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# **First Technology Safety Systems**

## **Design Freeze Status**

### **FLEX-PLI-GTR Development Instrumentation and Electrical Design**

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FTSS Europe

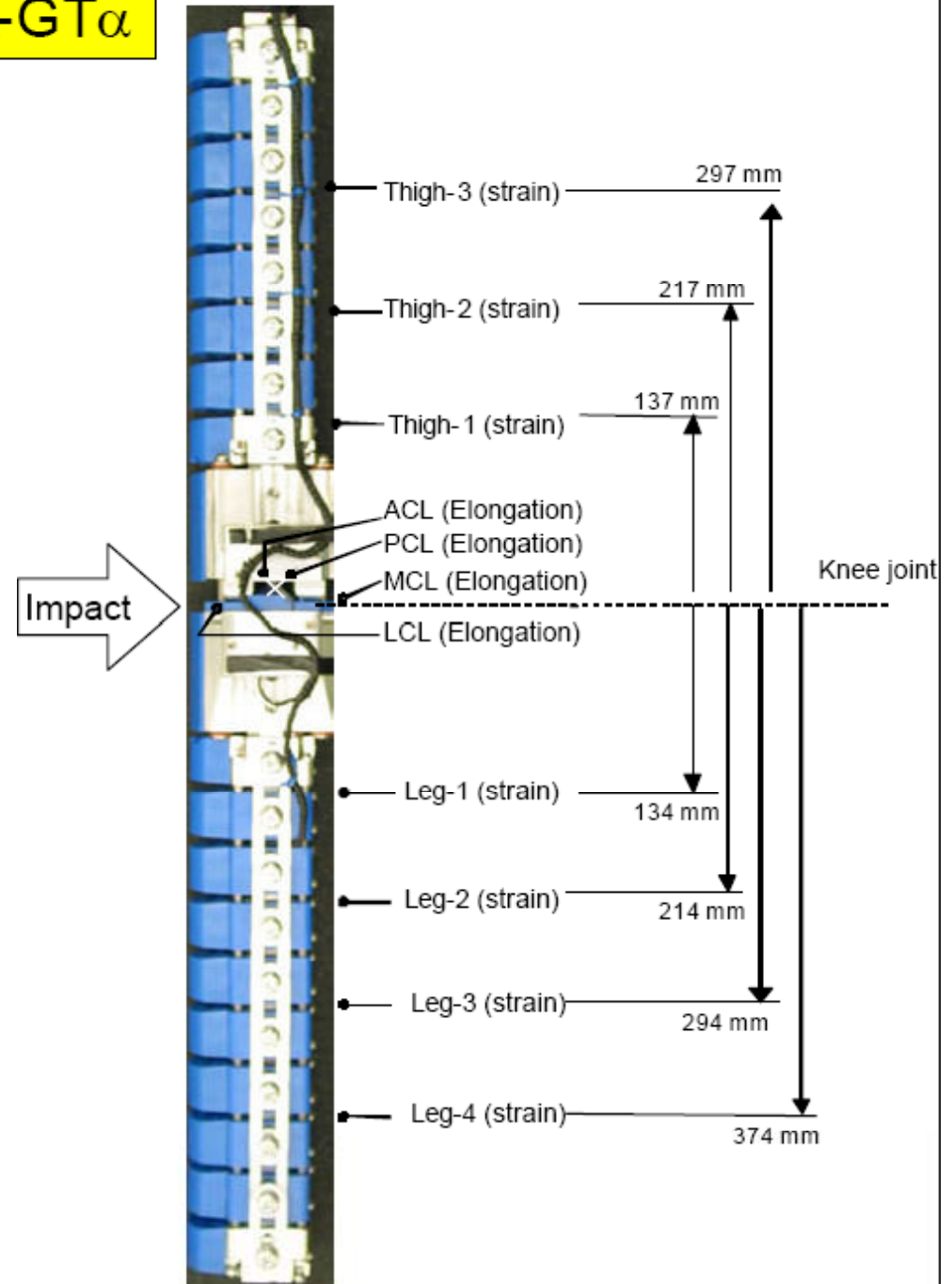
Comments addressed from Design Freeze meeting

February 20<sup>th</sup> 2008, JARI, Tsukuba, Japan

Update February 29<sup>th</sup>, 2008

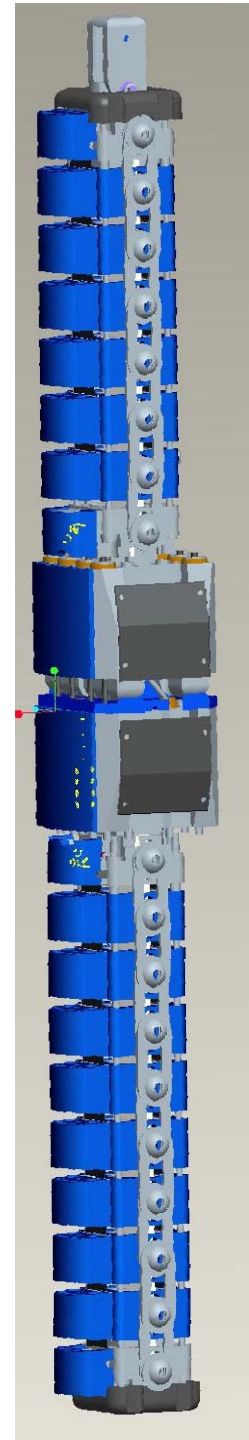
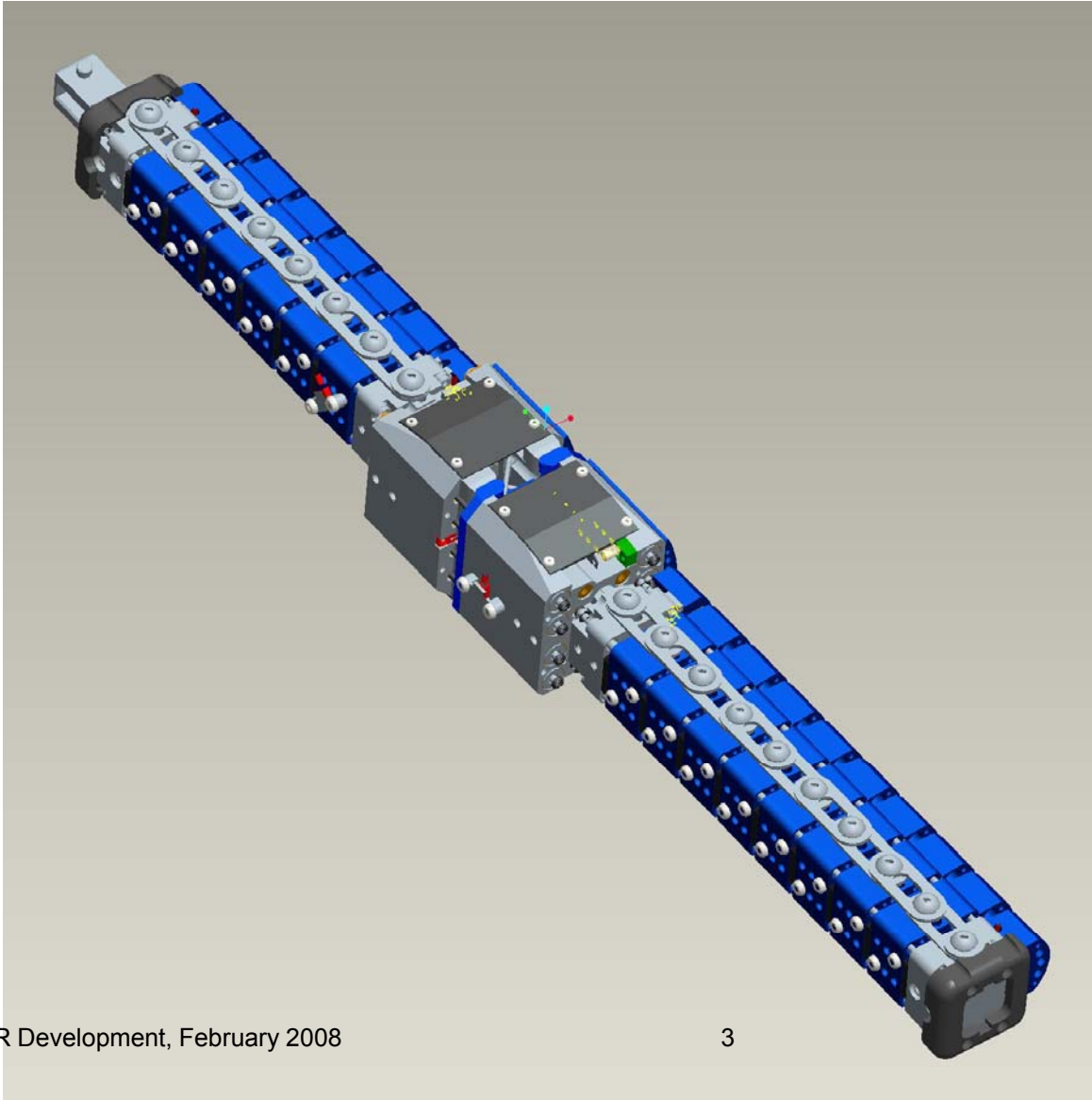
Flex-GT $\alpha$

# Introduction



# Introduction

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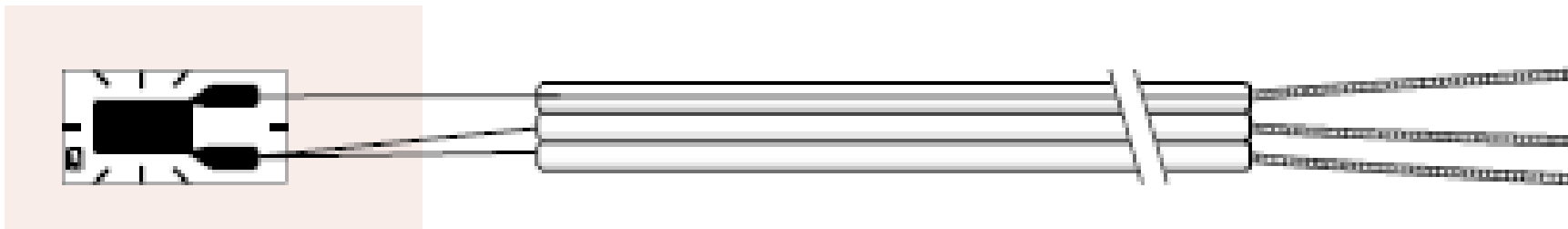
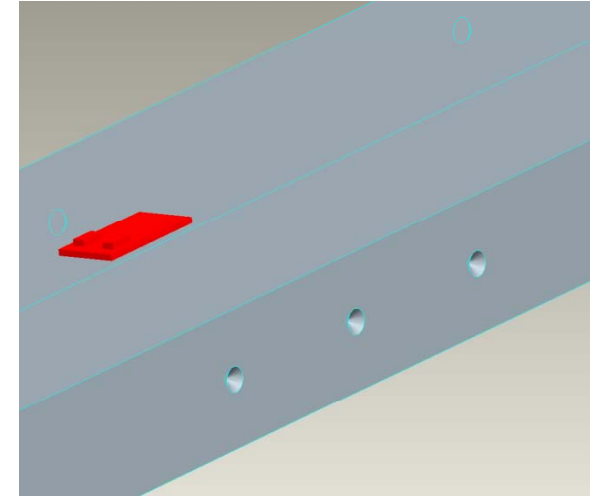


Channel	Purpose	Standard	Option	DAS	Priority
Femur moment 1, 2 and 3	Calibration	3	0	Standard option On board DAS	
Tibia moment 1, 2, 3 and 4	Injury	4	0		
Tibia top acceln ax	Calibration	1	-1		
MCL elongation	Injury	1	0		
ACL elongation	Calibration	1	0		
PCL elongation	Calibration	1	0		
LCL elongation	Calibration	1	0		
Tibia top acceln ax, ay, az	Motion	0	3	optional on board if feasibl	1
Femur bottm acceln ax, ay, az	Motion	0	3		1
Tibia angular rate $\omega_x, \omega_y, \omega_z$	Motion	0	3		2
Femur angular rate $\omega_x, \omega_y, \omega_z$	Motion	0	3		2
Femur top acceln ax, ay, az	Motion	0	3	Lab	3
Tibia bottom acceln ax, ay, az	Motion	0	3	Lab	3
Segment acceln ax	Research	0	15	Lab	4
<b>Total</b>		<b>12</b>	<b>32</b>		

# Strain Gauges and Wiring

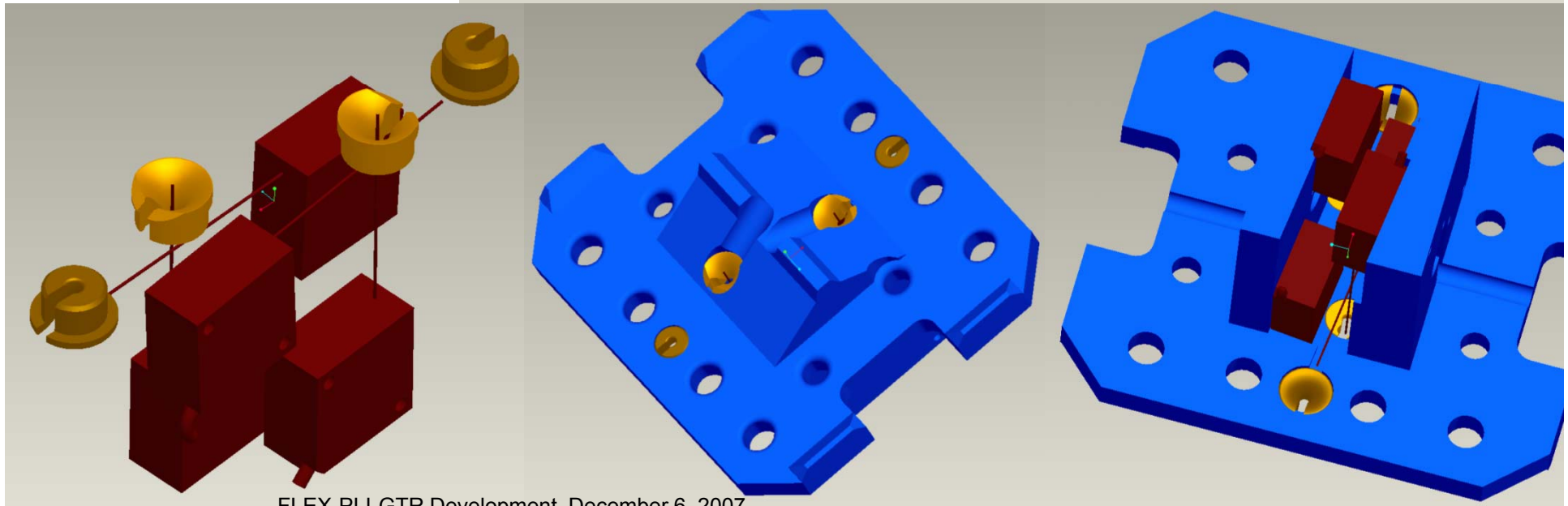
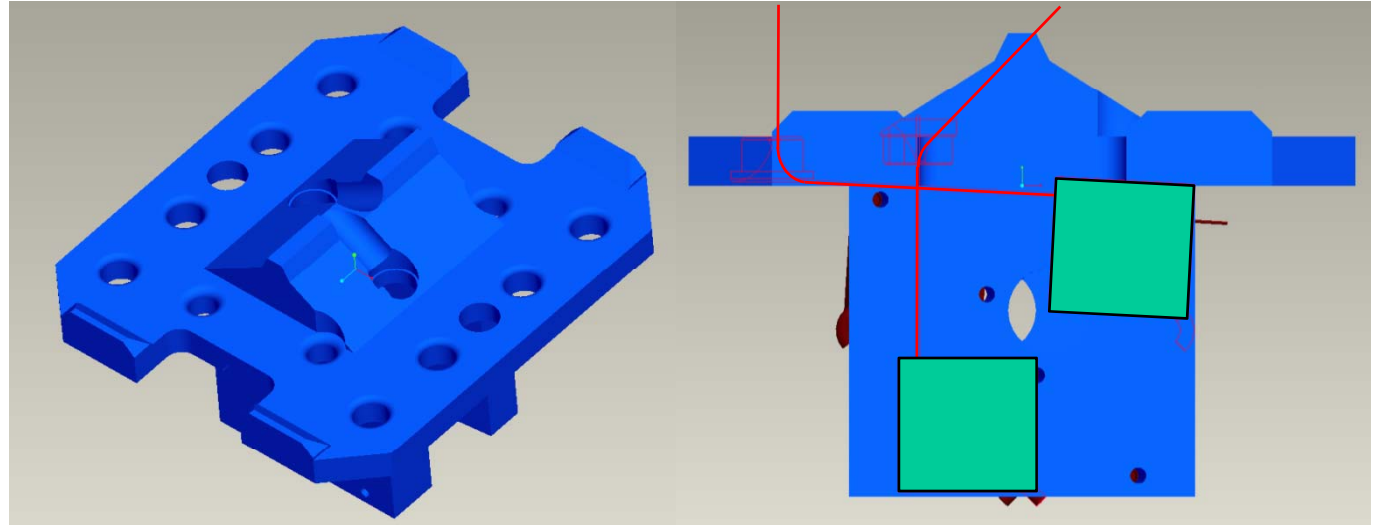
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- Kyowa KFRP-2-350-C1
- Uni-axial, 2mm length, 350 Ohm
- Base size 5x10mm
- Kyowa: please check the JARI specs
- Open issues:
  - Wires type selection
  - Adhesive selection
  - How to fix leads and bridge resistors

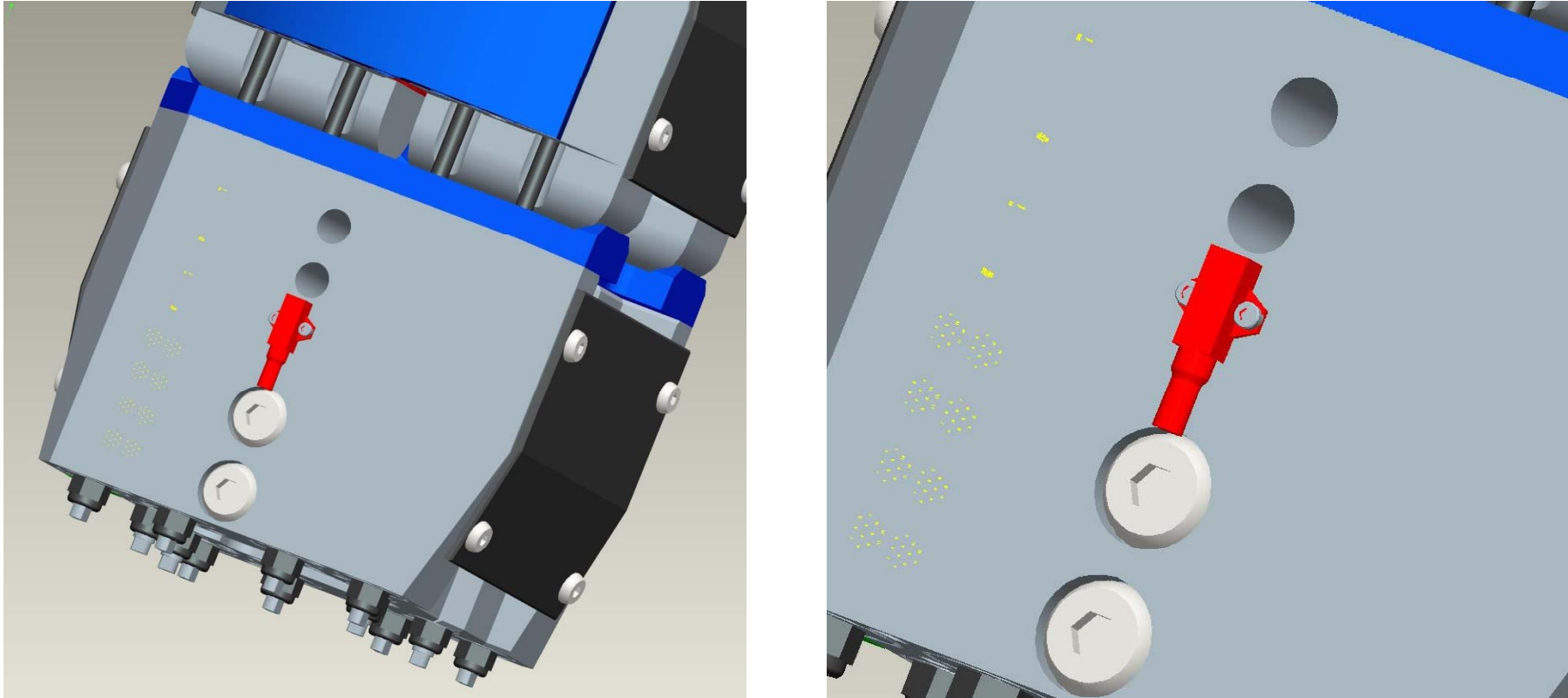


# Packaging ligament elongation stringpots

Space Age Control  
150 series  
19\*19\*10mm  
49G acceleration  
38mm stroke  
2xLH & 2xRH pull  
Bronze wire guides

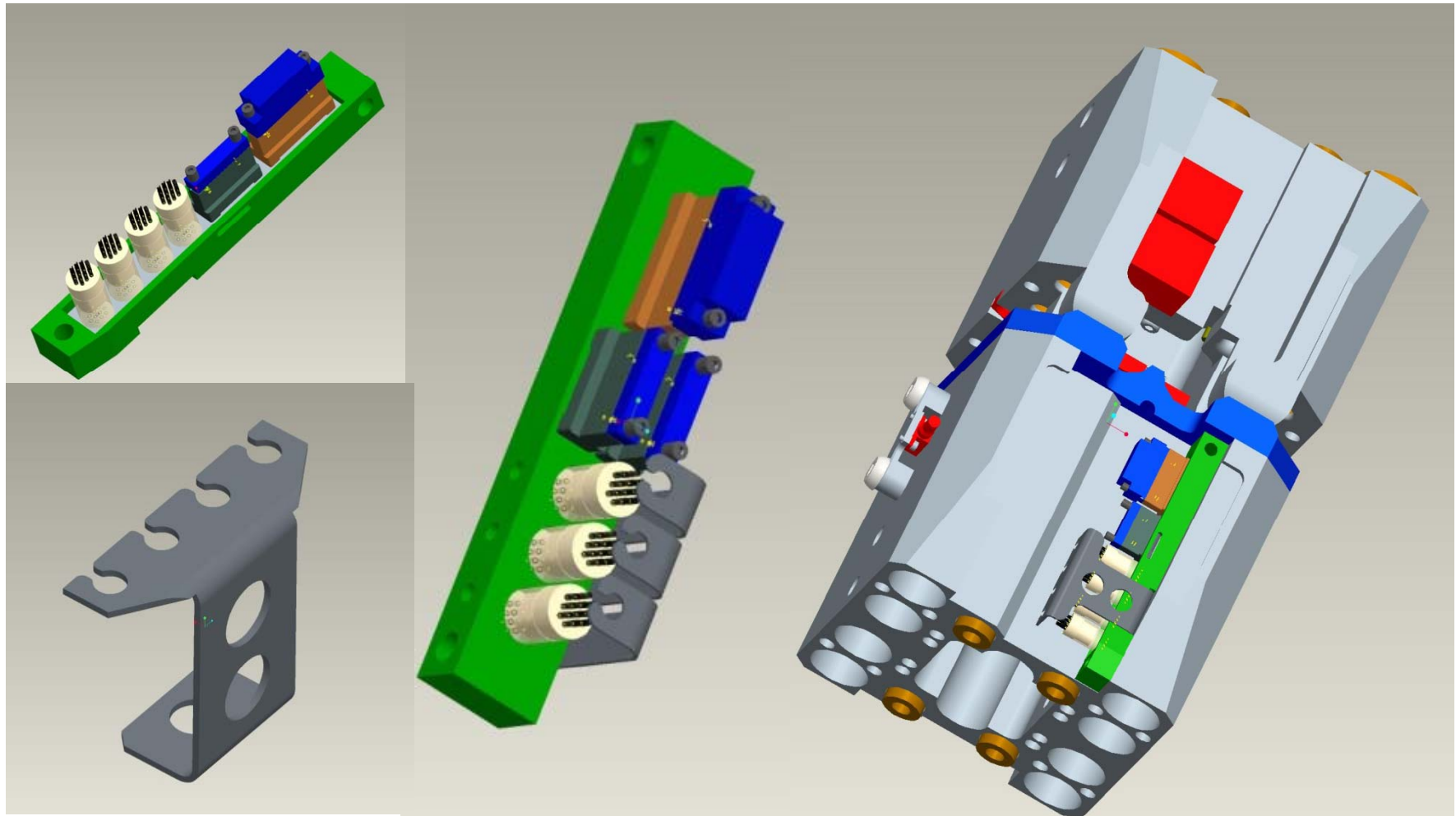


# Single axis accelerometer x-direction for certification



- Mounted behind Nylon Impact Cover
- Threaded metal inserts to enable thread repair
- Measurement specialties M62, Endevco 7264, Kyowa?

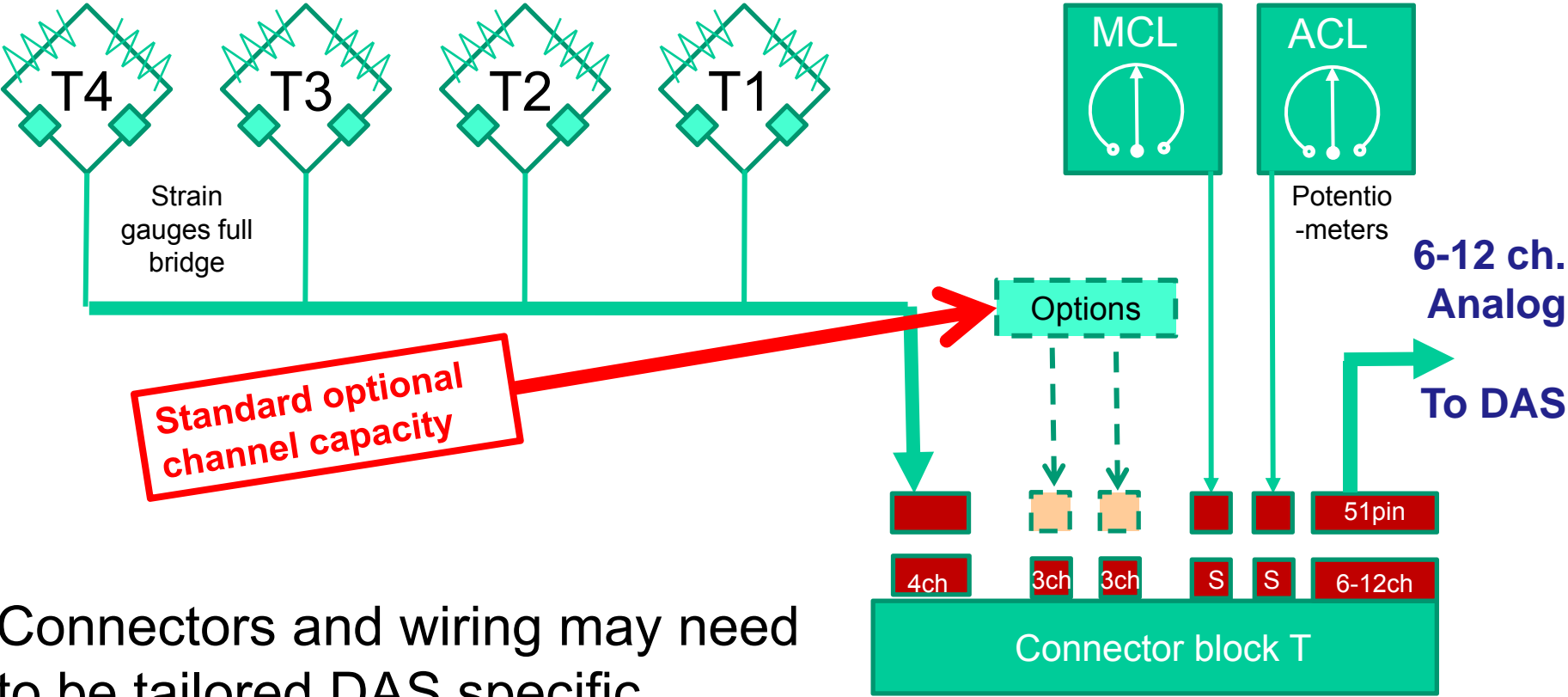
# Packaging Connectors & Wiring



Develop wire count in co-operation with DAS application

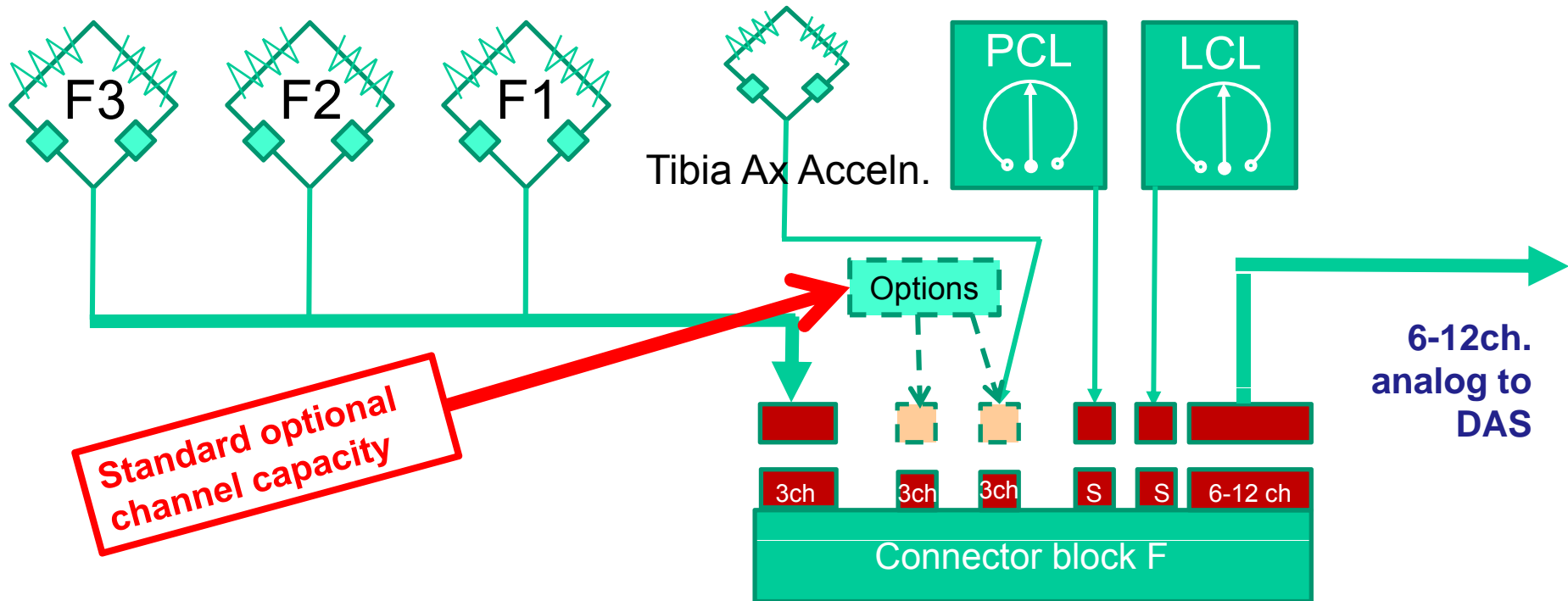


# Wiring Diagram Tibia 51 pin



Connectors and wiring may need to be tailored DAS specific

# Wiring Diagram Femur 51 pin



Connectors and wiring may need to be tailored DAS specific

# Connectors agreed

single channel

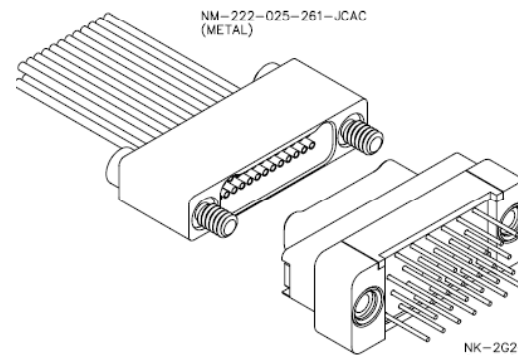
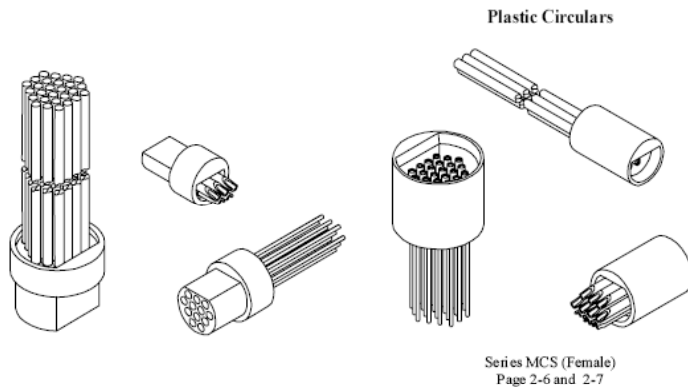
multi channel



- Omnetics: [www.omnetics.com](http://www.omnetics.com)
- Male and female connector pins protected
  - Plastic circular design
- Plastic housing, screw strain relief
- Repair by hand soldering possible and need epoxy potting for strain relief
  - Can be done trained staff



- AirBorn: [www.airborn.com](http://www.airborn.com)
- Male and female connector pins protected
  - Military spec. Nano D type
  - High conductor density
- Spacing 0.025 inch = 0.64mm
- Metal housing, screw strain relief
- Cables pre wired by manufacturer by crimping and potting
- Repair by splitting the cable and a pig tail connector



# Cables agreed

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- Cables will influence free flight motion
- How much is highly dependent on test set up wire routing
- Wire gauge is a trade off:
  - thinner wires will easily damage
  - Thicker wires/cables will influence free flight accuracy
- We have to route 50 wires out, without compromising flexibility, the common practice is to use several smaller cables instead of a large one
- We propose three 21 conductor cables, each of which has a diameter of 4 mm
- MSC Cable sample was send to JARI and agreed during the meeting

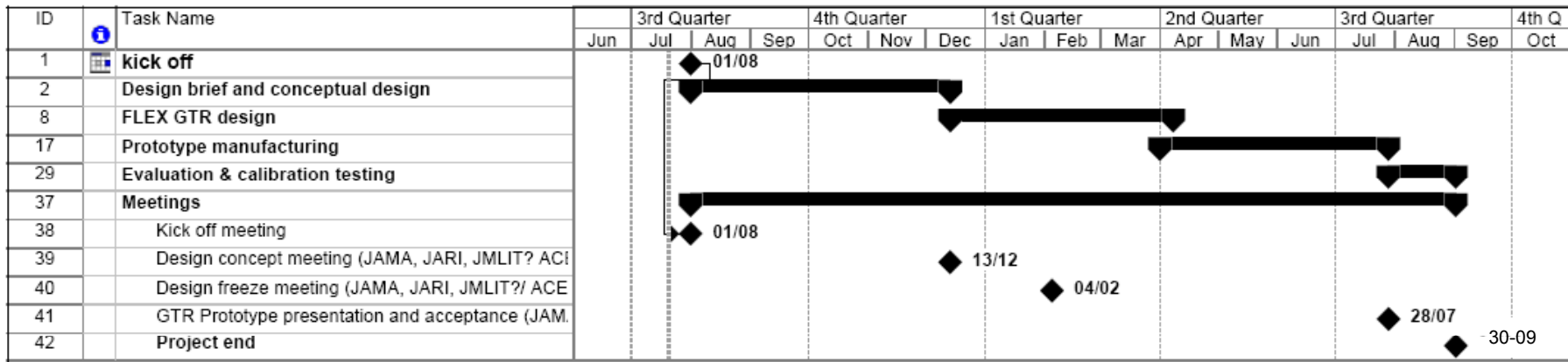
# Detail Design Issues

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- Detail design wire count and connectors in collaboration with DAS application
- Optimized wire routing and wire lengths
  - Allow for motion and stretching of wires
  - Wire clamping provisions
- Mark bone for assembly position reference
- Rounded edges in wire route
- Colour coded cables
- PCB design of standard features
- Wiring diagrams

# Schedule, future activities, etc.

- Inform FLEX-TEG members development status end February
- Drawings February 22<sup>nd</sup> – mid April
- 6<sup>th</sup> FLEX-PLI-TEG meeting, March 31<sup>st</sup> Germany
- Prototype Manufacturing 1st April – 28st July
- Prototype Testing and calibration 29 July- End September
- GTR prototype Delivery End September 2008



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# Design frozen!