

# Resolution and Accuracy of BioThermo Chips

(Brief summary)

## I. General Overview of Resolution and Accuracy

Quite often in describing the sensitivity of a temperature-measuring device, people use the terms “resolution” and “accuracy” interchangeably and may assume that the two terms represent the same thing. In reality, they mean different things.

### A. Resolution

“**Resolution**” means the “**smallest detectable change**” in temperature that a system (device) can measure.

A device with a “*resolution*” specification of  $0.1\text{ }^{\circ}\text{C}$  implies the device can detect the *smallest change of  $0.1\text{ }^{\circ}\text{C}$*  in temperature.

### B. Accuracy

“**Accuracy**” means the “**correctness** of the measured value **relative** to the true value”.

A device with an “*accuracy*” specification of  $\pm 0.5\text{ }^{\circ}\text{C}$  implies that the *error* of measured value is *less than  $\pm 0.5\text{ }^{\circ}\text{C}$*  with respect to the true value.

### C. Remarks:

True value is the temperature value based on the International Temperature Scale of 1990 (ITS-90) standard. The ITS-90 is the “official” standard for temperature scale. It is based on the true, dynamic temperature scale, but the real, working temperature scale is something practical which can be repeatedly produced anywhere in the world given the correct practices and equipment.

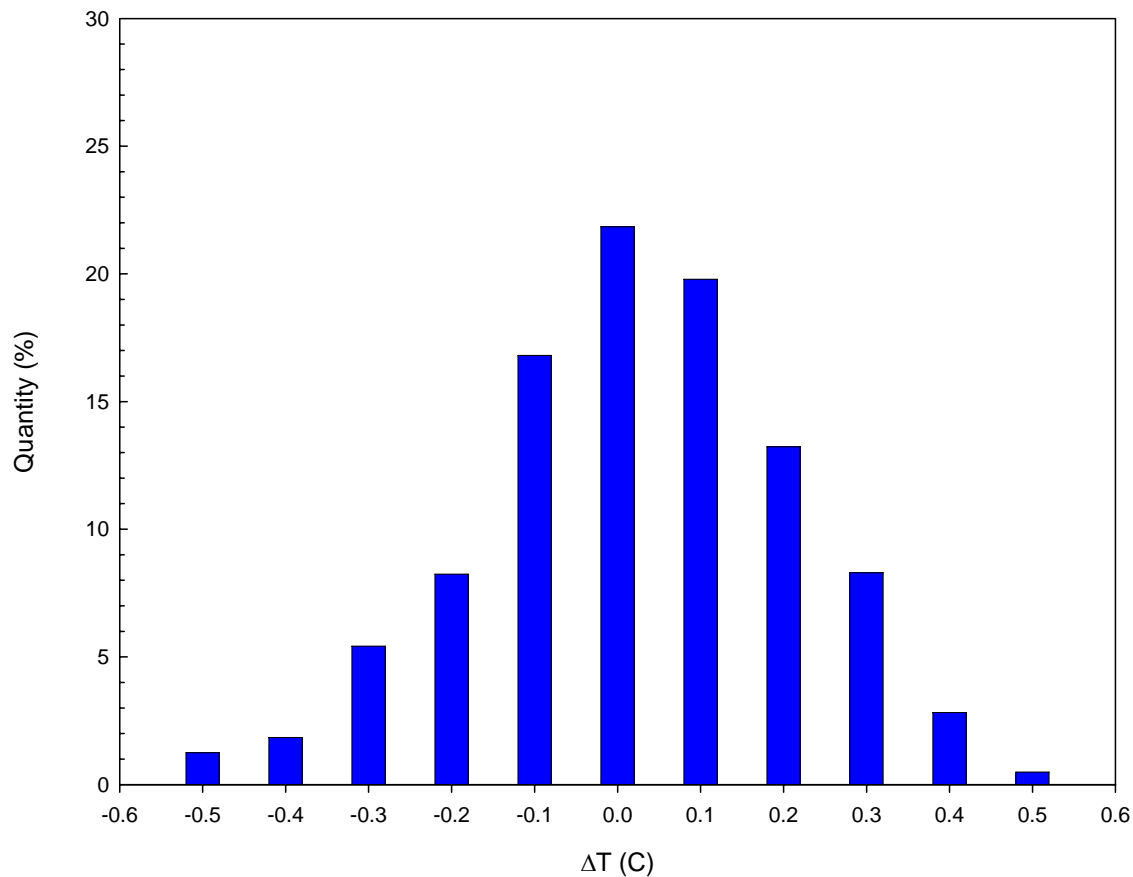
In the United States of America, the National Institute of Standards and Technology (N.I.S.T.) provides a calibration service for thermometer according to the ITS-90 standard. Calibrated units with N.I.S.T. traceable number can then be used as practical reference units.

At Digital Angel Corporation, we use an Ultra-High Accuracy and Resolution Handheld Thermometer calibrated to a N.I.S.T. traceable unit as our reference unit. The reference unit is calibrated annually to ensure its consistency and quality.

## 2. Resolution and Accuracy of BioThermo Chips

- Resolution  $\sim \pm 0.1$  °C
  - Can detect the smallest change of 0.1 °C in temperature.
- Accuracy  $\sim \pm 0.5$  °C
  - Completion of Digital Angel Corporation's BioThermo Sorting Machine (V.2) enables us to sort out BioThermo chips with accuracy of  $\pm 0.5$  °C
  - A trial of running 1,845 units through the sorting machine yields the following % distribution of sorted units (units meet the specification of:  $\Delta T \leq \pm 0.5$  °C)

% Distribution of Sorted Units  
[Sample size: 1845 units]



Notes:

1.  $\Delta T$  = BioThermo Chip Temperature - Reference Thermometer (Chamber) Temperature
2. Sample size: 1845 sorted units
3. Sorted units: units that pass the sorting process (Digital Angel BioThermo Sorting Machine\_V2) and meet the specification of  $\Delta T$  less than or equal to  $\pm 0.5$  C