

# INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS

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Uta Bilow, TU Dresden



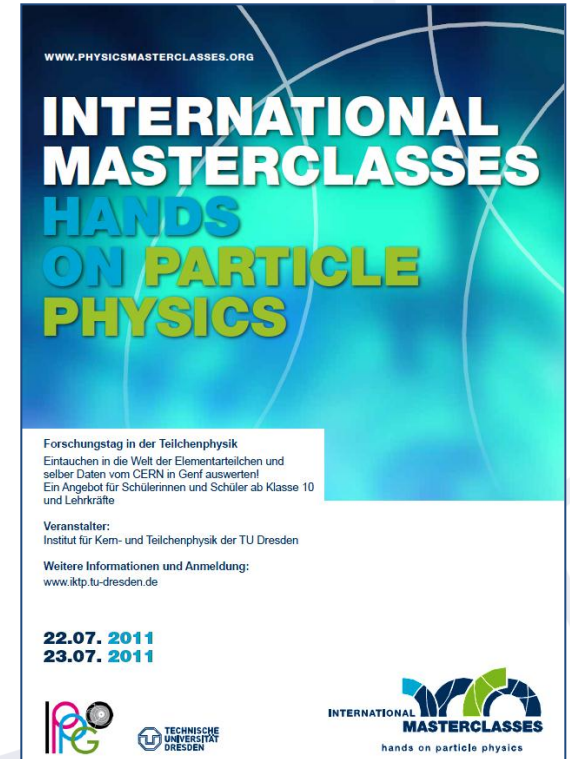
# International Masterclasses: Concept

- High school students (16 – 19 years-old) spend one day at a research institute
- Researchers for one day
- Work like scientists and with scientists („masters“)
- Program:
  - Introductory lectures
  - Introduction to measurements
  - Students get real data from the LHC (ATLAS, CMS, ALICE)
  - International video conference
- Started in 2005 (in UK: 1996, Roger Barlow et al.)



# International Masterclasses: Organisation

- Central coordination at TU Dresden
- Local organisation at each site (> 130 institutes in 28 countries) → individual design of the program within the framework
- Institutes invite schools or teachers to send students
- One-time event, recurring every year



# International Masterclasses: Aims

Students should be \*informed\* (not taught) about:

- big questions/possible discoveries at the LHC
- central findings of hep research  
(standard model, building blocks, forces, charges,...)
- status of experiments - ATLAS, CMS, ALICE

Students should get insight in the way HEP research is organized

- in international collaborations
- in dialogue/exchange of experiment and theory
- wrt. methods of discovery of new phenomena  
(counting methods, mass peaks, etc.)



# International Masterclasses: Aims

Students should \*learn\* themselves to:

- identify different particles via their pattern in detectors
- categorize events in pre-defined final states
- do a measurement of a physics observable
- interpret this measurement and get basic insights from it
- combine results to improve results
- identify events which would be candidates for new physics
- and qualitatively understand pre-conditions for claiming a discovery



# International Masterclasses: Aims

Students should \*get the feeling\* that they:

- understand the basic principles about how particles are identified
- are able to perform themselves measurements
- are able to draw conclusions from these measurements
- understand the way modern hep research is organized

Students should \*get the impression\* that:

- topics of fundamental research in natural science are interesting
- its results are relevant as cultural knowledge of mankind



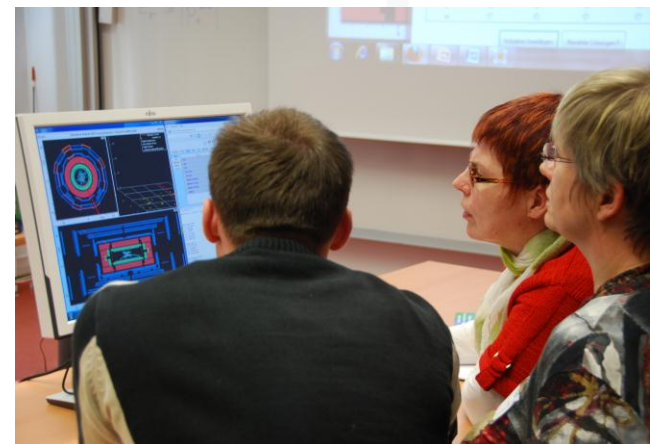
# Network with Schools and Teachers

- Network building depends on local organisers
- Participants: 20 students from 1 school → 120 from 20 (or even more...Portugal!)
- Separate teachers days
- 2011: 13 teacher days  
(former years: 11 / 8 / 7 / 6 / 5)
- Also: teachers at students days



# Concept Teachers Day

- Participants: between 10 and 30
- Program: ~ following students' agenda
  - No video conference
  - Analysis: Fewer events, more discussion
  - Info on other activities for schools, students, and teachers
  - general discussion on hep in school
- Motivation
  - Interest in modern hep research / LHC
  - Prepare for teaching hep
  - Get new ideas how to teach modern physics
  - Be able to respond to students questions (from black holes to superluminal neutrinos)
  - In Germany: enter Netzwerk Teilchenwelt





# Teachers day – follow up?

- Full range: One-off activity → sustainable contact (come again, send their students, other activities...)
- Greece: included in workshop on IBSE
- Germany: Netzwerk Teilchenwelt activities
- Berlin: group of teachers meeting regularly for 2 years, developing lesson plans and teaching materials
- Austria: close contact with some teachers
- Brazil: plan increased cooperation with teachers
  - how to spread information about Masterclasses in schools
  - how to bring the outcome of Masterclasses to school

