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Centro Nazionale di Ricerca in HPC,  
Big Data and Quantum Computing



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Big Data and Quantum Computing

## Updates on Analysis Facility @ Naples

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Biweekly Meeting Spoke2 - WP2.5 – 27/03/2024

# Documentation efforts on GitHub



The screenshot shows a web page for registering on the INFN Cloud interface. The page features the INFN logo at the top center and the title "Register at iam-demo". Below the title, there is a brief instruction: "This is the iam-demo registration page. To proceed with the registration please fill in your personal information below." The registration form includes several input fields: "Given name" (with placeholder "Your first name"), "Family name" (with placeholder "Your family name"), "Email" (with placeholder "Your email address"), and "Username" (with placeholder "Choose a username"). There is also a "Notes" section with a text area and a placeholder text: "Providing a clear explanation on the motivation behind this request will likely speed up the approval process". At the bottom of the form, there are two buttons: "Register" and "Reset Form". Below the form, there is a paragraph of text explaining the account creation process: "Once the account creation process is complete, you will receive an email containing a confirmation URL within a few moments. Upon clicking the URL, you will need to wait for the account activation by the admins. You will receive further communication via email (this may take longer than the initial email), confirming your username and providing a URL for setting the password. Upon accessing the new page, you will need to join the 'highrate' group."

- We have developed a detailed step-by-step guide to enable users, who have access to the national Cloud, to configure their own infrastructure using the INFN Cloud interface.

# Documentation efforts on GitHub

- To ensure ease of editing and accessibility, the documentation was written using the markup language: "Markdown"
- We integrated the .md files, provided by F. Gravili, with more detailed instructions on the steps to follow, including the addition of explanatory images

The screenshot displays a GitHub repository page for ICSC. The left sidebar shows navigation options: Infrastructure Details, Resource Access (selected), Examples, and Troubleshooting and Notes. The main content area shows a 'Resource Access' section with a search bar and a list of infrastructure details. Below this, there is a 'Server Options' section with a dropdown menu for selecting a server image and a 'Start' button. The text below the screenshot reads: 'Once joined to the group (which should be visible in the "Groups" section), through the URL provided, <https://hub.192.135.24.49.myip.cloud.infn.it> you will gain access to the resources of the INFN cloud. Specifically, you can choose from the dropdown menu:

- The Operating System image to be used
  - Alma8-0.0.34 + python3.11 + Dask
  - Alma8-0.0.40 + python3.11 + Dask + ROOT 6.30
- The required number of cores
  - 1, 2, 4 o 8
- The required memory capacity
  - 2, 4, 8, 16

Below the list, there is a 'Server Options' section with a dropdown menu for selecting a server image and a 'Start' button. The text below the screenshot reads: 'Wait for the server startup and access JupyterHub.'

The screenshot shows a JupyterHub interface with a dashboard containing various application icons such as Notebook, Console, and others. The interface is clean and modern, with a dark theme.



## Documentation efforts on GitHub

- Due to complications with fork/push operations for “.md files”, the documentation was initially developed locally
- The next step involves uploading the documentation to the wiki of our official repository on GitHub, making it easily accessible and editable for everyone.

**Account Requests**

If the user doesn't already have an account, please use the same authentication page available at the following link: <https://iam-demo.cloud.cnaf.infn.it/>

Welcome to **iam-demo**

Sign in with your iam-demo credentials:

Or sign in with:

Not a member?

By clicking on "Sign in with OAuth 2.0", you will be redirected to the login [page](#)

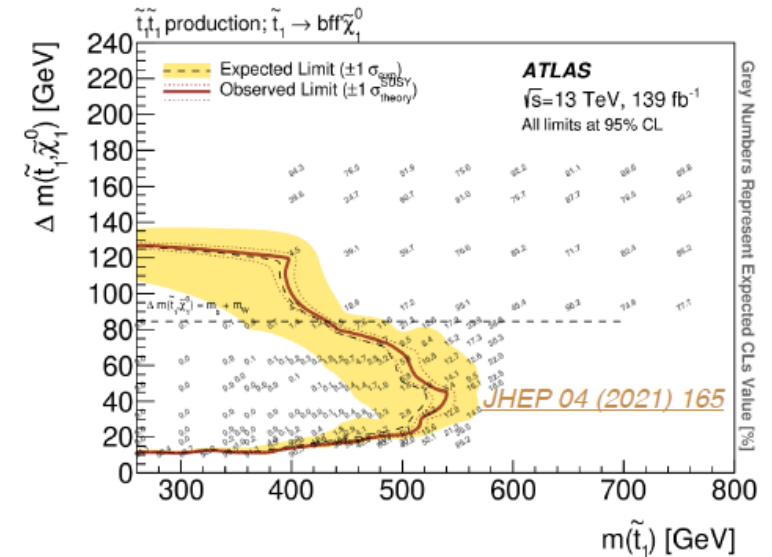
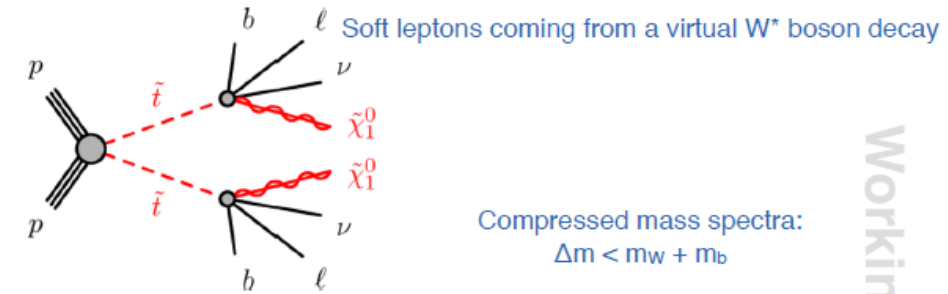
For first time access:

1. Apply for a new account by clicking on the green "Apply for an account" button (see fig.1);
2. The page will redirect you to a form to be filled in (fig.2). You can use "spoke2 tests" as motivation;
3. Click on "Register" and wait for the confirmation email to the address indicated in the form and click on the URL in the email to confirm;
4. After the first confirmation, the account activation process will start. At the end of this process, you'll receive a second email to confirm the username and to set the password;
5. When you access the new page, you will have to join the "highrate" group.

# ATLAS use-case I

- Three different analysis in the *Run 2 paper*, already published, according to mass splitting between *stop* ( $\tilde{t}_1$ ) and *neutralino* ( $\tilde{\chi}_1^0$ ), allowing different decay modes:
  - 2 body  $\rightarrow \Delta m > m_t$
  - 3 body  $\rightarrow m_W + m_b < \Delta m < m_t$
  - 4 body, the one picked up  $\rightarrow \Delta m < m_W + m_b$
- Common final state signature: 2 OS leptons (electrons/muons), jets and missing transverse energy
- Cut & Count based approach
- Final, i.e. starting from flat ntuples, event selection done with *ROOT RDataFrame* and 3 helper classes, 100% python based:
  - List of cuts, in dictionaries
  - I/O, mainly to define and store output structures/yields
- Main workflow, to extract nominal yields and systematic variations, starting from single *TTree(s)* and/or *TChain(s)*

## SUPerSYmmetry: Beyond Standard Model theory

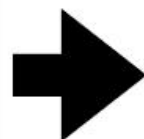
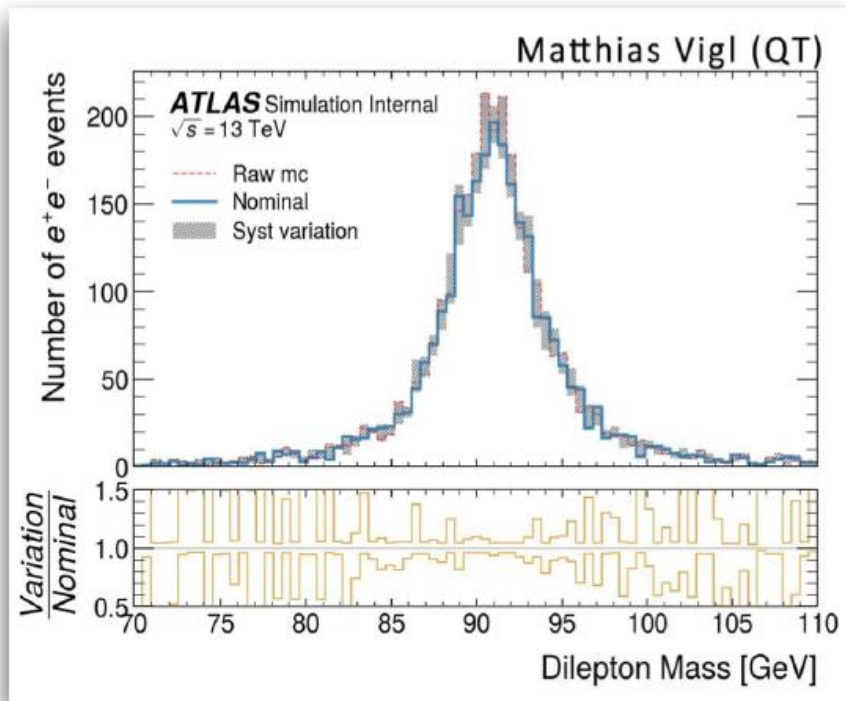


Preliminary results, using simulations and including systematic variations: evaluating execution time halved using the local Client and tests ongoing for the distributed client

Working with INFN Lecce

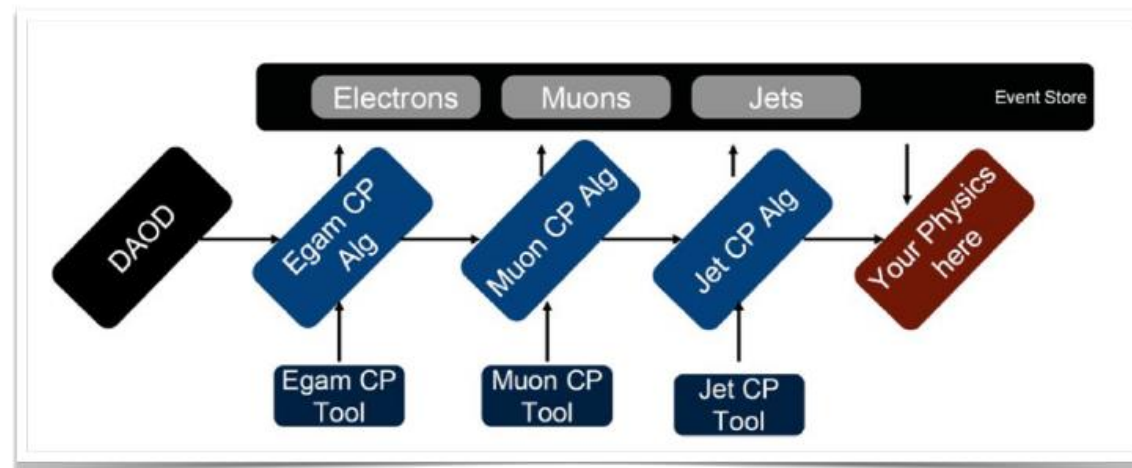
# ATLAS use-case II

- Effort just started, based on other colleagues work
- Goal: evaluate computing performance on INFN clusters



Example to implement and improve: Zee demonstrator

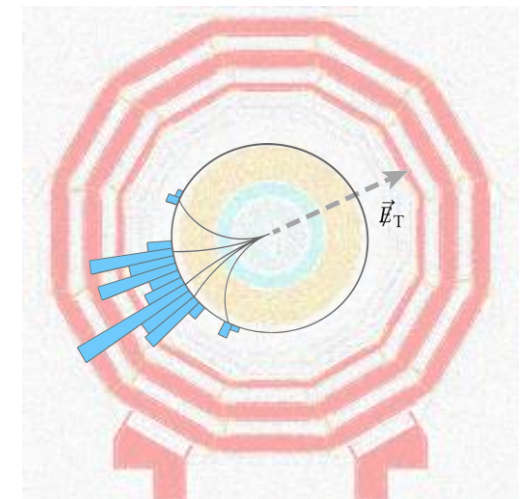
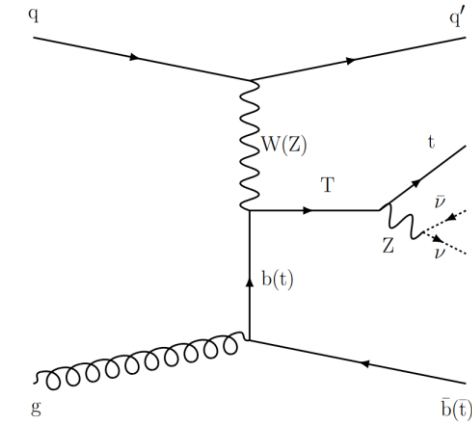
## Columnar analysis implementation in CP tools





## CMS use-case

- Early Run3 analysis (2022-2023 data taking)
- BSM searches : Vector-Like Quark T in  $T \rightarrow tZ$  channel
- Final state: hadronic Top quark and Z ( $\nu\nu$ )
- Development of the already published full run2 analysis [JHEP05\(2022\)093](#), with the idea to extend the results interpretation to more models predicting the same final state
- Dark Matter production in association with a Top quark



## CMS use-case : goals and next steps

- Implement the analysis on the facility to evaluate the performance on INFN clusters
- Right now the code include the selection and the calculation for the final fit variables, we'd like to move part of the process from the preprocessing step to the one on the facility, among which ML prediction process and calculation of systematic variation (through [correctionlib](#), optimized also for RDataFrame)