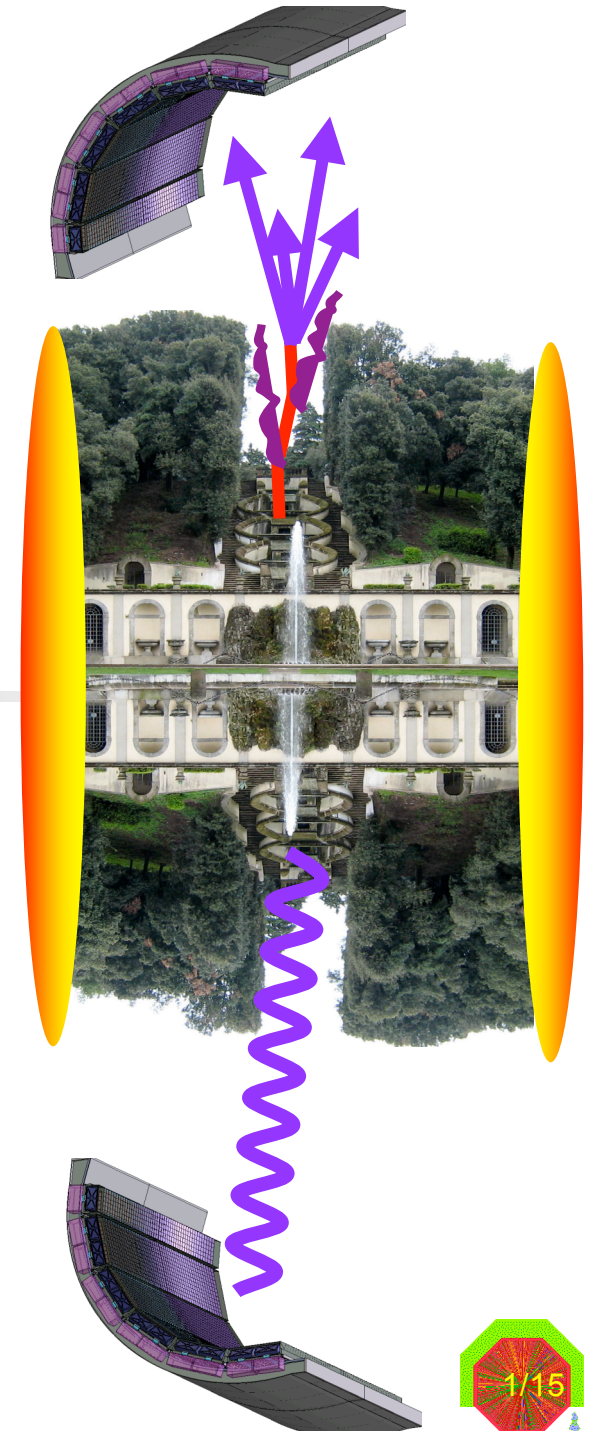


# EMCal Offline Code Status: Introduction and tasks

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# Outline

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- Introduction for non experts
- Geometry tasks
- Simulation tasks
- Reconstruction tasks
- Online calibration tasks
- Offline calibration tasks
- Analysis tasks



# Fast introduction for non experts

(and to refresh memory for the rest)

- **Simulation steps:**
  - **Generation:** PYTHIA, HERWIG, HIJING
    - Kinematics.root filled with generated particles
  - **Particle transport:** GEANT (default) - FLUKA
    - Geometry of Alice taken into account
    - Kinematics.root filled with particles generated in material
    - **Hits generation (EMCAL.Hits.root):**
      - Definition : energy deposited in a point of the detector
      - Consists of: Energy, hit time, tower ID, position, primary generated particle ID.
      - Many hits per tower.
  - **Digitization:**
    - **SDigits (EMCAL.SDigits.root):**
      - Sum of hits per tower.
      - Consists of: deposited energy per tower (GeV), tower ID, most recent time, list of primaries that contribute.
    - **Digits (EMCAL.Digits.root)**
      - SDigit with energy transformed into ADC units plus random noise and time smearing
  - **Raw Data:**
    - Digits transformed into ADC pulse shapes.
    - A digit supposed to be the amplitude extracted after the fit of the pulse shape.



# Fast introduction for non experts

- **Reconstruction steps:**
  - Can start from digits or from raw data (produce digits).
  - **Clusterization**
    - Towers grouped in clusters with one more or less central maximum tower.
    - **RecPoints (EMCAL.RecPoints.root):**
      - Consists of: Sum of the towers in the cluster (GeV), reconstructed local EMCAL position, time, list of digits ID, shower shape parameters (ellipse axis, dispersion ...)
  - **Tracking**
    - Matching between tracks in the central barrel and EMCal surface.
  - **Particle identification PID:**
    - Bayesian method.
  - **Event summary data (ESD): AliESDs.root**
    - Collects information of all detectors.
    - Final output of reconstruction for analysis.
    - Calorimeters (EMCAL/PHOS) information kept in
      - **AliESDCaloCluster:** Consists of Cluster energy, global position, shower shape parameters, time, index of matched tracks, Bayesian PID weights, primary particles index, list of towers ID
      - **AliESDCaloCells:** Consist of tower amplitude, ID and time.
- **Analysis oriented data (AOD): AliAODs.root**
  - Filtered ESDs.
  - Final analysis must be done with them.
  - Calorimeters keep same information as in ESDs (except time).



# Fast introduction for non experts

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- More definitions:
  - OCDB: Offline Conditional Data Base
    - Information from the pit/DAQ and other systems is kept here for access during reconstruction, not Raw Data:
      - Calibration parameters
      - Temperature
      - ...
  - Shuttle and PreProcessors
    - Ship the information from online (pit/DAQ etc) to offline world (the OCDB) since access to the pit computers is restricted. Not Raw Data.
    - Some of this information is preprocessed before keeping.
      - Put average temperatures for a period in histograms.
      - Do some gain equalization for calibrations.
      - ...



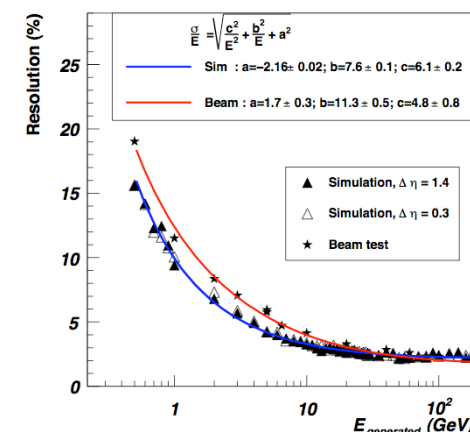
# Geometry tasks

- Space frame and detector complete geometry in place.
- Task: Year one geometry implementation.
  - Options:
    - 2 SM:  $80^\circ < \phi < 120^\circ$ ,  $-0.7 < \eta < 0$  (on the pit now)
    - 3 SM:  $80^\circ < \phi < 160^\circ$ ,  $-0.7 < \eta < 0$
    - 4 SM:  $80^\circ < \phi < 120^\circ$ ,  $-0.7 < \eta < 0.7$
  - Task not urgent, not really important in simulations, but to be done in the next months by Jenn or Gustavo.
- Task: Move geometry to independent library.
  - Now geometry fully dependent on full AliRoot, need to move it to an independent library for analysis purposes.
  - Magali's in charge (see her talk?).
- Task: Test misalignment with realistic survey.
  - Detector geometry implemented is ideal.
  - Geometry can be modified shifting the SM volumes with measured values.
  - Need survey data to test misalignment in software, check overlaps.
  - Jenn or somebody else in charge?

# Simulation tasks

## ★ Task: Light yield (or else) correction to match Beam Test resolution results.

- One possible factor among many others, light yield attenuation is not considered.
- **Need to identify manpower to work on this now.**
- See discussion in Delias's session.
- Task: Implement realistic time resolution.
  - Extract time resolution from beam test
  - See David's presentation.
- Task: Handling of the time information from hits during digitization
  - Simple method to associate time to a digit. New method needed.
  - Nobody in charge, to be done after redesign of sdigits/digits is done.





# Simulation tasks

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## Task: Trigger simulation

- Need modification of sdigits definition in order to
  - simulate triggers
  - Take into account pile-up
- Sdigits should be pulse-shape like
- New branch at the digits level to consider "trigger digits"
- Rachid in charge, see his presentation.
- Task: Implement embedding procedure
  - For example, mix real background or signal in simulated events.
  - Nobody in charge, to be done after sdigit/digit modifications are done.





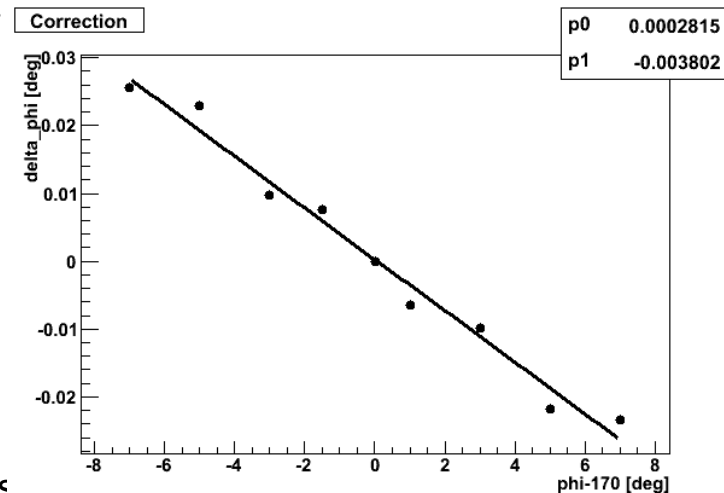
# Reconstruction tasks

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- ★ Task: Dead/hot channels consideration during reconstruction
  - Online DA already available to define which channels are bad (see David presentation)
  - Need to retrieve the list from the ODCB, and put them to 0 during the reconstruction.
  - See effect of N% of bad channels in reconstruction.
  - Gustavo can work on the implementation.
- Task: Effect of misalignment in reconstruction
  - Related to misalignment in geometry task.
  - Nobody in charge

# Reconstruction tasks

- Task: Cluster unfolding implementation for  $\eta \neq 0$ 
  - Cynthia studied and implemented 1.5 years ago the "simple" case  $\eta = 0$
  - Nobody in charge right now (postdoc at SUBATECH?)
- Task: Track-matching
  - Implemented 4 years ago by Alberto
  - Many improvements-bug corrections done recently
  - See Jenn's/Ken's talk.
- Task: Correction of cluster reconstructed phi shift
  - Small shift in the reconstruction of global phi position when close to the phi borders of the supermodule.
  - Paola is investigating this issue.





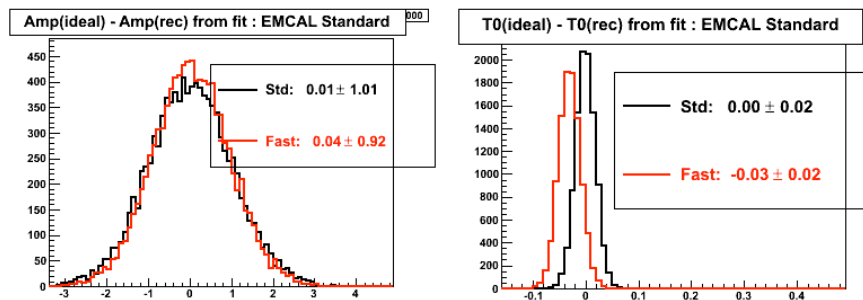
# Reconstruction tasks

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- Task: Bayesian PID
  - Parameters recalculation needed, different for pp and PbPb environment.
  - Make it possible to use during analysis, like for the geometry, to recalculate PID.
  - Marie in charge, see her talk.
- Task: Simple PID
  - Identify clusters just with a simple shower shape parameter: main ellipse axis
  - Study photon, pi0, hadron identification:
    - With GEANT and FLUKA
    - 3 cases, single particle only EMCAL, single particle ALICE material, single particle+ALICE material+HIJING background.
    - Pseudo-rapidity dependence.
    - Compare shape of clusters in beam test.
    - Amaya in charge until she goes (unfortunately nothing to show now)

# Raw data and monitoring QA tasks

- Task: Raw data fitting
  - Now: TMinuit used, too slow, too dependent on initial parameterization.
  - Fast fitting procedure investigated by Alexei, see his presentation.



## Task: QA

- Need to check all the steps from simulation and raw reading to ESD creation in case of problems.
- EMCal software incorporated to the general QA frame developed by Yves.
  - New: Raw data QA incorporated a week ago, all steps are checked. Thanks to David.
- Right now few histograms filled for each step.
- What is missing:
  - Define the histograms for experts and shifters.
  - Define reference for these histograms.
- Sevil, with the help of David is in charge. See David's presentation.



# Online Calibration Tasks

- See David's talk, here just some summary.
- Task: DAQ Detector Algorithms (DA):
  - 2 DA and preprocessor available and working,
    - EMCALLEDDA: LED amplitude vs time.
    - EMCALPEDDA: DeadMaps+Pedestal info.
  - DA for pi0 calibration, Hisa's (PHOS) method. David contacts Hisa.
- Task : HLT: same as with DAQ can be done here
  - Mateusz can export existing DAQ code to HLT (next weeks)
- Task DP (Data Points): New data points to be added
  - TPC plans to keep some parameters of the pedestals ZS in the OCDB, since we use the same electronics, we can do the same.
  - Not clear why could this be interesting, David follows this issue.
- Task: Time dependence online calibration interface
  - Place holder classes already there.
  - To be done in next months (ORNL?)



# Offline calibration tasks

- PHOS and EMCAL had a joint effort.

## ★ Task: Calibration with Pi0

- Strategy discussed last week and we somehow know how to proceed.
- See Yuri's talk.
- Gustavo can work here with some help.

## ★ Time dependent calibration with Pi0

- After discussion last week with offline team, we have to consider a procedure for doing this during the reconstruction.
- Check run by run (or any other time length), the pi0 peak in a full SM, or strip ... not channel by channel.
- To follow by Gustavo and David, but somebody new is welcome.
  - See David's talk.

- Task: Calibration with tracks

- Electrons
- MIPs?



# Analysis tasks (first data)

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- ★ Task: Single  $\text{Pi}^0$  spectra
  - Need to create a group.
  - See Yuri's presentation on the work done in PHOS.
  - People involved now: Jocelyn, Gustavo and maybe David.
- Task: Direct Photon spectra
  - Depends on luminosity, running time, etc.
  - First we need to fully understand the  $\text{pi}^0$  spectra, it will take time.
  - Correlations?
- Task: Electron spectra.
- Task: Jets in EMCal acceptance?
- $E_T$  measurement vs centrality.