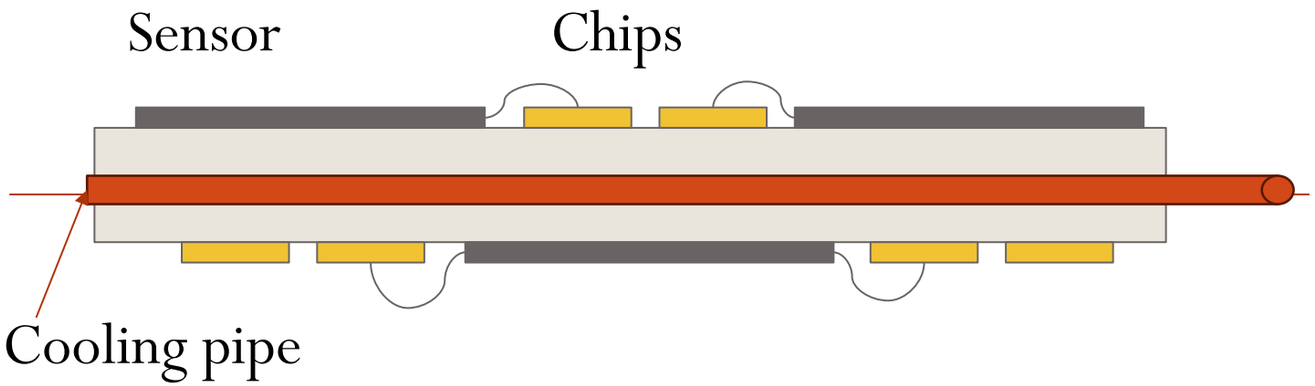
ePIC TOF barrel demontrator

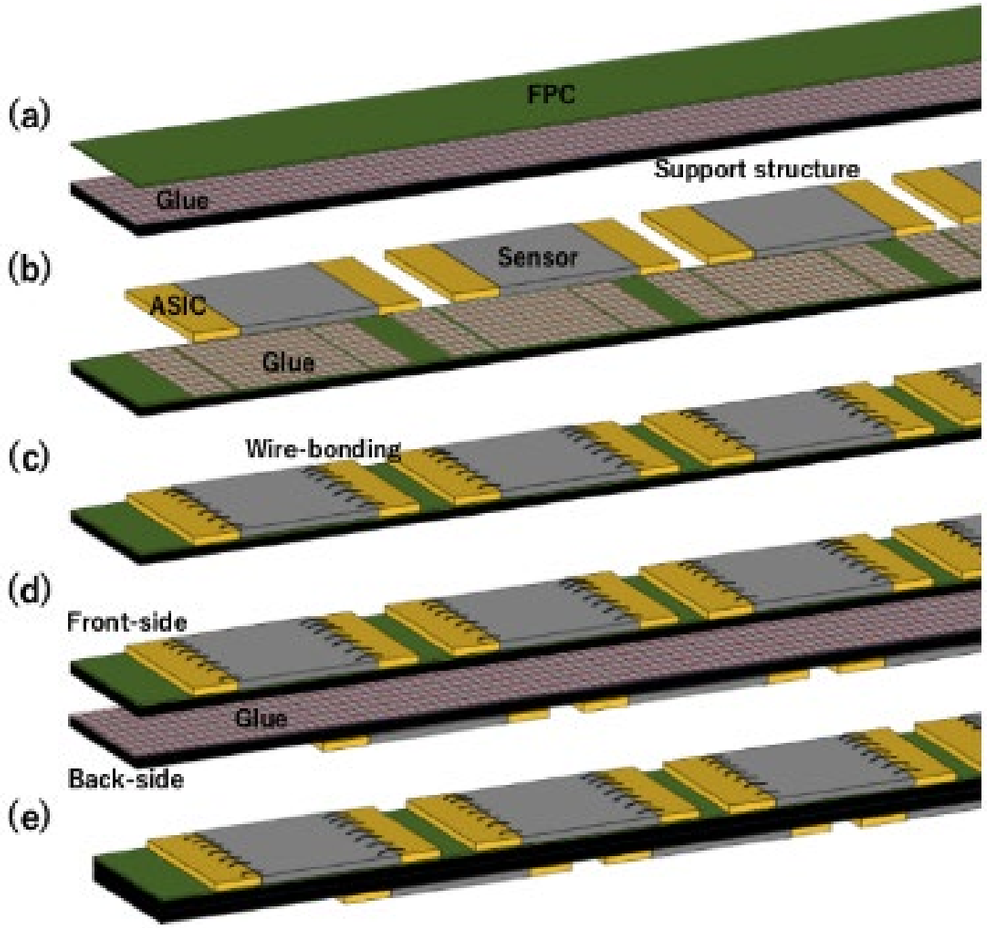
Dr. Simone M. Mazza (UCSC) for the SCIPP group

SCIPP
SANTA CRUZ INSTITUTE FOR PARTICLE PHYSICS
UC SANTA CRUZ

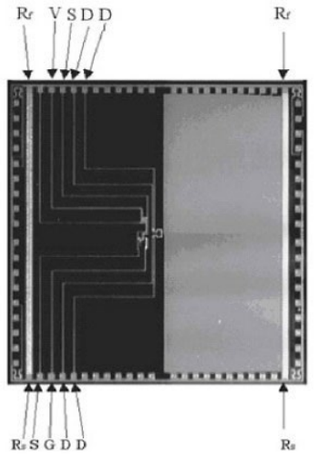
Double-sided design

- "Original": 2 ASIC per sensor originally, now 1 ASIC per sensor
  - 1 ASIC service two half sensor



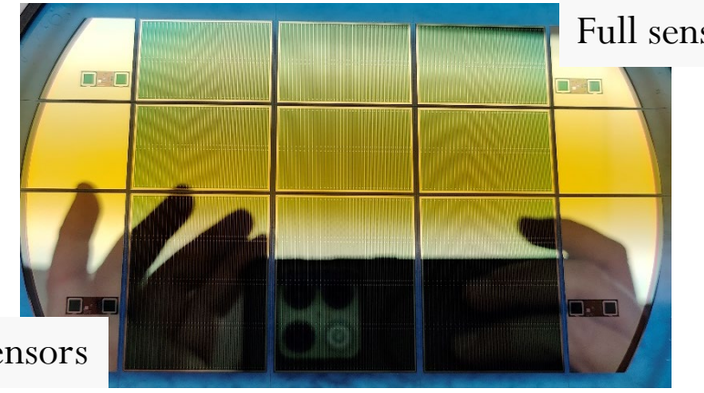


Demonstrator project



- Goal: build a thermo-mechanical stave demonstrator to:
  - Test assembly procedure
  - Test thermal proprieties of the stave, e.g. temperature gradient
- Project flow:
  - Purdue and ORNL will fabricate two half staves co-cured with Flex
  - UCSC will glue, verify positioning (metrology) and wirebond sensors (HPK new production) and silicon heaters (https://www.topline.tv/PST.html).
  - Heathers (1x1cm) have embedded temperature sensor and a series of bond pads to be paired with sensor.
  - Purdue or ORNL will assemble the two half staves with cooling pipe
  - UCSC will perform electric and thermal tests with a custom setup to be built (dry box with connection). The component will be controlled by a board to be designed by UCSC (mostly Arduino or RasPi)
- HPK sensors arrived at UCSC, many are NOT working, so ok to be used in this project
- Envisioned size:
  - 4 sensors + 1 half sensor, or longer (6+1 sensors) to match the existing mini-staves that are being produced by the Purdue group (depending on the availability of sensors).

Half sensors

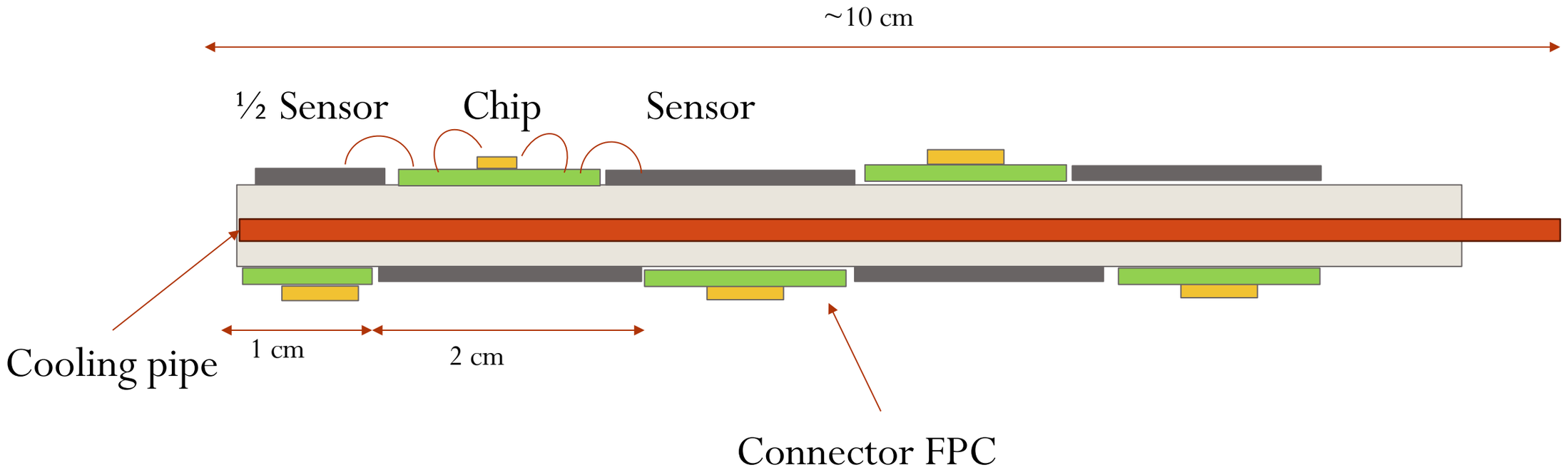


Full sensors

Double sensors

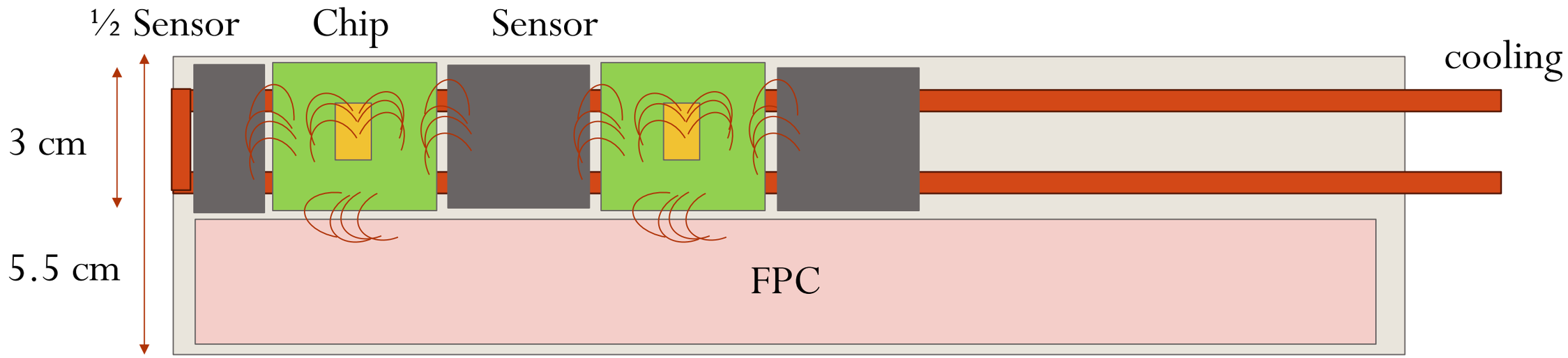
Double-sided design

- Since last discussion two changes:
  - 1 chip between two sensors
  - “Connector” board to match sensor/chip pitches, sensor and chip wire bonded to it and the connector is wire bonded to the FPC



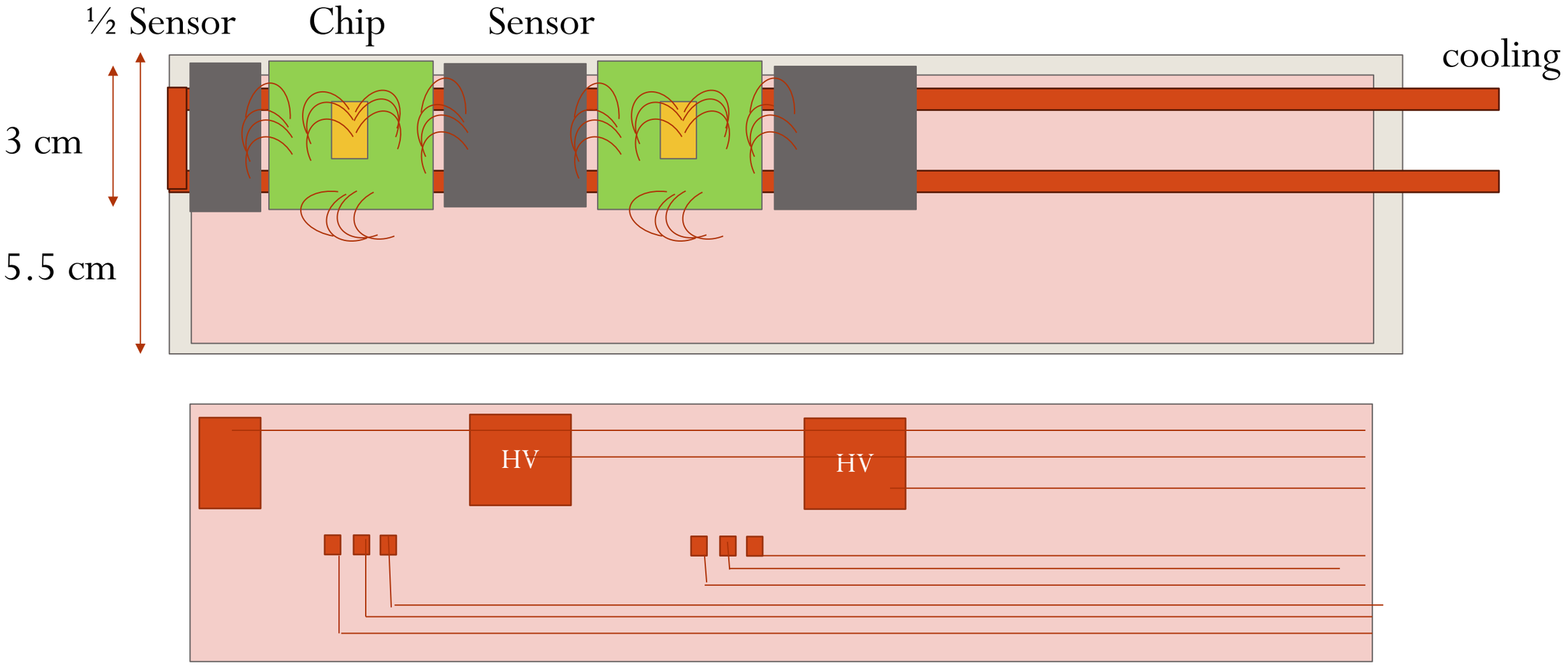
Double-sided stave

- Since last discussion two changes:
  - 1 chip between two sensors
  - "Connector" board to match sensor/chip pitches, sensor and chip wire bonded to it and the connector is wire bonded to the FPC



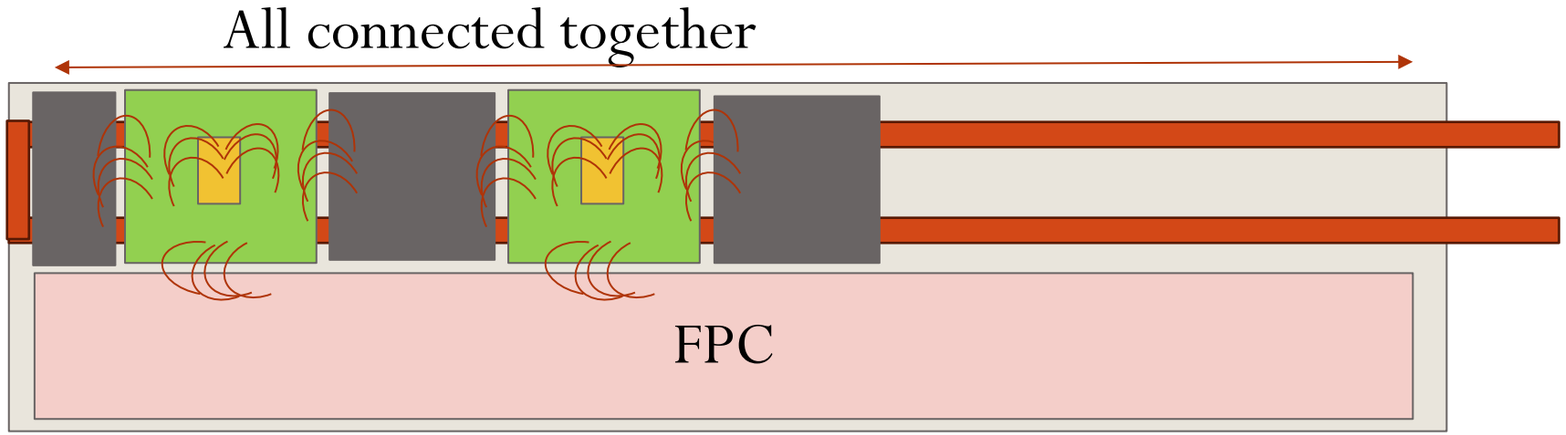
Double-sided stave

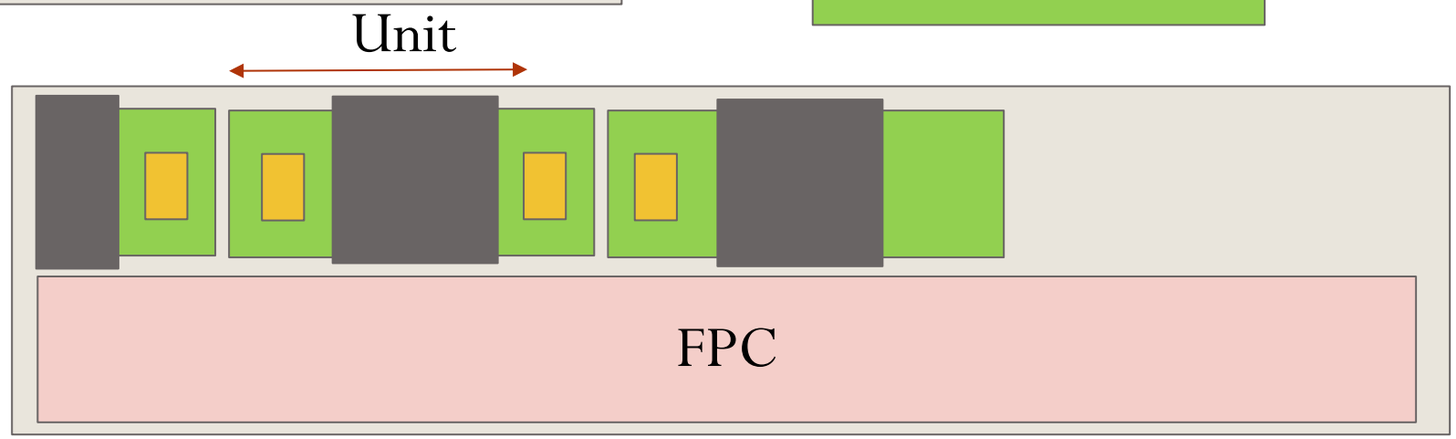
- FBC carries traces, likely multi-layer but for demo can be simple
- Wide as the stave, carrying HV under sensors/chips



Double-sided stave

- Issue with long stave with this design: it's all stitched together as a single piece
  - Hard for fabrication!
  - Better if we split it in 'units' that are assembled and then mounted on FPC





- Doubles number of ASICS

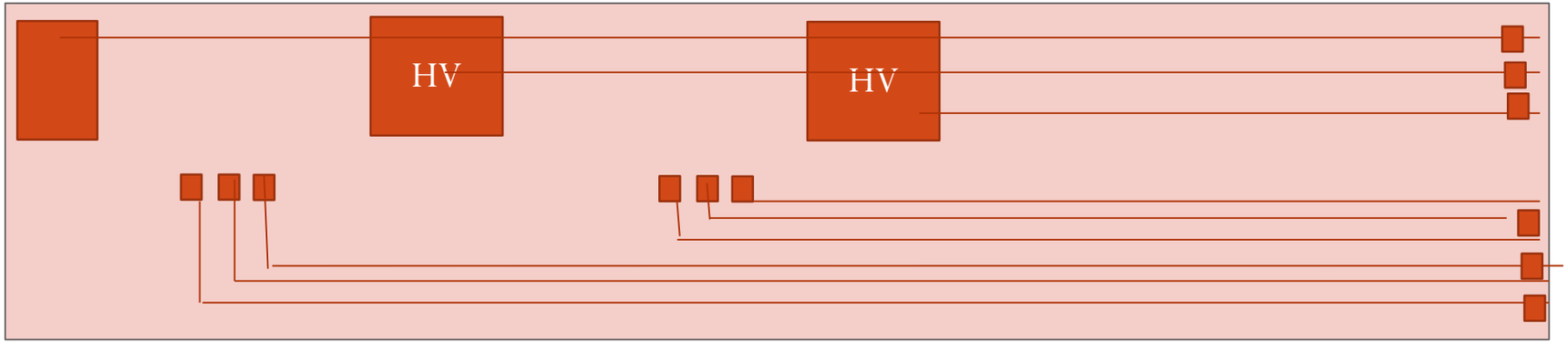
Questions

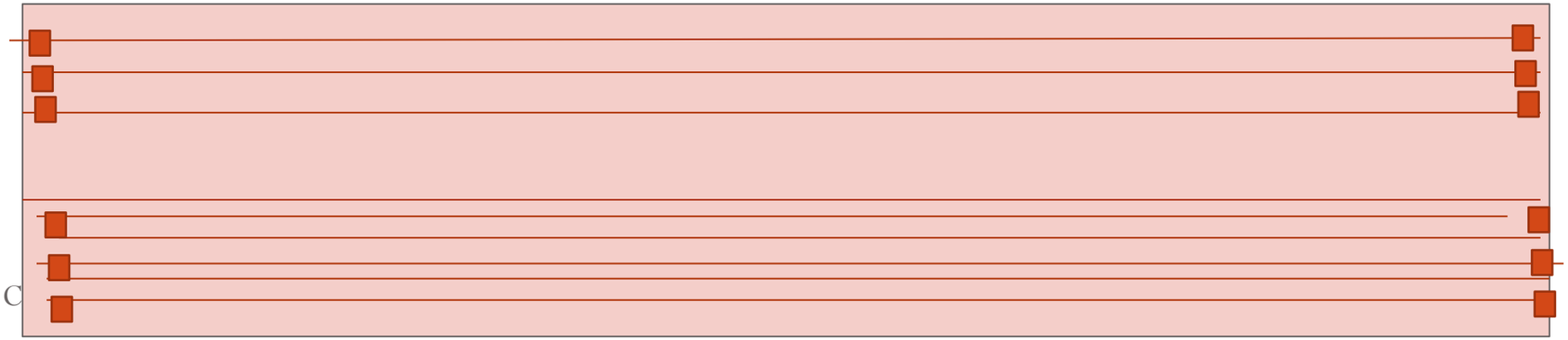
- Should we go 1 ASIC per sensor or 2 ASICs per sensor in the demo?
- In the FPC, we bring one line per sensor of HV? What about "LV" (Si heater controls)
- What size Si Heater we should buy to simulate the ASIC?

FPC idea

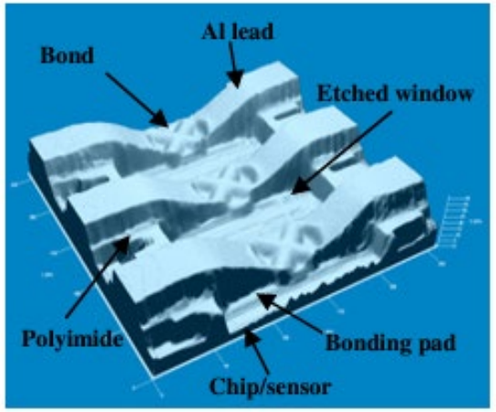
FPC idea

- Build two type of 2 layer (channels and ground) FPC ‘connection’ and ‘extension’
- Each ‘connection’ FPC service a number of ASICs that fit in a single plane

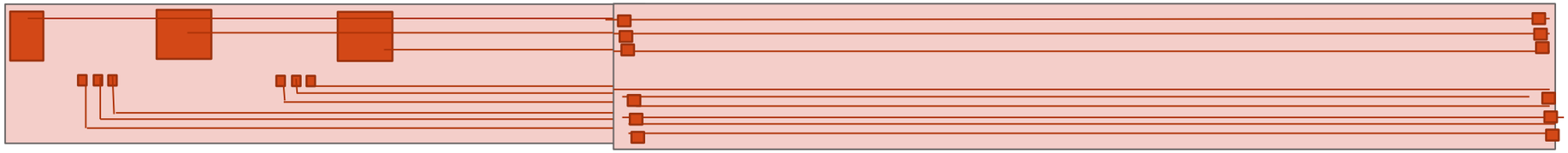




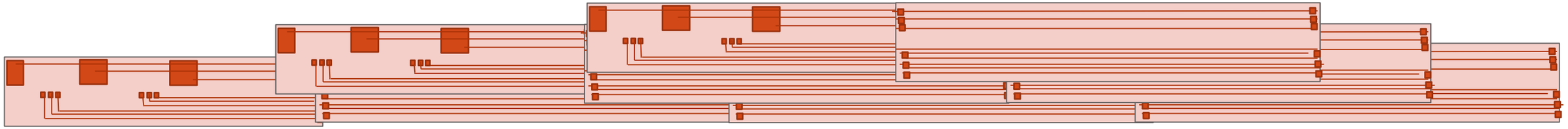
FPC idea



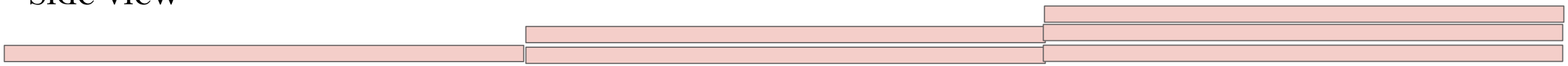
- FPCs are spTAB bonded to be extended so it's flush



- Flex are stacked and glued on the stave one on top of the other to service the entire stave

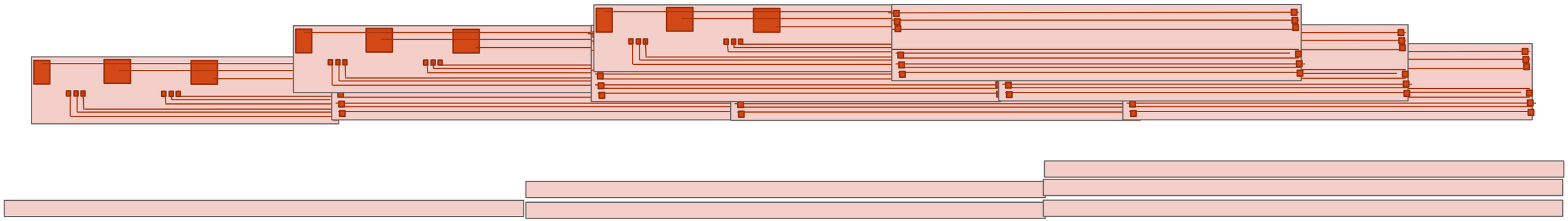


- Side view



FPC idea

- Advantages
  - Decreased material budget going towards the center
  - Modular approach to flex production, no need for a very long flex (units can be 20cm?)
  - Can be assembled with a simple wire-bonder
- Disadvantage
  - Need to figure out good connection with spTAB and connect ground plane (on the other side?)



Backup