Summary and Conclusions:

From our initial calibration, we determined the confidence intervals of the fit and measurement for the thermocouple temperature measurements. At the end of our range, around 0oC and 100oC, we found the confidence limit to be 2.42 x 10-5 ± 1.67 oC. At the middle of our temperature range, around 50oC, the confidence limit is 49.4 ± 1.48 oC. These limits describe the accuracy of the sensors used in reviewing and analyzing different methods for determining the thermal time constant of the sensors when placed in water baths.

The most accurate method to determine the thermal time constant involves using the time corresponding to the maximum absolute slope of the temperature vs. time data as the initial time, and by using the slope of the best fit line for ln(Γ) vs. time to determine the time constant. However, after an appropriate initial time is found, determining the time constant as the time it takes to reach 63.2% of the final temperature difference between water baths will also provide an similarly accurate result.

Finally, once time constant values were determined, we found that the lumped capacitance model did in fact describe the trends in the time constants correctly. As predicted, the time constants for Aluminum were smaller than those of Stainless Steel.