

Open and Closed Design Questions

Tom LeCompte
SLAC



U.S. DEPARTMENT OF
ENERGY

Office of
Science



Outline/Intro

- About a year ago I circulated a list of open issues with the intent to revisit it after a year
- We've made progress!

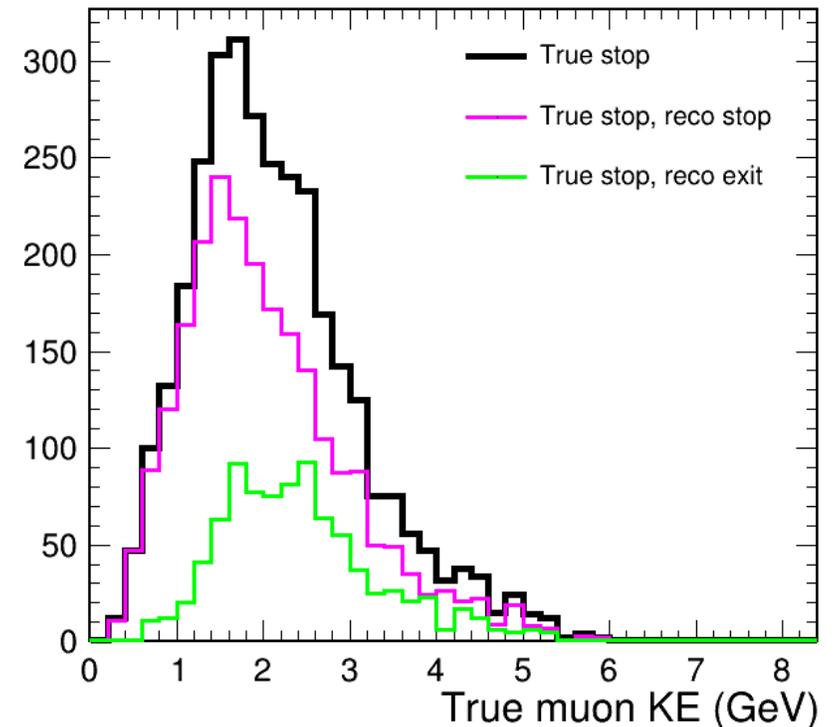
- I will step through the decisions. "Closed" does not mean "carved in stone for all time, even if we find a horrible problem", but it does mean that we have, either explicitly or implicitly, made a decision.

Water Cooling The Coils

- Cooling the coils with water has very few advantages and adds complications
 - It removes more heat → so you can run more current → which generates more heat we need to remove
 - You can use less copper, but this saving is eaten by the cost of the power supplies and the water cooling
 - We're limited in how much heat we can discharge to the hall
 - Taking hot water back through the energy chain complicates it
 - There is no physics improvement from doing this.
- Decision: **Air cool**
- Status: **Closed**

Changing the WLS Fiber Diameter

- We have 1.2 mm because that was our best cost estimate
- From the Decision Document: “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”
 - We’re starting to get some useful feedback from simulations. See plot at right by Clarence.
- Decision: **Open**
- Status: **Open**



3-D printed Diffuser/Coupler

- This was for mating counters to 16-channel SiPMs. Now that we have switched to single channel, this is moot.
- Decision: **Unnecessary**
- Status: **Closed**

Scintillator Hole or Groove?

- In principle, you get more light from a hole. In practice, not so much, since you can usually do a better assembly job working with a groove you can see and touch
- We decided on a hole because
 - A groove increases the counter thickness and variability in a constrained dimension
 - We have a lot of test “holey” scintillator
- We are often asked about filling the hole with glue to improve the optical coupling.
 - This strikes me as tough
 - This strikes Scott Oser (LBNC) as tough – and he’s actually done it!
 - If someone wants to study this using their own resources, fine, but I think it will be an uphill battle to show that this is the best and most cost-effective way to get more light – enough to influence the physics
- Decision: **Hole**
- Status: **Closed**

Move On Panel Boards Off-Panel

- An early design had the light from the counters travel by fiber to an accessible PMT box. There were some fine military-grade fiber assemblies that would do this.
 - For the low, low price of \$2M
- Decision: **No**
- Status: **Closed**

Move Some or All of Data Concentrator Functionality to On-Panel Boards

- This will be settled when we do a detailed electronics design in a year or two.
- Status: **Open**

Switch To Single-Channel SiPMs

- The 4x4 2mm SiPM is unavailable from any vendor at any price. So we bit the bullet and went with single channel SiPMs.
 - The alternative was to make 4x4's ourselves by mounting single channel SiPMs in a bracket. This seemed like a lot more work for little or no benefit.
- Decision: **Yes**
- Status: **Closed**

Orthogonal Tracking

- Everybody hates stereo
- We have stereo because it's an inexpensive way to get some measurement in the non-bend view
 - This unquestionably trades off better charge identification for worse pattern recognition, especially when there are more than two muons in a TMS panel.
 - This is related to the question “why magnetize at all? We can get the charge ratio from the Monte Carlo.”
 - Favoring the bend view makes no sense if you don't have one.
 - While that question is still open, that argument can be applied to the entire Near Detector. If we knew the Monte Carlo was perfect, we wouldn't need a near detector at all. So this is a matter of degree, not black and white.
- Status: **Open**

Calibration and Monitoring

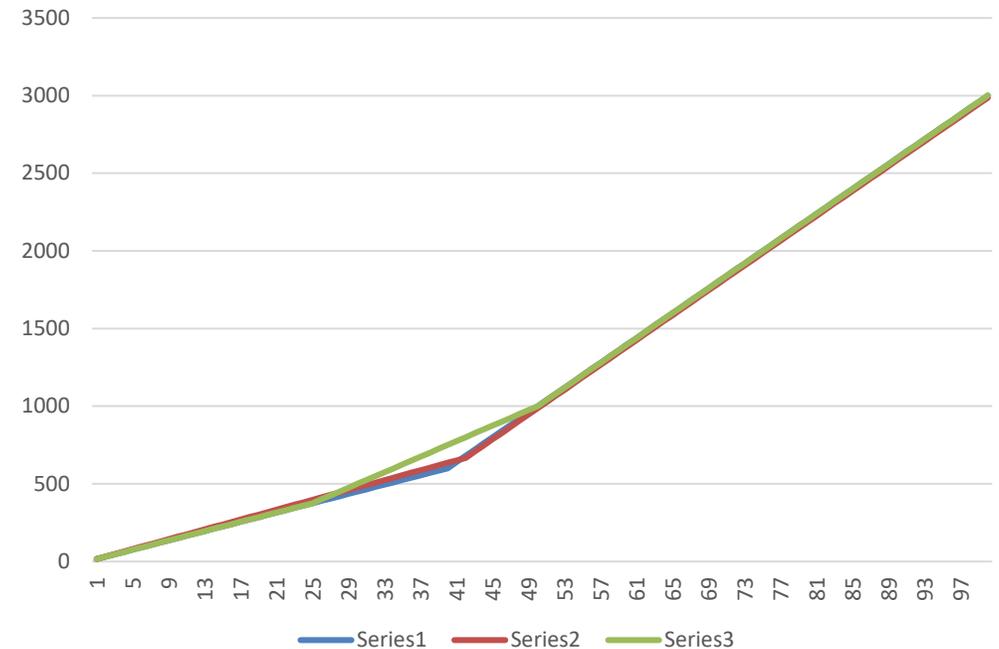
- Essentially, this is “Do we need LED flashers”
- Mu2e’s Cosmic Ray Veto has them, and we stole their design.
 - Parts cost is small compared to redesign cost. So they are “cheaper than free”.
 - However, programming to support this is off-project.
- Decision: **Yes**
- Status: **Closed**

Steel Thickness Distribution

- We have costed 40 planes @ 15mm and 60 at 40 mm.
- US vendors seem less than enthused about 15mm steel, 5/8" is available.
 - That would be 42 planes @ 5/8" and 58 at 40 mm
- Why not three layers? e.g. 25 planes @ 15mm, 25 at 25mm and 50 at 40 mm
- Status: **Open, But**

There's not much difference between the options. Many inputs are fixed or approximately so: 100 layers, distance between ND-LAr and SAND, steel stay-clear and counter thickness.

Small improvements are likely. Large improvements are not.



Summary

- Six of ten design choices are closed
- Four are still open
 - One is almost closed
 - One is closing as the simulation work finishes
 - Two are quite open.