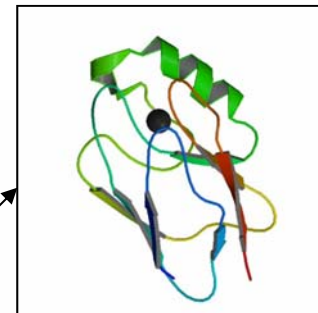
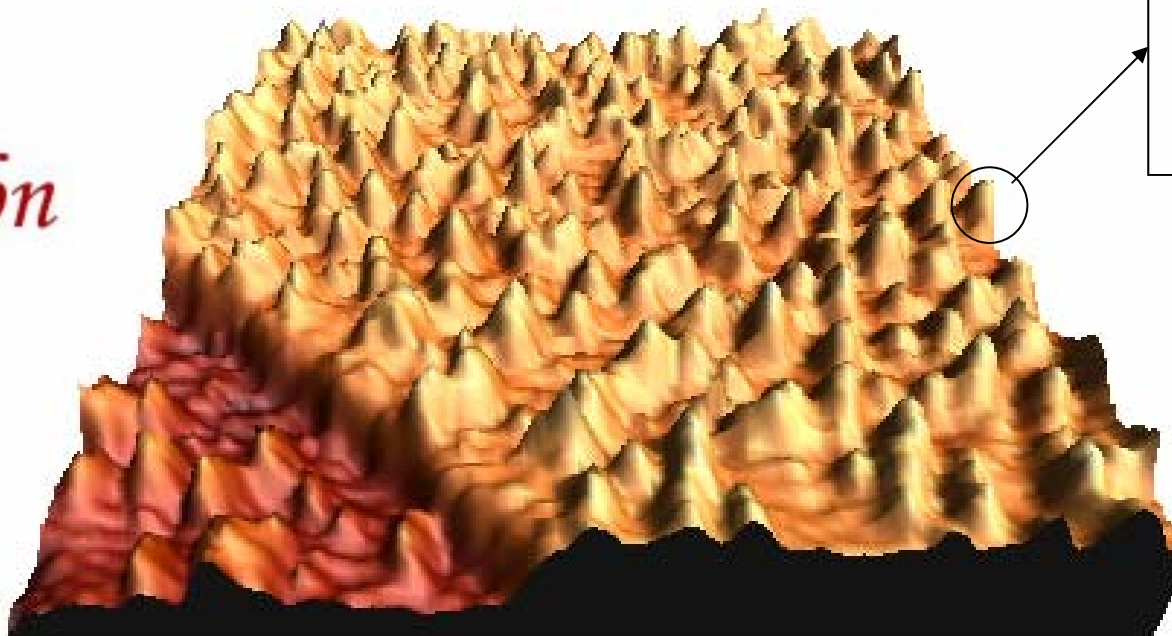


Study of an electron transfer protein by Electrochemical Tunneling Microscopy and Spectroscopy



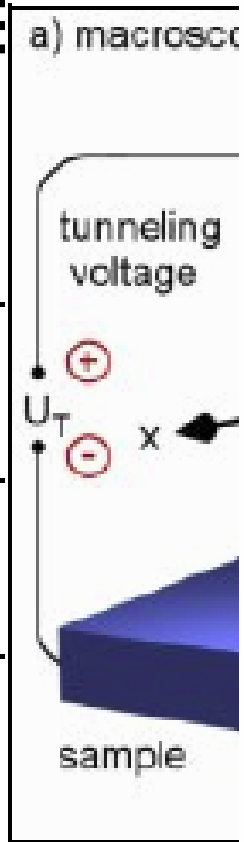
ciber-66n



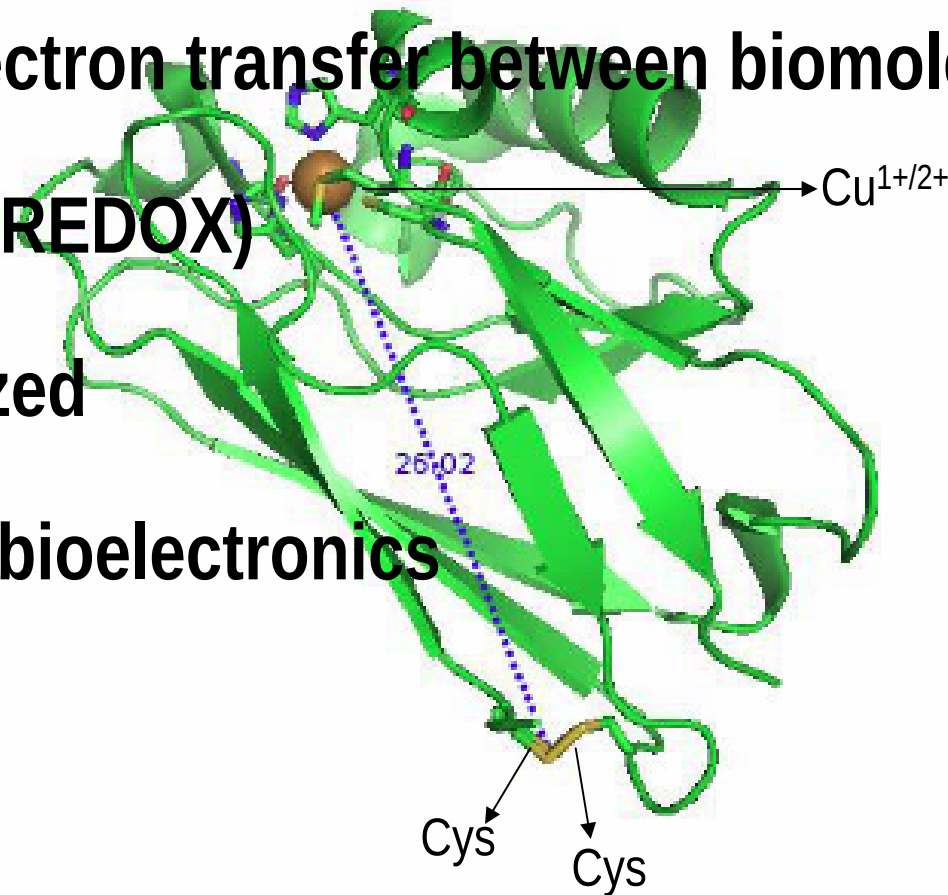
J. M. Artés, I. Díez-Pérez, J. Hernández-Borrell, F. Sanz
and P. Gorostiza

Nanoprobes and Nanoswitches Group. Institute for
Bioengineering of Catalonia (IBEC). Barcelona

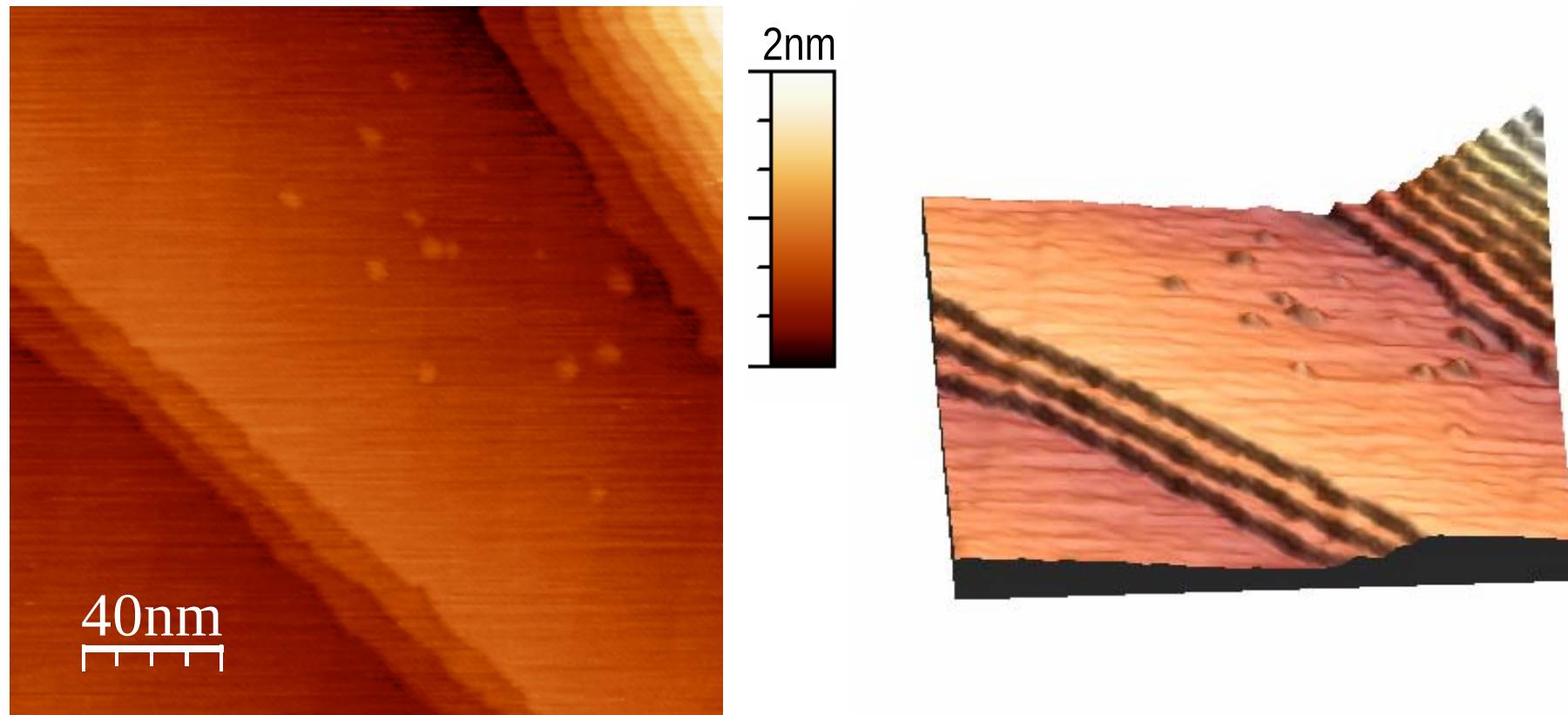
E



- Involved in electron transfer between biomolecules
- Electroactive (REDOX)
- Well characterized
- Promising for bioelectronics



ECSTM single molecule imaging

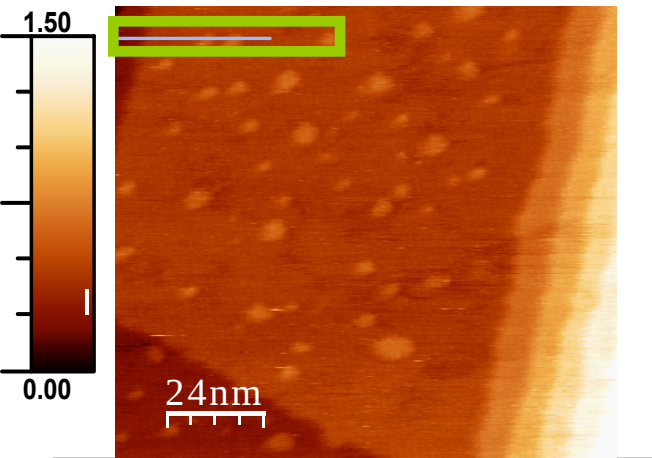


Electrochemical STM image of azurin molecules on an atomically flat gold monocrystal ($\text{Au}\langle 111 \rangle$) in 50 mM ammonium acetate buffer pH 4.55. Monoatomic gold steps can be observed.

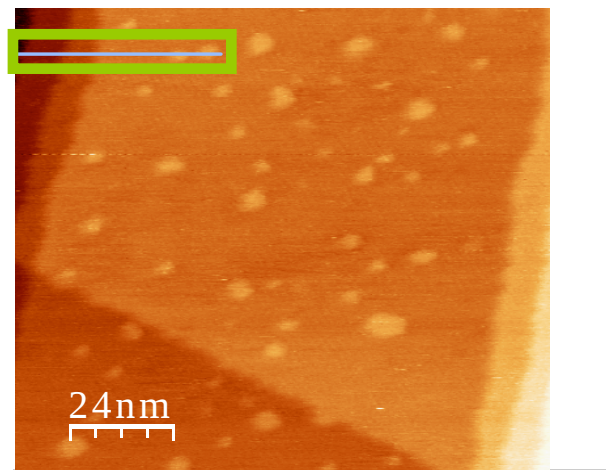
$U_{\text{sample}} = 200 \text{ mV}$, $U_{\text{tip}} = 250 \text{ mV}$ (vs SCC)

Results: Changes in apparent height

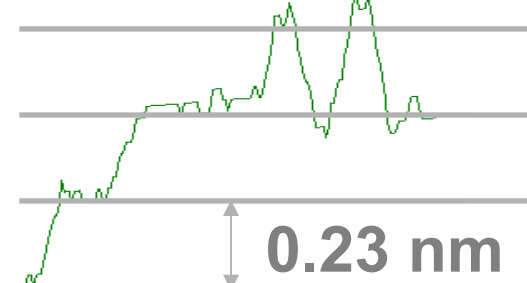
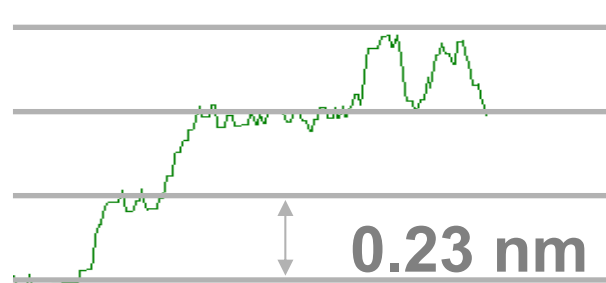
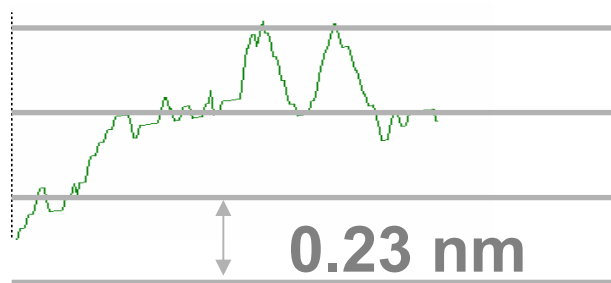
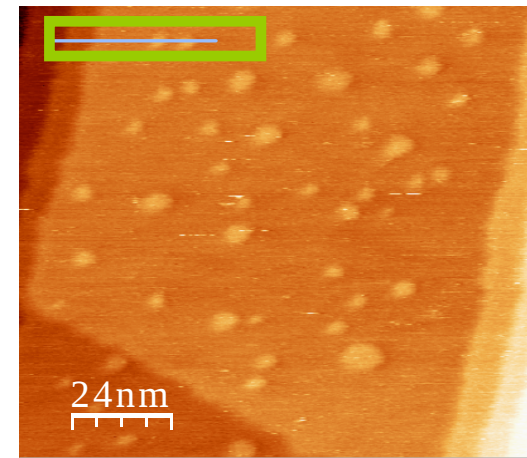
$U_s = 300 \text{ mV}$
 $U_t = -250$

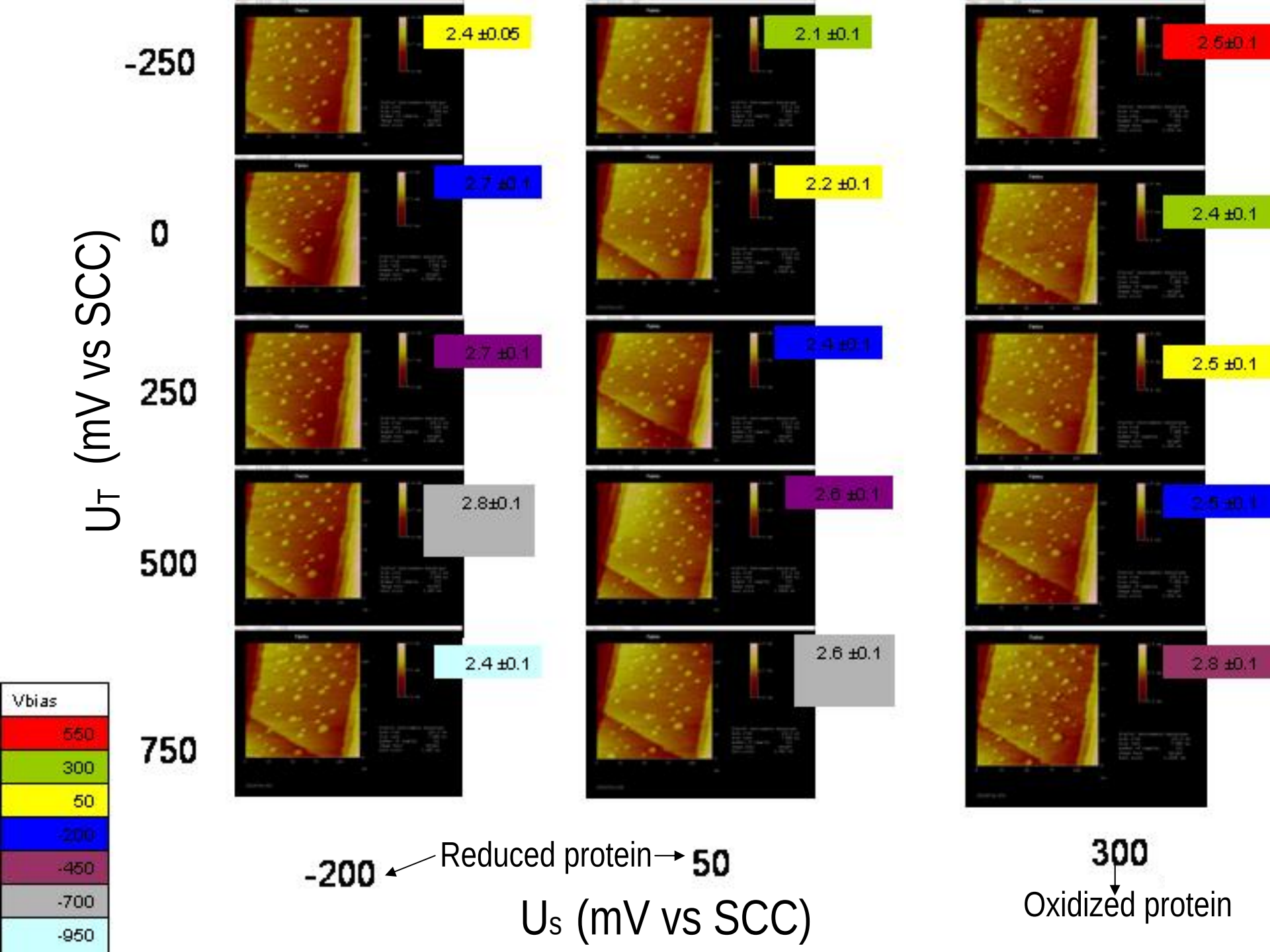


$U_s = 300 \text{ mV}$
 $U_t = 0 \text{ mV}$

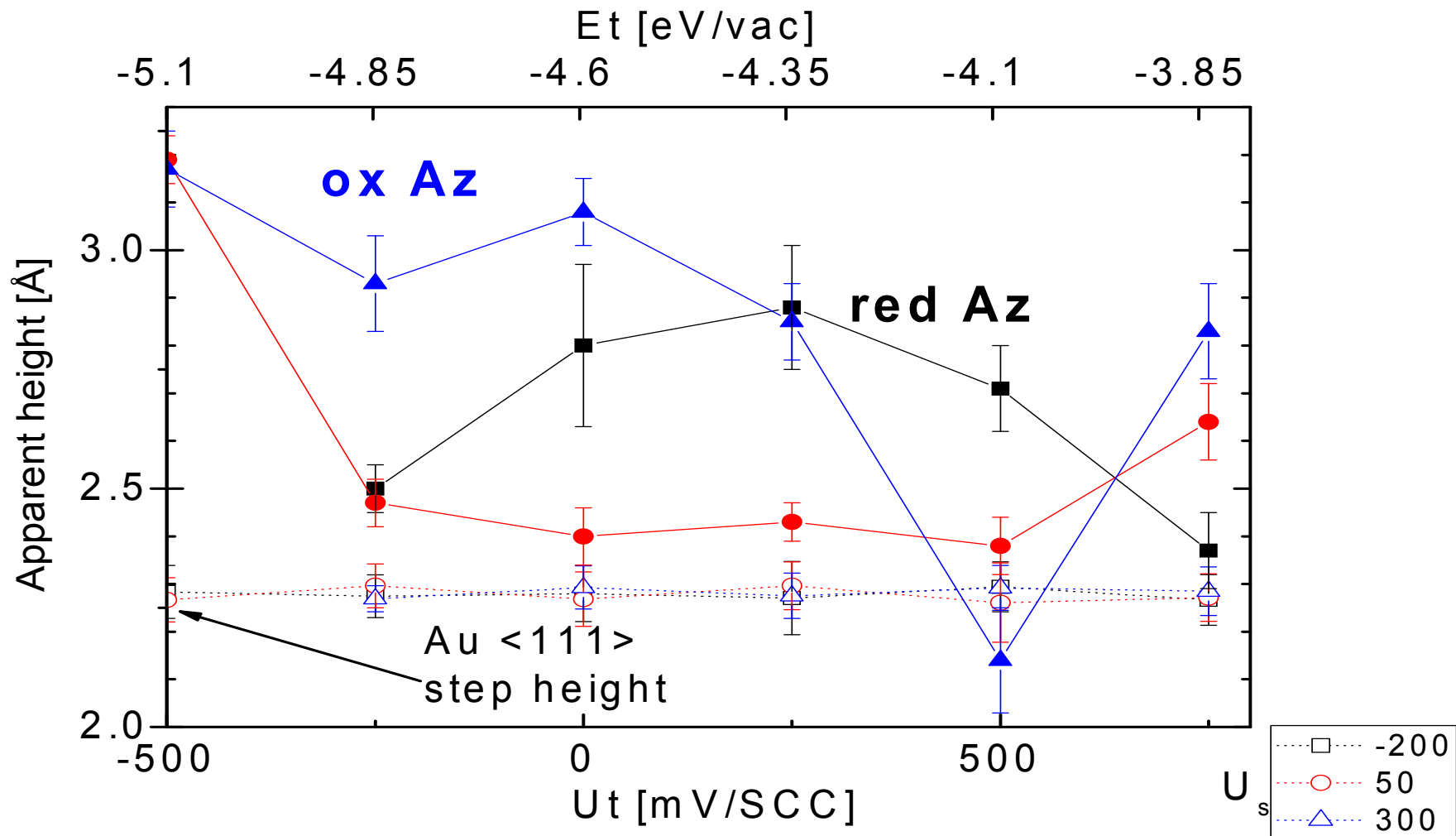


$U_s = 300 \text{ mV}$
 $U_t = 750 \text{ mV}$

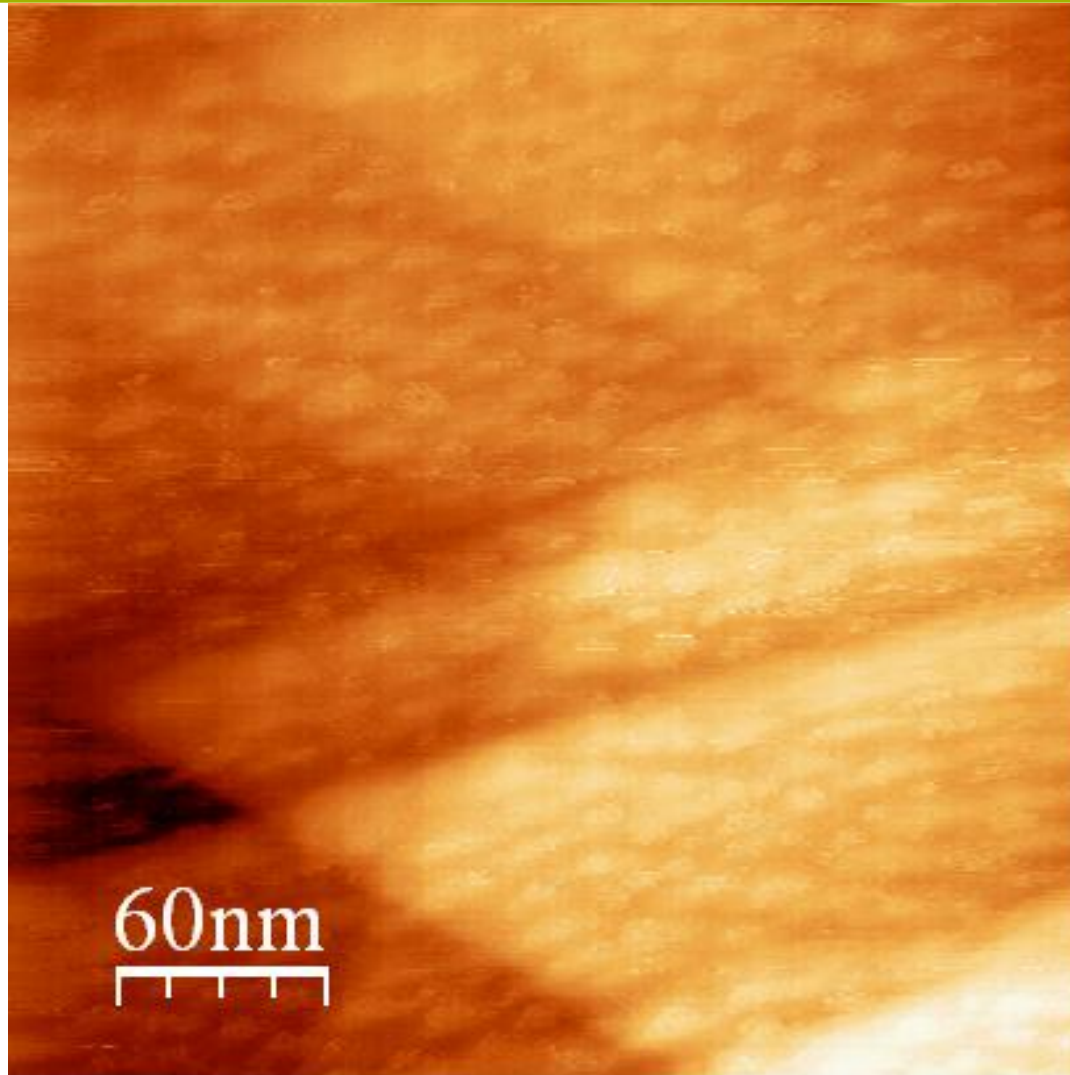




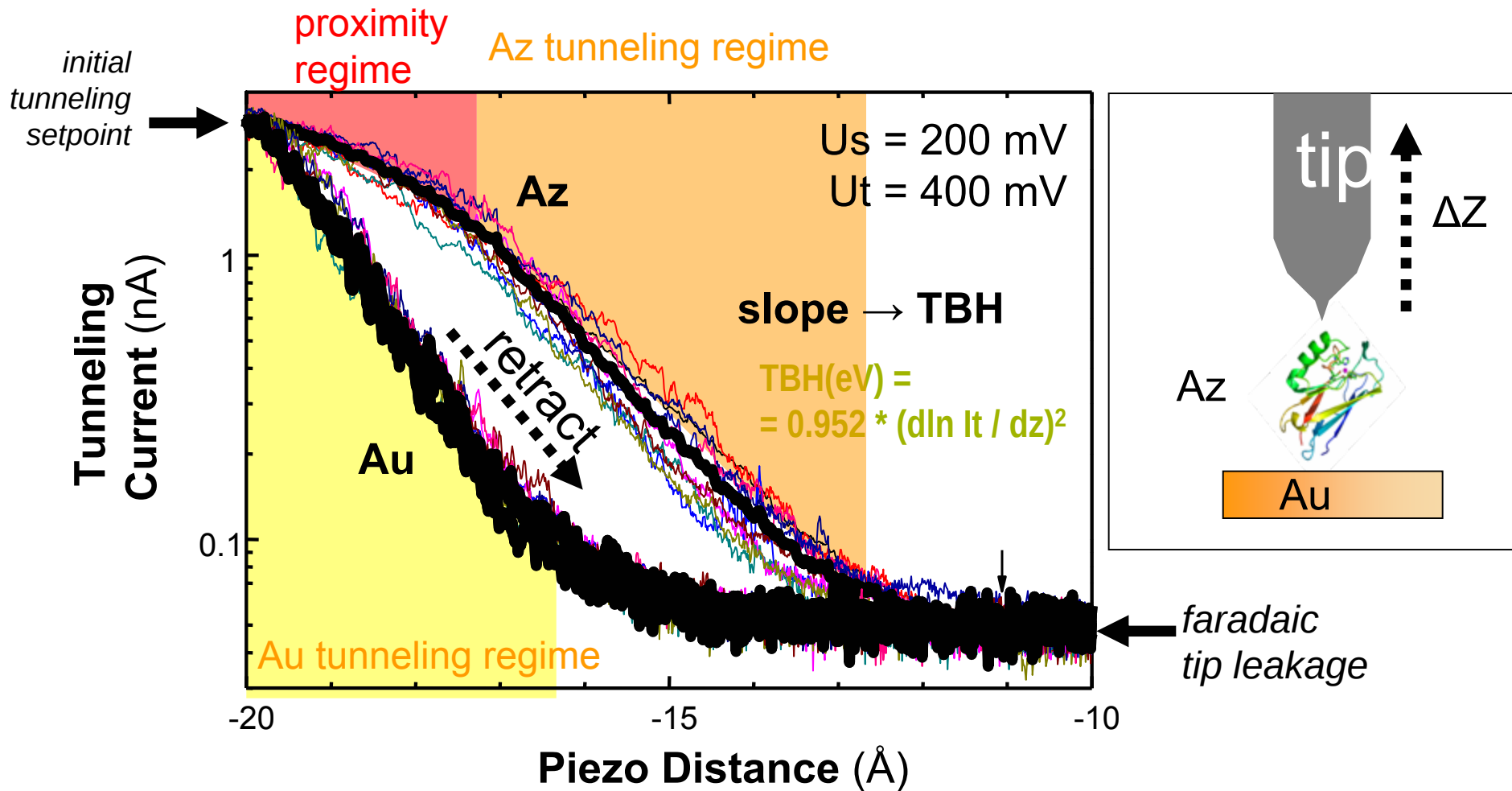
Results: Apparent height changes



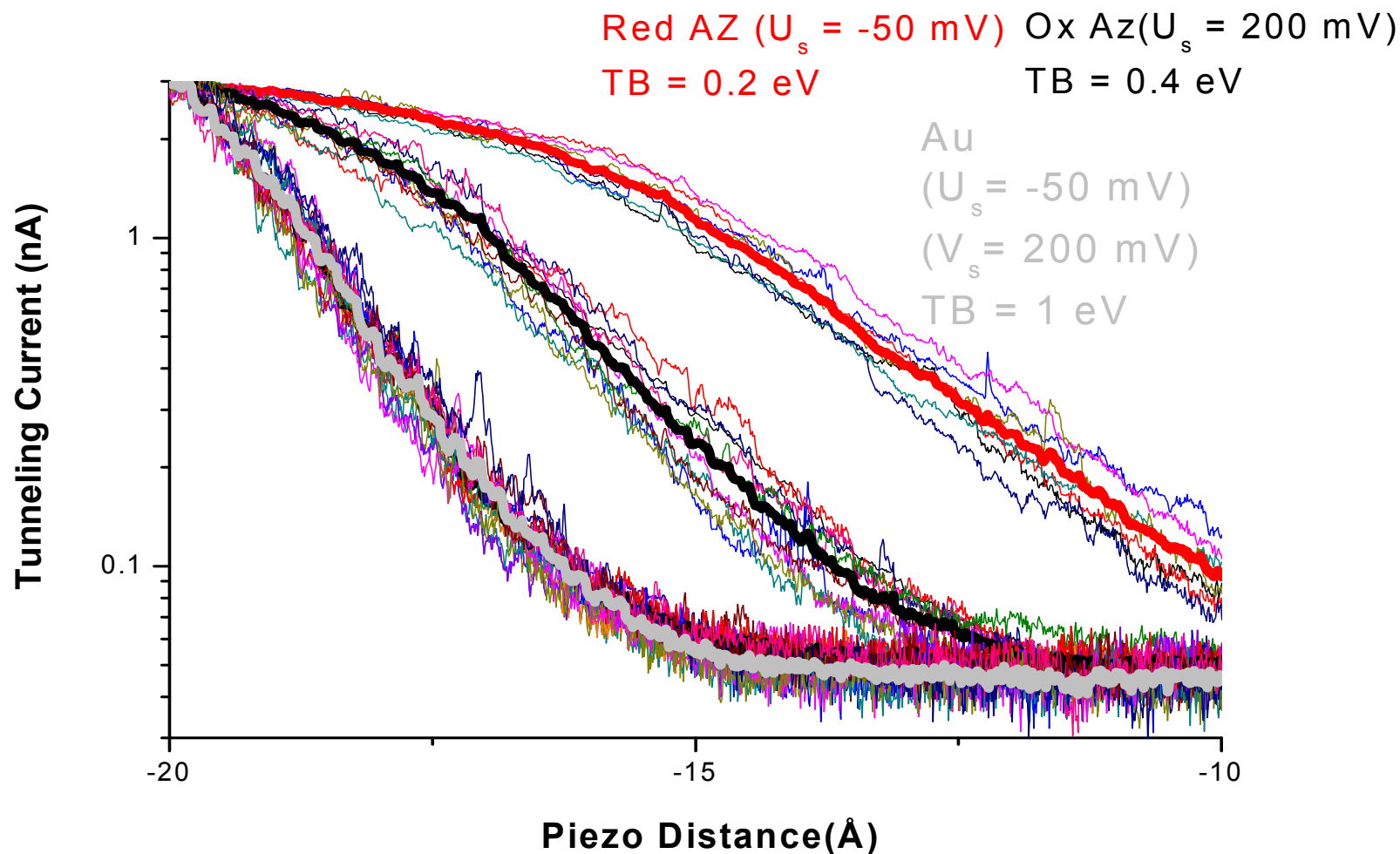
Results: Full sample coverage for Spectroscopical measurements



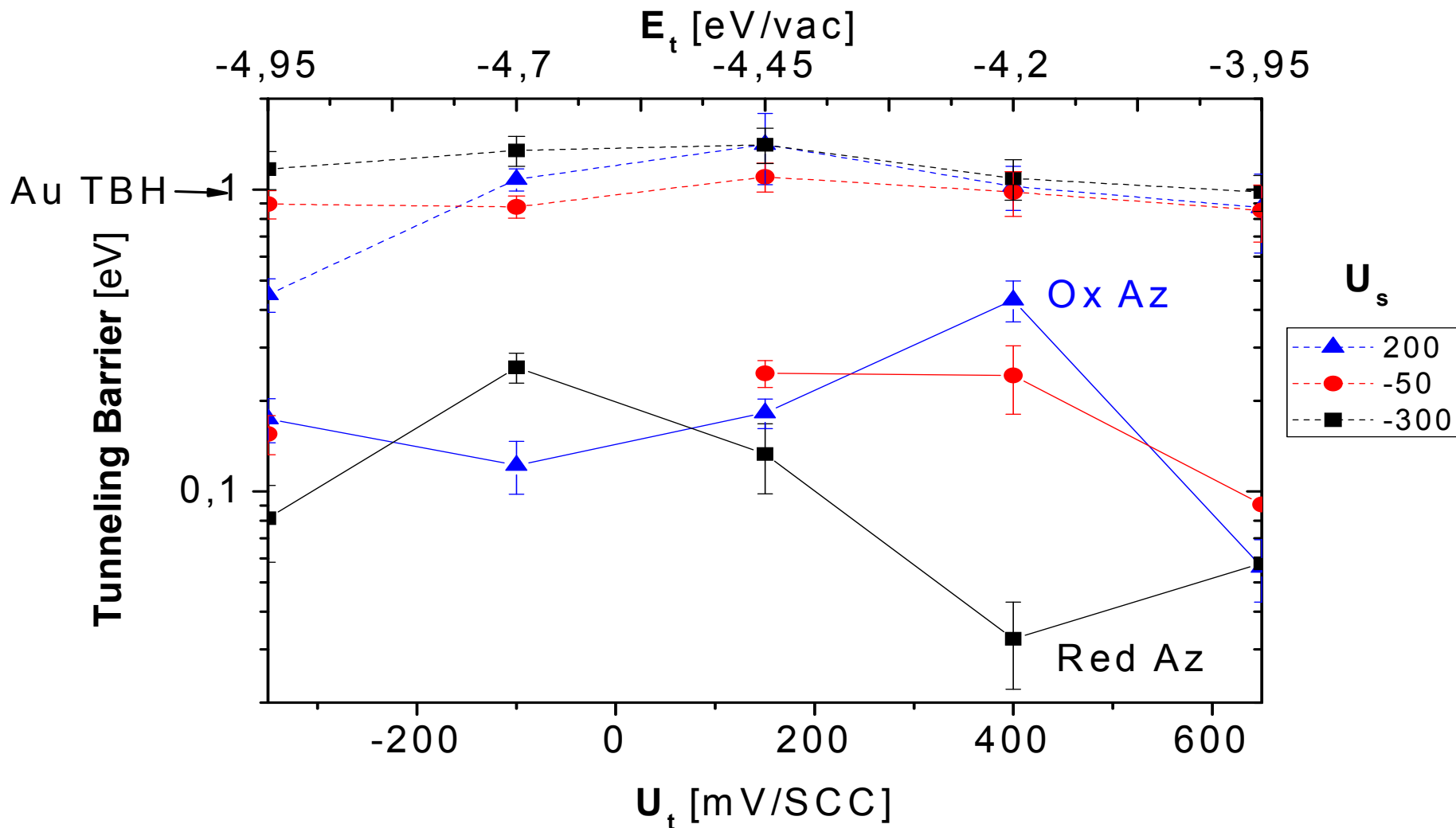
Results: Current / Distance Spectroscopy



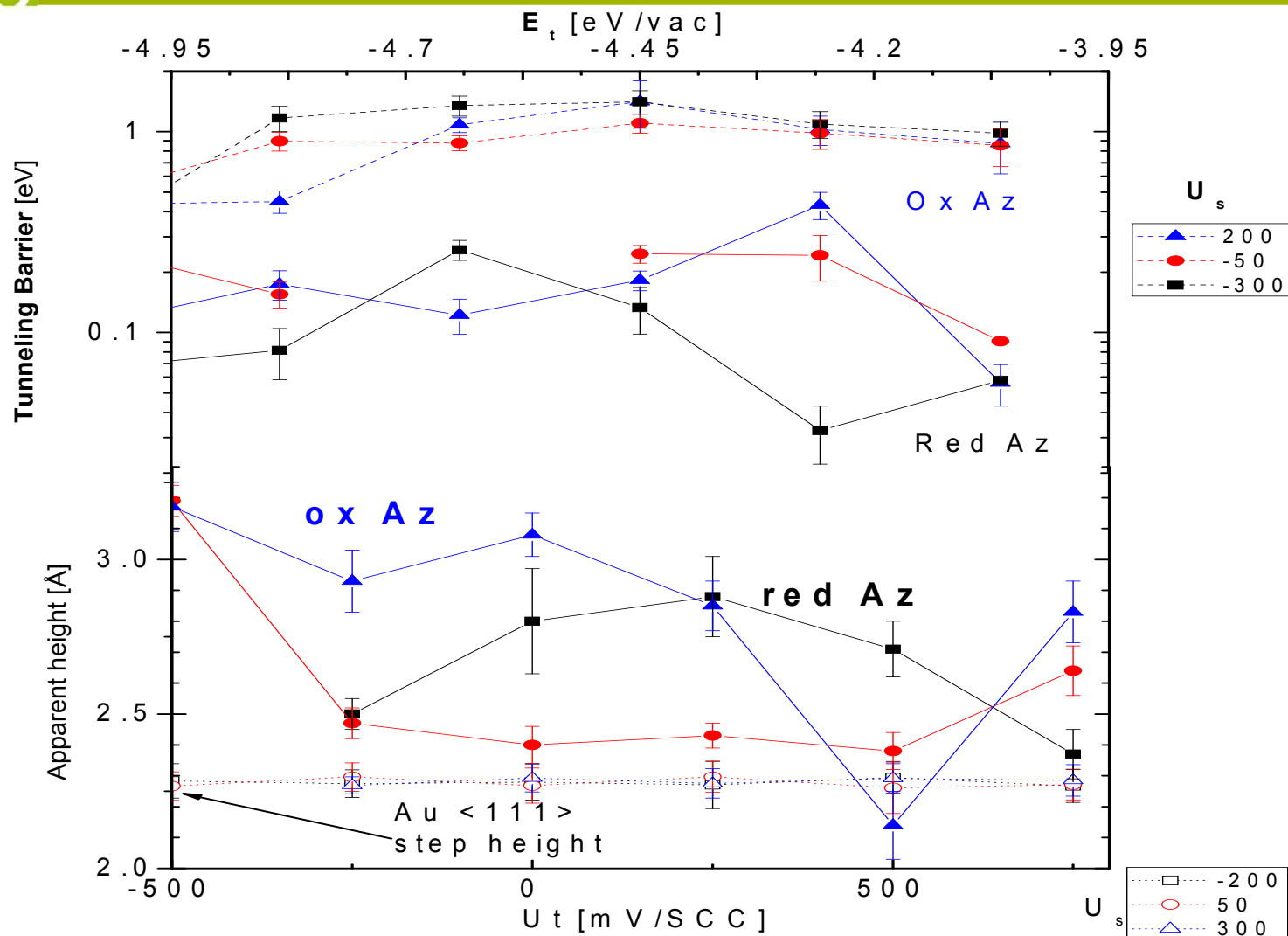
Results: Current / Distance Spectroscopy



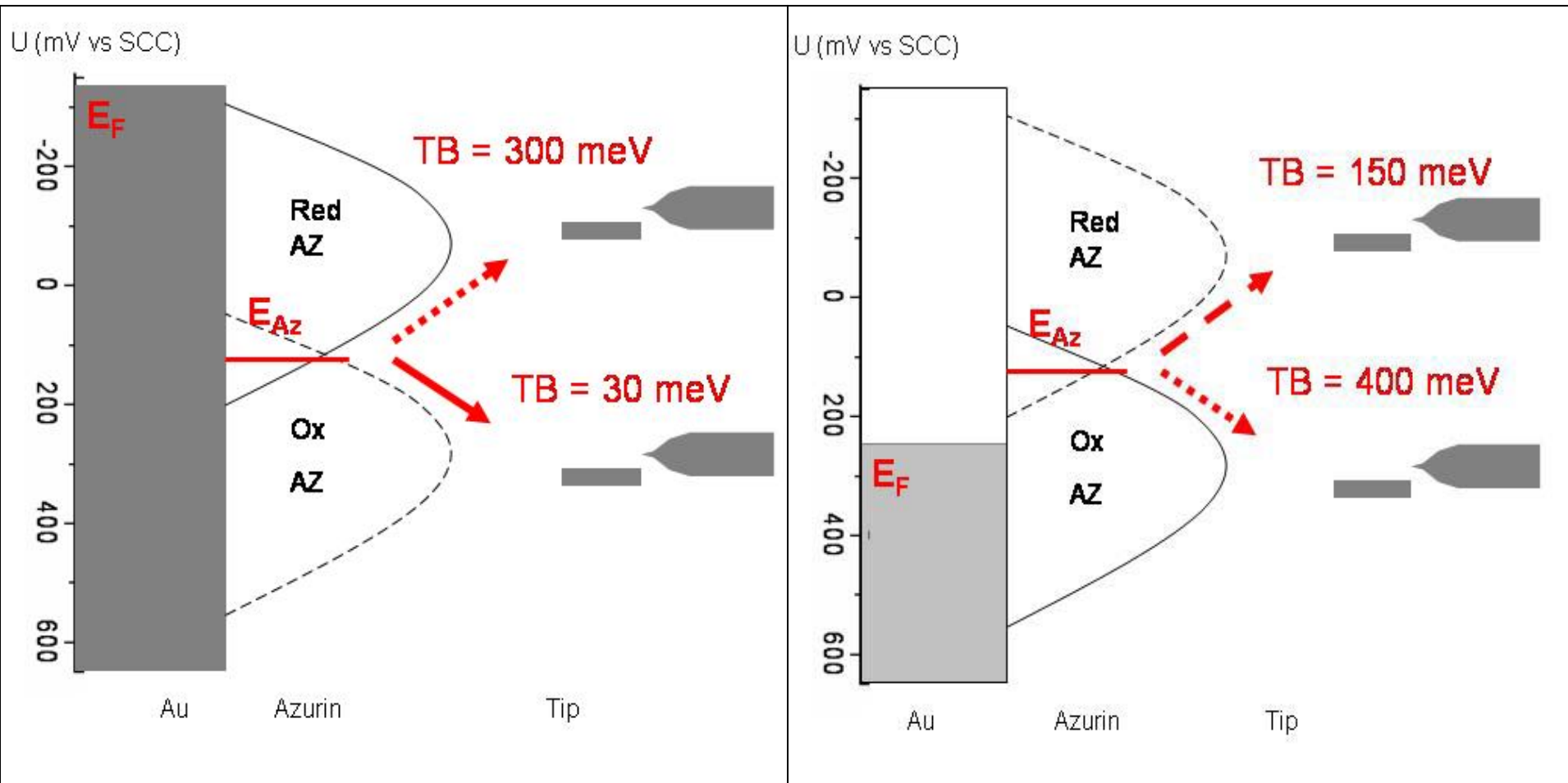
Results: Tunneling Barrier Heights



Discussion: Correlation between apparent height and tunneling barrier



Discussion



- Electrochemical STM Imaging of azurin under bipotentiostatic control has been obtained.
 - **Dependence of azurin apparent height** on the azurin **redox state** and also on **tip potential** has been found
 - Quantitative **tunneling barrier height** results have been obtained from current/distance curves, which show a **dependence of azurin tunneling barrier height** on **redox state** and **tip potential**.
 - **Tunneling barrier** and **apparent height** results are clearly **correlated** and coherent with the expected redox behaviour of the metalloprotein.
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