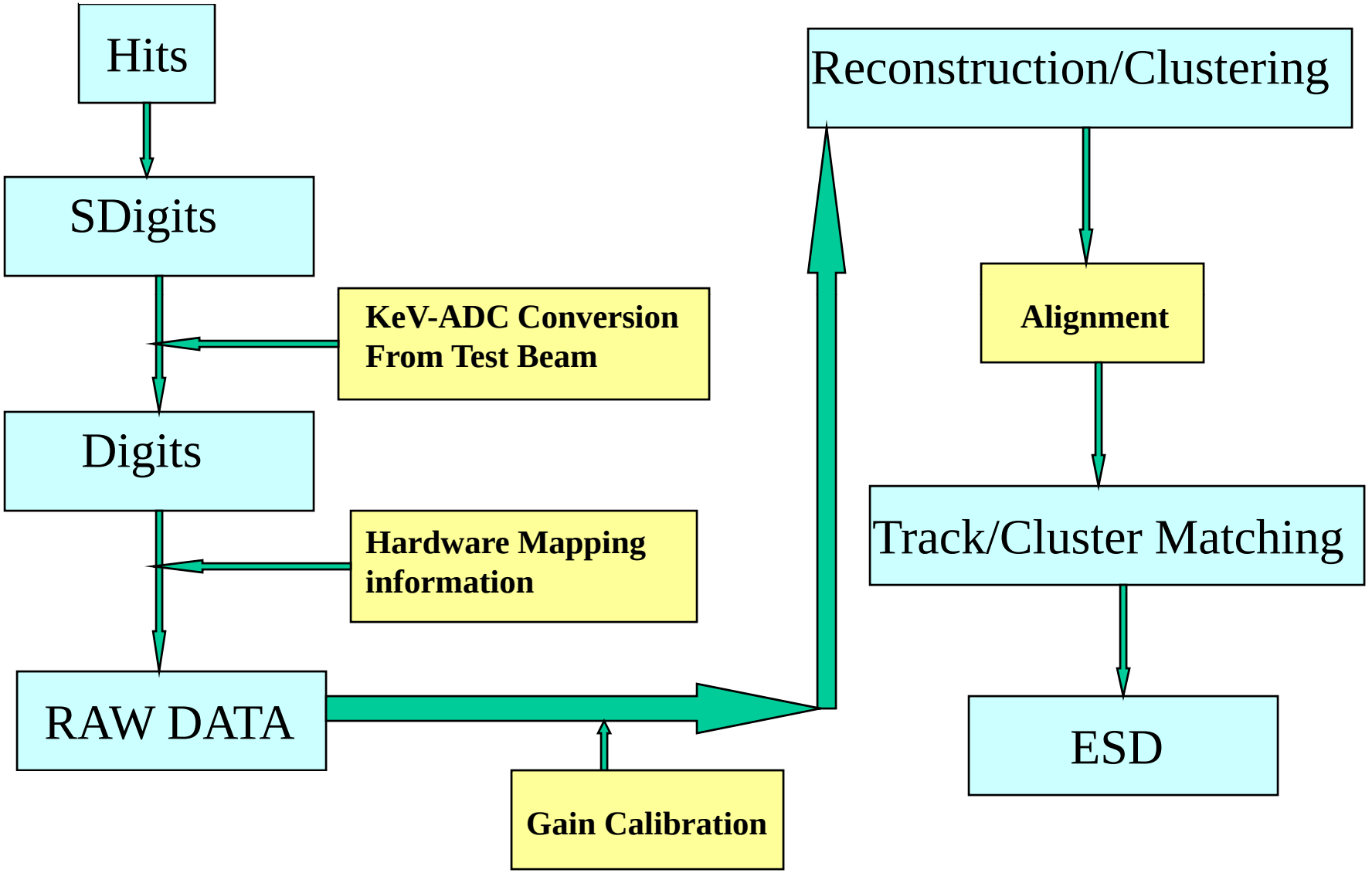
PMD Software Status

Prepared by:

The PMD Software team

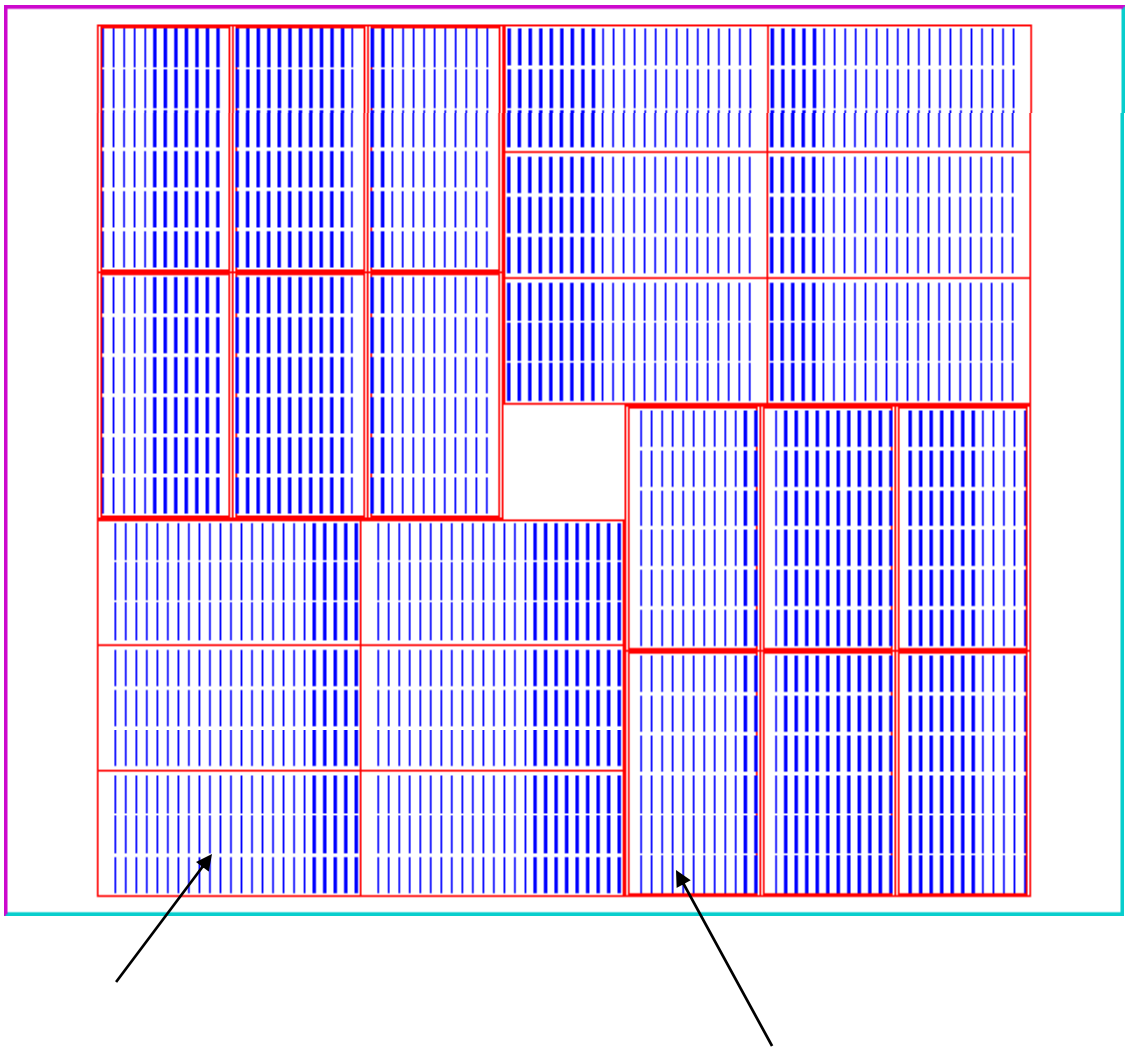
- Geometry
- Raw data
- Calibration
- Reconstruction
- Alignment
- ESD/QA
- Event Display
- Task list – time lines etc.
- Simulation results on photon efficiency and purity

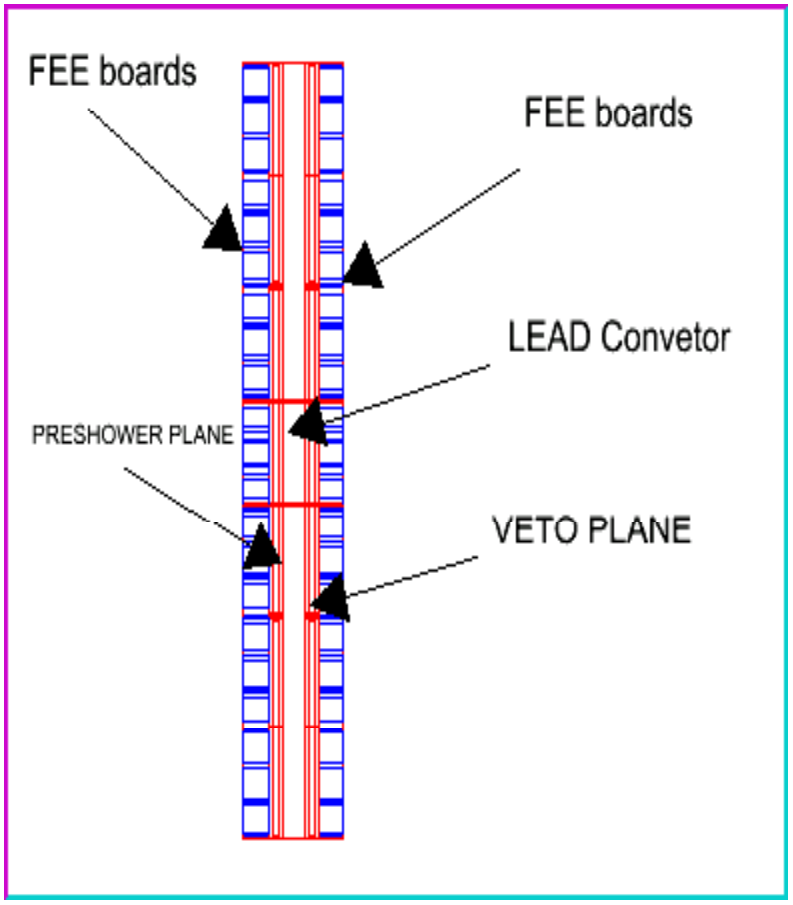
Flow chart of PMD data reconstruction



GEOMETRY

All modules, Pb plates, SS plates, FEE boards are implemented





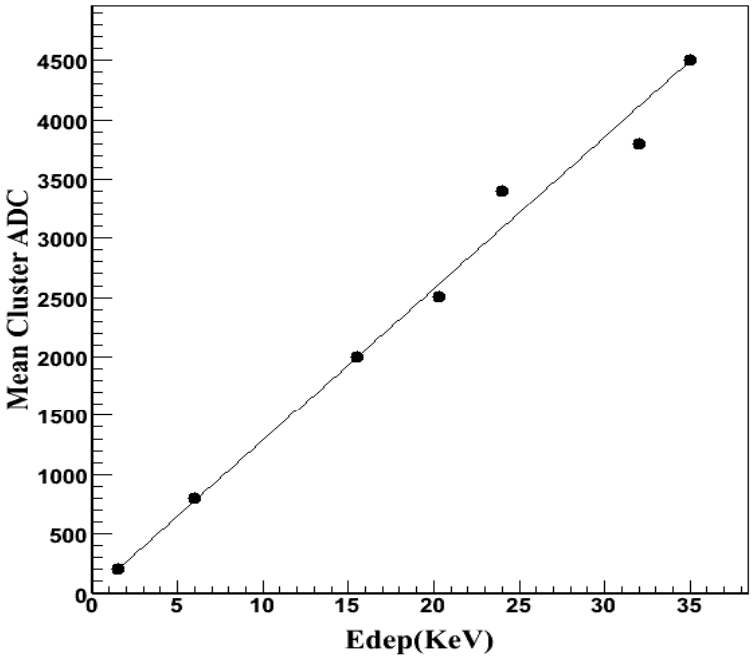
GEOMETRY: Code Status

Code for Geometry with FEE boards exists.

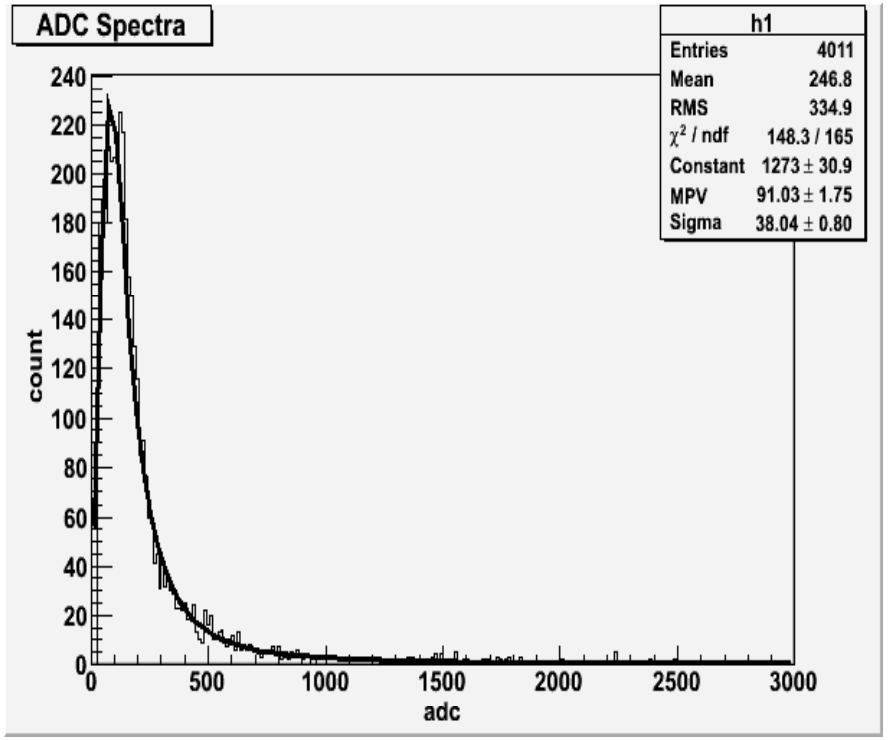
- Cables will not be in front of the detector, thick cables are on the sides.
- At the moment exact cable layout still unknown as the place of PMD location is quite crowded with lots of material. It is not possible to implement these in the software.
- PMD movement mechanism is getting finalized and will also be included in the software.
- PMD installation is scheduled for April 28th
- Geometry-as-installed (implementation) will be after that.

SDigit and Digit

- Taken care of by AliPMDDigitizer.
- Geant Energy deposition is converted into a 12 bit ADC (Information from 2003 and 2006 Test Beam).



AliPMDDigitizer in SVN



ADC from digits

Number of DDL

Geant simulation with dN/dη = 4K

- Considering 250 words per patch bus
  (*read out time and the bus length*)

•*Preshower plane:*

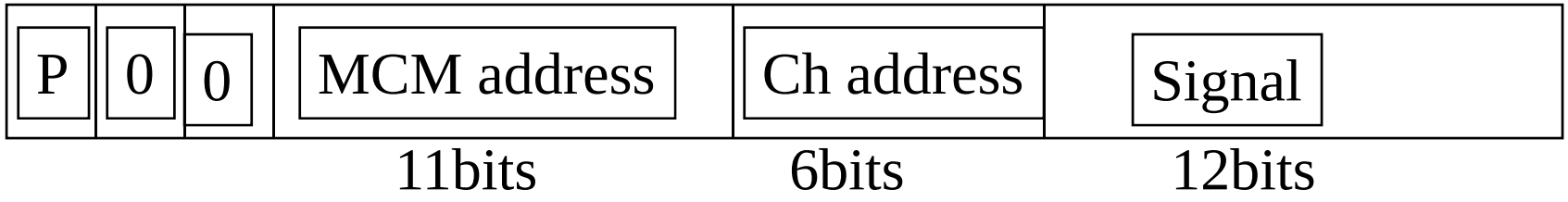
12 FEE boards per chain, 6 chains per Module, 36 chains – 1 crocus
Total number of DDL = 4

•*CPV plane*:

For module type A(12 in total):
24 FEE boards per chain, 3 chains per module
For module type B(12 in total):
24 FEE boards for 2 chain,
12 FEE boards for 2 chain
42 chains - 1 CROCUS, Total number of DDL=2

DDL Data

Two blocks of data
Each block of data contains
8 Block Header words
10 DSP Header words
4 PatchBus Header Words
Loop over data words



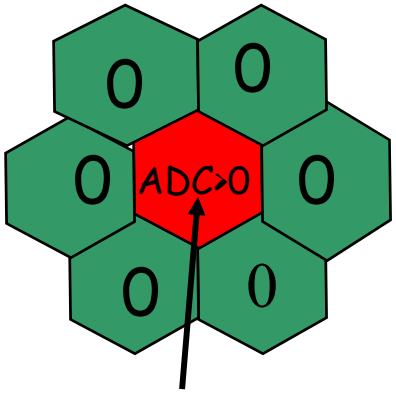
If the number words are odd, one word is added in the end

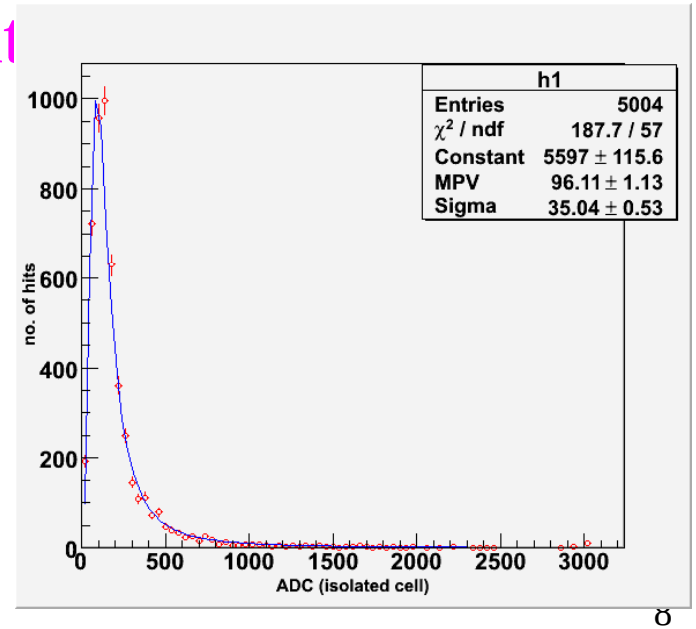
Calibration: isolated cell spectra

It is important that the response of each cell be uniform through out the detector.

From test beam result we know that charged hadrons typically hit single cell while photons hit more than one cell.

We look for hit cell whose surrounding six neighbors are not hit. These isolat are assumed to be hadrons.





Calibration Status (Offline):

Calibration Class: AliPMDCalibrator

Calibration Object: AliPMDCalibData

Data member: GainFact[Int_t][Int_t][Int_t][Int_t]

All codes are committed in SVN.

De-calibration and calibration tests with dummy gain factors done
- Also tested with simulated data.

Calibration algorithm includes isolated cell search method.
- Cell-to-cell normalization factors exits (in SVN)
- Module-module normalization factors included
- Cleanup for hot cell included in calib. algorithm

Calibration Status (online):

PreProcessor for SHUTTLE

AliPMDPreprocessor.cxx and AliPMDPreprocessor.h

Pedestal information included.

Add RunType Functionality added

Codes are written, tested in nightly test

Codes are in SVN

DA: code in SVN. Validation is waited.

Reconstruction

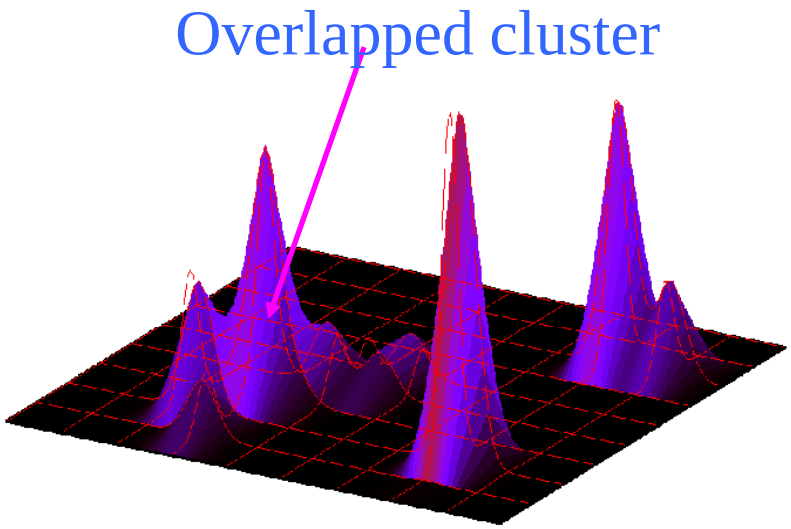
- **CLUSTERING**
- **PHOTON-HADRON DISCRIMINATION**

- PMD data are not pedestal subtracted
- Needs pedestal subtraction before reconstruction
- There will be a separate pedestal data file
- Extract the mean and rms and put it in OCDB
- Extract the numbers from OCDB and keep it in the memory
- Subtract it channel-wise in every event

We have implemented the pedestal information in AliRoot Framework.
AliPMDPedestal.cxx and AliPMDPedestal.h in SVN.

Reconstruction: Clustering

- Clustering done module by module
- First all connected cells are grouped
- Gaussian unfolding is used to find out the Edep and No. of cells for overlapping clusters



AliPMDClustering : base class
AliPMDClusteringV1 All codes in SVN.
AliPMDClusteringV2

Clustering code in SVN. An improved version will be committed this week.

Discrimination/Cluster Matching

- Clusters of CPV plane and PRE shower plane to be matched
- PID is assigned depending on this and a threshold on energy deposition.
- After assigning the PID, variables are stored in the ESD for physics analysis
- Out of these clusters, a set of clusters are identified as Gamma-like clusters
- For these samples efficiency and purity to be determined

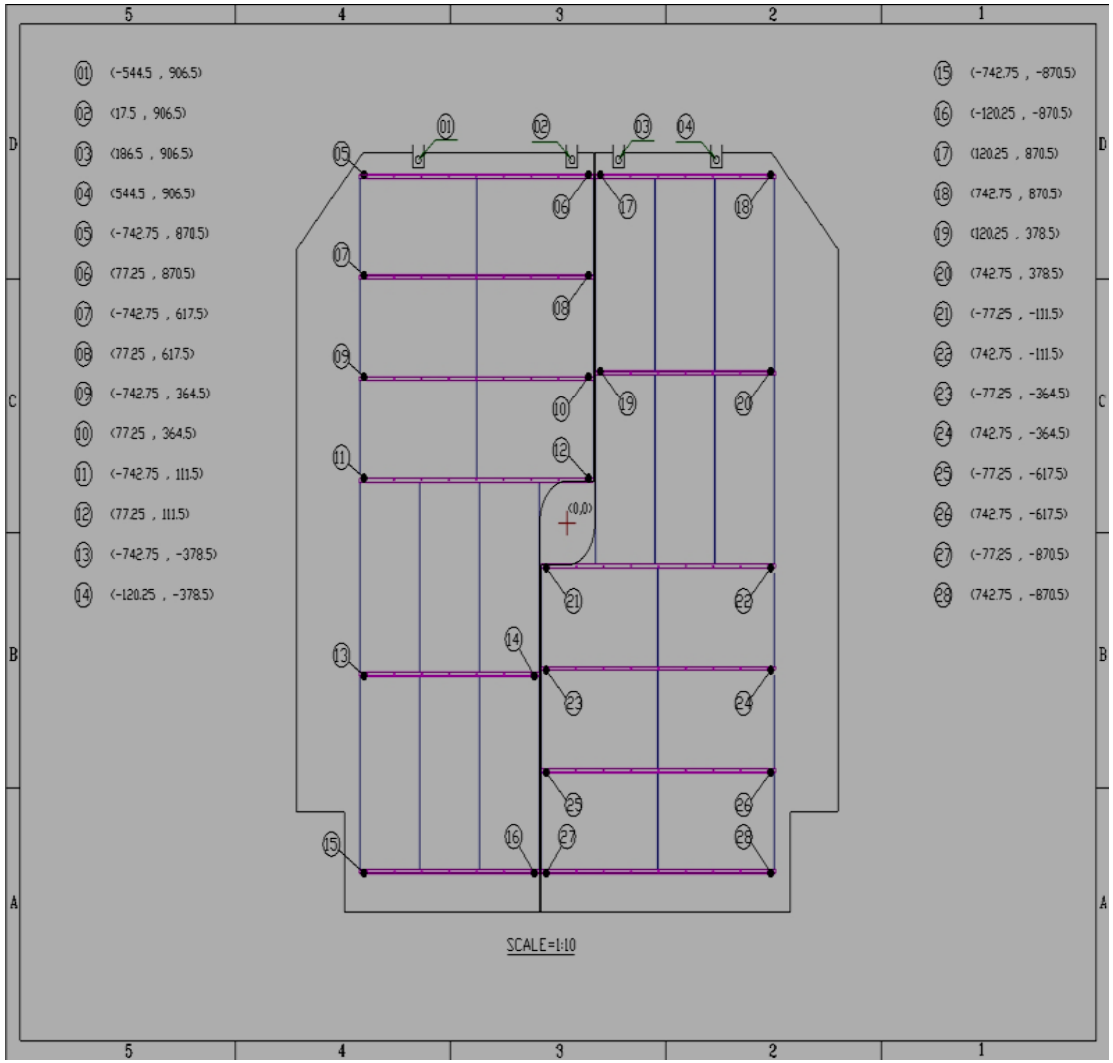
AliPMDDiscrimination : base class

AliPMDEmpDiscrimination : takes care of the cluster matching

Codes in SVN

Only the modules are there, but no logic inside. Not tested also. Work in Progress

Alignment targets

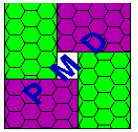


Survey points for PMD co-ordinates and alignment

Some adjustment possible by adjusting the align-able screws

Planarity problems and shift in steel frame in one direction possible.

Alignment:



✓Each plane has 24 modules which will be mounted separately on steel plates. The precision of distances between modules mounted on the steel plates can be controlled .

✓ Align-able parts of the PMD are

(i) steel plates

(ii) distance between the two planes

(iii) Cells of two planes

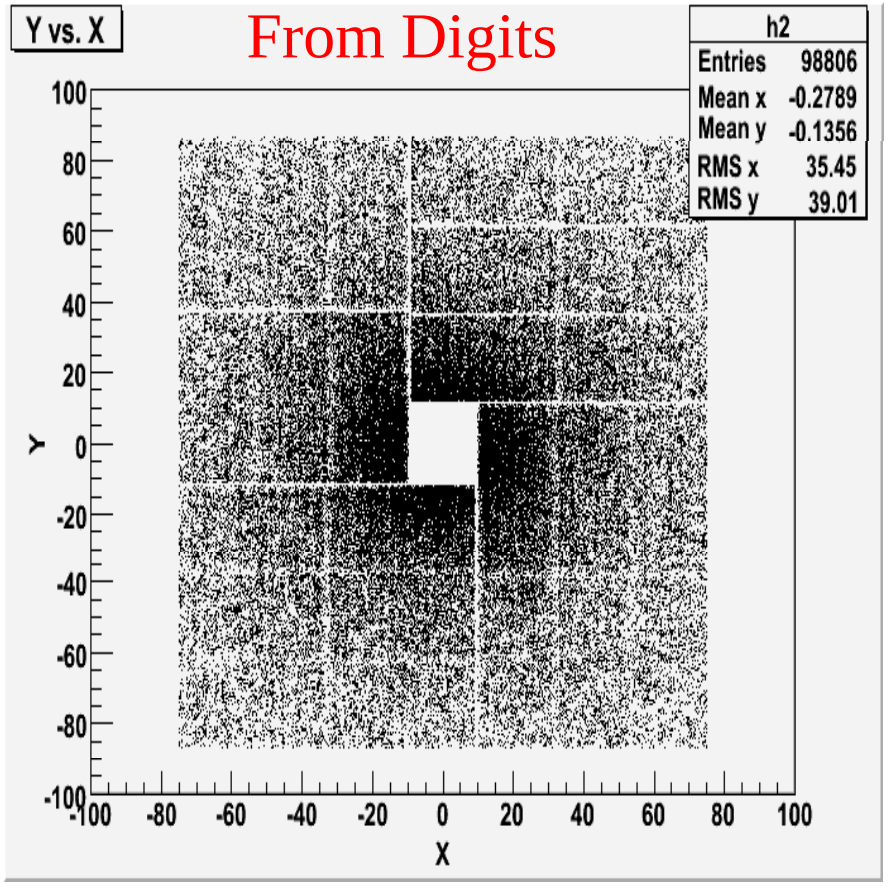
- Macro to generate the Alignment object is in SVN
- Macro to generate the misalignment from the survey data is being written now.

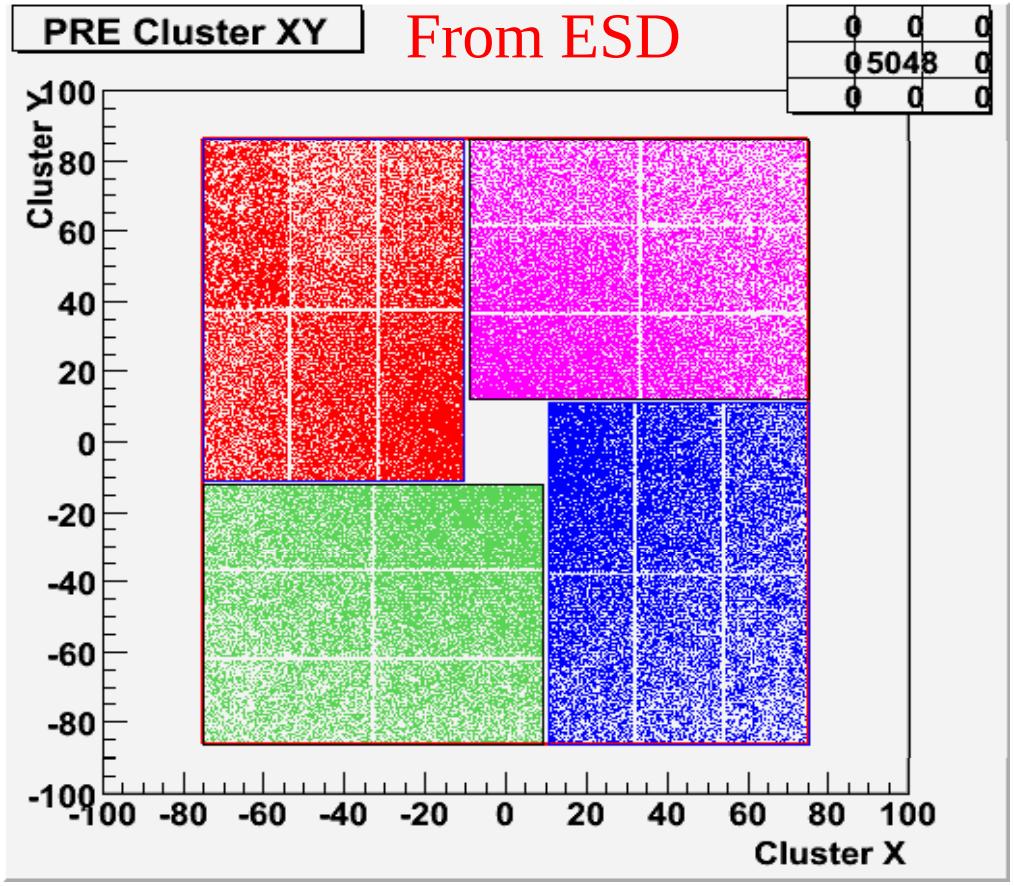
ESD

- Following variables are being stored for Physics Analysis
  - Detector plane (PRE:0, CPV:1)
  - Cluster X
  - Cluster Y
  - Cluster Z (without vertex correction)
  - Cluster ADC
  - Number of cells in a cluster
  - Cluster PID

AliESDPMDTrack : code in SVN

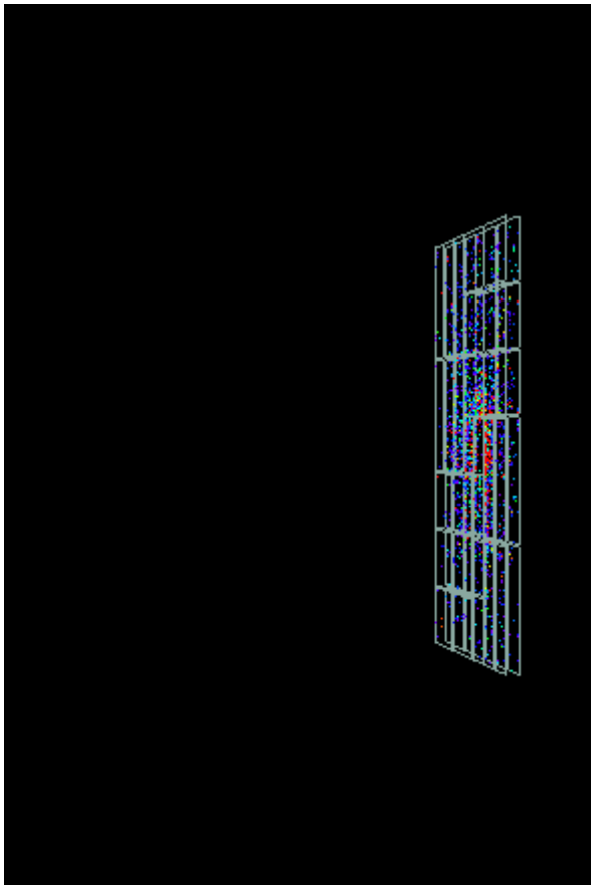
ESD: QA

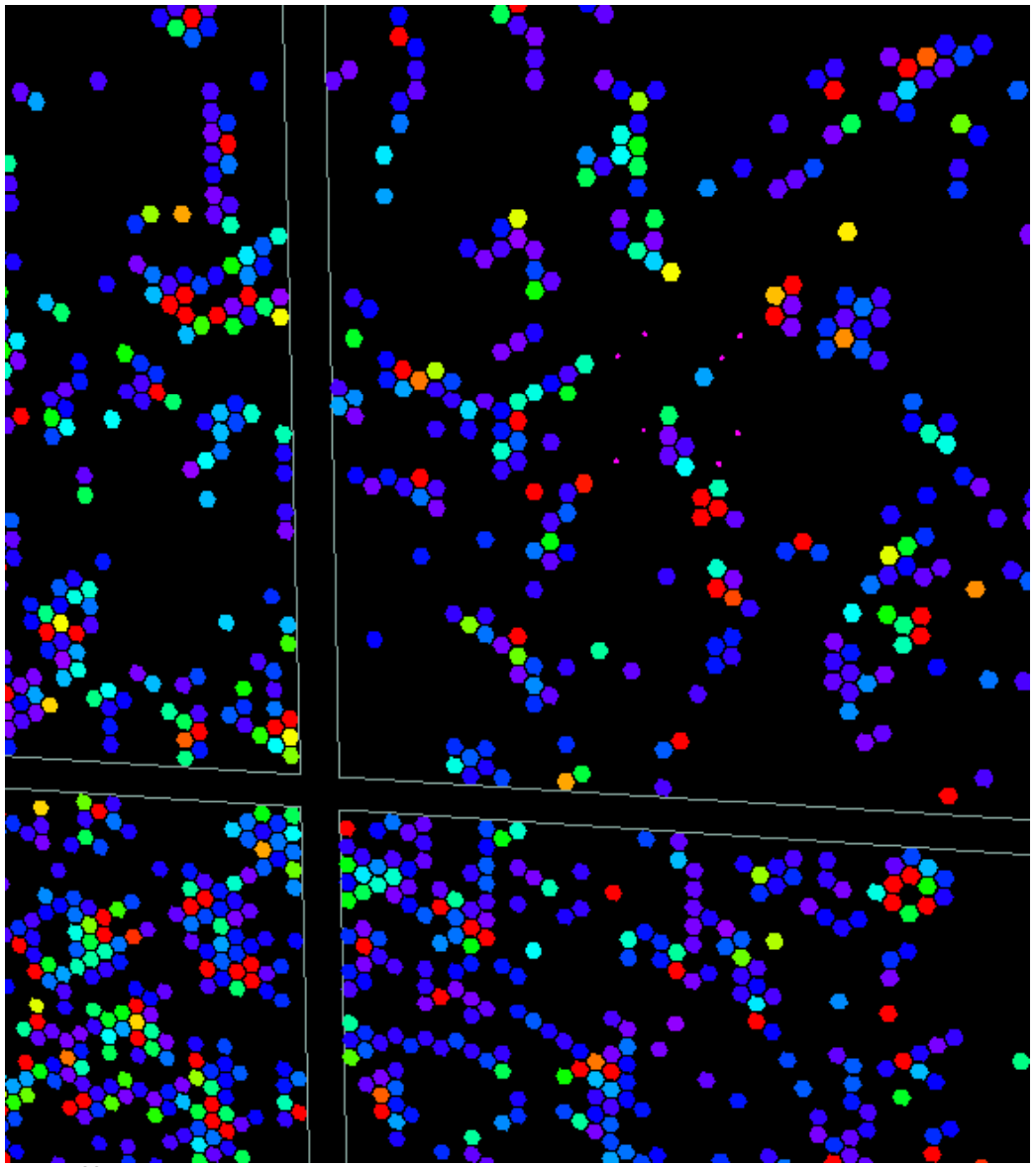




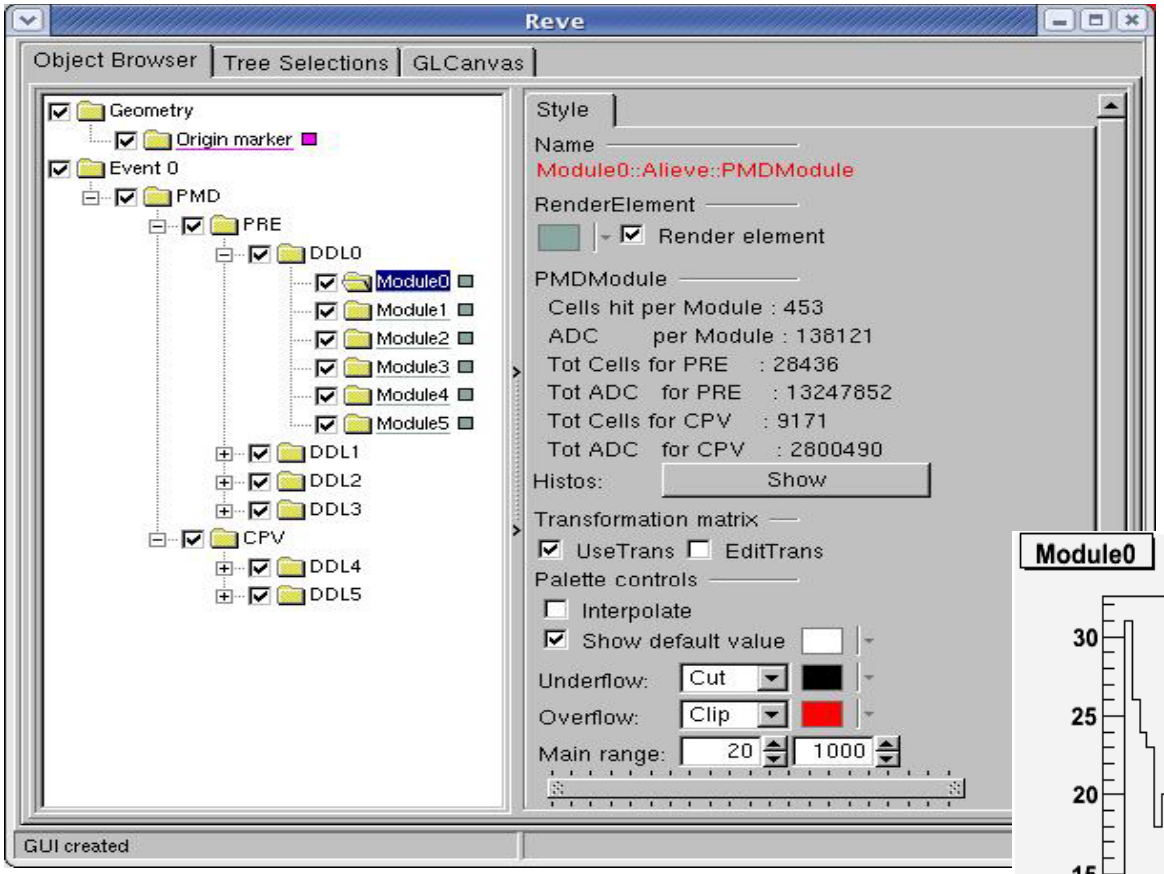
PMD QA codes are in SVN.
Logfile for comparison missing.

Visualization

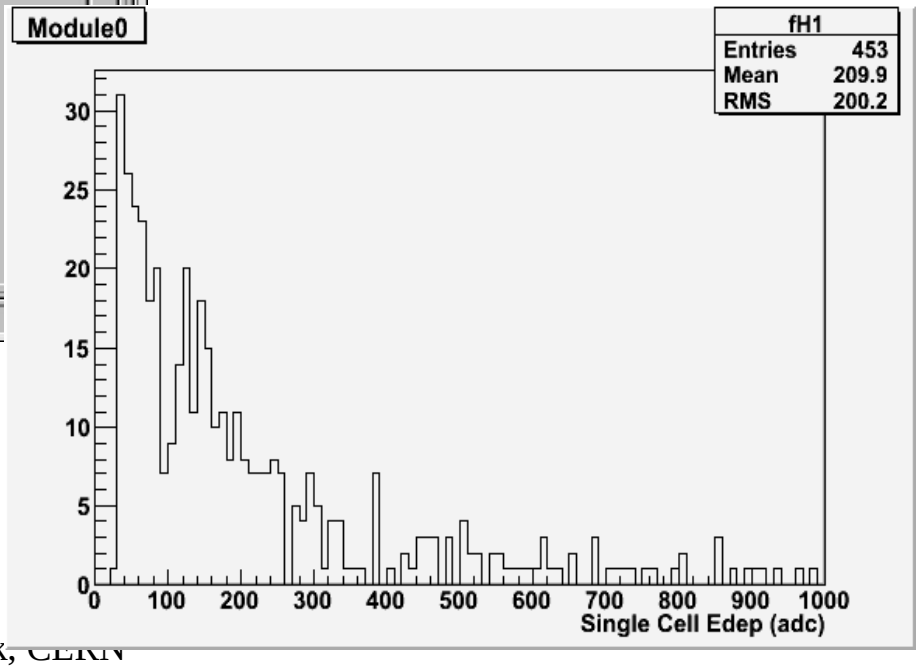




Visualization



Implemented reading digits as well as raw data



Codes in SVN

Documentation

Present documentation available at:

http://www.veccal.ernet.in/~pmd/ALICE/software.html

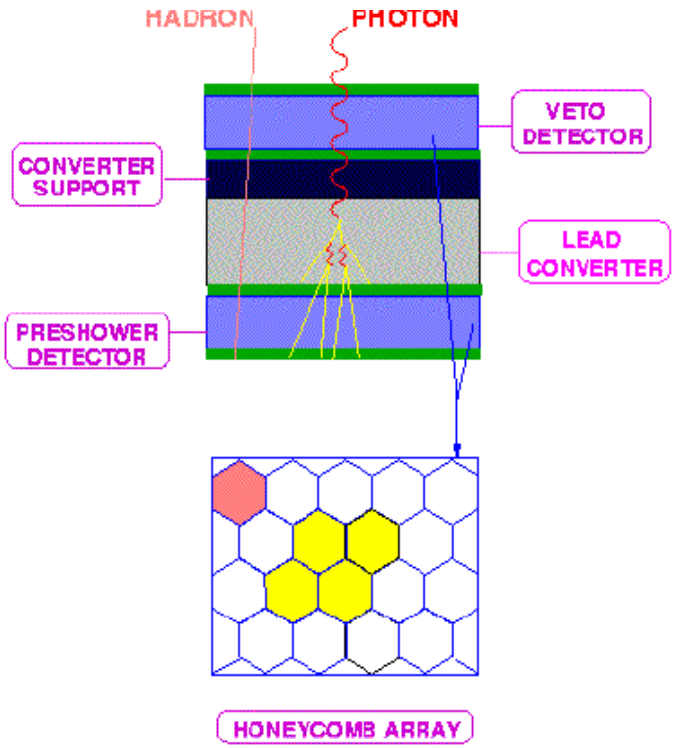
The page is updated regularly.

Task	Committed to SVN?	Comment / Timeline
1. Geometry: Detector with structure and FEE	Yes	yes
2.Cables in geometry	No	After installation
3. Geometry as installed, overlap vols.	Not complete	After installation
4. Raw Data format	Yes	
5. Calibration (Offline)	Yes	
6. Preprocessor	Yes	
7. DA	Yes	To be validated
8. Alignment & survey data to align-able objects	Yes	Testing and bug-fixing to be done end June
9. Clustering Routine	Yes	New version with a week
10. Discrimination	Yes	Improvement in progress
11. QA(Digit/ESD)	Yes	Ref. histograms missing
12. ESD and AOD	ESD: Yes, AOD: No	Work in progress
13. Event display	Yes	
14. Documentation	Yes	In progress

CLUSTERING

Natasha Sharma

- Photon when hit lead converter produce shower.
- The shower hits a group of cells of Preshower plane.
- The group of connected cells is called a cluster.



ASSOCIATION

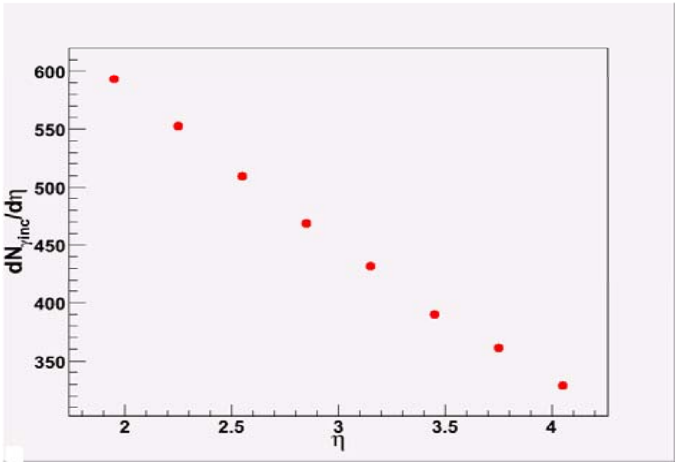
Present Clustering Routines

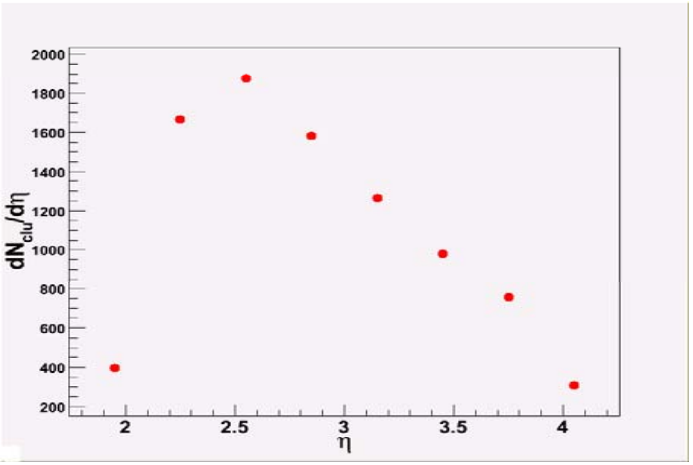
Terminology Used

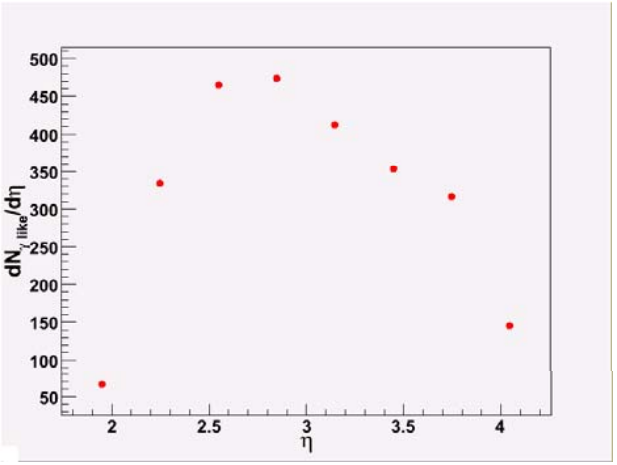
- Number of incident photons from Hijing:$N\gamma_{inc}$
- Total number of clusters on PMD: N_{clu}
- Number of clusters after 3 MIP cut: $N\gamma_{like}$
- Number of detected incident photons on PMD : $N\gamma_{det}$

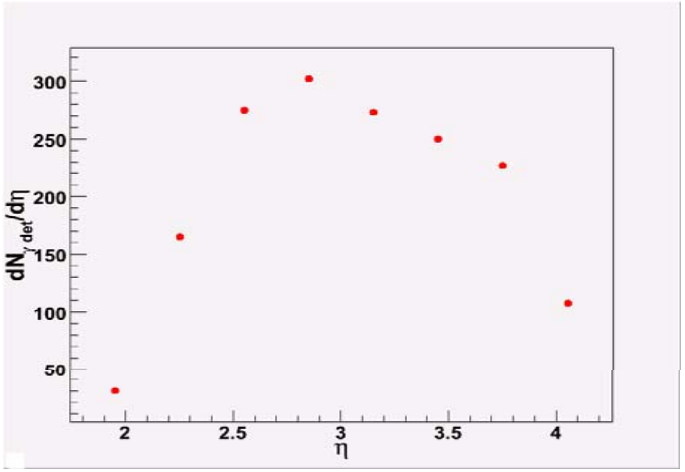
- Efficiency = $N\gamma_{det}/N\gamma_{inc}$
- Purity = $N\gamma_{det}/N\gamma_{like}$

η distributions of $N\gamma_{inc}$, N_{clu}, $N\gamma_{like}$ and $N\gamma_{det}$









Efficiency and Purity of photons

Preliminary results: dN/dη~1000