38
- 1% percentile: -3.0642630577087404
- 99% percentile: 2.4360705947875974



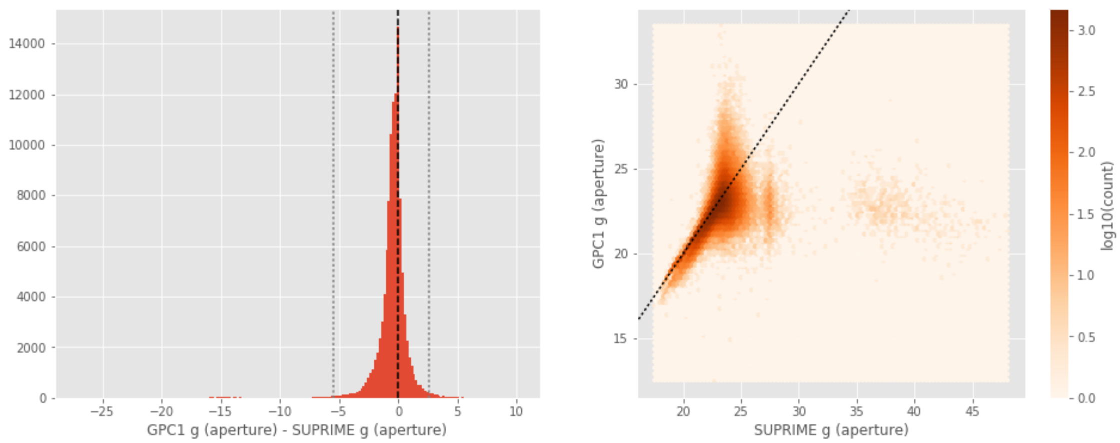


GPC1 g (total) - KIDS g (total):
- Median: -0.18
- Median Absolute Deviation: 0.29
- 1% percentile: -3.8469621086120607
- 99% percentile: 1.8934726333618062

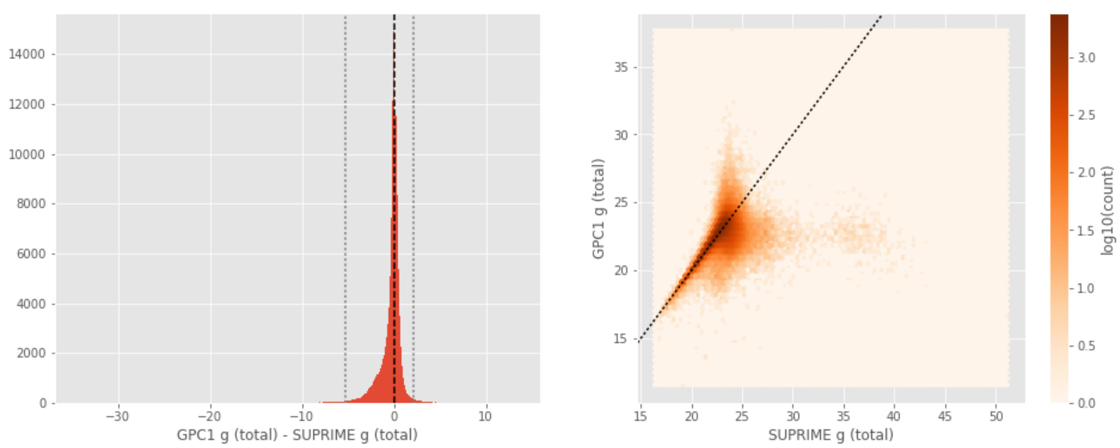




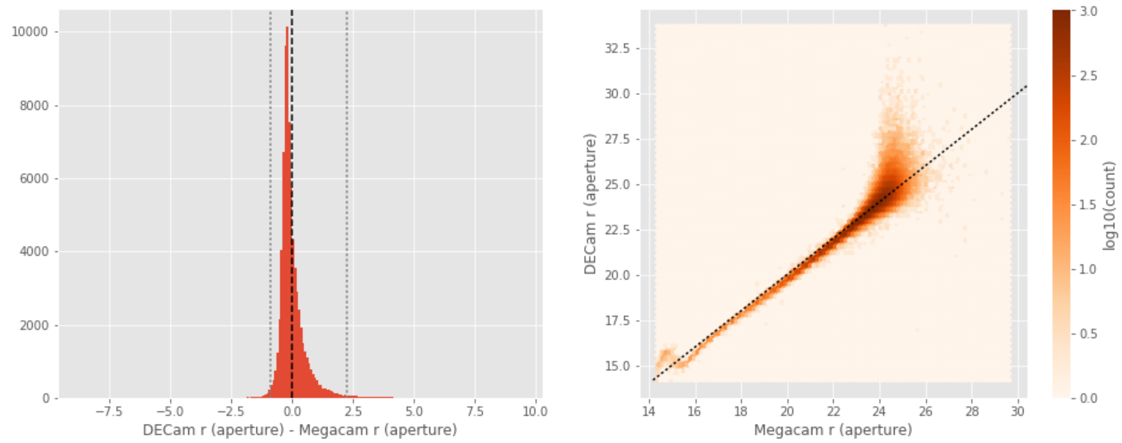
GPC1 g (aperture) - SUPRIME g (aperture):
- Median: -0.32
- Median Absolute Deviation: 0.44
- 1% percentile: -5.444828033447266
- 99% percentile: 2.6096390151977586



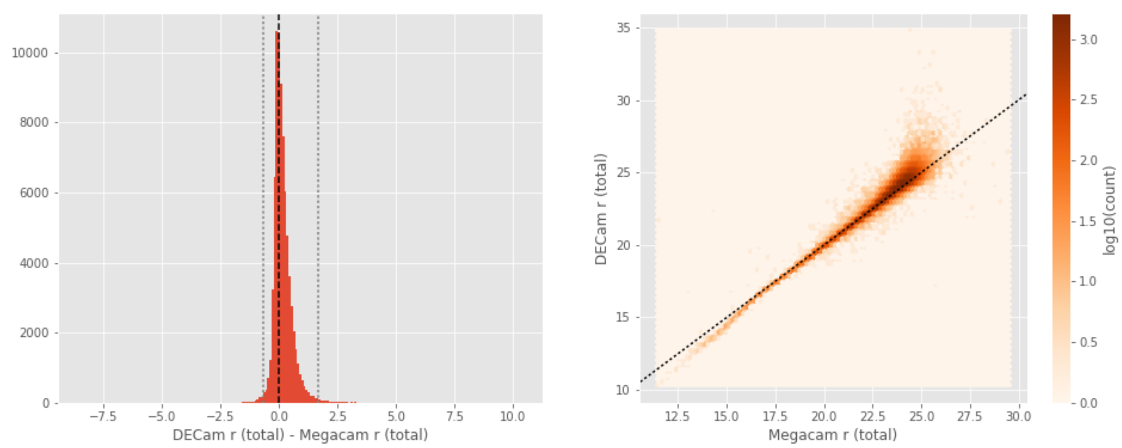
GPC1 g (total) - SUPRIME g (total):
- Median: -0.04
- Median Absolute Deviation: 0.36
- 1% percentile: -5.233756103515626
- 99% percentile: 2.1164352226257295



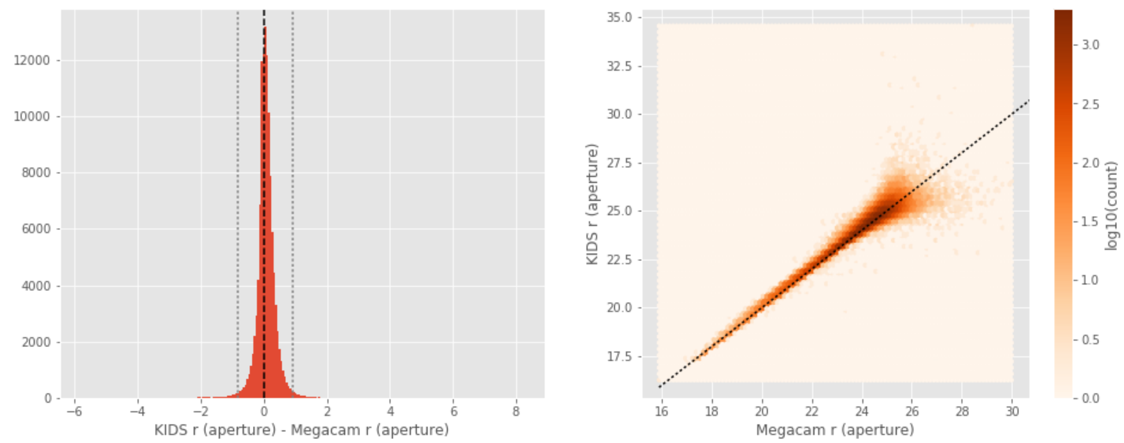
DECam r (aperture) - Megacam r (aperture):
- Median: -0.13
- Median Absolute Deviation: 0.20
- 1% percentile: -0.8681503295898437
- 99% percentile: 2.269659233093262



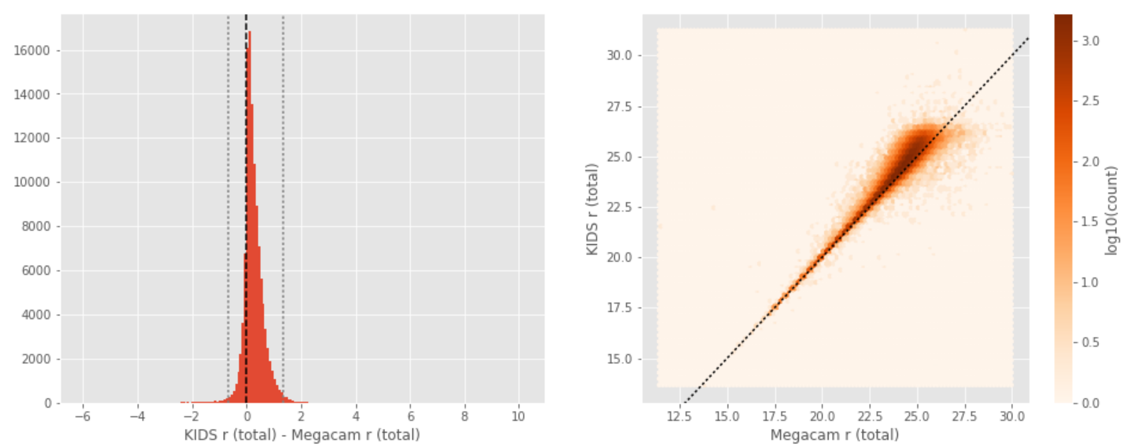
DECam r (total) - Megacam r (total):
- Median: 0.09
- Median Absolute Deviation: 0.19
- 1% percentile: -0.6512541961669922
- 99% percentile: 1.6617598724365095



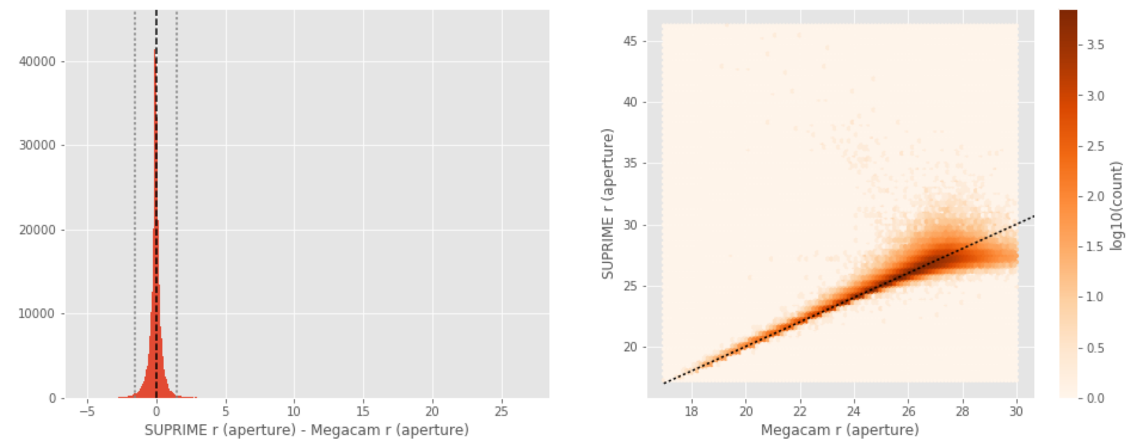
KIDS r (aperture) - Megacam r (aperture):
- Median: 0.07
- Median Absolute Deviation: 0.14
- 1% percentile: -0.8357596588134766
- 99% percentile: 0.920283718109131



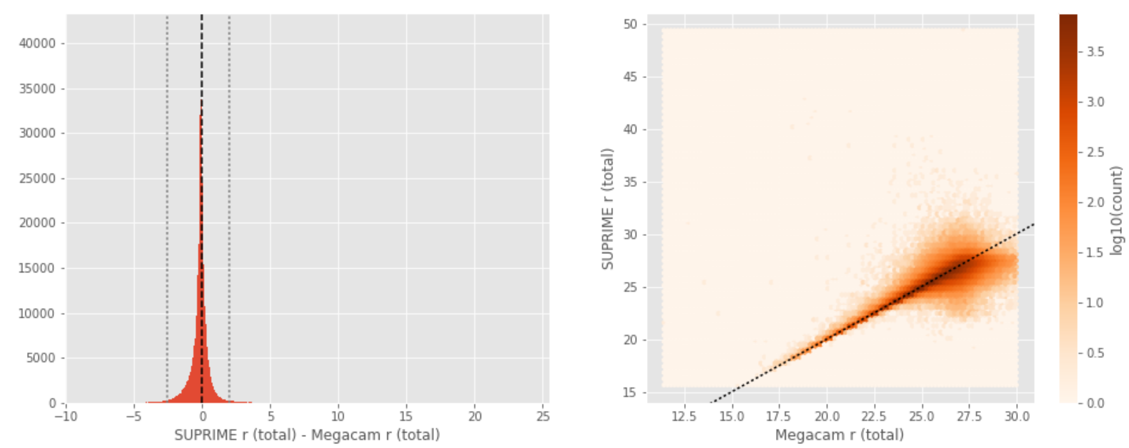
KIDS r (total) - Megacam r (total):
- Median: 0.20
- Median Absolute Deviation: 0.17
- 1% percentile: -0.6918363189697266
- 99% percentile: 1.3556387138366697



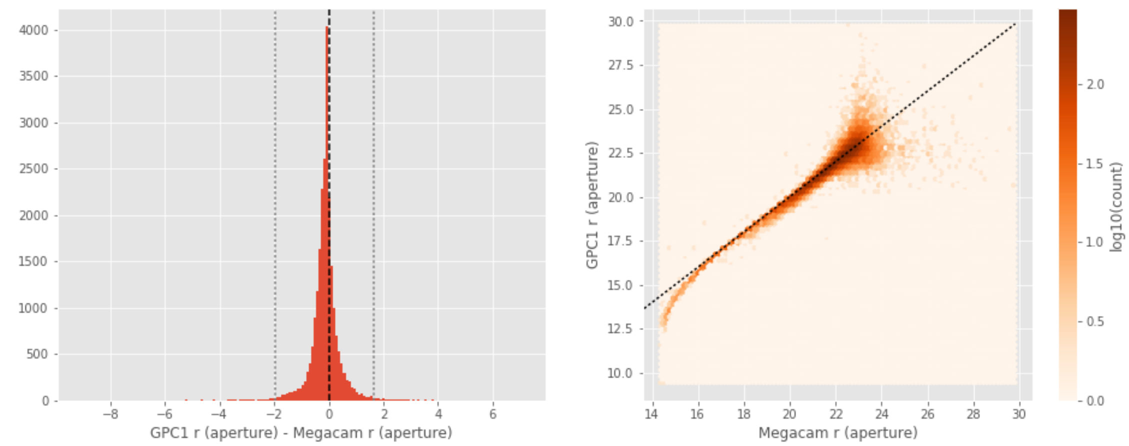
SUPRIME r (aperture) - Megacam r (aperture):
- Median: -0.04
- Median Absolute Deviation: 0.17
- 1% percentile: -1.5472402572631836
- 99% percentile: 1.5144849014282227



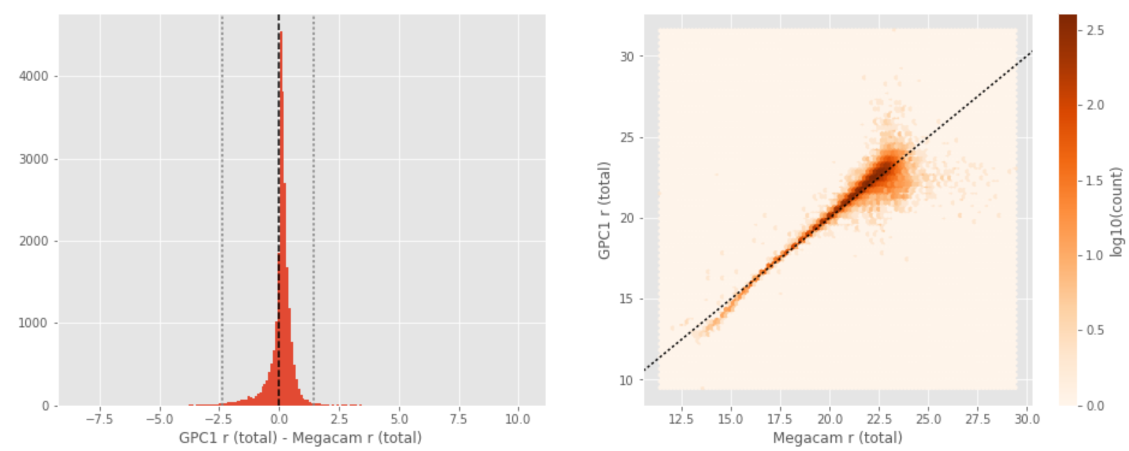
SUPRIME r (total) - Megacam r (total):
- Median: -0.11
- Median Absolute Deviation: 0.22
- 1% percentile: -2.5586280822753906
- 99% percentile: 1.996949577331535



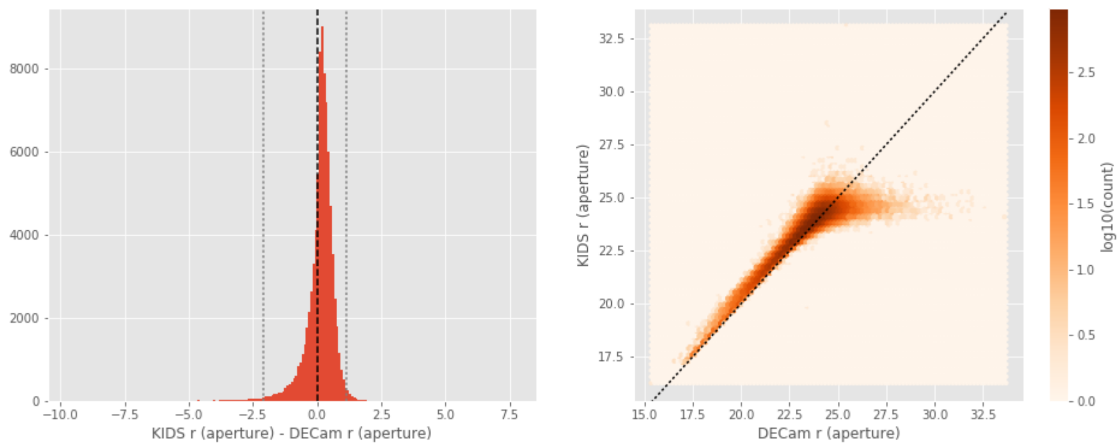
GPC1 r (aperture) - Megacam r (aperture):
- Median: -0.10
- Median Absolute Deviation: 0.19
- 1% percentile: -1.9410191535949708
- 99% percentile: 1.6266898155212433



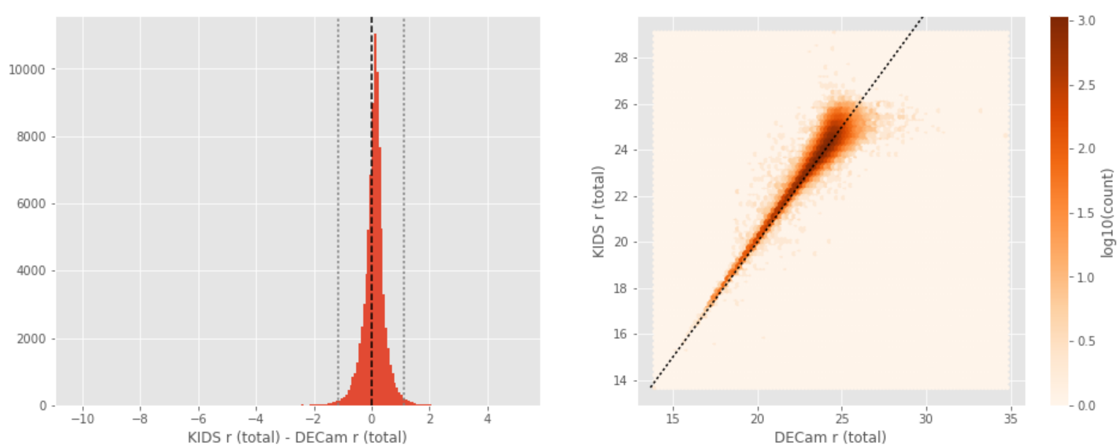
GPC1 r (total) - Megacam r (total):
- Median: 0.12
- Median Absolute Deviation: 0.15
- 1% percentile: -2.388612747192383
- 99% percentile: 1.45269229888916



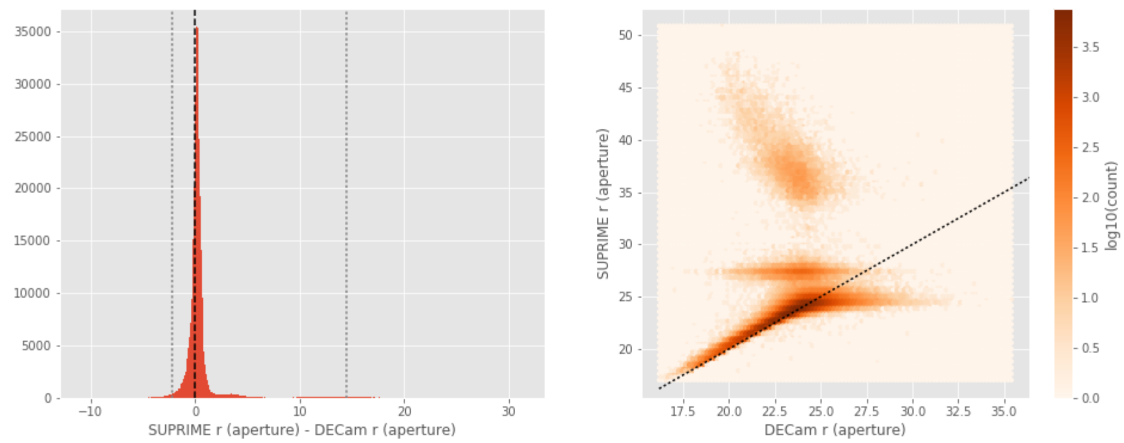
KIDS r (aperture) - DECam r (aperture):
- Median: 0.19
- Median Absolute Deviation: 0.24
- 1% percentile: -2.0812751770019533
- 99% percentile: 1.1308261871337906



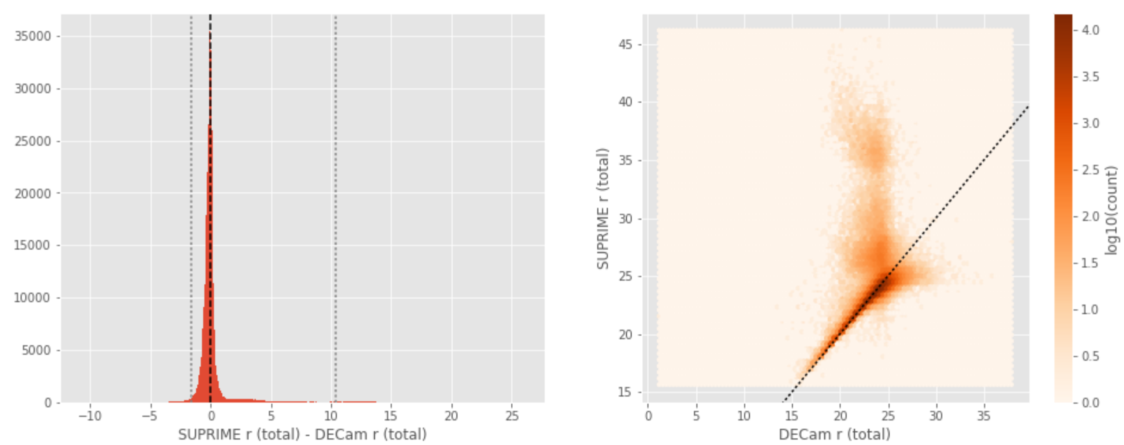
KIDS r (total) - DECam r (total):
- Median: 0.11
- Median Absolute Deviation: 0.18
- 1% percentile: -1.138597011566162
- 99% percentile: 1.1307144165039062



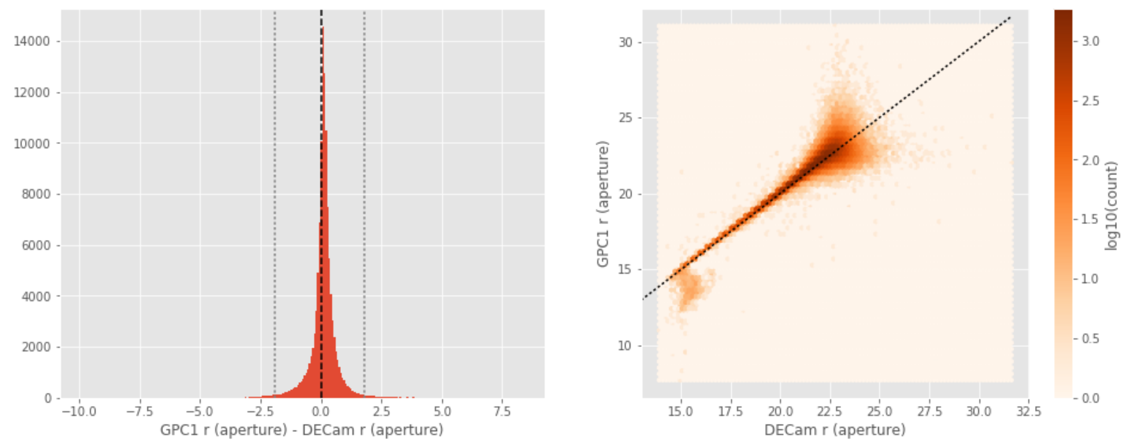
SUPRIME r (aperture) - DECam r (aperture):
- Median: 0.18
- Median Absolute Deviation: 0.27
- 1% percentile: -2.1634254455566406
- 99% percentile: 14.466812896728527



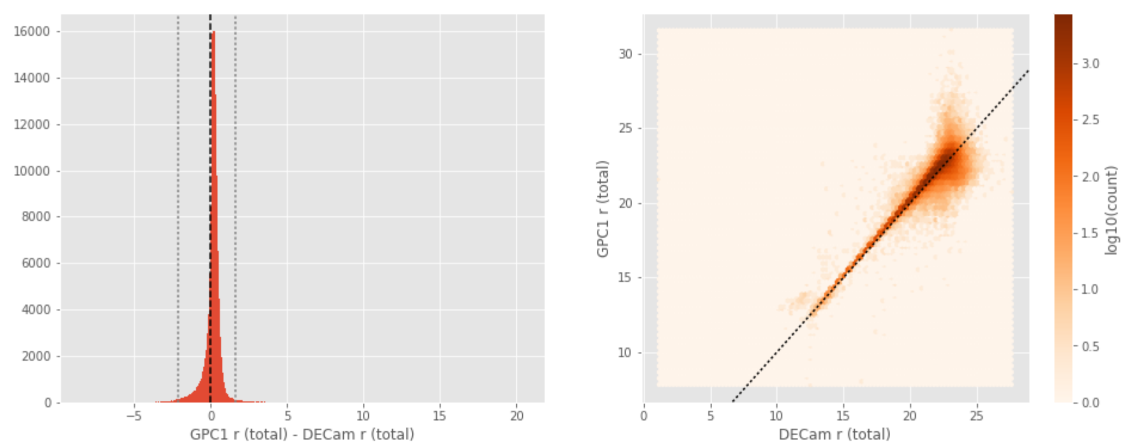
SUPRIME r (total) - DECam r (total):
- Median: -0.07
- Median Absolute Deviation: 0.21
- 1% percentile: -1.6294122505187987
- 99% percentile: 10.362137470245345



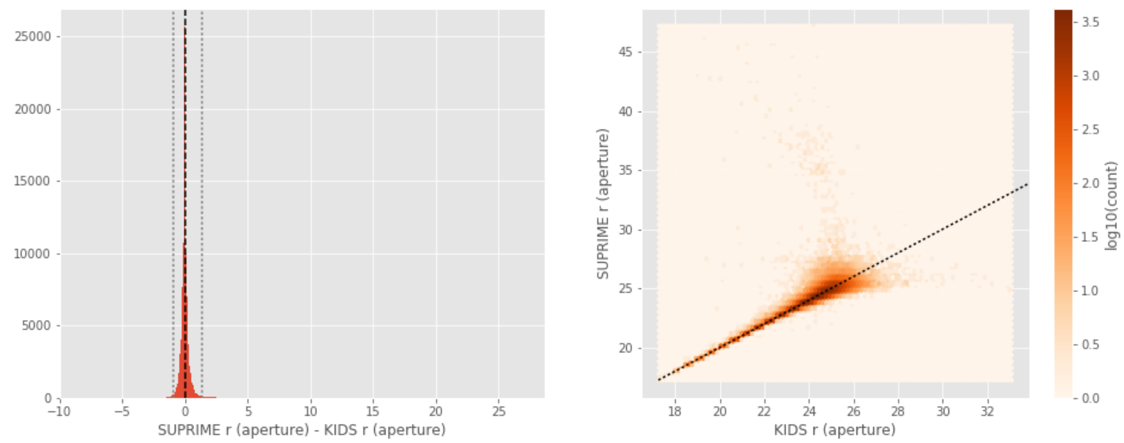
GPC1 r (aperture) - DECam r (aperture):
- Median: 0.11
- Median Absolute Deviation: 0.18
- 1% percentile: -1.9238129806518556
- 99% percentile: 1.8205731201171866



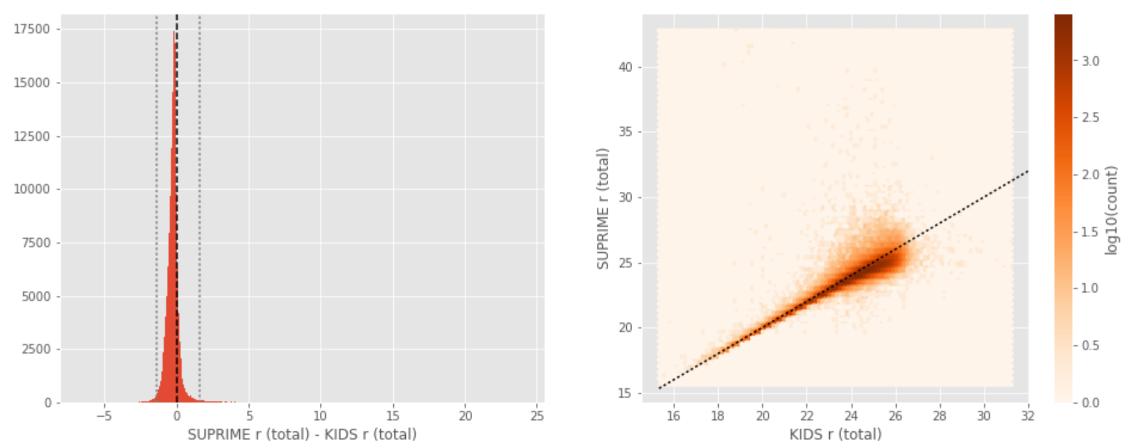
GPC1 r (total) - DECam r (total):
- Median: 0.19
- Median Absolute Deviation: 0.17
- 1% percentile: -2.1555244445800783
- 99% percentile: 1.6214006423950202



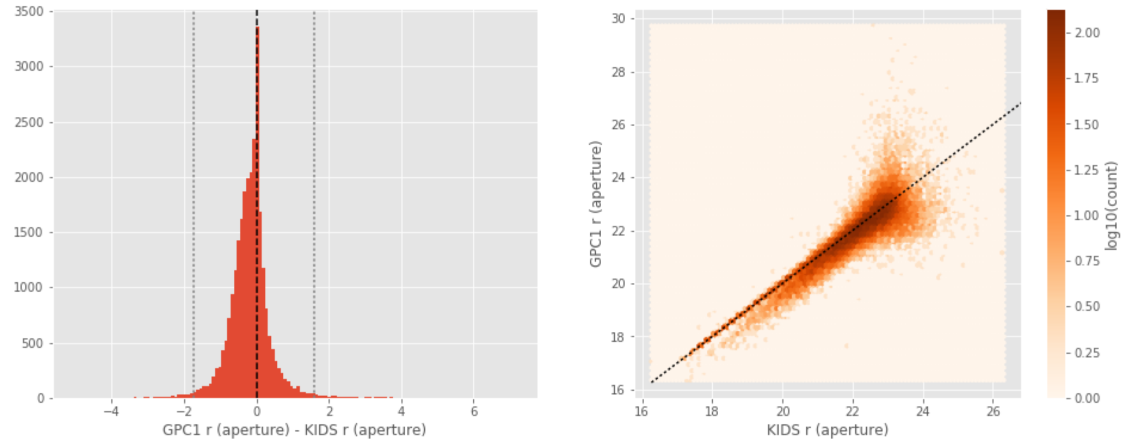
SUPRIME r (aperture) - KIDS r (aperture):
- Median: -0.04
- Median Absolute Deviation: 0.12
- 1% percentile: -0.8950873947143554
- 99% percentile: 1.3212809181213354



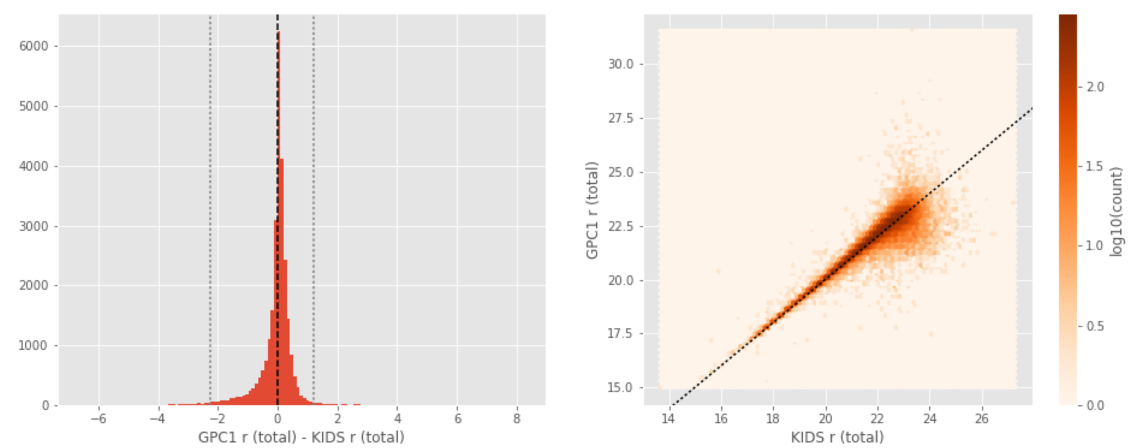
SUPRIME r (total) - KIDS r (total):
- Median: -0.25
- Median Absolute Deviation: 0.19
- 1% percentile: -1.4168214416503906
- 99% percentile: 1.6143164825439458



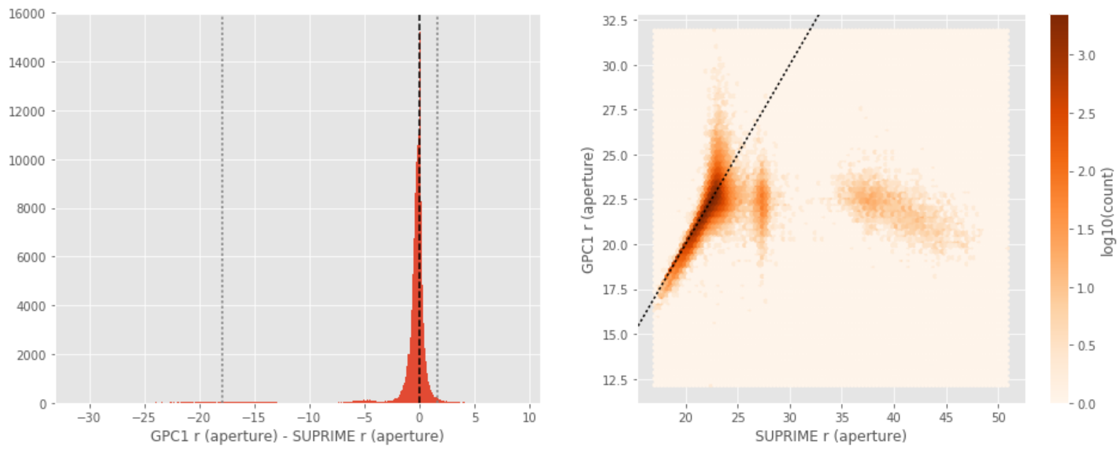
GPC1 r (aperture) - KIDS r (aperture):
- Median: -0.15
- Median Absolute Deviation: 0.26
- 1% percentile: -1.7364138793945312
- 99% percentile: 1.6038119888305666



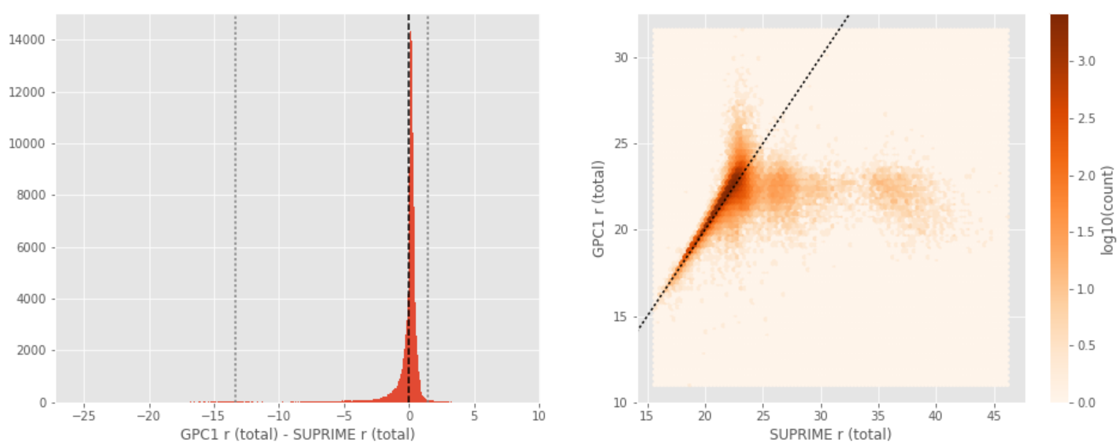
GPC1 r (total) - KIDS r (total):
- Median: 0.05
- Median Absolute Deviation: 0.16
- 1% percentile: -2.239205780029297
- 99% percentile: 1.2124087905883782



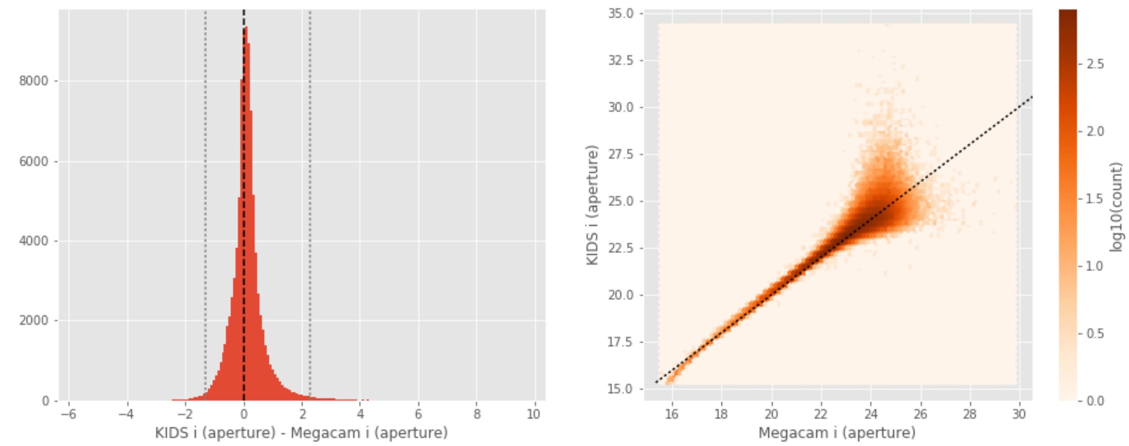
GPC1 r (aperture) - SUPRIME r (aperture):
- Median: -0.18
- Median Absolute Deviation: 0.29
- 1% percentile: -17.90644989013672
- 99% percentile: 1.6656947135925286



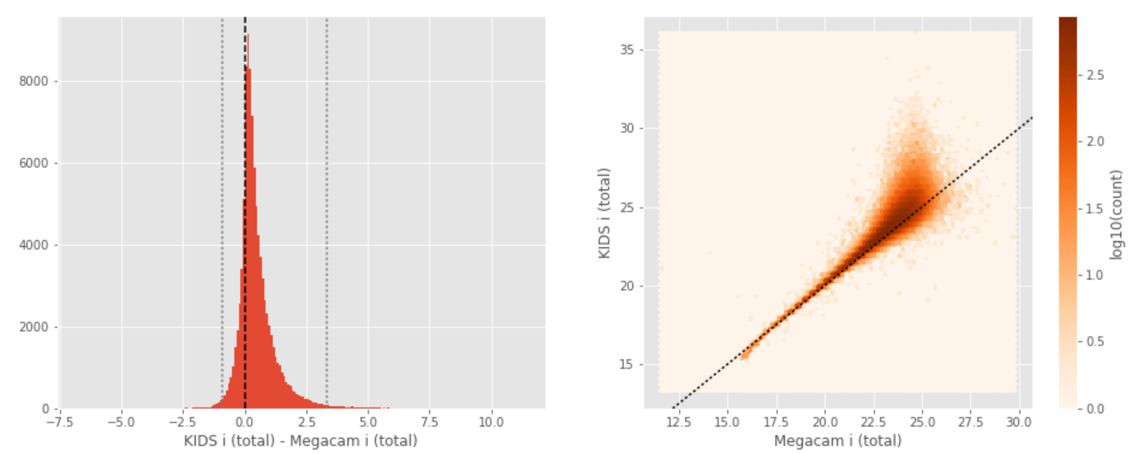
GPC1 r (total) - SUPRIME r (total):
- Median: 0.14
- Median Absolute Deviation: 0.20
- 1% percentile: -13.332757339477554
- 99% percentile: 1.4203444671630852



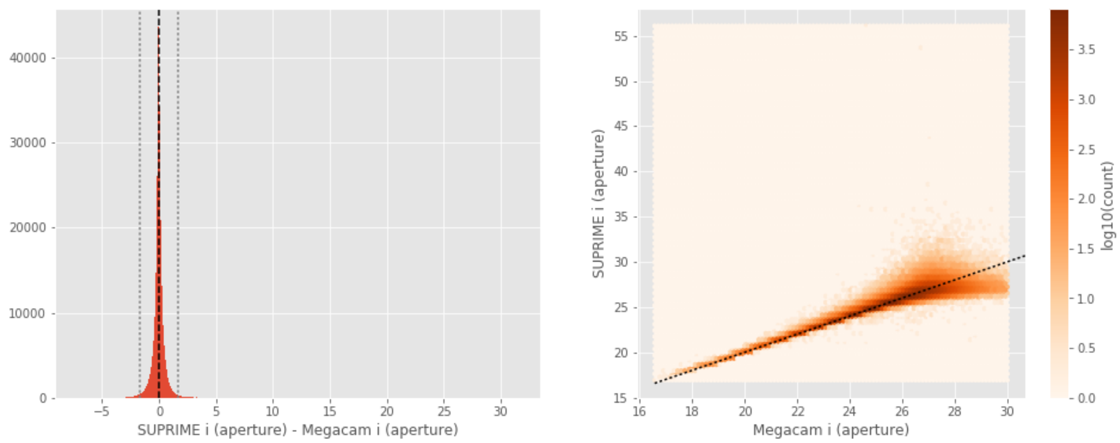
KIDS i (aperture) - Megacam i (aperture):
- Median: 0.10
- Median Absolute Deviation: 0.23
- 1% percentile: -1.2901405334472655
- 99% percentile: 2.2804393005371058



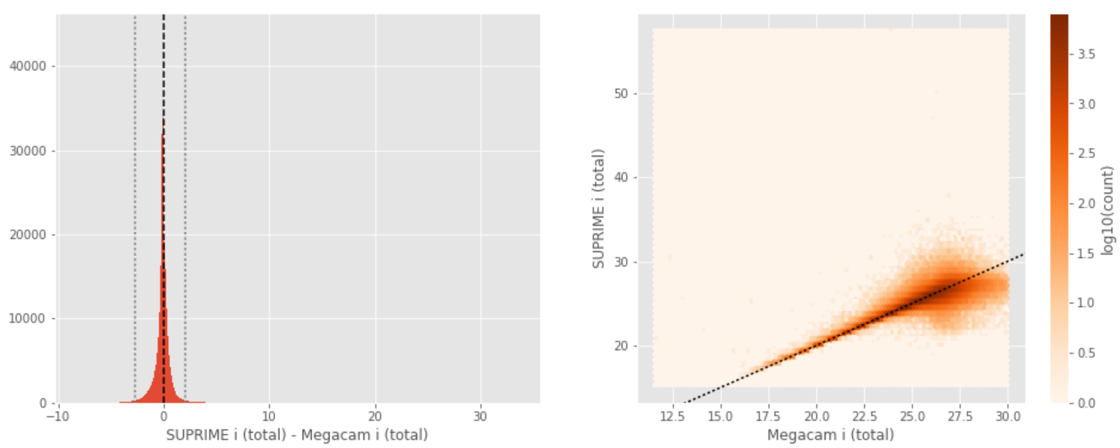
KIDS i (total) - Megacam i (total):
- Median: 0.30
- Median Absolute Deviation: 0.30
- 1% percentile: -0.8911037445068358
- 99% percentile: 3.329991149902342



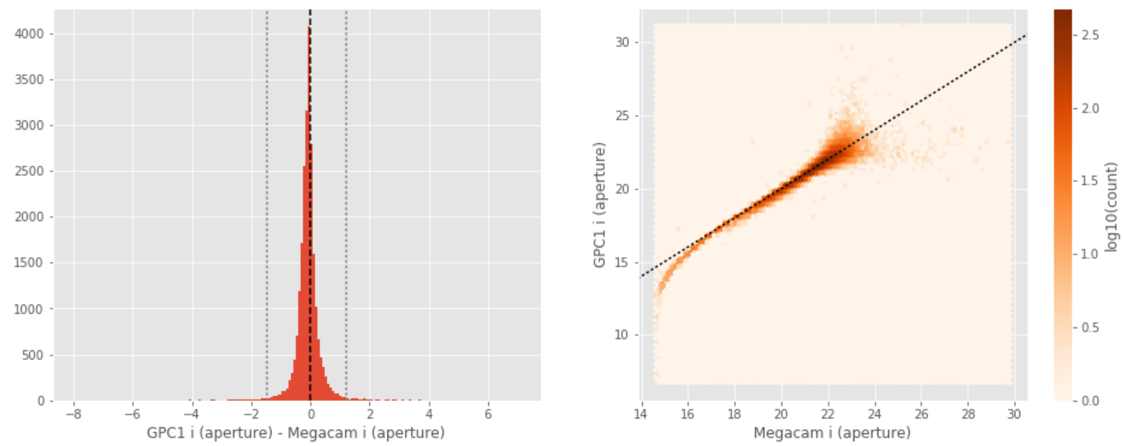
SUPRIME i (aperture) - Megacam i (aperture):
- Median: -0.02
- Median Absolute Deviation: 0.18
- 1% percentile: -1.6956094360351561
- 99% percentile: 1.6799184417724655



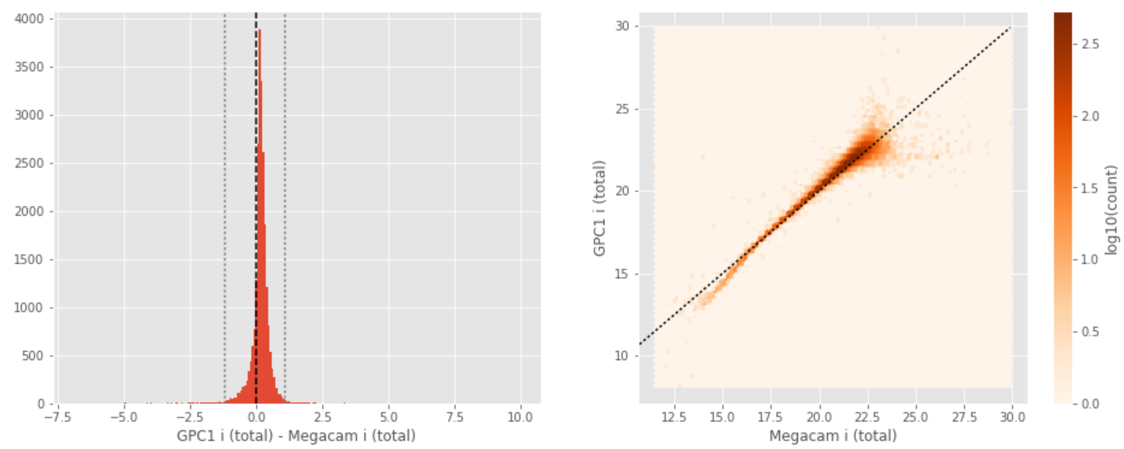
SUPRIME i (total) - Megacam i (total):
- Median: -0.08
- Median Absolute Deviation: 0.24
- 1% percentile: -2.6978379821777345
- 99% percentile: 2.0625018310546874



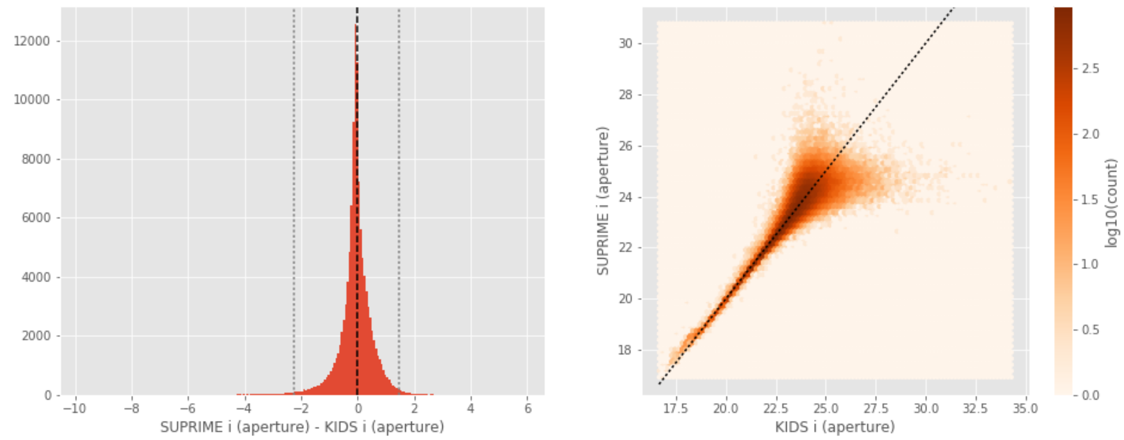
GPC1 i (aperture) - Megacam i (aperture):
- Median: -0.09
- Median Absolute Deviation: 0.15
- 1% percentile: -1.4649522781372069
- 99% percentile: 1.2202685546875007



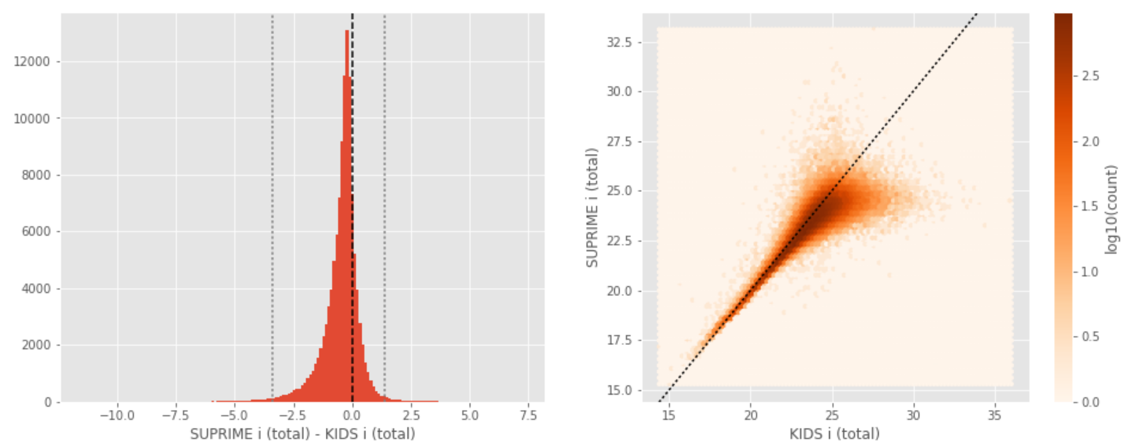
GPC1 i (total) - Megacam i (total):
- Median: 0.16
- Median Absolute Deviation: 0.12
- 1% percentile: -1.2191693878173828
- 99% percentile: 1.069381637573249



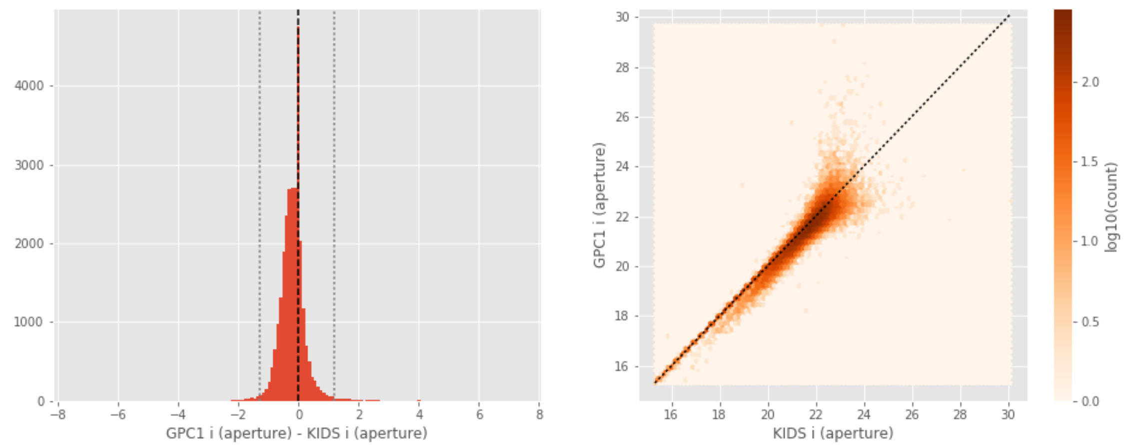
SUPRIME i (aperture) - KIDS i (aperture):
- Median: -0.06
- Median Absolute Deviation: 0.23
- 1% percentile: -2.2342630004882813
- 99% percentile: 1.456025543212891



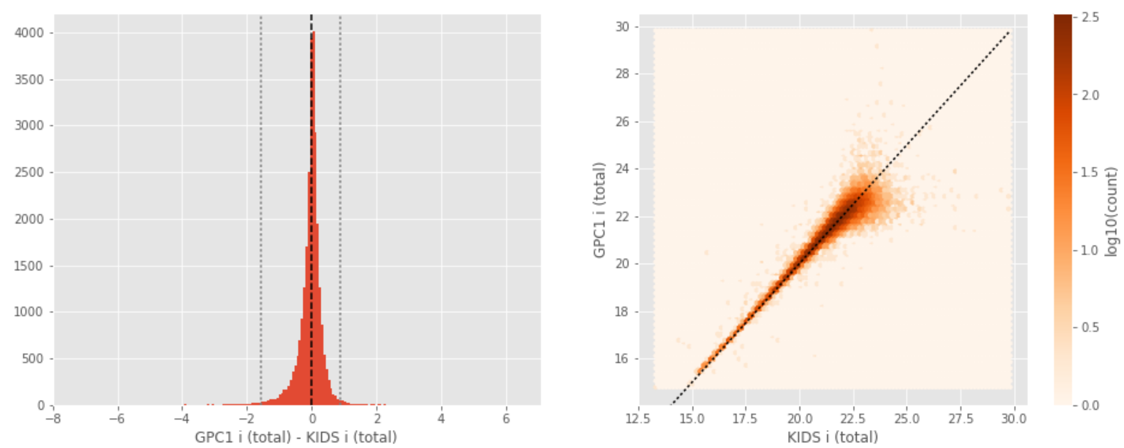
SUPRIME i (total) - KIDS i (total):
- Median: -0.33
- Median Absolute Deviation: 0.33
- 1% percentile: -3.3811874389648438
- 99% percentile: 1.3634872436523438



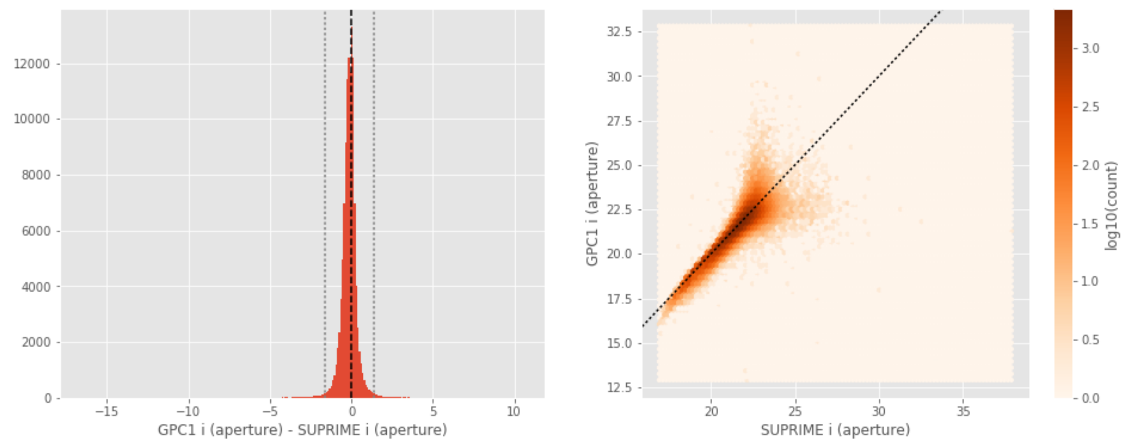
GPC1 i (aperture) - KIDS i (aperture):
- Median: -0.17
- Median Absolute Deviation: 0.20
- 1% percentile: -1.3024194717407227
- 99% percentile: 1.1682369232177683



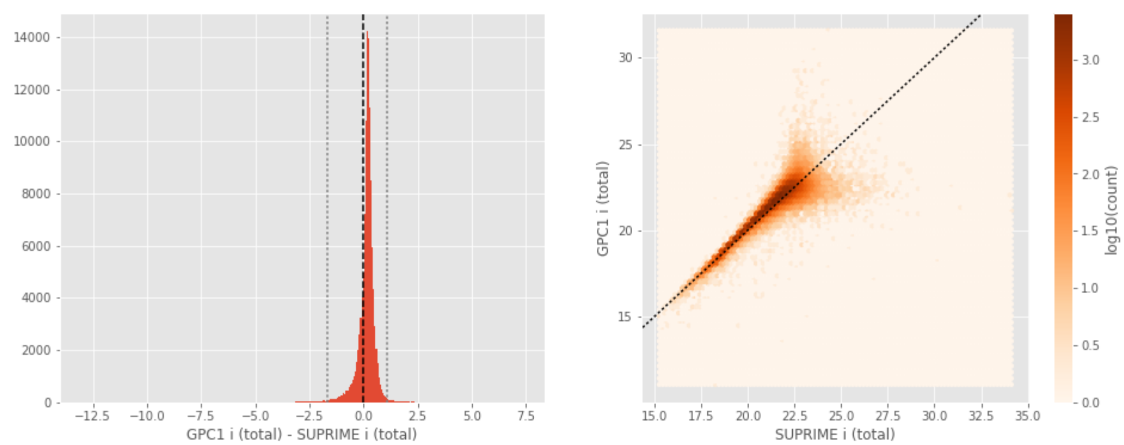
GPC1 i (total) - KIDS i (total):
- Median: 0.01
- Median Absolute Deviation: 0.14
- 1% percentile: -1.5711121368408203
- 99% percentile: 0.8988835525512694



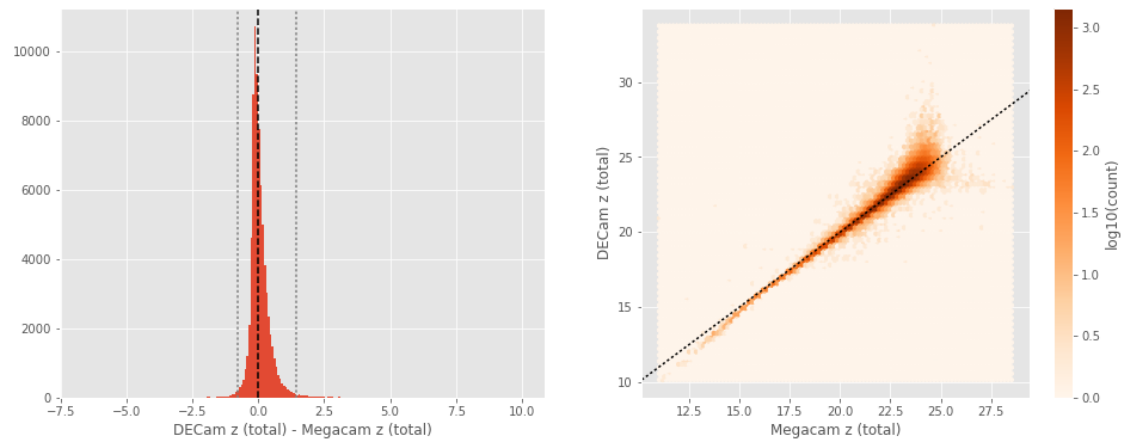
GPC1 i (aperture) - SUPRIME i (aperture):
- Median: -0.12
- Median Absolute Deviation: 0.23
- 1% percentile: -1.646259536743164
- 99% percentile: 1.3540364074707063



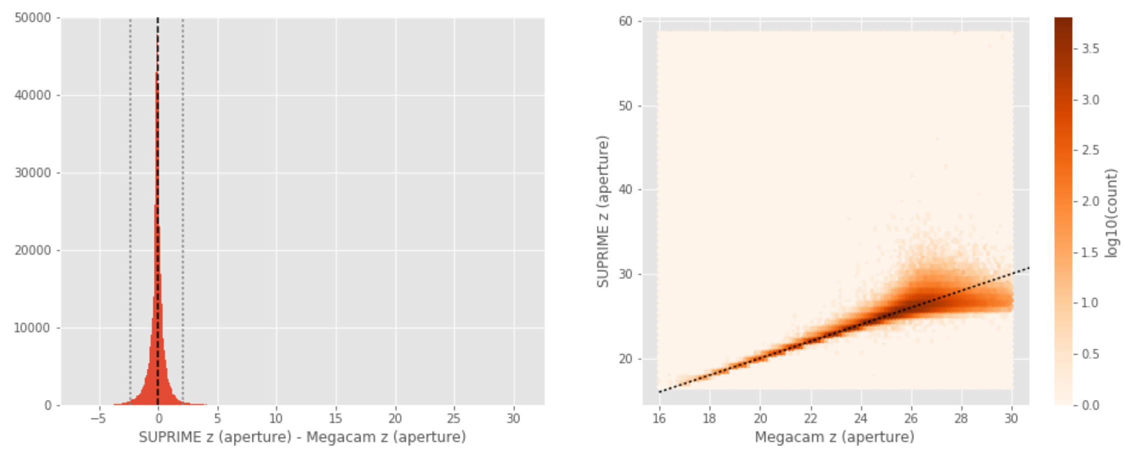
GPC1 i (total) - SUPRIME i (total):
- Median: 0.18
- Median Absolute Deviation: 0.15
- 1% percentile: -1.6534666633605957
- 99% percentile: 1.0704294586181642



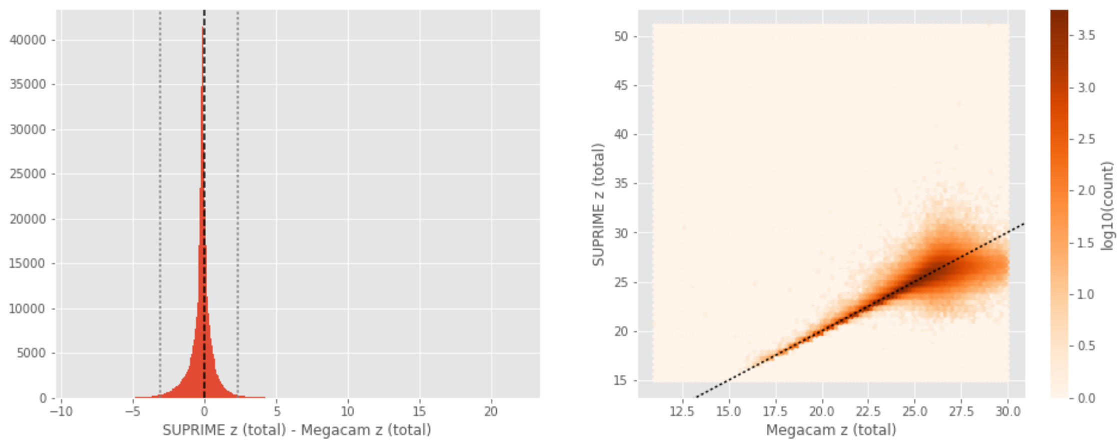
No sources have both Megacam z (aperture) and DECam z (aperture) values.
DECam z (total) - Megacam z (total):
- Median: -0.02
- Median Absolute Deviation: 0.16
- 1% percentile: -0.8012932777404785
- 99% percentile: 1.4513275146484492



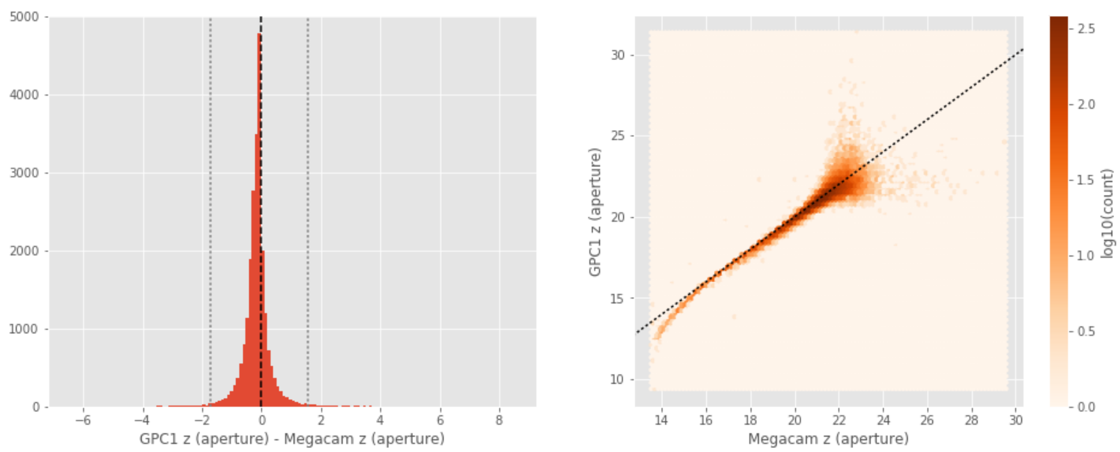
SUPRIME z (aperture) - Megacam z (aperture):
- Median: -0.07
- Median Absolute Deviation: 0.23
- 1% percentile: -2.3648147583007812
- 99% percentile: 2.137202262878418



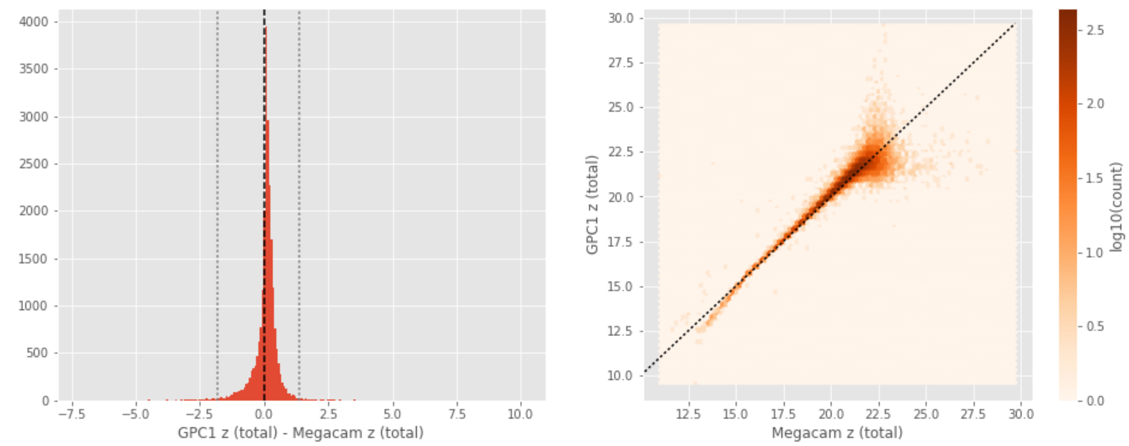
SUPRIME z (total) - Megacam z (total):
- Median: -0.14
- Median Absolute Deviation: 0.28
- 1% percentile: -3.0843325233459473
- 99% percentile: 2.309737834930417



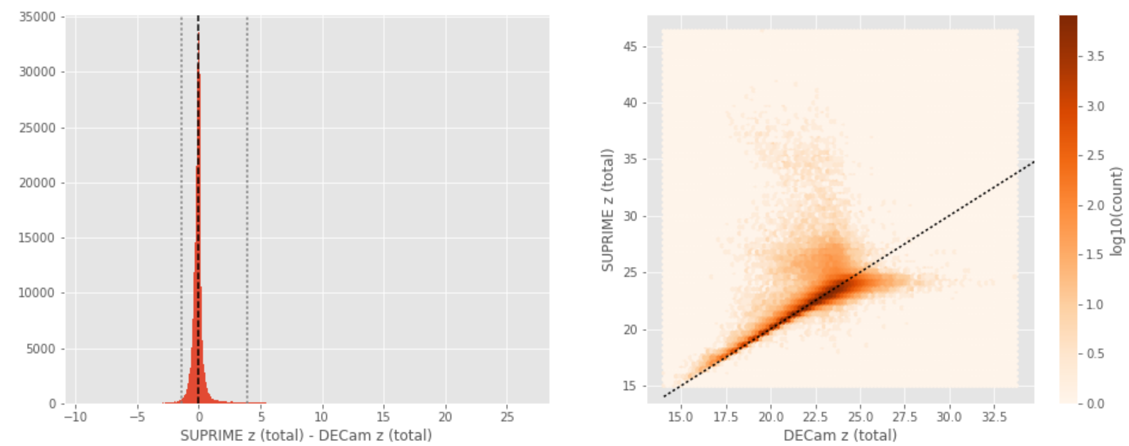
GPC1 z (aperture) - Megacam z (aperture):
- Median: -0.14
- Median Absolute Deviation: 0.17
- 1% percentile: -1.7039887619018554
- 99% percentile: 1.5755089950561514



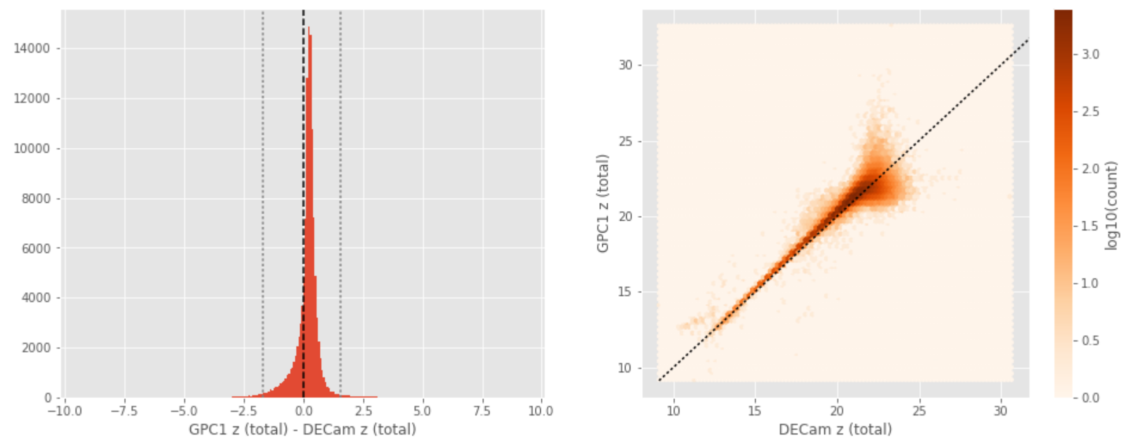
GPC1 z (total) - Megacam z (total):
- Median: 0.10
- Median Absolute Deviation: 0.15
- 1% percentile: -1.8154647827148436
- 99% percentile: 1.3765792083740254



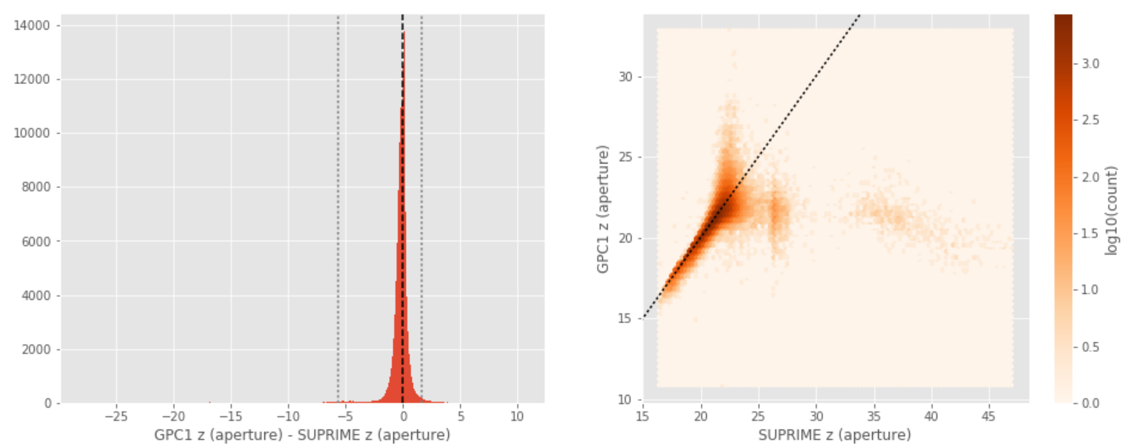
No sources have both DECam z (aperture) and SUPRIME z (aperture) values.
SUPRIME z (total) - DECam z (total):
- Median: -0.06
- Median Absolute Deviation: 0.17
- 1% percentile: -1.4441093444824218
- 99% percentile: 3.9348754501342404



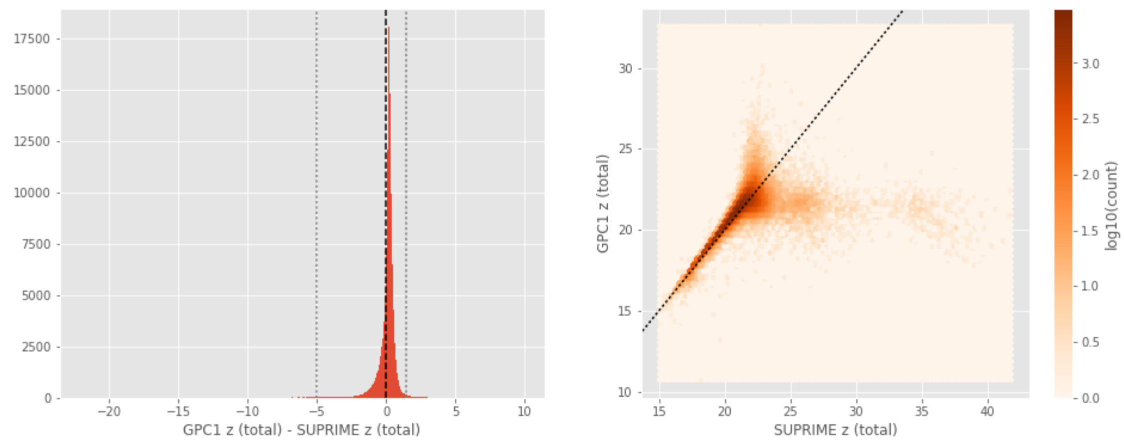
No sources have both DECam z (aperture) and GPC1 z (aperture) values.
GPC1 z (total) - DECam z (total):
- Median: 0.23
- Median Absolute Deviation: 0.16
- 1% percentile: -1.7236251831054688
- 99% percentile: 1.5656242370605469



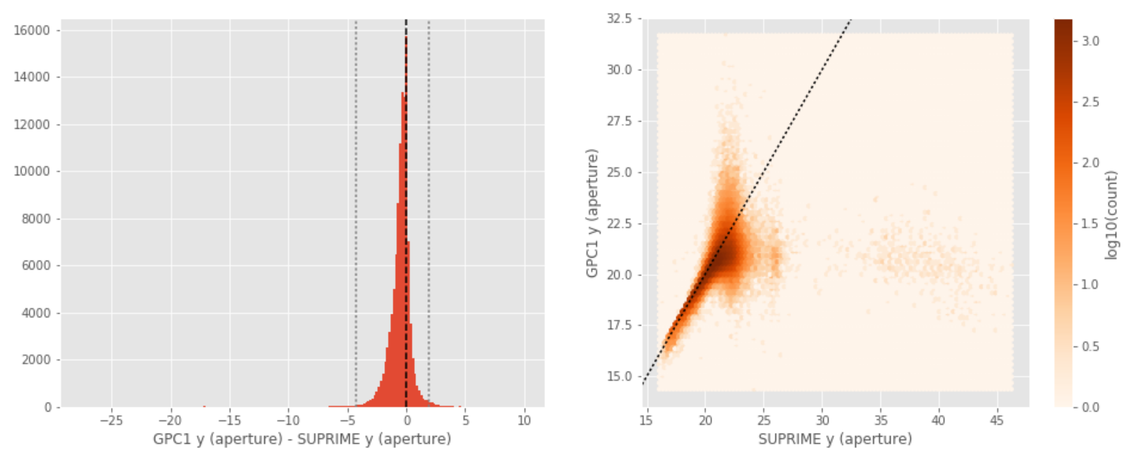
GPC1 z (aperture) - SUPRIME z (aperture):
- Median: -0.13
- Median Absolute Deviation: 0.26
- 1% percentile: -5.637487907409668
- 99% percentile: 1.6668732452392658



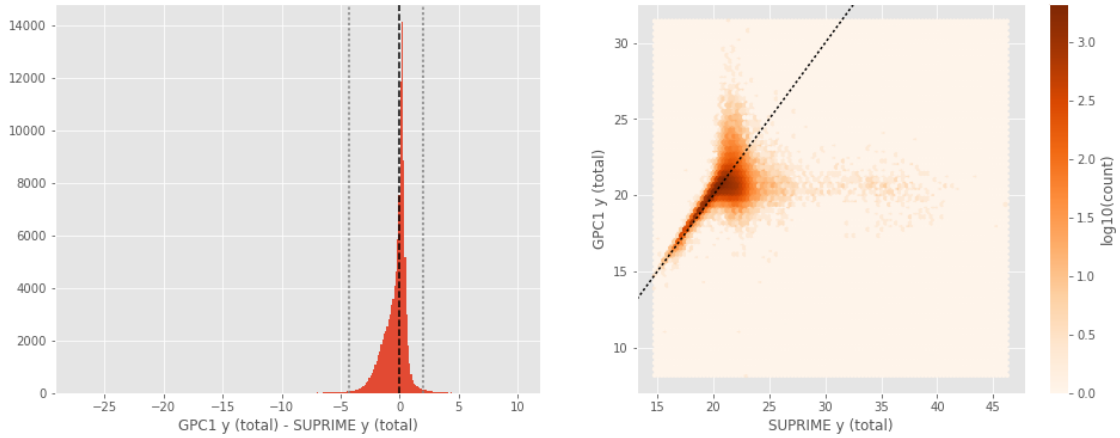
GPC1 z (total) - SUPRIME z (total):
- Median: 0.19
- Median Absolute Deviation: 0.18
- 1% percentile: -5.06588077545166
- 99% percentile: 1.4522491455078124



GPC1 y (aperture) - SUPRIME y (aperture):
- Median: -0.36
- Median Absolute Deviation: 0.40
- 1% percentile: -4.261415328979492
- 99% percentile: 1.8999283218383725



GPC1 y (total) - SUPRIME y (total):
- Median: -0.04
- Median Absolute Deviation: 0.41
- 1% percentile: -4.285578727722168
- 99% percentile: 1.9863888740539288



1.5 III - Comparing magnitudes to reference bands

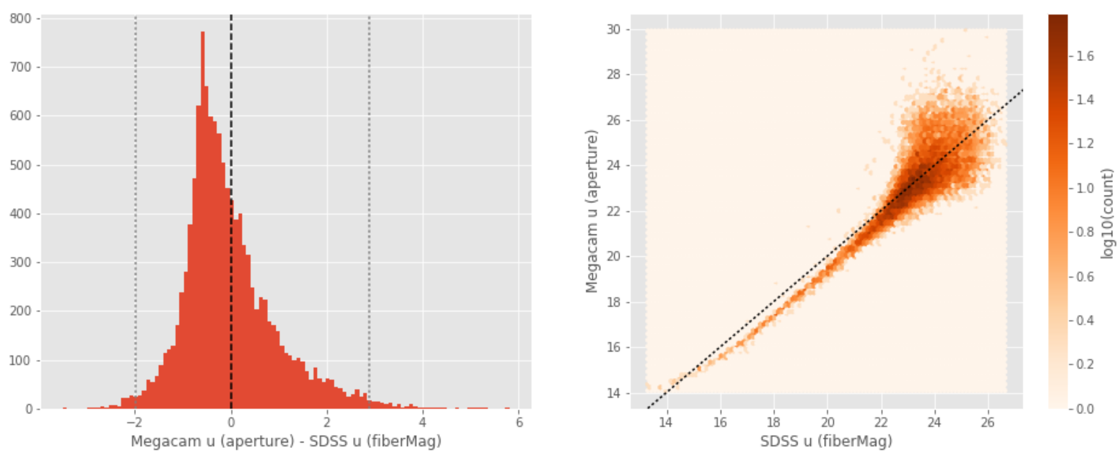
Cross-match the master list to SDSS and 2MASS to compare its magnitudes to SDSS and 2MASS ones.

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

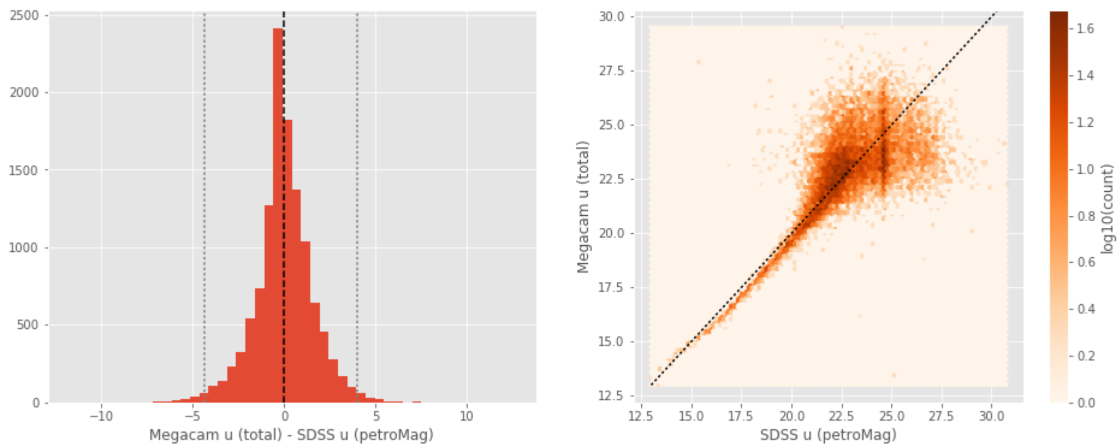
The catalogue is cross-matched to SDSS-DR13 withing 0.2 arcsecond.

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.

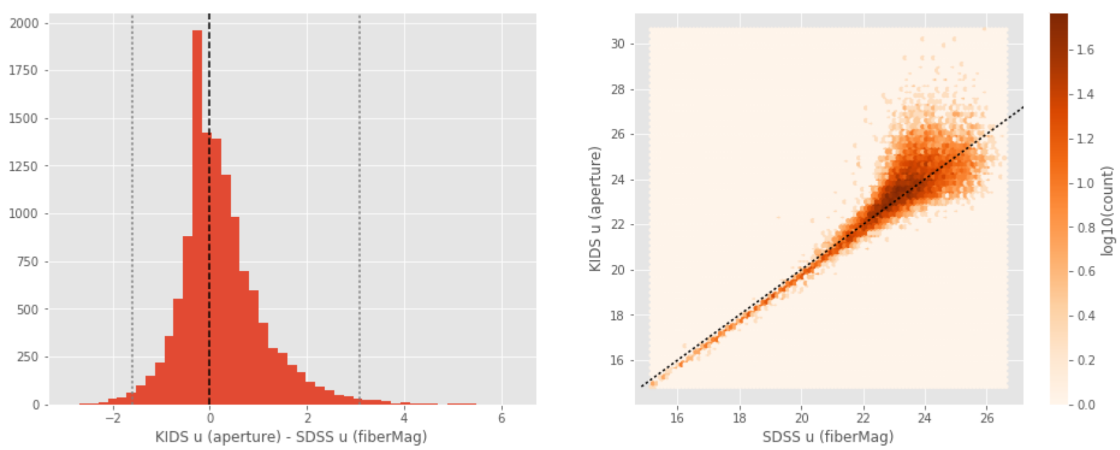
```
Megacam u (aperture) - SDSS u (fiberMag):
- Median: -0.23
- Median Absolute Deviation: 0.48
- 1% percentile: -1.9805518150329589
- 99% percentile: 2.8978856086730964
```



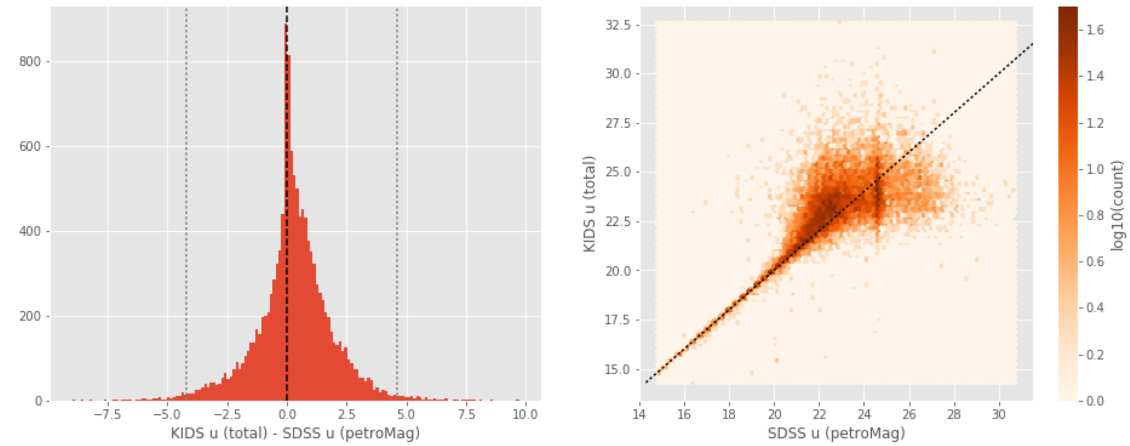
```
Megacam u (total) - SDSS u (petroMag):
- Median: -0.07
- Median Absolute Deviation: 0.81
- 1% percentile: -4.32380428314209
- 99% percentile: 3.993292770385745
```



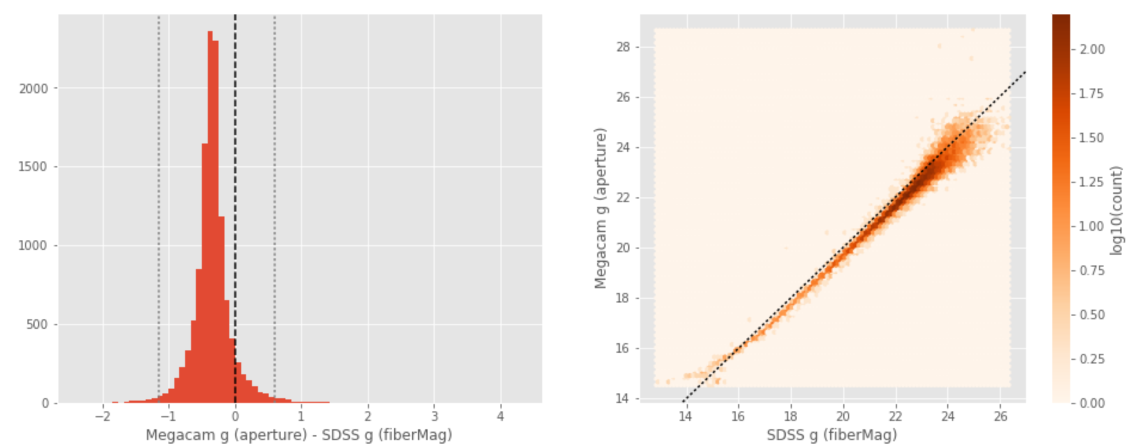

```
KIDS u (aperture) - SDSS u (fiberMag):
- Median: 0.10
- Median Absolute Deviation: 0.43
- 1% percentile: -1.597728576660156
- 99% percentile: 3.084534339904783
```



KIDS u (total) - SDSS u (petroMag):
- Median: 0.23
- Median Absolute Deviation: 0.76
- 1% percentile: -4.194290618896484
- 99% percentile: 4.597708740234376

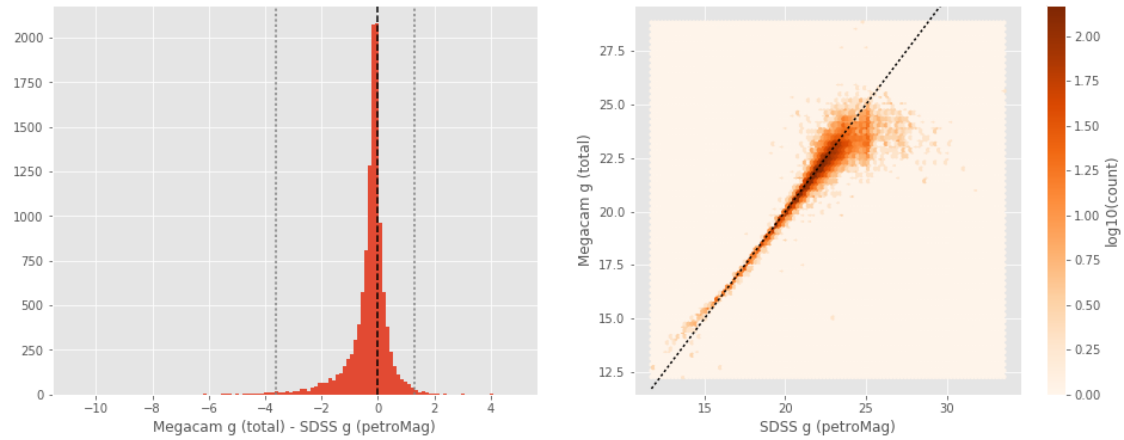


Megacam g (aperture) - SDSS g (fiberMag):
- Median: -0.35
- Median Absolute Deviation: 0.11
- 1% percentile: -1.1430648040771485
- 99% percentile: 0.5928711700439458

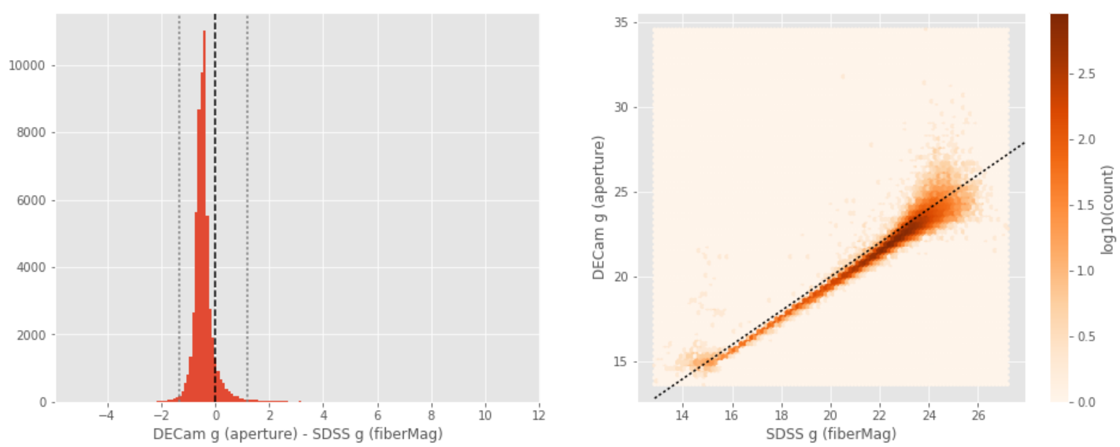


Megacam g (total) - SDSS g (petroMag):
- Median: -0.16

- Median Absolute Deviation: 0.22
- 1% percentile: -3.6148287582397463
- 99% percentile: 1.3122706222534195

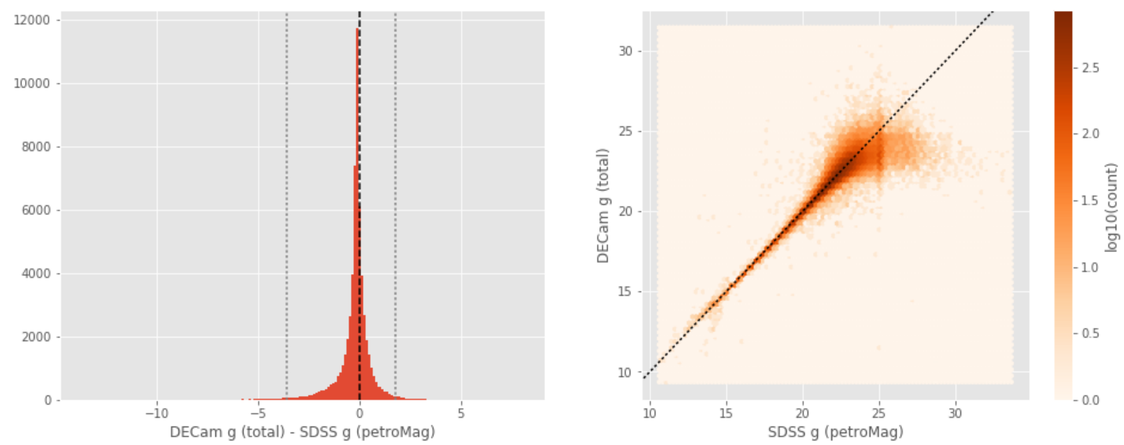


DECam g (aperture) - SDSS g (fiberMag):
- Median: -0.47
- Median Absolute Deviation: 0.15
- 1% percentile: -1.3167925262451172
- 99% percentile: 1.1856491088867194

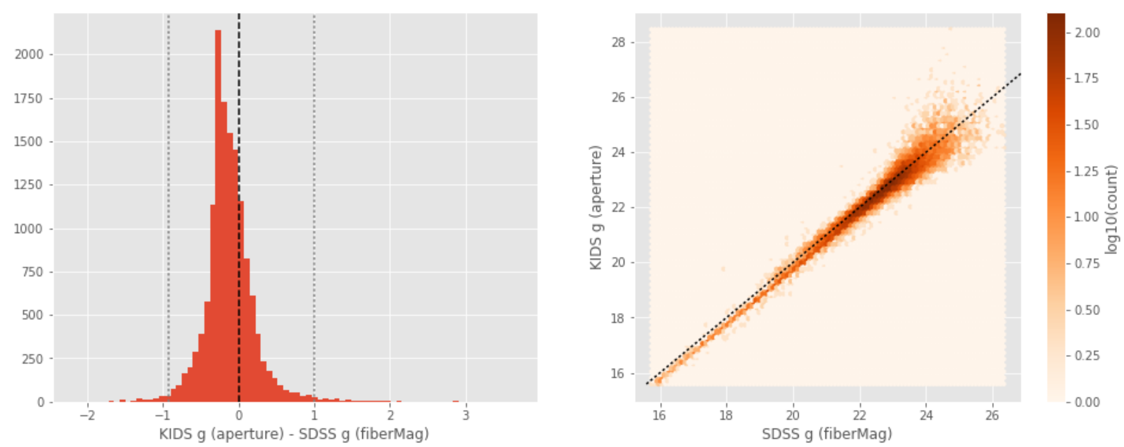


DECam g (total) - SDSS g (petroMag):
- Median: -0.11
- Median Absolute Deviation: 0.23
- 1% percentile: -3.570223388671875

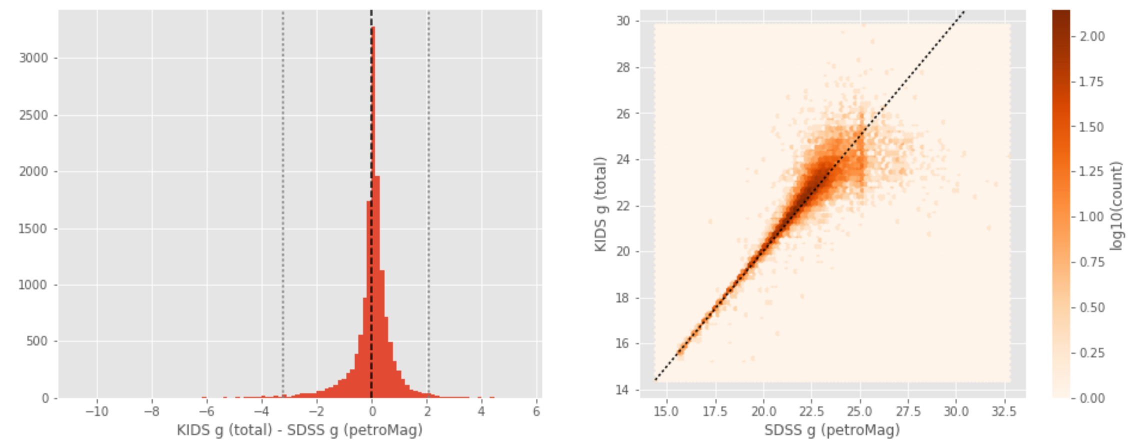
- 99% percentile: 1.755621414184573



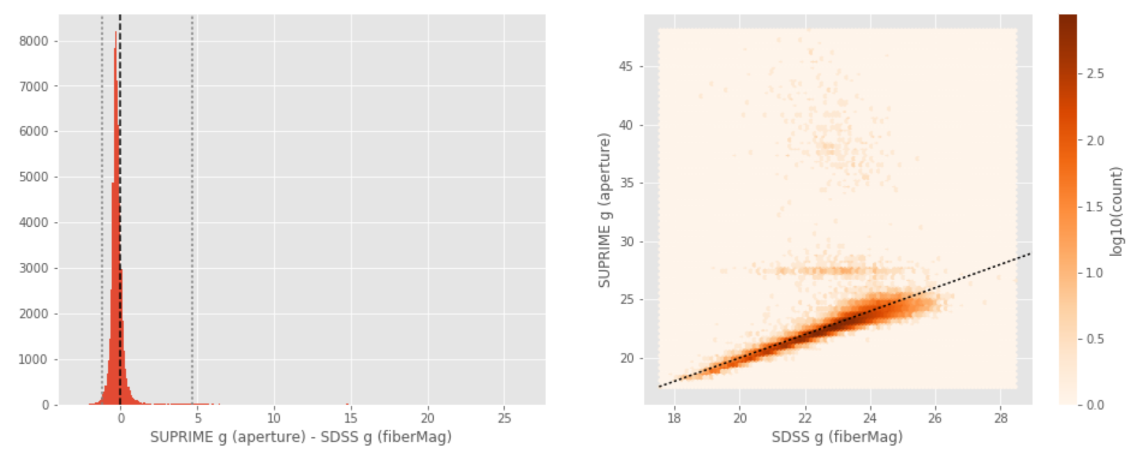
KIDS g (aperture) - SDSS g (fiberMag):
- Median: -0.15
- Median Absolute Deviation: 0.15
- 1% percentile: -0.9207930374145508
- 99% percentile: 0.9936396789550703



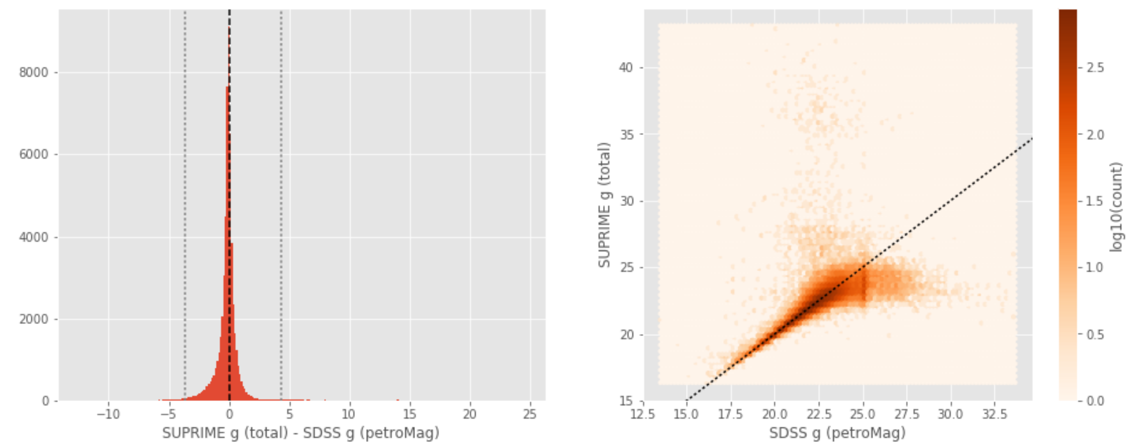
KIDS g (total) - SDSS g (petroMag):
- Median: 0.08
- Median Absolute Deviation: 0.23
- 1% percentile: -3.234930610656738
- 99% percentile: 2.091851272583008



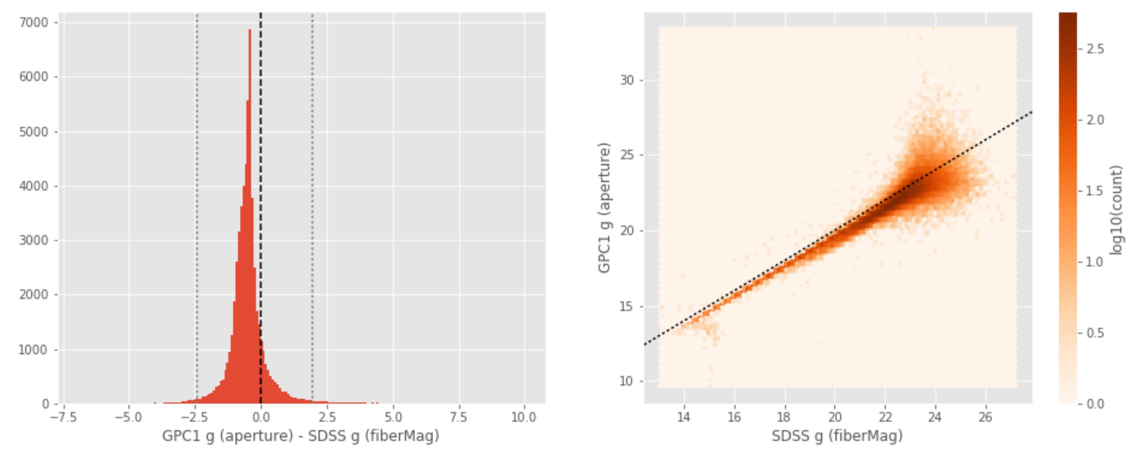
SUPRIME g (aperture) - SDSS g (fiberMag):
- Median: -0.28
- Median Absolute Deviation: 0.17
- 1% percentile: -1.1816984939575195
- 99% percentile: 4.6542678451538



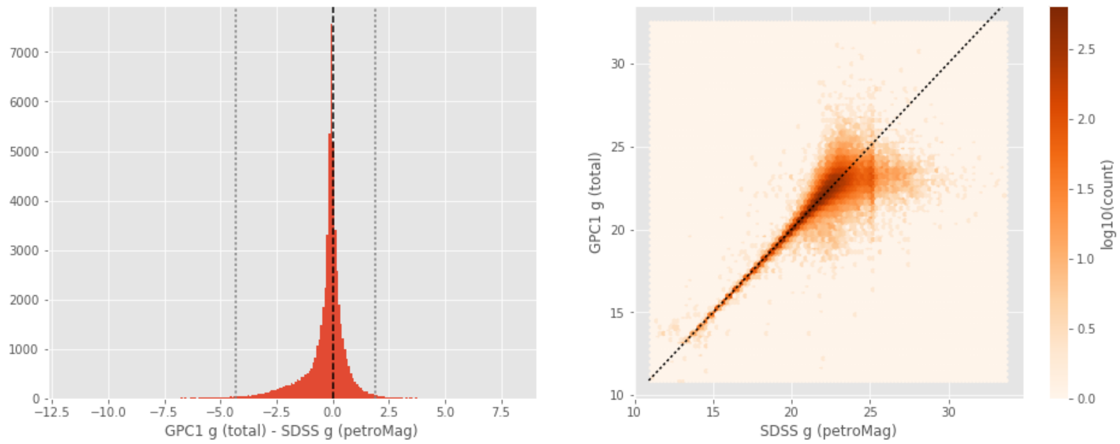
SUPRIME g (total) - SDSS g (petroMag):
- Median: -0.08
- Median Absolute Deviation: 0.27
- 1% percentile: -3.6394704818725585
- 99% percentile: 4.310194206237822



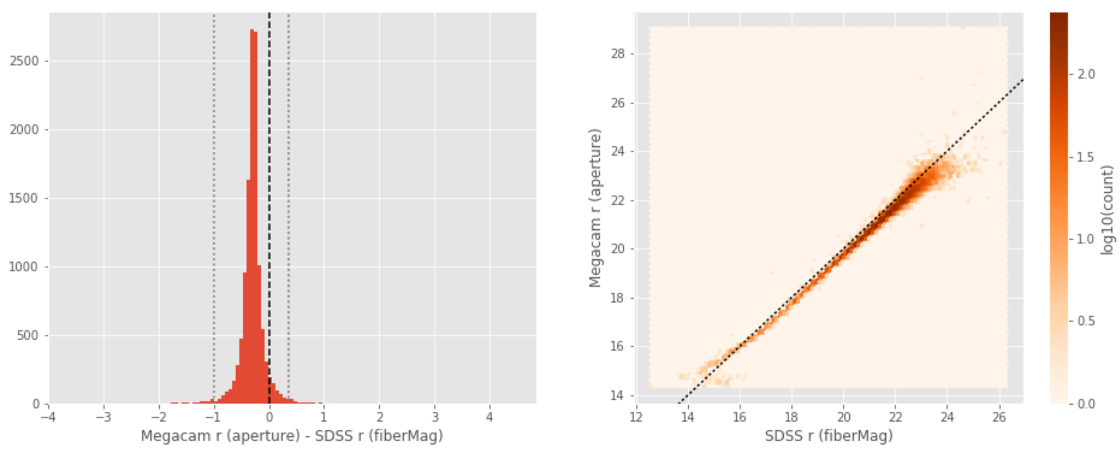
GPC1 g (aperture) - SDSS g (fiberMag):
- Median: -0.51
- Median Absolute Deviation: 0.26
- 1% percentile: -2.4366831970214844
- 99% percentile: 1.9779932022094666



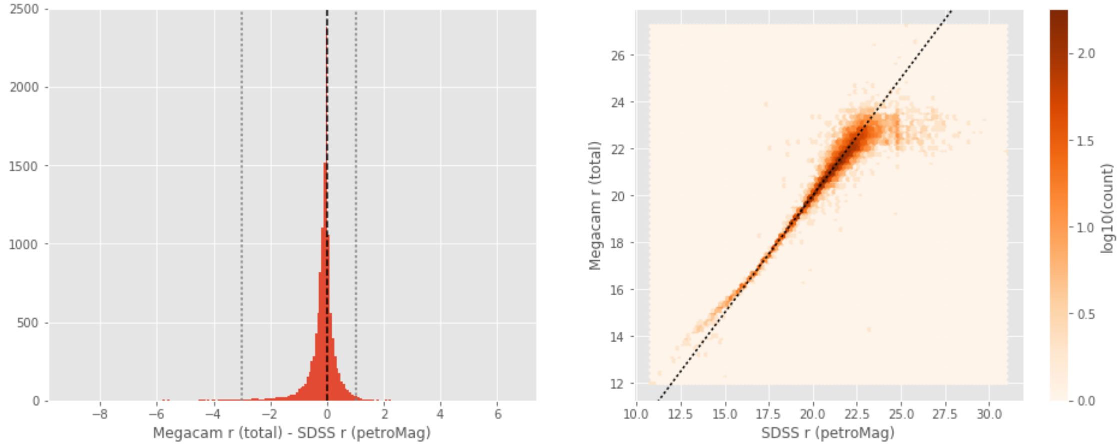
GPC1 g (total) - SDSS g (petroMag):
- Median: -0.09
- Median Absolute Deviation: 0.28
- 1% percentile: -4.29937391281128
- 99% percentile: 1.905803394317626



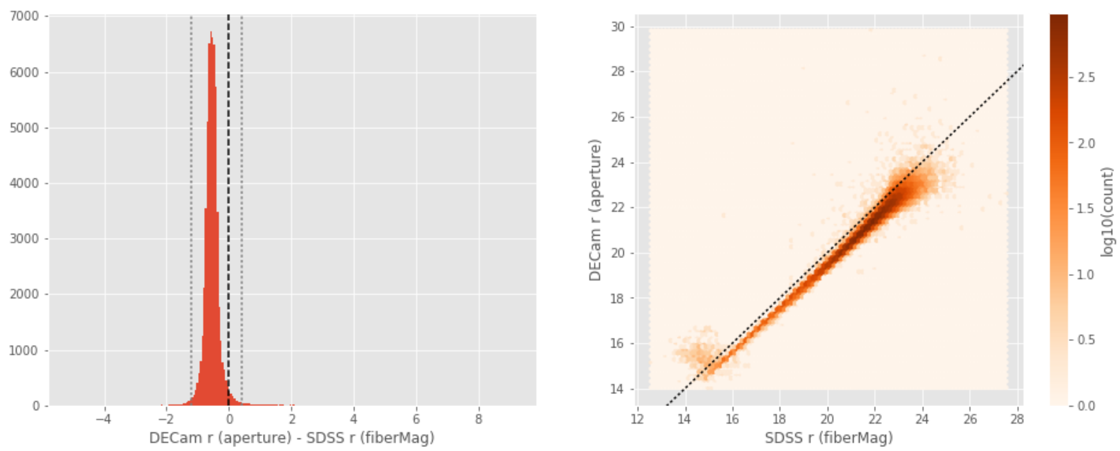
Megacam r (aperture) - SDSS r (fiberMag):
- Median: -0.29
- Median Absolute Deviation: 0.07
- 1% percentile: -0.9997333526611327
- 99% percentile: 0.35298034667968753



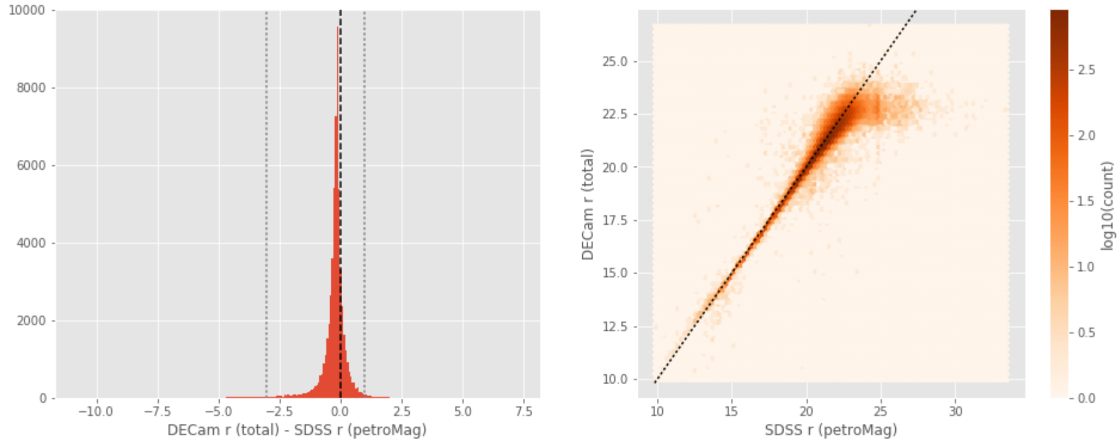
Megacam r (total) - SDSS r (petroMag):
- Median: -0.06
- Median Absolute Deviation: 0.14
- 1% percentile: -3.0153173446655273
- 99% percentile: 1.0062030029296885



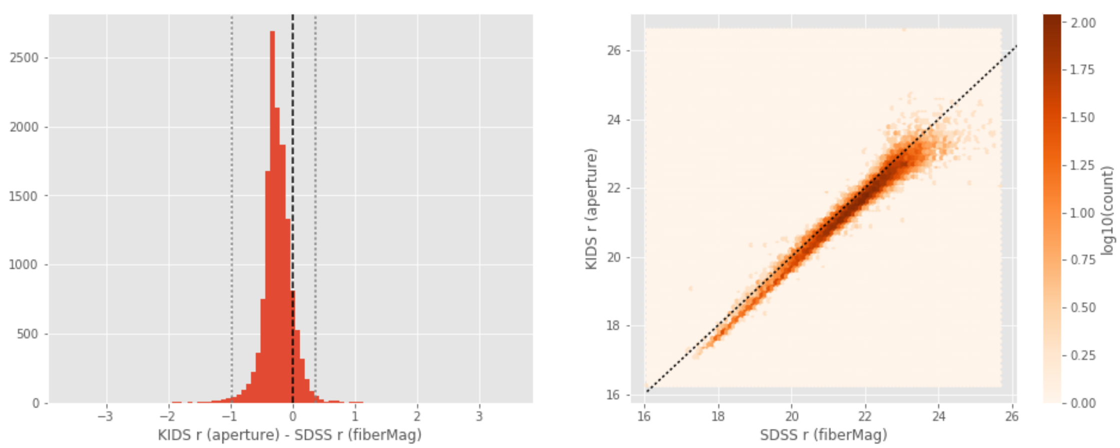
DECam r (aperture) - SDSS r (fiberMag):
- Median: -0.55
- Median Absolute Deviation: 0.12
- 1% percentile: -1.1997455024719237
- 99% percentile: 0.4048216056823746



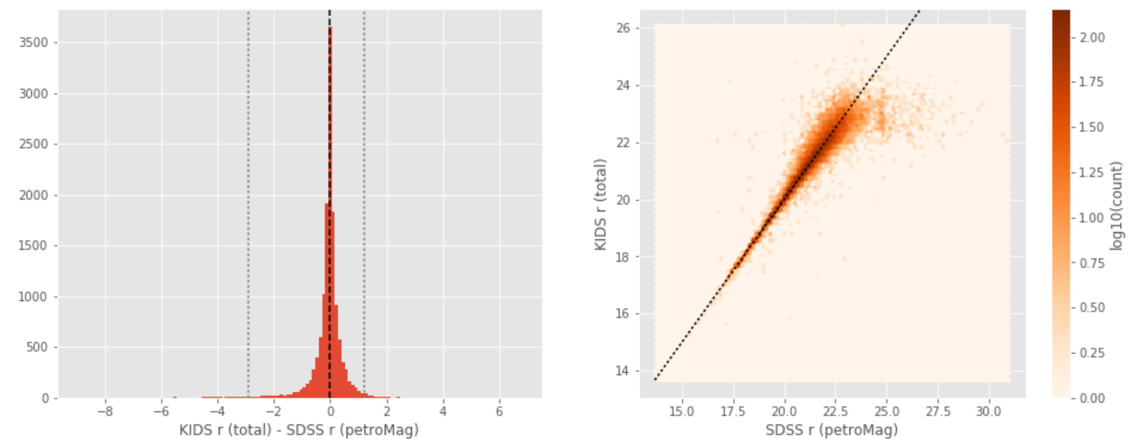
DECam r (total) - SDSS r (petroMag):
- Median: -0.16
- Median Absolute Deviation: 0.15
- 1% percentile: -3.0106480789184573
- 99% percentile: 0.9799940490722654



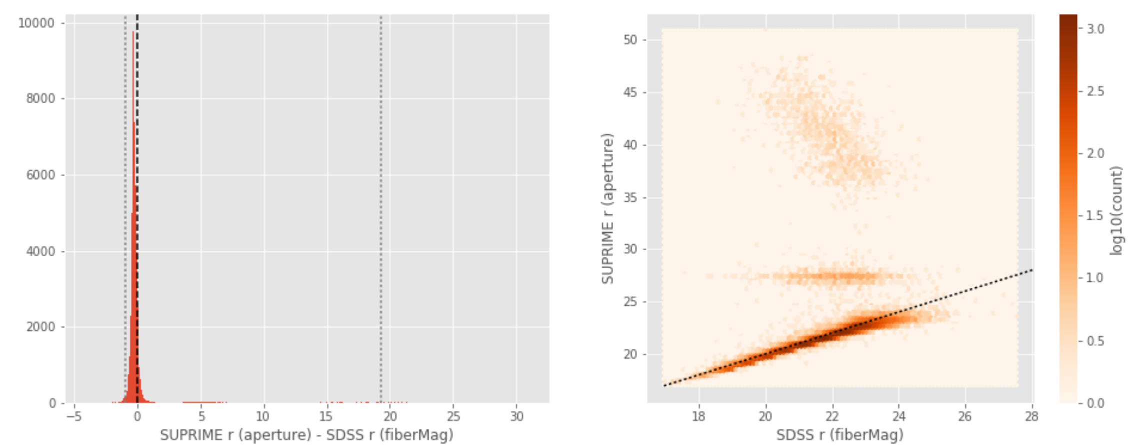
KIDS r (aperture) - SDSS r (fiberMag):
- Median: -0.25
- Median Absolute Deviation: 0.12
- 1% percentile: -0.9678285980224609
- 99% percentile: 0.38065771102905005



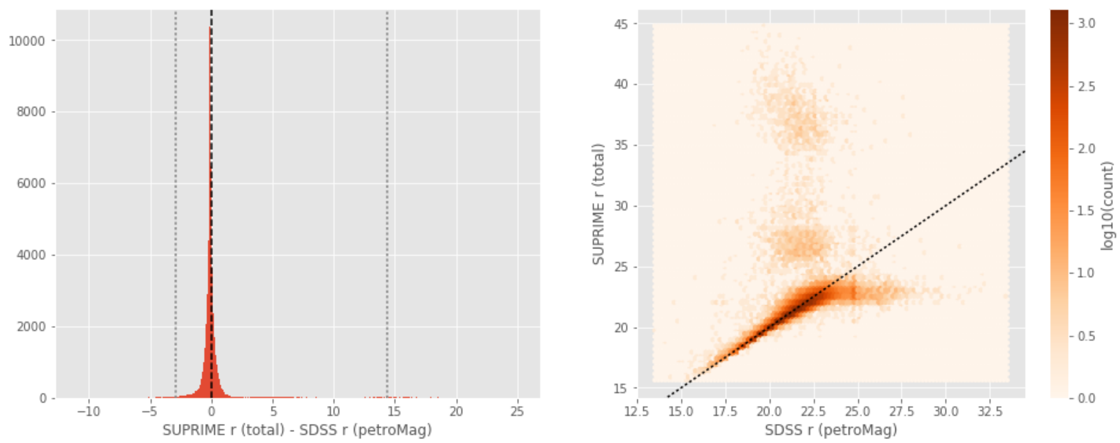
KIDS r (total) - SDSS r (petroMag):
- Median: -0.01
- Median Absolute Deviation: 0.15
- 1% percentile: -2.9153534698486325
- 99% percentile: 1.2088365554809566



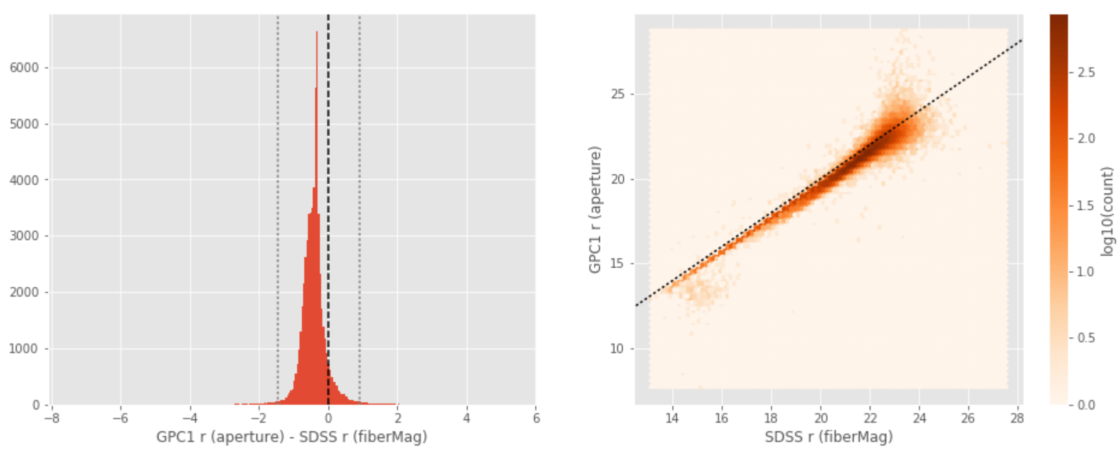
SUPRIME r (aperture) - SDSS r (fiberMag):
- Median: -0.27
- Median Absolute Deviation: 0.13
- 1% percentile: -0.9376730728149414
- 99% percentile: 19.31510007858273



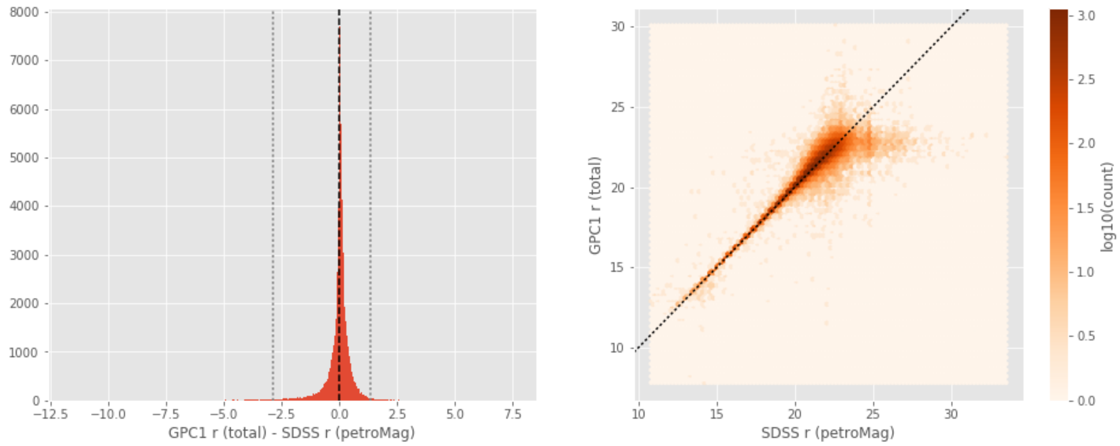
SUPRIME r (total) - SDSS r (petroMag):
- Median: -0.10
- Median Absolute Deviation: 0.18
- 1% percentile: -2.8906237030029294
- 99% percentile: 14.384326629638673



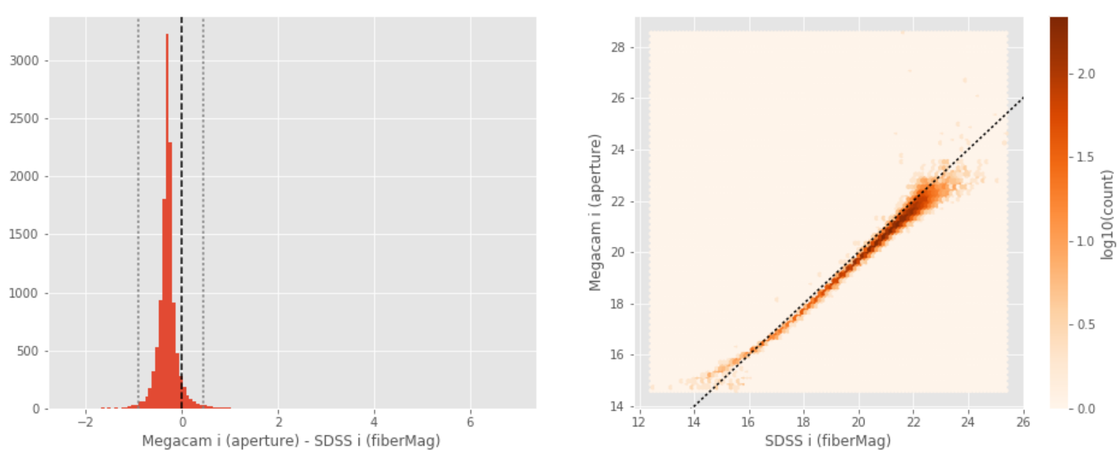
GPC1 r (aperture) - SDSS r (fiberMag):
- Median: -0.40
- Median Absolute Deviation: 0.16
- 1% percentile: -1.4502239227294922
- 99% percentile: 0.918971061706543



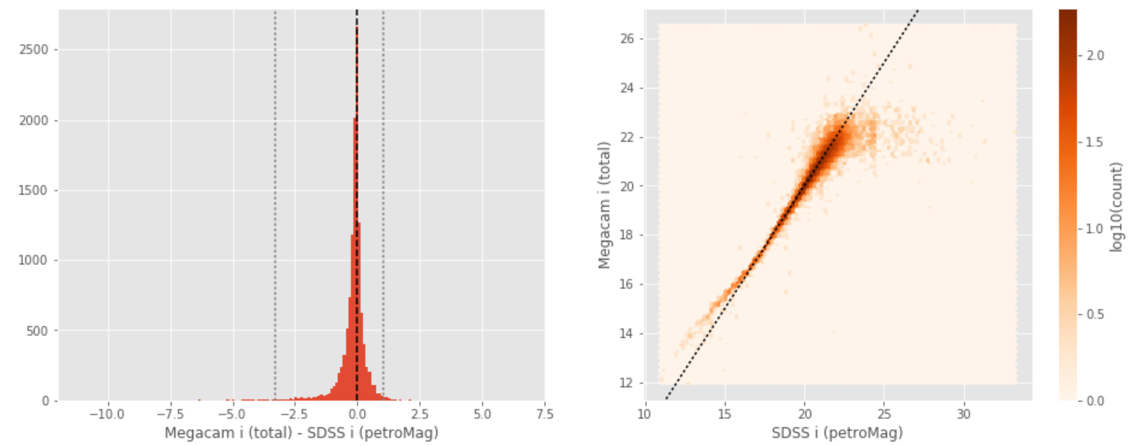
GPC1 r (total) - SDSS r (petroMag):
- Median: 0.03
- Median Absolute Deviation: 0.15
- 1% percentile: -2.8935000038146974
- 99% percentile: 1.3557196998596144



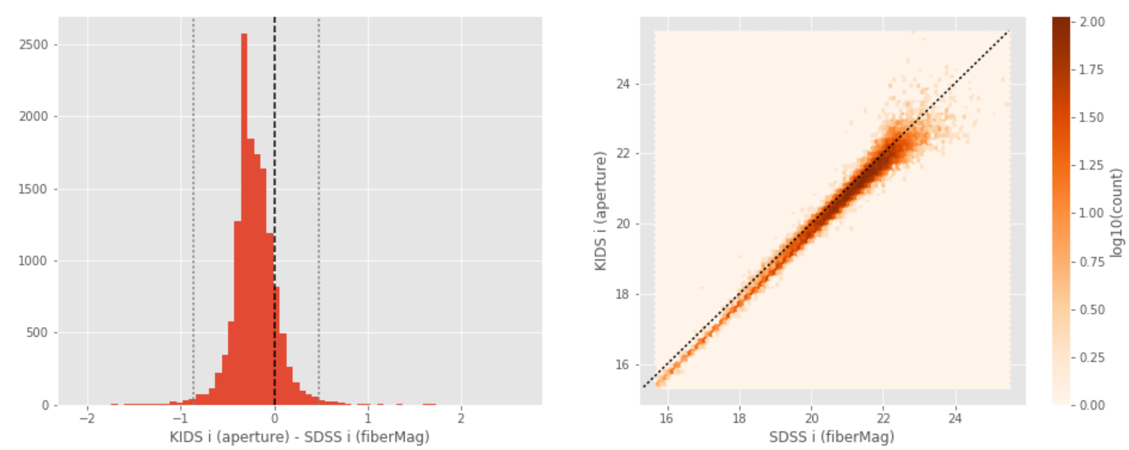
Megacam i (aperture) - SDSS i (fiberMag):
- Median: -0.30
- Median Absolute Deviation: 0.08
- 1% percentile: -0.9130830001831055
- 99% percentile: 0.4375060462951687



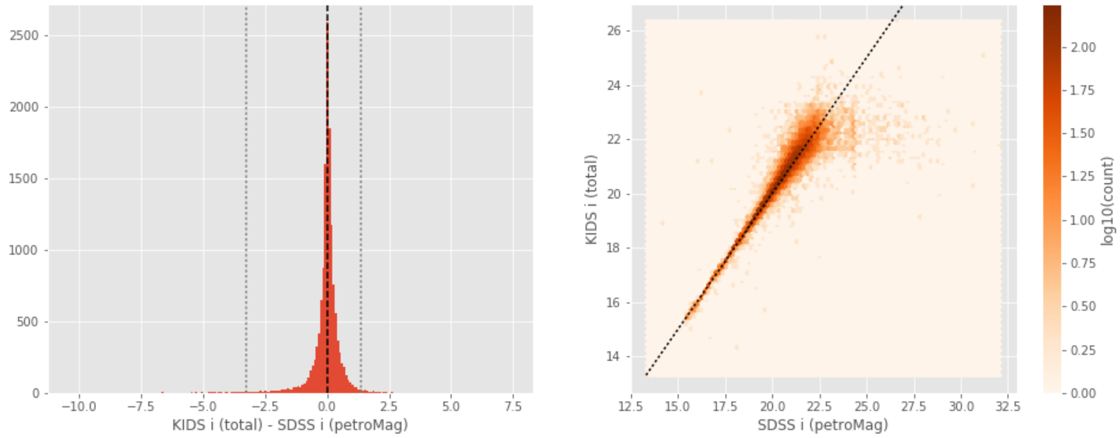
Megacam i (total) - SDSS i (petroMag):
- Median: -0.07
- Median Absolute Deviation: 0.15
- 1% percentile: -3.27773380279541
- 99% percentile: 1.0300380706787147



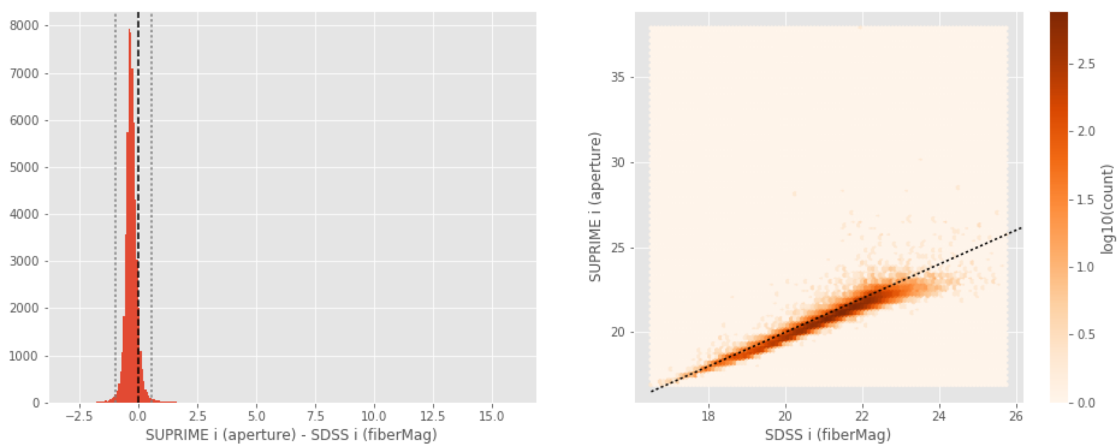
KIDS i (aperture) - SDSS i (fiberMag):
- Median: -0.23
- Median Absolute Deviation: 0.12
- 1% percentile: -0.868525390625
- 99% percentile: 0.4777779388427732



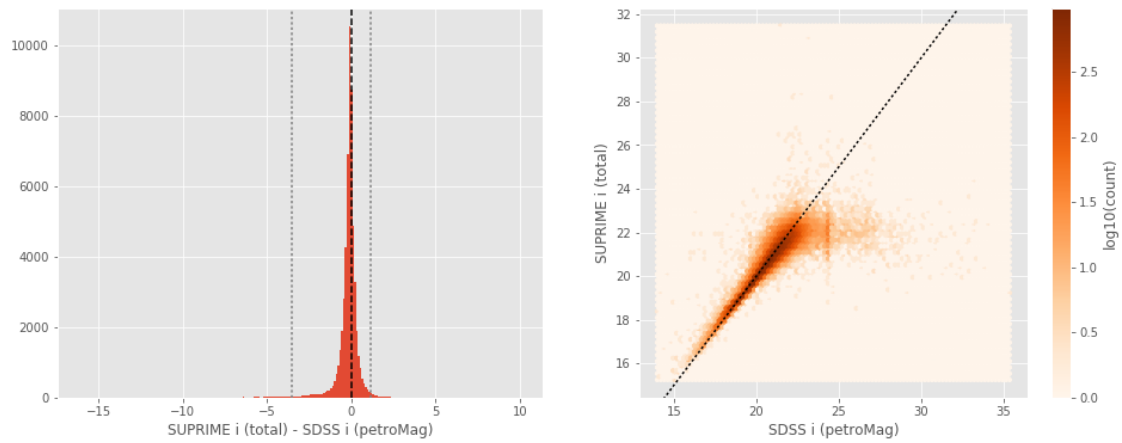
KIDS i (total) - SDSS i (petroMag):
- Median: 0.03
- Median Absolute Deviation: 0.16
- 1% percentile: -3.2415502166748045
- 99% percentile: 1.3450832366943337



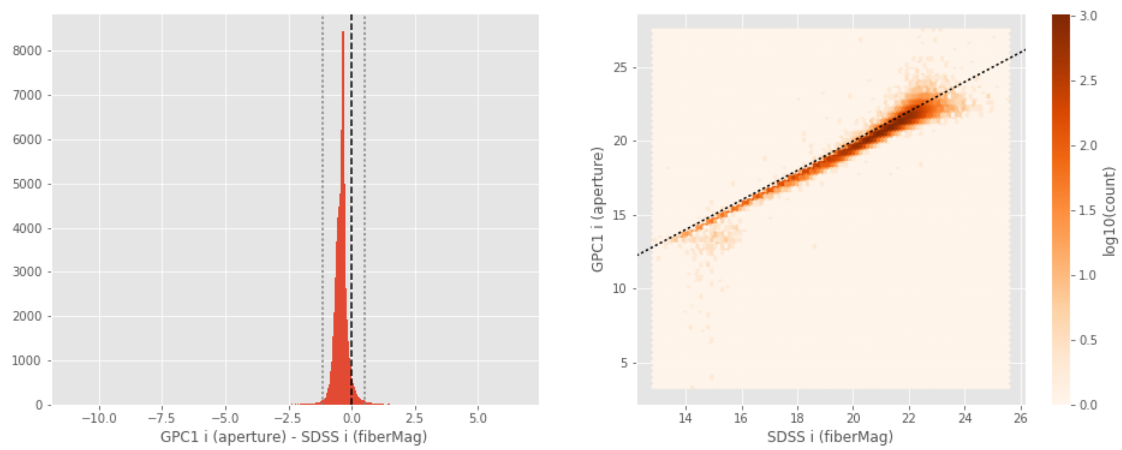
SUPRIME i (aperture) - SDSS i (fiberMag):
- Median: -0.30
- Median Absolute Deviation: 0.13
- 1% percentile: -0.9517079925537109
- 99% percentile: 0.5569943237304685



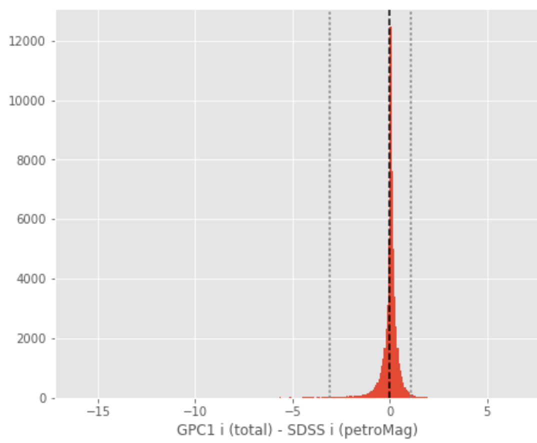
SUPRIME i (total) - SDSS i (petroMag):
- Median: -0.11
- Median Absolute Deviation: 0.18
- 1% percentile: -3.5039387512207028
- 99% percentile: 1.1432917404174916

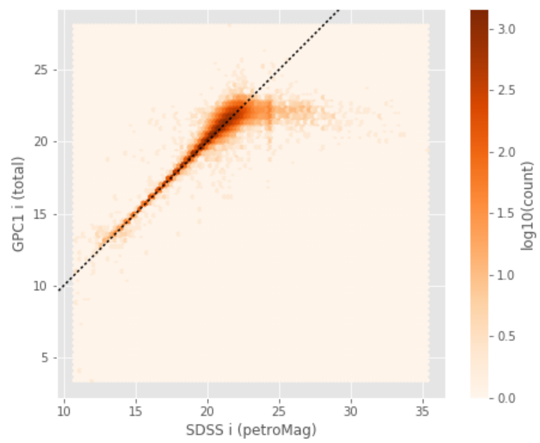


GPC1 i (aperture) - SDSS i (fiberMag):
- Median: -0.40
- Median Absolute Deviation: 0.13
- 1% percentile: -1.1375551223754883
- 99% percentile: 0.5163507461547852

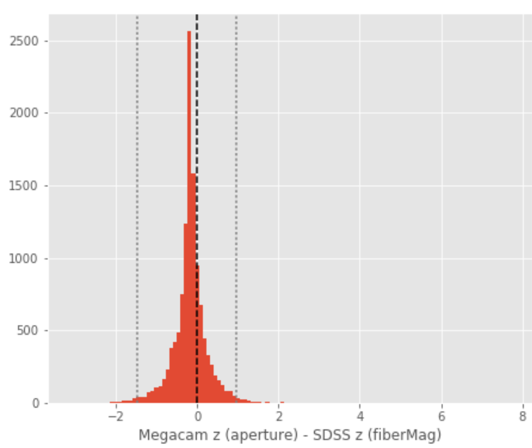


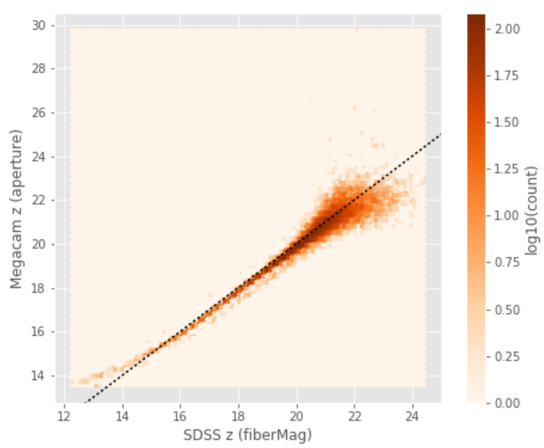
GPC1 i (total) - SDSS i (petroMag):
- Median: 0.05
- Median Absolute Deviation: 0.14
- 1% percentile: -3.095174293518067
- 99% percentile: 1.112330322265624



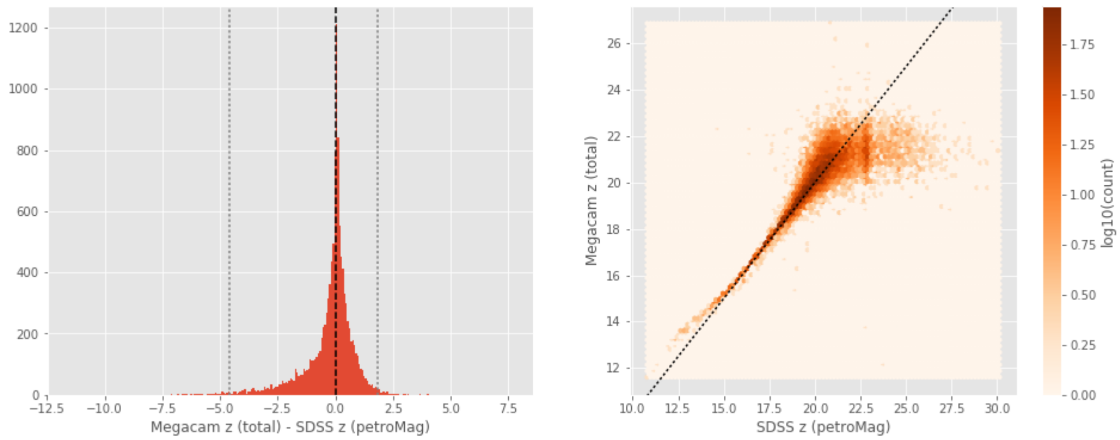


Megacam z (aperture) - SDSS z (fiberMag):
- Median: -0.17
- Median Absolute Deviation: 0.16
- 1% percentile: -1.4817494392395019
- 99% percentile: 0.9686054229736301

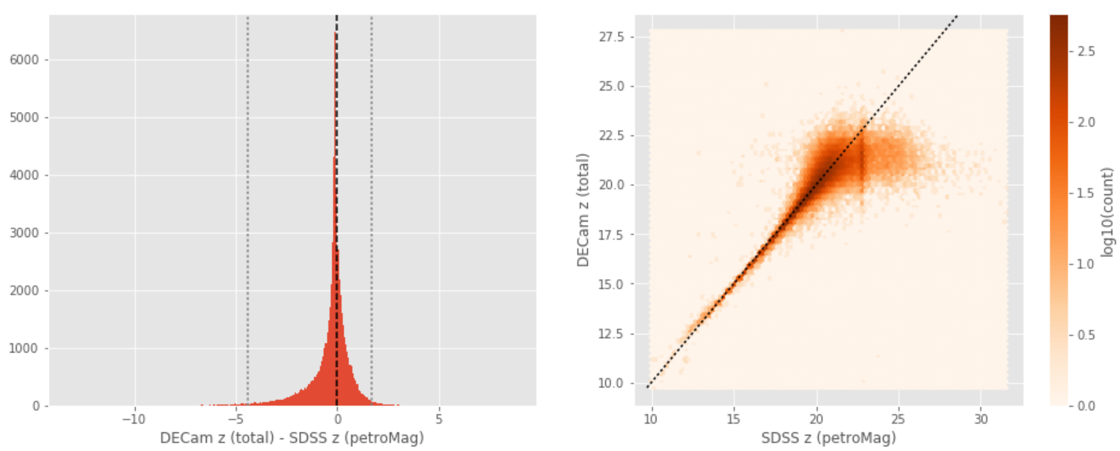




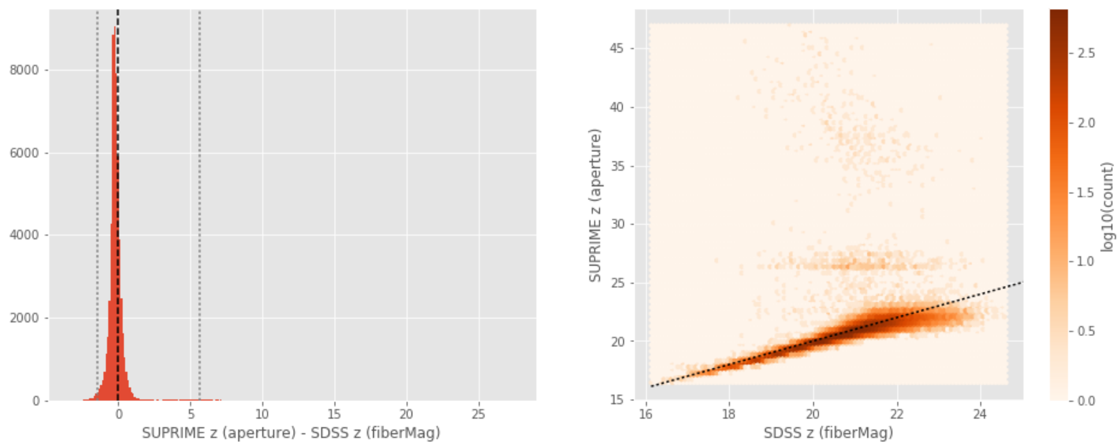
Megacam z (total) - SDSS z (petroMag):
- Median: 0.02
- Median Absolute Deviation: 0.36
- 1% percentile: -4.5977295303344725
- 99% percentile: 1.824040069580078



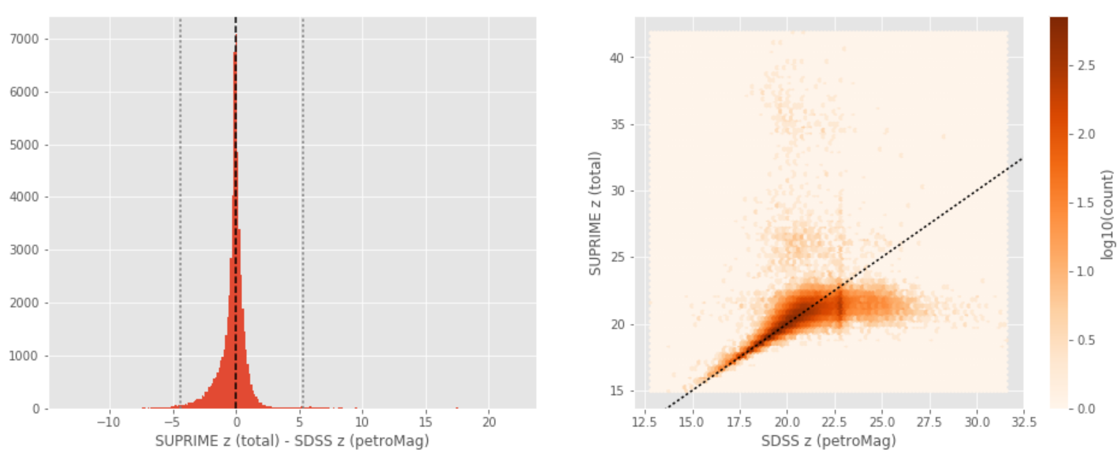
No sources have both SDSS z (fiberMag) and DECam z (aperture) values.
DECam z (total) - SDSS z (petroMag):
- Median: -0.12
- Median Absolute Deviation: 0.32
- 1% percentile: -4.39703239440918
- 99% percentile: 1.7188212585449198



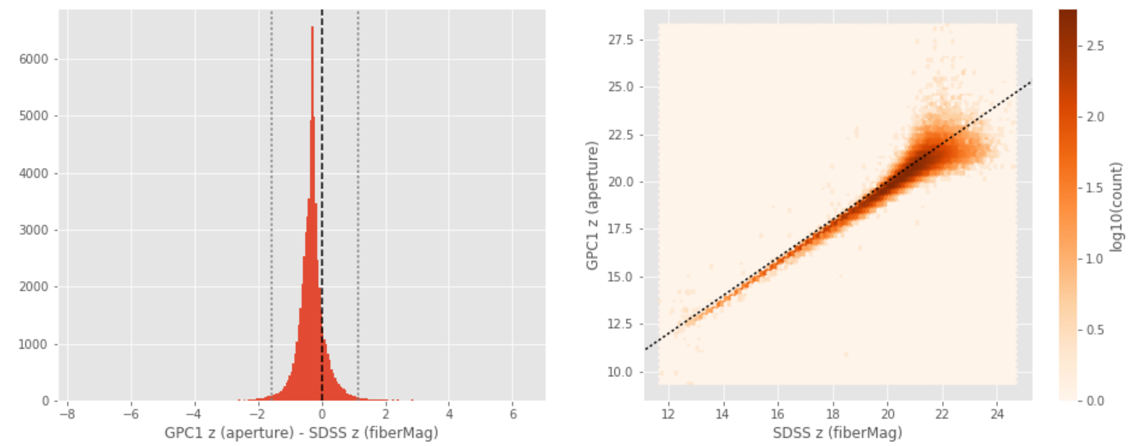
SUPRIME z (aperture) - SDSS z (fiberMag):
- Median: -0.20
- Median Absolute Deviation: 0.19
- 1% percentile: -1.4075223922729494
- 99% percentile: 5.631384277343743



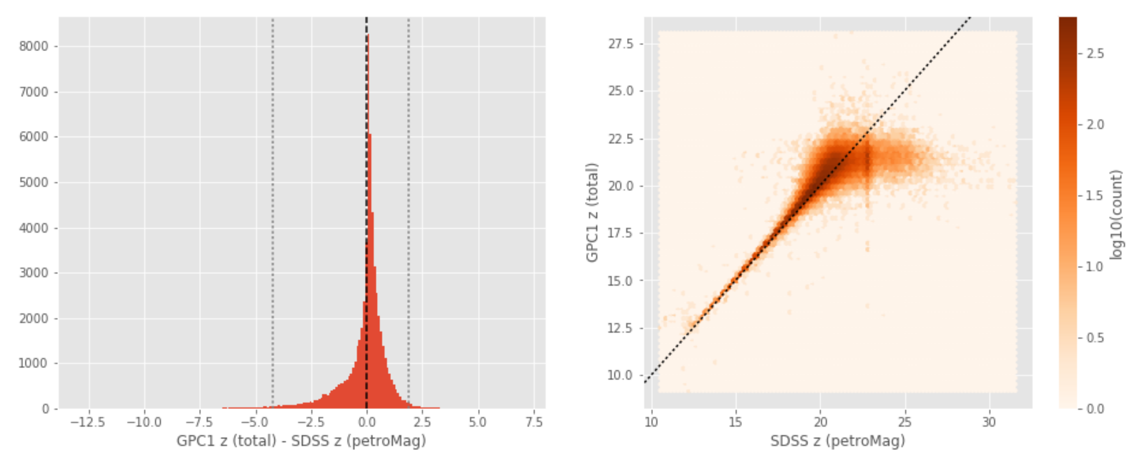
SUPRIME z (total) - SDSS z (petroMag):
- Median: -0.06
- Median Absolute Deviation: 0.38
- 1% percentile: -4.427087116241455
- 99% percentile: 5.343105926513672



GPC1 z (aperture) - SDSS z (fiberMag):
- Median: -0.31
- Median Absolute Deviation: 0.19
- 1% percentile: -1.5797478485107423
- 99% percentile: 1.140282135009764




```
GPC1 z (total) - SDSS z (petroMag):
- Median: 0.10
- Median Absolute Deviation: 0.32
- 1% percentile: -4.19742603302002
- 99% percentile: 1.8786336898803697
```



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.

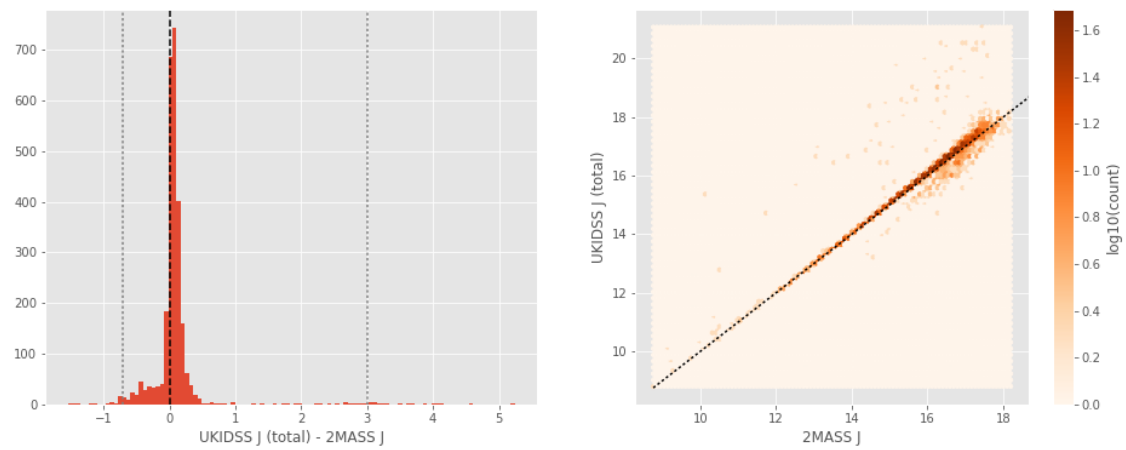
The 2MASS magnitudes are "*Vega-like*" and we have to convert them to AB magnitudes using the zero points provided on this page:

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

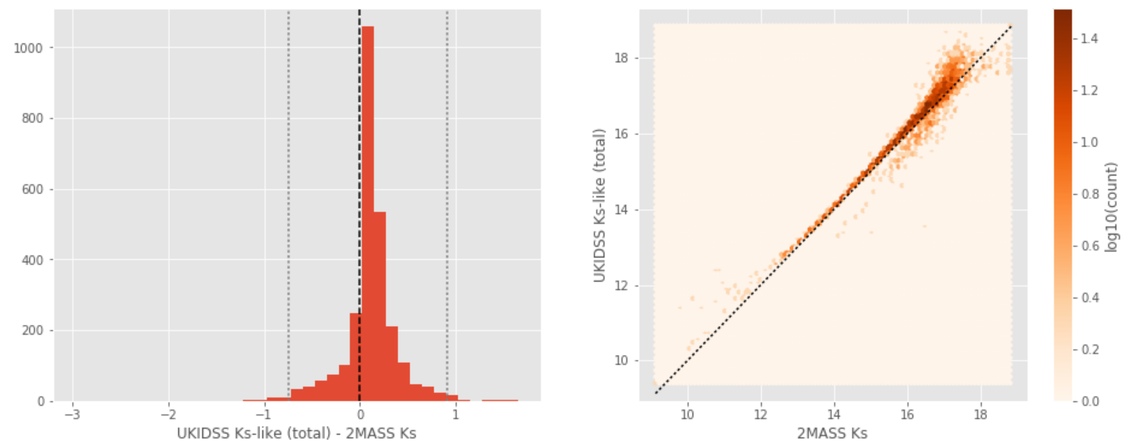
In addition, UKIDSS uses a K band whereas 2MASS uses a Ks ("short") band, this page give a correction to convert the K band in a Ks band with the formula:

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

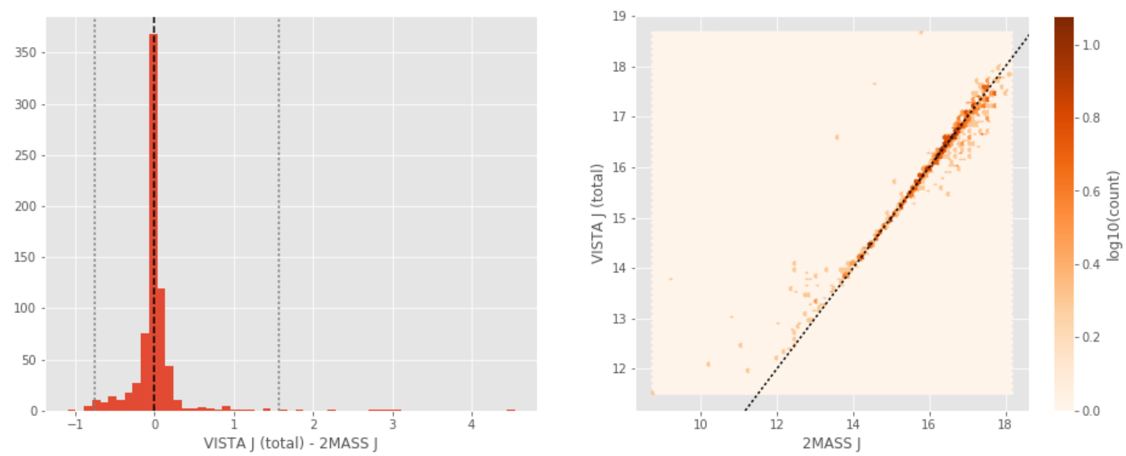
```
UKIDSS J (total) - 2MASS J:
- Median: 0.06
- Median Absolute Deviation: 0.06
- 1% percentile: -0.7163926483060652
- 99% percentile: 2.9992231956575597
```



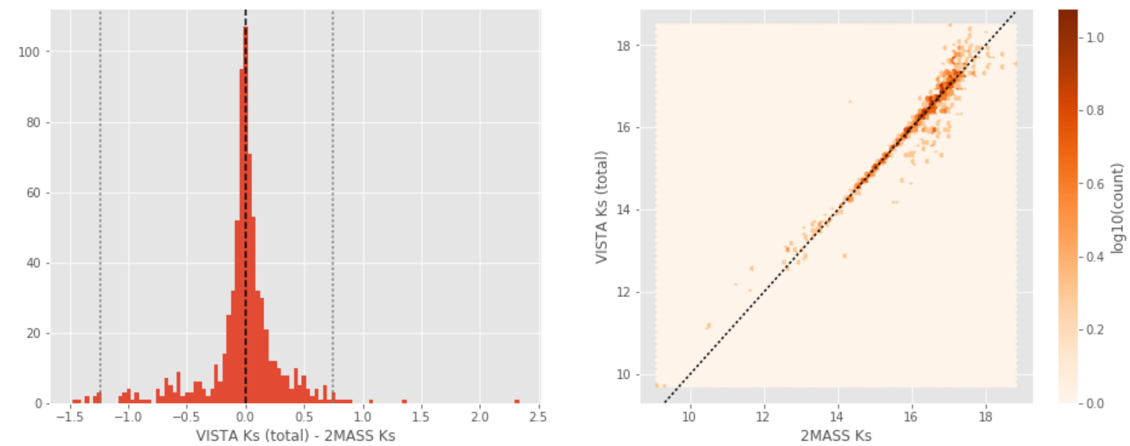

```
UKIDSS Ks-like (total) - 2MASS Ks:
- Median: 0.11
- Median Absolute Deviation: 0.08
- 1% percentile: -0.7419853468950799
- 99% percentile: 0.9120592234174177
```



VISTA J (total) - 2MASS J:
- Median: -0.01
- Median Absolute Deviation: 0.05
- 1% percentile: -0.749675903799232
- 99% percentile: 1.565876096200768

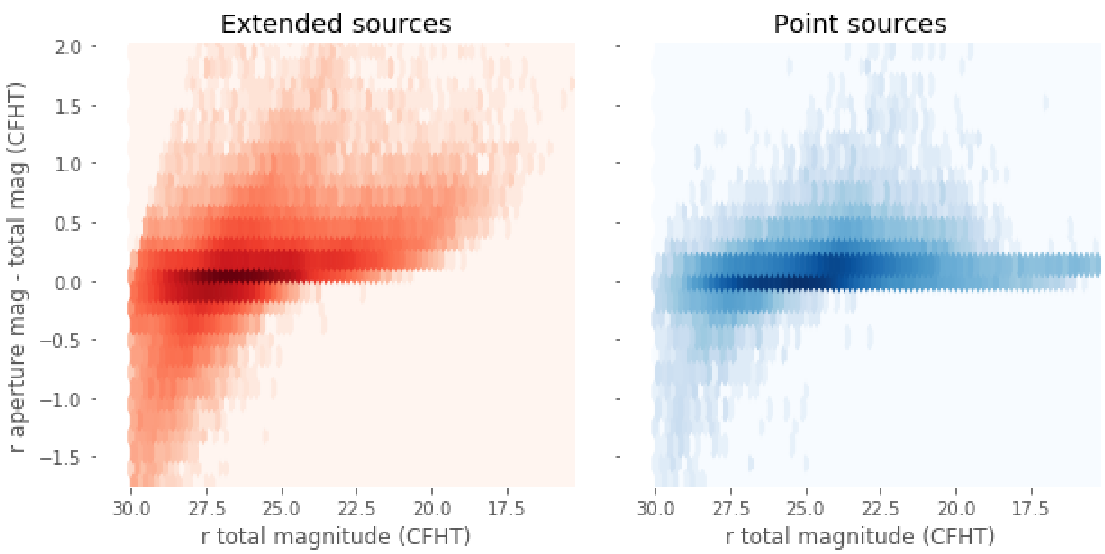


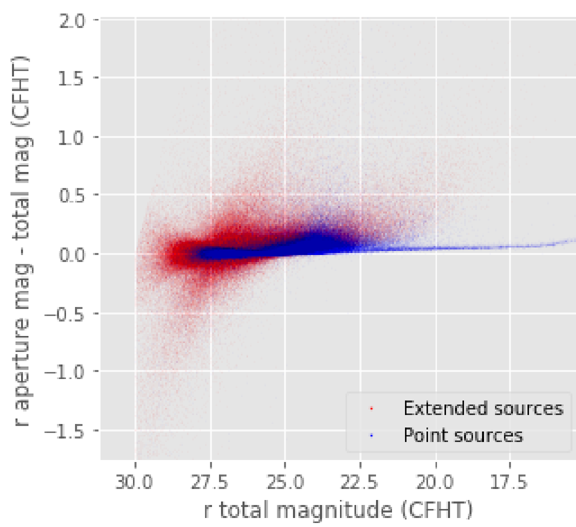
VISTA Ks (total) - 2MASS Ks:
- Median: -0.00
- Median Absolute Deviation: 0.09
- 1% percentile: -1.2388374844683208
- 99% percentile: 0.7511585155316783



1.6 IV - Comparing aperture magnitudes to total ones.

```
Number of source used: 524587 / 2779194 (18.88%)
```

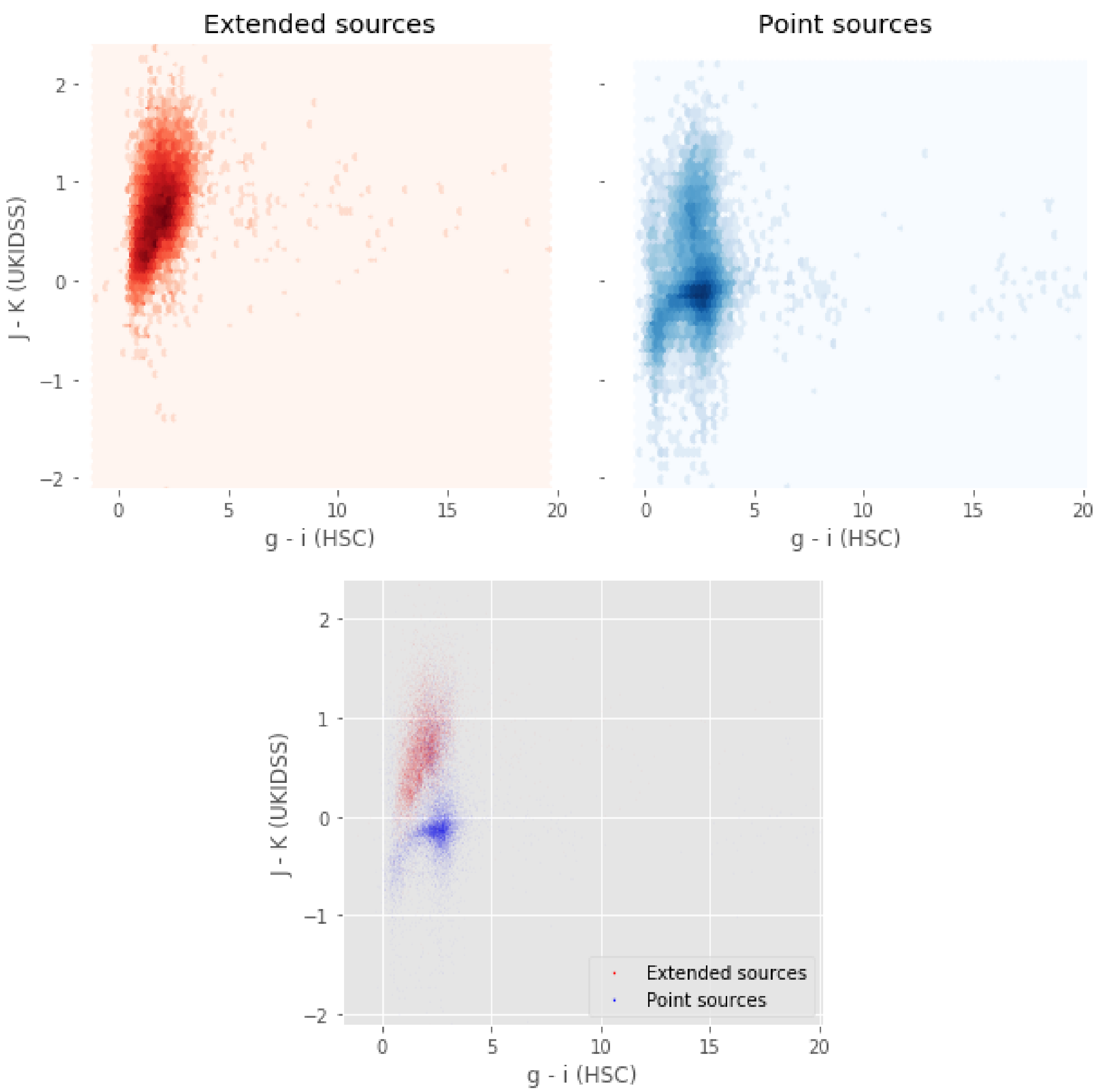




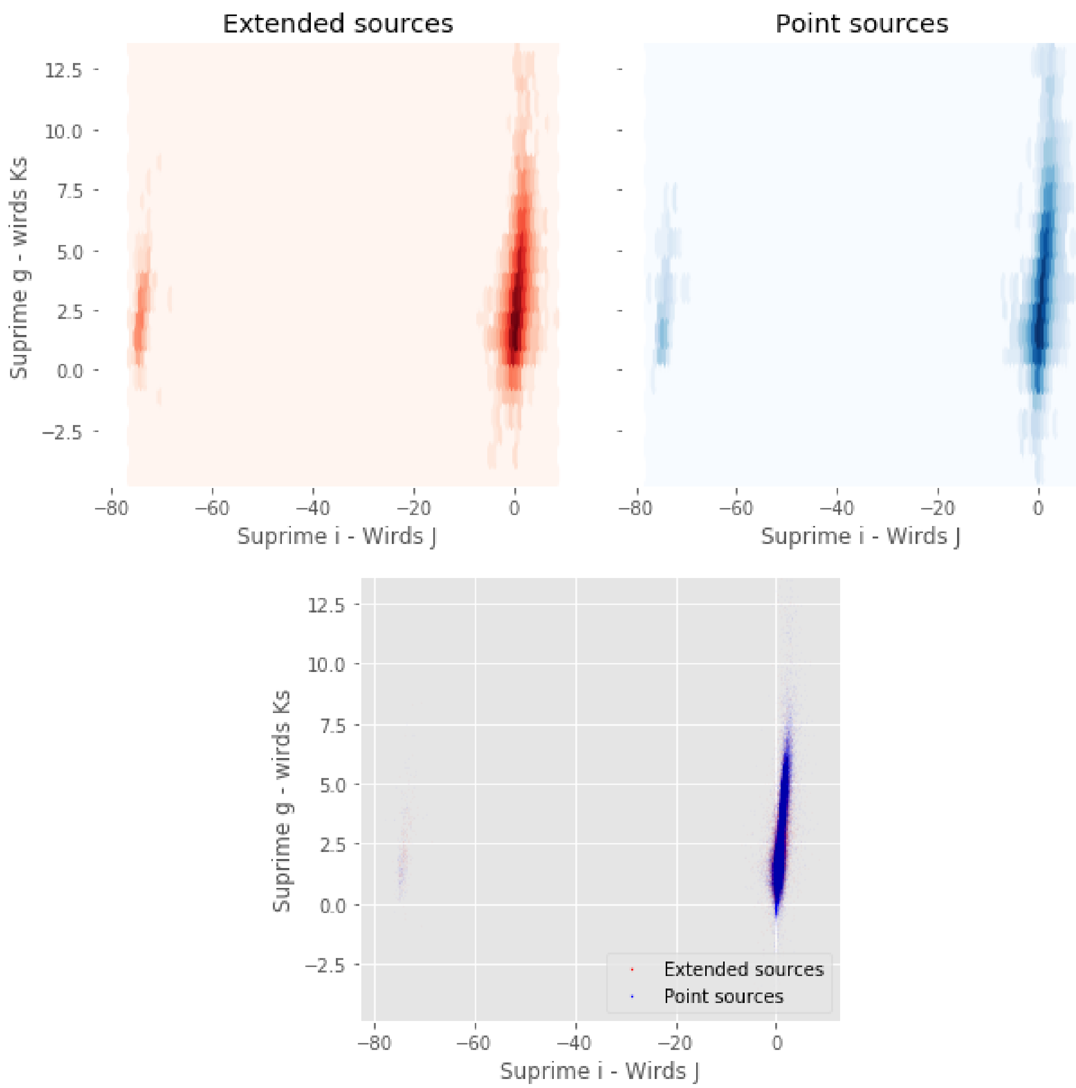
1.7 V - Color-color and magnitude-color plots

```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:2: R
  from ipykernel import kernelapp as app
```

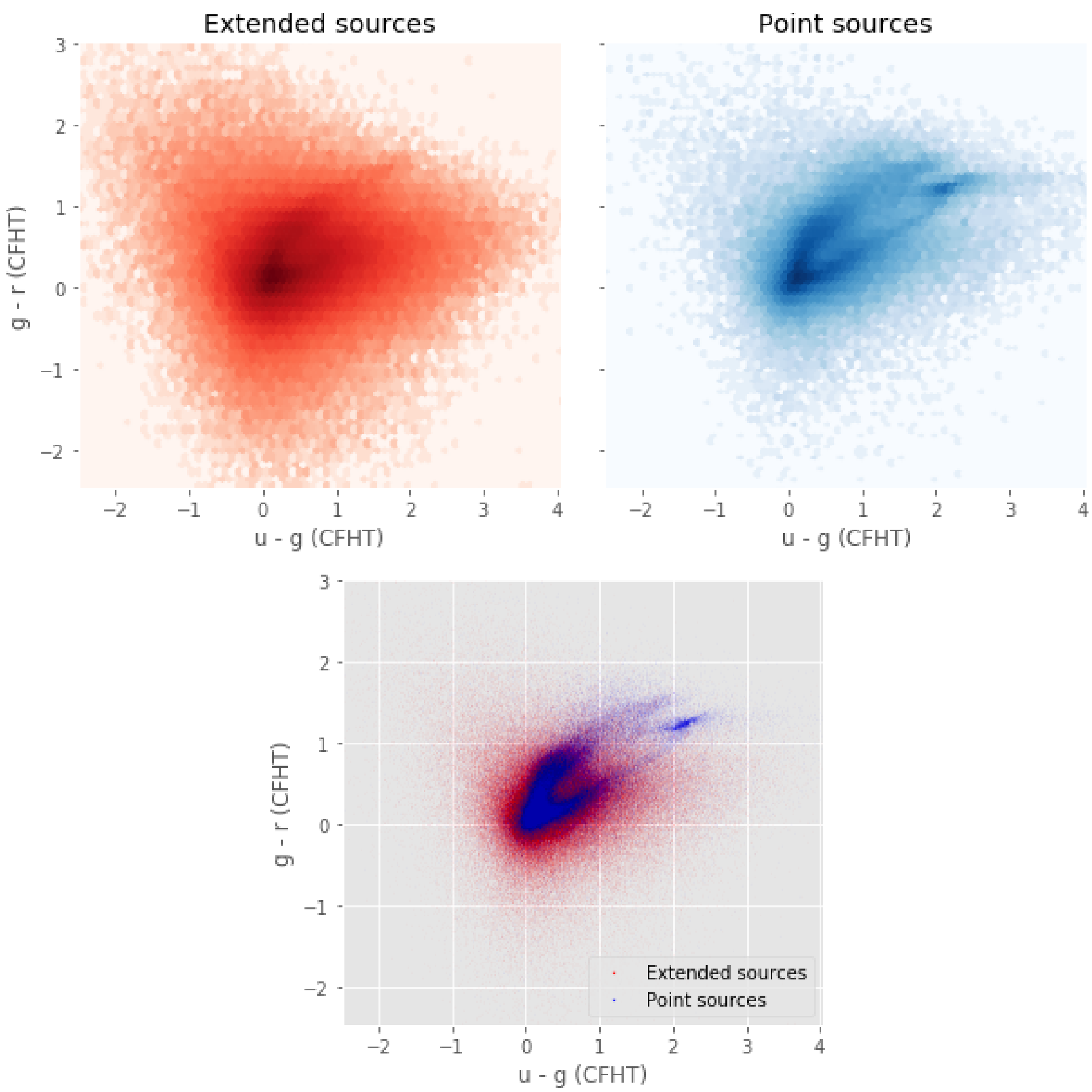
```
Number of source used: 24171 / 2779194 (0.87%)
```



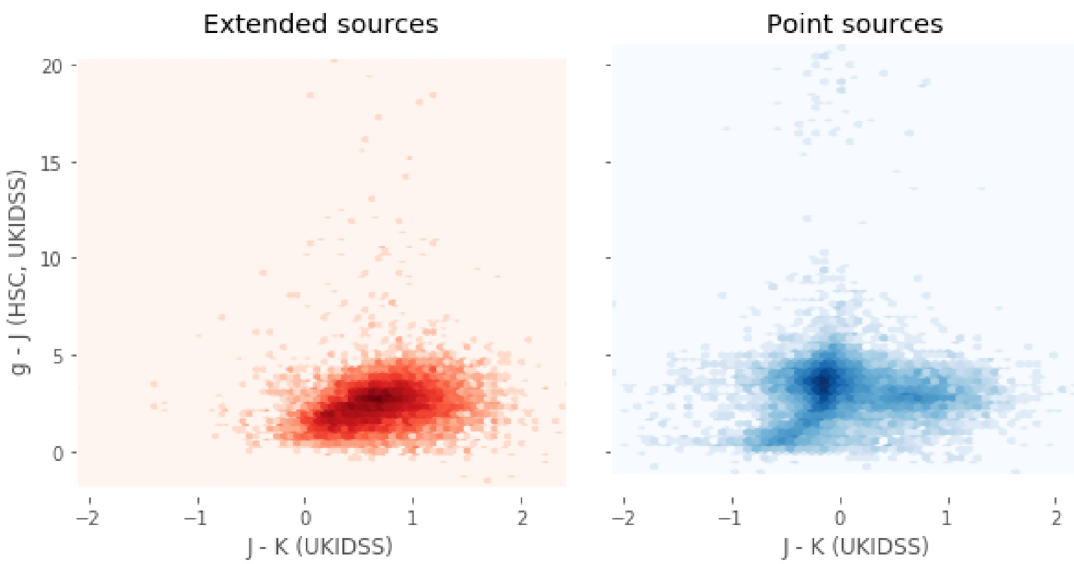

```
Number of source used: 101176 / 2779194 (3.64%)
```

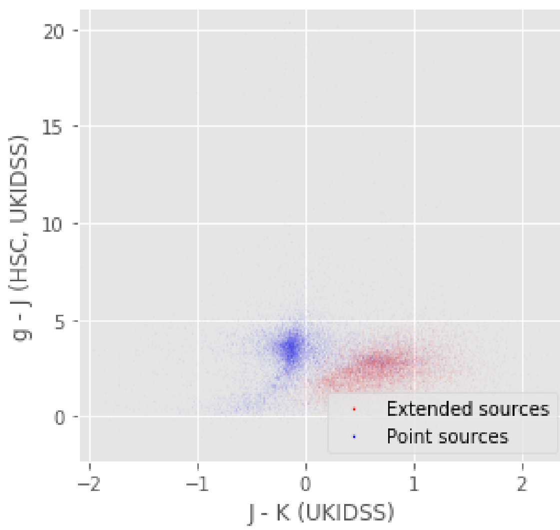


Number of source used: 439840 / 2779194 (15.83%)



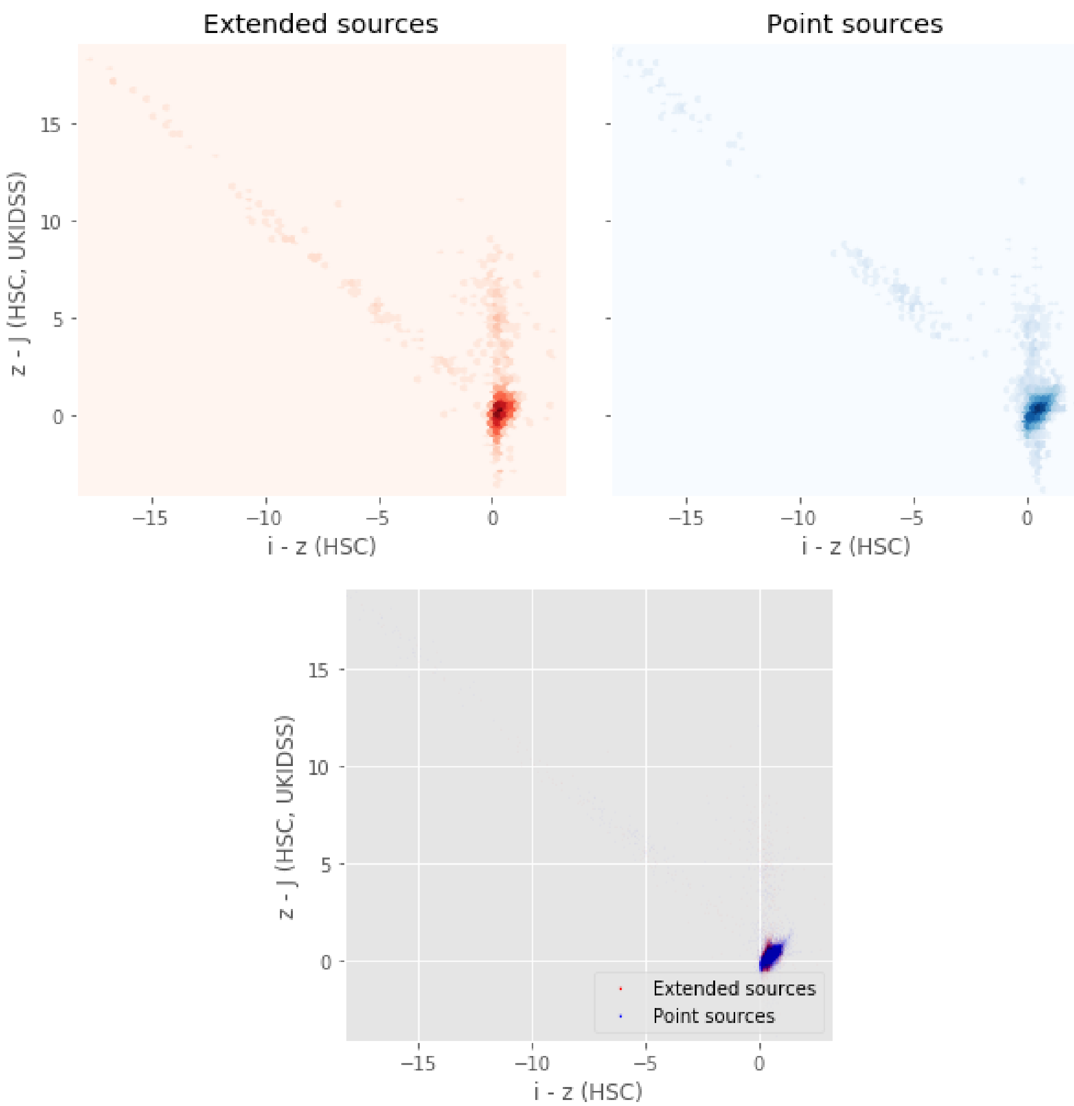
Number of source used: 24173 / 2779194 (0.87%)






```
/opt/anaconda3/envs/herschelhelp_internal/lib/python3.6/site-packages/ipykernel/__main__.py:2: R
  from ipykernel import kernelapp as app
```

```
Number of source used: 27723 / 2779194 (1.00%)
```


Extended sources
Point sources
z - J (HSC, UKIDSS)
i - z (HSC)
15
10
5
0
−15
−10
−5
0
z - J (HSC, UKIDSS)
i - z (HSC)
Extended sources
Point sources