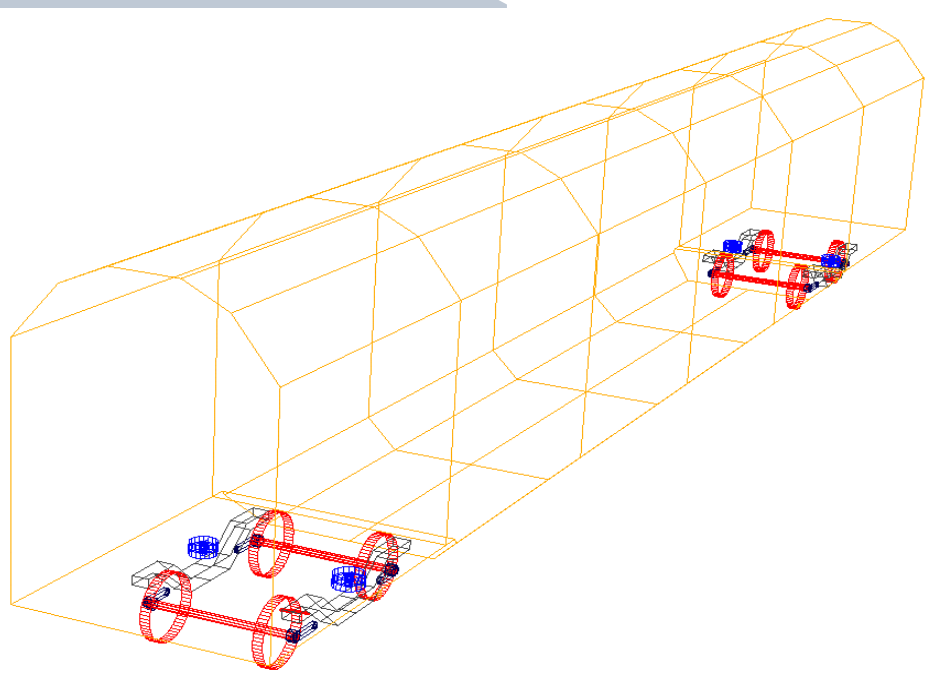
Assessing the Track Geometry by Calculated Vehicle Reactions



Customer:

NS Railinfrabeheer

Contractors:

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- Joost den Decker
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Overview

- Introduction
- Theory
- Vehicle modelling in ADAMS/Rail
- Conclusion

Introduction

Goal of maintenance

- functionality;
- safety;
- quality.

Limiting conditions :

- *Minimum effort;*
- *Maximum availability.*

Criteria


Vehicle related criteria:
force, acceleration
Geomety relateded criteria:
cant, level, allignment, twist,....

Introduction

First approach on the outer limits of the criteria according to UIC 518.

Comfort:

y and z accelerations < 2.5 m/s^2

weighted y and z accelerations < 0.5 or 1.3 m/s^2

Wheel/rail forces:

Y/Q < 1,2 or 0,8

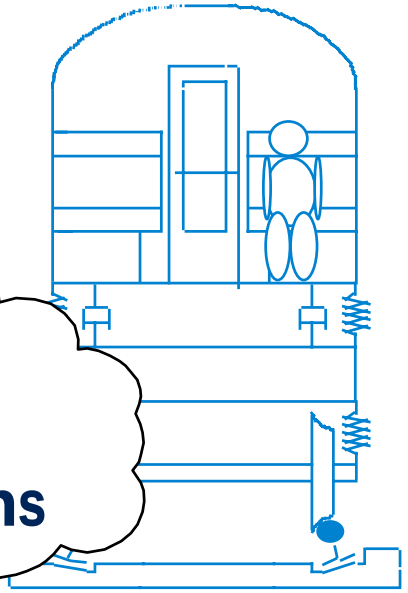
Prud' homme

Introduction

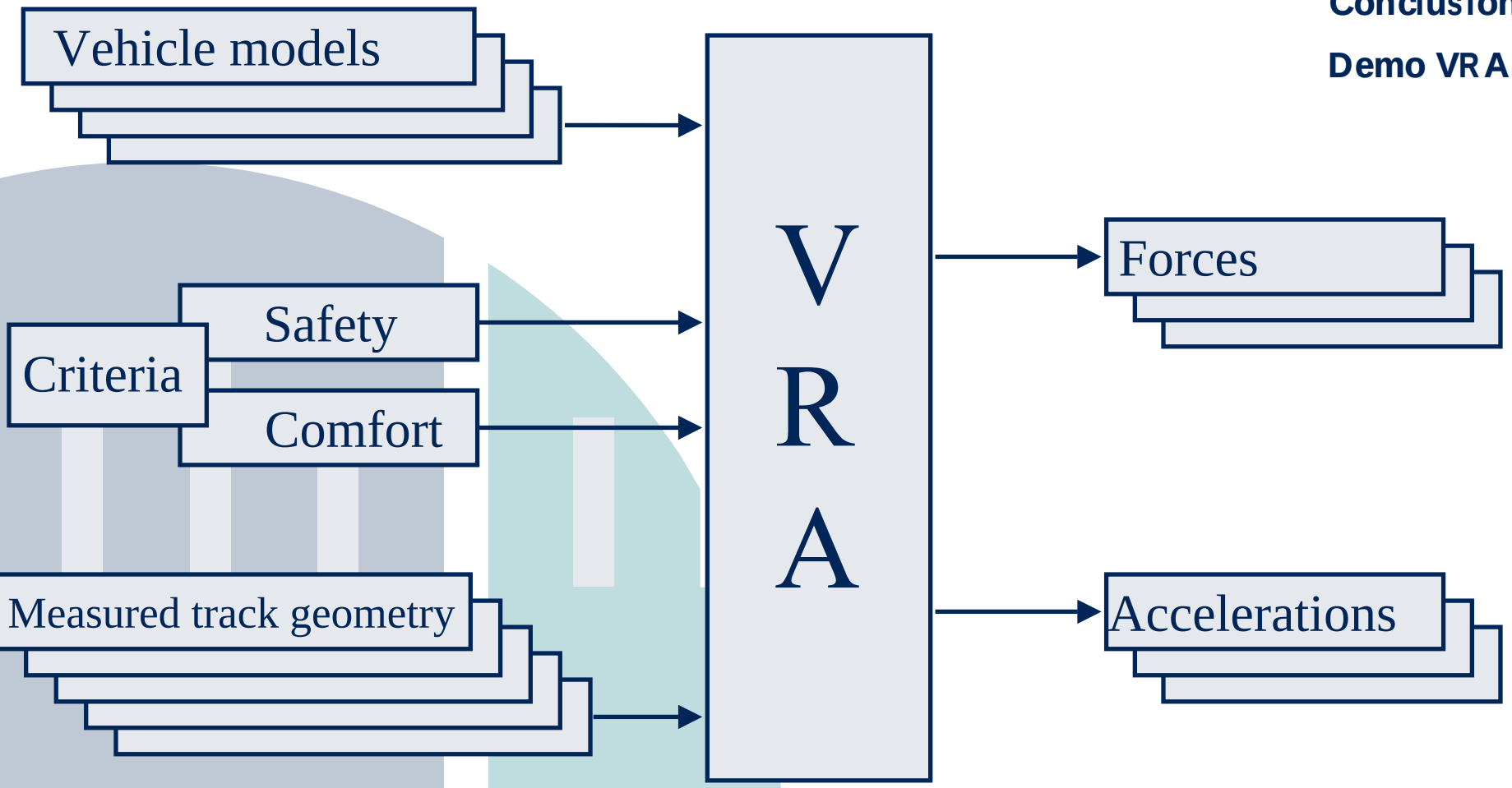
Track quality?

Comfort
Safety

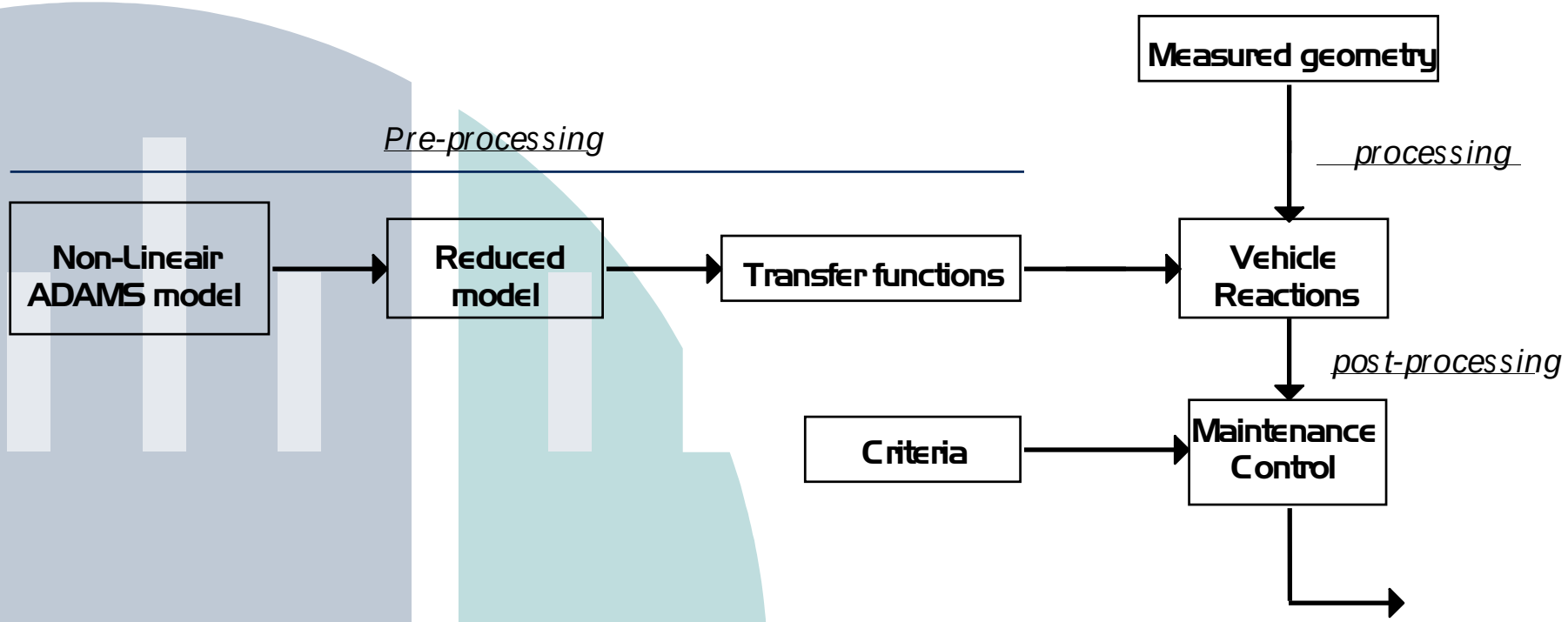
Vehicle
Reactions



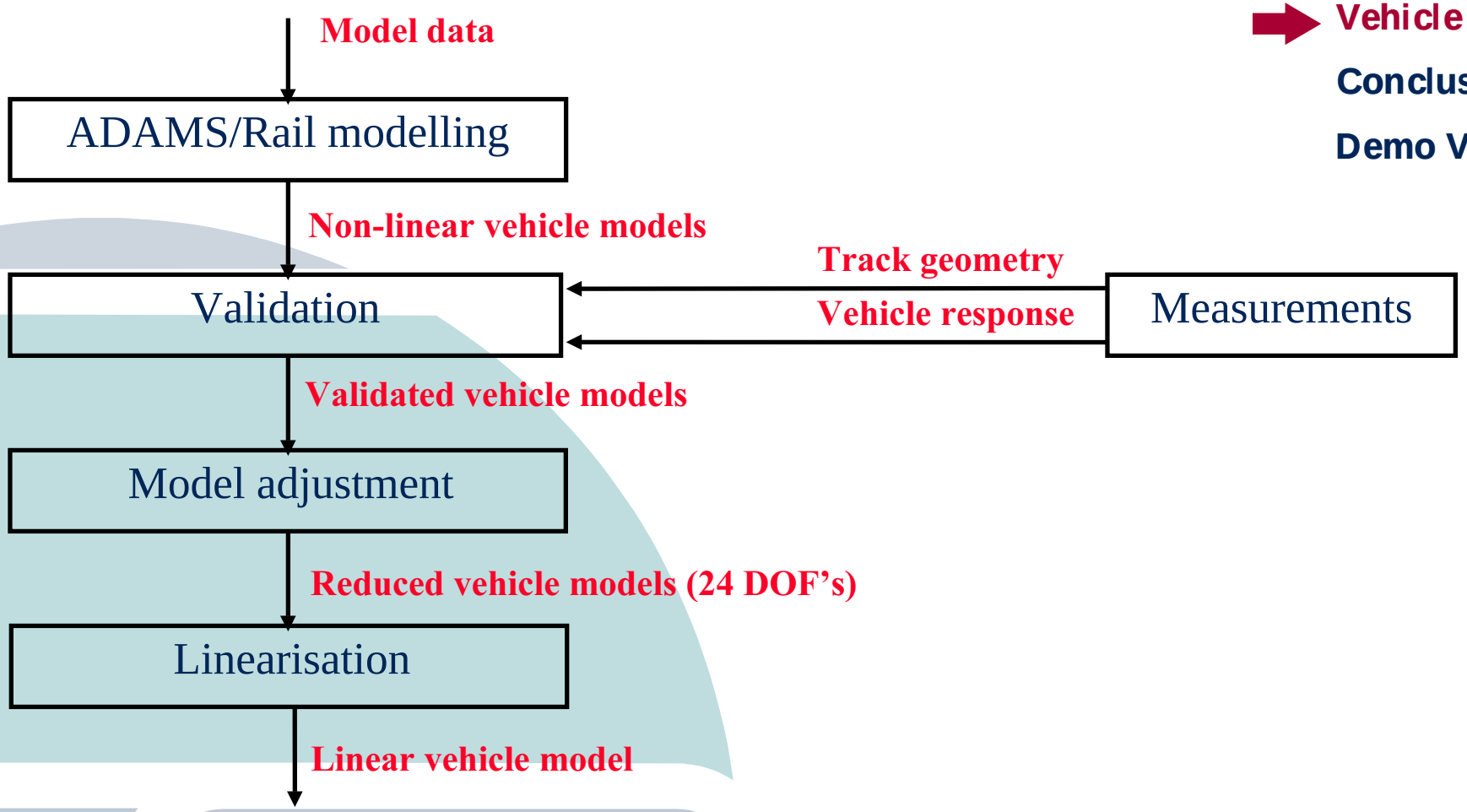
Theory



Theory


Measured geometry
Pre-processing
processing
Non-Lineair ADAMS model
Reduced model
Transfer functions
Vehicle Reactions
post-processing
Criteria
Maintenance Control

Creating the vehicle model



Vehicle modelling in ADAMS/Rail

Objectives:

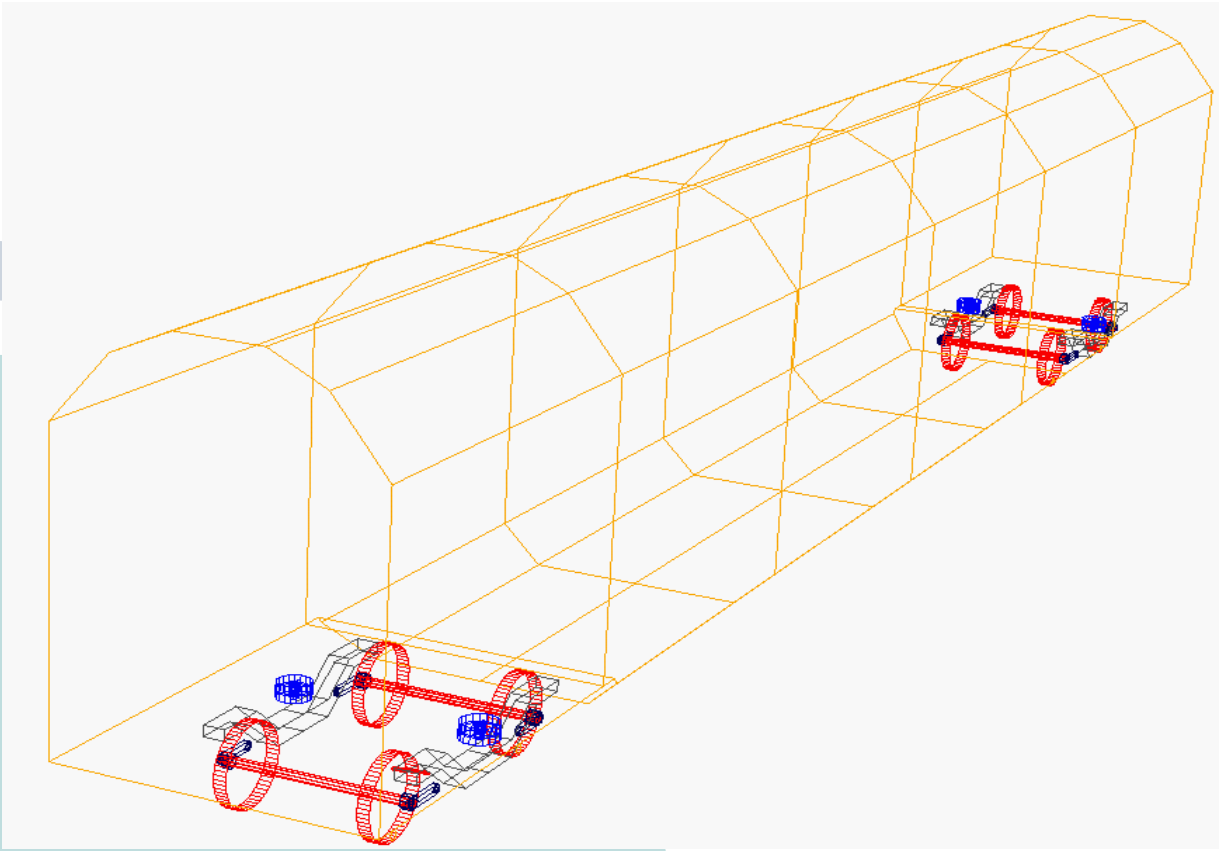
- Achieve good correspondence between measured and calculated vehicle reponses
- Focus on: Safety requirements and comfort criteria
- Number of DOF's are prescribed (total 24)

Vehicle models: DDM-Bvk (double stock passenger coach)

UMR (NSTO measuring vehicle)

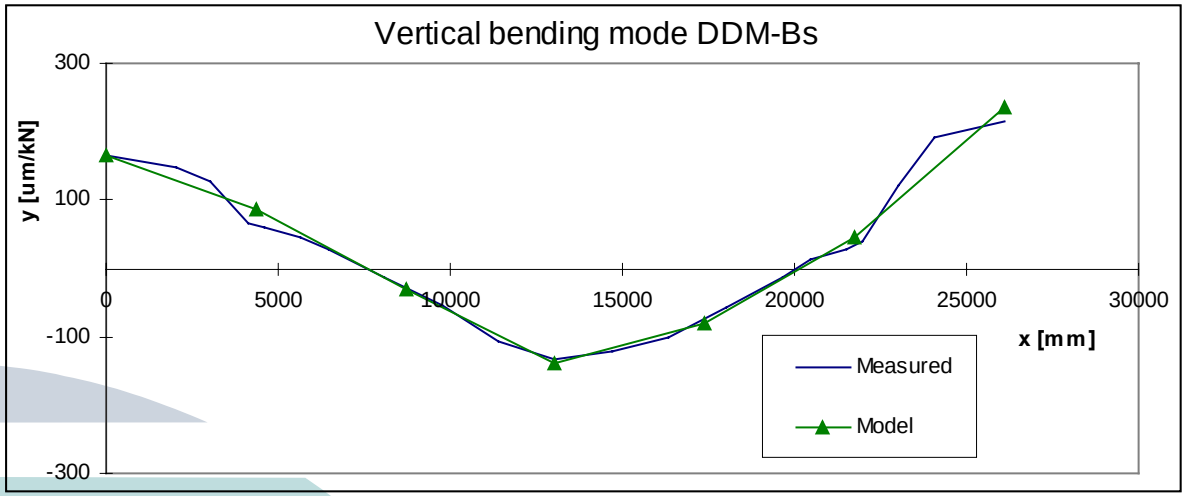
Vehicle model DDM

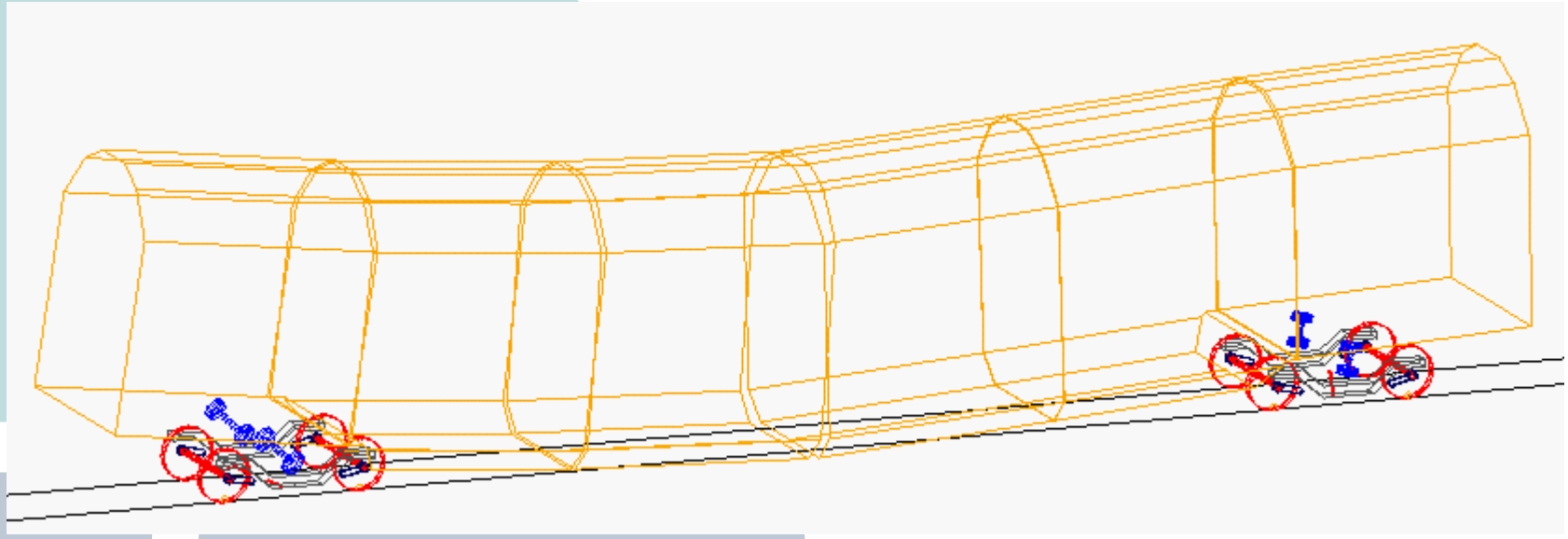
Main characteristics:



- 20 parts, 51 DOF
- First bending mode of coach is included

First vertical bending mode

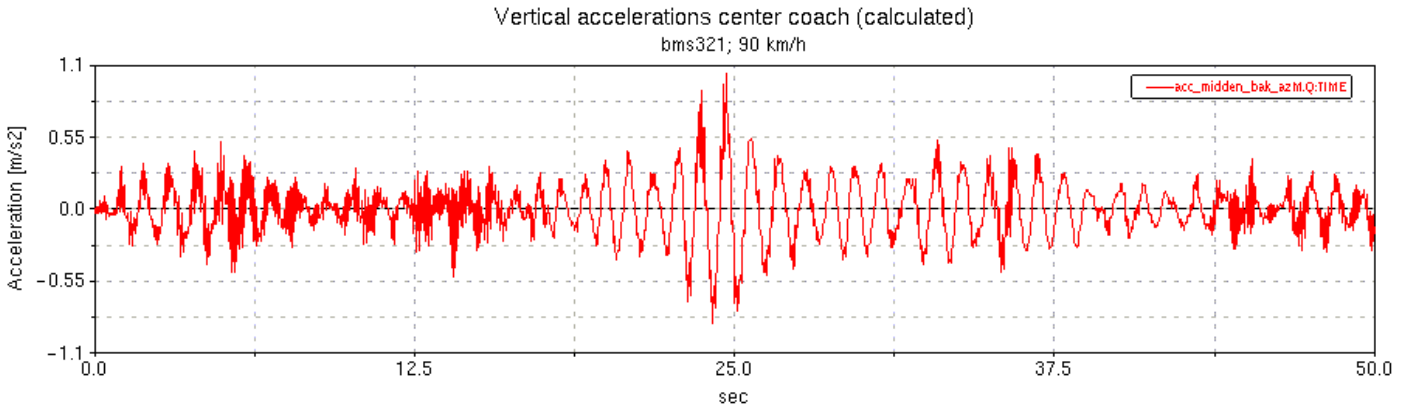


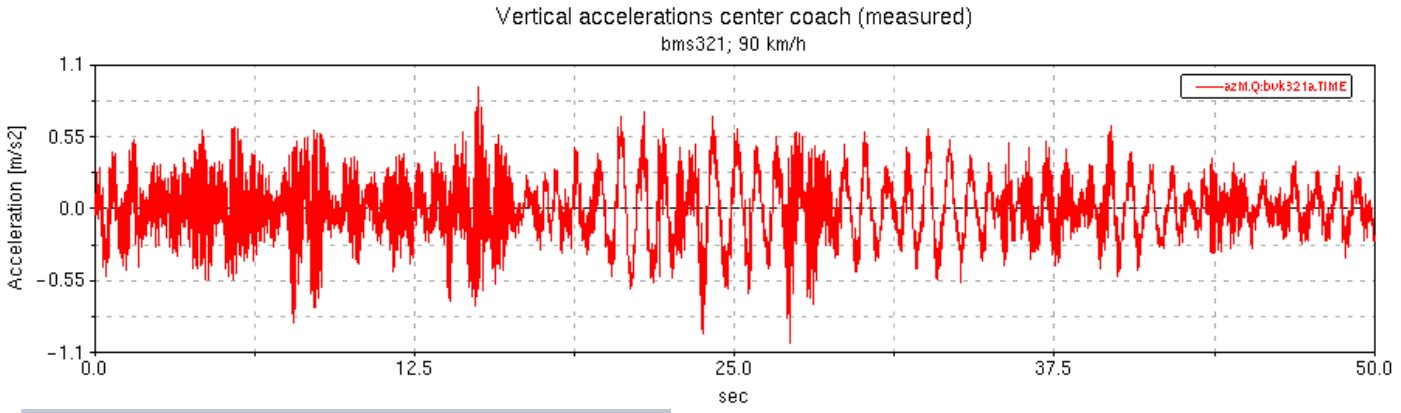


Validation results (1)

Track: Woerden - Alphen a/d Rijn, 90 km/h

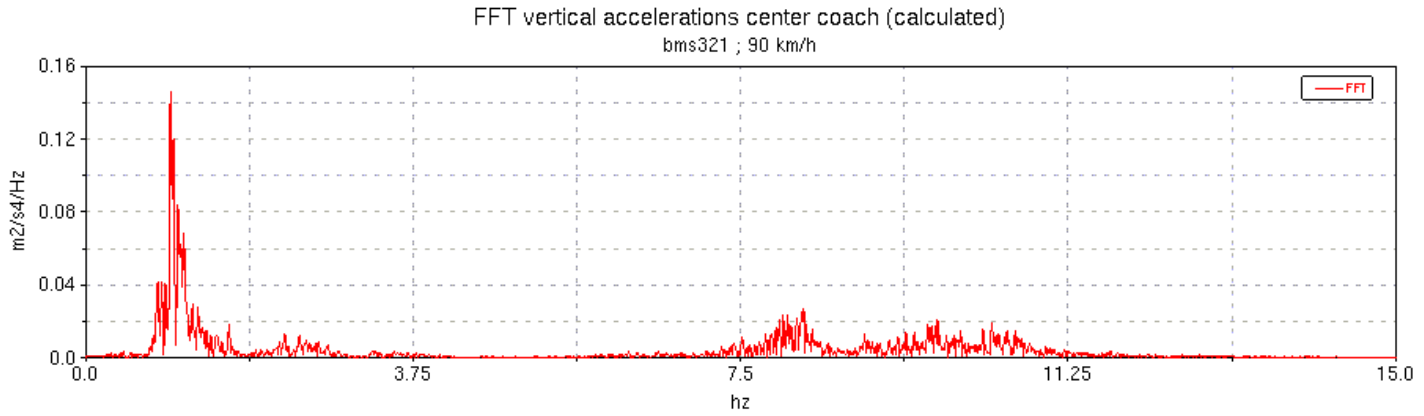
Vertical accelerations midplane coach

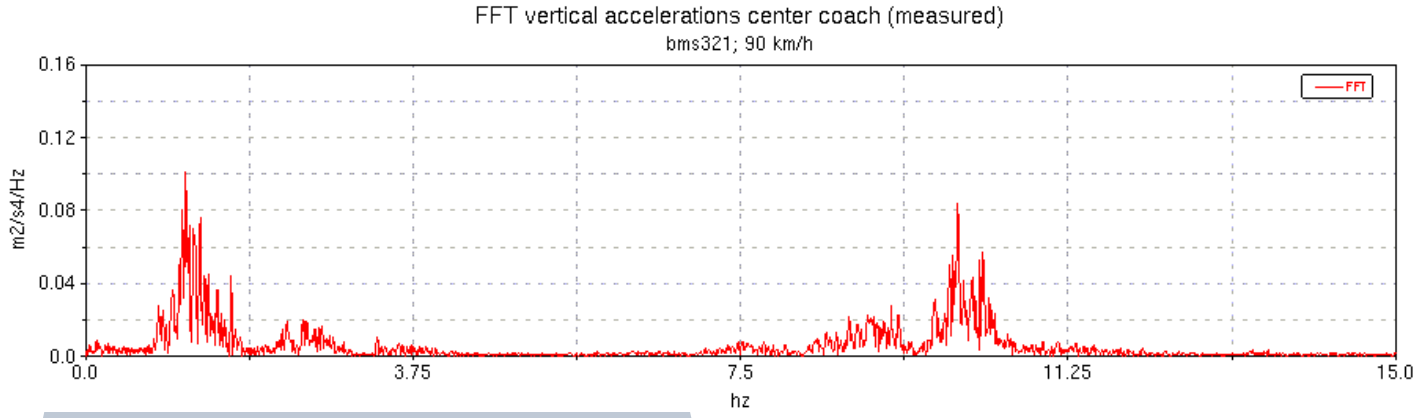




Validation results (2)

FFT diagrams:





Model modification

Number of DOF's:

■ coach:	5 (rigid)	$y, z, \varphi_x, \varphi_y, \varphi_z$
	1 (flexible)	η
■ bogies:	2x5	$y, z, \varphi_x, \varphi_y, \varphi_z$
■ wheelsets:	4x2	y, φ_z
Totaal	24	

Linearising

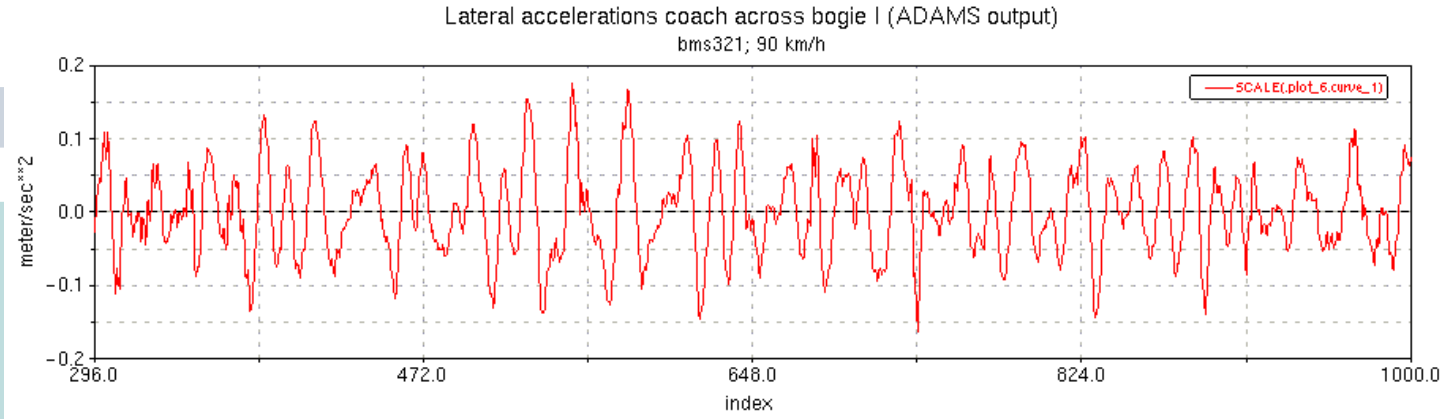
$$\frac{dx}{dt} = Ax + Bu$$

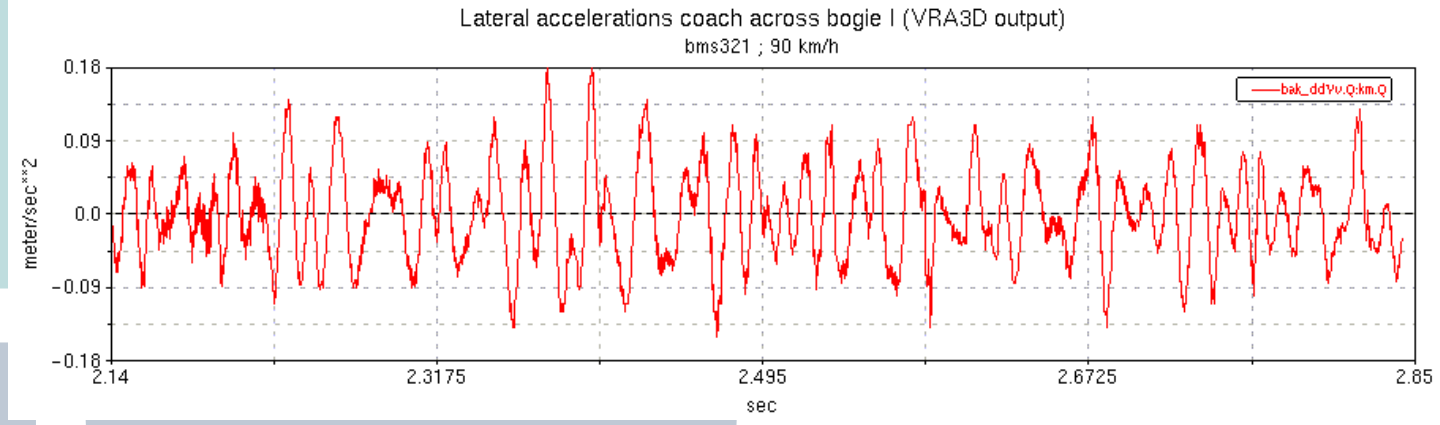
$$y = Cx + Du$$

Validation results (3)

Track: Woerden - Alphen a/d Rijn, 90 km/h

Lateral accelerations coach across bogie I





Conclusions

- With help of simple vehicle models it is possible to establish an assessment of the measured track geometry

Future developments

- Validation VRA on geometry incidents
- Influence of non-lineair aspects on the precision;
- Implementation of track layout;
- On-line processing on the NS measure coach
- Modelling of ICR (single stock passenger train) and Loc1600 (locomotive)

Demonstration VRA