

INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS

IMC18 Report

Uta Bilow + Ken Cecire

IPPOG meeting, Pisa

19.04.2018



New in IMC18: Sofia



- CMS Masterclass
- 69 students from whole country
- Selected from 112 applicants
- 5 students helped as mentors, had already experience with the measurements from the CERN Internship program last year

“The students were excited about their work and results, they really enjoyed it. We all are very happy with the first CERN Masterclass in Bulgaria.”

New in IMC18: Vilnius



- CMS Masterclass
- 2 institutes: Vilnius Gediminas Technical University + Vilnius University
- Pupils from Lithuanian High Schools

“Both the CERN event and the excursion (research laboratories of the Physical Science and Technology Centre) were very successful actions.”



New in IMC18: Doha



Ilham Al-Qaradawi, Professor of Physics, Qatar University and President of Qatar Physics Society

- CMS Masterclass

“Students enjoyed it very much. I particularly enjoyed the video conference, and I think it made a big difference to the event particularly to the students; the only disadvantage is being a bit late for them.”

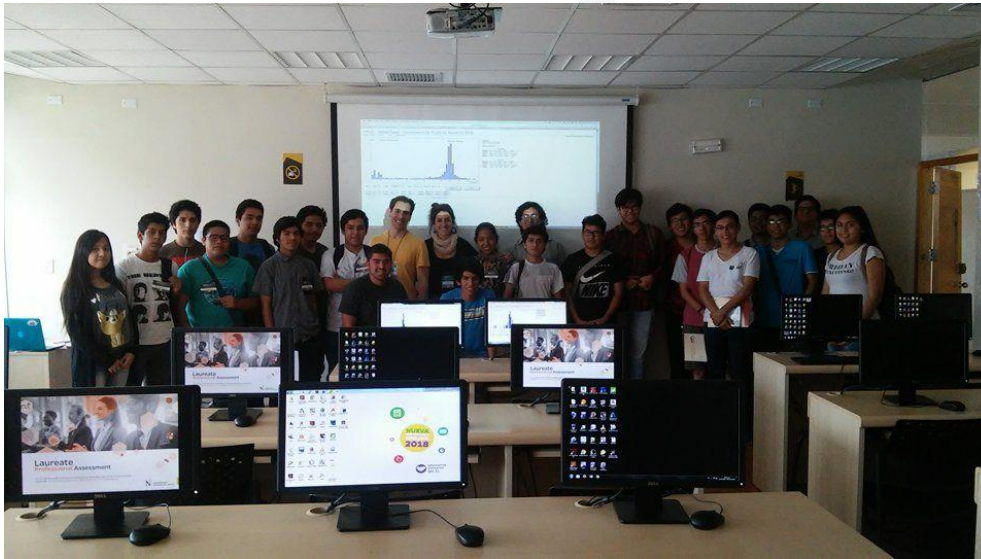
New in IMC18: Mostar



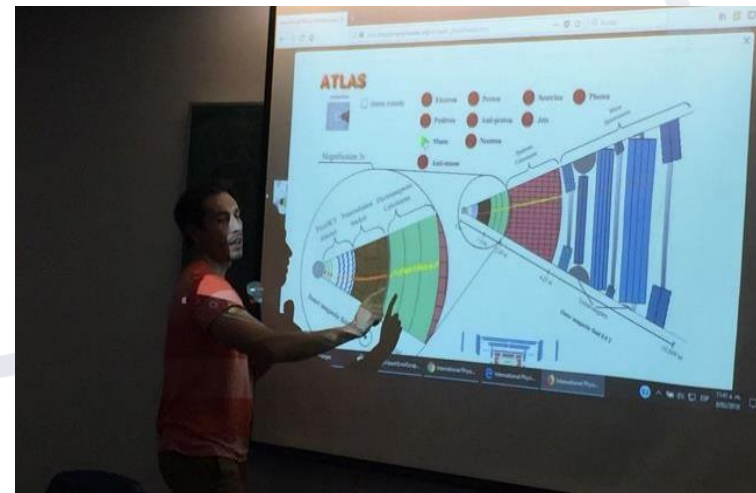
University of Mostar - Faculty of Mechanical Engineering, Computing and Electrical Engineering

- CMS Masterclass
- Facilitated by Nikola Godinovic, Split (Croatia)
- Antonija Bosnjak kindly accepted to act as the contact person for Bosnia and Herzegovina
- Antonija also kindly accepted to host the future participants at MC in the computer lab at her university

New in IMC18: Lima and Trujillo



- ATLAS Masterclasses in Lima and Trujillo
- Alejandro de la Puente (TRIUMF) + Estefania Coluccio travelled to Lima
- AP was supported by IPPOG funds (travel)



New in IMC18: Tehran



- 2 CMS Masterclasses
- No VC, due to different time zone
- Facilitated by Fatemeh Elahi (Postdoc) and Mohsen Khakzad (Researcher), both IPM-Institute for Research in Fundamental Sciences in Tehran

بزرگترین آزمایشگاه فیزیک ذرات جهان در کشور
سوئیس قرار دارد که هدف آن یافتن ذرات ریز اتمی جدید و پاسخ به
سوالات دانشمندان در مورد چگونگی تشکیل و تولد جهان است.

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کلاس بین المللی
ذرات بنیادی

ویژه دانش آموزان دبیرستان

آدرس:
تهران، بزرگراه آرشی، روبروی اراج،
پژوهشگاه دانش های بنیادی

زمان: ۲۰ بهمن ۱۳۹۶

کشف ذرات کوارکها و لپتونها یا دانشمندی واقعی از سون
سناری به کوچکترین اجزای هستی
تجزیه های دست اول در فیزیک ذرات
تجربیه های دست اول در فیزیک ذرات

IPM INSTITUTE FOR RESEARCH IN FUNDAMENTAL SCIENCES
IPE
QuarkNet
INTERNATIONAL MASTERCLASSES
hands on particle physics
CERN
Tel: 021-22809150
Email: particles@ipm.ir
www.physicsmasterclasses.org

بزرگترین آزمایشگاه فیزیک ذرات جهان در کشور
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New in IMC18: Indore



Acropolis Institute of Technology and Research, Indore

- ATLAS Masterclass
- Facilitated by Ravjeet Kour, lecturer in UK (ONcampus Coventry)
- No VC (time zone...)

“During my recent visit to India, I gave few presentations on the masterclasses and we had quite an interest to participate in the next round.”

New in IMC18: Montevideo



Universidad de la República, Montevideo, Uruguay

- ATLAS Masterclass
- VC with Fermilab (Spanish!) on April 27
- Contact: Dr. Gabriel González Sprinberg, Profesor Titular, Inst. de Física

International Masterclasses 2018



15.2. - 28.3.2018
+ extra dates w. Fermilab

52 countries involved
+ 3 countries without VC



Coord.: QuarkNet / TU Dresden



- 48 institutes (43)
- 50 Masterclasses (50)
 - 31 CMS (35)
 - 19 ATLAS (15)

- 177 institutes (173)
- 257 Masterclasses (264)
 - 35 ATLAS W (45)
 - 104 ATLAS Z (93)
 - 58 CMS (52)
 - 39 LHCb (45)
 - 18 ALICE SP (24)
 - 3 ALICE R_AA (5)

Statistics International Masterclasses

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

18

countries

52

58

institutes

225

72

masterclasses

307

3k

students

14k

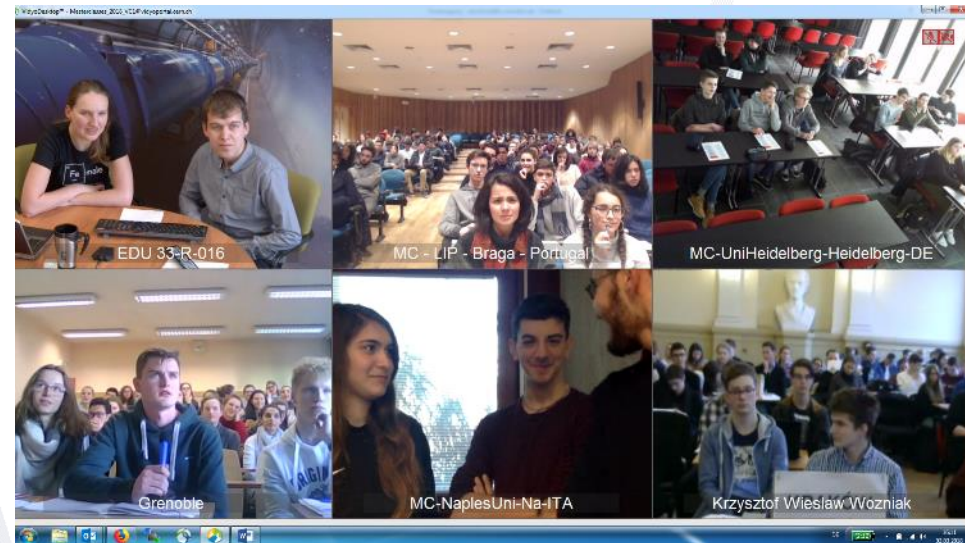
12

video conferences

82

Videoconference

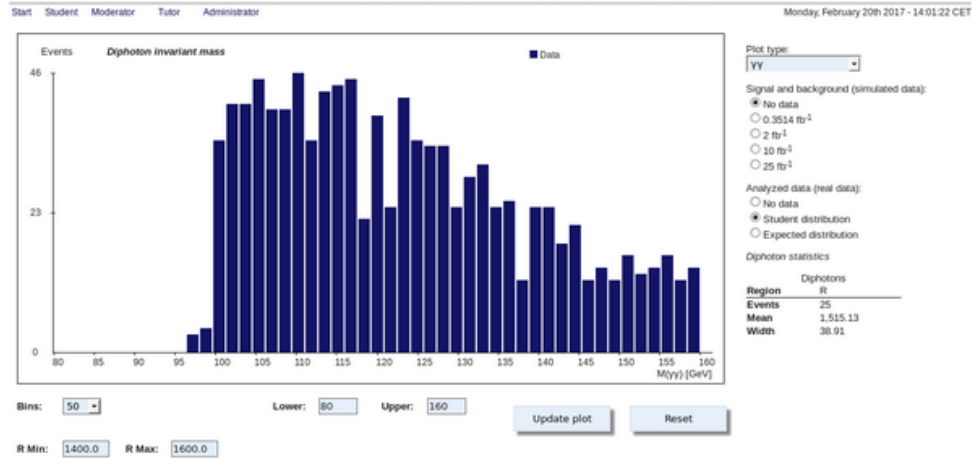
- 61 videoconf. with CERN (57), 50 moderators
- 18 with Fermilab (24), 18 moderators
- 1 with TRIUMF (1)
- Lack of moderators this year
→ unconventional solutions



Discussion of Physics Results

- For ATLAS and CMS: 5 “scenarios”
- Each scenario: combination of plot/table and relevant question for students
- Examples on next slide
 - streamline the discussion of measurements
 - help moderators to go through the results and the physics discussion in an efficient way
 - help students to prepare for the discussion
- Included in moderators’ training and wiki
- Institutes informed via [circular](#)

Example for ATLAS Z



- Question 2: Do you see a peak corresponding to the Higgs boson? Why not? (Hopefully students are aware of statistics limitations from local institute discussions.)

Example for CMS

- Share with students: Combined Results (Overall e/nu and W+/W- results)

Back Mass Histogram Results All

Tables: Buffalo2017 Mayaguez2017 Medellin2017 Williamsburg2017

Groups: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100

Group	Muon	Electron	W	W-	W+	NP	Higgs	Zoo	Total
1	45	45	28	6	34	22	1	9	100
2	46	49	6	26	38	25	1	3	99
3	47	48	15	29	29	22	2	3	100
4	47	53	1	30	45	24	0	0	100
5	50	48	6	26	43	23	2	0	100

- Question 4: What do you expect the ratio of electron events to muon events to be? Is your result consistent with this?
- Question 5: What is the ratio of W+ to W- bosons? What does this ratio tell us about protons?

Some key factors for success

- Stable measurements
- Well prepared institutes
 - (bi)weekly circulars http://physicsmasterclasses.org/index.php?cat=local_organisation&page=organisation
 - Orientation for Fermilab institutes
 - Question time for all measurements
 - Manual for videoconference
http://www.physicsmasterclasses.org/downloads/manual_local_organizers_2018_02_06.pdf
- WG videoconference (Ina Carli, K. Leney, Marzena, Kate, Uta)
 - Training for moderators (2 h) <https://indico.cern.ch/event/696223/>
 - twiki, manual
 - Rooms at CERN
- Vidyo team / Marek Domaracky + videoconference team at Fermilab
 - Room 31-S-27
 - Vidyo support at every session
- Maureen
 - Room 33-R-16
 - Shirts for moderators

Website – slightly reorganized

3 entry points:



International Particle Physics Outreach Group

INTERNATIONAL MASTERCLASSES
hands on particle physics

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

International Masterclasses
14th International Masterclasses 2018

Each year more than 13.000 high school students in 52 countries come to research centres for one day in order to unravel the mysteries of particle physics... insight in topics and methods of basic research at the fundamentals of matter and measurements on real data from particle physics experiments themselves. At the research collaboration, the participants join in a video conference for discussion [here](#) for media coverage.

Communication

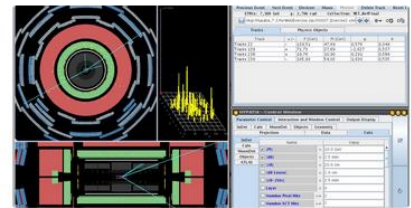
- Circulars
 - 2017: biweekly on Fridays
 - 2018: weekly on Fridays
- Twitter
 - @physicsIMC
 - #LHCIMC18
 - Team: Nicolas, Kate, Ken, Uta
 - Schedule (Nov – April)
 - Encourage institutes to tweet with specific tips (circular)
- Press release
 - Template for institutes



Twitter impressions

Top Tweet earned 5,685 impressions

Looking for decays of Z bosons and searching for the #Higgs. High school students at @UU_University, @HumboldtUni + @desy Zeuthen, Univerzita Mateja Bela in Banska Bystrica, @unizar, and @UniOslo. #LHCIMC18 pic.twitter.com/l2VOFngmLD



Top mention earned 623 engagements

CHIPP_news
@CHIPP_news · Feb 1

for the: #WomenScienceDay Leonora Vesterbacka: PhD student at @ETH_en Zürich, based at @CERN, Searching for Supersymmetric particles at the @CMSexperiment detector! moderator at the International masterclasses for high school girls goo.gl/1JK3yT @physicsIMC #ChatCERN pic.twitter.com/j2F9z0bRVWY



1 18 69

Top media Tweet earned 4,559 impressions

@Fermilab-connected masterclasses have begun! Yesterday, Rio de Janeiro, Brazil and Quincy, Illinois. More today! pic.twitter.com/ZWZeOJCN7Q



Top media Tweet earned 923 impressions

Our hashtag for this year's Masterclasses: #LHCIMC18 pic.twitter.com/8ESKN9G5sv



4 12

Top Follower followed by 41.6K people



Tayo Rockson
@TayoRockson | FOLLOWS YOU

21st Century Gentleman | CEO @uydmanagement | 3x @TEDx Speaker | Brand Strategist | Cultural Translator | Podcaster | Consultant | Storyteller | Ravenclaw | TCK

JAN 2018 SUMMARY

Tweets	18	Tweet impressions	16.9K
Profile visits	1,097	Mentions	11
New followers	53		

FEB 2018 SUMMARY

Tweets	34	Tweet impressions	32.2K
Profile visits	2,707	Mentions	53
New followers	38		

MAR 2018 SUMMARY

Tweets	46	Tweet impressions	29.6K
Profile visits	2,221	Mentions	98
New followers	55		

APR 2018 SUMMARY

Tweets	6	Tweet impressions	3,086
Profile visits	219	Mentions	8
New followers	13		

Social media



A screenshot of the Twitter profile for physicsIMC. The profile picture shows a laboratory setting with blue cylindrical components. The header includes the name 'physicsIMC' and the handle '@physicsIMC'. Below the header, the statistics are displayed: 79 tweets, 100 following, and 202 followers. In the background, a person's hand is pointing at a laptop screen showing a circular diagram.

TWEETS	FOLLOWING	FOLLOWERS
79	100	202

2016



A screenshot of the Twitter profile for physicsIMC. The profile picture is the same as in 2016. The header includes the name 'physicsIMC' and the handle '@physicsIMC'. Below the header, the statistics are displayed: 242 tweets, 238 following, and 397 followers. The background image is the same as in 2016.

TWEETS	FOLLOWING	FOLLOWERS
242	238	397

April 2017



A screenshot of the Twitter profile for physicsIMC. The profile picture is the same as in 2016. The header includes the name 'physicsIMC' and the handle '@physicsIMC'. Below the header, the statistics are displayed: 462 tweets, 257 following, and 730 followers. The background image is the same as in 2016.

Tweets	Following	Followers
462	257	730

April 2018

Int. Day of Women and Girls in Science

- UN: Feb 11th, since 2016
www.un.org/en/events/women-and-girls-in-science-day/
- To support and promote the access of women and girls to science education and research activities
- MCs for girls on Feb 12th (Mon)
 - 8 institutes participating
 - ~ 250 students (not only girls)
 - Female lecturers and tutors (as much as possible)
 - 2 videoconferences with female moderators

	Mon, Feb 12	Mon, Feb 12
	VC 1: ATLAS W	VC 2
moderators	Stefanie	Marianna
moderators	Rosa	Leonora
	Paris APC webpage	Barcelona (ATLAS Z) webpage
	Czech Technical University Prague webpage	Cagliari (LHCb) webpage
	Cosenza webpage	Madrid CIEMAT (CMS) webpage
	London UC webpage	
	Lund webpage	

Moderators:

 Marianna Fontana (LHCb)	 Stefanie Morgenstem (ATLAS)	 Rosa Simoniello (ATLAS)	 Leonora Vesterbacka (CMS)
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VC 1

Ana Godinho (head of ECO) gave a welcoming address

Moderators Stefanie and Rosa (ATLAS)

Some institutes invited girls + boys

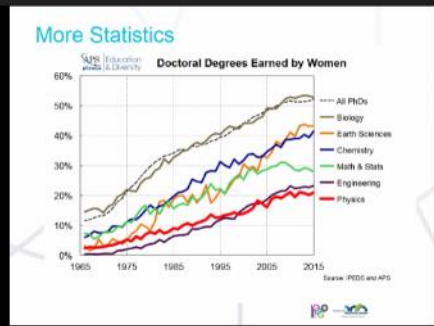


5 institutes with ATLAS W path

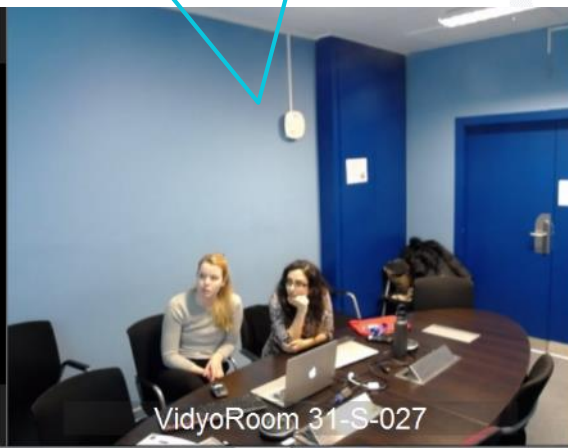
VC 2

Short presentation about situation of women in physics

Moderators Leonora (CMS) and Marianna (LHCb)



MC Moderator CERN



VidyoRoom 31-S-027



MC-IFAE-Barcelona-Spain



CIEMAT Madrid Spain



CAGLIARI

3 institutes with ATLAS, CMS, and LHCb measurement

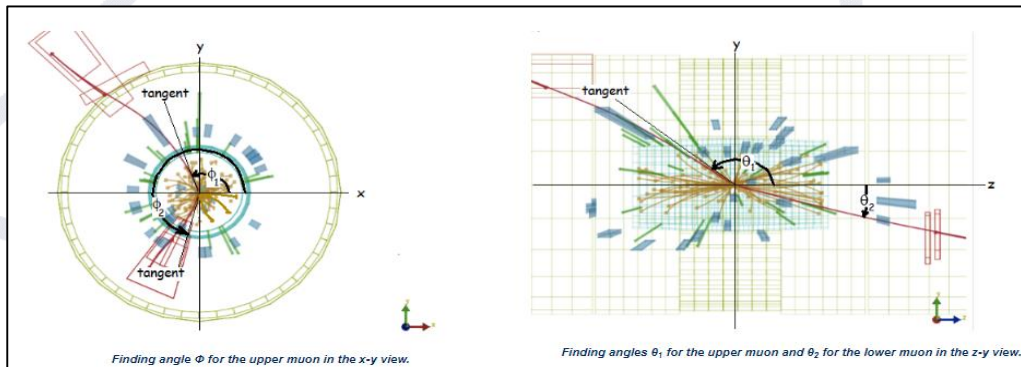
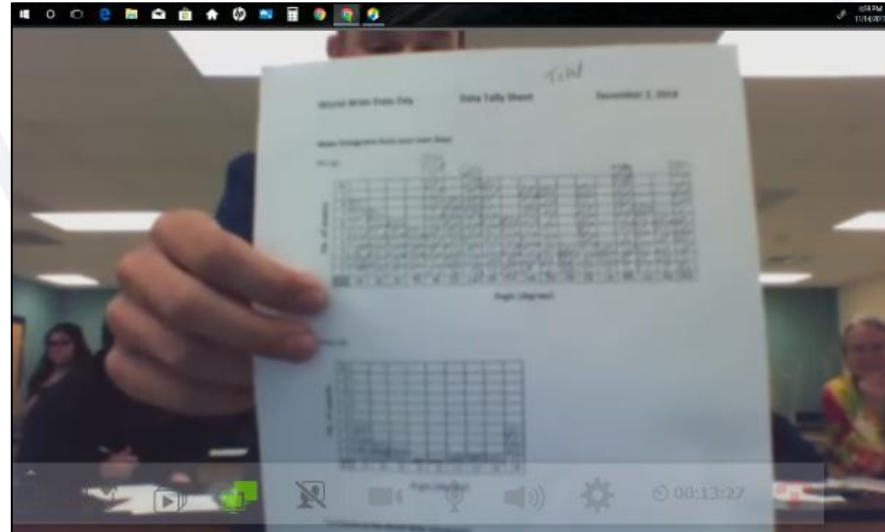
World Wide Data Day



- 14th November 2017 (2nd December 2016)
- The numbers:
 - Participating groups - 34 (21)
 - Students - 445 (354)
 - Moderators – 14 (8)
- <http://tiny.cc/w2d2-17>
- Students measure theta and phi for dimuon events
- Data analysis at school, physics discussion in VC
- Report: <http://tiny.cc/94lrsy>
- Not widely advertised outside IPPOG
- Measurement will be used in Chile, Africa in 2018
- Development of measurement expected in 2018



World Wide Data Day



- Clockwise, from top-left:
- Students in Herouville-St. Claire, France
 - Student in Colorado shows group plots
 - CMS event

Discussion

19.04.2018

IPPOG meeting Pisa

