Response to
Advisory Board Recommendations
November 2020

1. Agenda, major items for discussion and materials should be available a week ahead of the AB meeting.

   Materials & discussion items should be available to Ad Board on Nov. 1 for Nov. 14 meeting.

2. Expanding the teacher pool. Reserve some of the data camp slots for recruiting new teachers and to allow new teachers to apply.

   The abrupt switch to a virtual "coding camp" meant that we could accept veteran applicants, and therefore we had no trouble with recruitment. Staff has not yet heard about any success in making a challenging task related to neutrinos but are hopeful that the new neutrino fellows will have some good ideas on this front.

   Consider recruitment bonus for teachers that recruit other teachers?

   We are not able to budget for recruitment bonuses at the time.

   Can the cosmic ray detectors be used as a recruitment and collaboration tool?

   Yes. Recycling current cosmic ray detectors continues, and components exist to supply a dozen new detectors; however, a mentor should drive teacher recruitment. The mentor must feel that supporting cosmic ray experiments is part of the center activities. He or she can also reassign detectors within the group of teachers.

3. Are there other ways to get communications out to QuarkNet members?

   This recommendation triggered thoughts about improving our social media footprint. That is one of the agenda items for staff discussion; however, some staff members remain skeptical due to concerns that both the effectiveness-to-effort and signal-to-noise ratios may be low. This year we have added videoconference opportunities beyond virtual workshops, like QED, SST, and QW2.

4. Is it possible to evaluate international aspect of program and connections with other efforts?

   For the most part, our international efforts and connections with other efforts are over and above the stated goals of our program. They are not supported by the QuarkNet budget, with the exception of an annual trip to IPPOG and STEP UP which is evaluated through workshops. Also, these activities are outreach and broader impacts by nature, as opposed to professional development for teachers. For these reasons, we believe that the focus of our evaluation should remain on the national QuarkNet program.

5. Data Activities Portfolio

   Congratulations to cleaning up the portfolio.

   Add feedback form to the Data Activities Portfolio.

   We developed a survey that is posted on the front page of the Data Activities Portfolio. The survey allows any teacher, not just QuarkNet teachers, to provide feedback since access to the Data Activities Portfolio is open to the public.

   Allows potential new teachers to contact QuarkNet.

Provides feedback and user information on activities.

6. Other Masterclasses?
   Neutrino Oscillations
   We are working on a NOvA Masterclass with UNM and possibly FNAL.
   Dark Matter – At the LHC this would be missing energy, and there are also direct-detection experiments.
   Darkside (Gran Sasso) has developed a masterclass and proposed it to International Masterclasses.
   LIGO – If LOGO sets it up, it would be available.
   LIGO-Virgo may be working on a Multi-messenger Astronomy Masterclass; if and when it becomes available, we will consider whether it is appropriate for QuarkNet.

7. Prioritize IT tasks by reserving some time each year to work on important but not urgent projects, as well as by finding student interns.
   Neither of those turned out to be very practical suggestions. Pretty much everything Joel does prioritizes itself by urgency, and we don't have any mechanism for obtaining student interns.

8. Reaching underrepresented groups.
   Congratulations to the expanded effort.
   Maintain flexibility for opportunities.
   We collaborate with other organizations and individuals to bring QuarkNet activities to a more diverse audience. We partnered with the American Association of Physics Teachers (AAPT) via the Committee on Contemporary Physics. Prior to the AAPT winter meeting in Orlando, Florida, staff presented QuarkNet activities to students in Title I schools.

   Staff continues to work with Agnes Chavez, an artist from New Mexico, to present STEAM (science, technology, engineering, arts, mathematics) workshops. A wide range of students including many from underrepresented groups in physics attended the (I=)UNIVERSE workshop.

   Plans for the future:
   Staff will pilot needs assessments in regions with diverse student populations and work with local teachers to develop better strategies that support teachers of underrepresented groups.

   To reach more teachers of underrepresented groups in physics, staff is planning a workshop for lead teachers that includes methods of engaging these teachers in the local QuarkNet program.

   Bring QuarkNet into STEP UP – So far, this connection only goes in one direction.
   This is a sensitive situation in which we needed to be cautious collaborators. With care, we have found a way to adapt STEP UP materials to support our centers. Feedback from staff, fellows and the virtual center provided guidance for setting up virtual workshops to engage participants, not just presenters, to use a series of STEP UP-related slides. Staff developed activities for teachers to use with students and materials for ambassadors/fellows to use in

workshops. These activities were incorporated into STEP UP materials for the Summer Summit 2020 meeting for STEP UP Ambassadors. Staff also developed a survey to seek feedback from QuarkNet teachers who implemented these STEP UP-related activities. In addition, STEP UP principals are incorporated into our content workshops.

9. Consider also using cheaper cosmic ray detectors.
   These continue to be attractive options to explore, even though cheaper also means their functionality is limited. This could include commercial products.

   Staff discussed goals for and limitations of cheaper cosmic ray detectors. Inexpensive detectors are slower and would not have absolute time stamps, so speed and shower experiments would be impractical; however, simple counting experiments are fine. The goal would be to have a set (~20 detectors) for use in a full classroom as an introduction to studying cosmic rays. Detectors must be able to perform two-fold coincidences so calibration, plateauing, and understanding backgrounds are possible. The Cosmic Watch appears to satisfy these criteria. A plan was developed to build a set at Notre Dame in Summer 2020 and have a teacher test this model in their classroom; however, COVID restrictions tabled that effort even before funding was identified.

   We recruited a new comic ray fellow, Dan Kallenberg, with Cosmic Watch experience. He and staff assessed the performance of several Cosmic Watches at Fermilab. Production quality limited the assessment; however, the detectors appear to have the functionality to satisfy our goals. The current processor seems too slow; can't support both visual displays and data readout simultaneously. We should build another few prototype detectors with improved processors and reassessed more rigorously.

   Ken arranged a virtual international meeting for those interested in Cosmic Watches where Kazuo Tanaka (Tohoku University, Japan) shared his experience with dozens of detectors. Dan is consulting him about components for the latest design.

   We have discussed lowering the cost of existing QuarkNet detectors by use of SiPMs; however, the $500 price tag of the DAQ makes the current design too expensive for detectors for a whole class.