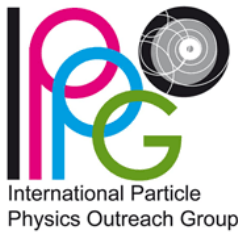


# INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS



Nantes



Swedish teachers CERN 1.11.2019



Despina Hatzifotiadou

## A day of immersion in particle physics for 16-18 year old pupils

### Typical day of International Masterclasses

**Morning** : introductory lectures on

- Particle physics (elementary particles, forces, Standard Model and beyond)
- Detectors – accelerators – experimental methods

Visit of laboratory / experimental site / discussion with scientists and graduate students

**Lunch** – usually offered by the Host Institute

**Afternoon** : students analyse data from an LHC experiment and do a physics measurement  
They work in groups of 2 per computer;  
analysis is visual in most cases

**At the end of the day** : Video Conference  
moderated by two physicists at CERN and connecting up to 5 institutes  
presentation / merging/ discussion of results, answering questions, quiz



# IPPOG : INTERNATIONAL PARTICLE PHYSICS OUTREACH GROUP



Network of scientists + communicators to promote and coordinate outreach + educational activities (in particle physics). Share experiences, resources and best practices

EPPOG established in 1997 (CERN Council/ECFA)  
IPPOG Collaboration: 39 members (32 countries, CERN, 6 int. collaborations: ALICE, ATLAS, CMS, LHCb, Belle II, HAWC) + two associate members (DESY, GSI)

<https://ippog.org>

IPPOG Meets twice a year (Spring, Autumn)

Flagship activity: International Particle Physics Masterclasses

<https://physicsmasterclasses.org>

Global cosmics, <https://ippog.org/global-cosmic-rays-portal>

Resource database <https://ippog.org/ippog-resource-database>

## A bit of history and present status

1996: Started in UK

2005: Adopted by EPPOG (European Particle Physics Outreach Group) for all Europe

Use data from LEP (the Large Electron Positron collider, CERN, 1989-2000)

**OPAL** Identifying Particles

**DELPHI** Hands on CERN

Z<sup>0</sup> decays / calculation of branching ratios

2006: U.S. joined program

2010: preparing to move to LHC-based Masterclasses

2011: Start using data from LHC

**ALICE** Looking for strange particles , Nuclear modification factor  $R_{AA}$

**ATLAS** W+W<sup>-</sup> (MINERVA), Z<sup>0</sup> (HYPATIA)

**CMS** J/ψ, Z

**LHCb** Measurement of the D<sup>0</sup> lifetime

More exercises added, nowadays



Central organisation

TU Dresden (Uta Bilow)

Quarknet (Ken Cecire)







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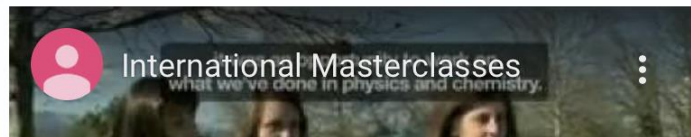
## International Masterclasses

16<sup>th</sup> International Masterclasses 2020

Each year more than 13.000 high school students in [55 countries](#) come to one of about 225 nearby universities or research centres for one day in order to unravel the mysteries of particle physics. Lectures from active scientists give insight in topics and methods of basic research at the fundamentals of matter and forces, enabling the students to perform measurements on real data from particle physics experiments themselves. At the end of each day, like in an international research collaboration, the participants join in a video conference for discussion and combination of their results. See [here](#) for media coverage.

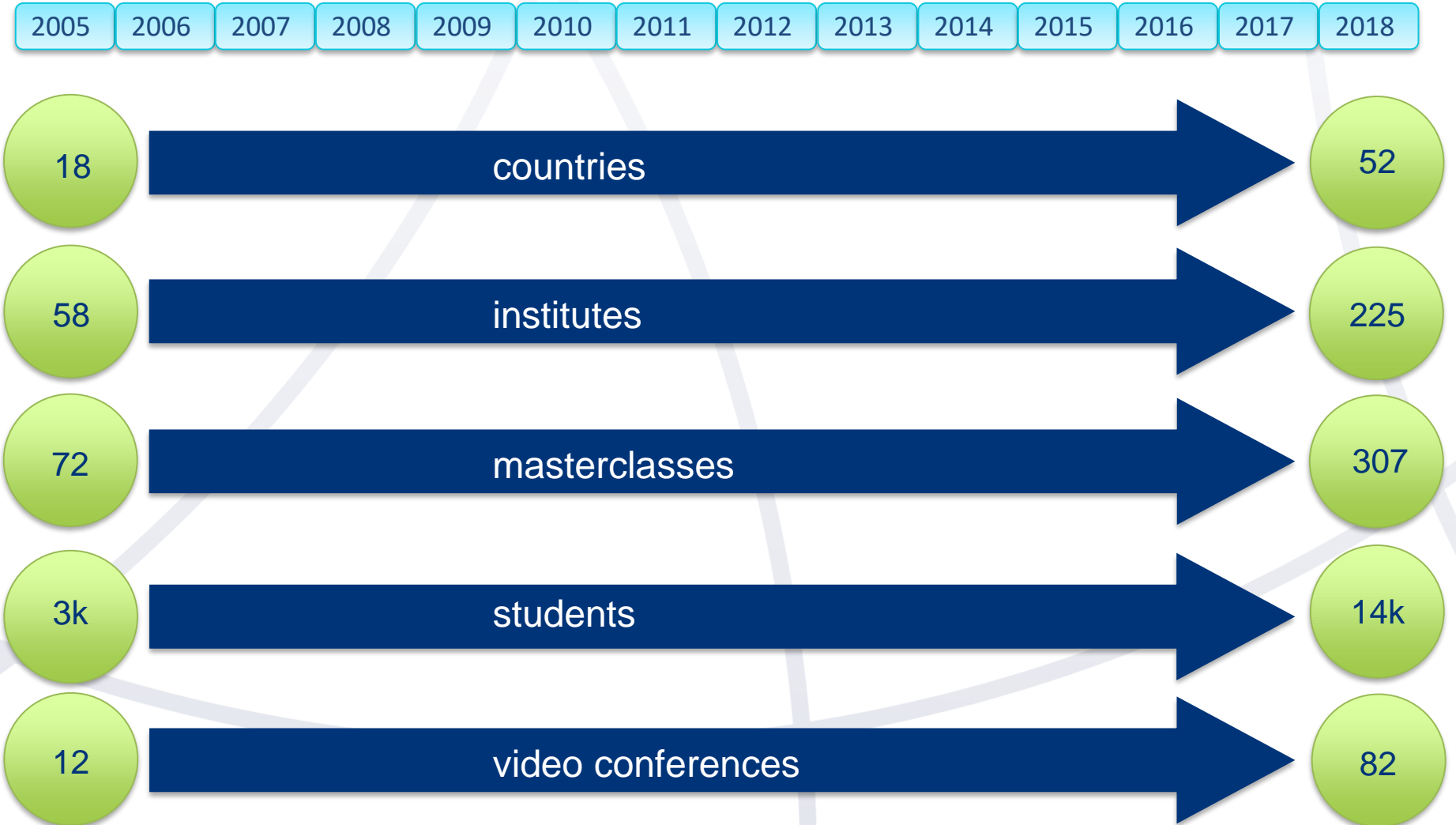
**International Masterclasses 2020** will take place from 26.2. - 8.4.2020.

**Discover the world of Quarks and Leptons with real data**



- get out of school for one day and come to a nearby university or research centre

# Statistics International Masterclasses



## Video Conference

- Presentation of the moderators
- Welcome of the participating institutes
- General questions from the participating institutes
- Presentation of the results of the measurements by institutes
- Merging of results by moderators
- Comments, discussion, more questions
- Quiz



Often it is the highlights of the day

- General appreciation of the International Masterclasses very positive
- New countries join every year

## Some information

International Masterclasses are typically announced in October

In 2023: 13 February – 31 March

11 February : International day of Women and Girls in Science : special masterclasses for girls

Limiting factors :

Computer rooms available at Institutes

Number of institutes per video conference (maximum 5)

In Sweden : Masterclasses in Uppsala – Lund (?) – Stockholm

LHC World Wide Data Day launched in 2016

<https://quarknet.org/content/world-wide-data-day>

This year : 10 November 2022