population of massive, old, and very dusty galaxies at $z \sim 2.6$ would result in an evolution of the number density of ETGs since $z = 3$ and would also provide good agreement between the observed abundance of massive galaxies at $z = 3.5$ and that predicted by semi-analytic models (e.g. Lagos, Cora, & Padilla 2008; Baugh et al. 2005).

The way in which the selection of a given population and its descentants proceeds, is usually via a fixed stellar mass selection (e.g. Robaina et al. 2010). Only in the case of ETGs, this can also be done using passively evolved luminosities, since these should scale linearly (and independent of the redshift) with the stellar mass in systems of old stars with no recent star formation activity (e.g. Cimatti et al. 2006). However, events such as mergers would produce a change in the stellar masses or passively evolved luminosities of the galaxies, which opens the possibility that this selection may not be appropriate for this purpose.

The approach we present here is intended to improve the selection of statistical descendants of a sample of high redshift ETGs. In order to do this we will use clustering information of the progenitor galaxies (the sample at high redshift from Padilla et al. 2010, hereafter P10), that will give us the mass of the host dark-matter halo masses which in a numerical simulation can be followed down to any given redshift. Then we will compare the number densities of the samples of progenitor and descendant galaxies (the lower redshift galaxies selected to have the clustering of the host haloes at this later cosmic time) obtained from luminosity function measurements (from Christlein et al. 2009, hereafter C09). We will interpret differences in these number densities in terms of mergers and their characteristics.

This article presents the measured correlation and luminosity functions used in our method in § 2, and shows the results and presents our conclusions in § 3.

2. LUMINOSITY FUNCTIONS AND CLUSTERING INFORMATION

We will analyse the evolution of MUSYC (MUltiwavelength Survey by Yale-Chile) ETGs using their measured LFs by C09. MUSYC comprises over 1.2 square degrees of sky imaged to 5σ AB depths of $U, B, V, R = 26$, $I = 25$, $z = 24$ and $J, K(AB) = 22.5$, with extensive follow-up spectroscopy. The source detection is done on the combined BVR image down to a magnitude of 27 (see Gawiser et al. 2006 for further details).

C09 proposed and applied a new technique, the photometric maximum likelihood (PML) method, to a subset of MUSYC comprising the Extended Chandra Deep Field South (ECDF-S), covering approximately 0.25 sq. degrees on the sky. The PML algorithm was used to measure the underlying luminosity function of galaxy populations characterised by different spectral types. The latter are parameterised with a set of SED templates from Coleman, Wu, & Weedman (1980, hereafter CWW) or fixed superpositions of two CWW templates, extended into the UV regime using Bruzual & Charlot (1993) models. For the present analysis, we will only use the LF corresponding to the two earliest type templates in this set, which correspond to an elliptical galaxy and to a E+20%Sbc mix. P10 demonstrate that the sample of ETGs selected this way is comparable to a selection of the red-sequence at each redshift (as adopted in e.g. Bell et al. 2004, hereafter B04; CDR; Brown et al. 2008). They also indicate that these ETGs are compatible with a sample resulting from a $K < 22.5$ selection. For the present article we will also use the PML estimate of the ETG LF obtained from the Extended Hubble Deep Field Sourh (EHDF-S), increasing the area of this analysis to an area on the sky of approximately 0.5 sq. degrees.

We use the rest-frame r- and B-band PML LF estimates from MUSYC ETGs in ECDF-S and EHDF-S. For comparison we will also use the LFs measured using the classic maximum likelihood estimate that uses photo-z measurements; these estimates are also provided by C09. All the ETG LFs are passively evolved down to $z = 0$ by applying an empirical passive evolution recipe whereby the evolved luminosity can be found via

$$M_B(z = 0) = M_B(z) + 1.15z\,, \qquad (1)$$

as proposed by CDR, following results from van Dokkum & Stanford (2003), Treu et al. (2005), and diSerego Alighieri et al. (2005). P10 showed that this passive evolution recipe is well followed by a [Fe/H]=0.3 single stellar population (SSP) which at $z = 1$ is 3.5 Gyr old, and used this SSP to work out the equivalent recipe for the r-band, which is fit by

$$M_r(z = 0) = M_r(z) + 0.98z\,. \qquad (2)$$

We apply these evolution corrections to B- and r-band LF measurements from relatively high redshift samples and compare them to results at $z \simeq 0.165$ from the Sloan Digital Sky Survey (SDSS; York et al. 2000) for ETGs by B04 in the B-band (selected using the red-sequence), and in the r-band by Benson et al. (2007, hereafter Be07), who selected ETGs as sources with a dominant bulge component (an alter-