

# 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

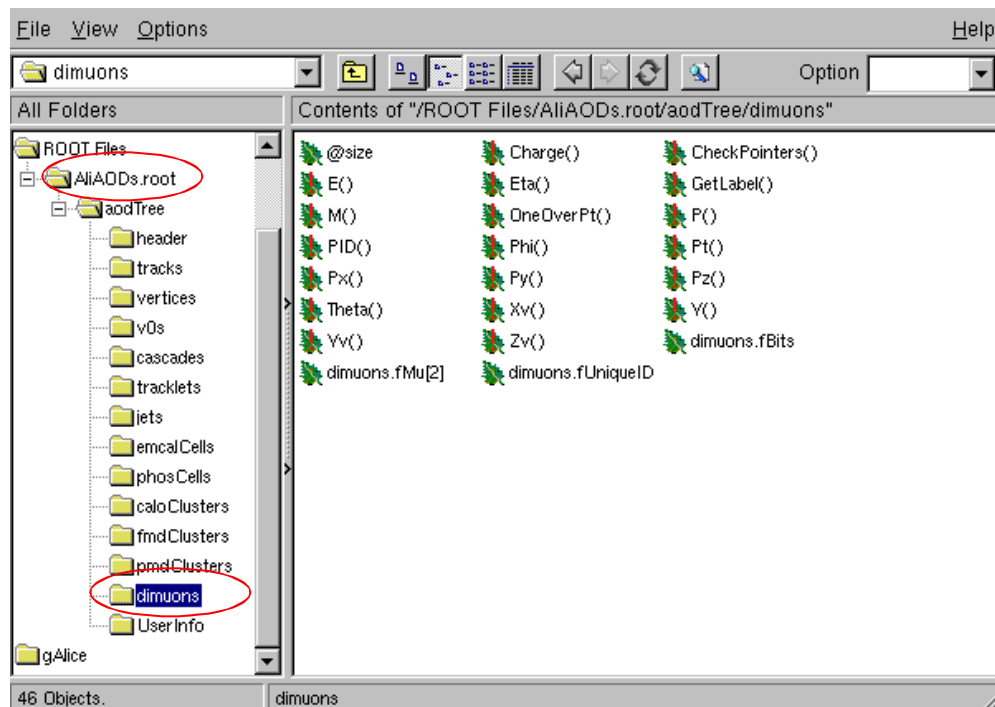
➔ A dimuon branch, containing the dimuon kinematical variables, has been added to the standard AOD

➔ 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;  
}
```

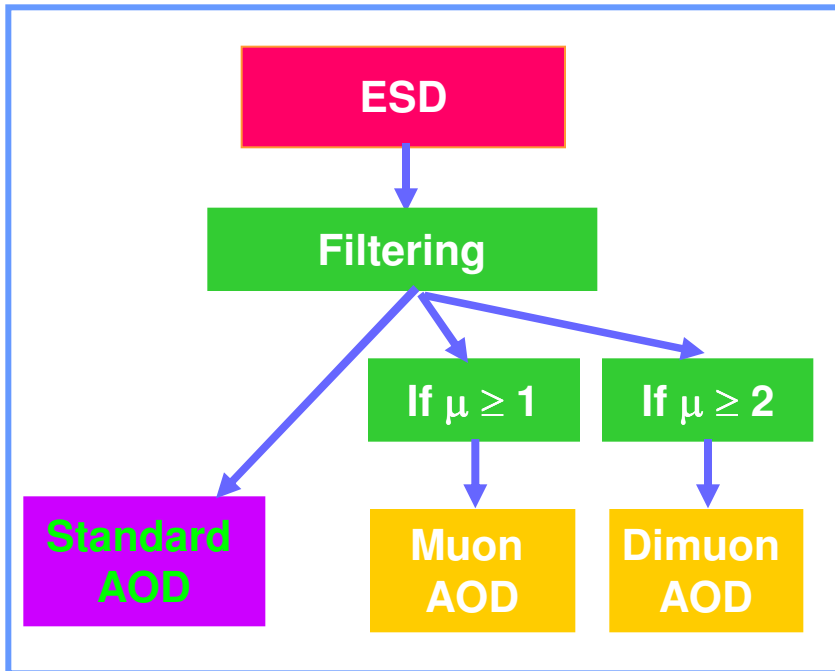
```
where TRef fMu[2];
```

➔ 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){  
  
  AliAODExtension *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):

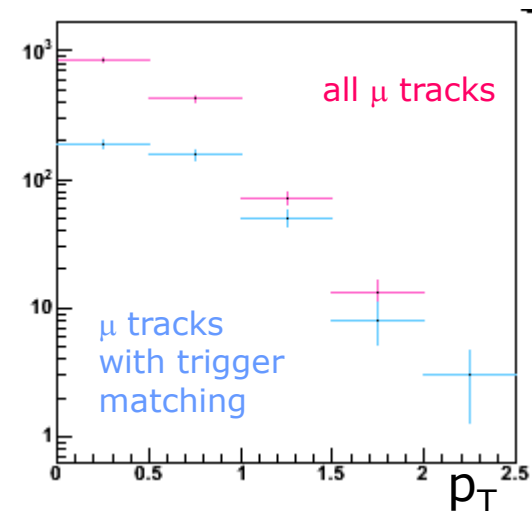
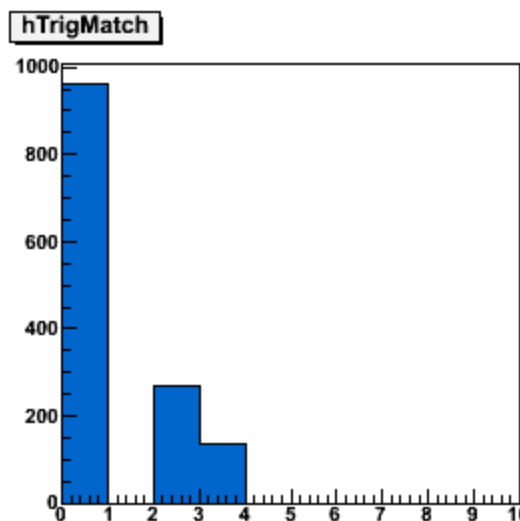
- 6 ESD chunks: ~180MB each
- 1 AOD: ~60MB (39000 events)
- 1 Muon AOD: ~0.5MB (110 muon events)
- 1 Dimuon AOD: ~60KB (3 dimuon events)

# 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 $\mu$	1366
Number of $\mu$ (matched with trigger)	406
$\mu$ 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(iESDAnalysis, iAODAnalysis, 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 displays the ALICE Repository interface. On the left is a navigation tree with categories like 'Production info', 'Job Information', and 'Services'. The 'Analysis train' sub-item is selected. The main panel shows a table of production cycles. The row for 'TR013\_LHC09a18ESD' is circled in red. An overlay window titled 'PRODUCTION CYCLES' shows the output files for this train, including 'AliAnalysisTaskMuonDistributions\_03'. A plot window titled 'hMassDimu' shows a histogram of dimuon invariant mass with a fit curve and statistical parameters.

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

**PRODUCTION CYCLES**

Output of train TR013\_LHC09a18ESD

Train TR013\_LHC09a18ESD

Results of Terminate()

- AliAnalysisTaskMuonDistributions
- AliAnalysisTaskMuonDistributions\_00
- AliAnalysisTaskMuonDistributions\_01
- AliAnalysisTaskMuonDistributions\_02
- AliAnalysisTaskMuonDistributions\_03

Output files

- PWG3histograms.root
- PWG4histograms.root
- pyxsec\_hists.root
- resonances.root

PartCorrEMCAL

- AliAnalysisTaskParticleCorrelation\_00

PartCorrPHOS

- AliAnalysisTaskParticleCorrelation\_00

hMassDimu

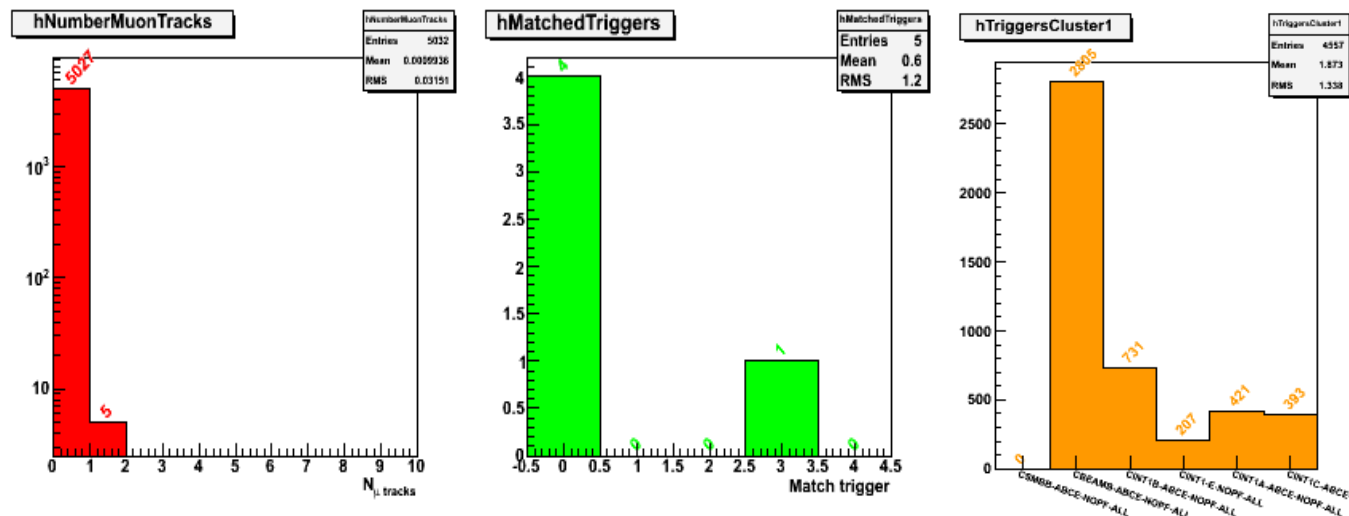
hMassDimu

Entries: 58175  
Mean: 3.719  
RMS: 0.5196

N: 260  
J/y = 3.880 GeV → 82.64 MeV  
S/B (2.9-3.3) = 1.74  
N: v(2S) = 11  
y(2S) = 3.600 GeV → 132.17 MeV  
χ<sup>2</sup>/ndf = 1.38

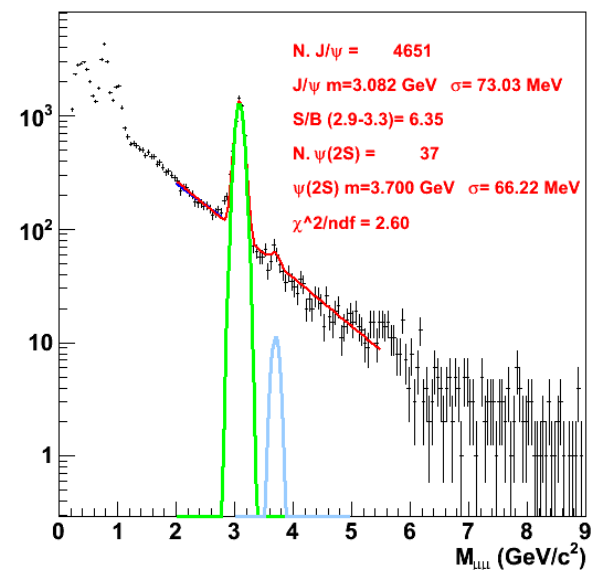
# PWG3 Muon Analysis Wagons

➔ 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**

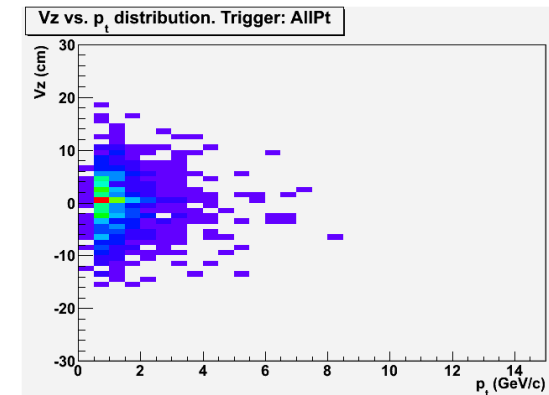
It build a CORRFW container with dimuon information

➔ **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

