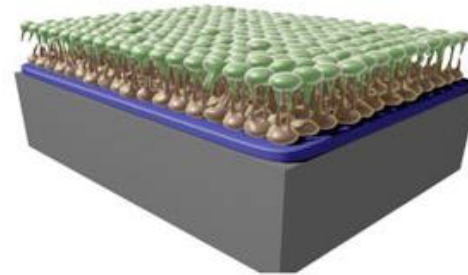


ISIS Progress on Model Membrane Development

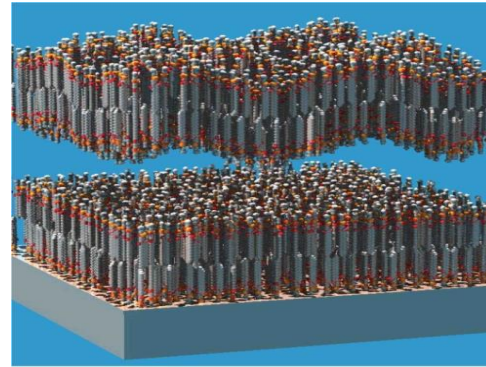
Arwel Hughes

ISIS STFC

A simple bilayer on a substrate suffers from frictional effects (membrane is constrained)

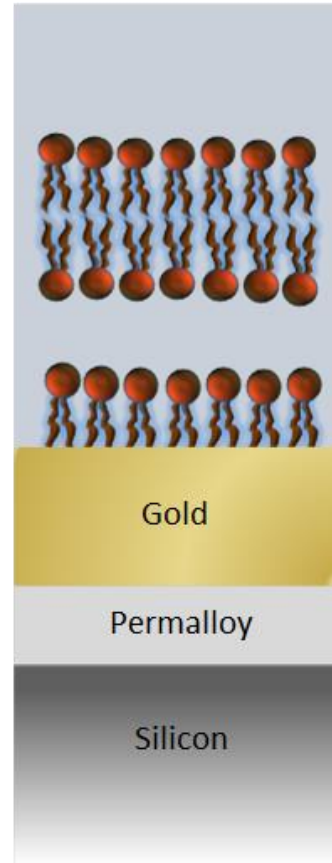
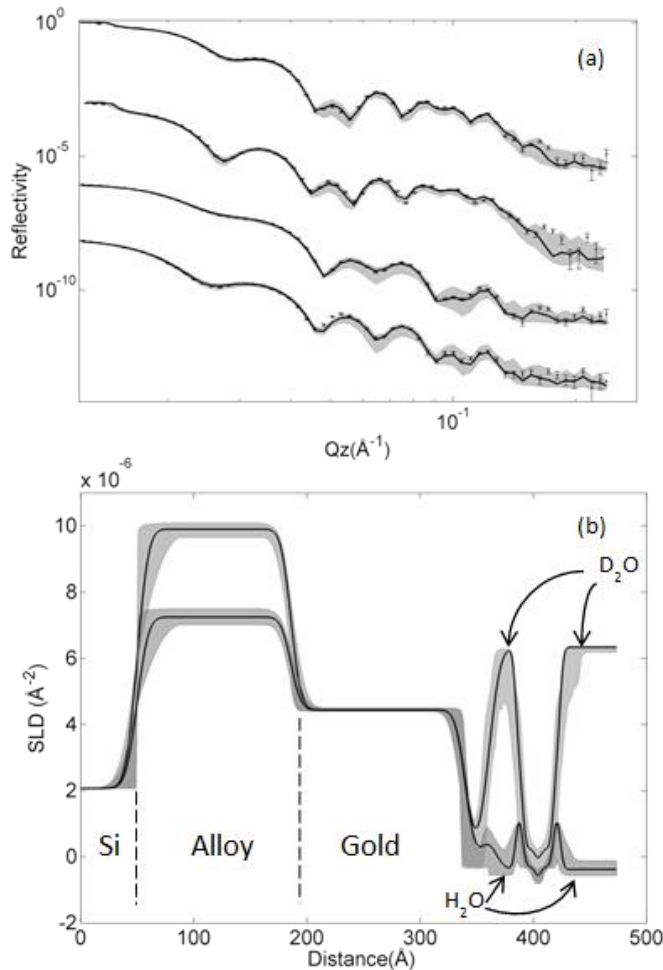


The way forward is to manipulate the membrane/substrate interactions so that the bilayer 'floats' on substantial water cushions (original ILL idea about 2000. Developed ISIS/ILL/University partners since then, and now NMI3)



For this JRA ISIS has been focussing on :- (a) More robust systems with fewer sample defects...(b) Better data fitting methods...

New system developed in last 3 years – bilayers supported on thiolipid on gold

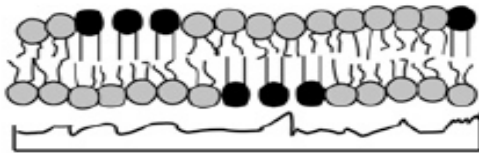
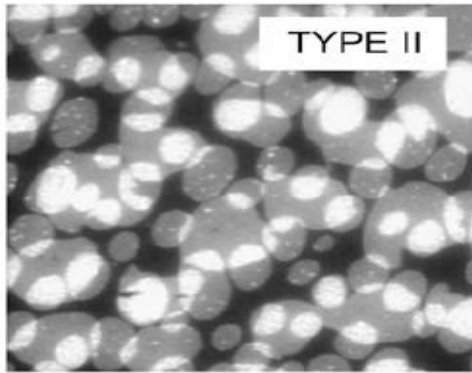


This system is giving us 100% coverage bilayers. Also notice we are now using magnetic underlayers and polarised neutrons to give additional contrasts.

(The PNR has been a joint development with ANSTO, using substrates made at NIST)

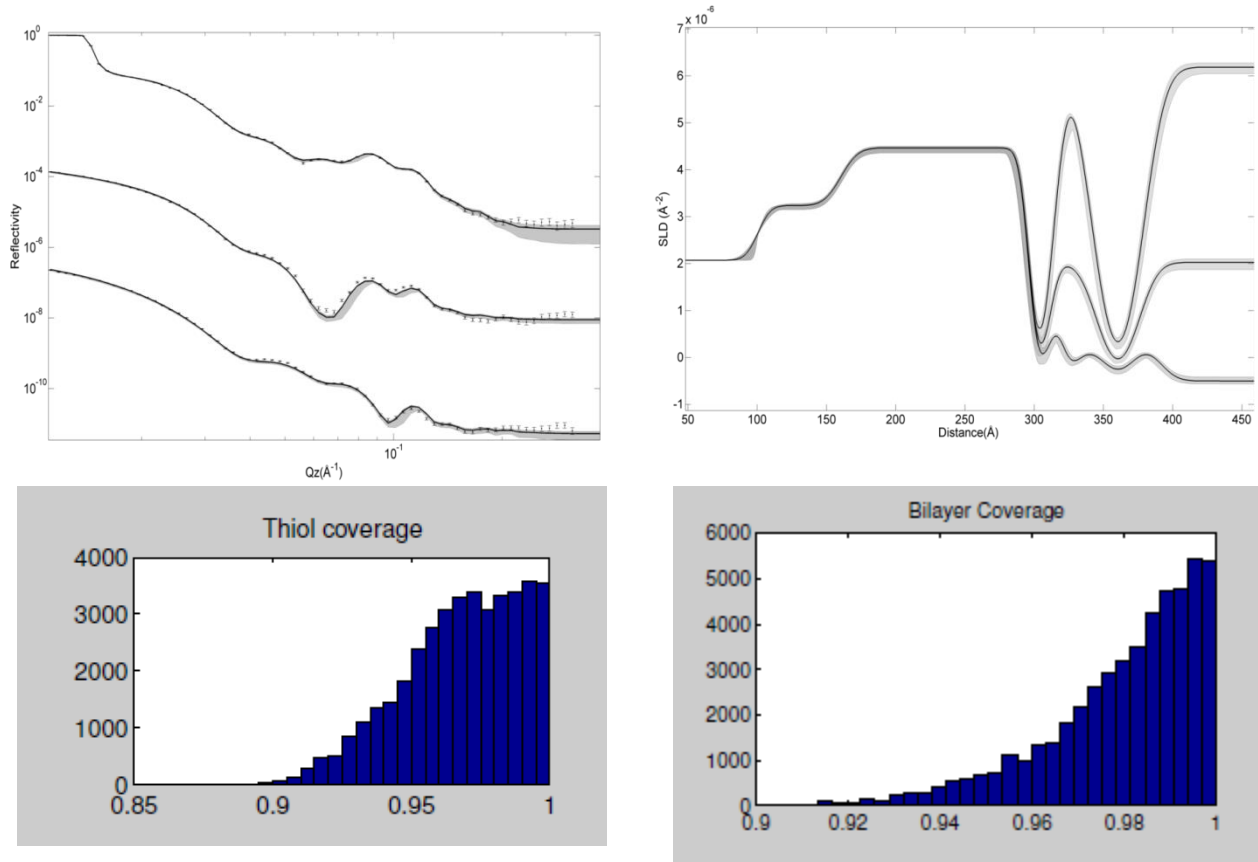
Unconstrained Membranes

Single bilayers are restricted (domains don't move), but the floating bilayers are unconstrained {click on the picture on the right Annie – it's fluorescence microscopy showing the domains move!}



Data Analysis...

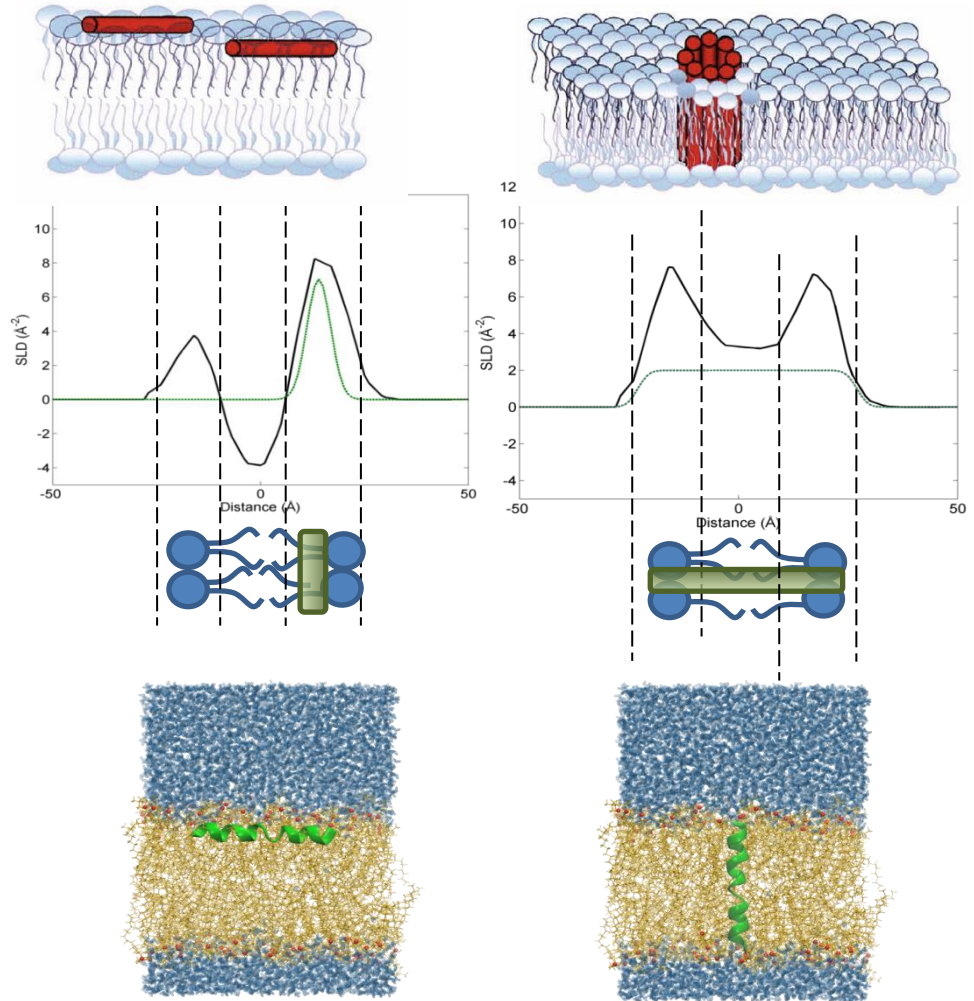
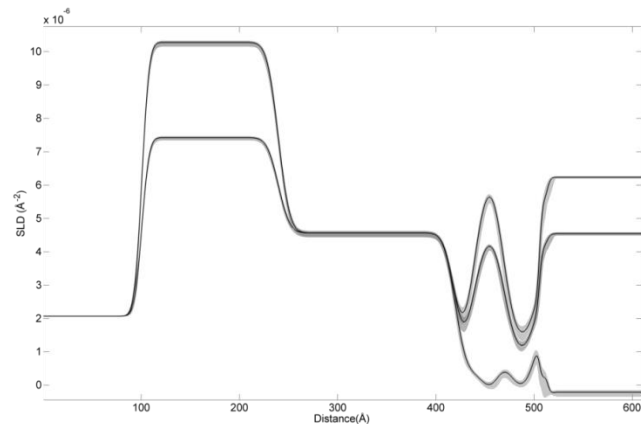
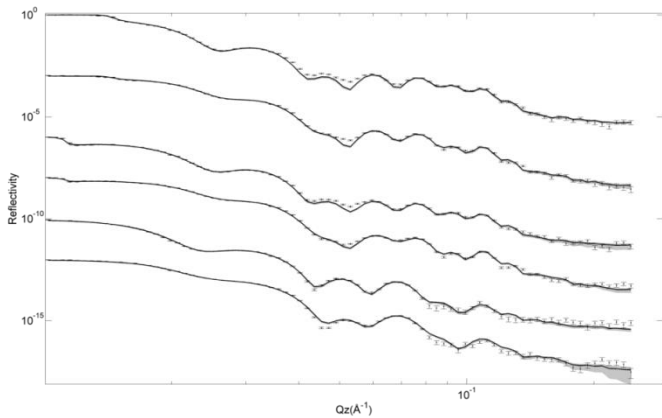
Our software effort has been in the development of Bayesian analysis codes for model fitting...



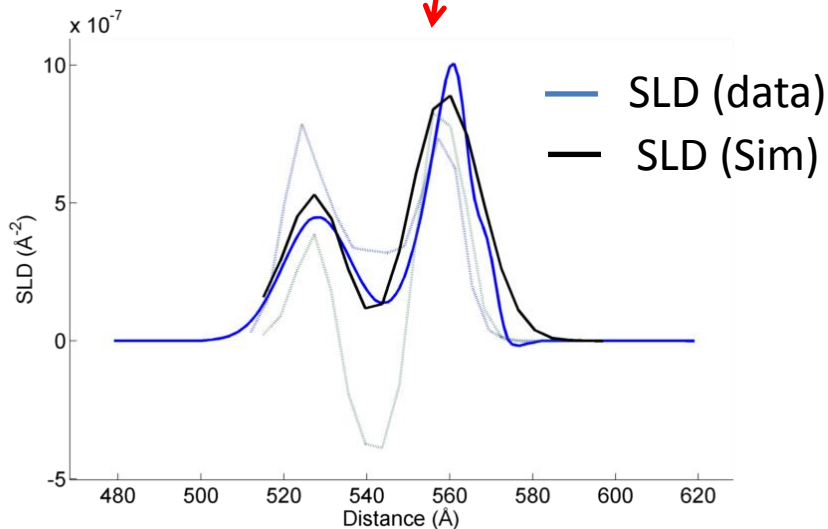
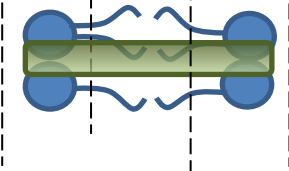
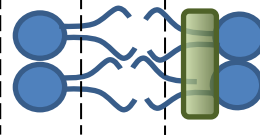
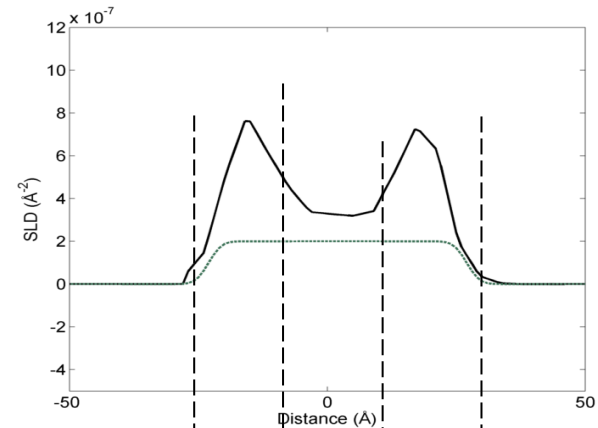
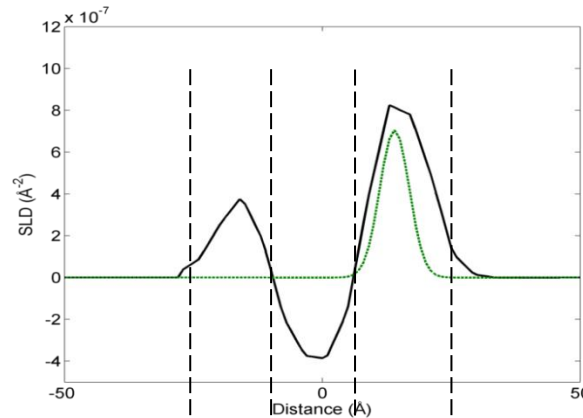
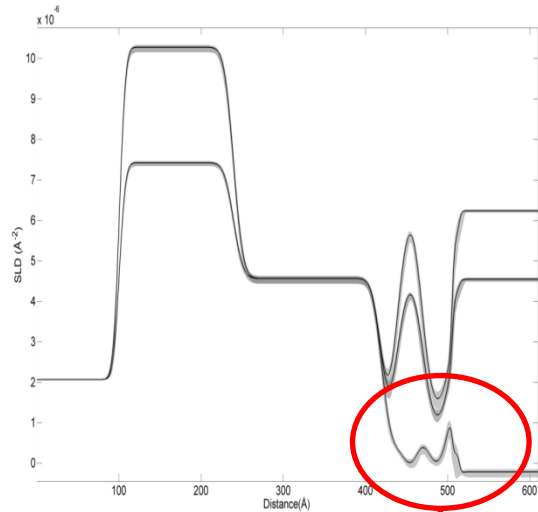
This gives robust methods for parameter (and uncertainty) estimation for 'traditional' scattering models. This is in a beta version soon ready for release (PDRA heavily involved)

Data Analysis...

..but the main focus of the PDRA has in developing methods for using molecular dynamics techniques to analyse reflection data. So for example, an analysis for a model antimicrobial peptide is allowing us to investigate the peptide orientation in the membrane – is it parallel to the membrane or perpendicular??



Our data suggests that actually we have both orientations present...



The SLD profile obtained from the data fit needs contributions from both orientations of peptide – 65% parallel 35% transmembrane under these conditions. So floating bilayers, polarised neutron reflection using magnetic reference layers, and bayesian analysis of the data coupled with molecular dynamics simulations of the membrane is giving us this information.