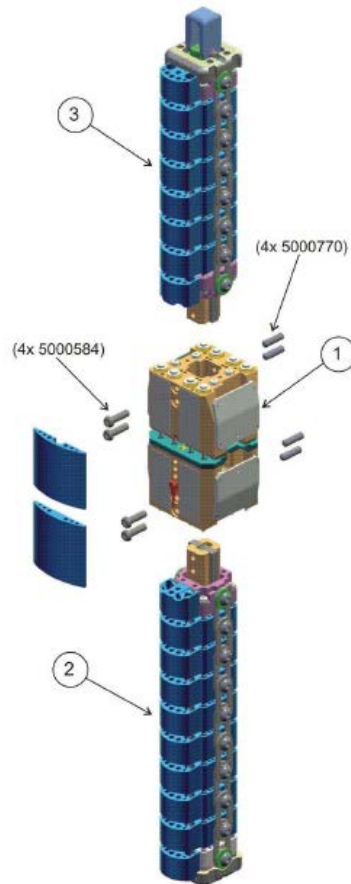


Humanetics Inverse and Round Robin Leg Preparation

TF-RUCC



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Content

- ▶ Long/short rubber flesh results
- ▶ Inverse rig investigation
- ▶ Round Robin leg preparation

Long vs Short Flesh Inverse Test

- ▶ In the last TF-RUCC meeting Humanetics promised they would rerun comparison due to low results previously presented.
- ▶ From Sept 2011 inverse results appeared lower than normal. The reason was investigated
- ▶ Internal engineering leg used to carry out test
- ▶ These results are from only one leg so further testing would be needed to confirm variation

Long vs Short Rubber test Results

Date				8/2/12	9/2/12	9/2/12	9/2/12	9/2/12	14/2/12	14/2/12	14/2/12	15/2/12	15/2/12
Time				5:31pm	2:01PM	2:33pm	3:06pm	3:55pm	1:09pm	2:49pm	4:12pm	8:01am	9:09am
Test site				plymouth	plymouth	plymouth	plymouth	plymouth	plymouth	plymouth	plymouth	plymouth	plymouth
Pre Impact velocity	10.9	11.3	m/sec	11.29	11.25	11.25	11.1	11.24	11.25	11.3	11.25	11.25	11.19
Peak Moment @ T1	237	277	N-m	242.94	241.09	238.99	238.97	242.54	241.27	241.54	242.25	243.13	243.33
Peak Moment @ T2	223	269	N-m	226.12	224.27	224.38	226.17	227.07	229.59	227.26	229.89	231.32	232.21
Peak Moment @ T3	176	204	N-m	172.63	170.08	171.26	171.41	171.2	177.25	176.66	178.23	179.18	179.68
Peak Moment @ T4	98	120	N-m	93.05	92.16	91.2	90.68	92.02	99.74	98.01	98.64	100.2	100.25
Peak ACL Elongation	8.5	10.5	mm	9.06	9.19	9.07	8.96	9.64	9.18	9.26	9.06	9.75	9.7
Peak MCL Elongation	18	23	mm	20.46	20.18	20.53	19.77	20.39	19.99	19.96	19.67	18.98	0.56
Peak PCL Elongation	4.5	6	mm	5.71	5.6	5.81	5.59	5.49	5.53	5.46	5.51	5.13	5.14
Temperature	18	22	degC	21.7	21.9	21.9	21.9	21.9	21.5	21.5	21.5	21.6	21.6
Humidity	10	70	%	28	26	26	26	26	25	25	26	26	27
Femur stiffness	mid-high												
Femur thickness	10.5			LONG RUBBER					SHORT RUBBER				
Tibia stiffness	high-in								MCL unplugged				
Tibia thickness	10.5												
Tibia Assembly	Pass												
Femur Assembly	Pass												
Knee Assembly	Pass												

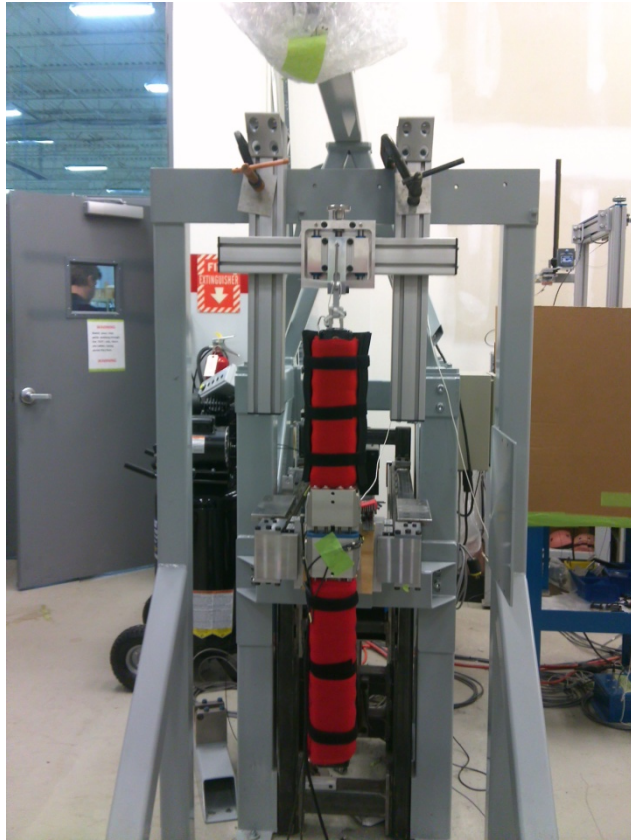
	Av Long	Av Short	Moment Increase with short rubber Nm
T1	240.906	242.304	1.398
T2	225.602	230.054	4.452
T3	171.316	178.2	6.884
T4	91.822	99.368	7.546

Results are from off board cables so would expect actual would be 1.7% higher with onboard DAS

Inverse Rig Investigation

- ▶ Due to movement seen in the inverse rig a frame was adapted to see the effect of remotely hanging the leg to ensure no movement of the leg before impact
- ▶ A base line test was run before the test without the frame
- ▶ 3 remote hanging tests were run
- ▶ SN05 was used with new batch 4 bones tuned to the stiff side of the bone corridor

Decoupled Leg Release



- ▶ Frame is completely independent from effects ram/air cylinder
- ▶ All existing adjustments were maintained.
- ▶ Leg release proved to be solid, with no movement detected in high speed video.

Decoupled Leg Release Data

Test ID	Velocity	Tibia 1	Tibia 2	Tibia 3	Tibia 4	ACL	MCL	PCL
Base Line Test								
242549	11.3	247.24	224.28	165.91	97.97	9.01	20.1	5.58
Decoupled Leg Release with new Alignment								
242607	11.2	243.05	224.16	170.59	99.03	9.33	19.32	5.28
242609	11.2	247.78	227.78	173.71	97.41	9.22	19.22	5.24
242610	11.2	246.62	227.61	173.96	97.49	9.46	19.45	5.35

Inverse Investigation

- ▶ Hanging the leg remotely from the rig did not show significant improvement. There was improvement to T3.
- ▶ Previous low inverse results appear to be due to frame movement releasing leg before impact or moving the impact point
- ▶ Existing rig stability has been improved by supporting overhang at ends, reducing moment in frame from piston. Tests will be rerun with this setup
- ▶ New rig design is on order

New parts - Refurbishment of SN01 and SN03 for Round Robin legs

- ▶ New bones
- ▶ All knee Stainless steel cables
- ▶ Knee meniscus including bronze bushes
- ▶ All knee springs
- ▶ All M5 cable nuts
- ▶ All segment buffers
- ▶ All curved magnesium bone contact spacers
- ▶ All attachment double sided tape
- ▶ Set screws for bone attachment
- ▶ Bone end buffers
- ▶ Release bracket roller
- ▶ Rubber flesh
- ▶ Velcro straps
- ▶ All Neoprene covers
- ▶ Tibia end cover
- ▶ Femur top plate on SN01 to meet latest pendulum weight design

Humanetics Calibration for RR Legs

- ▶ 12 channel SLICE system for each leg was recalibrated by DTS
- ▶ The 3 accelerometers in the knee were recalibrated
- ▶ String pots on SN01 and SN03 were recalibrated. Some pots were replaced with new and recalibrated.
- ▶ Bone sensitivity was ascertained at 380 Nm in loading direction of bone as requested from JARI
- ▶ Bone stiffness's were set so they would be in the middle of the corridor. Three sets to be selected from the six provided. Batches 2, 3, 4 and 5 were used to provide bone batch variation.
- ▶ Knees were assembled and statically tested for function, conformance to GTR and comparison to JARI results

Thank You!