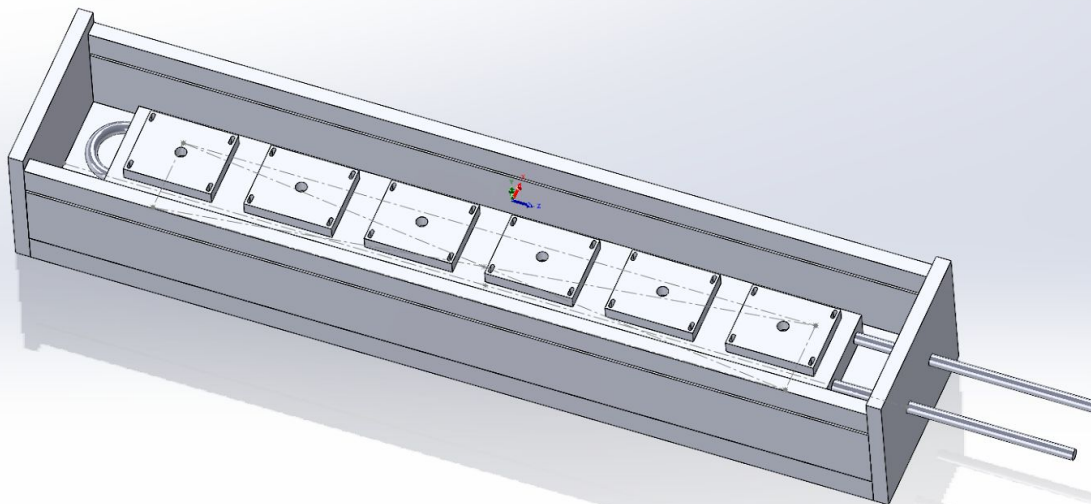


# System Tests with the Serial Power Chain

# Motivation to Upgrade the Serial Power Chain

- More systems testing needed for ITk pixels PRR
  - Specifically: "Before the stage-2 PRR ... perform system tests of final-design modules mounted on final-design local supports and using final-version services to prove that there are no issues showing up under real operating conditions in a serial powering chain for modules that have passed the final version of the QC tests."
  - This won't happen on LLS before stage-2 PRR, so this setup should aim to cover this phase space as much as possible



# System test: Overview and Goals

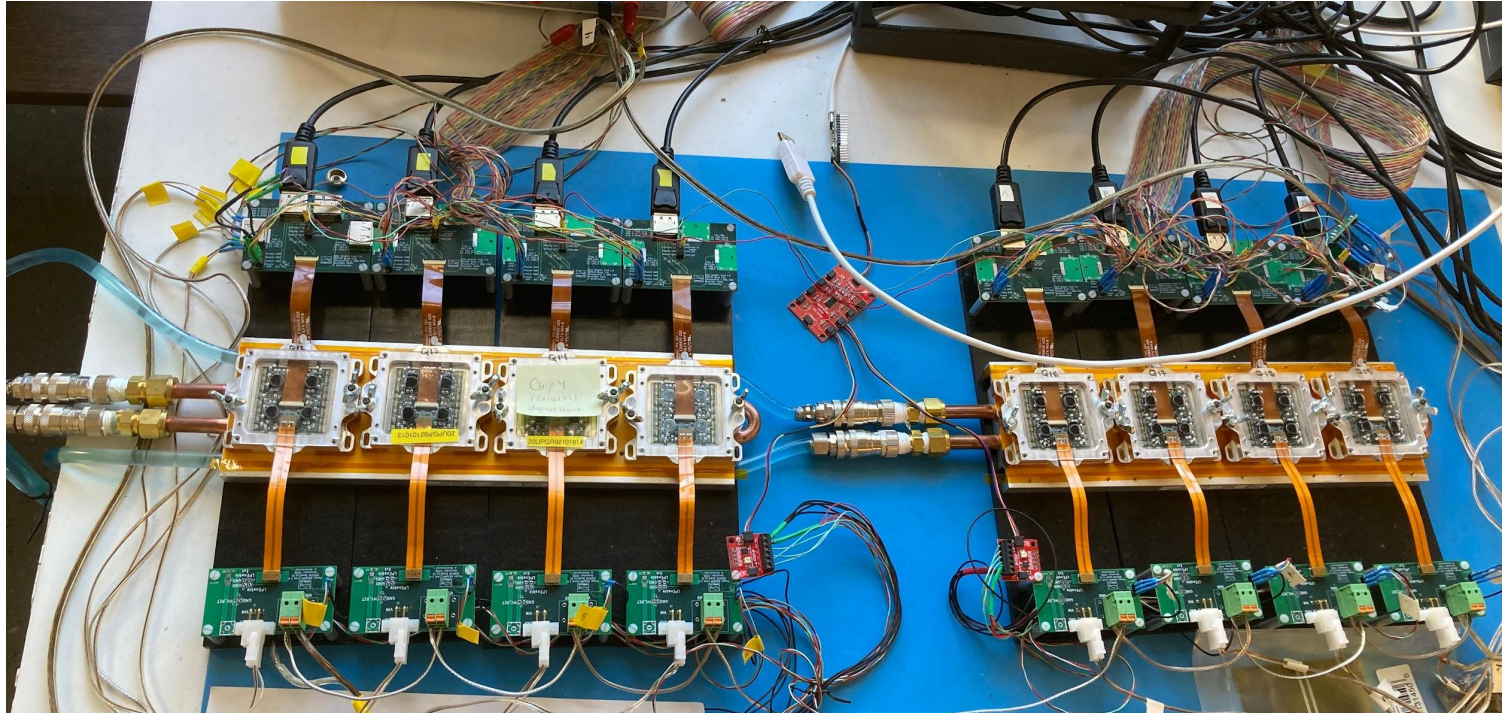
- Want to test limits of a system of modules that resembles the detector
  - What happens when many modules operate together?
  - When does serial powering break down?
- Ensure system components work together
- Inform us if our single module tests help us determine how modules will work in ITk

What do we need?

- Drybox and Chiller
  - Planning to just use large chiller from the strips lab cool through force of will
- Modules
  - Start with 8 v1.1 digital modules in serial power to validate system
  - Migrate to 8 v2 modules in serial power
- Powering
  - LV serial powering
  - HV for sensor bias
- Readout
  - Start with 2 spec cards
  - Potentially migrate to FELIX
- Rate?
  - Would be interesting to stick some big sources over modules and see what happens

# Serial Power Chain: Current Status

- 8 v1.1 digital modules
- Readout via 2 spec cards running YARR
- Cooled to room temperature



# Challenges in Upgrading the Serial Power Chain

- System Control
- Cooling
  - We hope this can be achieved with one of the large chillers in the strips lab and a water block
  - Plumbing with novac may be slightly annoying but a lil solder can go a long way
- Condensation
  - A positive pressure drybox will be built to keep the SPC and cooling condensation-free
- Powering
  - A serial powering scheme is already in place in 6007, but upgrading this to resemble detector operation as closely as possible is worthwhile
  - High voltage for sensor biasing will need to be added as well
- Chip Monitoring
  - Hopefully copy multimeter setup for Emily's box x2 to reuse as much as possible
  - Potentially move to bigger multimeter later, but keep to reusable systems for now
- Environmental Monitoring
  - Need to monitor temperature and humidity
  - Hoping to reuse systems already developed for existing systems

\*not necessarily in order

# System Tests with the Serial Power Chain

- Sustained operation of modules in a setup similar to ITk
  - Run for a long time
  - See how modules may interact with each other
- DAQ Testing
  - A similar setup in a testbeam, or many very strong sources, could be a way to stress-test DAQ software
- Following loose ends we find
  - Investigate any odd behaviour and get started on 'integration hell' in a small controlled environment