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Improved waveforms for barrier-bucket systems

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Barrier-Bucket (BB) systems provide a method to apply a short gap to a coasting beam. This is utilized for different applications, like ion cleaning, or to compensate the medium energy loss caused by internal experiments. BB-cavities are broadband cavities, and the applied signal is commonly a short sine burst, followed by a flat section at zero voltage. Since the transfer function of the BB-system is usually neither flat nor linear, it is common to predistort the signal to obtain the desired shape at the rf gap. Nevertheless, the resulting waveform still has a ripple in the flat section. This is due to the lowpass characteristic of the amplifier and the sharp edges at the ends of the sine, which lead to an infinite number of harmonics. This paper provides better suited BB-waveforms, which are designed with a finite number of harmonics from the beginning. It is shown that a much better flatness can be achieved than for a conventional BB-waveform, without sacrificing any performance. These advanced waveforms are currently used at the hadron synchrotron COSY at Forschungszentrum Jülich, leading to improved BB-bunch shapes, in particular for electron-cooled beams.

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Primary author: BREITKREUTZ, Bernd (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Co-author: STASSEN, Rolf (Forschungszentrum Jülich GmbH)

Presenter: BREITKREUTZ, Bernd (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

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