



Collaborating with ANSTO

Dr Richard Garrett

Science. Ingenuity. Sustainability.



Employing

1,300

on two campuses



Providing

**expertise,
products,
services**

and trusted advice to
governments and public



Supporting
Australia at the

**IAEA
NEA**



Welcoming

**6,000
users**

each year



Managing over

\$1 billion

worth of
Australia's scientific
infrastructure

AAEC Established 1954, HiFAR Reactor 1958

ANSTO Strategy

OUR VISION



Nuclear science and technology for the benefit of all Australians

OUR MISSION



To deliver knowledge, value and trust through the application of nuclear science, technology and engineering

OUR STRATEGIC OBJECTIVES



1. Deliver on Australia's priorities for the benefit of people, industry and the environment through nuclear excellence in research and the use of national infrastructure



2. Improve the health of Australians by supporting access to current and future nuclear technologies for diagnostic, therapeutic and innovative treatments for current and emerging diseases



3. Australia's source of nuclear expertise, advice and services to governments, academia, industry, and community



4. Lead the development of a nuclear capable workforce aligned with government policy objectives

OUR VALUES

Curiosity

Leadership

Excellence

Working together

Trust + Respect

Safe. Secure. Sustainable

Globally connected



Delivery of NST at ANSTO

Outcomes to **benefit** Australia and support a sustainable world

Public Benefit Research

R&D for ANSTO business and operations

Sovereign Capability

Environment



Health



Nuclear Materials



Infrastructure





Nuclear Science protecting our environment

How we inform sustainable environmental management strategies and add to our capacity to respond to modern environmental challenges.

1

Environmental change

Scale and speed of environmental change

2

Water

Sustainability and quality of key water resources and aquatic ecosystems

3

Contaminant impacts

Pathways and impacts of contaminants in biota and the environment

Human Health



Nuclear Science essential in the treatment of disease

How nuclear science and technology increases our understanding of disease causation and improve patient outcomes for major health challenges.

1

**Nuclear
technology for
disease
characterisation
and treatment
efficacy**

2

**Radiotherapy
and theranostics**

Nuclear Materials



Nuclear science for a safer & sustainable nuclear industry

How ANSTO assists in the development of a sustainable nuclear industry for Australia's future energy and economic security.

1

**Fuel resources
and systems**

2

Reactor systems

3

**Spent fuel
management**

Landmark and National Research Infrastructure

Nuclear infrastructure delivering atomic scale science with global impact

How ANSTO empowers research supporting National priorities delivering impact in health and wellbeing, environment and for the economy.



Australian Synchrotron

1

Best users experience and partnerships

Australian Centre for Accelerator Science

Australian Centre for Neutron Scattering

2

World-class infrastructure

National Deuteration Facility

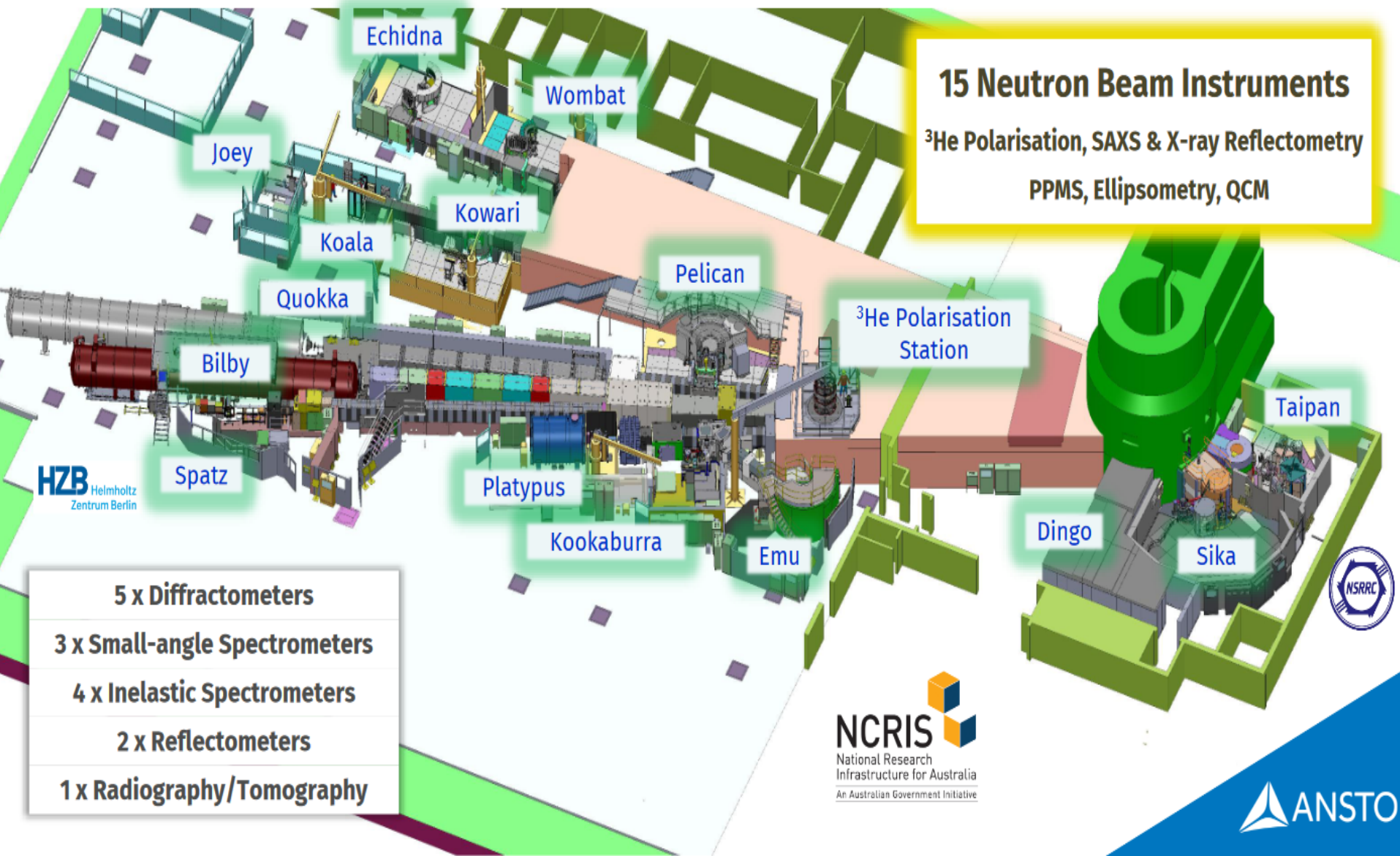
3

World-class workforce

Australian Centre for Neutron Scattering



Australian Centre for Neutron Scattering



15 Neutron Beam Instruments

^3He Polarisation, SAXS & X-ray Reflectometry

PPMS, Ellipsometry, QCM

HZB
Helmholtz
Zentrum Berlin

5 x Diffractometers

3 x Small-angle Spectrometers

4 x Inelastic Spectrometers

2 x Reflectometers

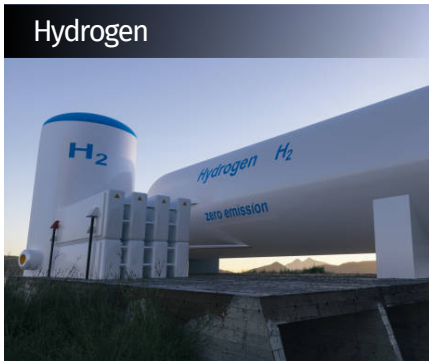
1 x Radiography/Tomography

NCRIS
National Research
Infrastructure for Australia
An Australian Government Initiative

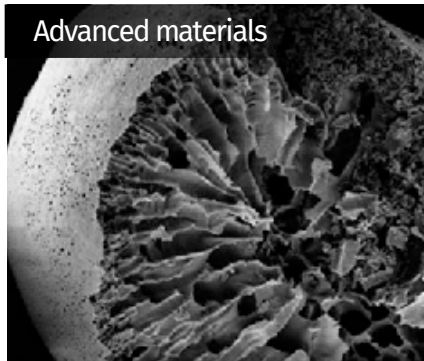
ANSTO

Neutron scattering research

Hydrogen



Advanced materials



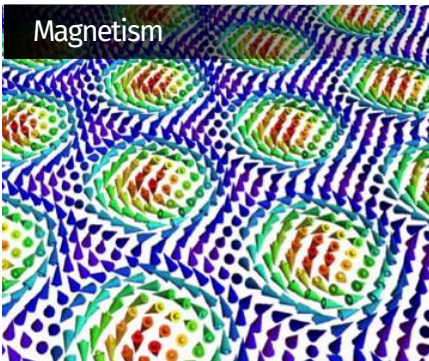
Food science



Cultural heritage



Magnetism



Mining



Antibiotics



Surfaces



Centre for Accelerator Science

World-leading centre for ion beam analysis and accelerator mass spectrometry for:

Radioisotope dating techniques

Trace element and actinide identification

Surface engineering and characterisation

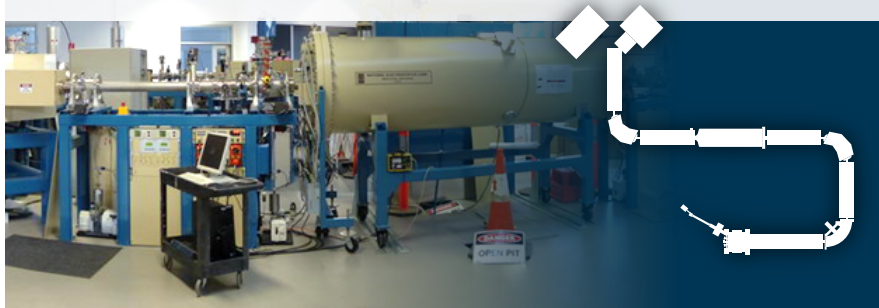
Radiation exposure and damage



VEGA Accelerator

AMS

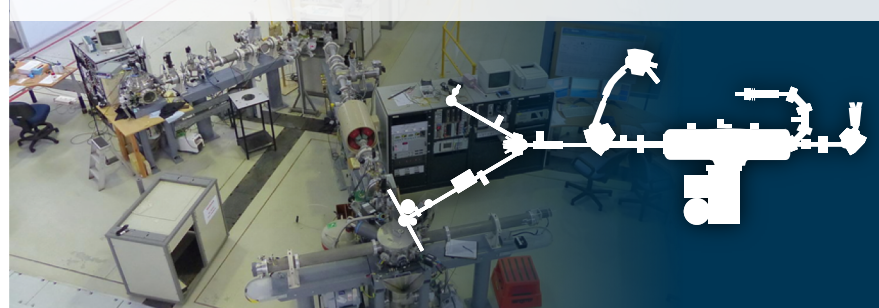
1 MV NEC Tandem



STAR Accelerator

IBA
AMS

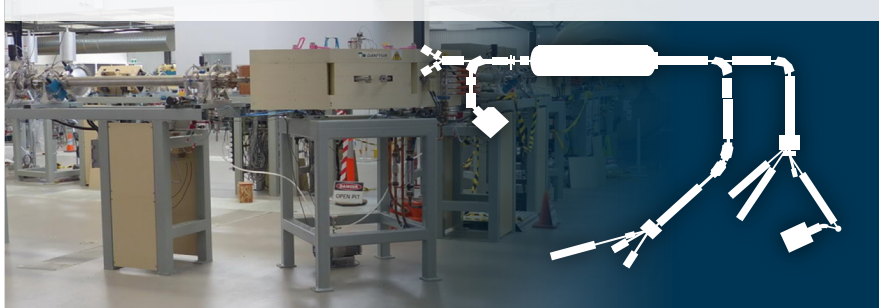
2 MV HVE Tandem



SIRIUS Accelerator

IBA
AMS

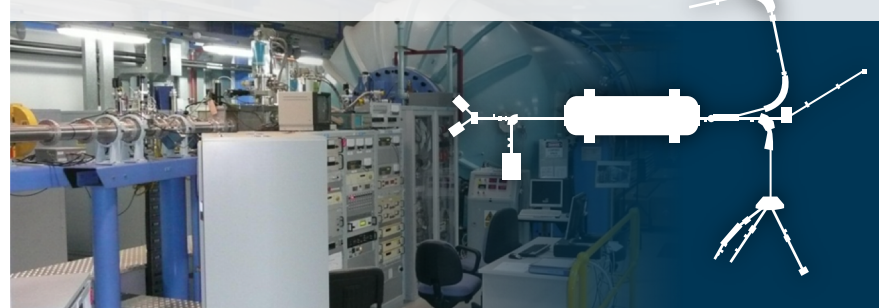
6 MV NEC Tandem



ANTARES Accelerator

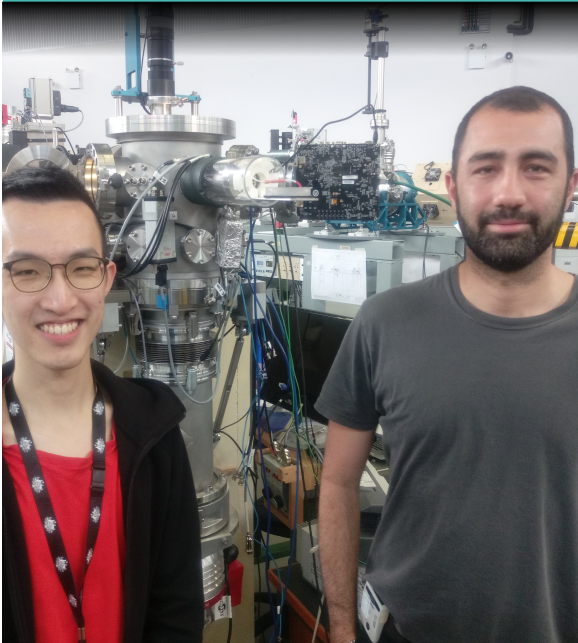
IBA
AMS

10 MV HVE Tandem



Accelerator Science

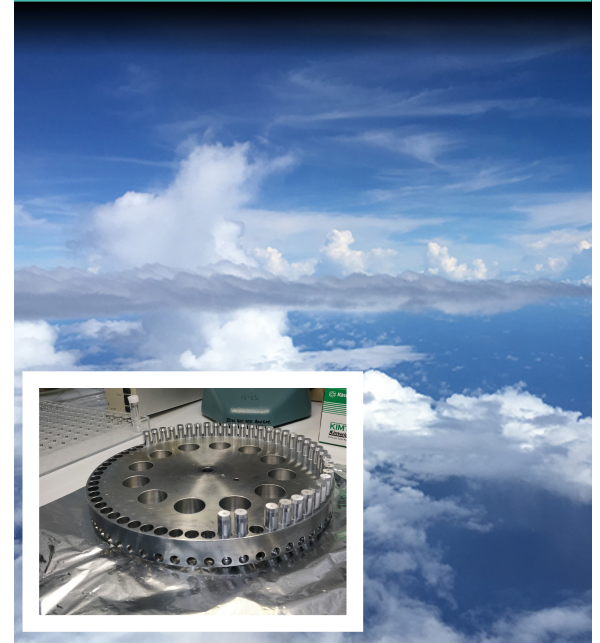
Heavy ion microprobe



Radioisotope dating



Micro samples

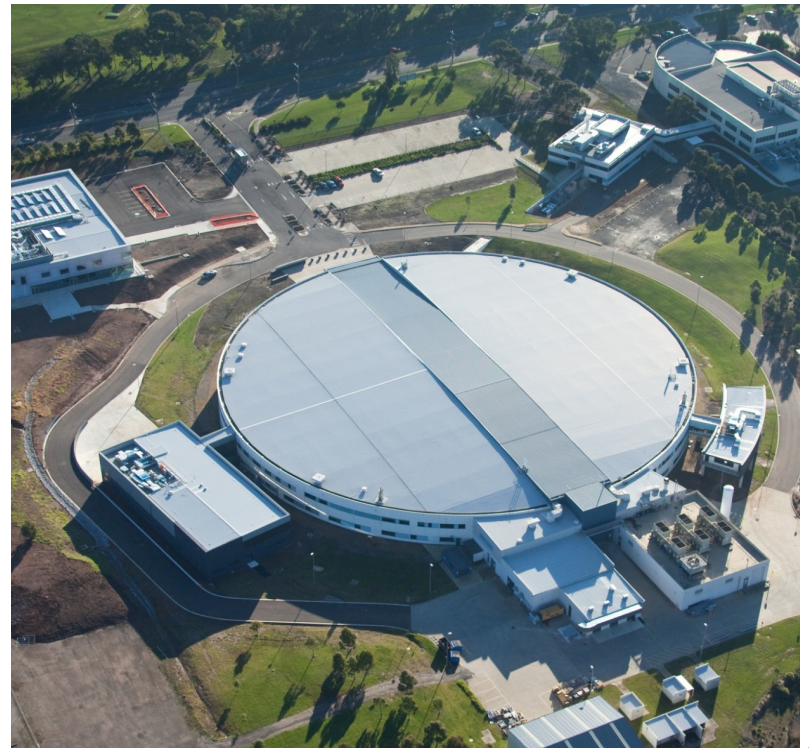
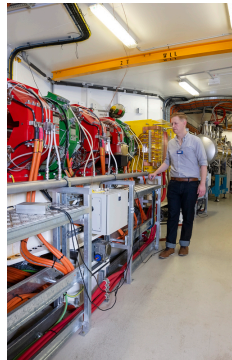


The Australian Synchrotron

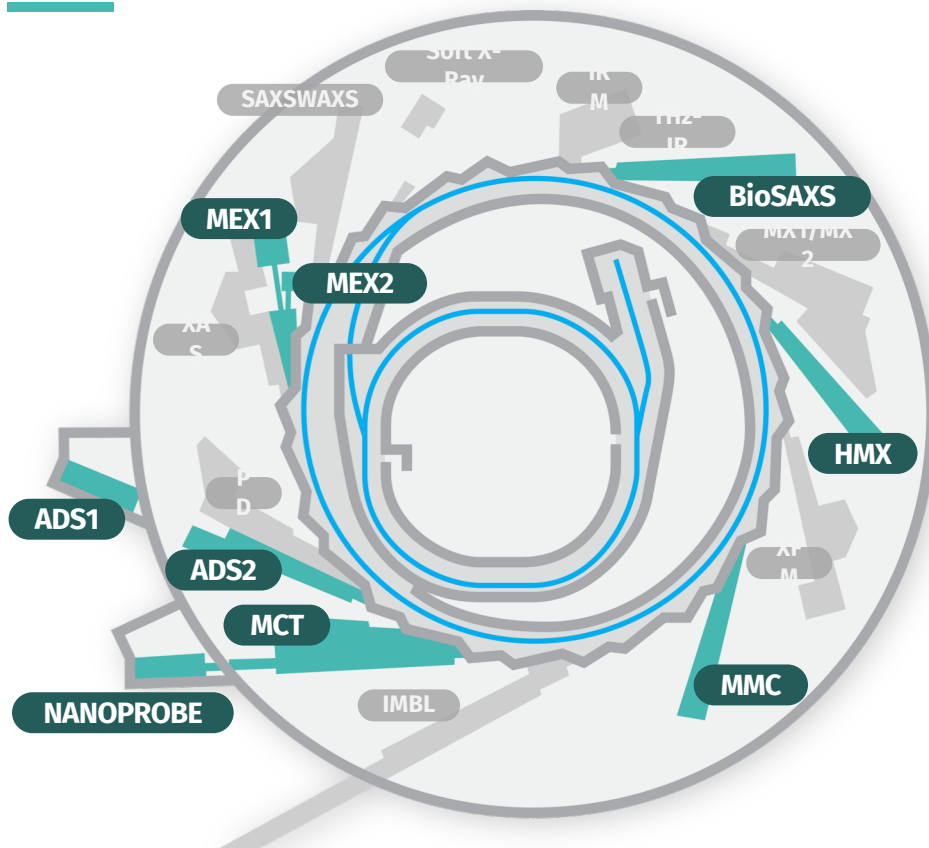
3 GeV third-generation synchrotron light source

13 operational beamlines

User operations began in 2007



The BRIGHT Beamlines



BRIGHT Program

~\$104 M

- Micro-Computed Tomography
MCT
- Medium Energy XAS 1 & 2
MEX1 | MEX2
- Biological Small Angle X-ray Scattering
BioSAXS
- Advanced Diffraction and Scattering 1 & 2
ADS1 | ADS2
- High Performance Macromolecular Crystallography
HMX
- X-ray Fluorescence Nanoprobe

8 New Beamlines – 4 In Operations; 4 Under Construction.

Micro-CT
(Operational Since Sept 2022)

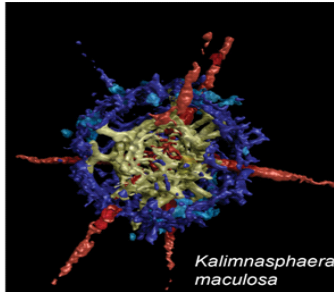
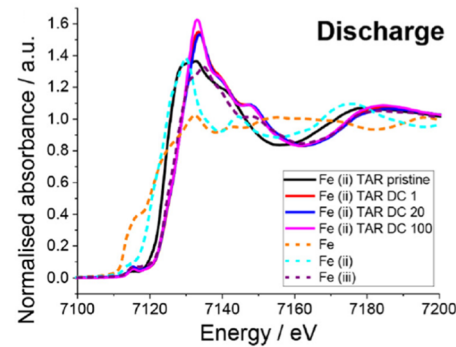


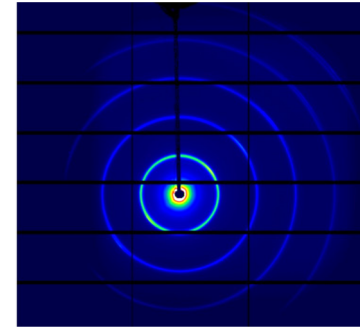
Image of radiolarian fossils
(Nature Comms.)

Medium Energy XAS 1 & 2
(Operational Since Nov 2022)



Metal dicarboxylates for Li batteries
(Materials Advances)

BioSAXS
(Operational Since Oct 2023)



BioSAXS Commissioning
Data

MX3
(First Light Nov 2023)



Advanced Diffraction & Scattering 1 & 2
(Operations Sept 2024)

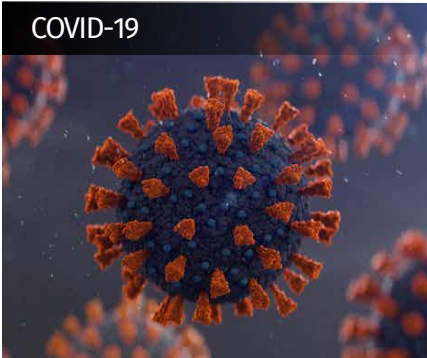


NANOPROBE
(Operations July 2025)



Synchrotron research

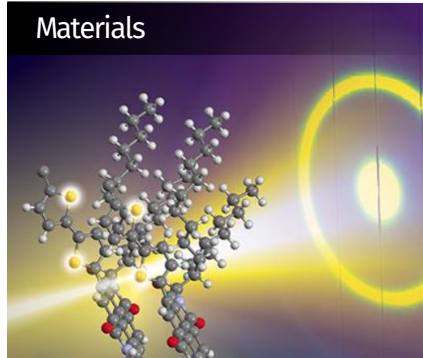
COVID-19



Environmental



Materials



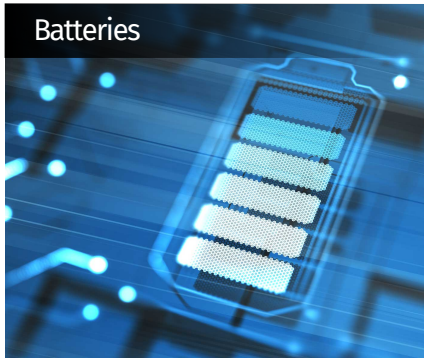
Food science



Cultural heritage



Batteries



Agriculture



Planetary science



Nuclear Stewardship Science

- Nuclear stewardship refers to a range of activities to support the safe use of radioactivity. At ANSTO, it comprises:
 - Radioactivity Measurement Standards
 - Primary and secondary radiation standards
 - Source preparation
 - Radioanalytical chemistry
 - Gamma and alpha spectrometry
 - Method development
 - Environmental Radioactivity Measurement Centre
 - HPGe detector suit – low level metrology
 - Nuclear security science
 - Environmental monitoring
 - stormwater, groundwater, air, soil, and biota

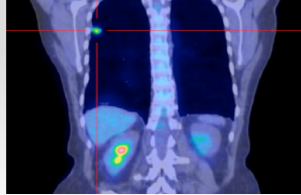


Capability delivers research

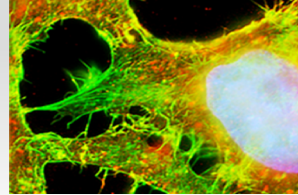
Isotope tracing in natural systems



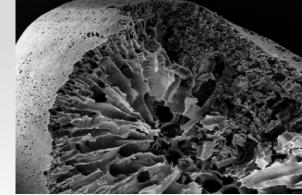
Vivarium facility



Biosciences



Nuclear materials and development characterisation



Nuclear stewardship



Environment

Human Health

Nuclear Fuel Cycle

Public benefit research



Centre for Accelerator Science



Australian Synchrotron



Australian Centre for Neutron Scattering



National Deuteration Facility

Access arrangements

Merit Program



- Academic or academic with industry partner
- Proposals submitted and reviewed by expert panels, 2-3 times per year
- Emphasis on publication in peer reviewed journals
- **ACKNOWLEDGEMENT:** publications, co-authorship, testimonials, media

Commercial Access



- Sample preparation, experiment, analysis and reporting conducted by a team of specialist scientists
- Timely access, minimal waiting period
- Confidentiality and IP conditions that support commercial use
- **ACKNOWLEDGEMENT:** revenue, case studies, testimonials

Collaboration



- Partnering on larger projects
- Collaborative grants or tenders
- Short to long term engagement
- **ACKNOWLEDGEMENT:** IP, revenue, reputation, co-authorship, media

Partnerships and collaboration are historically an excellent way to create pathways for employment

AINSE and ANSTO



Cohort

Creates a cohort from existing and new members
PhD, Masters, Post-docs, ECR graduates on projects
Space on both sides of the fence; with research; with
nandin



Partnership

Universities, research institutions, industry
Supervision and mentorship by ANSTO



Translation and industry

Strategic positioning for research that plans to have
impact and which supports industry
Supervisors and members are ready for innovation and
entrepreneurship (*nandin*-ready)



Workforce

Development of nuclear-ready skilled people.

Partnership opportunities

Joint Appointments

- Adjunct Positions with Universities

Joint Research

- Universities and Industry
- Students, Post-docs
- Cooperative Research Centres
- Australian Research Council
 - Discovery
 - Linkage
 - LIEF
 - Centres of Excellence
 - Industrial Transformation Training Centres and Research Hubs



Australian Government
Australian Research Council

Early career opportunities



Traineeship PROGRAM

Trainees learn on the job while completing their formal qualifications

Cert IV 2 Year Program

Year in Industry Internship PROGRAM

Industry-based learning and experience for penultimate year students

1 Year Program

Graduate Development PROGRAM

A rotation program providing professional development opportunities, hands-on experience, mentoring and coaching

2 Year Program followed by permanent employment

Apprenticeship PROGRAM

Apprenticeships combine formally recognized training with practical work experience and on the job training

4 Year Commitment

Vocational PLACEMENT/INTERNSHIP

Industry experience completed during study, increase job readiness

Length determined by course requirements

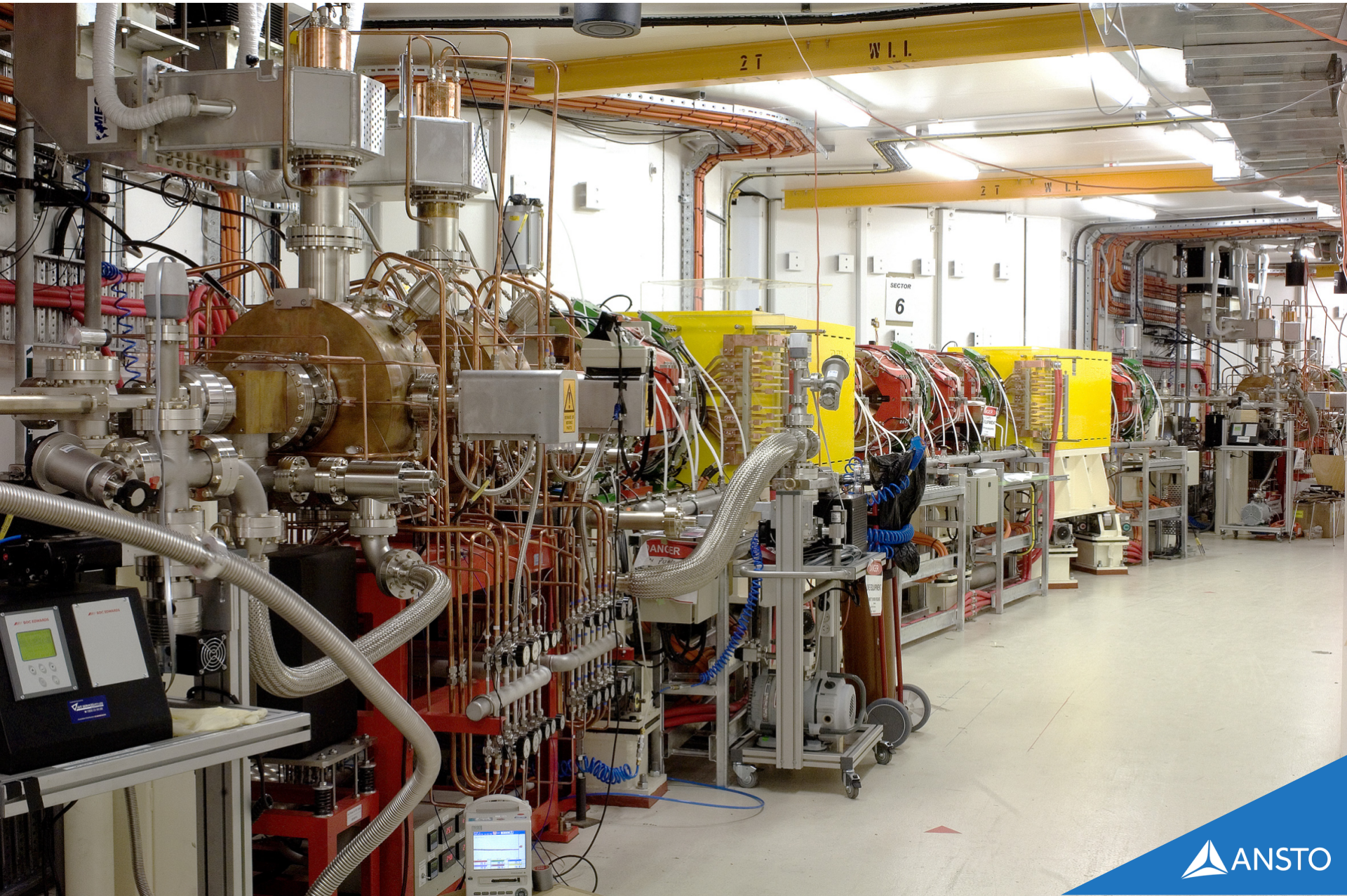
Emerging Engineers PROGRAM

Entry-level engineering positions with rotation opportunities

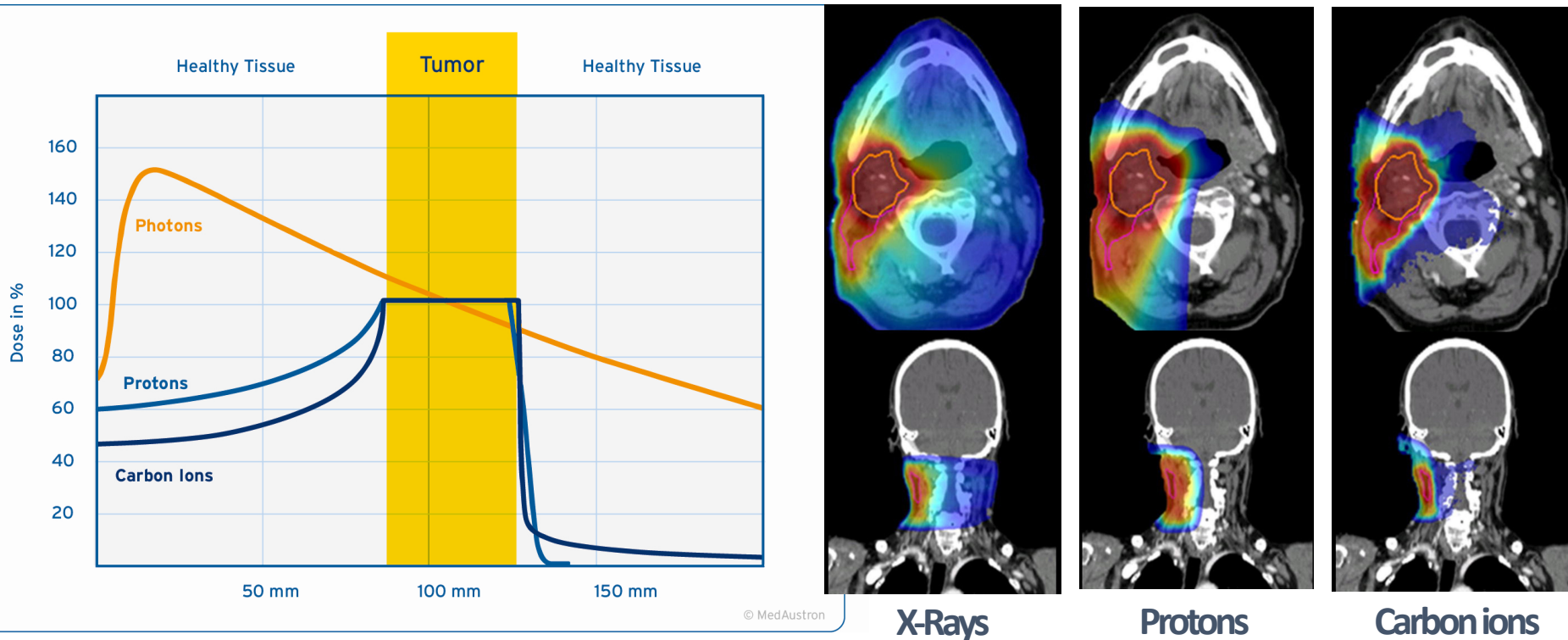
2 + 1 Year Program

Visit Careers at ANSTO: <https://www.ansto.gov.au/careers>

Accelerator Science and Technology



Particle Therapy



Adelaide: Australian Bragg Centre for Proton Therapy and Research

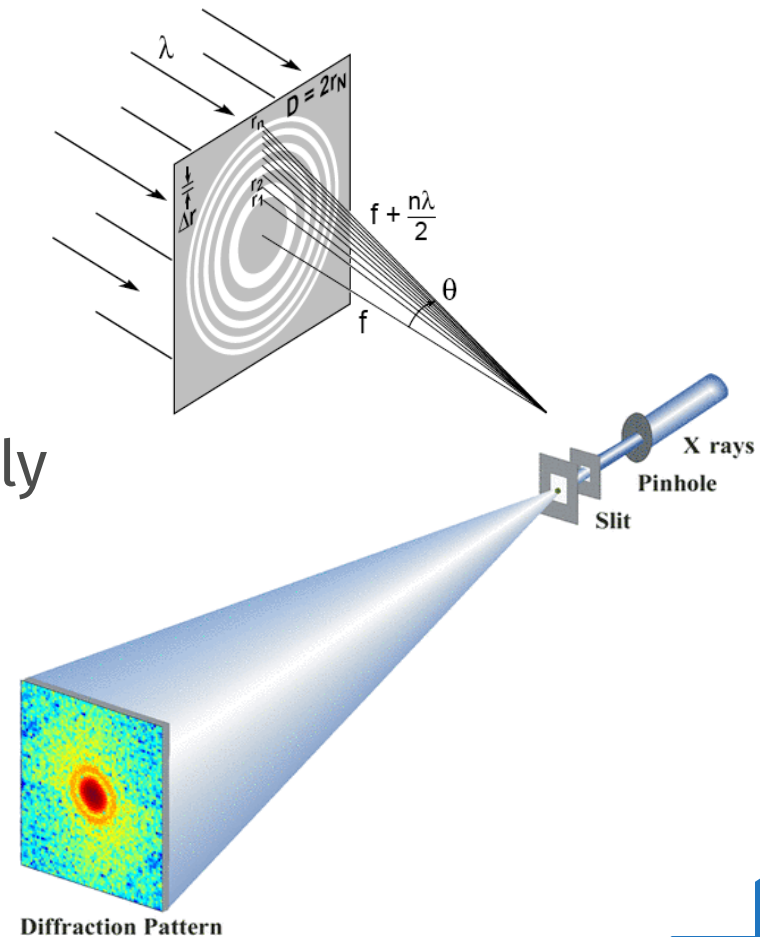
Brisbane: new Queensland Comprehensive Cancer Centre

Sydney: proposed national centre with proton and carbon ion therapy and research

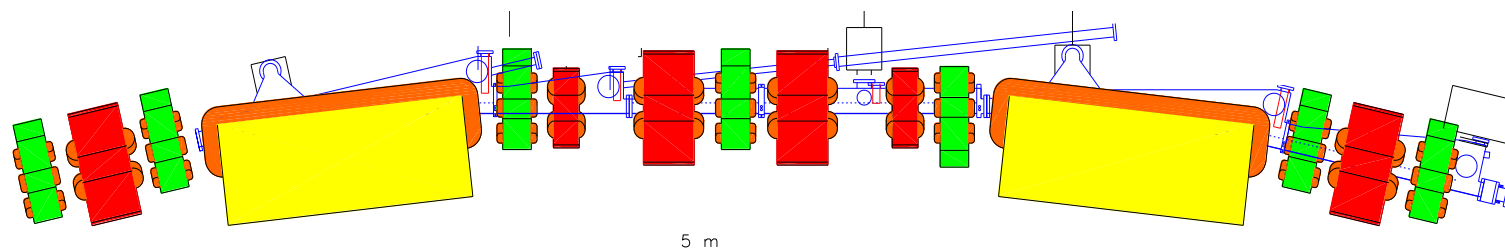
Melbourne: early-stage proposals

SR History: towards higher brightness

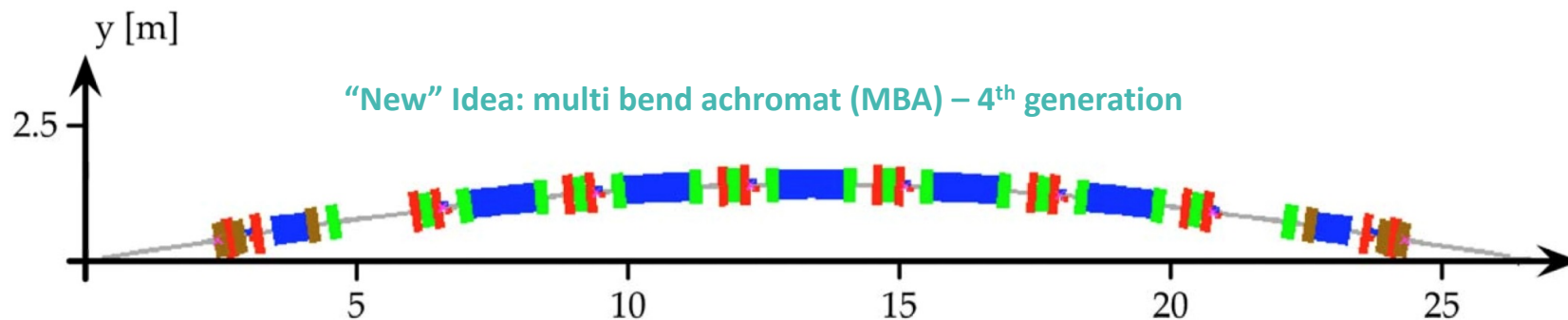
- Higher spatial resolution:
 - Tiny samples (e.g. protein crystals)
 - Nano-structure materials
 - Non-homogeneous samples...
- New imaging techniques – especially coherence based imaging
- New spectroscopies
- Many techniques are brightness/coherence limited



Australia's next light source?

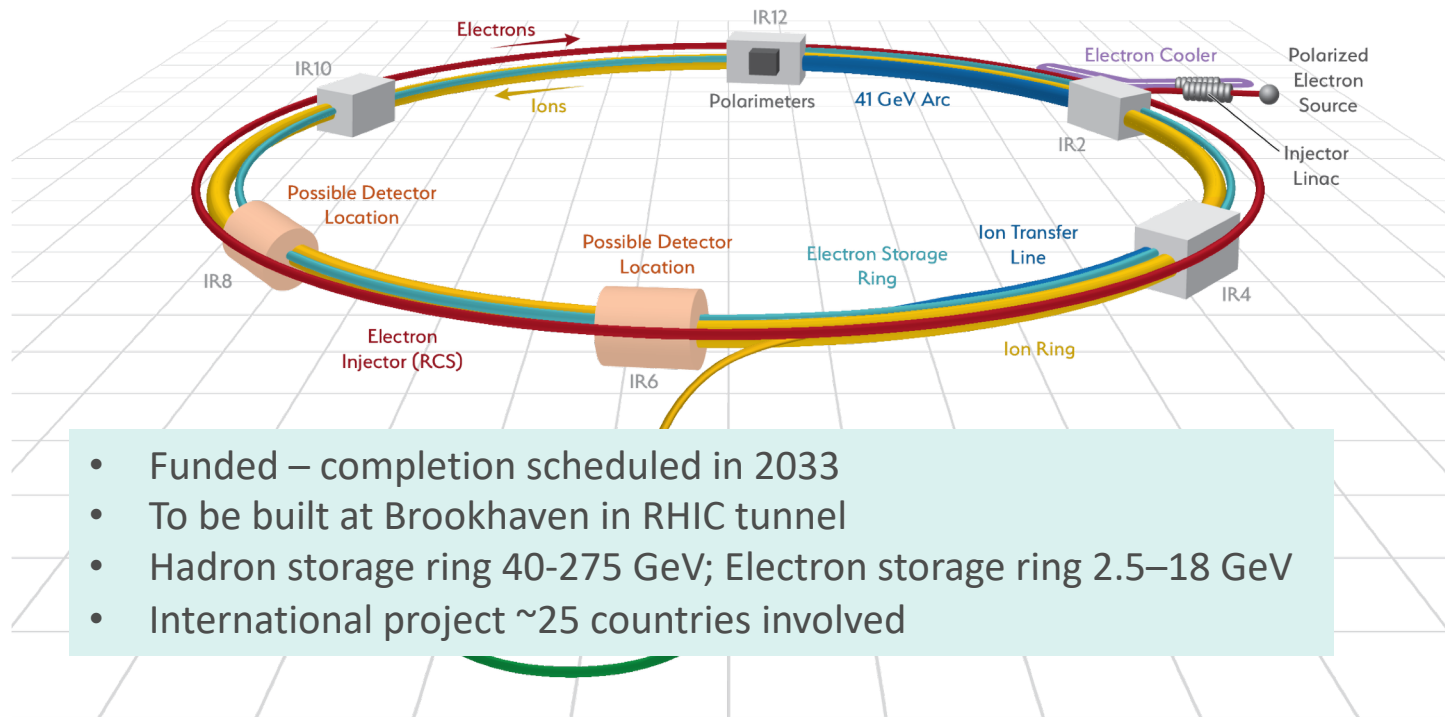


Most 3rd Generation are “double bend achromat” (DBA)



Source	Energy (GeV)	Lattice	H Emittance	Circumference
AS	3	DBA	10 nm.rad	213m
SPring-8	8	DBA	3 nm.rad	1436m
MAX IV	3	7BA	250 pm.rad	528
SIRIUS	3	5BA	280 pm.rad	518
ESRF-EBS	6	7BA	120 pm.rad	844

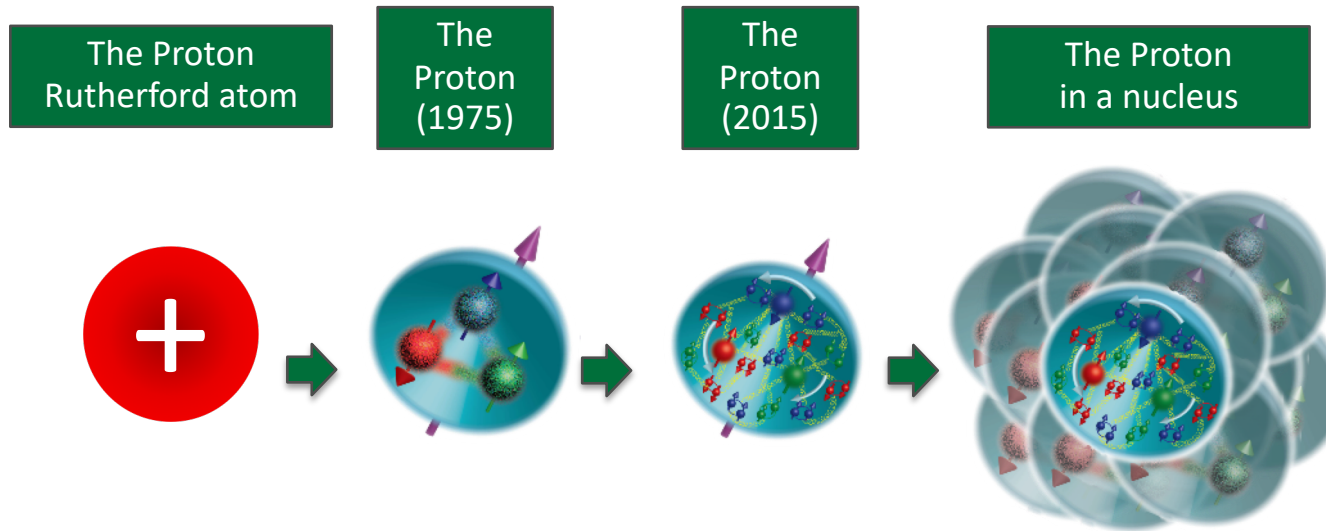
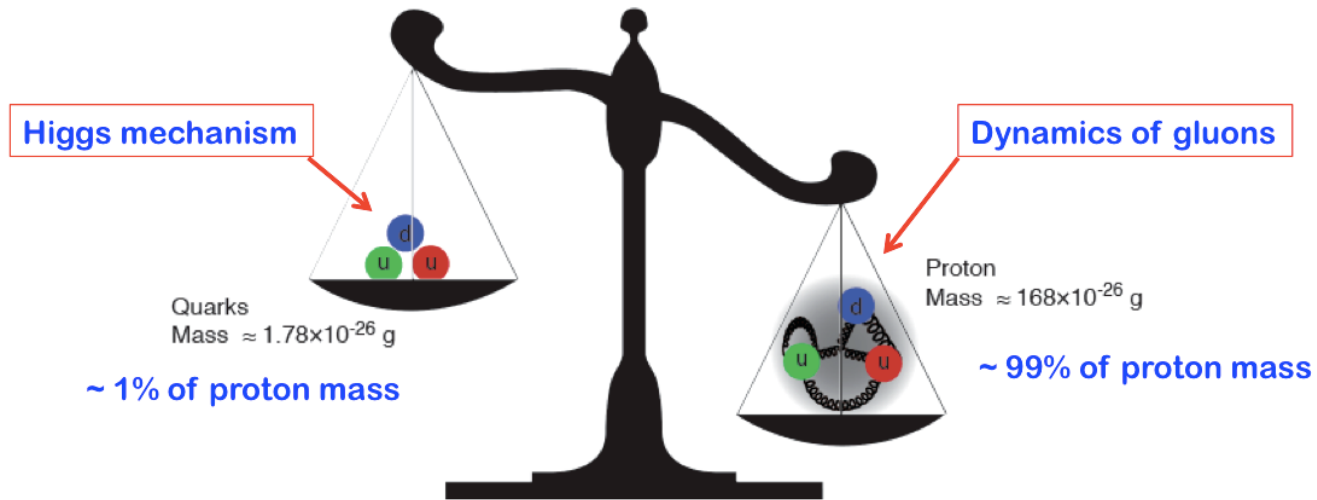
The next major collider: the Electron-Ion Collider



Science case: investigate the structure of the proton -

- to understand in detail the mechanisms by which the mass of nucleons, and thus the mass of all the visible matter in the universe, is generated.
- to understand the origin of the spin of nucleons (fundamental to MRI for example)
- to understand the nature of gluons in matter and the details of how they hold matter together

Proton structure and mass?





Australian Government



Thank you.

Questions

www.ansto.gov.au