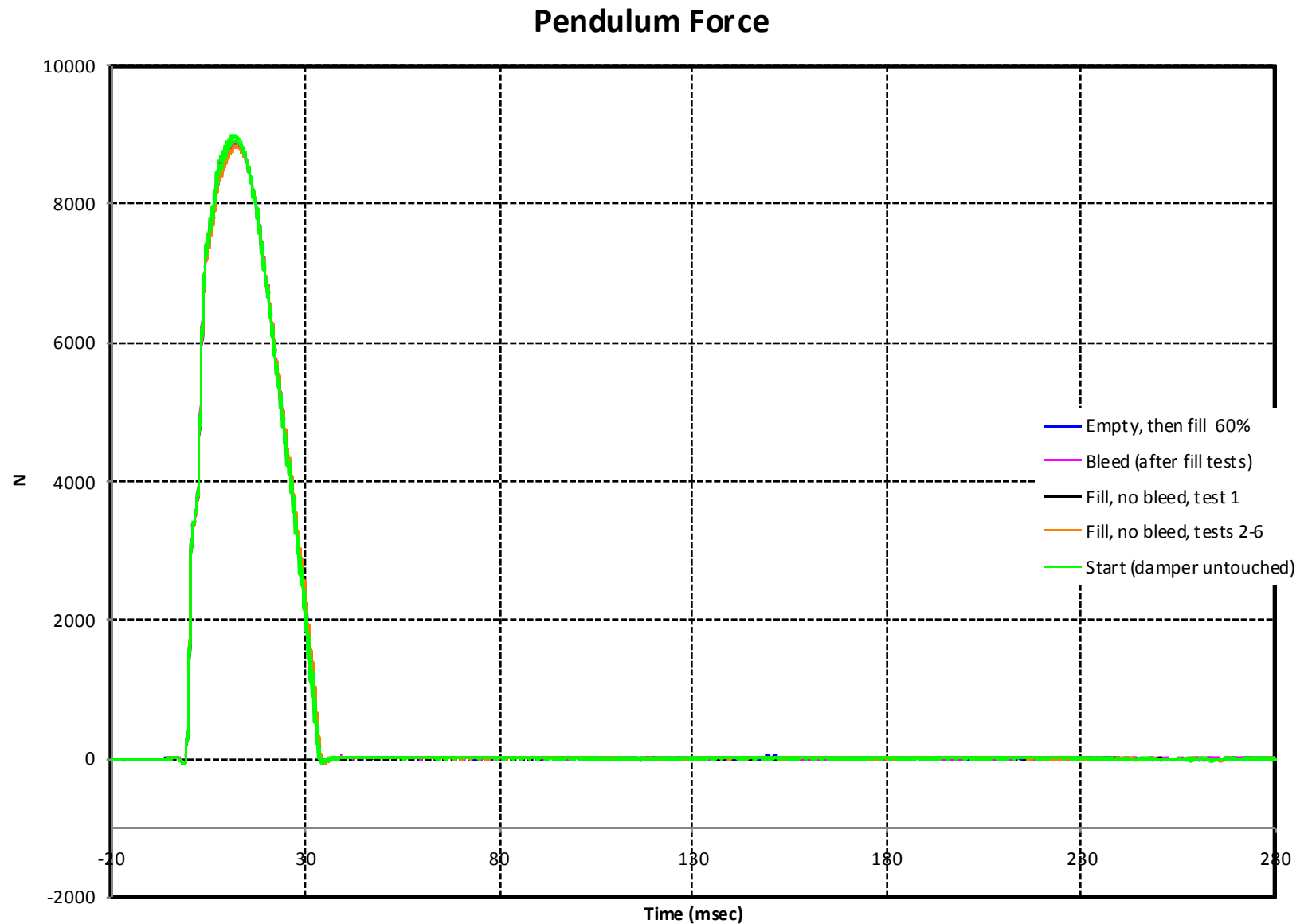


Variation Studies: Damper Oil Quantity

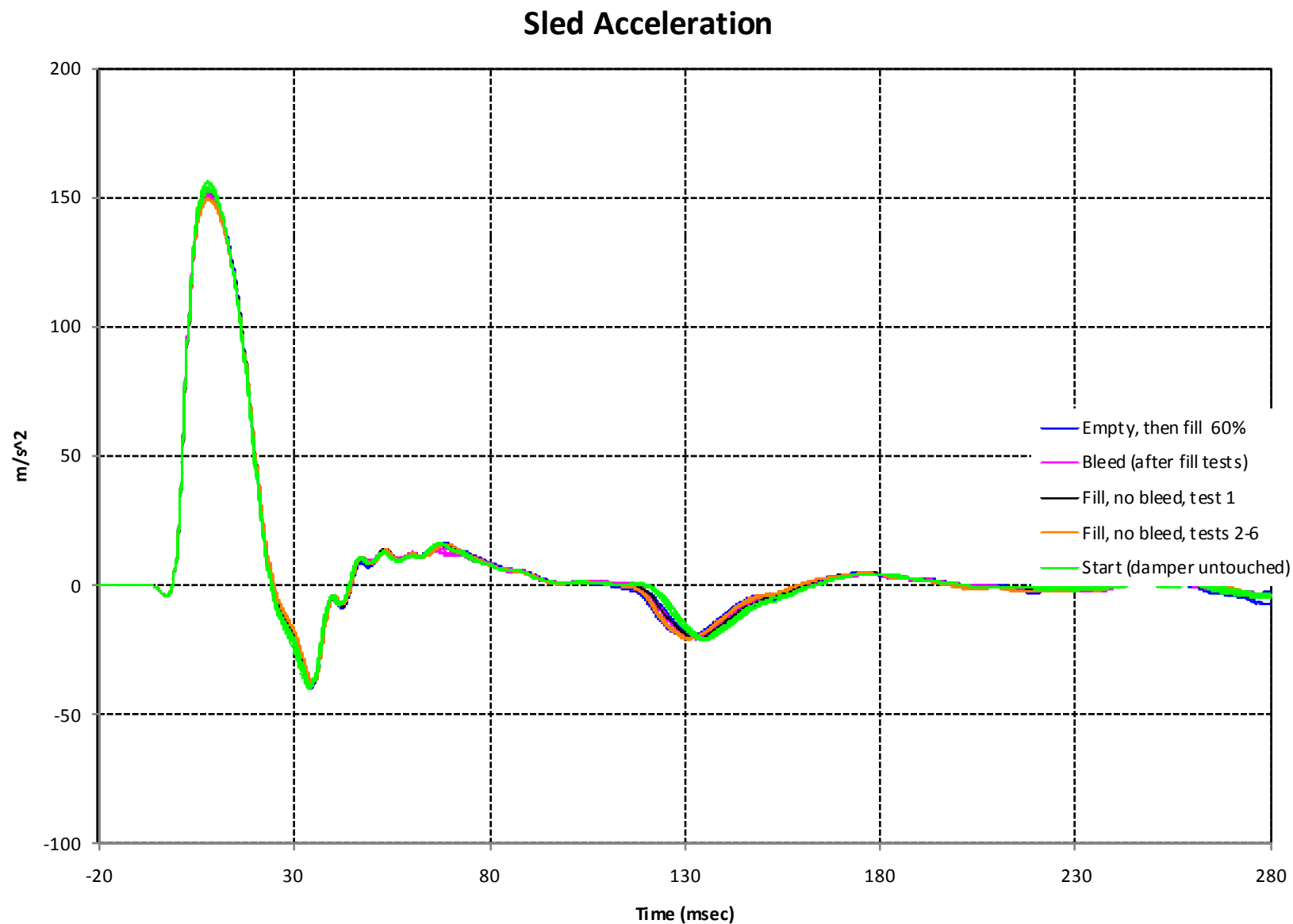
TEGID-17

- Study Goal
 - Determine how much effect missing oil due to leakage or poor bleeding has on performance.
- Study Design
 - Run dummy certification test
 - Test dummy as is
 - Loosen damper cables, remove damper, empty oil and refill to 60%, reinstall damper and test
 - Loosen damper cables, remove damper, finish filling but do not bleed, reinstall damper and test
 - Loosen damper cables, remove damper, bleed, reinstall damper and test

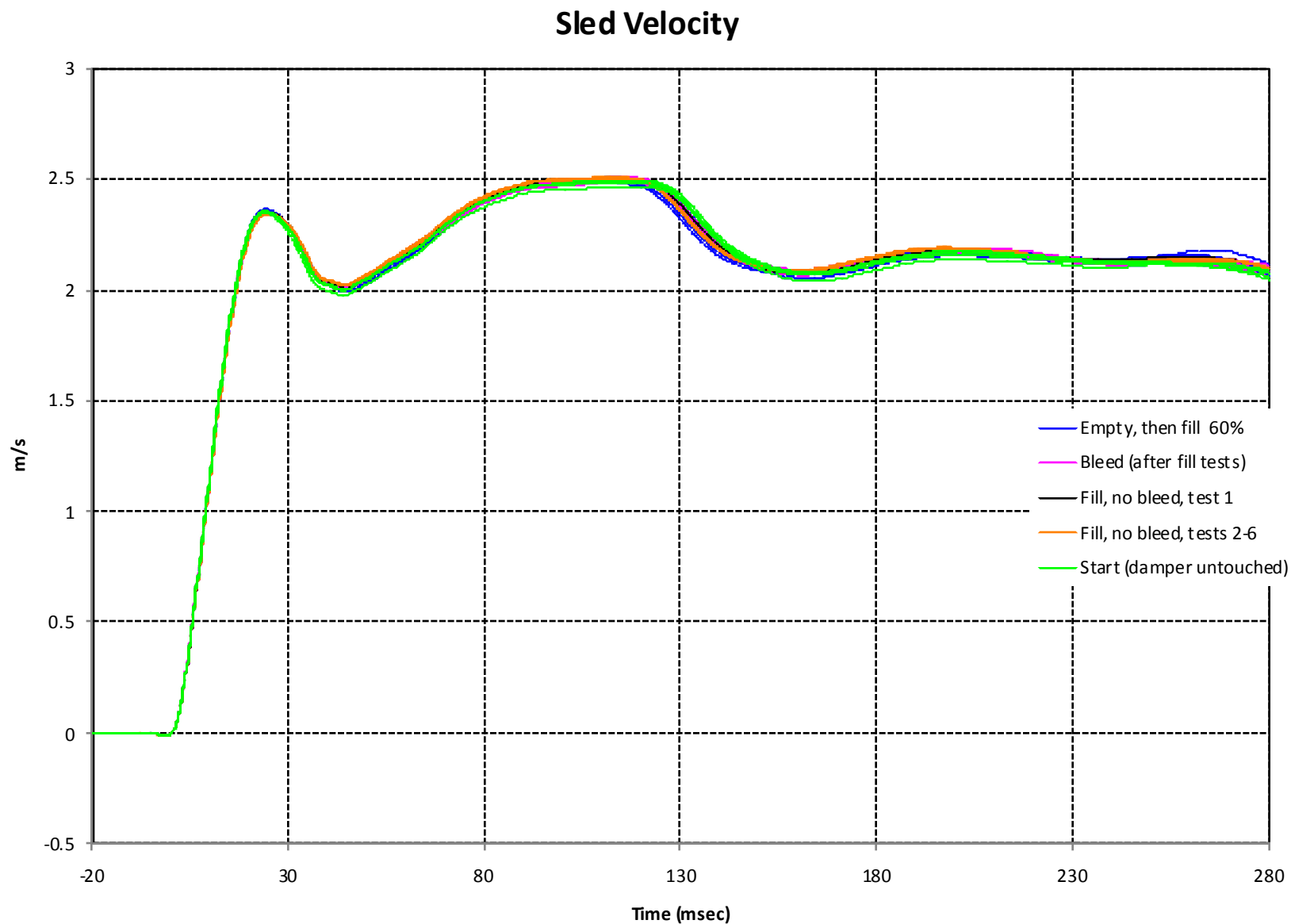
Variation Studies: Damper Oil Quantity



Variation Studies: Damper Oil Quantity

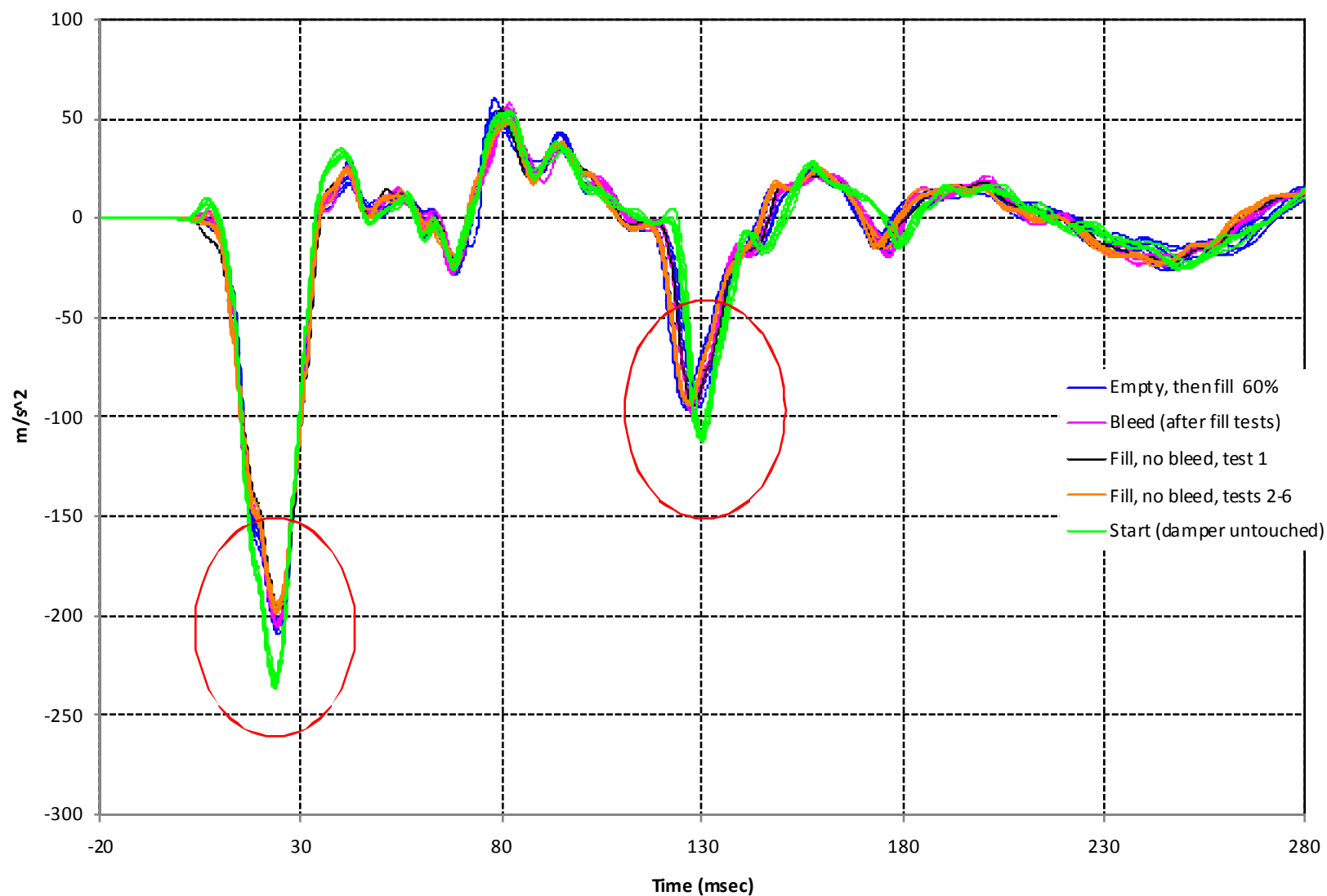


Variation Studies: Damper Oil Quantity



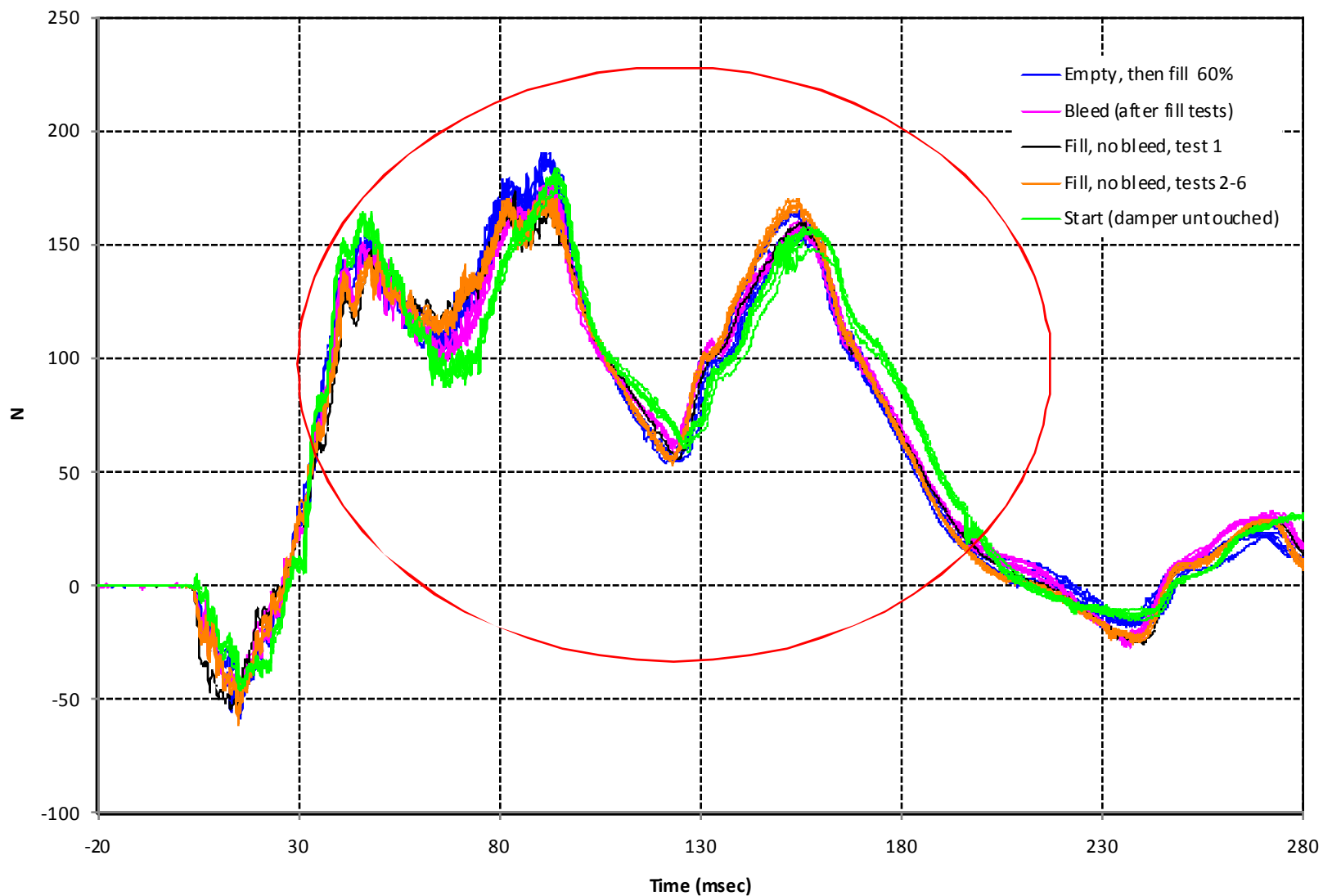
Variation Studies: Damper Oil Quantity

T1 X Acceleration

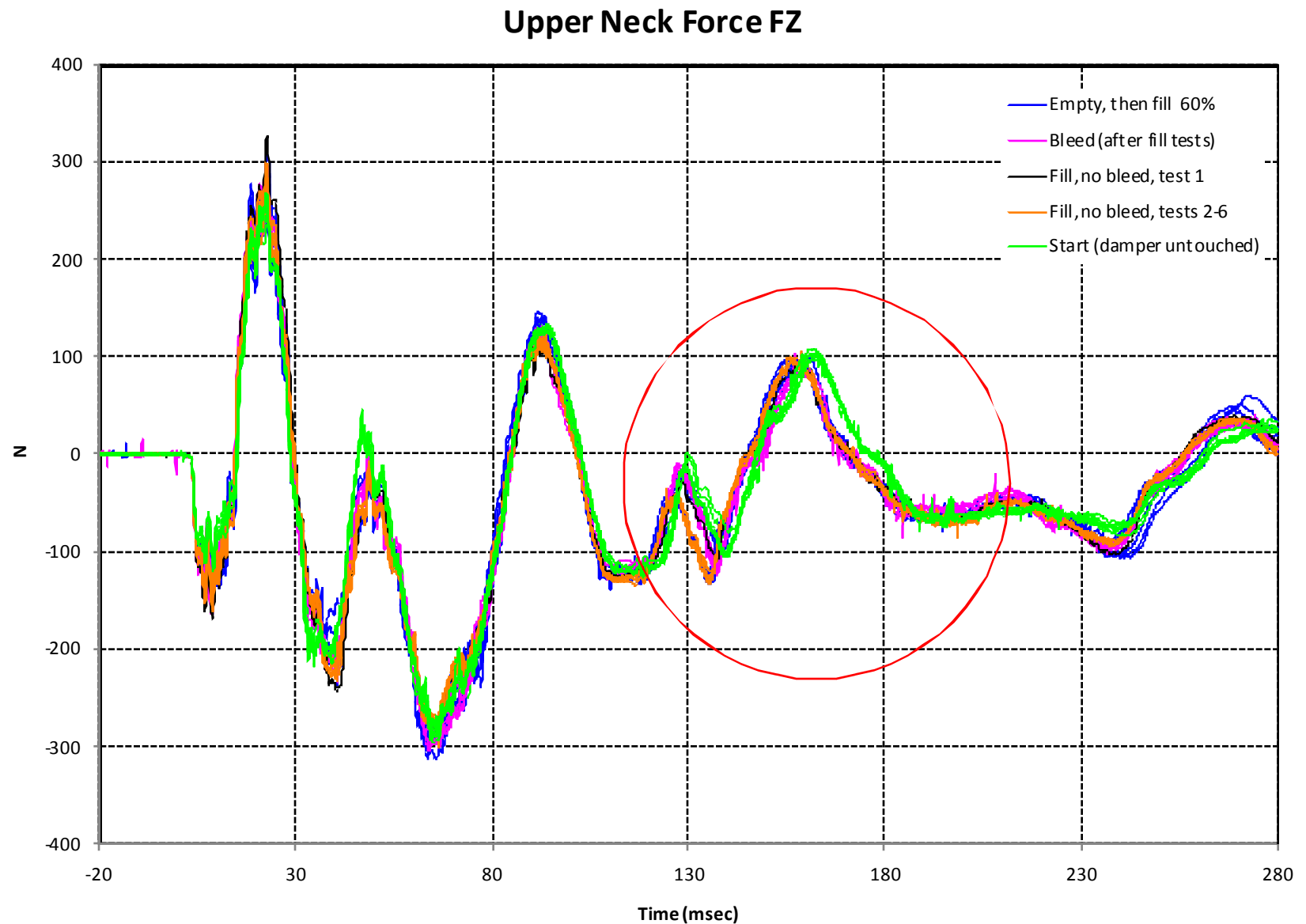


Variation Studies: Damper Oil Quantity

Upper Neck Force FX

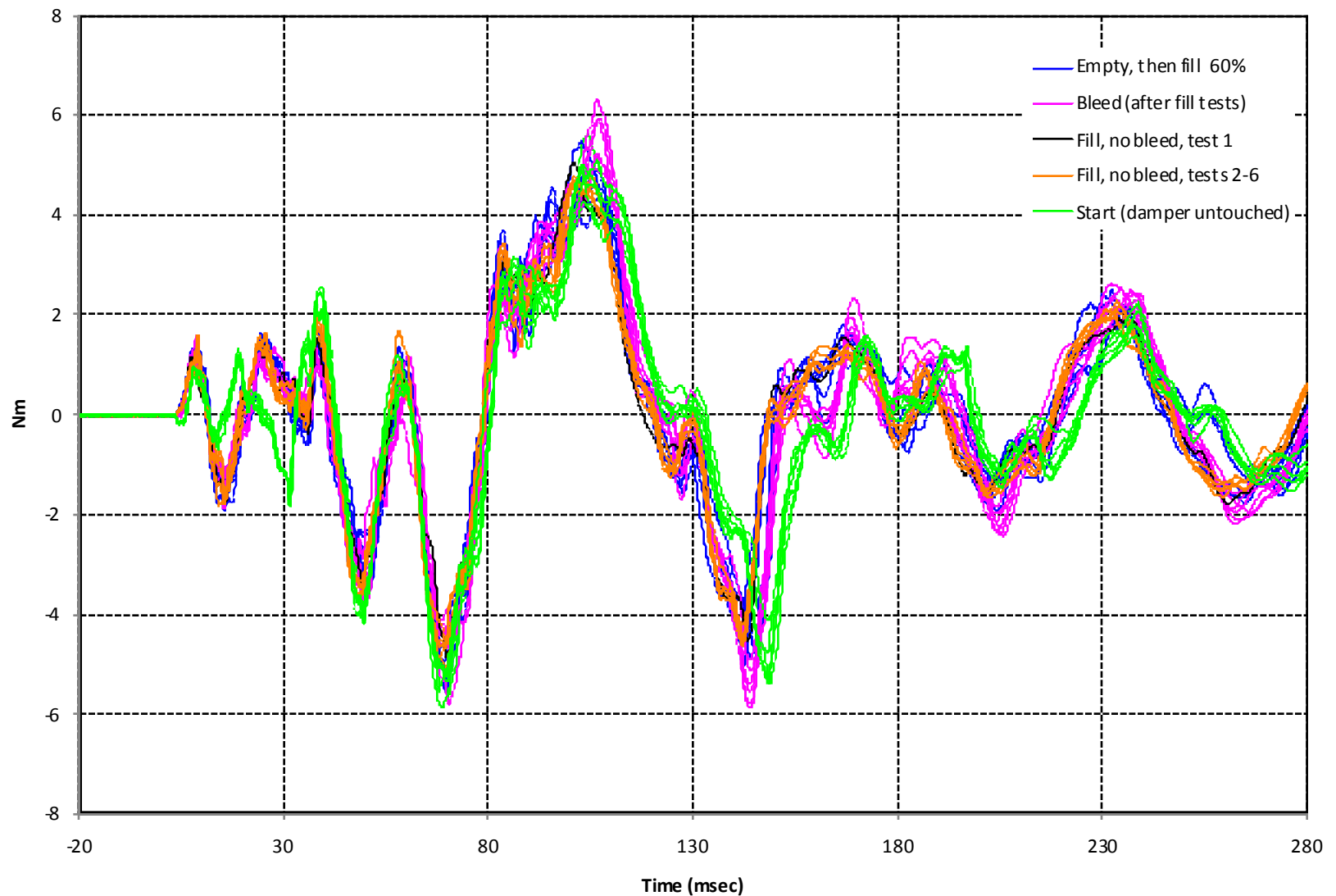


Variation Studies: Damper Oil Quantity

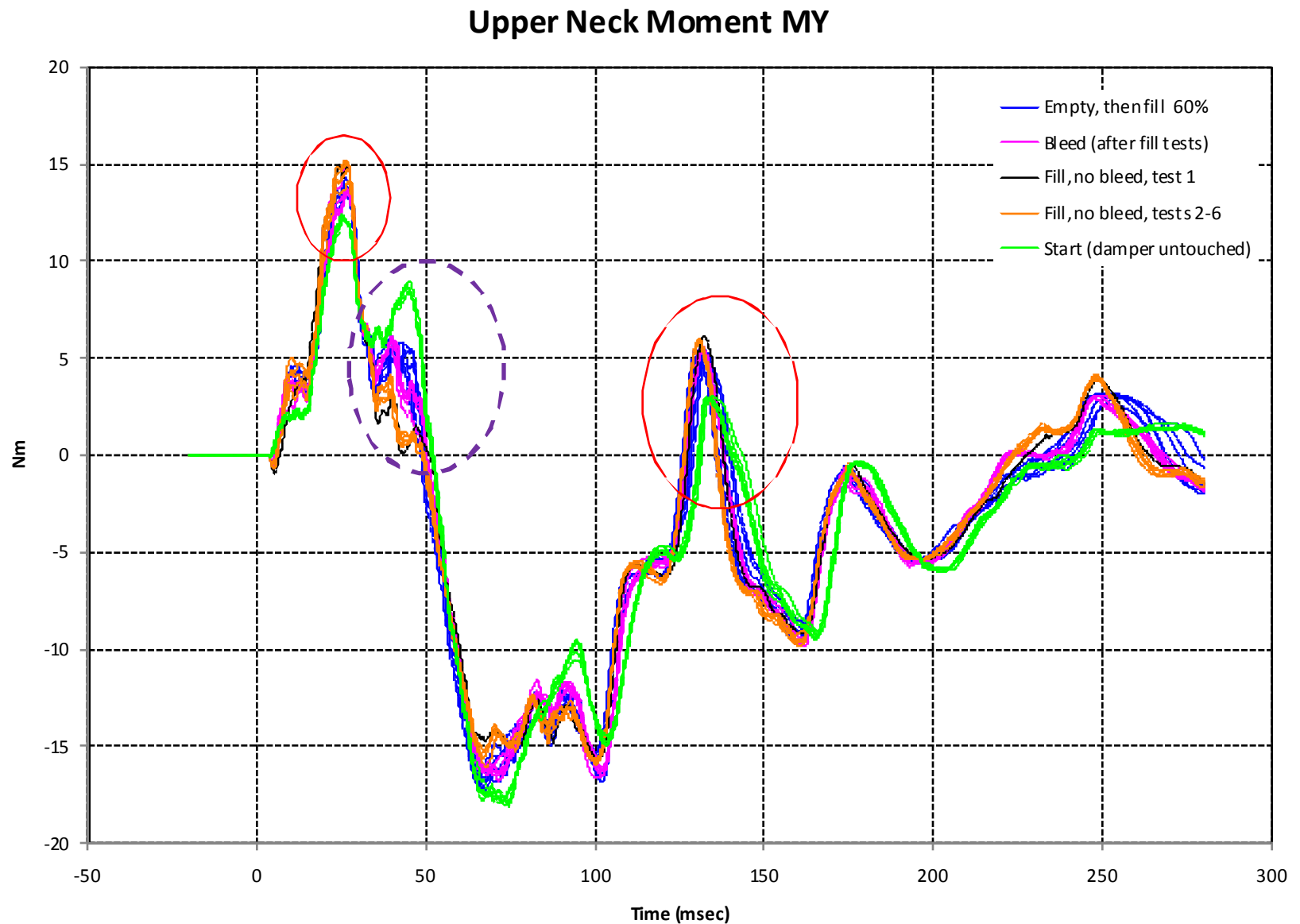


Variation Studies: Damper Oil Quantity

Upper Neck Moment MX

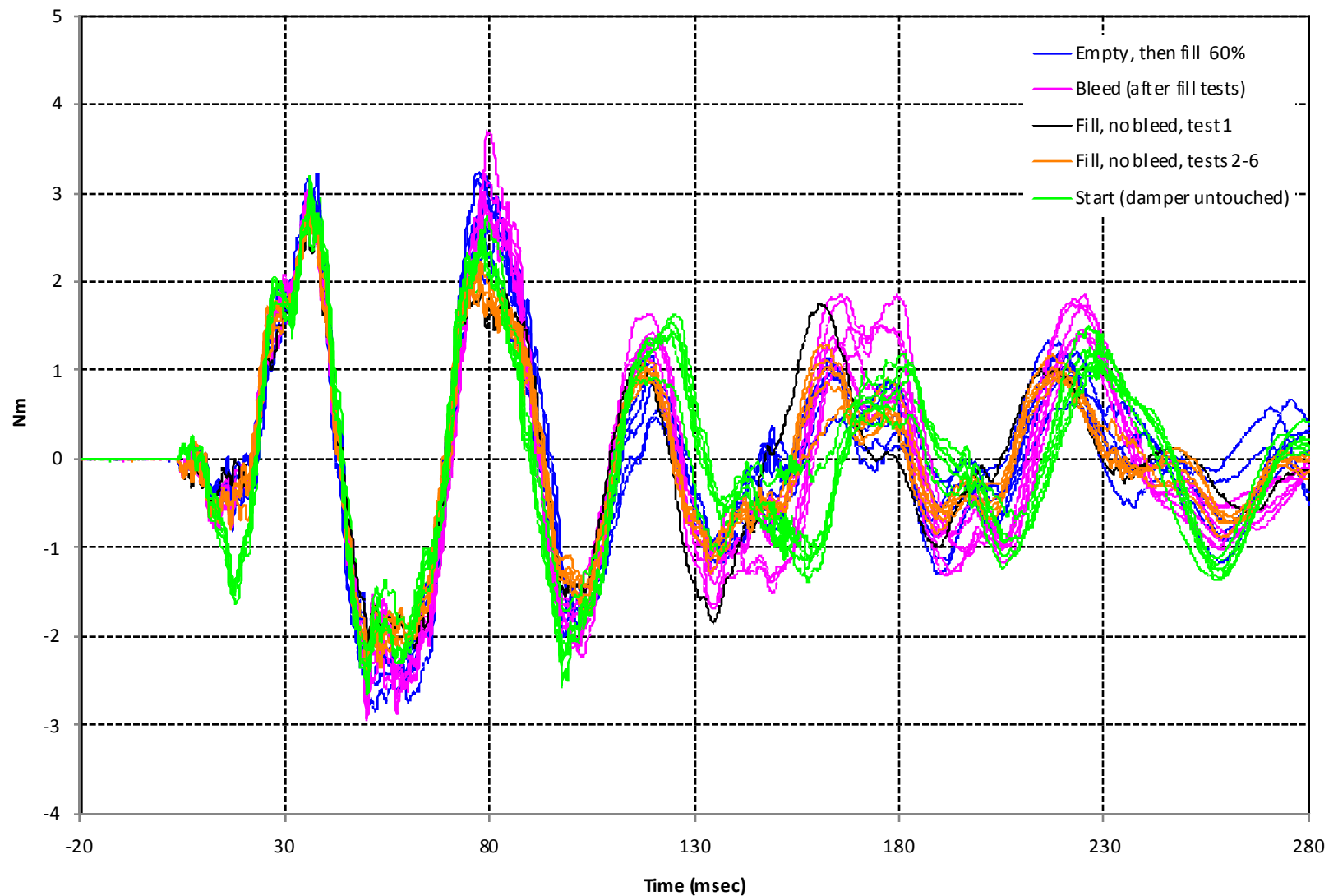


Variation Studies: Damper Oil Quantity

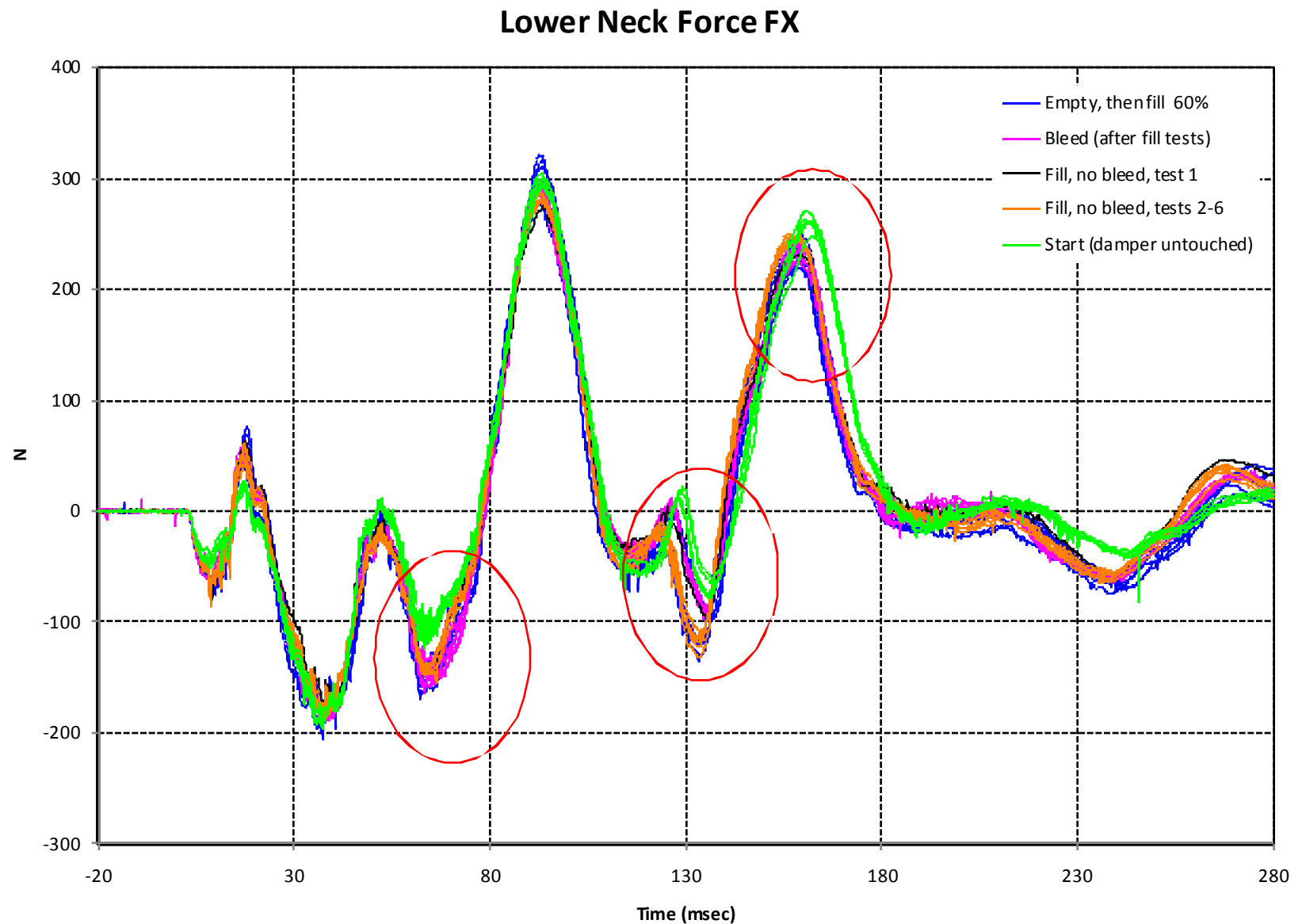


Variation Studies: Damper Oil Quantity

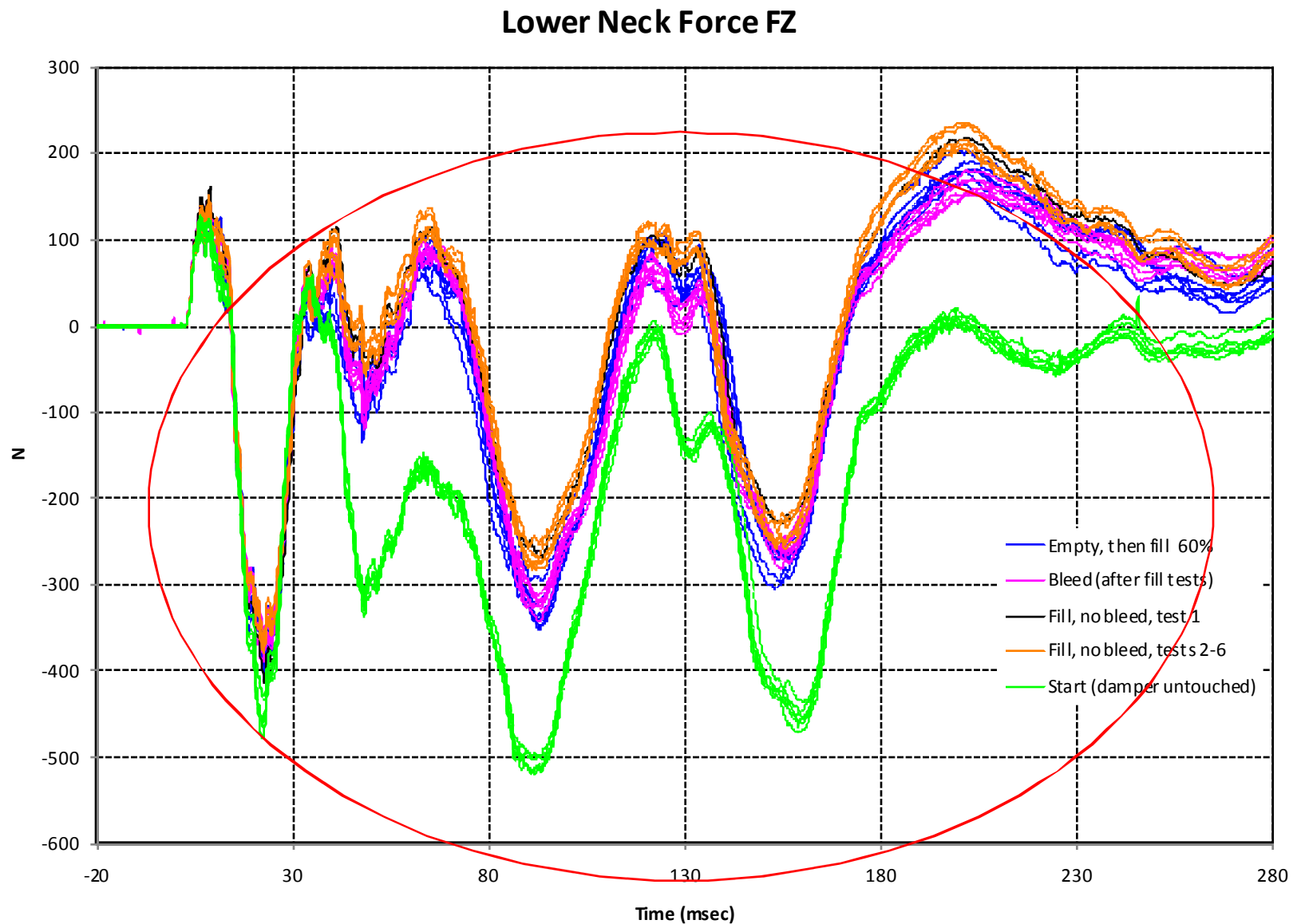
Upper Neck Moment MZ



Variation Studies: Damper Oil Quantity

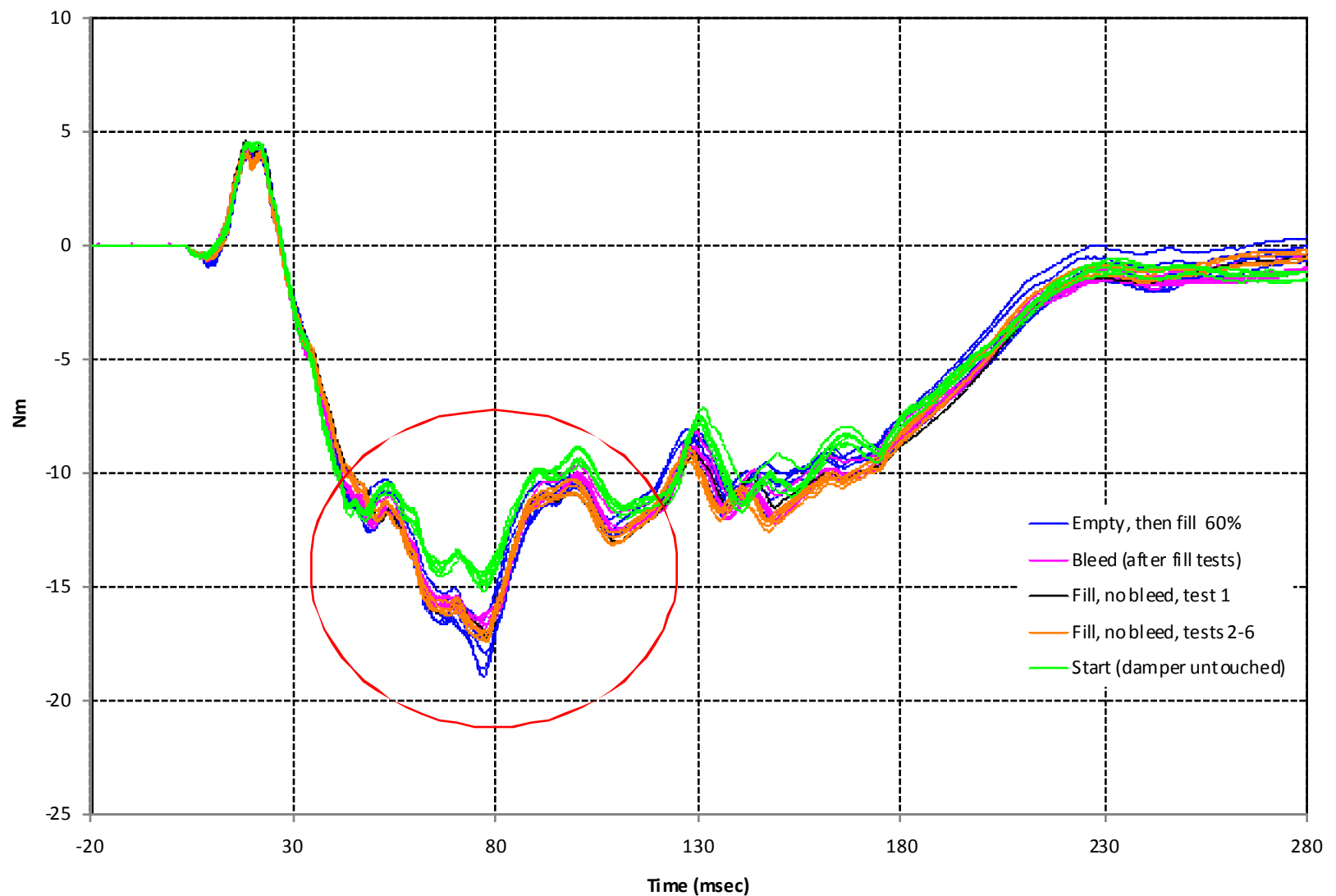


Variation Studies: Damper Oil Quantity



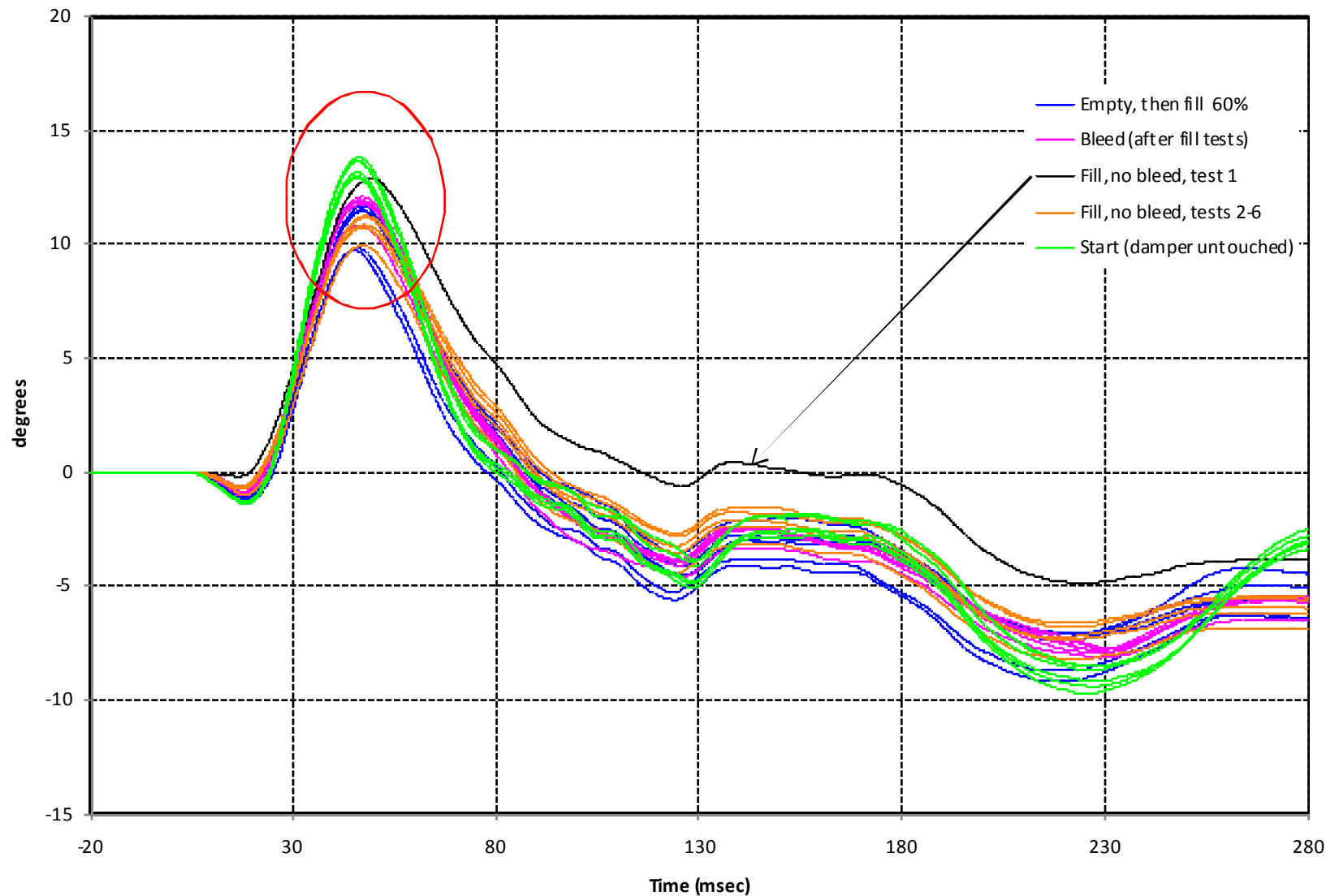
Variation Studies: Damper Oil Quantity

Lower Neck Moment MY



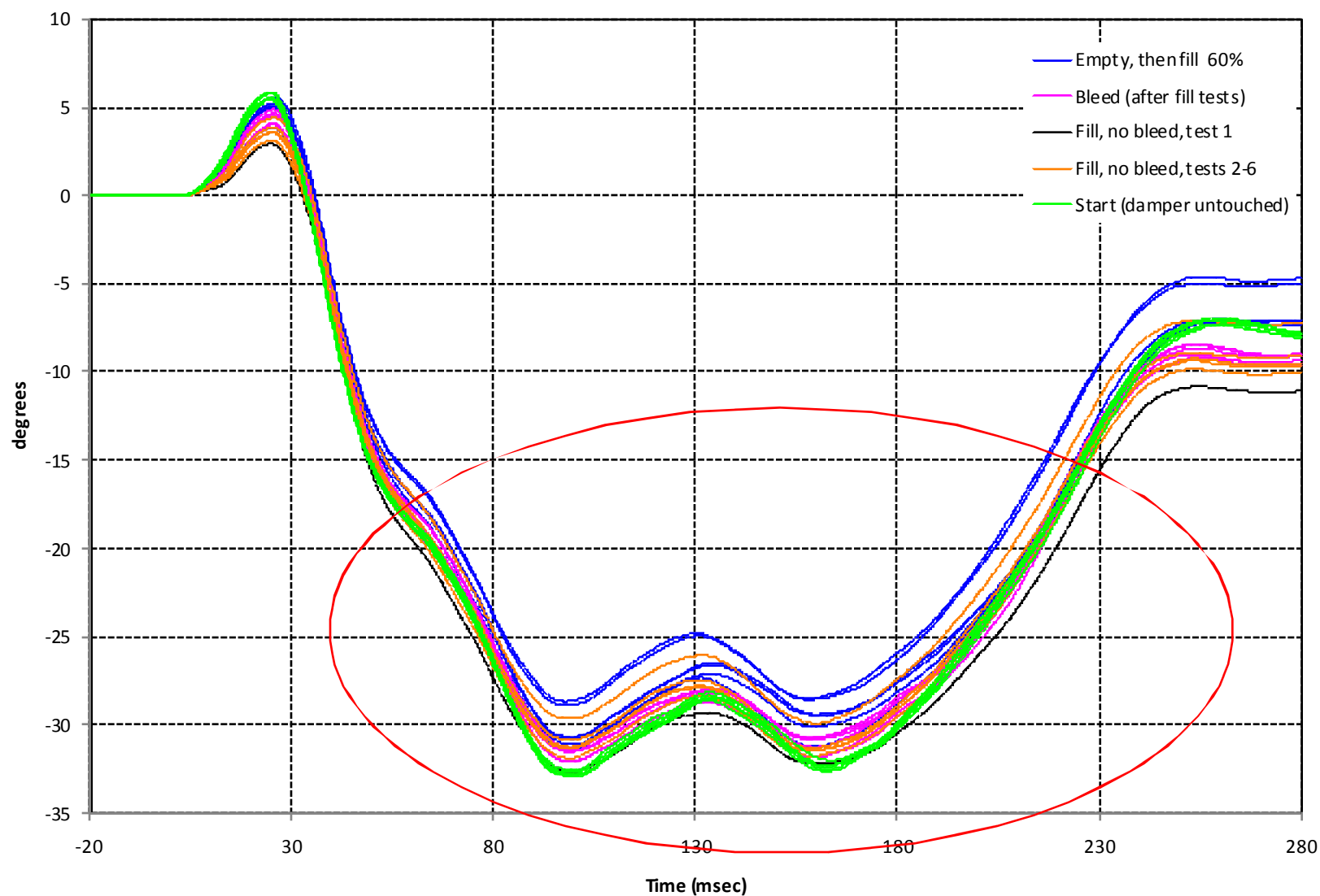
Variation Studies: Damper Oil Quantity

Pot A - Head Rotation about OC

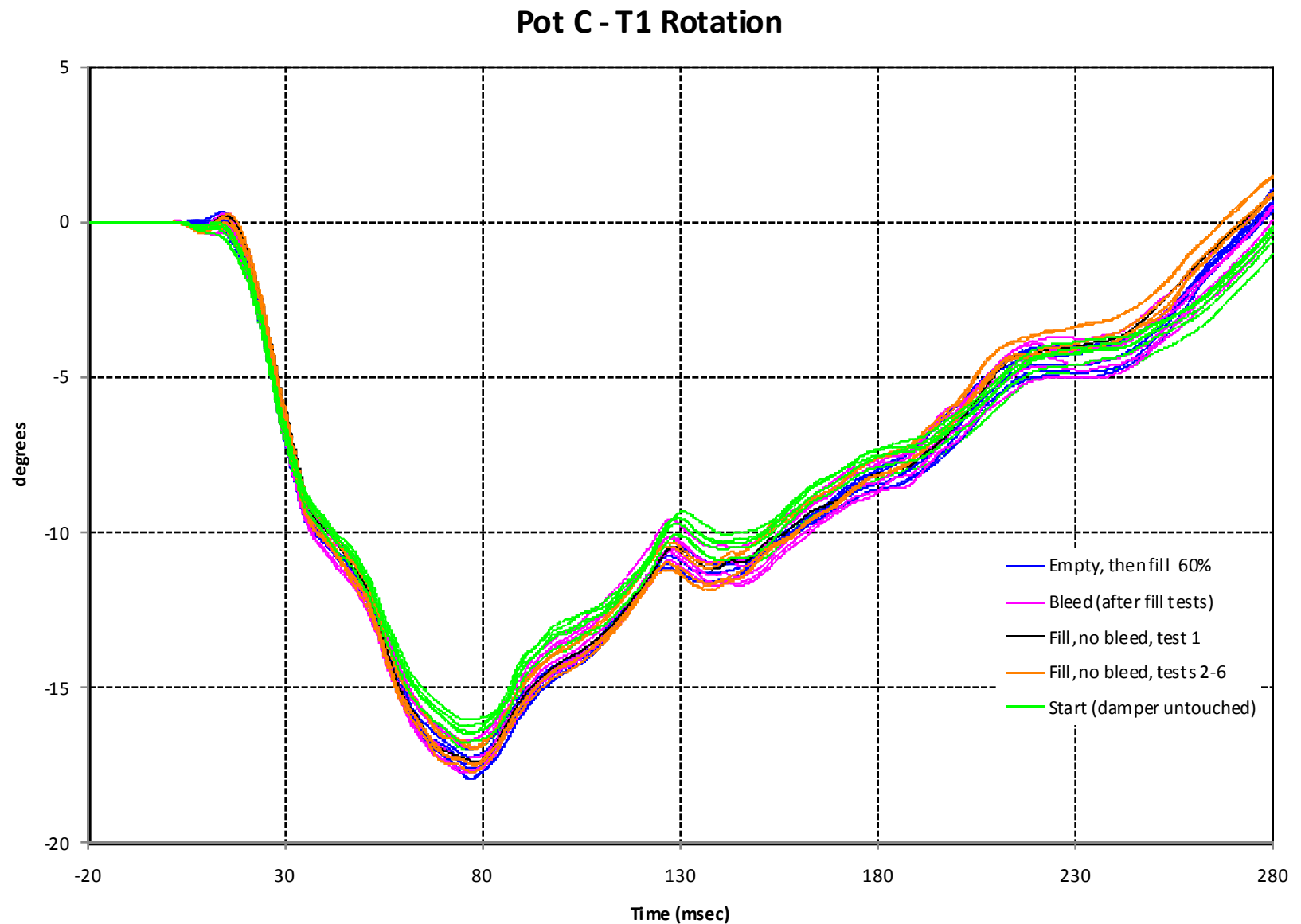


Variation Studies: Damper Oil Quantity

Pot B - Neck Link Rotation about T1

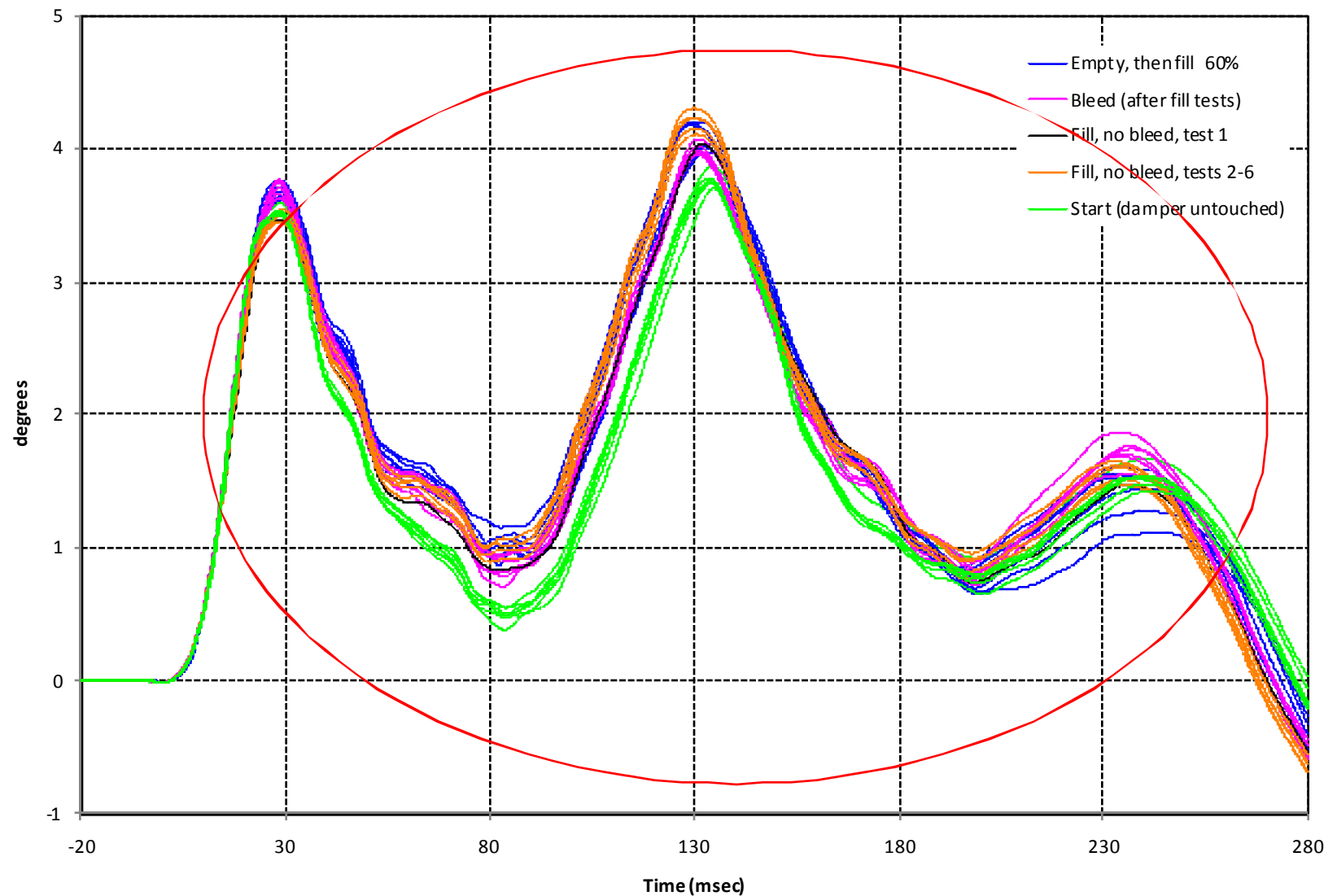


Variation Studies: Damper Oil Quantity

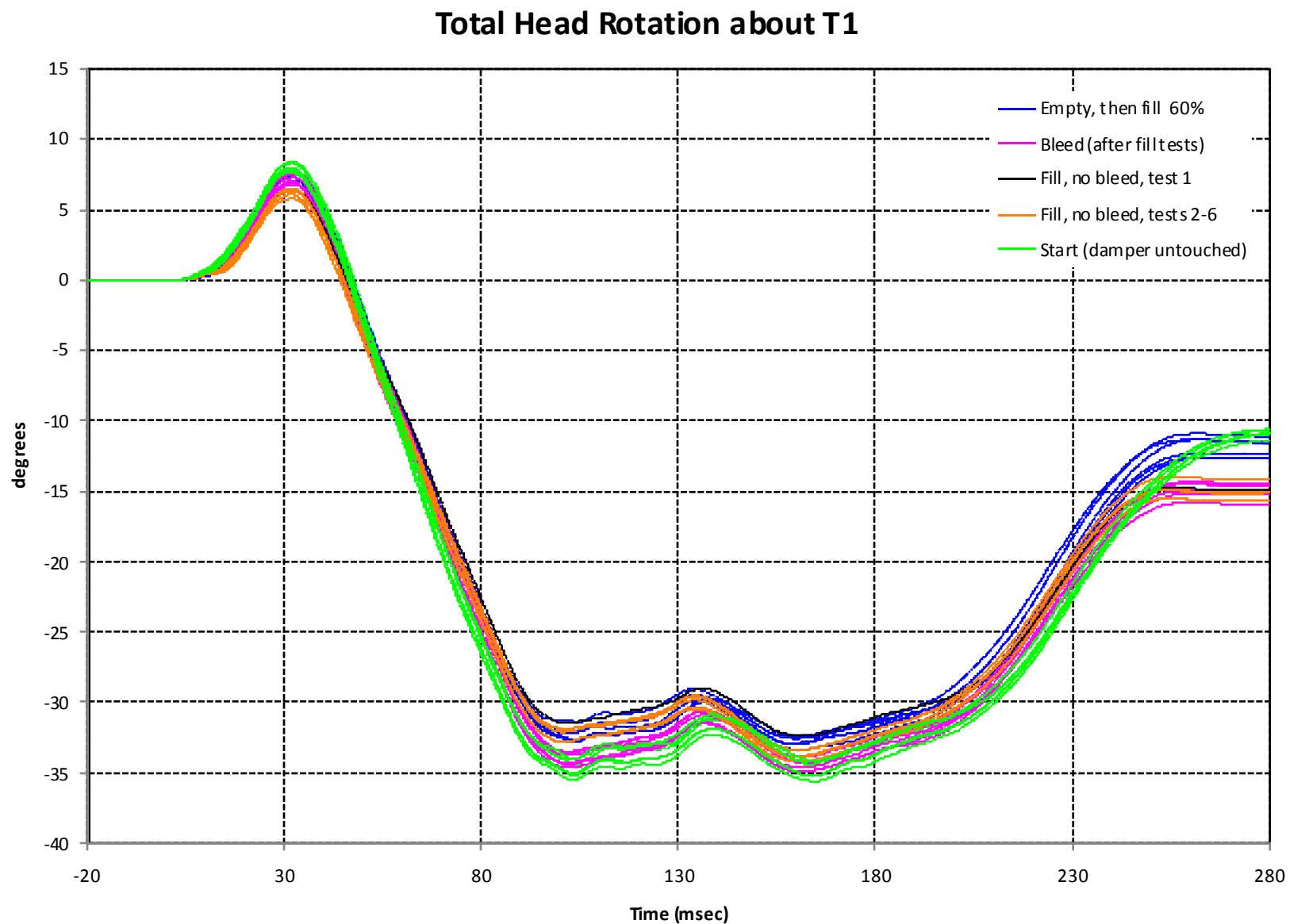


Variation Studies: Damper Oil Quantity

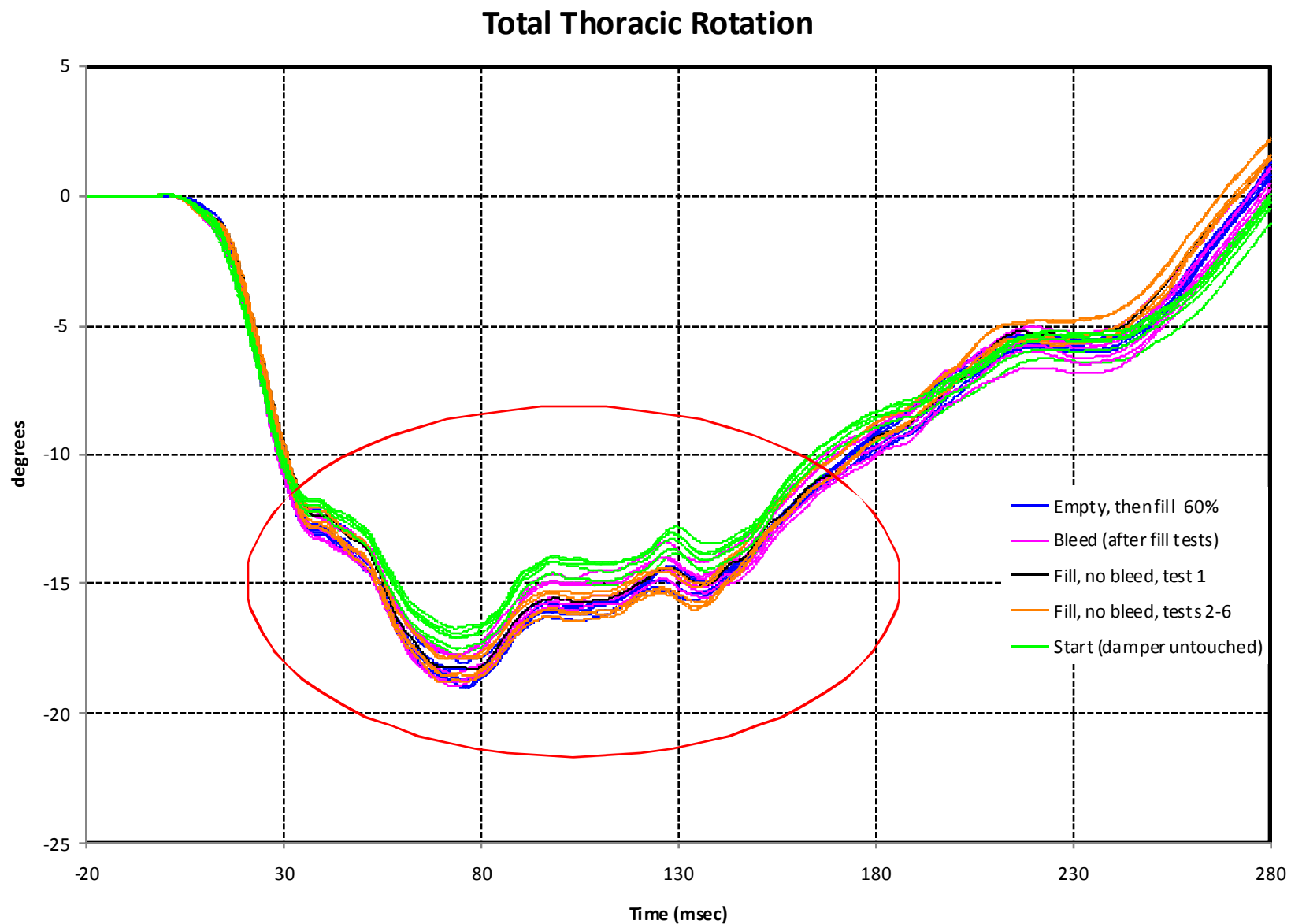
Pot D - Lower Thorax Rotation



Variation Studies: Damper Oil Quantity



Variation Studies: Damper Oil Quantity



Variation Studies: Damper Oil Quantity

- **Conclusions**

- Amount of oil and bleed condition from 60% to full made no noticeable difference in performance
 - Reason: air pocket is above damper paddle and orifice
- Something was slightly different in the “as is” condition which doesn’t appear due to the damper oil quantity
 - Hypothesis: OC plate tilt adjustment

Variation Studies:

Upcoming Studies

- Lateral tilt adjustment of OC plate
- Pin fit in vertebrae
 - Recent anecdotal evidence says this may be very important
- Spine setup differences
- Bumper stiffness & height variation
- Vertebrae fit tolerances
- Muscle substitute spring stiffnesses
- T1 load cell bushing wear

Component Tests

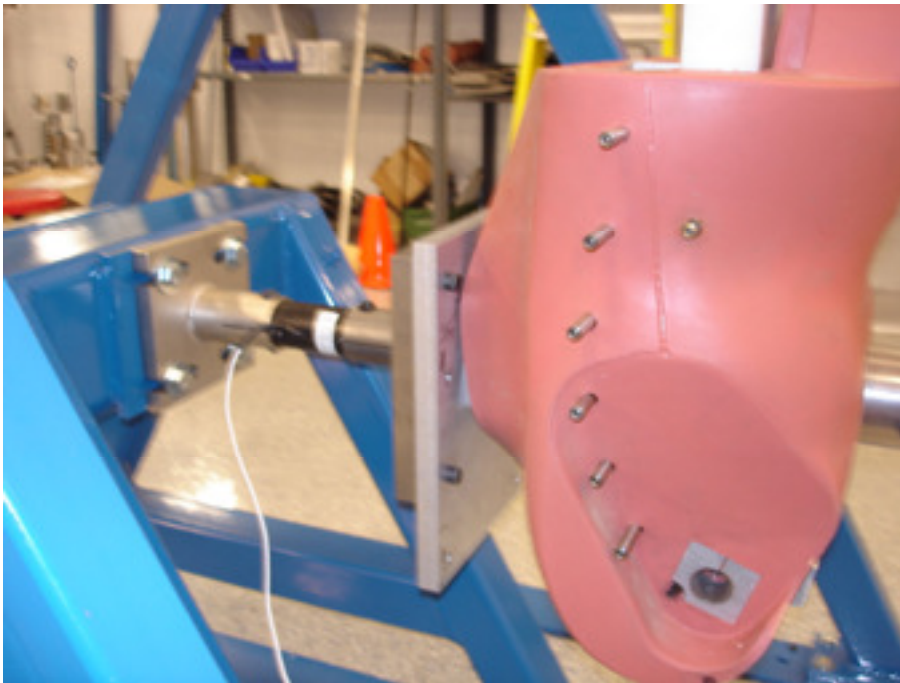
- Components
 - Jacket impact test
 - Pelvis impact test
 - Back
 - Bottom
- Requirements
 - Dynamic
 - Repeatable and reproducible
 - Adapt to standard lab equipment

Component Tests: Jacket Impact

- Goals:
 - Determine if either method is more repeatable
 - Determine if either can depict differences between jackets
- Perform jacket impact tests
 - Knee Impact Stand
 - Mini-Sled

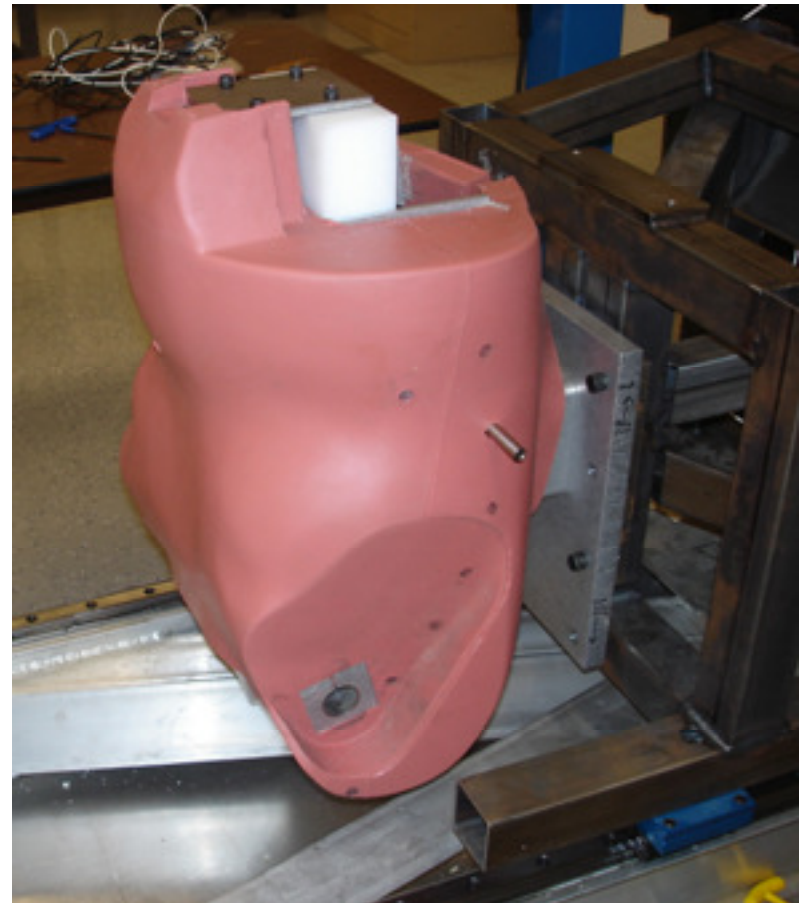
Jacket Testing

- Jacket mounted on knee stand



Using H-III50M knee impact probe

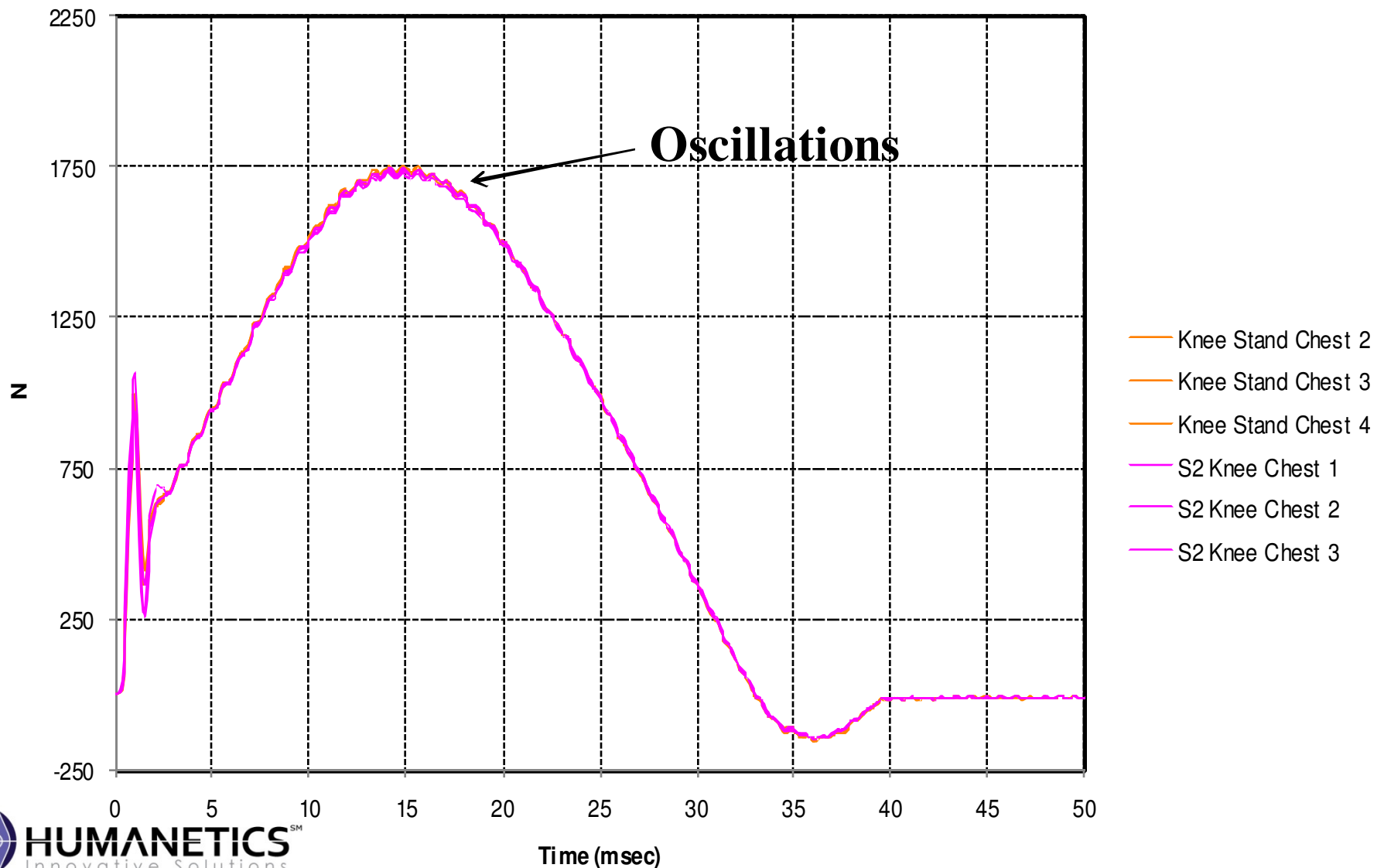
- Jacket mounted on mini sled



Using H-III5F thorax impact probe

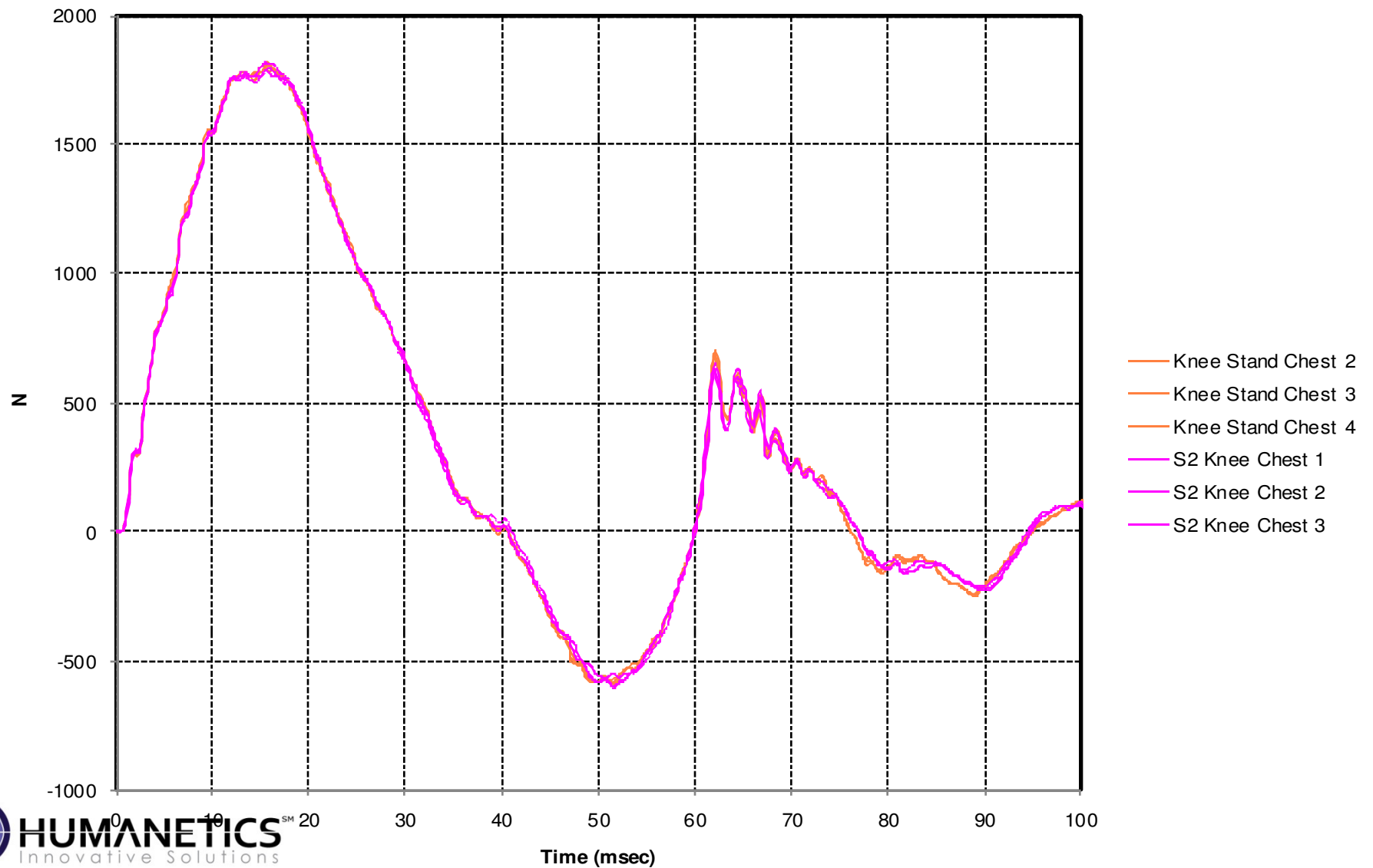
Jacket Test – Knee Stand

Pendulum Force



Jacket Testing – Knee Stand

Support Load - Knee Stand



Jacket Testing – Knee Stand

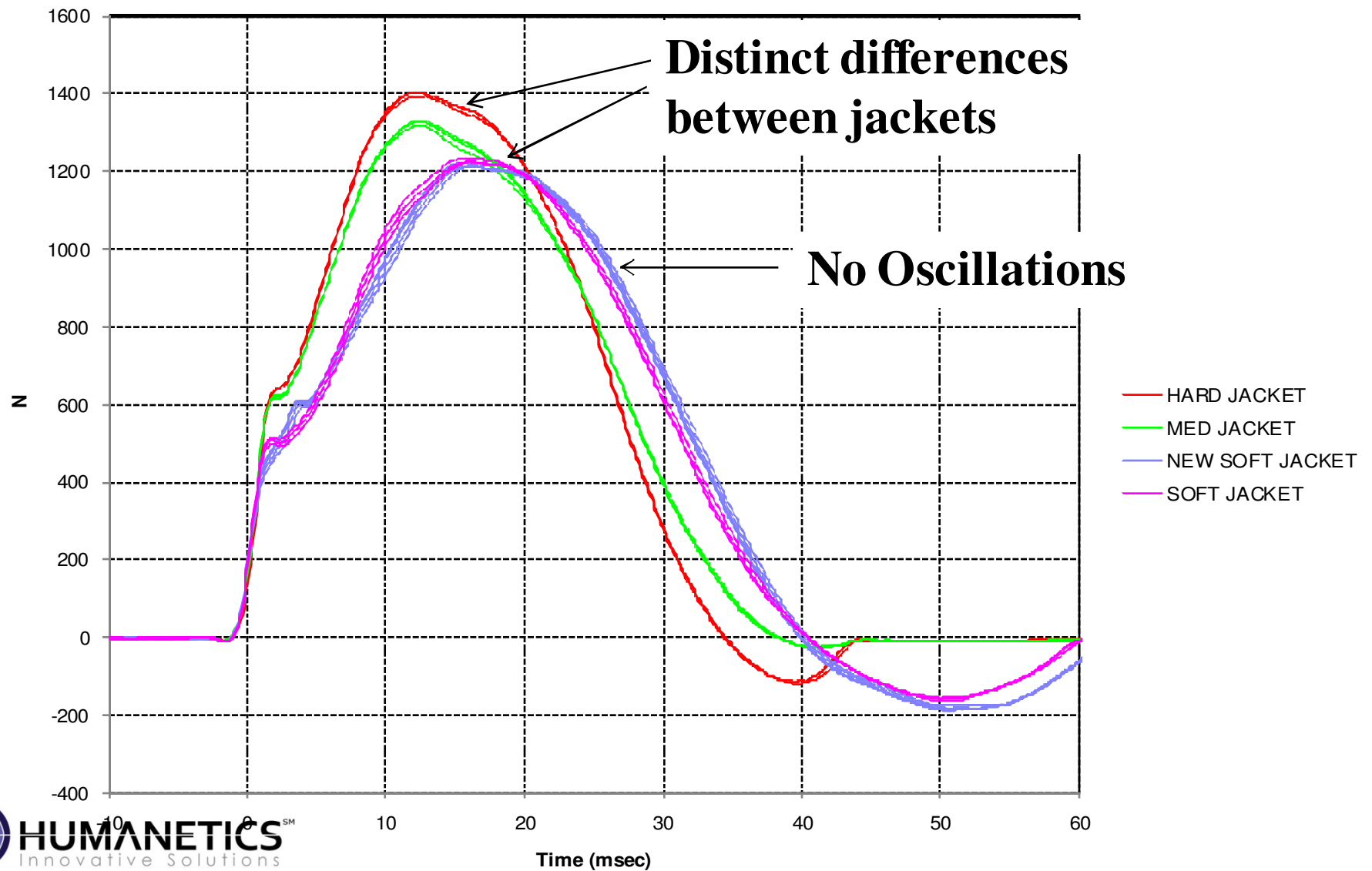
- Jacket Testing on knee stand showed oscillations in test data.
 - Confirmed by video

Jacket Testing – Mini Sled

- Tested four jackets on mini sled version of test
 - Hard, Medium, Soft was rank ordered using durometer gage
 - “Hard Jacket”
 - Standard production jacket from a few years ago kept around for engineering
 - “Med Jacket”
 - Standard production jacket from a few years ago kept around for engineering
 - “Soft Jacket”
 - Standard production jacket off a production dummy coming through lab
 - “New Soft Jacket”
 - Jacket made by engineering using current material control methods to try to duplicate “soft jacket”

Jacket Testing – Mini Sled

Jacket Testing - Minisled - Pendulum Force



Jacket Testing – Mini Sled

Jacket Testing - Minisled - Sled Acceleration

