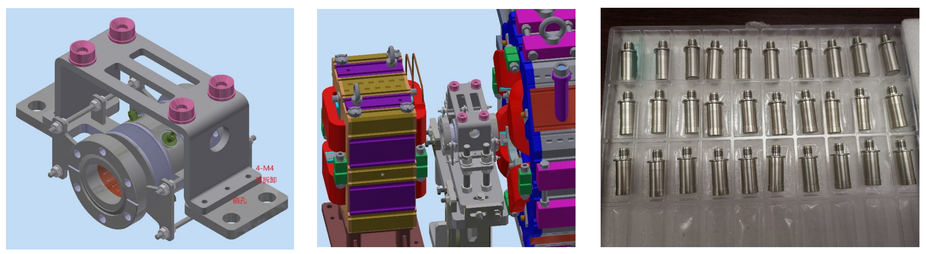
Consideration and Design of HEPS Beam Instrumentation

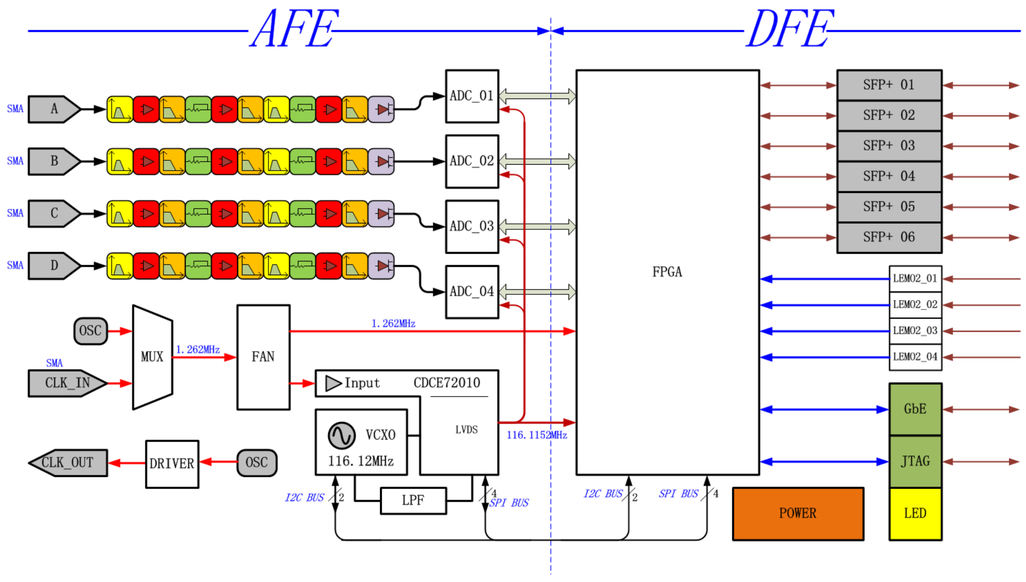
J.H. Yue, Y.F. Sui, S.J. Wei, Y.Y. Du, Q. Ye, D.C. Zhu, J. He, Y. Zhao, J.X. Zhao, X.Y. Zhao,
H.Z. Ma, L.D. Yu, Y.H. Lu, L. Wang, D. Yin, J.S. Cao, T.G. Xu, X.E. Zhang, J. Yang,
IHEP, Beijing, P. R. China

Abstract

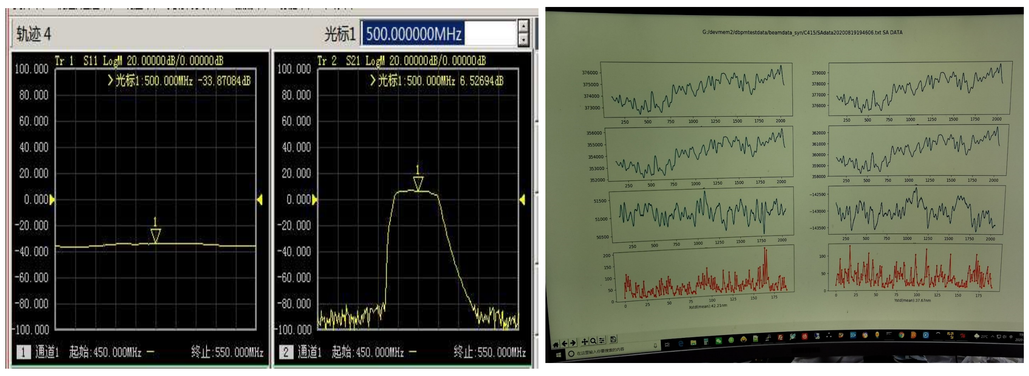
High Energy Photon Source (HEPS) is an ultra-low emittance light source, of which the energy is 6 GeV, the current is 100-200mA, so it is more difficult to the physics design and hardware design. To the beam instrumentation, sub-micron level beam position measurement and controlling system, sub-micron synchrotron measurement system based x ray and bunch by bunch feedback system are the technologies which we need to master and to develop. Beam position measurement system is based on digital technology; it is difficult to design and home-made. Emittance measurement of storage is relied on the accuracy measurement of beam profile, of which the resolution is sub-micron level; x ray KB mirror imaging system can meet such high resolution requirement and is a good choice. bunch by bunch feedback systems are used to restrain the beam instabilities. The author present some of the beam instrumentations design in this poster.



BPM monitor and feedthroughs



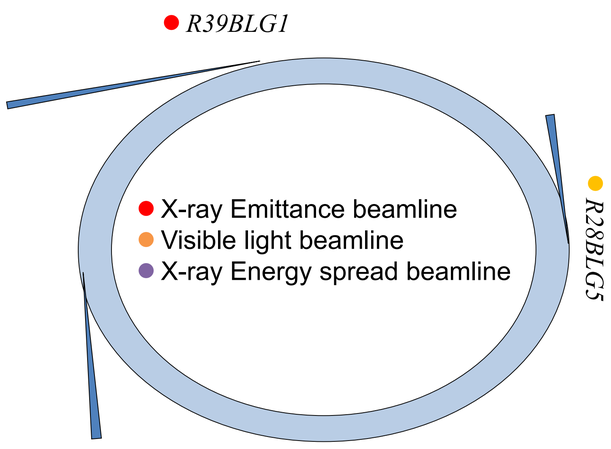
Schematic of DBPM electronics AFE



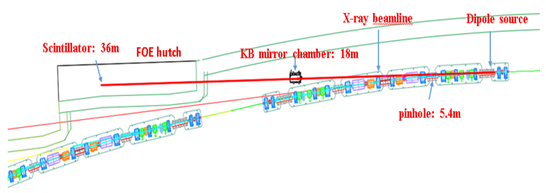
The test result of DBPM in lab

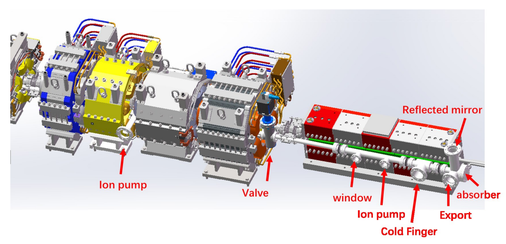
The result shows that the center frequency of AFE is 500MHz, and the bandwidth is 22MHz, and Signal to Noise Ratio is about 86dB. The new SA(10Hz) resolution result in the lab is about 21nm.

A 18 sets of self-developed have been used in the linac for one year and 50 sets of DBPMs are installing in rings in this September.

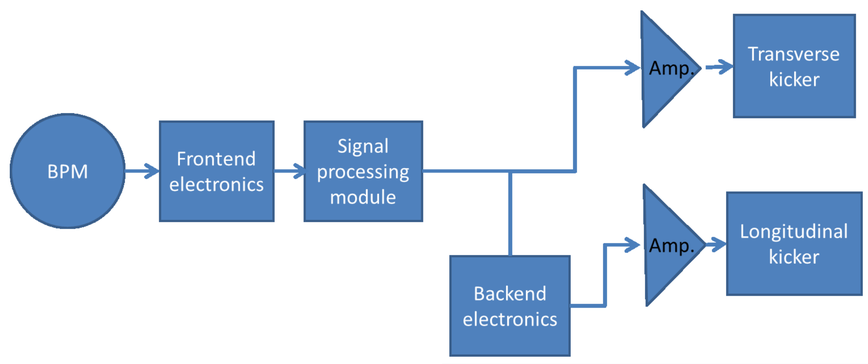


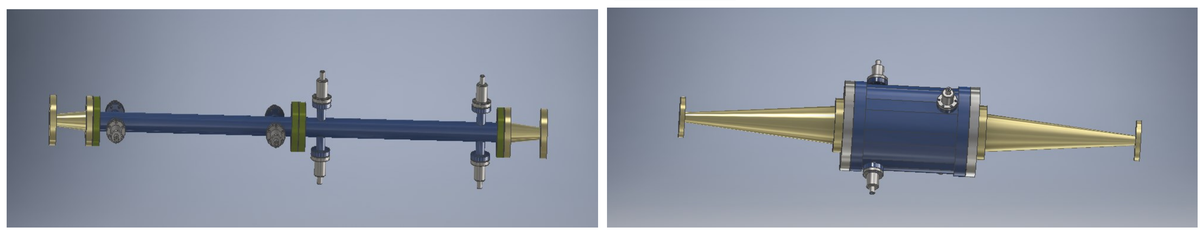
There are 3 beam lines for diagnostics. One is visible light beamline for bunch length and bunch purity measurement, the other two are x ray beam lines, one is for beam size measurement, the other is ready for beam energy spread measurement. The detailed design is finished almost.



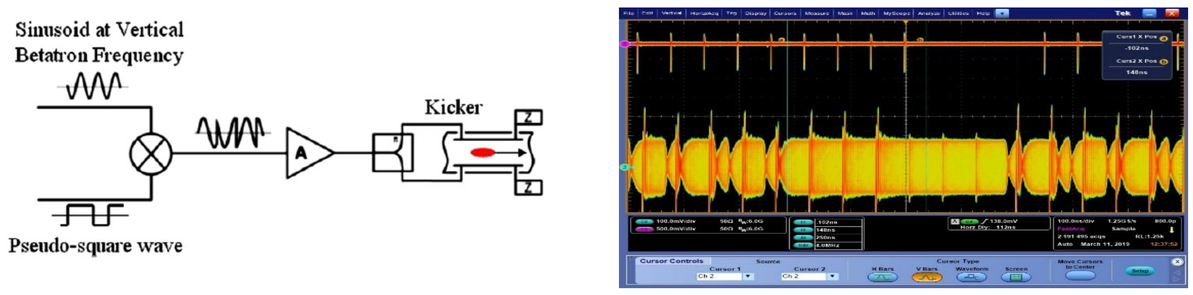


X ray beam line and Visible beam line

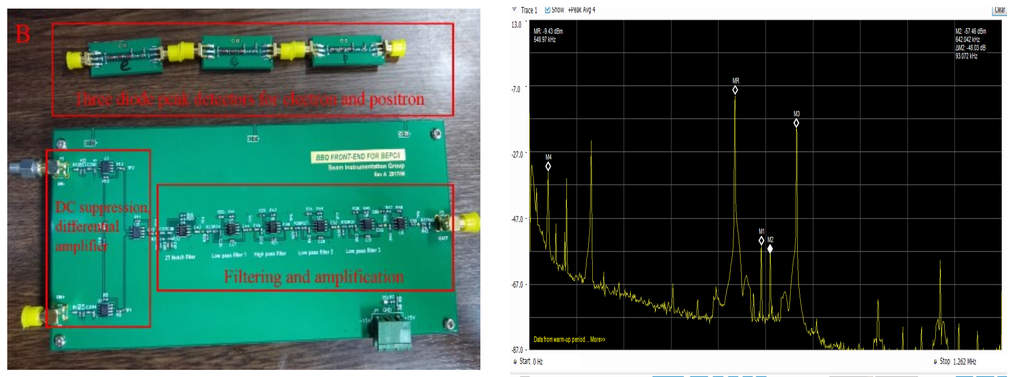




The kickers have been already been designed, we will use Dimtel electronics



Schematic diagram of bunches cleaning system and cleaning signal.



The test result of 3D tune measurement system on BEPCII

Conclusion

Beam instrumentation of HEPS are designing step by step in details. Some prototypes have been tested on BEPCII and the equipment of linac and transport lines have been manufactured. In the future, mass production of BPM monitor and electronics are a great challenge.

Institute of High Energy Physics
Chinese Academy of Sciences