

# Using ROOT Files in the Python Ecosystem

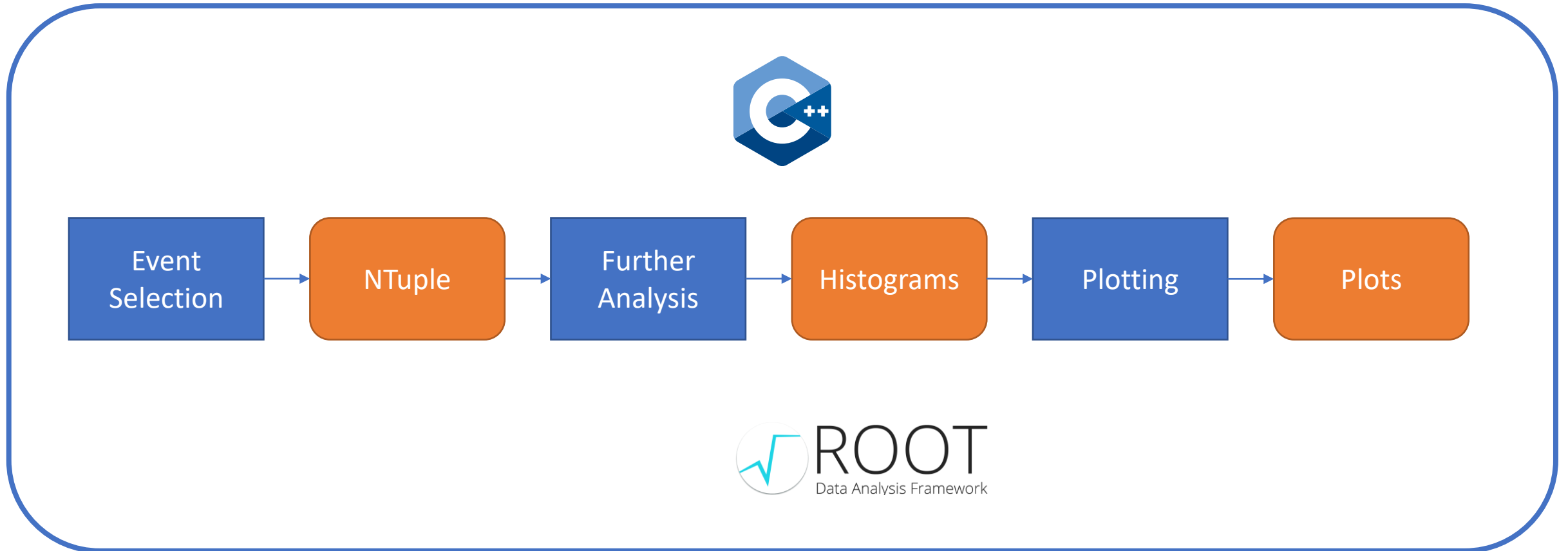
HPC Meeting - 21.06.2022

Thomas Lenz

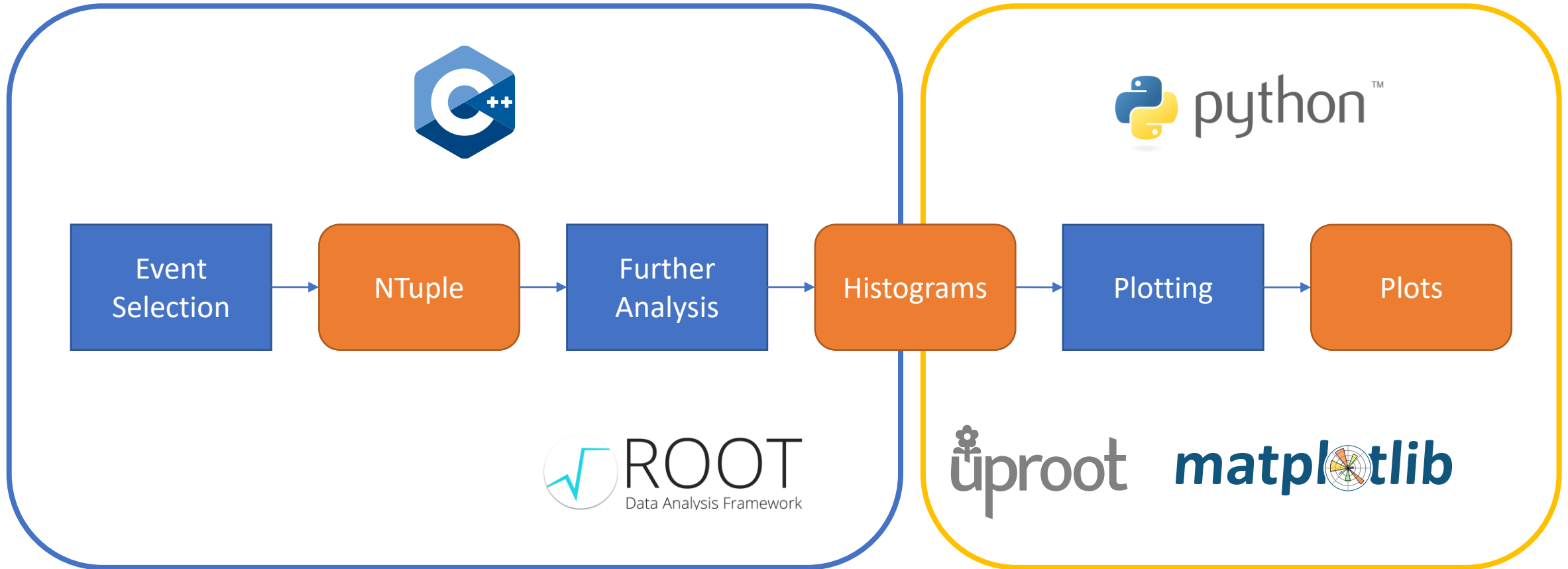
JOHANNES GUTENBERG  
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# Conventional/Historic Workflow



# My (Current) Workflow



# Scikit-HEP



- <https://scikit-hep.org/>
- “The Scikit-HEP project is a community-driven and community-oriented project with the aim of providing Particle Physics at large with an ecosystem for data analysis in Python.”
- Contains 32 packages
- Number of applications:
  - **Datasets:** data in various sources, such as ROOT, NumPy/Pandas, databases, wrapped in a common interface.
  - **Aggregations:** e.g. histograms that summarize or project a dataset.
  - **Modeling:** data models and fitting utilities.
  - **Simulation:** wrappers for Monte Carlo engines and other generators of simulated data.
  - **Visualization:** interface to graphics engines, from ROOT and Matplotlib to even beyond.

# Uproot



- “Uproot is a library for reading and writing ROOT files in pure Python and NumPy.”
- Does **not** need a local ROOT installation
- Open file and list content
- Access ROOT file substructure and ROOT objects like branches or histograms

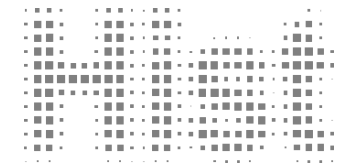
- TBranch (Arrays)

Awkward  
Array

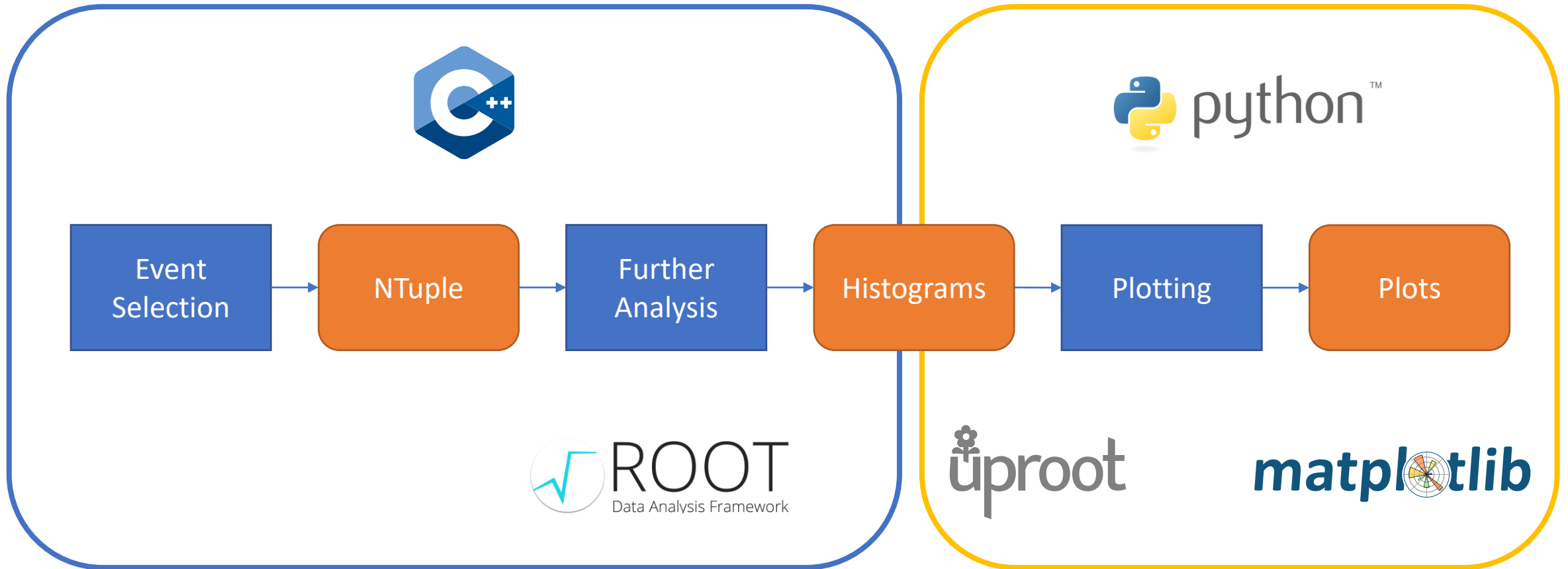


pandas

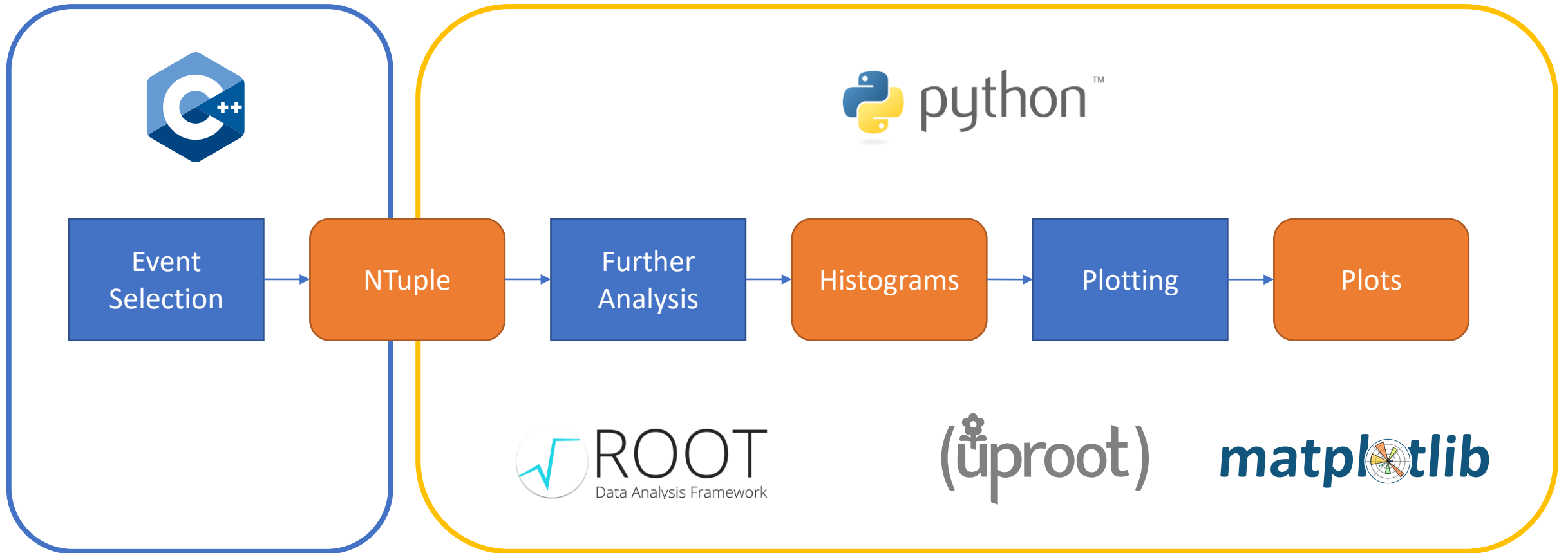
- TH1, ... (Histograms)



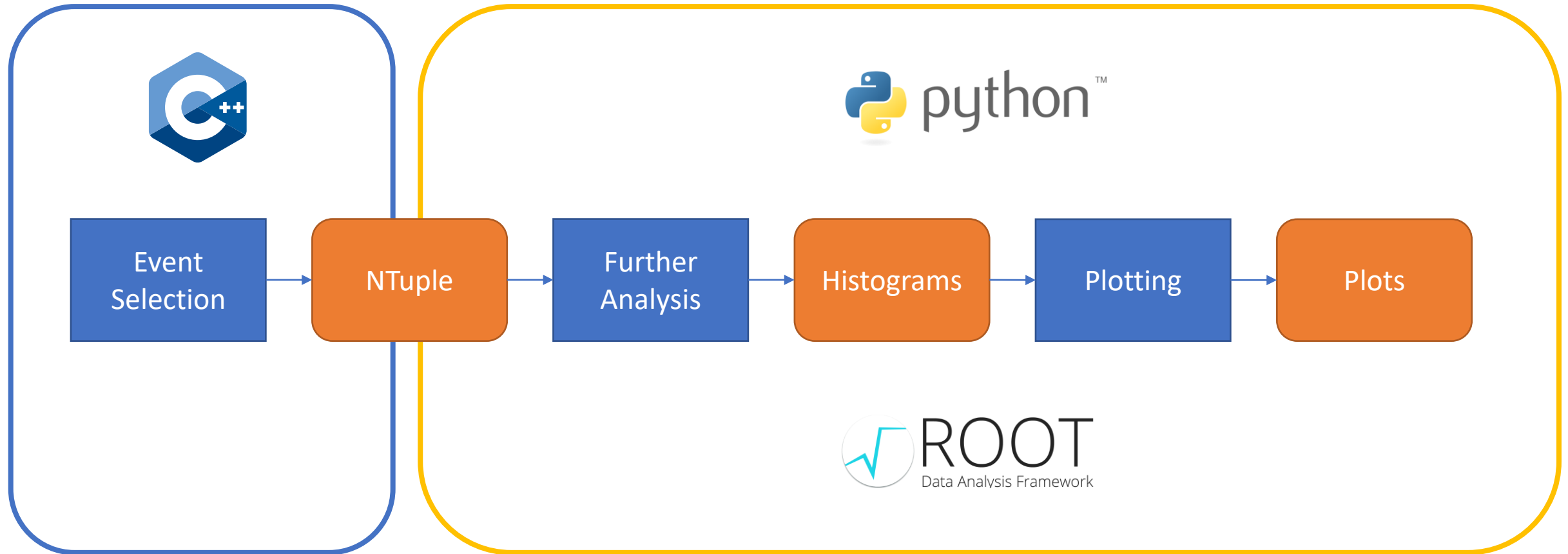
# My (Current) Workflow



# PyROOT Workflow



# Pure PyROOT Workflow



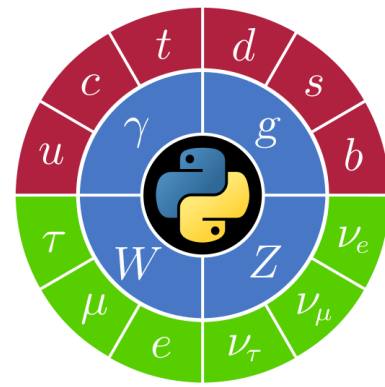


# PyROOT



- Python interface/bindings to ROOT
  - Data frames (high performance)
  - Defining new variables (also 4-vectors)
  - Cuts
  - Histograms
  - Fitting
  - Canvases (also in Jupyter Notebooks)
- Does need a local ROOT installation
  - Also accessible in virtual environments
- Installation Guide:
  - Install ROOT locally
  - PyROOT installed by default
  - Building from source:
    - 'pyroot' build option enabled by default
    - Uses latest Python installation if not specified
    - [https://root.cern/install/build\\_from\\_source/#root-python-and-pyroot](https://root.cern/install/build_from_source/#root-python-and-pyroot)

# PyHEP 2022 Workshop



- <https://indico.cern.ch/e/PyHEP2022>
- Remote Workshop
- September 12-16 2022
- The agenda is composed of plenary sessions:
  1. Hands-on tutorials.
  2. Topical sessions.
  3. Presentations following up from topics discussed at PyHEP 2021.
- “The PyHEP workshops are a series of workshops initiated and supported by the HEP Software Foundation (HSF) with the aim to provide an environment to discuss and promote the usage of Python in the HEP community at large. Further information is given on the PyHEP Working Group website.”