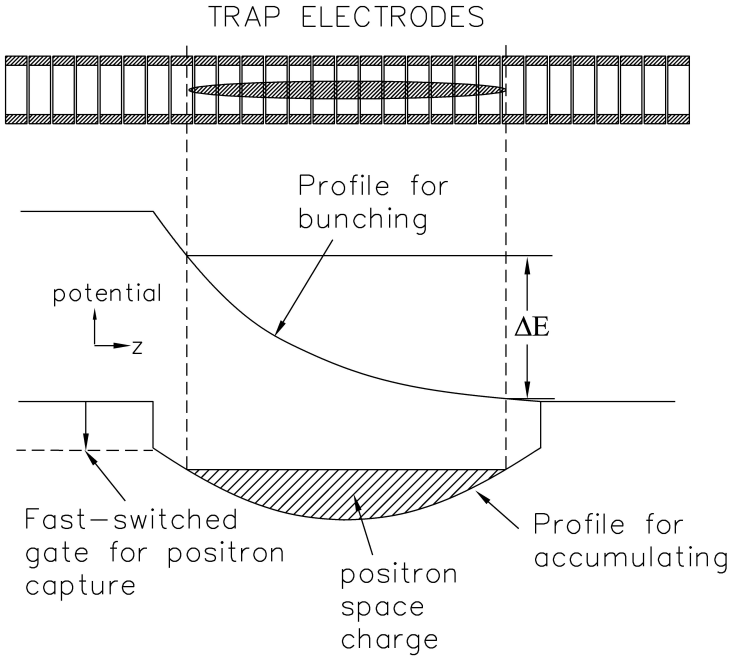
Positron "Witness" Beam Source for a Wakefield Accellerator

R. G. Greaves[1]

Accumulator/prebuncher



1. Positrons captured from trap by fast gate switching
2. Positrons ejected from trap by applying bunching potential profile along accumulator.
3. Bunching profile applies "energy correction" to time focus positrons downstream.
4. "Harmonic" potential produces time focus at end of accumulator
5. Time focus location can be positioned at arbitrary location by using different bunching profile shapes.
6. Bunching always increases energy spread ΔE. (Longitudinal phase space conserved)
7. Shorter pulses can always be obtained using larger bunching voltages but there are technology limitations for this geometry (~1 kV).
8. Space charge is a complicating factor.

[1] Communicated *via* C. M. Surko, U. C. San Diego

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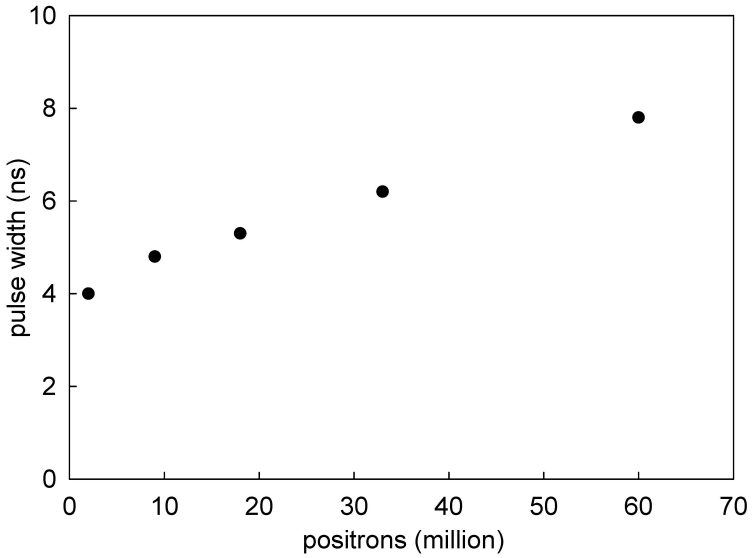
Accumulator/prebuncher example data



1. Early data from testing AEGIS electronics (2012).
2. Beam radius ~1 mm FWHM in 400 gauss field.
3. Energy spread ~50 – 100 eV for 60M data (estimated).
4. Further optimization possible but 1ns likely to be difficult with this geometry.
5. Note effect of increasing space charge on pulse width.

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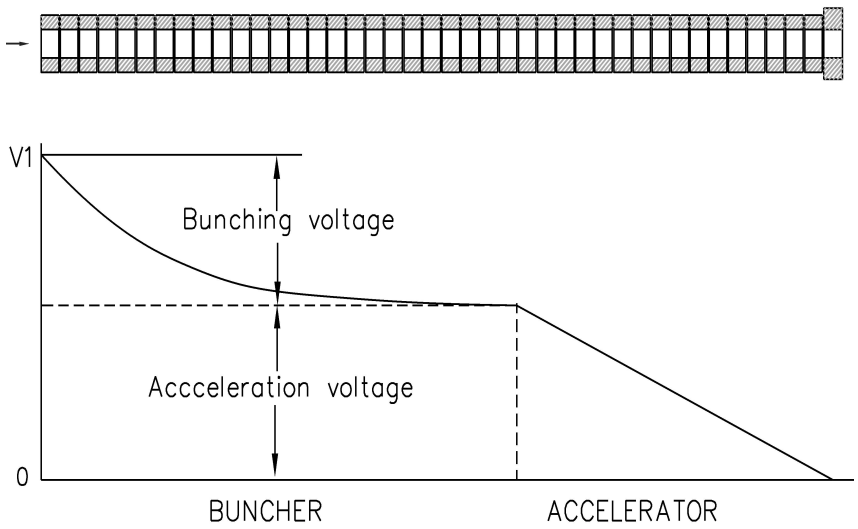
Buncher/accelerator



1. Additional bunching + acceleration can be obtained using a separate buncher/accelerator.
2. Potential profile produced using in vacuum resistor divider chain.
3. Mills obtained 1ns with 70M positrons using 2kV bunching voltage, but no improvement above 2kV.
4. With some optimization, factor of 2 improvements should be possible up to 100M positrons.
5. Parameter space above 100M is more challenging.
6. Shorter pulse widths (<100ps) possible using remoderation brightness enhancement, with ~ tenfold loss in number of positrons.

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