Discussion

The results for B_E and K were as expected. e/m was too far off to be due to an inaccuracy of measurements. However, the value was in the correct magnitude. Within the error of B_E is the accepted reference which means that the results are contain the correct value. The big discrepancy between the actual charge to mass ratio and the one calculated can only be due to a measurement mistake with the radius of orbit. The result is heavily dependent on the radius of the electron orbit as it is inversely proportional to the radius squared. Looking at the final array of e/m values before averaging them they are all consistently too high instead of fluctuating around the reference. This means that the measurements of the orbital radius were consistently too low. Therefore, during the experiment the measurements were taken with care but with a clear bias to a lower radius which skewed the result. Even though a couple values were re-measured because of the biased measuring method the results were practically the same.

To remedy this for future experiments the team taking measurement must be especially careful with this specific metric. By ensuring that the ruler goes exactly through the middle of the circular orbit. If the ruler does not go through the centre the measured values are automatically smaller. In general, it is good practice to first identify the variable with the biggest impact on results and spend more time on measuring it to reduce error as much as possible.

The fact that the calculated value for the earth's magnetic field is very close to the reference value reinforces the statement above. As all diameters were measured too low the voltages and currents were consistently off by a bit as well. However, because the calculation of earth's magnetic field does not directly depend on the orbital radius but rather on a ratio. The consistency between two sets of measurements is more important here which explains why the bias did not affect the result.