

GTR No. 9 Amendment

NHTSA test data analysis

NHTSA Understanding of Amendment 3

Rationale for using Aiming/Measuring Point

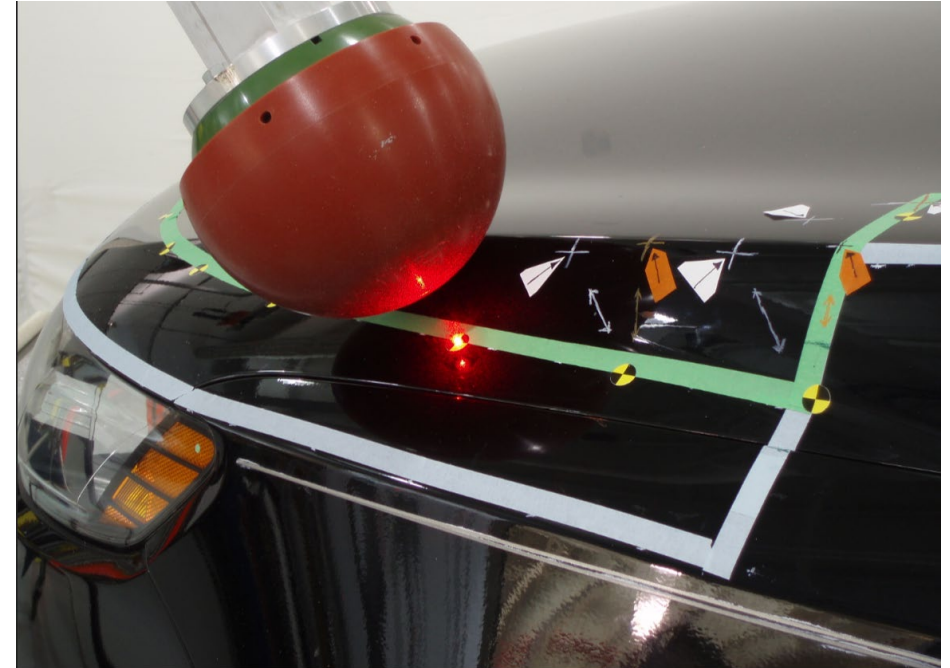
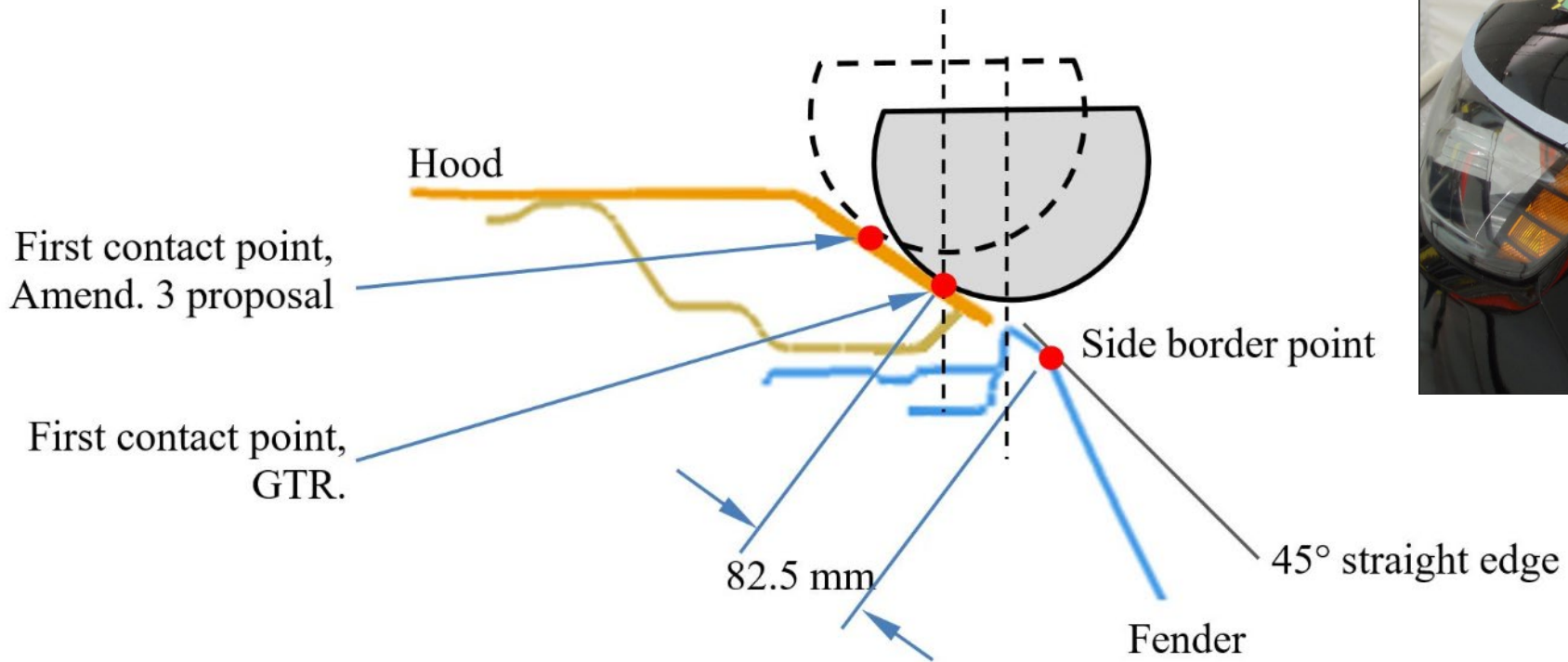
- The Aim Point (AP) or Measuring Point (MP) method is preferred over the Point of First Contact (POFC) method along the Side Reference Line (SRL) because it moves the headform launch inboard by a few mm.
- The amount that it moves inboard is dependent on the angle of incidence: for an angled, clamshell-style hood, the AP launch position is moved inboard of POFC by somewhere between 0 – 82.5 mm depending on the amount of slope. For a flat hood, it is not moved at all.

NHTSA Understanding of Amendment 3

Rationale for using Aiming/Measuring Point

- The AP/MP method is preferred because it prevents impacts on angled areas that could cause z-axis spinning of the headform upon impact, which in some cases may influence the HIC15 computation. Such spinning is an unwanted artifact of the headform component test (i.e., human heads are attached to the body and do not spin).
- Thus, the AP/MP method is preferred because it tends to move the launch point inboard and away from the angled surface near the edge of clamshell-style hoods.

AP vs. POFC Targeting Methods



NHTSA Evaluation of HIC and Head Rotation

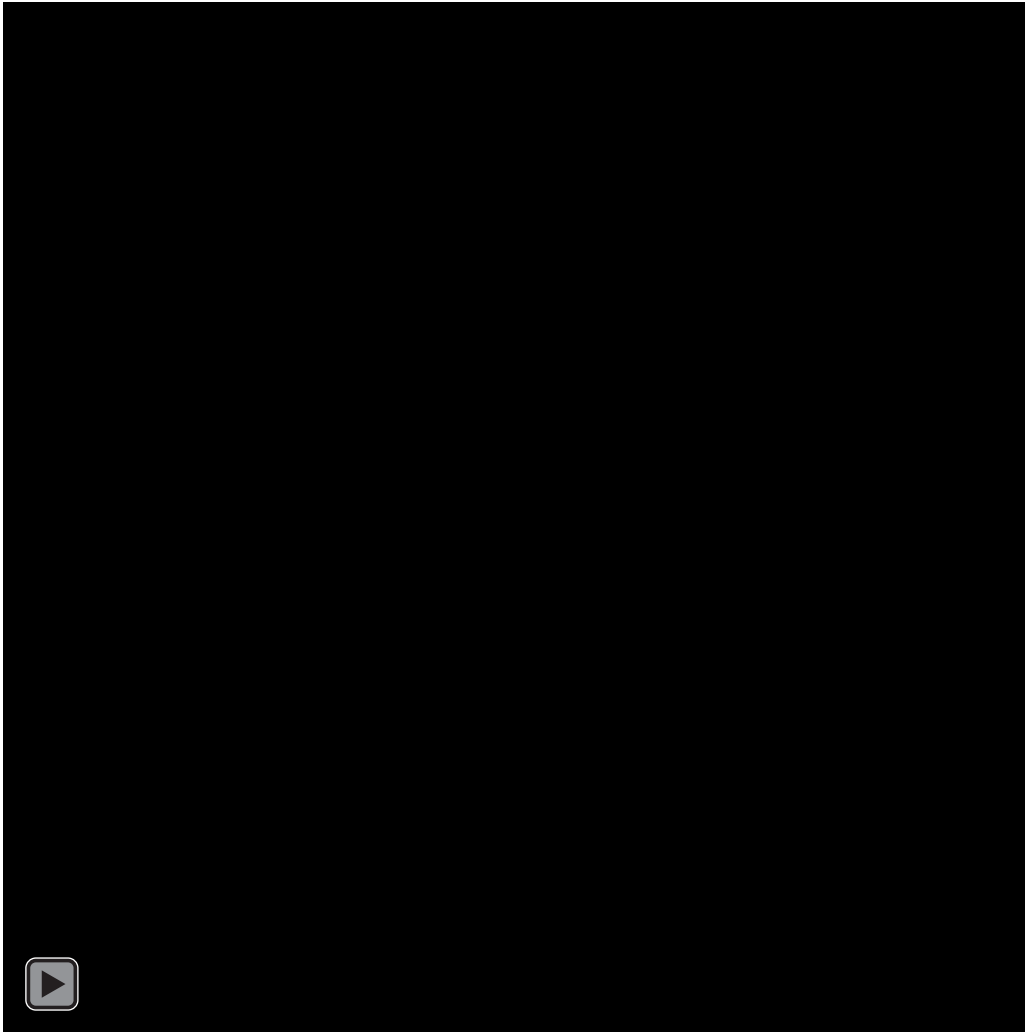
- Vehicle structures influence the higher HIC score for impacts close to the SRL – the effect of headform spinning does not contribute to HIC.
- In many instances, the difference in initial headform contact location between the AP vs. POFC does not significantly affect the angle of incidence.
- In these instances, spinning is not reduced by going from POFC to AP.
- The reason why the 82.5 mm margin was devised in the first place: because it was accepted that the hood-fender junction is a necessary "hard spot" (i.e., closure of the hood along the edges is needed for the hood to function).

Supporting Analysis

- NHTSA tests on both “clamshell” and “flat” hoods where HIC15 is higher for impacts closer to the SRL.

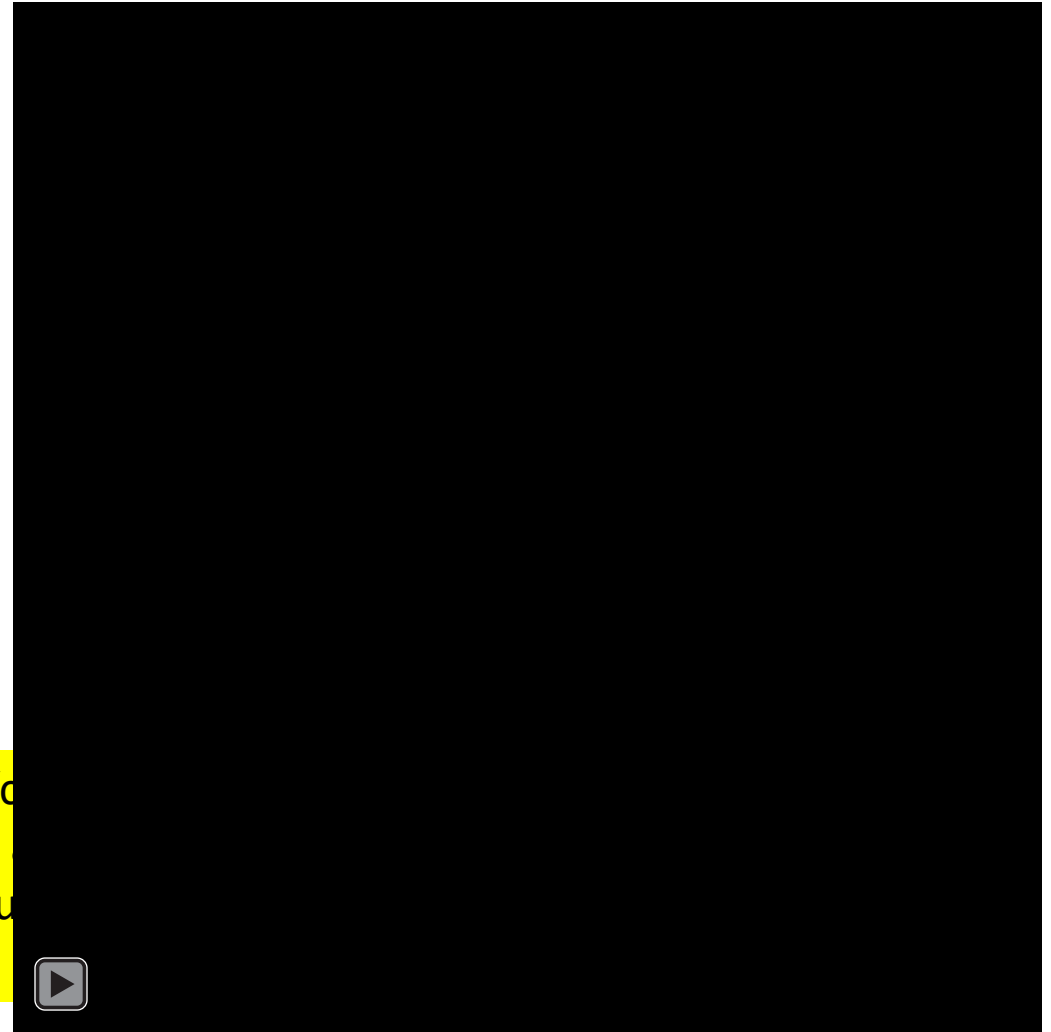
Ref: Vehicle Hood Testing To Evaluate Pedestrian Headform Reproducibility, GTR No. 9 Test Procedural Issues, And U.S. Fleet Performance, NHTSA-2008-0145-0014.

2010 Kia Forte – Side, Passenger Side



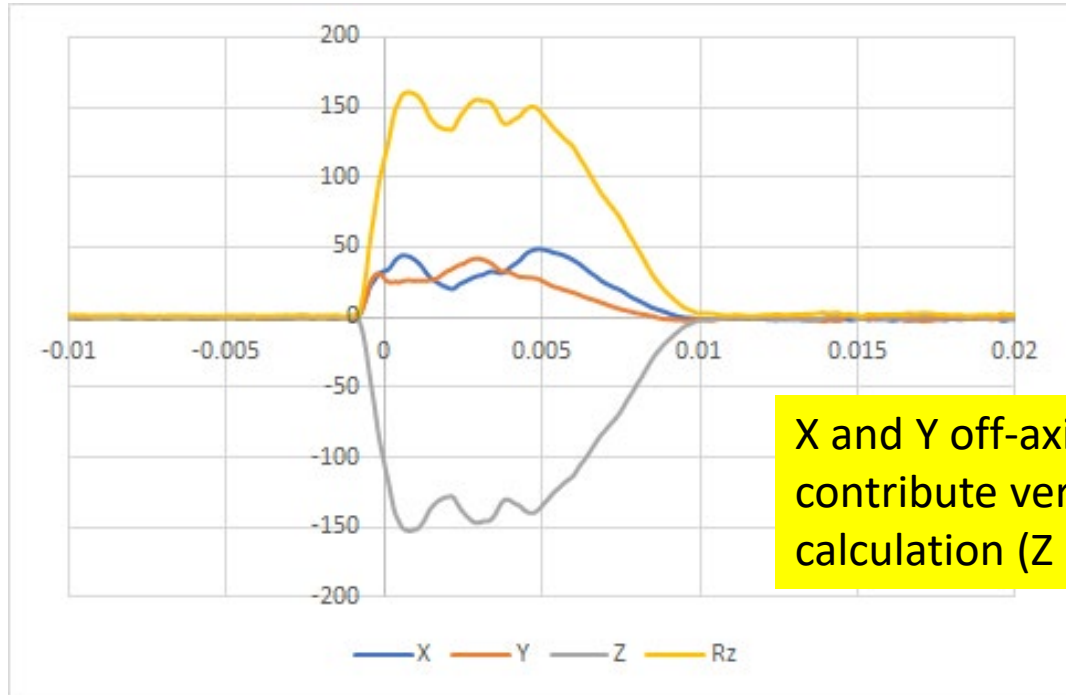
Point of First Contact Method
HIC15 = 1587

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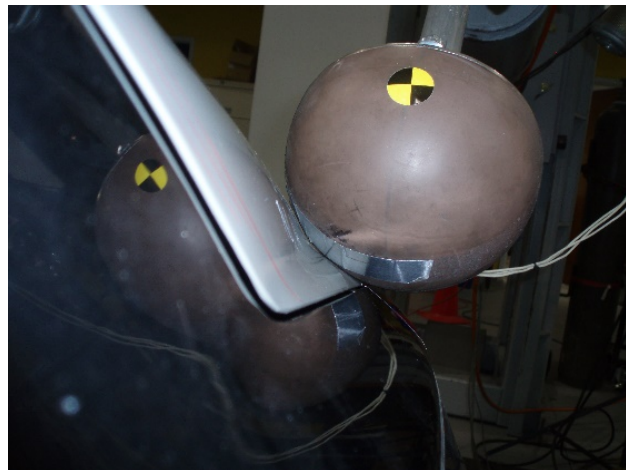
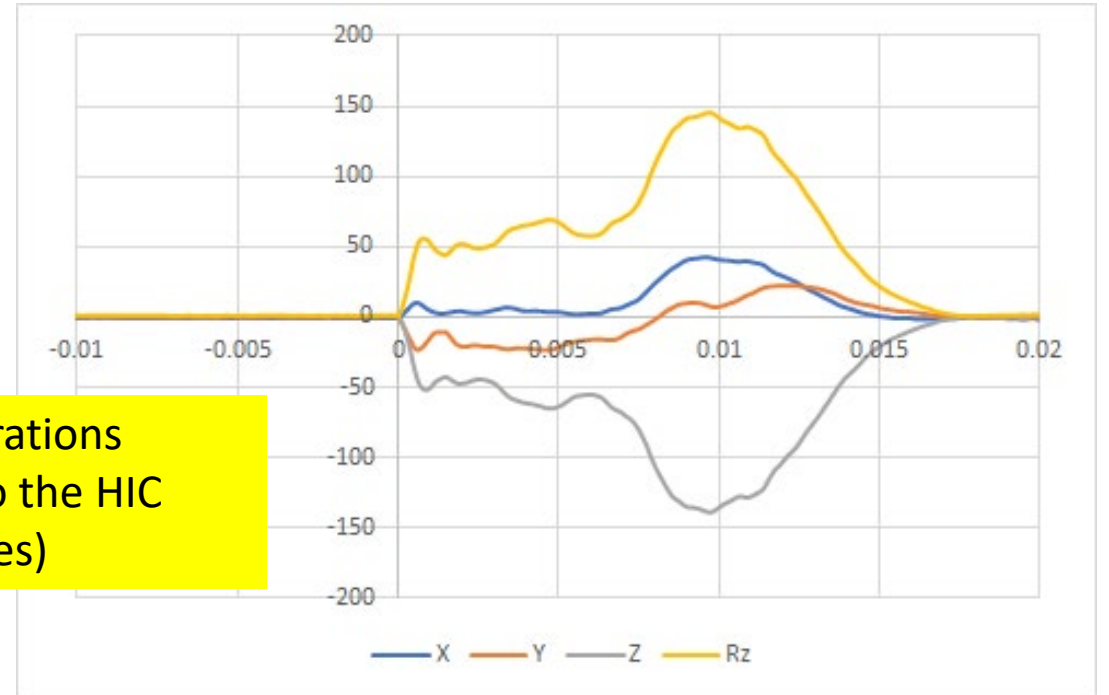


Aiming Point Method
HIC15 = 927

2010 Kia Forte – Side, Passenger Side

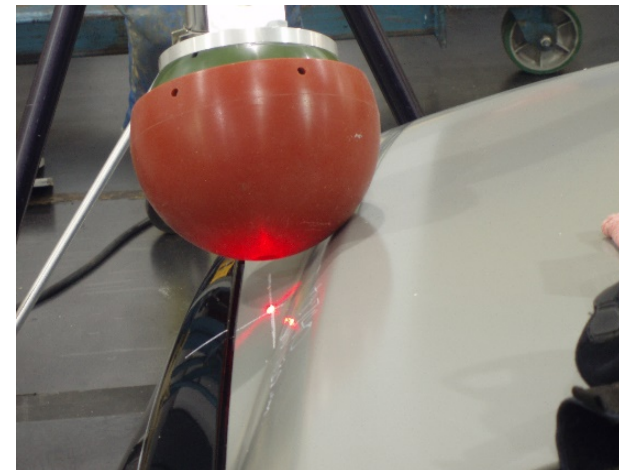


X and Y off-axis accelerations contribute very little to the HIC calculation (Z dominates)



Point of First Contact Method

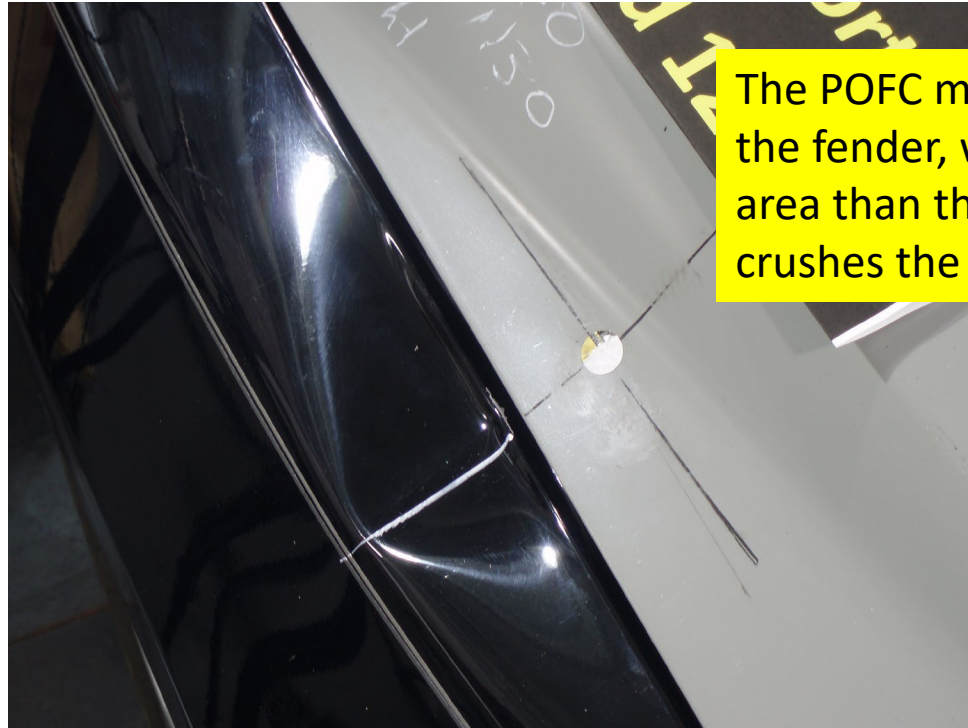
HIC15 = 1587



Aiming Point Method

HIC15 = 927

2010 Kia Forte – Side, Passenger Side



The POFC method encompasses the fender, which is a much harder area than the AP method, which crushes the hood primarily



Point of First Contact Method

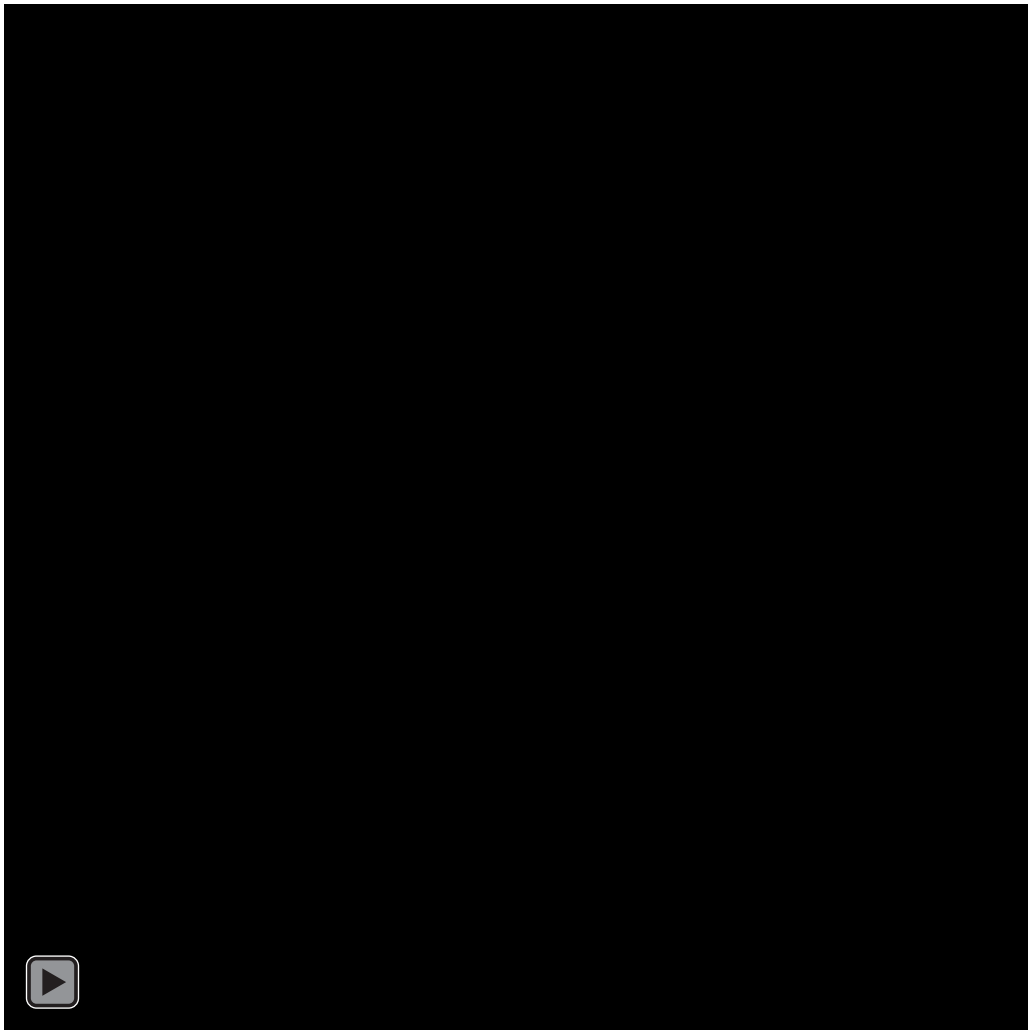
HIC15 = 1587



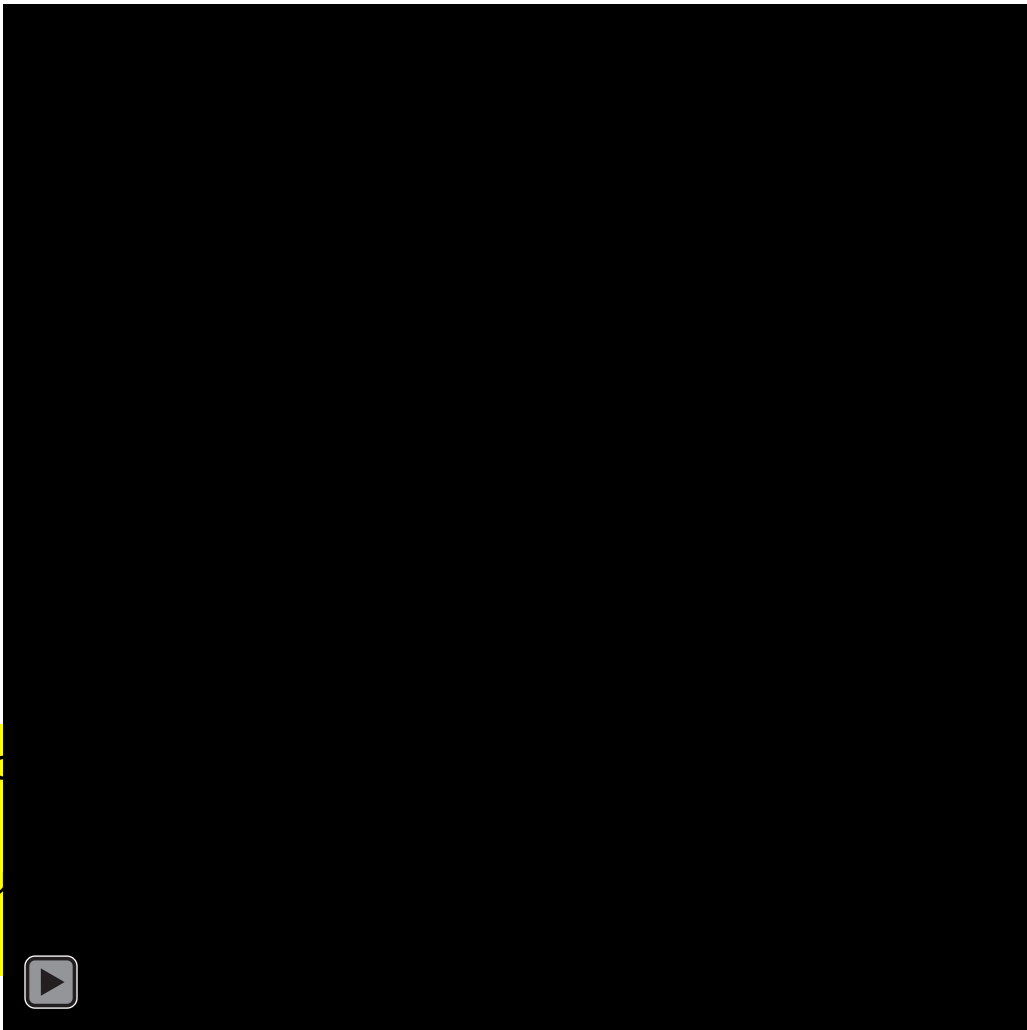
Aiming Point Method

HIC15 = 927

2010 Buick LaCrosse – Side, Driver Side

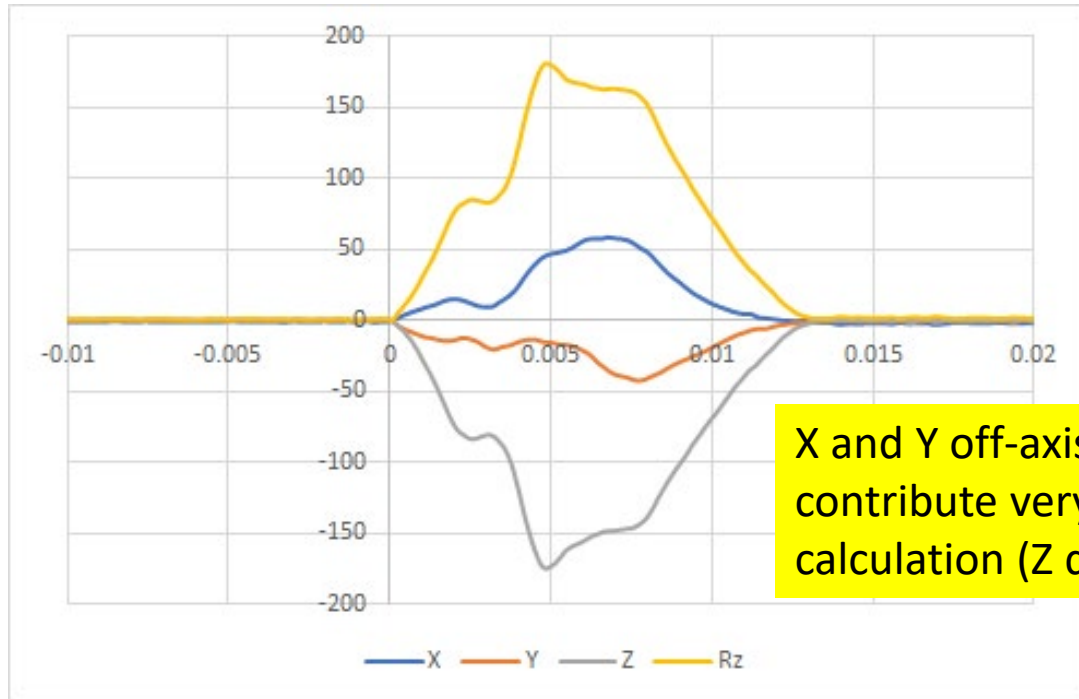


Point of First Contact Method
HIC15 = 1602

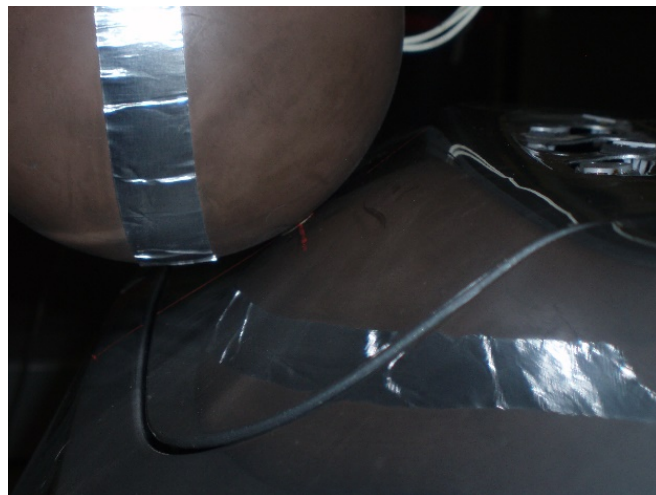
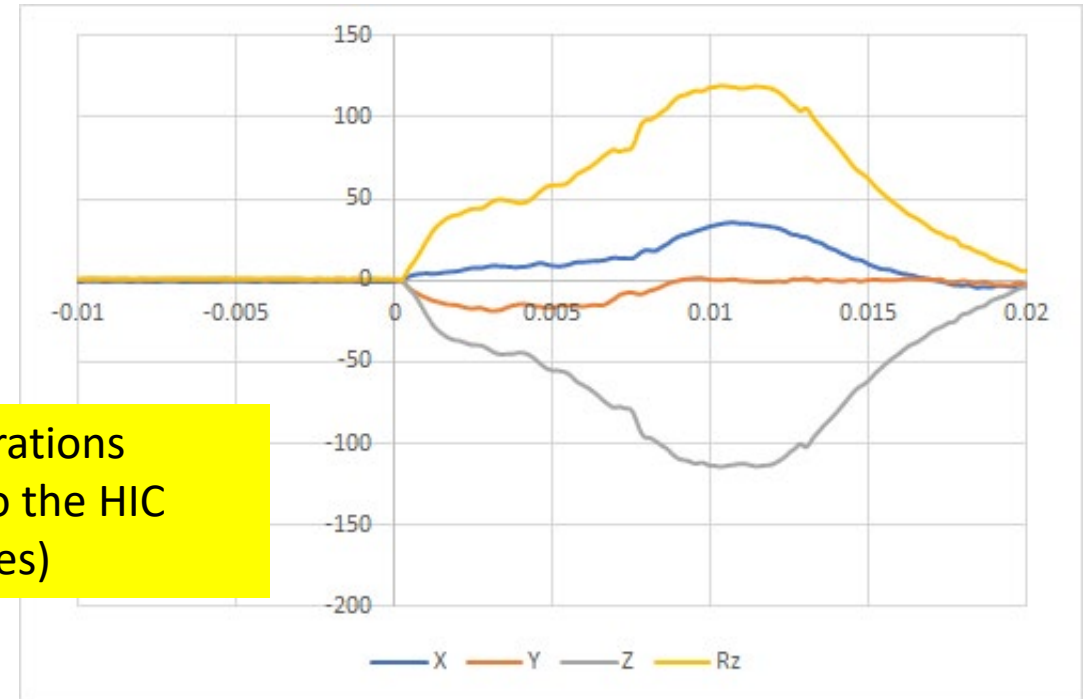


Aiming Point Method
HIC15 = 888

2010 Buick LaCrosse – Side, Driver Side



X and Y off-axis accelerations contribute very little to the HIC calculation (Z dominates)



Point of First Contact Method

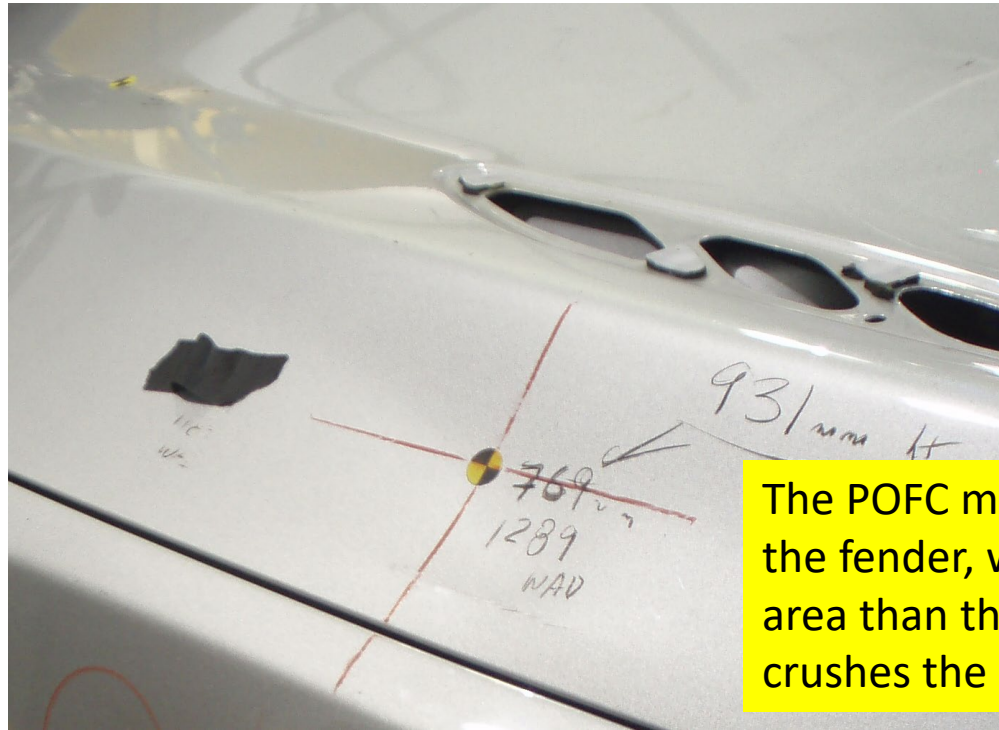
HIC15 = 1602



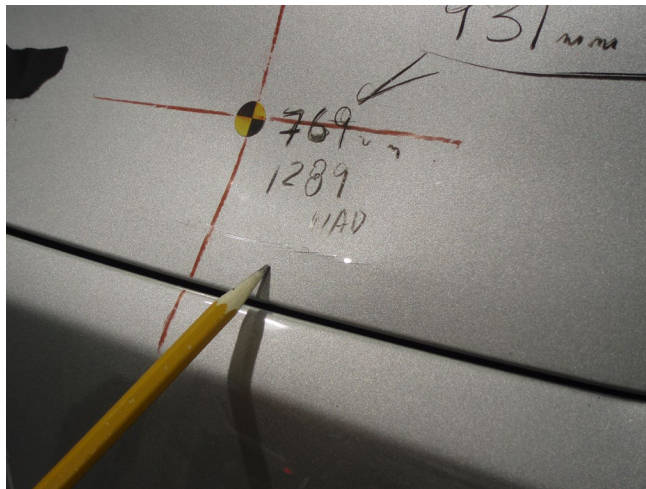
Aiming Point Method

HIC15 = 888

2010 Buick LaCrosse – Side, Driver Side



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Point of First Contact Method

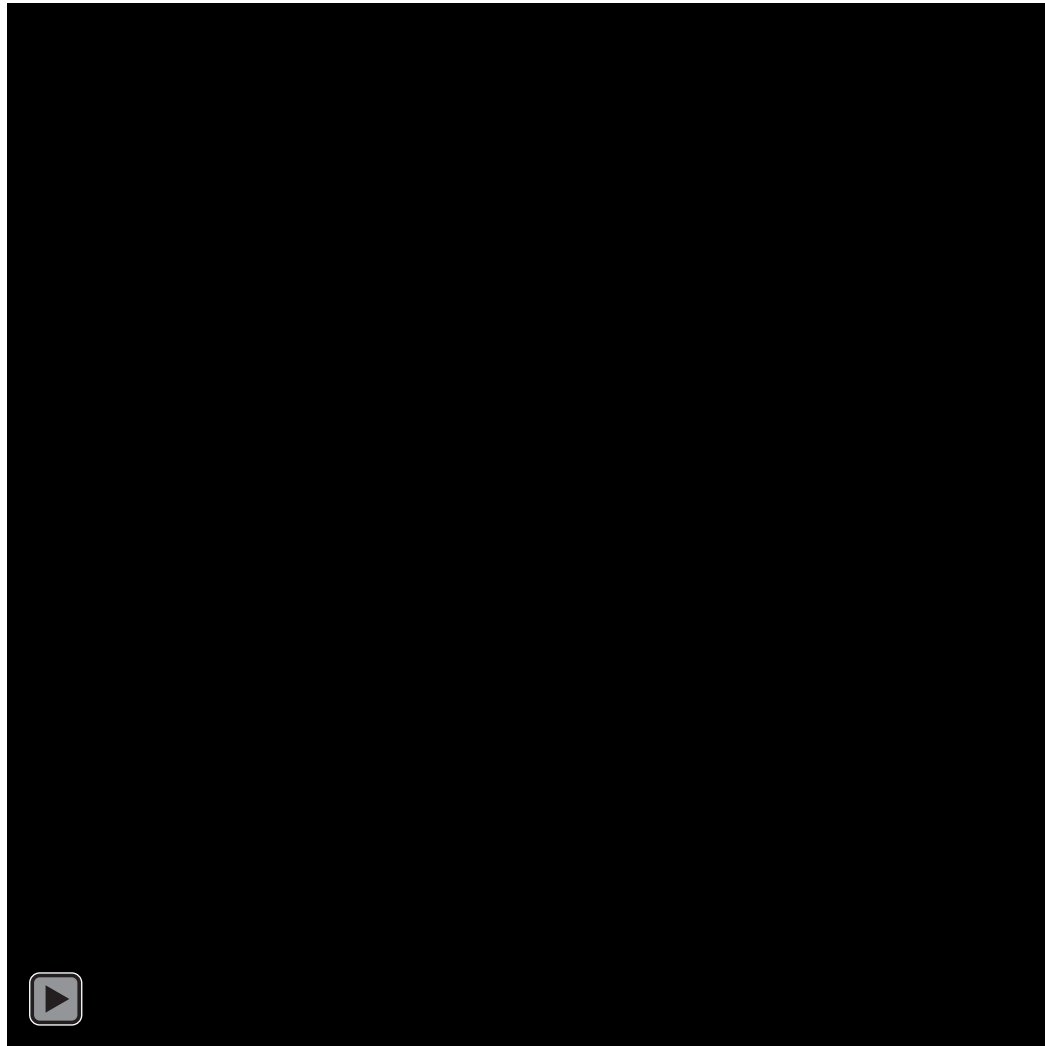
HIC15 = 1602



Aiming Point Method

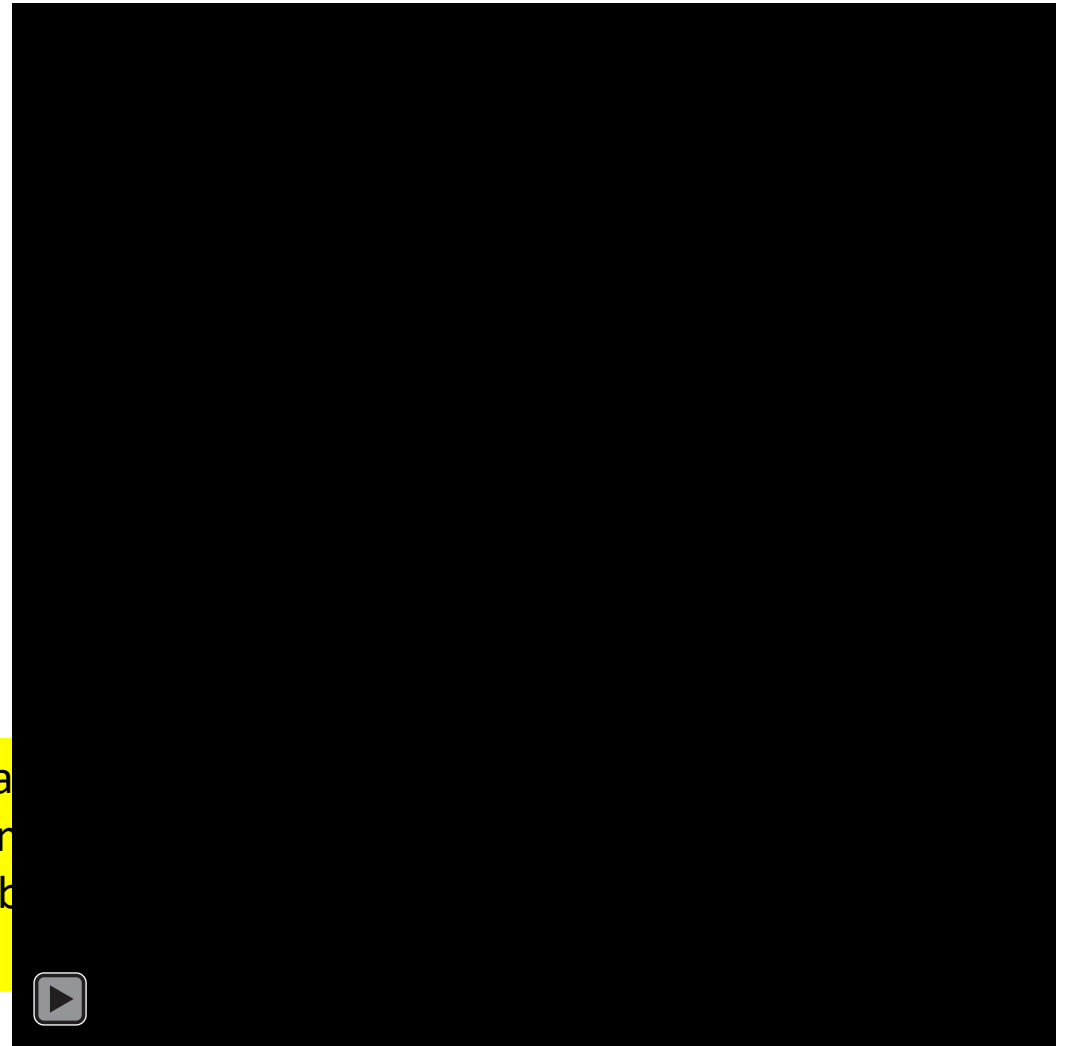
HIC15 = 888

2010 Acura MDX – Rear, Passenger/Driver Side



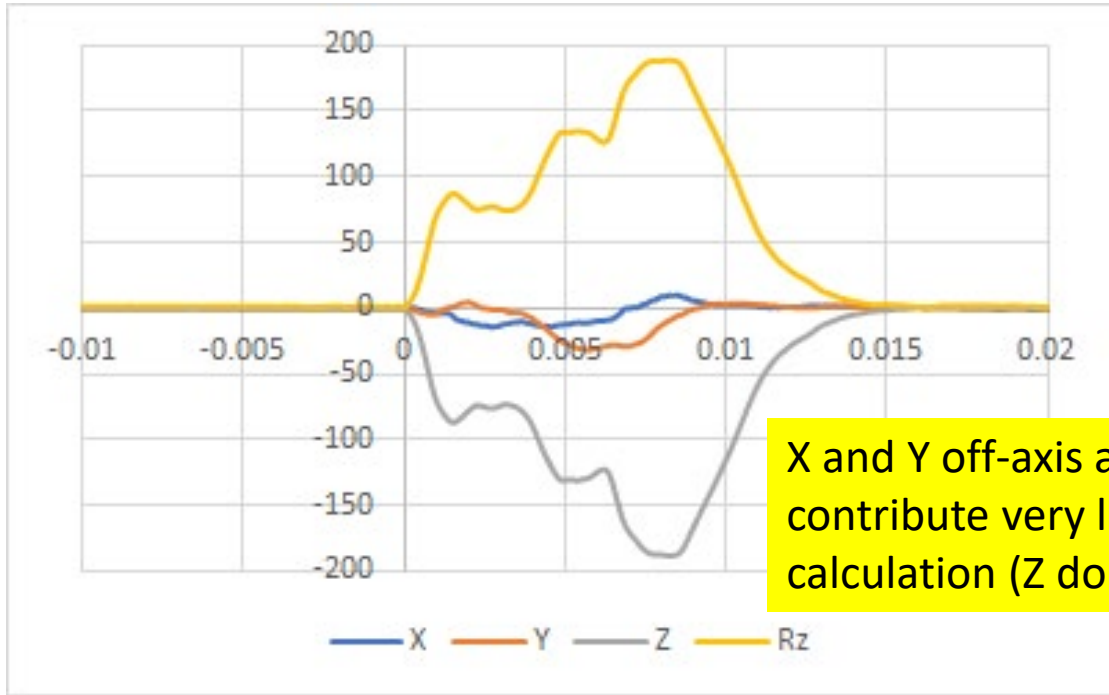
Point of First Contact Method
HIC15 = 1100

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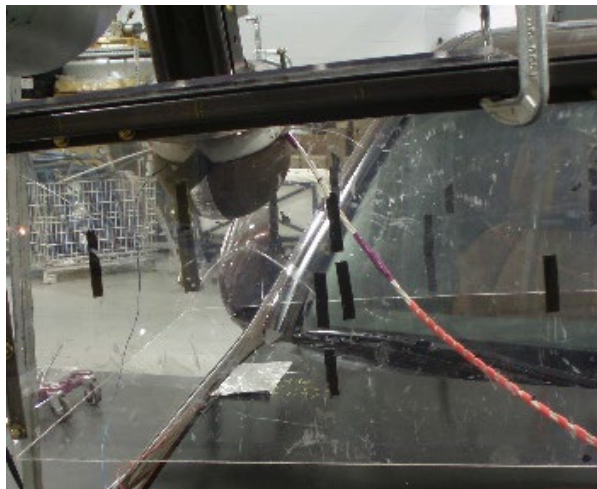
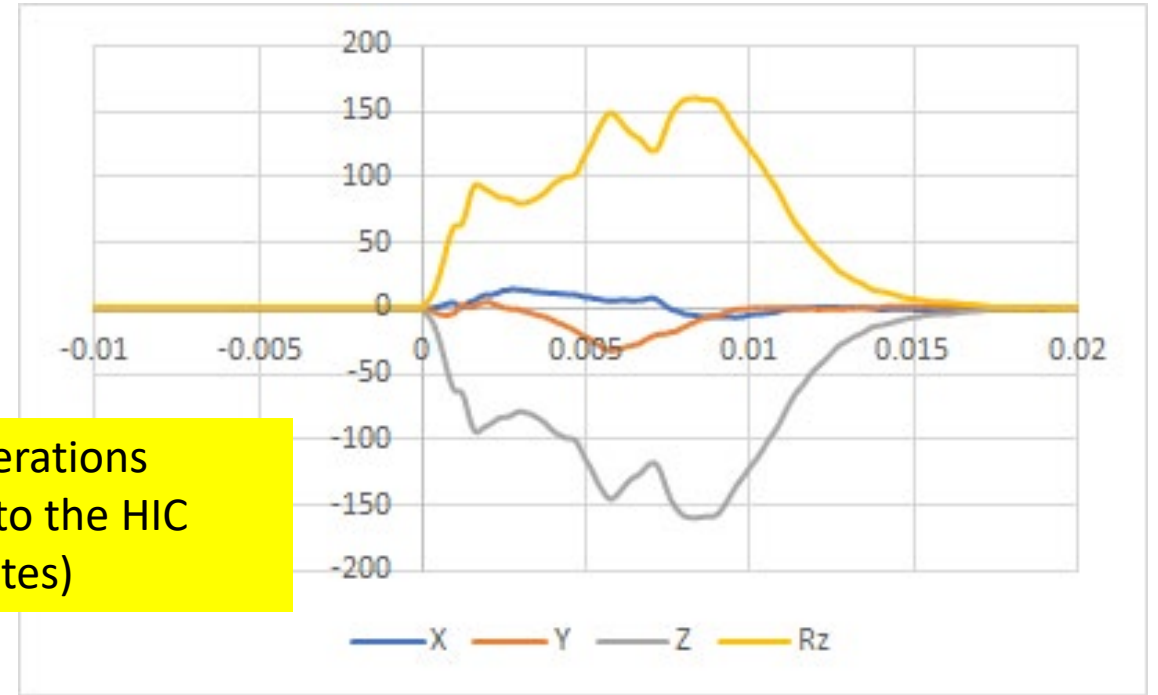


Aiming Point Method
HIC15 = 875

2010 Acura MDX – Rear, Passenger/Driver Side

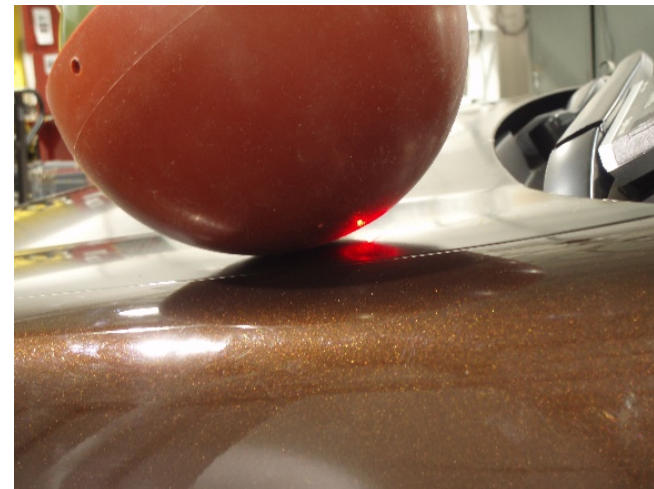


X and Y off-axis accelerations contribute very little to the HIC calculation (Z dominates)



Point of First Contact Method

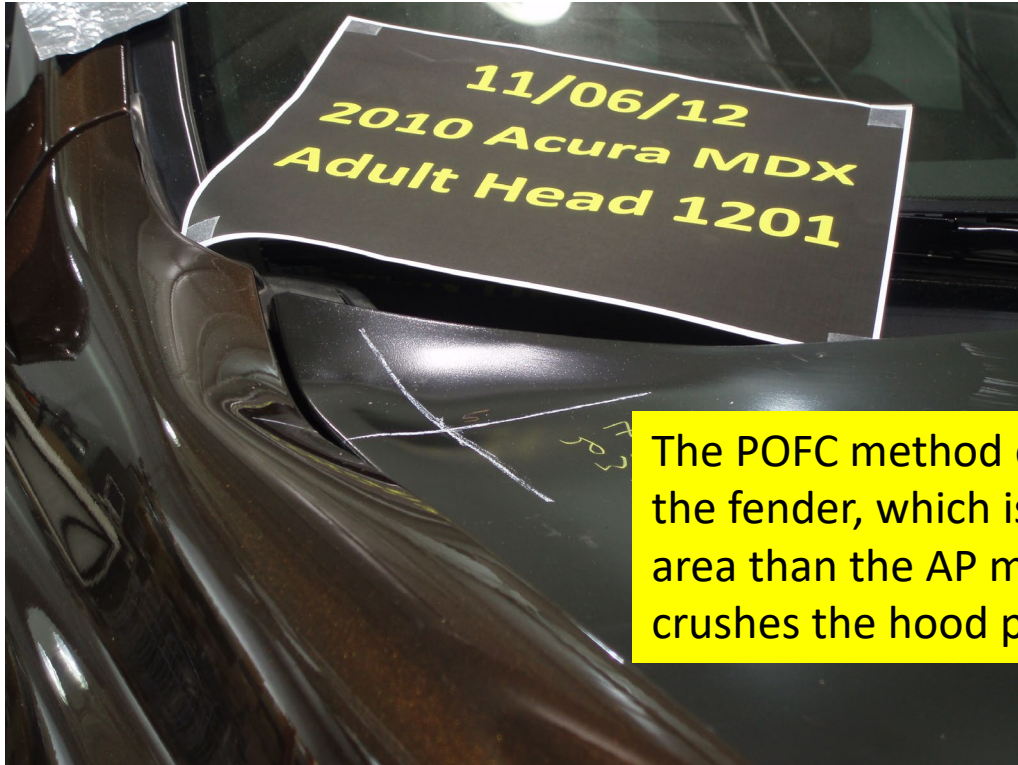
HIC15 = 1100



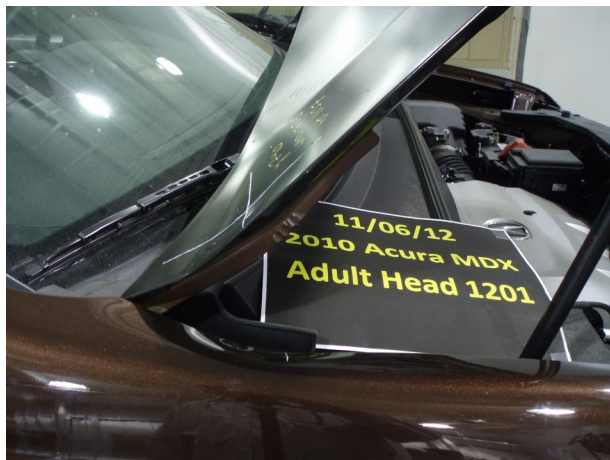
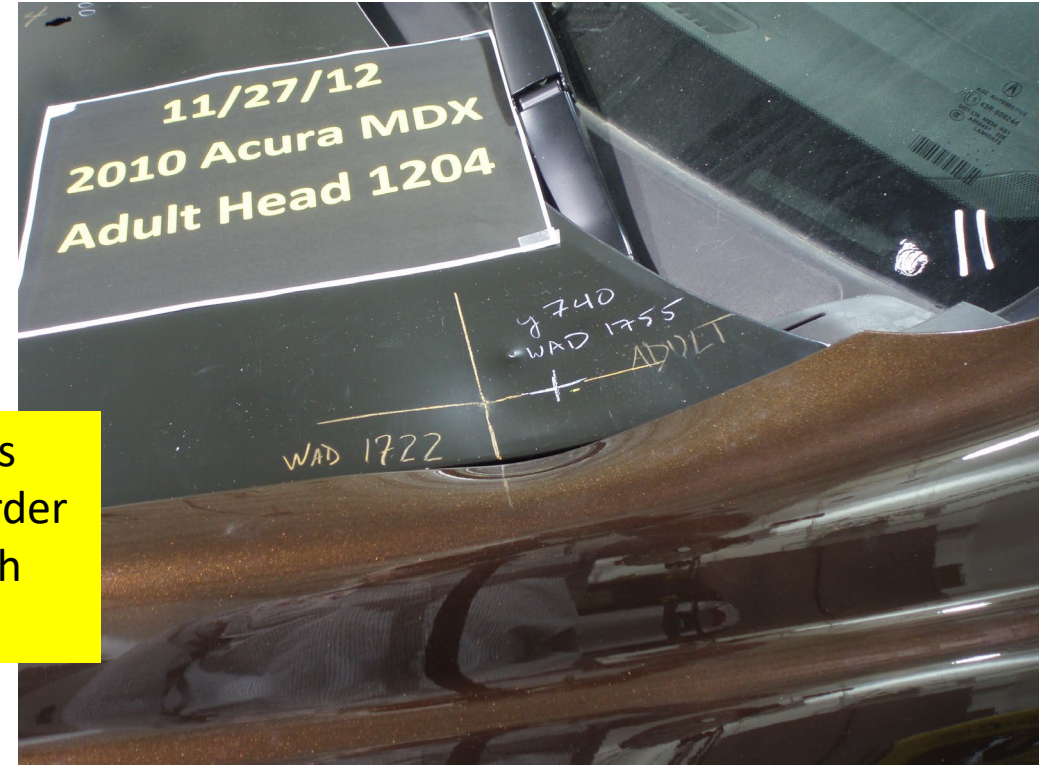
Aiming Point Method

HIC15 = 875

2010 Acura MDX – Rear, Passenger/Driver Side



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Point of First Contact Method

HIC15 = 1100



Aiming Point Method

HIC15 = 875

HIC Contributions – Clamshell Hoods

- When HIC is calculated using various combinations of X, Y, and Z accelerations, we see that the contributions of the X and Y components are similar for POFC and AP

	Test#	Method	XYZ	Z	ZX	ZY
Kia Forte	ChildHead1210	POFC	1587	1366	1503	1448
	ChildHead1213	AP	927	822	900	865
Buick LaCrosse	ChildHead1204	POFC	1602	1370	1527	1445
	ChildHead1207	AP	888	816	879	826

HIC Contributions – Flat Hoods

- Again, when HIC is calculated using various combinations of X, Y, and Z accelerations, we see that the contributions of the X and Y components are similar/minimal for POFC and AP

	Test#	Method	XYZ	Z	ZX	ZY
Acura MDX	AdultHead1201	POFC	1696	1646	1654	1688
	AdultHead1204	AP	1472	1433	1444	1461

Conclusions

- In tests along the SRL, the amount of headform spinning is similar for POFC and AP
 - The “spinning” occurs very late/during rebound (doesn’t affect HIC)
- The contribution of off-axis accelerations to HIC is almost negligible for both POFC and AP
- The vehicle’s under-surface structure is the dominant factor determining the HIC differences between POFC and AP