

Minutes – Calibration Task Force Meeting, July 17, 2018

Agenda: <https://indico.fnal.gov/event/17565/>

Attendees: S. Gollapinni, H. Rogers, J. Wang, R. Svoboda, J. Klein, A. Reynolds, T. Junk, G. Horton-Smith, J. Maniera, J. Reichenbacher, V. Pec, J. Stock and possibly others.

Talk 1: Far site logistics call back and discussion – Everyone

Google sheet:

<https://docs.google.com/spreadsheets/d/1WTelb5qEKpS5U1bC5YZgr8T9Noo5XXLjot0ENOAD0gQ/edit#gid=1760148533>

Laser sheets need more work, but, sheets for Muon Tagger, Radioactive source and neutron generator are filled out. Let's discuss any open questions for these.

Radioactive source needs discussion:

SG: Is the cost factor that is driving the no. of systems because you say we can have one system that we can move around 8 ports.

JR: we have a great deal of flexibility here and can optimize based on funding and cost factors. Also, on the read out, we talked about partitioned readout before where we don't have to readout all APAs, one or two APAs can be readout for sources and the rest of the APAs can be regular readout.

SG: Sure, we did talk about partitioned readout, and it is reasonable to do that. I am more concerned that moving one system around multiple ports can be an issue especially if you have to move the system from one end of the cryostat to other. I think two (one on each side) would be minimum in terms of operational efficiency and safety. But, 4 would be optimal. Probably 8 is an overkill.

JR: Yes, Agreed. 4 is optimal because you can have one system fixed and move the other. We also need to understand how easy it is to move parts of the system around e.g. the source and the Purch (?) box.

JR: Also, it would be good to have a technical drawing of the top of the cryostat. Perhaps multiple drawings are needed e.g. drawings for the east and west side in case the clearance is different on either side (we know there is mezzanine on one side).

SG: Also, in the sheet you say you don't need any rack space. Doesn't your system have electronics that are associated with it that might require power and any special power requirements that might require rack space?

JR: We do need power at each feedthrough location and we have motors and vacuum pumps, but no special power requirements.

SG: Okay, so, it seems like you only need minimal rack space even if you have some power requirements. We should get in touch with Grounding and Shielding folks about this.

JR: Yes, the safety reviews will reveal this for us.

JR: In terms of other space requirements around the system, we want to visually monitor things as we are deploying so we would need a small table and chair for a member to sit and use a laptop to control things.

Neutron Generator needs discussion:

SG: There is a question in the spreadsheet if the 2.1 m clearance is from the Cryostat insulation or from the I-beams. Email sent to Jim to get clarification.

RS: I think this clearance is from the cryostat/insulator to mezzanine not from I-beams.

SG: you say the weight of the system (4 tons per system) might be an issue on the cryostat?

RS: Yes, we are thinking of supporting it from the I-beams not placing it on top of I-beams.

JR: Why 4 tons per system?

RS: I think it is driven by the shielding and the moderator, mostly shielding. Jingbo can clarify.

JW: It is due to the moderator and the lead reflector. If we use Ni for the reflector, it can reduce the weight.

RS: should make a note here that 4 tons is the maximum

SG: Is the half rack requirement per system? So, do you need 1.5 racks for the 3 systems?

RS: Yes.

SG: Do you not need network? Otherwise how do you plan to control and monitor the system?

RS: In Super-K, for example, a signal is sent to the DAQ to start data taking. Most LabVIEW. Local experts for control and monitoring. If the expert can sit nearby the system with a laptop to control, that is enough.

SG: But, don't you need the shifters be monitoring (just monitoring not controls) the system while its running? The experts won't it monitoring it full time.

RS: Yeah, maybe, probably just if the system is on or off. I think everything can be monitored by experts. The system only runs for a few minutes max, so monitoring is not a big issue.

JM: don't you want to monitor the rate?

JR: also the neutron flux, right?

RS: the plan is to design the shielding for this.

JR: But, don't you still want to monitor the flux as part of safety?

RS: Yeah, likely, we will know as we go through the safety review.

SG: Do you have any other space needs around the system? For example, some systems have motors or other hardware they would want nearby.

RS: I think a desk with a laptop to operate the system as we start things would be useful.

JW: Concerned about the I-beam structure, not sure if it would lead to requiring additional shielding. Currently don't have it in simulation, need to include it.

RS: Well, we won't put the system on top of I-beams, just use them to support the systems.

Muon Tagger needs discussion:

JK: The sheet says front and top, but it should be front and back, back is easier to do if there is no septum. Of course, top is without a doubt valuable but tricky to get it right due to mezzanine

and space issues. Ritchie filled out these sheets, we did discuss it, but I didn't look at them. Also says 5 tons based on polystyrene density, need to get a better estimate of this as well.

JR: In terms of the integration and installation needs, I think you would have to ship in pieces and integrate it mostly underground? The Integration test facility (ITF) foot print is 100 m x 50 m.

JK: We haven't thought about it yet, is the reason because cage an issue?

JR: Yes, cage and many other things, space available around the cryostat for integration. At the end of the cryostat, we have dual phase, so constrained there as well. Also, we need to know special needs for the ITF, the sooner we know the better.

JK: Will do and take a careful look at the spreadsheet.

Talk 2: Update on Lifetime Studies – Aidan Reynolds

JR: (Slide 10) this is in milliseconds, not microseconds, right?

AR: Yes, it is milliseconds, not micro.

AR: (Slide 11) any comments on what sort of granularity we should aim for the lifetime measurement? and how accurately we want to know lifetime in each spatial bin.

JK: we can easily convert an uncertainty in energy to a requirement on lifetime. (<SG missed some specific numbers here>). It also depends how good the lifetime is. For example, if it is like MicroBooNE where it is all excellent, then no need at all. But, if it is not, then we need to have granular measurement.

JR: There are also requirements coming from the radiopurity group. 3 ms is reasonable. Also, if the HV is not at the desired voltage, then the lifetime requirement becomes more stringent. It is important to consider scenarios like that as well.

SG: Just to add to Josh's point, in MicroBooNE because the detector size is small, it was easy to see lifetime was relatively uniform all across the detector and great, so not a worry. But, given the size of DUNE, when we say lifetime is great, we would want to ensure that it is true across all the detector, so it still requires certain granularity spatially to confirm this and put it off the table.

JK: Yes, agree with Sowjanya. We can say beam events are going to be everywhere, so on an average it is good. But, for bias and resolution, it won't work anymore because here, tails and worst bins matter, so granularity is critical here. Also, this is impacted by fluid flow pattern. CFD is good but it is still a prediction and needs to be validated to fully trust.

JR: ProtoDUNEs would be a test of the CFD simulations and to tune model parameters if needed.

SG: Aidan, you have started with a large number of tracks and finally after the full selection, you have 3300 tracks. It would be good to understand how this translates to how many days of data will give us one reasonable (statistically significant) measurement of lifetime. I remember, we expect 4000 tracks/day/10-kt and APA-CPA crossers (not sure about piercers) are 200 to 500 per day per 10-kt? So, do you need 6 months of data for a single measurement? would be good to understand (just under ideal conditions to start with).

AR: Yes, that is the ultimate goal. I need to talk to Tom about this as he has looked into those statistics for this sample.

JR: BTW Aidan, did you put in a request for MC11? It will start next week.

AR: No, I haven't, will do.

JR: Yes, send me an email.

SG: Juergen, are you leading the production effort for DUNE?

JR: No not me, Jason Stock is coordinating the effort. So, we can put Aidan's request in the pipeline.

SG: some news, it is possible that we will have calibration discussion in Executive Board (EB) this month to start discussion on proposed systems and about moving calibration into consortium.

JK: This is interesting to hear. I haven't heard about this yet. So, what is the plan.

SG: This will be a first discussion. The goal is to move to a consortium structure as we have presented in our talks before. We are preparing a document for EB (largely from what we prepared for the Interim Design Report) before the meeting and if the agenda is confirmed, we will discuss calibration with EB.

JK: Great. Is there a conceptual model for funding (like we saw when other consortia were formed) and will there be a call for institutes to join the consortium?

SG: Currently, as far as I know, no clear conceptual funding model. But, yes, I expect the consortium formation will be announced and institutes will be asked to join.

JK: Great, this is very positive to hear. Thanks to Sowjanya and Kendall for moving this important forward into a consortium. Calibration is clearly something we have heard is very important, so I am glad this is happening.

JR: BTW the source deployment system is being decommissioned from Double Chooz and we will do mock up tests and refitting at SDSU and also use it long term at ProtoDUNE (in about 2 years) for testing. Also, the glove box from the system will be used for the Watchman experiment. For DUNE, we won't need a glove box, instead we will use a purch (?) box. Bob is sending a postdoc to France and there will be 2 graduate students from Sheffield and Liverpool as well who will go to France.

SG: Great, thanks for the update.