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Developments in International Masterclasses

APS Division of Particles and Fields
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U.S. DEPARTMENT OF
ENERGY

Office of
Science



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INTERNATIONAL
MASTERCLASSES
hands on particle physics



Overview

What is a masterclass?

“Particle physicist for a day”

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



International Masterclasses 2017, 1 March–11 April

- 50 Countries
- 116 Institutes
- 314 Masterclasses
- $> 10^4$ Students
- Videoconference moderation from CERN, FNAL, TRIUMF





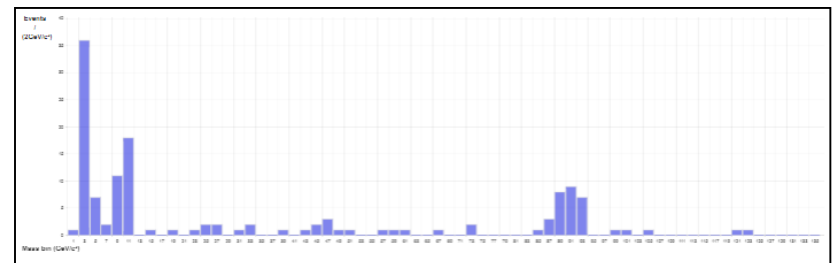
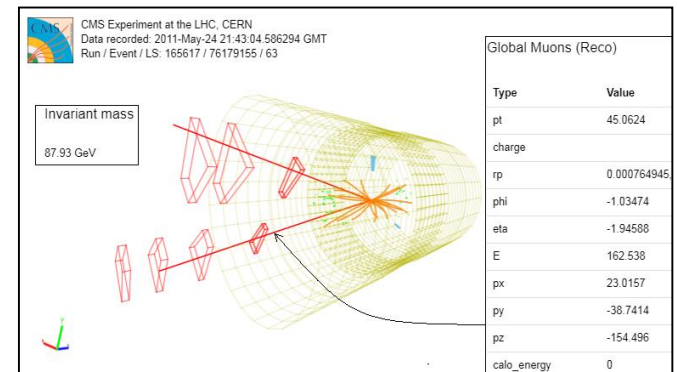
LHC Measurements

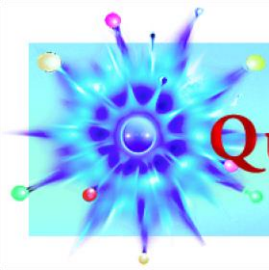
4 LHC Experiments

- ALICE – strange particles and nuclear modification factor
- ATLAS – Z path and W path
- CMS – J/Ψ path (schools) and WZH path (IMC)
- LHCb – displaced vertices

Development of CMS Measurement

- Increased amount of data
- 4-vectors in webgl event display
- Add Drell-Yan in 2018.
- Higgs path in 2019?



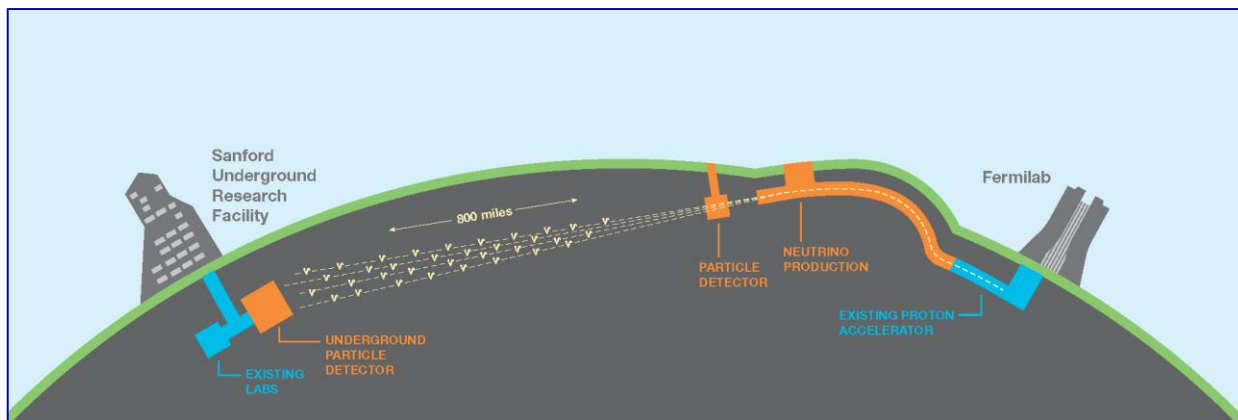


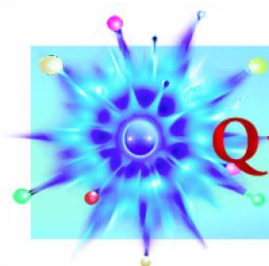
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Neutrino Measurements

Neutrino Masterclasses are New and Developing

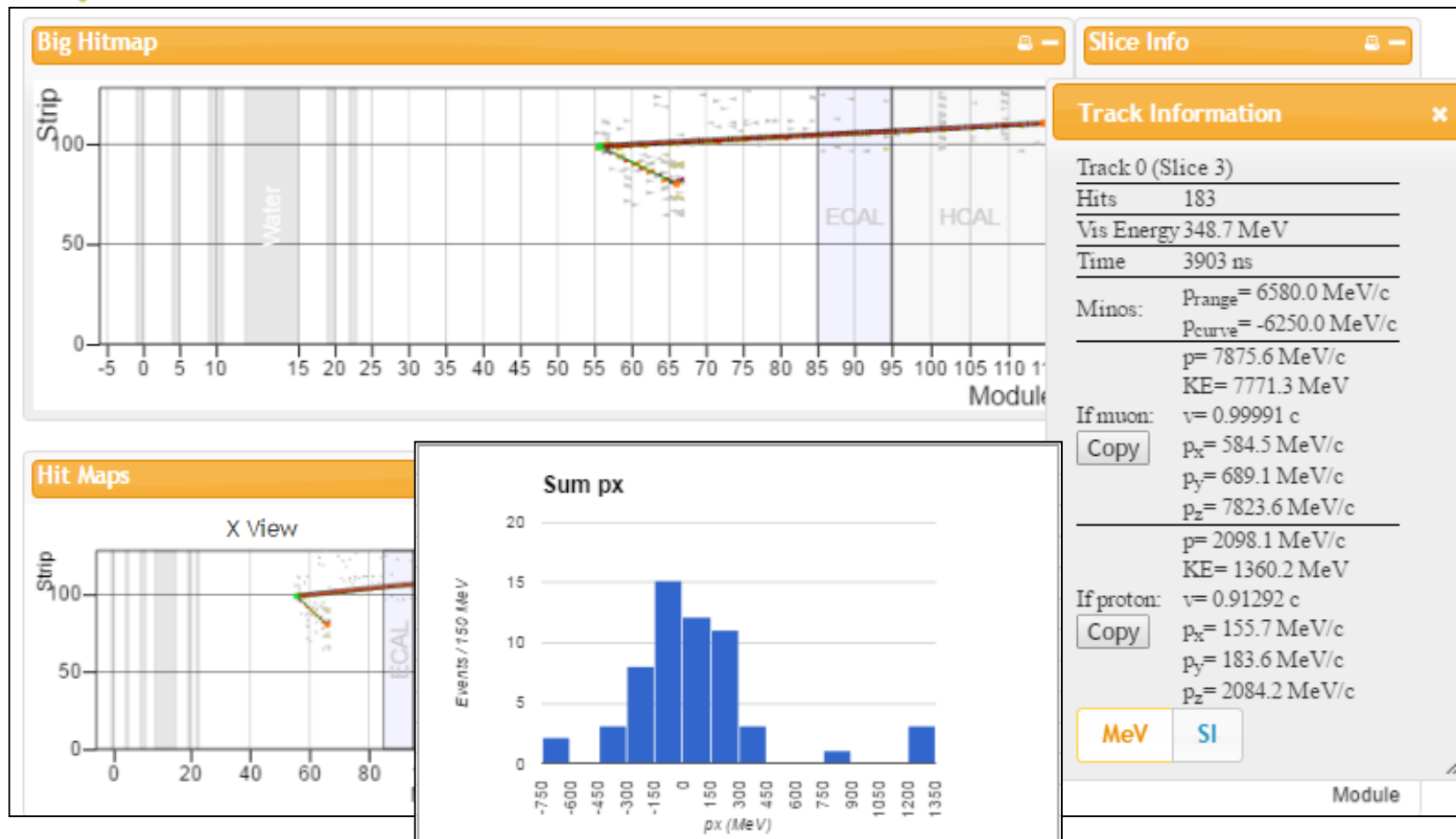
- IceCube – Already in use but not yet in IMC
- MINERvA – Ready for IMC 2018
 - Use momentum; uncertainty to probe carbon nucleus
- MicroBooNE – Projected for IMC 2019
 - Argon purity and weak interaction multiplicity
- DUNE – Longer-term development underway
 - Neutrino oscillations and more





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MINERnA Measurement

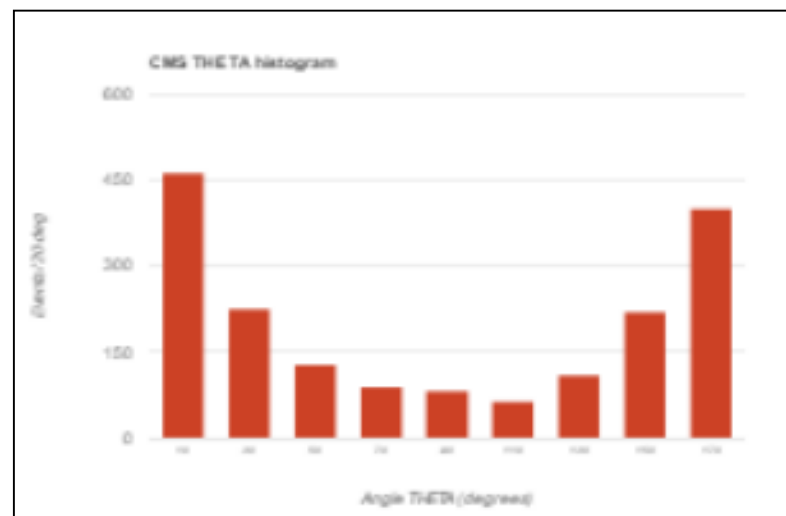




IMC Reaches Out

World Wide Data Day (W2D2)

- Pilot December 2016, 20 sites
- Simple measurement – dimuon angular distributions
- Measurement and videocon from school – teacher leads
- 24 hours of videocon shifts around the globe
- Continue in 2017 and beyond.





IMC Reaches Out

International Day of Women and Girls in Science (IDWGS)

- Special masterclasses, Fri. 10 Feb. and Sat. 11 Feb. 2017
- ATLAS, CMS, and LHCb measurements
- Female students, female videocon moderators
- ~320 girls in 10 masterclasses
- Successful, repeat in 2018; expect to grow.





IMC Collaborates

African School of Fundamental Physics and Applications

Kigali 2017

- 1.5-day teacher workshop, CMS masterclass
- ATLAS masterclass for ASP students
- 3 x 0.5-day high school visits, mini-masterclass
- Addis Ababa – CMS masterclass



Windhoek 2018

- Project similar work
- Longer teacher workshop

Physics without Frontiers (ICTP)

- Masterclasses to developing countries
- Work at university level

