

INTERNATIONAL SCHOOL ON BEAM DYNAMICS AND ACCELERATOR TECHNOLOGY ISBA A REPORT FROM ISBA24 IN CHIANG MAI, THAILAND

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Abstract

ISBA24 (The 7th International School of Beam Dynamics and Accelerator Technology) was held in Chiang Mai, Thailand, jointly hosted by Chiang Mai University, Hub of Talents in Particle Accelerators (operated by the Thailand Center of Excellence in Physics), Synchrotron Light Research Institute (Public Organization) and Hiroshima University. ISBA is a series of international accelerator schools initiated in 2018 at Hiroshima, Japan promoted by IINAS(IINAS-NX). ISBA24 was held from November 1 to 9, 2024. The school brought together over 80 participants, including 18 professors and experts, and 64 students from ASEAN countries and beyond. All participants enjoyed intense lectures, practical exercises, student presentations, and social events such as excursions and Thai northern style banquet. An overview of ISBA24 will be presented and human resource development in accelerator science will be discussed.

INTRODUCTION

ISBA24 [1], the seventh International School on Beam dynamics and Accelerator technology was held from 1st to 9th November, 2024 at Chiang Mai University, Thailand. Chiang Mai city, founded in 1296, was once the capital of the ancient Lanna Kingdom in northern Thailand. Surrounded by mountains, it became a center for Buddhism, reflected in its many temples like Wat Phra Singh. Chiang Mai University (CMU) was established in 1964 as the first institution of higher education in northern Thailand. Located at the foothills of Doi Suthep, it offers a scenic and academic environment for students. ISBA24 is chaired jointly by CMU [2] and Hiroshima University [3]. Four organizations jointly hosted the event: Chiang Mai University, the Hub of Talents for Particle Accelerators under the operation of the Thailand Center of Excellence in Physics, the Synchrotron Light Research Institute, and the Program Management Unit for Human Resources & Institutional. Development, Research and Innovation (PMU-B).

The aim of ISBA is to provide young researchers and graduate students with an opportunity to learn about beam dynamics and technologies related to accelerators, such as RF and magnet systems, and to serve as a gateway to full-scale accelerator research. Since they are the warp and weft that support accelerator system, the viewpoint of the accelerator as a system are important for understanding the complexity of accelerators. In addition to the above perspec-

tives, ISBA aims at the development of accelerator science in the Asian region. It is the duty of Japan, Korea, China, Taiwan, and Thailand, as the leading accelerator regions in Asia. ISBA series was initiated as a school supported by IINAS program by MEXT, Japan in 2018 [4] and has been operated by researchers in Japan, Korea, China, Taiwan, and India. From 2023, researchers from Thailand joined the operation. The past ISBA series can be referred from the web site [5] [6] [7] [8] [9] [10]. Fig. 1 is a picture of the opening ceremony in a beautiful garden in CMU.



Figure 1: The group figure in the ISBA24 opening ceremony.

Since accelerator projects are realized through international cooperation, it is essential to improve the level of the entire region. It is important to provide graduate students and young researchers with opportunities to study intensively in an international environment, not only to acquire knowledge and skills, but also to create opportunities for accelerator research, to form international human networks, and to lay the groundwork for their future activities as researchers. As shown in Tab. 1, ISBA24 [1] was able to welcome students not only from the Asian region, but also from Europe (Turkey and Germany). Although ISBA's main scope is in the Asian region, it continues to develop as a global school. While there is United States Particle Accelerator School (USPAS) in the USA and CERN Accelerator School (CAS) in Europe, ISBA has become the leading accelerator-wide international school in the Asian region.

CURRICULUM

The curriculum of ISBA24, including the lecture material, can be found at the ISBA24 website [1]. Of the 32 lectures, roughly half are on basic accelerator topics, a quarter on accelerator applications and a quarter on hot topics. The lectures are summarized in Table 2 This time, AI, which

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Table 1: Number of students from each region based on their home institute location.

Region	Number of students
Thailand	20
Japan	13
China	12
Indonesia	7
Korea	4
Taiwan	2
India	4
Turkey	1
Germany	1
Sum	64

is developing rapidly and is used in accelerators, and FEL, which is promoted by Chiang Mai University, were presented as the hot topics.

AI has had a big impact on accelerator science in recent years. However, it is quite possible that it could have an impact comparable to that of the industrial revolution or even the information revolution. The Industrial Revolution replaced many simple tasks once performed by humans with machines. The Information Revolution also replaced much of the information processing done by humans with computers, and AI can now process information that was difficult for conventional computers, such as image and voice recognition. Furthermore, generative AI, which has been developing explosively in recent years, is attempting to replace human “thinking” itself. How accelerator research will utilise AI and how it will be developed by AI are extremely important issues.

Beginning on the second day, November 2nd, until before the final presentation of the school on November 9th, all students concentrated on the hands-on training sessions. Four training courses were set up in parallel, and students chose to work on either ASTRA [11], ELEGANT [12], OPERA [13], or CST [14]. Abhay Deshpande and Zachary Liptak were responsible for the ASTRA [11] course. Yujong Kim was responsible for the ELEGANT [12] course. Prapajwan Sunwong and Warissara Tangyotkhajorn were responsible for the OPERA [13] course. Pikad Buaphad was responsible for the CST [14] course. On the last day, November 9th, we held the final presentation session where each group presented their simulation results done in the sessions. The five top teams chosen by the lecturers were awarded as shown in Fig. 2, 3, 4, 5, and 6. Congratulations to all the award winners. Your efforts have paid off.

However, in a short period of time, even non-winning teams and students with no previous experience were able to understand the simulation code, run the simulations, and properly calculate the beam parameters from their designed accelerators. Since only 64 students had been admitted after a strict screening from 108 registrants, all students demonstrated their high level of excellence in designing of accelerators with the simulation codes.



Figure 2: Awards for the Group Presentation (Hands-on Session) were given to Mr. Nguyen Huynh Phuc, Ms. Jembar Lugina Pardja, Mr. Azza Alifa Muhammad, and Mr. Daniel Manuturi Simanjuntak.



Figure 3: Awards for the Group Presentation (Hands-on Session) were given to Ms. Sahar Abdelhay Ali Farrag, Mr. Kang, Jing-Hao, Mr. Tatsuki Kobayashi, Mr. Xinghao Guo



Figure 4: Awards for the Group Presentation (Hands-on Session) were given to Ms. Min Yang, Ms. Ruau Watanabe, Mr. Noman Habib, Mr. Natthapong Saengwises, Mr. Jirapat Jaroennapararat, Mr. Chang Yi-Chieh



Figure 5: Awards for the Group Presentation (Hands-on Session) were given to Mr. Komaruddin, Mr. Himanshu Mishra, Mr. Rao Zhiqiang, Mr. Noppawath Thamsanong

Table 2: Lecture summary of ISBA24

Subject	Lecturer	Affiliation
Introduction to Accelerator Science	Masao Kuriki	Hiroshima University
Foundation of Beam Dynamics I, II, II	Yujong Kim	KAERI
Magnet Theory	Prapaiwan Sunwong	SLRI
Particle Source	Zachary Liptak	Hiroshima University
Accelerating RF cavity	Sakhorn Rimjaem	CMU
Superconducting Accelerator	Tomohiro Yamada	KEK
Electron Injector and Linac	Masao Kuriki	Hiroshima University
RF System	Sakhorn Rimjaem	CMU
Advanced Beam Dynamics in XFEL Driving Linacs	Yujong Kim	KAERI
Beam Diagnostics	Hirokazu Maesaka	RIKEN/SP8
Analytical Treatment of Linear Accelerator	Jie Gao	IHEP
Circular Accelerator and Synchrotron	Hiroyuki Hama	Tohoku University
Foundation of Collider	Hitoshi Hayano	KEK
Advanced Beam Dynamics in Circular Accelerator	Jie Gao	IHEP
Industrial Accelerators and Applications	Pikad Buaphad	CMU
Proton and Heavy Ion (Carbon) Cancer Therapy	Abhay Deshpande	SAMEER
Accelerator-based BNCT Cancer Therapy	YoungSoon Bae	DAWON MEDAX
Electron Linac-based Cancer Therapy	Abhay Deshpande	SAMEER
The Latest Medical Applications: Theranostics	Masao Kuriki	Hiroshima University
Foundation & Applications of AI	Arnan Sipitakiat	CMU
AI for Medical Applications	Ekkarat Boonchieng	CMU
AI for Accelerator Operation	Hirokazu Maesaka	RIKEN/SP8
AI for Beam Diagnostics	Hirokazu Maesaka	RIKEN/SP8
3rd Generation Synchrotron Light Source	Waikeung Lau	NSRRC
Insertion Device	Takashi Tanaka	RIKEN/SP8
4th Generation Synchrotron Light Source	Hiroyuki Hama	Tohoku University
Foundation of FEL	Takashi Tanaka	RIKEN/SP8
FEL Facilities and Applications	Hideaki Ohgaki	Kyoto University
THz FEL Light Source and Applications	Waikeung Lau	NSRRC



Figure 6: Awards for the Group Presentation (Hands-on Session) were given to Mr. Mario Delon Simanjuntak, Ms. Amanjot, Mr. Letian Liu, and Mr. Rattacha Boonchoo



Figure 9: Students receiving a blessing from a priest at Wat Phra That Doi Suthep.



Figure 7: The final group figure taken at the ISBA24 closing session. Students hold up their certificates with wonderful smiles on their faces.



Figure 10: Traditional dances were performed in the restaurant's courtyard, with customers joining in at the end to enjoy the enchanting Thai dances, and ISBA participants were no exception.

At the end of the ISBA24 closing ceremony, certificates were handed to all students by the lecturers. The certificate is just a piece of paper, but it will be more worthwhile than \$10,000,000 to those who have completed 9 long days of the intensive lectures and the rigorous hands-on training. This is evident in their proud smiles as shown in figure 7. This picture is also evidence of the great success of the first accelerator school, ISBA, in Thailand.

SOCIAL EVENTS

A welcome dinner in traditional Lanna-style "Kad Mua" was organized to allow lecturers and students to experience the culture in Chiang Mai and to provide an opportunity for meeting. A wide variety of food and drinks were served at the stalls and participants enjoyed a meal with a cultural flavour. In Fig. 8, Sakhorn Rimjamem and Duangmanee Wongratanaphisan, two key persons running ISBA24 introduced themselves.



Figure 8: A snapshot of the reception dinner in Lanna-style.

The excursion, which featured many attractions, took place at Wat Phra That Doi Suthep, Bo Sang Umbrella Making Centre, Tha Phae Gate, and Wat Chedi Luang. Wat Phra That Doi Suthep, about 10 km from Chiang Mai University, is a major religious and historical site in northern Thailand, founded in 1383 during the Lanna Kingdom. It features classic Lanna architecture and houses a revered Buddha relic, making it a key Theravada Buddhist pilgrimage site. The temple also plays a vital role in preserving Northern Thai culture and supporting academic studies. Located at 1,073 meters, it symbolizes spiritual elevation. A popular hiking route, the Monks' Trail, connects the temple to the back of the CMU campus. Students receiving a blessing from a priest at Wat Phra That Doi Suthep as shown in Fig. 9

In the evening, a farewell banquet was held at Khum Khan-toke Restaurant, where ISBA participants enjoyed a traditional Lanna dinner and cultural performance. The event offered a rich cultural experience, with traditional dances that attendees, including ISBA students and lecturers, joined in on—captured in Fig. 10.

CONCLUSION AND FUTURE LOOK

ISBA24, the first ISBA school held in Thailand, successfully brought together 64 international students for nine days of intensive study on accelerator beam dynamics and technologies, concluding with student group presentations from hands-on training. The next ISBA school will be held in Shanghai, China—now a leading accelerator research hub alongside Japan, with major projects like SHINE, CSNS, and

CEPC. The host institute, SARI, features advanced facilities such as SSRF and the cutting-edge SHINE accelerator. The hope is that ISBA will continue to grow at this world-leading research site. The site of the ISBA is already fixed for 2026 and 2027. ISBA 2026 will be held in Taiwan. ISBA 2027 will be held in India. ISBA 2028 location is still blank. If there are any research institutions or universities that would like to host ISBA in 2028, we encourage them to apply. The ISBA International Organizing Committee will provide its full support and guarantee the success of the event.

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