Phase Advance in Quads

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Quads setting

- 0m - 0.4245m : Drift
- 0.4245m - 0.5815m : Q1, $K_1 = -7.56277$
- 0.5815m - 0.9745m : Drift
- 0.9745m - 1.1315m : Q2, $K_1 = 8.50925$
- 1.1315m - 1.5245m : Drift
- 1.5245m - 1.6815m : Q3, $K_1 = 0.698665$
- 1.6815m - 2.0745m : Drift
- 2.0745m - 2.2315m : Q4, $K_1 = -8.30714$
- 2.2315m - 3m : Drift
Introduction
Using Transfer Matrix
Using Simulation

\( \beta \) change

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Phase Advance in Quads
Calculate transverse phase advance using

- Transfer matrix
- Simulation
**Figure:** $\beta$ change (left) and phase at initial (right).
Figure: $\beta$ change (left) and phase before Q1 (right).
**Figure**: $\beta$ change (left) and phase after Q1 (right).
Figure: $\beta$ change (left) and phase before Q2 (right).
Figure: $\beta$ change (left) and phase after Q2 (right).
**Figure:** $\beta$ change (left) and phase before Q3 (right).
**Figure:** $\beta$ change (left) and phase after Q3 (right).
Figure: $\beta$ change (left) and phase before Q4 (right).
Figure: $\beta$ change (left) and phase after Q4 (right).
Figure: $\beta$ change (left) and phase at final (right).
- Cold beam as background
  One line in transverse direction
- Cold beam with ion
  Subtract background to visualize modulation signal
- Cold beam with initial kick
  Subtract background to visualize modulation signal
- Cold beam with initial kick $\times 1e+6$
  No need to subtract background
Figure: Phase at initial of background (left) and signal (right).
Figure: Phase before Q1 of background (left) and signal (right).
Introduction
Using Transfer Matrix
Using Simulation

With ion
With initial kick
With initial kick $\times 1e+6$

Figure: Phase after Q1 of background (left) and signal (right).
Figure: Phase before Q2 of background (left) and signal (right).
Figure: Phase after Q2 of background (left) and signal (right).
Figure: Phase before Q3 of background (left) and signal (right).
Figure: Phase after Q3 of background (left) and signal (right).
**Figure:** Phase before Q4 of background (left) and signal (right).
Figure: Phase after Q4 of background (left) and signal (right).
Figure: Phase at final of background (left) and signal (right).
Figure: Phase at initial of background (left) and signal (right).
Figure: Phase before Q1 of background (left) and signal (right).
Figure: Phase after Q1 of background (left) and signal (right).
Figure: Phase before Q2 of background (left) and signal (right).
Figure: Phase after Q2 of background (left) and signal (right).
**Figure:** Phase before Q3 of background (left) and signal (right).
Figure: Phase after Q3 of background (left) and signal (right).
Figure: Phase before Q4 of background (left) and signal (right).
Figure: Phase after Q4 of background (left) and signal (right).
**Figure:** Phase at final of background (left) and signal (right).
Figure: Phase at initial using transfer matrix (left) and simulation (right).
Figure: Phase before Q1 using transfer matrix (left) and simulation (right).
Figure: Phase after Q1 using transfer matrix (left) and simulation (right).
**Figure:** Phase before Q2 using transfer matrix (left) and simulation (right).
Figure: Phase after Q2 using transfer matrix (left) and simulation (right).
Figure: Phase before Q3 using transfer matrix (left) and simulation (right).
**Figure:** Phase after Q3 using transfer matrix (left) and simulation (right).
Figure: Phase before Q4 using transfer matrix (left) and simulation (right).
**Figure:** Phase after Q4 using transfer matrix (left) and simulation (right).
Figure: Phase at final using transfer matrix (left) and simulation (right).