Mostly About Geometry

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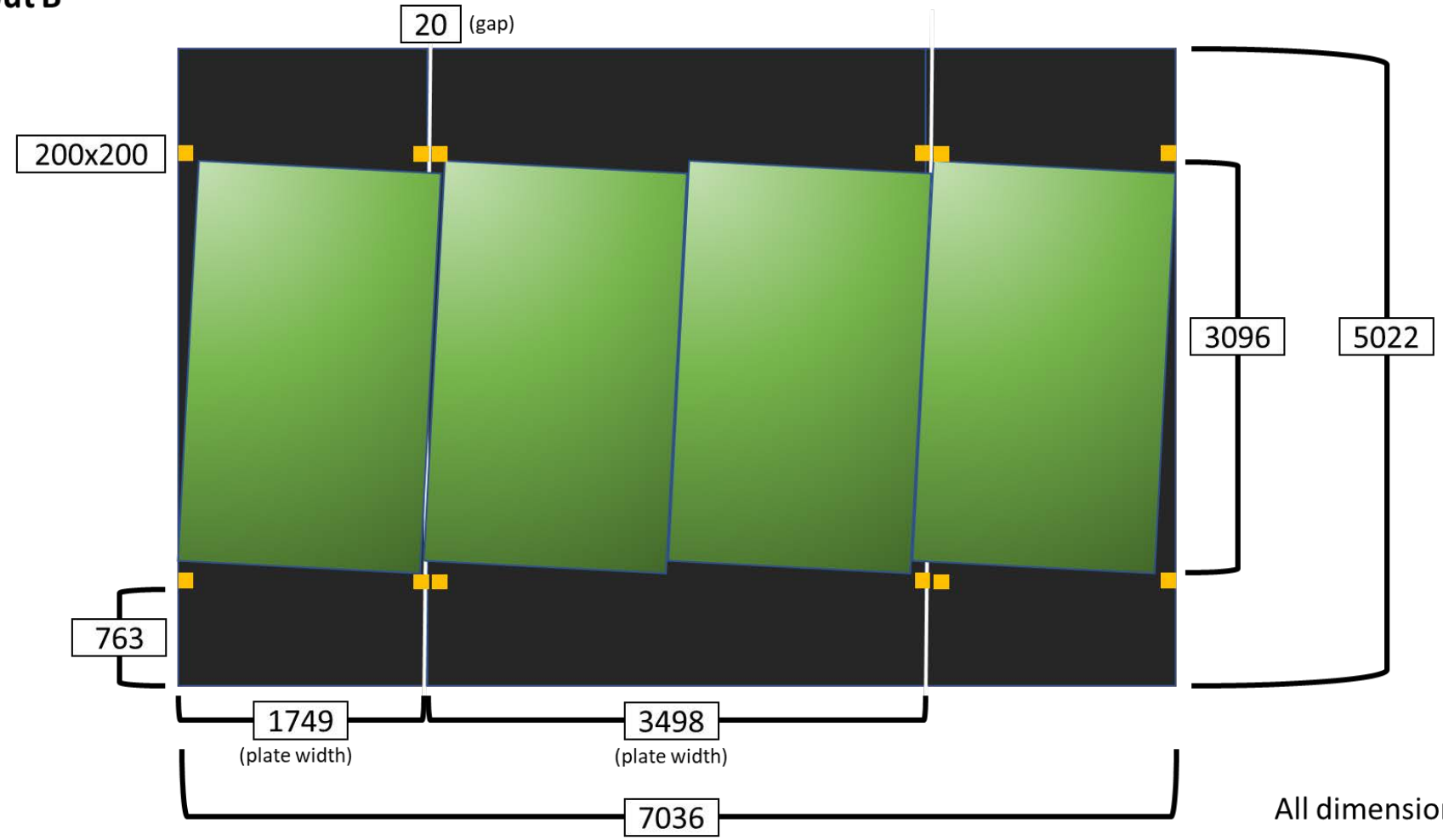
Steel and Panel Dimensions

Layout B



All dimensions in mm

Counter boxes are 1710 x 3010

What Changed?

- A mistake was corrected in the panel rotation
  - Root cause: parts of the calculation done in different times and places
  - Proximate case: not sure – however it is numerically equal to rotating the panels about a corner instead of the center
  - Who made the mistake? I don't know – it may even be two people each making a half-mistake. But I am the person responsible for it.

- Magnet coil dimensions were changed from 175x175mm to 200mm x 200mm
  - This was triggered by the selection of 40mm bus bars – 160x160 is too small

- Steel dimensions are rounded up to the nearest mm
  - Note that in real life we are unlikely to get metric steel

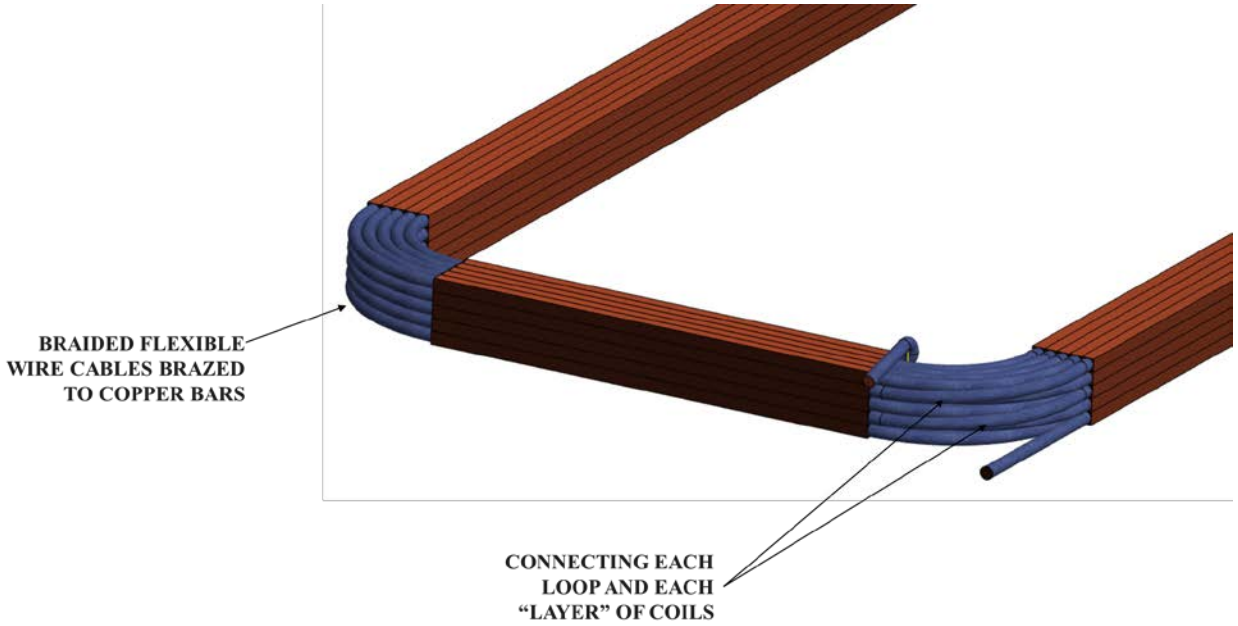
Magnetic Implications

- The maximum field in the relevant region is $\frac{h_{\mathrm{top}}}{w} B_{\mathrm{top}}$

- The pre-factor has improved by about 7%.
  - In principle that lets us reduce the height of the plates by 4¾”
    - Saves about $25,000 in steel
  - I’d like to hold off on this decision until later.
    - We have zero stay-clear on the magnet coils, so we know things will change
    - We don’t know if we are better off saving money on the steel or the magnet power supplies
    - We don’t know how much margin we have on the sign-identification requirements

More Magnet Good News

- We're still converging on the final design, but…
  - (Still some design work needs to be done on selecting power supplies)
- We have a cooling solution – the coils are thermally but not electrically coupled to the steel
  - Transfers enough heat to raise the temperature only 0.3K/day.
  - Convective cooling can handle this
- L = 1.8 H, R = 5 mΩ.
  - Time constant is 6 minutes. Good enough for PRISM?



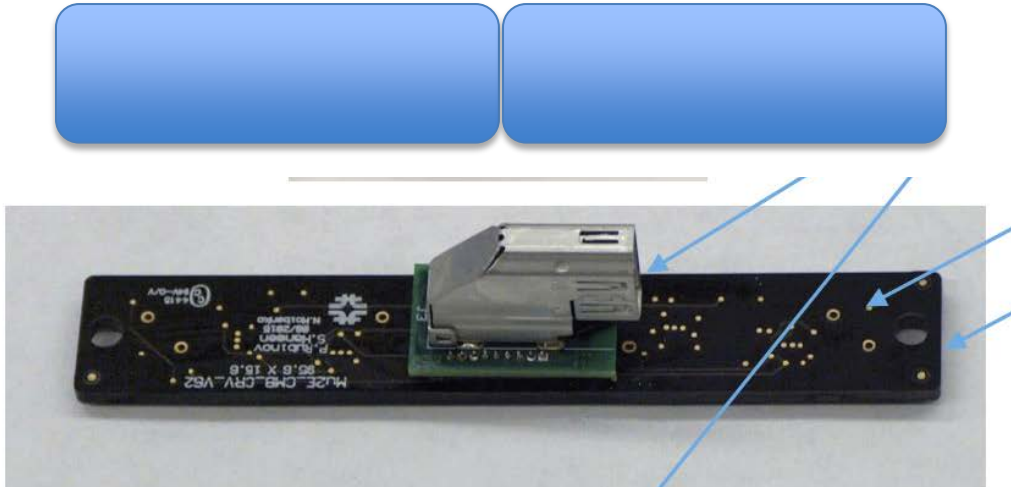
The corner pieces are bolted on – no brazing or welding required.

They are $92/each – one hour of tech time and << 1 hour of welding time.

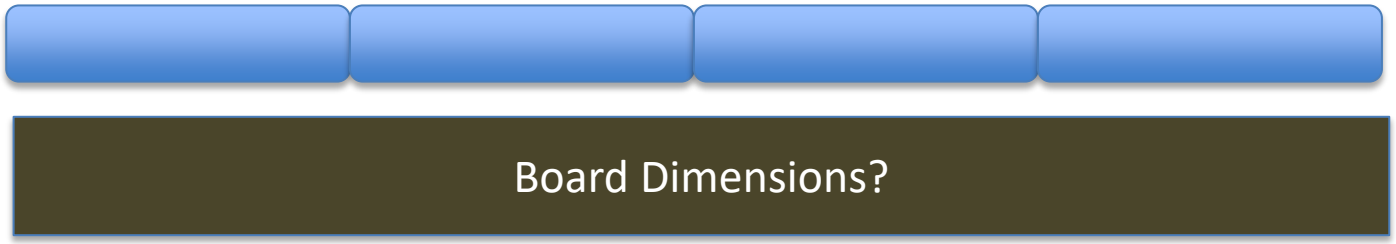
SiPM-Counter Dimensions

- Our counters are thin compared to the mu2e CRV
- It is likely our board will need to extend above and below the scintillator
  - We have 1cm space assigned for this
  - Has some implications on exactly what screws in/is glued to what
  - It is possible (but far from certain) that we have space for a thicker counter – 12mm?
  - 10% thicker means ~5% more cost. Worth it?
- Handling a di-counter looks hard
  - It's very small.

mu2e di-counter



DUNE TMS quad-counter



Dead Space

- The detectors are 1700 x 3000 mm, in a box 1710 x 3010 mm.
  - This provides 98% coverage of the canonical 3m x 7m with 50% instrumentation (i.e. hits a corner) and 96% with 100% instrumentation

- There are dead regions within the 1700 mm
  - The TiO_2 layer is 0.5 mm thick out of 35.4 mm overall (98.6% coverage)
  - If we wrap the counters in plastic, this adds ~0.25 mm per wrapping
    - The exact thickness is not known – this is an average of a 4 mil single-wrap and a 3-mil double wrap
      - A di-counter design adds 6mm per panel, or 99.6%
      - A quad-counter design adds 3mm per panel, or 99.8%
  - Glue takes up space too!
    - As much as possible, glue the counters top and bottom, not side to side

Scintillator Hole Dimensions

- We have scintillator slats with holes and with grooves

- The hole is really, really big.
  - Picture to the right shows four 1mm fibers fitting into the hole.
  - Hard to imagine a hole this big has good optical coupling between counter and fiber.

Summary

- The geometry has been updated and errors fixed
- Magnet design is progressing
  - Changes are all in how it is constructed. The field map is unchanged
- Wrapping the counters adds insignificant dead areas
  - Within the margin of error on the TiO_2 co-extrusion thickness
- The single channel SiPM design requires some thinking on exactly how we attach the electronics. This may set a minimum N for an N-counter.