Prototype Design of Bunch Arrival Time Measurement System Based on Cavity Monitor for SHINE



zhouyimei@zjlab.org.cn

Authors: Y.M. Zhou, S.S. Cao, J. Chen, Y.B. Leng

Shanghai Advanced Research Institute, CAS, Pudong, Shanghai 201210, P.R. China

Introduction

The Shanghai high repetition rate XFEL and extreme light facility (SHINE) is planned to be built into one of the most efficient and advanced free-electron laser user facilities over the world to provide a unique tool for kinds of cutting-edge scientific research. The measurement of bunch arrival time is one of the key issues to optimize system performance. This is because the FEL facility relies on the synchronization of electron bunch and seeded lasers. Currently, there are mainly two methods to measure the bunch arrival time: the electro-optical sampling method and the RF cavity-based method. Considering the latter one has a simpler system and lower cost, the method has been adopted by SXFEL. The previous results show that the measurement uncertainty of bunch arrival time has achieved to be 45 fs, which can be further optimized. For SHINE, the bunch arrival time resolution is required to be better than 25 fs@100pC, and 200 fs@10 pC. The RF cavity-based method will also be applied. This paper will present the system prototype design and related simulation results.

Methods to measure bunch arrival time

Electro-optical sampling method

• Advantages High sensitivity

• Advantages Simple system structure





System framework of bunch arrival time measurement system



Prototype design of RF front-end



Main modules and simulation results



IBIC'20, Santos, Brazil

