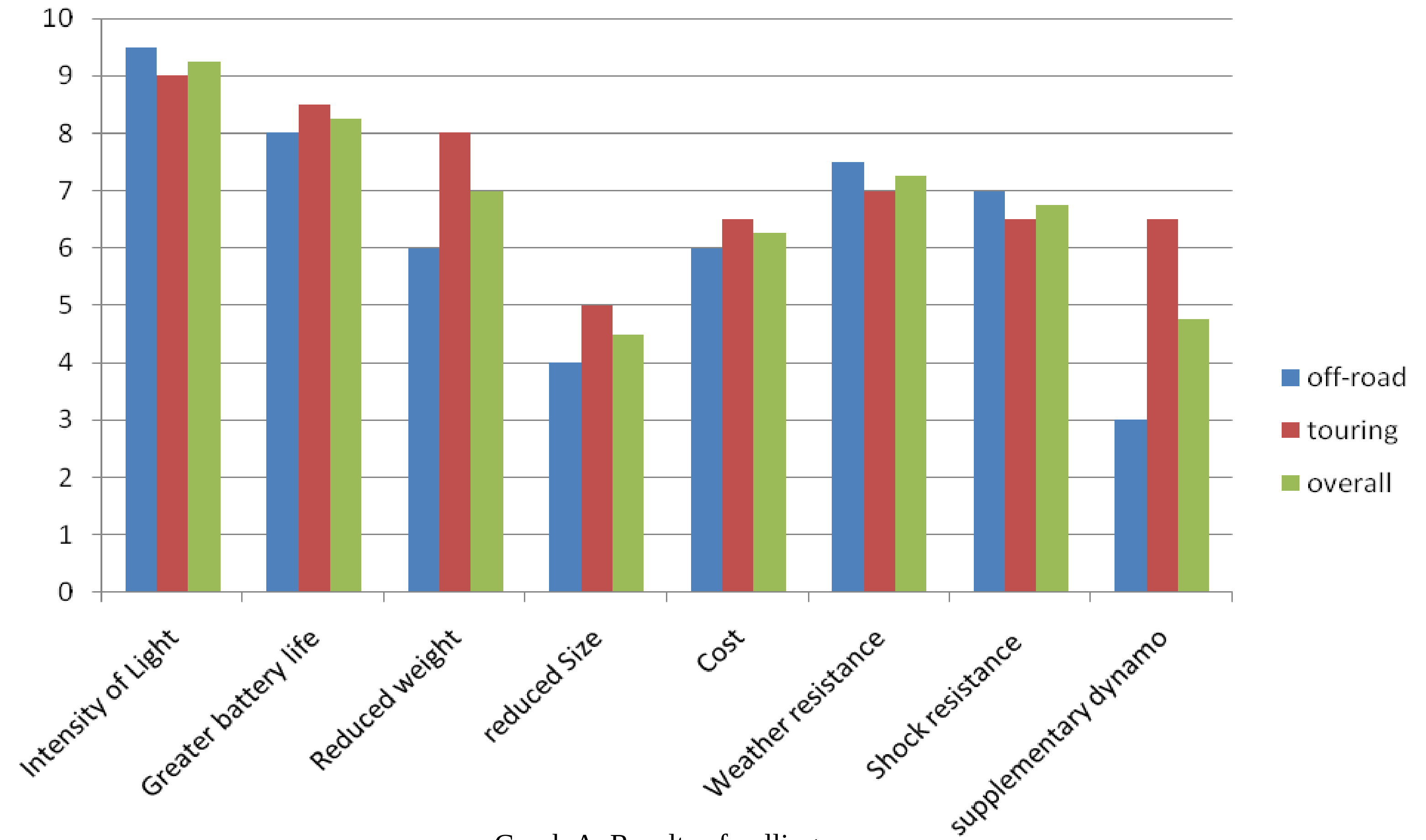
Appendix A. General Supporting Documentation

Graph A showing the results of polling 42 cyclists, with an even distribution between off-road and touring bicycle users. Polling took place in the Southampton University off-road cycling club and in a local section of the Cycle Touring Club. A rating of 10 being important.

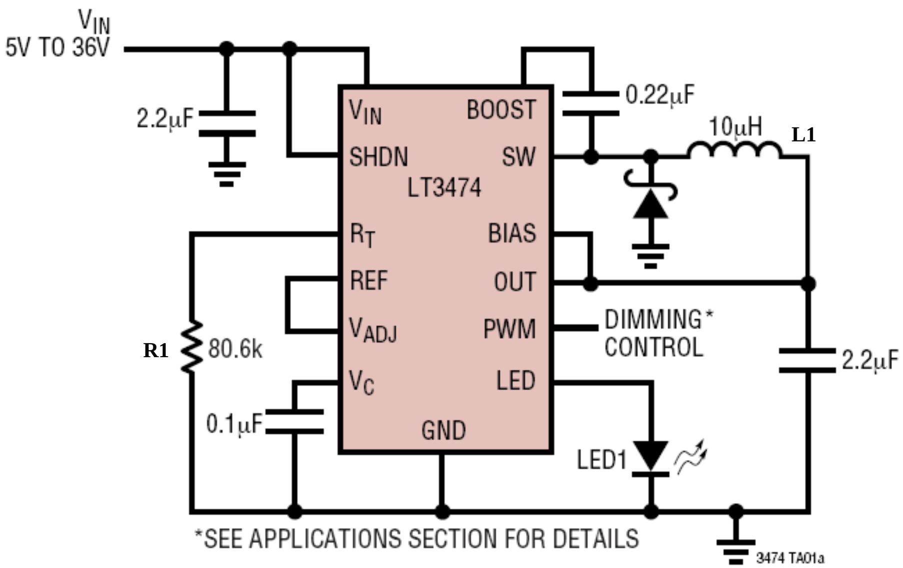


Graph A, Results of polling

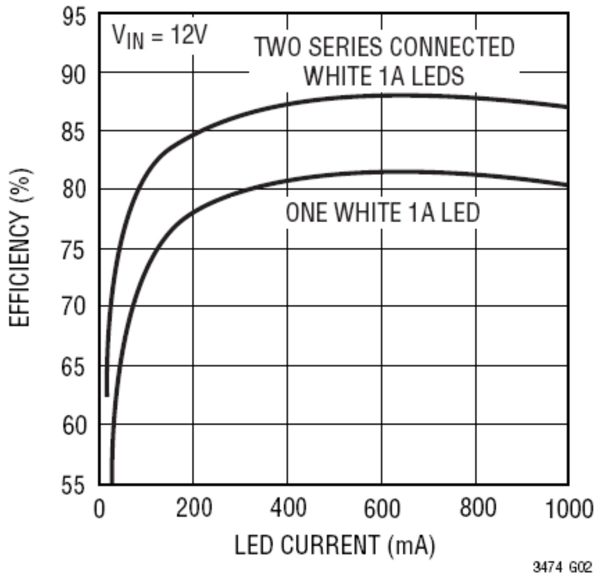
Extract from the LT3474 datasheet [27], showing the typical operation circuitry for the 1A step down converter. Circuitry used in the prototype uses a similar layout but component values must be selected to suit the application. The accompanying efficiency curve clearly show improved efficiency with two series LEDs; the prototype should be able to achieve efficiencies of ~88%.

TYPICAL APPLICATION

Step-Down 1A LED Driver

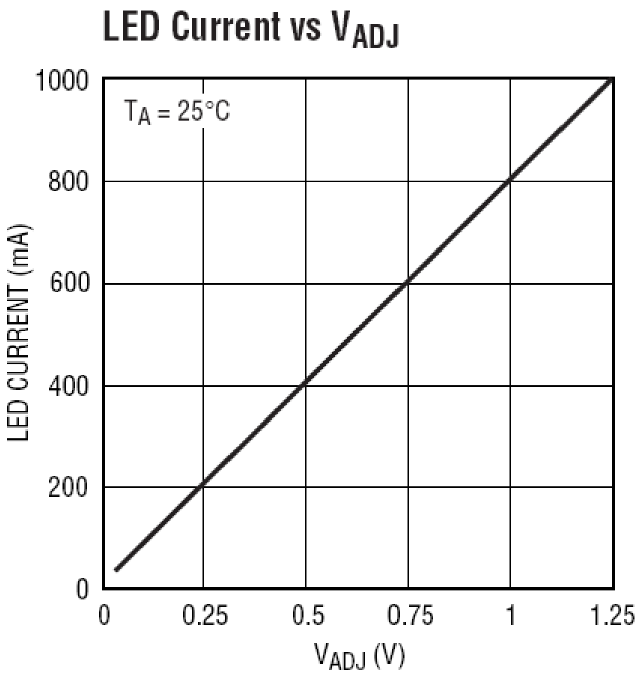


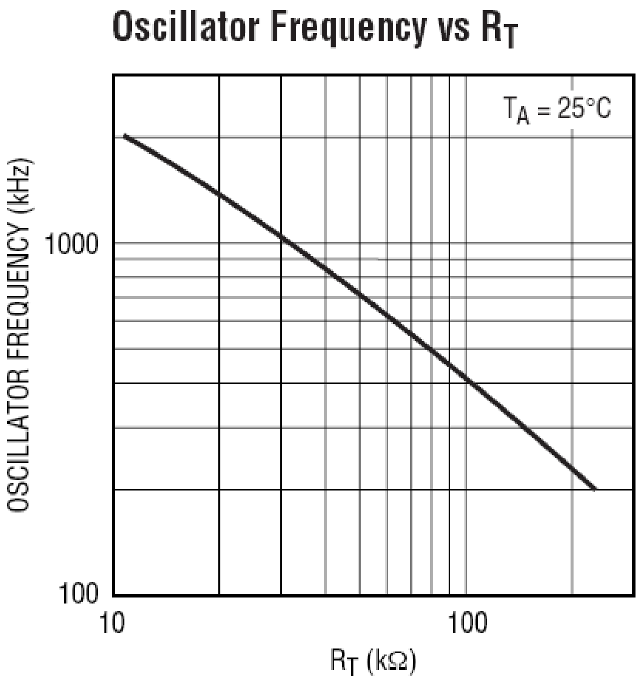
Efficiency



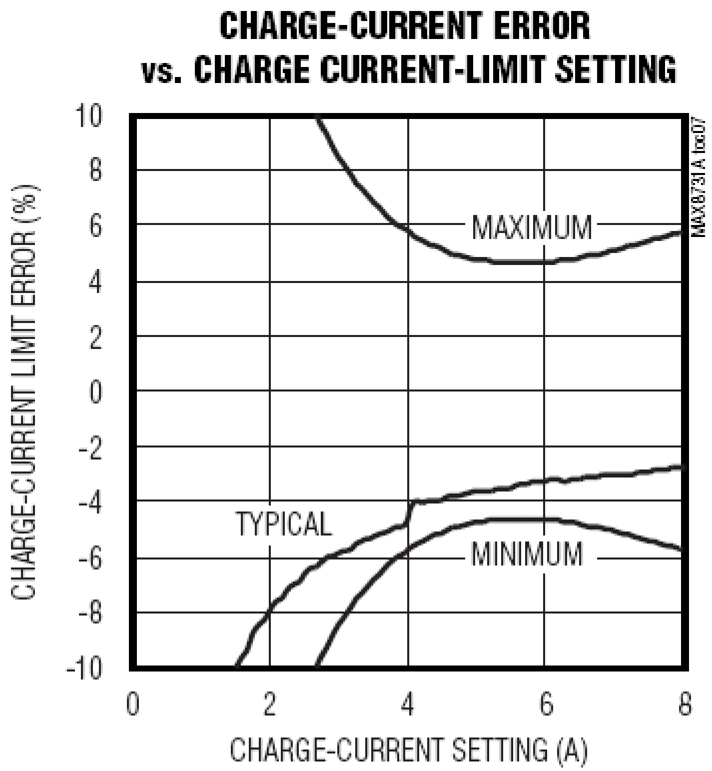
3474fc

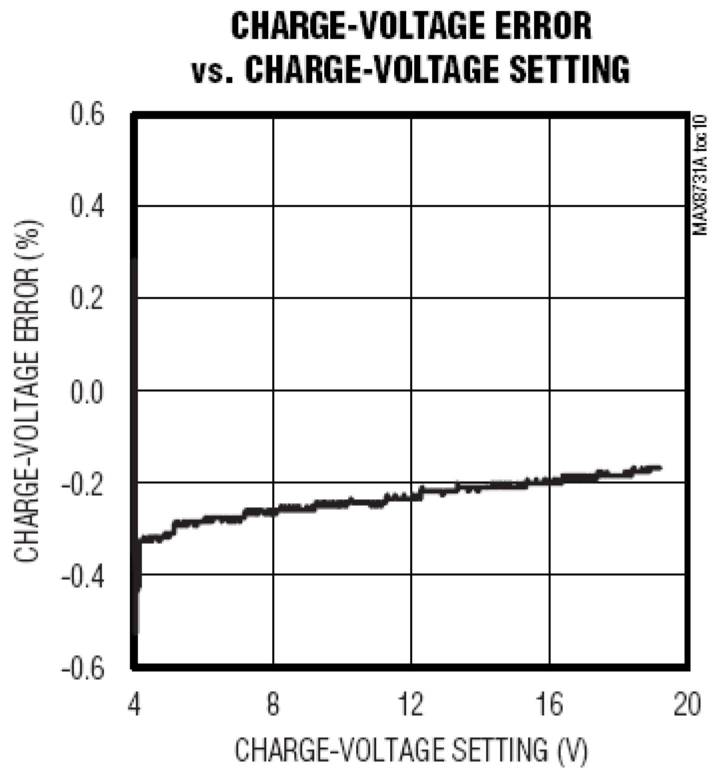
Extract from LT3474 datasheet [27], The graph on the right shows the performance of LED current as a function of voltage present on the Vadj pin; this clearly shows a very linear relationship from zero to 1A. The graph on the left shows the decreasing oscillator frequency as the value of Rt increases.





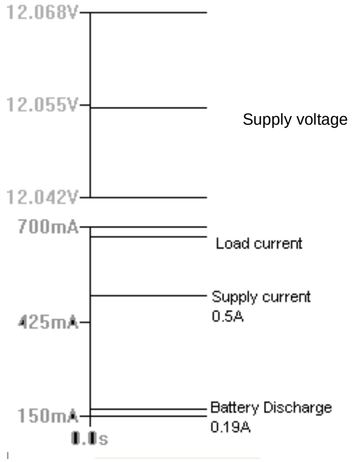
Max 8731A charge current limit error graphs and voltage limit error graph from the datasheet [23]

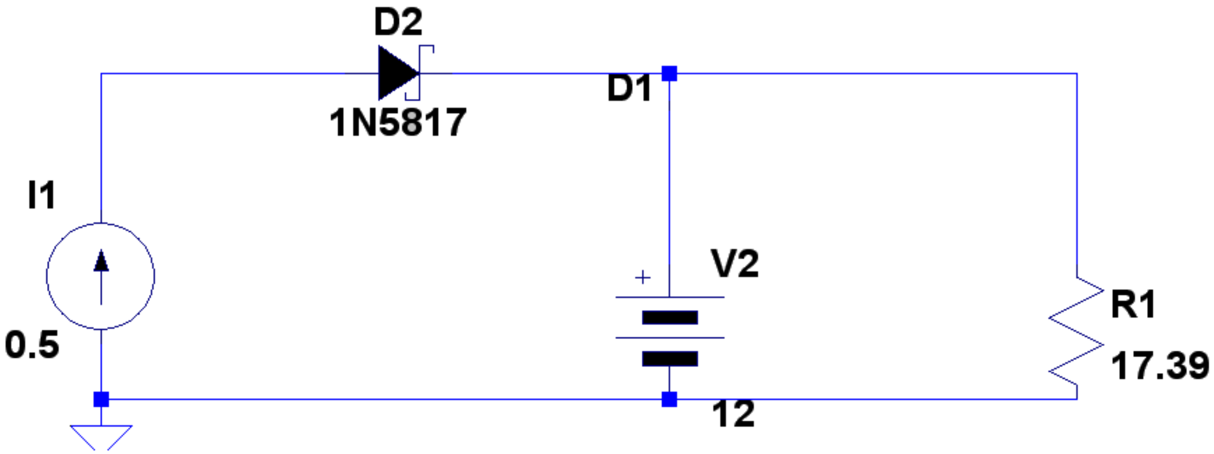


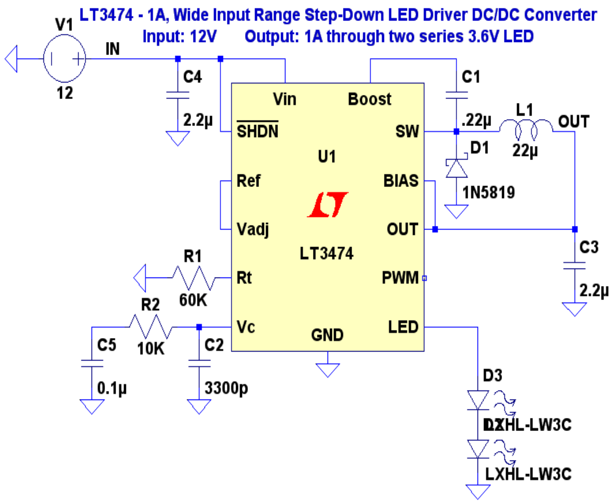


Appendix B. Graphs and Measurements

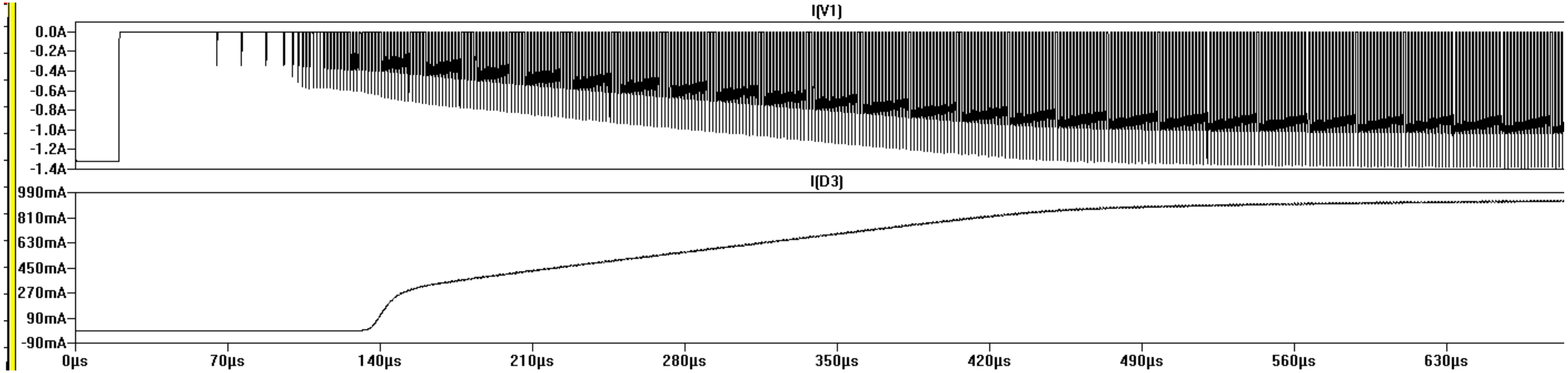
Simulation of system in state three, discharge into load. It can be seen that the battery supplements the power supply to deliver power to the load.







Circuit diagram of LT3474 in simulation, component values calculated being tested.



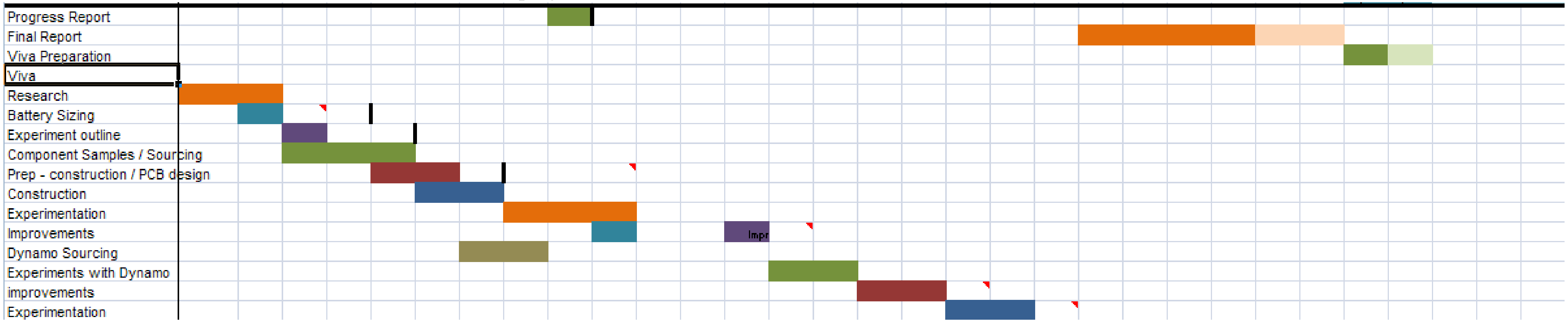
Measurements made in simulation, I[V1] is the current from the power source (shown negative because of the incorrect orientation of Ammeter – current is flowing from power source) I[D3] Current measurement in LED string. There is a clear transient response in the power source current trace, this lasts approximately 20µs. After 0.5ms the device is in a steady state condition with 1A output, and a peak input current of 1.4A.

Appendix C. Project Costing and Timescale

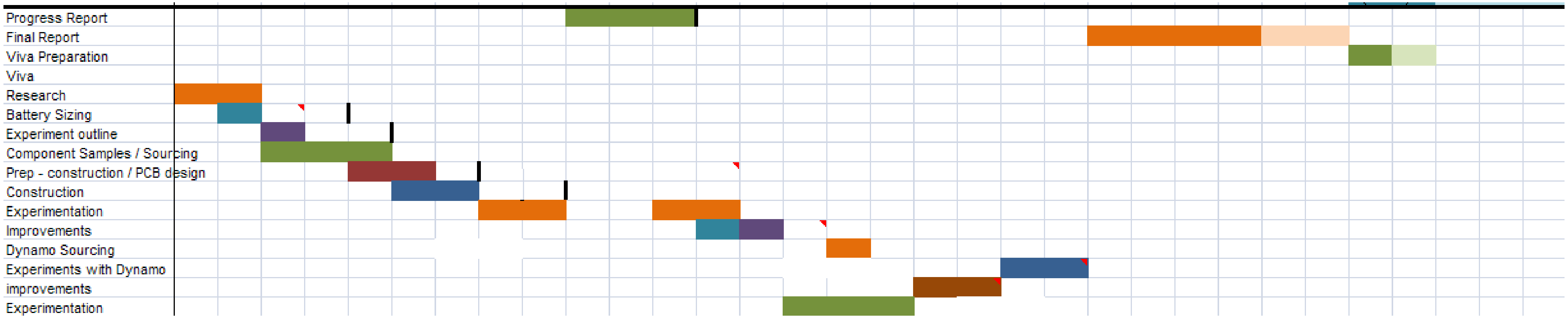
Unit Description	Quantity	Cost (£) – not p.u.
HiModel 11.1V, 1.3Ah 20C battery	1	18.44
ATmega406 AVR	1	5.20
LT3474 LED Driver	1	4.23
QFP Multiadapter (needed for AVR)	1	15.77
22uH Inductor – low DCR	1	1.52
3A schotty diode 1N5821	10 (minimum order)	3.30
Inductor 22uH	1	0.70
N-Channel MOSFET	2	0.22
IRL2703	2	1.50
6W wirewound resistor R1	5 (minimum order)	2.90
2.5W wirewound resistor 1R	5 (minimum order)	1.60
Total		**£55.38**

Table showing the costing of components sourced from outside the university, does not include the cost of the AVR Dragon programmer Dr Tim Forcer acquired for development purposes.

Gaunt chart 1- created at the start of the project

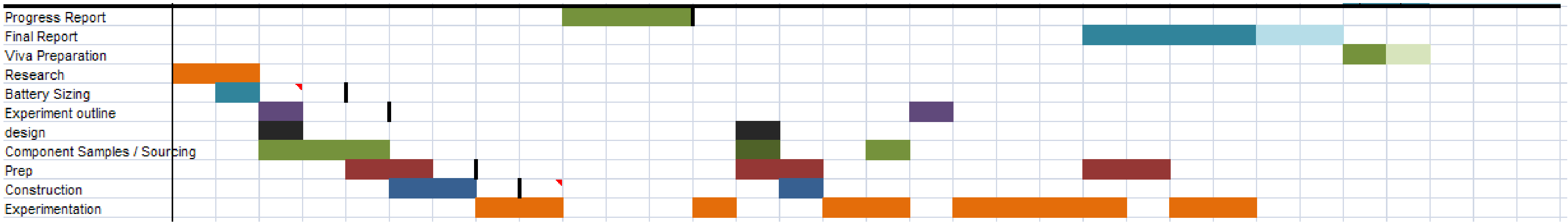


Gaunt chart 2 – created after interim report



Gaunt chart 3 – actual to date

Setbacks prevented the experimentation using a dynamo, instead systems design, building and experimentation took place, significant experimentation at the end of the project to get results of the system. A significantly different gaunt chart – but demonstrates a good use of time where despite setbacks progress was consistent.



Appendix CD. Code and Detailed Measurements

Contents of CD;
Osc trace for smBus control (5) - Oscilloscope trace of ‘smBus control(5) communication
PIC 16F88 Programming – set of code files, numbered sequentially
Charger – load testing.xls – measurements of charger current as load is increased
Charging measurements.xls – set of measurements made during charging cycle
Stage three test.xls – results of discharging into load with current source
V vs I curve measurements.xls – V vs I measurements made for Smart Charger