



Maximising performance of a BEV Twist Beam suspension through a pioneering approach

ADAMS Real Time on DiM250 Driving Simulator

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INTRODUCTION

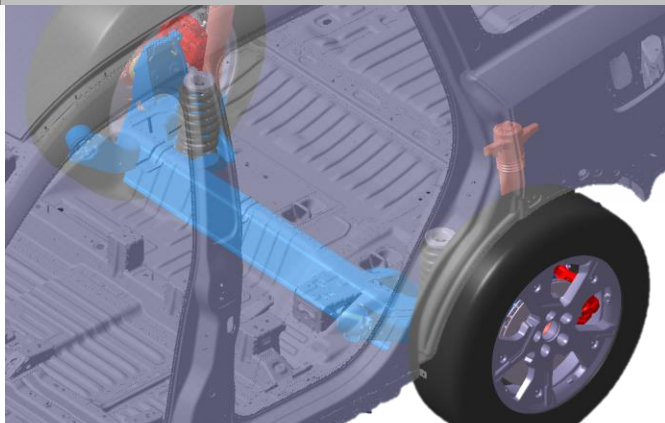
CONTENTS

1. MAHINDRA BEV – THE CHALLENGE



New BEV platform of Mahindra with a challenging rear suspension

2. TWIST BEAM VIRTUAL DEVELOPMENT



Custom model approach plus **ADAMS Real-Time** to maximize efficiency of development process.

3. RESULTS & CONCLUSION



How the DiM250 simulator made it possible



INTRODUCTION

COMPANY OVERVIEW

MAHINDRA & MAHINDRA LIMITED



260k+

PROFESSIONALS



500k+

FY24 SUV SALES



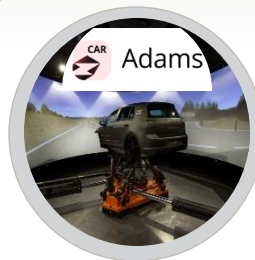
100+

PRESENCE



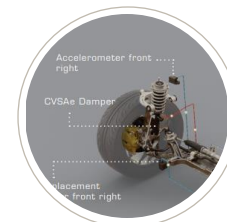
2022

Achieving world-class dynamics performance of the new XUV700, cutting down development time and cost using "Driving Simulator"



2024

Maximizing performance of a BEV Twist Beam suspension through a pioneering approach



2023

Implementation of a driver-in-the-loop methodology for virtual development of semi-active dampers

Applus IDIADA



+3.000

PROFESSIONALS
WORLDWIDE



FIRST CLASS
STATE-OF-THE-ART
TESTING
FACILITIES



22 COUNTRIES
58 LOCAL OFFICES



INTRODUCTION

MAHINDRA'S NEW BEV PLATFORM

NEW PLATFORM DETAILS

#CostEfficient; #LightWeight





INTRODUCTION

MAHINDRA'S NEW BEV PLATFORM

NEW PLATFORM DETAILS

#CostEfficient; #LightWeight



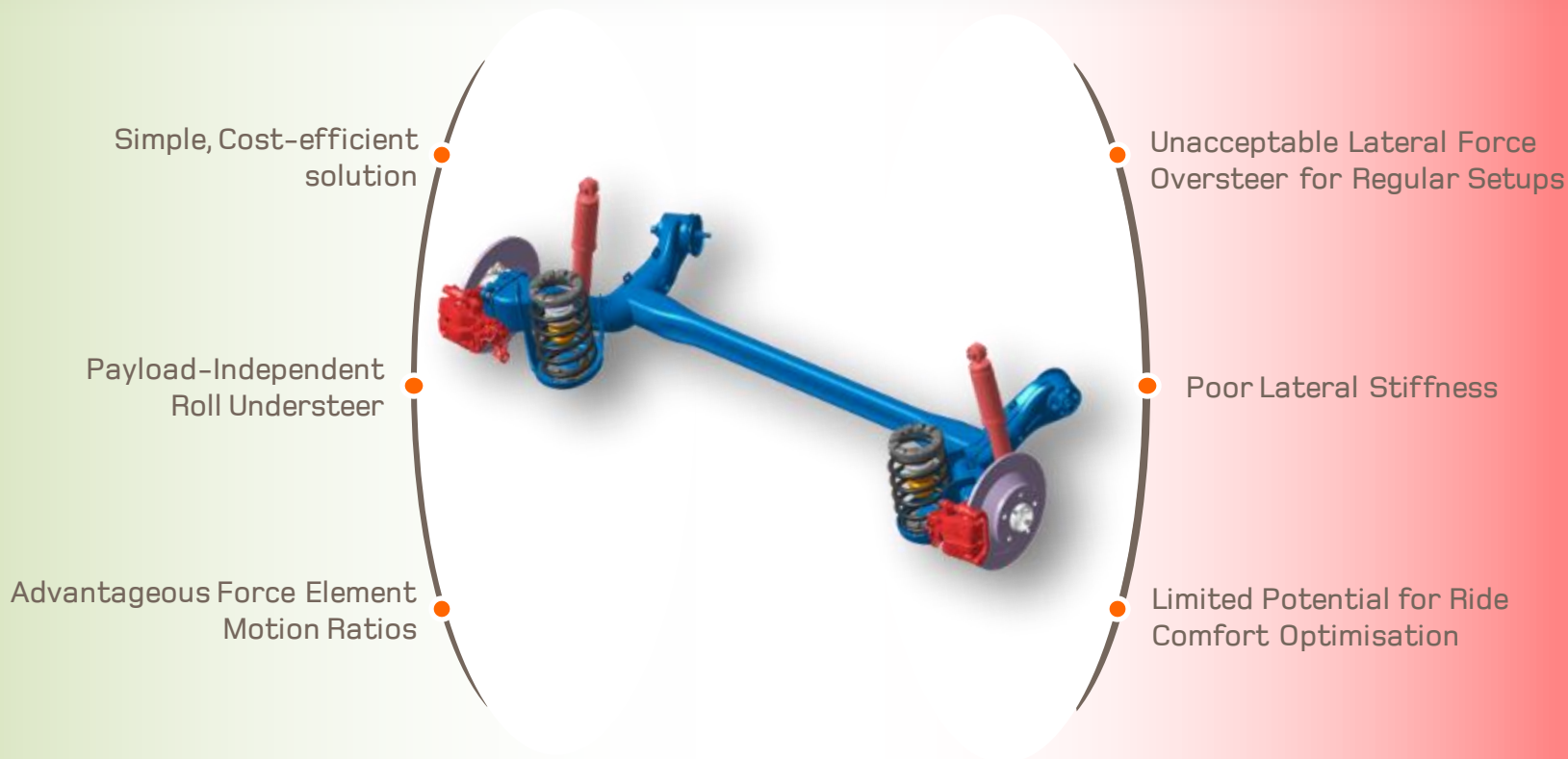
TECHNICAL CHALLENGE





THE TECHNICAL CHALLENGE

TWIST BEAM PERFORMANCE DEVELOPMENT





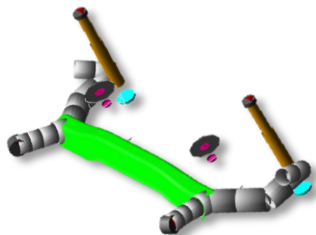
THE TECHNICAL CHALLENGE

TWIST BEAM PERFORMANCE DEVELOPMENT

TWO MAIN CHALLENGES

SHORT DEVELOPMENT TIME,
MANY TUNABLE ITEMS

SOLUTION:



PERFORMANCE LOSS IN REAL
TIME PARAMETRIC SOFTWARE

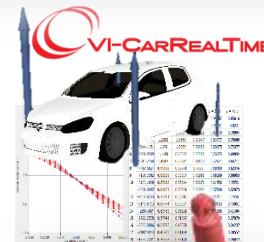
SOLUTION:



Adams Real Time



Adams Car

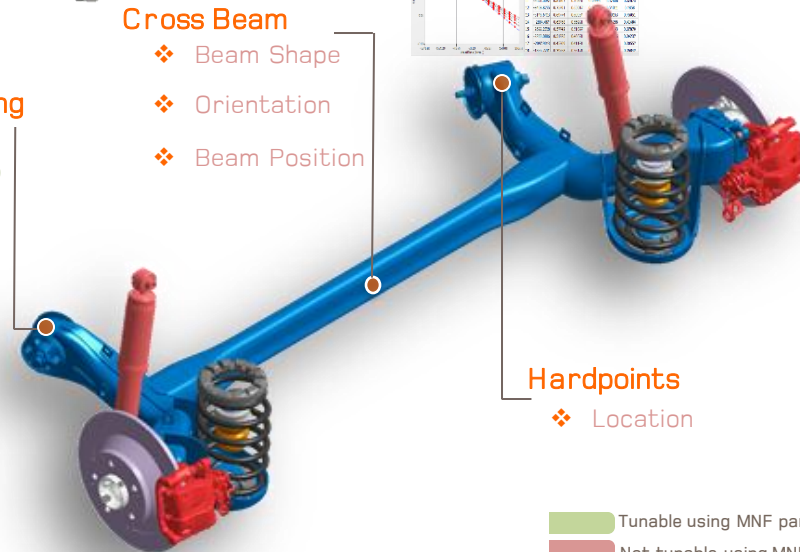


Cross Beam

- ❖ Beam Shape
- ❖ Orientation
- ❖ Beam Position

Beam-Body Bushing

- ❖ Radial to Axial Stiffness Ratio
- ❖ Bushing Orientation



Hardpoints

- ❖ Location

Tunable using MNF part
Not tunable using MNF part



A GROUNDBREAKING APPROACH

THE CONCEPTUAL TWIST BEAM

MODAL NEUTRAL FILE (MNF)



Accurate Performance



Time-consuming file
generation & iteration



No Tuning Items



ADAMS BEAM ELEMENTS



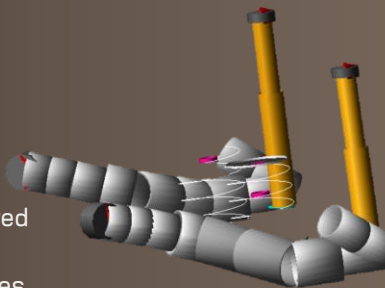
Parametric Design



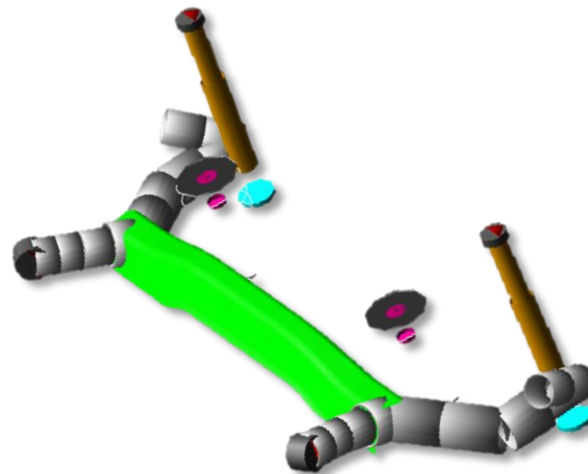
No open sections allowed



Beam Section Properties
required



TWIST BEAM HYBRID CONCEPT MODEL





A GROUNDBREAKING APPROACH

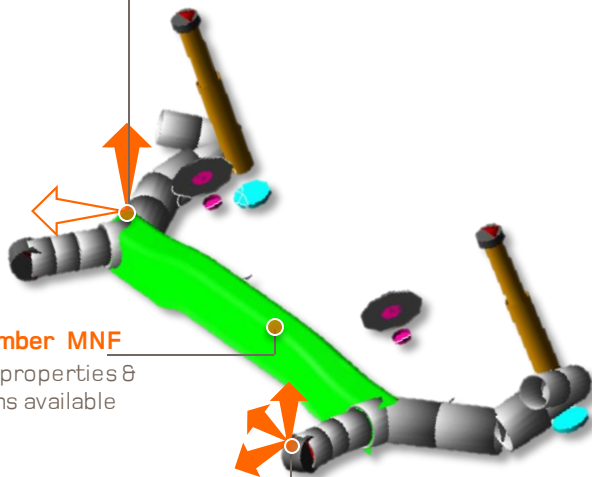
THE CONCEPTUAL TWIST BEAM



Parametric Design

Hardpoint-connected Beam

Allows different layout studies



Cross-member MNF

Real beam properties & any sections available

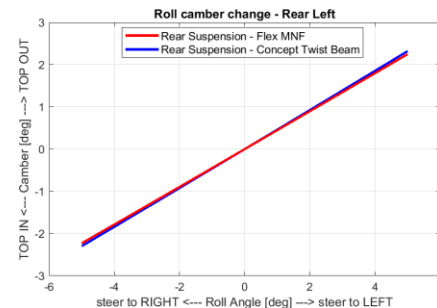
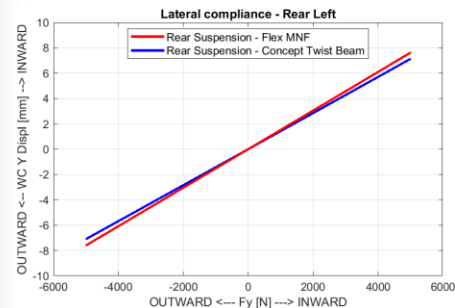
Hardpoint Freedom

Change hardpoints in all directions

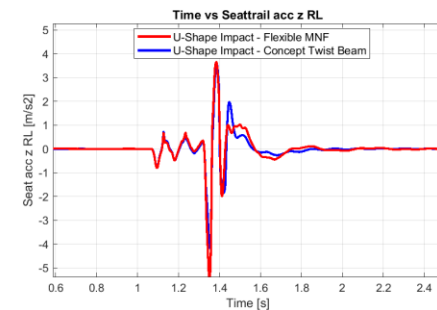
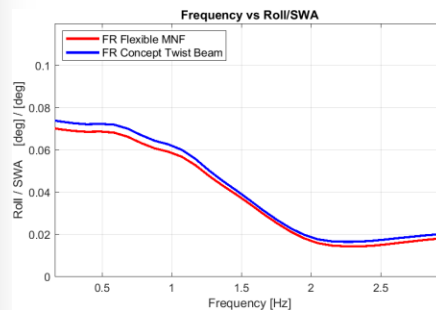


Accurate Performance

Kinematics & Compliance



Objective Manoeuvres

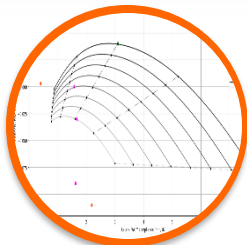




A GROUNDBREAKING APPROACH

VIRTUAL DEVELOPMENT PROCESS

Performance Status

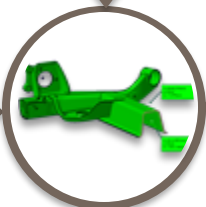


DiM250 Evaluation



Virtual Development Process

4 ITERATIONS: ~3 WEEKS

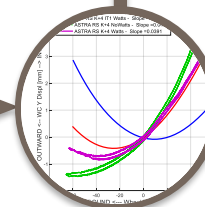


Proposal Study

Iterations proposed based on
theoretical analysis & experience



MNF File Generation



Result Validation

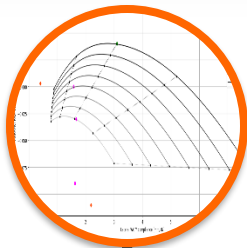
Assess iterations and refine
proposals based upon results



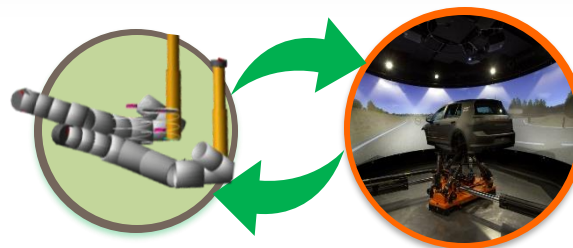
A GROUNDBREAKING APPROACH

THE CONCEPTUAL TWIST BEAM

Performance Status



DiM250 Evaluation

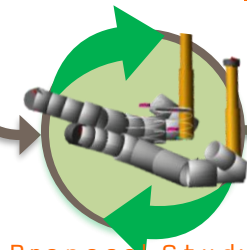


Virtual Development Process

4 ITERATIONS: ~~~3 WEEKS~~

~5 DAYS

70% Development Time Reduction



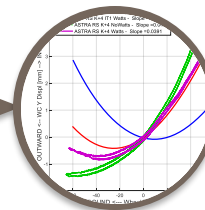
Proposal Study -

CONCEPT

High volume of proposals
evaluated before MNF request



MNF File Generation



Result Validation



A GROUNDBREAKING APPROACH

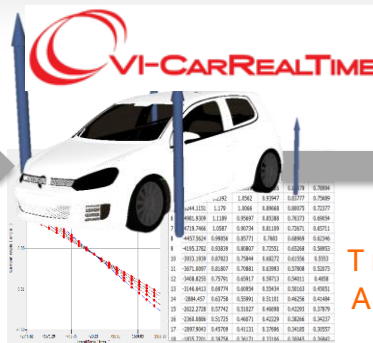
ADAMS REAL TIME



Adams Car



MODEL
CONVERSION



TROUBLESHOOTING
AND CORRELATION





ADAMS REAL TIME



Adams Car



NO MODEL CONVERSION

ADAMS Model tested straight into DiM250
Driving Simulator



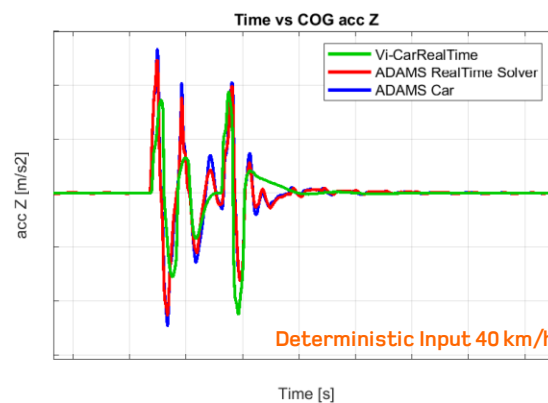
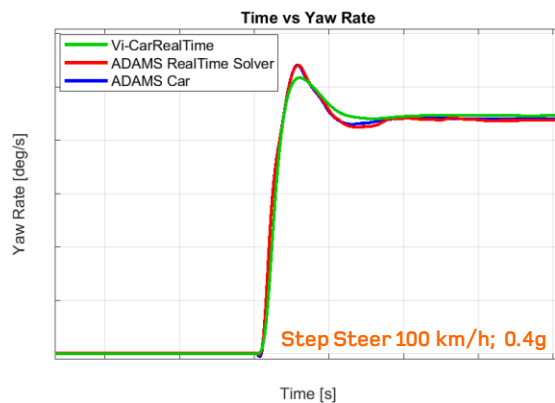
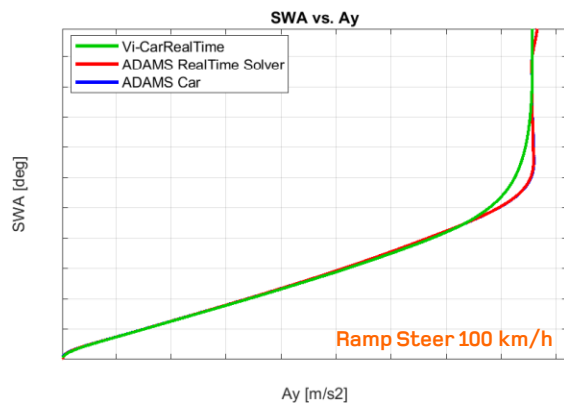
Fast & Accurate



Flexible Bodies



Real-Time Tuning





A GROUNDBREAKING APPROACH

ADAMS REAL TIME

REAL TIME: SUBJECTIVE PERCEPTION

"Natural and Progressive Body Motions With More Realistic Damping"



BODY MOTIONS

"Perceivable System Dynamics: Compliance, Overshoots & Delays"



HANDLING



Adams Real Time



RIDE COMFORT

"Richer feeling of Primary/Secondary ride"



"Higher frequencies can be felt on MBS model"

STEERING

"Realistic Torque Build-up and system damping"

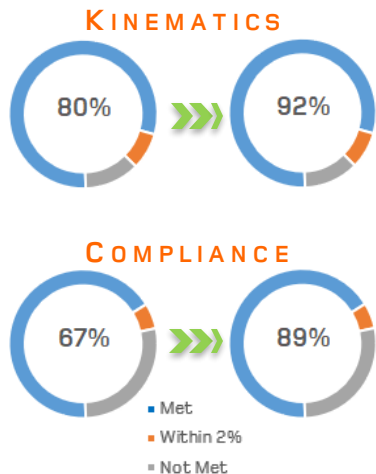




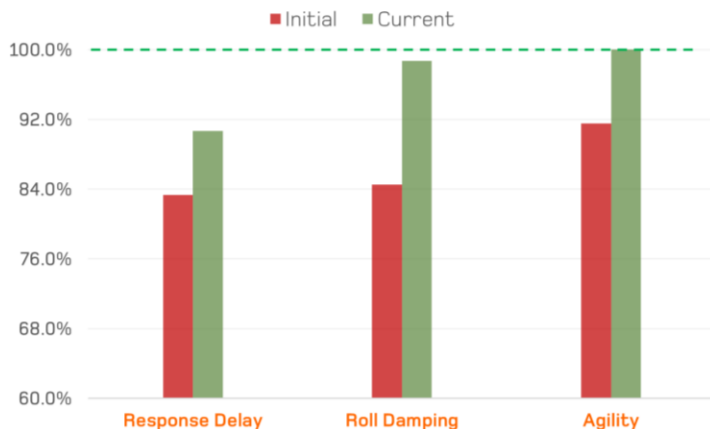
RESULTS & CONCLUSION

SUMMARY OF RESULTS

PERFORMANCE EVOLUTION



Metric Accomplishment



6 MONTHS DEVELOPMENT

25 HARDPOINT SETTINGS
+20 CROSS BEAM LAYOUTS
8 CROSS BEAM DESIGNS
10 BUSHING CONFIGURATIONS

4 DRIVING SIMULATOR SESSIONS

+20 VARIANTS TESTED
CONCEPT MODEL VALIDATIONS

ZERO PROTOTYPES



T H A N K Y O U F O R Y O U R K I N D A T T E N T I O N



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