



FIGURES AND FACTS

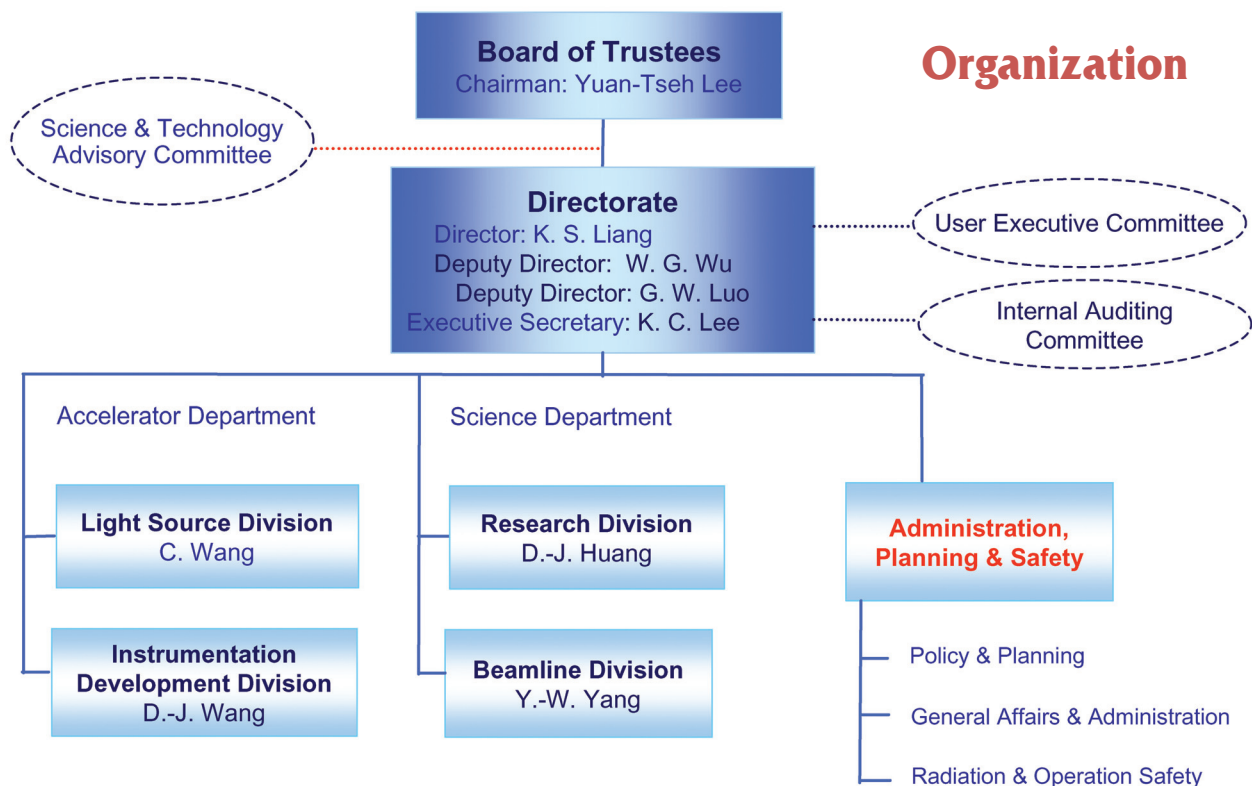


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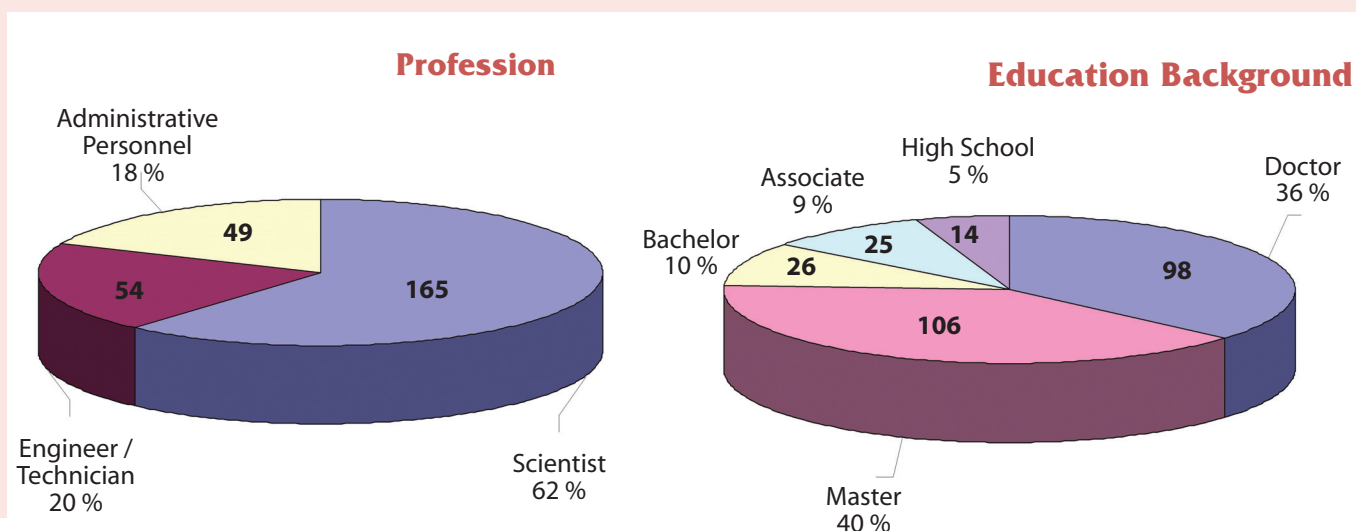
2008 User Executive Committee

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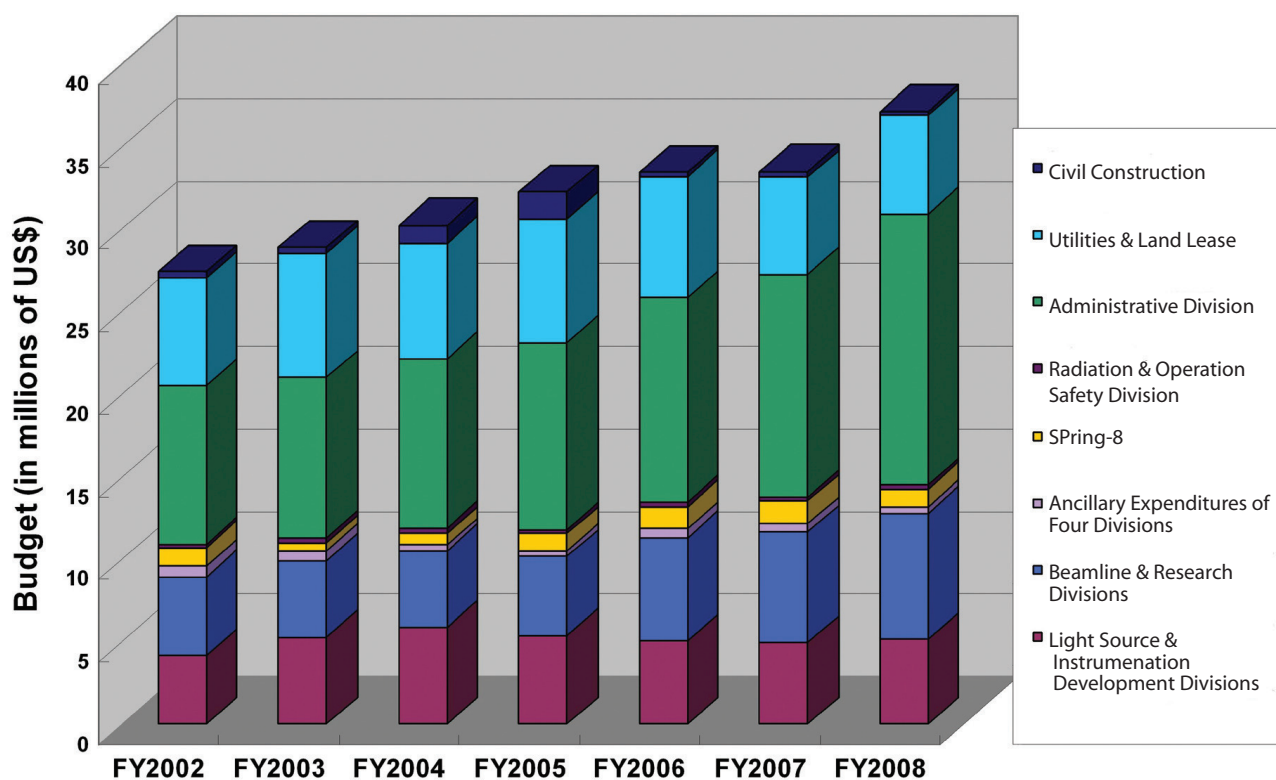
Manpower

As of March 2008, the NSRRC workforce consists of 268 staff members. The following pie charts show the manpower distributions by profession and by education background.



Budget

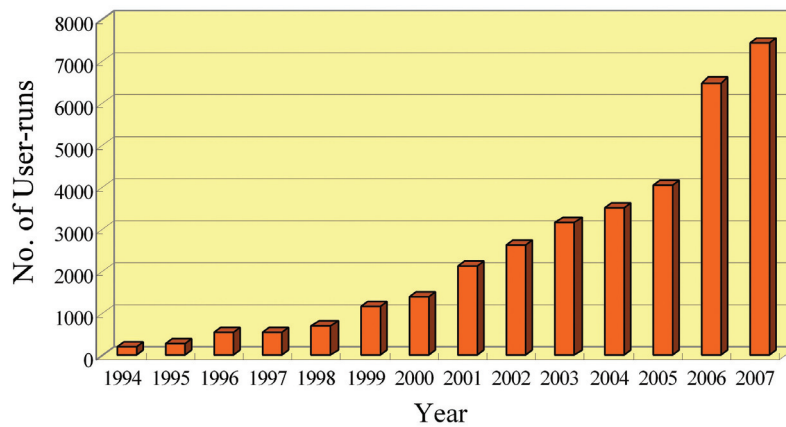
An NSRRC budget breakdown into eight categories for the past seven years is presented below. It comprises Light Source & Instrumentation Development Divisions, Beamline & Research Divisions, ancillary expenditures of the above four divisions, SPring-8 group, Radiation & Operation Safety Division, Administrative Division, utilities & land lease, and civil construction. The total budget for fiscal year 2008 is 37.5 million US dollars (based on 2008 currency, exchange rate: 1 USD=31 New Taiwan Dollars), a 5.24% increase over that of the prior year.



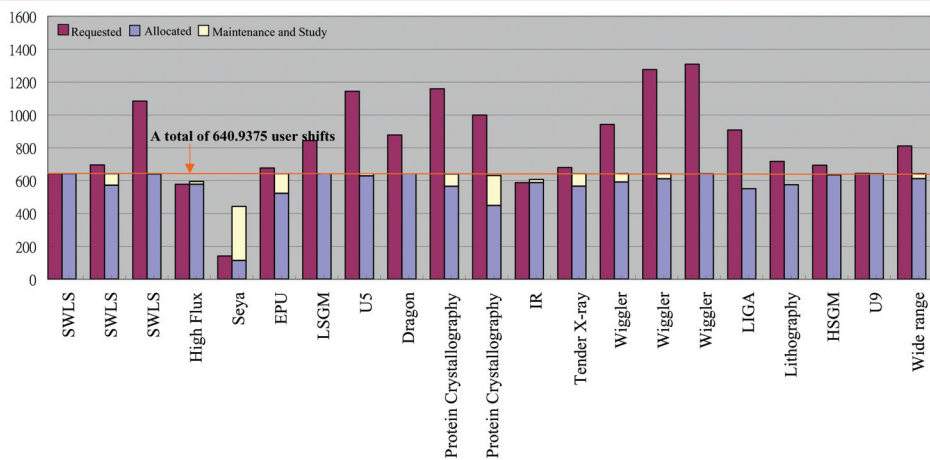
User Administration

From 1994 to 2007, the total number of beamlines opened to the public users has increased from 4 to 19. During the year of 2007, the User Administration Office (UAO) handled 1,045 beam line proposals and 7,458 user runs. The total executed beamtime (excluding beamline maintenance and study) for TLS and SPring-8 beamlines is 10,853.5 shifts and 867 shifts respectively. The UAO has issued 836 new user cards (including 736 new applications and 100 renewals), 2,618 financial aids for students/postdocs, and 131 financial aids for SPring-8 experiments. The number of users in 2007 is 1,623 (196 Principal Investigators) drawn from 101 affiliations (including 196 users from 55 foreign institutions). At the end of 2007, the NSRRC user community has 1,892 active users (268 Principal Investigators). Operational data on beamlines and users are summarized in the following figures.

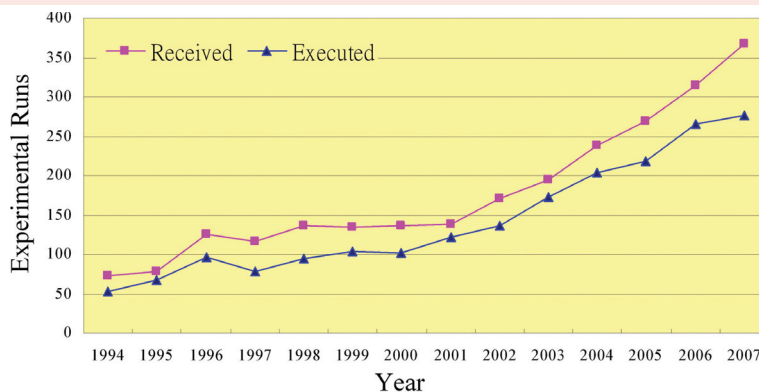
Number of user-runs from 1994 to 2007



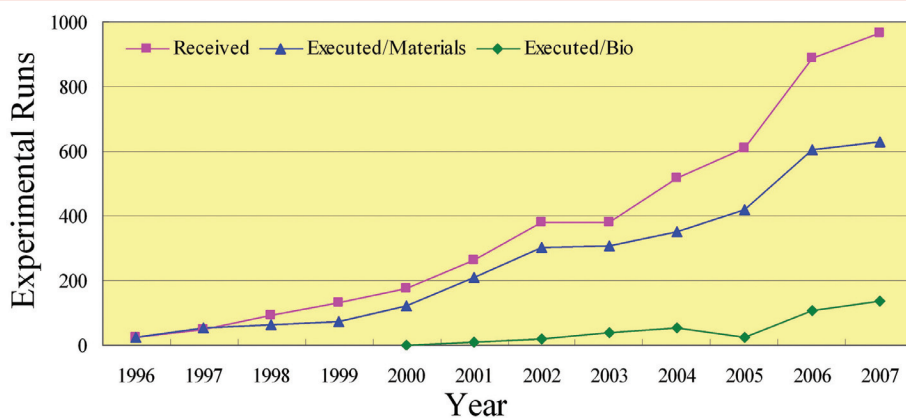
Beam time requested vs. allocated for different beamlines in Year 2007



Number of VUV experiments from 1994 to 2007



Number of X-ray experiments from 1996 to 2007



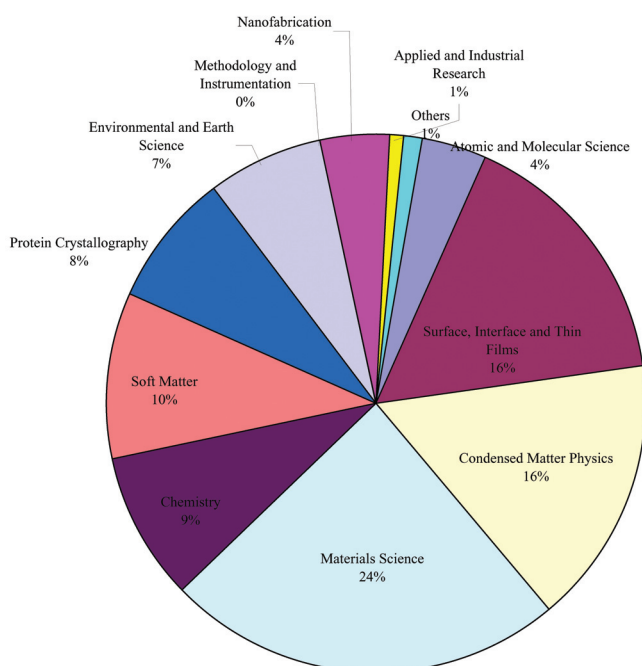
User Executive Committee

The NSRRC’s User Executive Committee (UEC) was formed in the year of 1998. The UEC serves in an advisory capacity and communicates general users’ needs and concerns to NSRRC’s management. During 2007, under the leadership of UEC Chair Prof. Kung-Hwa Wei of Department of Materials Science & Engineering, National Chiao Tung University, UEC held 2 general business meetings. New UEC members elected are Prof. Nei-Li Chan, National Taiwan University, Prof. Yun-Liang Soo, National Tsing Hua University, Prof. An-Chung Su, National Tsing Hua University, Prof. We-Fang Su, National Taiwan University; student: Hsiao-Chi Lu, National Chiao Tung University.

In year 2007, the NSRRC Users' Meeting was held together with the 2nd Asia-Oceania Forum for Synchrotron Radiation Research (2nd AOFSSR). On October 31, UEC and NSRRC jointly organized the Thirteenth Users’ Meeting (Venue: National Synchrotron Radiation Research Center). Following this, the 2nd AOFSSR was held on November 1 – 2 (Venue: National Chiao Tung University Library).

The main mission of the AOFSSR is to establish a general framework of collaboration in synchrotron research in the Asia and Oceania region. It was an honor for NSRRC to organize the 2nd AOFSSR and this also signified the recognition of

Distribution of the users’ proposal in different experimental fields in 2007



our achievements in synchrotron radiation research within the Asia-Oceania region.

In summary, there were 561 attendees for the joint events, including 80 attendees from Japan, Korea, Australia, Singapore, Thailand, India, China, and France. Further, there were 16 invited talks and 260 poster presentations during the conference. Apart from the regular program, the 2nd AOFSSR also included the “Young Scientist Presentation” section to this year’s program with the intention to encourage young ones in participating in synchrotron radiation research. This newly added section, which featured oral presentations by 10 young scientists drawn from the member countries of AOFSSR, was of a great success and a characteristic of the 2nd AOFSSR due to the outstanding performance of the presenters.

As announced at the end of the 2nd AOFSSR, the 3rd AOFSSR will be held in Australia and NSRRC users are encouraged to take part in the next conference.

Beamlines in Operation/Commission

No.	Name	Mono. Type	Energy Range(eV)	Res. Power (E/ΔE)	Status
01A	SWLS - White X-ray	none	> 5k		in operation
01B	SWLS - X-ray Microscopy	DCM	8k - 11k	1,000	in operation
01C	SWLS - XAS/XRD	DCM	6k - 33k	7,000	in operation
03A	BM - High Flux VUV	CGM	4 - 40	50,000	in operation
04B	BM - Seya	SNM	4 -40	5,000	in operation
05A	EPU - Soft X-ray Scattering	AGM	400 - 1.5k	20,000	commissioning
05B	EPU - Spin-polarized PES/PEEM	SGM	60 - 1.5k	20,000	in operation
08A	BM - Low Energy SGM	SGM	15 - 200	20,000	in operation
08B	BM - Medium Energy AGM	AGM	300 - 1k	10,000	in operation
09A	U5 - SPEM / Spectroscopy	SGM	60 - 1.5k	15,000	commissioning
11A	BM - Dragon	SGM	8 -1.5k	15,000	in operation
13A	SW6 - X-ray Scattering	ACCM	12k - 14k	1,000	in operation
13B	SW6 - Protein Crystallography-B	DCM	5k - 20k	7,000	in operation
13C	SW6 - Protein Crystallography-C	ACCM	12k -14k	1,000	in operation
14A	BM - Infrared Microscopy	FTIR	1 - 25 μm		in operation
16A	BM- Tender X-ray	DCM	1k - 9k	7,000	in operation
17A	W20 - X-ray Power Diffraction	ACCM	8k - 12k	1,000	in operation
17B	W20 - X-ray Scattering	DCM	4k - 15k	7,000	in operation
17C	W20 -XAS	DCM	4k - 15k	7,000	in operation
18B	BM - Micromachining	none	> 500		in operation
19A	BM - X-ray Lithography	none	800 -1.8k		in operation
19B	BM - Photo Stimulated Desorption	none	White Light		in operation
20A	BM - High Energy SGM	SGM	70 -1.2k	10,000	in operation
21A	U9 - Chemical Dynamics	none	4 - 500	50	in operation
21B	U9 - Spectroscopy	CGM	4 - 100	100,000	in operation
23A	IASW - Small Angle X-ray Scattering	DCM	5k - 23k	7,000	commissioning
24A	BM - Wide Range SGM	SGM	10 - 1.5k	30,000	in operation
SP12B	Biostructure and Materials Research	DCM	5k - 100k	7,000	in operation
SP12U	Inelastic X-ray Scattering	DCM/HRM	5k - 30k	1,000,000	in operation

Beamlines under Construction/in Planning

No.	Name	Mono. Type	Energy Range(eV)	Res. Power (E/ΔE)	Status
07A	IASW - X-ray Scattering	DCM	5k - 23k	7,000	under construction
15A	IASW - X-ray beamline	DCM	5k - 14k	7,000	under construction
SP12D	HE photoemission	DM/HRM	6k - 14.4k	300,000	under construction

ACCM: Asymmetrically-cut Curved Crystal Monochromator
 AGM: Active Grating Monochromator
 CGM: Cylindrical Grating Monochromator
 DCM: Double Crystal Monochromator
 PEEM: Photo-Emission Electron Microscope

SPEM: Scanning Photoemission Electron Microscope
 SGM: Spherical Grating Monochromator
 SNM: Seya-Namioka Monochromator
 XAS: X-ray Absorption Spectroscopy
 XRD: X-Ray Diffraction

Spokespersons for End Stations (2008)

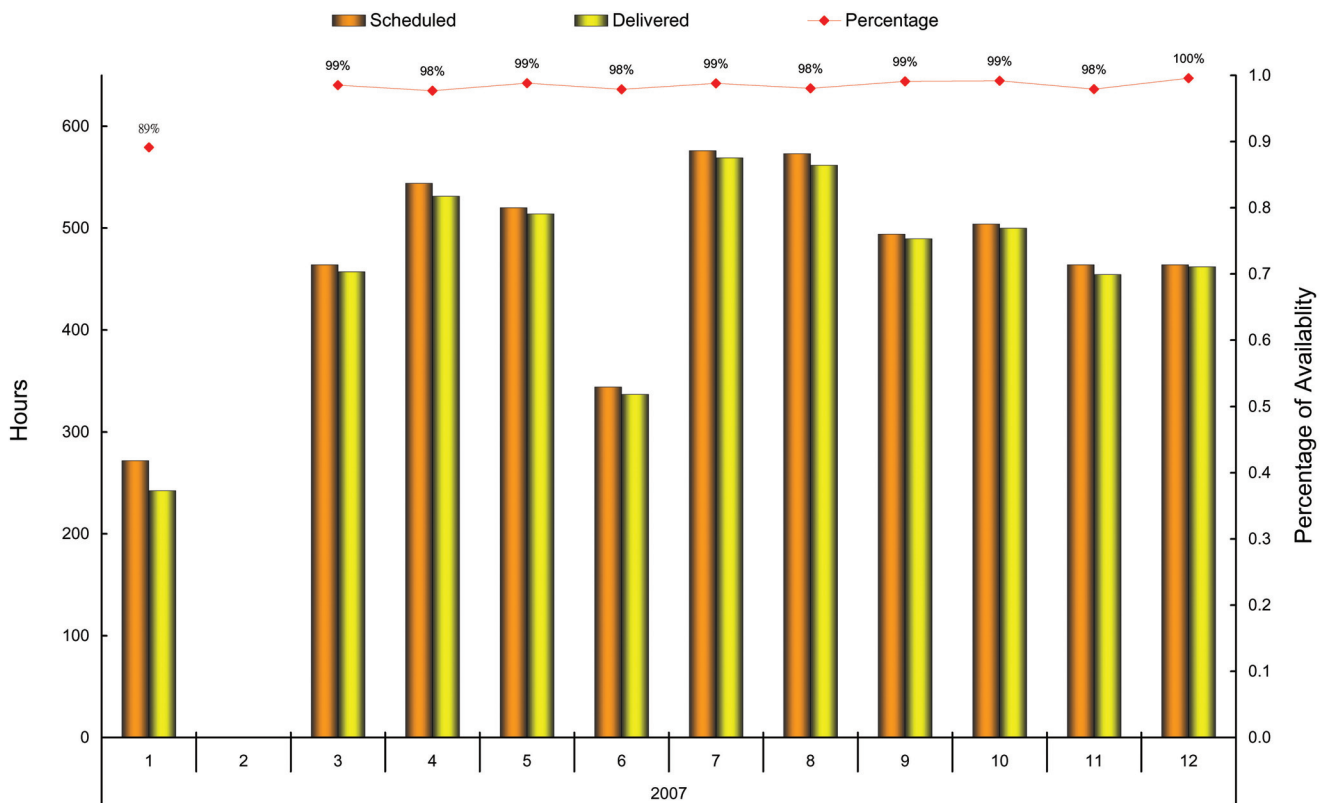
No.	Beamline	End Station Spokesperson	Beamline Tel ext. (Tel:+886-3-578-0281)	E-mail
01A1	SWLS - White X-ray (PRT 75%)	Hwu, Yeu-Kuang	1011	phhwu@sinica.edu.tw
01B1	SWLS - X-ray Microscopy (PRT 75%)	Song, Yen-Fang	1012	song@nsrrc.org.tw
01C1	SWLS - EXAFS	Lee, Jyh-Fu	1013	jflee@nsrrc.org.tw
01C2	SWLS - X-ray Powder Diffraction	Sheu, Hwo-Shuenn	1013	hsheu@nsrrc.org.tw
03A1	BM - (HF-CGM) - Gas Phase/Photoluminescence	Cheng, Bing-Ming	1031	bmcheng@nsrrc.org.tw
04B1	BM - (Seya) SRCD	Chiang, Su-Yu	1042	schiang@nsrrc.org.tw
05A1	EPU - Inelastic Scattering	Huang, Di-Jing	1053	djhuang@nsrrc.org.tw
05B1	EPU - Spin-polarized PES	Huang, Di-Jing	1053	djhuang@nsrrc.org.tw
05B2	EPU - PEEM	Wei, Der-Hsin	1052	dhw@nsrrc.org.tw
05B3	EPU - Soft X-ray Scattering	Huang, Di-Jing	1053	djhuang@nsrrc.org.tw
08A1	BM - (L-SGM) XPS, UPS	Pi, Tun-Wen	1081	pi@nsrrc.org.tw
09A1	U5 - SPEM	Chen, Chia-Hao	1101	chchen@nsrrc.org.tw
09A2	U5 - Spectroscopy	Hsu, Yao-Jane	1101	yjhsu@nsrrc.org.tw
11A1	BM - (Dragon) MCD, XAS (PRT 75%)	Lin, Hong-Ji	1111	hjlin@nsrrc.org.tw
13A1	SW6 - X-ray Scattering	Huang, Yu-Shan	1131	jade@nsrrc.org.tw
13B1	SW6 - Protein Crystallography	Jean, Yuch-Cheng	1132	ycjean@nsrrc.org.tw
13C1	SW6 - Protein Crystallography	Chao, Frodo	1133	frodo@nsrrc.org.tw
14A1	BM - IR Microscopy	Lee, Yao-Chang	1141	yclee@nsrrc.org.tw
16A1	BM - Tender X-ray Absorption, Diffraction	Jang, Ling-Yun	1161	lyjang@nsrrc.org.tw
17A1	W20 - X-ray Powder Diffraction	Lee, Jey Jau	1171	jjlee@nsrrc.org.tw
17B1	W20 - X-ray Scattering	Lee, Hsin-Yi	1172	hylee@nsrrc.org.tw
17C1	W20 - EXAFS	Lee, Jyh-Fu	1173	jflee@nsrrc.org.tw
18B1	BM - LIGA	Shew, Bor-Yuan	1182	yuan@nsrrc.org.tw
19A1	BM - X-ray Lithography	Shew, Bor-Yuan	1191	yuan@nsrrc.org.tw
20A1	BM - (H-SGM) XAS	Chen, Jin-Ming	1201	jmchen@nsrrc.org.tw
21A1	U9 - (White Light) Chemical Dynamics (PRT 75%)	Lee, Shih-Huang	1211	shlee@nsrrc.org.tw
21A2	U9 - (White Light) Photochemistry	Cheng, Bing-Ming	1211	bmcheng@nsrrc.org.tw
21B1	U9 - (CGM) Angle-Resolved UPS	Lee, Yin-Yu	1212	yylee@nsrrc.org.tw
21B2	U9 - Gas Phase	Tsuei, Ku-Ding	1212	tsuei@nsrrc.org.tw
24B1	BM - (WR-SGM) XPS, UPS	Yang, Yaw-Wen	1241	yang@nsrrc.org.tw
SP12B1	BM - Materials X-ray Study	Ishii, Hirofumi		h_ishii@spring8.or.jp
SP12B2	BM - Protein X-ray Crystallography	Chen, Chun-Jung	7330	cjchen@nsrrc.org.tw
SP12U1	U3.2 - Inelastic X-ray Scattering	Tsuei, Ku-Ding	7105	tsuei@nsrrc.org.tw

2007 Machine Operation

Energy :	1.5 GeV
Current :	300 mA top-up operation
Lifetime :	4~7 hr @ 300mA, SWLS @ 5.0 Tesla, SW6 @ 3.2 Tesla, IASW @ 3.0 Tesla.
Orbit stability :	~ 1 μm
Orbit drift :	< 3 μm / 8 hr
Photon stability :	better than 0.2% for 98% of user beam time
Operation :	weekday : 08:00 – 24:00 user time, 00:00 – 08:00 machine study (Only Tuesday and Thursday)
weekend :	00:00 – 24:00 user time
Up-time :	> 98.1%

The storage ring was shutdown during January ~ February for machine maintenance. The scheduled user time was about 75% of the available machine time and the delivered user time was 98.1% in 2007. The faulty reading value of SWLS had been solved, which was one of the major sources of causing the spikes. Effort has contributed to the improvement of machine performance; hence the annual number of beam loss dropped to 45 % of previous year. The statistics indicates that the beam stability index of better than 0.2% exceeded 98% of the available user time.

Machine statistics of users' shift from January to December 2007

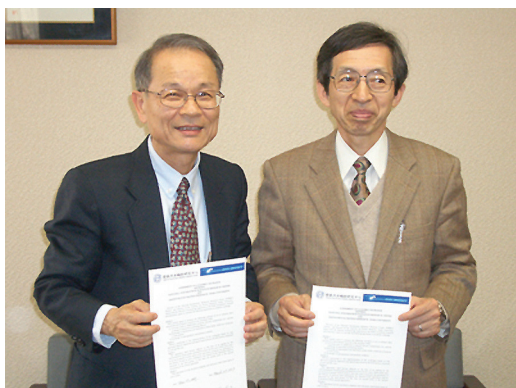


Major Events in Year 2007

March 2007

NSRRC Signs MOU with Osaka University, Japan

The National Synchrotron Radiation Research Center (NSRRC) has signed a memorandum of understanding with Institute for Protein Research of Osaka University, Japan (IPR-Osaka) in March 2007. IPR-Osaka is a world leading institution established for protein research, with emphasis on the structure and function of protein molecules and their biological significance. IPR-Osaka has constructed and operates successfully a contract beamline dedicated for structure determination of macromolecule assemblies at the SPring-8 synchrotron facility that has produced outstanding research results with state-of-the-arts performance. NSRRC has constructed two contract beamlines at SPring-8 designed for biostructure and materials research with half of the beamtime designated for protein crystallography research. The MOU represents the joint force of NSRRC and IPR-Osaka to develop and construct laboratories for sample preparation and characterisation at SPring-8.



Keng Liang (NSRRC) and Tomitake Tsukihara (IPR-Osaka) after signing the MOU in Japan

April 2007

A Successful Open House for ALSP Candidates

The NSRRC hosted a successful Open House on April 9, 2007. Over twenty participants, both candidates and those on the waiting list to the Advanced Light Source Program (ALSP), have a chance to hear briefing from over a dozen of instructors on synchrotron-based research, in particular, demonstrations such as "Recipe for doing science at the NSRRC" and basic science activities. Tours were offered that included basic explanations of how the storage ring works and the research that is done here at the NSRRC. It has been one among important missions on the NSRRC's agenda to create programs to attract and equip the scientific talent among the younger generation in the universities to build science strengths. The ALSP is the initial step of this grand plan allowing NSRRC to joint effort with universities to pursue its goal.



Open House for ALSP candidates

June 2007

NSRRC Offered Hands-on Training on Mastering the Data Collection and S-SAD Phasing Experiments

3-day *Protein Crystallography Training Course* co-organized by Institute of Biological Chemistry, Academia Sinica and NSRRC was held at both locations at the end of June 2007. This is the 2nd year such course been offered with emphasis on two experimental techniques this year. The course is particularly designed for researchers who previously do not have experience in using protein crystallography technique.

The hands-on training at the experimental stations helped trainees to master the high resolution data collection and S-SAD phasing experiments. The process starts with sample preparation, crystallization of proteins, X-ray diffraction data collection and processing, S-substructure determination and protein model building and analysis. Furthermore, trainees also learned the impact of radiation damage on protein crystals, and data collection strategy to reduce the influence of it. At the end of the program, those who fulfill the requirements will receive credential on their conduct that certifies the realization of these techniques and ability of implementing such experimental methods.

June 2007

The First TPS Machine Advisory Committee Meeting

The NSRRC Machine Advisory Committee (MAC) convened for its first meeting on June 4 - 5, 2007 at the NSRRC to review the present status of planning for a new 3 GeV synchrotron radiation facility, the Taiwan Photon Source (TPS). In a series of presentations the committee was given an overview of the project and insight of the beam dynamics, injection systems, conventional construction plans, conceptual technical design and integration plans. The committee members were positive about the thoroughness and quality of the presentations as well as the effort on optimization of the design. The NSRRC team has developed its expertise greatly through the process based on their experience built on the exiting 1.5 GeV light source through the years. The invaluable knowledge and know-how combining with solid comments from the Committee become the key driving force of the TPS project.



Group photograph of the MAC committee members and NSRRC staff

Comments were particularly gathered on the areas of lattice type, lengths of the straight sections, option of the booster ring sharing the tunnel with the storage ring, and overhead cranes. These issues pose urgency for they affect the architectural design of the facility and, if so, the milestone of the project. The next MAC meeting was scheduled in January 2008 and these topics will be revisited for progress evaluation.

June 2007

Renowned Accelerator Physicist Dr. Lee Teng received the 2007 Robert R Wilson Prize

Dr. Lee Teng, member of the NSRRC Board of Trustees and NSRRC director (1983-1985), received the 2007 Robert R Wilson Prize for achievement in the physics of particle accelerators during the 22nd Particle Accelerator Conference in Albuquerque. The APS honoured him for *"the invention of resonant extraction and transition-crossing techniques critical to hadron synchrotrons and storage rings; for early and continued development of linear matrix theory of particle beams; and for leadership in the realization of a facility for radiation therapy with protons."* The award marks the zenith of Teng's distinguished career of 40 years in the accelerator physic. (see *"CERN Courier Magazine, Vol 49 Num 9, November 2007"* by Diana Lin, NSRRC).

July 2007



Thomas Roser (left), chair of the APS Executive Committee, presents the 2007 Robert R Wilson Prize to Lee Teng

Australian Synchrotron and the NSRRC Seal MOU for Future Collaboration

A Memorandum of Understanding (MOU) was established on July 27, 2007 between Australian Synchrotron and the NSRRC, announced by The Minister for Innovation of Australian, John Brumby, to promote further scientific collaboration. The announcement signals further and closer collaboration of the already-undertaken cooperation starting in mid-July of 2002.

Visiting the Australian Synchrotron was Minister Chien-Jen Chen, Chairman of the National Science Council of Taiwan, who affirmed the joint effort to build on existing relationships between Taiwanese and Australian scientists. The agreement has created bond and will enable both facilities to advance synchrotron techniques and form international teams to explore scientific issues of global significance.

July 2007

The Taiwan Photon Source Steering Committee

The 4th and 5th meeting of the Taiwan Photon Source (TPS) Steering Committee were held at the NSRRC in February and July 2007.

The Steering Committee, consisting of 35 members of both domestic and internationally renowned experts in the fields of synchrotron research, accelerator, instrumentations, civil engineering, reviewed the the planning and design of Taiwan Photon Source (TPS), the next accelerator of the NSRRC, on an on-going basis. Design of the civil engineering and TPS lattice design are two primary focuses of these meetings. Conclusions were derived based on the comments produced from these meetings on the size of circumference, adoption of a design with a booster ring installed in the same shielding tunnel as the storage ring, requirements of high injection efficiency, top-up mode operation, and economical energy consumption, etc. As for the civil engineering task, to reserve the green land and consideration of minimizing the environmental impact within such a condensed area in the Hsinchu Science Park poses the greatest challenge. Tremendous resources and studies have been spent on ensuring all regulations being satisfied and green land being preserved. As a result, the majority of the building of the storage ring will go below ground level.



TPS Steering Committees

August 2007

Vietnam National University of Ho Chi Minh city and NSRRC Sign Agreement

An Memorandum of Understanding was signed by the rector of University of Natural Sciences, Vietnam National University of Hochiminh city with the NSRRC to promote cooperation between researchers of both countries in synchrotron research and science. The MOU was signed on August 13, 2007.

The MOU will facilitate the exchange of scientific and technical personnel and students between these two organizations in the fields of synchrotron-based education and research, including materials research and biomedical and life sciences.

As part of effort launched during 2007, NSRRC is re-directing its resources to enhance the research activities. The education of Ph.D. students has taken the highest priority by implementing of joint courses with renowned universities in Taiwan and Asian Oceana region. This is a new avenue to attract bright scientists to become part of the NSRRC user community in the coming years.

Vietnam National University- Ho Chi Minh City (VNU-HCM) was established in January 1995 for the purpose of integrating into the worldwide university system and producing a distinguished resource of personnel. VNU-HCM recognized its missions as to train qualified graduates and specialists to meet with social needs, do research and implement science & technology, establish international exchange and cooperation with other universities in the region and the world at large. Approved by the government, VNU-HCM then consisted of eight member universities, one research institute and two specific centers. In 2001, VNU-HCM was reorganized to guarantee the quality education, training and management.

August 2007

2007 Mini-Workshop on Protein Crystallography

A one-day Mini-workshop on Protein Crystallography co-organized by Institute of Biological Chemistry, Academia Sinica and NSRRC was held at the Academia Sinica, Taipei on August 30th, 2007. This workshop is designed to introduce the recent understandings of the effect incurred by radiation damage and cryo-condition on protein crystals, as well as the methodology and strategy in MAD/SAD data collection and processing on Se and S proteins.

The goal is set to help users simplify data collection and structure determination while conducting experiments at the NSRRC. Due to the space limitation, number of participants was reserved to 100 for those experienced users who are familiar with the process. The attendants were enthusiastic and interactions constructive. Everyone considered the workshop very successful.



Mini-workshop on protein crystallography

September 2007

NSRRC offered Mini-School for XANES Theoretical Calculations

A 3-day program focuses on the state-of-the-art FDMNES theory and practice was given by the inventor himself, Dr. Yves Joly, starting September 3, 2007 on NSRRC's campus. Joly took the audience from the point of beginning of how the theory originated to various implementations based on its calculation and simulation of X-ray absorption spectra. He also talked about the implementation and areas that FDMNES is most powerful and applicable to. Furthermore, a special research topic on charge, spin and orbital ordering by resonant diffraction was addressed. Case study on how to define and adjust the parameters of FDMNES was demonstrated in great details to guide the participants on about how to operate the program effectively.

FDMNES has been well adopted in recent years in the synchrotron-based research to analyze and to simulate X-ray absorption near-edge structure (XANES), anomalous or resonant X-ray scattering, polarization and dichroism spectra of materials. The theoretical calculations can offer a better understanding and more accurate data analysis of experimental spectra.



Discussion continued after the XANES lectures

There are about 130 participants and their response is overwhelming. The mini school is part of many programs NSRRC offers to well equipped its users with scientific knowledge and experimental techniques. Currently, classes available on NSRRC campus include summer school, protein

crystallography class, Ph.D. and master program jointly offered by the National Tsing Hua University, and accelerator physics class.

October 2007

Leading the Future Generation to the World of Synchrotron Science

When Dr. Hsieng-Cheng Tseng, president of National Hsin-Chu University of Education (NHCUE), and Dr. Keng S. Liang, Director of the NSRRC shook hands after signing the Memorandum of Understanding (MOU), the ceremony marks a beginning of an unique project that will lead the future generations in Taiwan to the world of synchrotron science. The program will create a joint collaboration between NHCUE and NSRRC to turn the highly advanced synchrotron research into a live materials as part of the scientific courses run at elementary schools through this island of 22.7 million in population in the future. The MOU was signed on October 16, 2007.

"One of the great engines of our growing economy is our country capacity to innovate. Through our investments in science and technology, we have revolutionized our economy and changed the society for the better. Among all the current and future projects conducted in the NSRRC, there is a common vision shared by all, to build a scientific foundation and to pave a prospective road for our future generations. Only with highly advanced technology segment, we will stand a competitive advantage in the race of global economic. We have great hope the collaboration and work we initiated today will be a part of elementary education of tomorrow," said Liang.

"NHCUE has always been one of the cradles of elementary school and pre-school teachers in Taiwan. While the tradition of promoting educational and cultural development will be continued at NHCUE, new transformations will also be undertaken. To cope with the rapid changes in Taiwan, some department at NHCUE will be transformed into those enhancing specific professional abilities and developing artists of various kinds," Tseng addressed in the ceremony, "*The Synchrotron Science for Elementary School - an Animation and Interactive Program* allows us to pass along the cutting edge information to the hand of teachers, the best workforce that bridges our current and future generations."



The MOU ceremony for the NHCUE and the NSRRC

October 2007

The 2007 Asia-Oceania Week of NSRRC

The Asia-Oceania Week (AOW) of NSRRC, which began on October 31 and ended on November 7, 2007, features a series of events. A combination of 3 different conferences and a mini-school program, was the first joint event for NSRRC's thirteenth Users' Meeting (October 31), Second Asia-Oceania Forum for Synchrotron Radiation Research (AOFSSR, November 1-2), the 1st IUCr International School of Crystallography in Asia (Crystallography School, November 3-4) in Hsinchu, and the 8th Asian Crystallographic Association (AsCA07) Meeting, which is held at Taipei from November 4 to 7. Over 400 people from 11 countries attended.

NSRRC Users' Meeting

This year's NSRRC Users' Meeting, held on October 31, included discussion of 5 interest groups and users' town meeting. Presentation of research highlights and poster sessions were jointly organized with AOFSSR event.

The 2nd AOFSSR conference

The 2nd AOFSSR conference event was held at the International Conference Hall of National Chiao Tung University, Hsinchu, Taiwan. The goal of the meeting is to establish a general framework of collaboration in synchrotron research in the Asia and Oceania region and to enhance the communication among regional organizations and world wide societies of synchrotron radiation research. Topics presented during the 2-day meeting include advanced development of synchrotron facilities in Asia and Oceania, innovative technologies in X-ray crystallography, spectroscopy and images, emerging applications of synchrotron X-ray in physics, chemistry, and biology.

In November 2006, 8 synchrotron research centers from Australia, China, India, Japan, Korea, Singapore, Thailand, and Taiwan, agreed to establish a framework of collaboration in the developments of science and technology. The understanding is mutual: "commitment to a joint effort to promote comprehensive cooperation in the Asia and Oceania region." By sharing the frontiers of scientific research, the collaboration among participating facilities express confidence and hope on things that will happen in synchrotron community over the next decade.



AOW group photograph



AOW conference

IUCr Crystallography School

Crystallography school 2007 of International Union of Crystallography (IUCr) is an interdisciplinary workshop designed to bring together experts from electron and X-ray diffraction in modern crystallography, chemistry and materials science. It offers courses on the following subjects; electron/ X-ray dynamical diffraction, phase problem and advanced diffraction/spectroscopy techniques on the structure of multi-scale materials. The key is to train young scientists on how to integrate techniques of electron and X-ray diffraction in search of materials properties.

AsCA'07

The AsCA'07 is the 8th conference of the Asian Crystallographic Association in Taipei. Research areas range from micro and macro molecular proteins, viruses, membrane proteins; protein engineering; structural chemistry, nanotechnology; genomics, drug design; and applications of electron, neutron, and synchrotron X-ray for structural investigation. The mission of the forum is keen on sharing information through meetings and activities.

The AO Week is a success and participants share a spirit of which, with new light sources have been continuously establishing in the coming decade, researchers need to share scientific information through forums and well established collaboration. The effectiveness of such channels will rely on better understanding the unprecedented global competition for research and innovators, extent and implications of innovation's globalization. Synchrotron



AsCA conference

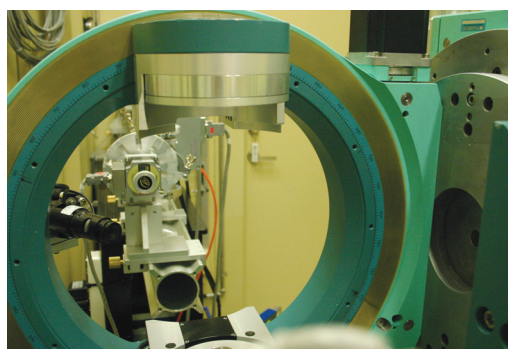
facilities will be expected to a continuous development of more powerful metrics and expectations for technology sharing and transfer.

October 2007

NSRRC Announced New Experimental Station for X-ray Membrane Scattering and Diffraction

The NSRRC announced in October 2007 the opening of one new beamline 13A1 to its users. An experimental station of X-ray membrane scattering/diffraction was recently installed at the beamline BL13A1 with light source generated by a superconducting wiggler.

Equipped with alternative point and area detecting systems, a four circle diffractometer was setup on an alignment table for X-ray scattering and diffraction measurements. With a flux of 6×10^{10} photon/sec at the fixed energy 12 keV, the instrument is capable of probing the bio-membrane conformation under controlled temperature and humidity environments. Structural information of bio-membrane, including thickness and surface morphology can be deduced from the diffraction/scattering profile analysis and model simulation. With a controlled sample chamber, which offers temperature ranging from 10 to 50 °C and relative humidity of 30% to 98% RH, influences of temperature and humidity on the phase change of biomembrane can be traced.



The newly opened beamline 13A1, an experimental station of X-ray membrane scattering/diffraction.

Furthermore, for those systems of bio-membrane interacting with proteins or peptides, the in-plane diffraction and grazing incident small-angle X-ray scattering introduce a paradigm to study the protein structure as well as correlation of bio-membrane thickness. The end station not only is setup for structural studies of bio-membranes, but also suitable for investigation of structural characterizations of thin film and bulk materials.

October 2007

NSRRC Signs MOU with Mahidol University

The NSRRC has signed a memorandum of under-

standing with the Mahidol University (MU) in Thailand intended to complement the scientific programs of protein crystallography at both facilities. The agreement, was signed on October 16, 2007. Through this agreement, NSRRC will sponsor programs to train researchers of MU and offer expertise of protein crystallography along with beamtime at its facility. Researchers at the NSRRC and the MU will work together on the study of protein crystals, and the three-dimensional molecular structures of proteins, other large molecules, and some viruses.

The Mahidol University MOU is the fourth agreement this year to be signed by the NSRRC with foreign research institutes in Asia.

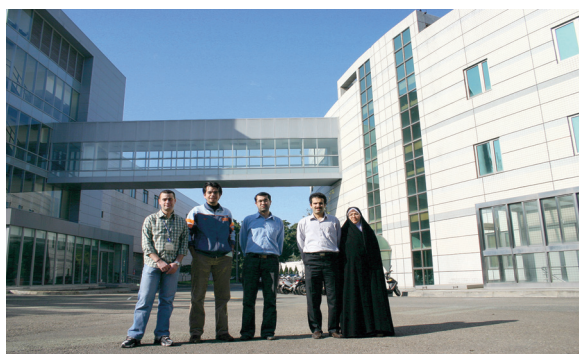
November 2007

SESAME Training Program Completes its Second Term

In November 2007, three young scientists recommended by SESAME project have completed their training at the NSRRC after a one-year scholarship. This is the second group of trainees NSRRC has undertaken to offer training as well as the usage of its synchrotron facility. This cooperative practice specially created for SESAME, offers the opportunity for SESAME scientists and technical staff to learn synchrotron experimental techniques as well as to gain knowledge in preparation of serving their synchrotron facility.

These young scientists from Hacettepe University (Turkey), Tarbiat Modarres University (Iran), and Jordan University (Jordan) studied along side of the NSRRC research groups of soft matter, biology, and materials physics.

In 2005, two scientists and one engineer from Middle East are the first group of SESAME members accepted by NSRRC and went through a 1-year training program. The SESAME program is one of many educational programs NSRRC engaged since 2005. In December 2006, National Tsing-Hua University and NSRRC jointly undertook a Ph.D. program for international students. Under such arrangement, international students will be able to join the NSRRC international internship and use synchrotron light to conduct their research.



Scientists of SESAME program and international Ph.D. students outside the storage ring.

November 2007

Australian CXS and NSRRC signed MOU to Affirm on Collaborative Research in Science and Technology.

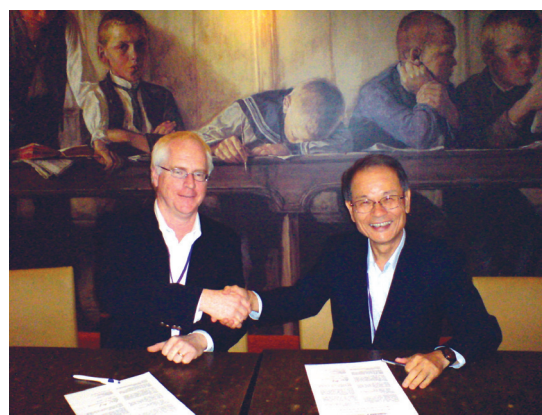
A Memorandum of Understanding (MOU) of technological collaboration on soft X-ray coherent diffraction Imaging was signed on November 1, 2007 during the 2nd Asia-Oceania Forum for Synchrotron Radiation Research conference (AOFSTR) by the Centre of Excellence for Coherent X-ray Science (CXS) of Australia and the NSRRC.

The MOU came as an answer for users who call such technology and much-needed facility an essential factor in their studies of chemical heterogeneities in biological and environmental science specimens in particular.

The program under the MOU will allow staff from both institutes to develop common specialized knowledge and effective use of facilities. In order to be able to complete the scientific goals, CXS will undertake to design and assemble the instrumentation for an end-station at the NSRRC beamline 09A2 suitable for routine diffractive imaging of nanoscale particles. NSRRC will ensure the reliable performance of its up-to-date beamline. Such experimental station will be optimized to the experimental conditions prevailing in the X-ray diffraction experiments expected by the users and will address issues such as sensitivity, response non-linearity and readout fidelity.

About CXS

The ARC (Australian Research Council) Center of Excellence in Coherent X-ray Science (CXS) is an Australian government initiative that began in July 2005 to explore what can be achieved with coherent X-ray optics; including an understanding of exotic phenomena such as X-ray phase discontinuities. CXS head office and administrating institution is the University of Melbourne in Victoria, Australia, with participating nodes at La Trobe University, Monash University, Swinburne University of Technology and the CSIRO. All work produced by CXS is done so with the assistance of the Australian Research Council under the Centre of Excellence Program.



Keith Nugent, CXS director, Univ. of Melbourne (left) and Keng Liang, NSRRC director, after signing the MOU

November 2007

NSRRC Researcher, Dr. Chaoen Wang, Is Named the 2007 Recipient of Nishikawa Prize.

The executive board of Foundation of Accelerator Sciences (FAS) awarded the 2007 Nishikawa Prize to Dr. Chaoen Wang of the NSRRC in Taiwan, for his achievement in establishing superconducting cavity system at Taiwan Light Source (TLS). The award has presented to Wang on March 21, 2008 during the award ceremony in Japan. This is the first international price offered to a NSRRC member in recognition of the system and operational accomplishment. Wang and his team delivered the first implementation of the SRF system to a 3rd generation synchrotron light source with success.

Wang is the leader of the superconducting radio frequency (SRF) project, which was part of the major machine upgrade of TLS at NSRRC. Such system is to replace the Doris cavities after eleven years of operation. Wang et al. conducted the feasibility study in 1997 on SRF based on a CESR-III design, developed by Cornell University (USA), and preceded with modifications suitable for TLS operational synergy and coping with restrictions posed by existing configurations. The planning of this project officially began in 1999 and was completed and commissioned on December 16th, 2004. The operation comprises three major procedures: addition of a cryogenic plant, replacement of the Doris cavities with a SRF module and finally the integration of the SRF module with a new rf system.

During the course, Wang et al. had to change the interface systems and add-on components including the construction of a two-story building just across the street from the cylindrical-shaped structure housing the storage ring, the two buildings being connected by an underground tunnel. Inside, one main helium compressor, which is part of the cryogenic plant, feeds the circulation of high-pressure helium gas. The gas will then be converted to low-pressure liquid helium via the cold box in the experimental area. This machine upgrade may be thought of as a 'heart transplant' for the storage ring. The SRF module should increase the beamline stability and double the photon flux by increasing the maximum beam current to 400 mA from a previous 200 mA. In addition, beam power is elevated to 82 kW from 33 kW.

Upon completion of the rf system, in order to achieve extreme photon stability and reliability at high beam currents, it took all members of NSRRC operational division to carefully study the performance and cross-interactions among all components of multiple systems.

One of the challenges faced was the deformation of thin plate structures under extreme pressure which contributed to mechanical instability. By increasing the wall thickness of the waveguide, the problem was successfully resolved for the second unit of SRF, module S2. To make

the rf system highly reliable, redundant components have been utilized, along with new operational procedures that optimize all processes. The result is one of the very few fully effective rf plants in the world today. Wang's creative implementation of SRF technology to TLS is considered the first in the world of such an attempt to a 3rd generation synchrotron light source with success. Designed to serve its users with brighter and more stable X-ray sources in South Asia, the SRF module S1 is now in operation.



Chien-Te Chen (left), NSRRC director (1997-2005); Chaoen Wang; Keng Liang, NSRRC director.

November 2007

Australian Soft X-ray Spectroscopy End Station Is Heading Home

When Dr. Anton Stmpfl, the NSRRC coordinator of Australian Synchrotron Research Program (ASRP), and his team packed the last box of equipment into the crate outside NSRRC storage ring, it also marked a successful collaboration paradigm that can be replicated among synchrotron facilities worldwide.

At a cost of US\$750,000, the scalable-versatile experimental station, owned by ASRP, is a multi-user system for conducting X-ray spectroscopic experiments, which had been stationed at the Taiwan Light Source (TLS) of the NSRRC in the past 2 years since commissioned in November 2005. The ASRP experimental station now was under process of relocation to the Australian Synchrotron in late 2007. In the past 2 years, Australian scientists relied on assistance from the ASRP to access synchrotron facilities in Taiwan and will continue doing so as a supplement to functions unavailable at the Australian Synchrotron.

The collaborative development between ASRP and NSRRC aims for two major areas: accessible beamtime of TLS-NSRRC to ASRP scientists and technology transfer from NSRRC researchers to those of ASRP. Under such arrangement, the ASRP experimental station underwent a series of tests and was used for experiments. The process

was designed to give the Australian scientists a jump-start and speedy process toward mastering the sophisticated equipment with sufficient access of NSRRC beamlines, resources and know-how. At the same time, Australian researchers were able to fine-tune the ASRP end station while carrying out some cutting edge research with Taiwanese colleagues.

Now the experimental station is heading home, Australian researchers will be able to make X-ray Photoelectron Spectroscopy (XPS) and Near Edge X-ray Absorption Fine Structure (NEXAFS) spectroscopy measurements on materials with special preparation or handling requirements. The current Australian and New Zealand main user base of soft X-ray spectroscopy primarily consists of approximately 15 user groups. The limited size of this user base reflects the absence of such facilities. With better access to currently oversubscribed beamlines and the end station designed to meet the requirements of research on surfaces and near-surface interfacial layers, like this specific station dissembled and transported from NSRRC, the number of user groups can soon increase to 30 from 18 universities, many research institutes and industrial conglomerates in Australia.



Scientists and engineers of ASRP loaded the experimental station to the crate outside the NSRRC storage ring.

November 2007

TWAS Elected Dr. Chien-Te Chen of the NSRRC as its New Fellow Member.

On November 15, 2007, Dr. Chien-Te Chen, distinguished scientist and NSRRC director (1997-2005), was elected as a Fellow of the Academy of Sciences for the Developing World. The Third World Academy of Science (TWAS) has chosen Chen for his "outstanding contribution to science and its promotion in the developing world," in the congratulation letter issued by professor Jacob Palis, President of TWAS.

TWAS currently has 880 members, including 45 scientists newly added to its existing members during its annual meeting held in Trieste, Italy this year. There are 746 Fellows and 134 associate Fellows. TWAS membership covers 90 countries; 73 in southern geographical area and 17 in the north. Among 45 new members are 4 academicians of

Academia Sinica, by which total to 23 seats in Taiwan.

Chen has a long outstanding career, in particular in synchrotron science and applications. In 1985, he proposed at Bell Labs, USA, the cylindrical-element monochromator design for synchrotron radiation (SR) and constructed the world's first high-resolution, high-transmission soft X-ray beamline, dubbed "Dragon", at NSLS-U4B port in 1986-1987. During 1988, the beamline was used to measure the K-shell photoabsorption of condensed N₂ to demonstrate, for the first time, that soft X-ray can reach an energy resolution of ($\Delta E/E$) of 10^{-4} , removing the fundamental impediment that had persisted for several decades in soft X-ray science. Since then, the Dragon design has been extended to serve the photon energy of 4-2000 eV, which cover the entire UV, VUV, and soft X-ray spectral regions. Moreover, its resolution has reached 10^{-5} in VUV region in recent years. Chen's invention has now been adopted by 24 synchrotron radiation (SR) facilities in Taiwan, USA, Japan, France, Germany, UK, Italy, Sweden, Switzerland, Denmark, Canada, China, Korea, India, and Brazil, making fundamental contribution to the science of synchrotron radiation worldwide.

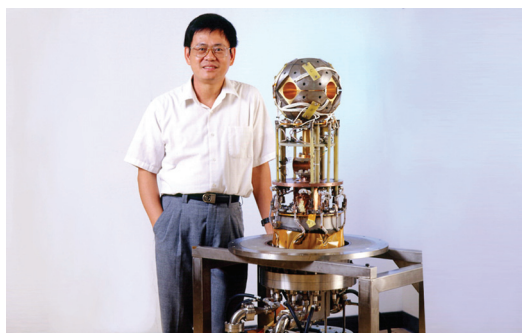
After joining NSRRC of Taiwan in 1995, Chen continues to make outstanding contribution in soft X-ray science. In condensed matter physics, Chen has built a world leading soft X-ray research group and experimental facility in Taiwan. By using the advanced instrumentations developed by himself at the NSRRC, his group and international collaborators have completed many decisive experiments that provide new insights into important issues of condensed matter physics. Chen is also the inventor of the active-grating-monochromator-active-grating-spectrometer system for inelastic soft X-ray scattering, which has a theoretical data collection efficiency 100 times higher than that of the conventional designs, and an octopole superconducting magnet that can produce strong magnetic field up to 4 Tesla in arbitrary 3D direction for large angle light scattering experiments.

During his tenure as the director from 1997 to 2005, the NSRRC has seen its facility and user program significantly progressing. There are 32 beamlines (including 2 hard X-ray beamlines at SPring-8, Japan) and 56 experimental stations, with many designed and built in-house that have earned NSRRC international recognition. Major accelerator upgrade projects have been launched and completed on target. The superconducting RF cavity began in operation in early 2005, coined as a successful model in synchrotron light storage ring. The same year, NSRRC became the 4th synchrotron facility in the world to operate fully in top-up injection mode, demonstrating that even an early-designed, low-energy and small-circumference third generation synchrotron ring can be advanced to high-current full top-up operation with excellent beam stability.

Chen is an internationally renowned experimental

physicist who has made innovative and monumental contributions to the science of synchrotron radiation and condensed matter physics. He has served in the science and technology advisory committees of SR facilities in China, Italy, Korea, and USA, and in the international advisory/program committees of major international scientific conferences.

TWAS is the world's leading academy for scientists from the developing world. Its membership consists of eminent scientists, more than 80 percent of whom live and work in the South. Founded and based in Trieste, TWAS also sponsors a large number of research and training programs for scientists from the developing world.



Chien-Te Chen and his invention of the Dragon Ball: a 3D-field 4 tesla cryogen-free superconducting octopole magnet.

December 2007

NSRRC and NCKU Agree on Joint Graduate Programs

The NSRRC has signed a memorandum of understanding (MOU) with the National Cheng Kung University (NCKU) in southern Taiwan to jointly create graduate degree programs in science departments. The agreement was signed on December 14, 2007 by Dr. Michael M. C. Lai, President of NCKU and an Academician, and Dr. Keng S. Liang, director of the NSRRC.

NCKU is the third university NSRRC established bonds with to create graduate degree programs, following those of National Tsing-Hua University and National Chiao-Tung University, both locate next to the NSRRC campus. Yet, the MOU of NCKU represents a new milestone, which NSRRC aggressively pursues to gain shares in the academic community.

To recruit more synchrotron users from southern Taiwan has been on the agenda of NSRRC's action plan to promote the use of its facility and to normalize its user population throughout the island. This MOU signals that the territory of synchrotron-based research is employing south as an inevitable eco-product of the high-speed railway commissioned this year. The geographic distance is no longer a barrier, giving the fact that commuters are able to reach any city within 2 hours. Such convenience has

changed the mentality in each individual in every level, including researchers.

To further ensure the future generations from all the universities to adopt the advanced experimental techniques offered by the NSRRC, several MOU(s) with universities acting as the collaborative vehicles are in place or in progress recently. It is a pro-active approach NSRRC took to prepare college students and researchers, both domestic and international, and to gear up the demands and readiness of working on its existing light source, TLS, and the future one, TPS.

The agreement outlined plans including joint faculty appointments from NCKU for NSRRC researchers, offering courses on accelerator physics, synchrotron research and experimental techniques as well as scholarship and joint research projects.



Members of NCKU and NSRRC after the ceremony

December 2007

NSRRC Strengthens Its Future Research in Nano and Marine Sectors by Entering MOU with NSYSU

The NSRRC has signed a memorandum of understanding (MOU) with the National Sun Yat-Sen University (NSYSU) in southern Taiwan to jointly create graduate degree programs in nano and marine science, announced by Dr. Chung-cheng Chang, President of NSYSU, and Dr. Keng Liang, director of the NSRRC, together. The MOU ceremony, held at the NSRRC campus on December 18, 2007, were attended by NSYSU and NSRRC leaders.

NSYSU has been working with the NSRRC closely in recent years promoting the use of synchrotron radiation as a mean to advance scientific research. In the past 2 decades, NSYSU has established itself as a leading institute in marine biology, developing well of information from marine research on coral reef, ocean, coast in Taiwan. The joint programs will increase the opportunities for domestic and international graduate students and researchers at the NSYSU to embrace the globalization of synchrotron research. In addition, the MOU offers a direct access for graduate students of NSYSU to equip with the synchrotron

research techniques and to carry out their experiments with the advanced light source when applicable.

According to the signed agreement, NSYSU will provide courses in nano-science and marine science in graduate programs and possible joint faculty appointments from NSYSU for NSRRC researchers, who will offer courses on accelerator physics, synchrotron research and experimental techniques.



Chung-cheng Chang, President of NSYSU (left) and Dr. Keng Liang, director of the NSRRC signed the MOU.

December 2007

The Physical Society of Republic of China Awards the Ph.D. Student Supervised under NSRRC Programs.

Frank Wu, who has been conducting experiments at the NSRRC, is selected and awarded by the Chinese Physical Society for an outstanding work of his Ph.D. thesis. Wu is under the supervision of Dr. Di-Jing Huang, a NSRRC scientist and an expert specialized in thin films of transition metal oxides and electronic structures of strongly correlated-electron systems, using soft X-ray to investigate the polarization and electronic nature of Mn and Co oxides.

The award not only stamps the creative and excellent work carried out by Wu, but also echos the positive evaluation on the launch of NSRRC Ph. D. programs since 2007. NSRRC is the first and only institute that offers its graduate programs jointly with other universities in Taiwan and bundled with practice, mainly on synchrotron-based research. The effort to promote synchrotron research and accelerator technology extends beyond educational domain itself. For instance, channels of implementing discovery and techniques generated via synchrotron research into production format have been introduced to bridge the gaps between the world of academic and industrial per se. The goal is to level up further the standard of creative research by graduate students but also to escort such creativity to the needing area of domestic industry and enterprise.