

Raster Calibration Via Detached VTX

Derek Holmberg
6-27-23

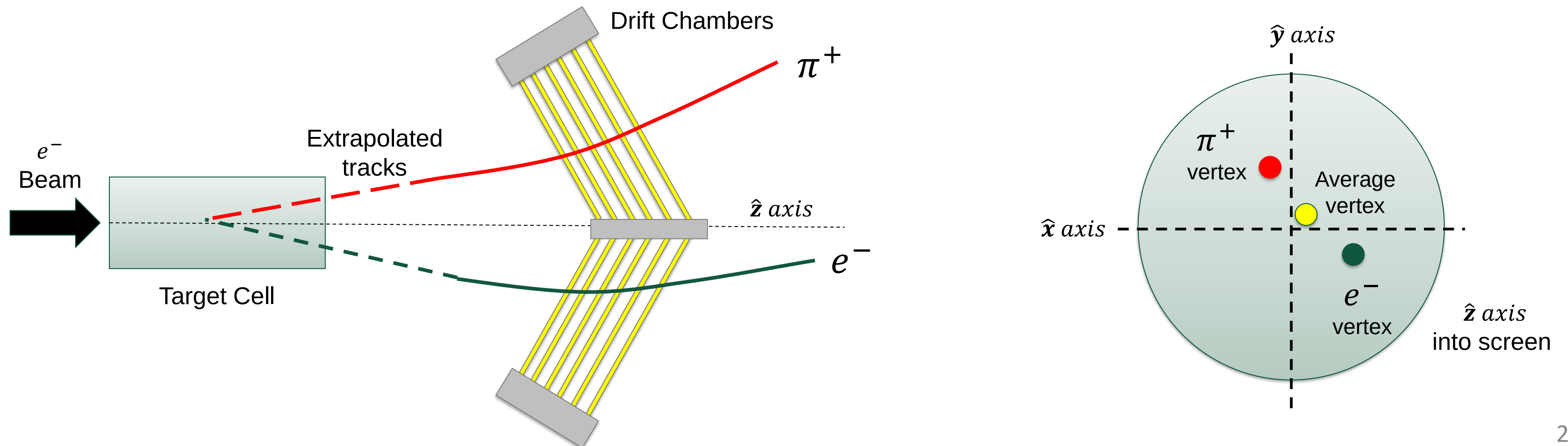


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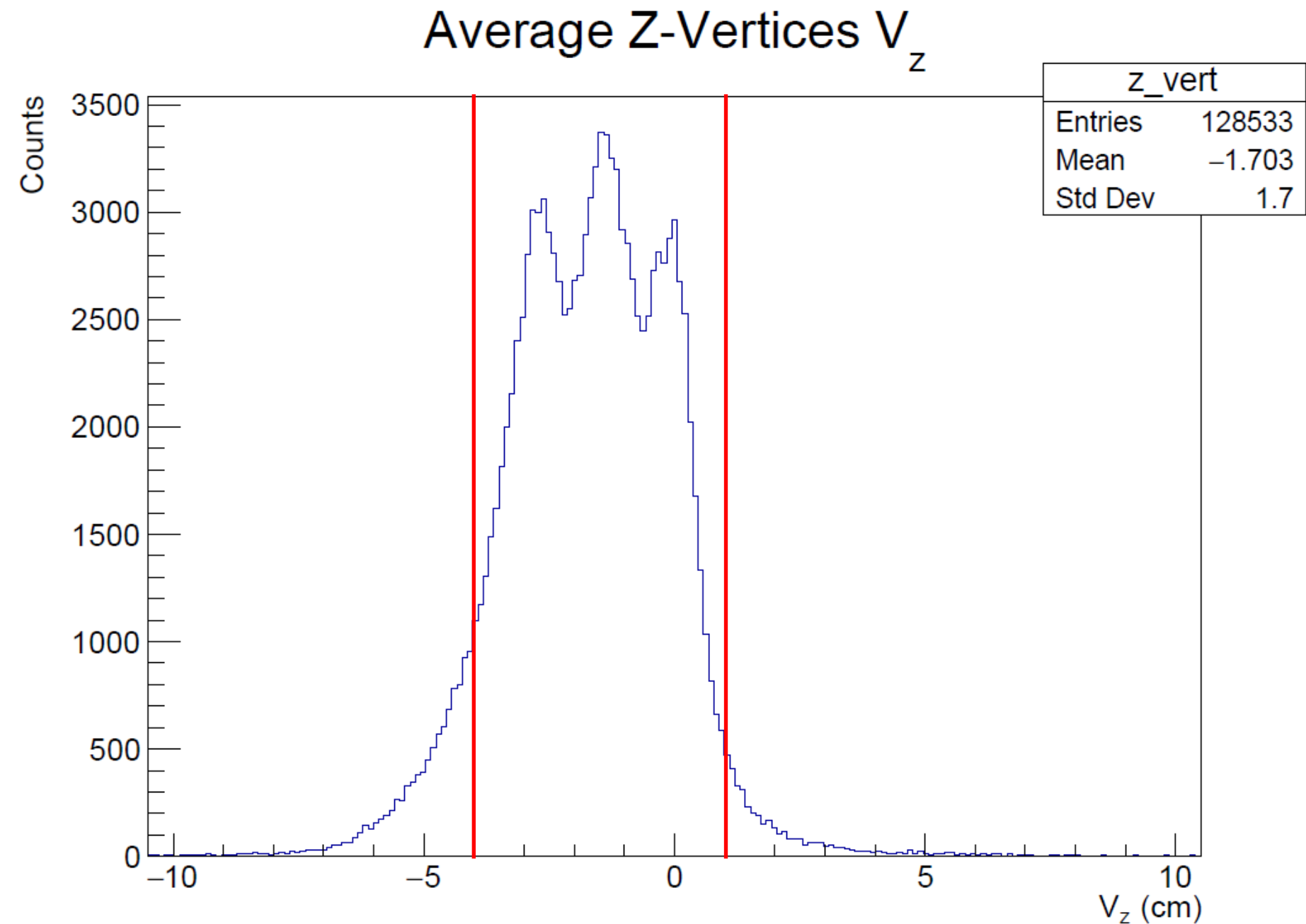
Raster Calibration

- **Goal:** find relationship between ADC signal $I_{x,y}$ vs. particle vertex position $V_{x,y}$
- **Detached Vtx:** reconstructing particle vertices using reconstructed tracks through the drift chambers (using Veronique Ziegler's code)
- Utilizes $e\pi^+$ coincidences, with π^+ events in the CVT



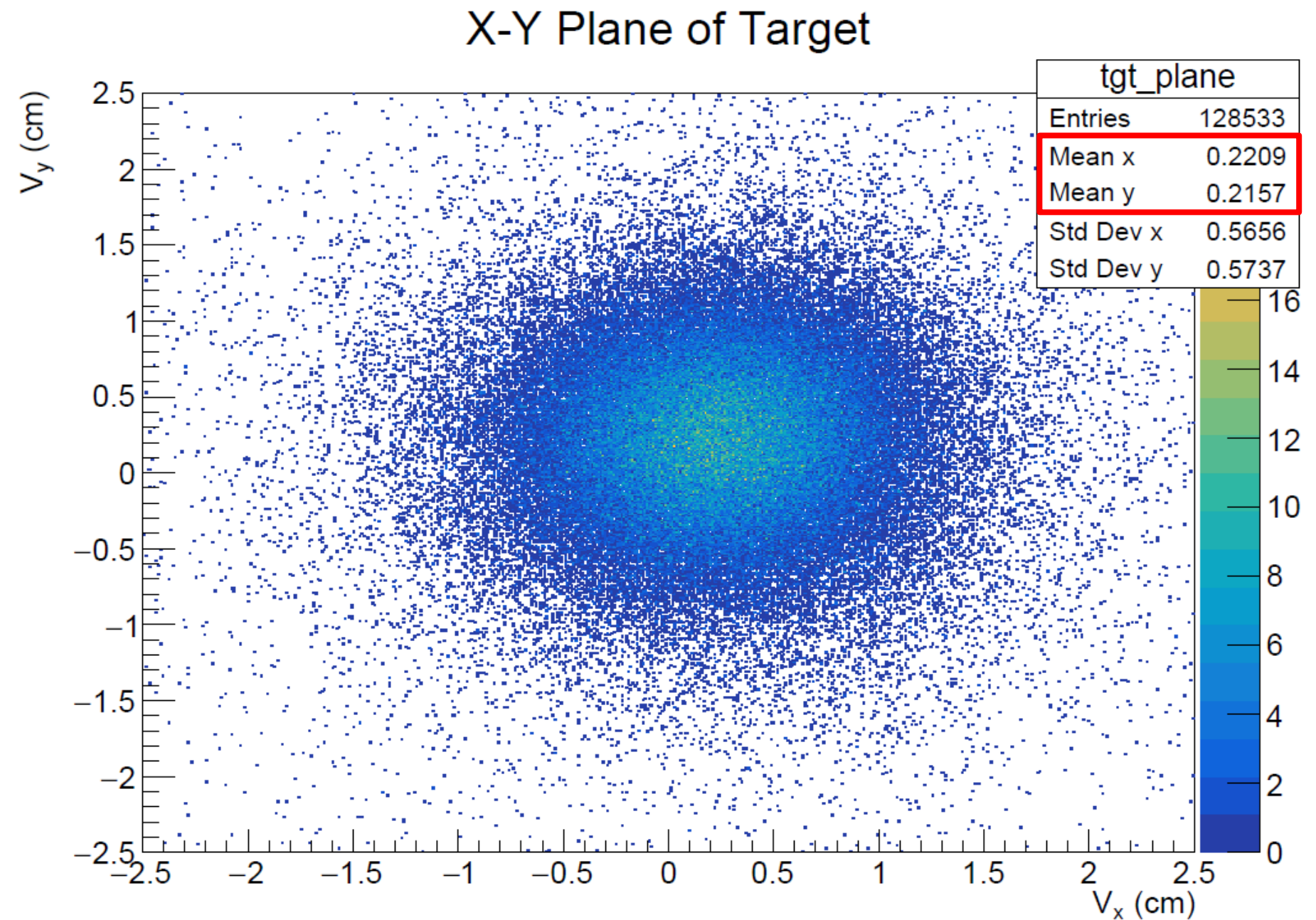
Cuts to the Data

- **New cuts to the data:**
 - π^+ in the CVT, e^- in the drift chamber (Forward Detector)
 - $\chi^2_{pid} < 3$ for both π^+ and e^-
 - Cut on the z-vertex $-4\text{ cm} < V_z < 1\text{ cm}$



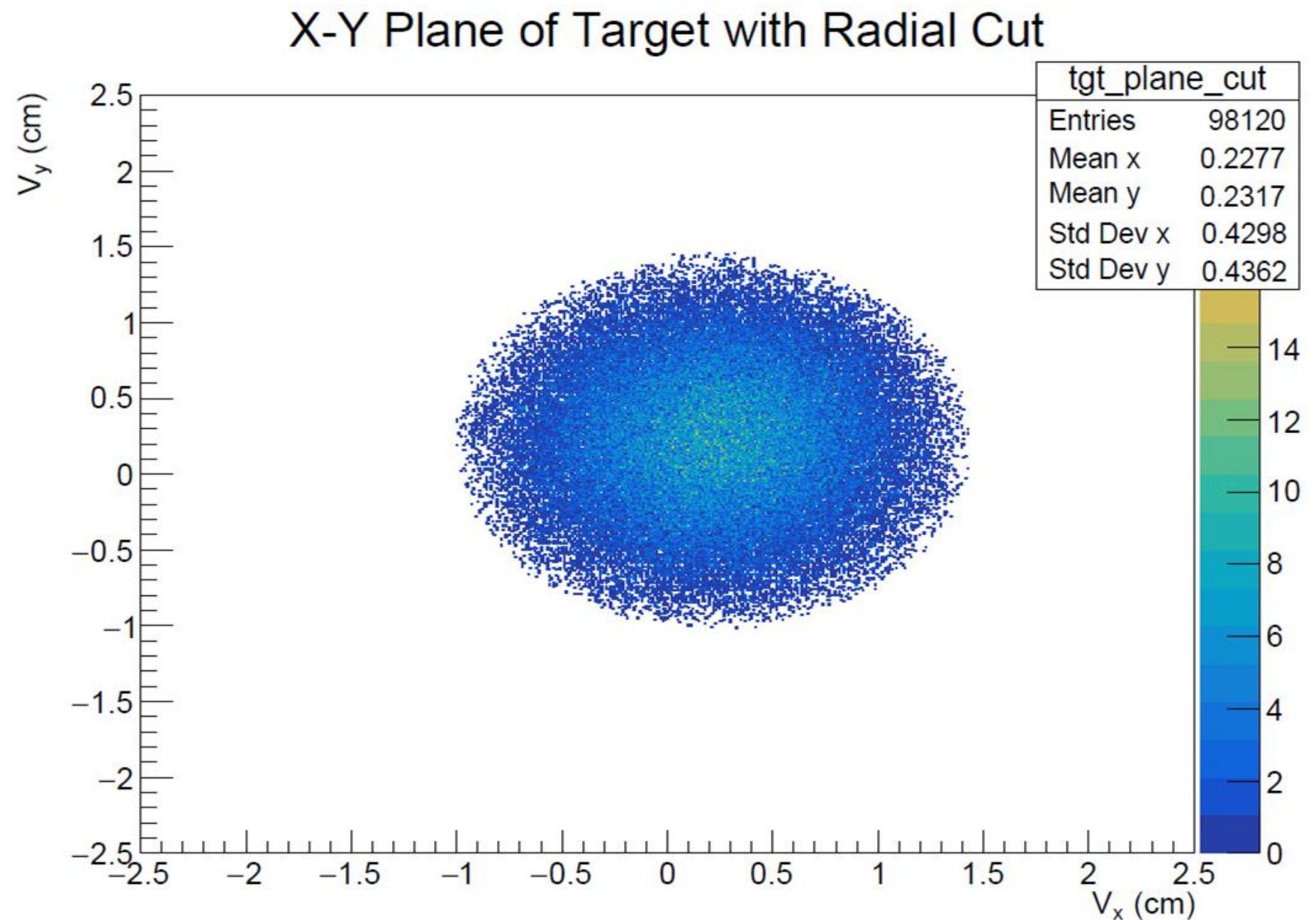
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 - Cut all $V_{x,y}$ not within 1.25 cm of the target center
 - Target center taken as average $V_{x,y}$
 - $X = 0.2209 \text{ cm}$, $Y = 0.2157 \text{ cm}$

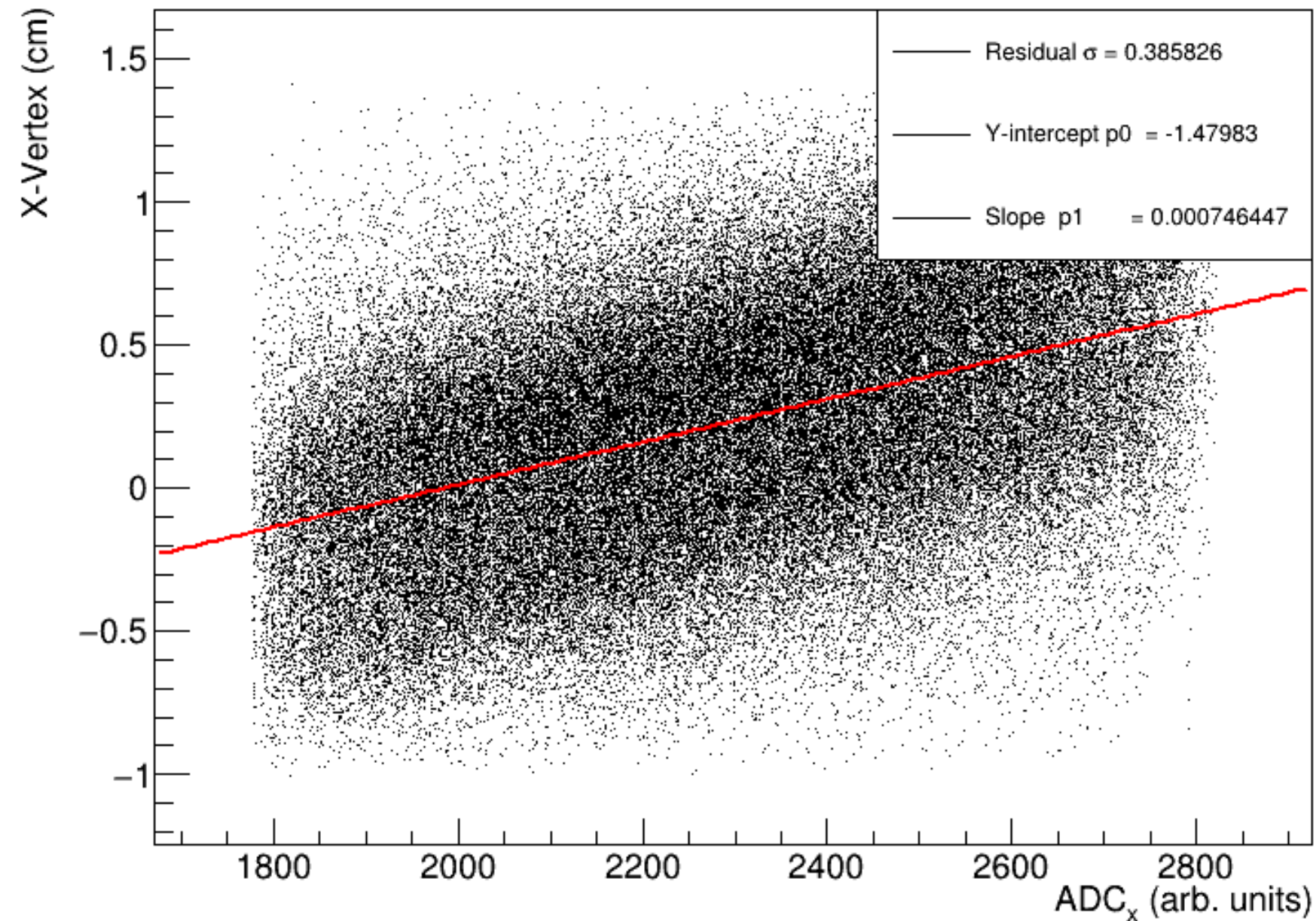


Cuts to the Data

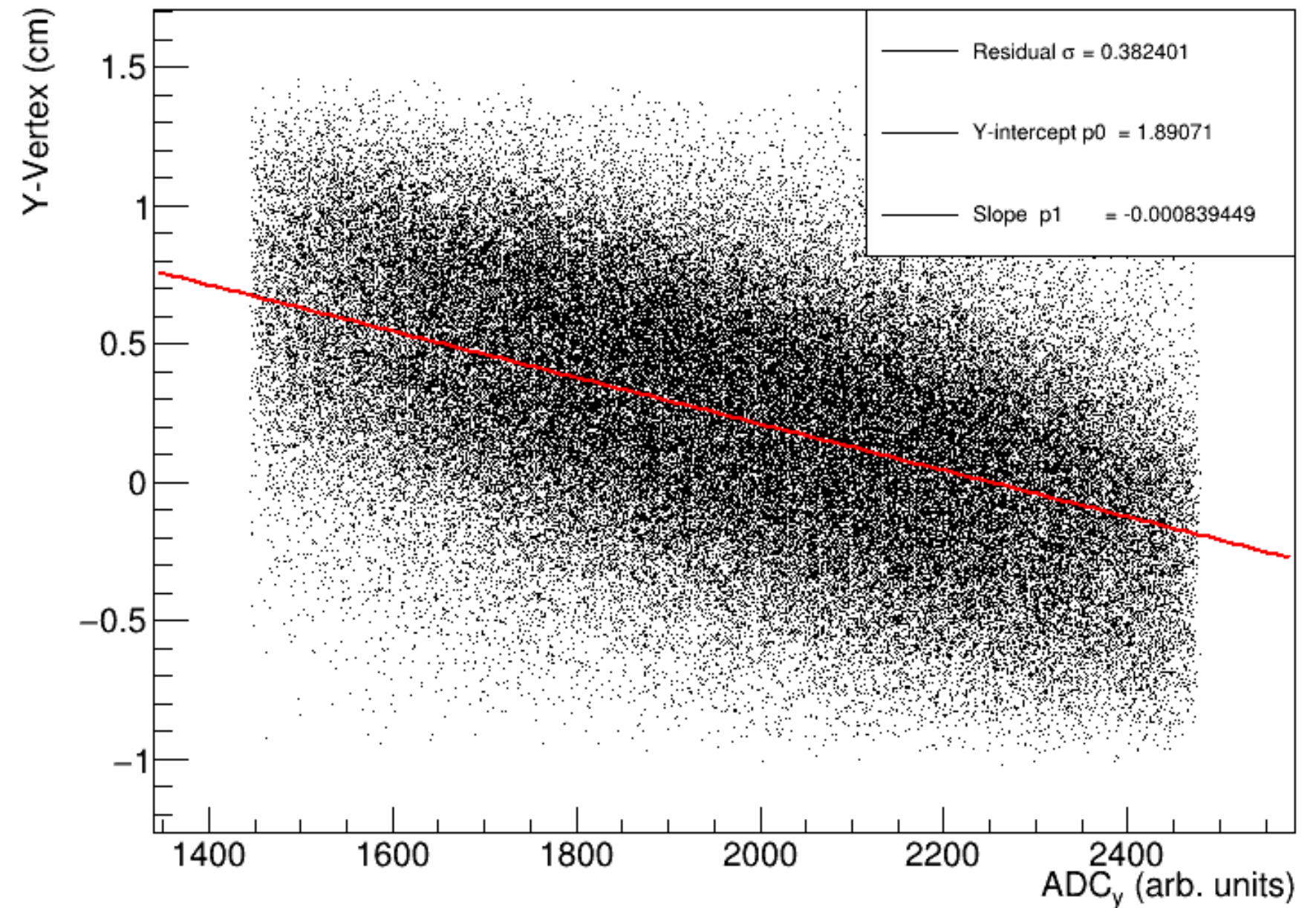
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X-Vertex vs. ADC_x Signal



Y-Vertex vs. ADC_y Signal



X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.480 + 0.000746 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex Data

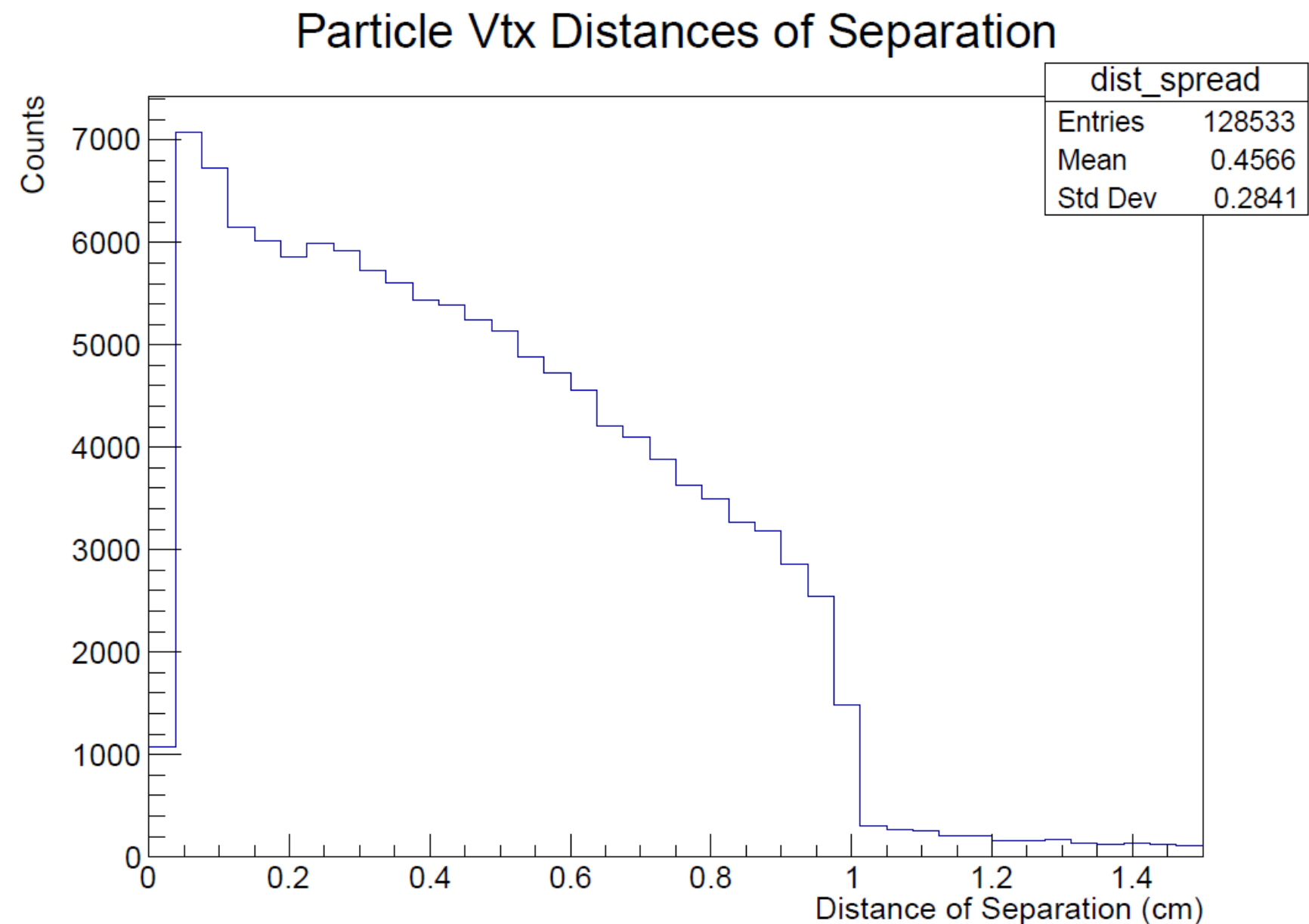
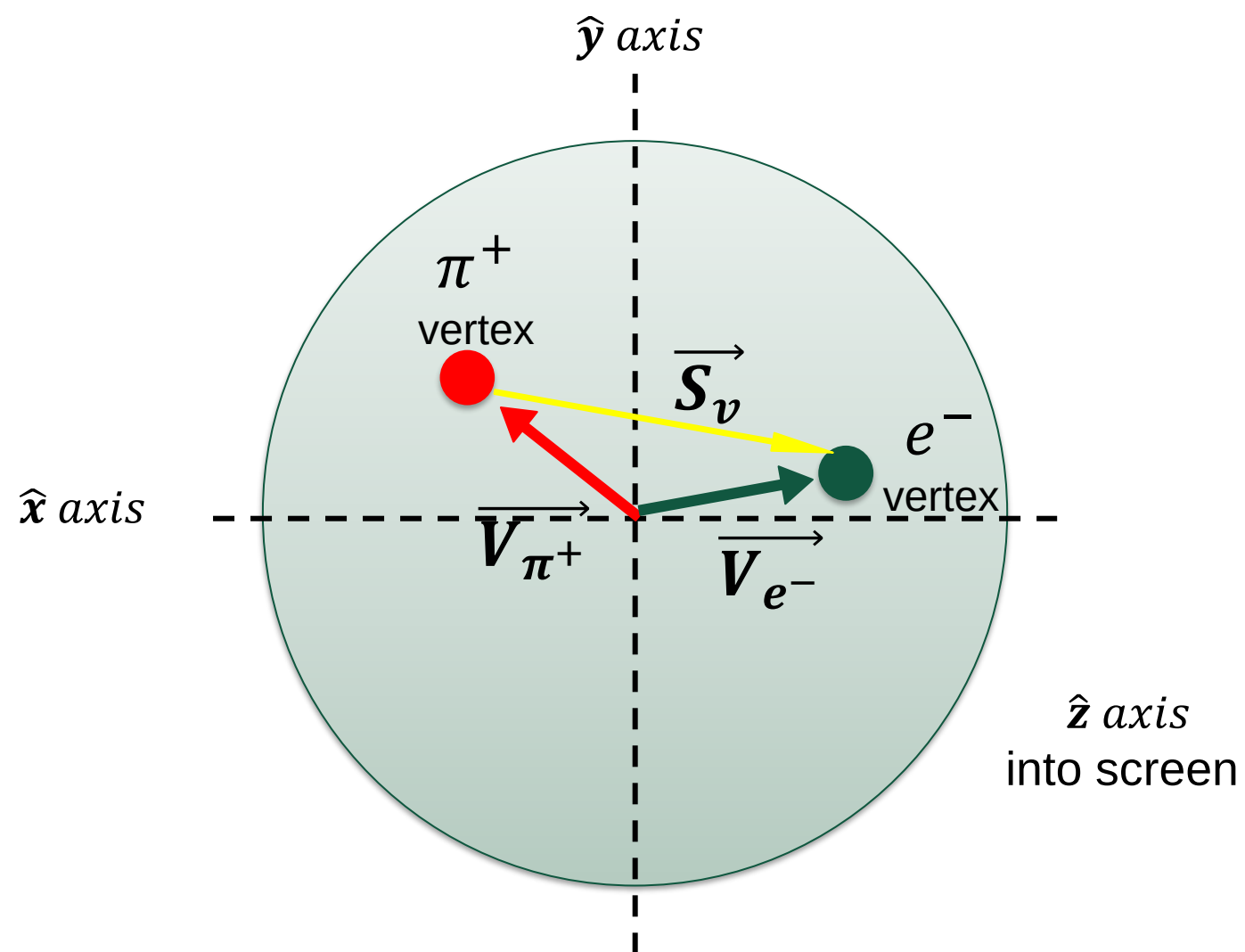
CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.891 - 0.000839 * ADC_y$

Residual $\sigma = 0.382$

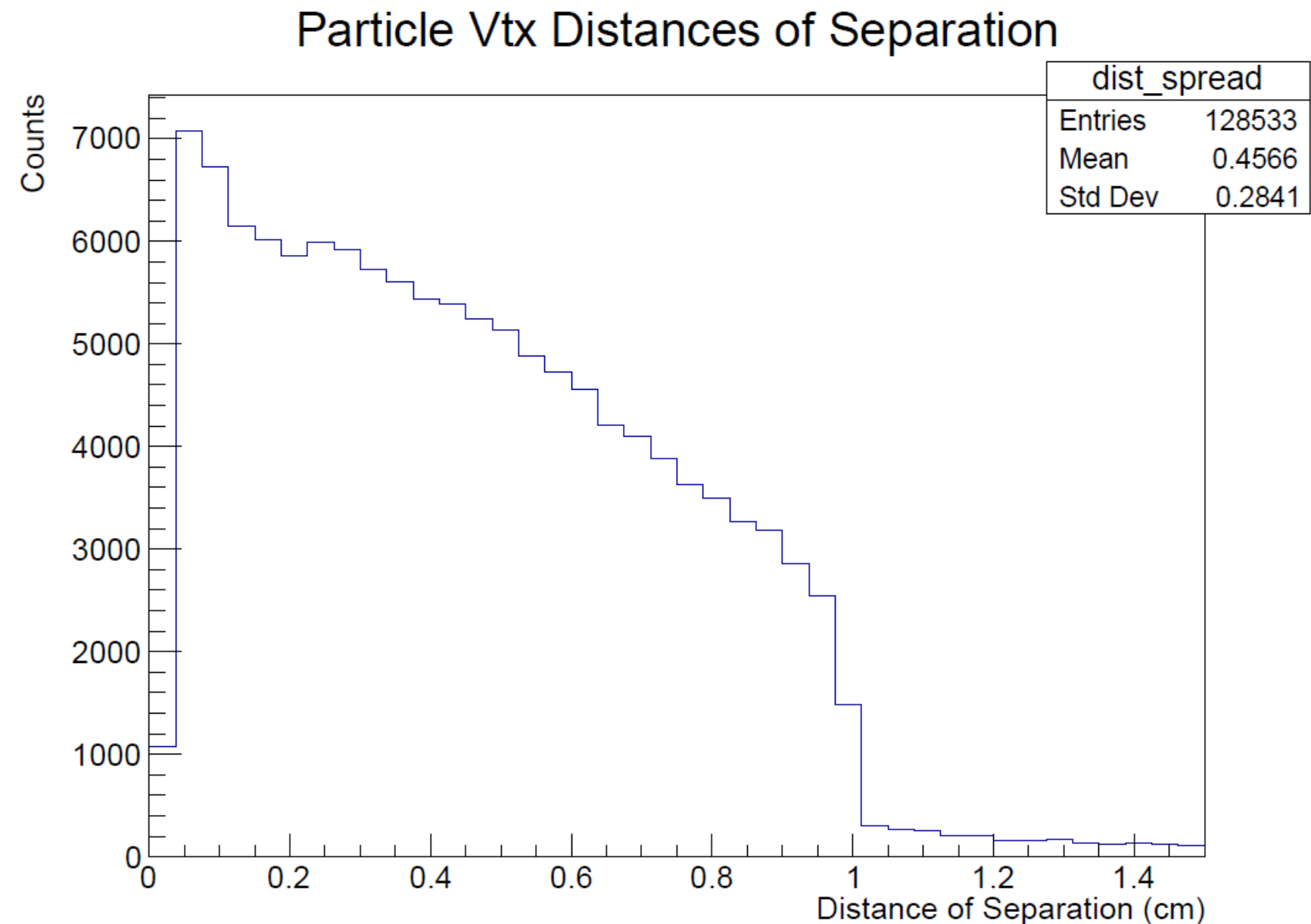
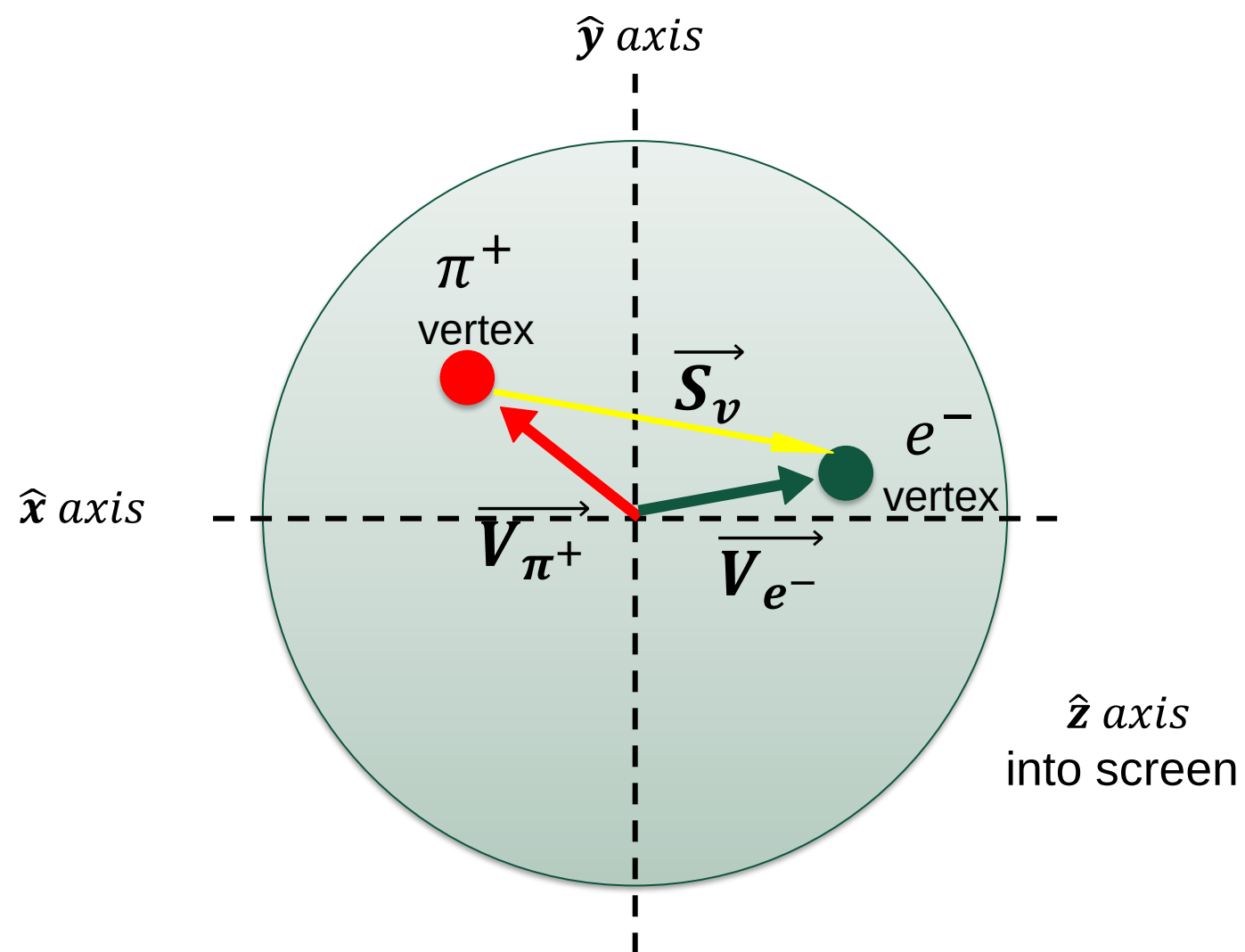
Distances of Closest Approach

- Not all particle vertices are close together; how far apart are they?
- **Distance of closest approach S_v** is how close together the vertices are
- $|\vec{S}_v| = |\vec{V}_{\pi^+} - \vec{V}_{e^-}|$



Distances of Closest Approach

- Making cuts to S_v had no effect on residual standard deviations of fits σ_r

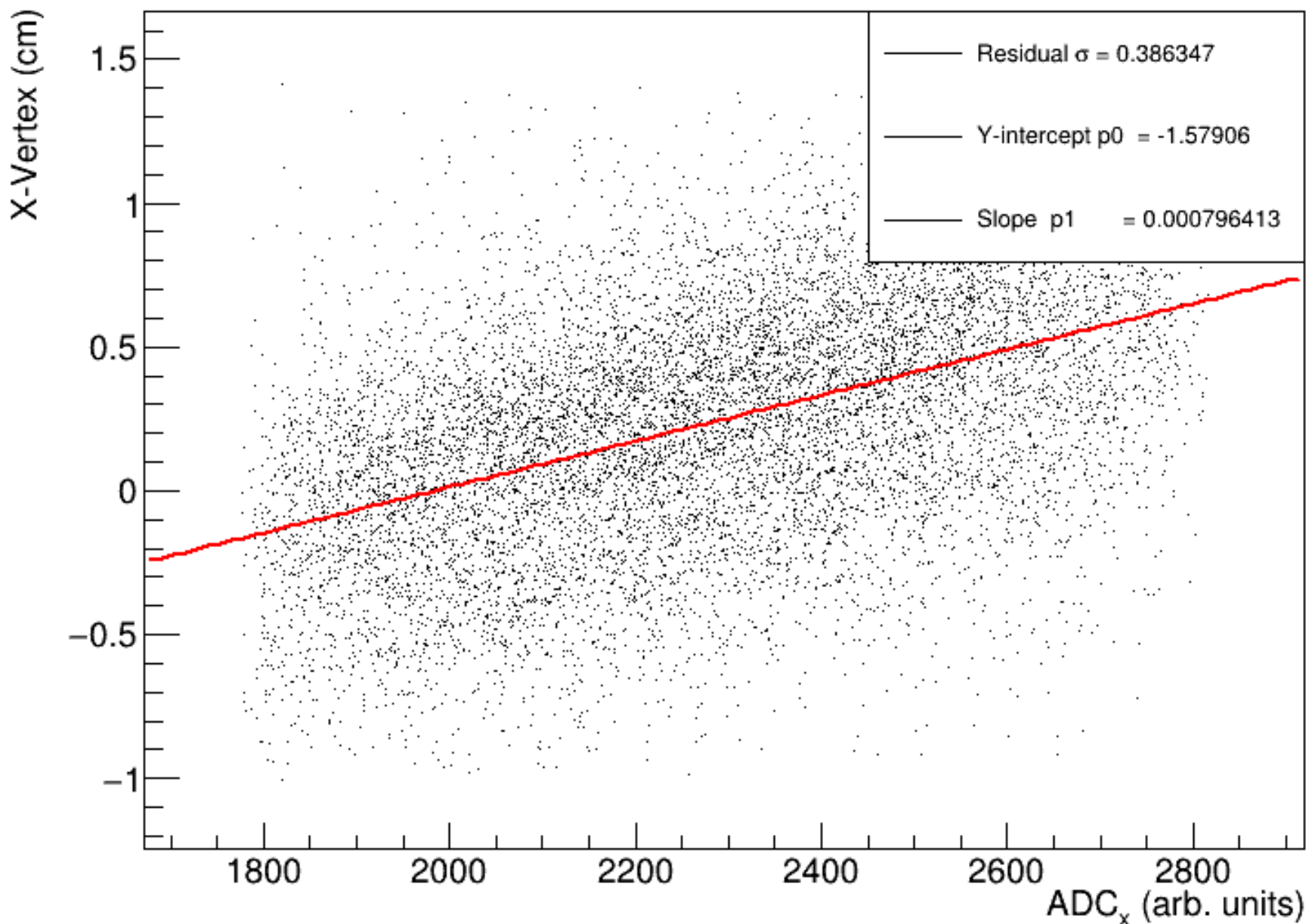


X-Vertex Data			
$\sigma_{residual}$ (cm)	S_V Cut (cm)	p0 (cm)	p1 (cm)
0.386347	0.1	-1.57906	0.000796
0.386475	0.2	-1.58222	0.000799
0.386391	0.3	-1.57078	0.000794
0.386307	0.4	-1.56995	0.000792
0.386172	0.5	-1.56301	0.000788
0.386052	0.6	-1.55362	0.000783
0.385942	0.7	-1.53459	0.000773
0.385878	0.8	-1.52078	0.000766
0.385839	0.9	-1.49978	0.000756
0.385826	1	-1.48093	0.000747
0.385826	none	-1.47983	0.000746

Y-Vertex Data			
$\sigma_{residual}$ (cm)	S_V Cut (cm)	p0 (cm)	p1 (cm)
0.384244	0.1	2.07258	-0.00092
0.384105	0.2	2.03349	-0.0009
0.383797	0.3	2.02435	-0.00089
0.383669	0.4	2.02605	-0.00089
0.383358	0.5	2.01362	-0.00089
0.383015	0.6	1.99278	-0.00088
0.382747	0.7	1.96934	-0.00087
0.382552	0.8	1.94342	-0.00086
0.382437	0.9	1.91517	-0.00085
0.382402	1	1.8917	-0.00084
0.382401	none	1.89071	-0.00084

- Same residual of ~0.38cm
- p0, p1 variances shift values of x-vert. by **0.1mm to 0.4mm**, y-vert. by **0.1mm to 0.8mm**
- 95% confidence band is ~0.77cm, roughly 1/3 of target diameter...
- Probably not precise enough?

X-Vertex vs. ADC_x for $S_V < 0.1$ cm



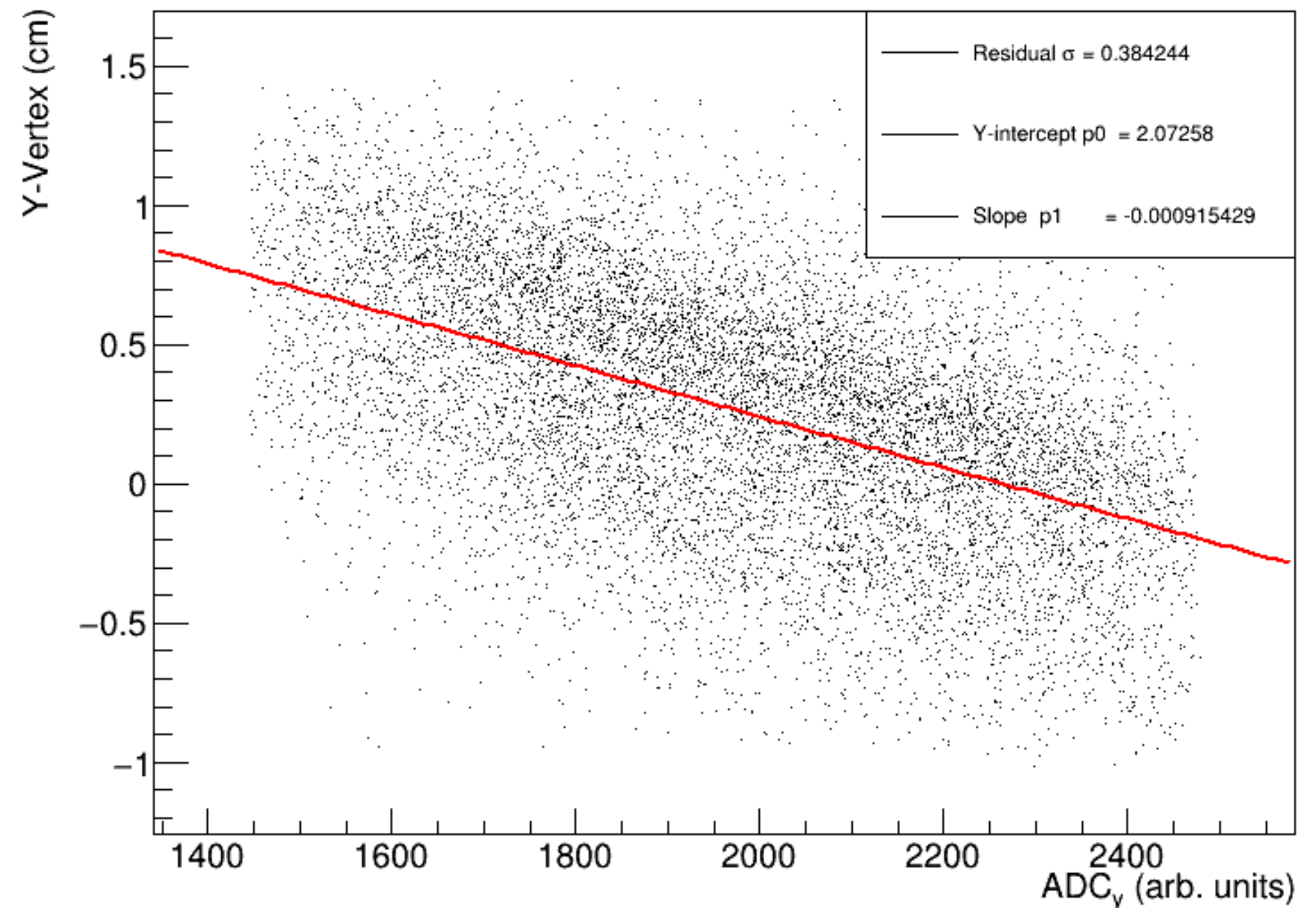
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.580 + 0.000796 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.1$ cm



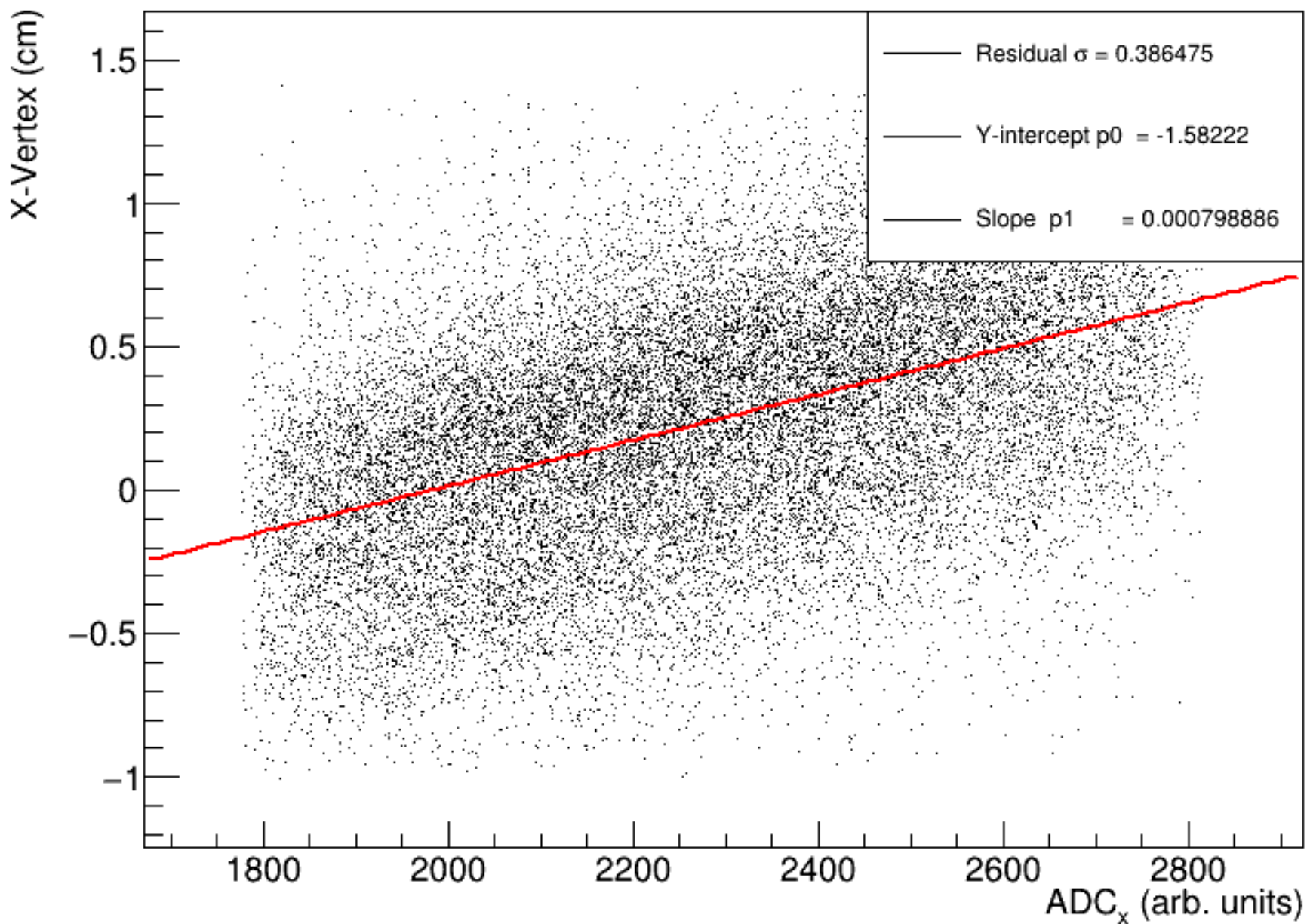
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 2.073 - 0.000915 * ADC_y$

Residual $\sigma = 0.384$

X-Vertex vs. ADC_x for $S_V < 0.2$ cm



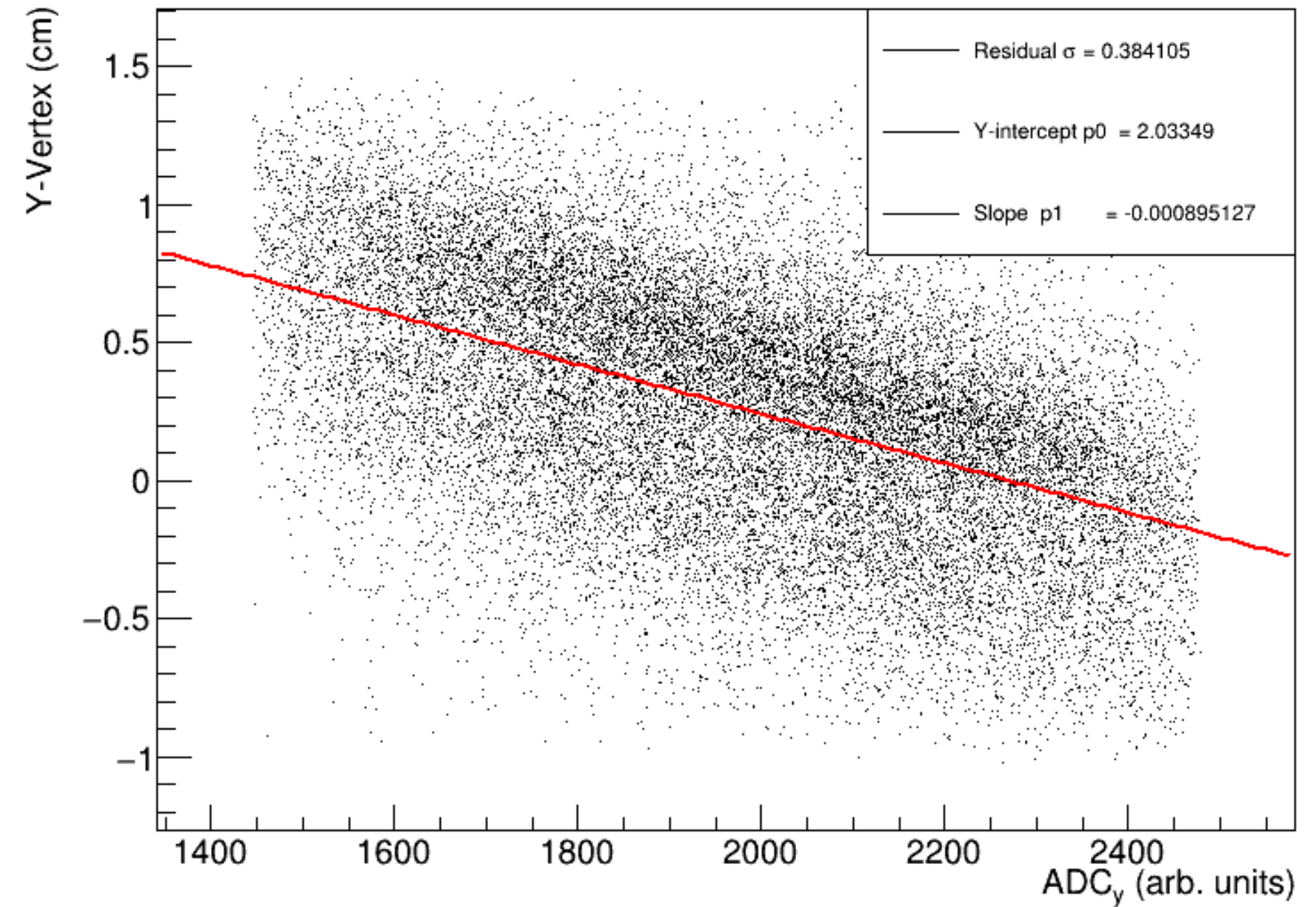
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.582 + 0.000799 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.2$ cm



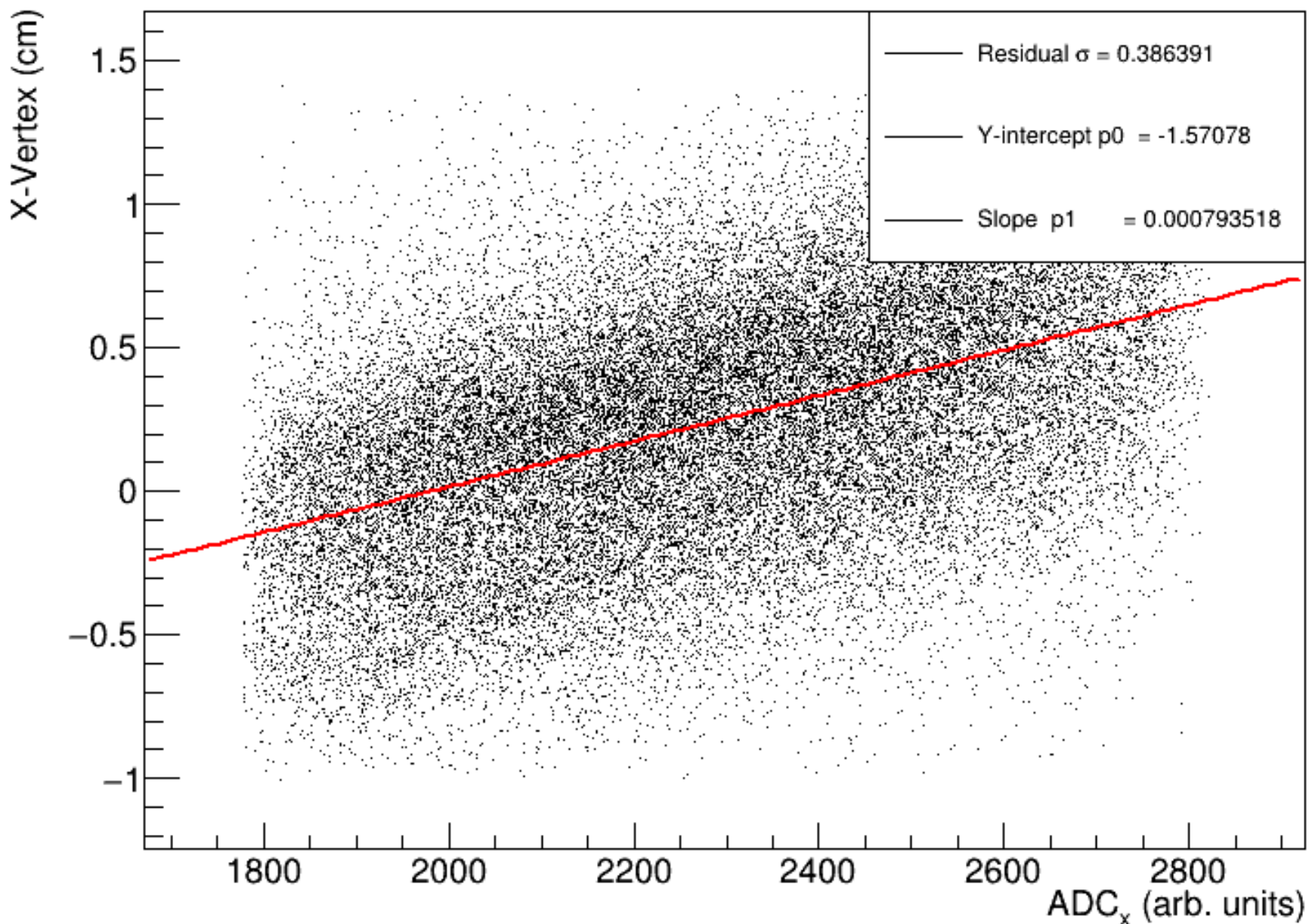
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 2.033 - 0.000895 * ADC_y$

Residual $\sigma = 0.384$

X-Vertex vs. ADC_x for $S_V < 0.3$ cm



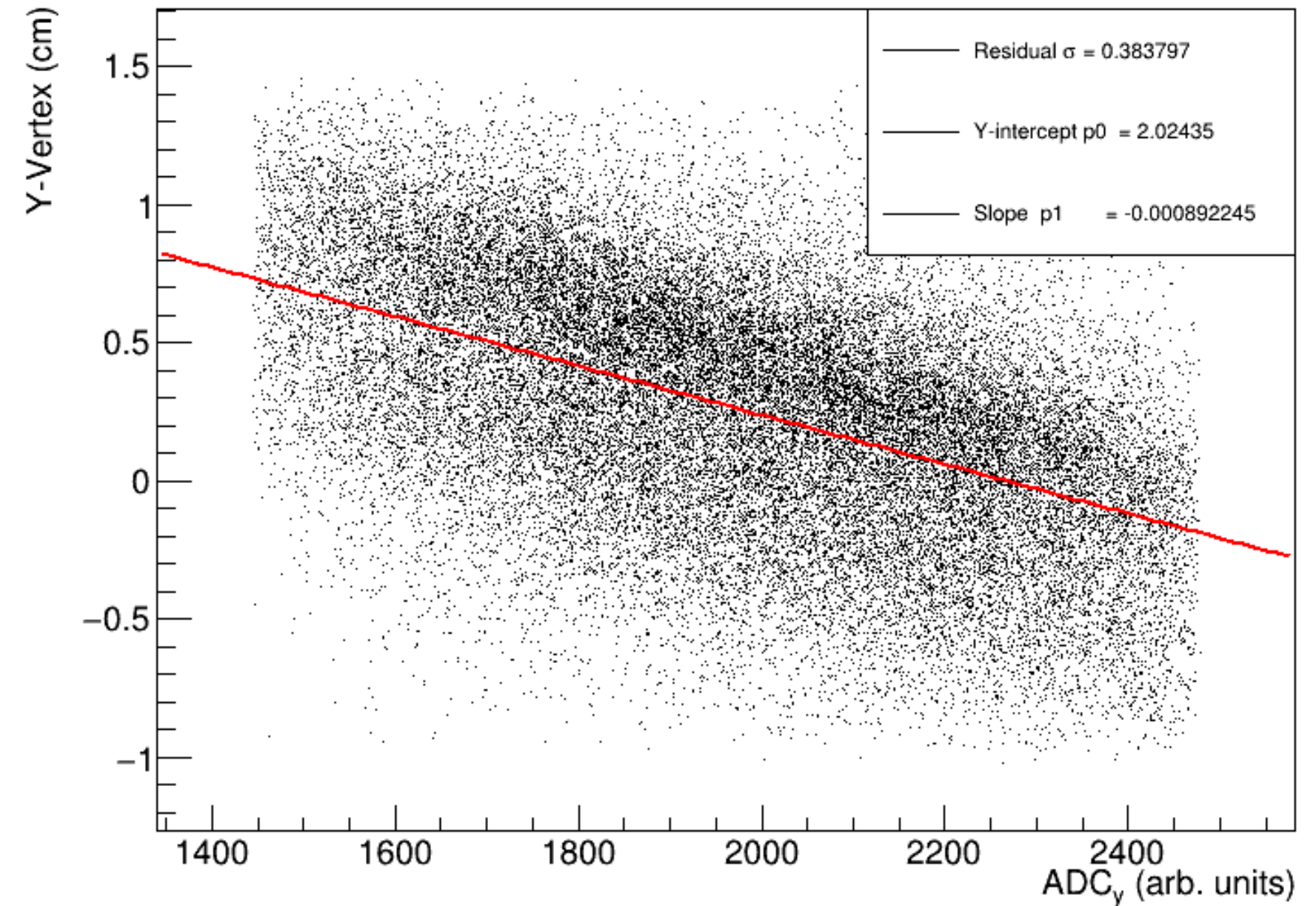
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.571 + 0.000794 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.3$ cm



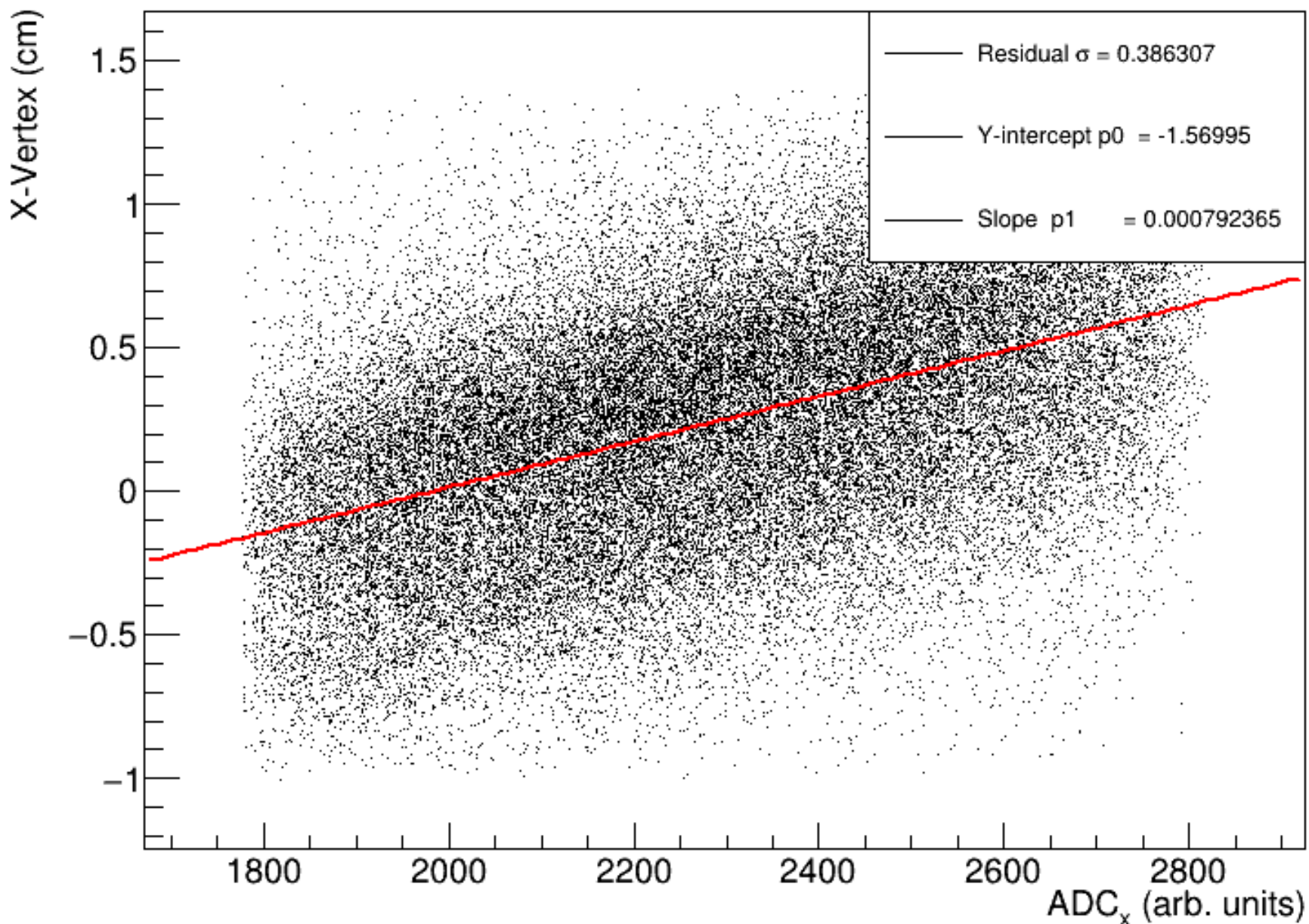
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 2.024 - 0.000892 * ADC_y$

Residual $\sigma = 0.384$

X-Vertex vs. ADC_x for $S_V < 0.4$ cm



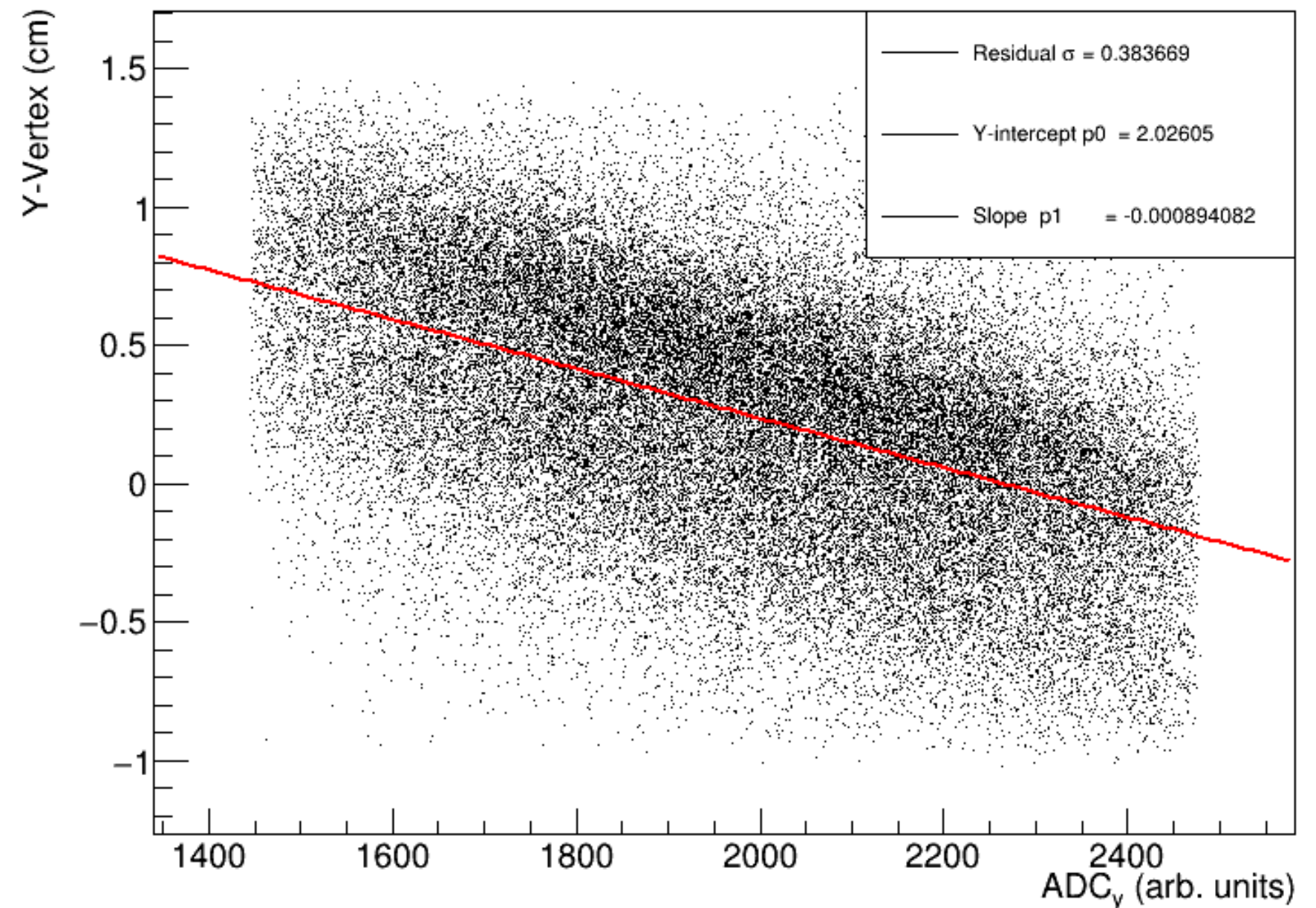
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.570 + 0.000792 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.4$ cm



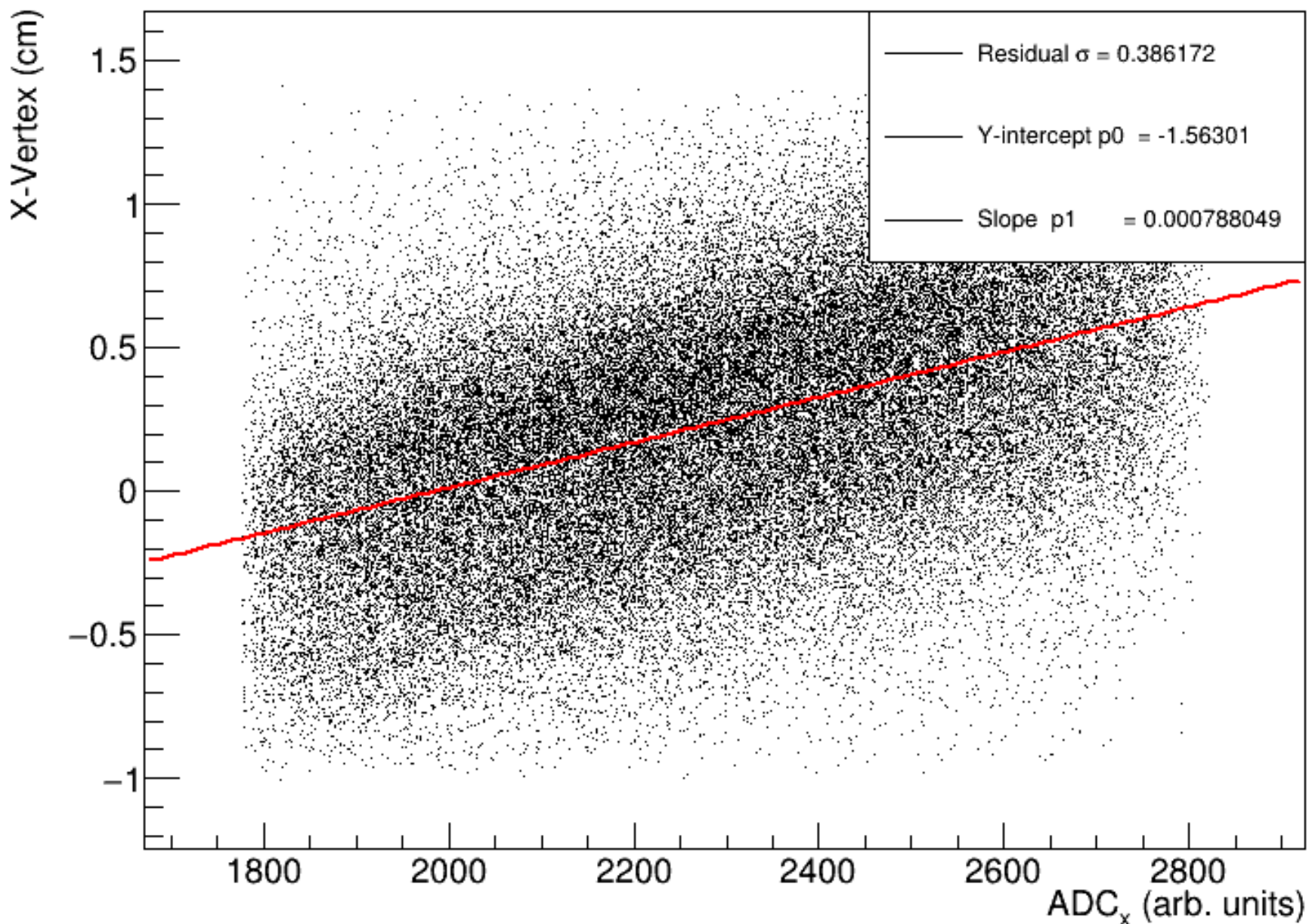
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 2.026 - 0.000894 * ADC_y$

Residual $\sigma = 0.384$

X-Vertex vs. ADC_x for $S_V < 0.5$ cm



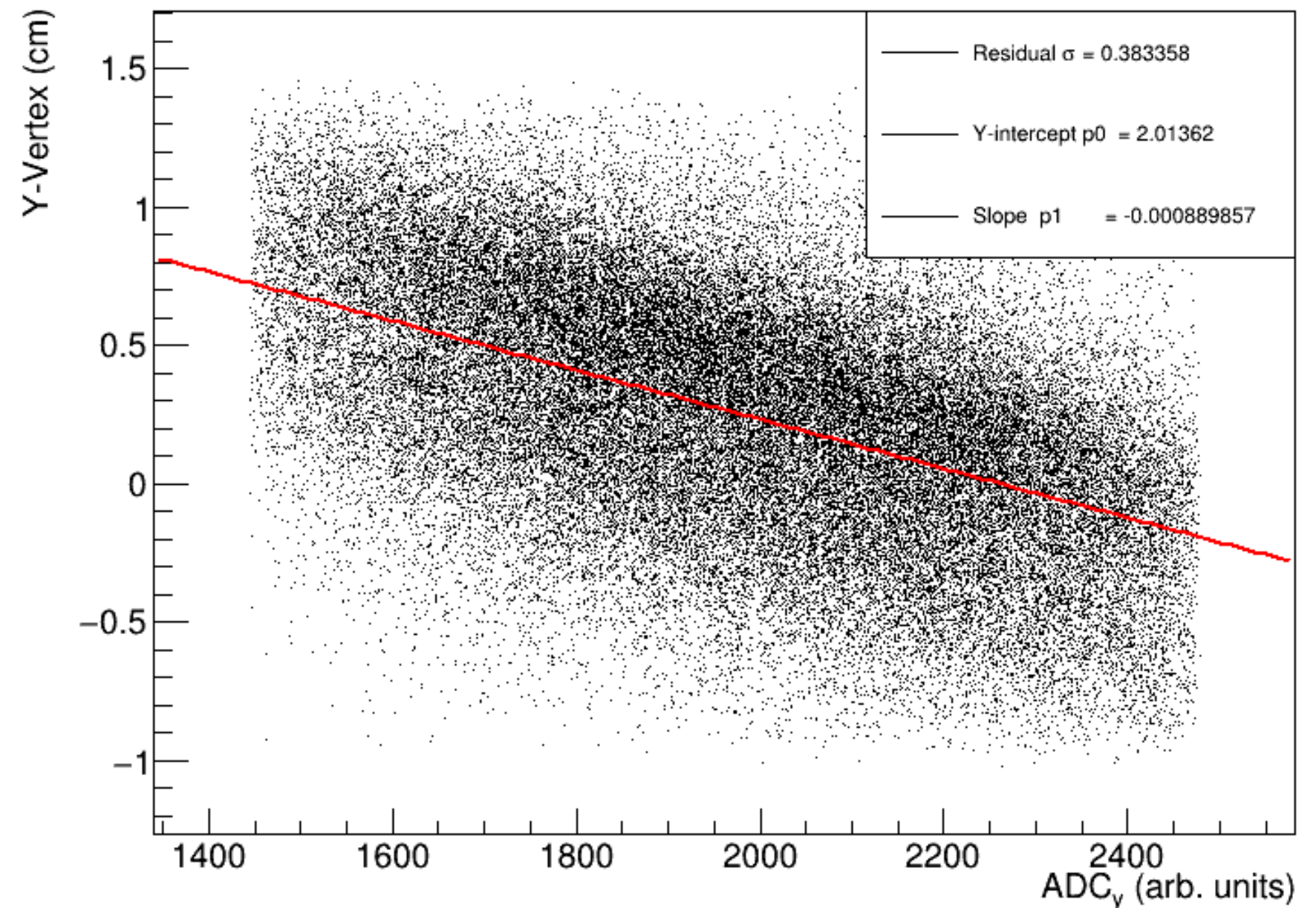
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.563 + 0.000788 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.5$ cm



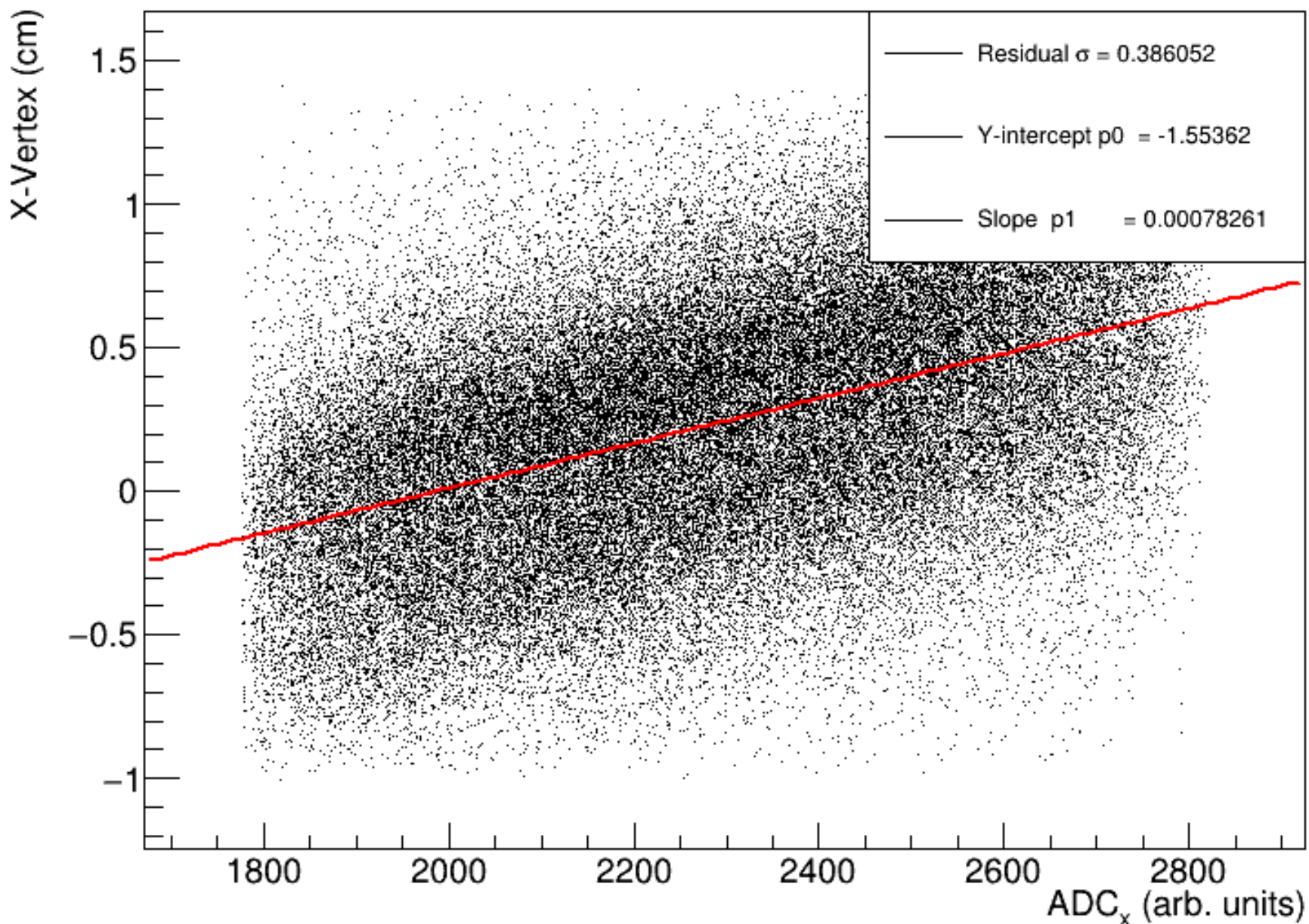
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 2.014 - 0.000890 * ADC_y$

Residual $\sigma = 0.383$

X-Vertex vs. ADC_x for $S_V < 0.6$ cm



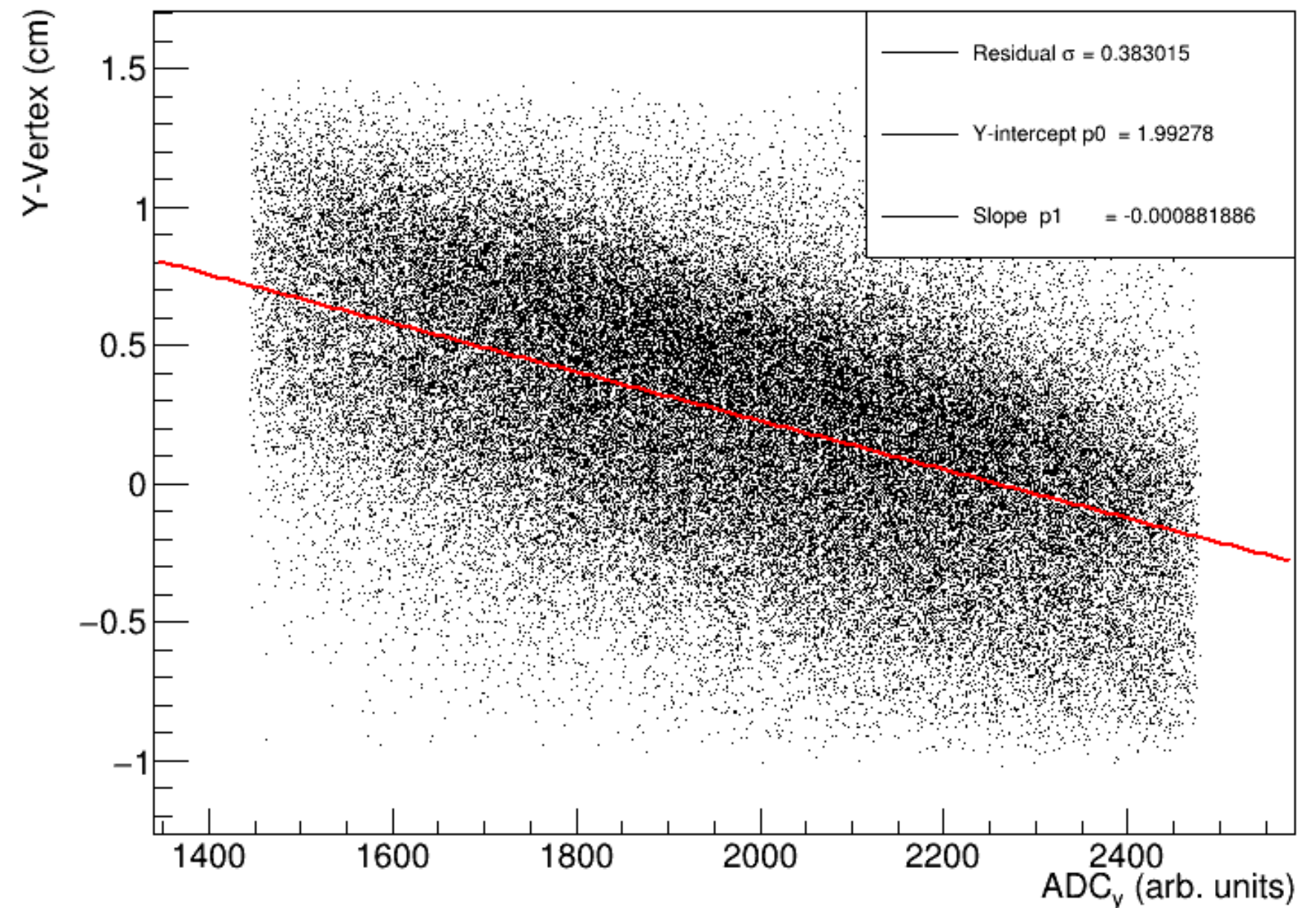
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.554 + 0.000783 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.6$ cm



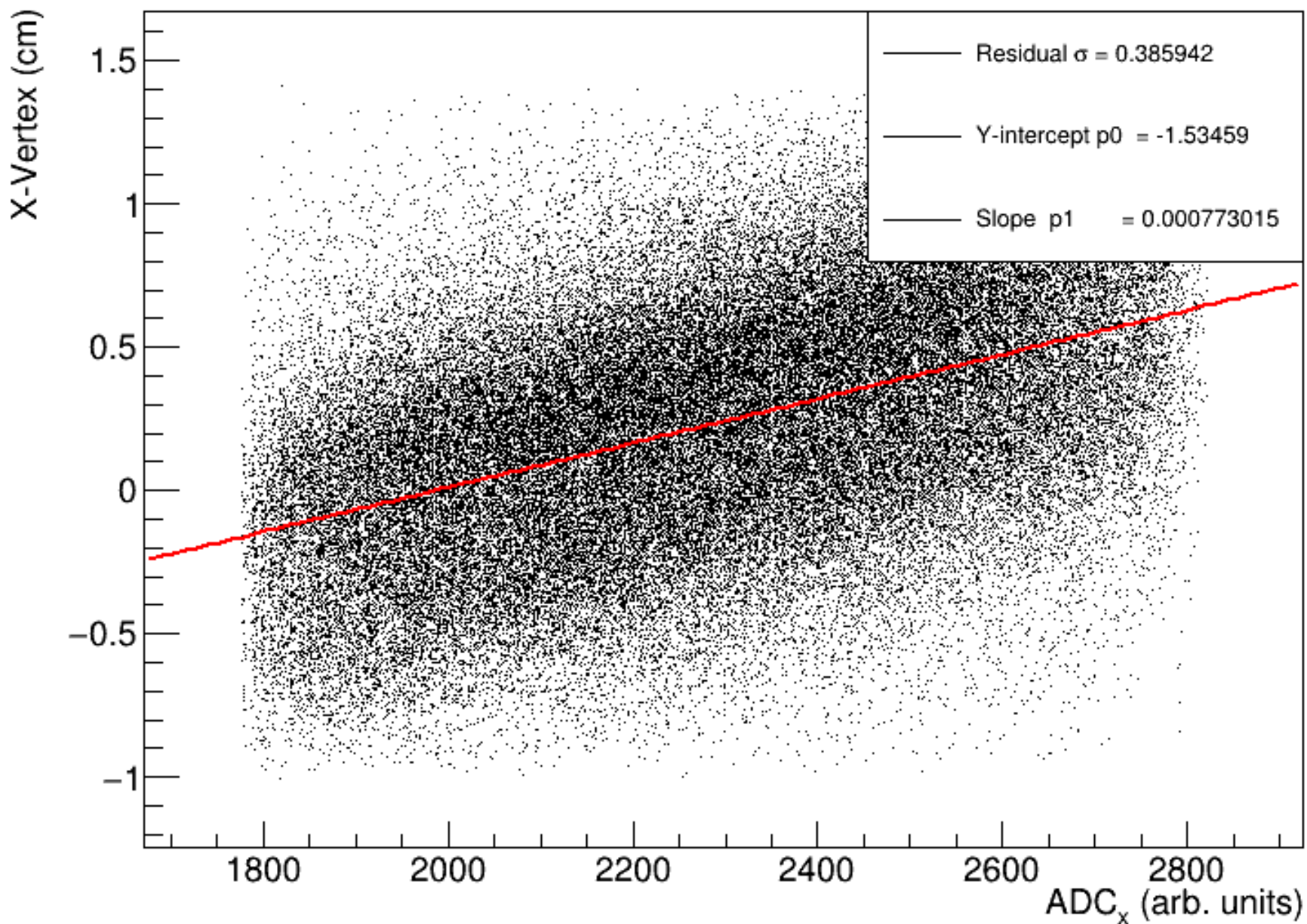
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.993 - 0.000882 * ADC_y$

Residual $\sigma = 0.383$

X-Vertex vs. ADC_x for $S_V < 0.7$ cm



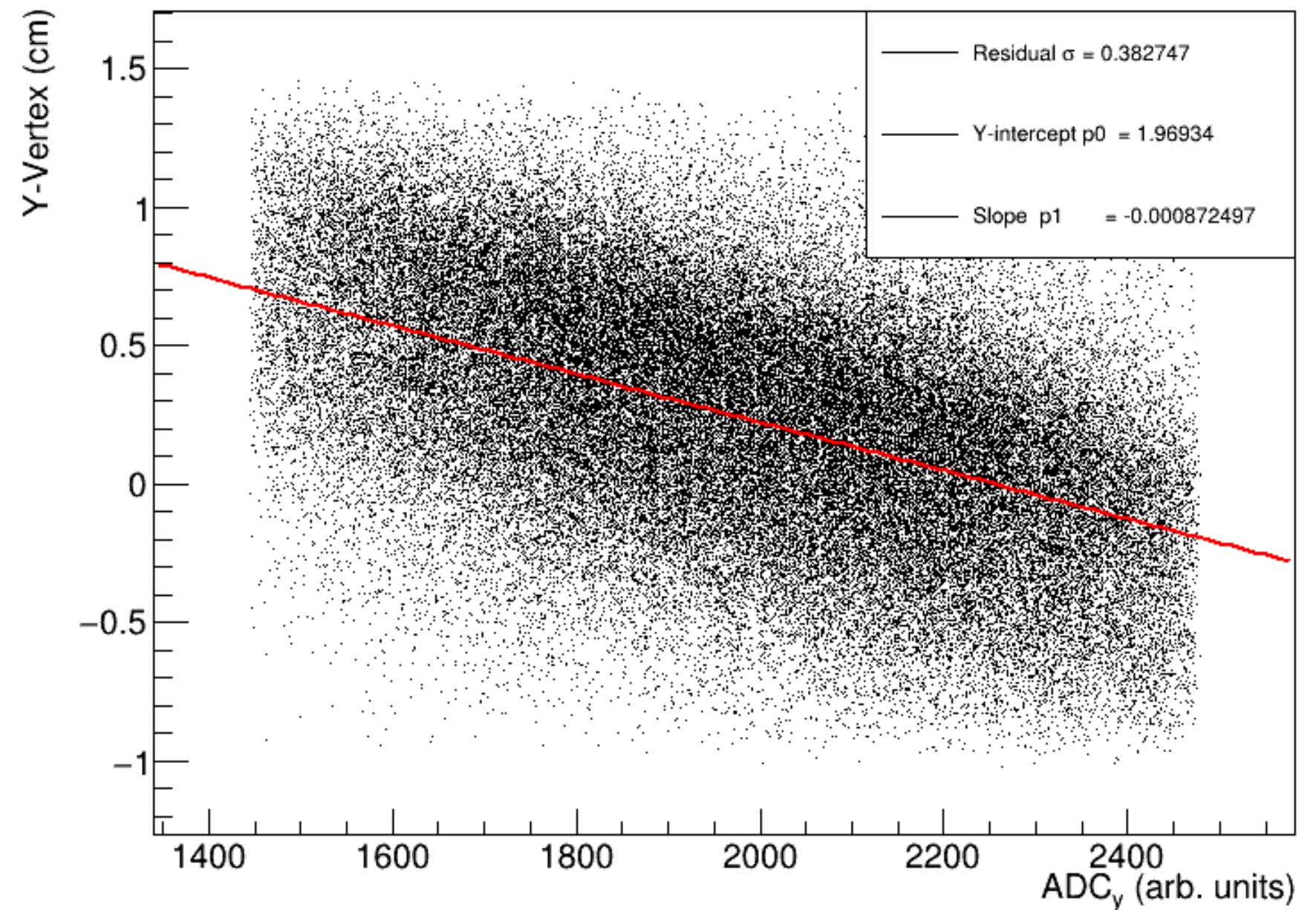
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.535 + 0.000773 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.7$ cm



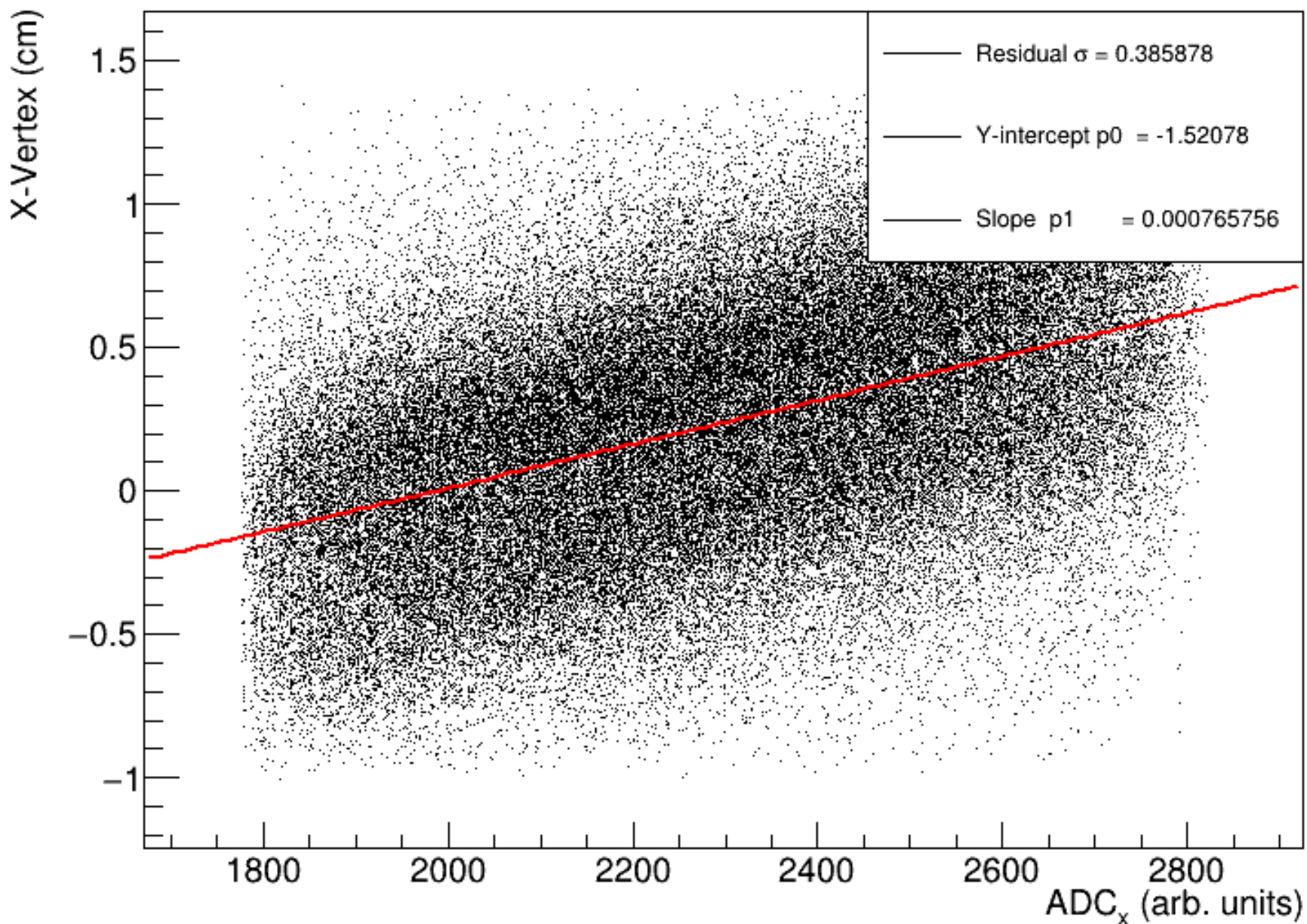
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.969 - 0.000872 * ADC_y$

Residual $\sigma = 0.383$

X-Vertex vs. ADC_x for $S_V < 0.8$ cm



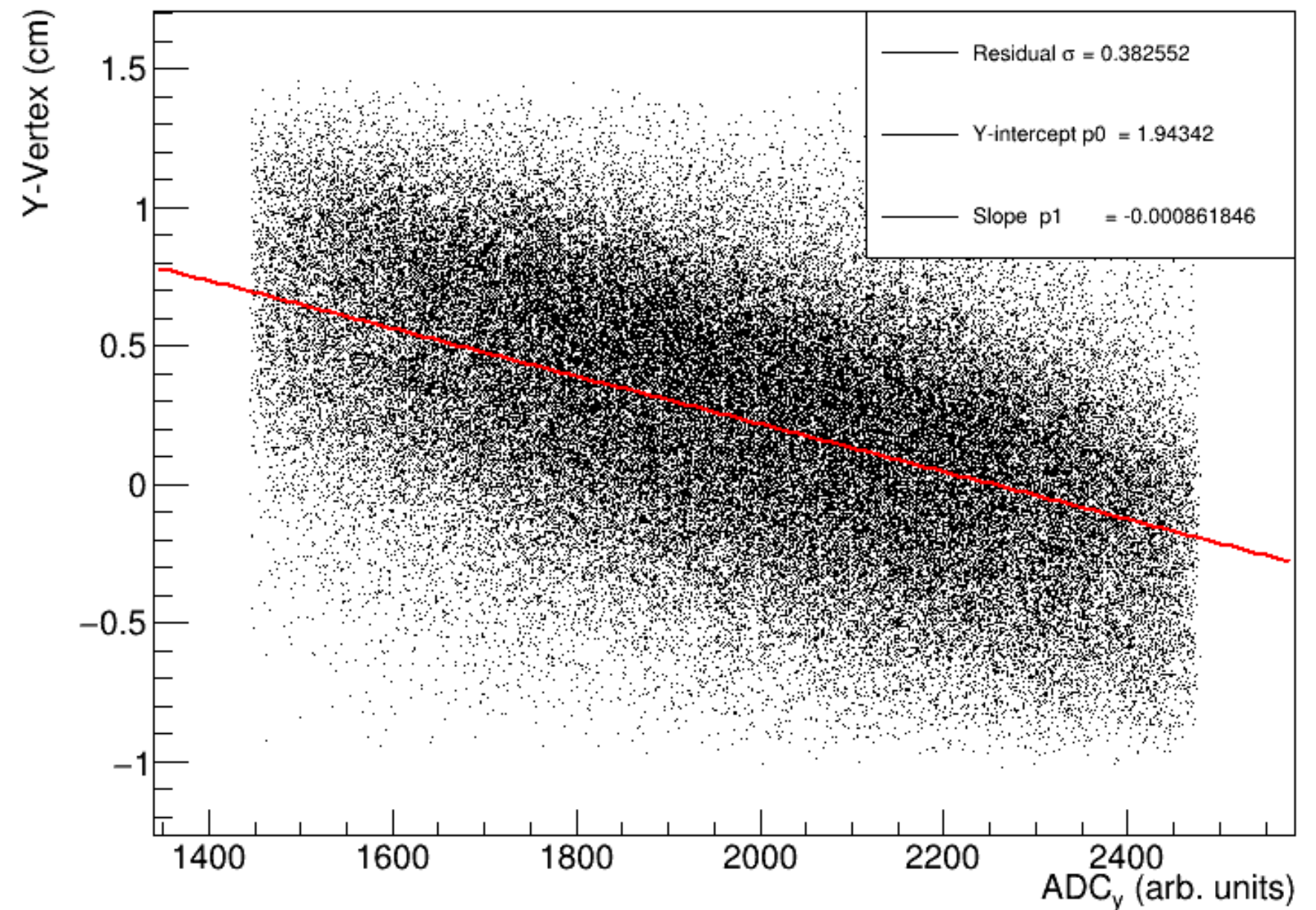
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.521 + 0.000766 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.8$ cm



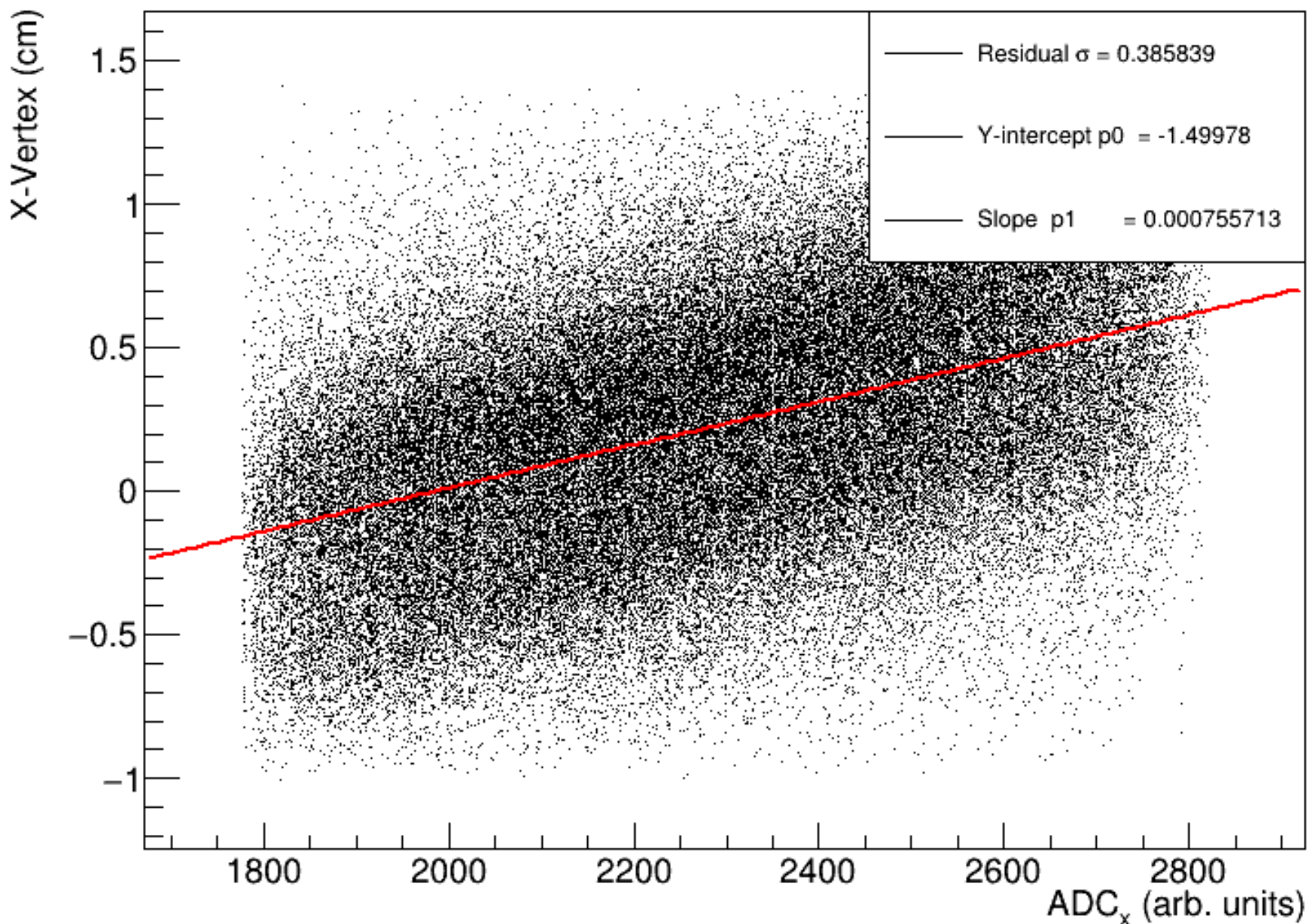
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.943 - 0.000862 * ADC_y$

Residual $\sigma = 0.383$

X-Vertex vs. ADC_x for $S_V < 0.9$ cm



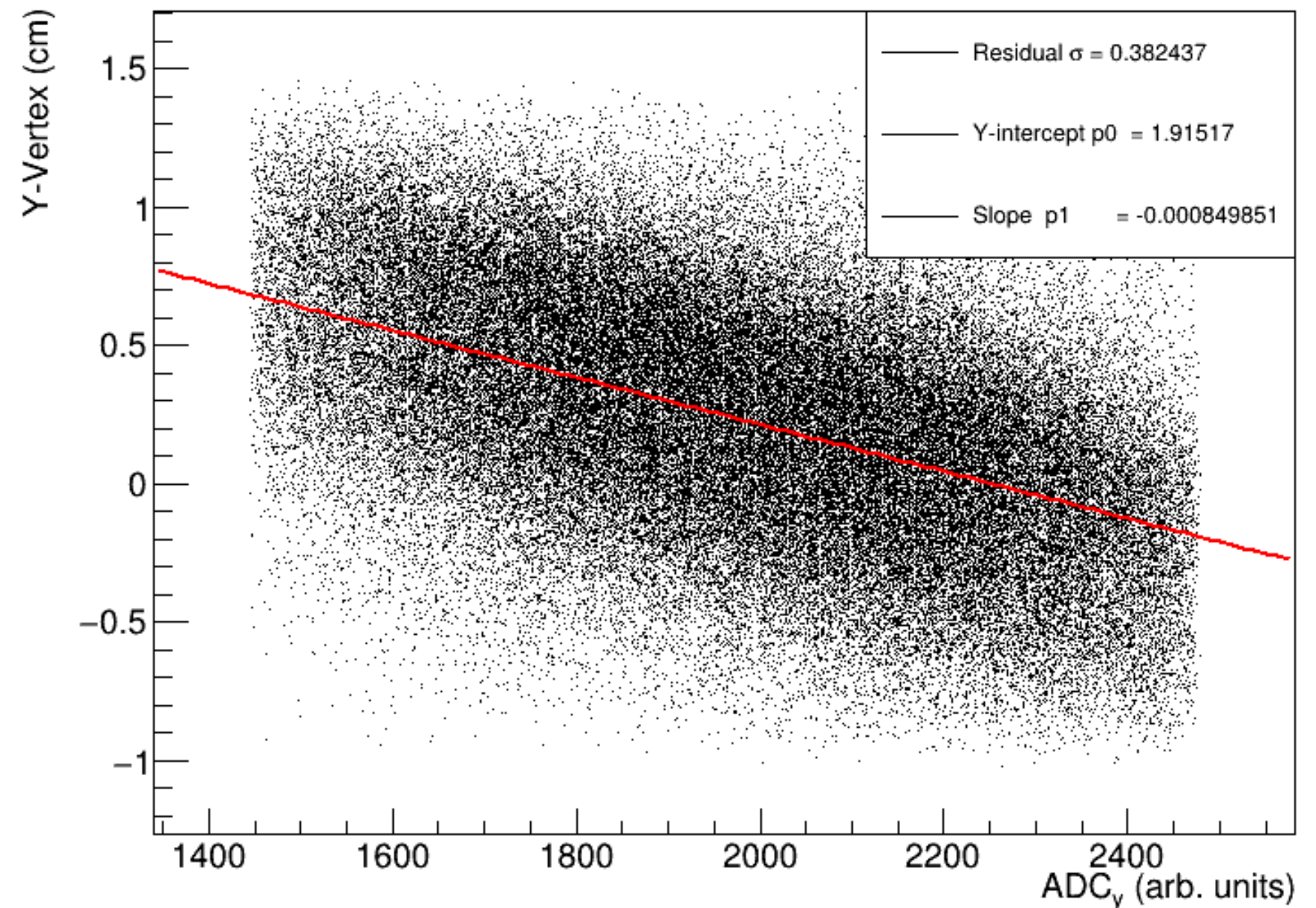
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.500 + 0.000756 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 0.9$ cm



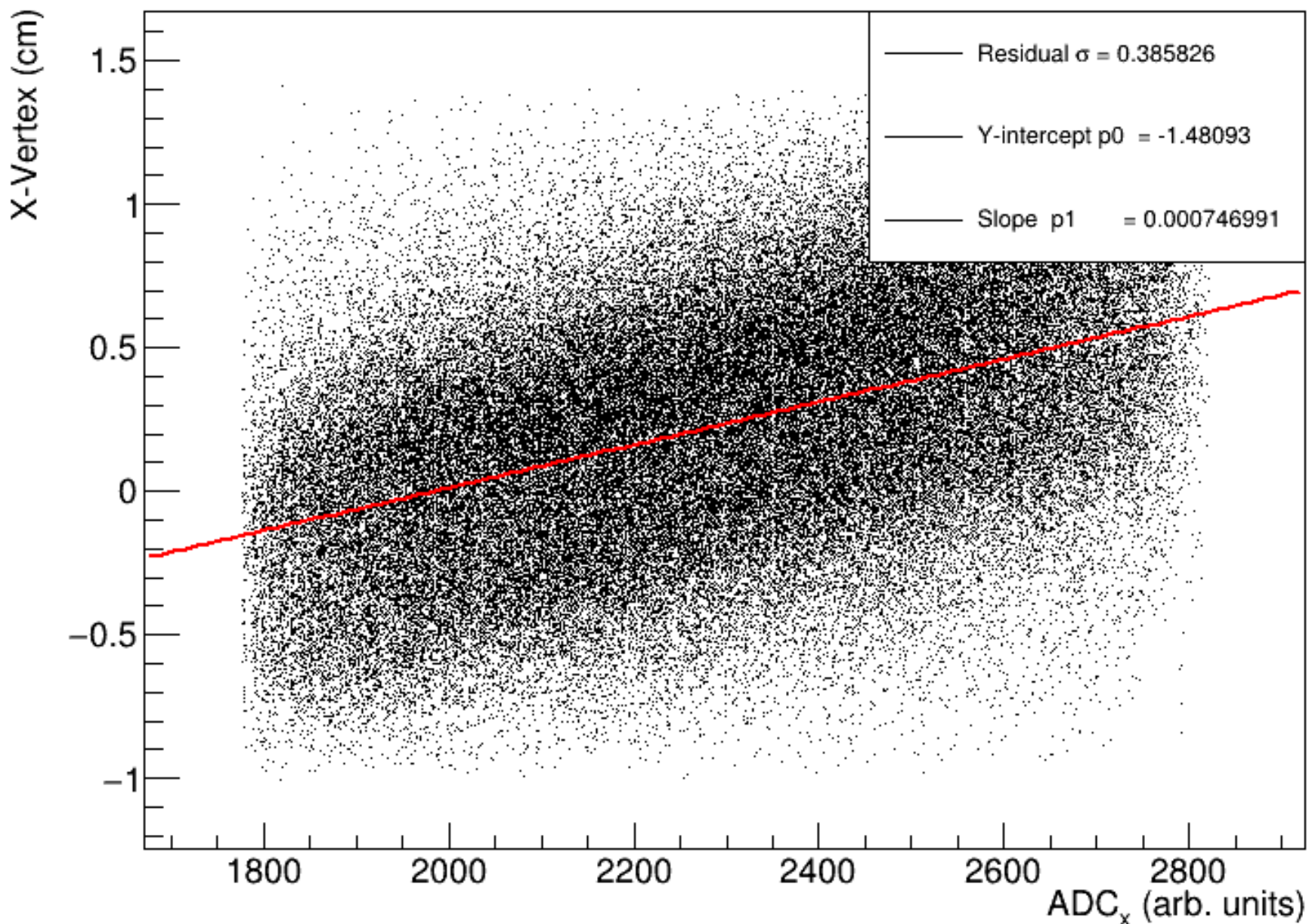
Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.915 - 0.000850 * ADC_y$

Residual $\sigma = 0.382$

X-Vertex vs. ADC_x for $S_V < 1$ cm



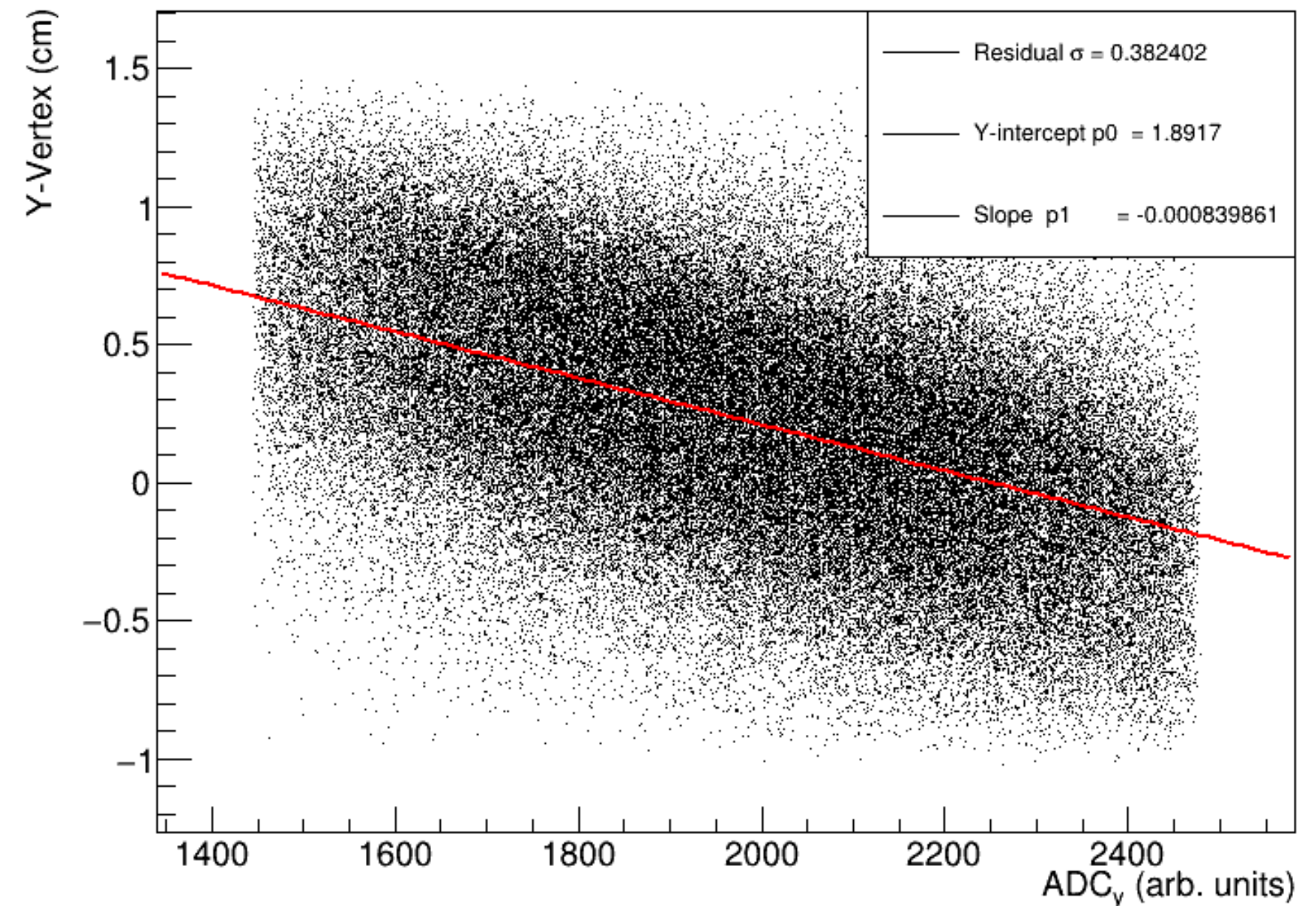
X-Vertex Data

CCDB Fit: $V_x = -2.139 + 0.001004 * ADC_x$

My Fit: $V_x = -1.481 + 0.000747 * ADC_x$

Residual $\sigma = 0.386$

Y-Vertex vs. ADC_y for $S_V < 1$ cm



Y-Vertex Data

CCDB Fit: $V_y = 2.515 - 0.001162 * ADC_y$

My Fit: $V_y = 1.892 - 0.000840 * ADC_y$

Residual $\sigma = 0.382$