Alps / MOPOS Status

Valid Delta values decision: Algorithm and implementation

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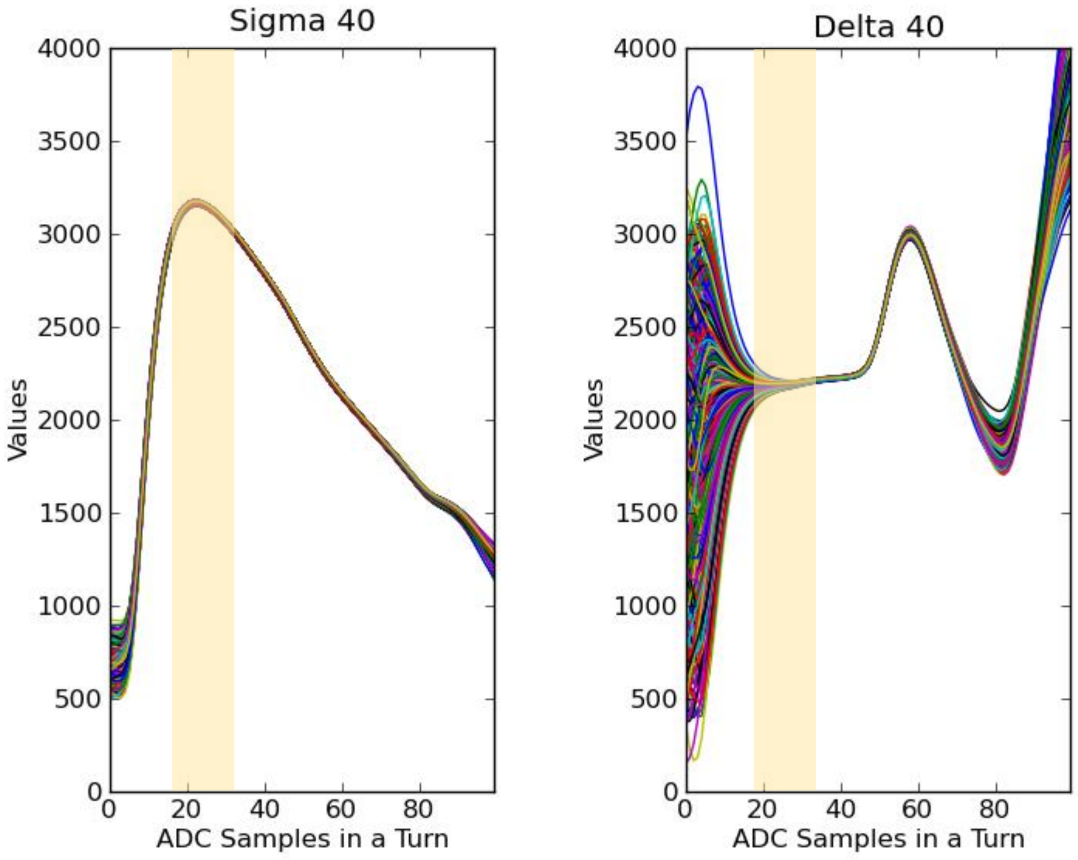
Outline

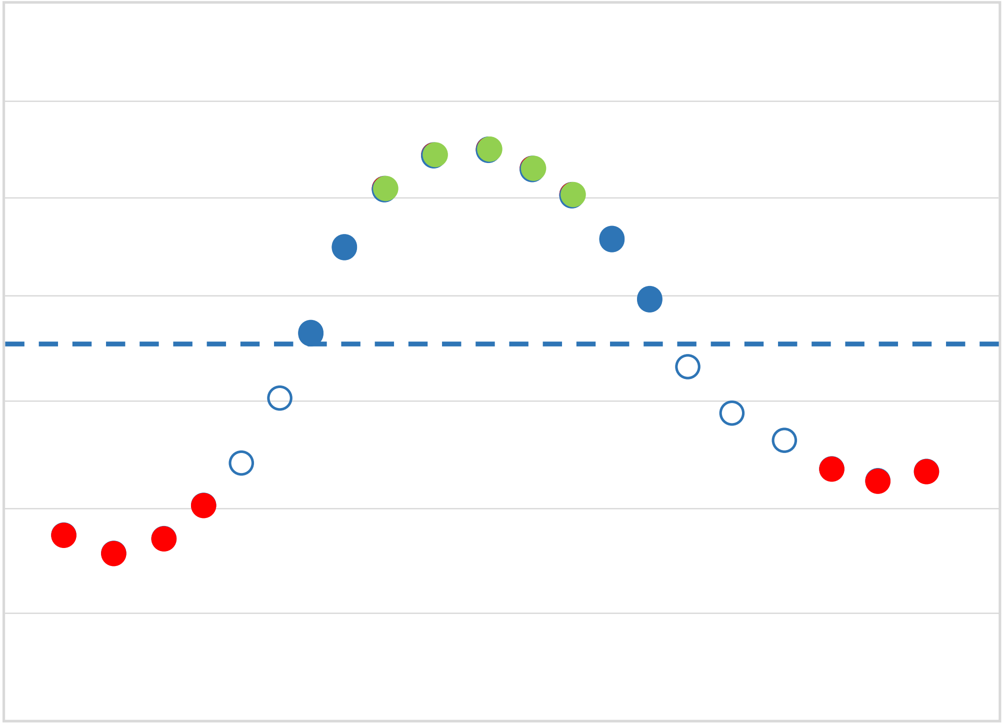
1. Valid Delta Values decision on runtime based on Sigma Values

2. Bandwidth limit: Decimation

3. Analog FE Data Analysis Comparison



Algorithm based on Sigma



Individuate maximum:

- Threshold

  Sigma[i] > SigmaTH

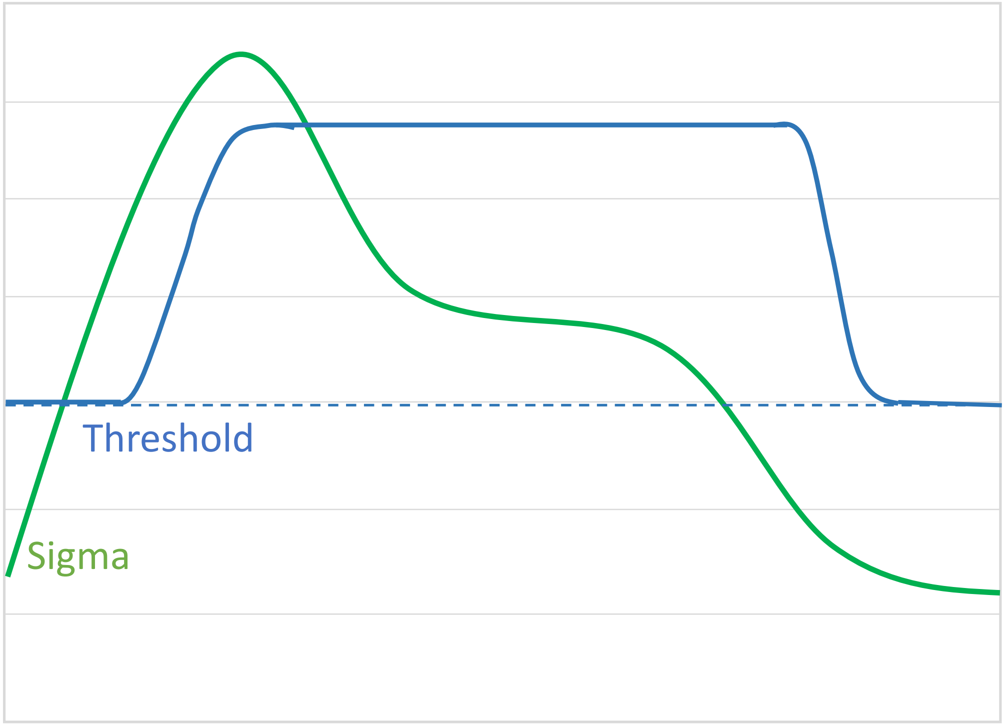
- Stability

  |ΔSigma[i]| < Tolerance

  |ΔSigma[i+1]| < Tolerance

Delta[i] valid

Dynamic Sigma Threshold

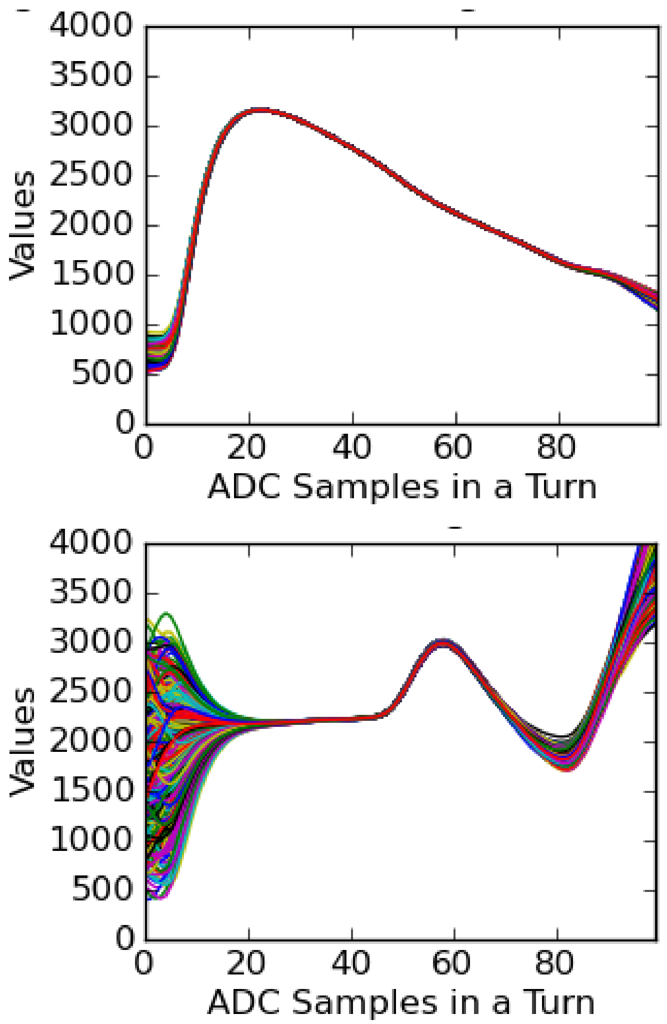


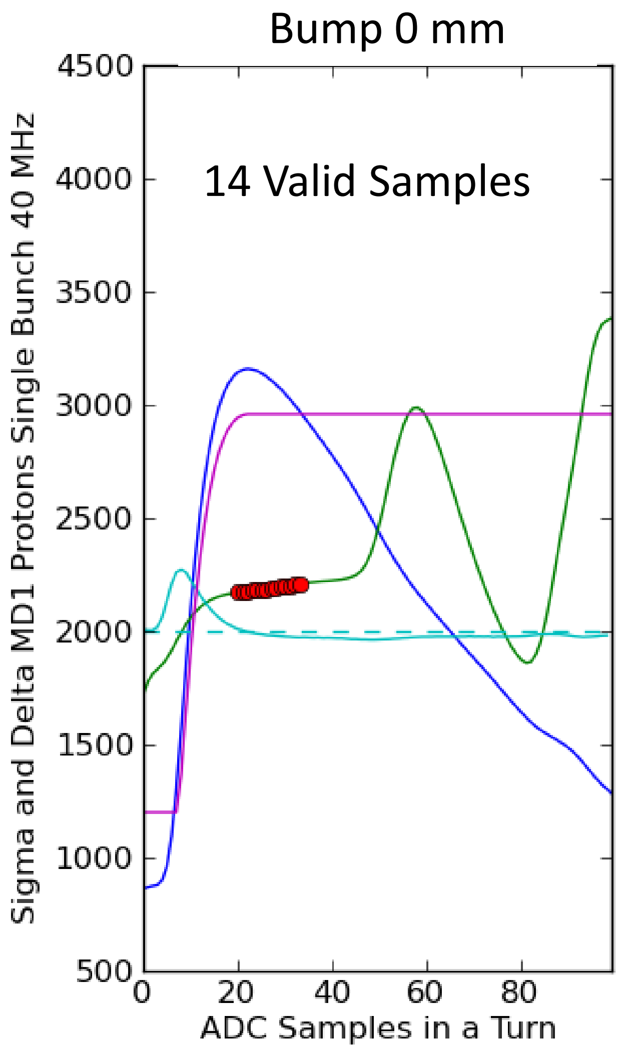
Dependence on Intensity, Filling pattern…

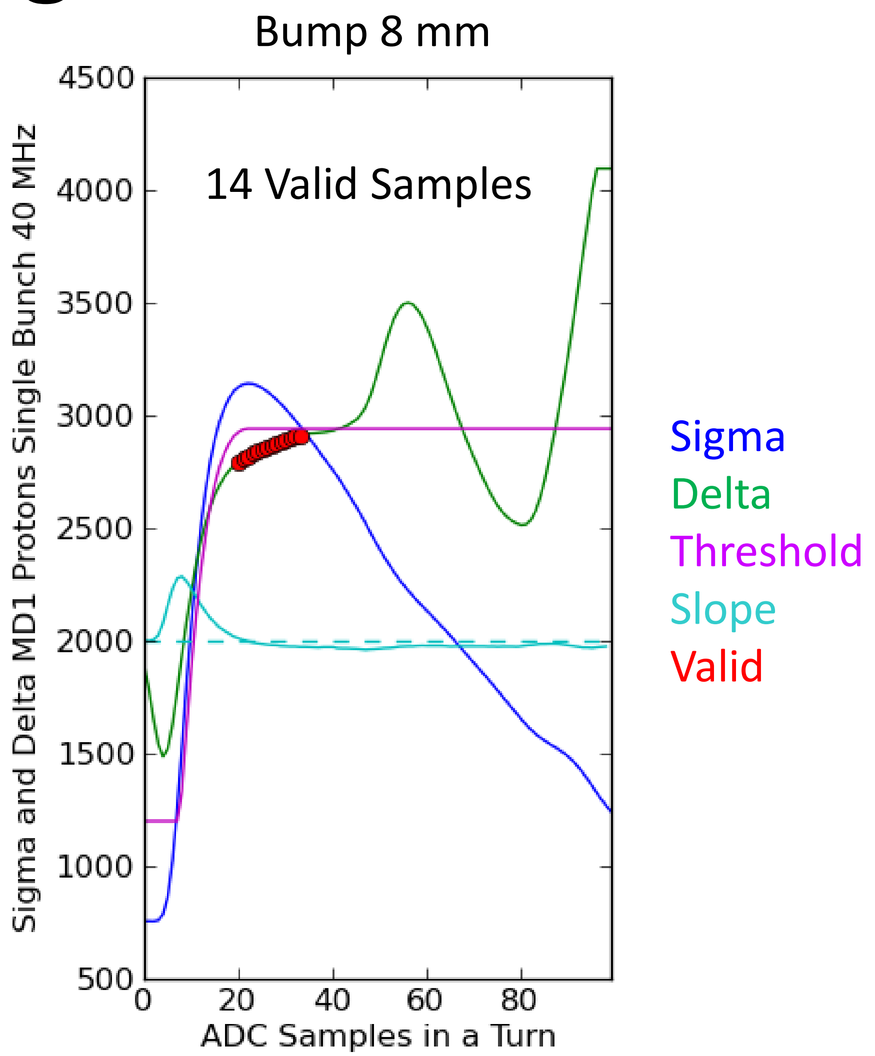
- Low -> Catch Low Intensity
- High -> Avoid flat areas

$$Threshold = \max(Sigma) - k = A\log(B\max(I)) - A\log(B\ \alpha) = A\log\left(B\frac{\max(I)}{B\alpha}\right)$$

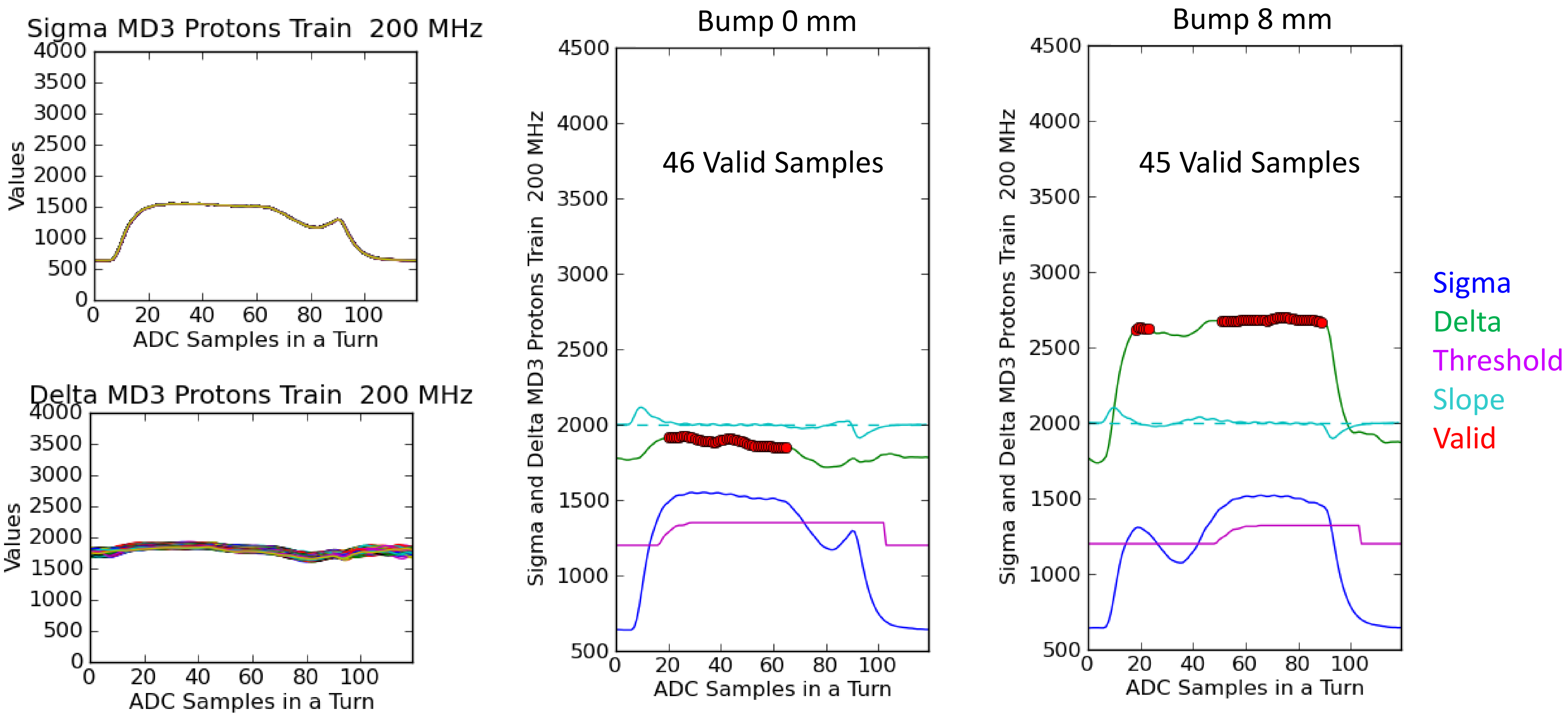
Simulation with Beam Data – Single Bunch 40MHz



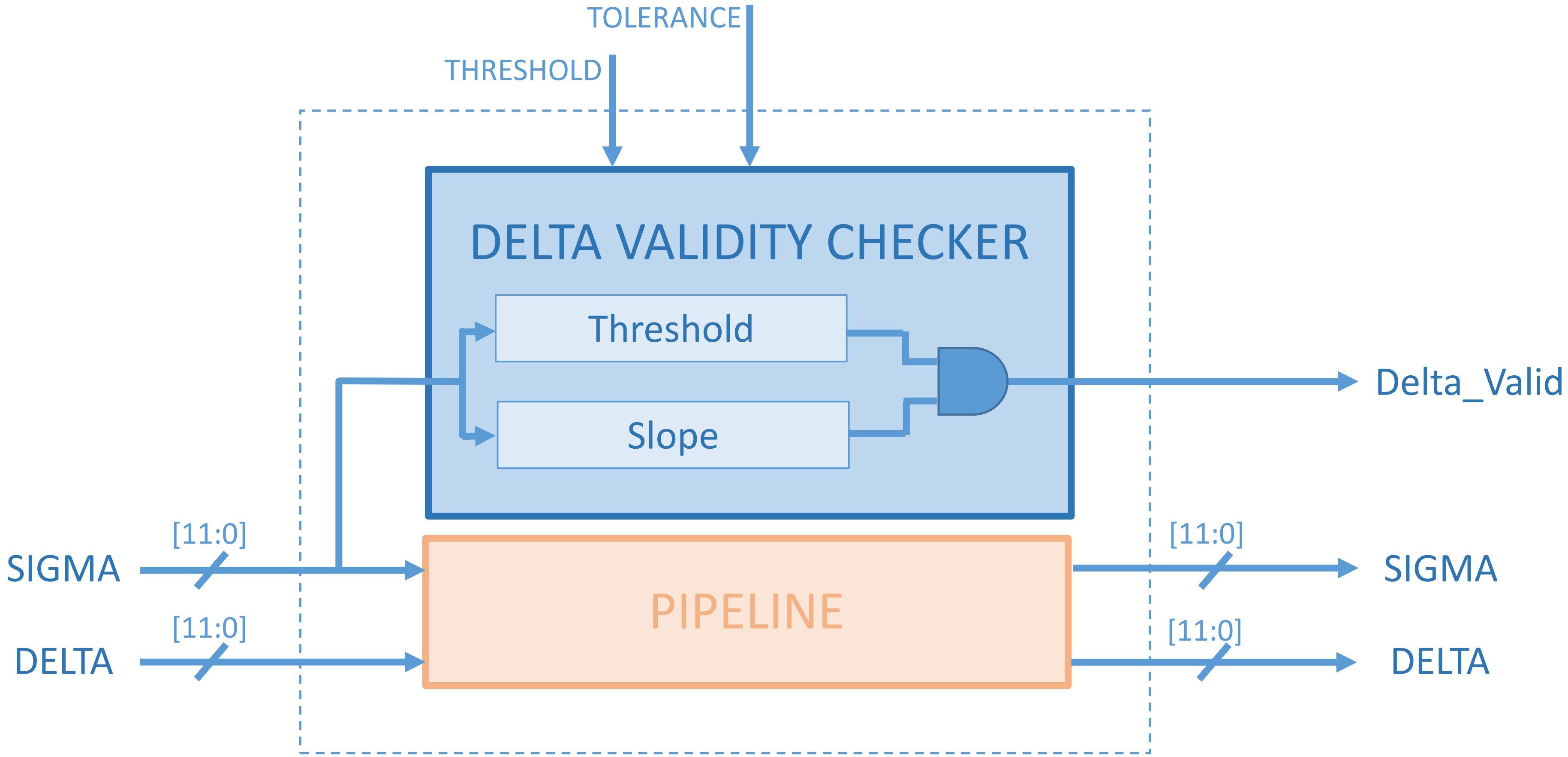




Simulation with Beam Data – Train 200MHz



Firmware Implementation



Bandwidth Limit

GBT: 80bit @40MHz

(12bit x 2) x 2 channels x 2 planes @40 MHz → 96bit @40 MHz

Solution: Decimation per 2 Sample_dec[2i] = Sample[i] + Sample[i-1]

(13bit x 2) x 2 channels x 2 planes @20 MHz → 52bit @40 MHz

- 16 lines for DOROS
- 12 lines available

Data Analysis Comparison

- Same Analysis
  - Position Linear Characteristic
  - Position Intensity dependence
  - Resolution Analysis (vs. Position – vs. Intensity)
- Decimated Input data selected with Delta Validity Algorithm

→ Generally same (or better) results

Single Bunch Exception

Example: Protons 200MHz – Intensity < 10^9

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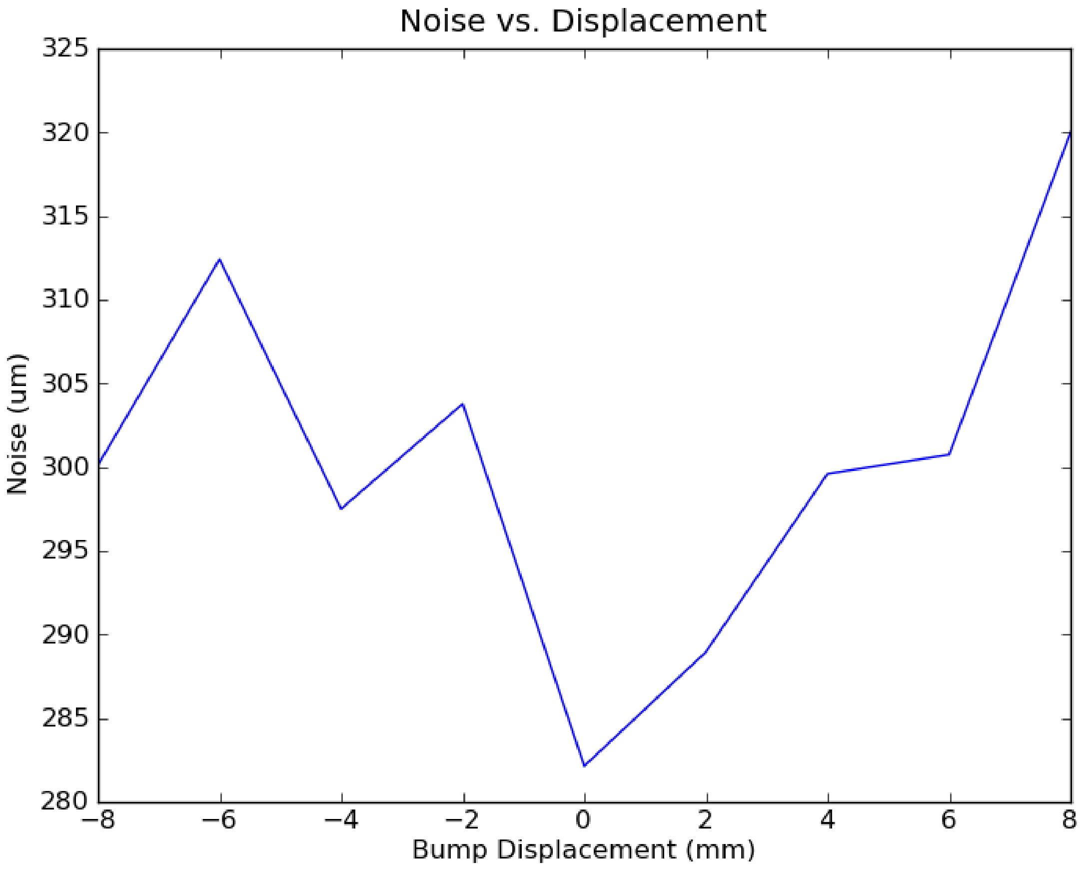
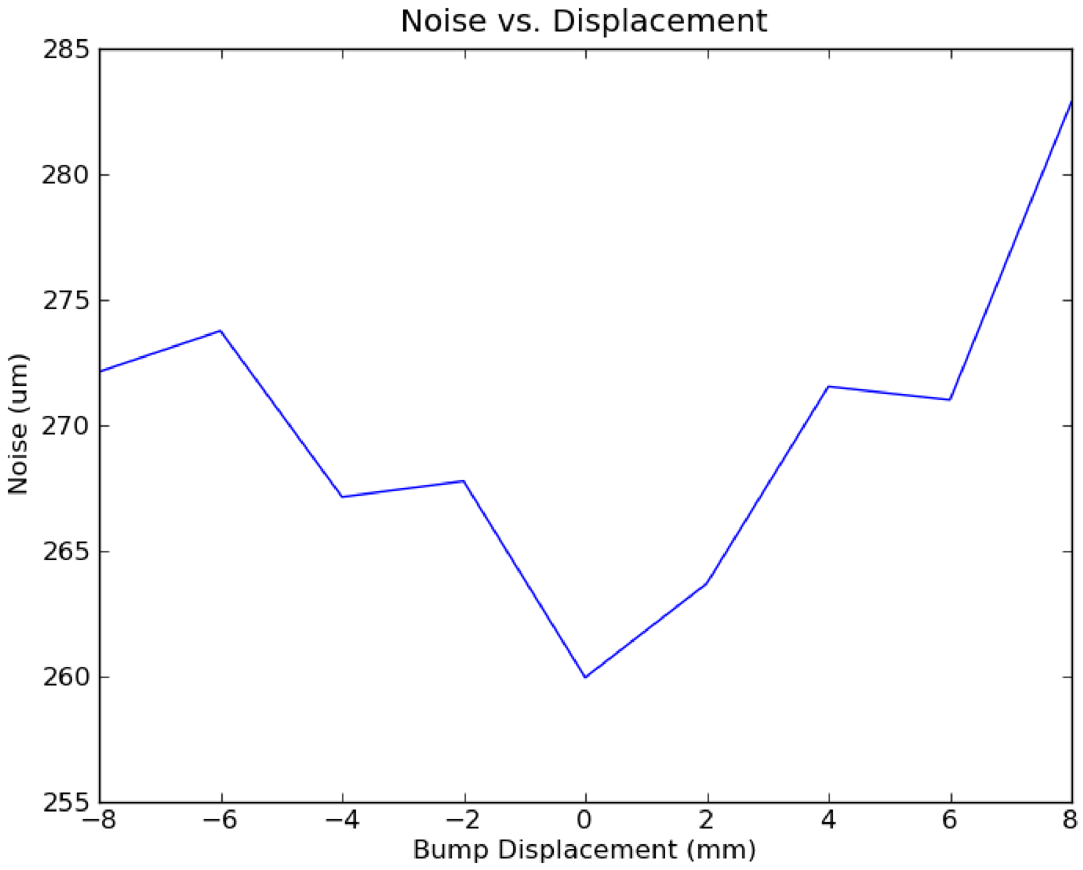
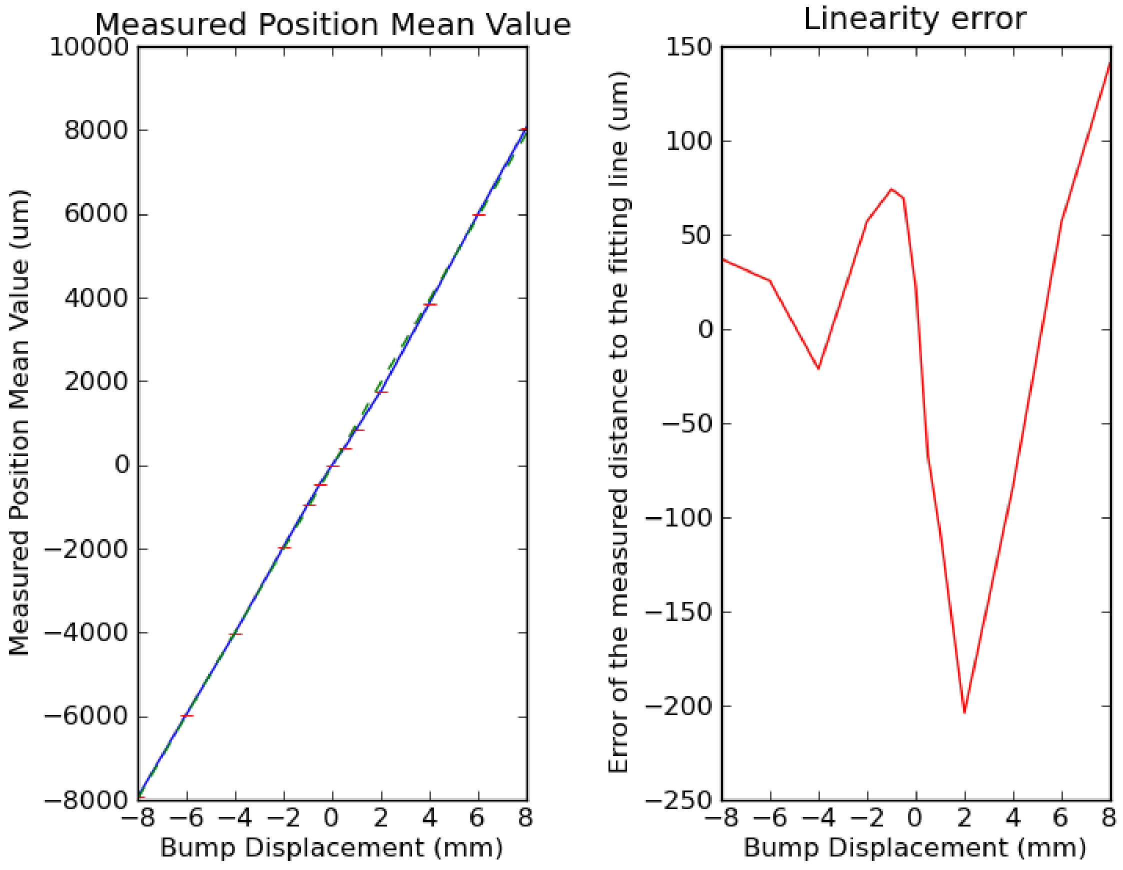
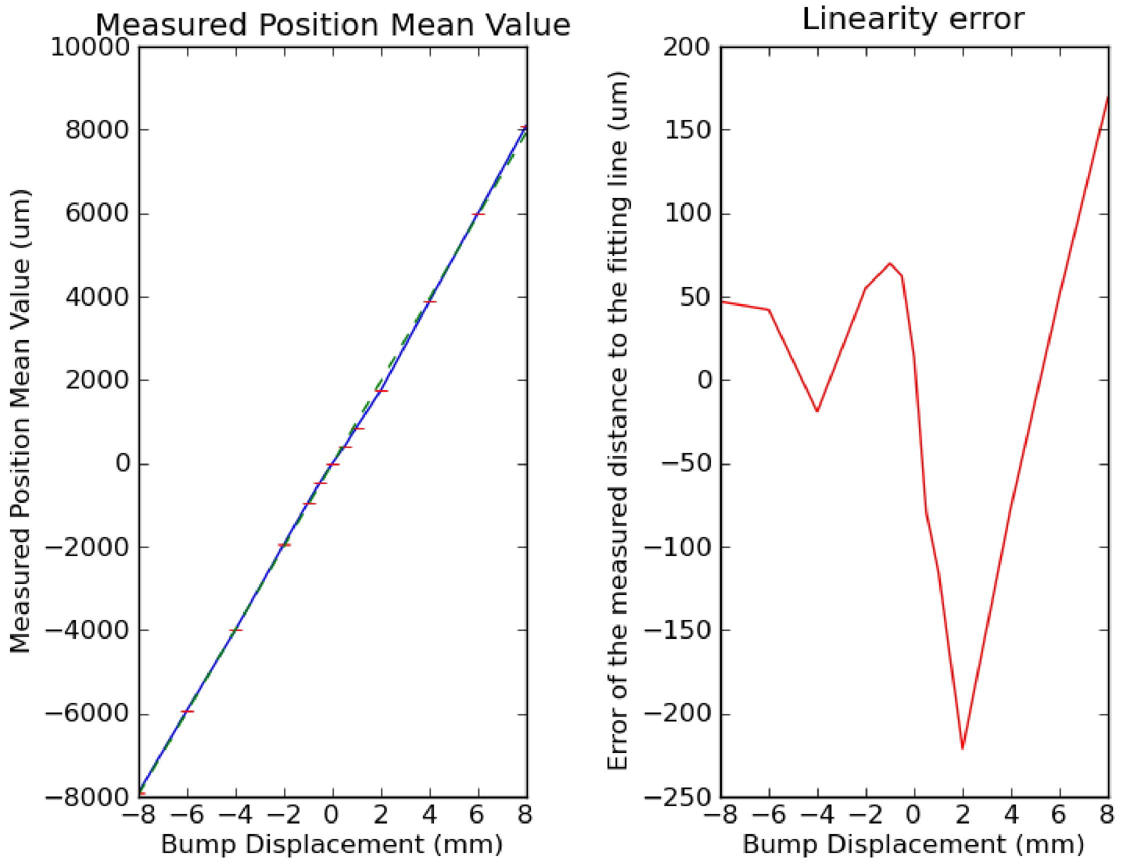




Example: Protons 40MHz – Intensity ~ 3·10^10





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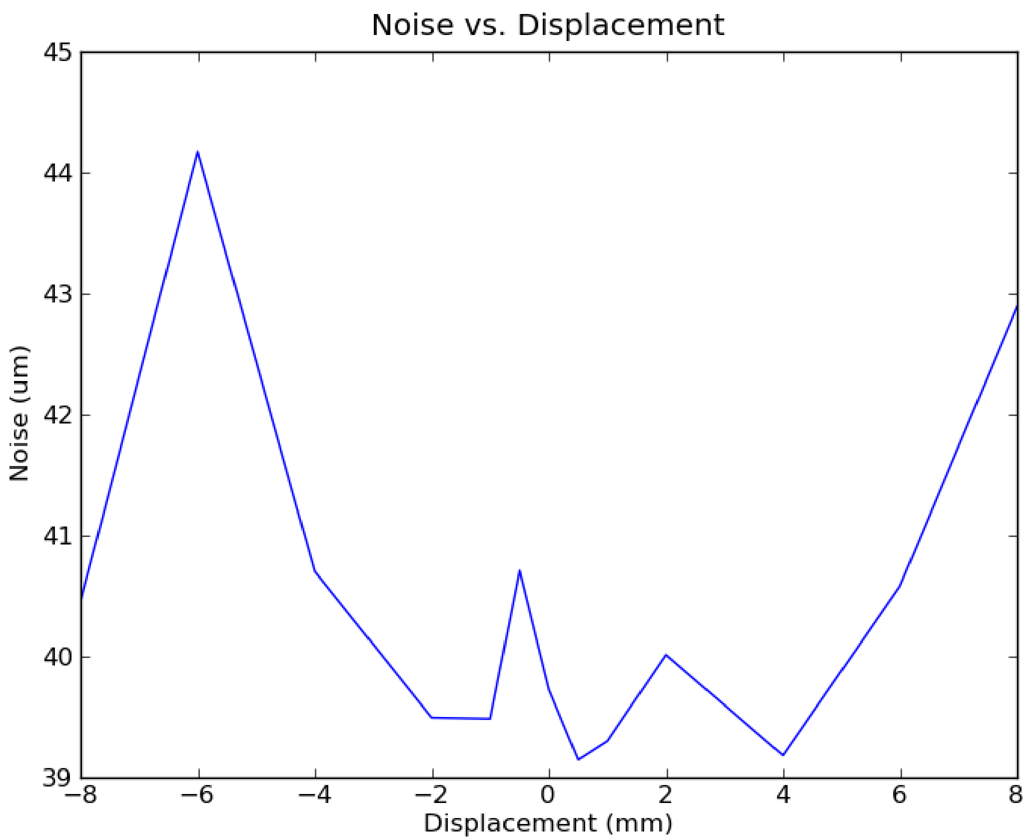
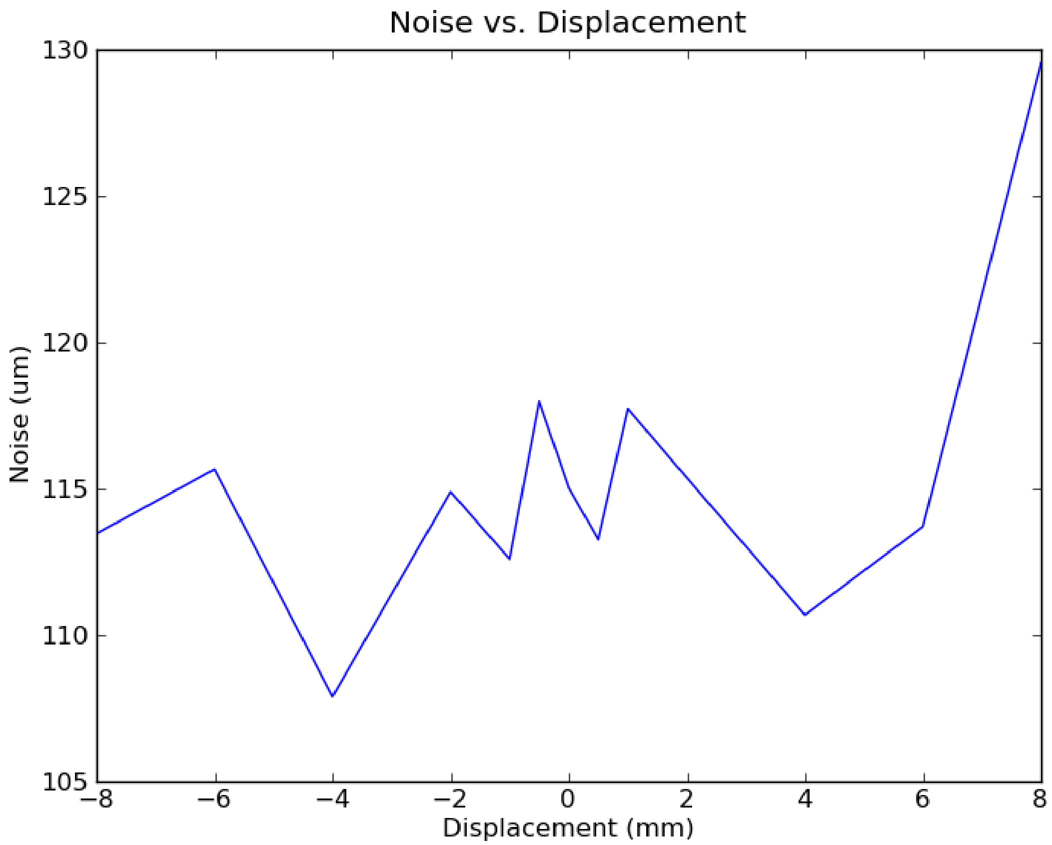
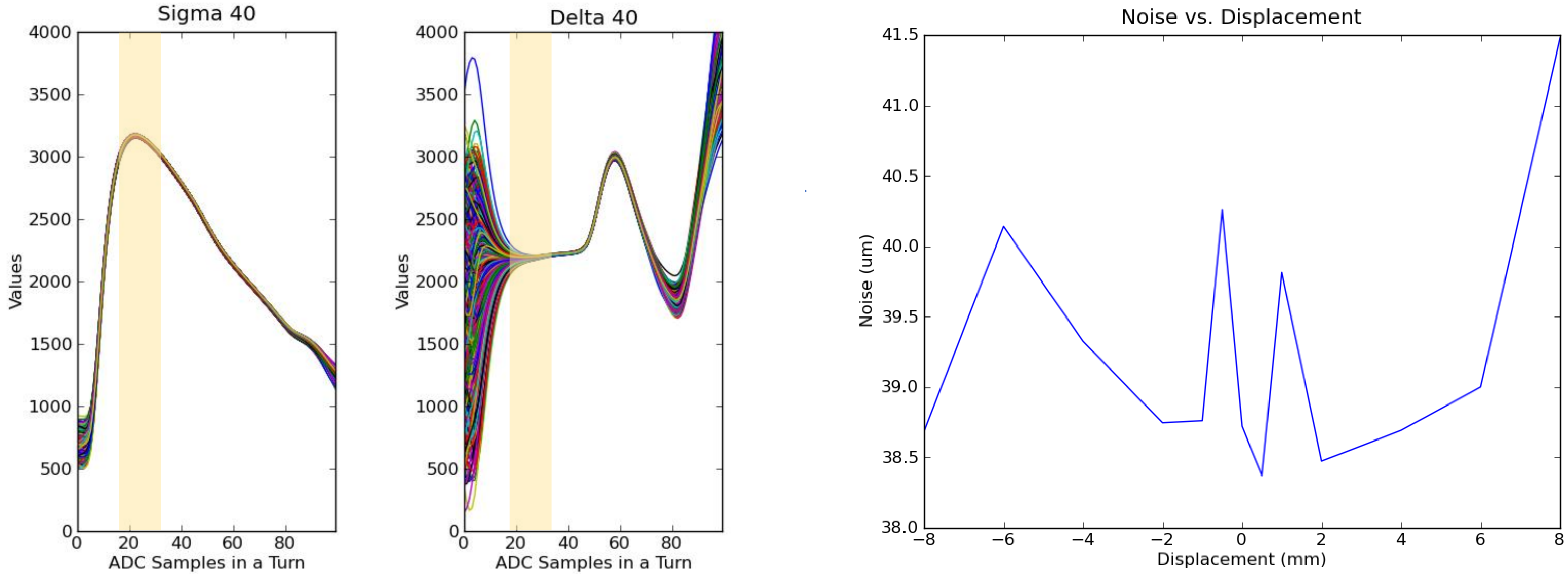


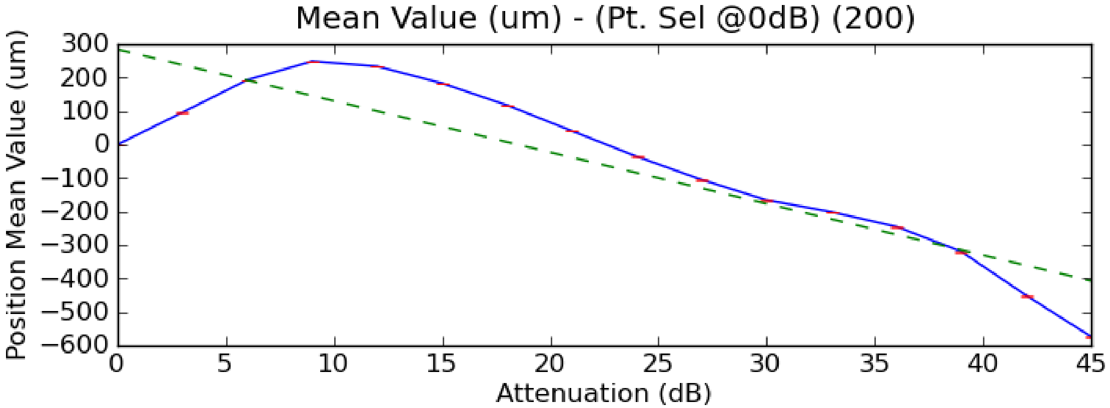


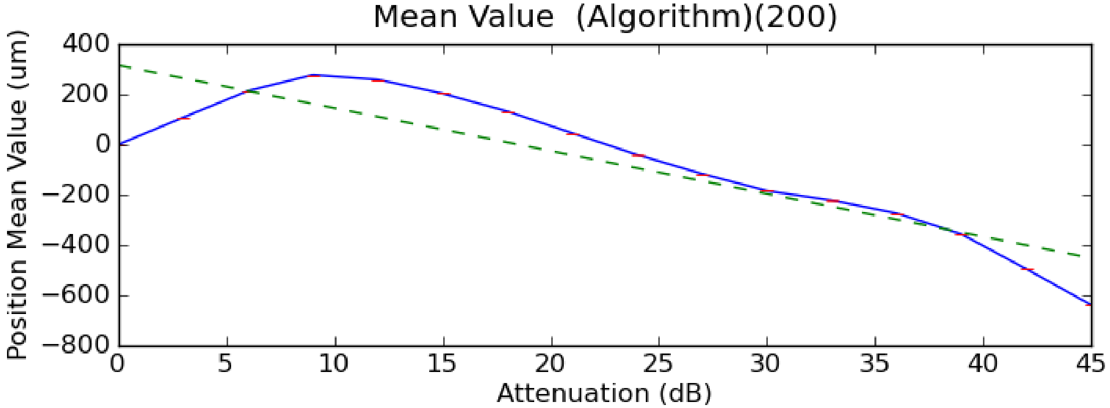
Example: Protons 40MHz – Intensity ~ 3·10^10

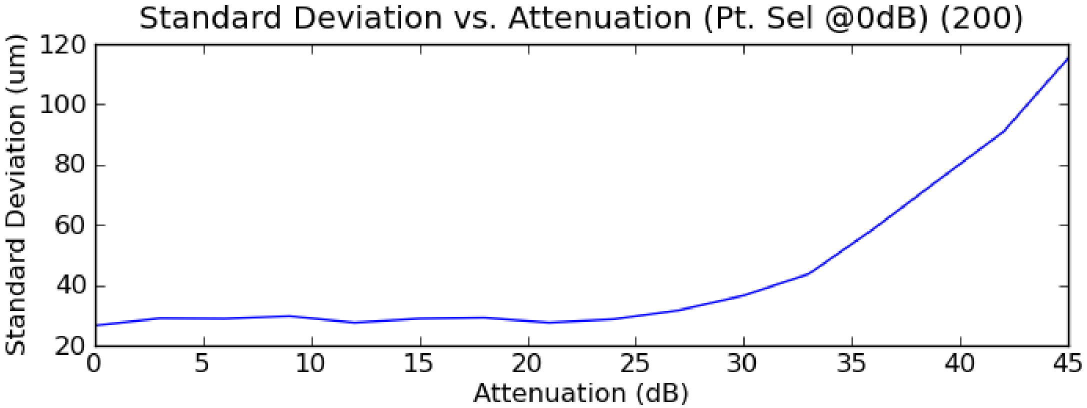


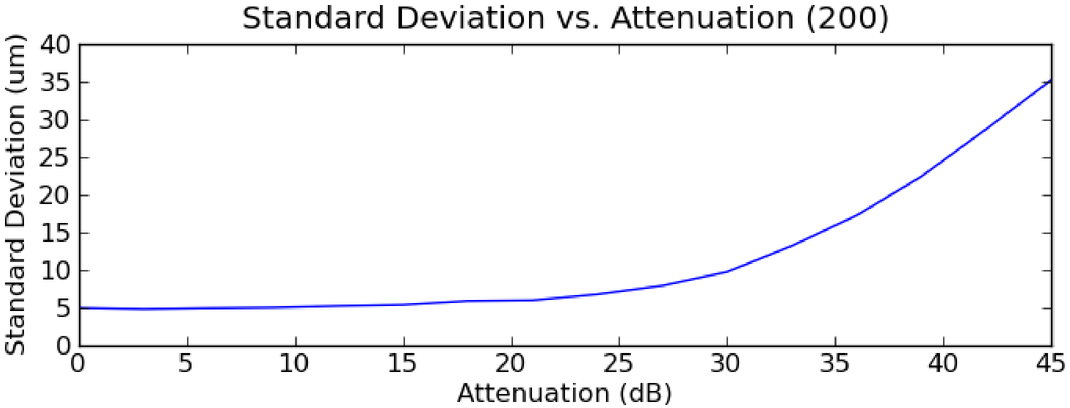
THANK YOU FOR THE ATTENTION

Example: Intensity dependence 200MHz

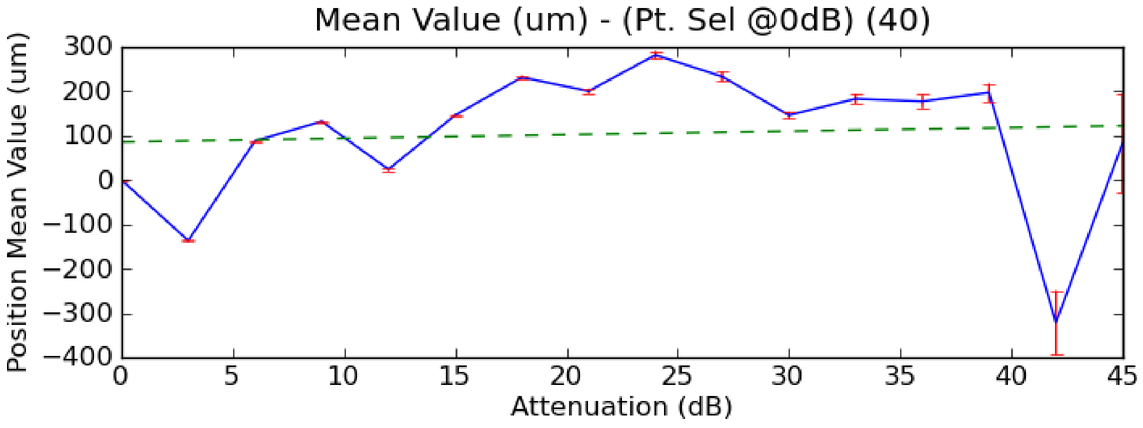


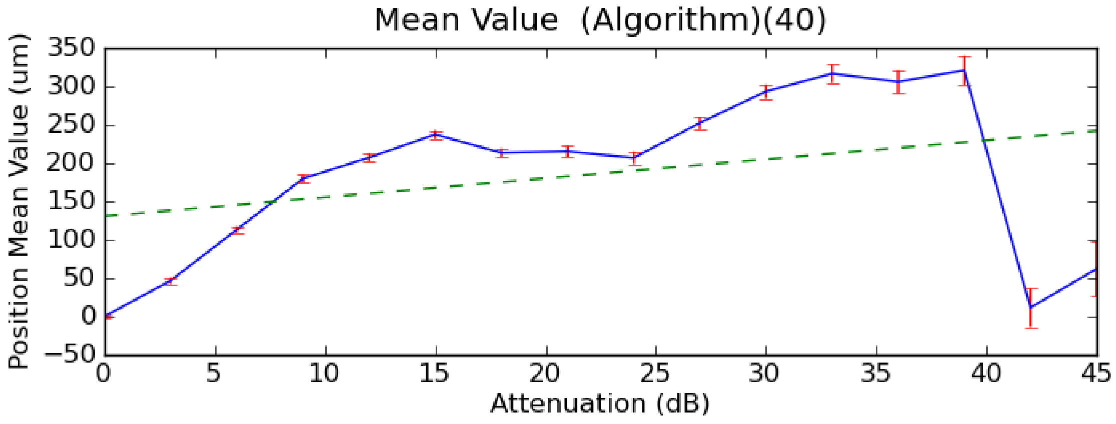


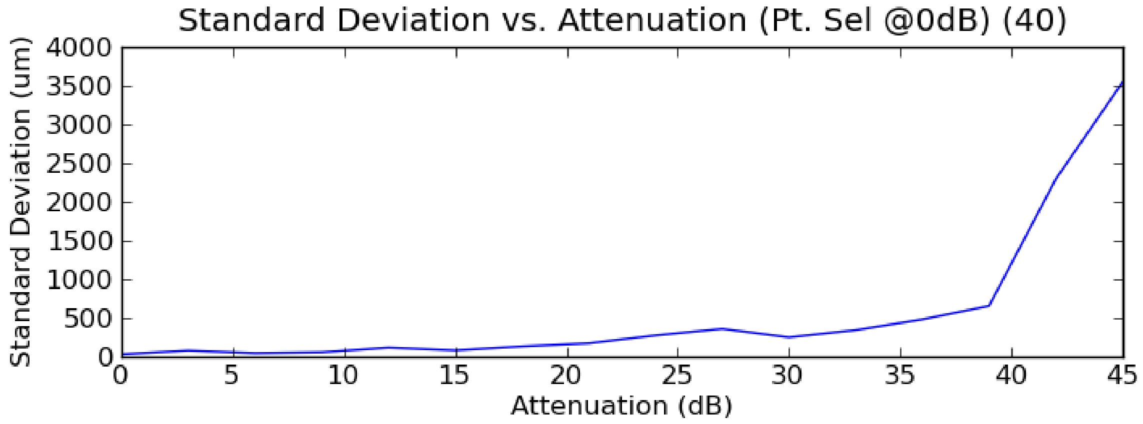


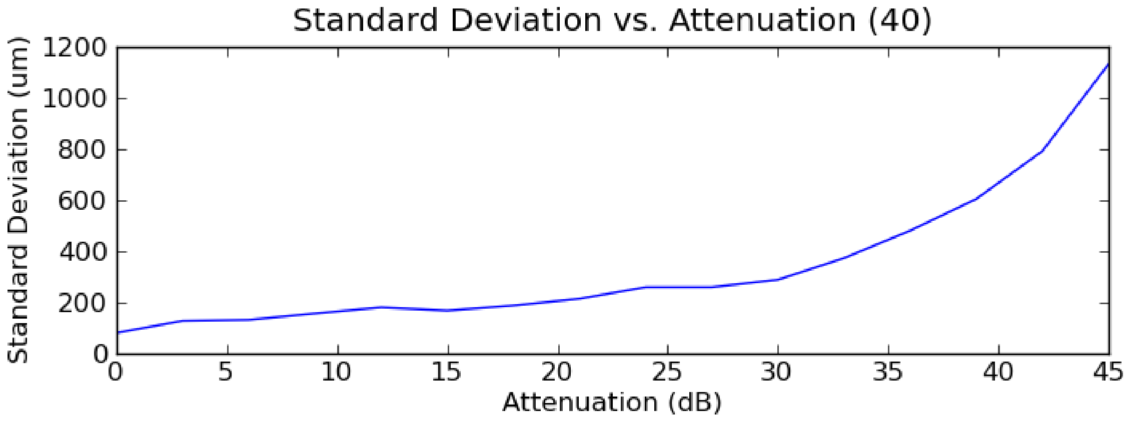


Example: Intensity dependence 40MHz



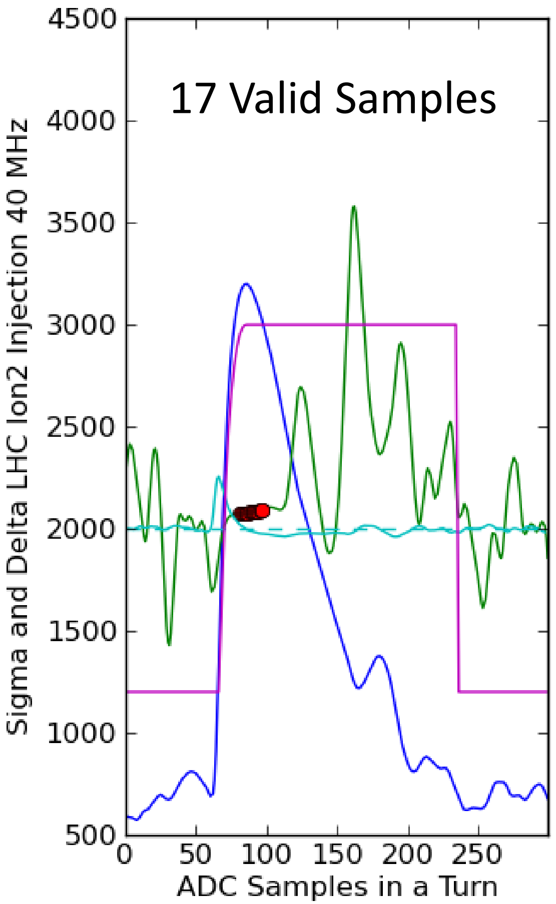




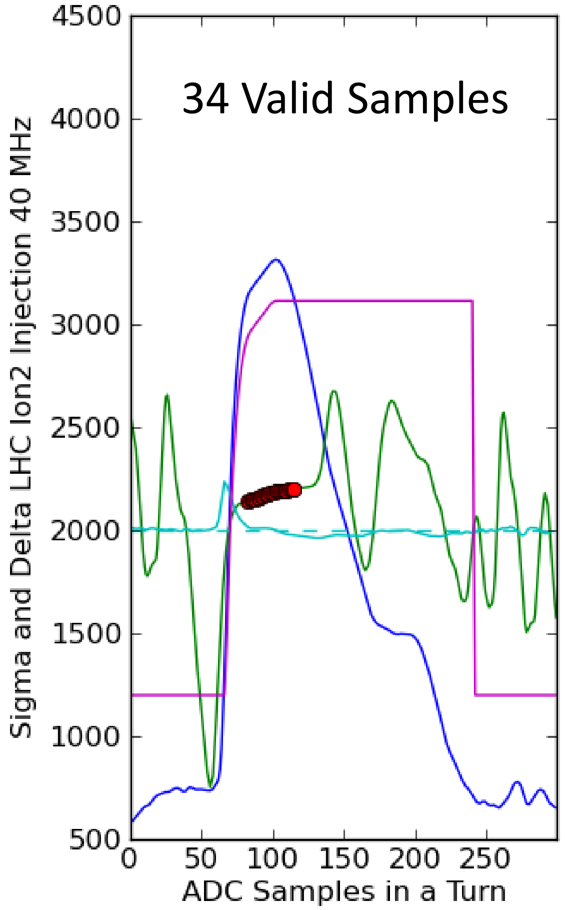


Simulation with Beam Data – Ion Injection 40MHz

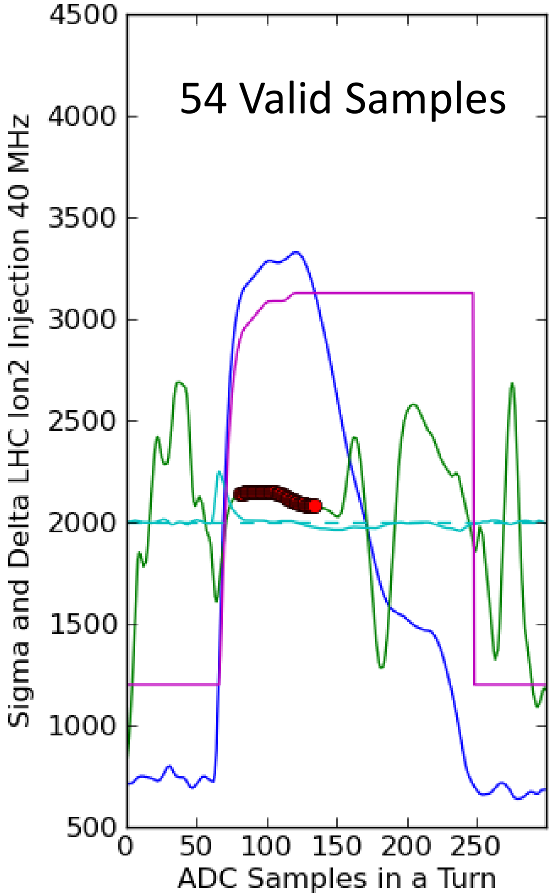
Injection 1



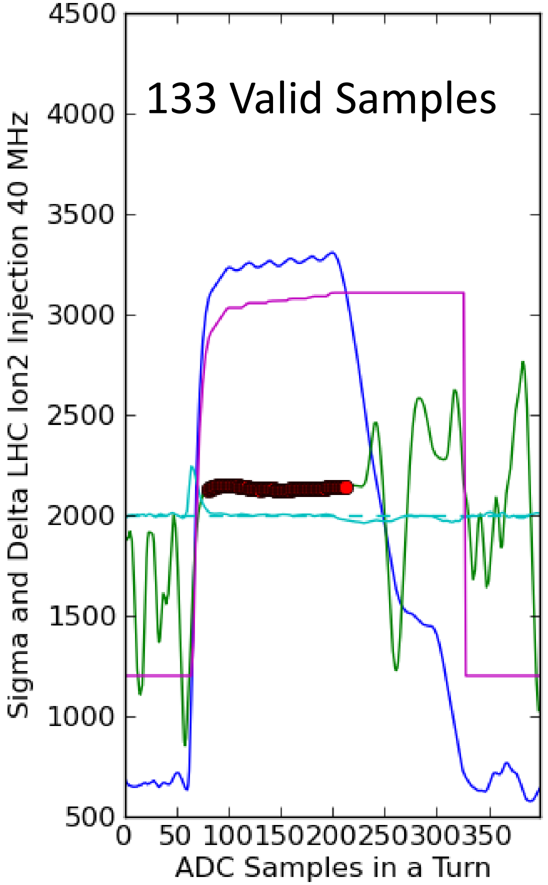
Injection 2



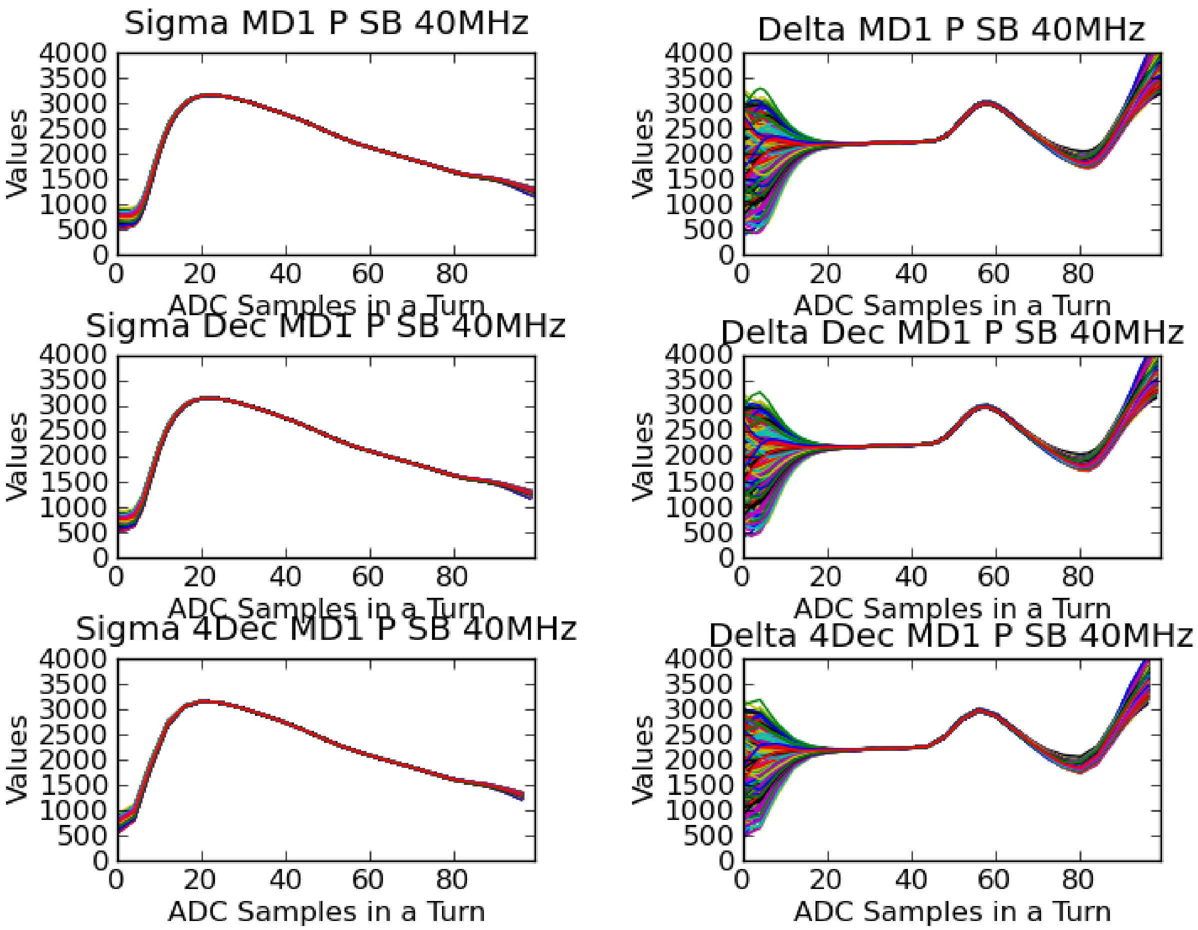
Injection 3

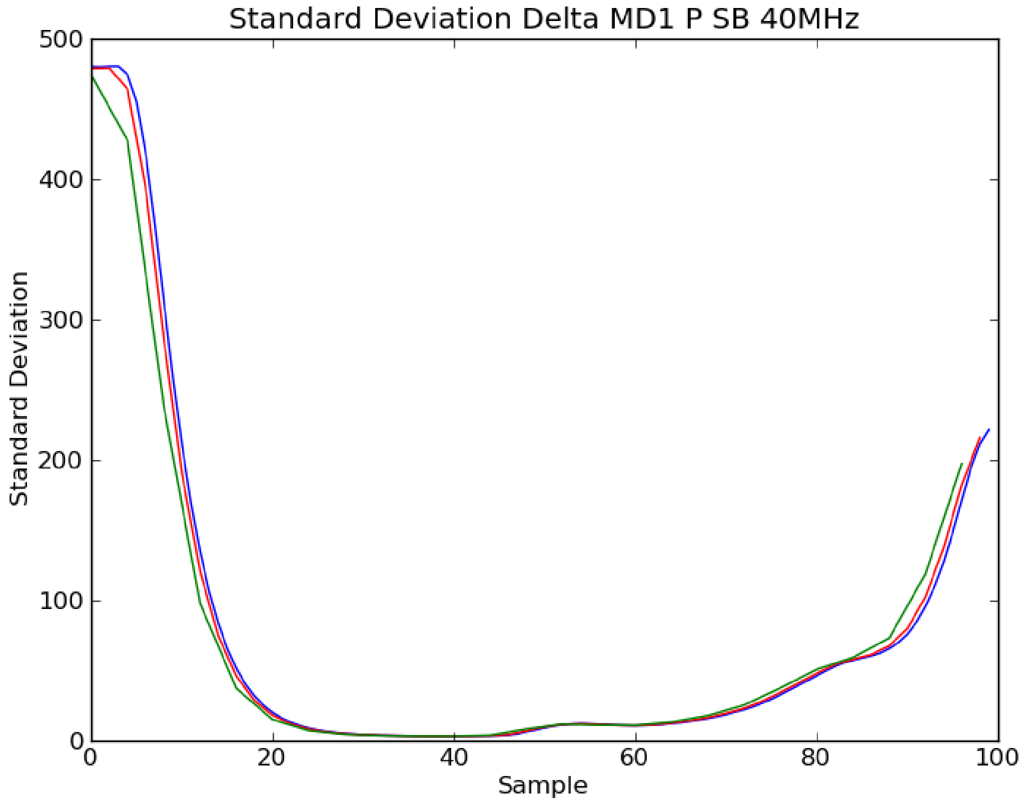


Injection 7

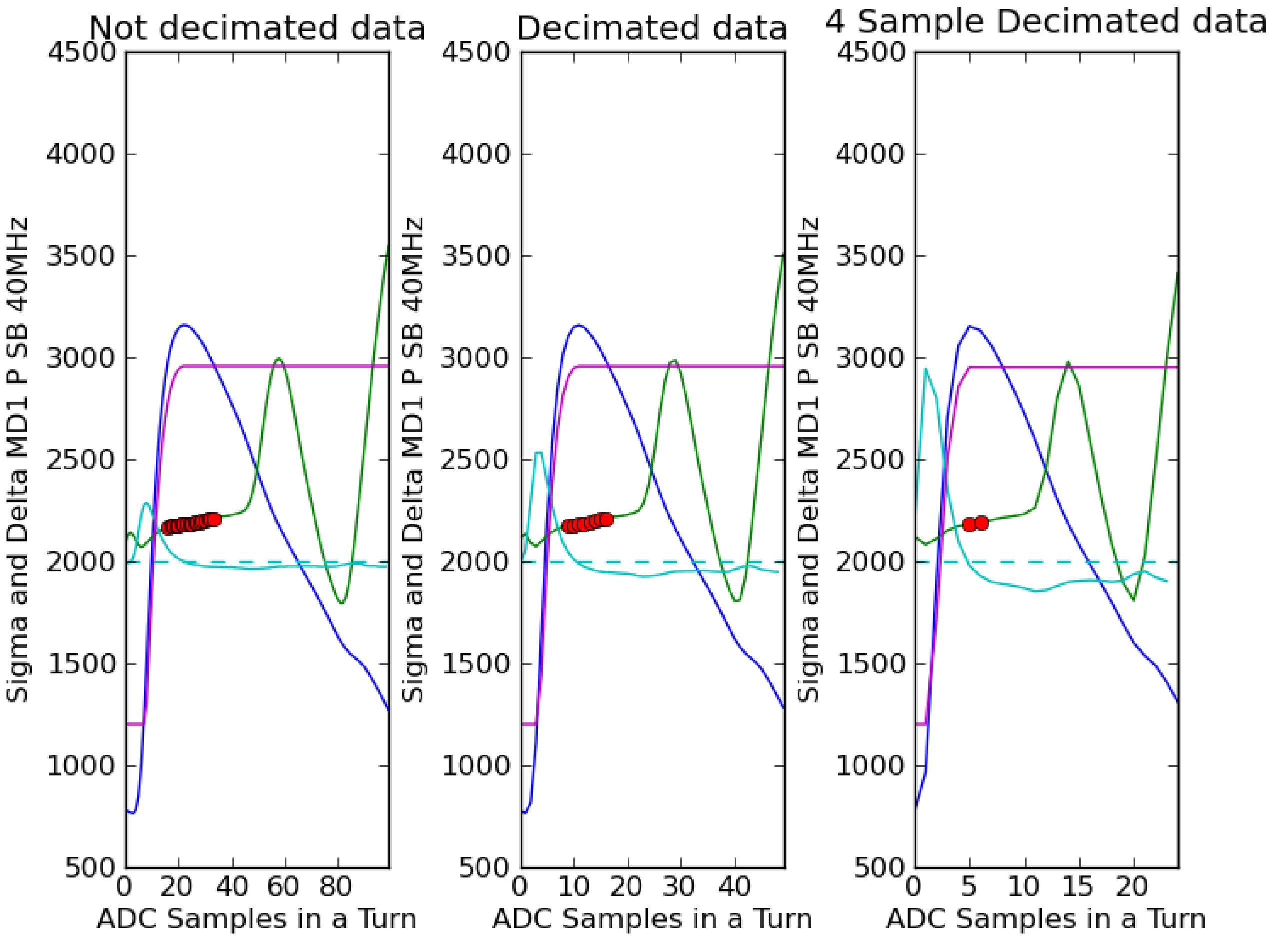


Eventual Decimation





Eventual Decimation



Without decimation:

- Number of valid sample: 18
- Mean value: - 437 um
- Swing: 520 um

Two samples decimation:

- Number of valid sample: 8
- Mean value: - 413 um
- Swing: 416 um

Four samples decimation:

- Number of valid sample: 2
- Mean value: - 485 um
- Swing: 80 um