Top-off stored beam perturbation

- peak-to-peak/FWHM:
  - **horizontal = 6**
  - **vertical = 100**
  - **IDs FWHM$_{x,y}$ = (1.0,0.022) mm**

y, peak-peak = 1.1 mm

(Oscillations at β_x = 3.5 m, β_y = 12.5 m)

- damping time: 5 msec

- repetition period
  - **now: 100 msec**
  - **top-off: 10 minutes**

x, peak-peak = 2 mm

3 msec
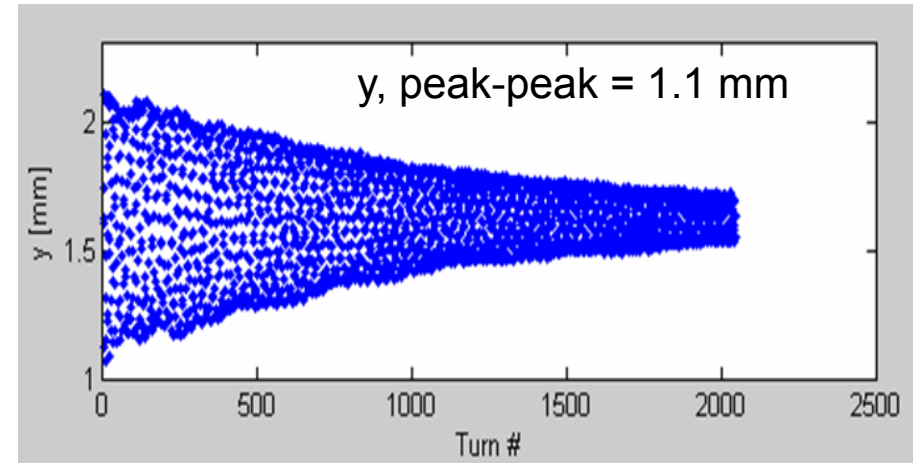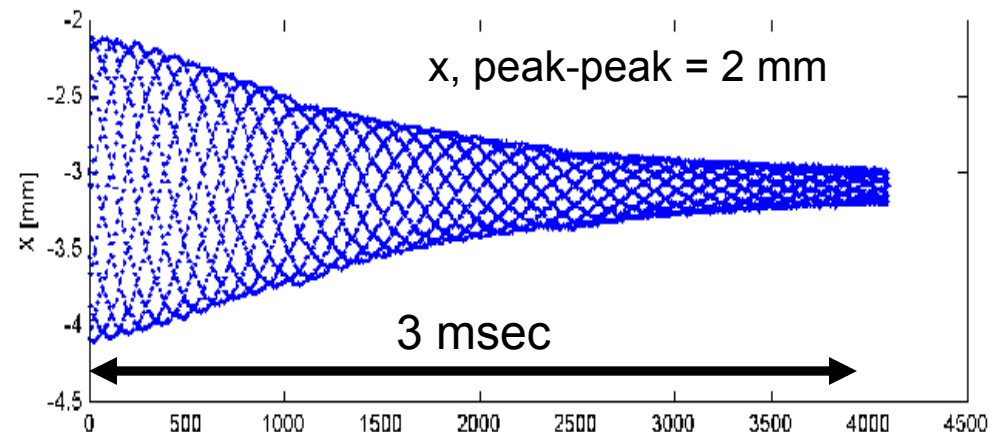
- Vertical transient from septum magnet leakage field corrected:

1.1 mm pk-pk

CORB9V + 2 skew quads

=

~20 μm pk-pk
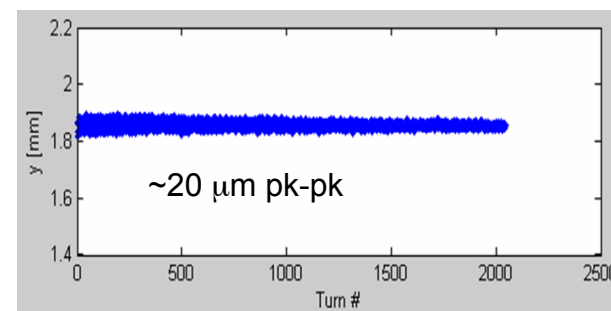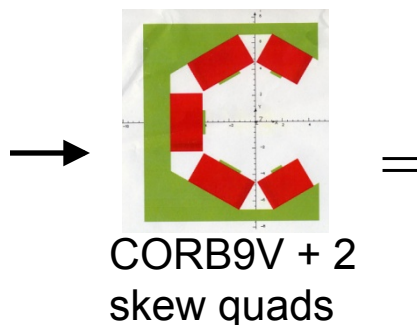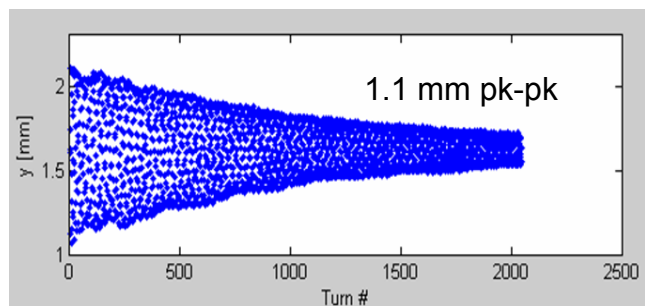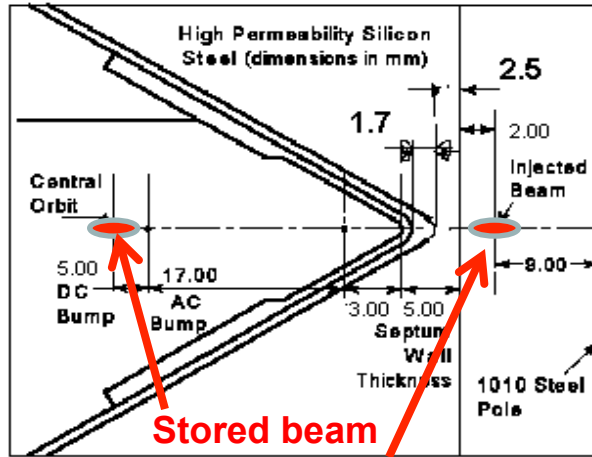
- Horizontal transient from injection kicker bump through sextupoles reduced by adjusting middle kicker pulse width:

one turn
780 nsec

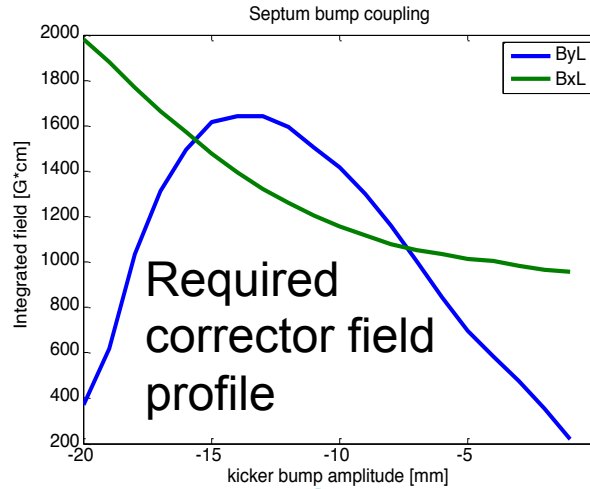SPEAR bunch pattern

SPEAR 3 Kicker Waveforms (superposed)

kicker waveforms superposed

K1 pulse width setpt = 730 ns
K2 pulse width setpt = 730 ns
K3 pulse width setpt = 725 ns

— K1 — K2 — K3

Identical pulses
K2 narrowed
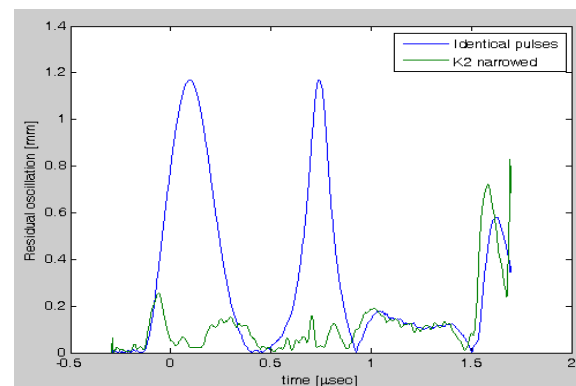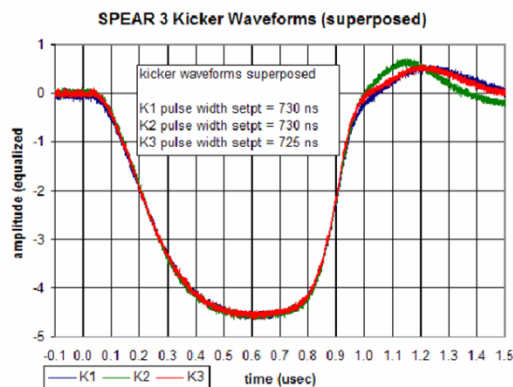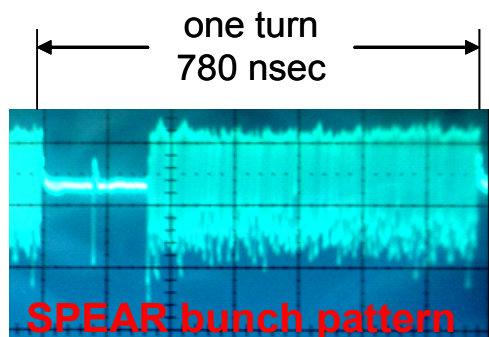
Stored beam kick vs. bump amplitude

Septum x-section

High Permeability Silicon Steel (dimensions in mm)

2.5

1.7

2.00

Injected Beam

Central Orbit

5.00 DC Bump

17.00 AC Bump

3.00 5.00

Septum Wall Thickness

8.00

1010 Steel Pole

Stored beam
Injected beam

Septum bump coupling

Required corrector field profile

5-pole magnet, cancels septum leakage fields

Measurements

BPM oscillation amplitude [mm]

kicker bump amplitude

+

orbit shift from septum

Top-Off Transient   Beam-based Diagnostics, USPAS, June 25-29, 2012, J. Safranek
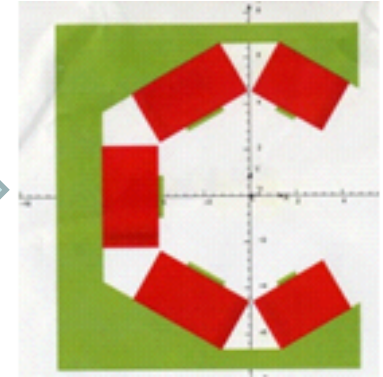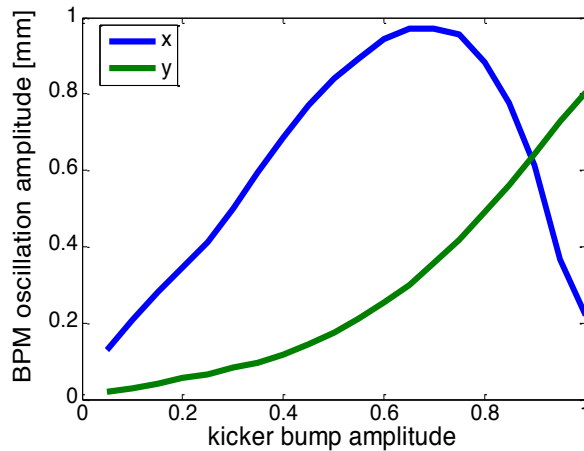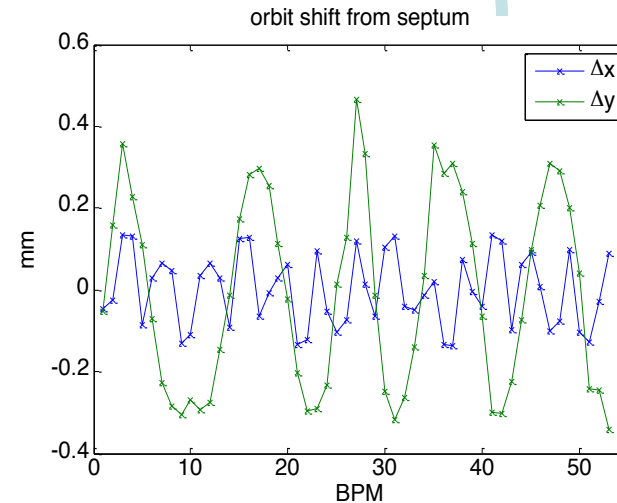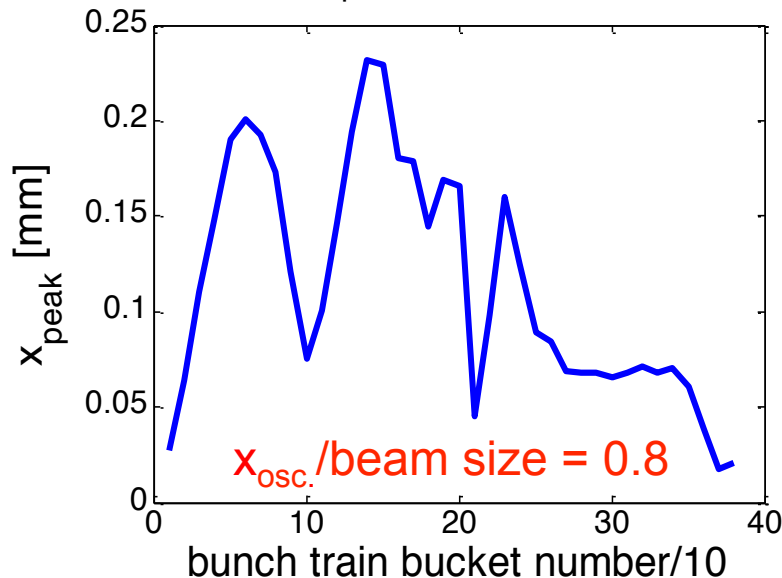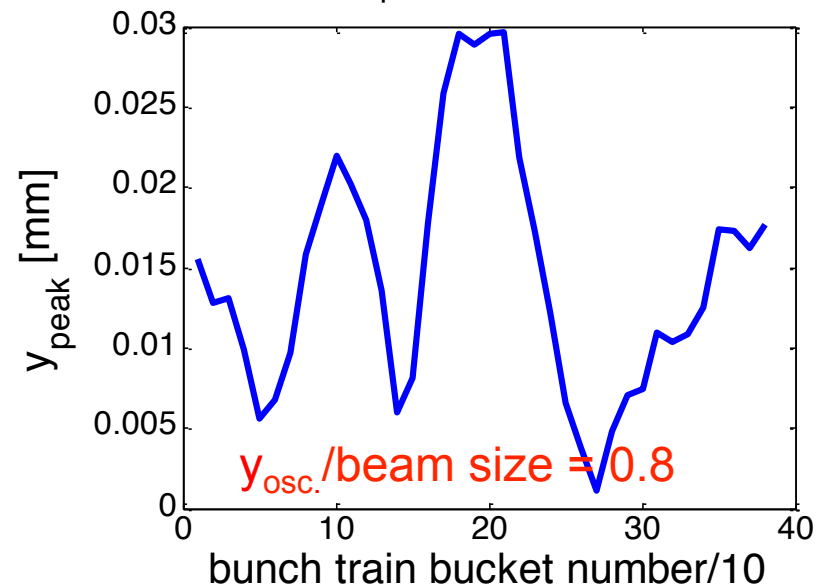
Beam-based injection bump matching

• Measure horizontal and vertical oscillations of stored beam as a function of bunch number kicked.

• Vary 2 kicker strengths, kicker timing, and kicker pulse widths to minimize x.

• Vary 2 skew quadrupoles plus septum 5-pole corrector to minimize y.

$\langle x_{peak} \rangle$ = 114 um

$\langle y_{peak} \rangle$ = 14 um

$x_{osc.}$/beam size = 0.8

$y_{osc.}$/beam size = 0.8

SPEAR injection kickers, first kicks

- Initial pulses narrower
- Increases stored beam kick
- Improvements under way

SPEAR injection kicker K3