CDFS Spectroscopic Redshift - Selection Functions and Completness - Version 1.0

The CDFS field is covered by a multitude of different mostly small surveys so selection and completeness are highly variable. Due to the number of sources available we have talked about the Selection and Completeness Sections in each section. The data for Sources 1–256 were taken from the MUSYC Subaru v1.0 catalogue (February 2010).

1 MUSYC catalogue - Szokoly et al. (2004) - Sources 1–256

The MUSYC catalogue is a collection of redshifts from a range of sources, however, for the sources where new data releases have been created we have listed them below. In total we collect 585 redshifts of which 495 are reliable. As these surveys in total make up a very small fraction of the redshifts for the CDFS field we do not discuss all the various selections.

2 VIMOS VLT Deep Survey (VVDS) - Source 512

The VIMOS VLT Deep Survey (VVDS) spectroscopic campaign described by Le Fèvre et al (2013) measures in total 1572 redshifts within the CDFS field, of which 1309 are reliable. This source contains data from the final release of the VVDS-deep survey which covers the entire ECDFS field. In this region all galaxies and AGN are targeted with the criteria that $17.5 \leq I_{AB} \leq 24$ and is purely a magnitude limited sample. Le Fèvre et al (2004) specifically looked at the CDFS field and say 88% of measured objects have a secure redshift and 95% of all their targets were observed. The distribution of observed sources is shown in Figue 1. The completless as a function of $I_{\rm AB}$ magnitude is shown in 2.

3 VLT/FORS2 - Source 1024

The GOODS/FORS2 survey is a spectroscopy survey with the VLT FORS2 instrument to observe faint galaxies in the CDFS. The data we used was taken from the final data release version 3. In total we obtained 1715 observations of which we assign 663 as reliable. Targets were out into the primary target catalogue if there $(i - z) > 0.6$ and $z_{AB} < 25$ and if *zphot* was in the range 1.0–2.0. A secondary target catalogue was created where the color criteria was relaxed to $0.45 < (i - z) < 0.6$. The completness of tbe sample versus redshift (based on the photometric sample) is given in Table 1.

4 GOODS/VIMOS DR 2.0.1 - Source 2048

This survey aimed to measure redshifts of faint galaxies in the CDFS field using the VIMOS instrument on the VLT and was designed to compliment the GOODS/FORS2 survey (above). The survey used two different grisms a low resolution blue for observing $1.8 < z < 3.5$ and a medium resolution grism for low redshift galaxies and Lyman Break Galaxies at redshifts higher than 3.5. From this survey we collected 5052 redshifts of which we classified 1681 as reliable. The survey was designed to cover the GOODS-S area rather than the entires CDFS, but did cover a larger area. The spatial distribution of the obsered targets is shown in Figure 3.

Many different catagories of target were chosen for this campaign. Based on photometric measurements the overall scheme was to target galaxies in the redshift range $1.8 \leq z \leq 3.8$ with the low resolution

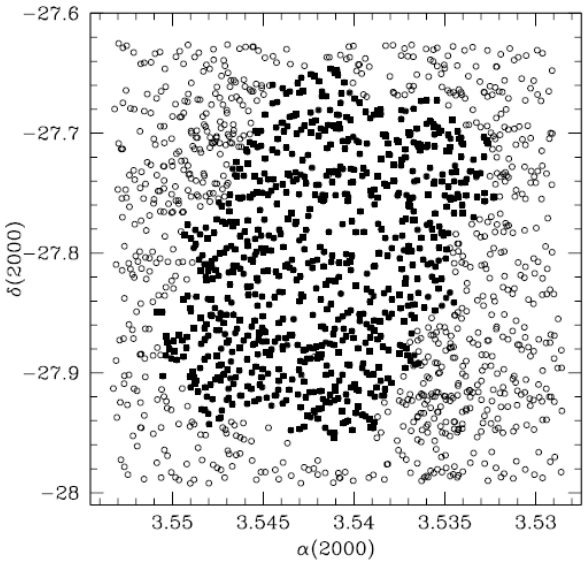

Figure 1 This figure has been taken from Figure 1 in Le Fèvre et al (2004). The caption taken directly from the paper is: Objects observed with VIMOS-VLT around the Chandra Deep Field South. Black circles are objects in the HST-ACS GOODS area.

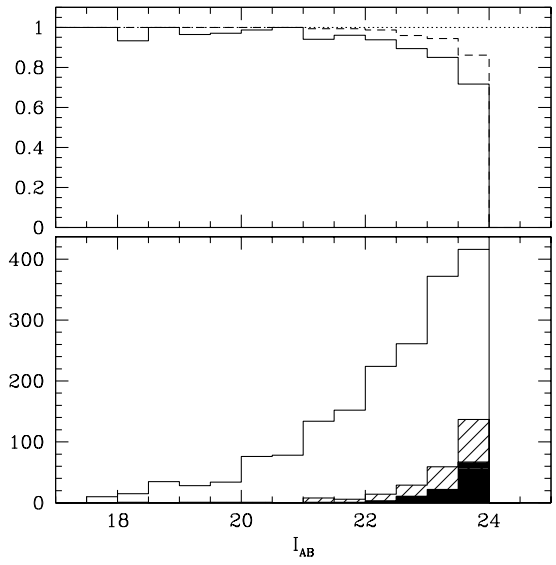

Figure 2 This figure has been taken from Figure 3 in the Le Fèvre et al (2004). The caption taken directly from the paper is: Completeness of the $I_{\rm AB} \leq 24$ sample. (Bottom panel) The magnitude distribution of galaxies with secure redshift measurements (flags 2,3,4,9; open histogram), uncertain and failed measurements (flags 0 and 1, dashed histogram), and failed measurements alone (flags 0, filled histogram). (Top panel) the ratio of secure redshift measurements (flags 2,3,4,9 continuous line histogram), and of all measurements (flags 1,2,3,4,9 dashed line histogram). The overall redshift measurement completeness is 88% (flags 2,3,4,9) and redshifts are measured for 95% of the sample.

Table 1 Completeness of the entire spectroscopic sample, taken from Vanzella et al. (2008).

z bin	zspec	compl.(%) $z_{850} < 24$	compl.(%) $z_{850} < 25$	compl.(%) $z_{850} < 26$
[0.6..0.7[	46	11	7	5
[0.7..0.8[	62	26	18	13
[0.8..0.9[	23	17	9	5
[0.9..1.0[	54	22	11	7
[1.0..1.1[	130	48	29	20
[1.1..1.2[	85	77	44	27
[1.2..1.3[	107	84	45	30
[1.3..1.4[	86	67	31	19
[1.4..1.5[	30	48	19	10
[1.5..1.6[	15	37	11	6
[1.6..1.7[	33	84	32	18
[1.7..1.8[	0	0	0	0
[1.8..1.9[	2	12	3	1
[1.9..2.0[	5	36	8	3
[2.0..2.1[	0	0	0	0

blue grism and galaxies between $2.8 < z < 4.8$ with the mid resolution orange grism (for more details see Balestra et al., 2010 and Popesso et al., 2008). The team claim a success rate of ∼60–70%, depending on the grism and if they are primary/secondary targets. As the target selection is not rigid a completness metric is not easy to give.

5 Silverman et al. (2010) - Source 4096

In this study spectrocopic follow up of X-ray sources observed with Chandra was completed. With there observations and data in the literature they achieve a completness of 55% of all X-ray sources (422 out of 762). For this catalogue we extract 801 redhsifts of which 420 are considered reliable.

6 6df Galaxy Survey - Source 8192

The 6dF Galaxy redshift survey covers most of the southern sky and as such covers the total XMM-LSS field. The survey is a combination of multiple magnitude limited samples, so an object is measured if either $K \leq 12.65, H \leq 12.95, J \leq 13.75, r_F \leq 15.60$ and $b_J \leq 16.75$. This results in a total of 125071 extra-galactic samples in the total survey, and overall the survey has ∼85% completness. In the CDFS field the survey has 82 redshifts of which 156 are considered reliable.

7 2df Galaxy Survey - Source 16384

The 2dF Galaxy redshift survey covers ∼1500 square degrees of sky which includes the total CDFS field. The survey selection is based on b_J magnitude, with any galaxies brighter 19.45 observed. The overall completness for the survey is 91.8% of galaxies with reliable redshifts, but this varoes with magnitude from 99% at the bright end to 90% at the survey limit. In the CDFS field the survey has 2583 redshifts of which 2409 are considered reliable (area is slightly larger than SPIRE imaging).

8 Dickinson et al. (2004) - Source 32768

This survey was looking at galaxies with very high redshifts (above 5.8). As such it only adds one redshift to our sample.

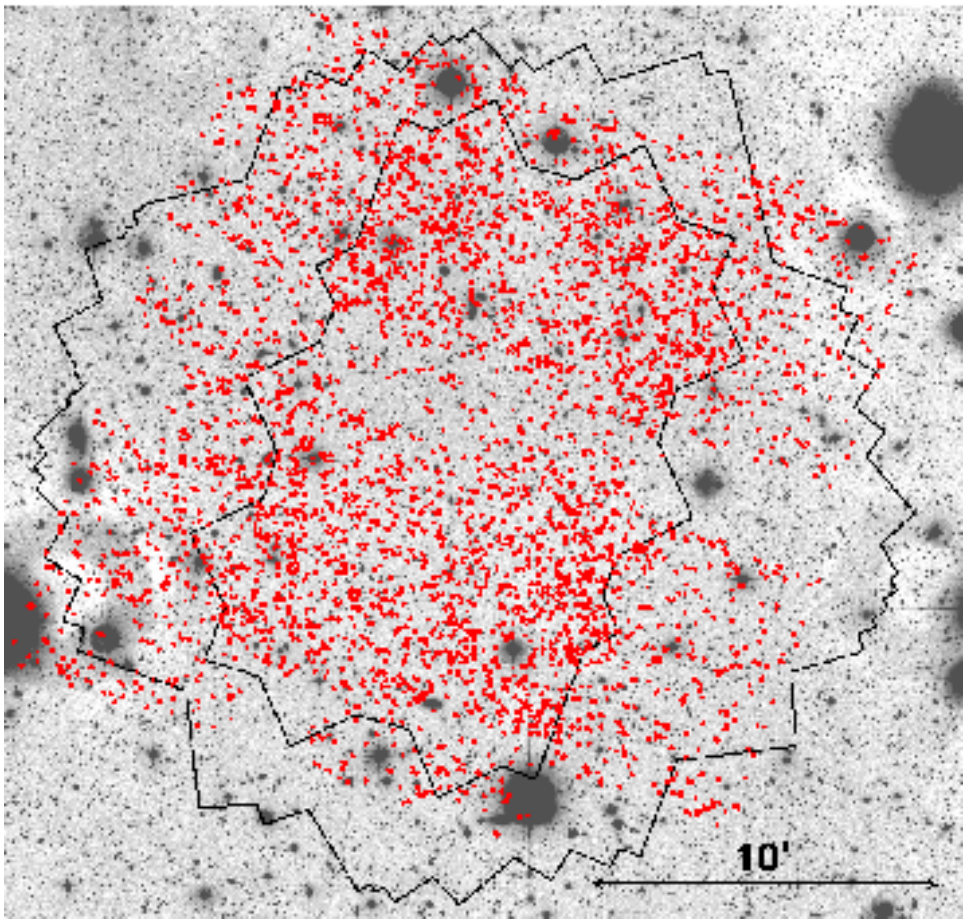

Figure 3 This figure has been taken from Figure 1 of Balestra et al. (2010). Spatial distribution of objects from the whole (LR-Blue plus MR grism) GOODS/VIMOS spectroscopic campaign (red circles) over the ESO-WFI R-band image. The contours outline the area of the 2 Ms exposure of the CDFS and the GOODS-S field.

9 IMAGES, Ravikumar et al. 2006 - Source 65536

This survey was to increase spectroscopic coverage to more intermediate mass galaxies than other surveys of the CDFS. Observations were taken with VIMOS on the VLT. The area covered by IMAGES is shown in Figure 4. The target selection for the survey is based on a rest frame J_{AB} magnitude selection $M_J AB \leq -20.3$), corresponding to stellar masses greater than $1.5 \times 10^{10}\, M_{\odot}$. While the paper does not specify the number of possible galaxies that met their selection criteria 1142 were observed. Of the observed sources 691 had a reliable redshift (635 within the $I_{AB} \leq 23.5$. Therefore, the success rate is 66%. The success as a function of magnitude is shown in Figure 5.

10 GMASS (Kurk eto al., 2012) - Source 131072

This survey aims to get spectroscopy for massive, quiescent and star-forming galaxies at $z > 1.4$. To achieve this it uses FORS2 of the VLT to measure redshifts in the CDFS/GOODS field. For the full distribution see Figure X. Sources were selected from a master catalogue at $4.5\,\mu$m, a photometric redshift limit of $z > 1.4$ and a magnitude constraints of $B_{AB} < 26$ & $I_{AB} < 26.5$. 174 observations of the primary sample were measured with 70 additional objects gave a total of 210 determined redshifts.

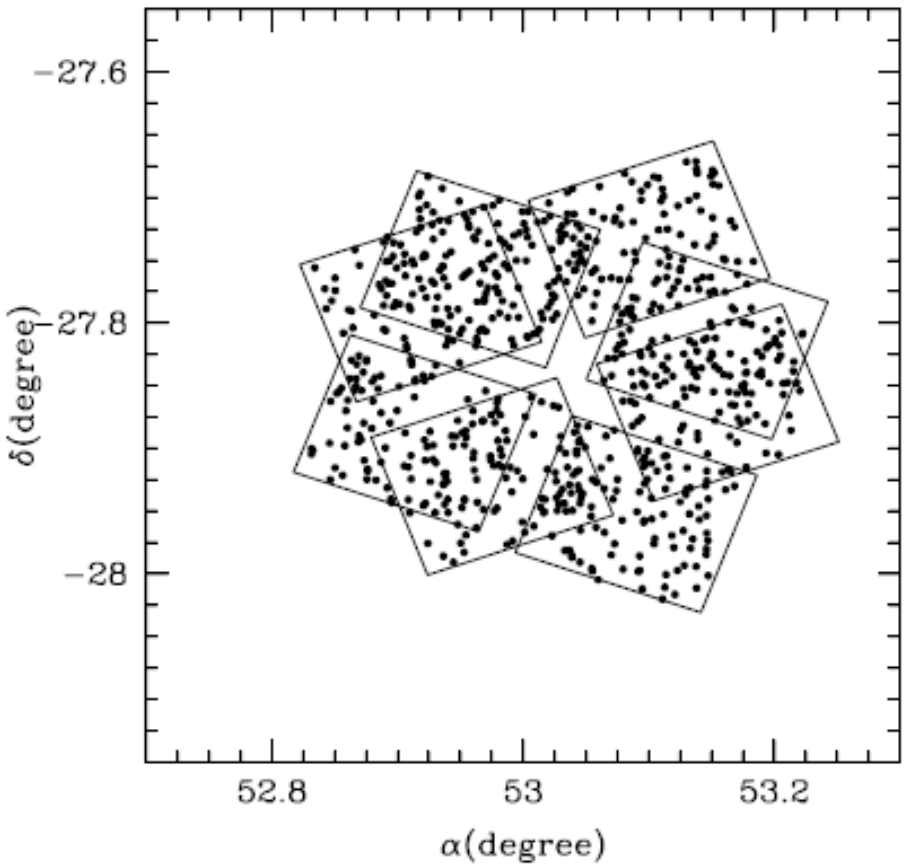

Figure 4 The two pointings by VIMOS in the CDFS covering roughly the same area in the sky as in the VVDS. The black dots are the positions of the objects for which we have determined redshifts. A sample of 969 objects with $I_{AB} \leq 23.5$ were selected for observation constituting $\sim$25% of galaxies on the field.

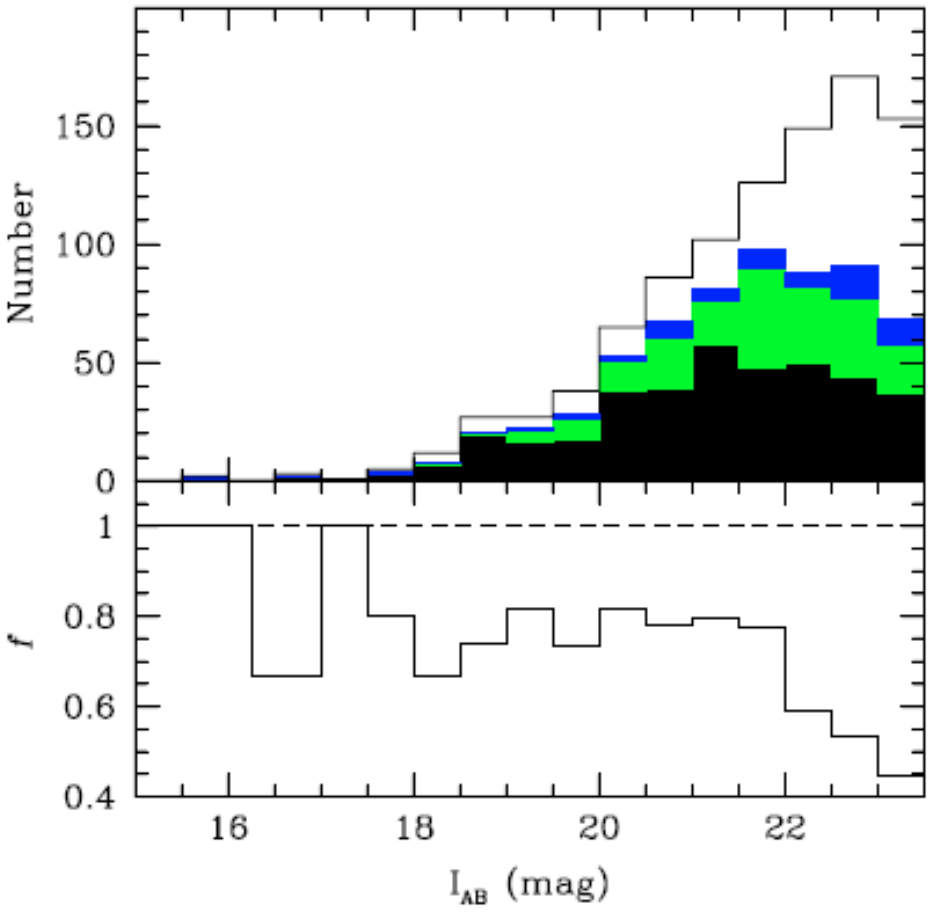

Figure 5 Redshift measurement completeness for the IAB 23.5 sample in IMAGES. In the upper panel, we show the magnitude distribution of objects with a redshift class 2 (black), 1 (green), and 9 (blue), along with that for the observed targets (open). The lower panel shows the histogram of the fraction (f) of objects with redshifts compared to the total observed from IMAGES.We measure redshifts for 66% of the target objects, while the completeness achieved is 76% when we exclude failures that have an explicit instrumental origin.