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# **Progress Report on the Balance Function for Pb-Pb@40 A GeV**

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## Outline

- Data sets used in the analysis
- Cuts for central and peripheral events
- Stability over cuts
- Centrality dependence of the BF width for real data
- Comparison with shuffled data
- Comparison with Pb-Pb@ 158 GeV, and STAR
- Future steps

# Data Sets Used In The Analysis

Without the acceptance filter

• **00W DST central (420K Events)**

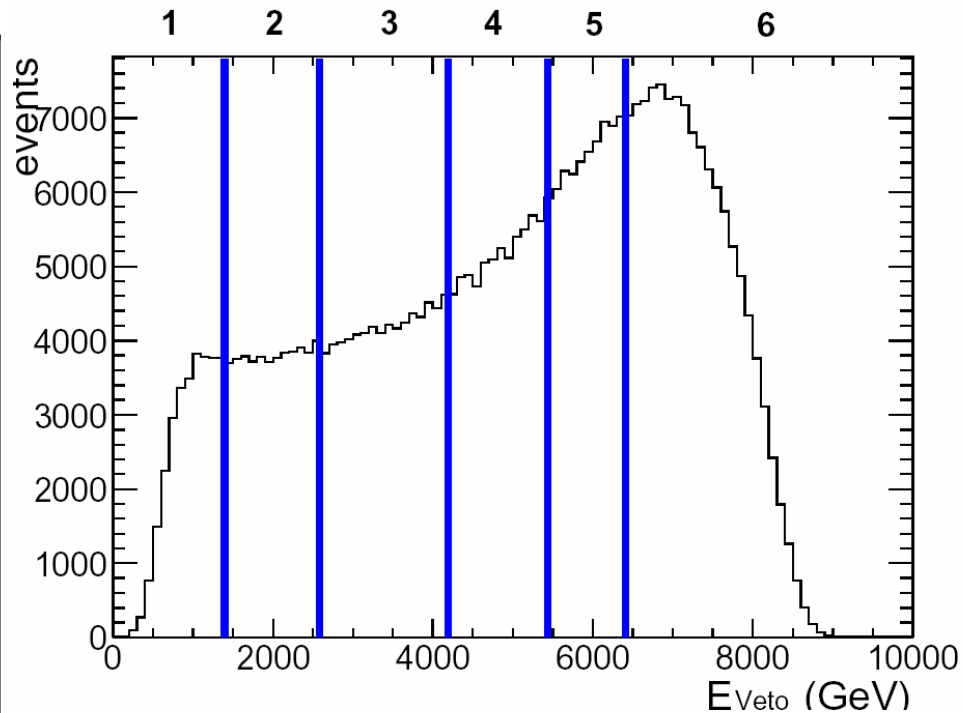
**(Veto 1 & 2)**

• **01D DST min bias (410K Events)**

**(Veto 3, 4, 5, 6)**

# Centrality Classes for Pb-Pb@40 A GeV

Veto Bin	$\sigma/\sigma_{total}$ %	E veto Energy (GeV)	$\langle Nw \rangle$ (Glauber)
1	0-7	<1398	349
2	5-12.5	1398-2586	281
3	12.5-23.5	2586-4191	204
4	23.5-33.5	4191-5436	134
5	33.5-43.5	5436-6406	88
6	>43.5	>6406	42



(Private communication with C. Meurer)

# Selection Criteria used in the analysis for the Central Events (00W-DST)

## Event Level Cuts

$$-0.1 \text{ cm} < V_x < 0.1 \text{ cm}$$

$$-0.2 \text{ cm} < V_y < 0.2 \text{ cm}$$

$$-581.4 \text{ cm} < V_z < -580.8 \text{ cm}$$

$$\text{Track Ratio} > 0.2$$

## Track Level Cuts

$$-2.0 \text{ cm} < b_x < 2.0 \text{ cm}$$

$$-1.0 \text{ cm} < b_y < 1.0 \text{ cm}$$

$$0.005 \text{ GeV} < P_t < 1.5 \text{ GeV}$$

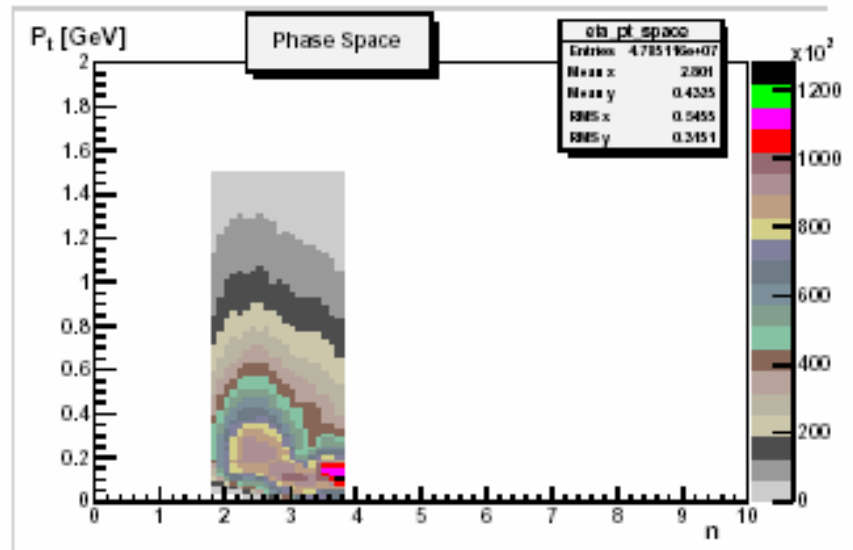
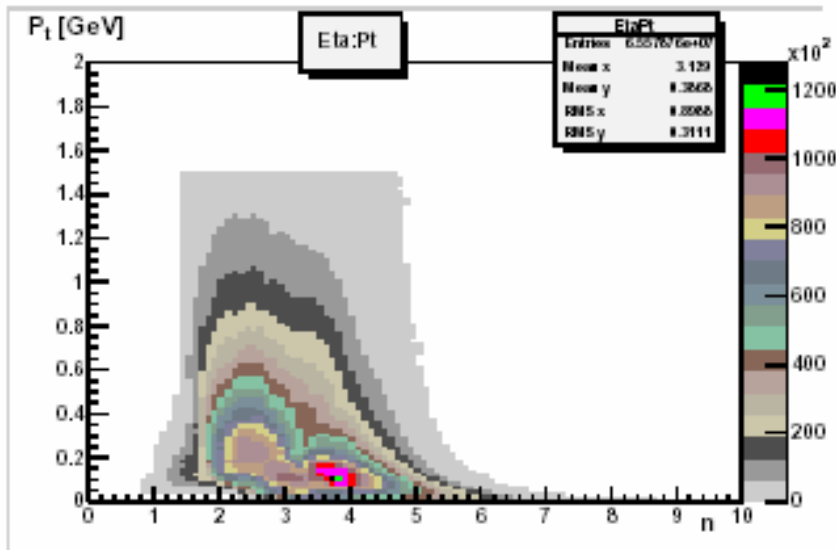
$$Z_{\text{first}} < 200.0 \text{ cm}$$

$$\text{NMP} > 30$$

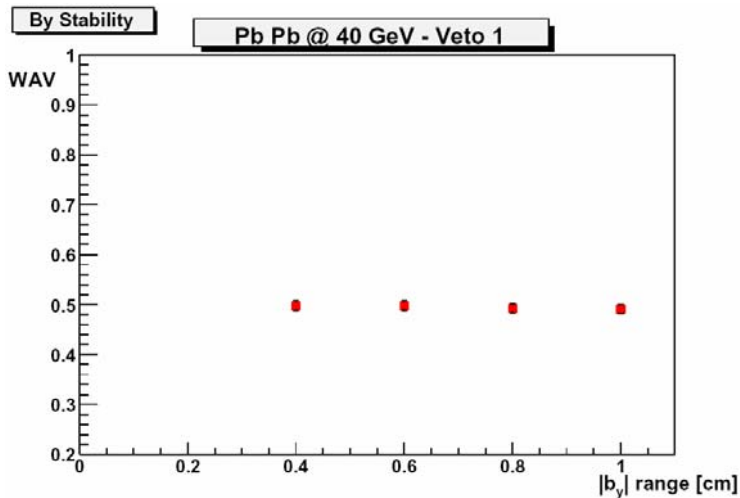
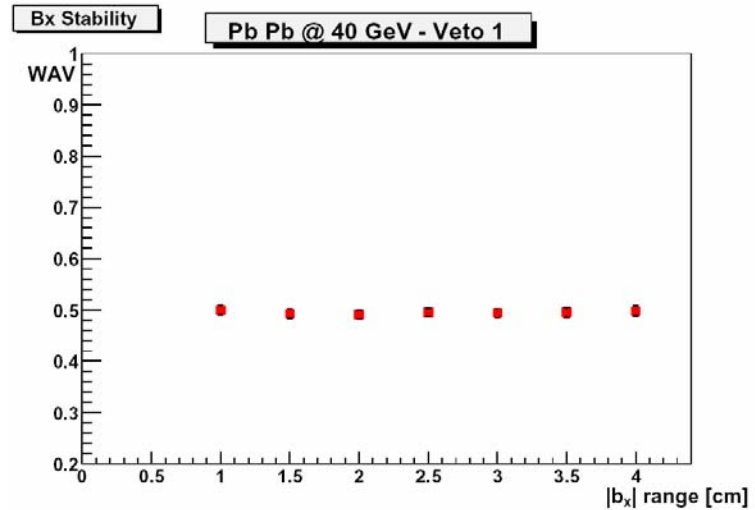
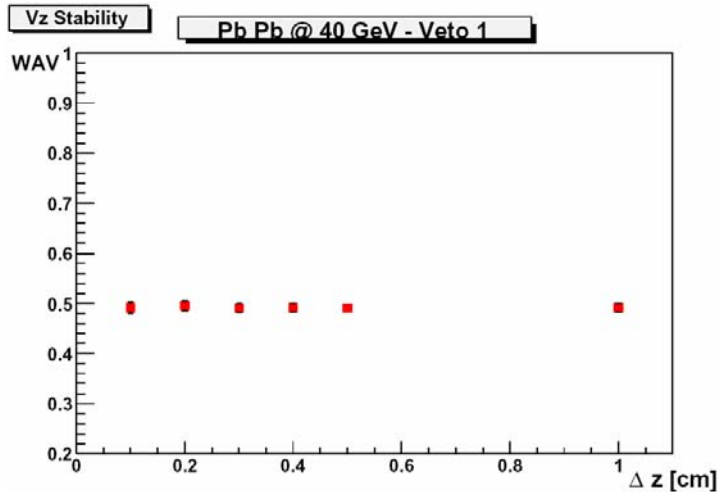
$$0.5 < \text{NP/NMP} < 1.1$$

# Pb-Pb@ 40A GeV

## Phase Space (Veto 1)



# Stability of the BF width (Veto 1)



Stability test of the width of the BF for:

- various values of  $\Delta V_z$
- various values of  $b_x$
- various values of  $b_y$

**The systematic error is of the order 0.002**

# Selection Criteria used in the Analysis for the Peripheral Events (01D-DST)

## Event Level Cuts

$$-0.15 \text{ cm} < V_x < 0.15 \text{ cm}$$

$$-0.25 \text{ cm} < V_y < 0.25 \text{ cm}$$

$$-581.4 \text{ cm} < V_z < -580.8 \text{ cm}$$

$$\text{Track Ratio} > 0.2$$

## Track Level Cuts

$$-2.0 \text{ cm} < b_x < 2.0 \text{ cm}$$

$$-1.0 \text{ cm} < b_y < 1.0 \text{ cm}$$

$$0.005 \text{ GeV} < P_t < 1.5 \text{ GeV}$$

$$Z_{\text{first}} < 200.0 \text{ cm}$$

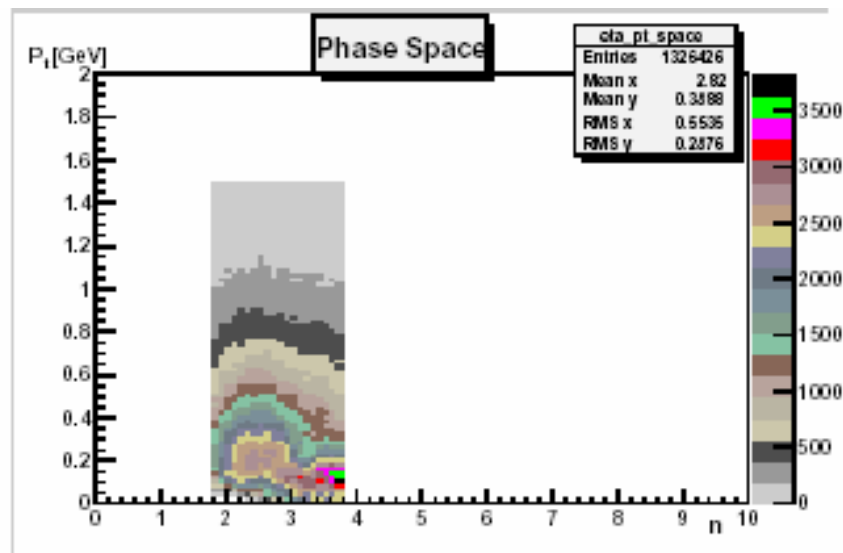
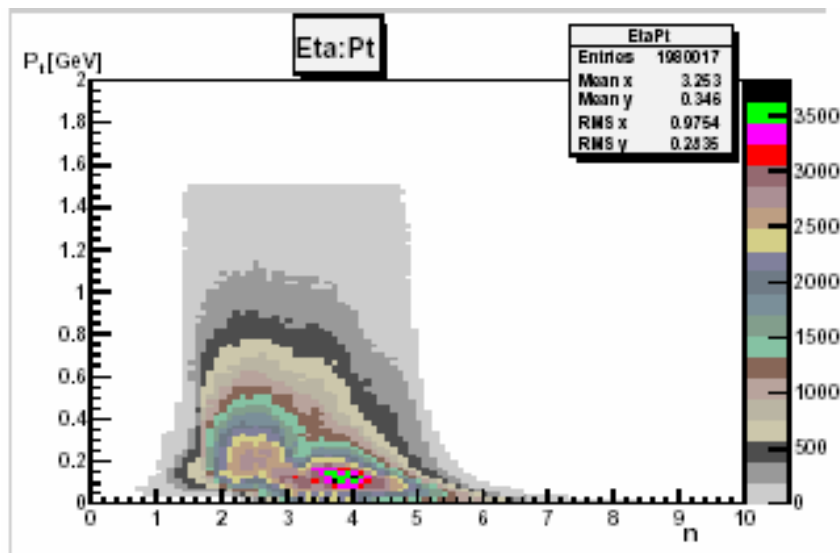
$$\text{NMP} > 30$$

$$0.5 < \text{NP}/\text{NMP} < 1.1$$

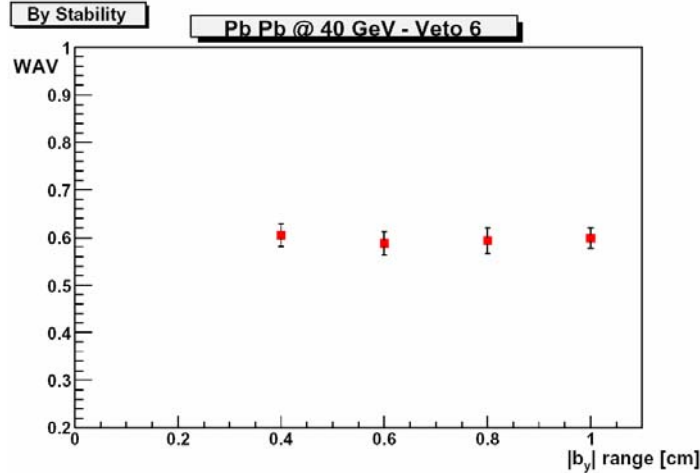
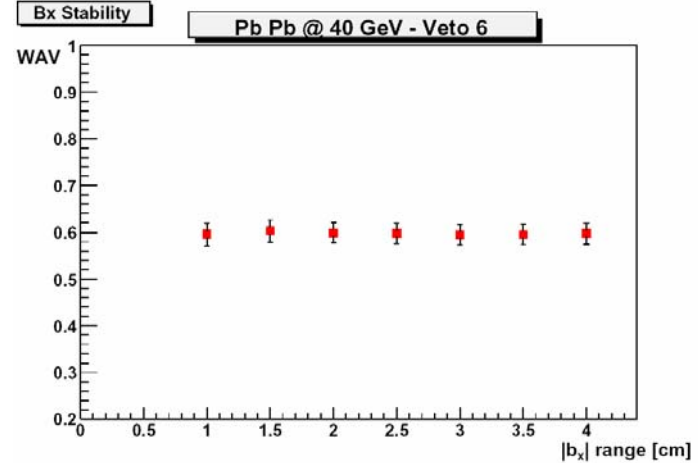
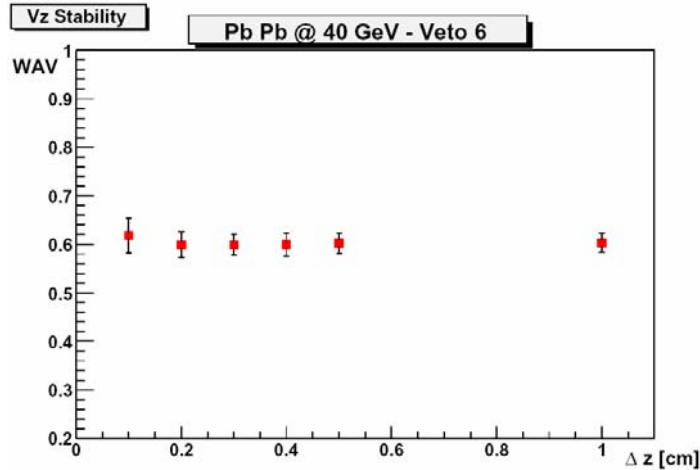


# Pb-Pb @ 40 A GeV

## Phase Space (Veto 6)



# Stability of the BF width (Veto 6)



Stability test of the width of the BF for

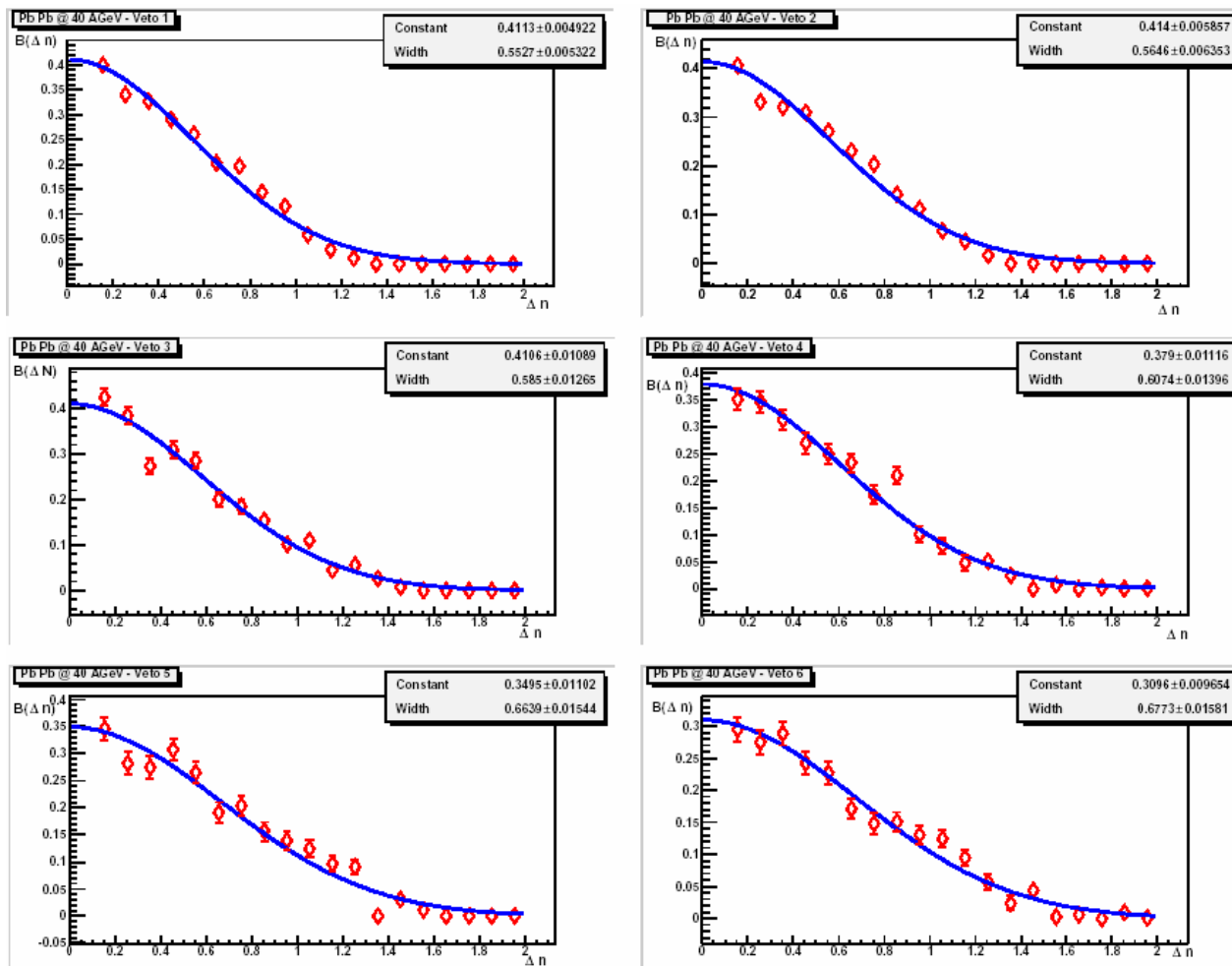
- various values of  $\Delta V_z$
- various values of  $b_x$
- various values of  $b_y$

**The systematic error is of the order 0.002**

# Balance Function for Pb-Pb @ 40 A GeV

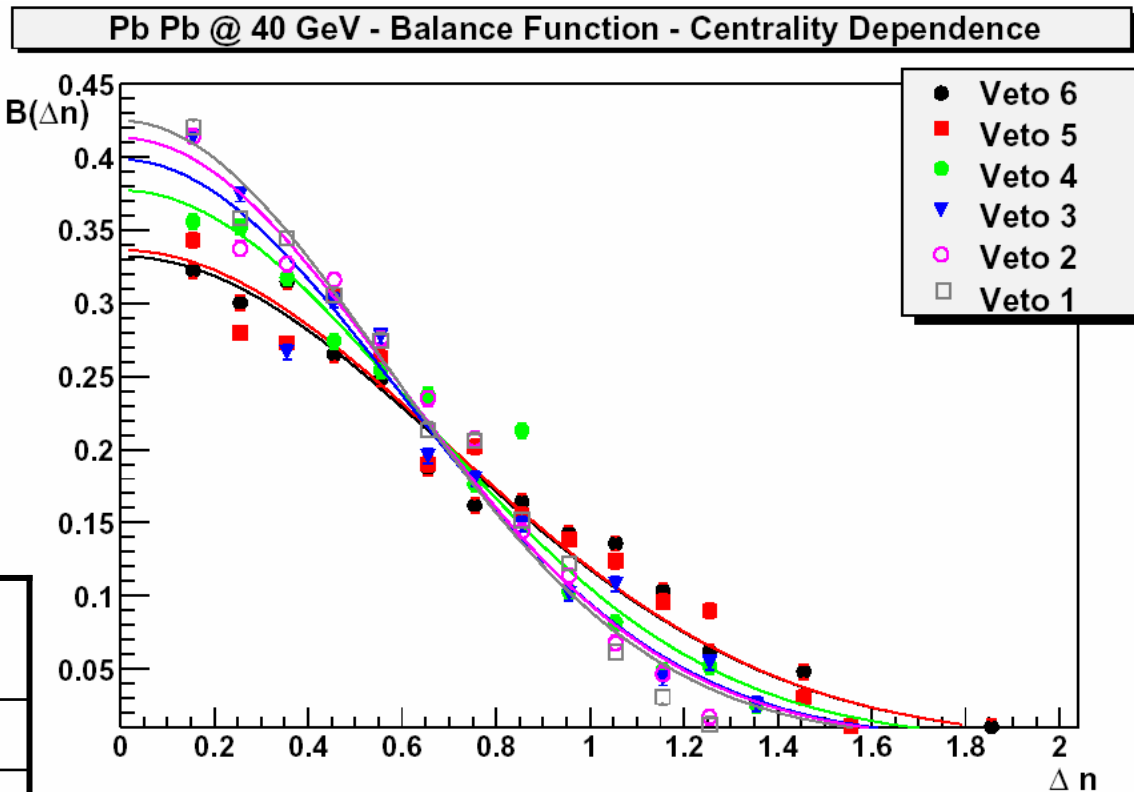
## All veto bins Real Data

Pseudorapidity window used in the analysis:  
 $1.8 < n < 3.8$



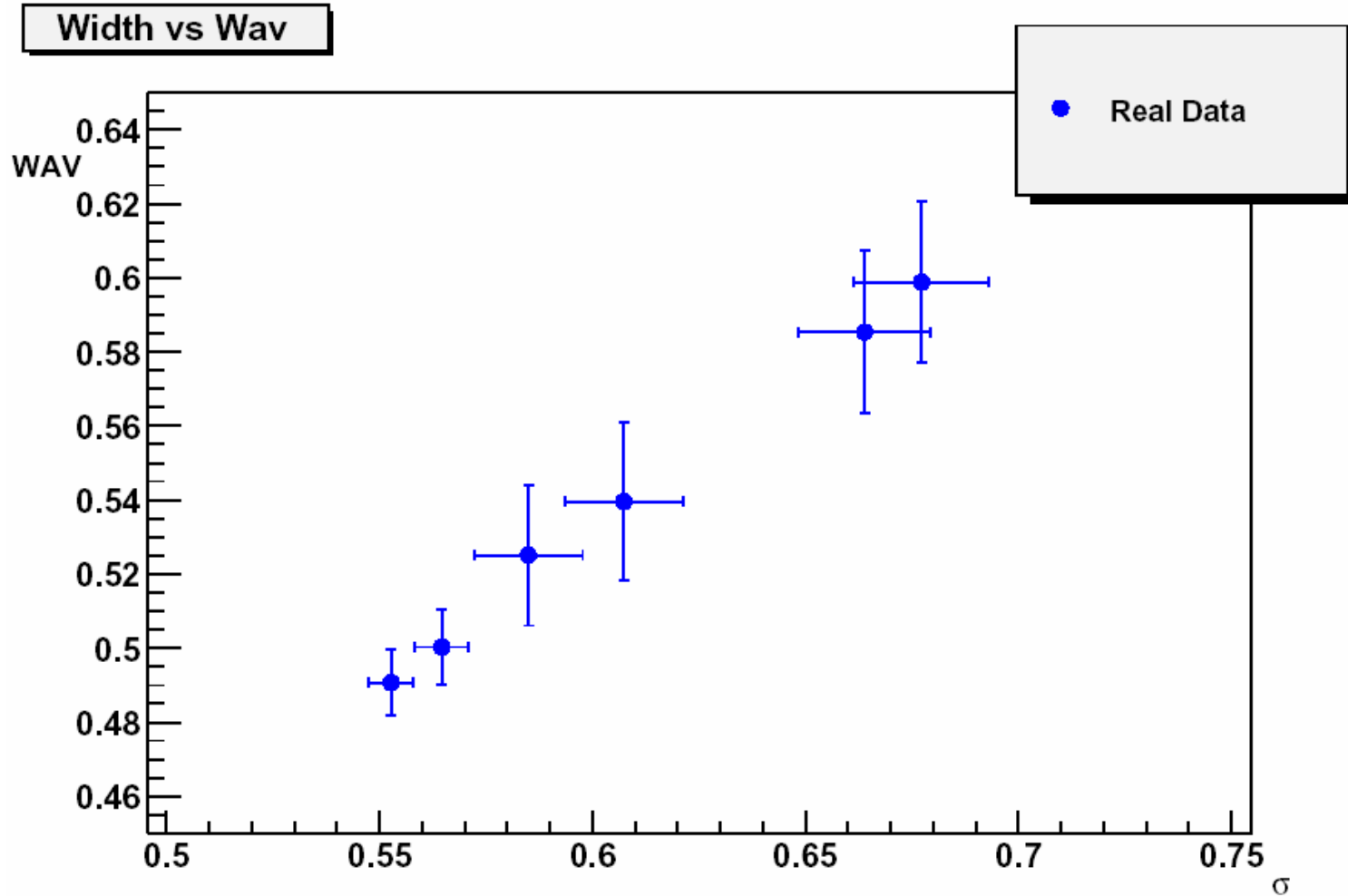
# Centrality Dependence of the Balance Function for Real Data

Veto bin	Gaussian Fit	Weighted Average
1	$0.553 \pm 0.005$	$0.49 \pm 0.01$
2	$0.56 \pm 0.01$	$0.50 \pm 0.01$
3	$0.58 \pm 0.01$	$0.52 \pm 0.02$
4	$0.61 \pm 0.01$	$0.54 \pm 0.02$
5	$0.66 \pm 0.01$	$0.58 \pm 0.02$
6	$0.68 \pm 0.01$	$0.60 \pm 0.02$



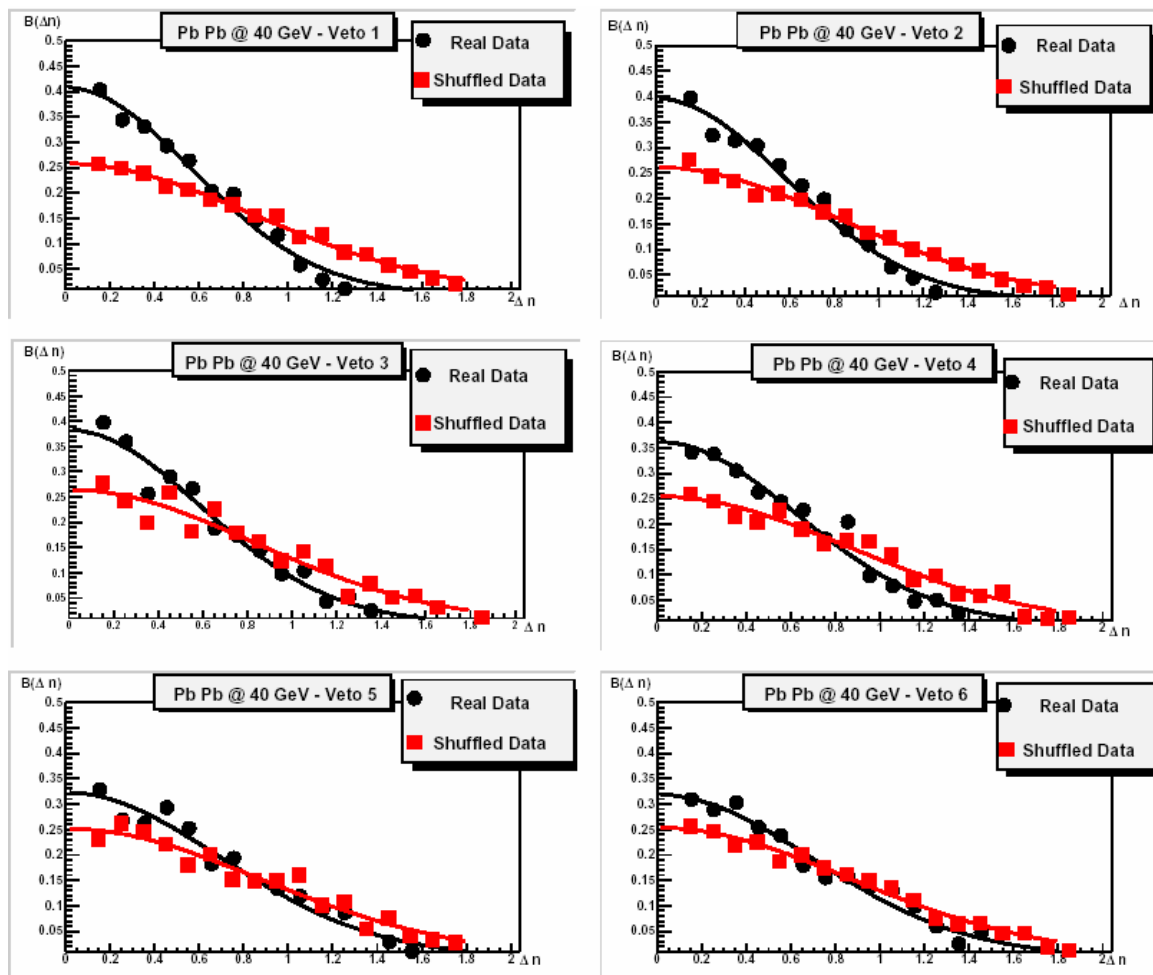
The BF for all veto bins normalized to the area corresponding to Veto 1

# Gaussian fit width vs Weighted average



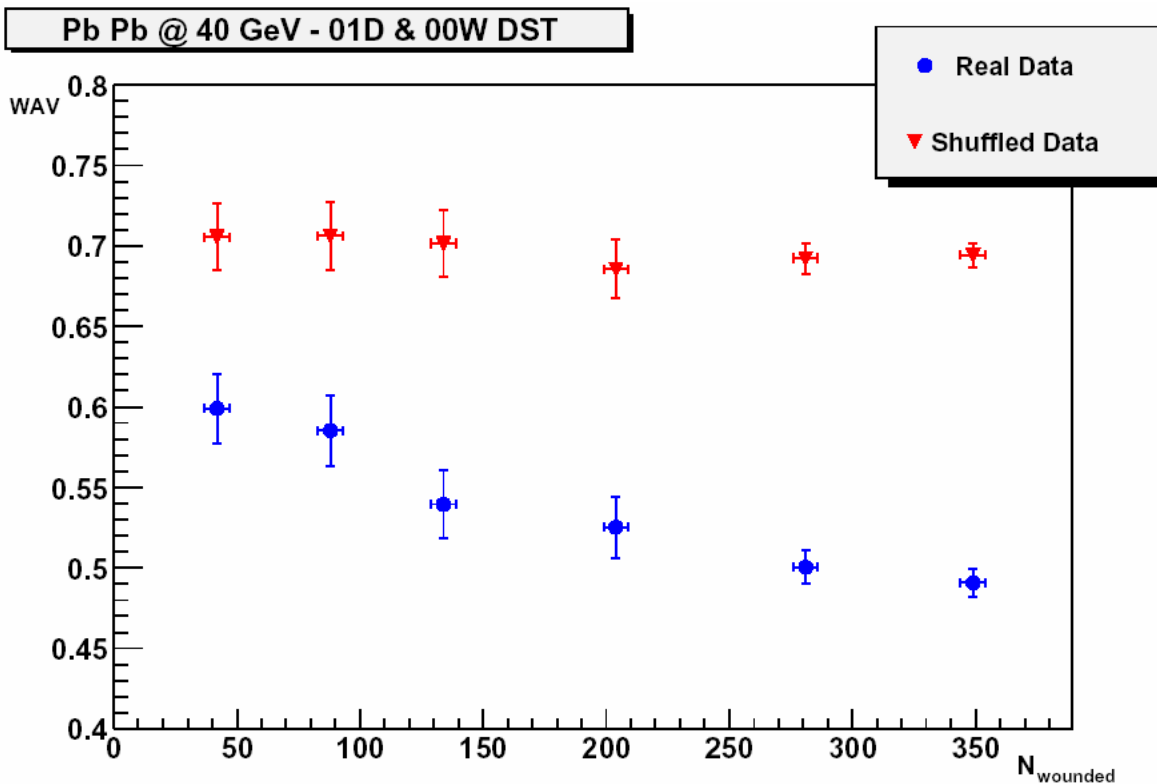
# Balance Function for Pb-Pb @ 40 A GeV all veto bins

## Real and Shuffled Data



# Centrality Dependence of the Balance Function for Real and Shuffled Data

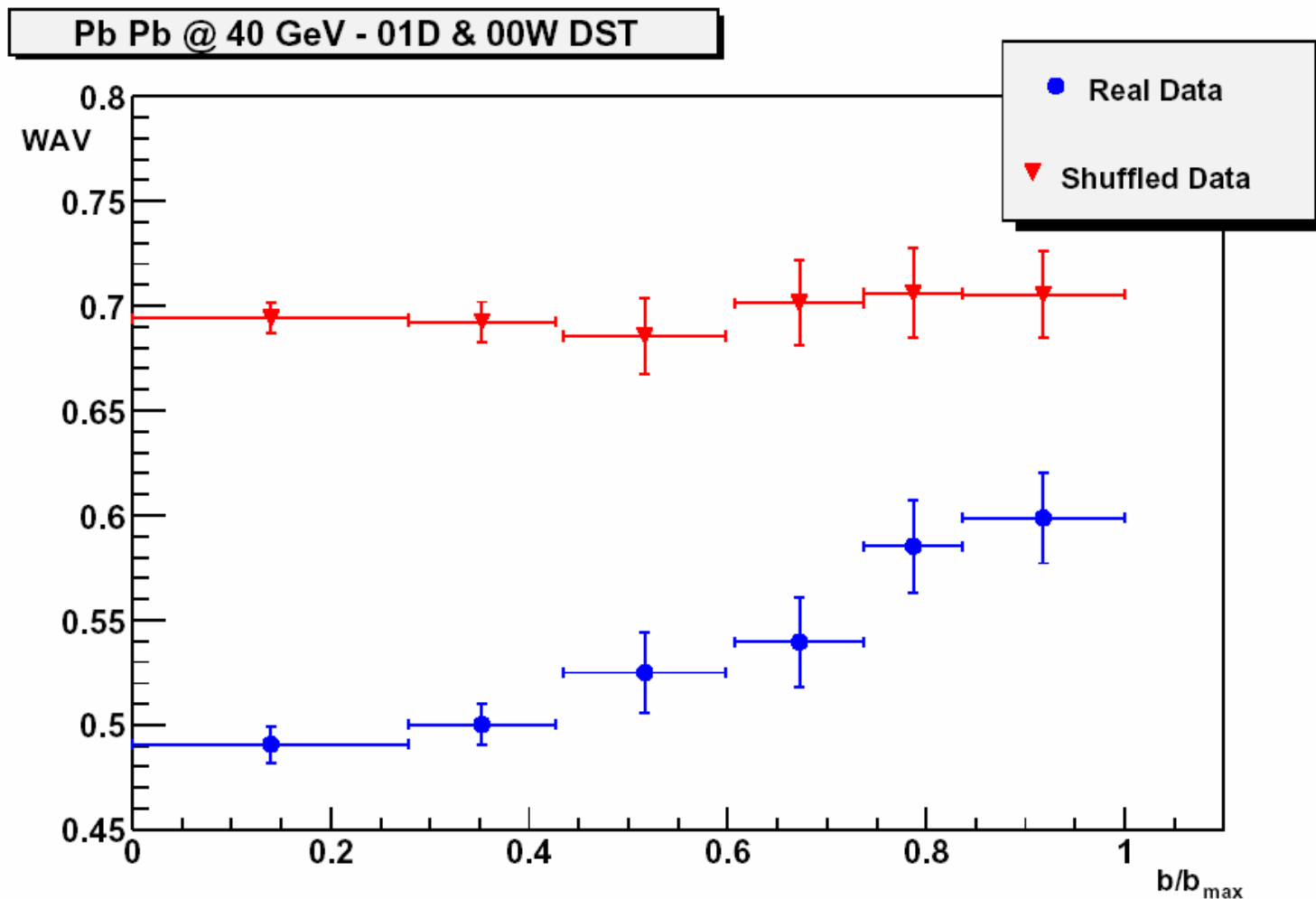
Veto bin	Real Data Weighted Average	Shuffled Data Weighted Average
1	$0.49 \pm 0.01$	$0.694 \pm 0.007$
2	$0.50 \pm 0.01$	$0.69 \pm 0.01$
3	$0.52 \pm 0.02$	$0.68 \pm 0.02$
4	$0.54 \pm 0.02$	$0.70 \pm 0.02$
5	$0.58 \pm 0.02$	$0.71 \pm 0.02$
6	$0.60 \pm 0.02$	$0.71 \pm 0.02$
Variation	<b><math>18\% \pm 4\%</math></b>	<b><math>1\% \pm 1\%</math></b>



\*If we use the width of the Gaussian fit instead of the weighted average we find the same variation

# Centrality Dependence of the Balance Function

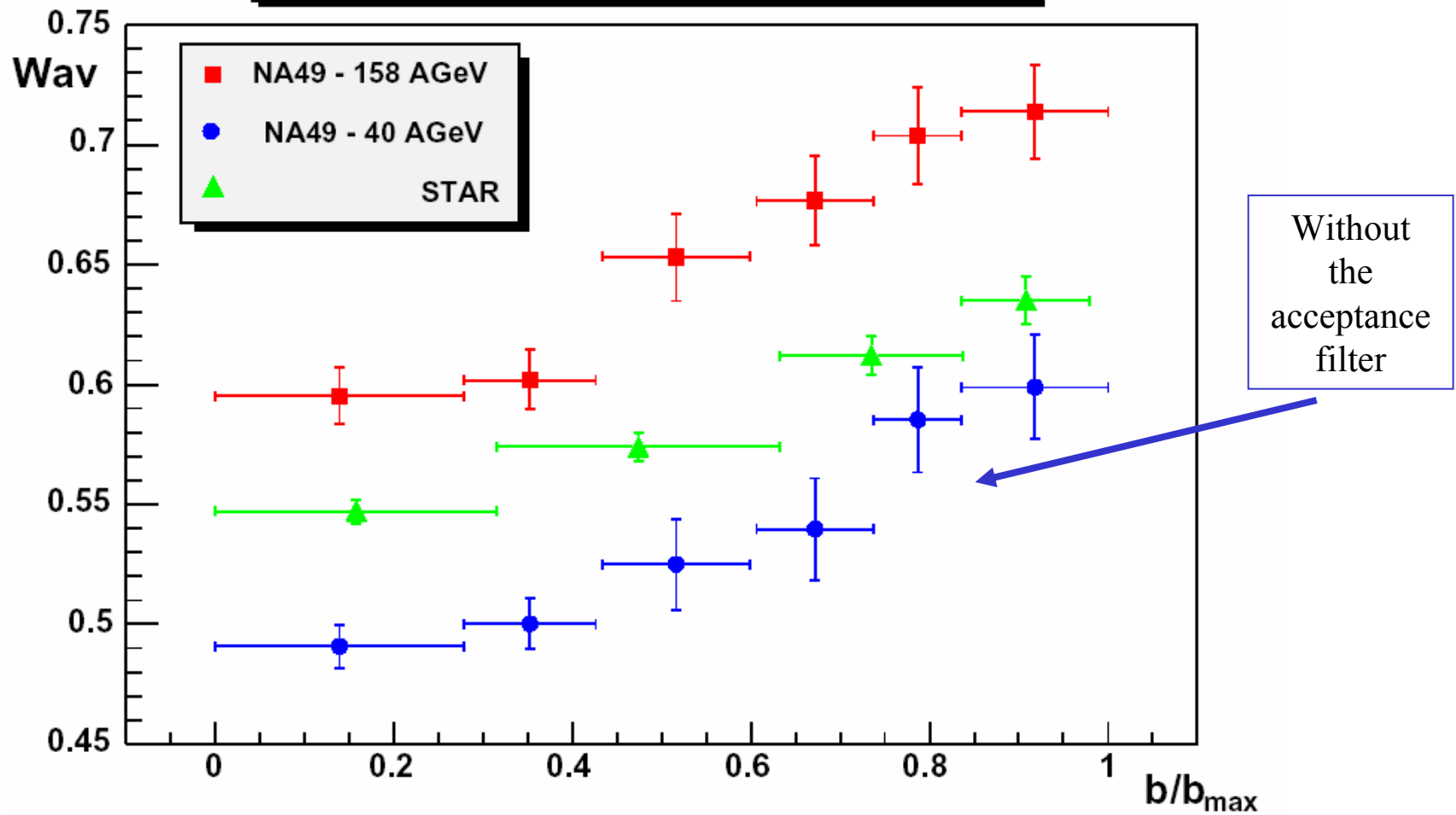
## Real and Shuffled Data





# Very preliminary comparison with Pb-Pb@ 158 A GeV and STAR

Centrality dependence - NA49 + STAR



## Results

- The width of the BF decreases with increasing centrality in Pb-Pb@ 40 AGeV
- The decrease is of the order  $(18 \pm 4)\%$
- Results are compatible with the NA49 Pb-Pb@ 158 AGeV analysis and STAR

## Future Steps

- Apply the acceptance filter
- Investigate the centrality dependence of the BF width for:
  - Forward – Backward Regions
  - Various pseudorapidity intervals
- Analyze Monte Carlo events