Network Mapping
Aerial Laser Survey

Temperature calculations and LiDAR positions

A presentation to;

2011 PLS-CADD™ advanced training and user group meeting

Presented by;
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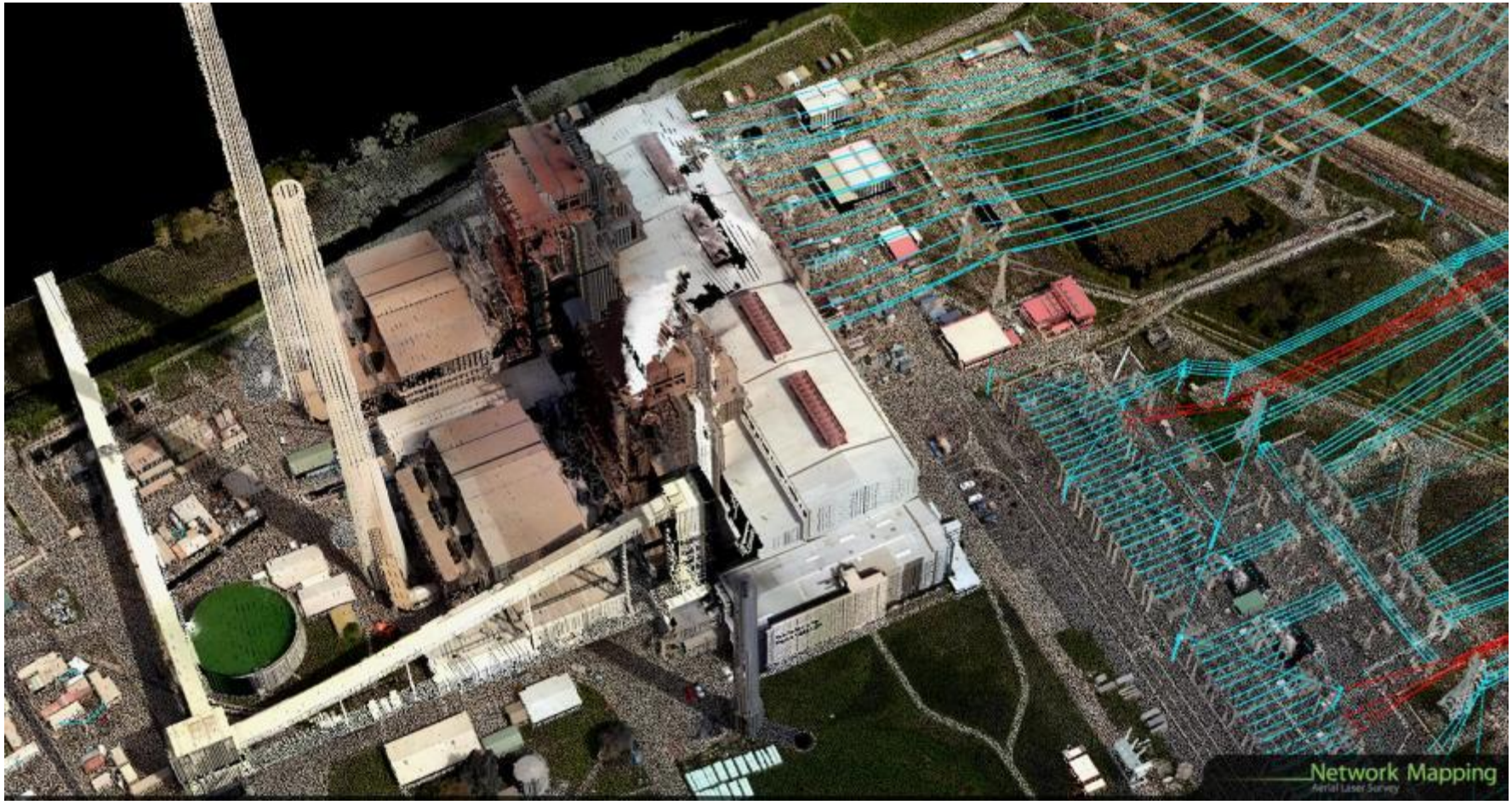
07/19/11

Scope for today's talk

Increasing utilisation without affecting reliability is achievable, but...

An accurate clearance assessment needs to be based on accurate initial (sag/tension and temperature) conditions.

Testing the IEEE 738 calculation – is this a robust and valid for temperature assessment?



IEEE 738 temperature calculations

Reliability of the technique

Effects of temperature increase on conductor sag -predicted and measured

The approach…

- Network Mapping wished to trial the adequacy of the IEEE-738 equation for determining conductor temperature.

- Our intention was to fly a line with the conductor at a lower temperature, where we could very accurately determine the effects of electrical load, solar radiation and wind speed. This would mean flying at a time of low electrical load, solar radiation and wind speed.

- The intention was to re-fly the same line and to compare the ‘predicted’ conductor sags against the ‘measured’ conductor sags.

The survey flights

- Network Mapping set up a trial site in North East US.
- We flew a section in the morning, expecting low ambient temperature, low electrical load and low solar radiation. We re-flew the same section in the afternoon expecting higher ambient temperature, higher electrical load and higher solar radiation.

The survey flights

- Electrical load was broadly similar to the afternoon reading. Also the solar radiation was not as low as we would have wished.
- Wind speed and direction was captured on both occasions using our ultrasonic weather stations, which unlike traditional anemometers do not suffer from stalling at low wind speed.
- The cooling effect of the wind was broadly similar, slightly higher in the afternoon.
- The effect of these was that the difference in temperature between the morning and the afternoon flight was not as large as we would have wished to trial the IEEE 738 calculation method.
- The IEEE-738 calculation of conductor temperature for the morning flight was 96 deg F.
- The IEEE-738 calculation of conductor temperature for the afternoon flight was 105 deg F.

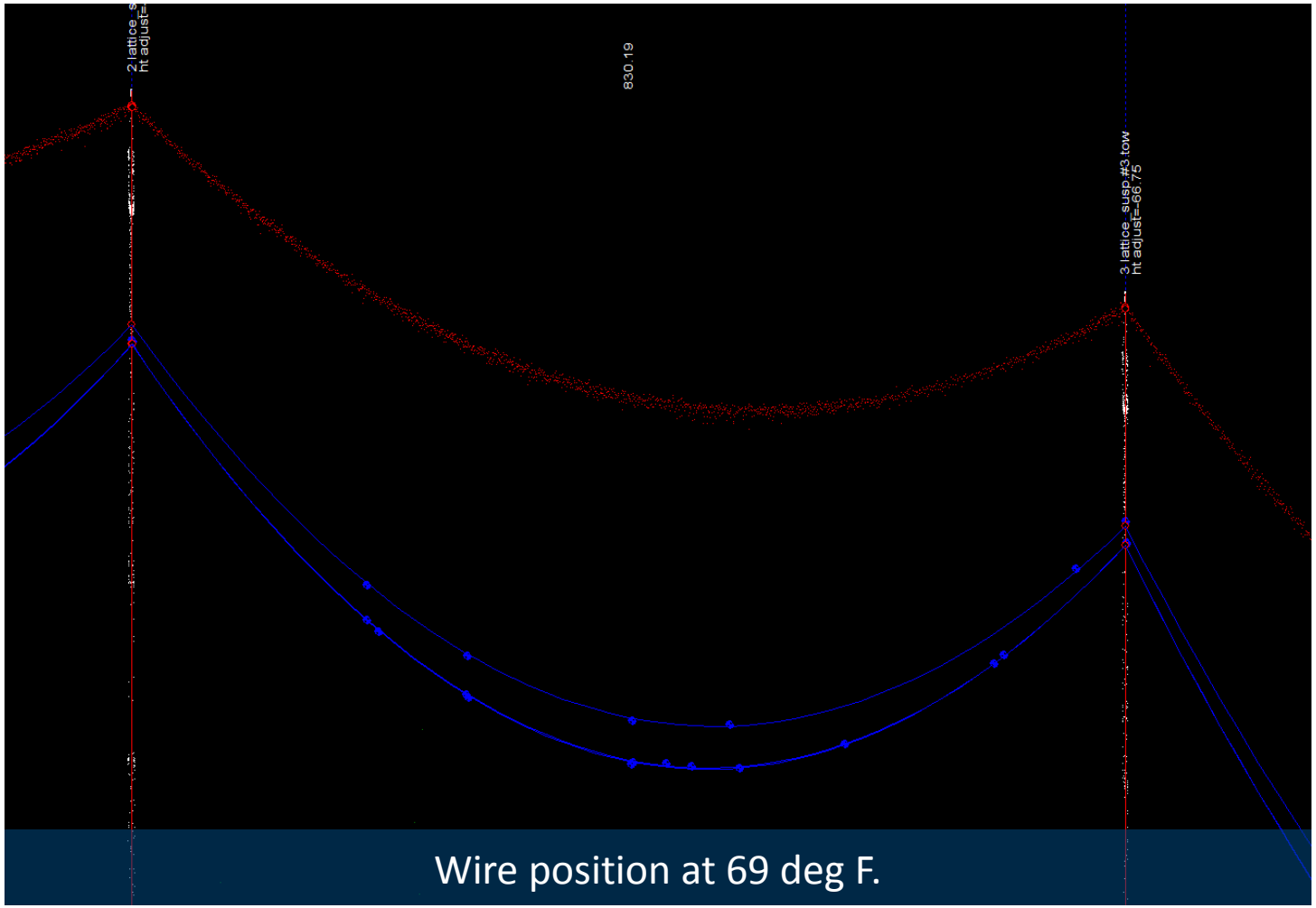
The control

- We had one of our guys capturing wire positions from a total station early on Sunday morning 03rd July 2011.
- At 06.30 EDT on Sunday morning we had low ambient temperature, low solar radiation and low electrical load.
- The IEEE-738 calculated conductor temperature was 69 degrees F.
- We considered this would give us a reasonable temperature shift to get a representative trial of the technique.

Summary of data acquisition

	Flight 1	Flight 2	Control
Date	06/07/2011	06/07/2011	07/03/2011
Time	08.30	16.30	06.30
Method	Aerial LiDAR	Aerial LiDAR	Ground-based total station
IEEE -738 calculated temperature	95 deg F	106 deg F	69 deg F

IEEE 738 temperature calculations - Control data 06.30 - 07/03/11



Wire position at 69 deg F.

IEEE 738 temperature calculations
Control data 06.30 – 07/03/2011

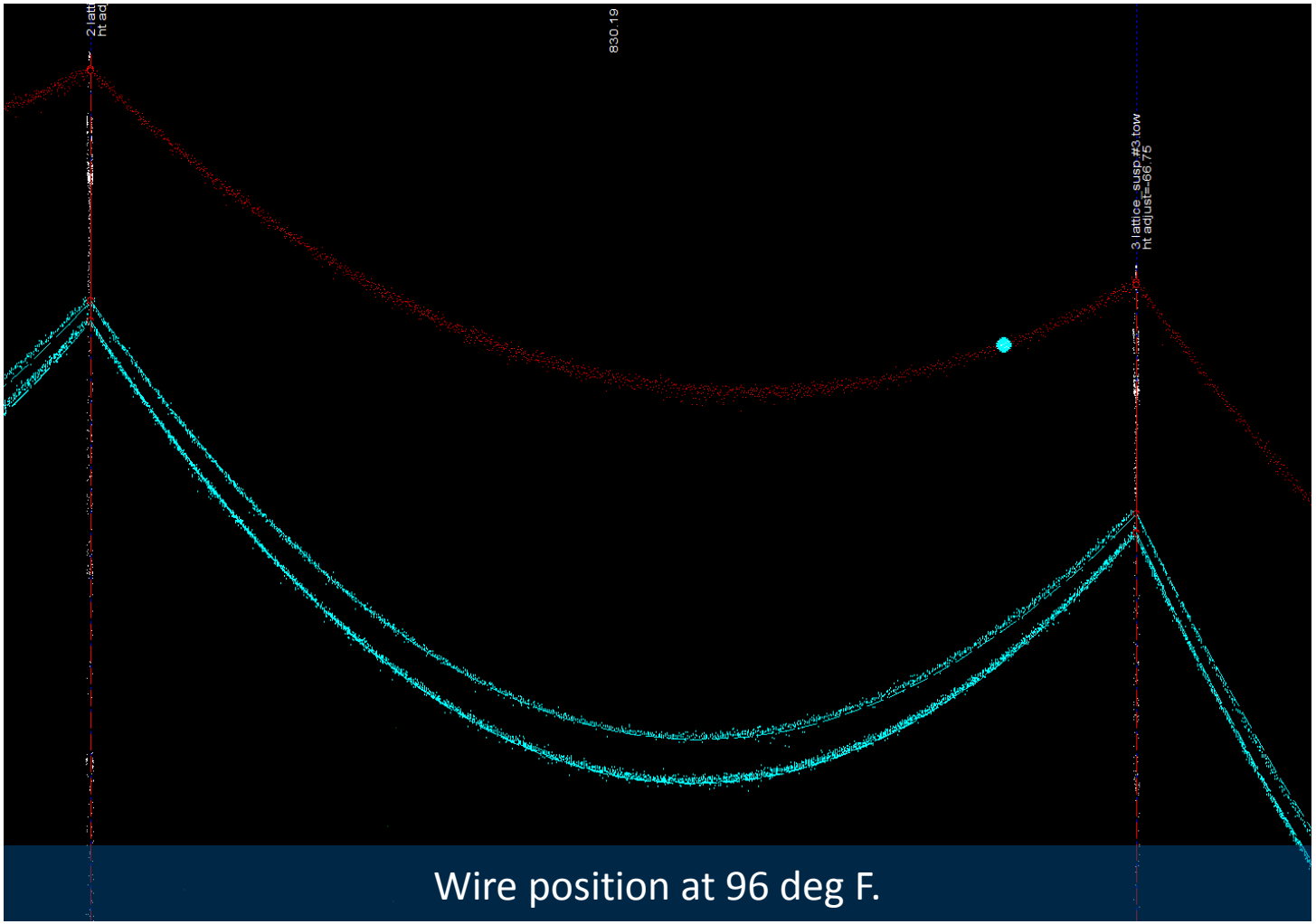
We used the points captured by the total station to set the 'sagging basis' for the conductor. We graphically sagged the conductor at the temperature of 69 deg F (creep Finite Element (FE)) to the total station points.

We then displayed the conductor at the two comparison conditions.

1. At 105 deg F. (creep FE)
2. At 96 deg F. (creep FE)

The 'predicted' conductor position could then be compared against the 'measured' sags using the points captured on our two LiDAR flights.

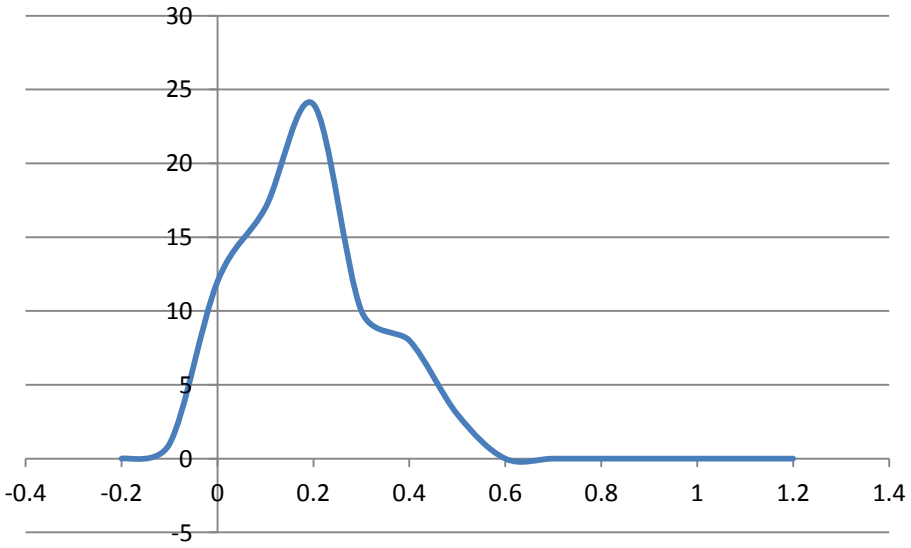
IEEE 738 temperature calculations
First comparison 08.30 – 06/07/2011



Wire position at 96 deg F.

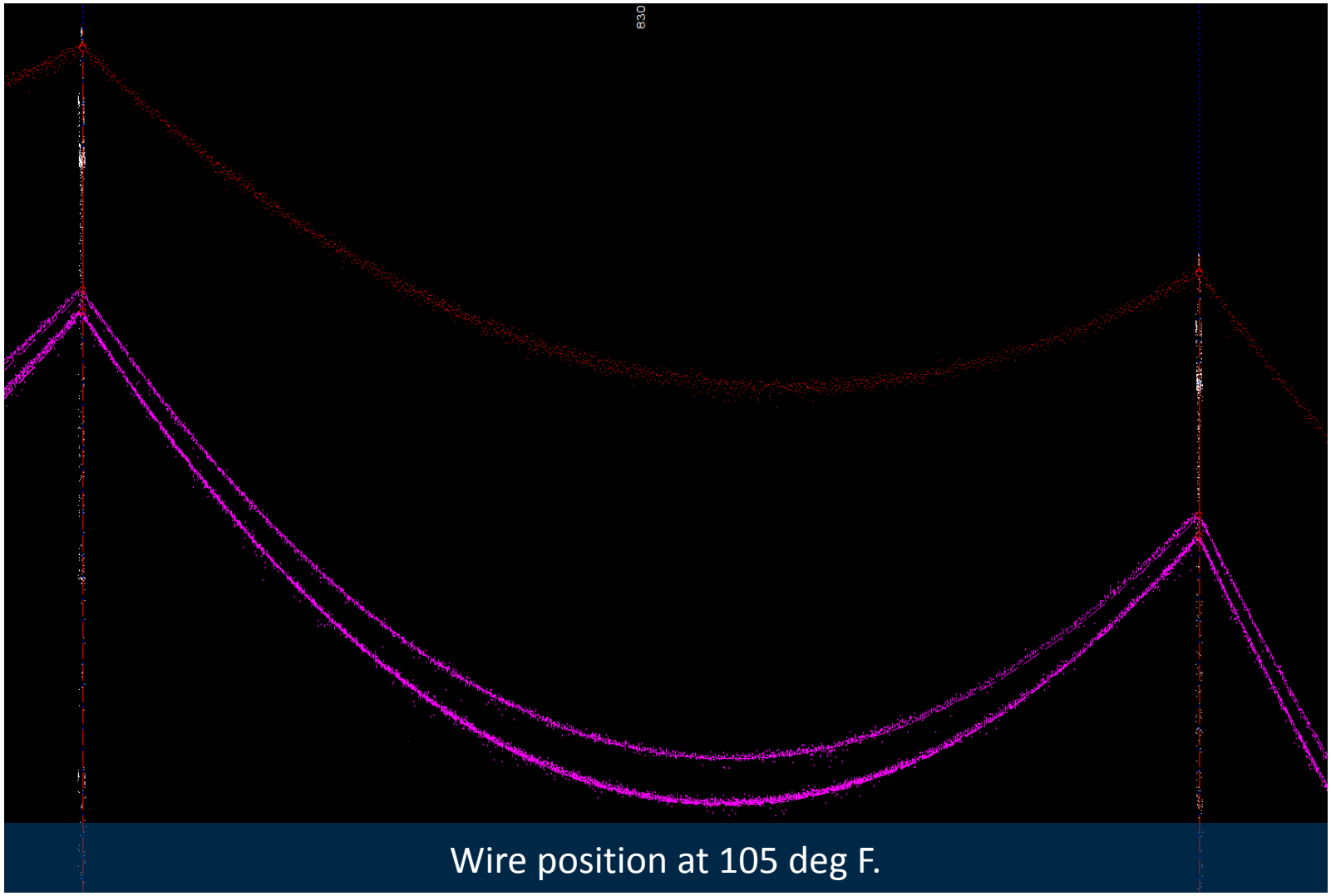
IEEE 738 temperature calculations
First comparison 08.30 - 06/07/2011

- At the 96 degree condition the comparison between predicted and measured results showed good agreement.
- All the LiDAR points were compared with the catenary from PLS-CADD™.



The results show a mean of 0.135 feet, with a standard deviation of 0.13 feet.

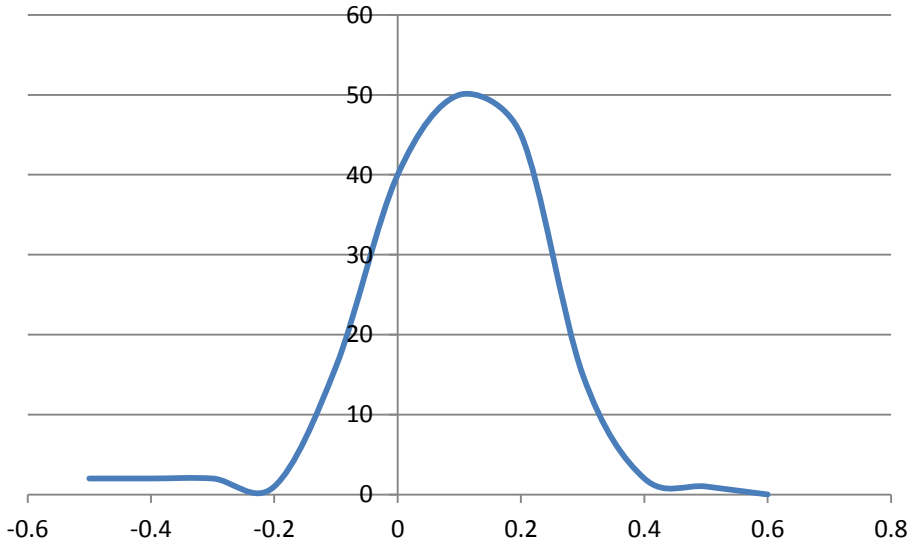
IEEE 738 temperature calculations
Second comparison 16.30 on 06/07/2011



Wire position at 105 deg F.

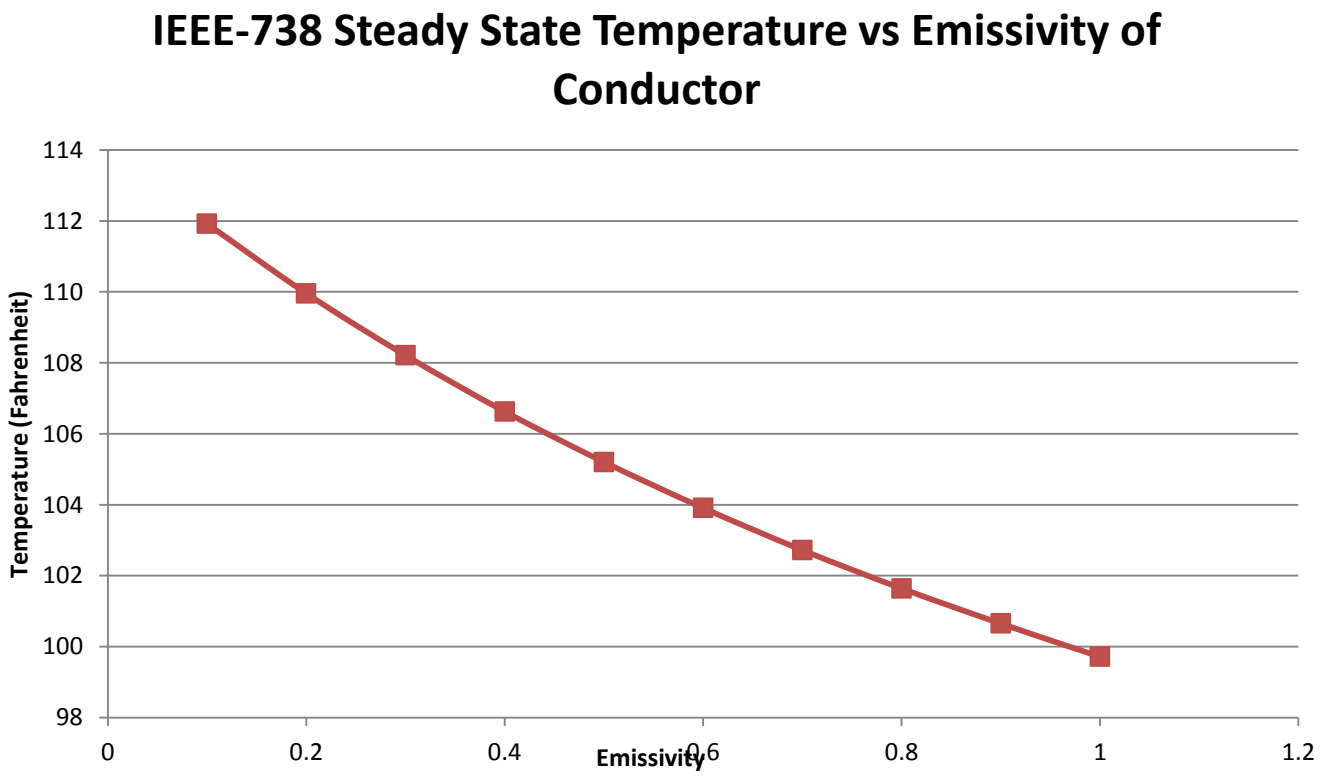
IEEE 738 temperature calculations
Second comparison 16.30 on 06/07/2011

- At the 105 degree condition the comparison between predicted and measured results showed excellent agreement.
- All the LiDAR points were compared with the catenary from PLS-CADD™.

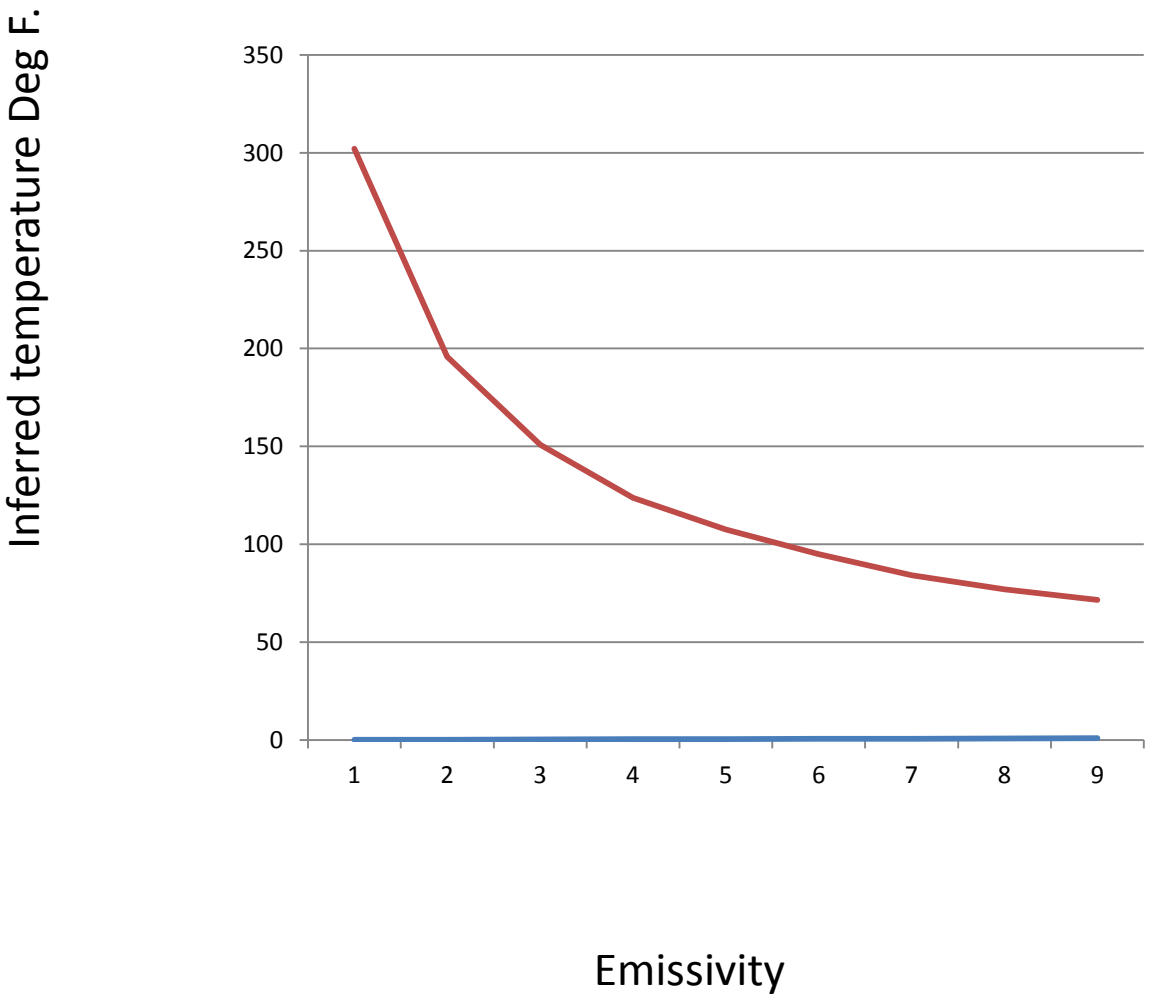


The results show a mean of 0.035 feet, with a standard deviation of 0.15 feet.

IEEE 738 temperature calculations
Effect of emissivity on temperature calculation.



IEEE 738 temperature calculations
By way of comparison the effect of emissivity on IR recordings.



Conclusions

- The IEEE 738 equation requires a number of inputs to the calculation.

- If these inputs can be captured effectively and are used correctly in the equation then excellent results can be achieved.

- Use of a good solar radiation meter and an ultrasonic wind speed meter will ensure good inputs to the calculation.

- The comparison between the predicted conductor position and the measured conductor position is first class.

- The tie up between measured and predicted shows the IEEE-738 equation is a robust and valid technique for temperature assessment

Thank you for your time

Contacts and questions

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