of matching abundances. To take into account this scatter in $M_{\rm s}$ at fixed $M_{\rm h}$ a probability density distribution should be assumed. The convolution of this distribution with the true or intrinsic *GSMF* gives the measured *GSMF*. The cumulative true *GSMF* is then the one used for the AM (BCW10). The observational data allow to estimate the scatter in luminosity (or $M_{\rm s}$) and to date it appears to be independent of $M_{\rm h}$ (More et al. 2009; YMB09). In BCW10 a log-normal mass-independent scatter in $M_{\rm s}$ of 0.16 ± 0.04 is assumed. Here, we follow the overall procedure of BCW10 for taking into account this scatter.

We also explored the effect of (iii) the statistical uncertainty in the number density of the *GSMF* (as given in YMB09), but we found that the effect is negligible as compared to the one produced by item (i) (see also BCW10, their § 4.3.1). The effect of the intrinsic scatter in $M_{\rm s}$ for a given $M_{\rm h}$ is also very small in the overall scatter of the $M_{\rm s}$–$M_{\rm h}$ relation but it affects the high mass end of the calculated $M_{\rm s}$–$M_{\rm h}$ relation, where both the *GSMF* and *HMF* decay exponentially, since there are more low mass galaxies that are scattered upward than high mass galaxies that are scattered downward (BCW10). For instance, at $M_{\rm h} = 10^{13.5}\ M_{\odot}$, the stellar mass after including this scatter is 1.2 times smaller. The contribution from all other sources of error, including uncertainties in the cosmological model, is much smaller, ranging from 0.02 to 0.12 dex at $z = 0$.

From Figure 4 we see that the 1σ uncertainty in the $M_{\rm s}$–$M_{\rm h}$ relation is approximately 0.25 dex in log$M_{\rm s}$ without any systematic dependence on $M_{\rm h}$, in good agreement with previous results (BCW10; Moster et al. 2010). This uncertainty is larger than the differences between the $M_{\rm s}$–$M_{\rm h}$ average relations found by different authors, including those that use the indirect AMT but with different *GSMF*s, methodologies, and corrections, and those who use more sophisticated formalisms (see for comparisons and discussions BCW10 and More et al. 2011). On one hand, this shows that most methods and recent studies aimed at relating halo masses to observed galaxies as a function of their stellar masses are converging to a relatively robust determination. On the other hand, this result suggests that attaining a higher precision in estimating $M_{\rm s}$ from observations is the crucial task for lowering the uncertainty in the inference of the $M_{\rm s}$–$M_{\rm h}$ relation.

3.2. *The stellar-halo mass relations for central blue and red galaxies*

The upper and lower left panels of Figure 5 show the mean $M_{\rm s}$–$M_{\rm h}$ and $f_{\rm s}$–$M_{\rm h}$ relations for: all central galaxies (solid line, as in Figure 4), central blue (short-dashed line), and central red (long dashed line) galaxies. In order to infer these relations for blue galaxies, the central blue YMB09 *GSMF* and the distinct (S-T) *HMF* corrected for excluding halos (i) associated to observed groups/clusters of galaxies and (ii) that suffered central major mergers since $z = 0.8$ (see § 2.2.2) were used. In the case of red galaxies, the central red YMB09 *GSMF* and the *HMF* complementary to the one associated to blue galaxies were used.

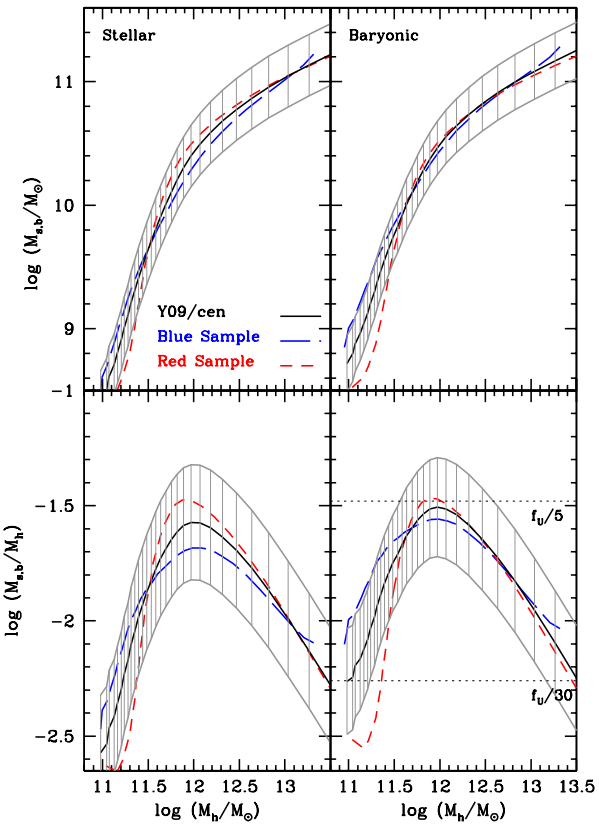

Fig. 5. Left panels: Mean $M_{\rm s}$–$M_{\rm h}$ (top) and $f_{\rm s}$–$M_{\rm h}$ (bottom) relations of all central (solid black line), blue central (long-dashed blue line), and red central (short-dashed red line) galaxies as inferred here using the YMB09 data. The grey curves connected by vertical lines show the 1σ uncertainty for the all-galaxies case; similar uncertainty regions around the main relations are found for the blue and red sub-samples (see Figure 8). Right panels: Same as in left panels but for $M_{\rm b}$ instead of $M_{\rm s}$. Dotted lines: $f_{\rm b} = f_U/5$ and $f_U/30$, where $f_U = 0.167$ is the universal baryon fraction. The color figure can be viewed online.

The shaded area in Figure 5 is the same 1σ uncertainty shown in Figure 4 for the overall central sample. The uncertainties corresponding to the $M_{\rm s}$–