4 - 8 Longitudinal Dynamics of Electron Cooled and RF-bunched Ion Beams at CSRe

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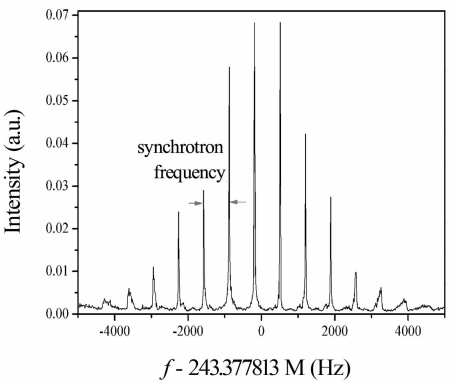

Fig. 1 Schottky spectrum of bunched $^{22}Ne^{10+}$ ion beam at the 50th harmonic of revolution frequency (black line), x axis is the frequency domain and y axis is the Schottky noise power intensity.

The longitudinal dynamics of electron-cooled and RF-bunched $^{22}Ne^{10+}$ ion beams have been studied at the experimental cooler storage ring (CSRe), at IMP Lanzhou[1]. By RF-bunching the ion beam at the 50 th harmonic of the revolution frequency, the Schottky spectrum was measured by a new resonant Schottky pick-up at an energy of 70 MeV/u, as show in Fig. 1. The longitudinal momentum spread of $\Delta p/p = 1.6 \times 10^{-5}$ has been reached with less than 10^7 ions.

The synchrotron oscillation frequency of the ions inside the bucket can be determined by the distance between every two adjacent peaks in the Schottky spectrum, and can be written as[1]:

$$\omega_s = \frac{\omega_{rev}}{\beta}\sqrt{\frac{qeh\eta U_b}{2\pi\gamma mc^2}} \quad (1)$$

which depends on the revolution frequency ω_{rev}, the beam velocity βc, the ion charge qe, the harmonic number h, the frequency dispersion η, the effective RF-bunching voltage U_b, and the relativistic Lorentz factor γ, while m is the mass of the ion and c is the speed of light. We have found out that the synchrotron frequencies of ions deduced from Fig. 1 are varied with different sidebands, the further data analysis is in progress.

Reference

[1] S. Chattopadhyay, CERN 84-11 (1984).

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