



Australian Government



Nuclear Science & Technology and Landmark Infrastructure User Focused Experience

Dr Miles Apperley
Head of Research Infrastructure

NUS 2016

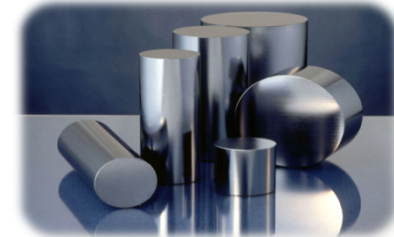
Australian Nuclear Science and Technology Organisation

ANSTO is a public research organisation with a variety of roles for the nation. ANSTO operates Australia's research nuclear reactor.

Research & Innovation
Science & Engineering



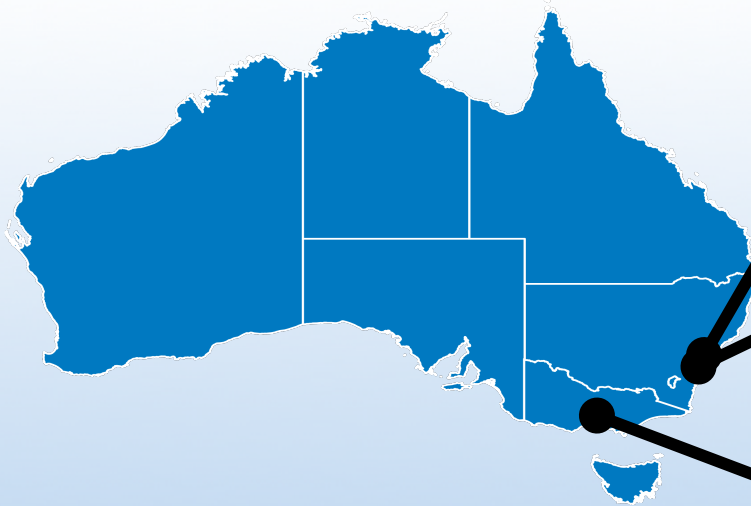
Commercial Businesses



Expert advice and support to
government & international agencies



Multi-site organisation



Camperdown
Cyclotron
NSW



Lucas Heights
Main Campus
NSW

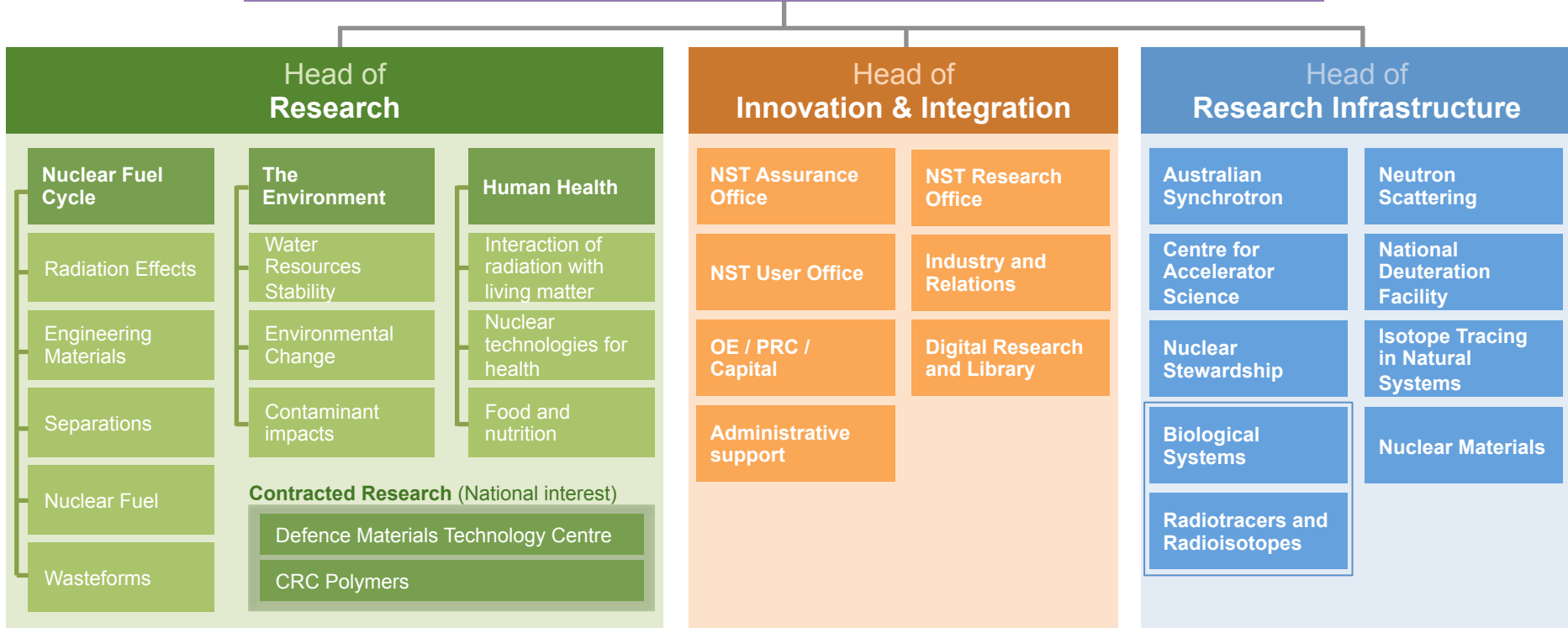


Clayton
Australian
Synchrotron
VIC



Nuclear Science & Technology and Landmark Infrastructure

Group Executive of
Nuclear Science & Technology and Landmark Infrastructure



Head of Research

- Nuclear Fuel Cycle
- Radiation Effects
- Engineering Materials
- Separations
- Nuclear Fuel
- Wasteforms
- The Environment
 - Water Resources Stability
 - Environmental Change
 - Contaminant impacts
- Human Health
 - Interaction of radiation with living matter
 - Nuclear technologies for health
 - Food and nutrition
- Contracted Research (National interest)
 - Defence Materials Technology Centre
 - CRC Polymers

Head of Innovation & Integration

- NST Assurance Office
- NST Research Office
- NST User Office
- Industry and Relations
- OE / PRC / Capital
- Digital Research and Library
- Administrative support

Head of Research Infrastructure

- Australian Synchrotron
- Neutron Scattering
- Centre for Accelerator Science
- National Deuteration Facility
- Nuclear Stewardship
- Isotope Tracing in Natural Systems
- Biological Systems
- Nuclear Materials
- Radiotracers and Radioisotopes

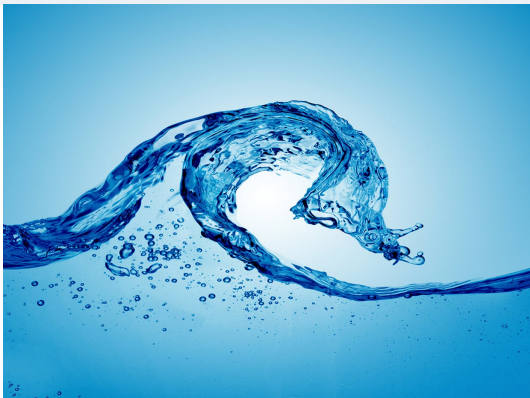
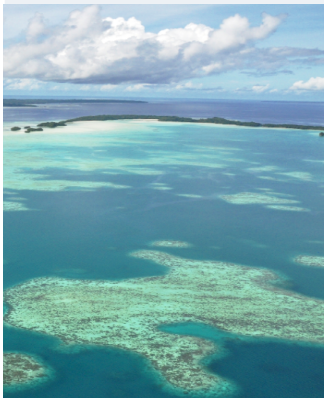
Environment

What

Uses our world-class expertise and nuclear-based capabilities to address some of Australia's (and the world's) most challenging environmental (& economic) problems: ***water resources sustainability, environmental change & contaminant impacts.***

Why

Using nuclear techniques, ANSTO is well positioned to fill critical data and knowledge gaps, which will inform sustainable management strategies and capacity to respond to these environmental challenges.



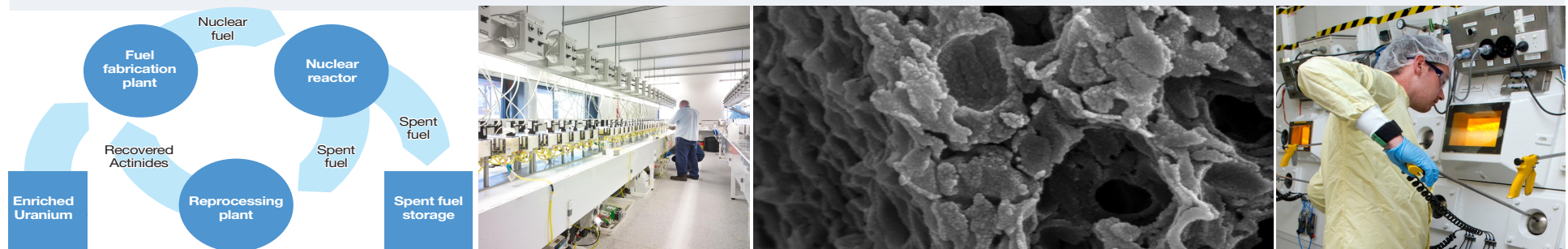
Nuclear Fuel Cycle

What

Uses our world-class expertise and unique-to-Australia nuclear science and technology capabilities to address some of the most challenging problems in the application of nuclear technology in the advanced nuclear power generation systems, immobilisation of nuclear waste and separation of important isotopes from production and waste streams.

Why

ANSTO has a mandate to provide advice to the Australian Government on the Nuclear Fuel Cycle. Using its world-leading wasteform technologies and expertise in nuclear materials, engineering and analysis, ANSTO is making significant contributions to clean nuclear energy systems for Australia's future energy security.



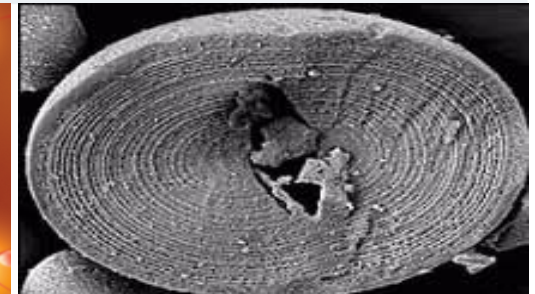
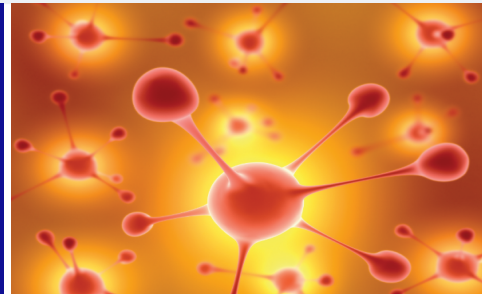
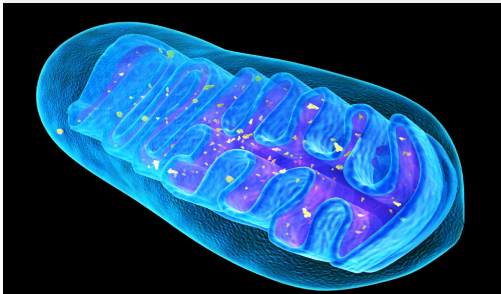
Human Health

What

Uses our world-class expertise, landmark facilities and unique power of nuclear technologies to understand the factors and changes that lead to disease and recovery from disease, develop strategies to enhance and maintain health through designed food and ingredients, and understand the mechanisms of radiation impact on biological materials.

Why

The knowledge gained will lead to earlier detection of disease and well-informed therapeutic intervention, improve health and promote disease prevention, contribute to assessing the impact of nuclear events on public health and the managing of doses and limits for radiation workers.



ANSTO Research Infrastructure

Landmark

OPAL
Research Reactor

Australian
Synchrotron

National

National
Deuteration Facility

Centre for
Accelerator Science

Neutron
Scattering

Other National Collaborative
Research Infrastructure
Strategy (NCRIS) Facilities

Institutional

Local but
national impact

Isotope Tracing & Dating

Nuclear Forensics

Activity Standards

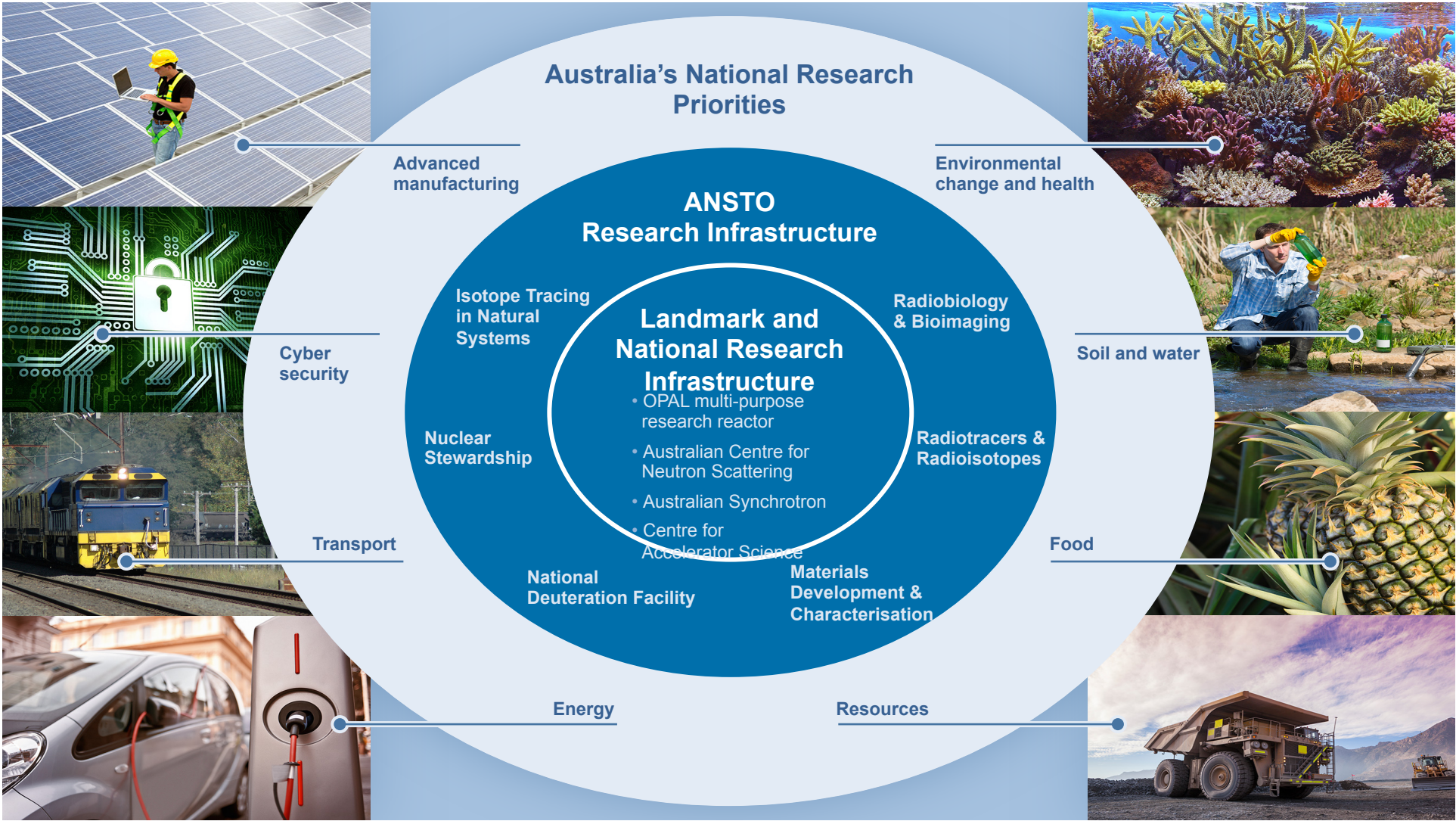
Medical Cyclotron

Neutron Activation

Bioimaging

Materials Characterisation

Merit Based & Collaborative Access | Solutions to industry | Developing Technology



ANSTO Research Infrastructure

Nuclear enabled

neutron scattering, diffraction and imaging; neutron irradiation & activation; radiochemistry; radiotracing

Accelerator based

X-ray scattering, diffraction and imaging; accelerator mass spectroscopy; ion beam (micro) analysis; 2D trace element mapping; irradiation and implanting

Process, detect and characterise nuclear systems (including naturally occurring) materials processing, 'hot' cells, active Characterisation, EM & mechanical testing; nuclear forensics and activity standards; γ irradiation and spectroscopy; multi modal imaging; Tritium & Radon detection; sediment analysis; TIMS and MC-ICPMS; modelling and informatics

OPAL multi-purpose research reactor

CAPABILITIES

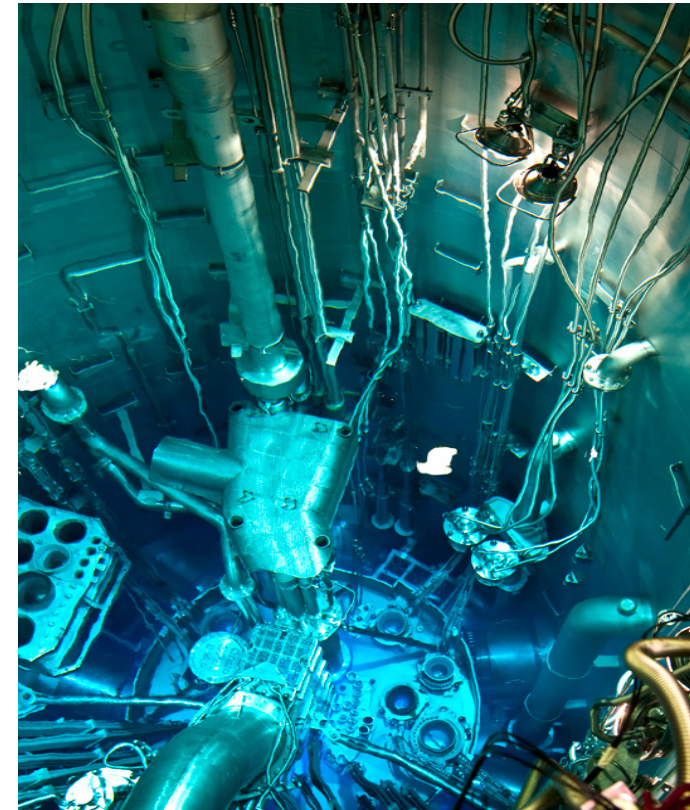
- 20MW Open Pool Lightwater Reactor uses low enriched uranium
- Production of radioisotopes, thermal and cold neutrons
- Neutron activation and irradiation

IMPACT

- 300 days of operation
- Supply of Mo-99 and other radiopharmaceuticals
- Resource for scientific, medical and industrial investigations and applications
- Source of Australian nuclear expertise

FUTURE DIRECTIONS

- Construction of 2nd Neutron Guide Hall



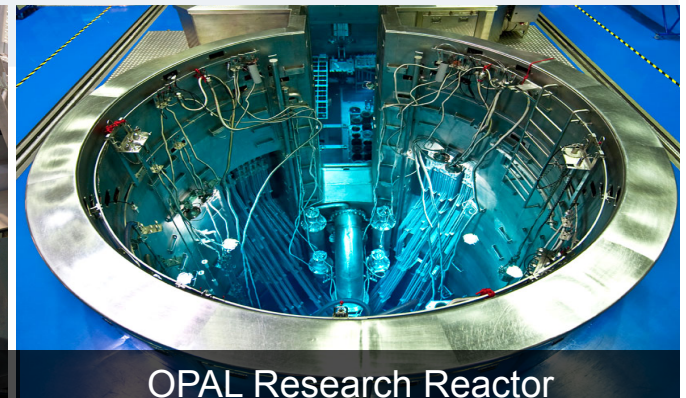
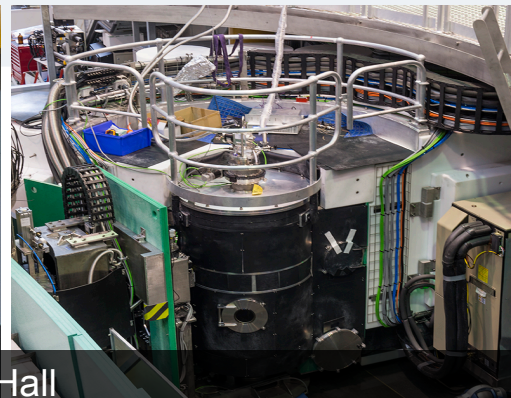
Australian Centre for Neutron Scattering

What

- Neutron & X-ray scattering and specialised sample environment.
 - Structure-function investigations for Industry, Health, Environment, Biotechnology, Nanotechnology, Energy, Advanced Materials, Engineering, Food and Heritage / Archaeology sectors.
-
- Infrastructure: neutron beamlines & 13 instruments; 3 X-ray instruments; Sample Environment; and Atomistic modelling capabilities.
 - Standardised software for instrument operation



Neutron Guide Hall



OPAL Research Reactor

Centre for Accelerator Science

What

Mega-electron volt ions for Ion Beam Analysis & Accelerator Mass Spectrometry including:

- High sensitivity trace element analysis and 2D mapping (environmental quality ~ soil/air/biota)
- Heavy ion irradiations and ion beam interactions with matter (material damage & modification)
- Surface characterisation with monolayer resolution (materials characterisation)
- Ultrasensitive isotope dating (for climate change, geomorphology, forensics, safeguards)

- Infrastructure: 4 Accelerators & 17 beamlines; Labs: sample & prep, electronic & mechanical, vacuum, Ice Core & Quarantine labs



Nuclear Materials Development and Characterisation

What

- Materials synthesis, characterisation, modelling, and testing for ANSTO and industrial clients. Includes product development (e.g., HIPing, PI^3 surface modification)
- Range of outputs: consulting, internal and commercial reports, patents, publications.

- Actinide Suite
XRD + chemistry and mechanical testing labs
- Materials Fabrication Bay & Hot Cells
 PI^3 Facility
- Active Characterisation
- EM Building



Actinides Suite Glove boxes



Active glove box



Synroc simulation



Molten salt furnace

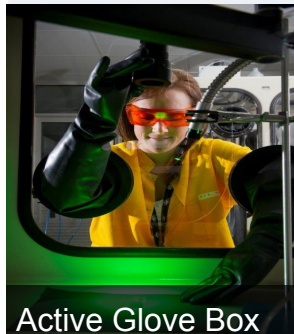
Nuclear Stewardship

What

Custodianship of ANSTO's capabilities required by Government and other stakeholders relevant to nuclear detection, forensics and standards and to sustaining analytical chemistry capabilities required to **fulfil corporate responsibilities** arising from ANSTO's operations & legacies.

Whom

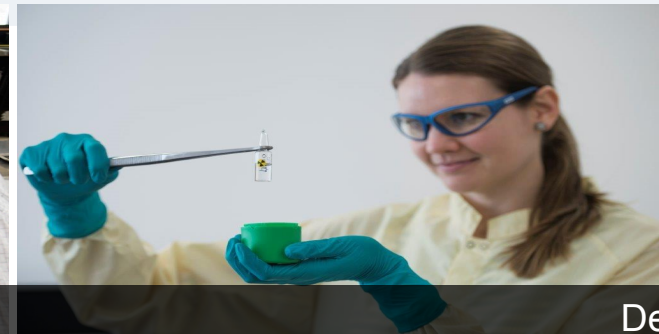
- Activity Standards and Detector lab Nuclear Forensics Facility Analytical Chemistry Radiochemistry labs
Medium level gamma-ray spectrometry



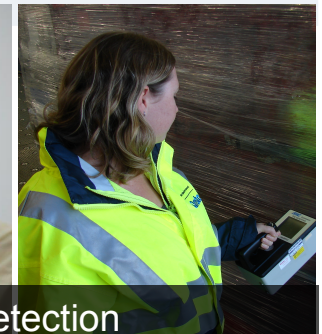
Active Glove Box



Radioactivity Counter App



Detection



National Deuteration Facility

What

- ^2H labelled proteins, biopolymers, lipids, aromatics / heterocyclics, surfactants, sugars for structural studies using neutron scattering at OPAL or NMR, IR or Mass spectroscopy
- Achieved by microbial synthesis in D_2O or chemical catalysis plus synthesis.

- 9 labs + instruments (e.g. NMR & LCMS), 10 staff
- 10 x better deuterated protein yield of conventional protein labs
- Widest range of deuterated organic chemicals of any facility; exceptional % ^2H level & purity



Isotope Tracing in Natural Systems

What

High sensitivity measurements of radioisotopes and stable isotopes in water, soil and air for:

- Sediment dating, tracing and analysis & soil erosion measurement
- Groundwater dating and tracing
- Atmospheric transport modelling
- Ecosystem analysis using stable isotopes.

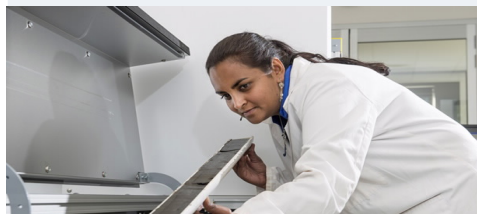
Low-level spectrometry labs;

Tritium lab; Radon Labs;

Sediment Analysis Lab; IRMS labs in B21 & B16

Isotope Geochemistry Clean lab

TIMS and MC-ICPMS; Fieldwork and radiotracing facilities



ITRAX core scanner



γ spec



Isotope ratio MS sample cup



radon extraction rig

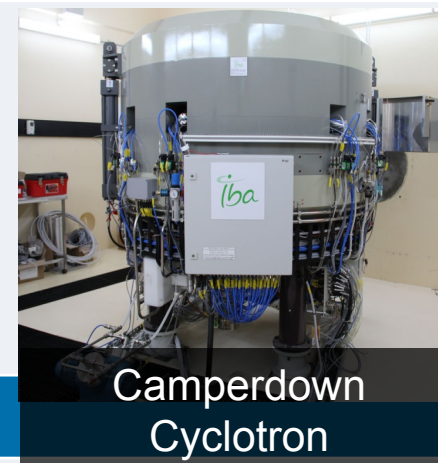


radon detector

Radioisotopes & Radiotracing

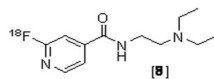
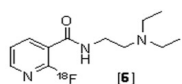
What

- Production, separation and purification of reactor and cyclotron produced isotopes.
- Synthesis of radiotracers for study of clinical, preclinical, environmental, industrial and materials
- Radiolabeling of small molecules, peptides, proteins, antibodies, nanoparticles for radiotracing
- Element analysis: neutron activation analysis (NAA), radiochemical NAA, delayed NAA (DNAA)
- Geochronology and materials irradiations.



Camperdown
Cyclotron

- Camperdown cyclotron facility, OPAL irradiation facilities and instruments.
- Complete work flow: irradiation (reactor based radioisotopes) – separations – radiolabelling – clinical or preclinical production



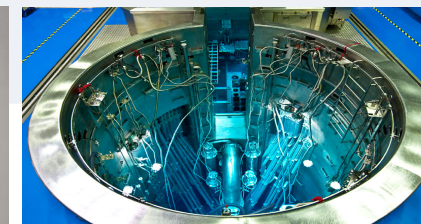
Radiotracer



Microfluidics synthesis rig



Ochre artifact for NAA



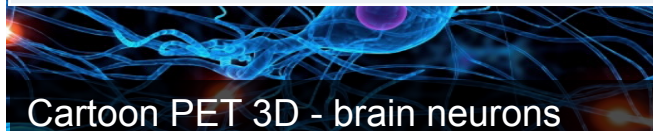
OPAL

Radiobiology & Bioimaging

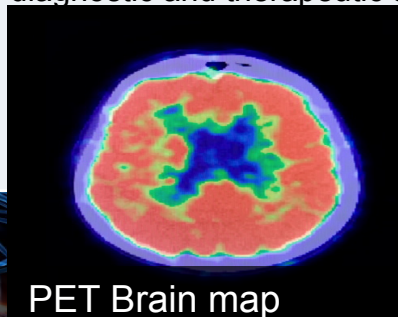
What

- Biology, ecology, physiology and imaging techniques combined to deliver validated bio-tracing for diagnostic and therapeutic applications
- Precise measurement of radiation damage on biological and ecological systems
- Diverse co-located instruments enabling work with any isotope or radiotracer.

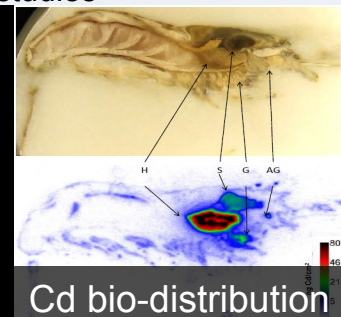
- in imaging quantification research. Few in the world can combine 2D imaging techniques with 3D reconstructions (histology, immunohistochemistry, XFM, PIXE and autoradiography)
- High throughput longitudinal imaging for diagnostic and therapeutic studies
- Multimodal imaging ~ PET/SPECT.



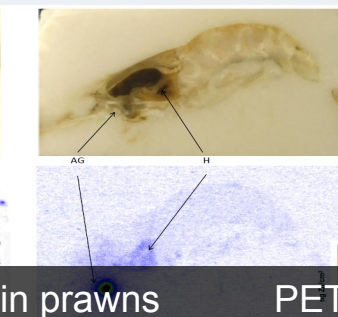
Cartoon PET 3D - brain neurons



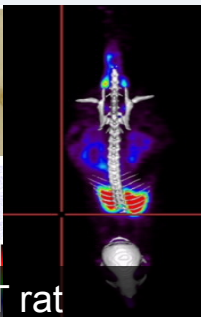
PET Brain map



Cd bio-distribution in prawns



PET rat



Australian Synchrotron

CAPABILITIES

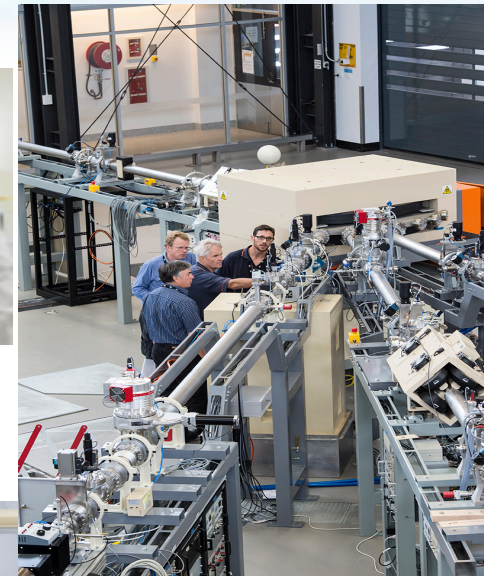
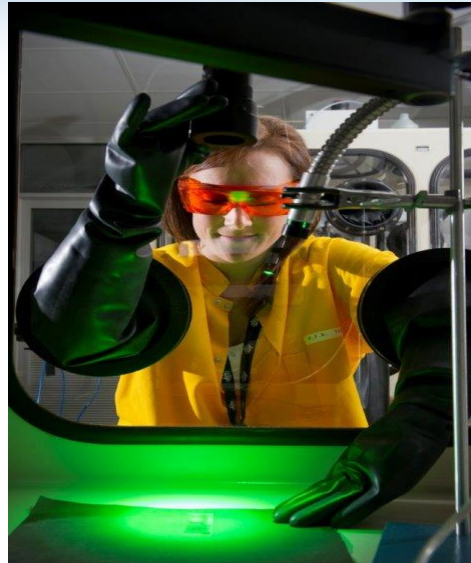
- 3rd generation light source
- Electron storage ring; 10 beamlines and instruments; HPC cluster, and user support labs
- ~140 staff
- Enables structure function characterisation of hard and soft materials
- Diffraction, scattering, imaging, microanalysis

IMPACT

- Used in health/medical, food, environment, biotechnology, nanotechnology, energy, mining, agriculture, advanced materials and heritage/archaeology sectors
- Over 800 research groups and over 2500 individual researcher visits per year



People



Welcome

to ANSTO's Interim Research Portal.

This is your gateway to all of ANSTO's research facilities and experience.

Sign in

Email:

Password:

[Login](#) | [Register](#)

[Forgot your password?](#)

The 2017-1 Proposal Round for access to ANSTO's facilities and capabilities from January 2017 is now open. The deadline for proposals is 30 September 2016.

What is the ANSTO Interim Research Portal?

From 15 February 2016, this interim research portal will accept new proposals for access to facilities and capabilities at the Australian Nuclear Science and Technology Organisation (ANSTO), with the exclusion of the neutron-beam facilities at OPAL and the National Deuterium Facility.

A new ANSTO Research Portal will be available later this year and, for the first time, will provide one central location for the submission of proposals and subsequent experiments at ANSTO. The new ANSTO Research Portal is being designed to harmonise arrangements and processes across ANSTO to better support our user community.

ANSTO is one of Australia's largest public research organisations and custodian of much of our country's landmark and national research infrastructure, including the Open Pool Australian Lightwater (OPAL) multi-purpose research reactor, the Australian Synchrotron, the Centre for Accelerator Science and neutron beam instruments.

On average, ANSTO accommodates over 1800 visiting researchers from other Australian research organisations and international research centres each year to provide access to a wide range of world-class research facilities that support research into human health, our environment and innovation for industry.

As outlined above, this new interim research portal has been put in place for the first round of proposals for 2016. Proposals related to environment, archaeology, geoscience, material science and engineering, life sciences, biomedical and human health should be submitted through this interim portal.



Australian Centre for
Neutron Scattering Portal

Half of 2017 is **Now Open.**

Subsequent experiments at the OPAL
If you are a new user please create
an account, submission of proposals, reviewing
and similar.

Someone may have added
click 'Forgotten Your



[Home](#) » [login](#)

✓ Please try your VBL p

Fields with * are requi

Email *

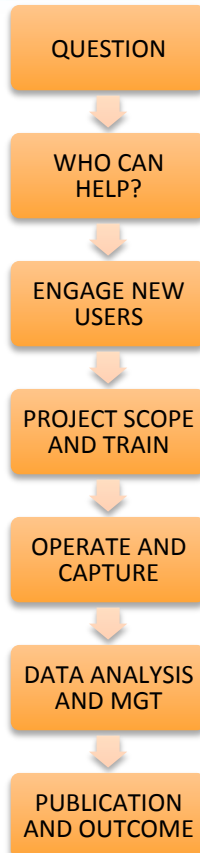
Password *

[Forgotten your Passw](#)

[Sign In](#)

User Experience

INSTRUMENTS
& FACILITIES



PEOPLE &
EXPERTISE



nature



Cell

PHYSICAL REVIEW LETTERS





Australian Government

ansto

Thank you
