



LOMONOSOV MOSCOW
STATE UNIVERSITY



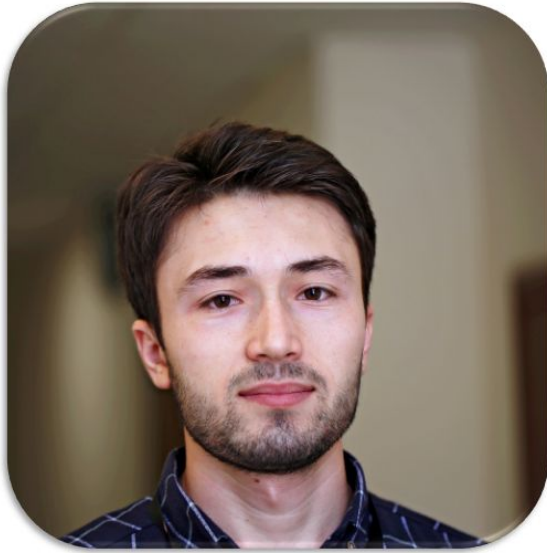
ATLAS Open Data & Tools release

Shodruz Umedov

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CERN - 2019/08/06

Short Bio About Me



Name: *Shodruz Umedov*

Country: *Tajikistan*

Where you study?:

– Lomonosov Moscow State University, Moscow , Russia

Field of Studies and Degree:

– Materials science, Master

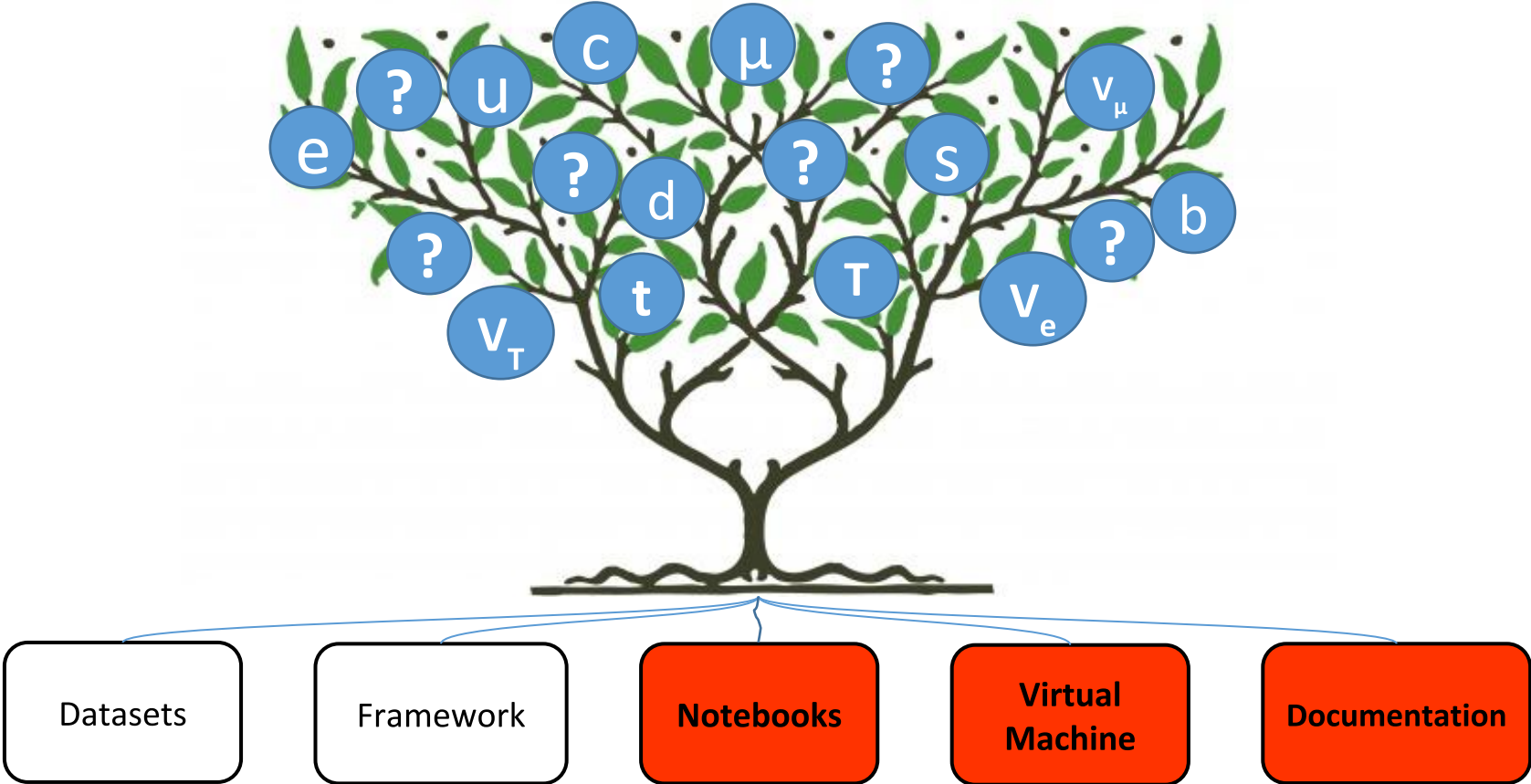
What have you been doing at CERN, your Department-Group?:

– Development, testing and documentation of educational resources for the ATLAS Open Data project. Including Particle Physics analysis examples. EP-ADT-DQ Department

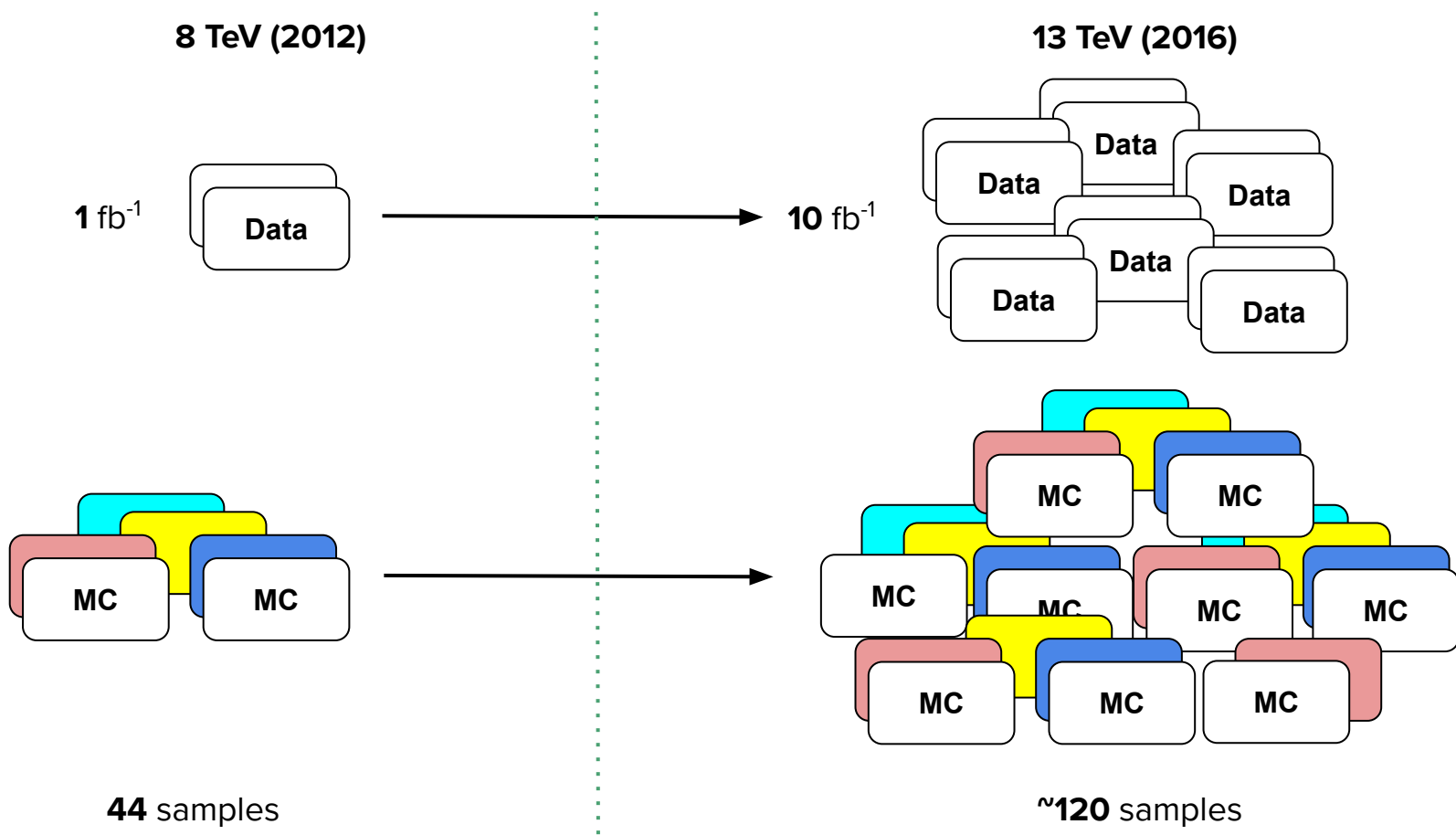
What are you thinking of doing after CERN?: *PhD in Materials science*

What you liked most in your experience as a summer student?:

– I liked everything! But I would suggest to increase the limited places to workshops and visit centers.



Datasets (p⁺p⁺ collision)



Framework(s)

13 TeV C++
analysis
8 examples

13 TeV Python
analysis
examples

non-ROOT
based analysis
examples

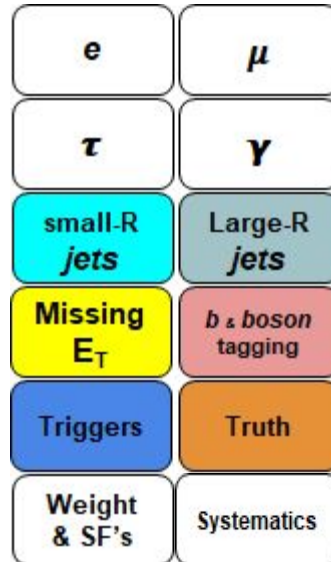
More analysis
examples in all
languages

8 TeV Analysis
Examples



~50 variables

13 TeV Analysis
Examples



~100 variables

Notebooks

Jupyter notebooks (Python / C++) | (8 TeV / 13 TeV)

~ Analysis Examples

~ Framework Integrations

- Histogram “one click” plotting
- More analysis methods
- Code explanation
- Code design

**10 Notebooks for 8 TeV
now ready for use**

https://github.com/atlas-outreach-data-tools/notebooks/tree/master/september_2018_v-2.0

**2 Notebooks for
13 TeV created**

NEW!

Let's open the [demo](#)

localhost:8888/notebooks/notebooks/september_2018_v-2.0/ATLAS_OpenData_03-cpp_invariant_mass_reconstruction_using_TLorentz_vectors 90%

ATLAS_OpenData_03-cpp_invariant_mass_reconstruction_using_TLorentz_vectors (unsaved changes) Terminal

File Edit View Insert Cell Kernel Help | ROOT Prompt

At first we have to include several helpers that will support our analysis.

```
In [1]: #include <iostream>
#include <string>
#include <stdio.h>
```

In order to activate the interactive visualisation of the histogram that is later created we can use the JSROOT magic:

```
In [2]: %%jsroot on
```

Next we have to open the data that we want to analyze. It is stored in a *.root file. By creating a TChain it is possible to add more datasets and accordingly analyze more data.

```
In [3]: TChain *dataset = new TChain("mini");
```

This following input is read directly from the same storage - so it is faster. If you want to you can comment in the last line to read it from the internet.

```
In [4]: dataset->Add("/home/student/datasets/MC/mc_105986.22.root");
//dataset->Add("http://opendata.atlas.cern/release/samples/MC/mc_147770.Zee.root");
```

We now declare some variables that are later used in the analysis.

```
In [5]: const int vs = 5;

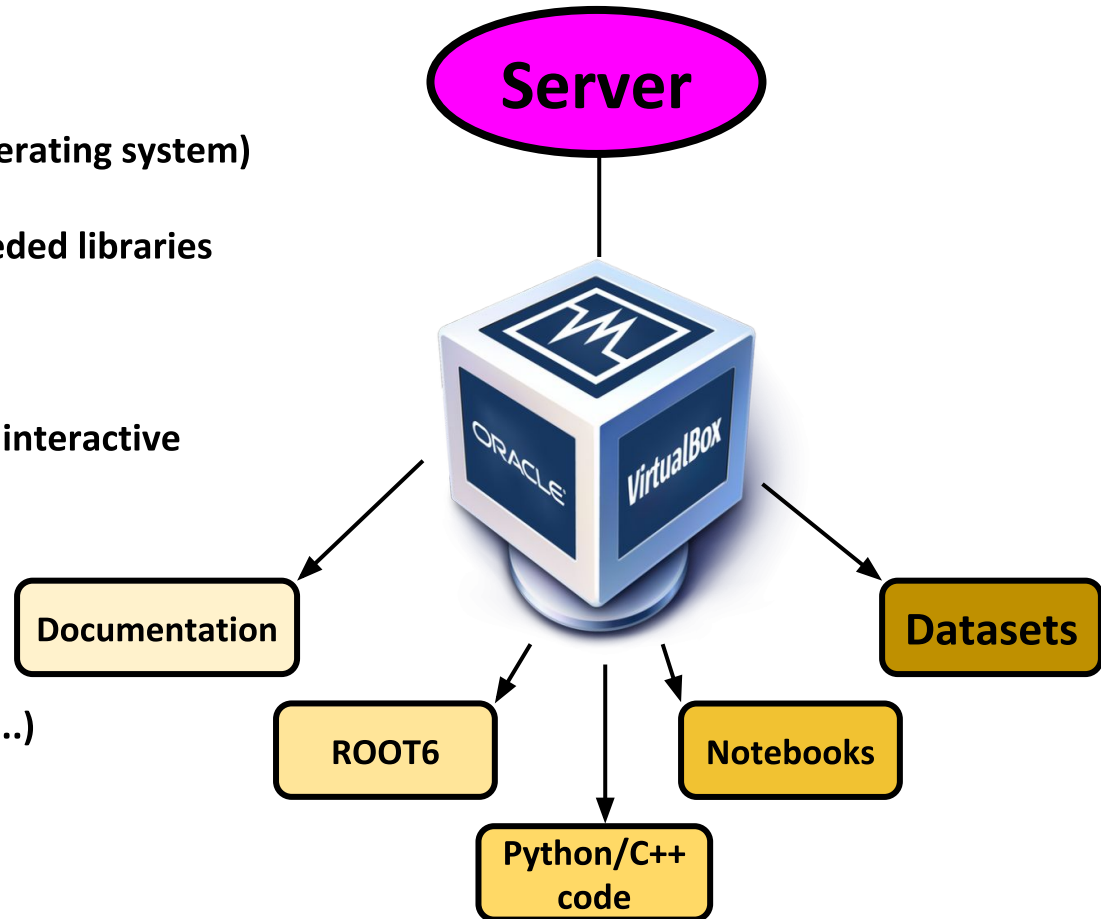
Int_t   lepton_n = -1,
lepton_charge[vs], //electrical charge of the lepton
lepton_type[vs];  //flavour of the lepton

Float_t lepton_pt[vs],
lepton_eta[vs],
lepton_phi[vs],
lepton_E[vs];
```

After we declared these variables we have to say the program where it can find the values for the variables.

Virtual Machine

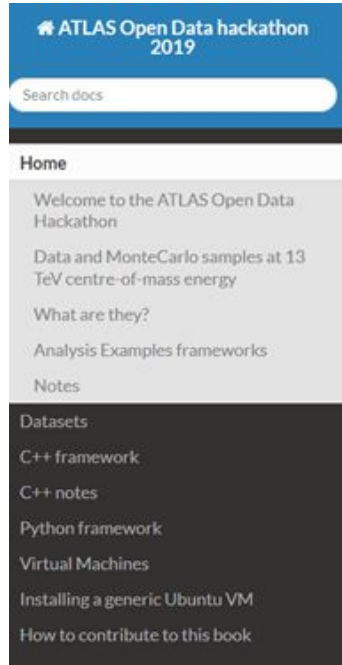
- Linux OS with standard GUI (for any operating system)
- The OS is enhanced with all ROOT's needed libraries and dependencies
- Jupyter Notebook – command shell for interactive computing
- Samples and tools for your analysis
- Some useful software (.i.e Python, gcc,...)
- One click installation



MkDocs

Project documentation with Markdown.

- Project general information
- ATLAS Open Data resources
- Explanation of **Data, Notebooks, Software**
- Comprehensive interpretation of code and the tools, like the Virtual Machine
- Data analysis teaching.



Docs » Home

Welcome to the ATLAS Open Data Hackathon

This is a documentation to run the resources to-be-released at the [ATLAS Open Data](#) project!

Data and MonteCarlo samples at 13 TeV centre-of-mass energy

- 8 TeV Run 1 samples
 - <http://opendata.atlas.cern/extendedanalysis/datasets.php>
 - You can get/read one by one, using the URL, from a Jupyter notebook, for example.
 - Or download the ZIP file with all in there.
 - References
 - [Online book](#)
 - [ATL-OREACH-PUB-2016-001](#)
- 13 TeV Run 2 samples
 - [/eos/project/a/atlas-outreach/projects/open-data/OpenDataTuples/](#)
 - Please, avoid any modification, you can simply read directly using LXF111S (use it as read-only)

<http://opendata.atlas.cern/tutorials/hackathon-2019>

What I learned?:

- ❖ Data analysis and processing
- ❖ Create Notebooks, write bash scripts
- ❖ Code in Python and C++
- ❖ Testing (software, site, code etc...)
- ❖ Work with Virtual Machines and Linux OS
- ❖ Documentation with Markdown
- ❖ Work in team on one project with Gitlab & Github

