

# Proposal: 2020 QuarkNet Coding Camp

## Background

For many years, the QuarkNet Data Camp has been a popular and successful outreach workshop for teachers, bringing them to Fermilab from all over the country to participate in a variety of activities including tours, lectures, data analysis activities, and teacher lesson planning. Since 2014, this camp has been organized and administered by QuarkNet's Teaching & Learning (T&L) Fellows.

The recent public health concerns have made the traditional Data Camp model unrealistic and potentially unsafe. Therefore, the T&L fellows have decided to pivot to a virtual asynchronous model - for the time being, simply named Coding Camp - which will still meet several of the Data Camp goals, incorporate new programming goals for both teachers and students, and allow time flexibility for participants who have increased demands on their time at home.

We hope to run this camp up to two times during the summer of 2020. The first session will be our pilot run and will take place in late June or early July, and accommodate up to 12 participants. The second session will be contingent on the success of the first, and if it takes place, will occur in late July or early August.

## Goals

1. Review and re-teach core concepts of particle physics, such as the framework of the Standard Model, the anatomy of a particle accelerator and detector, and the methods for calculating invariant mass from 4-vector data.
2. Review and apply basic aspects of computer programming in Python, such as conditionals, math functions and plotting, and file manipulation.
3. Use simple programming tools to analyze large datasets generated from the CMS experiment in the 2010 and 2011 runs, and run analyses of these data. Generate conclusions about these analyses that include both calculations and plots (e.g. of invariant or transverse mass).
4. Search for new scientific datasets available online and write code to perform analyses of these new data.
5. Design a series of code-centered activities that either append to existing units in a high school physics course, or replace an already existing activity; create a plan for implementation of these activities.

## Evaluation

1. Program will be open to evaluation by Race & Associates, and the T&L fellows are in ongoing talks with Kathy Race to ensure the camp is built from the ground up in a logical and coherent manner according to her criteria.
2. T&L Fellows will evaluate the participants continually and informally by monitoring their process and their completion of periodic “progress milestones” in a manner analogous to that used in Data Camp.
3. Fellows will evaluate the participants formally by requiring “deliverables” at the end of the workshop, in the form of the activities and lesson plans described in Goal 5 above.
4. The participants will evaluate themselves using daily surveys designed for them to self-reflect and comment on their progress and satisfaction with the camp activities. They’ll provide final feedback to the T&L Fellows in an exit survey, and complete a program evaluation questionnaire for Race & Associates.

## Budget (estimated)

<i>Item</i>	<i>Qty</i>	<i>Cost per Unit</i>	<i>Subtotal</i>	<i>Details</i>
Fellows Expenses	3	\$300	\$900	Miscellaneous needs for fellows to prepare and implement the workshop: hardware, software, etc. Receipts will be submitted to Anne
Fellows Daily Rate	45	\$125	\$5,625	Stipends for 15 days per Fellow: 5 days for planning and post-workshop debrief; 5 days for each workshop
Teacher Stipends	24	\$500	\$12,000	The usual stipend amount for Data Camp: \$100 per day per participant, up to 24 participants
Teacher Expenses	24	\$250	\$6,000	Small fund for participants to purchase equipment for virtual workshop: microphones, headsets, a cheap Chromebook, etc. Note: <b>this replaces the usual per diem for food.</b>
Emergency Expenses	1	\$2,000	\$2,000	A general fund for expenses above and beyond the baseline amount; e.g. if a teacher doesn't have access to a computer or internet at home. We anticipate not using this fund except in an emergency.
<b>Total</b>				<b>\$26,525.00</b>

## Appendix 1: Itinerary

- Prior to Camp
  - The “Swim Test:”
    - Complete assigned reading
    - Watch instructional videos
    - Complete simple coding tasks using a Jupyter notebook
  - Procure all needed hardware
  - Make arrangements to be open and available for AM and PM work sessions
- Monday
  - AM All Hands, “Lecture Hall” - Meet and Greet; cover norms and expectations; review results of swim test activities
  - AM Small Group sessions: Break into partner groups and join “small meeting rooms” to complete basic physics and coding tasks
  - PM All Hands: debrief the AM session, discuss obstacles and improvements, assign tasks for following AM meeting
  - PM Small Group sessions: continue and complete introductory coding tasks and physics conceptual goals
  - Ongoing: check in with Fellows throughout the day by re-joining Lecture Hall; complete daily feedback survey at the end of their workday
- Tuesday, Wednesday
  - AM All Hands, Lecture Hall: participants share their work and successes from previous day’s sessions
  - AM Small group sessions: work on second-level coding tasks and data analysis
  - PM All Hands: debrief the day, discuss obstacles and improvements, assign tasks for following AM meeting
  - PM Small Group sessions: complete second level coding tasks and begin the “big” data analysis task
  - Ongoing: check in with Fellows throughout the day by re-joining Lecture Hall; complete daily feedback survey at the end of their workday
- Thursday
  - AM All Hands, Lecture Hall: participants present their “big analysis” project and interesting results; Fellows introduce the teacher-hat phase involving exploring new datasets
  - AM Small group OR individual sessions: explore a new dataset and write code to perform an analysis
  - PM All Hands: share preliminary results of explorations; Fellows instruct participants to begin writing a lesson plan linked to their exploratory coding project, intended to provide their students the same opportunities
  - PM Small Group sessions: complete exploratory coding project and lesson plans
  - Ongoing: check in with Fellows throughout the day by re-joining Lecture Hall; complete daily feedback survey at the end of their workday
- Friday
  - AM All Hands, Lecture Hall: participants share their completed exploratory project and its associated lesson plan
  - AM Individual sessions: develop unit plan (for a block of consecutive classes OR interspersed throughout course) for multiple student coding activities
  - PM All Hands: briefly share unit plan drafts; Fellows provide instructions for submitting final plans and completing program evaluation
  - PM Individual sessions: complete and submit unit plans; fill out exit survey and evaluator questionnaire