



QuarkNet Data Portfolio and Activities

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IPPOG Fall 2018 Meeting

4 October 2018

Data Portfolio Goals

Make current physics accessible to high school teachers and students

Establish a resource on the Web of tested lessons vetted against best practices in instructional design

Develop pedagogical pathways to guide teachers in selecting modern physics lessons for the classroom

Data Portfolio

The Data Portfolio is available at:

<https://quarknet.org/data-portfolio>



QuarkNet Data Portfolio


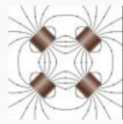

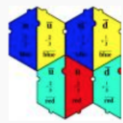

The Data Portfolio is a compendium of activities organized by data strand and level of student engagement. Follow the links provided for information about using the Data Portfolio to plan your students' experience. **Level descriptions** explain the data analysis skills that students apply at each level: tasks in Level 0 are simpler than those in Levels 1 and 2. While each level can be explored individually, students who start in one level and progress to more complex levels experience increasingly engaging and challenging tasks.

Sample pathways provide a progression of activities to help students better understand practices that lead to discovery. Each sample pathway is matched to a particular data strand and a particular skill set.

Data Strand	Level	NGSS Practices	Topic	
- Any -	- Any -	- Any -	- Any -	Apply

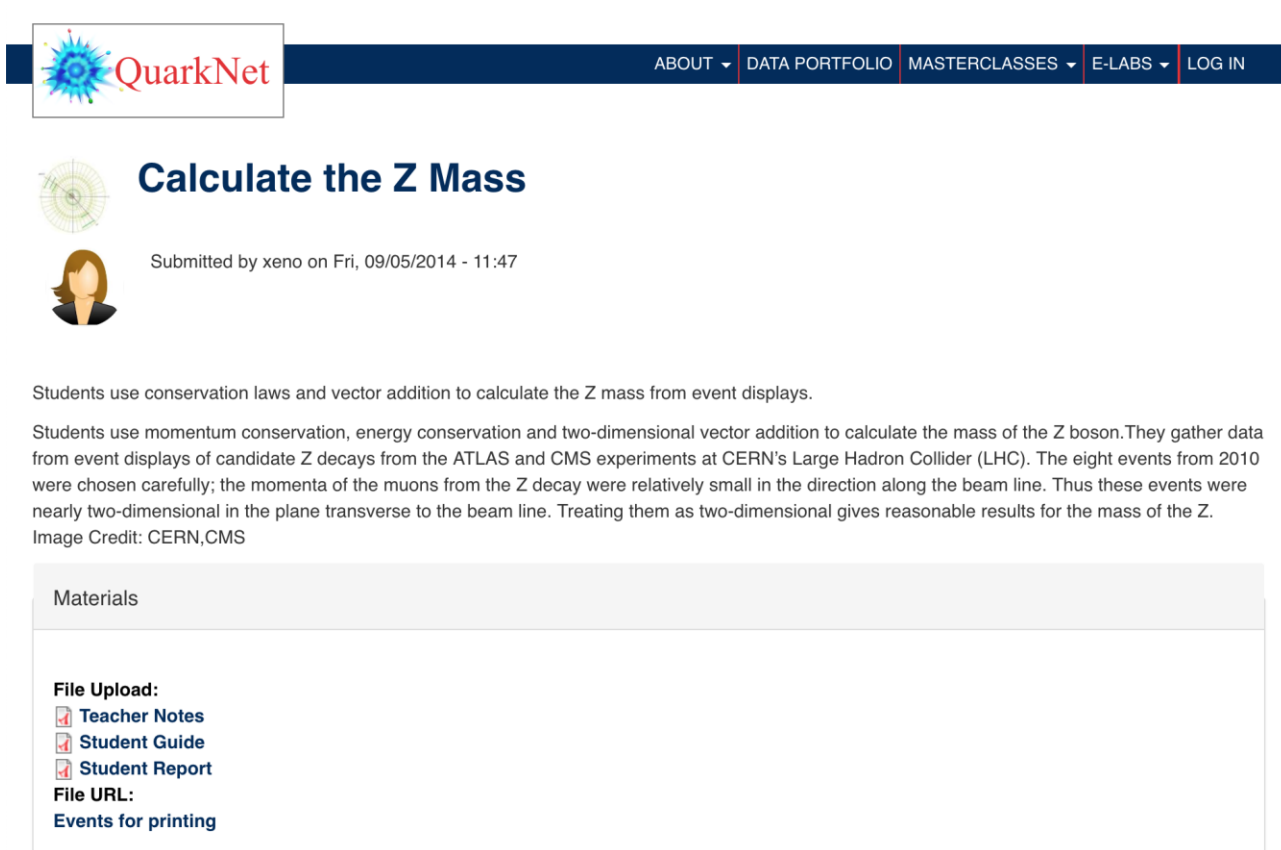
Accessing Activities

Activities are all free and available for download. Each is keyed to one or more Data Strands, a Level of complexity, Science and Engineering Practices, and one or more Topics

		ABOUT DATA PORTFOLIO MASTER			
ACTIVITY NAME	DATA STRAND	LEVEL ▲	NGSS PRACTICES	TOPIC	
 <p>Making it 'Round the Bend - Qualitative Students explore the effects of electric and magnetic fields on particles.</p>	LHC	Level 0	4, 5, 7	Electric Potential, Lorentz Force, Motion of Charged Particles	
 <p>Mass of U.S. Pennies Students create and interpret a histogram of penny masses.</p>	Cosmic Ray, LHC	Level 0	1, 3, 4, 7	Data Analysis, Measurement	
 <p>Quark Workbench 2D/3D Students use Standard Model rules to build hadrons and mesons from quarks.</p>	Cosmic Ray, LHC	Level 0	2, 6	Particle Composition	
 <p>Dice, Histograms & Probability Students roll dice, record the resulting individual values as well as the sum of the values, create histograms of the data and develop insight into the concept of "degrees of freedom."</p>	Cosmic Ray, LHC	Level 0	1, 2, 3, 4, 5, 6, 7, 8	Data Analysis, Measurement	

Inside a Lesson

When you go to a lesson page, you will see links for a student page, a teacher page, and any data files or supplemental materials you need.



The screenshot shows the QuarkNet website interface. At the top is a dark blue navigation bar with the QuarkNet logo on the left and menu items: ABOUT, DATA PORTFOLIO, MASTERCLASSES, E-LABS, and LOG IN. Below the navigation bar is a white header area with a circular diagram icon and the title "Calculate the Z Mass". Under the title is a user profile picture and the text "Submitted by xeno on Fri, 09/05/2014 - 11:47". The main content area contains two paragraphs of text describing the lesson's focus on conservation laws and vector addition for calculating the Z boson mass. Below the text is a "Materials" section with a list of links: Teacher Notes, Student Guide, Student Report, File URL, and Events for printing.

QuarkNet ABOUT DATA PORTFOLIO MASTERCLASSES E-LABS LOG IN

Calculate the Z Mass

Submitted by xeno on Fri, 09/05/2014 - 11:47

Students use conservation laws and vector addition to calculate the Z mass from event displays.

Students use momentum conservation, energy conservation and two-dimensional vector addition to calculate the mass of the Z boson. They gather data from event displays of candidate Z decays from the ATLAS and CMS experiments at CERN's Large Hadron Collider (LHC). The eight events from 2010 were chosen carefully; the momenta of the muons from the Z decay were relatively small in the direction along the beam line. Thus these events were nearly two-dimensional in the plane transverse to the beam line. Treating them as two-dimensional gives reasonable results for the mass of the Z. Image Credit: CERN, CMS

Materials

File Upload:

- Teacher Notes
- Student Guide
- Student Report

File URL:

Events for printing

Path Structure

Level 0 lessons help build knowledge and skill base.

Complexity builds through Level 3; hoping to implement Level 4 lessons in this grant cycle.

We are also planning to expand neutrino content, which brings us to our activity for the day:

Neutrinos in the Classroom (MINERvA activity)

This is an activity where students can use events from the MINERvA detector to estimate the muon lifetime.

Students look for events in which a muon stops in the detector, measure how long it takes the muon to decay, and then plot that data collectively to make the measurement.

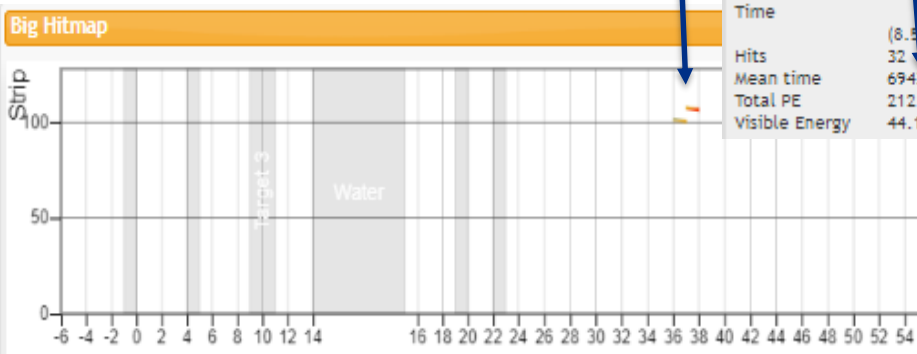
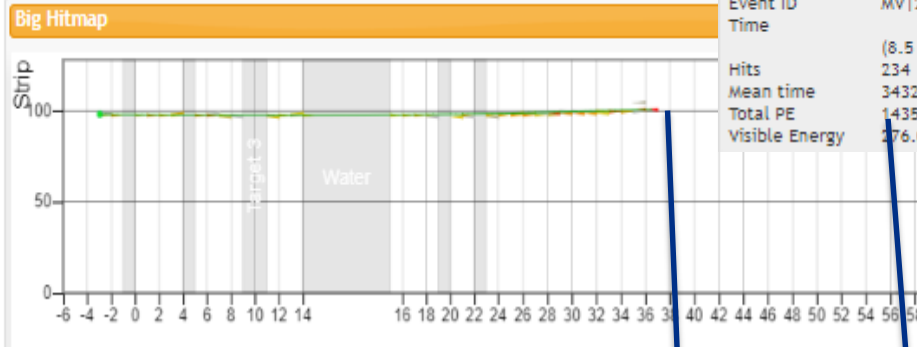
http://neutrino-classroom.org/particle_decay.html

Measurement

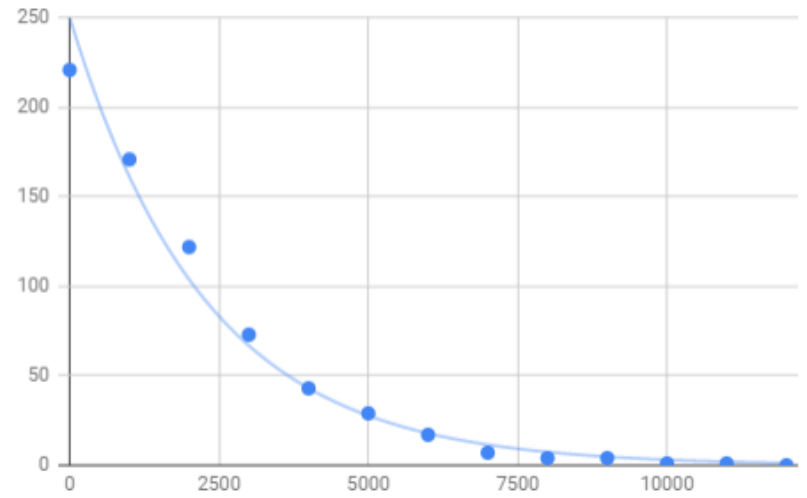


Slice Info	
Slice	3 of 12
Event ID	MV 2072 18 670
Time	(8.5 years ago)
Hits	234
Mean time	3432 ns
Total PE	1435 pe
Visible Energy	176.0 MeV

Slice Info	
Slice	10 of 12
Event ID	MV 2072
Time	(8.5 years ago)
Hits	32
Mean time	6943 ns
Total PE	212 pe
Visible Energy	44.1 MeV



Time (ns) and Muons not decayed



Questions for you:

What are the enduring understandings that you think students should take away from this activity?

What do you think students should be able to do as a result of completing this activity?

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Content and Caption Slide [28pt Bold]

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Picture and Caption Slide [28pt Bold]

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Collaborations / Partnerships / Members 28pt Bold



UNIVERSITY OF MINNESOTA



KANSAS STATE
UNIVERSITY



NORTHWESTERN
UNIVERSITY



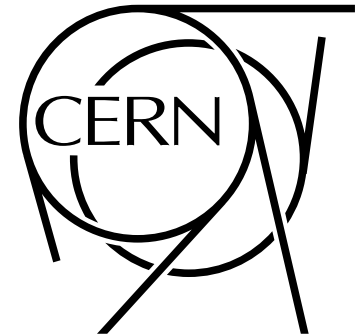
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