



Surface Profile Analysis Reflectometer (SPEAR)



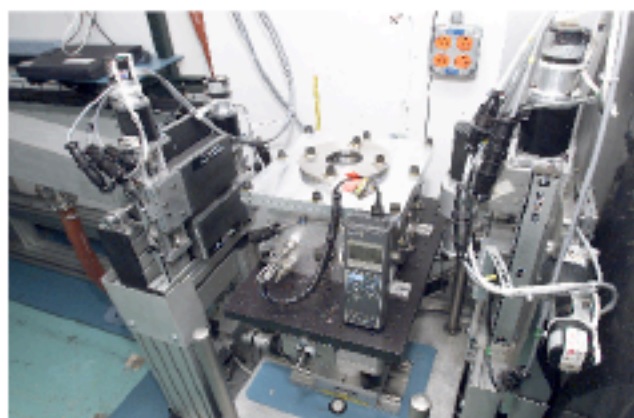
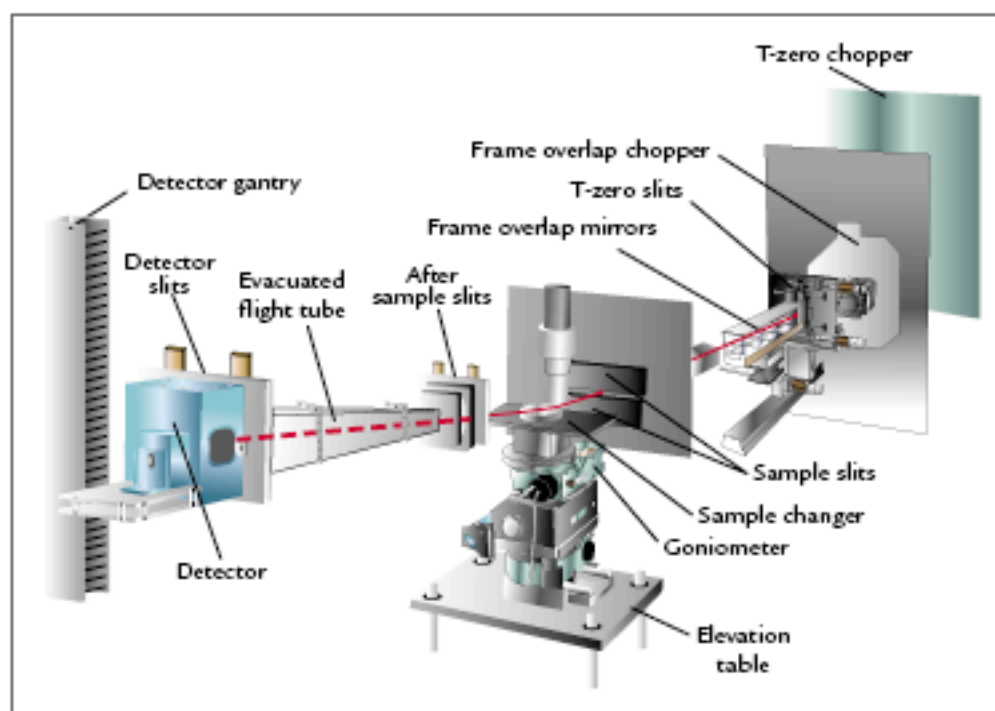
The Surface Profile Analysis Reflectometer (SPEAR), located on flight path 9 in the Lujan Neutron Scattering Center, is ideally suited to study thin (from 5 to 3000 Å) organic and inorganic layers in a variety of different environments. The instrument uses an unpolarized neutron beam to study a broad range of materials including polymers, nano-engineered films, and biological systems. SPEAR is a time-of-flight (TOF) reflectometer using two choppers to define a typical wavelength range of 1.5 Å to 16 Å. With this polychromatic beam, a range of momentum transfer

vectors (Q_z) can be measured without altering the angle of the incident beam. An important feature of SPEAR's design is that the beam is inclined to the horizon at 0.9° . This inclination allows for reflectivity measurements from liquid/air interfaces. Using a position sensitive detector, the TOF and reflected position of individual neutrons can be measured and converted to a wavelength and reflection angle. With this arrangement, good statistics can be obtained down to a minimum reflectivity of about 5×10^{-7} in 3-4 hours.

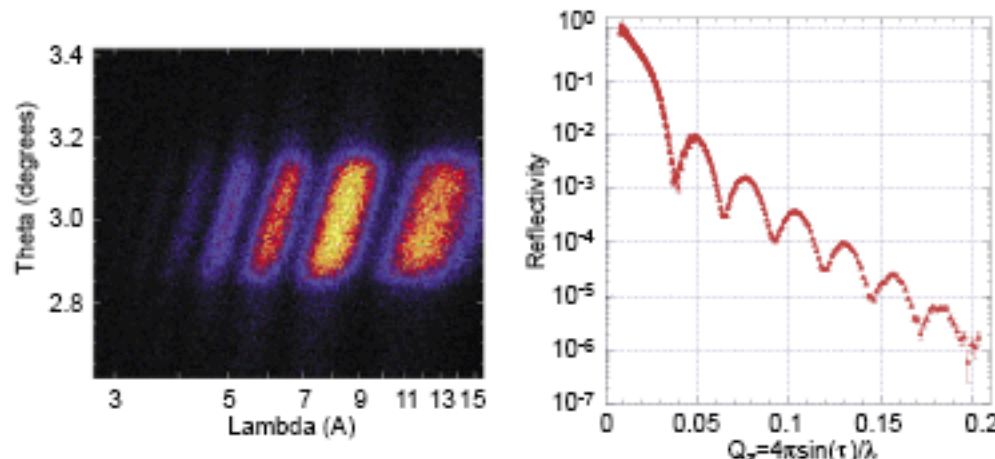


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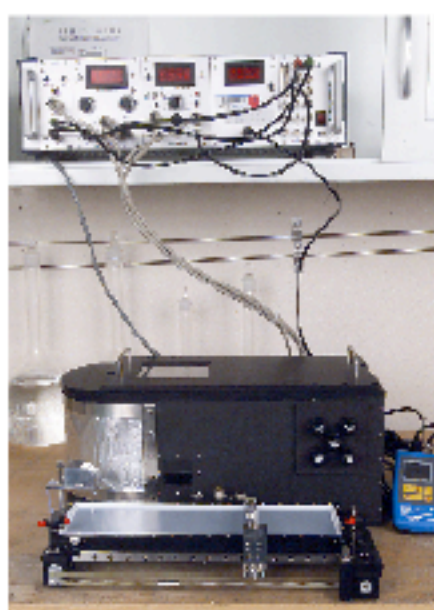
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SPEAR's sample area and goniometer.



Low and high angle detector images and the corresponding Reflectivity vs. Q_z plot for specular neutron reflection from a 300Å layer of deuterated polystyrene.



Langmuir trough for gas/liquid interface experiments.

Specifications					
Moderator-to-detector distance	12.4 m				
Wavelength frames at 20 Hz	$1 < \lambda < 16 \text{ \AA}$ and $16 < \lambda < 32 \text{ \AA}$				
Q range (liquid sample)	$0.006 < Q < 0.15 \text{ \AA}^{-1}$				
Beam cross section at sample position (maximum sample acceptance)	3-mm high x 30-mm wide				
Moderator	Partially coupled liquid hydrogen at 20 K				
Neutron flux at sample position at 100 ?Å	<table border="1"> <tr> <td>$2 < \lambda < 6 \text{ \AA}$</td> <td>$\sim 7.0 \times 10^6 \text{ n/cm}^2/\text{s}$</td> </tr> <tr> <td>$6 < \lambda < 16 \text{ \AA}$</td> <td>$\sim 1.5 \times 10^6 \text{ n/cm}^2/\text{s}$</td> </tr> </table>	$2 < \lambda < 6 \text{ \AA}$	$\sim 7.0 \times 10^6 \text{ n/cm}^2/\text{s}$	$6 < \lambda < 16 \text{ \AA}$	$\sim 1.5 \times 10^6 \text{ n/cm}^2/\text{s}$
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Detectors	Linear ^3He position-sensitive detector				
Minimum reflectivity	$< \sim 10^{-7}$				
Sample environment	Solid/liquid interface cells; Langmuir trough; and solid/liquid interface Poiseuille shear cell				
Experiment duration	5 minutes to 6 hours				