

# INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS

Report

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IPPOG meeting, CERN

04.10.2018



# Scope of Activity

## International Masterclasses

Since 2005,  
~ 14 k students,  
225 institutes  
in 52 countries

## Int. Day of Women and Girls in Science

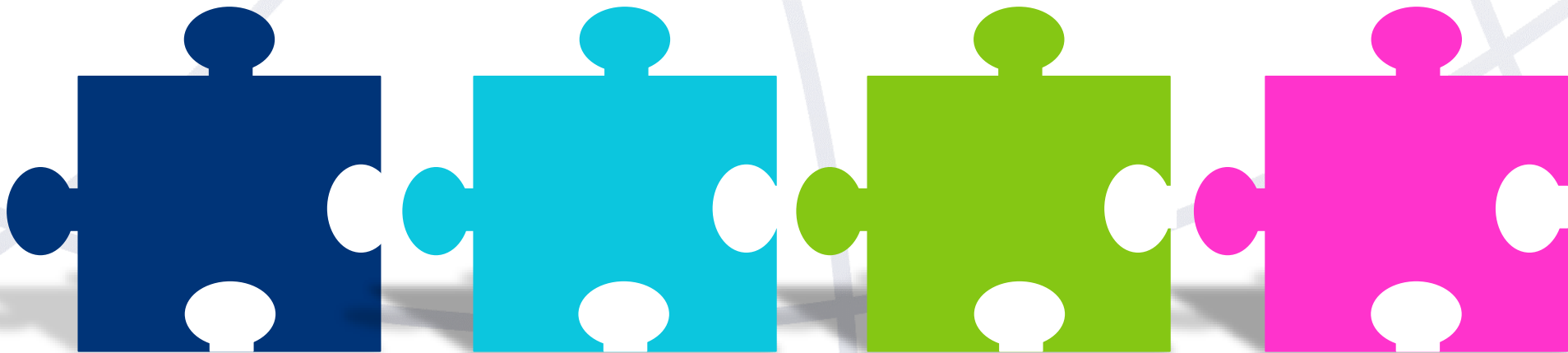
Since 2016,  
300 students,  
10 institutes  
in 6 countries

## World Wide Data Day

Since 2016,  
400 students,  
29 institutes  
in 10 countries

## Neutrino Masterclasses

New in 2019

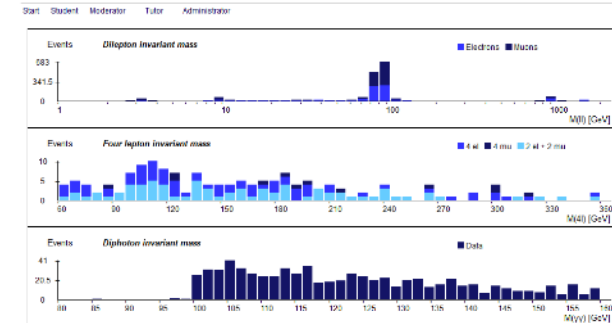


# International Masterclasses

- IMC19: March 3 – April 17
- First announcement sent on Sept 14
- Mailing list with 601 recipients
- Registration process ~ end of October
- Interest in joining expressed:
  - Algeria: Essma Redouane Salah (Theorist)
  - Costa Rica: Johan Bonilla (ATLAS)
  - India, Jammu University: Ramni Gupta (ALICE)
  - India, Bose Institute Kolkata: Supriya Das (ALICE)
  - Tomsk, Polytechnic University: Vitalii Okhotnikov (CMS)
  - More groups via MC2NC?



OPlOT – MasterClass – Combination for all institutes on 2018-03-19



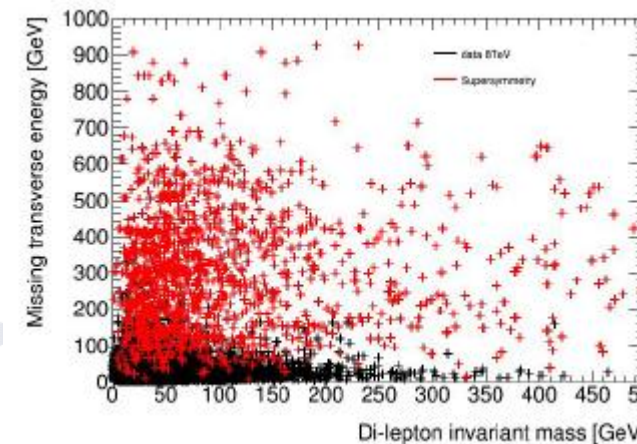
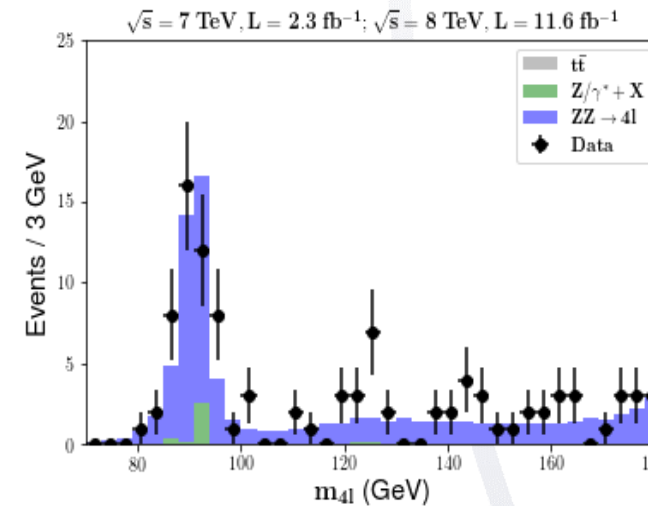
# LHC Measurement Updates

## CMS:

- Add ZZ and  $Z\gamma$  candidates
- iSpy and CIMA modifications
  - $1l \rightarrow W^+/W^-$
  - $2l \rightarrow$  (dilepton) mass plot 1
  - $4l \rightarrow$  (4-lepton) mass plot 2
  - All  $\rightarrow e/\mu$

## ATLAS Z path:

- Including high MET events from simulated supersymmetric scenarios
- OPloT: 2D plots of MET vs.  $M_{ll}$
- Might not be ready before 2020
- Further plans:
  - 13 TeV data
  - Use 3D event display



# Int. Day of Women and Girls in Science

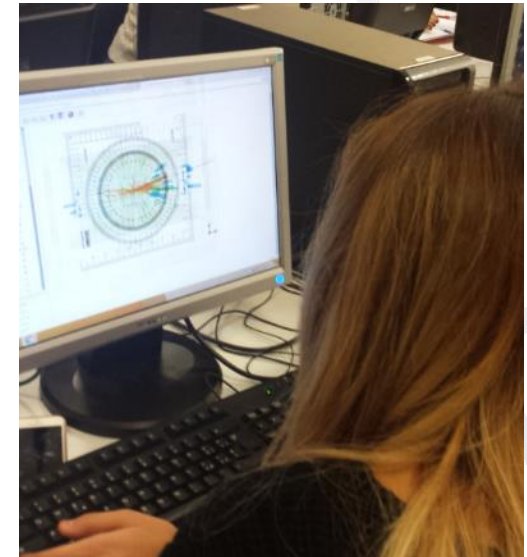
- Feb 11, declared by United Nations
- Masterclasses targetting girls + involving female scientists
- Will be offered again in 2019
- [webpage](#)
- [Paper](#) from EPS-HEP 2017 proceedings



# Help with World Wide Data Day

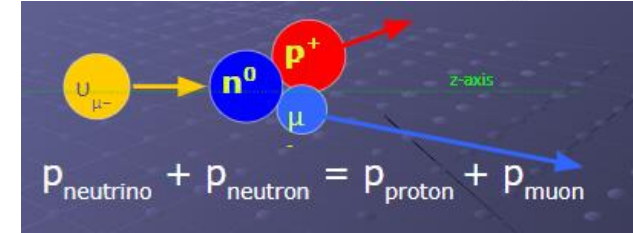


- IPPOG Members, Associates, and Friends can help with:
- Institutes/Teachers with students – contact
- Moderators – can do from anywhere
  
- More information:
- Soon: 15<sup>th</sup> November 2018
- Register on web page: <http://tiny.cc/w2d2-18>
  - Go to Registration button
- Can always e-mail me ([kcecire@nd.edu](mailto:kcecire@nd.edu))



# Neutrino Masterclasses

- MINERvA in 2019\*
- MicroBooNE in 2020\*
- DUNE\*\* later
- <http://tiny.cc/numc19>



## MINERvA measurement

- neutrino beam  $\rightarrow$  carbon target
- $\nu + n \rightarrow p + \mu$
- Measure  $p_x$  and  $p_y$  of proton and muon
- momentum distribution  $\rightarrow \Delta p$
- Fermi motion, nucleus is active place
- $\Delta p_x \rightarrow \Delta x \rightarrow$  bound on neutron motion  $\rightarrow$  radius of nucleus

*Videoconferences moderated at Fermilab!  
3 days in schedule!*



- \* Short baseline
- \*\* Not-so-short baseline

04.10.2018

# Timeline

## Oct:

- Registration

## Nov:

- Preliminary schedules
- **World Wide Data Day**

## Dec:

- Restart WG VC

## Jan:

- Recruiting moderators
- updates:
  - Instructions for tutors
  - Moderators' manual + twiki

## Feb:

- Vidyo tests
- Question time
- Moderators training
- **Int. Day of Women and Girls in Science**



# Communication

- Circulars
  - Biweekly Friday circulars from Oct 2018
  - Weekly Friday circulars in 2019
- Twitter
  - @physicsIMC
  - #LHCIMC19
- Press release
  - Template for institutes
  - Coordinate with EPPCN



14.09.2018

Dear friends and supporters of International Masterclasses,

It is our pleasure to inform you about the dates for the next round of International Masterclasses!

1. The period for IMC19 has been set to March 3 – April 17, 2019.
2. CERN videoconferences will be scheduled throughout this interval, except Sundays.
3. Fermilab videoconferences will be close to these dates as well; details to follow.
4. Masterclass activities on the UN International Day of Women and Girls in Science will be arranged on Feb 11, 2019, with CERN videoconferences.
5. We will roll out first-ever Neutrino Masterclasses for IMC19. A small set of Fermilab videoconference dates will be set aside for this.

Please begin to consult the calendar for your institution. You might also want to contact teachers who can check with their schools so that you can identify likely dates for your Masterclass.

More details on the registration procedure will follow in October.



The screenshot shows the Twitter profile for @physicsIMC. The profile picture is a globe. The bio reads: "International Masterclasses is where high school students receive particle physics for one day: #LHCIMC19". The bio also includes the website @physicsIMC, the URL physicsmasterclasses.org, and the text "Joined November 2018". There are 176 photos and videos. The stats show 514 tweets, 260 following, 849 followers, 175 likes, 0 lists, and 0 moments. The tweets section shows three tweets, including one about IMC2019 starting to ramp up and another about science knowing no borders.

# Website: New menu item



The screenshot shows the website interface for 'Hands on Particle Physics Masterclasses'. On the left is a navigation menu with the following items: Home, Information for High School Students, Information for Teachers and Educators, Information for Institutes and Physicists, Schedule, Intl. Day of Women and Girls in Science, My Country, Physics, In the media, **Published Papers** (circled in pink), Archive, Contributors, and Contact Us. Below the menu are social media links for Facebook and Twitter (@physicsIMC). The main content area is titled 'PUBLISHED PAPERS' and lists papers from 2017, 2016, 2015, and 2007.

## Hands on Particle Physics Masterclasses

### PUBLISHED PAPERS

2017

- Particle Physics Masterclasses for the International Day of Women and Girls in Science  
Julia Djuvsland for the IPPOG collaboration  
Proceedings of the LHCP Conference, Shanghai, China, May 15-20, 2017
- Bringing particle physics into classrooms  
Ken Cecire, Ivan Melo, Boris Tomasik  
Proceedings of the conference Physics Teaching in Engineering, Education, PTEE 2017, University of Zilina, Slovakia, May 18-19, 2017
- International Masterclasses in Particle Physics – An excellent instrument to inspire high-school students  
Uta Bilow on behalf of IPPOG  
Proceedings of the EPS-HEP Conference, Venice, Italy, July 5-12, 2017
- Developments in International Masterclasses  
Ken Cecire  
Proceedings of the APS Division of Particles and Fields Meeting, Fermilab, July 31-August 4, 2017
- The challenge of explaining new physics concepts and phenomena  
Eirik Gramstad  
Proceedings of the EPS-HEP Conference, Venice, Italy, July 5-12, 2017

2016

- The QuarkNet CMS masterclass: bringing the LHC to students  
Kenneth Cecire, Tom McCauley  
Nuclear and Particle Physics Proceedings 273-275 (2016) 1261-1264

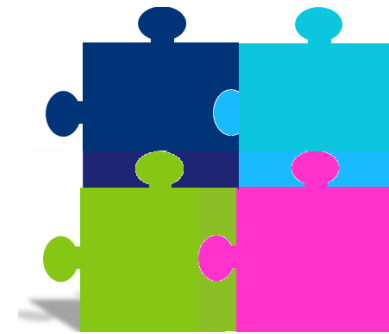
2015

- Discovery and the QuarkNet Data Portfolio  
Kenneth Cecire  
Presented at: DPF 2015, The Meeting of the American Physical Society, Division of particles and Fields, Ann Arbor, Michigan, August 4-8, 2015
- LHC discoveries and particle physics concepts for education  
Farid Ould-Saada  
Proceedings of the EPS-HEP Conference, Vienna, Austria, July 22-29, 2015

2007

- Discovery and the QuarkNet Data Portfolio  
K.E. Johansson, M. Kobel, D. Hillebrandt, K. Engeln, M. Euler  
Physics Education, 42 (2007) 636-644

# Summary



- IMC scope
  - Traditional LHC masterclasses → updated; new institutes
  - IDWGS → growing
  - W2D2 → growing + want your help
  - Neutrino masterclasses → starting and more coming
  - More to come
- Communication
  - Circulars → also Friday Flyer
  - Social Media → tweet #LHCIMC19
  - Press Release → in a newspaper near you
  - Lots of e-mails!
- Begin thrust toward publications