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Dispersion control experiment

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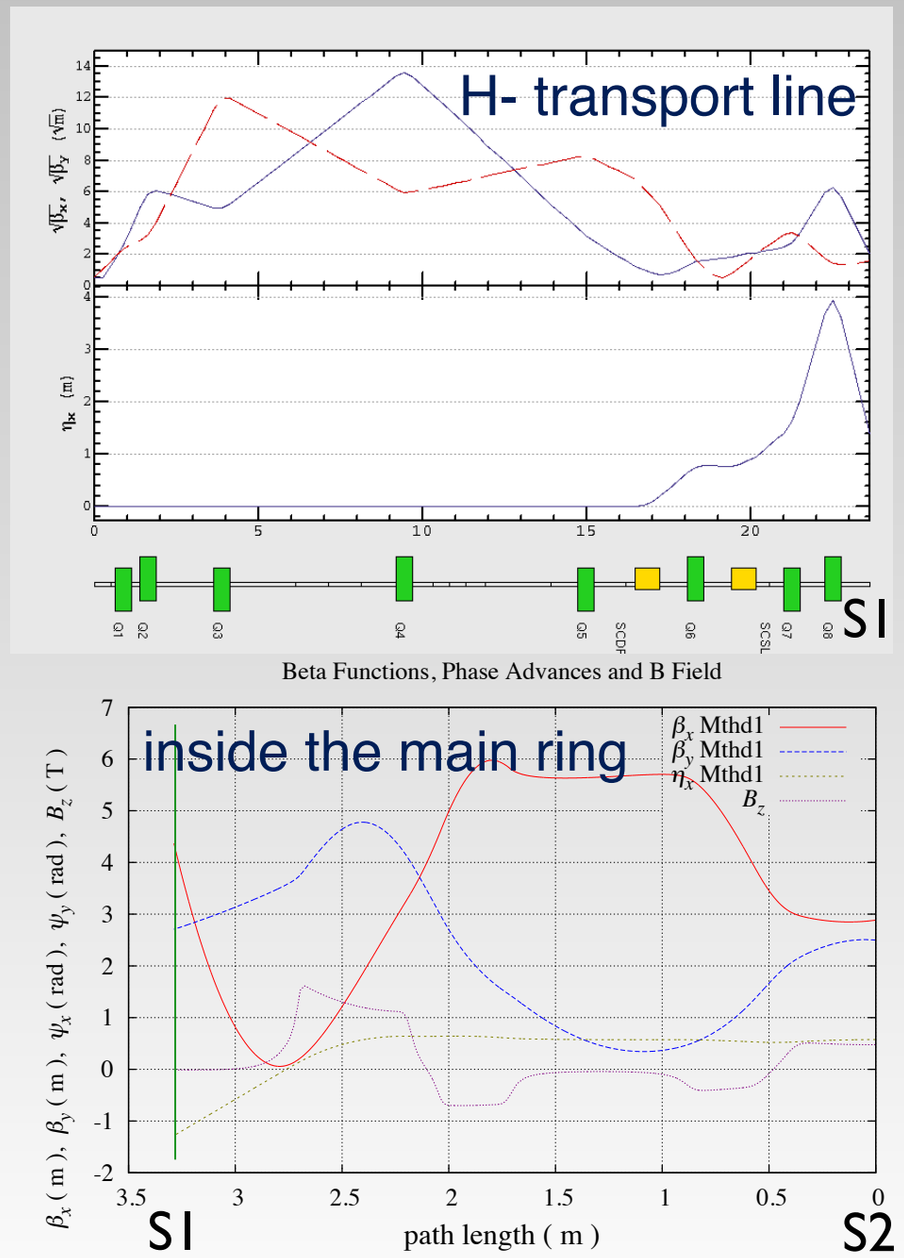
26/6/14

Desired values for 'matched' beam



Y. Ishi & M. Tahar independently simulated the transfer matrix from matching point to the foil

$\xi(S1)_{BT} = (1.28, -2.44)^{(1)}$

$\xi(S1)_{RING} = U1\xi(S1)_{BT}$
$= (-1.28, 2.44)$

$U_2\xi(S1)_{RING} = (-1.28, -2.44)$

$M_{BWD}^{-1}(S1|S2)$ (-1.28, -2.44)
=(0.57, -0.003)

$\xi(S2)_{RING} = (0.57, 0.003)$

(1) slightly changed from values used in SAD file

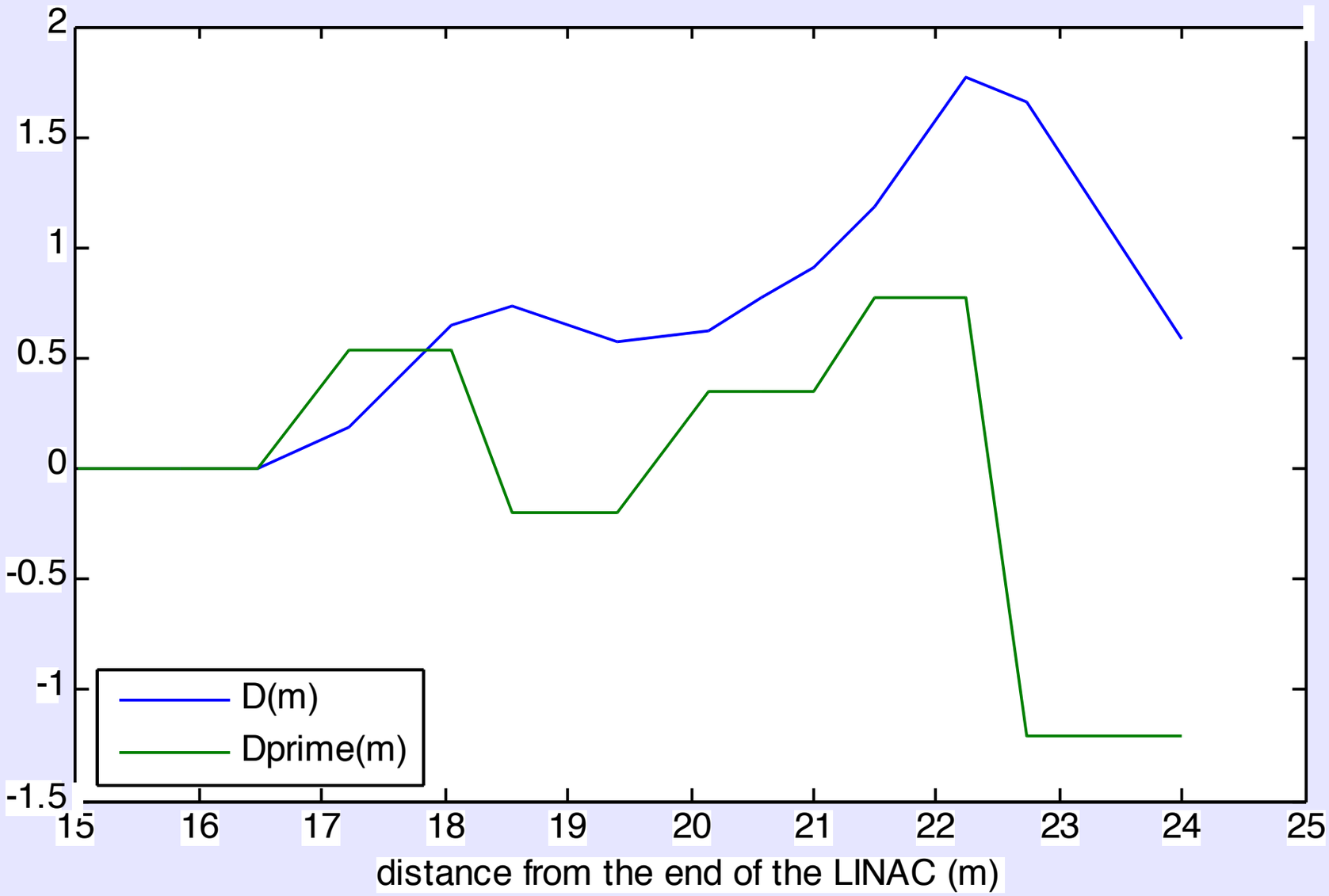
For current (& 26-28/3/14) experimental setup:

Final values D=0,5819
D'=-1,207

Parameters

Q1	=(L =.5	K1 = -1.9220779221)
Q2	=(L =.5	K1 = 1.012987013)
Q3	=(L =.5	K1 = -0.3554837407)
Q4	=(L =.5	K1 = 0.1474449606)
Q5	=(L =.5	K1 = -0.1979398101)
Q6	=(L =.5	K1 = 1.0139365785)
Q7	=(L =.5	K1 = -0.4160775601)
Q8	=(L =.5	K1 = 1.1028075136)

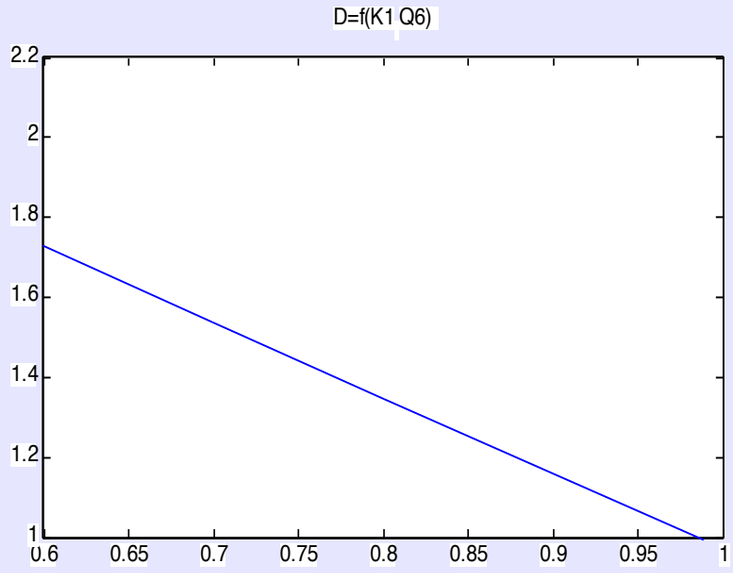
;

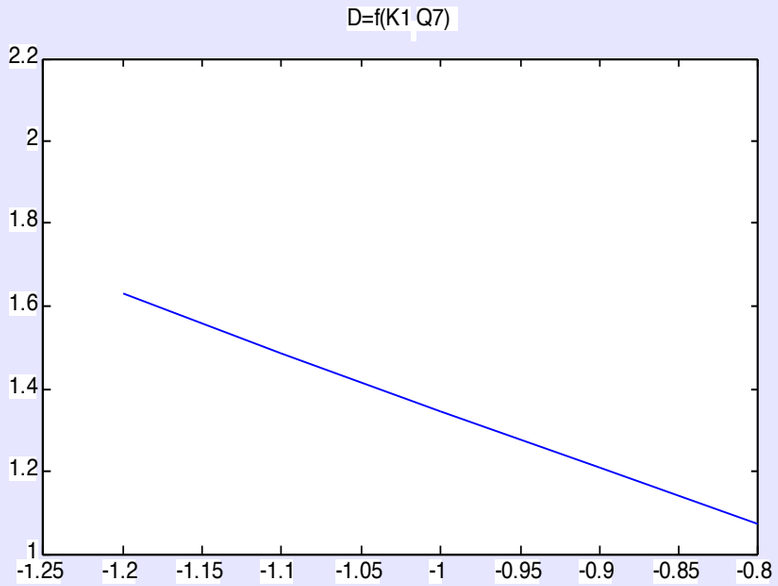


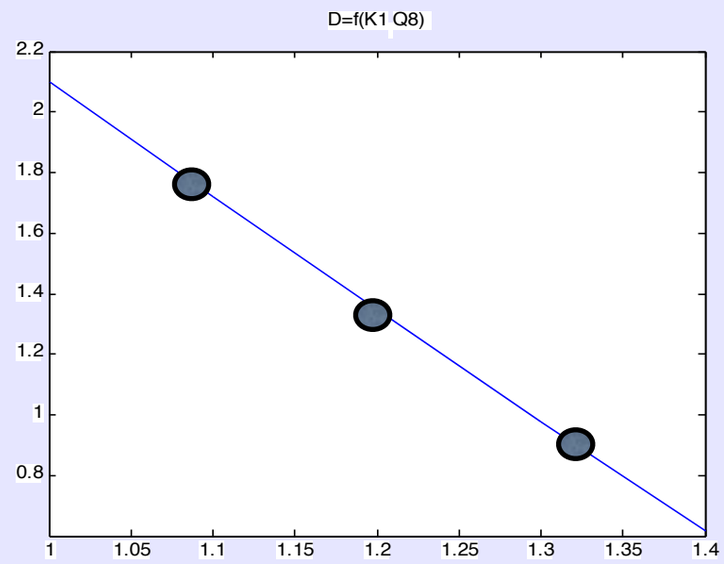
Slide from L. Volat

Slide from L.Volat

Influence of Q6,Q7,Q8 on the dispersion







Simulation of how the values of the normalised field K of Q6,Q7,Q8 affect the dispersion at the matching point

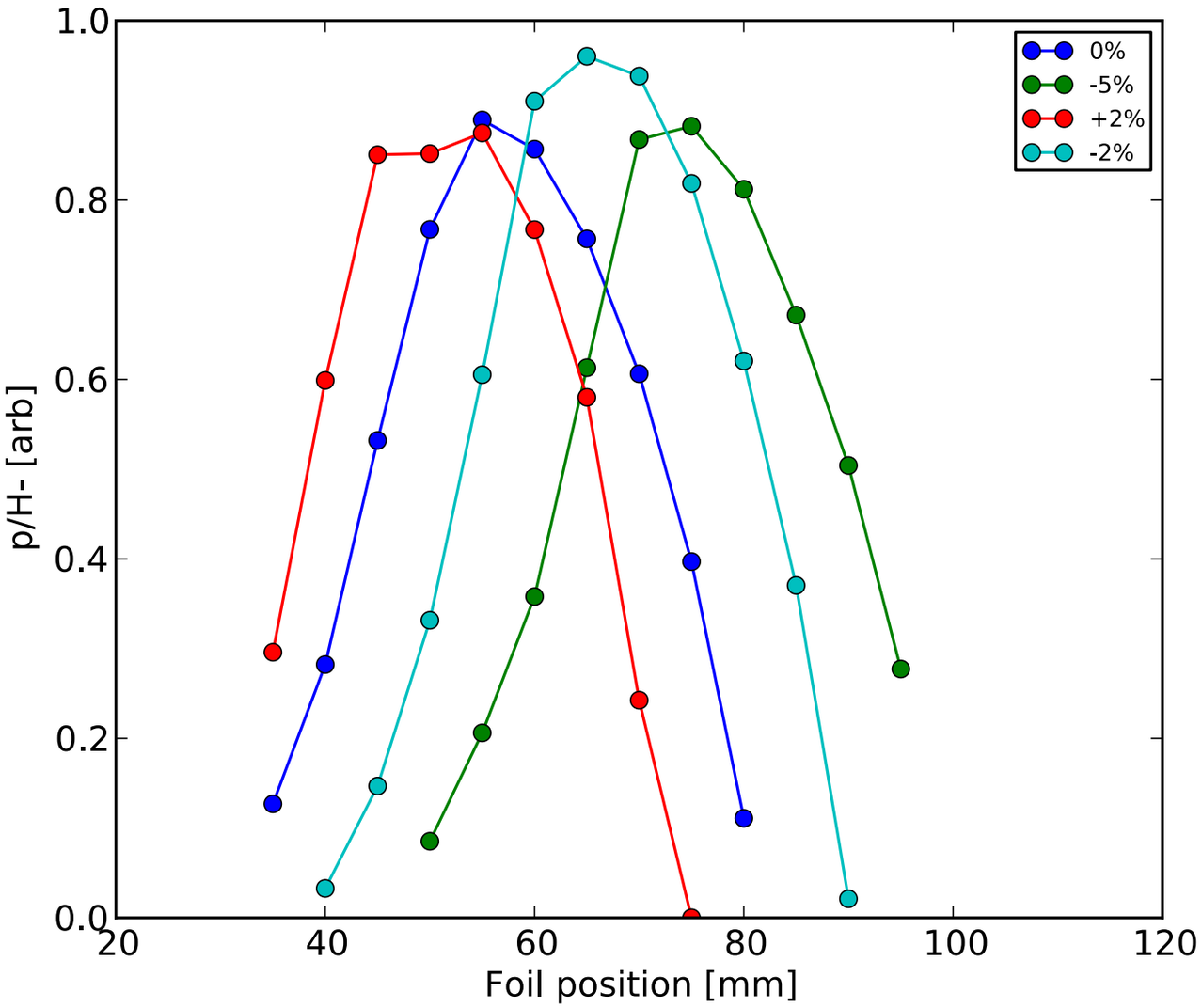
→ Dispersion is more sensitive to Q8

Dispersion control experiment

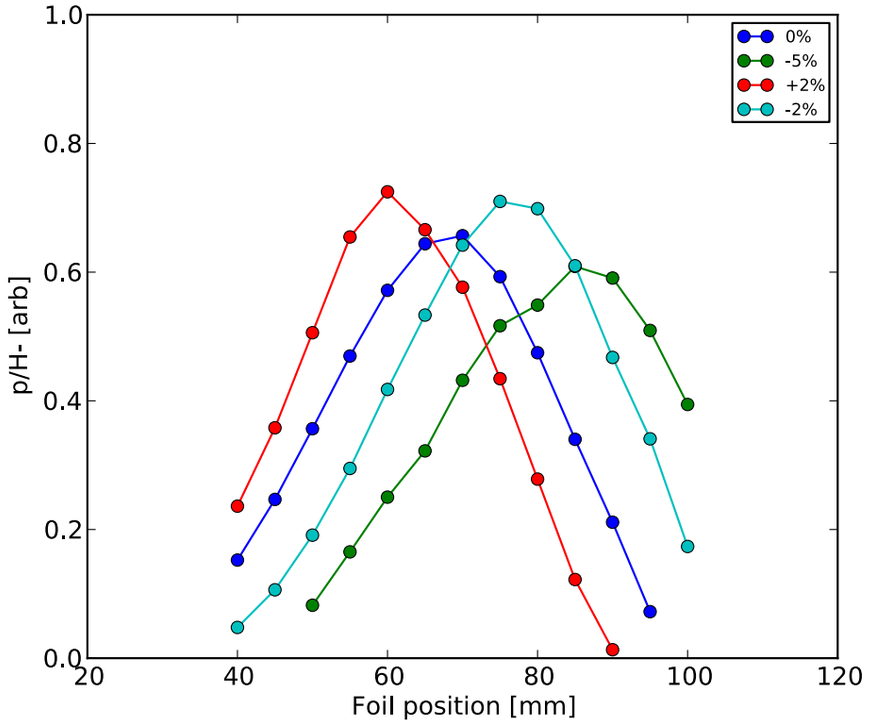
- Adjust the injection line to change dispersion at the foil – using Q8 quad with +/-10% excitation
- Here we use the same set values for F/D based on Shinji's 26-28/4/14 tune measurements
  - (for -5%, -2%, 0%, +2% in F current)
- Injection line setup is the same "2014_03_26_151924"
- Compare first p peak to height of H- peak

Experimental data

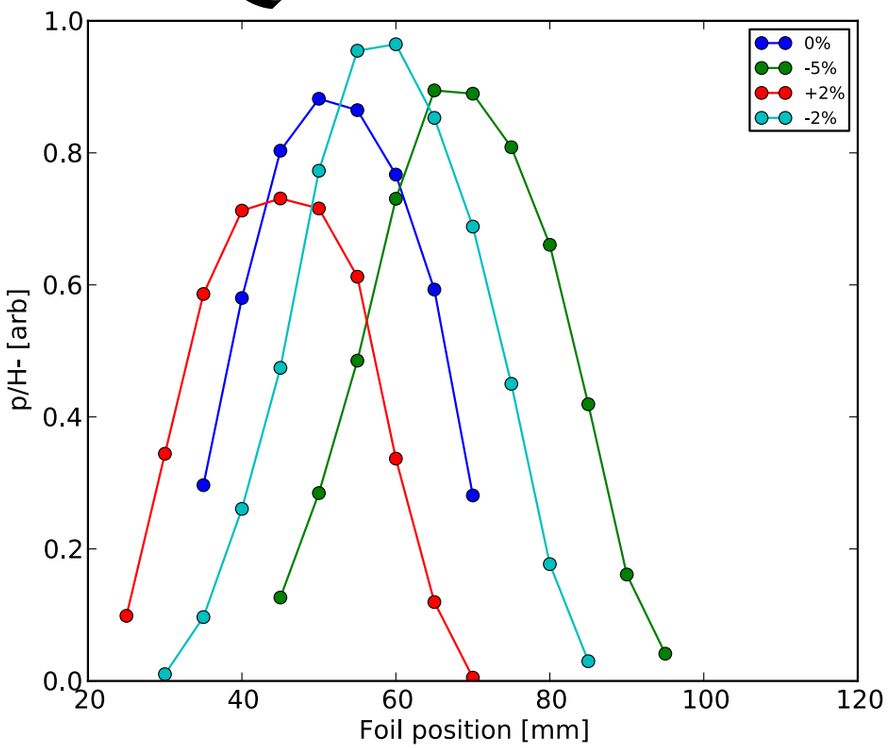
Q8=nominal



Q8=+10%



Q8=-10%



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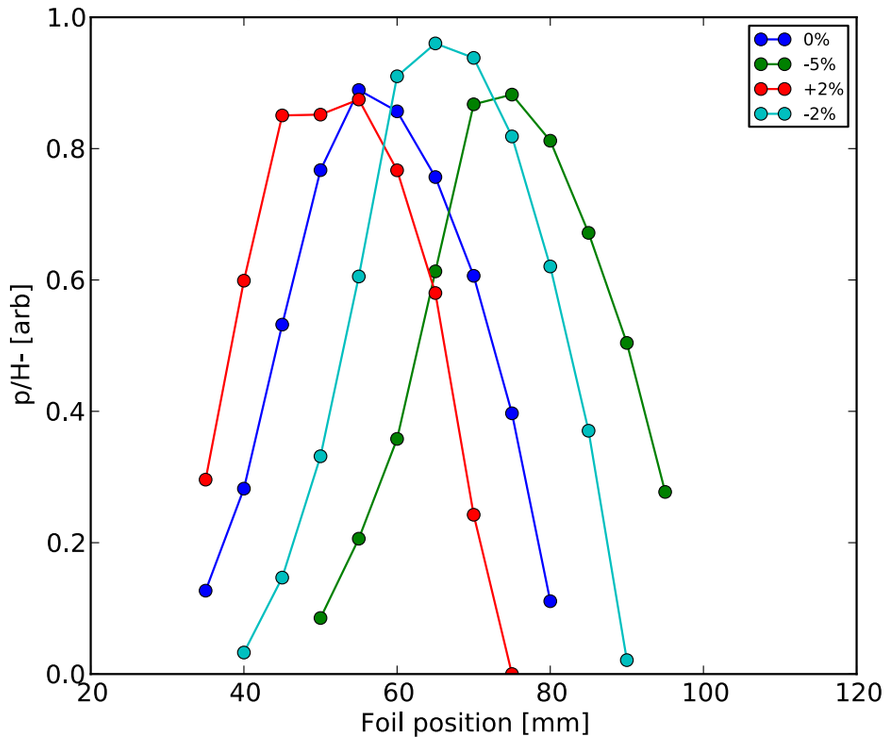
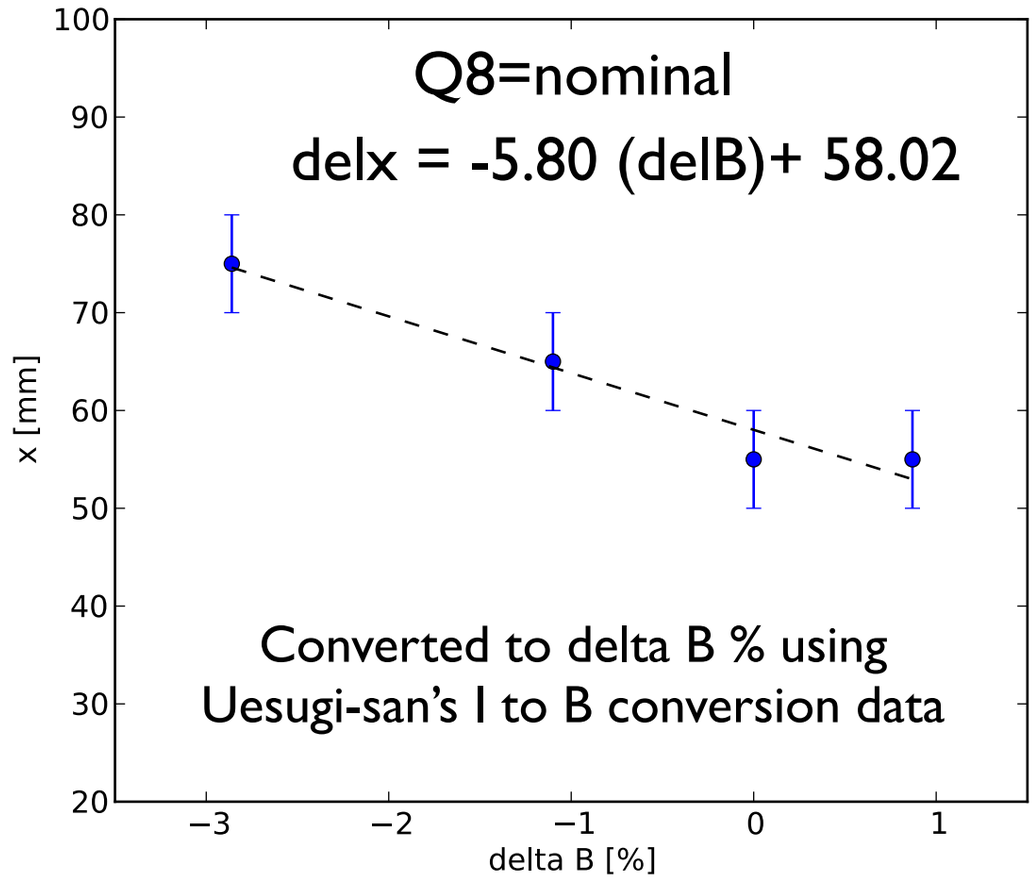
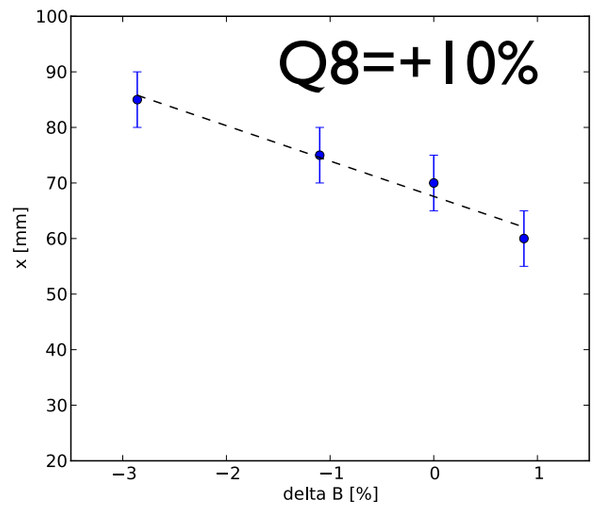
Dispersion vector @ foil results (ROUGH)

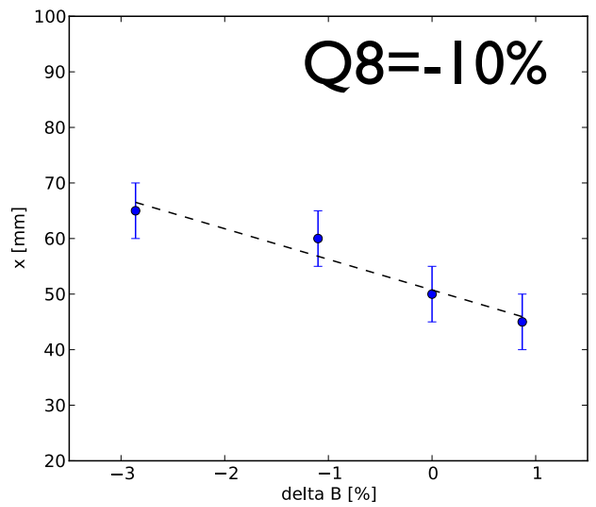
Q8=nominal





THIS USES Method 1: Find max point of data (rough!!)





ROUGH RESULTS:
D[Q8(norm)] = 0.58
D[Q8(+10%)] = 0.55
D[Q8(-10%)] = 0.64

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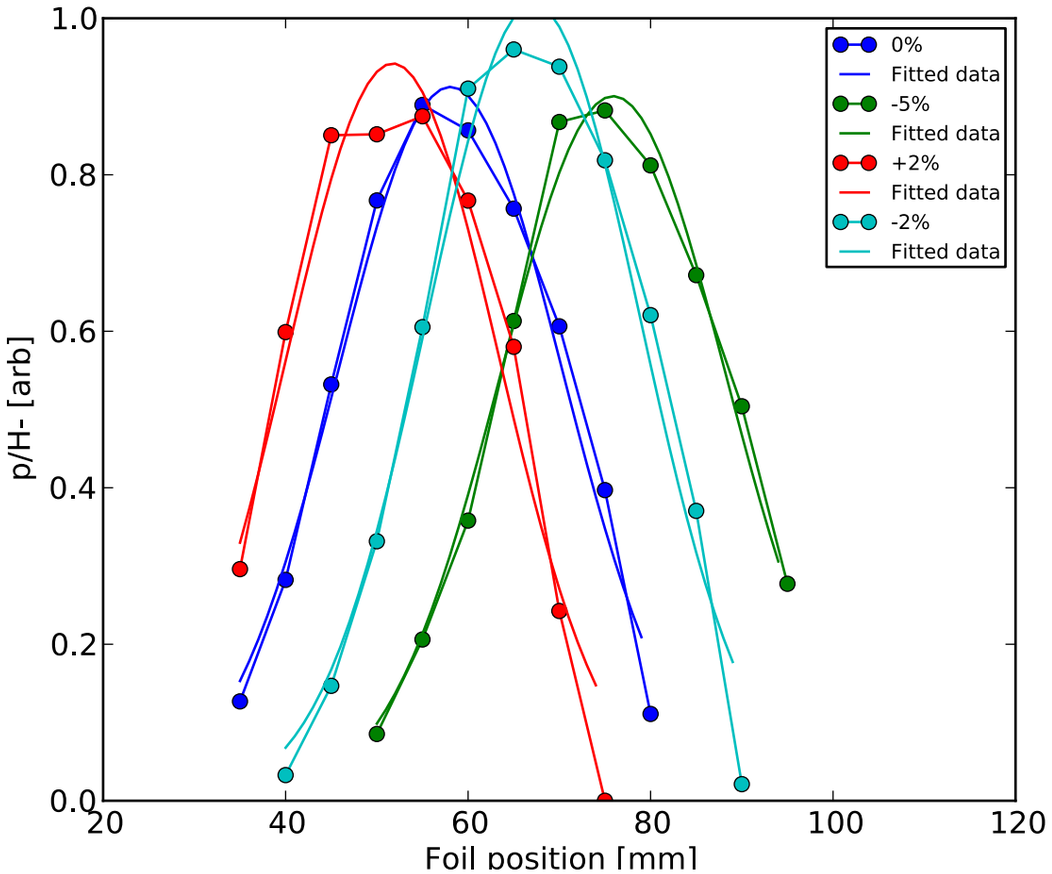
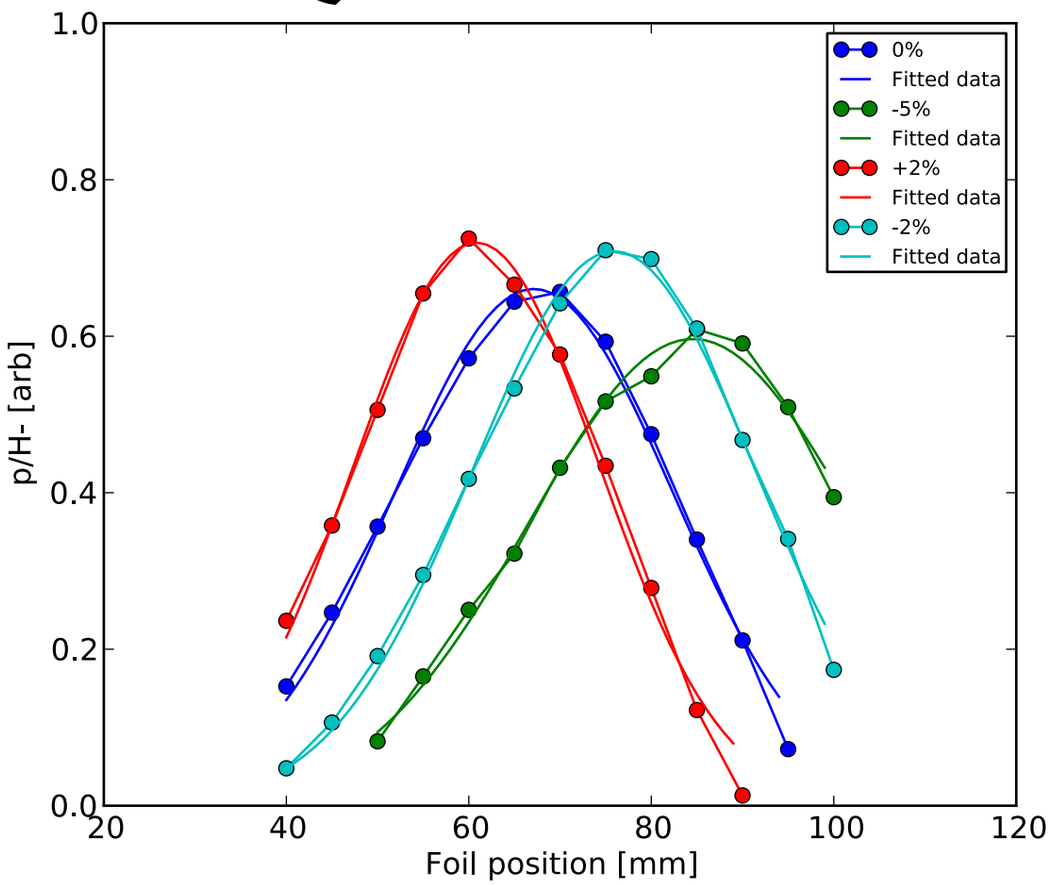
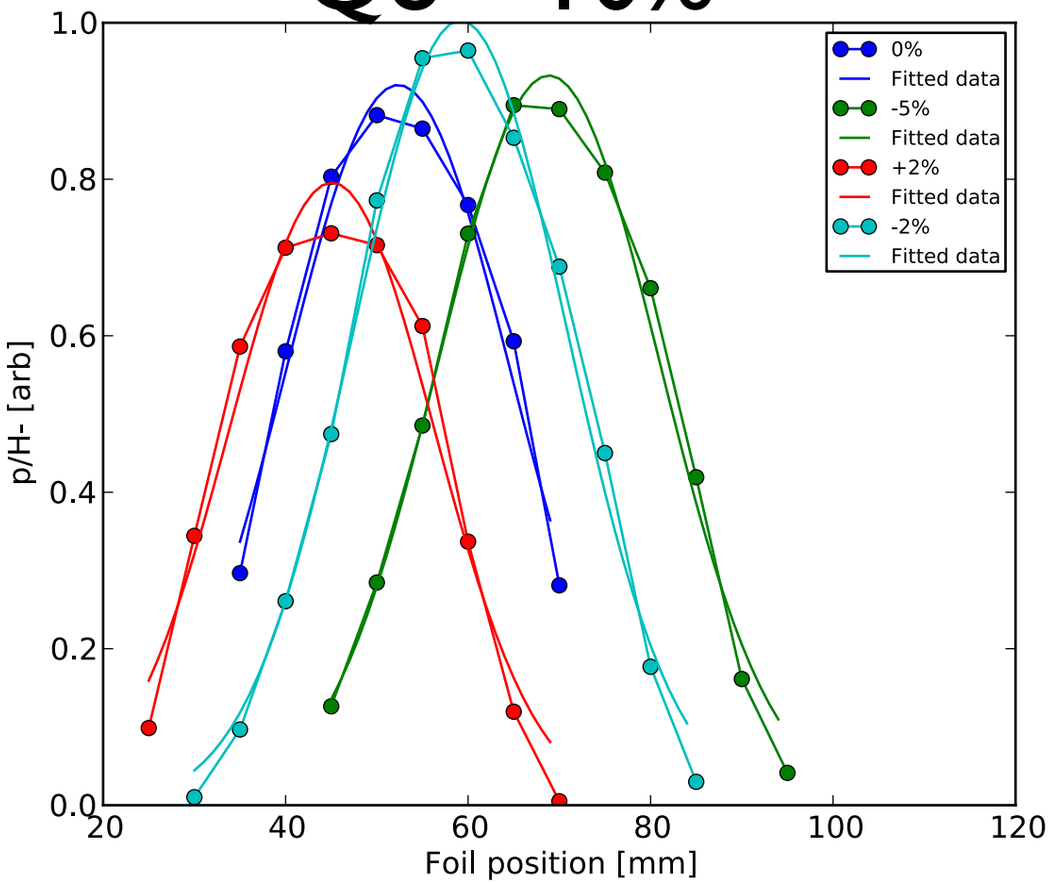
Q8=nominal



Q8=+10%



Q8=-10%



Fitted gaussians to find mean…

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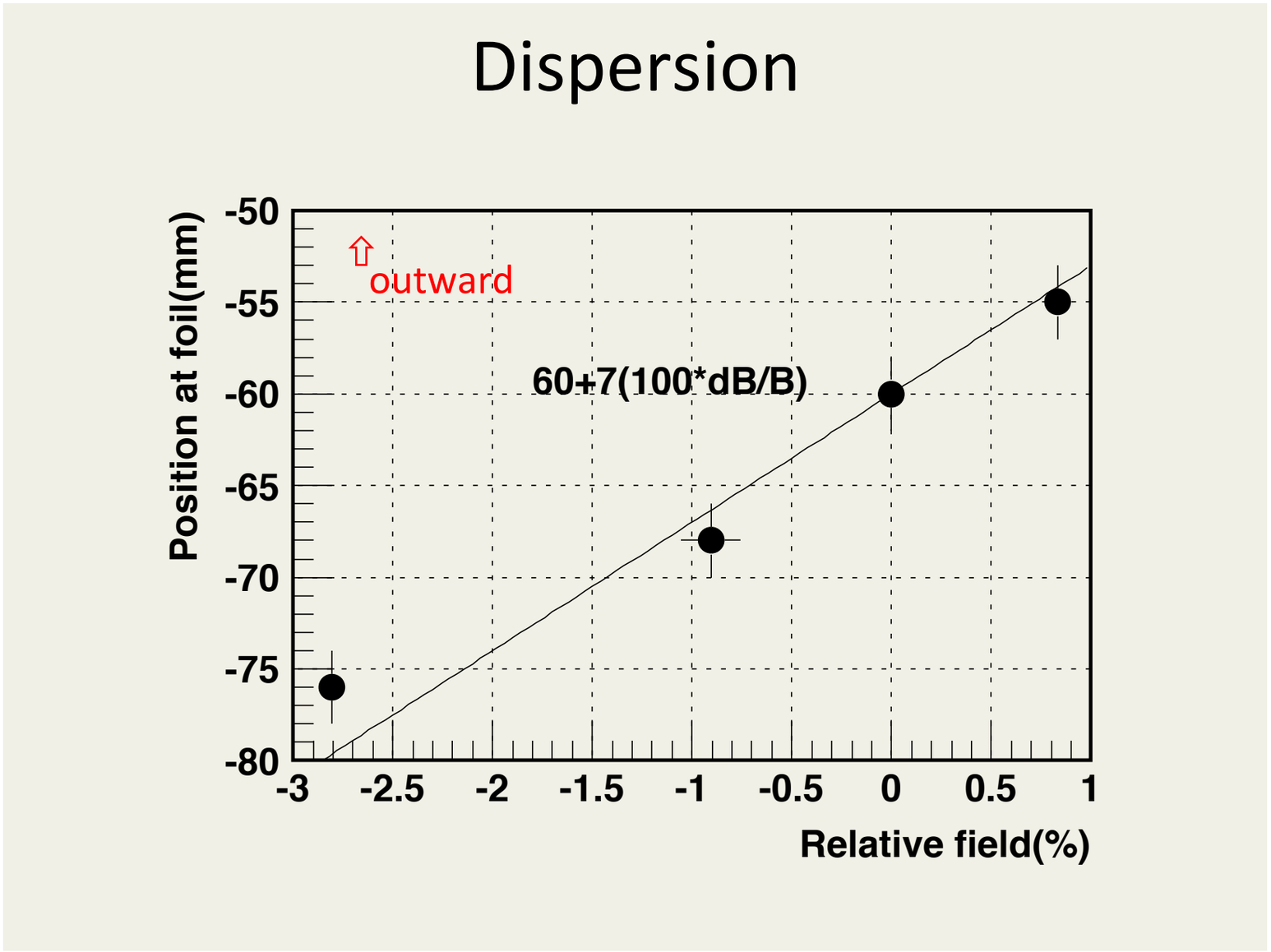
Uesugi-san's result from March '14 data using TOSCA field calculation

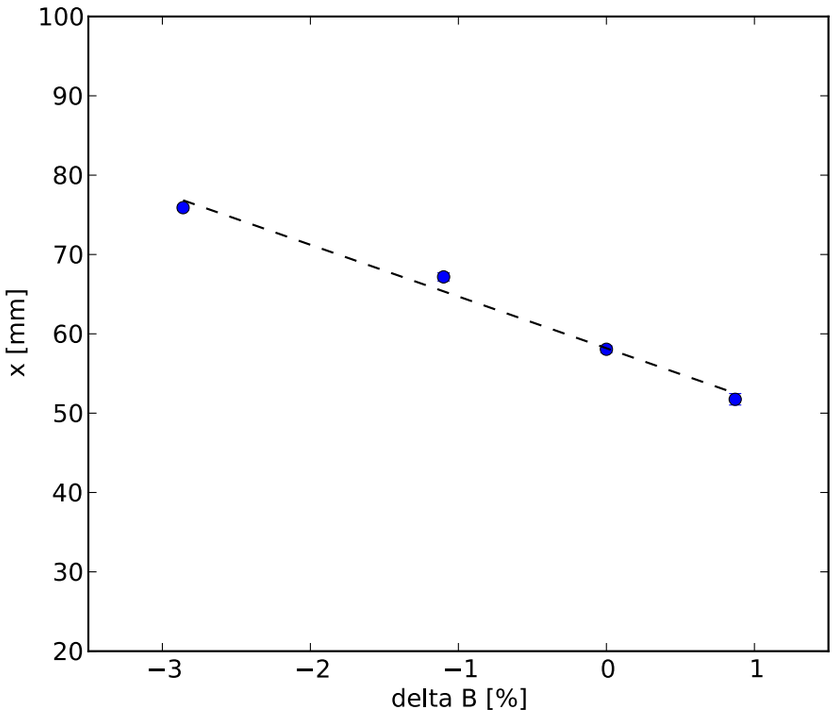


d=0.7m at foil

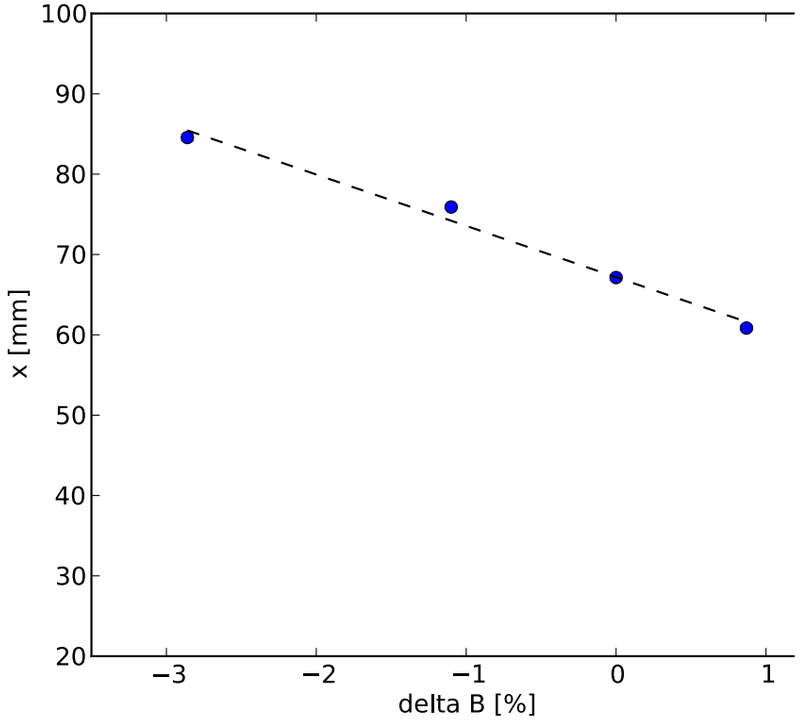
Results d@foil (gauss fit)

Plots show mean from fitted gaussian

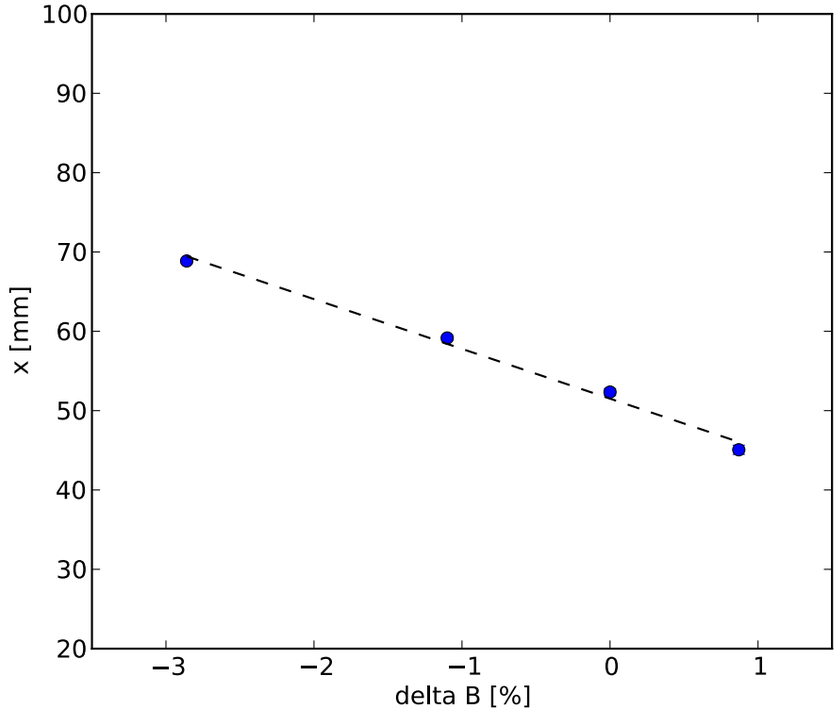
(error bars are sqrt of diagonalised covariance matrix from least squares fitting)



Q8=nominal



Q8=+10%



Q8=-10%

RESULTS:

D[Q8(norm)] = 0.652

D[Q8(+10%)] = 0.627

D[Q8(-10%)] = 0.639

Discussion

Want this to match ring dispersion

From tracking

$M_{11} = -3.358$

$M_{12} = 1.305$

From inj. line model
D(s1)=0.5819, D'(s1)=-1.207

$$\begin{bmatrix} D(s_2) \\ D'(s_2) \\ 1 \end{bmatrix} = \begin{bmatrix} M_{11} & M_{12} & d \\ M_{21} & M_{22} & d' \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} D(s_1) \\ D'(s_1) \\ 1 \end{bmatrix}$$

S.Y. Lee 'Accelerator Physics' pp.116
'Dispersion vector'

$$\begin{bmatrix} \eta(s_2) \\ \eta'(s_2) \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{bmatrix} \begin{bmatrix} \eta(s_1) \\ \eta'(s_1) \end{bmatrix} + \beta_0 \begin{bmatrix} R_{16} \\ R_{26} \end{bmatrix}$$

A. Wolski 'Beam Dynamics' pp. 162
For a beamline

$$D(s_2) = M_{11}D(s_1) + M_{12}D'(s_1) + d$$

So our result means D at the foil:

$$D(s_2) = 1.954 - 1.575 + d_{meas.}$$
$$\approx 1.01$$

We need to change D & D' at matching point to match into the ring

If matched to the ring the measured value should be…

$$\therefore d = 0.6 - 1.954 + 1.575$$
$$= 0.22$$

(Which it's not.)

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