



Dynamic Geometric Options

Presented by David Hynd

GTR Meeting

8th November, 2007



Dynamic Geometric Seat Testing

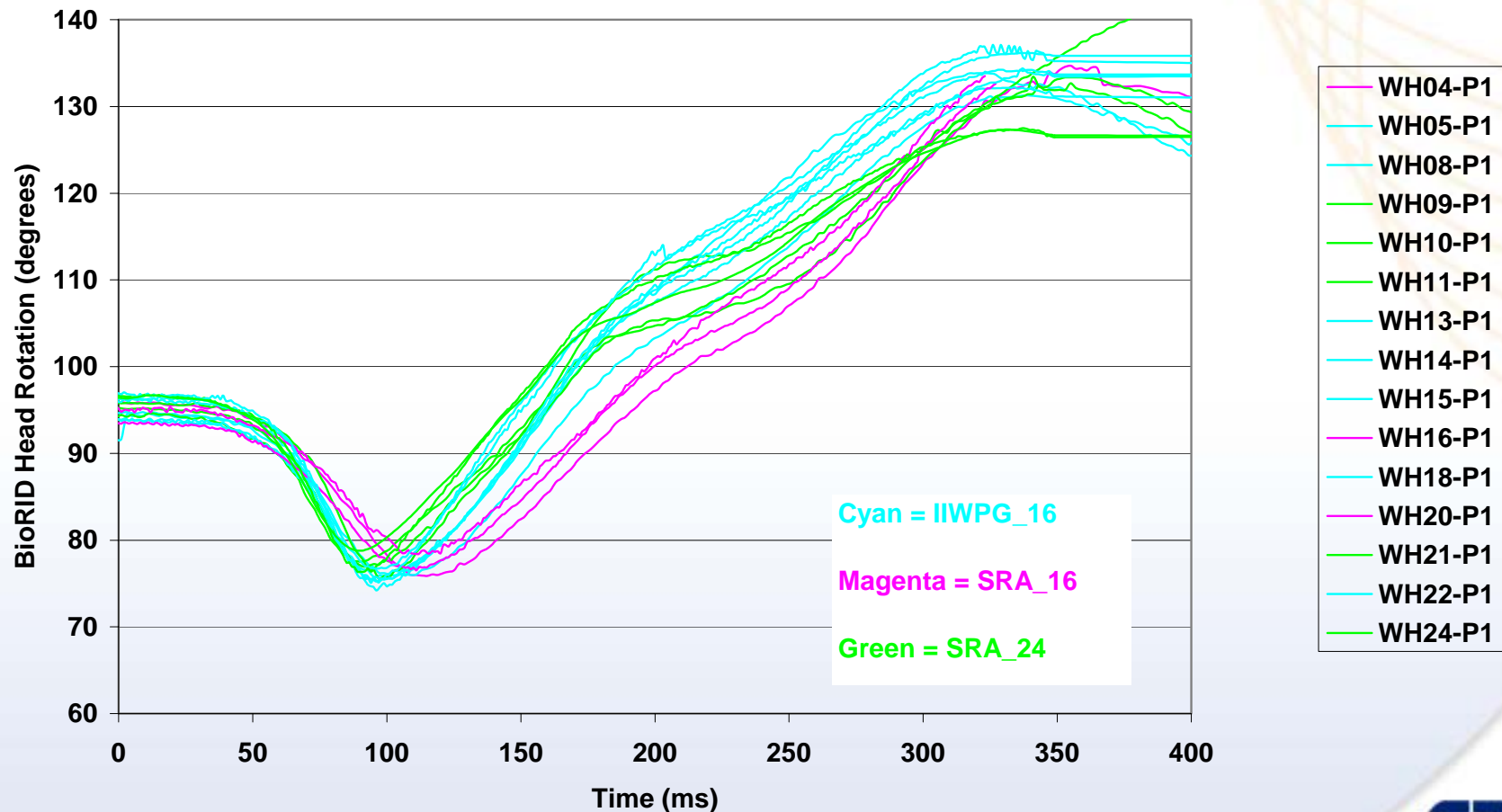
- **Using a biofidelic dummy in terms of**
 - Seat back interaction
 - Head-neck motion
 - i.e. BioRID II
 - To ensure correct actuation of reactive head restraints
- **Three main measurement options**
 - Head restraint movement - relative to initial position
 - Backset at a certain time - relative to back of dummy's head
 - Retraction of dummy's head

Dynamic Geometric Seat Testing

- **Option 1: Head restraint movement - relative to initial position**
 - Relatively straightforward to calculate from marker tracking
 - Could give equivalent test to static geometric
- **Option 2: Backset at a certain time - relative to back of dummy's head**
 - Most difficult to implement - dynamic distance between two curved surfaces that may not always be in view
- **Option 3: Retraction of dummy's head**
 - Relatively straightforward to calculate from marker tracking (relative to seat back angle)
 - More relevant to real-world safety than static backset

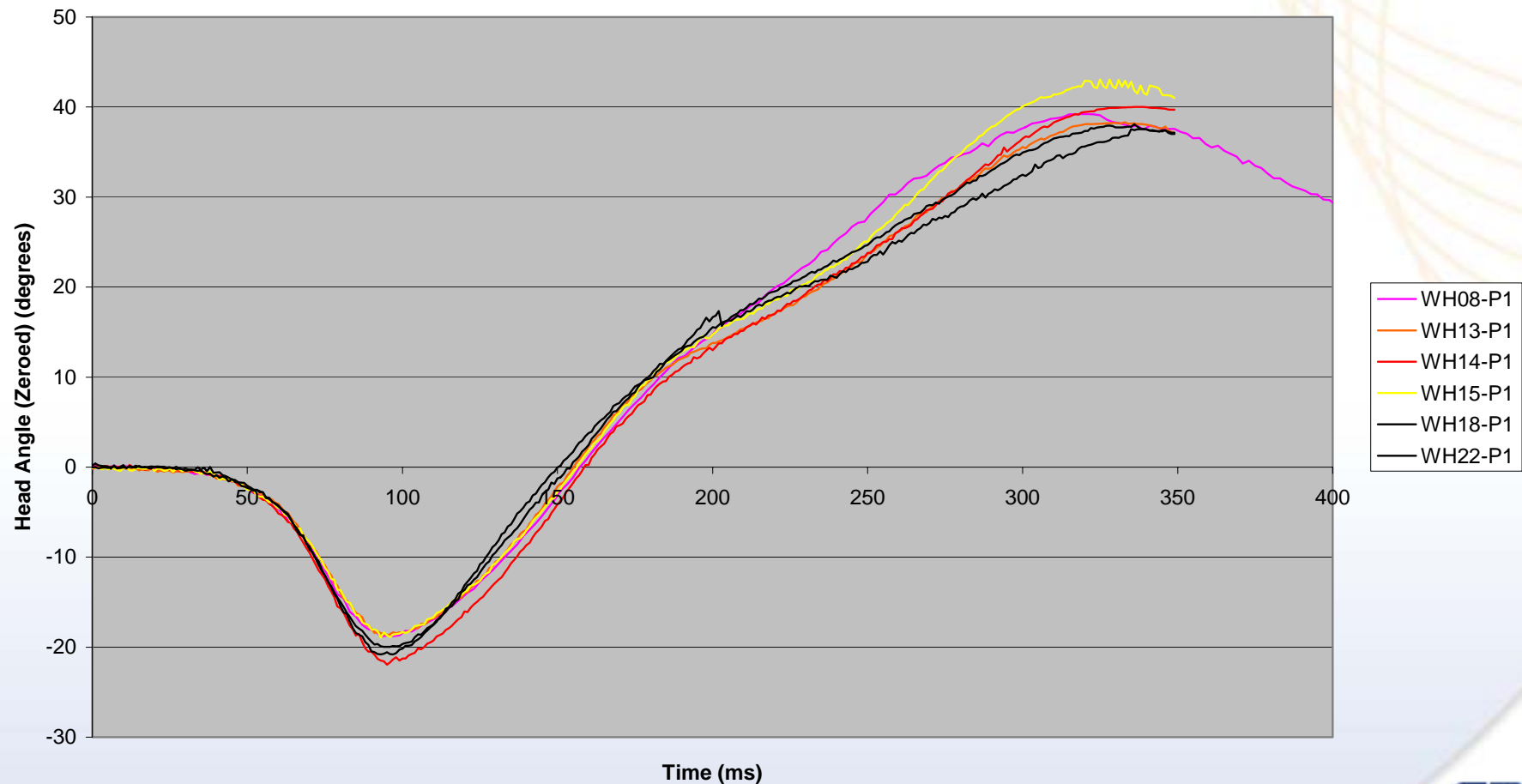
BioRID Kinematic Reproducibility

Head Rotation Angle
Two BioRID Dummies - Three Pulses - One Laboratory Seat



BioRID Kinematic Reproducibility

BioRID Head Angle (zeroed)
Two Dummies - IIWPG Pulse - One Laboratory Seat

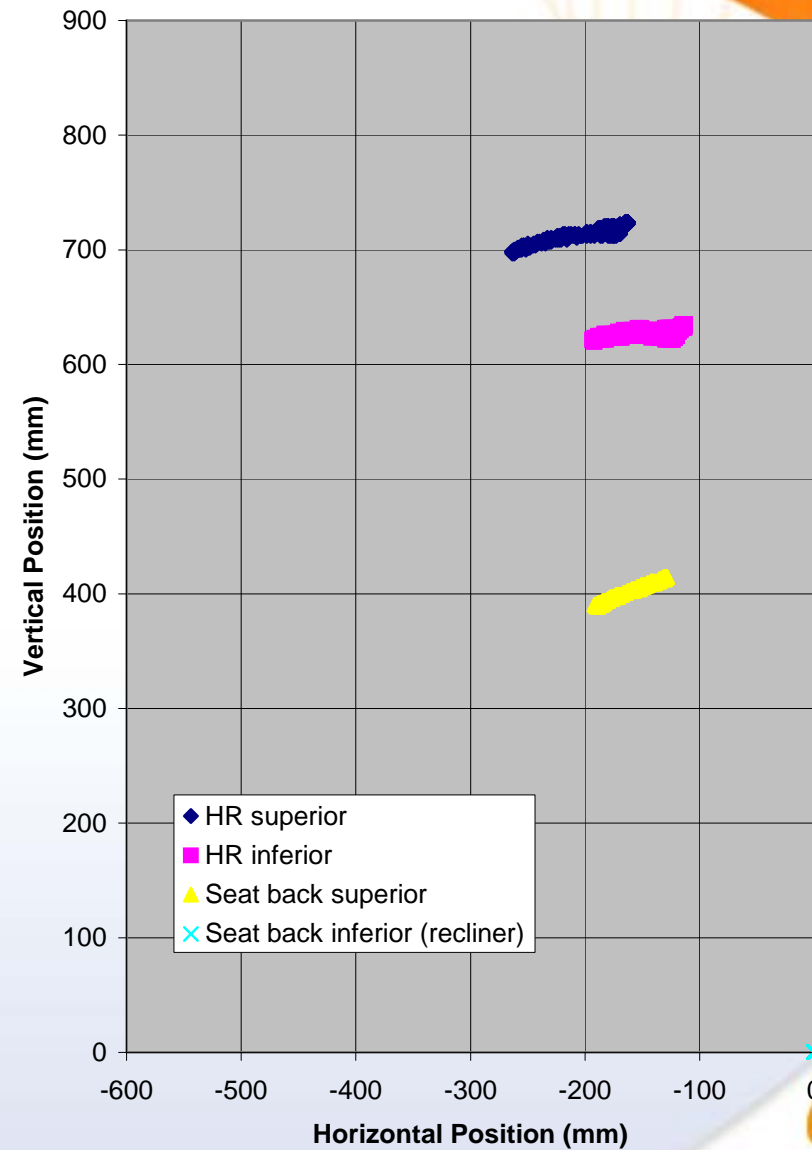
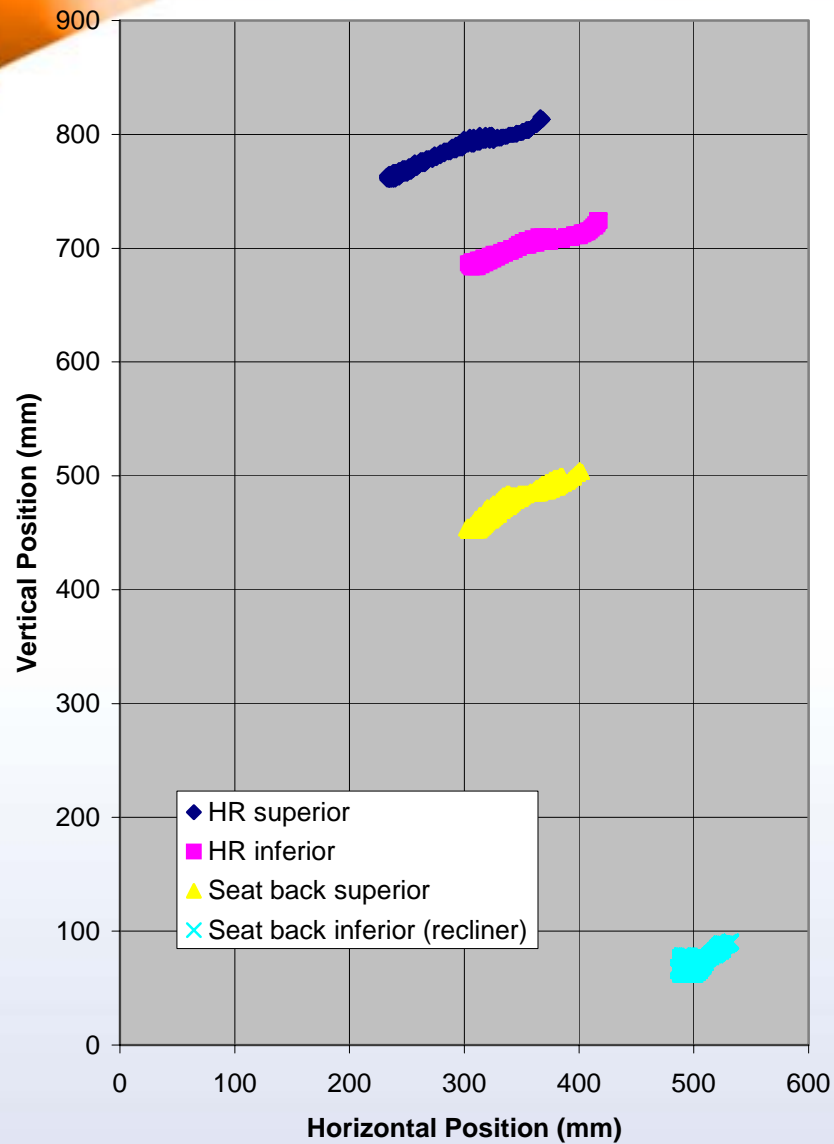


Option 1: HR Movement

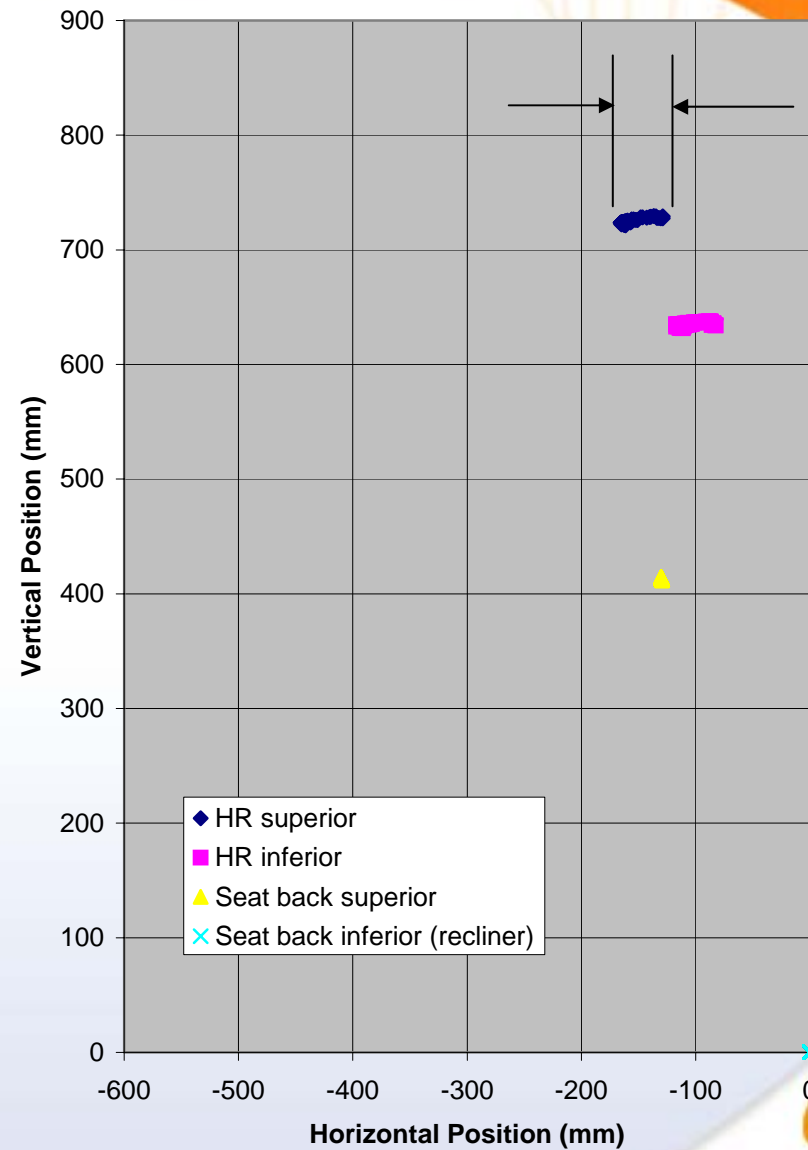
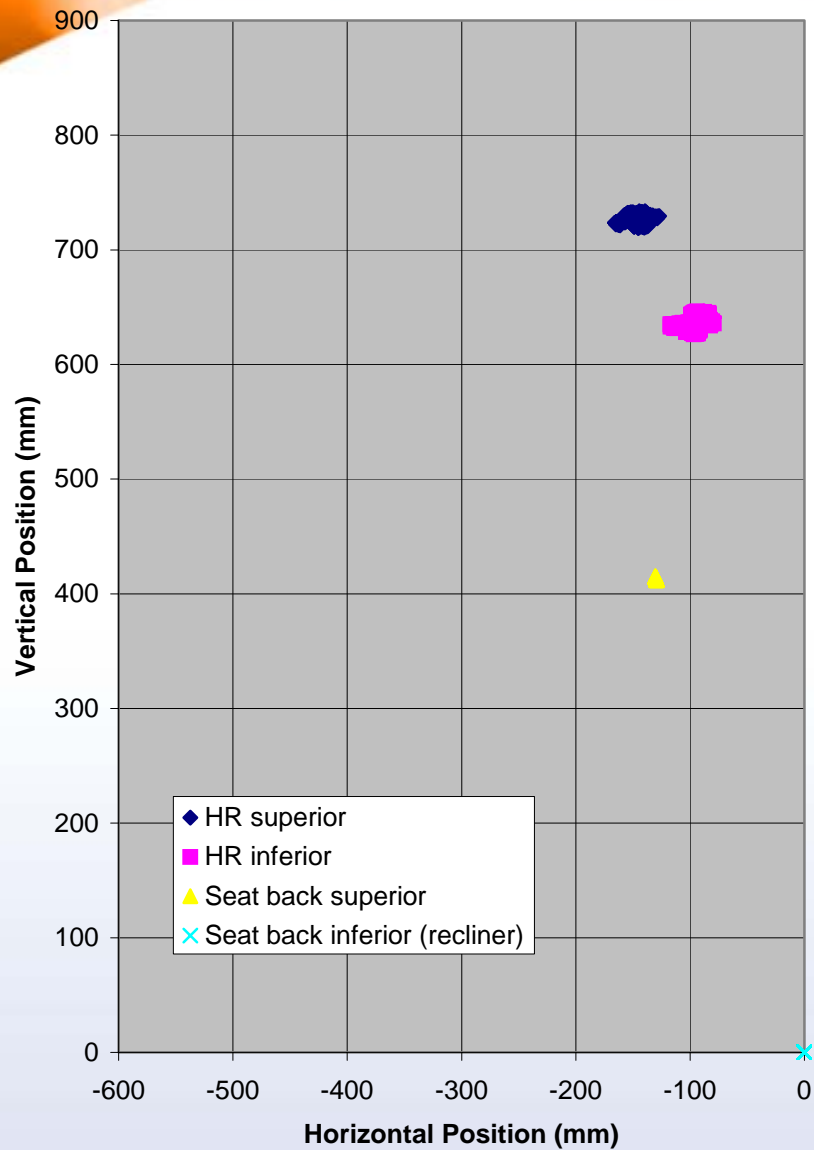
- **Use lower seat back marker as origin**
- **Translate upper seat back and both head restraint markers to origin**
- **Rotate upper seat back and both head restraint markers to original seat back angle**
- **Measure maximum HR x-axis displacement up to head contact**

- **E.g. ...**

Option 1: HR Movement



Option 1: HR Movement

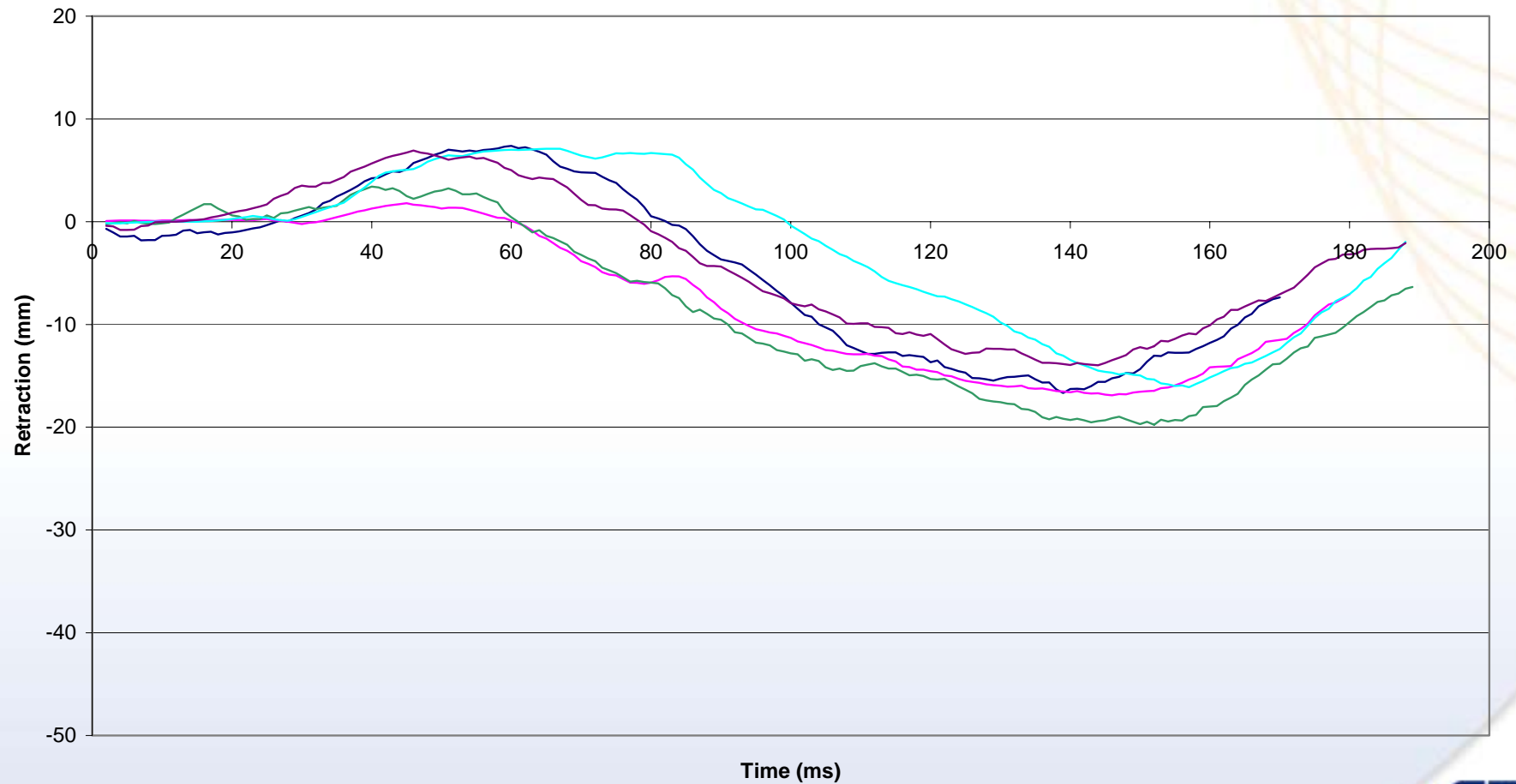


Option 3: BioRID Retraction

- **Same process as head restraint movement**
- **Calculate maximum x-axis retraction**
 - Movement of OC marker relative to T1 marker
- **Reproducibility with**
 - 4 or 5 different labs
 - 4 or 5 different BioRID IIg dummies
 - Deceleration and HyGe sleds
 - On-board and off-board cameras
 - No control over marker placement (tests run for other reasons)
 - Highly compressed .avi films

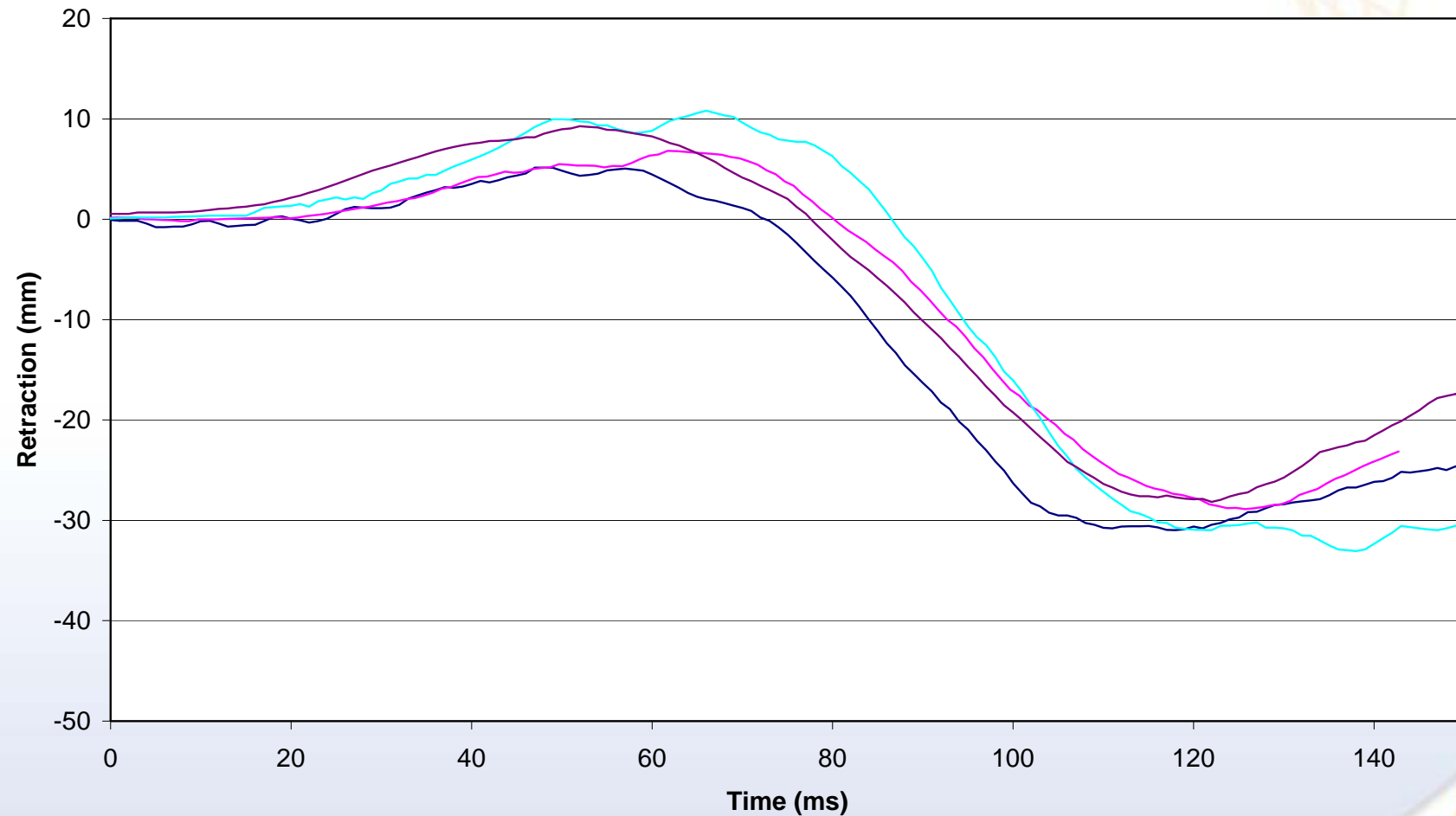
Option 3: BioRID Retraction

BioRID Retraction - S3 Seats - Pulse 2 - Five Laboratories and BioRID II's
2 Deceleration Sleds - 3 HyGe : 2 On-board Cameras - 3 Off-board Cameras



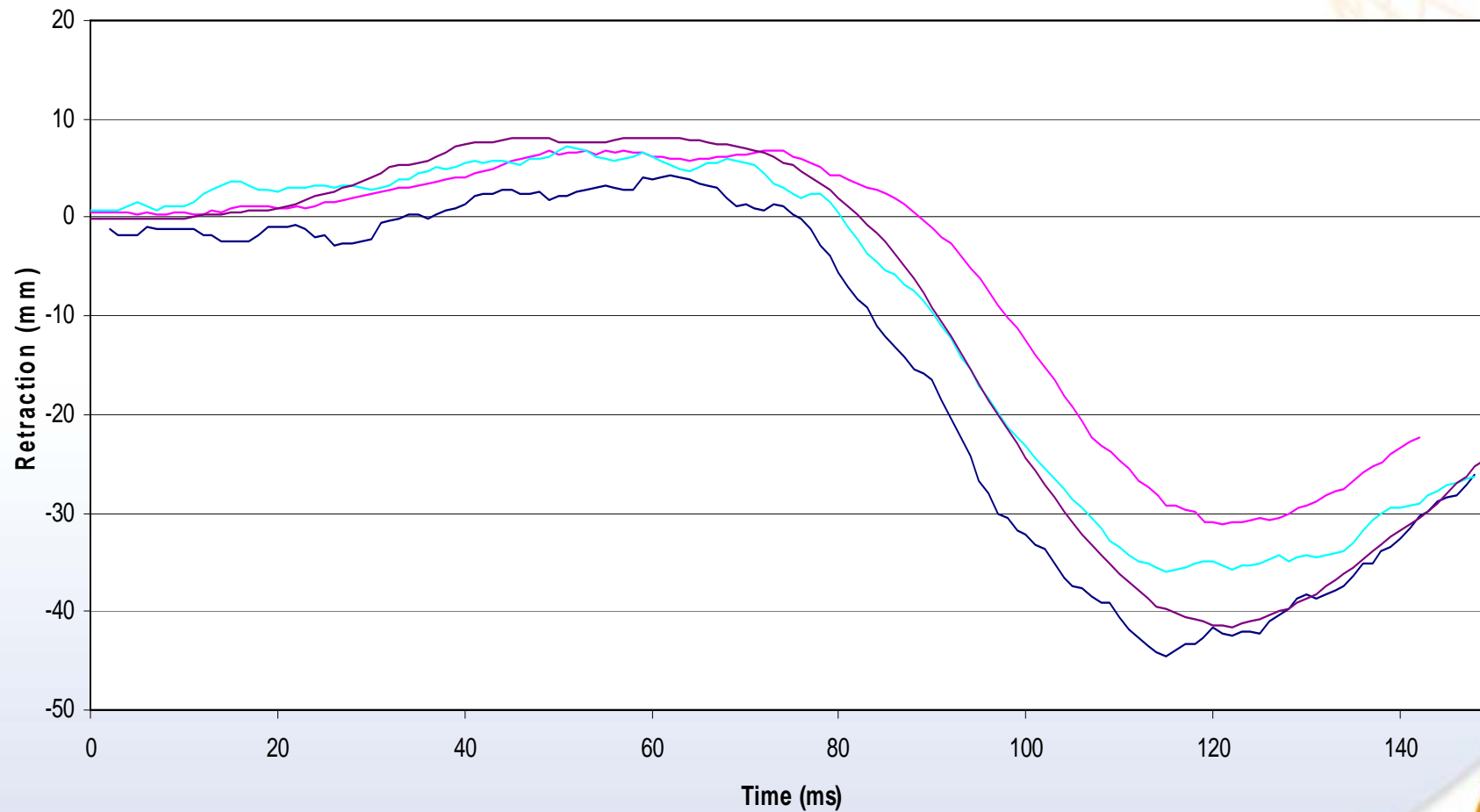
Option 3: BioRID Retraction

BioRID retraction - S5 seats - Pulse 2 - Four Laboratories and BioRID II's
2 Deceleration Sleds - 2 HyGe : 1 On-board Camera - 3 Off-board Cameras



Option 3: BioRID Retraction

BioRID retraction - S4 seats - Pulse 2 - Four Laboratories and BioRID II's
2 Deceleration Sleds - 2 HyGe : 1 On-board Camera - 3 Off-board Cameras



Option 3: BioRID Retraction

- **Comparison with 202a validation data**
 - Kleinberger *et al.* [ESV 2007]
- **Four seats with reactive head restraint systems**
 - 2006 model year
 - Saab 9-3
 - Honda Civic
 - Subaru Outback
 - Nissan Altima

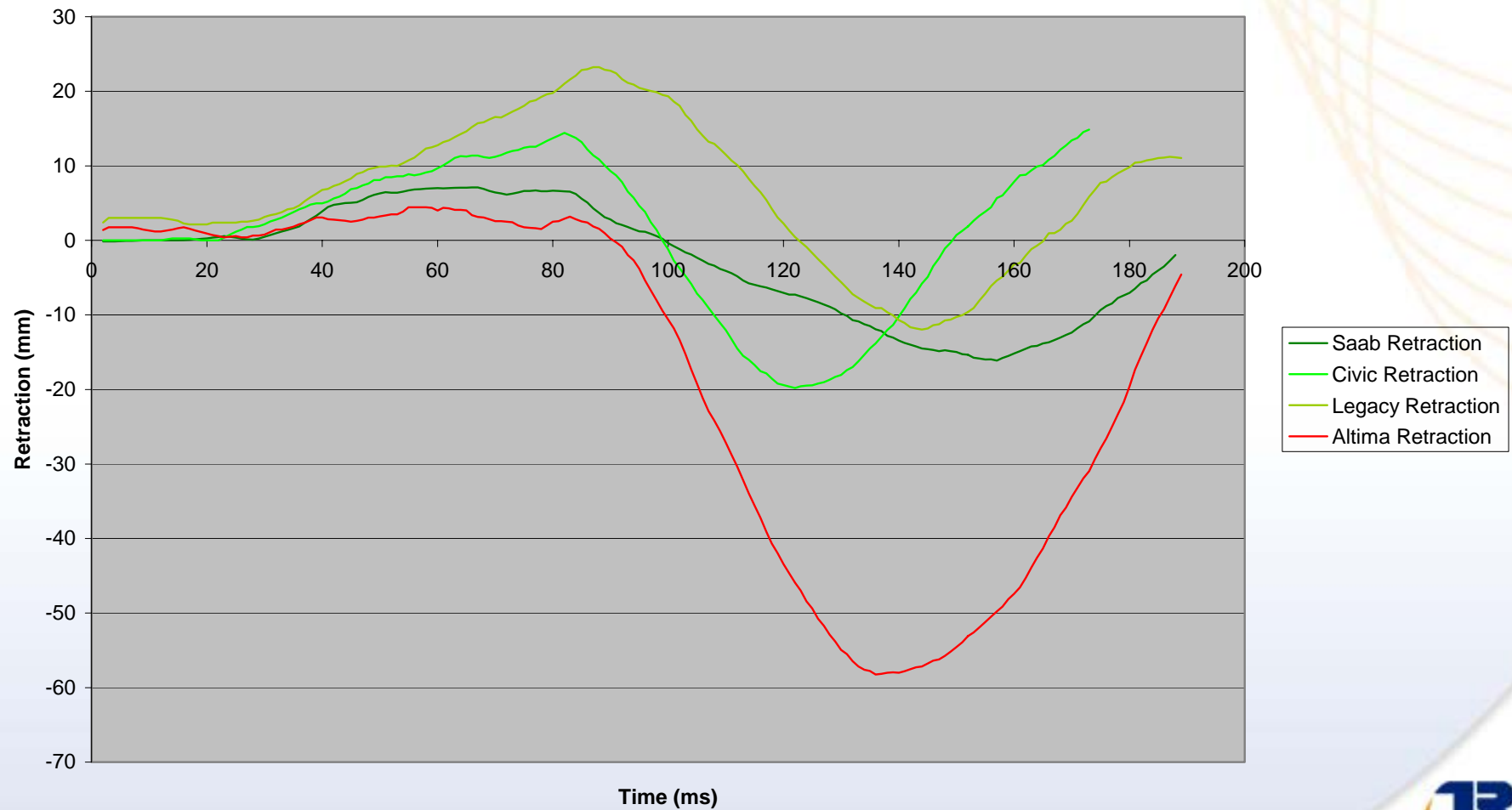
Option 3: BioRID Retraction

- **Comparison with 202a validation data**
 - Kleinberger *et al.* [ESV 2007]
- **Four seats with reactive head restraint systems**
 - 2006 model year
 - Comparison of Hybrid III head angle and IIWPG rating

Seat	IIWPG Rating	Hybrid III Head Angle
Saab 9-3	Good	4.1
Honda Civic	Good	7.7
Subaru Outback	Good	4.1
Nissan Altima	Acceptable	19.9

Option 3: BioRID Retraction

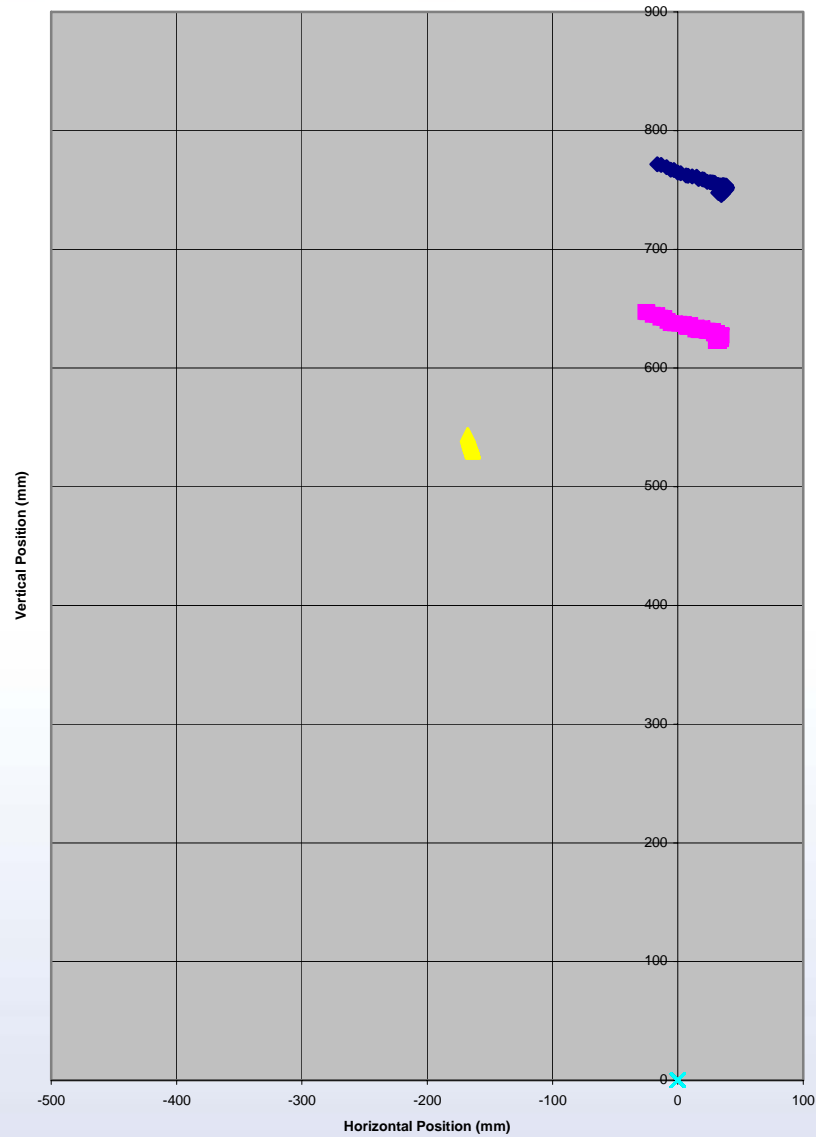
BioRID Retraction - Kleinberger *et al.* [2007] Seats



Option 3: BioRID Retraction

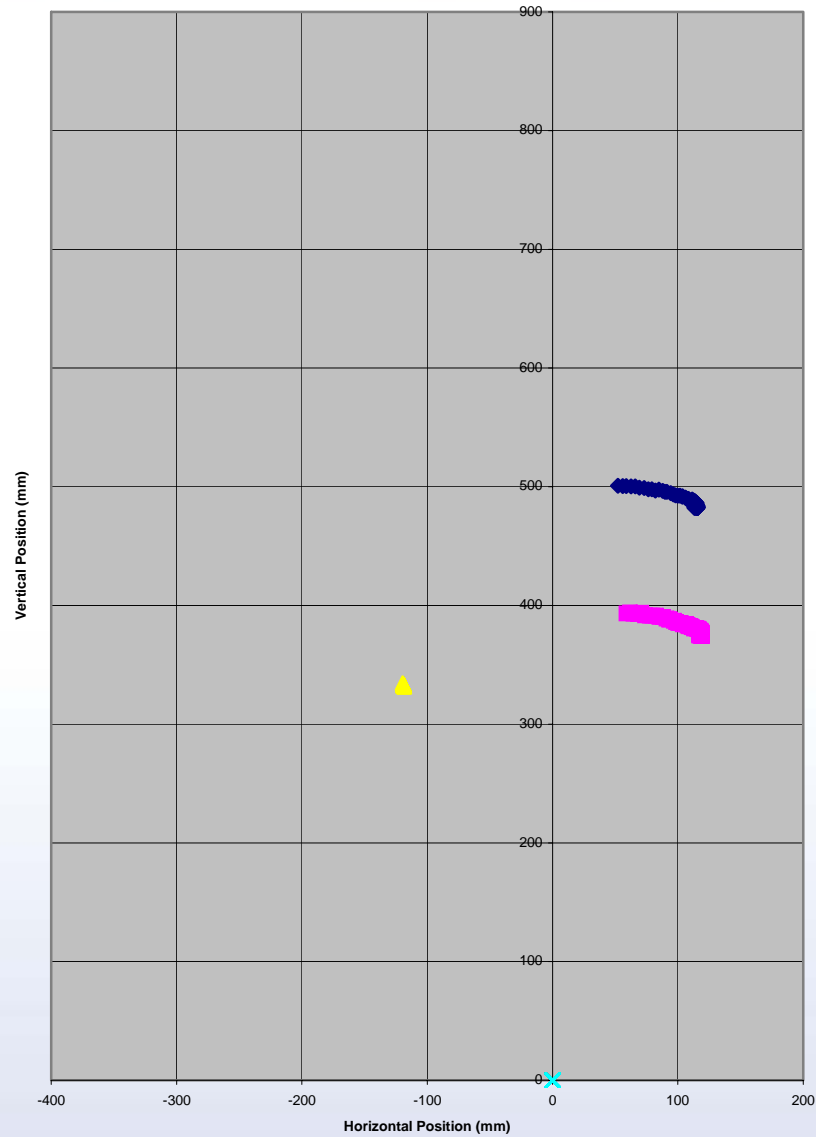
- **S3 retraction graphs...**

Option 3: BioRID Retraction



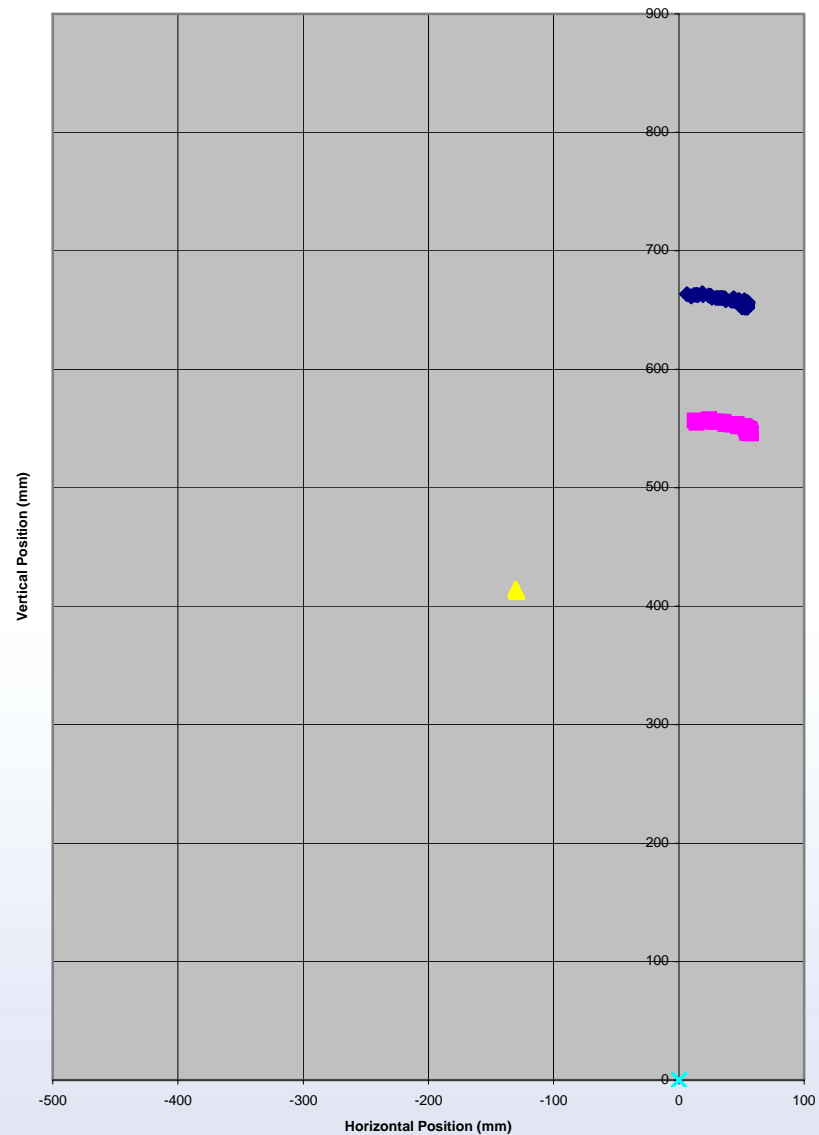
- ◆ OC pin
- T1 pin
- ▲ Seat back superior
- × Seat back inferior (recliner)

Option 3: BioRID Retraction



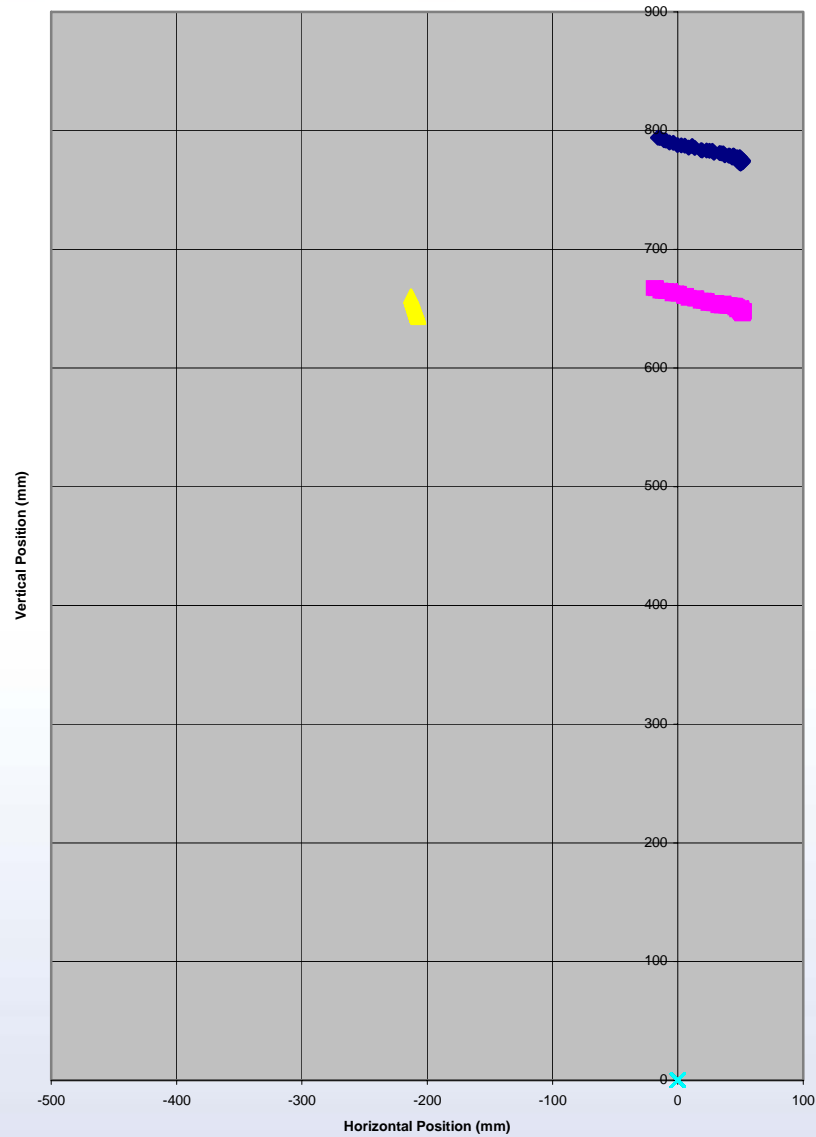
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Option 3: BioRID Retraction



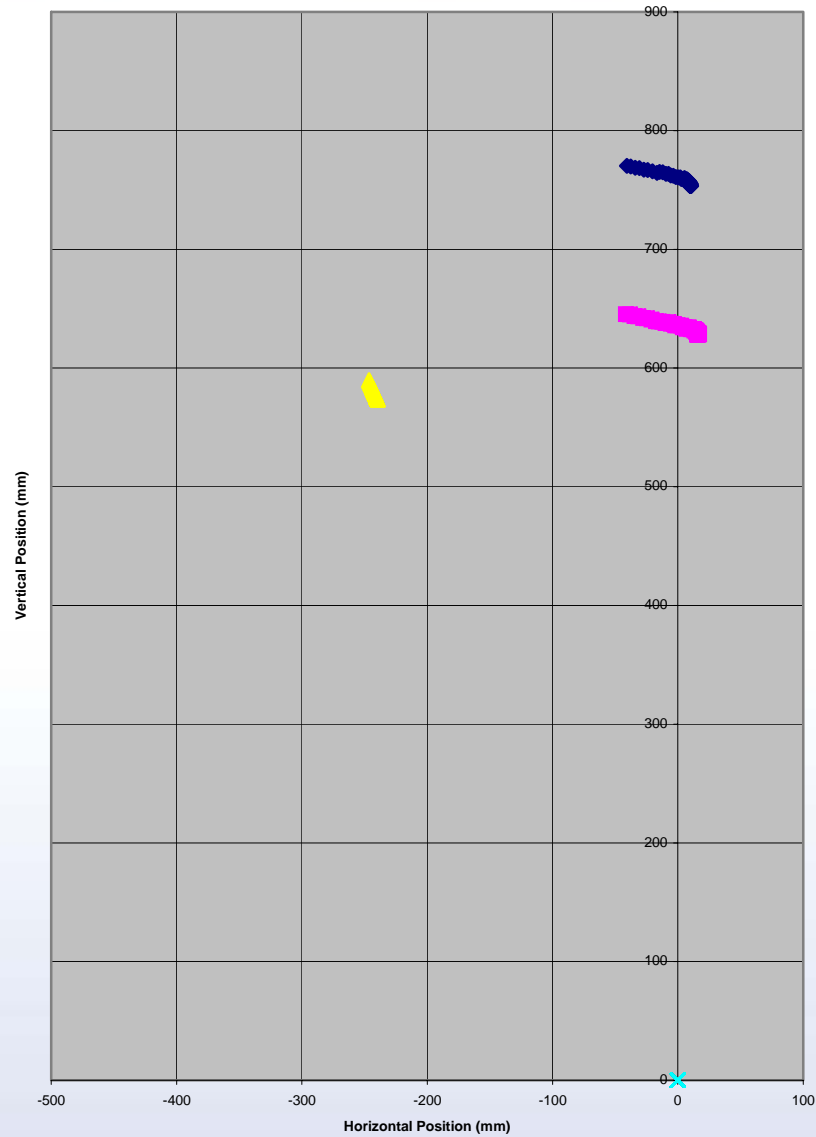
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Option 3: BioRID Retraction



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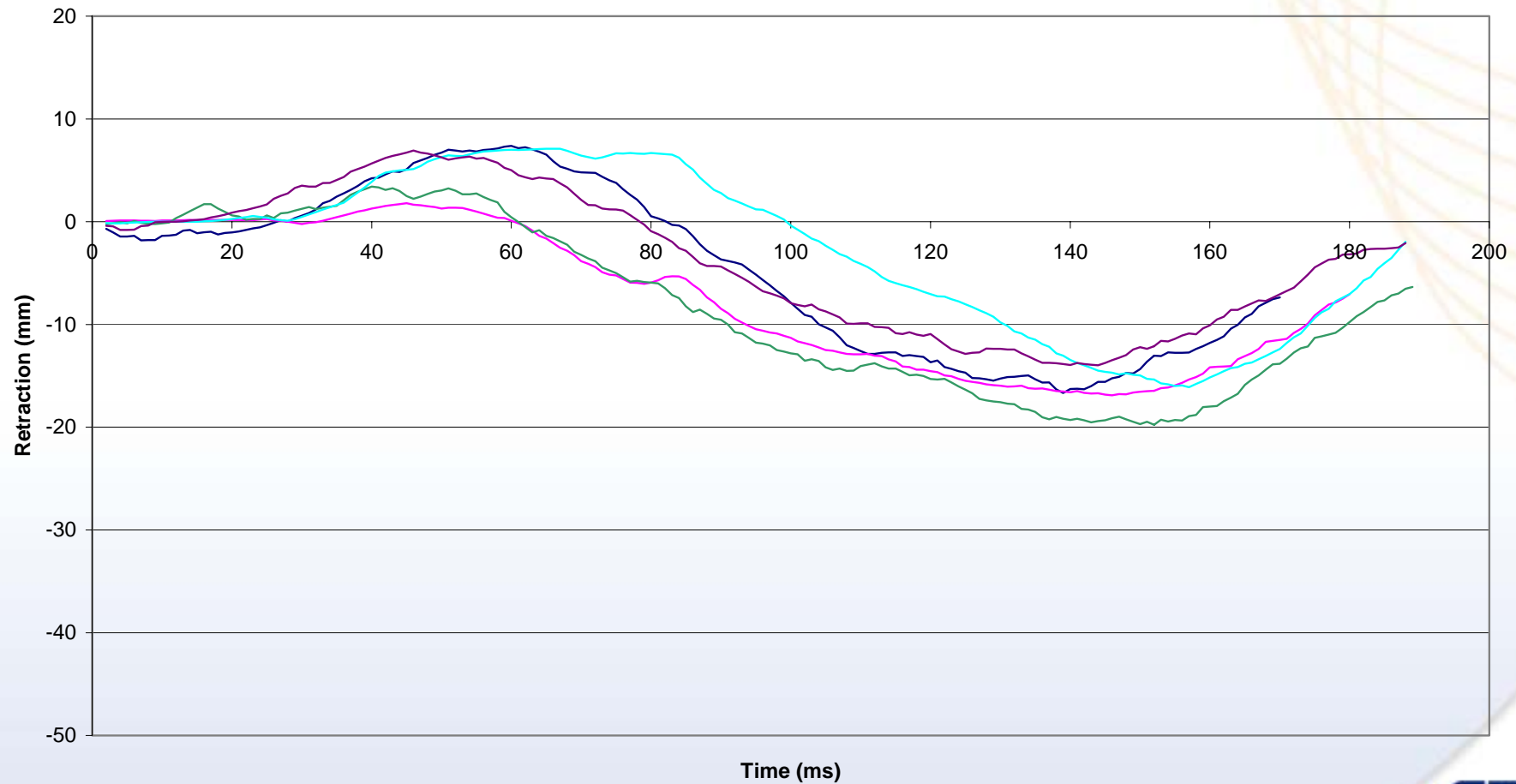
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