FIVE QUESTIONS WITH

DR. GERARDO GUILLERMO CANTON

Intra-beam stripping: Challenge to accelerate high-intensity accelerators

A standard method for high-intensity proton beams consists in accelerating a hydrogen ion (H-) beam, i.e., a proton with two electrons, injecting said H- beam in a synchrotron with a circulating proton beam, then, strip the electrons from the H- beam to keep the proton beams. However, it was found that H- beams were subjected to large beam loss. Lebedev proposed the intra-beam stripping (IBSt), i.e., the single electron stripping in H- beam due to a binary collision, as a mechanism to account for unexplained losses at the Spallation Neutron Source [1]. The IBSt is an effect that challenges the operation of present high-intensity proton accelerators.

Could you introduce yourself?

Figure 1. Dr. Gerado Guillermo Canton

My name is Gerardo Guillermo Cantón, I am originally from Mérida, Yucatán. I studied mechatronics engineering at the Universidad Autónoma de Yuacatán (UADY) [2]. Then, I did a Master's and Ph.D. at the Centro de Investigación y Estudios Avanzados del IPN Unidad Mérida [3], doing my research at the European Organization of Nuclear Research (CERN) [4], with the support of the BEAM program. My research focused on synchrotron radiation in the highest energy accelerators at CERN. During that time, I took several accelerator schools such as CAS (CERN), JUAS (Joint Universities), and MePAS2 (Mexico). Together with my fellow co-founders of CMAP, I was in the organization of MePAS3. After a very long unplanned holiday (a consequence of COVID), I started a postdoc at China Spallation Neutron Source (CSNS) [5].

Could you tell me about your institute and research topic?

My institute is the CSNS, which belongs to the Institute of High Energy Physics (IHEP) which is part of the Chinese Academy of Sciences (CAS). CSNS is the first pulsed neutron source in China. It is a platform for both fundamental and high-tech physics research. The accelerator consists of a H- source, a linear accelerator (linac), a fast-cycling synchrotron, the target (where the neutrons are generated), and the experimental lines.

The CSNS has been designed in stages. The first stage is in operation, delivering a 125-kW beam and work is currently underway on the design and implementation of the second stage: CSNS-II, which will have an output of 500 kW. To this end, the beam current will be increased five-fold. At low energies, the negative ions, confined in a tiny volume, tend to lose electrons through collisions with each other. This phenomenon is known as intra-beam stripping or IBSt. My current research is to determine this effect and propose methods to mitigate it.


Figure 2. Accelerator system for the CSNS.

How or why did you choose that topic?

Rather than choosing the topic, I was asked to look at the projects that were in the department. From among those projects, I was asked to propose all the topics that I thought were needed and would help in either operations or design, and my boss selected the ones that were most urgent for the department.

Right now, what is the biggest challenge of your work?

Without doubt, my biggest challenges to overcome are circumstantial: language, the different types of bureaucracy, and even the working customs in such a different culture.

What did you think that will be the future of you research area?

My research has a very specific topic. Once we have found the answer to the IBSt problem in the second stage of the CSNS, we can start working on a possible third stage. As for me in particular, it is likely that having solved this challenge, I will be assigned to one of the other topics that will be available at IHEP in due time.

References

[1] V. Lebedev, et al., "Intrabeam Stripping in H-Linacs," Proceedings of the LINAC2010 Conference, Tsukuba, Japan, September 12-17, 2012, pp. 929-931
[2] Universidad Autónoma de Yucatán, https://uady.mx/
[3] CINVESTAV Unidad Merida, https://www.mda.cinvestav.mx/
[4] CERN, https://home.cern/
[5] CSNS, http://csns.ihep.cas.cn/