

H-III50 M REAR IMPACT
R&R INTRL LAB SEAT
PRELIMINARY RESULTS

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prepared by: Paul Depinet



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Agenda

- Background
- Test description
- Critical channel plots with R&R
- Complete R&R summary
- All plots (see external file)



Background

- Question: is the Biorid R&R as good or better than the Hybrid III?
- Hybrid III hasn't been evaluated in an equivalent fashion
 - Rear impact, GTR pulse
 - Same seat
 - Multiple dummies, multiple tests
 - Calculate R&R



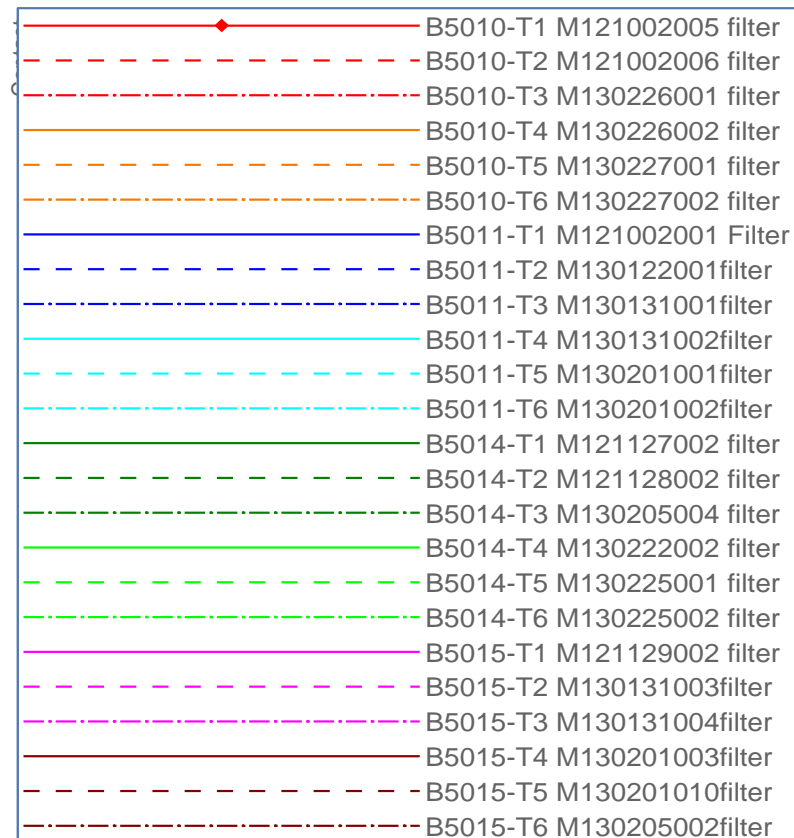
Test Description

- Testing at BAST
- TRL lab seat
- Four certified dummies
- Six tests per dummy, dummies alternated
- Calculate R&R per traditional CV method



H-III50M R&R critical channel plots

Legend



H-III50M R&R critical channel plots

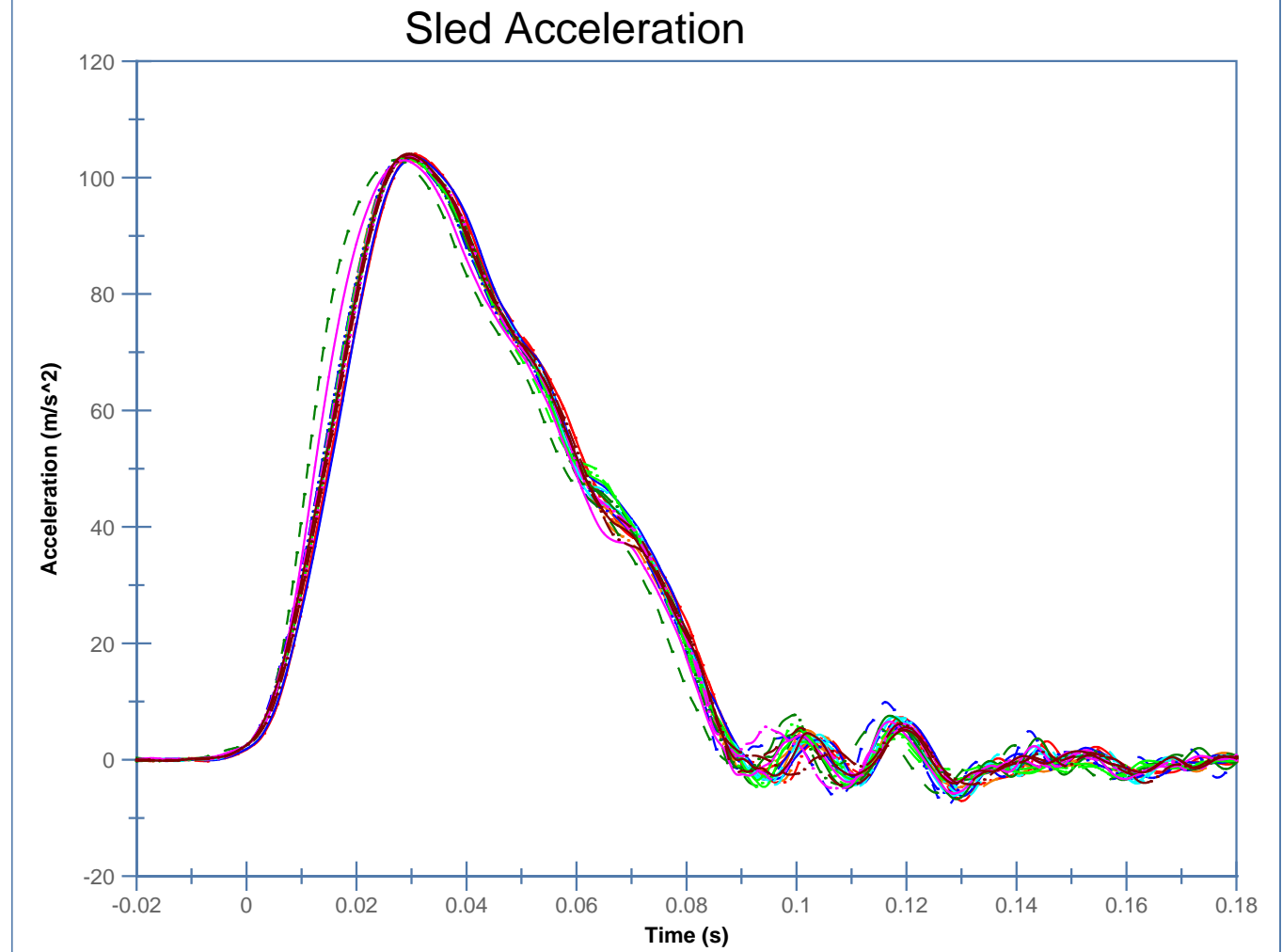
Traditional CV:

Worst dummy
repeatability:

0.4%

Reproducibility:

0.3%

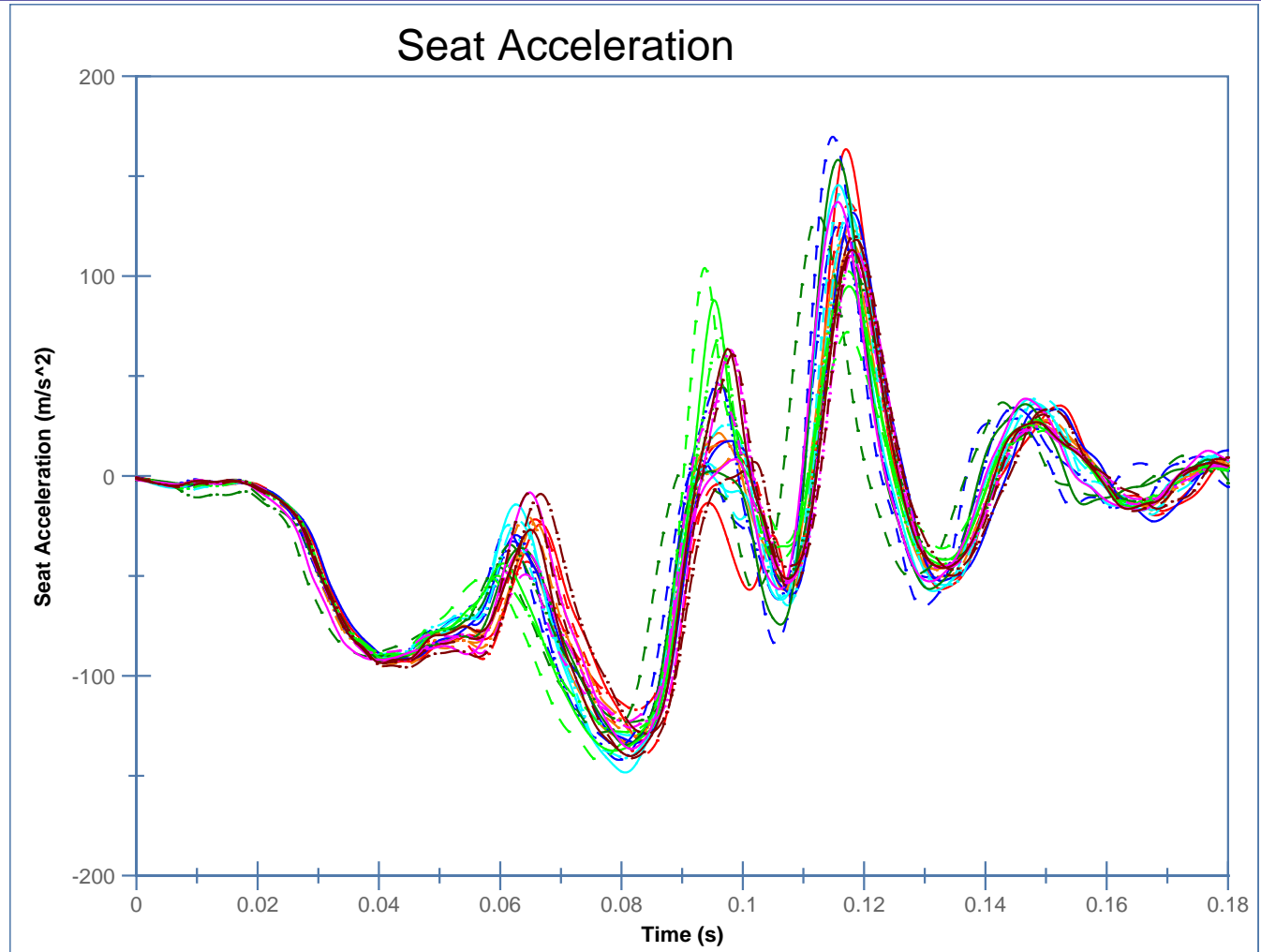


H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:
20.4%

Reproducibility:
15.3%



H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:

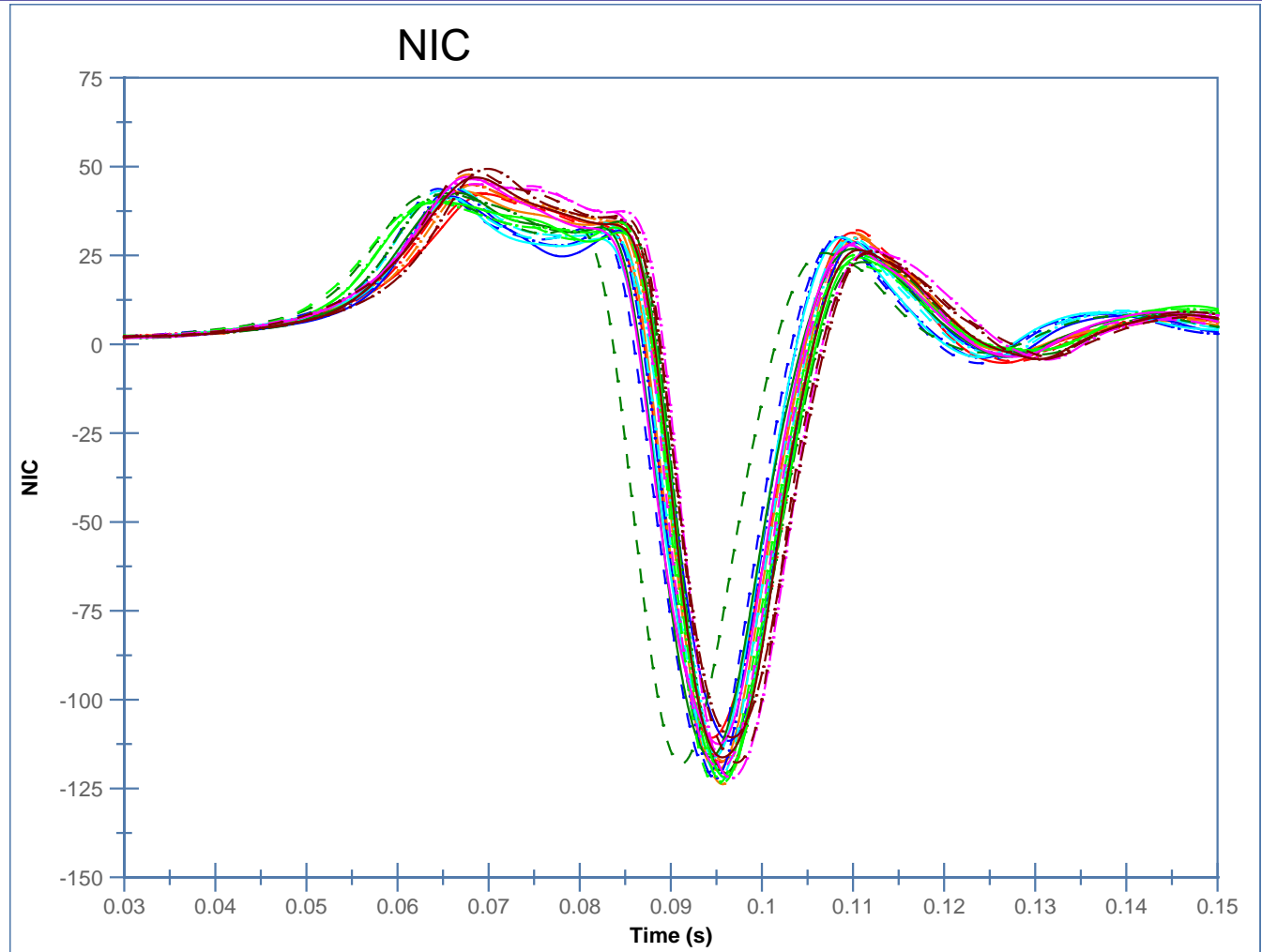
+4.6%

-3.7%

Reproducibility:

+6.2%

-3.5%



H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:

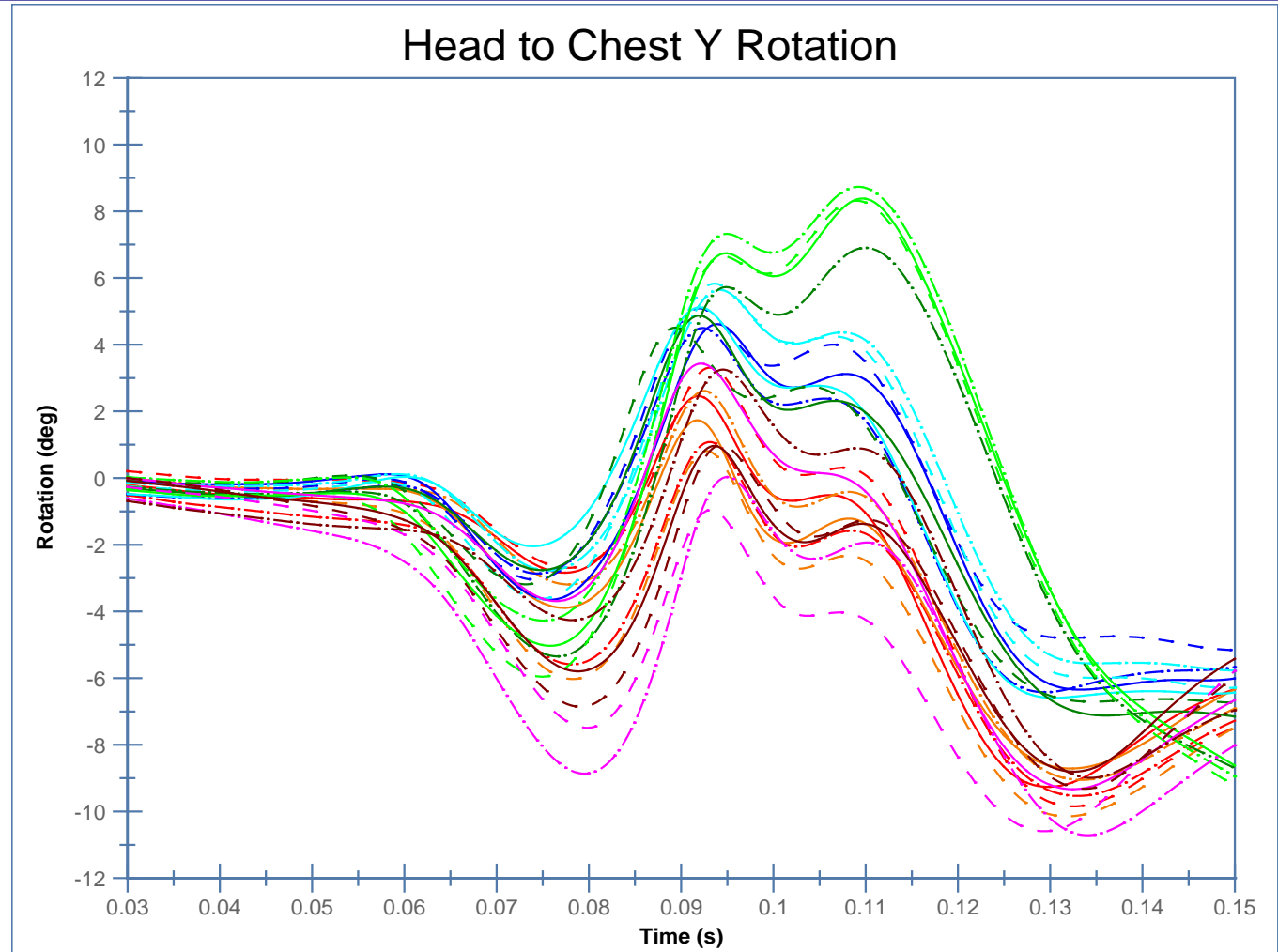
+108.6%

-18.6%

Reproducibility:

+67.8%

-26.2%



H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:

+13.6%

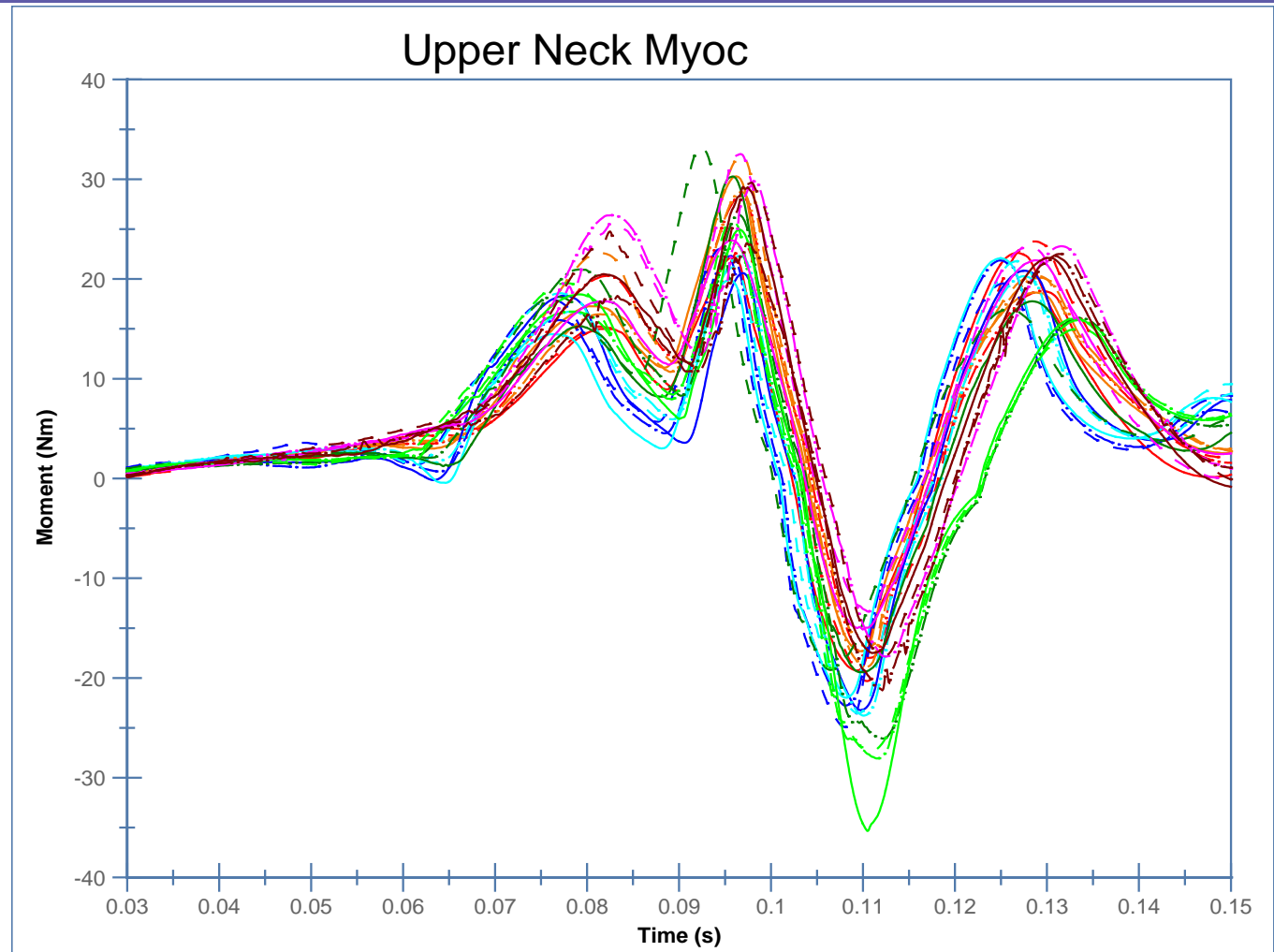
-23.2%

Reproducibility:

+15.1%

-23.4%

NOTE: 2 tests with
spikes in data
removed before
R&R calculation.



H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:

+11.0%

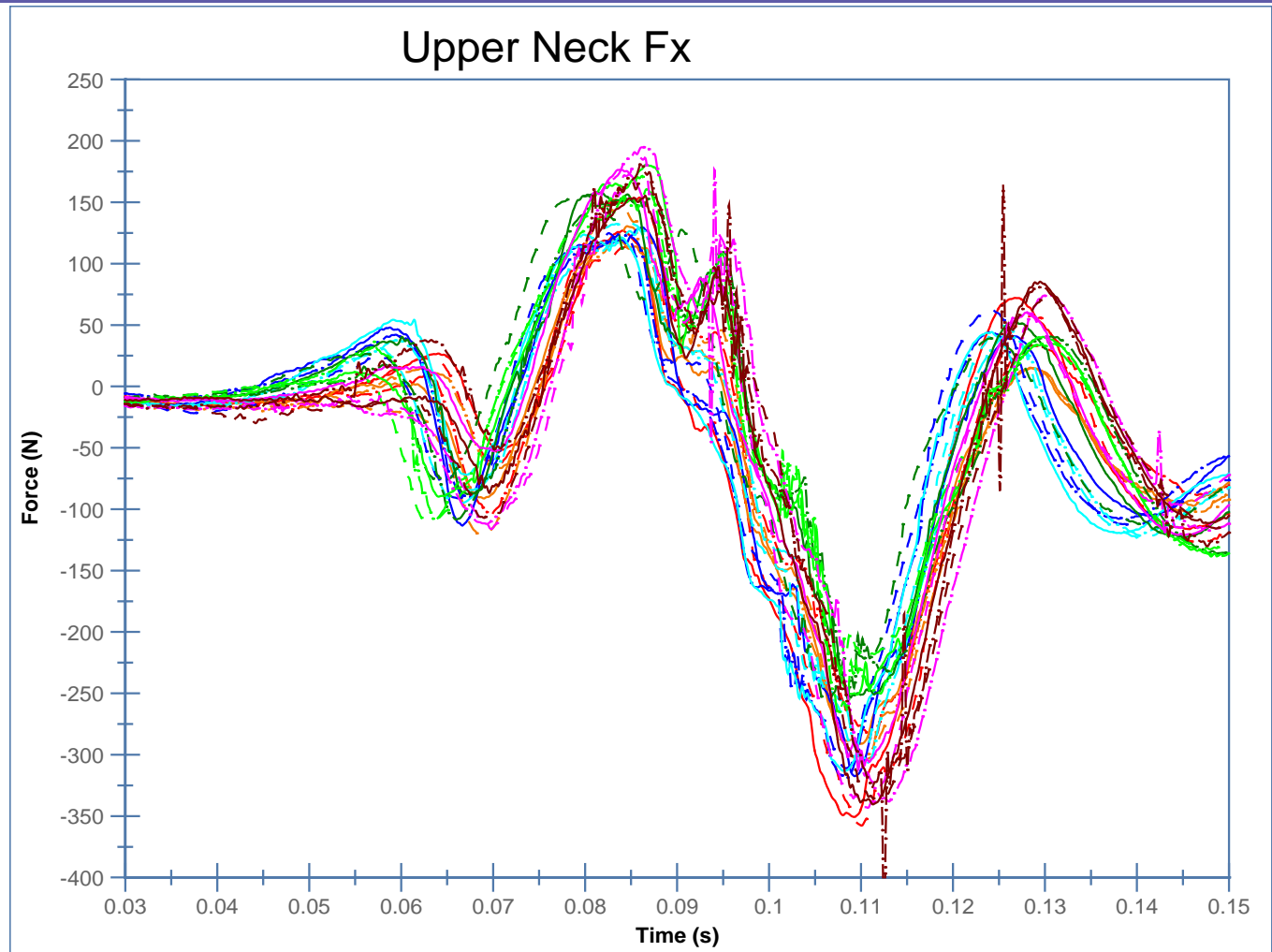
-9.6%

Reproducibility:

+15.0%

-11.7%

NOTE: 2 tests with
spikes in data
removed before
R&R calculation.



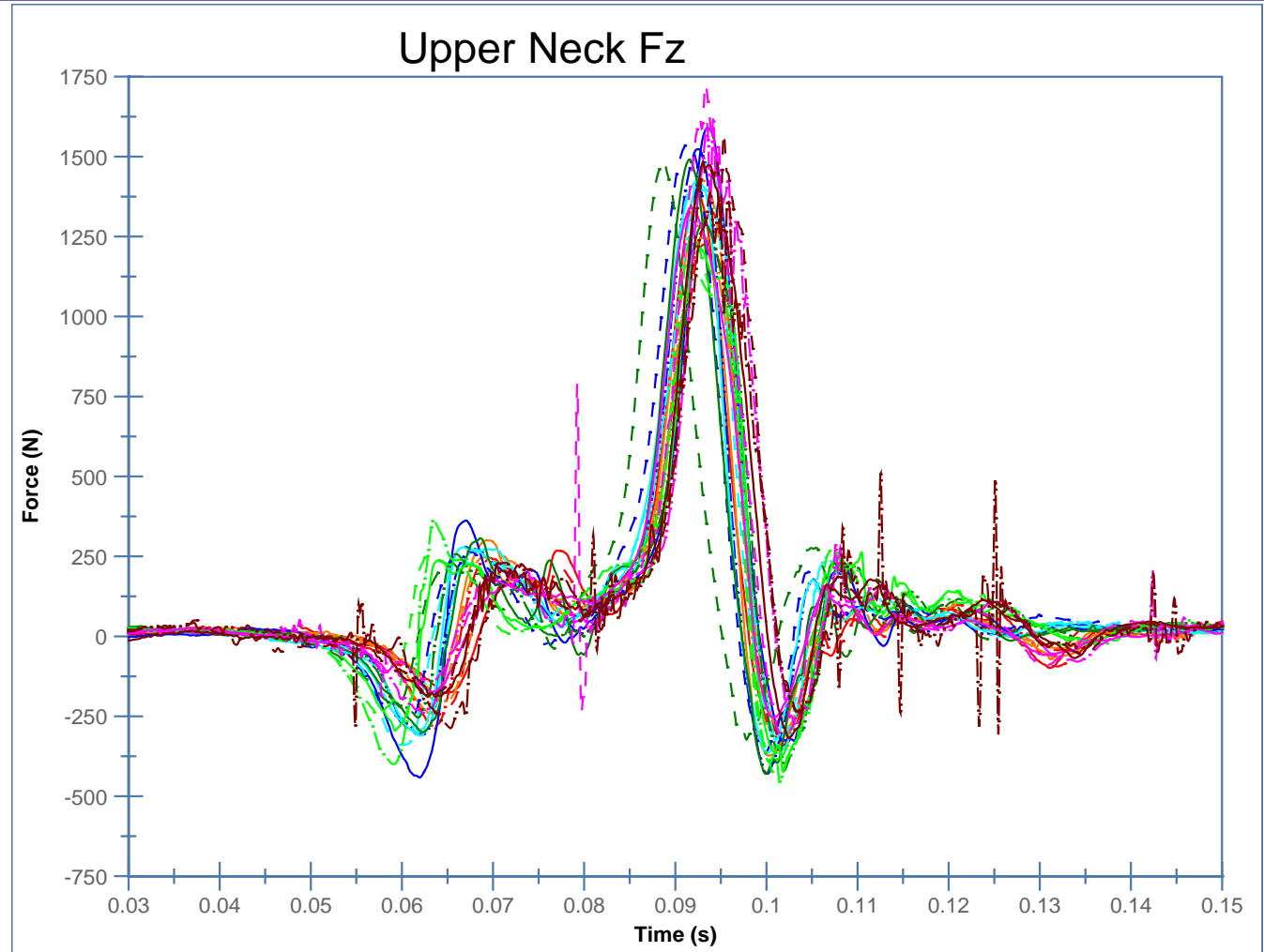
H-III50M R&R critical channel plots

Traditional CV:

Worst dummy
repeatability:
11.1%

Reproducibility:
9.1%

NOTE: 4 tests with
spikes in data
removed before
R&R calculation.



Complete R&R summary

- Tables containing for all channels
 - CV % (repeatability & reproducibility)
 - Averages and standard deviations
 - Max & Min



R&R: all CV page 1 of 2

ChnDesc	B5010 CV	B5011 CV	B5014 CV	B5015 CV	All CV
Sled Acceleration	0.3	0.2	0.2	0.4	0.3
Sled Velocity	0.4	0.3	0.4	0.4	0.4
Seat Accel +	14.5	11.2	20.4	8.2	15.3
Seat Accel -	-5.8	-4.9	-5.5	-5.9	-5.6
Head X accel.	3.2	3.0	2.7	4.9	3.3
Head Z accel +	10.3	7.8	7.0	22.1	21.6
Head Z accel -	-16.8	-19.9	-23.3	-23.8	-29.0
Chest X accel.	3.4	2.7	5.6	7.1	6.3
Chest Z accel +	7.8	7.7	9.6	16.7	18.3
Chest Z accel -	-18.5	-27.4	-24.9	-12.5	-36.4
Pelvis X accel.	4.1	4.6	4.8	7.4	5.8
Pelvis Z accel. +	5.9	5.6	8.4	11.7	15.2
Pelvis Z accel. -	-11.4	-11.2	-20.1	-28.6	-21.3
Head Resultant Accel.	3.0	2.9	2.6	5.0	3.3
Chest Resultant Accel.	3.4	3.0	4.3	7.0	5.8
Pelvis Resultant Accel.	4.1	4.3	4.6	6.7	5.3
NIC +	4.6	2.9	3.1	3.5	6.2
NIC -	-3.7	-3.6	-2.5	-3.7	-3.5
Upper Neck Fx Force +	11.0	3.6	6.2	7.6	15.0
Upper Neck Fx Force -	-9.6	-1.7	-4.4	-4.3	-11.7
Upper Neck Fz Force	6.0	4.5	11.1	6.7	9.1
Up Neck My +	11.1	2.3	13.9	13.6	14.8
Up Neck My -	-7.2	-3.3	-19.4	-11.5	-16.7
Upper Neck Myoc +	13.6	3.4	13.2	12.5	15.1
Upper Neck Myoc -	-6.9	-4.2	-23.3	-13.1	-23.4



R&R: all CV page 2 of 2

ChnDesc	B5010 CV	B5011 CV	B5014 CV	B5015 CV	All CV
Head Rot. Vel +	5.7	4.7	8.5	6.0	8.7
Head Rot. Vel -	-9.3	-3.0	-9.9	-6.5	-9.2
Chest Rot. Vel. +	5.1	3.5	4.0	5.3	7.2
Pelvis Rot. Vel. +	77.5	49.9	5.4	4.2	41.6
Head-Chest Rot. Vel +	9.0	9.3	15.0	9.2	17.1
Head-Chest Rot. Vel -	-8.3	-3.2	-13.7	-9.6	-11.5
Chest-Pelvis Rot. Vel. +	77.6	50.3	10.1	11.4	41.5
Chest-Pelvis Rot. Vel. -	-77.9	-50.1	-5.9	-12.8	-39.9
Head Rotation	2.5	3.6	11.5	4.6	10.7
Chest Rotation	5.3	2.0	4.3	6.9	8.3
Pelvis Rotation	78.3	76.5	12.5	78.0	61.0
Head-Chest Rot +	48.1	10.4	26.8	108.6	67.8
Head-Chest Rot -	-5.6	-11.5	-18.6	-8.5	-26.2
Chest-Pelvis Rot.	78.0	49.7	5.2	9.5	43.5
Head Contact Fx	2.4	2.8	2.9	5.0	3.1
Head Contact Fz	-6.9	-5.1	-14.5	-6.4	-11.0
Head Contact Resultant	2.5	2.4	2.0	5.0	2.8
Head Contact Angle	-6.6	-3.1	-13.6	-15.6	-12.5



R&R: all avg/std dev: pg 1 of 2

ChnDesc	B5010 Avg	B5010 StdDev	B5011 Avg	B5011 StdDev	B5014 Avg	B5014 StdDev	B5015 Avg	B5015 StdDev	All Avg	All StdDev
Sled Acceleration	103.6	0.3	103.6	0.2	103.5	0.2	103.7	0.4	103.6	0.3
Sled Velocity	17.7	0.1	17.7	0.1	17.7	0.1	17.7	0.1	17.7	0.1
Seat Accel +	129.1	18.7	141.4	15.9	116.4	23.7	118.7	9.7	126.4	19.4
Seat Accel -	-130.6	7.6	-138.3	6.8	-132.4	7.3	-132.6	7.8	-133.5	7.5
Head X accel.	678.4	21.5	676.9	20.0	685.1	18.4	674.4	33.0	678.7	22.7
Head Z accel +	76.0	7.9	78.8	6.2	72.6	5.1	105.6	23.3	83.3	18.0
Head Z accel -	-45.3	7.6	-69.2	13.8	-56.2	13.1	-40.9	9.7	-52.9	15.4
Chest X accel.	181.2	6.1	179.1	4.9	168.1	9.4	188.9	13.3	179.3	11.4
Chest Z accel +	55.1	4.3	72.3	5.6	66.7	6.4	48.9	8.2	60.8	11.1
Chest Z accel -	-25.9	4.8	-47.8	13.1	-38.7	9.6	-25.3	3.2	-34.4	12.5
Pelvis X accel.	368.7	15.0	378.6	17.3	350.3	16.9	358.3	26.4	364.0	21.1
Pelvis Z accel. +	69.0	4.1	78.2	4.4	78.2	6.6	96.7	11.3	80.5	12.3
Pelvis Z accel. -	-22.1	2.5	-19.9	2.2	-18.9	3.8	-15.1	4.3	-19.0	4.0
Head Resultant Accel.	681.5	20.5	682.4	19.8	688.2	18.0	679.0	33.7	682.8	22.5
Chest Resultant Accel.	183.2	6.2	182.6	5.4	172.3	7.4	191.2	13.3	182.3	10.6
Pelvis Resultant Accel.	372.7	15.1	382.2	16.4	357.4	16.5	366.5	24.7	369.7	19.6
NIC +	44.2	2.1	42.9	1.2	41.3	1.3	47.4	1.7	43.9	2.7
NIC -	-118.3	4.4	-119.0	4.3	-120.7	3.0	-116.4	4.3	-118.6	4.1
Upper Neck Fx Force +	131.8	14.5	127.0	4.6	163.8	10.2	171.9	13.0	146.5	21.9
Upper Neck Fx Force -	-316.1	30.4	-312.2	5.4	-253.0	11.2	-332.9	14.3	-300.9	35.2
Upper Neck Fz Force	1316.6	79.6	1496.0	67.6	1316.0	146.0	1407.9	94.9	1379.4	125.9
Up Neck My +	27.8	3.1	22.3	0.5	28.5	4.0	28.5	3.9	26.8	4.0
Up Neck My -	-24.0	1.7	-28.9	1.0	-30.1	5.8	-23.0	2.7	-26.5	4.4
Upper Neck Myoc +	27.7	3.8	22.1	0.8	27.4	3.6	28.8	3.6	26.3	4.0
Upper Neck Myoc -	-18.4	1.3	-23.4	1.0	-25.9	6.0	-15.9	2.1	-21.4	5.0



R&R: all avg/std dev: pg 2 of 2

ChnDesc	B5010 Avg	B5010 StdDev	B5011 Avg	B5011 StdDev	B5014 Avg	B5014 StdDev	B5015 Avg	B5015 StdDev	All Avg	All StdDev
Head Rot. Vel +	19.4	1.1	19.5	0.9	22.3	1.9	21.5	1.3	20.7	1.8
Head Rot. Vel -	-12.8	1.2	-14.1	0.4	-14.7	1.5	-13.0	0.8	-13.6	1.3
Chest Rot. Vel. +	9.2	0.5	8.5	0.3	8.7	0.3	9.8	0.5	9.0	0.6
Pelvis Rot. Vel. +	3.8	3.0	5.0	2.5	5.8	0.3	4.3	0.2	4.7	2.0
Head-Chest Rot. Vel +	12.7	1.2	13.6	1.3	17.7	2.7	15.1	1.4	14.8	2.5
Head-Chest Rot. Vel -	-10.7	0.9	-11.4	0.4	-11.9	1.6	-9.9	0.9	-11.0	1.3
Chest-Pelvis Rot. Vel. +	3.7	2.9	4.3	2.2	5.4	0.6	6.7	0.8	5.1	2.1
Chest-Pelvis Rot. Vel. -	-2.6	2.0	-3.4	1.7	-3.9	0.2	-4.2	0.5	-3.6	1.4
Head Rotation	18.1	0.5	20.3	0.7	22.2	2.6	18.6	0.9	19.8	2.1
Chest Rotation	17.6	0.9	15.9	0.3	15.9	0.7	18.5	1.3	17.0	1.4
Pelvis Rotation	6.6	5.2	6.4	4.9	9.9	1.2	5.0	3.9	7.0	4.3
Head-Chest Rot +	2.0	1.0	5.1	0.5	7.0	1.9	1.4	1.6	3.9	2.6
Head-Chest Rot -	-9.4	0.5	-6.0	0.7	-5.7	1.1	-9.6	0.8	-7.7	2.0
Chest-Pelvis Rot.	7.0	5.5	7.6	3.8	8.5	0.4	12.7	1.2	9.0	3.9
Head Contact Fx	3076.8	74.4	3097.6	87.5	3010.2	88.8	2949.1	147.1	3050.3	95.9
Head Contact Fz	-992.0	68.6	-1154.5	58.5	-997.6	144.4	-1053.5	67.9	-1048.6	115.1
Head Contact Resultant	3207.6	80.4	3234.9	77.2	3153.9	63.1	3092.4	155.9	3188.2	88.0
Head Contact Angle	-0.3	0.0	-0.4	0.0	-0.3	0.0	-0.4	0.1	-0.4	0.0



R&R: all max/min: page 1 of 2

ChnDesc	B5010 Min	B5010 Max	B5011 Min	B5011 Max	B5014 Min	B5014 Max	B5015 Min	B5015 Max	All Min	All Max
Sled Acceleration	103.2	104.1	103.5	103.9	103.1	103.8	103.0	104.1	103.0	104.1
Sled Velocity	17.6	17.8	17.6	17.8	17.6	17.8	17.6	17.8	17.6	17.8
Seat Accel +	113.1	163.5	125.4	169.7	94.9	158.1	110.5	137.1	94.9	169.7
Seat Accel -	-140.1	-117.0	-148.4	-129.7	-143.0	-123.1	-141.2	-122.8	-148.4	-117.0
Head X accel.	642.7	706.2	642.4	696.1	657.6	711.6	631.6	711.6	631.6	711.6
Head Z accel +	68.3	87.5	69.2	86.6	66.8	78.3	58.1	118.1	58.1	118.1
Head Z accel -	-56.8	-35.8	-95.6	-56.9	-80.7	-42.2	-55.3	-30.0	-95.6	-30.0
Chest X accel.	176.2	190.5	171.5	184.1	152.6	177.3	171.1	206.1	152.6	206.1
Chest Z accel +	49.1	62.5	67.4	80.5	59.8	77.5	37.7	58.7	37.7	80.5
Chest Z accel -	-33.7	-20.3	-73.4	-37.7	-57.8	-31.6	-29.0	-21.8	-73.4	-20.3
Pelvis X accel.	350.8	385.7	344.8	395.3	333.3	382.4	324.2	393.6	324.2	395.3
Pelvis Z accel. +	62.2	73.2	72.5	85.0	70.1	85.5	73.9	102.7	62.2	102.7
Pelvis Z accel. -	-25.7	-18.5	-22.1	-15.9	-22.9	-12.4	-22.0	-10.3	-25.7	-10.3
Head Resultant Accel.	648.2	708.4	648.3	702.5	662.0	714.0	632.9	717.1	632.9	717.1
Chest Resultant Accel.	178.0	191.6	173.8	187.8	160.7	180.6	172.8	209.4	160.7	209.4
Pelvis Resultant Accel.	354.2	389.6	350.3	398.3	338.5	385.8	335.3	397.8	335.3	398.3
NIC +	42.3	47.7	41.1	44.1	39.8	42.6	45.1	49.4	39.8	49.4
NIC -	-123.8	-110.7	-122.2	-111.6	-124.0	-116.2	-122.1	-110.6	-124.0	-110.6
Upper Neck Fx Force +	116.2	153.8	121.0	133.9	155.3	180.8	155.4	186.3	116.2	186.3
Upper Neck Fx Force -	-357.7	-288.2	-319.3	-305.7	-267.2	-233.4	-343.5	-312.1	-357.7	-233.4
Upper Neck Fz Force	1225.8	1424.3	1414.0	1589.3	1128.5	1490.8	1340.8	1475.0	1128.5	1589.3
Up Neck My +	23.9	32.2	21.5	22.8	24.2	34.9	23.7	33.4	21.5	34.9
Up Neck My -	-26.6	-22.3	-30.4	-27.5	-39.3	-23.8	-26.8	-19.4	-39.3	-19.4
Upper Neck Myoc +	22.6	32.3	20.8	23.1	23.6	33.1	23.9	32.5	20.8	33.1
Upper Neck Myoc -	-20.3	-16.9	-24.9	-22.0	-35.3	-19.2	-17.7	-13.3	-35.3	-13.3



R&R: all max/min: page 2 of 2

ChnDesc	B5010 Min	B5010 Max	B5011 Min	B5011 Max	B5014 Min	B5014 Max	B5015 Min	B5015 Max	All Min	All Max
Head Rot. Vel +	18.0	21.2	18.2	20.8	19.7	24.0	20.3	23.8	18.0	24.0
Head Rot. Vel -	-14.9	-11.7	-14.6	-13.5	-16.2	-12.8	-14.0	-11.7	-16.2	-11.7
Chest Rot. Vel. +	8.5	9.8	8.1	8.7	8.2	9.0	9.0	10.3	8.1	10.3
Pelvis Rot. Vel. +	0.0	5.9	0.0	6.5	5.4	6.4	4.1	4.5	0.0	6.5
Head-Chest Rot. Vel +	11.4	14.4	12.0	15.4	14.0	20.3	14.1	17.7	11.4	20.3
Head-Chest Rot. Vel -	-12.2	-9.7	-11.9	-10.8	-13.6	-9.8	-11.1	-8.8	-13.6	-8.8
Chest-Pelvis Rot. Vel. +	0.0	5.8	0.0	6.1	4.6	6.0	5.5	7.3	0.0	7.3
Chest-Pelvis Rot. Vel. -	-4.2	0.0	-4.8	0.0	-4.2	-3.5	-5.0	-3.5	-5.0	0.0
Head Rotation	17.2	18.5	19.6	21.5	18.9	24.3	17.0	19.4	17.0	24.3
Chest Rotation	16.5	18.6	15.5	16.3	14.9	16.6	16.6	20.0	14.9	20.0
Pelvis Rotation	0.0	11.0	0.0	9.9	8.5	11.7	0.0	8.4	0.0	11.7
Head-Chest Rot +	0.8	3.3	4.5	5.8	4.5	8.7	-0.1	3.4	-0.1	8.7
Head-Chest Rot -	-10.1	-8.7	-6.6	-4.8	-7.1	-4.3	-10.7	-8.8	-10.7	-4.3
Chest-Pelvis Rot.	0.0	11.4	0.0	10.1	7.8	9.1	11.2	14.5	0.0	14.5
Head Contact Fx	2953.4	3161.3	2943.6	3201.2	2893.5	3131.4	2845.1	3053.1	2845.1	3201.2
Head Contact Fz	-1128.2	-949.8	-1211.7	-1067.4	-1185.5	-802.3	-1101.5	-1005.5	-1211.7	-802.3
Head Contact Resultant	3091.1	3321.9	3110.4	3331.9	3059.5	3245.3	2982.1	3202.6	2982.1	3331.9
Head Contact Angle	-0.4	-0.3	-0.4	-0.4	-0.4	-0.3	-0.4	-0.3	-0.4	-0.3



R&R: all plots

- See separate file:

“H-III50M R&R TRL seat - graphs 18APR13.pdf”

