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1st Flex-TEG MT
OICA office, Paris

General Information for the Flexible Pedestrian Legform Impactor - type G - (Flex-G)

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BACKGROUND

- In 2004, we developed a Flexible Pedestrian Legform Impactor ver. 2004 (Flex-PLI 2004) and loaned the Impactor to several organizations (NHTSA,JAMA member, J-MLIT).
- After the loan activities, we obtained several comments for the impactor improvement.
- In 2005, we developed a Flex-G which is developed to improve several parts of the Flex-PLI 2004.
- This presentation introduce the Flex-G specifications.

Structure

Basic structure

Flex-PLI 2004

Thigh
flexible

Knee Joint
ligament
restraint
system

Leg
flexible

Flex-G

Thigh
flexible

Knee Joint
ligament
restraint
system

Leg
flexible

Basic structure is same

Specifications

Length, C.G. location, and Mass

Length, C.G. location, and Mass	50th percentile of American Male*	Flex-G
a) Thigh length (mm)	428	433
b) Leg length (mm)	493	495
c) C.G. location of thigh (mm) **	218	213
d) C.G. location of leg (mm) **	233	225
e) Total leg form impactor mass (kg)	13.4	13.9
f) Thigh mass (kg)	8.6	8.6
g) Leg mass (kg)	4.8	5.3

* Robbins, D.H. ' Anthropometry of Motor Vehicle Occupants, Volume 2' NHTSA Contract DTNH22-80-C-07502 Pub. 1985.

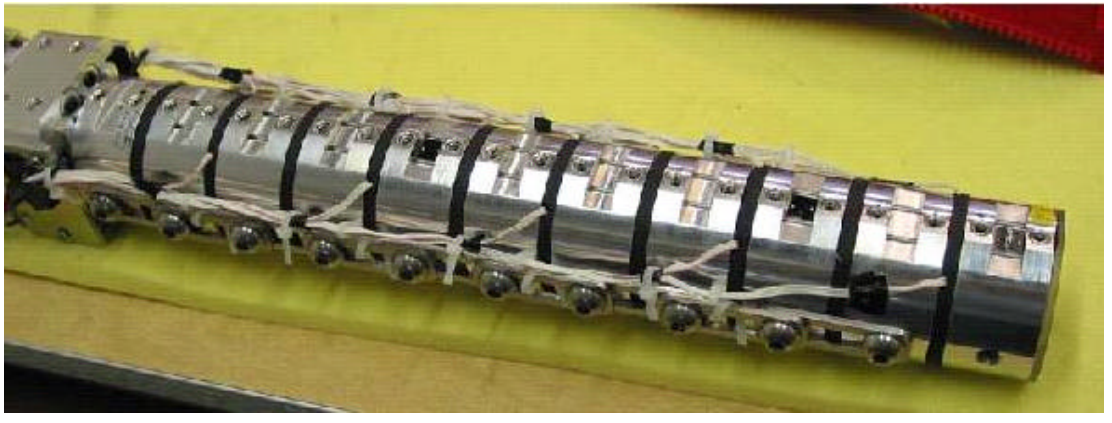
** from the knee joint center

Comparable to the 50th percentile of American Male

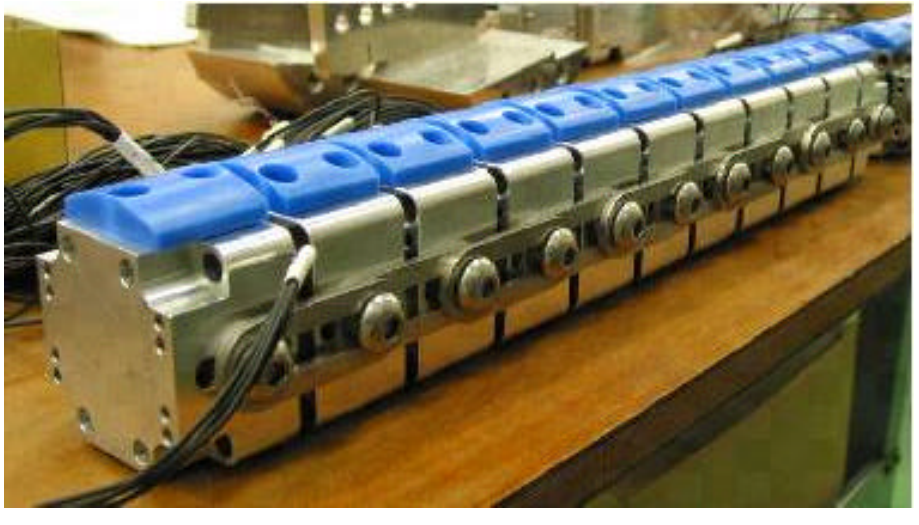
Long bones

outer shape

Flex-PLI 2004



Flex-G



slightly different shape

Long bones

outer shape (cont.)

Flex-G

Oblique view

Frontal view

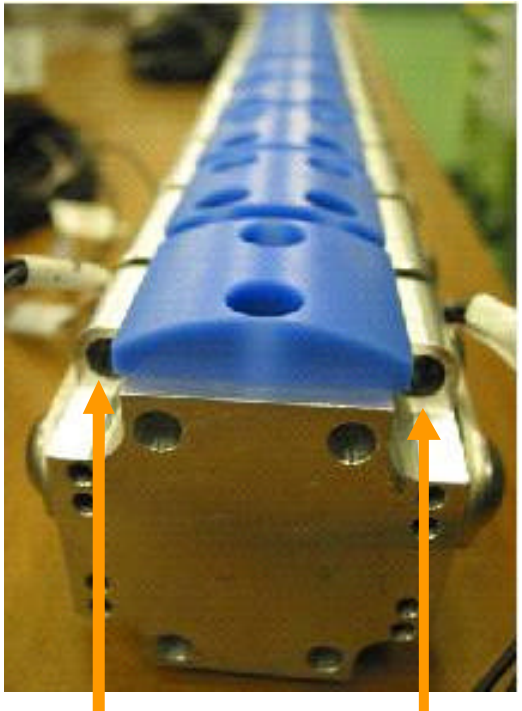
Side view

Back view

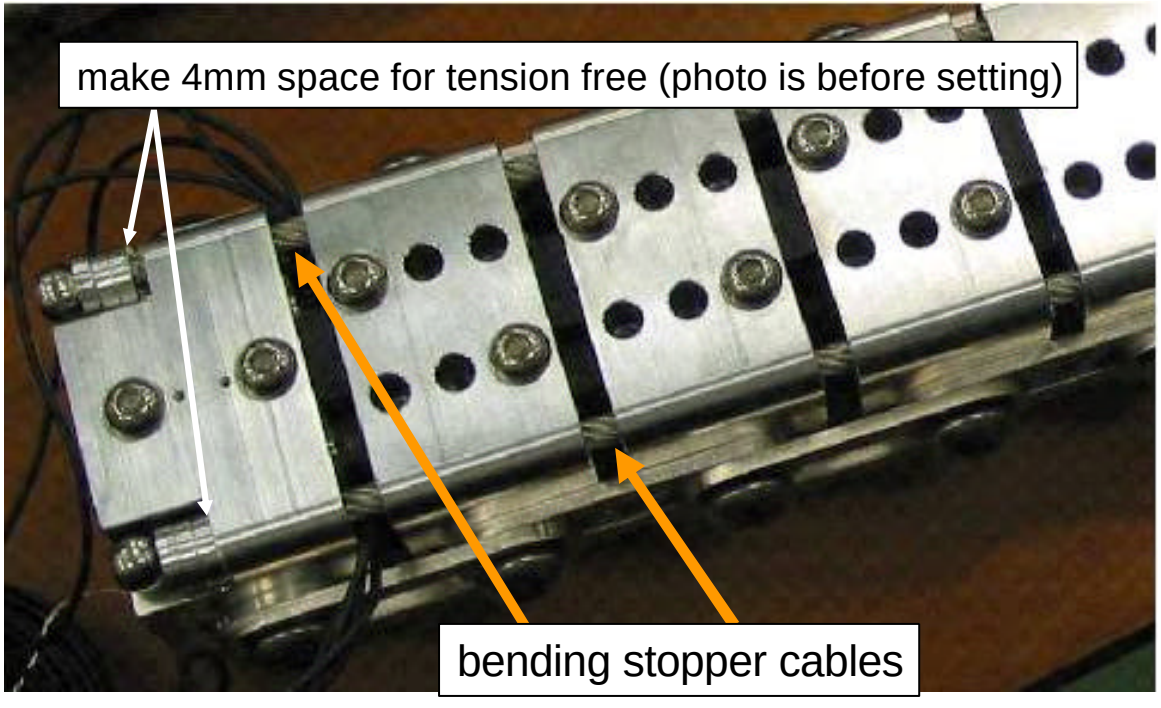
Long bones

outer shape (cont.)

Reason: To install bending stopper cables into the long bone parts
(prevents to apply large bending onto the long bone parts)



hole for bending stopper cables



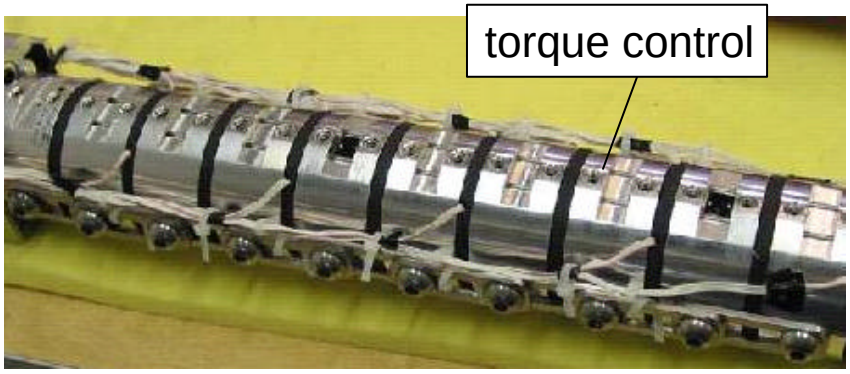
Initial -> Free for bending (does not generate any tensions)
After a certain bending level -> Work to prevent bending

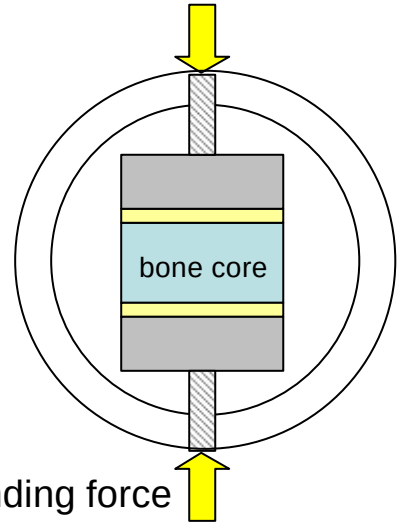
Long bones

screw setting

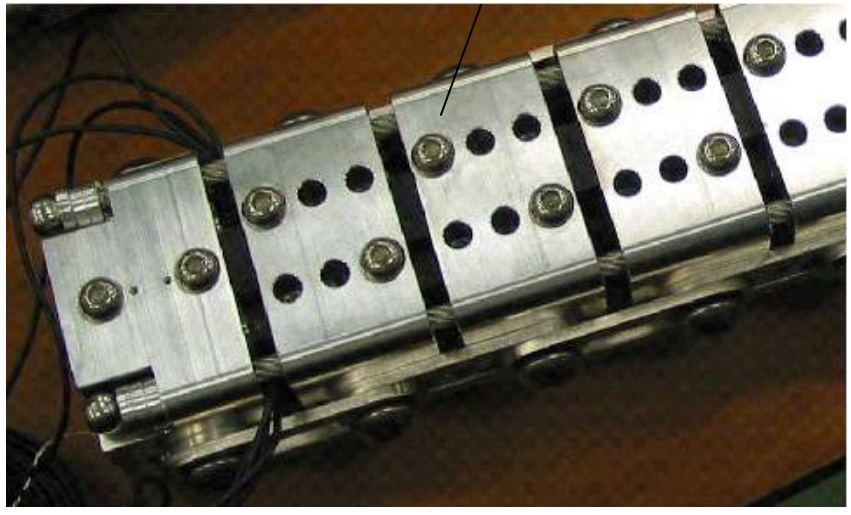
Reason: Easy maintenance
(need not to check the screw torque after the each test)

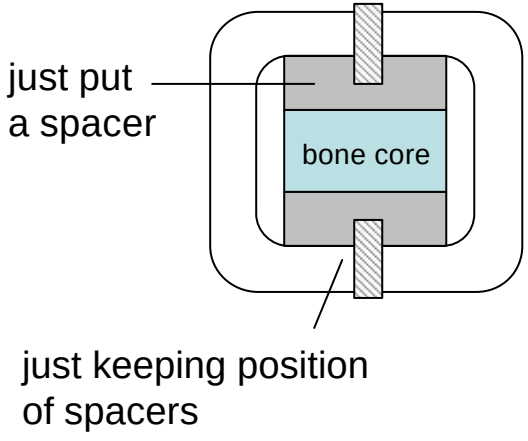
Flex-PLI 2004





Flex-G





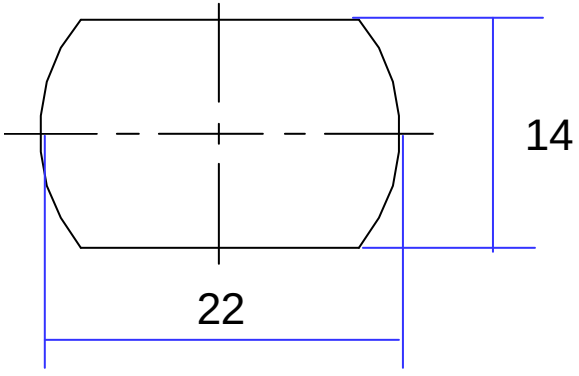
Long bones

cross-sectional shape of bone core

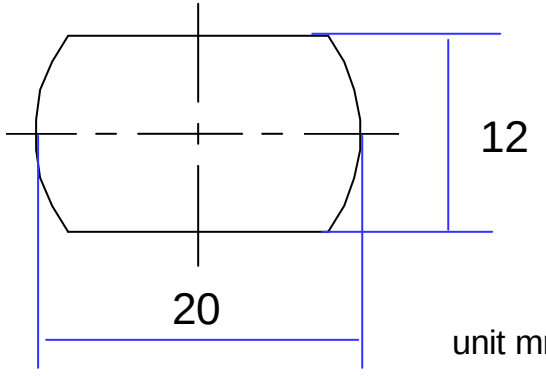
Reason: To improve durability of long bones

Flex-PLI 2004

Thigh



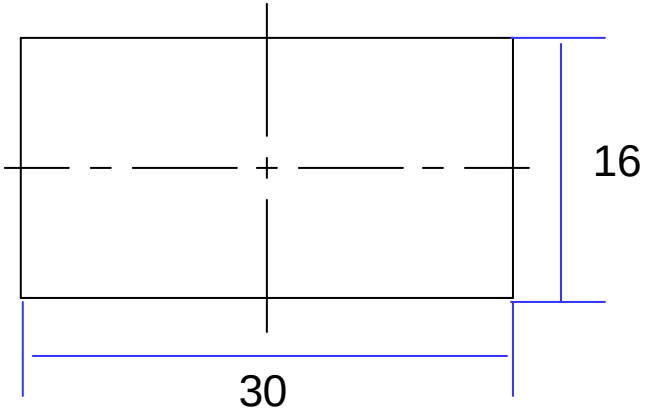
Leg



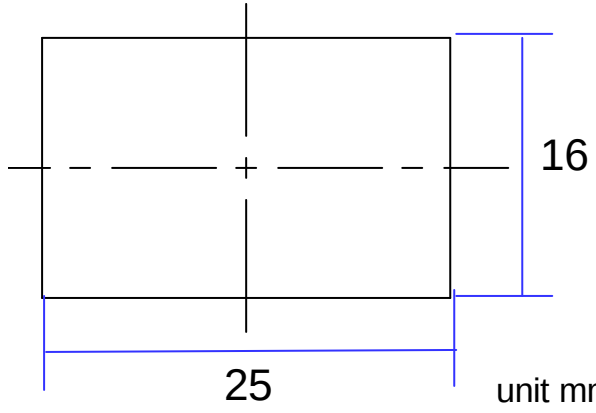
unit mm

Flex-G

Thigh



Leg



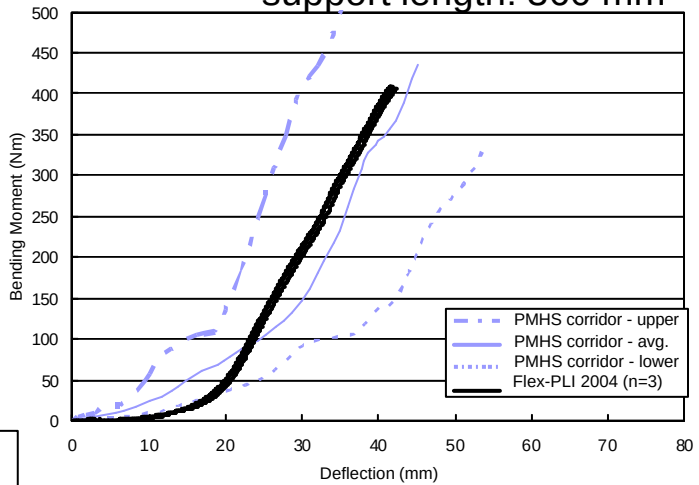
unit mm

Long bones

biofidelity of thigh

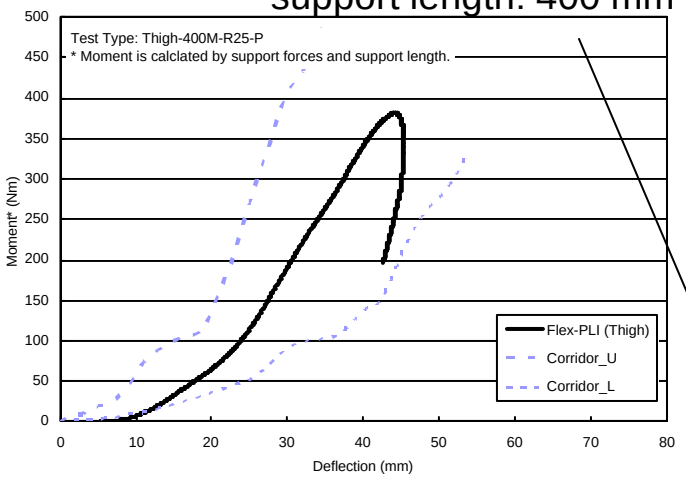
Flex-PLI 2004

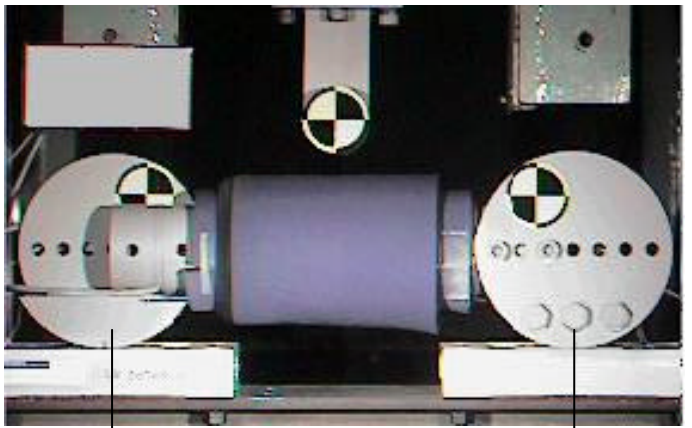
support length: 360 mm



Flex-G

support length: 400 mm





support length

(PMHS test: 404.1 mm)

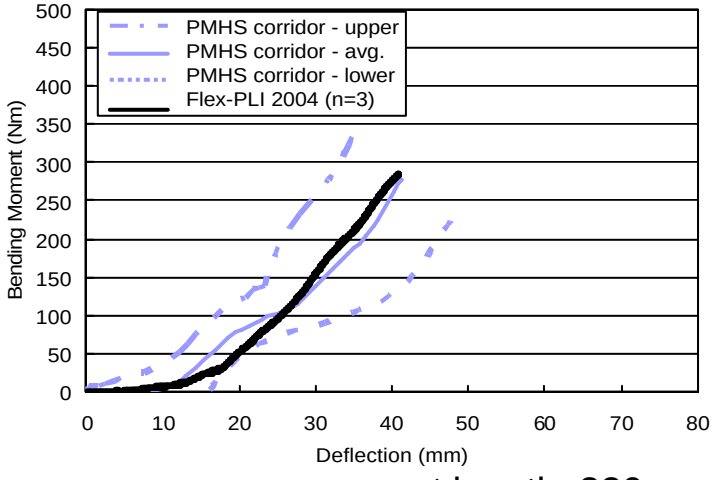
More appropriate support length

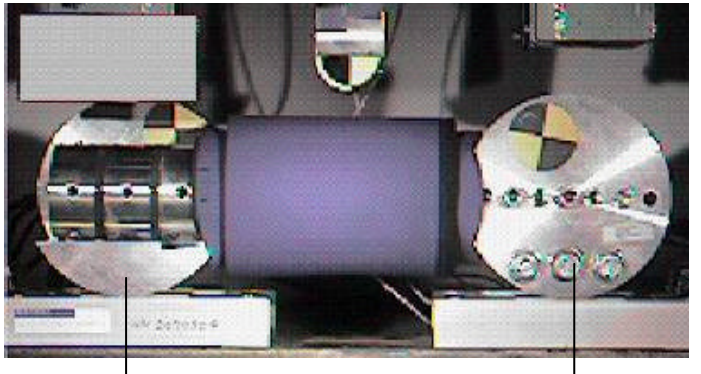
Long bones

biofidelity of leg

Flex-PLI 2004

support length: 320 mm

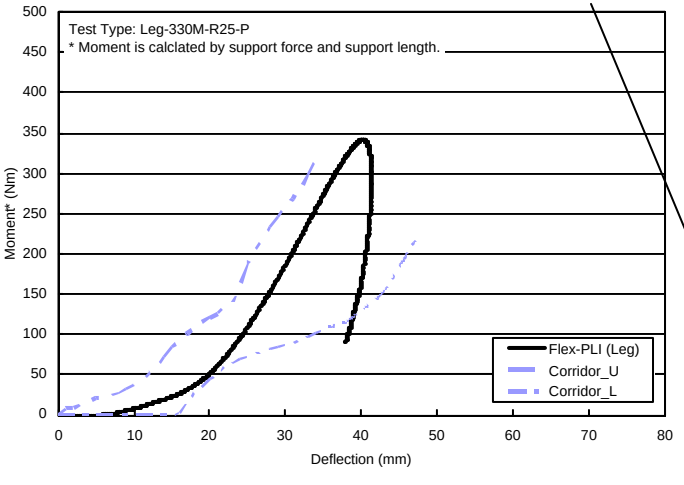




support length
(PMHS test: 334.4 mm)

Flex-G

support length: 330 mm



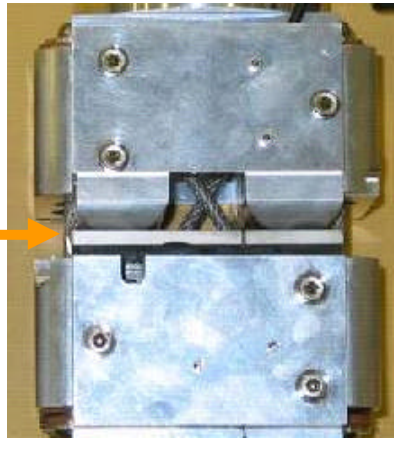
More appropriate support length

Knee joint

surface of condyle

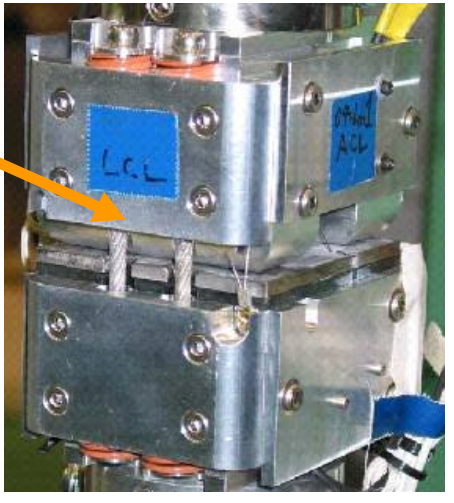
Flex-PLI 2004

Frontal view



Material
(Steel)

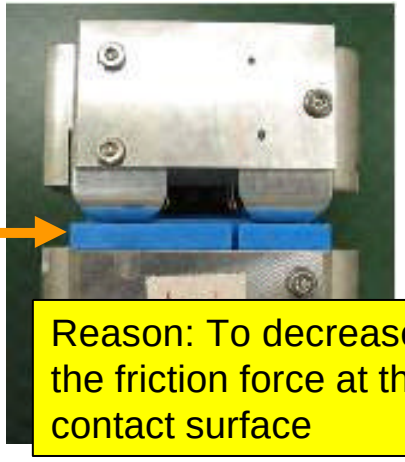
Side-frontal view



no groove

Flex-G

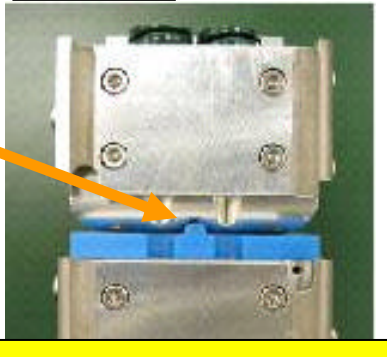
Frontal view



Material
(Plastic)

Reason: To decrease the friction force at the contact surface

Side view



Groove

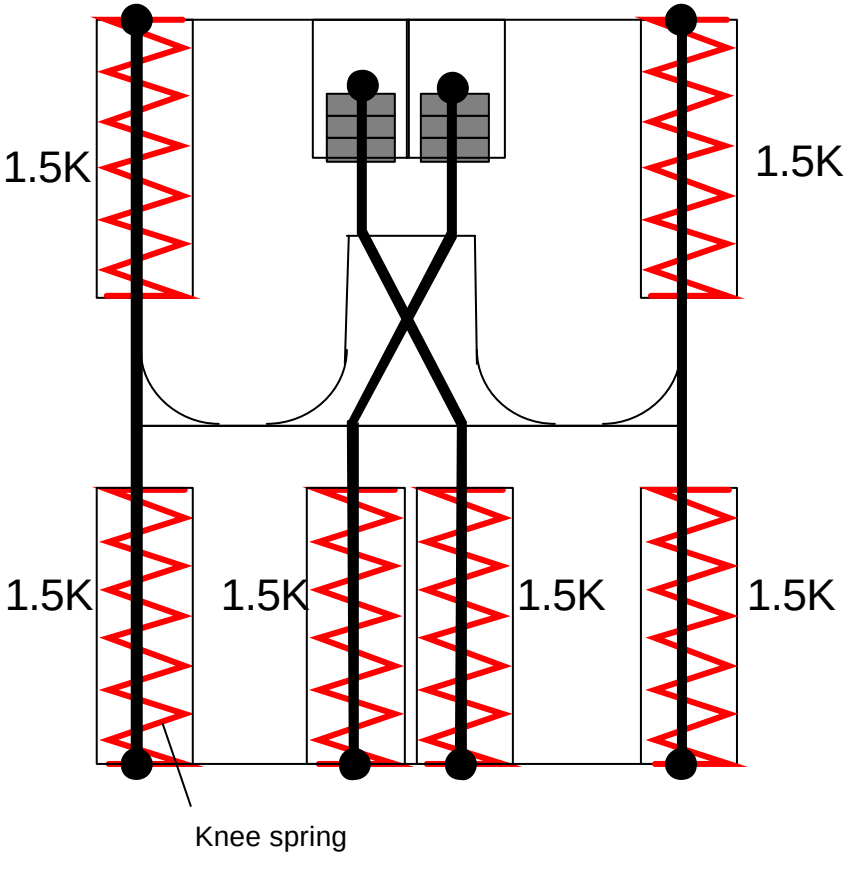
Reason: Easy maintenance (easy to set initial position)

Knee joint

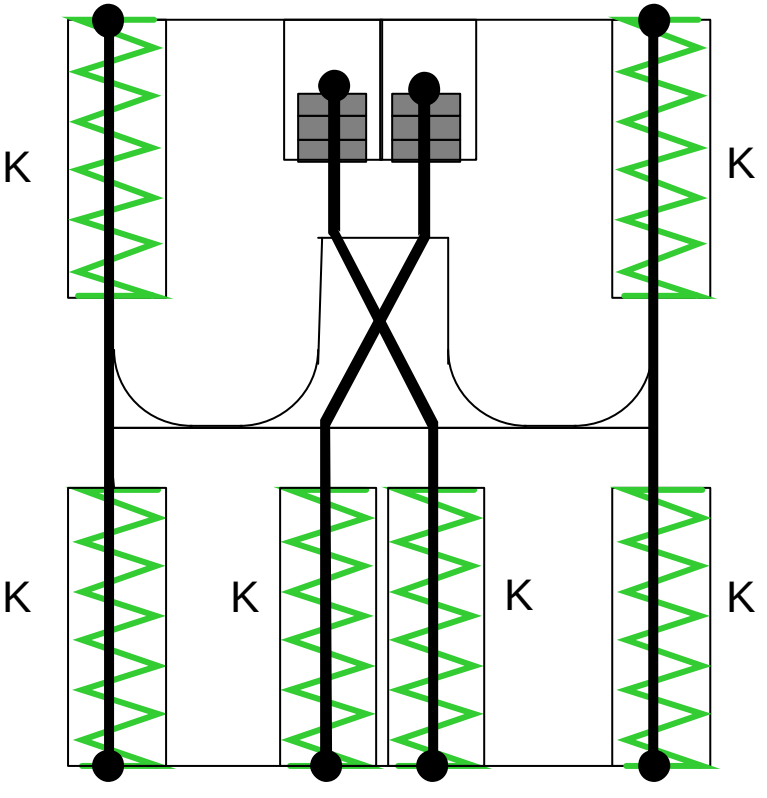
knee spring

Reason: To close its bending stiffness to the PMHS one

Flex-PLI 2004



Flex-G (SN: 1)

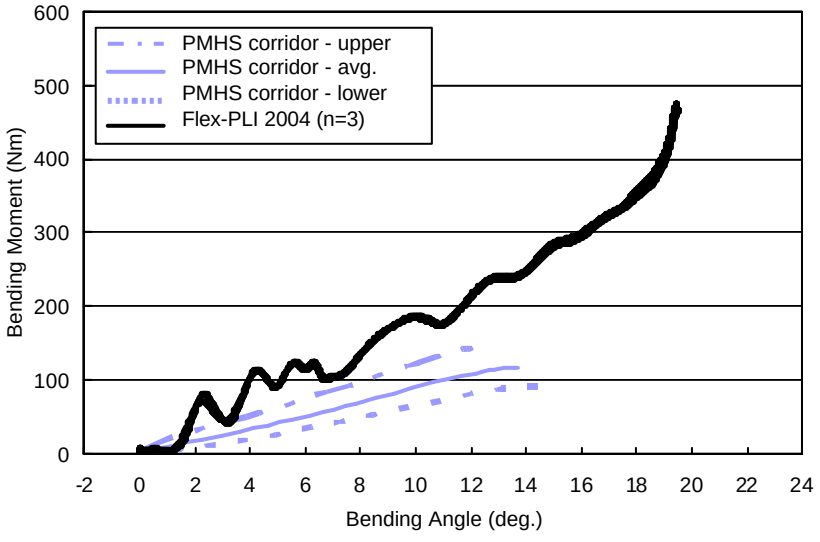


Knee joint

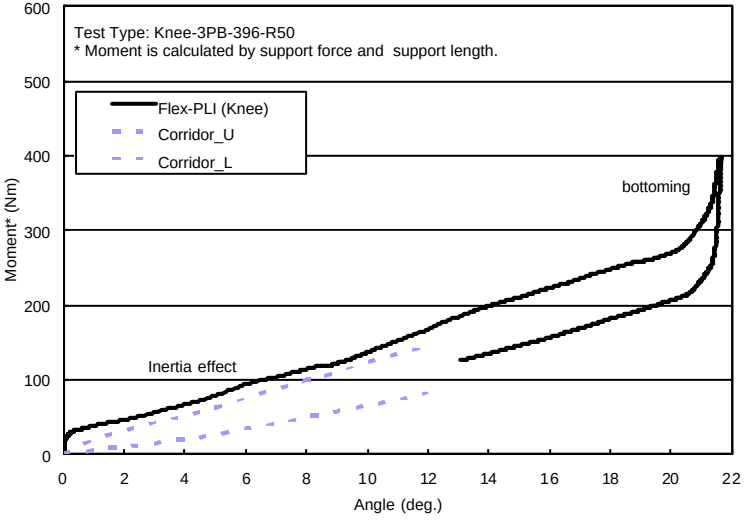
biofidelity

Much closer to the PMHS response corridor

Flex-PLI 2004



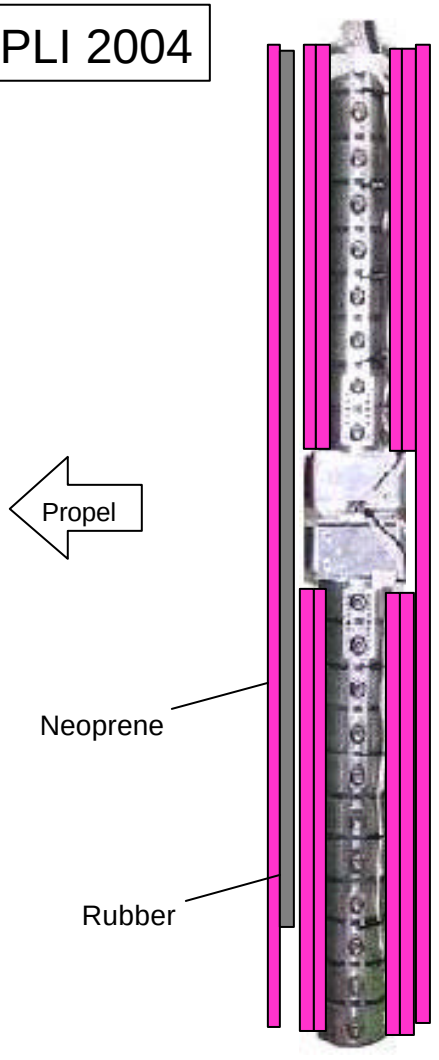
Flex-G



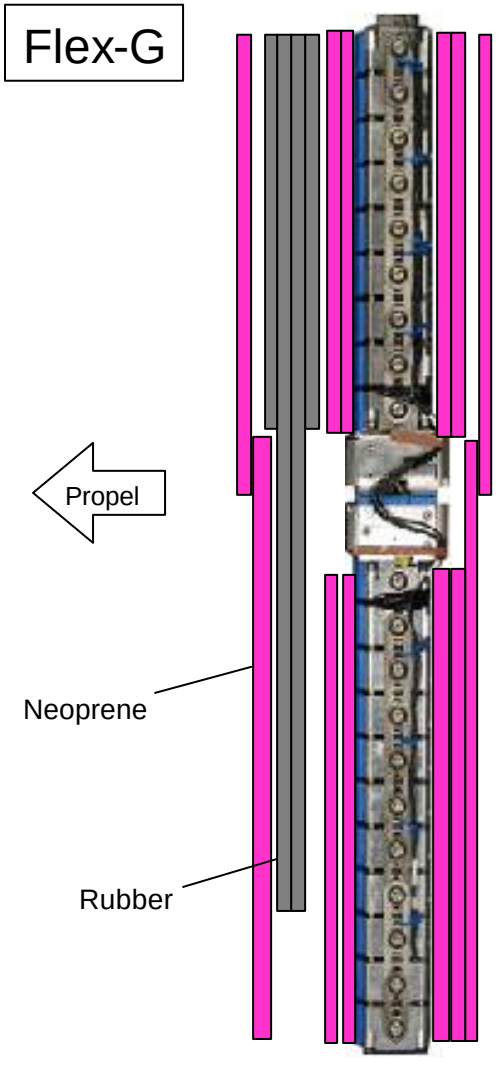
Flesh

number of sheets

Flex-PLI 2004



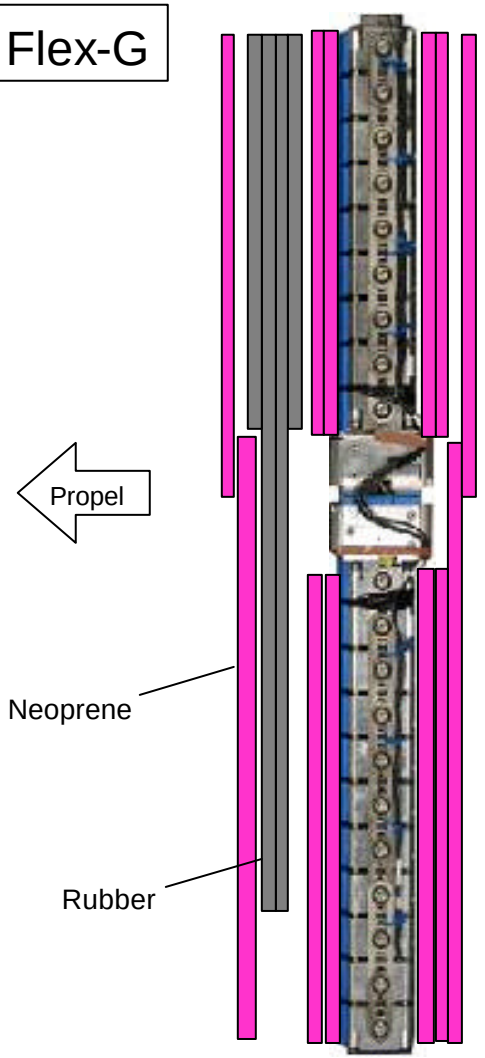
Flex-G



Flesh

number of sheets (cont.)

Flex-G



Side view

Frontal view

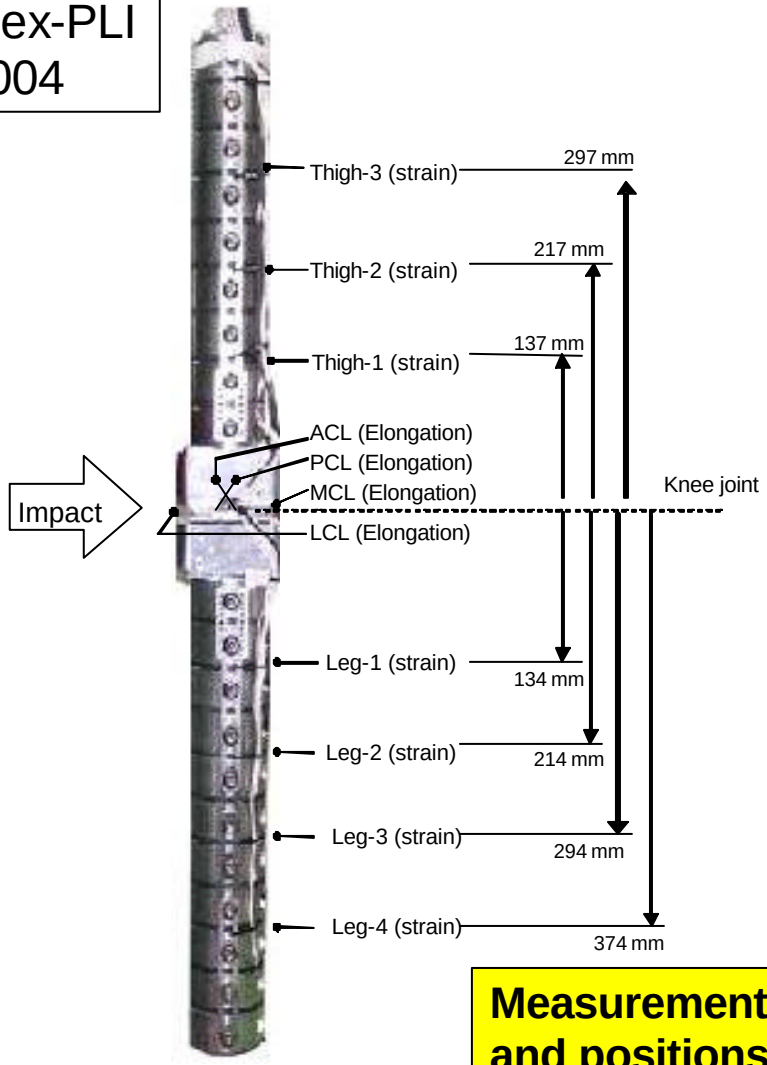
Reason: To obtain comparable thigh and leg response of the PMHS ones.

Measurement

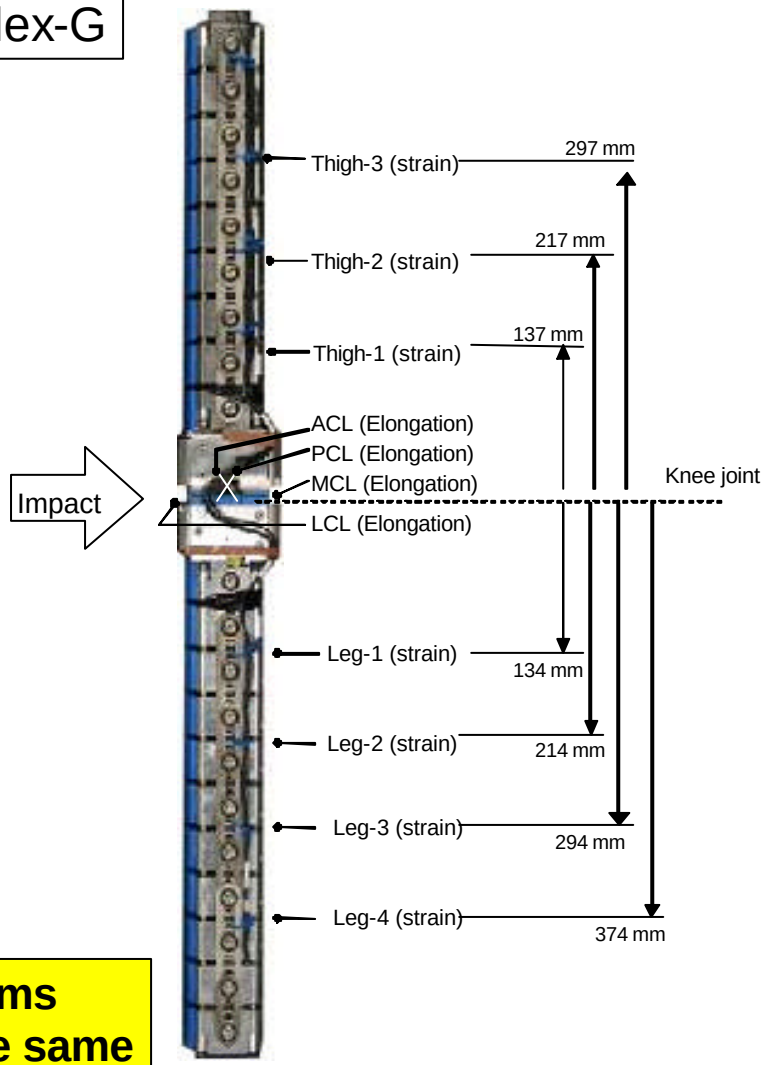
Long bones

measurement items and positions

Flex-PLI 2004



Flex-G



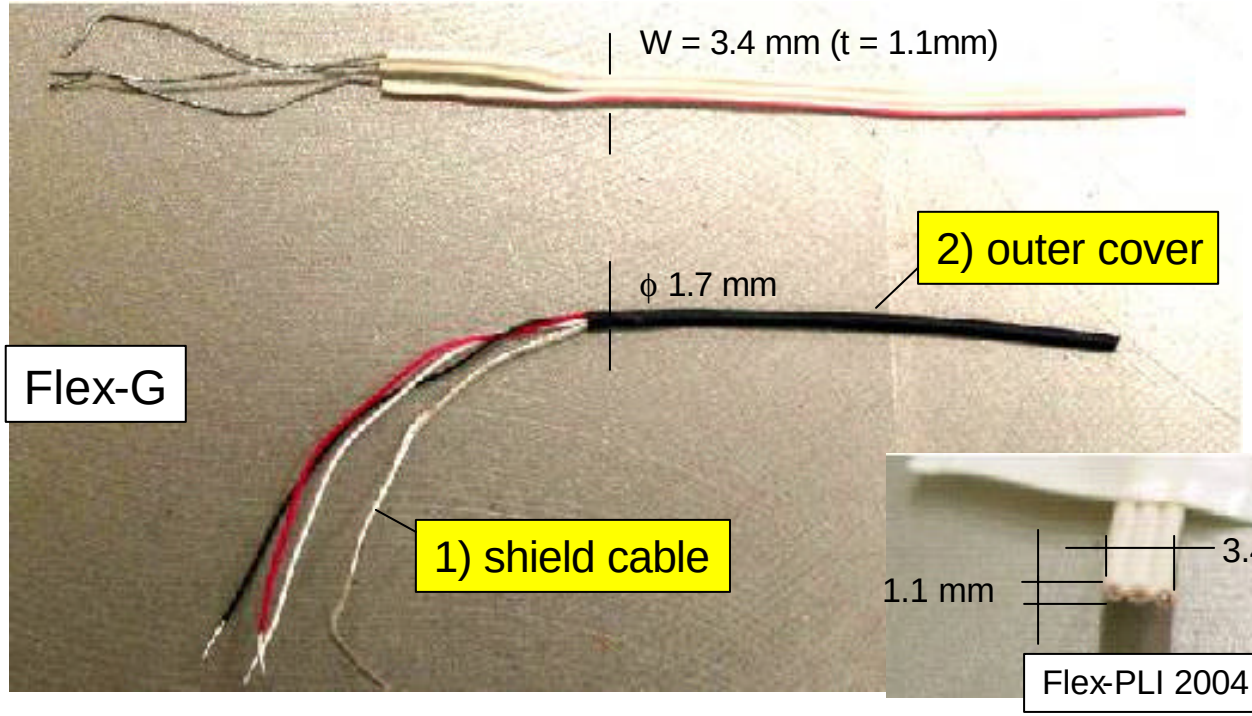
Measurement items and positions are same

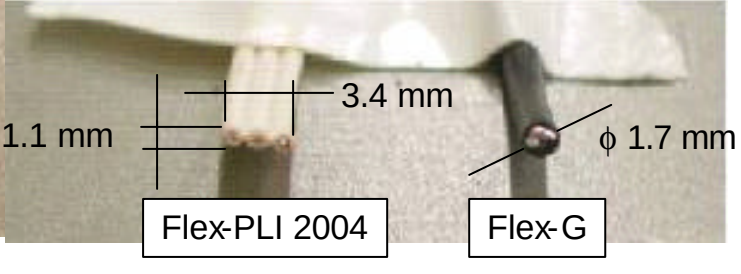
Long bones

strain gage cables

Reasons:
1) for better measurement
2) to increase durability of cables

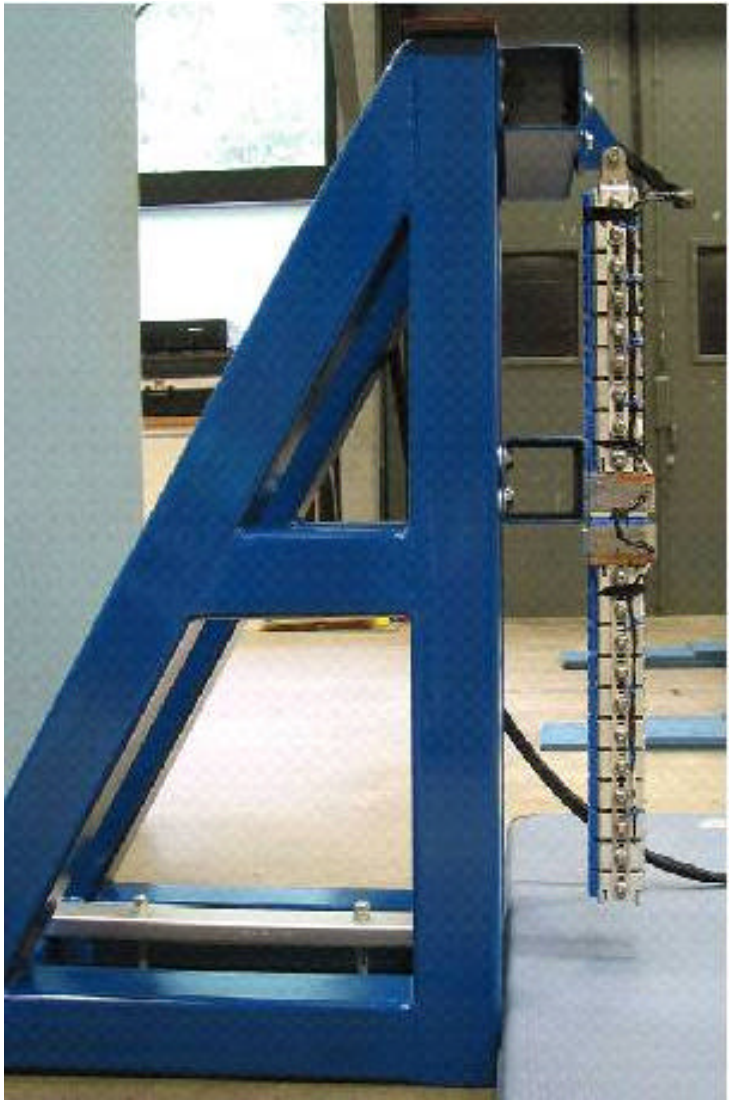
Flex-PLI 2004

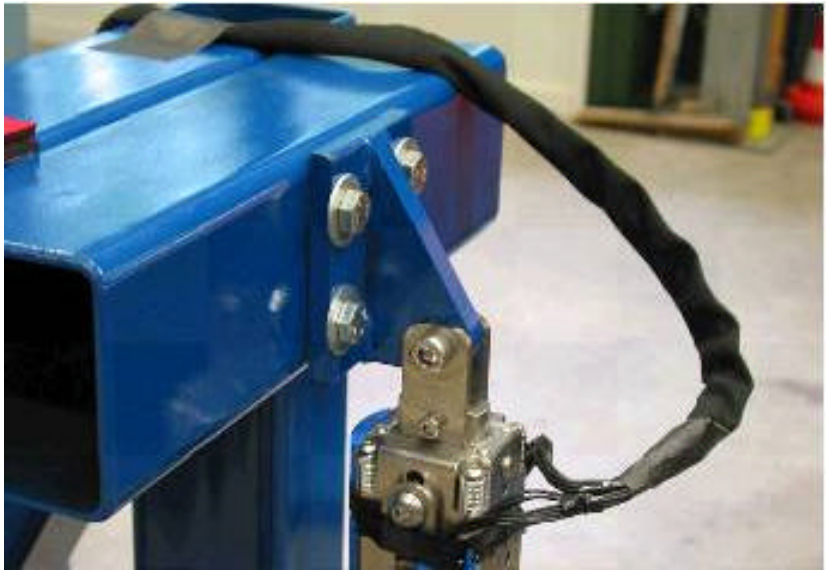


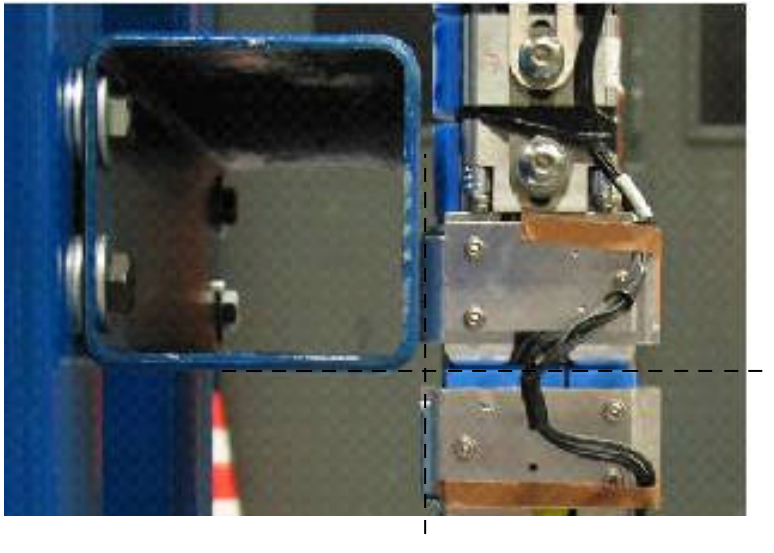


Certification test

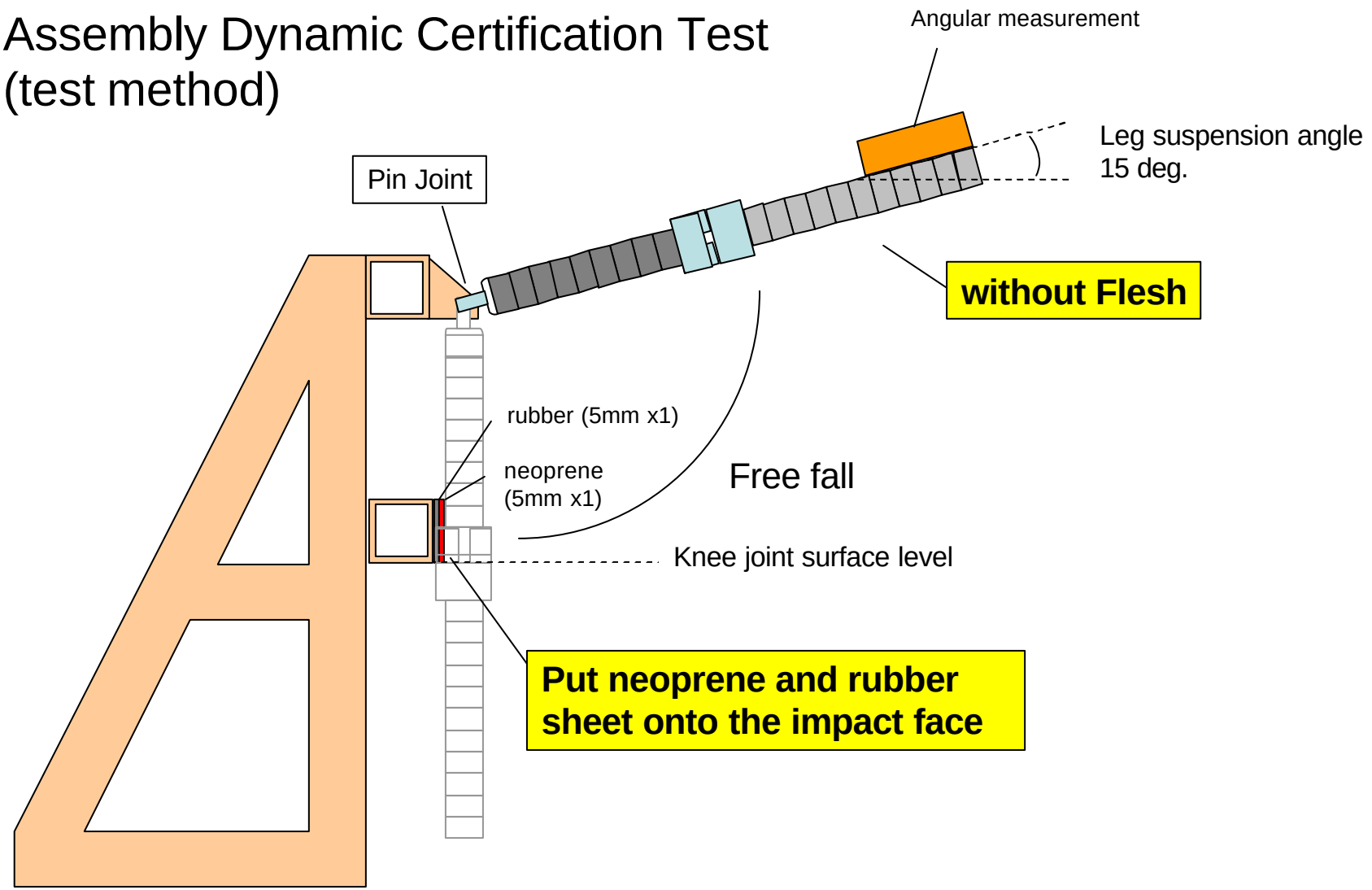
Assembly Dynamic Certification Test (initial setting)



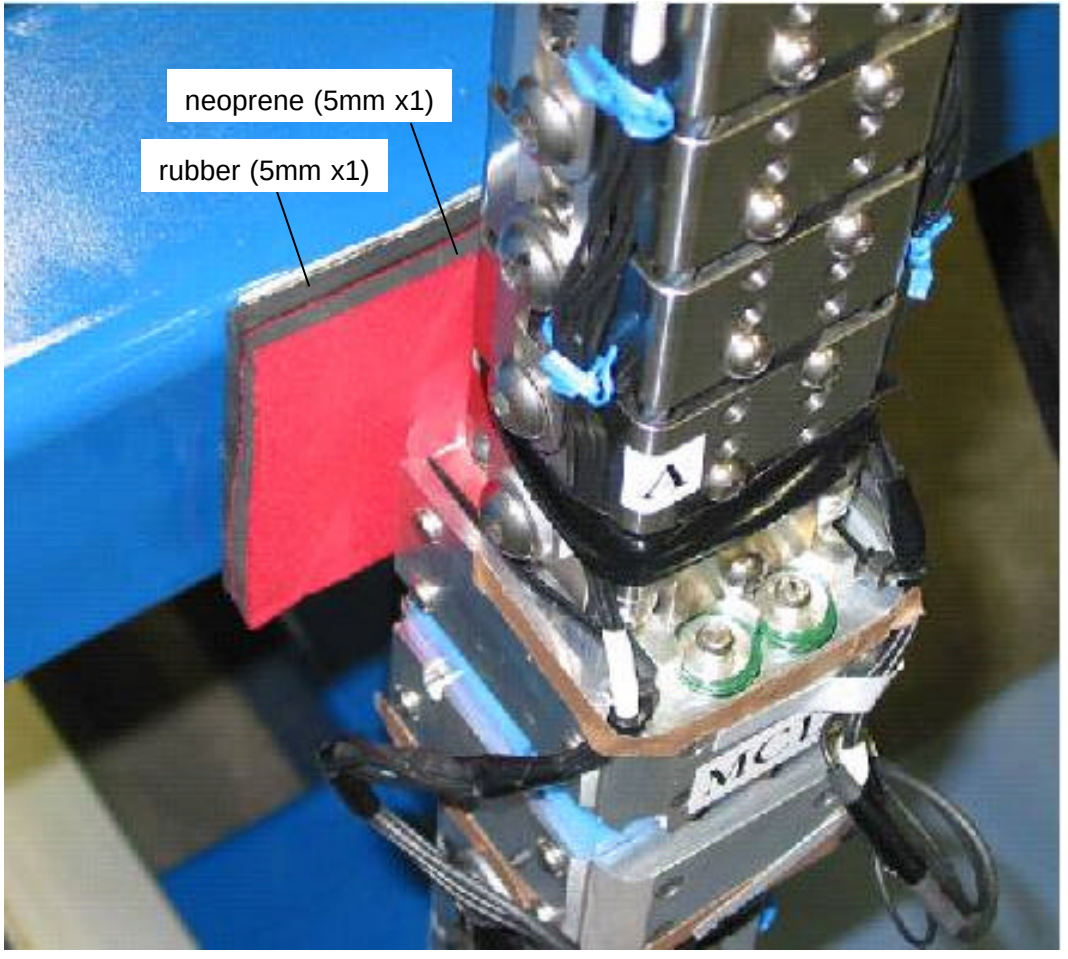




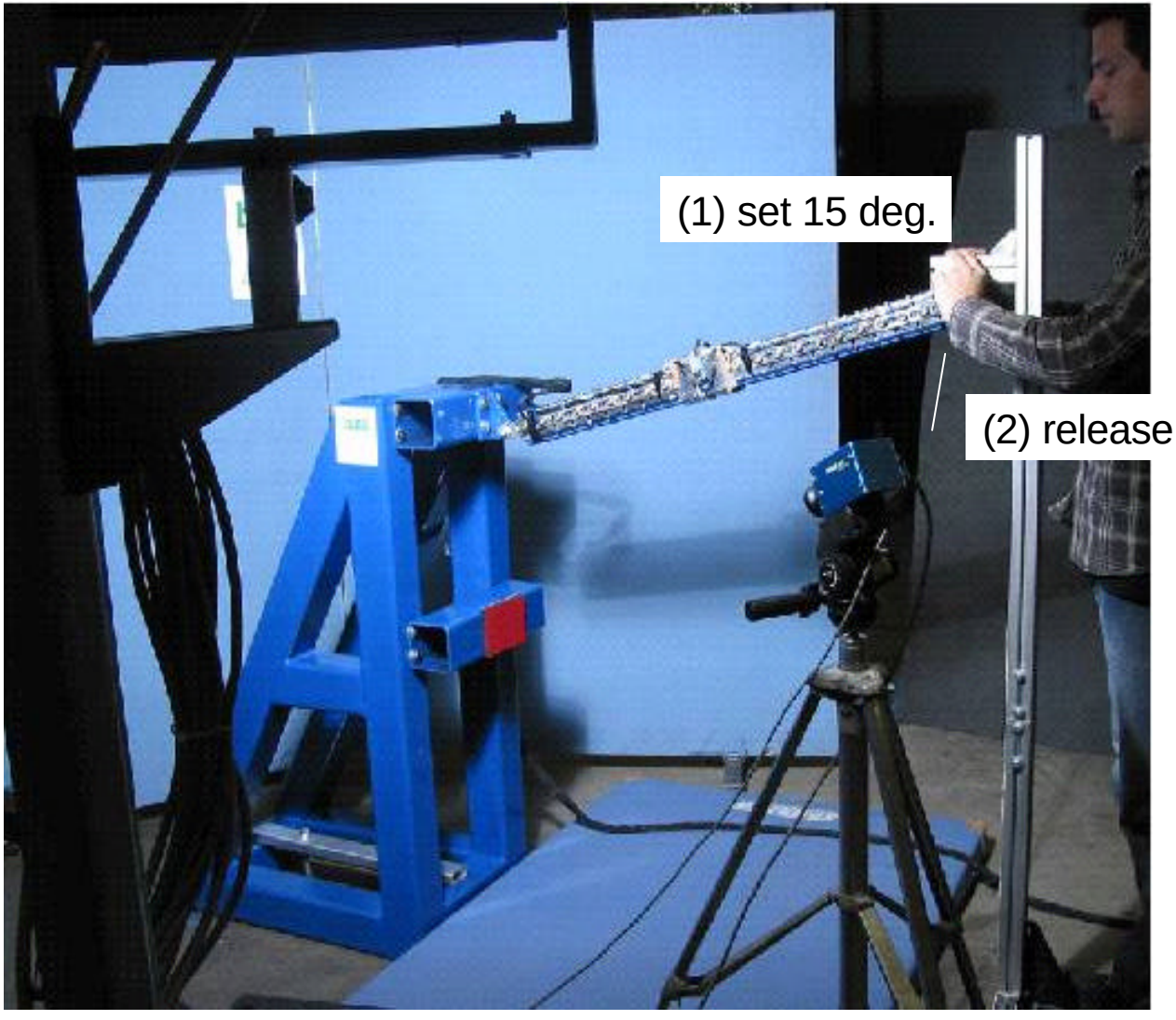
Assembly Dynamic Certification Test (test method)



Assembly Dynamic Certification Test (impact face)



Assembly Dynamic Certification Test (example at BASt/BGS)



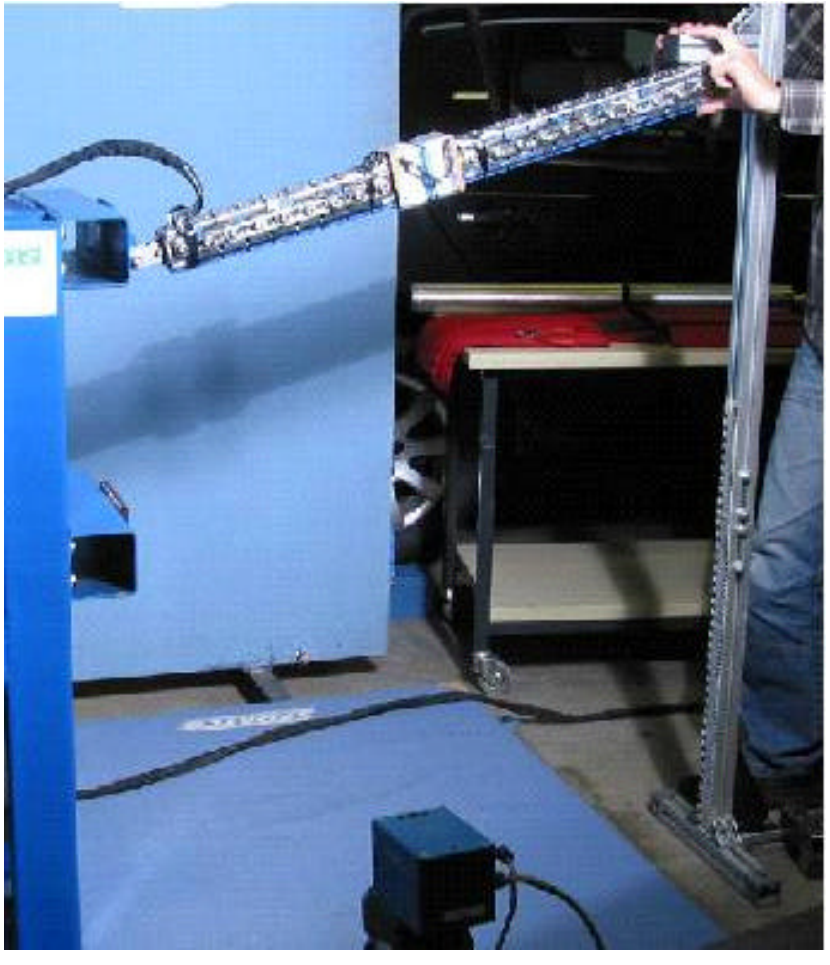
Assembly Dynamic Certification Test Procedure

(example at BASt/BGS)

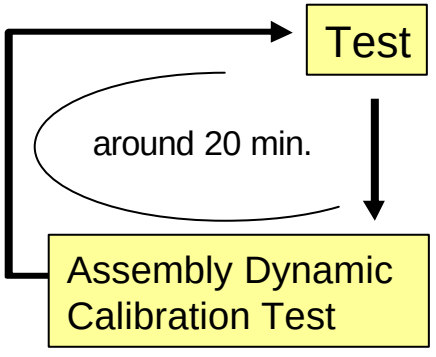
Step 1) set zero level for sensors

Step 2) attach rubber and neoprene at the impact face

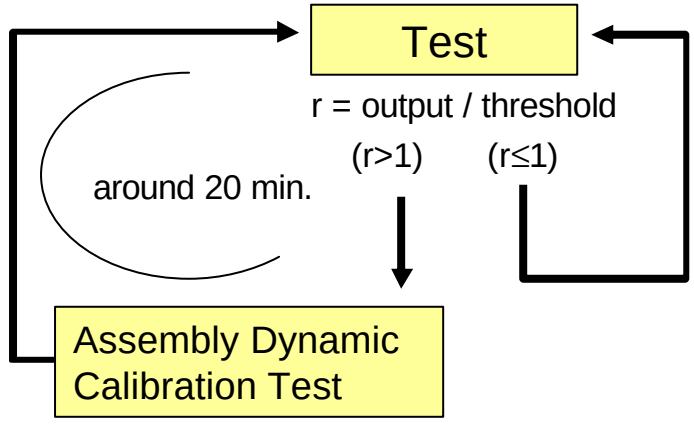
Step 3) set the impactor to the 15 degree upward from horizontal level and release



Test flow 1



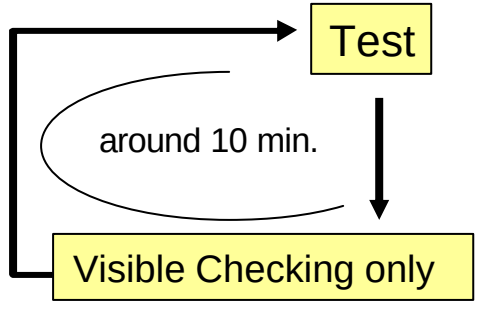
Test flow 2



JARI Example

*photo is for Flex-PLI 2004

Test flow 3



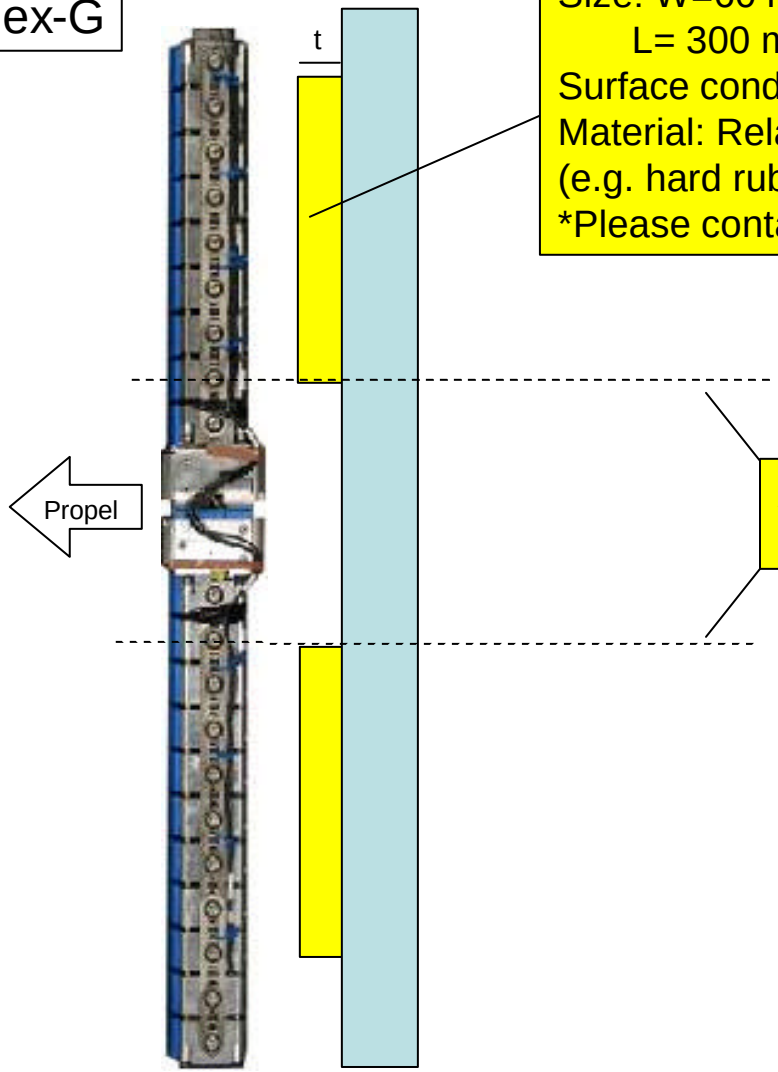
Test flow 1 or 2 is recommendable

Car test

Equipment

pushing surface

Flex-G



Size: W=60 mm or over, t= 20 mm,
L= 300 mm or over (for leg), 240 mm or over (for thigh)
Surface condition: Flat
Material: Relatively hard materials are needed.
(e.g. hard rubber, aluminum, etc).
*Please contact to JARI more details.

Attach the spacers at the center of the second bone core segments.

CONCLUSIONS

- Flex-G is developed with several modifications onto the Flex-PLI 2004.
- We are very appreciate to evaluate the Flex-G by many organizations/users, and to obtain precious comments for the Flex-G improvement.

Thank you for your attention.