

## Flex GT $\alpha$ – Handling and Usage

4<sup>th</sup> Flex TEG Meeting  
April 2<sup>nd</sup>, 2007  
BASt, Bergisch Gladbach

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# Content

- Performed test program at BASt  
December 2006 - April 2007
- Test preparation
- Test execution
- Inspection after test
- Certification
- Time between tests
- Particularities
  - Wiring
  - Defects
- Proposals
- Summary



## Performed test program at BASt

- 2 Pre Tests
- 45 Vehicle Tests (plus 3 to be performed)
- 15 Tests with Test Rig
- 8 Inverse Tests
  
- Sum: 70 Impact Tests
  
- 52 Certification Tests



- Installation of the legform support onto the accelerator
- Height adjustment of the guiding system to achieve the required impact height
- Installation of the certification rig next to the impact test stand (in order to avoid disconnecting and connecting the sensor cables between impact test and certification)
- Connection of the impactor instrumentation to the data acquisition system and its preparation:  
10 – 17 channels (10 standard, 7 redundant)  
(EEVC WG 17 legform impactor: 3 channels; max. no. of channels required for current pedestrian protection tests: 5.)
- Certification test

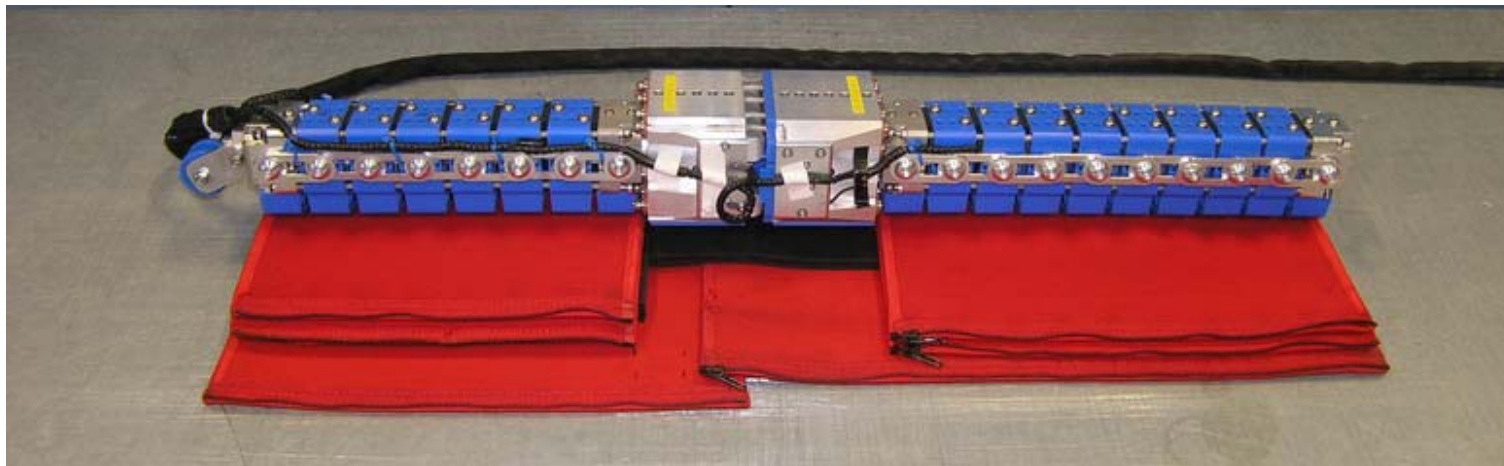


- Settings are similar to tests with the EEVC WG 17 legform
  - 40 km/h, ballistic flight, no rotations
- Special care of the 17 cables is required
  - Likely to be damaged when the impactor falls on them
  - Influence of the flight behaviour due to the cable mass
- Roller guiding allows rotation around z-axis during acceleration
  - Possible reason for scatter in ACL and PCL results
- Edged shape of the legform's impact surface seems to increase rotation around z-axis during impact
  - Possible reason for scatter in ACL and PCL results
- Impact accuracy detection by paint spot is difficult
  - Due to movement of the two outer skin pieces
- Behaviour after impact
  - Higher flight curves and greater rotations around y-axis, compared with the EEVC legform, were observed in some cases.



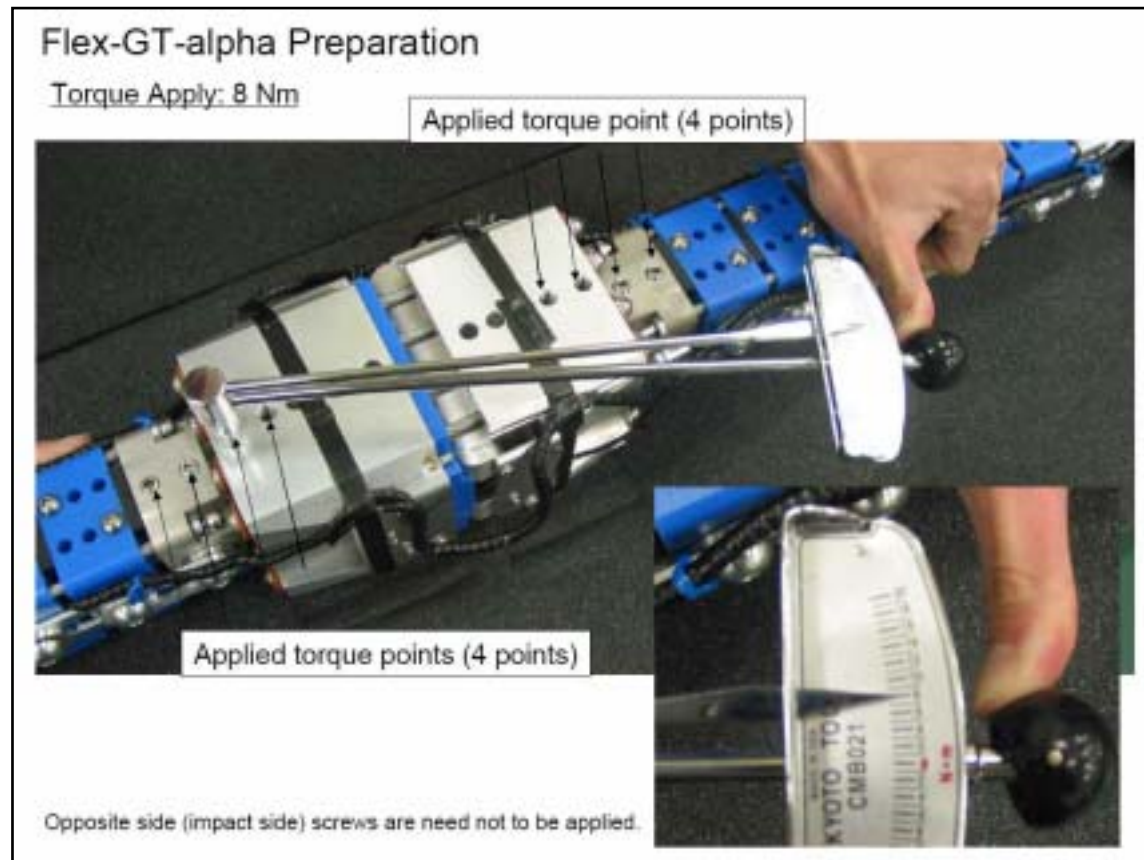
# Inspection after test

- Visual inspection of the impactor components and the cabling



# Inspection after test

- Verification of the torque of 8 screws

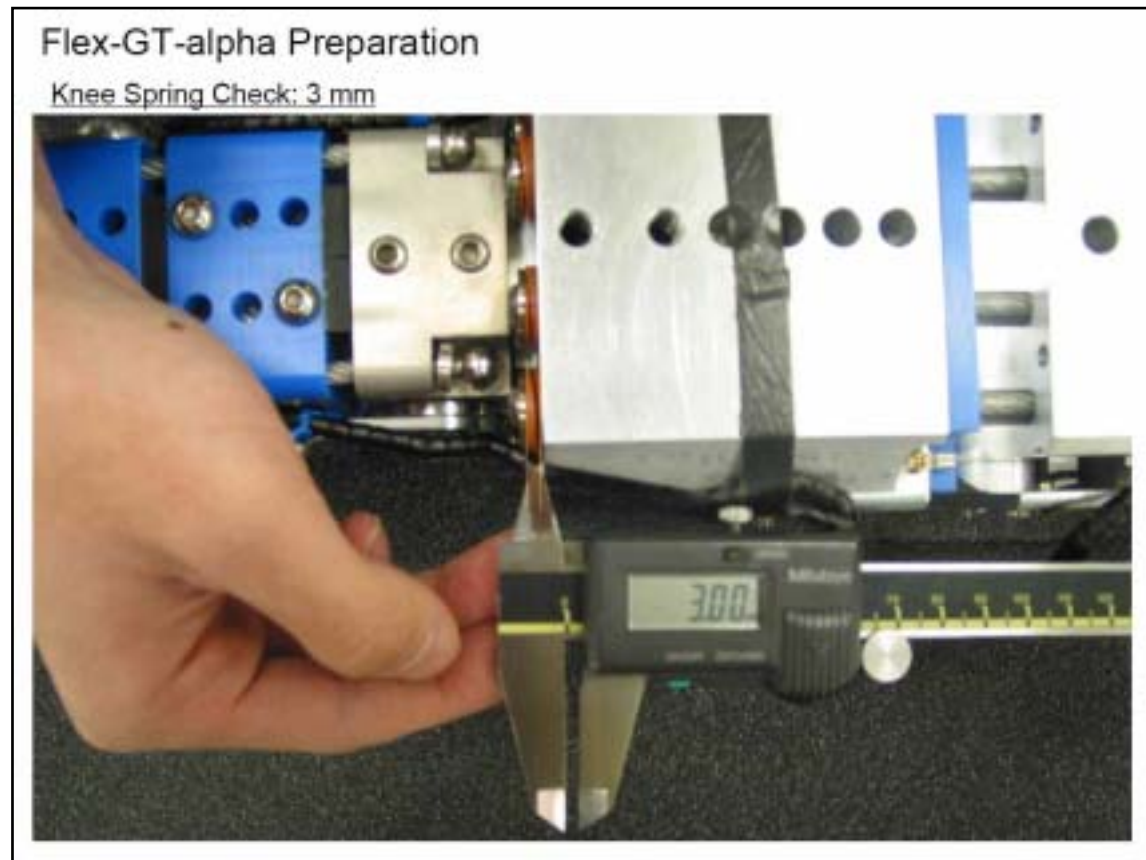


(Flex GT $\alpha$  Handling Manual, Konosu, 2006)



# Inspection after test

- Check of the length of the 20 knee spring ends



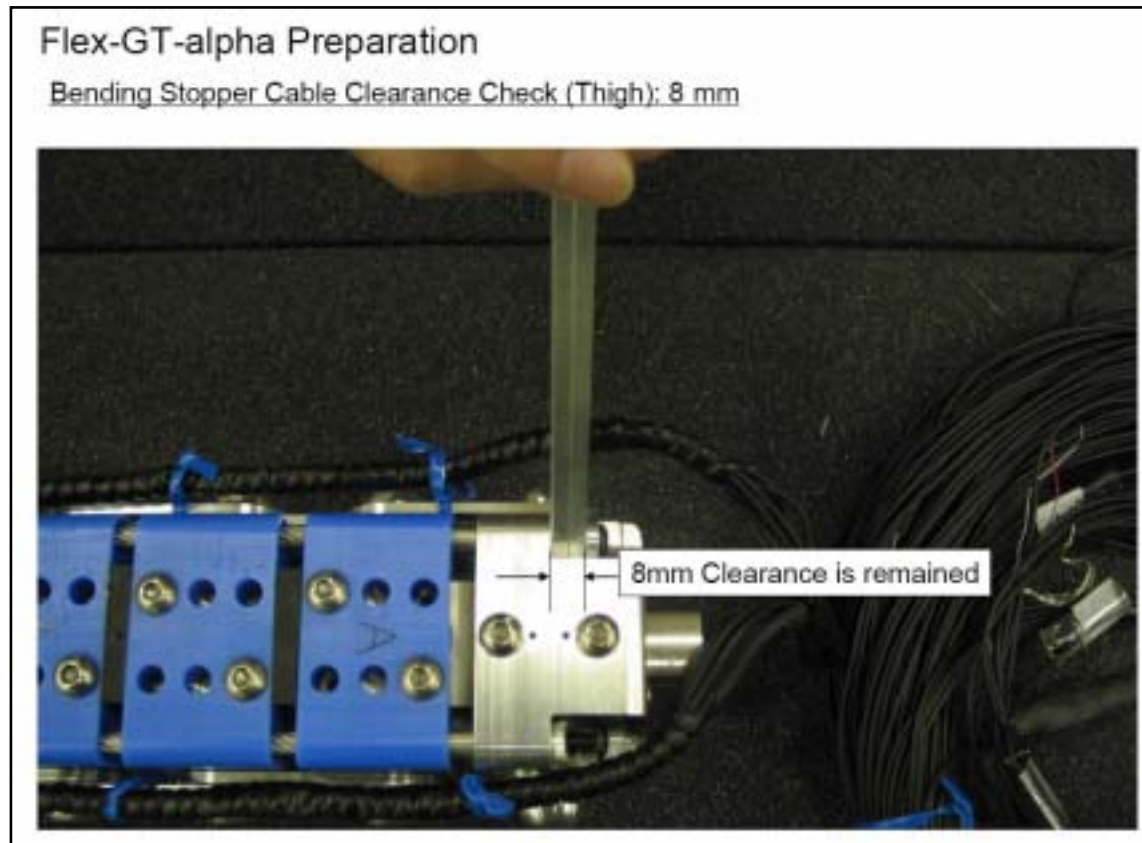
(Flex GT $\alpha$  Handling Manual, Konosu, 2006)





# Inspection after test

- Check of the length of the 4 upper leg bending stopper cable ends

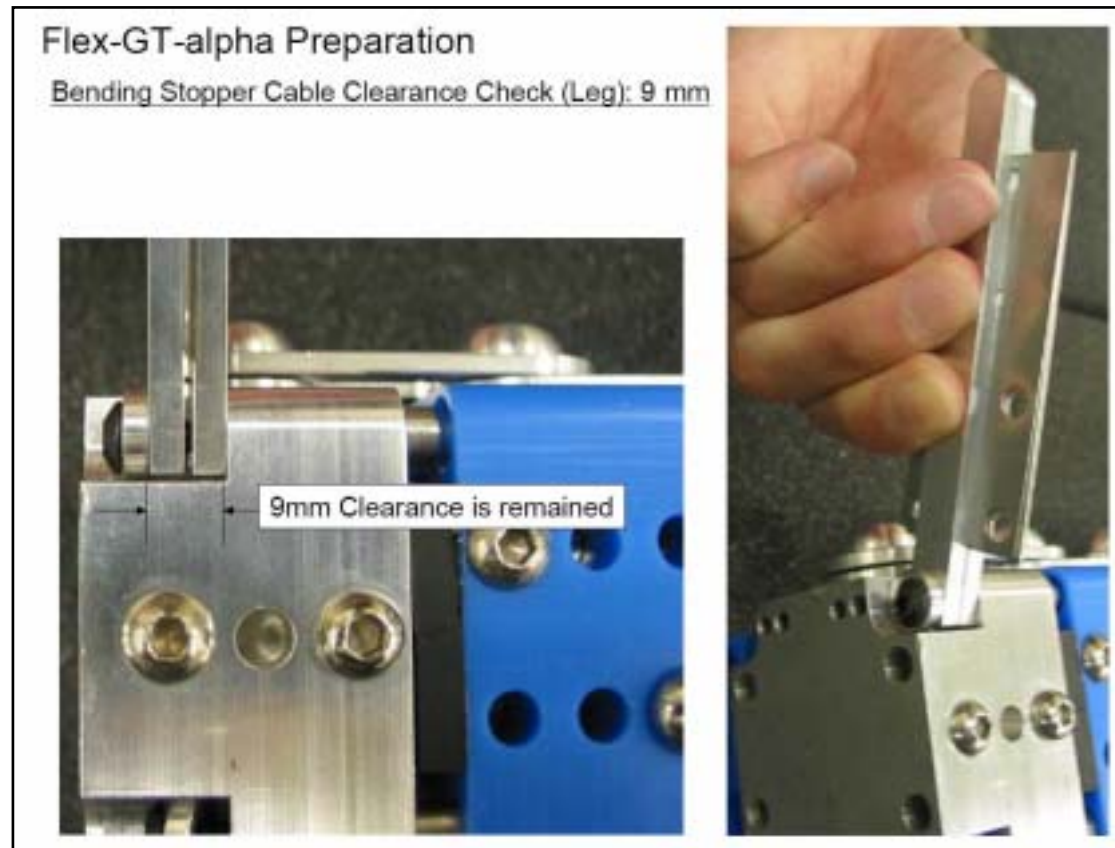


(Flex GT $\alpha$  Handling Manual, Konosu, 2006)



# Inspection after test

- Check of the length of the 4 lower leg bending stopper cable ends



(Flex GT $\alpha$  Handling Manual, Konosu, 2006)

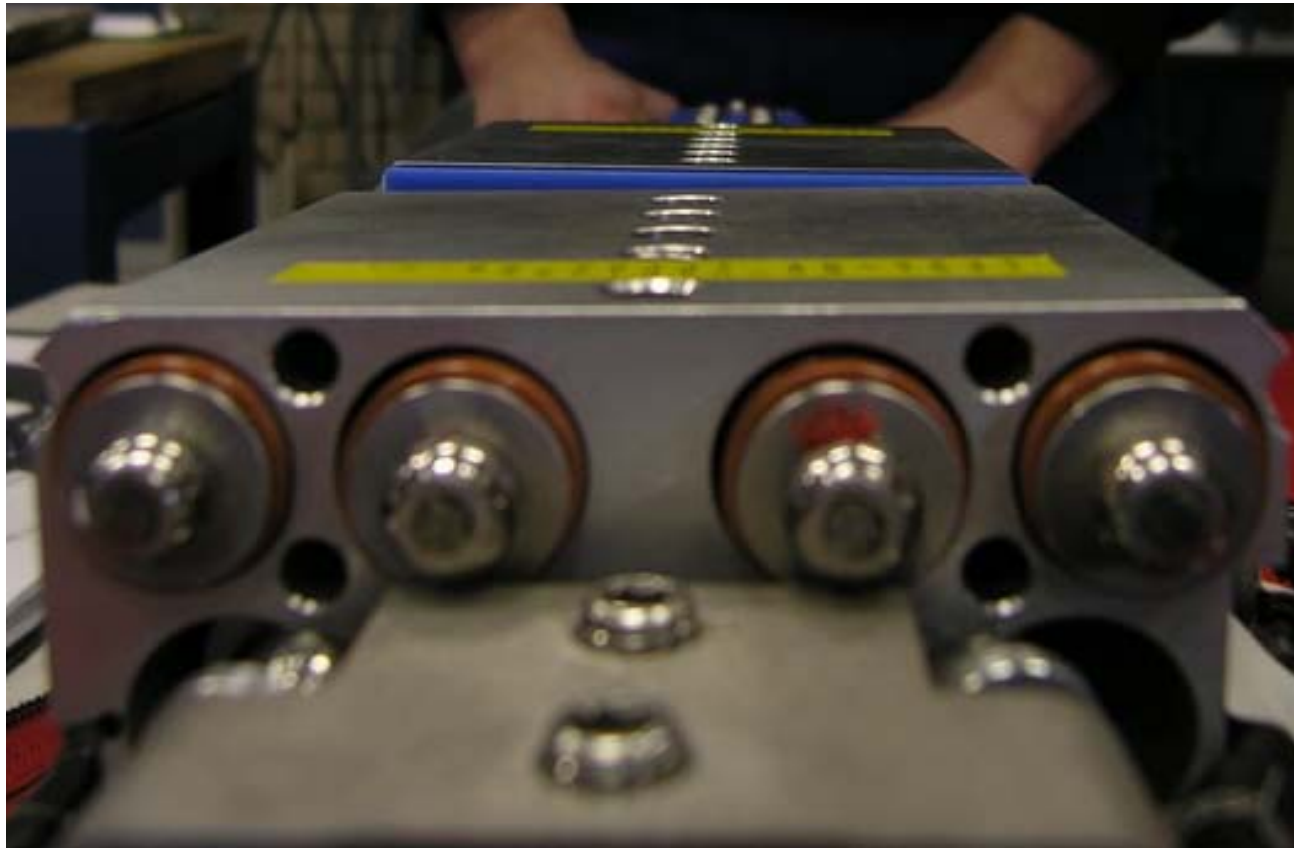


- New tool for cable clearance checks:
  - Thicknesses: 9 mm and 8 mm



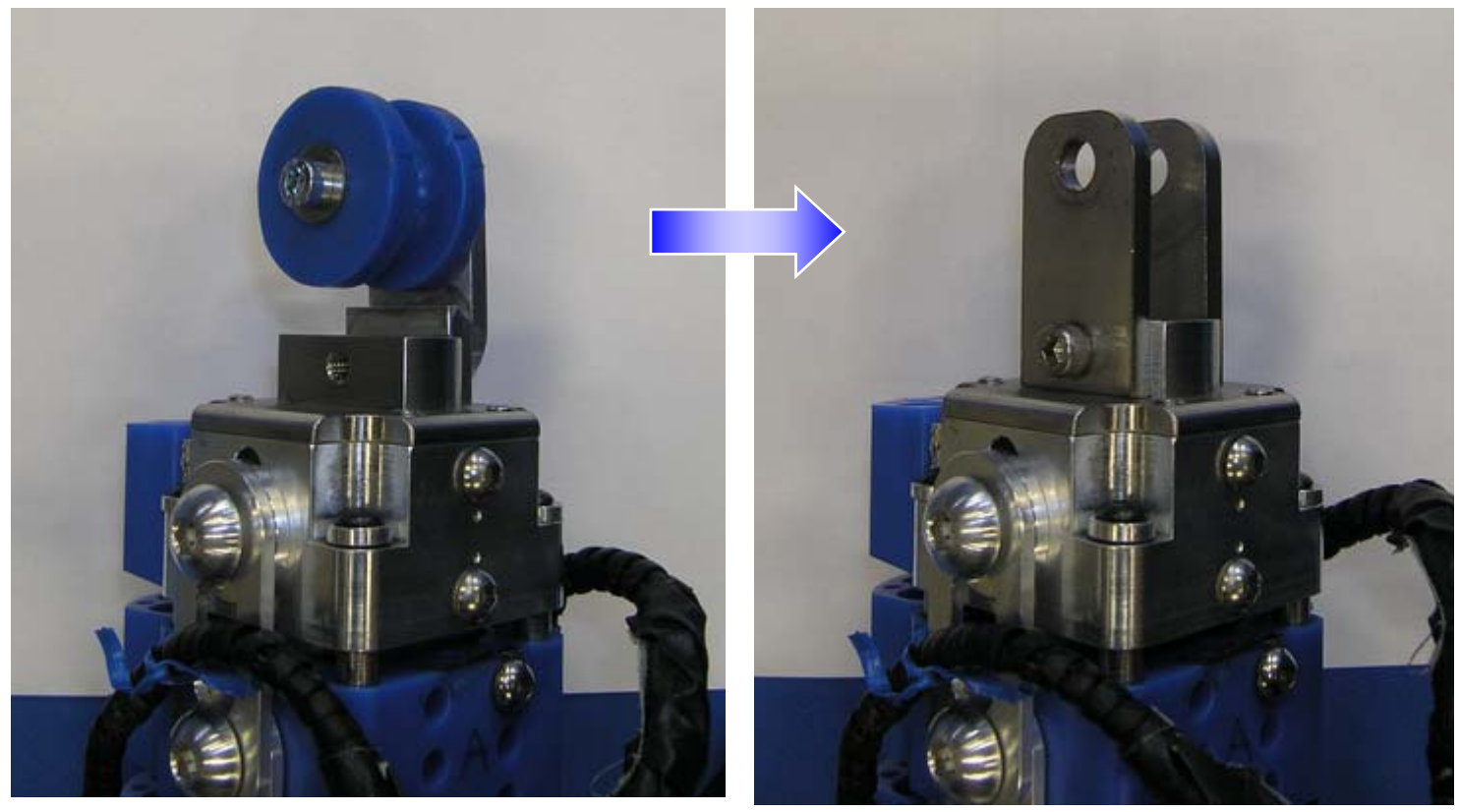
# Inspection after test

- Check for distortion



# Certification

- Change from roller to mounting bars



# Certification

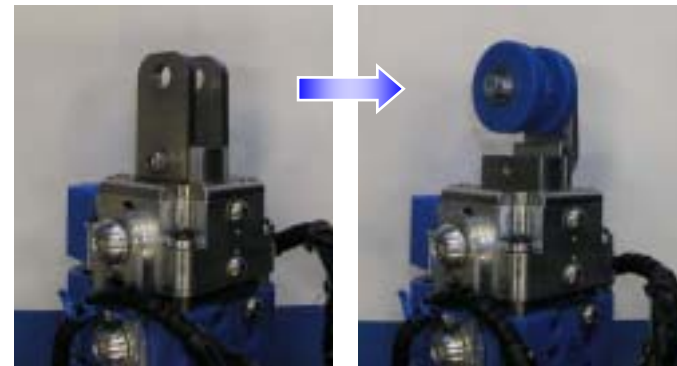
- Mount to the certification rig, zero the offsets, lift up the impactor to +15° and release



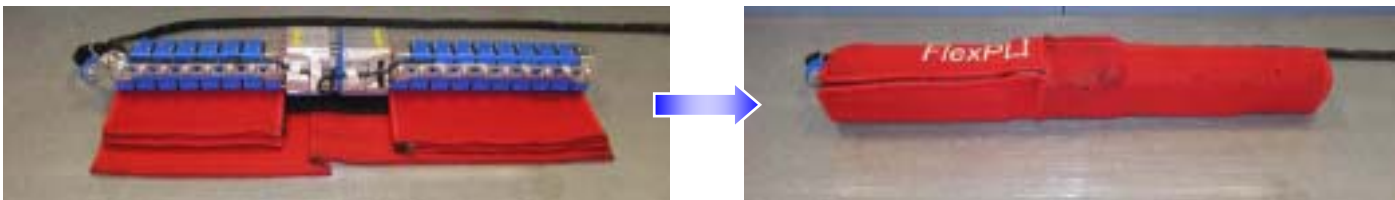
- Check again for distortion



- Mount the roller again



- Wrap the legform



- Ready for new test



# Mounting the skins





# Time between tests

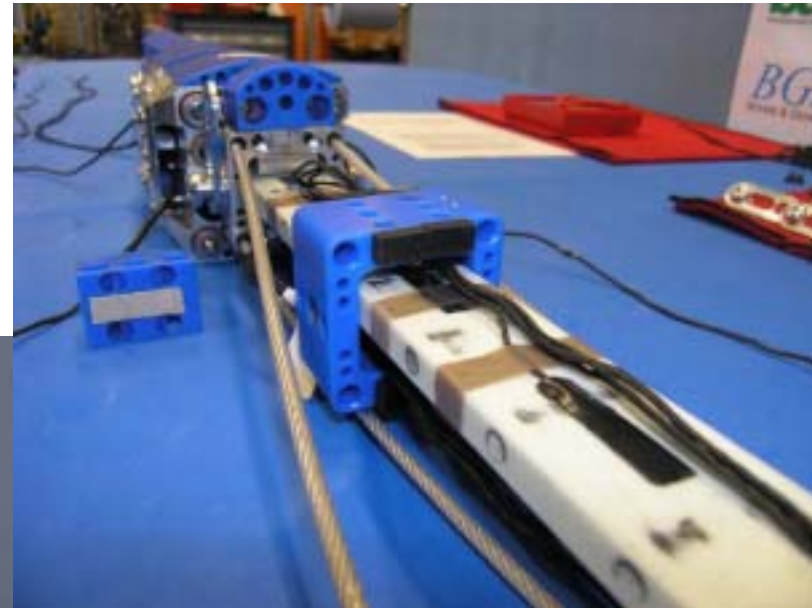
- Required work between impact tests:
  - Inspection
  - Certification
  - Minor assembly/disassembly work
- Required time between impact tests:

30 to 45 Minutes



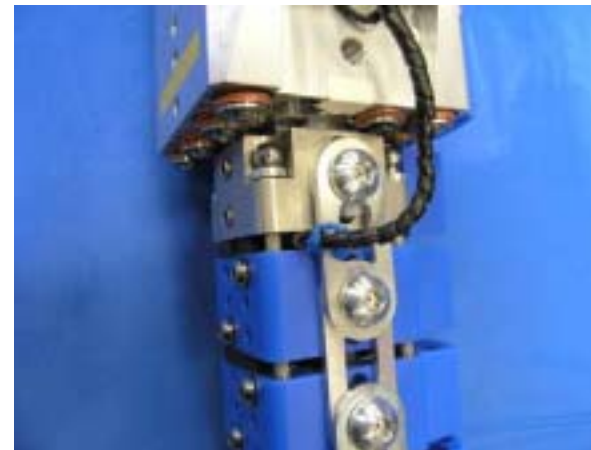
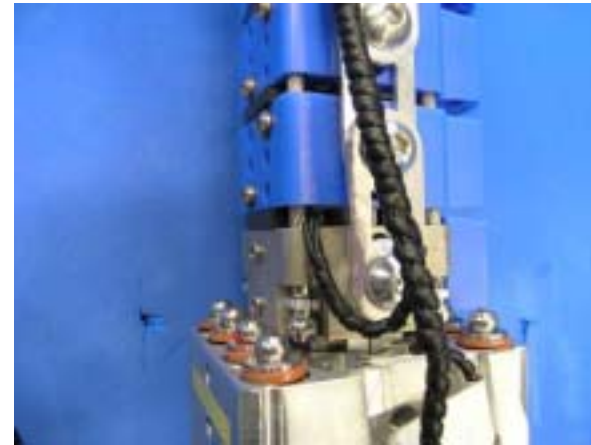
# Particularities: Wiring

- In case of multiple cable damage the impactor has to be dismantled



# Particularities: Wiring

- Cable guiding with sharp angles and around sharp edges
- Cables likely to be damaged near the impactor



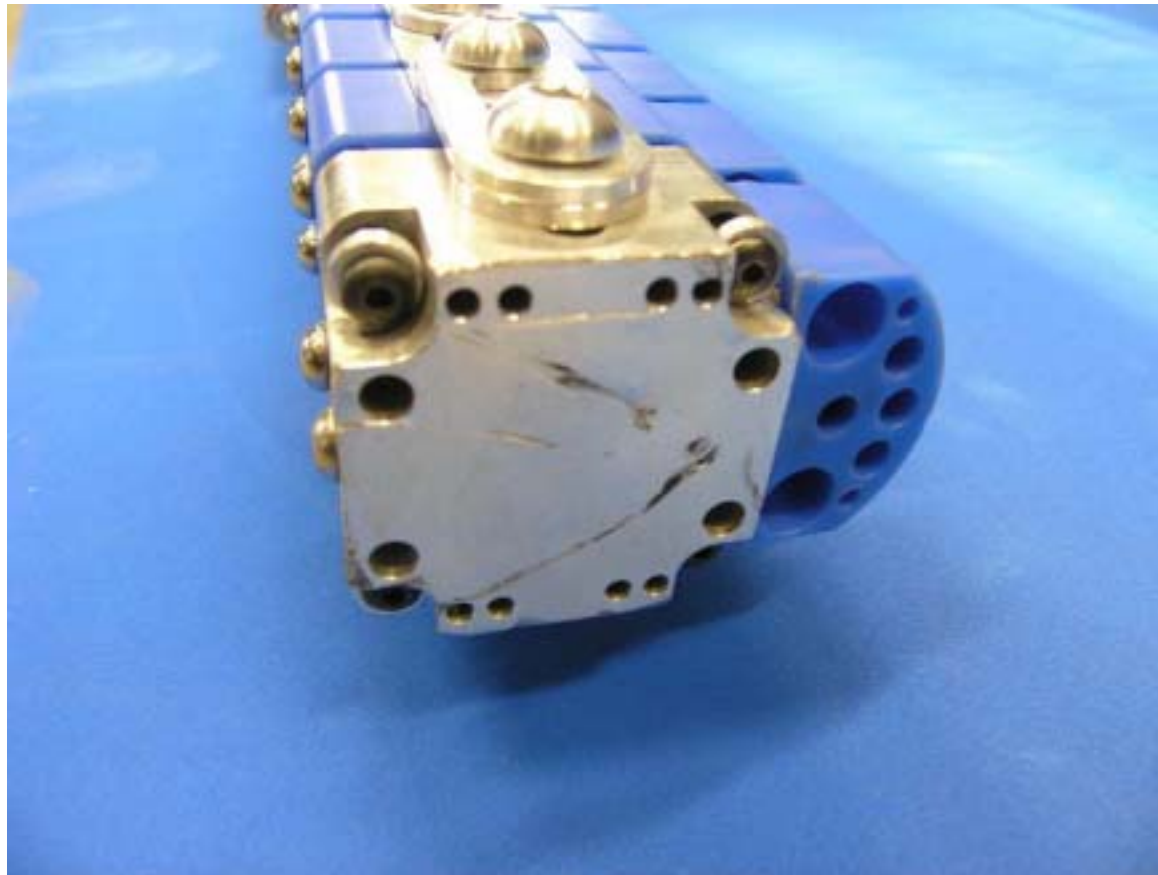
## Particularities: Defects

- Broken guidings at tibia surface plate



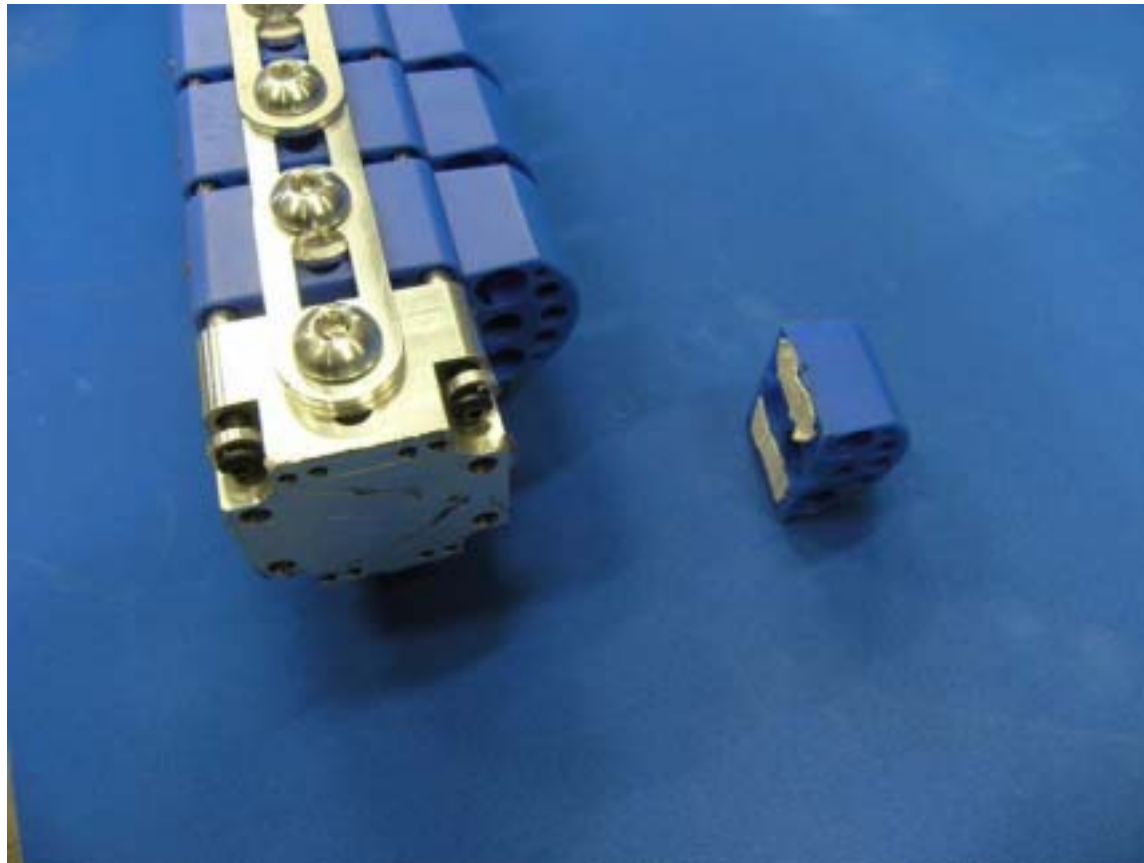
## Particularities: Defects

- Scratches at tibia lower end



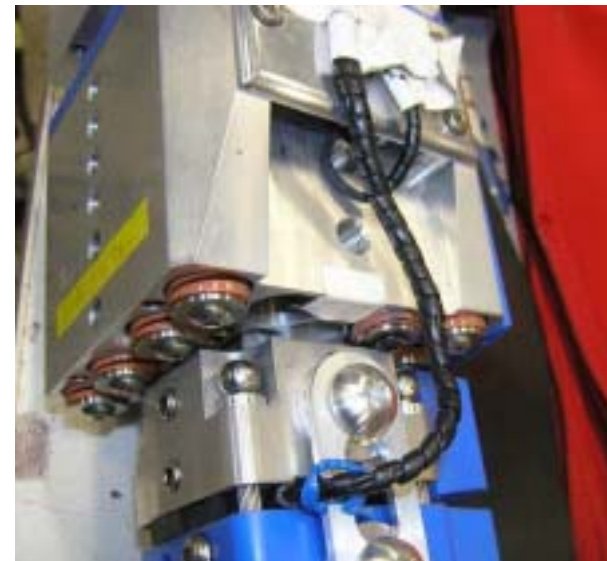
## Particularities: Defects

- Separation of lowest segment impact face



# Particularities: Defects

- Neoprene skin:
  - Zippers very sensitive
  - Skin gets caught in spring ends
  - Skin damaged by sharp edges of knee



- Modification of the cable guiding within the impactor, e.g. integration of the guiding in the tibia and femur segments
- Introduction of a single 17-channel connection cable
- Introduction of a central plug and socket at one end of the impactor in order to be able to replace the connection cable immediately in case of damage
- Rounding of all outer sharp edges of metal parts
- Introduction of a one-piece outer skin with strong zipper
- Improvement of the axial guiding between upper and lower leg
- Replacement of the roller with a linear guiding system to reduce the ACL/PCL-offset at point of first contact
- Certification test to be performed after 3 - 5 impact tests or after severe or unexpected results (to be defined)





- Flex GT $\alpha$  withstood more than 70 impact tests at 40 km/h
- No greater mechanical defect
- Cable defects outside the impactor lead to measurement faults and time-intensive repairs
- Improvement of endurance through minor design and wiring modifications required
- Preparations for the test laboratory are comparatively negligible
- Handling effort comparable with EEVC legform
- Significantly more measurement channels than in other pedestrian protection impactor tests
- The necessity of a certification test after every single impact test should be reconsidered



Thank you  
for your attention

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