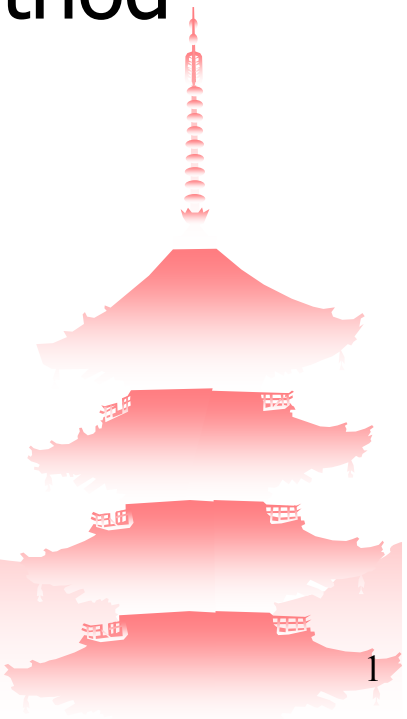
GTR7-03-03

Japan Automobile Standards Internationalization Center

Japan Research Activities in the GTR-7 Phase 2 IWG

Repeatability and Reproducibility study with new Bio RID II calibration method



JASIC/Japan

Rev.1 May. 31. 2010

May. 17. 2010

Contents of Study

Dummy Calibration Method Comparison Tests

The current method and newly proposed methods for calibrating BioRIDII dummies were compared and studied using 3 dummies.

(1) Current calibration method (calibration method currently used)
(2) New calibration method (newly proposed calibration method without headrest)
(3) New calibration method (newly proposed calibration method with headrest)
(4) Sled Test (ΔV16km/h)

Dummies used:

BioRIDII dummies (Ver.G)

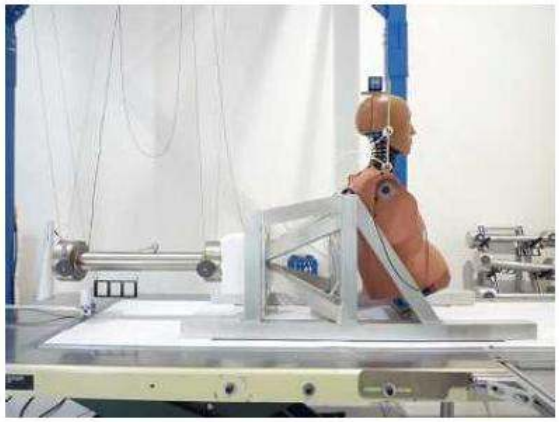
(1) 02G dummy (used for about 7 years)
Old damper, new jacket

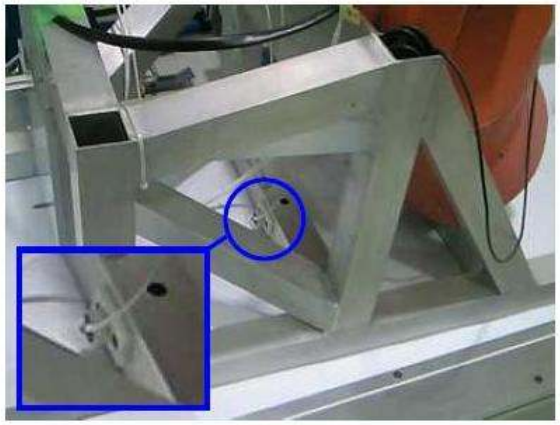
(2) 95G dummy (used for about 1 year)
New damper, new jacket

(3) 102G dummy (new)
New damper, new jacket

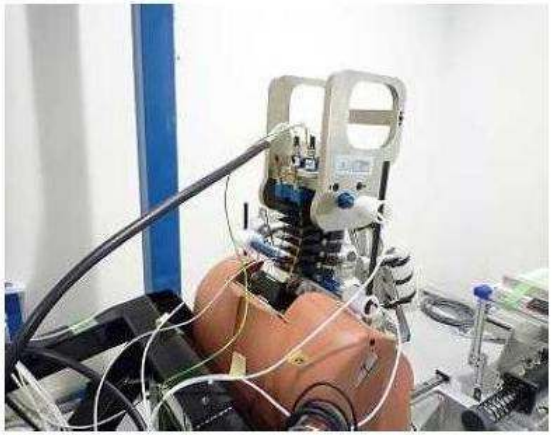
Calibration Method

(1) Old mini Sled





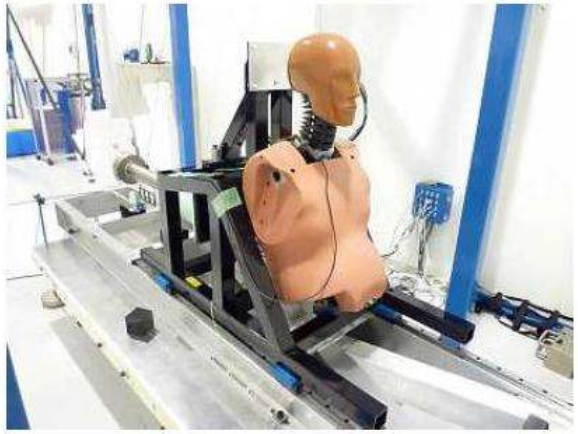
(2) New mini Sled without H/R

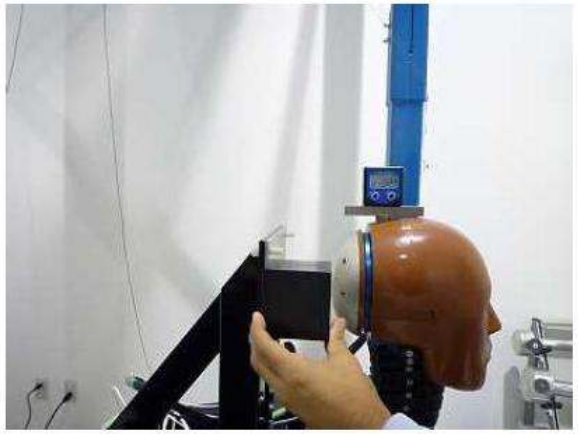


Parameters to measure: Pendulum force, Sled acceleration, T1(first thoracic vertebra) acceleration, Head rotation angle (Pot.A), Neck rotation angle (Pot.B), First thoracic vertebra rotation angle (Pot.C), Upper neck force & moment (UpperNeck-FX, FZ, MY)

Calibration Method

(3) New mini Sled with H/R



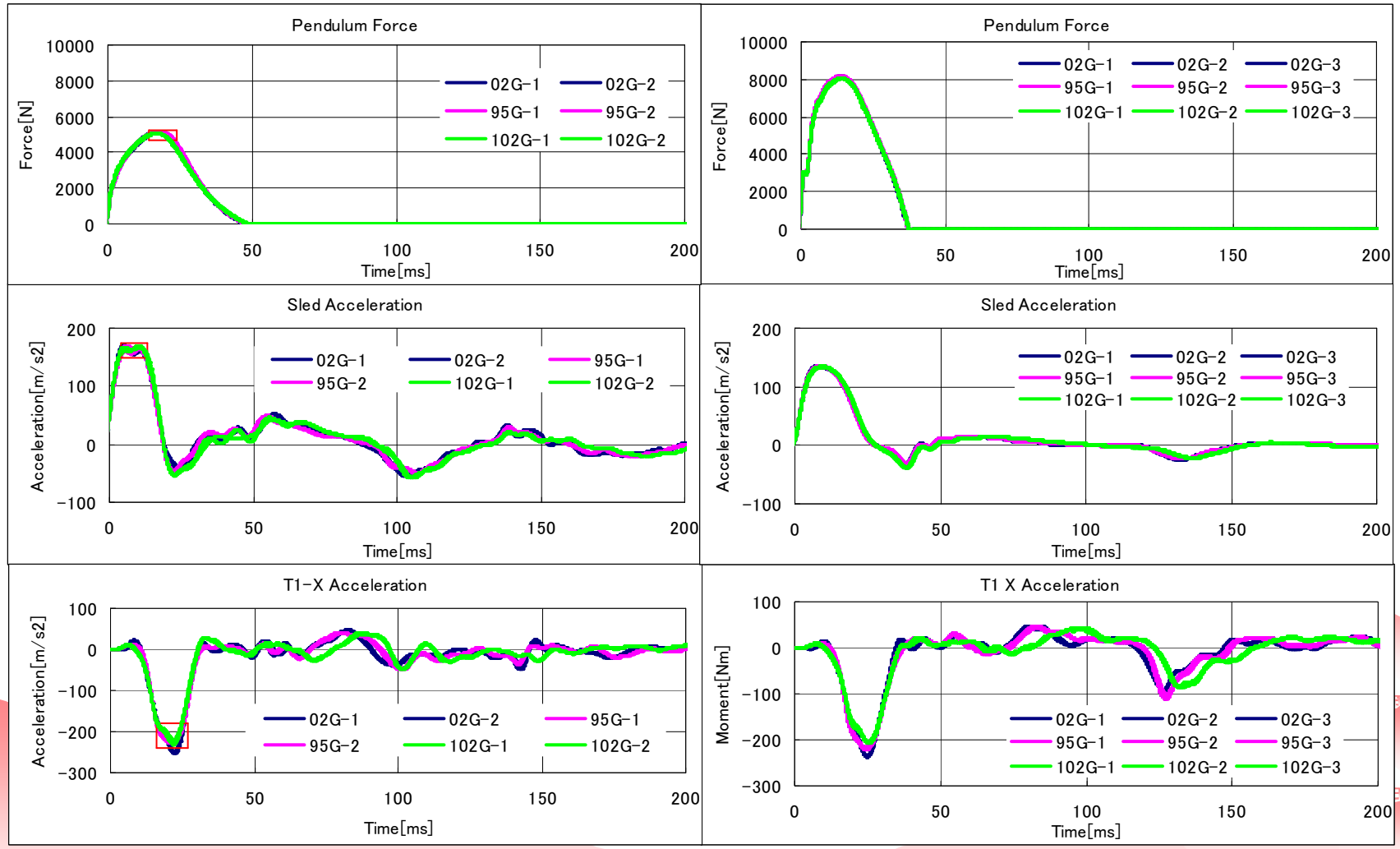


Parameters to measure: Pendulum force, Sled acceleration, Upper neck force & moment (UpperNeck-FX, FZ, MY), Lower neck force & moment (LowerNeck-FX, FZ, MY)

Old Mini Sled & New Mini Sled without H/R

(1) Old mini sled without H/R

(2) New mini sled without H/R

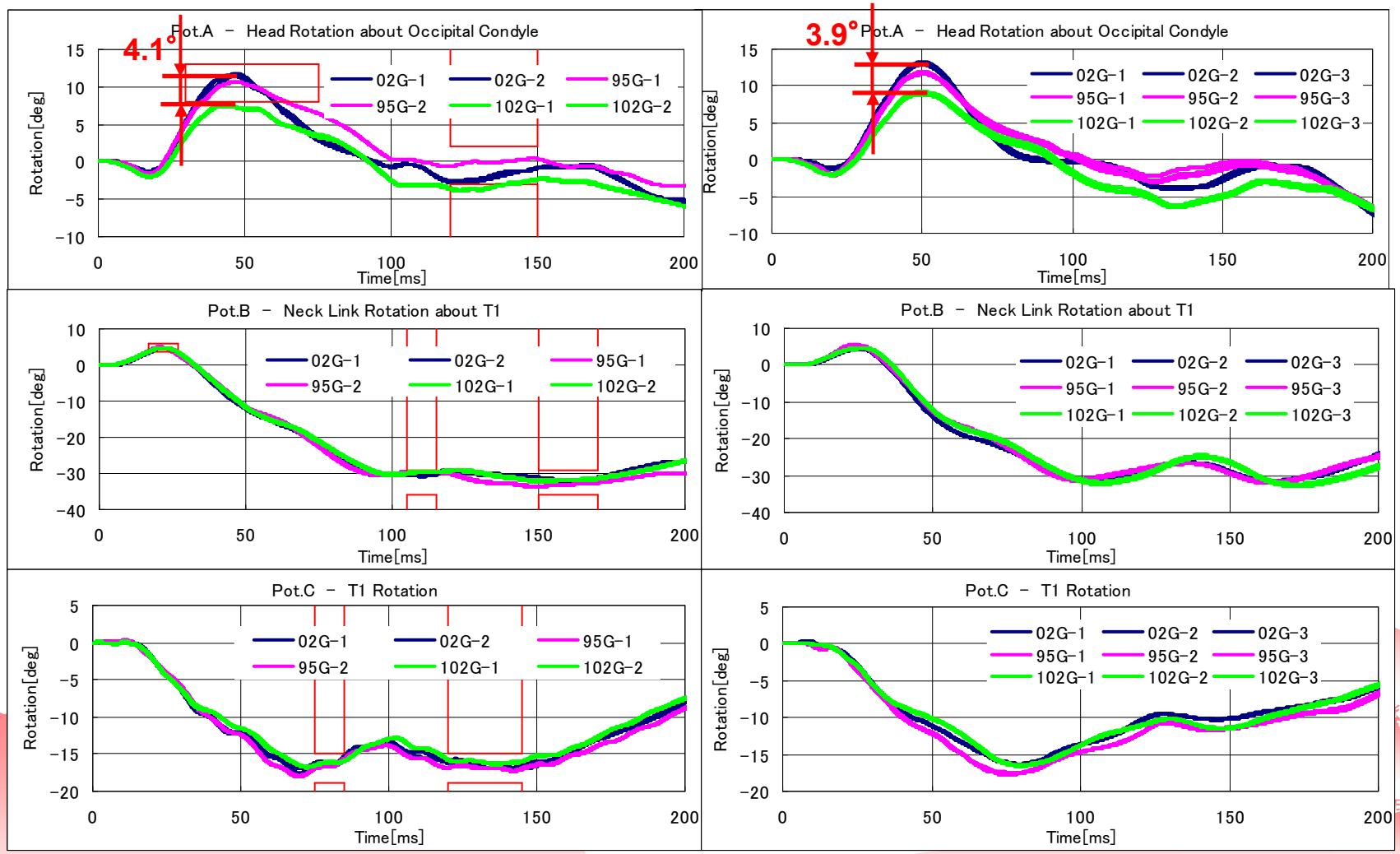


*** The level of impact was almost the same between current and new methods in all tests.**

Old Mini Sled & New Mini Sled without H/R

(1) Old mini sled without H/R

(2) New mini sled without H/R

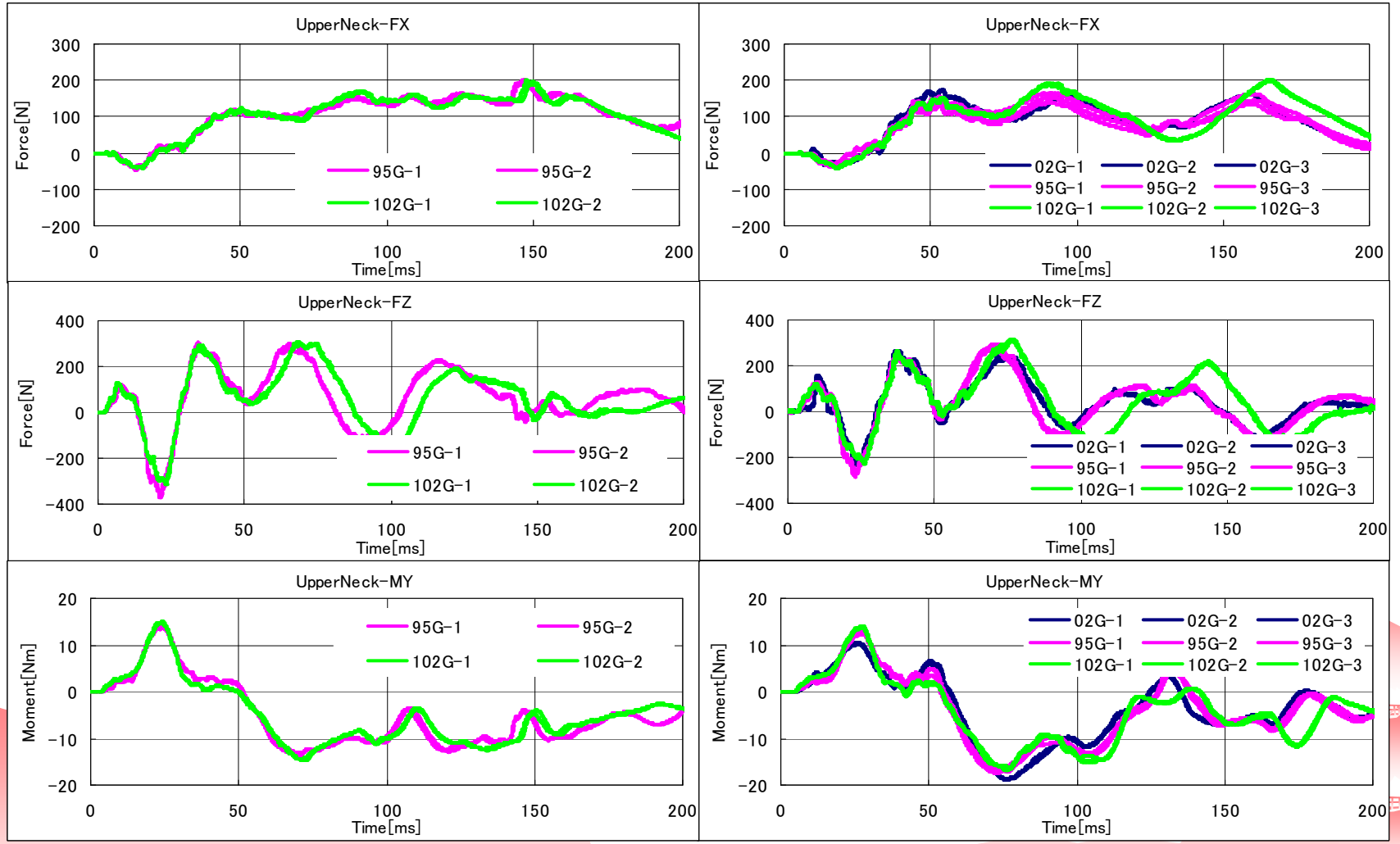


* Rotation Angle: While the waveform tendencies differed between current and new methods, the same differences that were seen among dummies in the current method were also observed in the new method.

Old Mini Sled & New Mini Sled without H/R

(1) Old sled without H/R

(2) New sled without H/R



* Upper Neck Force & Moment: While the waveform tendencies differed between current and new methods, the same differences that were seen among dummies in the current method were also observed in the new method.

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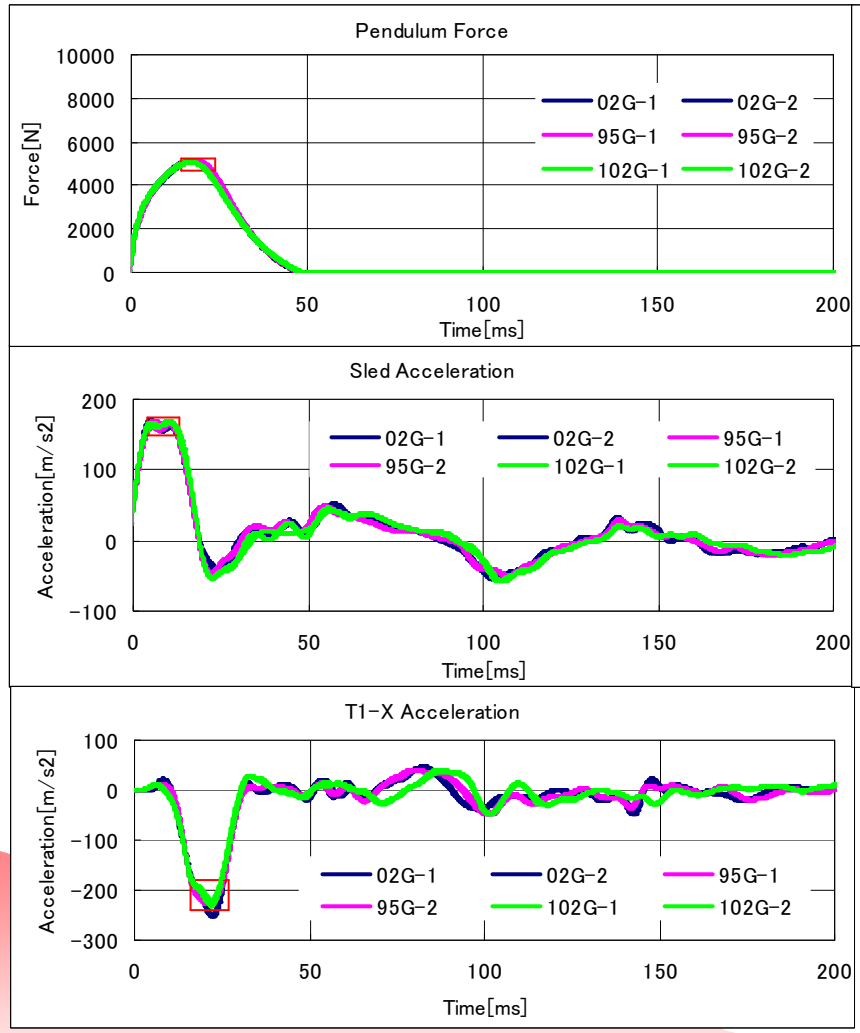
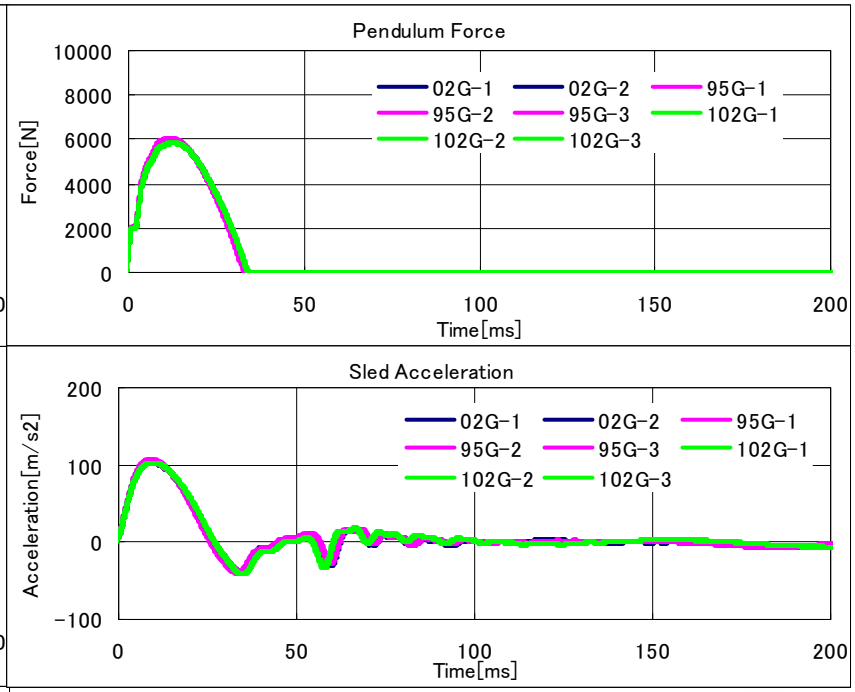
Old Mini Sled & New Mini Sled with H/R

(1) Old mini sled without H/R



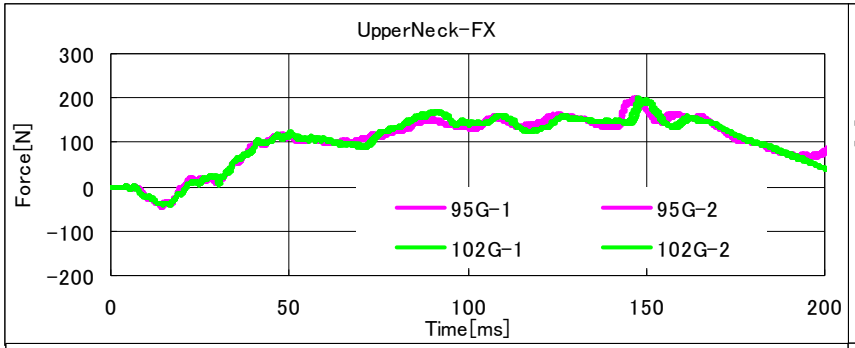
(3) New mini sled with H/R

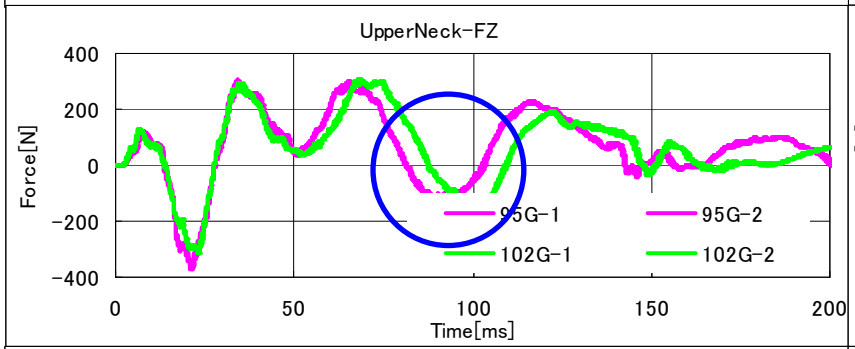


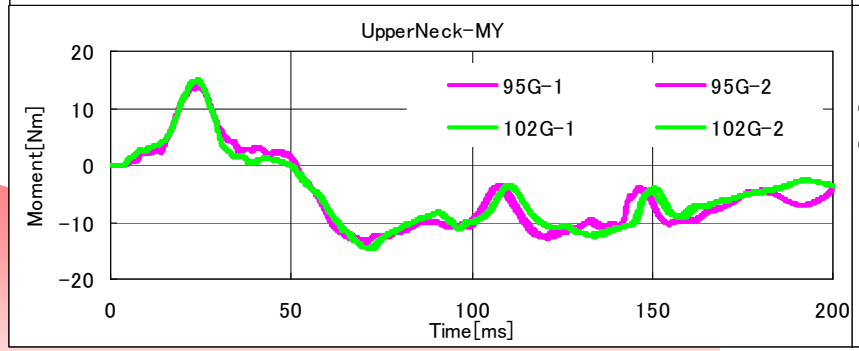
No data

Old Mini Sled & New Mini Sled with H/R

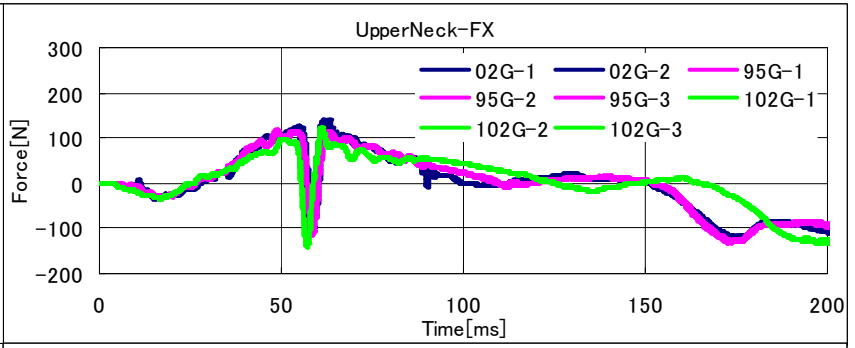
(1) Old mini sled without H/R

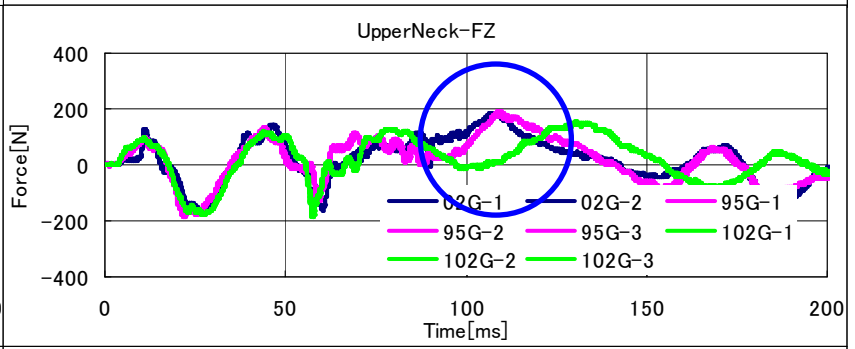


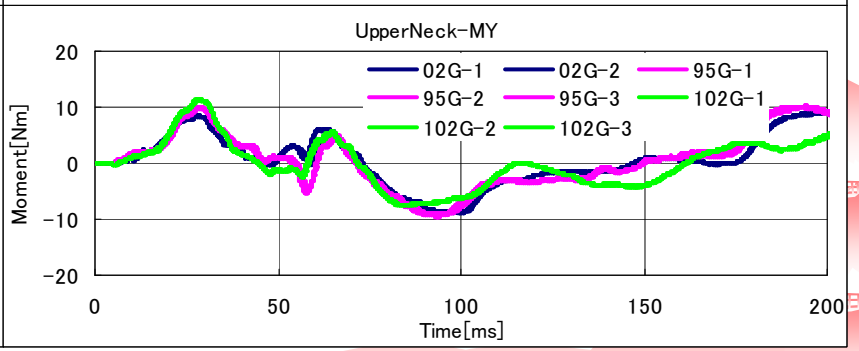




(3) New mini sled with H/R







* Upper Neck Fz differed between current and new methods,

Old Mini Sled & New Mini Sled with H/R

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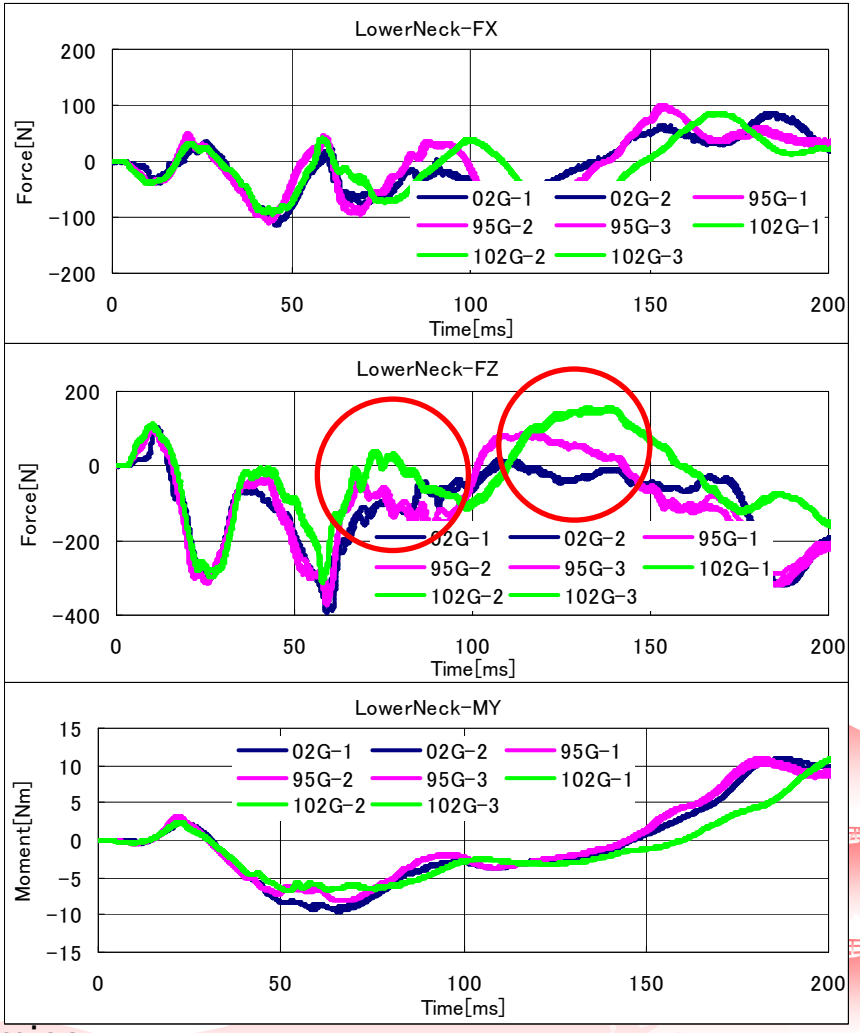
(1) Old mini sled without H/R

No data

No data

No data

(3) New mini sled with H/R



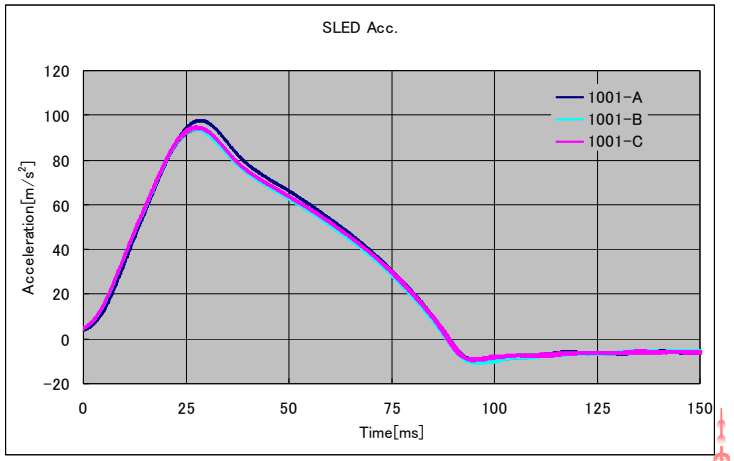
* Lower Neck Fz shows variation among dummies,

Summary of the Results of Three Calibration Tests

- The level of impact was almost the same in all tests.
- The same differences in the peak acceleration, rotation angle, force/moment, etc. among dummies that were seen in the current method were also observed in the new method.
- In the new method with headrest, the same differences in the peak force/moment among dummies except for “ Upper Fz and Lower Fz” that were seen more than current and new methods without headrest.
- The damper damage that had occurred in Korea was not observed in these tests.

Sled Test

(4) Sled Test



Teat Pulse : ΔV16km/h with Euro NCAP mid pulse

Sears : Normal seat, Passive seat, Reactive HR seat

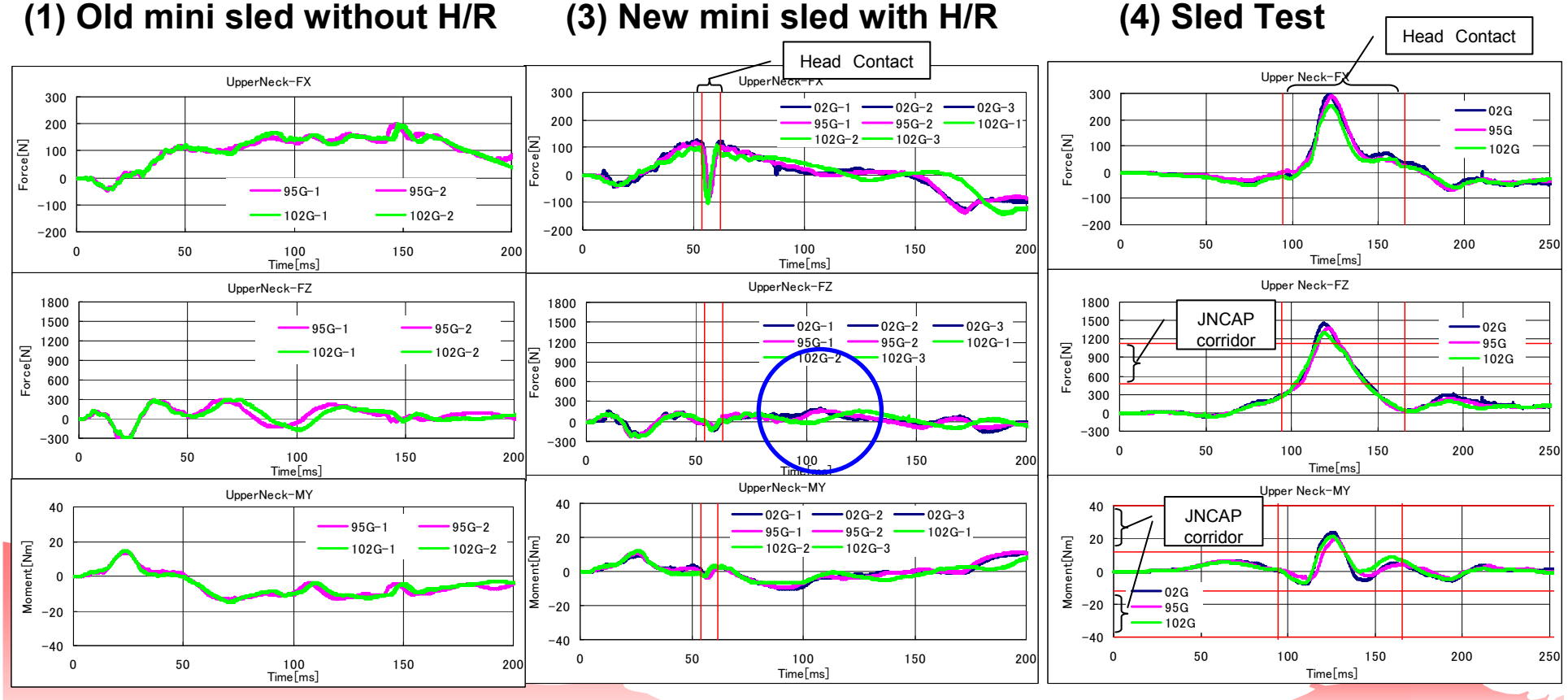
Parameters to measure:
Sled acceleration, Upper neck force & moment (UpperNeck-FX, FZ, MY), Lower neck force & moment (Lower Neck-FX, FZ, MY) and video

Comparison between Calibration and Sled with Normal seat

Upper Neck Force and Moment

- **All peak values of sled test are higher than both mini sled.**
- Rev1 **• Upper Fx and Fz mini sled values are smaller than JNACP corridor.**
- **Upper Fz variation of Sled test is smaller than mini sled with H/R.**

(1) Old mini sled without H/R **(3) New mini sled with H/R** **(4) Sled Test**

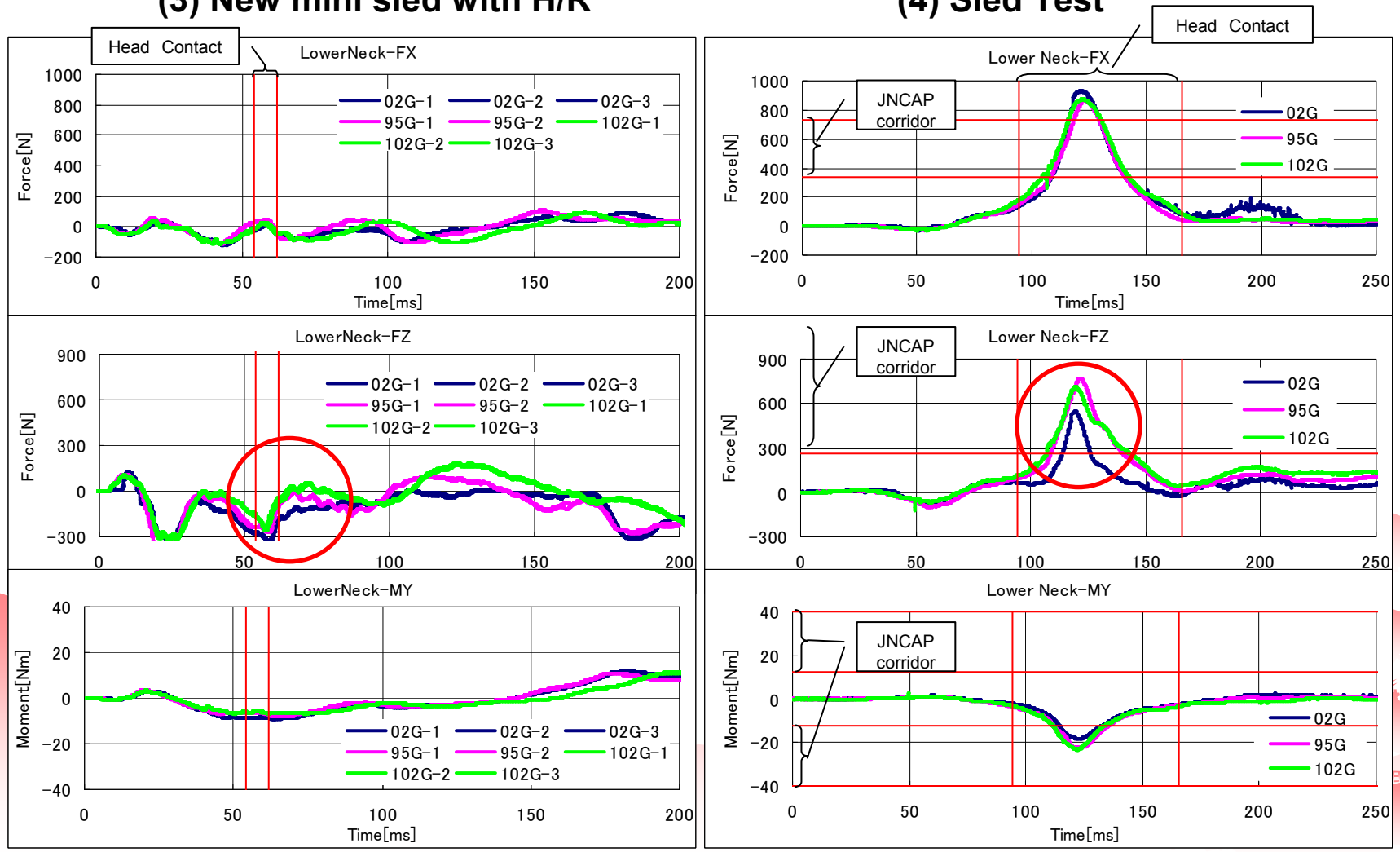


Comparison between Calibration and Sled with Normal seat

Lower Neck Force and Moment

- **All peak values of sled test are higher than both mini sled.**
- Rev1 **Lower Fx and Fz valuee are smaller than JNCAP corridor.**
- **Lower Fz variation of Sled test is also high as like as mini sled with H/R.**

(3) New mini sled with H/R **(4) Sled Test**



Comparison between Calibration and Sled with Normal seat

Peak Values and Reproducibility C.V.

- **C.V. of peak Upper Fz is relatively small.**
- **C.V. of peak lower Fz is relatively high.**

Dummy No.	HRCT (ms)	Hx Acc. (m/s^2)	T1 Acc. (m/s^2)	T1-R Acc. (m/s^2)	T1-L Acc. (m/s^2)	NIC (m^2/s^2)	NIC-R (m^2/s^2)	NIC-L (m^2/s^2)
02G	96.8	-322.4	-141.0	-135.5	-146.5	28.4	28.7	28.1
95G	96.3	-315.3	-132.5	-126.8	-138.1	23.2	22.7	23.8
102G	94.5	-304.1	-150.5	-142.1	-158.8	24.5	24.3	24.7
C.V値(%)	0.7	1.7	3.7	3.3	4.1	6.1	7.2	5.1
S.D.	1.1	9.2	9.0	7.7	10.4	2.7	3.1	2.2
Dummy No.	Upper FX (N)	Upper FZ (N)	Upper MY-Flx. (Nm)	Upper MY-Ext. (Nm)	Lower FX (N)	Lower FZ (N)	Lower MY-Flx. (Nm)	Lower MY-Ext. (Nm)
02G	297.3	1458.0	23.8	-7.6	933.0	545.6	1.4	-18.1
95G	290.2	1388.3	19.9	-4.7	866.0	772.0	1.4	-22.3
102G	254.3	1307.8	21.4	-6.8	874.9	707.7	2.9	-23.2
C.V値(%)	4.7	3.1	5.2	13.8	2.4	10.0	26.0	7.4
S.D.	23.1	75.1	2.0	1.5	36.4	116.7	0.8	2.7

Comparison between Calibration and Sled with Passive seat

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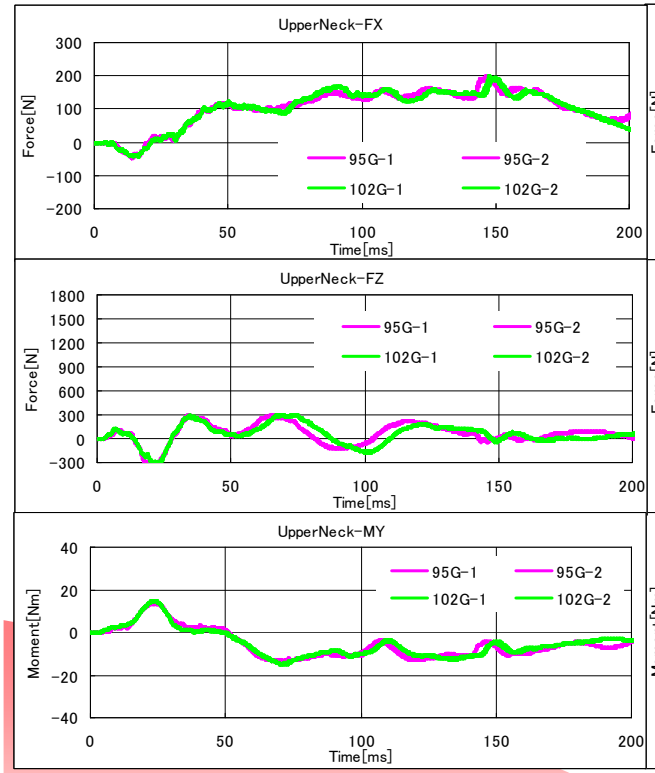
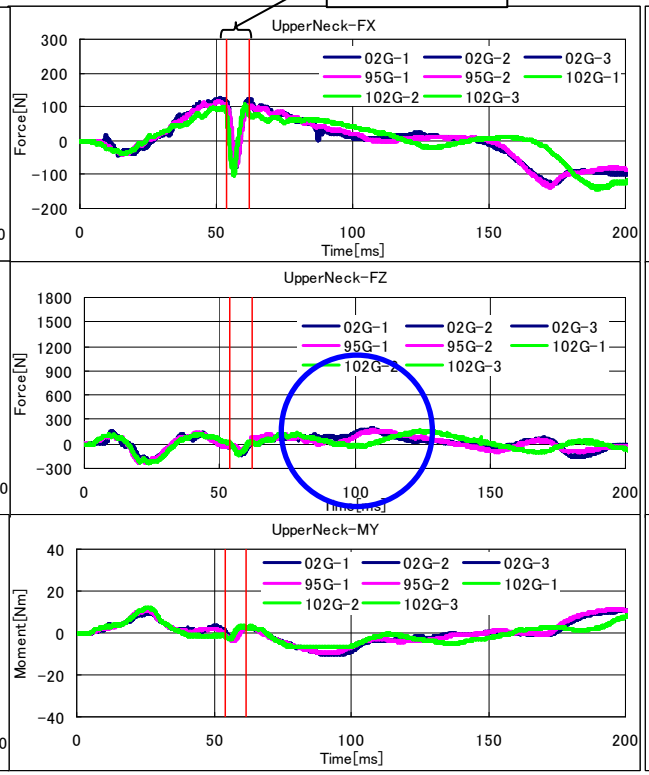
Upper Neck Force and Moment

- All peak values of sled test are higher than both mini sled.
- Upper Fz variation of Sled test is smaller than mini sled with H/R.

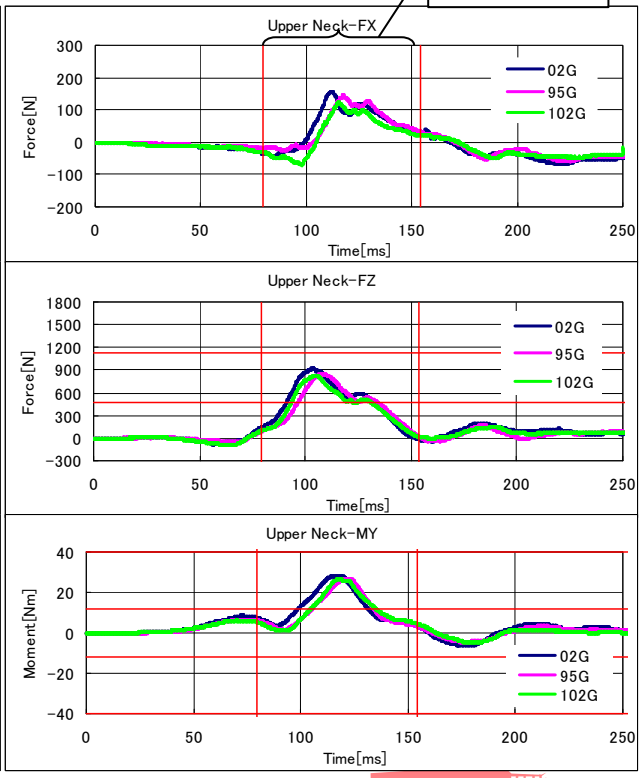
(1) Old mini sled without H/R



(3) New mini sled with H/R



(4) Sled Test

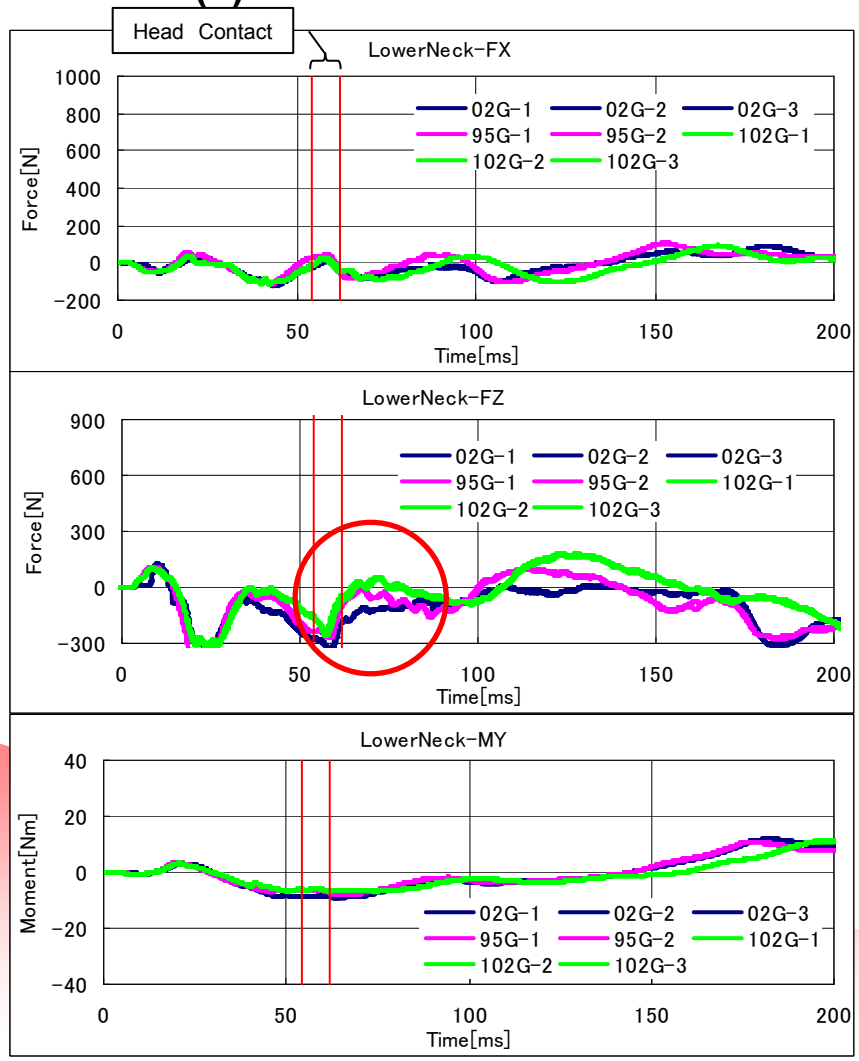


Comparison between Calibration and Sled with Passive seat

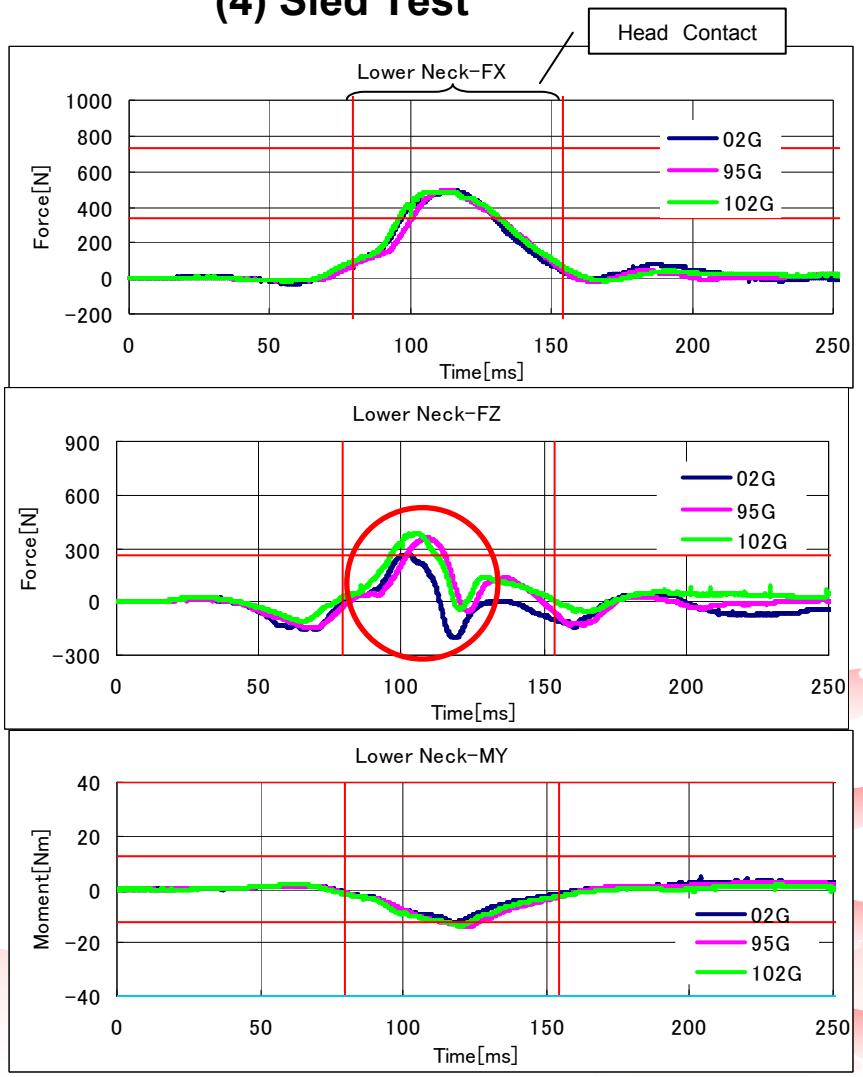
Lower Neck Force and Moment

- **All peak values of sled test are higher than both mini sled.**
- **Lower Fz variation of Sled test is also high as like as mini sled with H/R.**

(3) New mini sled with H/R



(4) Sled Test



Comparison between Calibration and Sled with Passive seat

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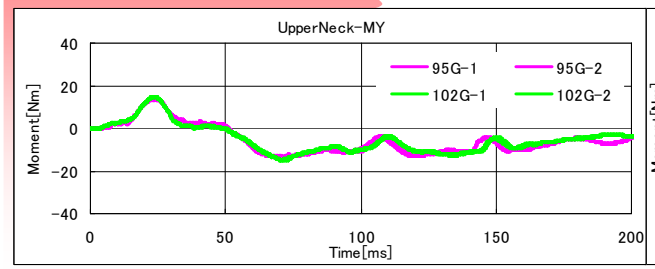
Peak Values and Reproducibility C.V.

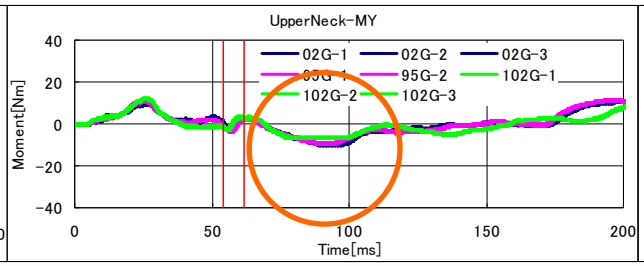
- **C.V. of peak Upper Fz is relatively small.**
- **C.V. of peak lower Fz is relatively high.**
- **C.V. of peak Upper My –Ext. is relatively high, however value is small.**

Dummy No.	HRCT (ms)	Hx Acc. (m/s^2)	T1 Acc. (m/s^2)	T1-R Acc. (m/s^2)	T1-L Acc. (m/s^2)	NIC (m^2/s^2)	NIC-R (m^2/s^2)	NIC-L (m^2/s^2)
02G	79.4	-216.7	-122.6	-123.3	-122.0	22.8	22.2	23.4
95G	83.0	-212.8	-134.4	-135.3	-133.4	21.4	20.9	22.0
102G	79.4	-202.2	-118.7	-119.6	-117.9	20.7	20.3	21.1
C.V値(%)	1.5	2.1	3.8	3.8	3.7	2.9	2.8	3.1
S.D.	2.1	7.5	8.1	8.2	8.0	1.1	1.0	1.2
Dummy No.	Upper FX (N)	Upper FZ (N)	Upper MY-Flx. (Nm)	Upper MY-Ext. (Nm)	Lower FX (N)	Lower FZ (N)	Lower MY-Flx. (Nm)	Lower MY-Ext. (Nm)
02G	158.1	925.1	28.5	-6.4	579.3	335.5	1.6	-12.1
95G	146.2	851.9	26.8	-4.4	500.7	356.7	1.8	-13.9
102G	122.3	835.0	26.7	-7.1	487.8	389.2	1.5	-13.6
C.V値(%)	7.4	3.2	2.1	13.9	5.5	4.3	5.3	4.1
S.D.	18.2	47.9	1.0	1.4	49.6	27.1	0.2	0.9

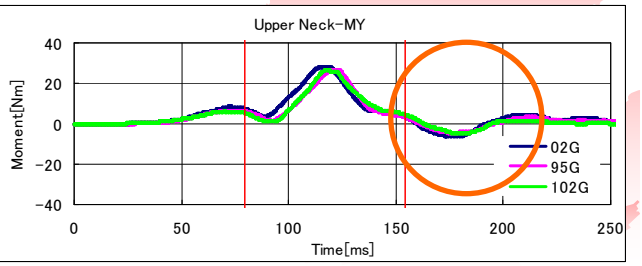
(1) Old mini sled without H/R



(3) New mini sled with H/R



(4) Sled Test



Comparison between Calibration and Sled with Reactive seat

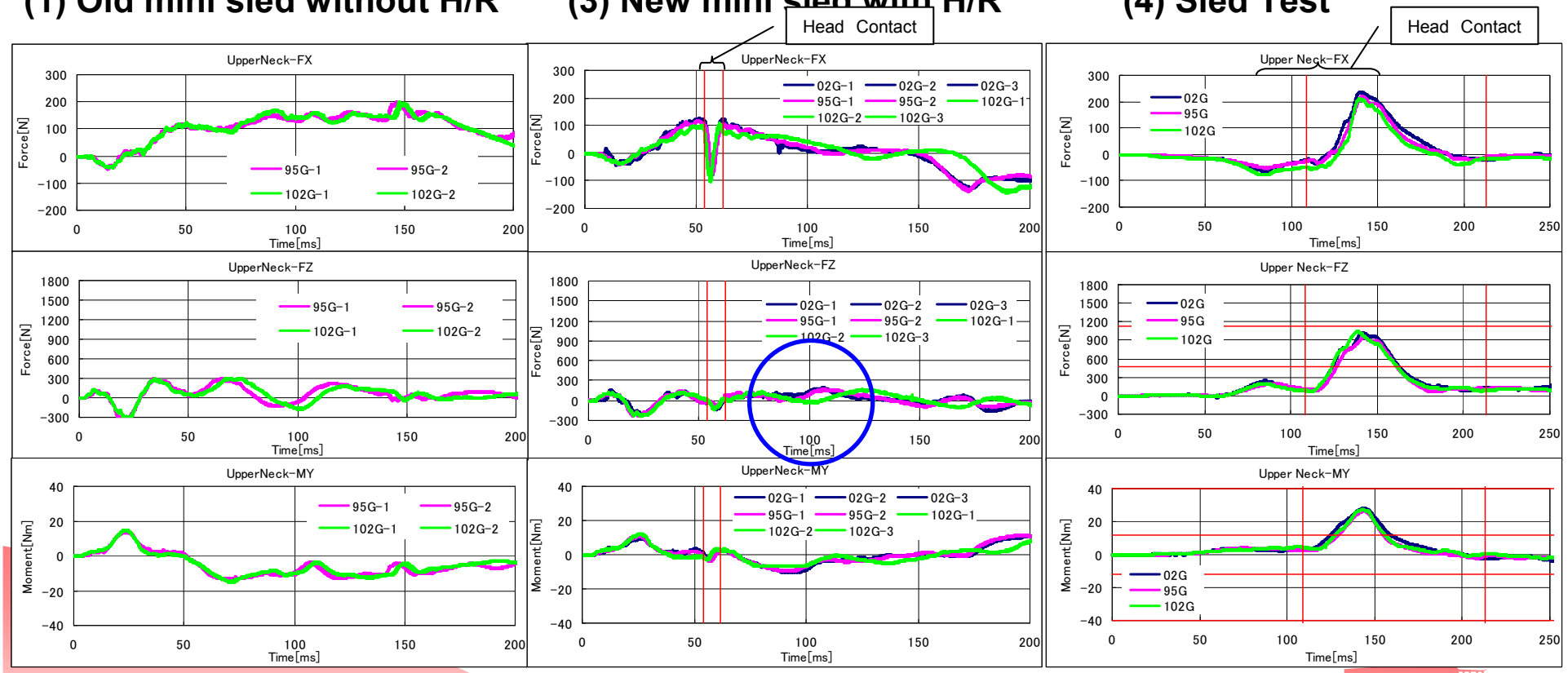
Upper Neck Force and Moment

- **All peak values of sled test are higher than both mini sled.**
- **Upper Fz variation of Sled test is smaller than mini sled with H/R.**

(1) Old mini sled without H/R

(3) New mini sled with H/R

(4) Sled Test

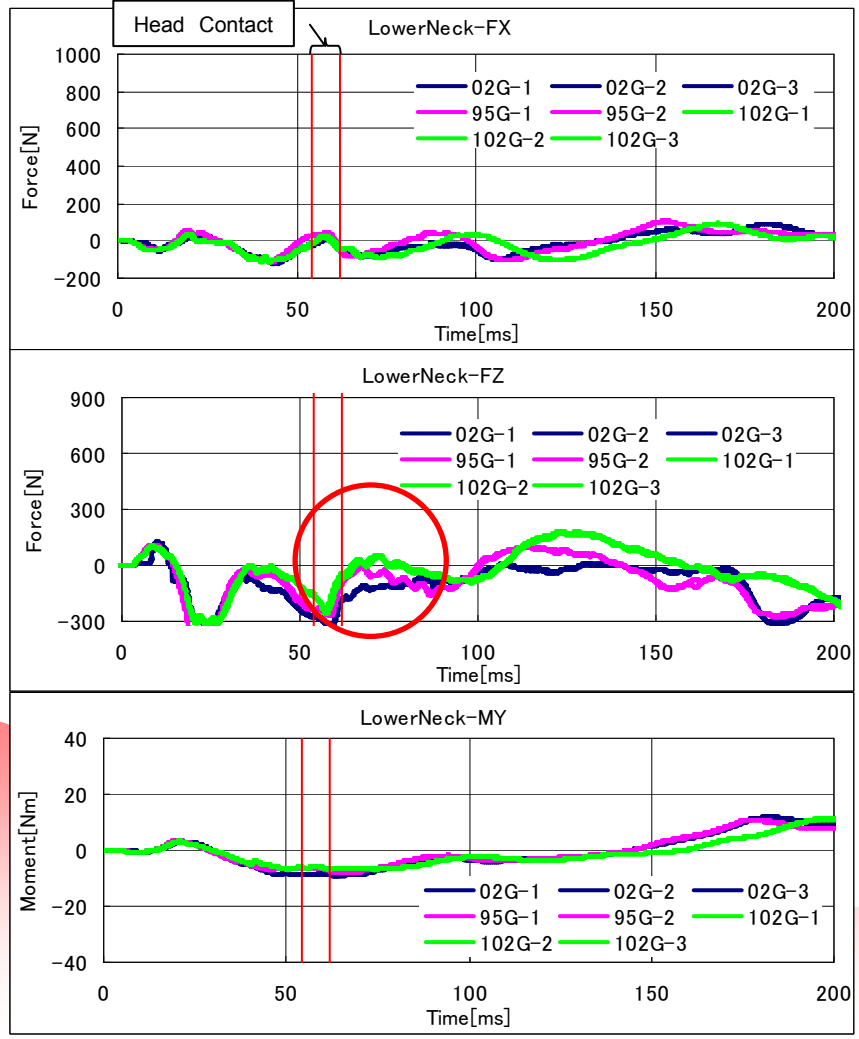


Comparison between Calibration and Sled with Reactive seat

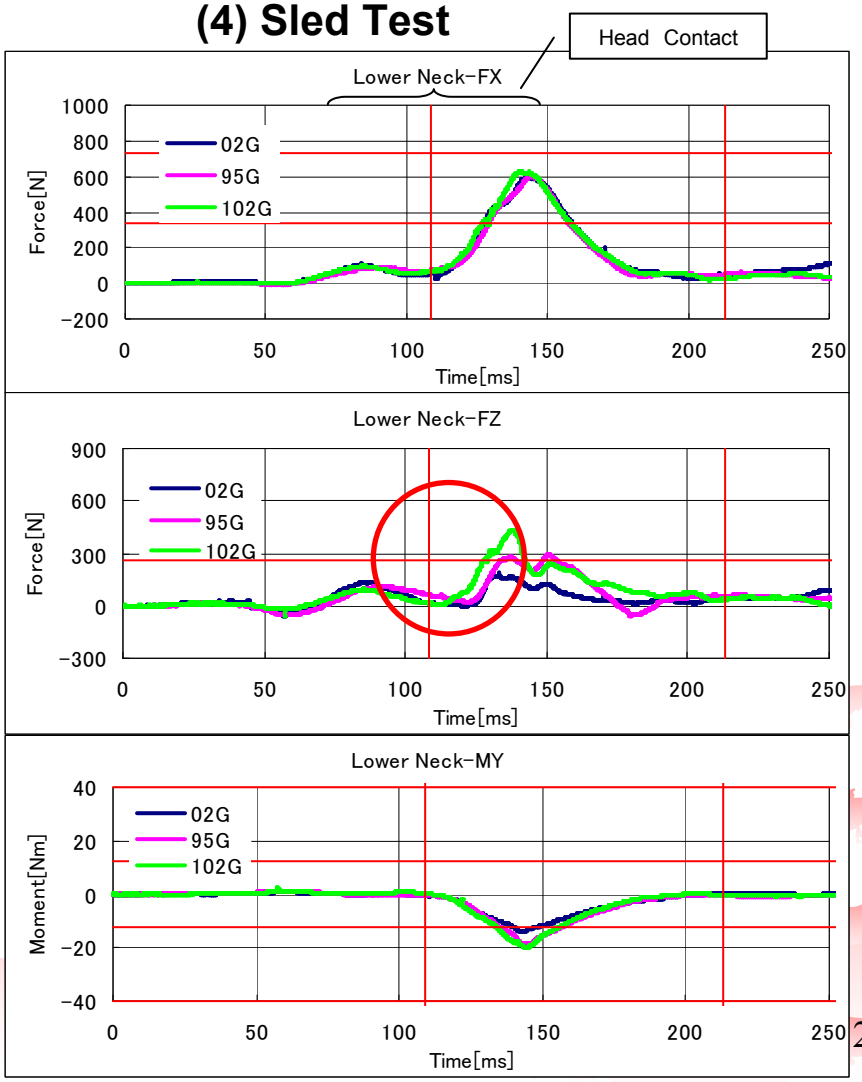
Lower Neck Force and Moment

- **All peak values of sled test are higher than both mini sled.**
- **Lower Fz variation of Sled test is also high as like as mini sled with H/R.**

(3) New mini sled with H/R



(4) Sled Test



Comparison between Calibration and Sled with Reactive seat

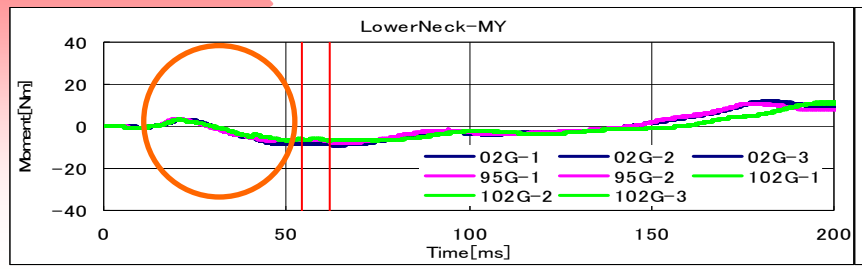
Peak Values and Reproducibility C.V.

- **C.V. of peak Upper Fz is relatively small.**
- **C.V. of peak lower Fz is relatively high.**
- **C.V. of peak Lower My –Flx. is relatively high, however value is small.**

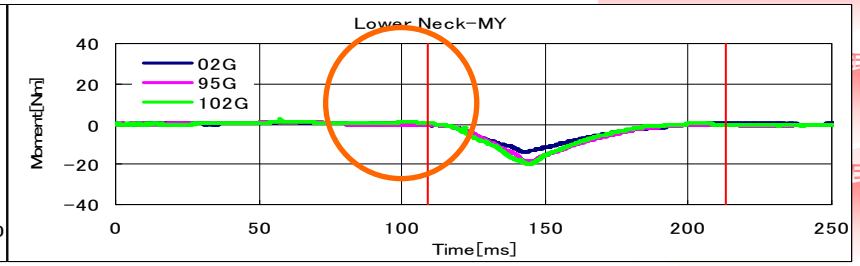
Dummy No.	HRCT (ms)	Hx Acc. (m/s^2)	T1 Acc. (m/s^2)	T1-R Acc. (m/s^2)	T1-L Acc. (m/s^2)	NIC (m^2/s^2)	NIC-R (m^2/s^2)	NIC-L (m^2/s^2)
02G	110.1	-250.5	-130.2	-131.0	-129.3	22.6	22.6	22.6
95G	112.2	-256.6	-123.3	-121.7	-124.8	23.3	22.6	23.9
102G	108.6	-254.1	-145.1	-147.8	-142.4	29.9	30.4	29.5
C.V値(%)	0.9	0.7	4.8	5.7	4.0	9.3	10.3	8.3
S.D.	1.8	3.1	11.2	13.2	9.1	4.1	4.5	3.7

Dummy No.	Upper FX (N)	Upper FZ (N)	Upper MY-Flx. (Nm)	Upper MY-Ext. (Nm)	Lower FX (N)	Lower FZ (N)	Lower MY-Flx. (Nm)	Lower MY-Ext. (Nm)
02G	236.5	1025.1	28.1	0.0	597.5	188.1	0.9	-13.8
95G	220.1	955.6	26.8	0.0	595.3	291.9	1.4	-18.7
102G	212.1	1048.6	27.4	0.0	627.3	431.6	2.3	-19.7
C.V値(%)	3.2	2.7	1.4	0.0	1.7	23.2	26.1	10.4
S.D.	12.5	46.4	0.7	0.0	17.9	122.2	0.7	3.1

(3) New mini sled with H/R



(4) Sled Test



SUMMARY

- All peak values of sled test are higher than both mini sled.

Rev1

- Upper & Lower Fx and Fz values of mini sled are smaller than JNACP corridor.

- Upper Fz variation of Sled test is smaller than mini sled with H/R.
  The min sled test variation may occur at rebound phase.

- Lower Fz variation of Sled test is also high as like as mini sled with
  H/R. The mini sled variation occur just after HR contact.

- Upper My-Ext. and Lower My-Flx. show variation at Sled tests, however values are very small.

Japan Automobile Standards Internationalization Center

Thank you for your attention！