

Hands-on Particle Physics

An overview of masterclass efforts

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for the IPPOG Collaboration



International Particle
Physics Outreach Group



IMC from 10 km altitude

What is a masterclass?

- High school students go to university or laboratory
- Learn about an experiment, analyze data, attend videocon:
 - Become “particle physicists for a day”
 - Professional physicists are experts that make it a masterclass.
- Students analyze from event displays, combine results

Who and where, IMC Feb-Mar 2024?

- >14,000 students in >350 masterclasses around the world
- Videocon moderation at CERN, FNAL, GSI, KEK, Auger
- More “off-shell” → outside videocon schedule

LHC Masterclasses moderated from CERN and Fermilab

ATLAS

- Z-path: dilepton, diphoton, 4-lepton events
- W-path: single- and two-lepton events

CMS

- WZH: dilepton and 4-lepton events



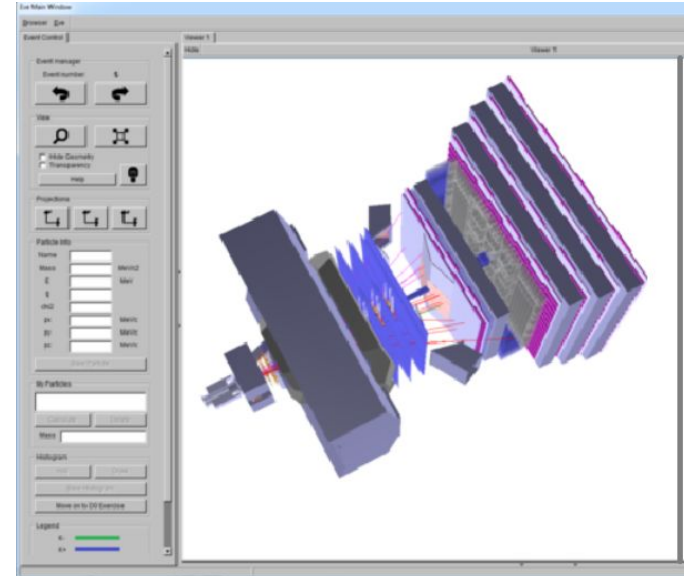
LHC Masterclasses moderated from CERN

LHCb

- Measure D0 lifetime from displaced vertices

ALICE

- Search for strange particles
- Measure nuclear suppression factor R_{AA}



More masterclasses

GSI:

- Particle therapy

KEK:

- Belle II

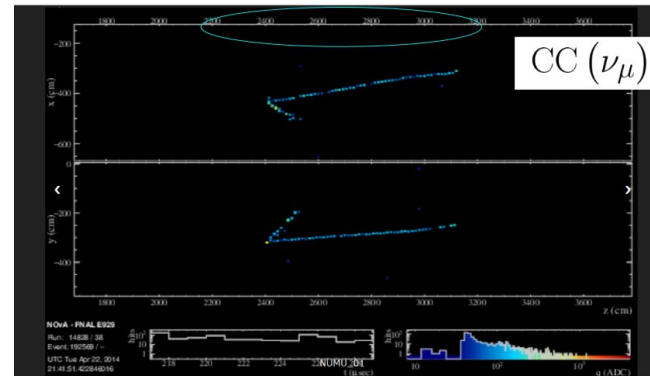


Pierre Auger:

- Auger

Fermilab (neutrino):

- MINERvA
- NOvA



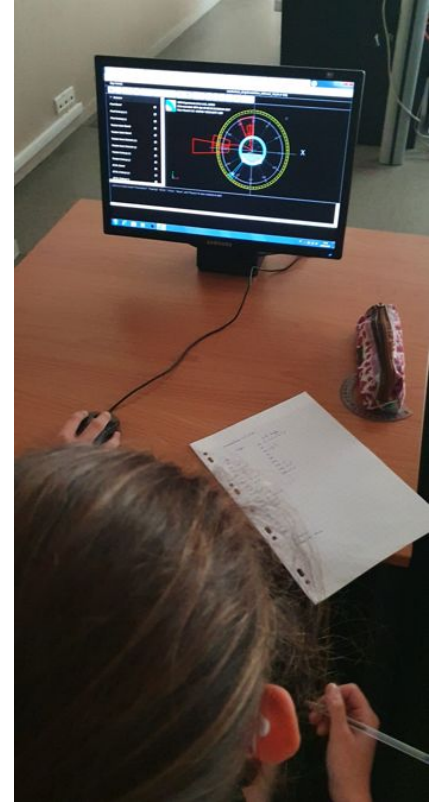
Still more:

World Wide Data Day

- Done from school in <2 hr
- Simple ATLAS and CMS measurements
- All videocons in one day → only physicist contact

International Day of Women and Girls in Science (11 Feb)

- ATLAS and CMS masterclasses
- Woman leaders, girls especially invited



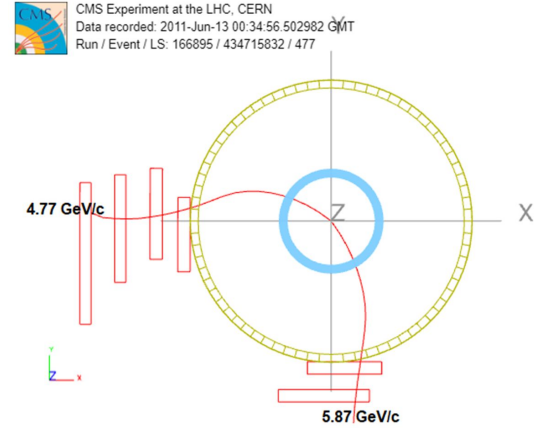
Let's try a sloppy Masterclass Mash-up

Get an event! They are all:

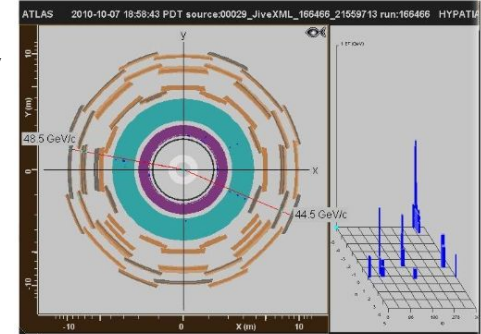
- dimuon
- Transverse (mostly)
- Back-to-back (mostly)

What we do:

- Estimate the invariant mass of the parent in GeV
- Submit to the Google form → combined result at <https://cern.ch/lhcp24plot>
- (Back-up) Make a post-it note histogram!



Run 166466 Event 21559713



We can use your help!

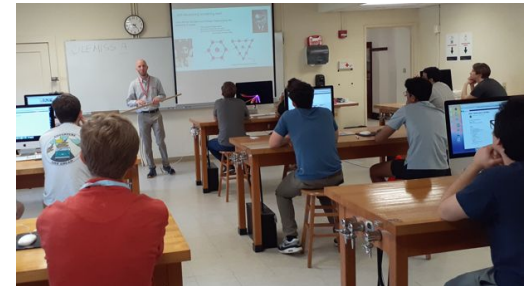
We pay in oodles of satisfaction as:

- Masterclass organizers
- Masterclass tutors
- Videoconference moderators



How:

- Contact
 - Uta Bilow (Uta.Bilow@tu-dresden.de)
 - Ken Cecire (kcecire@nd.edu)
- Go to our website (<https://ippog.org/imc-international-masterclasses>)



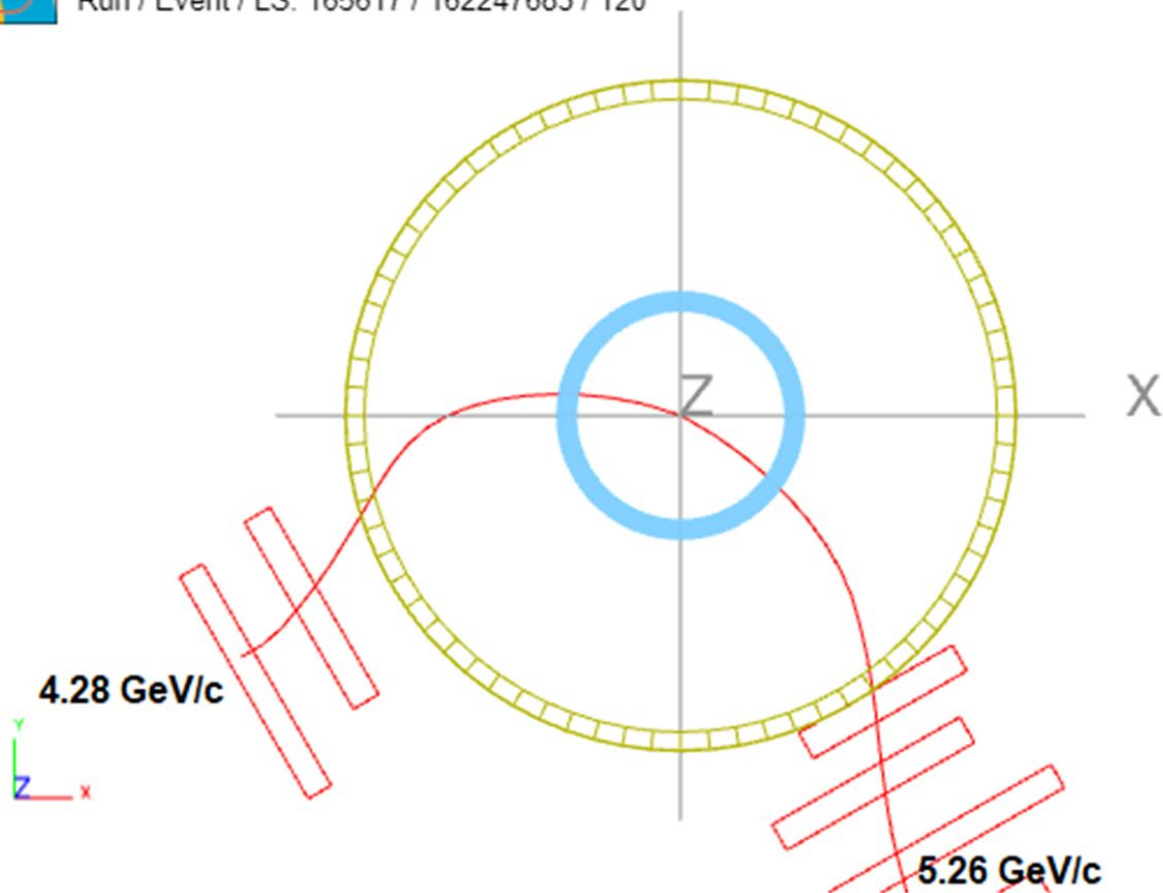
Events



CMS Experiment at the LHC, CERN

Data recorded: 2011-May-24 22:05:14.174709 GMT

Run / Event / LS: 165617 / 162247683 / 120



Submit your result:



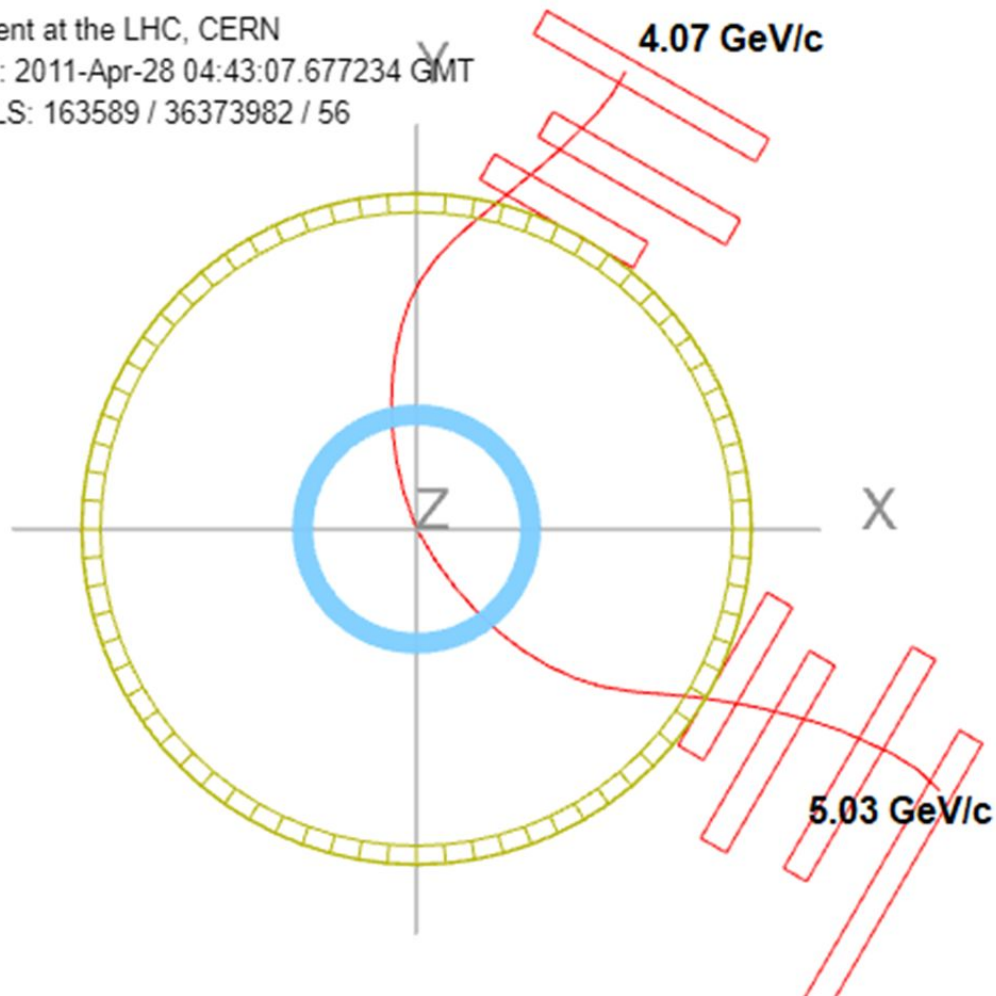
<https://cern.ch/lhcp24/masses>



CMS Experiment at the LHC, CERN

Data recorded: 2011-Apr-28 04:43:07.677234 GMT

Run / Event / LS: 163589 / 36373982 / 56



Submit your result:



<https://cern.ch/lhcp24/masses>



CMS Experiment at the LHC, CERN

Data recorded: 2011-May-29 10:51:11.488092 GMT

Run / Event / LS: 166033 / 454243799 / 323

6.46 GeV/c

5.36 GeV/c

Submit your result:



<https://cern.ch/lhcp24/masses>

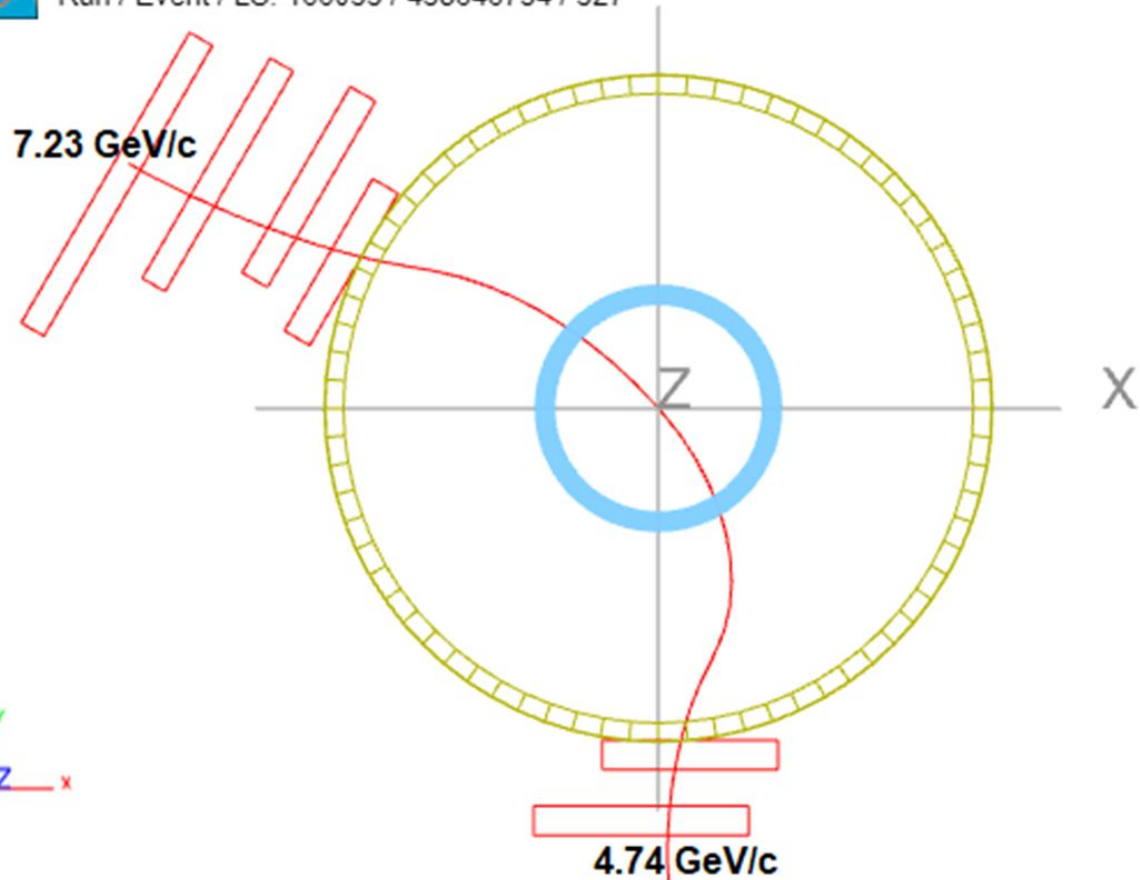




CMS Experiment at the LHC, CERN

Data recorded: 2011-May-29 10:52:22.686068 GMT

Run / Event / LS: 166033 / 458646734 / 327



Submit your result:



<https://cern.ch/lhcp24/masses>

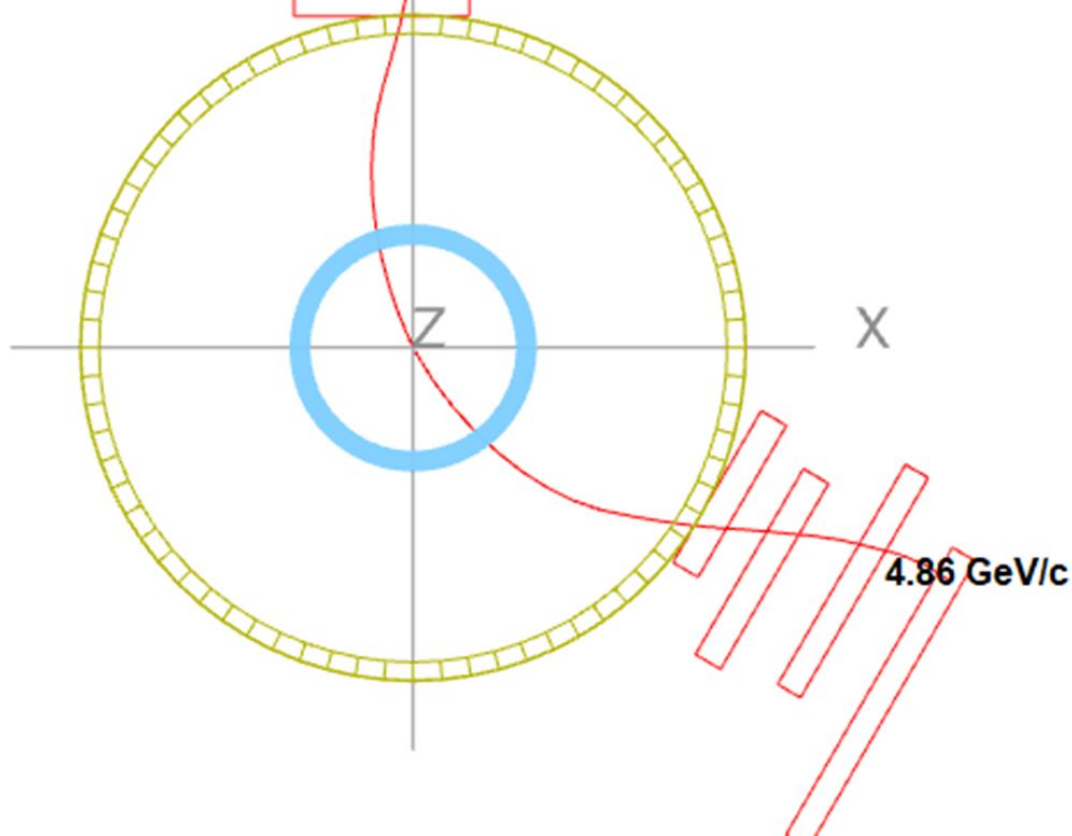


CMS Experiment at the LHC, CERN

Data recorded: 2011-Jun-12 22:40:53.739733 GMT

Run / Event / LS: 166895 / 169229149 / 184

6.36 GeV/c



4.86 GeV/c

Submit your result:



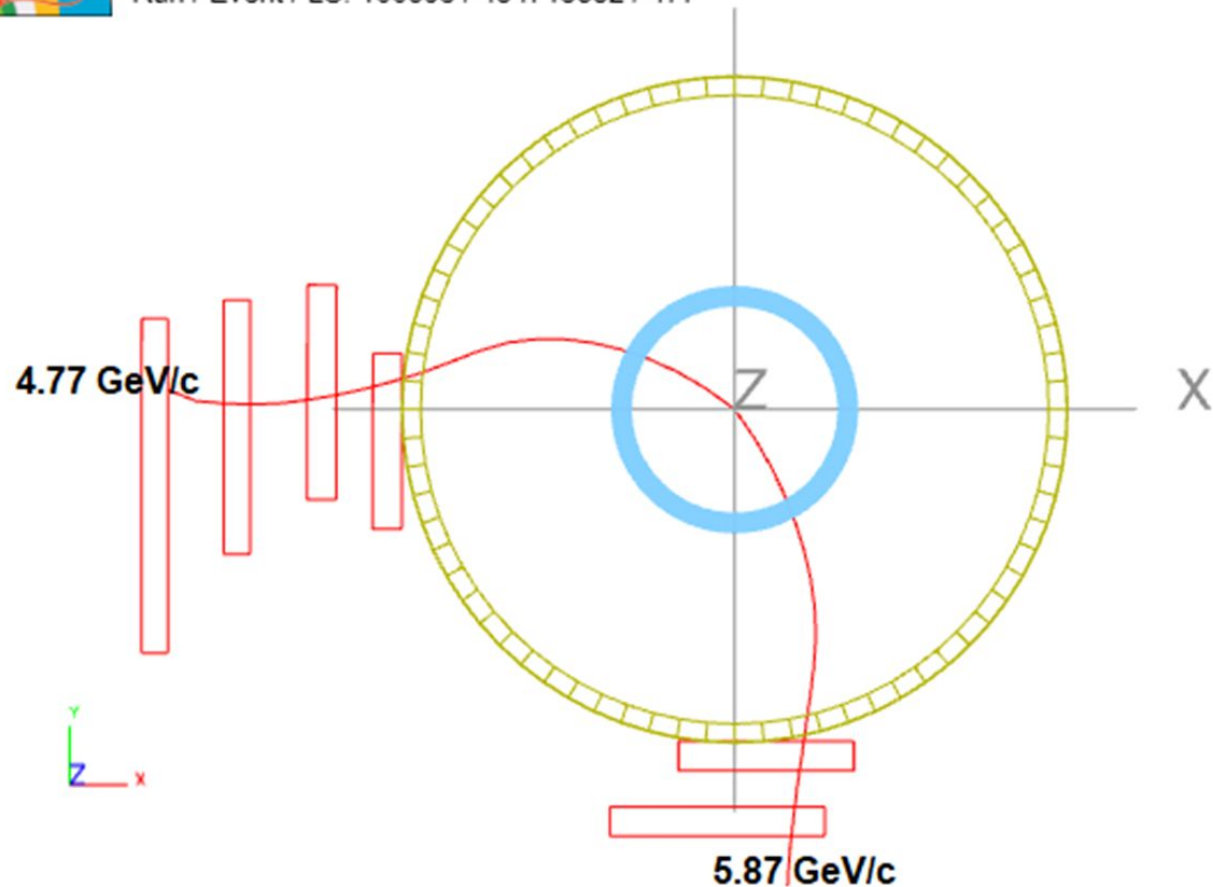
<https://cern.ch/lhcp24/masses>



CMS Experiment at the LHC, CERN

Data recorded: 2011-Jun-13 00:34:56.502982 GMT

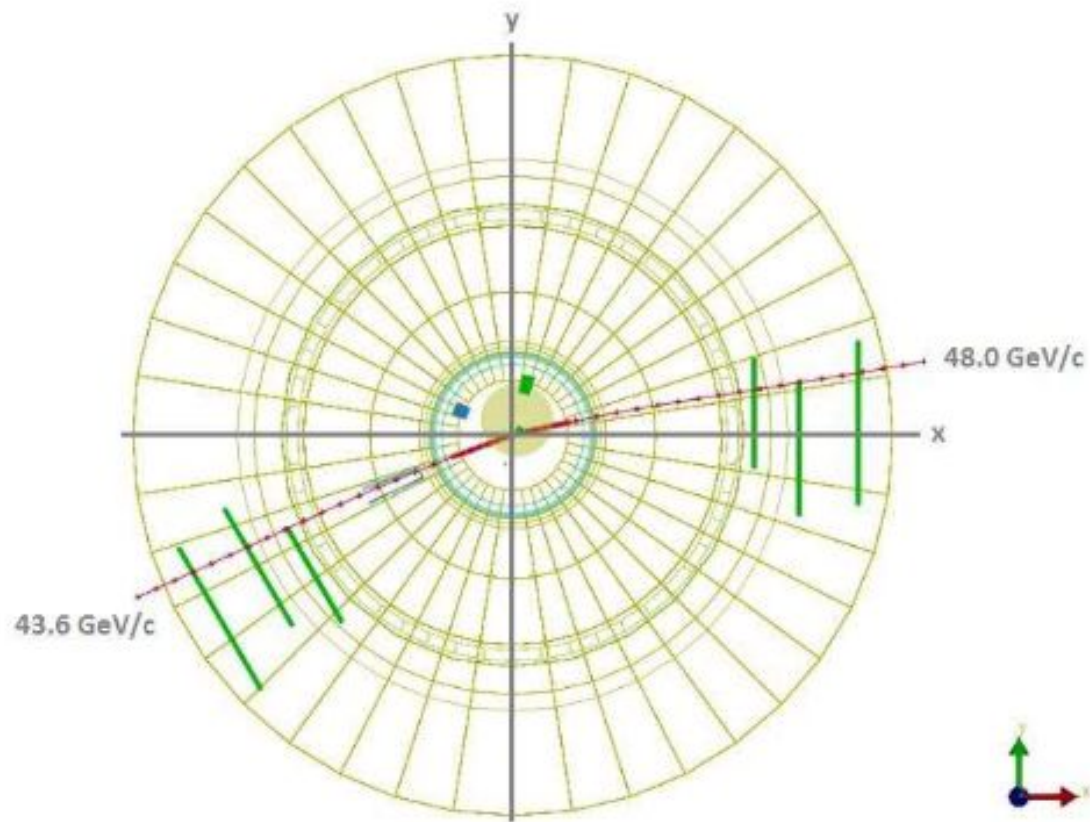
Run / Event / LS: 166895 / 434715832 / 477



Submit your result:



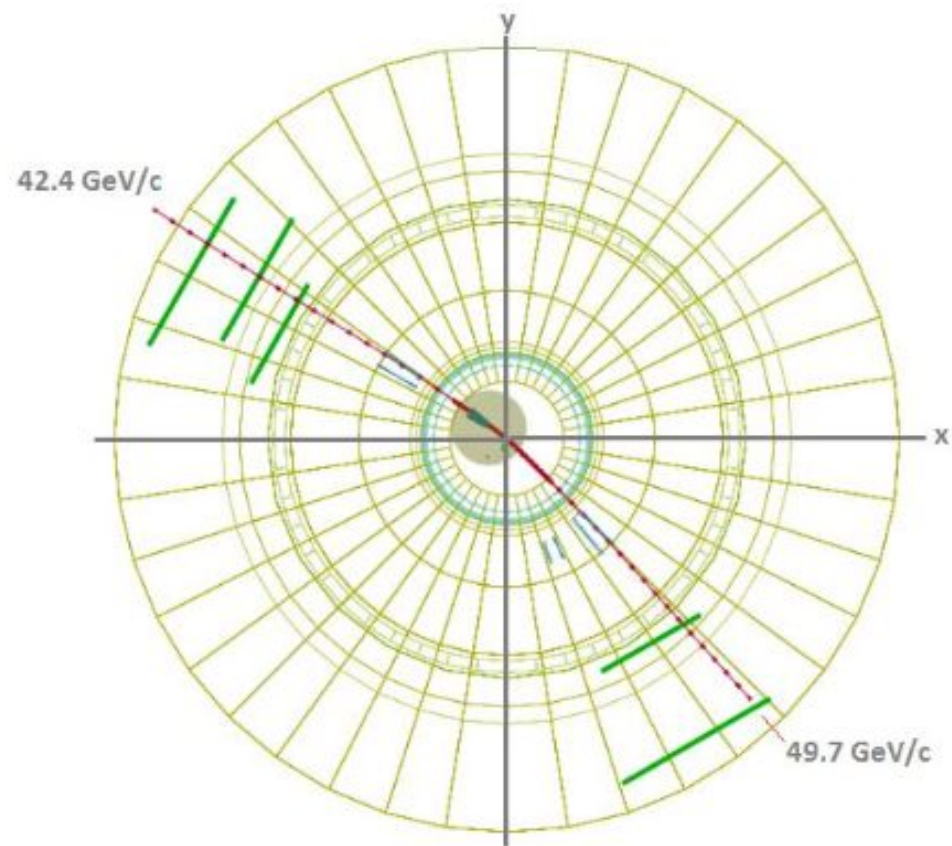
<https://cern.ch/lhcp24/masses>



Submit your result:



<https://cern.ch/lhcp24/masses>

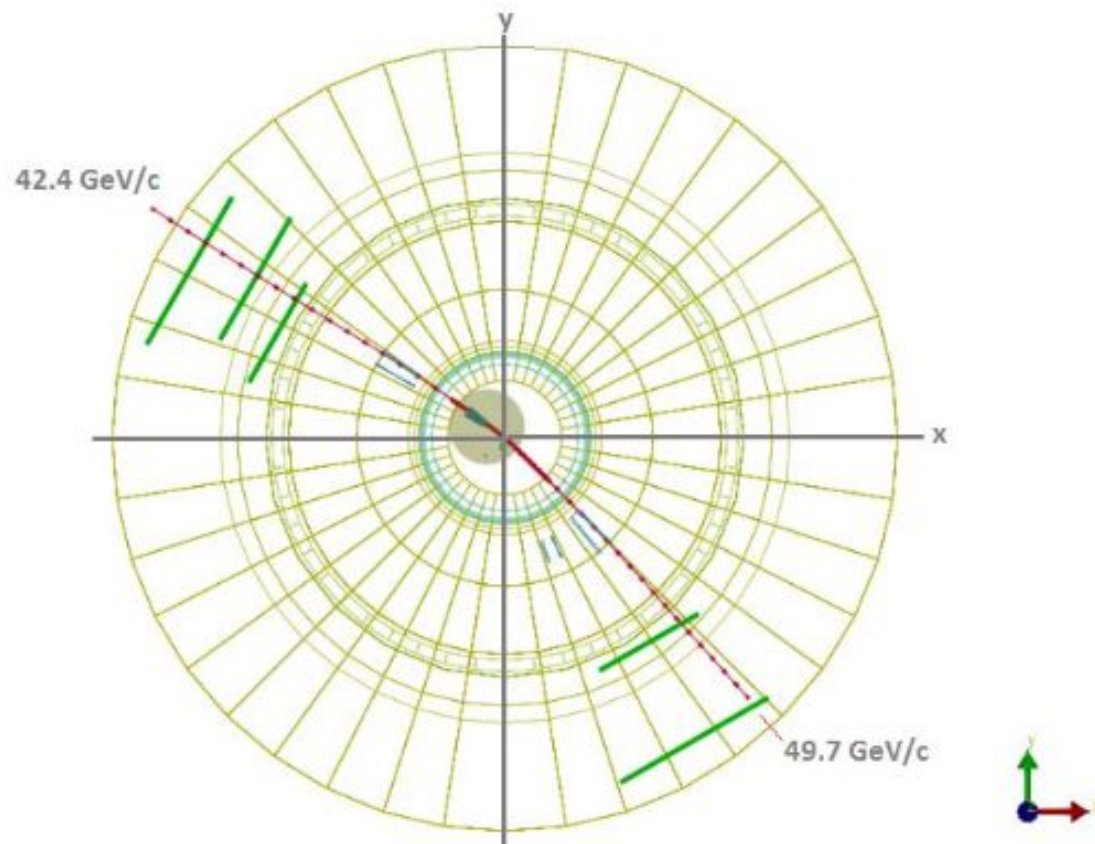


Submit your result:



<https://cern.ch/lhcp24/masses>

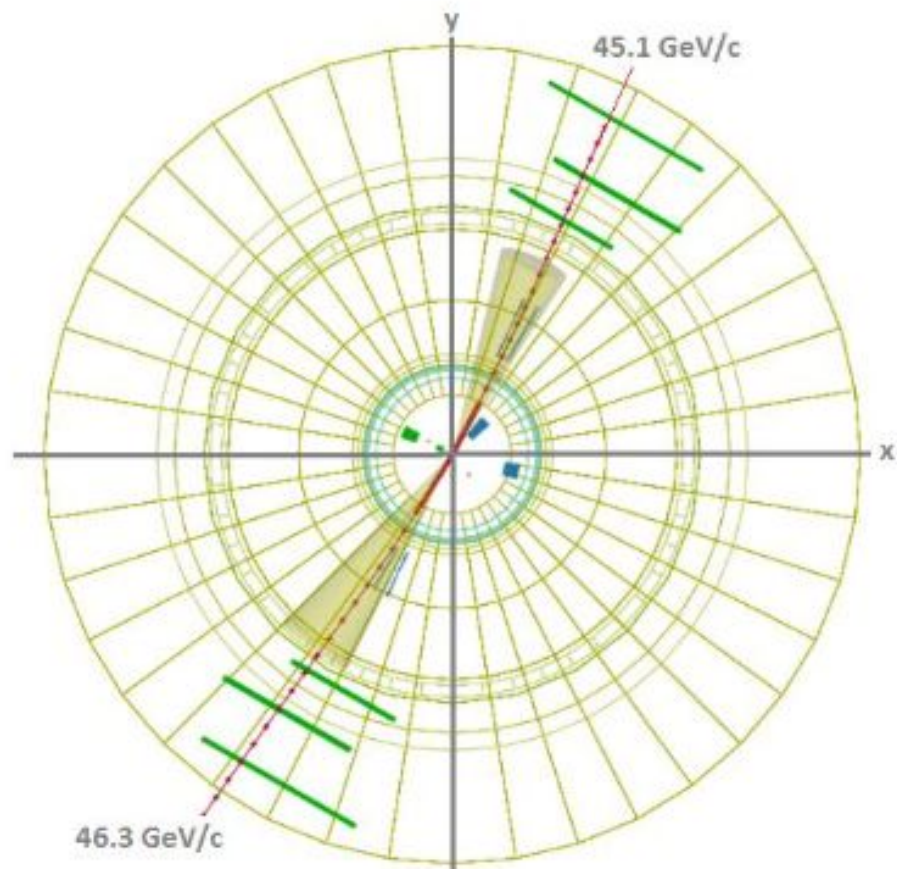




Submit your result:



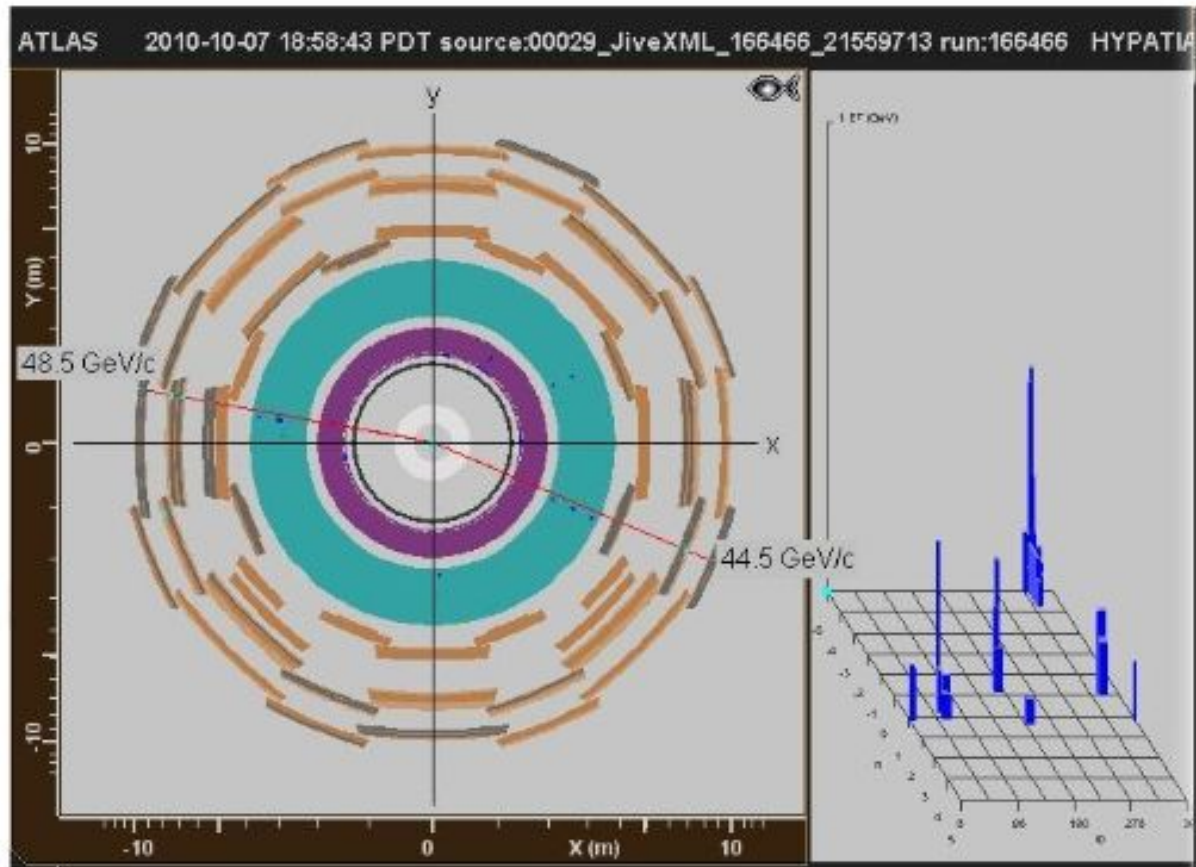
<https://cern.ch/lhcp24/masses>



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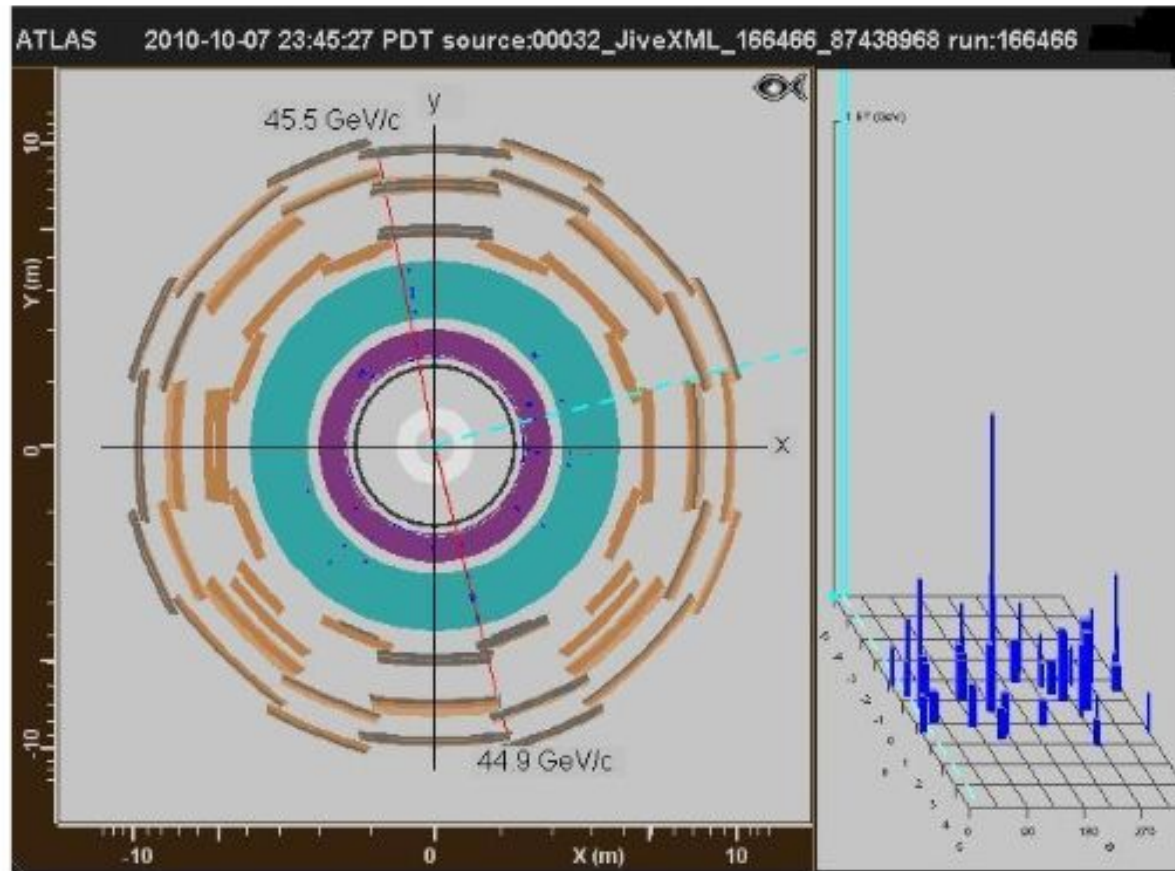


Submit your result:



<https://cern.ch/lhcb24/masses>

Run 166466 Event 87438968



Submit your result:



<https://cern.ch/lhcbp24/masses>