RIB Target and Ion Source Development at TRIUMF

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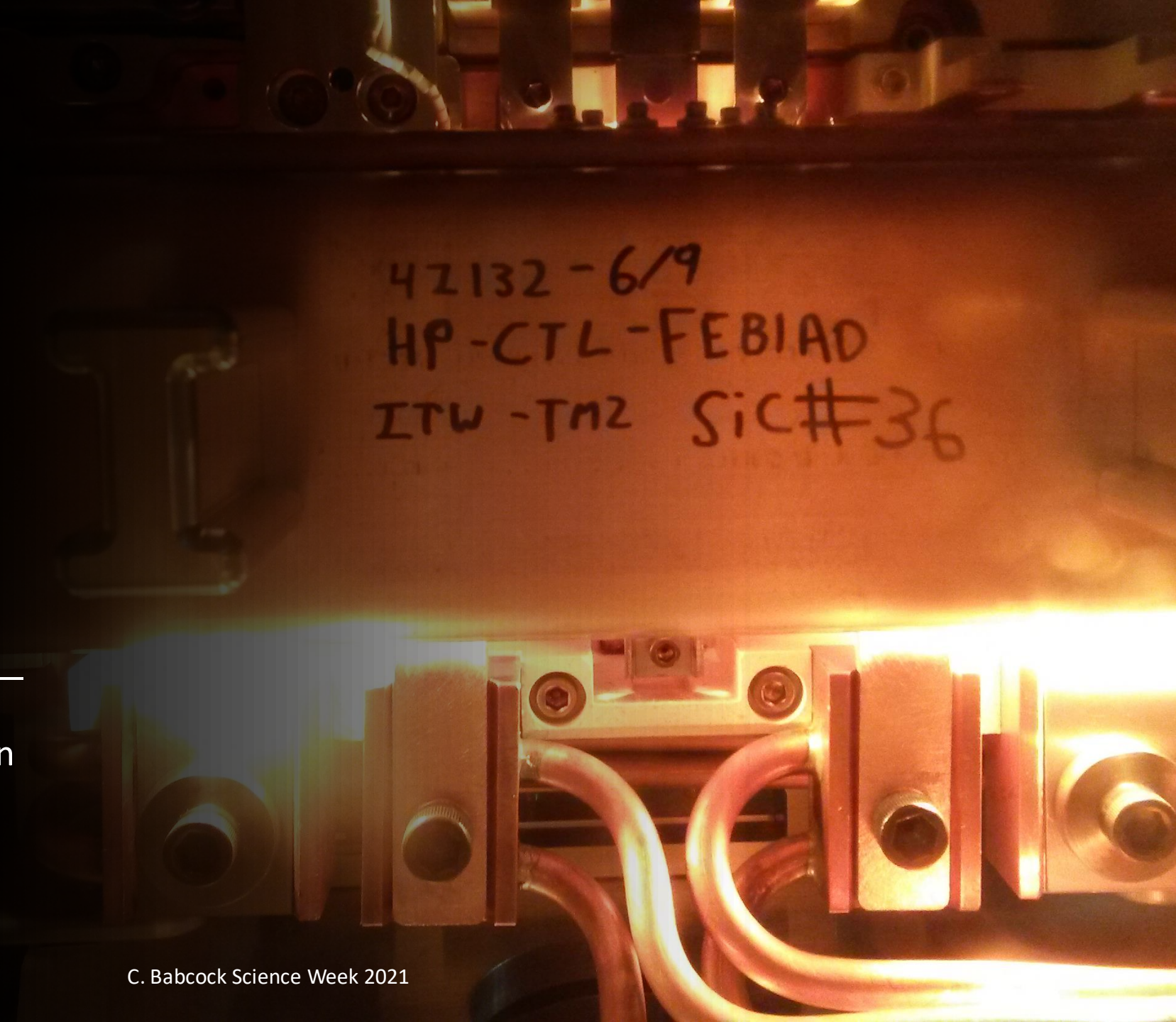
Science Week 2021



RIB Development Strategy

- Beam development is carried out by the Targets and Ion Sources group and Beam Delivery group on a regular basis

All development work is done for user benefit with the end goal of improving science output

- Development efforts must be balanced:
  - Short term developments
  - Long term projects
  - Ongoing beam delivery requirements

User needs are top priority

- Feedback from users highlights priorities:
  - Increase the types of beams
  - Increase the quality of beams delivered (intensity/purity)
  - Increase the availability of beam time
  - Increase the flexibility of ISAC
  - Increase the reliability of ISAC

Examples of recent/ongoing work

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New yields of Sn and Sb from the laser ion source team

Examples of recent/ongoing work

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Graphite target designed to increase 7Be yields successfully run last year as part of PhD of Marla Cervantes.
(Image: Marla Cervantes)

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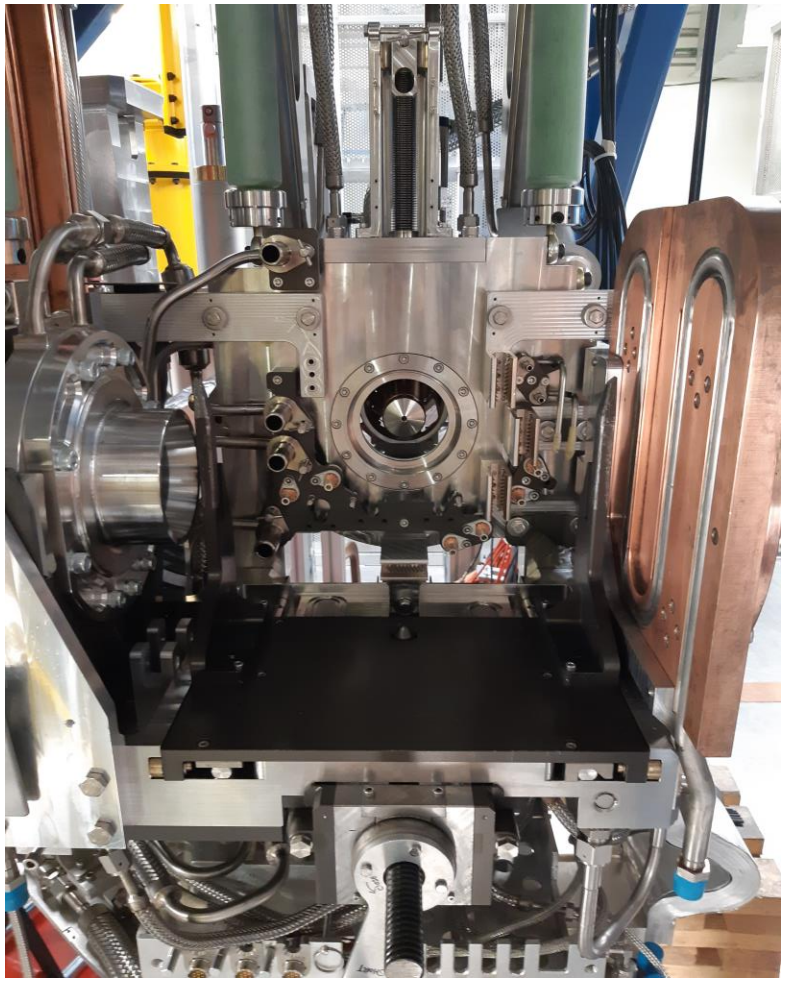

ARIEL will help accommodate different schedule needs and provide overall more beam time

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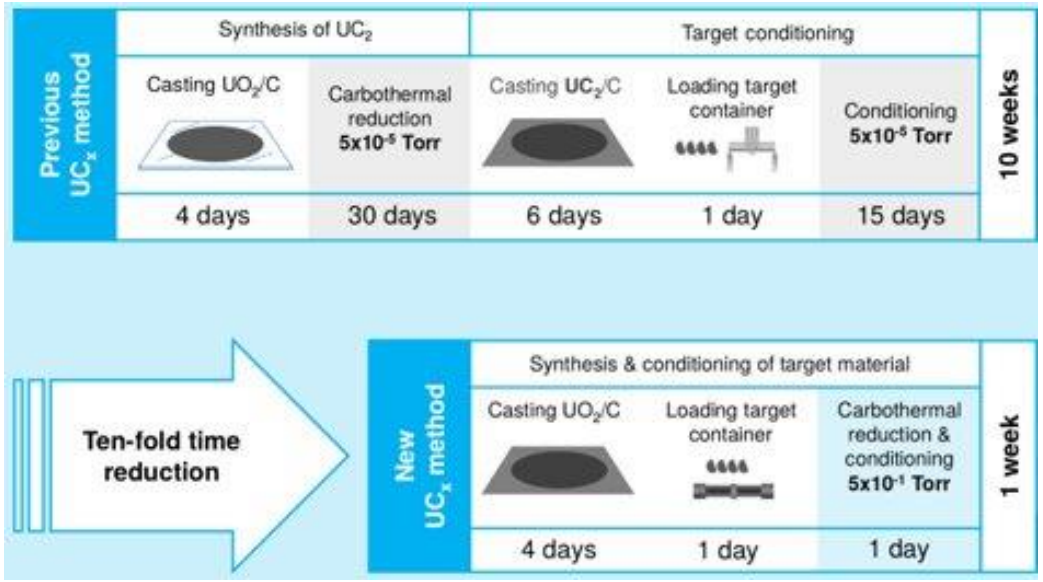

The transition to a more efficient method of UCx production increased the number of UCx targets ISAC can run per year (Image: Marla Cervantes)

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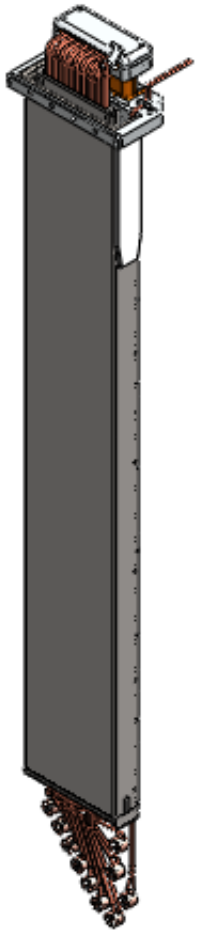
Refurbishment of TM3 will put three modules into rotation, making recovery from failures faster and beam delivery more reliable

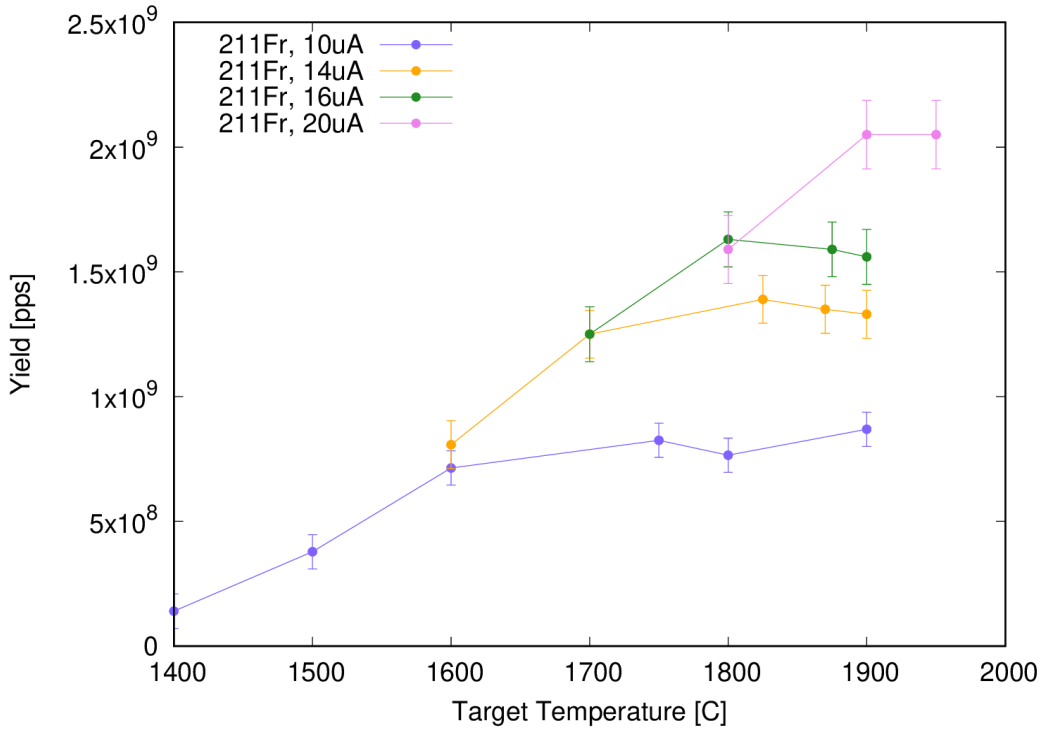


Opportunistic and Long-term Developments

- Can categorize projects into opportunistic and long-term developments
  - **Opportunistic** development - based on what seems feasible and fits into the established schedule with minimal impact to other users.
  - **Long-term** development - often part of a student thesis, requiring significant offline work and system upgrades.

Opportunistic developments

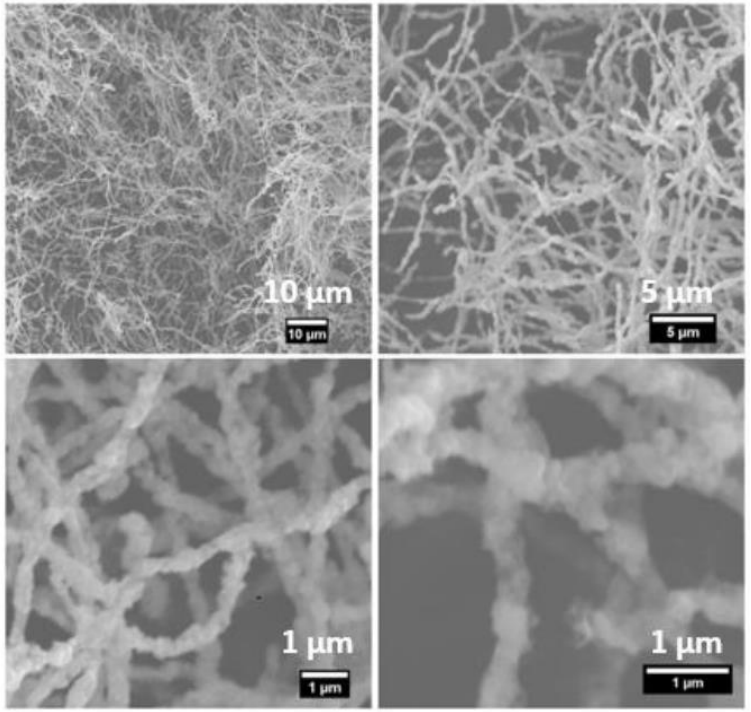
- **Opportunistic** development recent examples:
  - Tests to determine how UCx targets react to **higher proton beam intensity** for better yields
  - Better yields of elements using rotating beam on various targets



Tests on a UCx target at > 10 uA proton beam current, leading to regular operation between 10 and 20 uA at ISAC

Long-term developments

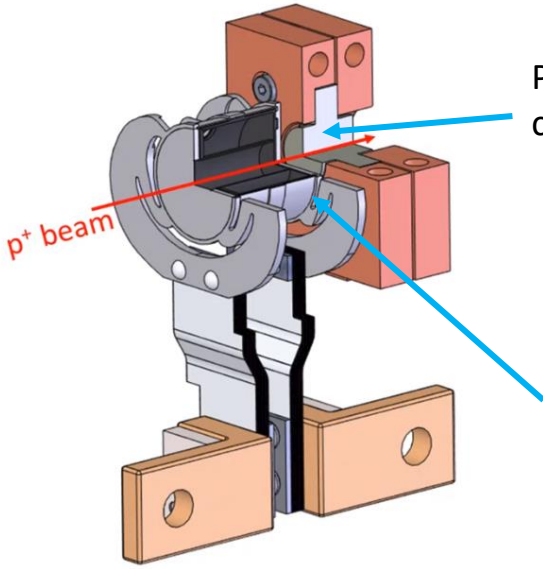
- **Long term** development project recent examples:
  - The nano-SiC target whose material structure was developed at TRIUMF, opening the door for other nanometric fibrous target materials.



SEM images of nano-SiC material for MSc of John Wong
(Image: John Wong)

Long term developments

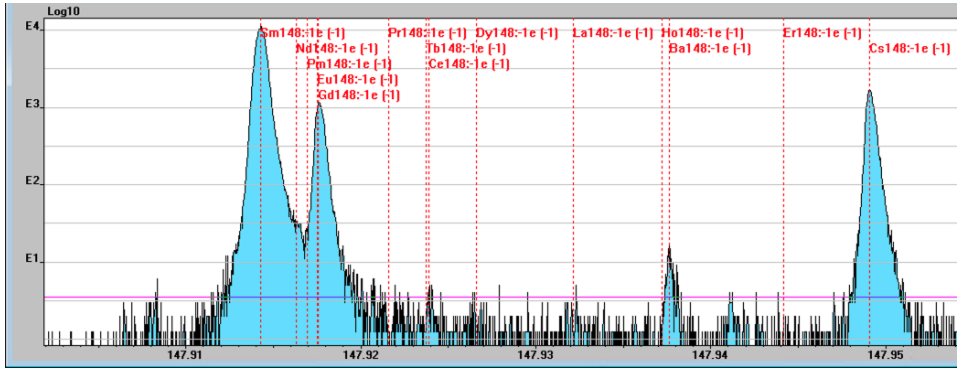
- **Long term** development project recent examples:
  - The proton-to-neutron converter target, which was successfully prototyped and tested in June, working towards improved yields of neutron-rich Cs and Rb



Proton beam impinges on tungsten converter, which creates neutrons

Neutrons interact with the annular UCx target material to produce neutron-rich species

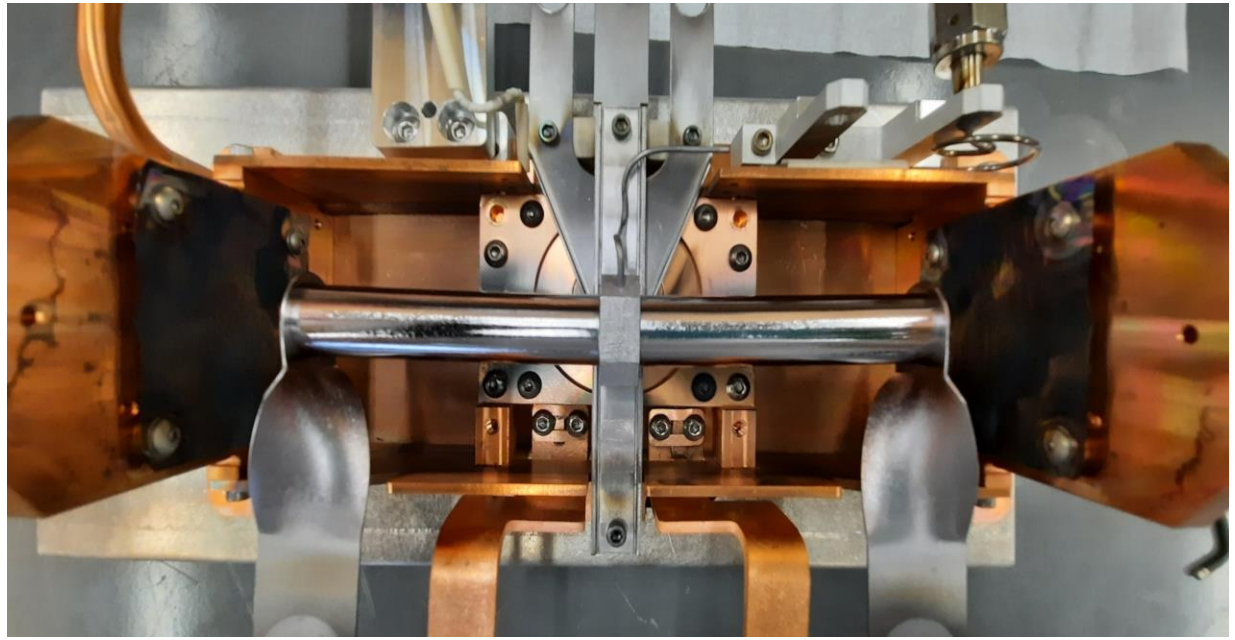
Image: Luca Egoriti



148Cs seen using the MRToF and p2n target in June (Image: TITAN group)

Behind the scenes work to benefit users

- Significant behind the scenes work is done to help meet user requests for improvements:
  - Systematic studies of the ISAC **FEBIAD** source by PhD student Fernando Maldonado
  - **CHI** test stand for target release studies by PhD student Luca Egoriti
  - Tests of **pulsed proton beam** on target by PhD student Aurelia Laxdal



FEBIAD target (Image: Fernando Maldonado)

Behind the scenes work to benefit users

- Efforts toward improvements of modules, targets and infrastructure increases reliability and availability:
  - Ongoing improvements to the modules allow us to **increase our HV limits** incrementally
  - **Increase in refurbishment** activities due to completion of North Hot Cell and Safe Module Parking

Spark captured during HV conditioning
(Image: Alexander Shkuratoff)

Communication channels for requests

- Standard communication channels for beam development requests and information:
  - meetings like Science Week
  - user newsletter
  - LoIs

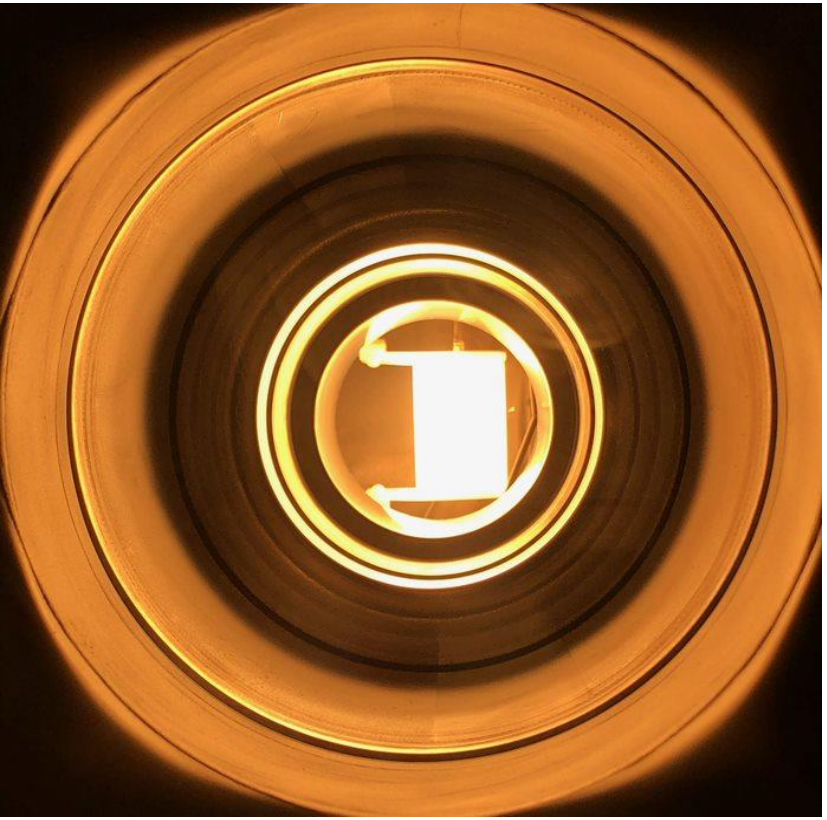
- In addition you can now email the beam development team at RIBdev@triumf.ca

for more information, to discuss ideas, to make requests and to collaborate.

Communication channels for requests

- Feedback from users results in development where possible
  - For example, the new UCx fabrication process increased the number of UCx targets available, which was a request based on conversations with users
- Development priorities are set based on personnel available, finances available, feasibility of the work and research priorities in the group

Strategy for the future



- Moving towards systematic studies for more reliable results
  - Yield program has been run very systematically, now including other aspects such as increased proton limit tests, HV tests, etc.
- Focus on continuous improvements to reliability and betterbeams through new target materials/new methods
- ARIEL capabilities will increase beam availability and development opportunities

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Thank you for your attention