O2 AT – 08/10/2023

From Hyperloop to the fit of invariant mass spectra

Luca Micheletti (CERN)

ALICE

The Hyperloop train system

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08/10/2023
O2AT

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- Hyperloop is the train system for Run3, replacing Run2 **LEGO train**

> Hyperloop page: https://alimonitor.cern.ch/hyperloop/
>
> Documentation page: https://aliceo2group.github.io/analysis-framework/docs/hyperloop/
>
> Mattermost channel: https://mattermost.web.cern.ch/alice/channels/o2-hyperloop-operation

- Hypeloop:
  - **is fully integrated with O²** (configurables, default settings taken from latest versions)
  - allows to use **Run3 data** and **Run2 converted datasets**
  - allows to create **derived datasets** and analyze them
  - allows to recover configurations, datasets, software versions ⇒ **reproducibility!**
  - produces all the information to **reproduce the train locally**

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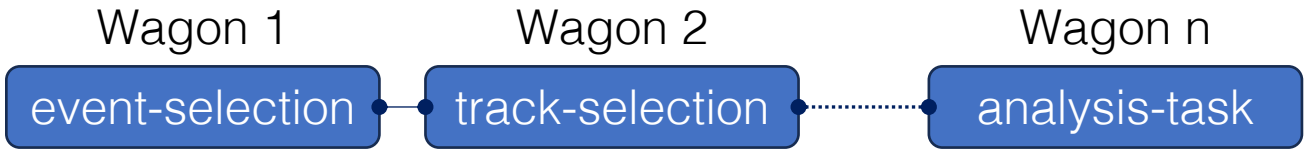

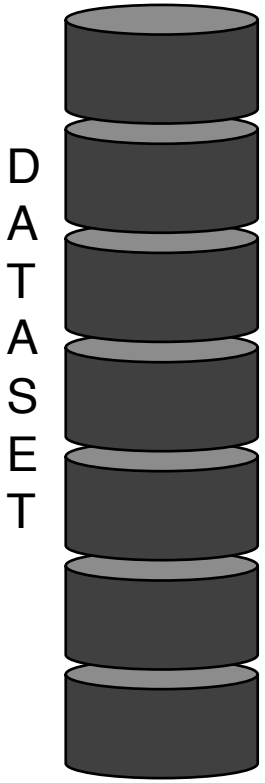

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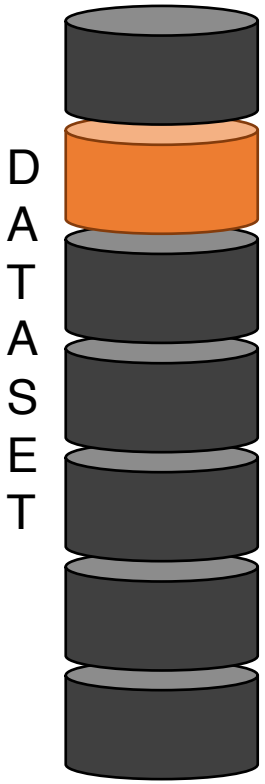

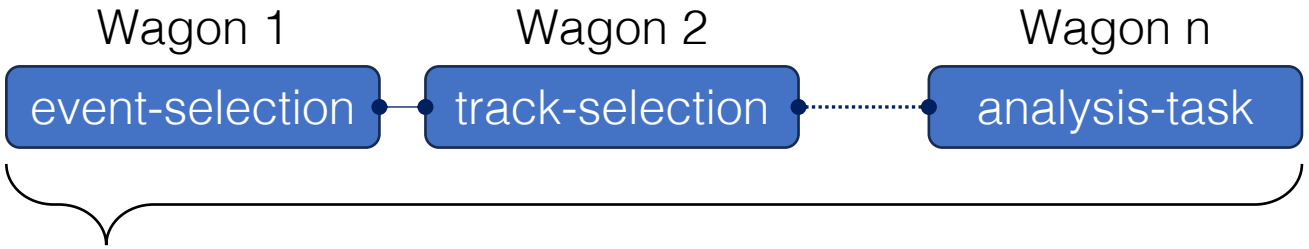

The analysis is tested on a **small fraction** of the dataset

! Time limit: 180 s

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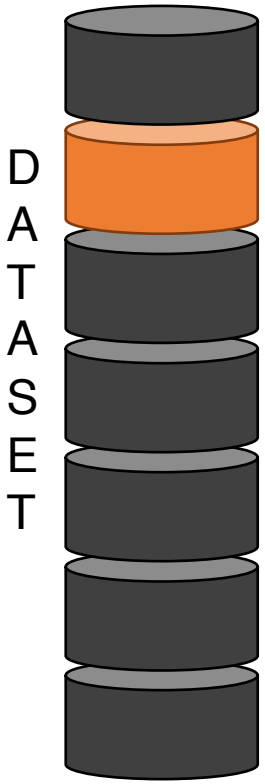

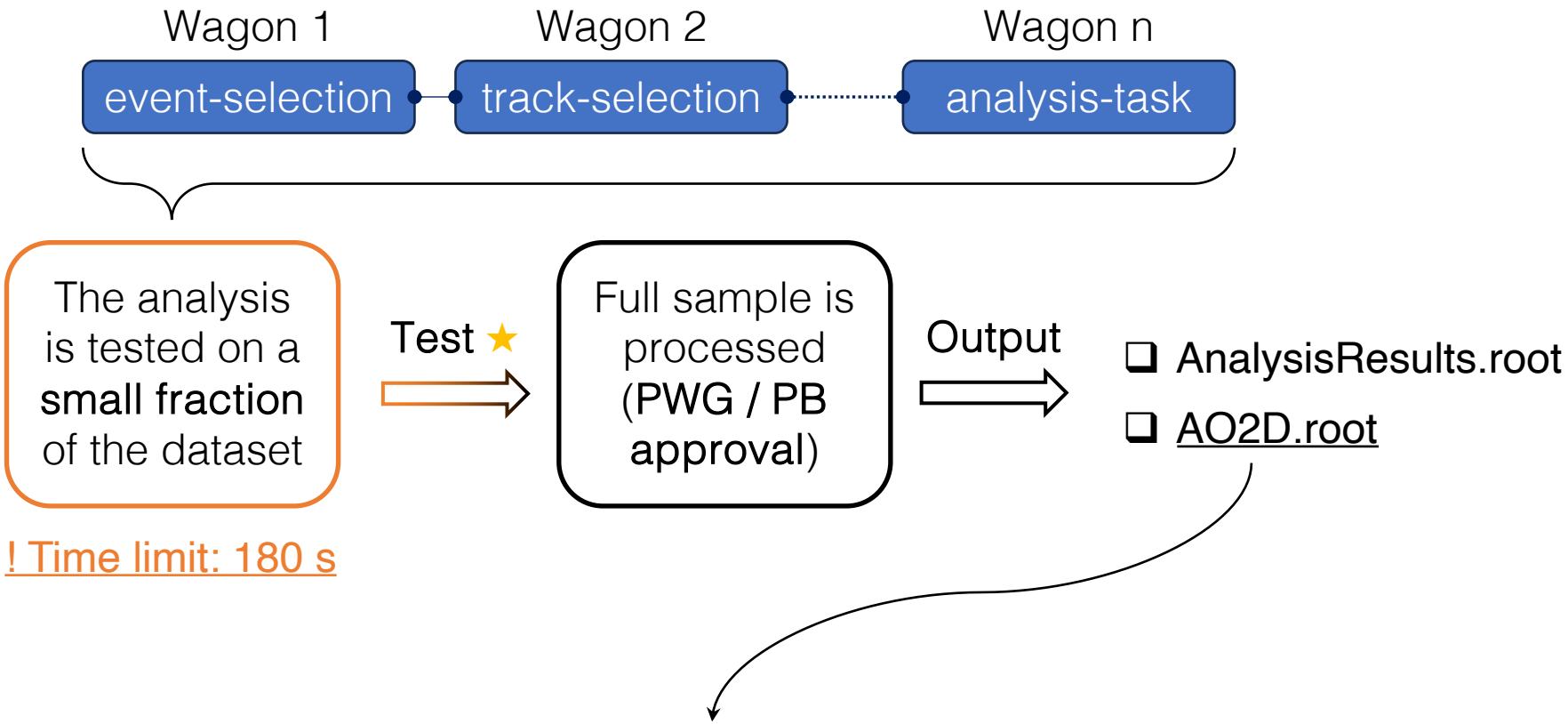

If the output is an **AO2D.root** it can be processed on Hyperloop after requiring the creation of the dataset to the train operators via the **Mattermost** channel

Analysis creation

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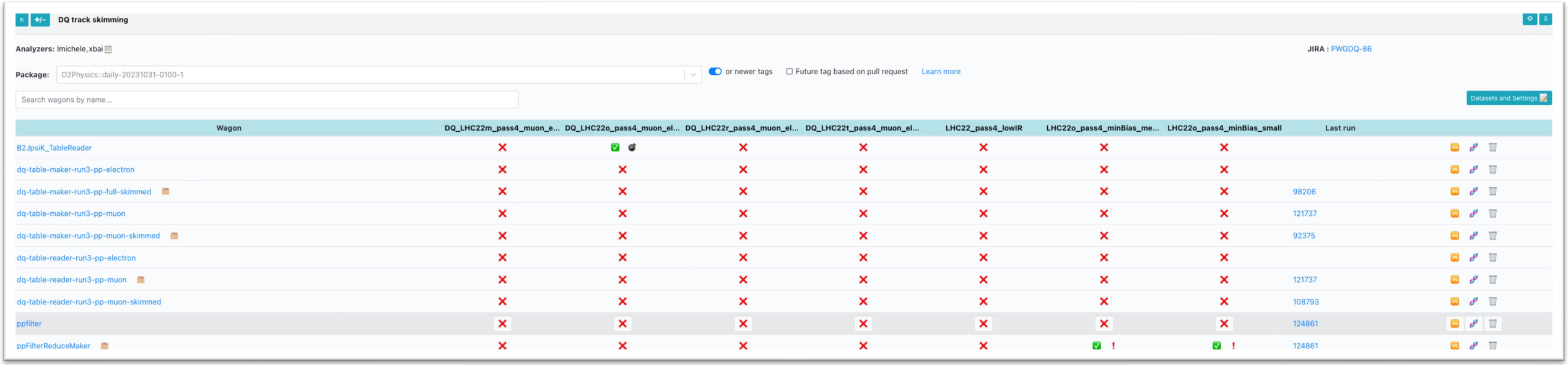
Hyperloop analysis window



Wagon	DQ_LHC22m_pass4_muon_e...	DQ_LHC22o_pass4_muon_el...	DQ_LHC22r_pass4_muon_el...	DQ_LHC22t_pass4_muon_el...	LHC22_pass4_lowIR	LHC22o_pass4_minBias_me...	LHC22o_pass4_minBias_small	Last run
B2JpsiK_TableReader	✗	✓	✗	✗	✗	✗	✗	
dq-table-maker-run3-pp-electron	✗	✗	✗	✗	✗	✗	✗	
dq-table-maker-run3-pp-full-skimmed	✗	✗	✗	✗	✗	✗	✗	98206
dq-table-maker-run3-pp-muon	✗	✗	✗	✗	✗	✗	✗	121737
dq-table-maker-run3-pp-muon-skimmed	✗	✗	✗	✗	✗	✗	✗	92375
dq-table-reader-run3-pp-electron	✗	✗	✗	✗	✗	✗	✗	
dq-table-reader-run3-pp-muon	✗	✗	✗	✗	✗	✗	✗	121737
dq-table-reader-run3-pp-muon-skimmed	✗	✗	✗	✗	✗	✗	✗	108793
ppfilter	✗	✗	✗	✗	✗	✗	✗	124861
ppFilterReduceMaker	✗	✗	✗	✗	✗	✓ !	✓ !	124861

Analysis creation

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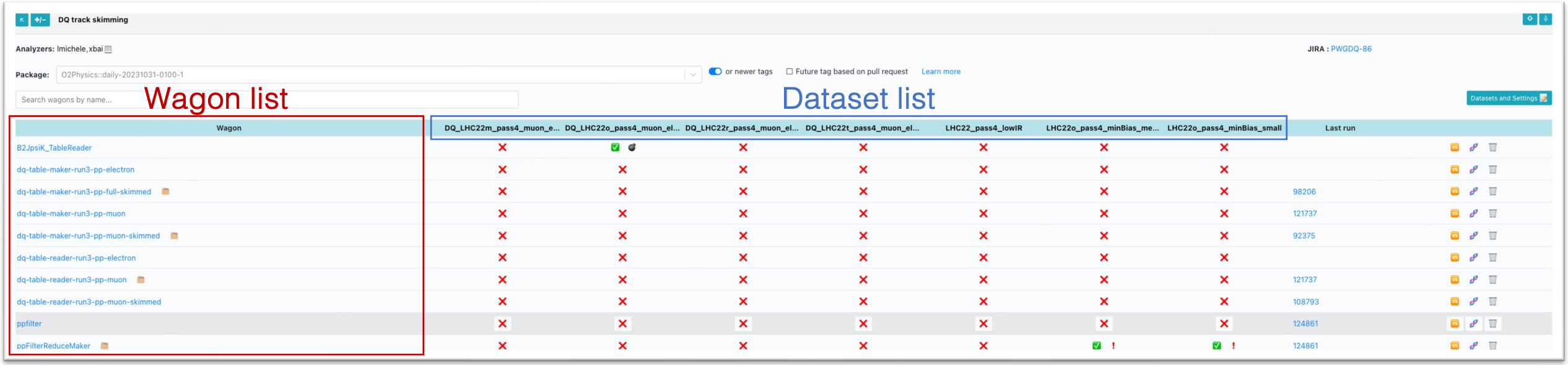
Hyperloop analysis window



Analysis creation

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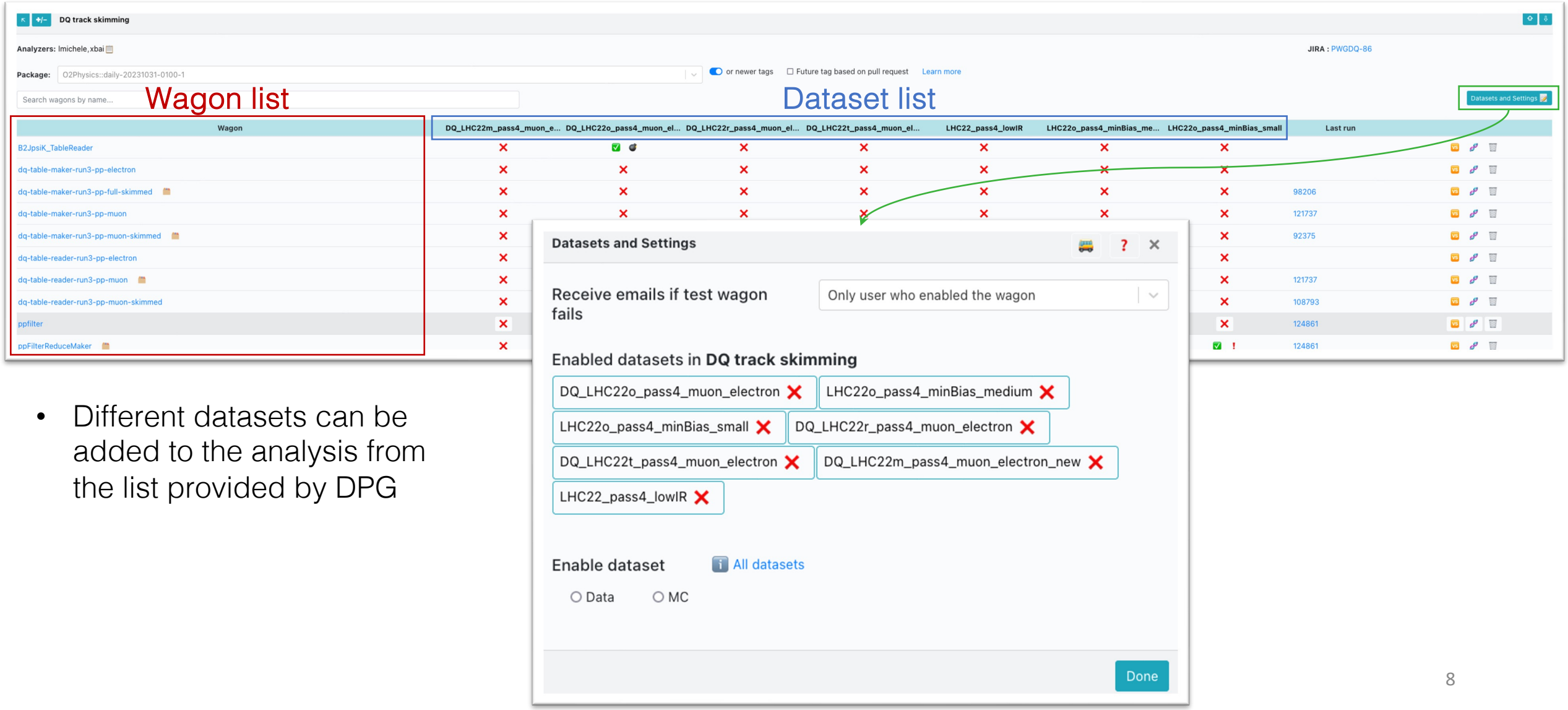
Hyperloop analysis window



- Different datasets can be added to the analysis from the list provided by DPG

Analysis creation

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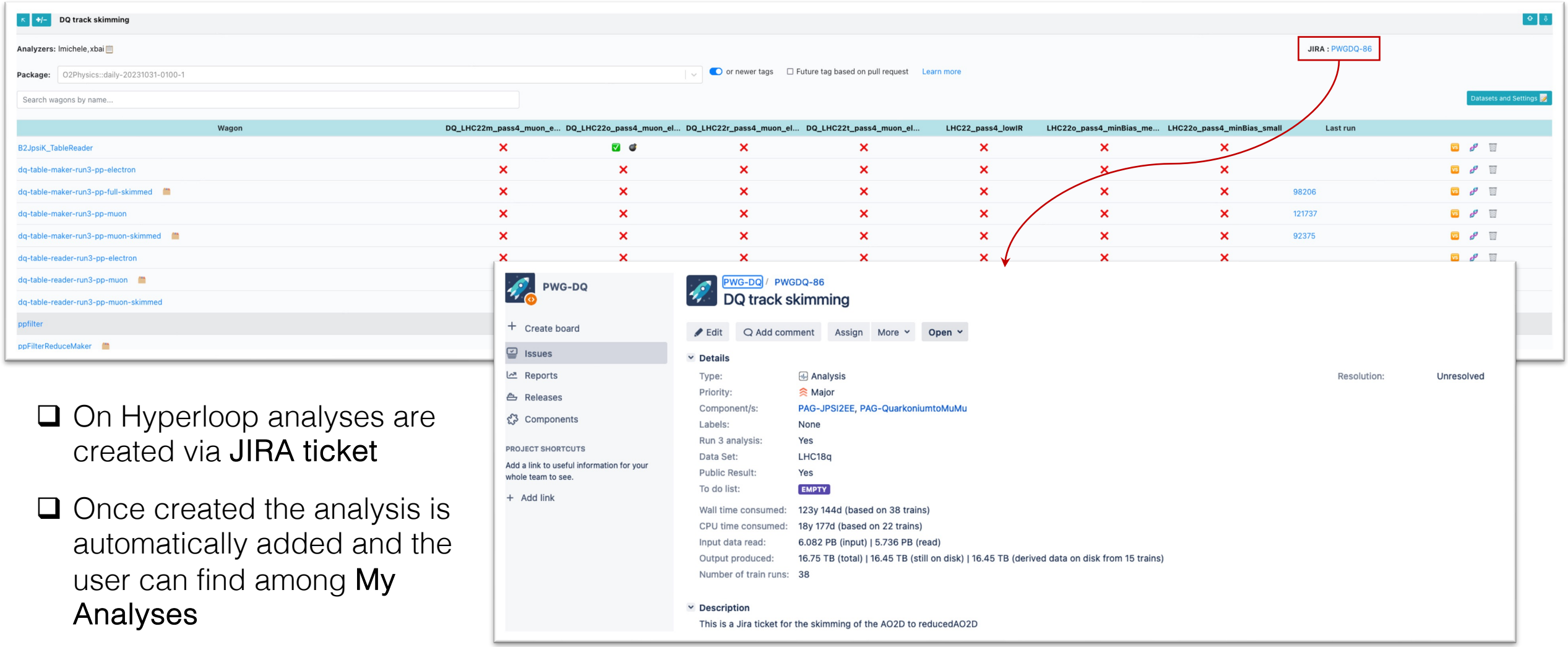
Hyperloop analysis window



- On Hyperloop analyses are created via **JIRA ticket**
- Once created the analysis is automatically added and the user can find among **My Analyses**

Debug

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❑ Hyperloop allows to test locally the analysis in case it fails (💣)

Wagon	PbPb_2023_cpass0...
dq-table-maker-run3-PbPb-muon	❌
dq-table-maker-run3-pp-muon	❌
dq-table-reader-run3-PbPb-muon	✅ 💣
dq-table-reader-run3-PbPb-muon-skimmed	❌
dq-table-reader-run3-pp-muon	❌

Debug

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ALICE

❑ Hyperloop allows to test locally the analysis in case it fails (💣)

Wagon	PbPb_2023_cpass0...
dq-table-maker-run3-PbPb-muon	✗
dq-table-maker-run3-pp-muon	✗
dq-table-reader-run3-PbPb-muon	✅ 💣
dq-table-reader-run3-PbPb-muon-skimmed	✗
dq-table-reader-run3-pp-muon	✗

Test 131222 🚌

General | Test

Package tag	O2Physics::daily-20231031-0100-1
Dataset	PbPb_2023_cpass0_QC
Enabled by	lmichele
Test status	Failed 💣 (output)
Start Time	01 November 2023 at 10:28:29 CET
End Time	01 November 2023 at 10:29:08 CET

Debug

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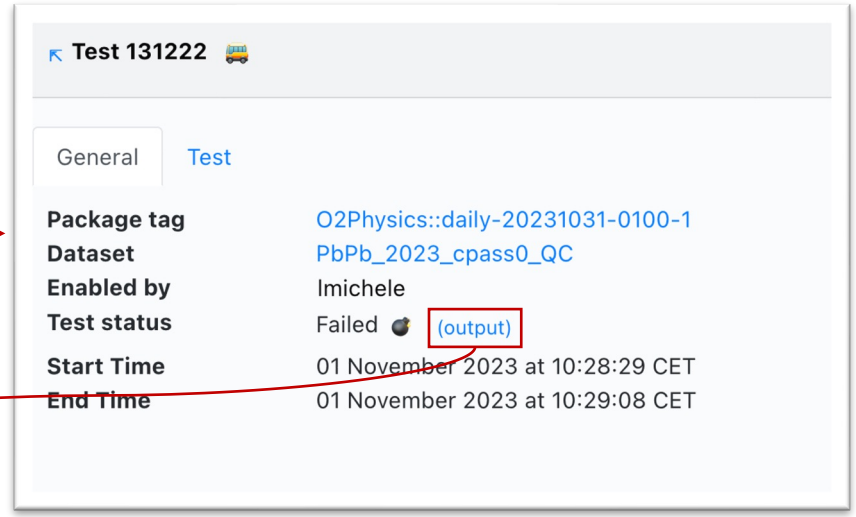
❑ Hyperloop allows to test locally the analysis in case it fails (💣)

Wagon	PbPb_2023_cpass0...
dq-table-maker-run3-PbPb-muon	✗
dq-table-maker-run3-pp-muon	✗
dq-table-reader-run3-PbPb-muon	✅ 💣
dq-table-reader-run3-PbPb-muon-skimmed	✗
dq-table-reader-run3-pp-muon	✗



Filename

- configuration.json
- download.log
- dpl-config.json
- env.sh
- full_config.json
- input_data.txt
- performanceMetrics.json
- profile.linux-perf.txt
- status.json
- stderr.log
- stdout.log
- wn.xml

❑ The output of the test contains all the information to perform locally the same analysis

❑ Download all the files locally (or on LXPLUS)

- **configuration.json:** has the setting of all the analysis wagons
- **input_data.txt:** has file list processed
- **stdout.log:** has all the information of the processing (crucial to reproduce)

Debug

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08/10/2023
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stdout.log

```
PACKAGE = VO_ALICE@O2Physics::daily-20231017-0200-1
Acquiring lock and downloading input files from /alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050 at Wed Nov  1 09:37:59 CET 2023
Acquired lock and started downloading at Wed Nov  1 09:37:59 CET 2023
Finished downloading at Wed Nov  1 09:38:05 CET 2023

This job will run over the following files:
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/633/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/637/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/082/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/328/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/259/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/636/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/617/AO2D.root
/home/alitrain/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/430/AO2D.root

You can directly access these files with the following URLs (while they are cached):
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/633/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/637/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/082/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/328/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/259/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/636/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/617/AO2D.root
http://alimonitor.cern.ch/train-workdir/testdata/LFN/alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/430/AO2D.root

The corresponding AliEn paths are:
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/633/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/637/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/082/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/328/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/259/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/636/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/617/AO2D.root
alien:///alice/cern.ch/user/a/alihyperloop/jobs/0019/hy_191050/AOD/430/AO2D.root

O2 job script starts at Wed Nov  1 09:38:05 CET 2023
O2 is taken from: /cvmfs/alice.cern.ch/el7-x86_64/Packages/O2/daily-20231017-0200-1
O2Physics is taken from: /cvmfs/alice.cern.ch/el7-x86_64/Packages/O2Physics/daily-20231017-0200-1
Running on 1 cores and configuring with shared memory 7500000000, rate limit 209715200, readers 1

Generating O2 command. Adding the following options:
Input files: --aod-file @input_data.txt
Reader/Spawner configuration: --readers 1
Memory options: --aod-memory-rate-limit 209715200 --shm-segment-size 7500000000
Time limit: --time-limit 180
Session: --session 131190
Monitoring: --resources-monitoring 2 --resources-monitoring-dump-interval 600
Benchmarking prefix: perf record -F 99 -g --call-graph dwarf --user-callchains

Global options (given once): --aod-file @input_data.txt   --readers 1 --aod-memory-rate-limit 209715200 --shm-segment-size 7500000000 --time-limit 180 --resources-monitoring 2 --resources-monitoring-dump-interval 600
Workflow options (given for each workflow): -b --configuration json://configuration.json  --session 131190

Adding o2-analysis-dq-table-reader

The following O2 command will be executed:
perf record -F 99 -g --call-graph dwarf --user-callchains o2-analysis-dq-table-reader -b --configuration json://configuration.json --session 131190 --aod-file @input_data.txt --readers 1 --aod-memory-rate-limit 209715200 --shm-segment-size 7500000000 --time-limit 180 --resources-monitoring 2 --resources-monitoring-dump-interval 600

However, if for local debugging you want to run the same workflow, you can achieve this with the following reduced command line:
o2-analysis-dq-table-reader -b --configuration json://configuration.json --aod-file @input_data.txt
```

On LXPLUS:

1. Copy the list of files in **input_data.txt**
2. Download **configuration.json**
3. Load O2Physics and create a grid token
4. Run the command reported in the log

DQ Fitter: introduction

Luca Micheletti
28/04/2023
O2 tutorial

ALICE

- github repository: git clone https://github.com/lucamicheletti93/dq_fitter.git
- PYTHON-based code to perform fits with ROOFIT

➢ Main advantages:
- the fit configuration is defined into a **.json** file ⟹ easy to cross check with other analyzers
- the user can add extra pdfs directly into the directory /fit_library (automatically compiled at run time)
- the implementation of extra pdfs is **templetized**
- all the fit outputs are saved into a **.root** file so that they can be easily used

❑ Tutorial:
1. on Lxplus: /cvmfs/alice.cern.ch/bin/alienv enter VO_ALICE@O2Physics::daily-20231027-0200-1
2. go in tutorial/
3. generate toy sample: python tutorial.py config_tutorial_fit--gen_tutorial
4. run the fit on the toy sample: python tutorial.py config_tutorial_fit.json--do_fit

DQ Fitter: configuration

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28/04/2023
O2 tutorial

```
{
  "input": {
    "input_file_name": "tutorial.root",
    "input_name": ["histMass"],
    "pdf_dictionary": {
      "pdf": ["Gaus", "Gaus", "Exp", "SUM"],
      "pdfName": ["Jpsi", "Psi2s", "Bkg", "SUM"],
      "pdfNameForLegend": ["J/#psi", "#psi(2S)", "Background", "Fit"],
      "pdfColor": [861, 417, 1],
      "pdfStyle": [1, 1, 2],
      "parVal": [
        [3.096, 0.6e-01],
        [3.096, 0.6e-01],
        [1, 1],
        [1000, 100, 100000]
      ],
      "parLimMin": [
        [2.9, 7.0e-02],
        [2.9, 7.0e-02],
        [-10, 0],
        [0, 0, 0]
      ],
      "parLimMax": [
        [3.5, 1.9e-01],
        [3.9, 1.9e-01],
        [10, 100],
        [5000000, 5000000, 50000000]
      ],
      "parName": [
        ["mean_Jpsi", "width_Jpsi"],
        ["sum::mean_Psi2s(mean_Jpsi,0.584)", "prod::width_Psi2s(width_Jpsi,1.05)"],
        ["aa", "bb"],
        ["sig_Jpsi", "sig_Psi2s", "bkg"]
      ],
```

- Input file and input histogram / tree

- Array of pdfs to be used in the fit
- The last element (SUM) indicates the operation among the pdfs

- The parameters of the pdfs have to be set providing the range
- The order is the same as the pdf list
- To set a parameter as constant it is sufficient to use the same value for parVal, parLimMin, parLimMax

- parName embed the constraints:

$$\mu^{FIT}_{\psi(2S)} = \mu^{FIT}_{J/\psi} + \Delta m_{PDG}$$

$$\sigma^{FIT}_{\psi(2S)} = \sigma^{FIT}_{J/\psi} \cdot \left(\frac{\sigma_{\psi(2S)}}{\sigma_{J/\psi}}\right)_{MC}$$

DQ Fitter: output

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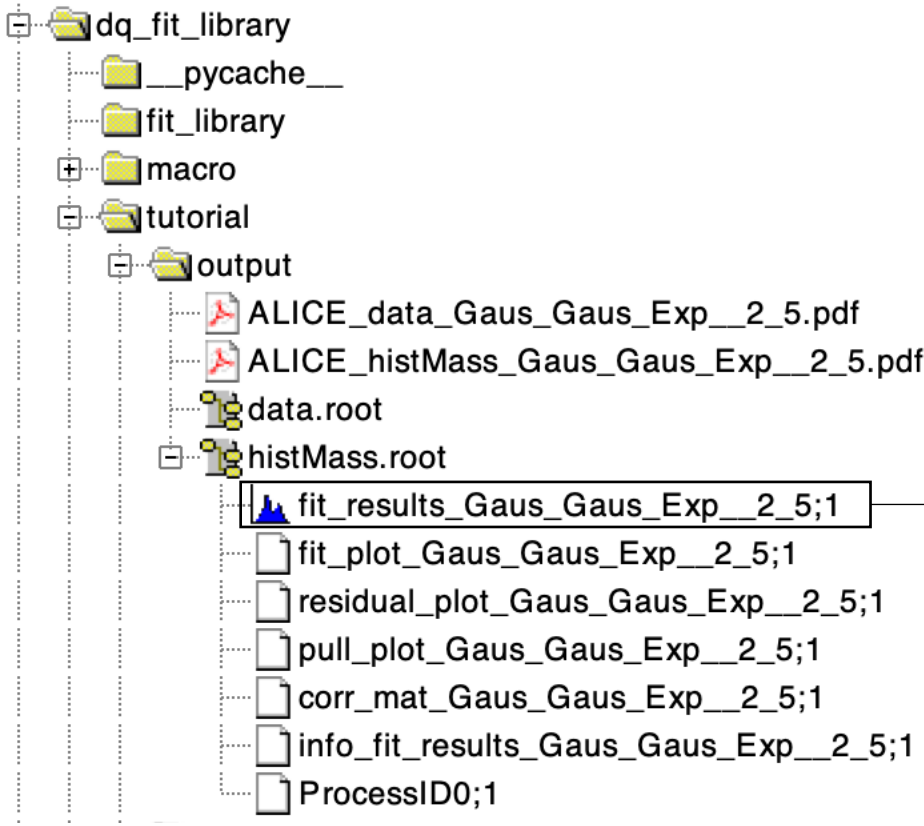
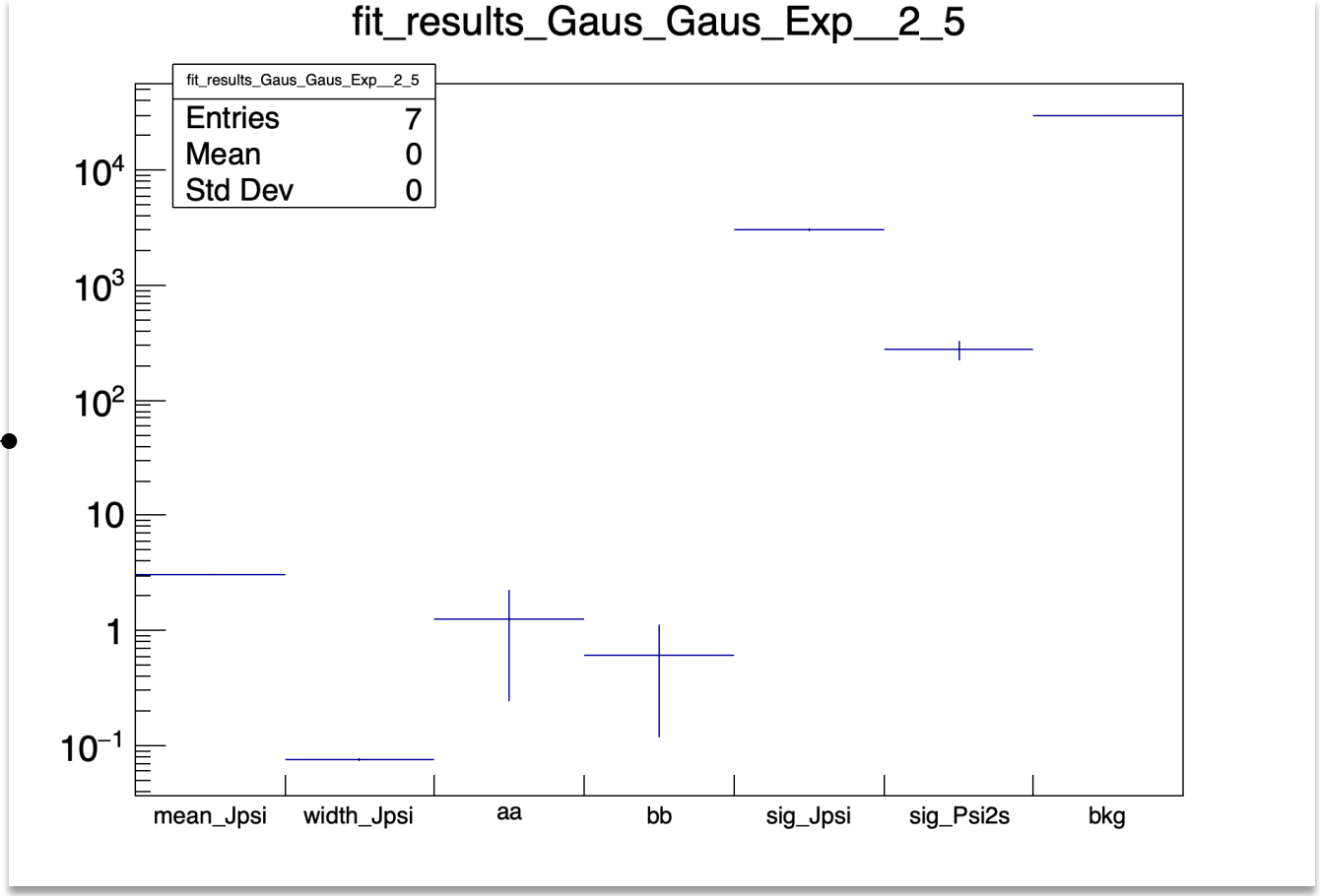
28/04/2023
O2 tutorial





DQ Fitter: output

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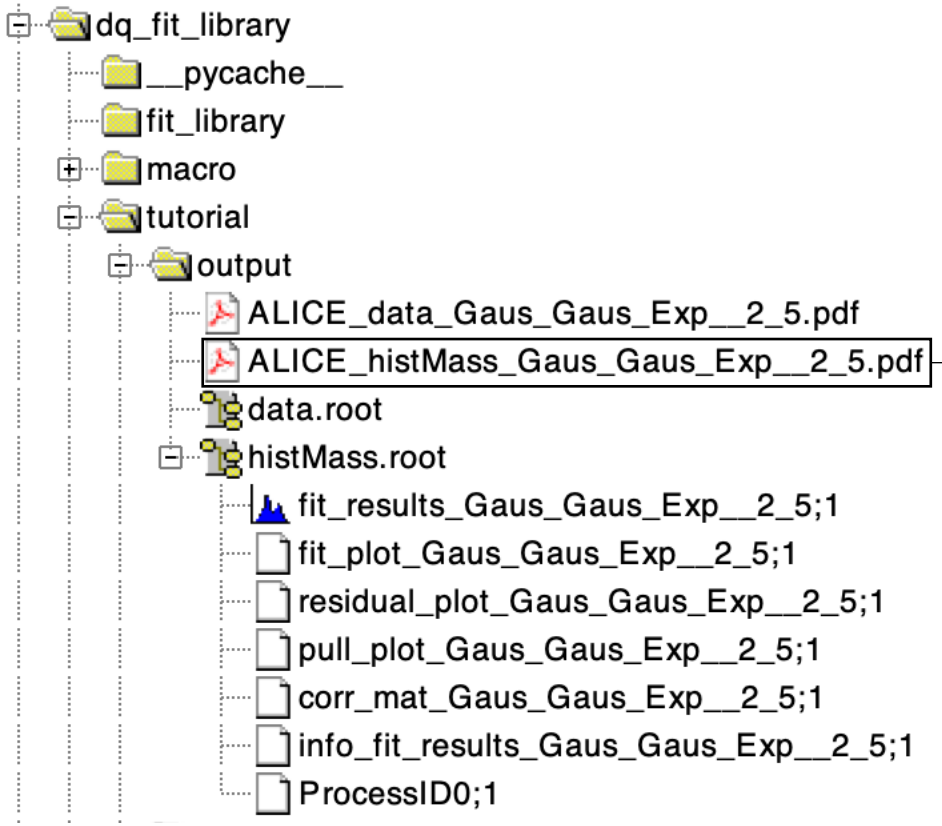

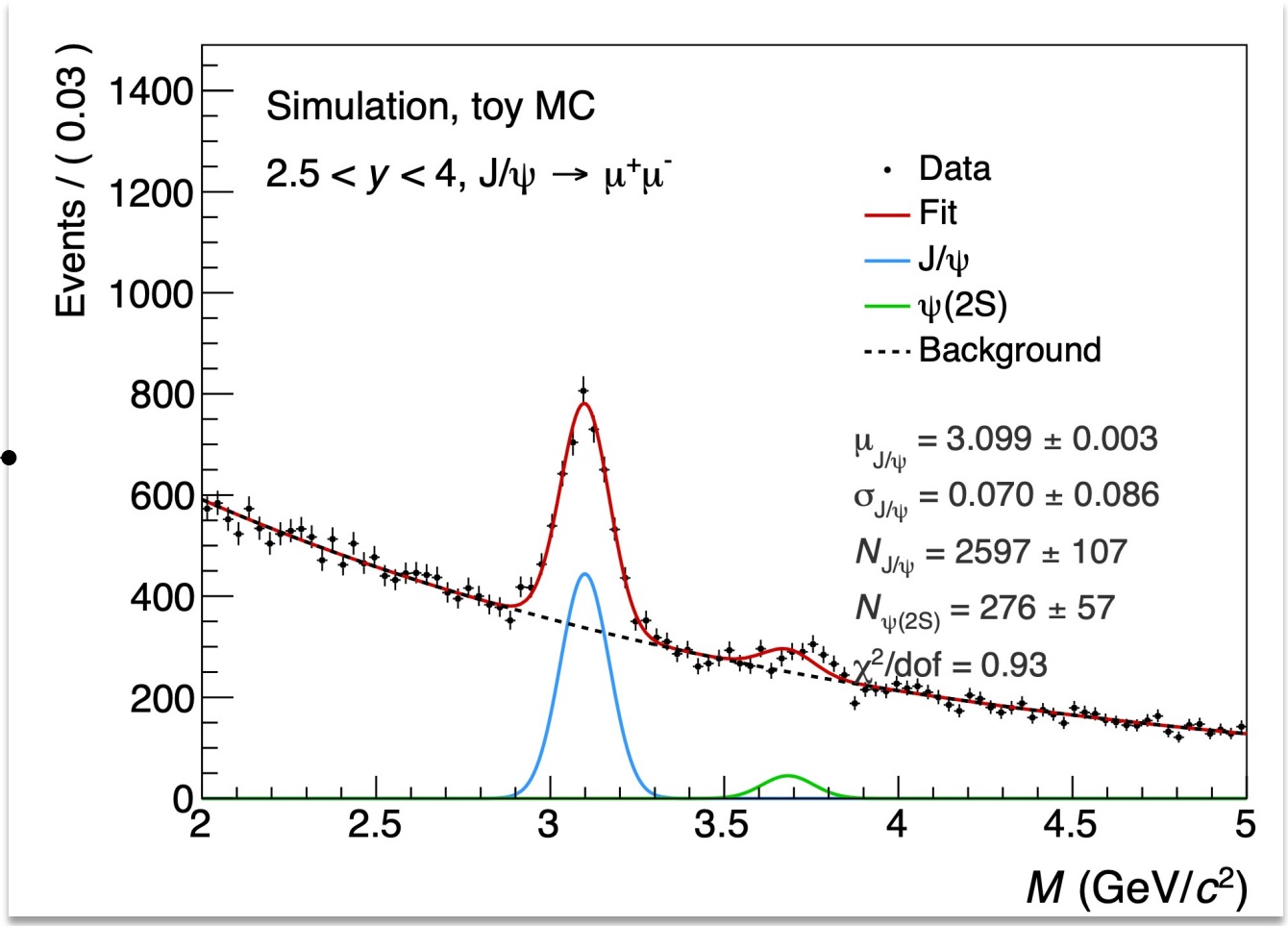

DQ Fitter: output

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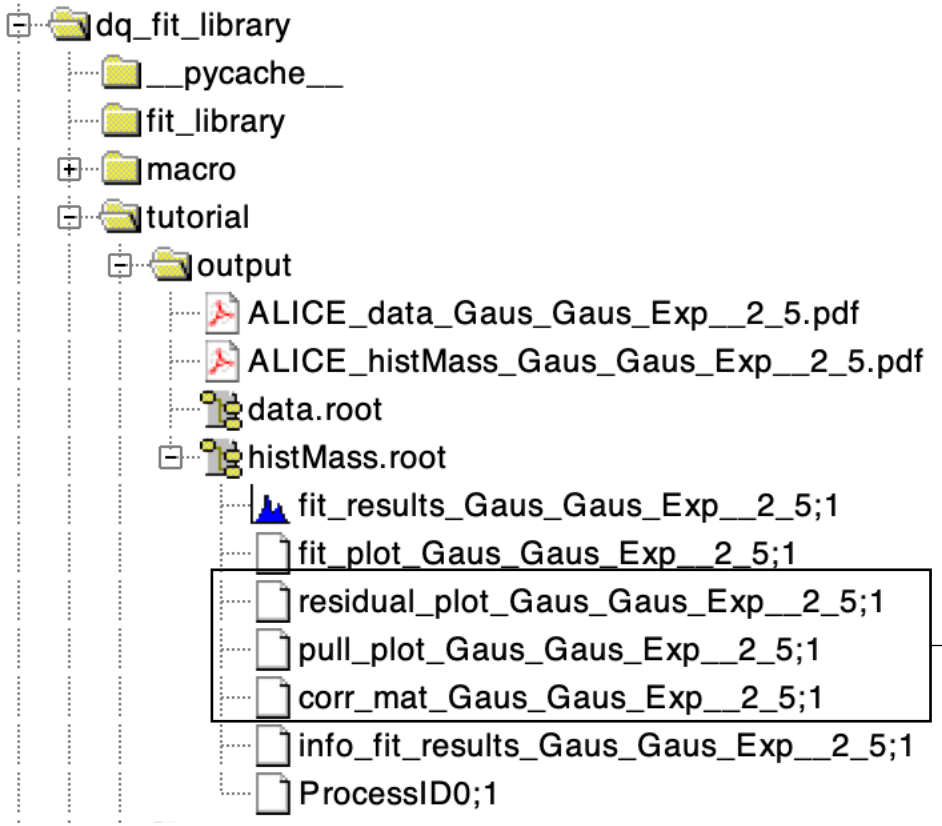

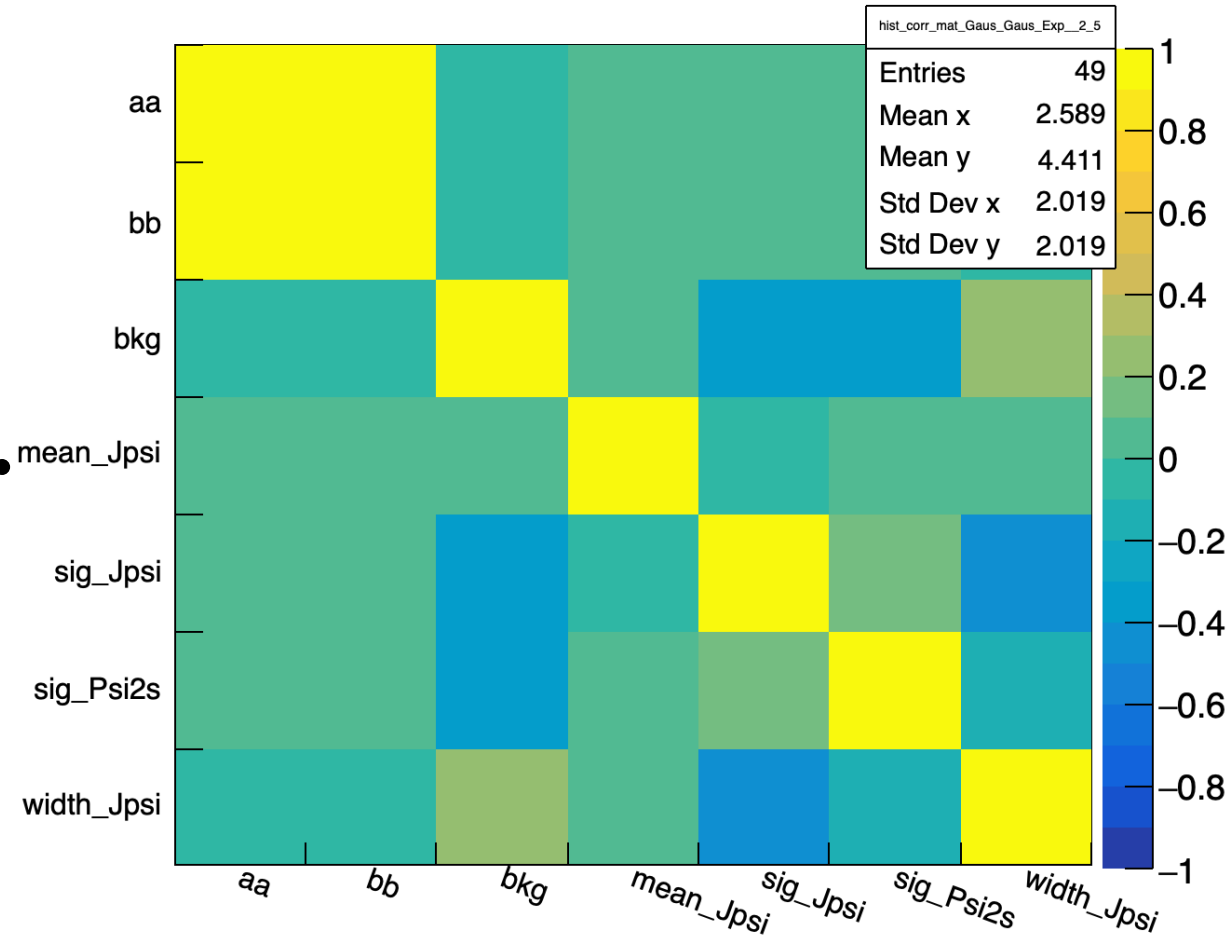

- The user can decide to save also the residual plot, the pull plot and the correlation matrix