



Australian Government

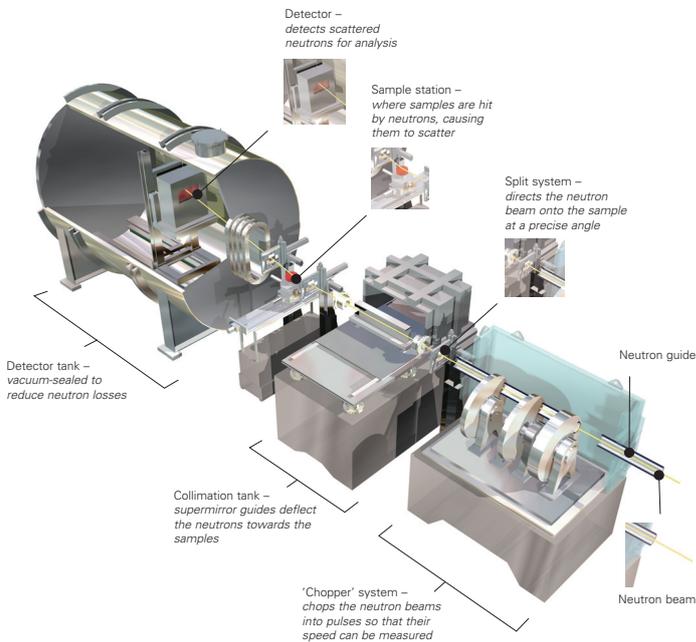
Ansto

For more information contact:

Dr Michael James: +61 2 9717 9299
michael.james@ansto.gov.au

Dr Andrew Nelson: +61 2 9717 9477
andrew.nelson@ansto.gov.au

Dr Frank Klose (magnetic films):
+61 2 9717 3592
frank.klose@ansto.gov.au



PLATYPUS

Time-of-flight neutron reflectometer

Platypus will be one of the world’s top neutron reflectometers with the added ability of studying films at the air-liquid interface (free-liquid surfaces). Neutron reflectometry is used to study surfaces, thin films, buried interfaces, magnetic films, multi-layered structures and processes that occur at surfaces and interfaces.

What makes Platypus special?

Neutron reflectometry provides information on the composition, changes in surface characteristics over time, thickness and interfacial roughness of thin films with the precision of a few atoms.

Applications:

Neutron reflectometry can be used to:

- Study soft matter in biological and chemical science:
 - Examining how surfactants work (substances that affect surface characteristics) eg: waterproofers, emulsifiers, lung surfactants in premature infants.
 - The interactions of proteins and enzymes with biomimetic cell membranes (synthetic membranes used to model those in living cells).
- Deliver critical information about polymer film composition, chemical properties and the quality of the film in conjunction with other surface sensitive techniques.
 - Nanoscale plasma polymer surface coatings are key elements used in the development of new biotechnologies for tissue growth, bio-functionalisation, surface passivation and anti-biofouling, protein and antibody biosensors.
- Study processes occurring at surfaces and interfaces such as adsorption, corrosion, adhesion and inter-diffusion between layers to solve important industrial problems
- Study thin-film magnetic devices to be used in future generations of computers, including magnetoresistive read head sensors and data storage films in hard drives as well as non-volatile magnetic random access memory devices.

Relevant fields include: Biology, chemistry, surface engineering, magnetic memory.

Instrument specifications:

Platypus is located on the cold neutron guide CG3

Wavelength Range: 2-20 Å

Q-range (liquids): 0 – 0.3 Å⁻¹

Q-range (solids) : 0 – 0.5 Å⁻¹

Δt/T (Δλ/λ) : 1-12%

ΔQ/Q: 2 -20%

R_{min}: 10⁻⁸

Off-Specular: yes

Polarised: yes

White flux @ sample: ~10⁹ ncm²s⁻¹

Beam size: (0.05 – 20) x 50 mm

Sample-detector: 0.65 – 3.65 m

Detector area: 500 x 250 mm

Detector: high speed 2-dimensional area

Chopper system: flexible 4-disc system

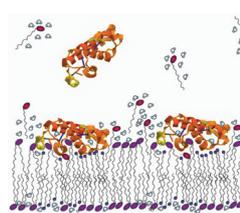
Vertical scattering plane



Case Study 1: Body repair and regeneration

Neutron reflectometry is helping ANSTO and researchers at the University Sydney unravel the molecular structure of the mysterious protein building block of elastin: (*tropoelastin*). *Elastin* is a critical component of elastic tissues present in the aorta, ligaments, major blood vessels, lungs, skin and tendons. It is present in all vertebrates. Synthetic elastin biopolymers are currently finding uses in areas such as the promotion of elastin regeneration, tissue engineering and medical implants.

Synthetic human elastin made in Professor Weiss's lab at the University of Sydney.



Schematic representation of the action of cobra venom PLA2 on a membrane

Case Study 2: Biochemistry of cell membranes

Neutron reflectometry provides unique structural information about cell membranes and how they interact with proteins, drugs and toxins. For example, the enzyme phospholipase-A2 (PLA2) plays a variety of roles from immune response in human cell membranes to being the active ingredient in many snake and insect venoms, including cobra venom. Neutron reflectometry has been used to study the mechanism by which PLA2 interacts with phospholipid molecules, which are the major constituents of cell membranes. This has enabled researchers to understand what activates and inhibits the enzyme, which has potential applications in gene therapy, treating autoimmune disease such as arthritis as well as targeted drug-delivery for cancer therapy.



OPAL

WORLD-CLASS NEUTRON SCIENCE