

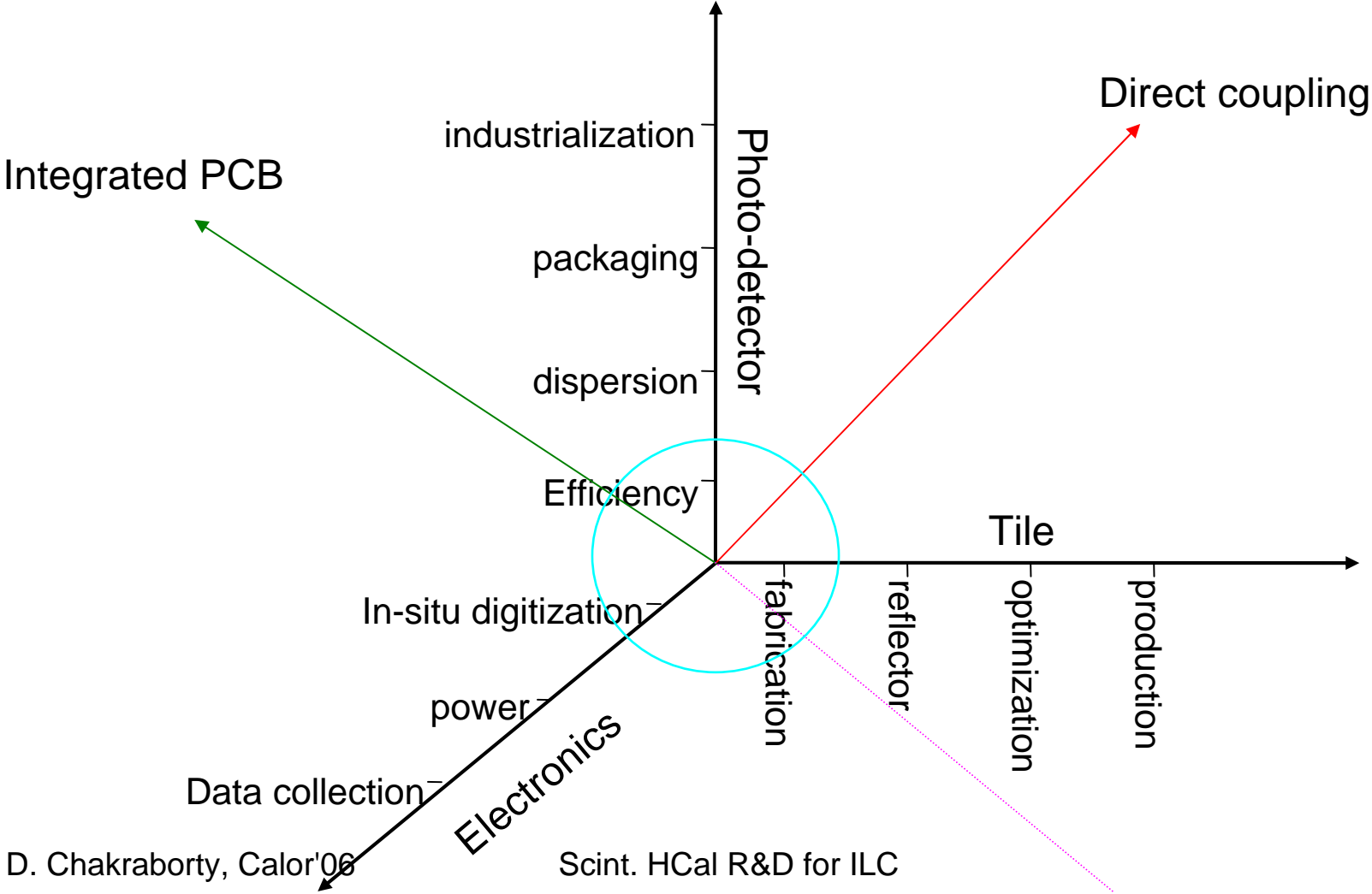
# Scintillator-based Hadron Calorimeter R&D for the ILC

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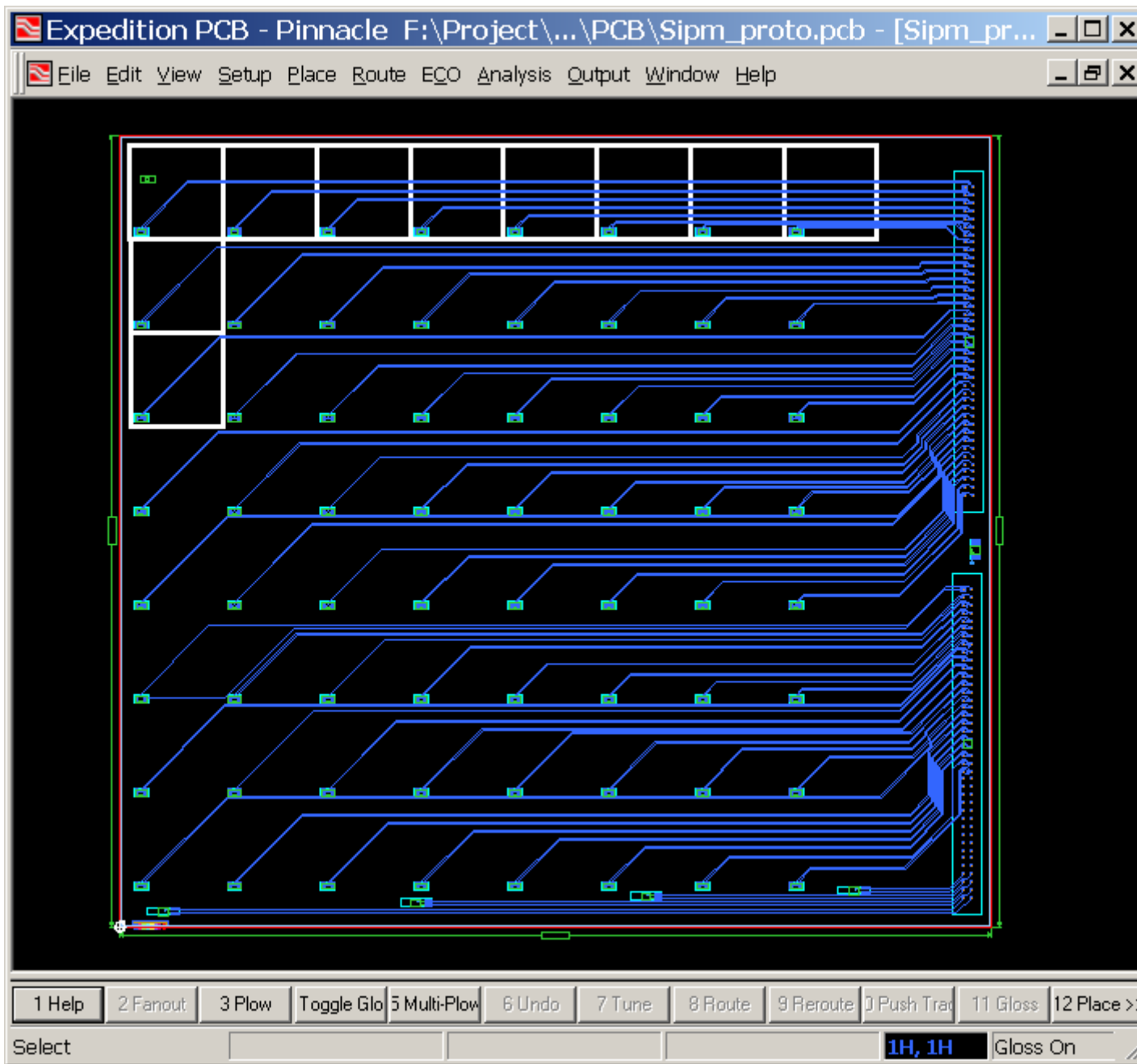


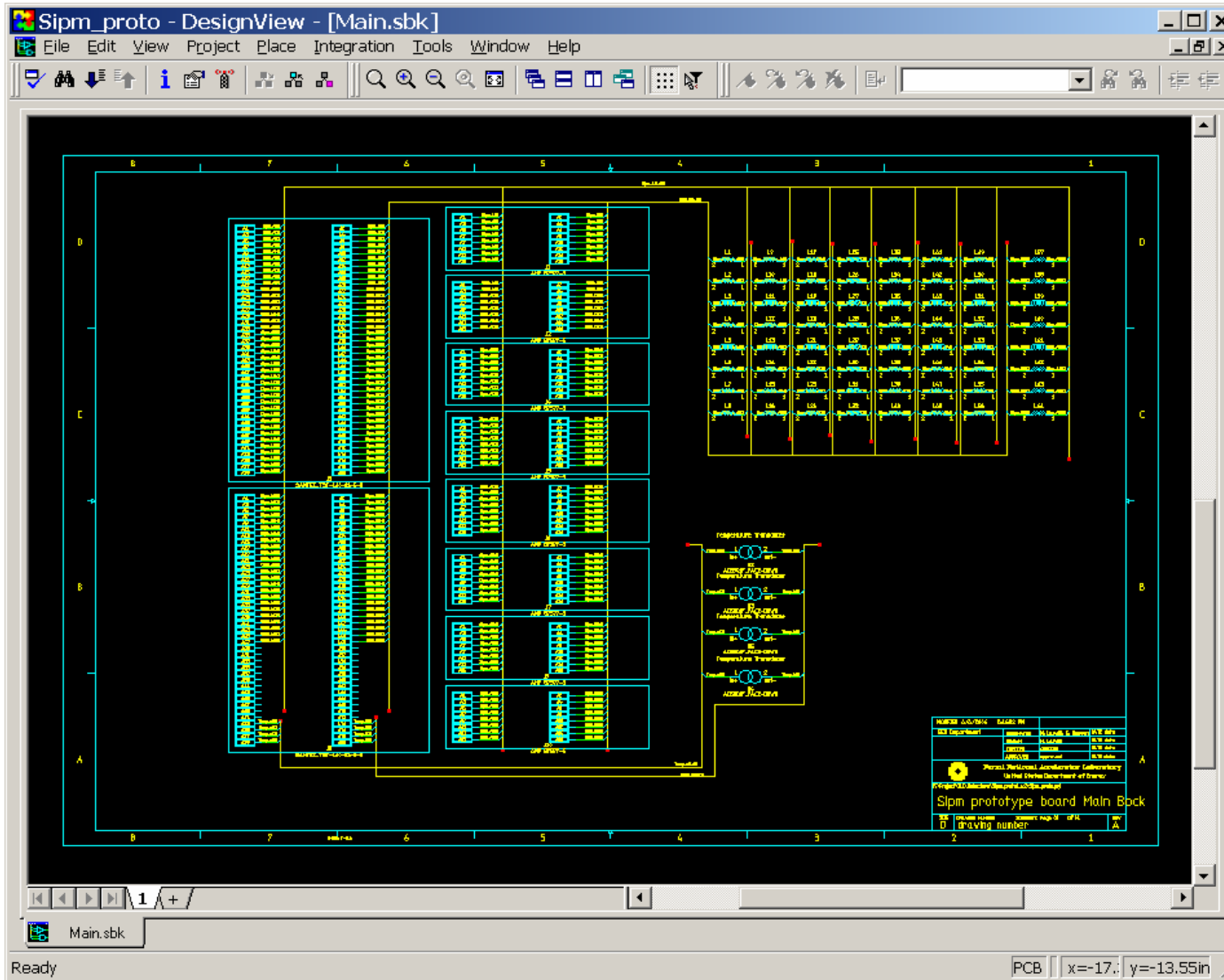
# R&D Grid



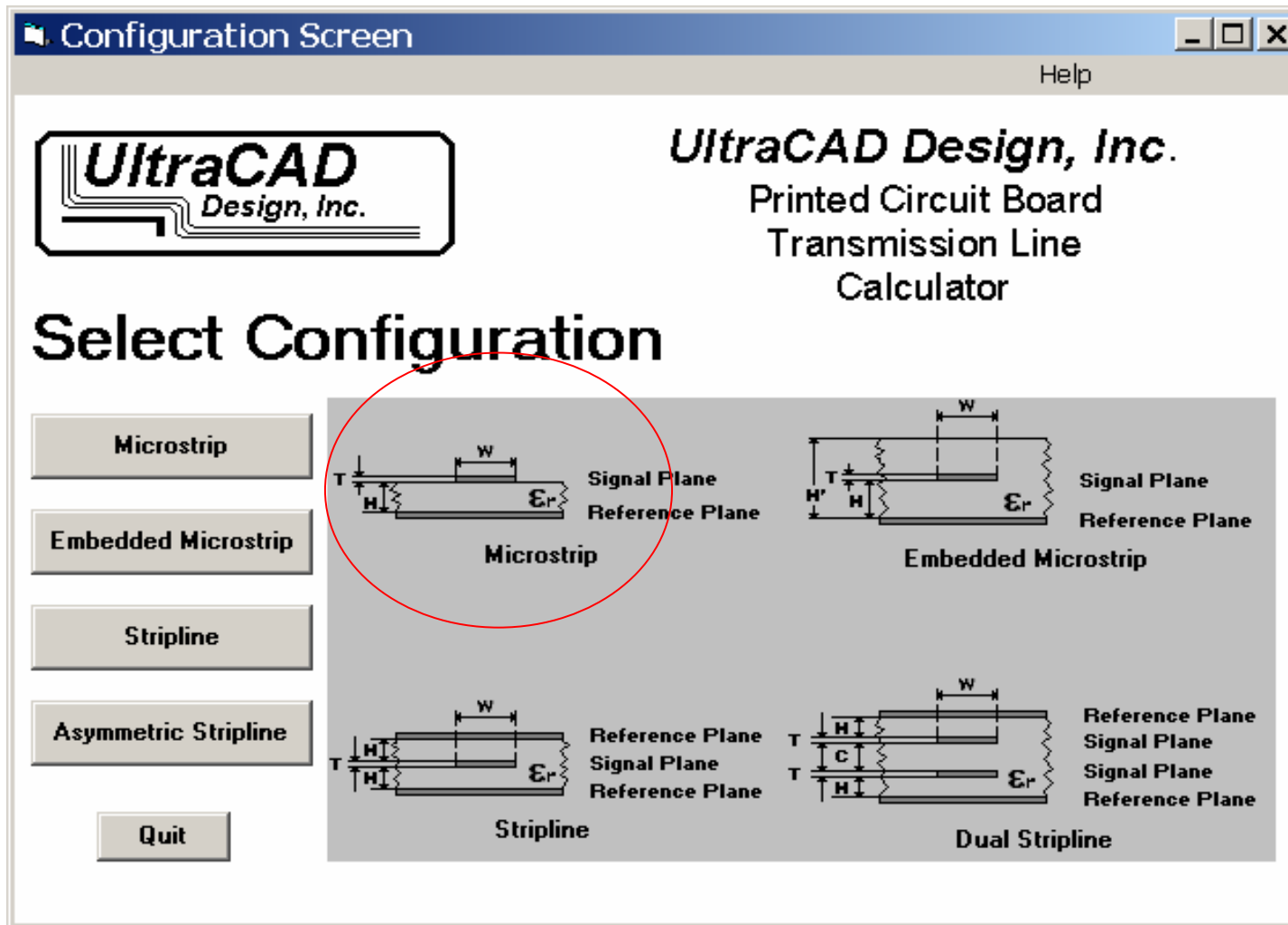
# Status and plans

- **Must take a staged approach due to funding constraints**
- **Start with:**
  - analog signals (signal, x-talk etc.)
  - tile-SiPM-board interface
- **Just begun PCB design (thanks to M. Larwill, Fermilab)**
- **Very first attempt at fiberless readout (direct coupling between scintillator & photosensor)**

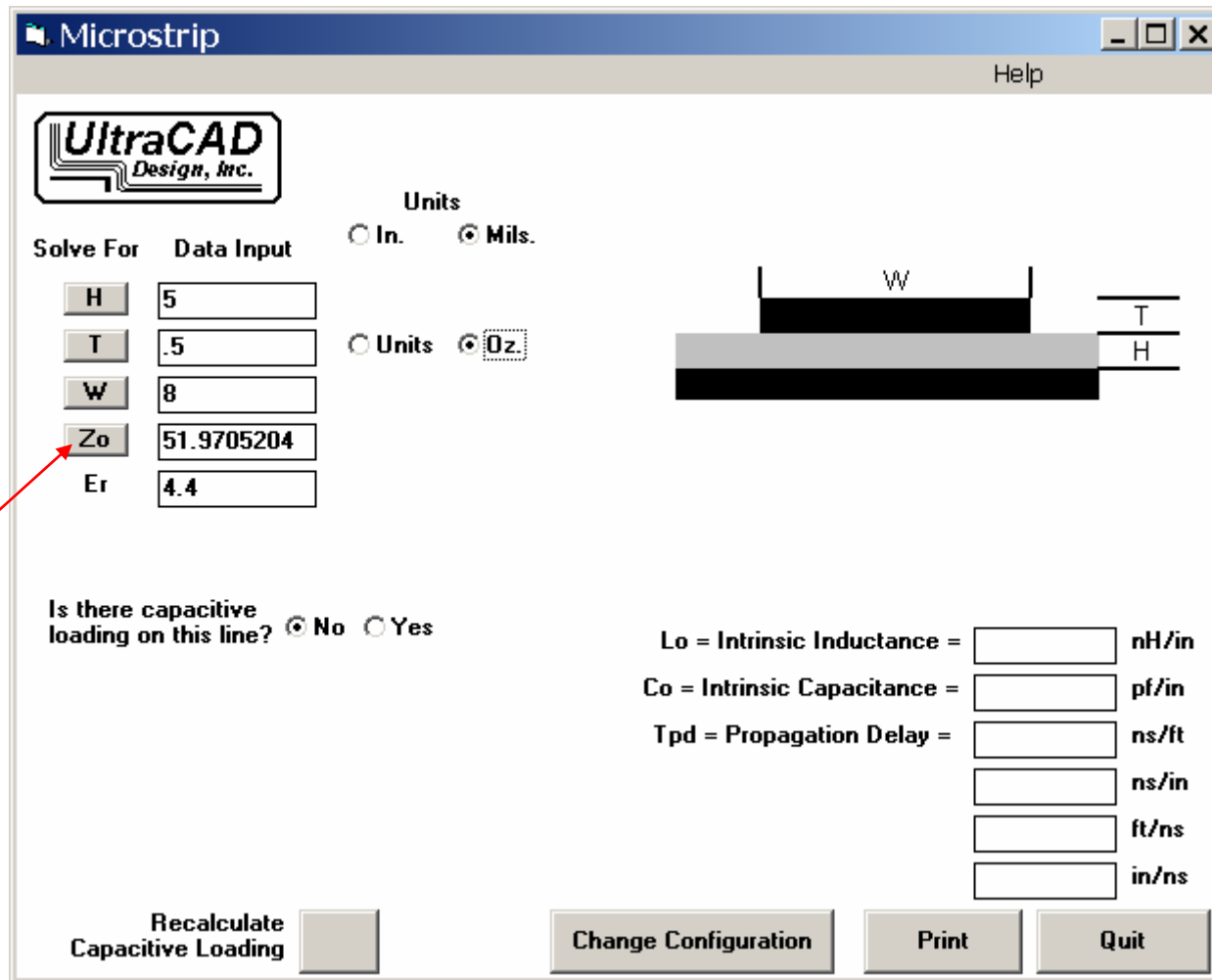




## Schematic with 2 possible connectors.



Different options for the transmission line.



- 51 ohms when using 8 mil trace , half ounce copper and 5 mil thick height.

# Pros & cons of direct coupling

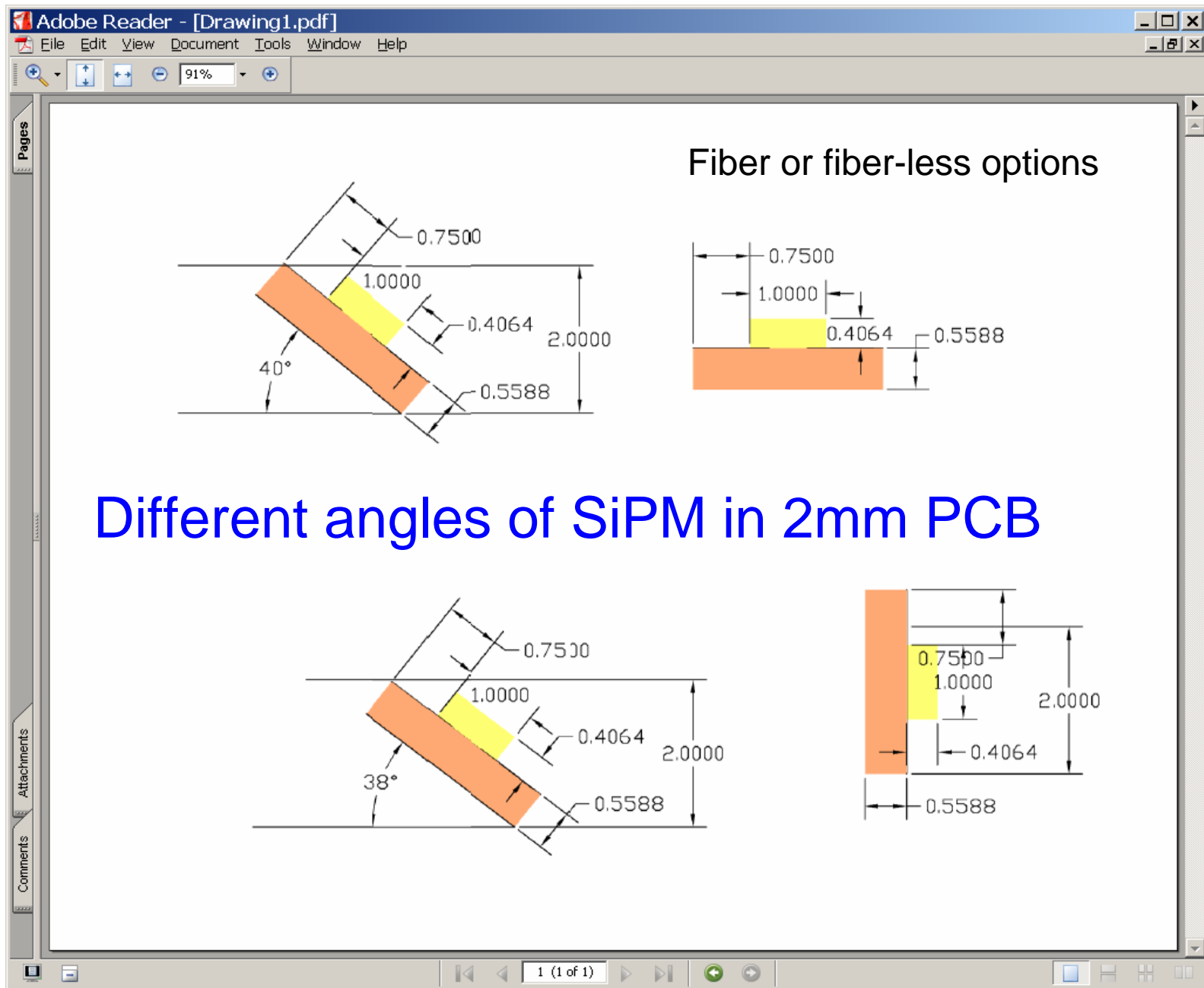
- Advantages

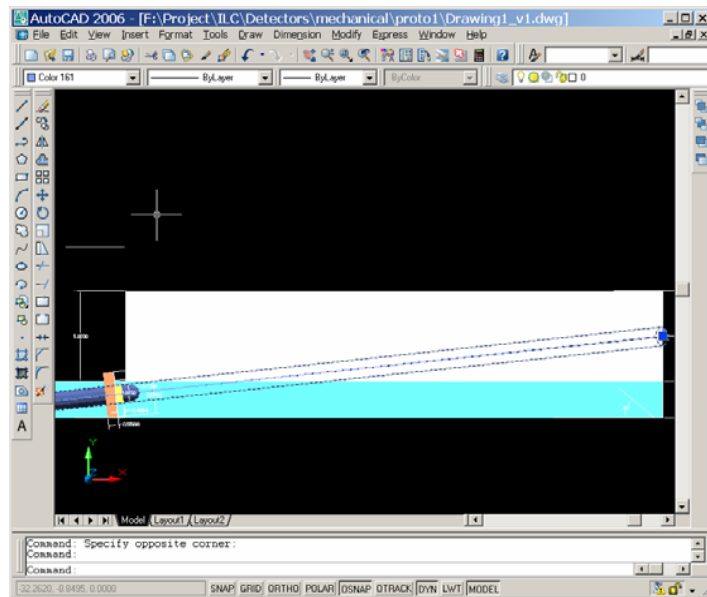
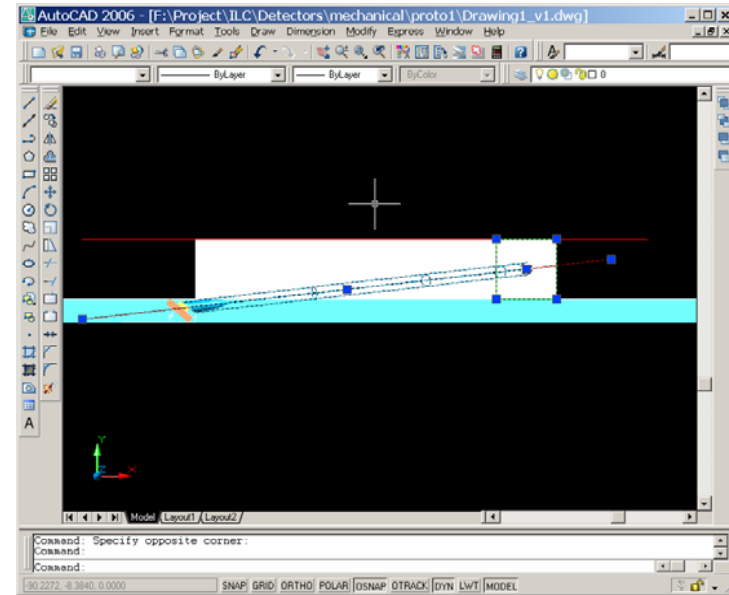
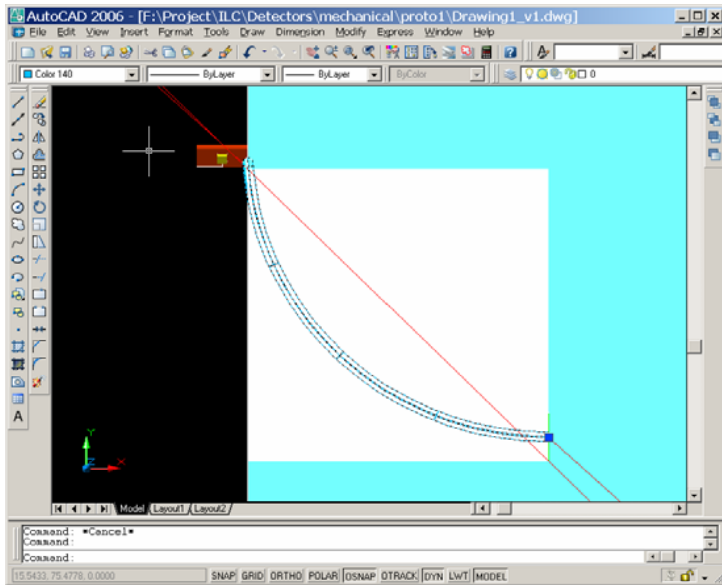
- By eliminating the WLS fiber, greatly simplifies large scale production & assembly.

- Challenges

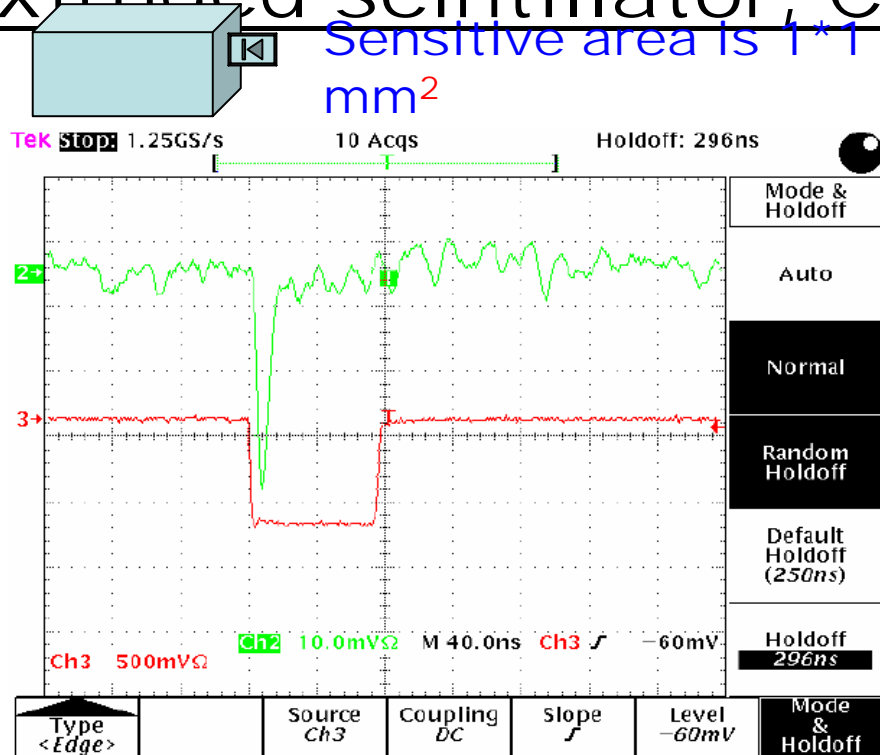
- Need photosensors with better blue sensitivity (availability improving).
- Getting enough light (seems feasible).



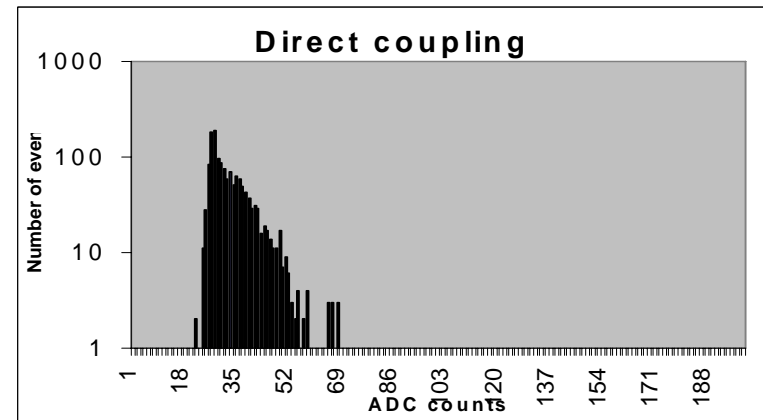
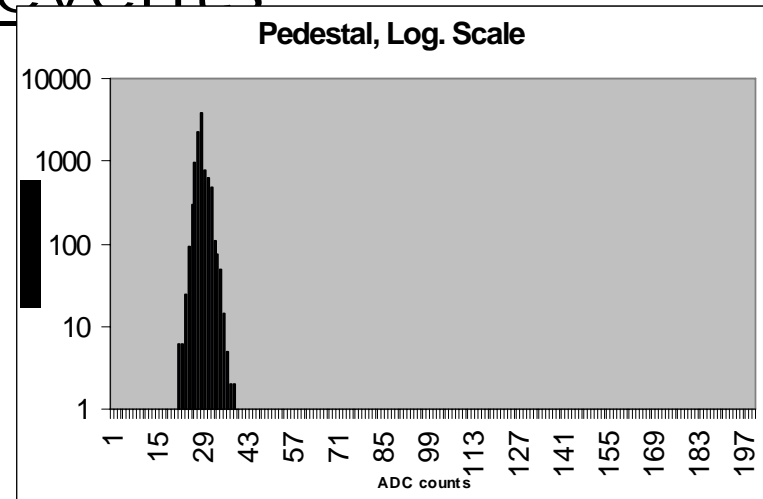




# Direct read-out of scintillation light by SiPM(CPTA), 2\*2 cm<sup>2</sup>, 5 mm thick, extruded scintillator, CR events



Sensitive area is 1\*1 mm<sup>2</sup>



Not great just yet, but considering how crude the current setup is, the idea is certainly worth pursuing further

# Summary

- SiPMs make finely segmented scintillating cells a viable and very attractive option for hadron calorimetry at the ILC (refer to earlier talks at this conference).
- Integrated PCB with on-board ASIC is on the horizon.
- Direct (fiberless) coupling option looks promising.
- R&D towards a scalable scintillator HCal design has begun and needs to be pursued vigorously.