



Kate Shaw (ICTP)

IPPOG and International Masterclasses



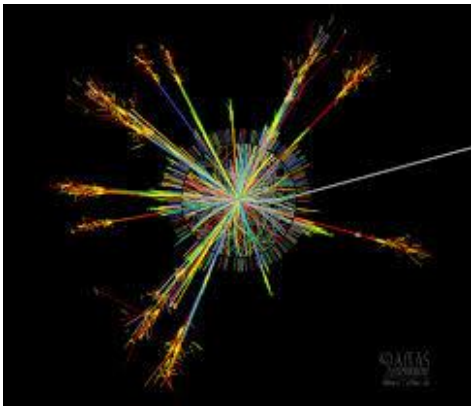
The Abdus Salam
International Centre
for Theoretical Physics

IPPOG



IPPOG: International Particle Physics Outreach Group

- Contribute to global efforts in strengthening cultural awareness, understanding and support of particle physics and related sciences and in developing the next generation of researchers.
- IPPOG's purpose is to raise standards of public outreach and science education efforts.





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International Particle Physics Outreach Group

[HOME](#) | [ABOUT](#) | [MEMBERS](#) | [RESOURCES](#) | [MASTERCLASSES](#)

The International Particle Physics Outreach Group (IPPOG)

IPPOG is a network of scientists, science educators and communication specialists working across the globe in informal science education and outreach for particle physics. Particle physics is the science of matter, energy, space and time. IPPOG brings new discoveries in this exciting field to young people and conveys to the public that the beauty of nature is indeed becoming understandable from the interactions of its most fundamental parts - the elementary particles.

Current member come from the 21 member states of CERN, Ireland, Romania, South Africa, the USA, and from DESY, CERN and five of the major experiments at the Large Hadron Collider (LHC).

Marge Bardeen (FNAL) and Hans Peter Beck (University of Bern), co-chairs of IPPOG.

Dans la peau d' un chercheur

To educate and enthuse 9-12 year olds in the world of Particle Physics and general science exploration.



Classroom Outreach Program

Latest Resources



Hand-outs for...

to prepare secondary school children for Particle Physics Masterclasses

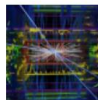
0 comments



Particle Physics:...

to teach secondary school children about research in particle physics

0 comments



The ATLAS-Detector

to inform secondary school children about the ATLAS Project

0 comments

- IPPOG organise and support the **International Masterclasses**
- And are a source of **resources** for all particle physics outreach

Resources

Activities

- Cart Demonstration
- Classroom Activity
- Facilitated Activity
- Presentation
- Game
- Display

Programs & Events

- Science Fair / Science Festival
- Science Camp
- Science Shows & Performances
- Symposium / Conference
- Classroom Outreach Program
- Multi-Media Contest

Media

- Audio / Podcast
- Film / Video
- Animation - real event
- Animation - simulated event
- Images
 - Photos
- Illustrations
 - Event Displays (static)
 - Plots
- Computer game
- Non-game Interactives / Virtual Tours
- Website
- Print Media
 - Fact Sheet
 - Brochure / Flyer / Leaflet
 - Article / Journal
 - Poster
 - Banner / Print
 - Pannel
 - Book

Learning Topics



- ▶ Physics
- ▶ Technology
- ▶ International Collaboration
- ▶ Broader Impacts

LATEST

FEATURED



Illustrations

Hand-outs for participants of Particle Physics Masterclasses
to prepare secondary school children for Particle Physics Masterclasses

Search by

Learning Topic

- Any -

Audience

- Any -

Item Type

- Any -

Availability

- Any -

Duration

- Any -

Language

- Any -

Key Words

GO

Resources in your language

[English](#) [French](#) [German](#)
[Italian](#) [Portuguese](#) [Spanish](#)

[more](#)

Filter by audience

6 to 9 years
9 to 12 years
12 to 15 years
15 to 18 years
18 to 25 years
25 years+
Science Educator / Science Explainer

IPPOG

Results

• WHAT DOES A HIGGS BOSON EAT DURING THE WINTER AND OTHER ESSENTIAL DETAILS



PaulineGagnon00@gmail.com

use [To download](#)

Presentation to explain to general audiences what is the Higgs boson. It reviews first what are the fundamental particles and the Standard Model, then explains the role of the Higgs field and the Higgs boson as an excitation of the field. It also shows how it was discovered at the LHC...

Presentation
[English](#)

• THE BASICS OF THE HIGGS BOSON (A TED ED LESSON)



steven.goldfarb@cern.ch

use [To download](#)

Let's Begin...

In 2012, scientists at CERN discovered evidence of the Higgs boson. The what? The Higgs boson is one of two types of fundamental particles and is a particular game-changer in the field of particle physics, proving how particles gain mass. Using the Socratic method, CERN ...

Website
[English](#)

• CRACKING THE COSMIC CODE



David.Barney@cern.ch

use [To download](#)

A simple presentation to explain the excitement surrounding the discovery of the Higgs boson. Borrows heavily from other presentations but adds lots of animation. Two versions are included: one is in English only; the other is in English and traditional Chinese. Talk was given in Taiwan in...

Presentation, Symposium / Conference
[Chinese](#), [English](#)

• THE LHC AND THE HIGGS BOSON: NATURE 96 - SCIENCE 4 (BUT IT'S EARLY IN THE GAME)



steven.goldfarb@cern.ch

use [To download](#)

Buried 100m below the French / Swiss countryside, between the Alps and the Jura Mountains, is a 27km tunnel housing the Large Hadron Collider at CERN. This chain of superconducting magnets accelerates protons to high energies and then collides them in four different underground halls. Inside...

Presentation
[English](#)

• THE LHC AND THE HIGGS BOSON: COMMUNICATING SCIENCE



steven.goldfarb@cern.ch

use [To download](#)

Buried about 100m below the French / Swiss countryside, between the Alps and the Jura Mountains, is a 27km tunnel housing the Large Hadron Collider at CERN. This chain of superconducting magnets accelerates protons to very high energies and then collides them at four different places...

Presentation, Game
[English](#)

Animation - simulated event

• CMS SLICE (JULY 2010 VERSION)



CMS Outreach

use [To download](#)

This slice shows a colorful cross-section of the CMS detector with all parts of the detector labelled. Viewers are invited to click on buttons associated with five types of particles to see what happens when each type interacts with the sections of the detector. The five types of particles users...

Animation - simulated event, Non-game Inter-actives / Virtual Tours
[English](#)

• TRANSITIONAL RADIATION TRACKER



Outreach ATLAS

use [To download](#)

This colorful 3D animation is an excerpt from the film "ATLAS-Episode II, The Particles Strike Back." Shot with a bug's eye view of the inside of the detector. The viewer is taken on a tour of the inner workings of the transitional radiation tracker within the ATLAS detector. Subjects covered...

Animation - simulated event
[English](#)

• MUON SPECTROMETER IN THE ATLAS DETECTOR ON THE LHC AT CERN



ATLAS Outreach

use [To download](#)

This colorful 3D animation is an excerpt from the film "ATLAS-Episode II, The Particles Strike Back." Shot with a bug's eye view of the inside of the detector. The viewer is shown the design of the Muon Spectrometer, what happens when particles pass through it and what it measures.

Running...

Animation - simulated event
[English](#)

• JOURNEY TO DISCOVER THE NATURE OF MASS (THE HIGGS FIELD)



Chris Mann

use [To download](#)

Produced by: Mannmade Productions
Director: Chris Mann
05:00 min. / 10 September 2008 / CERN Copyright
<http://www.mannmade.co.uk/>
See files here: <http://cdsweb.cern.ch/record/1128122...>

Film / Video, Animation - simulated event
[English](#)

• ATLAS EVENT - HOW ATLAS DETECTS PARTICLES



ATLAS Outreach

use [To download](#)

This is a segment of the movie 'Episode II, The Particles Strike Back', illustrating how the ATLAS detector detects different types of particles.
Running Time 1min 47 sec

For video files, see here: <http://cdsweb.cern.ch/record/1096390...>

Animation - simulated event
[English](#)

International Masterclasses



Organised by IPPOG around March each year

- High school students (15 – 19) get to be “Researchers for one day” at their local university or research institute
- **Morning:** Introductory talks on Standard Model, Detectors, Accelerators
- **Afternoon:** Hands on session, 2 hours to perform measurement using data from ALICE, ATLAS, CMS or LHCb
- At the end of the day they have an International Video conference with CERN or Fermilab in a group of 3-5 institutes

International Masterclasses



LOCAL TIME:

8:30 - 9:00
9:00 - 10:00
10:30 - 11:30
12:00 - 13:00
13:00 - 15:00
15:00 - 16:00
16:00 - 17:00

ACTIVITY:

registration & welcome
introduction to Particle Physics
second talk or tour
lunch
data analysis, including introduction
local combination and discussion
video conference with CERN



International Masterclasses

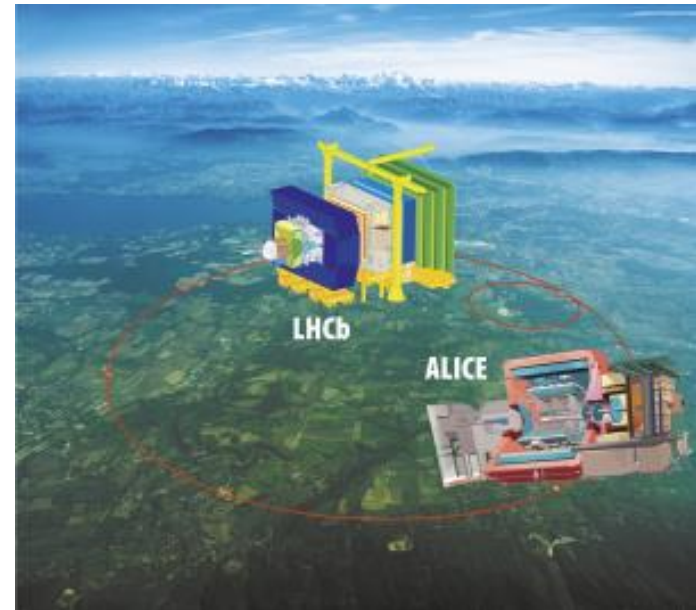
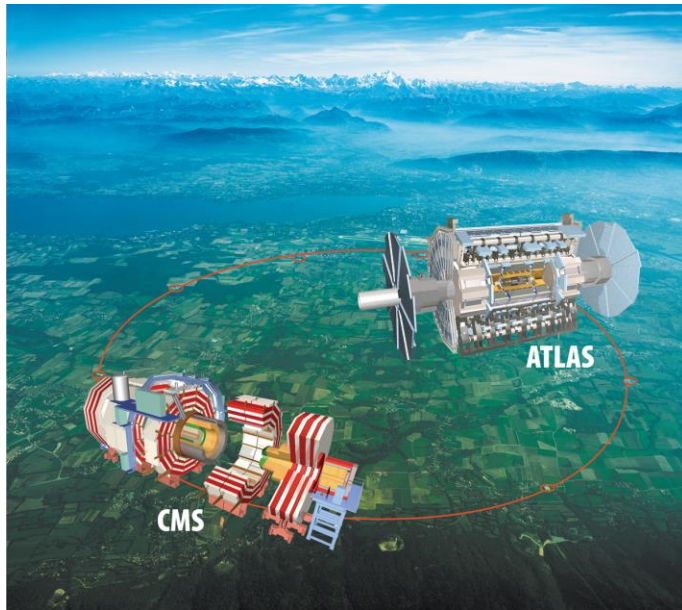


In summary, for a Masterclass the following is needed:

- a group of students (aged 15 - 19)
- an inviting institute, providing the infrastructure
- at least 1 scientist, holding the lecture
- some tutors for students during the measurement (1 tutor per 10 students)
- a lecture hall
- PC-pool (students work in groups of 2)
- facility for video conferencing, if possible

International Masterclasses

Hands on session



- Analysis data and do a measurement from one of the four main experiments at the LHC

International Masterclasses

Hands on session



HOME PAGE

W-Path

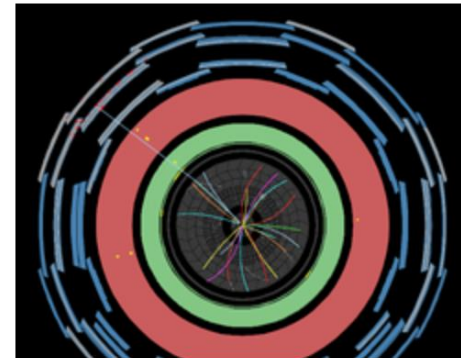
Z-Path

LHC@InternationalMasterclasses

Join us on a journey to the smallest pieces of matter! Learn what is happening 100 meters below the ground at the European Organization for Nuclear Research (CERN). In the Large Hadron Collider, with a circumference of 27 kilometres, the experiments ALICE, ATLAS, CMS, and LHCb are running. The following short video gives an impression of the start of a fascinating journey looking for the origin of mass, Dark Matter, and new phenomena such as Supersymmetry or Extra Dimensions.

ATLAS: <http://atlas.physicsmasterclasses.org/en/index.htm>

Links



No live events available, showing recently recorded events.

International Masterclasses

Hands on session

Z-Path

ATLAS: Z Path

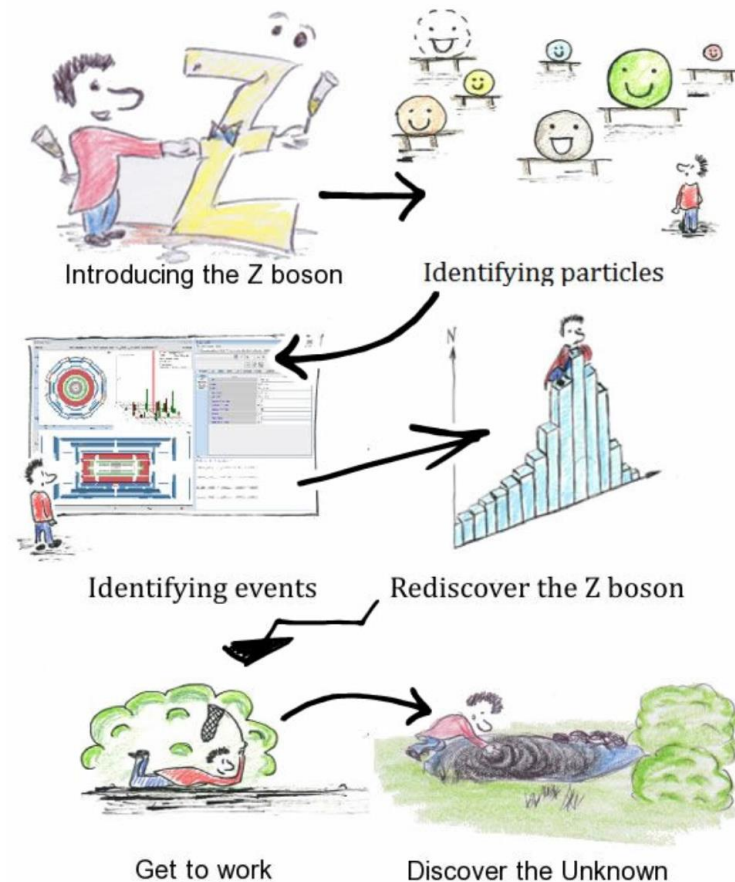
HYPATHIA event display program

Download data samples, giving each group one data package with 50 events

Students find the Z boson, and maybe find the Higgs or even unknown particles

Upload results to an online plot submission page

Discuss results locally, then present results in the video conference



International Masterclasses

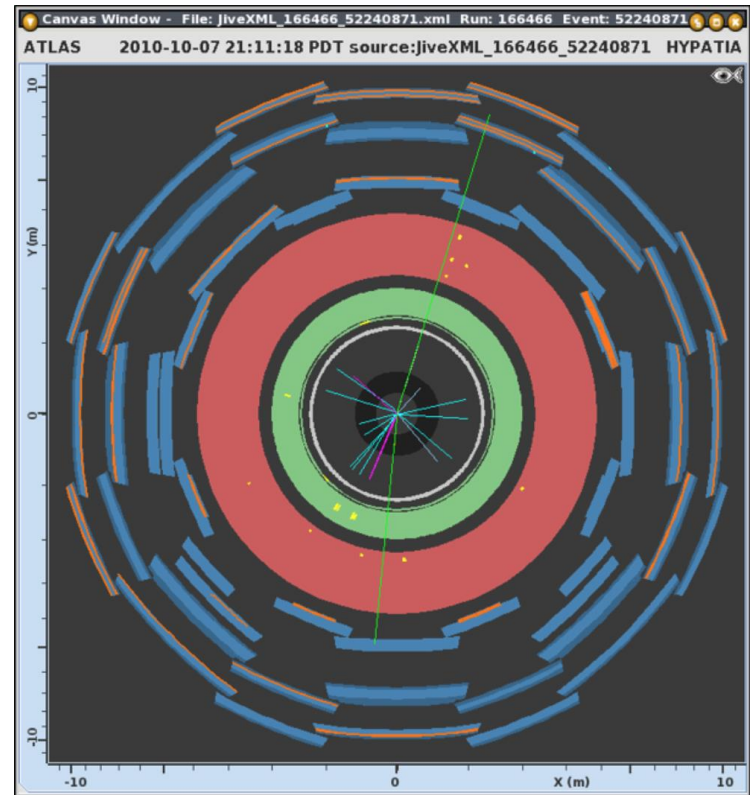
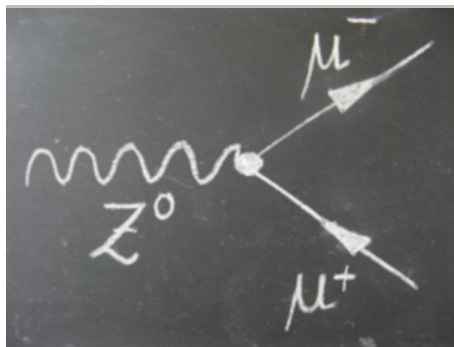
Hands on session

Z-Path

ATLAS: Z Path

HYPATHIA event display program

Students learn how to identify Z boson decays and Higgs boson decays



From this enlarged view into the direction of the proton, you can clearly see the two muons. Both particles might arise from one particle that decayed after its creation.

International Masterclasses

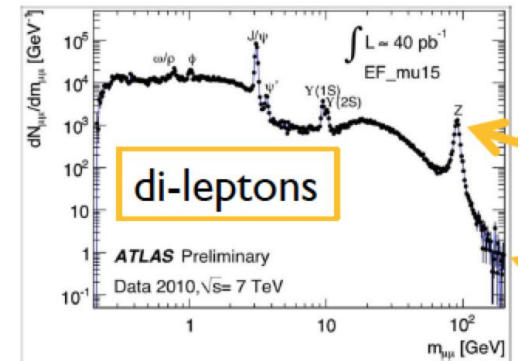
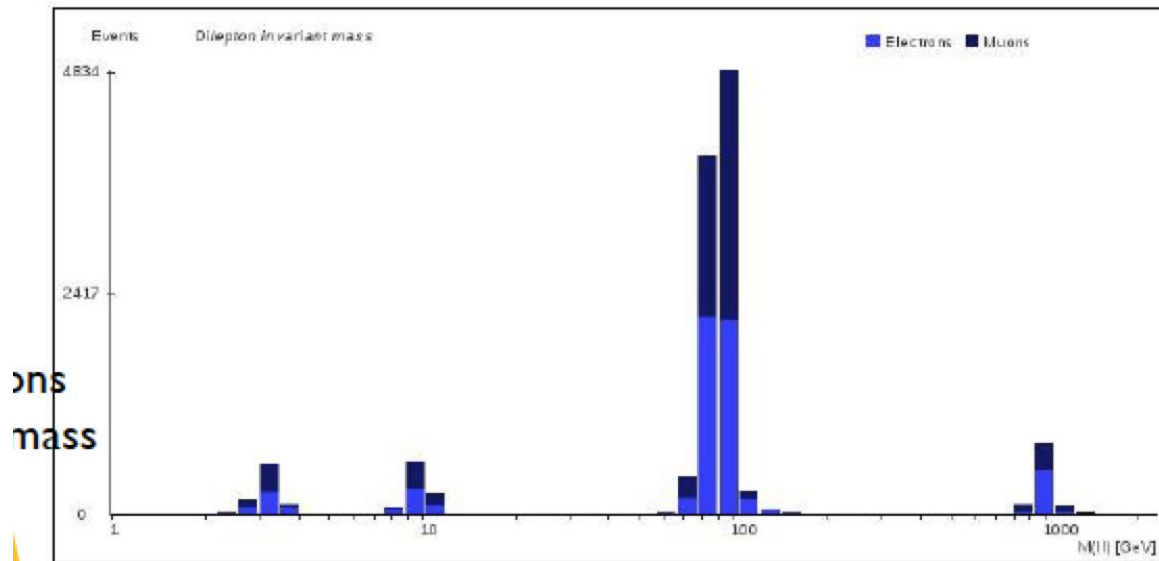
Hands on session

Z-Path

Di-leptons

OPlot - MasterClass – Combination for all institutes on 2014-01-01

Start Student Moderator Tutor Administrator



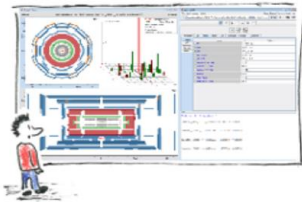
International Masterclasses

Hands on session

ATLAS: W Path



Identifying particles



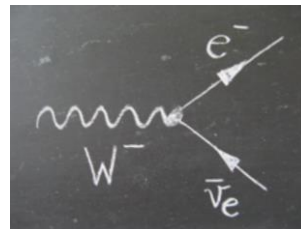
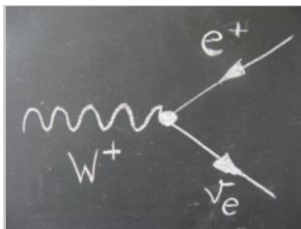
Identifying events



Looking for the Higgs



Exploring the Proton



Measurement

In this part you are going to analyze original data from the ATLAS experiment that was taken in 2011 in order to draw your own conclusion about the structure of the proton on the one side and to understand how the yet undiscovered Higgs particle can be found on the other side.

For the measurement, you will need the following tools:



1. An event display program: MINERVA - [Download starts here.](#)



2. A [Data sample](#) - All in all there are 6000 events. You will only analyze a subsample of 50 events. The 120 subsamples are labeled as follows: 1A, 1B, ..., 1T, 2A, ..., 2T, ..., 6A, ..., 6T.

Data sample:	
Event #	
1	1
2	2

3. A tally sheet ([PDF](#)) to count your events. In the upper left corner your subsample is defined.

International Masterclasses



LOCAL TIME:

ACTIVITY:

8:30 - 9:00

registration & welcome

9:00 - 10:00

introduction to Particle Physics

10:30 - 11:30

second talk or tour

12:00 - 13:00

lunch

13:00 - 15:00

data analysis, including introduction

15:00 - 16:00

local combination and discussion

16:00 - 17:00

video conference with CERN



Vidyo



International Masterclasses

Video Conference

- At 16 CERN time two scientists from CERN will have a one hour live video conference with 3-5 institutes around the world
- Each institute will have two minutes to present their results
- The results are combined and discussed, just as in normal scientific meetings
- At the end there is a fun quiz and that's the end of the day!



Mon, March 17 VC 1: ATLAS W	Tue, March 18 VC 1: ATLAS Z	Wed, March 19 VC 1: ATLAS W	Thu, March 20 VC 1: ATLAS Z	Fri, March 21 VC 1: ATLAS W	Sat, March 22 VC 1: ATLAS Z
Konrad, Fabian Bonn	Claire, Katharine Bralisleva	Eva, Fabian Maynooth	Michael H., Roland Amsterdam	Barbara, Duc Dublin, UC	André, Guilherme Beja
Bielsko-Biala	Nijmegen	Faro	Milano	Brookhaven	Evora
Dresden	Marseille	Copenhagen	Prague Charles U.	Hamburg DESY	
Poznan	Napoli	London Queen Mary	Stockholm		
Santiago de Compostela	Granada	Lund	Banska Bystrica		



International Masterclasses



International Masterclasses



<http://www.physicsmasterclasses.org/index.php>



Hands on Particle Physics Masterclasses ORGANISATION

Welcome to the organisation section of International Masterclasses!

Here, we hope to provide you with all that you'll need in order to organise an event that students, teachers and staff will never forget.

Therefore, you can find:

- an **introduction** to the overall organising scheme including a **step-by-step list** for preparation
- some example **lectures**
- information on the **measurements**
- a **manual** for the video conference, including information on the quiz
- **corporate material** (logos, poster, invitation letters, participation certificates)
- english **press release 2014** (template)
- english **alternative press release 2014** (template)
- german **press release 2014** (template)
- french **press release 2014** (template)
- **CERN 60 years** (presentation)

International Masterclasses



- 39 institutes
- 41 Masterclasses
 - 25 CMS
 - 16 ATLAS
- 19 video conf. with Fermilab



- 160 institutes
- 200 Masterclasses
 - 119 ATLAS
 - 46 CMS
 - 21 LHCb
 - 14 ALICE
- 48 video conf. with CERN

International Masterclasses



Summary



International Particle
Physics Outreach Group

IPPOG website – great place to get resources for teaching and organising particle physics events

<http://ippog.web.cern.ch>



hands on particle physics

International Masterclasses Spring each year – take part!

<http://www.physicsmasterclasses.org/index.php>