TRIUMF

User Services Newsletter

Volume 2 | No.1 June 2019

A Message from the Physical Sciences Division ALD – *Jens Dilling*

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Dear Friends and Colleagues,

Welcome to the third newsletter. We are happy to share with you that the Canadian Federal Government endorsed the next TRIUMF 5 Year Plan (5YP), which was put together cooperatively by management and users over the last year. The government will provide $292.7 million over the next 5 years (2020-2025), representing an increase of over 30% compared to the previous 5 Year funding. This puts TRIUMF in a strong position to continue the user programs and start the ARIEL programs.

The next 5YP also puts strong emphasis on talent development and user engagement, and in order to facilitate this, the directorate at TRIUMF will organize and facilitate this for all science and research aspects of TRIUMF. Marcello Pavan has moved from the Physical Science Division (PSD) to this new office within the directorate and will continue to help our users. The PSD User Liaison Scientists will continue to be available for you and will be supported by Marcello.

I am also happy to welcome two new ISAC scientists dedicated to supporting key experimental facilities: Annika Lennarz (gamma detectors) and Andrea Teigelhoefer (laser and ion traps). They join Martin Alcorta (reactions and detectors), who has been in this role for a few years now, to fashion a formidable support team for users.

TRIUMF is making some structural changes to the buildings, in particular in ISAC II, where more and more space for users and students is urgently needed, especially in light of the future ARIEL user program. We have therefore moved the experiment counting rooms in ISAC II (ISAC II 247/8) to a new location at the east side of the ISAC II experimental hall and made room for extra offices for students and post-docs.

For ARIEL, the CANREB systems are currently undergoing commissioning and we are hopeful to be able to start the user program using CANREB this year. In order to facilitate this, we are organizing a workshop as part of the 2019 Science Week. Also, during Science Week we will celebrate 20 Years of ISAC operation and science.

If you have any questions or comments, please feel to reach out to me (jdilling@triumf.ca) or the Liaison Scientists (see articles below).

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Improvements for Onboarding Visitors – *Anne Trudel* atrudel@triumf.ca

TRIUMF is streamlining the administrative workflow for the Visitor Application process related to issuing an access card and radiation badge.

Effective June 1st, we request that *visitors must complete their application one week prior to the start of their visit.* This would include providing all the information required for issuance of an access card and a radiation badge as well as completing the required training - Safety Orientation and Basic Radiation Protection. Adhering to this timeline will ensure that we provide all visitors with their required credentials upon arrival.

TRIUMF contacts should ensure that the invitation is entered in the Visitor Application database well ahead of time to provide visitors the time to complete requirements one week ahead of their visit. For requests that lack the one-week lead time, the radiation badge and access card may not be ready upon the visitor's arrival. In this case, alternate arrangements will need to be made and this will delay the onboarding process. (n.b. anyone escorting a visitor through Stores to obtain a direct reading dosimeter must be a TRIUMF Safety Supervisor.)

Thank you for helping us improve the TRIUMF visitor experience, as we work to ensure better delivery of services to visitors and minimize delays at the time of arrival.

-Environmental Health and Safety (EHS) & TRIUMF Administration

Nuclear Physics with Isotope Beams – *Martin Alcorta* malcorta@triumf.ca

Many thanks to all the users who have filled out the ISAC exit surveys. We are already making improvements on our communication in the operations group as a result of the feedback we have received. The survey itself is undergoing a few changes as we move it to the Office 365 platform. The survey is still accessed via the scientific visitors homepage. In addition, we have now formed a user survey committee which will be tasked with analyzing responses from the surveys as they are received. This will ensure that issues which were identified during beamtimes will be responded to promptly and by the appropriate groups within the different divisions. The committee will consist of myself along with the two experimental officers and three members from the accelerator division.

An option is in place for those users who would prefer only the liaison have access to the responses. In the near future, we hope to have an anonymous feedback system in place which all users (not just the spokesperson(s) as for the survey) will be able to use. The existing survey and other feedback mechanisms will be discussed with users during the beam delivery meeting.

Science Technology - *Thomas Lindner*

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The goal of the Science Technology Department is supporting the physics community in bringing to reality their projects by providing technical resources for the design, construction, and operation of experiments and other apparatus. The Science Technology Department has started using a new project management framework, called Project Insight, for managing our projects. Project Insight will provide better tools for users to monitor Science Technology projects, as well as improving estimates of project resources and timelines. Work requests submitted through our webpage automatically go into Project Insight and will be evaluated and assigned by the head of the Science Technology Department.

A user survey that will allow users to provide feedback to the Science Technology Department upon the completion of projects is nearing completion. It will be based upon TRIUMF's new Office365 framework and can be accessed here.

Further details on the different services provided by the department and the procedure for requesting assistance is provided on our website: http://www.triumf.ca/science-technology.

Centre for Material and Molecular Science - *Iain McKenzie*

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μSR experiments began in early May and have been scheduled until September 3rd, 2019. ^{8}Li βNMR will run from July 16th to July 30th and ^{31}Mg βNMR will run from October 9th to 12th. *Beam requests for μSR experiments during September 3rd to December 3rd, 2019 and βNMR during October 15th to December 24th, 2019 must be submitted by June 25th, 2019* via the Physical Sciences Division Dashboard. Shifts allocated at the MMS-EEC meeting on June 17th-18th, 2019 can be used in the Fall beam period. There will be a mini-shutdown from September 30th to October 7th.

Recent and ongoing developments at the CMMS:

1) The CMMS group has hired two new scientists; Kenji Kojima and Sarah Dunsiger. They have been hired as TRIUMF Board Appointed Employees (BAEs), which are equivalent to faculty at Canadian universities and are eligible to apply for external funding. In addition, Iain McKenzie has been promoted to a BAE position. These three new BAE scientists will advance the in-house scientific program and form collaborations to bring in new users.

2) The repair of the M9 beam line's connection to the pion/muon production target is ongoing. A new front-end quadrupole magnet doublet will be installed in the 2020 winter shutdown which will enable the commissioning of M9A with surface muons. Beam delivery to M9A is anticipated at the beginning of the Summer 2020 beam period when the beam line and new, dedicated 3T spectrometer with APD detectors will be commissioned. User operations are anticipated in the Fall 2020 beam schedule. The M9A beam line and spectrometer will be optimized for rapid sample characterization with user-friendly operation.

3) A collaboration of Canadian μSR groups (led by Jeff Sonier) and TRIUMF has received funds from the Canadian Foundation for Innovation (CFI) and matching funds from the provincial governments of British Columbia, Ontario, Quebec and New Brunswick for a $10.7M project to redevelop the high-momentum M9B channel into one geared for μSR research into quantum systems under extreme conditions of high pressures, high magnetic

fields, and very low and very high temperatures. The beam line, to be re-christened as M9H, will be optimized to produce transversely-polarized muons at all practical momenta and thus excel at high transverse-field (TF) μSR. To this end, the new M9H includes a new spectrometer based upon on a 4T superconducting omni-directional Helmholtz magnet that will accommodate a 50 mK dilution refrigerator specifically designed for high-pressure cell experimental targets (~ 2.5 GPa). M9H will also support the insertion of high-pressure liquid or gas target sample cells under extreme conditions (temperatures to 1000 K and pressures to 0.6 GPa). We anticipate commissioning of the M9H beam line and spectrometer in 2023 with user operation shortly thereafter.

4) Graeme Luke (CAP Brockhouse Medal 2019), Jeff Sonier, Rob Kiefl and Andrew MacFarlane were recently awarded a grant from the NSERC Research Tools and Instruments Grants Program for a ^{3}He cryostat for the NuTime spectrometer. This will be ready for user operation in Fall 2019.

5) A new βNMR spectrometer is being constructed that will have in-sample-plane magnetic fields of up to 2 kG and temperature down to 300 mK. The first stage, which involves rebuilding the βNQR beam line to with new electrostatic optics and beam tuning diagnostics, will be completed in the 2019 winter shutdown. The second stage, which will involve extension of the beam line past βNQR and installation of the mid-field magnet, is planned for Fall 2019 with user operation in 2020.

6) 6) There will be reduced availability of βNMR in 2019 due to the delayed startup of ISAC. This year, as in 2018, we are anticipating approximately four weeks of 8Li βNMR, instead of the usual five weeks, and one week of ^{31}Mg βNMR. The delayed startup is due to personnel being shifted to tasks related to the completion of the Advanced Rare IsotopE Laboratory (ARIEL). ARIEL is TRIUMF's flagship multidisciplinary research facility and will broaden Canada's research capabilities in particle physics, nuclear physics, nuclear medicine, and materials science by tripling TRIUMF's output of rare isotopes for research upon completion in 2023. The βNMR facility will see an increase in beam time starting in 2021 and eventually reaching 15 weeks of beam per year. Additional developments to increase the amount of beam delivered to the βNMR facility are in progress, including rapid beam switching (kHz) between the βNMR and βNQR, which will allow simultaneous and independent running of both spectrometers.

M11 Beam Testing – *Isabel Trigger*

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The M11 beamline is ready to accept requests for beam to test new equipment, and its first customers already have been booked. This summer students at the GRIDS2019 summer school will again use M11 for training on techniques used in experimental beam lines. Later this year the HyperK collaboration will be engaging in some detector studies. If you are interested in using M11 for testing, please submit a proposal to the SAP EEC, or contact Isabel Trigger.

Isabel Trigger is the new M11 Facility Coordinator, succeeding Stan Yen. Patrick De Perio was appointed deputy. Users having completed their beam time on M11 are asked to fill out the new user survey, which can be accessed via the scientific visitors homepage.

Beam Schedule Update - *Chris Ruiz*

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TRIUMF Schedule 136 commenced on April 15th this year, with the operation of beamlines 1B and 2C for Proton Irradiation Facility, before beamline 1A started operation on May 8th for the Meson Hall Molecular & Material Sciences program. Beamline 2A will start up on June 17th for the ISAC program, with beam ready for setup to experiments on June 20th.

The ISAC program begins with the newly repaired TM2 module in the East target station, fitted with a tantalum target and surface ion source. Experiments in this block, mainly utilizing rotating proton beam capabilities, will focus on ISAC II experiments at SEBT1 and IRIS, as well as producing ^{8}Li for the beta-NMR/NQR program. This target will be run until August 6th, to allow for completion of critical TM4 source tray work before that module goes into the West station, with a uranium-carbide target and surface source. In particular, this will produce high-intensity ^{7}Be beams for implantation and the astrophysics program. That will be followed by a zirconium-carbide target with a surface source, notably for the first SAP-EEC approved EMMA experiment, the radiative proton capture on ^{83}Rb. Schedule 136 at ISAC ends on September 30th for the mini-shutdown,
though the uranium-carbide target will remain in place and start up for one extra week as the beginning of Schedule 137.

Significant blocks of time have been committed to the commissioning of the CANREB facility, both using the off-line ion source (OLIS) and ISAC in this schedule. We thank users for their patience as we develop this important facility, which will greatly benefit users ultimately.

Note that CMMS experiments for September have not yet been scheduled, and Iain McKenzie will do so after the next Call for Beam Requests, which will go out prior to the summer SAP-EEC meeting.

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Target and Ion-Source Updates – *Carla Babcock, Alex Gottberg, Jens Lassen*

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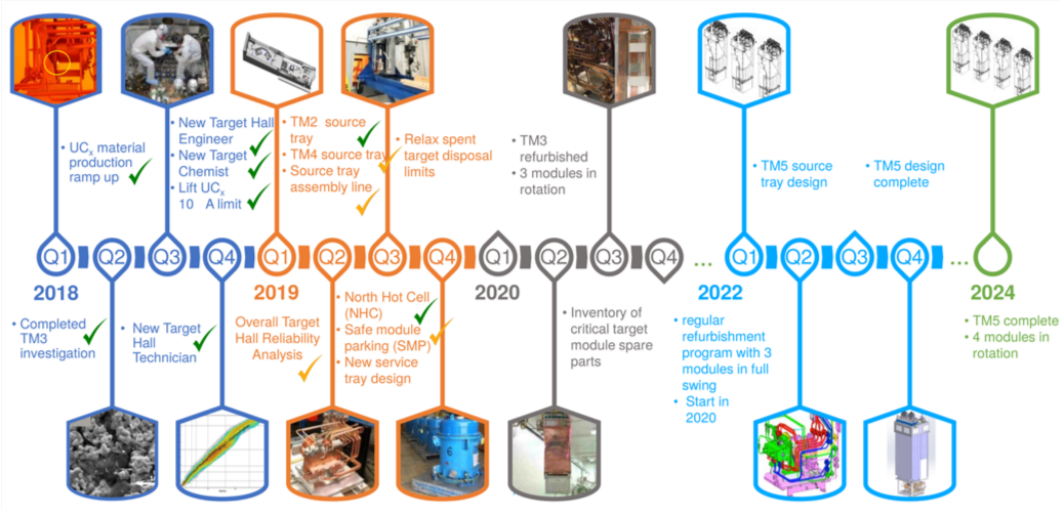
In the last newsletter's update, we reported on several infrastructure projects in progress, including the new hot cell and safe module parking, the installation of new source trays on Target Module 2 and 4, and the re-development of the disposal chain for irradiated targets. We are pleased to follow up here on the success of these projects.

The completion of the North Hot Cell (NHC) and the installation of the Safe Module Parking (SMP) is the realization of a long-term goal for the ISAC facility. In the next running period (schedule 136), and for the first time at ISAC, these two installations will provide the operational flexibility to have a hot cell continually available for routine refurbishment tasks, such as work on TM3.

A refurbishment task of importance to ISAC is the replacement of source trays on the modules. The function of the source tray is to hold the target itself, as well as the extraction optics and the distribution system for all cooling, power and other services required for target operation. This system is ageing rapidly during operation due to high temperatures, high radiation and mechanical stresses, and thus requires regular replacement to avoid component failures. During this winter shutdown, two source trays will be replaced, which is unprecedented. The TM2 source tray has been replaced successfully and we are in the process of replacing the one on TM4. The new source trays have design modifications to reduce the risk of high-voltage breakdown and damage to insulators. It is anticipated that this results in more reliable target modules. The main issues with high voltage are being addressed in a wider context, as many of the large, complex and activated components have never previously been replaced. The new ISAC infrastructure (NHC and SMP), addressed above, is making it finally possible to address these ageing and failing components.

The continued operation of ISAC relies not just on reliable equipment, but also on our ability to regularly dispose of irradiated targets by shipping them to the CNL disposal facility in Chalk River, ON. We were required to develop new shipping containers and rigorously test them in order to have our shipping procedure re-certified. This was successfully accomplished, and one shipment of 5 spent targets has gone out, with two more planned for this year. This frees up much needed space in the target storage vault to store newly irradiated targets. The timeline below is an updated version of the one found in the last newsletter, with completed tasks shown in green and in-progress tasks shown in orange.



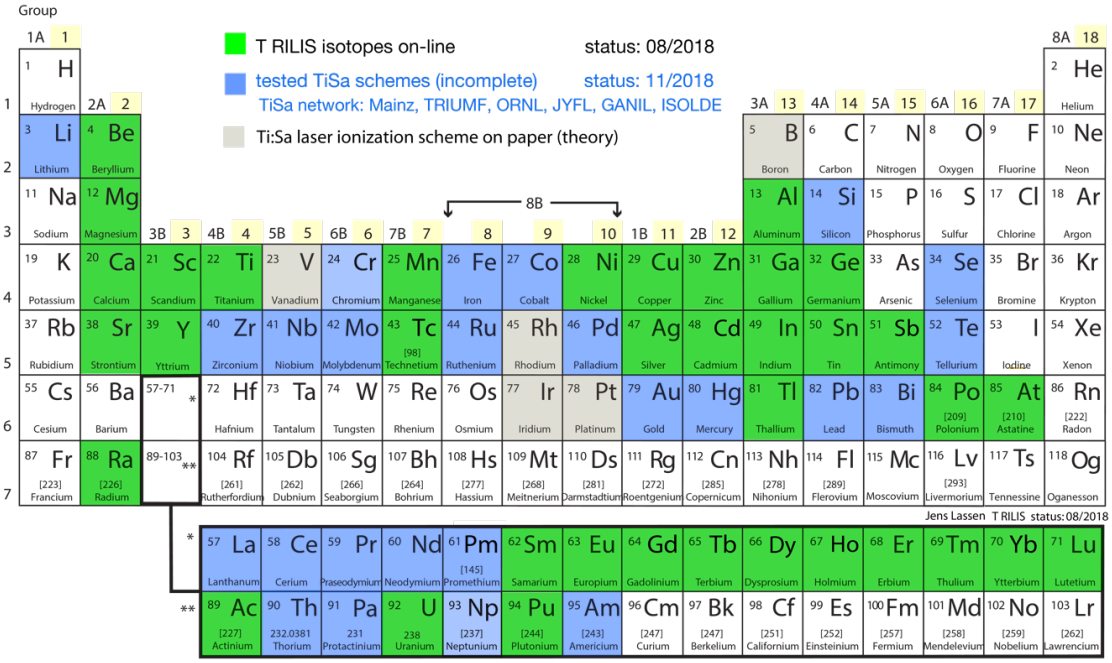
With infrastructure upgrades well on their way, we turn to ongoing target development. This past running period saw several new achievements. To begin with, the first target made of a nano material, nanoSiC, was run online in October 2018. 50 μA of protons were put on target during this run, and the target material survived well in the online environment. Some yields were improved, and selected yields are now included in the online database. This is an important first step towards the development of more exotic target materials for use at ISAC.

Another milestone in target material production was reached with the first online run of a UCx target made with using a newly developed “1-step” process. For more information on this process, see https://doi.org/10.1016/j.nimb.2019.04.058. The previous process for UCx production was very time intensive, limiting the number of these targets that could be run per year. As reported in the last newsletter, the dramatically increased speed of this new process lifts this limitation. The first 1-step target was successfully run online in December 2018 and all yields were within normal parameters. All future UCx targets are planned to be made in the same way, allowing us to produce material according to demand and giving us the flexibility to optimize the production of radioisotope beams for the ISAC user program.

First 1-step UCx target after irradiation with 20 μA of protons at ISAC. Target and target material show no signs of ageing. Picture taken in the ISAC south hot cell.

The first run with the 1-step UCx target was also a first chance to test the ability of our actinide targets to withstand higher proton currents. Historically, TRIUMF has operated under a limit that restricts the rate of protons we can put on any actinide target to 10 μA. We are pleased to announce that our license has now been modified to limit instead the total charge per irradiation and per target material thickness. Using our previous license, we were operating at about 15% of what the new limit allows, meaning that if the target can survive, we have the opportunity to operate at increased proton beam currents as well as to operate these targets for longer periods of time. The preliminary tests with 20 μA conducted on the 1-step UCx target at the end of 2018 showed no signs of target material ageing. This opens the door to developments that may increase yields, and tests will continue during the next running period.

Development capabilities for new nuclear spin polarized elements have been added to allow new laser systems for development activities in parallel to polarized beam delivery. Spin-polarized Mg beam delivery – with high-power UV laser light for optical pumping has become routine. A new ion polarization scheme has been developed allowing for rapid changeover between atom and ion beam polarization. The He reionization cell can now permanently stay in place. The additional benefit of these improvements is that Mg^{2+} spin-polarized beams can, if desired, be produced by double ionization in the He cell and be delivered to any location downstream without polarization loss, due to the zero electronic magnetic moment of Mg^{2+}.



Currently available laser ionized elements (green) and ready to test elements (blue). In 2018 optimized RILIS schemes for La and Pm have been developed off-line and are ready for on-line yield measurements.

Off-line new resonant laser ionization schemes for La, Pr, and Tm were developed. On-line, the new ionization scheme for Tm was employed. In addition, higher beam delivery complexity was tested with concurrent laser ionization of 225Ac/Ra for increased implantation yields for medical isotope research. Further, the yields for Y were improved and a needed pilot beam for IG-LIS was tested, i.e. laser ionized U. On the instrumentation side a system upgrade to dual pump laser operation improved setup and switchover times.

Beam delivery highlights 2018 and outlook for 2019 – *Friedhelm Ames*

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All beam lines from the cyclotron were in operation during 2018. Start of BL2A (ISAC) was scheduled later to free up resources for ARIEL/CANREB installations. The total availability of the cyclotron was at 85% of the scheduled time. Main sources for the down time were failures in the rf system and power outages. Planning for refurbishments and improvements of the rf system are on the way and will be applied during the next few years. The implementation of results from developments for performance improvement of the H^- ion source (see K. Jayamanna, et al. MIMA 895, (2018) 150) let to a substantial reduction in maintenance time for the source from about 1 day every 3 weeks to one day every 6 months. This was already reflected in the schedule.

Highlights of the beam delivery at ISAC in 2018:

- The first βNMR experiment with polarized neutron rich Mg isotopes
- The first operation of a uranium carbide target with a cold transfer line FEBIAD source, which delivered clean beams of neutron rich noble gas ion beams to GRIFFIN and TITAN
- A development run with nanofiber target material (SiC), which proofed stable operation with those materials and improvements of some yields of Na, Mg and Al isotopes.
- The change in the operating license to allow higher beam current on uranium targets. The last 2 uranium carbide targets have been operated with up to 40 μA proton beam current, with substantial increase in the yields.
- Development of several new laser ionization schemes for lanthanide elements.

Developments to facilitate beam delivery, especially with the increased demand for the ARIEL era, and to improve quality of the delivered beams are done in a collaborative approach with beam physics, beam delivery, operations and controls groups. A common platform to deploy high level applications for the set up and tuning of all machines has been established (see C.B. Barquest et al, Proceedings of IPAC'18, JACoW.org) and several applications both for ISAC and e-linac operation are already in use. New applications especially for the operation of CANREB are presently being implemented and tested during the commissioning of The CANREB devices.
In 2019 the shutdown for ISAC has been extended again. Additionally, to the work on ARIEL/CANREB, the resources freed are also being used for ISAC upgrades and refurbishments.

Main goal for the beam delivery in 2019 is the finishing of the commissioning of the charge breeding system of CANREB and first tests with radioactive beams from ISAC.

TRIUMF Users Group Update – *Gwen Grinyer*

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What are TUG and TUEC and how do you become a member?

The TRIUMF Users Group (TUG) is a formal organization of scientists and engineers whose professional activities have special interest in the use of the TRIUMF facility and/or TRIUMF resources. Becoming a member of the TRIUMF users group is free and is open to all TRIUMF users in all TRIUMF disciplines. We encourage everyone who is not yet a TUG member (including students and postdocs!) to please sign up via the TUG mailing list at:

http://lists.triumf.ca/mailman/listinfo/triumf-user

The TRIUMF Users Executive Committee (TUEC) for 2019, as elected by the TUG membership, are:

- Gwen Grinyer, University of Regina, Chair
- Caterina Ramogida, Simon Fraser University, Chair elect
- Ania Kwiatkowski, TRIUMF, Past Chair
- Christian Diget, University of York (UK), Member
- Sarah Dunsiger, TRIUMF, Member
- Alex Gottberg, TRIUMF, Member
- Blair Jamieson, University of Winnipeg, Member
- Marcello Pavan, TRIUMF, Liaison

For any TRIUMF user-related questions, concerns or suggestions please feel free to contact TUEC at any time by sending an email to tug@triumf.ca. We want to hear from you!

TUG AGM 2019

The annual general meeting (AGM) of the TRIUMF users group will be held on Thursday August 22 as part of TRIUMF Science Week 2019. This full-day event will bring together users from across all TRIUMF disciplines to highlight recent research and discuss future perspectives for user-driven science at TRIUMF. Confirmed invited speakers include: Andrea Capra (TRIUMF), Graeme Luke (McMaster), Anna McCoy (TRIUMF), and Dennis Muecher (Guelph). This year's AGM will also be awarding $1000 in student cash prizes for the best student talk and best student posters at our poster slam competition! More information on how to enter will be sent out via the TUG members email list so sign up to be a member today (see instructions above) and stay tuned!

END

If you have any questions or concerns regarding the contents of this newsletter, please contact Marcello Pavan at marcello@triumf.ca; or Allayne McGowan - PSD Administrative Assistant, at sciencediv@triumf.ca