BALANCE FUNCTION – DRAFT 1

PROPOSED TITLE

"CENTRALITY DEPENDENCE OF THE BALANCE FUNCTION IN Pb + Pb COLLISIONS AT 158 AGeV AT THE CERN SPS (NA49)"

University of Athens group

OUTLINE

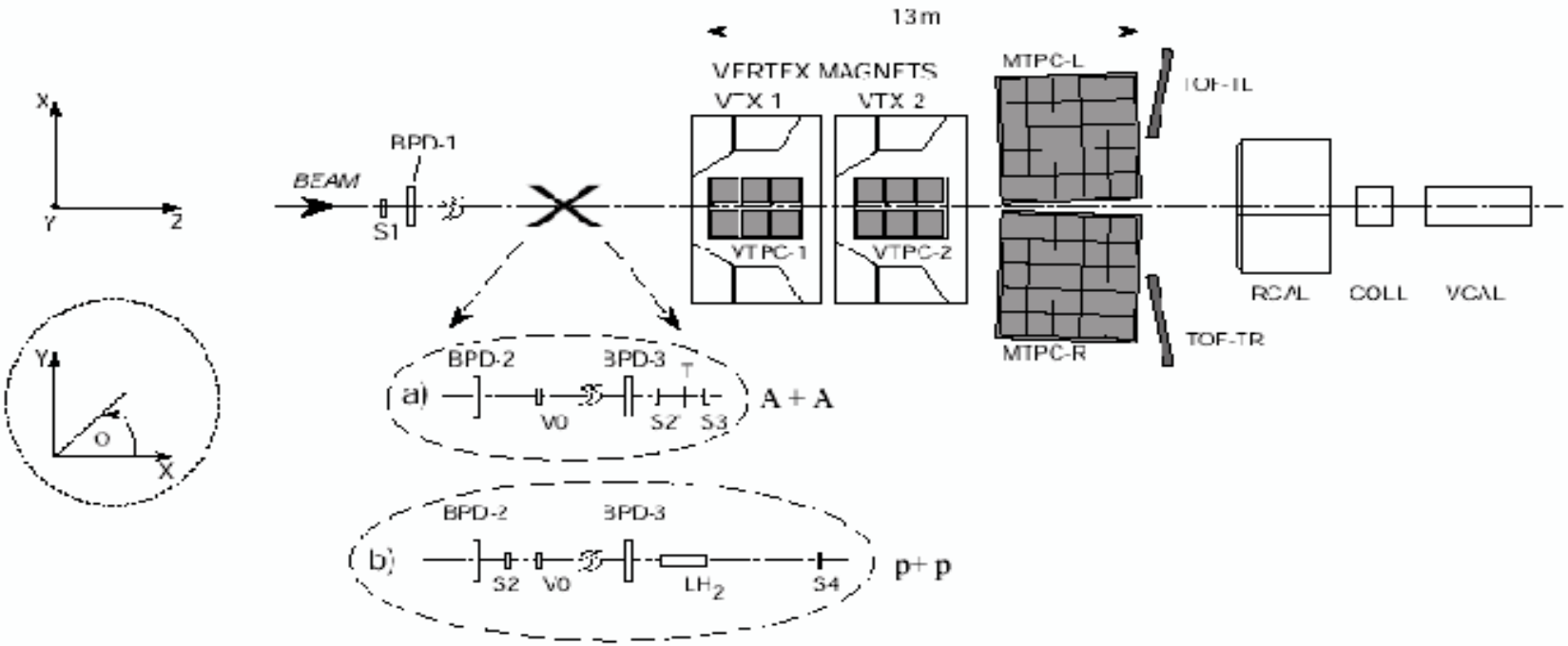
- INTRODUCTION
  - Balance Function Method
- EXPERIMENTAL SETUP
- DATA ANALYSIS
  - Data Sets
  - Event And Track Selection
  - Systematic Errors
- RESULTS
- DISCUSSION
- SUMMARY

INTRODUCTION

- Introduction on the experimental signals of QGP.
- The Balance Function method
  - Motivation
  - Definition – Formula – Explanation of terms
  - Properties of the width → could signal delayed hadronization
  - Properties of the B.F.
    - Width independent on the multiplicity and net charge.
    - Width depends on the number of correlations.

EXPERIMENTAL SETUP

- Description of the setup (TPCs , TOFs , Calorimeters)
- Description of targets (Pb , p)
- BPDs and triggers
- Centrality selection → Veto calorimeter



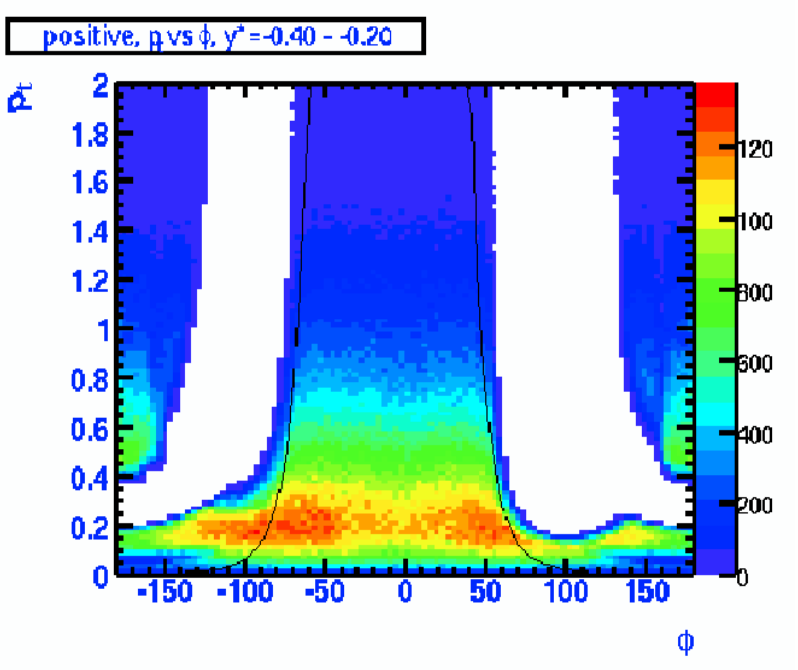
DATA ANALYSIS

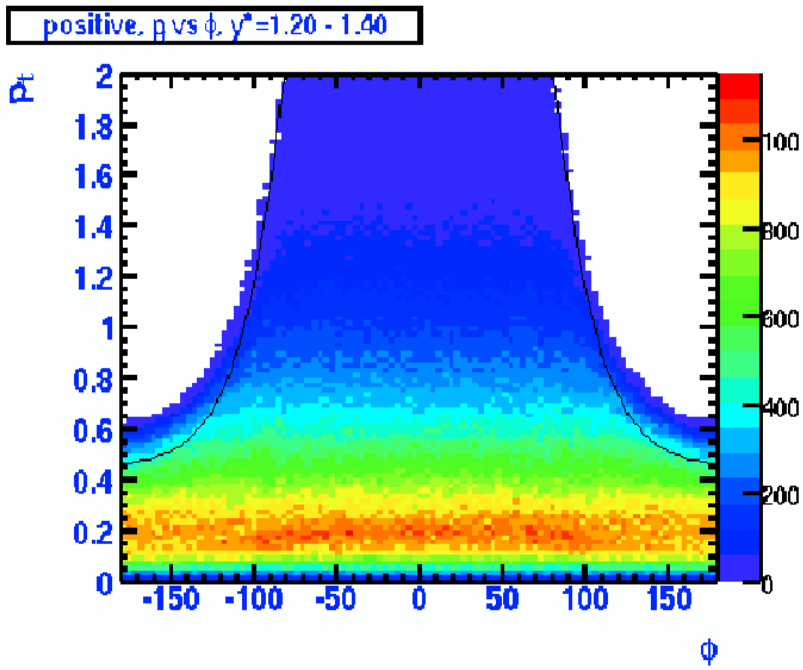
- DATA SETS
  - Description of data sets (number of events , polarity , reconstruction date)
  - Description of the NA49 centrality classes (table with information about: Centrality Class – Number Of Events – E_o Range – N_w – b range)

Interaction	Number of events	Eo range [GeV]	<Nw>	b range [fm]
p + p	1M		2	
Pb + Pb (Veto 6)	300K	29340 – 40000	42	10.2 - …
Pb + Pb (Veto 5)	110K	26080 – 29340	88	9.1 – 10.2
Pb + Pb (Veto 4)	88K	21190 – 26080	134	7.4 – 9.1
Pb + Pb (Veto 3)	75K	14670 – 21190	204	5.4 – 7.4
Pb + Pb (Veto 2)	100K	9250 – 14670	281	3.4 – 5.4
Pb + Pb (Veto 1)	100K	0 – 9250	352	0 – 3.4

DATA ANALYSIS (cont.)

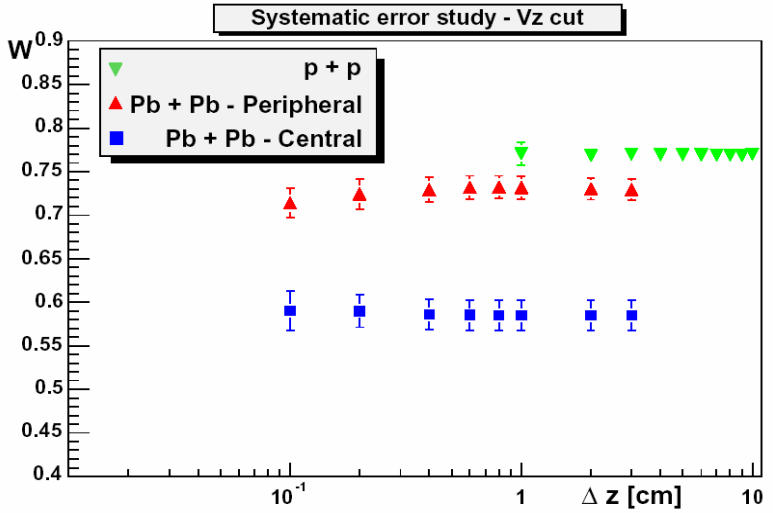
- EVENT AND TRACK SELECTION
  - Description of cuts on event level (V_x , V_y , V_z).
  - Description of cuts on track level (b_x , b_y , N_{points} , $N_{points}/N_{(max\ points)}$).
  - Description of acceptance curves (reference to Jacek).
  - Phase space analyzed.

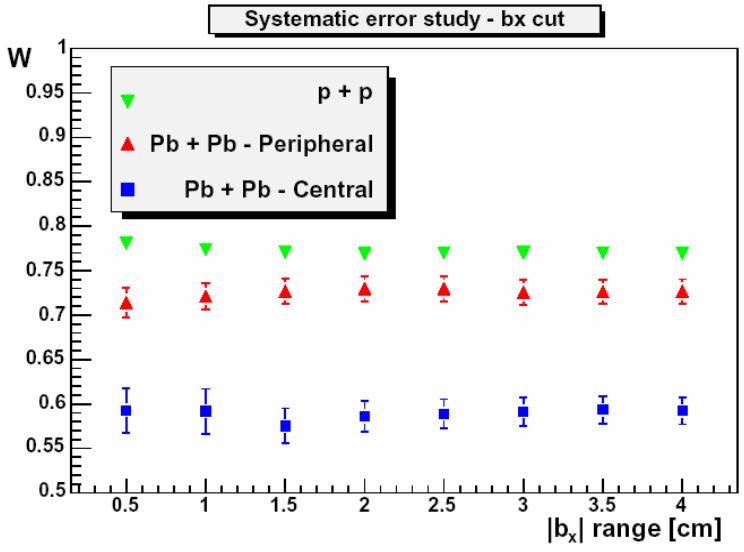


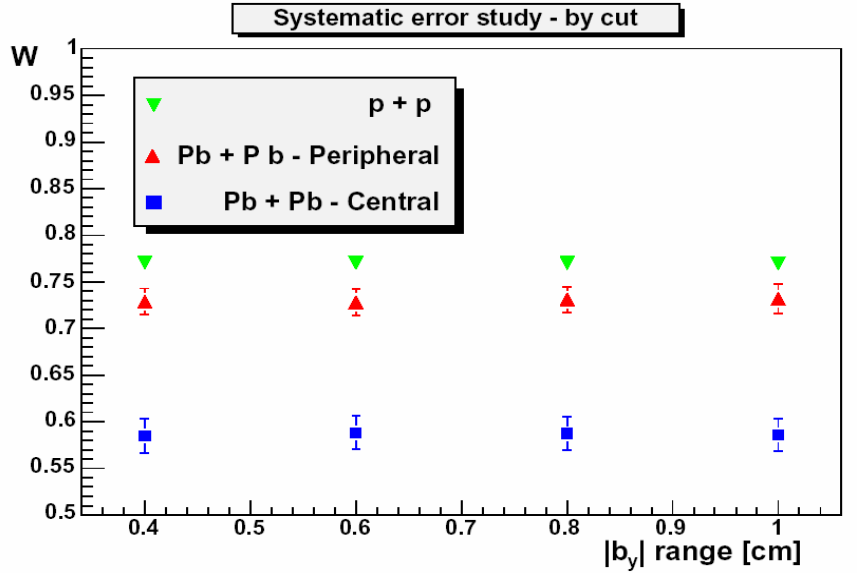


DATA ANALYSIS (cont.)

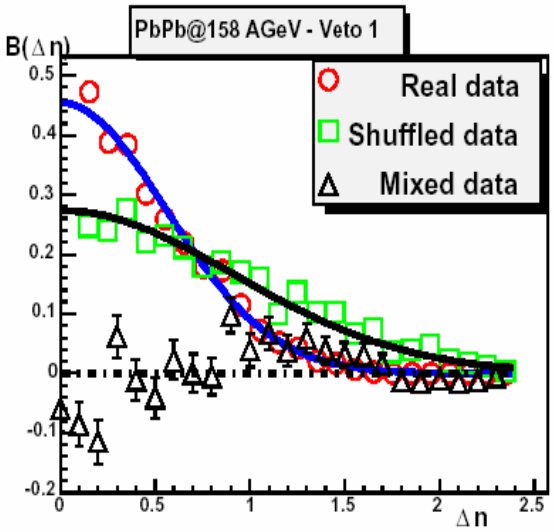
- SYSTEMATIC ERRORS
  - Varying Δz.
  - Varying bx.
  - Varying by.
  - Different data sets.

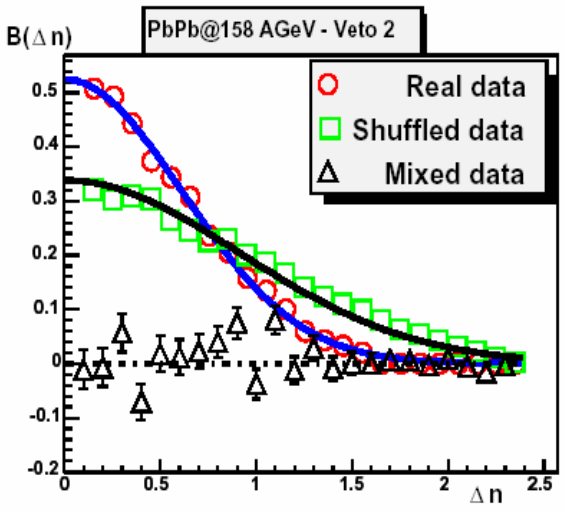


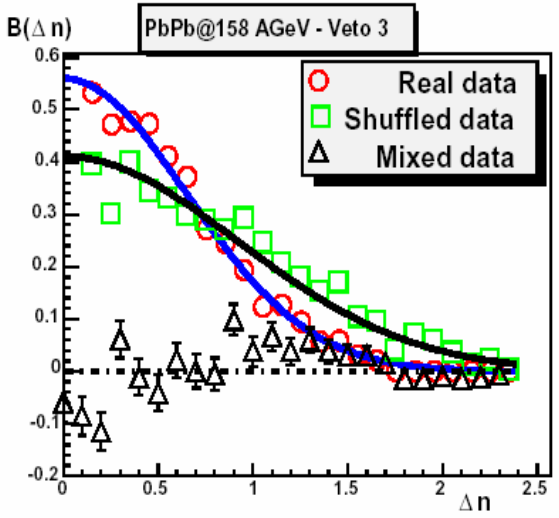


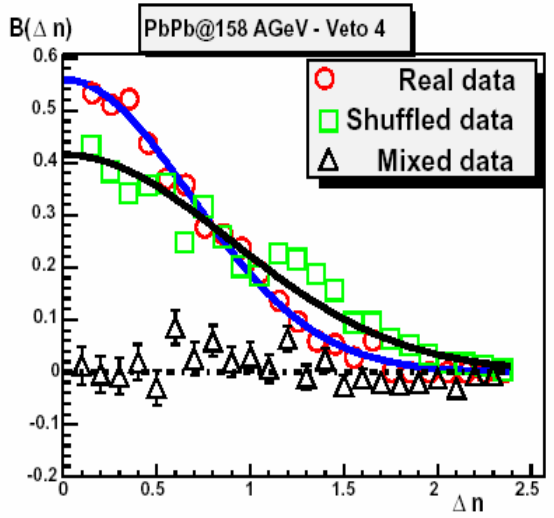


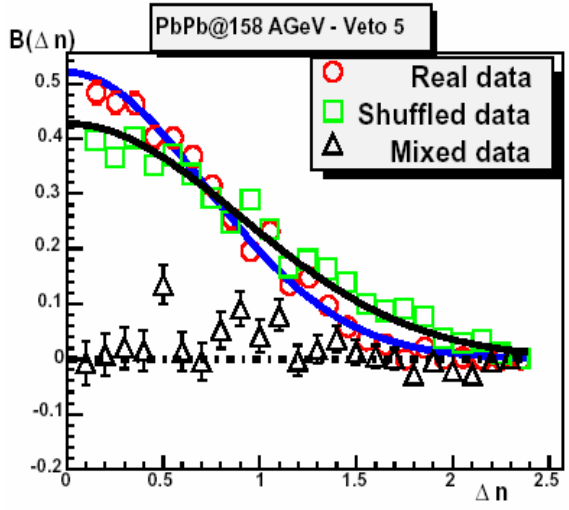
RESULTS

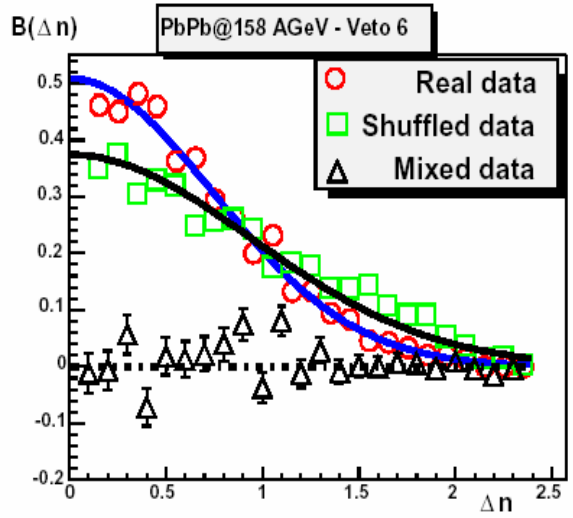

PbPb@158 AGeV - Veto 1
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n


PbPb@158 AGeV - Veto 2
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n


PbPb@158 AGeV - Veto 3
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n

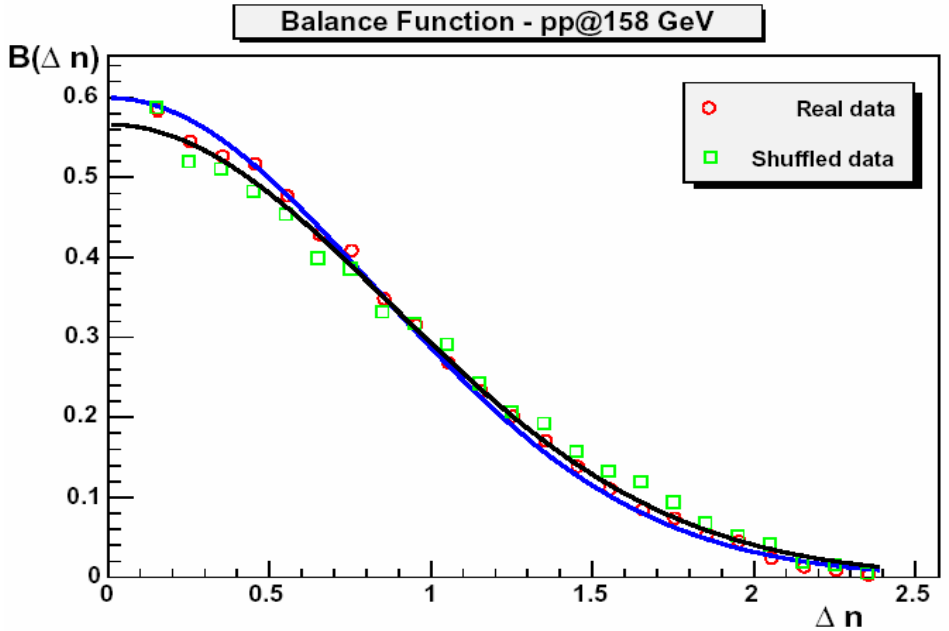

PbPb@158 AGeV - Veto 4
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n


PbPb@158 AGeV - Veto 5
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n

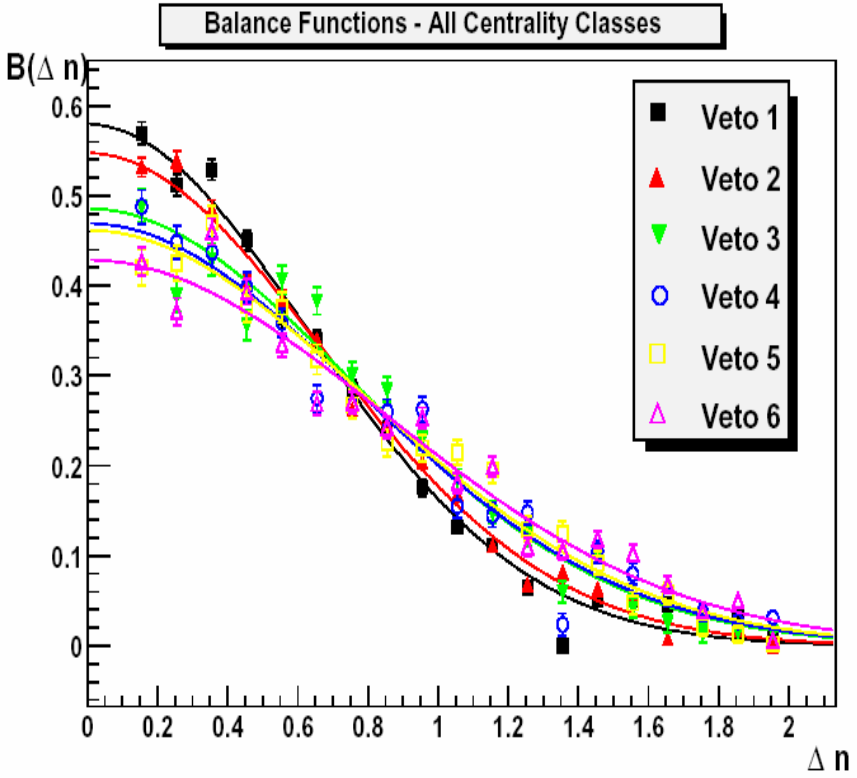

PbPb@158 AGeV - Veto 6
B(Δ n)
Real data
Shuffled data
Mixed data
Δ n

RESULTS (cont.)

Interaction	W (Real data)	W (Shuffled data)
p + p	0.772 ± 0.007	0.793 ± 0.002
Pb + Pb (6)	0.714 ± 0.020	0.812 ± 0.005
Pb + Pb (5)	0.704 ± 0.021	0.795 ± 0.005
Pb + Pb (4)	0.677 ± 0.019	0.806 ± 0.005
Pb + Pb (3)	0.653 ± 0.019	0.812 ± 0.005
Pb + Pb (2)	0.602 ± 0.012	0.803 ± 0.003
Pb + Pb (1)	0.595 ± 0.012	0.806 ± 0.004



RESULTS (cont.)

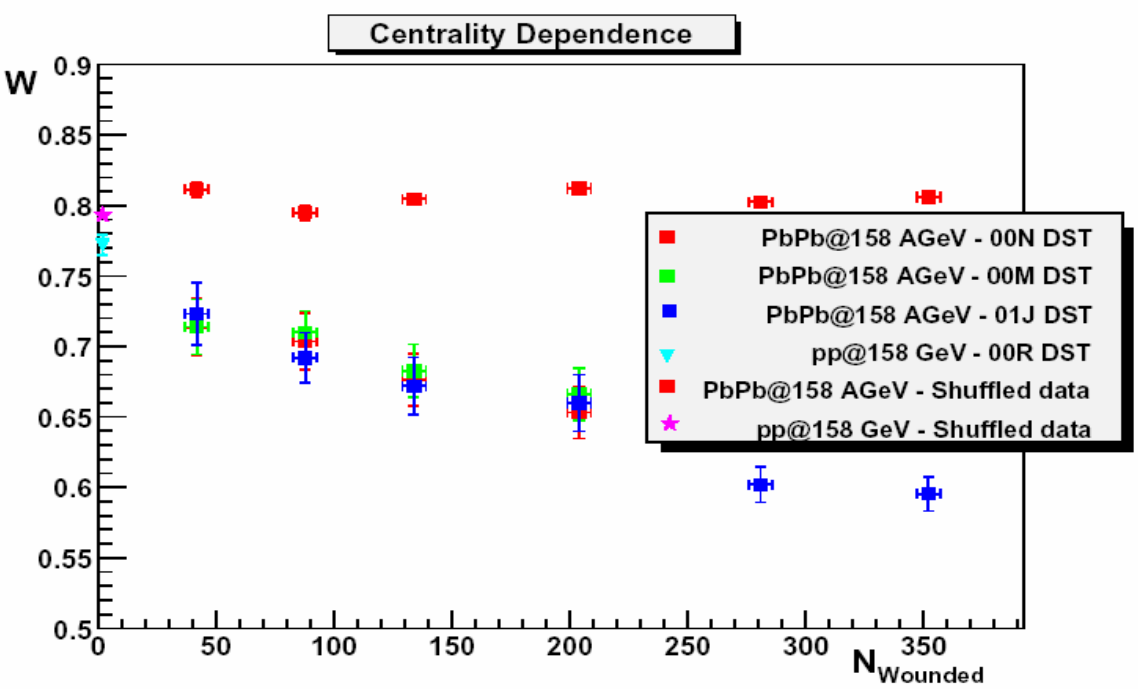


The results show that:

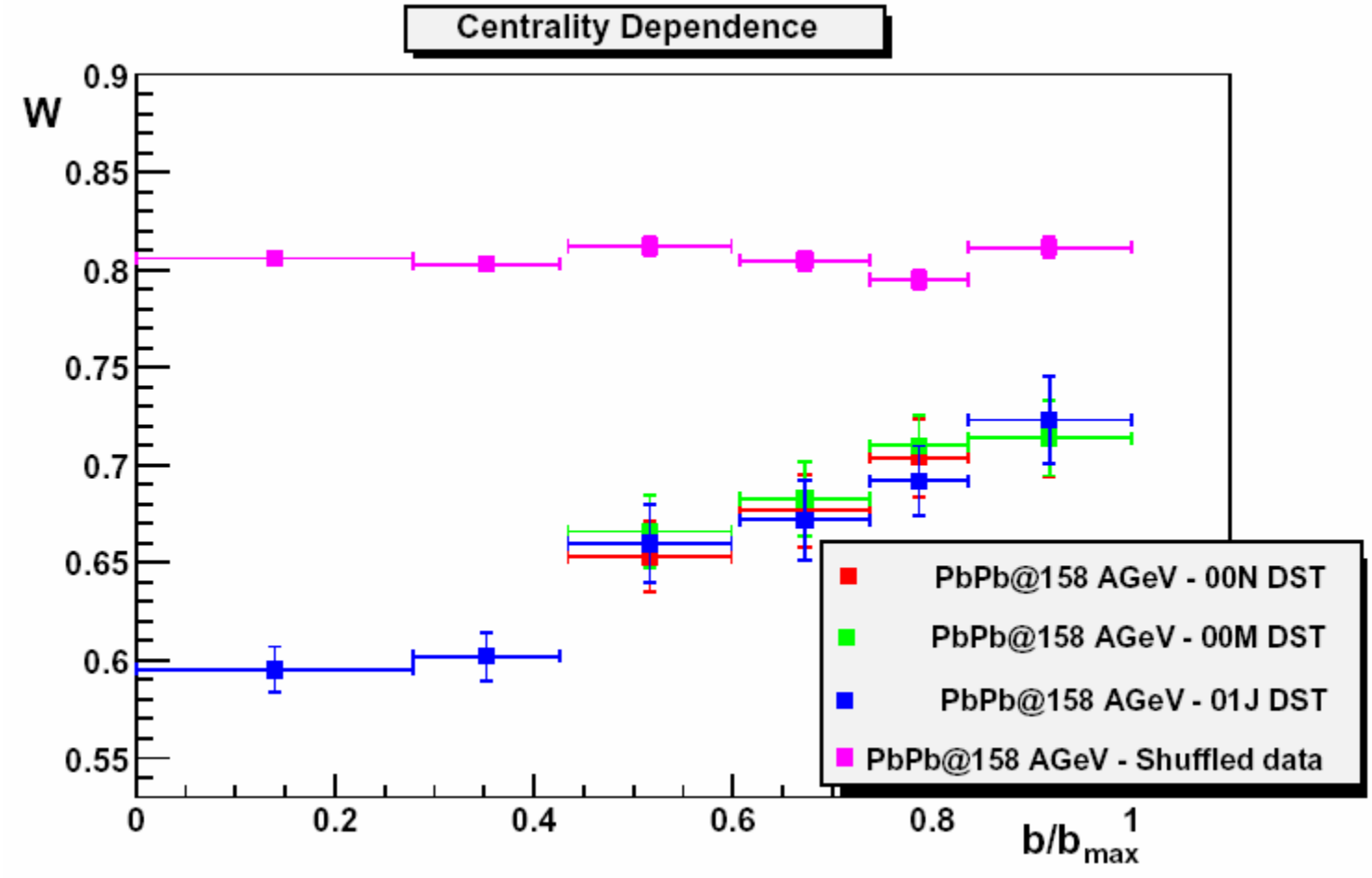
- The width of the B.F. takes its maximum value for p + p interactions.
- The width decreases with increasing centrality in Pb + Pb collisions.
- The B.F. for mixed events goes to zero for all the bins of Δn , due to the removal of global charge conservation.
- The B.F. for shuffled events is constantly broader than the one for real events.

DISCUSSION

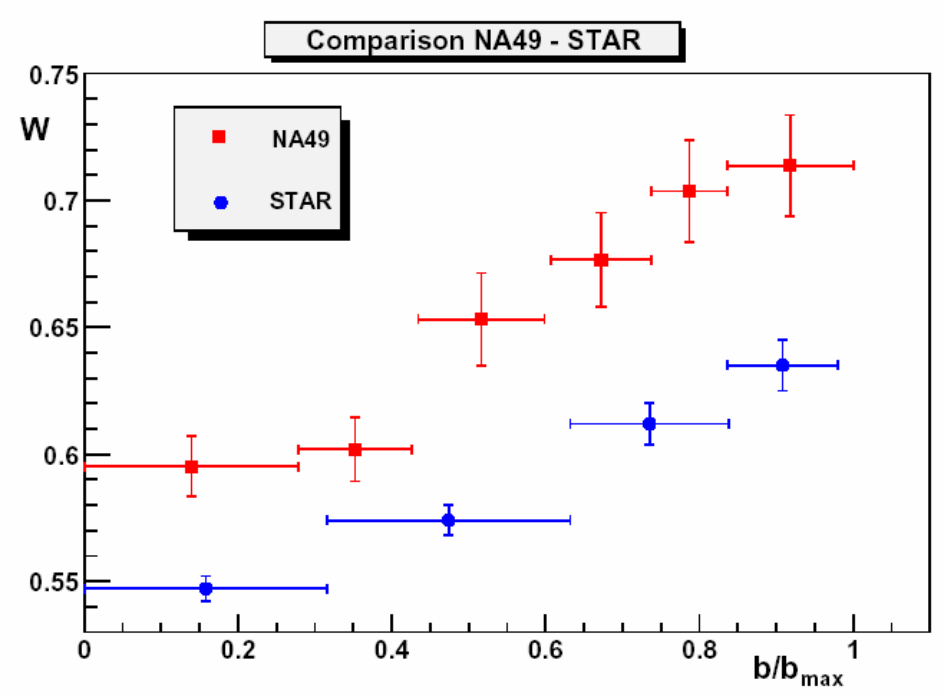
Interaction	W (Set 1)	W (Set 2)	W (Set 3)
p + p	-	-	0.772 ± 0.007
Pb + Pb (6)	0.714 ± 0.020	0.714 ± 0.019	0.723 ± 0.022
Pb + Pb (5)	0.704 ± 0.021	0.710 ± 0.015	0.692 ± 0.018
Pb + Pb (4)	0.677 ± 0.019	0.683 ± 0.019	0.672 ± 0.020
Pb + Pb (3)	0.653 ± 0.019	0.666 ± 0.019	0.660 ± 0.020
Pb + Pb (2)	0.602 ± 0.012	-	-
Pb + Pb (1)	0.595 ± 0.012	-	-



DISCUSSION (cont.)



DISCUSSION (cont.)



- NA49 data show a strong centrality dependence of the order of (17 ± 3)%.
- STAR data show also a strong centrality dependence of the order of (14 ± 2)%.

SUMMARY

- Analysis of centrality selected Pb + Pb @ 158 AGeV and p + p @ 158 GeV collisions using the Balance Function.
- B.F. could give us insight about the time of hadronization.
- Results show that:
  - The width of the B.F. takes its maximum value for p + p interactions.
  - The width of the B.F. for shuffled events doesn't show any sign of centrality dependence.
  - The width decreases with increasing centrality in Pb + Pb interactions.
  - STAR experiment shows the same trend.

NEXT DRAFT

- Hijing events + Acceptance filter – Centrality dependence study.
- Will be ready soon.

- This draft can be found in the directory:

  /afs/cern.ch/user/p/pchrista/group/BalanceFunction/draft1.ps

- For any comments or suggestions: Panos.Christakoglou@cern.ch
- Web page: http://poseidon.phys.uoa.gr/pchrist/NA49.html