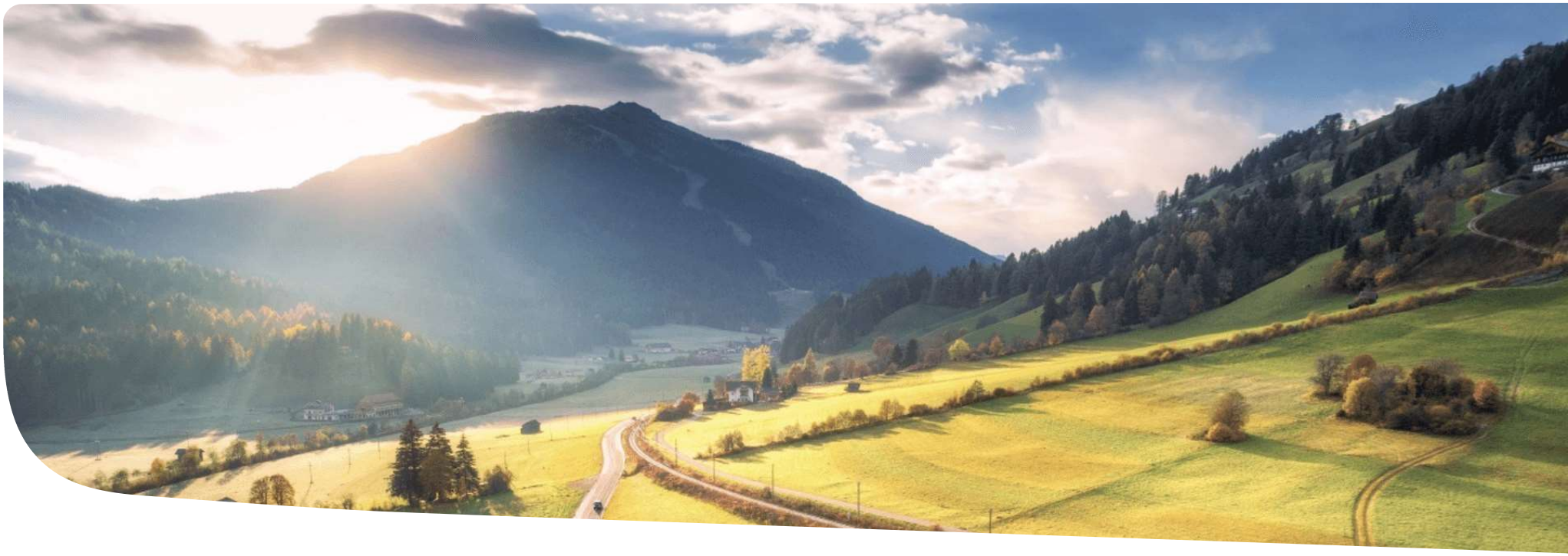
Internal & Partners

DEOP – Whiplash for females

INES LEVALLOIS – R&D SAFETY & REGULATIONS

June 9th, 2022

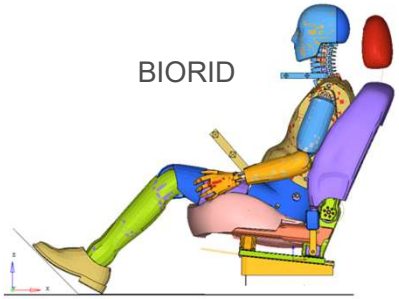


DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

Problematic :

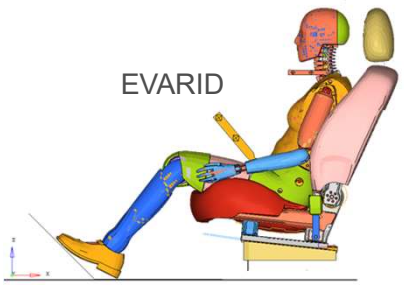
- How good is the whiplash protection of seats with GOOD dynamic EuroNcap whiplash rating for 50th females ?



Methodology :

- Whiplash protection of 3 typical serial seats were compared :
  - BioRid simulation model -> representing 50th male

    (simulation results were also compared to tests, but here not shown)
  - EvaRid simulation model -> representing 50th female
- 3 pulses used of EuroNcap protocol: SRA16, IIWPG16, SRA24



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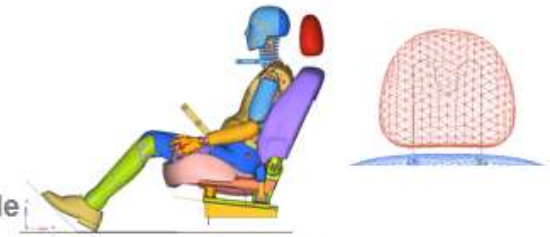
DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

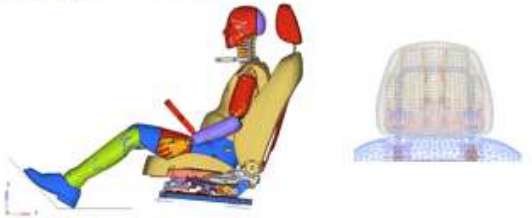
Comparison EvaRid – BioRid on 3 seats

3 Different seats :

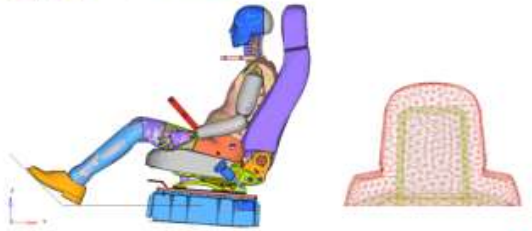
A – seat with adjustable head restraint
classic passive head restraint
seat structure not height adjustable



C – seat with adjustable head restraint
head restraint with plastic insert
seat structure height adjustable



D – seat with integrated head restraint
head restraint not adjustable
seat structure height adjustable



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DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

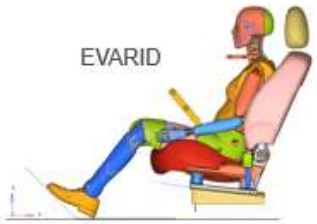
Comparison EvaRid – BioRid on 3 seats

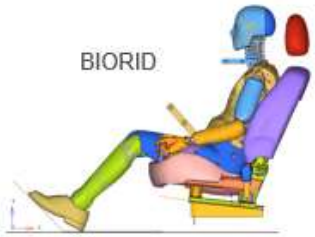
Seat set-up :

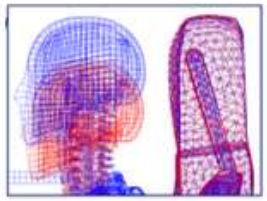
- BioRid : According EuroNcap whiplash protocol 3.1, head restraint mid-height
- EvaRid : identical as for BioRid except head restraint height at lowest position

Dummy positioning :

- BioRid : according EuroNcap whiplash protocol 3.1,
- EvaRid :
  - H-point, pelvis angle, head angle and femur angle identical to BioRid
  - Angle between femur and tibia adjusted in a range between 90°-120°
  - Occipital points of heads of BioRid and EvaRid were aligned







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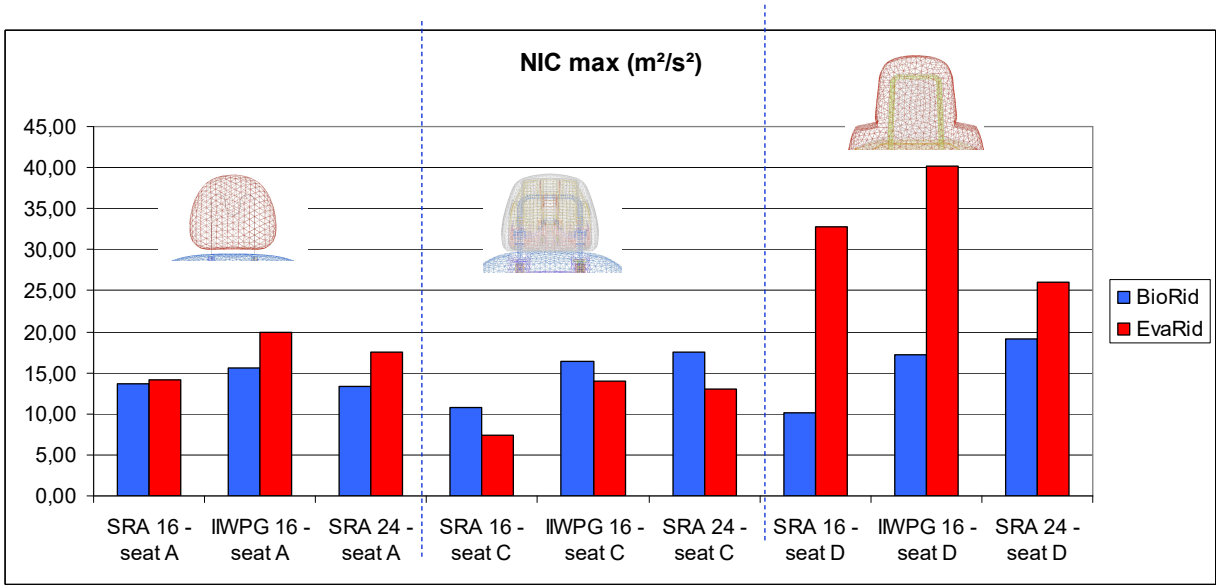
DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

Results :

- High NIC values for EvaRid on seat D where the head is not retained by the head restraint



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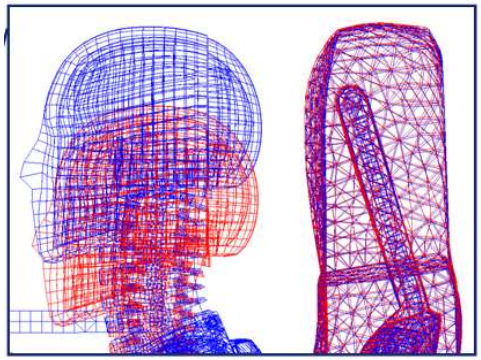
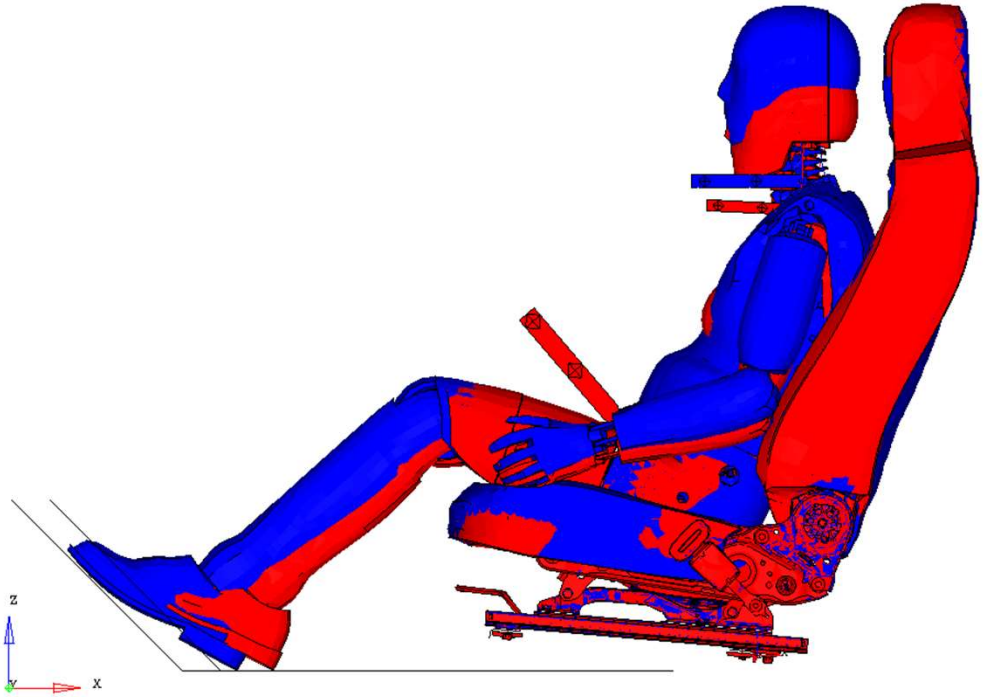
DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

Results :





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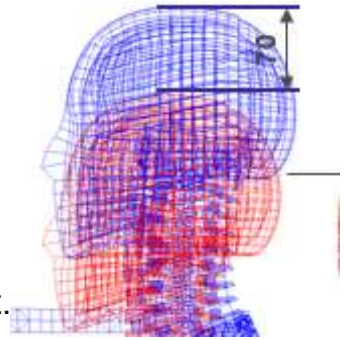
DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

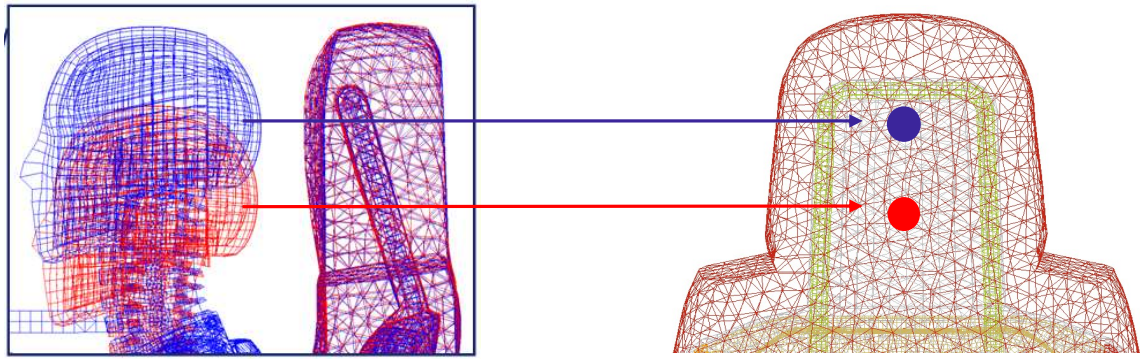


Reason for high NIC values on seat D ?

- 50th Female head is only supported by foam and not by any stiff part in the head restraint.

Blue : area where BioRid occipital point touches the head restraint

Red : area where the EvaRid occipital point touches the head restraint



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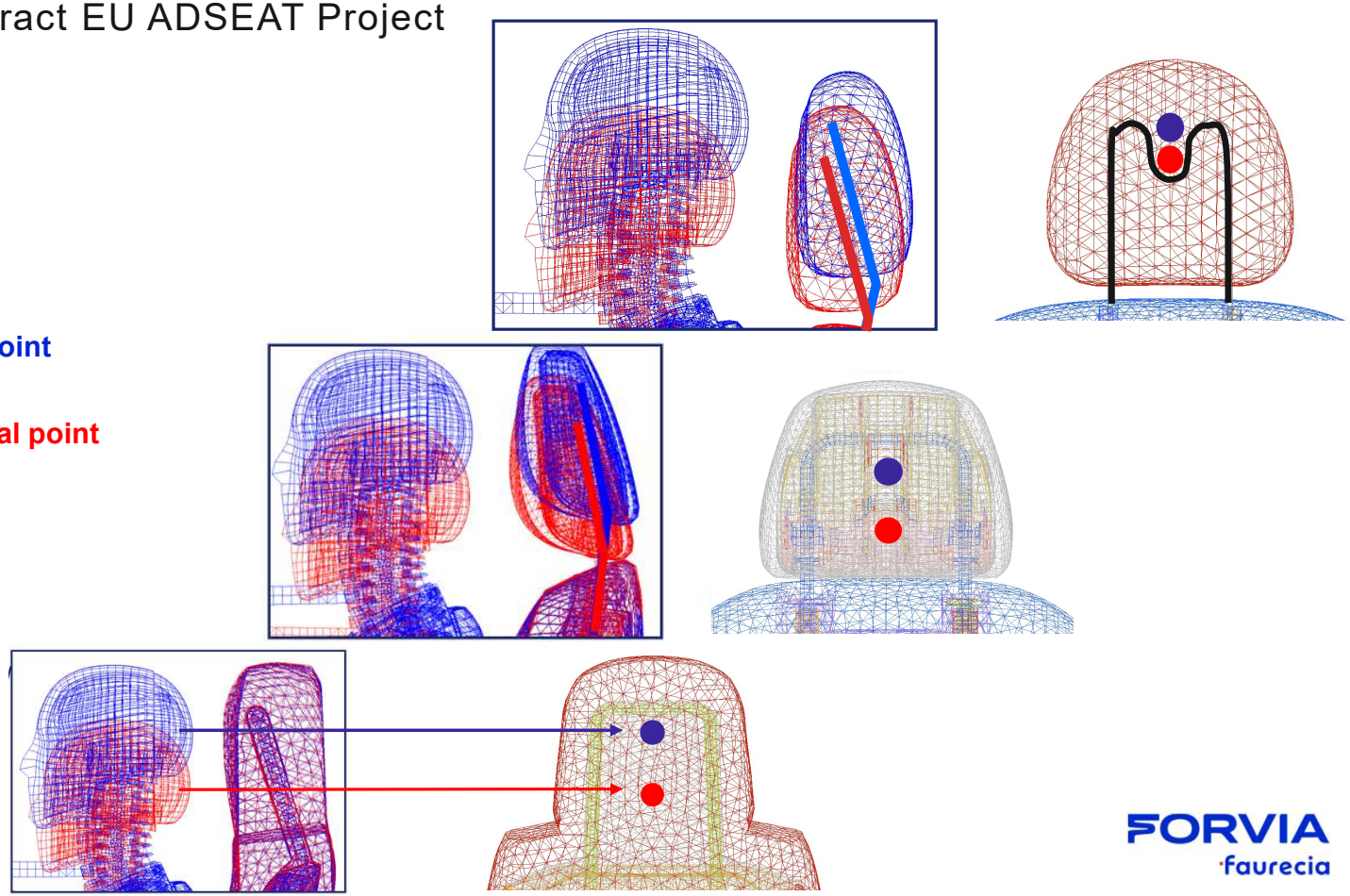
DEOP – Whiplash

Whiplash for females – Extract EU ADSEAT Project



Blue : area where BioRid occipital point touches the head restraint

Red : area where the EvaRid occipital point touches the head restraint

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DEOP – Whiplash

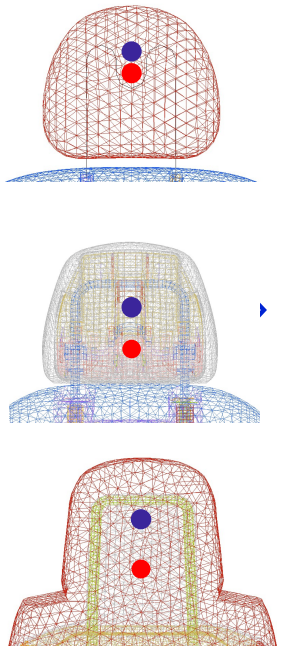
Whiplash for females – Extract EU ADSEAT Project (2011-2014)

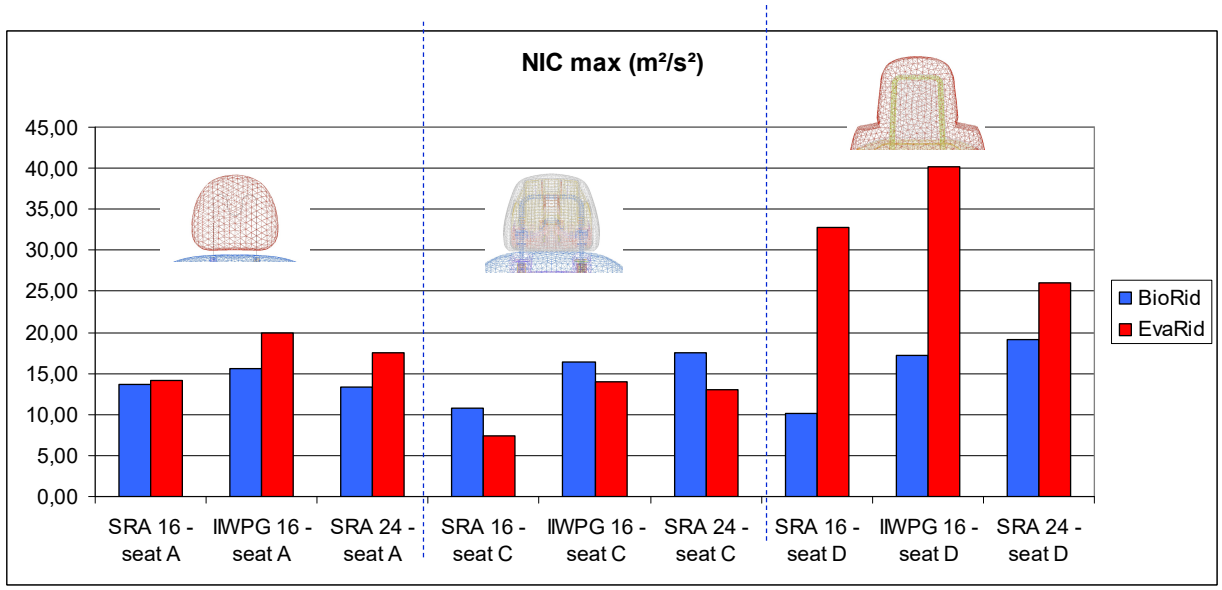
Results :

- High NIC values for EvaRid on seat D where the head is not retained by the head restraint
- **No need to realize EvaRid tests, geometric mismatch can be seen by a geometric analysis of head restraint**

Blue : area where BioRid occipital point touches the head restraint

Red : area where the EvaRid occipital point touches the head restraint





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DEOP – Whiplash

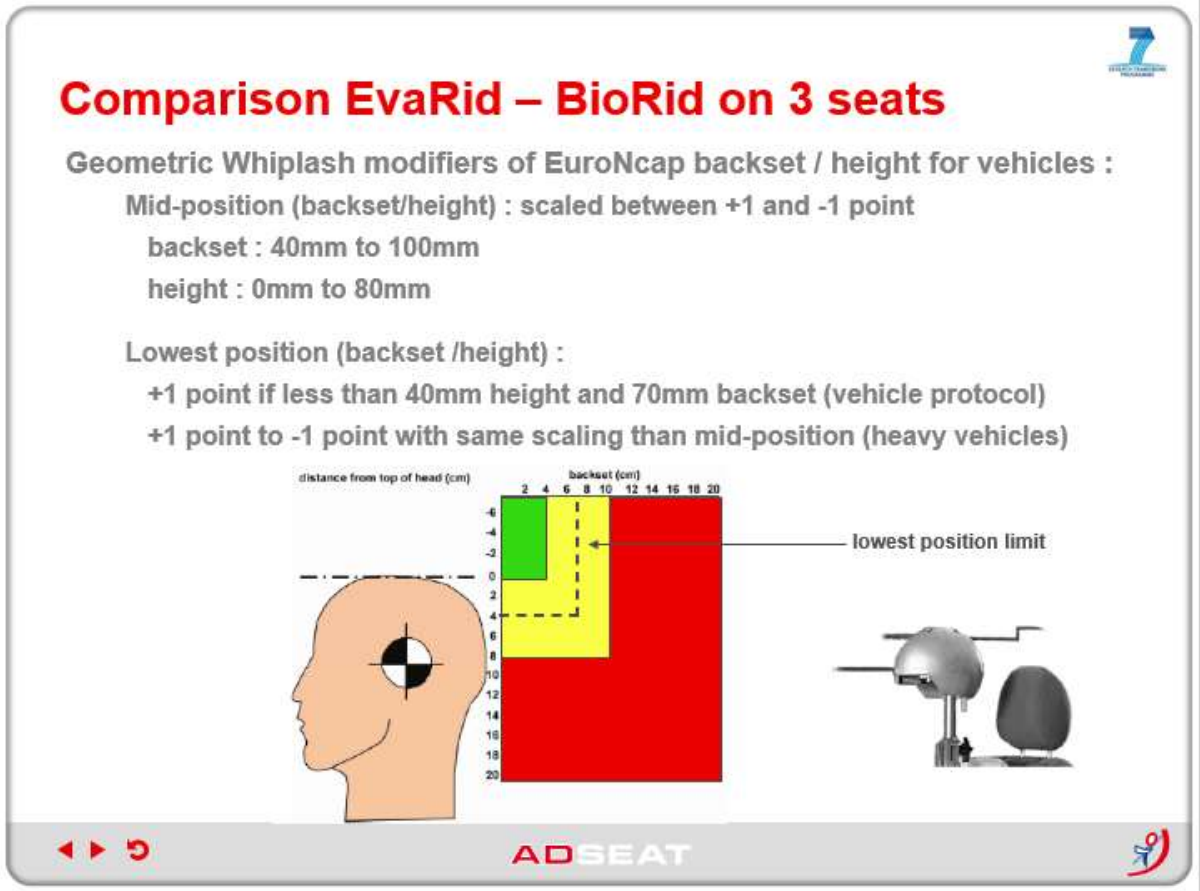
Whiplash for females – Extract EU ADSEAT Project (2011-2014)

EuroNCAP Geometric modifiers

- Test position (mid-height)
- Lowest position

EuroNcap Reason :

- Have sufficient height for 95th male
- Do not have too low height for 50th male



DEOP – Whiplash

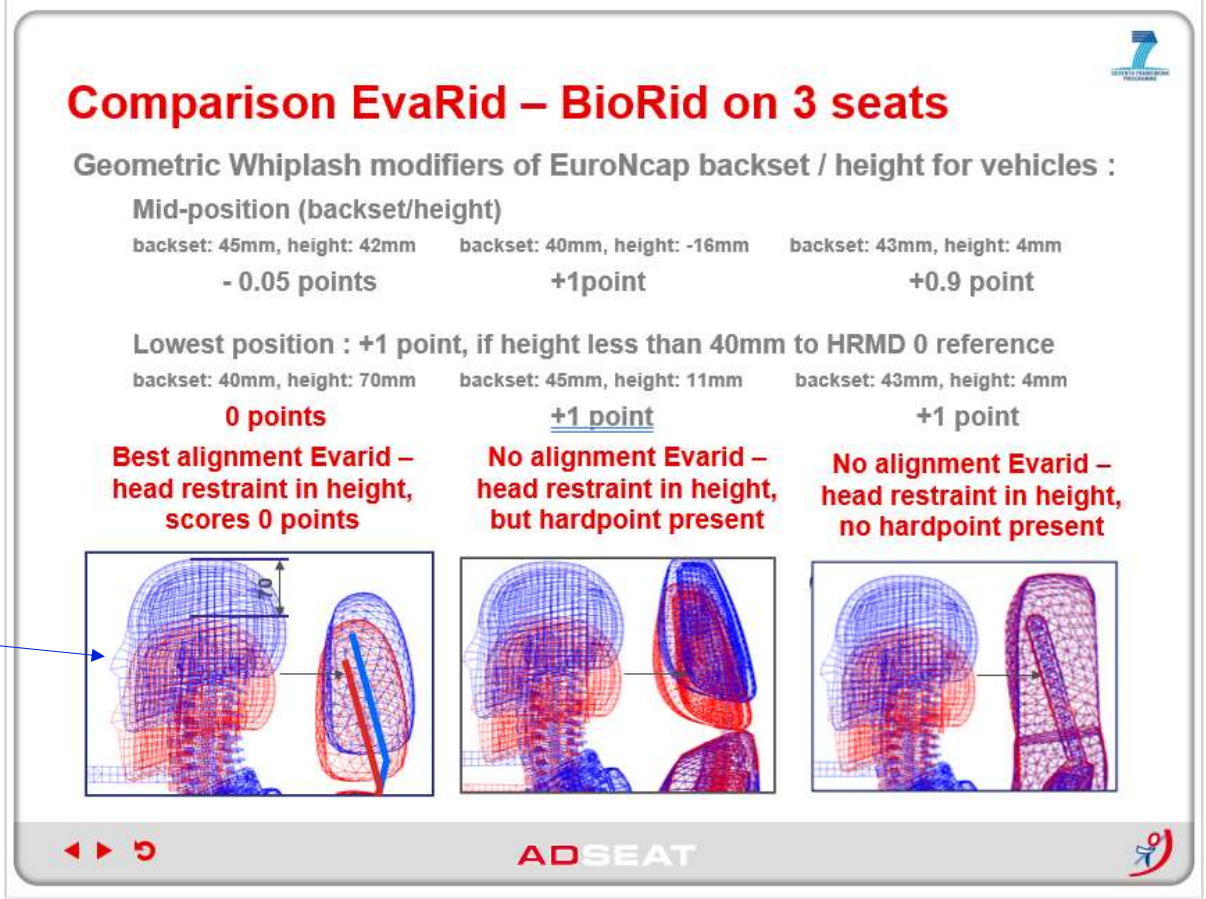
Whiplash for females – Extract EU ADSEAT Project (2011-2014)

Head Restraint positions :

- Test position (mid-height) in blue
- Lowest position in red

NOTA : Range of up/down adjustement of HR is limited to about 50-60mm.

Seat A penalized in geometry inspite of GOOD dynamic behaviour for both males and females.



WHIPLASH Research

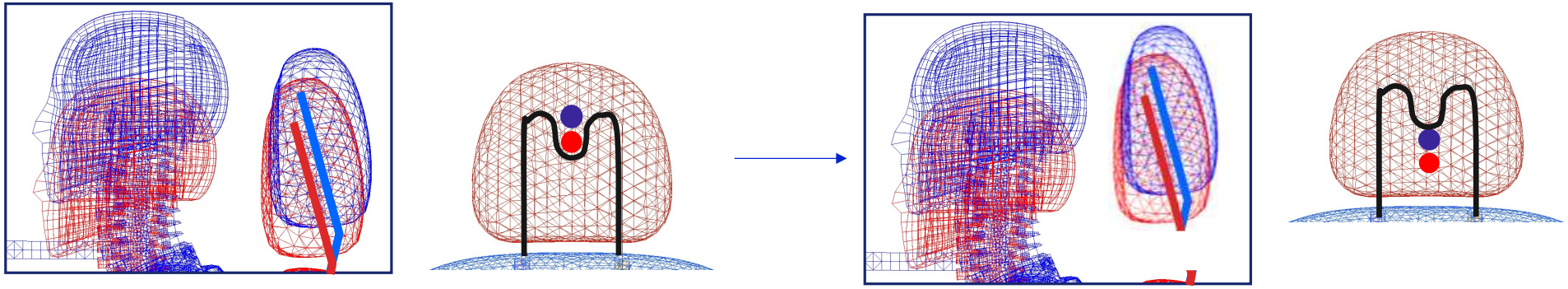
Whiplash for females – Extract EU ADSEAT Project (2011-2014)

EuroNCAP results of seat A, C & D with Geometric modifiers

- Seat C&D had full points in geometric assessment, but Seat A penalized (too low in test position)

Consequence :

- **Risk of readjustement of mid-height of head restraints of type A to have good EuroNcap results in european market ->** may not be favorable for females



- NEW minimum effective height of 830mm in UN-R 17.10 has a similar effect !

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WHIPLASH Research

Whiplash for females – Extract EU ADSEAT Project (2011-2014)

EuroNCAP Geometric modifiers effects :

- Positive for 95th male as high head restraint
- Positive for 50th male as eliminating incorrect adjusted head restraints for males
- Negative for 50th female and smaller as if no specific countermeasure is applied on head restraint.

Define countermeasure in Regulations

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WHIPLASH Research

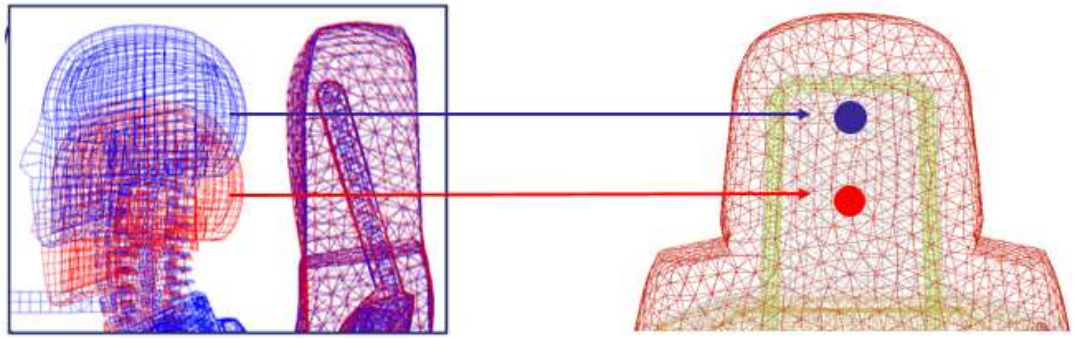
Whiplash for males and females

Recommandation for regulations : assure that no geometric mismatch occurs

- No need to wait for EvaRid or a new female dummy : a geometric check is possible
- For **correctly** height adjusted Head Restraints for [50th] female (lowest or head restraint aligned with the head, whichever is higher) :

Assure that the head of the [50th] female is retained in rear impact by stiff parts within the head restraint.

Details how to define it and which coverage area is sufficient -> to be further discussed



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WHIPLASH Research

References

SEAT OPTIMISATION CONSIDERING REDUCTION OF NECK INJURIES FOR FEMALE AND MALE OCCUPANTS – APPLICATIONS OF THE EVARID MODEL AND A LOADING DEVICE REPRESENTING A 50th PERCENTILE FEMALE, P. Lemmen, A. Carlsson, K. Schmitt, I. Levallois, A. Linder, E. Tomasch, 23rd ESV

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