# Calibrations – Data flow and computing

KLOE-2 Computing mini-Workshop
13-06-2015 LNF

Eryk Czerwinski & Simona Giovannella & Elena Perez del Rio & Antonio Passeri

# Overview

- Drift chamber calibration procedures
  - Hardware status
  - Cells t0 measurement
  - s-t relations check and calibration
- Calorimeter calibration procedures
  - Energy calibration
  - Time calibration
- Data quality monitor
- Summary table

# Drift chamber calibration

- Hardware status → DB information
- t0 of the drift chamber cells
- DC run-wise parameter calibration
  - DC check
  - DC calibration

# Drift chamber calibration

- Hardware status
  - Dead and hot channels are evaluated every two days
  - Triple check to disentangle sources of dead/hot channels
  - Three runs are taken
    - Synchronized with Run_Control → run type
    - Pulse and cosmic events are taken
    - Data analysis is launched at the end of the run on the offline farm
    - List of dead/hot channels set to the DB

# Drift chamber calibration

- Time offsets of the sense wires → t0's
  - Time offset of the cells due to the electronics chain from the preamplifier to the TDC input
  - Dedicated calibration run at the beginning of the run period and every time there is a change in the FEE settings
  - ~ 30 M cosmic events are used
  - $t_{drift}$ + t0 distributions fit for every one of the 12582 sense wires

$$a + b\,\frac{e^{-d(t-t_1)}}{1+e^{\frac{-(t-t_0)}{c}}}$$

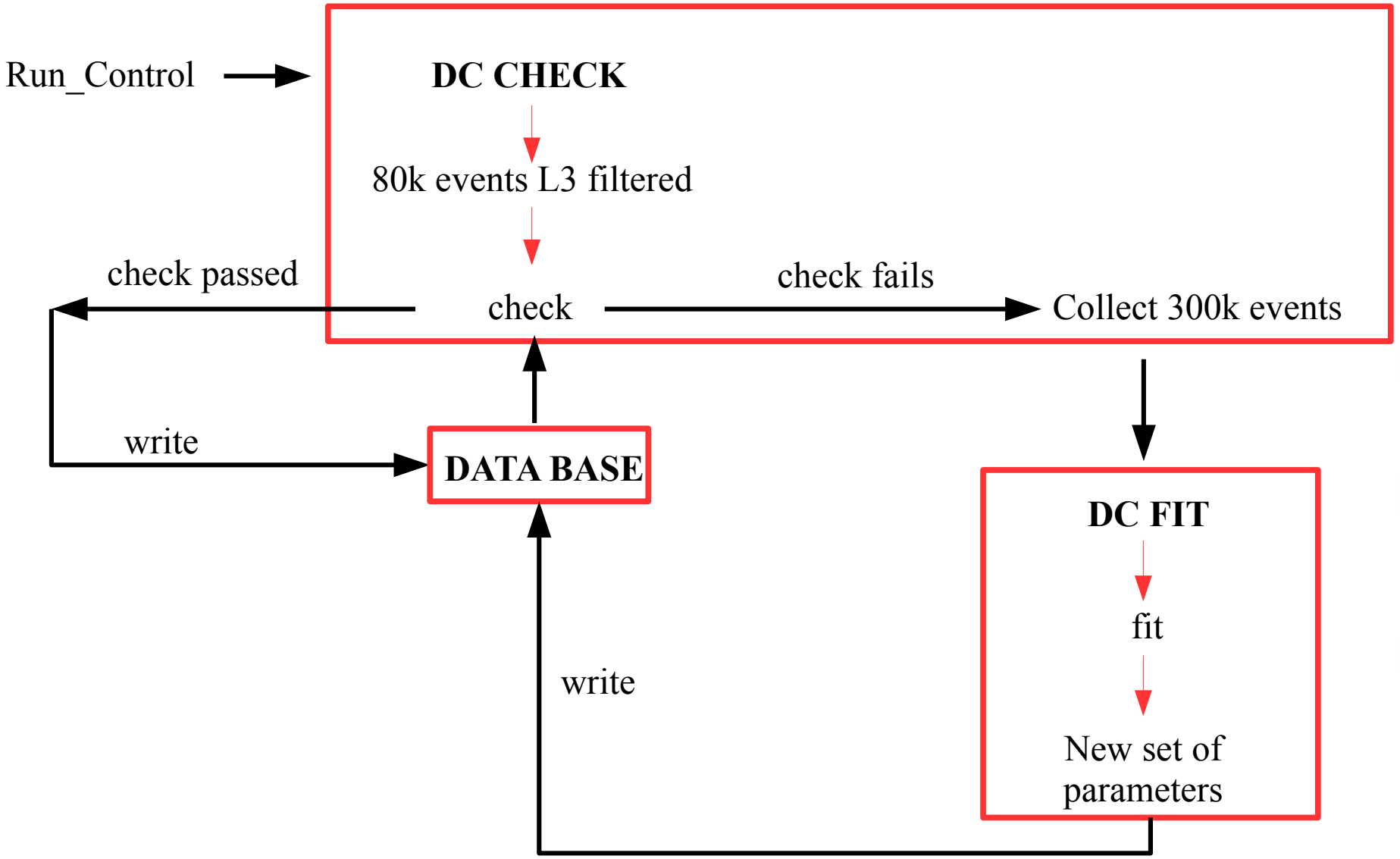
noise

Time resolution close to wire

# Drift chamber calibration

- Run-wise DC calibration
  - Cosmic events online selected by L3 filter
  - Evaluation of the s-t relations in the chamber
    - Parametrized by Chebychev polynomials up to 5$^{th}$ order
  - Performs check of the current relations on a 80k cosmic rays sample
  - If needed performs a new calibration and sets new parameters to the DB based on 300k events
    - About 4 hour process all together with stable running conditions
  - Offline reconstruction done only if calibration is present

# Drift chamber calibration



# Calorimeter calibration

- Calorimeter calibration procedures
  - Energy calibration
  - Time calibration

## Calorimeter calibration: Energy

$$E_i(MeV) = \frac{ADC_i - PED_i}{MIP_i} * Mip2MeV * K_{Ei}$$

**PEDs measured by dedicated runs w/o zero-suppression every 2 days. Averages calculated online and uploaded in DB after end-run.**

**MIPs measured with dedicated long cosmic runs every few months. Dedicated filters for different detector regions run online to insure enough statistics coverage: 12 Gbyte of data for the overall barrel + >15 Gbyte for ECAPs written on tape. Analysis is run manually on the offline farm and takes few hours. From time to time MIP values in ADC counts are equalized by adjusting PM HVs.**

**Mip2Mev is an overall conversion factor evaluated from offline shower analysis.**

## Calorimeter calibration: Energy/2

$$E_i(MeV) = \frac{ADC_i - PED_i}{MIP_i} * Mip2MeV * K_{Ei}$$

$K_E$ are the fine energy calibration constants calculated every 800 $nb^{-1}$ by a process launched at the end of each run: $e^+e^- \rightarrow \gamma\gamma$ events are selected in an online L3 filtered sample, and cluster energy is fixed to 510 MeV.

Process launched by Run_Control checks that enough luminosity has been integrated since last calibration. If yes, launches *calib_ene* process on a dedicated batch queue on the offline farms.

Clusters contained in one «column» (5 cells) are selected. Individual cell calibration constants are adjusted during a 10 iterations procedure to bring the average cluster peak to 510 MeV. Program is quite slow an takes up to few hours (on average is more than the time needed to integrate another calibration sample)

A simple authomatic calibration quality check allows or prevents writing on DB. Offline reconstruction does not start if this calibration is missing.
Experts cure offline single bad cases if needed.

# Calorimeter calibration: Time (and position)

$$t(ns) = \frac{t_A + t_B}{2} - \frac{t_{A0} + t_{B0}}{2} - L/2v - T0_{global}$$

$$z(cm) = \frac{v}{2}(t_A - t_B - t_{A0} + t_{B0})$$

$$t_{A,B} = C_{A,B} * (TDC_{A,B} - Toffset_{A,B})$$

$T_{offset}$ measured by dedicated pulse runs every 2 days. Averages calculated online and uploaded in DB after end-run.

$t_{0(A,B)}$ basic values are measured by a dedicated 1 Mevts cosmic run every 2 days. Only straight tracks are used (p> 7 GeV). Data analysis is launched at the end of the run on the offline farm. A first fast job evaluates $t_{0A} - t_{0B}$, and then launches a second long (~2 hours) job to evaluate $t_{0A} + t_{0B}$.

$T0_{global}$ is evaluated online by a dedicated spy process that gets events from the L3 $\gamma\gamma$ filter. The T0glob value that sets to zero the average T-R/c is calculated. At end-run a simple automatic calibration quality check allows or prevents writing on DB. Offline reconstruction does not start if this calibration is missing.

$$t(ns) = \frac{t_A + t_B}{2} - \frac{t_{A0} + t_{B0}}{2} - L/2v - T0_{global}$$

$$z(cm) = \frac{v}{2}(t_A - t_B - t_{A0} + t_{B0})$$

$t_{0(A,B)}$ fine corrections are calculated every 800 $nb^{-1}$ by a process launched at the end of each run: e+e-→ γγ events are selected in an online L3 filtered sample and cluster (T-R/c) is fixed to zero.

Process launched by Run_Control checks that enough luminosity has been integrated since last calibration. If yes, launches *calib_time* process on a dedicated batch queue on the offline farms.

Clusters contained in one «column» (5 cells) are selected. Individual cell calibration constants are adjusted during a 3 iterations procedure to bring the average cluster (T-R/C) to zero. Program takes less than 1 hour.

A simple automatic calibration quality check allows or prevents writing on DB.
Offline reconstruction does not start if this calibration is missing.
Experts cure offline single bad cases if needed.

# Data quality monitor

- L3ALL, L3COS and L3BHA processes
  - Run online
  - Spy data from the circular buffer
  - Filter Bhabha, $\gamma\gamma$ events and cosmics
  - Write filtered events on disk (after archiving on tape)
- PHYSMON process
  - Runs online
  - Gets data from L3ALL, L3COS and L3BHA
  - Fills data quality histograms
  - Serves to multiple browser programs

# Summary table

| process | Run type | Input data | DB input | DB output | Present Running time |
|---|---|---|---|---|---|
| Calibration triplet | dedicated runs | Online circular buffer | NO | YES | Coincide with DAQ |
| t0's | Dedicated run | Offline disk or tape | YES | YES | ~ 3 hours |
| Calibration check | Physics run | Offline disk or tape | YES | YES | ~ 2 hours |
| Calibration fit | Physics run | Offline disk or tape | YES | YES | ~ 30 min |
| Pedestals + pulses | dedicated run | Online circular buffer | NO | YES | Coincide with DAQ |
| MIPs | dedicated run | Offline disk or tape | YES | YES | ~ 4 hours |
| t0's basic | Dedicated run | Offline disk or tape | YES | YES | ~ 2 hours |
| T0-global | Physics run | Online circular buffer | YES | YES | Coincide with DAQ |
| Energy-fine | Physics run | Offline disk or tape | YES | YES | ~ 4 hours |
| t0's fine | Physics run | Offline disk or tape | YES | YES | ~ 1 hour |
| physmon | Physics run | Online circular buffer | YES | NO | |

# Summary computing situation

- Calibrations
  - Run on 4 processor /8 thread machine with 12 GByte memory
  - Present calibration scheme is well handled with a small delay respect to data taking
- Current situation → only two detectors
  - HET, LET, CCALT, QCALT and IT will need similar / new procedures