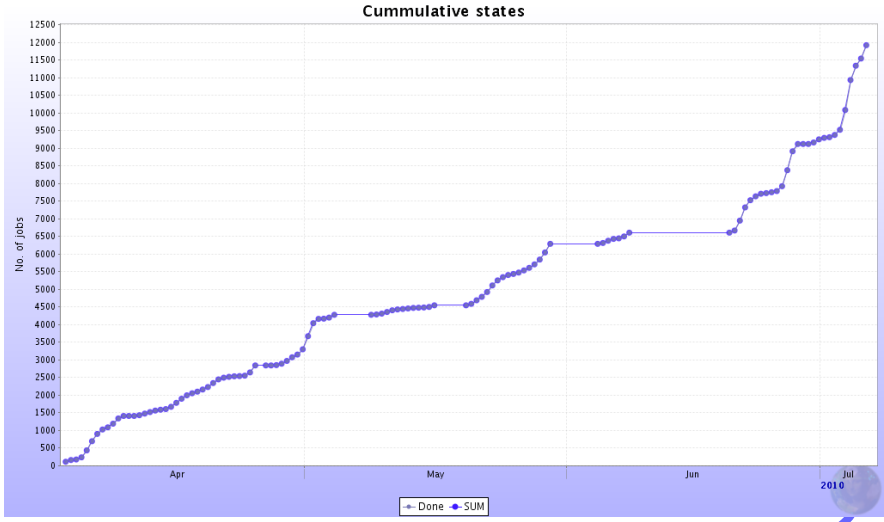
PWG3-Muon: Analysis Software

- 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:

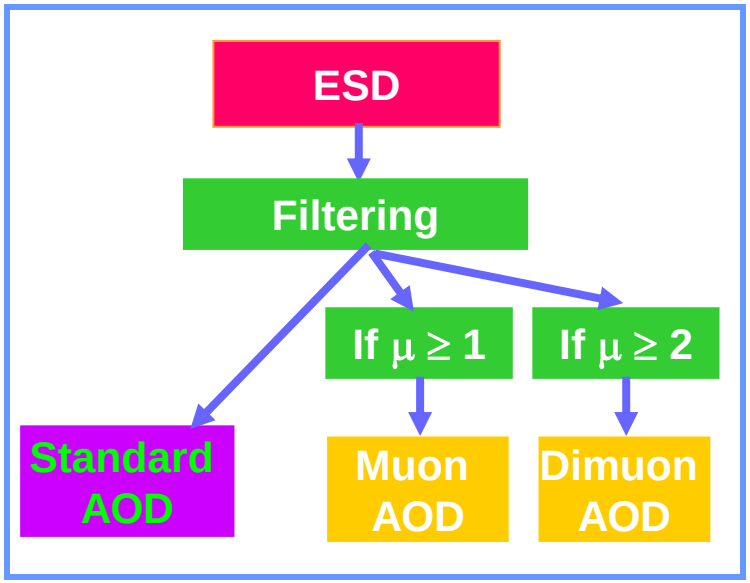
    `/alice/cern.ch/user/a/arnaldi/Data7TeV_LHC10x/passx`
  - AODs contain only events which have passed the Physics Selection



- 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 10^6 events)
- AliAOD.Muons.root → 200 MB (75 10^3 events)
- AliAOD.Dimuons.root → 10 MB (3000 events)

AOD based analysis

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

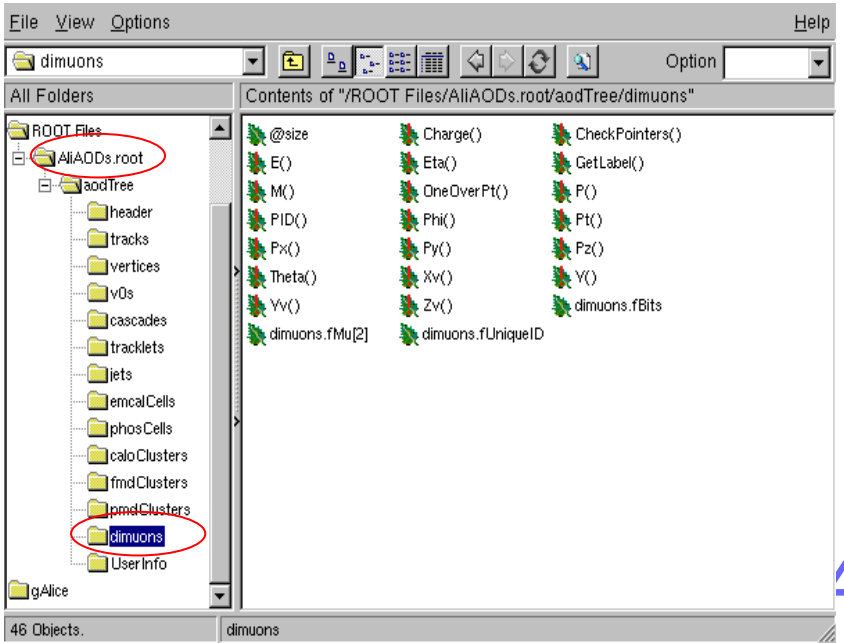
  The situation even improves, for muon based analysis, if Muon/Dimuon AODs are used: few minutes to loop over all the 7TeV events!

- 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

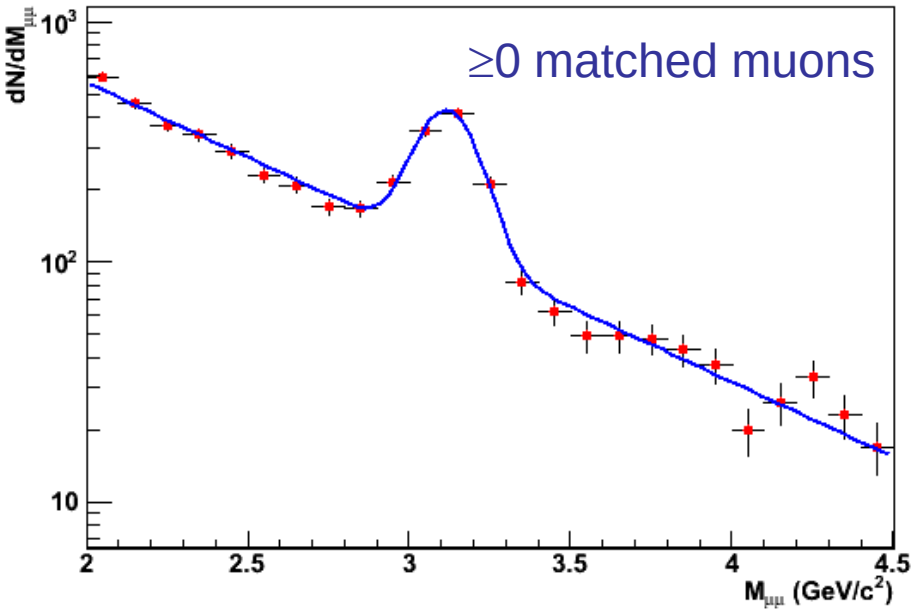
```
AliAODDimuon::AliAODDimuon
(TObject *mu0, TObject *mu1):
{   fMu[0]=mu0;
    fMu[1]=mu1;}

where  TRef fMu[2];
```



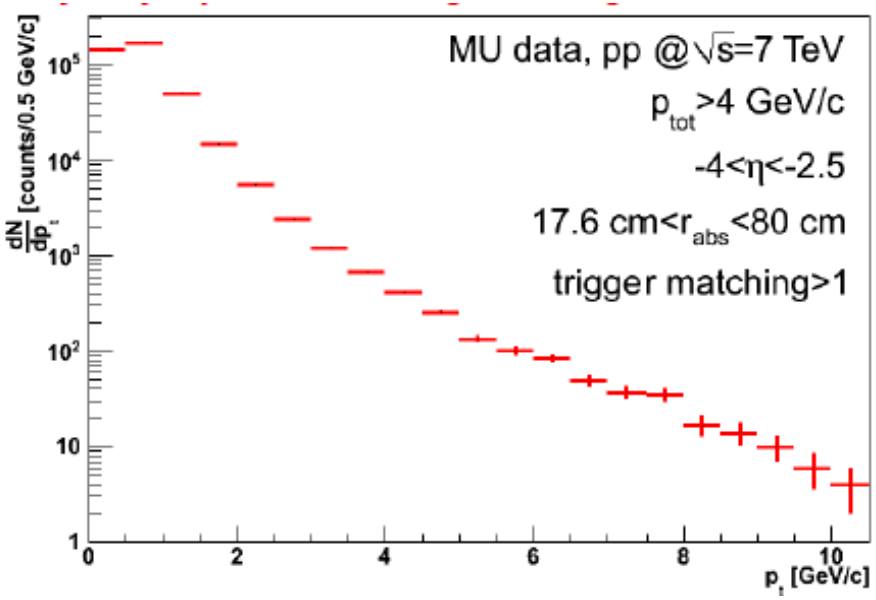
AOD based analysis

- 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;

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

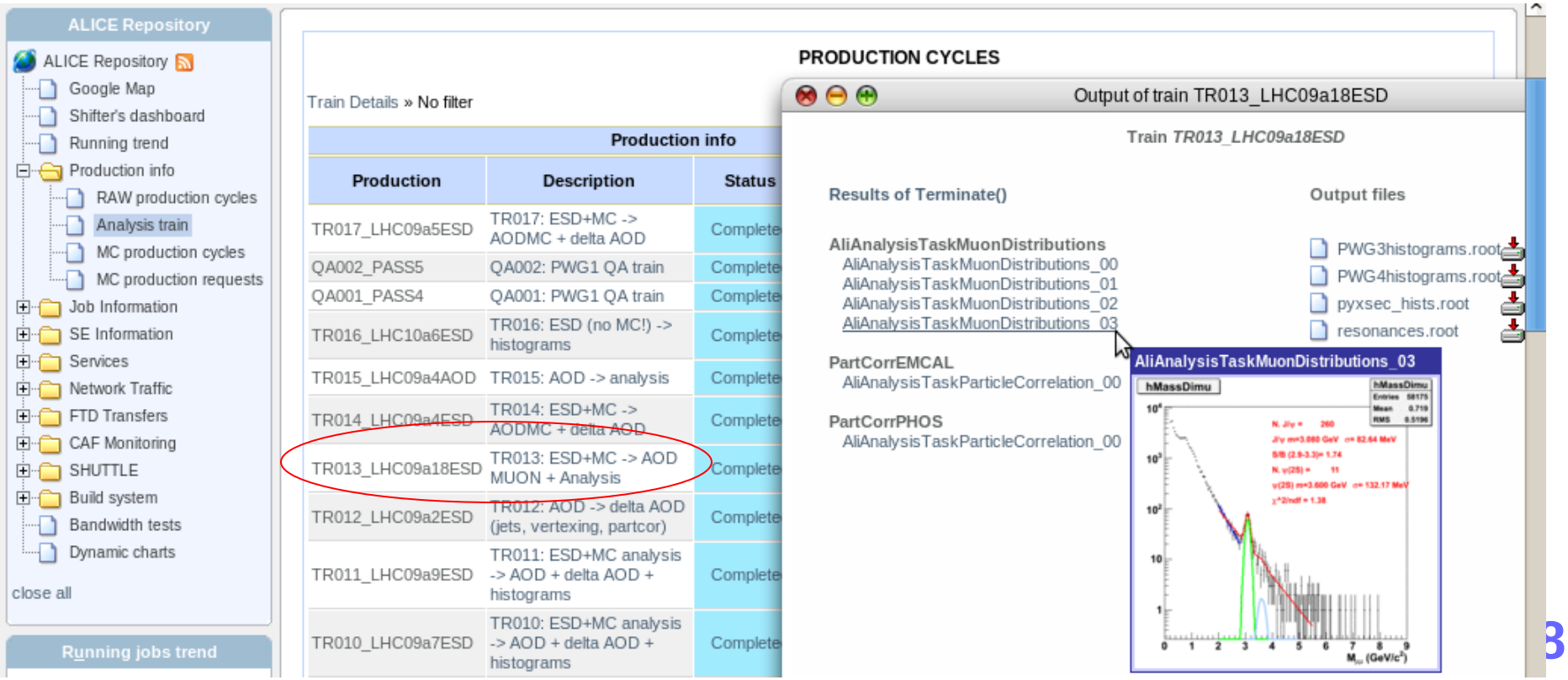
analysis included up to now

- 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)



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

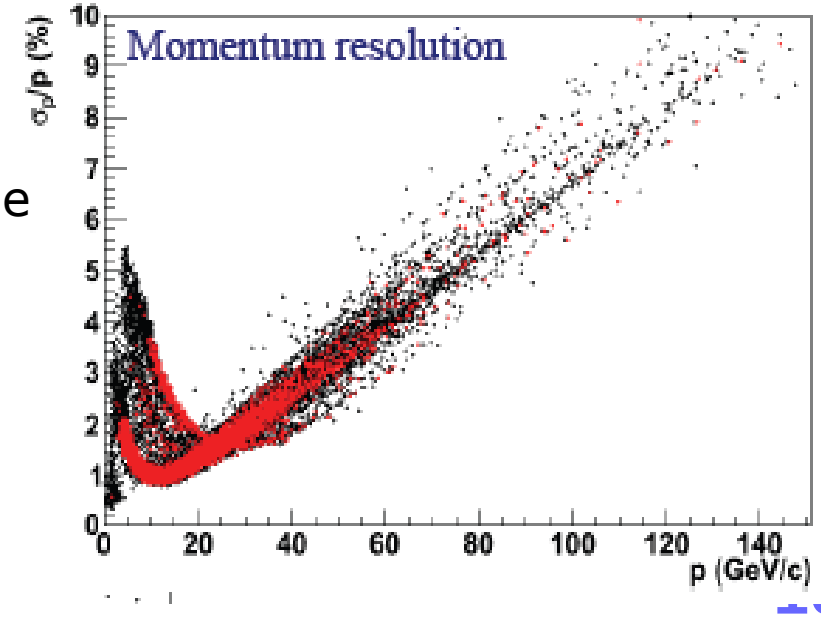
Evaluate tracking efficiencies → this wagon will be added to the PWG1 train

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

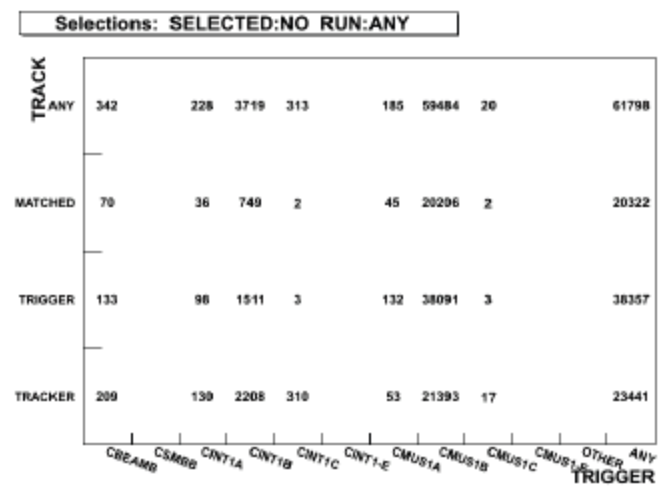
In this task the following class is used:

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");
```

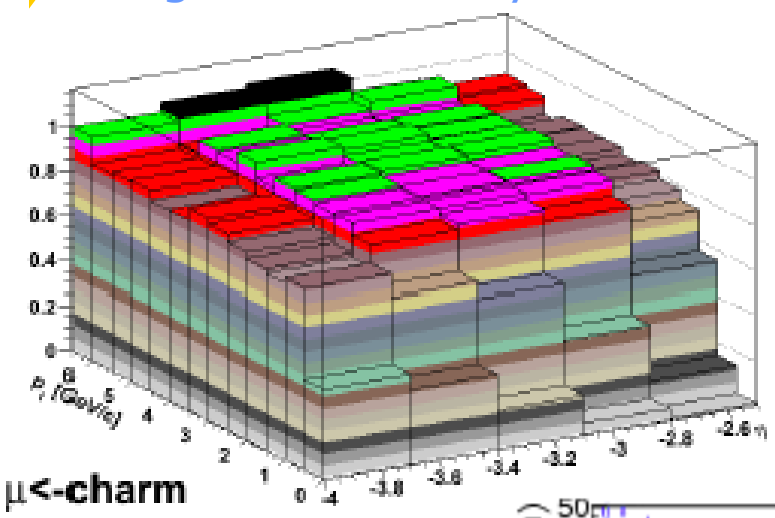
```
fTrackCounters->AddRubric("track", "tracker/trigger/matched/any");
fTrackCounters->AddRubric("trigger", "CINT1A/CINT1B/……/any");
fTrackCounters->AddRubric("run", 1000000);
fTrackCounters->AddRubric("selected", "yes/no");
fTrackCounters->AddRubric("triggerRO", "good/bad");
```



Other analysis tools: CORRFW

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

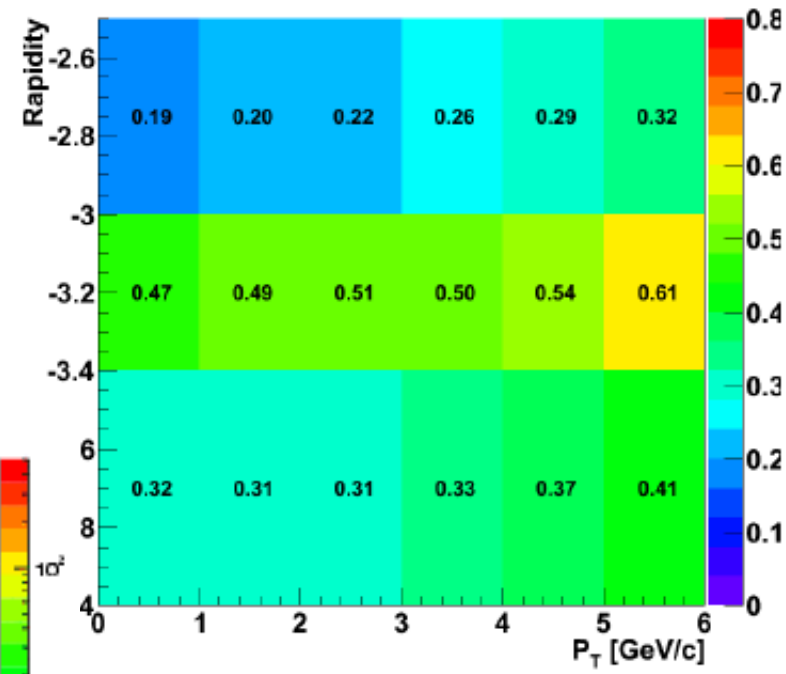
- Single muon analysis

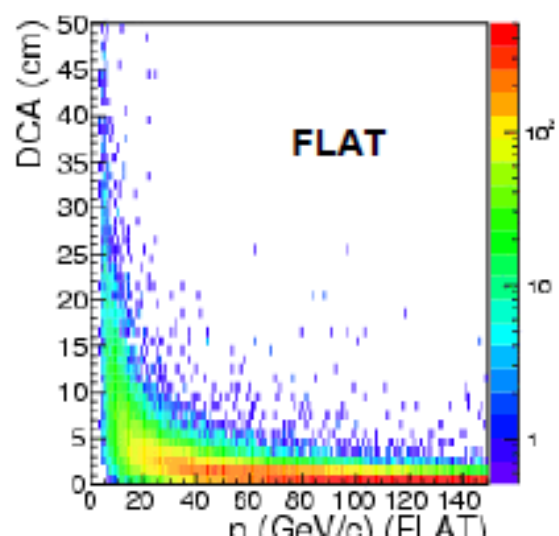


X. Zhang

- 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) ~200 10^6 events

    N. Bastid

  - 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 ~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?

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