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Real Time Detection of Low Adhesion in the Wheel/Rail Contact

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The University Of Sheffield.



The University of Nottingham

Peter Hubbard  
Chris Ward  
Roger Dixon  
Roger Goodall

“Real Time Detection of Low-Adhesion in the Wheel Rail Contact”



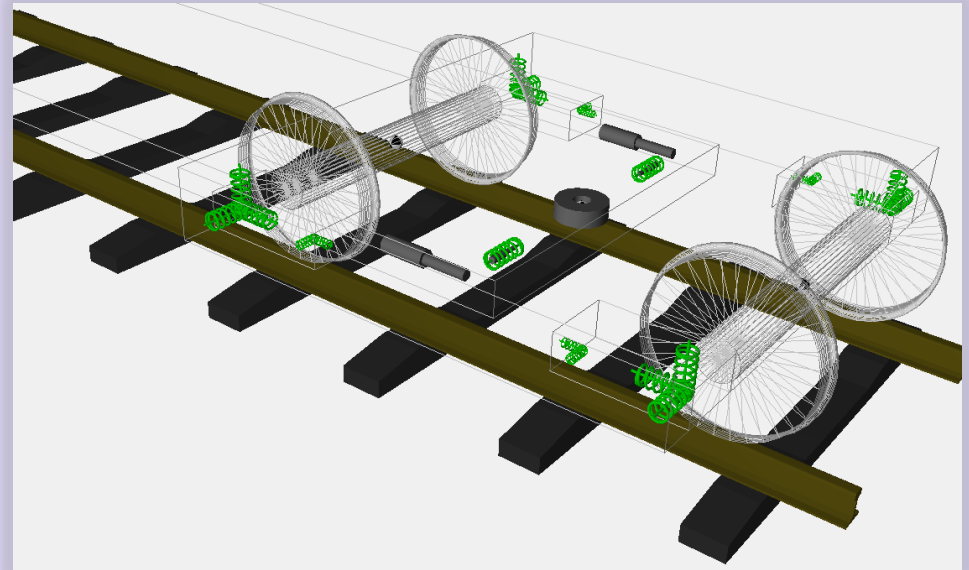
## What is low adhesion?

- Braking relies on contact friction
- Reduced by
  - Leaf contaminant
  - Rain and ice
  - Oil contaminant
  - 'Micro-wetting'
- SPADs
  - Cat. A  $\approx 300$ /year
  - Stonegate cl. 375, 8/11/2010
    - Train at 100kph
    - Expected to stop in 1240m
    - Took 5180m, 3940m past the station



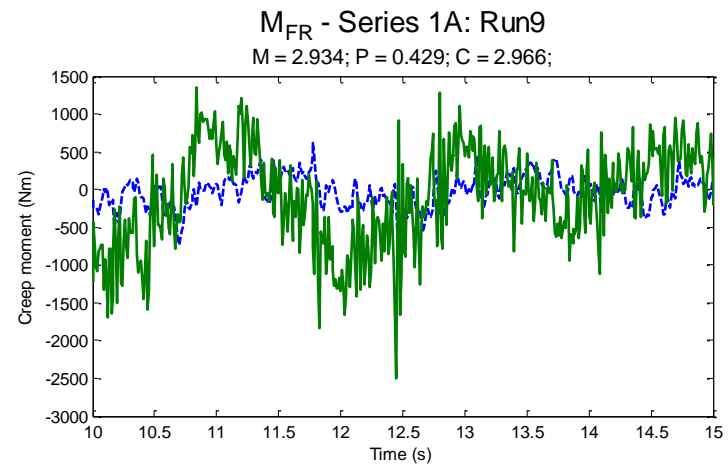
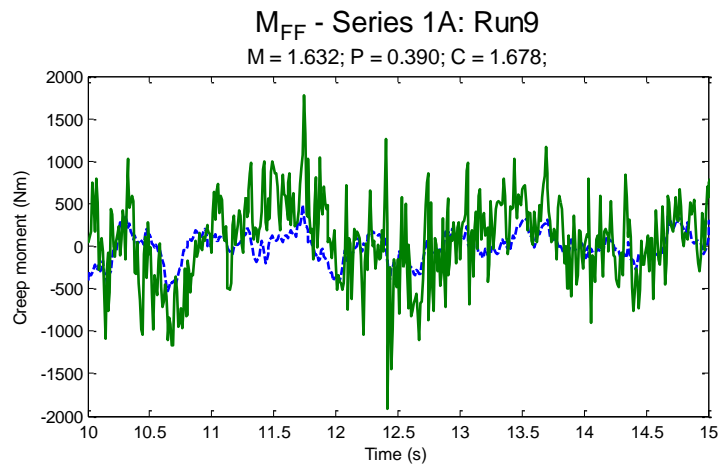
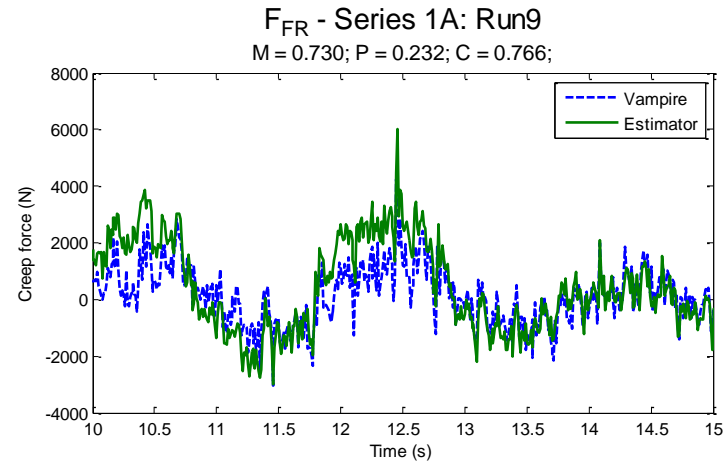
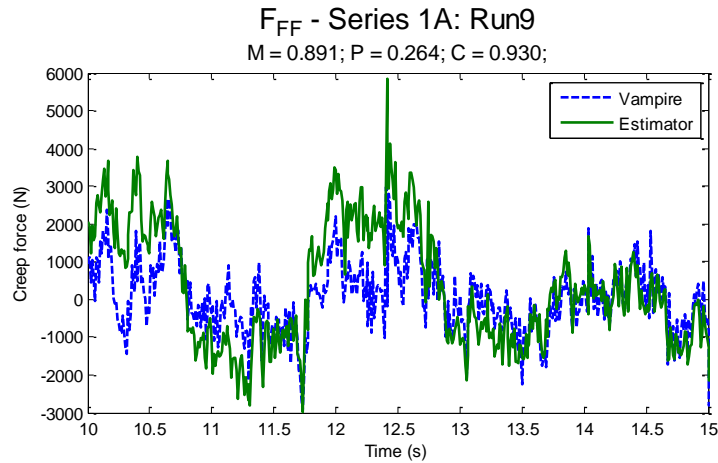
## Methodology

- Linear Plan-view model
- Form Kalman-Bucy filter
- Estimate Contact Forces
  - (augmented states)
- Use relationships with dynamics to approximate adhesion





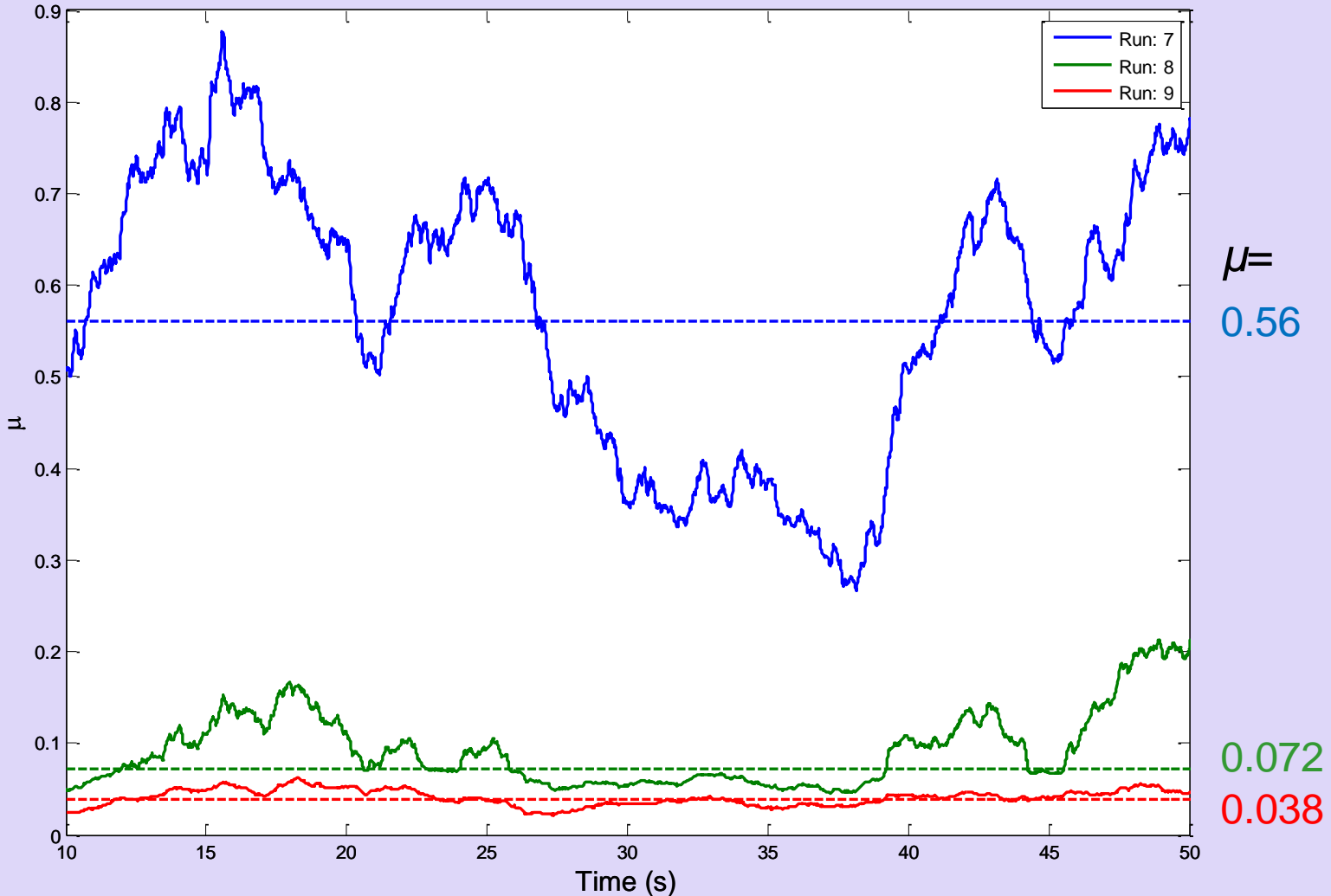
# Results – Comparison to ‘real’ VAMPIRE data





# Results – Comparison to ‘real’ VAMPIRE data

Adhesion Estimation - Series 1A Datasets  
RMS window: 5s





## Conclusions

- Reasonable approximation of adhesion estimation
  - Direct data methods showing good results too
- Success against 'Blind Data'
- Progression to track testing – June 2013?