

Football Impact evaluation

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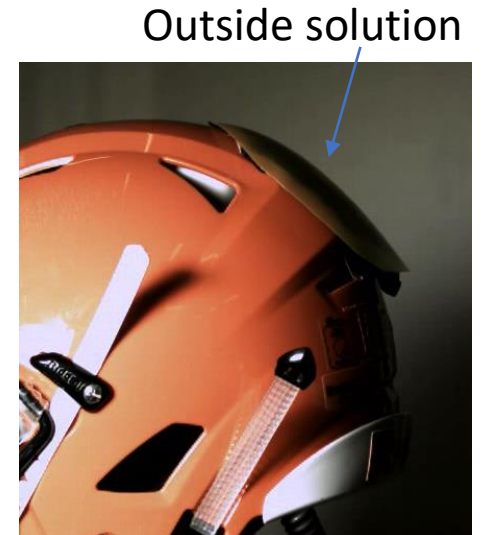
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Background

- Riddell SpeedFlex helmets were rebuilt with regions of MIPS surfaces.
 - For Test series 1-3 was the MIPS inside solution evaluated.
 - In Test Series 4 was an outside solution used.
- *Test series 1:* The MIPS helmet was first tested in the drop test rig (45degrees impact anvil, 6.2m/s)
- *Test series 2:* The NFL Frontal and UT impact points were evaluated (7.5m/s), as these impact points were the two with the highest potential for a positive MIPS effect.
- *Test series 3:* As a complement was another impact point chosen called *RearPitch* (7.5m/s).
- *Test series 4:* And finally was a new impact anvil built to generate a tangential force to the rear portion of the helmet (7.5m/s). Anvil made of wood and covered with grinding paper (quality 45)
- In all tests were the 50% HIII head form used covered with stocking. 9-accelerometer system.

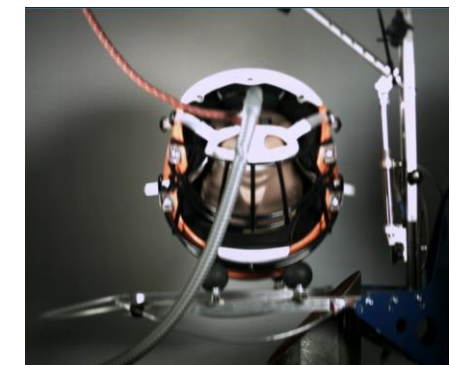
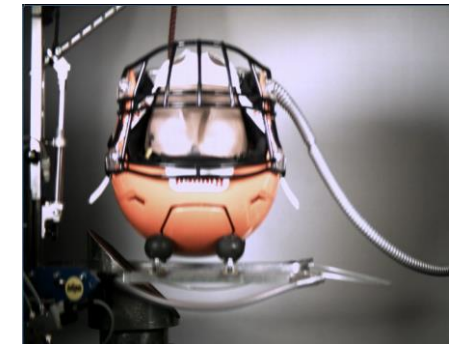
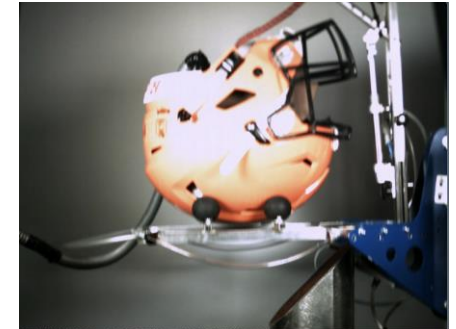
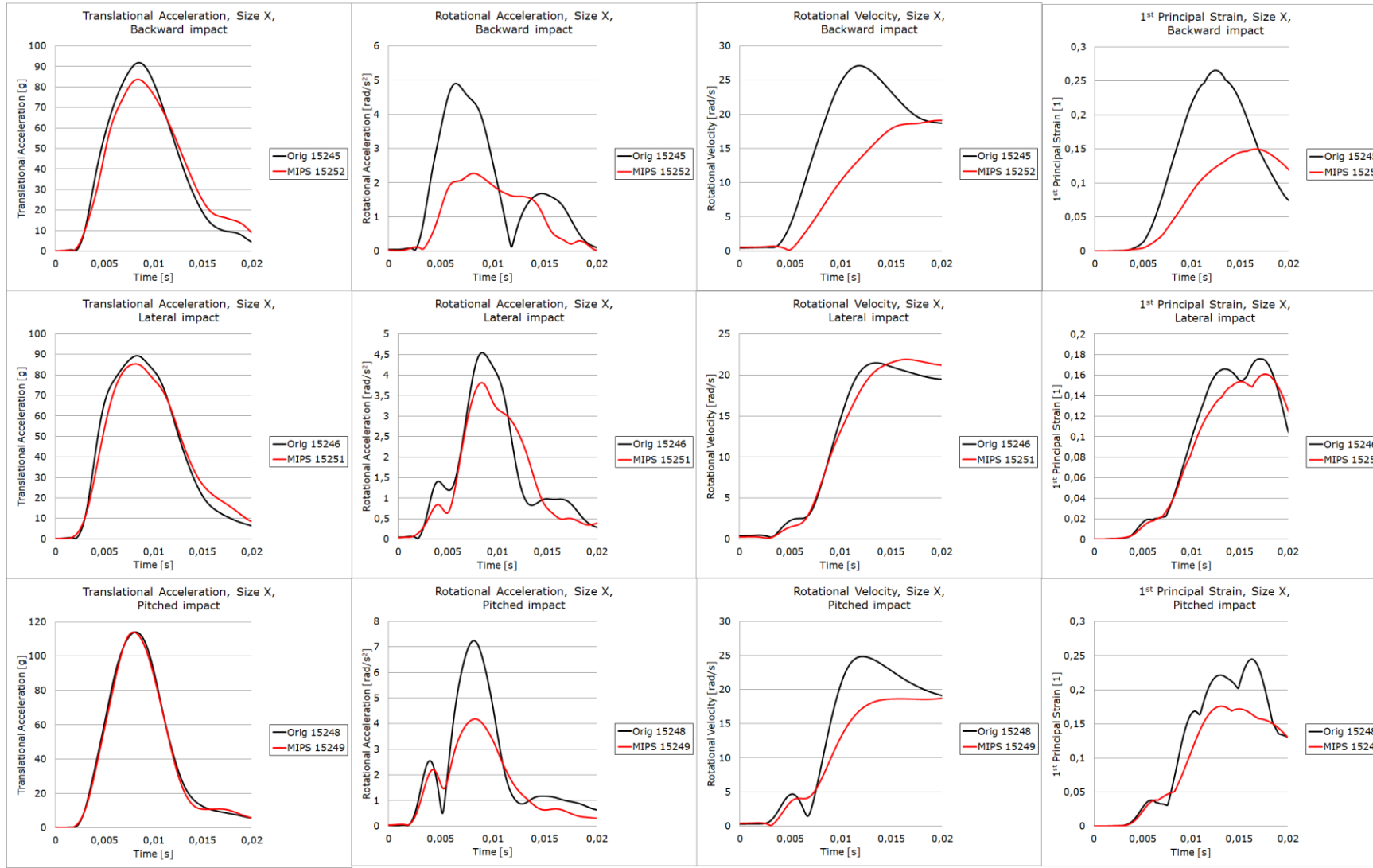


Chin pad and front pad is covered with MIPS sliding surfaces



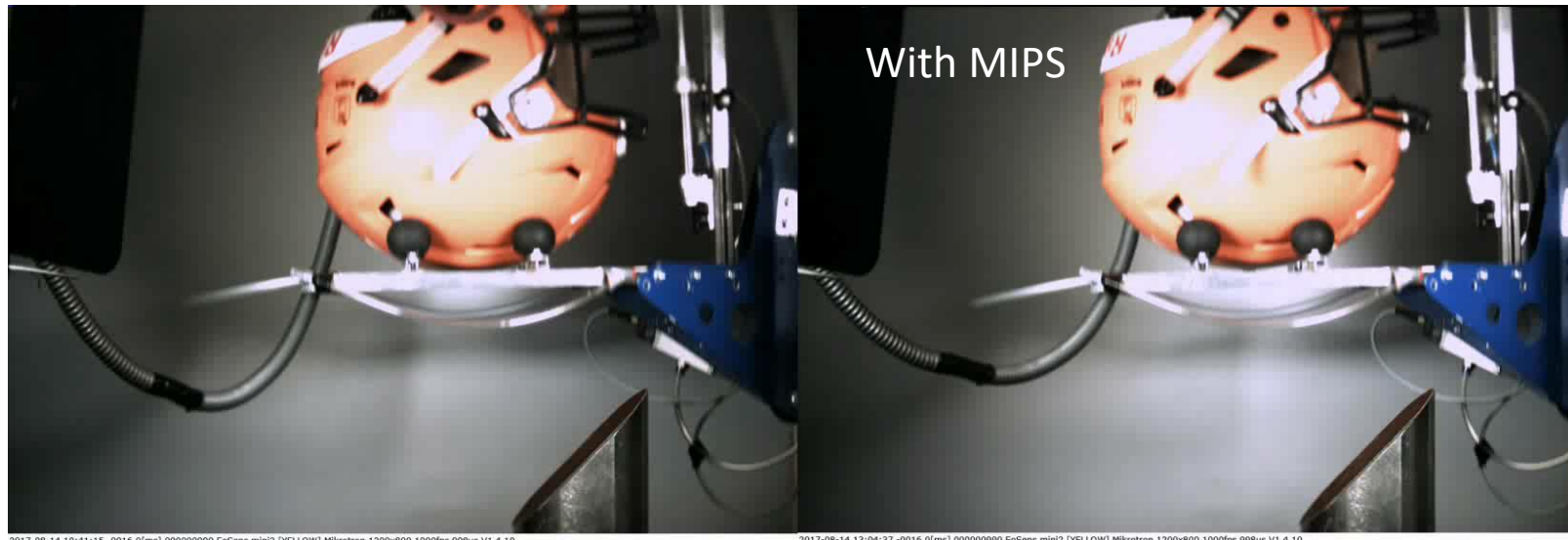
Outside solution

Test series 1: 45degrees drop test - Speed Flex V.s. Speed Flex with MIPS (6.2m/s)

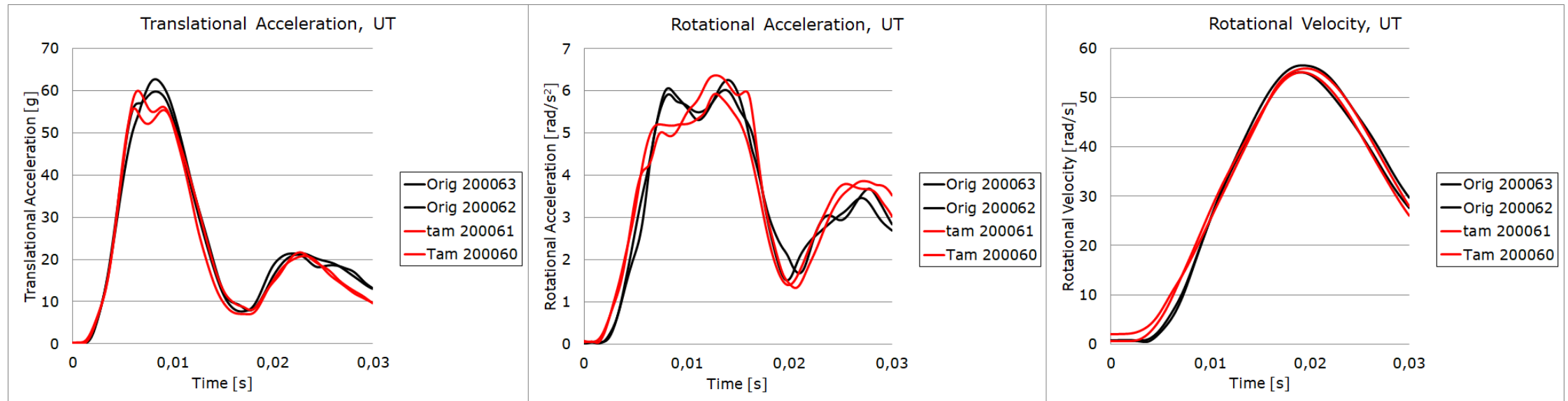


Test series 1: 45degrees drop test - Speed Flex V.s. Speed Flex with MIPS (6.2m/s)

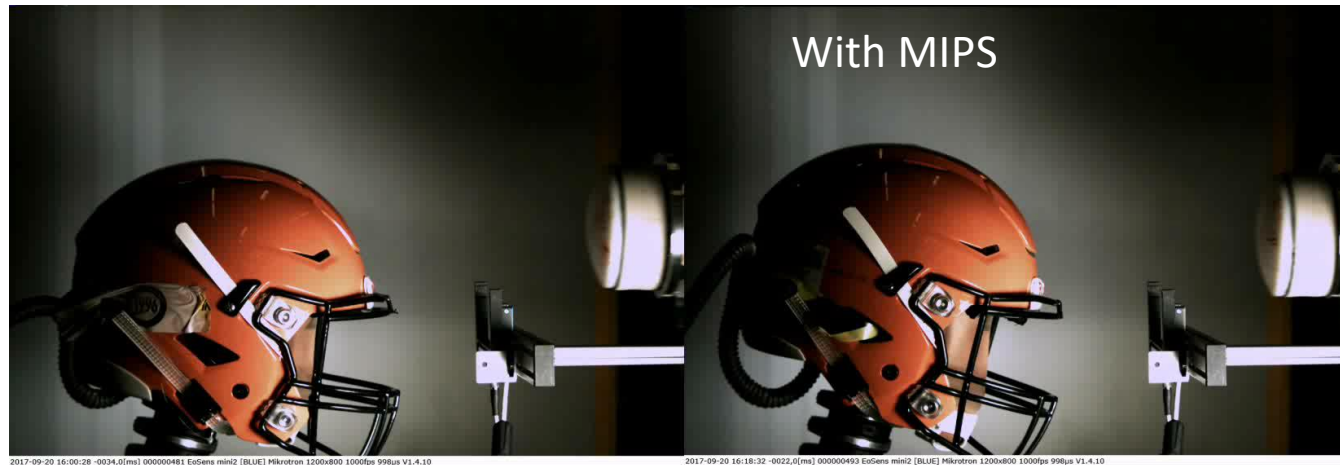
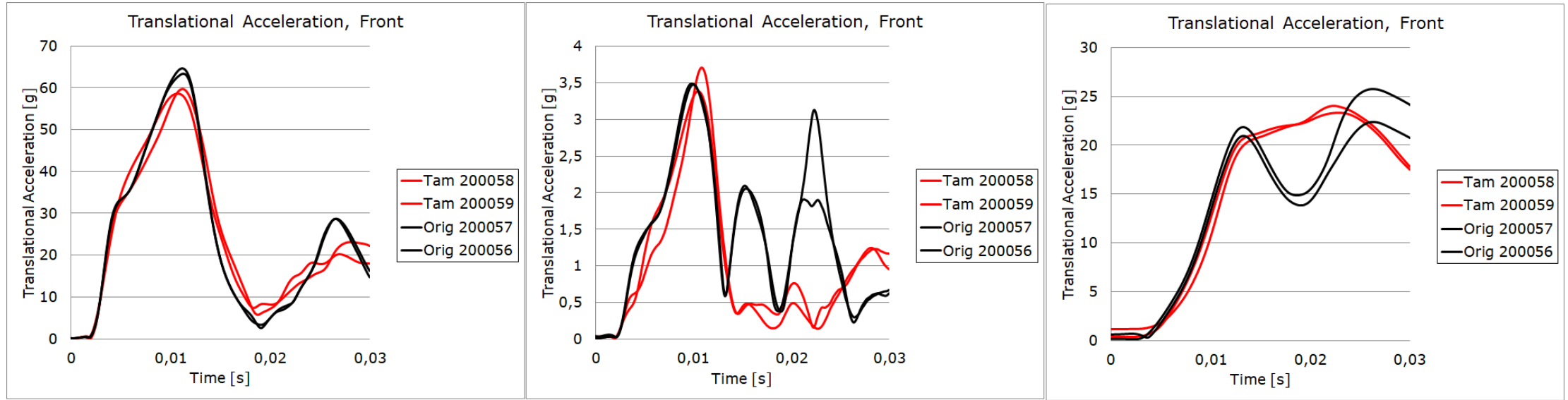
Test	Impact	Equipped with MIPS	Resultant Translational Acceleration [g]	Resultant Rotational Acceleration [krad/s ²]	Resultant Rotational Velocity [rad/s]	1 st Principal Strain [1]	Impact	Relative Difference Resultant Translational Acceleration	Relative Difference Resultant Rotational Acceleration	Relative Difference Resultant Rotational Velocity	Relative Difference 1 st Principal Strain
Riddell Speedflex L MIPS 15252	Back	MIPS 15252	83,6	2,3	19,1	0,15	Backward	9,0%	53,8%	29,4%	43,4%
Riddell Speedflex L Orig 15245	Back	Orig 15245	91,9	4,9	27,1	0,27					
Riddell Speedflex L MIPS 15251	LatL	MIPS 15251	85,3	3,8	21,9	0,16	Lateral	4,4%	15,9%	-2,2%	8,4%
Riddell Speedflex L Orig 15246	LatL	Orig 15246	89,3	4,5	21,5	0,18					
Riddell Speedflex L MIPS 15249	PitchR	MIPS 15249	114,0	4,2	19,2	0,18	Pitched	-0,1%	42,4%	22,8%	28,4%
Riddell Speedflex L Orig 15248	PitchR	Orig 15248	113,9	7,3	24,9	0,25					



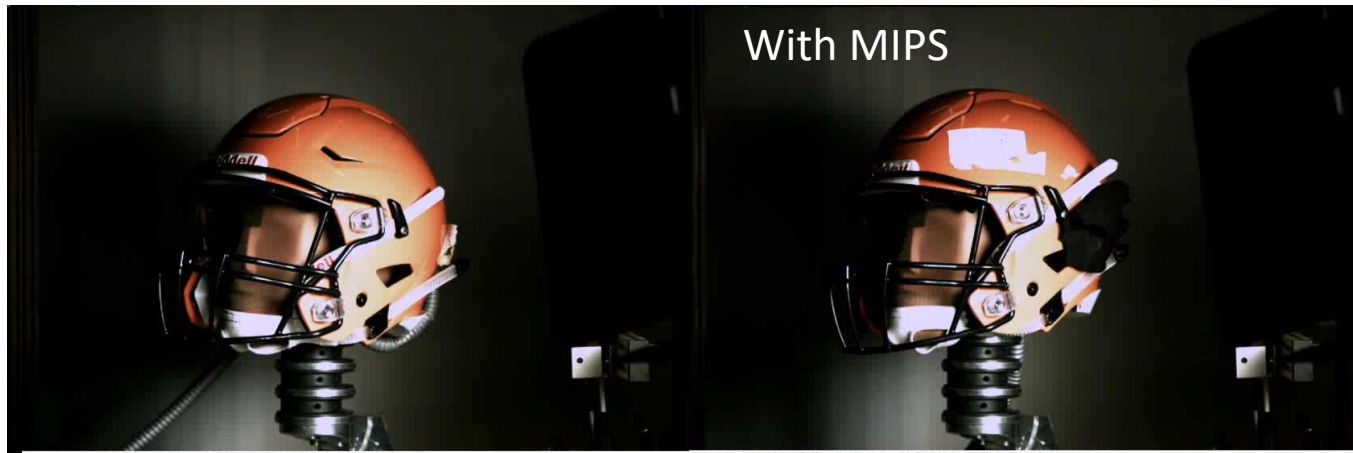
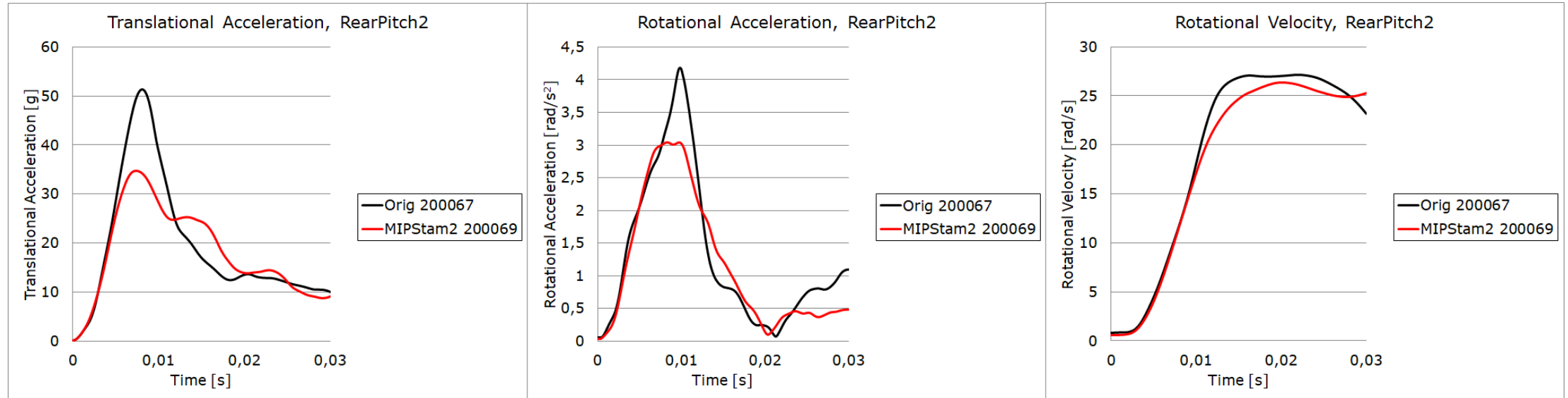
Test series 2: UT – Speed Flex V.s. Speed Flex with MIPS



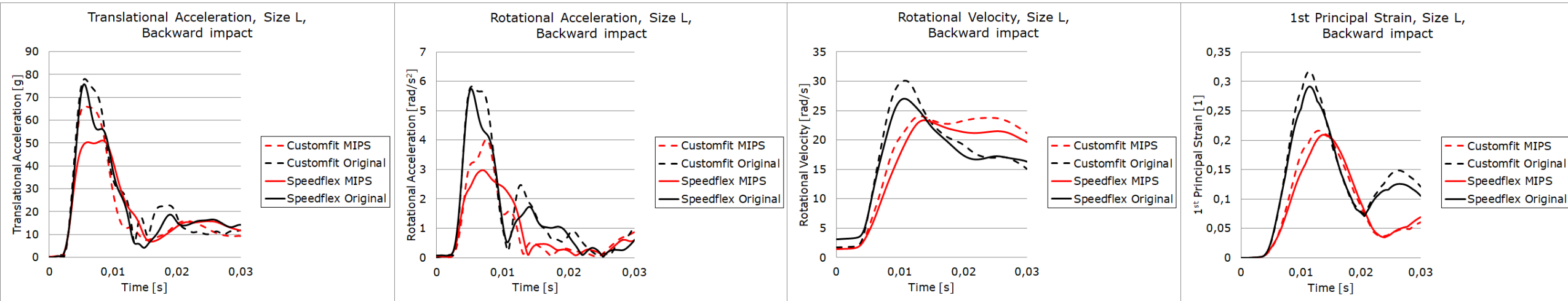
Test series 2: Front - Speed Flex V.s. Speed Flex with MIPS



Test series 3: RearPitch - Speed Flex V.s. Speed Flex with MIPS

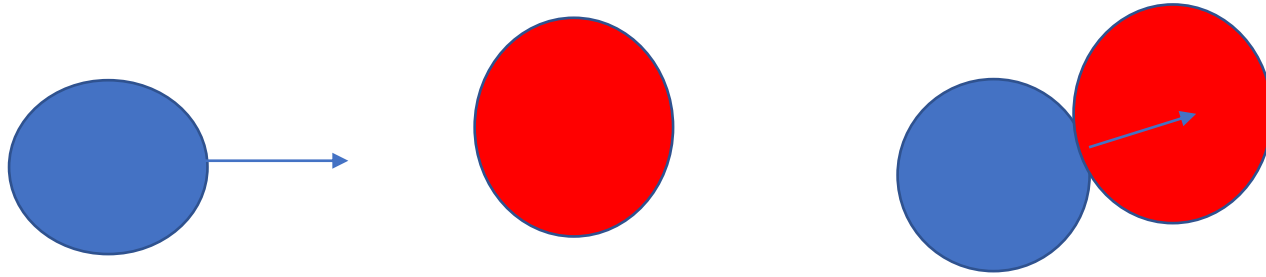


Test series 4: Back45Degree - Speed Flex V.s. Speed Flex with MIPS (Obs outside solution)

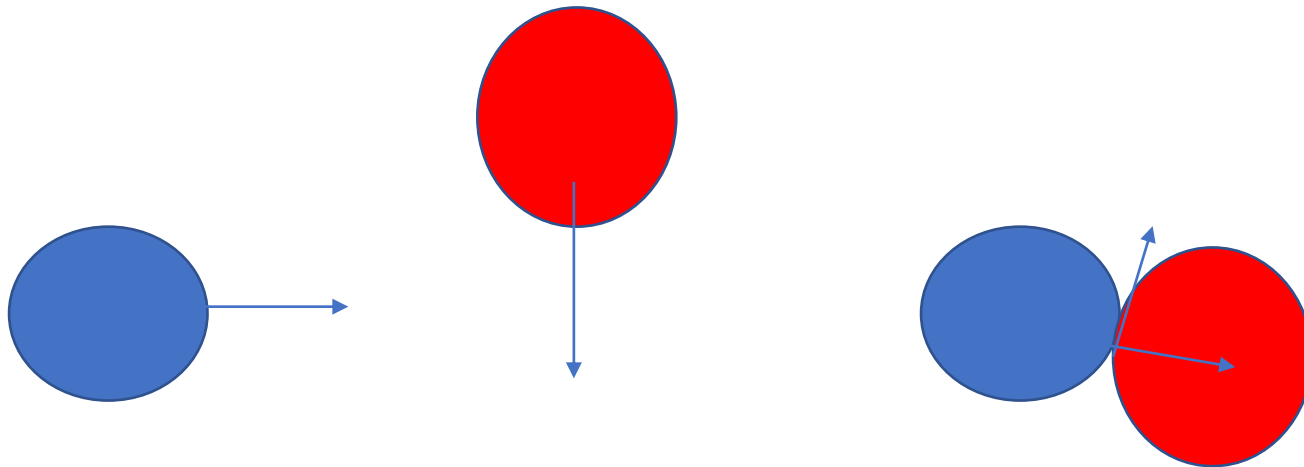


Schematics of potential impacts

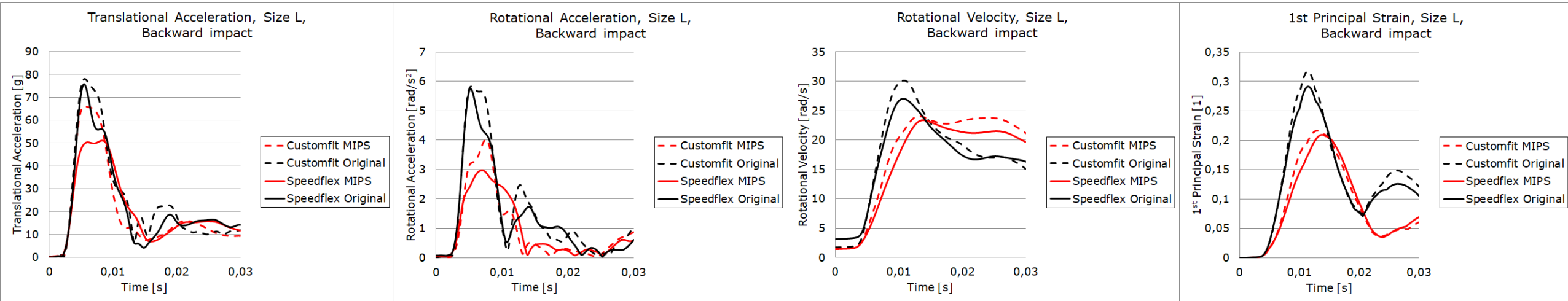
A



B



Test series 4: Back45Degree - Speed Flex V.s. Speed Flex with MIPS (Obs outside solution)



Test	Resultant Translational Acceleration [g]	Resultant Rotational Acceleration [krad/s ²]	Resultant Rotational Velocity [rad/s]	1 st Principal Strain [1]	Impact	Relative Difference Resultant Translational Acceleration	Relative Difference Resultant Rotational Acceleration	Relative Difference Resultant Rotational Velocity	Relative Difference 1 st Principal Strain
Speedflex Original	75,8	5,7	27,1	0,29	Custom fit	15,2%	30,8%	19,9%	31,8%
Speedflex MIPS	51,2	3,0	23,4	0,21					
Customfit Original	78,1	5,8	30,1	0,32	SpeedFlex	32,4%	48,1%	13,5%	28,0%
Customfit MIPS	66,2	4,0	24,1	0,22					

Conclusion

- SpeedFlex MIPS-T showed significant reduction of the rotational velocity and strain in the vertical drop test against a 45 degree impact angle in Y and Z direction. In X the helmet was not equipped with a LFL at the region of impact.
- SpeedFlex MIPS-T did not show any improvement in the linear impact test rig according the NFL test point Front and UT (7.5m/s).
 - The reason is that the NFL test set up exclude a tangential force.
- SpeedFlex MIPS-T showed significant reduction of the rotational velocity and strain in the Linear impact test rig adjusted with an 45degrees impact angle anvil.
 - The reason for the reduction is the added tangential force