ZDC status report: update

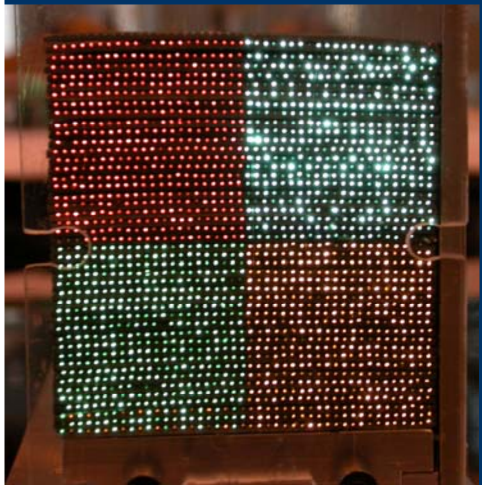
C. Oppedisano

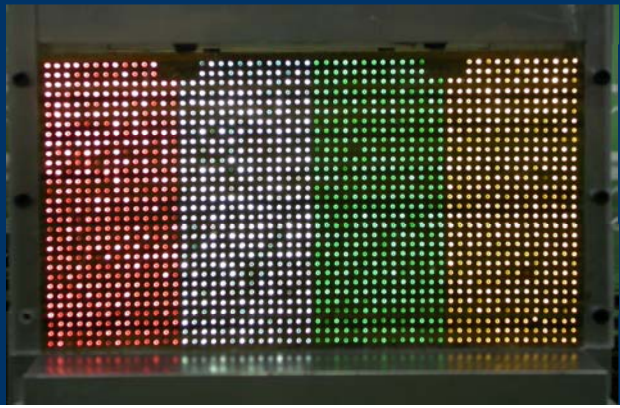
RECONSTRUCTION ALGORITHM

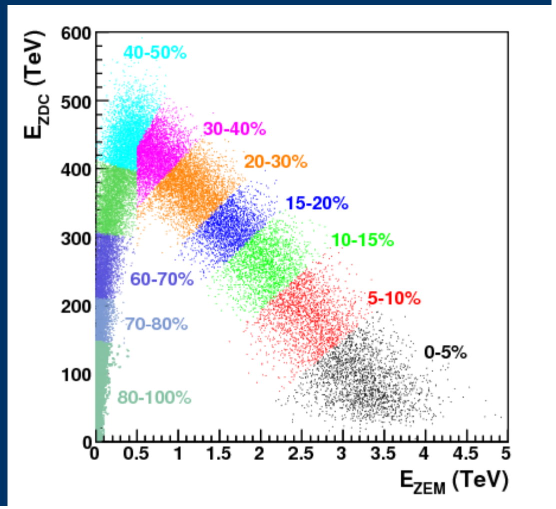
CALIBRATION OBJECT

ESD STRUCTURE

ONGOING TASKS







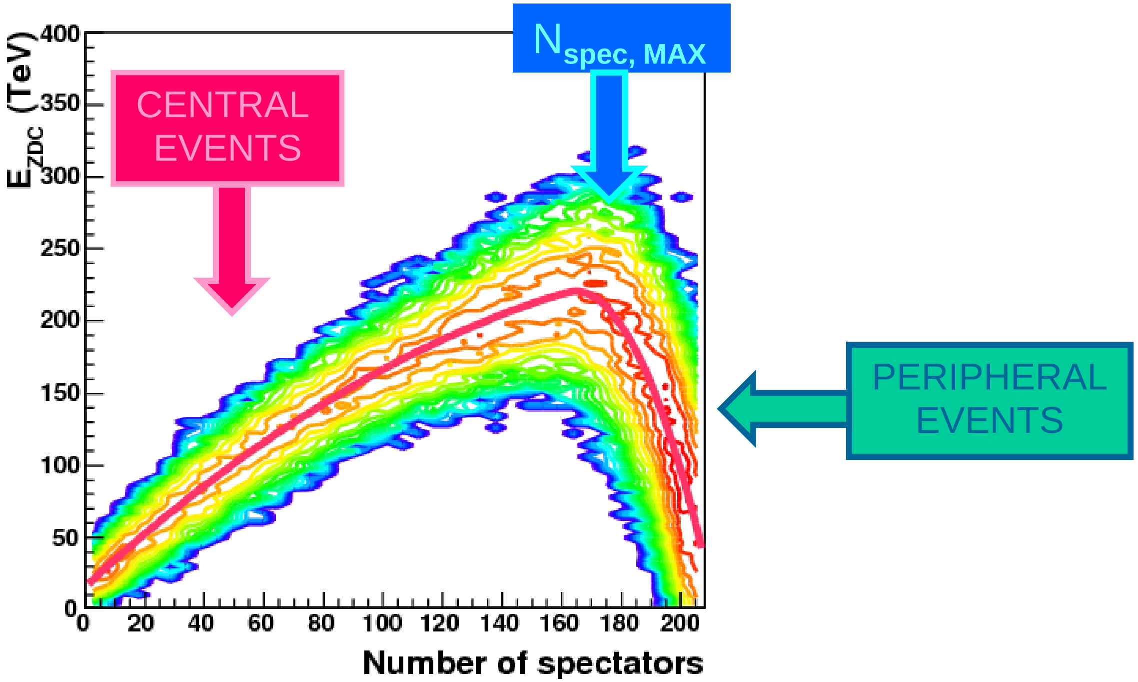
ZDC RECONSTRUCTION (I)

ZDC reconstruction relies on the parameterization of various correlations:

E_{ZDC} vs. N_{spec}, E_{ZDC} vs. b and E_{ZEM} vs. N_{spec} (see PPR vol.II, par. 6.1.2)

Due to fragments production these correlations have 2 branches corresponding to central and peripheral event samples

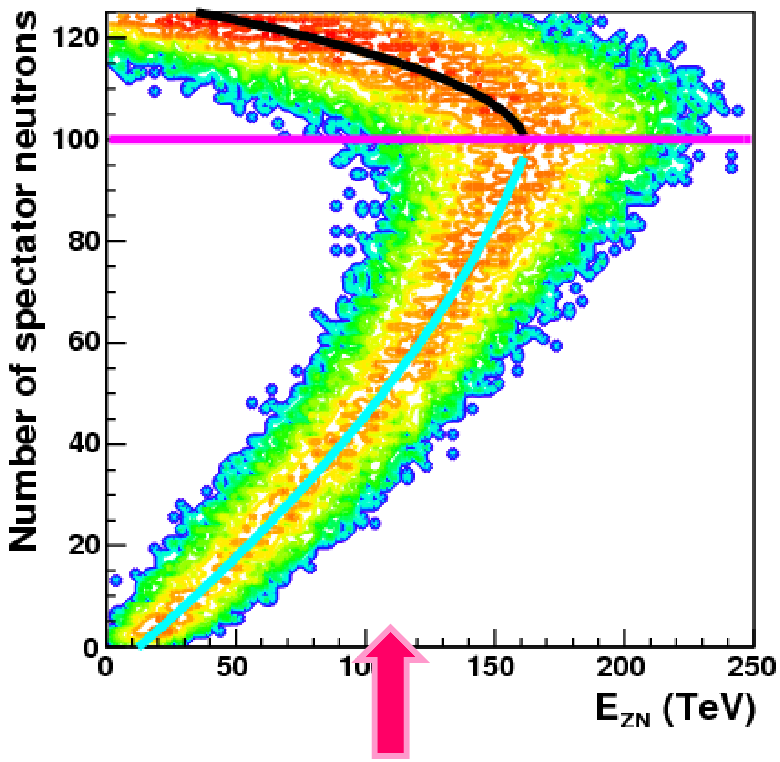
The two branches of N_{spec} vs. E_{ZDC} spectra are fitted separately, requiring the same values for the 2 fitting functions for $N_{spec} = N_{spec, MAX}$

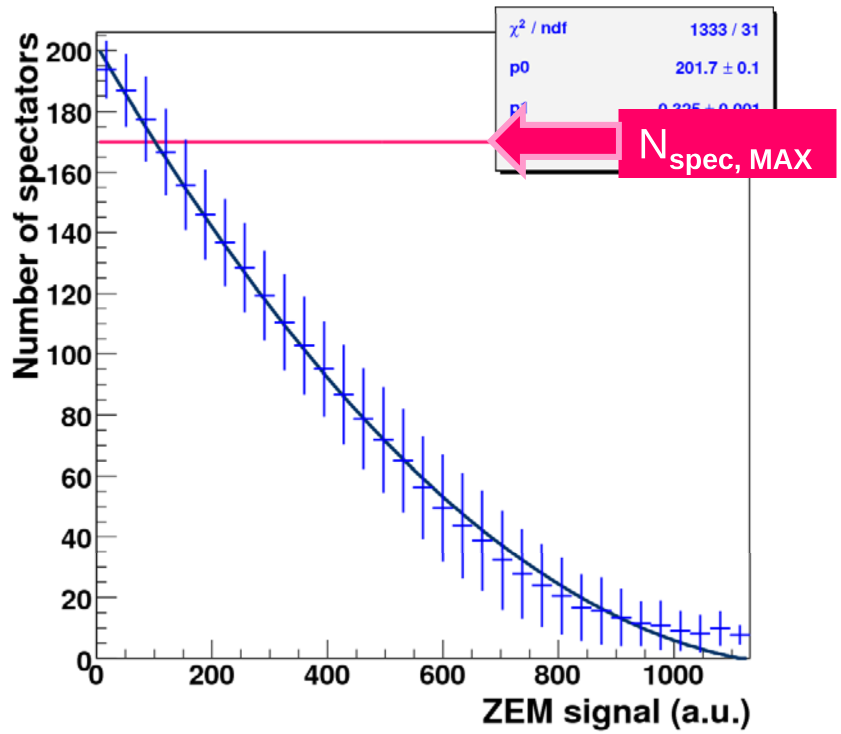


ZDC RECONSTRUCTION (II)

Inverting these 2 functions one gets two possible N_{spec} values for each experimentally measured E_{ZDC} value

Using the ZEM signal, N_{spec} from one branch of events can be correctly determined since E_{ZEM} is a monotonic function of N_{spec}





CALIBRATION DATA

Besides calibration data needed for pedestal subtraction and energy calibration, new data members needed for reconstruction have been added to AliZDCCalibData class

```
// --- Coefficients for tower calibration
 Float_t  fZN1EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
 Float_t  fZP1EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
 Float_t  fZN2EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
 Float_t  fZP2EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs

// --- Coefficients for centrality selection from ZEM signal
 Float_t  fZEMEndValue;       // End point value of ZEM energy spectrum
 Float_t  fZEMCutFraction;    // Fraction of ZEM energy spectrum used to cut
 Float_t  fDZEMSup;           // Upper value of EZDCvs.ZEM correlation
 Float_t  fDZEMInf;           // Lower value of EZDC vs.ZEM correlation

// --- Parameters from EZDC vs. Nspec correlation
 Float_t  fEZN1MaxValue;      // Max value of ZN1 vs. Nspec n correlation
 Float_t  fEZP1MaxValue;      // Max value of ZP1 vs. Nspec p correlation
 Float_t  fEZDC1MaxValue;     // Max value of ZDC1 vs. Nspec n+p correlation
 Float_t  fEZN2MaxValue;      // Max value of ZN2 vs. Nspec n correlation
 Float_t  fEZP2MaxValue;      // Max value of ZP2 vs. Nspec p correlation
 Float_t  fEZDC2MaxValue;     // Max value of ZDC2 vs. Nspec n+p correlation
```

CALIBRATION DATA: SOURCE (I)

Coefficients needed to calibrate the response in different towers of each ZDC

```
// --- Coefficients for tower calibration
  Float_t  fZN1EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
  Float_t  fZP1EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
  Float_t  fZN2EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
  Float_t  fZP2EqualCoeff[5];  // Equalization coefficients for ZN1 PTMs
```

➡ source: cosmic data

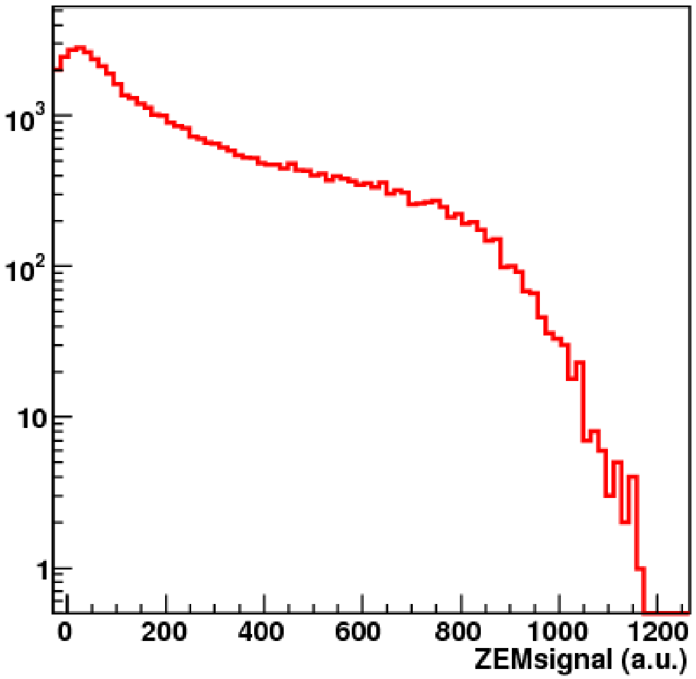
the peak given by a single photoelectron is used to calibrate the 5 PMTs of each hadronic ZDC

DA needed to process cosmic data ready but still to be committed
(done by end of October)

Parameters needed to reconstruct centrality variables from E_{ZDC}

```
// --- Coefficients for centrality selection from ZEM signal
  Float_t  fZEMEndValue;       // End point value of ZEM energy spectrum
  Float_t  fZEMCutFraction;    // Fraction of ZEM energy spectrum used to cut
  Float_t  fDZEMSup;           // Upper value of EZDCvs. ZEM correlation
  Float_t  fDZEMInf;           // Lower value of EZDC vs. ZEM correlation
```

➡source: ZEM signal spectrum (not energy calibrated!)
+ E_{ZDC} vs. ZEM signal correlation



- fZEMEndValue from a fit of the spectrum (knee of the distribution)

- fZEMCutFraction, fDZEMSup and fDZEMInf from E_{ZDC} vs. ZEM signal correlation

CALIBRATION DATA: SOURCE (II)

Parameters needed to reconstruct centrality variables from E_{ZDC}

```
// --- Parameters from EZDC vs. Nspec correlation
  Float_t  fEZN1MaxValue;      // Max value of ZN1 vs. Nspec n correlation
  Float_t  fEZP1MaxValue;      // Max value of ZP1 vs. Nspec p correlation
  Float_t  fEZDC1MaxValue;     // Max value of ZDC1 vs. Nspec n+p
correlation
  Float_t  fEZN2MaxValue;      // Max value of ZN2 vs. Nspec n correlation
  Float_t  fEZP2MaxValue;      // Max value of ZP2 vs. Nspec p correlation
  Float_t  fEZDC2MaxValue;     // Max value of ZDC2 vs. Nspec n+p
correlation
```

➡source: E_{ZDC} vs. “true” N_{spec} correlation, built using ZEM information

the no. of DETECTED spectators derived from E_{ZDC} is “biased” by fragmentation

$N_{spec} = E_{ZDC}$[TeV]/2.76

DAs to be implemented
(done by end of October)

EVENT RECONSTRUCTION (I)

RECONSTRUCTION STEPS

from ADC data
(raw or digitized)

↓

PEDESTAL SUBTRACTION

↓

equalization of signal from different sectors

↓

ENERGY CALIBRATION

↓

sum of signals from the 5 sectors
➡ E_{ZN1}, E_{ZP1}, E_{ZN2}, E_{ZP2}

↓

calculation of detected N_{spec}

CALIBRATION DATA

subtraction of mean pedestal values
fCalibData → GetMeanPed()

corrected ADC * equalization coeff.
fCalibData → GetZN1EqualCoeff(i)

equalized signal * energy calib. coeff.
fCalibData → GetEnCalib(i)

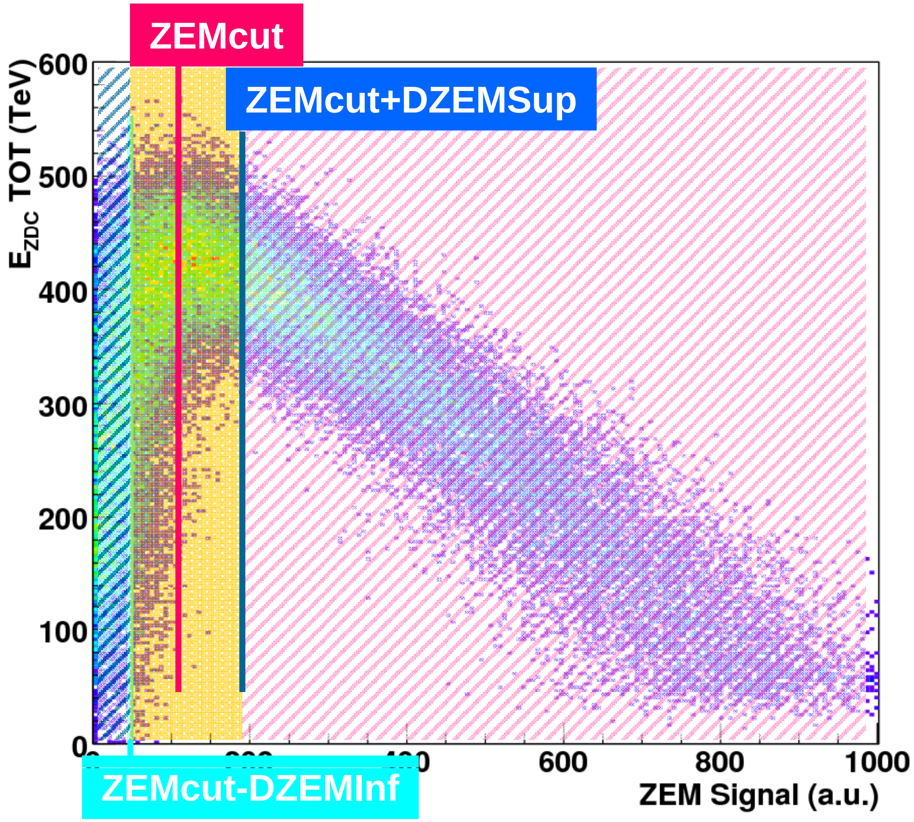
EVENT RECONSTRUCTION (II)

RECO

evaluation of "true" N_{spec}, N_{part}, b

CALIB

use of calibration data from ZEM signal
fCalibData → GetZEMEndValue()
fCalibData → GetZEMCutFraction()
fCalibData → GetDZEMSup()
fCalibData → GetDZEMInf()



According to ZEM signal the centrality variables are evaluated from different parameterizations

ZEM > ZEMcut+DZEMSup ➨ parametrization of the central branch of correlations vs. E_{ZDC}

ZEM < ZEMcut-DZEMInf ➨ parametrization of the peripheral branch of correlations vs. E_{ZDC}

ZEM > ZEMcut-DZEMInf && <ZEMcut+DZEMInf ➨ parametrization from correlations vs. ZEM

MODEL DEPENDENCY

Extrapolation of centrality variables relies on models!

Parametrized functions from HIJING + fragmentation model:

- central and peripheral branches of N_{spec} vs. E_{ZDC} for ZN, ZP and ZDC

  (+) (-)

  $$N_{spec} = \frac{-p_1 \pm \sqrt{p_1^2 - 4p_2(p_0 - E_{ZDC})}}{2p_2}$$

- central and peripheral branches of b vs. E_{ZDC}

  $$b = p_0 + p_1 E_{ZDC} + p_2 E_{ZDC}^2 + p_3 E_{ZDC}^3 \qquad b = p_0 + p_1 E_{ZDC} + p_2 E_{ZDC}^2$$

- N_{spec} vs. ZEM signal for n, p and n+p

  $$N_{spec} = p_0 + p_1(ZEM) + p_2(ZEM)^2$$

- b vs. ZEM signal

  $$b = p_0 + p_1(ZEM) + p_2(ZEM)^2 + p_3(ZEM)^3 + p_4(ZEM)^4 + p_5(ZEM)^5$$

Now the parametrized distributions are in AliZDCReconstruction constructor

Distributions will be fitted once from experimental data and these fit functions will be used to provide centrality variables

The extrapolation still depends on fragmentation model

ESD

New data members in AliESDZDC class:
energy measured in the 4 sectors for the 2 neutron calorimeters

```
Double_t    fZN1TowerEnergy[4];// reconstructed energy in 4 neutron ZDC towers
Double_t    fZN2TowerEnergy[4];// reconstructed energy in 4 neutron ZDC towers
Double32_t fZDCN1Energy;      // reconstructed energy in the neutron ZDC
Double32_t fZDCP1Energy;      // reconstructed energy in the proton ZDC
Double32_t fZDCN2Energy;      // reconstructed energy in the neutron ZDC
Double32_t fZDCP2Energy;      // reconstructed energy in the proton ZDC
Double32_t fZDCEMEnergy;      // signal in the electromagnetic ZDC
Int_t      fZDCParticipants;  // number of participants estimated by the ZDC
```

- ➡ provide event by event the centroid of the spectator neutrons spot
- ➡ reconstruct the 1st order event plane
- ➡ In AliESDEvent a method GetZDCCentroid to provide the spot coord. will be added

$$x = a_0 \frac{\sum_{i=1}^{4} E_i^{\alpha} x_i}{\sum_{i=1}^{4} E_i^{\alpha}} \qquad y = a_0 \frac{\sum_{i=1}^{4} E_i^{\alpha} y_i}{\sum_{i=1}^{4} E_i^{\alpha}}$$

ONGOING TASKS (I)

DAQ DA

Tasks | Tasks (Inactive) | Gantt Chart | Task Logs

Show: ☐ Incomplete Tasks Only

Pin	Log	P	Work	Task Name	Task Owner	Assigned Users	Start Date	Done Date	Expected Finish Date	Last Update
	Log			***ZDC*** (136)	Chiara.Oppedisano	-	01/01/2006	-	01/11/2007	-
	Log			***Alignment*** (1089)	Chiara.Oppedisano	-	01/01/2006	28/02/2007	05/03/2007	-
	Log			***Calibration*** (1092)	Chiara.Oppedisano	-	01/01/2006	-	01/11/2007	-
	Log			***Requirements*** (1104)	Chiara.Oppedisano	-	01/01/2006	03/10/2006	12/12/2006	-
	Log			***Online*** (1120)	Chiara.Oppedisano	-	01/01/2006	-	01/11/2007	-
	Log			preprocessor algorithm (1112)	Chiara.Oppedisano	-	01/01/2006	01/03/2007	31/08/2006	-
	Log			Configuration: names of DCS data points: prototype (1115)	Chiara.Oppedisano	-	01/01/2006	07/07/2006	30/01/2007	-
	Log			DAQ DA (1121)	Chiara.Oppedisano	-	01/01/2006	-	01/11/2007	-
	Log			DAQ FXS Output files (1123)	Chiara.Oppedisano	-	01/01/2006	28/02/2007	30/11/2006	-
	Log			DCS FXS Output files (1124)	Chiara.Oppedisano	-	01/01/2006	05/03/2007	30/11/2006	-
	Log			HLT DA (1575)	Chiara.Oppedisano	-	20/02/2007	21/02/2007	05/03/2007	-
	Log			HLT FXS Output files (1576)	Chiara.Oppedisano	-	20/02/2007	21/02/2007	05/03/2007	-
	Log			***Offline*** (1487)	Chiara.Oppedisano	-	09/02/2007	08/03/2007	05/03/2007	-

☒ already committed DAs (for pedestal subtraction and energy calibration coefficient calculation) are waiting to be tested by the DAQ expert (aware from last Offline week!)

☐ missing DAs (needed to evaluate parameters for centrality reconstruction) implemented, tested and committed by end of October

ONGOING TASKS (II)

QA and geometry

Log	⏩	***Quality Assurance*** (1399)	Chiara.Oppedisano	-	01/01/2006	-	31/10/2007	-
Log	✔	Provide name of contact for MC data quality control (1400)	Chiara.Oppedisano	-	01/01/2006	01/08/2006	01/08/2006	-
Log	⏩	ESD QA (1401)	Chiara.Oppedisano	-	31/01/2007	-	31/10/2007	-
Log	⏩	Digit QA (1402)	Chiara.Oppedisano	-	31/01/2007	-	31/10/2007	-
Log	⏩	Pre-production validation (1437)	Chiara.Oppedisano	-	01/02/2007	-	31/10/2007	-
Log	⏩	Code quality (1440)	Chiara.Oppedisano	-	01/02/2007	-	31/10/2007	-
Log	✔	***Reconstruction*** (1580)	Chiara.Oppedisano	-	01/01/2006	28/08/2007	30/09/2007	-
Log	✔	***Simulation*** (1581)	Chiara.Oppedisano	-	01/01/2006	15/02/2006	15/02/2006	-
Log	!	***Geometry*** (1098)	Chiara.Oppedisano	-	20/02/2007	-	30/09/2007	-
Log	!	Geometry as installed (1578)	Chiara.Oppedisano	Roberto.Gemme (50%)	20/02/2007	-	30/09/2007	-

☐ ESD and digit QA by the end of October

☐ preliminary version of the geometry “as installed” (by R. Gemme) is under debug. Hopefully it will be working by the end of October

CONCLUSIONS

CALIBRATION
- calibration object finalized
- use of calibration object in event reconstruction completed

RECONSTRUCTION
- reconstruction algorithm under final tests (something still remains to be tested…)

ESD
- new ESD structure implemented
- AliESDEvent::GetCentroid method to be committed

Open question…
- where to put the parametrized function

…not in calibration object since in principle they don't change over the whole run
(they depends only on the ZDC energy response)

A production of Pb-Pb with PIXEL+ZDC+forward detectors (T0, V0, FMD, PMD) is foreseen to study the multiplicity production as a function of centrality estimated with the ZDC