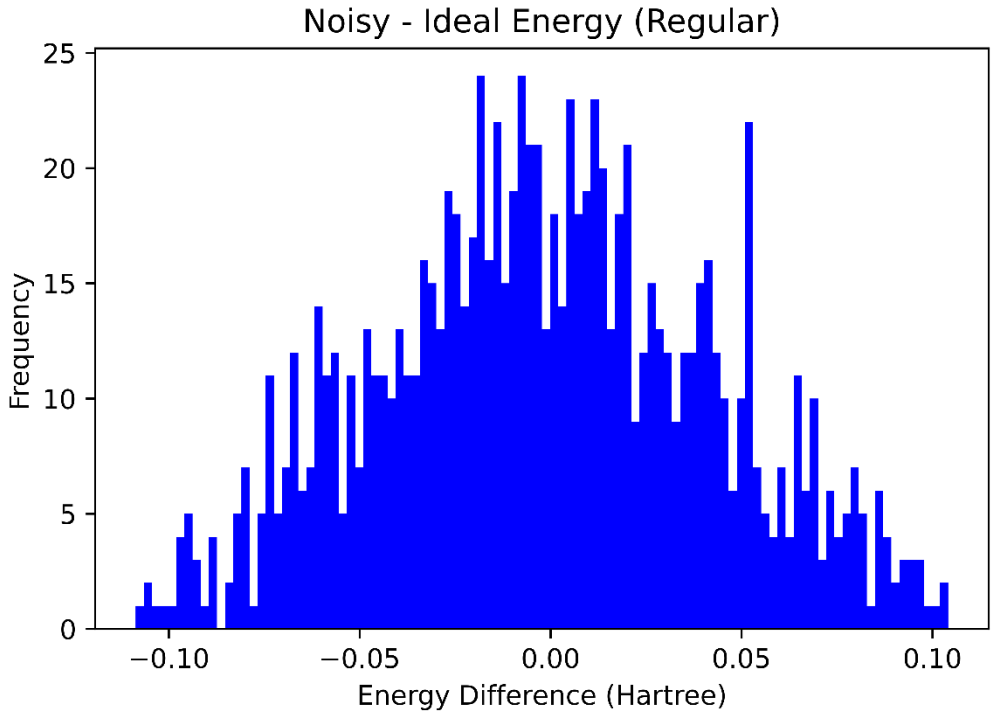
Effects of Noise on Energy
(as a function of random parameter values)

Meeting with Professor Schnetzer

October 28, 2020

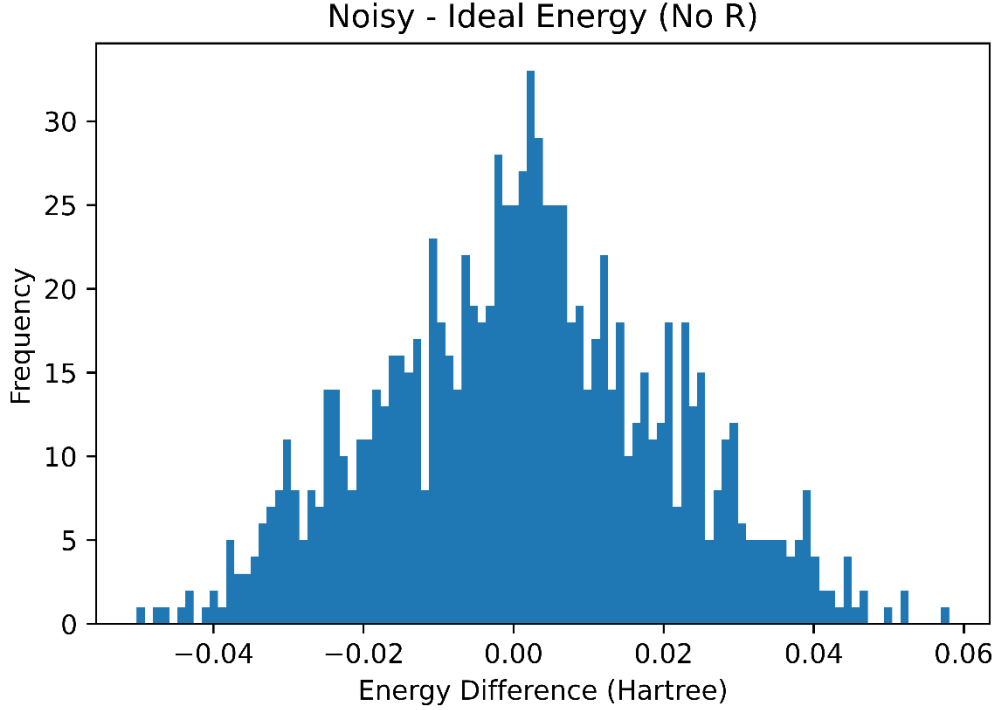
Experiment

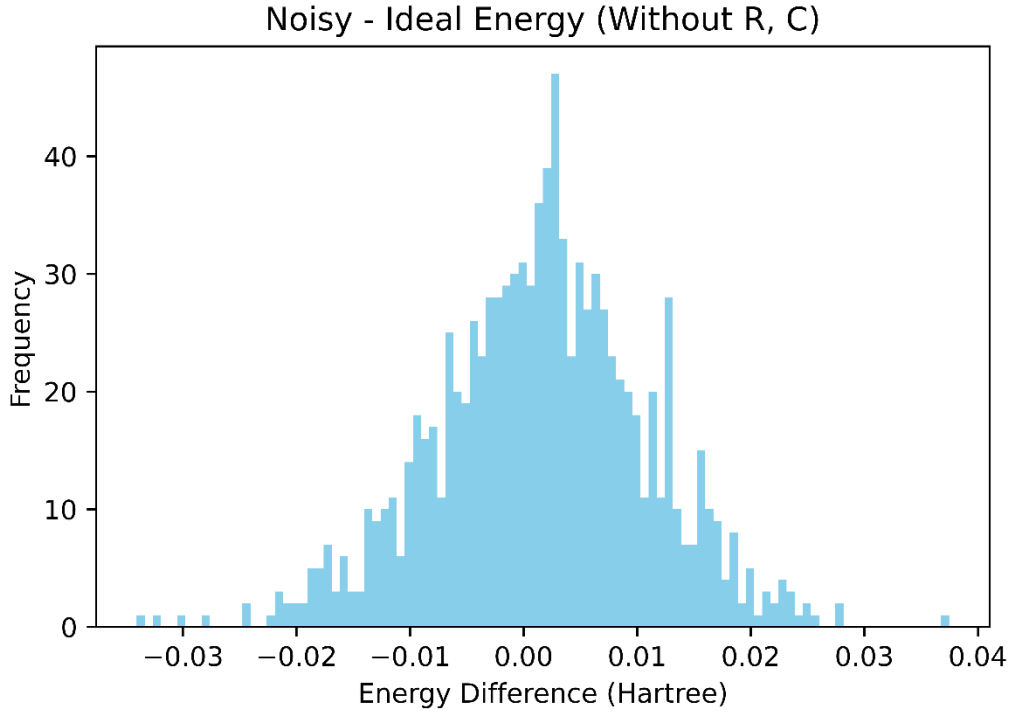
- Randomly choose the 3 parameter values in H2 UCSSD circuit from the range $(-\pi, \pi)$.
- Compute the energy on both noisy and ideal simulator(Fake London noisy sim used), and plot the differences.
- Do so 1000 times
- **Expected**: An assymetrical shift to the right with some outliers with negative energy difference (i.e. noisy being lower than ideal)
- **Outcome:** Roughly normal distribution, which is surprising.



Isolating individual error types

- (R) refers to readout errors and (C) refers to coherent errors
- There seems to be huge change in spread when we remove readout errors – approx. reduction by a factor of 3
- In the bottom plot, we **expect** incoherent errors to have some asymmetrical effect but that is not shown by the plot





Restricting the Range of parameters about optimized parameters

- Obtaining the parameters after VQE finished optimizing (H2 at 0.74 ang sep.) on FakeLondon noisy simulator, we get
- [0.00172129 -0.00182397 -0.11217598]
- So the range for the 3 parameters was restricted to :
- [0.0015 +/- 0.0005, -0.0015+/- 0.0005, 0.15+/- 0.05] Then sampling parameters from this range, we get the following plot.
- **Expected:** From slide 2, we would expect the same normal distribution centered at 0
- **Reality:** A significant asymmetrical shift to the right.