

TF3 works only on a POC (Proof of Concept) for Front Impact with VT.

➤ **UN R137**

- VT in sled → robustness of the restraint system (TF4)
- Injury risks for different EQOP results - body shapes (female & male), elderly
 - Timeline: POC → 2027; implement ~10 years
 - Testable conditions for TA to check real cars

➤ **2 discussion topics** in this meeting:

1. Determine value of HBM to close equity issues wrt. numerical ATDs.
2. Determine if it possible to use HBMs in regulations within the next 10 years

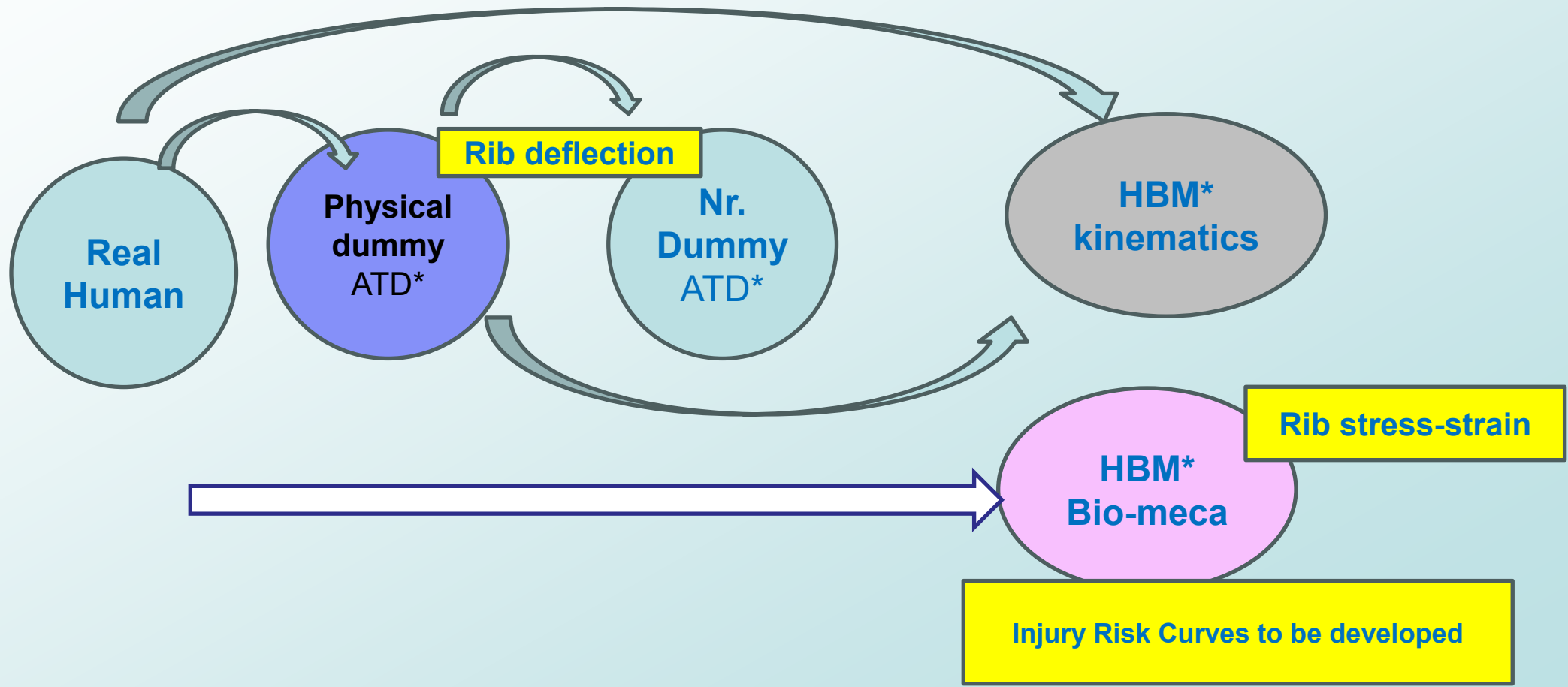
OICA proposal for rewording:

1. VT approach in Regulation needs to show a clear benefit in terms of safety, time and robustness.
2. Clarify the limits for TA & promote VT as alternative only

➤ **After the POC, a decision should be made on which scenarios would be usable for Regulation for all OEMs, Tech Services, Type Approval-Authorities (tools, etc...).**

1. VT approach in Regulation: show a **clear benefit in terms of safety, time and robustness.**

➤ **Need to establish what tools need to be assessed:**



HBM* - Human Body Model
ATD* - Antropometric Tool Device

What tools need to be assessed? How?

- Models' correlation, validation, traceability :
 - vehicle and sub-systems: seat, restraint system.

Numerical ATDs

- **standardization of hardware**
- **collect data to standardize the numerical dummies** (curves in a corridor),
- **easy test with a subsystem test** (sled);
- **filter class** (ISO...), as a basis, but **more "blocks" need to be added.**

☹ **Lower extremities**

😊 **Thorax => pelvis excursion**

😊 **Head, neck**

“kinematics & bio-mechanical” HBMs

- **whole new world=> avoid mixing topics**
- **To be used in addition to nr. ATDs.**
- **No clear standardization (nor in Euro NCAP).**
TUG Proposal: TB ENCAP= 1st step => Biofidelity of the models need to be tested.
- **HBMs need to be correlated** to real world
- **Recent thorax injuries studies:** new scanners more accurate:
 - ⇒ increase of " detected " injuries. HBMs have many injuries: Reality or method related?
 - ⇒ the belt buckle load limiter shows
 - no improvement on HBMs, but
 - Helps on a single rib of an HBM & ATD's potentiometer

VT explanation follow-up

Level 2.5. Simplify real humans to “dummies” → UNR “rib deflection”

Physical dummy	Numerical dummy	Injury risk
Metal brackets	Same brackets	Bracket displacement 42 mm & 34mm

Level 3. Simulate real humans to HBM (Human Body Model) → “bone ribs injuries”

Kinematics HBM	Bio-mechanical HBM	Injury risk
Movement only – no ribs	Numerical bone ribs	Stress-strain ? To be developed

POC (Proof of Concept) for Front Impact with VT Conclusion

- ❑ Too much to do in a limited period:
 - ⇒ **use numerical ATDs for the POC.**
 - ⇒ let NCAPs explore more in applicability of HBMs.

- ❑ For Type Approval:
 1. a real full vehicle crash test would be performed with "nominal parameters", then
 2. a dossier with all nr. Simulations cases, then
 3. the Technical Service will perform one or more real sled tests to correlate with the nr. Simulations
 4. Evaluation method needs to be developed and agreed upon by Technical Services

- ⇒ **increase of physical tests and increase of numerical tests**
- ⇒ **additional loop if fail** (with updated pulse, dummy position) in NCAP.
- Would this be accepted in Regulation? The acceptance is granted only if the validation is "Pass"
- ⇒ **Models** (vehicle, subsystems, nr. ATDs) to be qualified, validated (for all sizes, weight), traced, & reworkable in "5 years" for COP purposes, stable enough for Regulation

- A step-by-step approach : from research and development, to NCAP integration, and ultimately regulation shall be considered.
- Tools need standardization => ISO group exists : TC22/SC36/WG4 : should be in charge of such tasks.
- Right now, it's only a sled test simulation - with different levels of energy and sizes - so it's only a subsystem, not catching all the field data.
- VT means **not** “ time free & gratuity”:
 - robustness means multiplying the different cases of nr. Simulations/ multidimensional scenarios: which benefit ?
- Test conditions need to be described in detail also for VT...
 - for all the diversity imagined: size, weight – tbd.
 - ⇒ Exceeds mass production: to be linked to priority field data showing safety benefits
- Make it possible for small volume manufacturers !
- VT as alternative only