



UNECE IG GTR9-PH2 TF-BTA

FlexPLI behaviour in outer area – Rev. 1

25 March 2013

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AUDI AG

on behalf of the Task Force "Pedestrians"

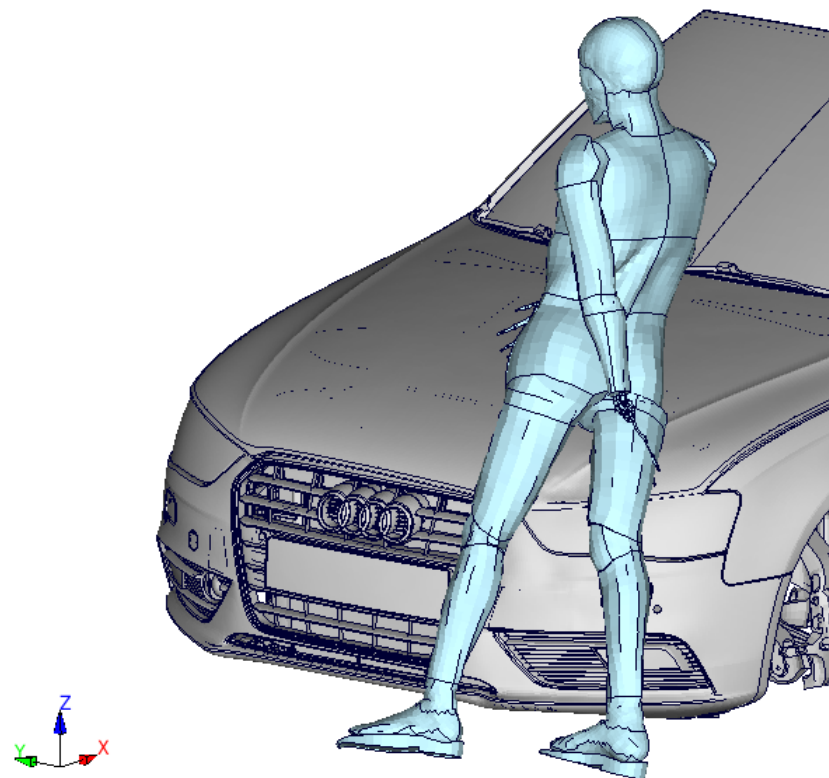
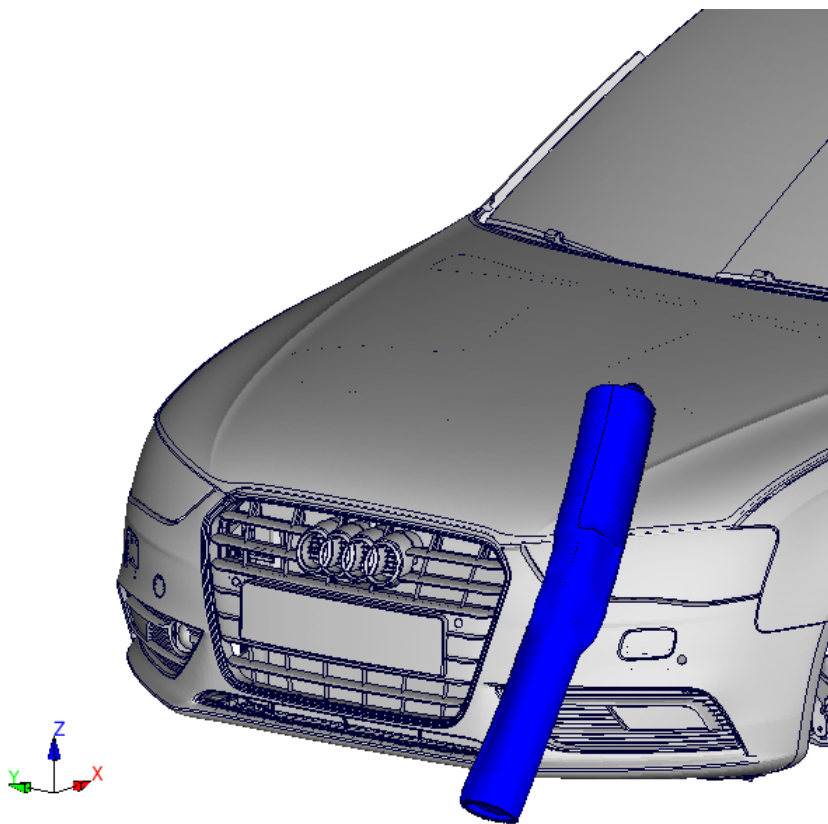
of the European Automobile Manufacturers' Association



FlexPLI Behaviour in Outer Area

Aim of the study

- Comparison of the behaviour from FlexPLI and Human Model THUMS in the outer area of the bumper

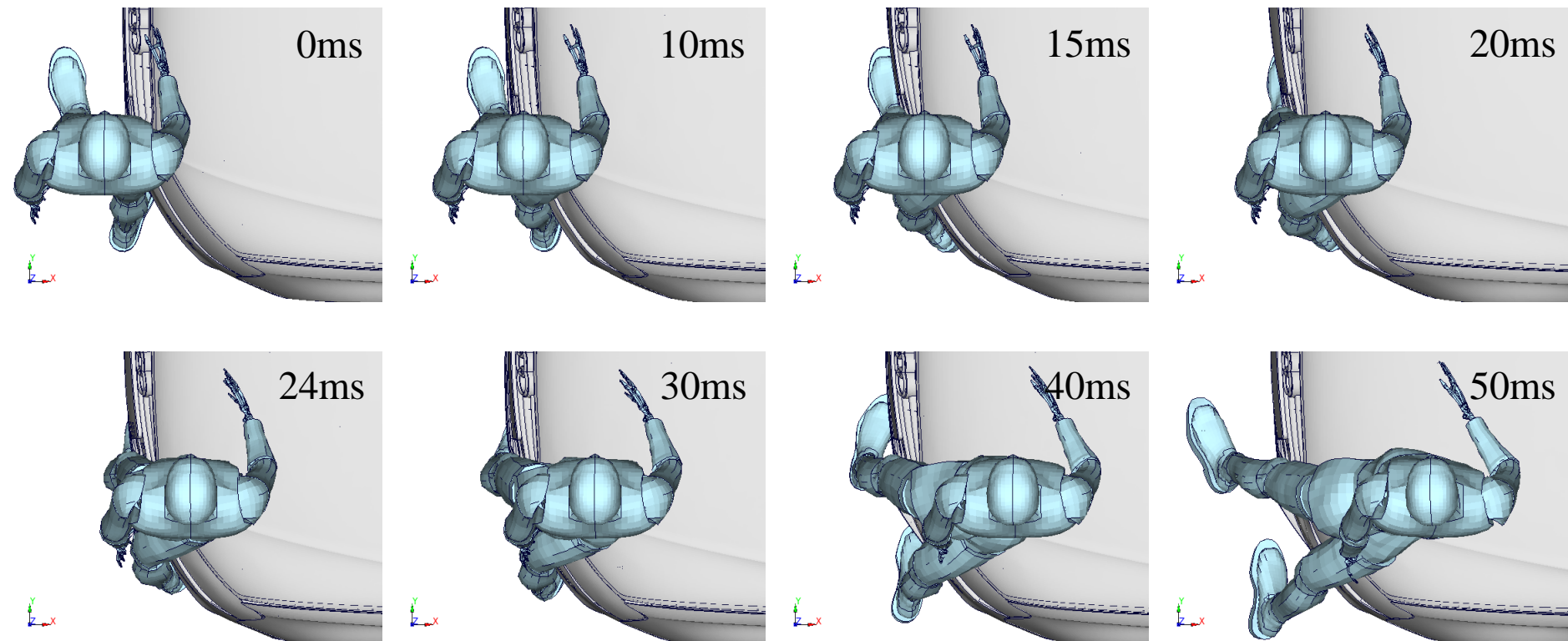




FlexPLI Behaviour in Outer Area

THUMS in area $\geq 30^\circ$

- Impact position Y500L (25°-tangent)

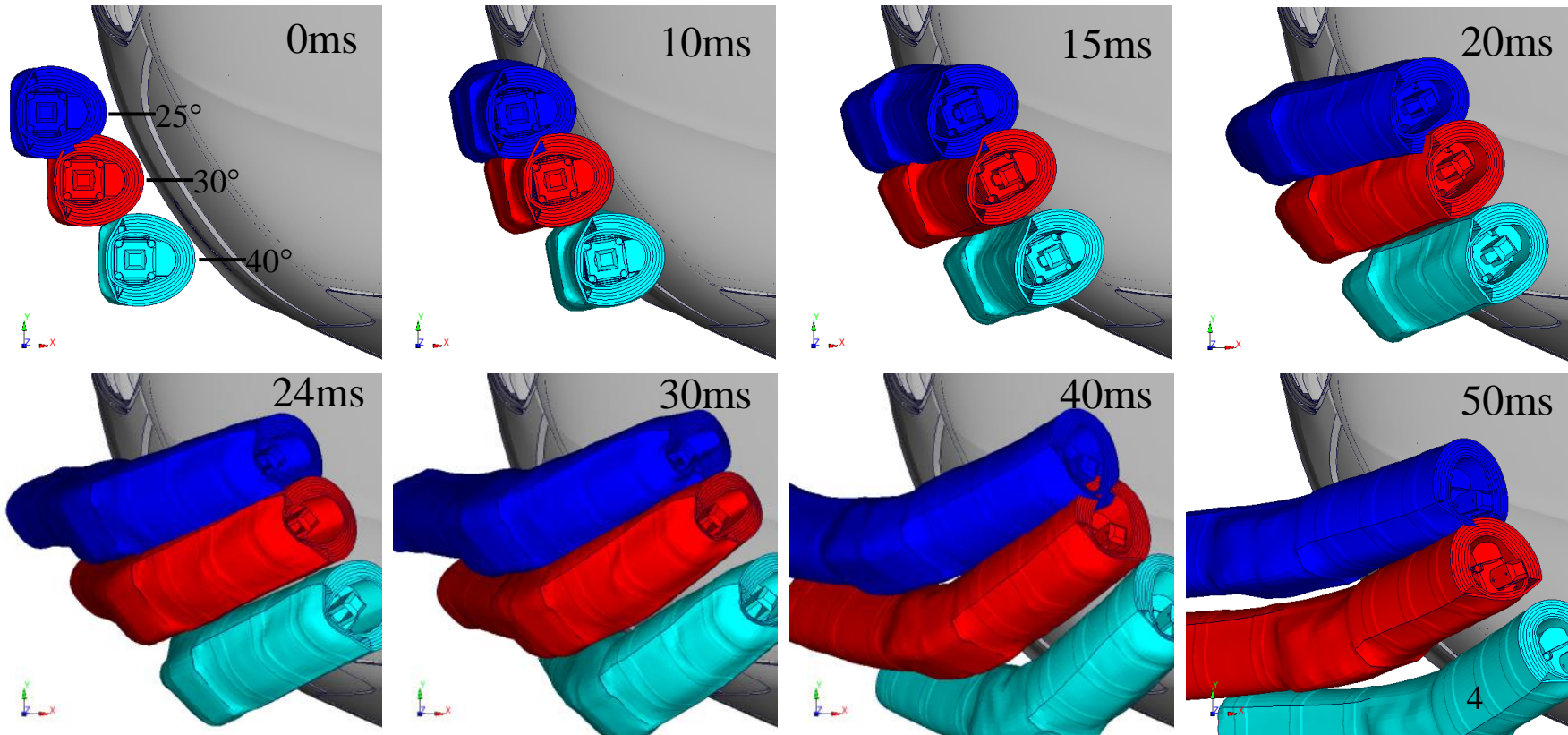




FlexPLI Behaviour in Outer Area

FlexPLI behaviour in area $\geq 30^\circ$

- **Impact positions**
Y500L (25°-tangent), Y600L (30°-tangent), Y700L (40°-tangent)
- **Strong lateral rotation of FlexPLI even at 25° as from 11 ms**

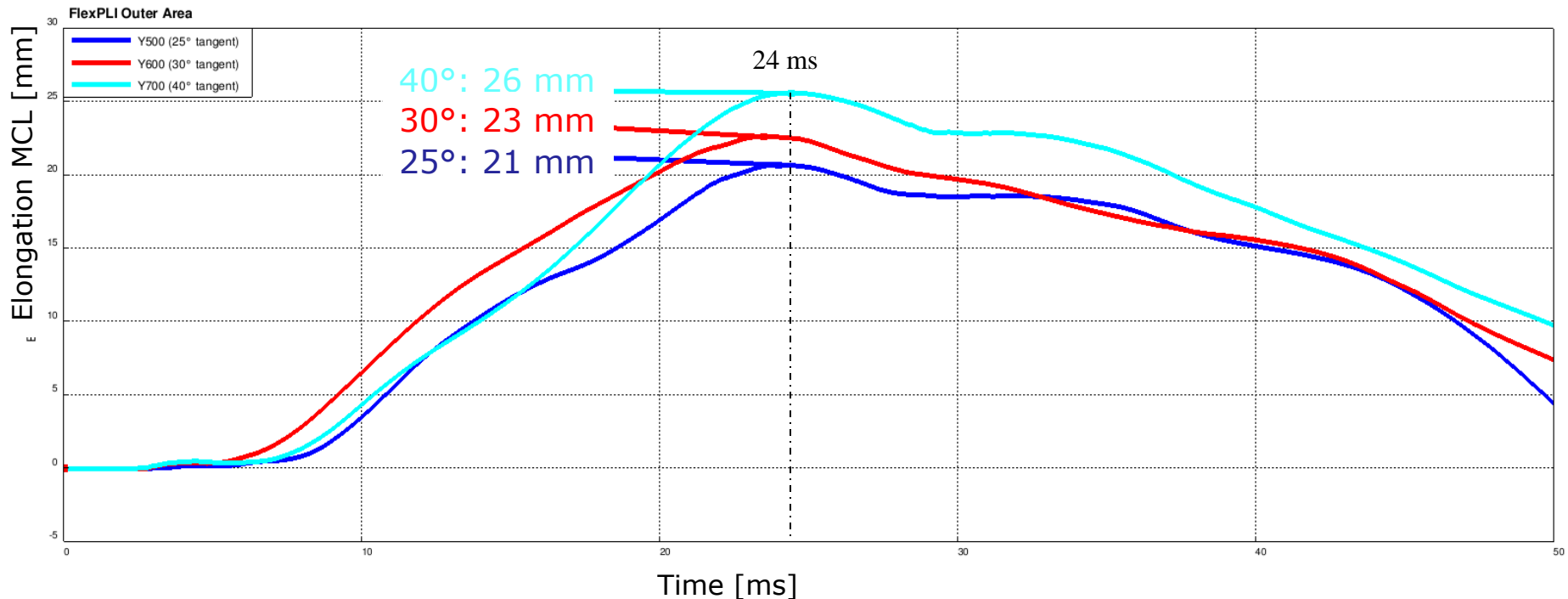




FlexPLI Behaviour in Outer Area

FlexPLI behaviour in area $\geq 30^\circ$

- Impact positions
Y500L (25°-tangent), Y600L (30°-tangent), Y700L (40°-tangent)
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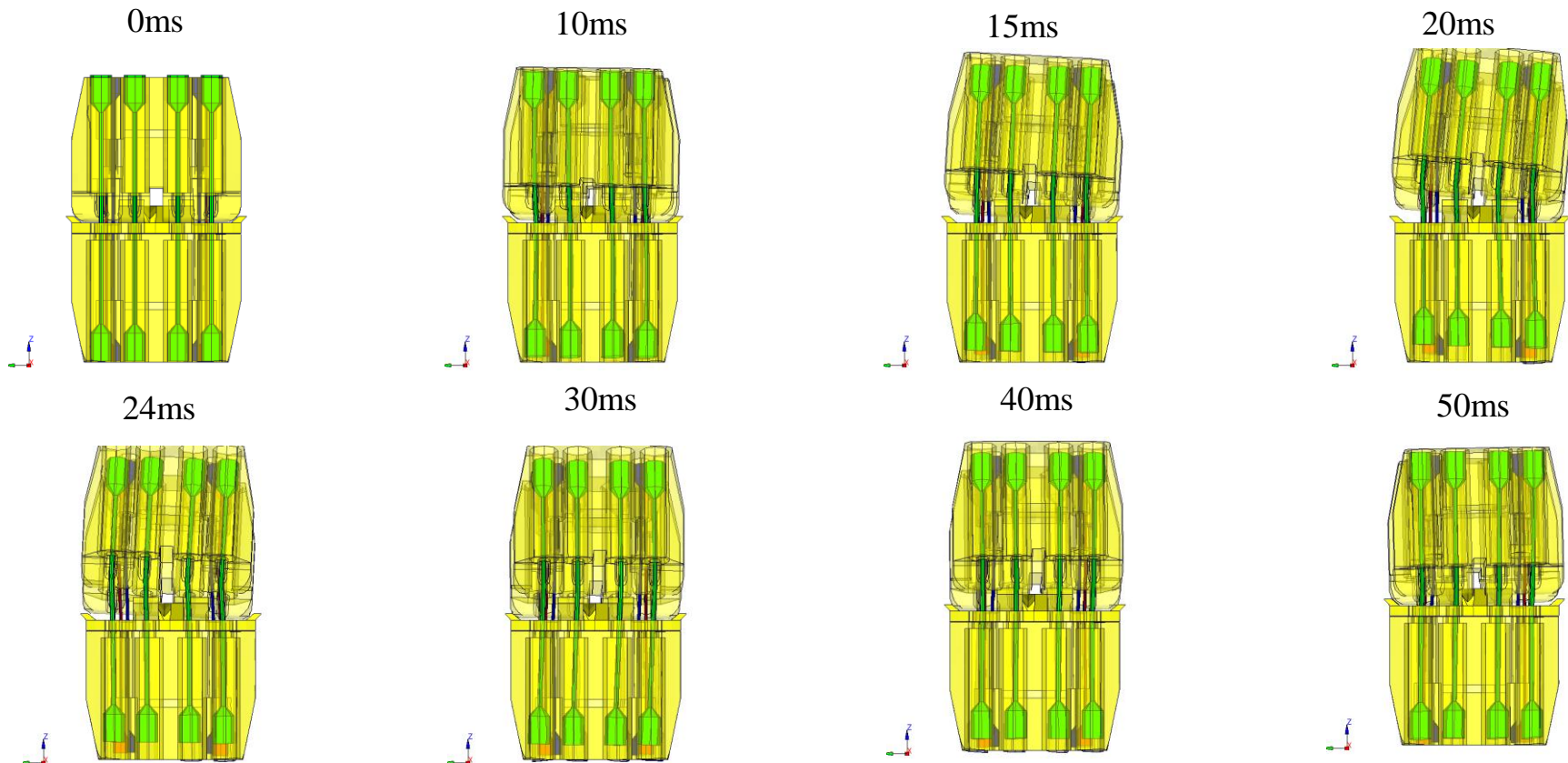




FlexPLI Behaviour in Outer Area

FlexPLI behaviour in area $\geq 30^\circ$

- **Detail FlexPLI: knee movement at Y=500L (25°)**
- **Tibia fixed: view of the relative movement of the femur**

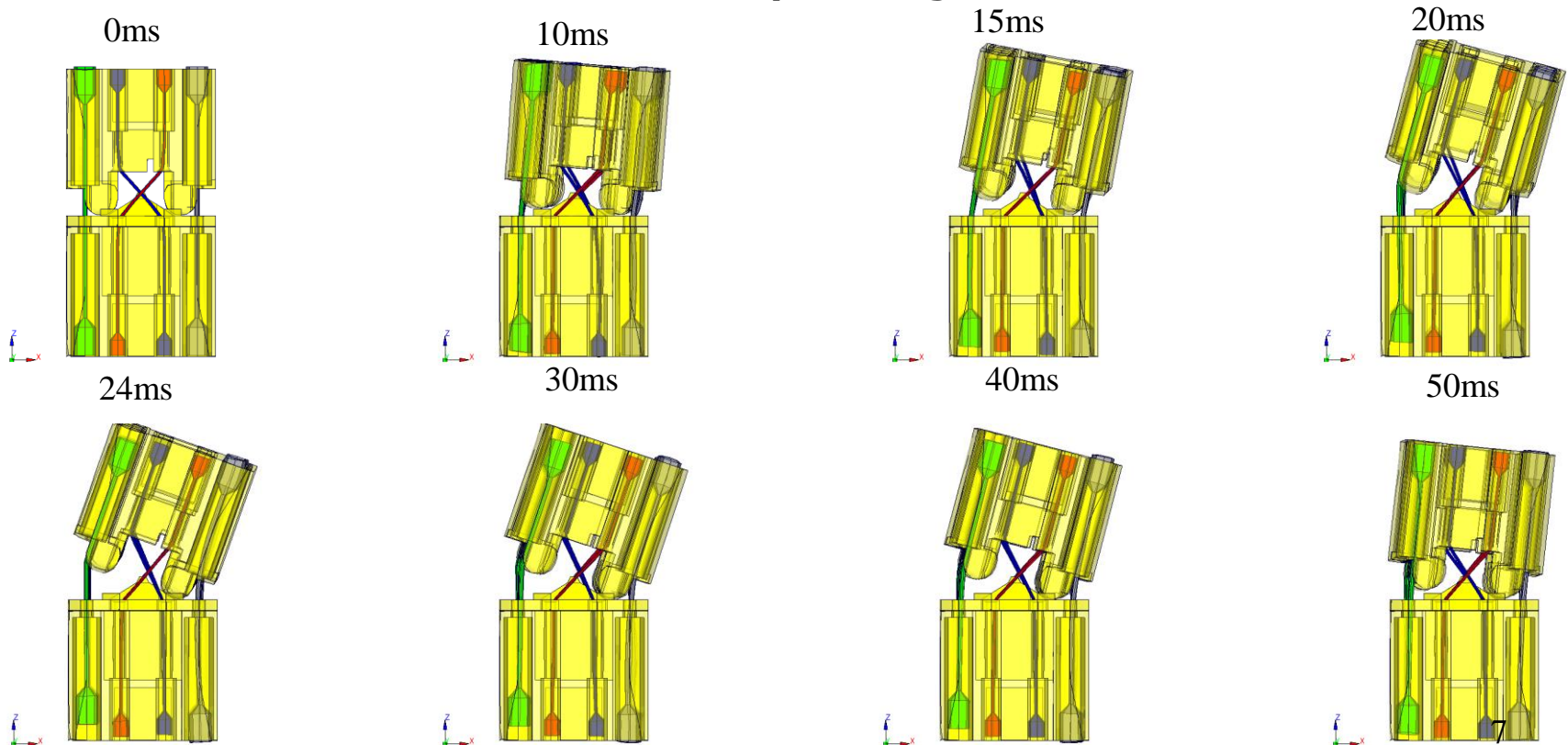




FlexPLI Behaviour in Outer Area

FlexPLI behaviour in area $\geq 30^\circ$

- **Detail FlexPLI: knee movement at Y=500L (25°)**
 - **Tibia fixed: side view of the relative movement of the femur**
- femur turns relative to tibia additionally to the global lateral rotation

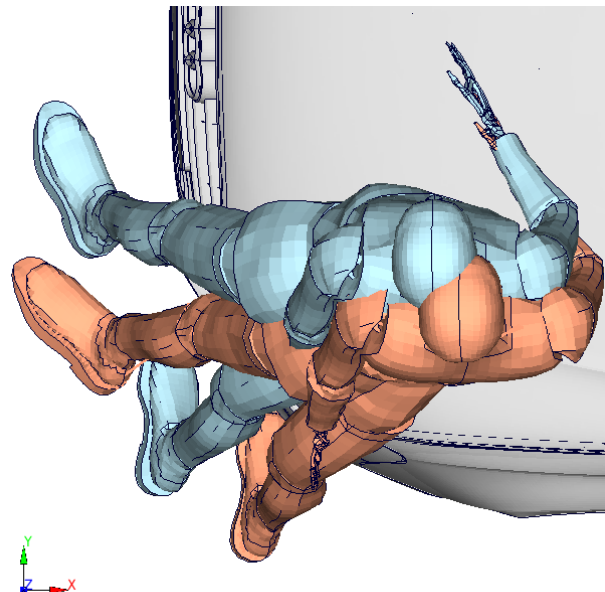
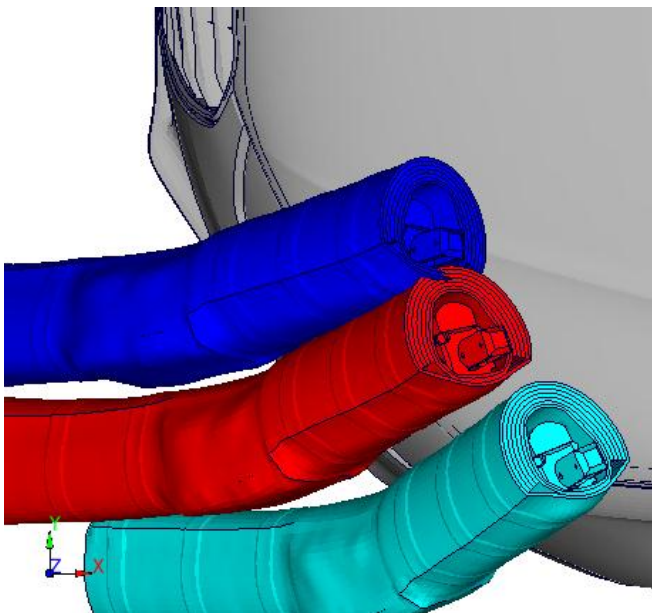




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation**

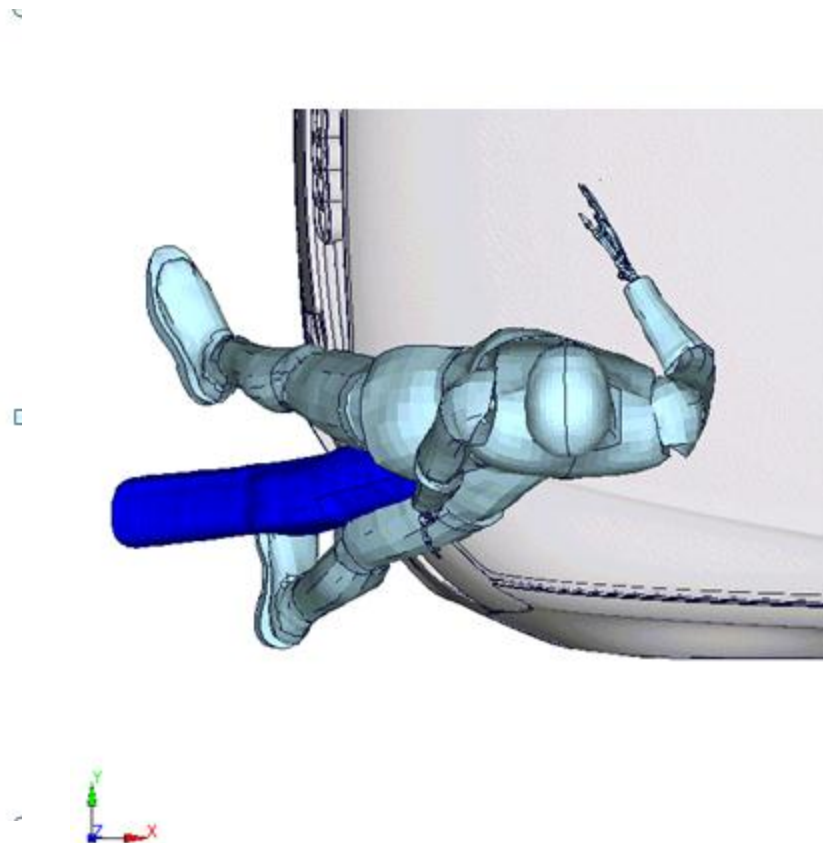
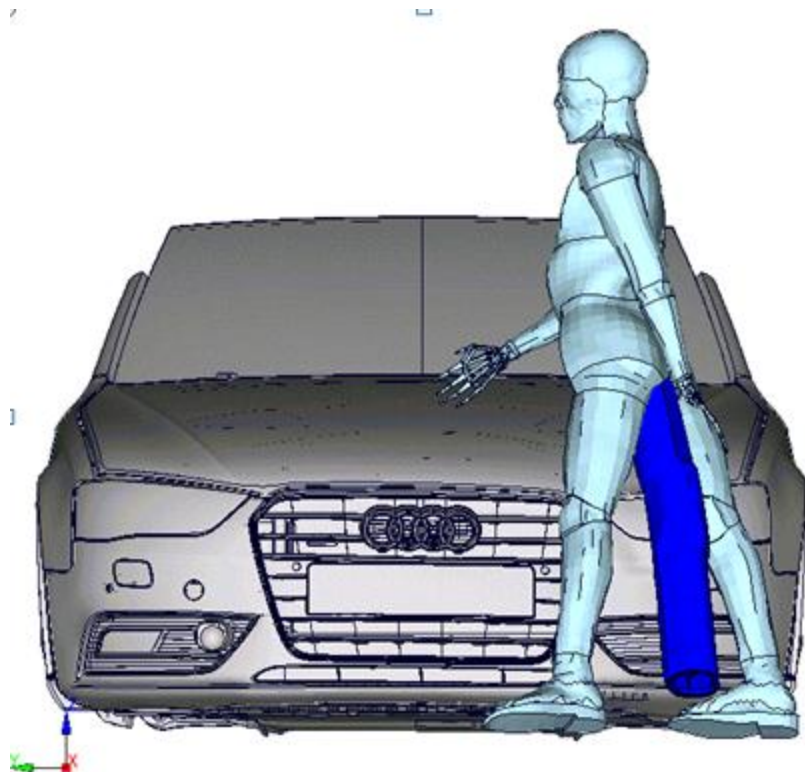




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y500**

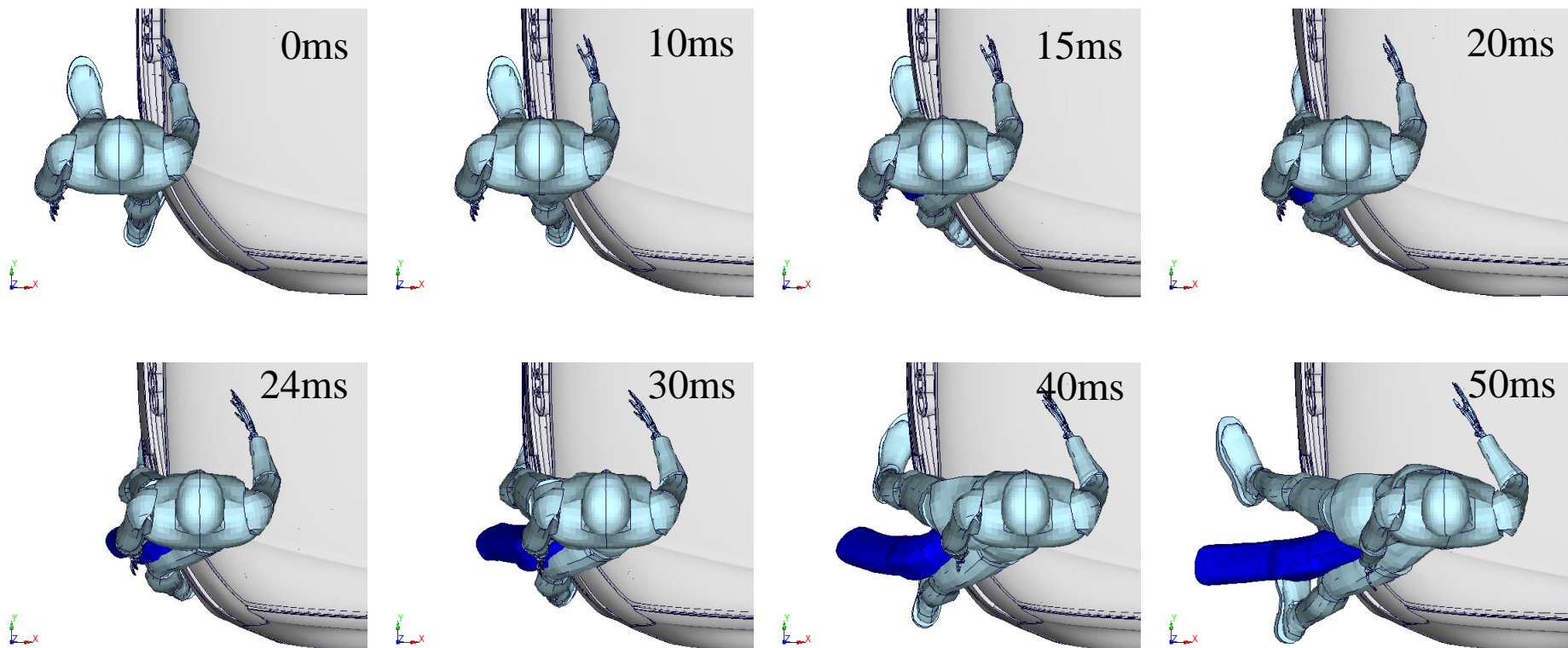




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y500**

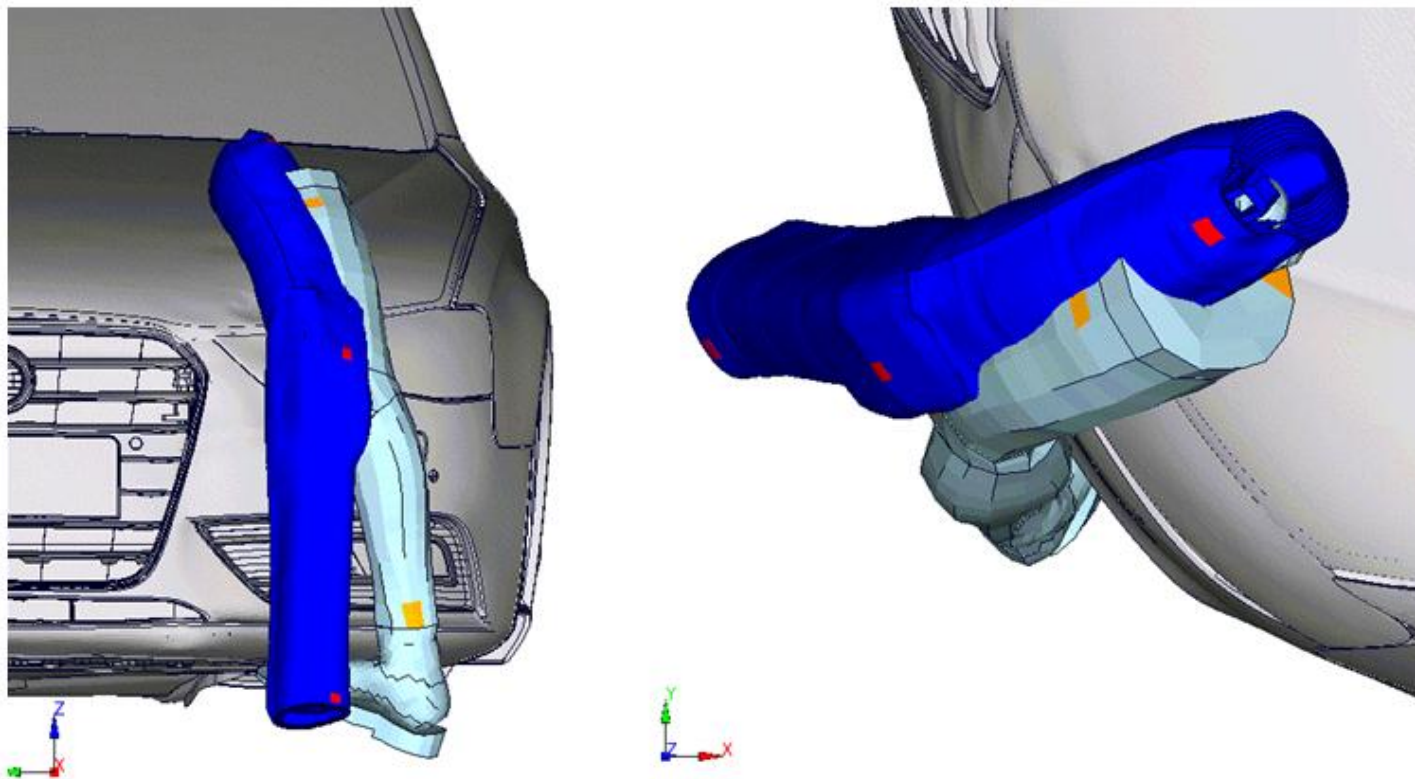




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y500**

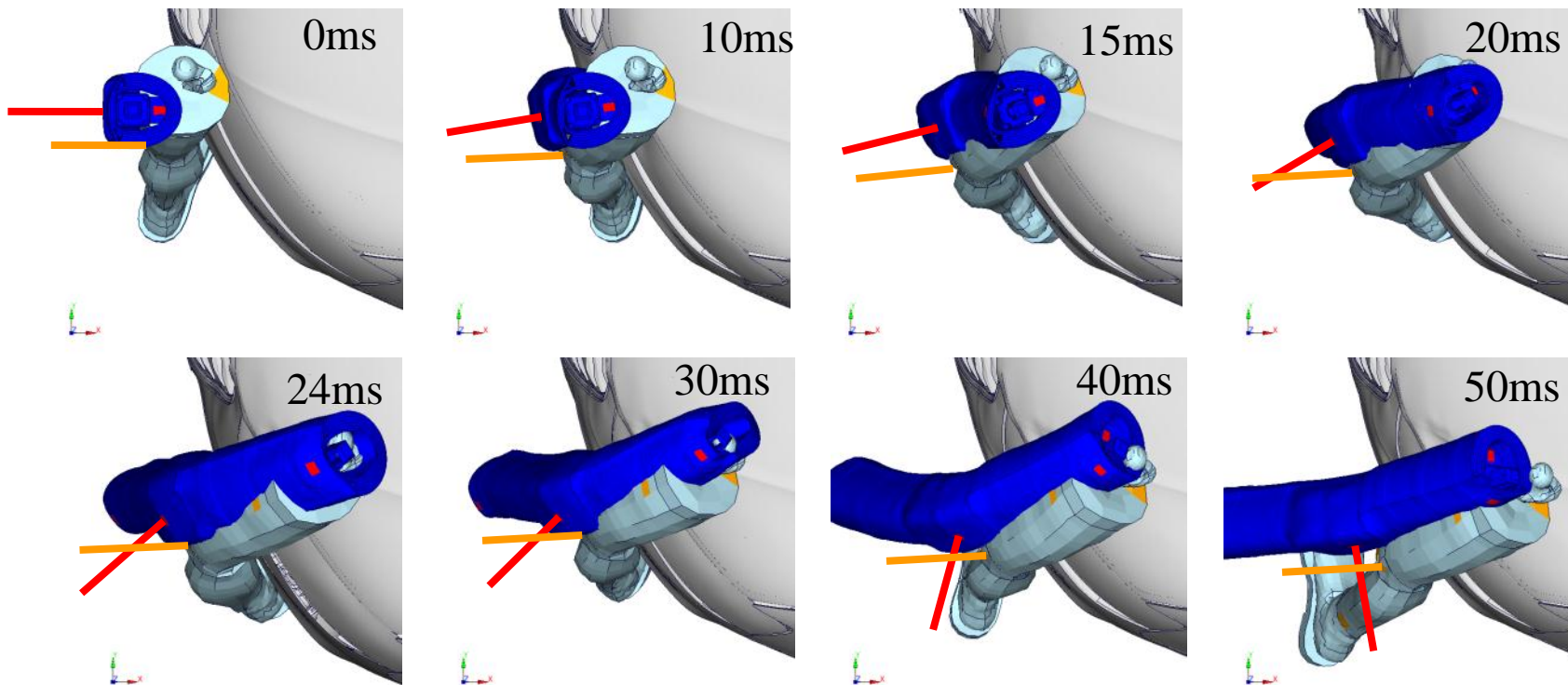




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y500**

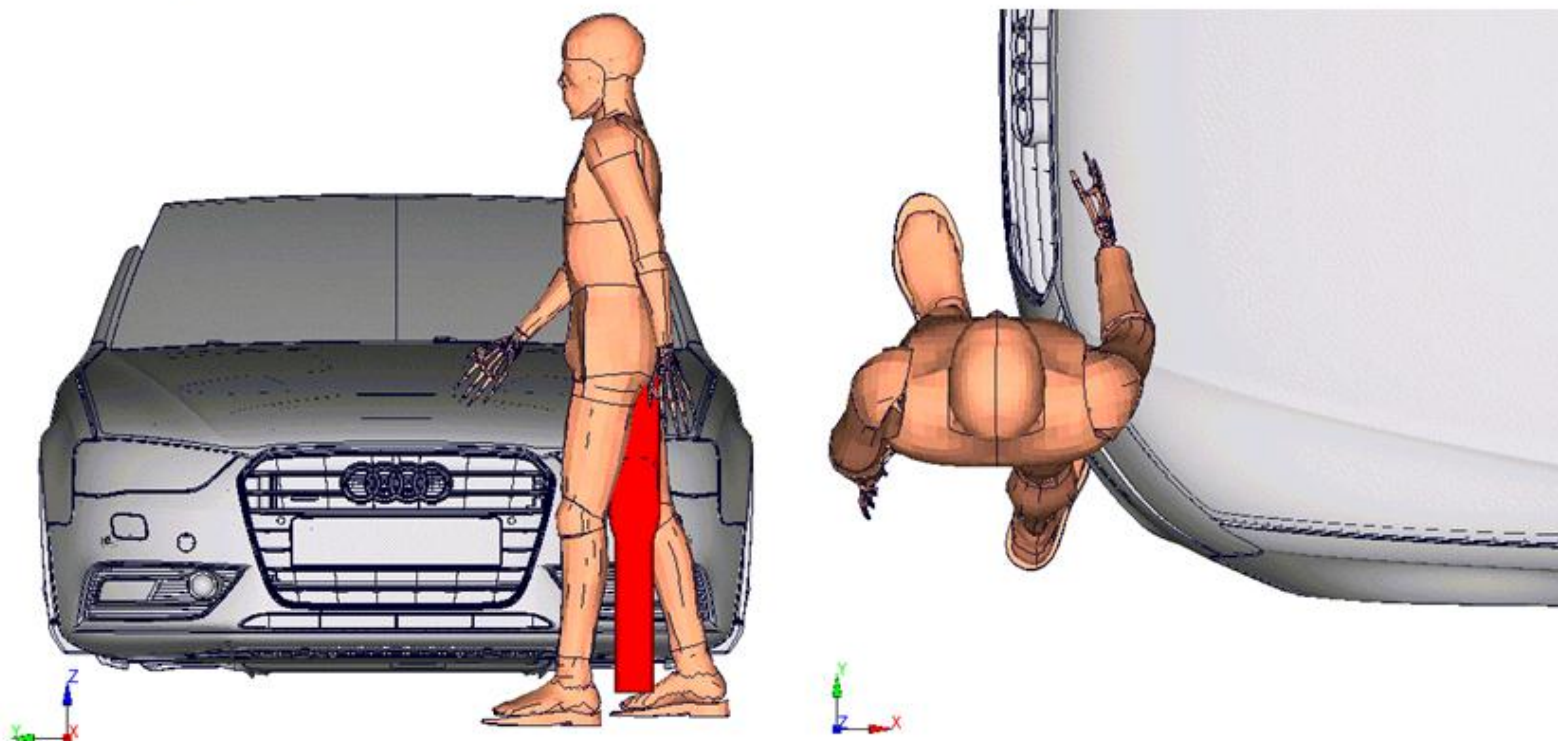




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y600**

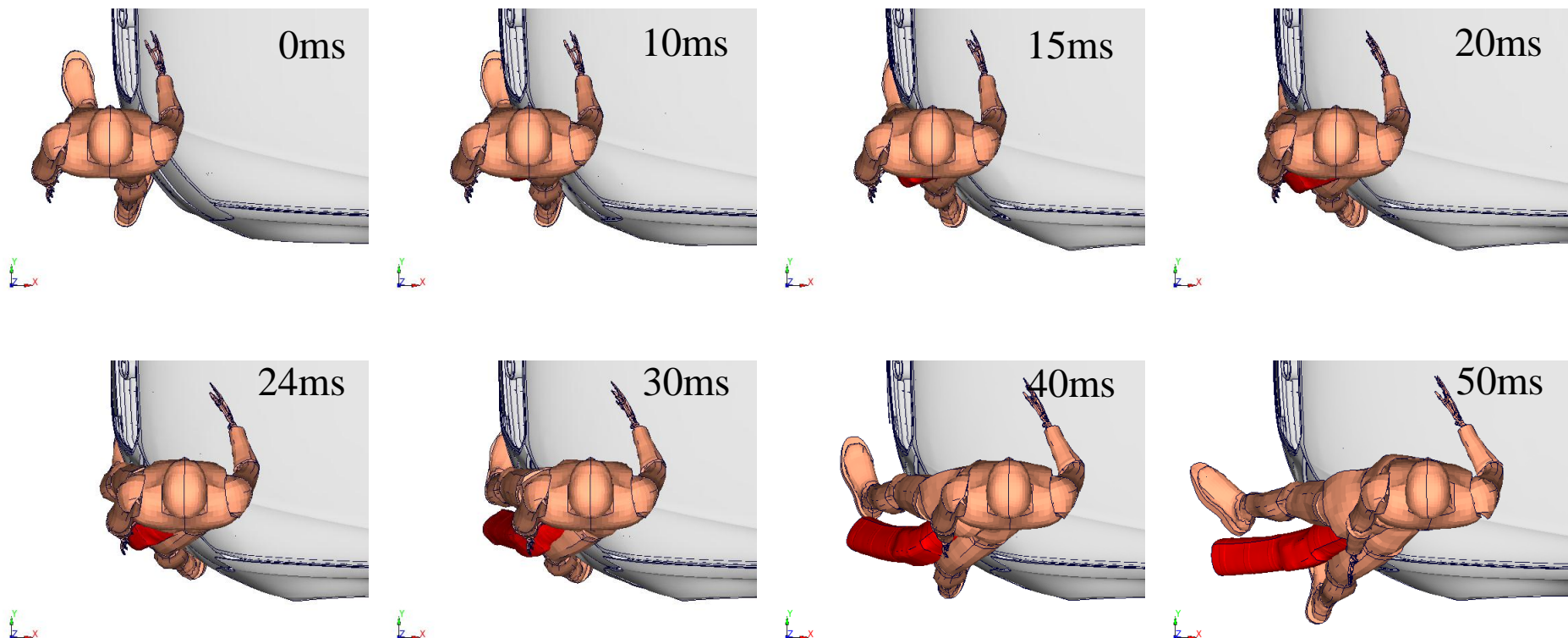




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y600**

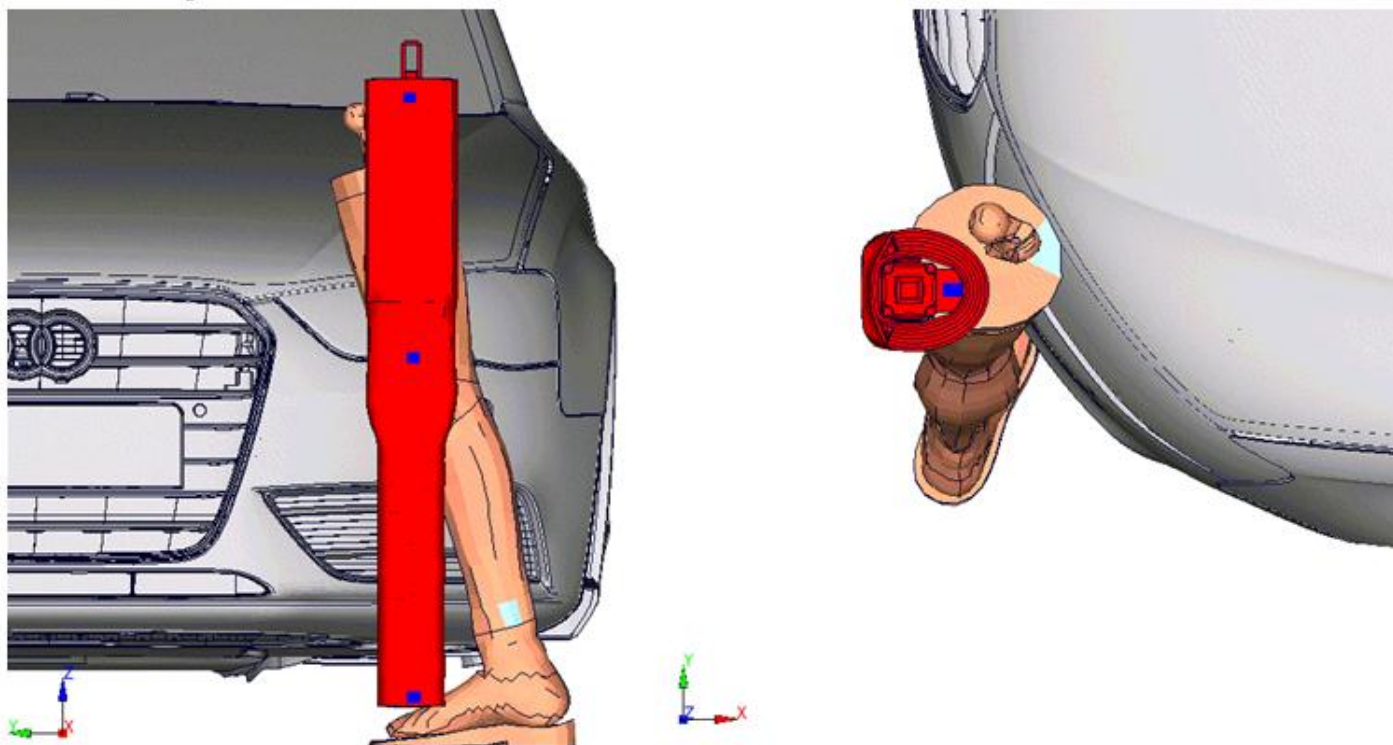




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y600**

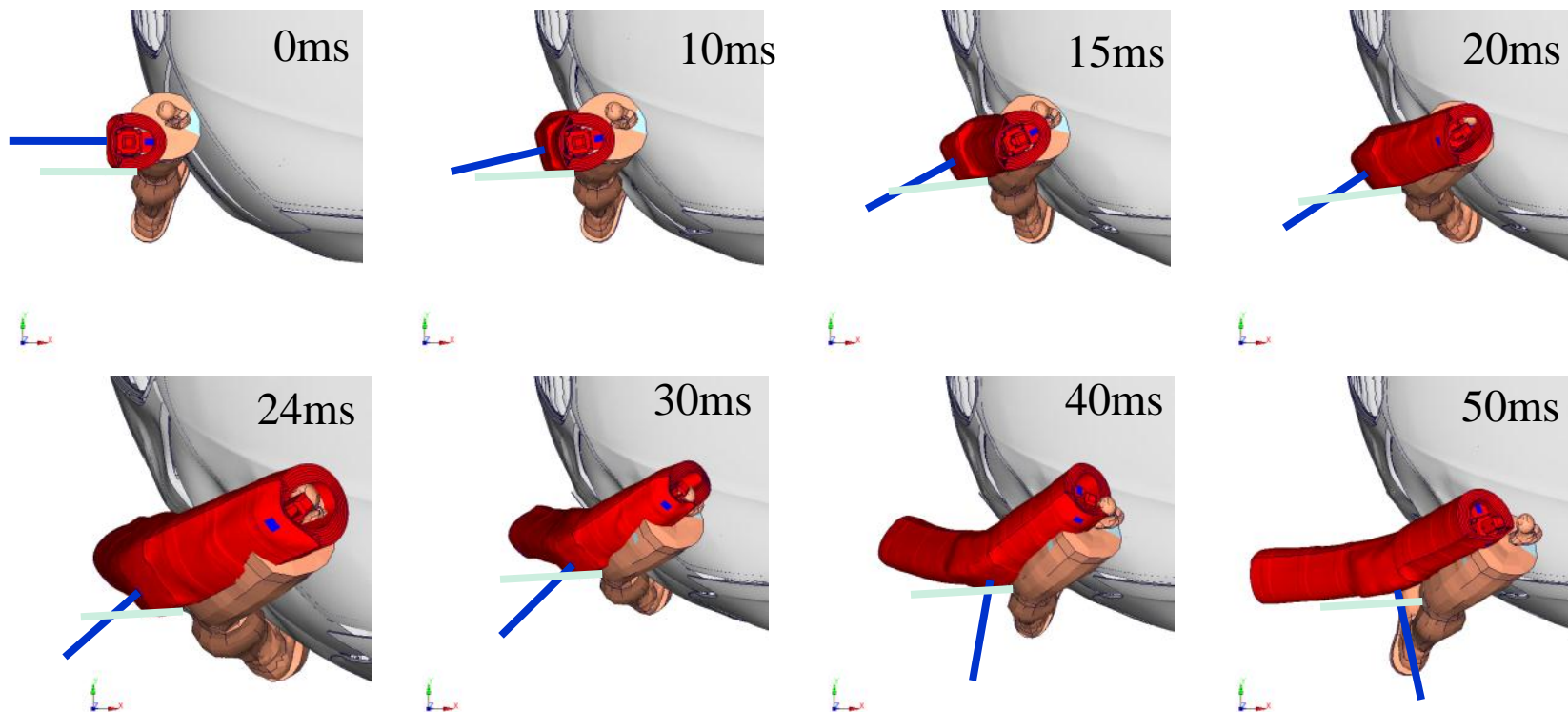




FlexPLI Behaviour in Outer Area

Comparison of THUMS / FlexPLI

- **Overlay of both legs**
- **Comparison of rotation Y600**





FlexPLI Behaviour in Outer Area

Conclusions

- **Strong lateral rotation of FlexPLI even at 25° as from 11 ms**
- **Increase of MCL elongation due to lateral and relative rotational effects of the impactor**
- **Lateral rotation of the impactor relative to the car front enables more bending (artificial)**
- **Lateral rotation of the impactor relative to the car front drives to additional artificial (non physical) bending**
- **Comparison with THUMS show that the impactor can not reproduce the behaviour of the human leg in the outer area**