

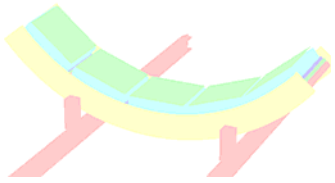
A stylized, colorful graphic of the ALICE detector at the Large Hadron Collider. The detector is shown in a perspective view, with its two main arms extending outwards and upwards. The central part of the detector is colored yellow, while the outer arms are colored green and cyan. The base of the detector is colored red. The overall shape is somewhat X-like, with the arms curving outwards.

# PHOS offline status report

Yuri Kharlov

ALICE offline week

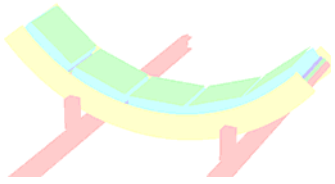
7 April 2008



# Steering the simulations

**AliPHOSSimParam** sets PHOS simulation parameters:

- `Float_t fLightYieldMean ;` // Average number of  
// photoelectrons per GeV
- `Float_t fIntrinsicAPDEfficiency;` // APD efficiency including  
// geometric coverage
- `Float_t fLightFactor ;` // Average number of photons  
// collected by APD per GeV
- `Float_t fAPDFactor ;` // factor relating light  
// yield and APD response
  
- `Float_t fAPDNoise;` //RMS of APD noise
- `Float_t fEMCDigitThreshold ;` //minimal energy to keep digit
- `Float_t fEMCADCchannel ;` //width of ADC channel in GeV
- `Float_t fTOFa ;` //constant term of TOF resolution
- `Float_t fTOFb ;` //stochastic term of TOF resolut.



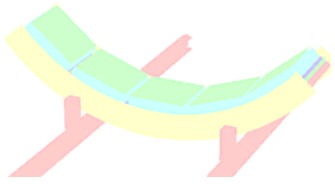
# Geometry

No additional clearance is needed around alignable volumes:

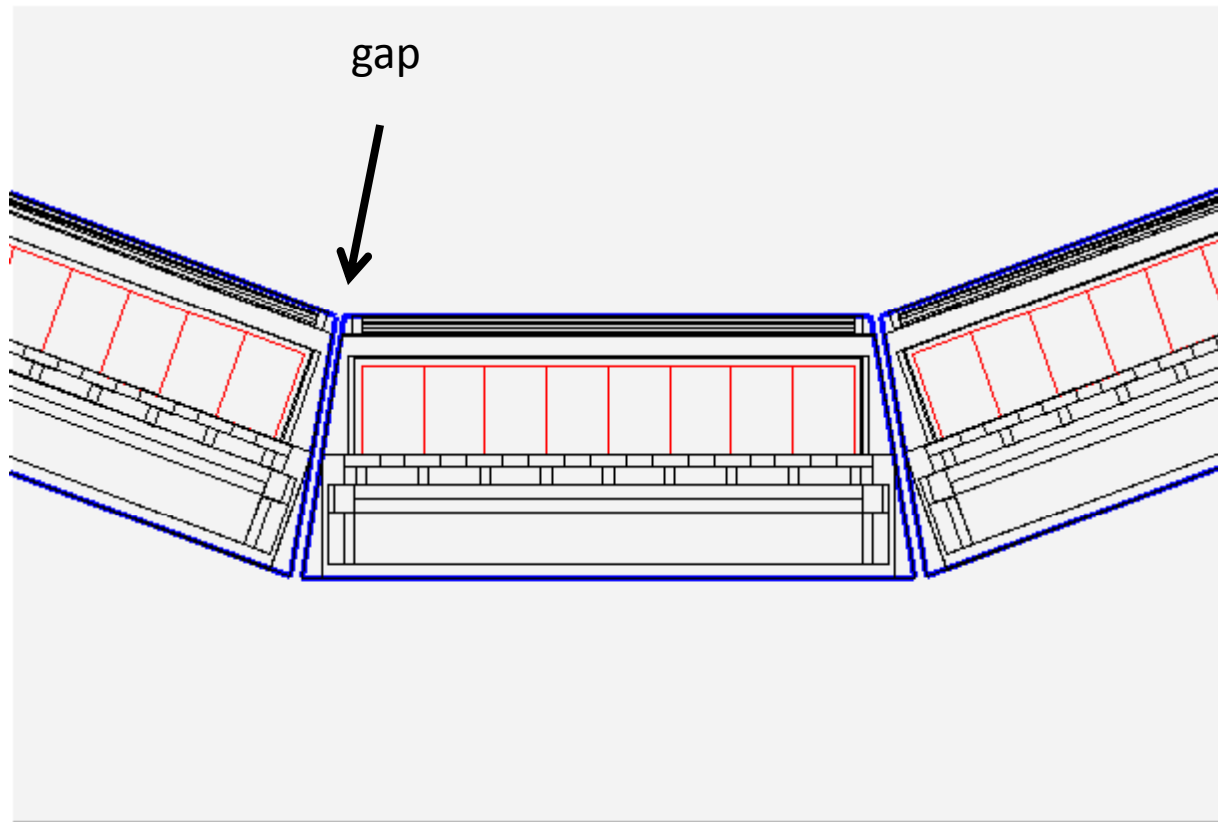
- Alignable volumes **PSTR** (strip units) are packed into 28x8 matrix which is embedded to the insulation foam **PTII**.
- The size of **PTII** is by 1 cm larger than the matrix of **PSTR**
- Individual **PSTR** are misaligned according to a real survey data, therefore they are misaligned coherently which avoids overlaps
- Alignable volumes **PHOS** (modules) are positioned inside **ALIC** with a gap between them, and with a gap between the PHOS modules and a PHOS cradle.

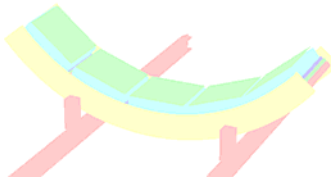


[illegible]



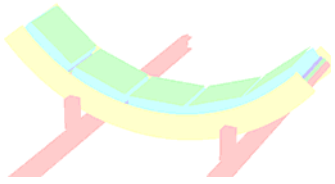
# PHOS inside ALIC





# Raw data

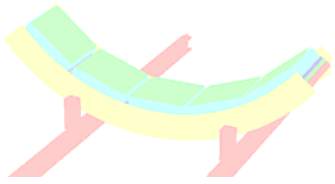
- Raw data as ALTRO samples with and without zero suppression is stored on MSS in a ROOT format
- Raw reader in aliroot is fault-tolerant: good for offline processing, but not suitable for hardware diagnostics of corrupted data.
- Raw data reader processes raw data in any of 3 formats: DDL, raw DATE and ROOT.
- Decoders exist, tested and commissioned with simulated and real data from PHOS-1



# On-line processing

- Raw data from DDL is split to DAQ and HLT.
- Detector Algorithms (DA) can be running in both DAQ and HLT environments. Algorithmic part and output are physically the same, but data reading and decoding are different.
- DA, either DAQ or HLT, creates common root files with objects needed to calculate **calibration parameters** and **bad channels map** in preprocessor.
- There is only one preprocessor for all DAs, independent on HLT/DAQ environment
- HLT can run more sophisticated DA due to higher performance and data parallelization.





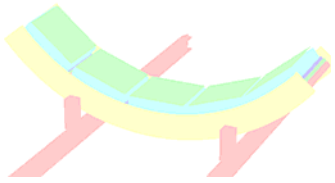
# PHOS objects in OCDB

## AliPHOSEmcCalibData

- Float\_t fADCchannelEmc[5][56][64]
- Float\_t fHighLowRatioEmc[5][56][64]
- Float\_t fTimeShiftEmc[5][56][64]

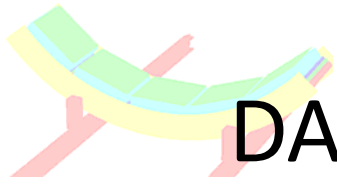
## AliPHOSEmcBadChannelsMap

- Bool\_t fBadChannelEmc[5][56][64]
  - Offline and HLT agreed to have Int\_t instead of Bool\_t for BCM.



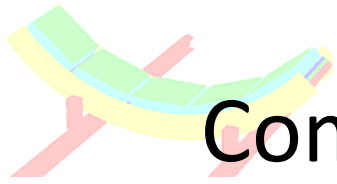
# Algorithmic part of DAs

- The input to the DA is scalable:
  - DAQ DQ: input is a full module (56x64x2)
  - HLT DA: input is one RCU (28x32x2)
- The input to the calibration DA is energy and time in the form: `nX, nZ, Float_t e[nX][nZ][2], t[nX][nZ][2]`
  - the input energies are in ADC counts
  - Input times are in sample
- DA stores separate histograms for HG and LG per channel
- Merging of HG and LG, conversion to energy and real time is done by the preprocessor.
- The input to the bad channel map DA is quality parameter: `nX, nZ, Float_t q[nX][nZ][2]`



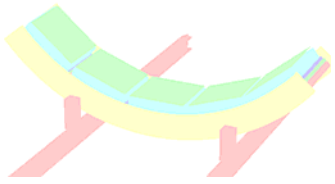
# DA in implementation in DAQ and HLT

- HLT or DAQ read and decode raw data. ALTRO samples are fit to give a digit energy, time and quality. These tasks are environment-dependent in DAQ and HLT.
- Algorithmic part of DA, storing DA histograms, preprocessors are the responsibility of Offline project.



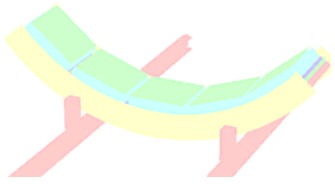
# Commissioning of DA and preprocessor

- DA was tested with real data read offline (from file).
- Integration of DA with DAQ will be done in P2 (May)
- Root files created by DA were submitted to the Shuttle commissioning team, where they were validated.
- See Boris' talk next.



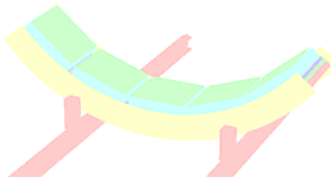
# Online monitoring

- Fully implemented in HLT, extensively used in the PHOS lab during PHOS-1 commissioning in 2007.
- Integration of the HLT monitoring with the ALICE monitoring:
  - HLT passes ROOT objects to the DATE stream (TH, Tcanvas)
  - AMORE receives raw data, selects HLT objects and displays them on online monitor
  - Can AMORE read TObject?
- Simple stand-alone monitoring will be done in AMORE framework.



# Reconstruction

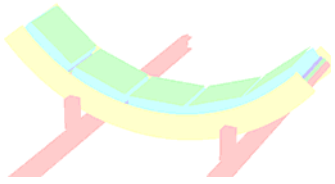
- Reconstruction from raw data is validated with PHOS-1 commissioning real data
- Reconstruction uses OCDB for calibration, bad channel map and alignment
- Experience with raw data reconstruction in AliEn: **2 kfiles** with **3 Mevents** were successfully reconstructed, ESD were obtained and used for further analysis



# Steering the reconstruction

**AliPHOSRecoParam** sets PHOS reconstruction parameters:

- `Float_t fClusteringThreshold;`
- `Float_t fLocMaxCut;`
- `Float_t fMinE;`
- `Float_t fW0;`
- `Float_t fSampleQualityCut;`
- `Bool_t fSubtractPedestals; // kTRUE for non-ZS`
- `Bool_t fUnfold;`
- `Bool_t fOldRCUFormat; // kTRUE if RCU has old  
// firmware (2006-2007)`
- `TString fDecoderVersion ;`



# Event embedding: use case

## Merging with raw data (Digits)

```
void Sim(const Int_t nevents=1500,
        const Int_t debLevel=0){

    //Simulation MC event and merge with
    //Digits from raw event.

    AliPHOSSimParam * phosSimParam =
        AliPHOSSimParam::GetInstance() ;

    AliSimulation sim;
    sim.SetMakeSDigits("PHOS") ;
    sim.SetMakeDigits("PHOS") ;

    sim.MergeWith("RAW/galice.root",1) ;

    phosSimParam->SetStreamDigits(1) ;

    sim.Run(nevents);
}
```

## Merging with simulated data (SDigits)

```
void Sim(const Int_t nevents=1500,
        const Int_t debLevel=0){

    //Simulation MC event and merge with
    //SDigits from raw event.

    AliPHOSSimParam * phosSimParam =
        AliPHOSSimParam::GetInstance();

    AliSimulation sim;
    sim.SetMakeSDigits("PHOS");
    sim.SetMakeDigits("PHOS");

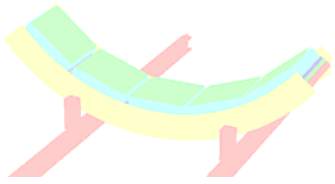
    sim.MergeWith("RAW/galice.root",1) ;

    phosSimParam->SetStreamDigits(0) ;

    sim.Run(nevents);
}
```

By default ALICE does not store Digits during official reconstruction, therefore for event embedding we will have to redo part of reconstruction ourselves



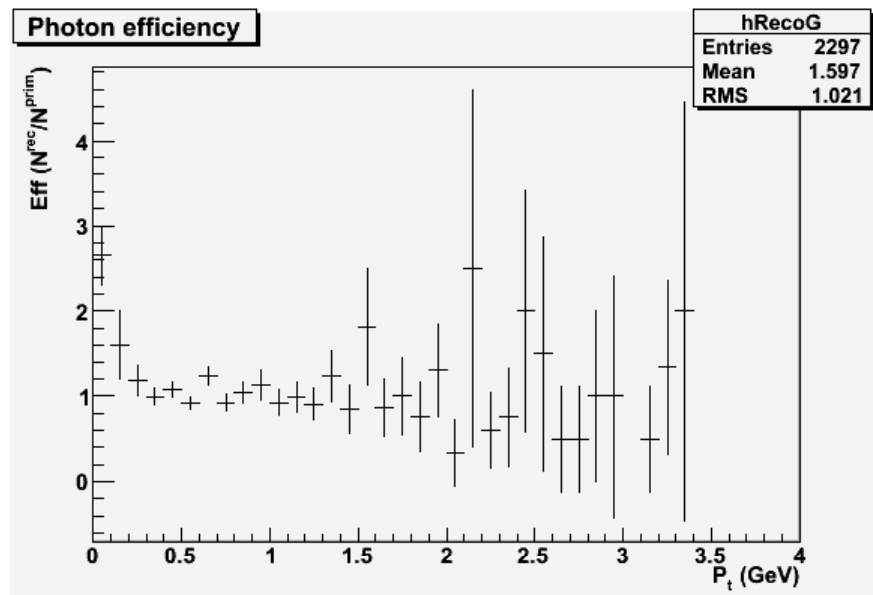


# Event embedding in work

(code in trunk and release v4-11-Rev-04 – not yet in AliEn)

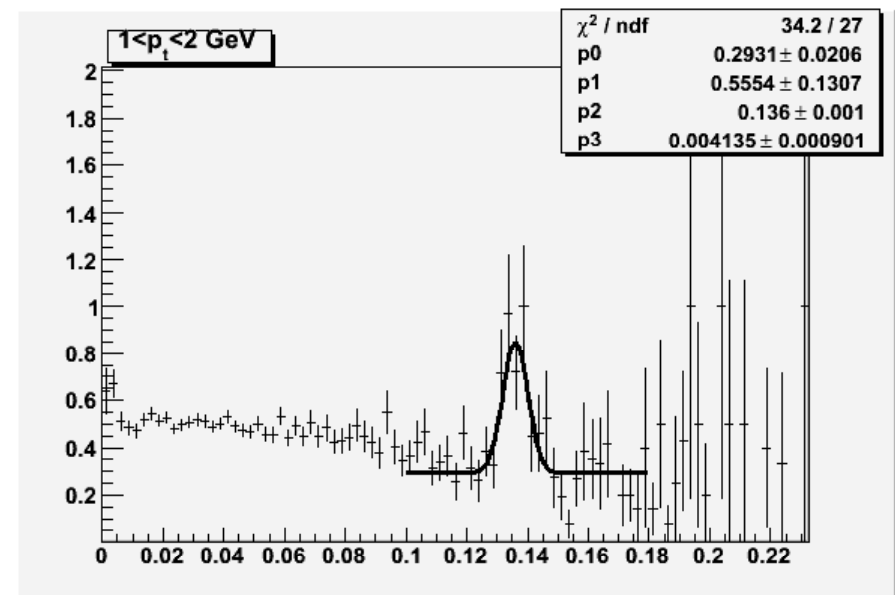
We embedded  $2 \pi^0$ /event/PHOS acceptance with HIJING pt spectrum into 2007 cosmic events and calculated single photon efficiency and constructed two-photon invariant mass

Embedded/primary ratio

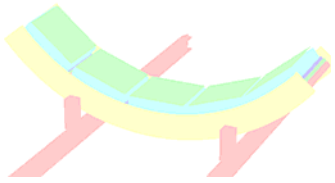


Single photon efficiency close to unit at  $p_t > 300$  MeV, while below there is a lot of noise from underlying event

Real/Mixed ratio

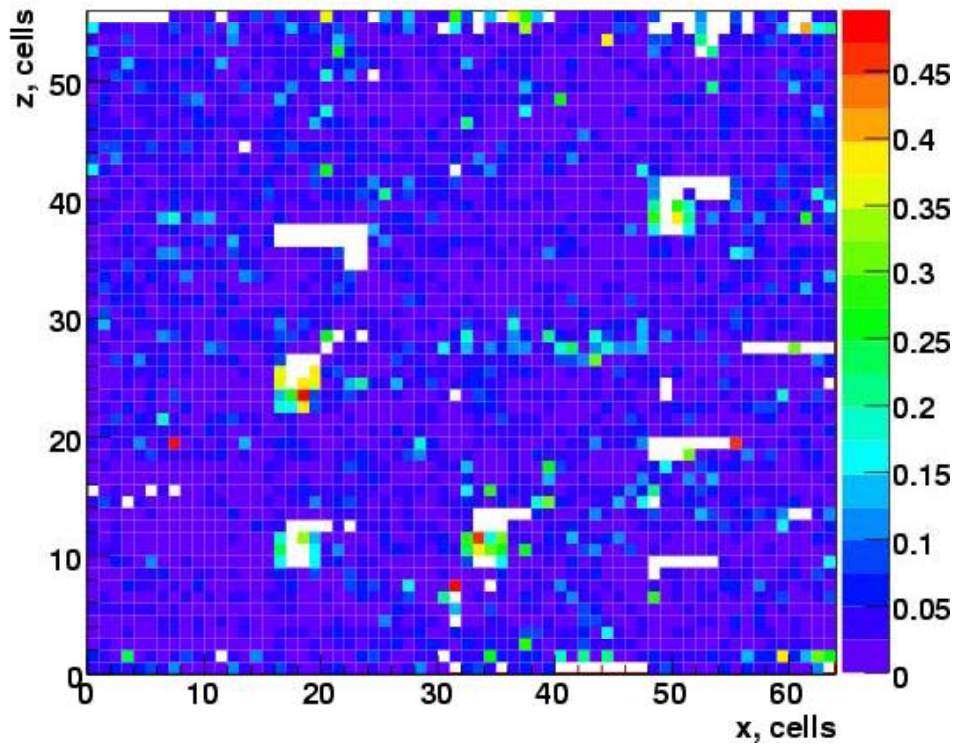


$\pi^0$  peak with width  $\sim 4$  MeV is seen at  $p_t > 1$  GeV

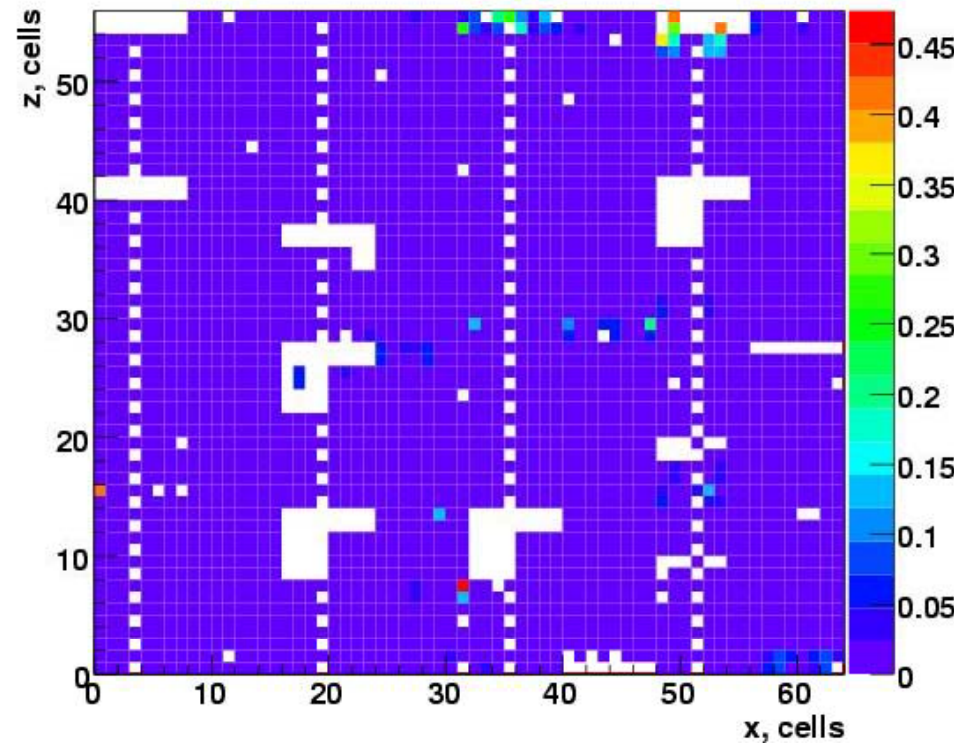


## Good channels in LED run

Good channels map for High gain ( $fQuality < 0.5$ )

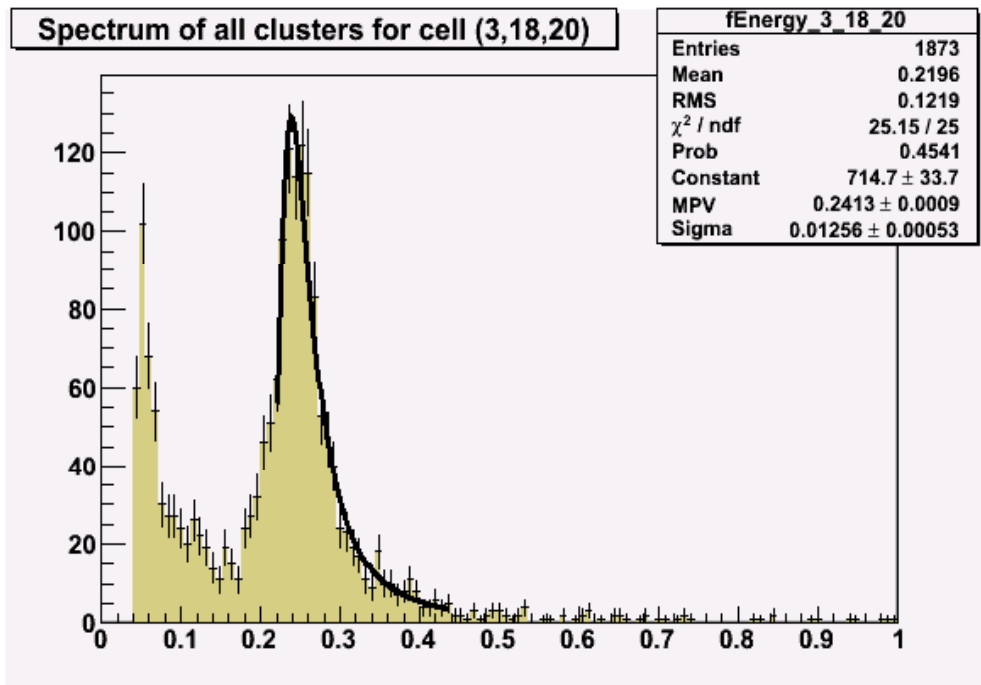


Good channels map for Low gain ( $fQuality < 0.5$ )



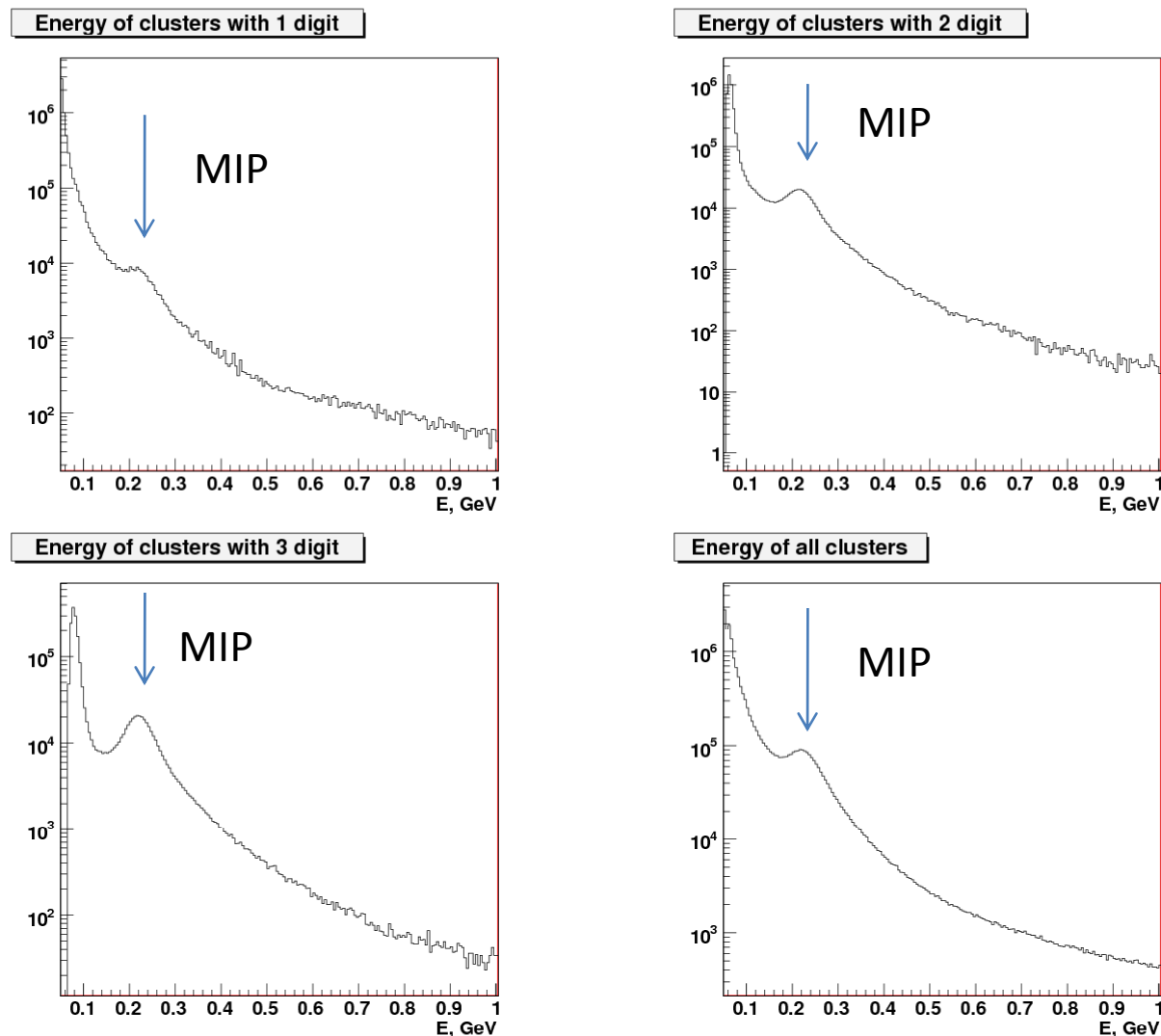
Fit quality parameter is used to construct the bad channel map  
**BCM is stored in OCDB**

# Reconstruction with bad channel map

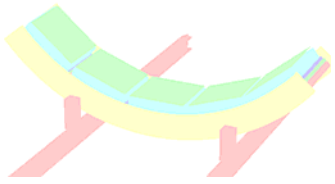


- BCM was built on the subset of Cosmic Run 8249 (Oct 2007)
- All runs under the same run conditions (“**apd 255**”) were reconstructed by AliRoot
- Clear MIP peaks (like this!) observed in all cells passed the good channel selection procedure
- Absolute calibration factor is assumed as 5 MeV/ADC

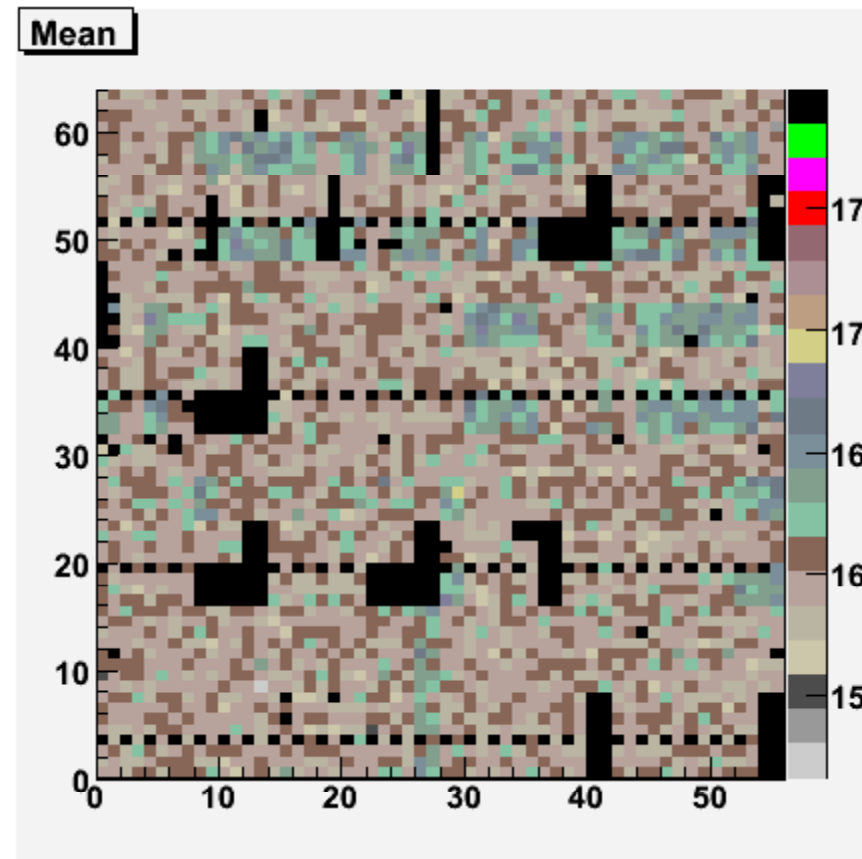
# Amplitude spectra of all clusters in cosmic runs



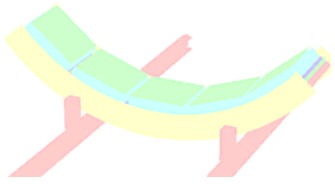
**Bad channel map** and relative **calibration** is applied



## HG/LG ratio in LED run 2007



**HG/LG ratio is stored in OCDB**



# PHOS data processing forum

- Web-based forum is available at <http://aliceinfo.cern.ch/static/phpBB3/>
- The aim of the forum is a rapid communications about current data processing status, new (even intermediate and preliminary) results, it provides an easy way to produce high-quality well-illustrated documentation.
- Posted results are considered as prototypes of future analysis notes.
- All PHOS users involving in the analysis are encouraged to join the forum.