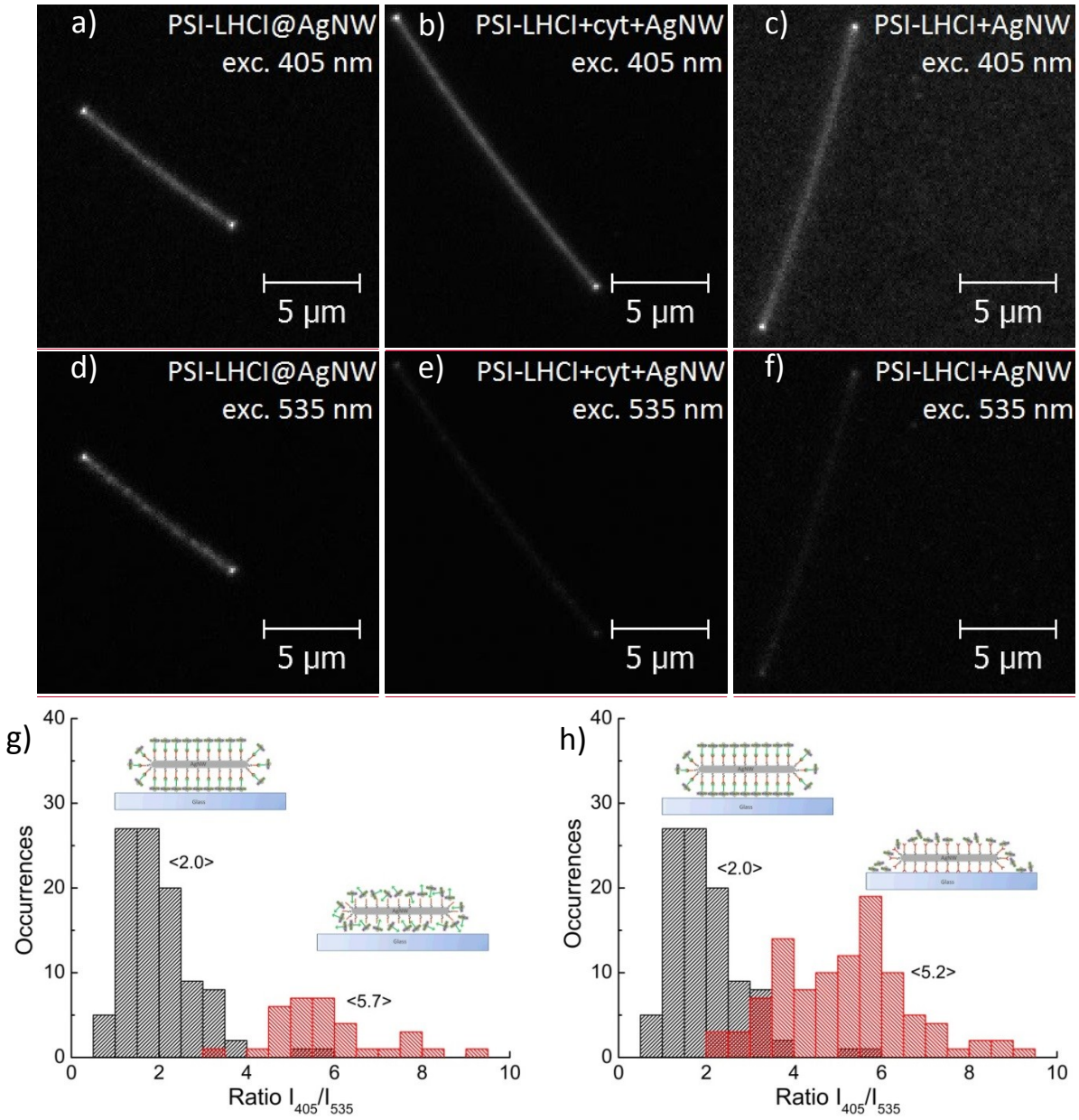
Supplementary information

In order to check for any possible interference of the cyt c_{553} absorption on the observed plasmon enhancement of PSI-LHCI complexes conjugated with AgNWs, we conducted analogous measurements on a sample composed of a mixture of PSI-LHCI complexes with c_{553} attached and AgNWs with NTA ligand attached (PSI-LHCI+cyt+AgNWs). In contrast to the PSI-LHCI@AgNWs structure, where oriented conjugation takes place, the absence of Ni^{2+} ions for the PSI-LHCI+cyt+AgNWs structure, should effectively inhibit any conjugation, and thus specific orientation of the protein on AgNWs. The sample was prepared in an identical manner as the conjugated sample (see Materials and Methods), with the exception that the nanowires contained no Ni^{2+} ions. While no formation of an oriented monolayer of PSI-LHCI complexes on AgNWs is possible in this case, it is still feasible for the protein complex to attach to AgNWs *via* physisorption.

In Suppl. Fig. 1 we compare the fluorescence intensity maps collected for PSI-LHCI@AgNWs (a,d), PSI-LHCI+cyt+AgNWs (b,e) and PSI-LHCI+AgNWs (d,f). For each sample we used two excitation wavelengths, namely 405 nm and 535 nm. It can clearly be seen that the qualitative behavior observed for the PSI-LHCI+cyt+AgNWs sample is very similar to the PSI-LHCI+AgNWs sample, where physisorption can be the only mechanism of attaching the protein to the nanowires (the intensity scales are similar across the maps collected for the given excitation wavelength). This is reinforced by analysis of tens of individual nanowires, as shown by histograms in Suppl. Fig. 1. Namely, the ratio between intensities measured for 405 nm and 535 nm excitation for the PSI-LHCI+cyt+AgNWs sample (5.2) is very similar to the results obtained for PSI-LHCI+AgNWs sample, indicating that including cyt c_{553} to the protein mixture results in minimal effects as far as plasmon coupling is concerned. Thus, in order to observe the strong enhancement of absorption in the green spectral region (535 nm), the PSI-LHCI complexes should be attached specifically to AgNWs *via* cyt c_{553} to maintain their specific orientation.



Supplementary Figure 1. Comparison of fluorescence intensity of three types of investigated samples: PSI-LHCI@AgNWs (a,d), PSI-LHCI+cyt+AgNWs (b,e), and PSI-LHCI+AgNWs (c,f) collected for the excitation wavelength of 405 nm (a – b) and 535 nm (d – f). All maps re plotted with the same intensity scale, to facilitate easy comparison. Histograms comparing the fluorescence intensity ratio measured for PSI-LHCI@AgNWs structure with those obtained for PSI-LHCI+cyt+AgNWs and PSI-LHCI+AgNWs are displayed in (g) and (h), respectively.