

The Fermilab Neutrino Division hosted a workshop on January 20-21, 2016 to introduce the community to the detector R&D facilities available at Fermilab. The workshop was attended by 65 participants, the majority of whom came from the user community outside Fermilab. Several participants were from non-US institutions.

One goal of the workshop was to gather feedback from the community on how to best evolve the facilities currently available at Fermilab for neutrino detector R&D. To that end, the workshop participants were asked to fill out a survey before the workshop to gauge their level of familiarity with the current facilities. After touring the facilities and hearing talks from current users about their experiences with the facilities, the participants took part in a feedback session to provide their input into how Fermilab could evolve its facilities to meet the needs of the community. The feedback session had the format of a panel discussion, with Jonathan Asaadi (UT Arlington), Janet Conrad (MIT) and David Schmitz (U. Chicago) serving on the panel. The discussion was moderated by Brian Rebel (Fermilab Neutrino Division). The questions that sparked the conversation during the discussion session are reproduced below. After each question is a summary of the resulting conversation.

### **What facilities do you see as the most useful at Fermilab for doing detector R&D?**

One panelist stated that facilities where there are multiple things going on in the same building are very productive for detector R&D. It was observed that many aspects of R&D are curiosity-driven, and that one can be inspired by seeing what others are doing. The liquid argon test stands at PAB are a prime example of where this type of synergy happens. The panelist also commented on the benefits of having access to a variety of equipment and areas with plenty of overhead space. The scintillator facility was also mentioned as a good location in which to work.

Another panelist mentioned that DAB and Lab 6 have been really useful during different phases of different experiments. For example, these locations have been helpful in tasks such as construction, testing and small-scale machining. The panelist further mentioned that the ability to find things quickly, have a large quantity of available floor space, and a tech shop are very important in doing detector R&D. The technicians, who are very helpful, are a great resource that should not be overlooked.

One workshop participant asked the panelist whether working at DAB is preferable to working at a home institution. The panelist responded that working it at Fermilab allows one to take the next step. For example, one can make a small test at a university and then get to larger scales with the higher ceiling height and floor space at DAB.

Another workshop participant ask whether Fermilab could make it easier for small universities to come to Fermilab to work.

## **What facilities do you wish were available at Fermilab for doing detector R&D?**

One panelist mentioned that when working with liquid argon one has to wait for a cryostat to cool down or warm up to make adjustments to tests. The panelist noted that in the case of scintillation light detection, what one needs is a 128 nm and 172 nm wavelength light in vacuum which would allow many studies to be done before worrying about the cryogenic component. The panelist concluded that adding a tunable monochromator fixture with a vacuum chamber to the liquid argon test stands would make these tests possible.

Another panelist noted that electronics testing is a major topic of interest and a common testing facility where people can bring their prototypes and run a suite of tests would be very helpful. Perhaps one could construct a large Faraday cage for such work.

The moderator noted that there were many requests during the workshop for a light detection test stand instrumented with a standard photosensor and asked if people thought that would be a useful addition to the facilities. Many participants and panelists voiced the opinion that such a facility would be helpful. One panelist also mentioned that it would be helpful to have a standardized DAQ available as well.

One participant mentioned that for light collection work it would be very nice to have access to a location with some small amount of shielding from cosmic neutrons and gammas. A cubic meter of water equivalent shielding surrounding a dark box was suggested.

Another participant noted that at one point Fermilab had standardized equipment within the detector development group to support R&D but that it was not clear what happened to that facility. One of the panelists replied that the group of R&D people from the Lederman era were extraordinarily successful, and that until recently many people have been able to assemble the devices built during that era in various configurations in order to make progress. However, now those solutions are no longer effective and we need to start making that kind of progress in detectors again. The panelist concluded that continued support of detector R&D is important for doing so.

## **What aspects of doing detector R&D at Fermilab have attracted/still attract you to using the facilities?**

One panelist summed up the answer as, "The people; technical and other." Another said that while the local expertise at Fermilab is very important, the fact that Fermilab is the crossroads of the field is even more so as it results in ideas and advances that would otherwise take longer. The final panelist noted that there is a creative environment at Fermilab that one gets from working among other people.

## **What aspects of doing detector R&D have deterred you/still deter you from using the facilities?**

One panelist noted that there is some folklore about hurdles that one has to overcome to get things done. The panelist noted the term “folklore” was used to acknowledge the possibility that it might be true and that increasing communication is key to avoiding that kind of impression. As a concrete example, the panelist noted that sometimes at Fermilab if one needed tools or similar equipment, one may not know where to find it and that can waste time. It was noted that at Fermilab, MCenter is a good example of where one is able to work easily as there are common tools are available that are well located and labeled. Another panelist had heard complaints about safety protocols causing barriers or hurdles, but that panelist noted from experience if one reaches out and contacts the person who is doing the safety walkthrough the process will go smoothly. Communication ahead of time, such as sending schematics, drawings, or plans made the process go much more smoothly and that the process will likely make the experiment better too. The final panelist noted that life for users has become more difficult since that panelist first started visiting the lab. There was a concern that there is not enough desk space anymore and that the make up of the lab has switched from 80% users and 20% staff to the other way around. The panelist noted that the situation is very unpleasant and unwelcoming to university users. The panelist noted that the R&D areas are a respite for this problem.

One workshop participant noted that from the student perspective, some students love it here, some hate it, and the FSPA is trying to improve the situation by working with the UEC. The participant noted that housing is an area that needs help and comments directed to the right people could help make the necessary changes happen.

## **How do we make the facilities best serve the current program while still allowing for new ideas and innovation for the future?**

One panelist said that many of the recent projects have had aggressive schedules which meant that when a problem arises one has to have a focus team directed at solving the problem and the effort often ends up being R&D. The panelist noted that within the experiments and projects there is sometimes resistance to allowing the R&D to happen or be broad enough to benefit the whole community. The panelist concluded that it would be nice to have the support to make the process function better so that the targeted R&D for a project can benefit more people in the end.

One workshop participant noted the importance of encouraging non-project-specific R&D such as ANNIE. The participant also noted that some of the R&D could become important in the future, even though it is not a main mission of the lab.

Steve Brice, Deputy Head of the Neutrino Division, responded to that comment by saying balance is a constant struggle, but where we've seen success in the past (and probably in the future) is facilities that serve the needs of an experiment but have a longer-term life after the experiment is finished, to serve the needs of more generic R&D

in the future. Examples mentioned were the DUNE 35-ton prototype and ANNIE. People should think about this when there are facilities coming online: how could you develop the facility to make it useful in the future, after the immediate use is finished.

Another participant indicated the importance of having people in charge who have broad view of the needs of the field.

One panelist indicated that there is a lot of pressure on the lab to adhere to the P5 recommendations. The panelist stated that the community needs to think about it carefully and make sure we can deliver what we promise, but at the same time we don't want to collapse down to just a few small projects. The panelist noted the importance of communication with the directorate to keep a good balance. A participant responded to that statement by reminding everyone that the community just went through a vast discussion of this (P5), and then gave it to Congress. The participant said the scheme is basically working, and that while having discussions is useful, the community also has to understand that the people who support science are very influenced by P5. The participant concluded that since P5 was put forth by our community's plan, we can't just say that it's wrong and go on our own path. Another panelist responded that this question should not be interpreted as people trying to redirect the path at a large scale. Instead, the panelist noted, we should continue these small R&D successes. The panelist pointed out the importance of advertising successes like the optical TPC that communicated with LArIAT and ran alongside them, and ANNIE, so that we can make these kinds of good communication continue, which will benefit the field in the future.

### **What issues related to doing detector R&D at FNAL that you wanted to discuss, were not covered in this workshop?**

A participant noted that ANNIE is a good example of recycling equipment and that often those items are not neatly catalogued, but one can find them by talking to people. The participant encouraged people to do that saying that people at Fermilab are very good about redirecting you to the right person.

Another participant noted that Fermilab has a lot of engineering & computing resources and wanted to know if there was some way to make those resources more available to the community. Steve Brice replied that if people are interested in those kinds of resources they should work with the Neutrino Division as small scale requests for resources like that can be handled at the division level while larger scale requests need to go to PAC. Jonathan Lewis of the Particle Physics Division noted that there is a lot of matrixed effort in PPD and ND. He said that while it is not possible to divert someone from a critical task, the divisions will do their best to match the right person to the right task.

A member of the ND Operations Support Group expressed a desire for a dedicated team who can address lower-level technical issues to help experiments start running. The support group would also like to be able to help people work safely at the lab.

