TRIUMF

20 Year Vision

Particle Physics Topical Group

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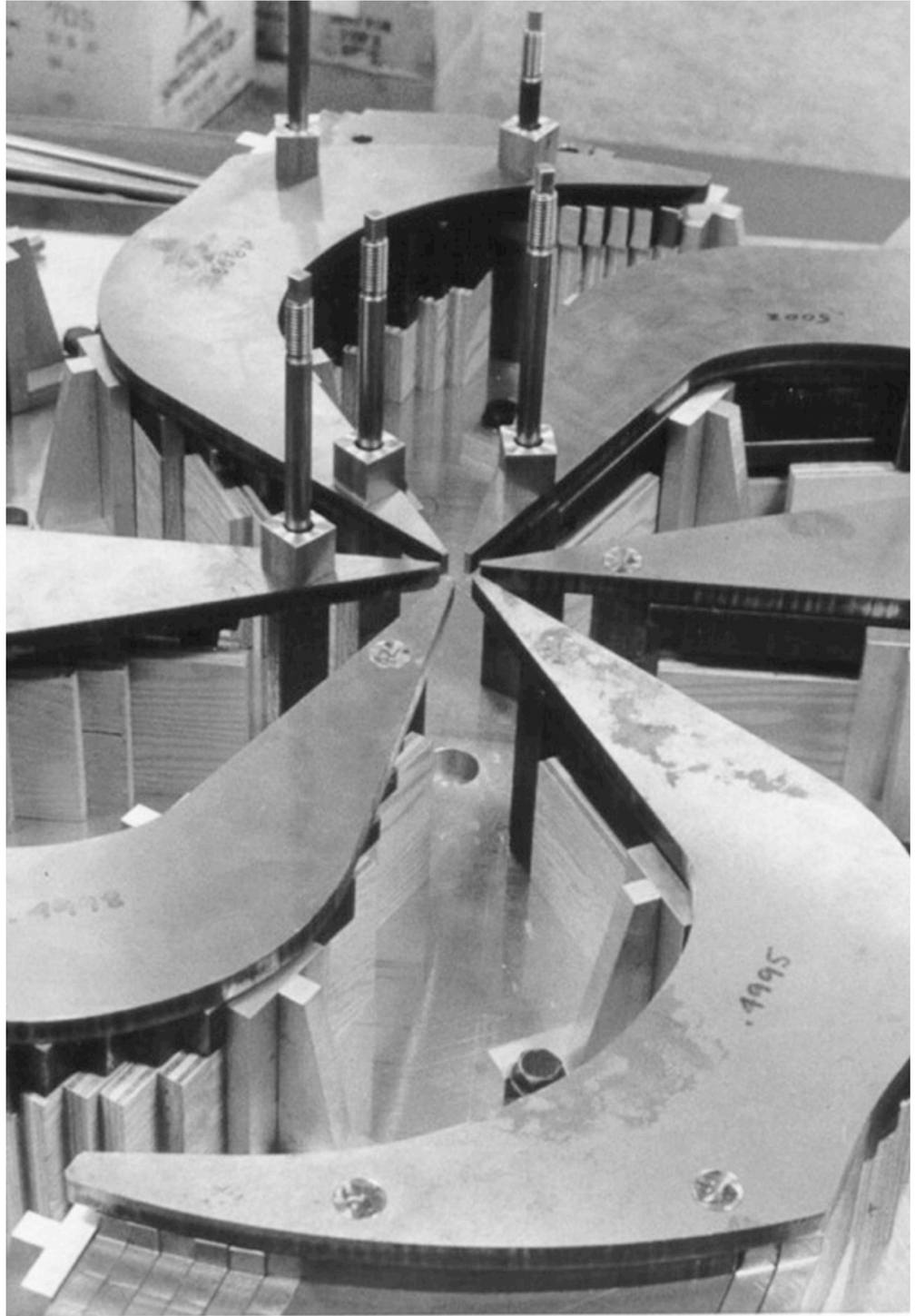

Discovery, accelerated

Particle Physics Topical Group Members

- **Chair:** Oliver Stelzer-Chilton (TRIUMF)
- Rick Bartmaan (TRIUMF)
- Erica Caden (SNOLAB)
- Robin Hayes (UBC/TRIUMF)
- Nikolina Ilic (U Toronto/IPP)
- Akira Konaka (TRIUMF)
- Chloé Malbrunot (CERN/TRIUMF)
- David Morrissey (TRIUMF)
- Patrick de Perio (TRIUMF)
- Max Swiatlowski (TRIUMF)

Community Consultation

- Open Call for Input
- Particle Physics Topical Survey
- ThoughtExchange Platform Survey
- Direct consultation:
  - JoAnne Hewett (SLAC, Chief Research Officer)
  - Young-Kee Kim (U Chicago, Snowmass Chair)
  - Klaus Kirch (PSI, Head of Particle Physics)
  - Art McDonald (Queen's, McDonald Institute)
  - Rob Myers (Perimeter Institute Director)
  - Tony Noble (Queen's, McDonald Institute Head)
  - Adam Ritz (UVic, LRP Co-Chair)
  - Mike Roney (UVic, IPP Director)
  - Brigitte Vachon (McGill, LRP Co-Chair, Canadian representative for European Strategy)

Some Useful Links

- Overview of the TRIUMF 20 Year Vision Development Plan:

  https://www.triumf.ca/20-year-vision

- Topical Group Responses:

  https://www.triumf.ca/sites/default/files/AllTopicalGroupSummaries.pdf

- Topical Group Response Summaries:

  https://www.triumf.ca/sites/default/files/Vision%20Summary-AllGroups.pdf

Our Vision for Particle Physics (PP)

1. Lead in Scientific Discovery

→ lead discoveries that change our understanding of the fundamental constituents of the Universe

2. Enable Particle Physics in Canada and Abroad

→ enable the Canadian community to participate in and drive particle physics research projects

3. Inspire, Attract, and Teach

→ inspire, attract, and develop the best talent from Canada and the World

1. Lead in Scientific Discovery — Now

- ATLAS: testing the universe at the LHC energy frontier, Tier-1 Data Centre
- T2K, HyperK, HALO, nEXO, SNO+: measure neutrino masses, mixings, CP
- UltraCold Neutrons: UCN facility for neutron EDM tests (TUCAN) and more
- ALPHA*: precision measurements of anti-hydrogen and its properties
- SuperCDMS, CUTE, DEAP, SBC: dark matter at SNOLAB and beyond
- PIENU, NA62, Belle-II: precision tests of flavour, searches for dark sectors
- Scientific technology and computing, theory, detector development, accelerators

1. Lead in Scientific Discovery

- **Pursue new discoveries in fundamental physics:**
  - basis for our training, outreach, technology development, and applications
  - probes of the energy frontier at the HL-LHC and future colliders like ILC, FCC
  - neutrino measurements at HyperK, SNOLAB, SNO+, P-ONE, and beyond
  - searches for dark matter and dark sectors at SNOLAB and internationally
  - precision tests of the Standard Model and searches for lighter new physics
  - develop new **on-site** experiments using TRIUMF beams and detector tech
    e.g. Developing New Directions in Fundamental Physics Workshop

1. Lead in Scientific Discovery

- **Build a strong national community in PP with international impact:**
  - new joint hires with member universities ensure strong connections
  - expanding geographically would strengthen our national mandate (but must also be careful to maintain lab unity and community)
  - establish an international workshop centre and program at TRIUMF (*e.g.* Banff International Research Station, Aspen Center for Physics, …)

2. Enable PP in Canada — Now

- TRIUMF's accelerator, computing, and technical resources extend beyond the capabilities of any single university:
  - LHC/ATLAS accelerator and detector contributions, Tier 1 computing
  - T2K ND280 near detector tracker
  - detector (components) for ALPHA*, SNO+, DEAP, and many more
  - on-site programs like PIENU and UCN
- Similar contributions will enable future Canadian participation in international big science programs such as the HL-LHC and HyperK.

2. Enable PP in Canada and Internationally

- **TRIUMF can further leverage its capabilities by creating three broad centres:**

  1. national detector research and development centre

  2. accelerator platform for research and beam delivery

  3. computing and data science centre

- Ensure transparent access to these resources for our partners and member universities.

- These centres would enable future Canadian participation in Big Science.

- They also extend beyond particle physics to nuclear, accelerator, and applications.

3. Inspire, Attract, and Teach — Now

- TRIUMF has a small but excellent communications team.
  We are known well in BC, but less so nationally.

- We attract talented undergraduate and graduate students and postdocs to TRIUMF and train them in research and beyond (with GAPS).

- We teach a small number of university courses in PP.

- We run summer schools including the TRIUMF Summer Institute, GRIDS detector school, TRISEP school with SNOLAB and Perimeter

- TRIUMF takes EDI very seriously but is still learning how to implement.

3. Inspire, Attract, and Teach

- Expand the national scope of our outreach program to demonstrate that science is for everyone. (*e.g.* Perimeter Institute)
- Expand our academic programs with on-site student placements and remote courses and summer schools that complement our universities.
- Become a champion in Equity, Diversity, and Inclusion:
  - build a diverse, inclusive, cutting-edge research culture at TRIUMF
  - support our students and workers across multiple dimensions including accessibility, housing, transportation, and childcare

Related Considerations

- TRIUMF's activities in PP should coordinate with the Canadian community including the IPP and Subatomic Physics Long Range Plan.

- Some projects in PP are global in scope and will require the participation of many countries to be completed (*e.g.* future colliders).

- Space is a challenge (as for everyone) and limits what we can do in research, collaboration, training, and EDI (*e.g.* nursing room, prayer room).

Our Vision for Particle Physics (PP)

1. Lead in Scientific Discovery
   - pursue new discoveries in fundamental physics, both on- and off-site
   - support the community through joint hires and a workshop centre
2. Enable Particle Physics in Canada and Abroad
   - contribute to allow Canada to participate in future Big Science PP projects
   - leverage our capabilities with centres in detectors, accelerators, computing
3. Inspire, Attract, and Teach
   - expand and refine our national activities in outreach, training, and EDI

Additional Feedback

- Please send any comments or suggestions to Oliver Stelzer-Chilton (or the relevant topical group chair)!

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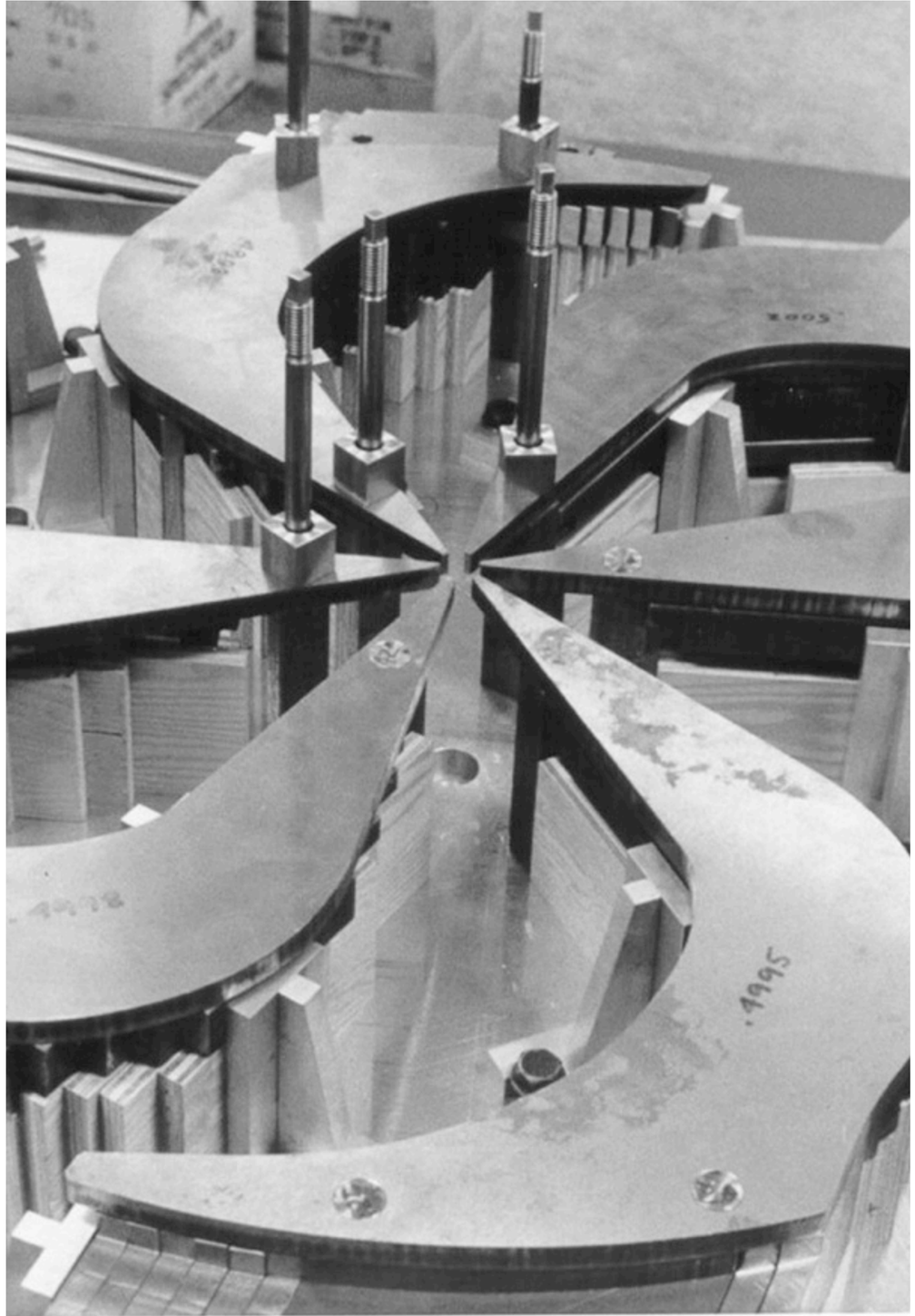
Thank you
Merci

www.triumf.ca

Follow us **@TRIUMFLab**



Discovery, accelerated

Extra Slides

Particle Physics (PP)

- What are the basic building blocks of the Universe? How do they interact?
- How did these pieces come together over the history of the cosmos?
- Why is there more (visible) matter than antimatter?
- What is dark matter?
- How do electroweak symmetry breaking and the Higgs work?
- What is the source of neutrino and quark flavour mixing?
- …

Vision

for Particle Physics

TRIUMF

“All truths are easy to understand once they are discovered; the point is to discover them”

-Galileo Galilei

“Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world”

-Louis Pasteur

Our Vision for Particle Physics

Lead Scientific Discovery

Build a strong, innovative particle physics community with a thriving on-site, national and international programs

Broker a network of university and institute partners in Canada and abroad

Perform world-class science and develop synergies with emerging areas for discovery

Lead the discoveries that change how we understand the fundamental nature of the universe

Enable Particle Physics in Canada and abroad

Create enhanced facilities for specialized expertise and infrastructure in research and development

- A detector development center
- An accelerator platform for research and beam delivery
- A computing and data science center

Enable the creativity and broad research and development that leads to discovery, in Canada and abroad

Train, Include, Inspire

Create programs that provide students and postdocs with on the job training with high engagement from both national and international partners

Bring the world to TRIUMF by expanding schools, workshop, and conference programs

Champion initiatives for equity, diversity, and inclusion, and integrate these programs in the heart of our training

Attract and develop the best talent in Canada and the world

	Now	Action	2042
Lead Scientific Discovery	• Recognized member in national and international collaborations • Footprint for local particle physics experiments is relatively small	• Build a strong network in Canada and abroad with joint appointments with member universities and partner institutes • Attract and connect talents • Develop and broaden TRIUMF's focus on key science programs	• Generate discoveries addressing the fundamental nature of the universe • Become a leader in innovative and collaborative research in a national and global network • Run a thriving on-site program engaging in new directions

Enable Particle Physics in Canada and abroad	• Collaborator with technical capabilities in accelerator and detector construction
	• Research and development infrastructure and expertise is in high demand but not leveraged
		• Establish three key facilities:
		  ○ Detector development center
		  ○ An accelerator platform for research and beams delivery
		  ○ Computing and data science center for subatomic physics
		• Allow for long-term investments in infrastructure and personnel that enhance particle physics capabilities
			• Leverage and multiply innovation in accelerator, computing and detector development across Canada
			• Access to centers in a transparent and regulated process that maximizes engagement
			• Enlarged Canadian participation in ground-breaking particle physics research at home and abroad

Train, Include, Inspire	• Mostly Canadian and local students are trained • Trainees have limited opportunities to collaborate outside their area of study • Limited reach of general outreach program	• Establish international workshop and conference program • Expand academic program with online courses and summer schools • Act on concrete measures for equity, diversity, and inclusion • Expand communications and outreach with partners	• The next generation of leaders are trained in a diverse, inclusive, cutting-edge research environment • A vibrant outreach programme demonstrates that science is for everyone
	5 Year Horizon	20 Year Vision	TRIUMF Firmly Established As Canada's National Laboratory

Lead Scientific Discovery

Explore and lead the discoveries that change how we understand the fundamental nature of the universe

- Build a strong and innovative particle physics community with thriving on-site, national and international programs at the energy, intensity, innovation and new technologies frontiers:
  - **TRIUMF can be an intellectual center for discovery in Canada answering the big questions in our field**
- Broker a network of university and institute partners in Canada and abroad:
  - **Joint hires ensure strong connections to universities and partner institutes**
  - **Expanding geographically could increase the mandate of TRIUMF nationally and alleviate the perception that it is a Western-only laboratory**
- Perform world-class science and develop new directions in emerging areas and future technologies for discovery:
  - **TRIUMF can lead the discoveries that change the course in particle physics, fundamental science and beyond**

Enable Particle Physics in Canada and abroad

Facilitate the creativity and development that leads to discovery in Canada and abroad

- TRIUMF's accelerator, computing, and engineering capabilities are unparalleled and beyond the capabilities of a single university:
  - **These resources enable Canadian participation in international projects such as HyperK, HL-LHC and future colliders**
- TRIUMF can leverage and multiply innovation by creating broad centers:
  - **Detector development center**
  - **An accelerator platform for research and beams delivery**
  - **Computing and data science center**
- Member universities will access TRIUMF's wealth of resources through a transparent process that maximizes engagement in cutting-edge projects:
  - **Enlarged Canadian participation in ground-breaking particle physics research at home and abroad**
  - **TRIUMF can be the lever arm that strengthens developments across the nation to deliver Canadian particle physics**

Train, Include, Inspire

Attract and develop the best talent in Canada and the world

- TRIUMF will become an EDI champion by advocating for a diverse workforce:
  - **Establish concrete measures to foster diversity including ensuring that its members can access housing, transportation, and daycare**
  - **The next generation of leaders is trained in a diverse, inclusive, cutting-edge research environment**
- TRIUMF can grow its cutting edge, international research environment by expanding programs to bring the world to TRIUMF:
  - **Establish international workshop and conference center**
  - **Expand academic program with online courses and summer schools that are complementary to what universities can offer**
- A vibrant outreach programme demonstrates that science is for everyone
  - **Partnering with Canadian and international communicators can expand our impact, and help Canadians feel connected to their national lab**