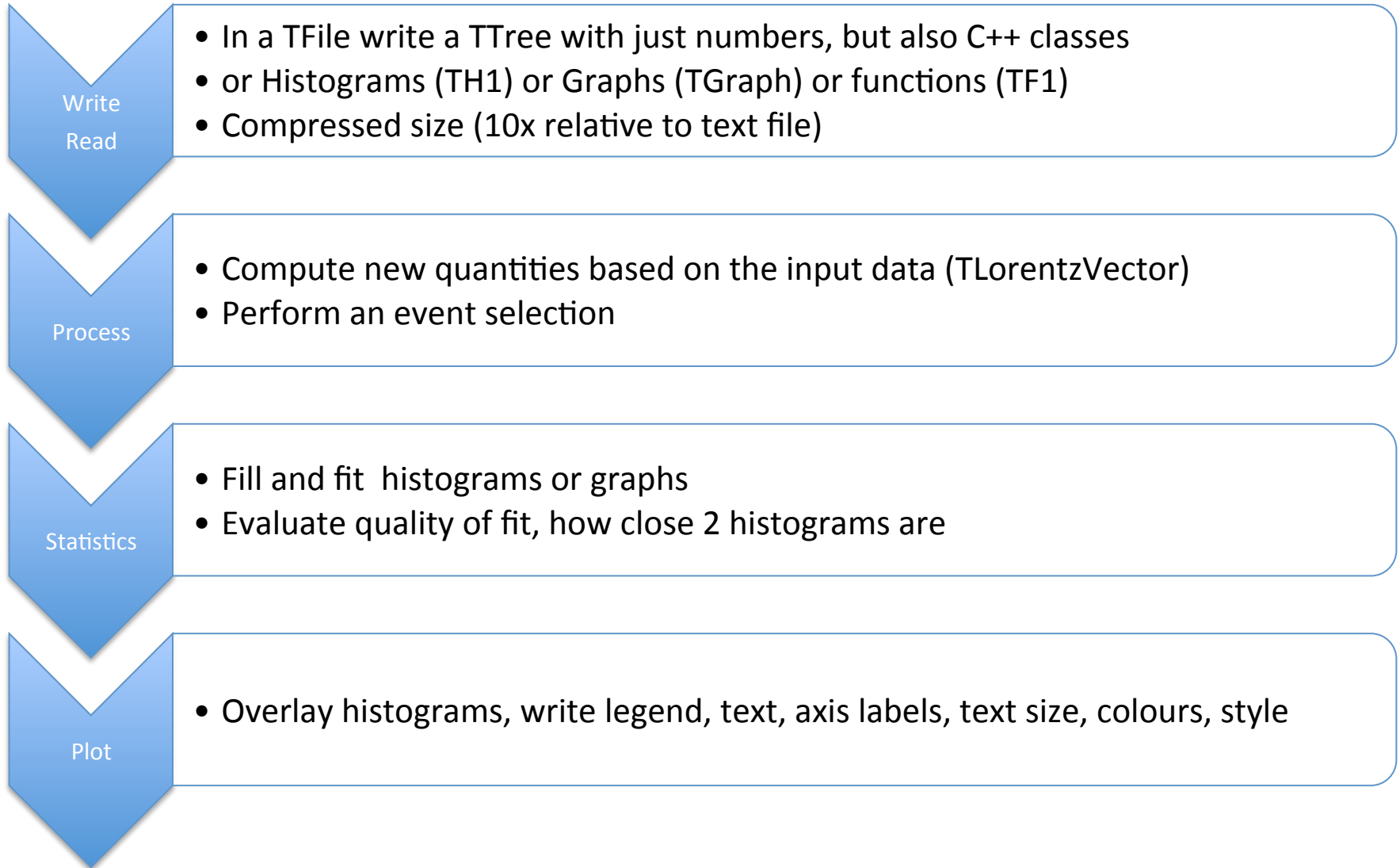# SUPA ROO (ROOT)
Lecture 1 – 19 Nov 2015
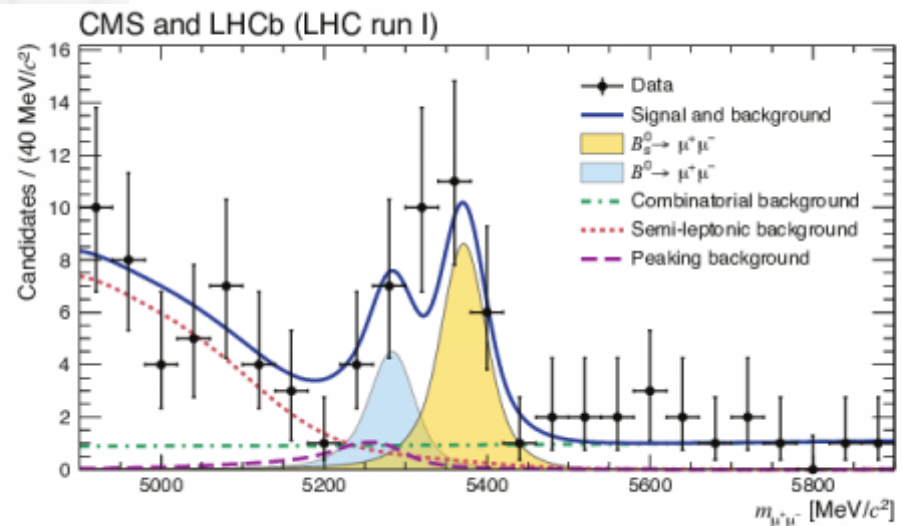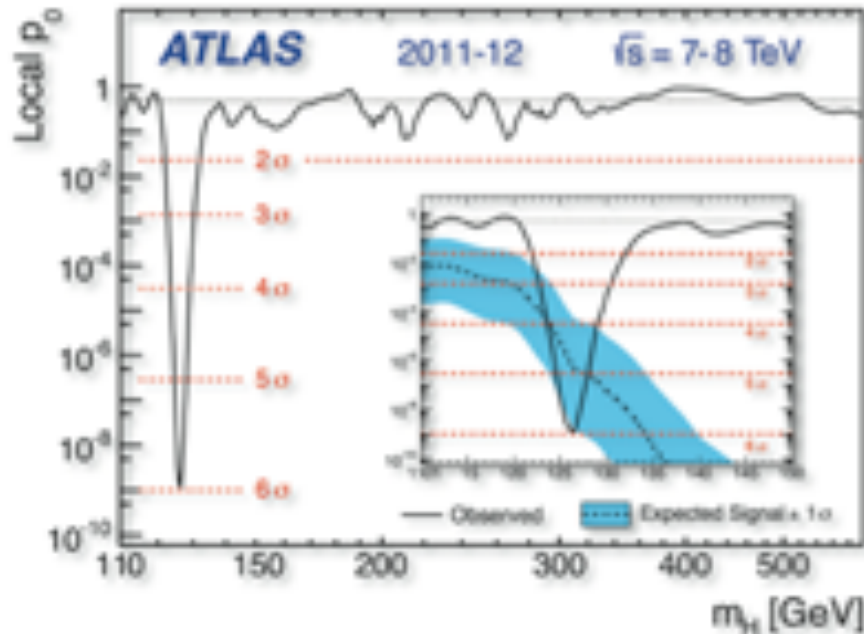
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Big data numerical analysis has particular needs. The solution are libraries in C++ called ROOT.

Write Read
- In a TFile write a TTree with just numbers, but also C++ classes
- or Histograms (TH1) or Graphs (TGraph) or functions (TF1)
- Compressed size (10x relative to text file)

Process
- Compute new quantities based on the input data (TLorentzVector)
- Perform an event selection

Statistics
- Fill and fit histograms or graphs
- Evaluate quality of fit, how close 2 histograms are

Plot
- Overlay histograms, write legend, text, axis labels, text size, colours, style

CERN uses ROOT for its data analysis.
Particle, astroparticle, nuclear physics too.

ROOT is open source from CERN, root.cern.ch and continuously updated and documented.

Interactive
- In terminal, one command at a time

Macro
- A .C file with functions, not compiled

Executable
- Complete C++ compilation executable, with int main () and #include

PyROOT
- Python interface, easier syntax, calls C++ code, not compiled

Learn Python by yourself in the next two weeks!
I takes only one day.
https://docs.python.org/2/tutorial/
Covered in Lab3.

Once I have a flat tree, I just use PyROOT.
Flat tree = a tree with just numbers

to create a tree that stores complex objects like a
class Planet, I use C++.

Download and install ROOT from CERN. Install also PyROOT.

Or ssh to your work linux machine.

Or ssh to brutha.physics.gla.ac.uk.

CERN has documentation and tutorials.

Official:

http://root.cern.ch

Documenation:

http://root.cern.ch/drupal/content/
documentation

User's Guide: many PDFs by categories:
http://root.cern.ch/drupal/content/users-guide

Tutorials:

http://root.cern.ch/root/html/tutorials/

How To:

http://root.cern.ch/drupal/content/howtos

Google a class to know its members, its methods, its history of inheritance, eg: "ROOT TH1"
 -> **ROOT: TH1 Class Reference - Cern**

Study on your own C++ class inheritance.

There are many tutorials out there - 1

BABAR ROOT tutorial
http://www.slac.stanford.edu/BFROOT/www/doc/workbook/root1/root1.html

ATLAS ROOT tutorial
wget http://www.ppe.gla.ac.uk/~abuzatu/SUPAROO/RootTutorial_ATLAS.tgz
tar xvzr RootTutorial_ATLAS.tgz
then read the instructions from tutorial.txt using the input file tutorial.root the solutions are presented in the .C file

There are many tutorials out there - 2

Dan Clemens: worked out examples
https://twiki.ppe.gla.ac.uk/pub/ATLAS/WebHome/RootManual.pdf

Fermilab ROOT tutorial
http://www-root.fnal.gov/root/CPlusPlus/
http://www-root.fnal.gov/root/class/exercises.htm

Columbia university
http://www.nevis.columbia.edu/~seligman/root-class/RootClass2011.pdf

Tasks until next lab

Work through the Babar and ATLAS tutorials.

Bring examples of your current research code to the lab.

Try to move it from macros to a compiled C++ mode.

Faster.
Fewer bugs.
Easier to develop upon.

Now: illustration of TreeDraw() for flat tree.