Bari, 16/10/2019

How to design an analysis using EventAnalysis and HERD software: a simple exercise.

Lorenzo Pacini, INFN Firenze,
lorenzo.pacini@fi.infn.it

A typical analysis.

- You need to compute new variables using the provided information (e.g. using the STK hits you can compute the track candidates or the clusters).

- Using the variables which you have computed, you can apply several selection cuts, also using the same code with different thresholds (e.g. using the STK cluster information you can apply a cut regarding the number of cluster).

- After several selections you may want to create some plots and save the survived events to run a further analysis step including only those events.

- Other common situations:

    - You may want to share with a colleagues the code of a selection.

    - You may want to merge your code in the common software.

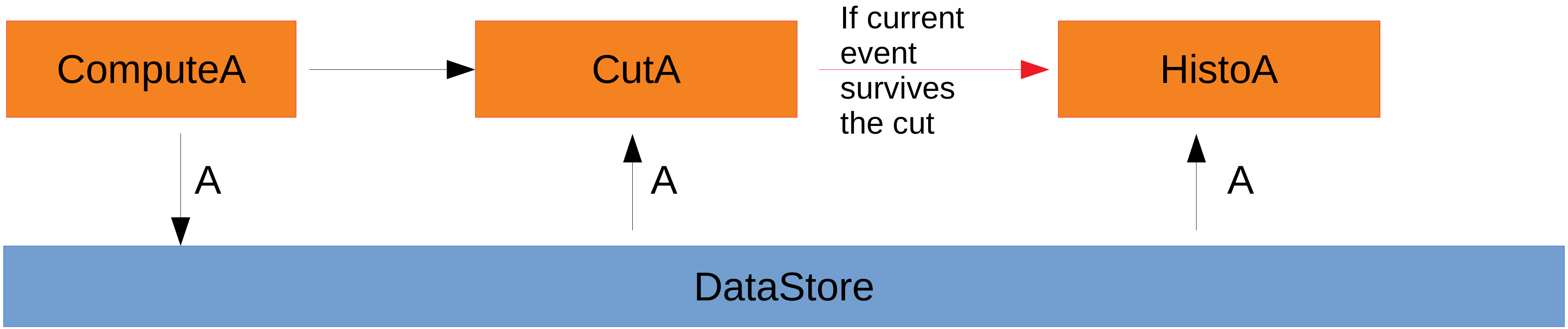
- I will present a way to design an analysis according to these items.

Multi algorithm analysis

- Why should you try to develop a code using several EA algorithm instead of one?
  - This is very useful to share algorithms, instead of cut – paste a section of your code. You can simply share a entire algorithm, if it is studied to performs a single task (e.g. a cut or a calculation of new variables).
  - Algorithm parameters are configured with the config. file thus you can use the same algorithm with different parameters without changing the code:
    - Lets consider a cut with a threshold, if you implement this cut in a separate algorithm, then to use the cut two times with different thresholds you only need to write a proper config. file, instead of add several code lines in your software.
- With EventAnalysis (EA) it is easy to separate an analysis in different algorithms, which interact each others.
- Quick EA review: algorithms share information thought the data store,
  - event store is for objects which "live" for a single event, global store is for objects which remain for the entire analysis job.

A simple example

- We want to implement a cut which needs some information to select events.
- Thus we can implement an algo ComputeA which computes those information and store those in a object A
- Object A can be sued also in a algo HistoA, which creates some plots using the computed information.
- A possible design of EA algorithms:

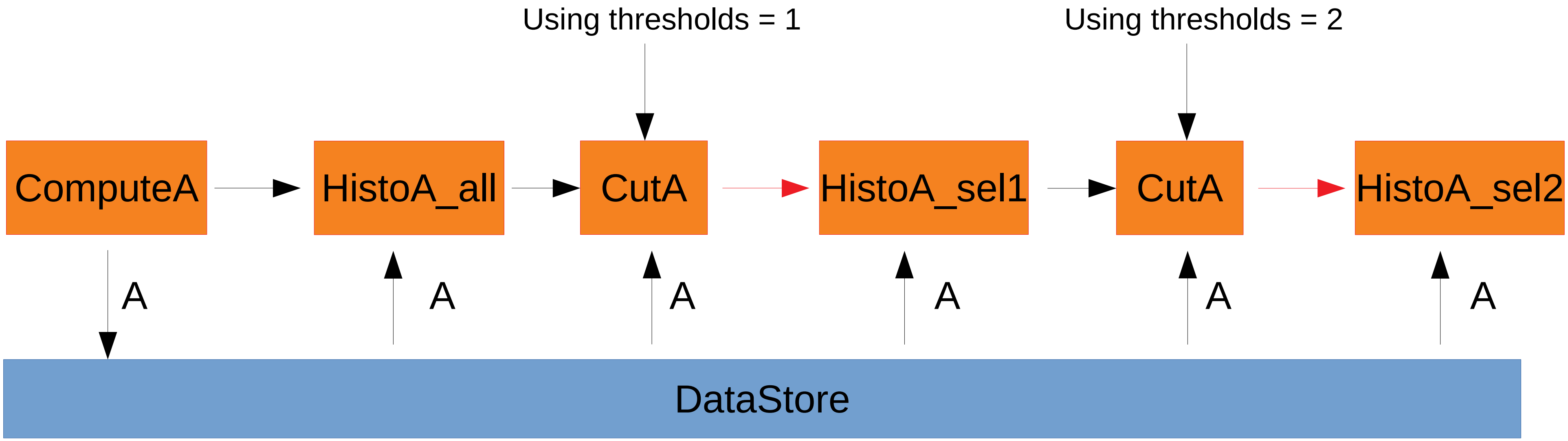


Where A is a object, which contains only the needed information.

More datails reagarding to how to develop an analysis: https://git.recas.ba.infn.it/herd/HerdSoftware/wikis/User's%20manual/Develop%20new%20analysis%20elements

Example: plot after different cuts

- Perform the plots before and after cut with different thresholds



- It allows to:
  - share the cut or/and the computation algorithm, excluding the plot algorithm.
  - replicate the plots with different configurations modifying only the config file. (no code modification needed).

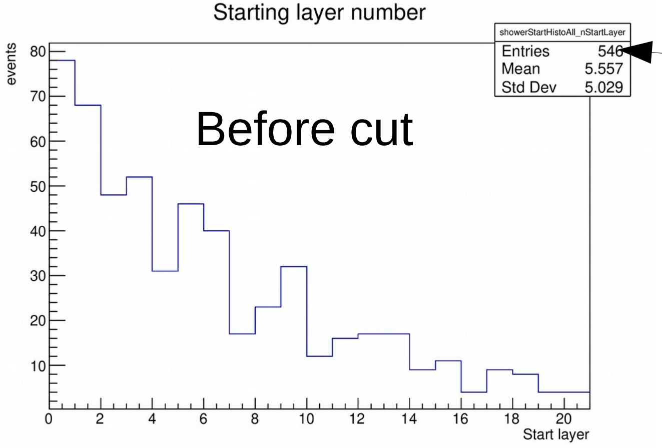
Exercise02: main content.

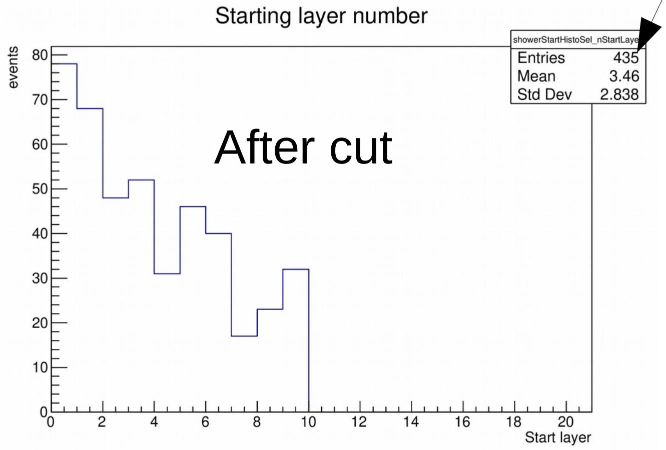
- Run a GGS simulation of vertical proton @ 10 GeV
- Find the shower starting layer:
  - It is defined as the first layer (starting from the top) which has a energy deposit $>$ THRESHOLD [GeV]
- Cut all the events with the shower starting layer $>$ LAYER
  - Both LAYER and THRESHOLD will be set using the config. file of the analysis.
- Plot some variables for all the events and selected events.
- Save the information of the shower starting layer inside a dedicated struct, for selected events.

- Option: check the correlation between the shower starting layer and the first interaction point, adjusting the THRESHOLD to find a better agreement (I never done that!!).

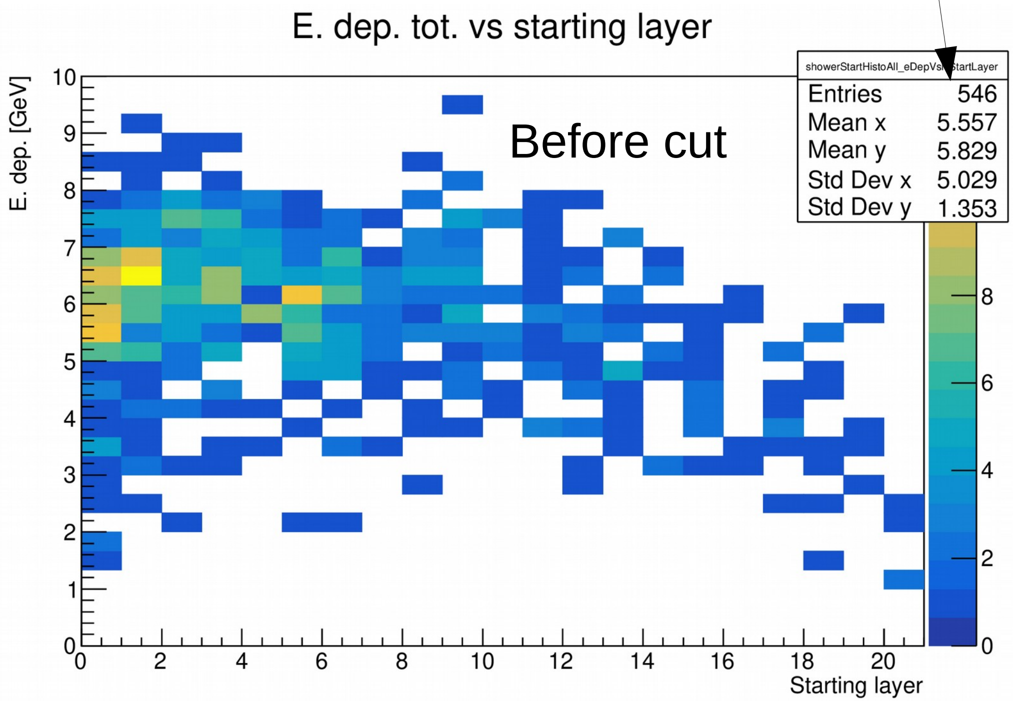
Exercise02: expected results

- Using THRESHOLD = 0.5 [GeV] and LAYER = 10: few plots.



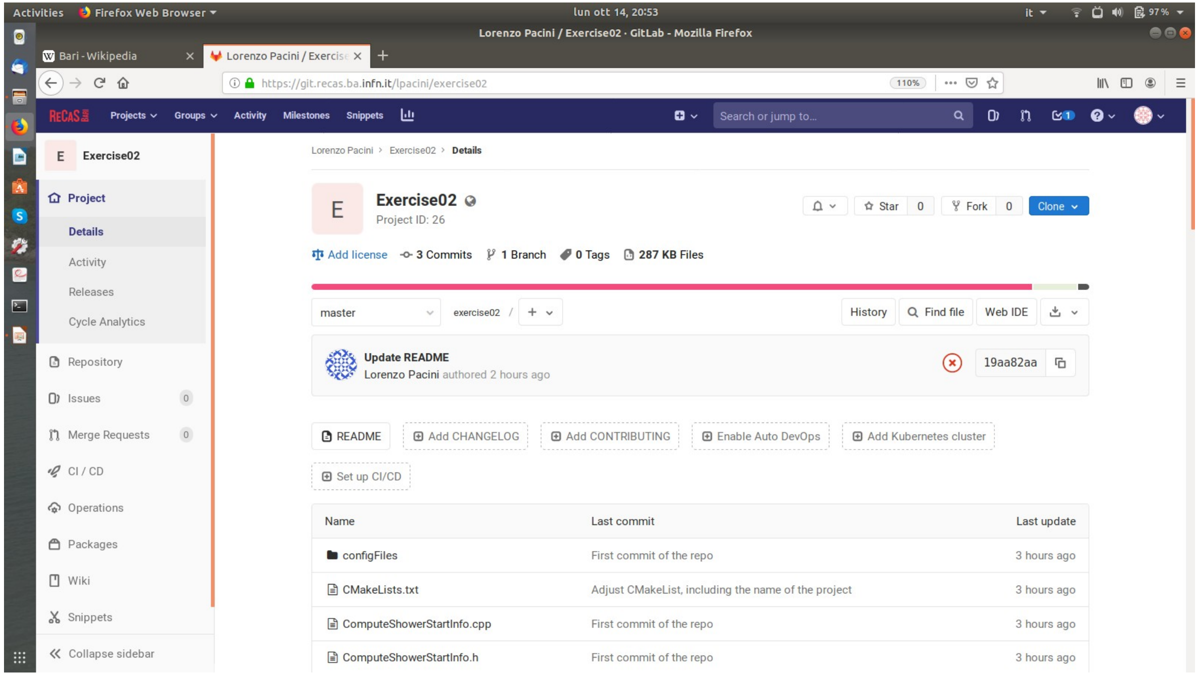


Including an events only if the shower starting layer information is available



Exercise02: download and instruction

- Repo on gitlab recas: https://git.recas.ba.infn.it/lpacini/exercise02
- Clone using the command: git clone git@git.recas.ba.infn.it:lpacini/exercise02.git
- On the web site is present a README file which describes how to compile and run the exercise.



Exercise02

Project ID: 26

Update README

Lorenzo Pacini authored 2 hours ago

19aa82aa

Name	Last commit	Last update
configFiles	First commit of the repo	3 hours ago
CMakeLists.txt	Adjust CMakeList, including the name of the project	3 hours ago
ComputeShowerStartInfo.cpp	First commit of the repo	3 hours ago
ComputeShowerStartInfo.h	First commit of the repo	3 hours ago