

Software Training Outreach (in IRISHEP-QuarkNet)

26th International Conference on Computing in High Energy & Nuclear Physics (CHEP 2023)

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Overview.

- IRIS-HEP workforce development activities contribute to the preparation of a highly qualified STEM workforce
- Several events organized
- Connect with Physics teachers
 - Growing partnership with QuarkNet
 - Run additional summer coding camps for K-12 teachers in US
 - Software training outreach in Puerto Rico
 - Social media (Facebook groups)
 - Society of Physics teachers
- Serves as an opportunity for the to perform public engagement and impact the nation's STEM education





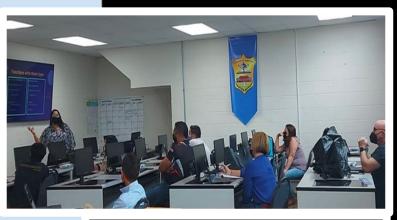
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That kind of feedback is music to the ears of Sudhir Malik, associate professor of physics at the University of Puerto Rico, Mayagüez Campus. Malik is part of IRIS-HEP and collaborating principal investigator (with Elmer) on a related NSF-funded project called "Framework for Integrated Software Training for High Energy Physics," or FIRST-HEP. Malik and his colleagues are responsible for prototyping various outreach and training ideas such as hackathons and programming workshops for STEM teachers.

Said Malik: "While our core software training model is built around high energy physics institutes, universities and national labs worldwide, it is also well positioned to engage corresponding local communities of K-12 teachers and student is ISTEM disciplines in cybertraining and software skills. We recently launched several activities, including software workshops, machine learning hackathons and Python programming for STEM teachers, which are all steps in this direction."

Outreach events

Year	Month	Name	Participants/ Tutors
2022	July	Coding Camp at Fermilab (1 week) with QuarkNet	21/5
2022	Mar	<u>Data Analysis for Lab Research</u> <u>(Virtual)</u> (1 day)	20/3
2021	Aug	Arduino Micro Controller and C++ programming (STEM Teachers) (In person) (2 days)	9/3
	Feb	<u>Machine Learning Basics for STEM</u> teachers (Virtual) (2 days)	8/3
2020	July	<u>Data Analysis for STEM teachers</u> (Virtual) (2 days)	16/3
	June	Data Camp for STEM teachers (Virtual) (1 day)	11/3
2019	June	An introduction to programming for STEM teachers (2 days)	16/1
	April	<u>Machine Learning</u> Workshop/Hackathon (3 days)	25/1



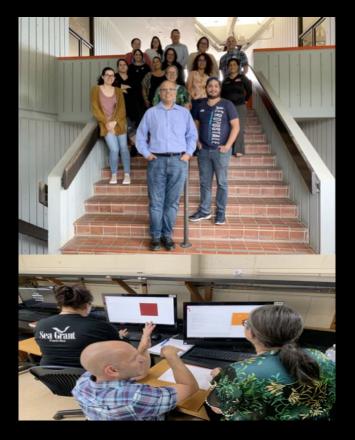
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Workshop and Engagement



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- Introduction to Programming
- Python, Jupyter notebooks, Colab
- hands-on Data analysis
- HEP data preview with CMS Open Data Examples

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IRISHEP & QuarkNet

To implement a strategic plan for training high school teachers, IRISHEP and QuarkNet have developed a program QuarkNet to provide software training paths from science teachers



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Communications

Friday Flyer - September



Submitted by kcecire on Fri, 09/09/2022 - 08:17

Friday Flyer/News Welcome back to the new school year and to your Friday Flyer. W



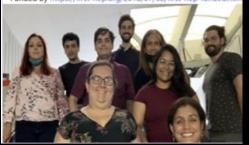
Spotlight on Summer 2022

Summer 2020 was the season the pandemic back. Now, in 2022, we are back. How busy ! is designed, and the new visics (IRIS-HEP) # and

Social Media

Maestros de Fisica de Puerto Rico

Taller de Python 101!!! Pendiente a nuestros próximos talleres... Funded by https://first-hep.org/2018/07/02/first-hep-funded.htm





Meetings

Coding Fellows Meeting Logs

Adam's Zoom link

Next meeting

Anyone using ChatGPT for teaching, physics, coding?

Monday, April 3

In attendance: Adam, Peter, Chris H, Chris D, Tracle, Mark, Danelix, Megan

Rolef connectionments

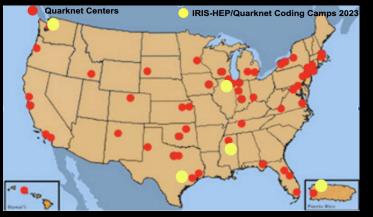
- Who could you encourage to apply to Data Camp. Coding Camps 0, 1, or 2? A personal email can make a big difference.
- folders for summer workshops are in the Shared Drive. Add info as you're able.
- We need a short paragraph to advertise the summer short workshops that would help ecruit a range of teachers (teachers who've never heard of QuarkNet, experienced coders, etc). Anyone want to draft that? Here's the text on the (RIS-HEP site and the Coding Camps page. If that helps

Discussion items

IRIS-HEP/Quarknet Partnership

QuarkNet

- Brings real research experience to high school Science teachers, students, and classrooms.
- QuarkNet has ~50 centers in universities and laboratories participating in high energy physics experiments



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IRIS-HEP

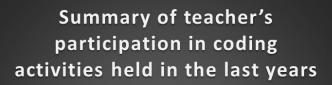
 Growing partnership with QuarkNet to run additional summer coding camps for K-12 teachers

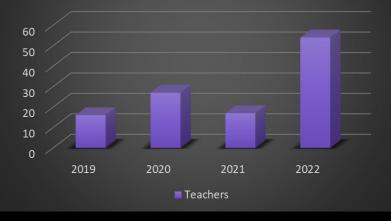
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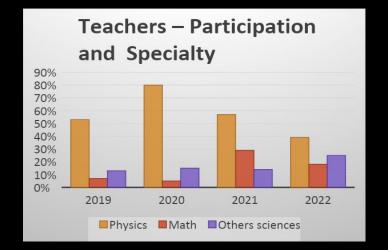
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QuarkNet Coding Activities Participation







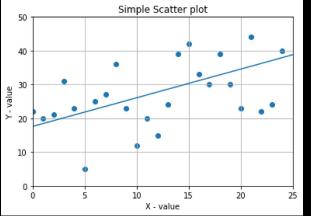
Quark

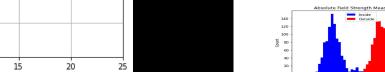
- Teacher participation has increased over the years
- Teachers develop educational material at the end of the workshop e.g. python notebooks on physics topics for students
- Inclusive more teachers of different specialties
- Increase the cross-cultural and diversity in the teacher's participation

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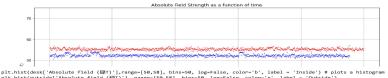
Coding Camp content

- Coding Camp (google colab, Jupyter notebooks)
- Data Visualization: Plot a function with lines, pace and customize plots with pyplot, define a function.
- B-field Variation: Analyze data from mobile app
- Muon Tracks: Analyze tracker data from muons in CMS \mathbf{O}
- Muon Tracks with Machine Learning: Repeat the muon tracks analysis with several machine learning









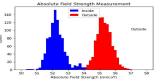
plt.hist(outside['Absolute field (碌T)'], range=[50,58], bins=50, log=False, color='r', label = 'Outside' plt.ylabel('Count')

plt.xlabel('Absolute Field Strength (mircoT)

plt.title('Absolute Field Strength Measurement'

plt.legend (loc='upper center') # In graph legend NOTE: must define labels as done in the first 2 lines plt.annotate ('Outside', xy=(57, 100)) # In graph text

plt.show (



Objectives





Review and reteach 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 conditional, math functions and plotting, and file manipulation.



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).



Search for new scientific datasets available online and write code to perform analyses of these new data.



Design a series of code-centered activities that either add onto existing units in a high school physics course or replace an already existing activity; create a plan from implementation of these activities.

Implementation Plan

Programming with nython

Start learning now

€ Contribute

Matplotlib for HEP

* Status: Beta testina

Start learning now

F Contribute

Make science prettier with beautiful

Get started with an incredibly popula

programming language.

plots!

Modules

The curriculum is comprised of a set of standardized modules, so that students can focus on what is most relevant to them.

The modules

Basics

The UNIX Shell Version controlling with git A guide through the basics of the file Track code changes, undo mistakes systems and the shell. collaborate. This module is a must. Start learning now! Start learning now € Contribute SSH Machine learning Introduction to the Secure Shell (SSH Get behind the buzzword and teach machines to work for you intelligently! A Status: Early development Start learning now! Start learning now H Match the videor F Contribute

ROOT The most famous data analysis ramework used in HEP. Start learning now!

F Contribute!

Software Development and Deployment

Control and the same that the integration of the integration of

"student hat" Engage, Explore, Explain

- Teachers work in groups
- Running Python code
- Using pre-Jupyter
 notebook
- Review basic coding
- Use CMS data



"teacher hat" Elaborate and Evaluate

 Teachers develop implementation plans for their own classroom Writing Jupyter notebook

 Adapt and apply appropriately to their classroom



Upcoming Plans





More Workshops across the nation

More virtual Workshops - Spanish and English language More HEP data relevant to HS Physics content

Coding Camps

- Engage in Coding Techniques
- 2 or 3 days in basic programming
- More model-fitting and ML



Thanks for your attention!

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