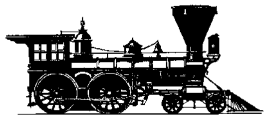
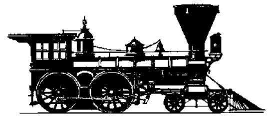


Derailment,
simulation and measurement

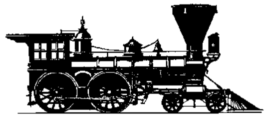
Kik, Menssen, Moelle (ArgeCare)
Bergander (DB-AG)
Vincent (SNCF)



Project:
Assessment of vehicle-track interaction with special reference to dynamic safety in operating conditions
(DYSAF)

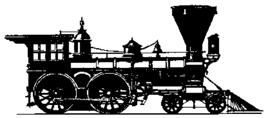
funded by the European Commission Industrial and Materials Technologies programme (Brite-EuRam III)

DYSAF – Structure



- **Design and use of a Test Running Gear for derailment tests at higher speeds**
- **Investigation of safety criteria by means of tests and MBS tools**
- **Feasibility and investigation in an Integrated Dynamic Measuring System**

DYSAF – Partners

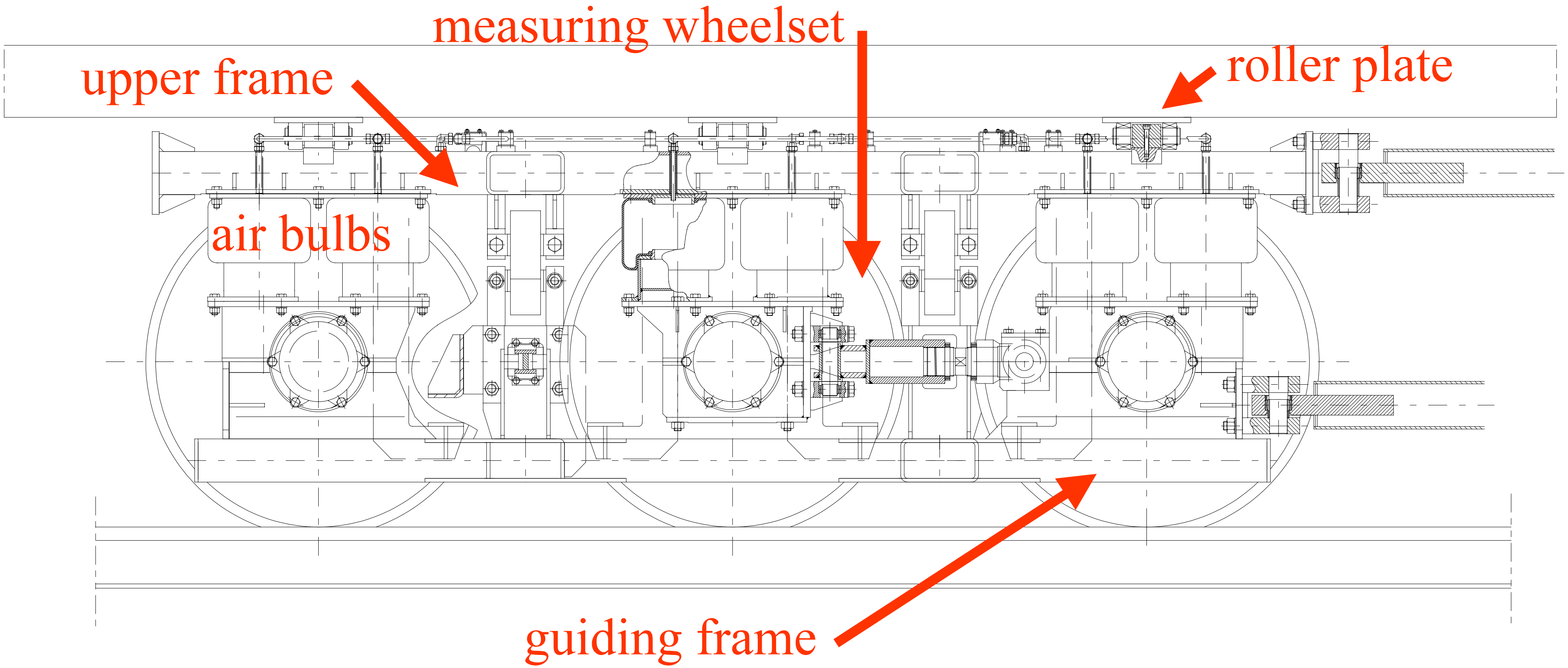


- **ERRI, ERESMAN**
- **DB AG, SNCF, ÖBB, NSTO**
- **FIATFerroviaria, Siemens SGP**
- **TU Graz, TU Munic, Uni. Bologna**
- **C+K, ArgeCare**

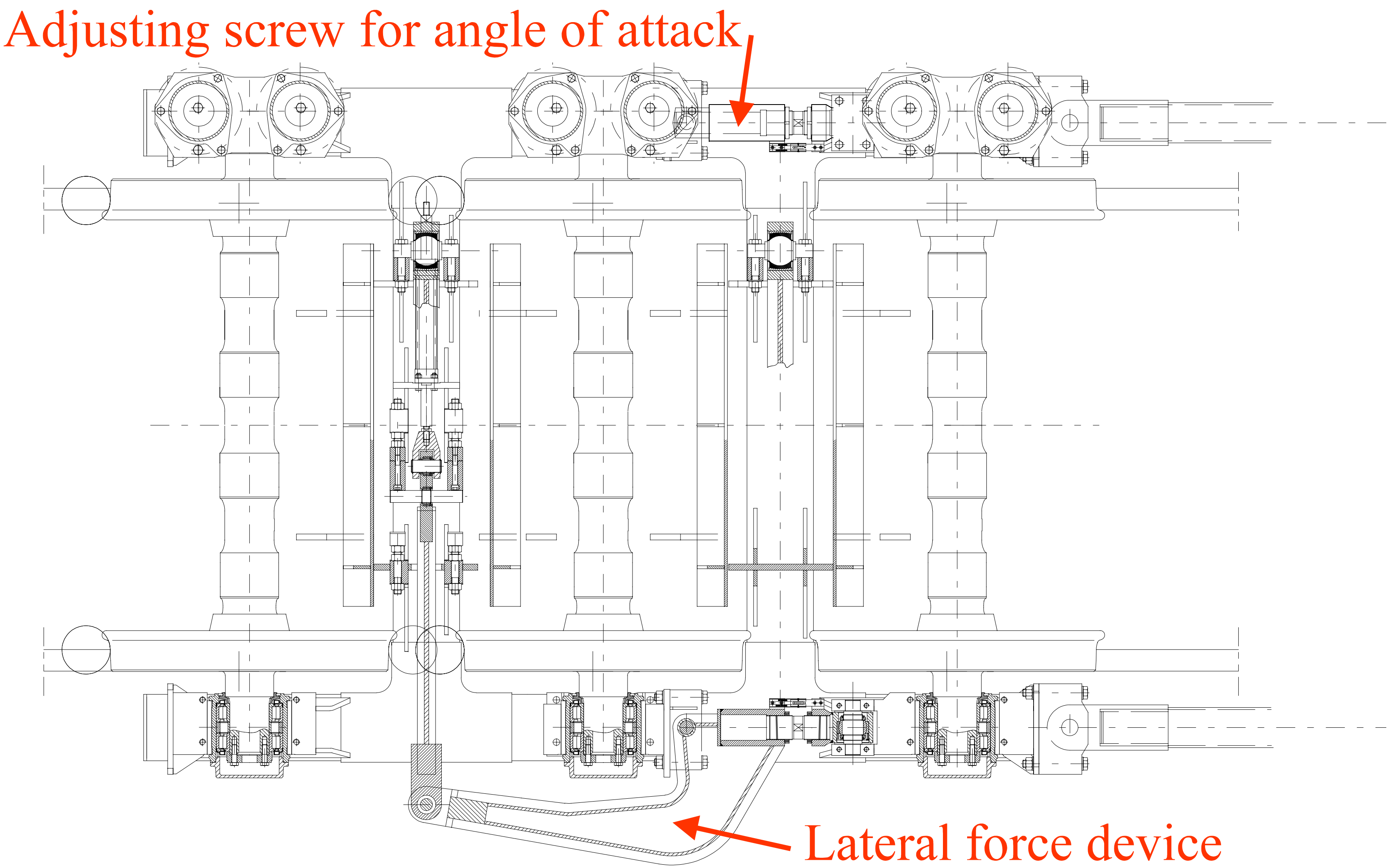
Comparison of measure-ments in Velim and simulation

- Test vehicle and model
- Test program
- Parameter identification
- Test and simulation results
- Conclusions

Test running gear

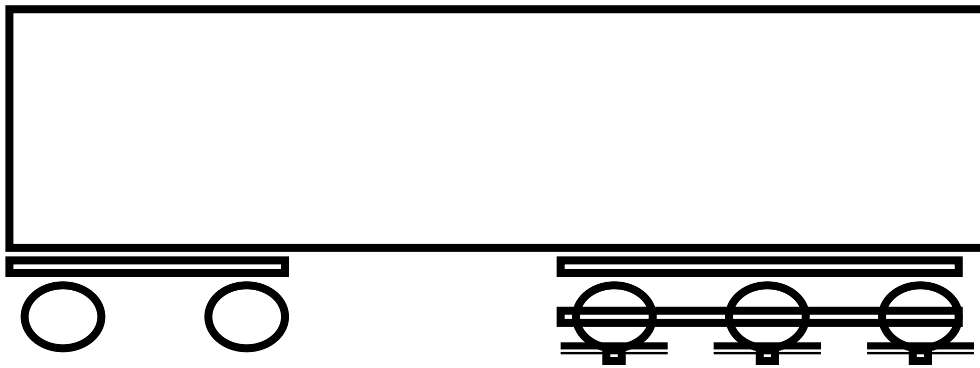


Test running gear



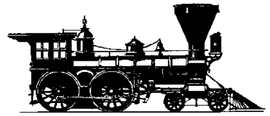
Date: 05.10.01

Mechanical model



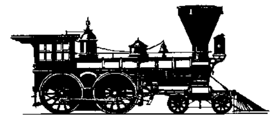
- 21 rigid bodies, 87 DOFs
- Wheel-rail elements, non-elliptic contact patches, multi point contact
- Different measured profile on each wheel
- Flexible rail/sleeper model for TRG
- Track irregularities by gauge and lateral and vertical alignment of left and right rail

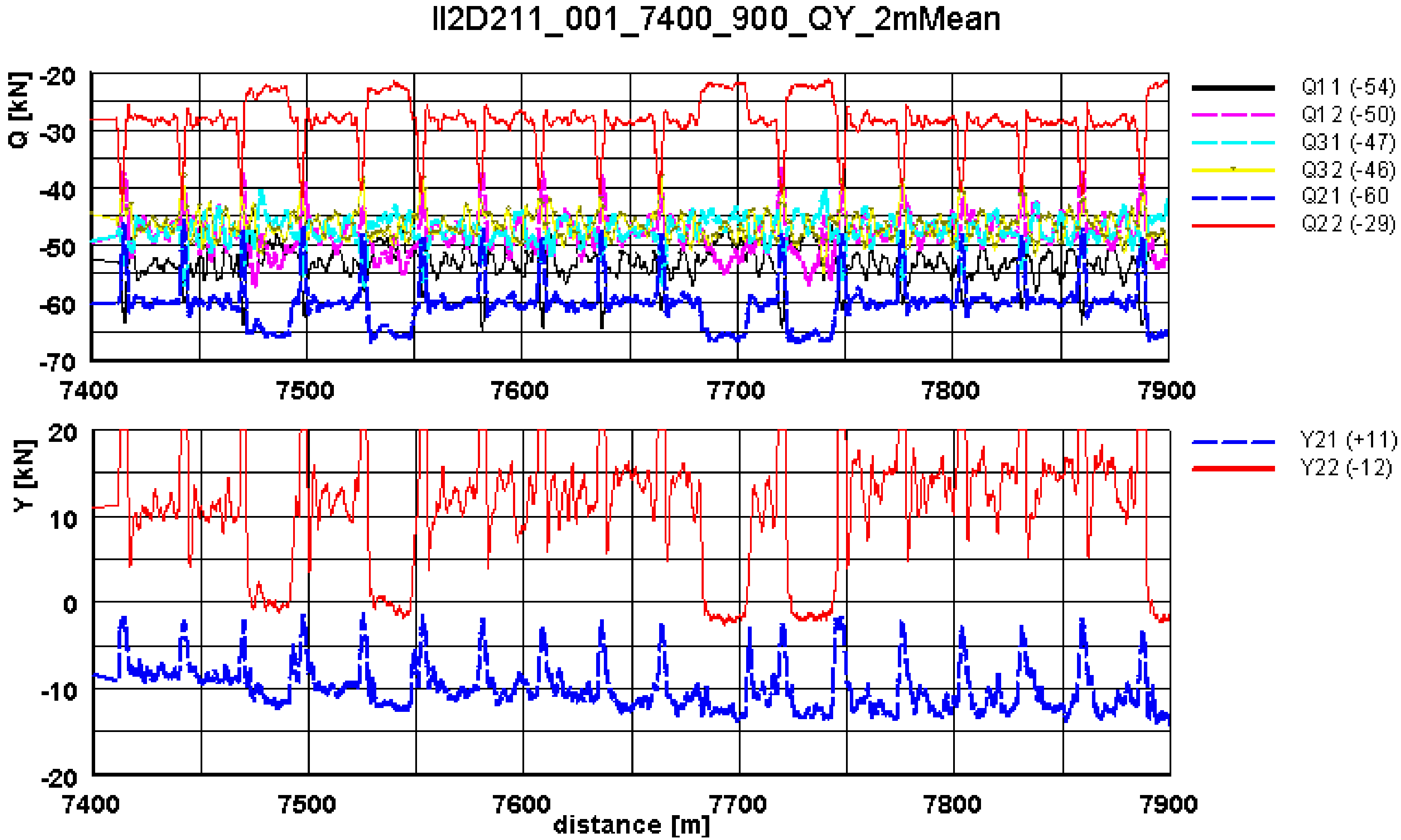
Purpose of test and simulation cases



- Investigation of safety criteria for vehicles in high speed operation
  - behavior of a guiding wheel,
  - behavior of an unloaded wheel
- under the effect of track irregularities

Identification of wheel loads and friction coefficient

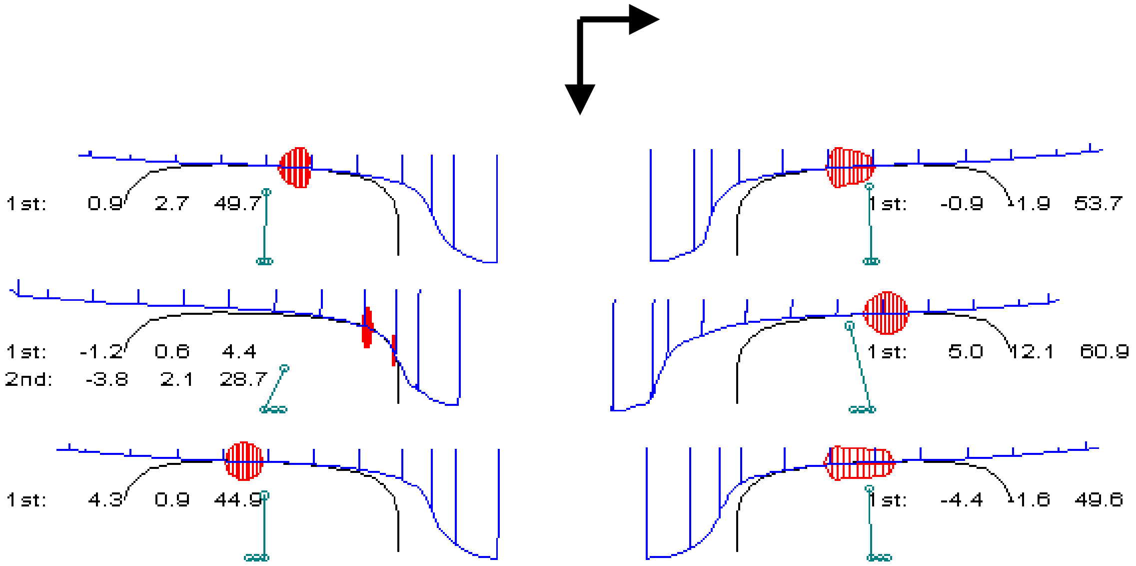




Wheel- rail and contact patch configuration

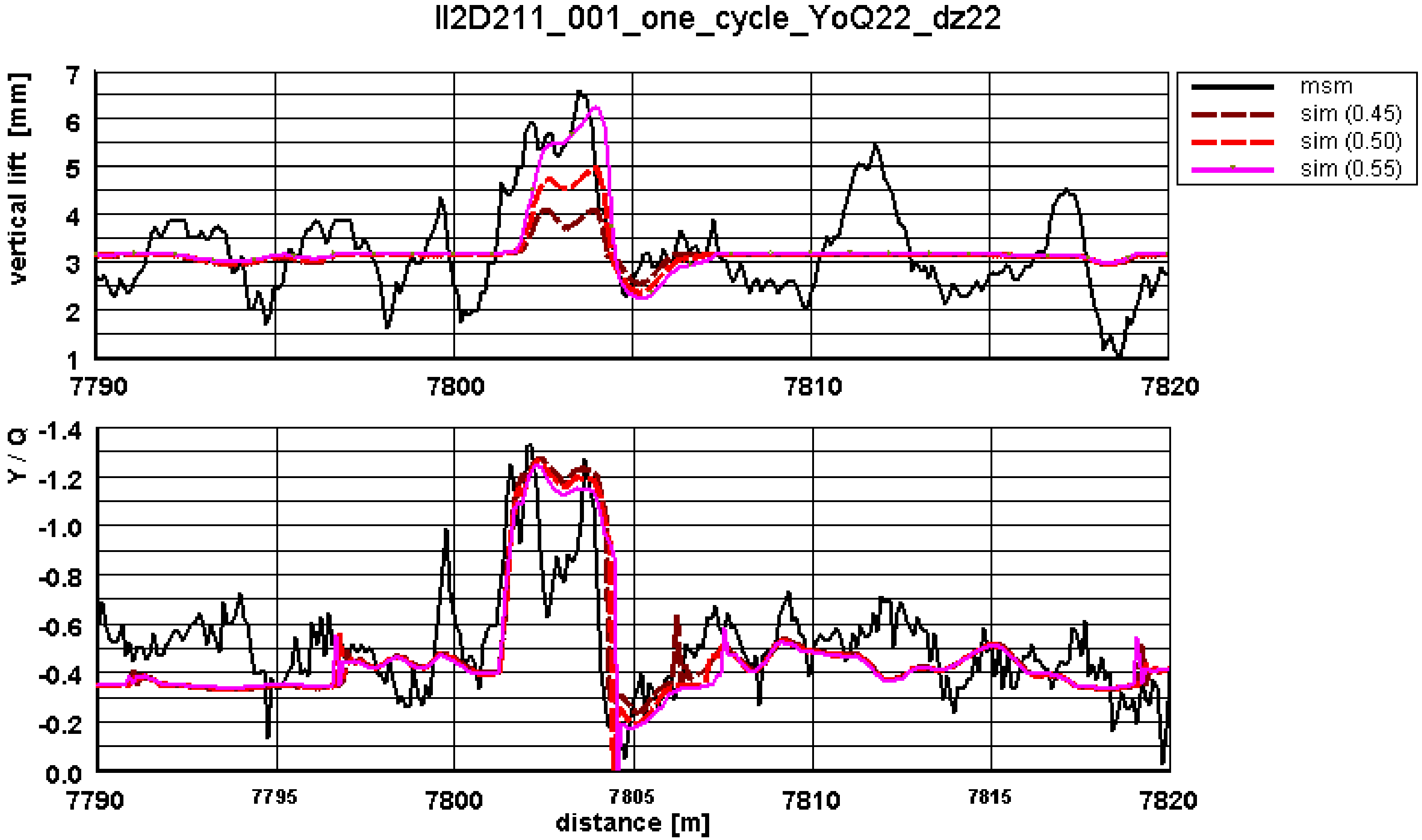
Track forces

left Qi2	left Yi2	right Qi1	right Yi1
50.		54.	
29.	-12	60.	12
46.		47.	

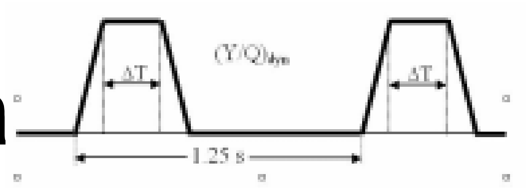


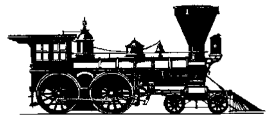
Contact forces, longitudinal, lateral and normal

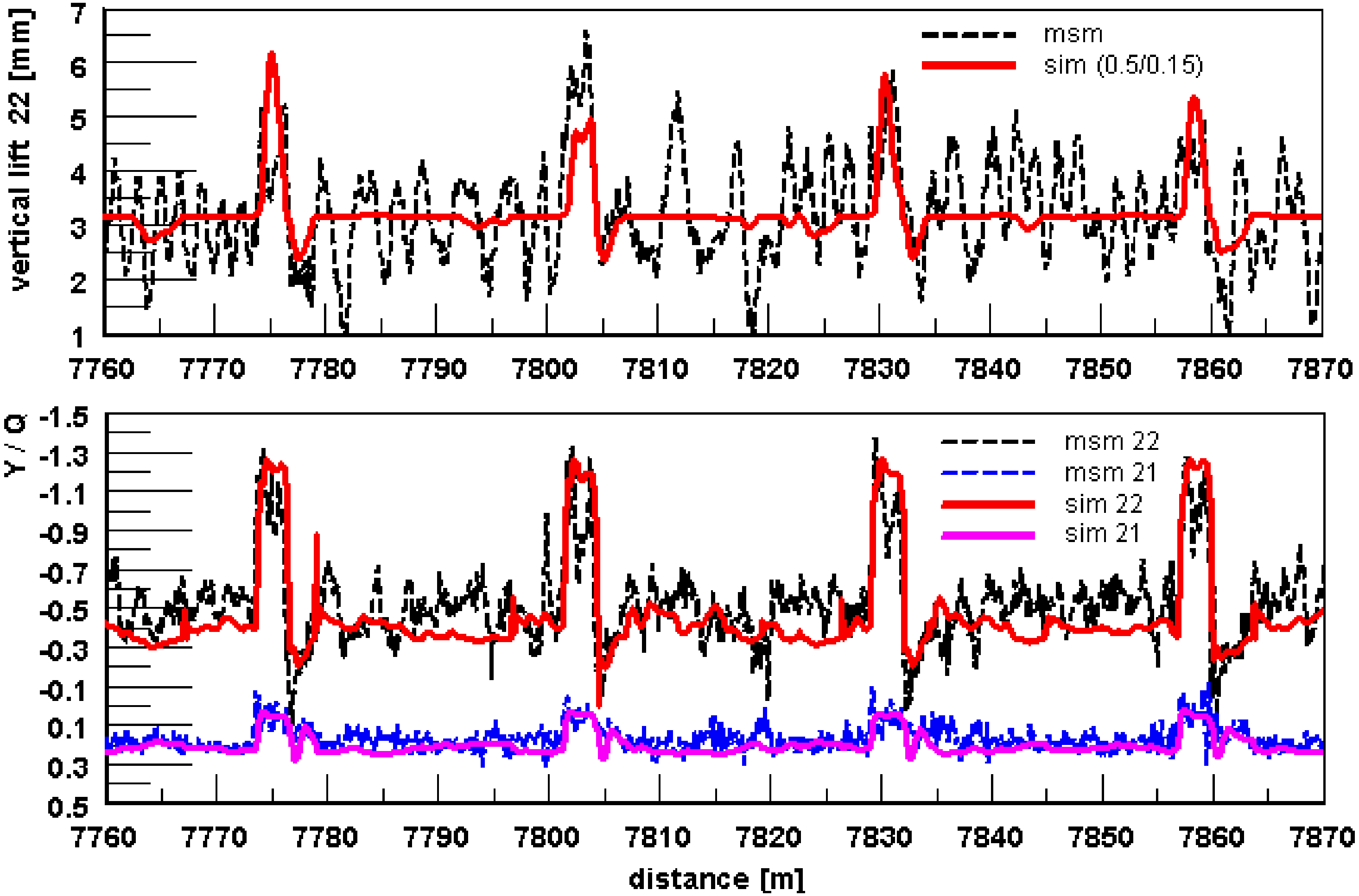
Identification of friction coefficient on flange



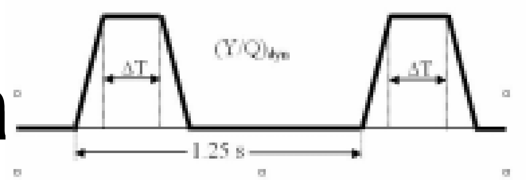
Run with 80 km/h

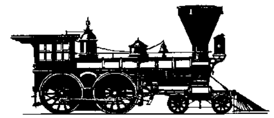


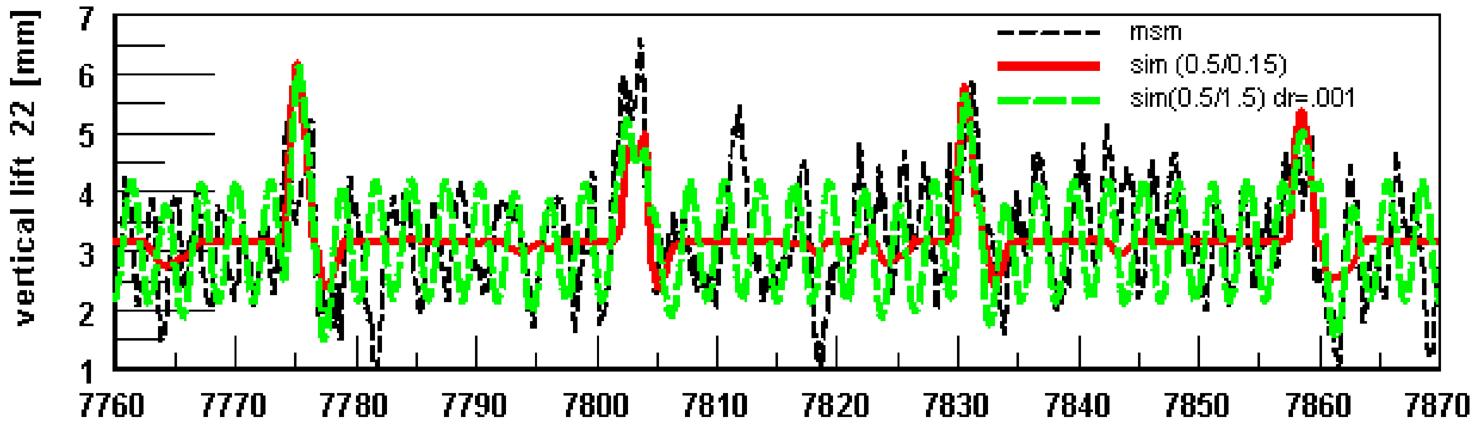


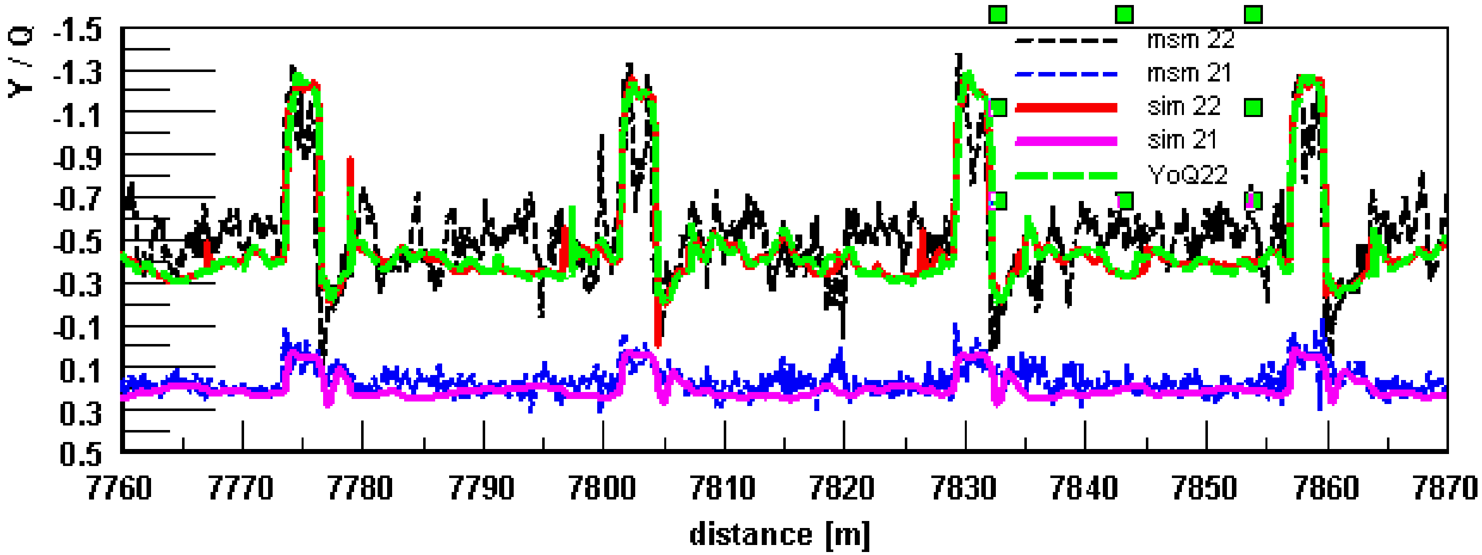


Run with 80 km/h

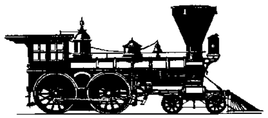


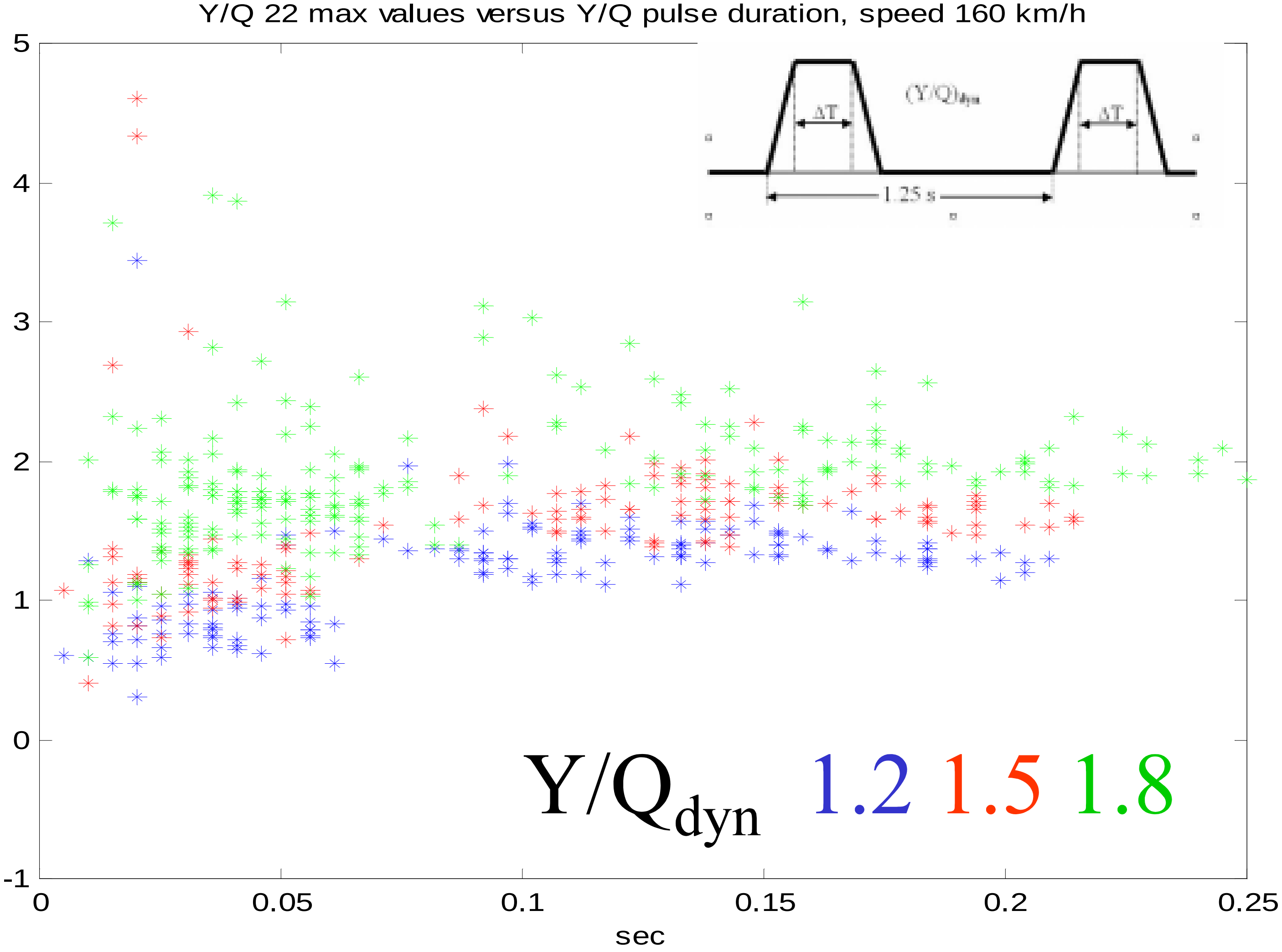






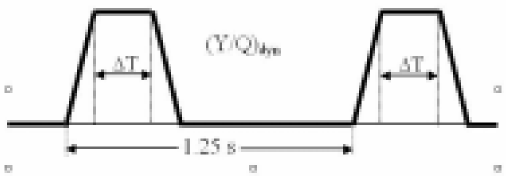
Y/Q of test runs 160 km/h

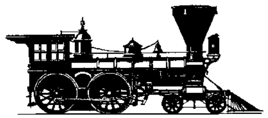


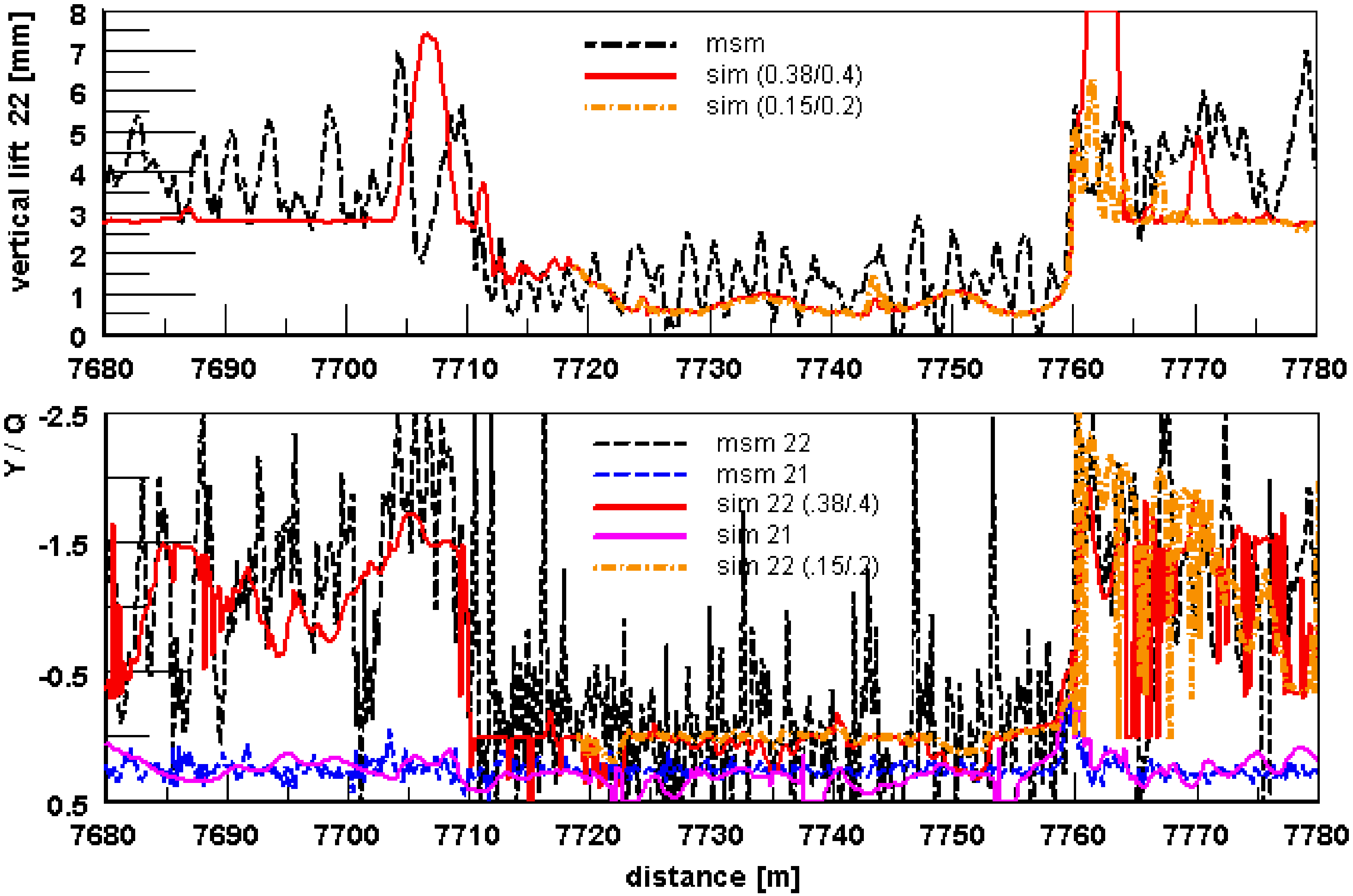


Source: Prof. Sumini, DIENCA, Bologna

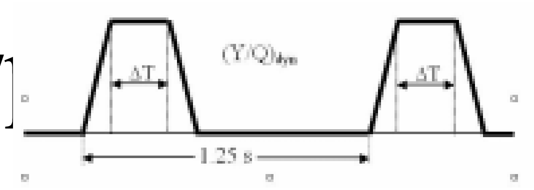
Run with 160 km/

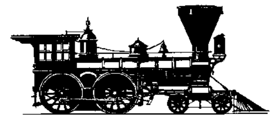


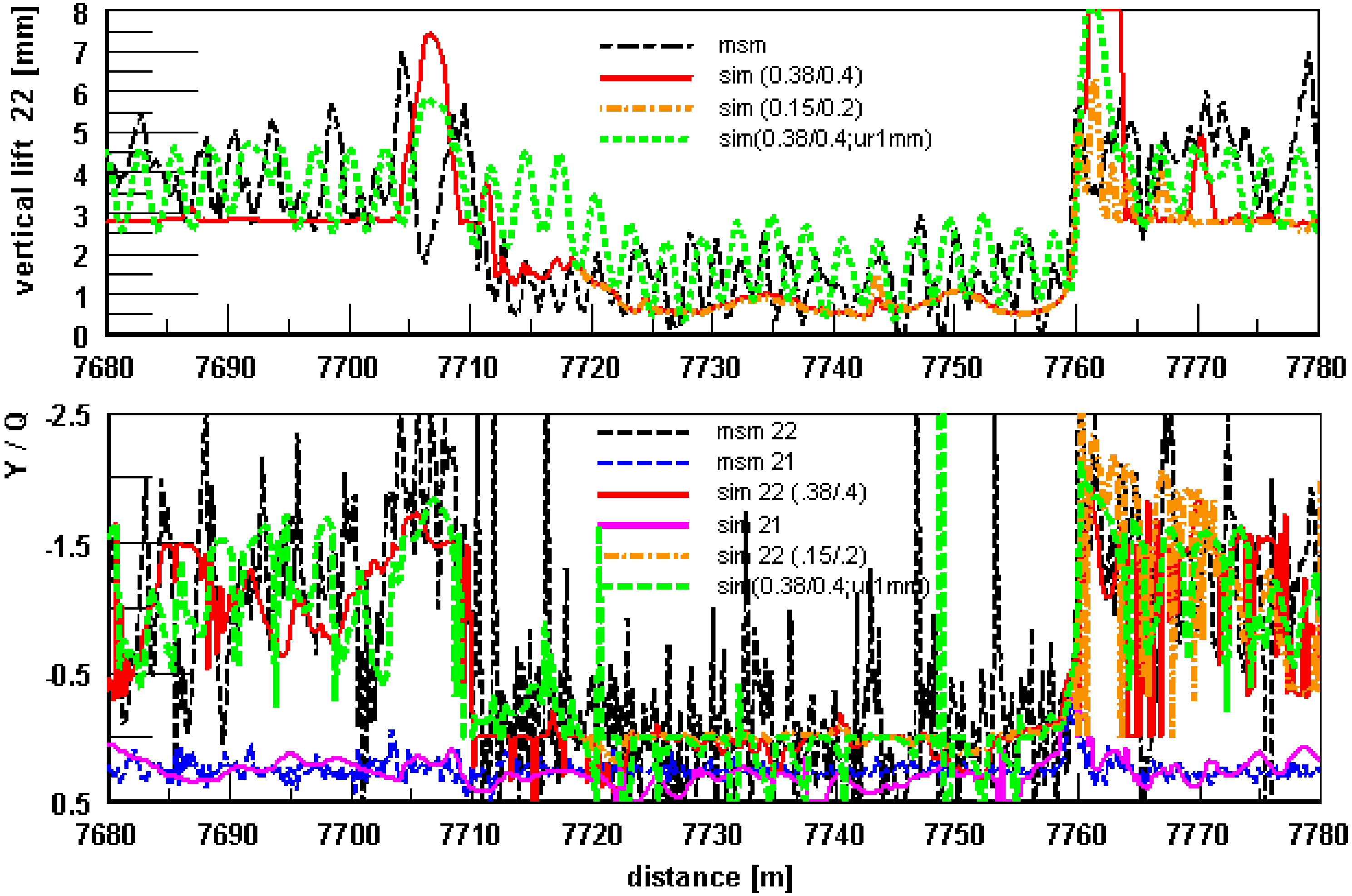




Run with 160 km/

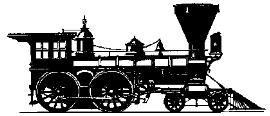






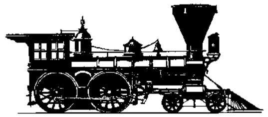
Animation of TRG, same run as in the last diagram II2D263_001

Improvements



- Comparison included dynamics due to an unround wheel. But dynamics of hydraulic device should be included too..
- Measurement of track irregularities should be improved to include smaller wavelength defects, e.g using an IDMS system.
- Test data should include rotational velocity of MWS and longitudinal wheel forces to ease identification of friction coefficient for rolling contact especially when using slightly curved contact for computation of creep forces.

Conclusion



- Wheel-rail element of ArgeCare with flexible normal contact for multi point contact is close enough to reality to enable derailment simulations.
- A reasonable threshold of Y/Q as derailment criterion or a general multi parameter criteria based on Y/Q could not be derived until now.
- Simulation nowadays is a powerful tool to investigate safety of railway vehicles.

Remarks

- Thanks to EU funding and Velim test facilities it was possible to do derailment tests up to 160 km/h which did and will improve our knowledge about derailment of railway vehicles.