

PWG3-Muon: Analysis Software

- ➔ Standard, Muon, Dimuon AOD production and use
- ➔ PWG3 Muon analysis wagons in the official train
- ➔ MC production requirements



AOD creation

➔ Standard AODs have been produced for each run (useful for muon analysis) of the 7 TeV datasets:

- LHC10b – pass1, pass2
- LHC10c – pass1, pass2 on-going
- LHC10d – pass1 on-going

➔ The analysis train is based on the official one (AnalysisTrainNew.C) and it uses the Alien Plugin

➔ Files are stored in:

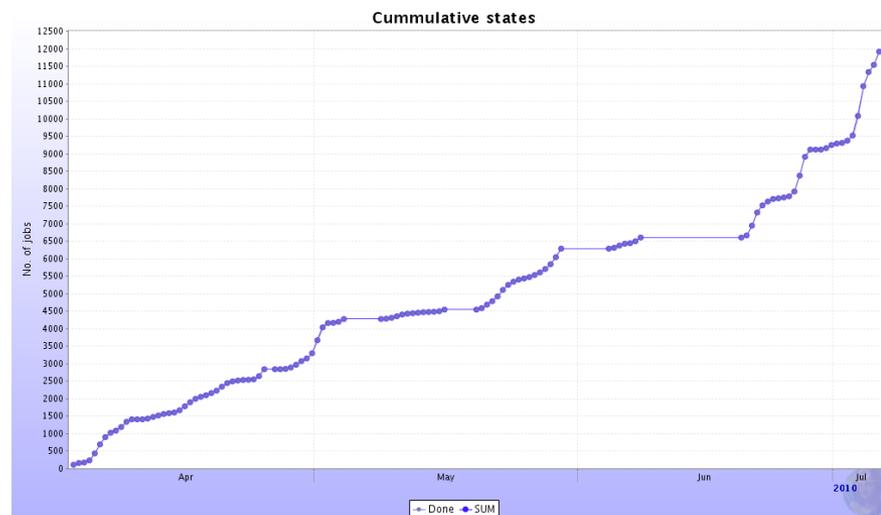
`/alice/cern.ch/user/a/arnaldi/Data7TeV_LHC10x/passx`

➔ AODs contain only events which have passed the Physics Selection

➔ Very good Grid performances and stability in the last months!

➔ Having to deal with a large number of jobs

➔ very useful job monitoring through “my jobs” in Monalisa page



Muon – Dimuon AOD creation

→ The same analysis train, running on ESDs, produces not only the standard AOD, but also the **Muon and Dimuon AOD**, containing only muon/dimuon events

→ Size of Muon/Dimuon AOD is, of course, much smaller than the AOD one:

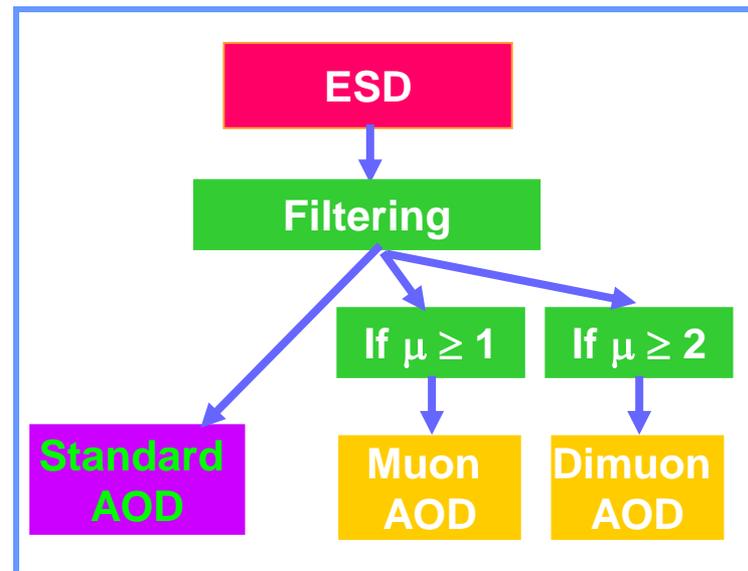
→ LHC10d (high intensity)

Run 124381

AliAODs.root → 3 GB (1.0 10⁶ events)

AliAOD.Muons.root → 200 MB (75 10³ events)

AliAOD.Dimuons.root → 10 MB (3000 events)



AOD based analysis

➔ As expected, AODs are indeed extremely useful for analysis.

The situation even improves, for muon based analysis, if Muon/Dimuon AODs are used: few minutes to loop over all the 7TeV events!

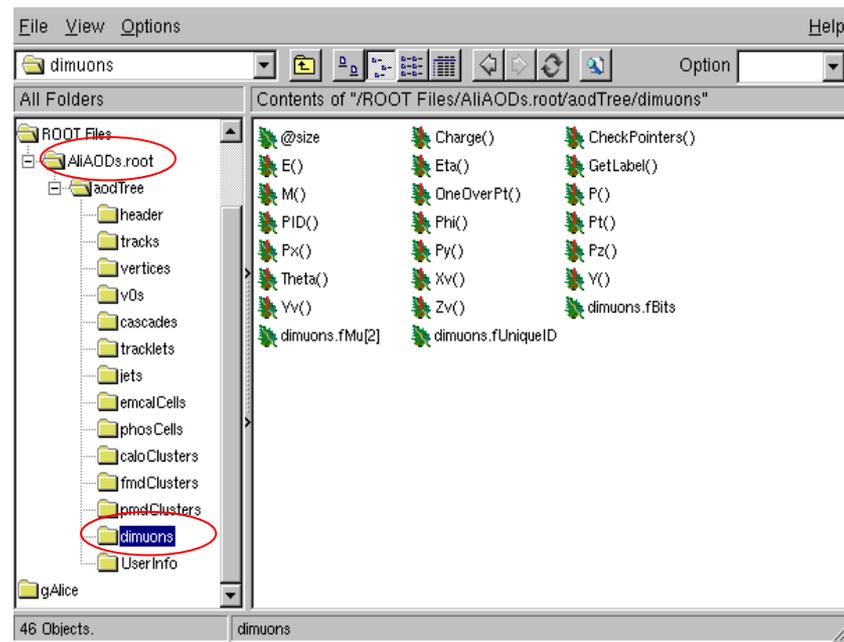
➔ In order to perform dimuon analyses, it is useful to directly access, at the AOD level, dimuon information

➔ A dimuon branch, containing the dimuon kinematical variables, has been added to the standard AOD

➔ dimuons infos are stored in a **AliAODDimuon** object containing the references to two muon tracks

```
AliAODDimuon::AliAODDimuon  
(TObject *mu0, TObject *mu1) :  
{ fMu[0]=mu0;  
  fMu[1]=mu1; }
```

```
where TRef fMu[2];
```

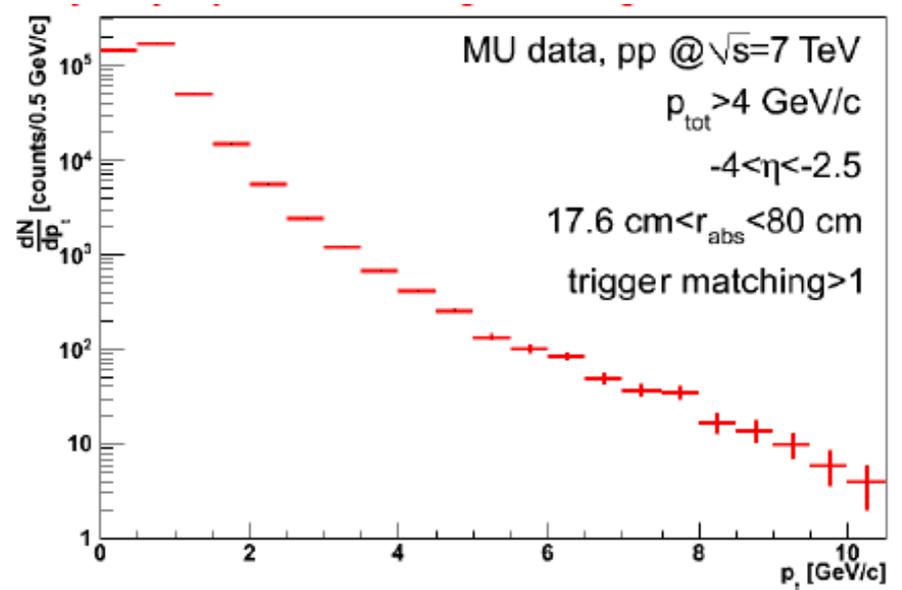
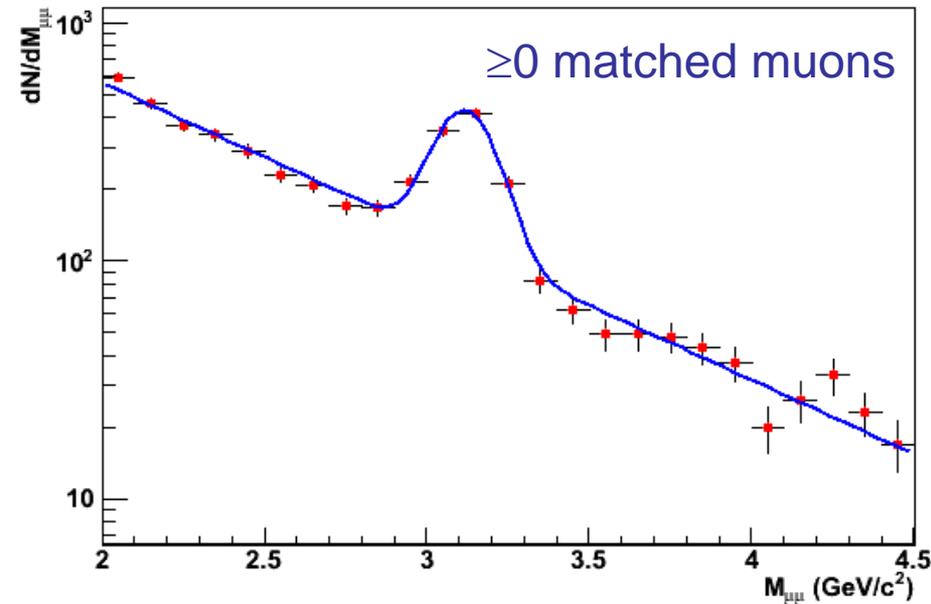


AOD based analysis

➡ Several on-going analysis in the PWG3-Muon are AOD based

➡ [J/ψ analysis](#)

➡ [Single muon analysis](#)



AOD - Requirements

- ➔ Since AOD are extremely useful for analysis:
 - ➔ it would be important to have AOD (+ Muon and Dimuon AODs) officially produced
 - ➔ AOD should be created not only for pass2, but also for pass1 data, as soon as data are reconstructed, at least in this initial data taking period!
 - ➔ AODs should contain events after the Physics selection
- ➔ Since Muon/Dimuon AODs contain only filtered events, it is no more possible to access information as the total number of CINT1B or CMUS1B triggers, useful for normalization purposes. Therefore to be able to base our muon analysis only on these objects:
 - ➔ Temporary (?) solution: store also EventStat.root and access the information from an histogram
 - ➔ Are there other solutions? Is it possible to add the histogram in a UserInfo Object?

Analysis wagons in the official train

- ➔ The PWG3-muon analysis code is included in the official analysis train

ANALYSIS/macros/AnalysisTrainNew.C

- ➔ The inclusion of the analysis wagons is done through

PWG3/muon/AddPWG3MuonTrain.C

Switching on/off some flags, it is possible to add analysis tasks

```
if (iPWG3MuonTrain) {  
gROOT->LoadMacro("$ALICE_ROOT/PWG3/muon/AddPWG3MuonTrain.C");  
Bool_t iESDAnalysis = !iAODAnalysis;
```

```
    Int_t addMuonDistributions = 1;  
    Int_t addSingleMuonAnalysis = 1;  
    Int_t addMuonHFAnalysis = 1;  
    Int_t addCFDimuonContainer = 1;
```

} analysis included up to now

```
AddPWG3MuonTrain(isESDAnalysis, isAODAnalysis, addMuonDistributions,  
addSingleMuonAnalysis, addMuonHFAnalysis, addCFDimuonContainer);
```

- ➔ These tasks accept ESDs or AODs as input

Analysis wagons in the official train(2)

➡ Almost all the official trains which have run on PDC09 productions contain:

- the standard AOD
- the Muon-AOD
- output histograms of the PWG3-MUON analysis wagons

➡ One specific train required on LHC09a18 (muon specific production)

The screenshot displays the ALICE Repository interface. On the left is a navigation tree with categories like 'Production info', 'Job Information', and 'Services'. The main area shows a table of production cycles. The row for 'TR013_LHC09a18ESD' is circled in red. An overlay window titled 'Output of train TR013_LHC09a18ESD' is open, showing a list of analysis tasks and their output files. A histogram plot is also visible, showing the invariant mass distribution of muon pairs.

ALICE Repository

- ALICE Repository
- Google Map
- Shifter's dashboard
- Running trend
- Production info
 - RAW production cycles
 - Analysis train
 - MC production cycles
 - MC production requests
- Job Information
- SE Information
- Services
- Network Traffic
- FTD Transfers
- CAF Monitoring
- SHUTTLE
- Build system
- Bandwidth tests
- Dynamic charts

close all

Running jobs trend

PRODUCTION CYCLES

Train Details » No filter

Production info		
Production	Description	Status
TR017_LHC09a5ESD	TR017: ESD+MC -> AODMC + delta AOD	Complete
QA002_PASS5	QA002: PWG1 QA train	Complete
QA001_PASS4	QA001: PWG1 QA train	Complete
TR016_LHC10a6ESD	TR016: ESD (no MC!) -> histograms	Complete
TR015_LHC09a4AOD	TR015: AOD -> analysis	Complete
TR014_LHC09a4ESD	TR014: ESD+MC -> AODMC + delta AOD	Complete
TR013_LHC09a18ESD	TR013: ESD+MC -> AOD MUON + Analysis	Complete
TR012_LHC09a2ESD	TR012: AOD -> delta AOD (jets, vertexing, partcor)	Complete
TR011_LHC09a9ESD	TR011: ESD+MC analysis -> AOD + delta AOD + histograms	Complete
TR010_LHC09a7ESD	TR010: ESD+MC analysis -> AOD + delta AOD + histograms	Complete

Output of train TR013_LHC09a18ESD

Train TR013_LHC09a18ESD

Results of Terminate()

- AliAnalysisTaskMuonDistributions
 - AliAnalysisTaskMuonDistributions_00
 - AliAnalysisTaskMuonDistributions_01
 - AliAnalysisTaskMuonDistributions_02
 - AliAnalysisTaskMuonDistributions_03
- PartCorrEMCAL
 - AliAnalysisTaskParticleCorrelation_00
- PartCorrPHOS
 - AliAnalysisTaskParticleCorrelation_00

Output files

- PWG3histograms.root
- PWG4histograms.root
- pyxsec_hists.root
- resonances.root

hMassDimu

Entries: 98175
Mean: 0.719
RMS: 0.5198

$N_{\text{fit}} = 260$
 $\sqrt{s} = 3.000 \text{ GeV}$ $\sigma = 02.64 \text{ MeV}$
 $S/B (2.9-3.3) = 1.74$
 $N_{\text{fit}}(2\pi) = 11$
 $\sqrt{s}(2\pi) = 3.000 \text{ GeV}$ $\sigma = 132.17 \text{ MeV}$
 $\chi^2/\text{ndf} = 1.38$

$M_{\mu\mu} \text{ (GeV/c}^2\text{)}$

PWG3-Muon Analysis wagons

➡ **AliAnalysisTaskMuonDistribution.cxx** R.A.

Control histograms for muon/dimuon studies

➡ **AliAnalysisTaskDimuonCFContainerBuilder.cxx** L. Bianchi

It build a CORRFW container with dimuon information

➡ **AliAnalysisTaskSEMuonsHF.cxx** X. Zhang

Single muon/dimuon distributions for Heavy Flavor studies

➡ **AliAnalysisTaskSingleMuon.cxx** D. Stocco

Task computing **single muon kinematical spectra**
for low p_T single muons studies

➡ All these wagons can run on ESD/AOD and on data or MC

New Analysis wagons



AliAnalysisTaskMuonTrackingEfficiency.cxx

M. Lenhardt

Evaluate tracking efficiencies → this wagon will be added to the PWG1 train



AliAnalysisTaskTrigChEff.cxx

D. Stocco

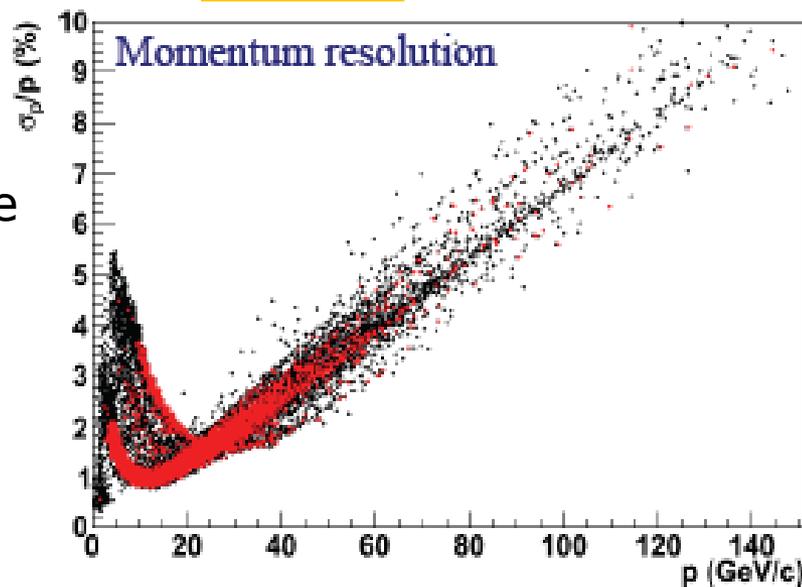
Evaluate trigger efficiencies → this wagon already runs in the PWG1 train



AliAnalysisTaskMuonResolution.cxx

P. Pillot

Allows the monitoring of the muon resolution
→ this wagon will be included in the PWG1 train



New Analysis wagons (2)



AliAnalysisTaskMuonQA.cxx

P. Pillot

Task to monitor muon track infos

→ this task will be included in the PWG1 train

In this task the following class is used:



AliCounterCollection.cxx

P. Pillot

Generic class which holds an arbitrary number of counters referenced by key words → it's possible to count the number of tracks/events/... as a function of trigger class/selection cut/...

```
fTrackCounters = new AliCounterCollection("trackCounters");
```

```
fTrackCounters->AddRubric("track", "tracker/trigger/matched/any");
```

```
fTrackCounters->AddRubric("trigger", "CINT1A/CINT1B/.../any");
```

```
fTrackCounters->AddRubric("run", 1000000);
```

```
fTrackCounters->AddRubric("selected", "yes/no");
```

```
fTrackCounters->AddRubric("triggerR0", "good/bad");
```

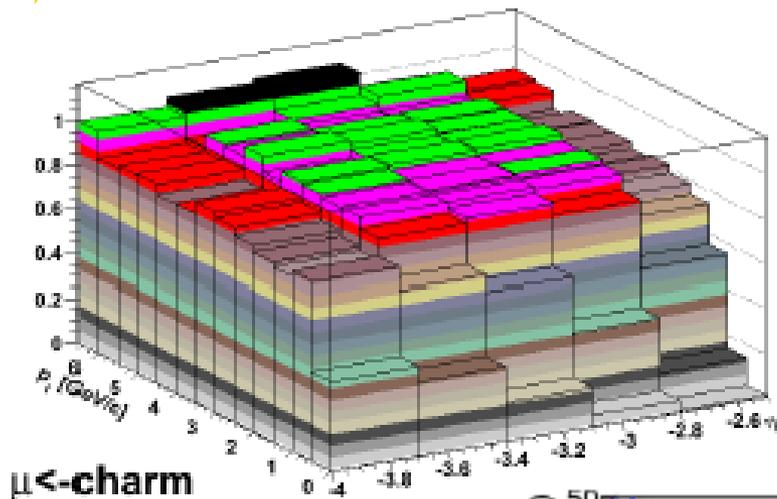
Selections: SELECTED:NO RUN:ANY

TRACK	CBEAMB	CSMRB	CINT1A	CINT1B	CINT1C	CINT1E	CMUS1A	CMUS1B	CMUS1C	CMUS1S	OTHER	ANY
ANY	342	228	3719	313			185	59484	20			61798
MATCHED	70	36	749	2			45	20296	2			20322
TRIGGER	133	98	1511	3			132	38091	3			36357
TRACKER	209	130	2208	310			53	21393	17			23441

Other analysis tools: CORRFW

➔ The CORRFW is widely used in MUON analysis to perform acceptance x efficiencies corrections

➔ Single muon analysis

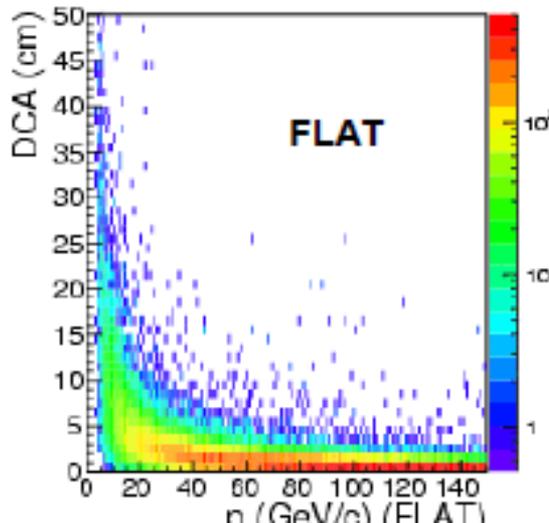
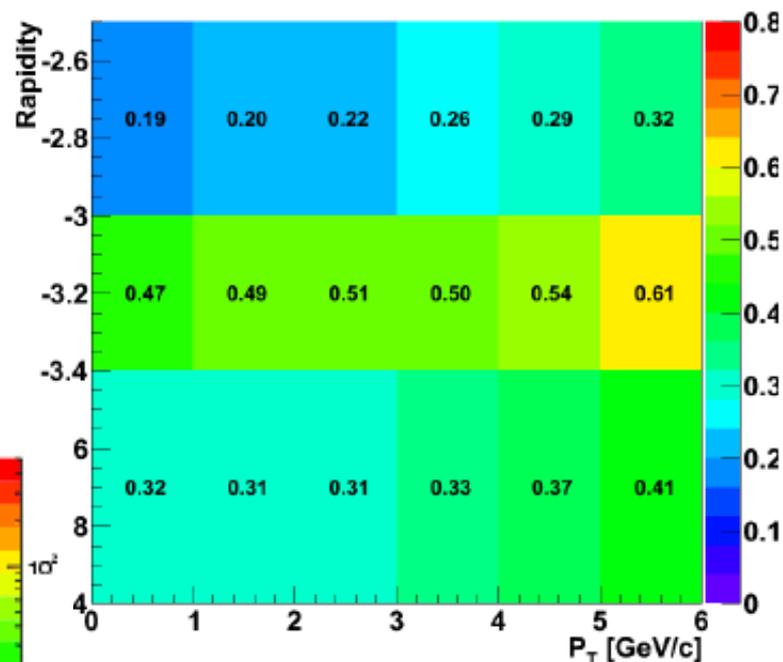


μ -charm

X. Zhang

➔ J/ ψ analysis

B. Boyer



X. Lopez

MC productions

→ In ~ 1 week from now we will submit the requests of several MC productions for pp@ 7TeV with realistic conditions:

→ Minimum bias production (PYTHIA, Atlas-CSC tuning) N. Bastid
 $\sim 200 \cdot 10^6$ events

→ Pure signal production (J/ψ ...) L. Bianchi,
E. Scomparin

e.g for J/ψ studies, in order to evaluate acceptance x efficiencies corrections, we need to simulate several samples of $\sim 10^6$ events with

- different kinematical distributions (y, p_T)
- different degrees of polarization

MC production requirements

→ Requirements:

- Also in this case it would be extremely useful to officially run the Standard/Muon/Dimuon AOD production including the MC branch
 - easy way to link generated particles and reconstructed tracks, as already tested for PDC09 productions
 - allows to run the same analysis code as on the data
- Muon/Dimuon AOD production
 - also in this case the MC branch needs to be replicated
 - a different approach is needed, because the AliAODExtension allows only the copy of the standard AOD content
 - need to replicate each branch separately?

```
aodOutputHandler->SetNeedsHeaderReplication();  
aodOutputHandler->SetNeedsMCBranchReplication();  
aodOutputHandler->SetNeedsDimuonsBranchReplication();
```

- Still some problems in navigating from vertices to tracks...

Conclusions

- ➔ Several analysis in the PWG3-Muon are already AOD based
 - ➔ Muon/Dimuon AODs extremely useful, since they allow to quickly loop on the interesting events
 - ➔ Important to have all these files officially produced!
- ➔ PWG3-Muon analyses can be performed on standard AODs or on filtered AODs
 - ➔ Several wagons already included in the official train

