$dN_{ch}/d\eta$ (η=0) for the d+Au reaction at $\sqrt{s_{NN}}$ =200 GeV based on TPM1 track data.

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An earlier analysis of the d+Au charged particle densities at $\sqrt{s_{NN}}$ =200 GeV based on the SiMA and TMA data finds good agreement between HIJING calculations and experiment. However, the analysis also has somewhat different results at mid-rapidity for the two arrays, with the SiMA results about 10% higher for more central collisions. An independent check of the mid-rapidity results can be obtained using the tracking information from TPM1. This note discusses an analysis where $dN_{ch}/d\eta$ at η=0 is deduced from the number of tracks counted in TPM1.

The analysis was done by developing a new class based on the existing BrTPMTrackVertexModule class. The new class, called MultTPMCount and located in /brahms_app/sjs_app/modules, is loaded after the BrMultCent (brat), BrInelSpVertexModule (Hiro), BrBbVertexModule (brat) modules. Two trees are created. The first tree, FullTree, contains an entry for every track in TPM1 that points back to the beam axis. The second tree, CoreTree, has one entry for each event giving the centrality and vertex information. I wanted to generate both trees in the same module to assure correspondence between the analyzed events. The tree entries are shown in the table below:

FullTree	CoreTree	
cent	cent	centrality
mult	mult	si+tile multiplicity
vtxBB	vtxBB	BB vertex
vtxINEL	vtxINEL	INEL vertex
vtx	vtx	BB vertex if present and within 10 cm of INEL vertex, otherwise INEL vertex. (INEL vertex required.)
x		Track x-projection onto global coordinates plane defined by global y- and z-axes.
y		Track y-projection, as above.
z		Track z-projection, as above.
xG		Track x-intersection with TPM1. (Global coordinates.)
yG		Track y-projection, as above.
zG		Track z-projection, as above
	hits	# of tracks in fiducial cut |yG|<5 cm; |zG|<10cm

Using the CoreTree, the number of events N_{ev} with centrality 0-30% and 30-60% were counted that had |vtx|<2.5 cm. The total number tracks N_{ch} that satisfies these centrality and vertex conditions and also fell within the fiducial cuts |yG|<5 cm and |zG|<10cm were then found. Only tracks pointing back to the vertex with |z-vtx|<14cm and with |y-0.8|<2cm were counted (as shown in Fig. 4 below, there is a y-offset of about 0.8 cm in the calibration). The plane for the fiducial cuts is at 91.13 cm from the beam axis. The cuts then correspond to $\Delta\eta = 0.219$ and $\Delta\phi = 6.28°$. The charge particle multiplicities are given by:

$$\frac{dN_{ch}}{d\eta} = \frac{N_{ch}/N_{ev}}{\Delta\eta} \times \frac{360°}{\Delta\phi}$$

Results: (Based on run 8404. Trigger 5 selected event. $\eta = 0$.) Uncertainties are statistical, only.

	0-30%	30-60%
N_{ev}	4725	4736
N_{ch}	287	167
$\dfrac{dN_{ch}}{d\eta}$	15.9±1.0	9.2±0.8
$\dfrac{dN_{ch}}{d\eta}$ from TMA	17.0	8.3
$\dfrac{dN_{ch}}{d\eta}$ from SiMA	18.2	8.3

The current analysis assumes 100% tracking efficiency for TPM1.

Background Figures:

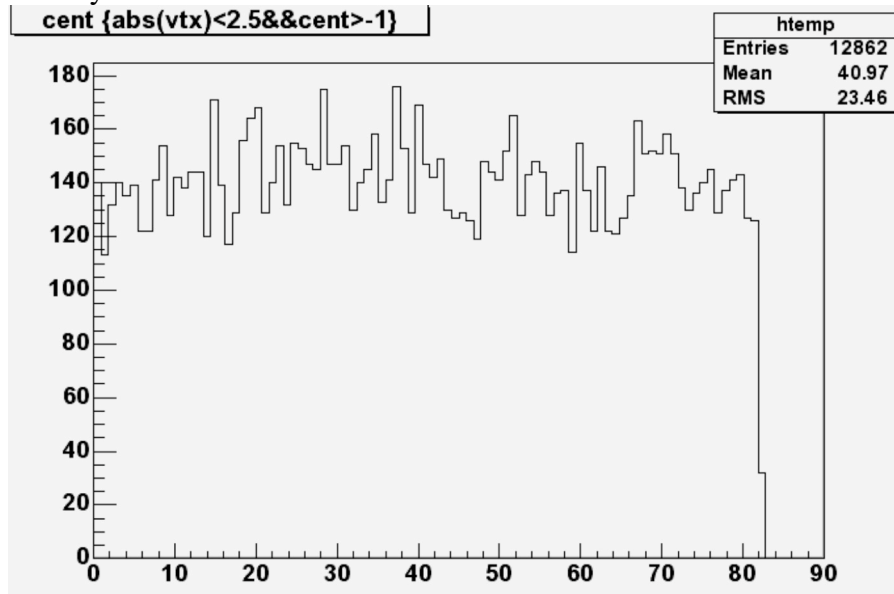Fig. 1. Centrality distribution with vertex cut.

Fig. 2. Track "hits" on plane used for fiducial cut.

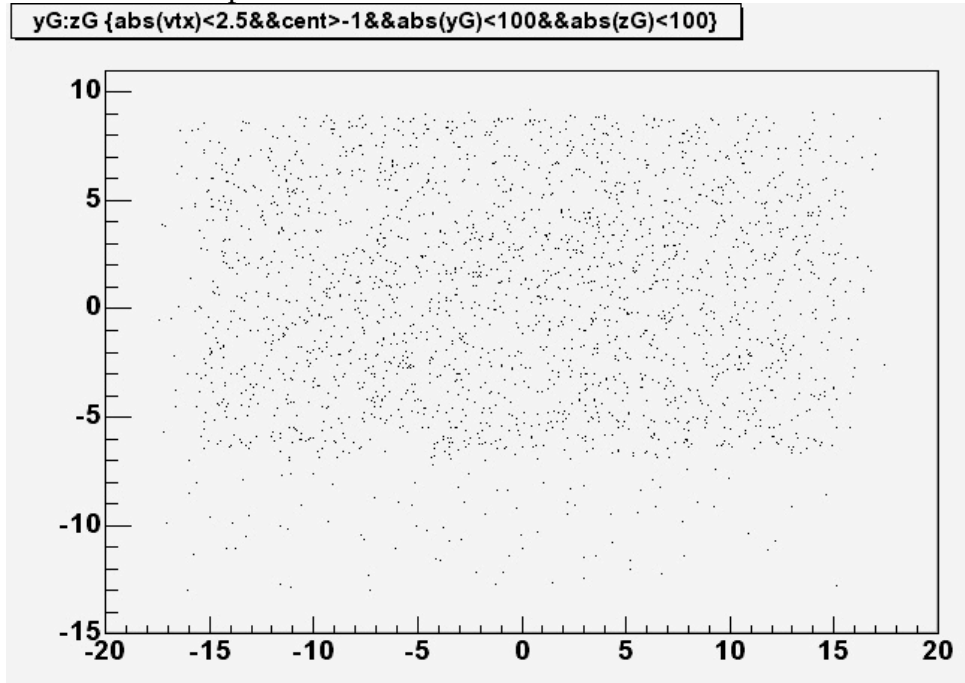yG:zG {abs(vtx)<2.5&&cent>-1&&abs(yG)<100&&abs(zG)<100}

Fig. 3. Track z-coordinates projected back to beam axis vs. vertex deduced from BB or INEL counters. This figure shows individual tracks and NOT the average vertex location determined for each event.
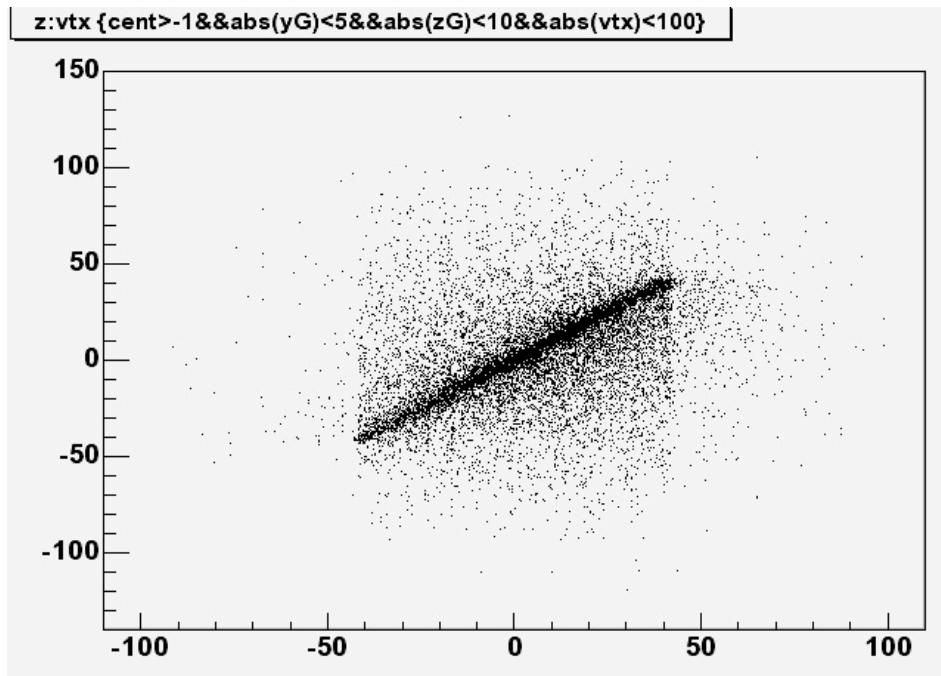

z:vtx {cent>-1&&abs(yG)<5&&abs(zG)<10&&abs(vtx)<100}

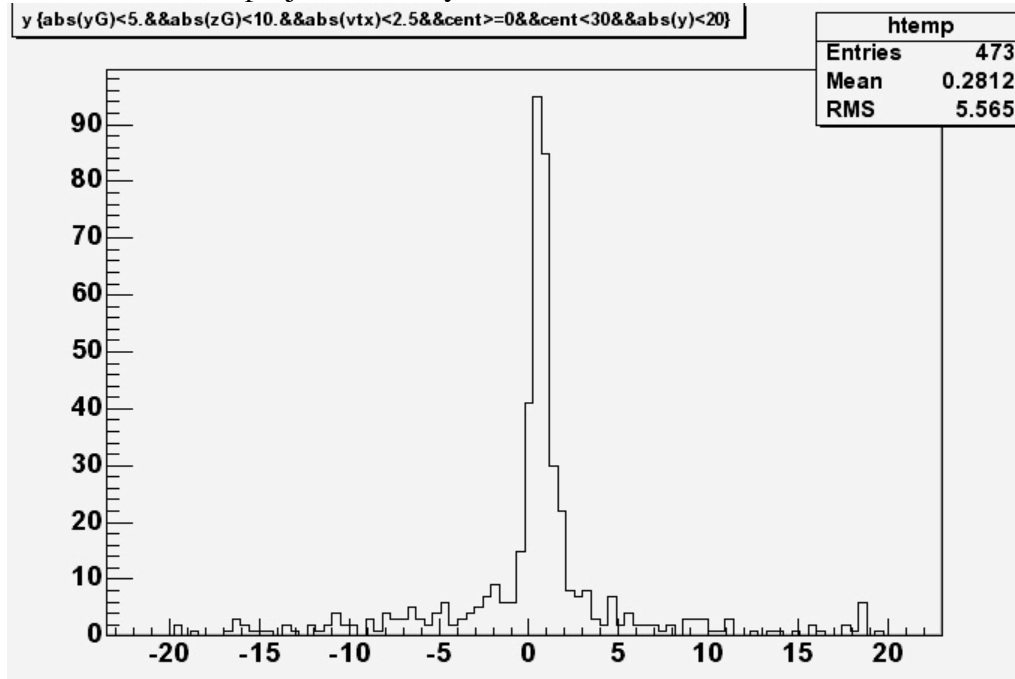Fig. 4. Distribution of projected track y-coordinate.

Fig. 5. Distribution of |z-vtx| for events that otherwise satisfy the data selection criteria.
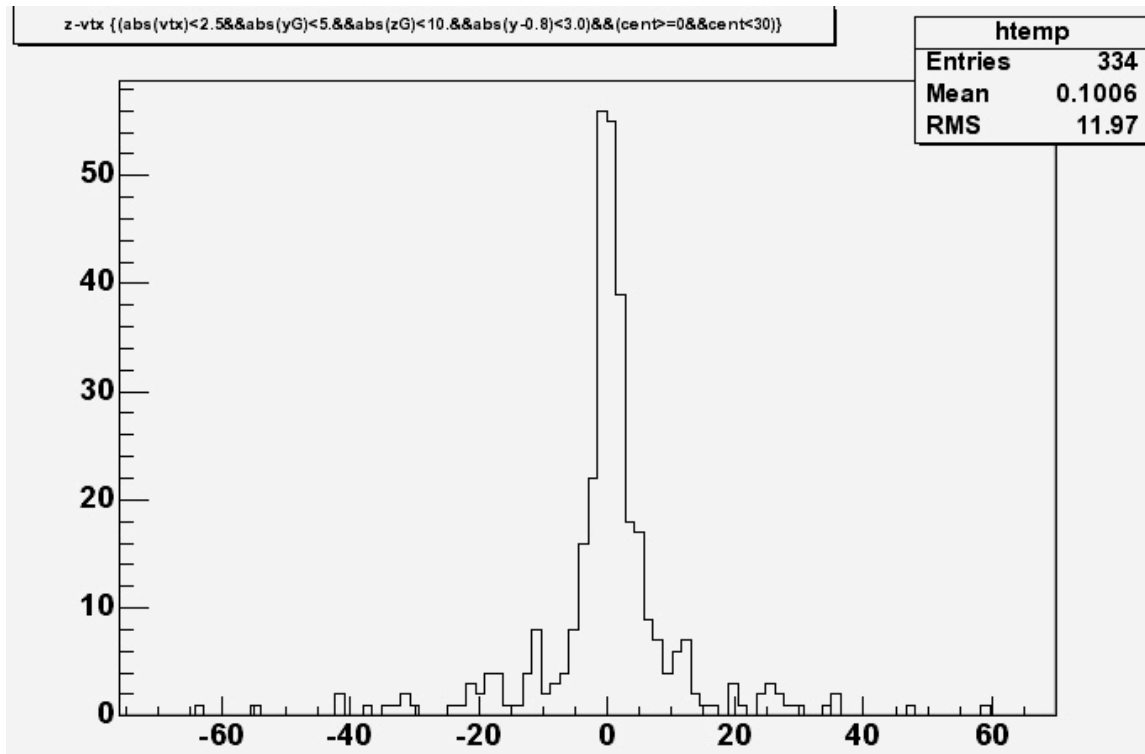Figure is for 0-30% centrality cut.

Fig. 6. Same as Fig. 4 with 30-60% centrality cut.

z-vtx {(abs(vtx)<2.5&&abs(yG)<5.&&abs(zG)<10.&&abs(y-0.8)<3.0)&&(cent>=30&&cent<60)}

htemp
Entries   197
Mean   -1.205
RMS   13.85