SiD Pigtail Readout Cable Design

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SiD Workshop

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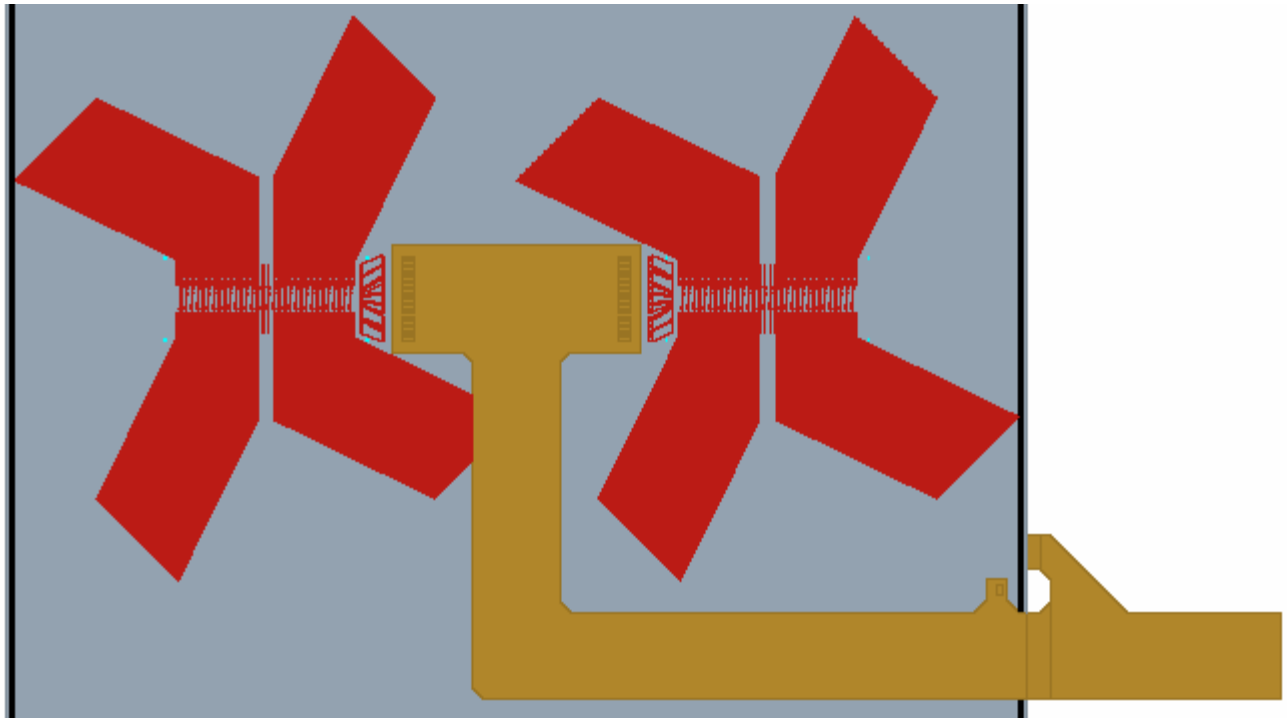
The University of New Mexico

Introduction

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



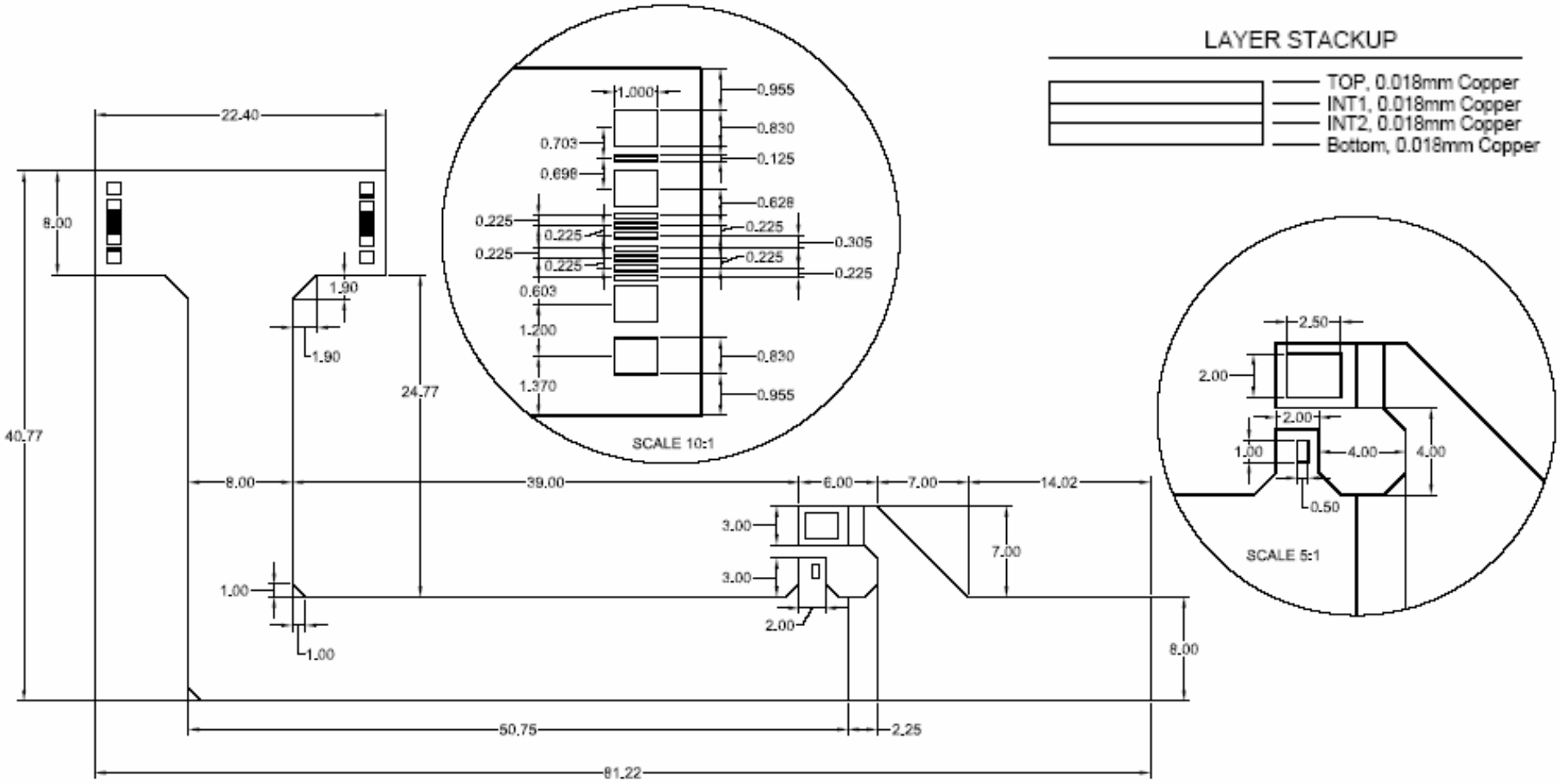
- This cable is divided into two components: a short “pigtail” which is glued to the module and a longer extension cable that connects the pigtail to the concentrator.

Pigtail Cable Specifications

- Length: Not determined
- Width: < 1cm
- Thickness: ¼ Oz. Cu, 100 micron Kapton
- Connectivity: Detector end connected with wirebonds,
  Extension cable end has a connector (TBD),
  HV Bias tabs at sensor edge for connection of bias
- Traces: Two pairs each for Analog and Digital Power
- Traces: One pair for High Voltage Bias
- Traces: 8 traces for Digital Control and Readout
- Metallization: ¼ Oz Cu, Gold plating on the wirebond pads
- Resistance: Power and Ground traces < 1ohm
- Filtering: of KPiX and HV Bias on the Pigtail cable
- Signals: Digital signals are LVDS (low voltage differential signaling)
- Pickup and Crosstalk: a big concern, want to minimize

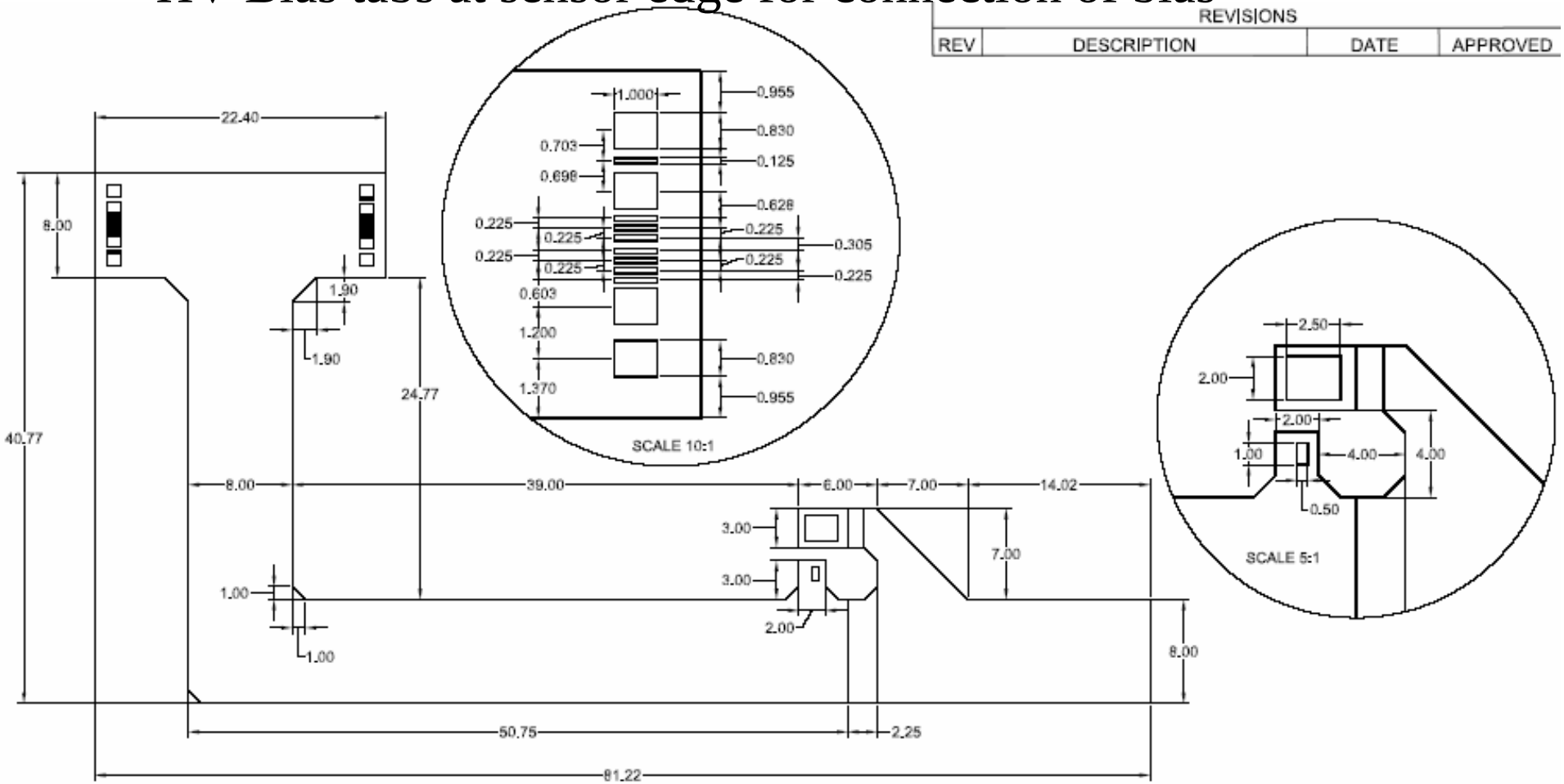
Dimensions

- Length: to be determined, Width: < 1cm
- Thickness: ¼ Oz. Cu, 100 micron Kapton



Connectivity

- Detector end connected with wirebonds, gold plated pads
  Extension cable end has a connector (TBD: Elco connector),
  HV Bias tabs at sensor edge for connection of bias

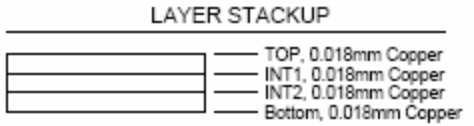


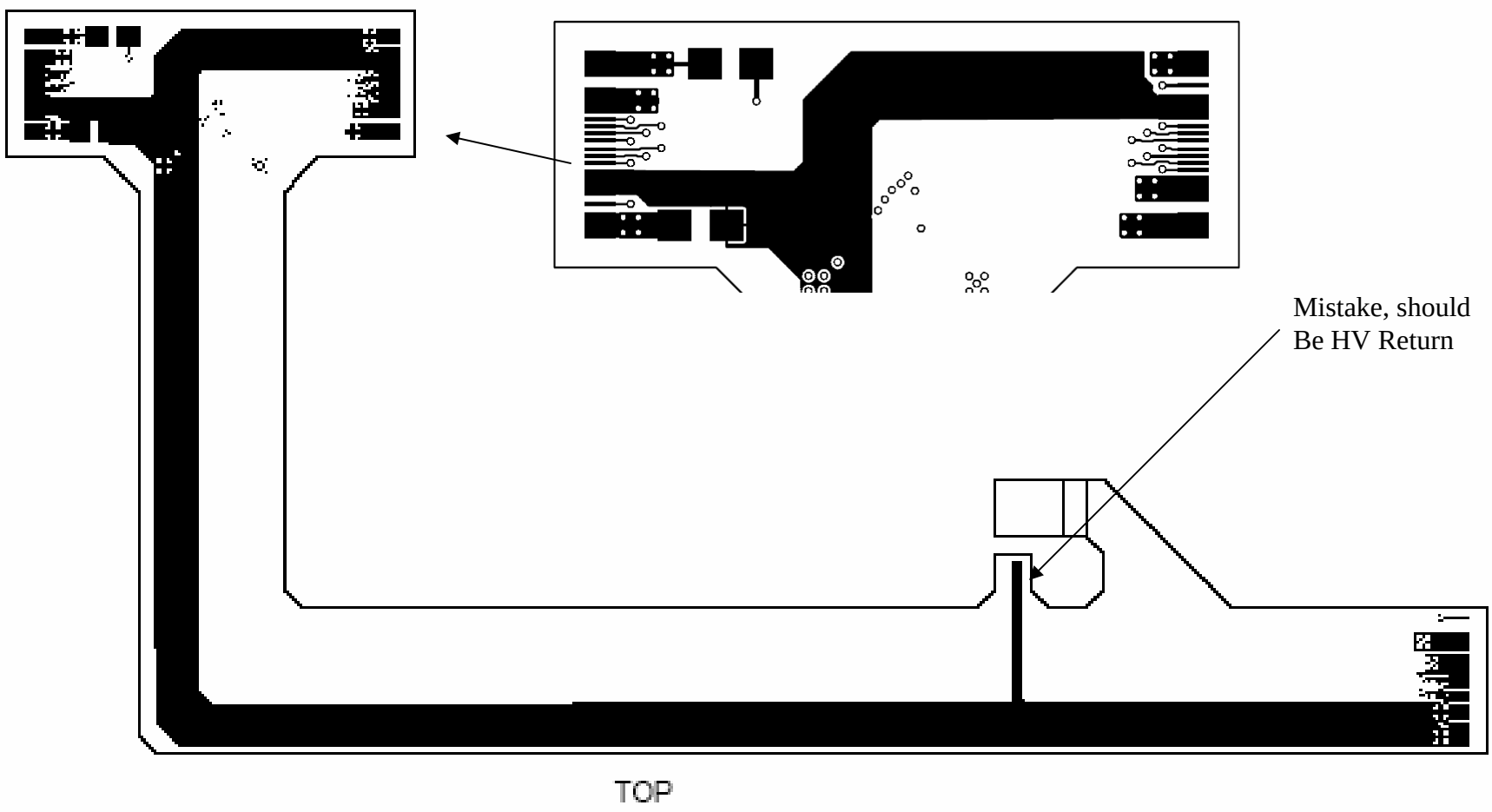
Cable Traces

- Traces: Two pairs each for Analog and Digital Power
- Traces: 8 traces for Digital Control and Readout

Traces, Top Layer

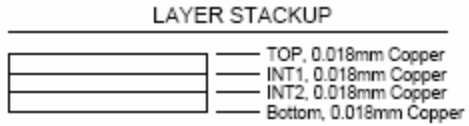
- Analog Return

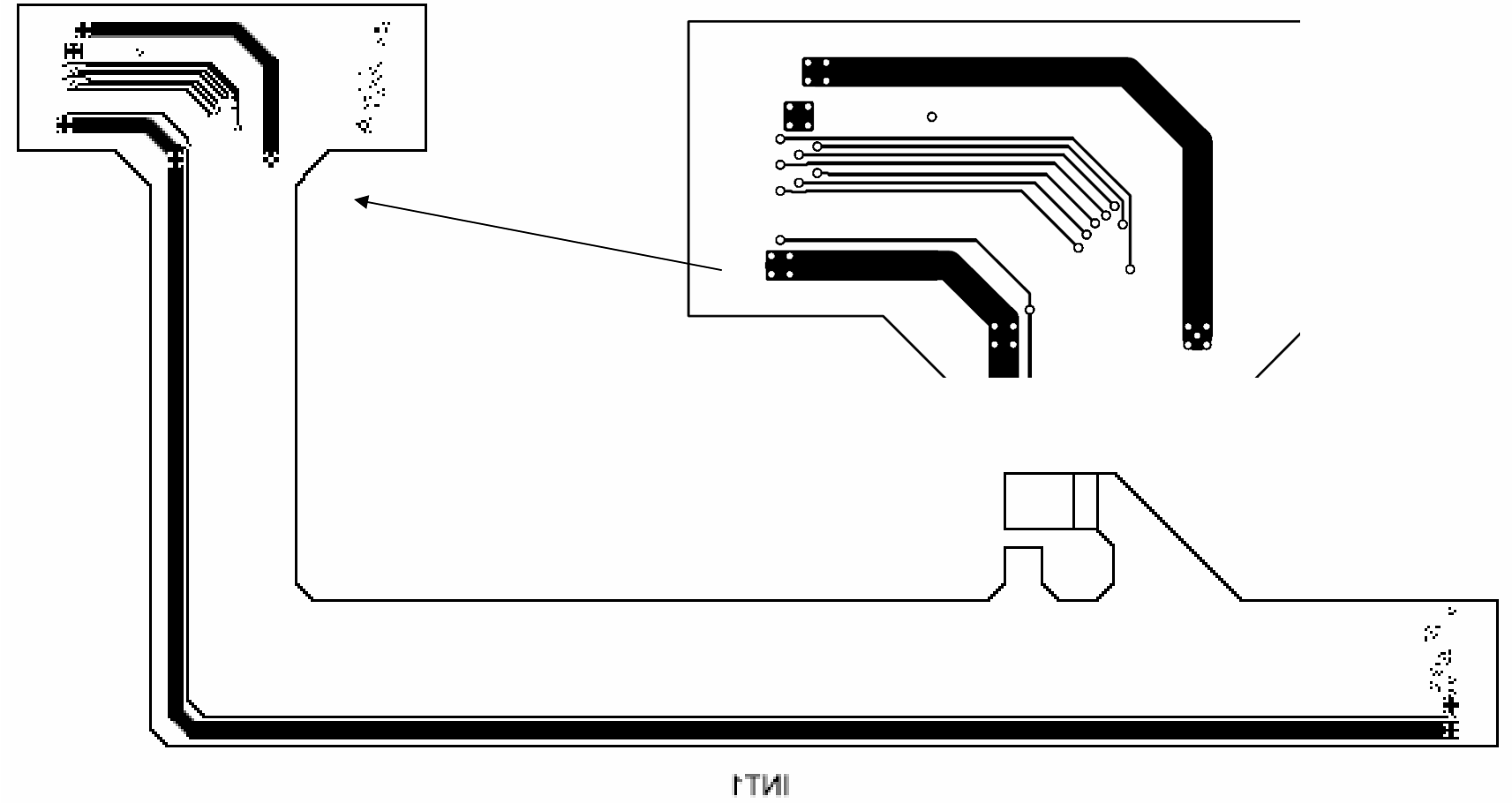




Traces, Internal-1 Layer

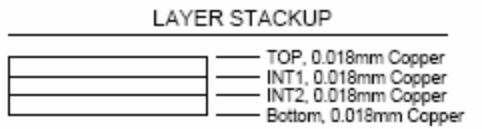
- Analog and Digital Power
- Vref, Digital Control and Readout

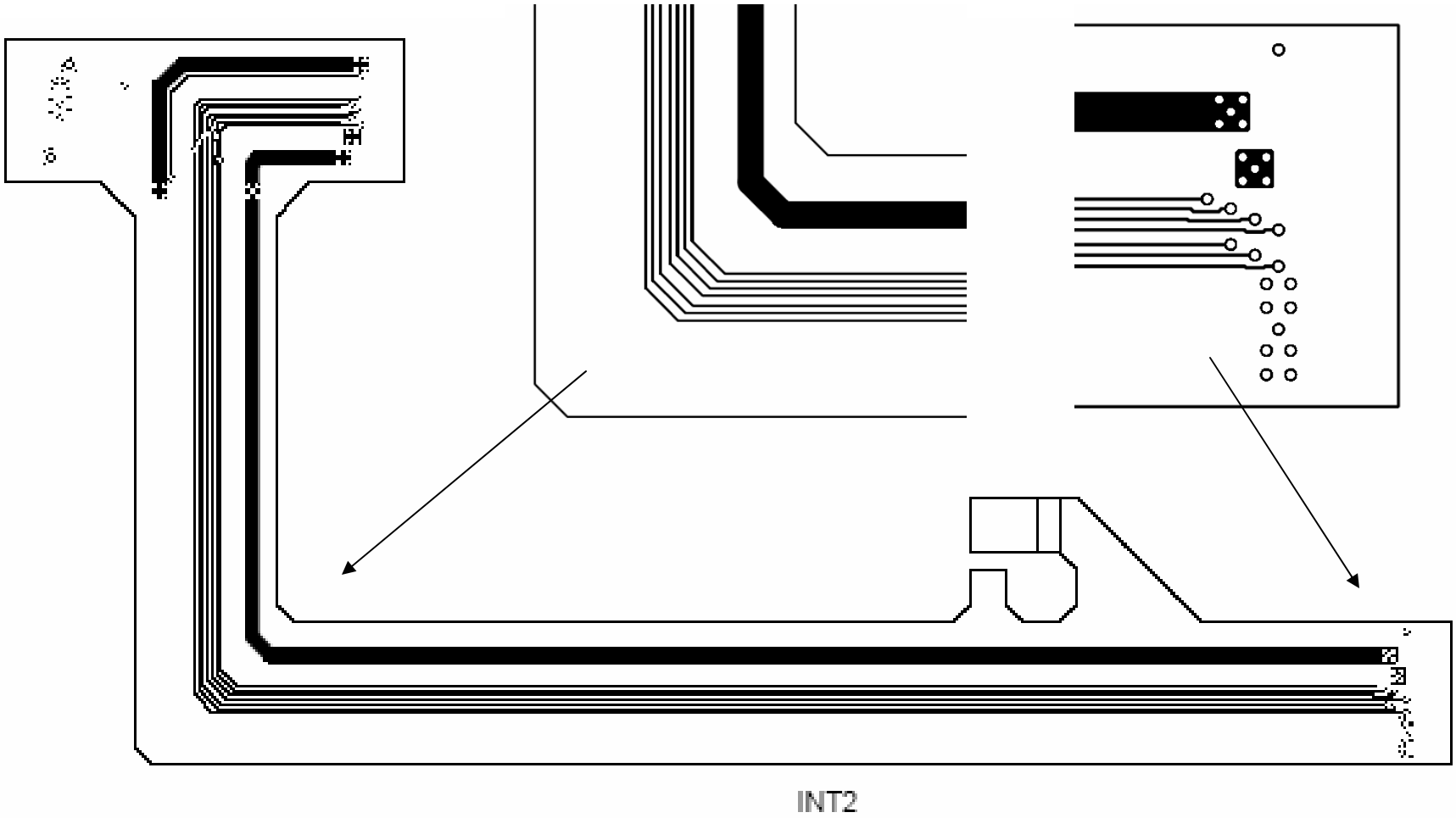




Traces, Internal-2 Layer

- Analog and Digital Power
- Traces: for Digital Control and Readout

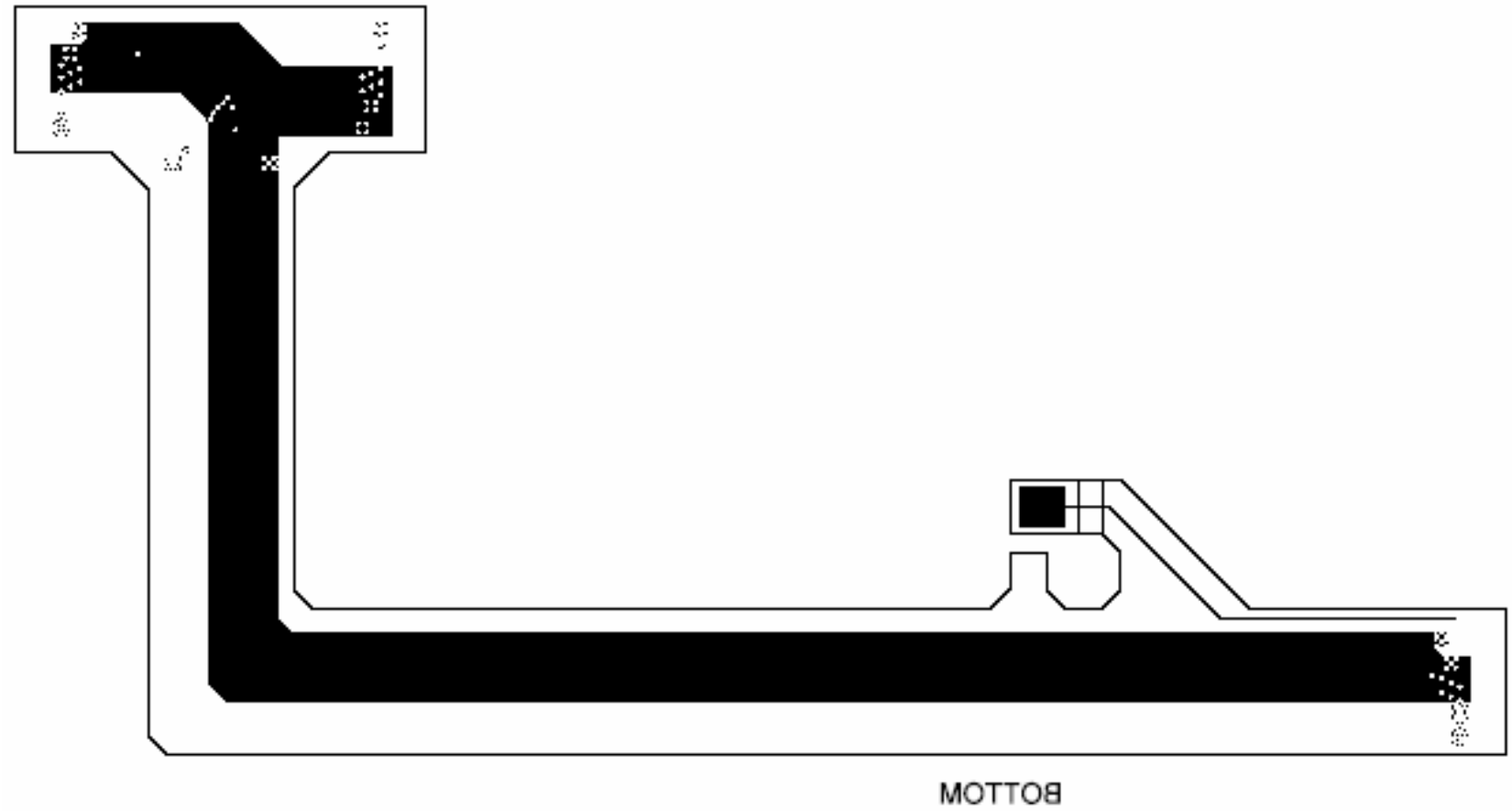




INT2

Traces, Bottom Layer

- Digital Return
- High Voltage Bias

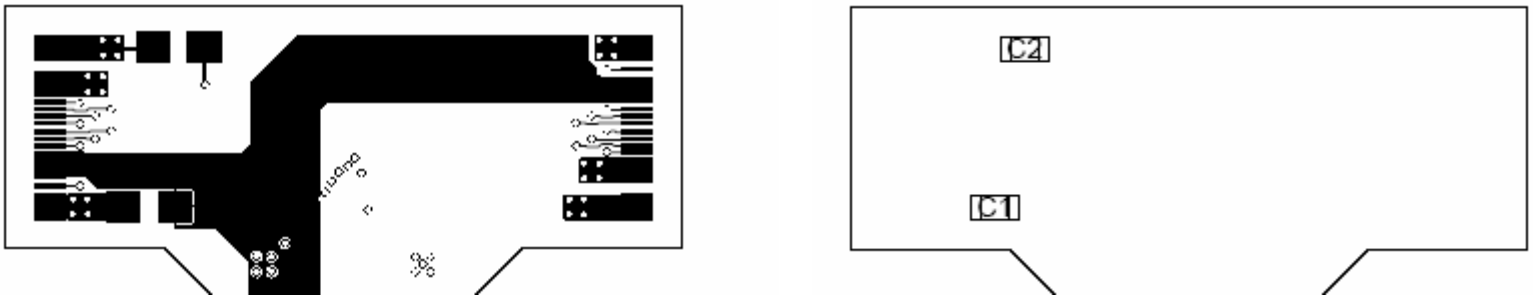


Metallization & Resistance

- Metallization: ¼ Oz Cu, Gold plating on the wirebond pads
- Resistance: Power and Ground traces < 1ohm
- Power conductors are 800um (30mils) width on voltage trace and wide planes on return

Power Filtering

- Filtering: of KPiX and HV Bias on the Pigtail cable
- Still need to add two more caps for chip Power and one more for the HV filtering



Signals, Pickup & Crosstalk

- Signals: Digital signals are LVDS (low voltage differential signaling)
- Pickup and Crosstalk: a big concern, want to minimize
- LVDS: balanced differential lines have tightly coupled, polar opposite signals which reduce EMI pickup and crosstalk.
- LVDS: what are the signal rise/fall times? Less than 1ns is typical so depending on the length of the extension cable we have to watch out for reflections.

Extension Cable

The extension cables are straightforward, which is important to the feasibility of fabricating such long cables: up to 2m in length. It will be important to establish that fine-pitch cables with miniature connectors at both ends can be reliably fabricated at this length (Tim Nelson)

Summary

- Pigtail Cable design is advancing
- Need to add separate pad and trace for HV Return
- Need to add filter capacitor for HV filter
- Need to select and add connector to Extension cable end
- Need to add additional chip power capacitors
- Need to make sure cable uses ¼ Oz Cu and not ½ Oz Cu