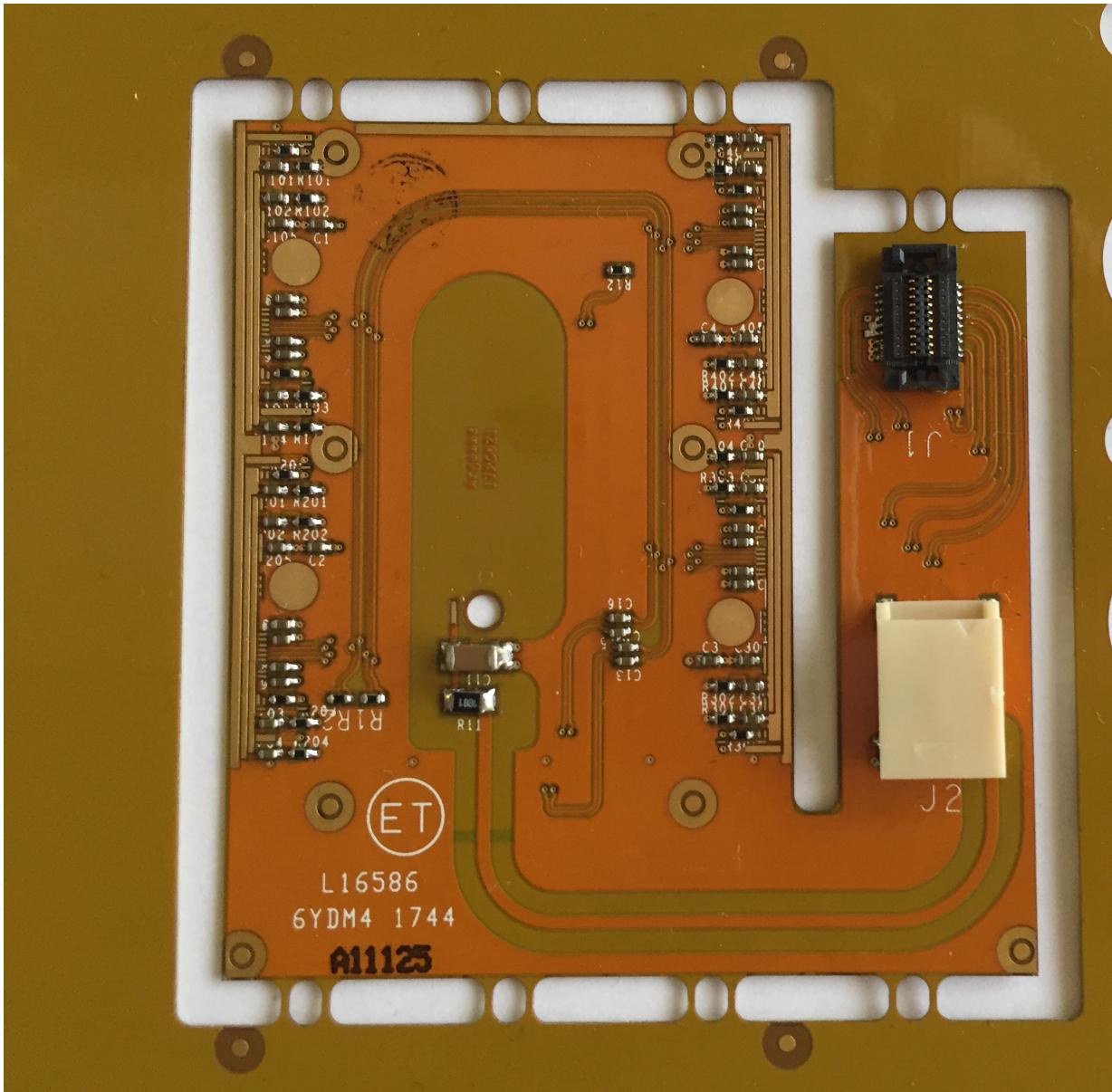


Quad Module Flex

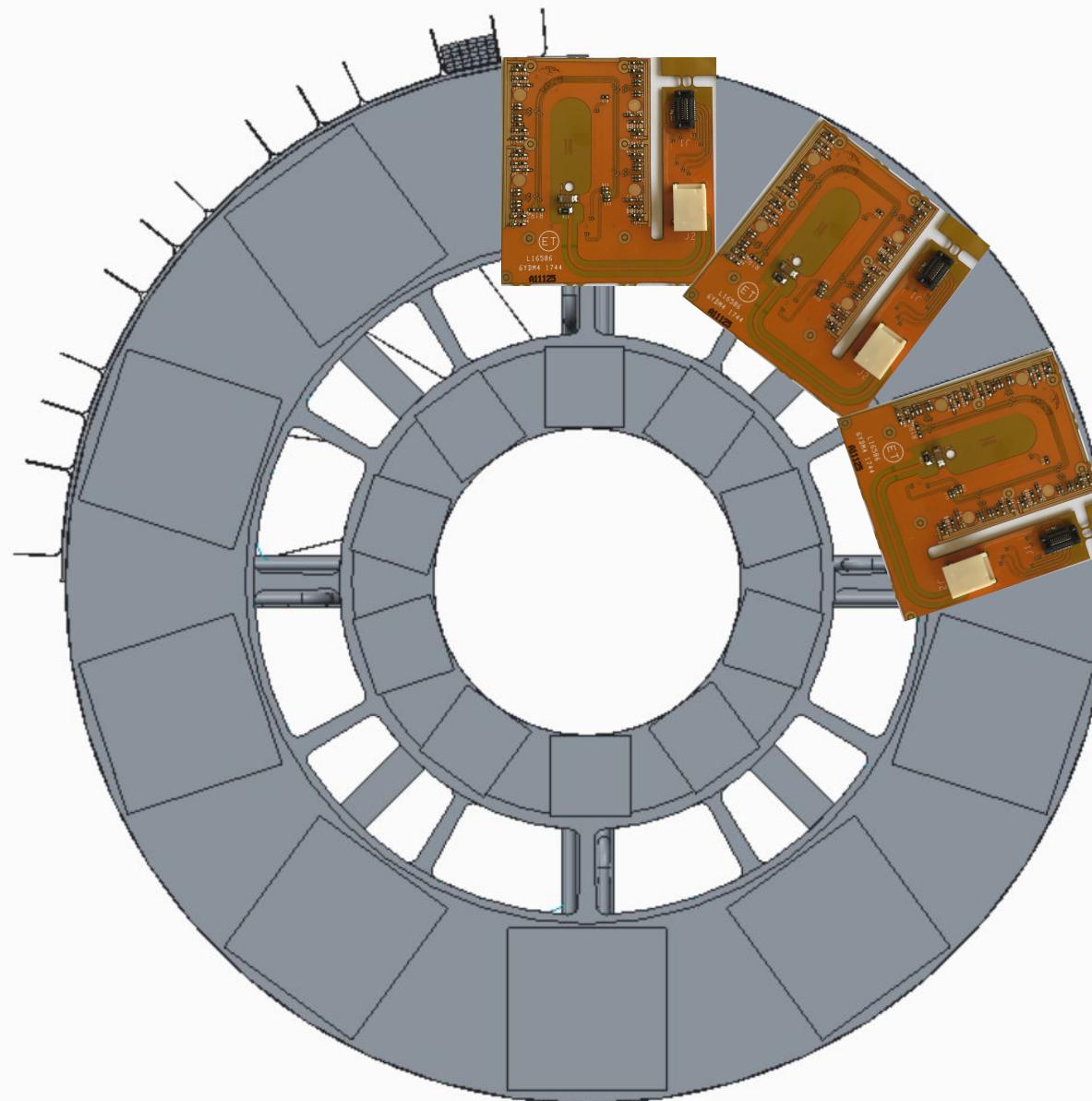
Jessica Metcalfe

Quad Flex

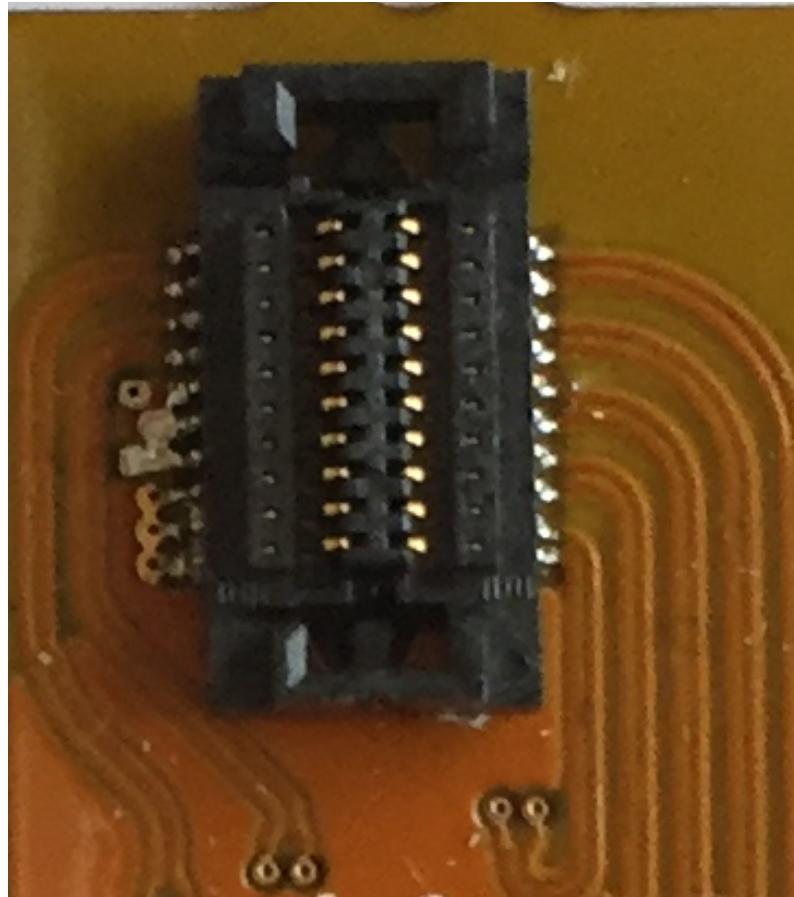
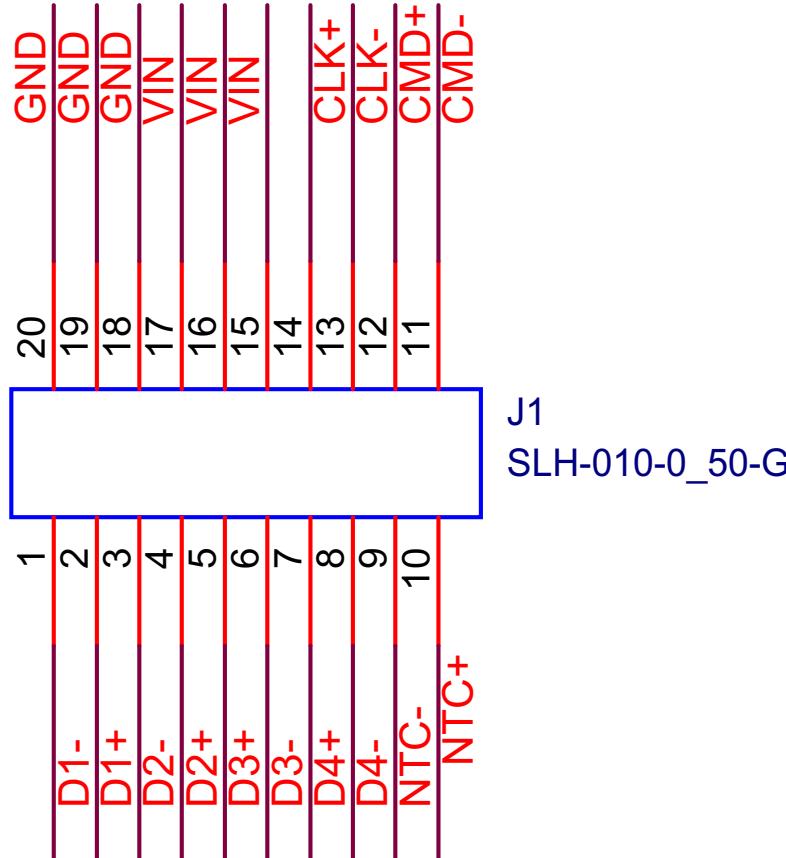


- Four layer flex
 - Flex provides good stiffness for module assembly (an issue with the last flex)
 - Thickness: 0.0094 mm
- Electroless Nickel Electroless Palladium Immersion Gold (ENEPIG)
 - More expensive than bondable gold, but wirebond technician had said it was too soft

Quad Flex Designed for Barrel-Rings



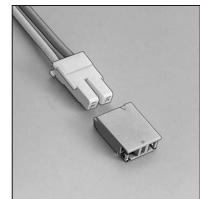
Connector



- XXX connector
- Connects from the top
- Only works if connector is not on the module
- The concept is to connect to the ring flex via the connectors
- This connector has a very solid connection—Downside: I ripped the connector off of the flex the first time I tried to disconnect it

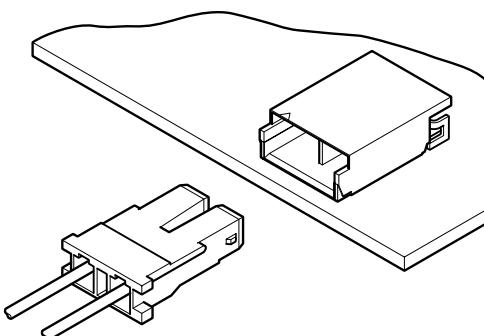
HV Connector

- Connector choice not optimized
- Selected for reliability during testing and safety specs



BHS CONNECTOR

3.5mm pitch/Disconnectable Crimp style connectors



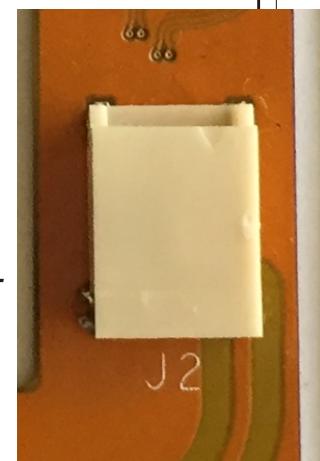
- Low profile
- SMT configuration
- Applicable to special wires
- Housing lock also serves as polarizing device
- Adopt wide large for socket contact

Specifications

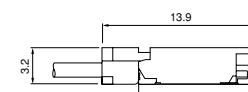
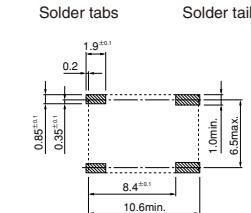
- Current rating: 1.0A AC, DC (AWG #24)
 - Voltage rating: 1,400V AC, DC
 - Temperature range: -25°C to +85°C
(including temperature rise in applying electrical current)
 - Contact resistance: Initial value/10m Ω max.
After environmental testing/20m Ω max.
 - Insulation resistance: 1,000M Ω min.
 - Withstanding voltage: 3,800V AC/minute
 - Applicable wire: AWG #28 to #24
Insulation O.D./0.9 to 1.7mm
- * Compliant with RoHS.
* Refer to "General Instruction and Notice when using Terminals and Connectors" at the end of this catalog.
* Contact JST for details.

Standards

- Recognized E60389
■ Certified LR20812

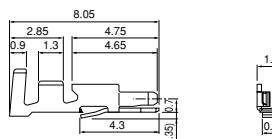


PC board layout (viewed from component side) and Assembly layout



Note: 1. Tolerances are non-cumulative: ±0.1mm for all centers.
2. The dimensions above should serve as a guideline. Contact JST for details.

Contact



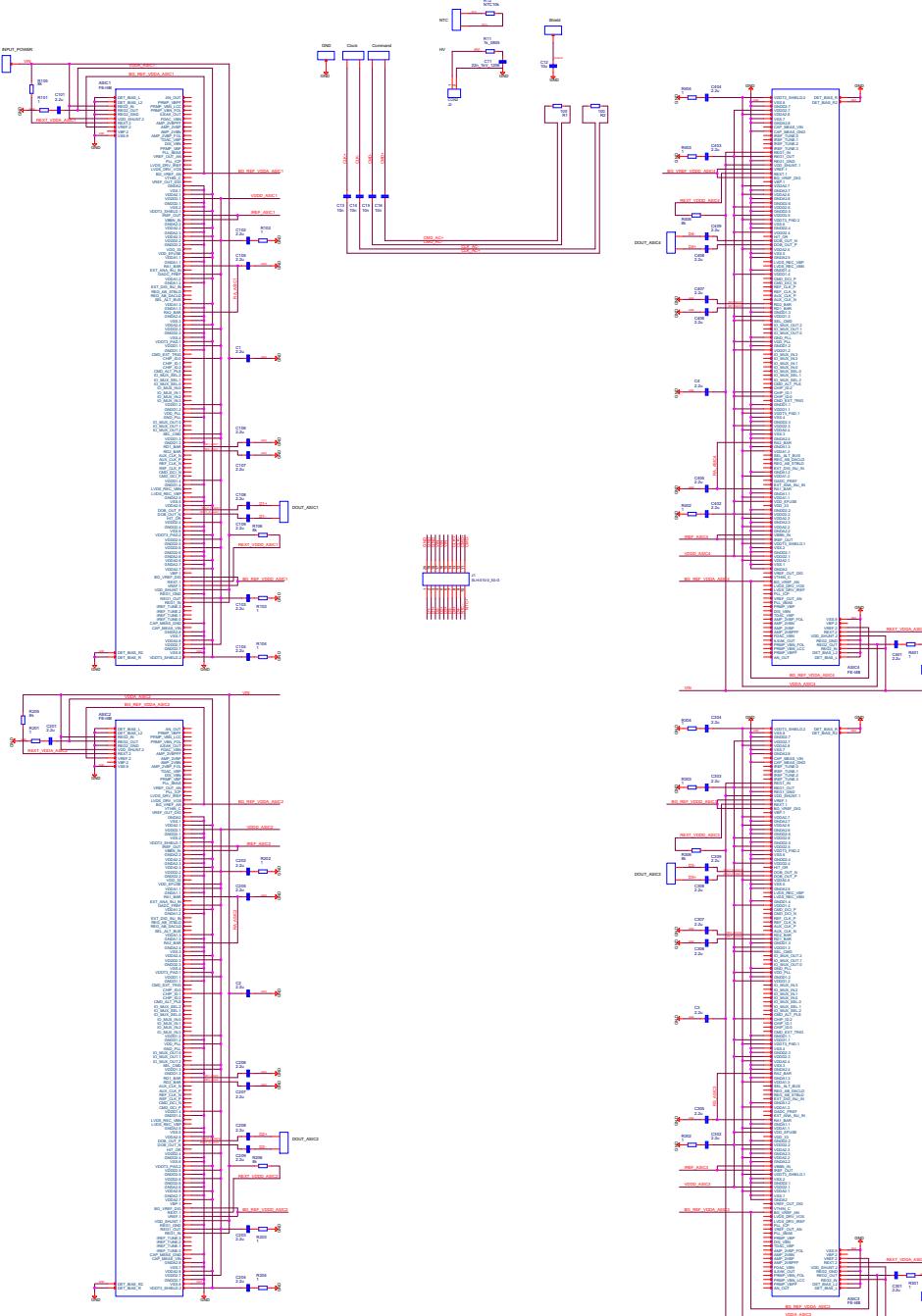
Model No.	Applicable wire		Insulation O.D. (mm)	Q'ty / reel
	mm ²	AWG#		
SBHS-002T-P0.5A	0.08~0.22	28~24	0.9~1.7	10,000

Material and Finish	
Phosphor bronze, tin-plated (reflow treatment)	

RoHS compliance	
Note: Contact JST for SBHS-002T-P0.5.	

Contact	Crimping machine	Crimp applicator	Applicator Dies	Crimp applicator with dies
SBHS-002T-P0.5A	AP-K2N	MKS-L	MK/SBHS-002-05	APLMK SBHS002-05

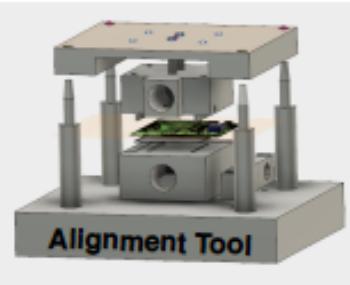
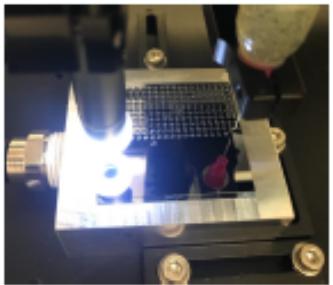
Schematic



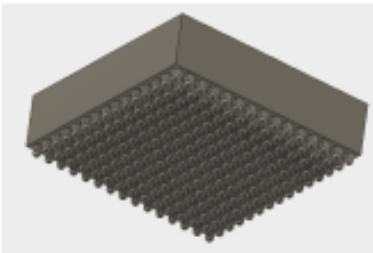
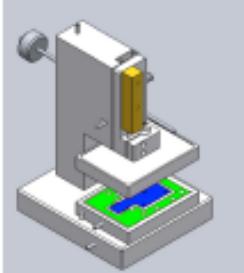
Quad Flex Assembly

Module Assembly Techniques

- Robot fluid dispenser (Argonne)



- Custom stamp machine (Glasgow)



- Epoxy-permeated rice paper (Liverpool)



Systematic Module Assembly Studies (w/ barrel-ring flex):

	Stamp Method	Rice Paper Method	Robotic Method
Peel strength	$0.155 \pm 0.005 \text{ N / mm}$	$0.155 \pm 0.015 \text{ N / mm}$	0.17 N / mm
Glue mass	$35.0 \pm 5 \text{ mg}$	$80 \pm 7 \text{ mg}$	90 mg
Rotational alignment	$1.69 \pm 1.09 \text{ mrad}$	$0.71 \pm 0.49 \text{ mrad}$	$0.96 \pm 0.70 \text{ mrad}$
Profile Thickness	$475 \pm 31 \mu\text{m}$	$474 \pm 34 \mu\text{m}$	$477 \pm 36 \mu\text{m}$
Wire bond strength	7.0 g	7.0 g	7.0 g
Relative difficulty (1-5)	3	1	3
Time estimate	5 min / module	1 min / module	6 min / module
Setup cost	\$ 6,200	\$ 400	\$ 18,166
Cost per modules assembled in parallel	\$ 6,200	\$ 300	\$ 1000
ASICs successfully wire bonded	6 / 12	20 / 24	16 / 24
Specific comments	Could be optimized to have tighter fitting tolerances. Design change could allow more than 1 module per machine	Unknown how paper will behave inside detector area. Frayed paper and dust particles were observed to come from rice paper around module edges.	Would likely require a dedicated technician to operate.

2 Dylan Frizzell

Dylan Frizzell OkU
ANL ASC fellowship

3/1/18

Dylan Frizzell's ITK Week Talk:

https://indico.cern.ch/event/694189/contributions/2890066/attachments/1598783/2534309/Dylan_Frizzell_ITK_week_FEB2018.pdf

INT Note: <https://cds.cern.ch/record/2304065>

- Continue to use flexes for module assembly studies
- Assembled first module with real quad module
 - Didn't work out of the box
 - Will debug soon
- Produced an adapter board for testing with HSIO2
- Would like to design a carrier board that the quad could be glued to for stability during electrical testing and have additional pads that can be wire bonded for debugging