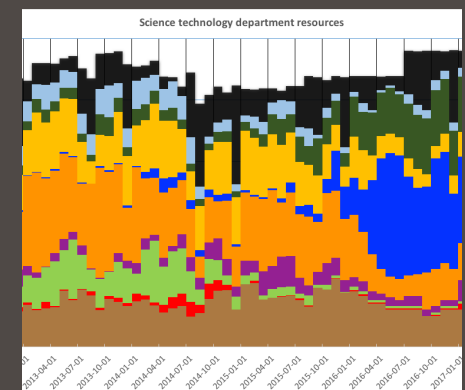
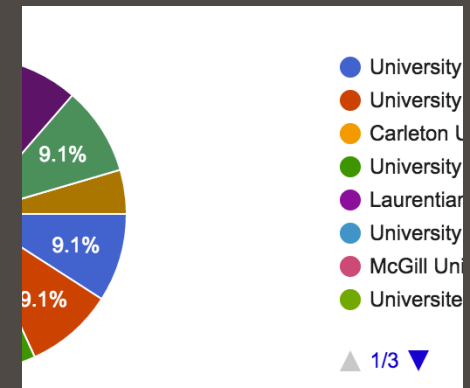
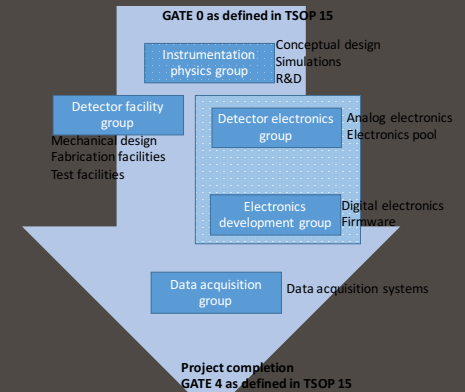


TRIUMF Science Technology Department & technical resources in Canadian SAP

Fabrice Retière

Accelerating Science for Canada
Un accélérateur de la démarche scientifique canadienne

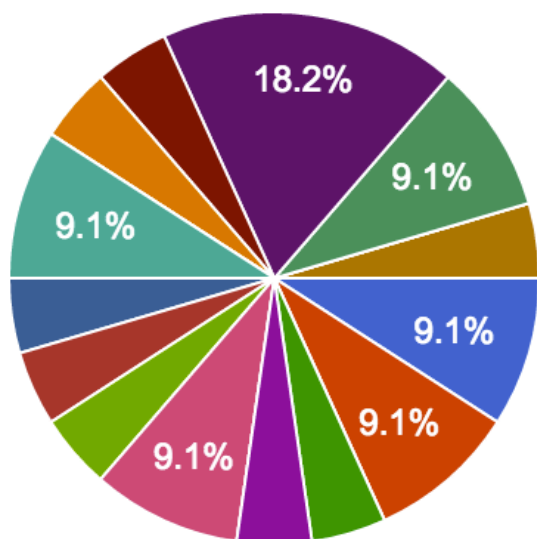
Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada
Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada



Scope of this talk

- Spelling out TRIUMF's strategy for supporting future SAP experiment construction and R&D
 - Strategy for TRIUMF Science Technology Department as defined in April 2016 to ACOT
 - Enhance organization
 - Maintain core competency
 - Expand in key area
 - Expand connections with Canadian community
 - Management considering options for supporting R&D effort via a LDRD-like system
 - LDRD = DOE Laboratory Directed Research and Development
 - Needed? Competing with other source of funds?
- Explore resource needed and available within the SAP community
 - Does the offer match the needs?
 - Resource available are fairly scattered. Good? Bad?

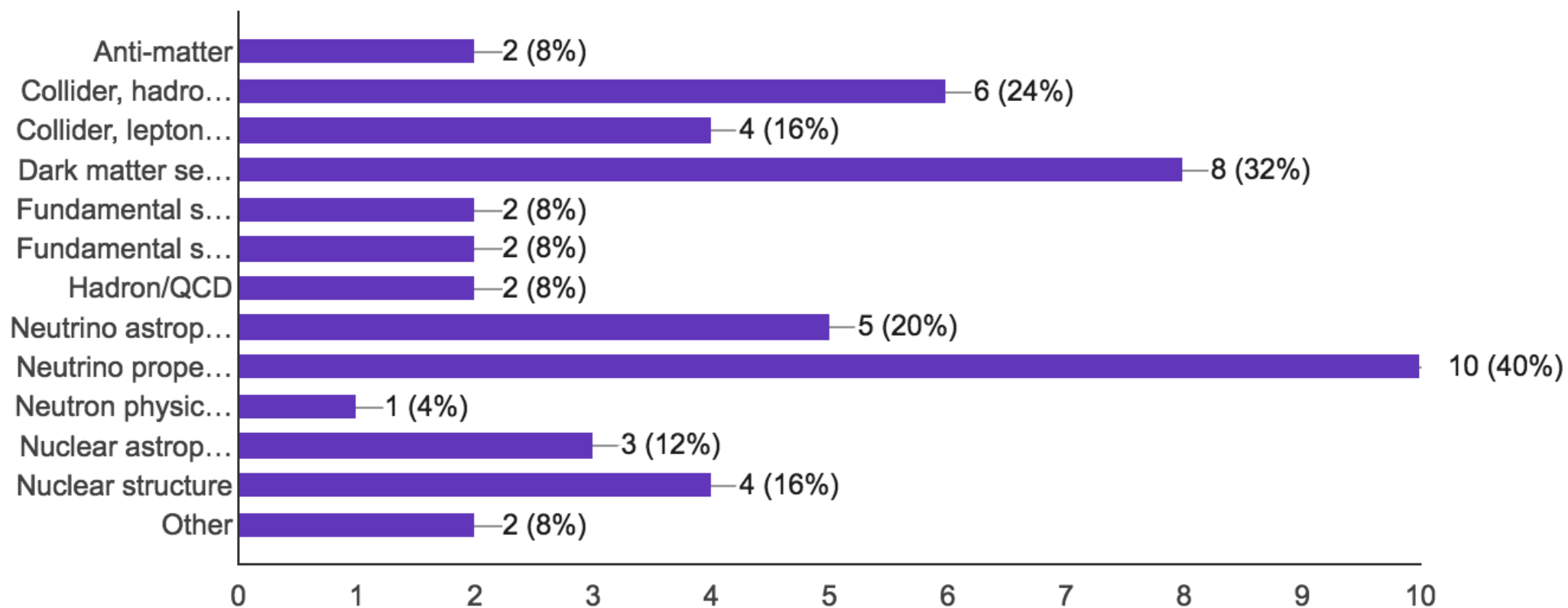
Resource survey. Thank you!



- University of Alberta
- University of British Columbia
- Carleton University
- University of Guelph
- Laurentian University
- University of Manitoba
- McGill University
- Universite de Montreal
- Mount Allison University
- Queens University
- Perimeter Institute
- University of Regina
- Saint Mary's university
- Simon Fraser University
- SNOLAB
- University of Toronto
- TRIUMF
- University of Victoria
- University of Western Ontario
- University of Winnipeg
- University of York

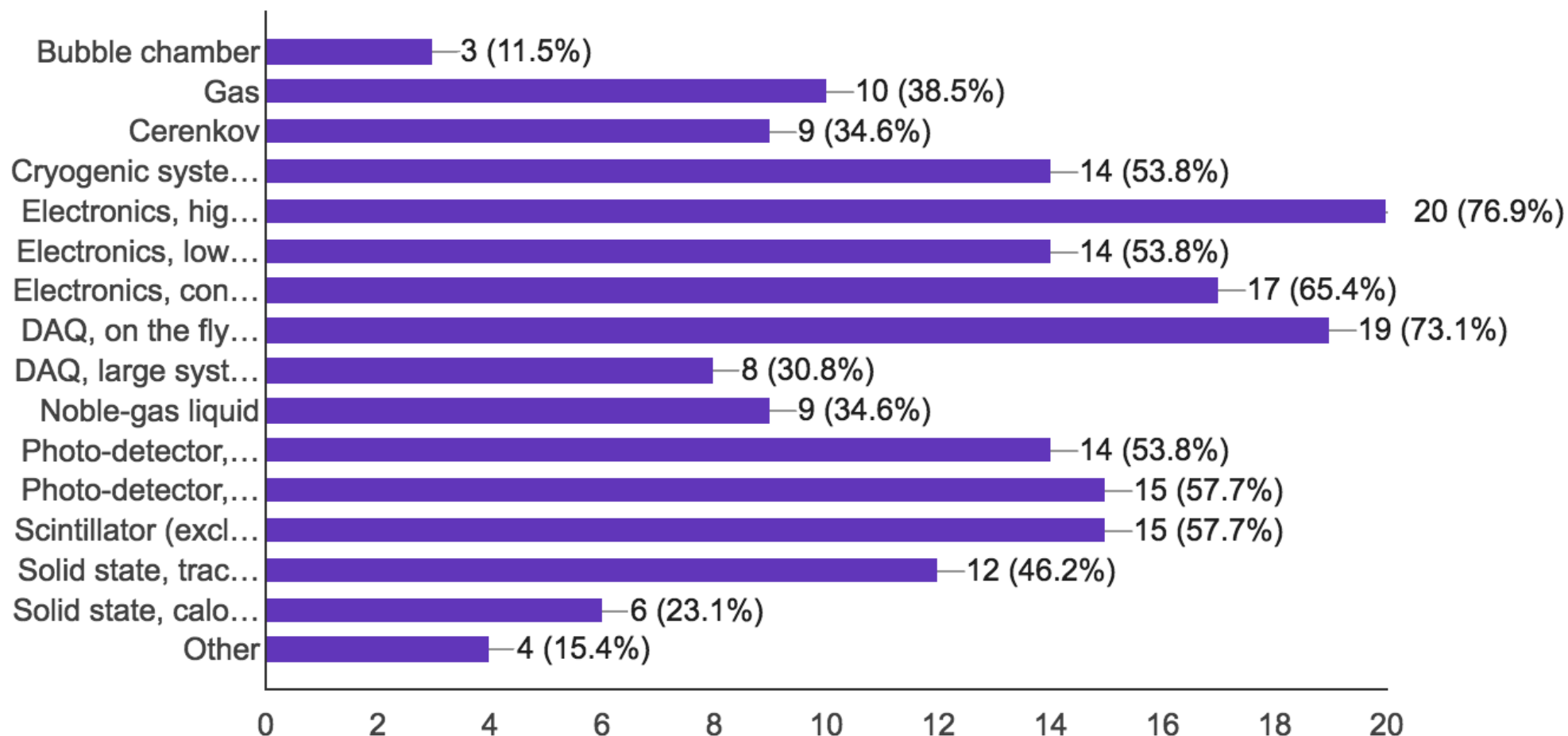
22 different institutes
 ×4 for TRIUMF
 ×2 for Alberta, UBC, McGill,
 Regina, Victoria
 ×1 for the others

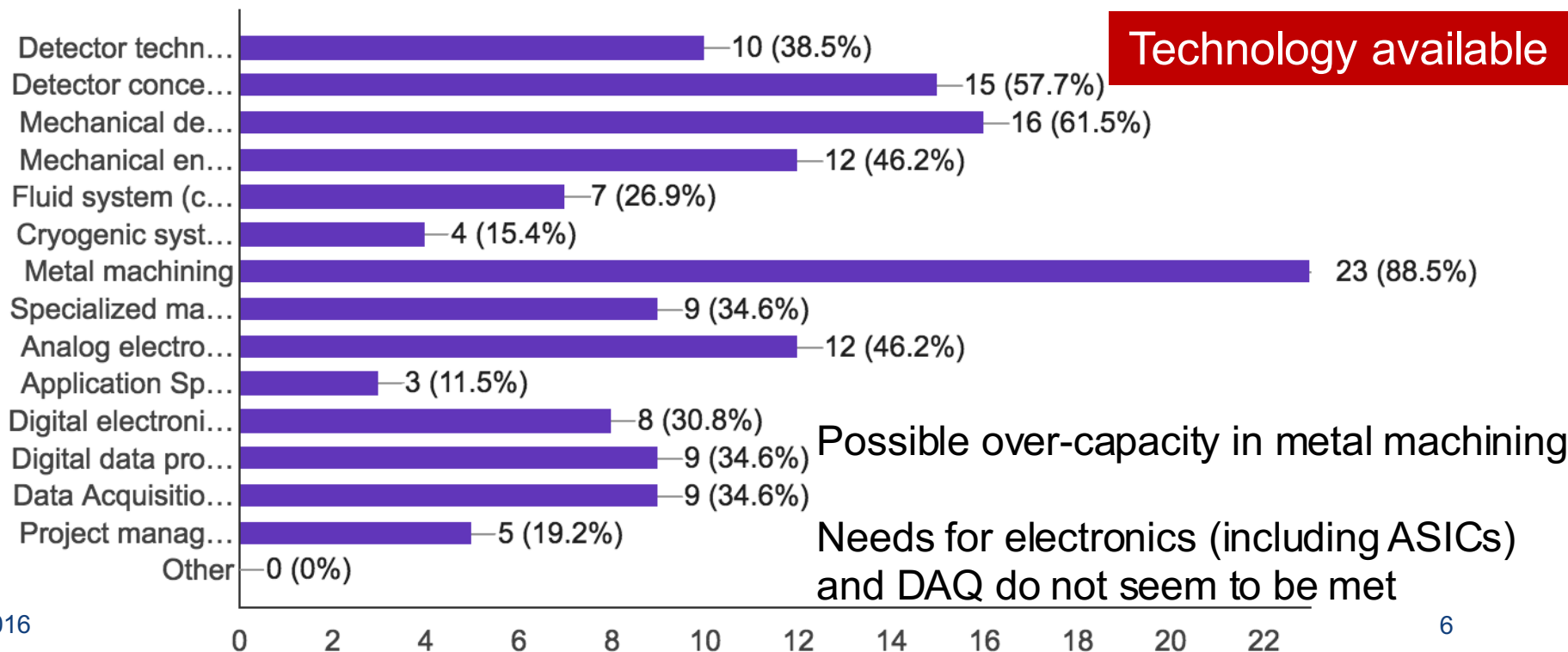
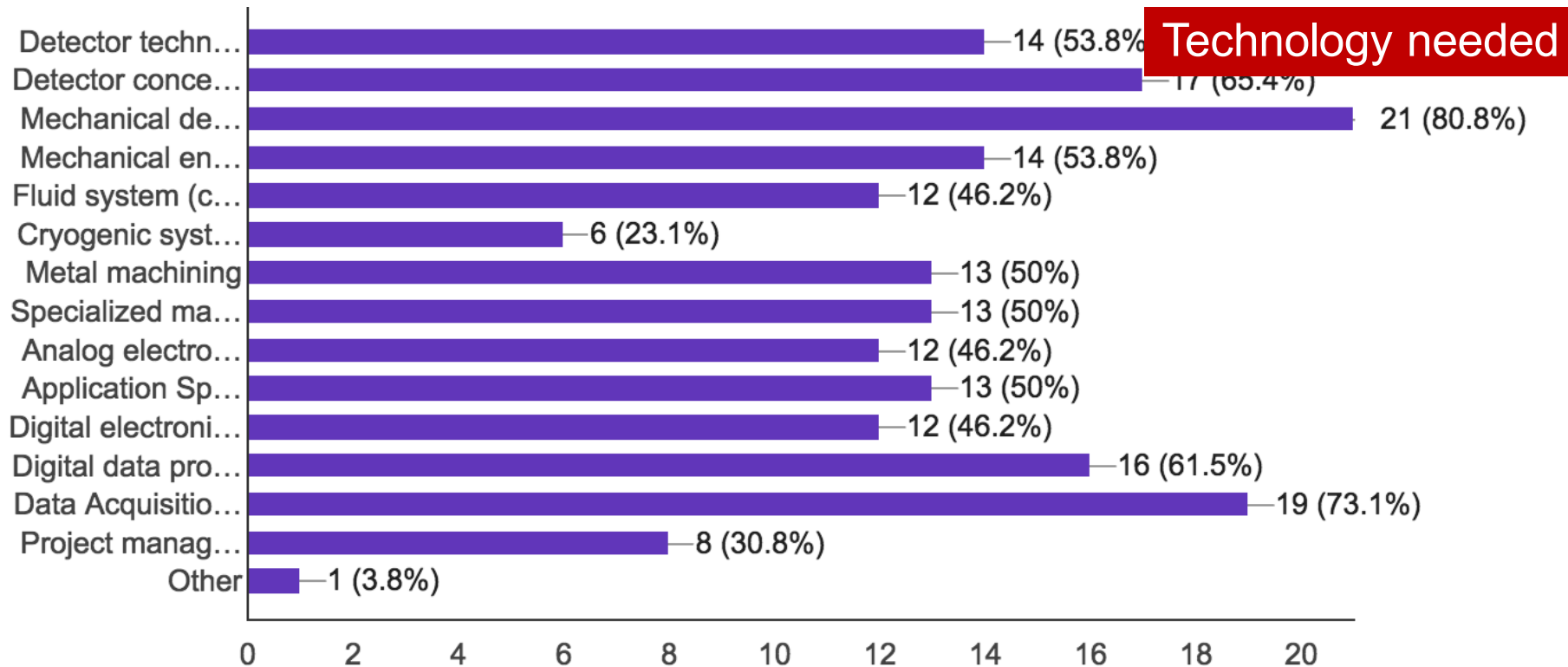
Physics topic



Technology that you foresee using

Technology(s) that you are or foresee using (26 responses)





Technical resources at TRIUMF

- Expertise/capabilities

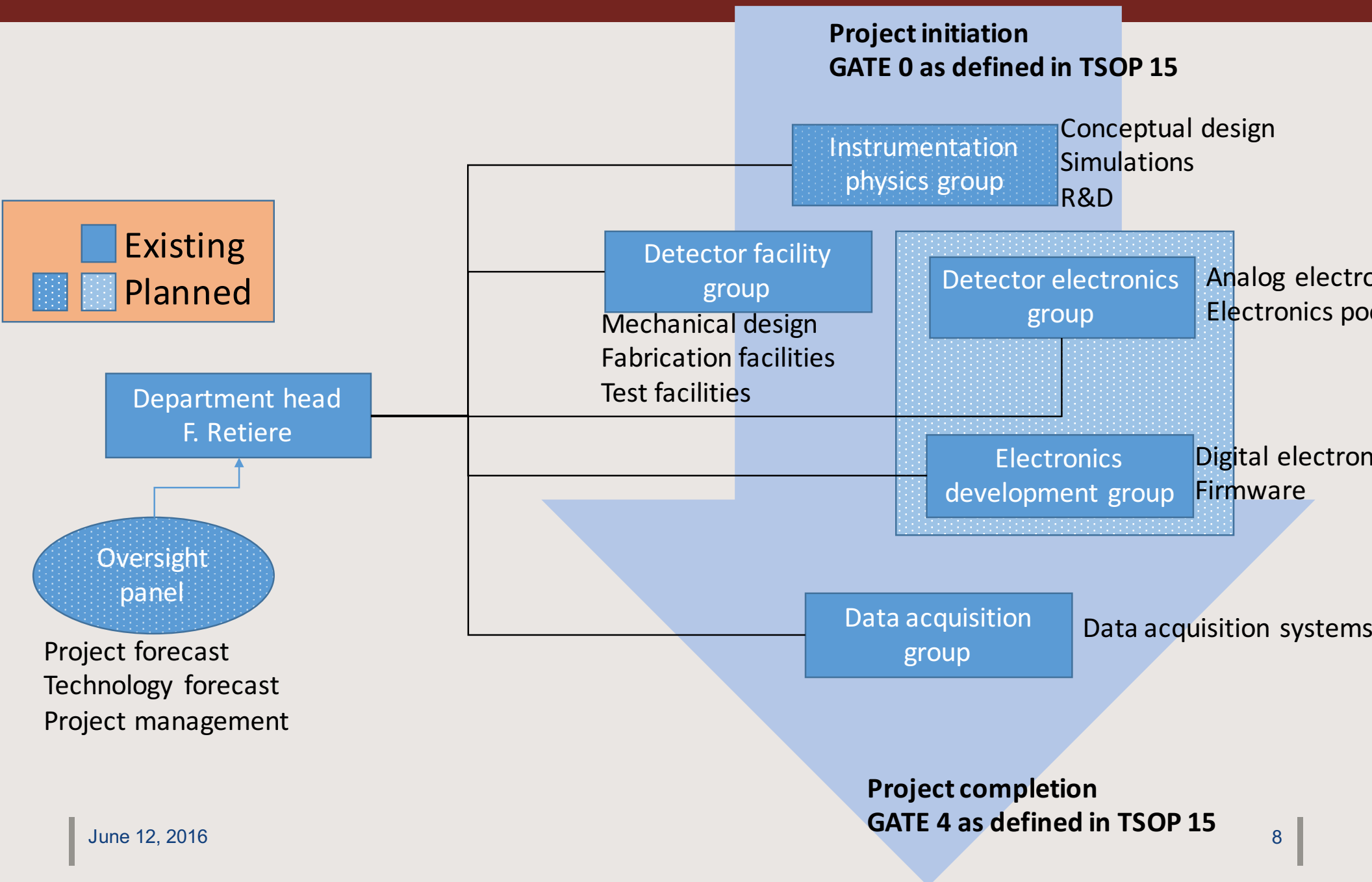
- Detector technology
- Mechanical design
- Mechanical engineering within engineering division
- Machining
 - Metal: main machine shop (limited availability)
 - Scintillator shop for specialized machining
- Electronics
 - Analog & digital but not ASIC
- Data acquisition
 - Focusing on MIDAS, a scalable system

- Science Tech Dept.

- *Instrumentation physics*
 - 2 + 2 physicists
- Detector facility
 - 4 engineers/physicists, 2 technicians
 - Scintillator shop
 - 1 engineer, 2 machinists
- Detector electronics
 - 2 engineers, 1 technician
- Electronics development
 - Moved from engineering division in 2014
 - 3 engineers
- Data acquisition
 - Moved from computing group in 2014
 - 5 engineers/physicists

- Engineering division

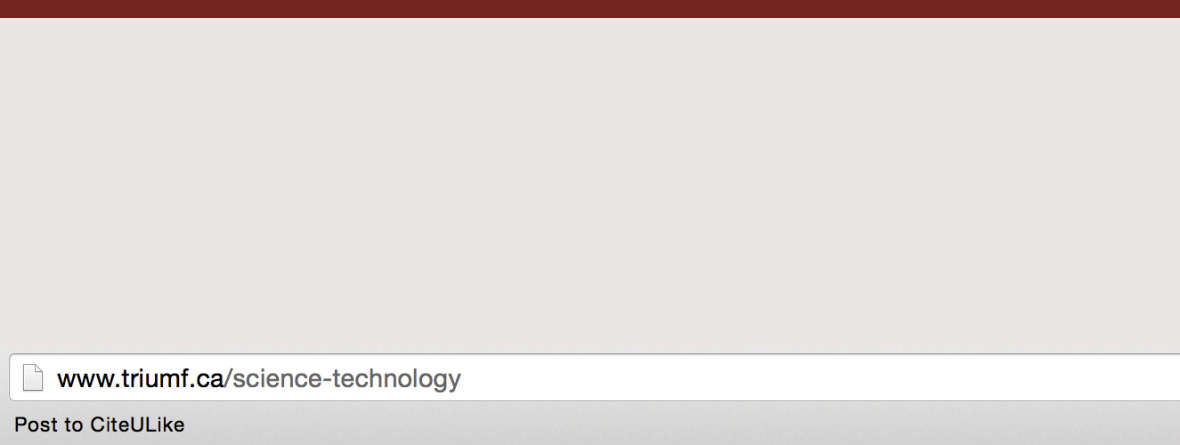
TRIUMF science technology department



Likely expansion within Sci. Tech. Dept

- **Expand project management capabilities**
 - Planning and tracking of resources usage together with TRIUMF project office
 - Develop project managers (dept. engineers)
- **Expand manufacturing and assembly capabilities**
 - New infrastructure for ATLAS-Itk and continued development of new machining techniques
- **Targeted R&D on 3-dimensionaly integrated technology for photon detection and tracking**
 - Expand from photo-detectors (e.g. nEXO) to tracking detector
 - Foster collaboration with strategic partners (U.Sherbrooke)
- **Develop ASIC design capabilities**
 - Projects: ATLAS LAr calorimeter upgrade and water Cerenkov mPMT (IceCube upgrade, Hyper-Kamiokande, new PRISM)
 - Identify a strategic partner
- **Setup infrastructure for on the fly data processing**
 - Projects: ISAC, (DEAP)
 - Easy to use firmware and software tools for physicists

Improving access to TRIUMF resources



TRIUMF Science Technology

Mission: To assist the physics community users in bringing to resources for the design, construction, and commissioning of

To request assistance from the Science Technology Department:

1. Please fill [this form](#). Information regarding the scope of the project and schedule are to be specified. We encourage you to be as specific as possible on your demand in order to evaluate correctly our possible involvement.
2. You will be contacted after initial review of the request for the outcome of the demand. Note that depending on the size of the scope or the Science Tech. resource allocation requirements, a Triumf Gate Review procedure may be initiate.
3. In the case the Sc.Tech. assistance has been granted, you will be given access to our project tracking tool, on which communication with the invovled Sc.Tech. group will take place until completion of the project.

Request Description *
 Description of technical services required

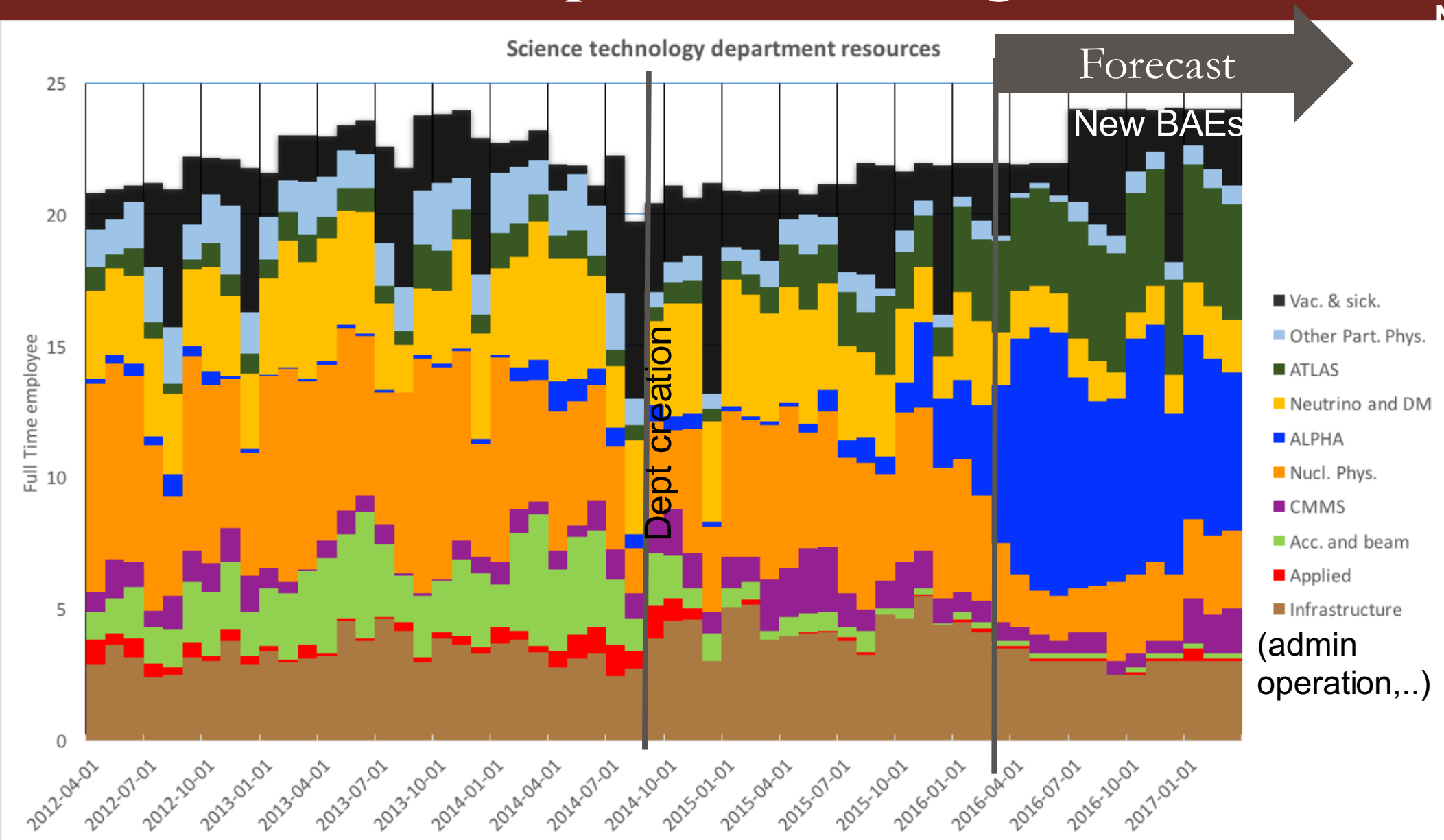
Request Support For *
☐ Simulation
☐ Detector Development
☐ Detector Electronics
☐ Electronics Development
☐ Data Acquisition

Completion Date *
 Year Month Day

File Upload
 No file chosen
 Please be sure to click the 'Upload' button after selecting a file from the file browser.
 Files must be less than 10 MB.
 Allowed file types: txt rtf html pdf doc docx odt ppt pptx odp xls xlsx ods xml bz2 dmg gz jar rar sit tar zip dwg dxf.

File Links
 Please separate multiple links by a new line

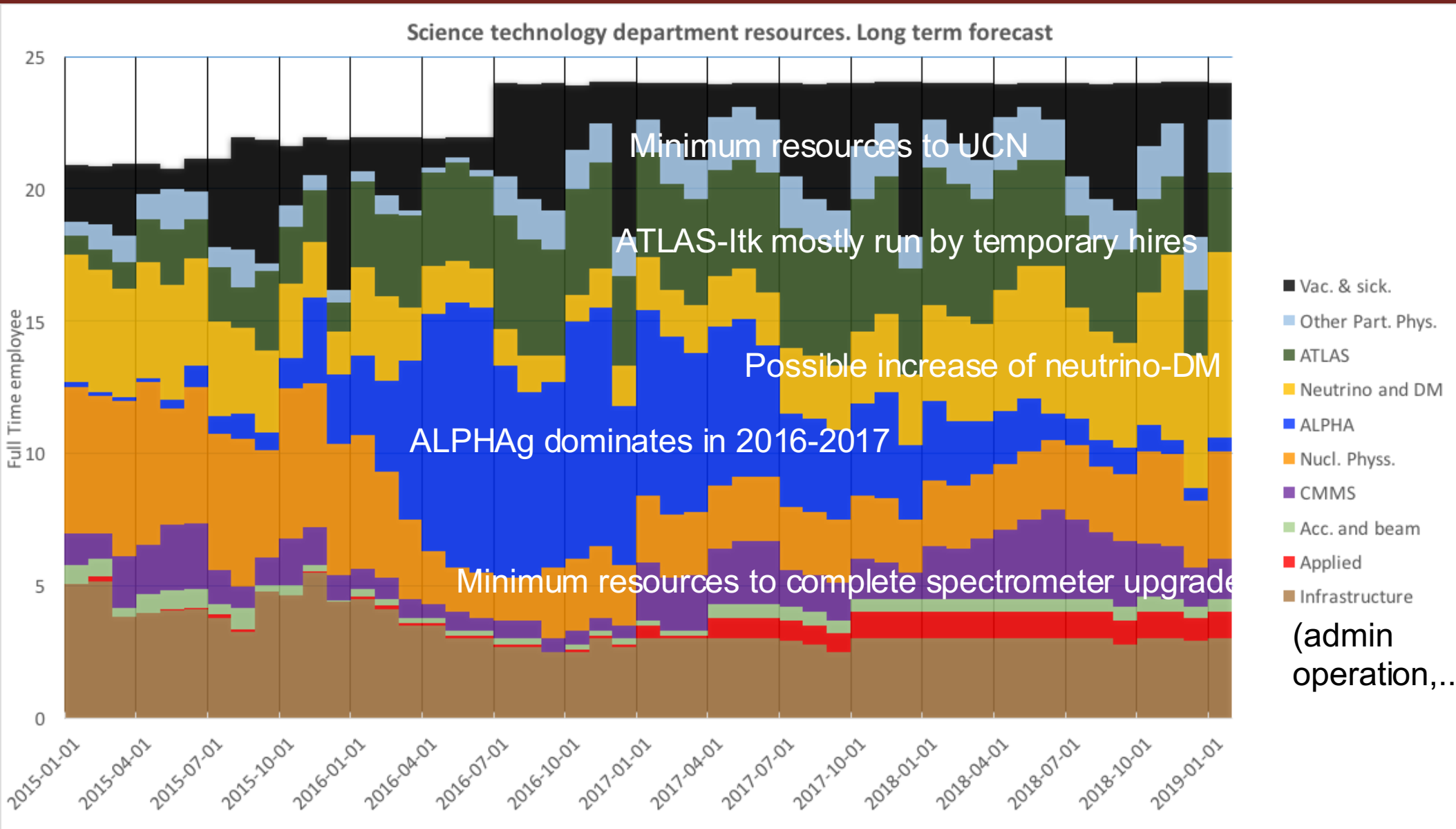
Sci. Tech. Dept resource usage. 2012-2017



Difficulties with forecasting

- **Future projects. Need for technical resources**
 - No major new nuclear physics experiments expected at TRIUMF in next few years though quite a few “small” requests
 - Expect significant contribution to ATLAS upgrade phase 2 effort
 - But exact contribution still being fleshed out
 - Enhanced visibility of SNOLAB program with Nobel prize. May lead to expansion of neutrino and DM physics in Canada
 - Funding uncertainty with most major projects: ILC, Hyper-Kamiokande, IceCube upgrade
- **Funding in Canada**
 - Limited support from NSERC for R&D and equipment (RTI)
 - Experiment construction funded by CFI
 - But not R&D in principle
 - TRIUMF charging for manpower in order to ensure appropriate level of support

A possible no growth scenario



Working together in Canada

- We need cutting edge yet flexible capabilities and expertise
 - To tackle challenging projects with limited long term visibility
 - TRIUMF charging major projects provides flexibility
 - Avoid overbooking (smooth out the bumps)
 - My opinion: TRIUMF direct support for R&D would be most welcome
 - Would promote “high-risk / high-payoff” projects
- A pan-Canadian strategy would enhance efficiency
 - Certainly would help us at TRIUMF sharpen our strategy
 - Hoping it would benefit other program such as MRS

Development of a pan-Canadian strategy

- Scope: management of resources for R&D and experiment construction
- Building from NSERC long range plan
 - With focus on technology
- Form a committee within CINF/IPP?
 - Include Material Science (μ SR/ β NMR), and some applied programs?

Thank you!

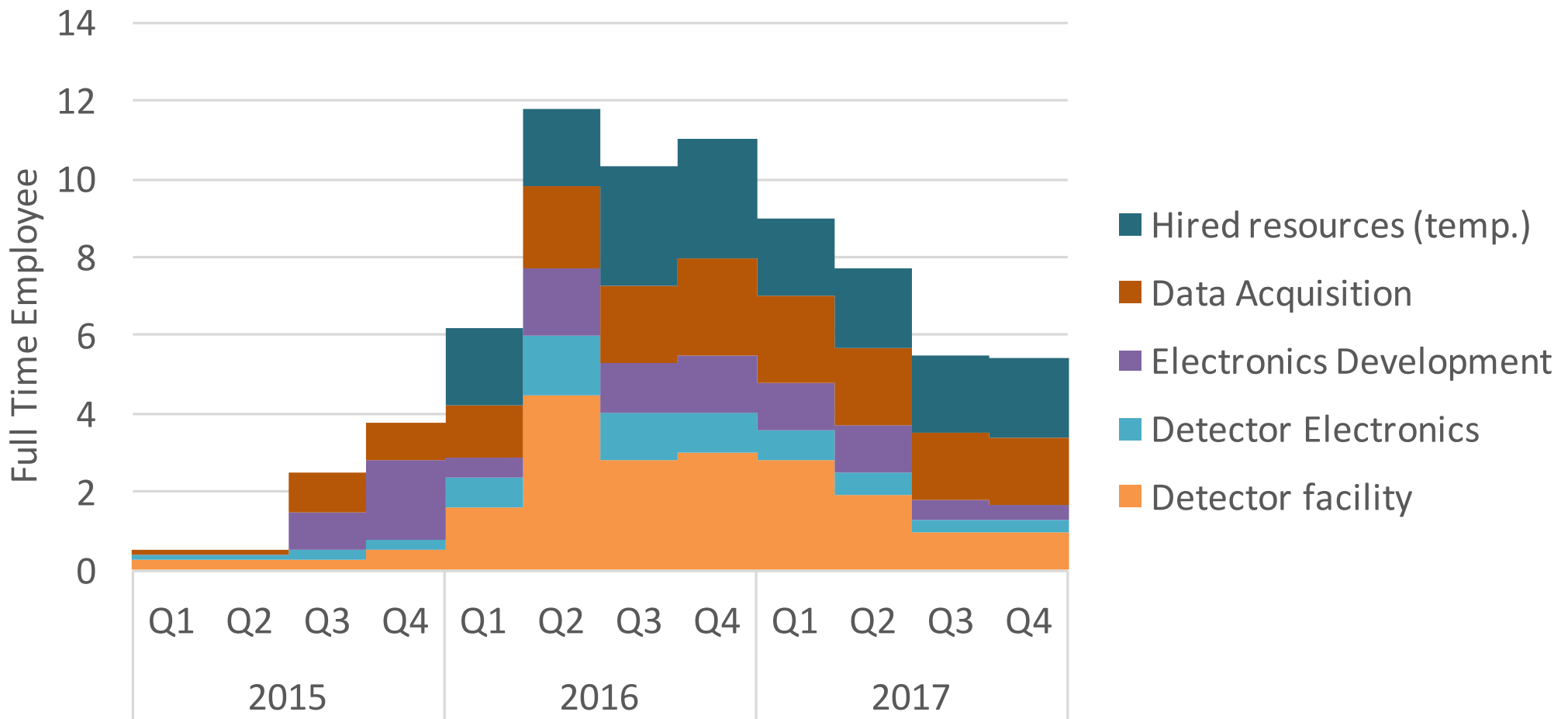
Merci

TRIUMF: Alberta | British Columbia |
Calgary | Carleton | Guelph | Manitoba |
McGill | McMaster | Montréal | Northern
British Columbia | Queen's | Regina |
Saint Mary's | Simon Fraser | Toronto |
Victoria | Western | Winnipeg | York



Resource forecast example

Science Technology Dept. ALPHAg project



Future projects, anticipated

Sources: NSERC Long Range Plan, TRIUMF projects reviewed by PPAC, AAPS (applied)

Project	Technology	Time scale
ATLAS LAr electronics (upgrade 1 & 2)	Passive and analog electronics	2014-2025
ATLAS-Itk (upgrade 2)	Silicon strip, precision assembly	2016-2025
Direct dark matter search	SuperCDMS (DAQ), NEWS? (gas) LAr or LXe (large area photo-detector)	2017-2020 2020+
International Linear Collider Detector	TPC (gas), calorimeter	Possible
Water Cerenkov(NuPRISM, PINGU, HK)	Assembly, photo-detector, electronics	2015-2025
ALPHA _g	TPC (gas), elec., DAQ, photodetector	2016-2018
Ultra-cold neutron	Beam control, and?	Possible
nEXO	Photo-detector, assembly?, DAQ?	2015-2025
MOLLER (JLab)	Analog electronics	2017-2020
Electronics for ISAC experiments	Analog and digital electronics, and DAQ	2016-2018
Detectors for ISAC experiments	Gas, photo-detector	2016-2020
CMMS spectrometer(s) upgrade	Precision assembly, SiPM, DAQ	2014-2020
Applied (PET, neutron det.,...)	Scintillator, SiPM, electronics, DAQ	Possible
Beam instrumentation	Digital driver and possible high voltage	Possible

Strategy 1. Re-organize

- Create an instrumentation physics group
 - Goals: support (user) projects conceptual design & Drive the detector R&D effort
 - Include BAEs and simulation, data analysis experts
- Create an oversight panel (not a formal group)
 - Goals:
 - Help forecasting (and attract new projects)
 - Develop technology development strategy (including R&D)
 - Help develop strategy for technology transfer and commercialization
 - Review department operation
 - Group composition: 50% internal (group head+BAE) and 50% external (users)
- Merge the electronics group
 - Goal: maximize synergies and realize growth potential
 - Will need to add one more technician eventually as support for small projects is lacking
- Identify a source of funds for supporting R&D and infrastructure upgrade
 - Need to identify opportunities together with TRIUMF management

Strategy 2. Support core competencies

- Detector technology: gas, solid-state, photo-detector (for scintillator and Cerenkov detectors)
 - Provide some support for simulation effort
- Mechanical design and construction
 - Micro-structure and micro-machining with $<50\mu\text{m}$ tolerance
 - More system requiring cooling including constricted environments
- Electronics
 - Analog: discrete front end
 - Digital: digitizer, data collector and significant firmware development
- Data acquisition
 - Continuing support of many experiments using the MIDAS platform

Strategy 4. Connect

- Improve department webpages
- Setup a user interface for requesting services
 - Eventually connected to a workflow system
- Enhance exchanges with existing technical groups in Canada
 - Use NSERC MRS resources for TRIUMF driven projects (e.g. ALPHAg)
 - Organize workshops to share expertise
 - Develop a pan-Canadian strategy for providing technical support to SAP
 - Find a balance between TRIUMF, SNOLAB and University based resources
 - Identify needs and core competencies
- Setup or formalize collaborative ties with foreign laboratories (MOU)

Projects in the department 2016-2017

- Projects to be completed in 2016: DEAP, EMMA, GRIFFIN electronics
- Projects to be completed in 2017: μ SR 3T spectrometer, new digitizers
- Project to be completed in 2018: ALPHAg
 - Significant funding coming from CFI
 - will require about 50% of the department resources in 2016-2017
 - Project managed within department in partnership with proponent. Project planning completed in May 2016 (GATE 2). Final design (GATE 3) expected in September 2016.
 - Significant contingencies (40%) to ensure project success but impact on flexibility
- Several projects associated to upcoming CFI application ramping up
 - Silicon assembly infrastructure to be commissioned in 2016

Internal considerations

- **Manpower**

- 3-5 retirements expected in the next 5 years
- Prospect for growth is unclear
 - Consider opportunity of growth through soft money

- **Infrastructure**

- Some aging infrastructure and equipment. Last major upgrade ended in 2005
- Significant upgrade in 2015-2016 driven by ATLAS-Itk
 - Upgraded clean room, wire bonding capabilities
- Testing facility is mostly adapted for gas detectors
- Groups scattered through site