

Flex-GT Certification Tests

NHTSA Vehicle Research & Test Center

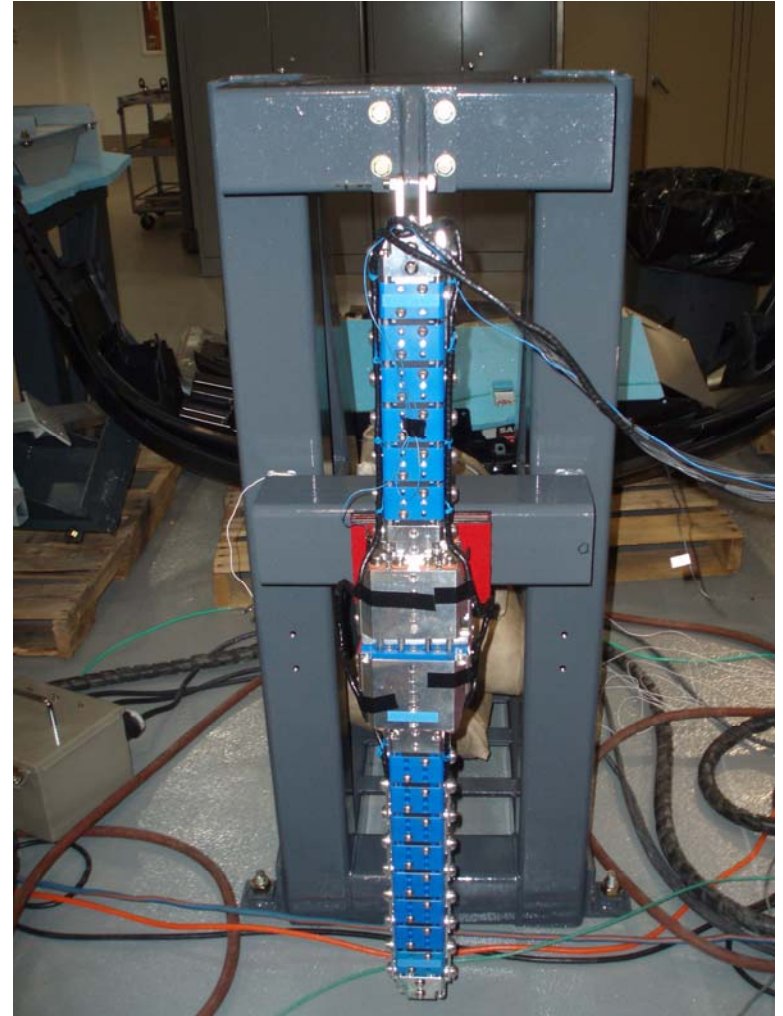
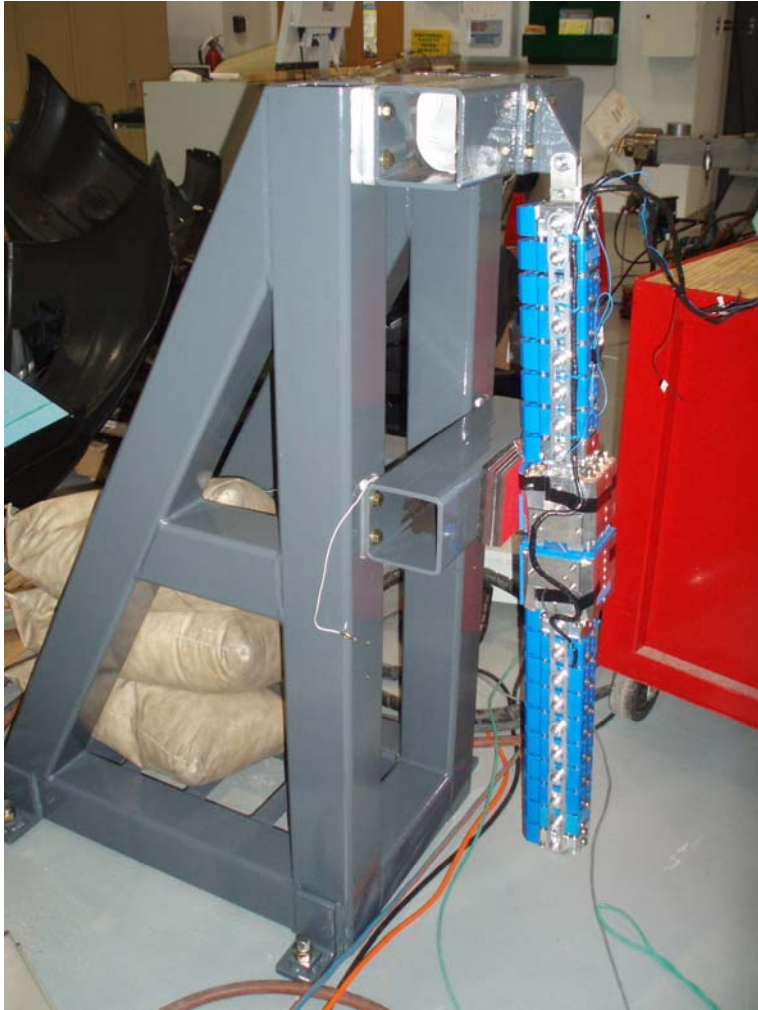
Flex-TEG Meeting

March 31, 2008

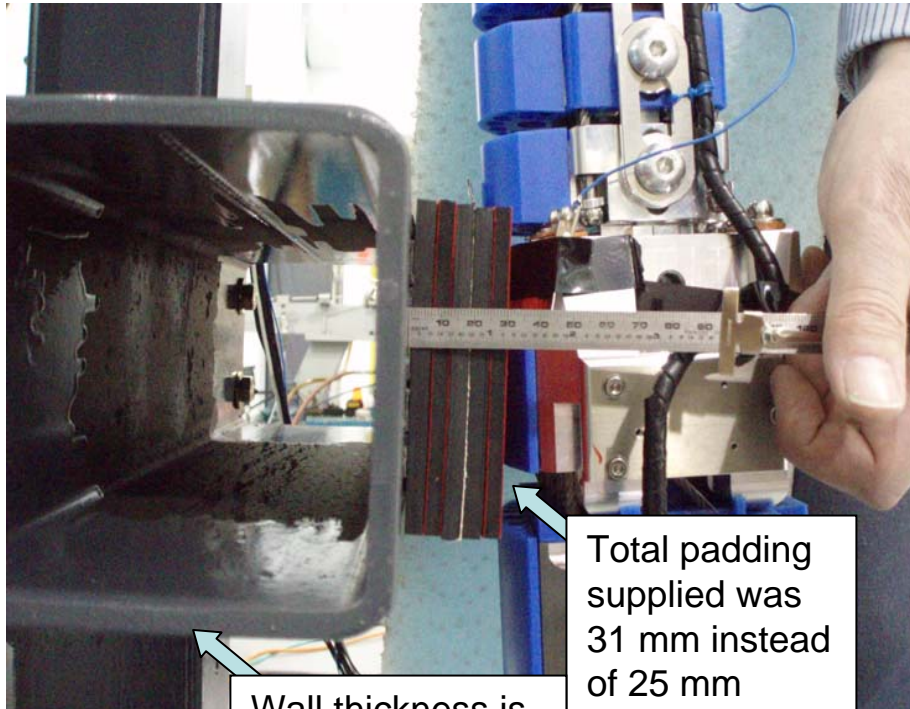
Overview

- Fabricated test rig
 - Slight differences from recommended setup
- Conducted 21 tests
 - Pre & post vehicle test
 - Analyzed various configurations
 - Spacer vs. no spacer
 - Ballast vs. no ballast
 - Nylon vs. steel pivot bolt
 - Physical vs. software offset
 - Release method

Test Setup



Setup Differences

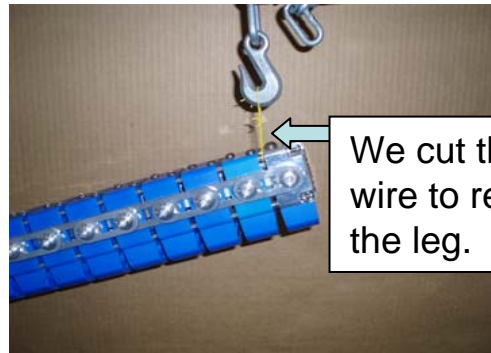


Wall thickness is 6.25 mm instead of 4.5 mm

Total padding supplied was 31 mm instead of 25 mm



Supported rig with sandbags instead of bolting it down



We cut this thin wire to release the leg.

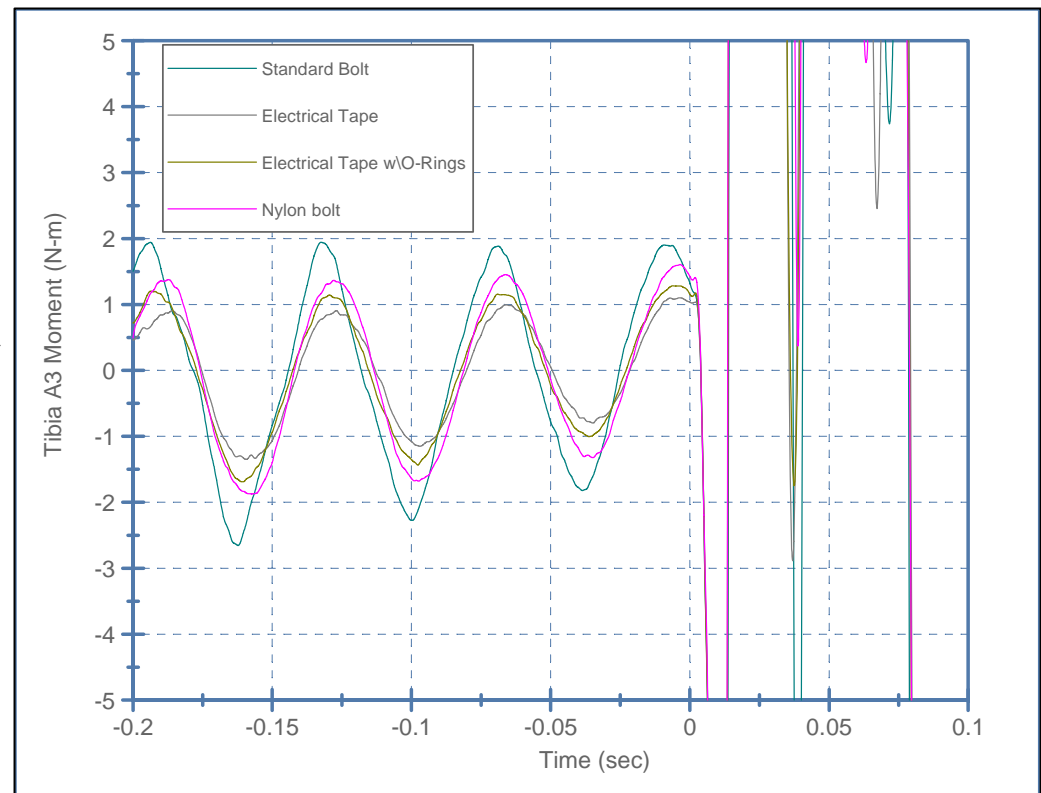
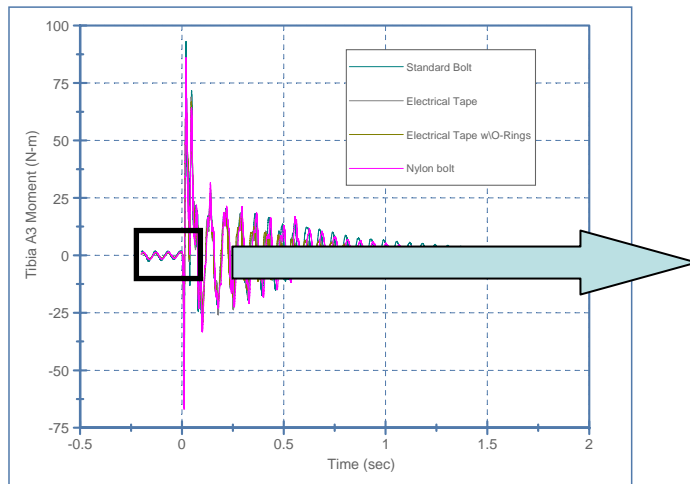
Effect of 3 mm Spacer & Ballast

- Presence of spacer and ballast did not affect leg measurements at all

Channel	UNIT	Spacers & Ballast	Spacers with No Ballast	No Spacers & No Ballast	No Spacers with Ballast
FemurA1_F	Nm	156.6	157.1	155.3	156.2
FemurA2_F	Nm	130.7	130.7	128.0	129.4
FemurA3_F	Nm	102.2	103.0	100.2	101.5
TibiaA1_F	Nm	138.1	139.1	139.0	139.2
TibiaA2_F	Nm	114.2	114.3	113.9	113.5
TibiaA3_F	Nm	87.9	89.5	88.5	87.6
TibiaB3_F	Nm	87.3	89.0	87.9	87.1
TibiaA4_F	Nm	46.0	47.2	46.8	46.2
ACL_F	mm	4.32	4.41	4.40	4.38
PCL_F	mm	4.24	4.38	4.29	4.26
MCL_F	mm	13.75	13.77	13.74	13.69
RIGXG_F	G	3.61	3.87	3.06	3.13

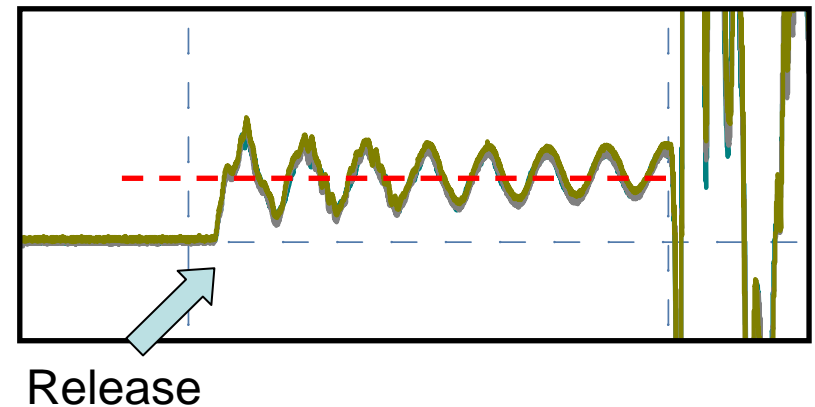
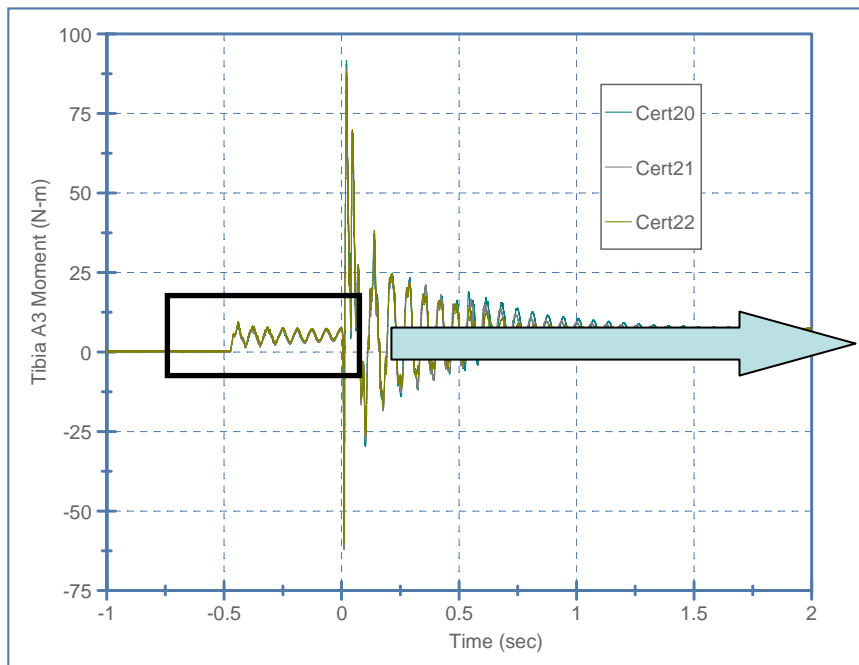
Effect of Pivot Bolt Material

- Adjustments to bolt improved pre-impact signal
 - Nylon and electrical tape wrap both reduced the magnitude of pre-impact oscillations



Offset Removal & Release Method

- Pre-impact offset can be done by post-processing the data rather than physically removing it
- Our release method is consistent

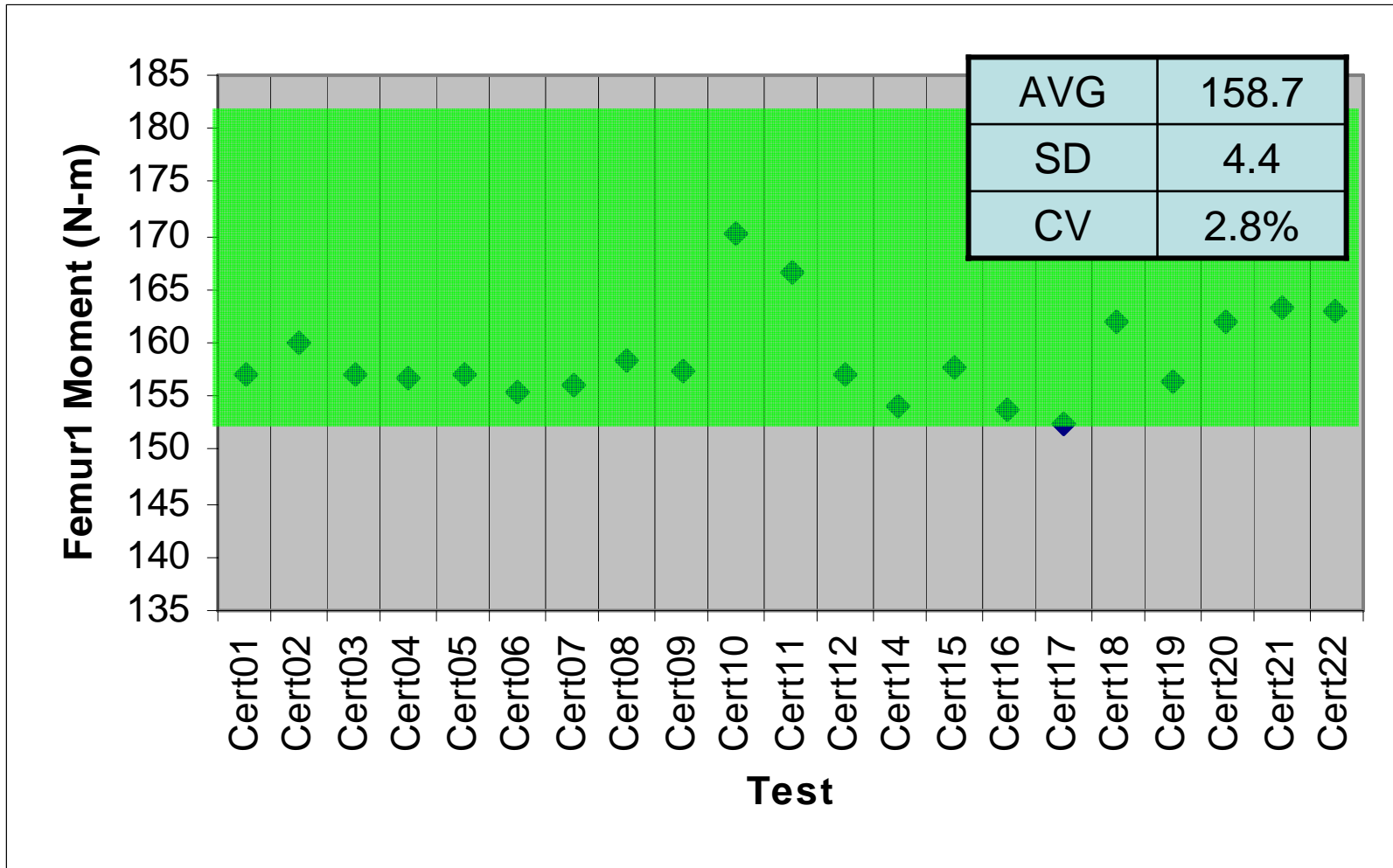


CERTIFICATION DATA

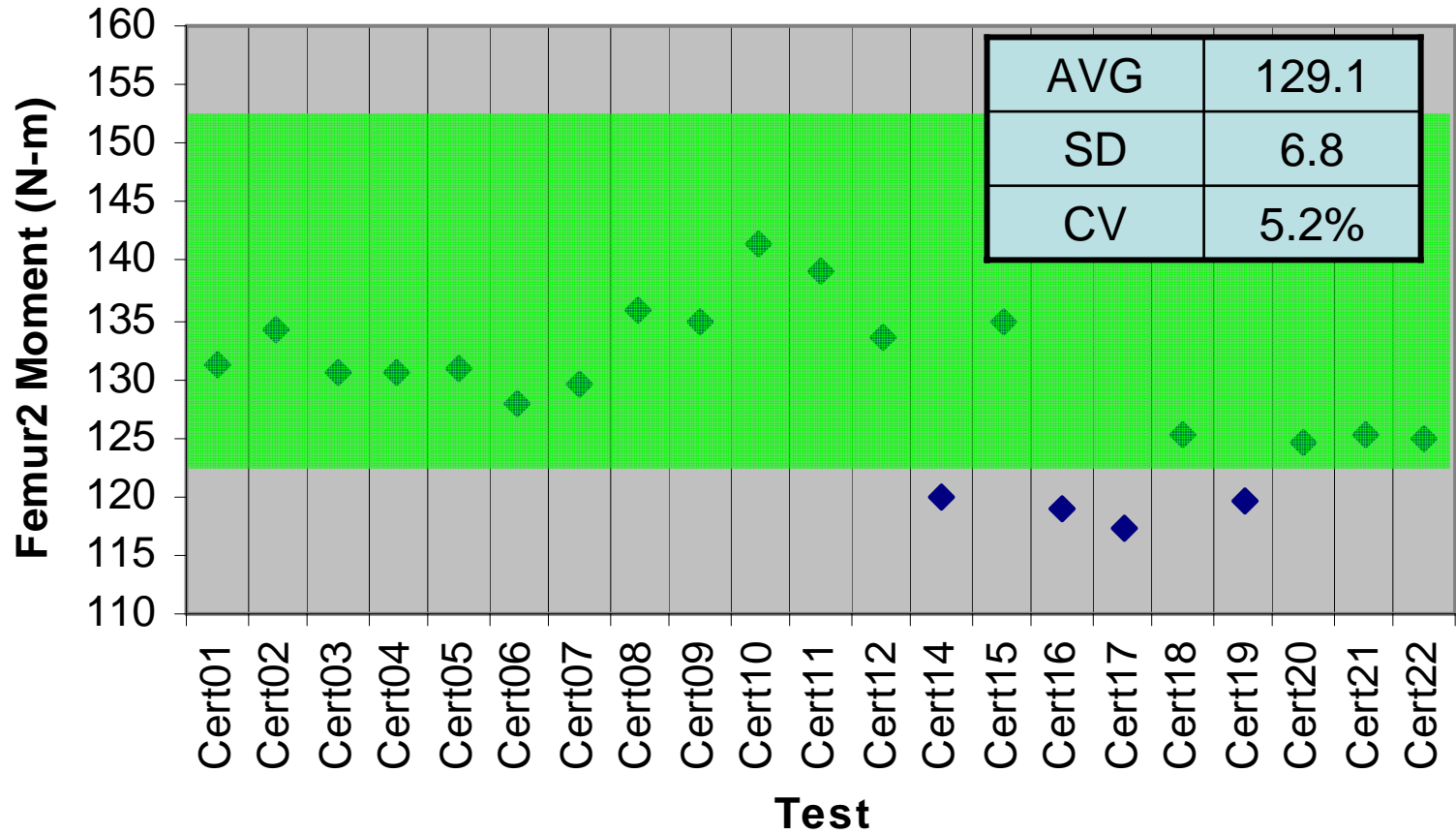
Test Record

Test Number	Date	Time	Comments
CERT01	2/13/2008	9:16 AM	Trial Test - TibiaA3 & PCL Failed Corridor
CERT02	2/13/2008	10:08 AM	Trial Test - TibiaA3 & PCL Failed Corridor
CERT03	2/13/2008	2:18 PM	Trial Test - TibiaA3 & PCL Failed Corridor
CERT04	2/15/2008	10:01 AM	Added Redundant TibiaB3, Trial Test - TibiaA3 & PCL Failed Corridor
CERT05	2/15/2008	10:07 AM	Bags Removed
CERT06	2/15/2008	10:27 AM	Bags & 3 mm Spacers Removed
CERT07	2/15/2008	10:52 AM	Spacers Removed, Pre CRV01 Test
CERT08	2/22/2008	9:26 AM	Bags Put Back On, Post CRV01 Test, Pre CRV02 Test
CERT09	2/26/2008	1:51 PM	Post CRV02 Test
CERT10	2/26/2008	3:00 PM	Wrapped Connection Bolt in Electrical Tape
CERT11	2/26/2008	3:25 PM	Pre CRV03 Test, Wrapped New Connection Bolt in Electrical Tape & Added Side O-Ring
CERT12	2/29/2008	9:47 AM	Post CRV03 Test
CERT13	----		No test CERT13
CERT14	3/4/2008	9:18 AM	Post CR-V F04, changed to plastic bolt to fix legform to fixture.
CERT15	3/4/2008	3:41 PM	Added accelerometer and returned to original bolt.
CERT16	3/5/2008	7:48 AM	Returned to plastic bolt
CERT17	3/12/2008	1:36 PM	Following speed shots, prior to MIATA F01
CERT18	3/13/2008	1:03 PM	Following MIATA F01
CERT19	3/14/2008	8:17 AM	Before MIATA F02
CERT20	3/18/2008	7:50 AM	Following MIATA F02, Before MIATA F03
CERT21	3/19/2008	6:43 AM	Following MIATA F03, Before MIATA F04
CERT22	3/20/2008	9:08 AM	Following MIATA F04

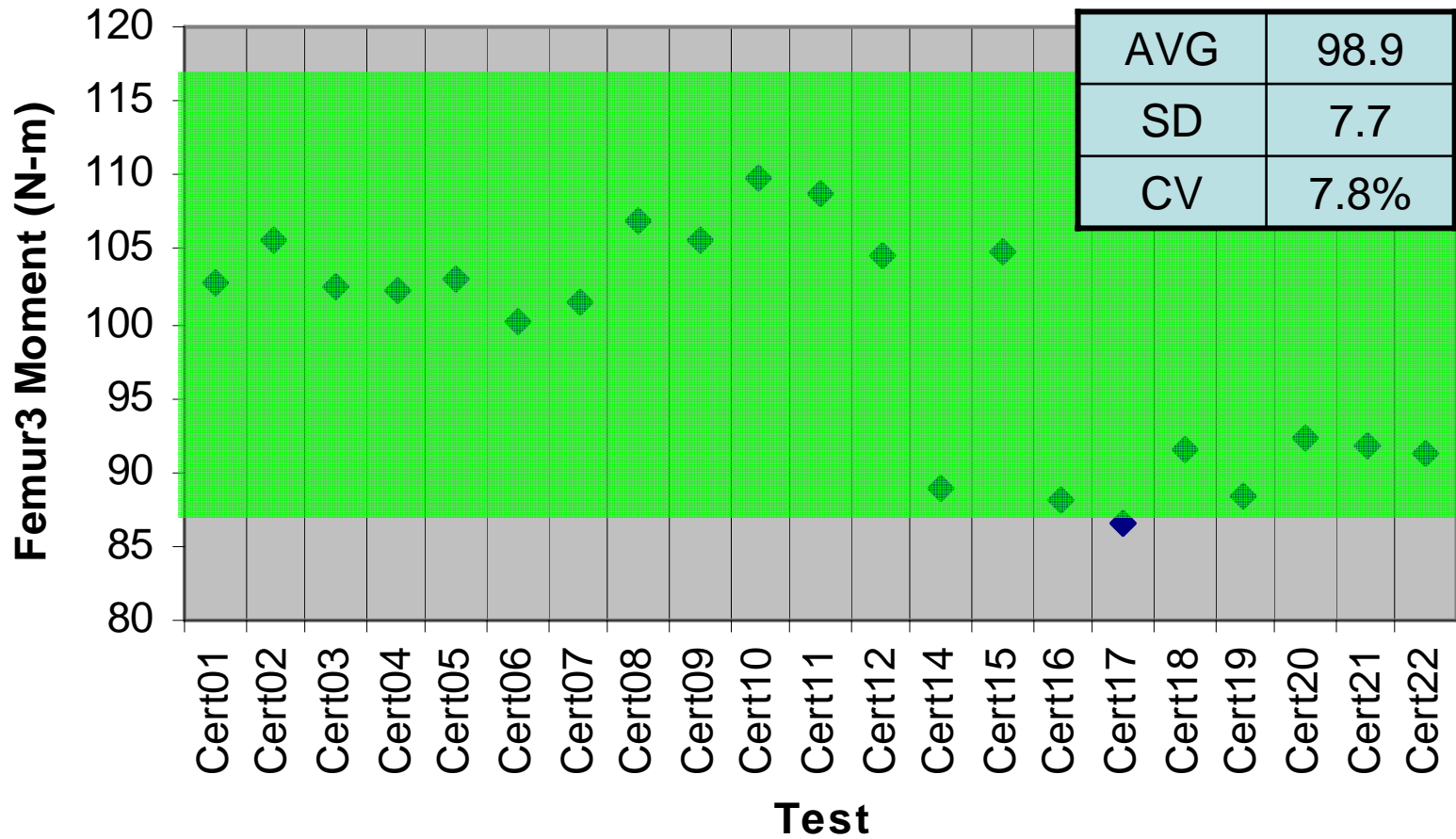
Femur A1



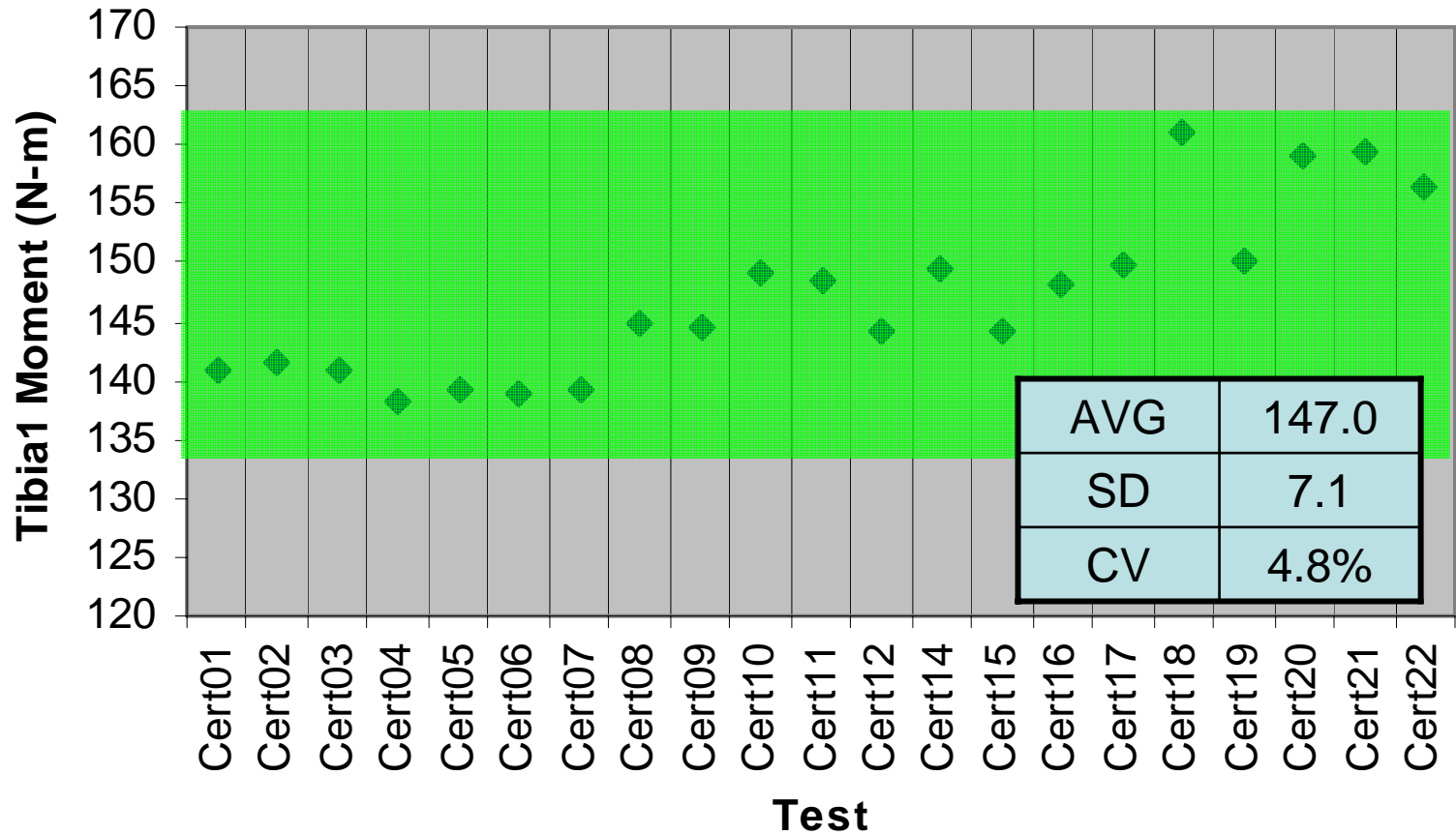
Femur A2



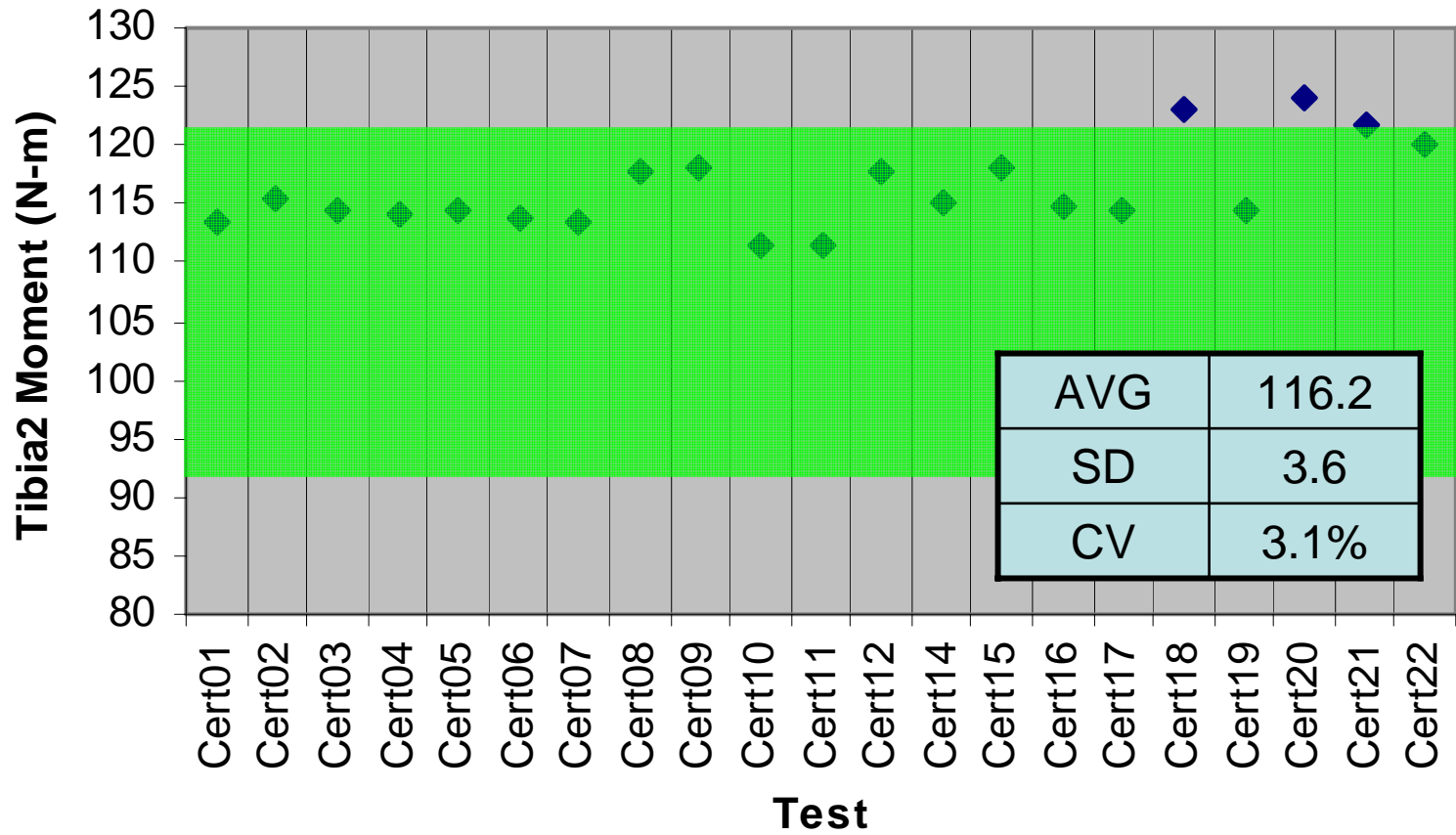
Femur A3



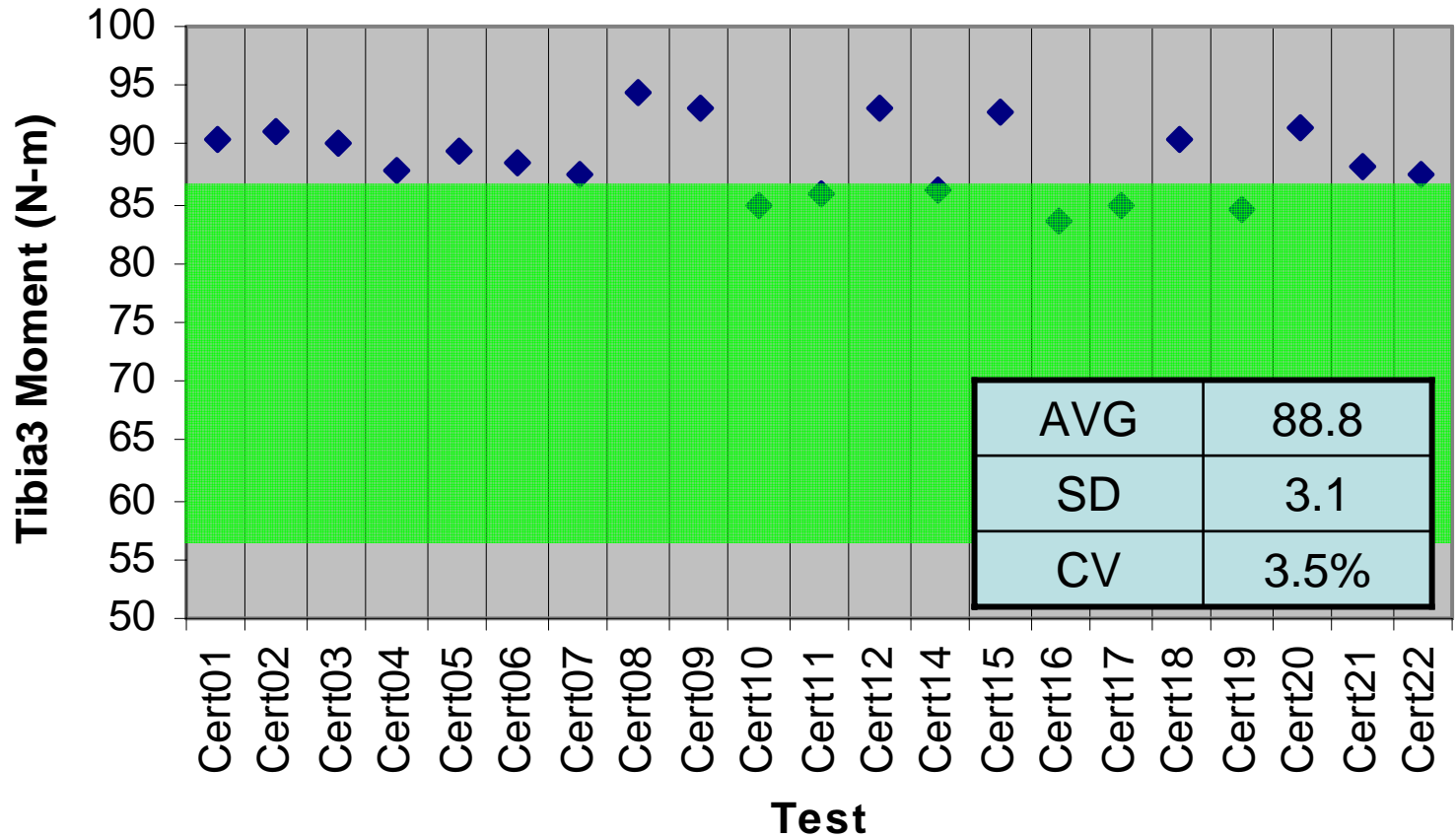
Tibia A1



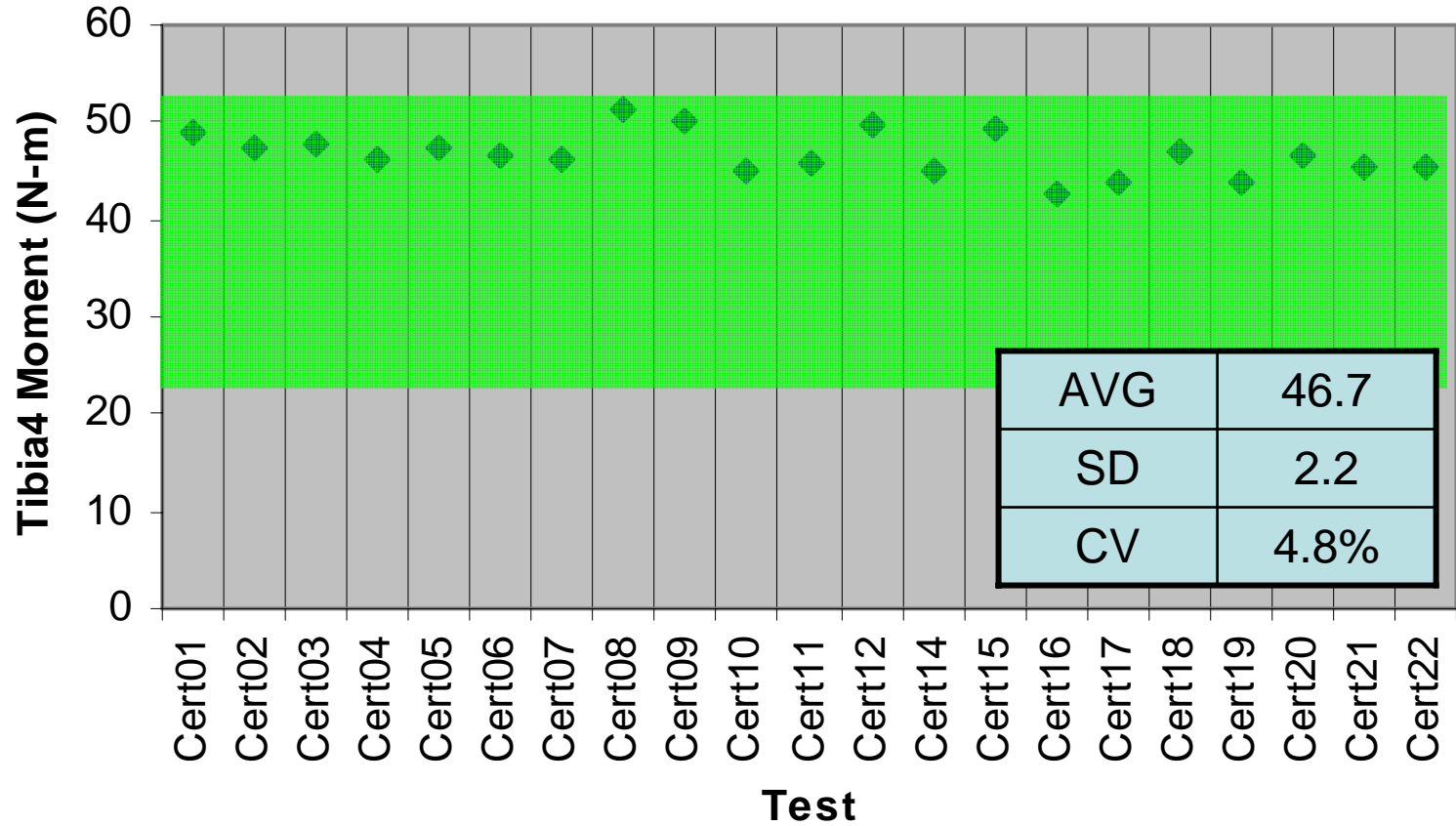
Tibia A2



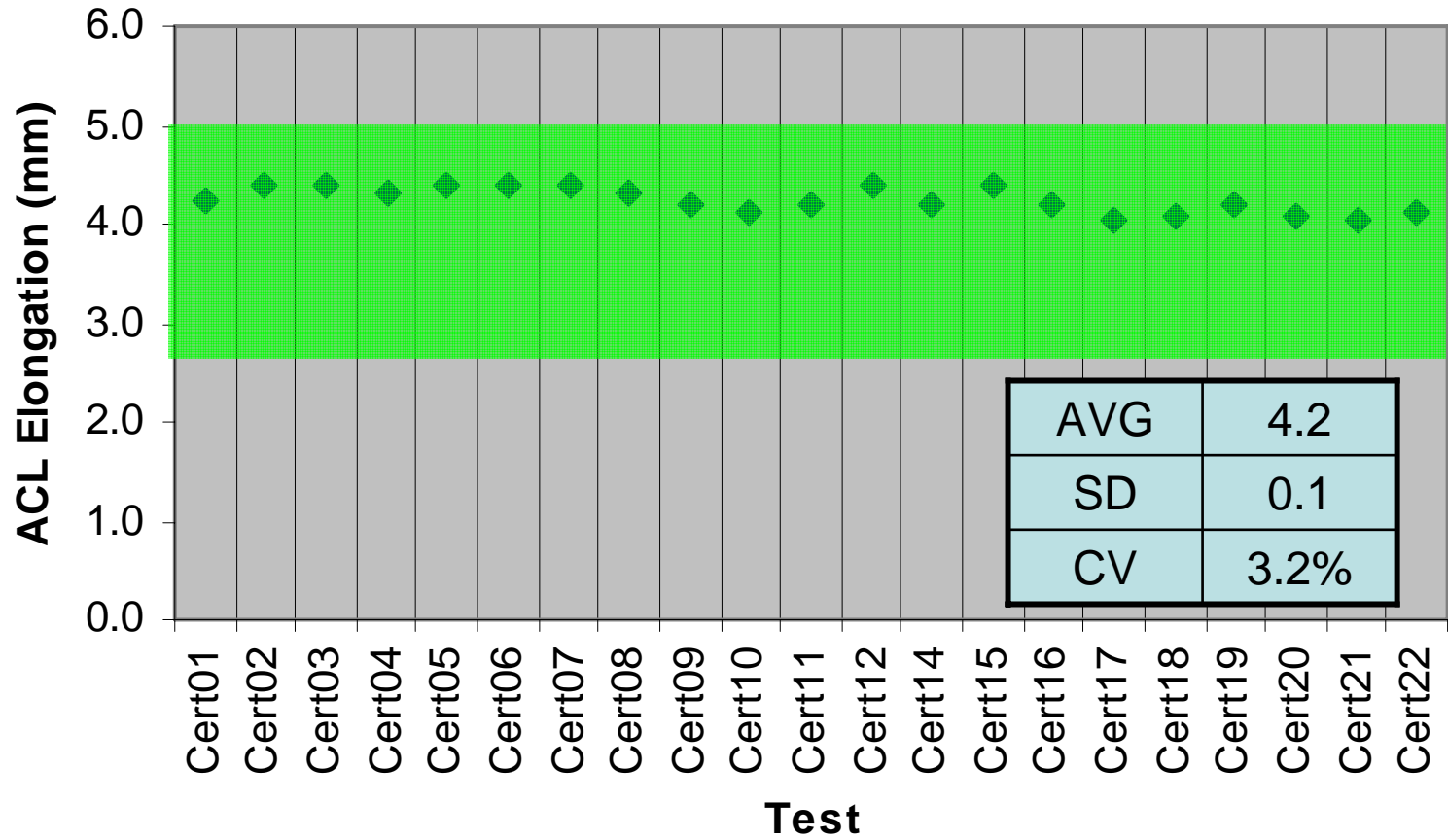
Tibia A3



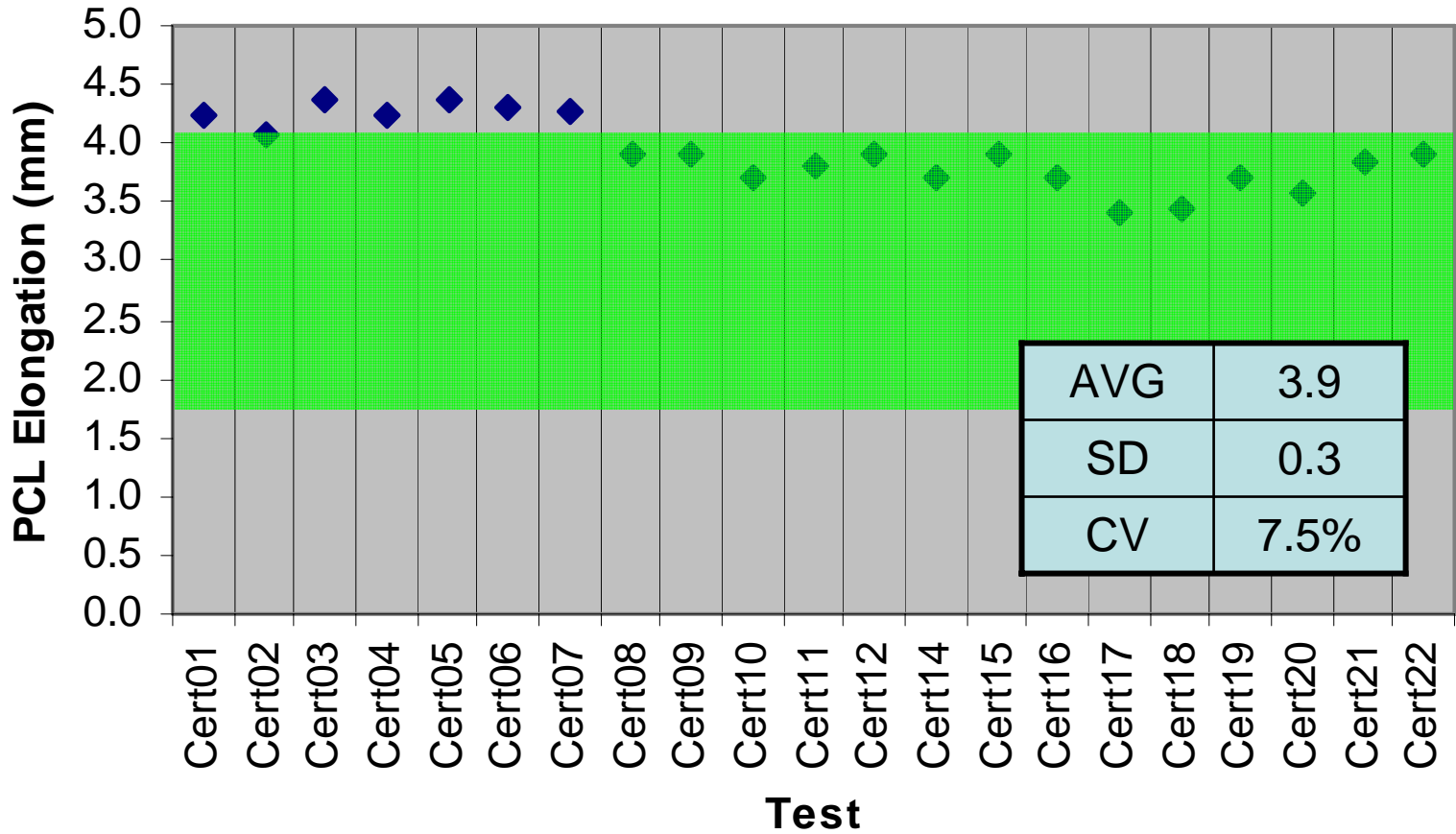
Tibia A4



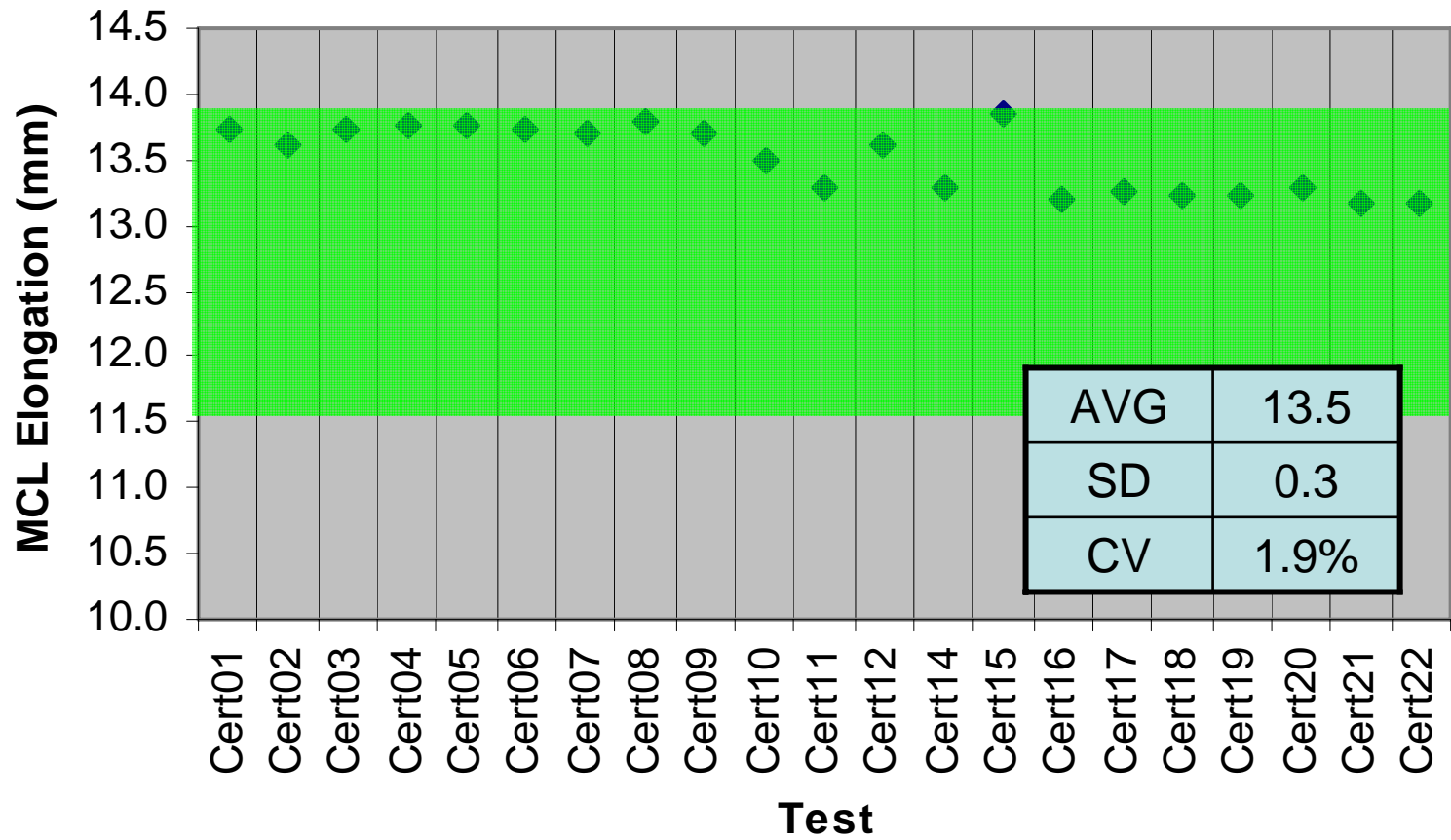
ACL



PCL



MCL



Summary

- Certification test does not seem to be sensitive to any of the following:
 - Rig connection/support
 - Impact plate width
 - Release method
 - Offset method
- Isolation of leg from rig seems to help reduce noise in moment signals
- Certification data was very repeatable, but did not always fall within the provided corridors