

Educational Platform ATLAS open data

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on behalf the
ATLAS Data&Tools Outreach Group

UK Teacher Programme
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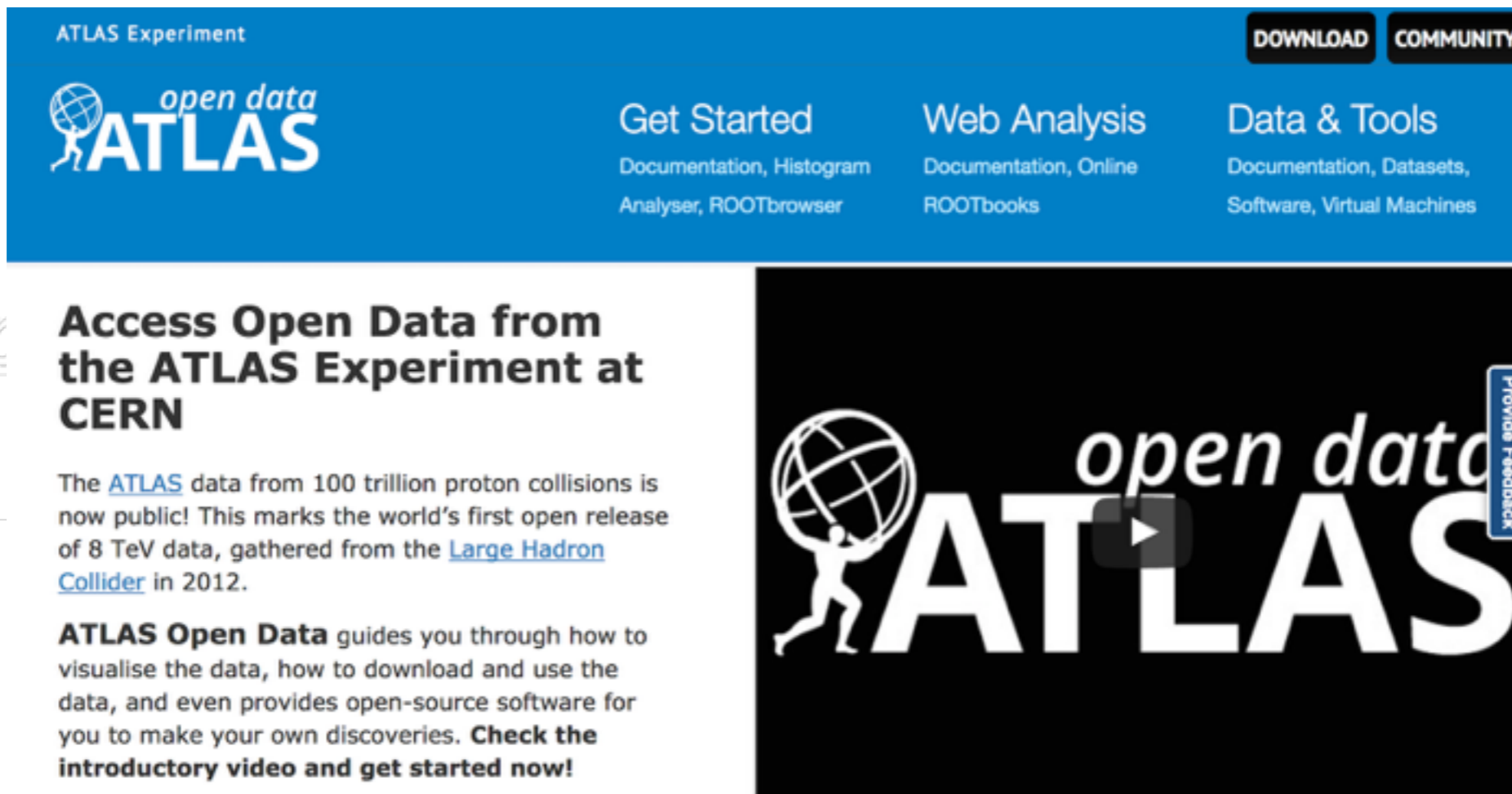
ATLAS OPEN DATA

EXPLORE 8TEV DATA ON
ATLAS' COMPREHENSIVE
EDUCATIONAL PLATFORM

[HTTP://OPENDATA.ATLAS.CERN](http://opendata.atlas.cern)

ATLAS open data

- **Data:** 1 fb⁻¹ of 8 TeV ATLAS data released (about 100 trillion proton-proton collisions)
- **Tools:** Analysis tools for educational use
- **Documentation:** To explain the different concepts and guide the user to look at the data
- **Target Audience:** Currently aimed at University students
- **Forum:** Questions and feedback welcome

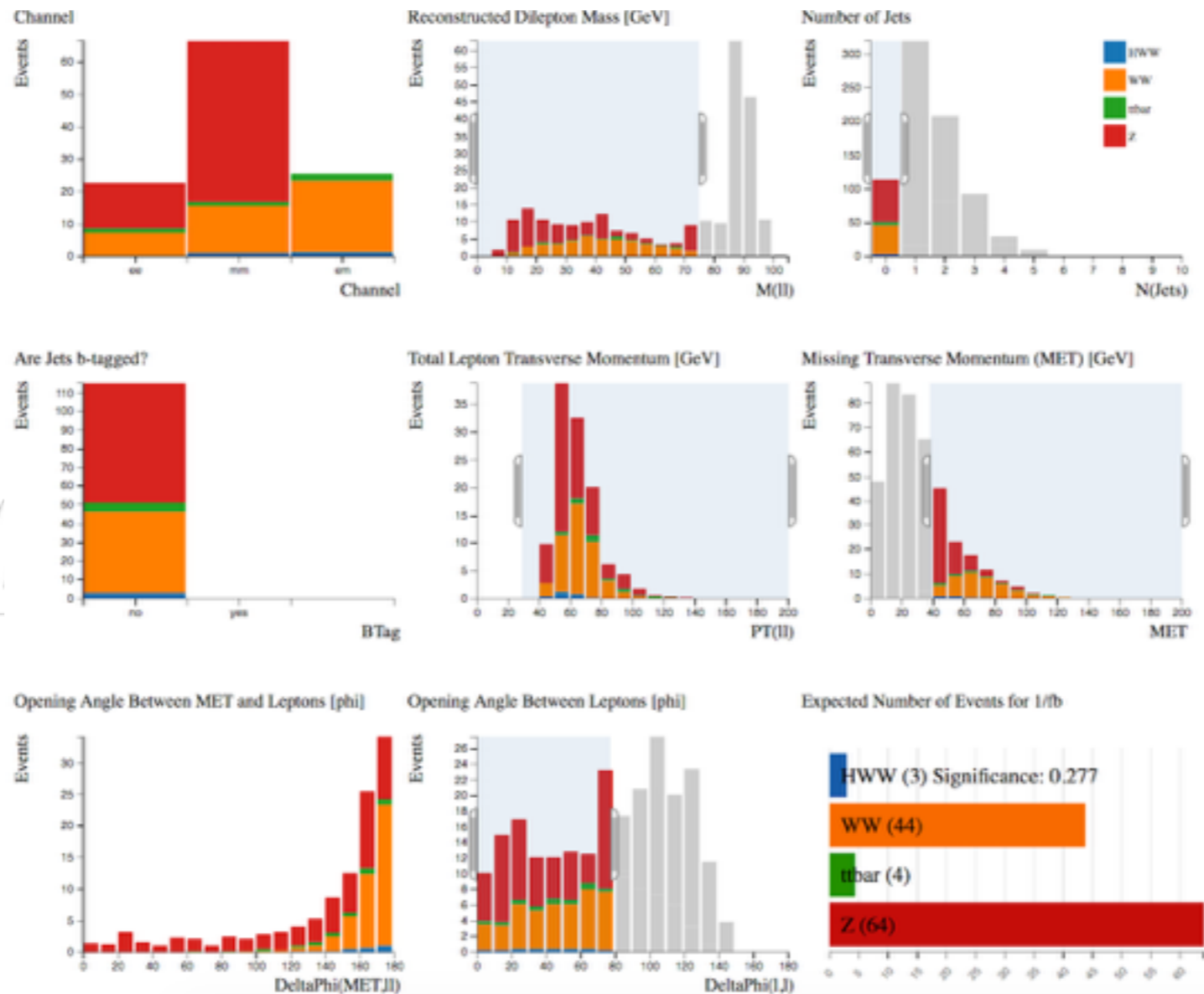


The screenshot shows the ATLAS open data website. At the top, there is a blue navigation bar with the text "ATLAS Experiment" on the left, and "DOWNLOAD" and "COMMUNITY" buttons on the right. Below this, the "open data ATLAS" logo is on the left. The main navigation area contains three columns: "Get Started" (Documentation, Histogram Analyser, ROOTbrowser), "Web Analysis" (Documentation, Online ROOTbooks), and "Data & Tools" (Documentation, Datasets, Software, Virtual Machines). Below the navigation bar, there is a white section with the heading "Access Open Data from the ATLAS Experiment at CERN". The text below the heading states: "The ATLAS data from 100 trillion proton collisions is now public! This marks the world's first open release of 8 TeV data, gathered from the Large Hadron Collider in 2012." It then says: "ATLAS Open Data guides you through how to visualise the data, how to download and use the data, and even provides open-source software for you to make your own discoveries. Check the introductory video and get started now!". To the right of this text is a large black video player with the "open data ATLAS" logo and a play button. A vertical "Provide Feedback" button is on the right side of the video player.



Get Started

- Data visualisation 4 processes: $H \rightarrow WW$, WW , top pair, Z
- Make cuts with cursor on one variable and immediately see the effects on the other variables
- Expected number of events for 1 fb^{-1} shown, along with significance of Higgs signal
- Documentation describes separate samples and suggests cuts inspired by Higgs Analysis



Get Started

Get Started

Analyses

Histogram Analyser

Separate Signals

Find the Higgs

ROOTbrowser

ROOTbrowser datasets

ROOTbrowser Variable Names

ROOTbrowser final plots

Glossary

ATLAS events

Animated ATLAS events

ATLAS at CERN

Analyses:

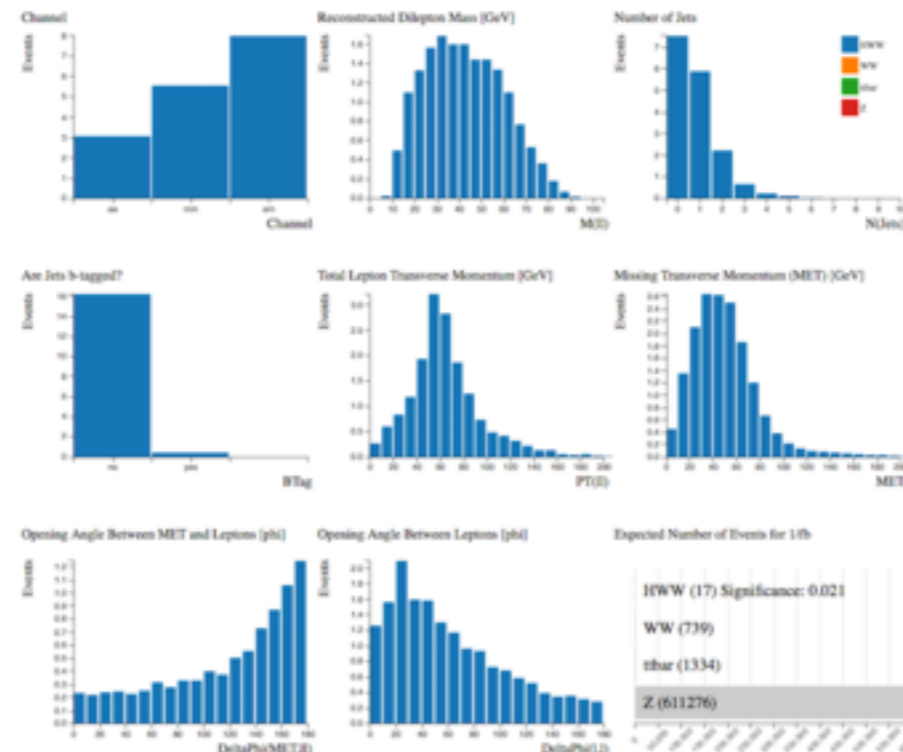
- Explains the signal and three background processes

Histogram Analyser:

- Making cuts with your cursor
- The histograms explained one by one

Separate Signals

- Simulated data allows us to look at the distributions and understand the differences between the signal and background



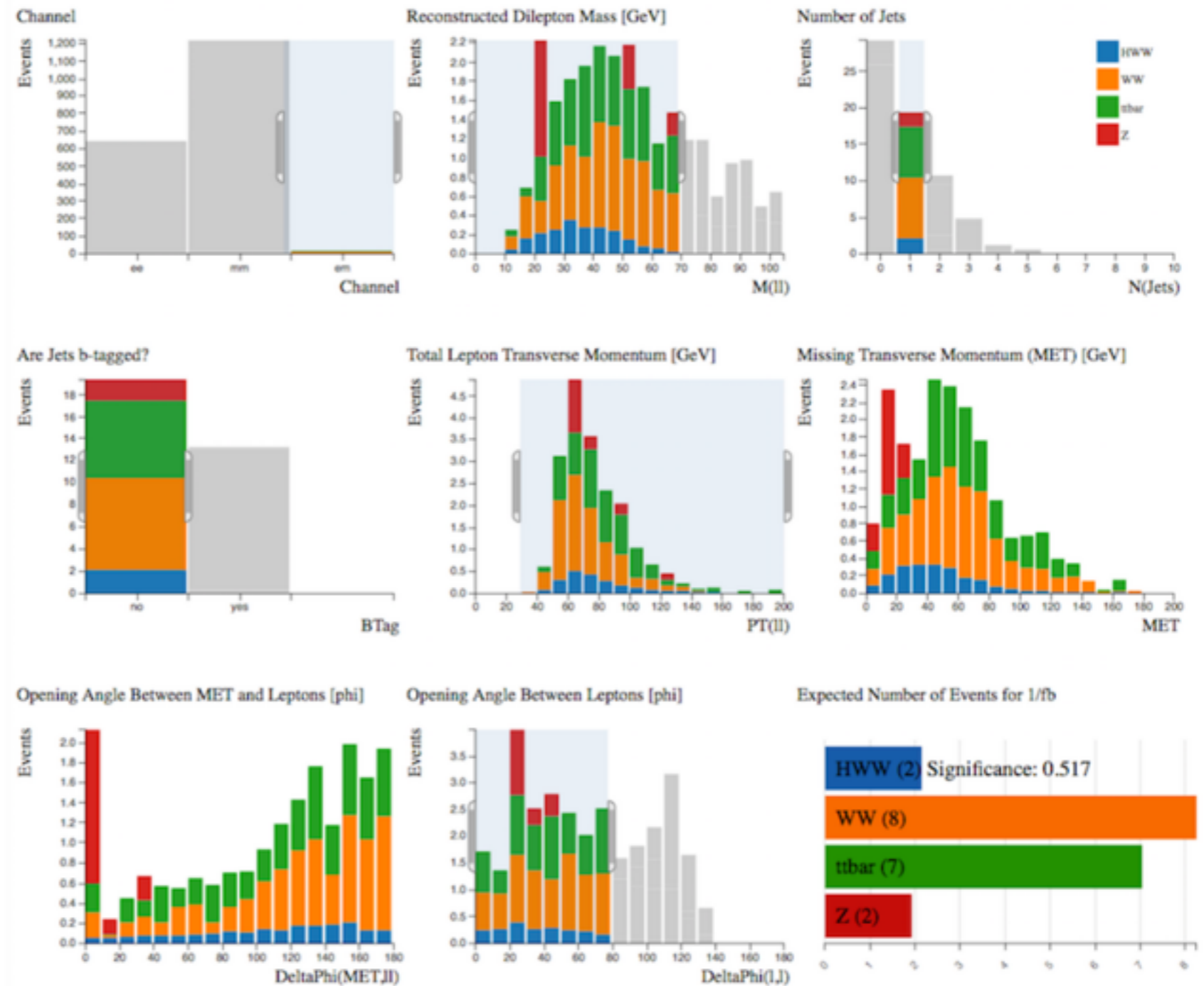
Find the Higgs

- Documentation explains idea of making cuts
- Steps through cuts to find Higgs

Higgs boson + 1 jet

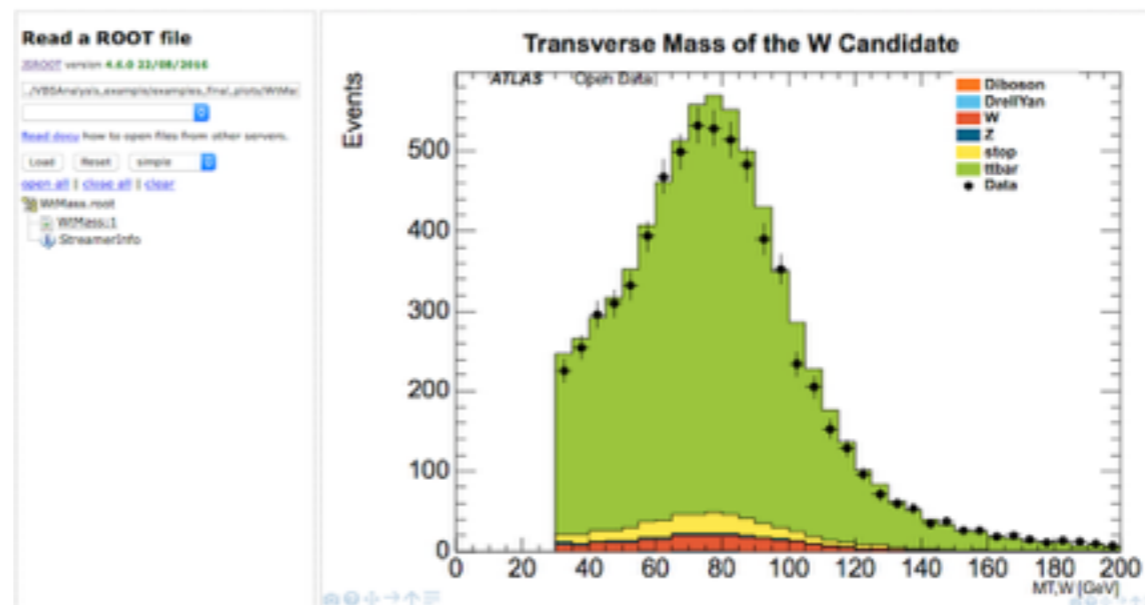
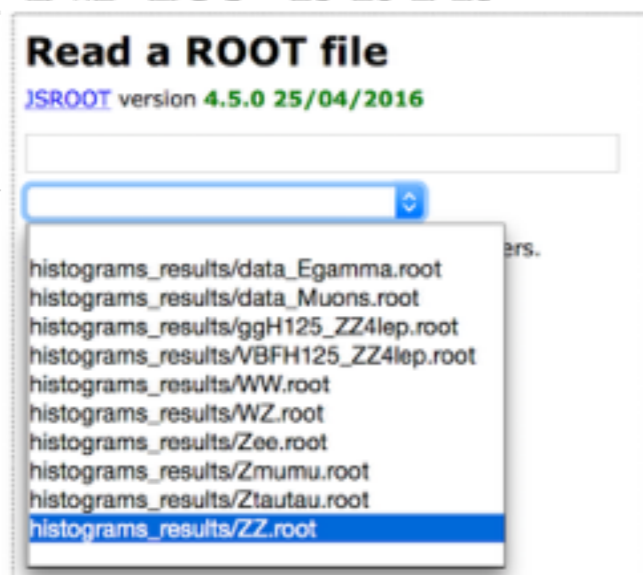
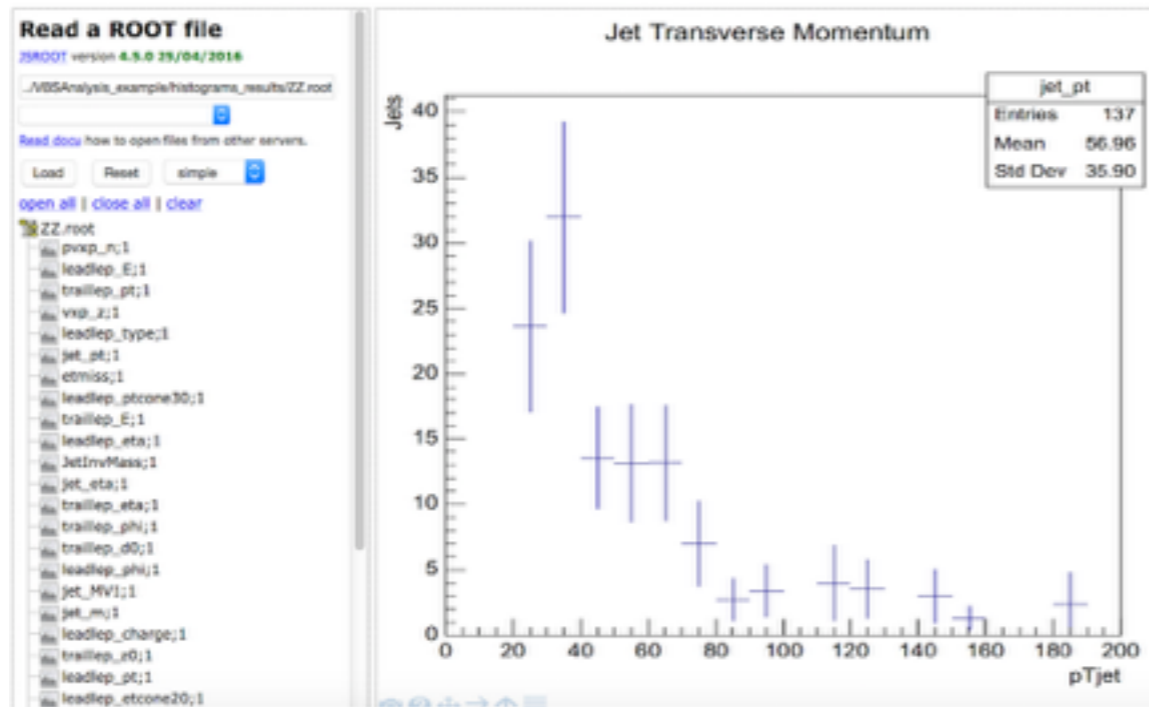
Select:

- Number of **Jets** = 1
- no b-tagged **jets**
- electron-muon **channel** only
- Reconstructed Dilepton Mass < 70 GeV
- Total Lepton Transverse Momentum > 30 GeV
- **Opening angle** between leptons < 80



ROOTbrowser



- A web based tool for displaying and analysing data
- Documentation defines ntuple variables
- Histograms explained and data-simulated data agreement discussed








Data

- Data and simulated data: ROOT tree format
- 1 fb⁻¹ of data
- egamma ~ 33.6 M events + muons ~ 33.8 M events
- Datasets available to be downloaded individually or bulk download
- Also available on the CERN open data portal

Set of Data samples

File type	Name	Description	Last modified	Size	# Events
	DataEgamma.root	ATLAS 2012 data Egamma-string sample for 2016 open data release	21-Jul-2016 16:00	746,3Mb	7917590
	DataMuons.root	ATLAS 2012 data Muons-string sample for 2016 open data release	21-Jul-2016 16:00	619,8Mb	7028084

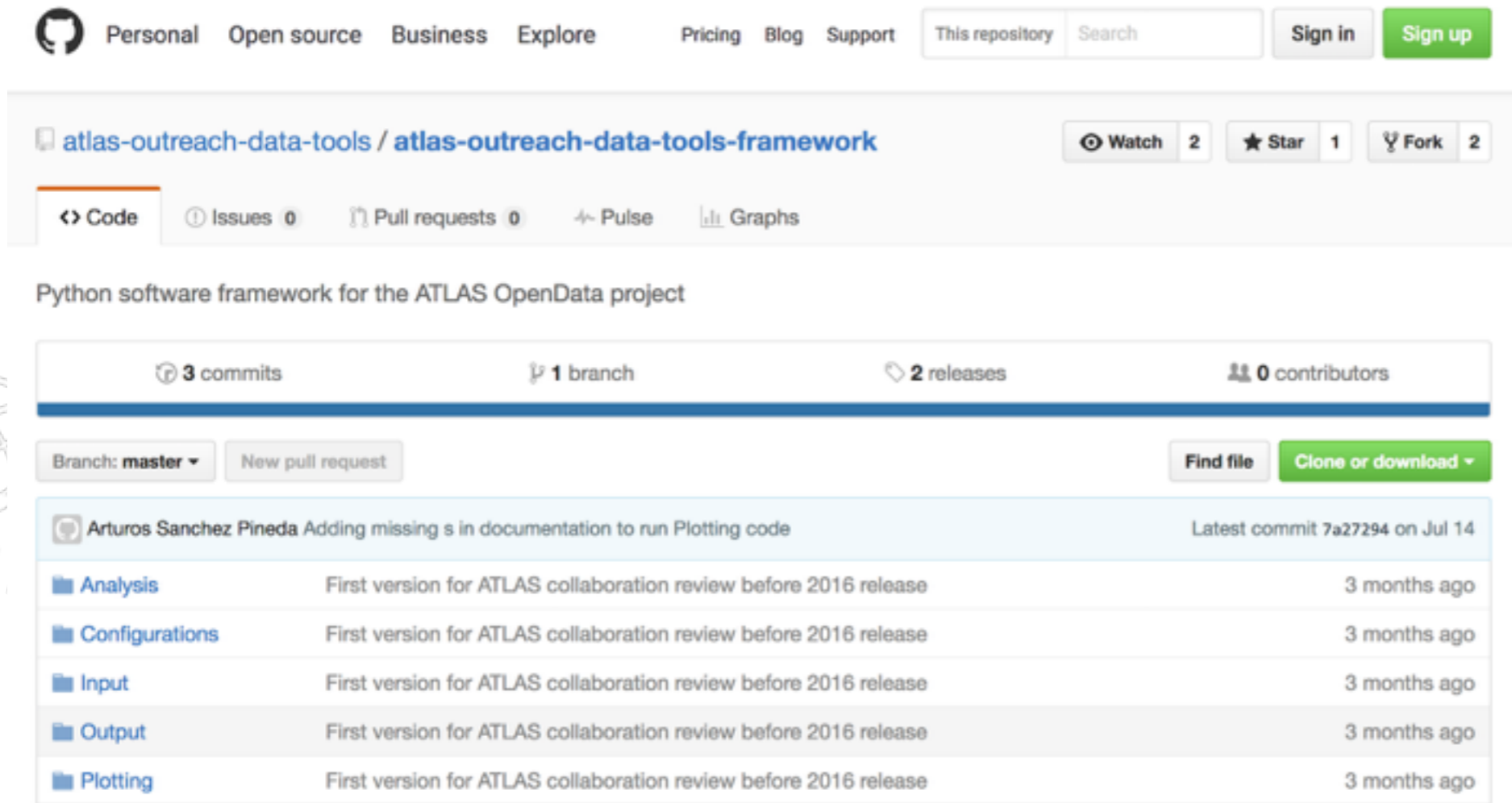
Set of MonteCarlo (MC) samples

File type	Name	Description	Last modified	Size	# Events
	mc_105985.WW.root	Diboson process WW	21-Jul-2016 16:00	64,7Mb	500000
	mc_105986.ZZ.root	Diboson process ZZ	21-Jul-2016 16:00	19,8Mb	125000
	mc_105987.WZ.root	Diboson process WZ	21-Jul-2016 16:00	69,5Mb	500000
	mc_110090.stop_tchan_top.root	Single top t-channel top	21-Jul-2016 16:00	21,6Mb	150000
	mc_110091.stop_tchan_antitop.root	single top t-channel antitop	21-Jul-2016 16:00	14,5Mb	150000



Tools

- Analysis software to run and modify
- Seven analyses: $H \rightarrow WW$, WW , ZZ , top pair, Z , W , Z'
- Documentation describes analysis steps to follow and produce histograms
- Available in GitHub repository, as zip file or on the CERN open data portal



Personal Open source Business Explore Pricing Blog Support This repository Search Sign in Sign up

atlas-outreach-data-tools / atlas-outreach-data-tools-framework Watch 2 Star 1 Fork 2

Code Issues 0 Pull requests 0 Pulse Graphs

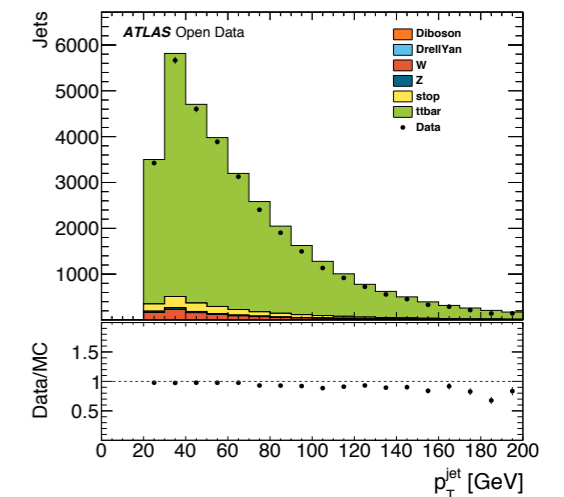
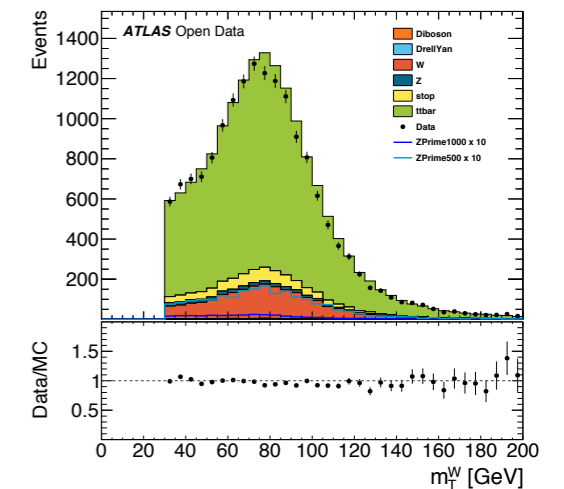
Python software framework for the ATLAS OpenData project

3 commits 1 branch 2 releases 0 contributors

Branch: master New pull request Find file Clone or download

Arturos Sanchez Pineda Adding missing s in documentation to run Plotting code Latest commit 7a27294 on Jul 14

File	Description	Last Commit
Analysis	First version for ATLAS collaboration review before 2016 release	3 months ago
Configurations	First version for ATLAS collaboration review before 2016 release	3 months ago
Input	First version for ATLAS collaboration review before 2016 release	3 months ago
Output	First version for ATLAS collaboration review before 2016 release	3 months ago
Plotting	First version for ATLAS collaboration review before 2016 release	3 months ago



Data & Tools

Virtual Machines

Virtual Machines to run on any operating system (5 available)

VM Small Version: 1.7 GB

Lubuntu in conjunction with ROOT and 10% of the data.

Can be downloaded fairly quickly. Remaining 90% data downloaded in background if required.

Documentation: Software book

Explains the different virtual machines & how to choose which one suits your needs

How to setup environment for small VM

How to run and look at data

Explains plots

Details event selection

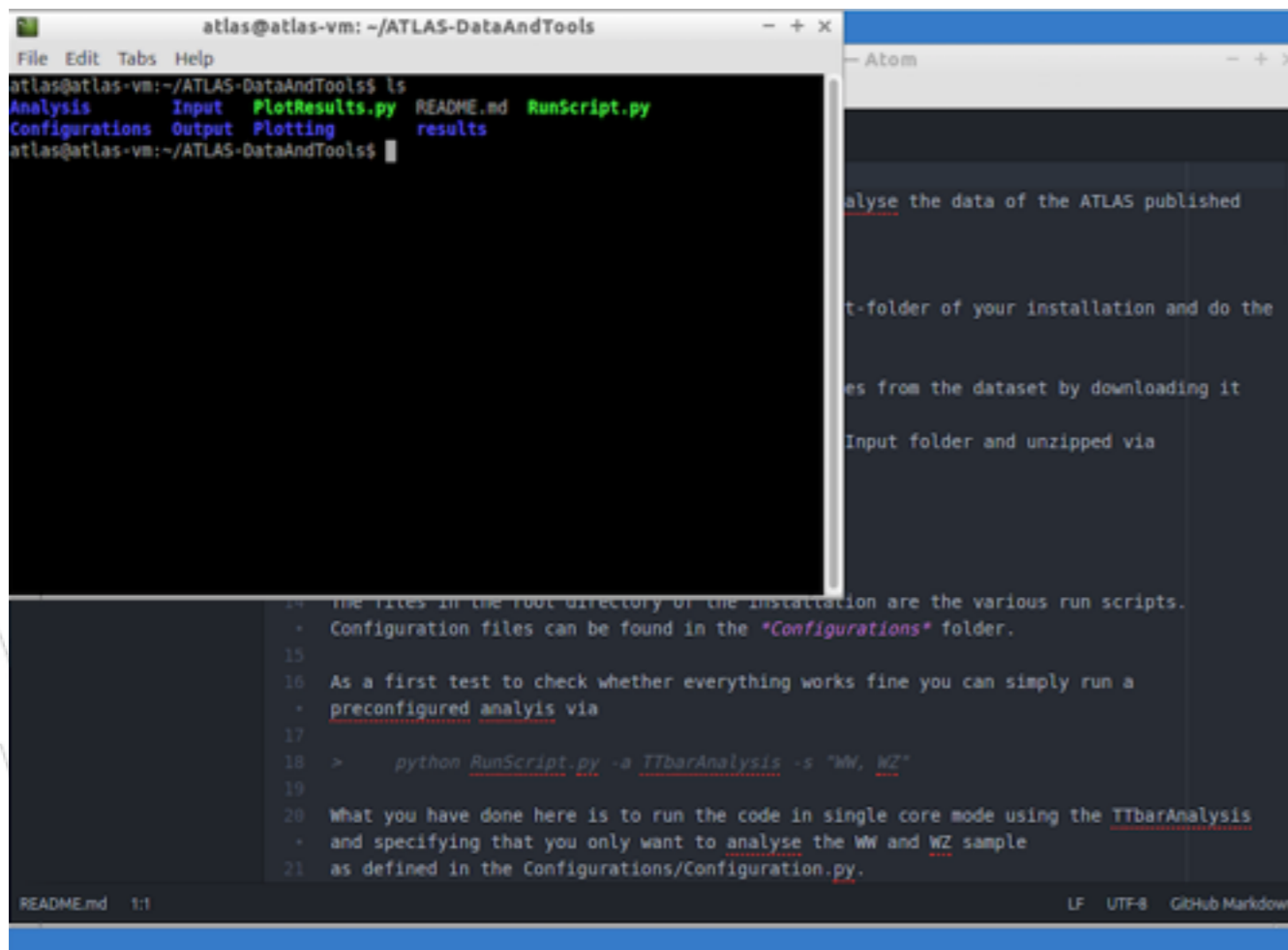
Defines variable names



relevant to all VMs

Virtual Machines

- Step by step instructions on how to set up a VM
- Documentation describes steps to follow, to run the software and produce histograms
- Histogram variables explained and differences between data and simulated data discussed

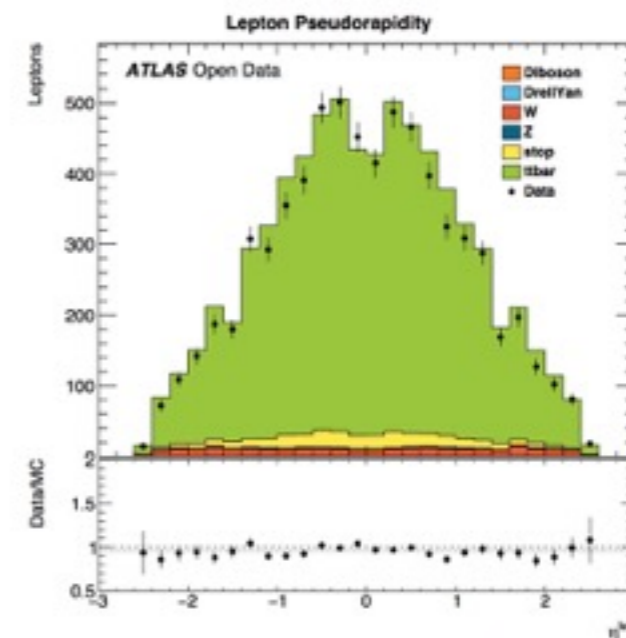
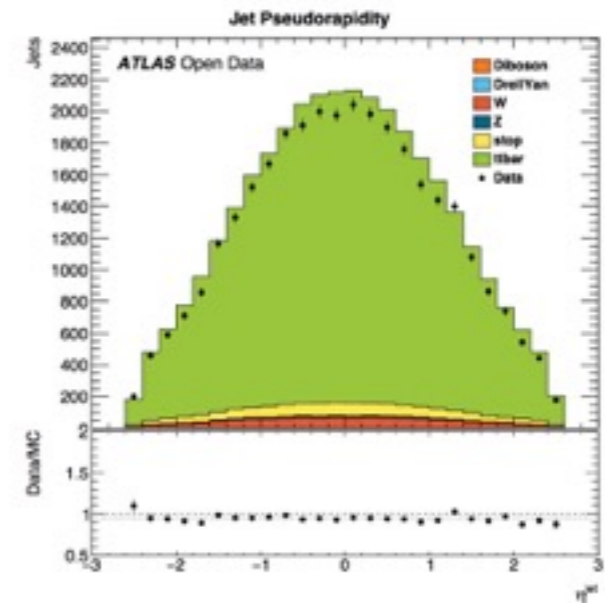


```
atlas@atlas-vm: ~/ATLAS-DataAndTools
File Edit Tabs Help
atlas@atlas-vm:~/ATLAS-DataAndTools$ ls
Analysis      Input      PlotResults.py  README.md  RunScript.py
Configurations  Output    Plotting        results
atlas@atlas-vm:~/ATLAS-DataAndTools$
```

analyse the data of the ATLAS published
t-folder of your installation and do the
es from the dataset by downloading it
Input folder and unzipped via

The files in the root directory of the installation are the various run scripts.
• Configuration files can be found in the "Configurations" folder.
15
16 As a first test to check whether everything works fine you can simply run a
preconfigured analysis via
17
18 > `python RunScript.py -a TTbarAnalysis -s "W, WZ"`
19
20 What you have done here is to run the code in single core mode using the `TTbarAnalysis`
and specifying that you only want to analyse the `W` and `WZ` sample
21 as defined in the `Configurations/Configuration.py`.

README.md 1:1 LF UTF-8 GitHub Markdown



Data & Tools

Software Book

[ATLAS open data](#)

ATLAS events

Data and simulated data

Histogram animation

Analyses

Setup your environment

Take a look at the data

Take a closer look

Plots explained

More plots

Event selection

Variable names

Glossary

Dataset Details

Chapters added to explain what happens in the code:

- production of histograms and plots
- code snippets to explain event selection

Event selection

The events in the dataset ntuples have been selected according to a selection criteria. The variables are defined in [variable names](#).

The standard event based selection criteria are:

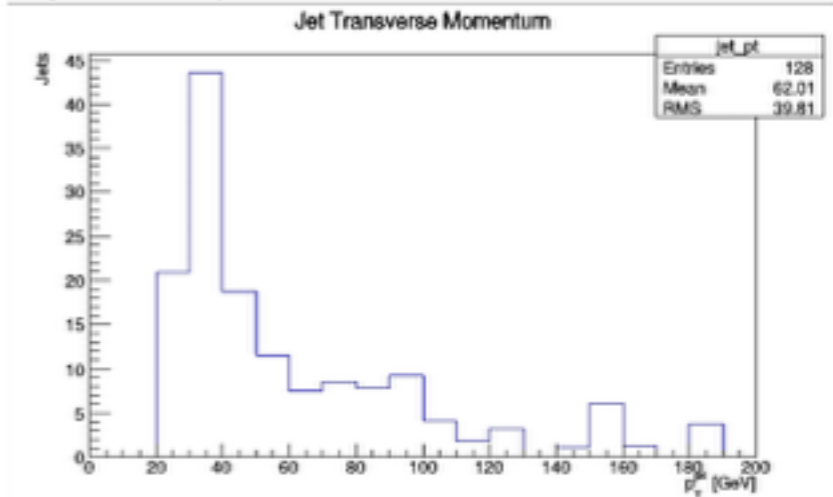
- A single electron or muon trigger has fired;
- The primary vertex has at least 5 tracks;
- There is at least one good lepton with $p_T > 25$ GeV;
- Leptons are required to be isolated (Both $ptcone30$ and $etcone20 < 0.15$);
- The event passes the [Good Run List](#) (GRL);
- A veto exists on events containing bad [jets](#).

The standard event based selection code is

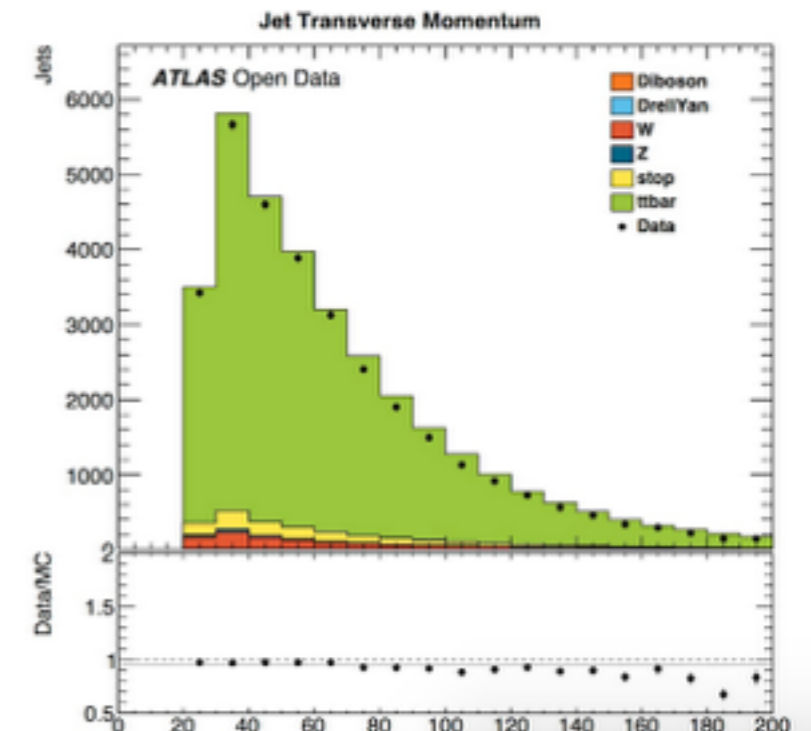
```
12 def isGoodLepton(Lepton):
13     if (abs(Lepton.pdgId()) == 11 and isGoodElectron(Lepton)): return True;
14     if (abs(Lepton.pdgId()) == 13 and isGoodMuon(Lepton)): return True;
15     return False;
16
17 def isGoodElectron(Lepton):
18     if not Lepton.isTight(): return False
19     if not Lepton.pt() > 25: return False
20     if not Lepton.isoetcone120() < 0.15: return False
```

Take a look at the data

1. Run an analysis using `RunScript.py` to produce histograms of individual variables eg `jet_pt`. The histograms are written to your results folder.



2. Plot the results using `PlotResults.py` to scale the histograms, colour them in and stack them. Combined plots are produced, for all the simulated and real data. These plots are written to your Output folder.



ATLAS open data



- Achieving international impact
- Release peak: will continue to re-advertise when new data or tools available
- Bounce rate and page visit length average for a website



Bounce Rate is the percentage of visitors that abandon the site after the first interaction with the site
 40 to 55 % is average

The average page visit ~1 minute

Summary

- Outreach is both central and essential to the scientific process
- ATLAS open data aims to make ATLAS data and tools accessible to all
- Broad target audience:

Currently aimed at University students

Interesting to high school teachers and students

- Development of tools ongoing
- Testing of website and tools ongoing with small groups volunteers
- Feedback always useful and very welcome



ATLAS Outreach



ATLAS public website

Engage public: news stories, evergreen content and opportunity to learn more about ATLAS
Core message: ATLAS, Physics, Collaboration, Detector/Technology

The screenshot shows the ATLAS public website interface. At the top, there is a navigation bar with the CERN logo and 'Accelerating science' tagline. Below this is a blue header with the ATLAS logo and a search bar. The main content area features four large tiles, each with a title and a descriptive caption:

- About the ATLAS Experiment:** One of the four major experiments at the Large Hadron Collider at CERN
- The Physics:** Exploring the basic building blocks and fundamental forces of nature
- The Collaboration:** One of the largest collaborative efforts ever attempted in particle physics
- The Detector:** One of the largest and most complex scientific instruments ever constructed

Social Media



ATLAS LIVE AT ICHEP
Join our Facebook Live event
Thursday, 4 Aug 16:45 CST (23:45 CEST)
www.facebook.com/ATLASexperiment
#ICHEP2016

ATLAS Experiment at CERN
August 30 at 3:02pm · €

An exceptional summer: 12 stories about ATLAS summer students and their supervisors

<https://atlas-public.web.cern.ch/.../atlas.../exceptional-summer>

For many studen...

See More

Thanks to CERN's Summer Student Programme, every year dozens of university students spend their holidays working at the ATLAS experiment.

12 STORIES ABOUT ATLAS SUMMER STUDENTS AND THEIR SUPERVISORS

An exceptional summer
For many students, summer means sun and beach volleyball. For some, though, it is an opportunity to learn at ATLAS! Thanks to CERN's Summer Student Programme, every year dozens of university students come to ATLAS to spend their holidays in...
ATLAS.CERN

Engage new audiences
Connects people with ATLAS
Brings traffic to the website

Facebook likes: 20 k
Twitter followers: 39 k
Google+ followers: 123 k

Picturing Particles

PICTURING PARTICLES

The evolution of event displays

0:05 / 2:09

Kate Shaw shared ATLAS Experiment at CERN's live video.
August 4 · 21

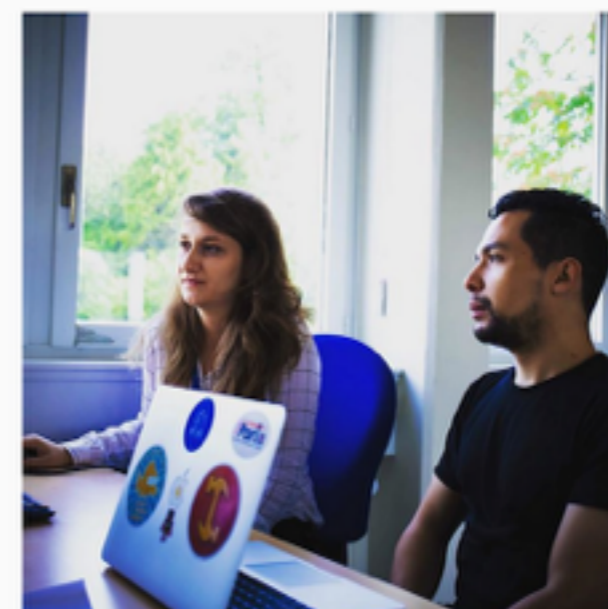
Interview with Marumi Kado, ATLAS Physics Coordinator Live from ICHEP 2016!

1,310 Views

ATLAS Experiment at CERN was live.
August 4 · €

Like Page

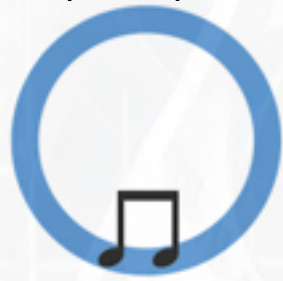
ICHEP Interview with Marumi Kado #facebooklive #ichep2016



ATLAS EXPERIMENT

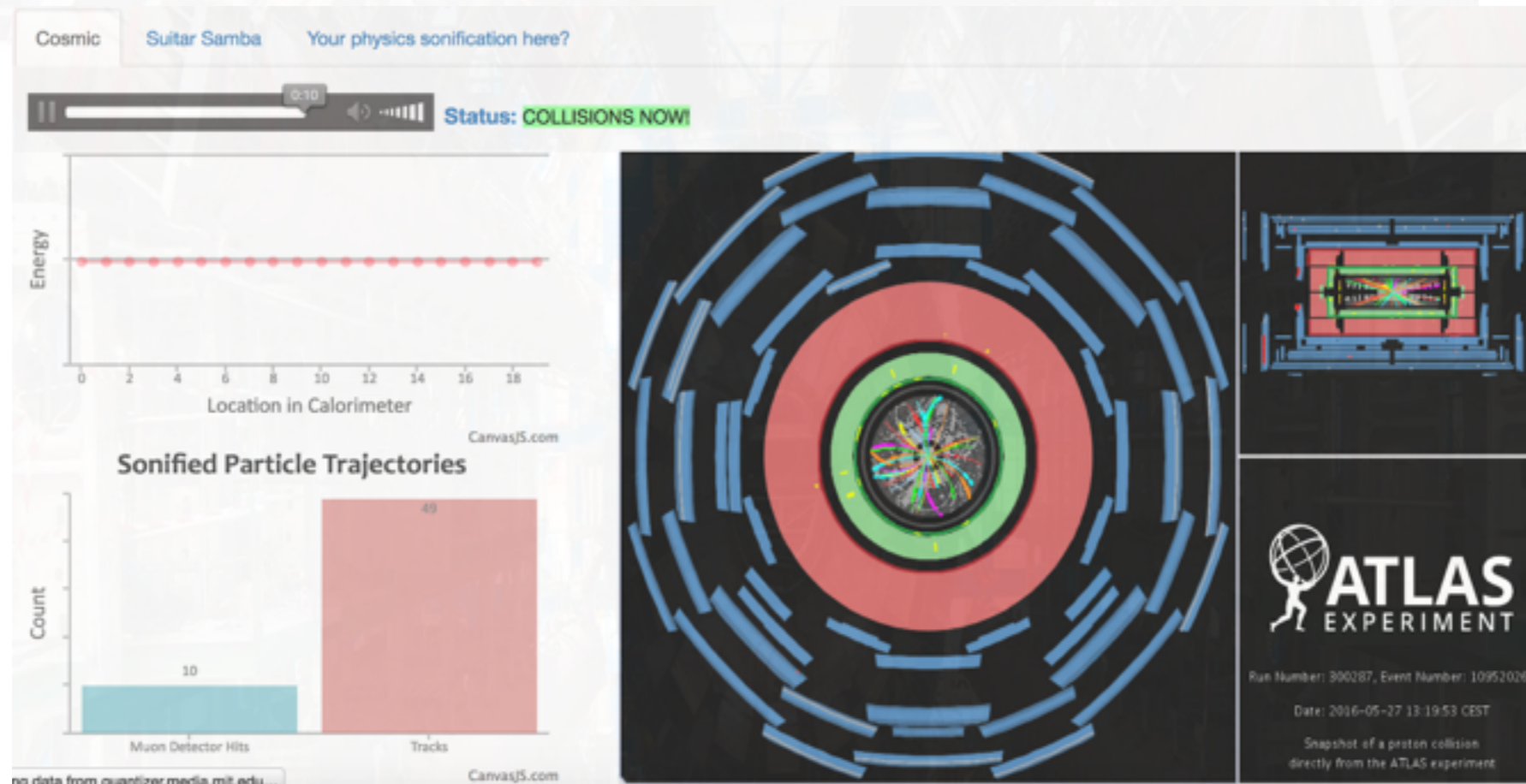
ATLAS Experiment at CERN
@ATLASexperiment





QUANTIZER

high energy physics experienced through real-time audio



Website:
~ 6300 visits
~ 4500 users

Soundcloud:
pre-recorded music
tracks
~3200 plays

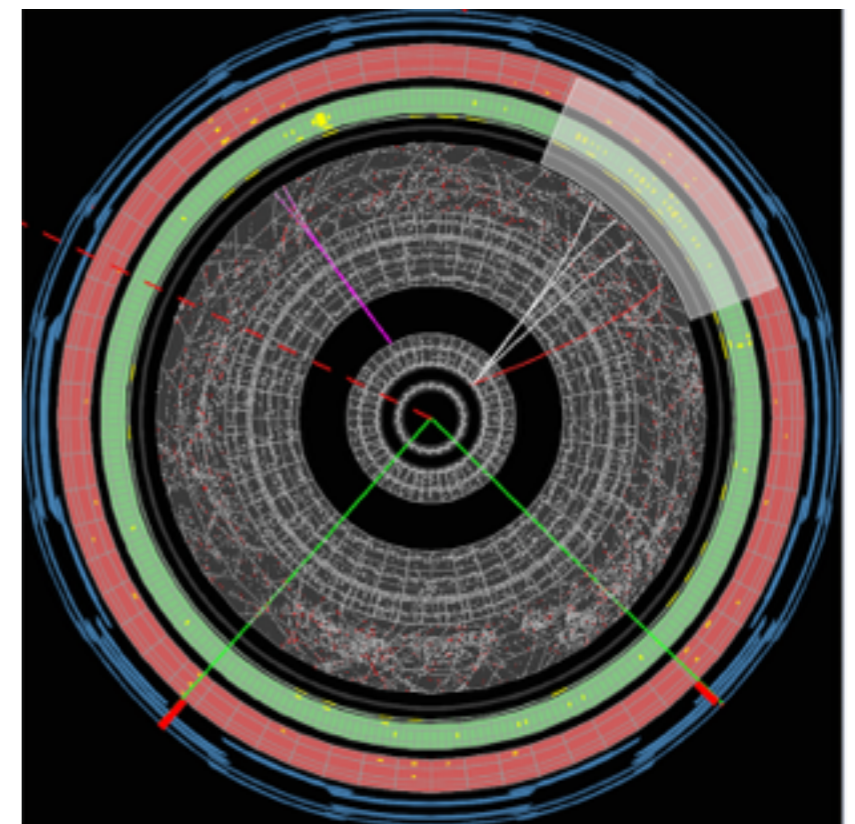
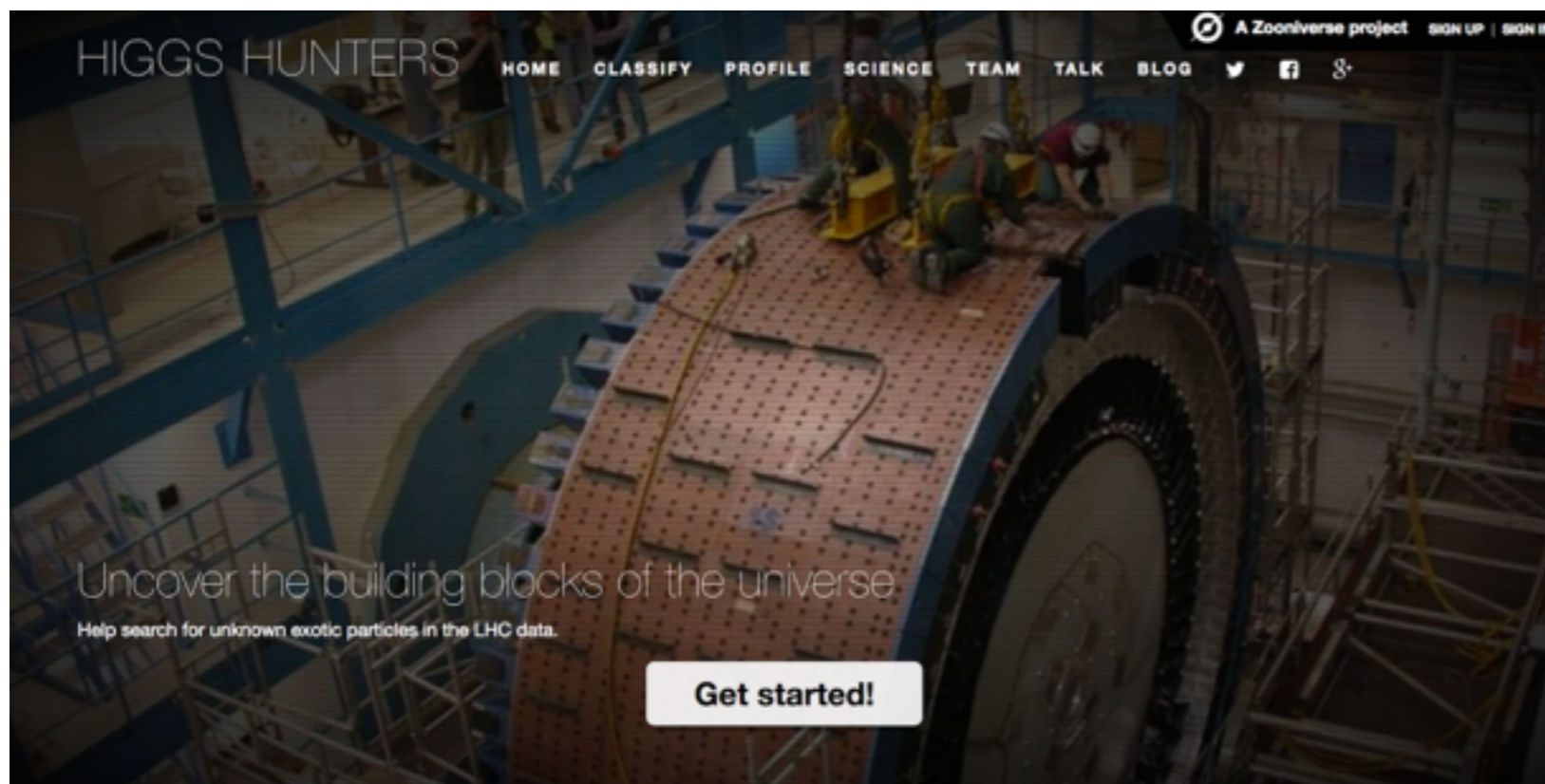
Data sonification:

- Property of sound, such as the pitch, mapped to a physical property, such as speed.
- Various different software packages available for turning numbers into sounds.

Citizen science project

Higgs Hunters

- A collaboration between Oxford, Birmingham and New York Universities
- The first particle physics venture on Zooniverse, a collection of web-based citizen science projects
- Invites online volunteers to participate in classifying off-centre vertices



- More than 30,000 volunteers from 179 countries participated, classifying 980,000 features of interest on about 39,000 distinct images.
- Non-expert volunteers are capable of identifying the decays of long-lived particles with an efficiency and fake-rate comparable to that of the ATLAS algorithms.

Virtual Visits

Digital Communications Award 2012

Virtual visits continue to be popular.
Excellent resource to connect with school and university students.

In 2016, around 70 visits from more than 14 countries



Higgs Branching Ratios

