Thin Parameters

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Experimental Setup

- 6 parameters that we're after:
  σx, σpx, σy, σpy, α [Landau], and β [Landau]
- The y parameters should be the same as our x parameters
- Initial momenta of 200, 195, 190 MeV/c (momentum loss across single thick absorber is roughly 10 MeV/c)
- 10,000 muons through 12,...,2 mm absorbers
- 1000 random seeds (the more the merrier)

Results: Tabular Data

- Much of the 2 mm data was unfittable by ROOT (i.e. χ^2>1,000,000)

Most probable σx (μm) for 100 random seeds

Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	12.243	9.198	6.558	4.518	2.13	0.726
195	12.375	9.735	7.238	4.377	2.311	0.739
190	13.232	9.743	6.708	4.478	2.307	0.806

Most probable σpx (eV) for 100 random seeds

Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	341.9	319.1	287.3	243.8	190.2	139.7
195	391.1	320	287.4	242.1	193.1	143.1
190	363	330.6	282.7	248.4	194.6	137.9

Most probable σy (μm) for 100 random seeds

Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	11.469	8.955	7.03	4.415	2.16	0.734
195	12.89	9.382	6.572	4.502	2.29	0.77
190	12.832	9.698	6.977	4.778	2.314	0.807

Most probable σpy (eV) for 100 random seeds

Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	341.9	319.1	287.3	243.8	190.2	139.7
195	391.1	320	287.4	242.1	193.1	143.1
190	363	33.06	282.7	248.4	194.6	137.9

Most probable α (keV) for 100 random seeds

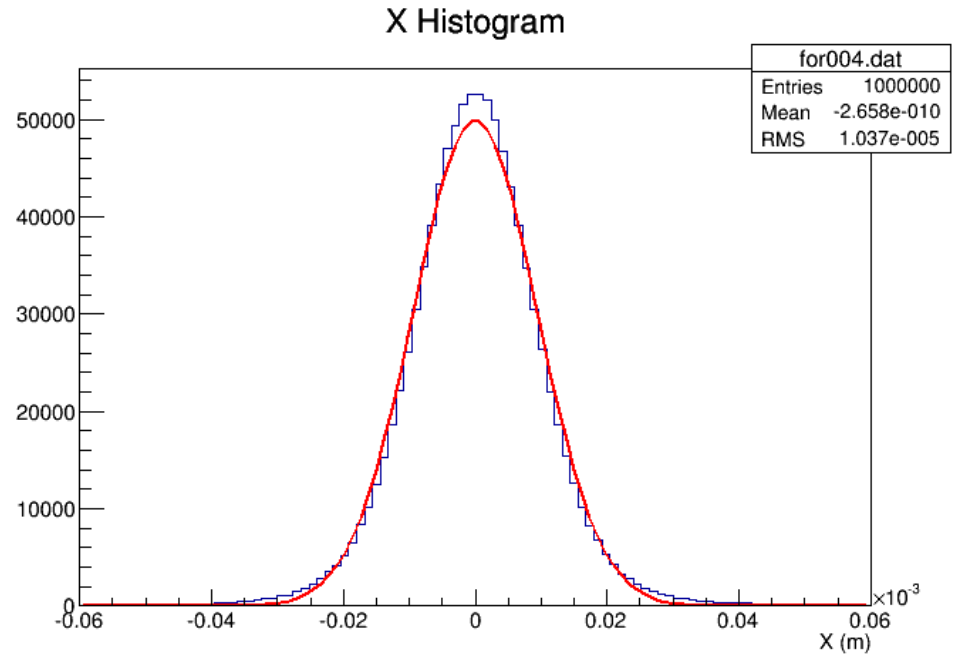
Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	304.1	250.9	198.2	146.3	95.3	45.7
195	307	253.3	200.1	147.7	96.2	46.1
190	310.3	255.9	202.1	149.1	97.2	46.6

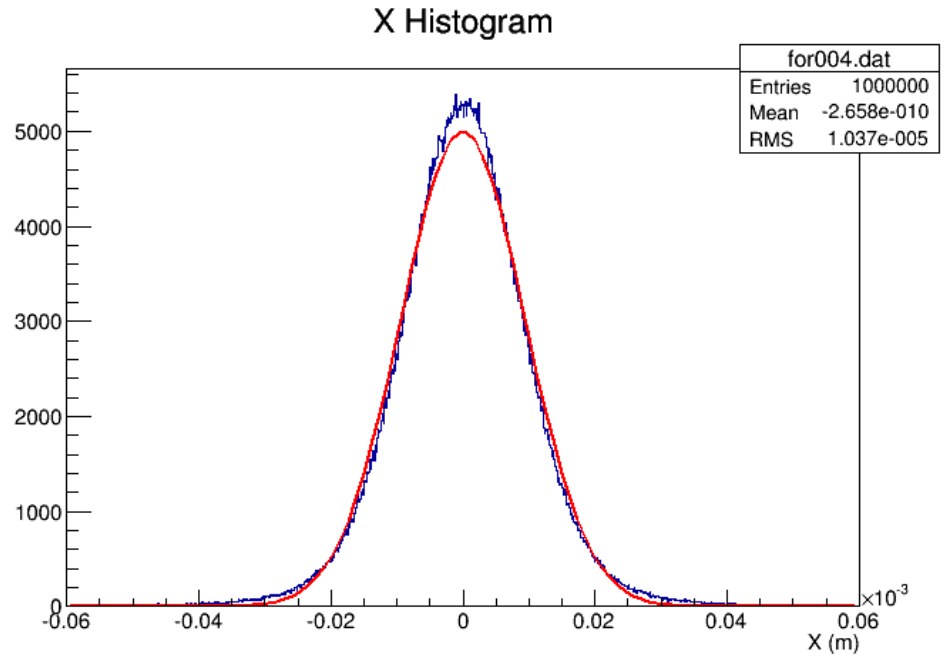
Most probable β (x10,000) for 100 random seeds

Pz\Length	12 (mm)	10	8	6	4	2
200 (MeV/c)	165.9	137.7	110	82.9	54.8	28
195	167.4	140.4	110.9	84.3	56.1	28
190	170.4	141.2	113.7	85.1	56.9	28.6

X: Is It Gaussian?

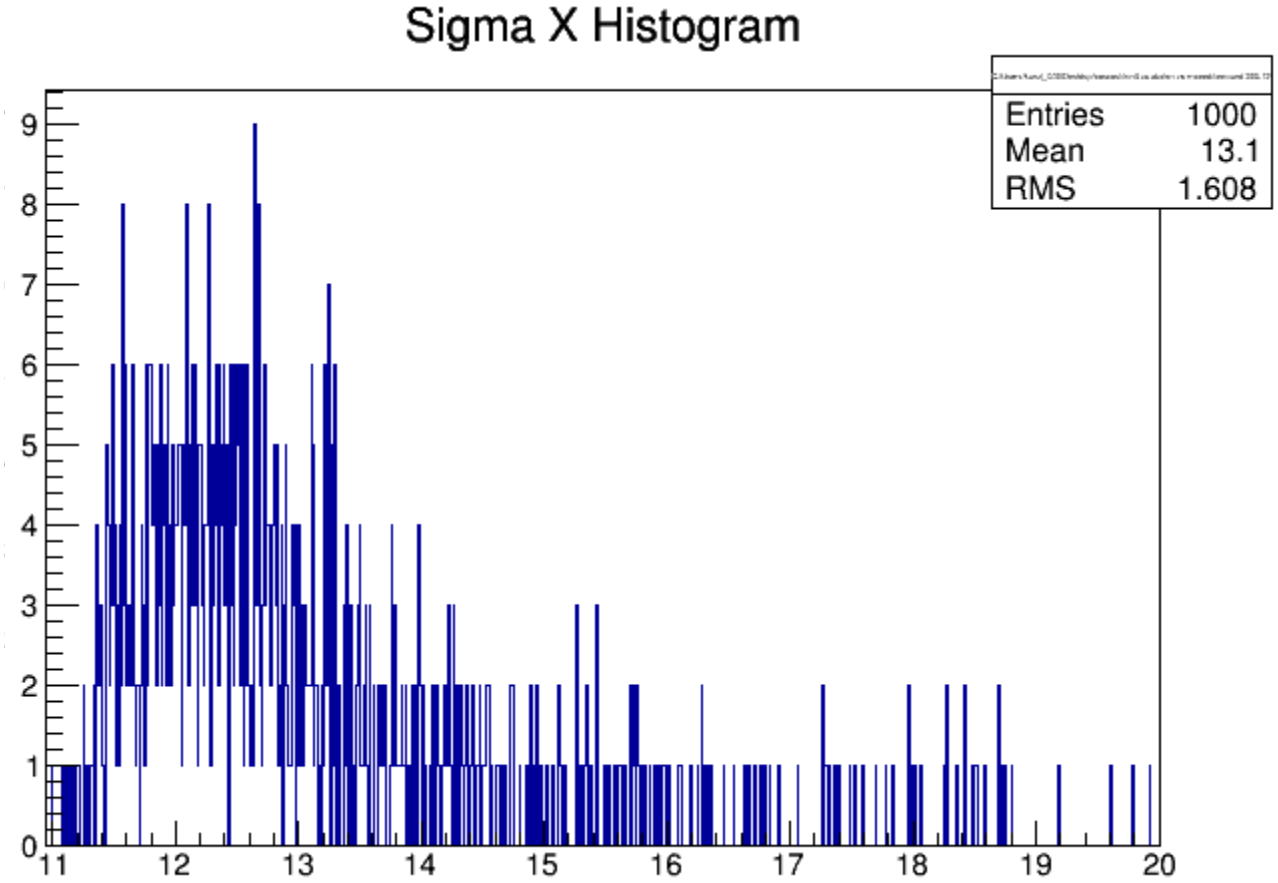
- 1M muons, abs length = 12 mm, Gaussian fit, 100/1000 bins
- Similar plots with length = 50 mm





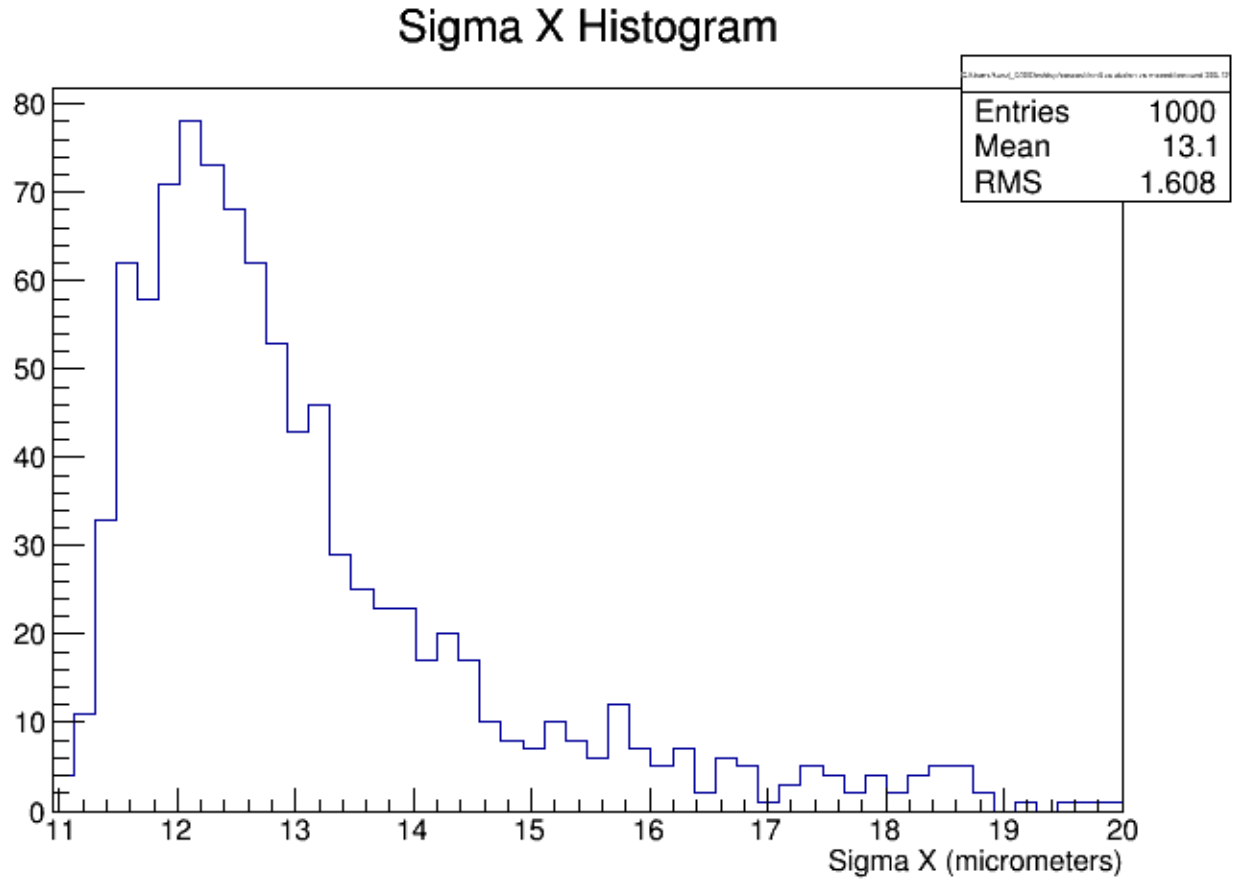
Improvements: More Data

- Example histogram: bin width = 0.01 µm (900 bins)
  - peak is ill defined



Improvements: More Data

- Example histogram: bin width = 0.18 µm (50 bins)
  - peak is well defined

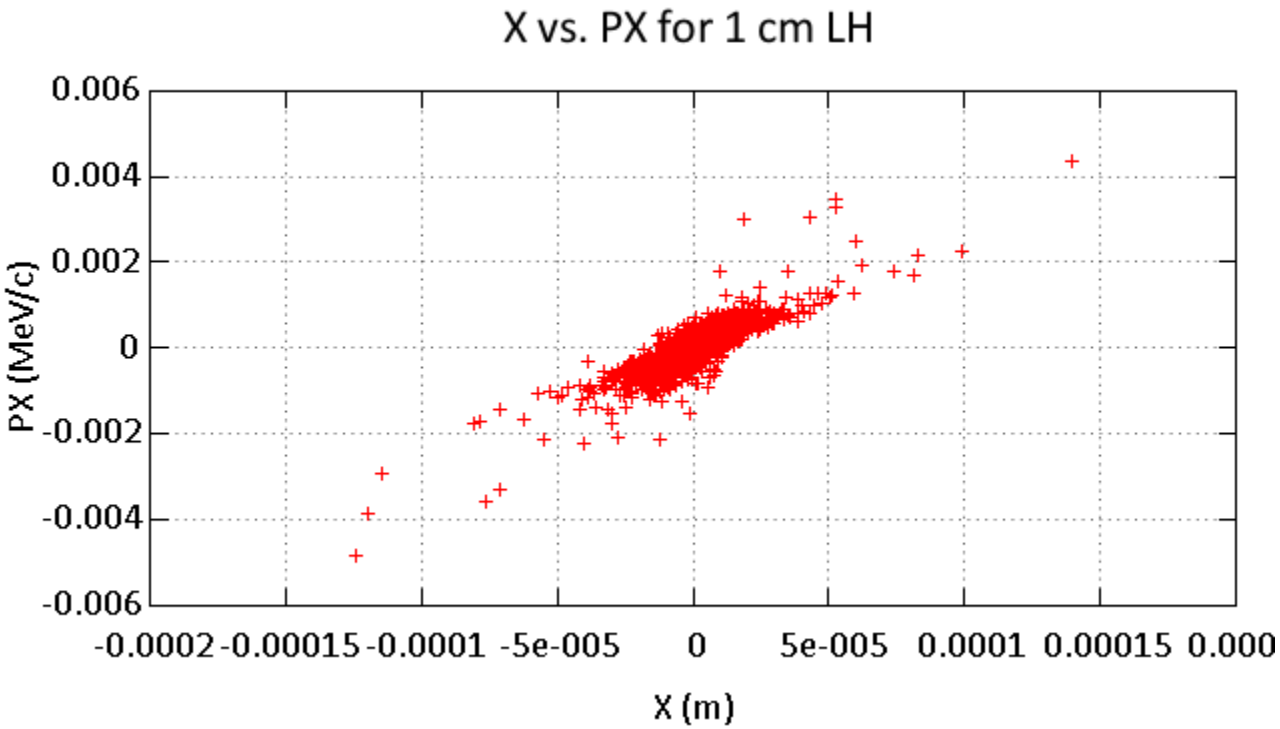


Improvements: More Data

- Only 1,000 random seeds
  - Distributions of parameter values are not precisely peaked
  - Peak values only contained ~100 samples, and in some cases only 20 samples
- Only 3 initial momenta (200, 195, 190 MeV/c)
  - Interpolation may not be sound

Improvements: Parameter Coupling

- Single run of 1 cm LH (rnseed=2)
- X, PX selections cannot happen independently



Improvements: Parameter Coupling

- Averages across 100 random seeds for 1 cm
- (X, PX) pairs cannot be selected independently but must come with the same sign, e.g. (+,+)