

# IWG-DPPS Comments

Study for a Pedestrian Sensing Impactor

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## Introduction

### Current State:

- A test for the Lower Threshold Sensing capability is left to manufacturers' due care. There is no common practice for type approvals as a pre-requisite for DP System activation
- Proof of concept is required by Korea, as part of certification procedure as a pre-requisite for activation of the DPPS

### Future State:

- The sensing proof is clearly defined to enable certification of deployable systems without the need for interpretation
- The sensing can be verified in hardware, repeatable and reproducible, with a limited number of tests

### What to avoid:

- Numerous impactors left for discretion of the certification authority
- Utilizing an impactor that has not been certified for legislation
- Boundary conditions leading to technically sensible solutions that result in false activation in the real world
- Maximizing the requirements, mixing due care considerations with basic proof for certification

### Thoughts:

- The PDI2 is a sensing impactor developed to challenge sensing systems for Consumer Metric tests
- It has been clearly shown that the impactor is very conservative compared to the biofidelic Human Body Models
- Its input into the vehicle is in fact below the range of statures given in GTR No.9

### Question:

- Is it possible to use one of the existing impactors as a tool to validate the sensing capabilities?

### Work Plan per TF-DPPS Task List, item 20:

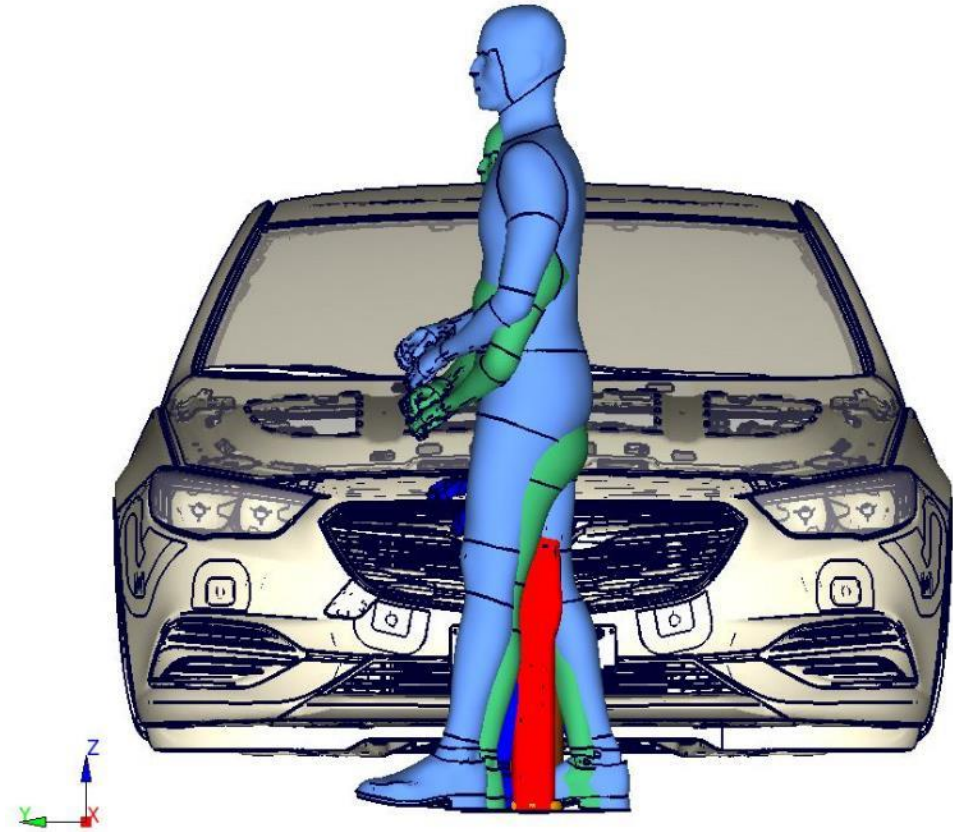
- Generate a proposal defining how to assess the 6yo detection when not using the PDI-2
- Compare the FlexPLI to the (HBM) statures, possibly adjusting the impact velocity to come close to 5th%ile or 6yo
- Assess the biofidelic contact parameters

Loadcases – @ Y=0:

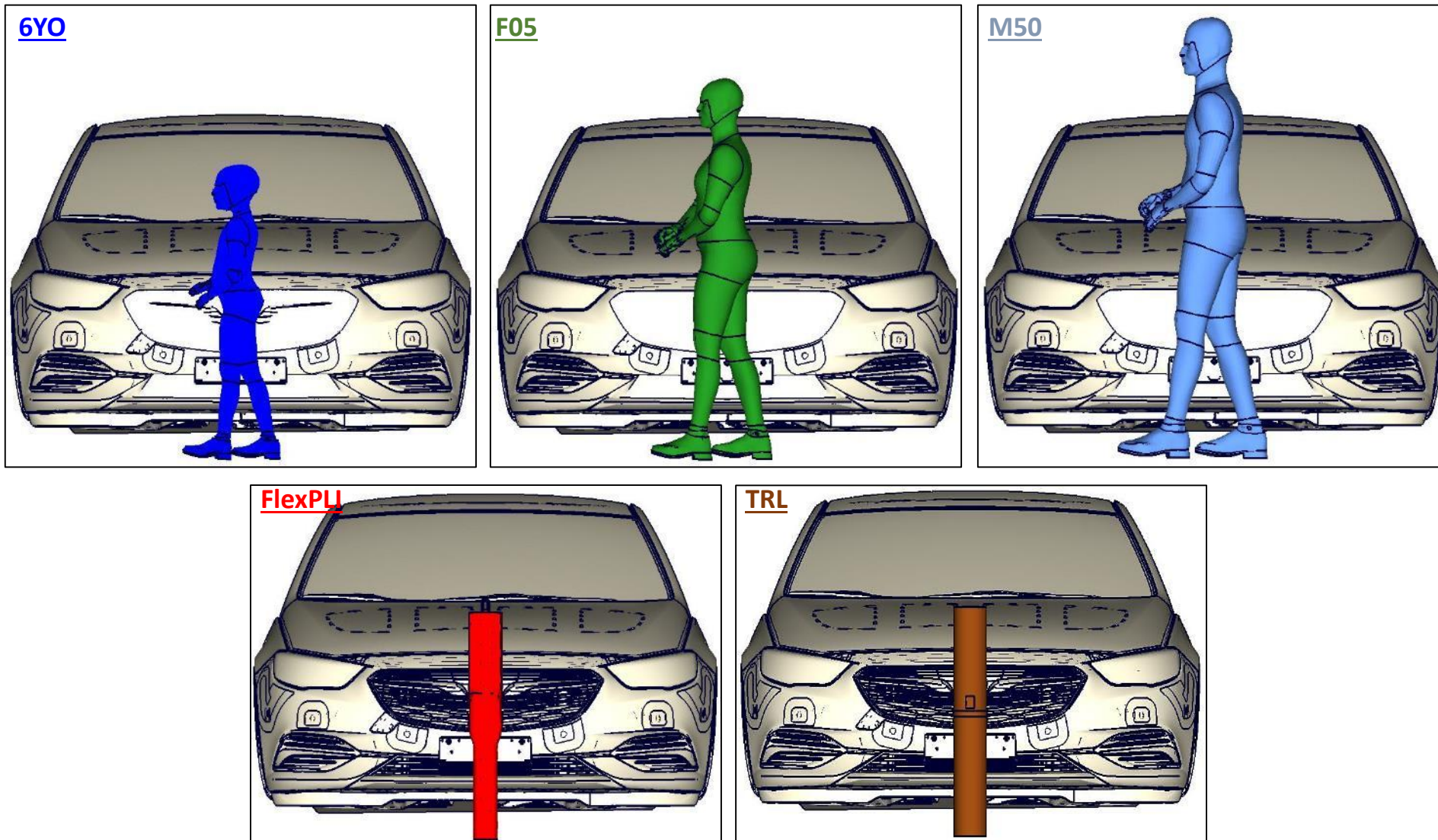
- HBM 6YO
- HBM 5%
- HBM 50%
- FlexPLI
- TRL Lower Leg

## Work Plan

1. New runs @ 25 km/h
2. Overlay all 25 km/h loadcases for:
  - Bumper intrusion
  - Impact energy
  - Bumper fascia contact force
3. Iterate @ lowered speeds based on PDI-2 energy to find results closest to HBMs



## Study



## FlexPLI and TRL leg with Energy as PDI2 Impactor



- PDI2 has KE = 162.7J = 6.748kg @ 25 kph



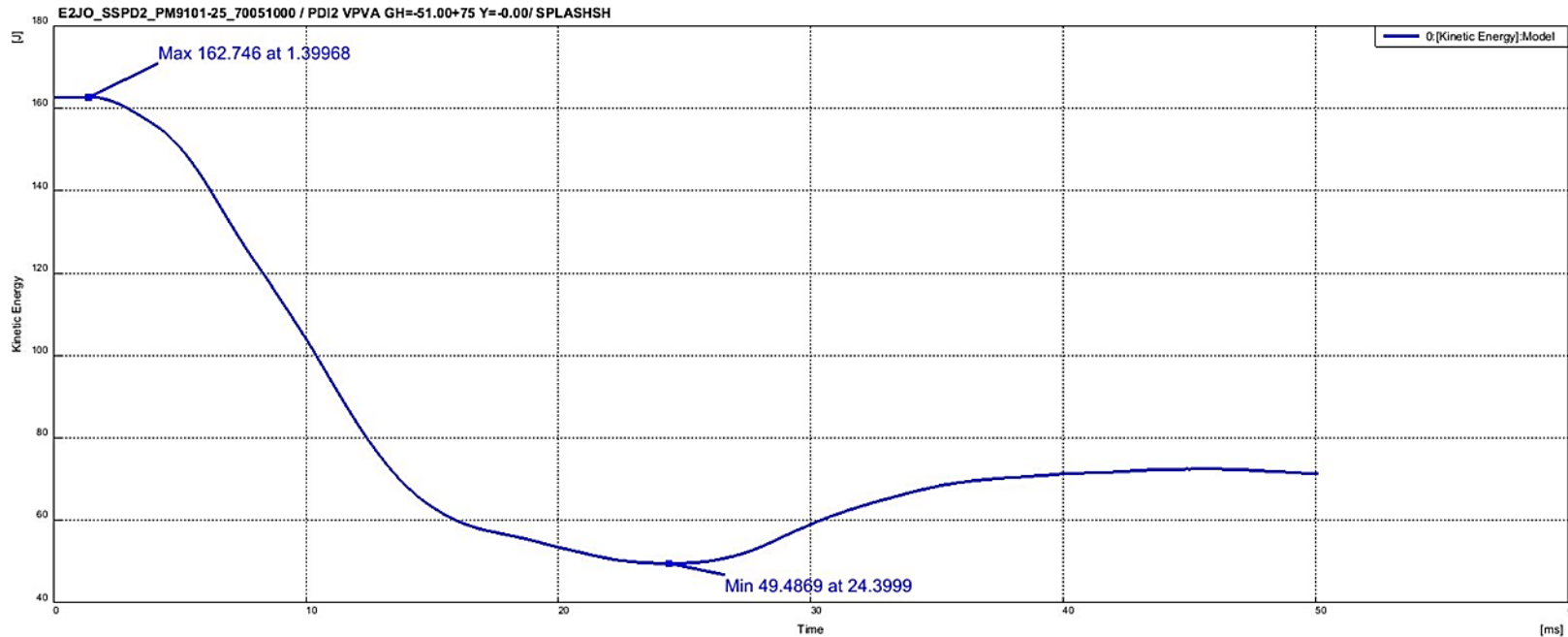
- FlexPLI @ 25 kph has 310J → Flex model mass = 12.85 kg

→ for 162.7J, FlexPLI requires 18.1 kph



- TRL Leg @ 25 kph has 323J → TRL model mass = 13.4 kg

→ for 162.7J, TRL requires 17.7 kph



## Fascia Maximum Intrusion

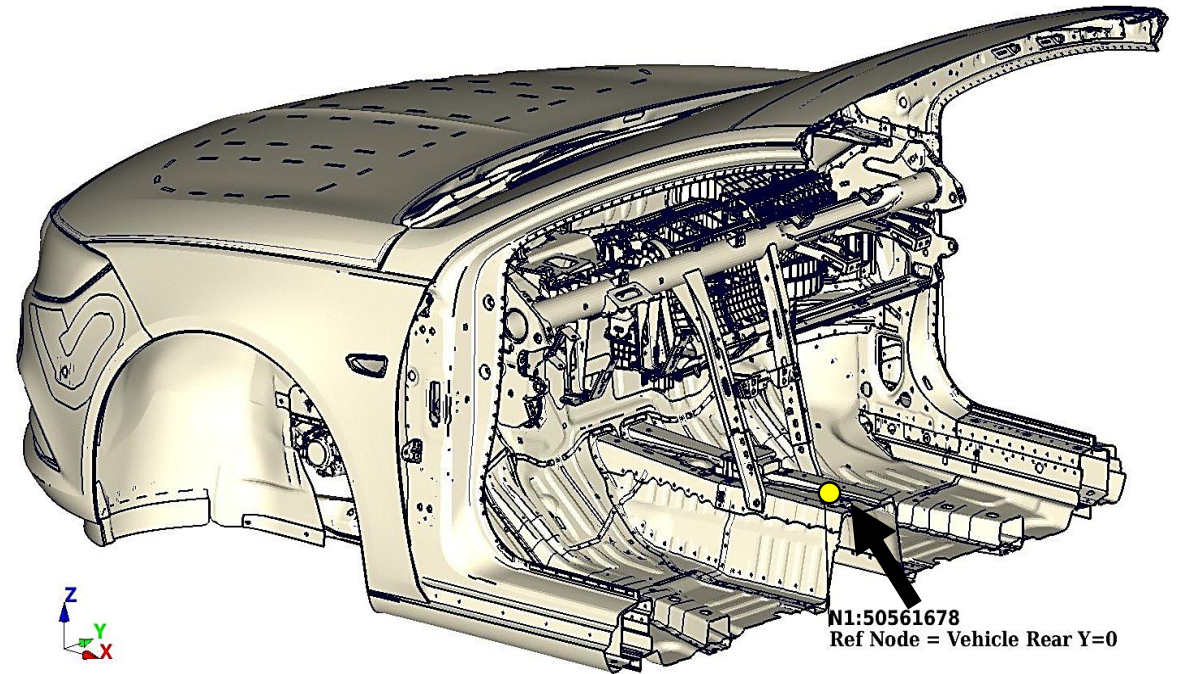
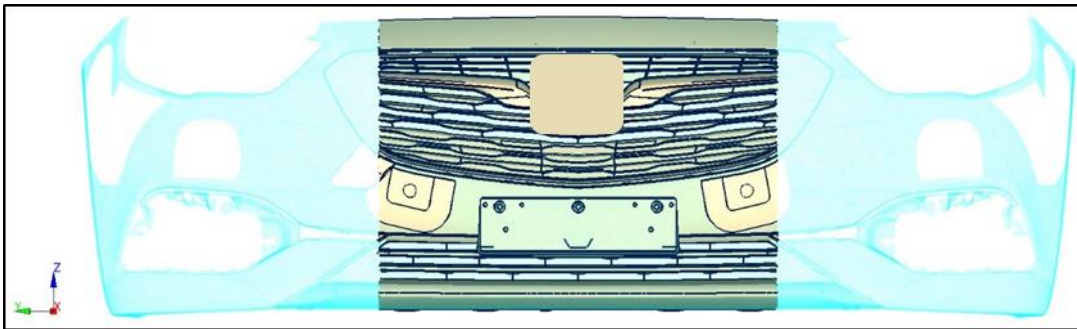
### Comments:

- This study is to show if an existing leg impactor can exert a similar load to a vehicle front end as an HBM
- This study is deliberately not related to any specific sensing system
- The intrusions shown are maximum intrusions that by far exceed the intrusions required for current sensing systems
- The maximum intrusions occur on a location that is different from the intrusions at the very beginning of an impact
- Hence, maximum intrusions shown have a different vertical position than current sensing system positions

## Fascia Maximum Intrusion

Intrusion plots on fascia front:

- Contour plot to find fascia node with Max. Intrusion
- Plot Time/History curves

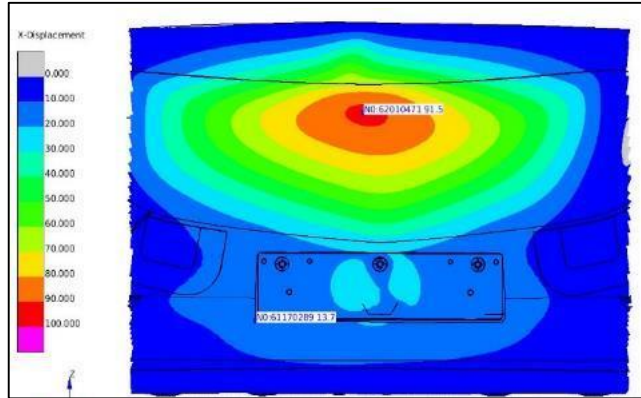




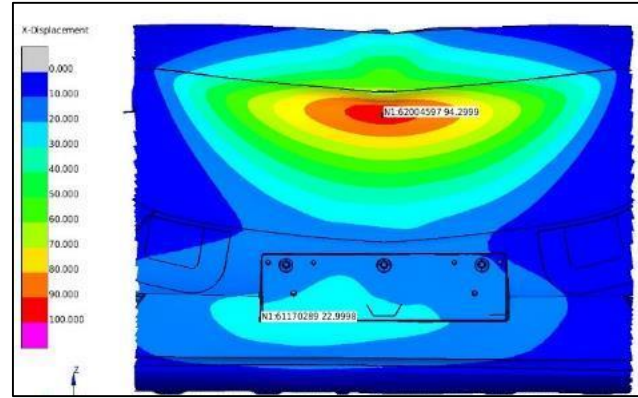
# Study

## Fascia Maximum Intrusion @25km/h

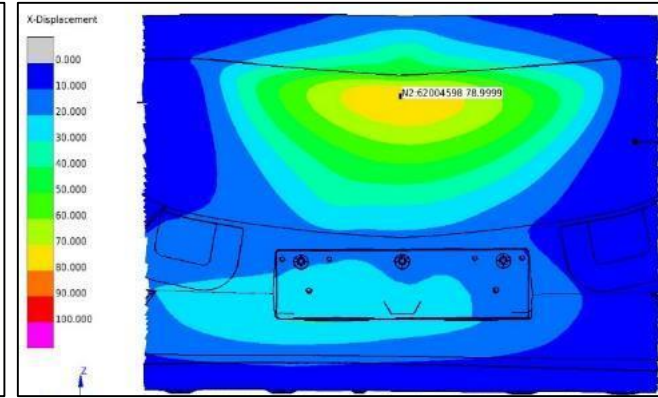
**6YO – N 62010471 @ 33ms**



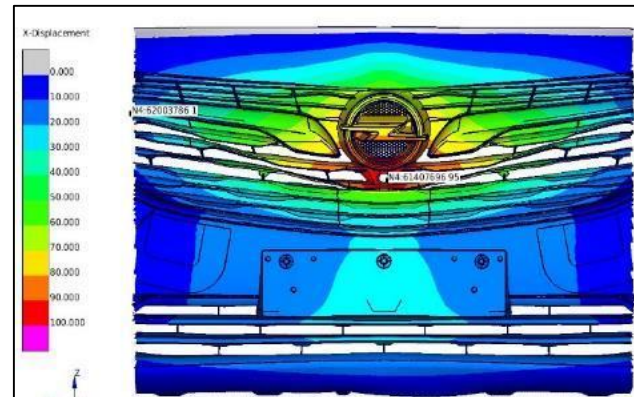
**F05 – N 62004597 @ 35 ms**



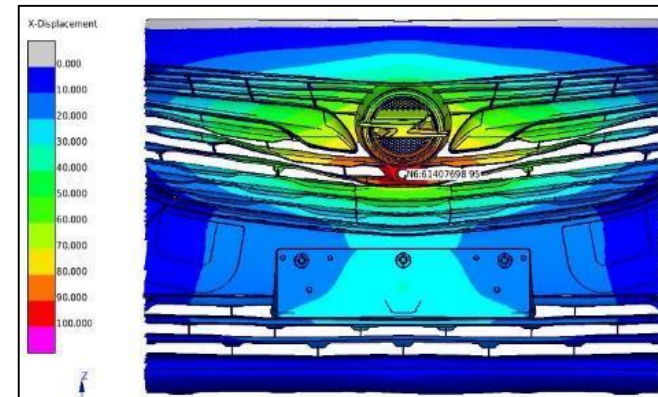
**M50 – N 62004598 @ 39 ms**



**FlexPLI – N 61407696 @ 17 ms**

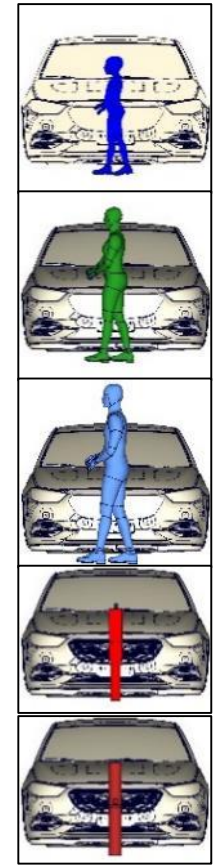
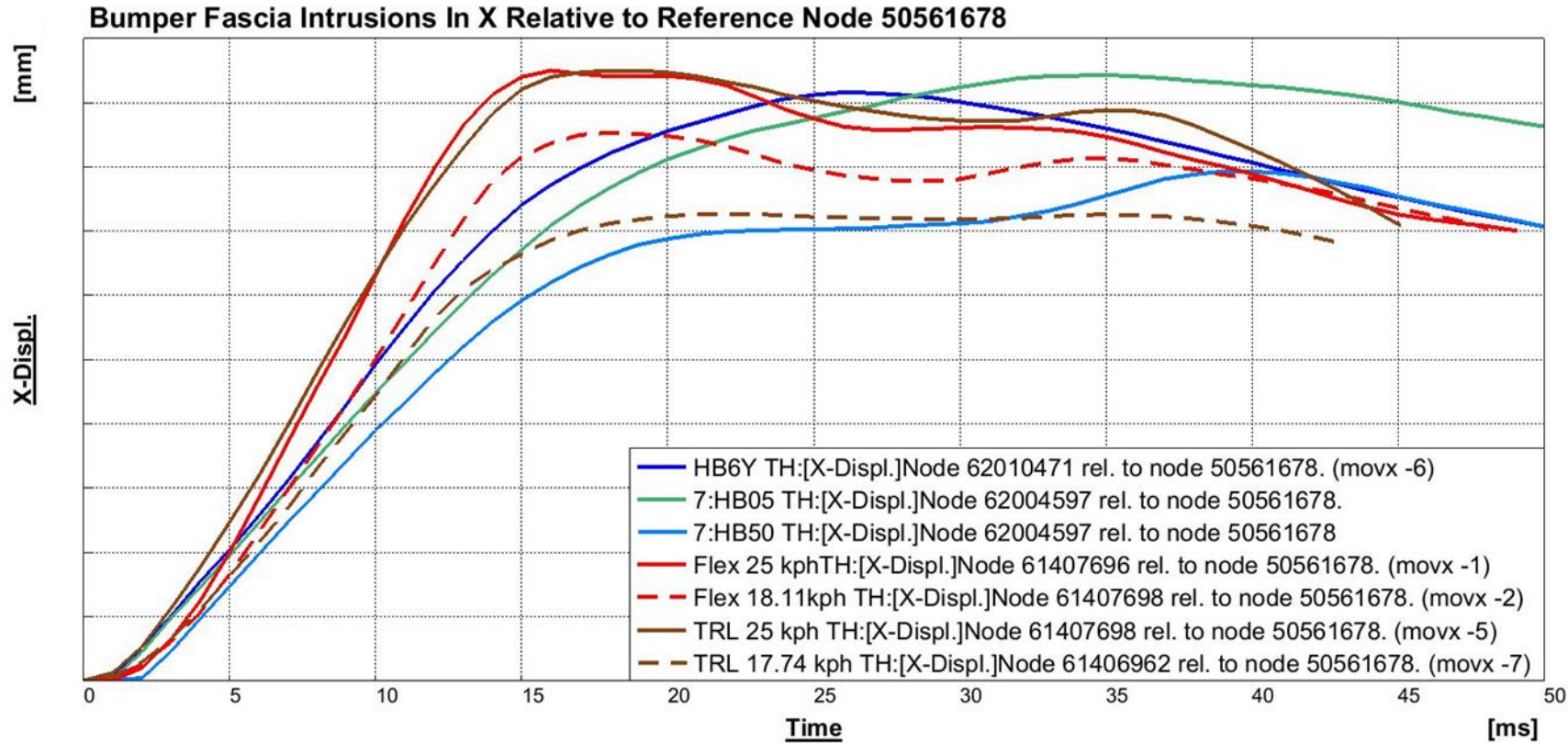


**TRL N 61407698 @ 23 ms**



The impactor intrusions are comparable to the HBMs over the impactor height.

## Fascia Maximum Intrusion



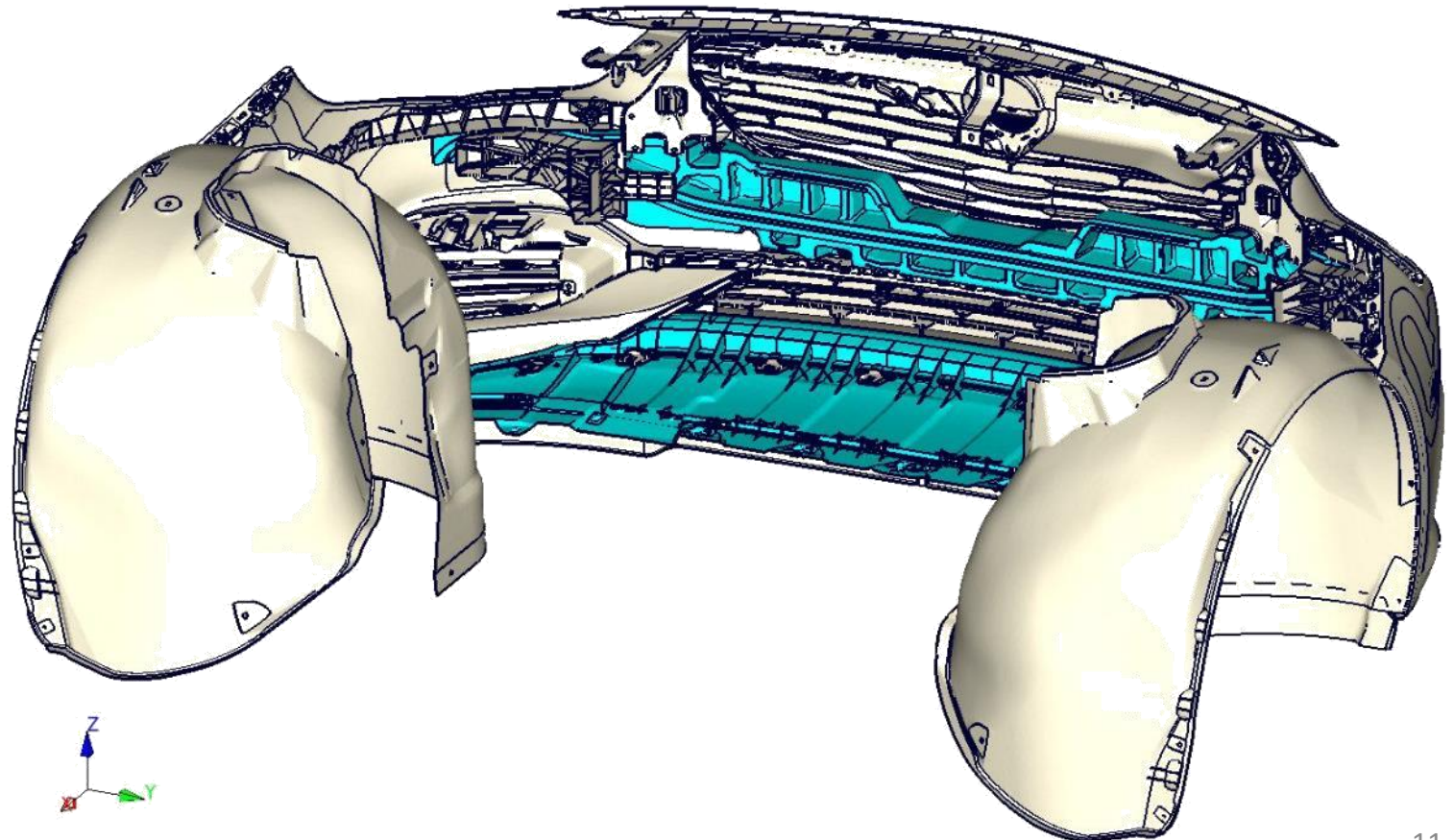
The HBM 50Male has the least maximum intrusion into the vehicle front.  
 The TRL impactor and the FlexPLI with reduced velocity are close.

Impact Energy

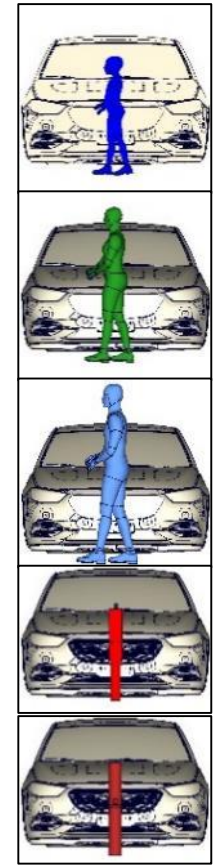
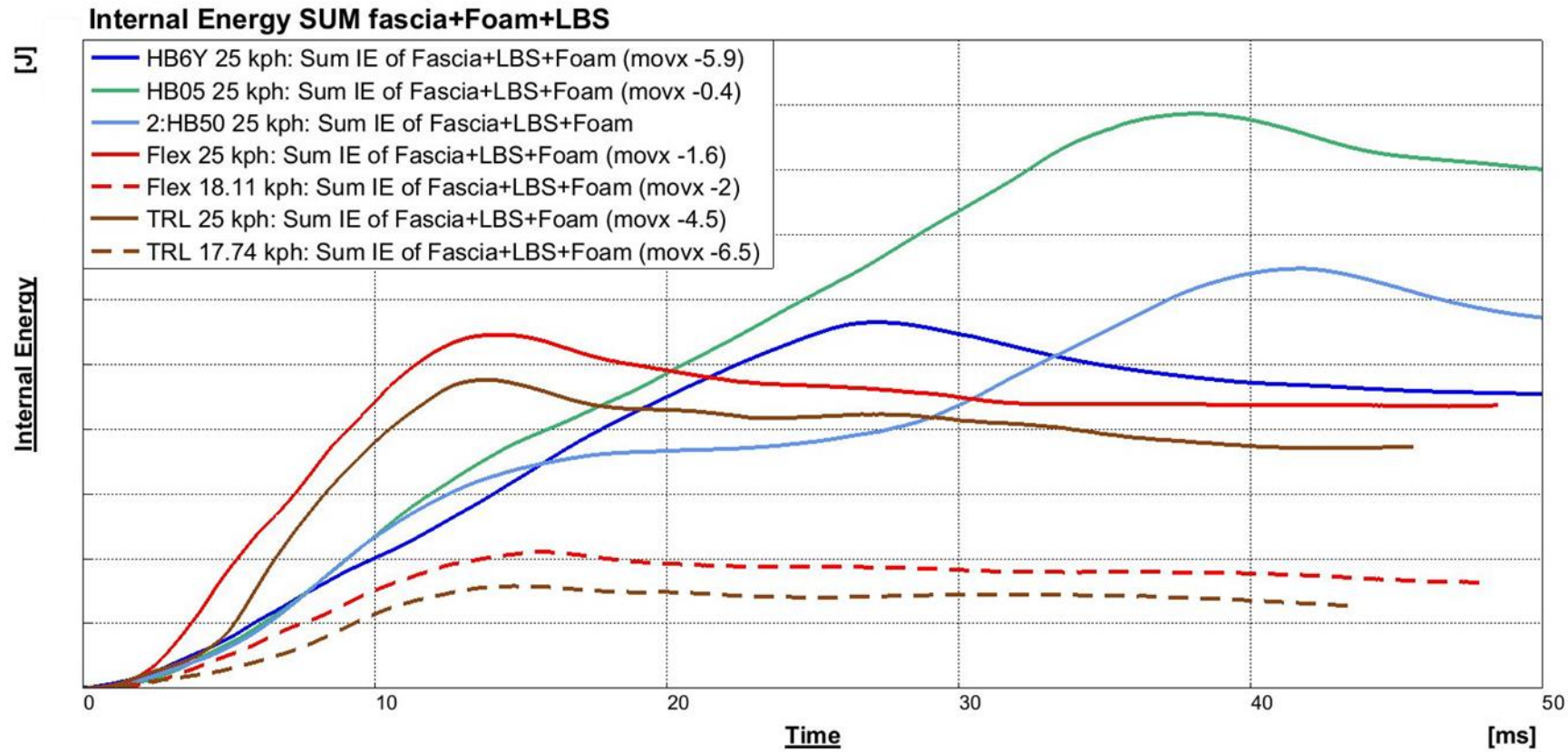
All relevant fascia parts taking energy were monitored.

Internal Energy summed for:

- Fascia, Grills and Fender Liners
- Lower Stiffener / Absorber
- Foam Absorber
- Foam Skin



Impact Energy

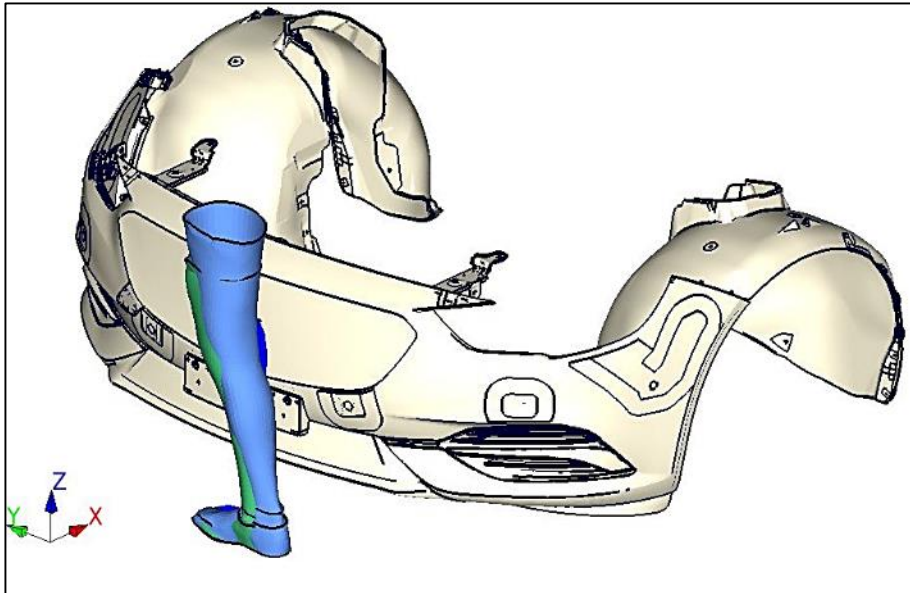


The TRL impactor and the FlexPLI without reduced velocity are close to the HBMs.  
 The impactors with reduced energy are too conservative, a velocity reduction to the PDI2 levels is not realistic.

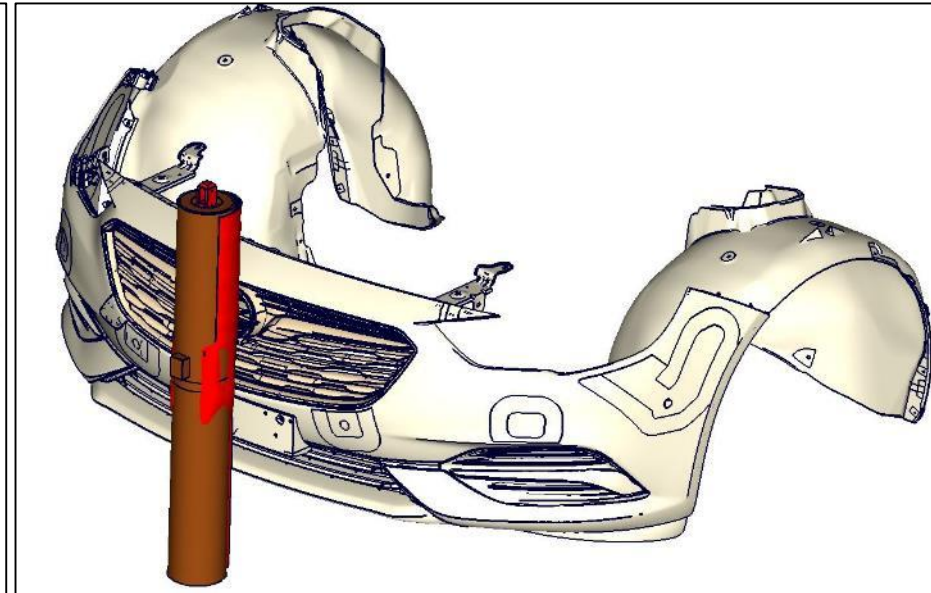
## Fascia Contact Force

The legs of the HBMs were used to check for the contact force compared to the impactors.

HBM RH Legs



Impactors



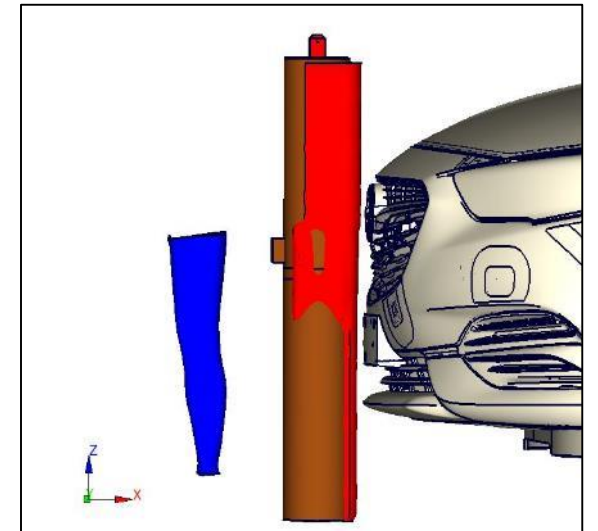
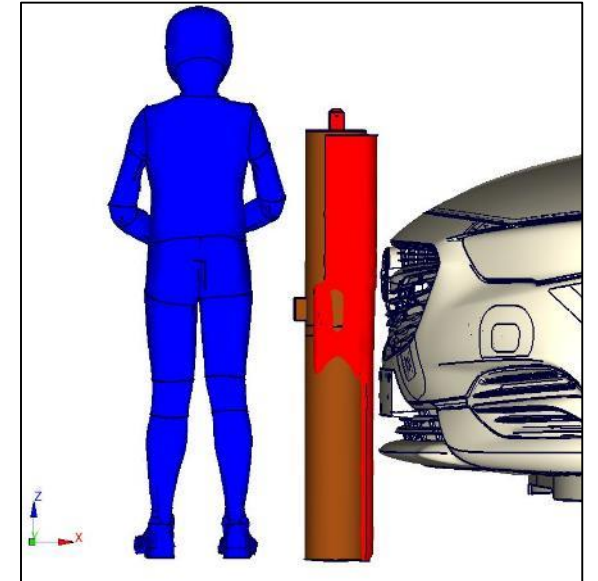
## Fascia Contact Force

A misconception may arise with regard to the 6YO force signal:

In fact, almost all of the 6YO may qualify to be used for contact force evaluation. However, this was hard to implement on the CAE model and not comparable to the other HBM legs.

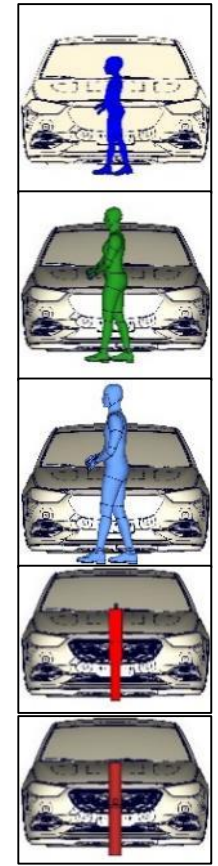
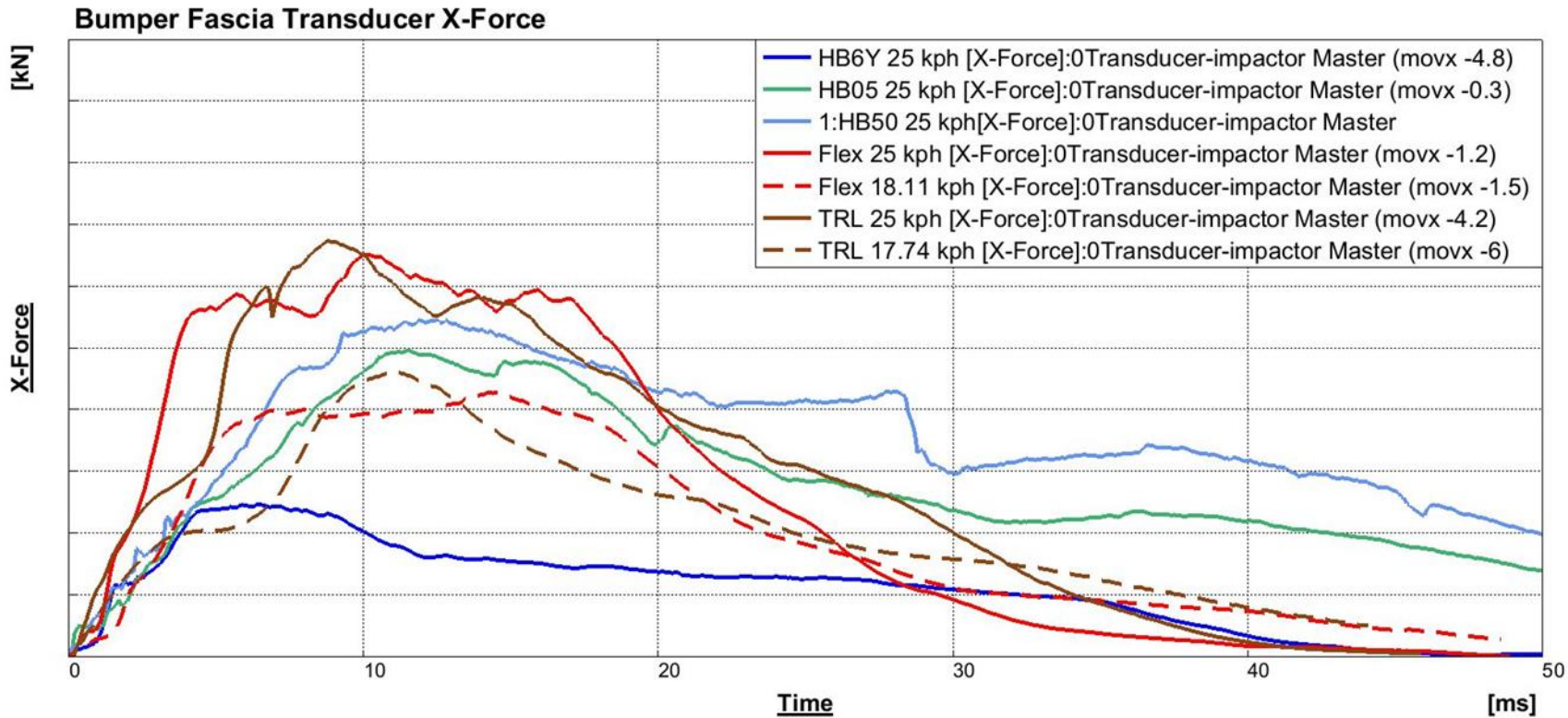
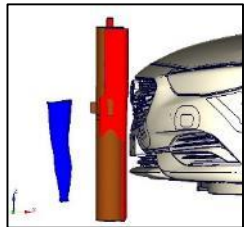
Only the leg was used, which is rather small compared to the impactors.

This must be considered when interpreting the curves on the next slide.



Leg Height of 6YO

Fascia Contact Force



The 6YO leg force is too low due to its limited height as expected per the description on the page before. The TRL impactor and the FlexPLI with reduced velocity induce less force than the HBMs.

## Conclusion

### Summary:

- It is possible to use one of the impactors existing in legislation for sensing validation @ Lower Threshold Velocity
- The reduced velocity using the same energy as with PDI-2 in this study was somewhat too conservative
- The same velocity as the Lower Threshold was quite close to the HBM signals

### Proposal:

- The velocity for sensing validation shall be the Lower Threshold Velocity
- It should be discussed within the IWG-DPPS whether one or both impactors (FlexPLI and TRL) can be used