

# INTERNATIONAL MASTERCLASSES HANDS ON PARTICLE PHYSICS

Masterclass Report for IPPOG  
Uta Bilow, Ken Cecire  
02.12.2020, Zoom

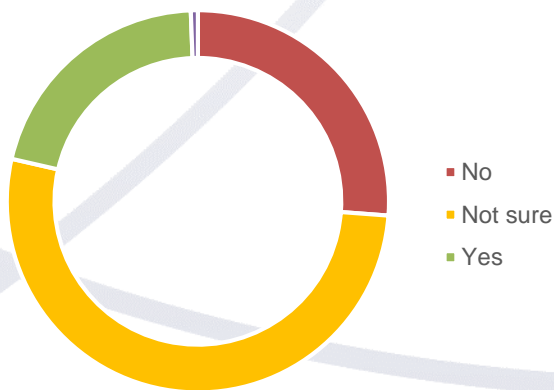


# IMC 21: What can we expect?

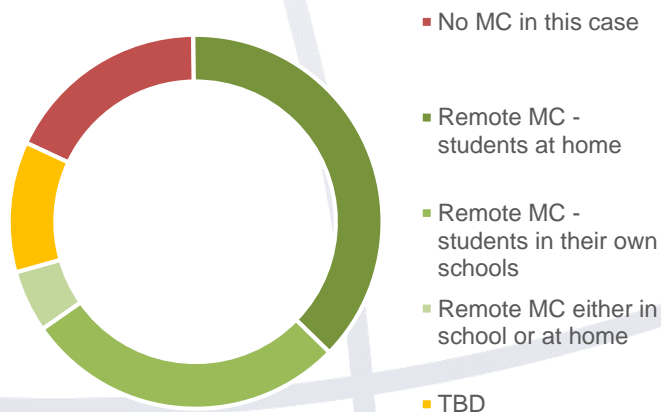
IMC 21: 11.2. – 27.3.2021

Results from intent-to-register survey, n=168 (1st week of Nov)

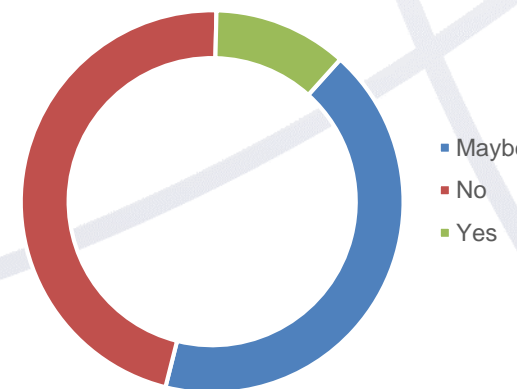
Do you expect to hold a Masterclass with students onsite at your institution?



What will you do if you can/will not hold an onsite MC?



Do you need extra support or advice?



# IMC 21: Registration

- Doodle registrations started on Nov 23
- A little fewer participants so far
- More slots will be added (announcement in next circular on Dec 4)
- International Day of Women and Girls in Science on Feb 11

	ATLAS Z	ATLAS W	CMS	LCHb	ALICE S.P.	ALICE R_AA	ATLAS Z	CMS WZH	MINERVA
	<b>CERN</b>						<b>Fermilab</b>		
VC slots offered	95	35	50	40	25	5	many	many	many
registrations	57	13	40	26	15	3	3	17	2
MC in 2020	104	24	66	43	38	4	15	35	18

# IMC 21: What can we expect?

## **We expect or should be ready for:**

- > Pandemic continues
- > No high school students allowed at universities or labs
- > Physicists might go to classrooms
- > MC mainly remote, either with school classes or individual students
- > Students run measurements on their computers
- > Institutes need support for remote MC (how-to guide)

## **Expected videocon situation:**

- > Mix of groups and individual students in one session
- > Moderators not sitting together
- > Zoom (webinar style for large groups)

# Remote MC

## Collection of recommendations

- via Zoom
  - webinar style for large groups
  - protect against zoom-bombing
  - Breakout rooms for pairs of students or 10 students +1 tutor when practical
- Masterclass structure
  - Start the day with community-building or introductions
  - Include interactive parts, preparatory materials (e.g. screencasts), breaks
  - Video lab tours and virtual visits
  - Consider splitting the whole Masterclass over 2 or more days
  - 1 tutor : ~5 students (?)
- Tools
  - Send links and software ahead of masterclass
  - Switch to online tools where practical, e.g software runs in browser
  - Simplify measurements, especially where there is less support
- BAMC/BAMA follow-up (May?)

# Updating ATLAS measurements with 13 TeV data

- ATLAS W path - <http://cern.ch/go/7ZZB>
  - W+/W- ratio from single W events → determines the composition of the proton
  - search for the Higgs in WW →  $\ell\nu\ell\nu$  events
  - Uses Minerva event display
- ATLAS Z path - <http://cern.ch/go/zJ8c>
  - Students identify dileptons, diphotons, or 4- $\ell$  events
  - Build invariant mass distributions → identify known particles and discover new particles (Z', Graviton) with plans to extend the tasks!
  - Uses Hypatia event display
- Citizen Science Project - <http://cern.ch/go/WN79>
  - Hypatia App
  - Build upon HiggsHunters project
  - Calculate invariant masses → aggregation of data from thousands of Citizen Scientists produce histograms → new particles?
- ATLAS Open Data Portal - <http://opendata.cern.ch/>



# Updating ATLAS measurements with 13 TeV data

## Discussion:

- Why 13 TeV data?
  - Recent events
  - Characterize Higgs
  - Additional possibilities, especially with Citizen Science and Open Data
- Move tech forward
  - Online event displays and tools
  - Integrate technology
  - Integrate new data with previous data
  - Include coding, spooling over many events, etc?
- Stimulate similar progress in other LHC masterclasses

# Web-based ALICE strangeness measurement

Why web-based?

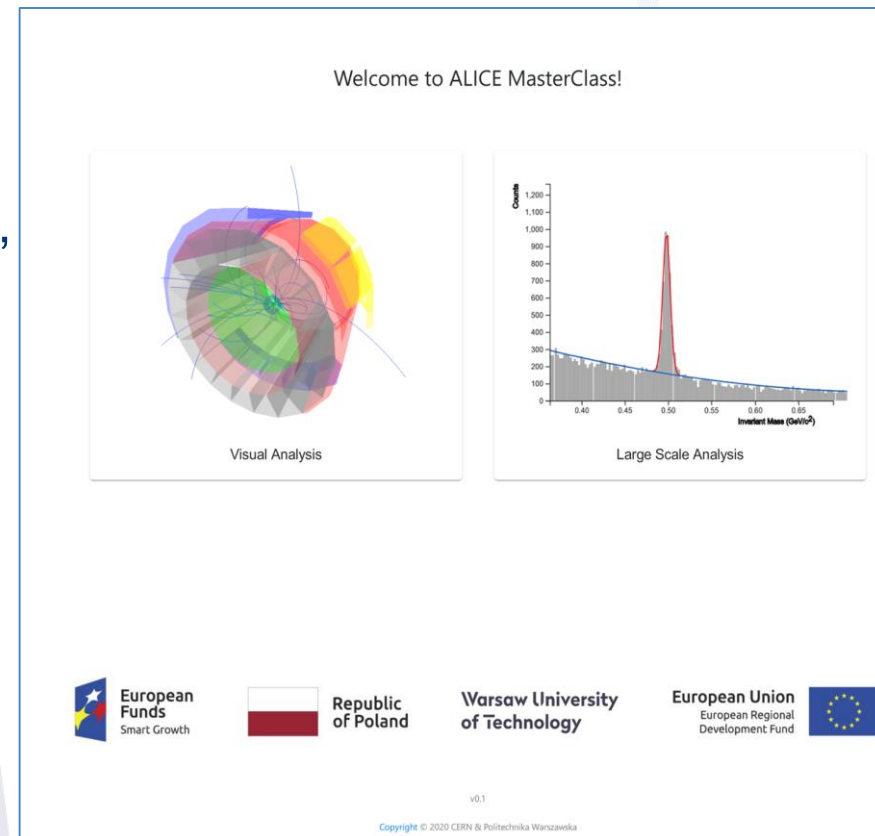
- “One code rules all” – OS
- No installation required

Convert from ROOT

- Seek ROOT functionality, “look & feel”
- Some elements might require simplification for javascript

Initial work already done

- Based on modified LHCb measurement
- Proof-of-Concept for ALICE internally tested at WUT with students
- It seems to work!





# Web-based ALICE strangeness measurement

ALICE Masterclass

## Visual Analysis Exercise

Event handler

event\_3\_0.json

previous

next

View

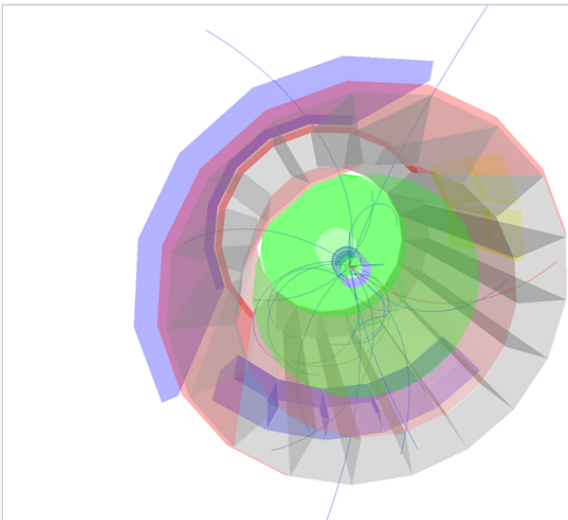
- Detector
- Tracks
- V0s

View

Auto rotate

Legend

$e^-e^+$	0.0005 GeV/c <sup>2</sup>
$\pi^-\pi^+$	0.1396 GeV/c <sup>2</sup>
$K_S^0$	0.4976 GeV/c <sup>2</sup>
$p\bar{p}$	0.9383 GeV/c <sup>2</sup>
$\Lambda\bar{\Lambda}$	1.1157 GeV/c <sup>2</sup>
$\Xi\bar{\Xi}$	1.3217 GeV/c <sup>2</sup>



ALICE Masterclass

## Large Scale Analysis Exercise

Navigation

Particle Type  
Kaon

Collision & Centrality  
Pb-Pb 30%-40%

Plot Invariant mass

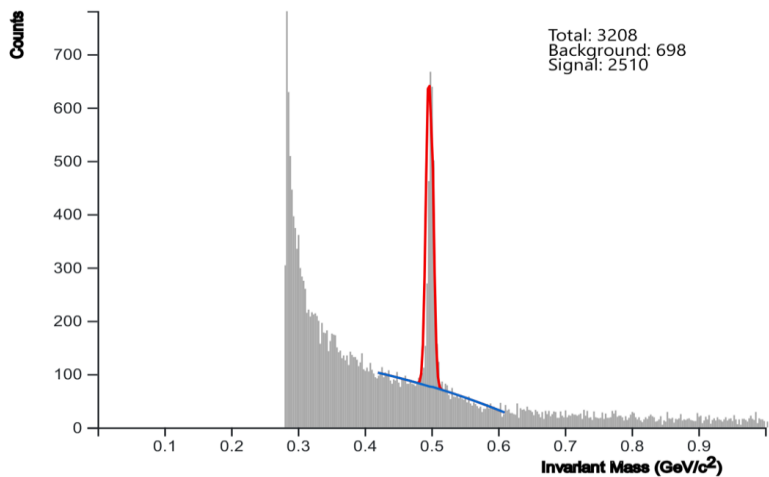
Fit

Signal range  
0.485

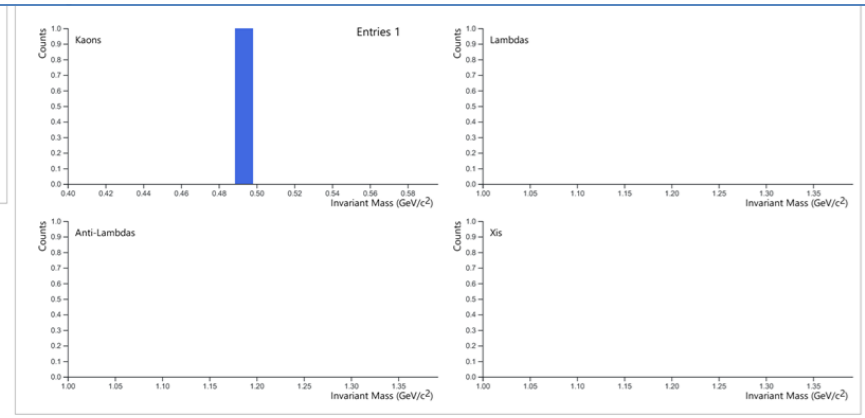
Background range  
0.419 0.612

Fit

Accept



Total: 3208  
Background: 698  
Signal: 2510



# World Wide Data Day 2020

- Completed November 12
- New measurement –  $\Phi$  and  $\Delta\Phi$  (previously  $\Phi$  and  $\theta$ )
- Plan to return to  $\Phi$  and  $\theta$  in 2021, spin off  $\Delta\Phi$  as a separate activity
- Adapted for remote learning
- 16 CMS groups, 24 ATLAS groups, ~800 students registered
- Survey results - <http://cern.ch/go/9CxF>

