

Prototyping, Electronics, Decisions and Miscellany

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Science

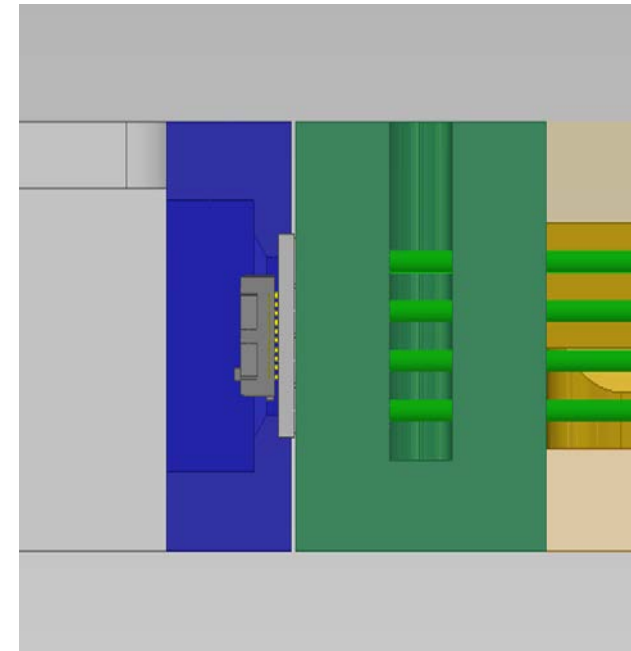
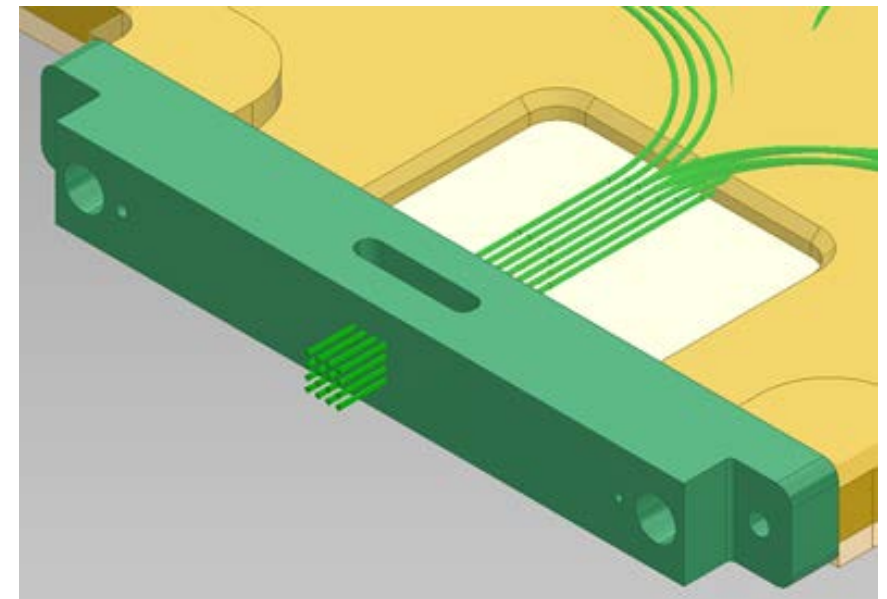


Electronics

- I asked an ANL team to take our preliminary designs and cost them out at the Bill-Of-Materials level. Our intent is not to design the electronics until we are closer to construction.
- Cost:
 - My cost: \$1.6M (base)
 - Their cost: \$1.2M (base)
 - These are not apples-to-apples. I am working through the differences now. It appears the base costs are very close, but the contingency is lower (because we have actual parts with actual part numbers)
- Changes:
 - More, but smaller FPGAs
 - Instead of taking just-digitized signals off the detector panels on a parallel link, use an FPGA to zero-suppress them and use a serial link (DisplayPort cables)
 - **This exceeds the DisplayPort spec**
 - Many applications routinely exceed it (but are not running next to magnet coils)
 - Data concentrators no longer concentrate
 - Each “unit” supports one panel
 - Probably multiple (4-8) units per card
 - No low-voltage power supplies anymore. Power is supplied by Power-Over-Ethernet ethernet switches (precludes fiber)

Prototype 1

- Purely Mechanical
 - Doesn't even use scintillator: mocks it up with clear fiber in a fixture
- Sixteen “channels” (one SiPM)
- Intended to:
 - Test fiber routing (yellow piece)
 - Test Fiber Guide Bar concept (green piece)
 - Test SiPM mounting concept (blue piece + leaf springs)
 - Refine our construction time estimates

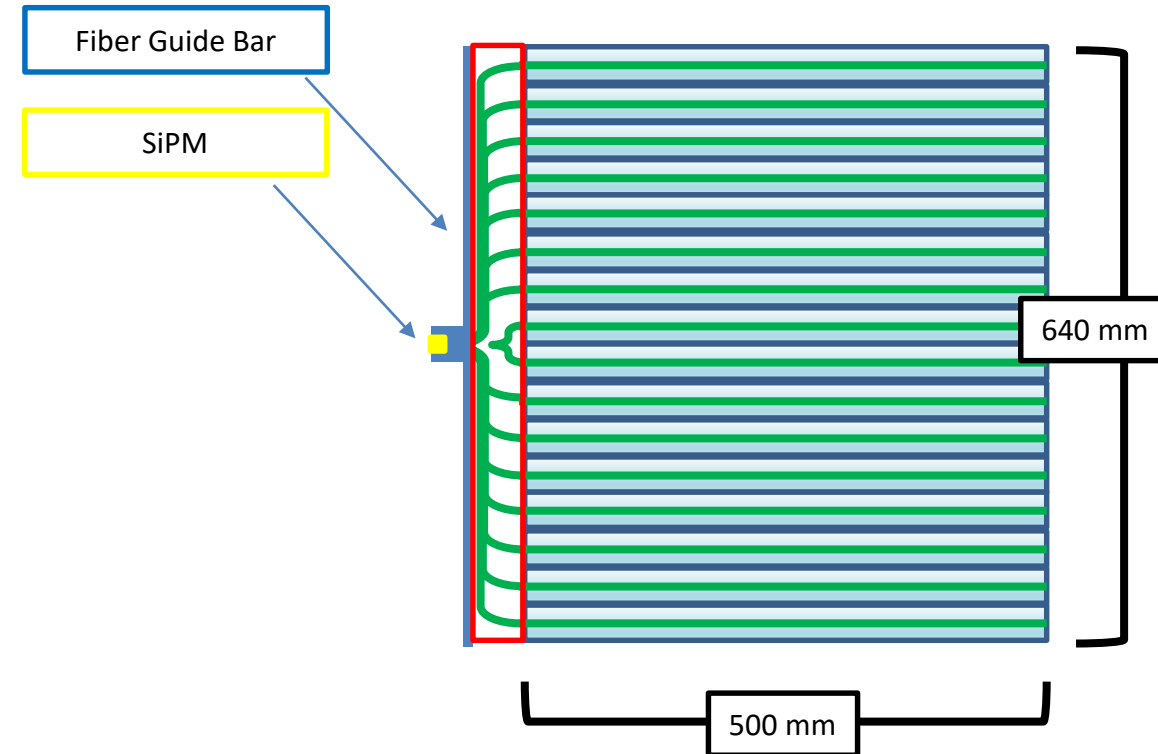


Prototype 2 & Beyond

- Prototype 2
 - A forty-eight “channel” (one panel) version of Prototype 1
 - Also purely mechanical and using fixtured clear fiber
 - Does Prototype 1 scale up?
 - Does the production time scale up?
- Future prototypes
 - Each prototype should set out to answer specific questions
 - We have 1.5mm WLS fiber. The baseline uses 1.2mm fiber. (1.5mm costs \$300K more)

Working Prototypes?

- We have the ability and the materials to build something like this.
 - 16 channels, 1/3 x 1/6 scale.
- Commercial readout exists (or will in February) for about \$2000.
 - 20 Lemo outputs
 - 16 single channel amplified outputs
 - 4 Four-channel sums
- The 16 channels wouldn't necessarily need to be identical
 - E.g. glued vs. non-glued



Decisions, Decisions



- We've made a number of decisions for baselining that may not be optimal.
- I wrote the alternatives down (attached to Indico) along with what it would take to change our minds:
- Example: Change WLS Fiber Diameter
 - Description: Change the WLS fiber diameter from the present 1.2 mm to a different radius. Other common radii are 1.5 mm, 1.4 mm, 1.0 mm and 0.8 mm.
 - Intended benefits: Reduced cost (smaller), improved performance by increased light (larger)
 - Other changes: may have implications for groove or hole co-extrusions. Affects all the downstream optics.
 - What would change our mind: A design showing a smaller diameter would work and be a net cost savings, or alternatively that a larger diameter would provide physics impact (beyond just "more light") commensurate with the cost increase. This physics impact is probably demonstrated via simulations.

The List (at Present)

- Water Closed-Loop Cooling the Coils
- Change WLS Fiber Diameter (last slide)
- Include 3D-printed Diffuser/Coupler
- Scintillator Fiber Hole
- Move On-Panel Boards Off-Panel
- Move DC functionality to OPBs
- Switch to Single-Channel SiPMs
- Orthogonal Tracking
- TMS yz-tilt
- Calibration and Monitoring
- Steel Thickness Distribution

We've taken some decisions so we could write the PDR.

If better alternatives exist, we can switch to them. But we have to demonstrate they are better. This should not be an unreasonably high bar. It will keep us from flip-flopping.

The earlier we decide to change, the easier it will be.