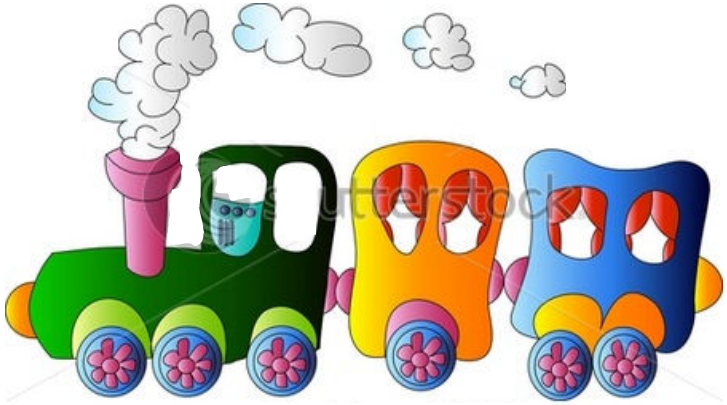
PWG3-Muon: Analysis Software

- 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

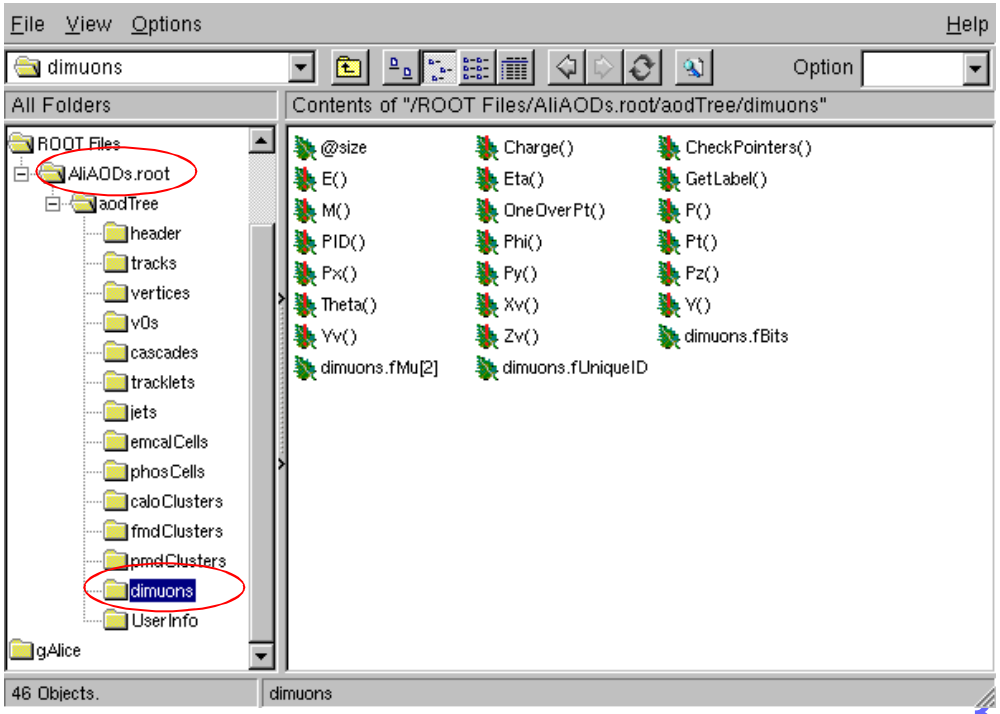
Dimuons variables in the AOD

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

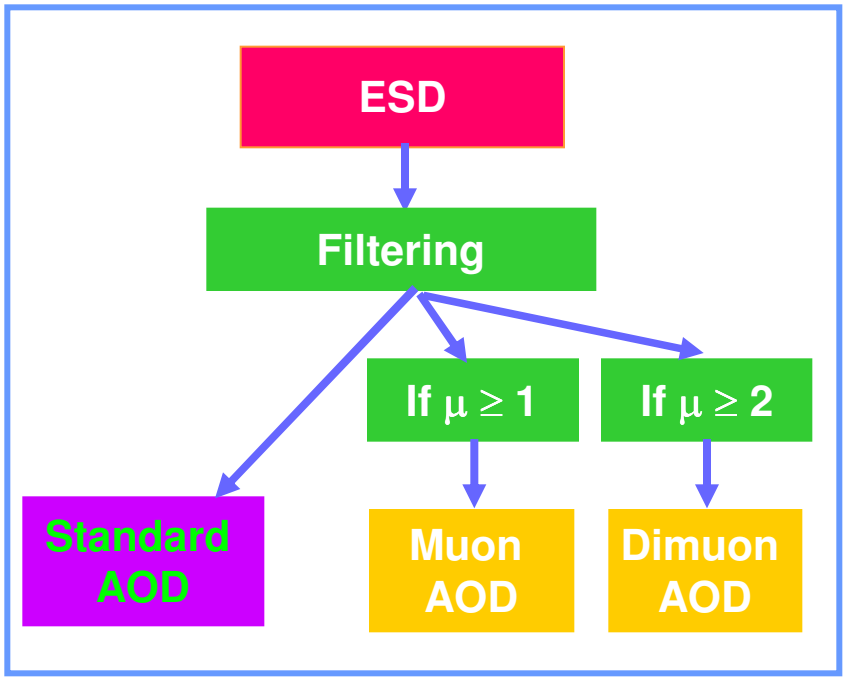
```
AliAODDimuon::AliAODDimuon(TObject *mu0, TObject *mu1):
{   fMu[0]=mu0;
    fMu[1]=mu1;}

 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

```
aodOutpuHandler->SetNeedsHeaderReplication();
aodOutpuHandler->SetNeedsMCBranchReplication();
aodOutpuHandler->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):

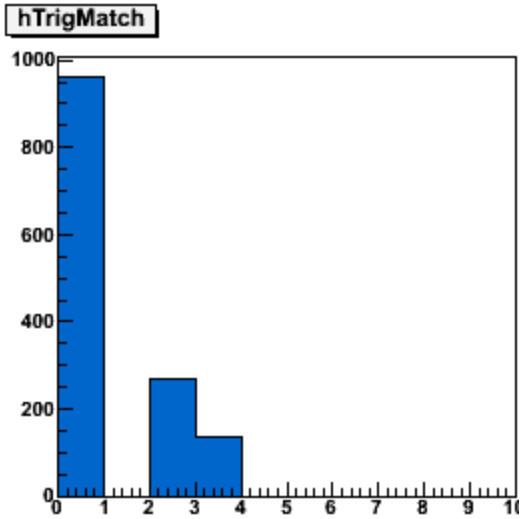
- 6 ESD chunks: ~180MB each
- 1 AOD: ~60MB (39000 events)
- 1 Muon AOD: ~0.5MB (110 muon events)
- 1 Dimuon AOD:~60KB (3 dimuon events)

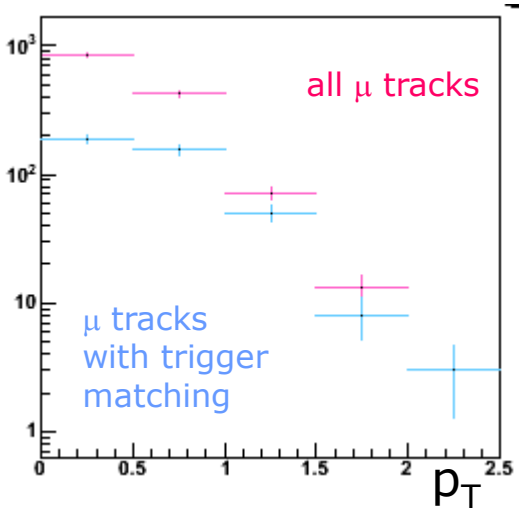
900GeV analysis based on AODs

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 μμ	20
μμ 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

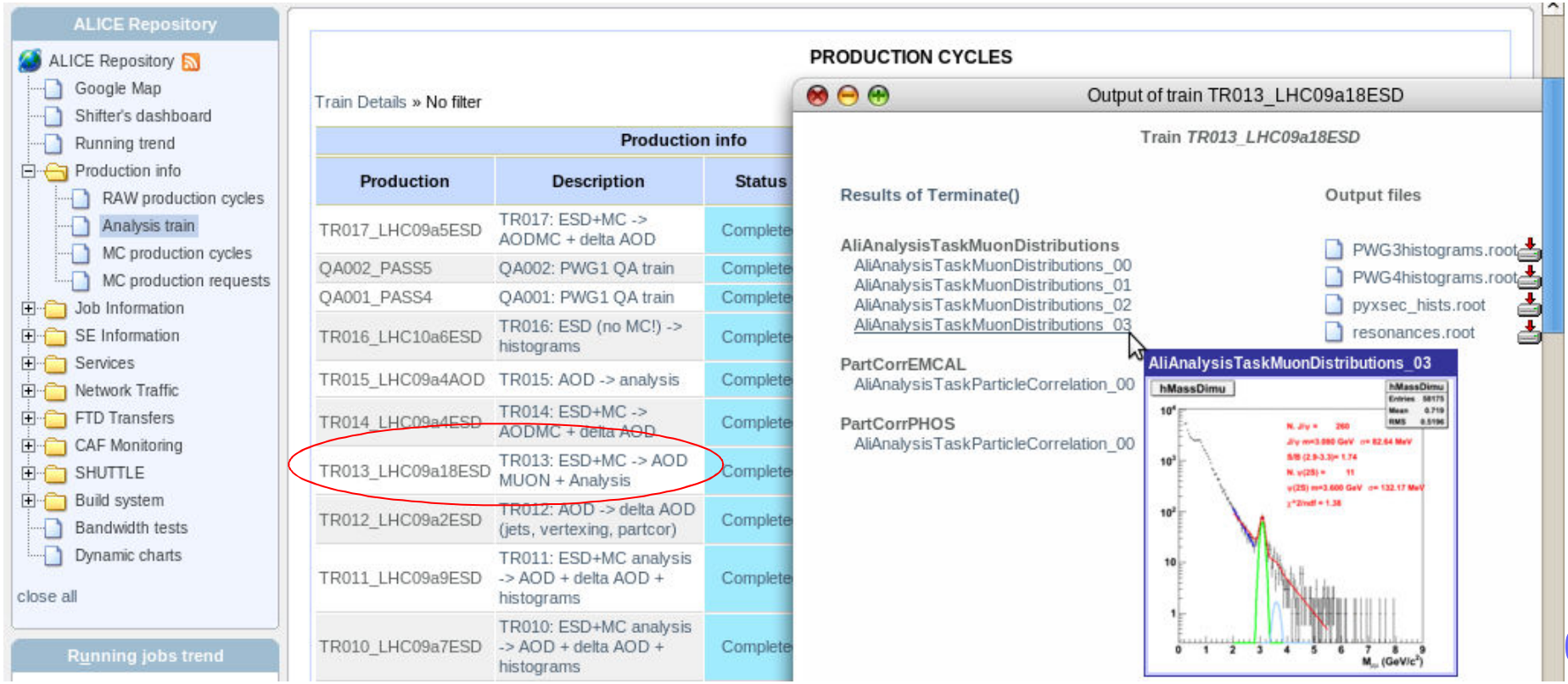
```
if (iPWG3MuonTrain) {
gROOT->LoadMacro("$ALICE_ROOT/PWG3/muon/AddPWG3MuonTrain.C");
Bool_t iESDAnalysis = !iAODanalysis;

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

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

analysis included up to now

- These tasks accept ESDs or AODs as input

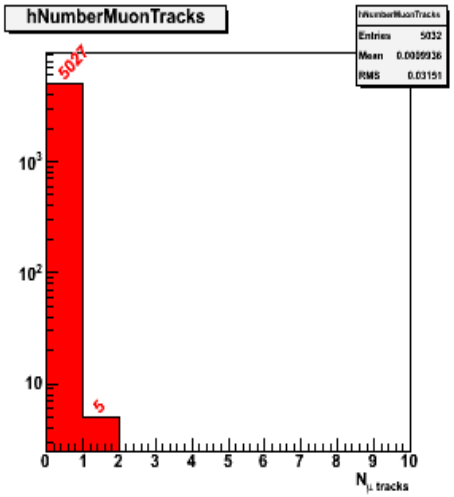
Official analysis train (2)

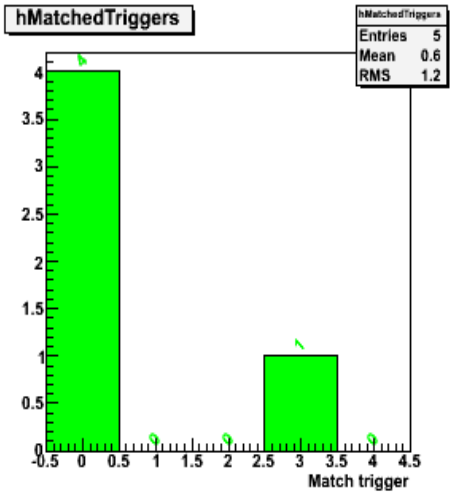
- Almost all the official trains which have been recently run on PDC09 productions contains:
  - the standard AOD
  - the Muon-AOD
  - output histograms of the PWG3-MUON analysis wagons
- One specific train required on LHC09a18 (muon specific production)

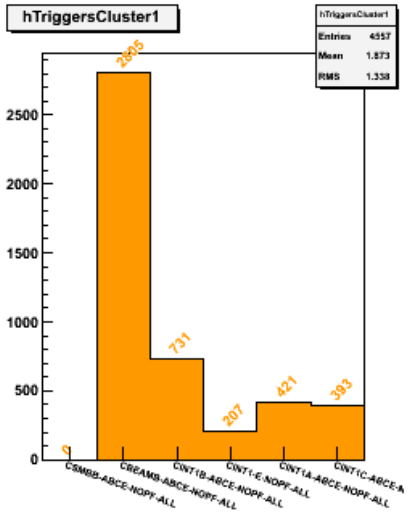


PWG3 Muon Analysis Wagons

AliAnalysisTaskMuonDistribution.cxx

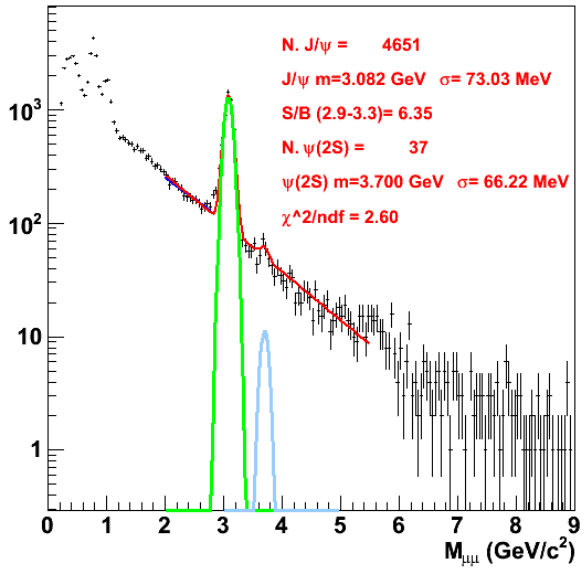






Control histograms for muon/dimuon studies

- 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

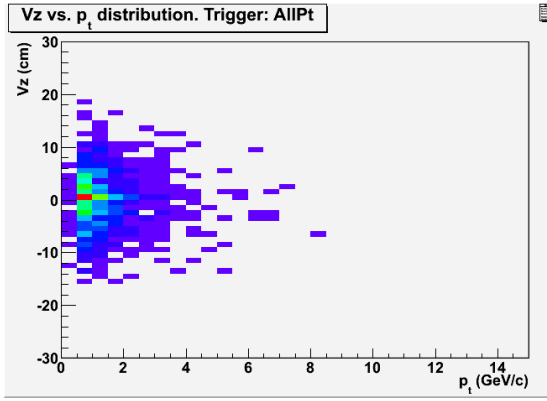
It build a CORRFW container with dimuon information

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