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# PWG2 Analysis status

Adam Kisiel,  
CERN

for the PWG2 group

# Outline

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- PWG2 subgroup status
  - Spectra, V0's
  - EbyE
  - Resonances
  - Flow
  - Femto
- PWG2 analysis train exercise
- Event mixing discussion

# Proton analysis (SPECTRA)

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- **The updated QA code in SVN contains:**
  - information about the vertices: TPC-SPD-Tracks (efficiencies)
  - Correlation plots between Nclusters(TPC)- $\eta$ - $\phi$
- **Further review of the existing code is on the way to deal with:**
  - Proper definition of “findable” tracks for secondaries (QA)
  - Particle identification based on the raw TPC dE/dx information both in the QA and in the actual analysis code (thanks to Alexander Kalweit)
  - The interface to the correction framework
- **Still to come: updates on the correction tasks**
- **Readiness for the train: code has been tested on CAF-GRID**
  - Simple macro that steers the analysis code (analysis type+cuts) is already in SVN



# SPECTRA – Cascades ( $\Xi, \Omega$ )

Situation on October, 28<sup>th</sup> (PWG2 meeting)

1. QA task dedicated to Cascade, ESD only (PWG2/SPECTRA)
2. Class AliAODcascade available (STEER)

Recent developments :

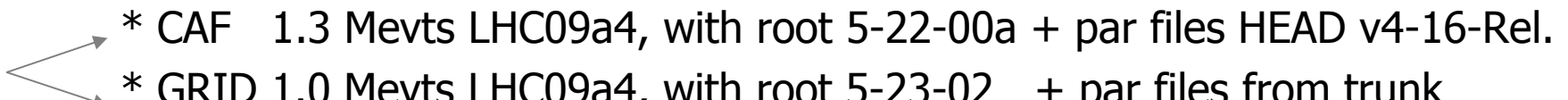
1. AnalysisTaskESDfilter+AODEvent updated to properly include Cascades at AOD level.

→ Code in SVN : [trunk/ANALYSIS](#) + [branches/v4-16-Release/ANALYSIS/](#) (See Savannah - #47433)

2. Extension of the QA task : AlinAnalysisTaskCheckCascade

41 TH1F+ 8 TH2F / ESD ... or AOD / pp or PbPb / Inheritance from AliAnalysisTaskSE

Tested on : \* local machine (alien catalog + local evts), with : trunk and HEAD v4-16-Rel.

*ESD only* 

- \* CAF 1.3 Mevts LHC09a4, with root 5-22-00a + par files HEAD v4-16-Rel.
- \* GRID 1.0 Mevts LHC09a4, with root 5-23-02 + par files from trunk

→ Task + « central » macro in SVN in [trunk/PWG2/SPECTRA](#)

To do :

1. Validation of this QA task within an « official » analysis train
2. New task : reconstruction efficiency for cascade

# RSN package status 1

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- Two main observations from core offline:
  - redundant copy of data from source (ESD, AOD, MC) with creation of an unnecessary duplicate stack
  - “non standard” implementation of event mixing
    - ...done to be able to run in CAF
- Work in progress (80% complete) to fix this
  - replaced data copying with reference pointers to data sources
    - **AliRsnDaughter** and **AliRsnEvent** will contain pointers to the source tracks and events, and they will not be stacked in memory, but used “on fly” during analysis
    - they will contain few data members which are necessary to organize data within the analysis work-flow (e.g.: easy retrieval of info about kink nature of a track)
  - made analysis objects “aware” of the input type, to keep being able to deal with any kind of input source (ESD, AOD or MC)
  - work going on to implement an AliAnalysisTaskME object for mixing

# RSN Status 2

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- Core offline allowed the use of current package version for AnalysisTrain in the few weeks necessary to complete the package revision
  - SVN status updated with a currently working version
  - analysis train macro already sent to Adam for testing
  - tutorial macros available in SVN
- Estimation of time required for committing revised package:
  - in progress
  - most part of work already done and tested
  - almost completely transparent to user
    - very few changes required in the analysis macros for single-event analysis
    - simple migration to multi-event analysis for event mixing

# Status of PWG2/FLOW

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- Flow code uses the Analysis Framework and the Correction Framework
- It can run locally in aliroot or root (with par files), on CAF and Grid.
- Several flow methods are part of the PWG2 train



# Status of PWG2/FLOW

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- **Recent developments:**
  - Splitting of the flow libraries in two;
    - AliFlowCommon (flow analysis code, aliroot independent)
    - AliFlowTasks (analysis framework classes)
  - Further improvement of the implemented methods and macros: Scalar product (reaction plane), cumulant (from generating functions and Q-vectors), Lee-Yang Zeroes, Reaction Plane with Lee-Yang Zeroes
  - Set up a mailing list
    - [alice-project-flow@cern.ch](mailto:alice-project-flow@cern.ch)
- **Ongoing longer term developments:**
  - Using PID for flow analysis
  - Flow analysis for charm and jets using an interface to the PWG3 and PWG4 AODs
- **Needed Additional developments:**
  - Store the flow-vectors from detectors in the AOD and make all methods work on just the flowvector
  - Get flowvectors from other forward detectors (FMD, PMD)
  - Get reaction plane estimate and resolution from the ZDC and compare the results with other methods

# AliFemto status

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- The code is in SVN, together with example macros. Code conforming to ALICE standards. New classes needed for the Train Exercise were added
- Several Analysis blocks and analysis proposals have been added during the exercise, code for them is being added to SVN. Train wagon consisting of three analysis blocks created (macro in SVN).
- Femto group meets on a monthly basis to discuss code and physics issues. TWiki page is maintained.
- Femto code is kept in a ready and working state, an effort to include UniCorr in Alice is ongoing.

# Event characterization

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- First analysis code: multiplicity measurement from FMD is in SVN (not in PWG2 subdirectory)
- Will try to include it in the next PWG2 train

# PWG2 analysis tasks status

PWG2	<a href="#">AliAnalysisTaskProtons</a>	p/pbar analysis	ESD/AOD/MC	Histograms, CF containers	OK	OK	OK
PWG2	<a href="#">AliAnalysisTaskFemto</a>	Femtoscopy	ESD/AOD/MC	Histograms	OK	OK	OK
PWG2	<a href="#">AliAnalysisTaskCheckV0</a>	V0 check	ESD/AOD	Histograms	OK	OK	OK
PWG2	<a href="#">AliAnalysisTaskESDDedx</a>	Dedx analysis	ESD	Histograms	?	?	?
PWG2	<a href="#">AliAnalysisTaskStrange</a>	Strangeness	ESD/AOD	Histograms	OK	OK	OK
PWG2	<a href="#">AliAnalysisTaskESDStrangeMC</a>	Strangeness on MC	ESD/MC	Histograms	?	?	?
PWG2	<a href="#">AliAnalysisTaskFlowEvent</a> + tasks using info from this	Flow analysis	ESD/AOD/MC	AliFlowEventSimple + QA hist Histograms	OK	OK	OK
PWG2	<a href="#">AliRsnAnalysisSE</a>	Resonances analysis	ESD/MC	Histograms	OK	OK	OK

# PWG2 Analysis Train

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- PWG2 Analysis Train exercise has been proposed in January PWG2 meeting
  - Proposal was made to the PWG2, discussed within software coordinators
  - Procedures and tools were defined, exercise was announced to PWG2
  - Timescales for the first train were defined at the PWG2 meeting in February,
  - The exercise is being executed since then

# Tasks for the PWG

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- **Preparation of individual analyses**
  - Authors responsible for SVN submission and initial tests. Integration of analyses into tasks by software coordinators.
- **PWG mini-train**
  - Attempt to integrate all cars from PWG. Test on CAF(?) and GRID(?). Final approval of train content.
- **Train debugging**
  - Interaction with the offline and response to problems.
- **Results analysis**
  - Each author responsible for retrieving his results and providing feed-back (results OK, not OK, what to change)

# Train Exercise webpage

- <https://twiki.cern.ch/twiki/bin/view/Alifemto/PWG2AnalysisTrainExercise>

## Examples of analysis blocks

Once a given physics analysis proposal is converted into corresponding code and configuration macro, it should be reported to the software coordinator. Some additional information should be specified in order to judge where a given analysis should be attached.

Physics description	Required input	Type of output	Libraries used	Macro status	Suggested train
Pion CF vs. kt	ESD or AOD	2x <kt bins> TH1D <sup>?</sup> data 3x <kt bin> TH3D <sup>?</sup> data ~10x <kt bin> TH2D control histos ~10x <kt bin> TH1D control histos	PWG2femtoscopy PWG2femtoscopyUser	Done <ALICE HOME>/trains/train1 /ConfigFemtoAnalysis.C	pp 10 TeV 1M events
Pion CF vs. kt vs. mult	ESD or AOD	2x <mult bins> x <kt bins> TH1D <sup>?</sup> data 3x <mult bin> x <kt bins> TH3D <sup>?</sup> data ~10x <mult bin> x <kt bins> TH2D <sup>?</sup> control histos ~10x <mult bin> x <kt bins> TH1D <sup>?</sup> control histos	PWG2femtoscopy PWG2femtoscopyUser	Done <ALICE HOME>/trains/train2 /ConfigFemtoAnalysis.C	pp 10 TeV 100M events
Pion CF in Spherical Harmonics	ESD or AOD/Kinematics	20 x TH1D <sup>?</sup> data 2x TH3D <sup>?</sup> data	PWG2femtoscopy PWG2femtoscopyUser	Done <ALICE HOME>/trains/train2 /ConfigFemtoAnalysisSH.C	pp 10 TeV 1M events pp 10 TeV 100M events
Pion-kaon CF	ESD or AOD	12 x TH1D <sup>?</sup> data ~20 TH2D <sup>?</sup> control histos ~20 TH1D <sup>?</sup> control histos	PWG2femtoscopy PWG2femtoscopyUser <sup>?</sup>	In preparation	pp 10 TeV 100M events

# Preparations of the PWG2 train

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- Timescales for PWG2 train preparation (as presented at the February PWG2 meeting):
  - Analysis blocks from members: Friday 27<sup>th</sup> Feb
  - Preparation and testing of subgroup mini-trains (group software coordinators): Friday 6<sup>th</sup> March
  - Preparations and testing of the PWG2 train (PWG2 software coordinator): Friday 13<sup>th</sup> March
  - Train running: starting March 16<sup>th</sup> (possible conflict with Offline week)
  - Discuss first results during ALICE week



# Exercise execution

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- The plan for the exercise has been discussed and approved at the PWG2 meeting in February
  - Analysis blocks have been submitted to respective subgroup software coordinators by Feb 27<sup>th</sup>

<https://twiki.cern.ch/twiki/bin/view/ALICE/PWG2ResonancesFirstAnalysisTrainexercise>

<https://twiki.cern.ch/twiki/bin/view/Alifemto/FirstAnalysisTrainexercise>

- Subgroup macros have been created and submitted to SVN last week
- The “PWG2 train” macro has been assembled and contains components from: Flow, Femtoscopy, Spectra/V0, Resonances. It was successfully run on the recent LHC09a4 production. Results validation will happen this week.

# Observations and TODO

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- Train exercise has been a stimulus for code submission, cleanup and development
- Framework worked reliably and as expected. Problems with wagons interaction found and fixed (can only be done in full train)
- Moving towards the AddAnalysisTask macro format (RSN: done; Femto, Flow, Spectra: Close)
- Established procedures to create and submit new analysis blocks, initial time estimates were realistic
- The results validation is ongoing in all subgroups, will be discussed at the PWG2 session of ALICE week

# Technical discussion

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- Code runs on ESD with Kinematics so far, will attempt to run on AOD as well.
- Would be useful to have merged tag files created automatically for simulation – will be a requirement for the Event Mixing with Event Pool mechanism
- Place to store the configuration macros is still being worked out:
  - Will store per-subgroup and PWG2-wide macros in AliRoot SVN (AnalysisMacros directory + train substructure)
  - Each block author must provide AliEn directory where his code was successfully run, with example results

# RSN functionalities proposal

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- Event mixing:
  - AnalysisTaskME is an optimal solution, and it will be the default, but:
    - in the “simple” case of protons, what about taking into account the idea of buffer of “mini” events like it is implemented in current RSN package?
    - is there any other “alternative” event mixing implementation (= no AnalysisTaskME) in analysis code for other topics?
  - How to take in consideration multiple binning criteria for event mixing?
    - difference in primary vertex position ( $V_z$ )
    - track topology (angular distribution)
    - each additional criterion --> a new array dimension in the event pool binning
  - Will it be possible to run an event mixing with AnalysisTaskME on CAF?
    - known problem: each CAF node “sees” only a part of events
      - --> “selective” staging of data?
      - --> unique buffer with event-to-event comparison functions?

# RSN functionalities proposal

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- PID weights:

- currently, in ESD --> AOD conversion, the PID weights used are the “combined” ones only, as they come from `AliESDtrack::GetESDpid(Double_t*)`
- **proposal:** allowing the user to “customize” how these weights are built from combination of the PID weights of each detector (e.g.: PID from TPC only for first physics?)

- PID-aware index arrays

- when analyzing an event for 2-particle correlations, one needs 2 nested loops over the whole track collection and skip all tracks with “wrong” PID (e.g. when doing  $\Phi$  analysis, we look for Kaons only)
- **proposal:** implement a “sorter” which returns the indexes of all tracks identified of each type only, in order to speed up these loops, or any kind of “PID filter” to be used for fast retrieval of tracks of a given PID

# Event mixing definitions from PWG2

- Event mixing is used extensively to construct “uncorrelated background” in PWG2 studies
- One needs to mix “similar” events so that the “background” does not have the “signal correlations”, but includes “non-signal correlations”
- Some requirements are compatible, but often one analysis' “signal” is another one's “background”, hence conflicting event mixing requirements arise

	Femtoscopy	Resonances	Flow	EbyE/Event structure	
z-vertex	YES	YES	YES	YES	Common ground
Centrality	YES	YES	YES	YES	
Multiplicity	coarse	coarse	coarse(?)	Very fine	Analysis specific
Reaction plane	YES	YES	NO/N.A.	NO	

# Analysis with event mixing

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- **Mixing procedure produces large memory footprint**
  - Buffer of input events – can be reduced in several ways, should be manageable
  - Per-mixing-bin output histograms – can be bigger than input event buffer, not so easy to reduce in size, as the size is usually defined by physics requirements
- **EventPool must be used to reduce number of mixing bins per single job – to manage the memory footprint.**
  - Some event mixing inside each task seems unavoidable due to physics requirements, with the “single train” concept
  - Other solution: run several separate trains for different event mixing configurations: can easily get out of control

# The End

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