

Developing the Cosmic Watch for High School Classrooms...and more

QuarkNet collaborates with Japan and the world

Kenneth Cecire, University of Notre Dame, kcecire@nd.edu
for QuarkNet and International Masterclasses

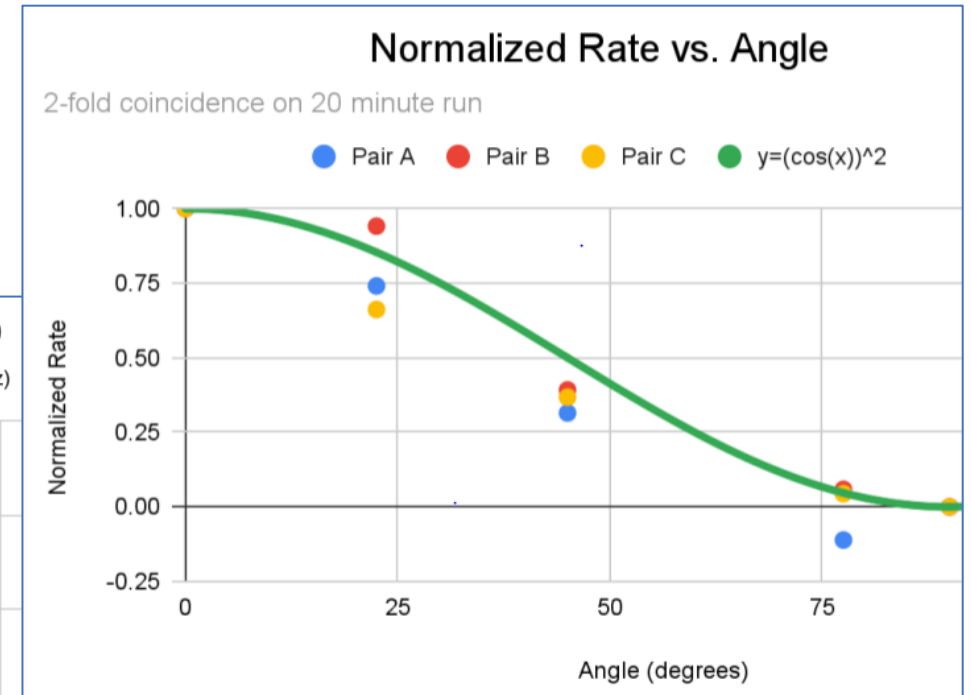
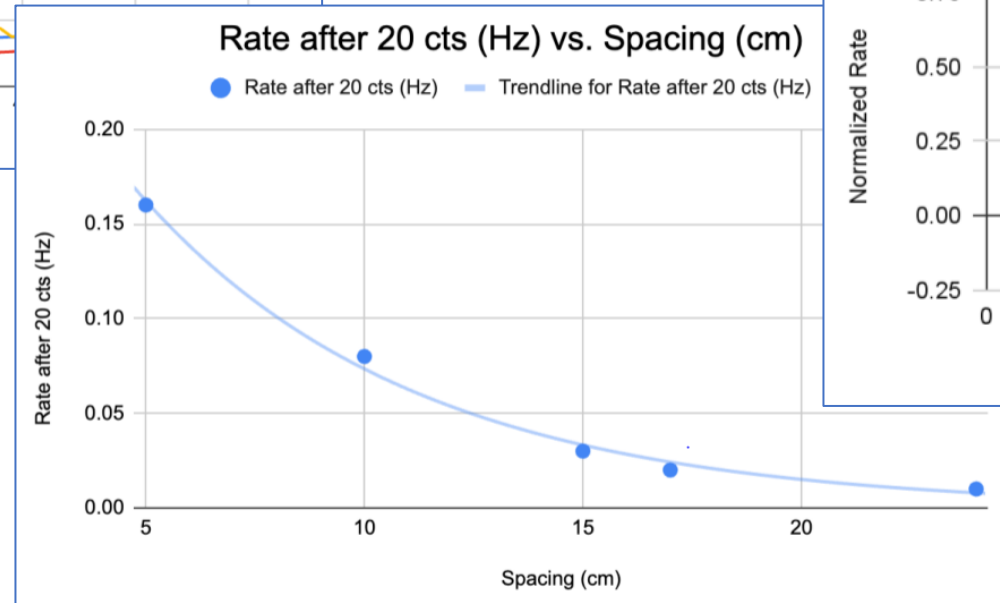
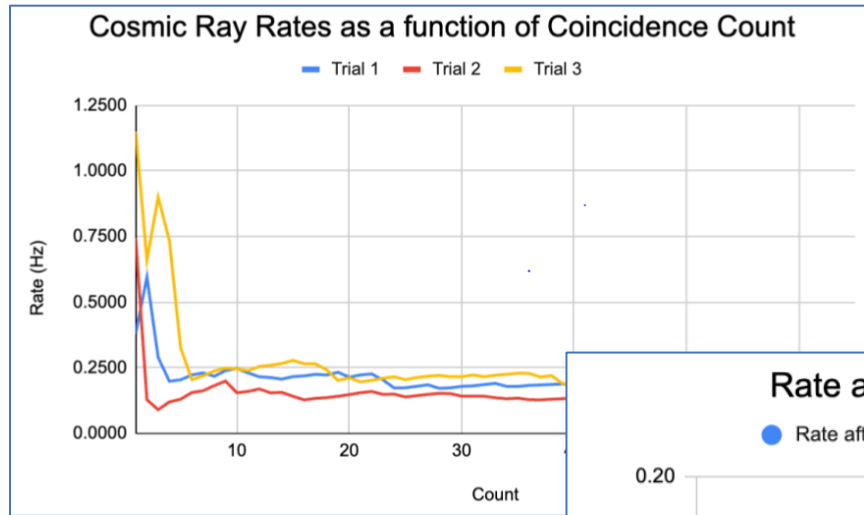




Development of use case

- Spencer Axani, others, have already explained the Cosmic Watch (CW)
- June-July 2022: QuarkNet and Fermilab had 48 CWs produced at University of Notre Dame
- September 2022 – May 2023: a few QuarkNet teachers used CWs in classes
- June-July 2023: testing at Notre Dame of characteristics and laboratory use
- September 2023 - present: try it out in schools

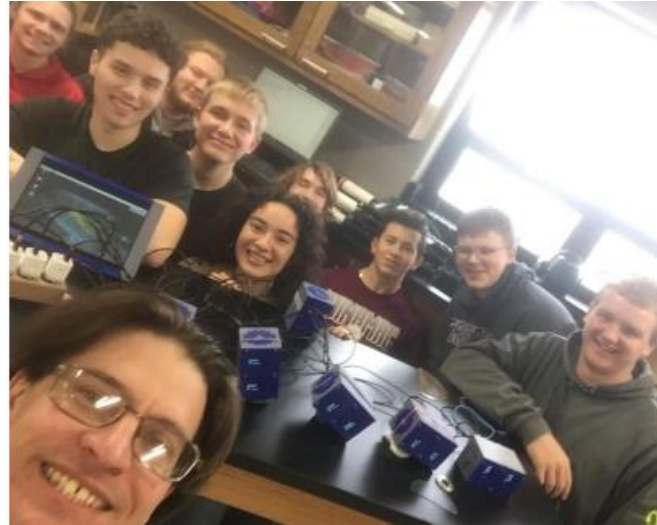






- Studies

- Rate vs. Zenith Angle
- Rate vs. Separation
- Muography
- More



Wegner, Jeremy, and students, *Angular Distribution of Cosmic Rays*, International Cosmic Day 2022



Separation study, Watervliet High School



Ohtsuka, Miki, et al, *墳 Q(fun-Q) project : muography of Japanese ancient mounds by high school students*, 38th International Cosmic Ray Conference (ICRC2023)





International Masterclasses

What is a masterclass?

- Students → Particle physicists for a day (at lab or university)
- Analyze authentic data from large particle experiments
- End the day with a videoconference
 - Fermilab ← ケンの一番好きな
 - CERN
 - KEK
 - more
- Many flavors: https://ippog.org/imc_projects



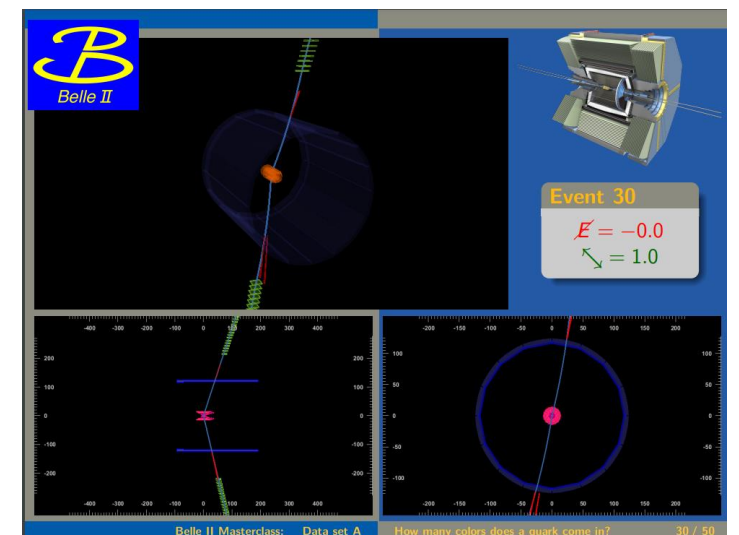
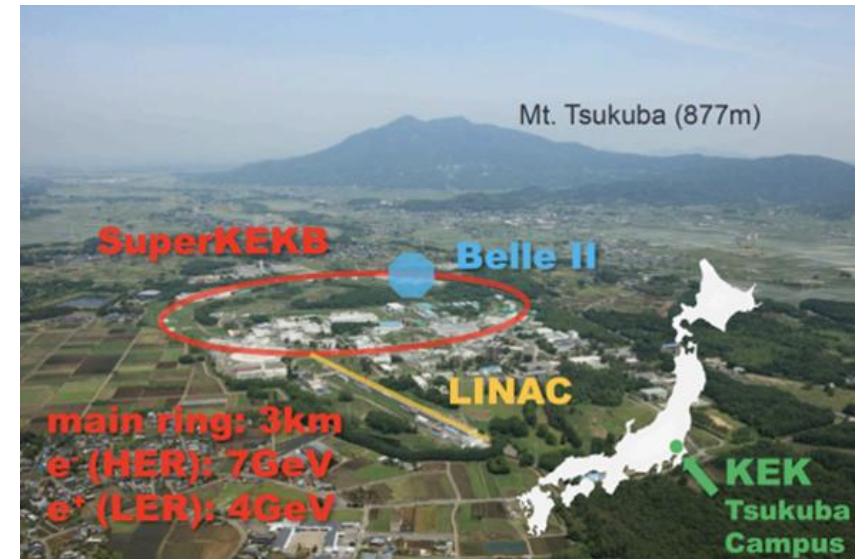
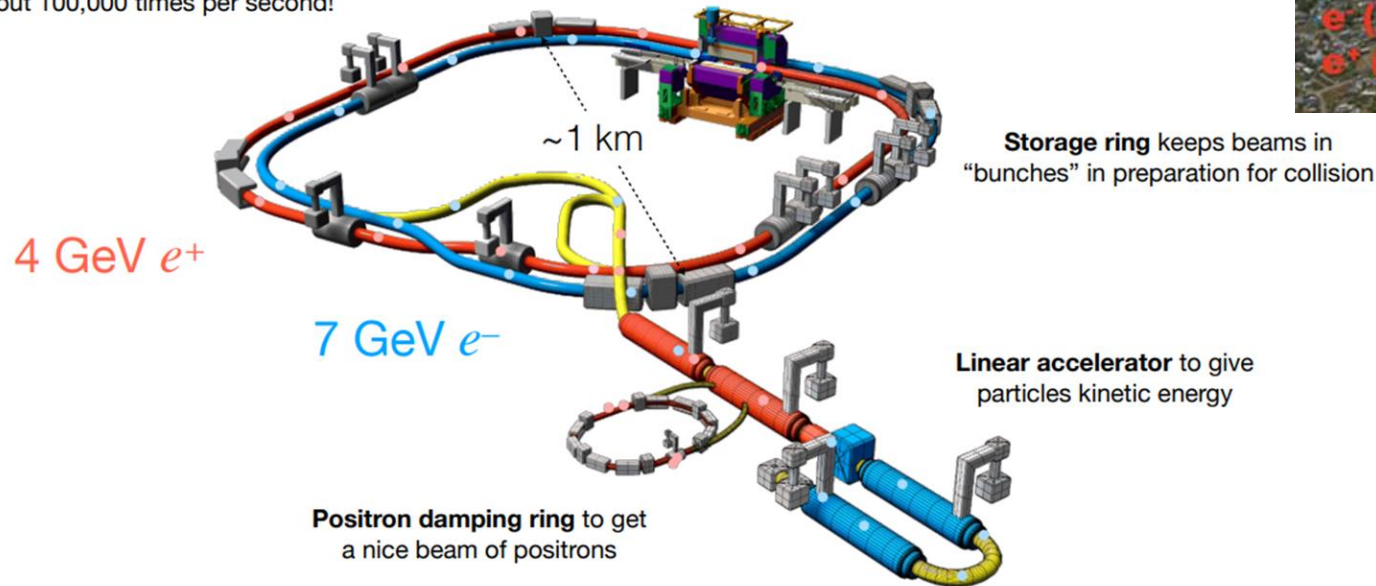
QUARKNET International Masterclasses

How about the [Belle II masterclass](#)?

- Experiment, data: KEK → 日本
- How many Quark colors?

Each beam bunch goes around the storage ring about 100,000 times per second!

Collide beams at the center of the Belle II detector

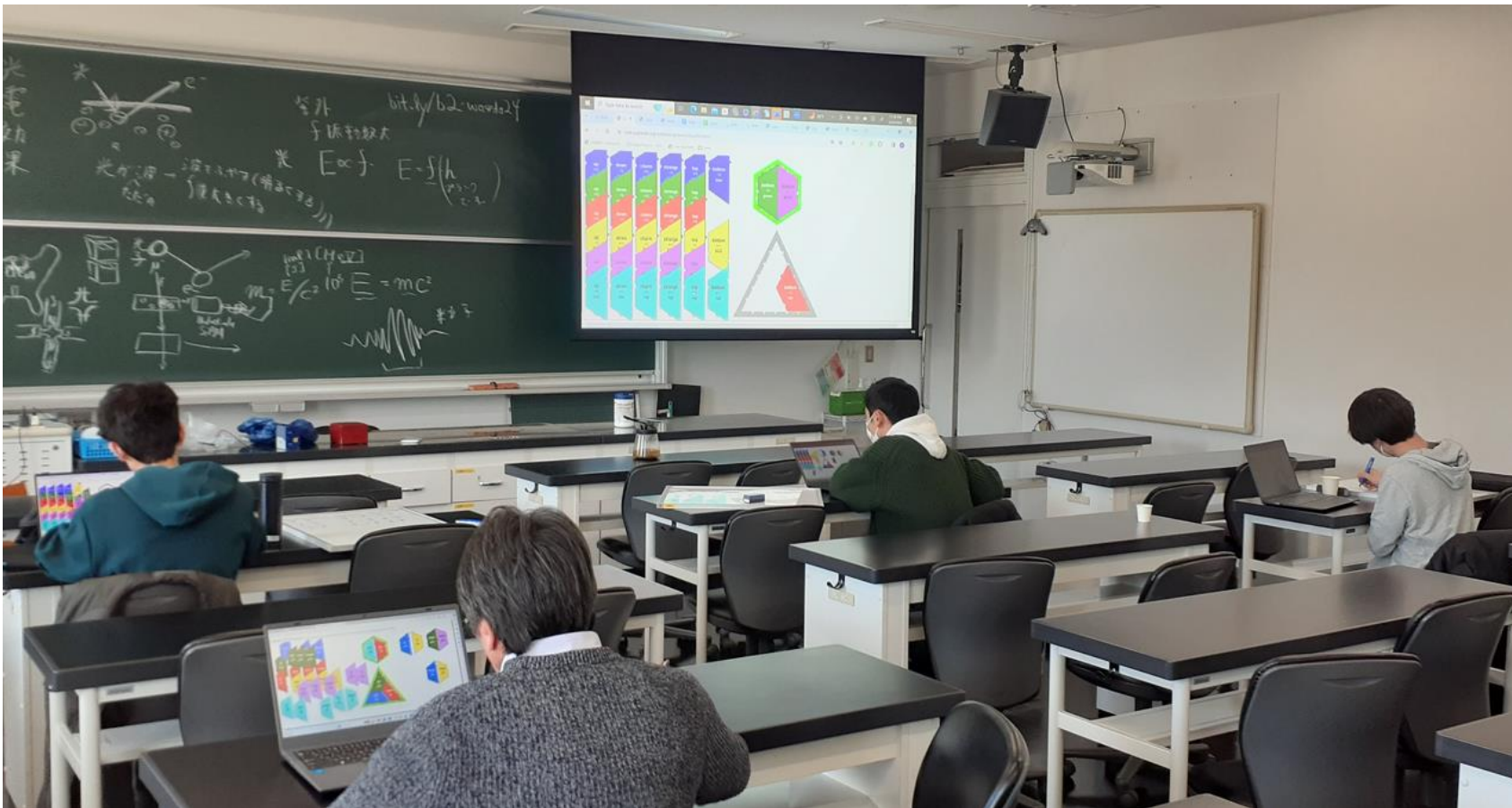


- Japan – January 2024, 16:00-17:00 JST

Cecire, JSAP 2024

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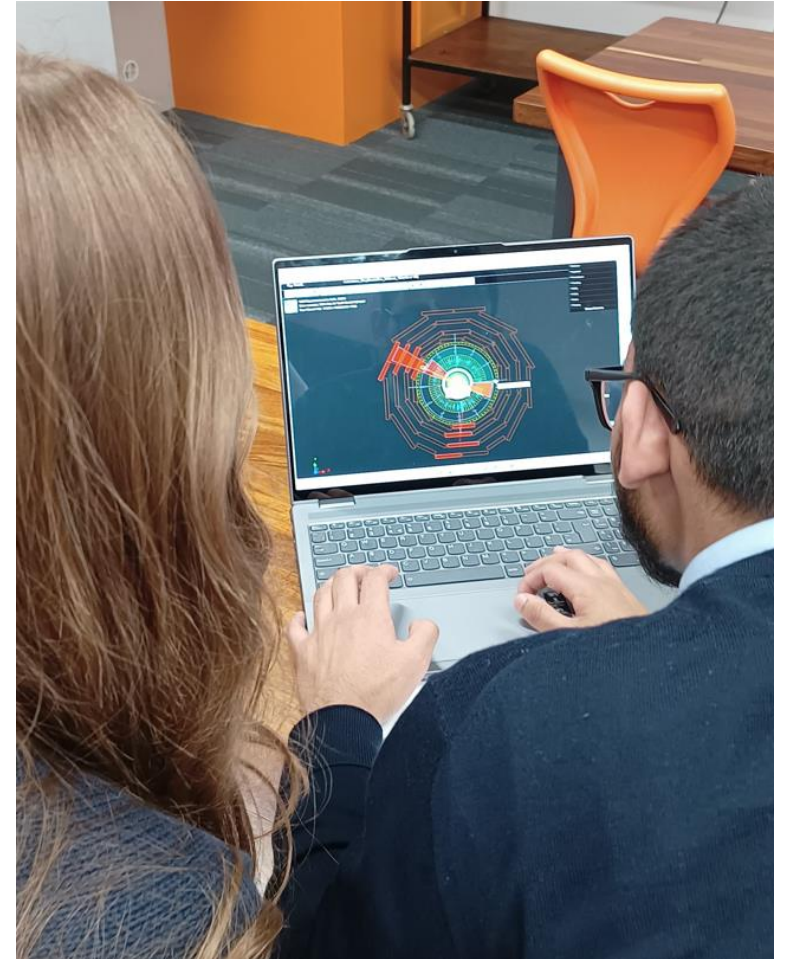
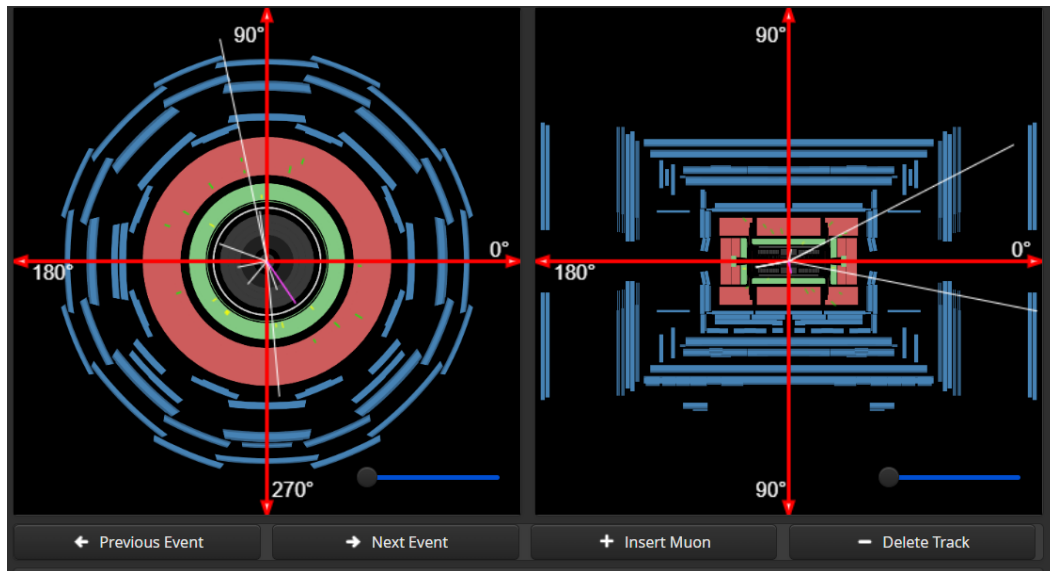
Belle II masterclass at Waseda Honjo Senior High School



QUARKNET International Masterclasses

How about [World Wide Data Day \(W2D2\)](#)?

- Simple measurement, real CERN data
- Where do the muons go in ATLAS or CMS?
- Classrooms collaborate worldwide.



The authors thank our collaborators!

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 - Department of Physics and Astronomy
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 - Waseda Honjo Senior High School
 - Watervliet High School
 - Winamac Community High School
 - And beyond