

Final report on the short-stay study at SLAC

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Department: Accelerator Science

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Receiving university/institute: SLAC National Accelerator Laboratory

Accelerator Research Division

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1. About the receiving institute SLAC [1]

As stated on its webpage, “SLAC is now a multipurpose laboratory for astrophysics, photon science, accelerator and particle physics research”. One of the SLAC core competencies is “electron-based accelerator research and technology”.

Dr. Yunhai Cai and Dr. Gennady V. Stupakov were my hosts during my stay at SLAC. Cai is leading the Beam Physics Department [2] and Stupakov is the group leader of collective effects in the same department [3].

At present, microwave instability and CSR (Coherent Synchrotron Radiation) are important frontiers in the field of beam physics. The theory and calculation of CSR and CSR induced instabilities have been extensively studied and are still hot topics among the investigations of the beam physics department at SLAC.

2. Preparation before leaving Japan

Calculation of CSR and CSR induced microwave instabilities in KEKB and SuperKEKB is important part of my thesis work. Before leaving Japan, I have been developing a code for CSR calculation. And I have been supporting the CSR involved studies for the KEKB and SuperKEKB. Obviously, improved CSR calculation and instability simulation are demanded for these projects.

In the end of 2008, Y. Cai paid a visit to KEK. Since then we established the collaboration to study CSR and microwave instability. And in August, 2009 and March, 2010, I paid two short visits to SLAC. Afterward we realized that a longer visit is necessary for purpose of intensive collaboration. That's why we apply to the SOKENDAI short-stay study abroad program.

3. Studies during the stay

During the first week of my stay, I concentrated on the CSR calculation. I finished the final step of my code development. And immediately I did careful benchmarks between three codes: G. Stupakov's, K. Oide's and mine. The resulting conclusions were amazing: In general, 1) my code is very flexible but have some problems of numerical noise which needs to be improved; 2) in Stupakov's code, a scaling factor was missed and the bug was fixed consequently; 3) Oide's code produced unphysical results in some special cases which is not well understood yet.

In the next two weeks, I moved to the simulation code for microwave instability (MWI). I found equivalence between Y. Cai's and G. Stupakov's codes. And I also tested my ideas, which were integrated in my own MWI code, by modifying Cai's code. And possibilities in speeding up the computing time in simulations and improving the boundary conditions were identified.

In the last week, I studied the linearized Vlasov solver for purpose of detecting MWI threshold, following Stupakov's idea. This mission was not finished but we got better understanding on the faced challenges. We agreed to continue this study until Stupakov's visit to KEK in this October.

3. Other activities

During this stay, I attended several seminars around FEL sponsored by SLAC. These seminars helped me to better understand the activities at SLAC.

On Aug. 20, I gave a talk to the beam physics department on the topic of chromatic aberrations in the KEKB. The talk was successful and the success of crab tuning with skew-sextupole magnets in the KEKB was very impressive to SLAC people.

We also discussed the details of Stupakov's visit to KEK, which is the natural extension of our collaboration, and fixed the schedule of his visit.

4. Travel expenses

The expenses mainly covered:

- 1) Flight ticket: ANA, Narita ⇔ San Francisco, around 220,000 JPY.
- 2) Accommodation: SLAC guest house, around 92 USD/day. In practice, I lived outside SLAC with help from my friend. Then I could enjoy convenience of transportation, shopping and food.
- 3) Food: around 20 USD/day. Lunch: SLAC cafeteria, around 7 USD. Dinner: Chinese restaurant, around 13 USD.

5. Language

English. It's great to polish my oral English and enjoy the culture and food in the fully American circumstance.

6. Things to be difficult

Nothing.

7. Advice for the future applicants

Just enjoy the life, but work hard.

References

[1] <http://www6.slac.stanford.edu/AboutSLAC.aspx>

[2]

https://slacportal.slac.stanford.edu/sites/ard_public/bpd/Pages/Default.aspx

[3] <http://www.slac.stanford.edu/~stupakov/>