Side Impact Test Procedure for Homologation of CRS

German View Point

Requirements Following ISO PAS13396 (preliminary version)

- Problem:
  - intrusion loading and non head containment
- Focus on head injuries (followed by neck and chest)
- Capability of simulation of
  - real world occupant kinematics
  - realistic loading conditions

Results ISO Research regarding Forward Component

- Accident data from Germany, Sweden and US
  - Indication perpendicular impacts more severe than angled ones (perpendicular means +/- 15°from 90°
  - Small sample size reduces reliability of data
- Forward component in hinged door test results in minor differences to perpendicular tests only
- Forward component in US FMVSS 214 tests minor

Boundary Conditions within Informal Group on CRS

- Draft version needs to be fixed by December 2009
- Two phase approach planned
- Group fears that hinged door is too complicated
- Simple test procedure preferred

Possible Procedures

- Sled tests with intrusion
  - hinged door (e.g. ISO)
  - translational intrusion (e.g. NHTSA)
- Sled test without intrusion
  - fixed door (e.g., CREP, ADAC)
  - no door (e.g. initial Australia AS/NZS 1754)
- Subsystem tests
  - to be defined later in this document

Short Description of Hinged Door

- Investigated by ISO for a couple of years
- Implemented at TNO, TRL and TUB with different experience
- Simulation of intrusion by a pivoted panel
  - In currently available set-ups: panel driven by rigid impactor
- Several validation tests to compare with ECE R95
- Generally good reproduction of ECE R95

Short Description of Hinged Door

Short Description of Translational Intrusion Procedure (NHTSA)

- Investigated by TAKATA
- Implemented at TAKATA and US labs
- Simulation of intrusion by sled on sled system
  - Bench sled moves towards door and is coupled by deformation element between bench sled and door
- Investigation of perpendicular and angled impacts
- No validation results known

Short Description of Translational Intrusion Procedure (NHTSA)

Source CRS-06-08e

Short Description of CREP

- Test bench mounted in 90°and 66°on sled, 24°angle to perpendicular emphasis forward movement due to forward component or pre impact braking
- Fixed door

Short Description of ADAC

- General design used by ADAC for a couple of years
- Body in white mounted in 80° on sled, 10° angle to perpendicular emphasis forward movement due to forward component or pre impact braking
- Fixed door

Assessment Hinged Door

- Repeatability: good
- Reproducibility: possibly good (only one sample compared at TUB and TRL)
- Reproduction of intrusion loading
- Simulation of real world occupant kinematics and realistic loading conditions
- Realisation at acceleration sled has not yet been proven

Assessment NHTSA

- Repeatability: is still subject to investigation
- Reproducibility: has not been analysed
- Reproduction of intrusion loading
- Validation data has not yet been provided
- Realisation on deceleration sled has not yet been proven
- Fixation between CRS and bench could have important influence
- Seems to be premature

Assessment Fixed Door

- Simple test set-up
- Repeatability: good according to ADAC
- Reproducibility: ? (however, Dorel and TUB reported about problems to meet ADAC severity level using the same input conditions)
- Rigid fixation of CRS prevents from hard contact -> TUB car test indicates that ISOFIX results in higher dummy loadings
- Intrusion loading not simulated
- Does not represent real world loading conditions according to ISO PAS13396

Assessment no Door

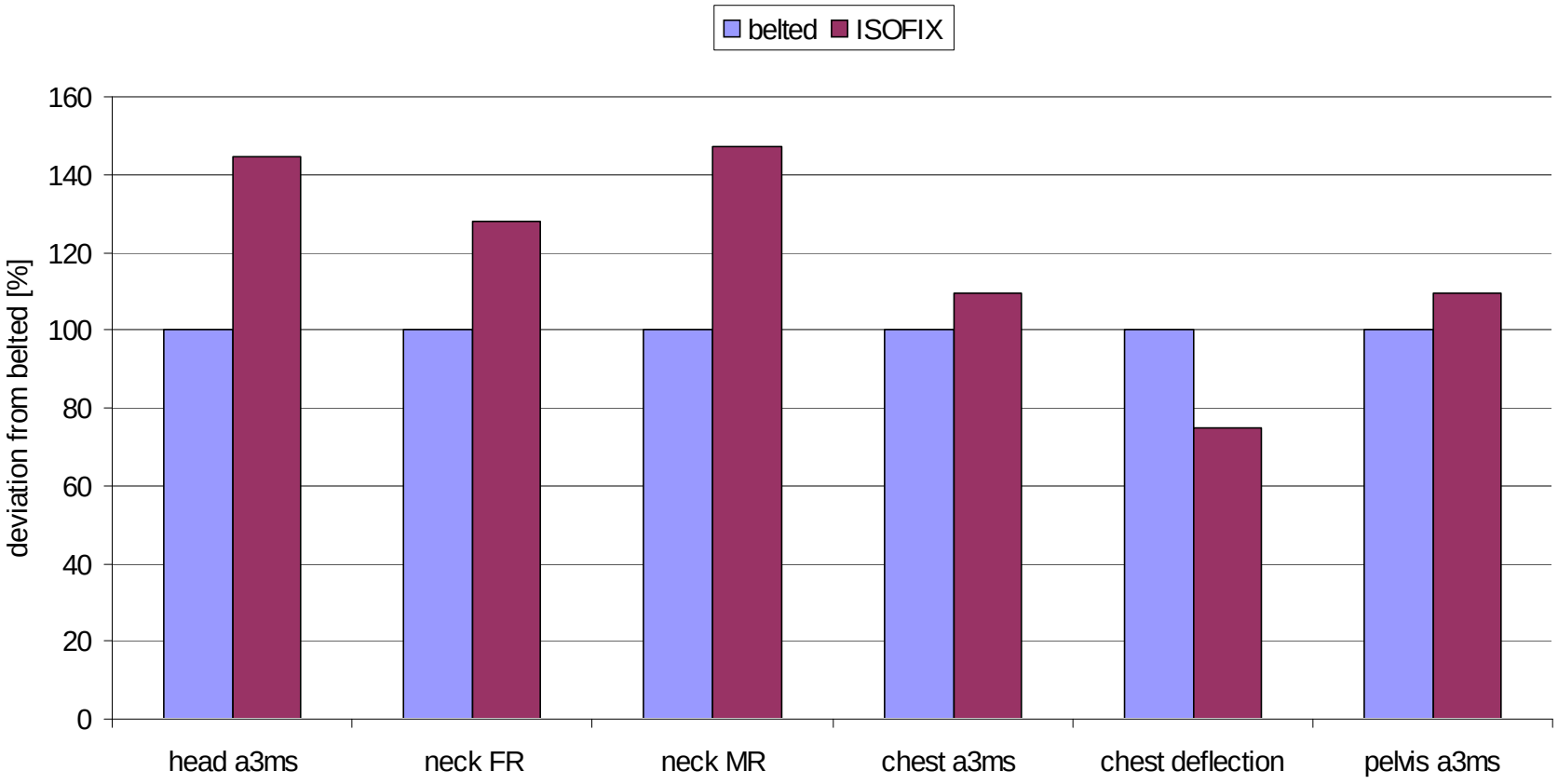
- Repeatability: ?
- Reproducibility: ?
- Euro NCAP tests indicate that head containment criterion is more challenging at non struck side
- No intrusion loading

Car Test to Compare ISOFIX and belted CRS

- FF in the front seat
- RF in the rear seat

- Results
  - ISOFIX tends to result in higher head loadings

Results FF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ISOFIX
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140
120
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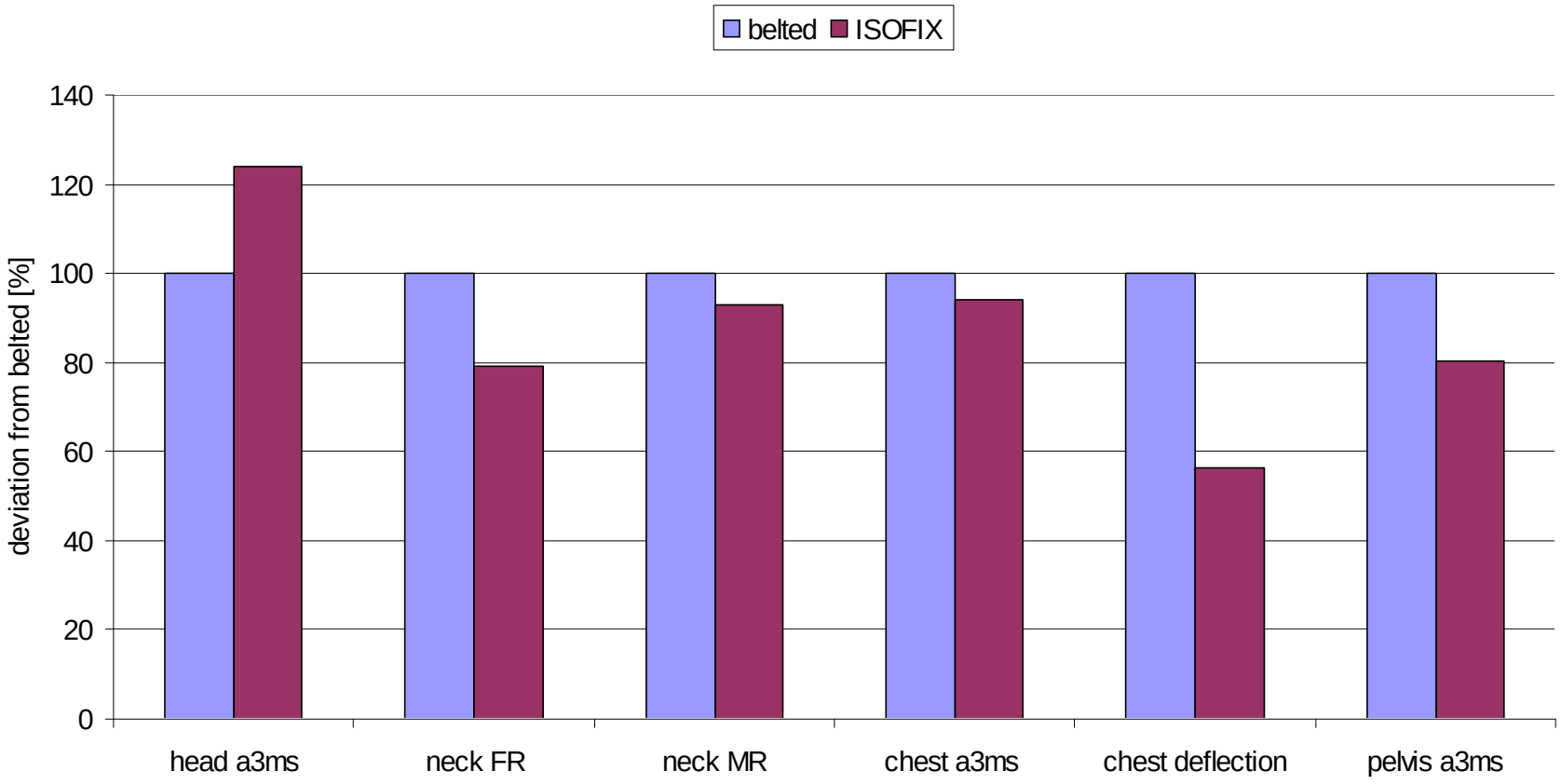
head a3ms
neck FR
neck MR
chest a3ms
chest deflection
pelvis a3ms

Results FF

Results RF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head a3ms
neck FR
neck MR
chest a3ms
chest deflection
pelvis a3ms

Results RF

Comparison with Full Scale Tests

- Tests conducted within NPACS
  - 3 different FF CRS and 3 different RF CRS models
  - 3 different cars
  - > 9 MDB tests with each 1 RF CRS in the rear and 1 FF CRS in the front
- Results
  - Different CRS behave differently in different cars
  - “average car” shows comparable trend to hinged door test for FF and RF but does not to fixed door tests for RF CRS

Proposal Basics

- Two step approach
  - 1st step: simple and fast realisation but representing of relevant loading conditions
  - 2nd step: hinged door
- Goal 1st step:
  - simple
    - existing equipment
  - valid
  - reliable test procedure

Proposal 1st Step

- Two separate tests for kinematics and energy management:
  - containment test
  - drop test for the assessment of energy management

1st Step Containment Test

- ECE R44 test bench in 90°
- Door
  - positioned with contact to CRS
  - fixed door
  - top of door 500 mm
  - padding according to draft ISO PAS13396 and draft ISO 29062
- Pulse
  - approx. 10 to 12 g
  - delta-v 25 km/h
  - according to draft ISO 29062
- Assessment
  - head containment only

1st Step Containment Test
Why Initial Contact?

- Intrusion in car tests results normally in dummy movement without displacement of CRS in the direction of the striking car
  - Without initial contact occupant kinematics would be unrealistic

1st Step Containment Test
Why Initial Contact?

1st Step Containment Test
Why Initial Contact?

1st Step Containment Test

containment test

hinged door test

1st Step Containment Test

containment test

hinged door test

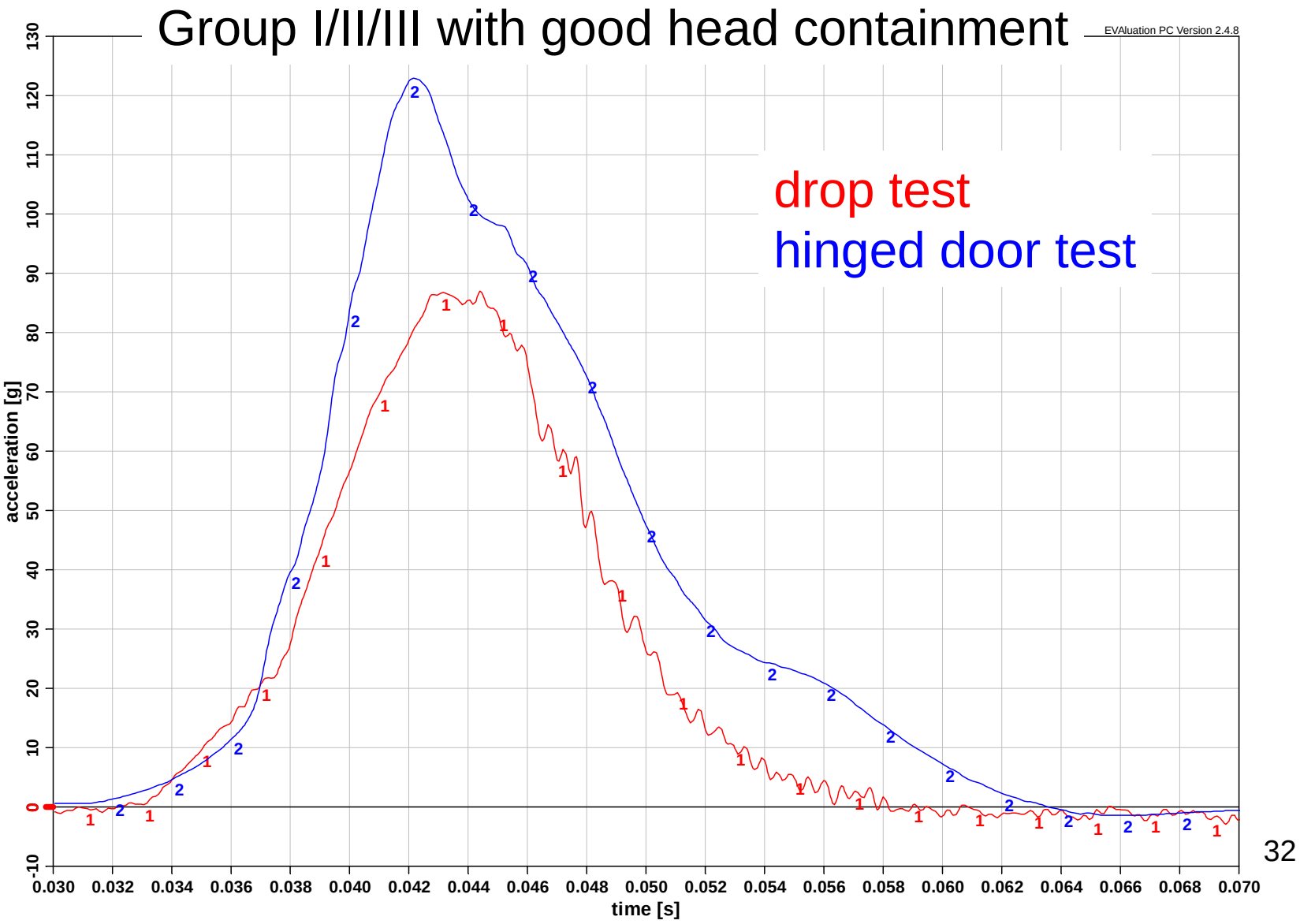
1st Step Energy Management Test

- Guided drop test with pedestrian child head form
- Additional weight at impactor resulting in 3.8 kg total mass
- Impact velocity approx. 9 m/s
- Half CRS fixed rigidly at the bottom
- Impact point at head level of smallest and largest dummy
- Validation possible within short delay

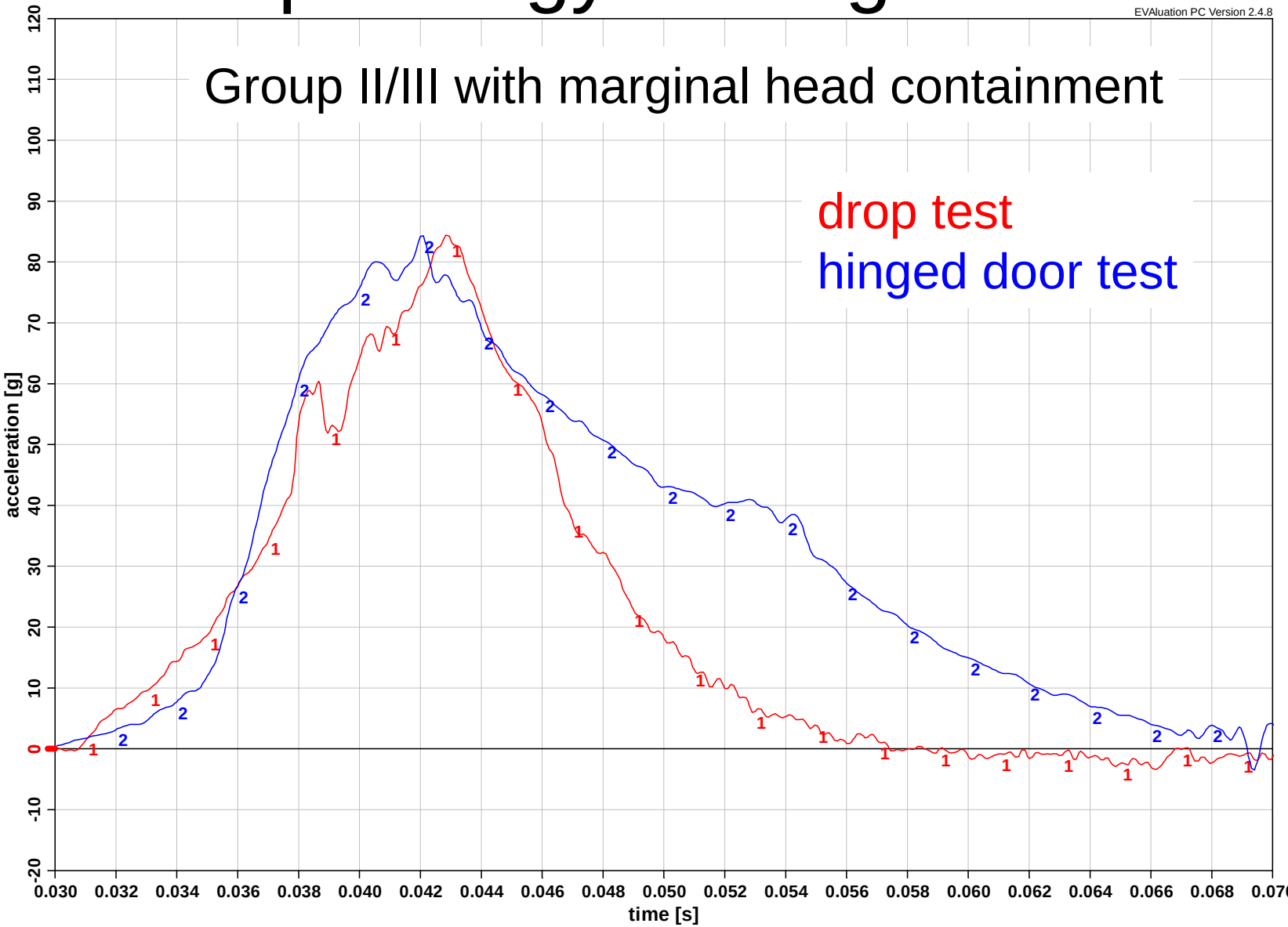
1st Step Energy Management Test
Why not Test According to ECE R44?

- Nose of the head form results in unrealistic loading conditions
  - Small surface loading instead of distributed loading
- Realistic drop heights do not allow free fall test
  - Guided fall necessary

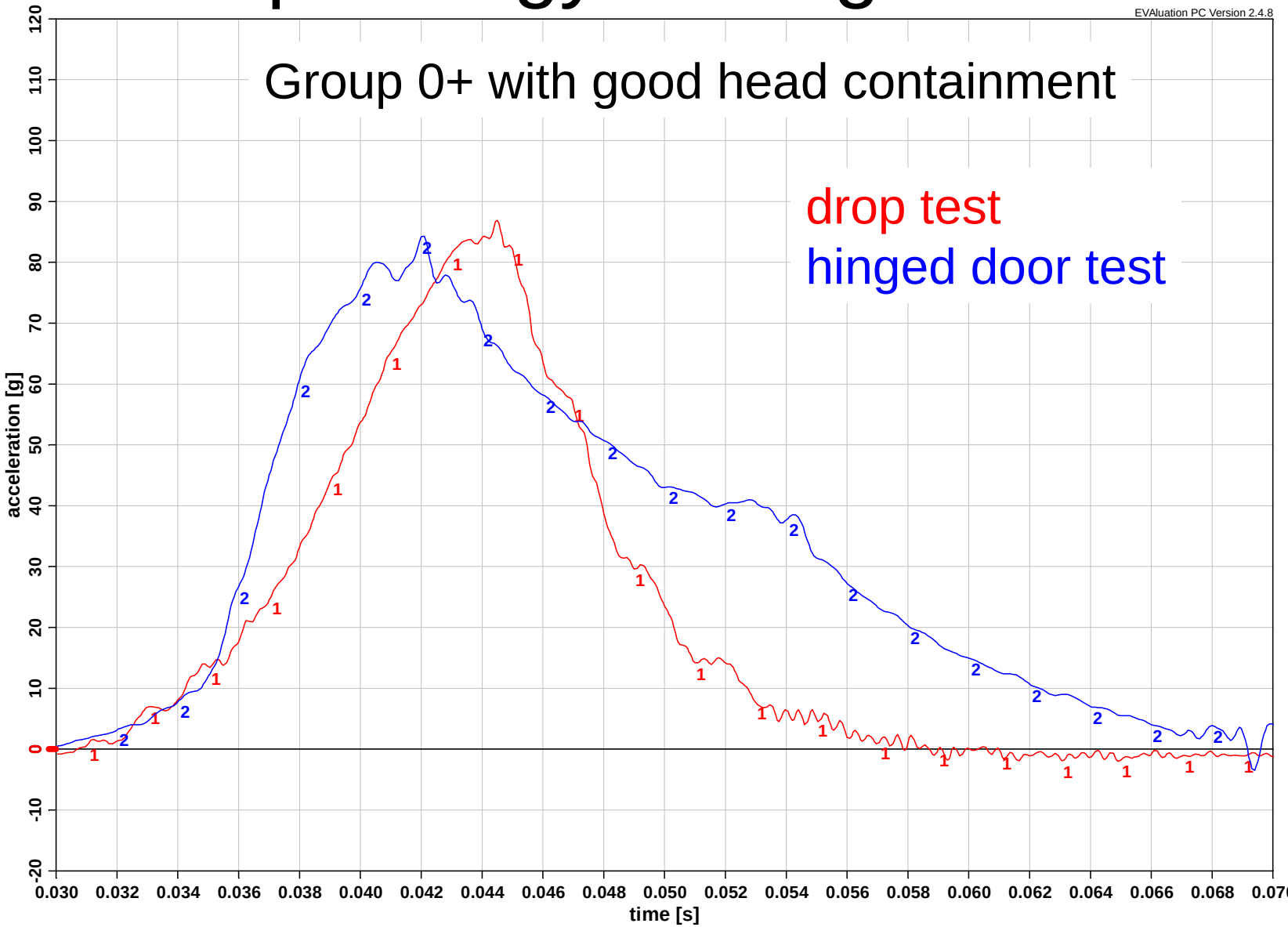
1st Step Energy Management Test



1st Step Energy Management Test



1st Step Energy Management Test



2nd Step Hinged Door Procedure

- Informal working group decided to use a two step approach for the development of the new regulation
- Delay for proposing hinged door procedure for the first step is too short
- 2nd step of the definition of the new regulation should included hinged door procedure