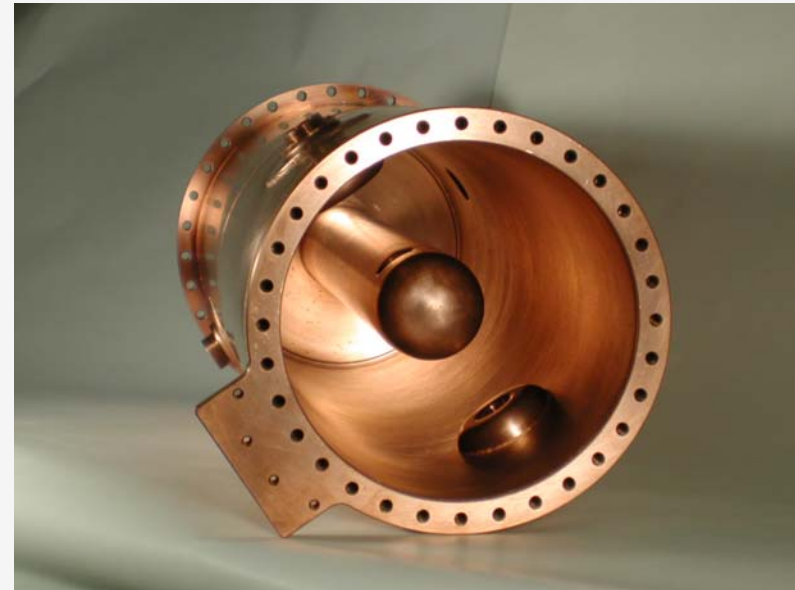




CANADA'S NATIONAL LABORATORY FOR PARTICLE AND NUCLEAR PHYSICS
Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada



A Vision for the Next Decade

Achieving Canada's Research Goals & Leading the Knowledge Based Economy

Nigel Lockyer, Director

Tim Meyer, Head, Communications

LABORATOIRE NATIONAL CANADIEN POUR LA RECHERCHE EN PHYSIQUE NUCLÉAIRE ET EN PHYSIQUE DES PARTICULES

Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada

The 5-Year Plan Status

- **Broad effort to form and write plan**
 - Led by Tim Meyer, Byron Jennings, Rob McPherson & Chris Oram
 - Others include: Yuri Bylinski, Barry Davids, Jens Dilling, Ann Fong, Gerald Gwinner, Garth Huber, Shane Koscielniak, David Kulp, Andrew MacFarlane, JMP, Shirley Reeve, Tom Ruth, Paul Schmor, Achim Schwenk, William Trischuk, Vijya Verma
 - Input from across Canada (universities) PPAC
 - TRIUMF scientists have contributed - Full story on the web
- **Now at publishers all 849 pages (~100 copies)**
- **Layered document (shortened bilingual version ~1000 copies)**
- **International Peer Review is Sept 24-26**
 - **Powerful committee: Chair is next DG of CERN**
- **NRC Council is next February 09**
- **Goes to Industry Canada, Cabinet, Finance over course of the year**
- **A budget is approved for April 2010 announcement**

Building ASK Status

- Formal request went through Ministry of Adv Ed in May
- Ask: \$60M for two buildings & tunnel
 - Buildings: Nuclear Medicine, Tier-1 Centre
- Working hard to make BC Ministers aware of great potential of TRIUMF 5-yr plan and building ask
 - Tomorrow 1:00-3:00:
 - Ministers George Abbott (Health) Ida Chong (Economic Development)
- Strong support:
 - Edward Odishaw (Chair of AAPS Board of Directors)
 - Don Rix (AAPS Board and Chair Vancouver Board of Trade)
 - GR firm H&K
 - Simon Sutcliffe, Don Wilson, Francois Benard BCCA
 - SFU, UVic, UBC VPRs


Two Major New Initiatives

- **ISAC**
 - Neutron rich nuclear astrophysics and nuclear structure from actinides
 - Fundamental symmetries using actinides: stringent probes of physics BSM
 - Expansion of “proton rich” science program including beta-NMR more beam time
- **Nuclear Medicine**
 - Strong Parkinson’s Program is essential
 - Lead National Radiotracer development (National CFI in progress 17 institutions)
 - Expand into cancer imaging and therapy (BCCA)
 - Commence R&D initiative with MDS Nordion

Three New Smaller Initiatives

- **Terascale Physics**
 - Ensure success of Western Regional Analysis Centre for ATLAS science
 - Tier-1 Centre Expands
 - R&D for sLHC and ILC
 - Major global investments awaits guidance from LHC discoveries
- **Ultracold Neutron facility (CFI initiative)**
 - Gravity (level spacing in earths g-field), lifetime (V_{ud}), (EDM)
- **SNOlab Experiment Support (science exciting)**

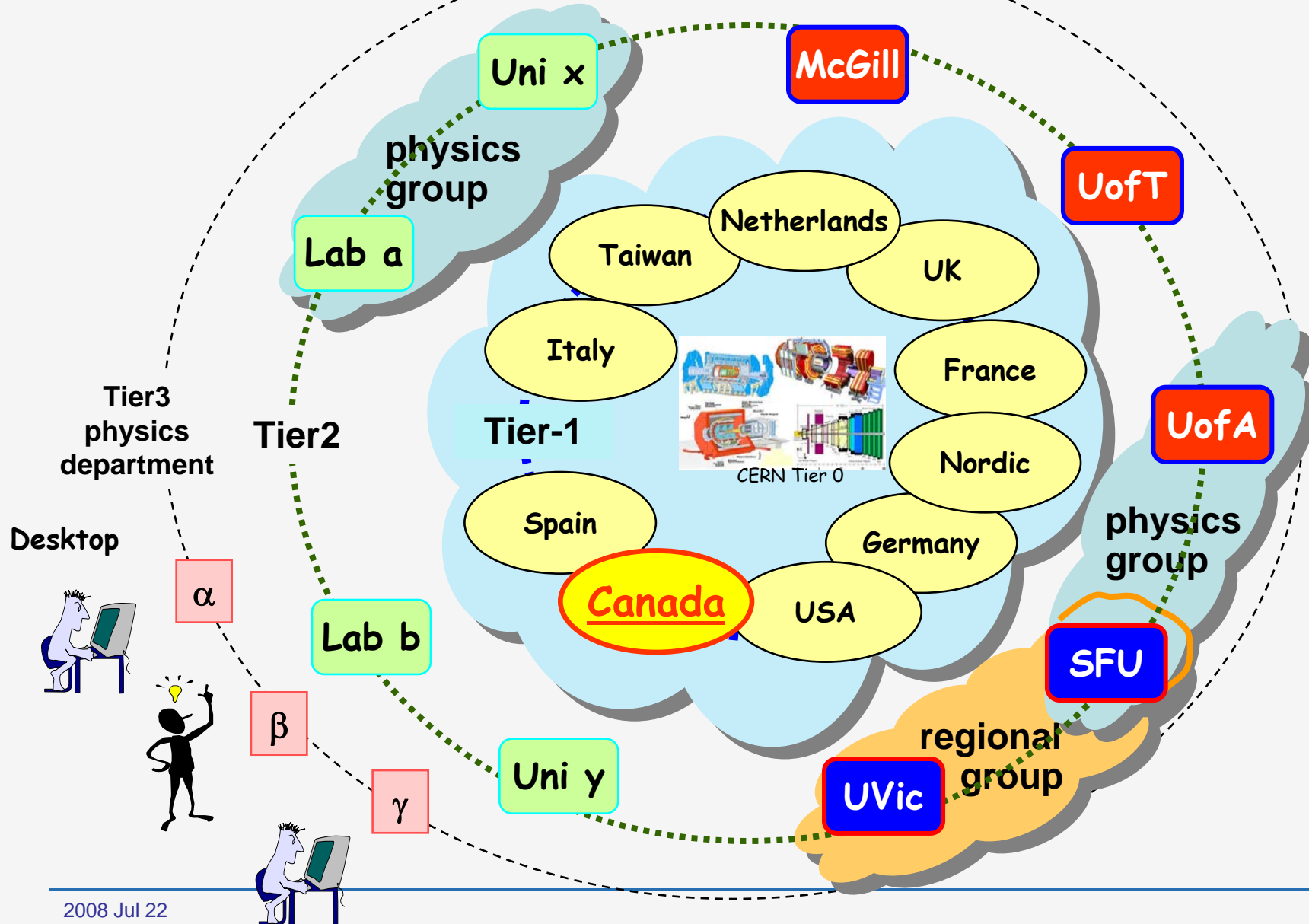
Underground Beam Tunnel

- **Key element of TRIUMF decadal vision is a new electron accelerator known as the “e-linac”**
 - Exploits world-leading superconducting RF technology developed in Richmond, BC (one of only 5 firms in the world)
 - Partnering with VECC laboratory in India
 - **Full spectrum of science & technology applications**
 - Nuclear physics of neutron-rich nuclei (astrophysics)
 - Technology of choice for global project in particle physics (International Linear Collider)
 - Provides beams for materials science studies relevant for next-generation semiconductors & superconductors
 - Exploring options to benchmark production capabilities of accelerators for medical isotopes traditionally produced by reactors
- 
- A 3D perspective rendering of a linear accelerator structure. It shows a long, narrow tunnel with various components like RF cavities and beam pipes. The structure is shown in a perspective view, receding into the distance.

Nuclear Medicine Revolution

- Disease metabolism subject to detailed investigation with targeted labeled molecules --- amino acid transporters, peptides... etc
- Establish efficacy of cancer treatment with quick turn around (FDG PET)
- Move towards imaging and therapy isotopes for cancer treatment (alpha emitters), e.g., ^{211}At
- Leads to mini SC cyclotron (espresso maker) in every hospital → AAPS

LHC Tier-1 Centre



Actinide Beam test

- Needed to give credibility to our main projects at the Peer Review in September:
 - e-linac
 - new beam-line for fundamental symmetries
 - Producing and purifying alpha emitting isotopes for cancer therapy
- Cutting edge physics and societal impact for these projects provides 10 year world-class program
- Essential for us to maintain lead and be competitive with new facilities around the world
 - \$4B investment in the next decade
 - All these facilities will use actinides

Actinide Beam test

- Goal of test is to measure yields of benchmark elements (eg. the alkali elements Fr, Cs, Rb, K, Na & Li) produced for experimentalists & for safety analysis
- Production numbers will help understand how to maintain high level of safety
- Plan is staged and has been approved by CNSC staff
 - 1 microamp on target (establish elements at yield station)
 - Plan in future calls for 10 microamps maximum on actinides (sufficient for proposed electric-dipole moments with radons)
 - We presently put 70 microamps on our non-actinide targets
- Actinides (some short lived and some long lived) undergo alpha decay that light elements do not

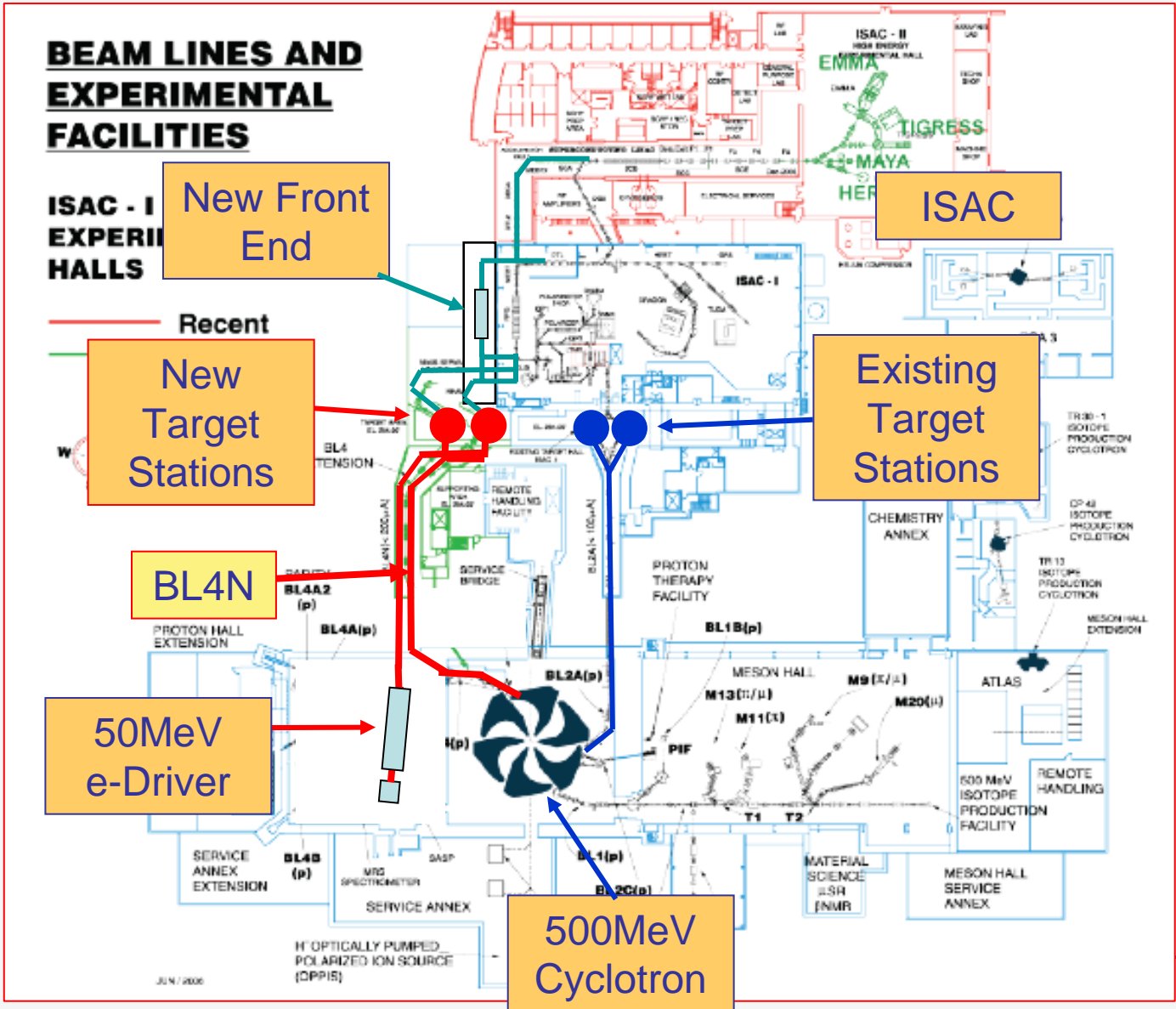
Actinide Beam test

- We have purchased & installed new monitors for detecting alphas
 - Not an issue for skin, short range (see cloud chamber short fat tracks—5 cm in length)
 - Health risks if you breath or ingest alphas in large quantities
- Primarily an issue for target hall and hot cell work
 - Air is already being monitored for alphas
 - Monitor target module vacuum for alphas, betas, gammas added last fall
 - Will sample along beamline for alphas
- Will purchase better safety equipment (new hoods) for work in hall
 - Present respirators are 10%, new ones 1% or even 0.1%
- Detailed safety plan (available from Anne Trudel) has been reviewed both internally and also externally by an actinide expert from Orsay France
- Final details being worked out for optimal plan
- In 5-yr plan we design a stand-alone actinide hot cell & target module

Working with Neighbours

- ~5000 people moving in next door
- Local civic group is University Neighbourhood Association (UNA)
- Have met with this group to describe “What is TRIUMF?” – handout the one-pager
 - Goal is total openness in what we do at TRIUMF
- Joint activities to raise awareness of benefits of TRIUMF to a small community
 - Summer lecture series (see headline news article—mostly kids)
 - TRIUMF Open house as part of UNA Block Party (Sept 6th)
 - Collaborate with Fuel Cell Institute to form South Campus Research Park
 - Forming a TRIUMF Citizens Advisory Board (Barry Davids, Colin Morton, and other residents) Please volunteer.
 - tours
- Since actinides require a CNSC license change from $Z < 82$ to $Z < 100$ we'll share this and other news with UNA

Site map for the future (2010-2018)



Proposal:

- BL4N is proposed to deliver 500-MeV protons to two actinide target stations for beam production
- Take advantage of the shielded and unused proton hall to add a 50-MeV electron driver to supply electrons to the new target area via a separate beamline
- Develop new ISAC front end to permit **three simultaneous RIB beams (two accelerated)**

Successes: Commercialization

- **TRIUMF AAPS awarded “Centre of Excellence for Commercialization”**
 - TRIUMF was 1 of 11 selected from >110 across the nation (only physical science)
 - Initial portfolio of work includes mining, environment, and accelerator technology for nuclear medicine (\$52M initial investments)
- **TRIUMF has been twice more recognized for its partnerships with BC companies by the NSERC Synergy Award ('08 D-Pace Nelson BC)**
- **Working with partners**
 - UBC/BCCA LEEF chair radio-isotope research centred at TRIUMF first 2 years
 - Joint major research program emerging with MDS Nordion
 - First superconducting “cavity” produced in Canada spring 08(1 of 5 firms in world)
 - \$2M partnership with physics institute in India---MOU will be signed by Director of VECC at TRIUMF for superconducting cavity accelerator project to be built in BC (August 7th)

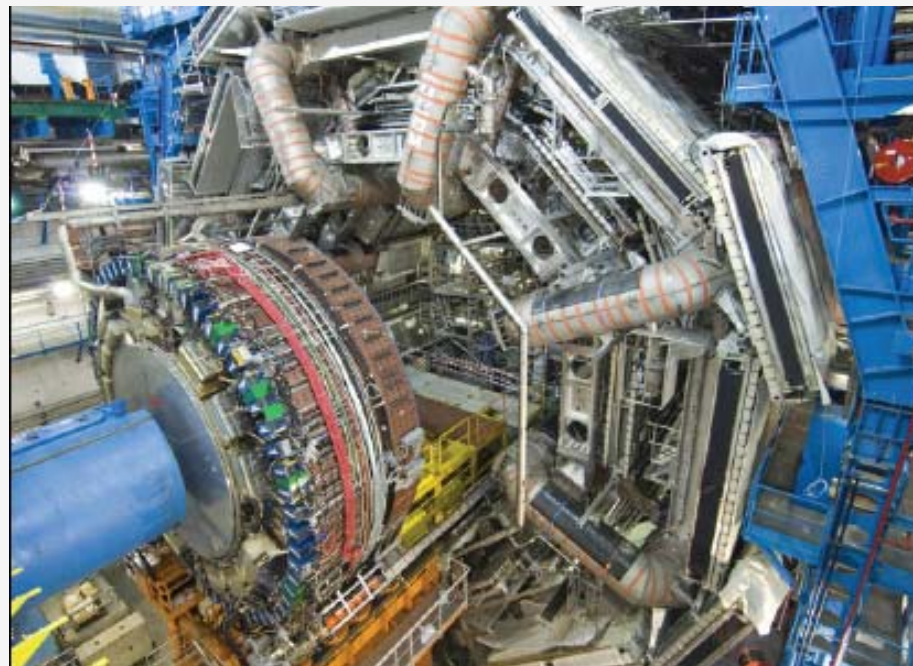
Building on Success: Science

- Particle Physics
 - ATLAS Canada
 - Accelerator contributions commissioned
 - Detector ready to take data
 - Largest academic computer in Canada by 2011
 - Largest amount of data stored by 2011
 - Western Regional Analysis Centre
 - (3 key 1st choice hires, 2 experiment, 1 theory)
 - T2K neutrinos
 - Premier accelerator neutrino experiment in world
 - Canada building 2/3 of near detector + accel contrib

ATLAS Canada



TRIUMF design built at
Alstom Tracy Quebec

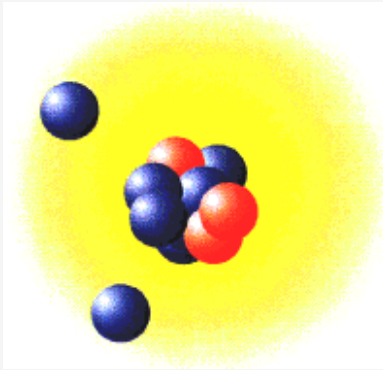


Hadronic Endcap &
Forward Calorimeter

**Total Investment by
Canada ~\$100M**

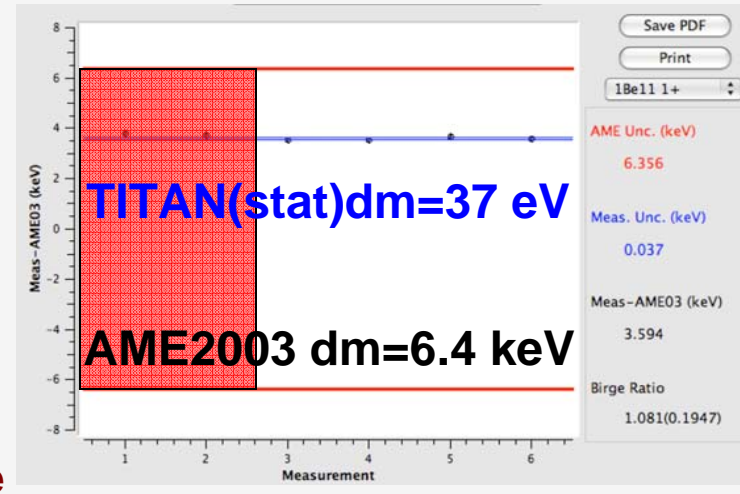
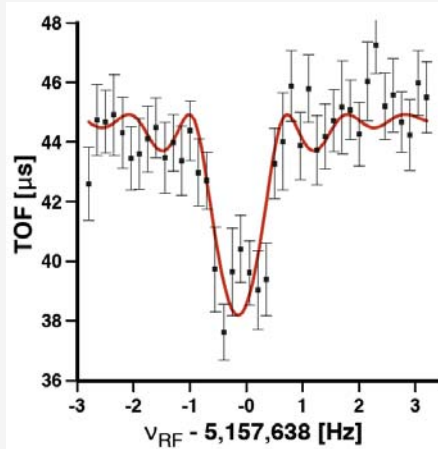
Building on Success: Science

- **Rare Isotope Beam (RIB) Program**
 - Highest power ISOL facility in world
 - Most intense beams of certain species in world
 - A dozen world-class experiments on floor
 - Leading proton-rich nuclear astrophysics
 - TRIUMF leads world in ^{11}Li halo nucleus studies

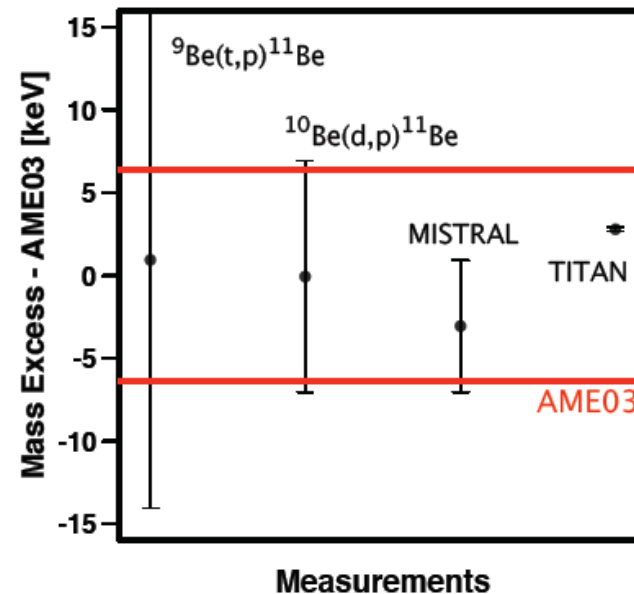


^{11}Li halo nucleus
(workshop...world's experts came
& helped define TRIUMF future program)

Very recent mass measurements: beryllium



- **New measurements of the mass of ^{11}Be measured (5 hours)**
- **G. Drake and Z. Yan (Windsor and NB) new calculations for IS (submitted to PRL)**
- **Tremendously improved precision (with systematic error included)**
- **BETTINA program (laser spec. @ ISOLDE)**
- **PhD thesis Z. Ke (Manitoba)**



Highest precision halo mass measurement
New developments in theory required:
they have to include next order, if mass
no longer largest error.

Building on Success: Science

- **Materials Science**

- Muon spin relaxation (μSr)

- World recognized research in warm superconductors
- Hydrogen storage research
- Presently undergoing major upgrades of beam lines++

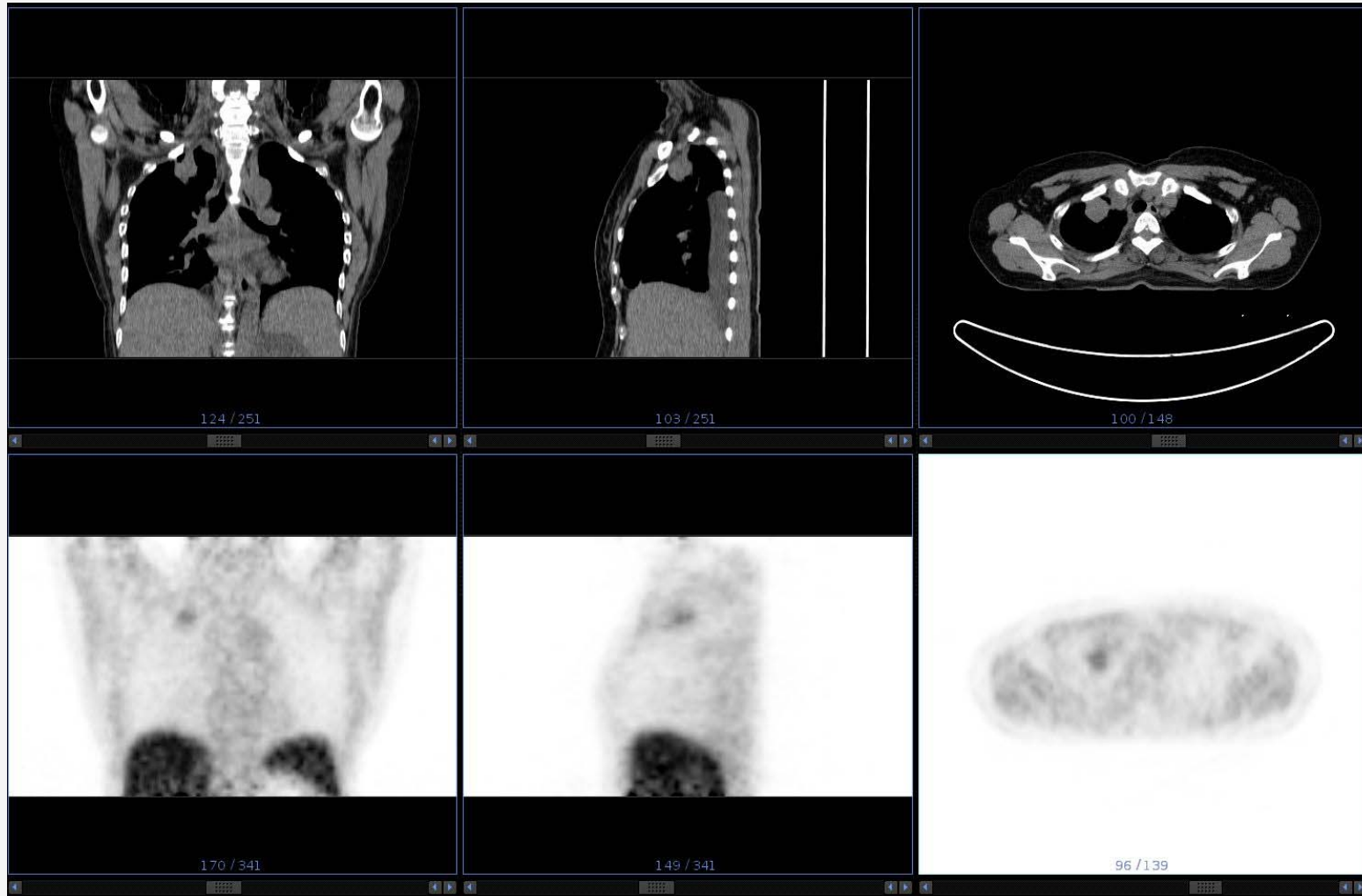
- β -NMR

- Study interfaces at 4 nm longitudinal resolution
- Basic research of material boundaries
- Unique facility in world

Building on Success: Science

- **Life Science Program**
 - World leading Pacific Parkinson's Research Centre (PPRC)
 - Placebo effect
 - Trauma
 - Core competencies
 - Imaging
 - Radiochemistry (^{18}F , ^{11}C)
 - Target development techniques

EF5-18F



Tests for Hypoxia – radiation resistant tumours

Thank you



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Any questions about the 5-year plan feel free to ask me