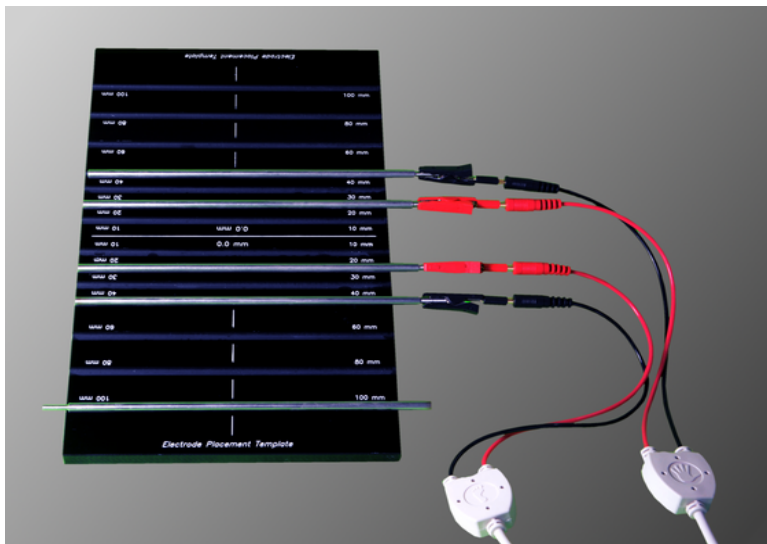


# Food Sciences

## Bioelectrical Impedance Analysis (BIA) Measurement of a New York Strip Steak for 22 Days

An accessory to the Quantum VII BIA is an acrylic electrode placement template with four stainless steel rods as food contact electrodes and an extra one (just in case). The food item is laid across the electrodes to complete a circuit with the BIA instrument. The rods are placed to span most of the food item. The indentations (radial slots) for the rods are precisely machined into the template and then engraved to indicate their distance each side from the center.



The electrode placement template is highly reproducible and repeatable and can be used with meats, fish, vegetables and fruit. The Quantum VII can be set to take samples for 2 seconds to 24 hours. A 15 minute sampling time will last 22 days on a single battery charge. This is a good interval for beef products, such as a New York strip steak. The Quantum VII will turn on for 5 seconds every 15 minutes and take 6 samples for averaging. There is very useful information on the display during this 5 second interval.

### ***Setting the sample time is starting and stopping the real time scheduler of the Quantum VII:***

#### **Starting:**

When SET SAMPLE TIME is greater than zero the scheduler is active. It is always started by pressing the ON button momentarily when the Quantum VII is OFF. That gives the user a chance to set up an experiment (relocate the analyzer and connecting leads) before scheduling BIA observations. It is a good idea to start the scheduler at a time that is convenient, such as the second and minute hand on a watch, to know exactly when it will turn back on.

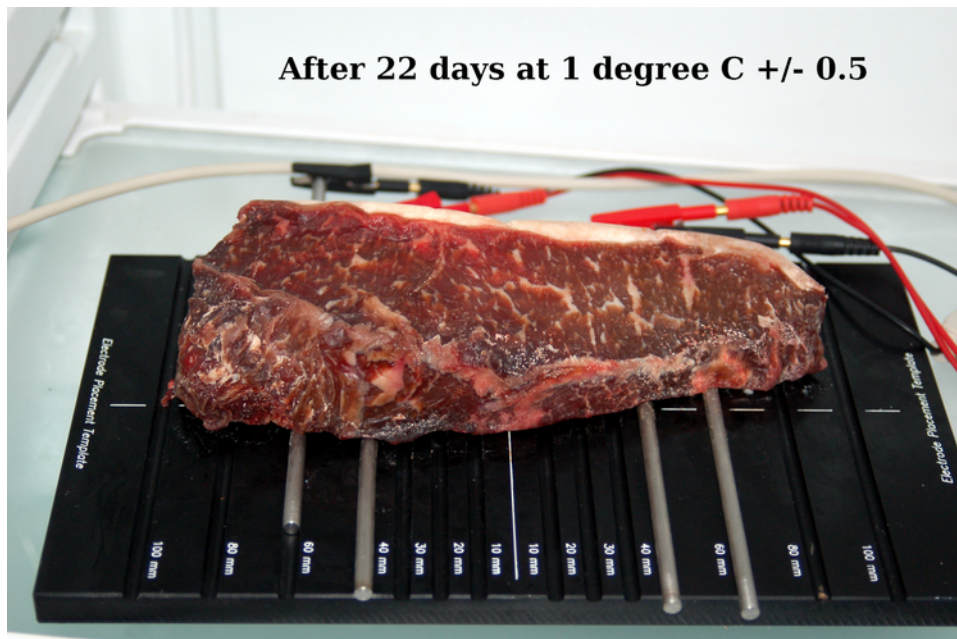
#### **Stopping:**

The scheduler is stopped (interrupted) by pressing the ON button for two (2) seconds or greater. This will allow menu items to be selected such as starting the built-in web server and downloading the saved records for spreadsheet analysis.

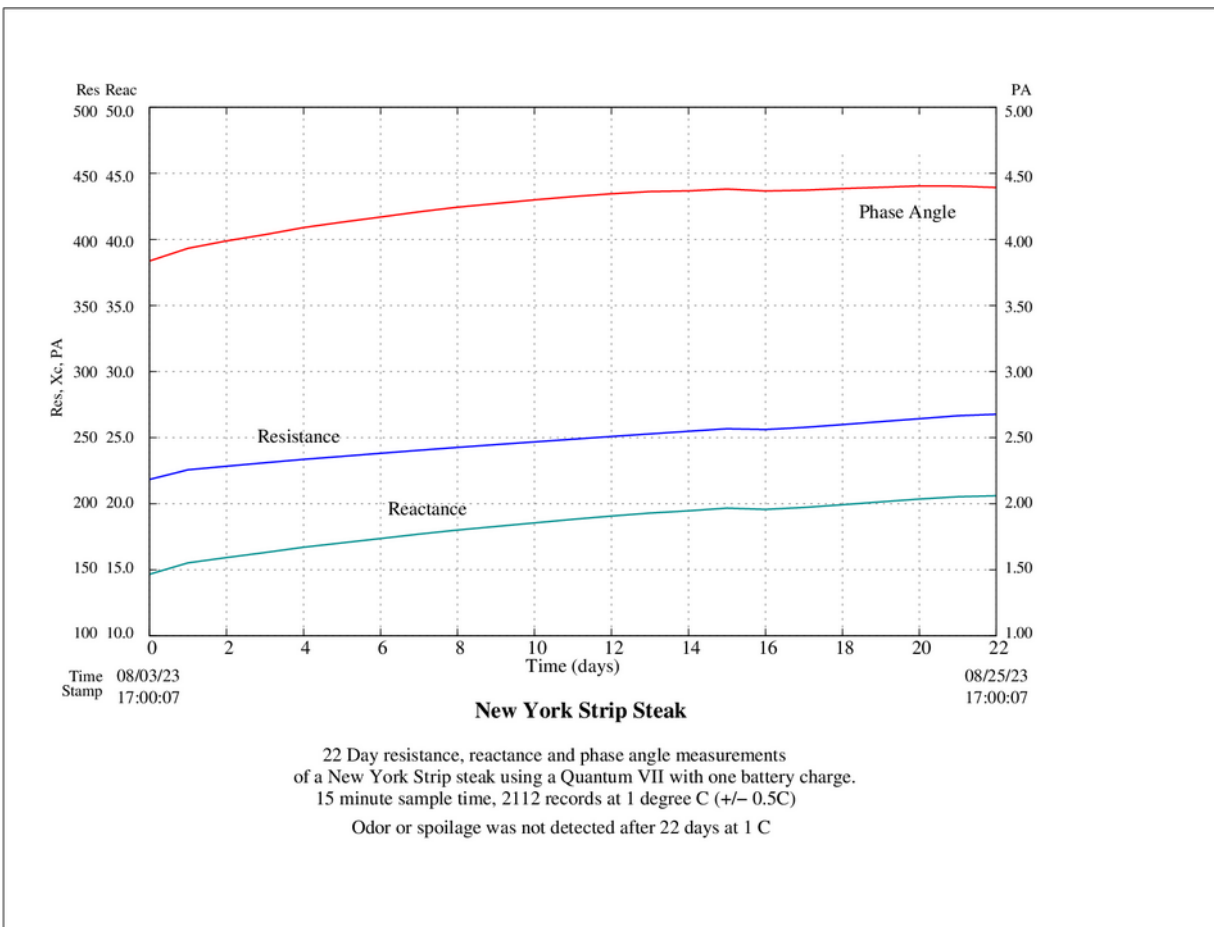
Each 15 minute record is time stamped with the measured resistance, reactance and phase angle and other statistical info along with the x, y and z orientation of the analyzer (like and airplane). Orientation is not important with this experiment but is important in other sciences.

## Results

Image of a New York strip steak after 22 days refrigerated at  $1^{\circ}\text{C} \pm 0.5\text{C}$  and void of any odor or indications of spoilage. The author is not a food scientist and does not have the knowledge to make any further comments.



BIA results after 22 days

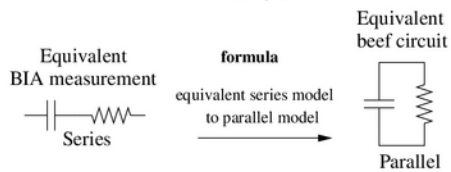
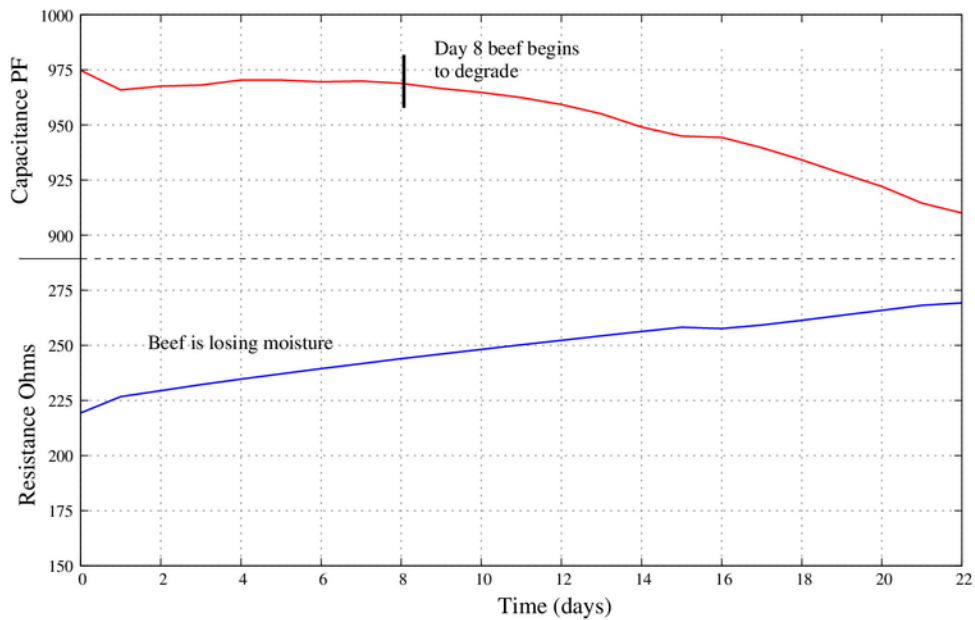


## BIA results

The above resistance and reactance measurements are independent measurements. This is an important salient features of all RJL Systems BIA instruments. However, in this graph they seem to track each other.

## Electrical Models: series - parallel

The Quantum VII measures an equivalent series model of resistance and reactance in series. This is not the case for the NY strip steak beef. Any capacitance or measured reactance is in parallel with the electrical resistance of the beef. The conversion of a equivalent series to a equivalent parallel model is a simple formula.



BIA Parallel Model Graph of Aging Beef

The results of the BIA parallel graph is much different than the series graph and clearly illustrates the aging process of the beef. The NY Strip steak was freshly cut from the short loin of the cow after aging. The red line indicates that the steak is beginning to degrade and should probably not be eaten after 8 days when refrigerated at 1° C. The blue line demonstrates slow dehydration or drying out of the beef.

Please note that these comments are not from an food expert or scientist of beef products. However, these measurements do illustrate the possible usefulness of BIA in analyzing fresh food products and its potential role in assessing freshness, maturity (aging) or poor quality. **RJL Systems**

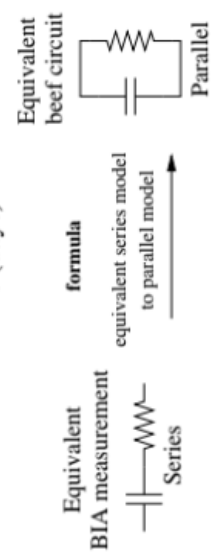
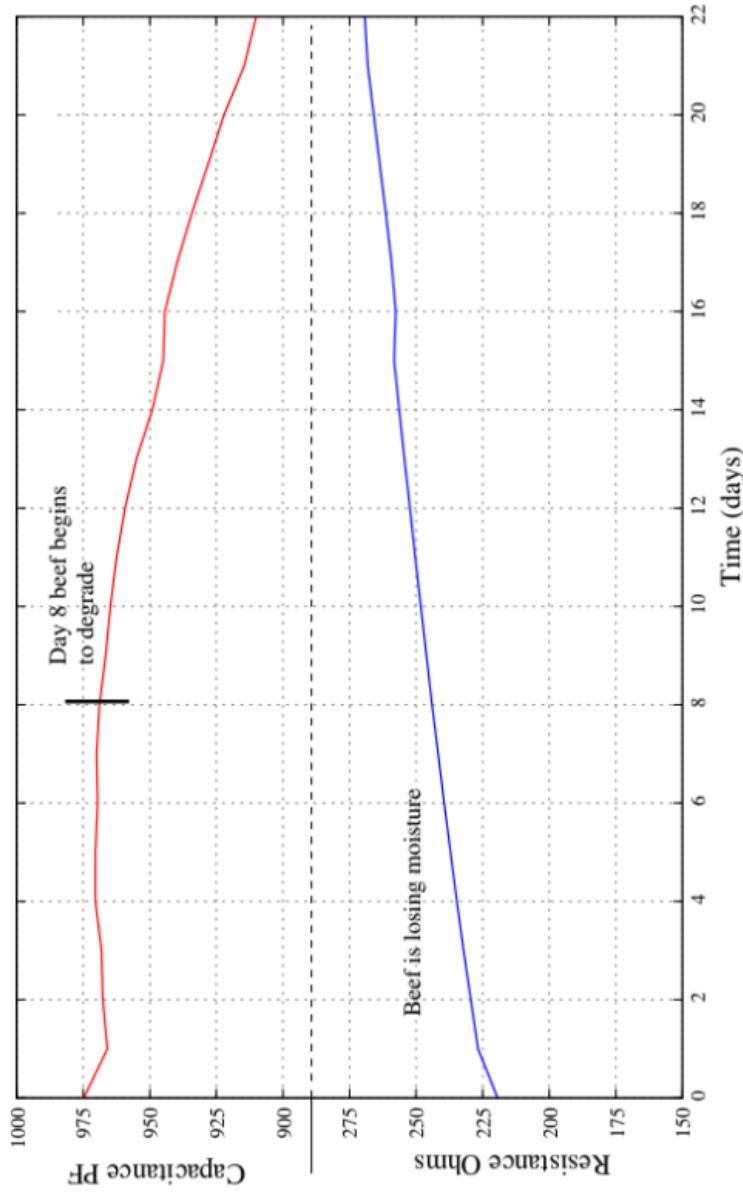
## Methods:



The refrigerator is an apartment type with the thermostat replaced with a precision electronic temperature controller with  $\pm 0.5^\circ\text{C}$  regulation (next to Quantum VII). The steak was covered with wax paper to reduce evaporation and the refrigerator was left closed for 22 days.



**Expanded PDF of the final BIA result of measuring a New York strip steak for 22 days at  $1^\circ\text{C}$**



BIA Parallel Model Graph of Aging Beef