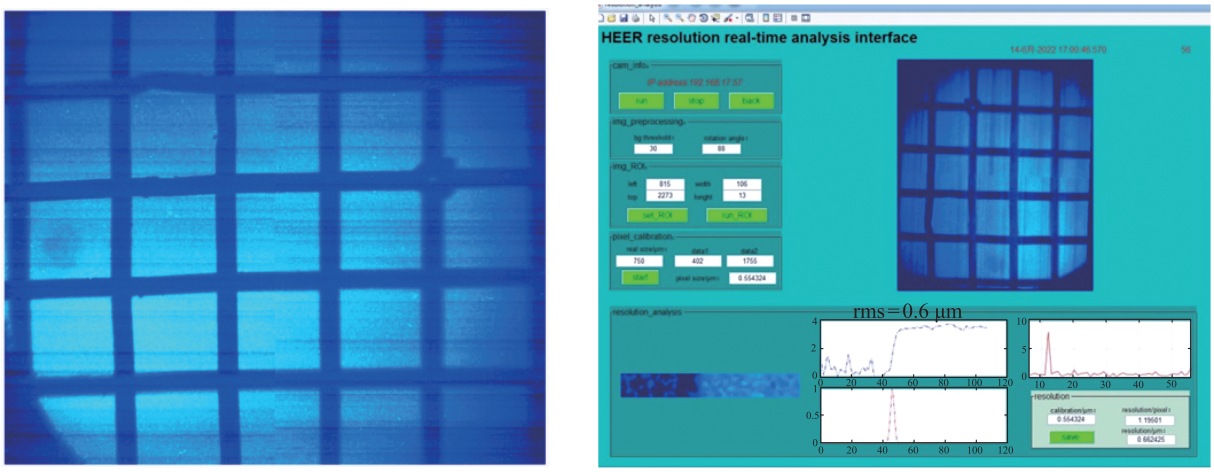

Fig. 2 (color online) HEER cascade image with TEM grid.

References

[1] Z. H. Ran, Z. P. Li, Q. T. Zhao, et al., Nuclear Instrum. Meth, A, (2021)1015,
[2] J. Li, Q. T. Zhao, Y. Zong, et al., Nuclear Instrum. Meth, A, (2021)1020.

8 - 15 Beam Parameters Measurement Using BPM with IMP Electron Linear Accelerator

Li Jia, Ran Zhaohui, Zhao Quantang, Cao Shuchun, Yuan Xiaoxiao, Yan Wenbin, Shen Xiaokang and Zhang Zimin

The IMP electron linear accelerator has now entered the stable operation stage. In order to improve the efficiency of beam operation and enhance the understanding of beam parameters for researchers, the BPM-based beam collimation method and the emittance measurement method have been developed. BPMs are arranged at the entrance and exit of the alpha magnet and the entrance and exit of the traveling wave accelerating tube. It is a strip structure, and the signal processing electronics used is Libera Spark EL[1].

The beam collimation experiment based on BPM was carried out at the beamline from the exit of the alpha magnet to the entrance of the accelerator tube. In order to achieve online correction, beam based alignment using on the PSO algorithm (PSO-BBA) was developed. The key variable is the strength of the steering magnet, and the fitness value is the transverse position of the beam after passing through the steering magnet, which is reflected as the reading of the BPM of the subsequent beamline in the experiment. The beam collimation results obtained by using PSO-BBA are shown in Fig. 1. As the number of iterations increases and the objective function decreases, the strength value of the correction magnet gradually converges to a certain area, the final collimation results can meet the needs of accelerator experiments.

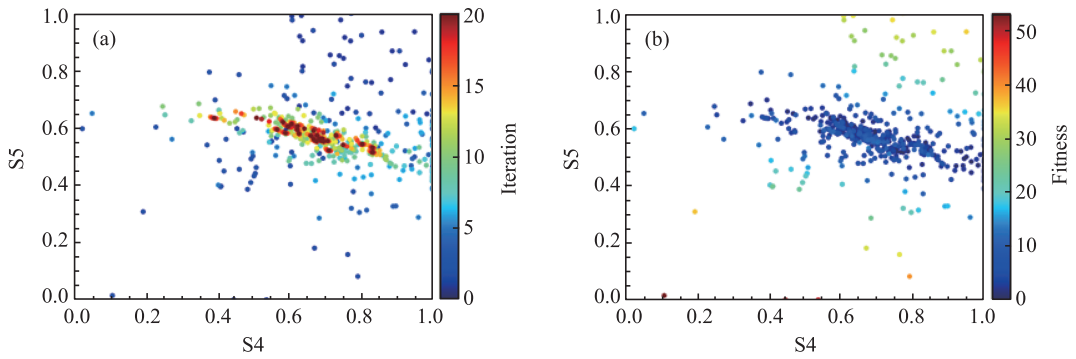

Fig. 1 (color online) Online PSO-BBA correction results, (a) steering magnet strength varies with iterations, (b) steering magnet strength varies with fitness.

The emittance measurement method based on BPM adopts a non-intercepting measurement method[2], and its measurement beamline is arranged at the exit of the accelerating tube[3]. The layout is shown in Fig. 2. The experimental process is divided into five steps in total. The first step is to change the steering magnet strength between the quadrupole iron and the BPM, and calculate the maximum fluctuation range of the fourth-order component measurement. The second step is to measure the beam energy using a deflection magnet. The third step is to set different quadrupole magnet current strengths, and the fifth step is to read the BPM fourth-order component under different quadrupole magnet strengths (take the average value of 100 groups). Finally, the emittance was calculated, and the projected emittance in the x and y directions were measured to be 8.676 and 10.29 πmm·mrad, respectively.

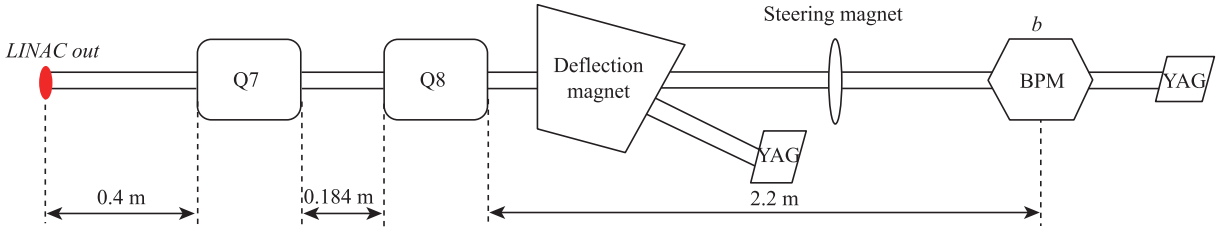

Fig. 2 (color online) Experimental beamline for emittance measurement.

References

[1] R. E. Shafer, Beam Position Monitoring[C]. AIP Conference Proceedings 212'Upton, New York, (1989), 26.
[2] R. H. Miller, R. H. Sheppard, M. B. James, et al., Proc. 12th Int. Conf. on High Energy Accelerators, (1983)602.
[3] Steven J. Russell, Review of scientific Instruments, 70(2)(1999)1362.

8 - 16 Power Supplies Progress in 2022

Gao Daqing, Wu Fengjun and Yan Hongbin

A series of power supplies have been upgraded in the power supply system of the Heavy Ion Research Facility in Lanzhou (HIRFL) in 2022. Upgrade of the Sector Focusing Cyclotron (SFC) main magnet power supplies, SFC harmonic magnet power supplies and shimming magnet power supplies are the main renovation project for SFC this year. The SFC is an injector in HIRFL which has been operating for a long time. As a result, its power supplies have been severely ageing, and a renovation project for power supplies is proposed.

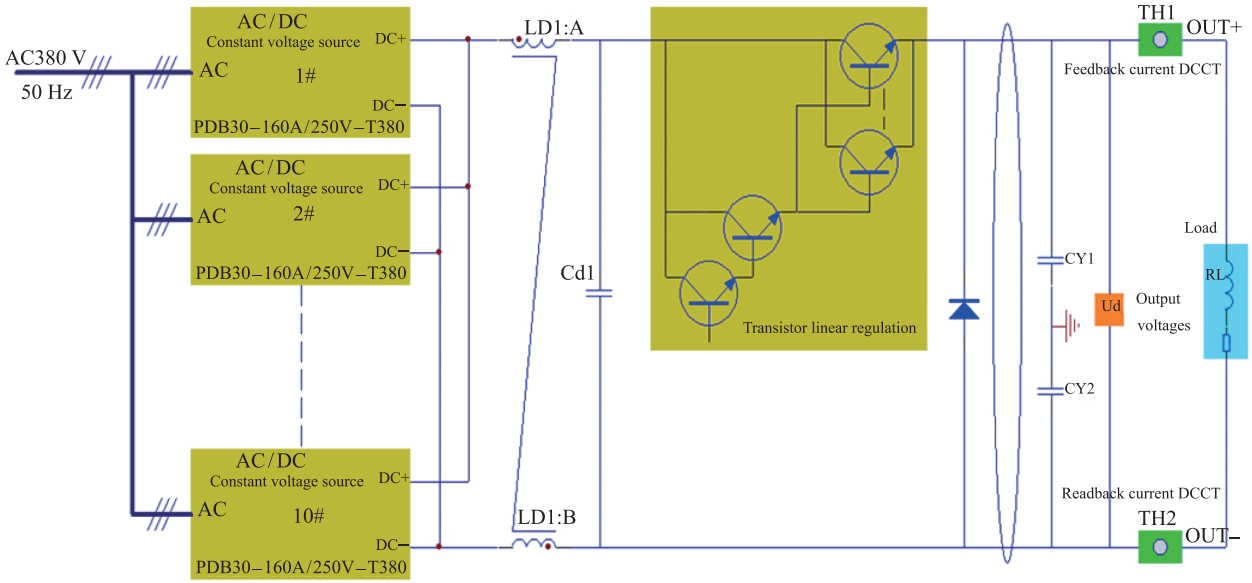

Fig. 1 (color online) The combination of the full digital control technology, switching method and linear adjustment tube scheme used in the SFC main magnet power supply in 2022.