



Developments in International Masterclasses

EPS-HEP 2019

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U.S. DEPARTMENT OF
ENERGY

Office of
Science



 **Fermilab**

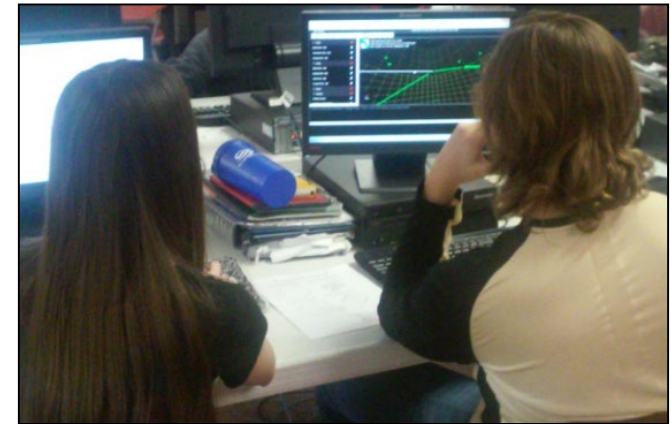
Overview



What is a masterclass?

“Particle physicist for a day”

- Intro
- Tour
- Analyze authentic HEP data.
- Videoconference



International Masterclasses 2019 and beyond

- > 50 Countries
- > 10⁴ Students
- 4 LHC experiments
- 1 new Neutrino experiment
- More on the way



Masterclasses Expand



New opportunities

- World Wide Data Day (W2D2)
- Masterclasses for International Day of Women and Girls in Science (IDWGS)

New measurements

- MINERvA
- More neutrino masterclasses
- CMS upgrade
- Belle II
- Masterclasses from GSI
- More on the way



W2D2

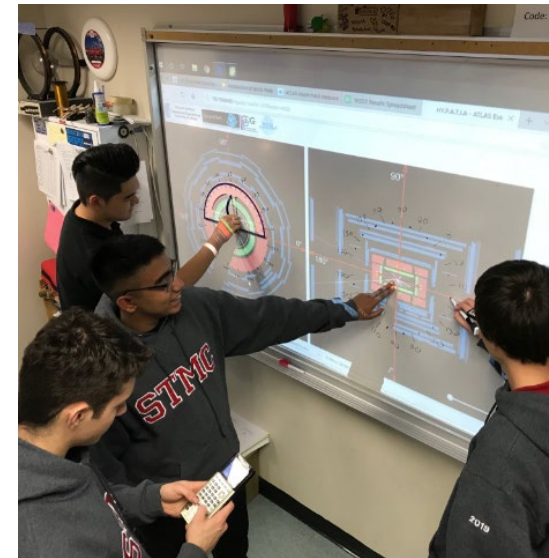
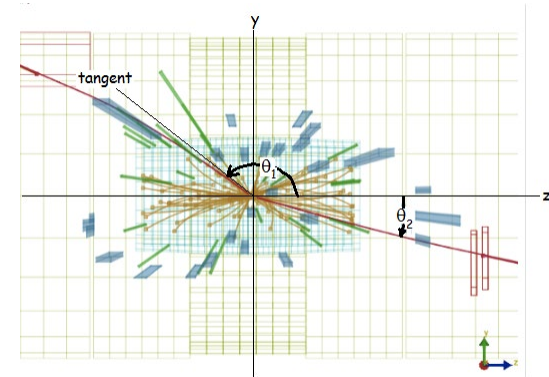


What it is

- Simple measurement: ϕ and θ of muons in events
- Can be done by teachers and students in school
- Worldwide combination of data
- 24-hour shift of videoconferences

Get involved

- Takes place in Oct or Nov each year
- Inform physics teachers
- Contact Ken



IDWGS

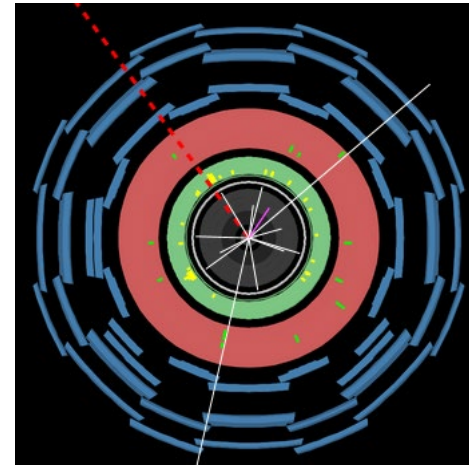


What it is

- LHC masterclass measurements
- By and for girls
- Learn about particle physics
- Discuss women in science

Get involved

- Takes place in Feb each year
- Recruit students, teachers, tutors
- Women as role models
- Encourage young women with a friendly physics environment
- Contact Uta

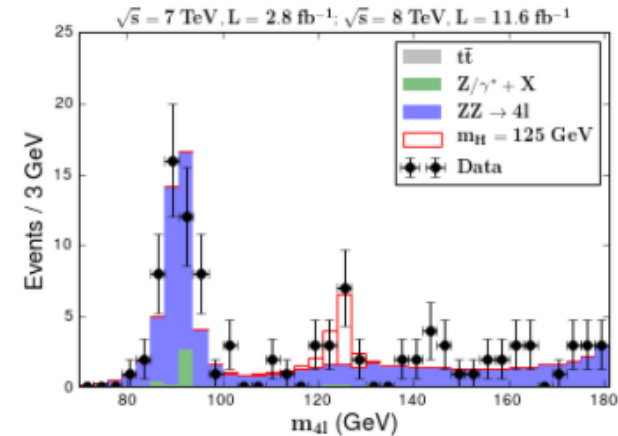


CMS upgrade, Belle II



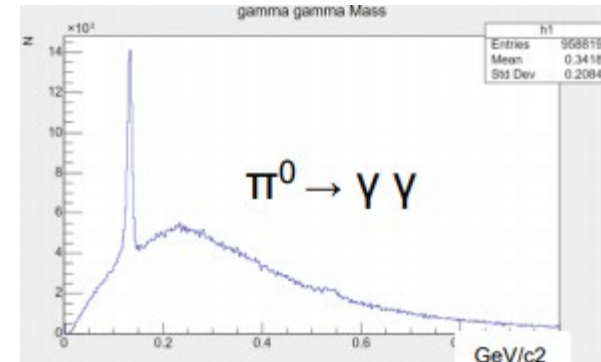
What they are

- CMS measurement adds a 4-lepton mass plot
 - Test this summer
 - Use in IMC 2019
- Belle II shows students how to code B-physics analysis
 - Tested in IMC 2019
 - Ready for IMC 2020



Get involved

- Take place in IMC
- Contact Uta, Ken, or Zdenek Dolezal @ Charles University



Neutrino masterclasses



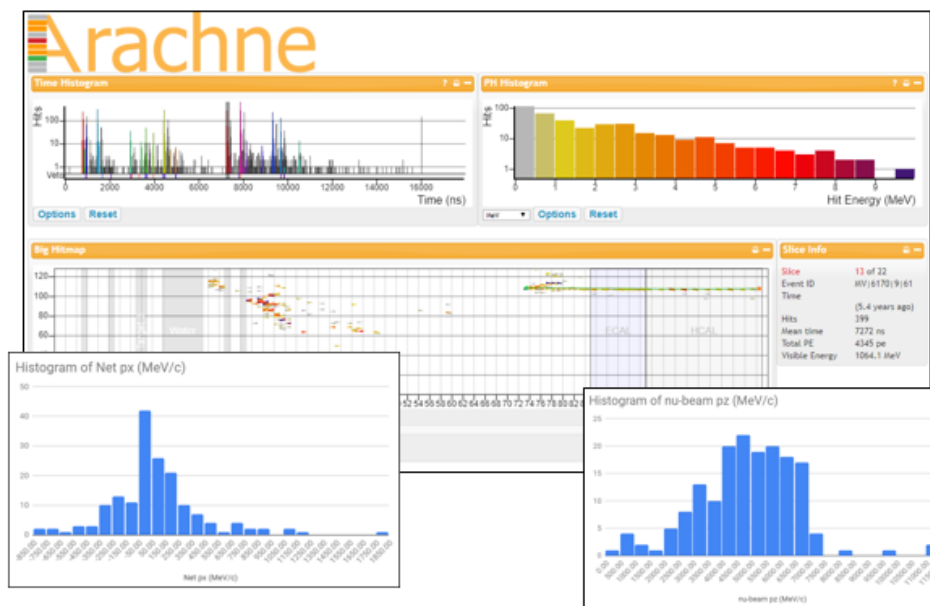
What it is

- First, MINERvA
 - Muon neutrinos interact with carbon target
 - Discover Fermi motion
 - Measure carbon nucleus to test interaction model
- Coming:
 - MicroBoone, more



Get involved

- Take place in IMC
- Contact Ken



GSI/FAIR



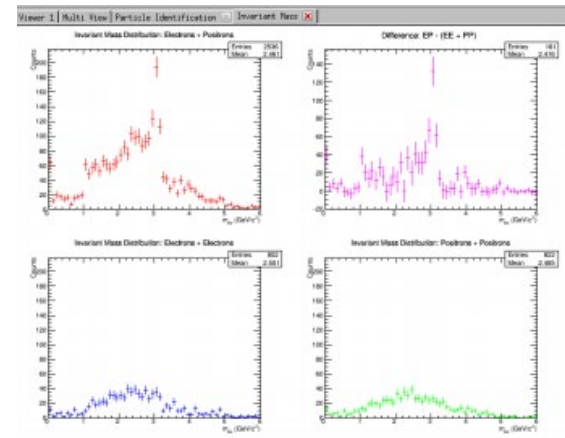
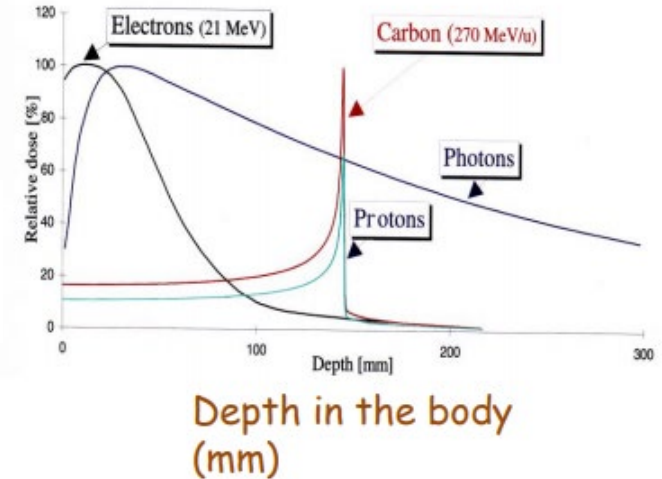
What they are

- Medical Imaging (HIT)
- J/ψ (ALICE)
- GSI
 - videoconferences
 - innovations



Get involved

- Take place in IMC
- Contact Uta, Ken, or Yiota Fokka @ GSI



Interesting future



Challenges

- 4 centers for videoconferences and growing
 - CERN
 - Fermilab
 - TRIUMF
 - GSI
- Organization and Coordination
- Structure will expand



Opportunities

- Rich offerings develop all involved
- New offerings yield new methods
- Multiplying pathways to reach students and teachers