

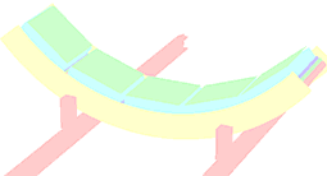
A stylized, colorful graphic of the ALICE detector at the Large Hadron Collider. The detector is shown in a perspective view, with its two main arms extending outwards and upwards. The central part of the detector is a bright yellow, while the outer arms are a light blue. The detector is supported by two large, red, V-shaped structures at the bottom. The background is white.

PHOS offline status report

Yuri Kharlov

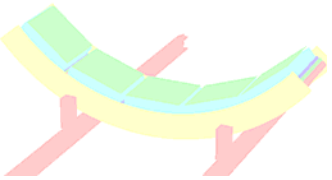
ALICE offline week

23 June 2009



Online calibration

- All needed run types were implemented in ESD: PEDESTAL, LED, PHYSICS
- LED run:
 - To find a bad channel map
 - **Implemented**, but **not deployed** in DAQ due to low performance (use of Minuit)
 - To calculate HG/LG ratio per channel
 - **Implemented, deployed** in DAQ, validated with real data
- PEDESTAL run:
 - To calculate mean pedestals needed to feed to FEE for Zero Suppression
 - **Not implemented**
 - Might be not needed if pedestals are calculated and subtracted by ALTRO
- PHYSICS run:
 - Relative gain equalization
 - **Implemented, deployed**, waiting for physics data
- At the moment working with non-ZS data. Modification needed.
- No GRP objects are needed for PHOS DA's.



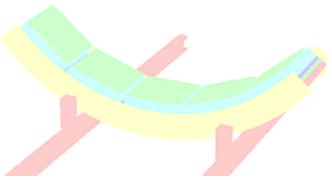
Online DA in DAQ

- **PHOSGAINda.cxx**

- collects amplitude vs time for High and Low Gain:
 - **TH2F*** fTimeEnergy[64][56][2]
- works with **non-ZS** data in **PHYSICS** runs
- DA+Shuttle @P2: **OK!**

- **PHOSLEDda.cxx**

- HG/LG ratios (one histogram per cell)
 - **TH1F*** fHgLgRatio[64][56]
- works with **non-ZS** data in **LED** runs
- DA+Shuttle @P2: **OK???**



Offline calibration

- PHOS offline calibration requires the statistics of 10^8 - 10^9 pp collisions.
- Algorithm is based in minimization of the π^0 measured mass deviation from the PDG value (135 MeV)
- Input for offline calibration:
 - ESD (AliESDCaloCluster + AliESDCaloCells) or
 - AOD (AliAODCaloClusters + AliAODCaloCells)
- OCDB requirements: need for the real (misaligned) ROOT geometry
- Calorimeter (PHOS, EMCAL) calibration is an iterative procedure, converges after 5-7 iterations.
- Implemented as an analysis task (inherits from AliAnalysisTaskSE)

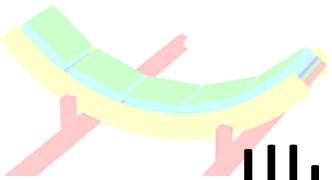
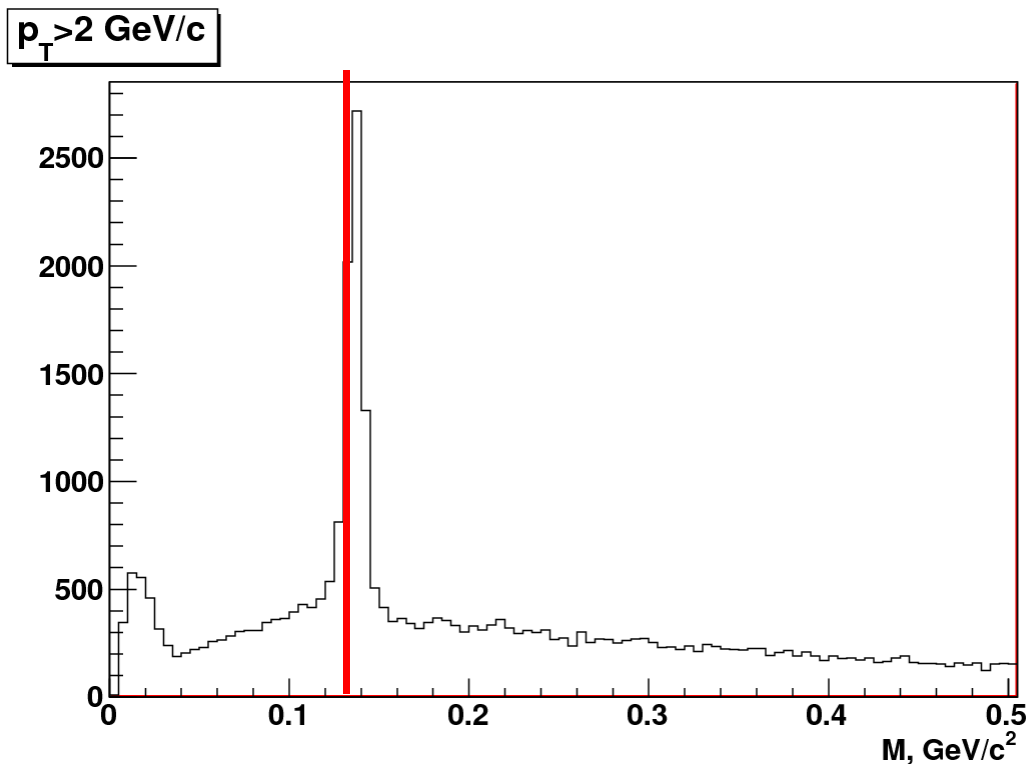


Illustration of minimization algorithm

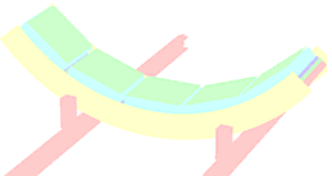


2-cluster invariant mass spectrum is accumulated for each cell; fitted by a Gaussian+polynomial to find a measured π^0 mass as a Gaussian's mean. Cluster energy is corrected to set the π^0 mass to 135 MeV .



Pi0 calibration implementation (B.Polishchuk)

- The code is in the aliroot trunk:
\$ALICE_ROOT/PHOS/macro/pi0Calib
- AliAnalysisTaskPi0CalibSelection.cxx
 - Inherits from AliAnalysisTaskSE
 - Input: collection of AliESDs.root files
 - Energy and coordinate of AliESDCaloCluster's is recalculated by applying the corrections to the calibration coefficients calculated in the previous iteration
 - Output: 5x64x56 TH1 histograms with a 2-cluster invariant mass in each cell stored in a .root file
- pi0Calib.C
 - Input: merged outputs of AliAnalysisTaskPi0CalibSelection
 - Output: corrections (of the order $O(1)$) to the calibration coefficients

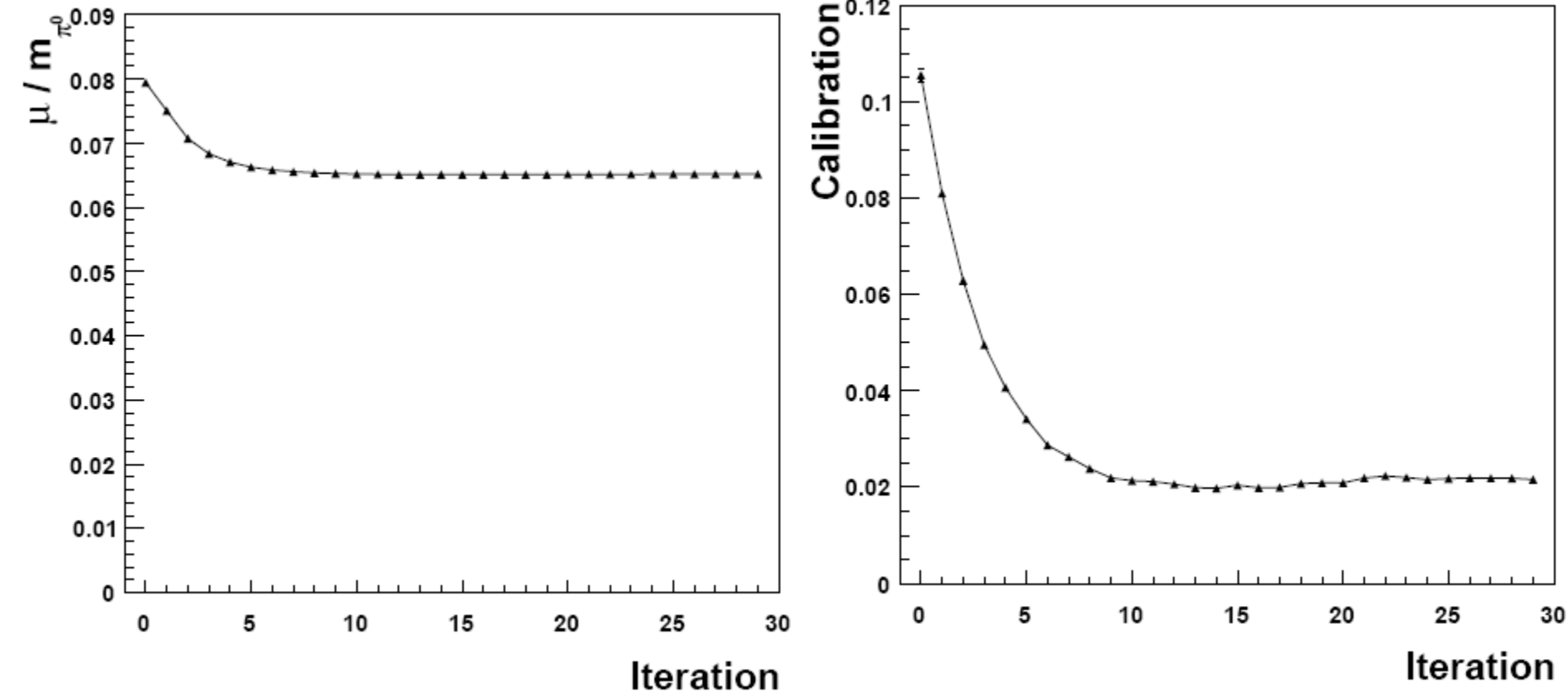


Pi0 calibration: current status

- Tested in AliEn with **LHC09a4** pp min. bias production
- Size of produced root file : 10 Mb, does not scale with statistics
- Needs further development:
 - To work with AOD instead of ESD (AliAODCluster and AliAODCells)
 - To compile into a shared library
 - To take the PHOS geometry from OCDB GRP using ESD information, **or**
 - To store rotation matrices in ESD (where, how?)

Convergence of calibration procedure (H.Qvigstad)

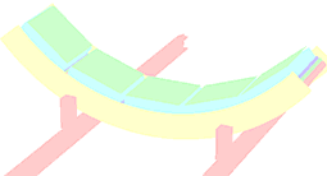
Validated with single- π^0 events at $p_T=10$ GeV/c





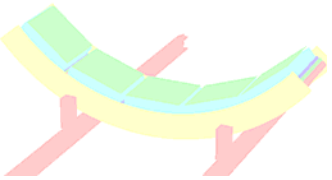
Relation to offline calibration framework

- The first reconstruction pass should produce “Calo-wise AOD”: AOD with only PHOS (EMCAL) clusters and cells, and the primary vertex.
- The first iteration can work at the end of the first reconstruction pass
- Any further iterations will work apart from the calibration framework
- New calibration objects should be submitted to OCDB manually.



PHOS alignment

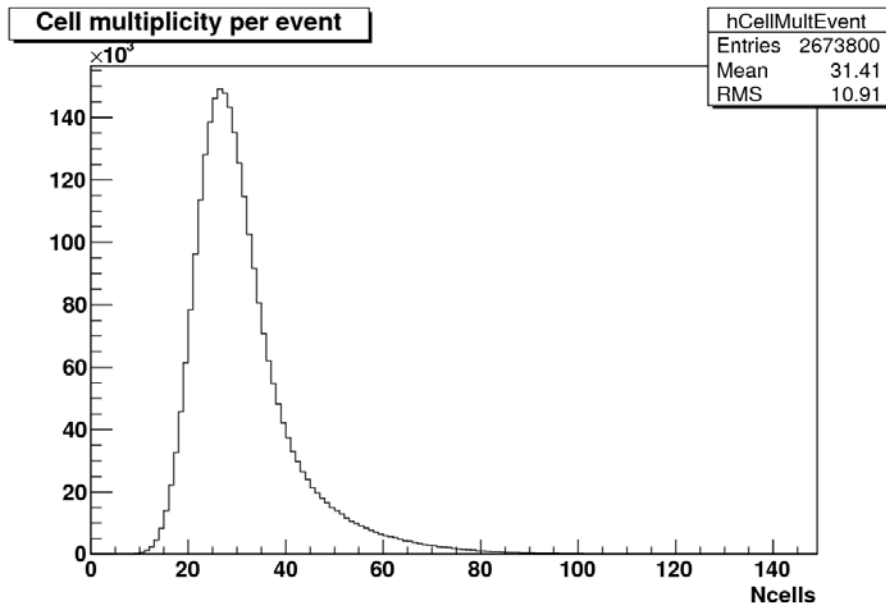
- Status has not changed since 2008
- Survey provides the following data:
 - coordinates of the PHOS module(s) in the physicist reference system
 - coordinates of “strip units” (groups of 8x2 crystals) in the local module’s reference system
- Impact of strip units misalignment (aver. 0.6 mm, max. 3 mm) on the physics performance was found to be negligible, and **will not** be provided to the official OCDB (unless survey observes larger displacements).
- PHOS modules misalignment affects physics and **will** be provided to the official OCDB
- Misalignment object is created by MakePHOSFullMisalignment.C. It reads survey table (ascii file) and creates AliAlignObjParams.
- Misalignment is overlaps-free: all modules should be displaced coherently to avoid overlaps
- Misalignment of PHOS modules leads to displacements of PHOS structures (cradle, wheels)



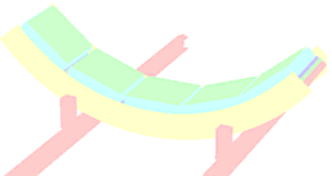
Time samples in (S)Digits

- Time of flight from IP to PHOS is 15.6 ns for photons and up to 20-30 ns for heavy hadrons.
- PHOS signal is shaped with 2- μ s rising time and sampled with 100-ns time bins.
- Merging of SDigits from different tracks and different events of the same collision does not introduced a noticeable change of the signal shape. It does not require precise sample-to-sample summation.
- Merging of different events from pileup might require sample-to-sample summation, provided these events are overlapped within a time window [100 ns – 10 μ s].

Pileup events in PHOS

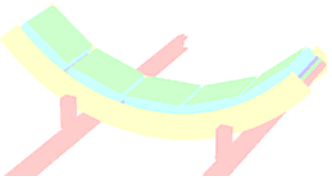


- Average cell multiplicity in PHOS is 31 cells per pp event, out of 17920 cells: probability to hit each cell is $1.7 \cdot 10^{-3}$.
- At $L = 3 \cdot 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$, $\sigma = 70 \text{ mb}$ and an **ideal** trigger, the event rate is 20 kHz.
- In the worst case, the hit rate in each PHOS cell is $1.7 \cdot 10^{-3} \times 20 \text{ kHz} = 360 \text{ Hz}$, i.e. mean $\Delta t = 2.8 \text{ ms}$.
- Typical PHOS signal length is $10 \mu\text{s}$.
- Event pileup in PHOS cells is a very rare event.
- High PHOS occupancy in PbPb events is compensated by low luminosity.
- **Event merging at the level of samples is not relevant to PHOS.**



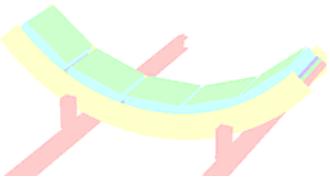
Raw data

- RCU firmware v3 will be programmed to PHOS. Will look at new data with AliAltroRawStreamV3. Then we will create AliCaloRawStreamV3 with derived AliPHOSRawStreamV3 and AliEMCALRawStreamV3.
- Mapping has changed in PHOS. Now the new mapping files are being produced.
- For correct reconstruction of non-ZS, ZS with fixed pedestals, ZS with self-calculated pedestals we need some ALTRO configuration parameters. These parameters will be stored in RCU trailers.
- TRU amplitudes are written to raw data as “fake ALTRO”. TRU mapping is being updated.

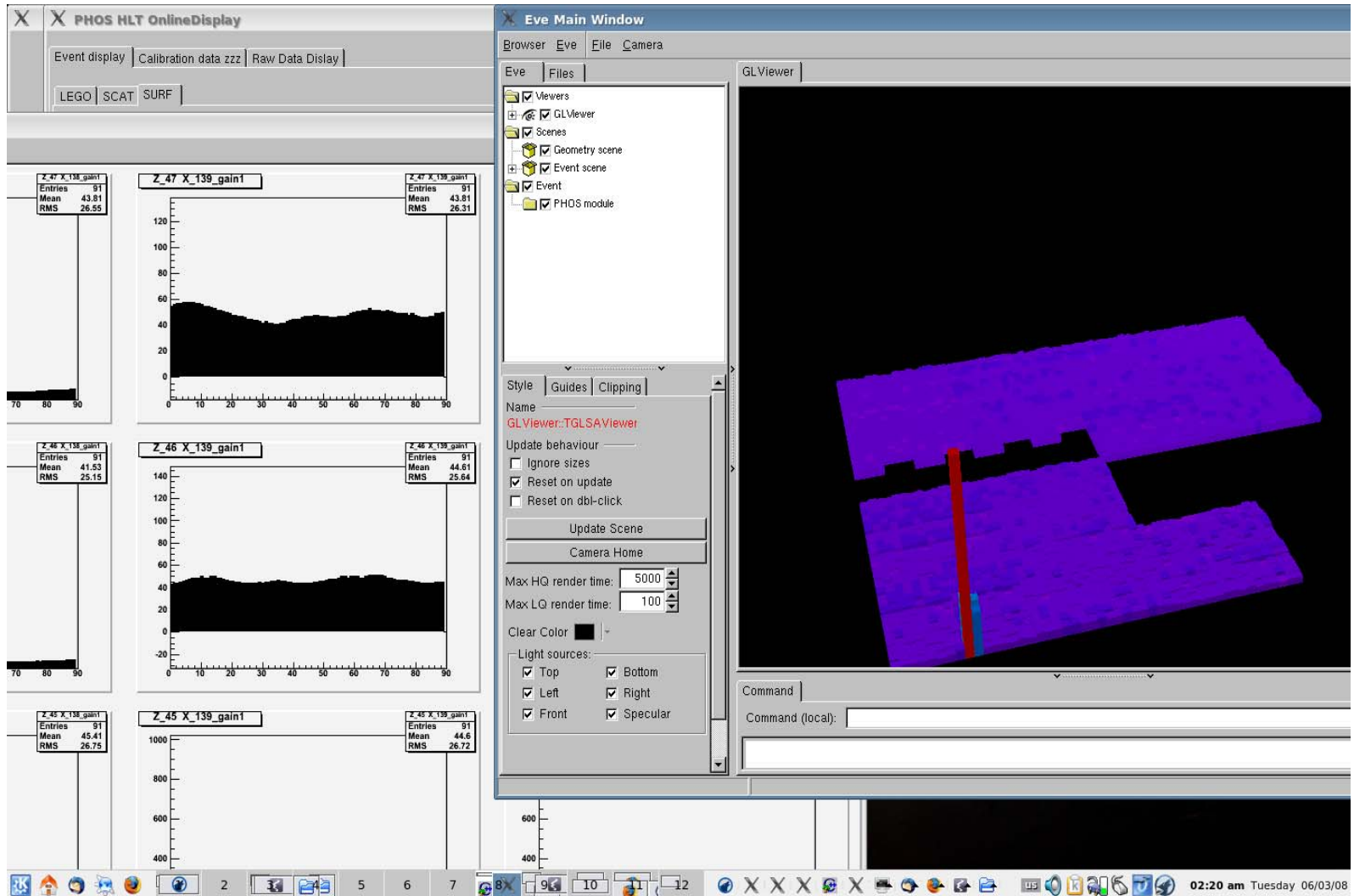


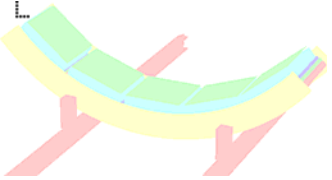
PHOS HLT tasks

- Process raw data and extract cell amplitudes and time from ALTRO samples.
- Inject PHOS cells with their amplitudes and time to the DAQ raw data stream (HLT is one of detectors).
- Perform clustering from found cell amplitudes.
- Having reconstructed clusters, HLT can build invariant mass spectra.
- PHOS HLT will contribute to HLT ESD.
- Provide online event display, much more powerful than that in DAQ AMORE. It was the only PHOS event display in fall 2008.
- Some online calibration algorithms will run in HLT DA.
- Real high-level trigger tasks, selecting events with a complicated topology which cannot be selected by TRU. For example, a trigger on π^0 at high p_t , or events with a large cluster multiplicity. EMCAL can select jets. At the end 2008, PHOS HLT ran high-energy event selection.



PHOS online display in HLT

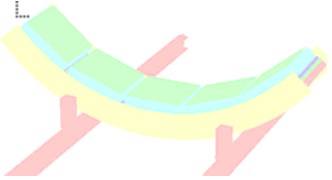




Planning: Calibration

| | | | | | |
|---|------------------------------------|------------|---|------------|---|
| Finalization of Das: correction before deployment of the LED DA finding the bad channel map; (2409) | Boris.Polichtchouk | 16/03/2009 | - | 30/05/2009 | - |
| Finalization of Das: implementation of the PULSER DA (2410) | Boris.Polichtchouk | 16/03/2009 | - | 30/05/2009 | - |

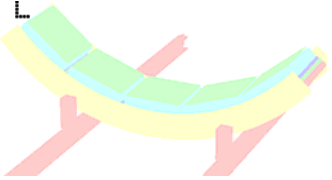
- Task 2409: waiting for new data with new FEE. New fast ALTRO fitter by A.Pavlinov can be applied. Move due date to 30.09.2009
- Task 2410: Pedestal run can be needed for ZS, but has not been used so far. Move due date to 31.10.2009



Planning: Reconstruction

| | | | | | |
|--|------------------------------|------------|---|------------|---|
| Verification of Reco Params for cosmic, high flux, low flux and calibration (2407) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
|--|------------------------------|------------|---|------------|---|

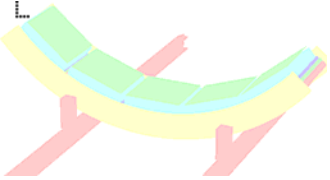
- Task 2407: We have one RecoParam object for all event species. Move due date to 30.08.2009



Planning: QA

| | | | | | |
|---|------------------------------|------------|---|------------|---|
| Implementation of run type (2414) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Implementation of simulation in QA checker (2415) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Implementation of reconstruction in QA checker (2416) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Implementation of reference data (2417) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |

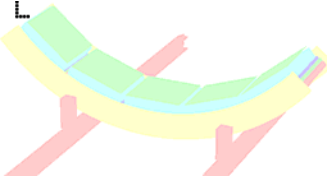
- Task 2414: Run types are implemented. Close it?
- Task 2415: Simulation QA checker is default one.
- Task 2416: Reconstruction QA checker is default one.
- Task 2417: A preliminary set of reference data were provided. To be extended. Move due date to 30.09.2009



Planning: Trigger

| | | | | | |
|---|------------------------------|------------|---|------------|---|
| Implementation of the code for trigger parameters for the simulation of the trigger input to the CTP (2412) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Simulation of the trigger input to CTP (2413) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |

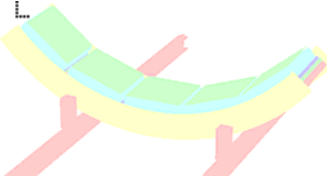
- Task 2412: Waiting for info from trigger HW developers. Move due date to 30.09.2009.
- Task 2413: Same as 2412.



Planning: Simulation

| | | | | | |
|--|------------------------------|------------|---|------------|---|
| Accounting for detector response in the time information stored in digits (2399) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Implementation of track references (2401) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Correct treatment of the detector signal in the sdigits for event merging (2403) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |
| Verification of the embedding procedures (2404) | Yuri.Kharlov | 16/03/2009 | - | 30/05/2009 | - |

- Task 2399: Time is stored in digits since 8 years. Close it?
- Task 2401: Not done yet. Move due date to 30.09.2009.
- Task 2403: Time samples in digits are not relevant for PHOS. Close it?
- Task 2404: Embedding is working in PHOS. Close it?



Planning: Raw data

| | | | | | |
|---|--|------------|---|------------|---|
| Update according to the new RCU firmware (2405) | Yuri.Kharlo v | 16/03/2009 | - | 30/05/2009 | - |
| Inclusion of the TRU information (2406) | Yuri.Kharlo v | 16/03/2009 | - | 30/05/2009 | - |

- Task 2405: To be done soon. Move due date to 31.07.2009.
- Task 2406: To be done soon. Move due date to 31.07.2009.