

CLS 4th Annual Users' Meeting – a summary

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Kathy Gough (CLS UAC, chair), *Stephen Urquhart* (CLS UAC, vice-chair),
Adam Hitchcock (CLS senior scientific consultant)



CLS – a new dawn on the prairie.

Insertion Devices Workshop (Friday, Nov 16, 2001)

Organizers: *Ingvar Blomqvist*, *Ron Cavell*

Support by: ASI, CISR, CLS

This high-powered, all-day workshop had 76 registered participants. It featured presentations from many of the world's experts in the design, construction and commissioning of insertion devices on third generation light sources. The day was lead off with an inspiring presentation by **Joel Chauvanne** (ESRF) on the IDs at the ESRF. He described novel solutions ESRF has pioneered for producing brightness at very high energies (through use of higher harmonics and in-vacuum undulators) as well as flexible circular & linear polarization sources in the soft X-ray range. There was considerable interest in the recently developed solutions developed at ESRF in end corrections for Apple II EPUs to eliminate coupling of the EPU motions to the performance in the rest of the ring. The second presentation by **Takashi Tanaka** (Spring8) on exotic undulator developments started with the summary of the policy at Spring8 which is to avoid wigglers since they have intractable heat load problems for high energy storage rings. Tanaka-san then went on to describe brilliant advances in ID technology pioneered at Spring8 – very long in-vacuum IDs (25 m continuous !), figure-8 and helical undulators for tunable linear polarization switchable from horizontal to vertical to circular polarization. He also outlined a



Elizabeth Moog (APS) described her work on fourth generation undulators

new design, currently under development, where all polarizations would be accessible within the helical / figure-8 approach to polarization control using advanced insertion devices.

After coffee, **Elizabeth Moog** (APS) described the IDs in use at the APS. In contrast to ESRF and Spring8 where there is a wide variety of ID designs, all but three of the IDs at the APS are the standard undulator-A. Two other undulators are of similar design but different period, and the third is an electromagnetic elliptically polarized wiggler. Elizabeth then described some of the challenges in fabricating and commissioning the ultra long undulator

structures (currently $7 * 4$ m, gearing up to 100 m) being developed for fourth generation free electron laser X-ray sources. The synergy between ID development for third and fourth generation light sources was explored. The last presentation of the morning session was given by **Steve Marks** (ALS) who focused on the challenges and successes of the elliptically polarized undulator at the ALS. An Apple II EPU features four rather than two sets of permanent magnets. Development of an antiparallel mode (Q2, Q4 moving oppositely to each other and relative to the fixed Q1, Q3 magnet chain) has allowed users to rotate the plane of linear polarization, a capability that will be particularly useful for exploiting linear dichroic contrast in X-ray microscopy where it is not practical to perform sample rotations about an arbitrary axis defined at the sub-micron scale. An extension of this technique in which all four of the quadrants will be independently moveable is the basis for the EPU being developed for the soft X-ray spectromicroscopy beamline.



Ingvar Blomqvist, CLS ID designer

The afternoon presentations started with a presentation by **Richard Talman** (Cornell) on an analytical formula to predict undulator radiation. One of his interesting conclusions was that wigglers are simply poorly designed / tuned undulators ! This was followed by a presentation by **Greg LeBlanc** (MAX Lab) on the challenges of cryogenic cooling of a set of wigglers being developed to allow the 1.5 GeV MAX-II ring to perform protein crystallography more effectively. **Ingvar Blomqvist** (CLS) then presented in detail four of the five IDs that he is designing for the first suite of CLS beamlines. These include a 185 mm period undulator (close to a wiggler) for the low energy PGM, a 38 mm undulator for

the SGM, a generalized Apple-II elliptically polarized undulator in which all four quadrants can

be phase shifted, allowing maximum flexibility in user selectable polarization from 100 to 4000 eV, and an in-vacuum undulator for hard X-rays which will be the source for protein crystallography. The fifth ID, a conventional wiggler, was described in detail by **Detong Jiang** (CLS) as the last talk of the workshop. There was considerable debate during Detong's presentation about the trade-offs of the greater heat load challenge of wigglers versus greater ease of the long range energy scans needed for EXAFS. **Michael Schillo** (ACCEL) described the turn-key ID systems that ACCEL is delivering to many synchrotron facilities. Their expertise in cryogenics was particularly emphasized.

There was more than 60 attendees present for the whole workshop. During and after each talk in both the morning and afternoon sessions there was a large number of questions from the audience, and extensive discussion among participants. Clearly the very extensive sharing of scientific and technical information at this workshop was a great benefit to CLS, and also a tribute to the initiative of *Ingvar Blomqvist* to attract such a stellar group for this specialized workshop. An article for Synchrotron Radiation News highlighting this workshop is planned.



Let there be light !

CLS Users' Meeting (Saturday, Nov 17, 2001)

A real crowd (197 people registered, about 250 were involved at various stages) attended the fourth annual users' meeting! The meeting began with a short welcome by **Kathy Gough** (Manitoba), the chair of the Users Advisory Committee who organized this meeting. After this, the President of the University of Saskatchewan, **Peter MacKinnon**, gave an inspirational welcome speech, praising the contributions of our first executive director, **Mike Bancroft**, who resigned as of 1-Sep01, and explaining the difficulties CLS is having in finding a new executive director. Project Leader, **Mark DeJong** has been appointed acting executive director and the search committee is actively seeking and interviewing candidates. In order to assist Mark, Mike Bancroft has been appointed acting Associate Director for Science. After wishing the users a successful meeting Peter MacKinnon departed to other presidential duties. President MacKinnon's welcome was followed by a short presentation by Kathy Gough bringing the audience up to date with details of the schedule for the user meeting.

The first scientific presentation was then given by **Mark DeJong** (CLS) who, wearing the hat of executive director, outlined the many advances made over the past year. These include:

- Completion of the conventional facility
- Restart of the linear accelerator (linac)
- CNSC licensing for linac and booster ring
- Delivery of the first booster components
- Completion of the ordering for most key parts of the storage ring

Mark emphasized that the project is on-time and on-budget. He summarized the challenges in finalizing, and successes in signing the agreements with the many funding partners. At this time the only agreements still under negotiation are those with NRCan and the Ontario Synchrotron Consortium. Mark also outlined the challenges CLS faces in securing adequate operational funding and attempts to resolve these at the federal government level. Finally Mark outlined the schedule for completion of the project.

Kathy Gough (chair, UAC) then outlined the role and activities of the **Users Advisory Committee** over the past year, which has



Mark DeJong, acting executive director of CLS



Ercan Alp (ALS) Keynote speaker describing inelastic X-ray scattering.

included instituting a regular dialogue between the CLS Director and the UAC (available on the CLS web site), initiating the electronic newsletter, and establishing a speakers program, the first scheduled presentation being a visit by **TK Sham** to Alcan and other industries in Quebec in February 2002. Minutes of all UAC meetings can be found on the CLS website, along with other useful information about the UAC. To learn more about it, just go to www.lightsource.ca and click on the UAC and contacts link.

The keynote speaker, **Ercan Alp** (APS) then gave a clear and inspiring presentation on inelastic X-ray scattering, covering in some detail, resonant and non-resonant inelastic scattering, Compton scattering, and nuclear

inelastic scattering (synchrotron based Mössbauer accompanied by phonon and electronic losses). These techniques have been revolutionized by combining high brightness third generation synchrotron light with brilliant innovations in ultra high energy and momentum resolution monochromators and analysers. In addition to giving a comprehensive overview, Dr Alp showed numerous examples of powerful applications, and outlined those areas where successful programs might be mounted at the CLS.

After coffee, **Jim Rini** (Toronto) gave an in-depth presentation of a structural and mechanistic study of rabbit N-acetylglucosaminyltransferase I, a membrane glycoprotein implicated in cancer metastasis. His presentation was a wonderful synthesis of genetics, biochemistry and mechanistic organic chemistry which illustrated the advances in medicine that may come about in the emerging era of proteomic studies assisted by synchrotron based crystallography.



Jim Rini (Toronto) glycoprotein structure and mechanisms

This was followed by an enthusiastic presentation by **George Sawatzky** (Canada Research Chair, UBC) of the physics of the newly developed technique of resonant soft X-ray scattering, and his applications to studies of the magnetic and electronic structure of transition metal and rare earth compounds. George emphasized the parallel with the MAD technique in crystallography, and noted that resonant soft X-ray scattering used MAD based on fine details of the near



George Sawatzky (UBC) Resonant X-ray Scattering

edge structure in the soft X-ray region (100-4000 eV) to provide site specific structural information. He outlined applications in a number of important condensed matter systems such as high temperature superconductors and nanostructured magnetic materials being designed for spintronics applications.

After this presentation, the CLS users were treated to a brief **tour of the facility**, which is in the process of installing the booster ring. Many of those who were making their first contact with a synchrotron facility were very impressed with the scale and technical complexity of the project.



Section of the booster ring

Lunch featured many animated discussions under the watchful eye of the U of S dinosaurs. **Breakout discussion groups** discussed issues of concern to users, including user services, communications and the funding of future beamlines. Reports on these three break out sessions are given below.

The session immediately following the lunch period focused on industrial applications. It featured a lead-in presentation by **Elizabeth Town-Andrews** (Daresbury), who described the recently formed Daresbury Analytical Research and Technology Service (DARTS). DARTS now grosses several million pounds per year in fees for a variety of services including protein crystallography, powder diffraction and various spectroscopies in the IR, UV and hard X-ray ranges. Elizabeth emphasized the need for a business-like approach, with proper identification of areas of expertise, an orderly exploration of growth opportunities and extensive marketing. **Jeanne Percival** (NRCan) then summarized the 19 projects in synchrotron science that NRCan is presently funding in the mineral, energy and forestry sectors. These projects are being seed funded in order to build expertise in that organization, and to enable it to provide collaborations with industrial clients based on CLS capabilities. The third presentation was made by **Bret Moldovan**, (Cameco, the world's largest uranium mining company headquartered in Saskatchewan). The Users' meeting was fortunate to be able to hear Bret's presentation as he had been stranded in northern Saskatchewan by a blizzard earlier in the day, and had only arrived in Saskatoon less than a half hour prior to his presentation. Bret outlined his use of X-ray absorption techniques, in collaboration with CLS industrial liaison scientist, **Jeff Cutler**, for advancement of environmental and process chemistry of vital interest to Cameco. He described three projects: characterization of the oxidation state and chemical structure of arsenic in Rabbit Lake mine tailings; identification of uranium oxidation state in sedimentary components of the rich McArthur River uranium deposits which are designated for solution extraction; and analysis of acid leachate potential in waste rock (displaced overburden in open pit mining) at the Key Lake site. The power of synchrotron X-ray absorption spectroscopy to provide relevant information to the mining sector was well illustrated.



Bret Moldovan, Cameco

In the final technical session, **Mark DeJong**, wearing his hat of project leader, gave a detailed outline of the technical status of the project. Overall the facility development is on track with the booster scheduled to start commissioning in Feb 2002, most of the insertion devices and beamline projects entering final engineering phase, and the front end designs being finalized. Mark identified four main challenges for the coming year:

- the booster commissioning,
- installation of the storage ring,
- executing tenders needed for front ends, IDs and long lead item beamline components (mostly optics), and



Barry Hawkins (UMA) – CLS project manager

- the further development of the beamline suite, including phase II funding.

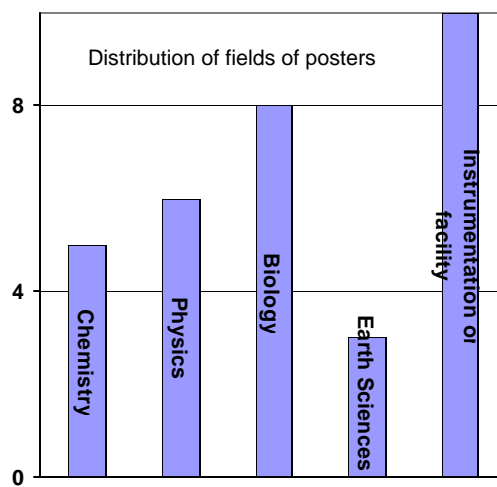
This was followed by a detailed presentation by **Ingvar Blomqvist** of the preliminary design of the five insertion devices being constructed as sources for the first phase beamlines. This presentation echoed many of the themes Ingvar presented in the ID workshop the previous day (see above).



Poster session

The last oral session dedicated to UAC business provided brief reports on the breakout sessions (see below) and gathered nominations for membership in the 2002 User Advisory Committee.

The oral session was then followed by a 2 hour **poster viewing session** which featured refreshments subsidized by Electronic Data Systems, who are a major CLS contractor firm in information technology. 32 posters with a variety of scientific and technical content were displayed and presented. A summary of the disciplinary and energy range distribution of these posters is given in the accompanying figure. As part of the poster event, presentations made by graduate students and postdoctoral fellow were evaluated for the best poster prize sponsored by the Canadian Institute for Synchrotron Radiation (CISR). The prize is a \$1000 honorarium to assist the winner in attending a conference to present their synchrotron based work



The Users' meeting finished with a very enjoyable banquet in the Marquis Hall. The wrap up was given by **Ron Cavell** (UoA, president CISR) in a post-banquet address in which he congratulated Mike Bancroft for his leadership role in bringing CLS into existence and guiding its early development. Ron also outlined some of the history of the CLS and the role played by CISR in its development.

Ron then presented the CISR 'best poster prize' to **Lisa Croll** (Chemistry, McMaster University) for her poster,



Lisa Croll (Chemistry McMaster), receiving the CISR best-poster prize for 2001 from Ron Cavell (President, CISR)

Integrating NEXAFS Microscopy and Crystallography: The Effects of Molecular Order on Soft X-ray Spectromicroscopy

Lisa is a third year PhD student in polymer chemistry.



Attentive audiences at CLS Users' meeting

CLS Users' Meeting - Break-out session reports

1. User Services (Urquhart) Attendance: ~15

1.A Housing

Urquhart described a proposal for a combined graduate student / research residence that is presently being developed by U of S Facilities management and is expected to be put forward for approval in the near future. This facility will be a ~400-bed facility located near the CLS building, in the approximate location of Pay Lot #4. This is approximately a 4-minute walk from the CLS. This facility is intended to serve several purposes: decant space for graduate student housing during necessary renovations of other residences on campus, and for researcher housing for visitors to the CLS. The size of the facility (~400 beds) is considered to be adequate for a self-financing residence. The residence would include office space on the ground floor and potentially a graduate student lounge at one end. The building plan would be based on a 2-bed suite configuration. Each suite would provide two bed/study rooms, which would share washroom facilities and a small servery (sink, table, microwave, etc). An approximate cost is \$35 / person / night (2-bed suite configuration).

Users in the meeting had the following comments:

- Many of the users of the research residence will be graduate students using the CLS. These travel costs will be born by NSERC grants or other limited sources of funds. Inexpensive housing is essential for these and other users, as long stays will be necessary and travel budgets are small and are extremely unlikely to grow.
- A basic level of facilities is desired; users need a bed and basic services, not luxury.
- The residence will need to be quiet at all times, as researchers will not be keeping regular sleeping hours. There are concerns about the graduate student pub being too close to the

researcher residence area, although there was interest in having a local place to go for a beer and food.

- Users wanted to ensure that there would be a central kitchen / eating / social space and access to laundry facilities.
- The time period for visitors will vary from very short stays (1-2 nights for protein crystallography users) to long stays (weeks to months) for other users. Some consideration will be necessary for these varied uses.
- Users desire telephone and internet access in the guest rooms
- It is important for the guest house to be very close to CLS; users were pleased with the current location
- Some users wanted to be able to monitor the CLS ring statistics (beam current, schedule, etc) from the guest residence (monitors in hallway, on Shaw cable?)

1.B Computer Facilities

Users were very concerned about access to e-mail and other computer services while using the CLS. Email access by webmail (via a web browser) was adequate for some users, although other users expressed the need for full ethernet access. User access to the internet is desired on the CLS floor and in the guest residence.

Users will need easy access to instructions on how to navigate the CLS firewalls, and gain access to the internet and shared printers from the CLS floor. Some users would want to use their own computer equipment (laptops, etc) to access these facilities, although access to shared public computers (computers, printers, etc) would be desirable for back-up, printing, e-mail, etc.

Urquhart commented that EDS (Electronic Data Services) has the Information Technology contract to design the computer infrastructure for the CLS. To date, EDS has made only limited contact with CLS users, although it is also understood that EDS has a very specific method of surveying user interests and they are not yet at that stage. Users at this meeting were willing to help provide information to EDS on user needs and were anxious that EDS seek this information from a wide range of CLS users.

1.C Technical Infrastructure

Many users asked questions regarding the plans for user support facilities at the CLS. Some of these concerns have been addressed by the CLS (wet and dry labs, etc), these concerns are repeated here for the record. An on-going policy of communicating the experimental environment at the CLS to future users (and not just beamline teams!) is desired. Users wanted to know what services will be provided, and who provides these services!

There was a great deal of interest in the development of chemical handling facilities at the CLS. Currently, a wet chemical preparation lab has been constructed on the CLS floor. There was interest in facilities to handle air sensitive samples



Vendor exhibits provide useful opportunities for technical discussions

(via a glove box) and a question concerning running of radioactive samples. There was need for access to liquid N₂ and liquid He, as well as standard gases (N₂, air, He),

User shops and support is extremely important to the workshop participants. There was strong desire to have a very well maintained stock room that would be accessible to all users on a 24-hour basis. There was also strong desire for electronic and mechanical support for users, in particular a machine shop that could work on user projects, as well as a work area / tools for users can do their own repairs on a 24/7 basis.

A pool of equipment for use by users was desired. This includes turbo-pumping units with leak-checkers, a general equipment pool (variacs, oscilloscopes, etc), a set of spare parts, and gas cabinets. Participants noted that not all experimental chambers will be controlled by beamtime teams or the CLS. Electrified storage space for user end-stations is necessary.

There was much curiosity in the development of user support facilities. There was interest in user access to photocopy / fax / phone services, and the ability to purchase through university services (printing, chemical stores, etc). Users will also need to access purchasing and courier services.

1.D University Infrastructure

Access to the University of Saskatchewan library system was of interest to the workshop attendees. There was a desire for the library to subscribe to journals related to synchrotron radiation research, despite the journal cancellation policies that many university libraries have recently suffered under. CLS users should be able to access the facilities of the U of S library, including access to e-journals and databases that are site-licensed by the U of S (i.e. when on-site, from the floor of the CLS).

Some interest was expressed in the various forms of ancillary research support on campus (Saskatchewan Structural Science Center, etc)

Parking is needed for both users and staff at the CLS. Some users noted that parking is free at all other synchrotron facilities.

1.E Air Service

The attendees were not pleased with the current air transportation situation in Canada.



Posters & reception

2. Communications (Hitchcock)

The attendance was smaller than in 2000, perhaps suggesting less concern over this issue. Even so, CLS communications were criticized, with concern being expressed about difficulties in finding key policy and technical information. In particular, one user said they were very frustrated in finding out the process to be used for applying for a beamline at the CLS, and the detailed technical specifications that would be needed for beamline conceptual design (source and ID parameters in particular). It was noted that providing users with improved access to this type of detailed information would help CLS gain the respect of seasoned SR users. In contrast, not supplying this type of information was considered to raise significant concerns about the risk

of developing experiments at the CLS which could have negative consequences to user participation. In general the group tried to understand whether the inaccessibility of technical information from CLS was a deliberate policy, or simply a case of insufficient resources / too low priority placed on this aspect of communications. Several suggested assignment of a part time communications officer explicitly responsible to develop communication policies and enforce their implementation.

The web pages were noted to be very dated in many cases. In addition to dated content, the organization of the web pages met some criticism. Suggestions for improvements include:

- Access to more information directly from the front page, by longer “pull-out menus”;
- addition of an effective topic selector and search function;
- implementation of a FAQ (frequently asked questions) page;
- use of a group of users to which the web page is oriented in order to test its usability.

*With regard to the later, **Marcus Karolewski** (ASI) volunteered to systematically walk through all of the CLS public web site and provide feedback to CLS.*

The group felt the **electronic newsletter** was an excellent addition to CLS-user communication. The content was felt to be appropriate. One suggestion was to put highlight phrases indicating the content of the issue within the first 3 lines of the body of the E-newsletter since a number of email programs (e.g. Outlook) have a feature which displays these with the subject/sender etc without opening the full document. Several said they preferred the in-line format to an attachment and requested the E-newsletter stay in that format.

The group discussed communications sent via the regular mail. Aside from the annual alert and registration form to the user meeting, it was not felt necessary to add additional items.

The registration for the annual users’ meeting was noted as an opportunity for providing communication from users to the CLS. This could take the form of a check box section on the electronic or paper registration form which would allow the user to indicate their areas of interest (as done in the CISR application form for example). It was felt this would help the CLS identify future users, and to develop a better understanding of the areas of greatest interest.

Finally a request was made that abstracts be provided to the oral as well as the poster contributions for the users’ meeting. Brief talk summaries, and if possible, key references for the scientific ones, were requested.

3. Beamline funding (Gough)

The discussion group was well attended, with over 20 participants at any time, and several more dropping by. Experience among the participants ranged from leadership of approved beamlines to persons involved in planning letters of intent for beamline proposals, as well as good representation from the general user community (government, industry and academics).

Discussion ranged over a number of related topics, leading to several questions:

1. *What are the funding options available to teams developing beamlines ?*
2. *Who at CLS, ASI, BC-SLI and other provincial synchrotron institutes has information on fund-raising processes?*
3. *Will there be operating charges for peer-reviewed access, and if so, can the categories be clarified?*
4. *What are the interpretations of policy arrangements with regard to entities such as NRCan and their industrial clients?*
5. *What is the policy from CLS on overall funding process in all phases: development, construction, operation?*

Several items were raised during the discussion. Concern was expressed over the recently approved policies on fees for beamline access. It was noted that space allocation around the ring is a significant consideration in developing the long-term plan for the CLS. It was acknowledged that there are a number of proposals for beamlines which will extend out the north face window, thus requiring building expansion. These proposals need to coordinate their efforts. The availability of some term-limited operating costs through new CFI (~10% of capital) can assist teams in the design and construction phase. Operating charges for remote service were discussed.

Beamline Team/ Design Team workshops and Scientific Meetings (Nov 18, 2001)

A range of scientific meetings and beamline team/ design team meetings were held on Sunday. The approved and funded projects are all at a critical stage of finalization of design and locking down the parameters for the engineering phase. In these cases the workshops were extremely valuable opportunity for the user community and the CLS beamline development scientist to have in depth interactions. In other cases, groups developing new proposals were able to refine their plans and introduce their ideas to potential new beamline team members. The schedule of these meetings follows.

Scientific program meetings (beamlines in earlier stages of proposal and planning)

Beamline	Contact	Room
BioMedical Imaging	Ed Kendall	Geology 155 14:00 – 16:00
MEMS /Nano-tech	Ken Mayhew	Biology 125 9:00 – 12:00
Powder Diffraction	John Tse	Geology 165 9:00 – 12:00
Small Molecule Crystallography	Jim Britten	Biology 124 9:00 – 12:00

Technical Design Meetings (beamlines in advanced stages of the development cycle)

Beamline	Contact	Room
Infra Red	Tim May	Physics 126 9:00 – 11:00
MicroXAFS and Hard X-ray microprobe	De-Tong Jiang and/or Ron Cavell	Physics 127 9:00 – 11:00
Canadian Macromolecular Crystallography Facility	Pawel Grochulski	CLS 9:00 – 14:00
Soft X-Ray Spectromicroscopy	Konstantine Kaznatcheev	Physics 128 8:30 – 17:00
VLS-PGM and High Resolution SGM	Ian Coulthard	Physics 129 9:00 – 11:00