

ACKNOWLEDGEMENTS

I have a passion for understanding how computers work and communicating with them through coding and programming languages. During my bachelor's studies, I focused on material analysis of Hard Disk Drives (HDDs). Upon completing my bachelor's degree, I desired to further explore semiconductor devices such as Random Access Memory (RAM) and Solid State Drives (SSDs). This led me to pursue a doctoral degree at Suranaree University of Technology (SUT) with a scholarship from the Development and Promotion of Science and Technology Talents Project (DPST) as a physicist. During the first year of my Ph.D., I didn't join any specific research group within the School of Physics as I wanted to explore various research fields to find the best fit for my interests. In my second year, my friend Thanachot Nasawad, who was conducting research for his master's degree in the Nuclear and Particle Physics group, informed me about their semiconductor development project for particle detection devices. Eventually, I became a member of the Nuclear and Particle Physics group. In 2016, I spent six months at the Thai Microelectronics Center (TMEC) in Chachoengsao, studying Technology Aid Design (TCAD), a commercial software used for semiconductor device simulation. My work focused on simulating gamma ray sensors for particle sensor development. After returning from TMEC, I joined the A Large Ion Collider Experiment (ALICE) at the European Organization for Nuclear Research (CERN). As an ALICE member, I had the opportunity to attend workshops on ALICE ITS Upgrade, MFT, and O2 Asia, where I was inspired by Dieter Röhrich's presentation on proton computed tomography using ALPIDE sensors. This innovative use of semiconductor devices in clinical research caught my attention, and I discussed the possibility of studying their work at the University of Bergen (UiB) with Professor Röhrich during the workshop. In 2020, I spent six months in Bergen as part of the pCT group, programming C++ code to communicate with Xilinx VCU118 FPGA via Transmission Control Protocol (TCP). The VCU118 board was used for reading/writing ALPIDE data and interfacing with the user. Additionally, I formed a pCT research team at SUT with the aim of replicating the pCT experiment conducted by the Bergen team. However, due to the challenges posed by COVID-19 and the situation in Ukraine, we encountered difficulties in procuring ALPIDE sensors for the pCT prototype. As an alternative, we decided to utilize a telescope consisting of six ALPIDEs for pCT

development and test it with treatment proton beams at King Chulalongkorn Memorial Hospital in Thailand.

I'd like to thank TMEC for my TCAD studies. I'd like to thank CERN for including me as an ALICE member. I'd like to thank Professor Dieter Röhrich for inspiring me to work on the pCT project. I'd want to thank the pCT Bergen team for including me in their group. I'd like to thank Asst. Prof. Dr. Christoph Herold for his assistance in designing the track reconstruction algorithm. I would also want to thank Dr. Narongrit Ritjoho, Dr. Phongnared Boontueng, Mr. Passakorn Phumara, Mr. Lattawat Charoonratana, Mr. Natthawut LaoJamnongwong, and Miss. Yaowaluk Buanill from the pCT SUT team.

I would like to thank the Development and Promotion of Science and Technology Talents Scholarship (DPST) and the Thailand Center of Excellence in Physics (ThEP-61-PHM-SUT4) for their financial assistance. I'd like to thank King Chulalongkorn Memorial Hospital in Thailand for providing us with the proton source. I'd like to thank KCMH members, especially Assistant Professor Dr. Taweap Sanghangthum, for operating a proton beam line and allocating beam time. As my advisor and co-adviser, I would like to thank Asst. Prof. Dr. Chinorat Kobdaj and Dr. Todsaporn Fuangrod for guiding me on how to complete this study. I'd like to thank Suranaree University of Technology (SUT) for their assistance with this research.

I'd want to express my gratitude to my family for their encouragement and assistance in obtaining my Ph.D. My parents' success in their careers has pushed me to work hard in my Ph.D. program. I'd like to thank my colleagues from SUT's Nuclear and Particle Physics Group for their assistance with my experiments. Finally, I am tremendously proud of myself for finishing my Ph.D. By the way, I believe I need to improve in order to be an excellent researcher in the future.

Arnon Songmoolnak