

QuarkNet in LHC Education and Outreach

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QuarkNet

QuarkNet is a teacher professional development program funded by the United States National Science Foundation, US-ATLAS, and US-CMS. It includes nearly 50 centers located at universities and national laboratories across the United States. *QuarkNet provides science teachers the means to develop their skills and bring real research experience into the high school science classroom.*



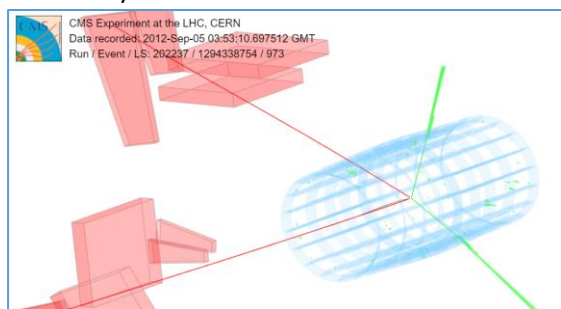
QuarkNet centers across the United States.

International Masterclasses

QuarkNet works with the International Particle Physics Outreach Group (IPPOG) to develop and support International Masterclasses (IMC) each year.

CMS

Students classify dimuon events in a J/Ψ measurement for in-school masterclasses. The WZH measurement is for IMC. Students use an event display to classify events based on number and curvature of tracks, missing E_T , and more. Students create mass plots and investigate lepton universality as well as the $W^+ : W^-$ ratio.



A 2-muon, 2-electron event in iSpy, the event display for the CMS masterclass. Muons show as red and electrons as green.

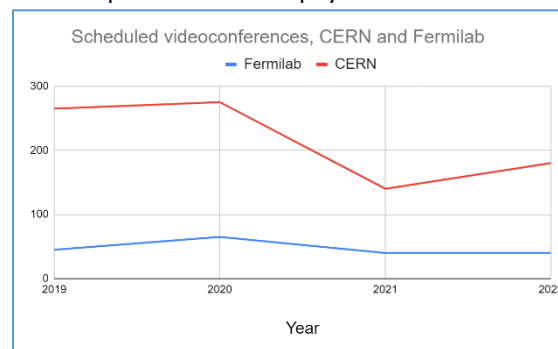
ATLAS

QuarkNet supports and promotes the ATLAS Z-path measurement for International Masterclasses. Students search for Z mass

resonances and other phenomena. There are also Monte Carlo insertions to suggest hypothetical particles such as the Z' .

Fermilab Videoconferences

Masterclass videoconferences enable students to interact with other students and physicists connected to Fermilab. They discuss their results with moderators and ask questions which range across topics in and out of physics.



Scheduled masterclass videoconferences at CERN and Fermilab, 2019-2022. Most 2020 videoconferences were ultimately canceled due to the pandemic.

World Wide Data Day

World Wide Data Day is a chance for students to make a simple ATLAS or CMS analysis in about two hours from beginning to end at their schools. It concludes with an international videoconference with physicist moderators and other students.

Additional CMS Opportunities

Data Camp is a week-long workshop offered at Fermilab to 24 QuarkNet teachers each year. Participants reduce csv files of CMS data and make mass plots of Z, W, J/Ψ , and other particles using spreadsheets and python notebooks. Also offered: QuarkNet Coding Workshops and a Coding Camp.

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