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The design and ideas of non-destructive ionization profile monitors for HIAF synchrotrons and future applications

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More than 4 Ionization Profile Monitors (IPM) have been mounted in HIRFL, which play an important role in the beam optics optimization, electron cooling research, and ion-electron recombination study so on since 2016.

To meet the profile needs of HIAF project with multiple beam species and high dynamic challenges, mainly two kinds of IPM structure have been chosen. At first, 5 IPMs equipped with the Micro Channel Plates (MCPs)、Phosphor screen (P46) and camera acquisition have been deployed in Booster Ring (Num. 3) and Spectrometer Ring (Num. 2), which use discrete electrodes for precisely high voltage supplying and can achieve a good spatial resolution around 50 μm . There is also another IPM designed without a P46 and camera for the electron-photon conversion and capture, but a ceramic anode and the fast multi-channel electronics instead. The purpose is to measure a fast turn by turn profile with a least 64 MHz sampling rate for machine studies. Some new features and experiments have also been performed at IMP, like using an IPM for transverse emittance measurements. A compact IPM with one cage measuring horizontal and vertical profiles has also been built and tested, which shows good results under a constraint magnet field. And a new prototype based on the ionization products captured by a microstrip line or coaxial 50 Ω anode is proposed to measure bunch shapes. It's for sure that the ionization mechanism or yields can be explored more values in the beam instrumentation.

Footnotes

Funding Agency

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Yes

Primary author: XIE, Hong (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: XIE, Hong (Institute of Modern Physics, Chinese Academy of Sciences)

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