A Week of SRI 2003 in San Francisco

The Eighth International Conference on Synchrotron Radiation (SRI 2003) ended its August 25-28 run at the Yerba Buena Center for the Arts in San Francisco with almost as many in attendance as at the beginning. The steady attendance was surely a tribute to the quality of the program and the excitement it generated among the more than 700 registrants who gathered for four days of plenary talks, parallel sessions, and posters, as well as facility tours of the ALS and SSRL on August 29.

On Monday, conference co-chairs Howard Padmore of the ALS and Jo Stöhr of SSRL started the proceedings with an introduction in the style of two television commentators setting the stage before a major sports event. Passing the microphone back and forth, they explained the structure of the meeting and the choices of topics and speakers for the plenary talks that occupied the morning of each conference day.

Advanced sources was the first focus of the plenaries. Pascal Ellaume (ESRF) led off with a summary of "Present limits and future developments of storage ring synchrotron sources," and Sol Gruner (CHESS, Cornell University) reviewed "Concepts and applications of energy recovery linacs (ERLs)."

Tuesday's plenary session began with Jerry Hastings (SSRL) speaking on "Free Electron Lasers." The organizers then switched the theme to the science driving the development of new sources and instrumentation. Phillip Bucksbaum (University of Michigan) gave an overview of "Ultra fast experiments," and Alain Manceau (University Joseph Fourier and CNRS, France) did the same for environmental sciences with his presentation "Shining synchrotron light on the complex world of environmental materials."

On Wednesday, the science theme shifted to condensed matter and materials physics with overviews by George Sawatzky (University of British Columbia) of "Scientific opportunities with x rays in condensed-matter physics," by Gene Ice (Oak Ridge National Laboratory) on "Below the grain size of most materials: How x-ray microscopy in the 21st century will revolutionize our understanding of materials," and by O. Shimomura (SPring-8) on "High-pressure studies illuminated by synchrotron radiation." Ice provided an opportunity for audience participation by accompanying himself on guitar at the end of his talk as he sang, "The Microbeam Science Song."

Thursday's final plenary session opened with a review of the critical topic of how to develop detectors that can keep up with the requirements for resolution and speed imposed by state-of-the art experiments at the powerful new sources. Garreth Derbyshire (Rutherford Appleton Laboratories, UK) spoke on "Detectors for synchrotron radiation experiments—maintaining the status quo or an opportunity for change?" John Spence (Arizona State University and ALS) concluded with a tour of developments in the new field of so-called lensless imaging (reconstruction of images from far-field diffraction patterns of non-periodic objects) with his talk "Coherent imaging with x rays and electrons."

After the plenary talks, which were designed to be tutorial and wide-ranging in their coverage of broad topics, more detailed views of specific developments were given by speakers in afternoon parallel sessions. In addition, for still more detail, poster sessions were held each day after lunch and at the end of the day in conjunction with exhibits by 39 vendors. These vendors also generously provided for food and beverages early in the morning, during meeting breaks, and at the end of the day during the poster sessions.

On Wednesday evening, conference attendees, their partners, and the general public were treated to a free public science lecture by Saul Perlmutter (Berkeley Lab), who spoke on "Supernovae, Dark Energy, and the Accelerating Universe." About 400 took advantage of this opportunity to hear this awarding-winning scientists discuss ways that observational science might help answer the question "Will the universe last forever, or someday will it come to an end?" Earlier in the day, the public and conference attendees also had a chance to view an exhibition artwork created by University of California, Berkeley, art students after two evenings of visits to the ALS. Visitors also viewed a superb mechanical model provided by Masahiro Hara of SPring-8 that demonstrated how a linear accelerator works as well as various other informational materials.

Closing out the formal presentations on Thursday afternoon, Friso van der Veen (Paul Scherrer Institut, Switzerland) attempted to summarize the week's proceedings with remarks titled "Synchrotron light of the third and fourth generation—how to fill the generation gap." After noting that he was certain to fail at summarizing so many high-level presentations, van der Veen gave a whirlwind yet almost encylopedic tour of the week's proceedings from sources to detectors.

For third-generation sources, van der Veen highlighted the increasing use of top-off operation, already under way at the Swiss Light Source (SLS) and the Advanced Photon Source (APS) and planned for upgraded facilities elsewhere. For ultrafast free-electron lasers, he noted the critical importance of low-emittance electron guns, which could reduce the size and hence cost of the facility. In the meantime, laser slicing sources, such as those at the ALS and planned at the SLS, fill in the gap but with rather low flux.

After reviewing progress in imaging technology including Kirkpatrick-Baez mirror systems, refractive lenses, capillaries and wedges, and Fresnel zone plates (including photon sieves), van der Veen noted a recent calculation of the minimum spot size for a capillary in the neighborhood of 10 nm (materials dependent) and speculated that the limit applies to all the x-ray microscope technologies. Aberration-corrected photoemission electron microscopes, such as PEEM 3 at the ALS and SMART at BESSY II are planned with slightly higher spatial resolution, perhaps 5 nm. Time-resolved, picosecond magnetic imaging with PEEM and with full-field imaging microscopes are another frontier area.

Moving on to the production and use of coherent synchrotron radiation (see also the report on the satellite workshop on "X-Ray Science with Coherent Radiation," page XXXXX), van der Veen reviewed progress with terahertz radiation at BESSY II when the storage ring was operated with special magnetic optics. He then switched to lensless

imaging, in which the technique of “oversampling” and knowledge of a “support” volume outside of which the object being imaged is known not to exist make it possible to reconstruct the image from the intensities in the diffraction pattern alone without initial phase information by means of an iterative tranformation between real and reciprocal space. Spatial resolutions as good as 10 nm have been demonstrated for test objects. The most complex objects imaged so far in this way are bacterial cells at SPring-8.

Regarding improved detectors, van der Veen noted that we keep talking about them, but do too little. He then mentioned several detector technologies for both x rays and electrons but emphasized progress in pixel detectors based on microelectronics. In these detectors, each pixel in effect has its own circuitry on a chip bonded to the active area of the detector. Such a detector designed at the SLS has been demonstrated at SPring-8 by recording protein diffraction patterns. He concluded with a look at the phenomenal growth of protein crystallography at synchrotron facilities. Automation is the current frontier with numerous projects under way at SSRL, the SRS at Daresbury, the ALS, and elsewhere. Standardization of automation schemes will soon be necessary.

In the end, van der Veen concluded, there would be no problem filling the gap by the next SRI because every three years the synchrotron performance increases by an order of magnitude in one parameter or another (flux, brilliance, coherence, time resolution), thanks to the new generations of facilities, the upgrades of existing sources, and most of all the instrumentation scientists who make it all happen.

Padmore and Stöhr then returned to the podium to end the conference and to report two pieces of news. First, the International Advisory Committee, consisting of the directors of operating synchrotron light sources, would be developing a formal constitution with an eye toward possibly widening its role beyond selecting the site of the triennial SRI conferences. Second, the ninth international conference, SRI 2006, was awarded to Korea. Hosted by the Pohang Light Source, the conference will be held in the Bomun resort area in Gyeongju, about 30 minutes from the PLS. Check your favorite Internet search engine or go directly to www.gyeongju.gyeongbuk.kr/en for information about this area, which has a rich history dating to its time as Korea’s capital during the Silla Dynasty (57 BCE–935 CE) and even earlier.

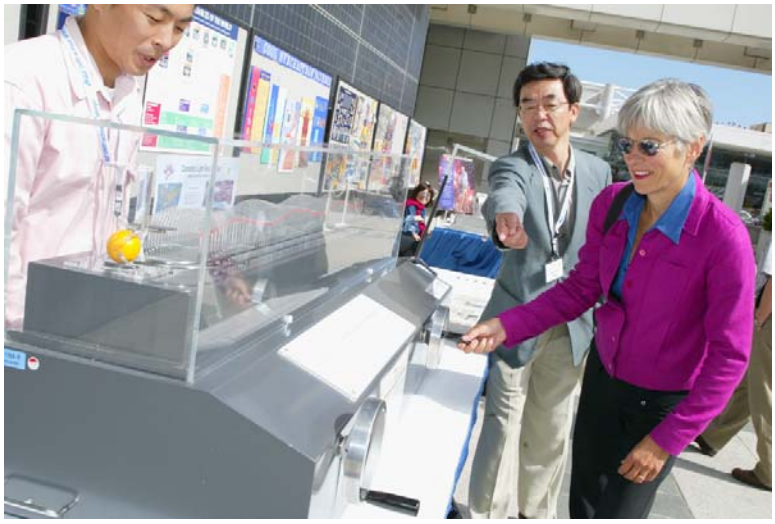
With the formalities completed, some 300 conference attendees repaired to the Yank Sing restaurant at the nearby Rincon Center in San Francisco for a multicourse feast as well as a dramatic performance by two pairs of acrobatic Chinese lion dancers.

On Friday, those interested were invited to tour either the ALS or SSRL. At the ALS, about 110 persons came to visit. ALS Division Deputy for Science Neville Smith divided those present into groups of 11, each with its own ALS staff guide. The visitors were able to visit several beamlines, where beamline scientists were stationed to give a brief introduction and answer questions. Visitors were then free to spend more time at specific beamlines of their choice. A box lunch on the ALS patio ended the tour.

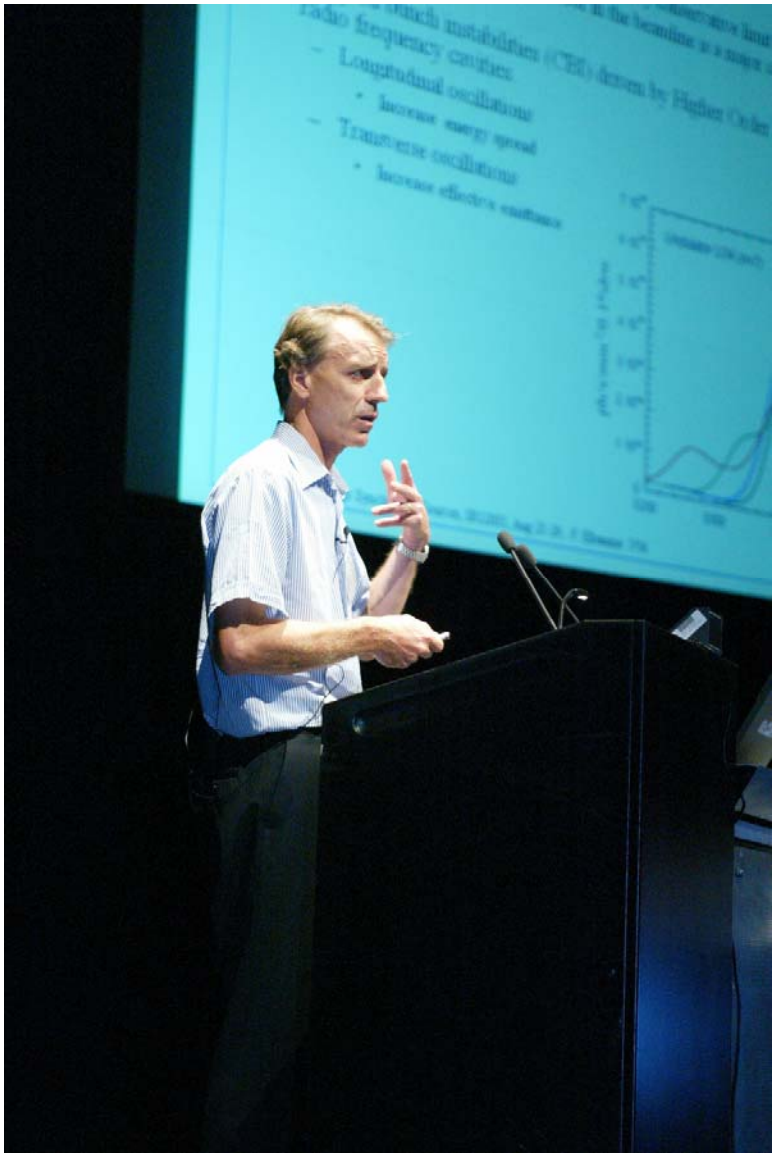
More than 130 people came to see what was new at SSRL. The tour started with a stop at the SLAC klystron gallery, comments by SSRL Director Keith Hodgson, and an informative introduction by Jerry Hastings while viewing the SPPS (Sub-Picosecond Pulse Source) experiment installation. The tour then became self-paced through the SSRL experiment hall, with staff stationed at beamlines to describe and answer questions about the science and instrumentation setups. The tour also included views of the newly installed components of the SPEAR2 to SPEAR3 accelerator upgrade.

The conference proceedings will be published by the American Institute of Physics. Tony Warwick (ALS) and John Arthur (SSRL) are the editors. Check the conference Web site for information (www.sri2003.lbl.gov). Organizers are also planning to post vu-graphs from all the oral presentations on the Web site.

Art Robinson
Advanced Light Source
Lawrence Berkeley National Laboratory



(XBD200308-00529-143.tif)
Masahiro Hara (SPring-8) uses a mechanical model of a linear accelerator to explain how electrons are accelerated to Kathryn Warden (University of Saskatchewan)



(XBD200308-00529.13.tif)
Pascal Ellaume (ESRF) reviews the prospects for squeezing more brightness from conventional third-generation storage rings.

(XBD200308-00529-200.tif)
In a public science lecture, Saul Perlmutter (Berkeley Lab) broadened the scope of the meeting to include the fate of the universe with a talk on “Supernovae, Dark Energy, and the Accelerating Universe.”