First Technology Safety Systems

Proposed Flex PLI GTR Updates

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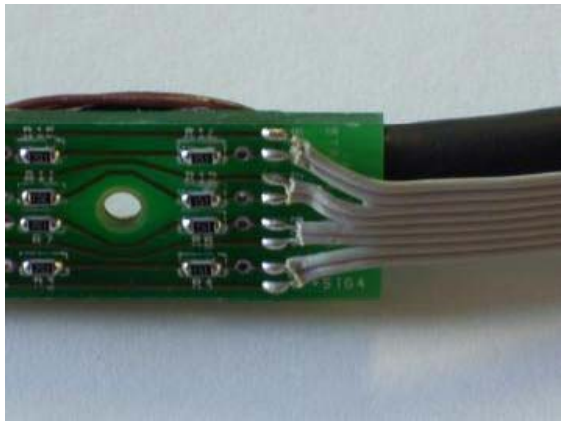
Content

- PCB for bridge completion resistors, build change
- String pot connectors and string crimp test
- Connectors
- New 12 and 24 Channel on board DAS solutions

Bone PCB potting replaced with shrink wrap

- Wire failures occurred in production process due to thin fragile gage wires
- Quality of molding was a problem (air pockets)
- This lead to scrap and rework
- New unit has lower profile
- PCB can now be repaired if there is a problem
- High strength Double sided tape still used to fit to bone
- Protective cover to gages still used

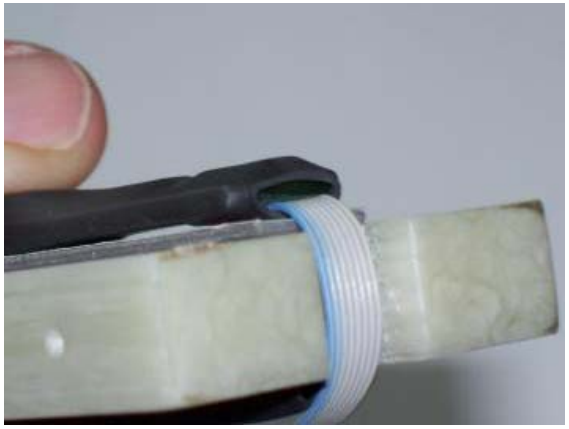
Pictures of new PCB details



Flexible ribbon gage wires more durable

Heat shrink cover with tie wrap retention

PCB fitted to bone



Flat wire detail at end on bone

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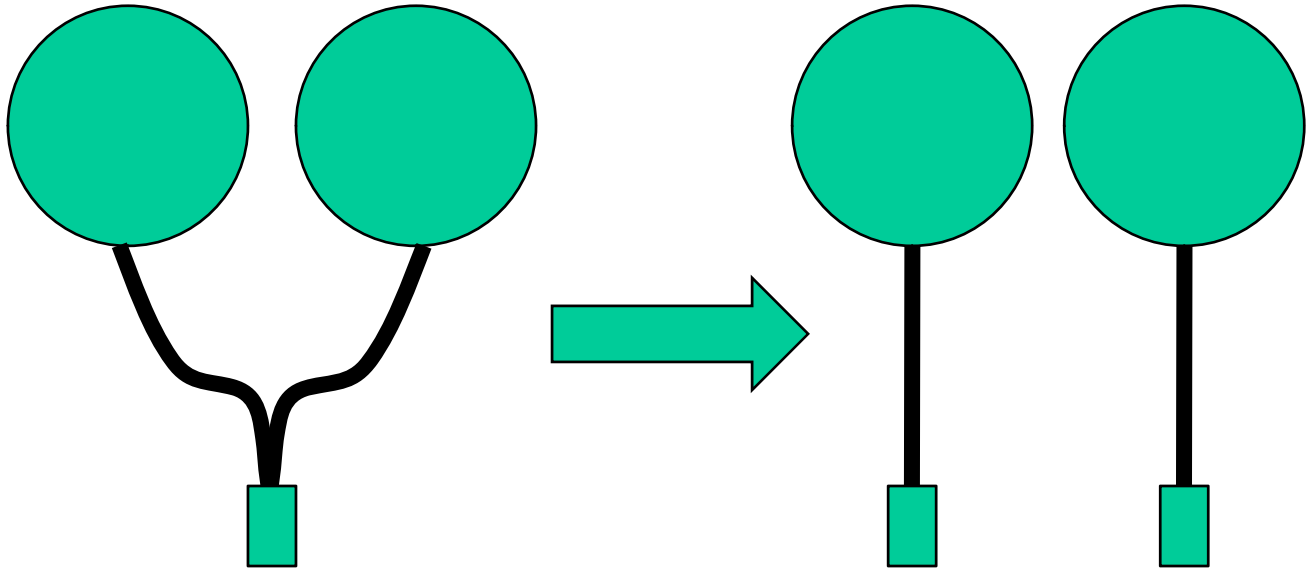
String Potentiometer connector

- Currently two string pots are linked to one connector
- This makes replacement more expensive
- Therefore we intend to isolate each of these sensors with there own connector
- Improved handling and repairs and exchange of sensors



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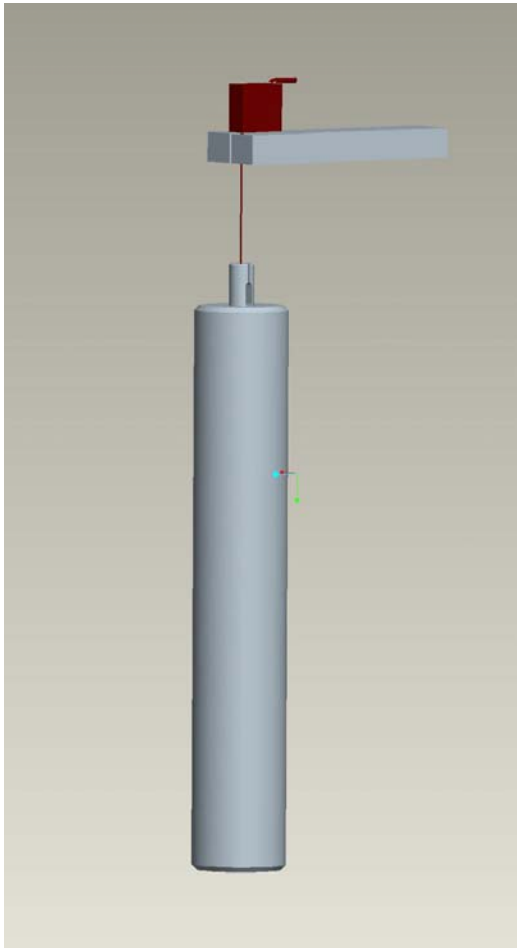
String potentiometer crimp test

Wire crimp is loaded to 20 N to Ensure crimp strength can withstand expected maximum loading



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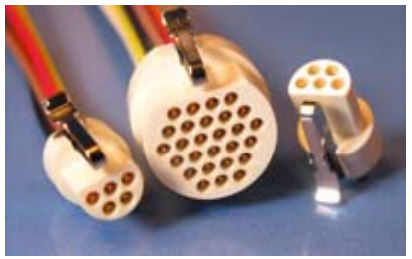
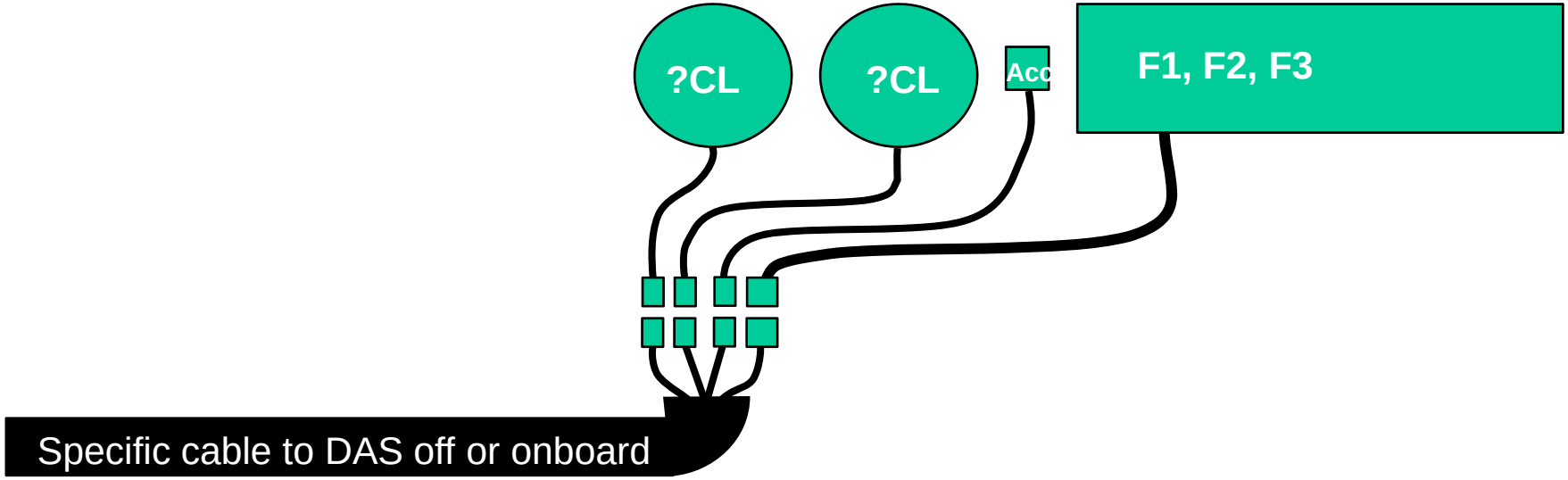
Proposed removal of connector blocks

- Off board cable and DAS connect directly to sensors
- Removal of block provides space for 24ch on board DAS
- Propose use of Omnetic connectors with locking latch 7 and 16 pin. ID chips fitted
- Can remove disadvantages of Nano D connectors
  - Nano D connectors are non serviceable
  - Nano D connectors and block are expensive
  - Nano D connectors have long lead time



Wiring diagram femur example



- To interface to various off board DAS systems will have specific solutions in the cable

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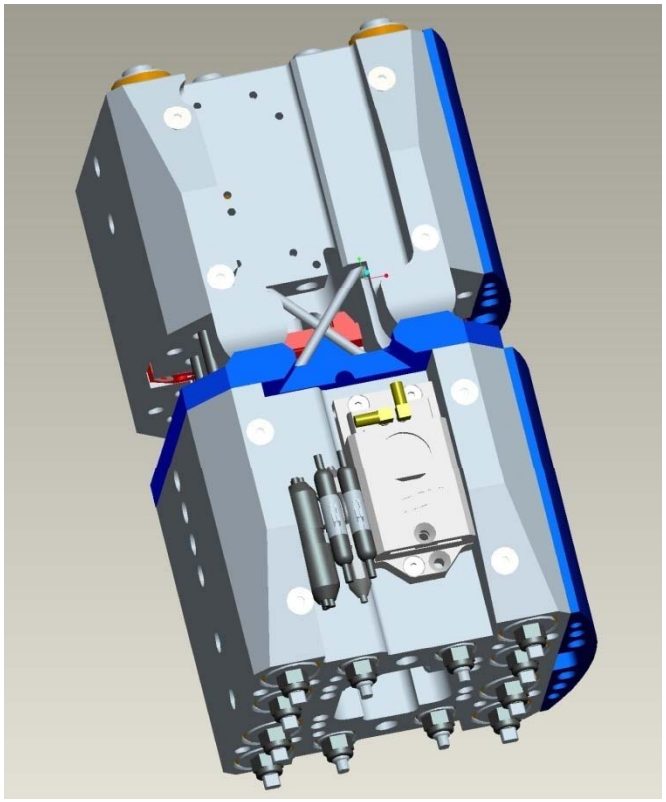
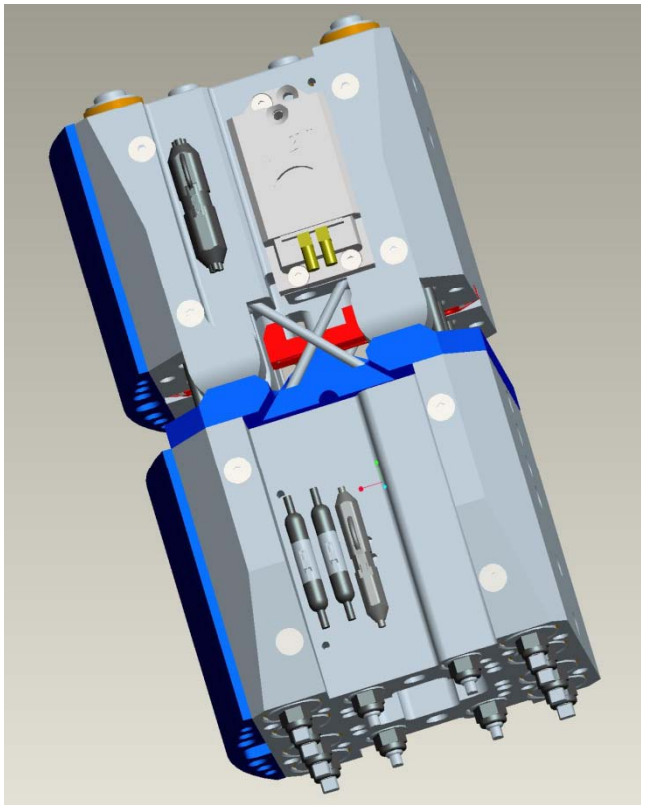
Design intentions for wiring

- Minimize number of wires crossing knee joint to prevent damage or disconnect
- Keep wire routing to a minimum
- Keep knee balanced for weight distribution and cg
- Minimize weight for onboard DAS and wiring

Proposed Messring 12 channel M=BUS



Right side view showing
M=BUS logger and connectors
Wiring not shown. 1 coax
Wire crosses knee joint



Left side view, wiring not shown
3 wires cross knee joint

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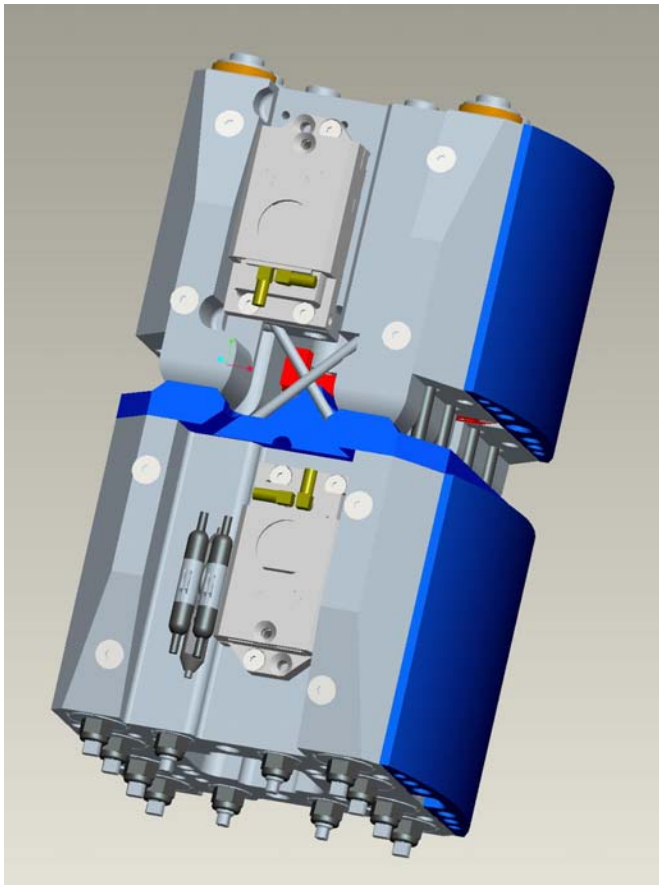
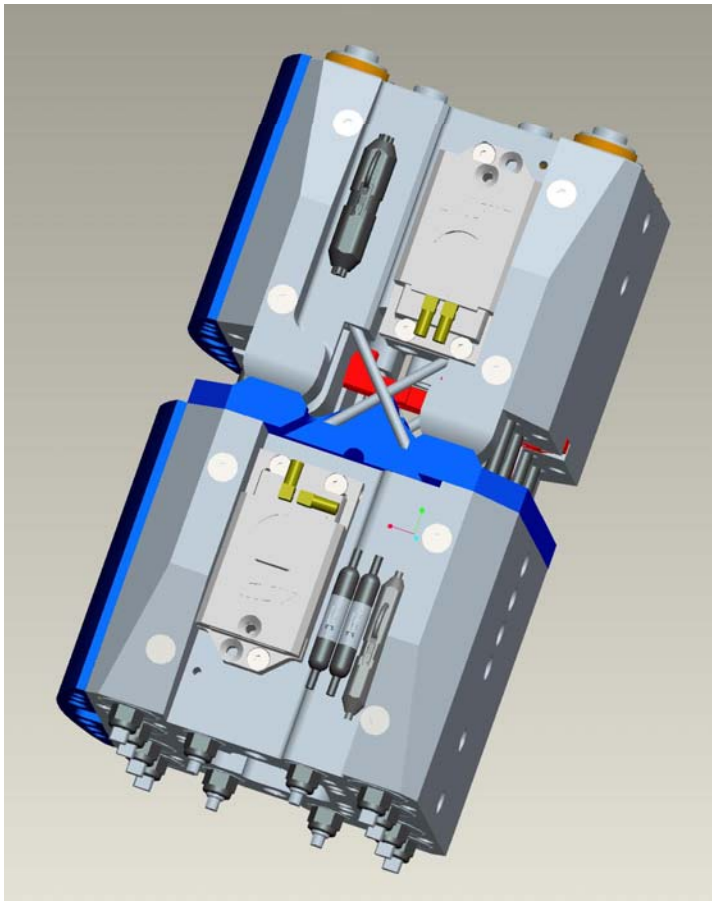
24 channel M=BUS





CAD pictures showing installation of 4x M=BUS loggers
Connector requirement will be specific to sensors req'd

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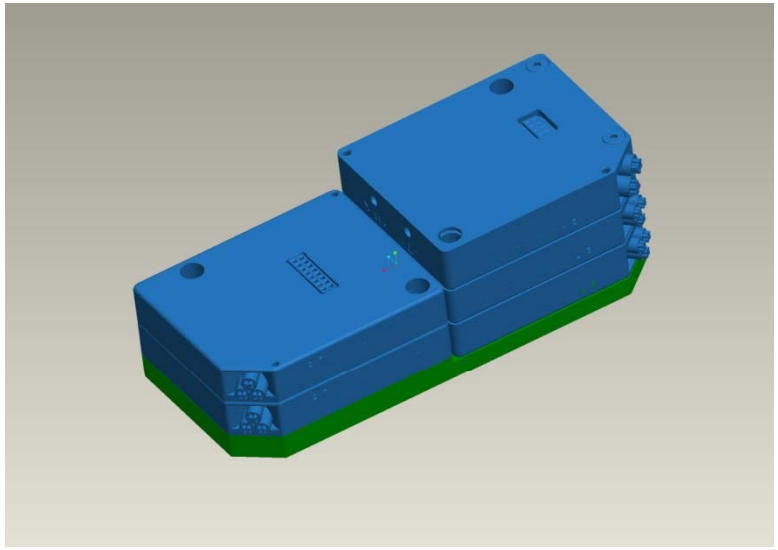
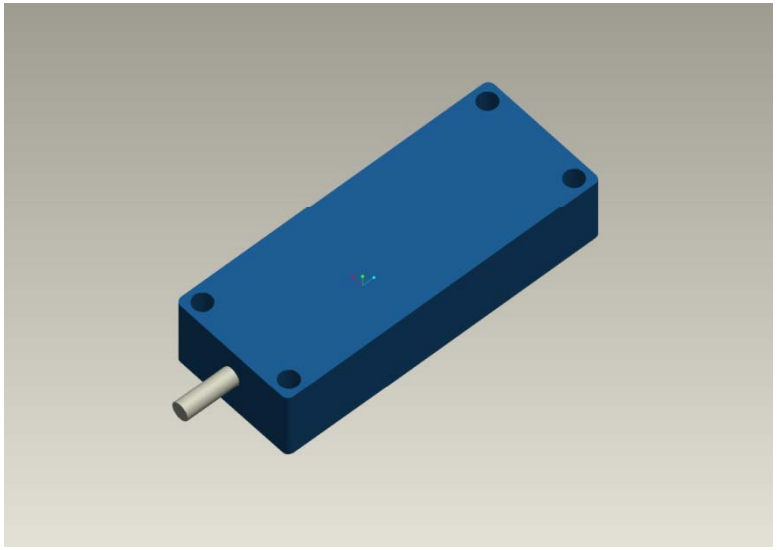
New SLICE Nano parts



New 12 channel SLICE stack using link PCB. Therefore only one Base SLICE is needed, saving cost. Weight 78 grams



New supercap housing 55x22x12, 35 grams estimated weight
2 second power life with 24 channels 4 secs with 12 channels

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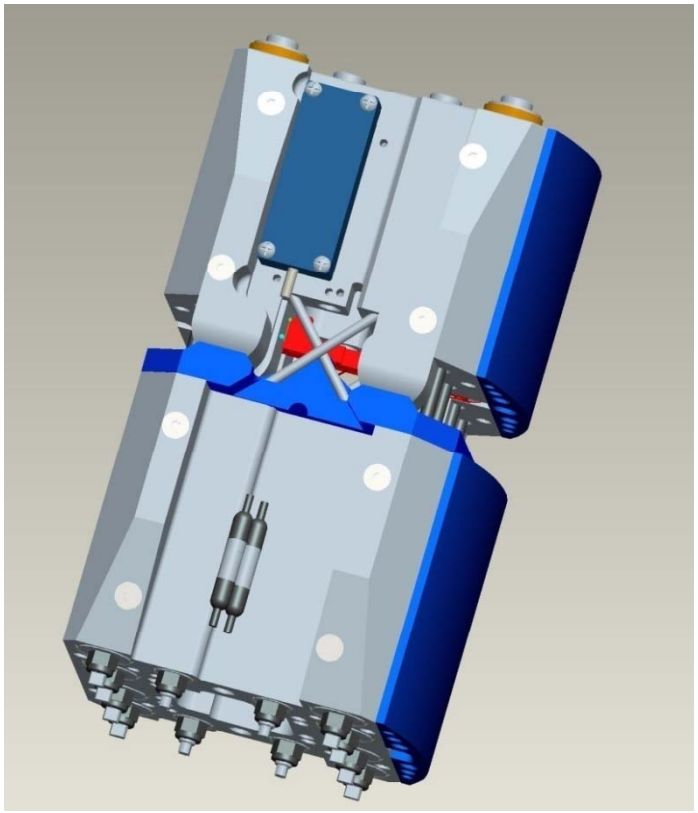
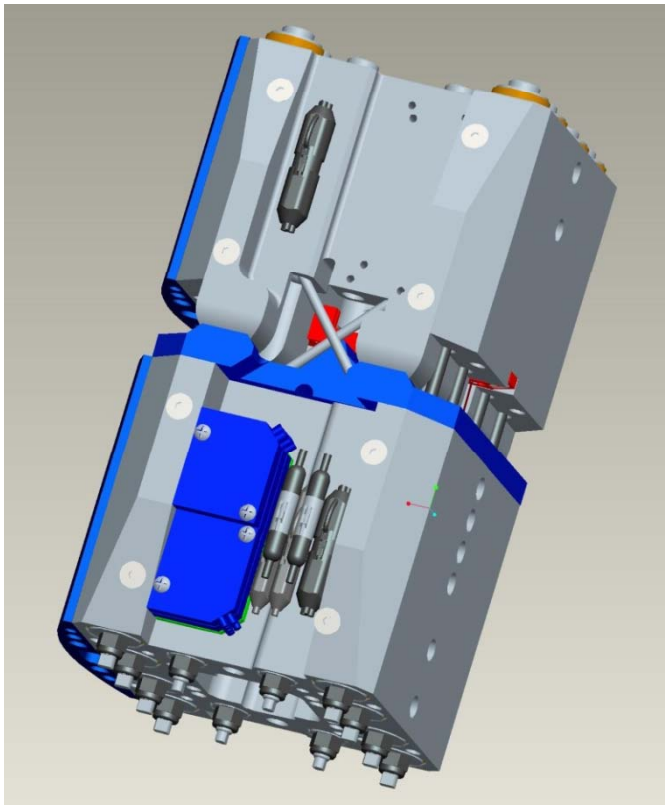
Proposed 12 channel SLICE Nano



Right side view showing supercap housing. Wiring not shown. 2 string pot wires routed under tibia block



Left side view showing SLICE assembly and connectors
3 wires cross knee joint

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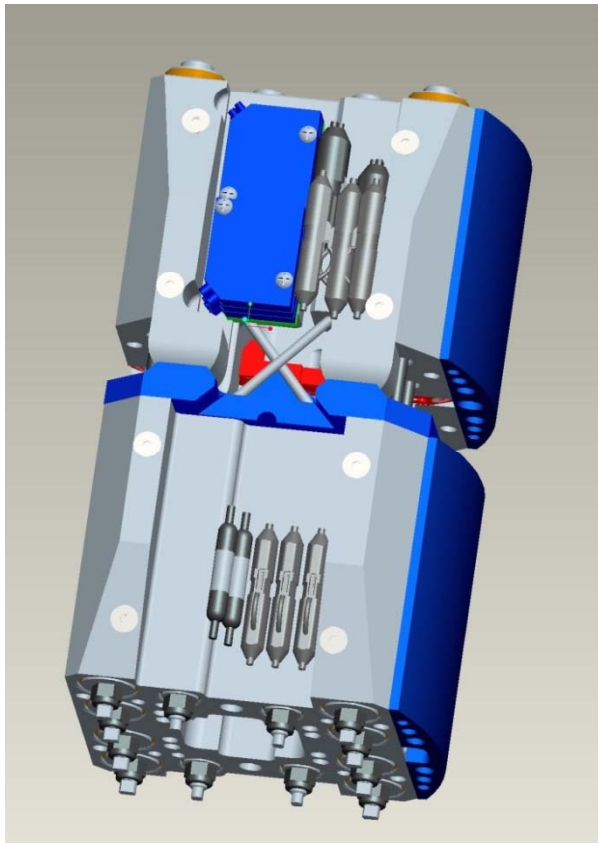
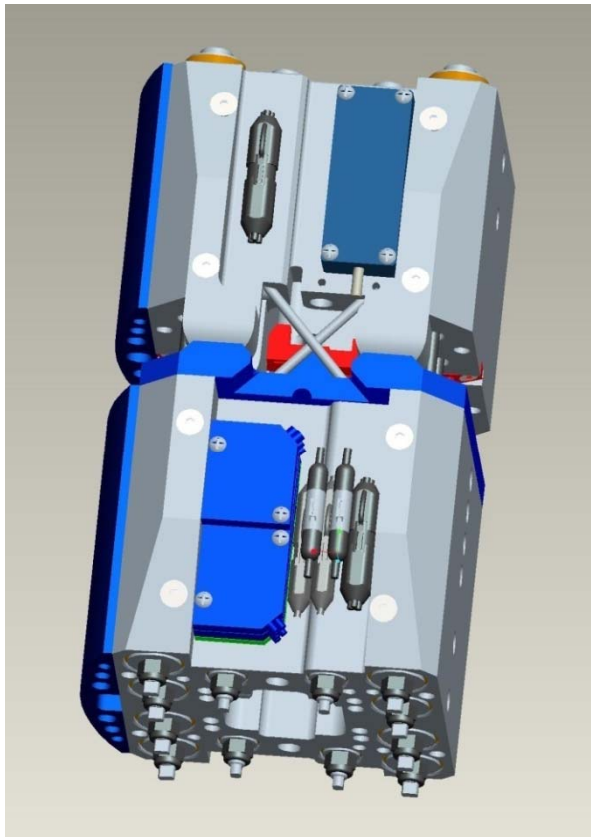
Proposed 24 Channel SLICE Nano



Example layout for a 24 channel SLICE requirement. 3 wires cross knee joint



Example layout for 24 channel SLICE right side. 3 wire cross knee joint

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24 channel onboard DAS

12 channels are the intended channel requirement expected for regulation

Up to 24 channel onboard is considered for research

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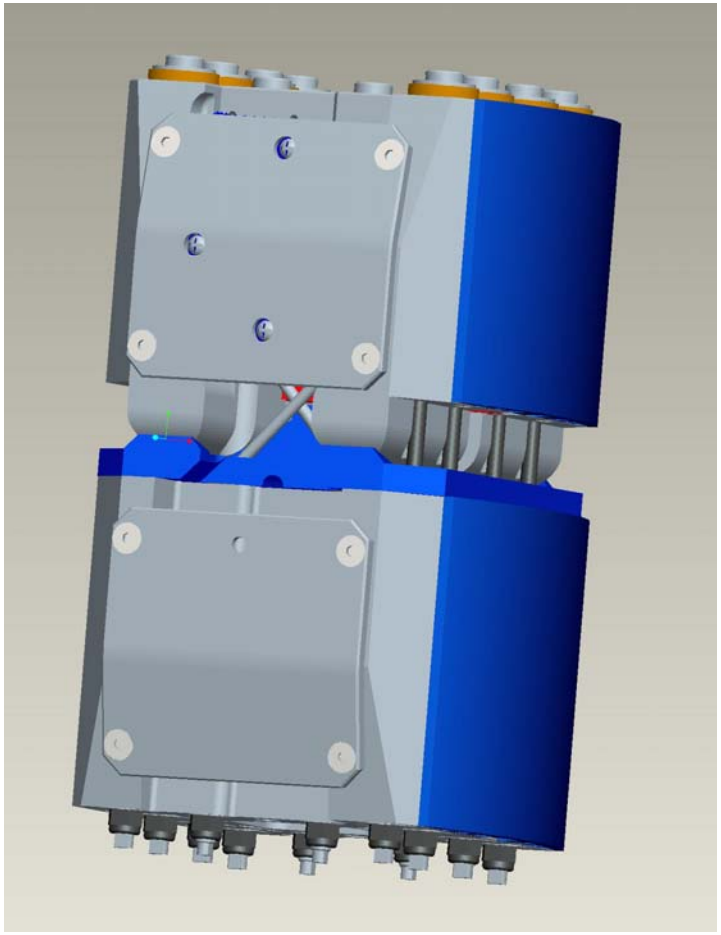
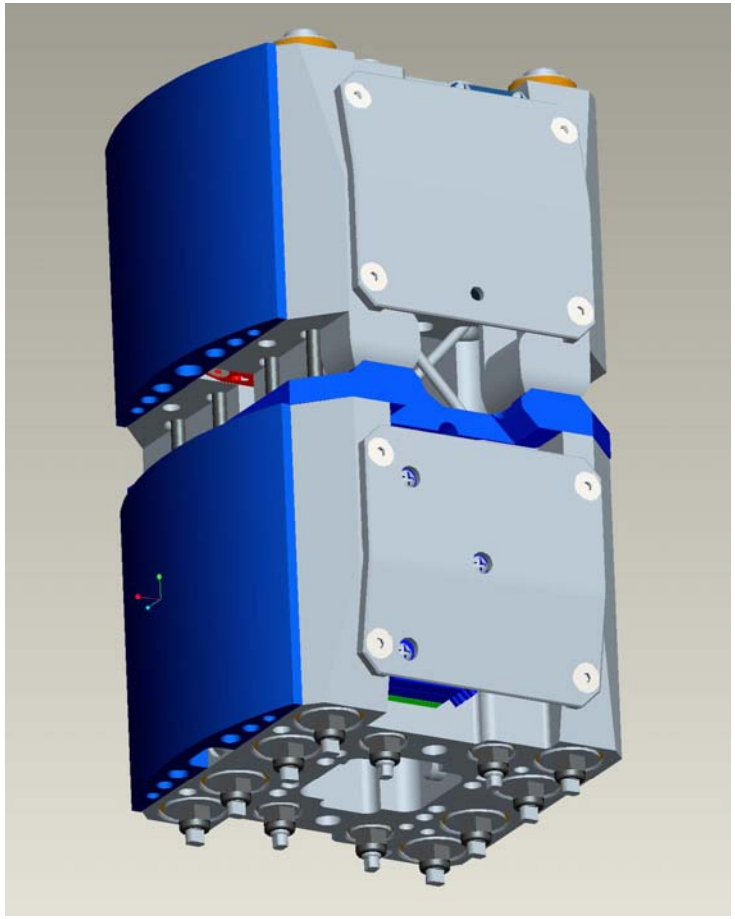
Holes added to side covers to clear SLICE screws





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Affect of DAS on mass and CG in knee

	Mass Est (kg)	cg from bottom of knee (mm)
12 channel off board *	4.276	91
12 channel SLICE onboard	4.286	92
12 channel Messring	4.287	92.5
24 channel SLICE onboard**	4.386	93
24 channel Messring**	4.360	92.6

Mass estimates from CAD layout
*Including 0.1 kg for off board wires
**Excluding additional mass sensors and wires

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FLEX-PLI for demonstration

- FTSS built one additional FLEX-GTR
- Support development of CAE model
- Demonstration & training purpose
- Temperature sensitivity tests
- Facilitate FLEX-TEG activities

Thank you for attention!

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