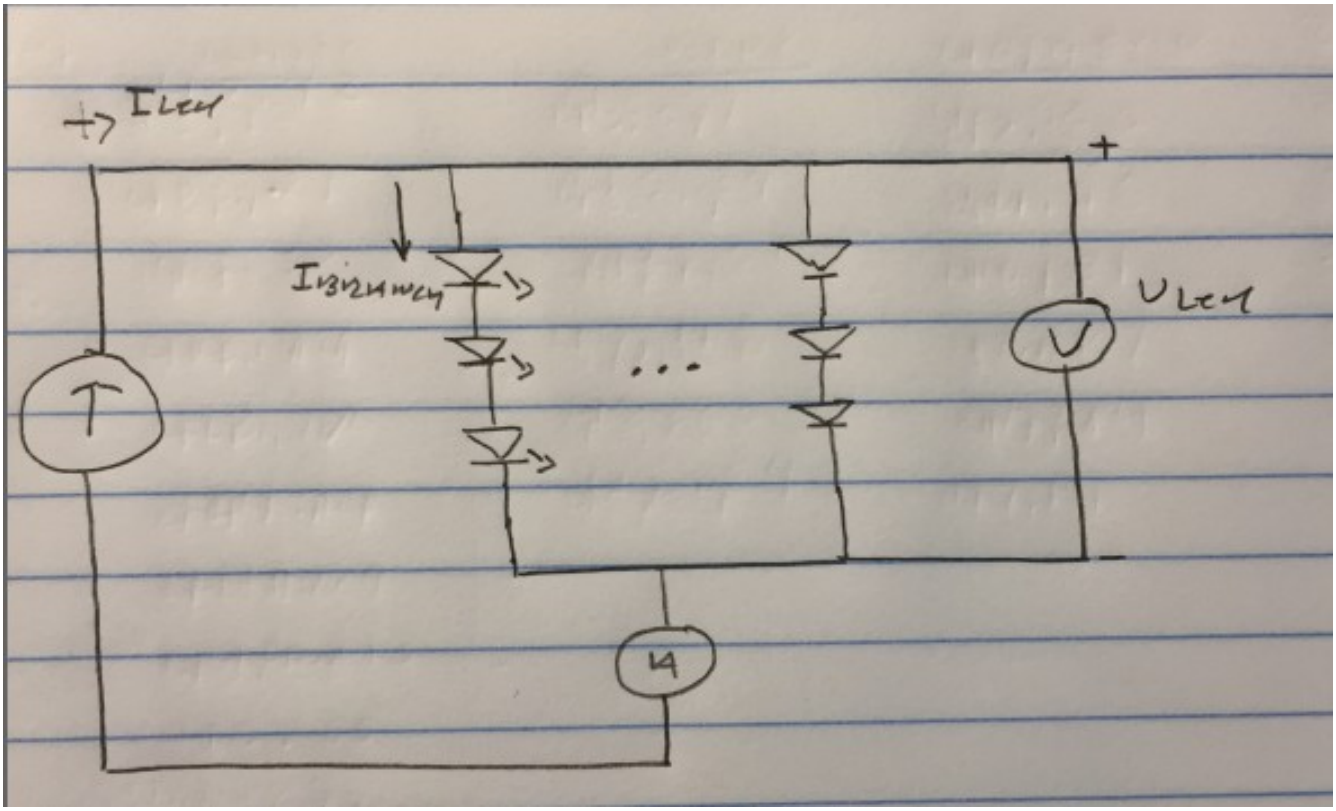
Goal/Objective:

Measure the relationship between LED current and LED voltage for all rail channels and then create curve fits of each.

Given/Draw:



	Parallel LED Branches				
Enclosure	White 1	White 2	Blue	Green	Red
4 Rail	6	6	8	8	8
3 Rail	6	6	6	6	6
5 Rail (Shorty)	6	0	5	5	5

Max Branch Currents:

- White: 1000 mA
- Color: 750 mA

HLG power supplies are linear to 5% and we configure the shunt cutoff for 5.5%.

Assume:

1. The current/voltage relationship for this rail is representative for all rails in the final system

Equations:

N/A

Solve:

A) Calculate Max LED Branch Currents per Enclosure Type

	Total Channel Current (mA)				
	White 1[1]	White 2[1]	Blue[2]	Green[2]	Red[2]
4 Rail	6000	6000	6000	6000	6000
3 Rail	6000	6000	4500	4500	4500
5 Rail (Shorty)[3]	6000	0	3750	3750	3750

NOTES:
1. Each white channel on a rail has a dedicated power supply, thus this number is the channel current on a single rail
2. Each color channel has a single power supply which supplies all color branches in the entire enclosure.
3. The 5 rail enclosure uses half-rails.

B) Calculate Minimum Shunt Cutoff Current

	Minimum Channel Cutoff Current (mA)				
	White 1	White 2	Blue	Green	Red
4 Rail	330.00	330.00	330.00	330.00	330.00
3 Rail	330.00	330.00	247.50	247.50	247.50
5 Rail (Shorty)	330.00	0.00	206.25	206.25	206.25

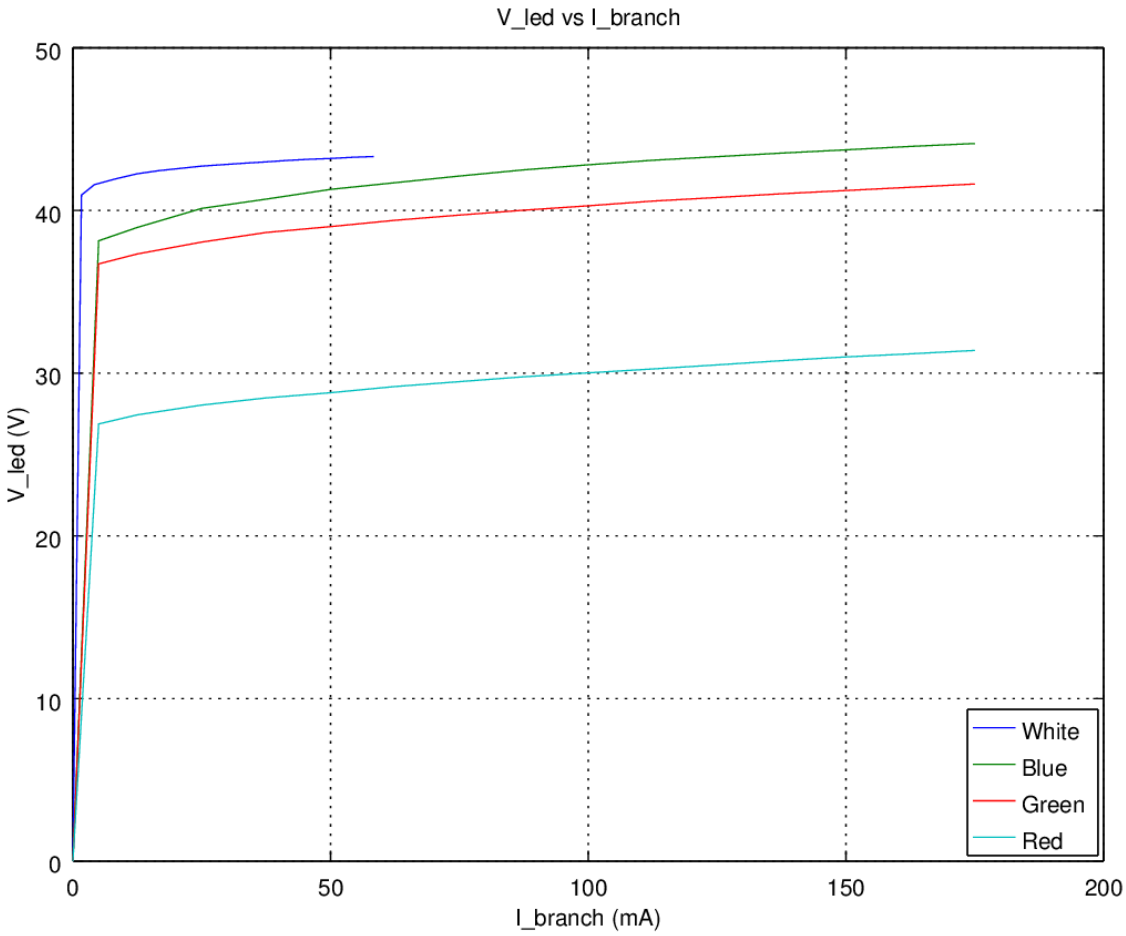
C) Calculate Branch Currents at Shunt Cutoff

	Minimum Branch Cutoff Current (mA)				
	White 1	White 2	Blue	Green	Red
4 Rail	55.00	55.00	41.25	41.25	41.25
3 Rail	55.00	55.00	41.25	41.25	41.25
5 Rail (Shorty)	55.00	0.00	41.25	41.25	41.25

D) Measure LED Current vs LED Voltage

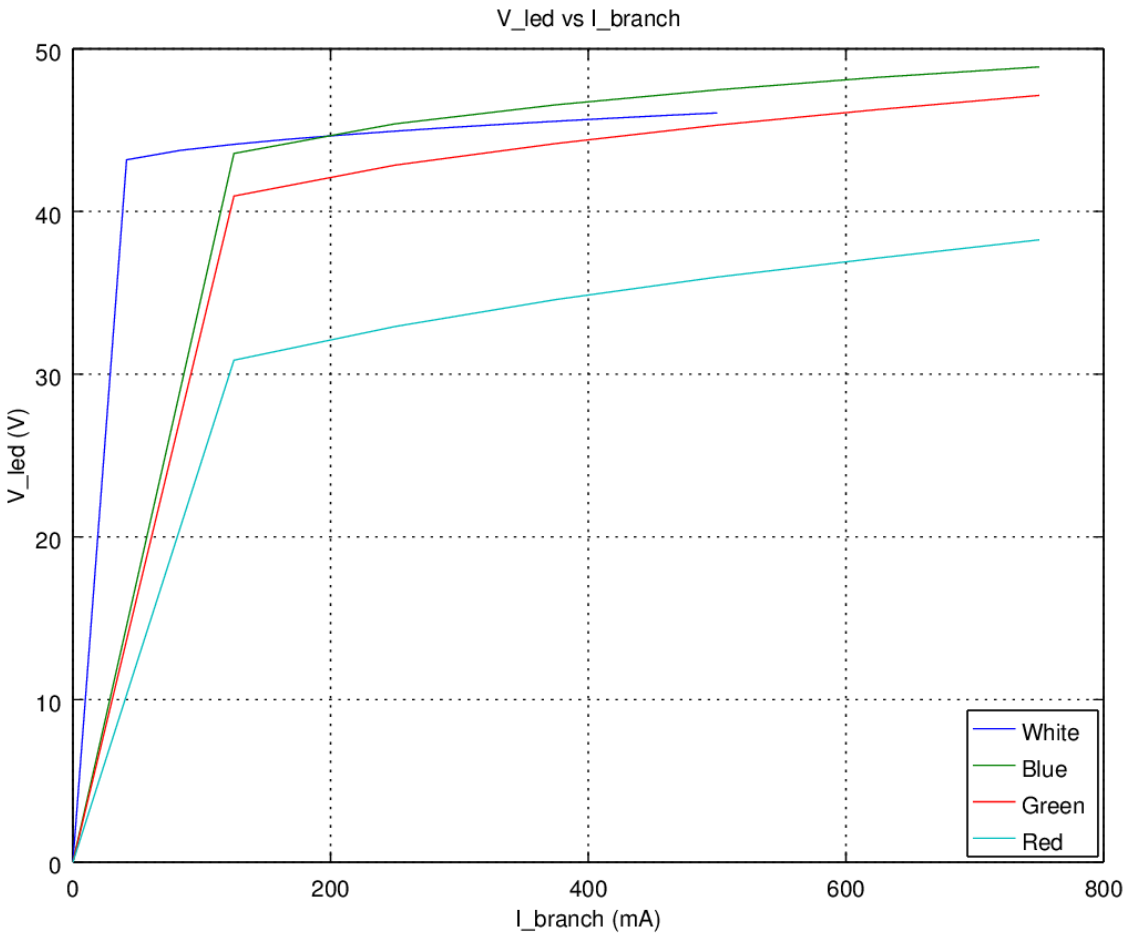
	V_{LED} (V)			
I_{LED} (mA)	White	Blue	Green	Red
0	0.00	0.00	0.00	0.00
10	40.95	38.14	36.72	26.88
25	41.59	38.96	37.33	27.44
50	41.95	40.13	38.06	28.04
75	42.26	40.70	38.65	28.48
100	42.45	41.30	39.01	28.80
125	42.59	41.71	39.40	29.18
150	42.73	42.12	39.72	29.48
175	42.83	42.50	40.02	29.78
200	42.91	42.81	40.29	30.02
225	42.99	43.09	40.58	30.26
250	43.08	43.31	40.80	30.51
275	43.15	43.53	41.03	30.77
300	43.20	43.73	41.23	31.00
325	43.27	43.94	41.43	31.19
350	43.32	44.12	41.63	31.40

Table 1: Low End – High Resolution


V_led vs I_branch
V_led (V)
I_branch (mA)
0
10
20
30
40
50
0
50
100
150
200
White
Blue
Green
Red

	V_{LED} (V)			
I_{LED} (mA)	White	Blue	Green	Red
0	0	0	0	0
250	43.18	43.57	40.95	30.86
500	43.76	45.39	42.85	32.93
750	44.13	46.56	44.18	34.59
1000	44.44	47.48	45.31	35.97
1250	44.70	48.25	46.27	37.14
1500	44.94	48.89	47.14	38.26
1750	45.16	X	X	X
2000	45.36	X	X	X
2250	45.55	X	X	X
2500	45.73	X	X	X
2750	45.90	X	X	X
3000	46.06	X	X	X

Table 2: Full Scale – Low Resolution

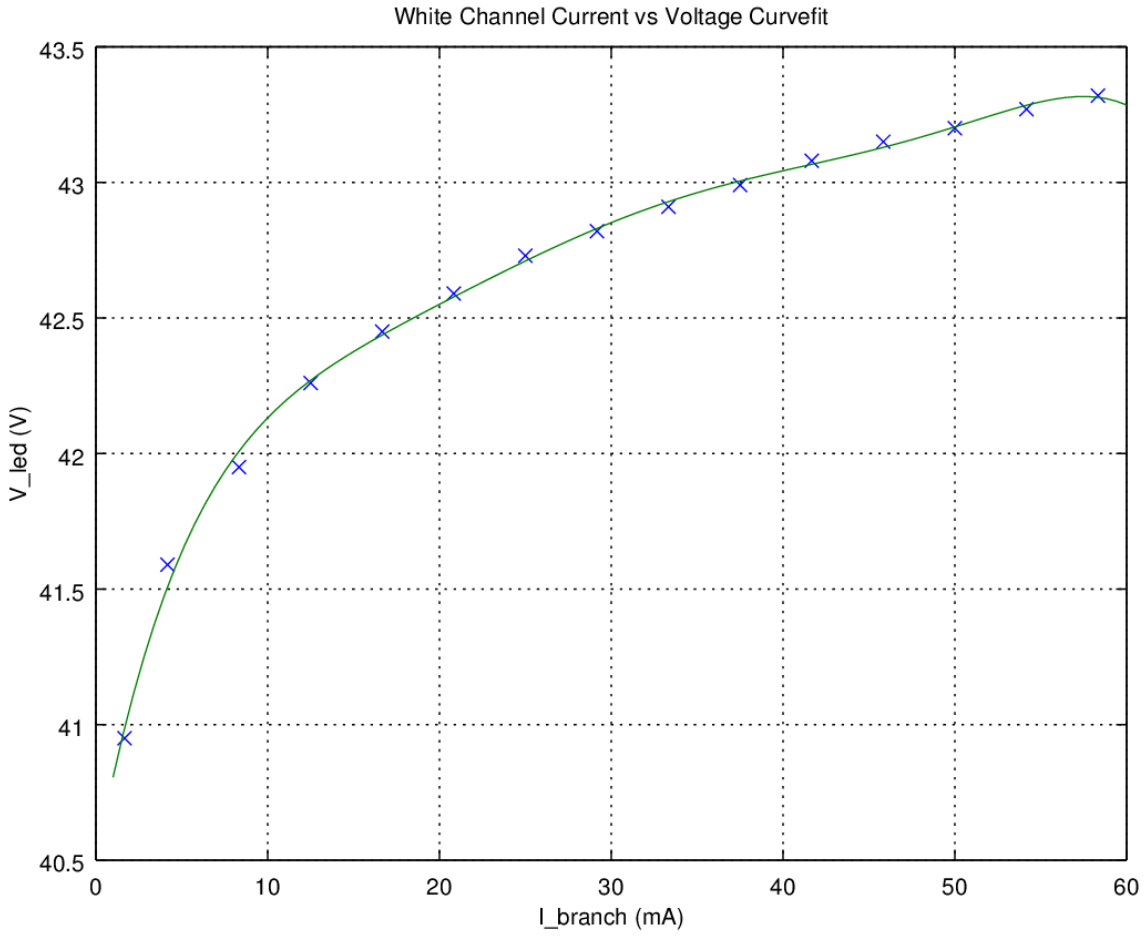

V_led vs I_branch
V_led (V)
I_branch (mA)
0
10
20
30
40
50
0
200
400
600
800
White
Blue
Green
Red

E) Curve fit current and voltage relationships

Solved with Octave (curve_fit_leds.m)

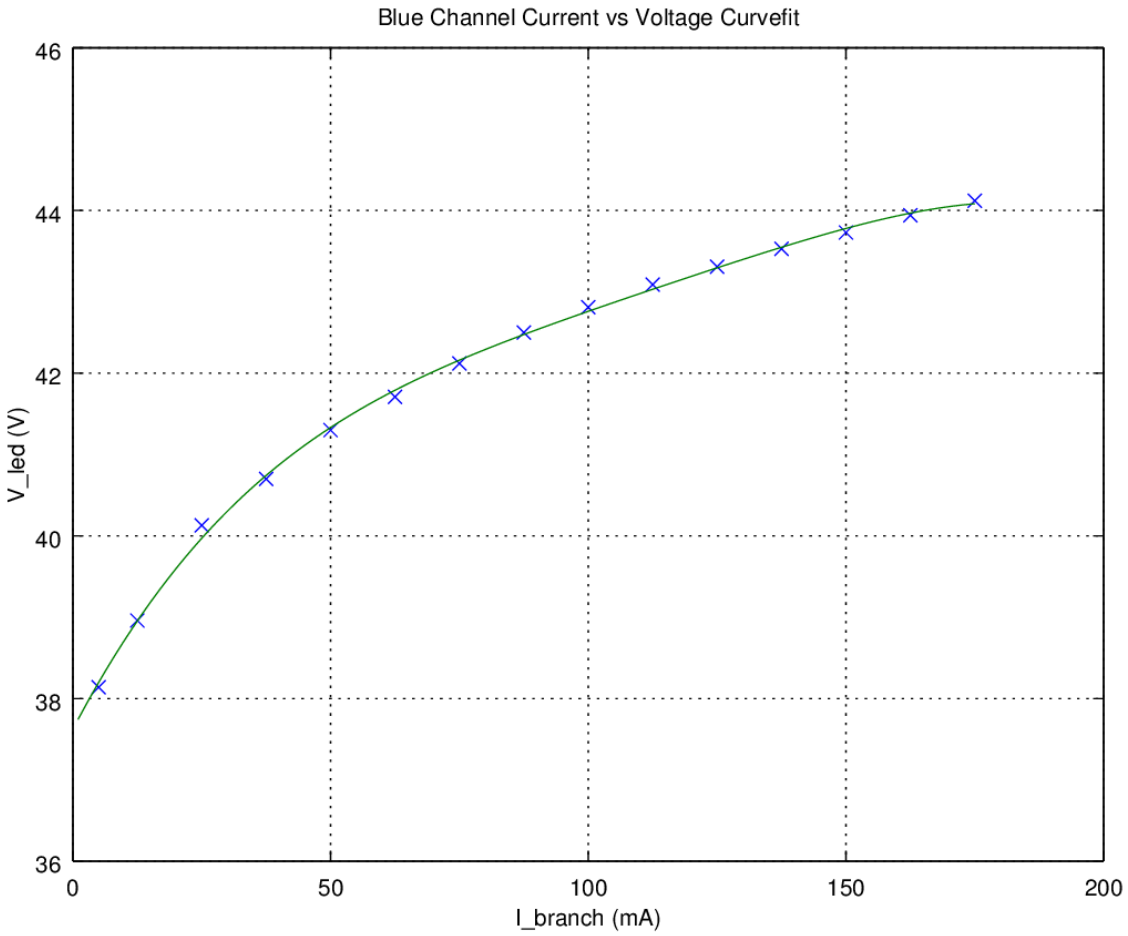
White channel:

$$V_{LED}(V) = -1.8998\,E^{-09}x^6 + 3.8188\,E^{-07}x^5 - 3.0380\,E^{-05}x^4 + 1.2220\,E^{-03}x^3 - 2.6609\,E^{-02}x^2 + 3.3402\,E^{-01}x + 4.0498\,E^{01}$$



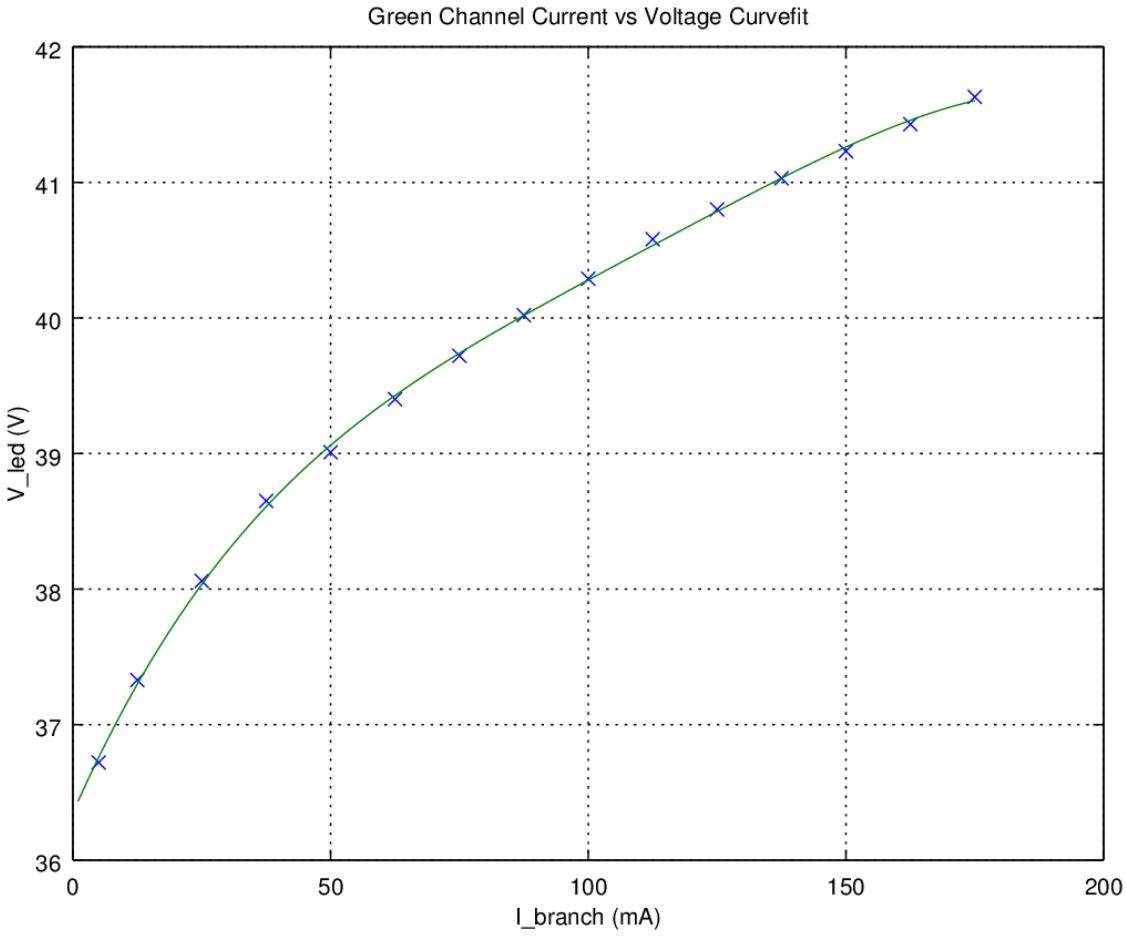
Blue channel:

$$V_{LED}(V) = -1.5501\,E^{-08}x^4 + 7.1433\,E^{-06}x^3 - 1.2562\,E^{-03}x^2 + 1.2106\,E^{-01}x + 3.7624\,E^{01}$$



Green channel:

$$V_{LED}(V) = -1.0977\,E^{-08}x^4 + 4.9623\,E^{-06}x^3 - 8.5031\,E^{-04}x^2 + 8.5673\,E^{-02}x + 3.6351\,E^{01}$$



Red channel:

$$V_{LED}\ (V) = -9.4871\,E^{-09}x^4 + 4.1834\,E^{-06}x^3 - 6.8852\,E^{-04}x^2 + 7.0540\,E^{-02}x + 2.6600\,E^{01}$$