

PWG3-Muon: Analysis Software

- Developments on the Muon/Dimuon AOD production
- 900GeV analysis based on AODs
- PWG3 Muon analysis wagons in the official train
- Requirements



Muon AOD creation

- Muon-AODs will be produced in the first analysis train, together with the standard AOD, running on ESD files

The muon AOD creation has been implemented in the task

PWG3/muon/AliAnalysisTaskESDMuonFilter.cxx

```
if(fEnableMuonAOD && MuonsExist) {  
AliAODExtension *extMuons = dynamic_cast<AliAODHandler*>  
((AliAnalysisManager::GetAnalysisManager())->GetOutputEventHandler())  
->GetFilteredAOD("AliAOD.Muons.root");  
extMuons->SelectEvent(); }
```

- In order to perform dimuon analyses, it is useful to directly access, at the AOD level, dimuon information
 - compute and store in a branch the dimuon kinematical variables
 - filter events containing dimuons in a separate file

Dimuons variables in the AOD

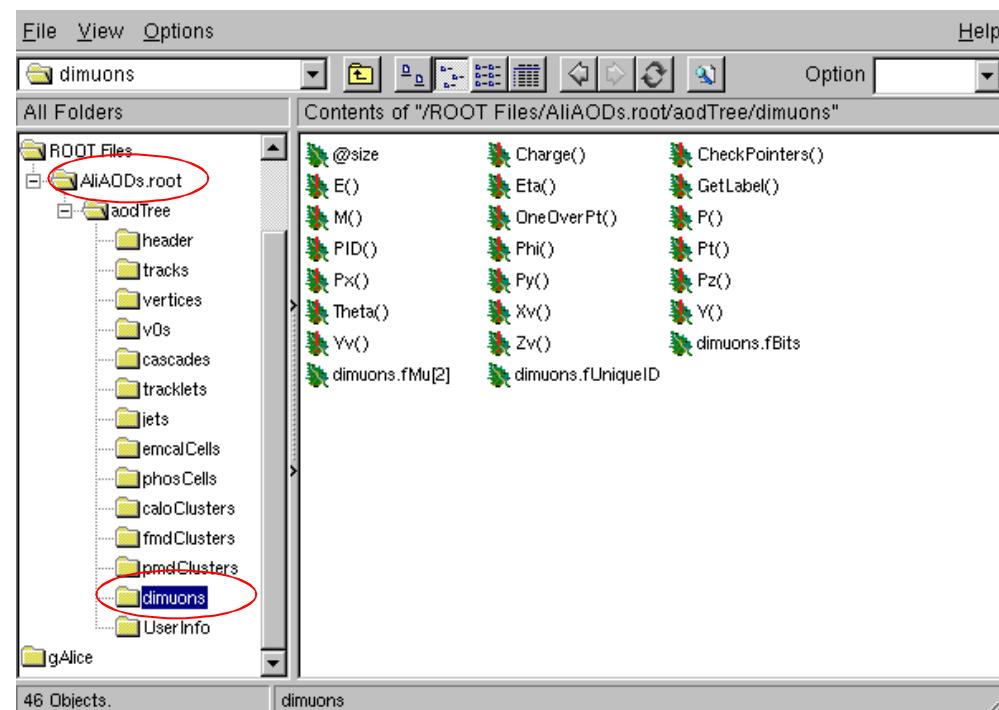
→ A dimuon branch, containing the dimuon kinematical variables, has been added to the standard AOD

→ dimuons infos are stored in a `AliAODDimuon` object which contains the references to two muon tracks

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

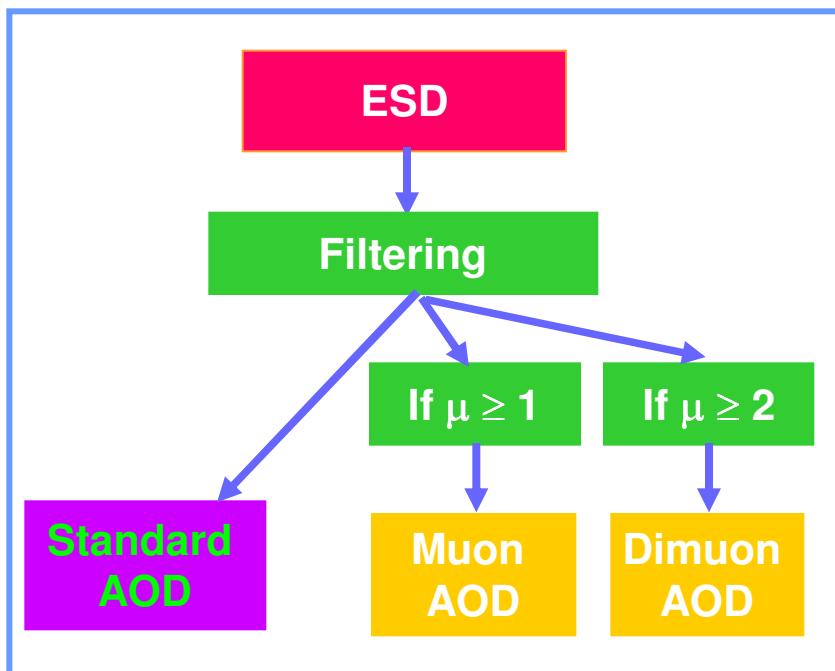
where `TRef fMu[2];`

→ AliAODDimuon code has been moved from PWG3/muon to STEER, to be accessible independently of PWG3



Dimuon AOD

- The dimuon branch is automatically copied in the Muon AOD
- In a similar way as we do with the Muon AOD, it is now possible to copy dimuon events in a Dimuon-AOD, by filtering the ESD



→ This approach works for data

```
if(fEnableDimuonAOD && DimuonsExist){  
    AliAODEExtension *extDimuons =  
        dynamic_cast<AliAODHandler*>  
        ((AliAnalysisManager::GetAnalysisManager())  
        ->GetOutputEventHandler())  
        ->GetFilteredAOD("AliAOD.Dimuons.root");  
    extDimuons->SelectEvent(); }
```

Muon/Dimuon AODs for MC

- A slightly different approach has to be used in order to create Muon/Dimuon AODs for MC production
 - in this case also the MC branch needs to be replicated (the AliAODExtension allows only the copy of the standard AOD content)
- We replicate the useful branches starting from the standard AODs

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



to be implemented in AliAnalysisTaskSE

Physics Selection

- Up to now, the Physics Selection has been implemented in an analysis task which runs, **on ESD**, before the analysis wagons
- AliPhysicsSelection is based on information which are available only at the ESD level
- To be able to perform analysis using AODs
 - is it foreseen to have the physics selection task running on AODs?
- Otherwise, AODs should be created after running the physics selection task
 - only events passing the physics selection will be copied in the AOD
 - drawback: if the physics selection is changed, AODs have to be recreated
- If this is the strategy foreseen:
 - important to keep the “official” physics selection at a basic level
Specific analysis selection have to be implemented a posteriori
 - important to keep track of the events before/after phys.
selection

900GeV AOD production

- AODs from **pass5-reconstruction ESDs** have been produced on the GRID
- Files are stored in AliEn:

/alice/cern.ch/user/a/arnaldi/Data900GeV/pass5/ PhysSelection
NoPhysSelection

AliAODs.root
AliAOD.Muon.root
AliAOD.Dimuon.root
AnalysisResults.root



Produced files

- Example of files size (run 104824):

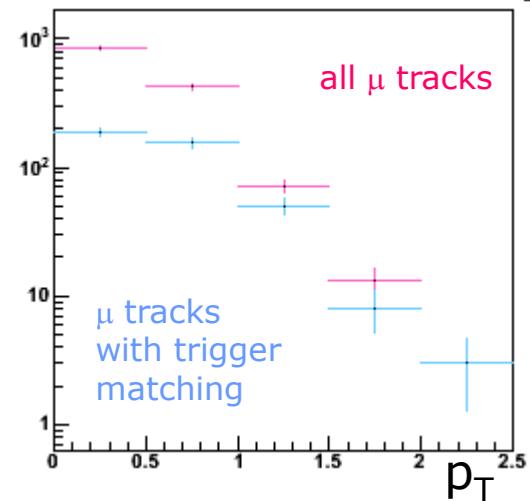
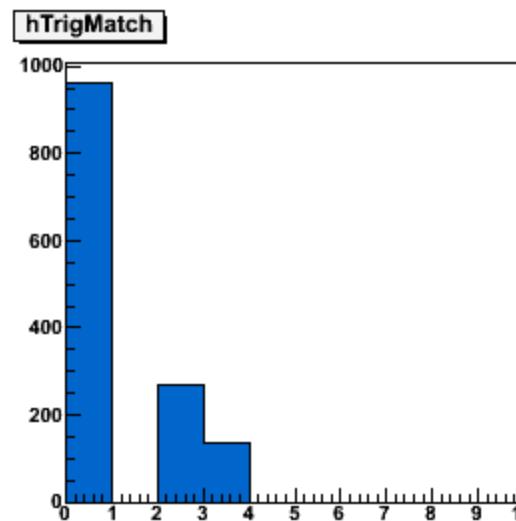
- 6 ESD chunks: ~180MB each
- 1 AOD: ~60MB (39000 events)
- 1 Muon AOD: ~0.5MB (110 muon events)
- 1 Dimuon AOD: ~60KB (3 dimuon events)

900GeV analysis based on AODs

→ A preliminary analysis of the 900 GeV data has been done, based on pass5 AODs with physics selection

| | |
|---|-------|
| Number of μ | 1366 |
| Number of μ (matched with trigger) | 406 |
| μ multiplicity | 0.008 |

| | |
|-----------------------|---------|
| Number of $\mu\mu$ | 20 |
| $\mu\mu$ multiplicity | 0.00012 |



Same statistics as the one used for ESD based analyses.

→ From a preliminary cross-check, all useful information seem to be present at the AOD level.

Official analysis train

- The PWG3-muon analysis code has now been 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

Official analysis train (2)

→ Almost all the official trains which have been recently run on PDC09 productions contains:

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

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

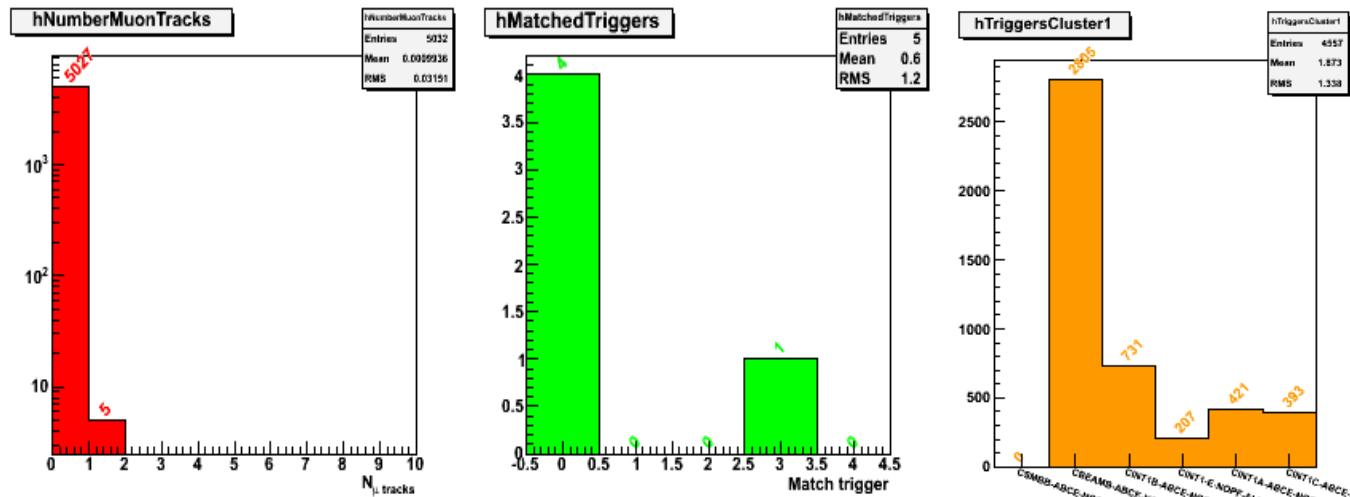
The screenshot shows the ALICE Repository interface with three main windows:

- ALICE Repository**: Left sidebar with navigation links like 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, and Running jobs trend.
- PRODUCTION CYCLES**: Main window showing "Train Details » No filter". It lists "Production info" for various trains:

| 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**: Right window titled "Train TR013_LHC09a18ESD". It shows "Results of Terminate()" for AliAnalysisTaskMuonDistributions and histograms for PartCorrEMCAL and PartCorrPHOS. It also lists "Output files" such as PWG3histograms.root, PWG4histograms.root, pyxsec_hists.root, and resonances.root.
- AliAnalysisTaskMuonDistributions_03**: Bottom right window showing a histogram titled "hMassDimu" with entries: N. J/psi = 260, J/psi m=3.880 GeV, m=82.84 MeV, S/R (2.9-3.3)= 1.74, N. pi(0) = 11, pi(0) m=3.600 GeV, m=132.17 MeV, y^2(m)= 1.38.

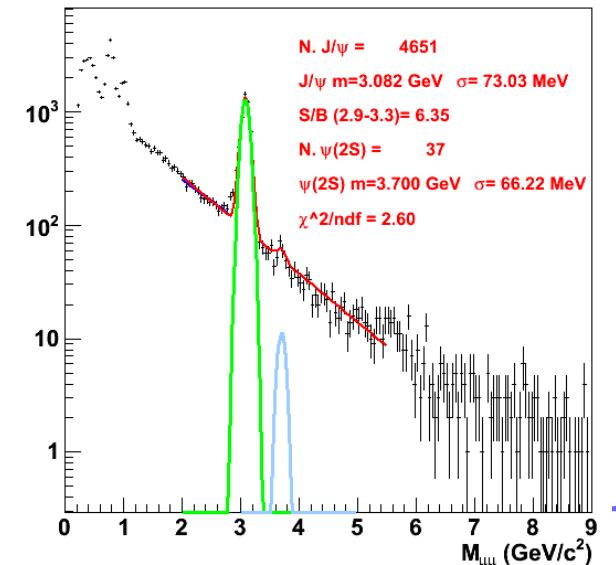
PWG3 Muon Analysis Wagons

→ AliAnalysisTaskMuonDistribution.cxx



→ Control histograms for muon/dimuon studies

- single muon kinematical variables
- number of muon tracks per event
- number of trigger/tracking matched tracks
- number of muons for each trigger class or trigger cluster
- dimuon kinematical variables...
- number of events containing dimuons (to be analyzed with AliEve)



PWG3 Muon Analysis Wagons (2)

→ **AliAnalysisTaskDimuonCFContainerBuilder.cxx**

It build a CORRFW container with dimuon information

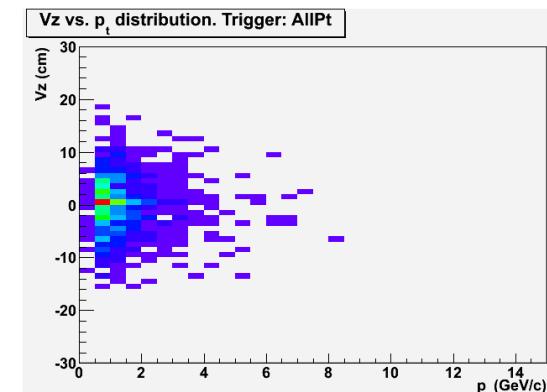
→ **AliAnalysisTaskSEMuonsHF.cxx**

Single muon/dimuon distributions for Heavy Flavor studies

→ **AliAnalysisTaskSingleMuon.cxx**

Task computing single muon kinematical spectra

It will be used to study low p_T single muons



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

Requirements for the next run

- AODs for the 900GeV data have not yet been produced officially.
 - for the incoming run, it would be useful to have AODs produced officially as soon as data are reconstructed
- The physics selection should be available at the AOD level if we want to perform analysis based on AODs, unless it is decided to keep the physics selection at a basic (trigger) level
 - In this case AOD will contain only selected events

Outlook and conclusions

- PWG3-Muon analyses can be performed on standard AODs or on filtered AODs
- Filtered AOD creation is done directly from ESDs
- AODs for the 900GeV data have been produced with/without the physics selection
 - important test to check if all the needed information are stored at the AOD level
 - also the PWG3-Muon analysis wagon have run on these data
- Usage of par files has really improved the work on the GRID
- Physics selection has to be included also in the Official AOD production, unless the physics selection task will be implemented also at the AOD level

