abstract We present a new deep (down to $V \sim 24$) photometry of a wide region ($\sim 6' \times 6'$) around the LMC globular cluster NGC1866: our sample is much larger (by more than a factor three) than any previous photometry and with a main sequence which may be considered complete, down to at least 3 mag below the brightest MS star: such an occurrence allows a meaningful and robust comparison with various theoretical scenarios produced by means of models computed with the evolutionary code FRANEC. Both age and present mass function slope, $\alpha$, are derived by a fit to the available MS and by the use of the parameter $\Delta\sigma$, which is simply the difference, in $\sigma$'s, between the observed and predicted integrated MS luminosity functions. Our main conclusions are:

a) the adoption of standard models (i.e. computed by adopting the Schwarzschild criterion to fix the border of the convective core) allows a fair fit to the MS for an age of the order of 100-140 Myr and a present mass function having a slope $\alpha$ between 2.3 and 1.9, the exact values depending on the adopted distance modulus. It is moreover possible to reproduce the average He clump luminosity while the total number of stars predicted in the He clump is twice the observed value: this means that we re-obtain and confirm the first finding of bec83, according to whom the simple adoption of a “classical” scenario leads to a neat discrepancy concerning the prediction of the number of stars in the He clump.

b) the adoption of models computed by increasing the size of the convective core by a certain amount, i.e. $0.25 H_p$, leads to a fair fit to the main sequence only for a visual distance modulus ($m - M)_V \simeq 18.6$, an age $t \simeq 200$ Myr and $\alpha \simeq 2.2$. In this case, the total number of He clump stars is well reproduced, although the luminosity function of the He clump itself is predicted to be systematically less luminous than observed.

The previous conclusions are based on the assumption that there is no appreciable population of binaries in NGC 1866. Though there are not yet sufficient data on the frequency of binary systems in these clusters, we analyzed how the previous scenarios would change if a consistent ($\simeq 30\%$) population of binary systems were present in the cluster. This choice is based on the fact that a fraction of binaries of the order of 30\% has already been found in NGC 1818, a cluster similar to NGC 1866 els98. The inclusion of a 30\% binary population leads to the following conclusions:

c) the adoption of the standard models now leads to a good fit to the entire luminosity function, i.e. main sequence, turn off, and He clump stars, for a visual distance modulus ($m - M)_V \simeq 18.8$, an age $t \approx 100$ Myr and a mass function slope $\alpha \simeq 2.4$, thus largely removing the “classical” discrepancy between observed and predicted number of stars in the He burning clump. The quoted visual distance modulus constrains the unreddened distance modulus ($m - M)_0$ within 18.50 and 18.62, depending on the reddening (whose most common values available in the literature range from 0.05 to 0.10).

d) at variance with point c), the fit obtained by using models computed with an enlarged convective core gets worse when a binary component is taken into account. This is due to the fact that the presence of binary systems increases the existing discrepancy between the observed and predicted clump luminosity, since the He clump is predicted to be even less luminous than in absence of binaries.
As a consequence of this analysis, we think that the next step towards a proper understanding of NGC 1866, and similar clusters, must include the accurate determination of the frequency of binary systems that will be hopefully performed with the incoming Cycle 8 HST observations of NGC 1866.