

Summary of UMTRI World SID Testing

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Goals

1. Conduct low- and high- speed side-impact testing of cadavers and WorldSID.
2. Compare cadaver and WorldSID responses
3. Publish results (ESV 2011)

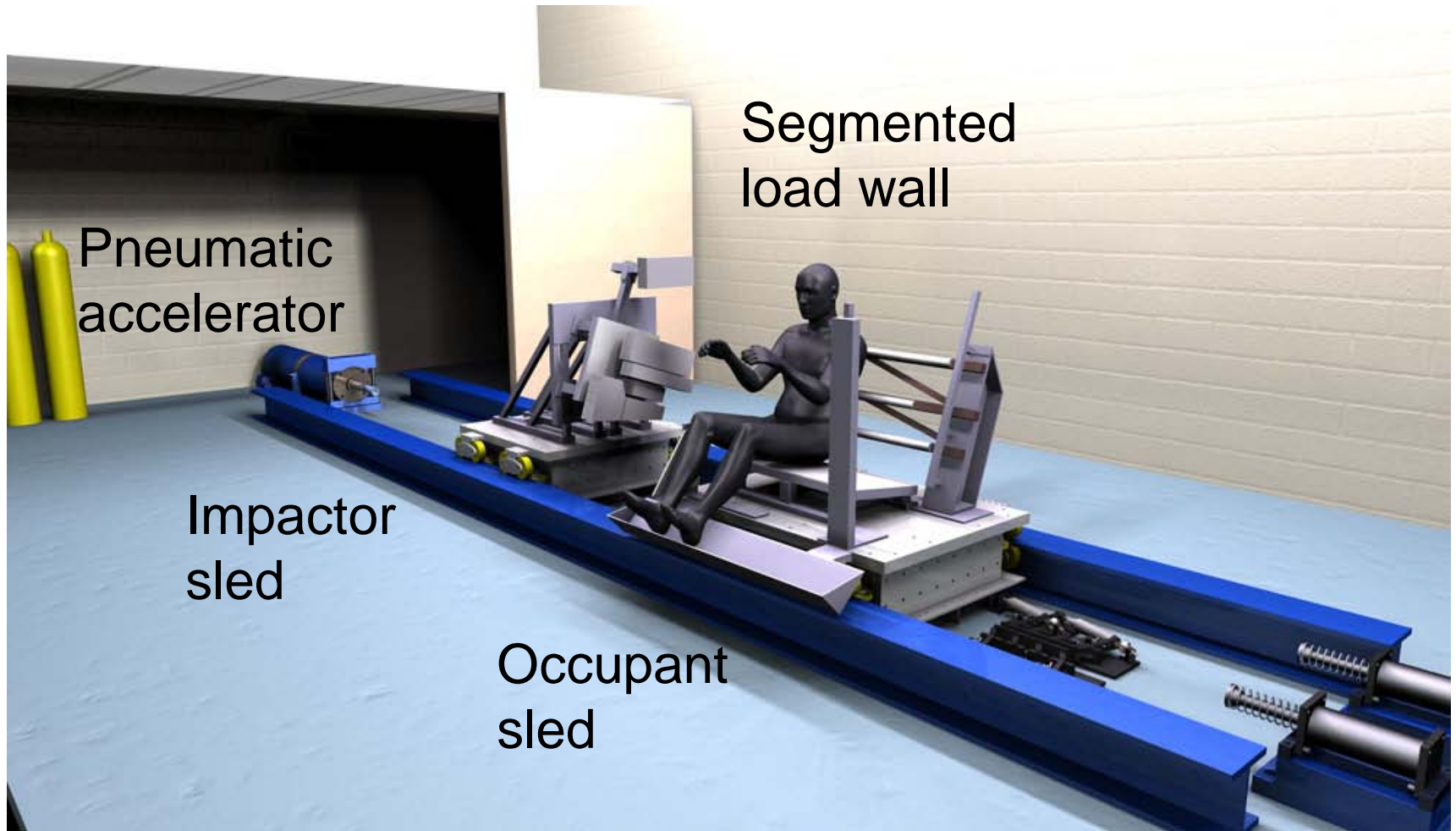
Test Methods

- Impacted each cadaver twice using a door-shaped padded impact wall
 - First impact at 3 m/s
 - Second impact at 8 m/s
- Padding force-deflection characteristics set so that mean ATD responses from SNCAP tests were reproduced when impactor and occupant sled masses and velocities were tuned to reproduce door and vehicle velocity histories from SNCAP tests.
- Do not load shoulder (loading the shoulder adds potential variability and does not represent worse case scenario for thoracic or abdominal injury)
- CT scan before and after 3 m/s test to verify that no rib fractures were present.

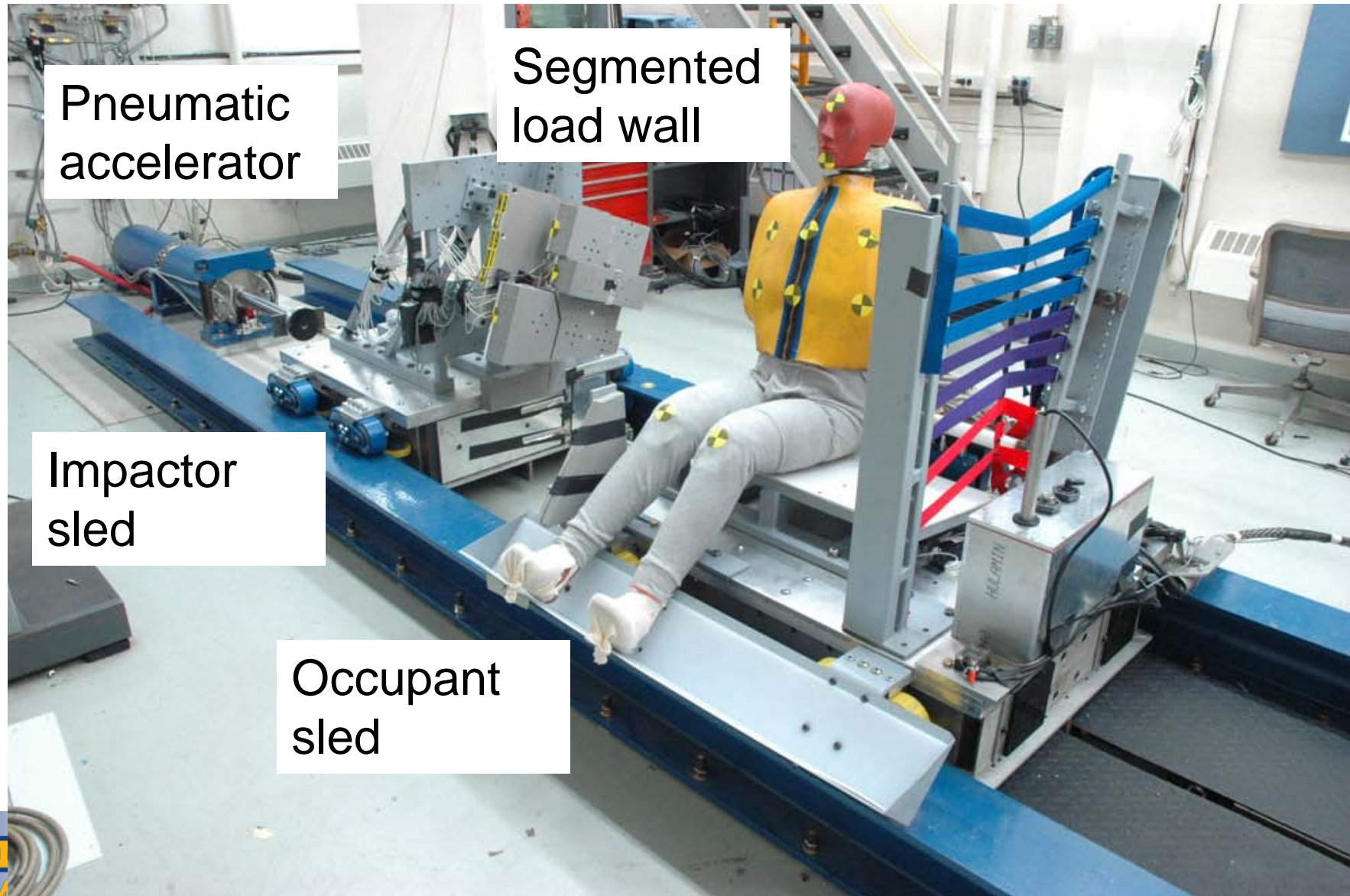
Test Methods, cont.

- Record forces applied to anatomic regions including: thorax, abdomen, iliac crest, greater trochanter, and mid femur. Scale height of impactor plates with subject size to ensure that each segment of the impact wall loads the same body region across tests.
- Record thorax and abdomen deflection using 59-channel chest bands.
- Use a redundant measures of thoracic deflection:
 - Digitized spine and impactor locations from HS video, measure foam deformation using potentiometer that passes through the foam
 - Measure rib and spine accelerations
- Record rib fracture timing using strain gages.

Dual sled side impact facility



Dual sled side impact facility

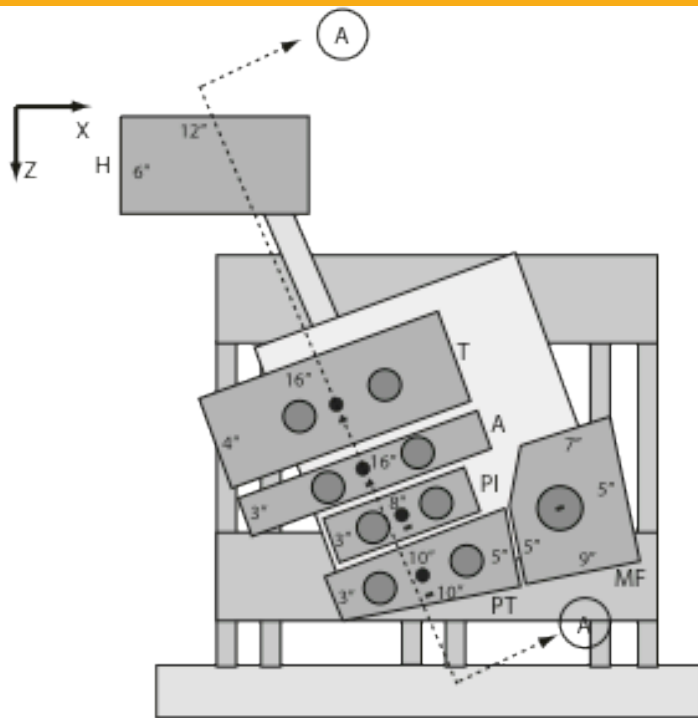


Pneumatic
accelerator

Segmented
load wall

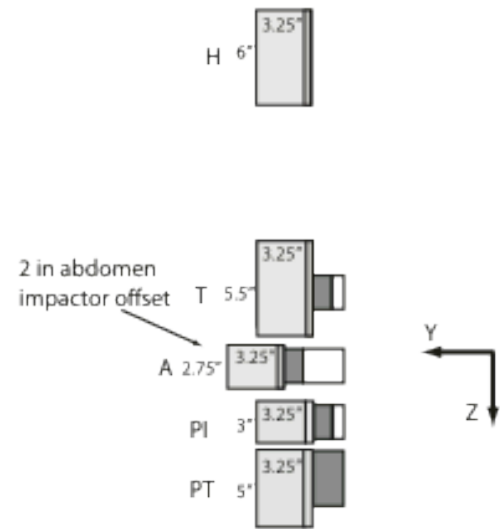
Impactor
sled

Occupant
sled

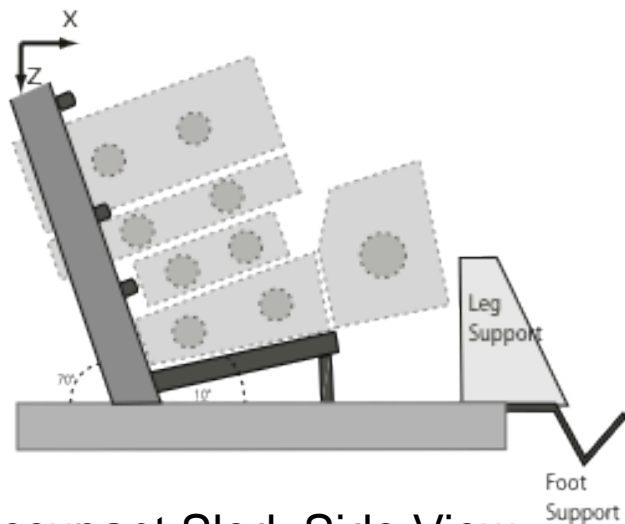


H = Head
 T = Thorax
 A = Abdomen
 PI = Pelvis-Iliac Wing
 PT = Pelvis-Greater Trochanter
 MF = Mid Femur

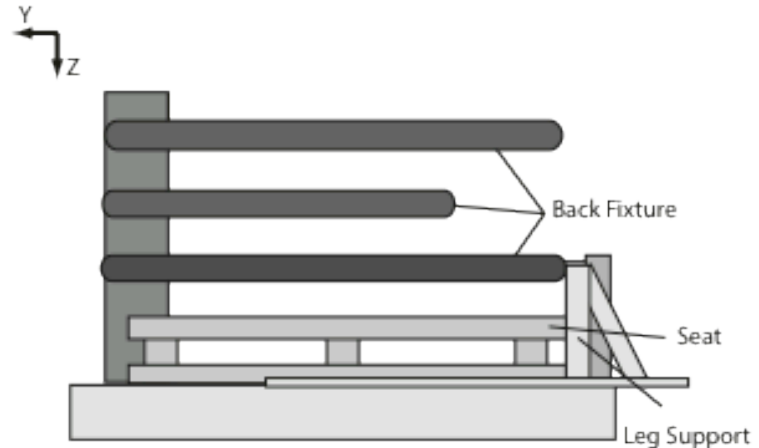
Impactor Sled, Side View



A-A
 Impactor Cross-Section



Occupant Sled, Side View



Occupant Sled, Front View

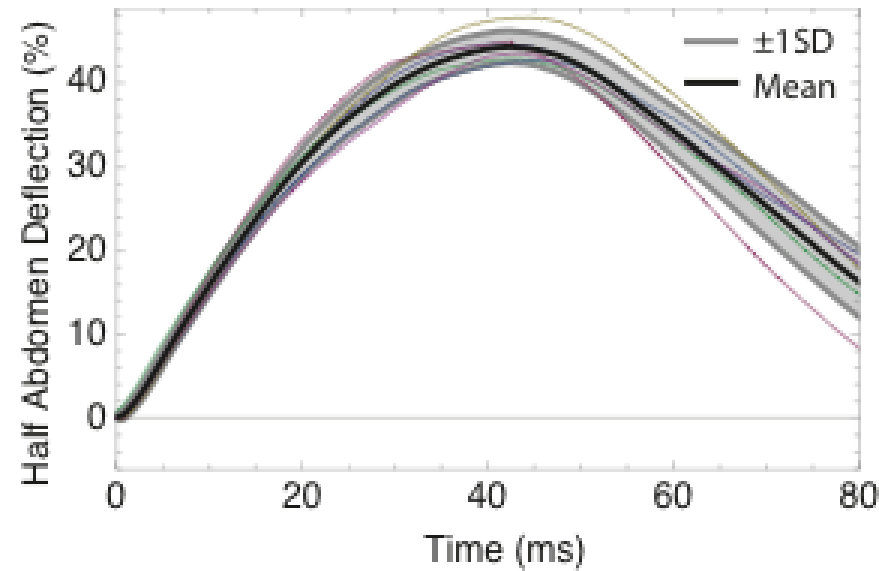
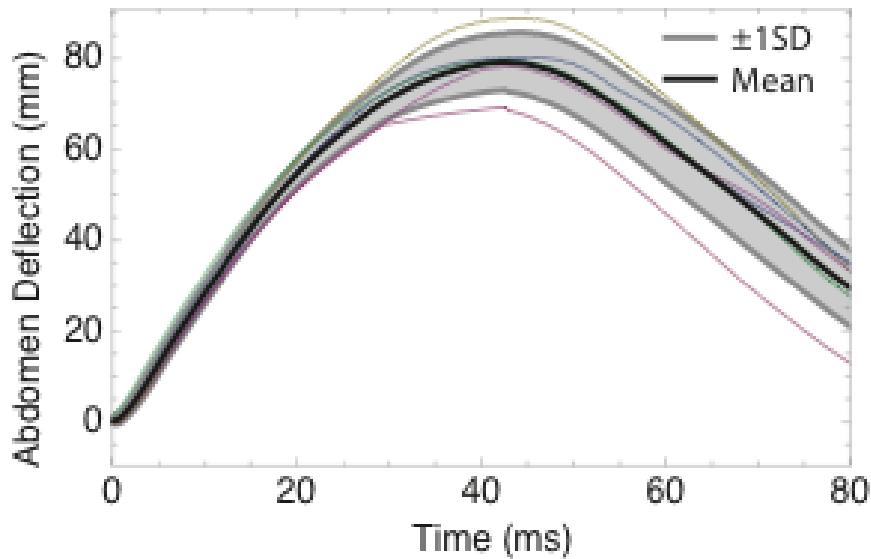
Cadaver Test Matrix

Test Series ID	Gender	Age (Yr)	Height (cm)	Weight (kg)	t-score	Impact Velocity		
						3 m/s	8 m/s	10 m/s
NBA0901	M	86	170	77	-1.8	x		x
NBA0902	M	61	185	82	-0.9	x		
NBA0903	M	50	173	64	1.6	x		x
NBA1004	M	66	173	79	-	x	x	
NBA1005	M	51	183	97	1.2	x	x	
NBA1006	M	34	188	102	2.0	x	x	
NBA1007	M	87	175	73	-	x		

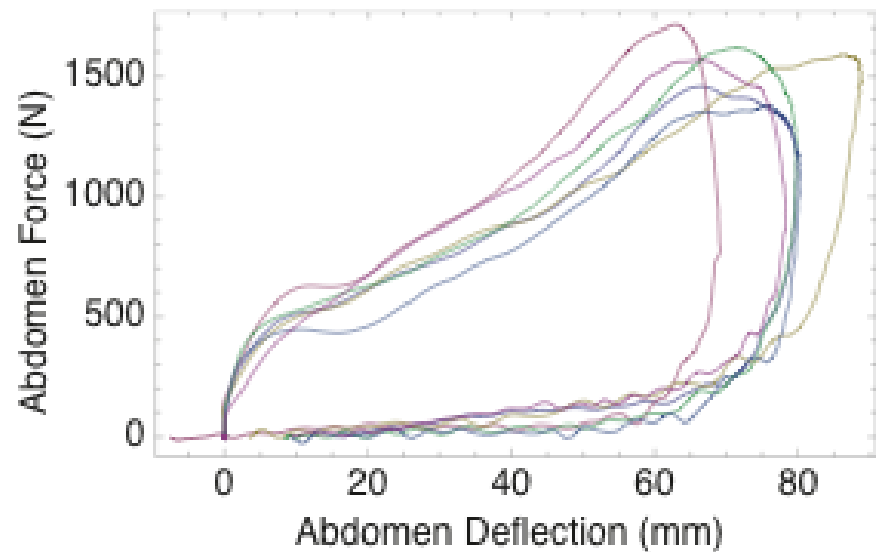
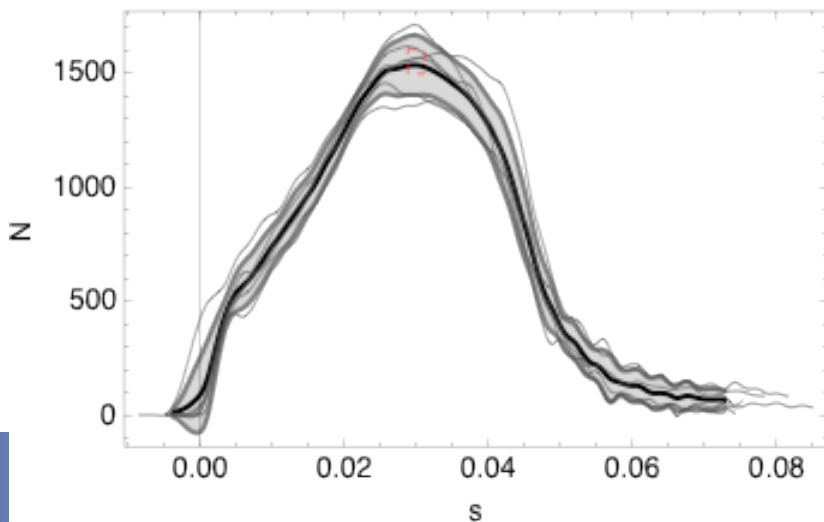
Cadaver Corridor Development

- Normalized using equal-stress equal velocity scaling based on total body mass.
- Calculated ± 1 SD responses using Maltese method

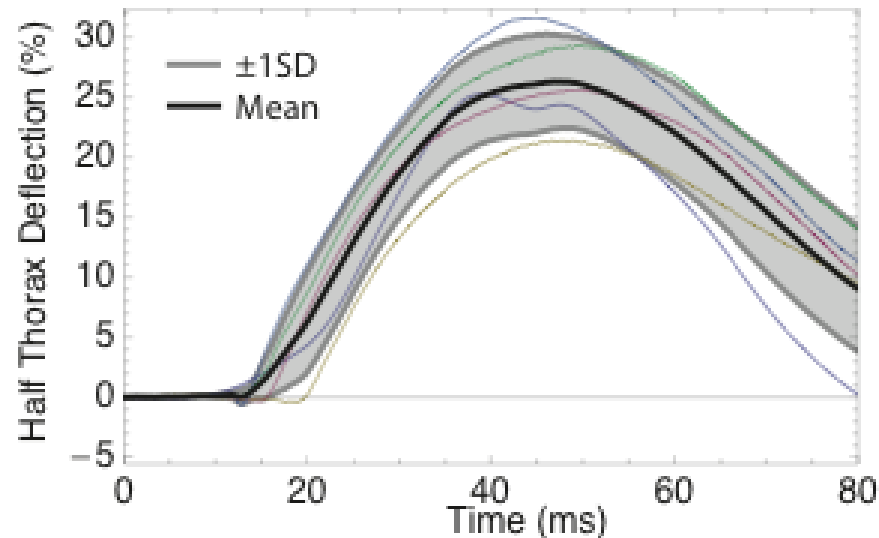
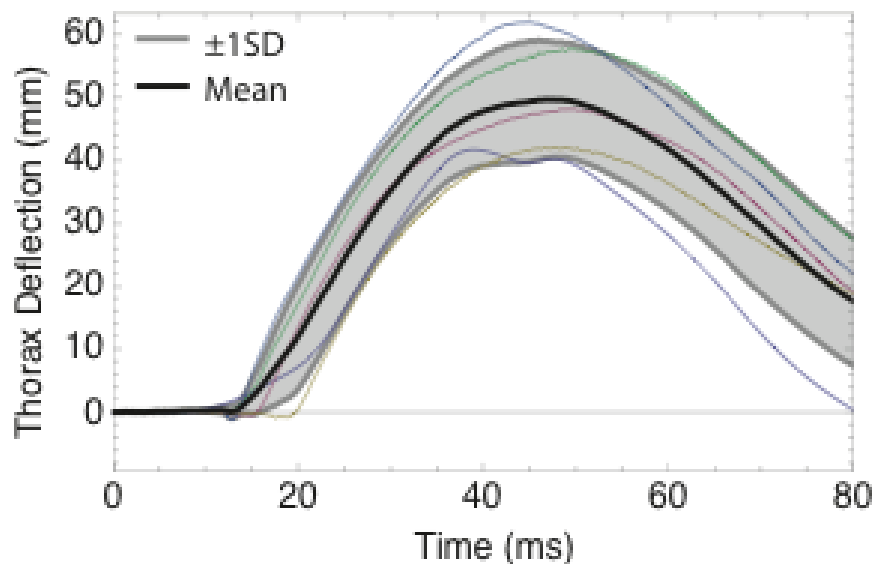
3-m/s Impacts: Abdomen Responses



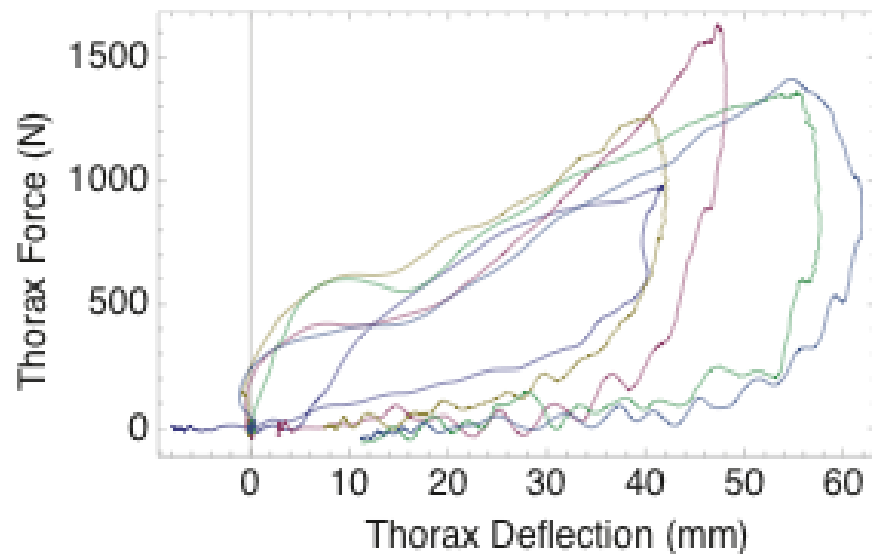
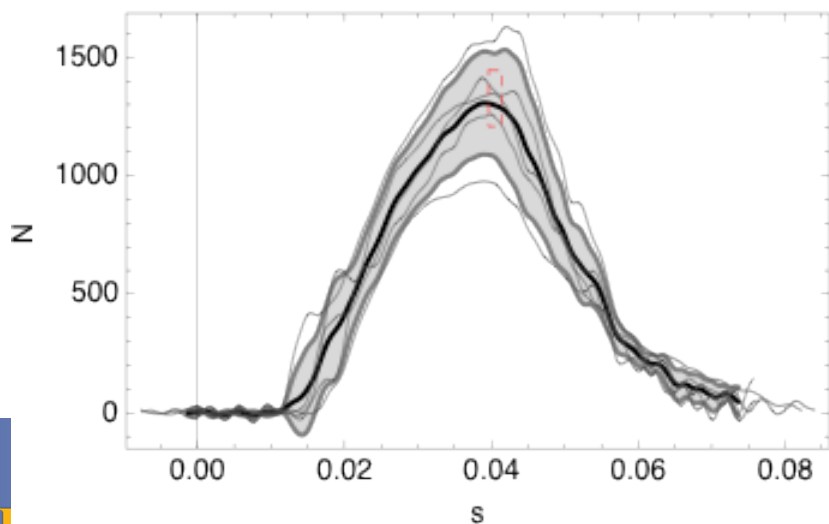
3 m/s Abdomen



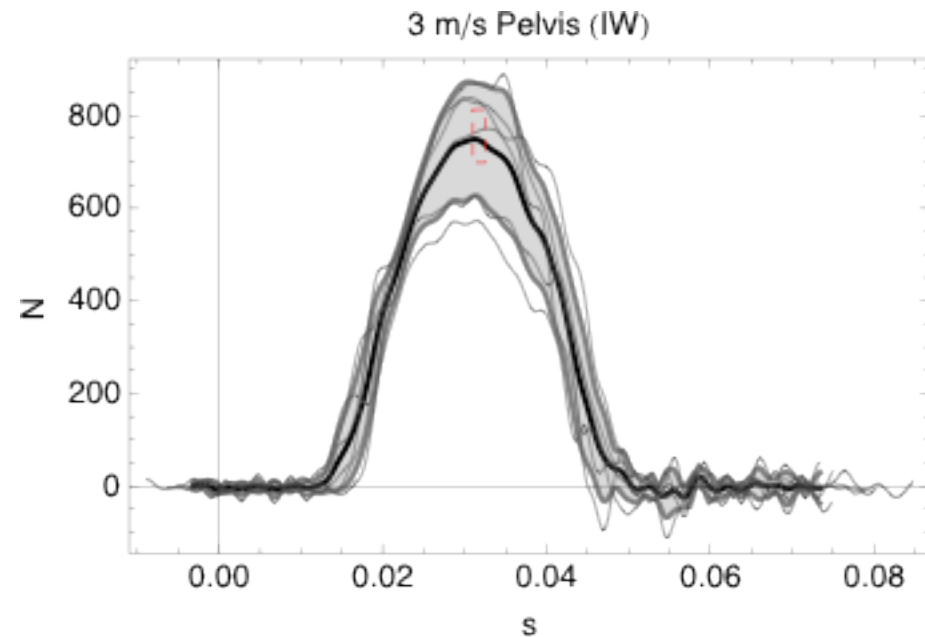
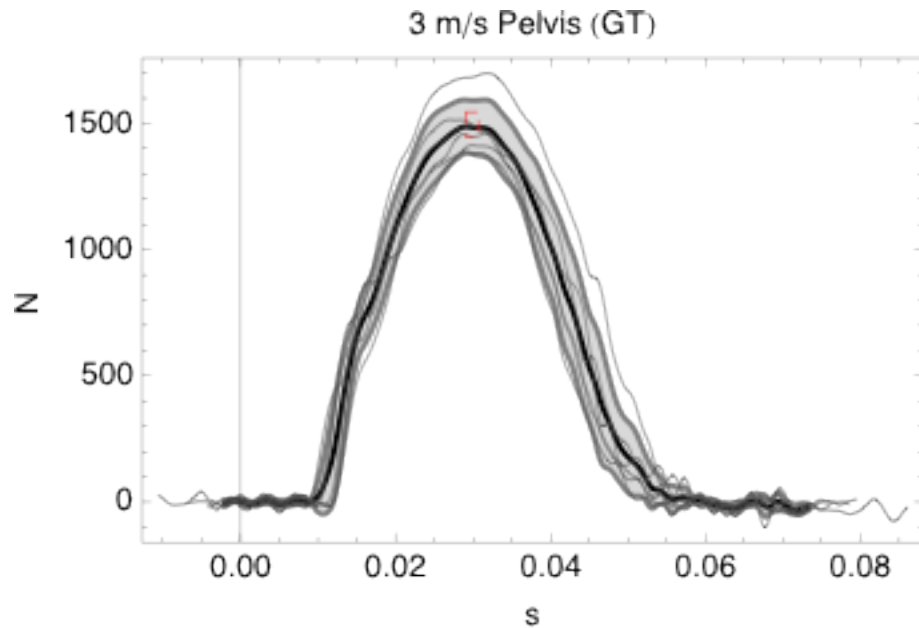
3-m/s Impacts: Thorax Responses



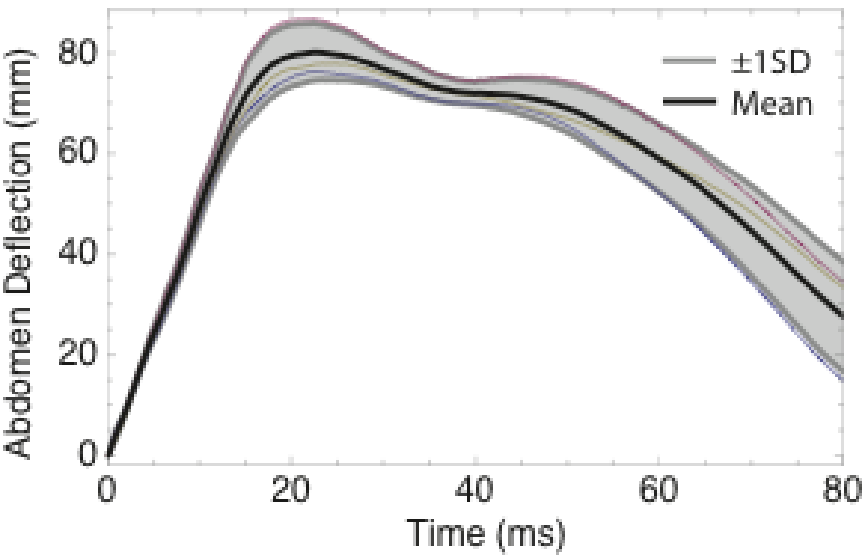
3 m/s Thorax



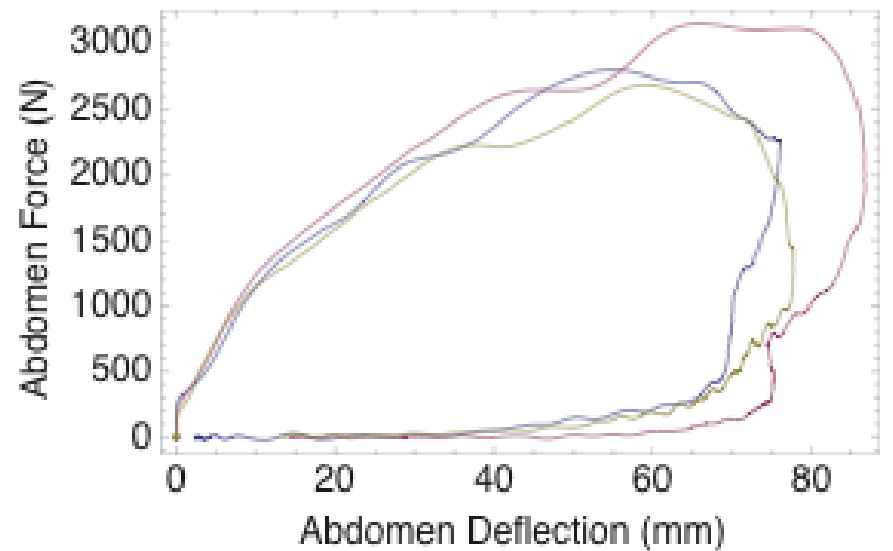
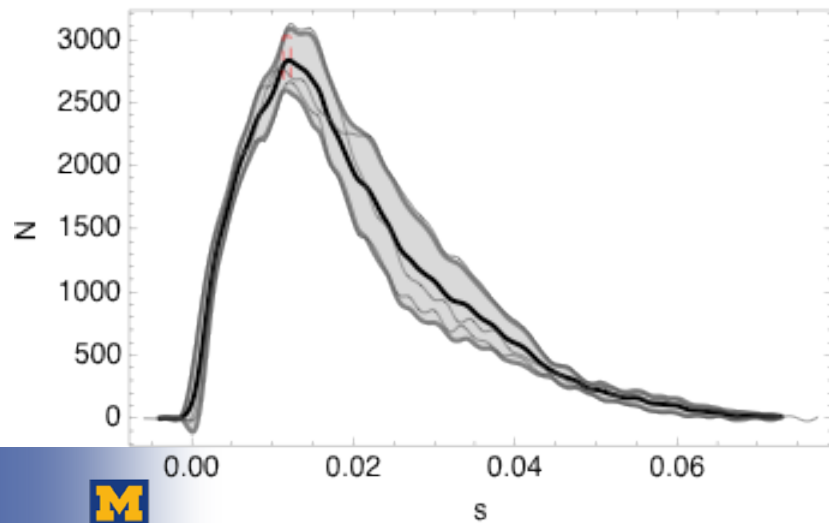
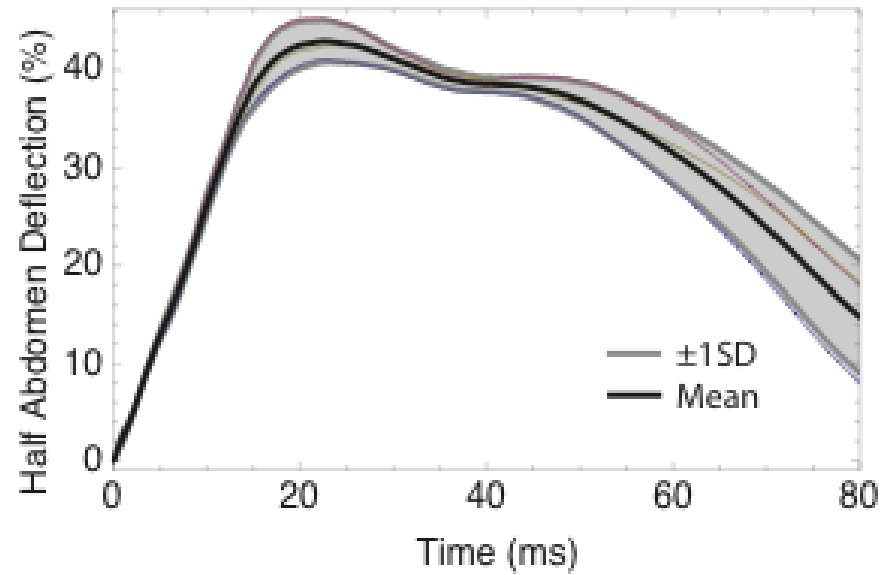
3-m/s Impacts: Applied Pelvic Force Responses



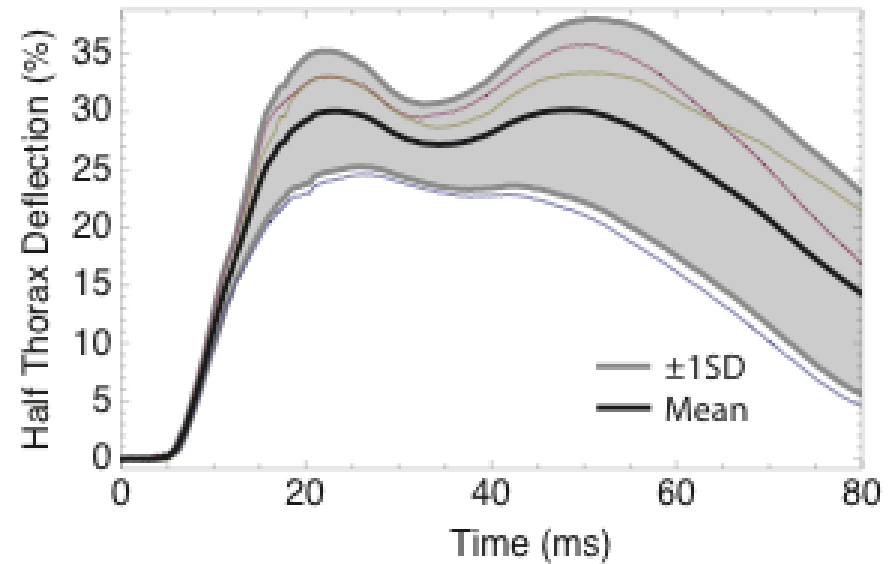
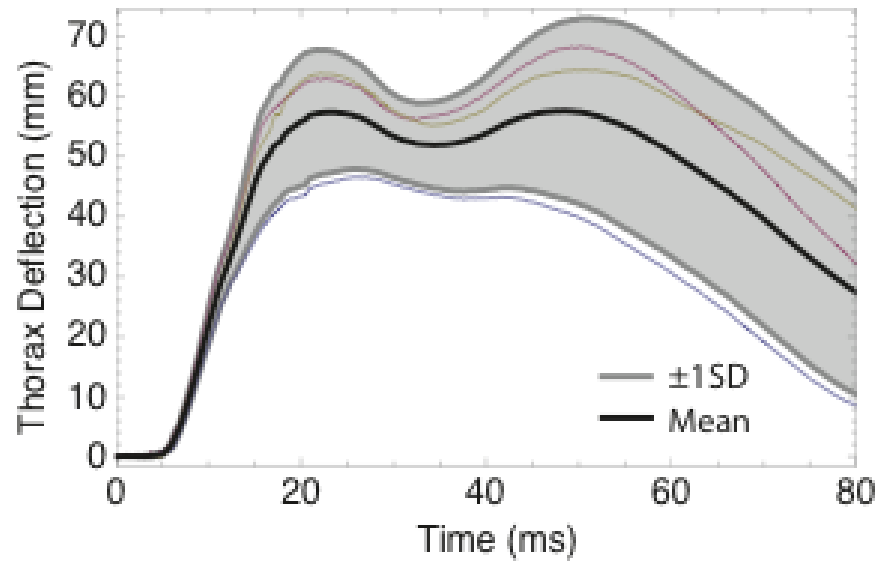
8-m/s Impacts: Abdomen Responses



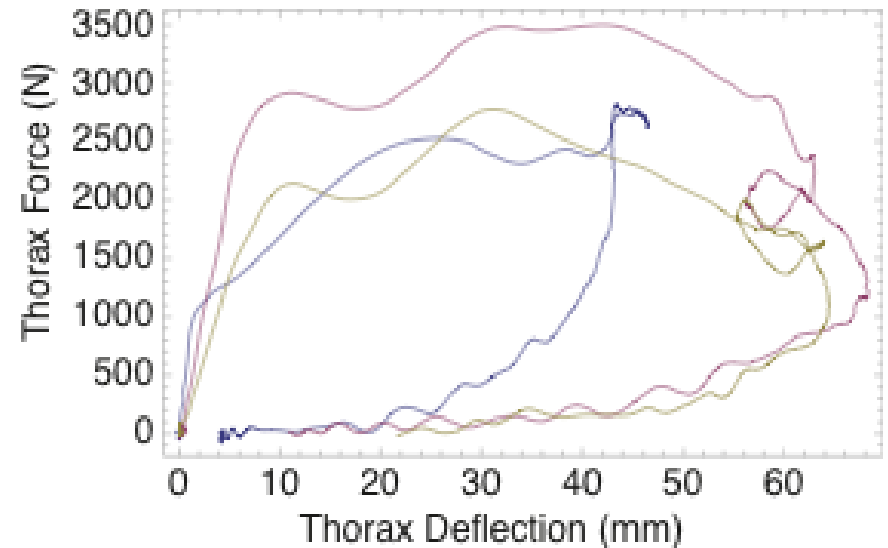
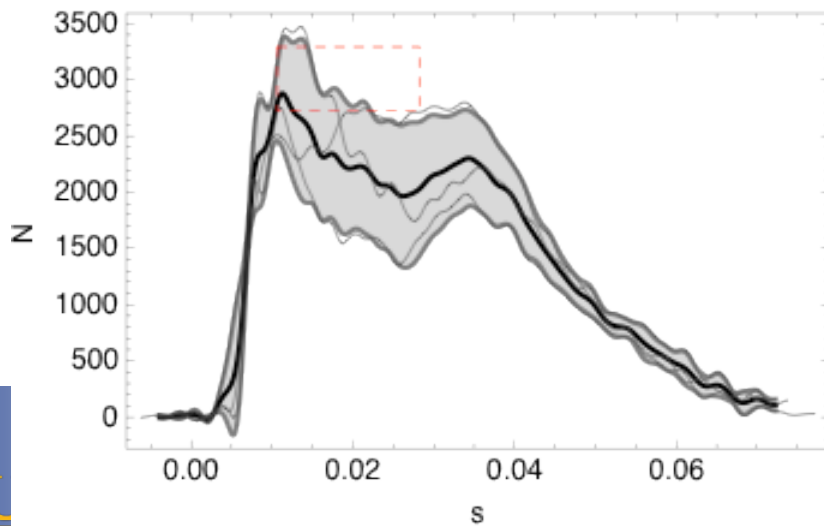
8 m/s Abdomen



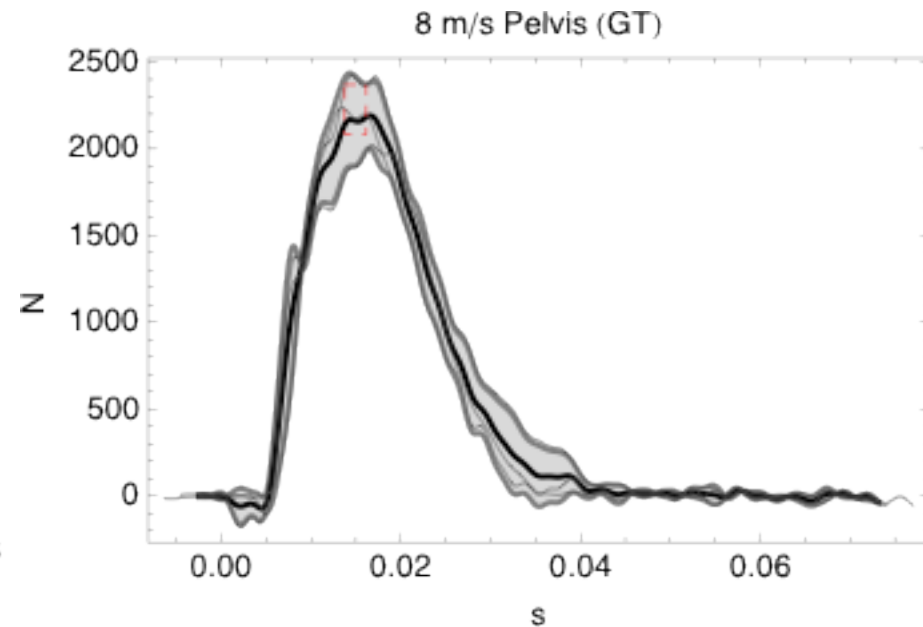
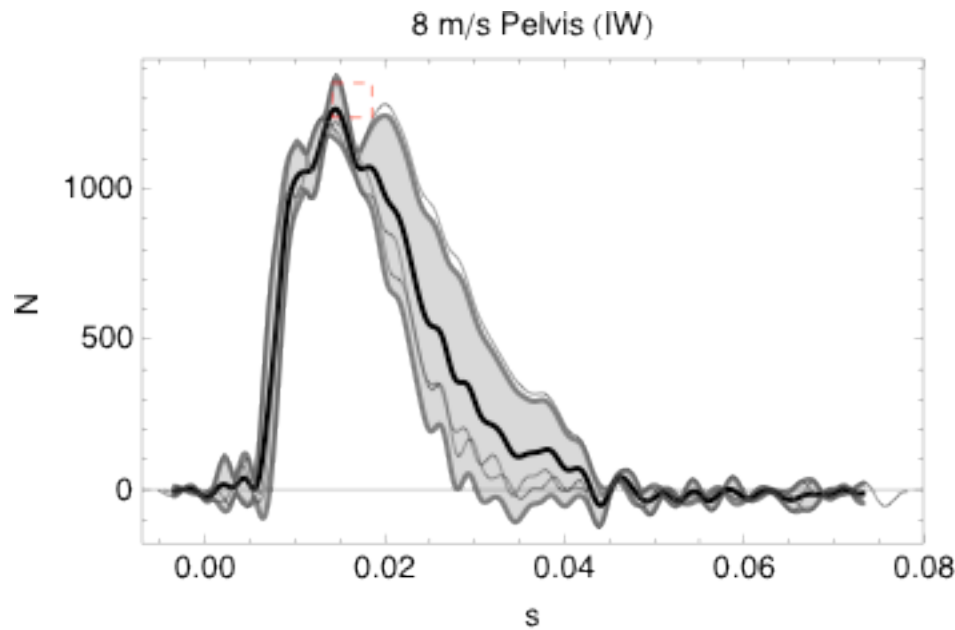
8-m/s Impacts: Thorax Responses



8 m/s Thorax



3-m/s Impacts: Applied Pelvic Force Responses



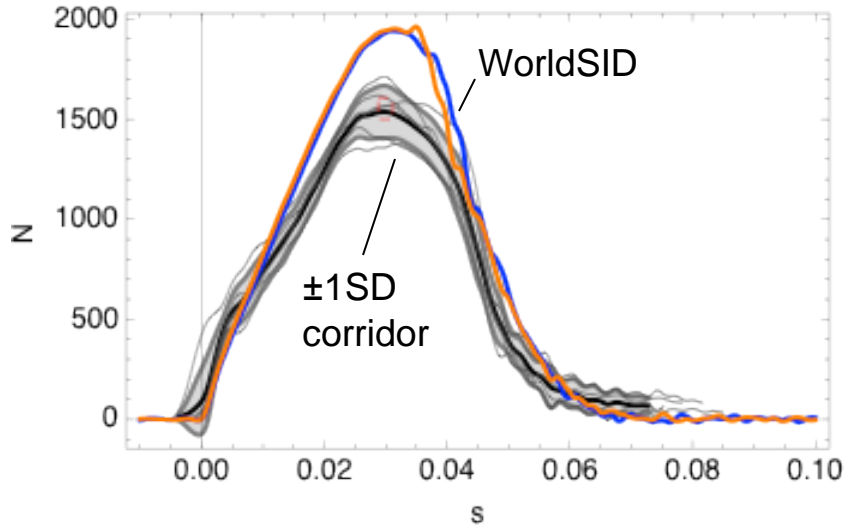
IW = Iliac wing, GT=greater trochanter

WorldSID test matrix

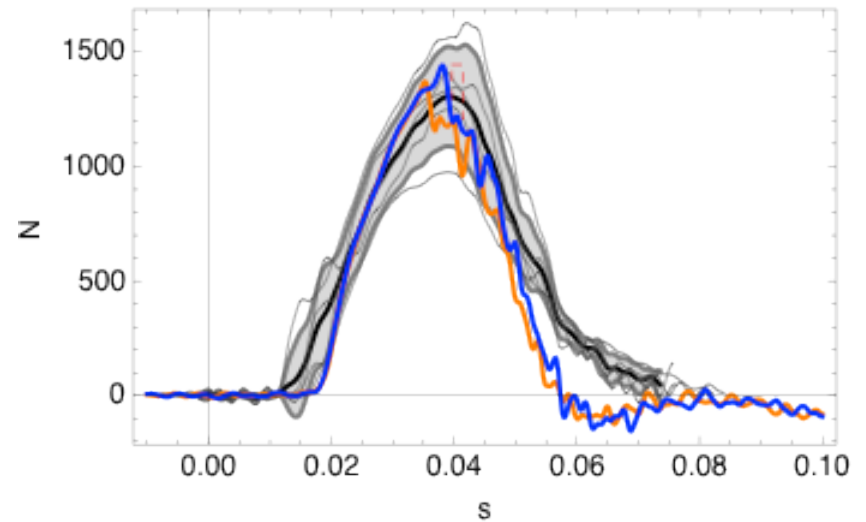
- 3 m/s, 8 m/s, and 10 m/s impact velocities
- Two impactor wall configurations
 - Padded with abdomen offset and
 - Padded with pelvis plus abdomen offset (more like FMVSS 214)
- 4 repeats in each test condition.
- Measure abdomen and chest deflection with chestbands and IR-TRACCs
- Recalibrate at halfway point in test matrix and after all tests are completed.

Preliminary Comparison of WorldSID Force Responses to Force Corridors from 3 m/s Impacts

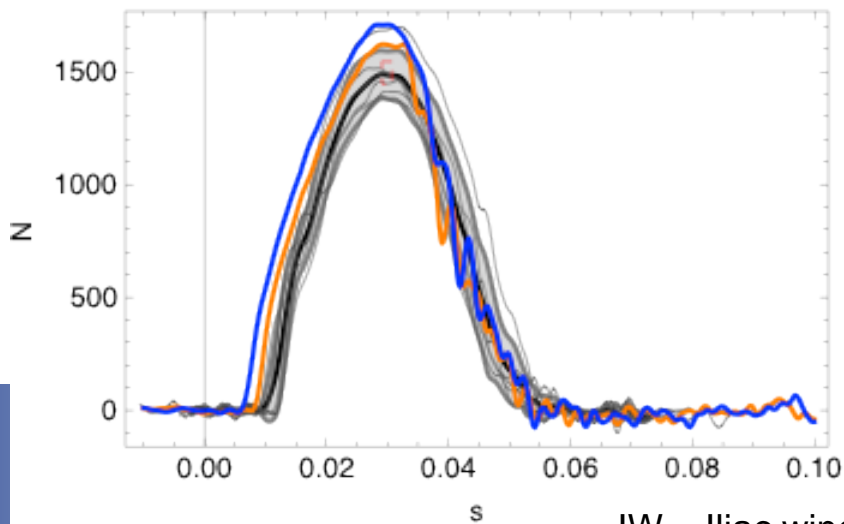
3 m/s Abdomen



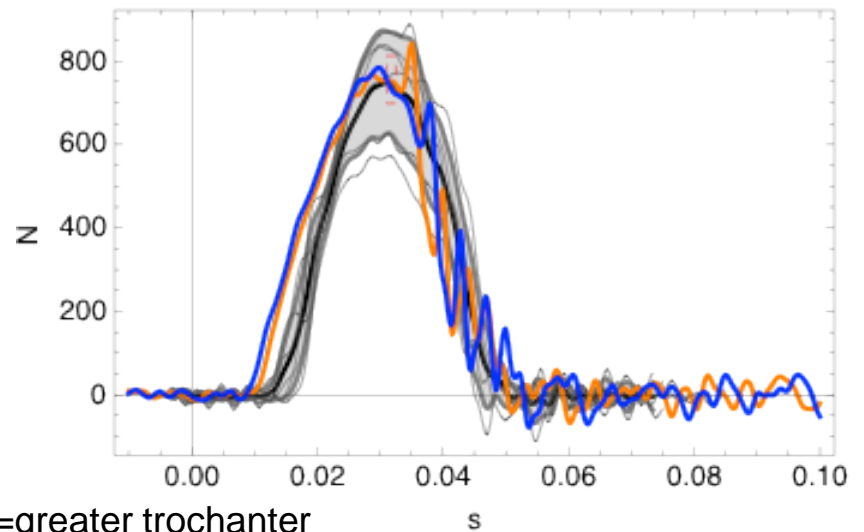
3 m/s Thorax



3 m/s Pelvis (GT)

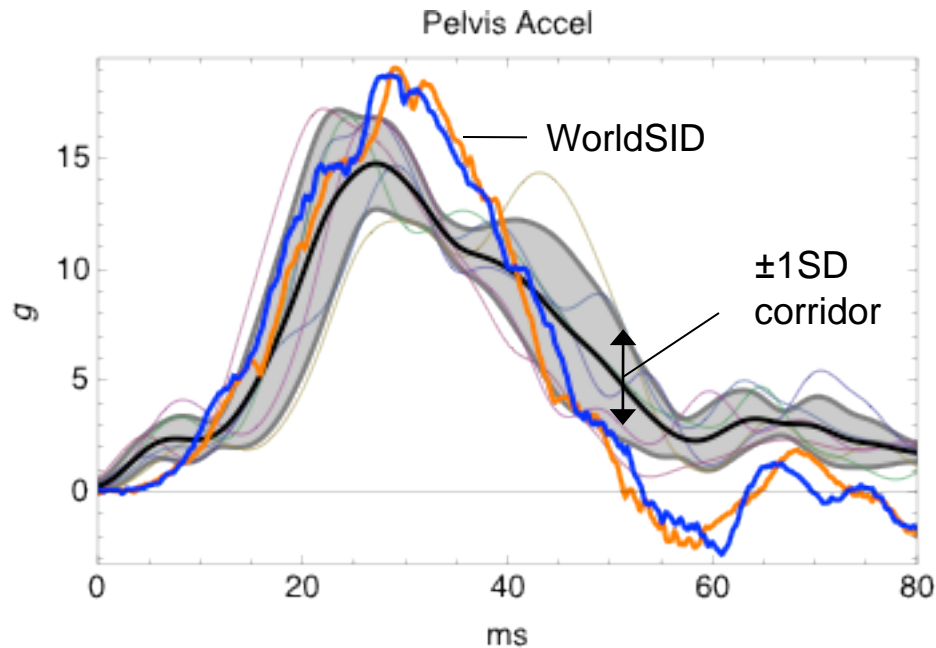


3 m/s Pelvis (IW)

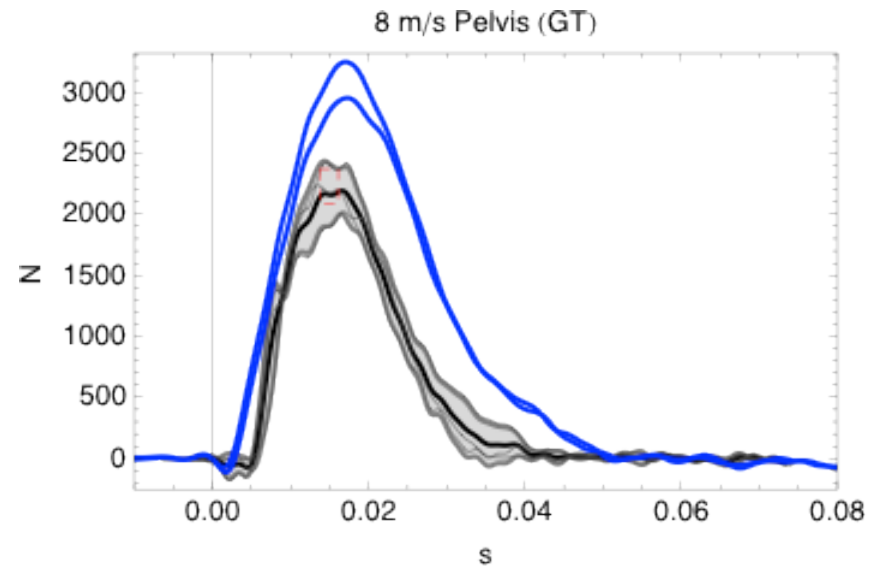
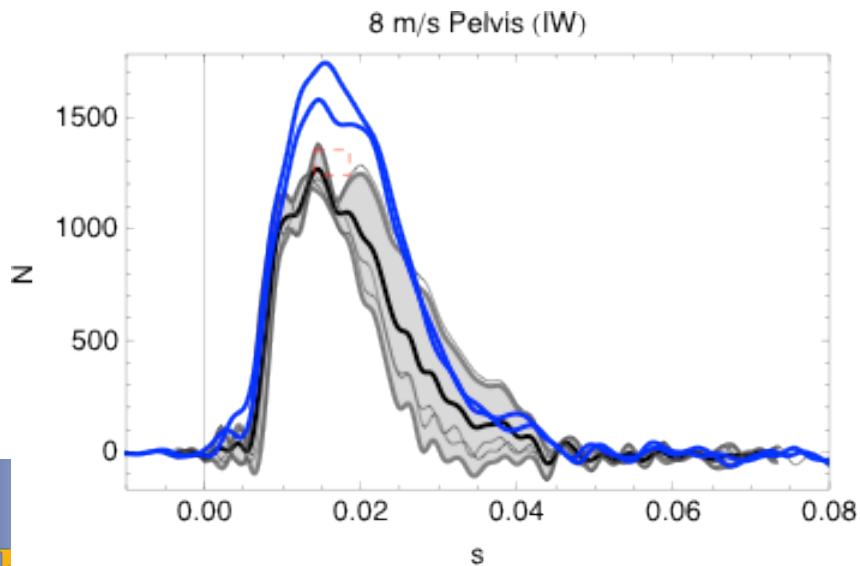
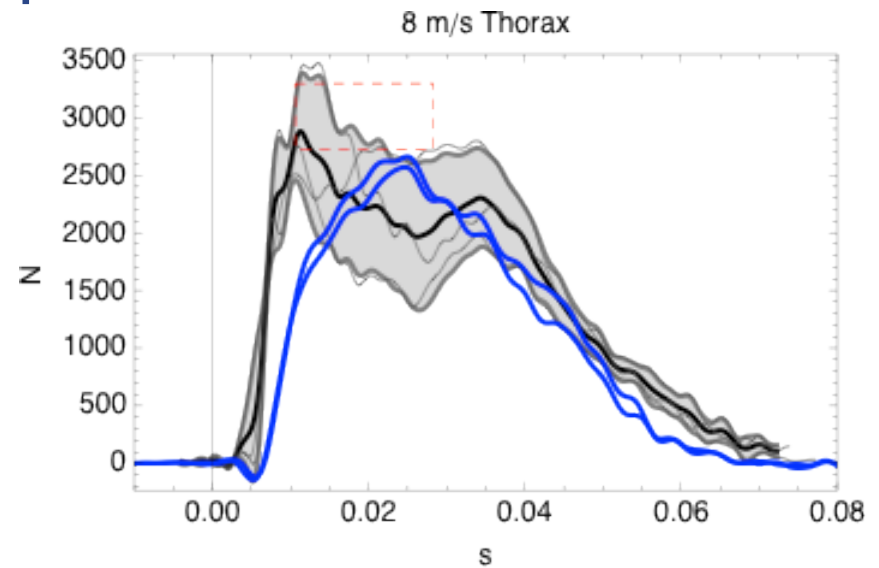
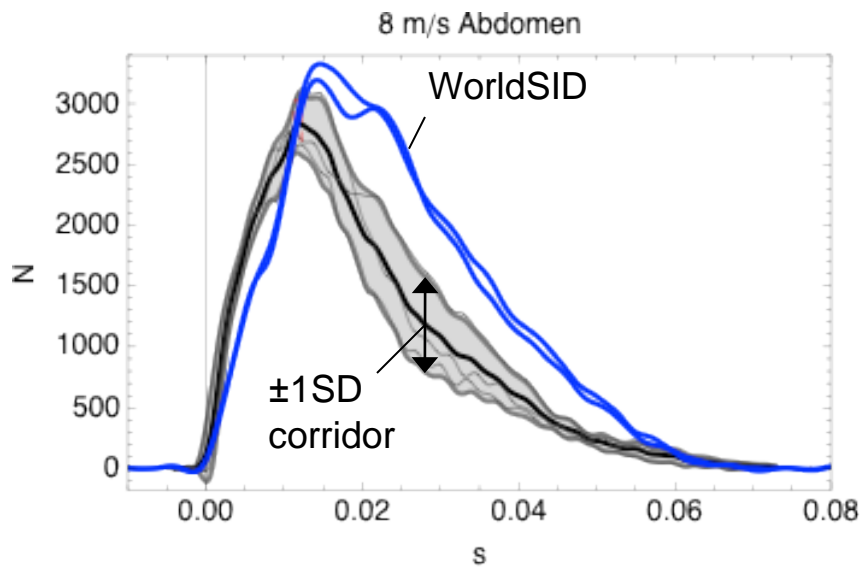


IW = Iliac wing, GT=greater trochanter

Preliminary Comparison of WorldSID Pelvis Y-Axis Acceleration Response to Force Corridors from 3 m/s Impacts

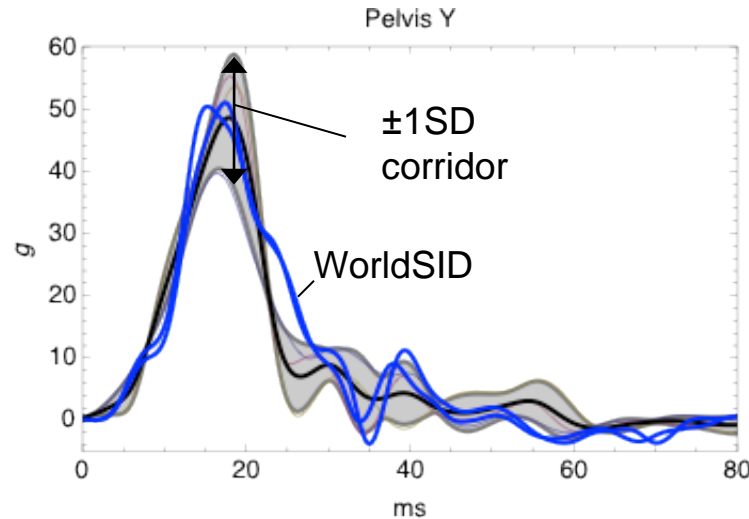


Preliminary Comparison of WorldSID to 8 m/s Responses



IW = Iliac wing, GT=greater trochanter

Preliminary Comparison of WorldSID Pelvis Y-Axis Acceleration Response to Force Corridors from 3 m/s Impacts



- Thoughts on differences in 8 m/s pelvis response
 - *Findings are preliminary*
 - Suggest that pelvis may be too stiff and may have too much tightly coupled mass.

Next Steps

- Compare thoracic and abdominal deflection measurements from cadavers (chestband) to WorldSID deflection measurements (IR-TRACC and chestband)
- Complete World SID testing and better identify reasons for response differences.
- Write ESV paper comparing WorldSID and cadaver 3 m/s and 8 m/s responses.