Descendants of Newton's tree

TRIUMF's 2nd director, Erich Vogt (RIP), took apples each year to his 1st-year physics students.

BEAM LINES AND EXPERIMENTAL FACILITIES

Welcome to TRIUMF, Canada's particle accelerator centre

ISAC-II HIGH ENERGY EXPERIMENTAL HALL

*Astrophysics & nuclei

high–Z molecules

SUPERCONDUCTING LINAC

TIGRESS

EMMA

*Ion trap for nuclear science

ISAC-I

Newton's apples from orbit

*Particle+Nuclear Theory
* liquid Xe detectors nEXO, PIONEER

ARIEL

*Atom trap: V helicity?

REMOTE HANDLING FACILITY

SERVICE BRIDGE

* Muons probe condensed matter

e–lihac

PROTON HALL EXTENSION

* DARKLIGHT
Producing dark photons

PROTON THERAPY FACILITY

MESON HALL

CYCLOTRON VAULT

* Ultracold neutrons test time reversal

* ATLAS&LHC detector assembly

* T2K CP violation HyperK PMT's

* ALPHA Antimatter falling –>

any TRIUMF scientist can be research supervisor. If you see something you like, let us know. Call x7333 if you get lost, not 911.

150 UG co-ops/year (you mentor them, they help you...)

TRIUMF scientists teach UG courses at UBC, SFU;
graduate Standard Model Theory, Accel Phys, Nuc Phys available nationwide

TRIUMF Theory Group

Cosmology & Dark Matter

Nuclear Astrophysics

Particle Physics

Electronics & Radiation Testing
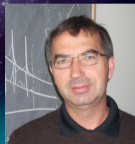
Nuclear Physics

Nuclear Medicine

Molecular & Materials Science

Nicole Vassh
nvassh@triumf.ca
Origin of the heavy elements, nuclear and neutrino physics in astrophysics

David Morrisey
dmorri@triumf.ca
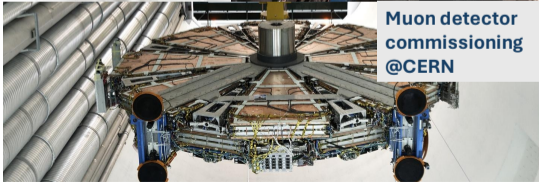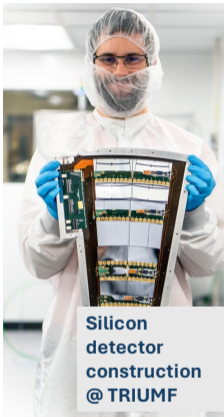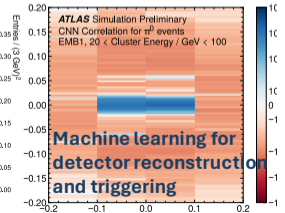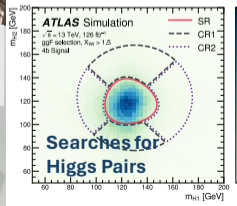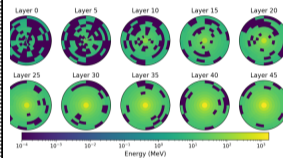Beyond the standard model particle physics, dark matter

David McKeen
mckeen@triumf.ca
Beyond the standard model particle physics, dark matter

Petr Navratil
navratil@triumf.ca
Nuclear structure, reactions, and fundamental symmetries

Jason Holt
jholt@triumf.ca
Nuclear structure, nuclear physics in BSM searches

ATLAS at the LHC

Silicon detector construction @ TRIUMF

Muon detector commissioning @CERN

Muon detector commissioning @CERN

Measurements Of Higgs Boson

Quantum Computing for detector simulation

Searches for Higgs Pairs

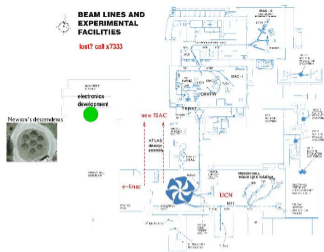**Machine learning for detector reconstruction and triggering**
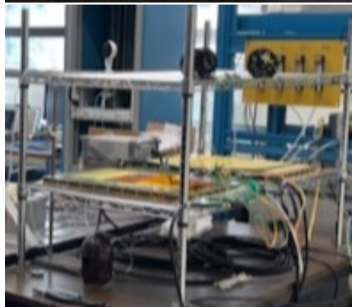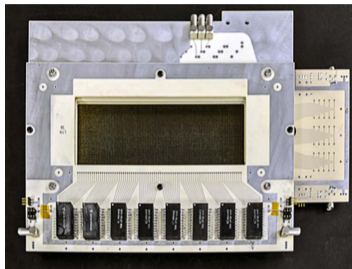
Labs in Main 'Office' Building
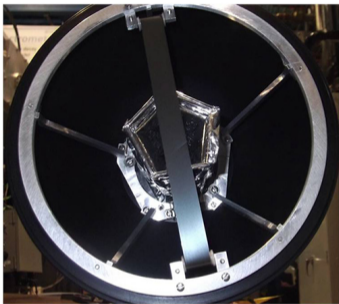
2π β detector ↑

**DarkLight tracking
detector →**

**Electronics development
ceramic/plastic/specialty
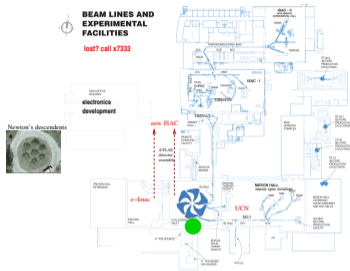machine shop
neutron EDM's HV lab**

**liquid Xe detection for
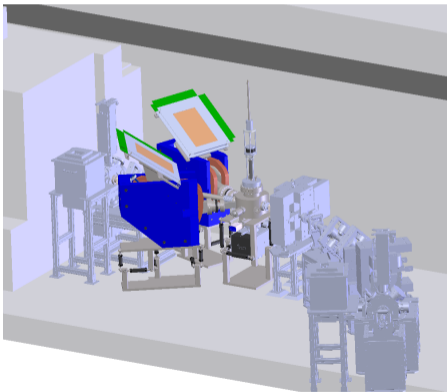PIONEER (π→e⁻ν PSI)
nEXO ββ0ν decay → SNOLAB**

500 MeV Cyclotron

2ndary beams of π, μ, nuclei
Biomedical isotopes (^{82}Sr $\to$ ^{82}Rb for PET)

Why so 'big?' Relativistic
$\vec{E} = \vec{v} \times \vec{B}$ **dissociates the H$^-$**
prematurely if B $\gtrsim$ 0.5 Tesla,
so the orbits must be big.

e-linac hall (in use today!)

e-Linac accelerator commissioning
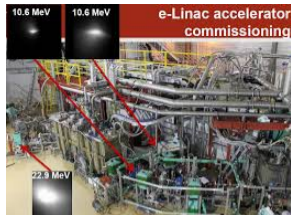10.6 MeV 10.6 MeV
22.9 MeV

The DarkLight experiment

This new, small experiment is being constructed at the 30 MeV e-linac

DarkLight will use the electron beam to strike a thin metal foil. The produced particles can be used to search for possible new particles beyond the Standard Model!

First data to start late this year
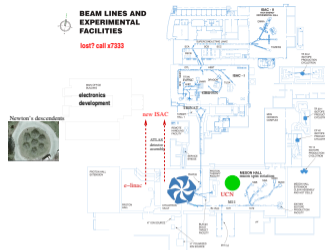
High-brilliance 30 MeV e^- beam designed → ILC

← Make dark matter particles

Free-Electron Laser for THz radiation: condensed matter probe

Photofission isotopes for nuclear physics

μ **spin rotation, ultra-cold neutrons,**

$\pi \rightarrow e\nu$ **should have final result soon**

BEAM LINES AND
EXPERIMENTAL
FACILITIES
lost? call x7333

electronics
development

new ISAC

Newton's descendents

e-linac

UCN

The concrete shield fasts
neutrons from the 500 MeV
proton beam.
Feynman asked in 1975 'why
such a low energy?': To make π
and μ in large quantitites
μSR has 1,000 users worldwide,
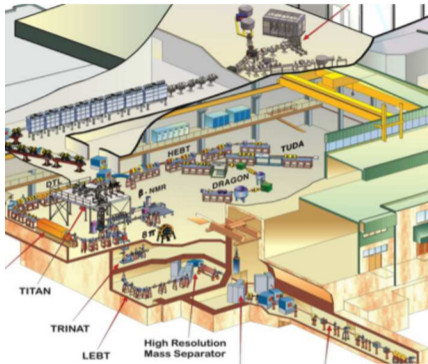including UBC

Detector Facility Clean Rooms
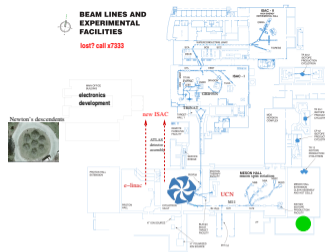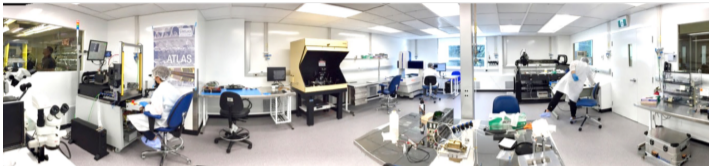
The LHC's ATLAS tracking detector and muon spectrometer are being built and tested in two cleanrooms. Another has 5-ton crane access and was used for the ATLAS endcap (earlier HERMES e-p collider).

Experiments on- or off-site use these development facilities (reconnected a microwire to TRINAT's silicon detector)

(some of) Life Sciences

- TR13 sends PET isotopes to UBC hospital by 2 km underground pneumatic tube for diagnostics and research
- Biochemistry hot cells for alpha- and Auger- emitters laser-separated at ISAC
- Developing ^{225}Ac production from thorium target near 500 MeV beam dump
- Proton therapy cured over 200 eye tumors with 90% success
- Future center under construction: IAMI

500 MeV p → ISAC

TRIUMF

TRIumf Neutral Atom Trap at ISAC
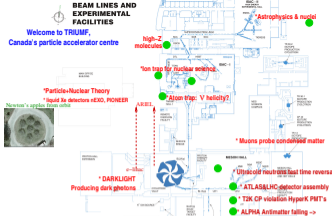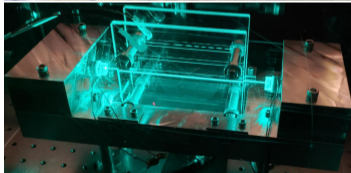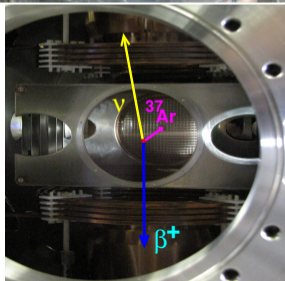main TRIUMF cyclotron 'world's largest' 500 MeV H^- (0.5 Tesla)

^{37}K 8x10^7/s   TiC target   70 μA
           1750°C   protons

^{92}Rb 6x10^8/s   UC$_x$ target
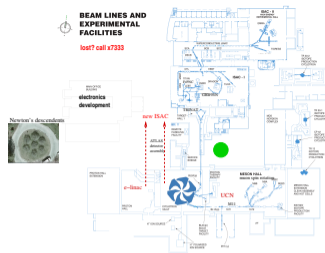
Nuclear properties, structure, reactions to study strong interaction and for:

Nuclear Astrophysics

Precision Measurement

Precision measurements at TRIUMF

CKM unitarity (nuclear
properties, decays, and
reactions)
TUCAN neutron EDM $\cancel{T}$
Francium trap: $\cancel{P}$, new Z''s
β decay trap: ν helicity, $\cancel{T}$
Ion trap for masses
High-Z (radioactive) molecules
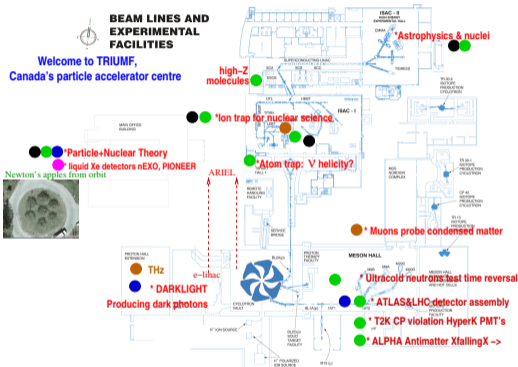to enhance $\cancel{T}$ soon
T2K ν $\cancel{CP}$ develops detectors
here

TRIUMF Subatomic, Condensed matter with UBC

• **Discover new particles:**
DarkLight
ATLAS Canada

• **Rare decays:**
detectors for
$\beta\beta0\nu$ **nEXO**
$\pi \to e\nu$
PIONEER
universal
couplings

• **Condensed**
matter
symmetries
and probes

BEAM LINES AND
EXPERIMENTAL
FACILITIES

Welcome to TRIUMF,
Canada's particle accelerator centre

high-Z molecules

* Astrophysics & nuclei

* Ion trap for nuclear science

* Particle+Nuclear Theory

* liquid Xe detectors nEXO, PIONEER

Newton's apples from orbit

* Atom trap: V helicity?

ARIEL

e-linac

* THz

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Producing dark photons

* Muons probe condensed matter

* Ultracold neutrons test time reversal

* ATLAS&LHC detector assembly

* T2K CP violation HyperK PMT's

* ALPHA Antimatter XfallingX ->

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let us know. Call x7333 if you get lost, not 911.

$\sim$ **one • per UBC PHAS grad student**

• **Precision measurement:**
CKM unitarity (many)
$\mathcal{T}, \mathcal{P}\ \nu$ **helicity atom trap**
Extra Z' **Fr atoms**
High-Z radioactive
molecules $\mathcal{T}$ **soon**
$\mathcal{CP}$ **T2K** ν **osc**
ATLAS: M_W**, curvature of**
Higgs potential

Nuclear properties, decays,
structure and reactions for
• **Strong interaction and**
many-body physics
• **Nuclear Astrophysics**
• **SM corrections to** *Vud*
and new interaction
searches