Facility Operations Division

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Introduction

The Facility Operations Division has the primary responsibility for all technical operations and services for the Canadian Light Source. These include operation and development of the accelerator systems, the provision of engineering, instrumentation, and control system support and services for the beamlines and research programs, and the maintenance and development of the information technology support infrastructure for the facility and its users. Over the past year, work by the division on the accelerator systems has continued to increase the average ring current and lifetime, as well as improve the reliability of photon delivery to the beamlines. The division continued to provide operational support for the first set of beamlines and associated insertion devices, while significant design, procurement, installation and commissioning work on the second set of seven beamlines proceeded. More detail of these accomplishments is given in the following reports, so only a brief summary of the Facility Operations Division is provided here.

Division Organization

There are four departments within the division:

- Accelerator Operations and Development (AOD) responsible for leading the development and operation of the injector and storage ring, including development of insertion devices for beamlines;
- Information and Communication Technology (ICT) responsible for maintenance and development of networking and communication infrastructure for CLS, as well as desk-top, office and administrative computing systems support;
- Engineering and Technical Services (ETS) responsible for mechanical and power electrical engineering for all areas of the facility, mechanical services including vacuum, survey and alignment, and mechanical and electrical CAD support for the facility; and
- Controls, Instrumentation and Diagnostics (CID) responsible for the control systems for facility services, the accelerators and beamlines up to the end-stations, development and selection of instrumentation and diagnostic systems for accelerators and beamlines, and providing support for these areas for researchers at CLS.

Major Achievements

The major achievement by the division overall was to continue improving operation of the CLS for normal user operation on the first suite of beamlines, while working to ensure the successful completion of the second set of beamlines. In 2007, the CLS operated for over 5700 hours total operation time, with over 4500 hours in Normal Operation (User Mode) and an integrated current of 802 Ampere-Hours. This operation time is approaching our long-term goal of over 5000 hours of User Mode operation. Development work on the accelerators is now focused on improving the reliability and stability of the beam.

The other major activity has been the work by the ETS and CID departments on the detailed design and construction of the seven Phase II beamlines that started in early 2005. By the end of 2007, construction of the building expansion for the Bio-medical Imaging and Therapy beamline was complete, all radiation hutches for the new beamlines had been installed, and three of the Phase II beamlines had received first light. The next year should see the completion of the Phase II beamline construction, and the start of the detailed design of the Phase III beamlines.

Accelerator/Machine Status Report

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Introduction

The Canadian Light Source accelerator systems have now been operating routinely since storage ring commissioning was completed in 2004. Changes to the injection system include single bunch capability improvements.

The storage ring optics have been refined to provide even more brilliant light. This includes modest reduction to the horizontal emittance and reduction to the vertical coupling. Preliminary commissioning of several Phase II beamlines occurred, including four new dipole sources and the installation of the powerful superconducting wiggler for the BMIT beamline 05ID-1.

Injection System

New power supplies for the steering and focussing magnets have improved the reliability of the 250 MeV linac. To ensure long term reliability, planning has started on refurbishing the linac, including replacement of some linac sections, power supplies and modulators.

The full energy 2.9 GeV booster continues to operate with high reliability delivering pulse trains of electrons to the storage ring and is more than adequate for top-up operations.

Storage Ring

In both hours of operation and beam brilliance, storage ring performance has continually improved [1]. In 2007, the integrated stored current from the start of storage ring operations has more than doubled, from 712 to 1470 Amp-hours of current. Machine activity and beam delivered to users in 2007 is summarized in Figures 1 and 2.

Improvements to the beam position monitor (BPM) software greatly improved the beam stability and consequently the effective beam size. This translates in improved beam brilliance. As well, improved position measurement results in improved orbit reproducibility from run to run. Work has started to optimize orbit reproducibility.

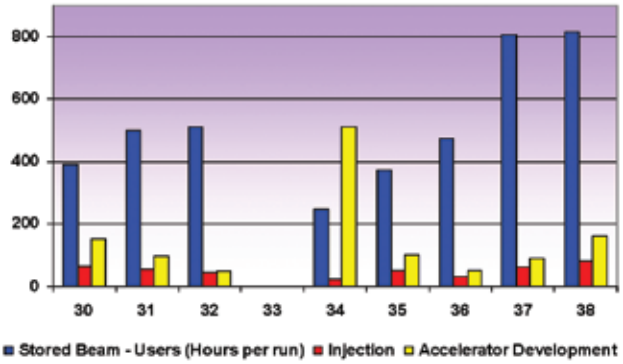

Figure 1 Machine operations for runs in 2007.

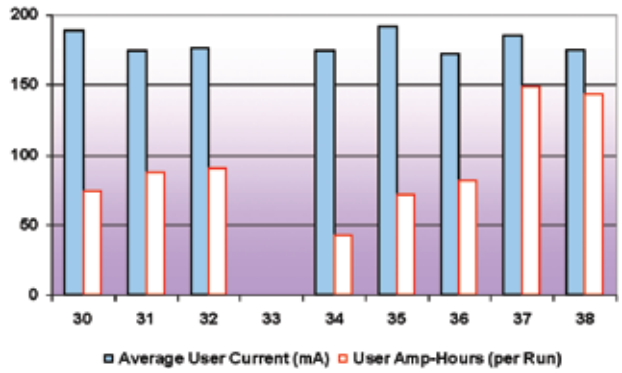

Figure 2 Beam delivered to users in 2007.

Operating Point. Both the horizontal and vertical tunes remained fixed through 2007. Other operating points, including higher dispersion and higher horizontal tunes, remain as options. These options will be revisited in 2008 now that the improved orbit correction has been implemented.

Operating current. During normal operations a maximum current of 250 mA is injected into the storage ring. Beam lifetime steadily increased over the year and now exceeds 20 hours (1/e) at full current. With the improved lifetime the time between injections was increased from 8 hours to 12 hours. Work will continue to increase the maximum current. 300 mA has been achieved but some effort is still required to operate at this current routinely.

Coupling correction. Although the vertical coupling can be less than 0.1%, the machine is routinely operated with coupling of about 0.5% to preserve beam lifetime. The small coupling option remains available. The improvements to the BPMs should result in even smaller vertical coupling and the benefits of smaller vertical beams sizes will be evaluated again in 2008.

Operating Modes

Several different operating modes remain available and will be used as required:

- **Low Energy Operation.** Lower electron energies could be beneficial for the short bunch mode described below. As well, the option of running much higher stored currents at lower electron energy is still a possibility.
- **Single Bunch Mode.** This mode of operation was used on several occasions in 2007. The implementation of a bunch purity monitor gave users a clear picture of the single bunch structure. Bunch purity will be improved with the installation of a transverse feedback system in the storage ring in 2008.
- **Short Bunch Mode.** Various bunch currents and fill patterns were invested in an effort to find the best mode of operation but nothing routine has yet been established. Theoretical considerations indicate that the production of THz radiation could benefit from operating the ring at lower electron energies.
- **Top-up.** The top-up mode of operation will allow the storage ring to operate continuously at maximum current by injecting electrons every few minutes (topping up). Preliminary tests indicate that top-up will be possible with a single shot from the injection system. This will keep the disruption to the stored beam to a minimum. Implementation of top-up as a normal mode of operation requires approval from the Canadian Nuclear Safety Commission after CLS submits documentation on the safety of this mode. This may be achieved in late 2008.

Insertion Devices and Diagnostic Beamlines

Two new insertion devices (ID) were installed over the last year: the new BMIT superconducting wiggler and the new elliptically polarizing undulator for REIXS. Preliminary testing of the BMIT wiggler resulted in successful operation with low electron current in the storage ring. Further testing of both IDs will take place in 2008.

XSR: The X-ray Synchrotron Radiation diagnostic beamline was upgraded with two new diagnostic tools: a position sensitive detector capable of 0.1 μm beam position resolution and a fill pattern monitor capable of measuring bunch charge ratios of 1 in 10 billion.

Both diagnostic beamlines will benefit from the installation of a multi-purpose transverse feedback system to be installed in 2008. Commercial single turn beam position monitors are also being investigated.

Conclusion

2007 saw improved beam current, beam lifetime and beam stability. These all result in higher beam flux and/or brilliance in all beamlines. Orbit reproducibility is now the main area for development in 2008. New diagnostic tools will help to further enhance the beam in both normal and special modes of operation.

Reference

1. Dallin, L., Summers, T. and Bodnarchuk, D. 2007."Optimizing Beam Brightness at the Canadian Light Source", PAC 2007, p. 920.

PAC and EPAC papers are available at:
http://accelconf.web.cern.ch/accelconf/

Control and Instrumentation Development

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Introduction

The Control and Instrumentation Development Department is responsible for the design, installation and maintenance of the accelerator, beamlines and conventional facility control systems. The design services provided include control system and software engineering, instrumentation development and electronics design. The group also provides installation and technical support services in electrical, electronics, RF, control and instrumentation technologies.

The three major activities during the year were ongoing improvements to the storage ring control systems, improvements to beam diagnostics and control, as well as development and deployment of control systems for the Phase I beamlines.

Background

The CLS control system is based on the Experimental Physics and Industrial Control System (EPICS). EPICS is used at synchrotrons in the United States, Europe, and Asia. Being part of the EPICS collaboration has allowed CLS to reuse applications from other facilities with minimal modification. CLS uses RTEMS as the real-time operating system for the control system. Originally developed for high reliability applications, RTEMS has proven to be a robust platform.

The department operates an electronics prototyping laboratory staffed by electronics designers and equipped with electronics design and test equipment. Services provided to the CLS community primarily consist of custom electronics development in areas where off-the-shelf commercial solutions are not readily available.

The department operates an electronics/electrical workshop equipped with electronics, electrical and RF test equipment. The workshop is staffed with technologists with a combination of electronics, electrical, RF and instrumentation backgrounds. This team also provides installation and maintenance services on the electrical, RF, control and diagnostic systems of the accelerators. On the beamlines, this team provides installation and maintenance services on the electrical, RF and process instrumentation systems. Finally, this team also maintains the electrical systems in the facility and the building automation systems.

A control software test laboratory is being setup to perform regression testing on accelerator and beamline software prior to deployment.

Significant Accomplishments in 2007

The SR1 storage ring orbit correction software was upgraded. By converting certain parts of the orbit correction system to make use of RTEMS, it was possible to increase the data acquisition rate and improve signal processing. As a result we were able to improve beam stability.

All of the insertion devices in the storage ring were upgraded to make use of new faster corrector power supplies and improvements were made to the feed-forward software. These changes also resulted in improved beam stability.

Work was ongoing in the design and procurement of major components for a transverse feedback system. In collaboration with the University of Saskatchewan Computer Science Department, a Matlab® simulation was developed to help optimise the design of the storage ring transverse feedback system.

An upgraded motor control system was developed and deployed on the Phase II beamlines. VESPERS was the first beamline to make use of this new system. Work is now underway to upgrade the Linac and some of the Phase I beamlines based on this technology.

Ongoing Projects

In partnership with the University of Western Ontario, TRIUMF, the Neutron Beam Facility at Chalk River, the National Research Council Institute of Information Technology a proposal has been developed for an integrated experiment management environment. Dubbed ScienceStudio, this proposal is now awaiting funding review.

Ongoing maintenance and development continued for the Phase I and Phase II beamline control and data acquisition systems based on user requirements.

Engineering and Technical Services

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Introduction

The Engineering and Technical Services (ETS) department is responsible for the design, operation, and maintenance of the CLS facility and technical systems. During this period ETS has provided engineering support for facility operations, beamlines, users, and was heavily involved with the design, fabrication and installation of Phase II beamlines and components. The department staff consists of mechanical and electrical engineers, mechanical and electrical designers (CAD), and technical and trades personnel.

Staffing

Recruiting and staffing efforts were ongoing, with the hiring of one senior engineer, one mechanical designer, two electrical designers and two mechanical technicians.

Operations & Maintenance

A variety of operational projects and activities were completed for the facility during this period, including:

- The design and fabrication of the storage ring tune-kicker. The installation and alignment of the HXMA diffractometer on a re-designed support table.
- The modification and lengthy bake-out of the CMCF In-Vacuum Undulator to improve beam lifetime.
- Continued vibration isolation projects to isolate mechanical systems from the foundation.
- Design and installation of upgraded lighting for the facility.
- Installation of sumps in the older Linac Hall to alleviate water seepage problems.

Regular maintenance activities are normally performed on all building systems and equipment such as air handling units, pumps, filters, etc. Many maintenance and project activities were focused around our two long shutdown periods in April and October.

Phase II Projects

A large proportion of ETS resources were focused on Phase II projects. Engineering staff are involved with these projects in areas such as design, CAD, procurement, evaluation, design review, manufacturing, vendor coordination, fabrication and assembly, installation, alignment and initial commissioning.

Some of the Phase II project work for ETS staff during this period included:

- Construction of 11 Phase II hutches was completed. This external contract involved a great deal of design review, coordination and support from ETS staff .
- Electrical and mechanical services for most of the Phase II beamlines was largely completed during this period. This work involved close coordination with the beamline scientists, other controls and engineering staff to ensure complete and appropriate system is designed and installed.
- Installation of the SXRMB and VESPERS beamlines. The installation of the beamlines was completed by ETS staff working closely with the vendors and the beamline scientists. The work requires skilled technicians for preparation, installation, vacuum assembly, alignment, bake-out of the beamline components.
- Design of the bulk of the components for the REIXS beamline were completed by ETS staff. The manufacturing was a mix of in-house and out-sourced manufacturing, with a target installation for spring of 2008. The design involved detailed coordination with the adjacent SM beamline which shares a hutch and beamline components to ensure compatibility.
- Installation of a pre-fabricated clean room for the REIXS endstation area of the experimental hall.
- Re-design, manufacture, assembly and installation of the REIXS EPU. This project involved improving an existing design and improving the manufacturing processes and control.
- Installation and commissioning of the SyLMAND scanner.
- Design, fabrication, assembly and installation of monochromators for BMIT and VESPERS. These projects involved taking existing designs and improving the vacuum performance, mechanical performance and manufacturability.
- The superconducting BMIT wiggler was installed in the storage ring, including various modifications to the ring, electrical services, mechanical and cryogenic services.
- The Phase II building expansion work was largely completed during this period resulting in occupancy in January 2008.

Conclusion

The brisk pace of activity for the ETS group will continue as delivery and installation of Phase II beamlines continue and preparations are made to commence Phase III.

Information and Communications Technology

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Introduction

ICT continues to work on updates and improvements to the CLS computer network infrastructure and administrative software support. Upgrades to the wireless system now allow user support for wireless in the experimental hall. ICT also installed a video conferencing system that is receiving steadily increased use. Work continued on the implementation of a new work order system that is integrated with the Great Plains© financial system used by Administration and Finance.

Achievements

Last summer, ICT supplied a large quantity of summer students with computing equipment, and determined computer requirements for the Synchrotron Summer School. As well, CLS users and visitors were supplied with wireless internet access.

Twelve month spending projections are close to the budget plan, but expenditures are higher than projected for the first 6 months of the fiscal year due to planned purchases being made ahead of schedule. These purchases included replacement and upgrades to many servers, and finishing the migration from CRT Monitors to energy-saving LCD flat panel monitors.

Improving network service and stability continues to be a top priority. To that end, ICT is working on a Centrify rollout for unification of Windows/Unix authentication, moving DNS and DHCP/tftp services off standalone windows servers and onto redundant Cisco servers, and testing Quality of Service (QoS) features to enhance phone call quality and other services. As well, CLS users and visitors (guests) got finally Wireless internet access within the facility.

Use of MKS for work orders and tracking problem reports and requests has expanded greatly, and work has also started on an upgrade of our internal staff and external public web sites.

The CLS User Services Office

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Introduction

The User Services Office is the first point of contact to the CLS for all current and prospective users. The mission of the User Services Office is to provide exceptional service in the areas of peer-reviewed beamline access, user access to the facility, comprehensive and efficient user support, user information on the CLS public website, and tracking of basic user information.

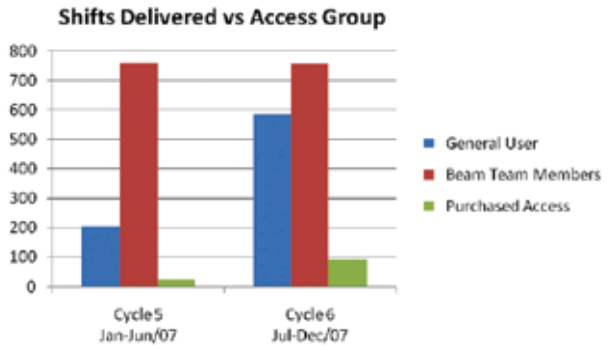
Access to Beam Time

Primary access to the CLS is based on peer review emphasizing the excellence of science and innovation, and normally results in the publishing of scientific results. The CLS allocates and schedules time on all beamlines twice per year. Beam time is obtained through General User, Beam Team Member and Purchased Access mechanisms.

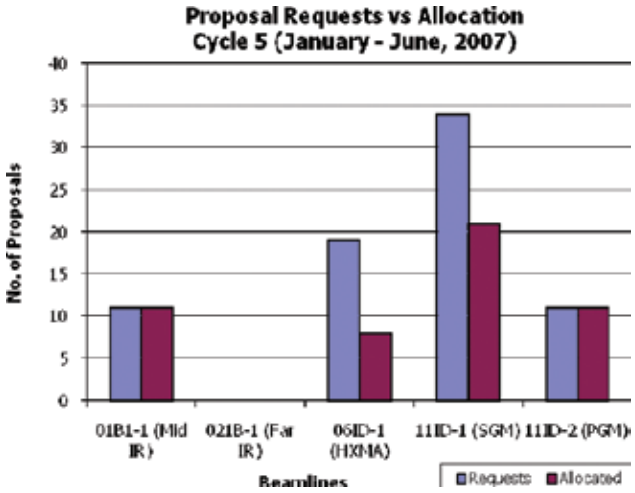
The past year has been exciting as progress in stability and reliability of the machine continued to increase and surpass design goals resulting in over 520 8-hour shifts available to perform research.

The number of shifts delivered nearly doubled from 1264 in 2006 to 2411 in 2007. Factors contributing to this growth include beamlines moving from commissioning to operational status and Phase II beamlines coming on-line.

In 2007, General User access received 785 shifts. Additional shifts were planned for the January-June/07 cycle, however, Run 33 (May 5-31) was cancelled due to a fault in the helium transfer line. Beam Team Member Access includes shifts used for beamline commissioning, Letters of Intent and Beam Team Member proposals.



Six Phase I beamlines participated in the General User Call for Proposals in 2007. The Peer Review Committee (PRC) rates proposals on a scale of one to five, one being the highest score, five being the lowest. Beam time is allocated based on each proposal's ranking in relation to all other proposals for a given beamline. A cut-off grade is assigned if the total requests for beam time exceeded available time, otherwise, all requests for beam time are granted.



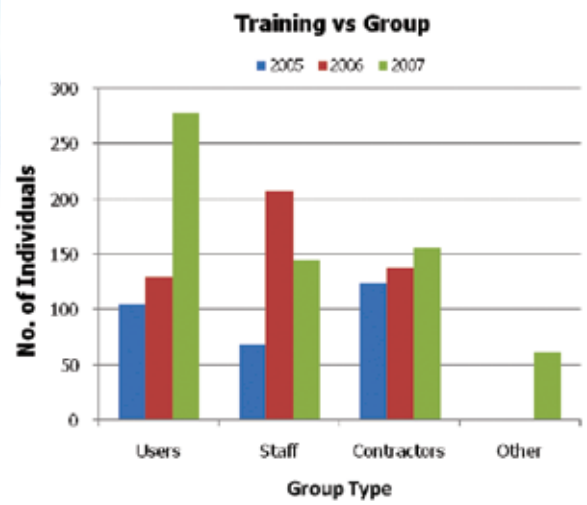
A plan to introduce score adjustment on General User beamtime requests was announced at the Annual Users' Meeting in June, 2007. Adjustments allow for a wider distribution of users on beamlines that are oversubscribed. This plan was implemented starting with Beam Time Requests for Cycle 7 (Jan-Jun/08) (see http://www.lightsource.ca/uso/general_user.php for details). Allocation of shifts is based on the highest ranked proposals (both new and active).

For details on Applying for Beam Time see http://www.lightsource.ca/uso/beam_time.php

Facility Access

The User Services Office facilitates training for all individuals requiring unescorted access to the facility. Health and Safety Orientation training is mandatory for all individuals and is a prerequisite for all other training, which is dependent upon the location and type of work being performed while at the CLS. Once an individual has completed required training they are assigned an ID badge, access card and Luxel dosimeter.

In 2007, 1419 training modules were completed by 631 individuals. The table below shows the number of individuals per group who received training. On average an individual is required to complete a minimum of two training modules, with most modules being valid for two years. The classification 'Others' includes training for summer school and high school participants.

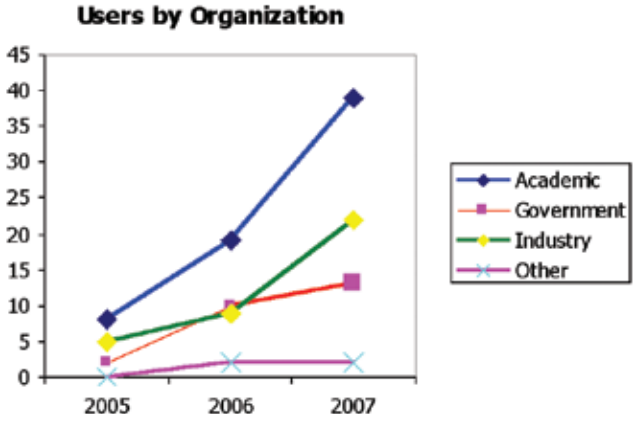


Users at the Facility

In May of 2005, CLS welcomed its first research group. Since then we have hosted 382 researchers, with representation from the Academic, Government and Industrial sectors.

User Classification Summary	
Faculty	81
Scientist	70
Research Chair	3
Research Office	3
Research Associate	2
Post Doctoral Fellow	41
Student	169
Technical	9
Other	4
	382

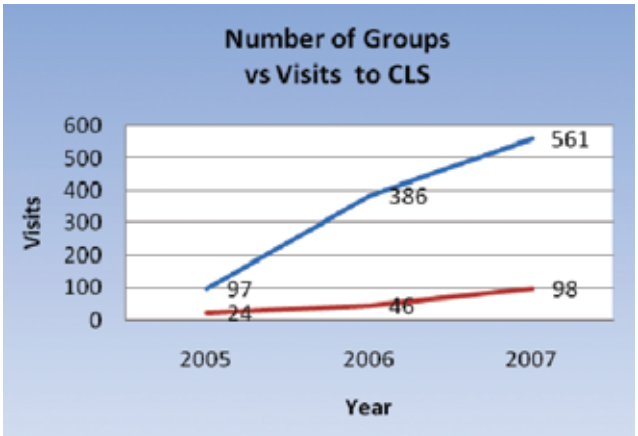
Interest in the CLS is growing among both the Canadian and international research communities.



Users per Year by Geographic Distribution			
	2005	**2006**	**2007**
Australia	0	5	2
Belgium	0	0	4
France	0	3	4
Germany	1	3	5
Italy	0	0	2
USA	1	3	21
Total Other	**2**	**14**	**38**
Canada			
AB	5	12	19
BC	0	0	15
MB	0	3	8
NB	3	6	3
NS	2	0	4
ON	14	28	36
QC	0	4	11
SK	52	128	148
Total Canada	**76**	**181**	**244**
Total Users	**78**	**195**	**282**

Users in the Life Sciences and Crystallography discipline show growth as beamlines come on-line to handle research in these areas.

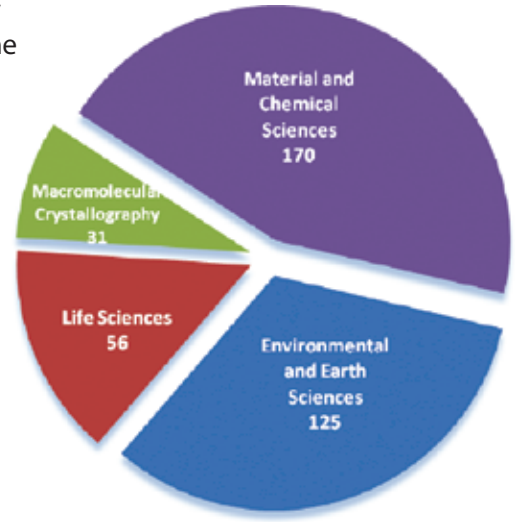
The following represents the growth in number of User Visits (blue) compared to the number of research groups per year (red).



User Amenities

The CLS leases 18 rooms from the Lutheran Seminary in order to satisfy user demand for affordable housing in close proximity to the CLS. The User Services Office administers room rental of this accommodation. Usage of the Seminary is increasing with the number of users coming to the facility and as awareness of this accommodation option grows. In 2005 a total of 511 room nights were utilized, and in 2006 this number grew to 963 room nights and continued to increase with 1818 room nights in 2007.

Users by Discipline



End of Run Reporting

As part of our reporting, CLS requests feedback from individuals who use the CLS facility to perform their research. Feedback received is shared with the Beamline Scientist, Director of Research and appropriate departments. In 2007 the manual End of Run Report was replaced with an online version. This feedback is critical for improving our services to the user community.

Logistics

Information on logistics for visiting the CLS can be found on our website: www.lightsource.ca/uso. We are continuing to expand this information to be as comprehensive as possible.

Development continues on our secure web portal to increase its functionality for proposal applications and beam time requests, scheduling, permits, and supporting documents.

Annual Users' Meeting

In collaboration with the Users' Advisory Committee, the User Services Office assists in organizing the Annual Users' Meeting and associated workshops. The workshops and meeting provide an exciting atmosphere for communications to take place between researchers to share ideas and accomplishments and provide time for exhibitors and the public to learn more of the synchrotron community. Past meeting highlights and upcoming meeting information is available at www.lightsource.ca/uac.

Conclusion

User Services staff is available to assist in making a visit to the CLS as pleasant and productive as possible. Please don't hesitate to contact us if you have any questions or concerns—we are here to be the link to the CLS facility.

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Saskatoon Synchrotron Summer School II (S_4II)

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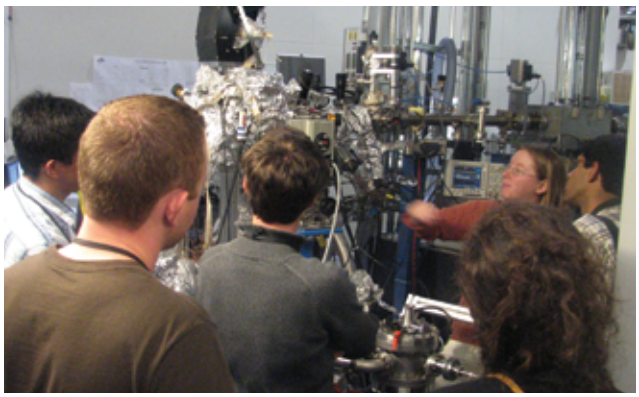
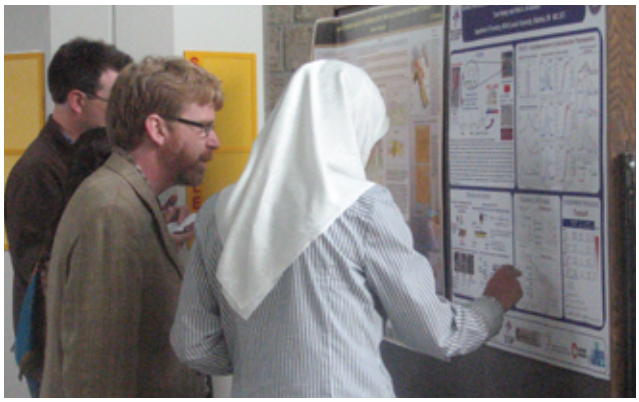
Introduction

CLS hosted its second Summer School for researchers who wish to add synchrotron techniques to their experimental repertoire. S_4II offered presentations ranging from a History of the CLS to Beamline Components and Optics, to Medical Imaging. This week- long school included case studies of Soft X-ray Spectroscopy, Hard X-ray Absorption Spectroscopy, and Infrared Spectroscopy in addition to explanations of Diffraction and Photo Emission. Participants also gained practical experience in XAFS data analysis.

Held August 20th – 24th, students enjoyed



scientific lectures from experts including John Tse (University of Saskatchewan), Adam Hitchcock (McMaster University) and Jeffrey Cutler (CLS). There was also opportunity to share their own research with speakers and CLS staff at the Wine and Cheese/Poster Session.



The prize for the best poster went to Hind Al-Abadleh, a faculty member at Wilfred Laurier University.

Participants in 2007 included students, faculty and industry researchers with backgrounds in Life Sciences, Materials Studies, Nano-Particles, Geoarchaeology, Physics, Engineering, and Environmental Studies, to name but a few. Sunny Saskatoon welcomed participants from coast to coast to coast. Funding assistance from the Canadian Institute for Synchrotron Radiation (http://www.cisr.ca/) was awarded to five young researchers to help with travel expenses (James D. Johnston – University of British Columbia; Fikre Debela – University of Northern British Columbia; Cunhai Dong – University of Victoria; Keith Abel – University of Victoria; and Wenbo Wang – University of Manitoba).

S_4III, to be held August 18th – 22nd, 2008, promises to provide the CLS user community with valuable information and a wealth of experience in several techniques available on Phase I & II beamlines. Further information can be found on our web site: http://www.lightsource.ca/education/summerschool

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Introduction

The CLSI Health Safety and Environment Department (HSE) supports the CLS by providing leadership, resources, and services to assure a safe and healthful working environment for all users, visitors, staff and to protect the general public and the environment from unacceptable risks. HSE is responsible for developing programs and services involving radiation protection and control, occupational health and safety, chemical and biological safety, industrial hygiene, fire protection, and building security and access. HSE provides training, review and monitoring, verification and validation of safety systems and technical consultation services. The department is actively involved in all aspects of the design, construction and operation of the CLS facility including all future developments to ensure compliance with all applicable health safety, and environmental law and operating license conditions.

The size of the HSE staff grew to six with the addition of a Biological Safety Coordinator. The position is responsible for the development and oversight of all safety issues concerning research with biological samples and live animals. Other members of the HSE department include a Radiation Protection and Control Coordinator, Occupational Health and Safety Coordinator and two HSE technicians.

Activities

Much of the department's activities in 2007 focused on supporting increased normal operations and the continued development of the Phase II beamlines. This included monitoring the installation and validation of radiation shielding enclosures, verification and validation of the Access Control Interlock Systems (ACIS), radiological surveys near new insertion devices and other components, monitoring technical commissioning, and commencing the process of regulatory approval to commission and operates the BMIT facility.

Verification and validation of the ACIS systems for the linac, booster ring and storage ring as well as for the optical enclosures for beamlines at ports 02B2, 05B1, 06B1, 07B2, 06ID, 08ID, 10ID and 11ID were also completed in 2007. Other activities included the verification and validation of changes to the CLS fire protection system, expanding the security card system to include the Phase II (BMIT) addition, shielding validation of SXRMB, VESPERS and SyLMAND radiation enclosures, and completion of a noise level survey of the facility.

On the conventional side, HSE staff monitored construction activities to verify contractor compliance with occupational health and safety regulations, national fire codes and applicable CLSI policies and procedures. HSE personnel also coordinated contractor safety training, conducted site safety inspections and issued hot-work permits. The advantages of HSE monitoring contractor safety include fewer regulatory inspections, fewer time delays and cost savings. The Phase II building addition was completed with one lost time injury.

The HSE department hosted the 4th International Workshop on Radiation Safety of Synchrotron Radiation Sources (RadSynch'07) in June 2007. The workshop is part of a series which began in 2001 at APS (USA), held subsequently at ESRF (France) in 2002, and at Spring8 (Japan) in 2004. The workshop is a unique forum to deal with various matters pertaining to radiation physics and radiation safety at synchrotron facilities, creating a unique opportunity for radiation physicists and radiation safety professionals from synchrotrons all over the world to discuss and exchange information. There were 44 registered participants representing synchrotron facilities and institutes from 12 countries.

HSE Training

A variety of HSE courses and orientation sessions were delivered to CLSI staff, users, contractors, workshop participants, high school student observers and University of Saskatchewan tour guides. A total of 1419 modules were completed by 641 individuals in a combination of traditional classroom and web-based settings.

User Safety Program

An experiment can only be conducted at the CLS after the activities associated with the experiment have been defined, hazards have been identified, and adequate hazard controls have been implemented. Once the proposals have met all applicable requirements, a permit is issued identifying engineering, and administrative controls and training requirements.

During 2007, HSE department reviewed 464 proposals and experimental permit amendments. Approximately 280 users spent over 520 8-hour shifts conducting research safely with no reported injuries or significant incidents.

Guidelines and procedures involving use of bio-hazardous materials, live animals, and radioactive substances in synchrotron research are being developed in consultation with beamline scientists.

Radiation Protection and Control

In 2007, 820 people (CLS employees, users, and contractors) were monitored for radiation exposure using optically stimulated luminescent dosimeters or electronic dosimeters. There was no exposure above 0.2 mSv recorded on any user or contractor dosimeter. The maximum annual dose recorded on a dosimeter worn by a CLS employee was 0.46 mSv, well below the annual regulatory limit for a member of the public.

Environmental/low level dosimeters are deployed at 25 strategic locations around the perimeter of the building in the public access zone. They are used to determine exposure to members of the public, which has been consistent with background radiation.

During 2007, 550 monitoring devices were deployed within the facility to help determine the spatial distribution of beam losses and obtain trends over time. To characterize the unique radiation environment encountered at the CLS, HSE maintains specialized radiation equipment that includes a gamma-ray spectrometer, pulse radiation survey meter, pulse neutron monitor, ionization chamber detectors, alpha/beta scintillation counter, low-energy X-ray scintillation detector, and electronic personal dosimeters.

Other activities included monitoring the installation of local shielding and shielding modifications, revising the CLS passive area radiation monitoring labelling and database, completing prompt radiological surveys at a new maximum stored current of 250 mA

Emergency Response and Preparedness

CLSI continues to hold a fire drill on an annual basis. The fire drill is conducted in conjunction with the University of Saskatchewan Department of Health, Safety and Environment. The time required to evacuate the building was well within the required limit. All Operators and Floor Coordinators have attended the Emergency Information Orientation course. HSE also continues to provide orientation to emergency responders from the City of Saskatoon and the University of Saskatchewan.

Environmental Programs

In 2007, HSE completed radiological surveys of 1220 kg of scrap metal. The material was released for recycling and included steel, copper, iron and aluminum. CLS continues to produce a low amount of hazardous waste, which is disposed through the licensed University of Saskatchewan Waste Management Facility and Envirotec Services Incorporated. So far, no radioactive or bio-hazardous waste has been generated.

Planned Initiatives

Planned initiatives for 2008 include an upgrade to the Linac ACIS to make it consistent with the interlock systems used on the booster, storage ring and beamlines. The upgrade will require redesigning lockup zones and revision to all documentation associated with the Linac ACIS. The system will be re-verified and re-validated following the upgrade. CLSI will require approval from the Canadian Nuclear Safety Commission (CNSC) before implementing the Linac ACIS upgrade.

CLSI is also planning to begin commissioning BMIT Beamlines in 2008. As per conditions stipulated in our Class 1B Particle Accelerator Operating License, CLSI will also be seeking written approval and a license amendment from the CNSC.

Conclusion

The HSE Department strives to eliminate risks of injury and illness in the workplace for all members of the CLS community. The continued success of the CLS HSE program is a testament to the commitment, dedication and cooperation of all members of the CLS community, including staff, users, contractors and visitors. Everyone has an integral role to play in ensuring a safe and healthy workplace and protected environment.