Energy Calibration of the Panda EMC using neutral pions

Status Report

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Outline

- The purpose of the calibration
- Steps of the energy calibration
- Strategy
- Integration
- Implementation
- Results
- Future plans

The purpose of the calibration

- the EMC channels gives different response for the same stimulus due to different reasons
  for example:
  - 'physics' - different light yields, different radiation damage
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  for example:
  - 'physics' - different light yields, different radiation damage
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- the purpose of the calibration to ensure that all the EMC channels gives the same response for the same stimulus

Steps of the energy calibration of the EMC

- 'preliminary' calibration with cosmic muons
    - rough calibration, based on the energy deposit in the crystals of a minimum ionising particle (cosmic muons)
        - this serves a calibration which is accurate within 10-15%

Steps of the energy calibration of the EMC

- 'preliminary' calibration with cosmic muons
- testbeam-calibration @ Julich
  - practically identical situation as at the HESR will be, but with p-p collisions
    - should serve a proper calibration

Steps of the energy calibration of the EMC

- 'preliminary' calibration with cosmic muons
- testbeam-calibration @ Julich
- 'on-line' calibration
  - calibration should be made on-line during data-taking

    Pro. better control on - for example - light-yield changes due to temperature instability, radiation damage, ..., etc.

    Con. the forward part of the EMC will be calibrated more frequently than the backward part of the EMC

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  - (neutral) pions are the most suitable:
    - large production cross section
    - narrow peak (accurate determination of the peak position)
    - invariant mass of the pion is very well known

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  - $M^2_{\gamma_i\gamma_j} = 2E_{\gamma_i}E_{\gamma_j}(1 - \cos\alpha)$

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  - This is an iterative method

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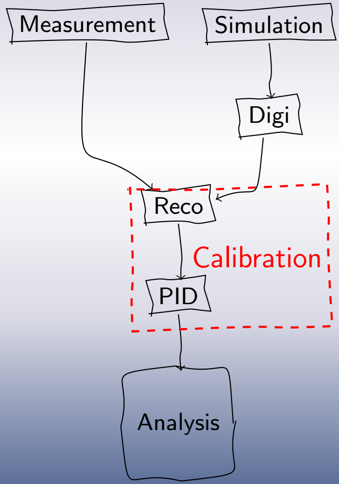
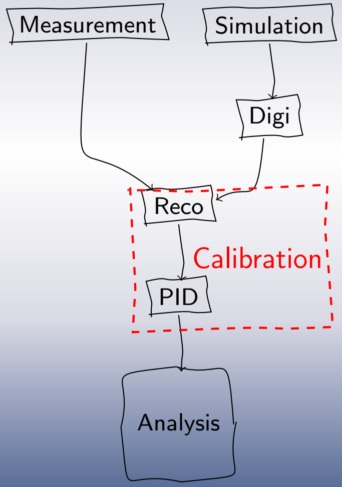


- The calibration constants enters at the 'Reconstruction'
  - Because of - for example - the reconstruction of the impact point of the particles also depend on their (real) energies

Integration



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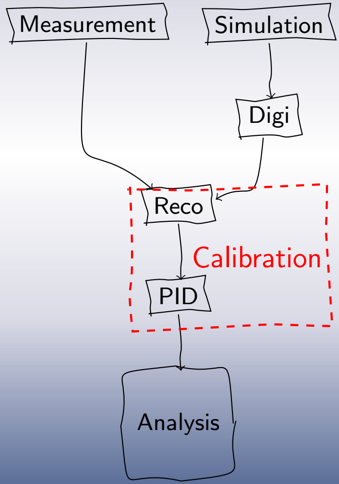

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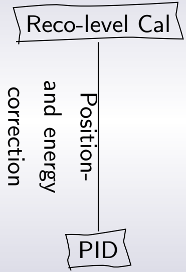
  - the other corrects the energy only
    - this second one is fast

Energy Cal

Integration



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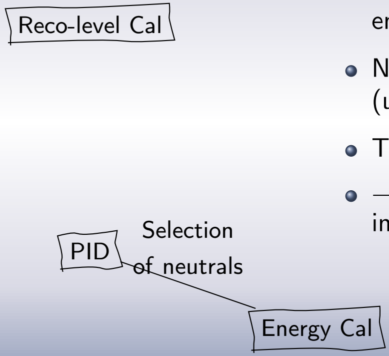

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Calibration → Energy Cal

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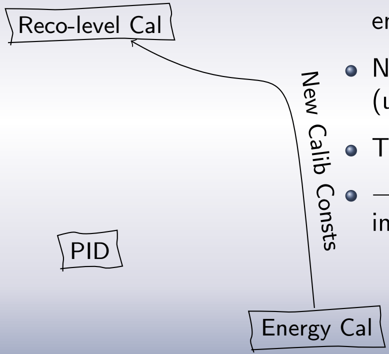

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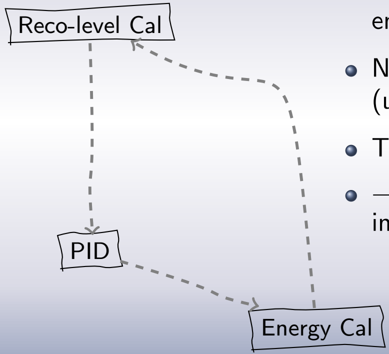

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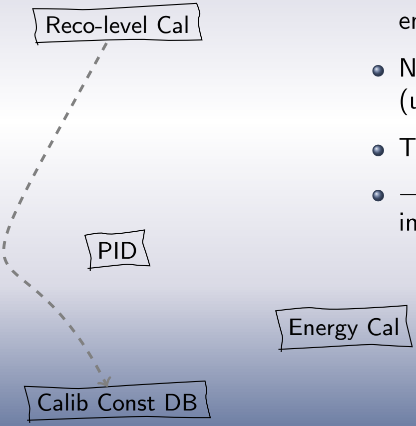

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Implementation

The energy-calibrator consists of

- Server
  - select pion-candidates (2-photon events),
  - serves an array of a given number of candidates to the actual iterative calibrator

Implementation

The energy-calibrator consists of

- Server
- Calibrator (client)
  - does the (iterative) energy calibration (fitting, correcting, ..., described above),

Implementation

The energy-calibrator consists of

- Server
- Calibrator (client)
- DB (client)
    - stores the calibration constants in some database (file or SQL (presently reads and writes calibration file))

Results

- Simulation
    - $2*10^6$ events with $\pi^0\pi^0\pi^0$ events
    - $2*10^6$ events with $\pi^0\pi^0$, $\pi^0\pi^0\pi^0$, $\pi^0\eta$, $\pi^0\eta'$, $\eta\eta$, $\eta\eta'$, $\pi^0\pi^0\eta$, $\pi^0\eta_c$, $\eta_c\gamma$, $\pi^0\gamma$ events (1/10 weights on every channel)
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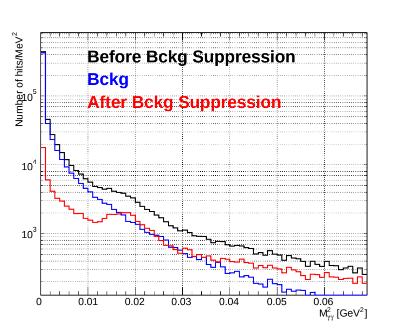

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  - On the [0.06-0.2 GeV] range
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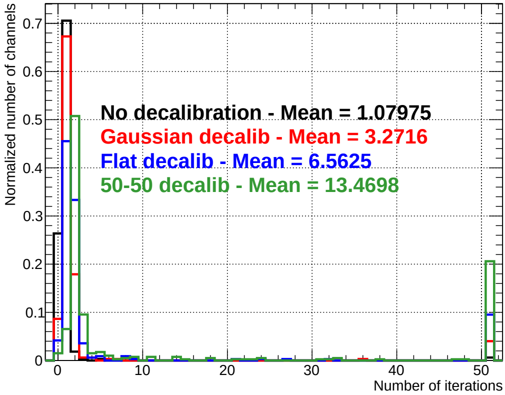
  - Stopping criteria:
    number of iteration reaches the maximum (50) ***OR***
    $((M^0_\pi - 0.0005) \leq (M^0_\pi) \leq (M^0_\pi + 0.0005))$

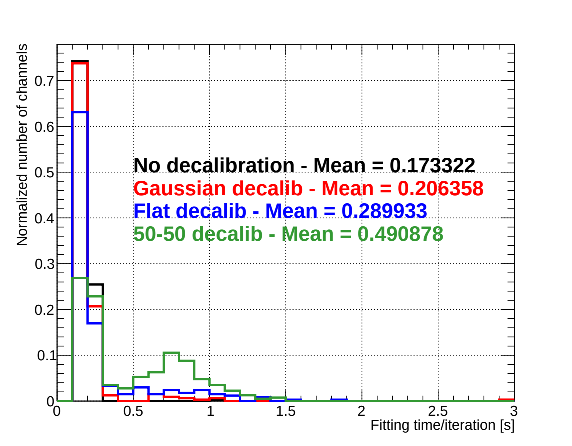
Results

Number of iterations



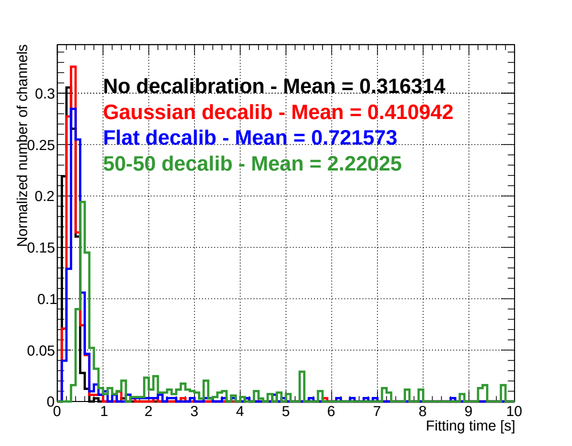
Results

Time for fit/iterations



Results

Time for fit



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- implementing the connection to the DB (Which one?)

Thank You!

I wish You Merry Christmas and Happy New Year!

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