Phase Advance in Quads with Space Charge

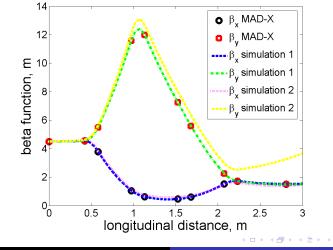
Jun Ma, Roman Samulyak

Department of Applied Mathematics and Statistics Stony Brook University

2017.1.12

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β change in quads



Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

- Track transverse phase advance of a line of particles.
- Only consider the $x v_x$ phase space.
- $y = 0, 0.5\sigma, 1\sigma$.
- With / without space charge effect from whole electron beam.

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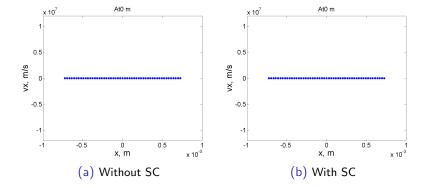
Comparison of space charge Comparison of *y* locations

- *y* = 0.
- With / without space charge effect from whole electron beam.

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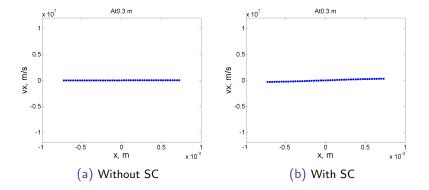




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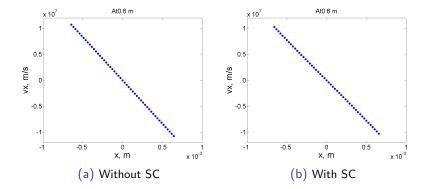


Comparison of space charge Comparison of *y* locations



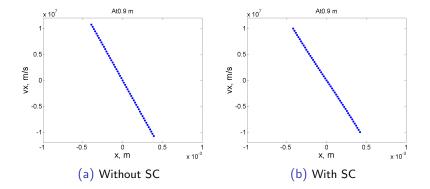
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Comparison of space charge Comparison of *y* locations



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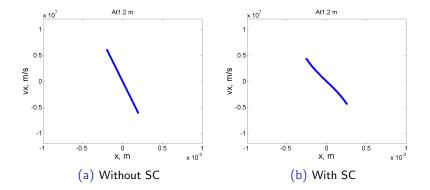
Comparison of space charge Comparison of y locations



Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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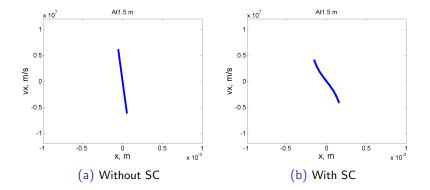




Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

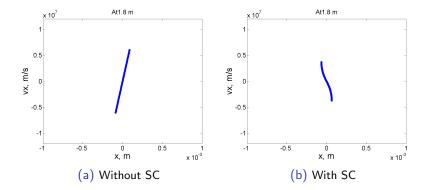
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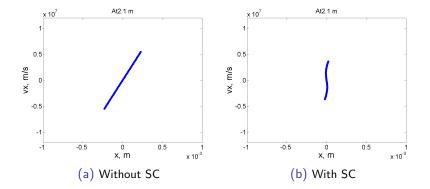




Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

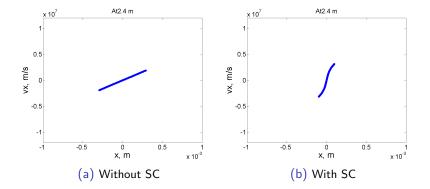
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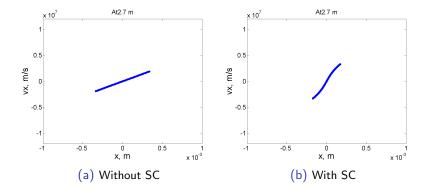




Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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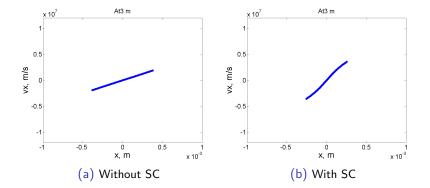




Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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Comparison of space charge Comparison of *y* locations

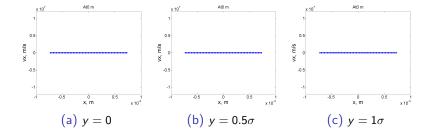
• $y = 0, 0.5\sigma, 1\sigma$.

• With space charge effect from whole electron beam.

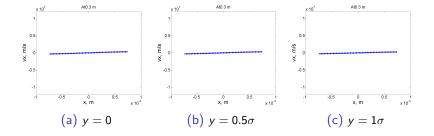
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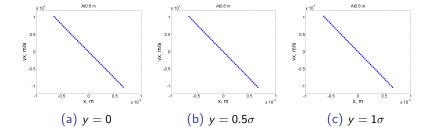




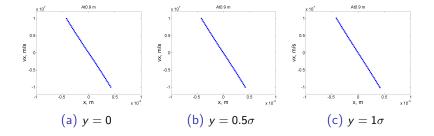




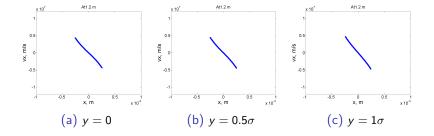




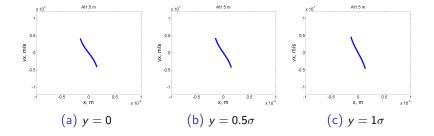




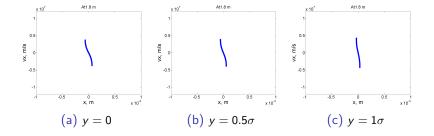




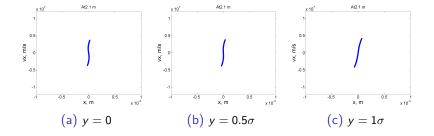




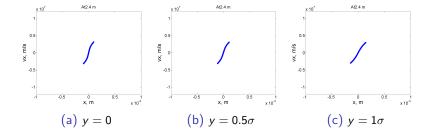




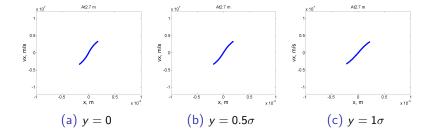




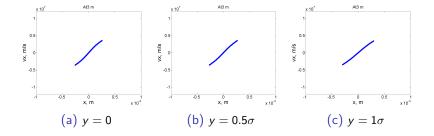












Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

- Initial kick.
- No ion.

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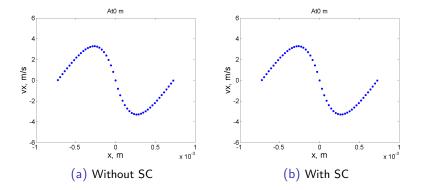
Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

- *y* = 0.
- With / without space charge effect from whole electron beam.

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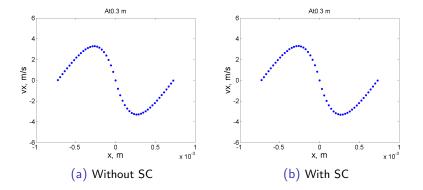
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of *y* locations, amplified signal



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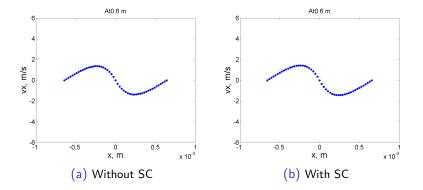
Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

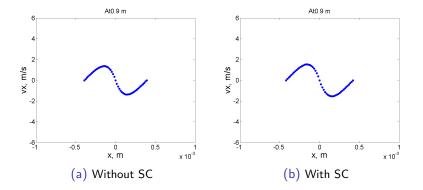
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



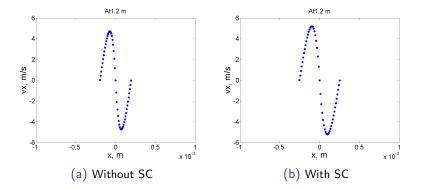
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



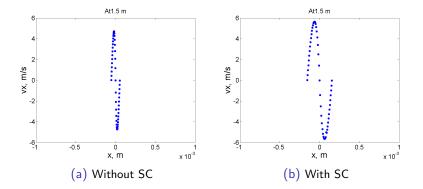
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



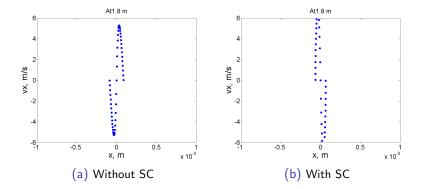
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



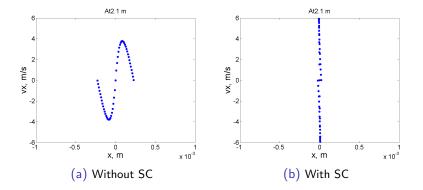
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



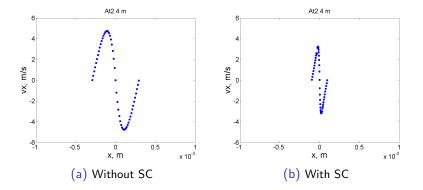
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



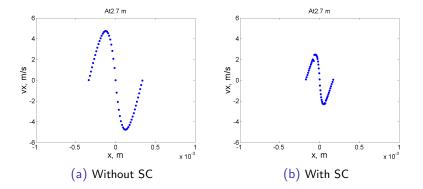
Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



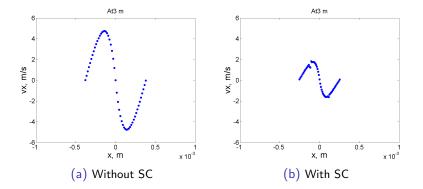
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



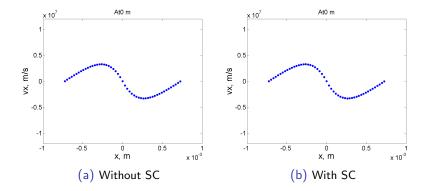
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

- Signal is amplified by 1e + 6.
- *y* = 0.
- With / without space charge effect from whole electron beam.

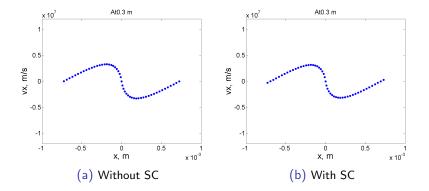
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Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

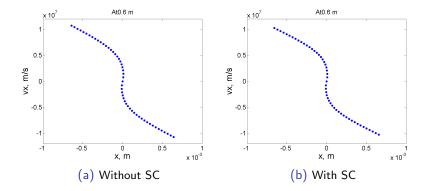
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Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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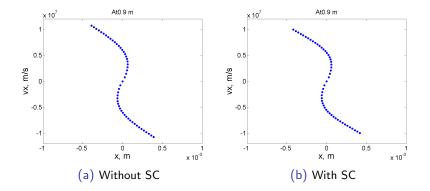
Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

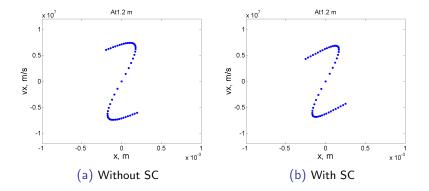
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

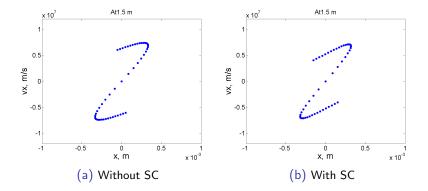


Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

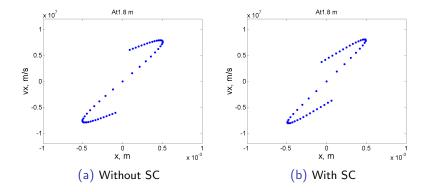
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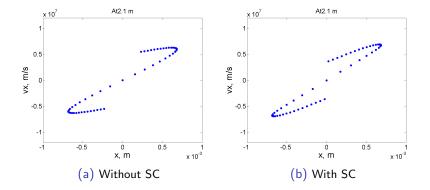


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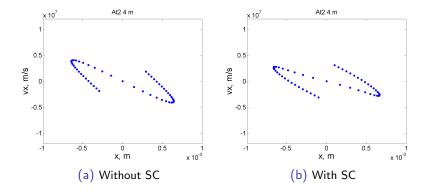
Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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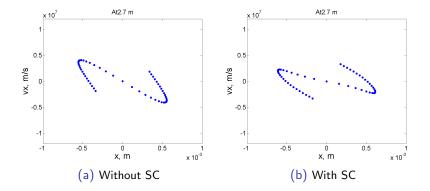
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Introduction Background Modulated Signal Ion Introduction Comparison of space charge, unamplified signal Comparison of y locations, amplified signal

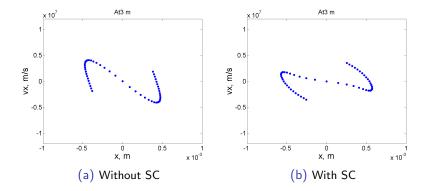


Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

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Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

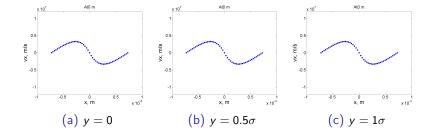
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

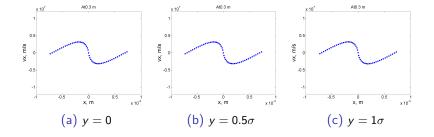
- Signal is amplified by 1e + 6.
- $y = 0, 0.5\sigma, 1\sigma$.
- With space charge effect from whole electron beam.

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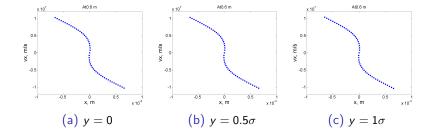
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

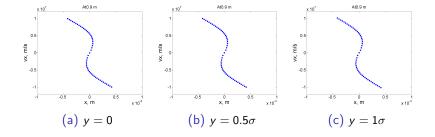


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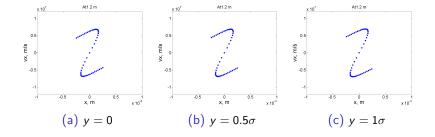


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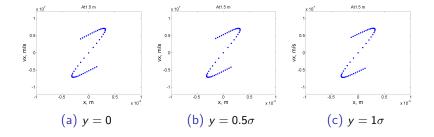
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

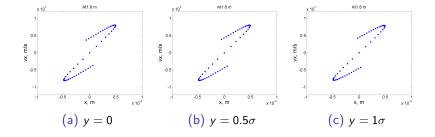


Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

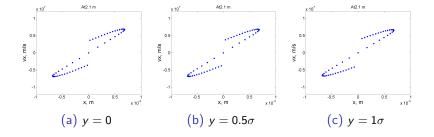


Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

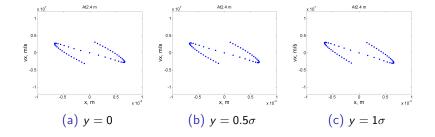
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal



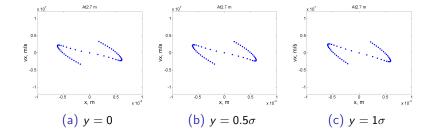
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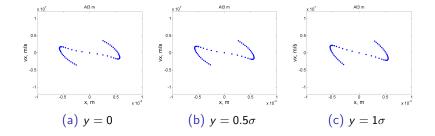
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Comparison of space charge, unamplified signal Comparison of space charge, amplified signal Comparison of y locations, amplified signal

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Introduction Background Comparison of space o Modulated Signal Comparison of y locat Ion

- No initial kick.
- With ion.

Comparison of space charge Comparison of *y* locations

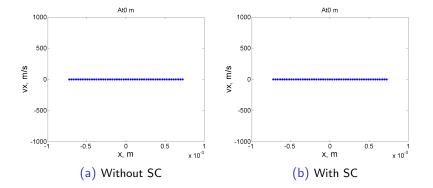
• *y* = 0.

• With / without space charge effect from whole electron beam.

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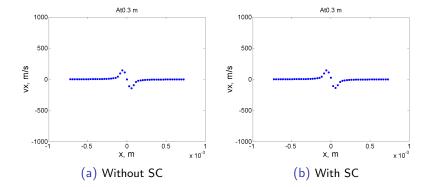
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Comparison of space charge Comparison of *y* locations



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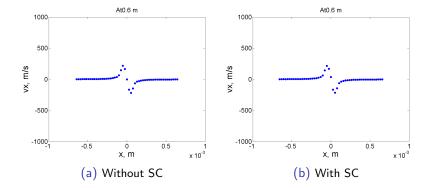




Jun Ma, Roman Samulyak Phase Advance in Quads with Space Charge

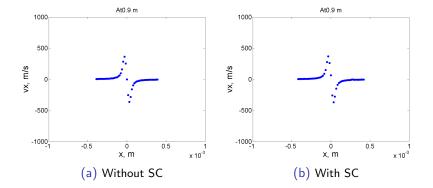
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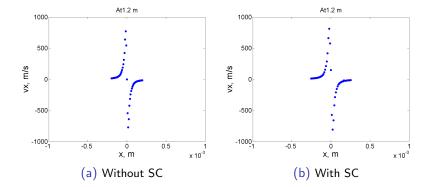
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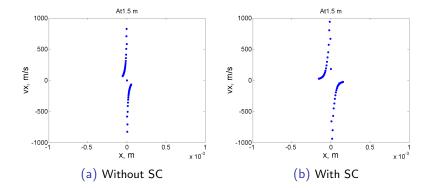


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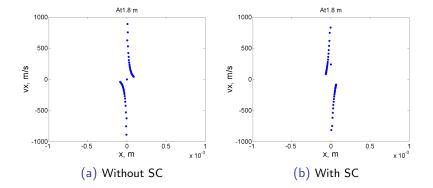




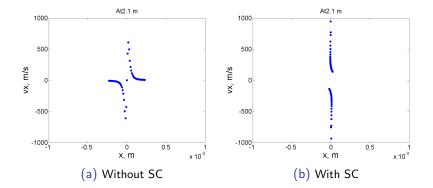
Comparison of space charge Comparison of *y* locations



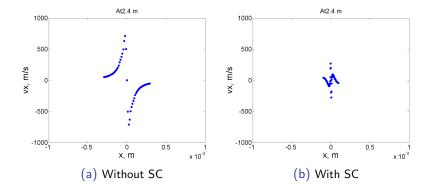




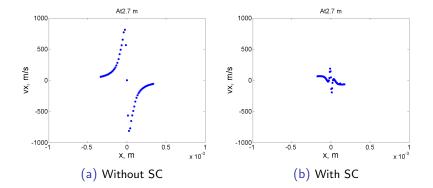




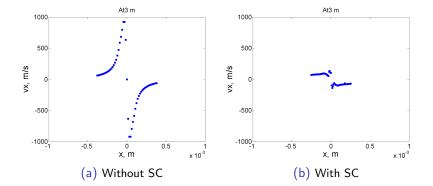












Introduction Background Comparison of space charge Modulated Signal Ion

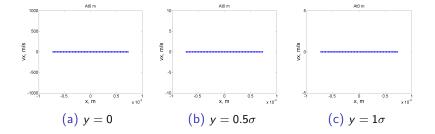
• $y = 0, 0.5\sigma, 1\sigma$.

• With space charge effect from whole electron beam.

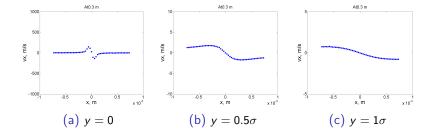
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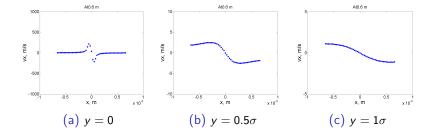




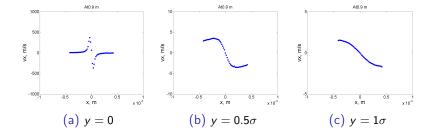




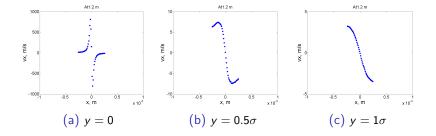




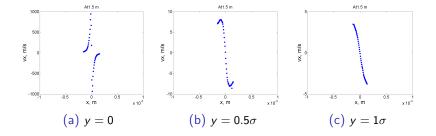




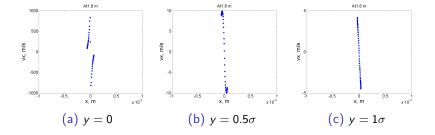




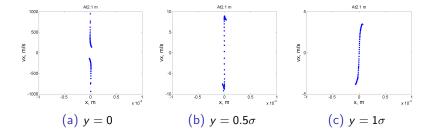












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