Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 22-H4.1A

File / dossier : 6.01.07
Date: 2022-03-16
Edocs: 6751289

Supplementary Information

Renseignements supplémentaires

Presentation from Canadian Light Source Incorporated

Présentation du Centre canadien de rayonnement synchrotron incorporé

In the Matter of the

À l'égard de

Canadian Light Source Incorporated

Centre canadien de rayonnement synchrotron incorporé

Application by Canadian Light Source Incorporated for renewal of their Class IB Particle Accelerator Operating Licence

Demande du Centre canadien de rayonnement synchrotron incorporé pour le renouvellement de son permis d'exploitation d'accélérateur de particules de catégorie IB

Commission Public Hearing

Audience publique de la Commission

March 23, 2022

23 mars 2022

Canada

Canadian Light Source

Application CLSI Class 1B Particle Accelerator Operating Licence Renewal PA1OL-02.01/2022

March 23, 2022

Bill Matiko, Gianluigi Botton, Mark Boland, Tim West, Grant Cubbon

Land Acknowledgement

We acknowledge we are on Treaty Six territory and the traditional homeland of the Métis.

We pay our respects to the First Nations and Métis ancestors of this place and reaffirm our relationship with one another.

Presentation Overview

- Background and History
- What is a Synchrotron
- Global Context
- Science Overview and Impact
- EDI and Indigenous Engagement
- Management System
- Safety Control Areas

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Background

- National research facility
- Only synchrotron in Canada
- One of the largest science projects in Canada's history
- Operational since 2005
- 22 beamlines (last 6 completed 2019-21)
- 1000 users per year from Canada and world
- ~$400M infrastructure
- Typically: 400-500 publications per year
- 250 staff
- 20,000m^2 total

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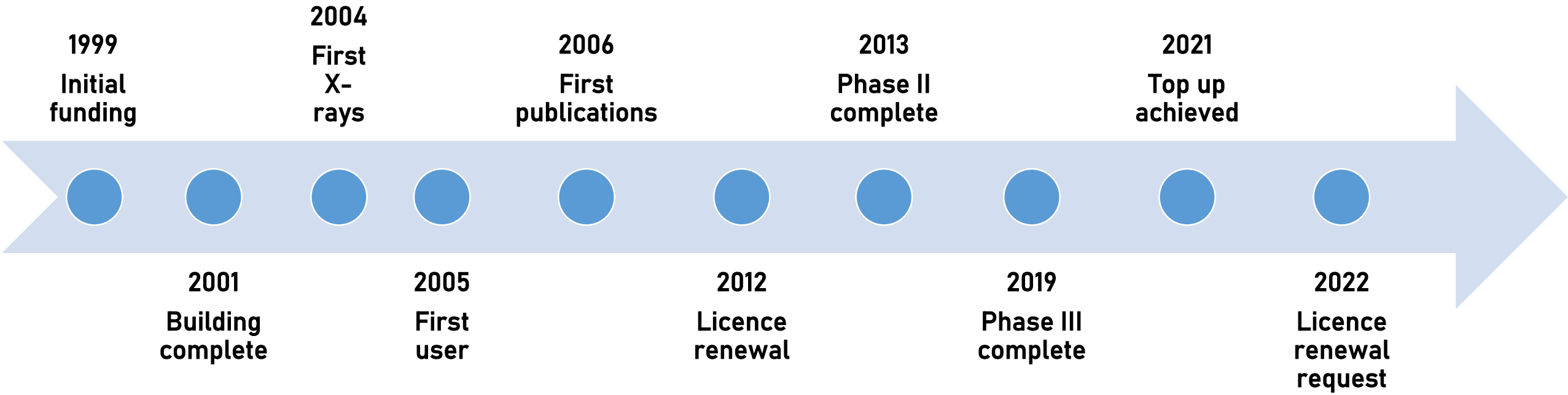
Timeline



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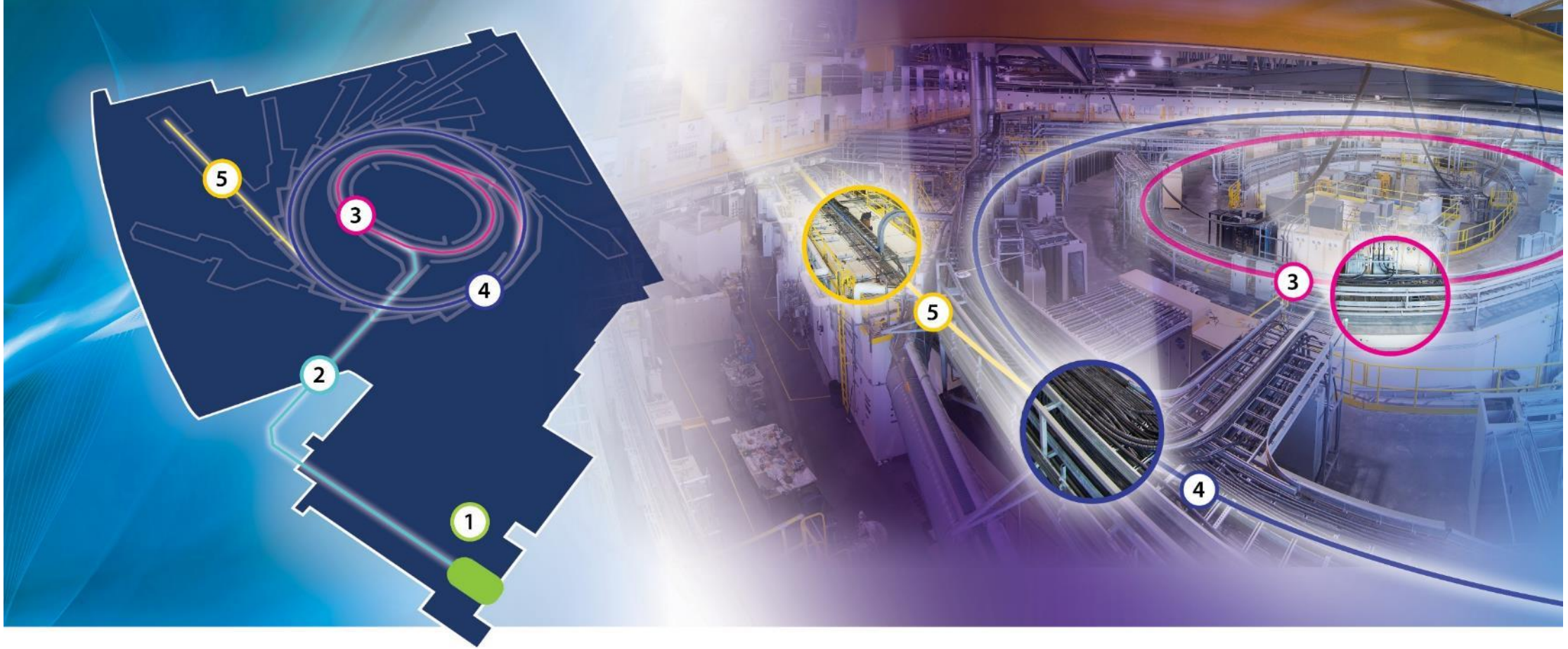


How the Light Source *Works*

1 ELECTRON GUN

Bursts of electrons are injected into a ultra-high vacuum stainless steel tube.

2 LINEAR ACCELERATOR

Microwaves increase the speed of the electrons to 99.9998 per cent of the speed of light.

3 BOOSTER RING

In the ring, microwaves continue to accelerate the electrons; they travel around the ring 1.5 million times in 0.6 seconds.

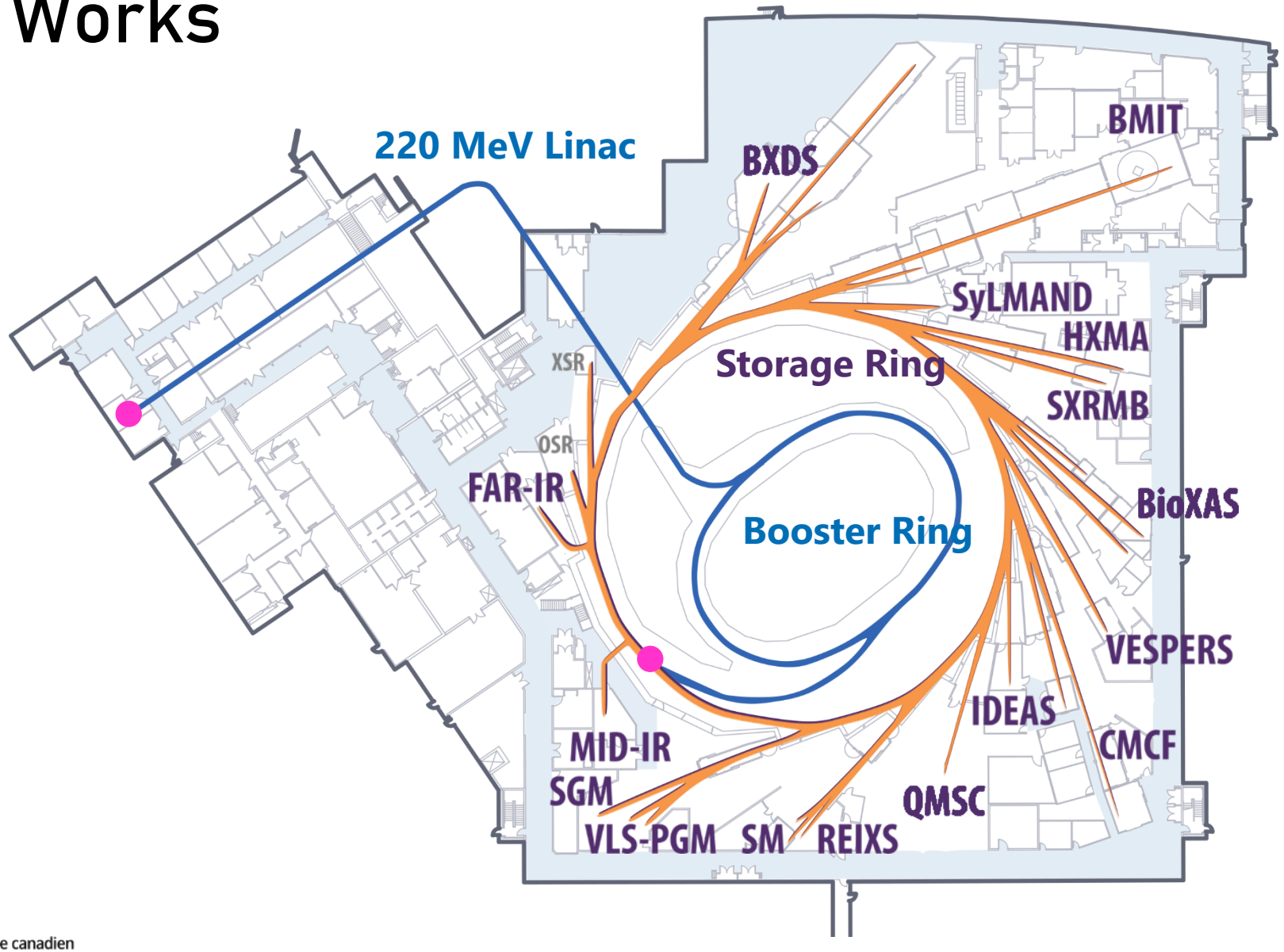
4 STORAGE RING

Magnets bend the electron beam many times, producing a super bright light.

5 BEAMLINES

Beams of light are directed down the beamlines to experimental stations.

How it Works



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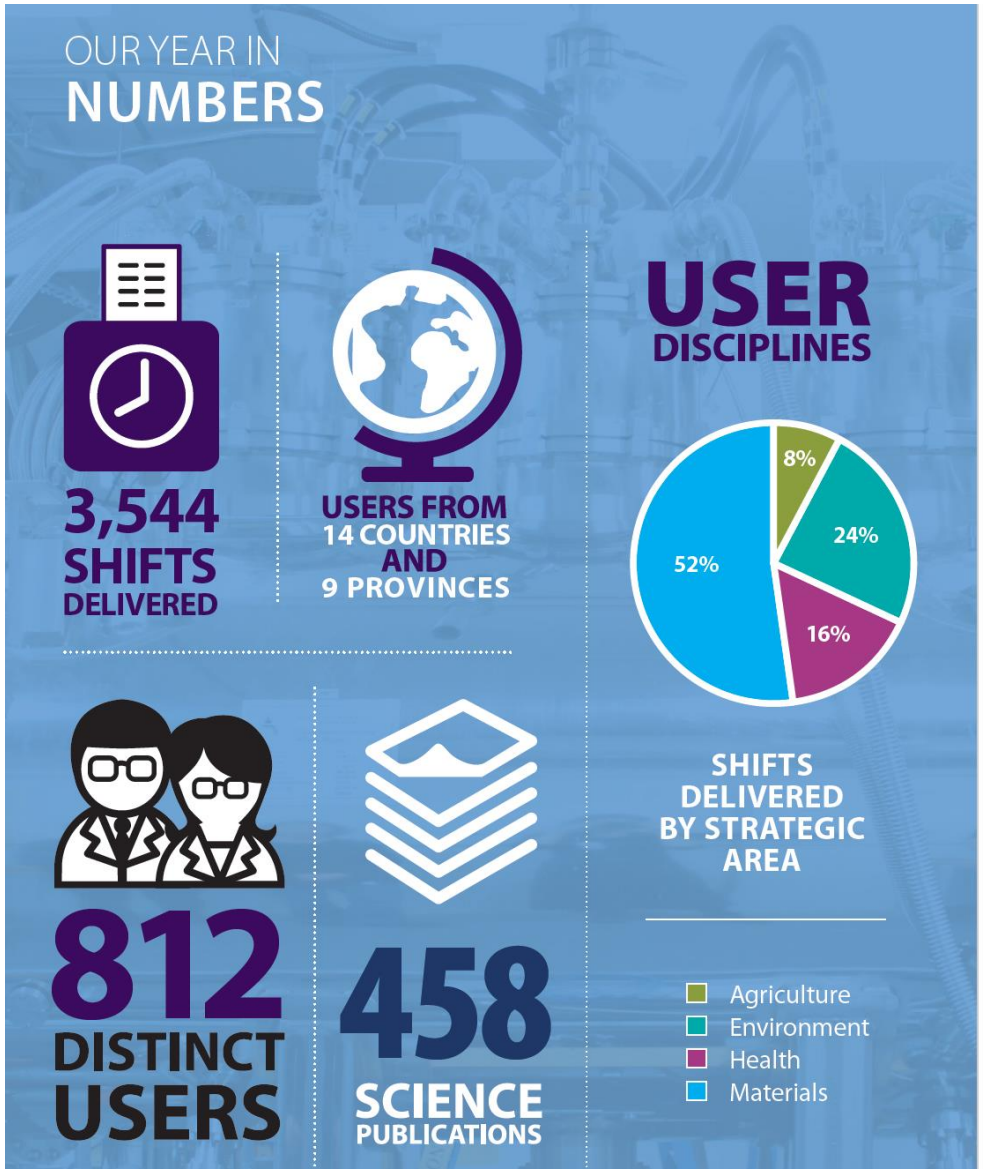
2021 in numbers



USERS FROM

39

CANADIAN UNIVERSITIES

OUR LIGHT IS MILLIONS OF TIMES BRIGHTER THAN THE SUN

ELECTRONS IN THE BOOSTER RING TRAVEL FAST ENOUGH TO REACH THE MOON IN 1.3 SECONDS

64

INTERNATIONAL COLLABORATIONS

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National Facility – 2021 Users

~25-30% international users

Synchrotron World Map

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Health

- Heart disease
- Cancer
- COVID-19
- Antibiotic resistance
- Diabetes and hypertension
- New drugs
- Diagnostics
- Biomaterials for implants

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Agriculture

- Plant drought and disease resistance
- Sustainable agriculture
- Soil nutrient dynamics and metabolism
- Increased crop yields
- Root structure
- Soil enhancements
- Healthier and safer food
- Food production and structure
- Nutrient utilization

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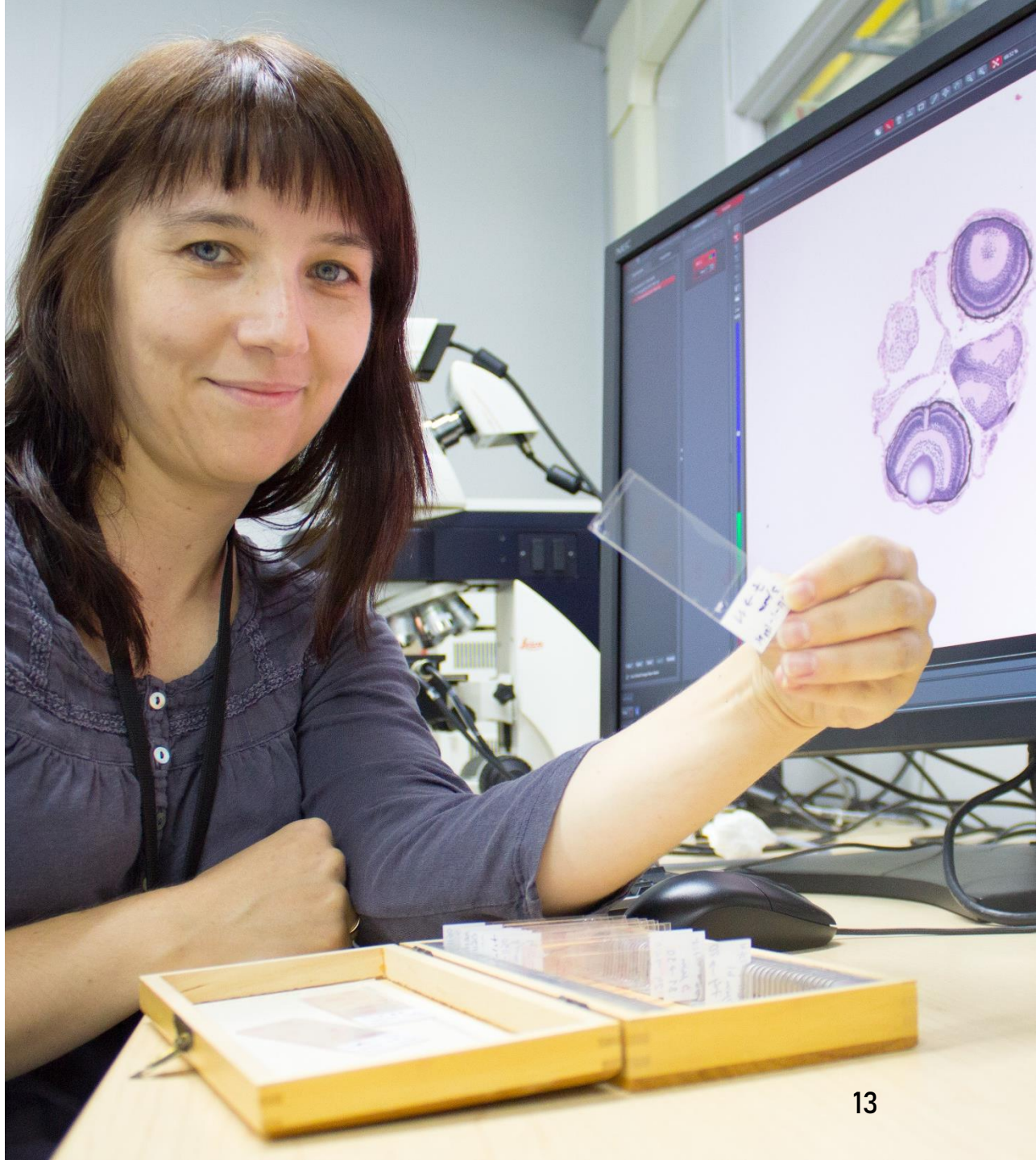
Environment

- Carbon capture
- Reduced volatile organic compounds
- Filtration membranes
- Sustainable mining
- Contaminants
- Airborne particulates
- Plastics
- Longer-lasting, higher capacity batteries
- Fuel cells



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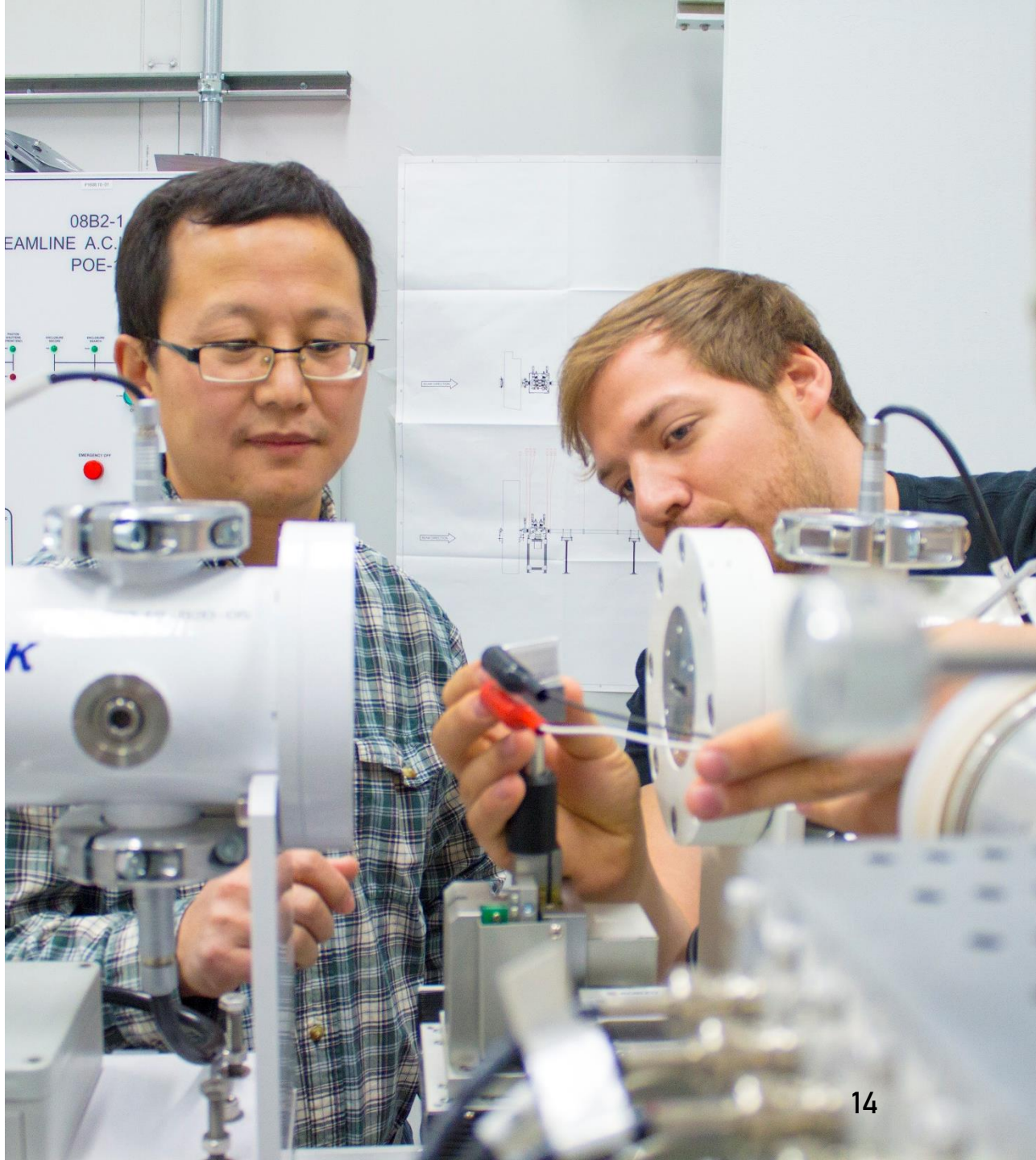
Advanced Materials

- Steel for pipelines
- Lightweight alloys
- Alloy aging and degradation
- 3D printing technologies
- Aerospace
- Improved manufacturing



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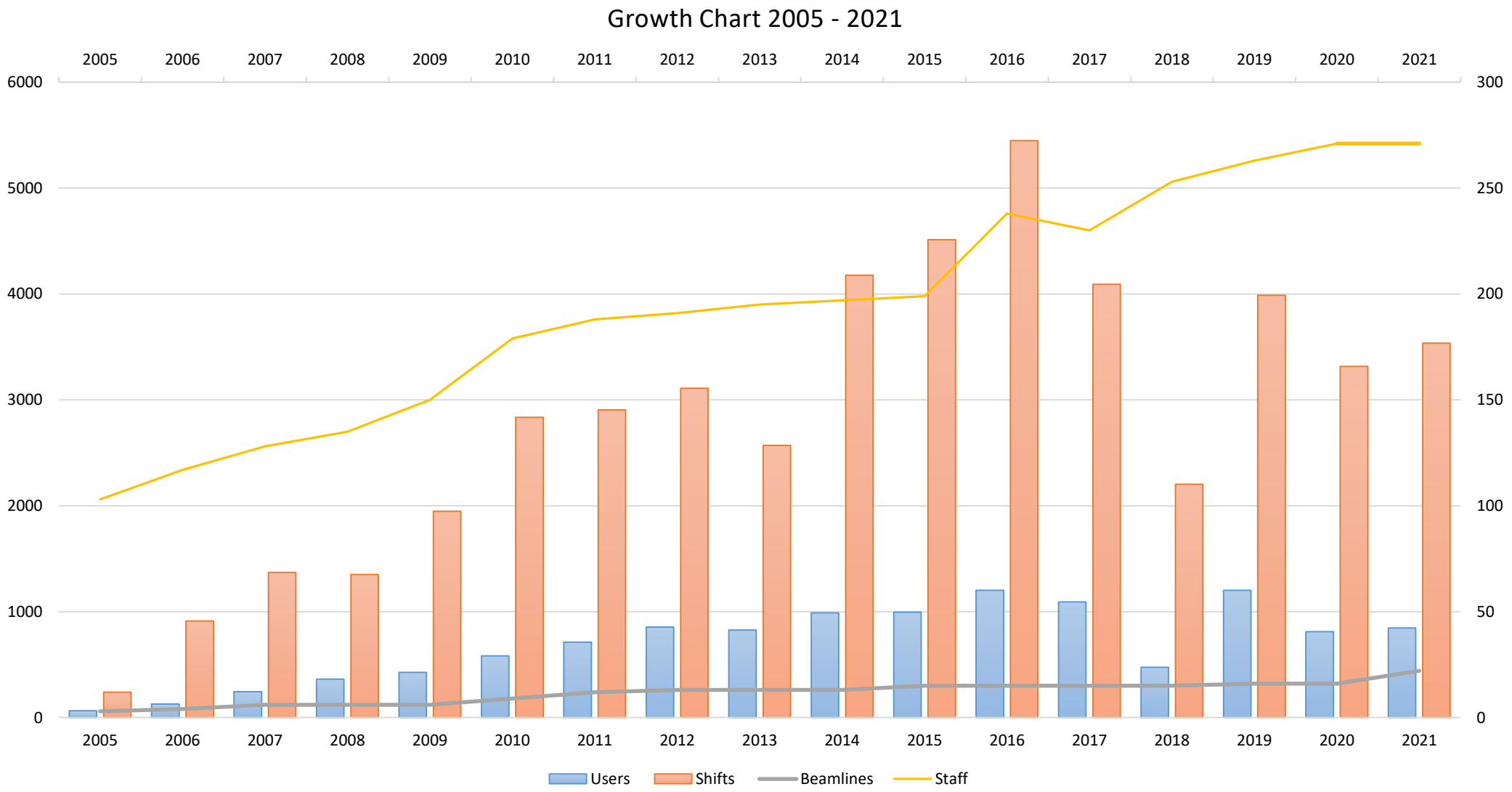
Growth Chart



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Leading Impact

Average of Relative Citations by Research Facility and Year (2006-2019)	
Center	Total
Swiss Light Source	1.68
Canadian Light Source	**1.56**
Diamond Light Source (UK)	1.40
Canada average	1.3
Australian Synchrotron	1.32
Soleil (France)	1.13
MAX Laboratories (Sweden)	1.06
World average	1
Brazilian Synchrotron Light Laboratory	0.80

Source : Observatoire des sciences et des technologies (Clarivate Analytics Web of Science) - Updated January 2021.

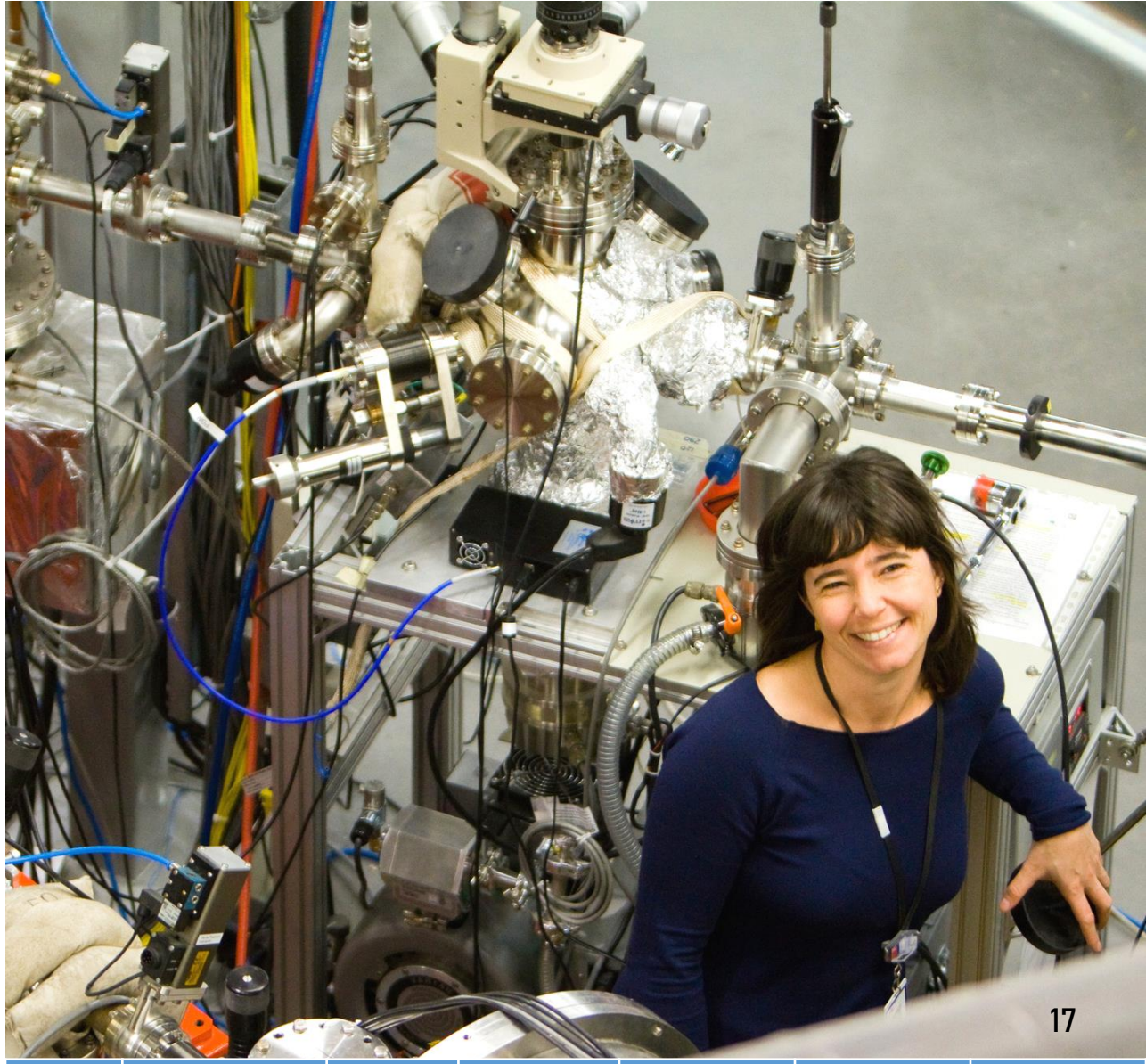
Equity, diversity, and inclusion (EDI)

Ongoing

- Employee training
- Employment Equity Policy review
- Diversity & Inclusion Policy implementation
- Recruitment Policy & Process improvement

Planned

- EDI culture survey
- Reconciliation plan
- Accessibility definition and audit
- Explore Dual Anonymous Peer Review
- Committees Terms of Reference w/ EDI principles



Year	Total Employees	Men	Women	Indigenous	Persons with Disabilities	Members of Visible Minorities
2020	223	165	58	6	3	25
		74%	26%	2.7%	1.3%	11.21%

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Indigenous Engagement

- kîwetinotahk mahkêsîs - ᑮᐍᑎᓄᑕ ᒪᐦᑫᓰᐢ (Artic Fox Project)
- paskwâwimostos - ᐸᐢᒀᐏᒧᐢᑐᐢ (Bison Project)
- pâsiminân ᐹᓯᒥᓈᐣ (The Berry Project)
- Trans-Canadian Research and Environmental Education (TREE) Project

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Indigenous Engagement

- Unique Indigenous Math and Science Educational Resources
- Weaving Traditional Knowledge, Traditional Cultural Expressions, and mainstream Science
- Lesson plans
- Custom Educator Workshops
- Virtual classrooms
- Professional development session
- Seminars

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Management System

- Organizational restructuring in 2015
- Successful transition to Management Standard N286-12
- Improvements to problem reporting and resolution process
- Development of quality culture, including Quality Manual
- Major improvements to work management process

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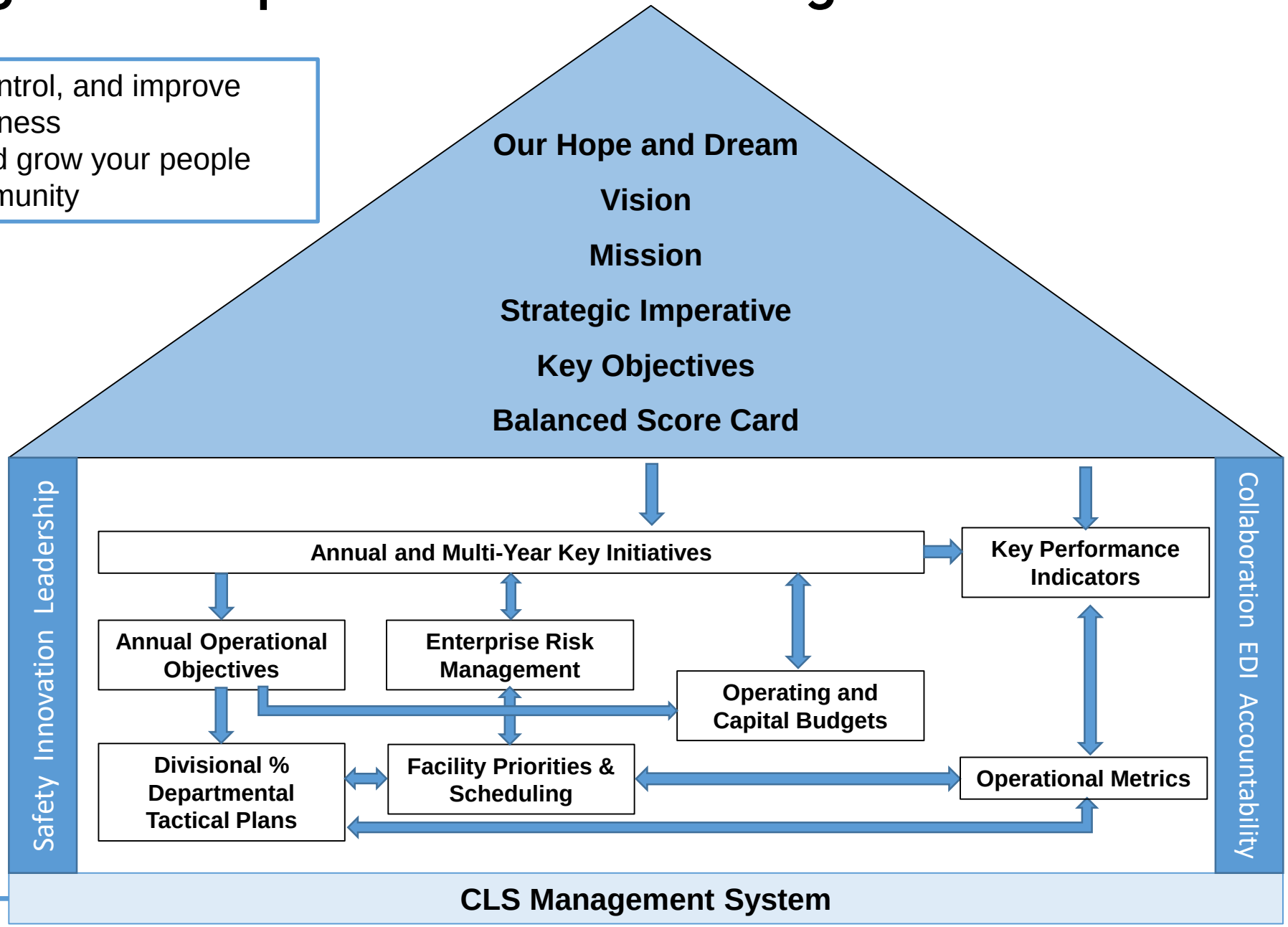
Strategic and Operational Planning

- Know, control, and improve your business
- Know and grow your people and community



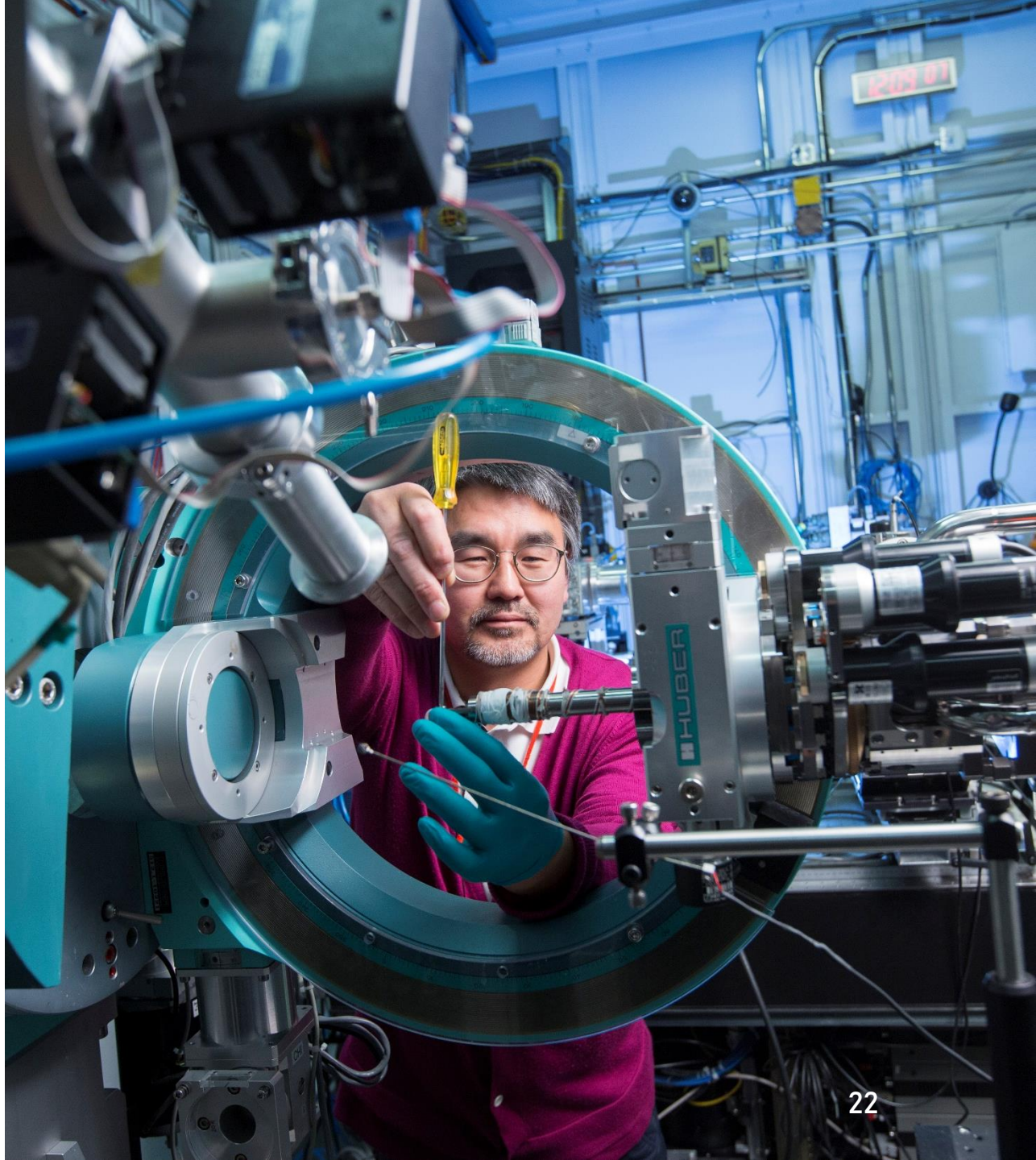
Strategic

Operational

Collaboration and Use of Experience

TRIUMF, SnoLAB, and Canadian Nuclear Laboratories (CNL):

- Radiation Protection
- Safety (e.g. COVID-19)
- Accelerator groups
- Project Management (Process and Capacity Planning)
- Quality (Audits and N286)
- MOU and NDAs for sharing (TRIUMF and Snolab)



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Human Performance

Qualified staff

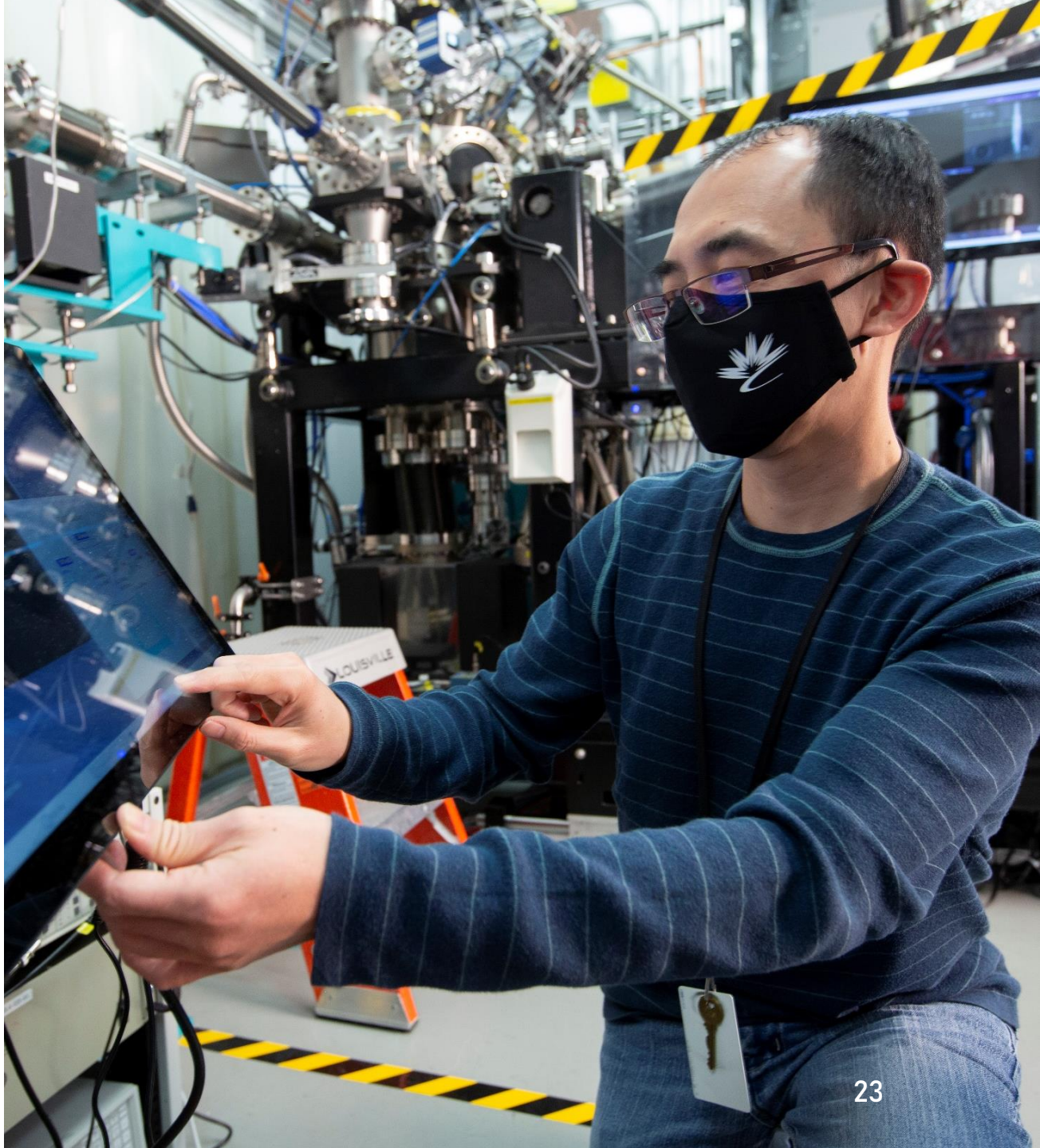
- Diverse backgrounds
- Local, National, International

Training Program

- Systematic Approach to Training (SAT) implemented
- Full-time training specialist position

Minimum Staff Complement

- Operator group introduced
- Highly trained on safety considerations for machine and beamline operation
- Strong focus on continual improvement



Operating Performance

- Strong operating performance while adding beamlines
- Expansion and refinement of maintenance strategy to ensure reliability of aging infrastructure

Fitness for service

- Implementation and maintenance of critical safety systems strong

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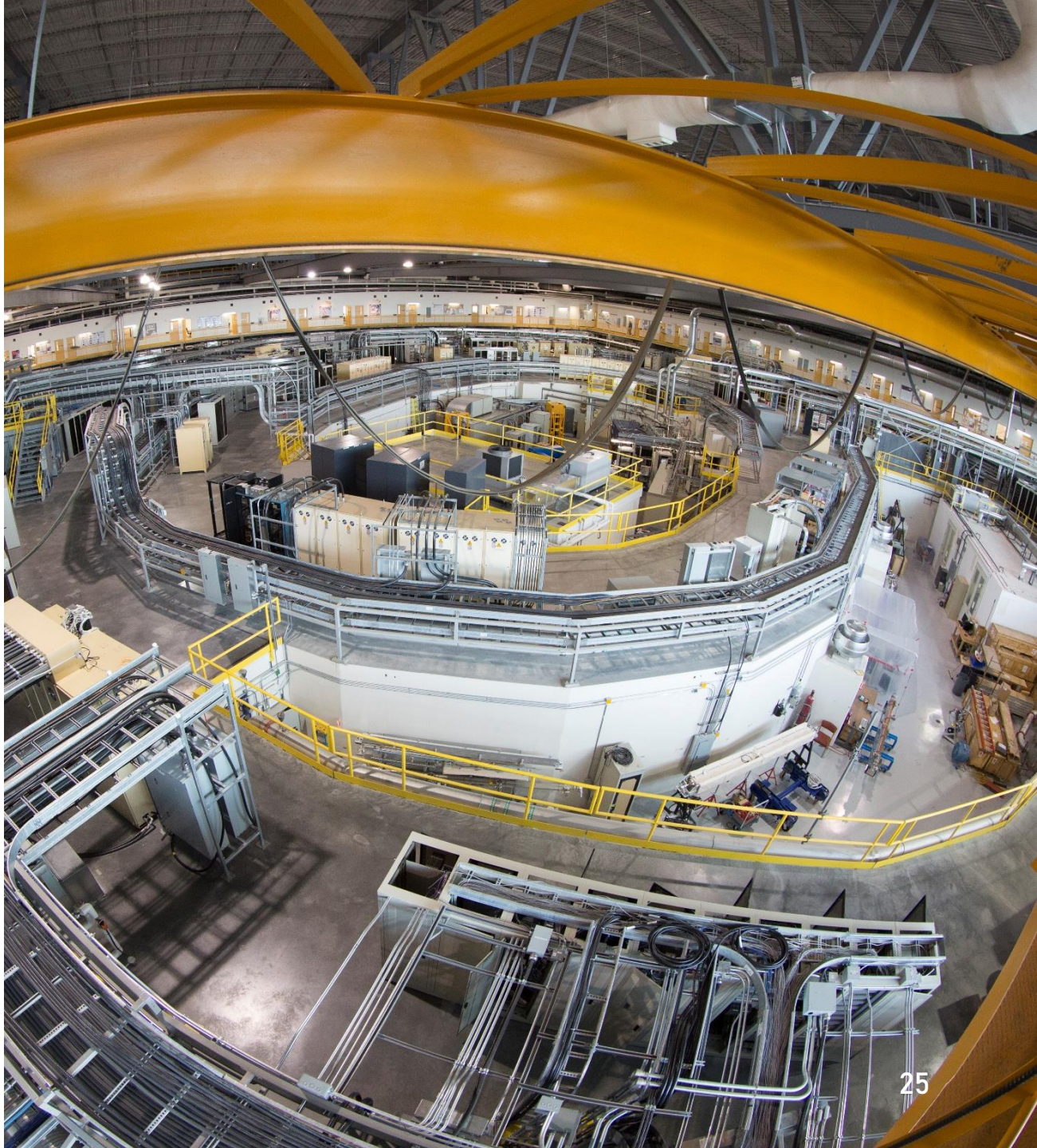
Safety Analysis and Design

- Planned changes with a graded approach to safety
- Well documented designs
  - Drawings, Documented descriptions (manuals), Operating Procedures
- Top-up Operation
  - Careful analysis of operational change
  - Rigorous measurement of worst-case scenarios to confirm computer models
  - Detailed documentation of proposed implementation



Radiation Protection

- Strong design, work management, and effective ALARA programs
- Transition to Top-up completed
- No quarterly action levels reached
- No personnel dose greater than the public limit reported
- Maximum dose to any worker in a 5 year period:

Dosimetry Period	Maximum Dose (mSv)
2011-2015	0.53
2016-2020	0.48

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Conventional Safety

- Personal injury rate low
  - 4 Lost time injuries during licencing period
- Development of Safety Reporting System
  - Implemented 2018
  - Fully transparent to all staff
- Safety Culture Assessment
  - Completed 2021

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Environmental Protection

- Very low risk for radiological release from operations
- Updated Screening-Level Ecological Risk Assessments (SLERA) will be completed by Oct 31, 2022

Waste Management

- Low-level, small-volume radioactive waste managed on site
- Chemical and other waste well controlled

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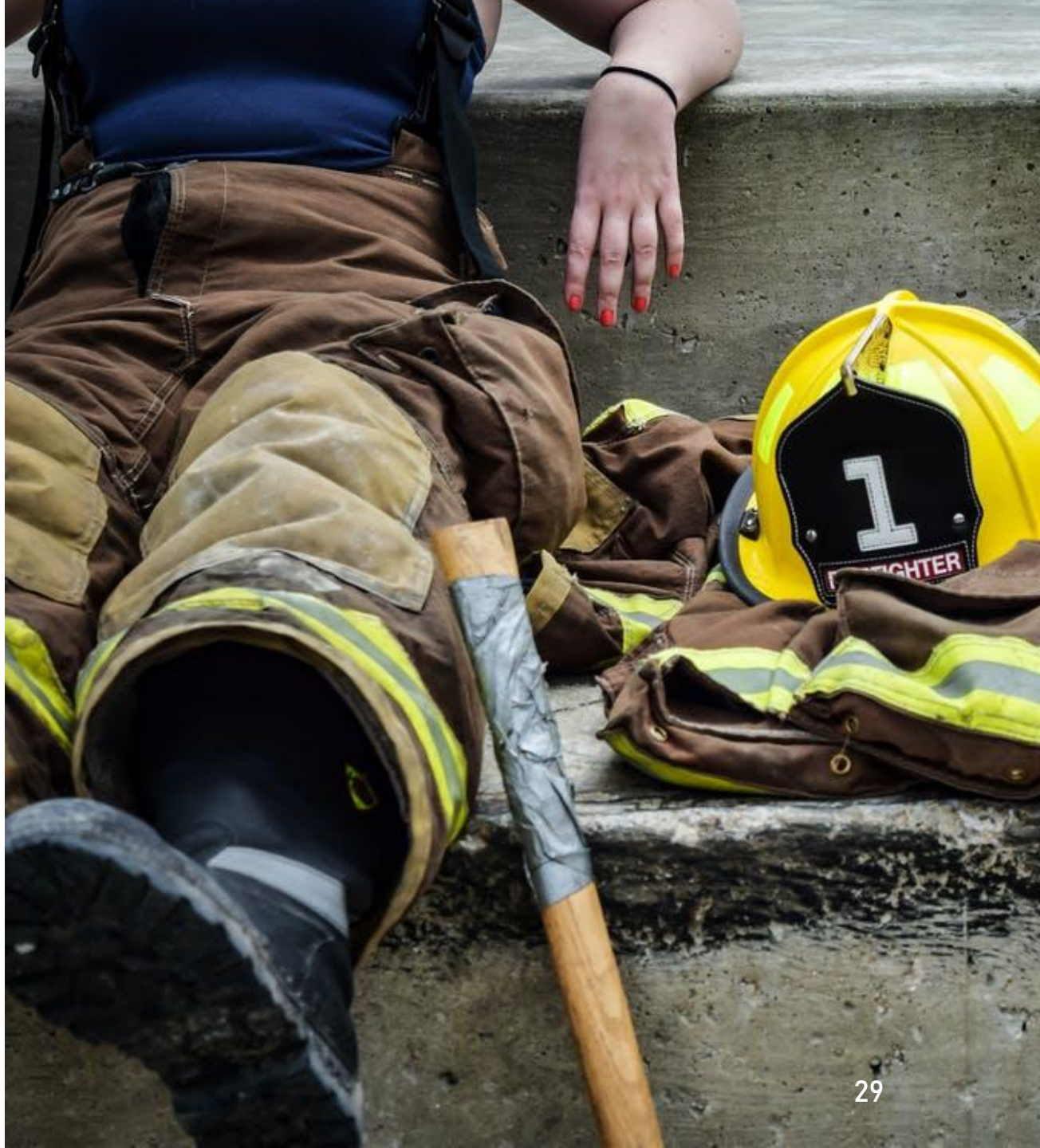
Emergency and Fire

- Regular inspections of fire detection and suppression systems
- Fire Hazard Assessment performed in 2022
- Transition to CSA N393
- Annual fire alarm drill



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Packaging and Transport

- TDG training for required staff
- Low activity, infrequent radioactive shipments

Safeguards

- CLSI does not possess safeguard material

Security

- The CLSI security program sufficiently addresses current security needs

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Public Information and Disclosure

- News releases
- Website
- Social media
- Virtual tour
- Annual reports
- Public tours
- School tour programs

Financial Guarantees

- Preliminary Decommissioning Plan (PDP) and cost estimate reviewed twice during 10-year licence period
- Request Commission acceptance of change

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Closing Remarks

- National research facility in global community
- Strong operating record
- Compliance issues corrected promptly
- Management system for safe and reliable growth
- All Management System Notices of Non-Compliance now closed

Thank you!

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