

Centrality, N_{part} & $N_{\text{collision}}$ at
BRAHMS

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Why do we want N_{part} ?

- Comparison of P-P , P-A , and A -A ?
- Comparison of Different Centrality?

What is the concern about using N_{part} ?

- No Direct Measurement
- Is there any indirect measurement (ZDC ,etc)?
- If not measured, are there any model dependencies?

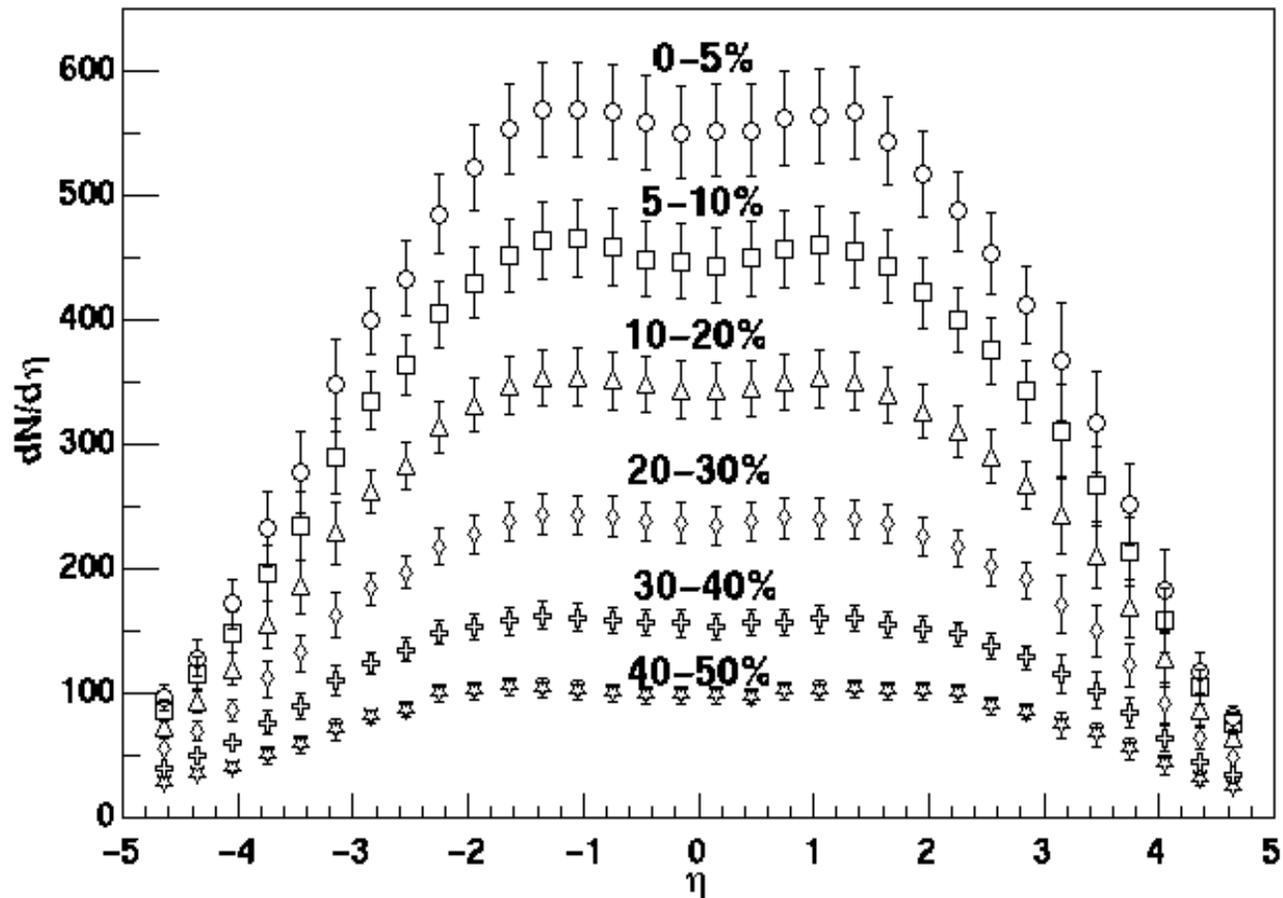
Can we live without N_{part} ?

- For comparison of P -P ,P -A & A -A , we can compare the most central collisions.

What Is Measured?

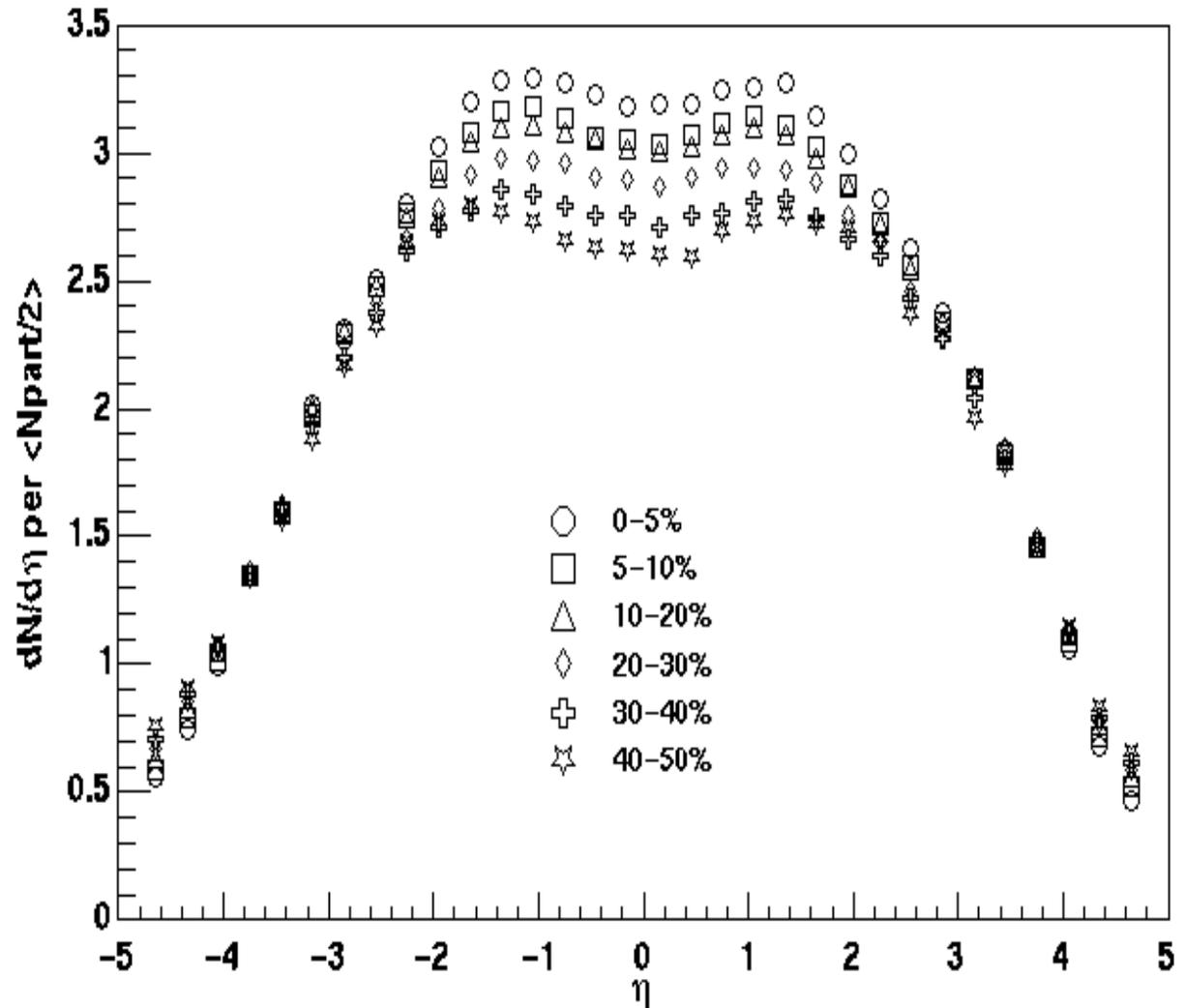
We can measure charged particle multiplicities.

N_{charge} in $-4.7 < \eta < 4.7$



What we have done with N_{part} up to now?

Using experimental centrality and comparing with the model calculation, we got N_{part} for our event selections.



How we calculated N_{part}

Measure charged particle multiplicities by **Silicon and Tile**

Assuming centrality and multiplicity have a linear correlation, select events by slicing the corrected multiplicity distribution vertically.

- Correct for missing fraction of the cross section and background events with small multiplicity by **Tile only**.
- Correct anomalous background events by **Silicon and Tile**.

By knowing the centrality, use Monte Carlo simulation to get corresponding N_{part}

Event Selection for Minimum Bias

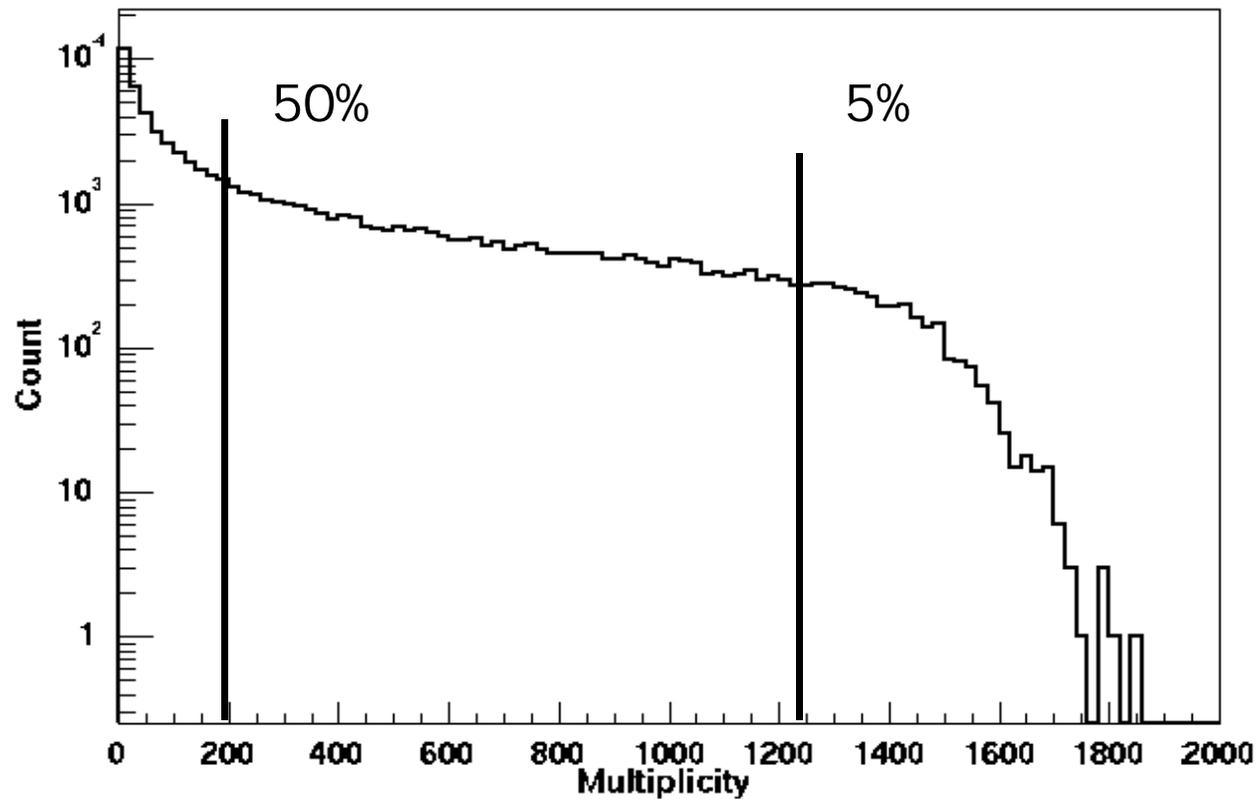
- ZDC is very close to 100 % efficient.
 - Not efficient at the most central events.
- Beam Beam (BB) is only about 75 % efficient.
 - Not efficient at the peripheral events.

Although the correlated events by BB and ZDC can be used to select only real collision events, it is not used for minimum bias selection.



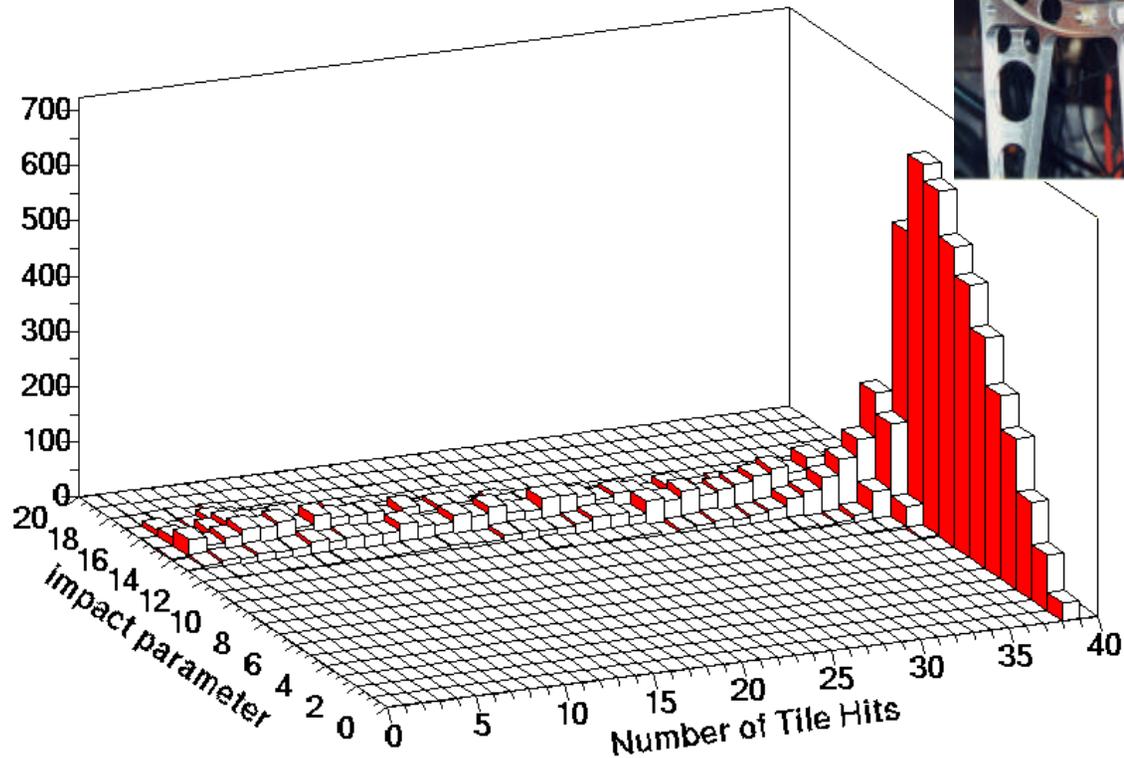
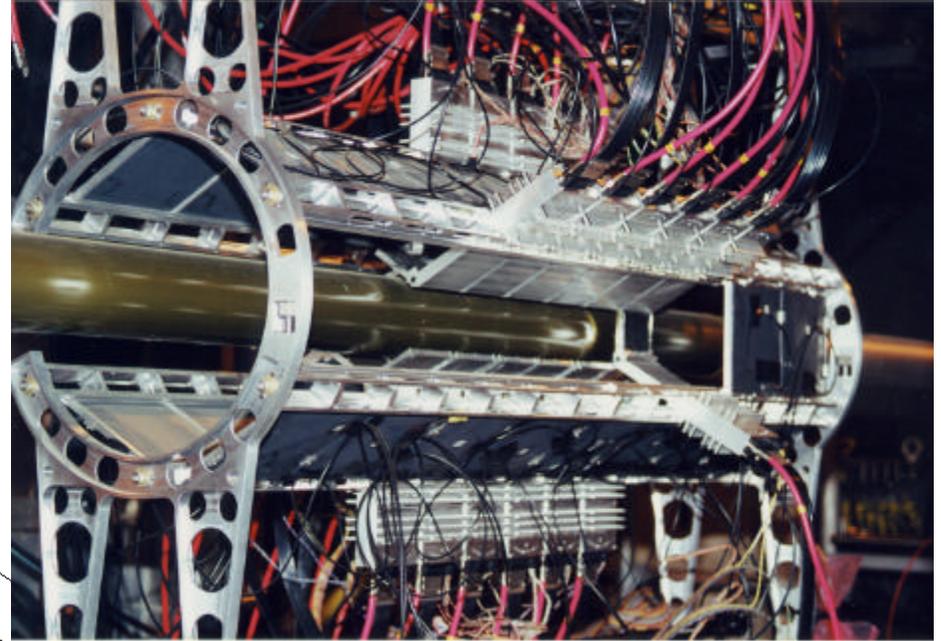
Multiplicity and Centrality Cut

Event selection is done by slicing multiplicity distribution vertically.

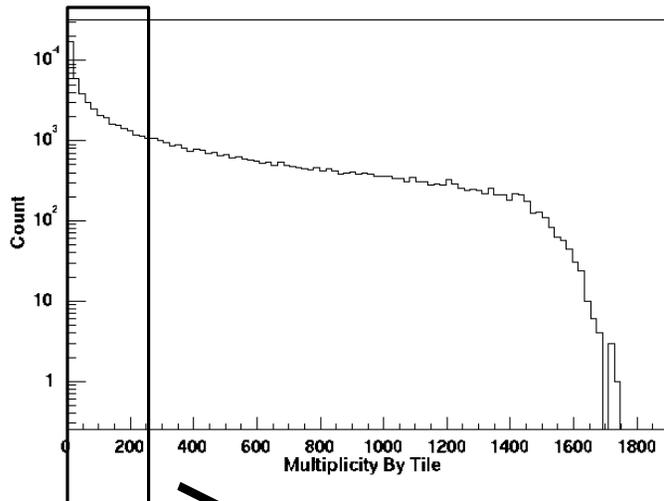


Efficiency for Minimum Bias Events

Efficiency of the Tile getting hit in minimum bias event is about **99%** in the Monte Carlo simulation.



How to get the fraction of missing cross section?

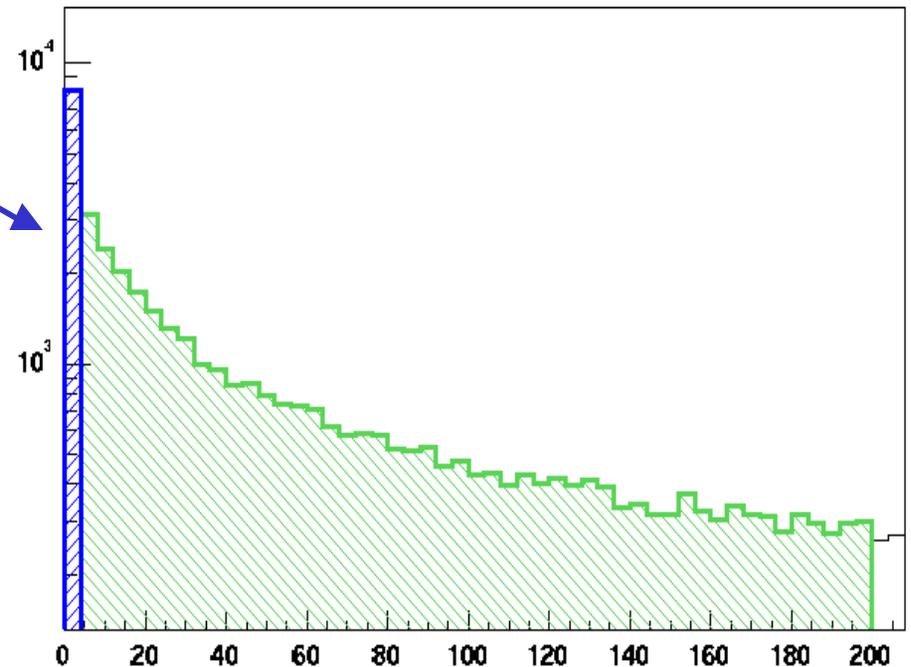


Measured multiplicity distribution by Tile

Using Hijing with GEANT, estimate how many events we should have for very small multiplicity events.

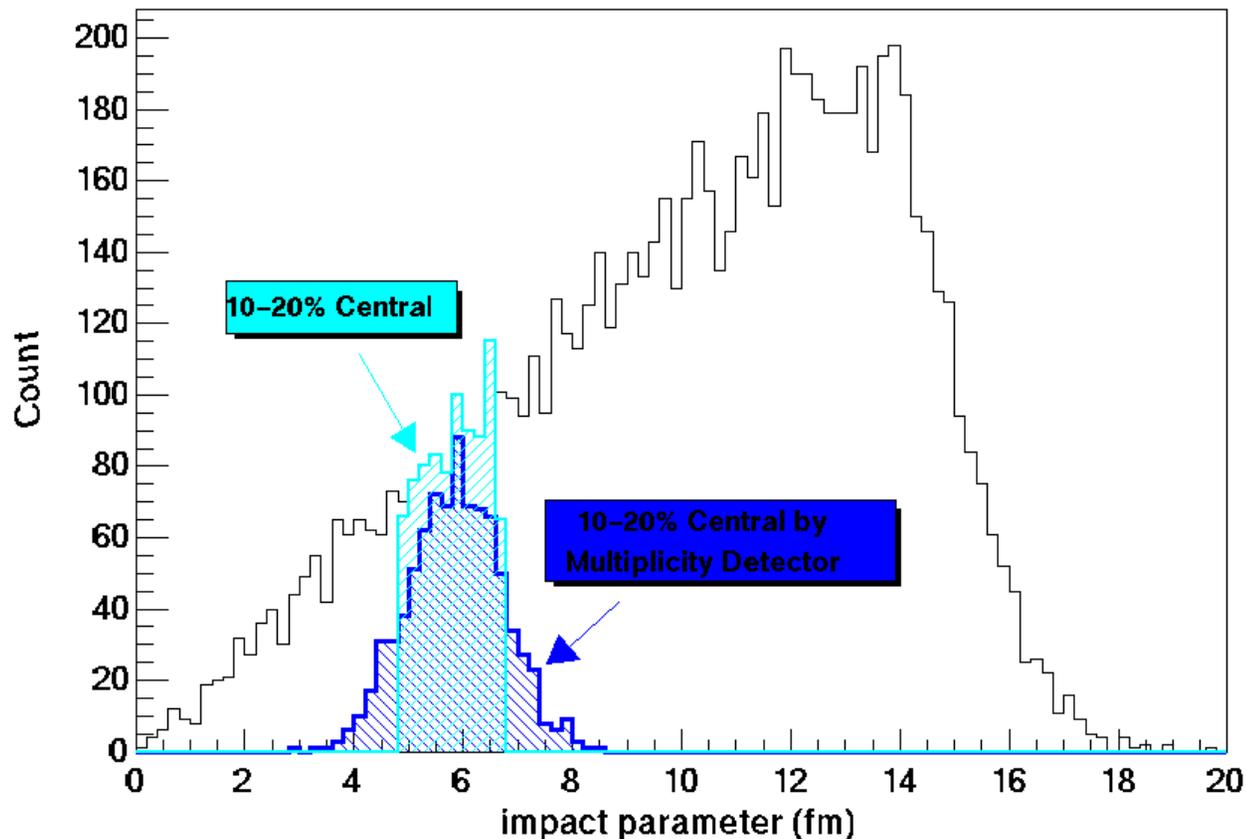
Throw out

$$\frac{\sum_{Event} M=0..4}{\sum_{Event} M=0..200} \cong .1 \rightarrow 10\%$$



Centrality Selection in Monte Carlo

Multiplicity measured by Silicon and Tile is use to select centrality.



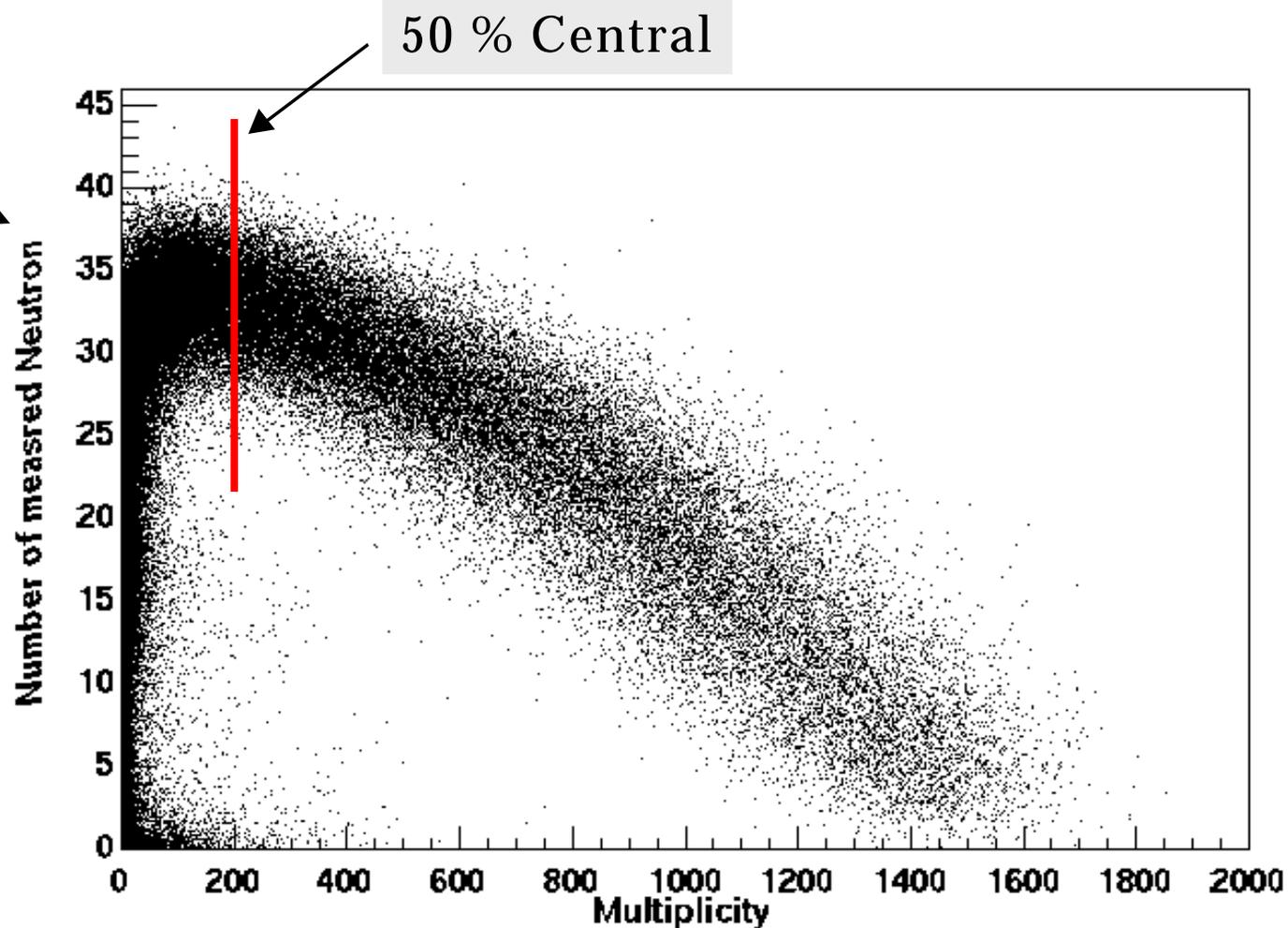
Wounded Nucleon Calculation

$$N_{NN} = 40\text{mb}, a = .54\text{ fm}$$

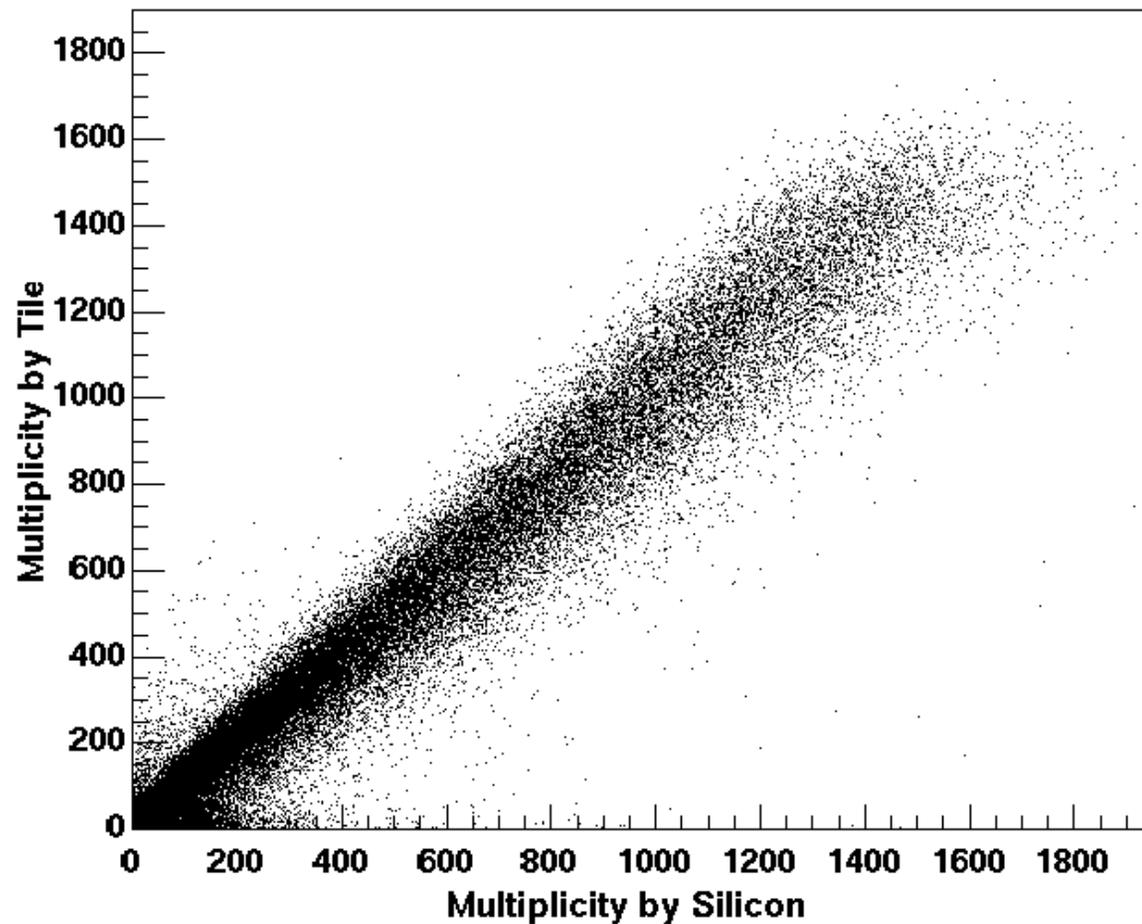
Centrality	N_{part} (WN)	$N_{\text{collision}}$ (WN)	N_{part} (Hijing)
0-5	346	873	352
5-10	293	708	299
10-20	228	516	235
20-30	164	333	165
30-40	114	206	114
40-50	76	118	75

Measured Neutron by ZDC

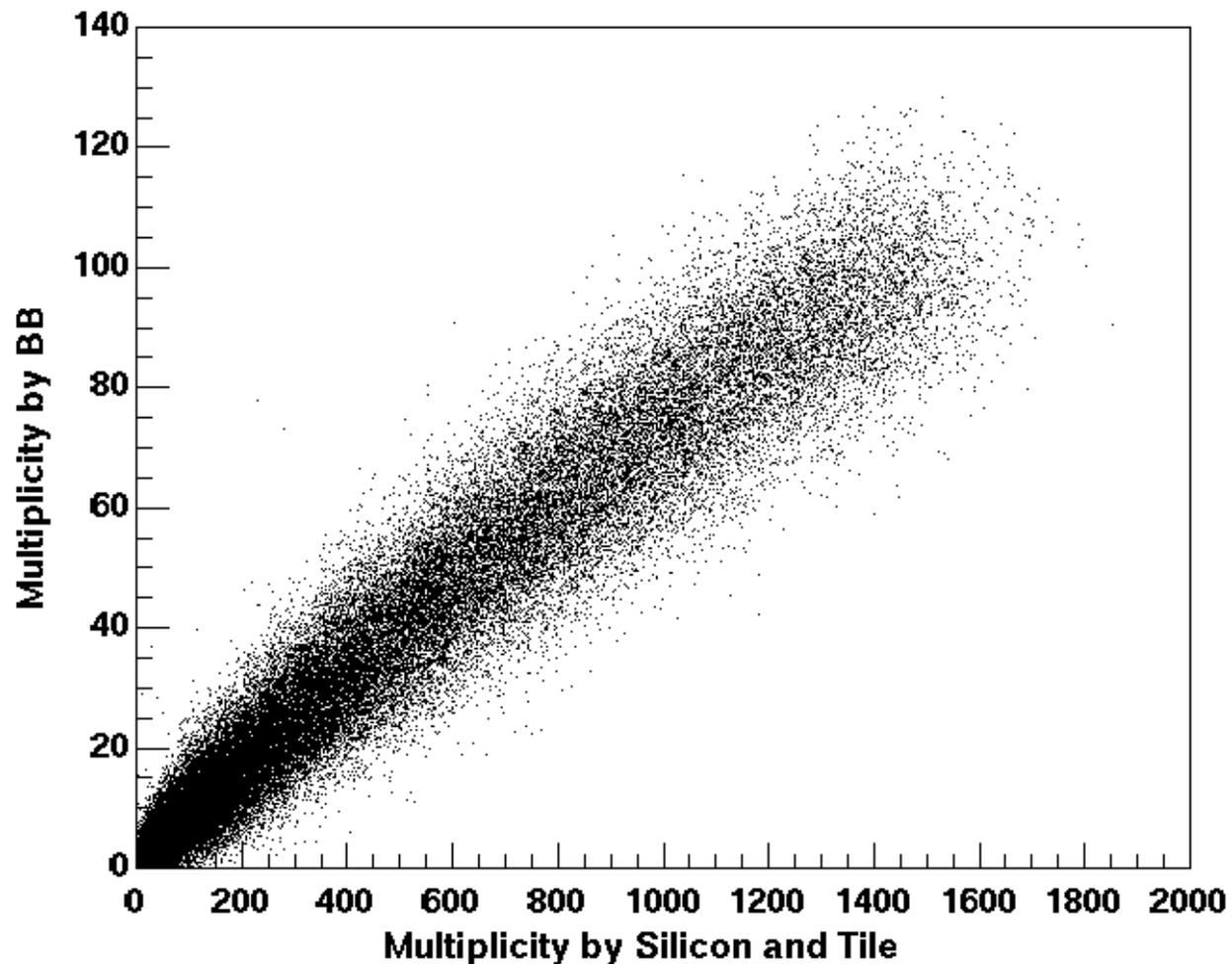
Very Few
Neutrons ???



Correlation of Tile and Silicon multiplicity



Correlation of BB and Silicon-Tile multiplicity



N_{part} , $N_{\text{collision}}$ and Impact Parameter

$$N_{\text{NN}} = 40 \text{ mb}, a = .54 \text{ fm}$$

