Hpw do 1st and 2nd generation TSD's compare – results of a UK trial

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Susanne Baltzer, DRD, Denmark

TRL colleagues

Acknowledgement of support from:

English Highways Agency
ANAS, Italy
Danish Road Directorate

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Background to network structural surveys in England

Until 2000 walking-speed Deflectograph surveys were needed to deliver this data

- Safety issues
- Disruptive to traffic
- Expensive per km

15 machines needed for whole network

Key Drivers for Traffic Speed Deflectometer Surveys

- TSD measures vertical deflection velocity
- Velocity highly correlated to maximum deflection
- Deflection can be used with construction and traffic to estimate structural condition
- One TSD covers whole network

TSD – History in England

- Worldwide review identified device
- 2nd prototype purchased for HA 2005
- Developed into surveying tool 2006-2009
- Routine surveys with HA TSD from 2010 under TRASS contracts

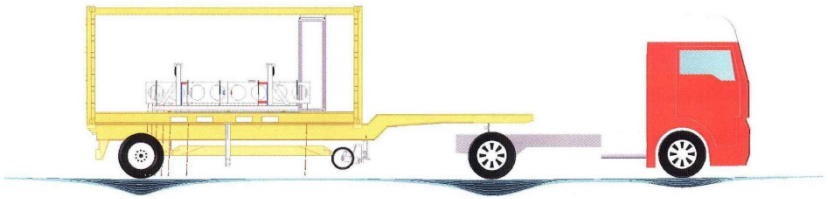
TRASS surveys provide:

- An efficient economical survey
- Without interfering with traffic flow
- Over the whole network, every one or two years

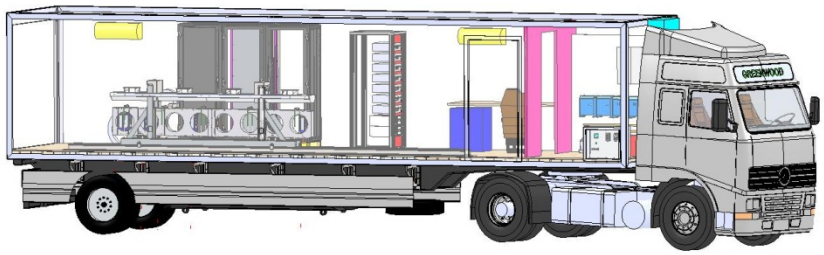
Programme of continuous improvement

- 2nd Generation machines now under assessment

First Generation TSD's – DRD, Denmark and HA, England



Second generation TSD's – ANAS, Italy, IBDiM, Poland, etc



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Purpose of comparative trial

To assess relative performance of first and second generation TSD's in terms of:

- Measured deflection response
- Short-term repeatability of measurements
- Stability of measurements, i.e. long-term repeatability
- Methods of calibration

And therefore provide guidance to the English Highways Agency (HA) on the potential benefits of upgrading their TSD

Methodology

Controlled side-by-side tests of 1st and 2nd generation machines

- Calibration methods – on suitable sites
- On closed instrumented track - MIRA
- On well-characterised section of road network
- 1st generation machines = HA TSD and DRD TSD
- 2nd generation machine = ANAS TSD
- ANAS and DRI TSD measured right hand wheelpath
- HA's TSD measured left hand wheelpath

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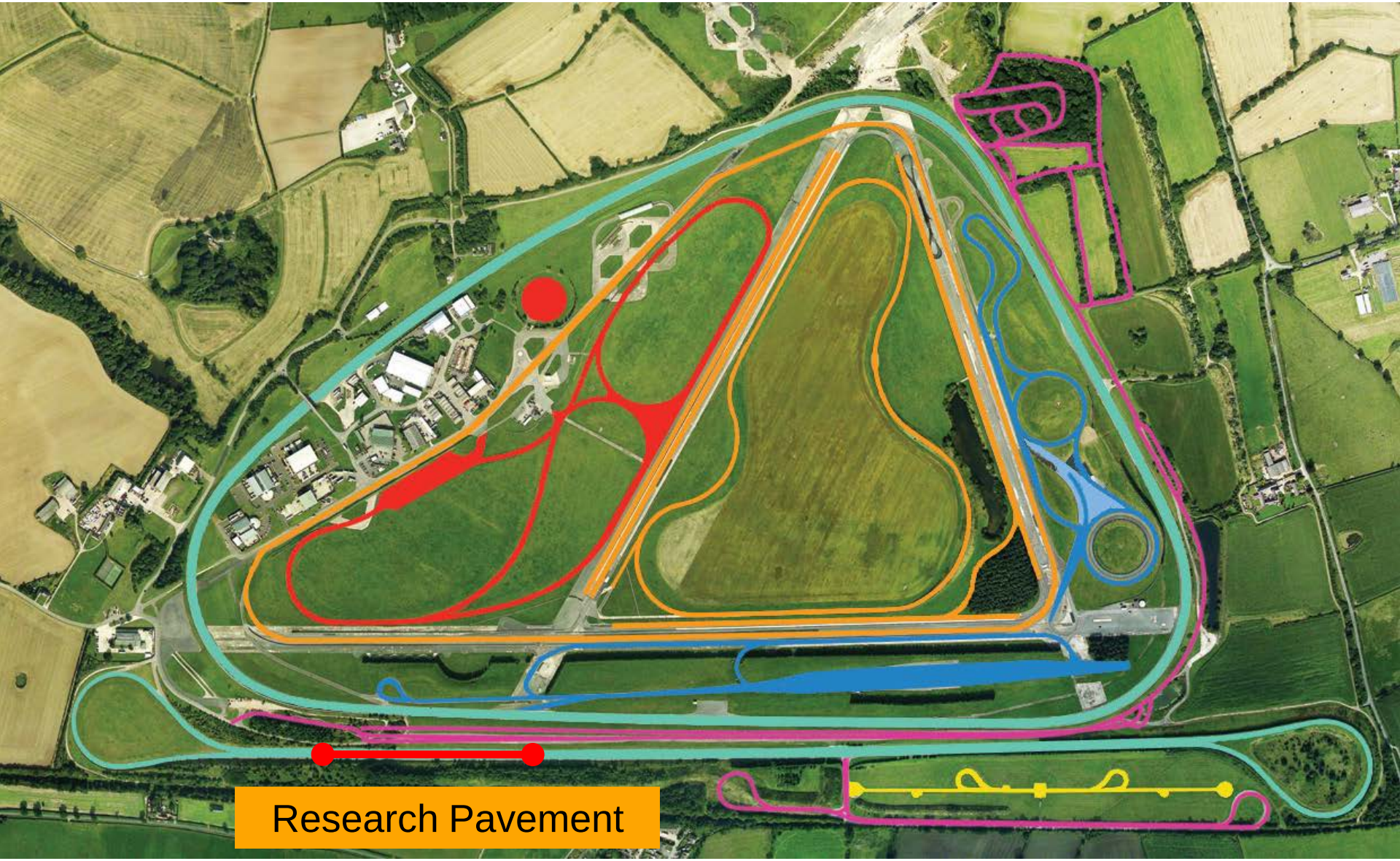
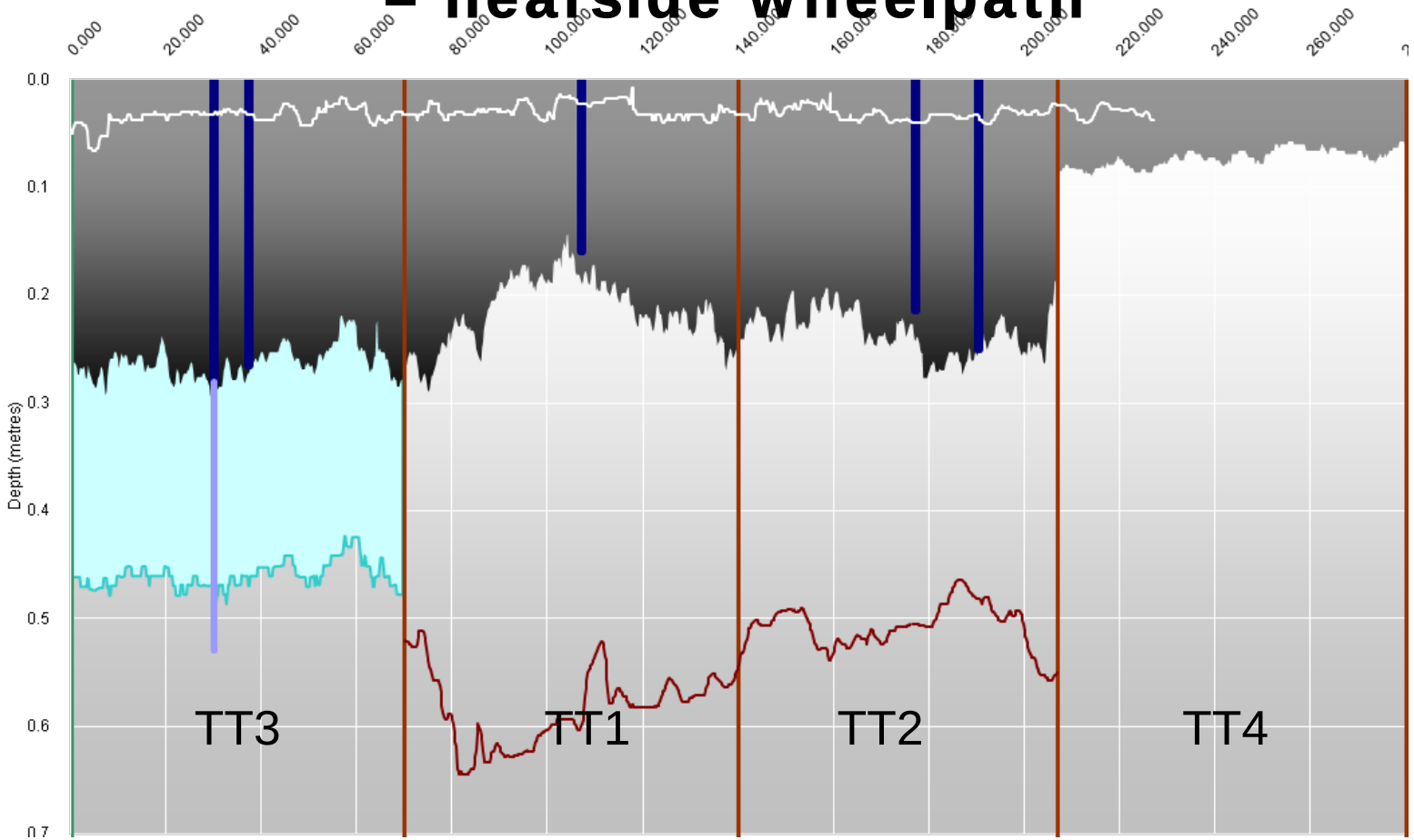
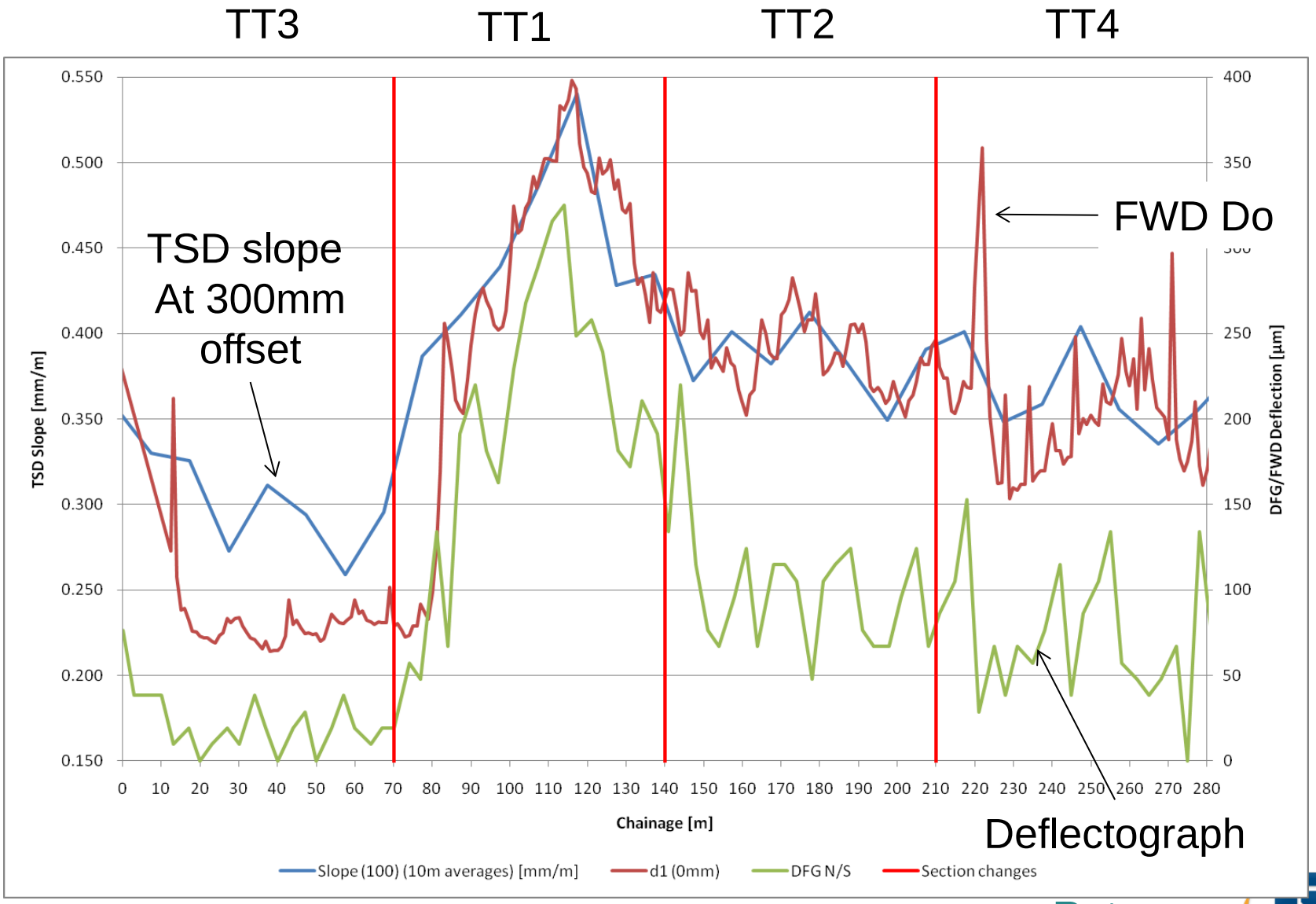
MIRA proving ground - Nuneaton, Warwickshire



Research Pavement thickness profile – nearside wheelpath



Deflection measurements on MIRA test sections



Return

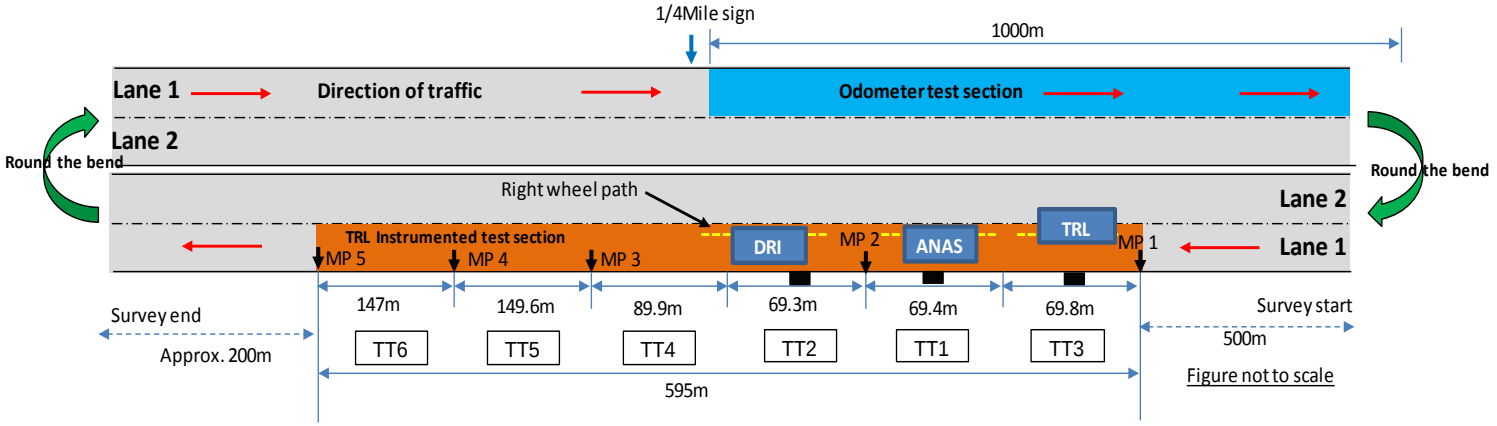
UK Comparative trials at MIRA

- October 2013
  - Closed instrumented site – MIRA HA test sections
  - Two 1st generation TSD's
    - HA TSD with sensors at 100, 300 and 756mm
    - DRD TSD with sensors at 100, 200 and 300mm
  - One 2nd generation TSD
    - ANAS TSD with sensors at 100, 200, 300, 600, 900 and 1500mm
  - However.....

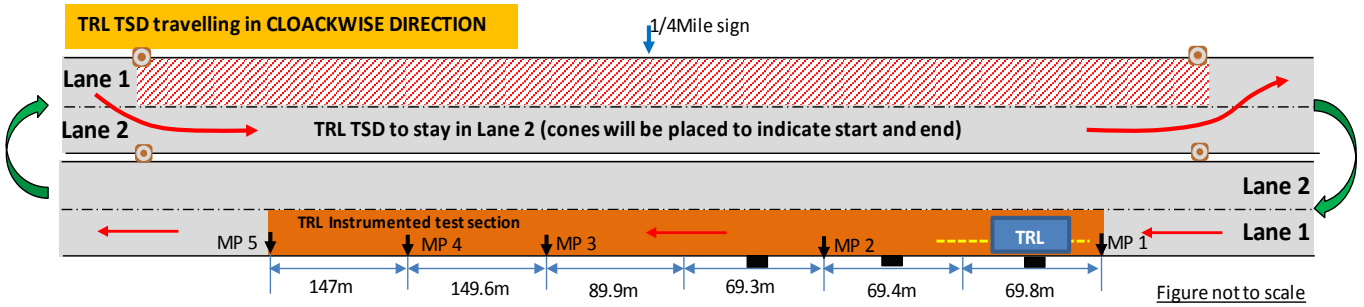
UK Comparative trials October 2013

- October 2013
  - Closed instrumented site – MIRA HA test sections
  - Two 1st generation TSD's
    - HA TSD with sensors at 100, 300 and 756mm – LH WP
    - DRD TSD with sensors at 100, 200 and 300mm – RH WP
  - One 2nd generation TSD
    - ANAS TSD with sensors at 100, 200, 300, 600, 900 and 1500mm – RH WP
  - Poor weather
  - Slow height sensor failure on UK TSD

Methodology 1 for comparing right and left hand sensors



Methodology 2 for comparing right and left hand sensors



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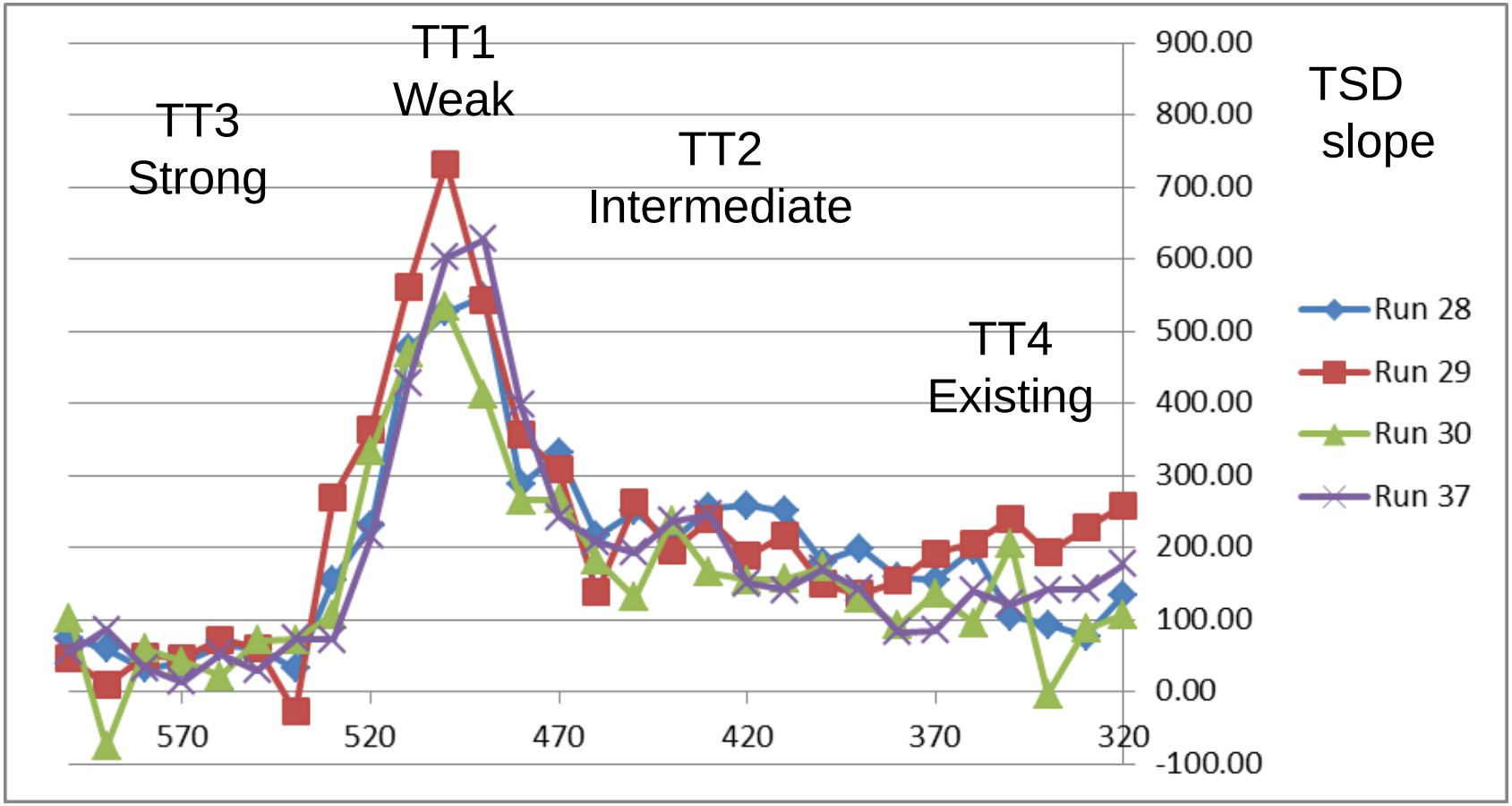
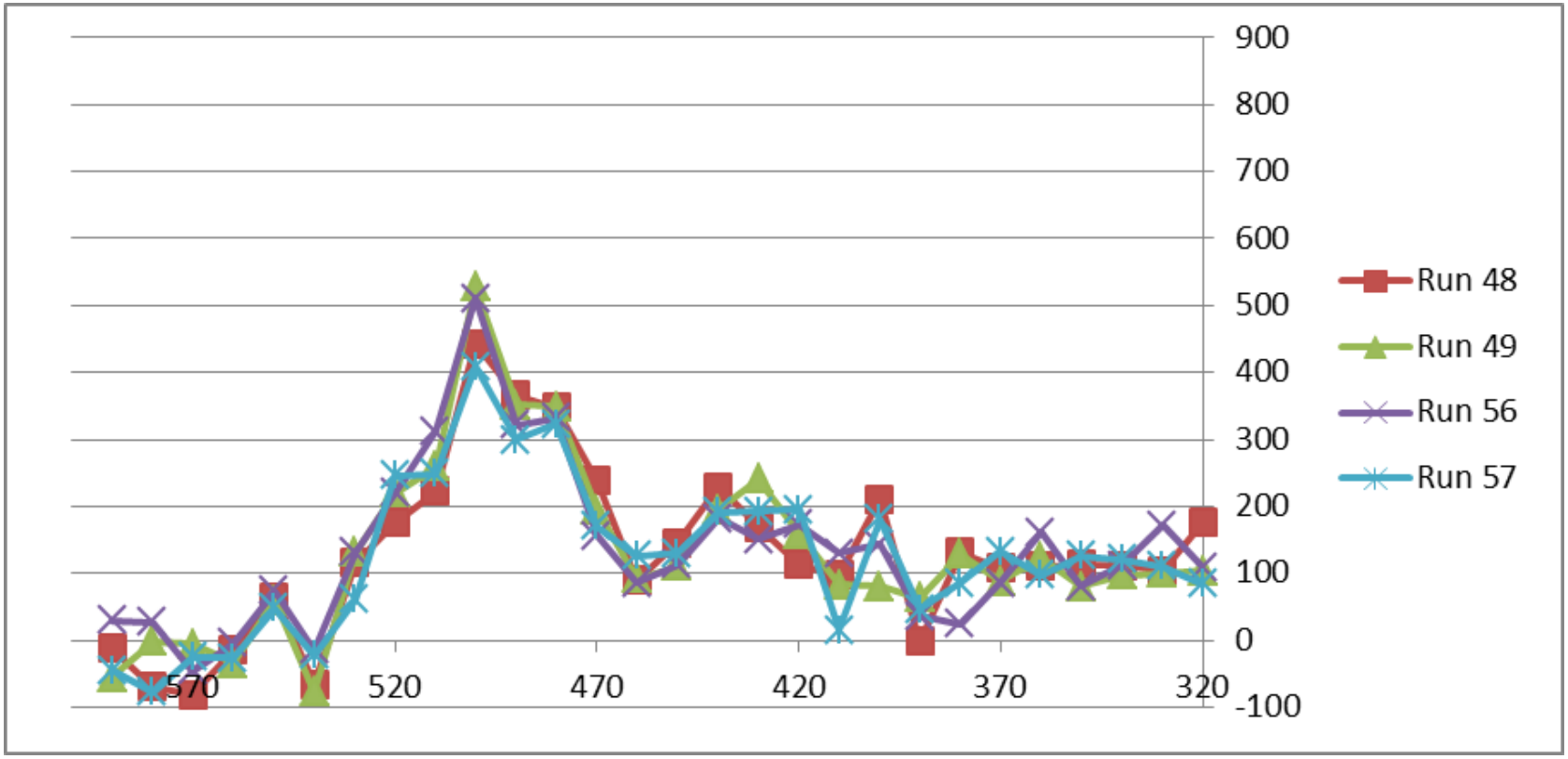
MIRA Trials ANAS TSD P300 sensor 4 runs at 70 km/h

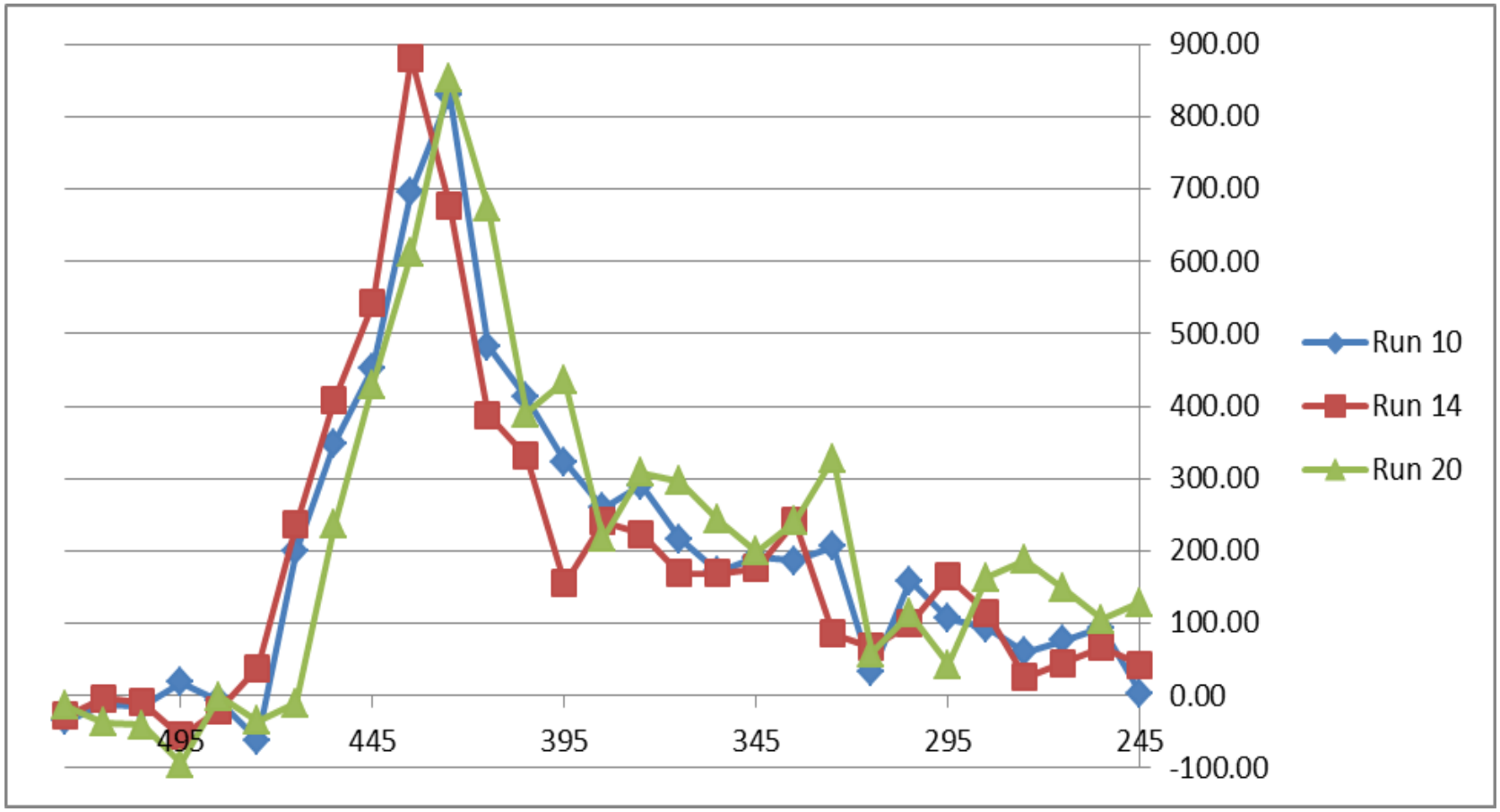


Distance (m)

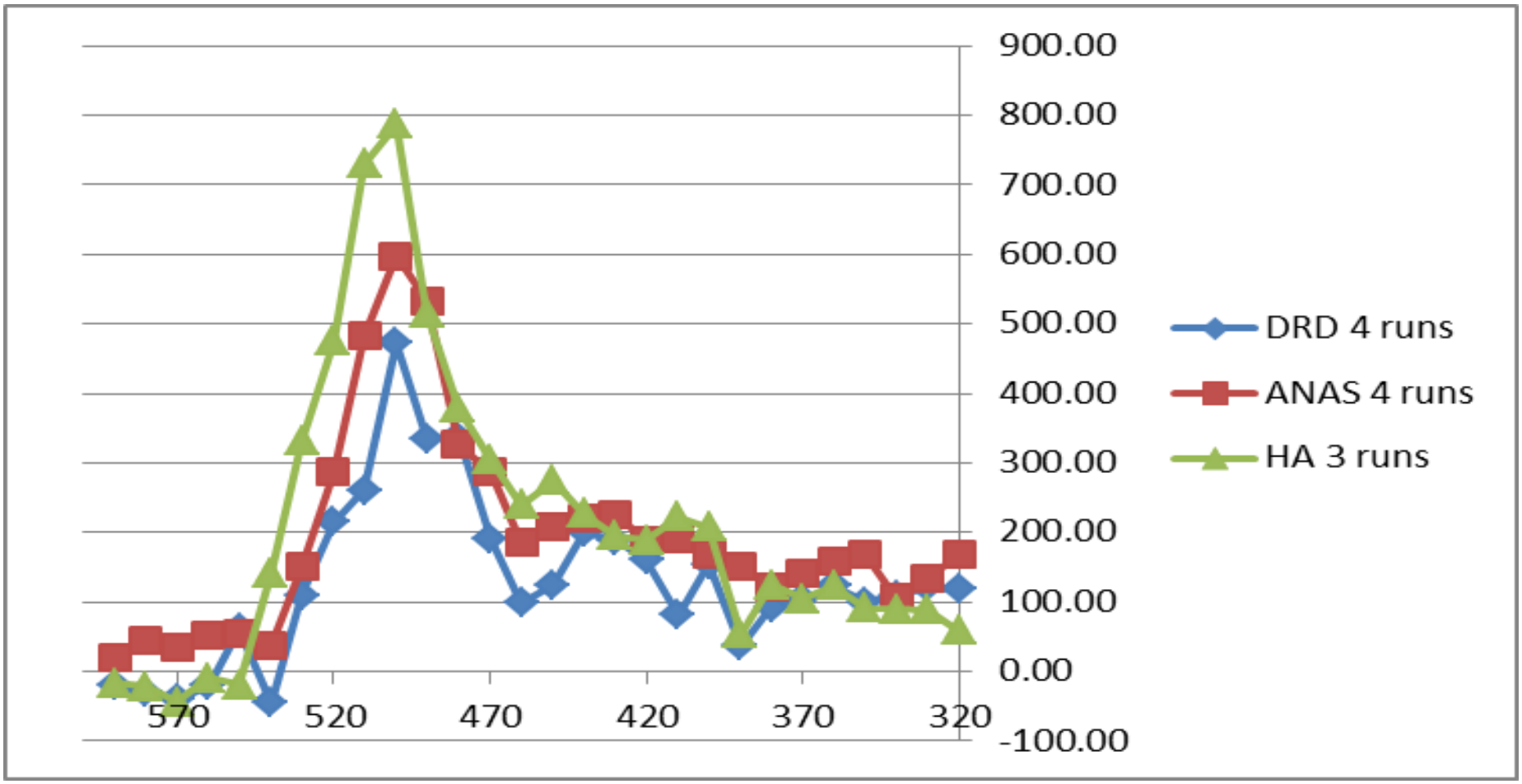
MIRA Trials DRD TSD P300 sensor 4 runs at 70 km/h



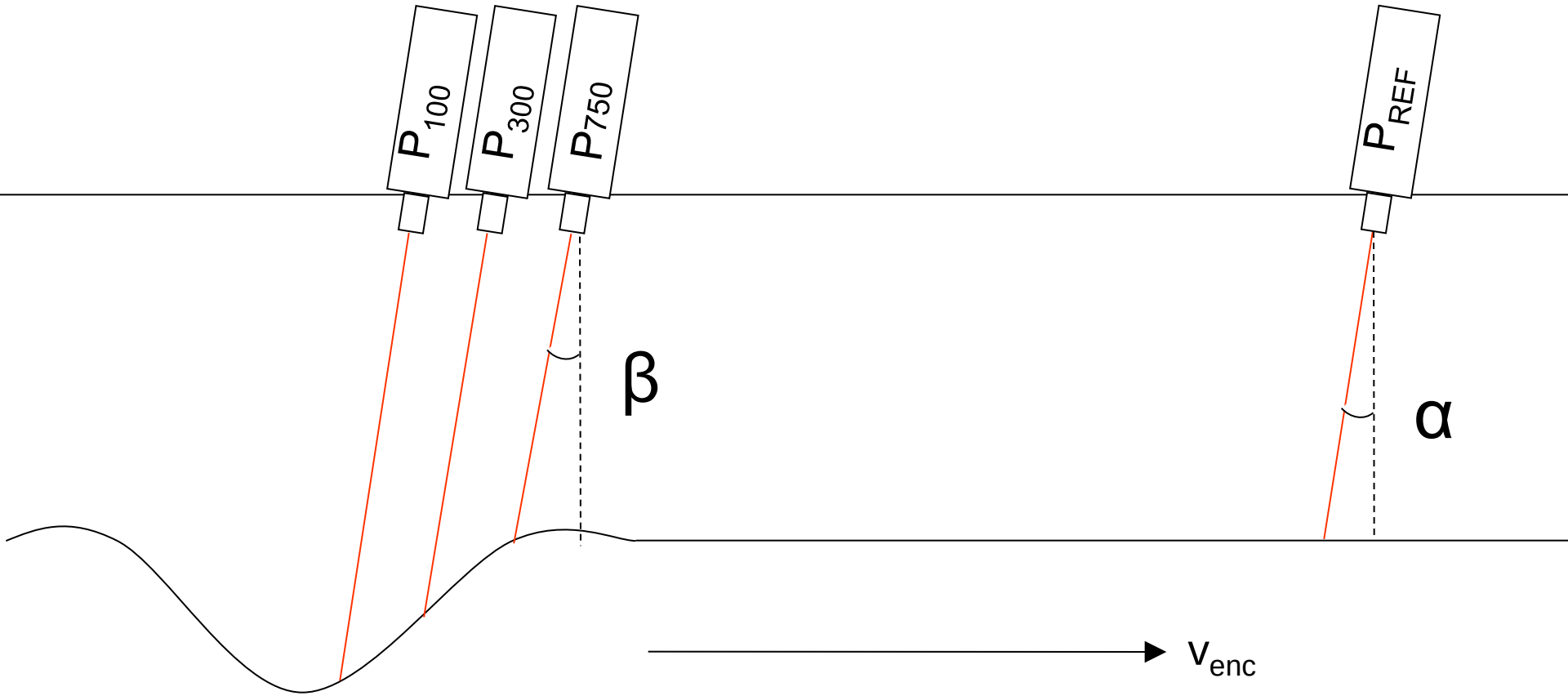
MIRA Trials HA TSD P300 sensor 3 runs at 70 km/h



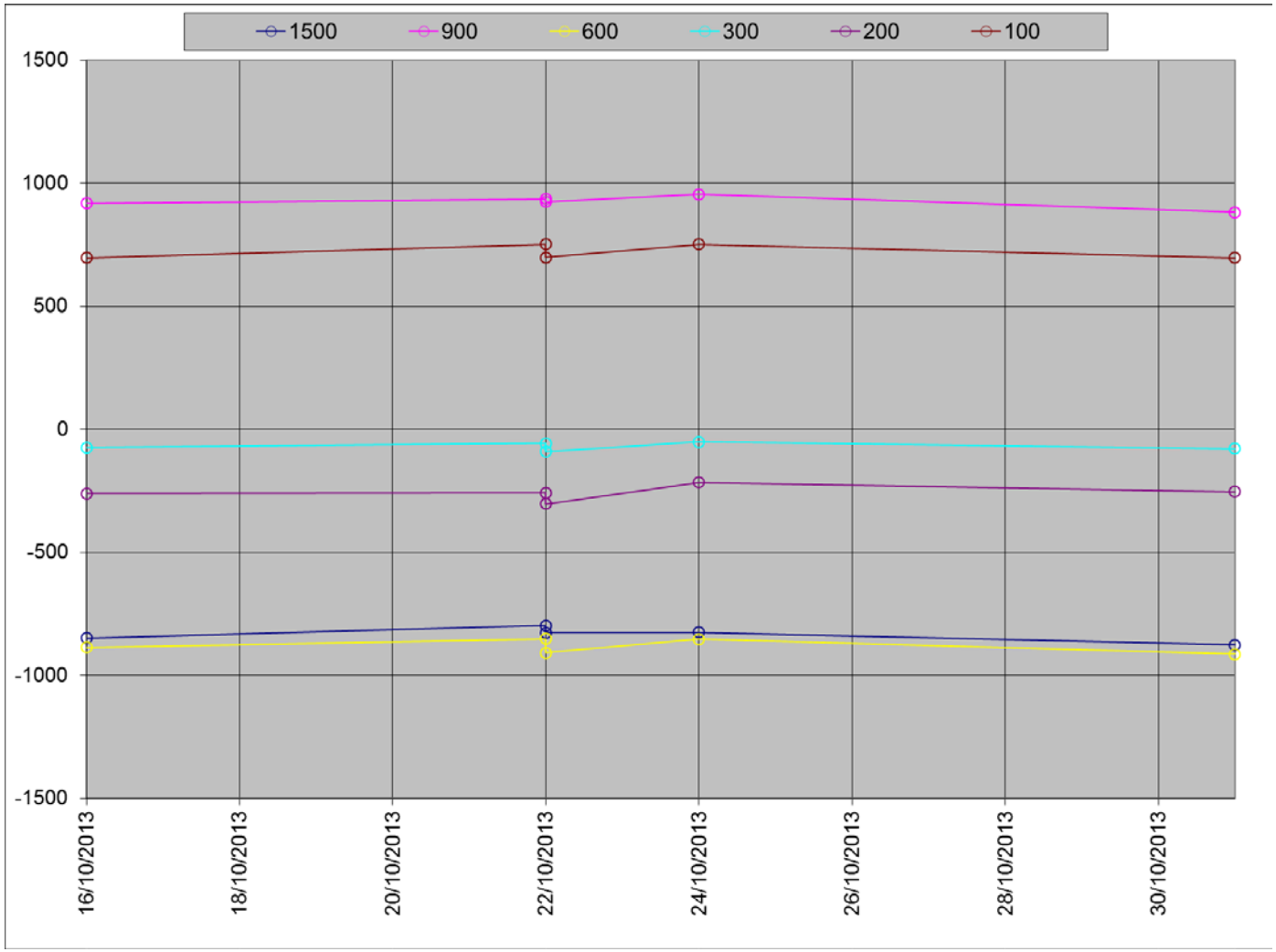
MIRA trials Averages of all three TSD's P300 sensor



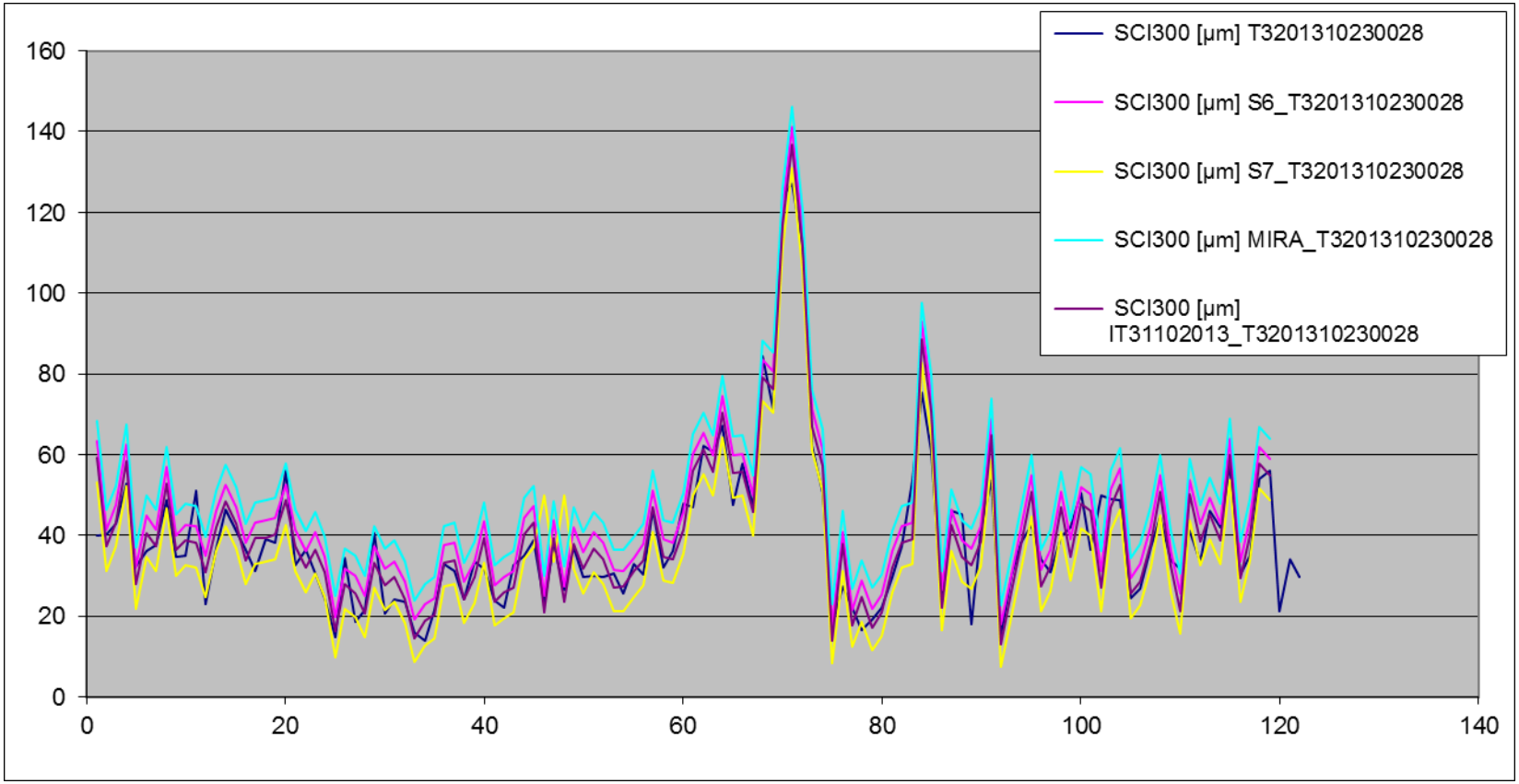
Laser set-up – calibration



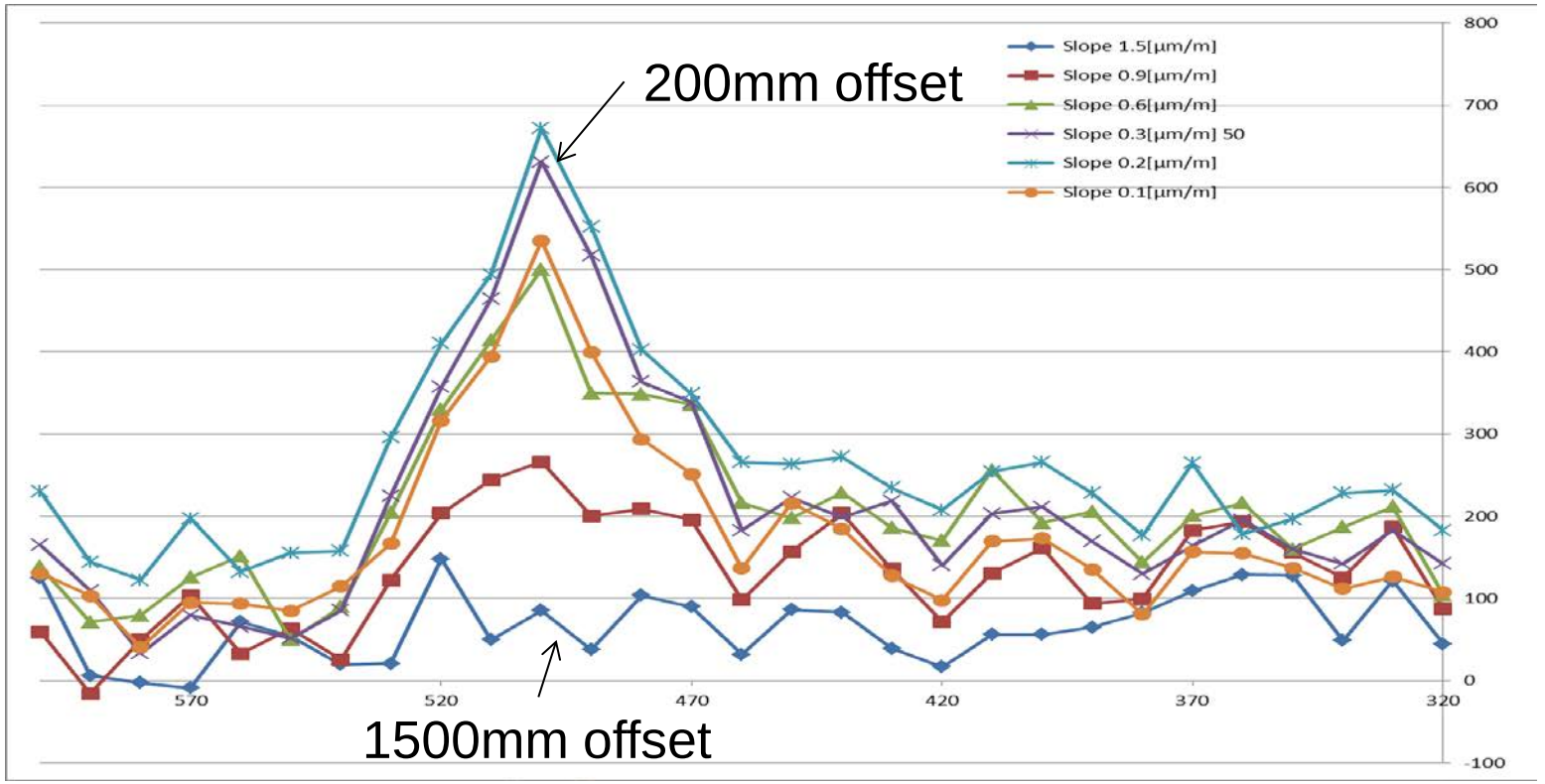
ANAS TSD – variation in calibration of each sensor through trial period



Effect of variation in calibration angles on estimates of SCI300



MIRA site - ANAS TSD – all sensors



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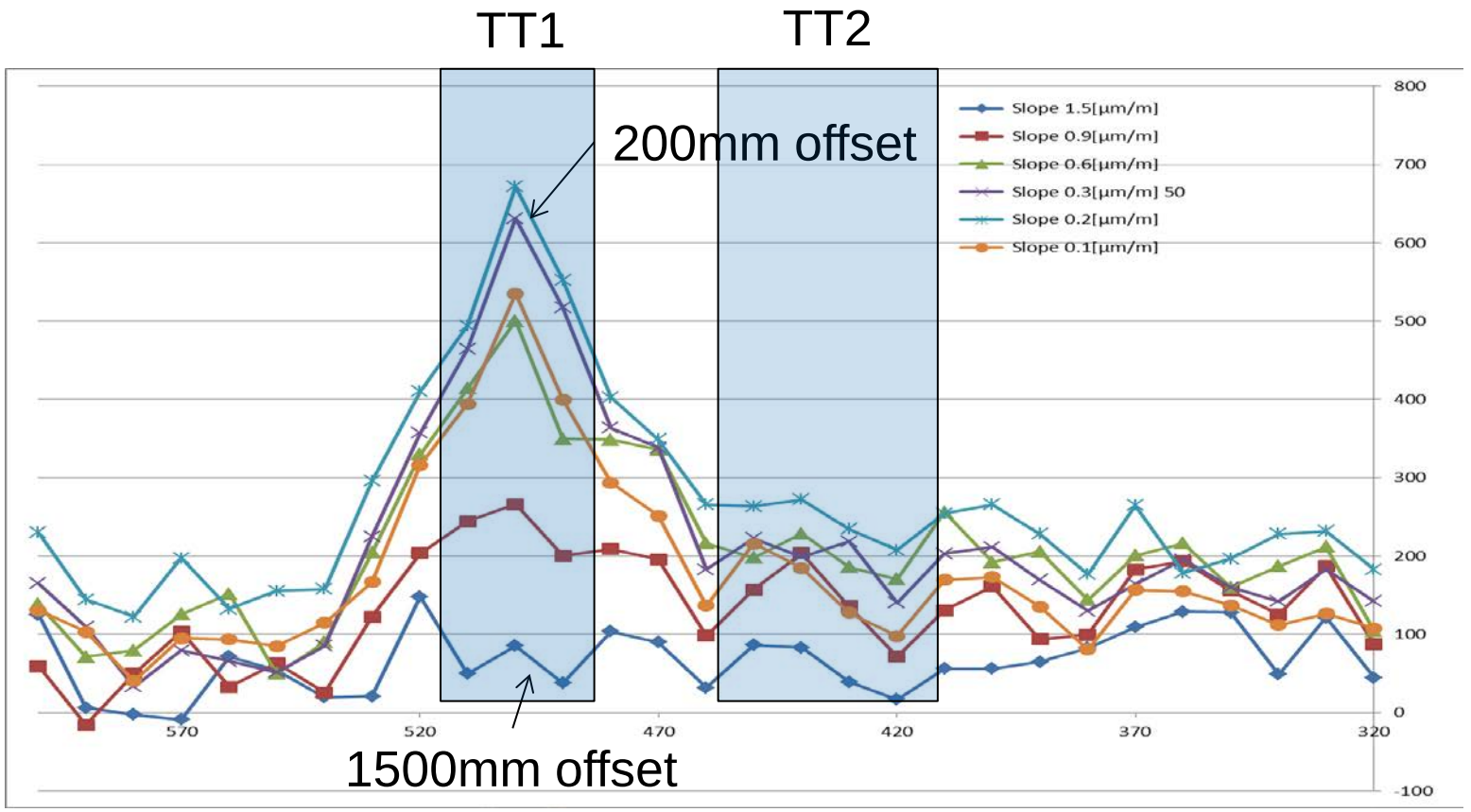
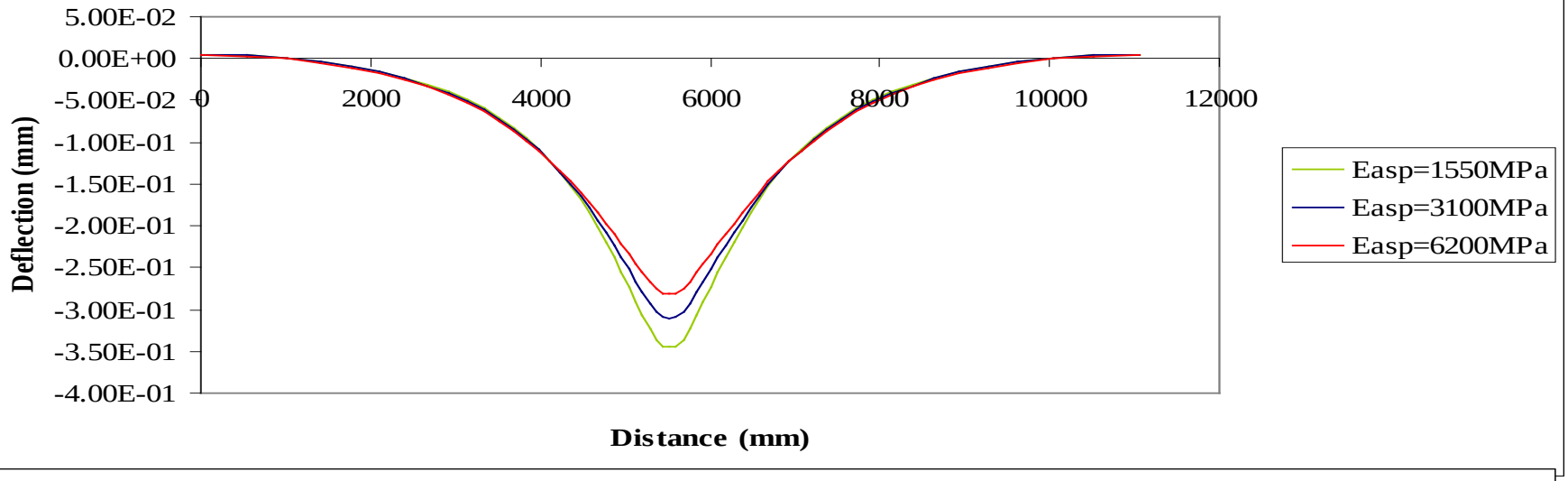
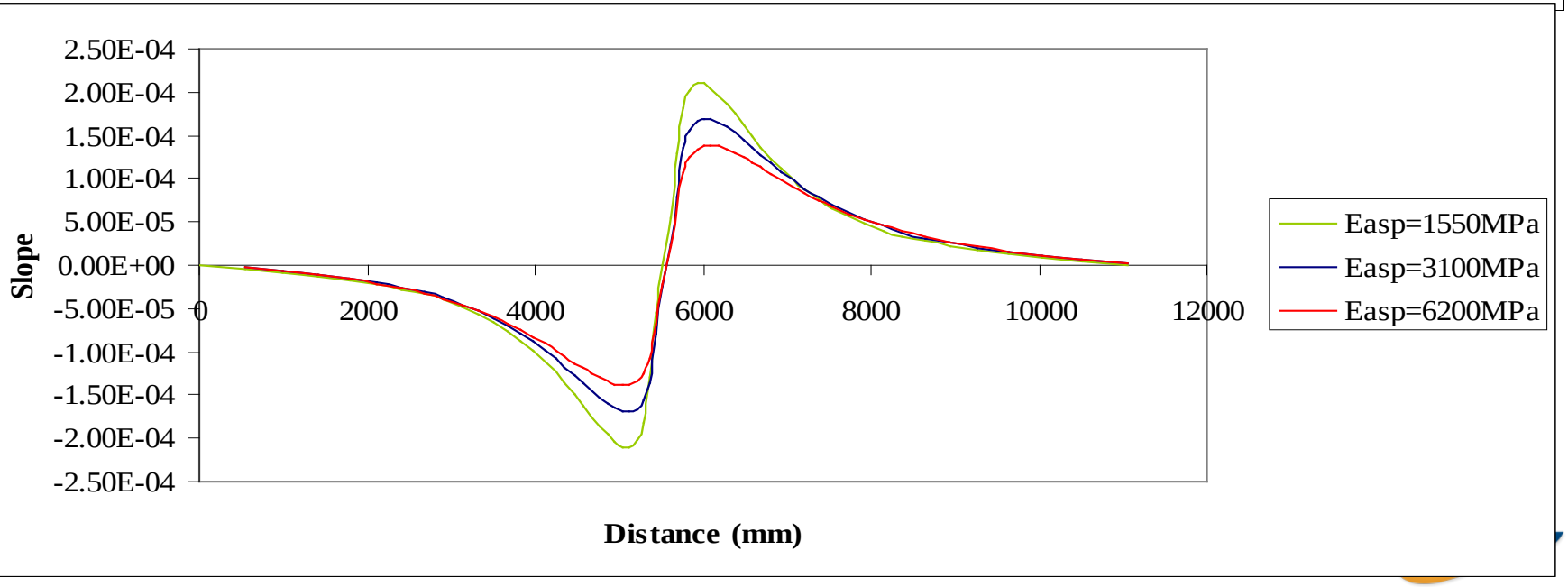


Examples of simple modelling of deflection and deflection slope under load.





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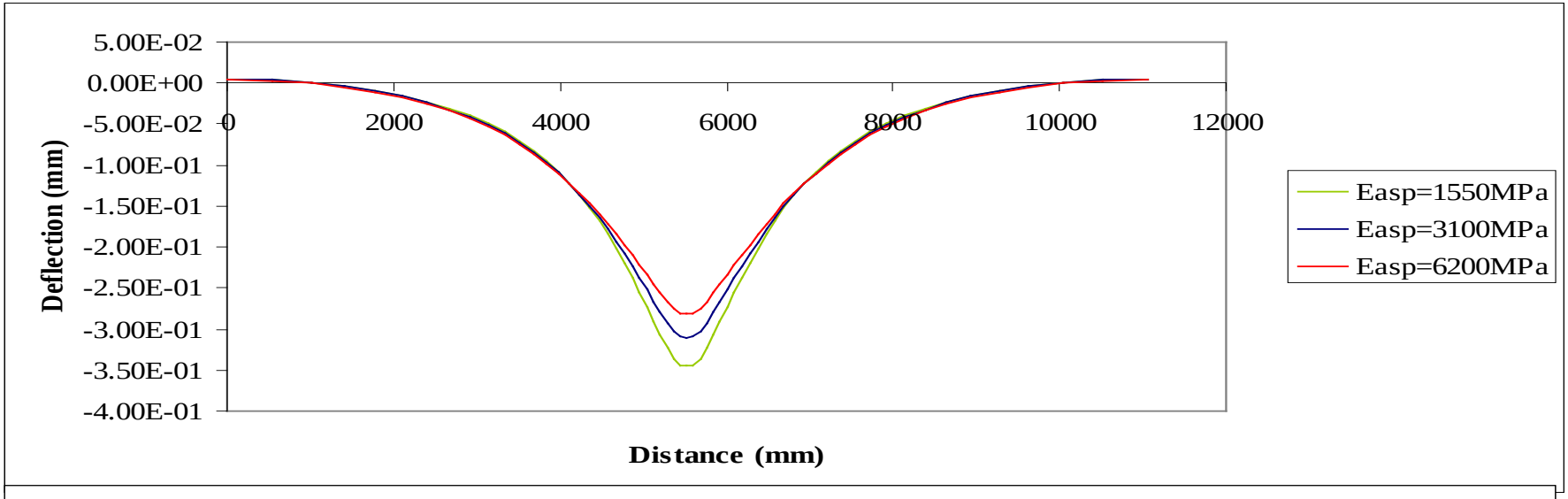
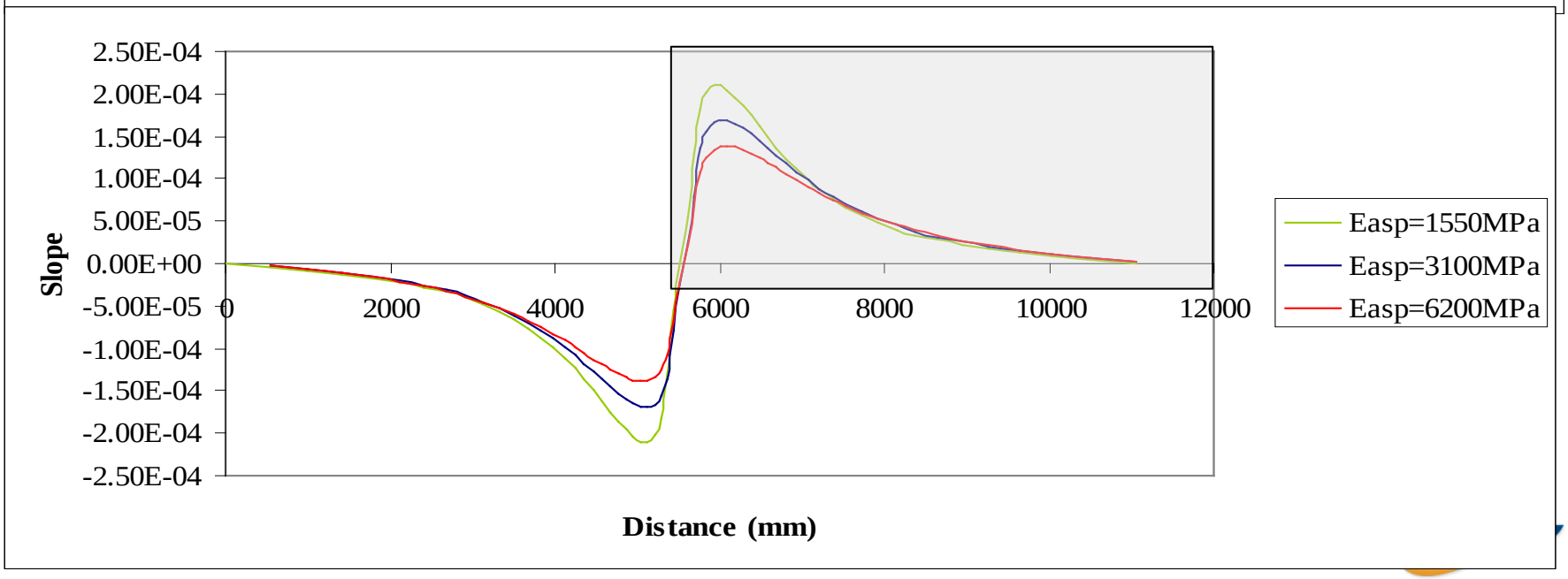
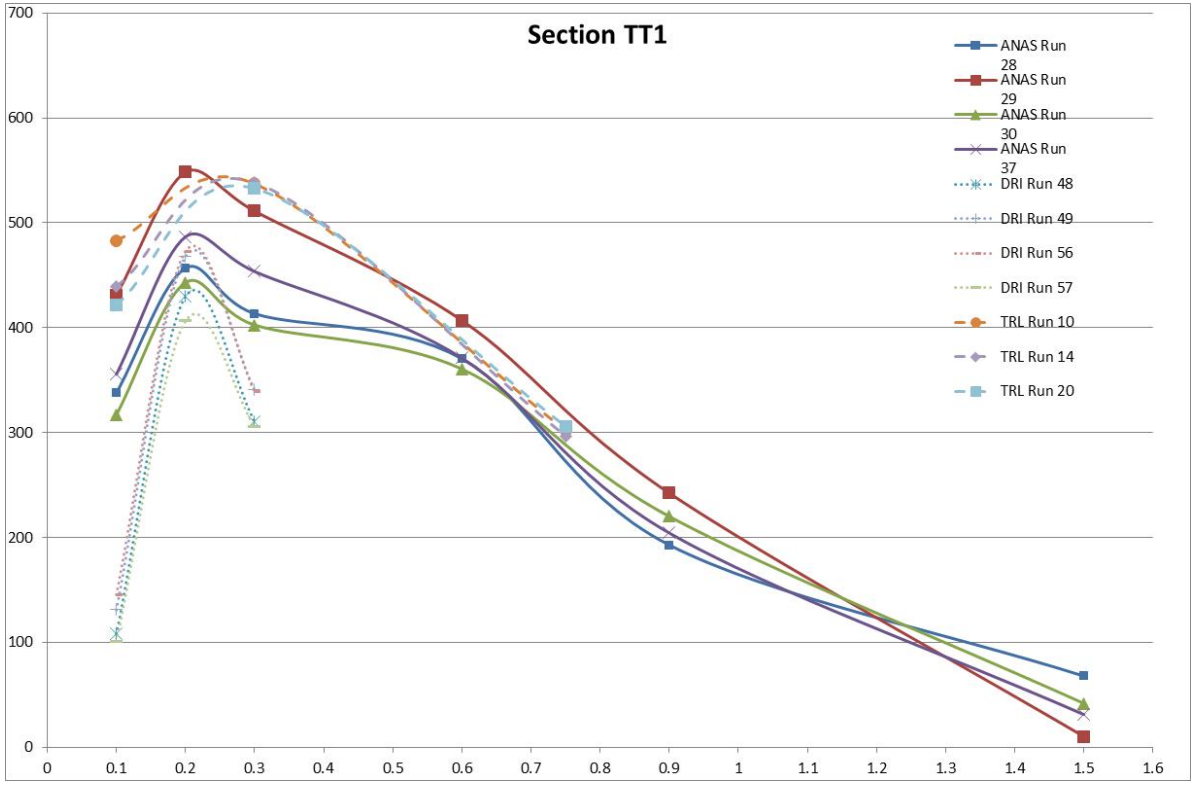
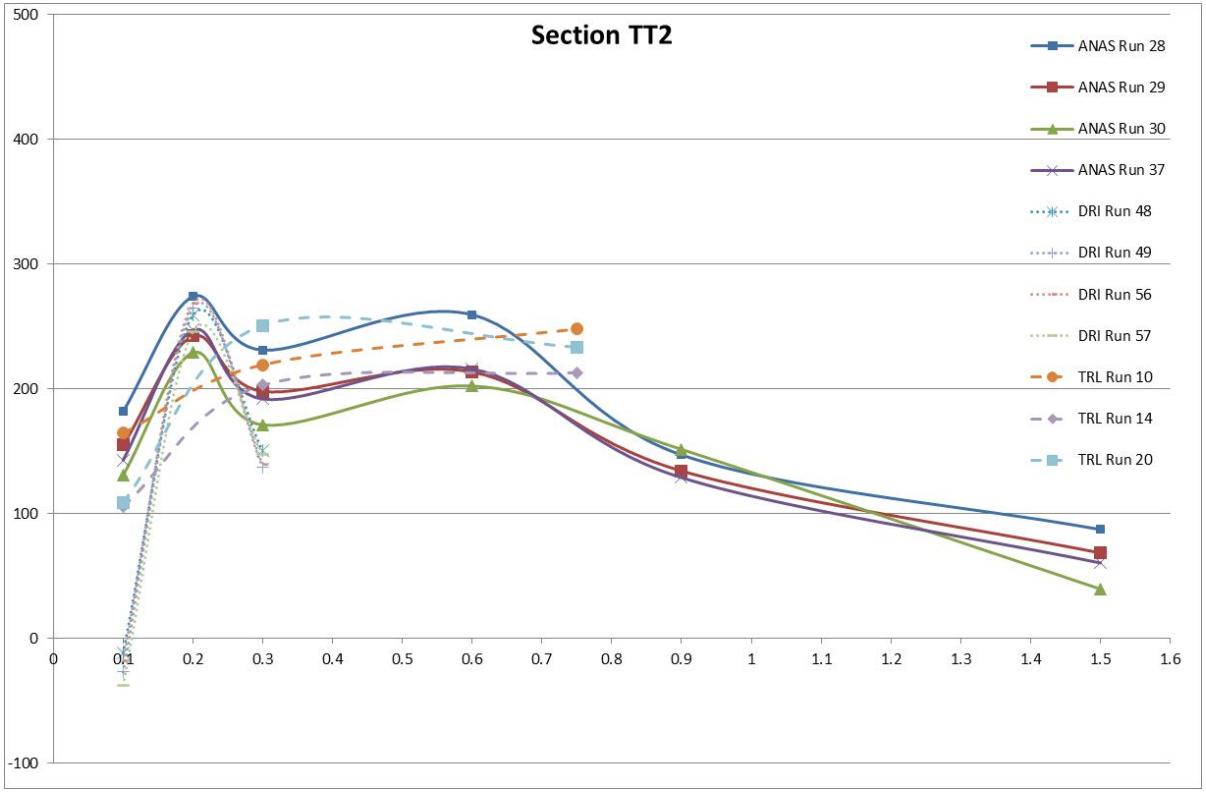




ANAS vs DRI vs TRL slopes vs offset – Section TT1



ANAS vs DRI vs TRL slopes vs offset – Section TT2



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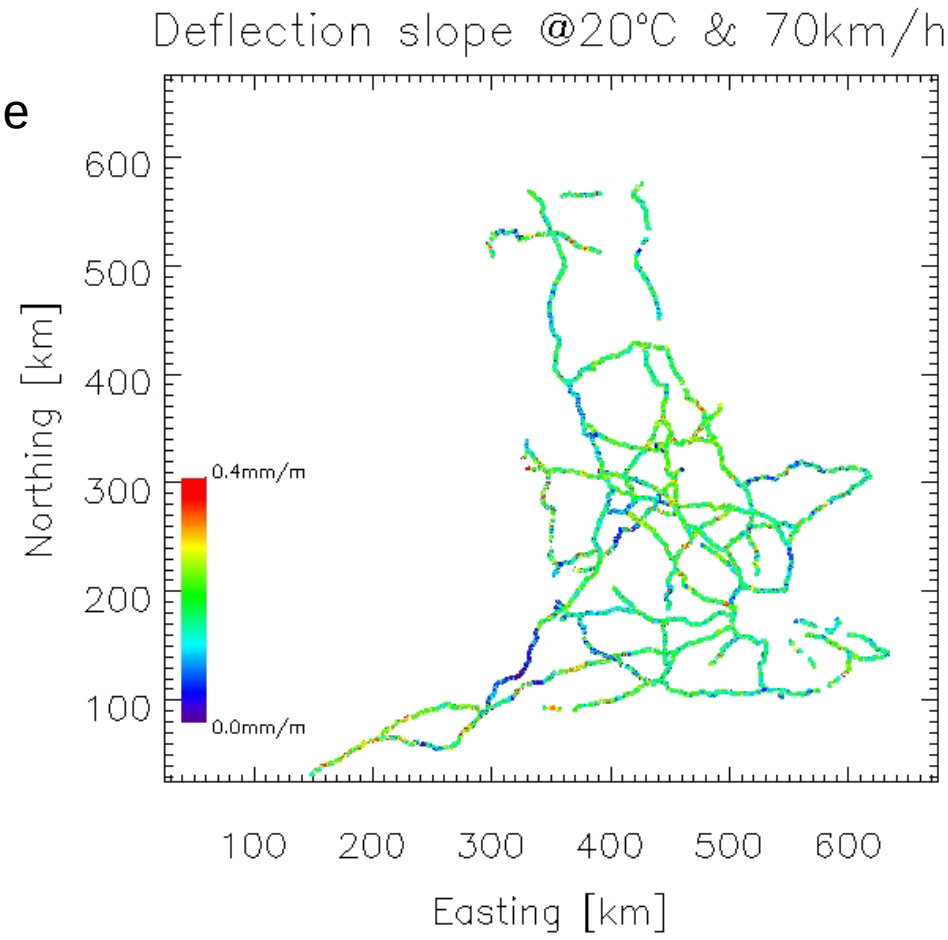
Summary and conclusions

Preliminary results from the 2013 TRL MIRA comparative trial have suggested that:

- First and second generation TSD's can measure very similar longitudinal strength profiles to each other and to other deflection devices
- Short term repeatability is good
- Long term repeatability is not yet proven although some available calibration methods for second generation machines appear to offer promise.
- Robust methodology for calibrating and quality auditing surveys is essential if meaningful measurements are to be collected.

TRASS1&2 Summary

- The HA TSD was successfully developed into a system capable of delivering routine network level surveys
- Over 18000km of structural condition information was collected by TRASS1 and TRASS2
- Robust QA regime established
- HA Managing Agents could be provided with indicator of network level structural condition
- TRASS3 started last week



Thank you

Presented by Brian Ferne

17 September 2014

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