Exploring JavaScript and ROOT technologies to create Web-based ATLAS analysis and monitoring tools

We explore the potentialities of current web applications to create online interfaces that allow the visualization, interaction and real physics cut-based analysis and monitoring of processes trough a web browser. The project consists in the initial development of web-based and cloud computing services to allow students and researches to perform fast and very useful cut-based analysis on a browser, reading and using real data and official Monte-Carlo simulations stored in ATLAS computing facilities.
Several tools are considered: ROOT, JavaScript and HTML. Our study case is the current cut-based *H→ZZ→llqq* analysis of the ATLAS experiment. Preliminary but satisfactory results have been obtained online.

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Workflow of an ideal Web-Analysis

The entire cycle starts with the reading of the input files from a local disk in the server or an external repository in one of the ATLAS distributed computer facilities (GRID). The server reads, filters and transforms the files, sending them to the client. She/he can work with them in a browser using custom JavaScript applications, performing online selections and send the results back to the server, that recreate a ROOT file that is delivered to the client as a product of her/his work.

1) Request of input files

The client ask for input files using a menu and/or inserting a string. This request is sent to the server that looks for it in the internal storage or in the GRID using https protocols.

2) Scan of the input files

The ROOT files must be scanned looking just for the variables that are needed in the current web analysis, to perform a transformation to .csv format files that will be sent to the client as the JavaScript application input.

3) Working with the Web-Apps

The creation of the .csv files is done and the analyzer can perform different selection or "cuts" on the variables one by one or in any desired combination to create a physics analysis test and/or optimization without coding and just using bars or mouse selection in the webpage.

4) Converting selection in .csv files

At the end of the online selections ("cuts") those results are recorded in the client and saved as .csv files using an user-button execution. This will send those files to the server for conversion.

5) Sending csv output files

Final results for all the variables into the online analysis are saved in .csv files. Using PHP instructions those files are sent to the server where a temporary folder stores the files for conversion.

6) Transformation to ROOT files

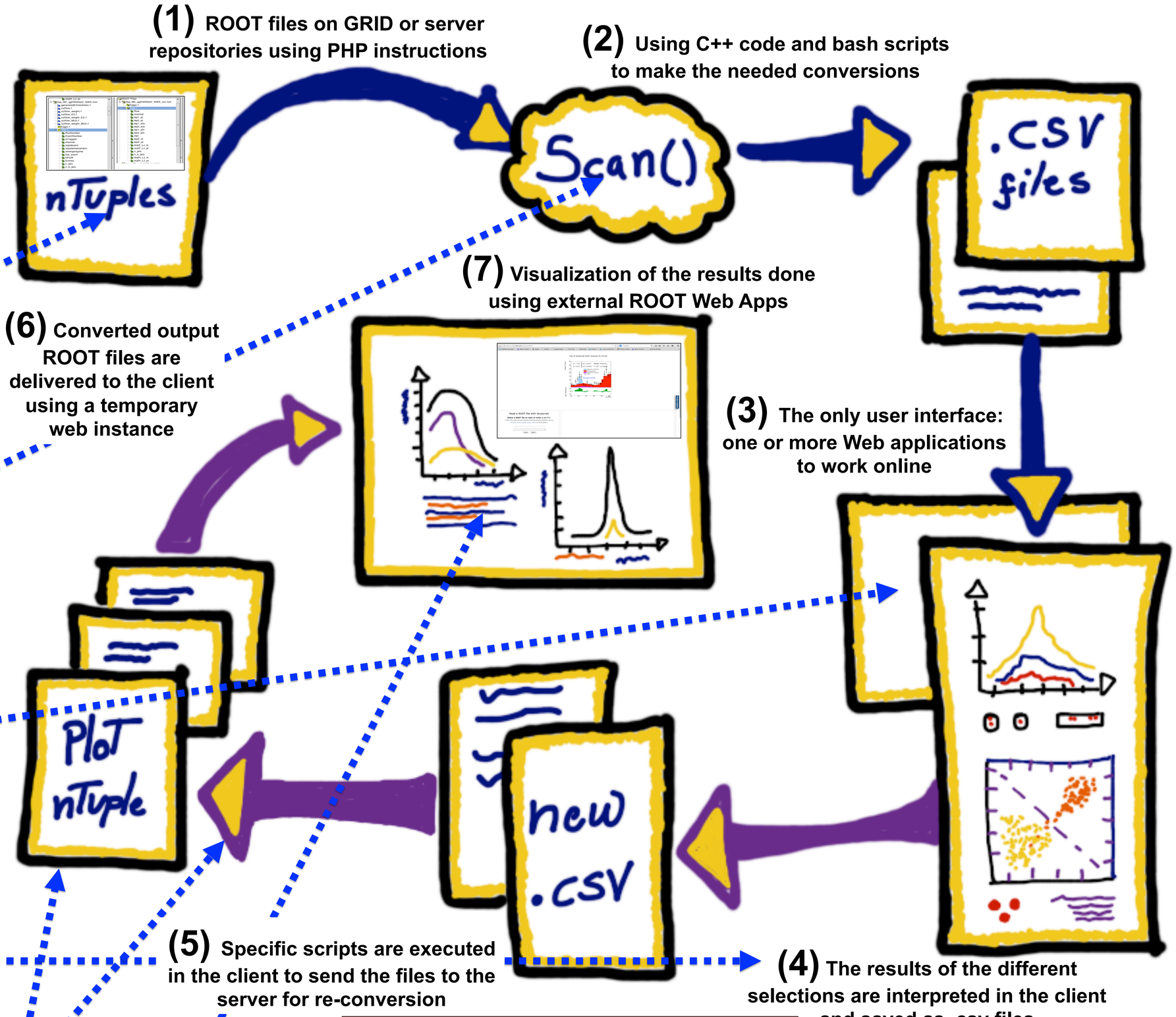
The results in .csv files are transformed to ROOT files using the inverse scripts of the step one of this workflow. A temporary html page is created to allows the user to download her/his final results.

7) Scan of the input files

Visualization of the output ROOT files can be done using https://root.cern.ch/js/ web applications.

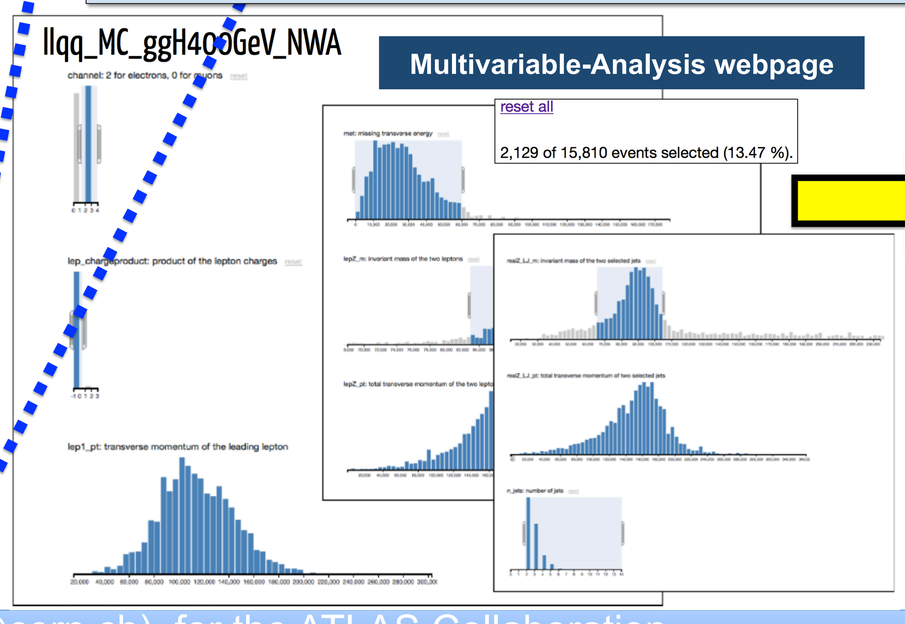
Objectives and Vision

- Create a web-based system that allows physics or performance analysis selection over real ATLAS samples in ROOT format.
- Generate a collaborative tool where students and researches can train how to perform new and current physics analysis.
- Generate fast preliminary results for checks of selection performance, sample production integrity or online monitoring.
- To have a pedagogical tool (with simple examples) for a more general public interested in High Energy Physics.
- Take advantages of the new Web applications and language + internet performance to present status or results visualizations.



Current Results

Several tools and examples have been tested and preliminary results show that is possible to handle a simple cut-base analysis in a browser using web applications. The ALTAS *H→ZZ→llqq* analysis was used to test the performance and the obtained numbers after each of the cuts are rather close, this is quite good for an online pre-analysis.



Cut	Official cutflow	Web-based pre-analysis	Difference (%)
OppositeSign	8056	8056	0.00
TwoJets	7282	7282	0.00
DileptonMass	6089	6088	0.02
MET	5763	5758	0.09
NumTagJets0,	4263	4261	0.05
NumTagJets1,	973	972	0.10
NumTagJets2	513	511	0.39
PtLeadingJet0,	4217	4197	0.48
PtLeadingJet1,	957	957	0.00
PtLeadingJet2	512	506	1.18
DiJetMass0,	2182	2160	1.01
DiJetMass1,	438	439	0.29
DiJetMass2	387	383	1.04

Table showing the number of events remaining after applying the cuts from the official analysis cutflow and in the Multivariable-Analysis webpage for MC signal sample *H→ZZ→llqq* for a 400 GeV Higgs mass.

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Reference: **CERN-STUDENTS-Note-2014-122**
https://cds.cern.ch/record/1751940