Estimating Battery Aging

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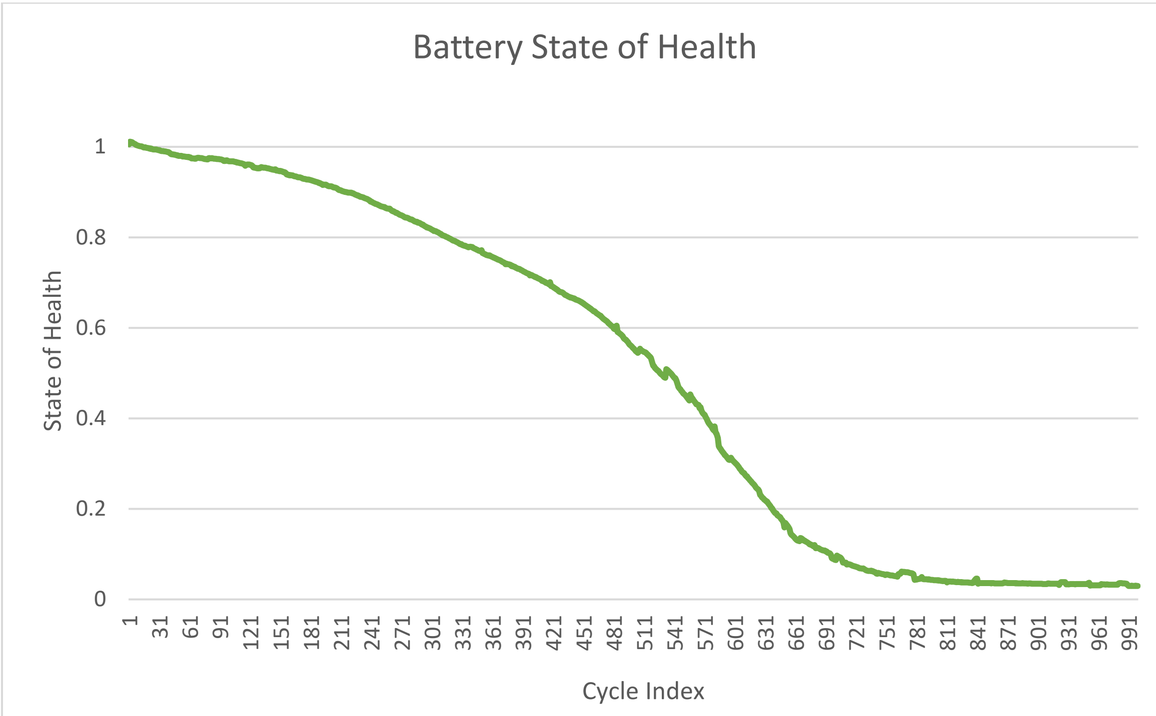
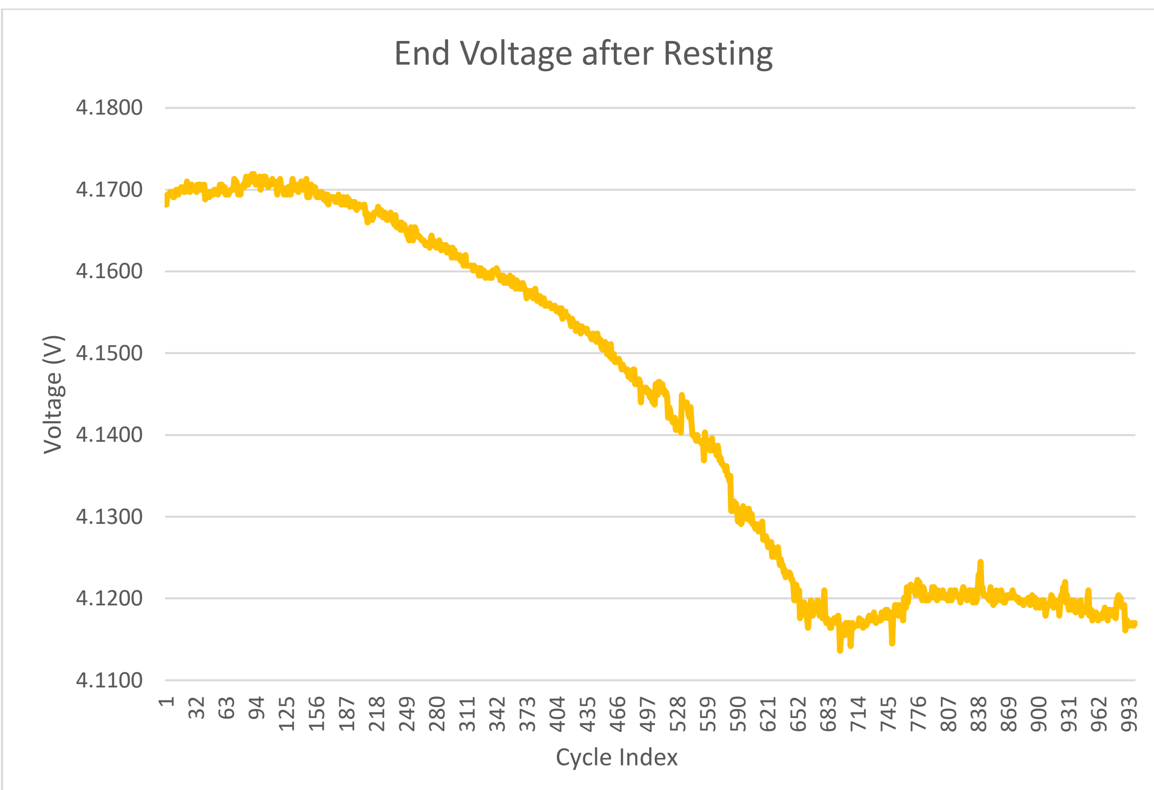
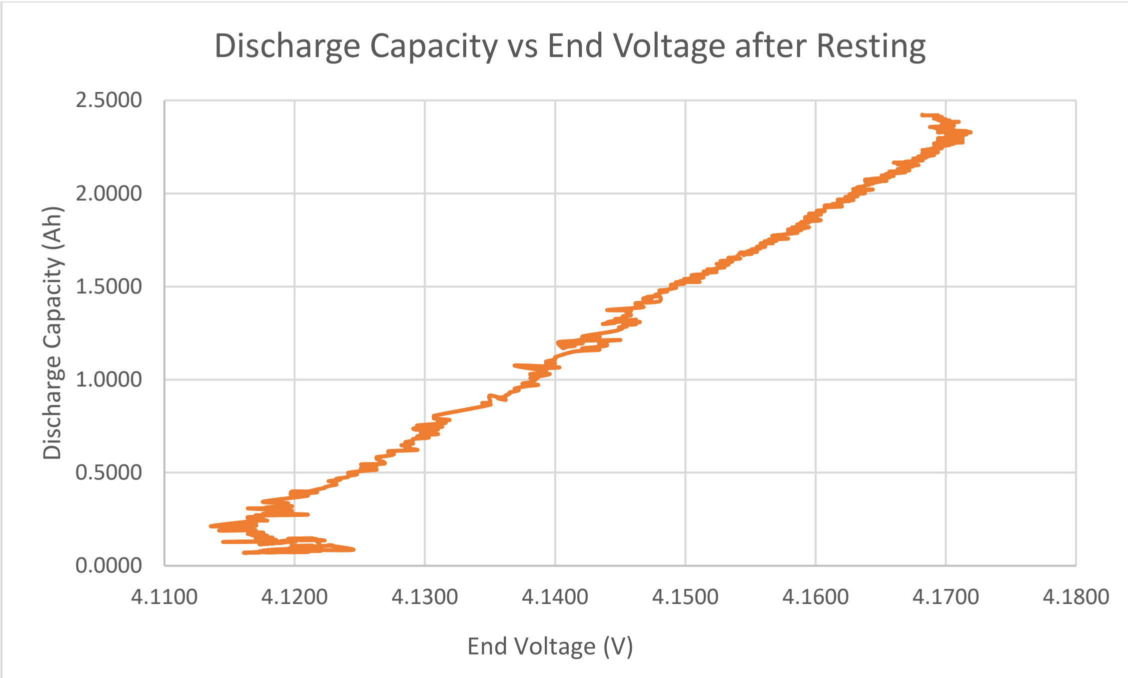
$$Battery\ State\ of\ Health = \frac{Full\ Charge\ Capacity}{Designed\ Charge\ Capacity} \rightarrow \frac{Full\ Charge\ Capacity\ (Ah)}{2400Ah}$$







Notes on Model Accuracy:

- A linear trend between the discharge capacity and end voltage but when discharge capacity is approximately between 2.28Ah – 2.42Ah, our end voltage stays around 4.17V despite the differences in discharge capacities.
  - One condition to keep in mind is temperature, which has been found to affect battery life and varying temperatures could've affected the discharge capacity rates when the battery was new.
- We can see a linear trendline, but we can see inaccuracies when our discharge capacity fall from .2131Ah to 0.0609Ah and our end voltage fluctuates between 4.1142V – 4.1245V.
  - Reasoning for why this might be occurring is because the battery is near the end of its life, which means that the battery charge capacity is much smaller than from when the battery was new.
  - Each battery has a depth of discharge, which is a fraction of the full battery capacity that can be released. If the depth of discharge was 100%, this would cause irreparable damage to the battery which could make it unusable.
    - We can see this running true as the discharge capacity never reaches 0 but gets close.
  - In the same case, temperature affects the voltage of a battery and as the temperature of a system rises, so does the battery's voltage, this can be calculated with Nernst Equation.
- Overall while most of our data aligns with the idea that end voltage decreases as discharge capacity decreases, we can see some outliers of our trendline at the highest and lowest points in our graph. The source of these outliers could be due to temperature, a fixed cap on the discharge rate, and the depth of discharge as the battery nears the limit of its lifecycle.