

SiD Pigtail Cable Updated Design

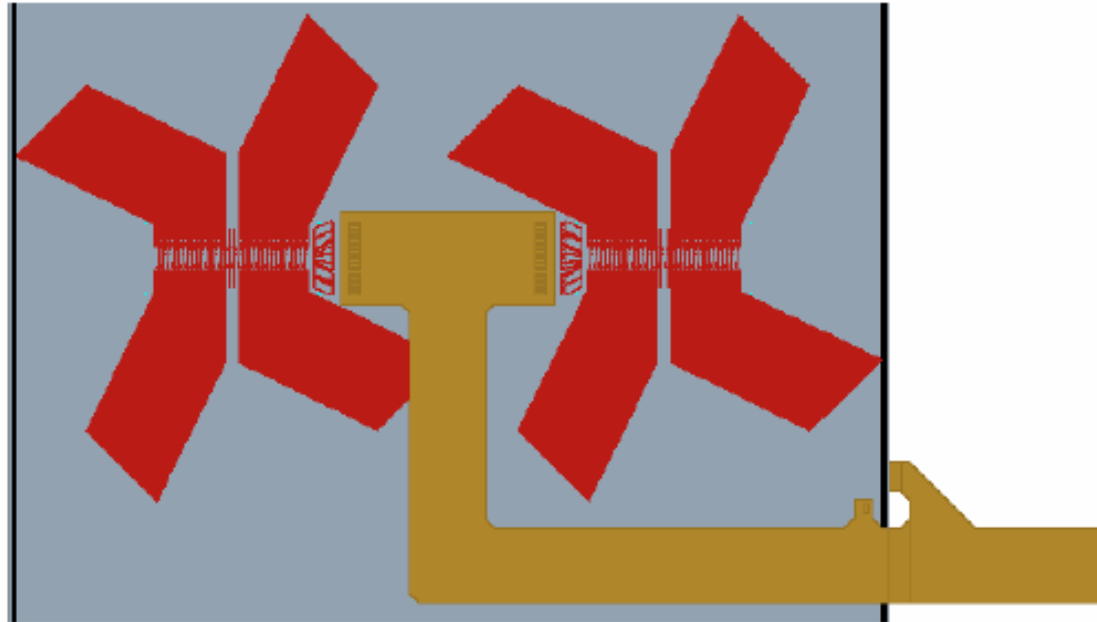
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U. of New Mexico

17 January 2013

Introduction

- Low-mass readout cables connect tracker modules to the concentrator boards mounted at the ends of each barrel.



- This cable has two components:
 - Pigtail, a short cable glued to the module
 - Extension, a long cable connecting the Pigtail to the concentrator

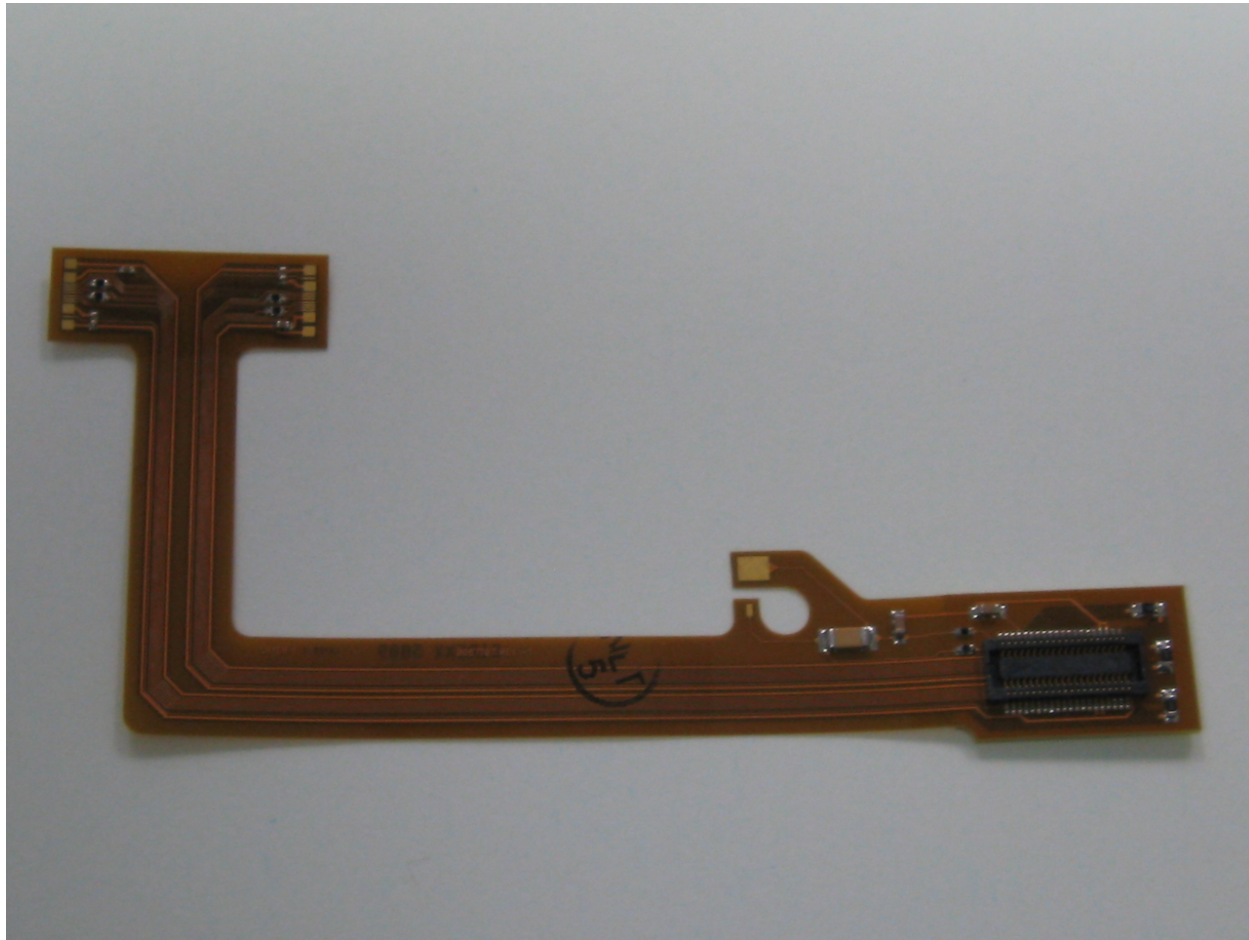
Pigtail Cable Specifications

- Connectivity: Detector end connected with wirebonds,
Extension cable end has a connector,
HV Bias tabs at sensor edge
- Traces: two pair for Analog & Digital Power
- Traces: one pair for High Voltage Bias
- Traces: 16 traces for Digital Control and Readout
- Metallization: Gold plating on wirebond pads only
- Filtering: of KPIX and HV Bias on the Pigtail Cable
- Signals: Digital signals are LVDS (low voltage differential signaling)

- Double-sided design
- Top and Bottom have coverlay to protect the exposed traces.
- Top side has all signal and power traces
- Bottom side has DGND plane
- FR-4 stiffener plate behind the connector

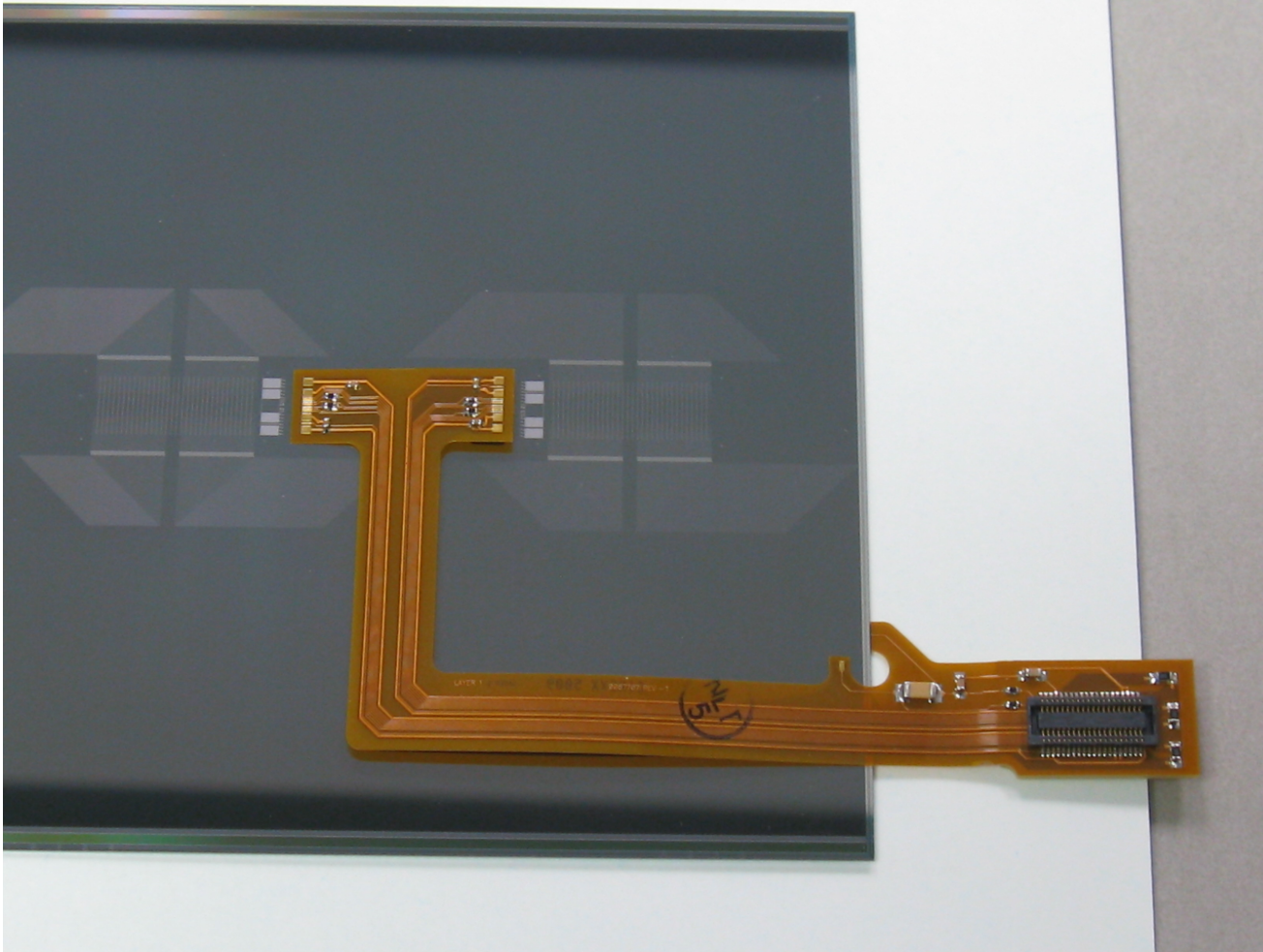
Manufacturing & Assembly

- 10 cables were manufactured at Cirexx for \$210.00/ea (thanks to Marcel)



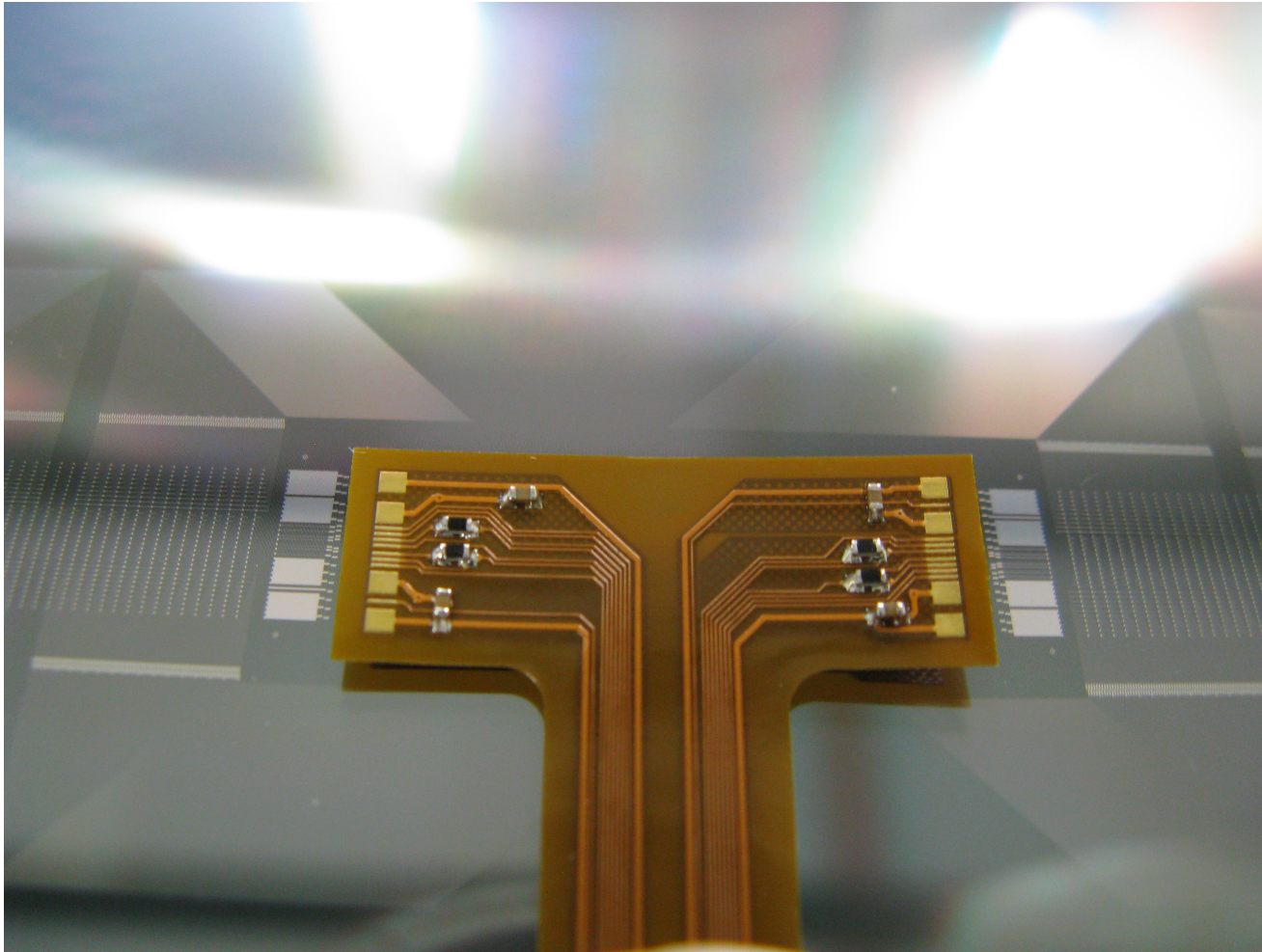
Pigtail Cable - Initial Design

- Initial design met all the objectives
- Cable is just laying on the sensor & is not attached



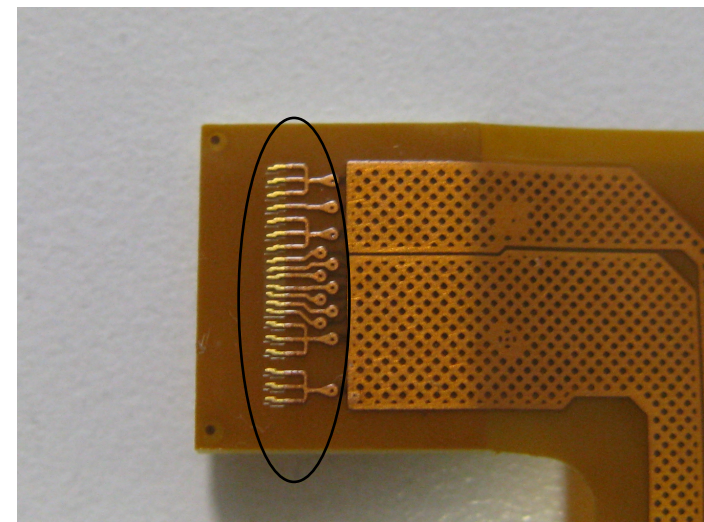
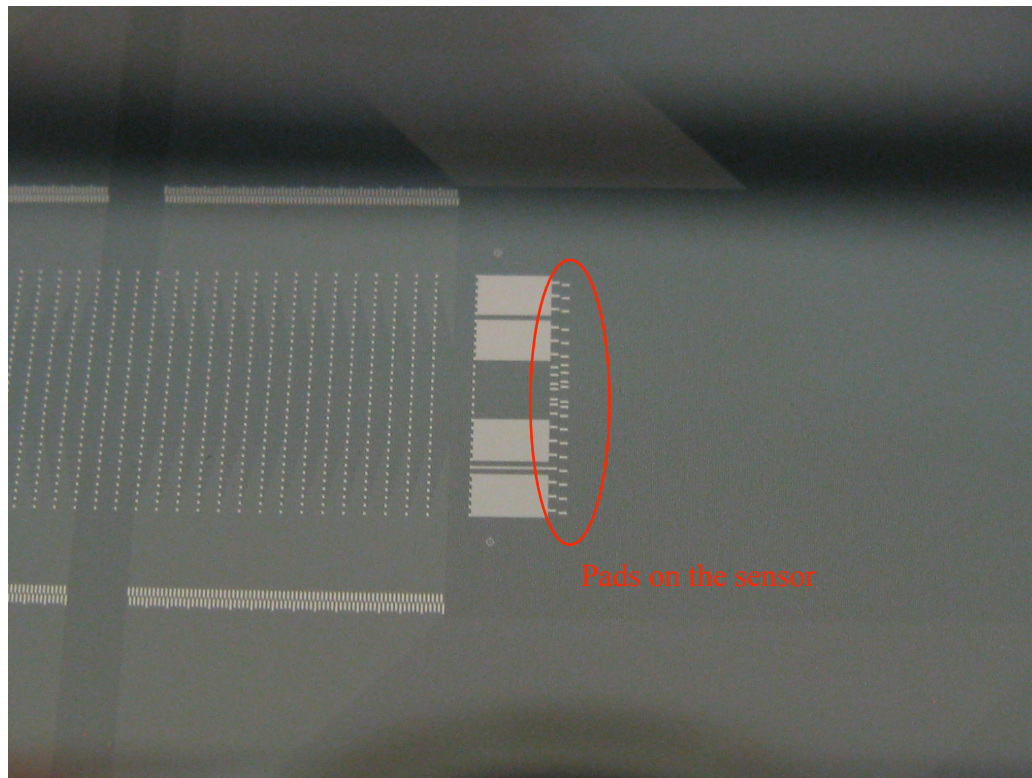
Pigtail Cable – Initial Design

- A problem with the sensor does not allow wire bonds to be used to make the connections between the sensor and the Pigtail Cable



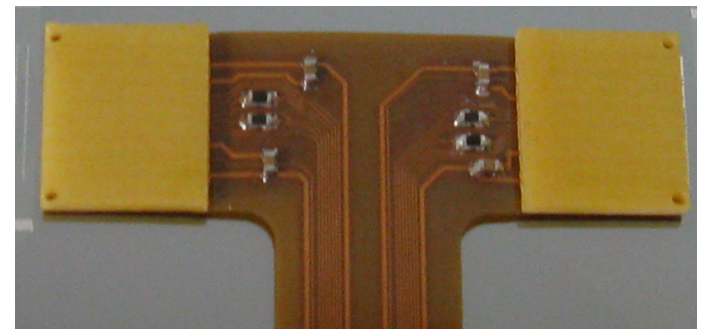
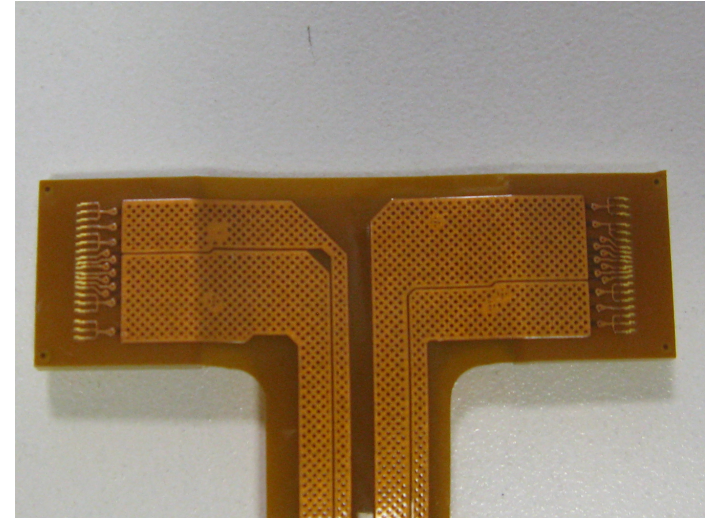
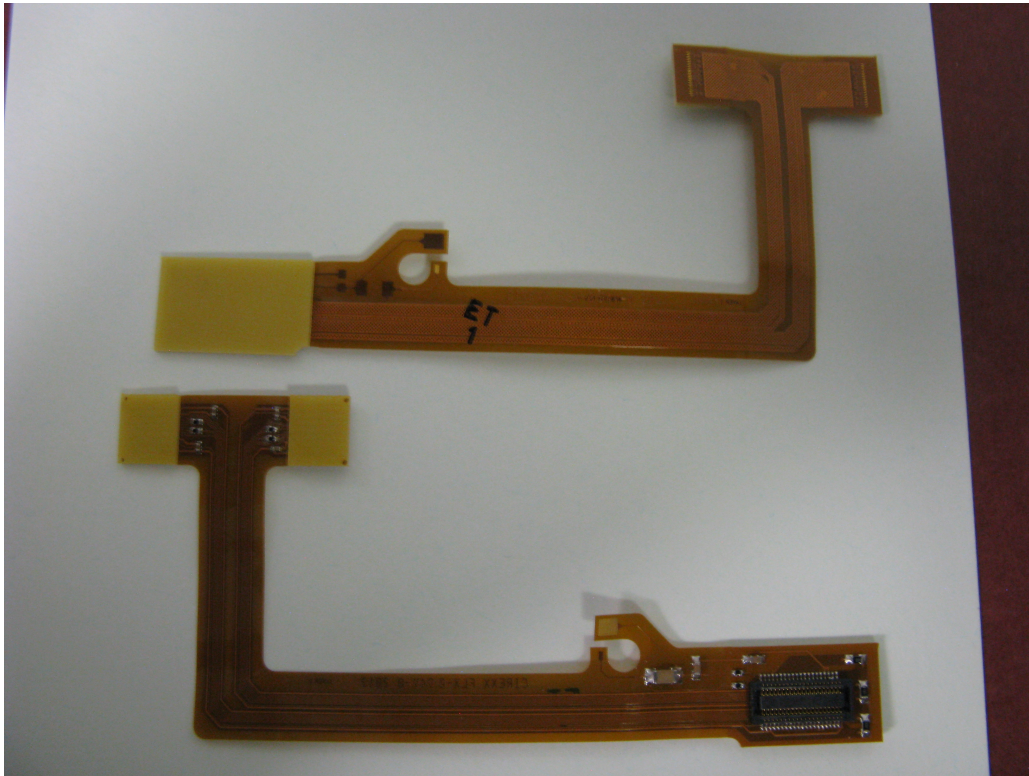
Pigtail Cable – First Revision

- The idea is to attach the Pigtail to the sensor with solder bumps
- So the Pigtail cable design was modified to match the connection pattern of the sensor



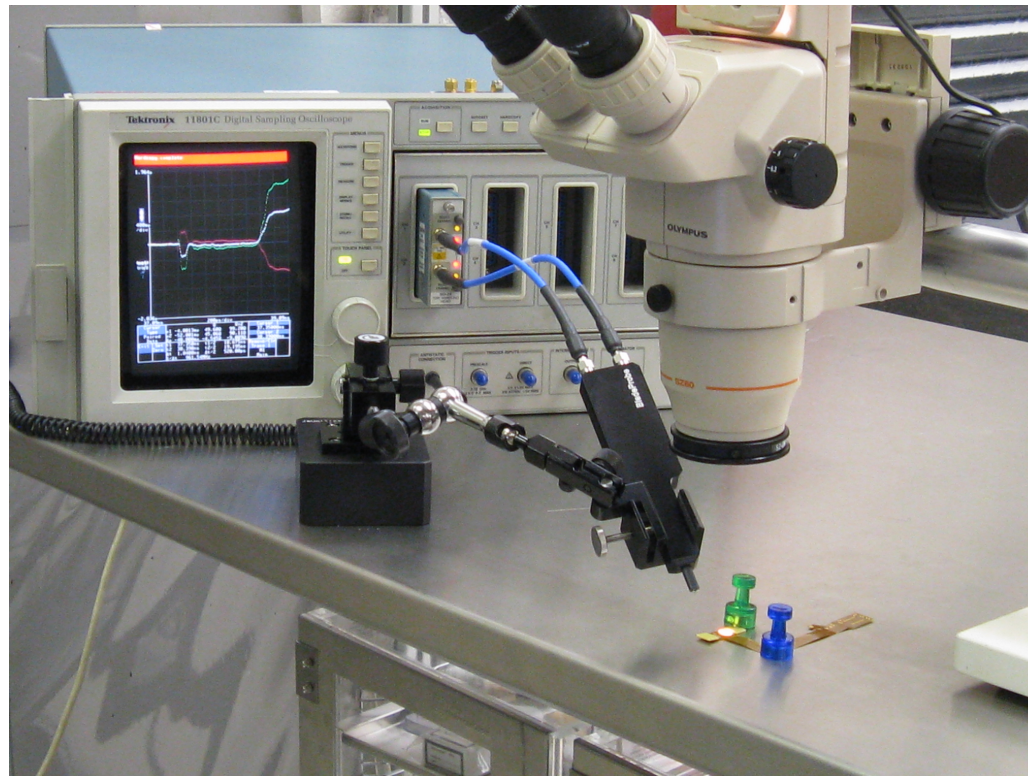
Pigtail Cable – First Revision

- 10 cables were made by Cirexx for \$237.00/ea
- Parts were soldered on the cable at UNM with no problems
- Front and Back sides of the revised Pigtail cable:



Pigtail Cable – First Revision

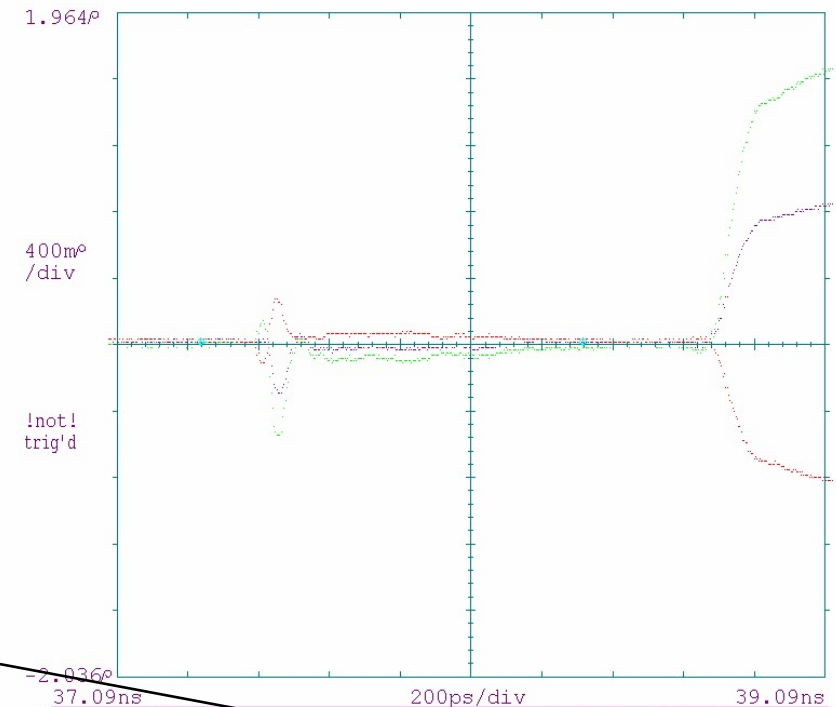
- TDR measurement of differential impedance
 - Mainframe: Tektronix 11801C 50GHz Digital Sampling Oscilloscope
 - TDR Plugin Module: Tektronix SD24 TDR Sampling Head, 25pS Risetime
 - Differential Probe: PacketMicro Bladeprobe Model TDP10205, PacketMicro TDR Calibration/Validation Substrate Model TCS10



Pigtail Cable – First Revision

- Differential impedance, want as close as possible to 100 ohms
- Results of 4 measurements/cable \times 10 cables: 84 – 98 ohms. Variation across a single cable $<$ 10 ohms, attributed to thickness variation.
- Increased thickness 20% to tweak up the average

11801C DIGITAL SAMPLING OSCILLOSCOPE
date: 7-JAN-13 time: 14:46:52

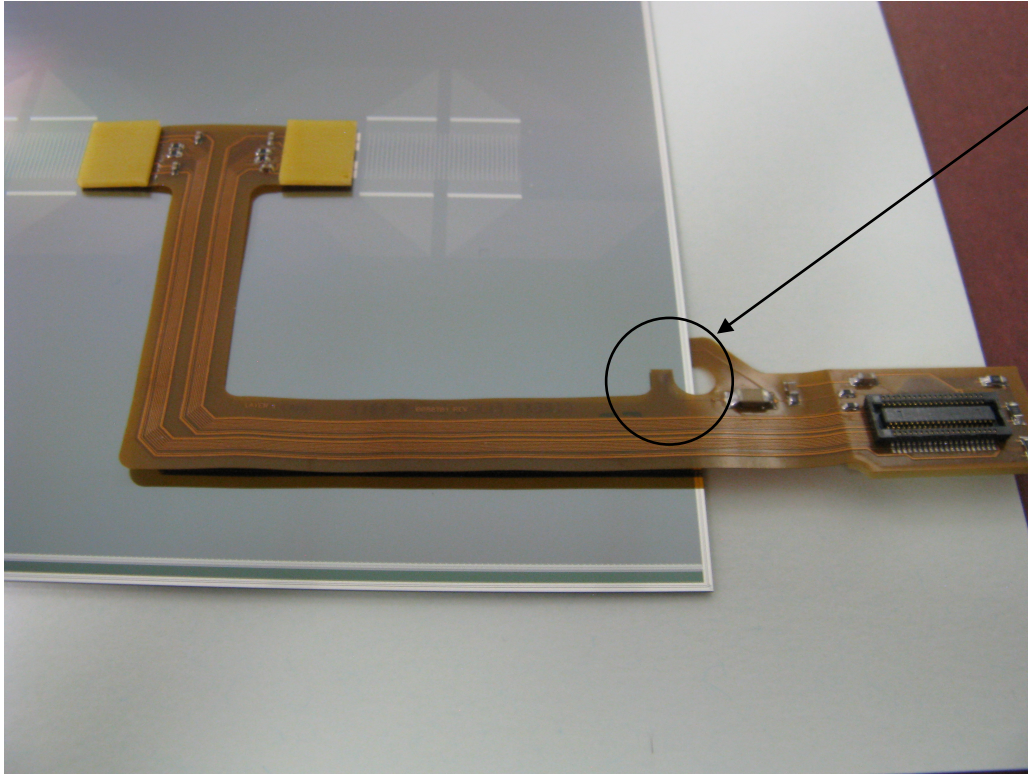


Differential Impedance result

Cursor		Ω				Cursor 1	
Type	P1	-20.001mV	48.040	96.080	Cursor 1	37.33000ns	
Paired	P2	-20.001mV	48.040	96.080	Cursor 2	38.41000ns	
Dots	ΔP	0.0000P	0.0000	0.0000			
Exit	Set	t1	37.330ns	t1/2	18.665ns	Remove/Clr	
	Zero	t2	38.410ns	t2/2	19.205ns	Trace 1	
		Δt	1.0800ns	$\Delta t/2$	540.00ps	M1	
		1/ Δt	925.93MHz		Main		

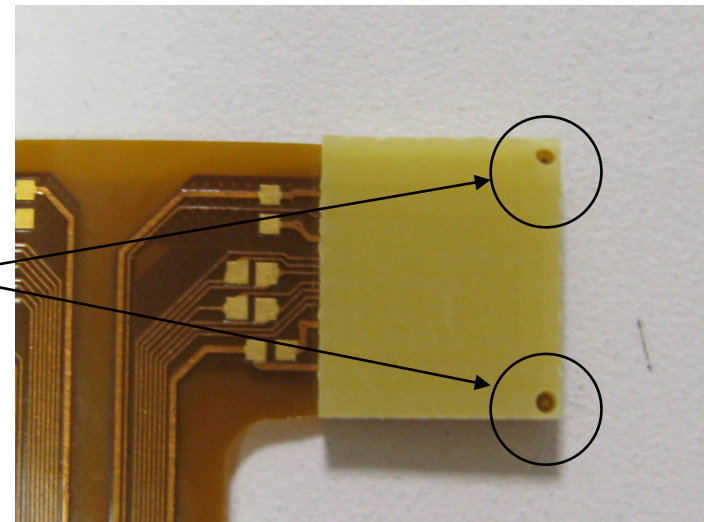
Pigtail Cable – First Revision

- Some design issues to fix in a second revision



- HV tab on top side of the sensor: moved the pad from front to back of cable. Now both sides' connections can be made with epoxy.
- HV tab & connection on back side of sensor is ok

- Need to revise the way we align the cable with the fiducial marks on the sensor, because the way it was done here there is no opening in the cable to see the mark on the sensor



January 2013

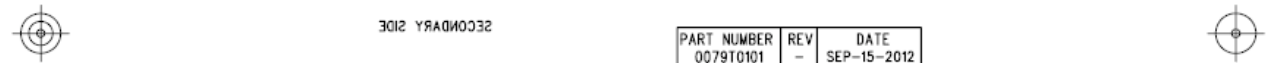
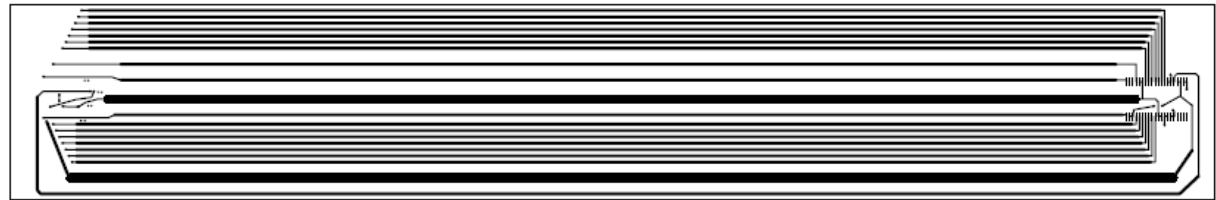
Pigtail Cable

Pigtail Cable – Second Revision

- Issues have been addressed and fixed in the design
- Revised design is complete and gerber files are at the manufacturer
- 10 pieces of the second revision will be made at Cirexx (thanks to Ron)

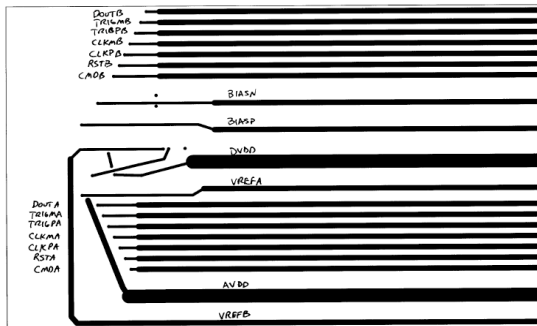
Pigtail Cable – Extension

- The design of the Extension cable is in process
- The fabricators of long flex cables recommend making a short length cable (much cheaper) to test and verify electrical properties such as impedance and resistance before making the full length ~ 2 meter final version (much more expensive).
 - So we plan on initially making a ~ .75 meter Extension cable
- Preliminary Design:

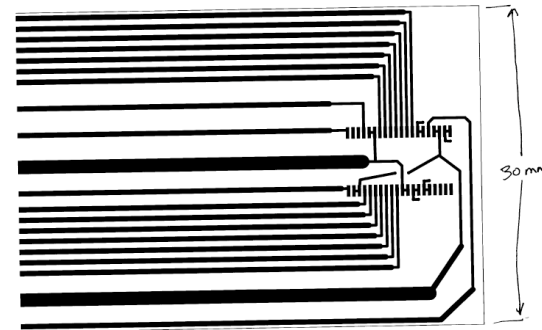


Pigtail Cable – Extension

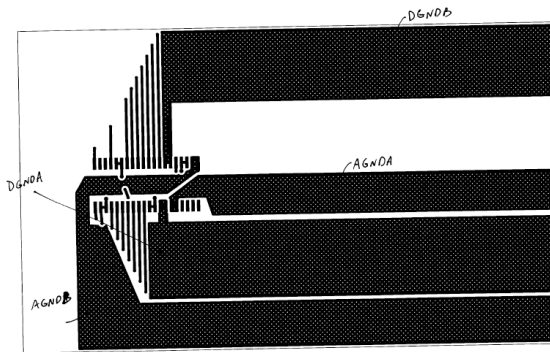
- Preliminary Extension Cable, Traces with Names:



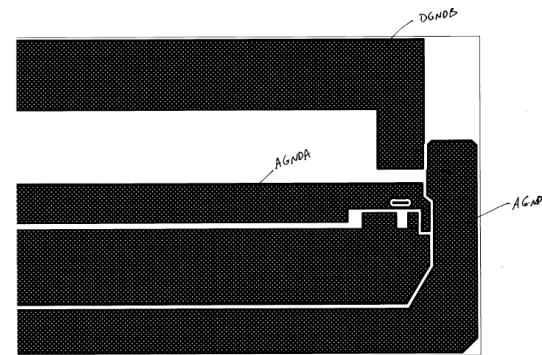
SIDE 1
MATES TO SENSOR
CONNECTOR ON SIDE 2



SIDE 1
MATES TO INTERFACE BOARD



SIDE 2
MATES TO SENSOR



SIDE 2
MATES TO INTERFACE BOARD
CONNECTOR ON SIDE 1

Summary

- The Pigtail cable design has been prototyped and no problems were encountered in the Manufacturing and Assembly.
- The goals of low mass (two-sided design) and low cost have been achieved.
- A First Revision of the design incorporating changes to modify the mating of the cable from wirebonds to solder bumps was completed and Manufactured
- A Second Revision of the Pigtail is in the manufacturing stage to be completed by the end of January
- The Extension Cable design is in process and a preliminary layout is in the review stage.