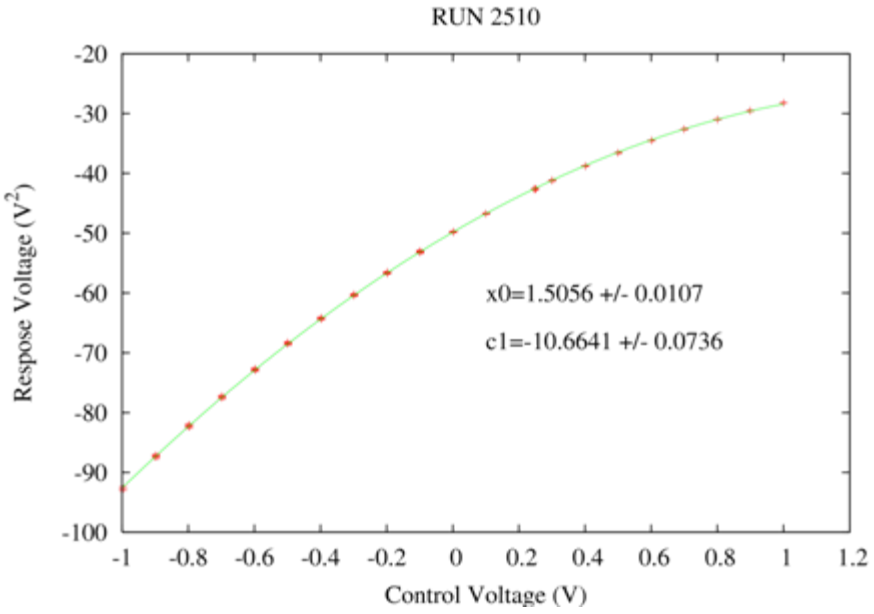
Future Research

- Charge feedback
  - Implications for LIGO and other sensitive experiments where charge noise is limiting factor
  - Noise is proportional to $\sqrt{(1/Q)}$ by
    - $\sqrt{(4kT/\omega Q)}$

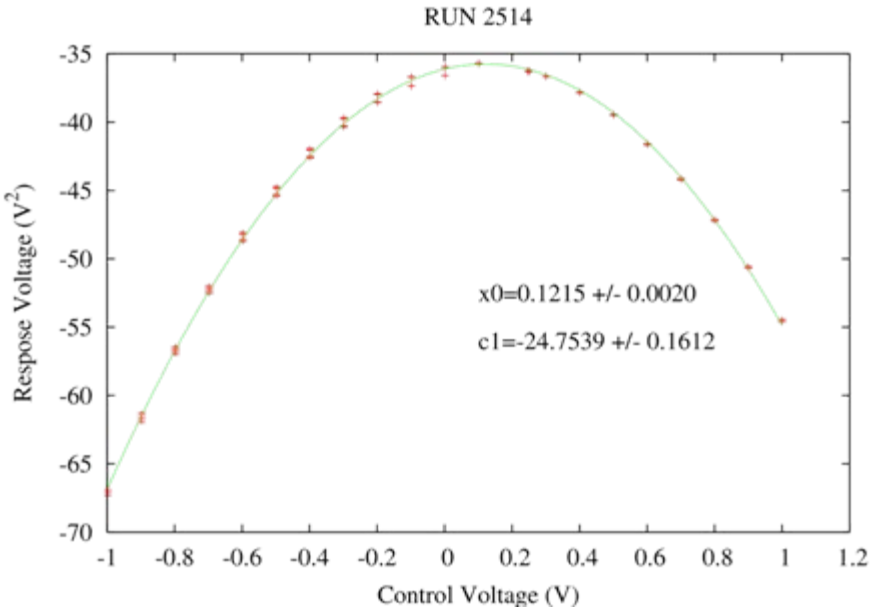
Measuring charge

- Indirectly measured charge on pendulum by measuring the voltage on pendulum
- $Q = VC$
- To measure the voltage of pendulum:
  - Vary the control voltage $V_{control}$ (split copper plates)
  - Plot the $V_{control}$ vs. $V_{response}^2$
  - Voltage on pendulum is the maximum/minimum of the parabola (denoted x0)

Electrode UV LED (UVB) off



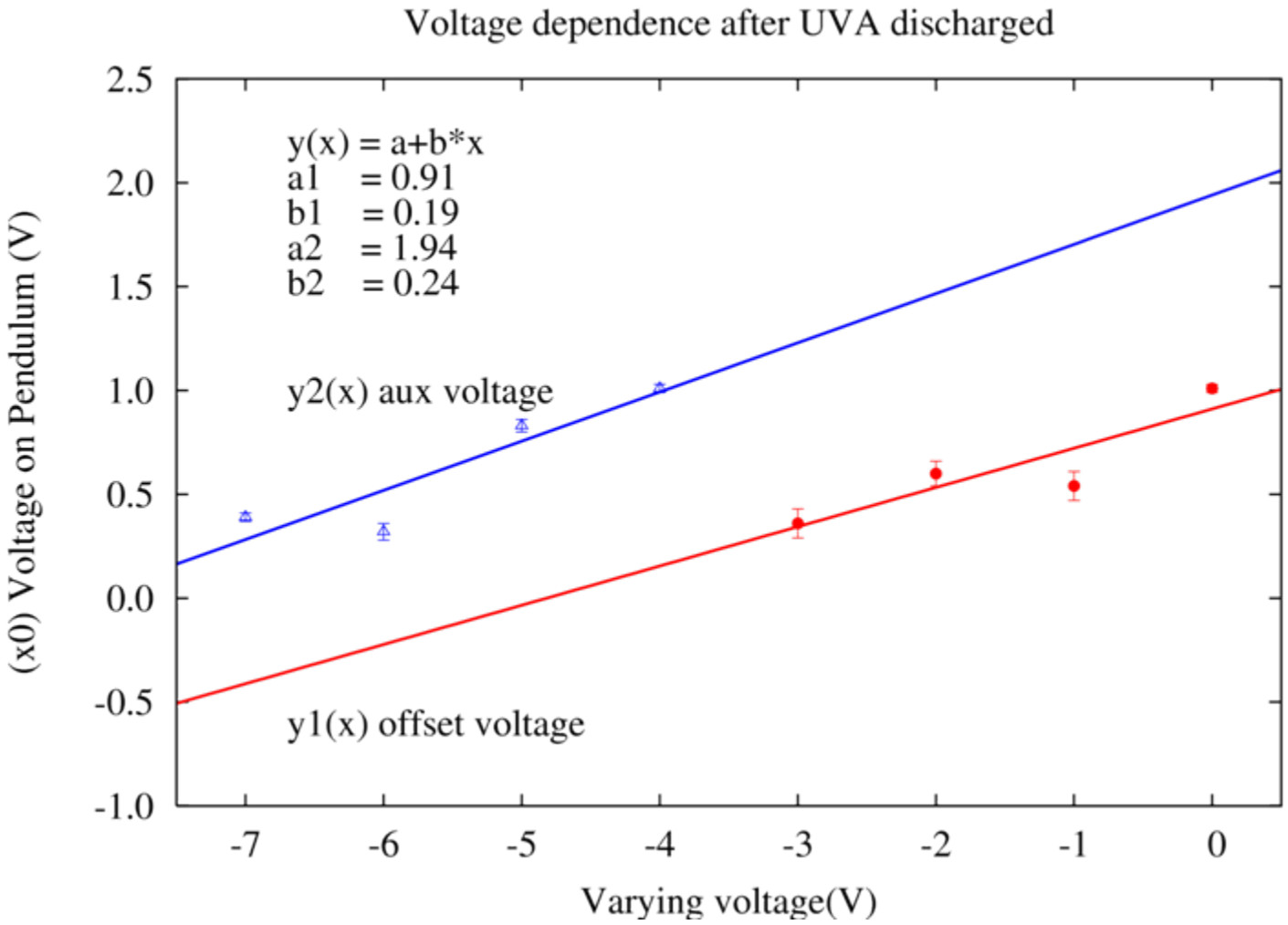
UVB on



•UVB clearly produces a negative effect on pendulum voltage

Summary of pendulum voltage measurement results

Run	Offset electrode (V)	Aux electrode (V)	UVB status	Pendulum voltage x0 (Volts)		
2526	0	-4	off-A	1.01	±	0.02
2525	-1	-4	off-A	0.54	±	0.07
2529	-2	-4	off-A	0.60	±	0.06
2537	-3	-4	off-A	0.36	±	0.07
2527	0	-4	on	0.00	±	0.00
2524	-1	-4	on	-0.23	±	0.01
2528	-2	-4	on	-0.31	±	0.01
2536	-3	-4	on	-0.39	±	0.01
2526	0	-4	off-A	1.01	±	0.02
2530	0	-5	off-A	0.83	±	0.03
2533	0	-6	off-A	0.32	±	0.04
2534	0	-7	off-A	0.39	±	0.02
2527	0	-4	on	0.00	±	0.00
2531	0	-5	on	-0.04	±	0.00
2532	0	-6	on	-0.12	±	0.00
2535	0	-7	on	-0.22	±	0.01


Voltage dependence after UVA discharged
y(x) = a+b*x
a1 = 0.91
b1 = 0.19
a2 = 1.94
b2 = 0.24
y2(x) aux voltage
y1(x) offset voltage
(x0) Voltage on Pendulum (V)
Varying voltage(V)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-7
-6
-5
-4
-3
-2
-1
0

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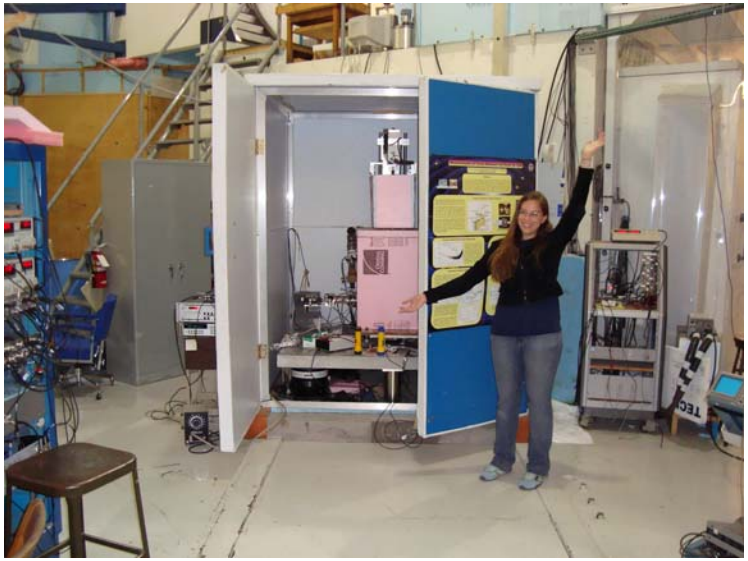
Jens Gundlach

Stephan Schlamminger

Charlie Hagedorn

Gnuplot is the greatest program ever!



Sources

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