

**80th IUVSTA Workshop**  
**on**  
**Ultra Low Emittance Light Source Vacuum Systems**

October 24-28, 2016, Hsinchu, Taiwan

Sponsored by the Vacuum Science and Technology Division of IUVSTA

Workshop Report

Prepared by

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## **1. SCIENTIFIC REPORT**

The goal of the “80th IUVSTA Workshop for the Ultra-low Emittance Light Source Vacuum Systems” is to find the best solutions on the vacuum design and the manufacturing processes for those upgrade projects, ongoing or being planned, of synchrotron light source facilities to achieve the ultra-low emittance of  $< 0.5$  nm·rad in the coming years. There are many challenging issues on vacuum design and engineering under debate and need to be well evaluated by the vacuum experts from the worldwide institutes or facilities. This workshop provides a forum for intensive discussions after each presentation, and was held in October 24-28 (2016) in Hsinchu, Taiwan. The venue is the National Synchrotron Radiation Research Center (NSRRC) where a brand new 3 GeV synchrotron light source named “Taiwan Photon Source (TPS)” has completed the commissioning and just opened to the user operations about one month ahead of the workshop.

There were about 50 participants from 26 organizations of 15 countries attended the 80th IUVSTA Workshop and enjoyed the fruitful presentations and technical discussions. Four-day program covers 34 presentations including 12 invited talks, a visit to the TPS light source, a welcome reception, an excursion, and a workshop dinner etc. activated the brainstorming on those critical issues of vacuum design for the new or upgrade projects. All the presentations were divided into 8 sessions covers the technical topics including the facility reports, the vacuum design concepts, the surface engineering and treatments, the NEG-coating technologies, the critical components, methodology of the manufacturing, and the gas pressure modeling. The facility reports include 3 new accelerator light sources,

NLS II (USA, 2015), TPS (Taiwan, 2016), and MAX IV (Sweden, 2016) being in operation or commissioning; 6 upgrade projects include ESRF-EBS (France), APS-U (USA), ALS-U (USA), SPring-8 II (Japan), Diamond II (UK), and PLS-III (Korea) under designing; and 2 new light source projects: KEK-LS (Japan) and HEPS (China) under planning. The most popular issue widely discussed in the workshop was the NEG-coating technologies implemented into the beam ducts of the storage ring vacuum systems that associated with 9 presentations. The operational experiences about the NEG-coated chambers built-in the existed accelerators including the LHC, LEIR, etc. at CERN (Switzerland), the Synchrotron SOLEIL in Paris (France), and the MAX IV in Lund (Sweden), presented the successful performance as expected. However, on the other hand, there are still more than half of new projects adopt different design aspects which may not be appropriate with the NEG-coating. There comes another issue about the reliability of the accelerators associated with the higher heat load from the synchrotron radiation during the higher beam-current operations. The design and manufacturing methodologies for the vacuum beam ducts and the critical vacuum components against the high heat load were widely discussed. Several participants from the manufacturing companies include VAT (Switzerland), SAES Getters (Italy), FMB (Germany), VACOM (Germany), Wave Power (Taiwan), as well as the research institutes include KEK (Japan), SPring-8 (Japan), BNL (USA), NSRRC (Taiwan), IMT (Slovenia), STFC (UK), and BINP (Russia), presented their manufacturing processes of the products, working experiences, trouble shootings, advices on the delivery scheduling controls, etc. were much valuable and helpful for the new projects on critical design, quality control, and entirely project control managements. For those upgrade projects of some facilities, a very tight schedule on replacing the entire machine by a new system is foreseen must be completed in a short period of shutdown interrupt the users' experiments typically within one year. It may result in a different systematic design philosophy of the accelerator vacuum systems associated with the fast installation procedure at the beginning of the project. The modeling works on pressure distribution of the accelerator vacuum systems are always helpful on reviewing the overall design optimization. There are 4 talks presented the simulation programs about the pressure distribution based on the "MolFlow", combined with the ray-tracing program of "SynRad" and the modeling from "3D-CAD", were useful and becoming practical when implemented with more experimental data.

Though the fruitful daily coffee breaks were filled in the sessions, a workshop dinner at a seafood garden restaurant near the Hsinchu harbor were arranged for all the participants tasting the typical local seafood. Besides, a half-day excursion to visit the National Palace Museum and the Taipei-101 Tower in Taipei city was still attractive for everyone to browse the Chinese culture, enjoy the Taiwanese life, and refresh the spirit. On Oct. 28, the last day of workshop, all the participants were invited to the TVS-2016 Annual Symposium (30th

anniversary of the Taiwan Vacuum Society) in conjunction with the 5th International Joint Symposium (co-organized by the Vacuum Societies of Korean, Japan, USA, China, Taiwan, and the Surface Science Society of Japan) in the National Tsing Hua University (NTHU) nearby the NSRRC for more interactions with the peoples from the academic and the industrial fields in Taiwan.

## 2. FINANCIAL STATEMENT

The income of the workshop included the registration fee, the funding supports from the Taiwan Vacuum Society (TVS) and the IUVSTA. It is certified that the financial support of 6,000 Euros provided by the IUVSTA for the 80th IUVSTA workshop on Ultra Low Emittance Light Source Vacuum Systems (IUVSTA-80) was fully used to cover the fixed costs for the 13 invited speakers. The financial support of 282 Euros provided by the TVS was used to cover the air ticket fee claimed by one invited speaker. The budget for the 80th IUVSTA Workshop, contains the Income and Expenditures, is listed in the following table,

### Budget for 80th IUVSTA Workshop (IUVSTA-80)

Unit of Currency: Euro (EUR)

<b>Income</b>	<b>Sub-Total</b>	<b>Remarks</b>
Registration Fee (Exempt for 13 invited speakers)	17,956	37 contributors and 2 accompanying
Taiwan Vacuum Society (TVS) funding	282	Funding support for air ticket fee
IUVSTA funding	6,000	Funding support for invited speakers

**Total Income (EUR): 24,238**

Unit of Currency: Euro (EUR)

<b>Expenditures</b>	<b>Sub-Total</b>	<b>Remarks</b>
Meals (4 days)	5,154	Lunch breaks, Dinner breaks, and Coffee breaks
Excursion	3,116	Transportation and Tickets
Banquet	2,500	
Meeting Rooms	1,286	
Hotel Rooms (4 nights for all the invited speakers)	6,000	Room charges, Breakfast, and Transportation fee
Advertisement	1,712	
Temporary Labors	2,100	
Miscellaneous	2,020	
Air ticket funding (for invited speakers by request)	350	One invited speaker claimed the funding

**Total Expenditures (EUR): 24,238**

### **3. ORGANIZATIONS**

#### **3.1 Hosted and Sponsored by**

Taiwan Vacuum Society (TVS)

National Synchrotron Radiation Research Center (NSRRC)

#### **3.2 Endorsed by**

International Union for Vacuum Science, Technique and Applications (IUVSTA)

### **4. COMMITTEES (in alphabetical order by last name)**

#### **4.1 International Organizing Committee ( Chair\* )**

Gao-Yu Hsiung\* (NSRRC, Taiwan)

Jay Hendricks (NIST, USA)

Joe Herbert (ASTeC, UK)

Tohru Honda (KEK, Japan)

Hsiao-Chaun Hseuh (BNL, USA)

Yoshio Saito (ICRR, Univ. Tokyo, Japan)

#### **4.2 Program Committee ( Chair\* )**

Hsiao-Chaun Hseuh\* (BNL, USA)

Eshraq Al-Dmour (MAX IV, Sweden)

Paolo Chiggiato (CERN, Switzerland)

Matthew Cox (Diamond, UK)

Michael Hahn (ESRF, France)

Jay Hendricks (NIST, USA)

Joe Herbert (ASTeC, UK)

Tohru Honda (KEK, Japan)

Gao-Yu Hsiung (NSRRC, Taiwan)

Hsin-Pai Hsueh (NSRRC, Taiwan)

Kazuhiko Mase (KEK, Japan)

Yusuke Suetsugu (KEK, Japan)

#### **4.3 Local Committee ( Chair\* )**

Hsin-Pai Hsueh\* (NSRRC, Taiwan)

Chia-Mu Cheng (NSRRC, Taiwan)

Jyun Yan Chuang (NSRRC, Taiwan)

Ying-Tzu Huang (NSRRC, Taiwan)

Cheng-Ying Kuo (NSRRC, Taiwan)

An-Ping Lee (NSRRC, Taiwan)

Sherry Tsao (TVS, Taiwan)

Eleen Lin (TVS, Taiwan)

## 5. NUMBER OF PARTICIPANTS (52)

Invited Speakers: 12

Contributed Oral Presentation Speakers: 22

Auditors: 16 (including committee members)

Accompanying Persons: 2

## 6. PROGRAM

The scientific program was composed of 34 oral presentations, including 12 invited speeches, were categorized into 9 Sessions and distributed in three days. The presentation times were 30 minutes for each invited talks (including the discussions), and either a short presentation (15 minutes) covering the problems/solutions or a longer presentation (30 minutes) including the comprehensive discussion was decided by the speakers of the contributed oral presentations. The technical program is shown in the following table,

<b>Presentations of the 80th IUVESTA Workshop, Oct. 24-28, 2016, NSRRC, Hsinchu, TAIWAN</b>		
<b>Monday, 24 Oct., 2016</b>		
<b>18:00</b>	<b>Registration and Welcome Reception (at Lakeshore Hotel)</b>	
<b>Tuesday, 25 Oct., 2016</b>		
<b>08:30</b>	<b>Bus leaves from Lakeshore Hotel to NSRRC</b>	
<b>Session 1 - Moderator - Gao-Yu Hsiung</b>		
<b>09:00</b>	<b>Opening</b>	<b>Shangjr Gwo, NSRRC</b>
<b>09:15</b>	<b>MAX IV 3 GeV storage ring vacuum system: from development to operation (Invited)</b>	<b>Marek Grabski, MAX Lab.</b>
<b>09:45</b>	<b>Vacuum for the ESRF EBS project (Invited)</b>	<b>Michael Hahn, ESRF</b>
<b>10:15</b>	Preparing and executing production of complete storage ring vacuum systems – Experience of a supplier	Uwe Schneck, FMB
<b>10:30</b>	<b>Break</b>	
<b>Session 2 - Moderator - Andre Anders</b>		
<b>11:00</b>	<b>NEG coating for high aspect ratio vacuum chambers (Invited)</b>	<b>Pedro Costa Pinto, CERN</b>
<b>11:30</b>	Development of copper electroformed chambers with integrated getter thin film coating	Lucia Lain Amador, CERN
<b>11:45</b>	NEG coating R&D for HEPS-TF at IHEP	Ping He, IHEP

<b>12:00</b>	Different approaches in the design of vacuum systems for synchrotron light sources based on NEG technology	Tommaso Porcelli, SAES
<b>12:15</b>	<b>The vacuum systems and studies for the low emittance storage rings at NSRRC (Invited)</b>	<b>June-Rong Chen, NSRRC</b>
<b>12:45</b>	<b>Lunch Break</b>	
<b>13:30</b>	<b>Group Photo</b>	
<b>13:45</b>	<b>TPS Tour</b>	
<b>15:15</b>	<b>Break</b>	
<b>Session 3 - Moderator - June-Rong Chen</b>		
<b>15:30</b>	<b>APS-Upgrade Vacuum System Status (Invited)</b>	<b>Jason Carter, APS</b>
<b>16:00</b>	Two-Year Operation Experience of NSLS-II Storage Ring Vacuum Systems	Hsiao-Chaun Hseuh, BNL
<b>16:30</b>	10 year experience of operation with NEG coating in storage ring the SOLEIL synchrotron light source	Christian Herbeaux, Synchrotron SOLEIL
<b>17:00</b>	Study of Vacuum Chamber Upgrading in PLS-II	Taekyun Ha, PAL
<b>17:15</b>	Low outgassing stainless steel and aluminum CF components	Michael Flaemmich, VACOM
<b>17:45</b>	<b>Wrap up</b>	
<b>Wednesday, 26 Oct., 2016</b>		
<b>08:30</b>	<b>Bus leaves from Lakeshore Hotel to NSRRC</b>	
<b>Session 4 - Moderator - Matthew Cox</b>		
<b>09:00</b>	<b>20 year's operational experiences of SPring-8 storage ring vacuum system (Invited)</b>	<b>Haruo Ohkuma, SPring-8</b>
<b>09:30</b>	<b>Design for the SPring-8 upgrade storage ring vacuum system (Invited)</b>	<b>Masaya Oishi, SPring-8</b>
<b>10:00</b>	Design Concept of KEK Light Source based on HMBA Lattice	Tohru Honda , KEK
<b>10:30</b>	<b>Break</b>	
<b>Session 5 - Moderator - Janez Setina</b>		
<b>11:00</b>	<b>Integrated montecarlo simulation environment for light source design (Invited)</b>	<b>Roberto Kersevan, CERN</b>
<b>11:30</b>	APS-Upgrade Vacuum System Simulations with SynRad and MolFlow	Jason Carter, APS
<b>12:00</b>	Simulating synchrotron radiation and ultra-high vacuum in the SuperKEKB interaction region	Marton Ady, CERN
<b>12:15</b>	Pressure analysis of Taiwan Photon Source storage ring	Hsin-Pai Hsueh, NSRRC

	vacuum system during commissioning	
<b>12:30</b>	A Simulation Study on Beam Lifetime Evolution for KEK Light Source	Yasunori Tanimoto, KEK
<b>12:45</b>	<b>Lunch Break / Bus departures from NSRRC</b>	
<b>13:00</b>	<b>Excursion</b>	
<b>18:00</b>	<b>Workshop Dinner</b>	
<b>20:30</b>	<b>Bus leaves for Lakeshore Hotel</b>	
<b>Thursday, 27 Oct., 2016</b>		
<b>08:30</b>	<b>Bus leaves from Lakeshore Hotel to NSRRC</b>	
<b>Session 6 - Moderator - Paolo Chiggiato</b>		
<b>09:00</b>	<b>Experiences in the vacuum systems for KEKB and SuperKEKB (Invited)</b>	<b>Yusuke Suetsugu, KEK</b>
<b>09:30</b>	<b>Status of the Diamond Light Source DDBA cell vacuum system and lessons learned for a Diamond II upgrade (Invited)</b>	<b>Matthew Cox, Diamond</b>
<b>10:00</b>	All metal RF sector valves – development and possibilities	Kurt Sonderegger, VAT
<b>10:30</b>	<b>Break</b>	
<b>Session 7 - Moderator - Roberto Kersevan</b>		
<b>11:00</b>	<b>Non-evaporative getter (NEG) coatings for ultrahigh vacuum in very narrow chambers (Invited)</b>	<b>Andre Anders, LBNL</b>
<b>11:30</b>	Development of Low-Cost, High-Performance Non-Evaporable Getter (NEG) Pumps for Synchrotron Light Facilities	Kazuhiko Mase, KEK
<b>12:00</b>	Thermal optimization of coating process – numerical simulations	Monika Sitko, CERN
<b>12:15</b>	Management of large NEG-coating projects: What can go wrong and what can help resolve it	Jochen Deiwiks, FMB
<b>12:30</b>	Impedance consideration, practice, and results of vacuum components of Taiwan Photon Source	Hsin-Pai Hsueh, NSRRC
<b>12:45</b>	<b>Lunch Break</b>	
<b>Session 8 - Moderator - Yusuke Suetsugu</b>		
<b>13:30</b>	<b>Challenges in design of vacuum system of ultra low emittance storage ring of Iranian Light Source Facility (Invited)</b>	<b>Omid Seify, ILSF</b>
<b>14:00</b>	<b>Insertion Devices and Vacuum Related Activities at the NSLS-II (Invited)</b>	<b>Toshiya Tanabe, BNL</b>

<b>14:30</b>	EMPIR SIP01 project on standardization of QMS calibrations and outgassing rate measurements	Janez Setina, IMT
<b>15:00</b>	Contamination Control for Vacuum Systems	Thomas Weston, STFC Daresbury Laboratory
<b>15:30</b>	Introduction to hermetic sealing of metal/metal and metal/dielectric joints	Bob Chen, Wave Power
<b>16:00</b>	<b>Break</b>	
<b>Session 9 - Moderator - Gao-Yu Hsiung</b>		
<b>16:30</b>	<b>General Discussion</b>	<b>Hsiao-Chaun Hseuh, BNL</b>
<b>17:00</b>	<b>Summary &amp; Closing</b>	<b>Gao-Yu Hsiung, NSRRC</b>
<b>17:30</b>	<b>Wrap up</b>	

## 7. REGISTRATION

Registration fee for the workshop was NTD18,000 (US\$570 or 500 Euros) which includes shuttle service between the workshop Hotel and NSRRC, excursion, welcome reception, and workshop dinner. Registration fee was exempted for the invited speakers.

## 8. ACCOMMODATION

All the participants were accommodated in the "Lakeshore Hotel Hsinchu" (4-star) during the workshop. The special discounted rate of Executive Room for the workshop's participants in Oct. 23-30, 2016 (breakfast included) was NTD2,500 (US\$80 or 70 Euros) per night. Accommodation fee was exempted for the invited speakers.

## 9. VENUE

### **National Synchrotron Radiation Research Center (NSRRC)**

Address: 101 Hsin-Ann Road, Hsinchu Science Park, Hsinchu 30076, Taiwan.

Website: <http://www.nsrcc.org.tw/>

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## 10. DELIGATES OF THE WORKSHOP

80th IUVESTA Workshop on the Ultra Low Emittance Light Source Vacuum Systems, Oct. 24-28, NSRRC, Hsinchu, Taiwan			
No.	Participant Name	Affiliation, Country	E-mail
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48	Hsiao-Chaun Hseuh	BNL, USA	hseuh@bnl.gov
49	Toshiya Tanabe	BNL, USA	ttanabe@bnl.gov
50	Andre Anders	LBNL, USA	aanders@lbl.gov

## 11. WORKSHOP PHOTOS

