

# **XBOX3**

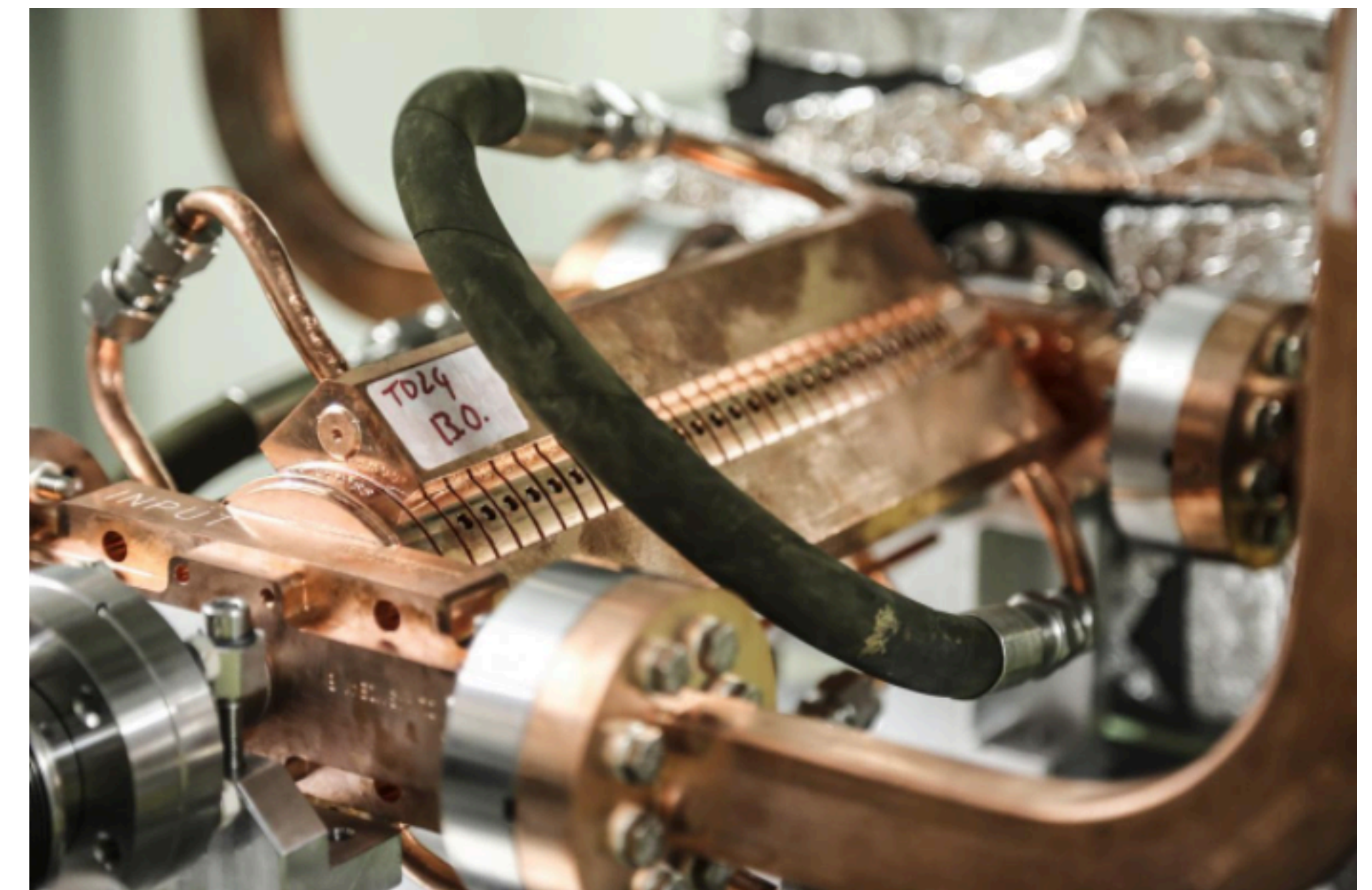
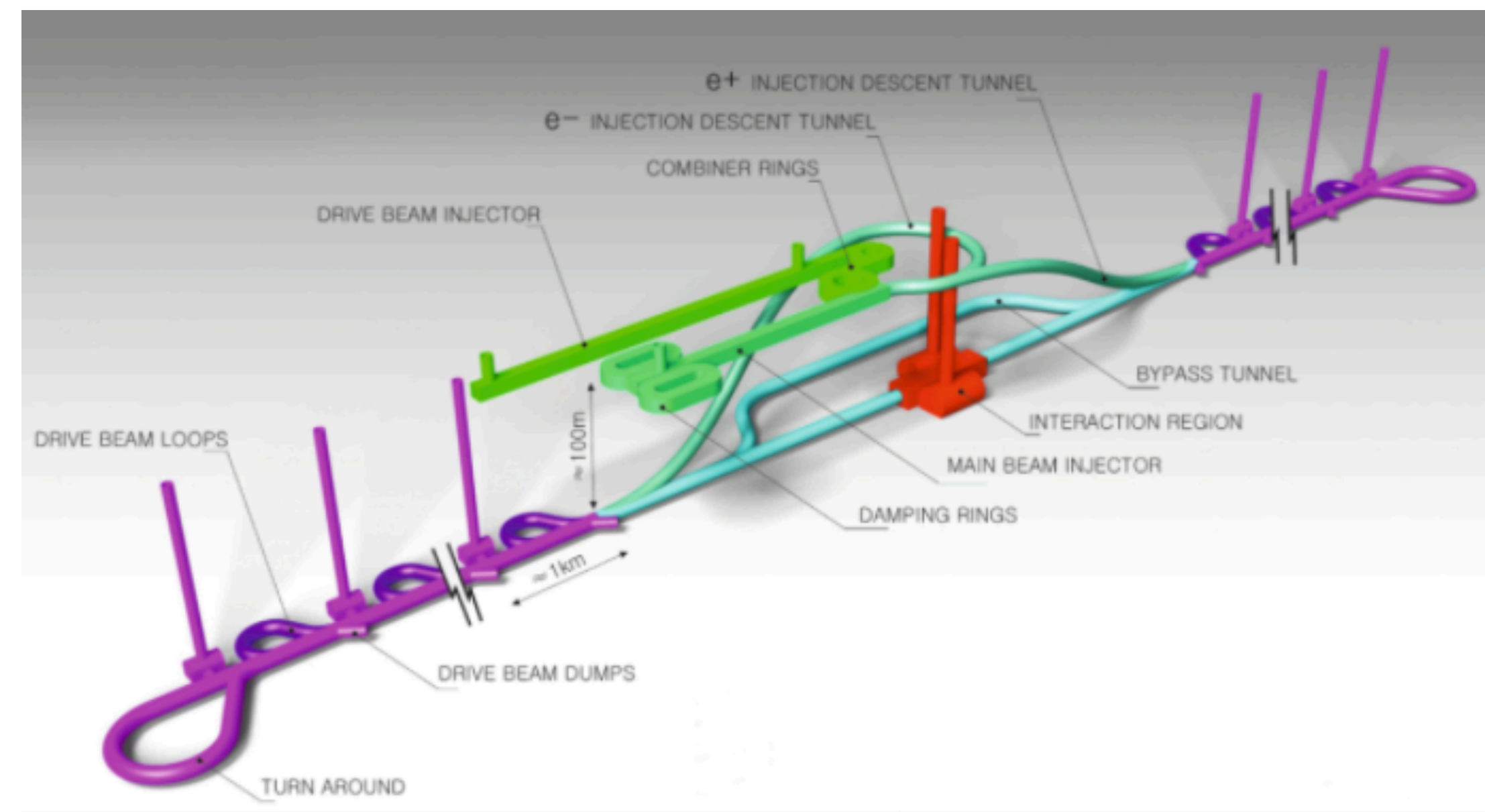
## **Implications for Future Accelerator Development and Applications in Australia**

**Geoffrey Taylor, University of Melbourne, 27 October, 2020**

# XBOX3

## Origins ...

- ***CERN Connection***
  - Over many years
  - CLIC - demands for new technology
- ***Australian Synchrotron and University of Melbourne***
  - Mark Boland, Roger Rassool, ...
  - Matteo Volpi, Tessa Charles, Tom Lucas, Paul Giansiracusa, Scott Williams, ...
- ***CERN Desire for XBOX in Technology Transfer***



CLIC X-band accelerating structure prototype undergoing testing at CERN

# A little history ...

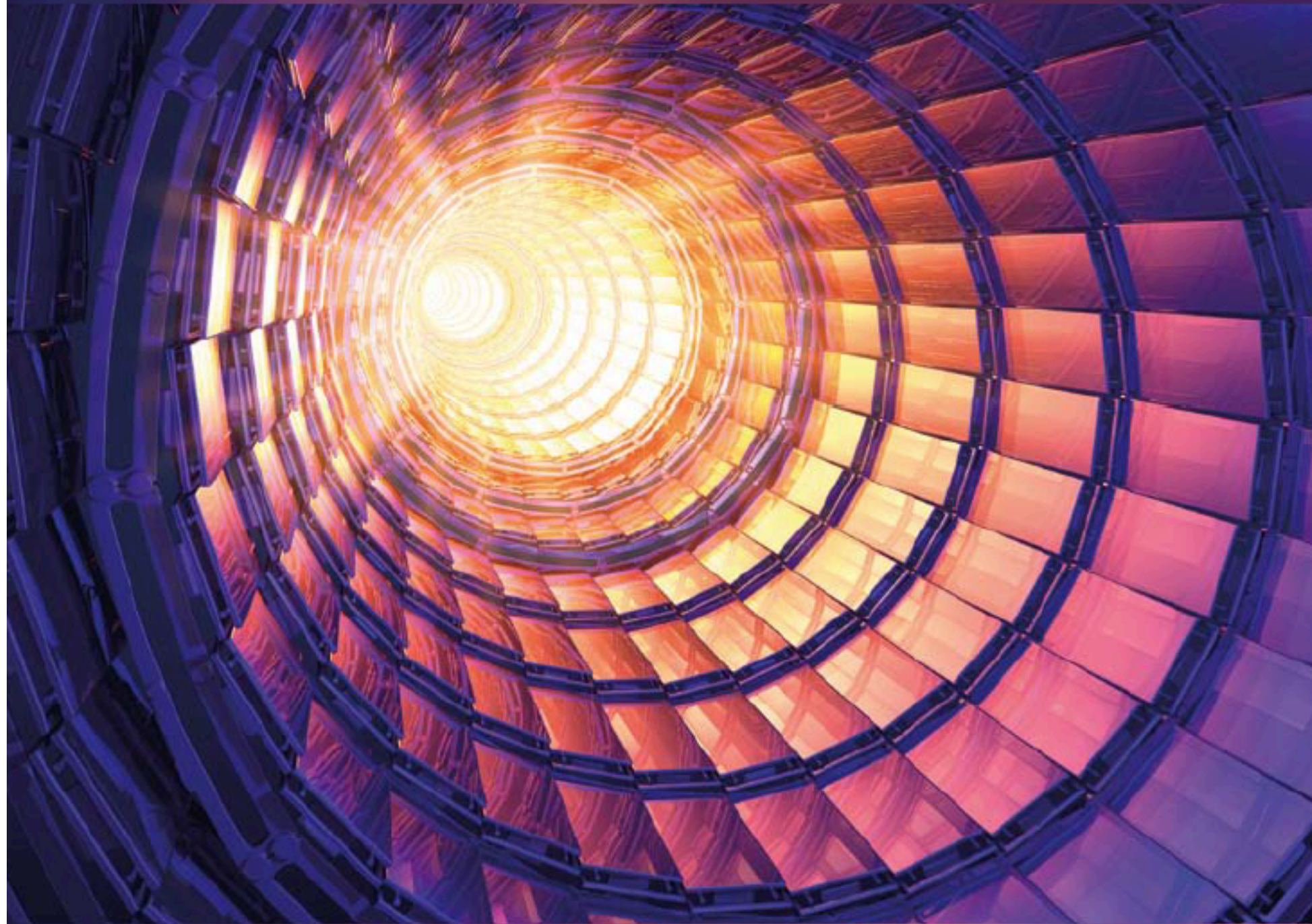
- From the beginning of CoEPP we have been negotiating the commencement of a national accelerators R&D Program
- ***ANSTO, Baker Foundation, University of Melbourne:***
  - Continuing Senior Lectureship funded.
  - Medical Accelerator Development and Group - Melbourne Physics
  - Dr Suzie Sheehy - Oxford/Melbourne
  - Important Nucleus for Accelerator Development in the University Sector



Future Science

## Discovery Machines

Accelerators for science, technology,  
health and innovation



Australian Academy of Science

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# AAS Report on Accelerators

## (2015)

### Appendix 1: Expert Working Group Membership

Professor Elisabetta Barberio	School of Physics, The University of Melbourne
Professor Eva Bezak	School of Health Sciences, University of South Australia
Associate Professor Mark Boland	Australian Synchrotron and The University of Melbourne
Professor David Cohen	Australian Nuclear Science and Technology Organisation (ANSTO)
Professor Rob Elliman	Department of Electronic Materials Engineering, The Australian National University
Professor Keith Fifield	Department of Nuclear Physics, The Australian National University
Dr Lizbeth Kenny	Royal Brisbane and Women's Hospital, Queensland Government
Professor David Hinde FAA, Co-Chair	Department of Nuclear Physics, The Australian National University
Professor Keith Nugent FAA, Co-Chair	La Trobe University
Professor Andrew Peele	Australian Synchrotron and La Trobe University
Professor Geoff Taylor FAA	ARC Centre of Excellence For Particle Physics at the Terascale, The University of Melbourne



# Discovery Machines

(AAS - 2015)

## 6.2 Recommendations

Australia sits at a major crossroad with respect to accelerator science. With a sound base of expertise and infrastructure, we are poised to take full advantage of the scientific and technological revolution in accelerator science emerging from major international collaborations. However, Australia will not be able to fully realise the health, economic, defence and other benefits of these new developments without a deliberate and strategic approach led by government, health authorities and research funding agencies to ensure that our base expertise and infrastructure is adequately supported and upgraded.

1. State and federal health departments work together to assess the value and the feasibility of investing in the technology, infrastructure and expertise needed for a national capability in **hadron therapy for cancer treatment**. Such a capacity would potentially have multiple benefits, including improving health outcomes and reducing overall cancer management costs, especially for patients who have no other treatment option, and establishing Australia as a regional capability centre in hadron therapy.
2. The recommendations of the Clark Research Infrastructure Review are implemented in a way that ensures **ongoing operations funding** for Australia's existing world-class accelerator infrastructure through NCRIS or any future program responsible for research infrastructure. Furthermore, that a national funding program for large-scale infrastructure projects be established with the capacity to keep Australia's national accelerator infrastructure up to world standard.
3. Australian universities develop an **outstanding program in accelerator R&D** to attract high quality PhD students. This program will improve Australia's accelerator capability, supporting training in the specialised technical skills needed to exploit new investment in accelerator technology, and position the nation to exploit the opportunities opening up in this critical area.
4. Dedicated funding through the Government's proposed International Science Engagement Strategy to allow Australian accelerator researchers and research facilities to **partner with international facilities** such as the proposed US\$10 billion International Linear Collider and the Linac Coherent Light Source in California—thus helping to develop high-tech local industry.
5. That current and future bodies responsible for development and operation of Australia's major national research infrastructure **liaise closely with the Australian Collaboration for Accelerator Science and relevant National Committees of the Australian Academy of Science** for advice and recommendations on issues relating to strategic directions, funding priorities and technical issues pertaining to accelerator facilities and capability in Australia.



# Accelerator Planning Workshop, ANSTO

August, 2018

#	Goals	Initiative	Activity
1	Leveraging ANSTO's expertise and partnerships to deliver advances in accelerator technology and contribute globally	Complete XBOX3 test stand program	<ul style="list-style-type: none"> <li>- Test stand established</li> <li>- Linkage Grant/LIEF</li> <li>- Other funding</li> </ul>
		Compact Light - collaborations	<ul style="list-style-type: none"> <li>- Formal MoUs</li> </ul>
		Compact Light – build up a broader compact accelerator lab	<ul style="list-style-type: none"> <li>- Plan for development</li> </ul>
		Define next gen Light Source pathway(s) for Australia	<ul style="list-style-type: none"> <li>- Workshops – capture drivers and technology developments</li> </ul>
2	Partner and support the integration of particle therapy in Australia	Complete stakeholder analysis to identify drivers for PT design and optimisation	Engage with: <ul style="list-style-type: none"> <li>- Clinicians</li> <li>- Commercial partners</li> <li>- Regulators</li> <li>- Researchers</li> </ul>
		Involvement at all stages of establishing PT in Australia	<ul style="list-style-type: none"> <li>- Work with researchers in non-clinical programs</li> <li>- Establish machine development/optimisation credibility/activity</li> </ul>
		Manage workshops, engagement programs	<ul style="list-style-type: none"> <li>- Satellite PT workshop at IPAC</li> <li>- Broader series of workshops</li> </ul>

3	To develop and strengthen partnerships and stakeholder programs	Re-launch ACAS	<ul style="list-style-type: none"> <li>- AIP Congress for awareness</li> <li>- Joint positions</li> <li>- Industry involvement</li> <li>- Formal MOUs</li> </ul>
		CERN membership	Engage with: <ul style="list-style-type: none"> <li>- Industry</li> <li>- Government</li> <li>- CERN linkages</li> </ul> Establish:
		Training programs	<ul style="list-style-type: none"> <li>- Accelerator school (INTL)</li> <li>- Technical streams</li> <li>- University subjects</li> </ul>
4	To increase awareness of Australia's AP, accelerator capabilities and scientific outcomes that deliver public benefits	Develop and execute Communications Plan	<ul style="list-style-type: none"> <li>- Capture the value proposition</li> </ul>
		Media engagement	<ul style="list-style-type: none"> <li>- IPAC – exposure of Australian content</li> </ul>
		Engage with communications teams	Identify and engage with: <ul style="list-style-type: none"> <li>- ACAS members</li> <li>- Academies</li> <li>- AINSE</li> <li>- ANSTO</li> </ul>

# A Roadmap for Australian Particle Physics and Accelerator Physics

A national, inclusive study, begun in 2019 and still in progress

3. ....

## 4. *Accelerator Physics: Development and Applications*

- Medical Accelerator Physics
- The Australian Synchrotron
- Accelerator Nuclear Physics
- Detector Physics
- Industrial Participation in Future HEP/Nuclear/LightSource Accelerators
- High energy accelerator developments

## 5. *Making the Case for Accelerator and Particle Physics in Australia*

- Public, Scientist, Academic, Industry, Government
- Particle and Accelerator Physics in STEM Education



# XBOX3 - on its way

2021 will be spent in reassembly and making operational





# **ARC Linkage Proposal**

**Built around XBOX3 and Suzie Sheehy**

- Compact accelerators
- Medical Applications
- Back-scattered X-ray source
- Expertise building



# ARC Linkage Proposal

*In preparation ...*

- The University of Melbourne
- ANSTO - The Australian Synchrotron
- Oxford University, The Canadian Light Source, Eindhoven, CERN,.
- Companies include:
  - Cyclotech, VHEE, Rapiscan, ANFF, Marand, ...



# The Future of Accelerator R&D in Australia

- XBOX3 is a great opportunity for accelerator R&D in Australia
- ANSTO and The University of Melbourne are at the Core of this potential
- But we *must grow the community and the institutions* involved.

? Propose?: ***Centre of Excellence in Advanced Accelerators***  
***- Development and Application -***