

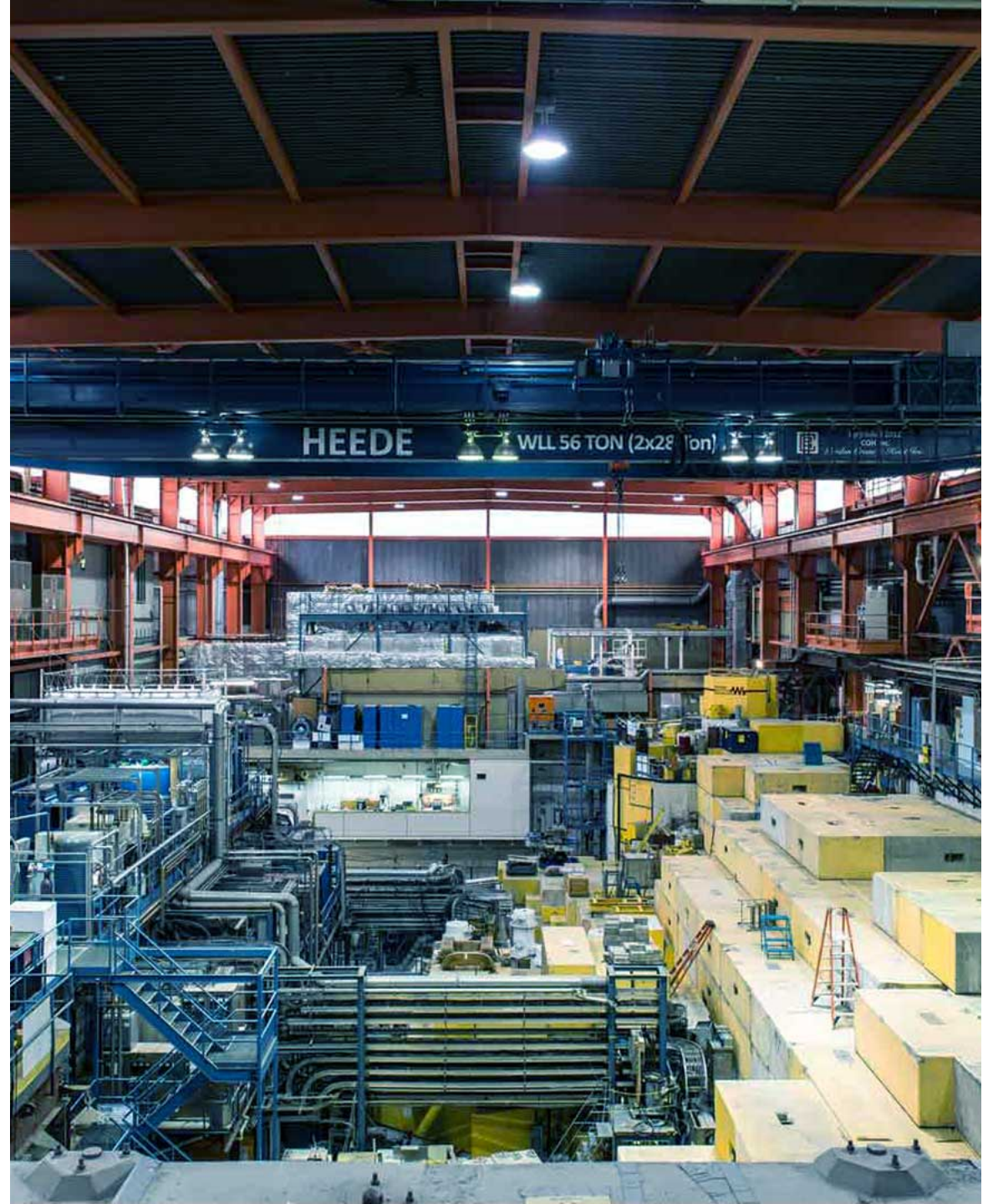
Workshop on *Beam-based Probes of Condensed Matter Physics, Chemistry and Related Fields in Canada*

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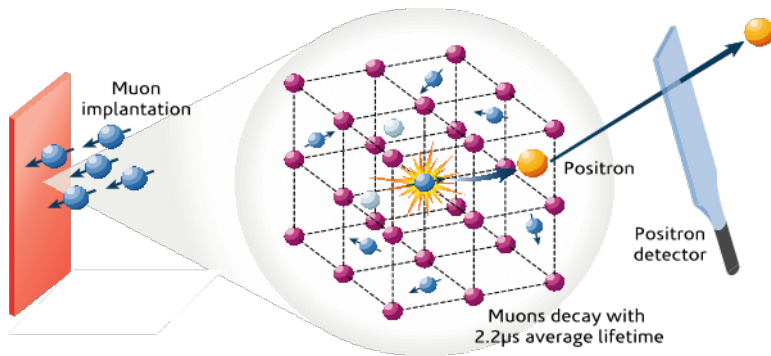
TRIUMF

2021-08-18



Molecular and Material Science at TRIUMF in 2042?

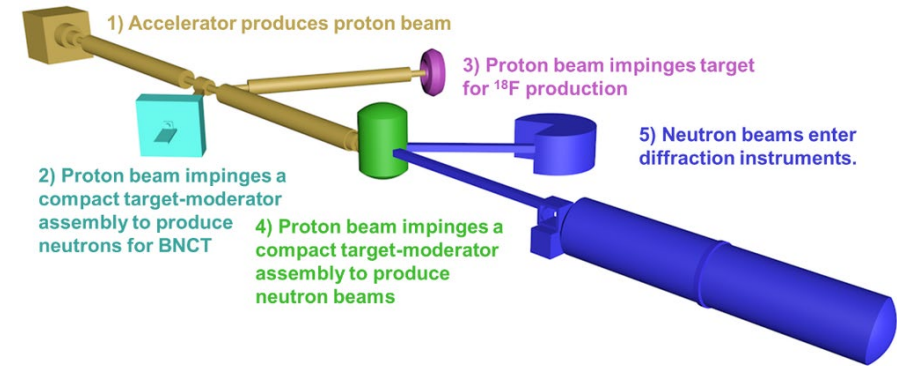
μ SR



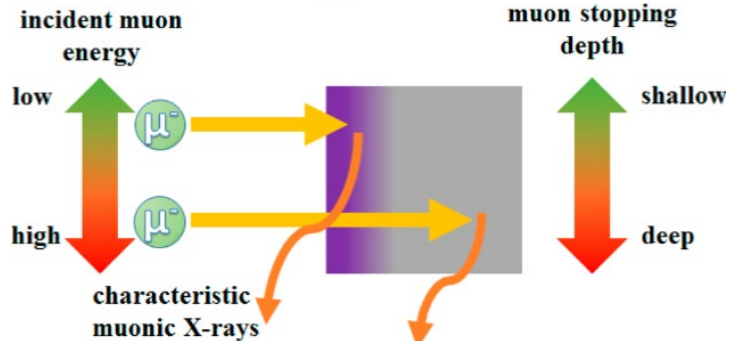
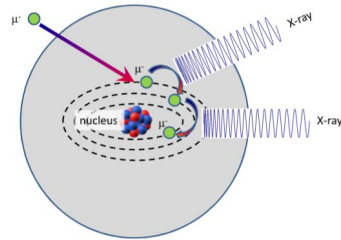
β NMR



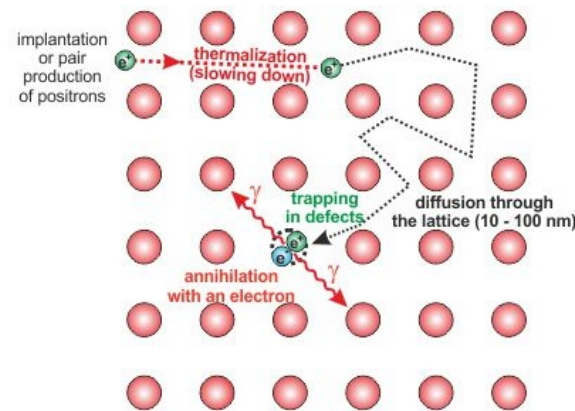
Neutron Scattering?



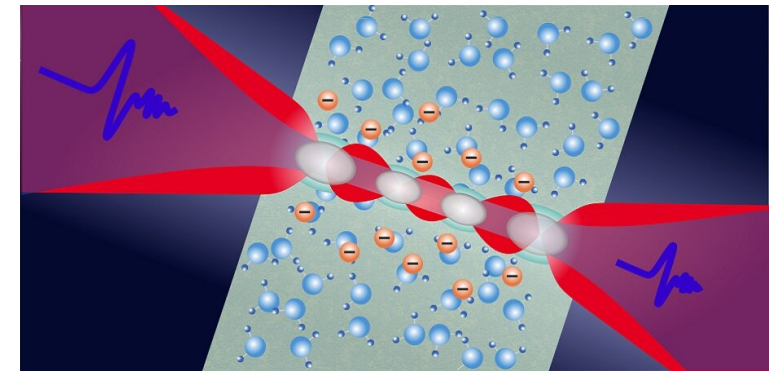
Muonic X-ray?



Positron Annihilation Spectroscopy?



THz Spectroscopy?



Coordination Among Large-Scale Facilities

At present, these facilities operate independently and without substantial coordination.

Workshop on Materials Science in Canada
July 2011

We see great benefit in addressing this deficiency such that Canada materials science facilities

- share best practices
- coordinate on outreach and education
- take part in strategic planning as appropriate

Workshop Timetable

Thursday, June 3rd

08:00

Session 1: Novel capabilities with μ SR

10:00

10:30

Session 2: Neutron scattering (with an accelerator-based source)

12:30

13:00

Session 3: Polarized radioactive isotopes

15:00

15:30

Session 4: Muonic X-ray analysis and μ -SR of materials

17:30

Friday, June 4th

Session 5: Positron annihilation spectroscopy

Session 6: THz spectroscopy in Canada

Session 7: Synchrotron light sources

Session 8: μ SR ideas and concepts

Broad Conclusions from the Workshop

1. The plan for the TRIUMF μ SR facility is well defined. There are two new beam lines / end stations that will greatly expand the program. At M9H, experimenters will be able to study quantum materials and chemical systems over a wide range of temperatures, magnetic fields and pressures. The M9A spectrometer will allow rapid characterization in a user-friendly facility.
2. Muonic X-ray elemental analysis would be complementary to those available at the CLS and offer significant advantages over XRF facilities. The key thing that sets muonic X-ray analysis apart is depth resolution over macroscopic length scales.
3. The POLARIS project would greatly expand the scope of β NMR experiments and make better use of the increased beam time available from ARIEL.

Broad Conclusions from the Workshop

- 4. Canada needs additional neutron sources.** The PC-CANS prototype at U. Windsor is an *essential first step* in proving the viability of the technology. Discussion focused on whether the following step would be to have a national neutron scattering facility like the HBS or whether smaller, regional facilities would better serve Canadian needs. Regional facilities should be located in places where there is significant relevant expertise, such as TRIUMF and the CLS.
- 5. Lab-based positron facilities would benefit from an additional source of Na-22,** which is currently available only from iThemba in South Africa. TRIUMF could produce such sources at the proton irradiation facility. Higher intensity sources could also be produced for an in-house facility. The technical skills needed to develop / run are facility overlap significantly with μ SR / β NMR and would provide information about defects in materials.

Broad Conclusions from the Workshop

6. If TRIUMF pursues a THz project, it should be part of the low frequency spectrum not covered by laser accessibility. This would elicit a broad user community buy-in.
7. Canada's large-scale facilities (TRIUMF, CLS, McMaster reactor) operate independently and without substantial coordination. There is great benefit in addressing this deficiency such that Canada materials science facilities share best practices, coordinate on outreach and education, and take part in strategic planning /lobbying as appropriate. The open question is how to best facilitate this coordination.