Status of Accelerator Facilities in Thailand: Past, Present, and Future

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Abstract

Thailand has progressively utilized the advantages of accelerator technologies across various applications, expanding to agriculture, scientific research, and transportation. Notably, the "Siam Photon Source (SPS)", a 1.2 GeV synchrotron light generator, was established in 1996 at the Synchrotron Light Research Institute (SLRI), Nakhon Ratchasima, with the main objectives including advancing scientific research. Since then, Thailand acquired a linear accelerator in 2014 and a cyclotron in 2017 at the Her Royal Highness Princess Maha Chakri Sirindhorn Proton Center (HPSP) and the Thailand Institute of Nuclear Technology (TINT), respectively, aiming to enhance precision radiation therapy and to facilitate the production of radiopharmaceuticals. Additionally, the establishments of more advanced accelerator facilities such as a new 3.0 GeV synchrotron light generator are planned and will be constructed in the near future.

Introduction

In 1996, a synchrotron light source, known as the Siam Photon Source (SPS), was installed at the Synchrotron Light Research Institute, Nakhon Ratchasima, with the ability to accelerate electrons up to 1.2 GeV. Since the construction, SPS has been extensively utilized for advanced research, education, industry, agriculture, and medicine. In 2014, Thailand acquired a cyclotron machine for proton therapy system, located at Her Royal Highness Princess Maha Chakri Sirindhorn Proton Center (HPSP), Bangkok. The cyclotron can accelerate protons up to 250 MeV, which was suitable for cancer therapy. In 2017, another cyclotron was installed at the Institute of Nuclear Technology (TINT), Nakhon Nayok. The new cyclotron can accelerate protons to an energy of 15-30 MeV and deuterons to an energy of 9-15 MeV, primarily for the utilization in radiopharmaceutical production, radioisotope production, and nuclear physics research. In the future, Thailand has planned to construct at least two more particle accelerators, namely (1) the accelerator mass spectrometer (AMS), for use in carbon dating and (2) a second synchrotron machine to support the development of advanced knowledge and research in Thailand.

Examples of accelerator facilities in Thailand

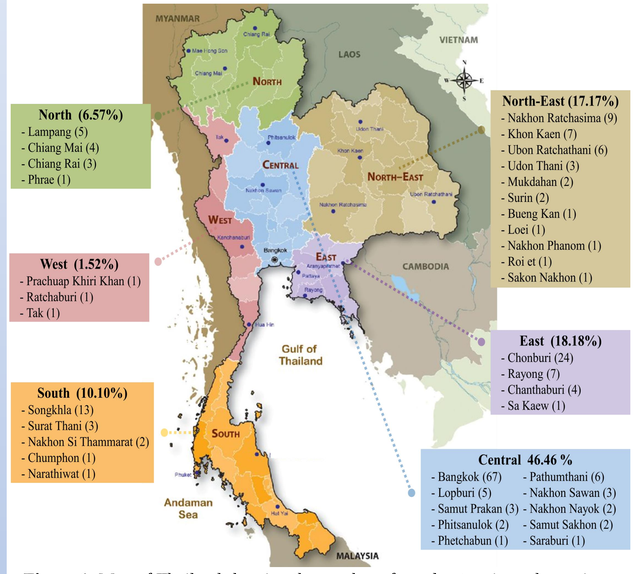
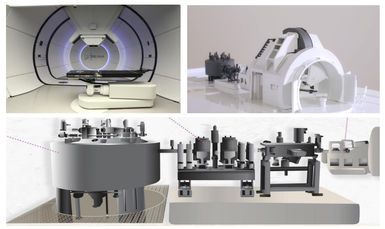


Figure 1: Map of Thailand showing the number of accelerators in each province.

Cyclotron (Proton therapy system)



- Located at Her Royal Highness Princess Maha Chakri Sirindhorn Proton Center (HPSP), Bangkok
- Able to accelerate protons to 250 MeV.

Figure 3: Cyclotron (Proton therapy system) at Her Royal Highness Princess Maha Chakri Sirindhorn Proton Center (HPSP)

- Located at ABEX Global Healthcare.
- Able to accelerate protons to 230 MeV.

Figure 5: Cyclotron (Proton therapy system) at ABEX Global Healthcare

Siam Photon Source (SPS)

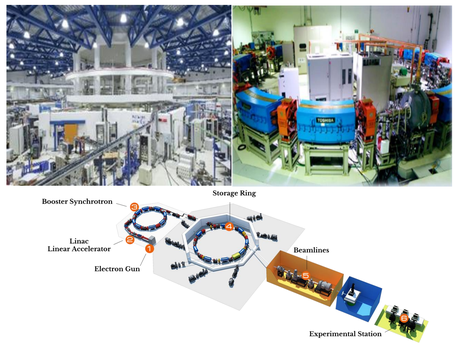


Figure 2: Synchrotron light generator at the Synchrotron Light Research Institute (SLRI)

- Located at The Synchrotron Light Research Institute (SLRI), Nakhon Ratchasima.
- Able to accelerate electrons to energy 1.2 GeV

Cyclotron

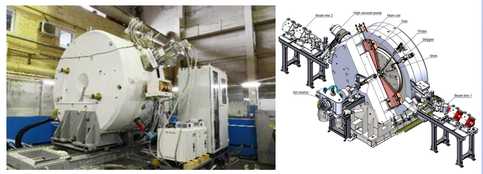


Figure 4: Cyclotron at Thailand Institute of Nuclear Technology (TINT)

- Located at Thailand Institute of Nuclear Technology (TINT), Nakhon Nayok
- Able to accelerate protons to 15-30 MeV and deuterons to 9-15 MeV.

Tandem accelerators

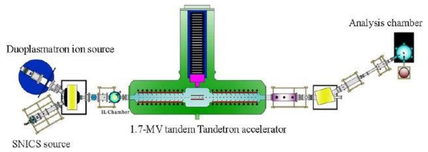


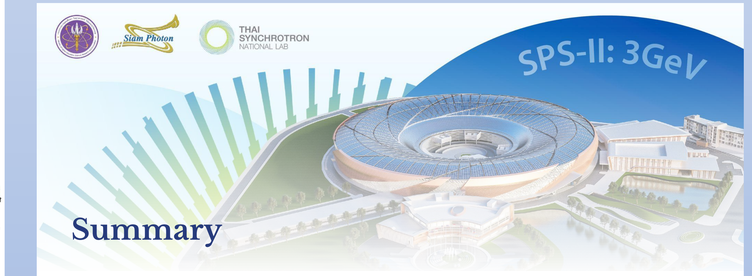
Figure 6: Schematic layout of the ion beam analysis system based on 1.7 MV Tandem accelerator at Chiang Mai University.

Facts about accelerator facilities in Thailand

Currently, Thailand uses a variety of particle accelerators, primarily for medical, research, industrial, and safety applications. According to current data, Thailand has applied for licenses to use

- 164 linear accelerators,
- 15 electron beams,
- 7 cyclotrons, and
- 1 synchrotron,

with the majority located in the central region (46.46%), followed by the eastern region (18.18%), north-eastern region (17.17%), southern region (10.10%), northern region (6.57%), and western region (1.52%).



Summary

Despite the widespread use of accelerators in Thailand, plans for more advanced facilities are underway to further expand the technological capabilities. These initiatives encompass the establishment of an accelerator mass spectrometer (AMS), featuring a 1.7 MV tandem accelerator for carbon dating purposes, as well as a second synchrotron light source, with a higher energy of 3 GeV. The implementation of these facilities is expected to significantly enhance Thailand's knowledge and research capabilities, as well as increasing economic competitiveness of Thailand's entrepreneurs.

Acknowledgements/References