See July 2023 Analysis here :

https://indico.fnal.gov/event/61191/contributions/274824/attachments/170638/229662/ana_wiyn_jul23.pdf

NCCS-WIYN analysis update

summary V5 tNCCSz catalog and NCCS x GAIA enriched catalog

R. Ansari , O. Perdereau, April 2024

1. Quick look to the tNCCSz summary V5 catalog
2. Star contamination using GAIA
3. Selection functions and reproducing magnitude distributions
4. Angular correlation with Planck extinction map
5. tNCCSz correlation function
6. Mocks using SDSS cutouts

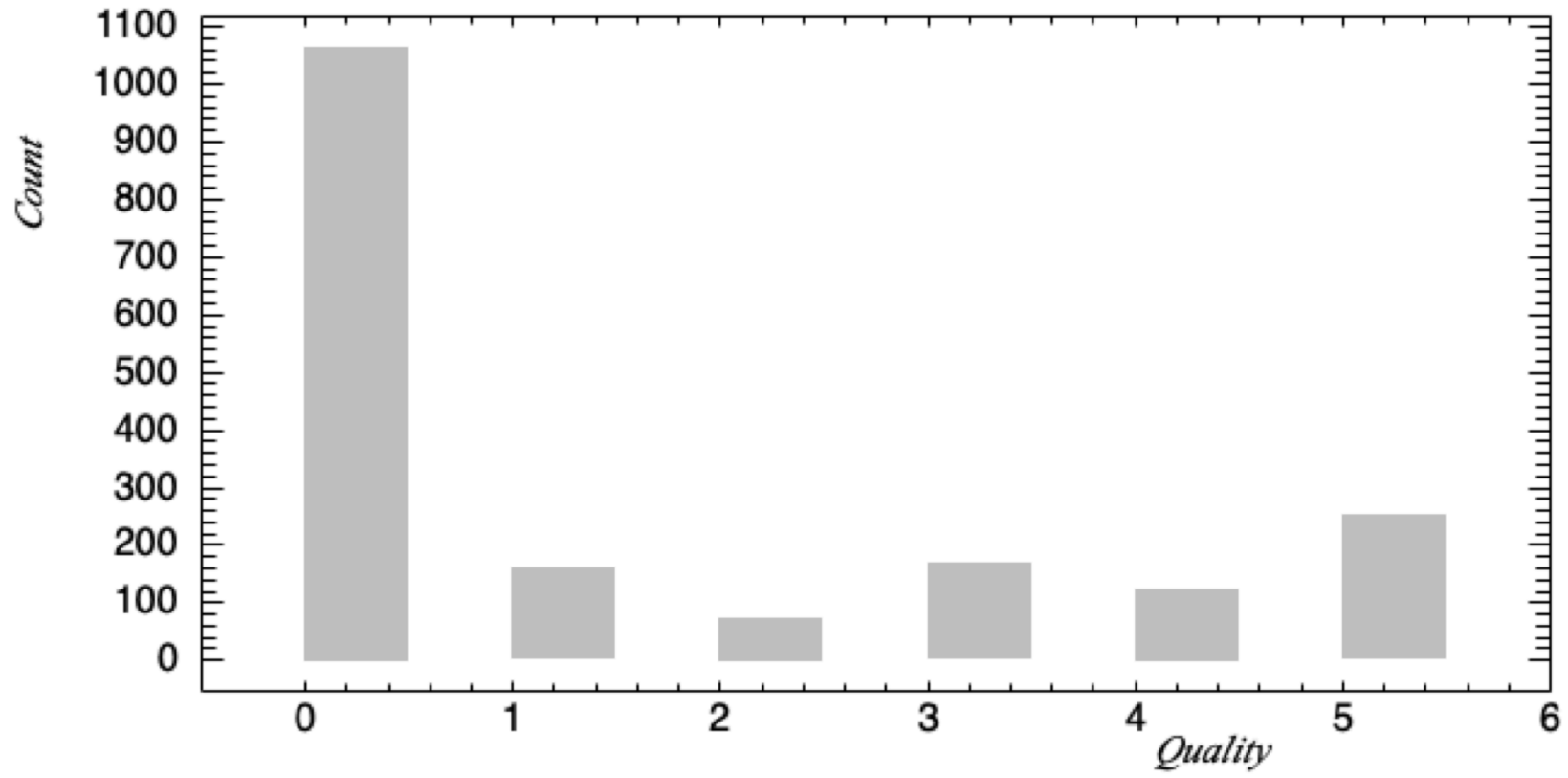
I. Quick look to the summary V5 tNCCSz catalog

	V4	V5
All	2801	2801
Q>=1	732	776
Q>=1 && Redshift>0.005	623	656
Q>=1 && Redshift>0.00001		658

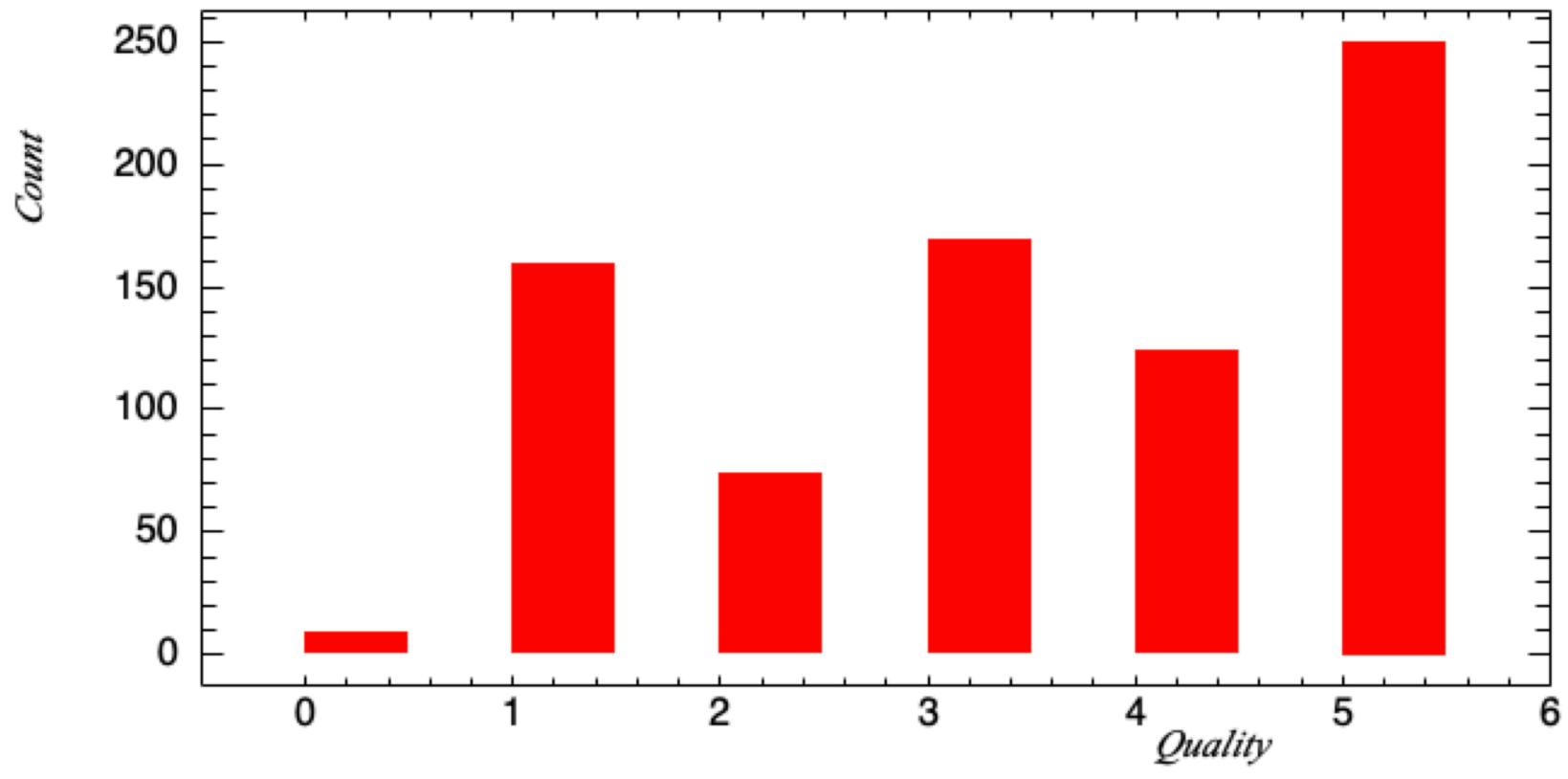
20% of objects with Q>=1 are stars !

WIYN_summary_v5.txt

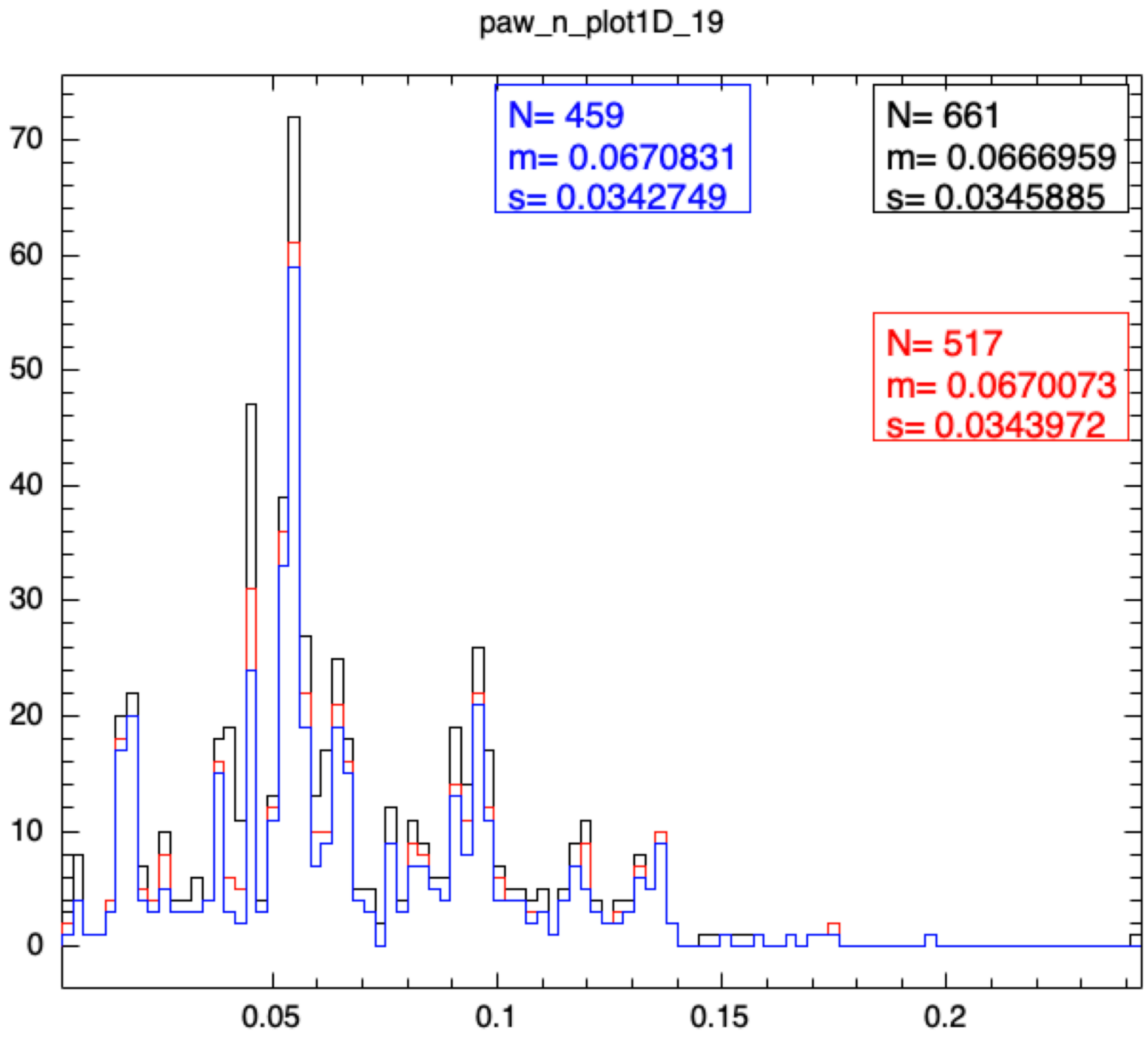
Quality distribution, Q>=0

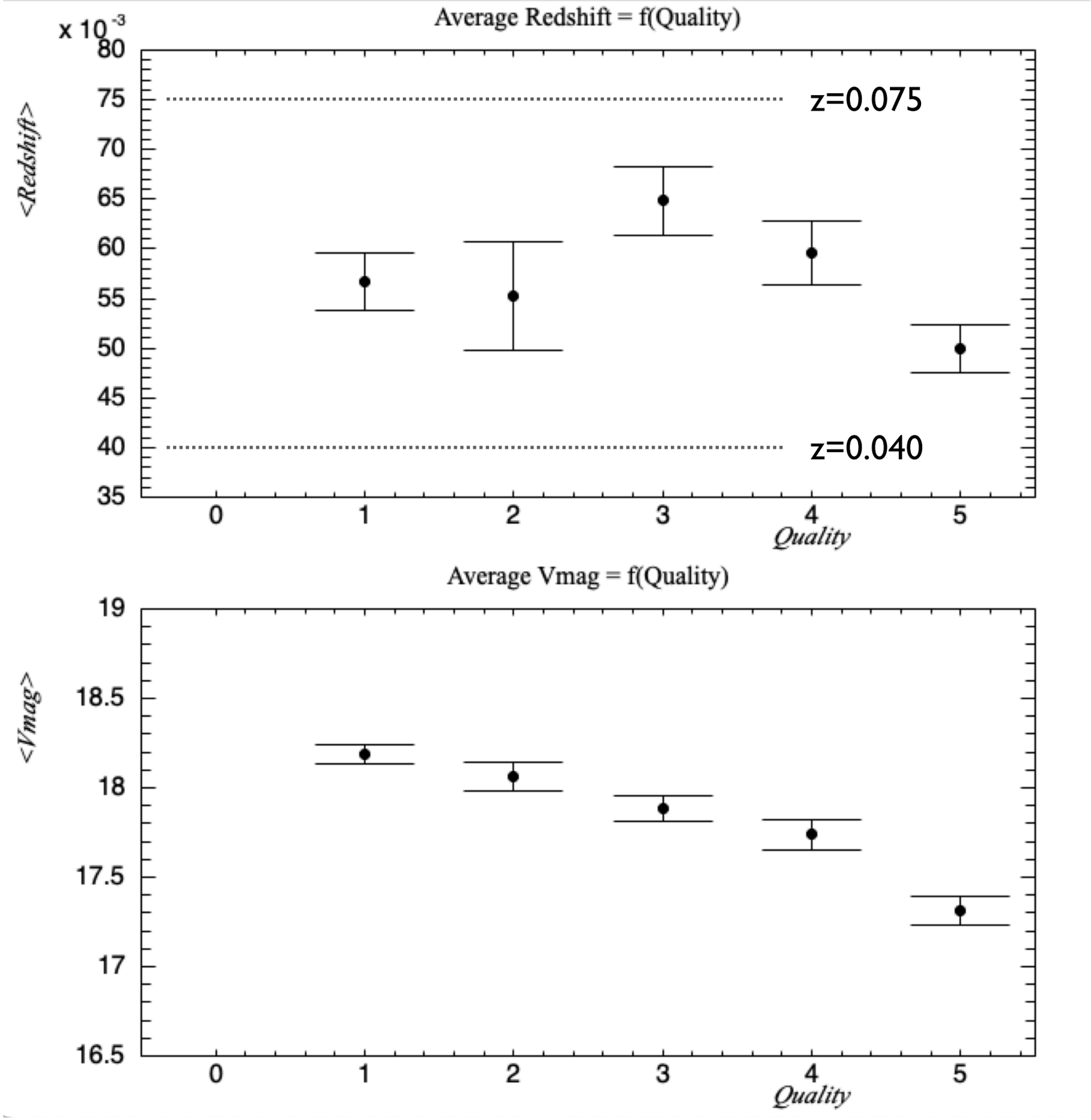


Quality distribution, Redshift>-0.05



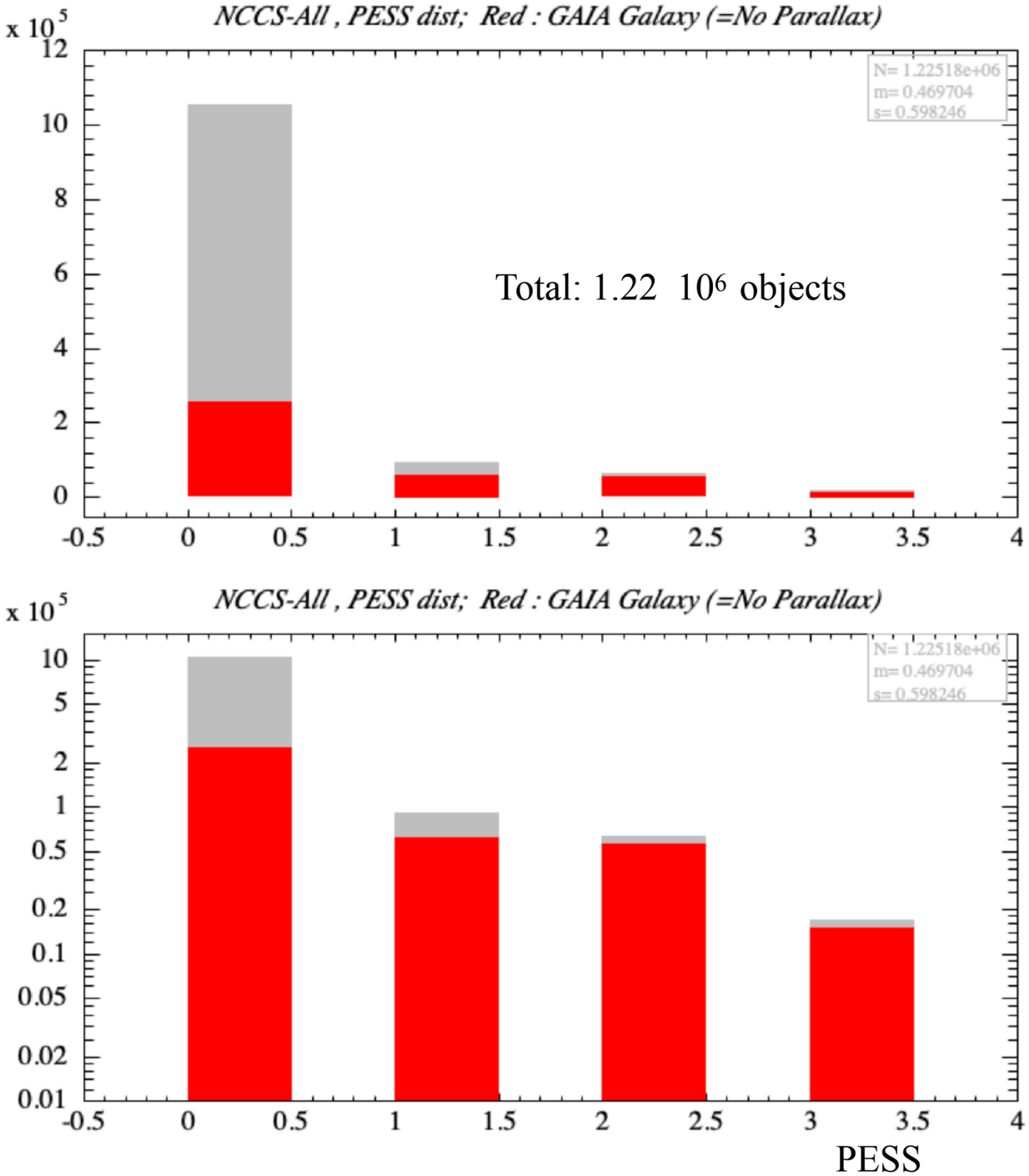
Redshift distribution - all , Q>=2 Q>=3

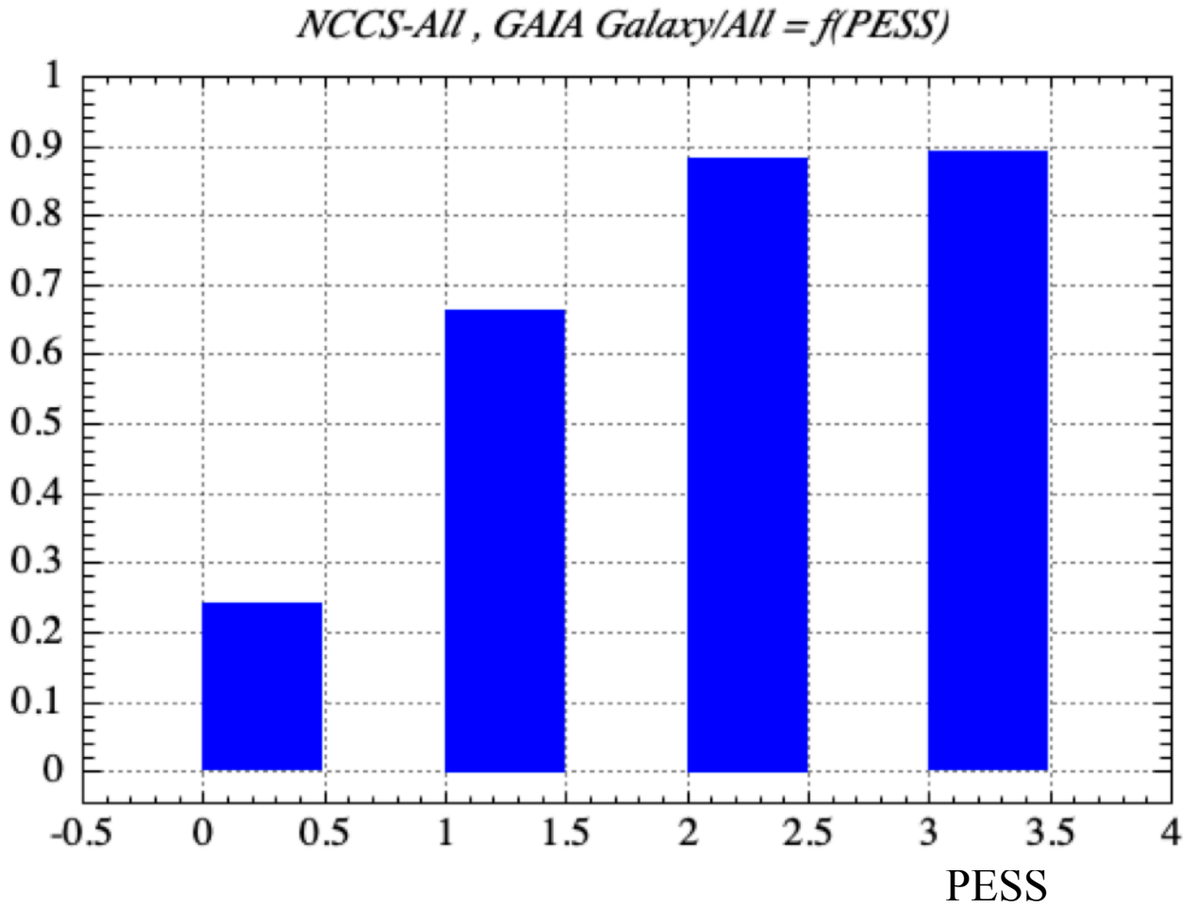



Average Redshift = f(Quality)
x 10^-3
<Redshift>
80
75
70
65
60
55
50
45
40
35
z=0.075
z=0.040
0
1
2
3
4
5
Quality
Average Vmag = f(Quality)
<Vmag>
19
18.5
18
17.5
17
16.5
0
1
2
3
4
5
Quality

2. Star contamination using GAIA

Red : Galaxy likely, No parallax



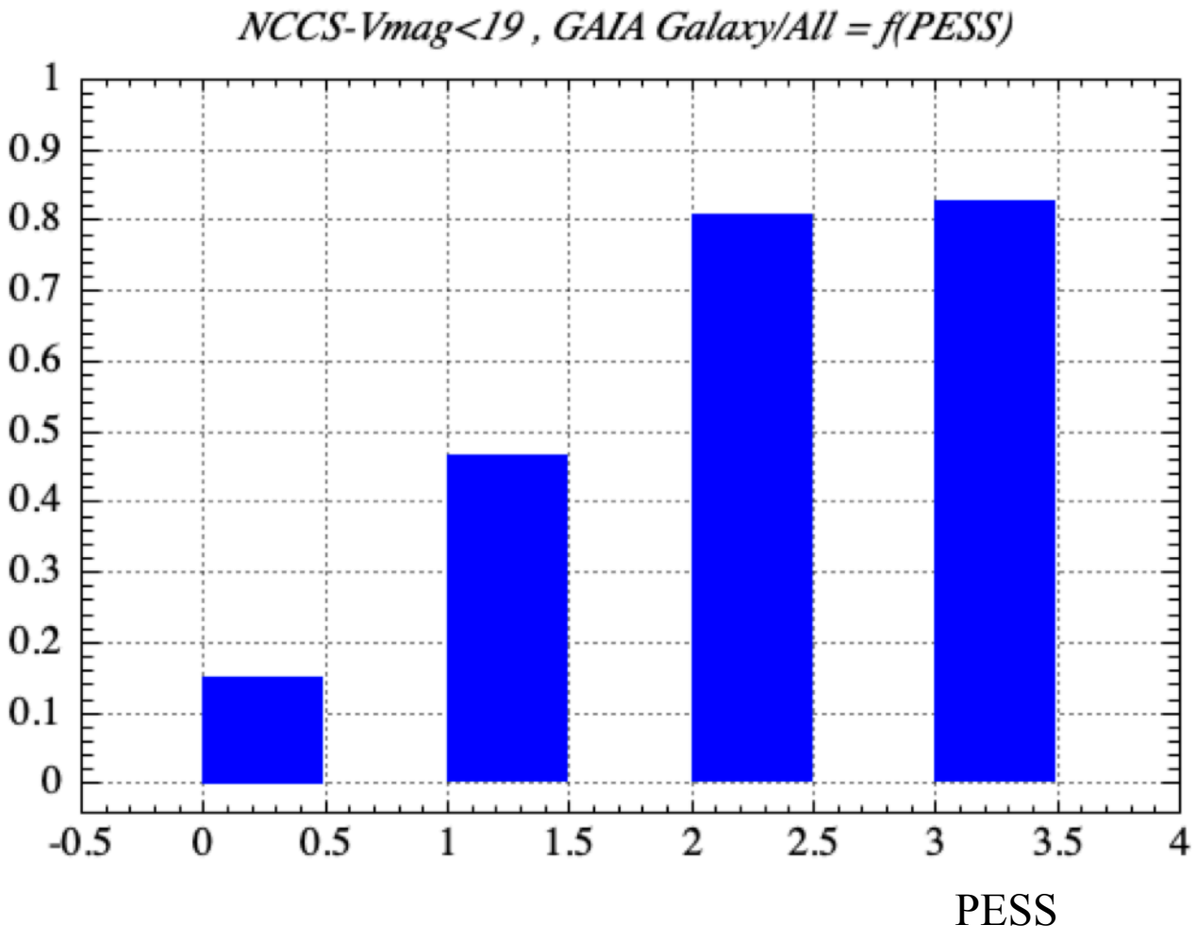


Ratio GAIA-Galaxy/All = f (PESS)

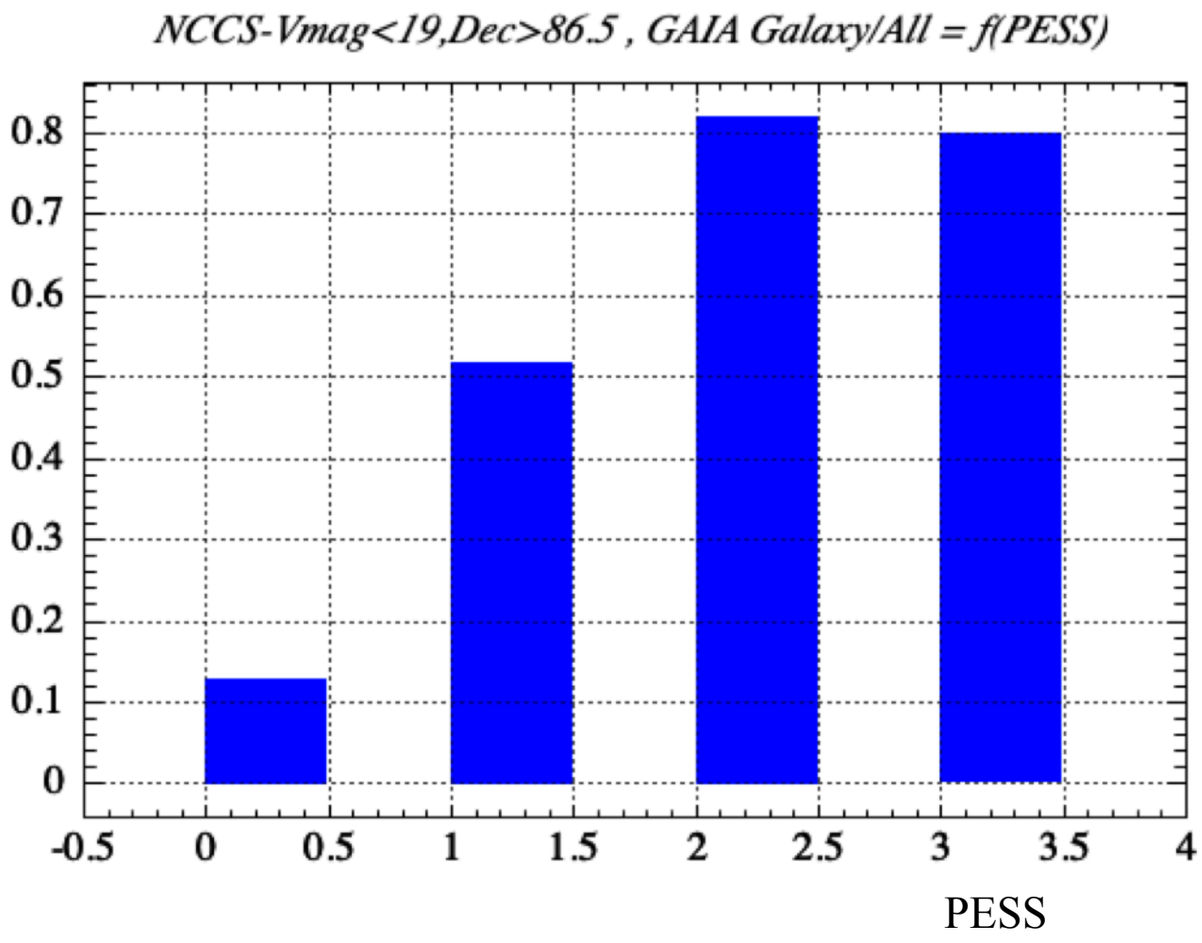
NCCS x GAIA , GAIA Galaxy = No GAIA object or no parallax

`(gaia_sep>2.5″)||(gaia_parallax/gaia_parall_err<3.)`

2.b GAIA star contamination for WIYN targets



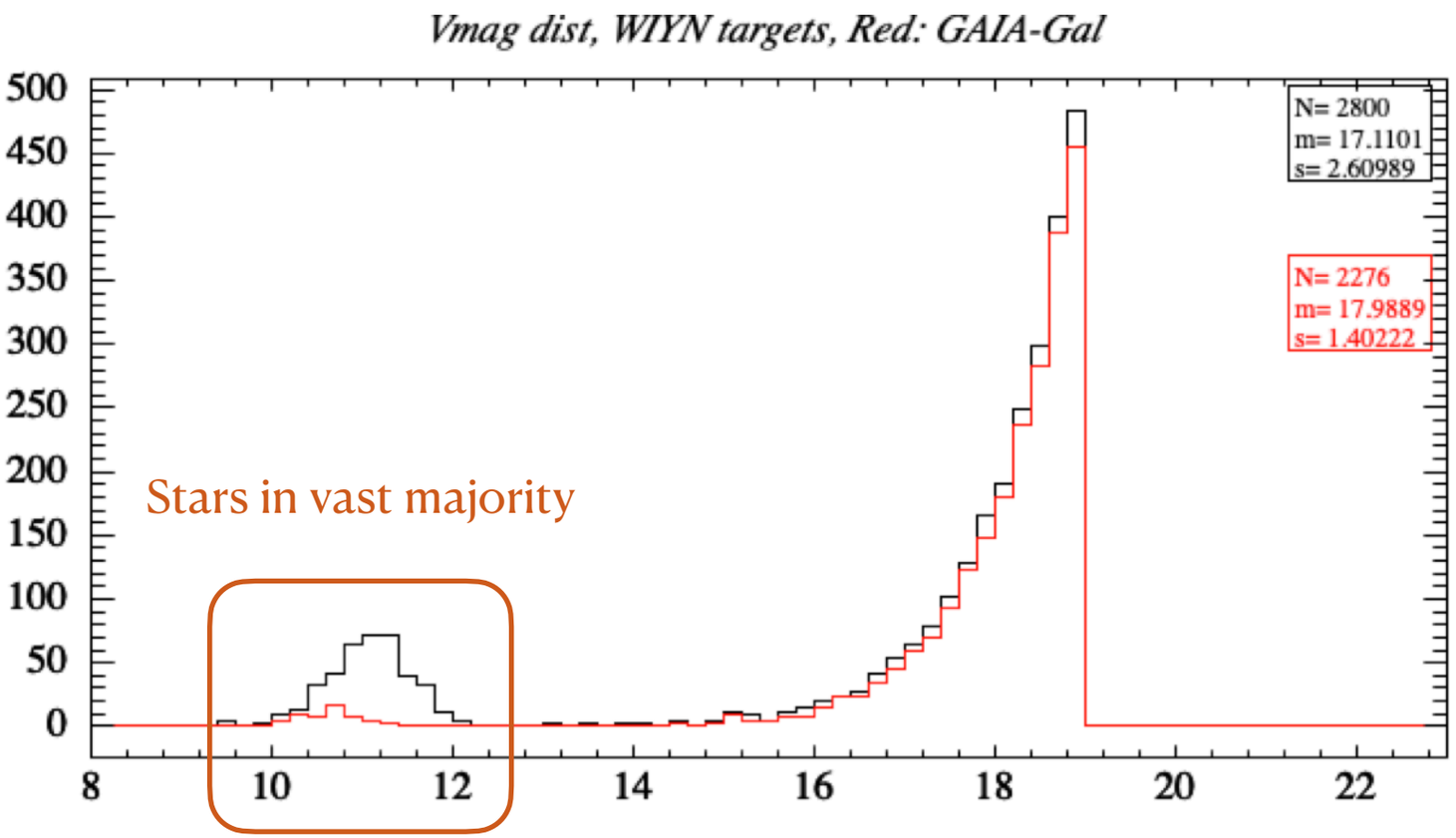
Ratio GAIA-Galaxy/(All Vmag<19) = f (PESS)



Ratio GAIA-Galaxy/(All Vmag<19, Dec>86.5) = f (PESS)

WIYN targets (2800 objects) :
Vmag<19, Dec>86.6 , PESS>=2
~ 20% star contamination

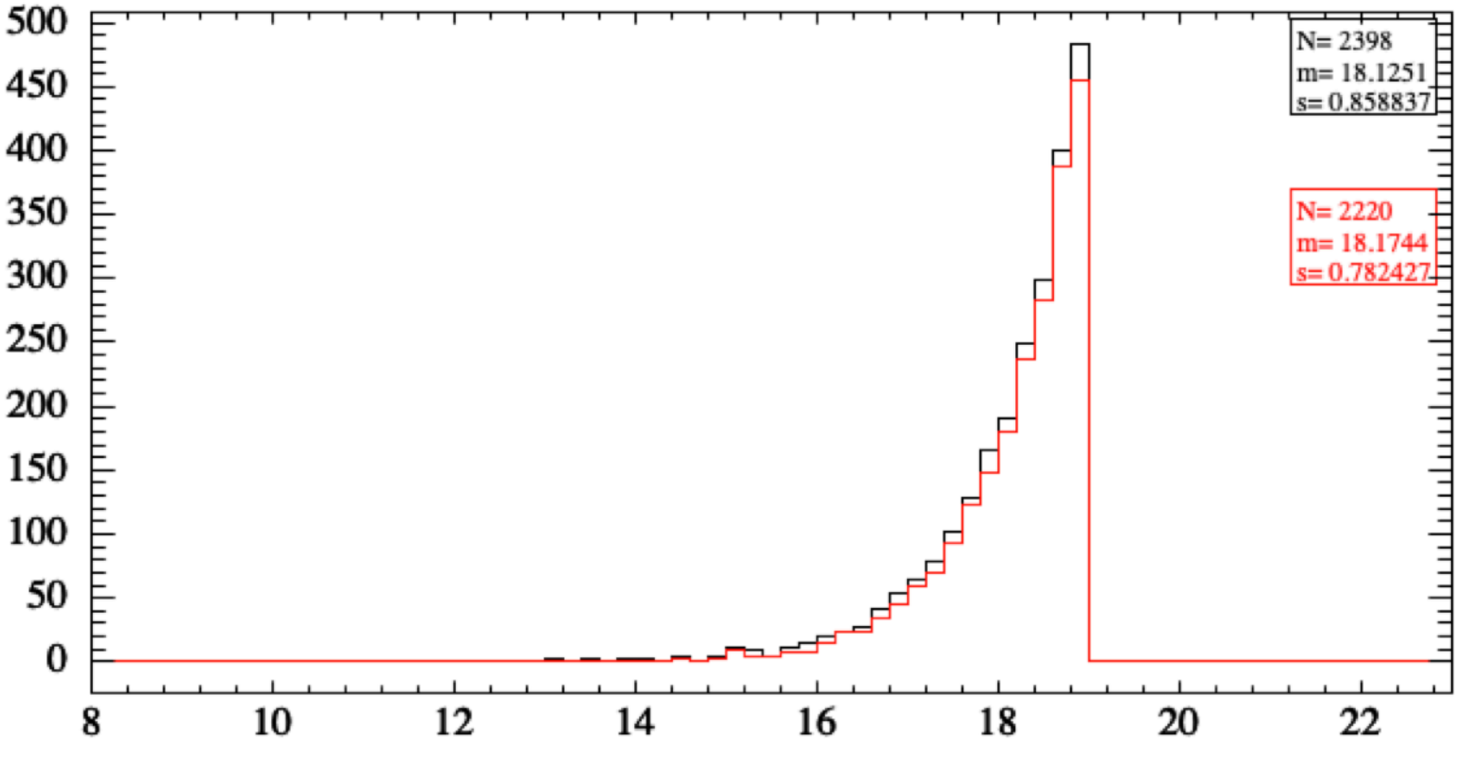
WIYN targets Vmag distribution, star contamination



~2800 objects

~2280 NOT a star in GAIA

≤ 20% star contamination, mostly bright objects



~2400 objects Vmag>12.5

2220 NOT a star in GAIA

≤ 10% star contamination, for objects with Vmag>12.5

3. Reproducing magnitude distribution

1. Galaxy luminosity function represented by a Schechter function with the following parameters :

   $\Phi^* = 0.006$; $M^* = -20.3$; Slope = -1.3

2. Apply Galactic extinction , according to Plank extinction map
3. Apply NCCS detection efficiency, represented by a Sigmoid function - $\eta_d(m)$

   $m^* = 19.75$, $\alpha = 2.5$
4. Apply Redshift determination efficiency,

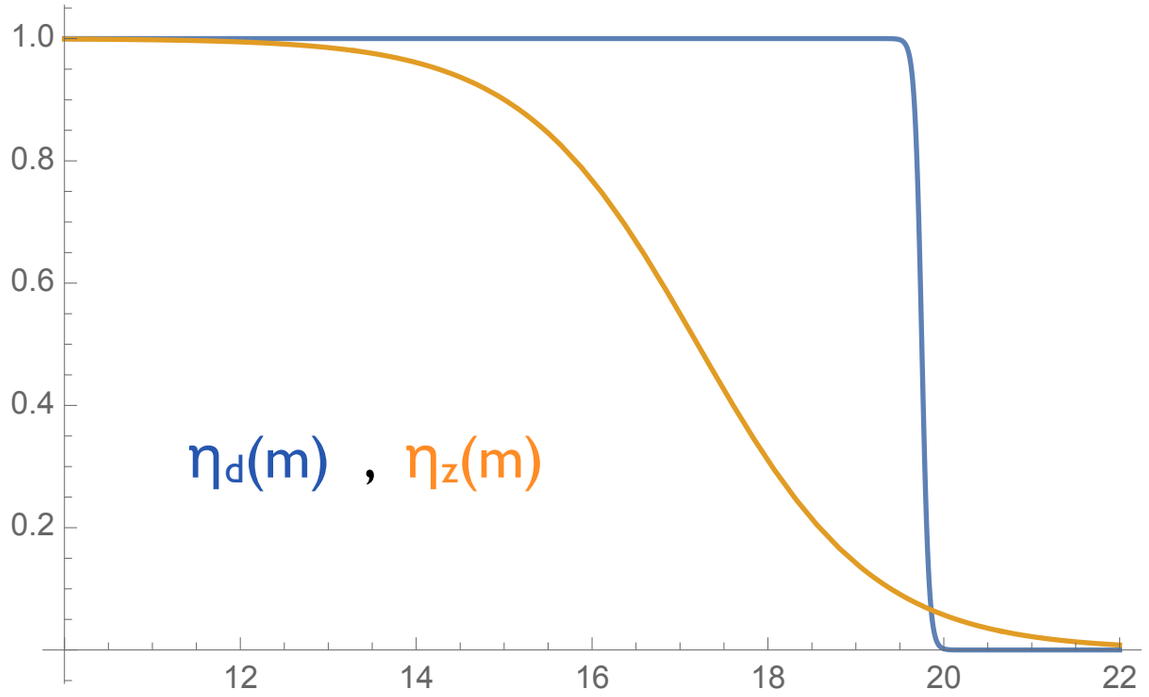
   represented also by a sigmoid function - $\eta_z(m)$

   $m^* = 17.2$, $\alpha = 1$

Selection function as a Sigmoid :

$$\eta(m) = \frac{1}{1 + \exp\left(\alpha(m - m^*)\right)}$$

The two selection functions:



NCCS (PESS>1.5) selection function:

$\eta_d(m)$: $m^* = 19.75$ $\alpha = 2.5$

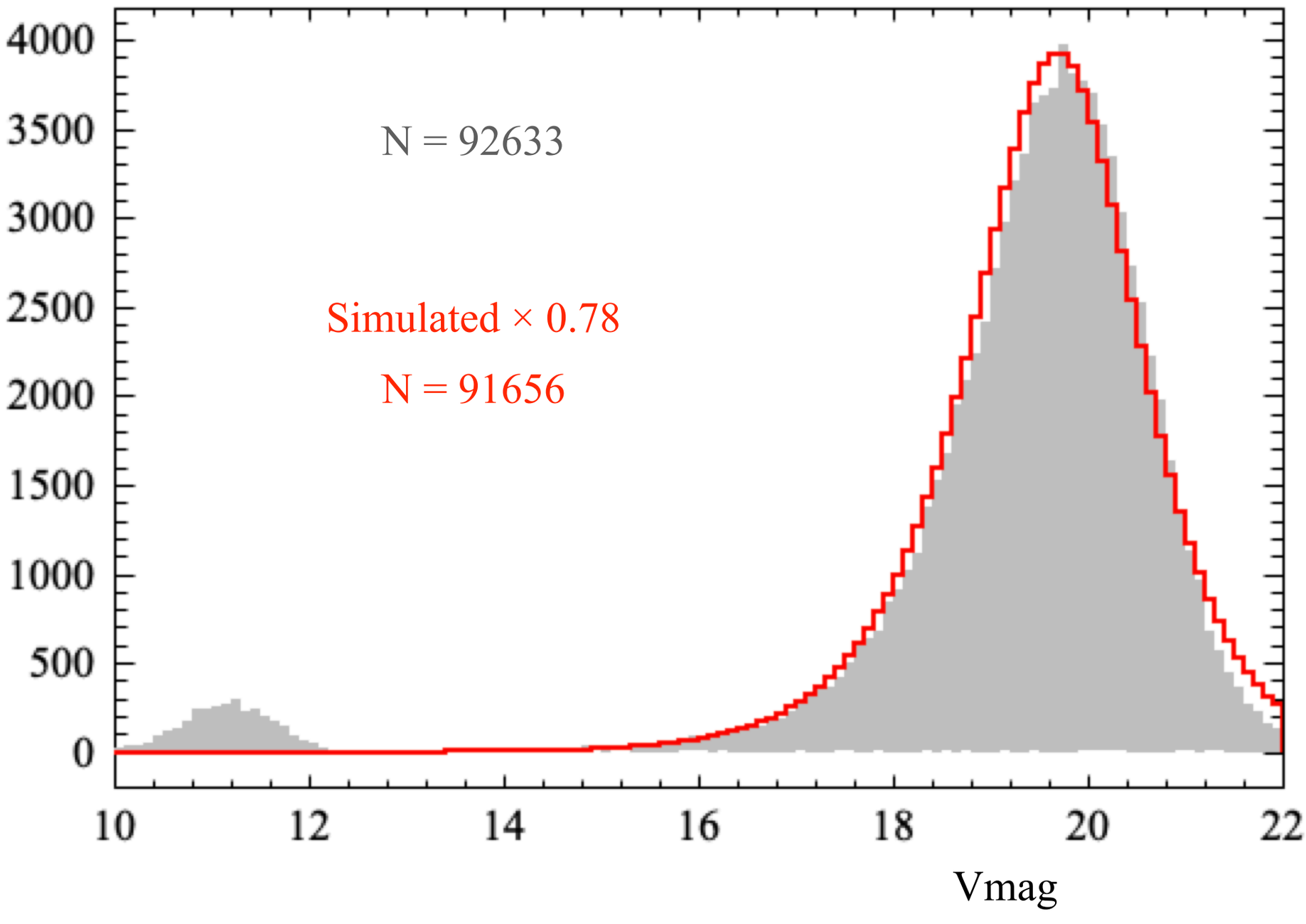
WIYN redshift finding selection function:

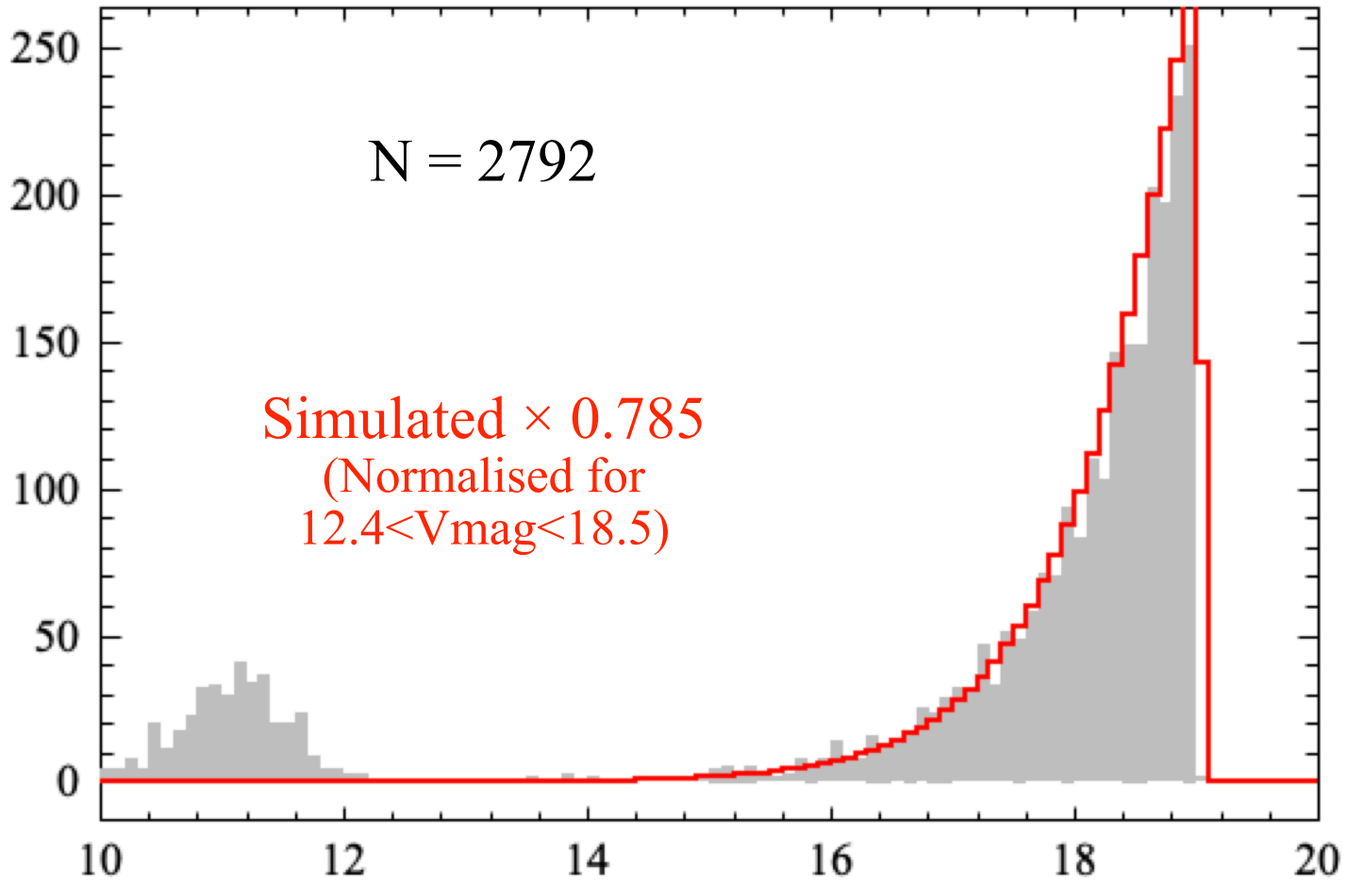
$\eta_z(m)$: $m^* = 17.2$ $\alpha = 1$

NCCS - all, PESS ≥ 2

R = 9 deg , 250 deg²

Use of normalisation coefficient (0.78) determined on the NCCS-WIYN target list





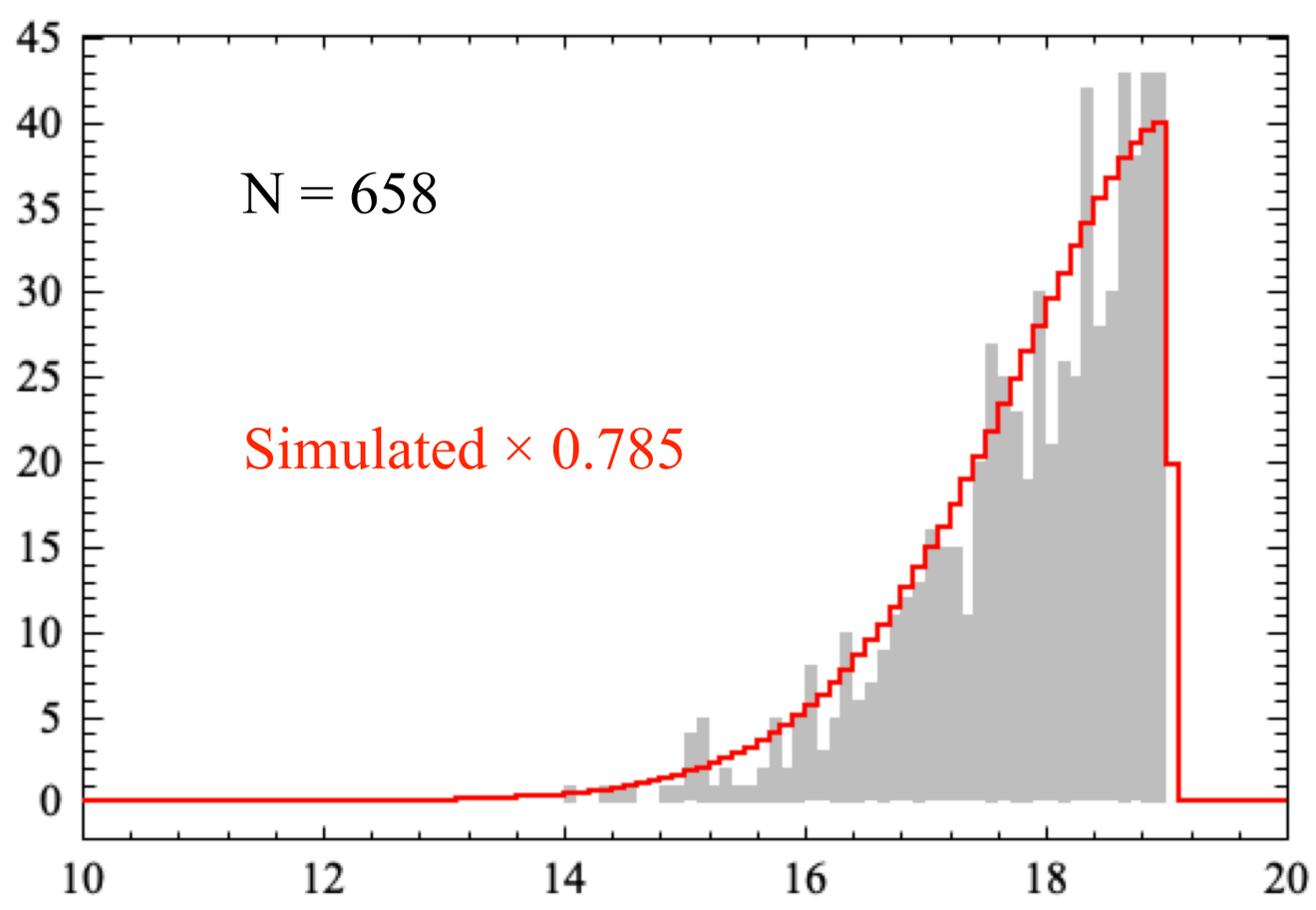
WIYN - V5

R = 3.5 deg , 38 deg^2

Vmag distribution
Q ≥ 1 , z > 0.

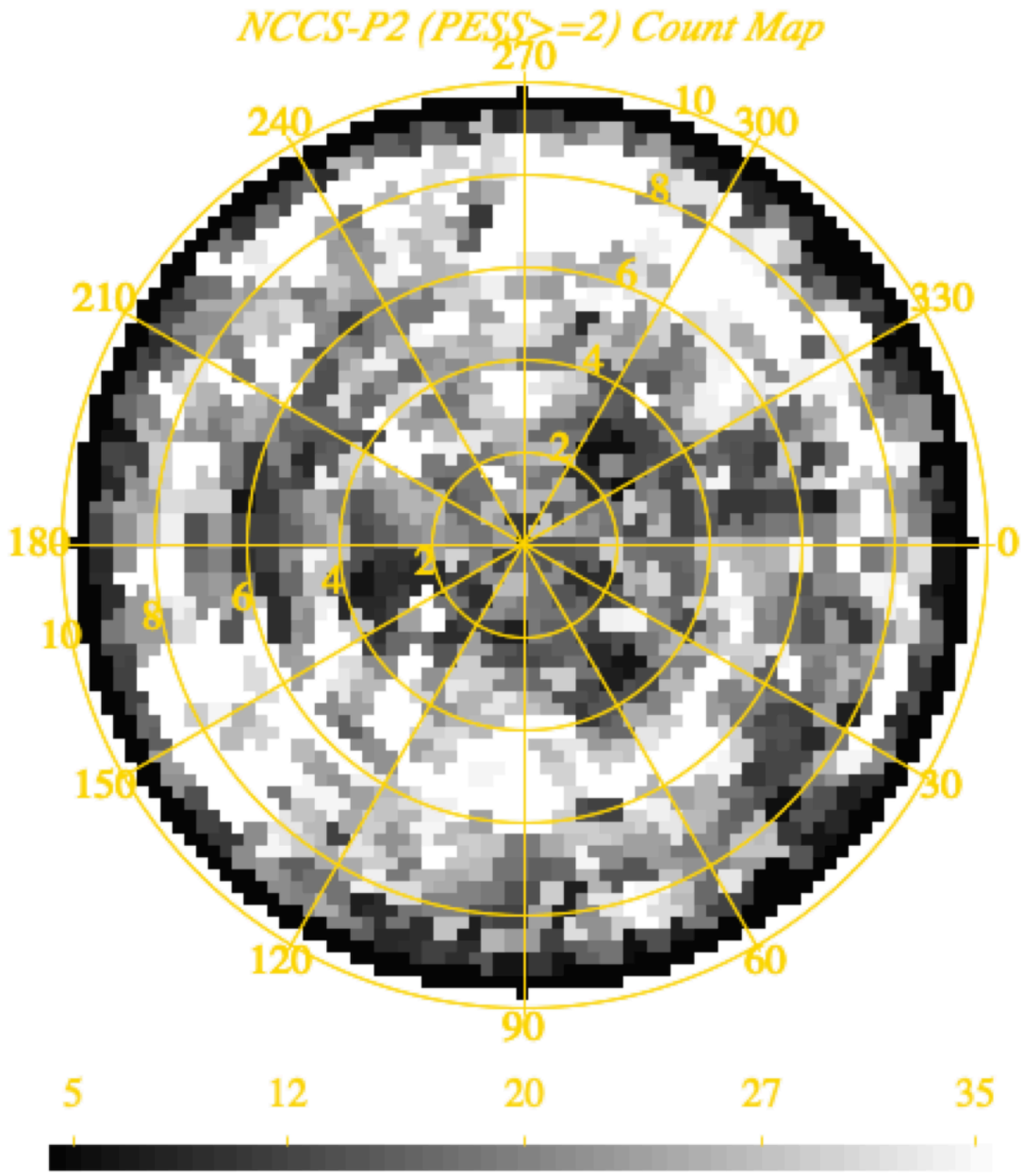
Vmag distribution
all WIYN targets

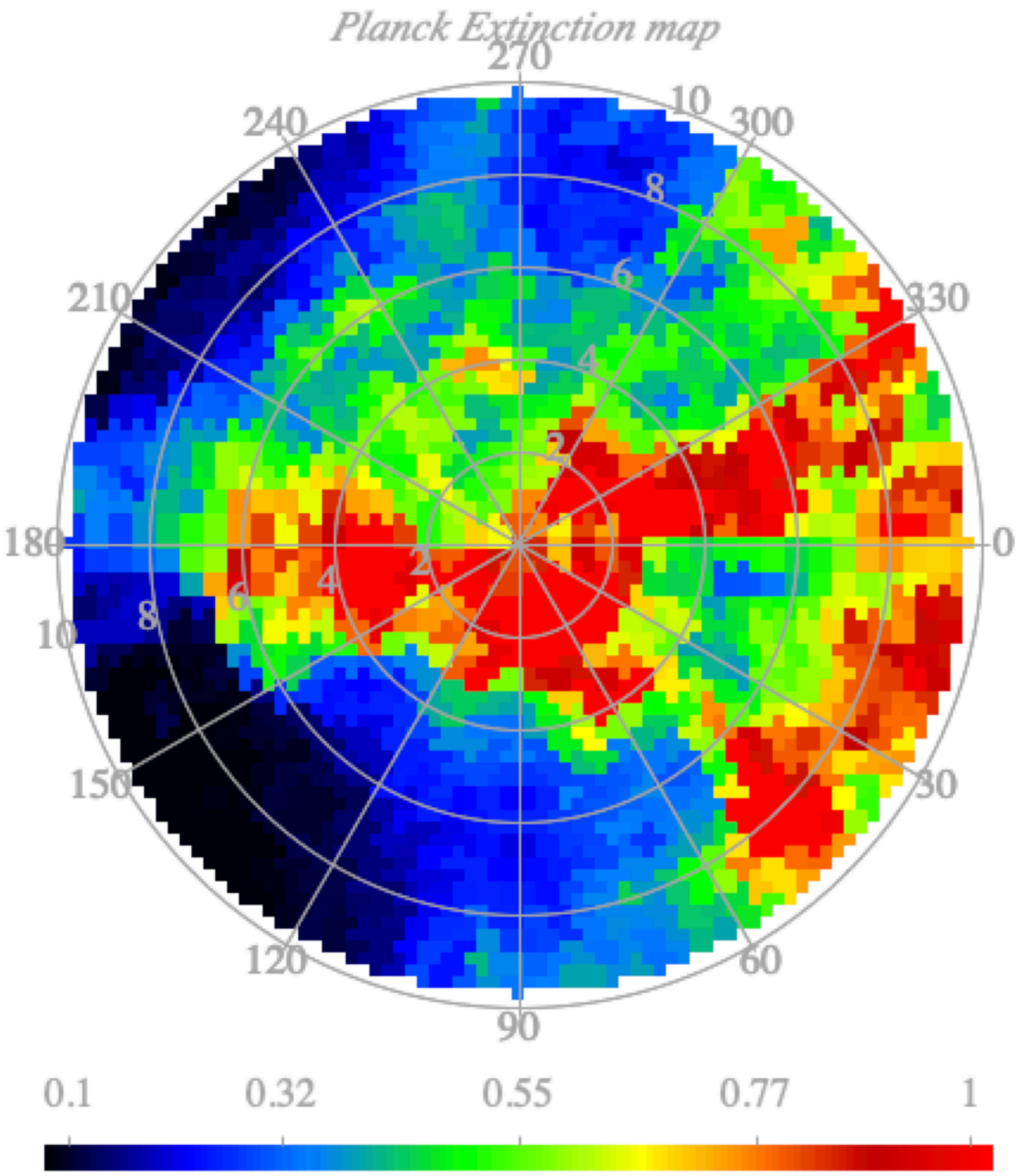
If extinction **not** taken into account, the normalisation coefficient would be **0.28** (instead of 0.785) to match the NCCS-WIYN selected targets



4. NCCS count map x Planck extinction map

PESS ≥ 2, Vmag < 19 , δ > 81 deg

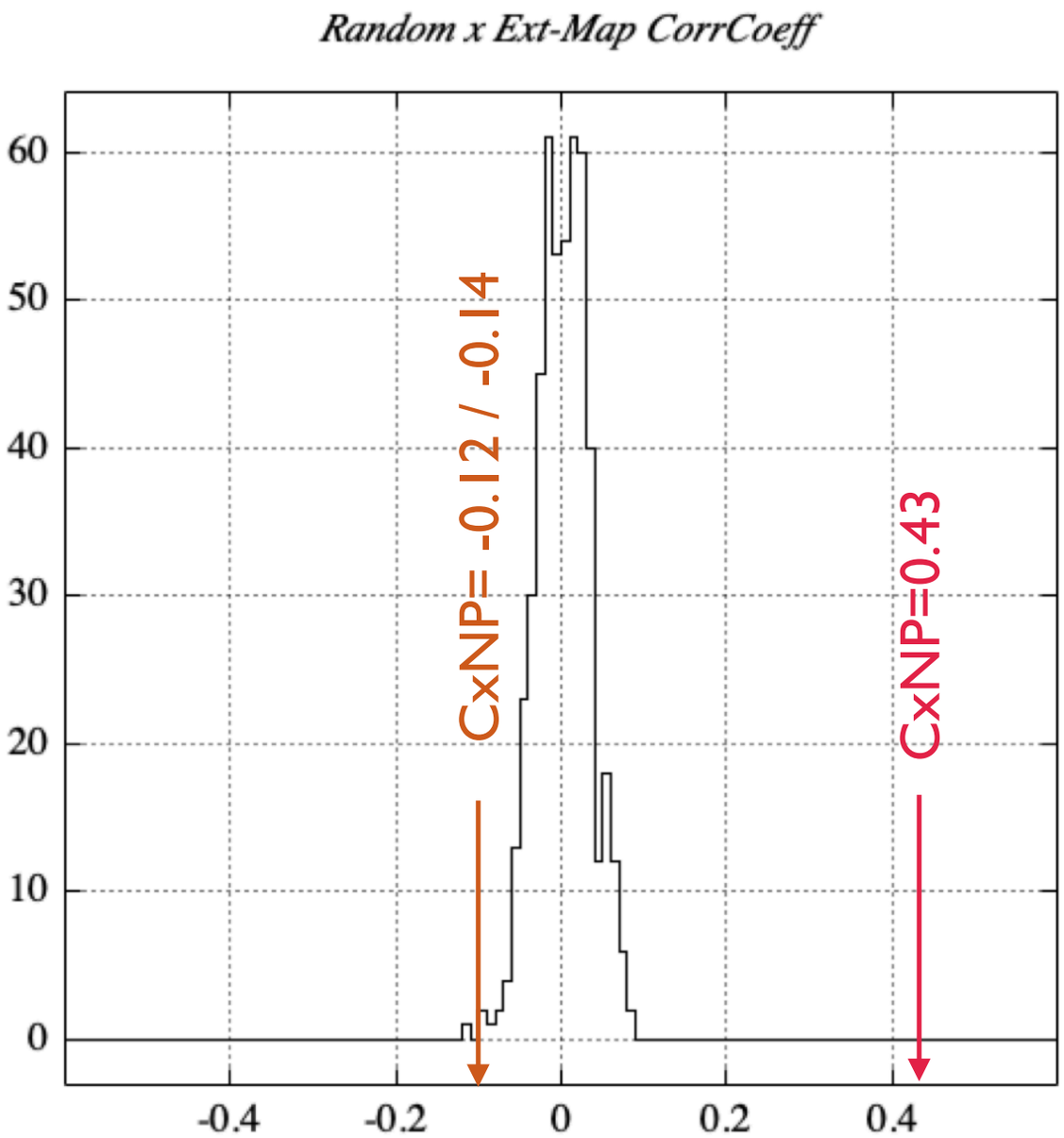




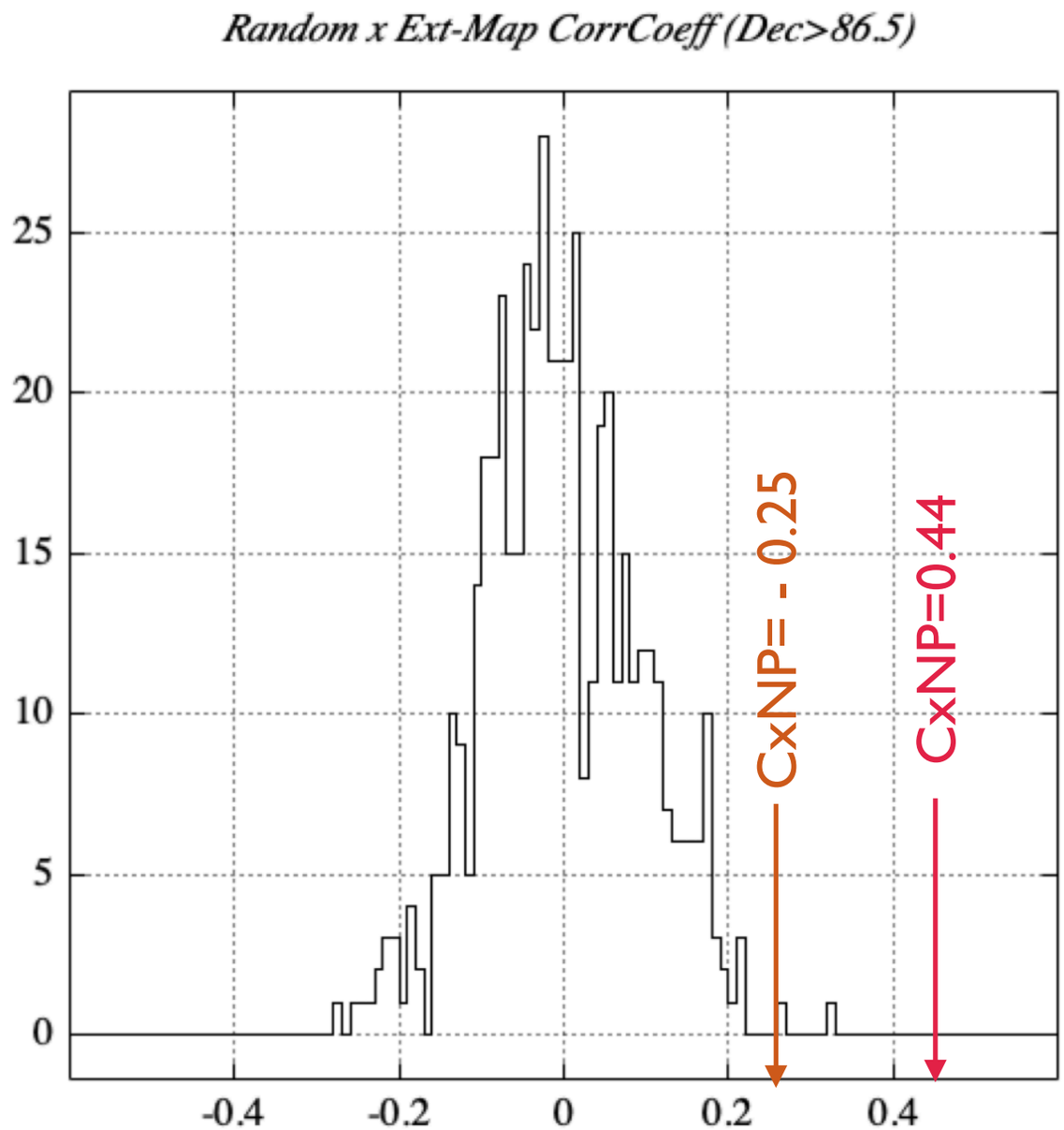
NCCS ALL sources, magV<19, PESS>=2, Dec>81 (ra,dec) distribution ,
Planck extinction Av map , at 0.5 deg resolution (map pixels)

Correlation coefficient : CxNP = NCCS Source-Count-Map × (- Planck-Extinction-Map)

δ > 81 deg



δ > 86.5 deg



Distribution of CxNP for random distribution × Planck extinction map

CxNP for NCCS PESS ≥ 2, Vmag < 19

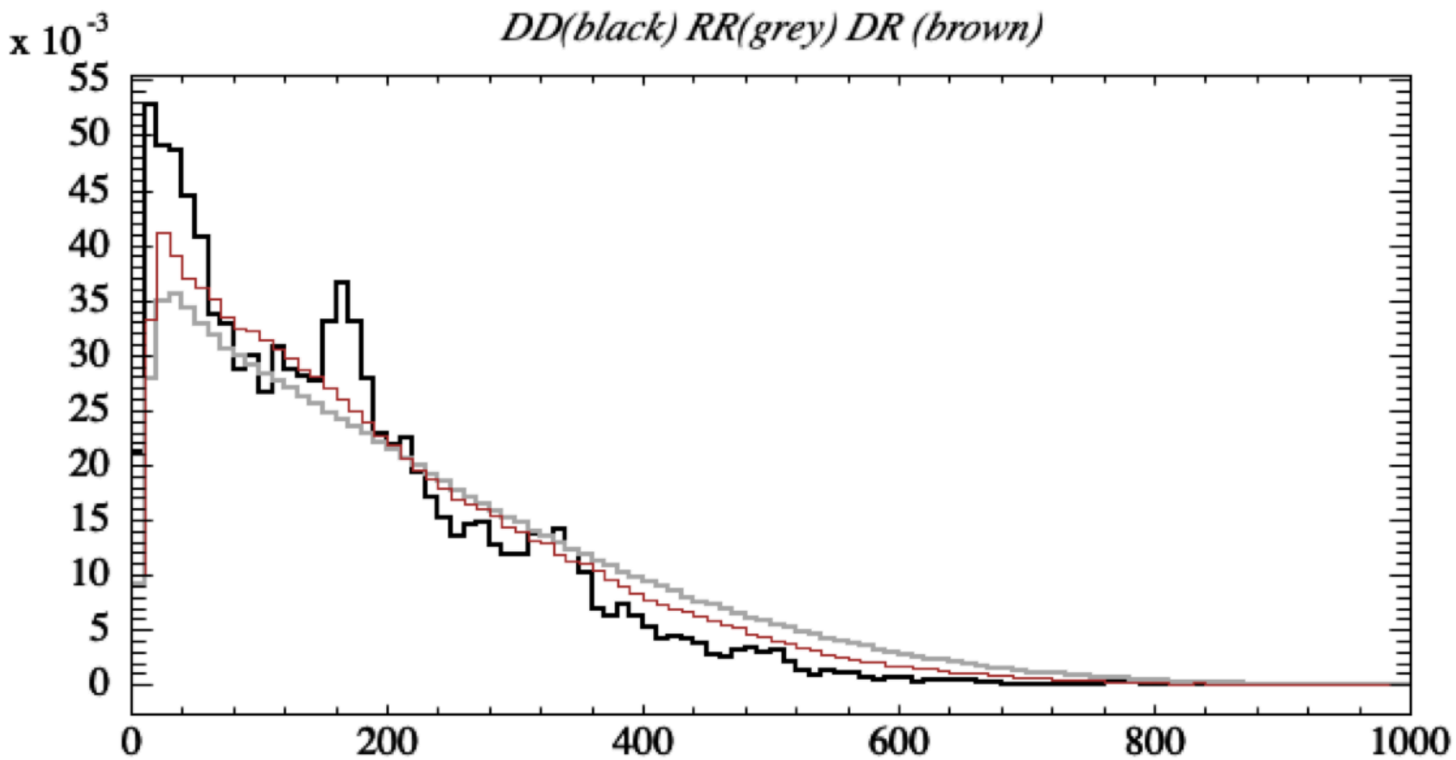
CxNP for NCCS PESS < 1 or GAIA star

5. Correlation function

Data auto-correlation function DD

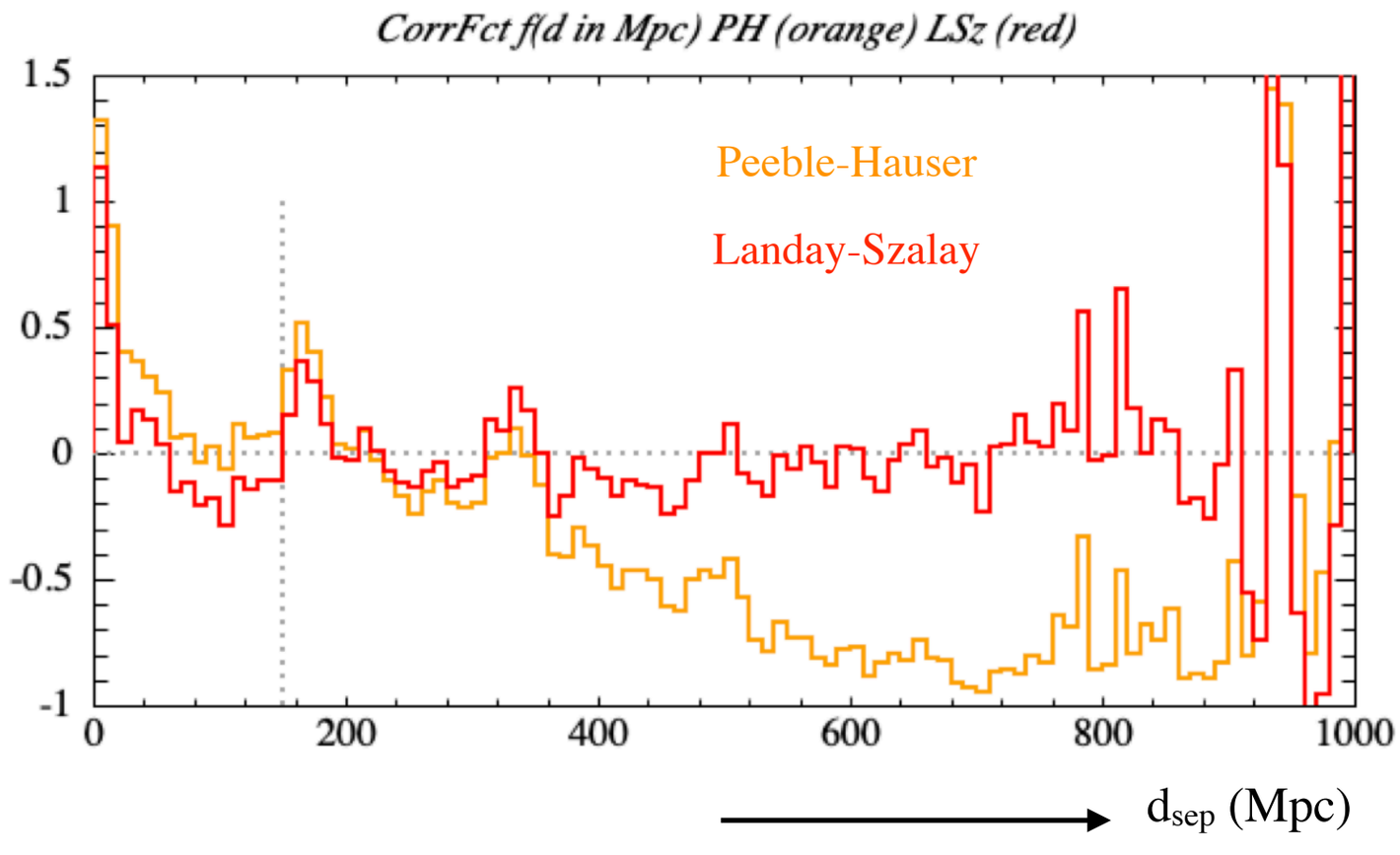
Random catalog auto-correlation RR

Data x random cross-correlation DR



$$f_{PB}(d) = \frac{DD}{RR} - 1$$

$$f_{LSz}(d) = \frac{DD - 2DR + RR}{RR}$$



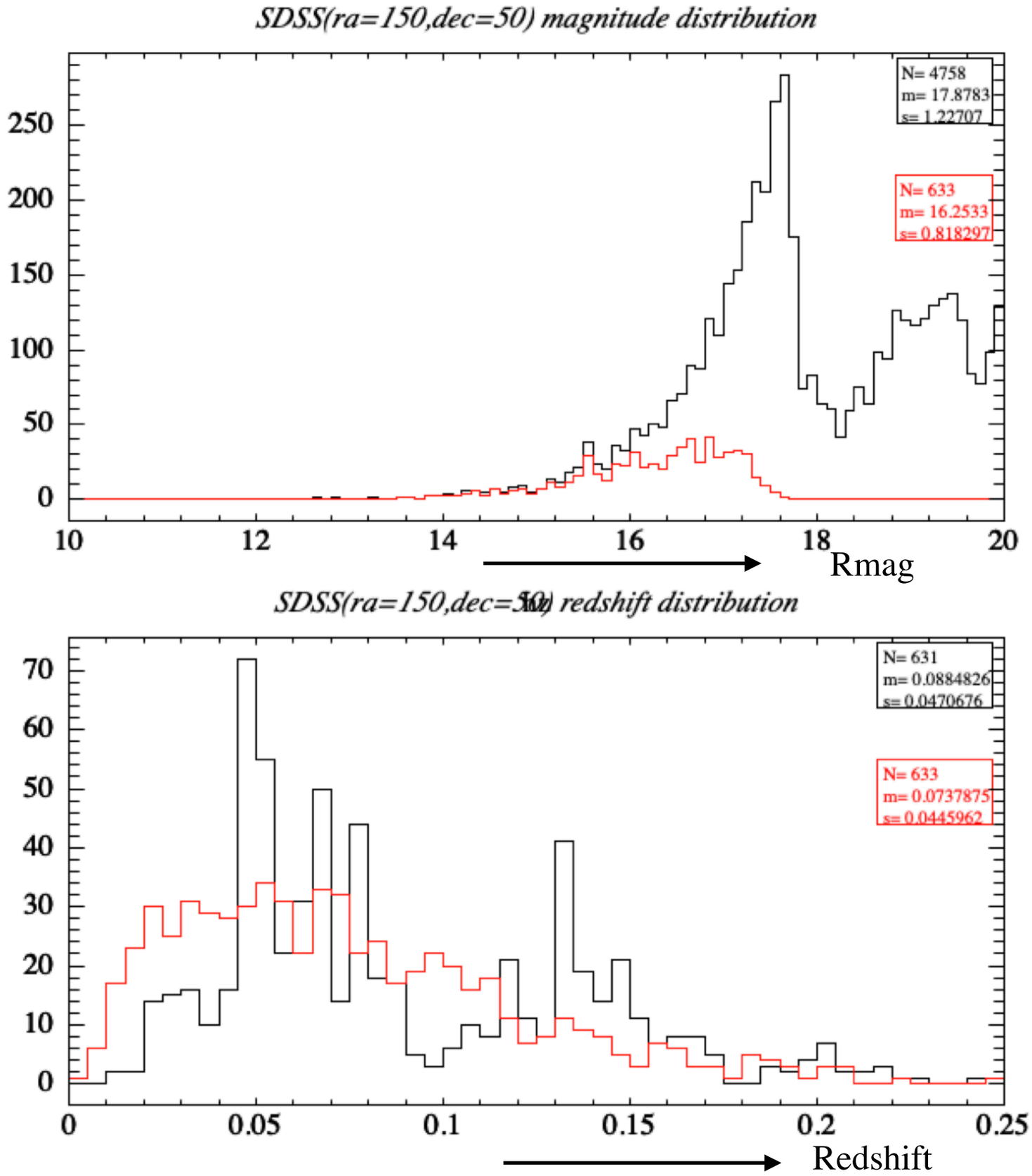
6.1 SDSS magnitude / redshift distribution

Apply extinction to SDSS galaxies

All within 3.5 degree of (ra,dec)=(150,50)
4760 galaxies (SDSS) to be compared to 2800 NCCS target galaxies

After extinction and WIYN redshift reconstruction efficiency and magnitude <18 cut
***630** galaxies (SDSS) to be compared with **650** NCCS-WIYN with z-spec*

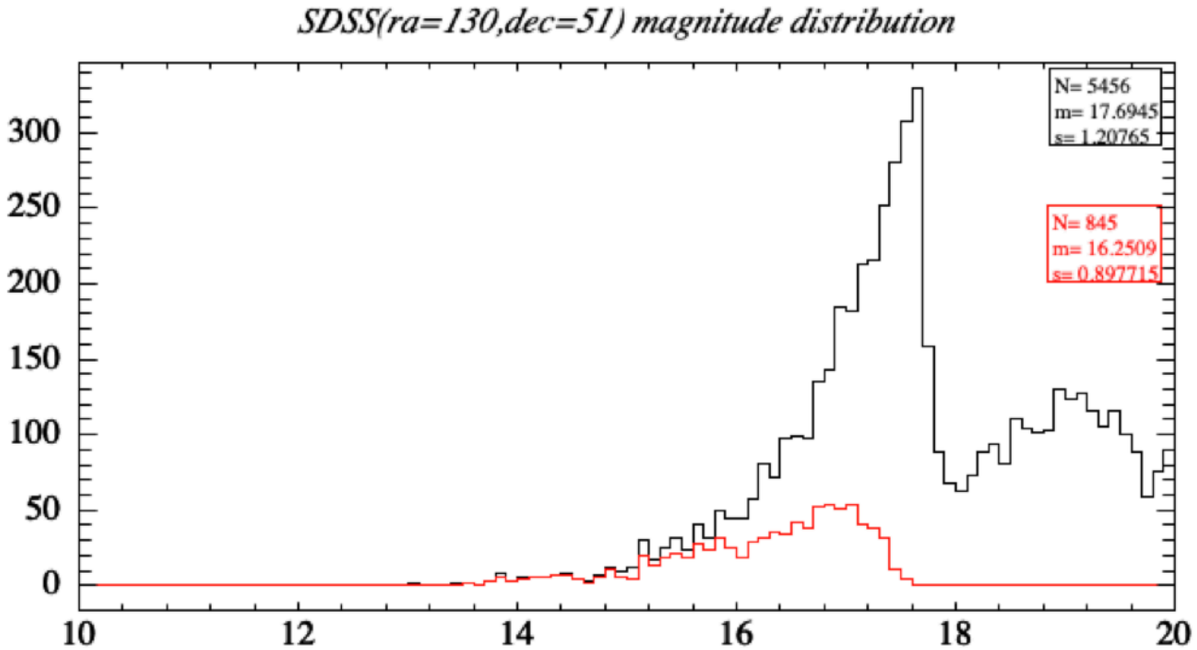
Selected SDSS galaxies redshift distribution, and the one expected for a uniform galaxy distribution

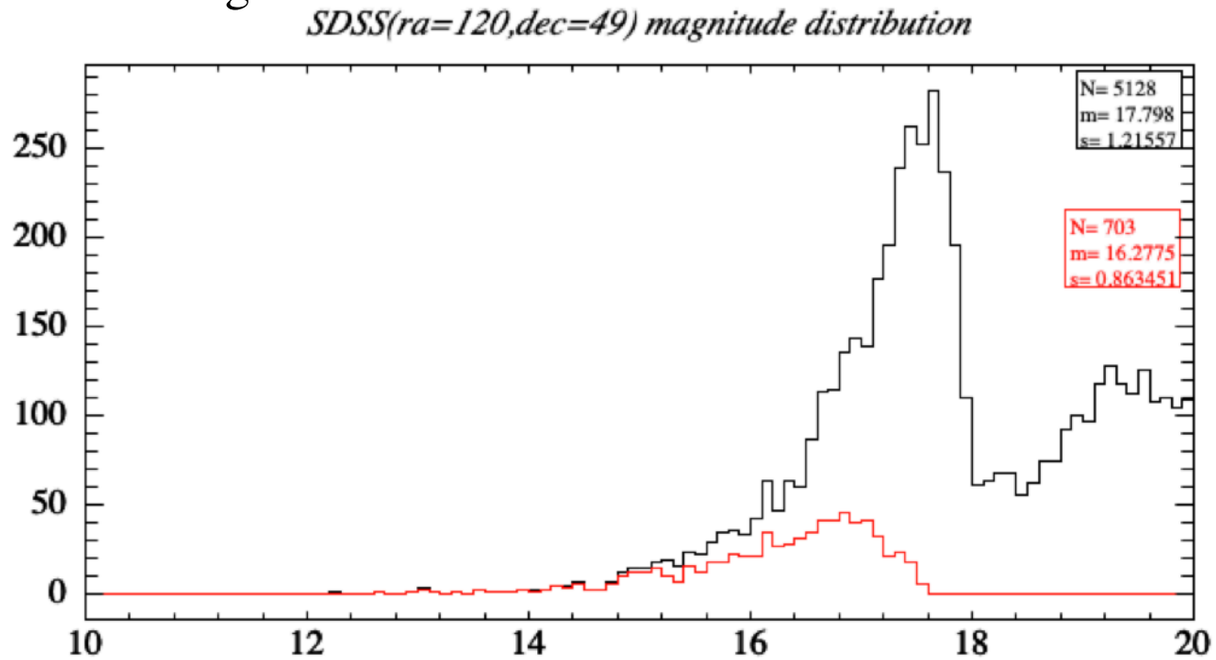


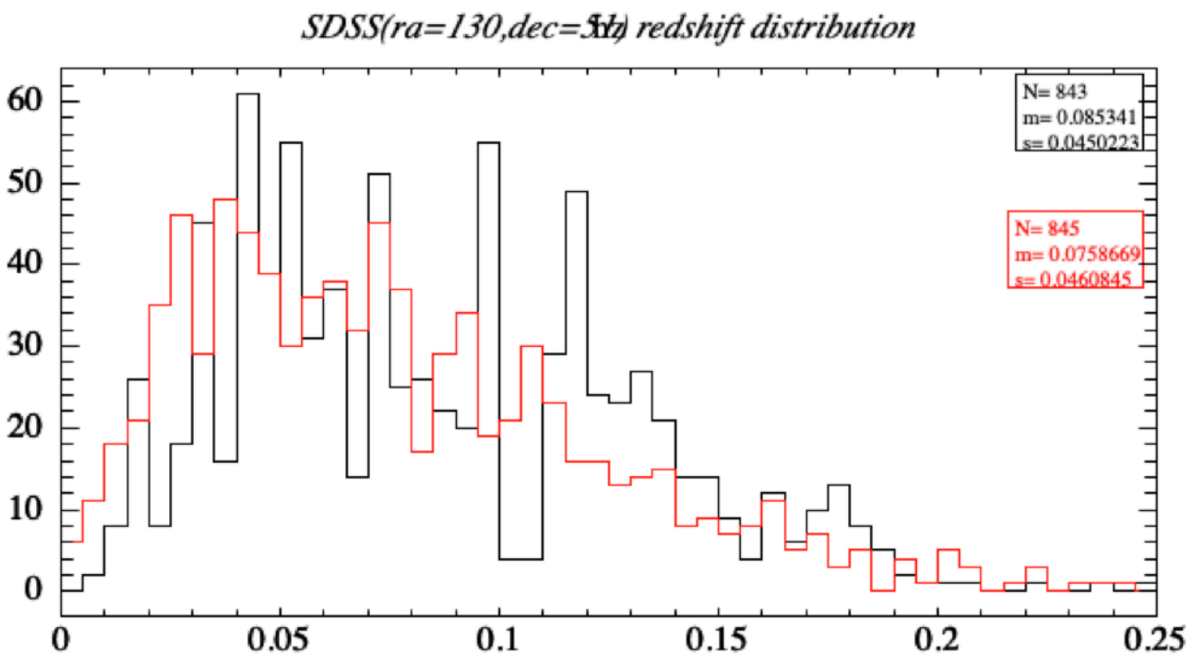
Centered on (ra,dec)=(130,51)

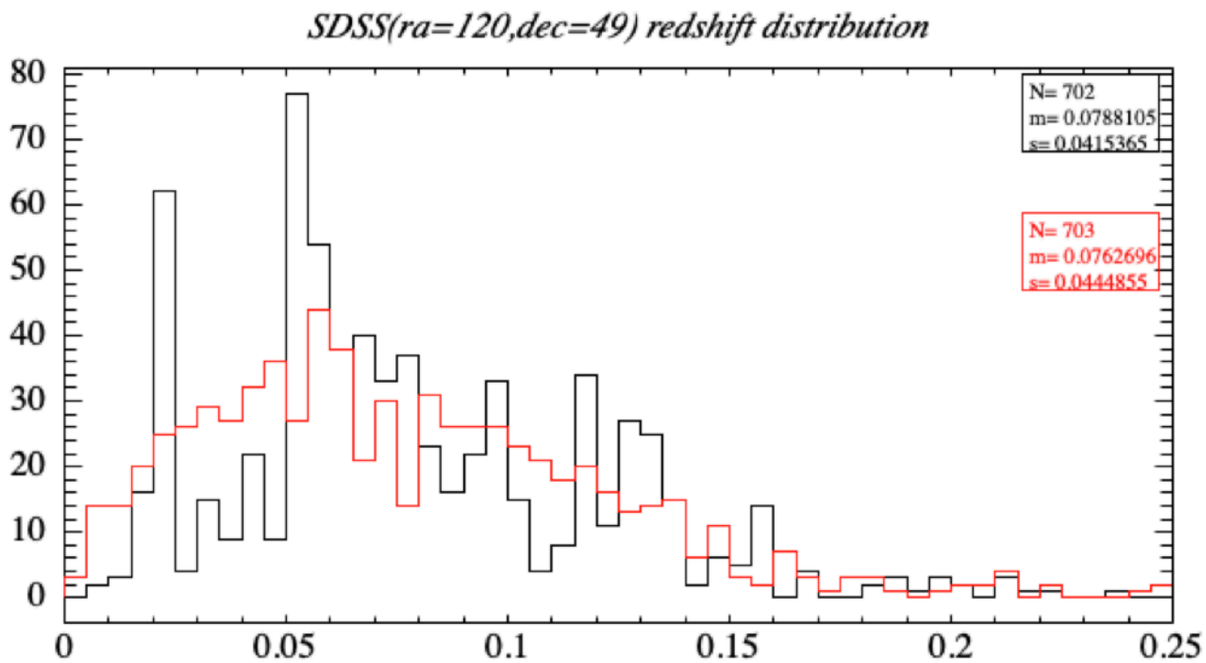
Centered on (ra,dec)=(120, 49)

Rmag



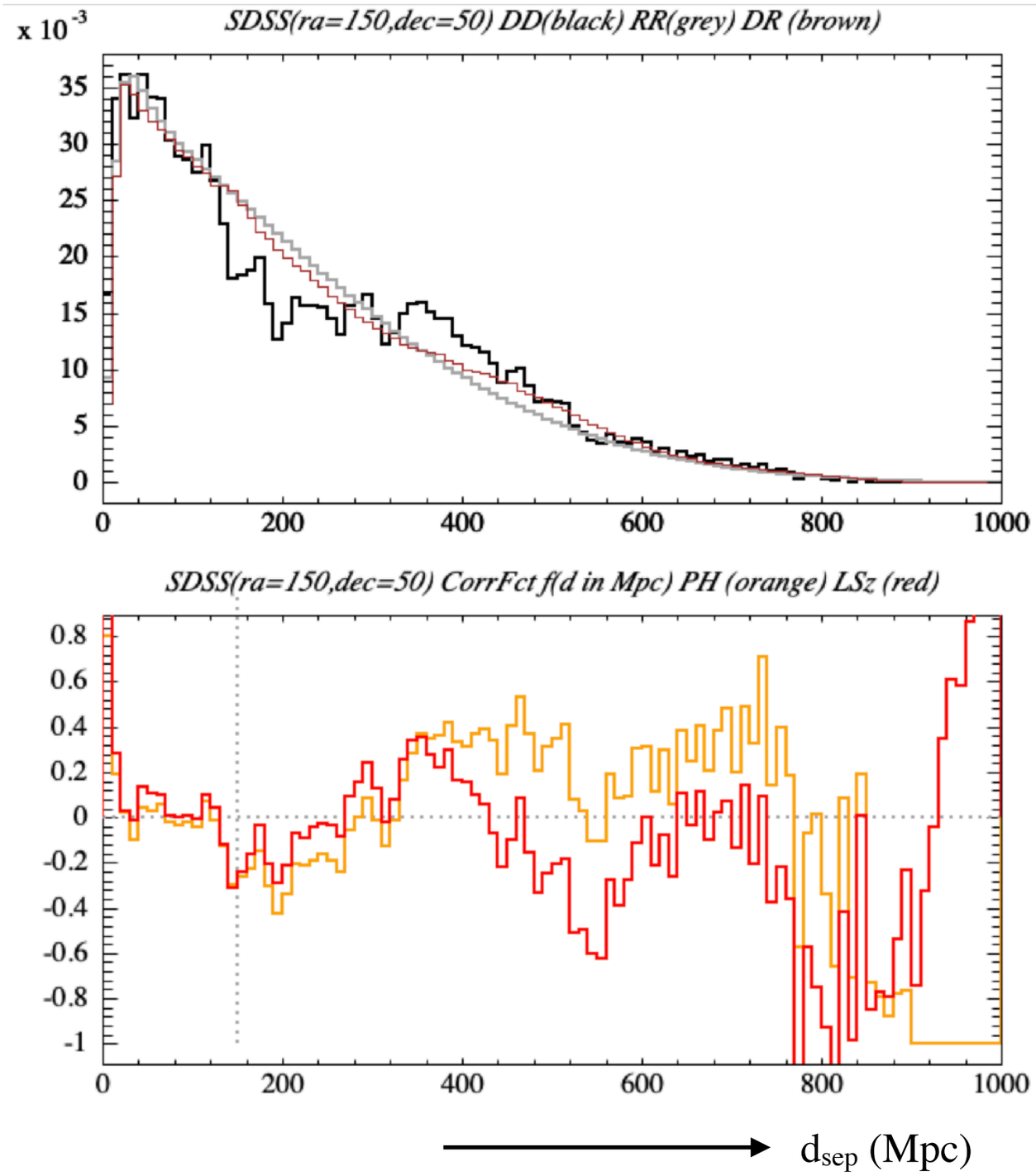




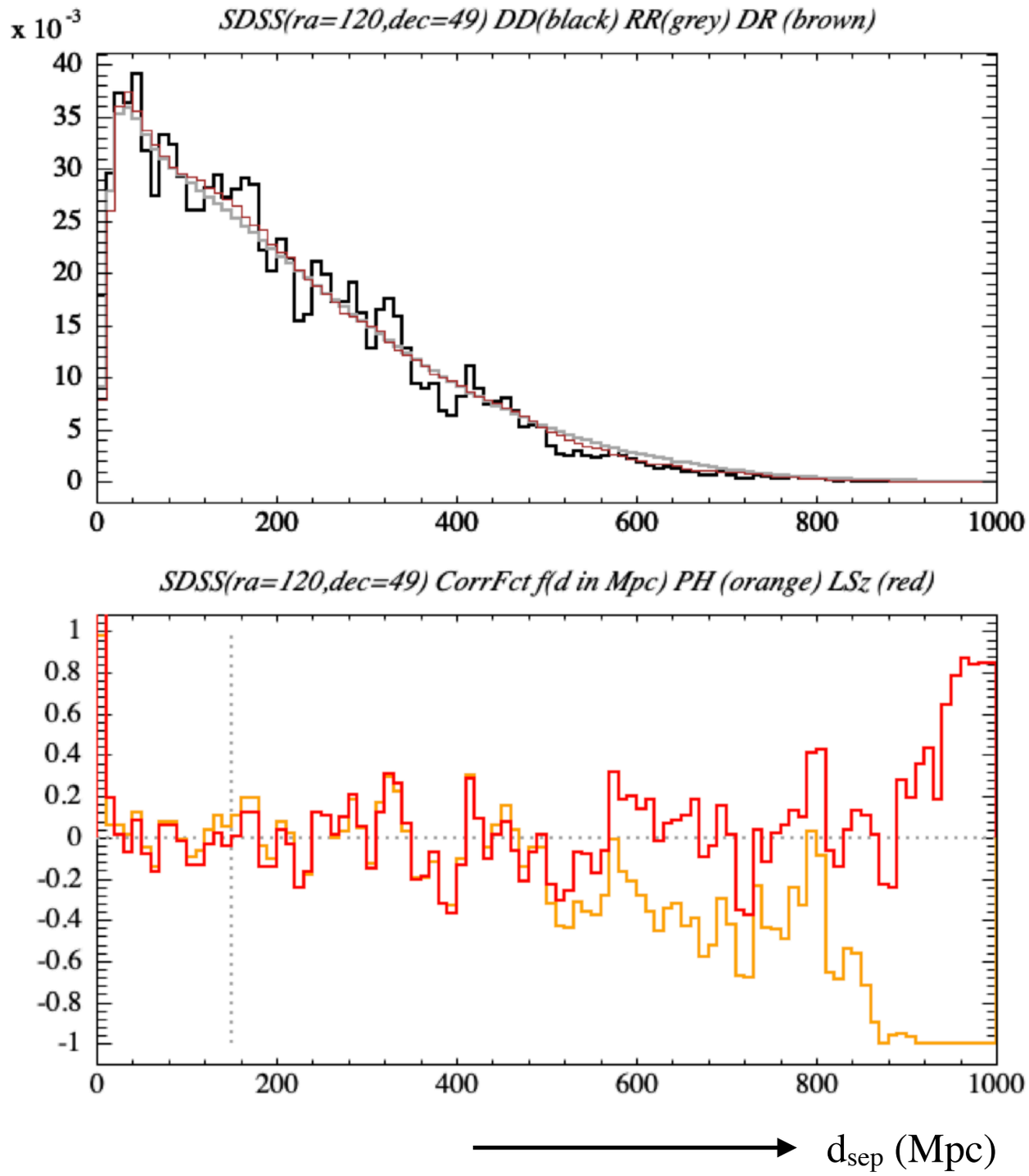


Redshift

6.2 SDSS Correlation function (a)

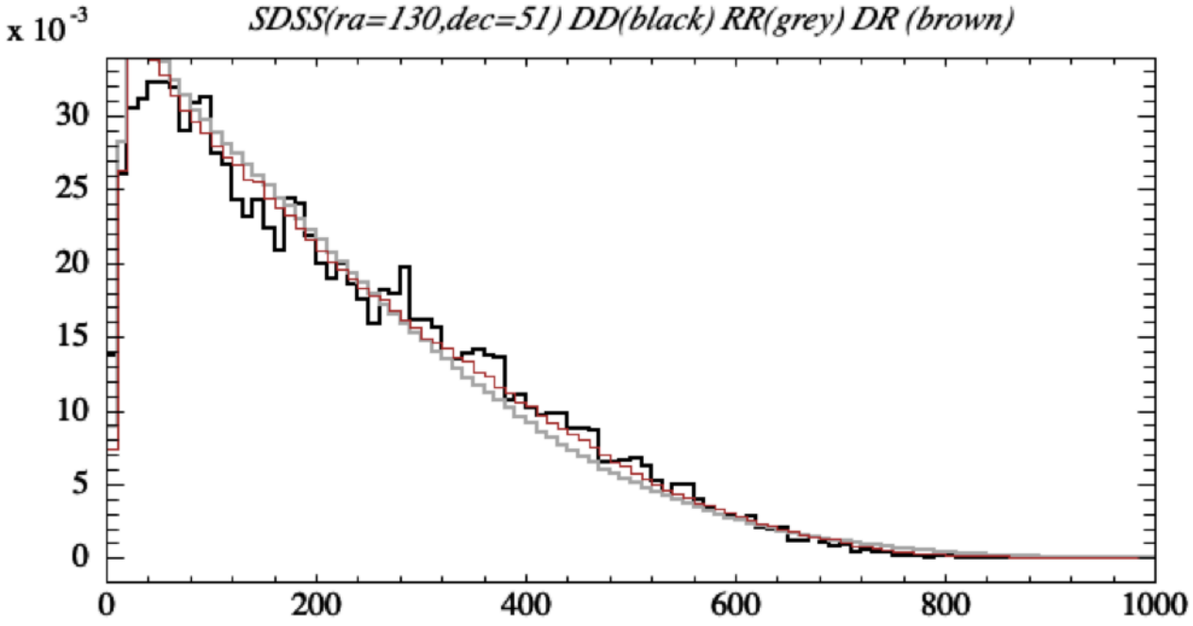


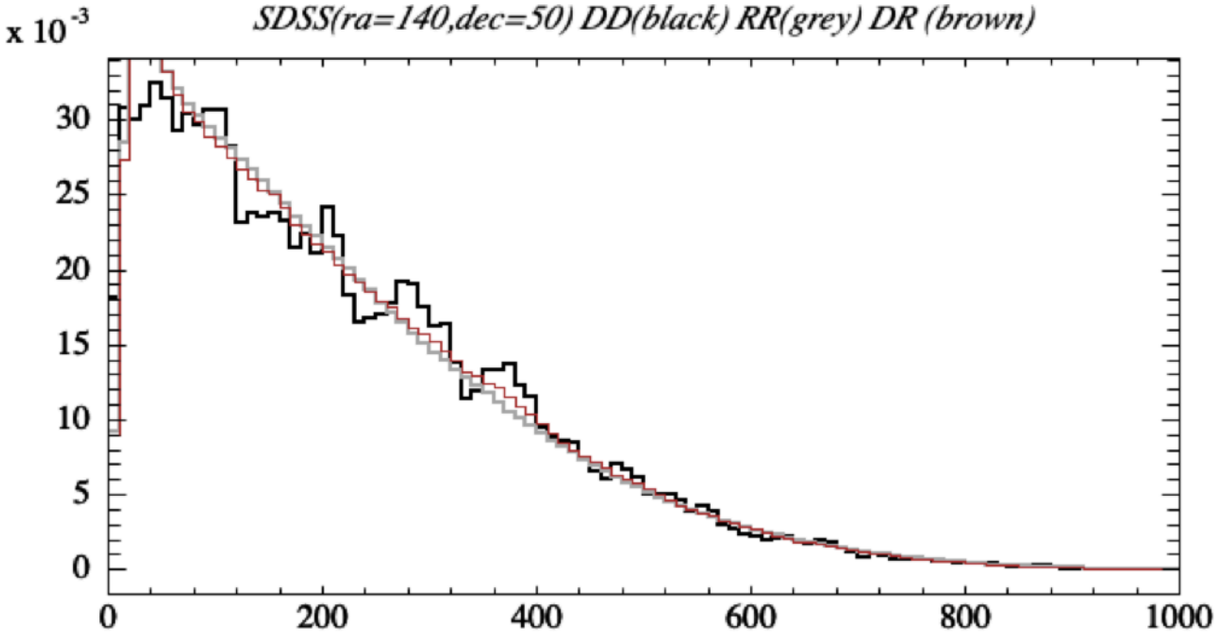
Centered on (ra,dec)=(150,50)

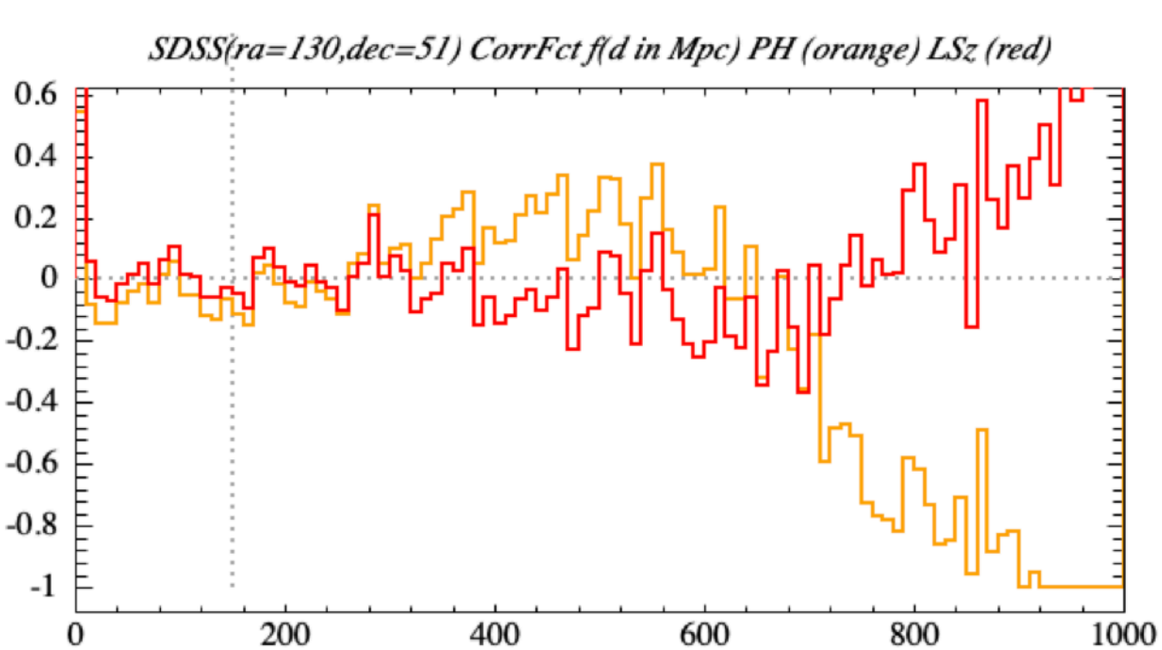


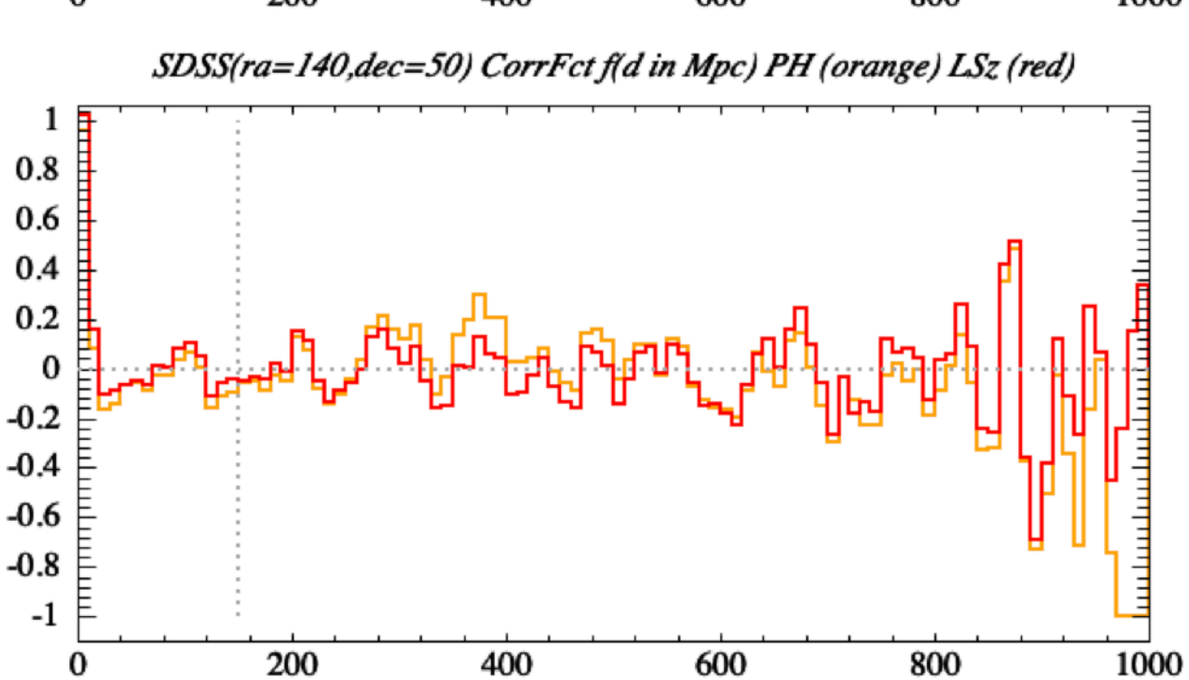
Centered on (ra,dec)=(120,49)

6.2 SDSS Correlation function (b)









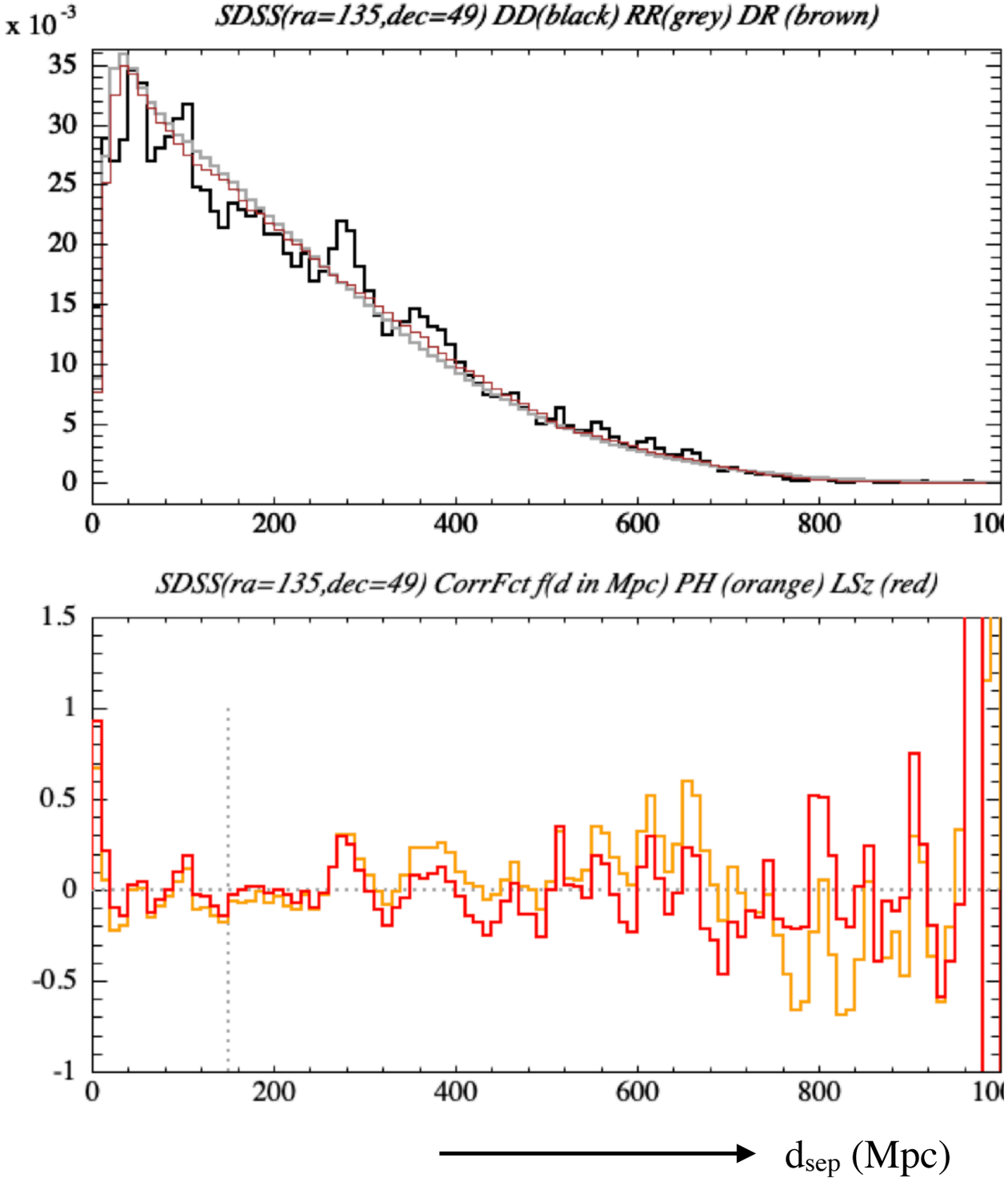
d_{sep} (Mpc)

d_{sep} (Mpc)

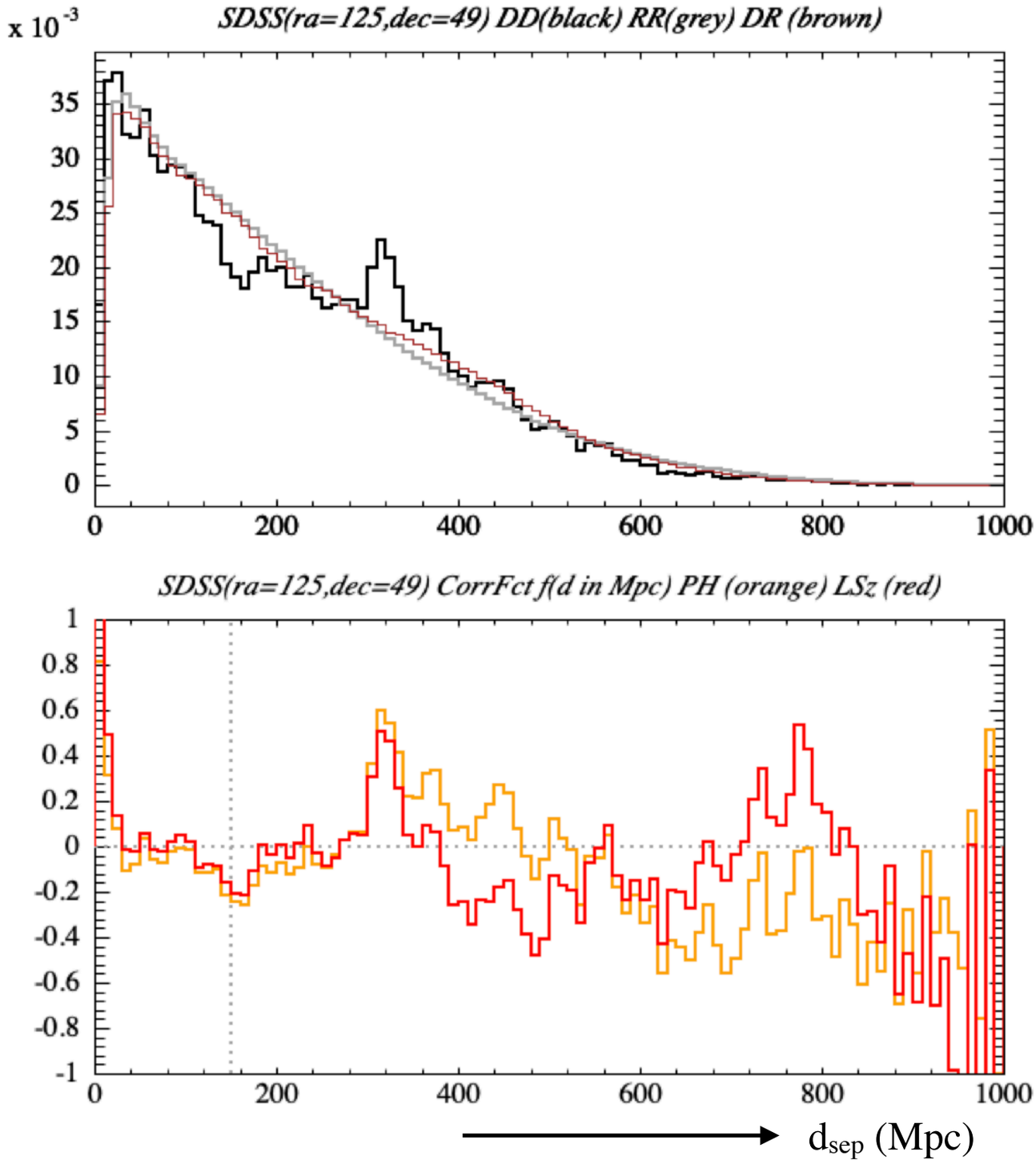
Centered on (ra,dec)=(130,51)

Centered on (ra,dec)=(140,50)

6.2 SDSS Correlation function (c)



Centered on (ra,dec)=(135,49)



Centered on (ra,dec)=(125,49)