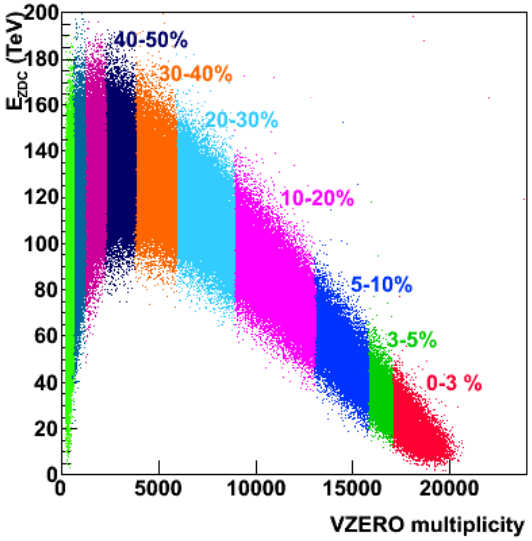
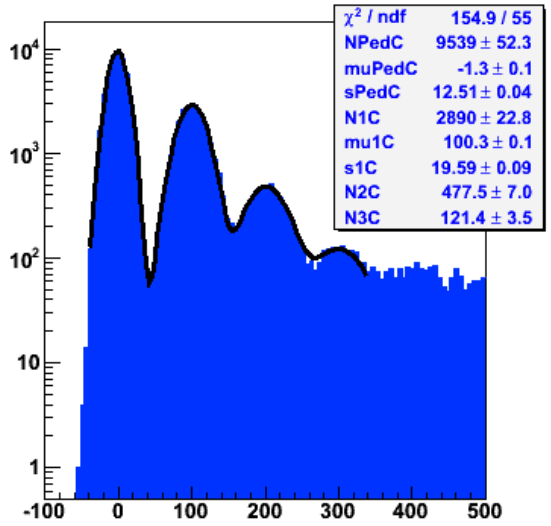
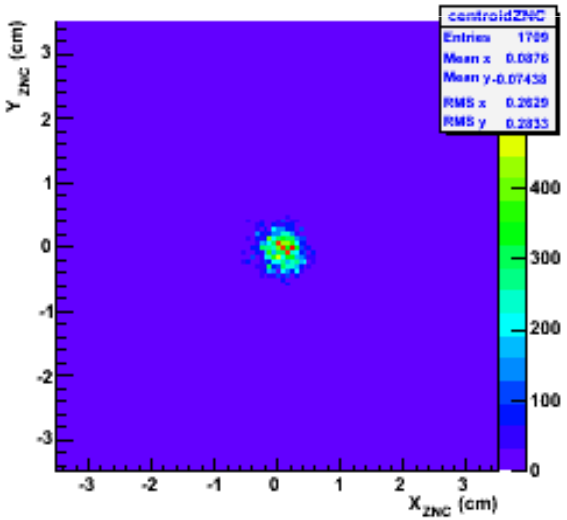
ZDC OFFLINE CODE

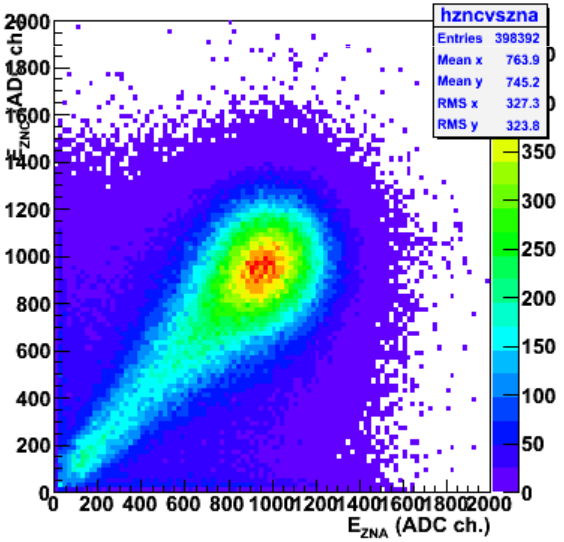


SUMMARY

- DAs STATUS
- CALIBRATION
- Pb-Pb PASS2 RECONSTRUCTION
- CENTRALITY
- ZDC IN PHYSICS SELECTION
- SIMULATION







DA STATUS

RUN TYPE	SOURCE	DA	OUTPUT
STANDALONE_PEDESTAL	LDC	ZDCPEDESTALda.cxx	ZDCPedestal.dat ZDCPedHisto.root
STANDALONE_LASER	LDC	ZDCLASERda.cxx	ZDCLaserCalib.dat ZDCLaserHisto.root
CALIBRATION_EMD	LDC	ZDCEMDda.cxx	ZDCEnergyCalib.dat ZDCTowerCalib.dat
CALIBRATION_MB	LDC	ZDCCALIBMBda.cxx	ZDCMBCalib.root
All but the above	MON	MAPPING	ZDCChMapping.dat

➡ DAs VALIDATED @ P2 AFTER MIGRATION TO SLC5
- MAPPING DA on monitoring machine
- LASER DA on LDC
- PEDESTAL DA on LDC

➡ DAs TO BE VALIDATED BEFORE NEXT Pb-Pb DATA TAKING
- CALIBRATION_EMD DA
- CALIBRATION_MB DA

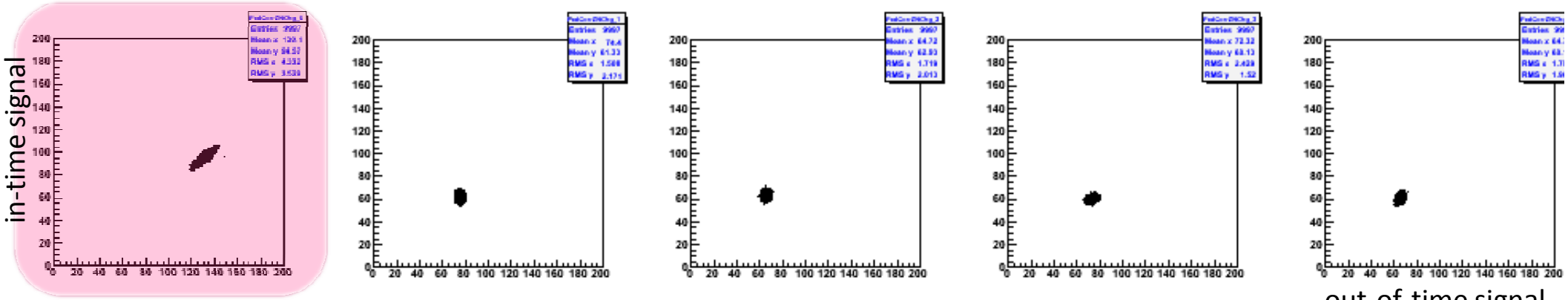
CALIBRATION (I)

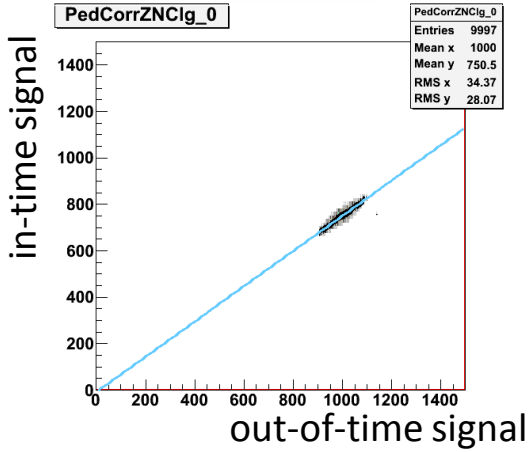
➡All ZDC calibration coefficients are evaluated in STANDALONE RUNS

① PEDESTAL DATA ➧ STANDALONE_PEDESTAL RUN

Run every new fill, 10^4 events, no reconstruction ➧ values from automatic fits stored in OCDB, histograms stored as Reference for offline checks

Past experience ➧ needed once to update the OCDB to include values from fitting the correlation of in-time vs. out-of-time pedestals for a better pedestal subtraction (not obvious a priori for which channels correlation would hold)

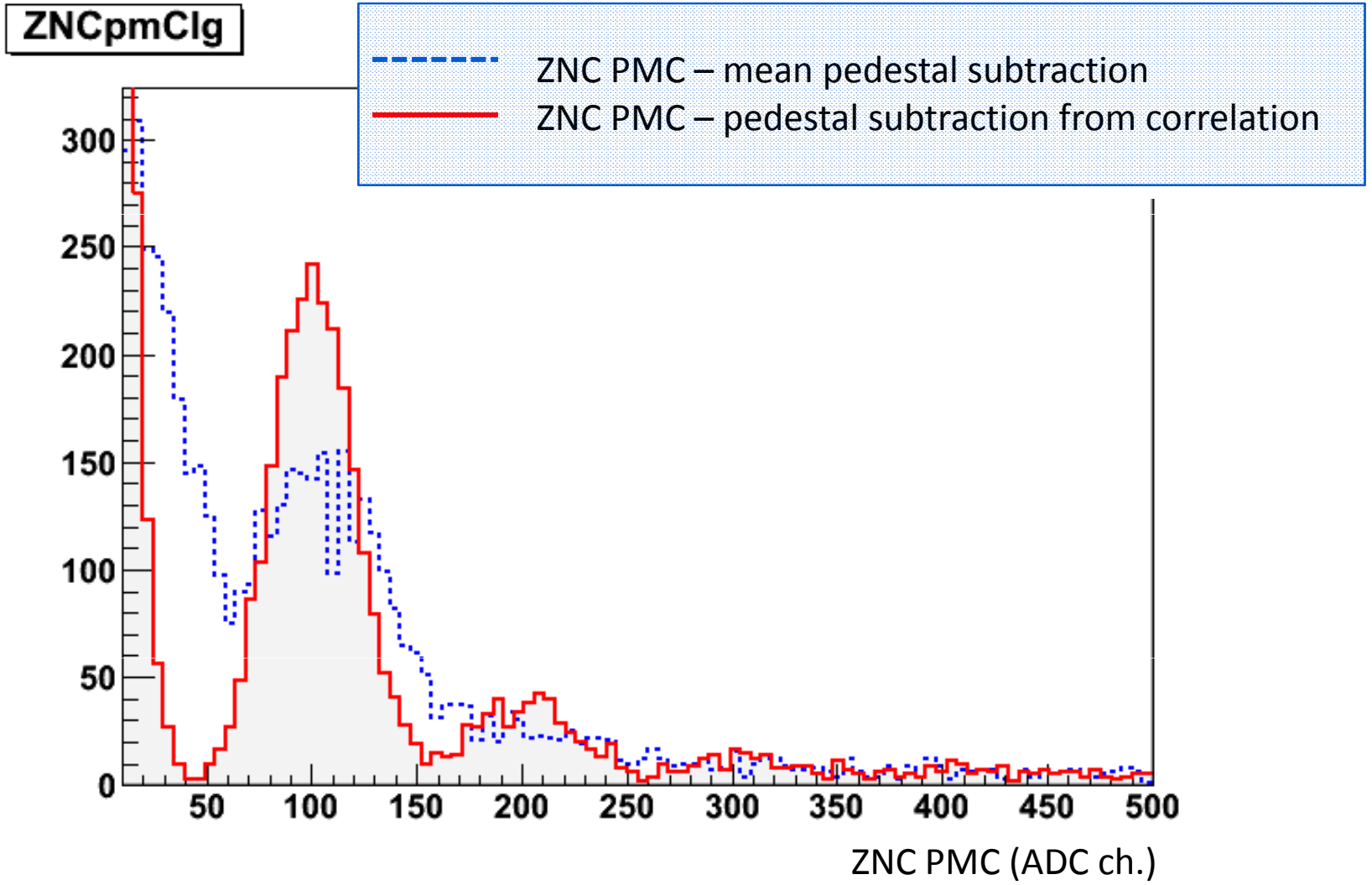




➡ the channels where a correlation is observable (4/22) have been fitted offline and the values have been written in the RAW OCDB

➡ PEDESTAL DA modified accordingly ➡ values currently stored in the OCDB object automatically

PEDESTAL SUBTRACTION FROM CORRELATION

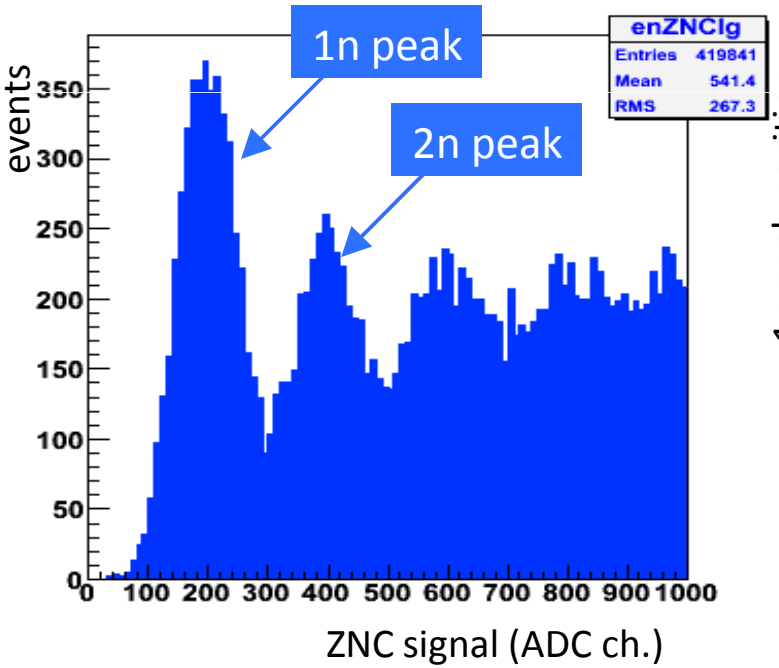


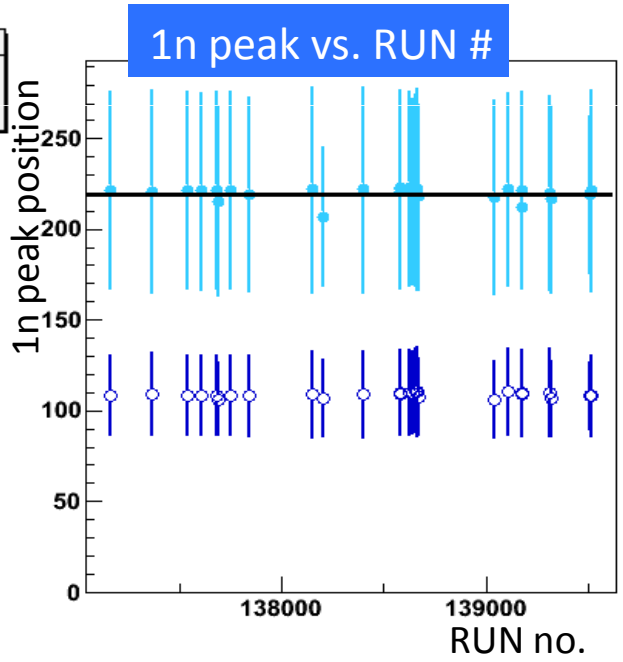
CALIBRATION (II)

② ENERGY CALIBRATION ➧ CALIBRATION_EMD RUN ONLY IN Pb-Pb!!!!!!!!!!

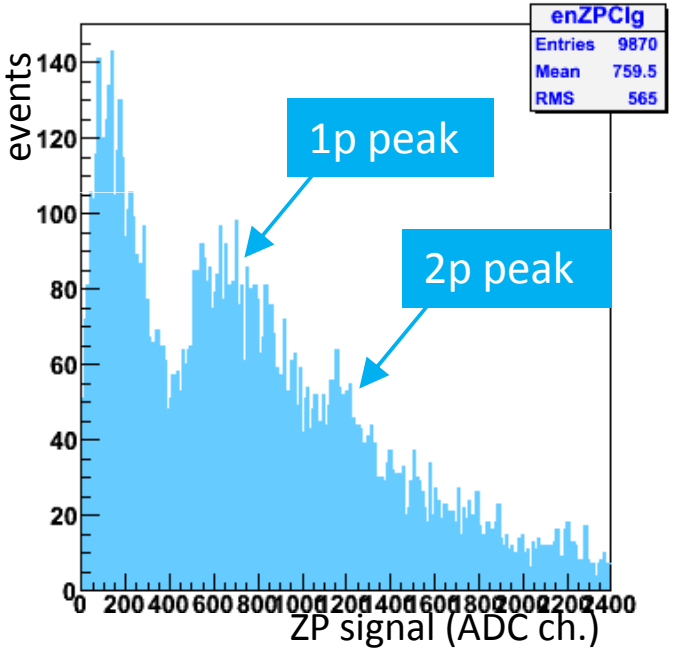
Data taken whenever ALICE allows ☺, needed more than 10^3 events in 1n peak (~few minutes), data reconstructed ➧ values from automatic fits stored in OCDB

Past experience ➧ update needed after careful analysis of 1st Pb-Pb data





1n peak fitted from ZNA (sum of 5 PMTs)



➡ the single proton peak in ZPs is not evident in the MB distribution, it appears when selecting most (0-2%) central events (an automatic procedure won't have worked!)

➡ implement the DA using what learned

CALIBRATION (III)

③ LASER DATA ➧ STANDALONE_LASER RUN

Data taken every fill, 10^4 events, not reconstructed ➧ values from automatic fits stored in OCDB, histograms stored as Reference for offline checks

Past experience ➧ OCDB never updated

④ TOWER INTER-CALIBRATION

Foreseen but not implemented (on purpose): no trivial way to do it automatically.

Data from physics runs analyzed offline ➡ OCDB eventually updated offline

Past experience ➧ OCDB never updated

⑤Pb-Pb MB DATA ➧ CALIBRATION_MB RUN ONLY IN Pb-Pb!!!!!!!!!!

Not run in past heavy-ion run, object extrapolated offline from PHYSICS RUN ESDs

Past experience ➧ OCDB updated offline

CALIBRATION SUMMARY

➡ ZDC calibration doesn't depend on any other detector

➡ reconstruction is needed only for energy calibration (and eventually MB calibration) data from STANDALONE runs (reconstruction is fast ! ☺)

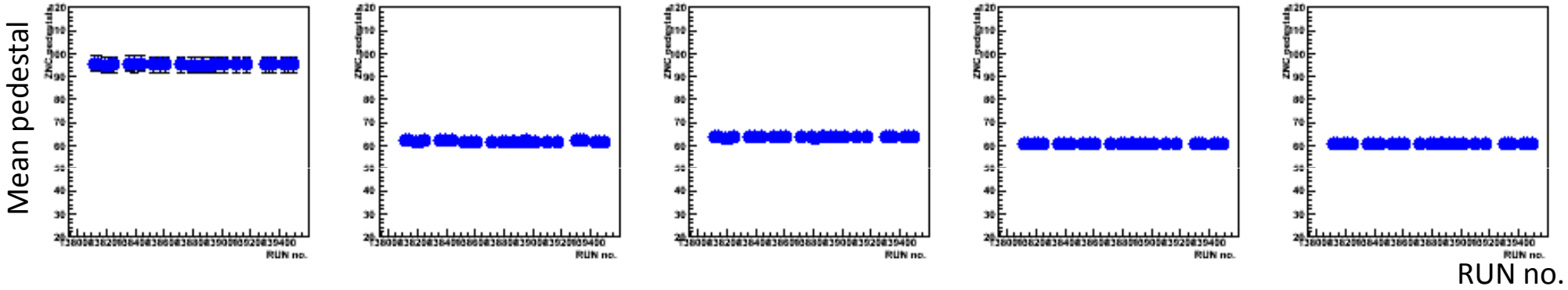
➡ monitoring of calibration coefficients vs. time is useful for PEDESTAL and LASER data

➡ monitoring of PHYSICS data quality (that depends upon calibration): ZDC wagon added to PWG1 QA train

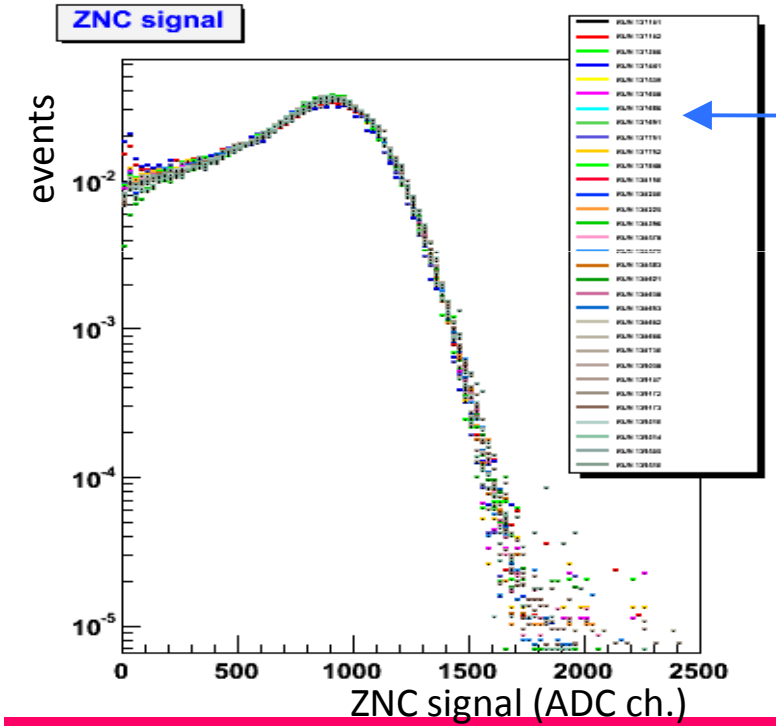
CALIBRATION MONITORING

➡ Monitoring of calibration coefficients for STANDALONE runs

Example: mean pedestal values for the 5 ZNC channels in LHC10h period

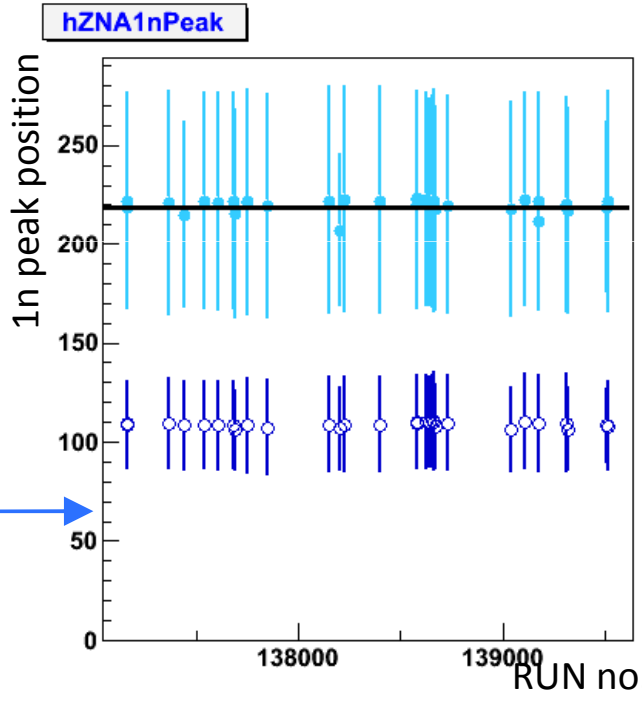


➡ QA on data to check consistency and quality of calibration data



Spectra monitoring allows to check pedestal quality

Monitoring the position of the 1n peak in data allows to assess energy calibration



Pb-Pb pass2 RECONSTRUCTION ➧ ENERGY CALIBRATION

➧Energy calibration provided for LHC10h pass2

ZN and ZP calorimeters are calibrated using the single nucleon peak

No physics signal to calibrate the ZEMs (ADC ch.)

➧ flag in AliESDZDC to check if signals are energy calibrated (pass2) or not (pass1 or pp data): AliESDZDC::kEnergyCalibratedSignal

➧ the absolute scale for hadronic ZDCs changes in pass2

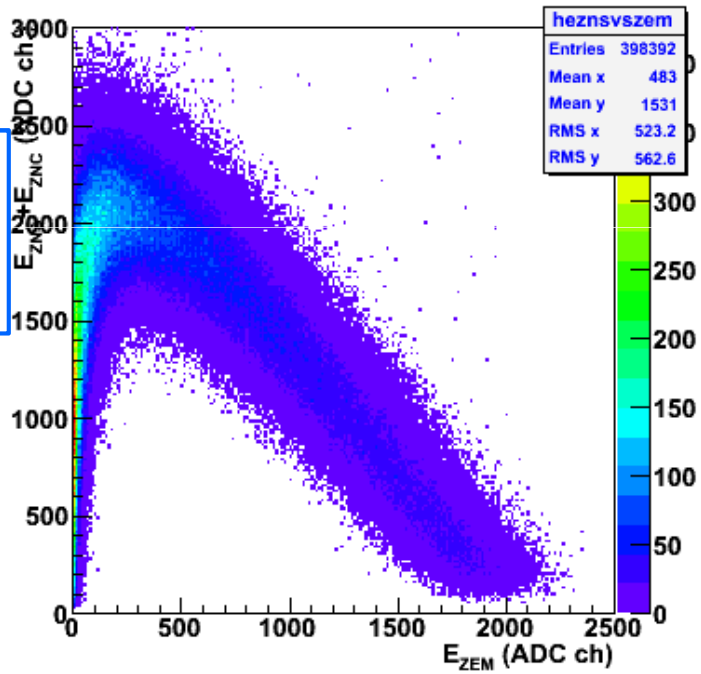
➧ hadronic signals do not need to be divided by 8 anymore

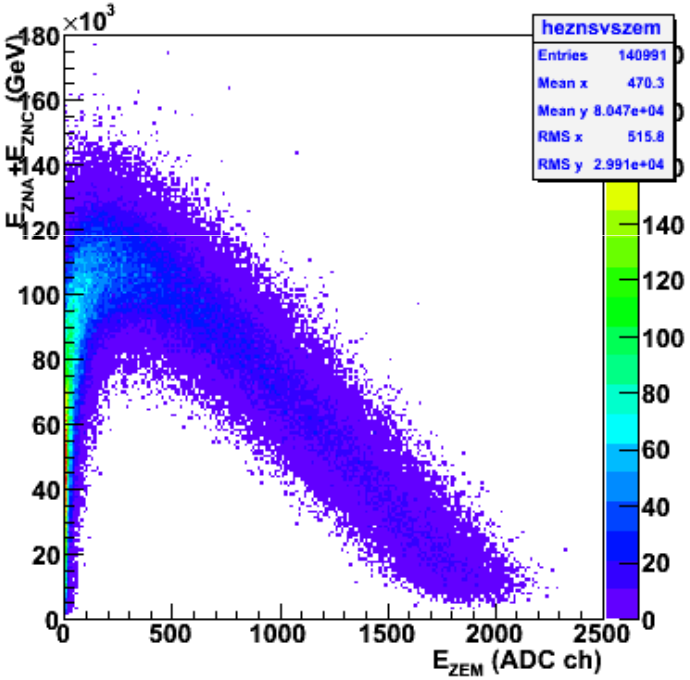
➧ ZEM signal is still to be divided by 8

E_{ZDC} vs. E_{ZEM} - RUN 139172

pass1

ZNA/8+ZNC/8 signal up to 3000 ADC ch.



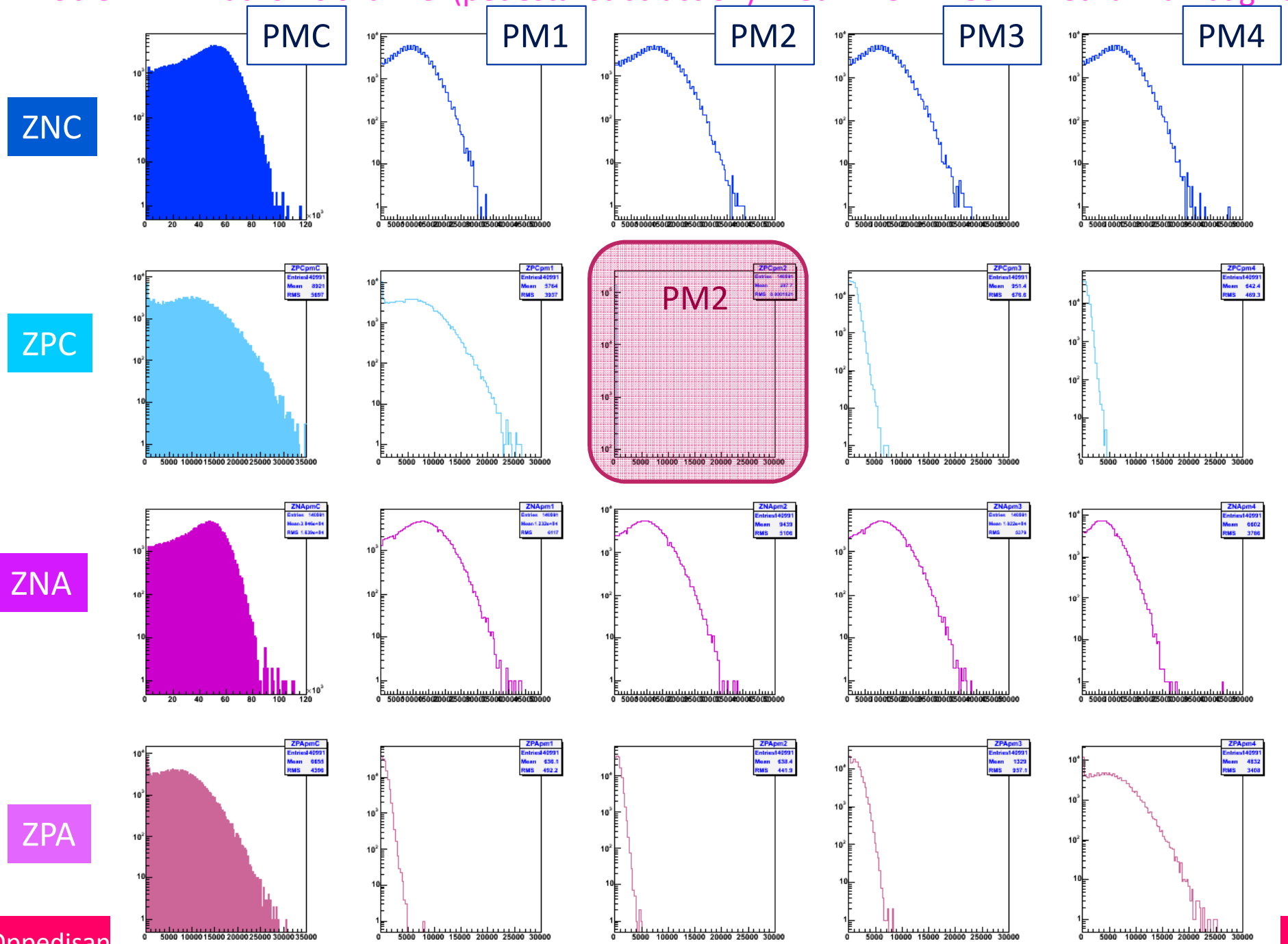


pass2

ZNA+ZNC energy up to 160 TeV

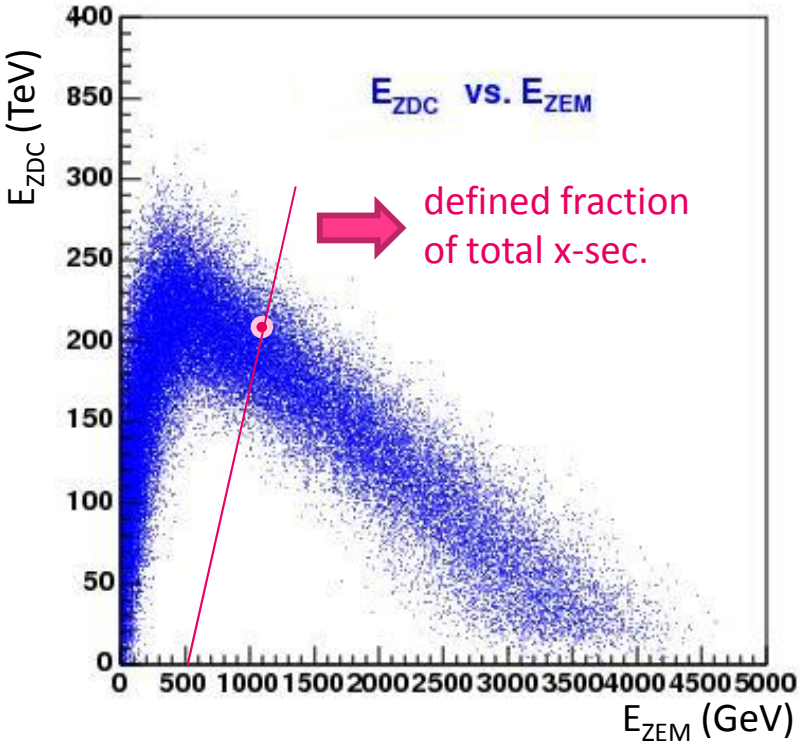
LHC10h PASS2 ➧ PROBLEM IN ZDC

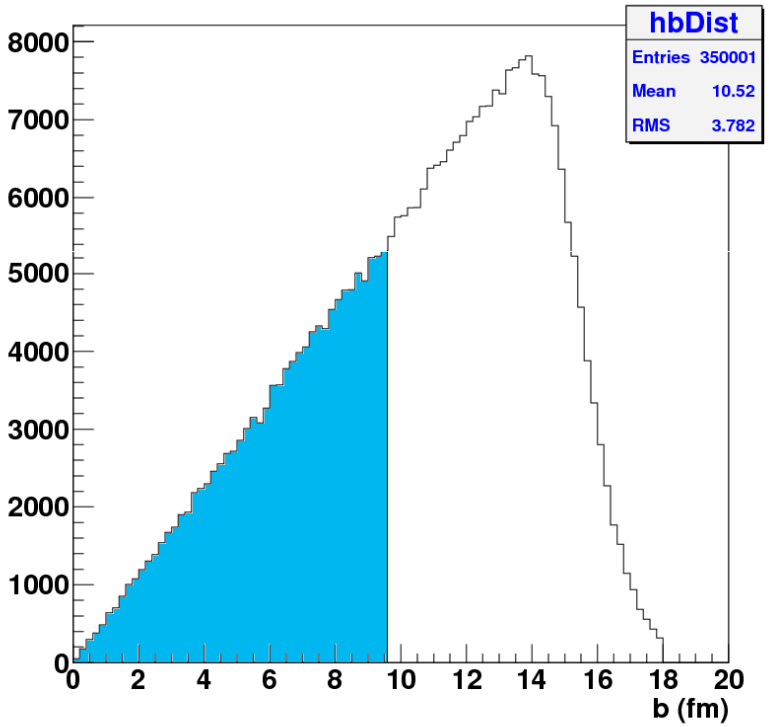
Problem in 1 hadronic channel (pedestal subtraction) fixed in rev. 47992 ➡ Savannah bug 78926



Pb-Pb pass2 RECONSTRUCTION ➧ CENTRALITY (I)

➡ Very preliminary b, N_{part} estimate from ZDC energy available in ZDC ESDs





➡ MB E_{ZDC} vs. E_{ZEM} distribution used as reference, collected in special RUNs (CALIBRATION_MB) or extracted directly from ESDs (2010 RUN)

➡ measured E_{ZDC}, E_{ZEM} values event by event select in the reference distribution a defined fraction of total x-section

➡ the same fraction is selected in b, N_{part} distribution from Glauber MC

➡ b, N_{part} values stored in ESDs for total ZDC energy and separately for side A and side C

Pb-Pb pass2 RECONSTRUCTION ➧ CENTRALITY (II)

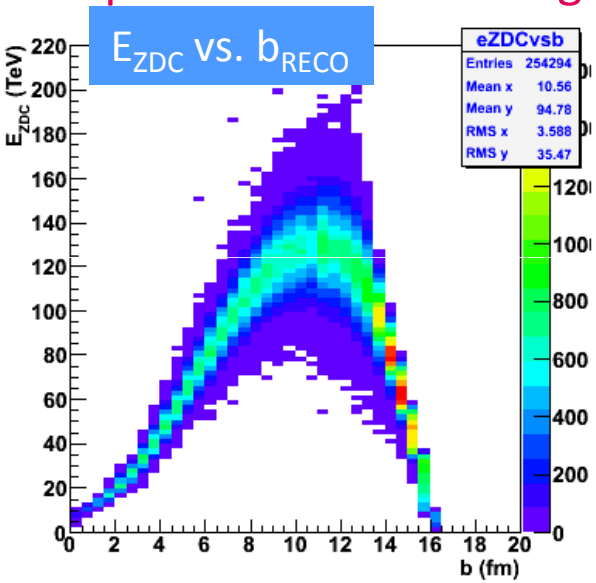
➡ MB E_{ZDC} vs. E_{ZEM} distributions tuned after pass1 ➧ RAW OCDB updated for pass 2

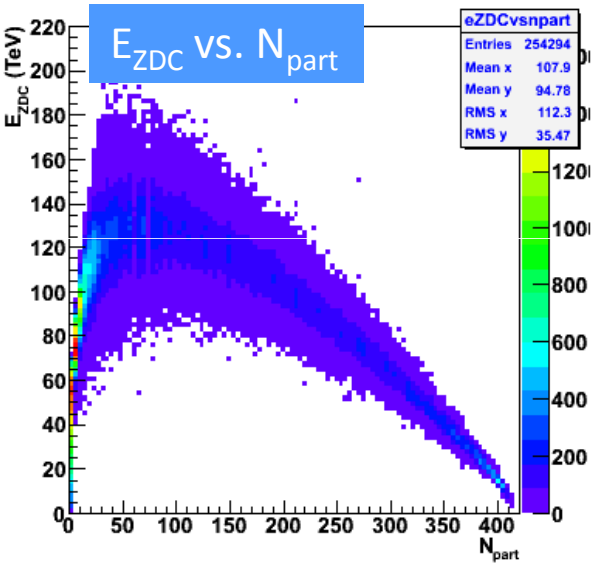
➡ the framework works in pass2 even if suffering from error in E_{ZPC} reconstruction

RUN 138200

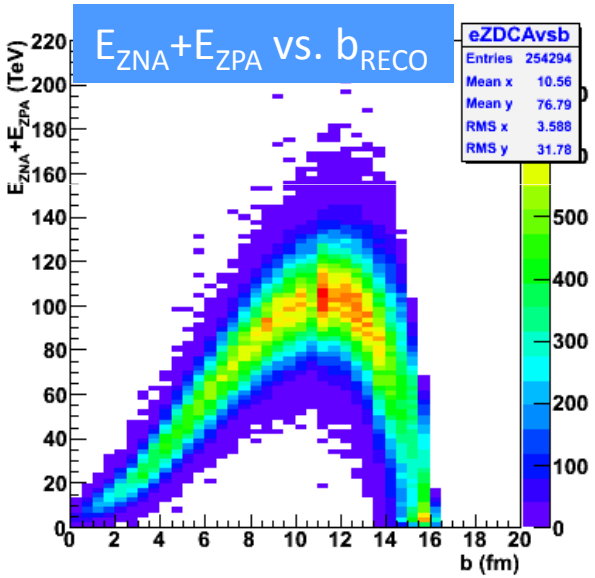
side A + side C

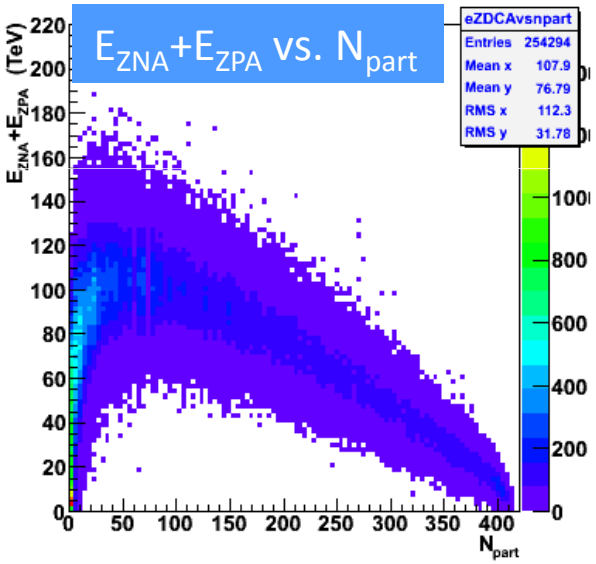
➡ bias due to wrongly reconstructed ZPC energy





only side A

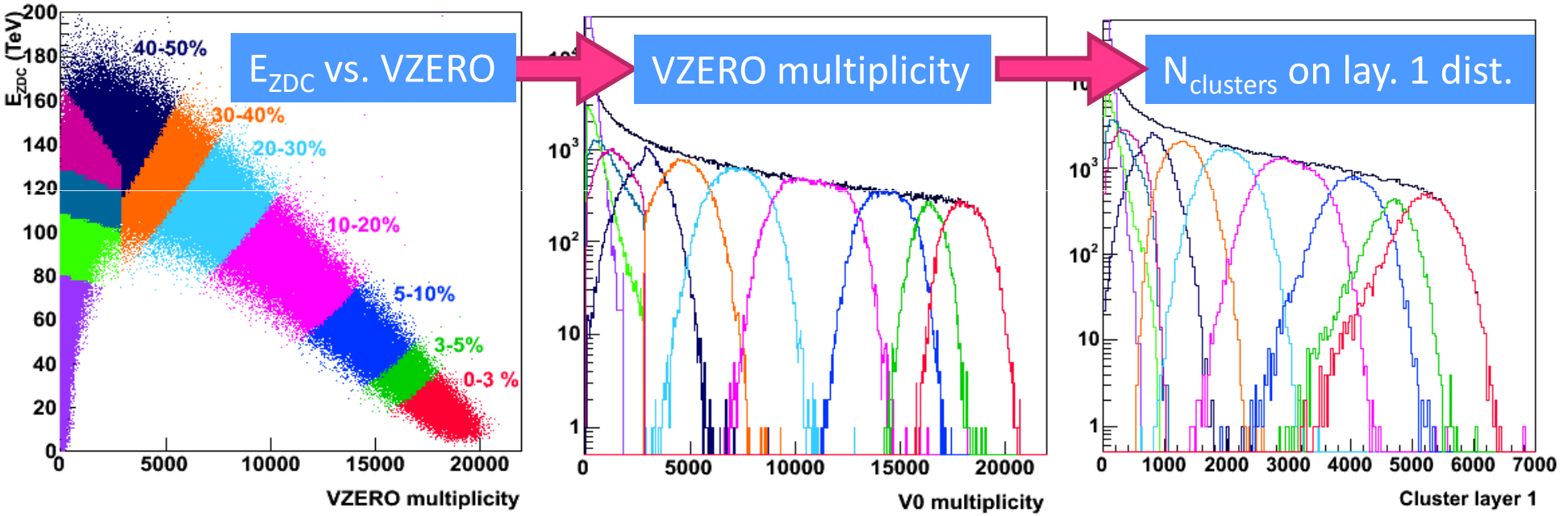


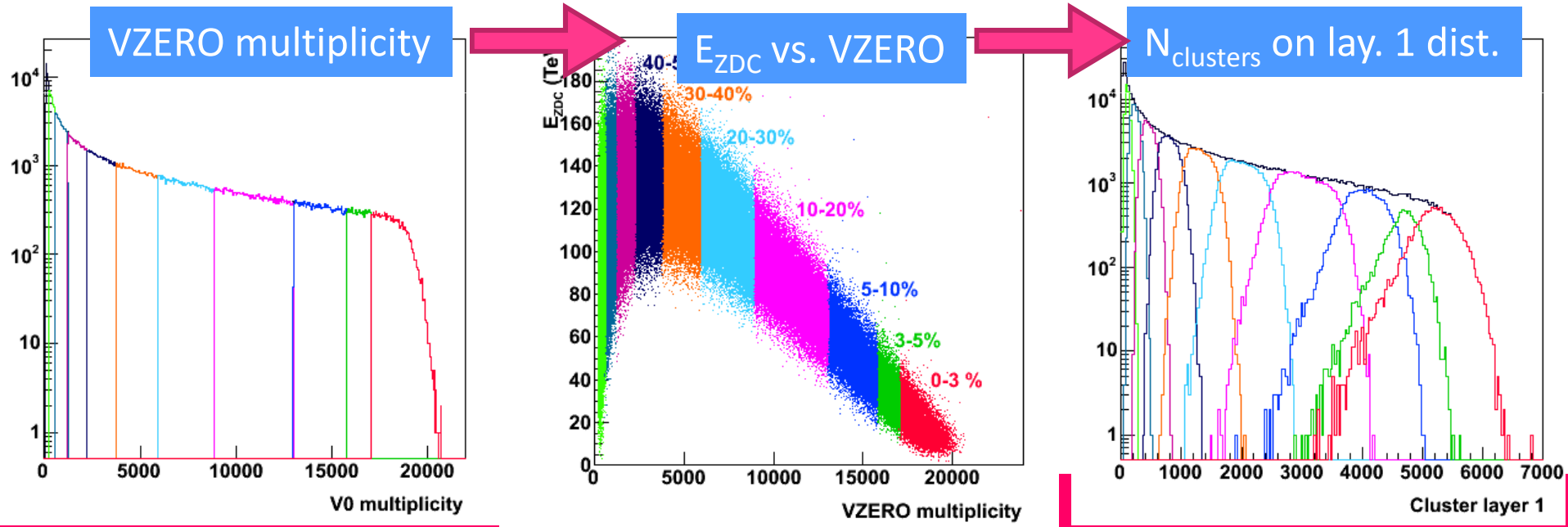


➡ very rough estimate (big uncertainty in total σ), centrality framework must be used!

ZDC IN CENTRALITY FRAMEWORK (I)

➡ Idea: select centrality using E_{ZDC} vs. E_{ZEM} (E_{ZDC} vs. VZERO) correlation + anchor point from Glauber fit to VZERO multiplicity distribution (i.e., fix 80% of total x-section)

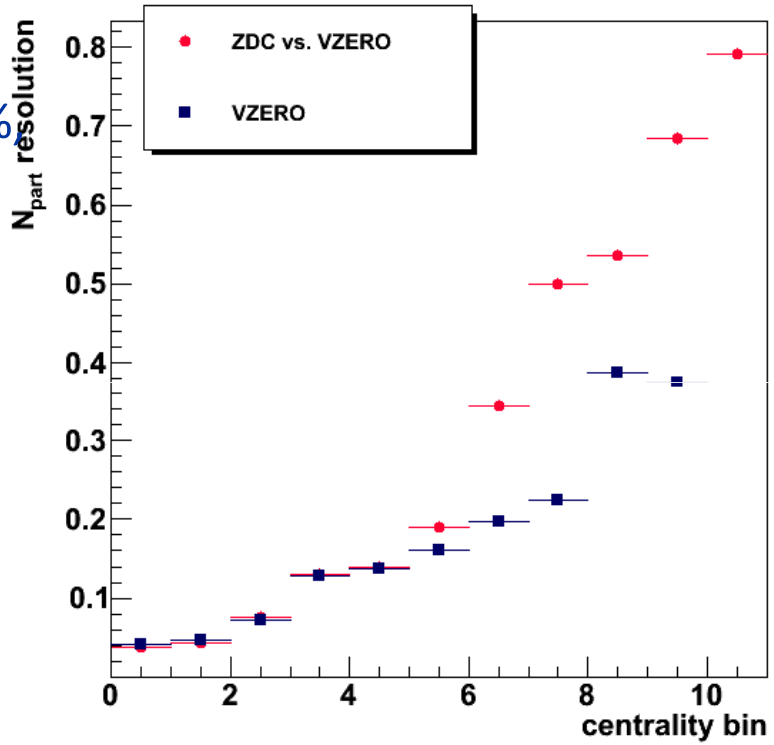


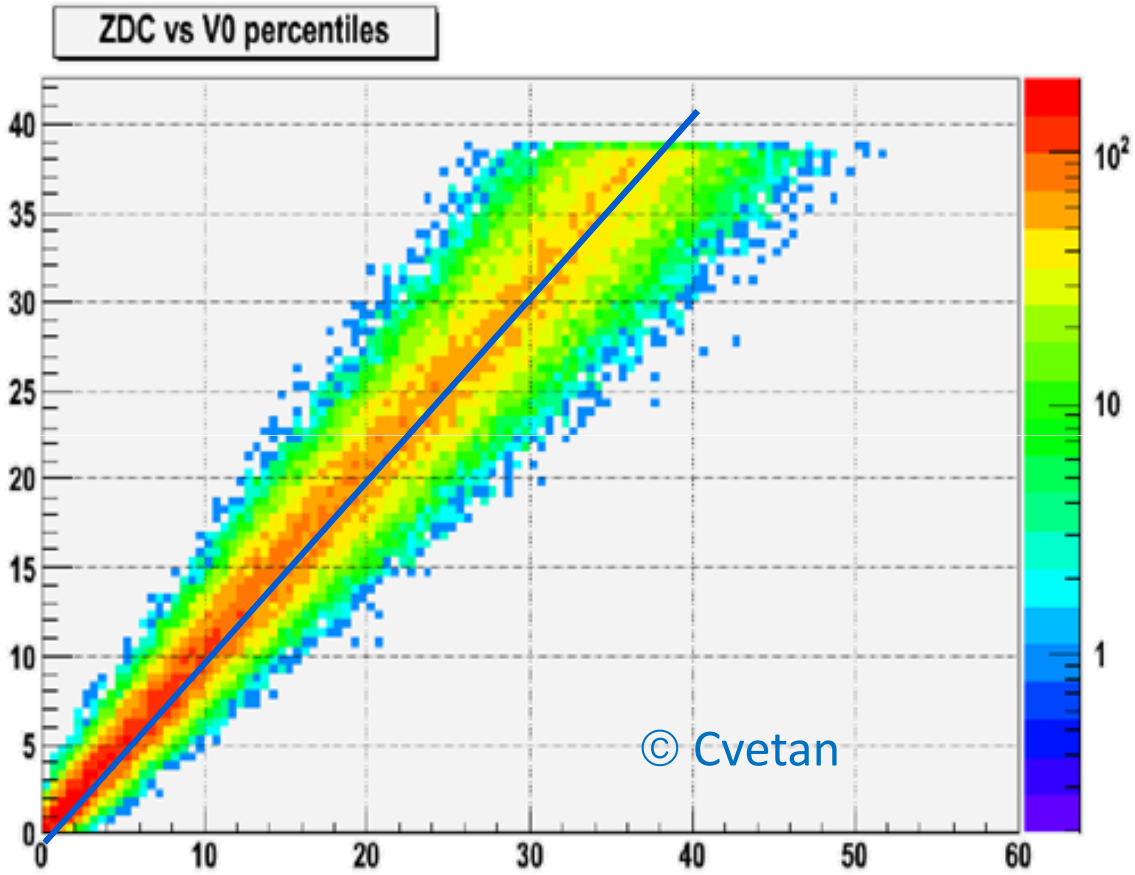


ZDC IN CENTRALITY FRAMEWORK (III)

➡ compare $N_{cluster}$ distribution in the defined centrality bins: 0-3%, 3-5%, 5-10%, 10-20%, 20-30% 30-40%, 40-50%, 50-60%, 60-80%

➡ resolution on N_{part} is comparable in the most central bins (<30% of total x-section)





➡ current aim: improve the method to select events from E_{ZDC} vs. E_{ZEM} correlation (around turning point)

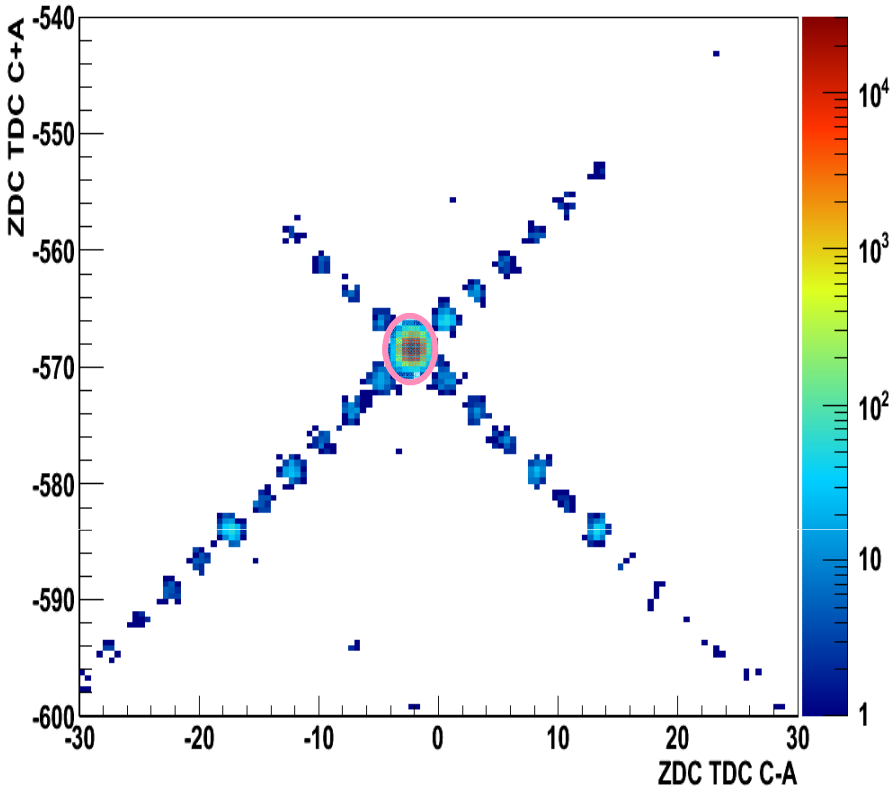
➡ Cvetan's idea currently implemented in centrality framework

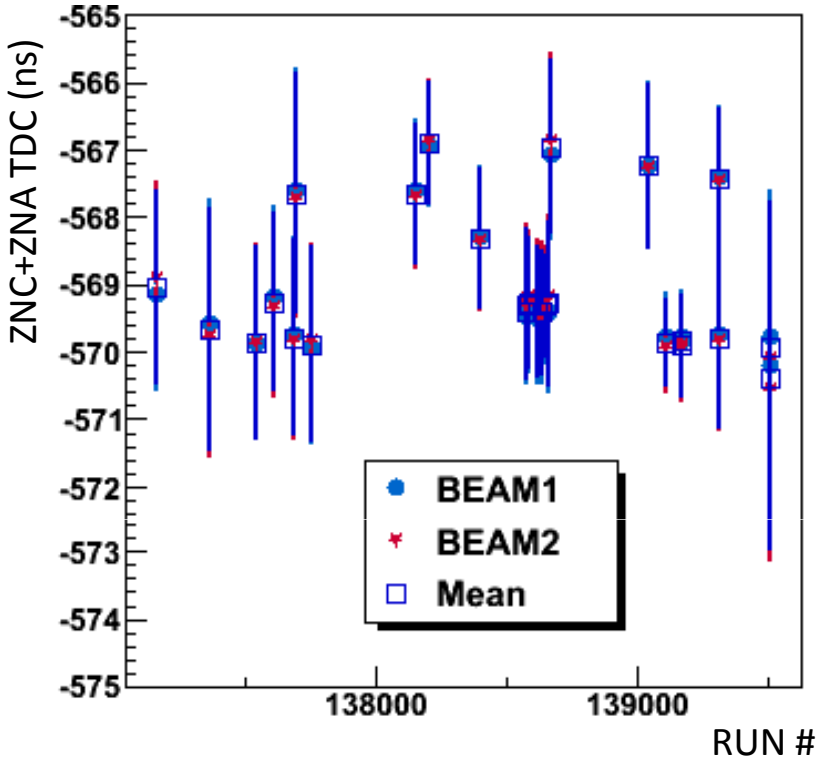
➡ works well up to 40% of total x-section (turning point in E_{ZDC} vs. E_{ZEM} plot)

PHYSICS SELECTION ➧ ZDC TIMING pass1

➡ (ZNC+ZNA) and (ZNC-ZNA) used in Pb-Pb physics selection to reject background from de-bunching events

$$\frac{\left(TDC_{DIFF}{}^2 - (-2.1\,ns)^2\right)^2}{\left(3\cdot\sigma_{DIFF}\right)^2} + \frac{\left(TDC_{SUM}{}^2 - (-568.5\,ns)^2\right)^2}{\left(3\cdot\sigma_{SUM}\right)^2} < 1 \qquad \begin{cases} \sigma_{DIFF} = 0.75\,ns \\ \sigma_{SUM} = 1.08\,ns \end{cases}$$





➡ TDC sum mean value variations ~4 ns affect pass1 physics selections in few runs

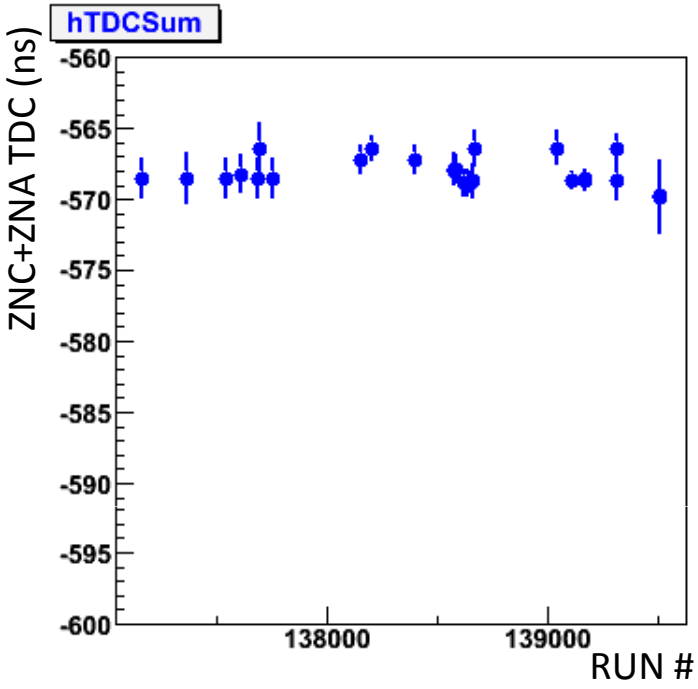
ZDC TIMING IN PASS2

Improvements in pass2

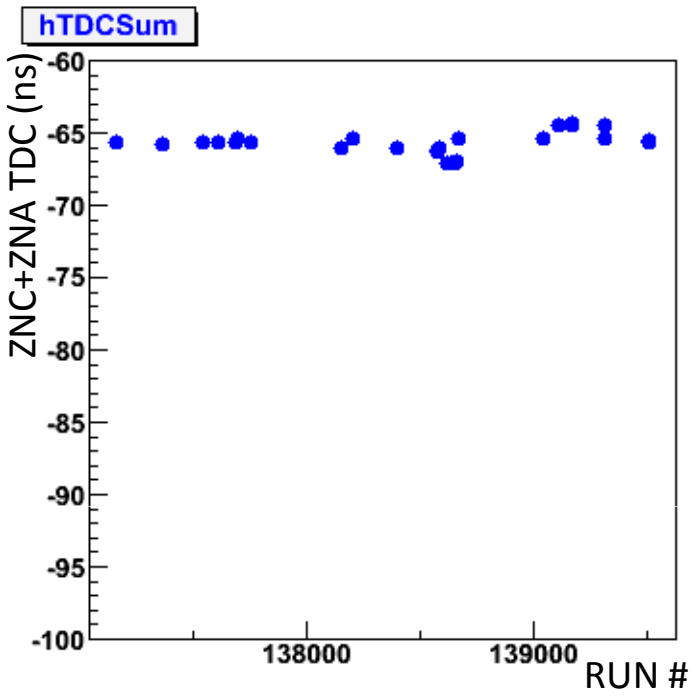
➡ using BEAM1 LHC clock phase shift to correct measured time values

➡ refer values to L0 time instead of ZDC ADC opening gate

pass1



pass2 (calculated from pass1)

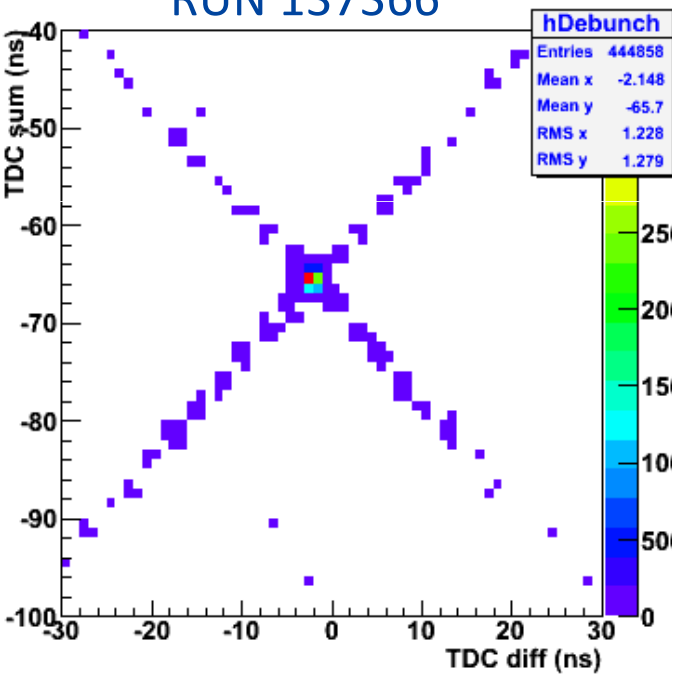


➡ TDC sum mean value spread reduced below 2 ns

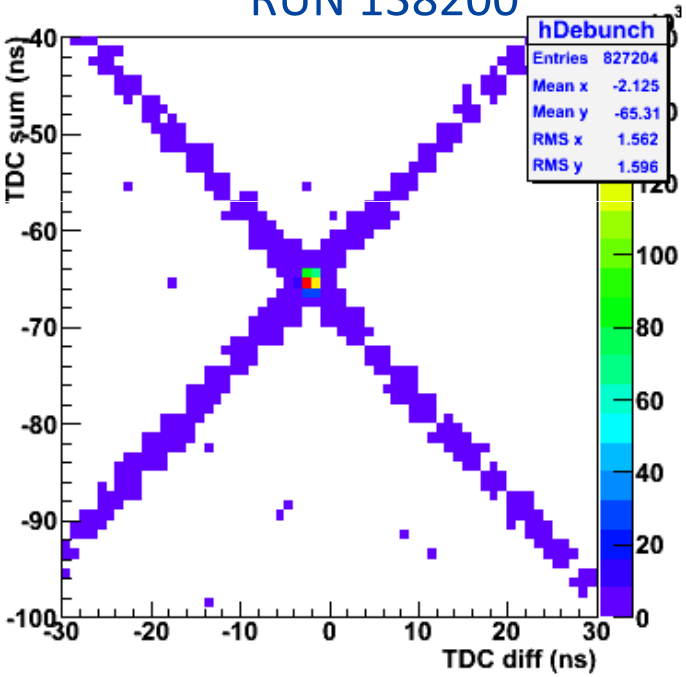
ZDC TIMING IN PASS2 ➧ PHYSICS SELECTION

➧ pass2-iteration2 data: (ZNC+ZNA) vs. (ZNC-ZNA)

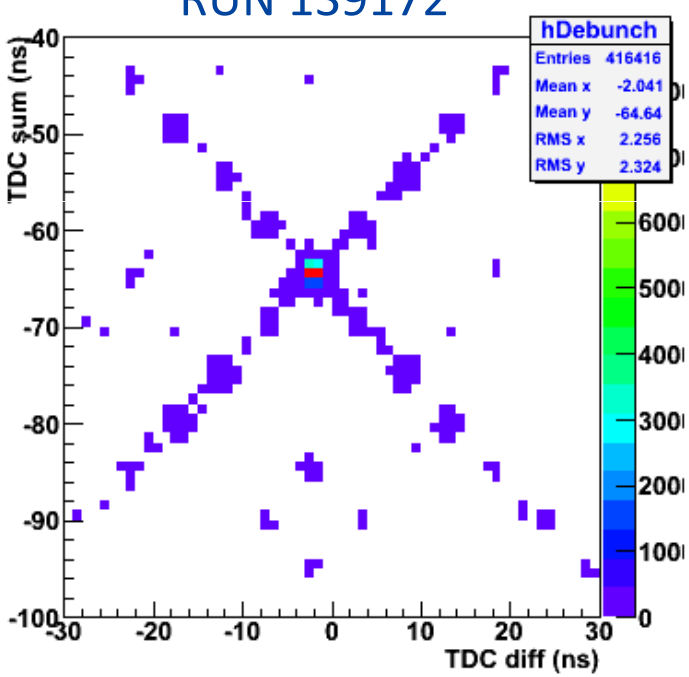
RUN 137366



RUN 138200



RUN 139172



➧ the difference is stable within 0.15 ns over the whole period

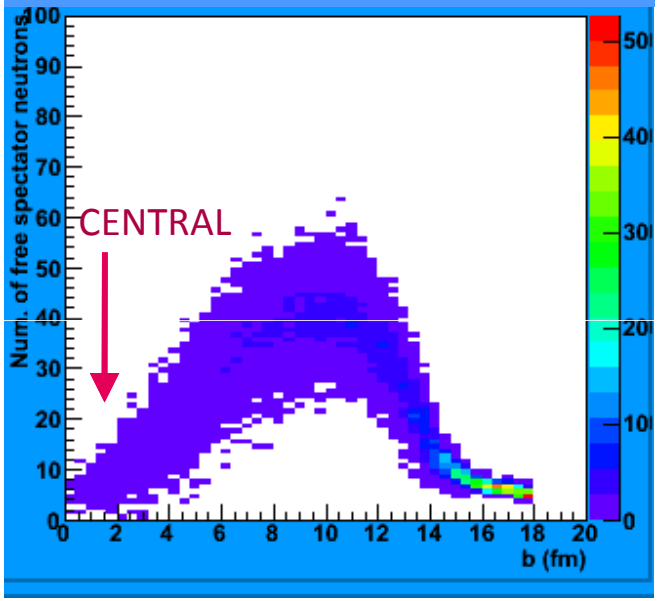
➧ the cut window on the sum can be conveniently enlarged in order not to loose good events for the observed time-shifts

$$\frac{\left(TDC_{DIFF}{}^2-(-2.1\,ns)^2\right)^2}{\left(3\cdot\sigma_{DIFF}\right)^2}+\frac{\left(TDC_{SUM}{}^2-(-65.5\,ns)^2\right)^2}{\left(3\cdot\sigma_{SUM}\right)^2}<1$$

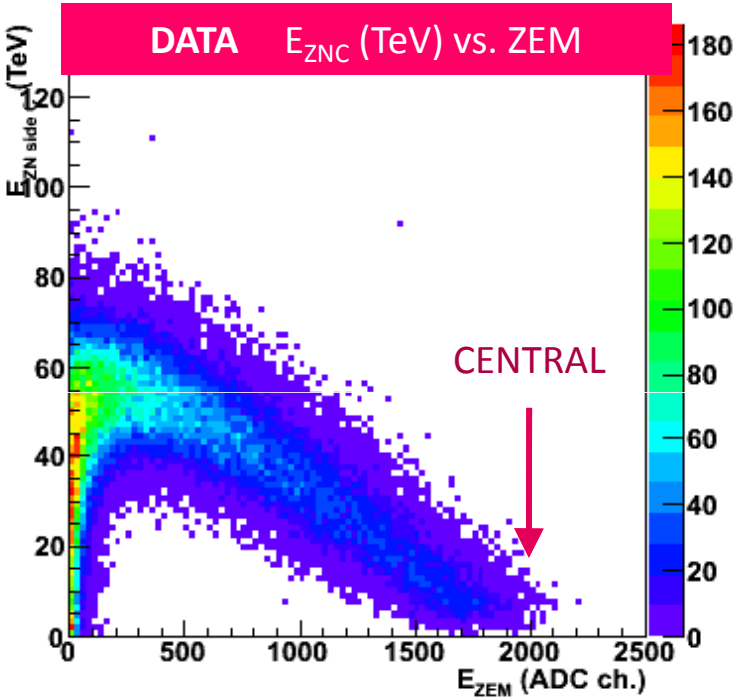
$$\begin{cases}\sigma_{DIFF}=0.20\,ns\\ \sigma_{SUM}=2.00\,ns\end{cases}$$

MC ➧ FRAGMENT PRODUCTION (I)

Nuclear fragment production model



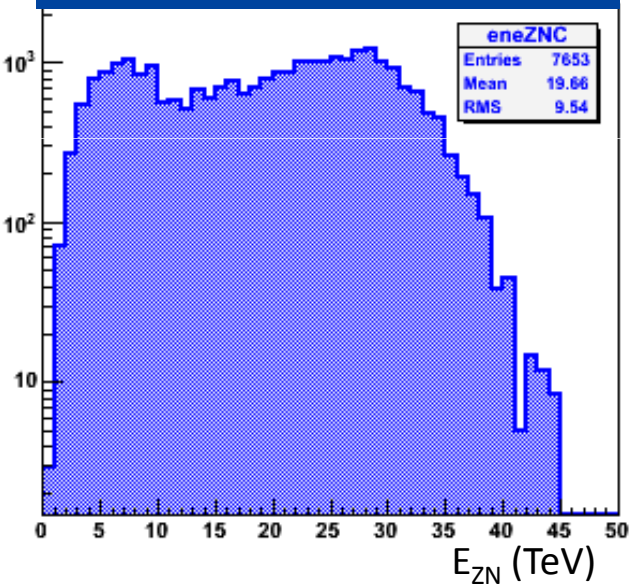
DATA E_{ZNC} (TeV) vs. ZEM



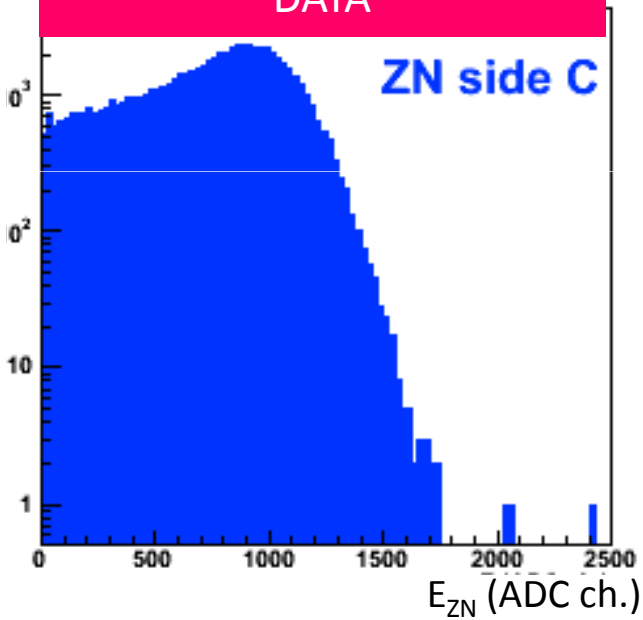
MC ➧ max. no. of free neutrons ~60

DATA ➧ max. no. of detected n ~82/1.38 ~ 59

MC HIJING+ FRAGMENT



DATA



MC ➧ ZNC spectrum shows a peak at low E values (low no. of free neutrons)

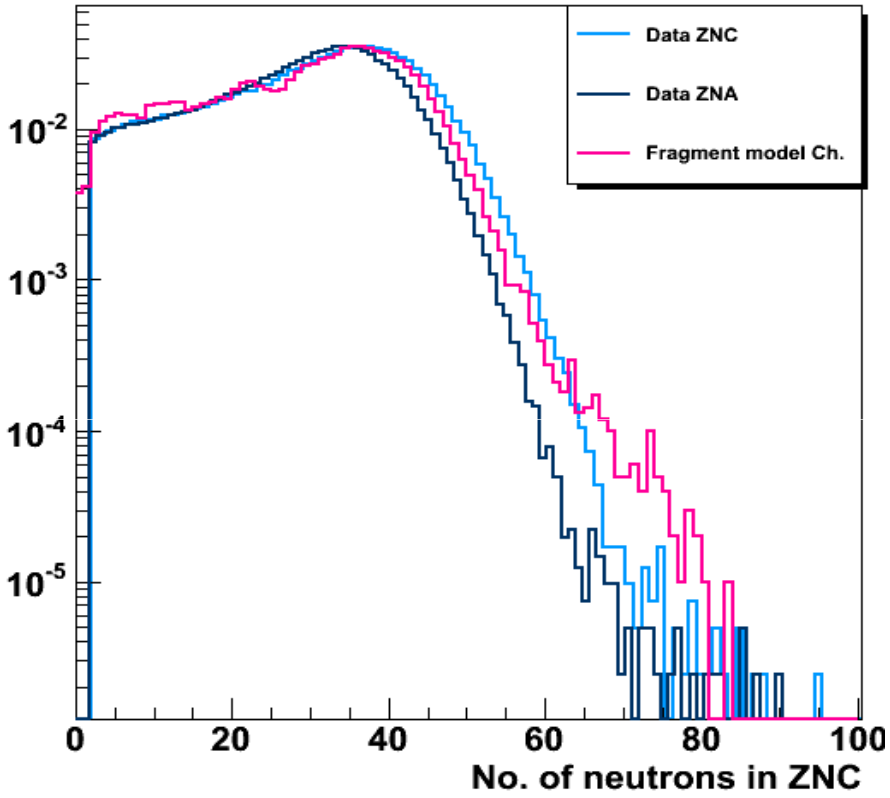
DATA ➧ in peripheral events a lower no. of fragments w.r.t. model predictions is produced

MC ➧ FRAGMENT PRODUCTION (II)

Fragment production model assumes nuclei as rigid spheres ➡ it works correctly for $b \leq 2*r_0A^{1/3} \sim 14.22$ fm

➡ tuning of the model for higher b values under different hypothesis

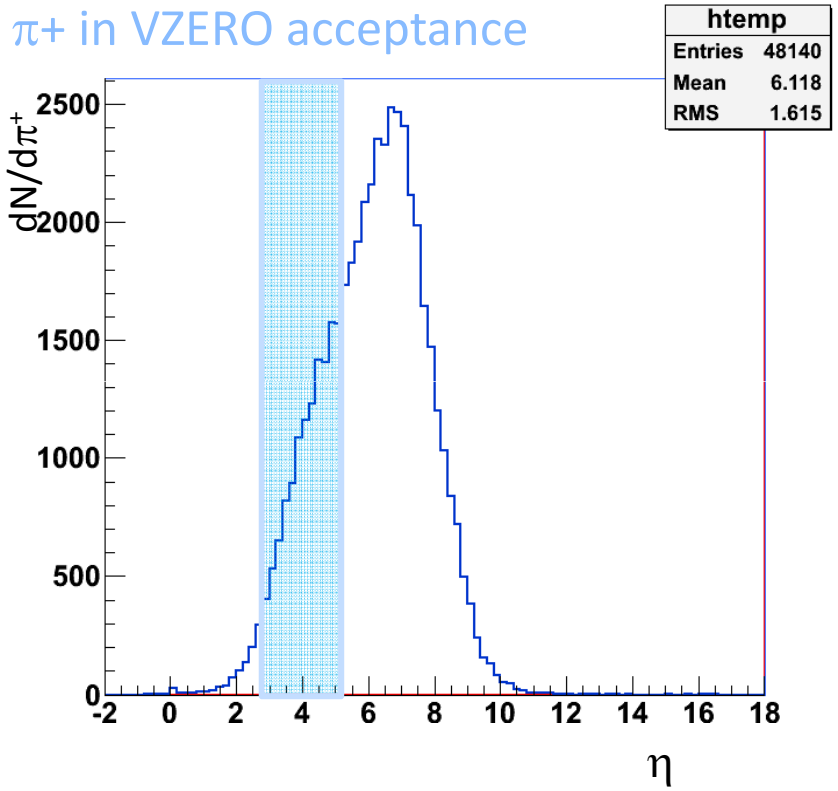
➡ assuming a higher no. of free nucleons for peripheral events $b \leq 2*r_0A^{1/3} \sim 14.22$ fm the model doesn't show the peak at low energies



MC ➧ EMD EVENT GENERATOR

I. Pshenichnov provided an updated version of RELDIS model for nucleus EM dissociation of Pb+Pb @ 1.38 A TeV ➡ used as input by class AliGenReaderEMD, updated to take into account all the particles that are now produced: n, p, π^0, $\pi^{\pm}$, η , ω , ϕ

➡ Study of EM dissociation events in VZERO + ZDC + SPD ➡ MC production?



Savannah bugs & planning

#69884 ZDC calibration object should be ported from trunk to SIM OCDBs	2010-07-12 13:48	hristov	coppedis
#78926 Change in ZDC code for Pb-Pb pass2 reconstruction	2011-03-02 19:58	hristov	coppedis

bug 69884 ➧ last comment: 2011-02-09 19:29, comment #5: Peter, I think this task is expired since it refers to the trunk of six months ago...can I closed it and eventually think again if something is still needed?

bug 78926 ➧ change to be ported to release to have ZPC correctly reconstructed in pass2

Child Tasks

Pin	Log	P	Work	Task Name	Task Owner	Assigned Users	Start Date	Done Date	Expected Finish Date	Last Update
	Log		✔	***Calibration*** (1092)	Chiara.Oppedisano	-	01/01/2006	12/10/2009	31/10/2009	-
	Log		✔	***Quality Assurance*** (1399)	Chiara.Oppedisano	-	01/01/2006	09/07/2010	28/02/2010	-
	Log		✔	***Simulation*** (1581)	Chiara.Oppedisano	-	01/01/2006	22/01/2010	31/12/2009	-
	Log		✔	***Geometry*** (1098)	Chiara.Oppedisano	-	20/02/2007	12/02/2009	30/05/2009	-
	Log		!	***Trigger*** (2389)	Chiara.Oppedisano	Chiara.Oppedisano (100%)	16/03/2009	-	31/01/2011	-
	Log		✔	Implementation of the code for trigger parameters for the simulation of the trigger input to the CTP (2512)	Chiara.Oppedisano	Chiara.Oppedisano (100%)	16/03/2009	19/06/2009	31/08/2009	-
	Log	↓	!	Testing of trigger simulation with raw data (2513)	Chiara.Oppedisano	Chiara.Oppedisano (100%)	16/03/2009	-	31/01/2011	-

Key: =Started and on time =Overdue =Done but with delay =Done

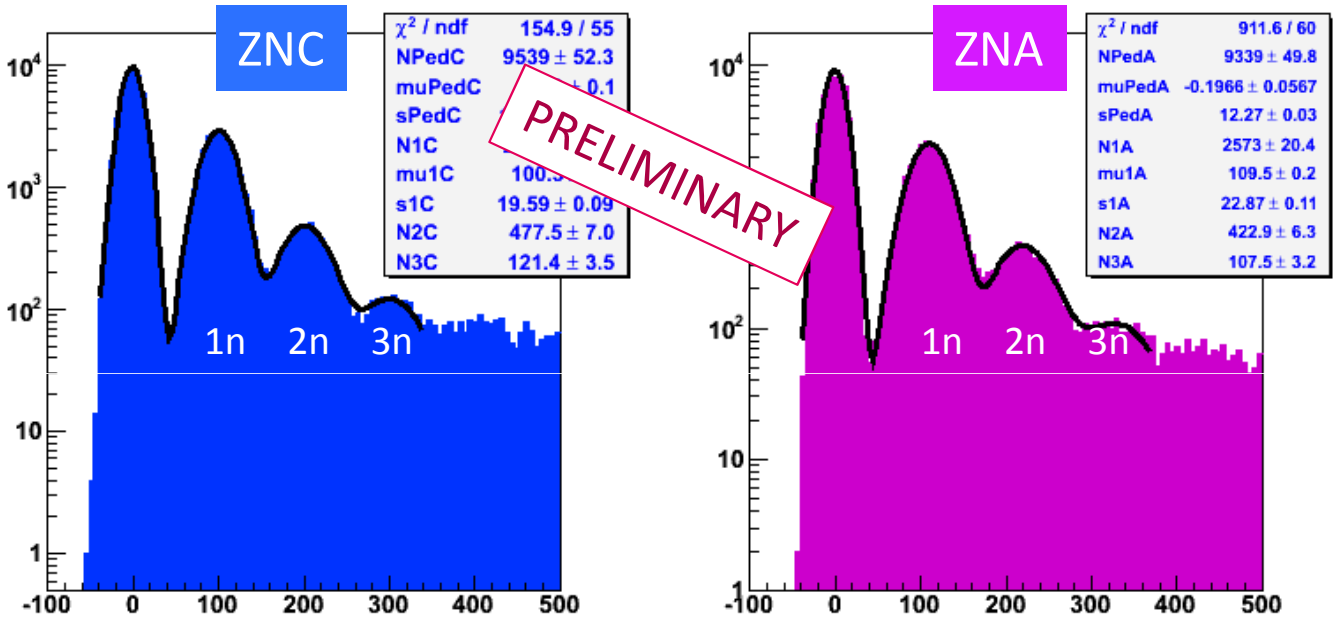
Testing of trigger simulation with raw data ➧ late for lack of resources (manpower)…
Postponing due date?

EMD STANDALONE RUN

➡ Single EM dissociation data

Comparison with RELDIS model

1n/2n DATA: 4.30 RELDIS: 4.26



➡ Mutual EM dissociation data

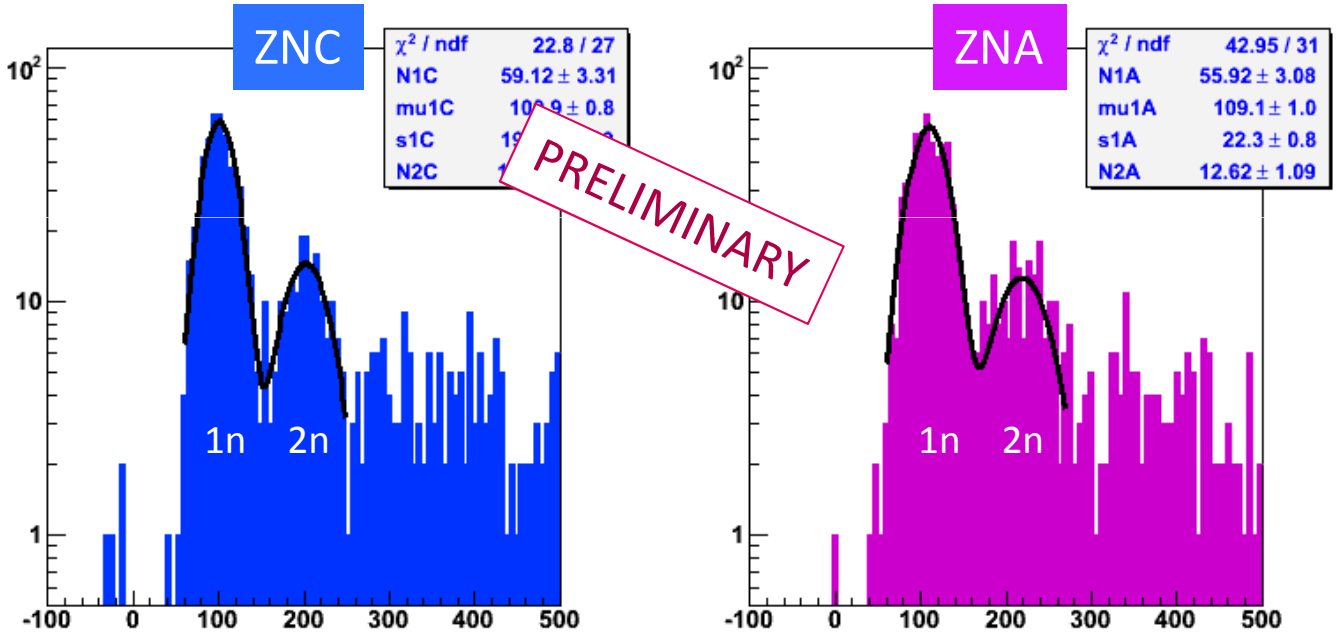
Comparison with RELDIS model

1n/2n DATA: 3.05 RELDIS: 3.74

1n peak resolution

ZNC DATA: 18.9% MC: 22.0%

ZNA DATA: 20.4% MC: 21.7%

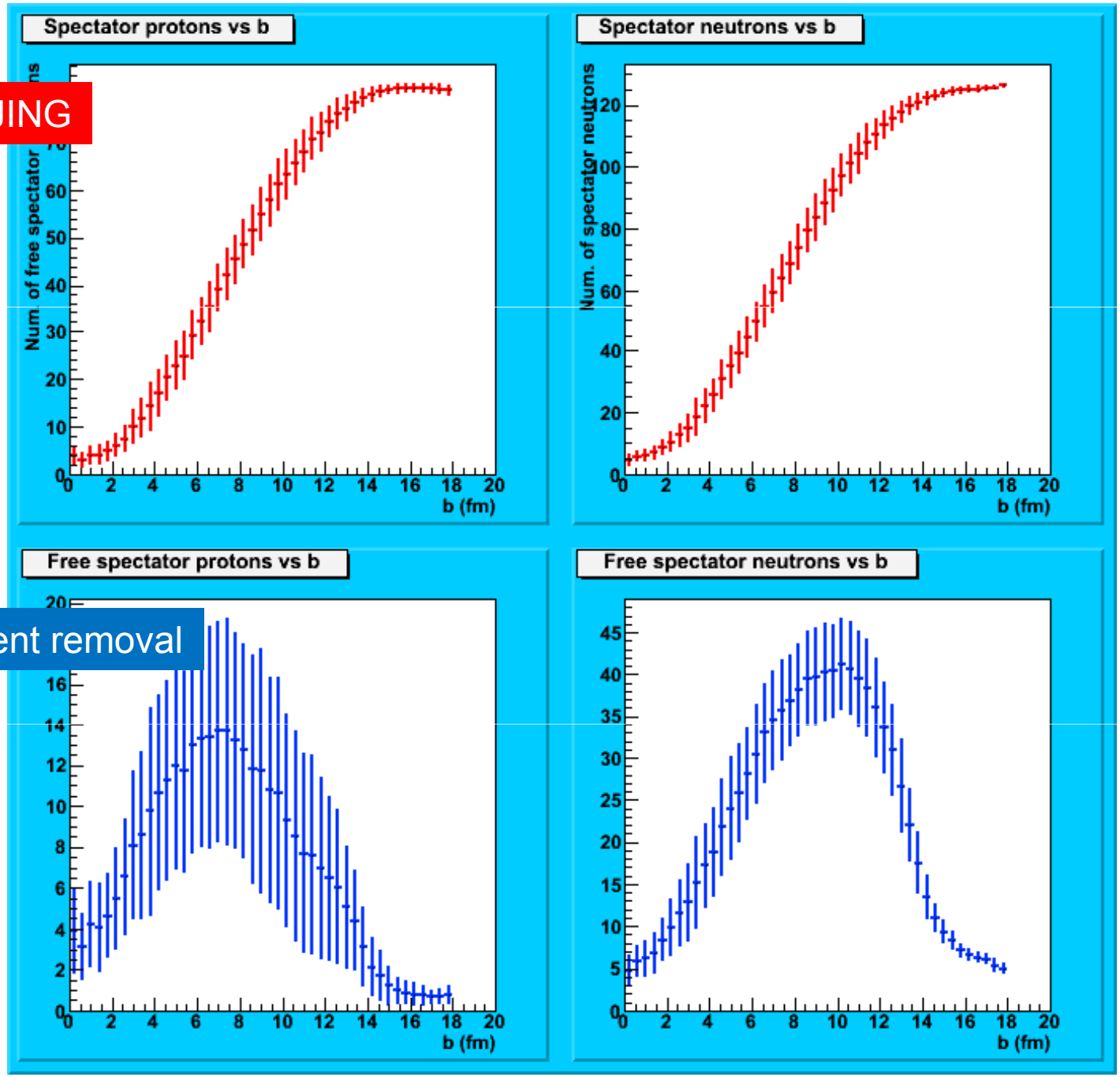


BACKUP SLIDES

NUCLEAR FRAGMENT PRODUCTION MODEL

N_{spec} from HIJING

N_{spec} after fragment removal



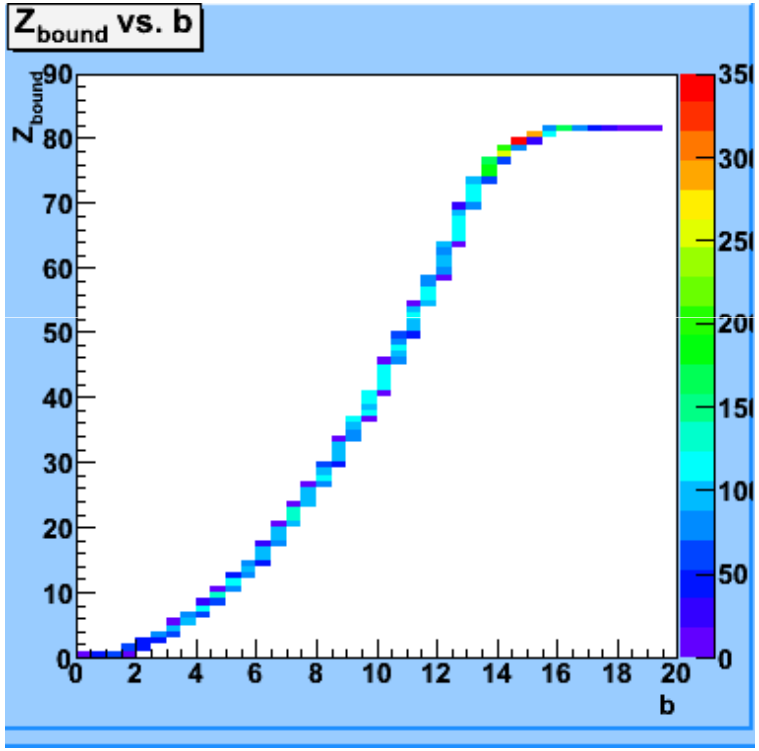
FRAGMENTATION MODEL ASSUMPTIONS

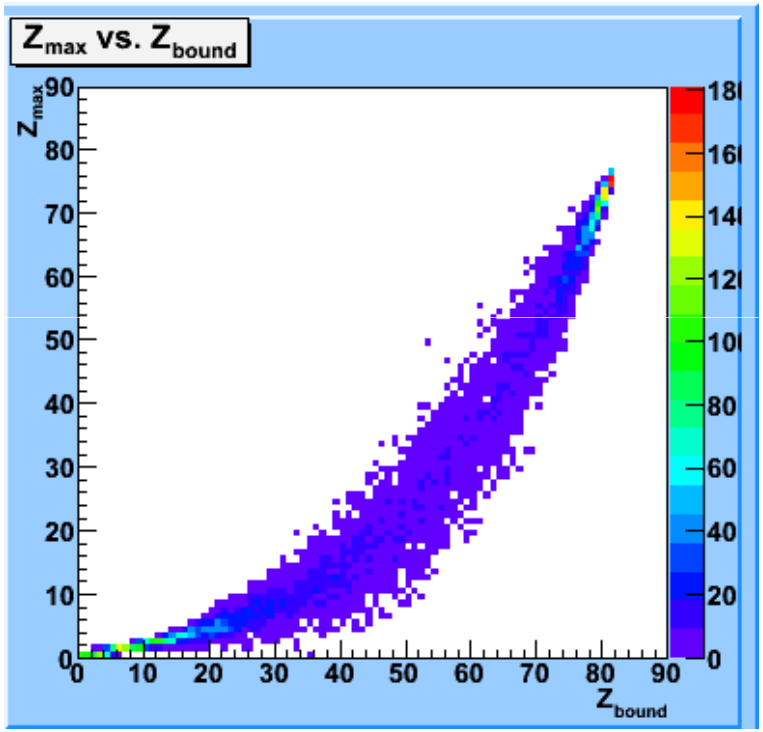
Experimental data from 1 to 200 A GeV ➡ x-section for nuclear fragment production has weak beam E dependence, it is strongly correlated to the geometry of the collision

SIS experiments ➡ no. of IMF ($3 \leq A \leq 30$), fragment Z distribution and Z_{max} do not depend on beam E or on colliding system when these quantities are plotted against

$$Z_{bound} = \sum_i Z_i \text{ with } Z_i \geq 2$$

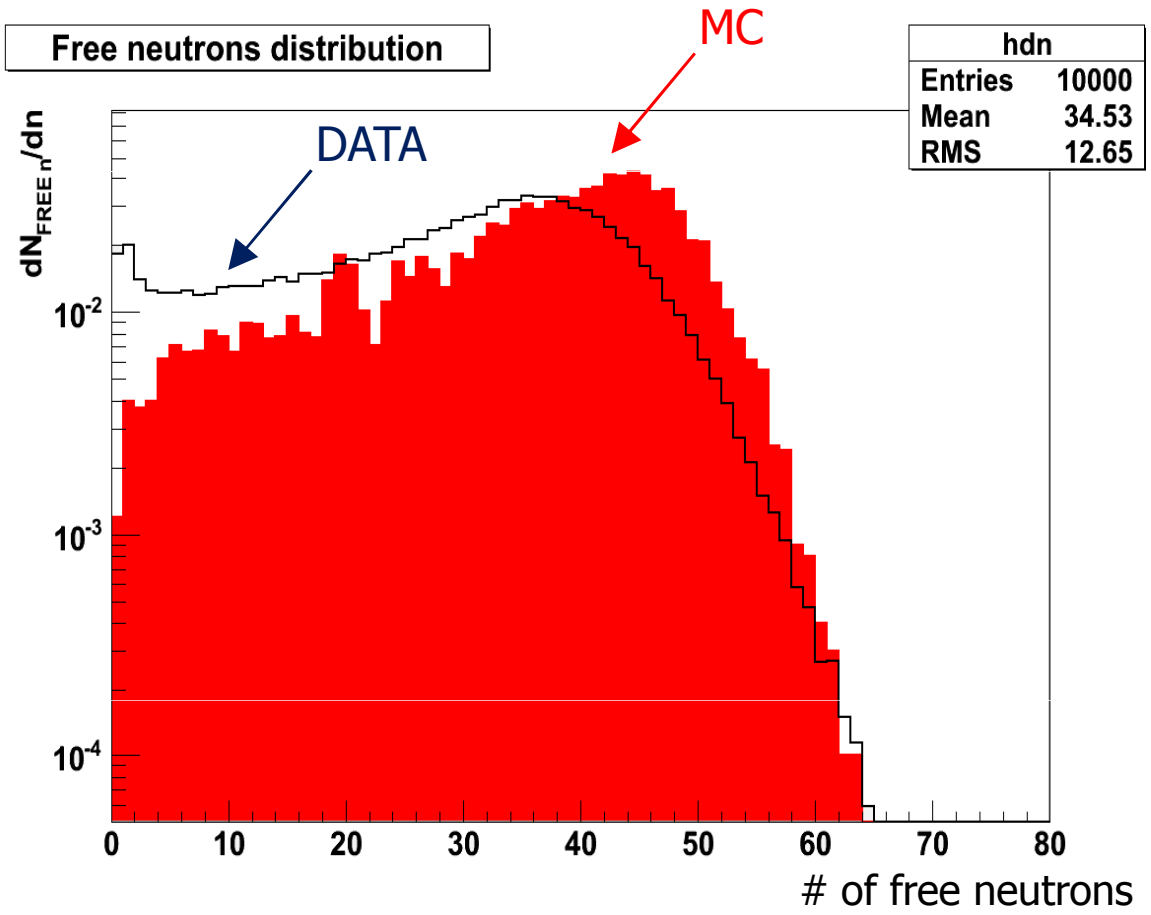
ASSUMPTION: invariant features @ LHC energies ➡ fragmentation features from a parameterization of ALADIN Au+Au experiment data





1st HOUR "RE-COOCKED" MODEL

➡ assuming a higher no. of free nucleons for very peripheral events $b \leq 2*r_0A^{1/3} \sim 14.22$ fm the model doesn't show the peak at low energies again



Just as qualitative check (no large MC production available) ➡ no. of free neutrons compared
Data ➡ contaminated by EMD events at low energies