QuarkNet: Supporting Physics Teacher Communities for 25+ Years

https://www.quarknet.org

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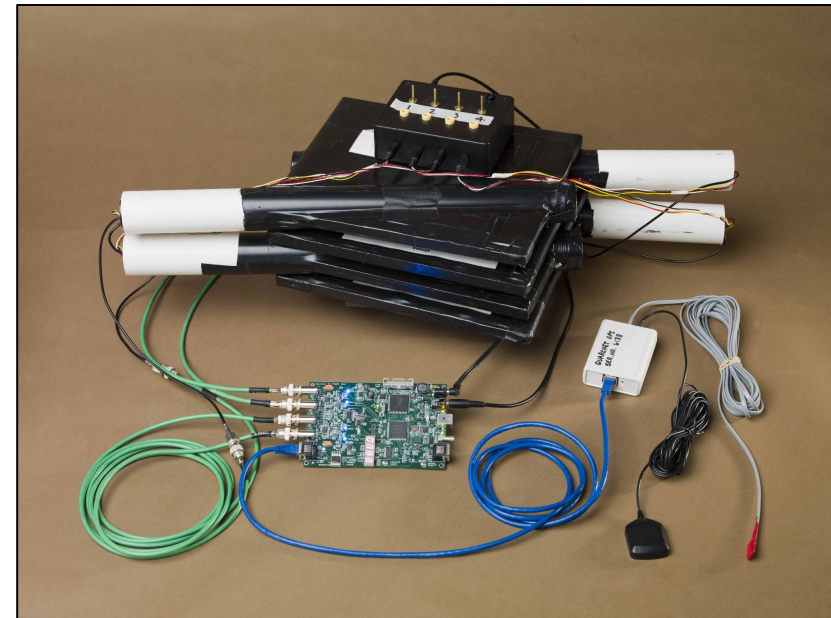PhysTEC @ AAPT – SM24 – July 8, 2024

Supporting Physics Teacher Communities
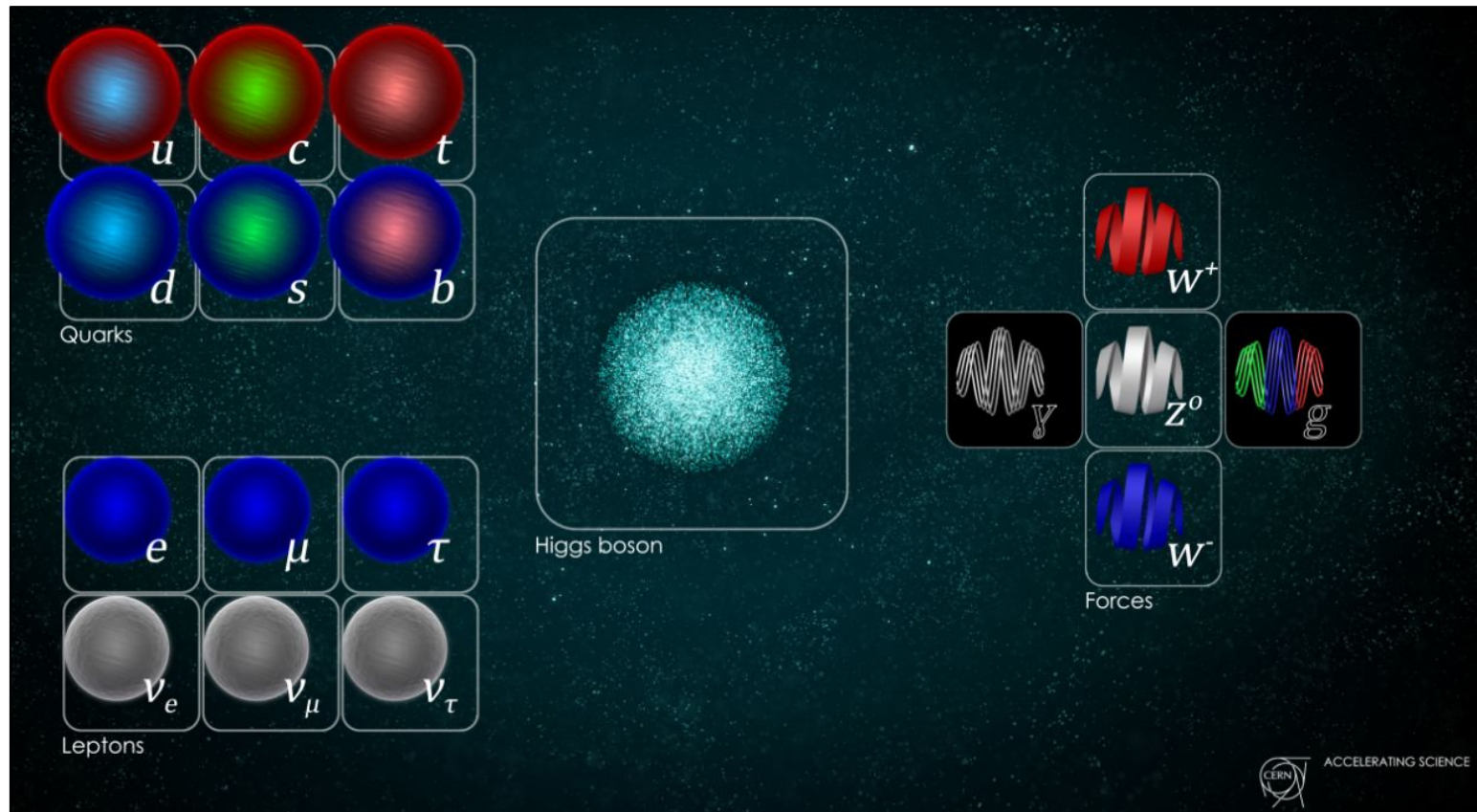
What is QuarkNet?

An NSF-supported sustained teacher professional development program that partners with physicist and teachers to build community and to bring 21-century physics into high school classrooms.

Setting the Stage: BIG, small...

The Standard Model

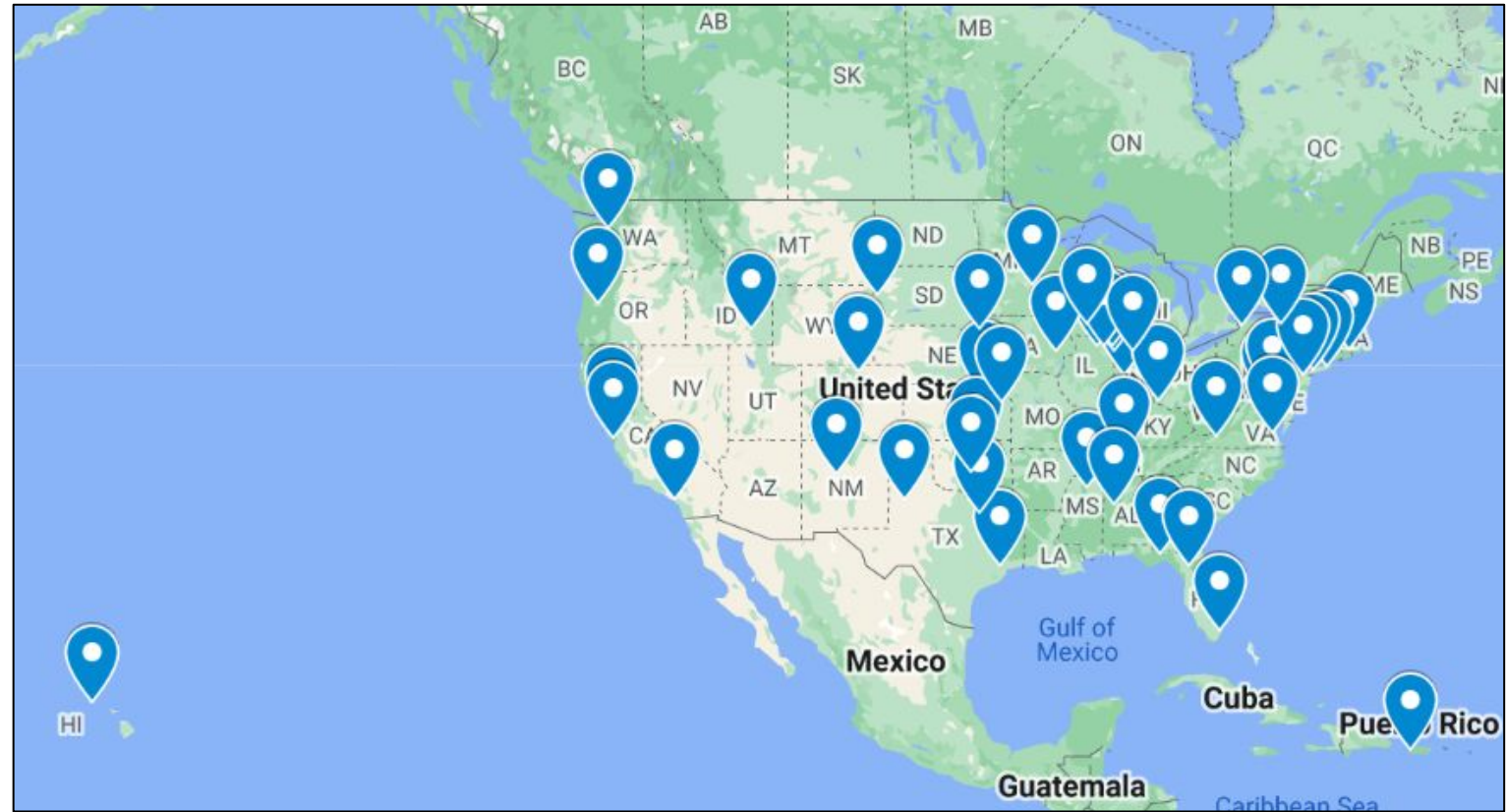## Learning Science/Physics - Parallels

About QuarkNet

~5 PIs and Staff

~50 QuarkNet Centers

~500 Teachers

Supporting Physics Teacher Communities

QuarkNet Centers

QN Staff work with mentors and lead teachers to provide workshop for teachers, masterclasses, and other activities at centers.

Supporting Physics Teacher Communities

![QUARKNET logo]

National & International Opportunities
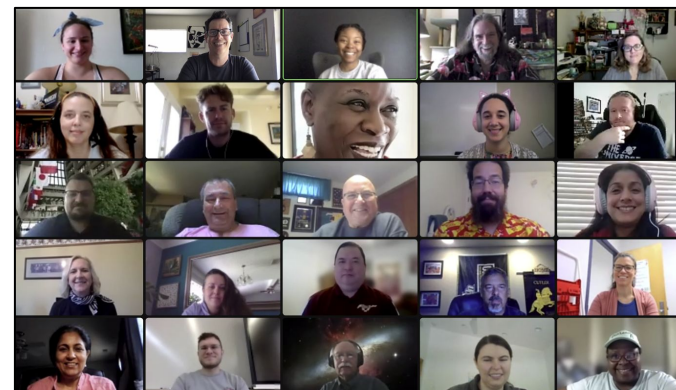
Fellows Camp

Data Camp

Coding Camps 1 & 2

Summer Session for Teachers

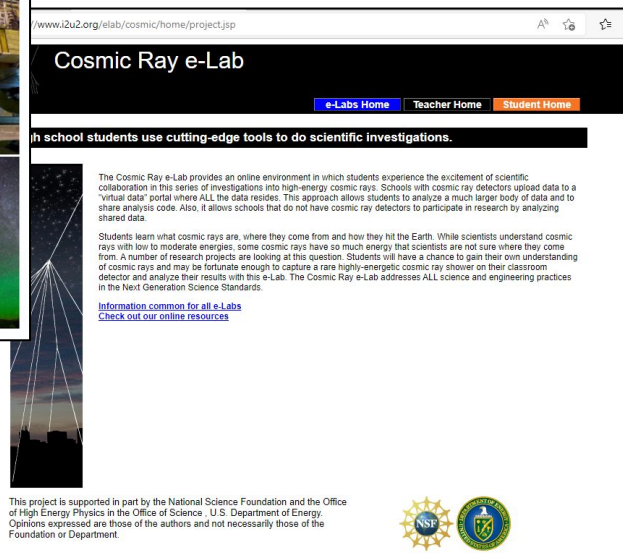QuarkNet Educational Discussions

HST @ CERN

ITW @ CERN

…

QUARKNET

Supporting Physics Teacher Communities

Resources

Data Activities Portfolio

Cosmic Ray e-Lab

CMS e-Lab

International Masterclasses

Friday Flyer Newsletter

Partnerships:

STEP UP

IRIS-HEP

…

ACTIVITY: Rolling with Rutherford

ACTIVITY: Rolling with Rutherford

Follow the instructions at:
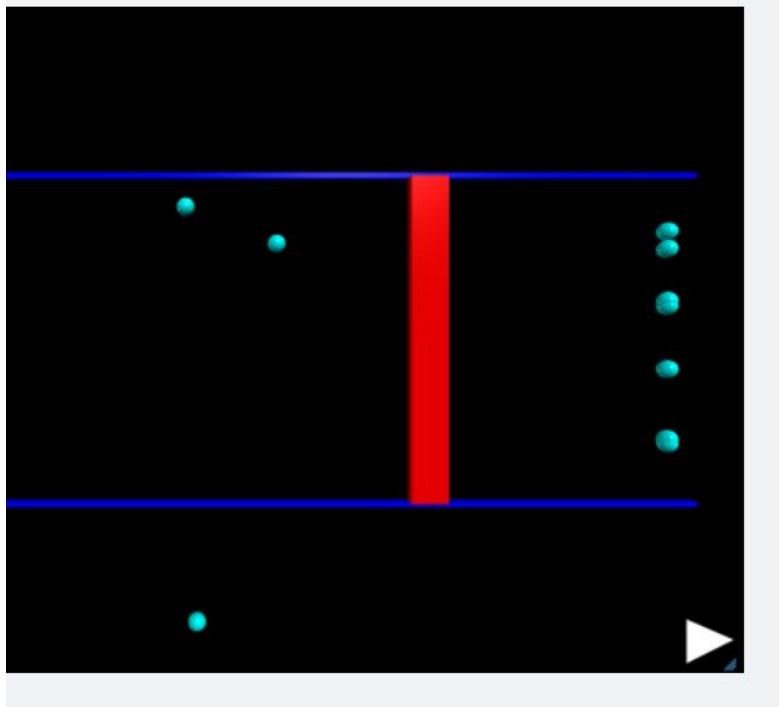
Follow the instructions at:
www.tinyurl.com/rwraapt24
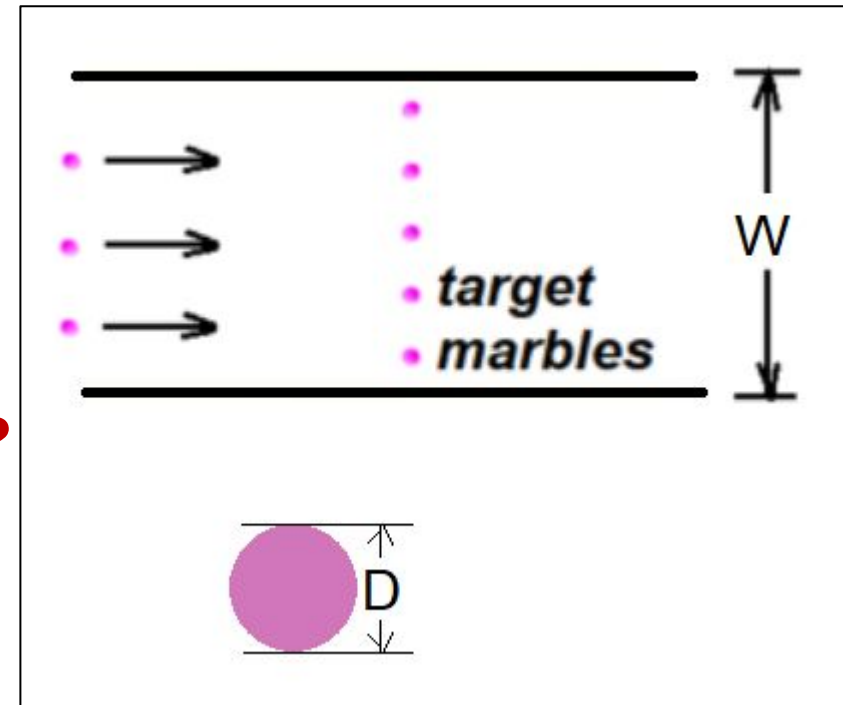
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ACTIVITY: Rolling with Rutherford

Build a mathematical model relating probability to other parameters

P = Probability of a hit (from histogram)

N = Number of target marbles = 5

W = Width of "beampipe" = 30 cm

*D = Diameter of each target marble = **??***

ACTIVITY: Rolling with Rutherford
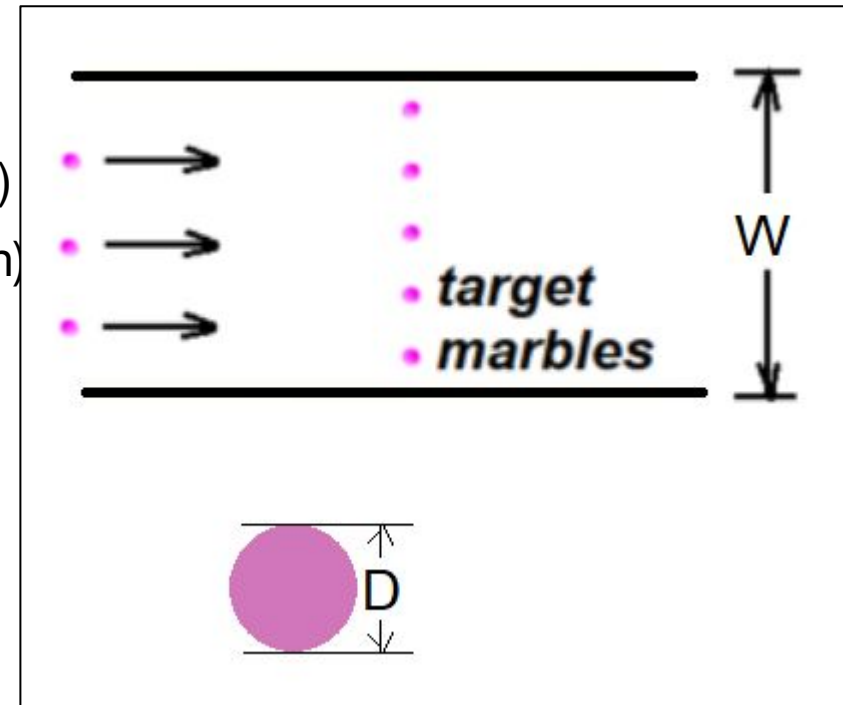
Solve for D, diameter of each target marble.

P = Probability of a hit (from histogram)

N = Number of target marbles = 5 (given, from simulation)

W = Width of "beampipe" = 30 cm (given, from simulation)

D = Diameter of each target marble = *??*

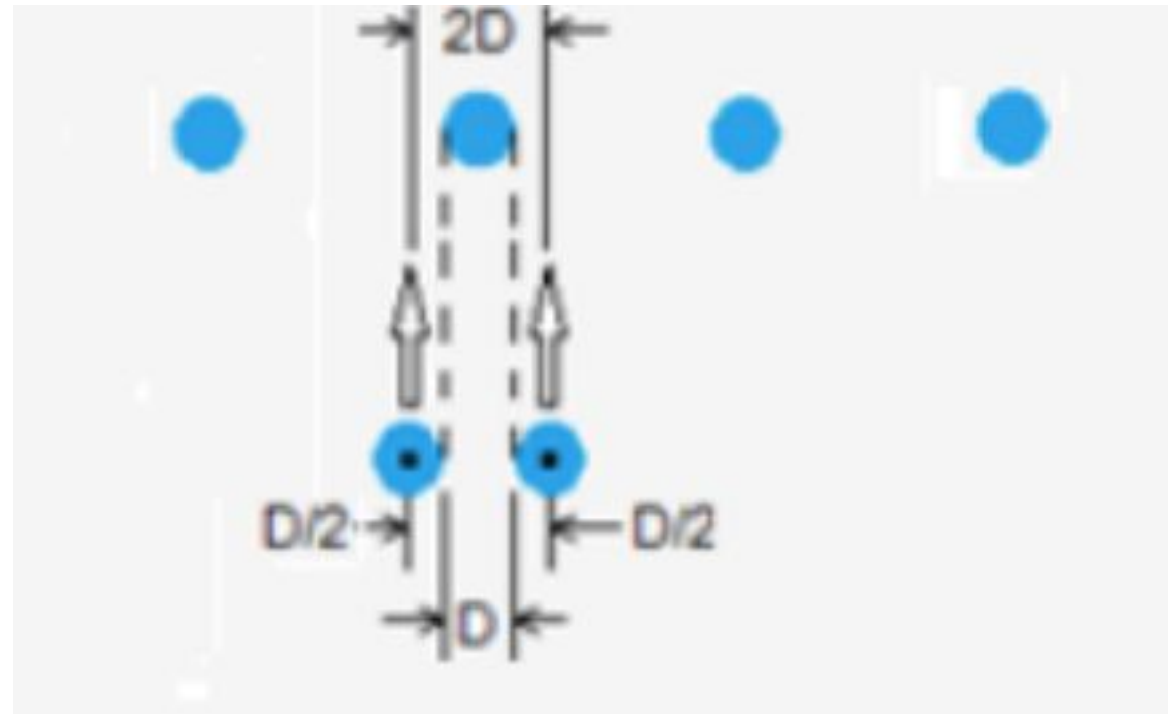$$D = \frac{P \times W}{N}$$

target marbles

W

D

QUARKNET

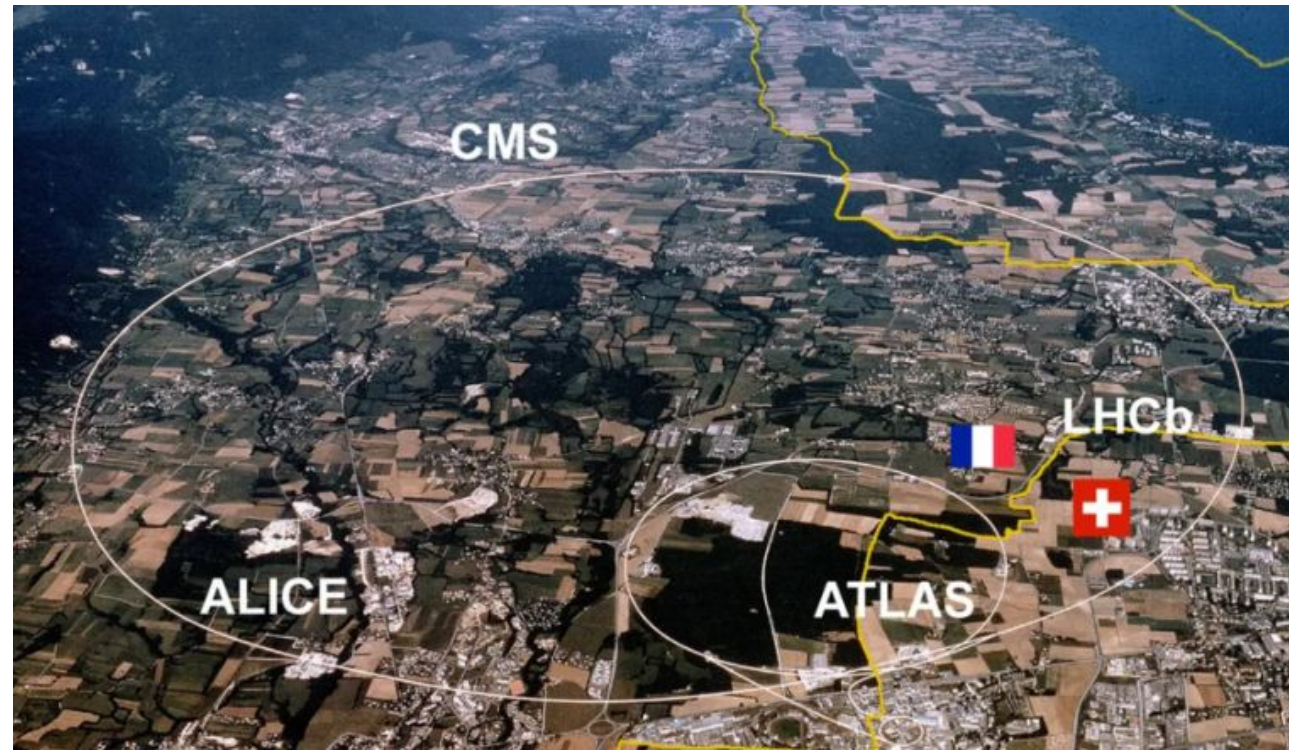## ACTIVITY: Rolling with Rutherford

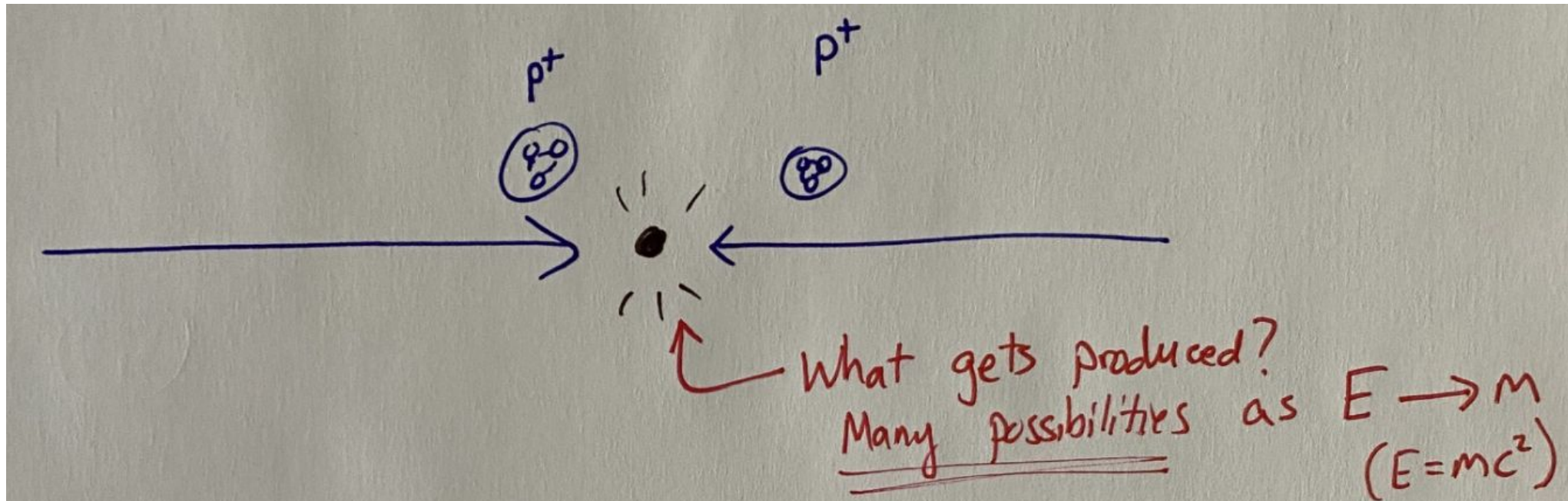*Improve the model…*

$$D = \frac{P \times W}{2N}$$

Indirect Evidence

ACTIVITY: Mass of the Z
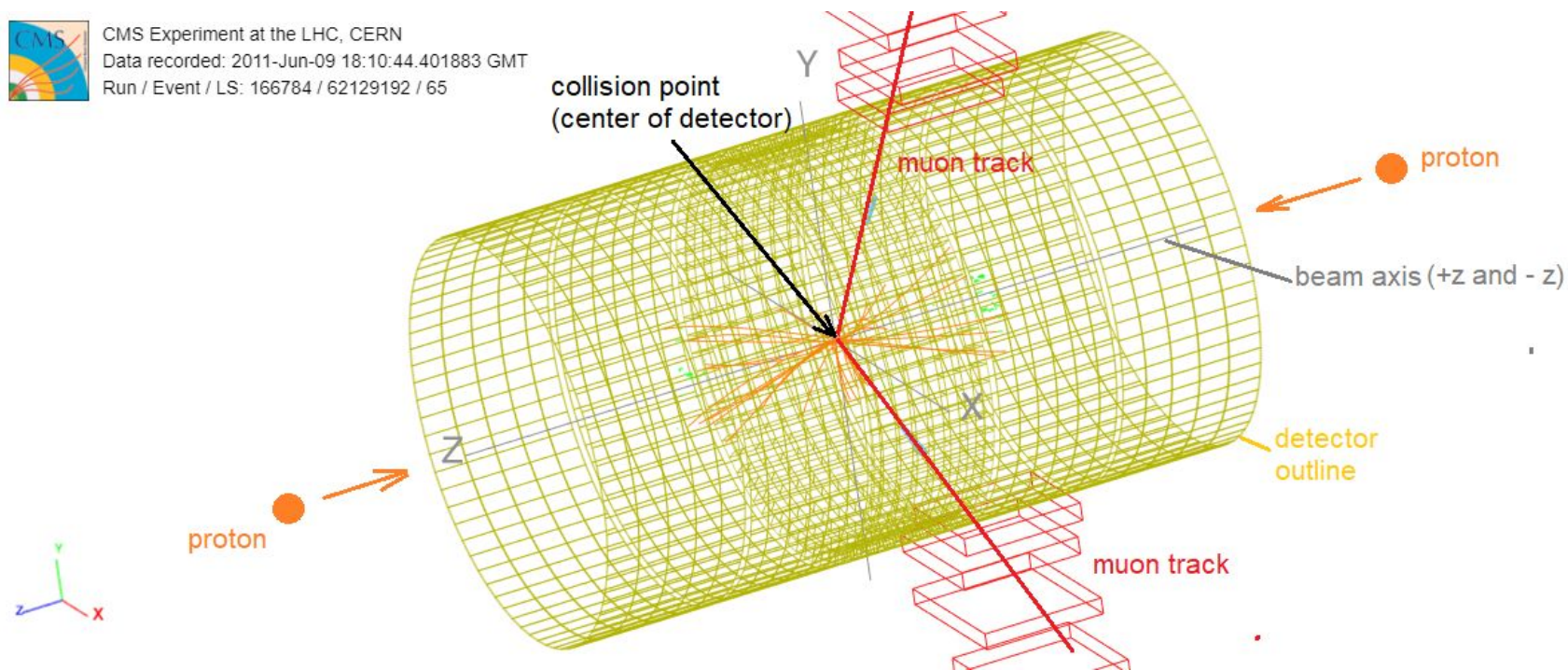*Using data from CMS detector at the LHC.*

ACTIVITY: Mass of the Z
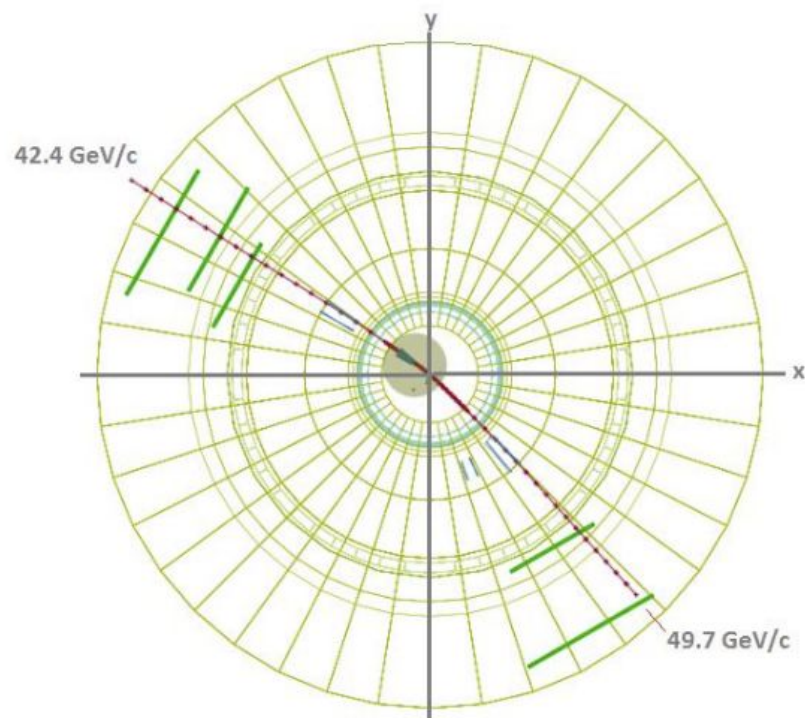*Using data from CMS detector at the LHC.*

ACTIVITY: Mass of the Z
Using data from CMS detector at the LHC.

CMS Experiment at the LHC, CERN
Data recorded: 2011-Jun-09 18:10:44.401883 GMT
Run / Event / LS: 166784 / 62129192 / 65

ACTIVITY: Mass of the Z
Using data from CMS detector at the LHC.

42.4 GeV/c

49.7 GeV/c

$$E^2 = p^2 c^2 + m^2 c^4$$

} Solve for
m

$$m = \sqrt{\frac{E^2 - p^2 c^2}{c^4}}$$

ACTIVITY: Mass of the Z
Using data from CMS detector at the LHC.

If time permits:

https://tinyurl.com/zmassaapt24

Supporting Physics Teacher Communities

Building Community

Contact Information

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www.QuarkNet.org